STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

CONSTRUCTION PROPOSAL
FOR
CITY OF BATON ROUGE-PARISH OF EAST BATON ROUGE

FEDERAL AID PROJECT

STATE PROJECT NO. H.012232
CONTROL SECTION NO. 450-10
LA 3064 TO BLUEBONNET BLVD. PHASE II
ROUTE I-10
EAST BATON ROUGE PARISH

STATE OF LOUISIANA
BETTY ELLZEY
REG. No. 31263
REGISTERED
PROFESSIONAL
ENGINEER IN
CIVIL ENGINEERING

28 Apr, 1 2023

STATE PROJECT NO. H.012232
TABLE OF CONTENTS

NOTICE TO CONTRACTORS (07/22)

Electronic bids and electronic bid bonds for the following project will be downloaded by the Louisiana Department of Transportation and Development (LA DOTD) on **Wednesday, June 14, 2023. Paper bids and paper bid bonds will not be accepted.** Electronic bids and electronic bid bonds must be submitted through www.bidx.com prior to the electronic bidding deadline. Beginning at 10:00 a.m., all bids will be downloaded and posted online at http://wwwapps.dotd.la.gov/engineering/lettings/. No bids are accepted after 10:00 a.m. The electronic bid download process is held in LA DOTD Headquarters Building, 1201 Capitol Access Road in Baton Rouge, LA, Room 113 C, and is open to the public. Visitors must check-in with the security desk in the first floor lobby.

DBE GOAL PROJECT
STATE PROJECT NO. H.012232
CONTROL SECTION NO. 450-10
FEDERAL AID PROJECT NO. H012232
DESCRIPTION: LA 3064 TO BLUEBONNET BLVD. PHASE II
NHS ROUTE I-10
NON-NHS ROUTE LOCAL ROADS
ROUTE: I-10
PARISH: EAST BATON ROUGE
LENGTH: 1.147 miles.
TYPE: CLEARING AND GRUBBING, GRADING, DRAINAGE STRUCTURES, CLASS II BASE COURSE, LIME TREATMENT, ASPHALT CONCRETE PAVEMENT, PORTLAND CEMENT CONCRETE PAVEMENT, TRAFFIC SIGNALIZATION, INTELLEGENT TRANSPORTATION SYSTEMS, AND RELATED WORK.
LIMITS: State Project No. H.012232 (DIJON DRIVE TO BE RENAMED CONSTANTIN BOULEVARD): PROJECT IS A NEW ROADWAY BEGINNING FROM THE CURRENT ENDPOINT OF CONSTANTIN BOULEVARD TO ITS APPARENT NEW JUNCTION WITH BLUEBONNET BOULEVARD, AS SHOWN IN PLANS.
LIMITS: State Project No. H.012232 (BLUEBONNET BOULEVARD): LOCATED ON BLUEBONNET BOULEVARD FROM ITS APPARENT NEW JUNCTION WITH DIJON DRIVE TO NORTH OF ITS INTERCHANGE WITH ROUTE I-10, AS SHOWN IN PLANS.
LIMITS: State Project No. H.012232 (Control Section No. 450-10): LOCATED ON THE ENTRANCE AND EXIT RAMPS OF ROUTE I-10 AT ITS INTERCHANGE WITH BLUEBONNET BOULEVARD, AS SHOWN IN PLANS.
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT FOR: CITY OF BATON ROUGE-PARISH OF EAST BATON ROUGE (Contracting Agency).

NOTICE TO CONTRACTORS (07/22)

ESTIMATED COST RANGE: $15,000,000 TO $20,000,000
The estimated cost range is for informational purposes only and may be subject to change. The bid prices received from bidders will be evaluated based on the actual estimate value, which will be published at bid opening, for award determination.
PROJECT ENGINEER: BRANCH, DAVID; HNTB; 10000 Perkins Rowe, Suite 640, Baton Rouge, LA 70810; (504) 913-0442.
DOTD COORDINATOR: SAM, DESMOND; (225) 231-4306.
PROJECT MANAGER: BRIGNAC, CHRISTINA

PROJECT CLASSIFICATION

The winning bidder shall be licensed under La. R.S. 37:2150-2192 for the classification of Highway, Street, and Bridge Construction before execution of the awarded contract.

SPECIAL NOTICE TO CONTRACTORS: The Build America Buy America ("BABA") provisions of the Infrastructure Investment and Jobs Act ("IIJA") as defined in PL 117-58, enacted on November 15, 2021, apply to this project.

Bids must be prepared and submitted in accordance with Section 102 of the *2016 Louisiana Standard Specifications for Roads and Bridges* as amended by the project specifications, and must include all information required by the proposal.

ONLINE BIDDER REGISTRATION IS FOR ALL PROSPECTIVE BIDDERS AND FOR OTHERS INTERESTED IN INFORMATION ONLY. Prior to the electronic bid submission deadline, ONLINE BIDDER REGISTRATION for each project bid is REQUIRED. Online Bidder Registration may be accessed via the Internet at wwwsp.dotd.la.gov. Select the following options: ***BUSINESS Working With DOTD***, then ***Project Letting Info***, then ***Online Bidder Registratio****n*.

When completed, a registration confirmation notice will be displayed and may be printed by the bidder. When approved for bidding, the bidder's name will be placed on the "List of Prospective Bidders" located on the LA DOTD Internet website. **It is the bidder's responsibility to review the "List of Prospective Bidders" to ensure approval to bid.** If a bidder does not register for a project, the bid will not be accepted by LA DOTD. As per 102.04.5 of the 2016 edition of the *Louisiana Standard Specifications for Roads and Bridges*, no bidders will be approved for bid registration within 24 hours before the bid opening. All bidders must register to bid before that deadline. If further information is required, please contact Mr. Alfonzo Simon, email: Alfonzo.Simon@la.gov, (225) 379-1111, fax : (225) 379-1857.

NOTICE TO CONTRACTORS (07/22)

Plans and bid proposals are available in electronic format ONLY. All Plans, Proposals, Addenda, Amendments, Letters of Clarification, and Withdrawal Notices will be posted online. **Paper notices will not be distributed.**

Construction bid proposals (includes specifications) and plans may be accessed via the Internet at wwwsp.dotd.la.gov. To receive update notifications on specific projects, ONLINE BIDDER REGISTRATION is required. From the LA DOTD home page, select the following options: ***BUSINESS Working With DOTD***, then ***Project Letting Info***. Once the ***Construction Letting Information*** page appears, find the ***Notice to Contractors*** box. From the drop down menu, select the appropriate letting date and press the "Go To" button to open the page, which provides a listing of all projects to be let and a ***Construction Proposal Documents*** link for each project. All project specific notices are found here. **It will be the responsibility of the bidder to check for updates.** Additionally, plans and specifications may be seen at the Project Engineer's office. Upon request, the Project Engineer will show the project site.

All questions concerning the plans shall be submitted via the Electronic Plans Distribution Center known as **Falcon**. All submitted questions will be forwarded by email to the Project Manager and the Project Engineer. Questions submitted within a period of 96 hours prior to the advertised time for the opening of bids, excluding Saturdays, Sundays, and any other legal holidays, may not be answered prior to bidding. Falcon may be accessed via the Internet at wwwsp.dotd.la.gov. From the home page, select ***BUSINESS Working With DOTD***, then select ***Project Letting Info***. On the Construction Letting Information page, select the link, ***DOTD Plans Room (Falcon)***; Login to Falcon (or request an ID if a first-time user). Once logged in, you will have access to view Project Information, submit a question concerning the project, and view the plans. To avoid any suggestion that a potential bidder is using the Falcon system to communicate with other potential bidders, DOTD will not post any question or any statement of fact or opinion not made for the purpose of seeking clarification of plans and/or specifications. Any non-questions posted on falcon will be limited to the statement of an issue considered unresolved by a previous DOTD response.

NOTICE TO CONTRACTORS (07/22)

Bidders assume the responsibility for accessing the Apparent Bid Results and final Bid Results on the Construction Letting Information web page located at wwwapps.dotd.la.gov/engineering/lettings/ to confirm whether they are the apparent low bidder for any given project and the specific due date of Form CS-6AAA. **Apparent Low Bidders on Disadvantaged Business Enterprises (DBE)/Small Business Element (SBE) Goal Projects shall comply fully with the "Required Contract Provisions for DBE/SBE Participation in Federal Aid Construction Contracts (DBE/SBE Goal Project)" contained in Section "F" of the Proposal; and, in accordance therewith, Apparent Low Bidders shall submit the completed Form CS-6AAA and Attachments to the LA DOTD Compliance Programs Office utilizing the list of DBE/SBE Certified Contractors as posted for this letting at:**

http://wwwapps.dotd.la.gov/engineering/lettings/construction.aspx.

The award of the contract will be electronically submitted to the successful low bidder on each project.

The U. S. Department of Transportation (DOT) operates a toll free "Hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., Eastern Time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should call 1-800-424-9071. All information will be treated confidentially and caller anonymity will be respected.

STATE PROJECT NO. H.012232
SPECIAL PROVISIONS

SPECIAL NOTICE TO CONTRACTORS: The Build America Buy America ("BABA") provisions of the Infrastructure Investment and Jobs Act (“IIJA”) as defined in PL 117-58, enacted on November 15, 2021, apply to this project.

S.P. GENERAL BIDDING REQUIREMENTS (11/16):

The specifications, contract and bonds governing the construction of the work are the 2016 Edition of the Louisiana Standard Specifications for Roads and Bridges, together with any supplementary specifications and special provisions attached to this proposal.

Bids shall be prepared and submitted in accordance with Section 102 of the Standard Specifications.

The plans herein referred to are the plans approved and marked with the project number, route and Parish, together with all standard or special designs that may be included in such plans.

The bidder declares that the only parties interested in this proposal as principals are those named herein; that this proposal is made without collusion or combination of any kind with any other person, firm, association, or corporation, or any member or officer thereof; that careful examination has been made of the site of the proposed work, the plans, Standard Specifications, supplementary specifications and special provisions above mentioned, and the form of contract and payment, performance, and retainage bond; that the bidder agrees, if this proposal is accepted, to provide all necessary machinery, tools, apparatus and other means of construction and will do all work and furnish all material specified in the contract, in the manner and time therein prescribed and in accordance with the requirements therein set forth; and agrees to accept as full compensation therefore, the amount of the summation of the products of the quantities of work and material incorporated in the completed project, as determined by the engineer, multiplied by the respective unit prices herein bid.

It is understood by the bidder that the quantities given in this proposal are a fair approximation of the amount of work to be done and that the sum of the products of the approximate quantities multiplied by the respective unit prices bid shall constitute gross sum bid, which sum shall be used in comparison of bids and awarding of the contract.

The bidder further agrees to perform all extra and force account work that may be required on the basis provided in the specifications.

The bidder further agrees that within 15 calendar days after the contract has been transmitted to him, he will execute the contract and furnish the Department satisfactory surety bonds.

If this proposal is accepted and the bidder fails to execute the contract and furnish bonds as above provided, the proposal guaranty shall become the property of the Department; otherwise, said proposal guaranty will be returned to the bidder; all in accordance with 103.04.

S.P. MANDATORY ELECTRONIC BIDS AND ELECTRONIC BID BONDS SUBMISSION (11/16):

This project requires mandatory electronic bidding. All Specifications, whether Standard, Supplemental or Special Provisions, are hereby amended to delete any references regarding paper bids and the ability to submit paper bid forms.

The contractor shall register online to be placed on the Louisiana Department of Transportation and Development (LA DOTD) prospective bidders list or for information only list.

Modifications to proposal documents will be posted on the Department's website at the following URL address: http://wwwapps.dotd.la.gov/engineering/lettings/.

LA DOTD shall not be responsible if the bidder cannot complete and submit a bid due to failure or incomplete delivery of the files submitted via the internet.

S.P. MANDATORY ELECTRONIC PAYROLL SUBMISSION (12/16):

This project requires mandatory submission of contractor payrolls using the AASHTOWare Civil Rights & Labor Software. All Specifications, whether Standard, Supplemental or Special Provisions, are hereby amended to delete any references regarding paper payrolls and the ability to submit such paper payroll forms.

S.P. DBE PARTICIPATION IN FEDERAL AID CONSTRUCTION CONTRACTS (11/16):

This project is a DBE goal project. In accordance with the Required Contract Provisions for DBE Participation in Federal Aid Construction Contracts elsewhere herein, the DBE goal for approved subcontracting work on this project is **ten (10) percent** of the total contract bid price. The contractor shall submit DOTD Form OMF-1A (Request to Sublet) and have it approved by the Department before any subcontract work is done on the project. Only those businesses certified by the Department as Disadvantaged Business Enterprises (DBEs) may be utilized in fulfillment of the DBE goal requirement. Such businesses are those certified by the Louisiana Unified Certification Program on the basis of ownership and control by persons found to be socially and economically disadvantaged in accordance with Section 8(a) of the Small Business Act, as amended and Title 49, Code of Federal Regulations, Part 26 (49 CFR 26).

S.P. PARTICIPATION IN JOB TRAINING (11/16):

If the contractor desires to participate in job training, as provided by Supplemental Specifications elsewhere herein, he/she shall submit a written request to the project engineer with a copy to the Compliance Program Section. According to the design formula, the number of potential trainees has been established as **seven (7)**. For the purposes of reimbursement, this number of trainees has been translated into an estimated **seven thousand (7,000)** trainee hours. The pay item for Trainee Reimbursement; will be established in the contract in accordance with the Supplemental Specifications for On-The-Job Training and the above hours.

Should the design formula not indicate that the contract could support training; a contractor may still train upon the approval of the Department.

S.P. BUILD AMERICA / BUY AMERICA PROVISIONS (01/23):

Section 106, Control of Materials, of the Standard Specifications for Roads and Bridges, 2016 Edition, is hereby amended to include the following:

Pursuant to the Build America Buy America ("BABA") provisions of the Infrastructure Investment and Jobs Act ("IIJA") enacted on November 15, 2021 (Pub. L. No. 117-58), all iron and steel materials (including the application of a coating), manufactured products manufactured in the United States and having the cost of the components greater than 55 percent of the total cost of all components of the manufactured product, as well as construction materials permanently installed in the project, shall be manufactured and produced in the United States, unless a waiver of these provisions is granted.

Contractor Certification and Certification Submission:

The apparent low bidder shall provide certification of intent to conform to BABA with their completed contract documents, through transmittal of a completed certification document. The certification document, "DOTD's Bidder's Build America, Buy America Certification Form", will be provided in the federal package with the other required federal documents, and shall be the only form acceptable for use in certification of intent to conform to BABA. The contractor shall provide a separate Certification Form from the supplier for each applicable material.

Waiver:

Minimal use of foreign steel and iron materials will be allowed without waiver provided the cost of these materials does not exceed 0.l percent of the total contract cost or $2,500, whichever is greater; however, the contractor shall make written request to the Chief Construction Division Engineer for permission to use such foreign materials and shall furnish a listing of the materials, their monetary value, and their origin and place of production.

Records Retention:

The contractor shall retain any and all records pertaining to or relating with the contractor's BABA certification and processes for a period of not less than five years after final acceptance of the construction project.

Inspection:

At the Department's sole discretion, the department shall have the right to inspect or audit any and all records pertaining to or relating with the contractor's BABA certification and processes.

For More Information on BABA:

More information may be found by going to FHWA website Made in America | US Department of Transportation and OMB M-22-11.

S.P. DEFINITIONS AND TERMS (DOTD Receives Bids) (12/21):

Subsection 101.03 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

Amended to include the following:

Contracting Agency. A city, levee board, police jury or other governing authority of a parish, state office, agency, board, commission, public corporation or other political subdivision of the State, in whose name the contract will be executed. Whenever the term "Department" is used as Owner, it shall mean the Contracting Agency. Whenever the term "Department" is used as Engineer, it shall mean the Engineer.

Construction Engineer. Whenever the term “Chief Construction Engineer” is used, it shall mean Construction Engineer.

Geotechnical Data Report. Includes a description of the subsurface soil investigations performed, field investigation logs, and results of laboratory and field test measurements.

Definitions ‘Bidding Documents’ and ‘Contract’ are deleted and replaced with the following:

Bidding Documents. The advertisement, plans, specifications, bid forms, bidding instructions, addenda, special provisions, Geotechnical Data Report, and all other written instruments prepared by or on behalf of the Department for use by bidders.

Contract. The written agreement between the Department and the contractor setting forth obligations of the parties thereunder for performance of the prescribed work.

The contract documents include the advertisement, bid forms, contract form, payment/performance/retainage bond form, standard specifications, supplemental specifications, special provisions, plans, standard plans, change orders/special agreements, supplemental agreements, Geotechnical Data Report, and other documents referenced therein that are required to complete the work in an acceptable manner, and contract time, including authorized extensions thereof, all of which constitute one instrument.

'2. Supplemental Specifications' of definition 'Specifications' is deleted and replaced with the following:

2. Supplemental Specifications: Approved additions and revisions to the Standard Specifications, and included in all Department Contracts. The supplemental specifications book can be found on the DOTD internet page at 2016 Supplemental Specifications Book.

S.P. CONTRACTORS' LICENSING LAWS (ITS) (12/17):

Subsection 102.02 is hereby amended to include the following:

The successful bidder, or subcontractor, will be required to possess a Louisiana contractor's license from the Louisiana State Licensing Board for Contractors in each of the following specialty classifications:

a. Highway, Street and Bridge Construction
b. Electrical Work (Statewide)
c. Specialty: Telecommunications

S.P. Contents of Bidding Documents (08/22)

Section 102 of the 2016 Louisiana Standard Specifications for Roads and Bridges are amended as follows:

Paragraph 4 of 102.03, is deleted and replaced with the following:

All manufacturers and products shall comply with the requirements of the plans, specifications, and the contract documents by meeting or exceeding the specified requirements. Unless explicitly stated otherwise in the contract, when the name of a certain brand, make, manufacturer, product, or definite specifications limit the manufacturer, product, or source to a single manufacturer, product, or source, that specification sets forth and conveys to prospective bidders the general, minimally acceptable style, type, character, quality and salient performance criteria of the manufacturer, product, or source specified in the contract and shall not restrict bidders to the brand, make, manufacturer, or product specified by the Department in the contract. The specified manufacturer, product, or source shall be a minimum standard by which substitute manufacturers, products, or sources will be compared to determine if the substitute manufacturer, product, or source will be approved for substitution by meeting or exceeding the general style, type, character, quality and salient performance criteria required in the contract. Bidders are informed that potential suppliers for buildings, plants, and related facilities may, but are not

required, to get prior approval from the prime design professional for products not specified in the contract documents. If a potential supplier submits a request for prior approval by the prime design professional, the potential supplier must do so through Falcon no later than seven working days prior to the opening of bids. The prime design professional must furnish, within three days, excluding holidays and weekends, after the potential supplier submits the product for prior approval, written approval or denial of the submitted product to the public entity or the Department and to the potential supplier. If the prime design professional fails to respond in writing within three days of submission of the product for prior approval, the submitted product will be approved. When the Department specifies a particular manufacturer, product, or source in the contract for bridges, highways, streets, or roads, substitute manufacturers, products, or source performance data not specified in the contract must be submitted to the Chief Engineer through Falcon for prior approval no later than seven working days prior to the opening of bids. The Chief Engineer will approve or deny the submitted substitute manufacturer, product, or source performance data within three days, exclusive of holidays and weekends, of the submission. If a manufacturer, product, or source sought to be used as a substitute for the Department's specified manufacturer, product, or source is not submitted prior to the opening of bids, the Department has the right to require the manufacturer, product, or source specified in the contract. Submission of a substitute manufacturer, product, or source performance data after the seven-day period prior to the opening of bids may only be allowed at the sole discretion of the Chief Engineer pursuant to 105.01.

S.P. INTENT OF CONTRACT (11/16):

Subsection 104.01, Intent of Contract, is amended to include the following.

104.01.1 Covenant of Good Faith and Fair Dealing.

This contract imposes an obligation of good faith and fair dealing in its performance and enforcement.

The contractor and the Department agree from the beginning to focus on creative cooperation, to avoid adverse confrontation, and to foster mutual respect, along with a positive commitment to honesty and integrity, and agree to the following mutual duties.

1. Each will function within the laws and statutes applicable to their duties and responsibilities.
2. Each will communicate in an open and candid manner.
3. Each will assist in the other's performance.
4. Each will avoid hindering the other's performance.
5. Each will proceed to fulfill its obligations diligently.

6. Each will cooperate in the common endeavor of the contract.

104.01.2 Voluntary Partnering.

The Louisiana Department of Transportation and Development intends to encourage the foundation of a cohesive partnership with the contractor and its principal subcontractors and suppliers. This partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objective is a cooperative approach to contract management that will reduce costs, litigation, and "stress" while completing the project in accordance with the plans and specifications.

This partnership will be bilateral in makeup, and participation in partnering will be totally voluntary and is not a requirement of the contract.

A partnering conference is to be implemented and held prior to beginning construction. The contractor's management personnel and the Project Engineer will initiate a partnering development conference. They, working with the assistance of the District Construction Engineer, will make arrangements to determine the facilitator, the attendees at the conference, agenda of the conference, duration, and location. Persons required to be in attendance will be the Project Engineer and key project personnel; the contractor's on-site project manager and key project supervision personnel of both the prime and principal subcontractors and suppliers. The project design engineers, FHWA, key company representatives, and key local government personnel will also be invited to attend as necessary. The contractor and DOTD will also be required to have Regional/District and Corporate/State level managers on the project team.

Any cost associated with effectuating this partnering will be agreed to by both parties and will be shared equally and will be paid for in accordance with Subsection 109.04. The contractor, DOTD, FHWA and all others invited to the partnering conference will be responsible for any expenses incurred by their respective employees which includes salaries, travel, and lodging.

Follow-up conferences may be held periodically throughout the duration of the contract as agreed by the contractor and the DOTD.

The establishment of a partnership charter on a project will not change the legal relationship of the parties to the contract nor relieve either party from any of the terms of the contract. This partnership charter is intended only to establish an environment of cooperation and communication between all parties involved with the completion of the project.

S.P. Maintenance of Traffic (08-22)

Section 104.03 of the 2016 *Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

104.03 is deleted and replaced with the following:

104.03 MAINTENANCE OF TRAFFIC.

The contractor shall provide for and maintain through and local traffic at all times and shall conduct his operations in such manner as to cause the least possible interference with traffic at junctions with roads, streets and driveways in accordance with Section 402, unless otherwise noted in plans or special provisions.

The contractor shall keep the portion of the project being used by public traffic, whether through or local traffic, in such condition that traffic (including mail delivery) will be adequately accommodated. The contractor shall furnish, erect and maintain barricades, warning signs and delineators, and shall provide flaggers and pilot cars in accordance with the plans and the MUTCD. The contractor shall maintain existing drainage and also provide and maintain in a safe condition all temporary approaches or crossings, intersections with roads, streets, businesses, parking lots, residences, garages and farms, at no direct pay.

The roadway and shoulders shall remain open to traffic during non-work periods unless allowed in the contract documents or previously approved by the Engineer. Do not store material or park equipment on roadway shoulders adjacent to lanes that are open to traffic.

When the engineer directs additional measures for the benefit of the traveling public, payment to the contractor will be made at the contract unit prices in the contract or as provided in 109.04. The engineer will be the judge of work to be classed as additional measures.

All lane, ramp, full roadway, and other roadway component closures shall be authorized by the engineer in accordance with the time frames described herein unless a shorter notification is allowed by the engineer. Unless otherwise authorized, closures will only be allowed while work is being performed. The contractor shall provide the engineer a 7 calendar day notice, prior to any lane, ramp, or other roadway component closure. The contractor shall provide the engineer a 14 calendar day notice, prior to any full roadway closure.

A late opening rental will be charged to the contractor for any closure that extends beyond the allowed closure times. The rental will also apply to any unauthorized closures by the contractor, whether short term or long term. The rental shall be computed in hourly increments only, with fractions of an hour rounded up to the next whole hour. Any rental monies assessed for a late opening or for an unauthorized closure will be deducted from payments due the contractor. The late opening rental or unauthorized closure rental will be in accordance with Table 104-1 for a maximum of four continuous hours per day per lane until late or unauthorized closures are no longer in place.

Table 104-1
Unauthorized Closure or Late Opening Rental

Current Average Daily Traffic (Vehicles per Day) stated in contract	Hourly Rate ($/Hour) per lane
<10,000	250
10,000 - 20,000	1,250
20,000 - 35,000	5,000
35,000 - 50,000	11,500
>50,000	15,000

Conduct paving operations on one side of the roadway at a time. The side of the roadway, including shoulder, that is open to traffic shall be clear at all times.

When pavement layers are 2 inches or less, paving will be permitted in one lane for a full day; the adjacent lane shall be paved the following workday.

When pavement layers are greater than 2 inches thickness, a wedged joint shall be used. Paving will be permitted in one lane for a full day; the adjacent lane shall be paved the following day or place approximately 1/2 of each day's production in one lane and the remainder in the adjacent lane.

All asphalt concrete pavement new construction, overlays, and shoulder surfacing operations open to traffic shall be conducted in accordance with the following requirements:

1. Shoulder Subgrade Preparation: Any required embankment widening shall be completed before placement of the asphalt concrete overlay. All vegetation shall be removed from existing shoulders before beginning temporary or final shoulder construction. When a shoulder wedge is required, the contractor shall blade and shape existing material to form a uniform surface for the placement of the wedge prior to placement of the asphalt concrete overlay.

2. Blading and Shaping of Material Adjacent to Pavement: Blading and shaping material adjacent to pavement described herein shall be completed at the end of each day's operations for all asphalt concrete courses. There shall be no drop-off from the pavement edge to the adjacent shoulder or foreslope. The contractor shall blade and shape existing material against, and approximately level with, the top of the pavement surfacing to form a uniform slope from the pavement edge to the adjacent existing shoulder, or to a point 10 feet from the pavement edge. If existing materials are insufficient, the contractor shall furnish, place, and shape additional materials to form the required tie-in or temporary shoulder. Permanent materials and procedures shall be in accordance with contract documents. Existing and/or additional materials placed temporarily shall be to the satisfaction of the Engineer. Compaction shall be by approved methods.

No direct payment will be made for temporary work; payment for permanent materials will be made using the appropriate pay items when additional materials are needed.

S.P. GUARANTEE AND WARRANTY OF CONTRACTOR'S WORK (02-21):

Paragraph 5 of 104.05 of the 2016 *Standard Specifications for Roads and Bridges* is deleted and replaced with the following:

The term of this guarantee and warranty is 3 years after final acceptance, except for National Highway System (NHS) routes. For NHS routes, the guarantee period and warranty term will be 1 year from final acceptance.

S.P. Maintenance During Construction (03-22):

Section 105 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

105.15 is deleted and replaced with the following:

105.15 MAINTENANCE DURING CONSTRUCTION.

The contractor shall satisfactorily maintain the entire area within the project, from the effective date of the Notice to Proceed until the date of final acceptance. This maintenance responsibility includes, but is not necessarily limited to, maintaining drainage, periodic mowing (not to exceed four times per calendar year) and removing of debris and remains, to the satisfaction of the engineer, as well as such striping, patching and shoulder maintenance which will provide safe and convenient conditions at all times for the public. The contractor shall continuously and effectively satisfy his maintenance responsibilities with such equipment and forces as may be necessary to maintain a safe and satisfactory condition for the duration of the project.

All adjacent and parallel roadways within the project limits which are affected by construction shall be the maintenance responsibility of the contractor.

The contractor shall maintain the roadway in a satisfactory condition to allow traffic to safely travel through the work zone at the posted speed limit.

When no item exists for temporary drainage, the cost of temporary drainage, including the cost of installation, maintenance, and removal of temporary drainage structures, shall be included in the contractor's original bid as incidental work not measured for payment in accordance with 102.05.

S.P. REQUESTS AND CLAIMS FOR ADDITIONAL COMPENSATION (04-19):

Section 105.18 of the 2016 Louisiana Standard Specification for Roads and Bridges is deleted and replaced with the following:

105.18 REQUEST AND CLAIMS FOR ADDITIONAL COMPENSATION.

If the contractor deems additional compensation is due for work, material, delays, inefficiencies, disruptions or other additional costs or expenses reportedly not covered in the contract or not ordered as extra work, the contractor shall notify the engineer in writing of his intention to make a claim for such additional compensation before beginning the work on which the claim is based or immediately upon encountering the conditions or effects which the contractor claims entitle him to additional compensation. Notification of a request or claim for compensation shall conform to the requirements of EDSM III.1.1.28, Contract Disputes and Requests for Additional Compensation. Notification must be timely given. The engineer must be afforded a reasonable opportunity and proper facilities by the contractor for keeping account of actual costs incurred by the contractor related to the claim. However, such notice by the contractor and the fact that the engineer has kept account of the costs as aforesaid shall not be construed as proving or substantiating

the validity of any claim. Within thirty calendar days after the completion of the event that caused the claim, contractor must submit its sworn Request for Additional Compensation in accordance with the requirements of EDSM III.1.1.28, Contract Disputes and Requests for Additional Compensation.

If notification and a Request for Additional Compensation is not given or the engineer is not afforded proper facilities by the contractor for keeping an account of actual costs incurred by the contractor, the contractor hereby agrees and shall waive any claim for such additional compensation.

If the claim, after consideration by the Chief Engineer, or judicial determination, is found to be just, payment will be made as specified in 109.04, by force account or negotiated price. Nothing in this subsection shall be construed as establishing any claim contrary to 104.02.

S.P. Laws to be Observed (07-21)

Section 107 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

107.01 is amended to include the following:

The contractor shall comply with any subpoena issued by the Louisiana Legislature or any of its committees pursuant to L.R.S. 48:252(I).

S.P. PERMITS, LICENSES, TAXES AND INSURANCE (03/21):

Section 107 of the Standard Specifications is amended as follows.

107.02, Permits, Licenses, Taxes and Insurance is deleted and replaced with the following.

107.02 PERMITS, LICENSES, TAXES AND INSURANCE.

Contractors shall procure temporary permits and licenses for the work, pay charges, fees, and taxes, and give notices necessary to due and lawful prosecution of the work. Contractor, and its subcontractors, shall maintain all licenses and certificates necessary to accomplish the work in accordance with the contract requirements and applicable law.

The contractor shall maintain, at a minimum, the following insurance coverage until final acceptance of the contract.

1. Workers Compensation in compliance with state law, with the exception that the contractor's Employer liability is to be at least $1,000,000 when work is to be over water and involves maritime exposures. For the coverage provided in this subpart the contractor's Insurer will have no right of recovery or subrogation against the State of Louisiana, the Louisiana Department of Transportation and Development, or *the* ***City of Baton Rouge-Parish of East Baton Rouge.***
2. Commercial General Liability Insurance with a combined single limit per occurrence for bodily injury and property damage. The aggregate loss limit must be on a per project basis. This insurance shall include coverage for bodily injury and property damage, and include coverage for Premises-Operation; Broad form Contractual Liability; Products and Completed Operation; Use of Contractors and Subcontractors; Personal Injury; Broad form Property Damage; and Explosion, Collapse and Underground (XCU) coverage. The required combined single limit amount of insurance shall be as provided in Table 107-1.
3. A separate Owner's and Contractor's Protective Liability (OCP) Policy shall be furnished by the contractor naming the Louisiana Department of Transportation and Development and *the* ***City of Baton Rouge-Parish of East Baton Rouge*** as the named insured. The required combined single OCP limit amount shall be as provided in Table 107-1.
4. Business Automobile Liability Insurance with a combined single limit per occurrence for bodily injury and property damage. This insurance shall include bodily injury and property damage coverage for owned automobiles, hired automobiles and non-owned automobiles. The required combined single limit amount of insurance shall be as provided in Table 107-1 below.

Table 107-01
Insurance Requirements
($ in millions)

Initial Contract Amount	Occurrence Minimum	Aggregate	Ultrahazardous Aggregate
Up to $1	$1	$2	$3
From >$1 to $2	$2	$4	$6
Over $2	$5	$10	$15

Aggregate coverage for projects with ultrahazardous activities shall be triple the occurrence minimum. Ultrahazardous activities include pile driving; transportation, use, storage, or removal of explosives, radioactive materials, or particularly hazardous or volatile chemicals; and asbestos or lead paint abatement; but does not include vibratory installation of sheet piles.

Each policy shall include provisions stipulating that the insurance company(ies) shall have no recourse against the State of Louisiana, and the Department, or *the **City of Baton Rouge-Parish of East Baton Rouge*** for payment of any premiums or for assessments under any form of the policy and that any and all deductibles in the above described insurance policy (ies) shall be assumed by and be at the sole risk of the contractor.

Insurance is to be placed with insurance companies authorized in the State of Louisiana with an A. M. Best's rating of A-: VI or higher. This rating requirement may be waived for Workers Compensation coverage only.

Should any policies be canceled, the contractor shall immediately notify the Department and *the **City of Baton Rouge-Parish of East Baton Rouge.***

Upon failure of the contractor to furnish, deliver and maintain such insurance for itself as required, this contract, at the election of the Department and *the **City of Baton Rouge-Parish of East Baton Rouge***, may be immediately declared suspended, discontinued or terminated. Upon failure of the contractor to maintain OCP insurance at any time prior to final acceptance of the project, work on this contract shall be immediately suspended until proof of such insurance is presented to, and accepted by the Department's Project Control unit and *the **City of Baton Rouge-Parish of East Baton Rouge***. During a suspension caused by the lack of any required insurance, contractual time charges will continue to be assessed against contract time, as will any assessment of stipulated damages, without interruption.

Failure of the contractor to maintain any required insurance shall not relieve the contractor from any liability under the contract, nor shall the insurance requirements be construed to conflict with the obligations of the contractor concerning indemnification under 107.17.

The contractor is responsible for requiring and verifying that all subcontractors working on the project maintain appropriate types and levels of insurance coverage.

This contract does not authorize or appoint contractor as an agent or mandatory of the Department, or of the State of Louisiana, or of *the **City of Baton Rouge-Parish of East Baton Rouge***. Accordingly, the contractor is subject to and responsible for all taxes incurred in the performance of its contractual obligations.

107.02.1 Reimbursement of OCP Insurance:

Contractor may submit the direct cost of OCP insurance (only) to the Department for reimbursement. The provisions of 109.04 shall not apply to this reimbursement. The cost of all other required insurance must be included in contractor's overhead applied to all other bid items.

The Department will reimburse the actual cost of OCP coverage, with no allowed mark-up, as shown on an invoice produced by the insurance provider. Contractor must also submit an original sworn affidavit from the insurance producer/agent in which that person attests that the submitted invoice is for the required OCP coverage only, and that the invoice accurately reports the cost to contractor of that coverage. The invoice and affidavit may be submitted at the preconstruction conference or thereafter for inclusion with a partial estimate.

There will be no reimbursement for any purchase of OCP insurance policy extensions necessitated by concurrent; non-excusable; or excusable, non-compensable delays in completion of the project, whenever such delays occur, or for claimed utility delays where such days were not added to Contract Time by change order. Any policy extensions necessitated by excusable, compensable delays will be reimbursed on a pro-rata monthly basis.

S.P. PUBLIC CONVENIENCE AND SAFETY (06/20):

Subsection 107.07 of the 2016 Standard Specifications for Roads and Bridges is amended to include the following:

The project engineer shall determine the need for police officers to assist in controlling traffic in a particular work zone. The number of officers needed, the tasks they will perform, and their location within the work zone will vary as a function of the zone type. Police officers shall be placed at strategic locations at times during construction as determined by the Department project engineer. To be eligible to assist in controlling traffic, a police officer must complete the DOTD class Work Zone Traffic Control for Law Enforcement Personnel. The class shall be taken at least every four years.

The three types of law enforcement services are Police Presence, Police Enforcement and Police Traffic Control.

Police Presence is defined as the use of police officers at the beginning of the active work zone area utilizing their blue lights to gain the attention of drivers. The presence officer will only be used if the following criteria exist:

a. On multi-lane divided highways (interstates, etc.) where the posted speed limit is 50 mph and greater,
b. When there is a lane closure, and
c. If the Project Engineer anticipates a queue.

If all three of the above conditions do not exist, the Department does not consider a Presence officer to be necessary and will not reimburse the contractor for it.

Police Enforcement is utilized when enforcement is required to enhance the safe operation of the work zone.

Police Traffic Control is to be used in detour / diversion situations.

The Department project engineer will extend an invitation to the appropriate Louisiana State Police (LSP) Troop Commander or the local law enforcement authority to attend the pre-construction conference.

Prior to commencing the work on the project, the contractor shall contact the LSP Troop Commander or the local law enforcement authorities to obtain law enforcement services of police officers during construction.

Police officers will report directly to the contractor. However, the contractor will not have the authority to direct the placement of the police officer or the patrol vehicle in situations that are contrary to established procedures and/or could endanger the police officer. The project engineer will make the final determination on all issues regarding police officer responsibility in work zones.

Prior to the beginning of the shift, the contractor shall provide a daily work zone briefing to the police officer. For major changes in traffic patterns, advanced notification shall be provided to the police agency working the detail. This information should also be provided to the motoring public through the Department district and/or the law enforcement authority used for Work Zone Traffic Control.

The contractor shall pay for law enforcement services provided by the police officers based on the hourly wage and vehicle rate fee schedule below. The Department will reimburse the contractor monthly for the incurred cost. The contractor shall furnish time record documentation with the request for reimbursement. In lieu of the provisions of Subsection 109.04, the contractor will be paid a 10 percent mark-up on the costs described below.

The agreed upon fee schedule for police officers in the work zone is the rate the law enforcement authority charges for off-duty contract details up to an hourly rate of $40.00 per hour (maximum) per officer (one officer per vehicle), with a minimum of two hours. This rate shall be paid per the individual police agency department policy up to the $40.00 per hour maximum. In addition, the agreed upon vehicle use fee is $25.00 per vehicle per day, if the individual police agency department has a policy for vehicle use. The exceptions to the above rates are found at http://wwwsp.dotd.la.gov/Business/Pages/Construction_Services.aspx.

S.P. NAVIGABLE WATERS AND WETLANDS (11/16):

Subsection 107.09 of the Standard Specifications is amended to include the following.

In accordance with the provisions of this Subsection, the Department has obtained the required U.S. Army Corps of Engineers (Nationwide) permit.

Bidders shall comply with the permit requirements. Bidders may view permit(s) online via the Department's FALCON system, or obtain a copy by contacting the Department's Environmental Section at (225) 379-1317.

S.P. ENVIRONMENTAL PROTECTION (11/16):

DESCRIPTION.

This work consists of constructing and maintaining temporary erosion control features that satisfy the terms and conditions of the SWPPP (Storm Water Pollution Prevention Plan) and the NPDES (National Pollution Discharge Elimination System General Permit). In addition, the contractor shall obtain and maintain a LPDES (Louisiana Pollution Discharge Elimination System) NOI (Notice of Intent) to Discharge Storm Water Associated with Construction Activity Greater than 5 Acres for the life of the project. The work also shall be in accordance with the plans, the 2016 Louisiana Standard Specifications for Roads and Bridges, this specification, and as directed.

MATERIALS.

The SWPPP shall be in accordance with Section 204 of the standard specifications.

RESPONSIBILITIES.

Devise a satisfactory SWPPP for the project prior to applying for the Storm Water General Permit for Construction Activities. Complete and submit to the Project Engineer for approval, the NOI TO DISCHARGE STORM WATER ASSOCIATED WITH CONSTRUCTION ACTIVITY application at least two days prior to the initiation of construction. Send the application to:

STATE OF LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Office of Environmental Services
Attn: Permits Division
Post Office Box 4318
Baton Rouge, Louisiana 70821-4313

All implementation duties to comply with the SWPPP and maintain the Storm Water General Permit will be the responsibility of the contractor.

Submit a NOT (Notice of Termination) to the Louisiana Department of Environmental Quality upon acceptance of the project by the Department.

MEASUREMENT AND PAYMENT.

No separate payment will be made for obtaining and maintaining the necessary permits; design of the SWPPP (Storm Water Pollution Prevention Plan) including all labor, equipment or materials required for the implementation of the SWPPP. Measurement and payment for the installation and maintenance of the Temporary Erosion Control items will be in accordance with Section 204, Temporary Erosion Control.

S.P. DAMAGE CLAIMS (11/16):

Subsection 107.17 of the 2016 Standard Specifications is amended as follows.

The contractor shall indemnify both the Department and the Contracting Agency, their officers and their employees from all suits, actions or claims as provided by this subsection.

S.P. Fiber Optic Cable Splicing Agreements (08/20)

Section 107 of the Louisiana Standard Specification for Roads and Bridges is amended as follows:

Subsection 107.28 is added and includes the following:

107.28 Fiber Optic Cable Splicing Agreements

It is the Contractor’s responsibility to notify the utility’s duly designated representative in order to coordinate fiber optic splicing work to be performed by the utility for the Contractor. Work shall be performed only to the extent as previously approved by formal agreement between the Department and the utility.

The Contractor will be required to reimburse the utility for the cost of all services performed by the utility for the Contractor and furnish documentation of utility invoices and evidence of payment before reimbursement.

The Department shall reimburse the Contractor for the work by change order with no contractor mark-up allowed.

S.P. SUBLETTING OF CONTRACT (11/16):

In accordance with 108.01 of the Standard Specifications, the following items are designated as "Specialty Items":

202-02-05000 Removal of Building (26,500 SQFT Structure Near Sta. 161+50, Rt.)
703-01-00100 Shoulder Underdrain Systems
719-01-01080 Plants (Tree) (Balled and Burlapped) (3 inch cal) (Live Oak)
719-01-01080 Plants (Tree) (Balled and Burlapped) (3 inch cal) (Nutall Oak)
719-01-01080 Plants (Tree) (Balled and Burlapped) (3 inch cal) (Sweetbay Magnolia)
719-01-01080 Plants (Tree) (Balled and Burlapped) (3 inch cal) (Wilow Oak)
729-01-00100 Sign (Type A)
729-01-00101 Sign (Type A)(Install)
729-04-00100 Sign (Type D)
729-06-00100 Sign (Overhead Mounted)
729-08-00100 Mounting (2 1/2" Size Post)
729-08-00200 Mounting (3 1/2" Size Post)
729-08-00600 Mounting (W6 x 12 Size Post)
729-08-00700 Mounting (W8 x 18 Size Post)
729-13-00100 Mounting (Bridge Fascia Mounted)
729-22-00100 Square Tubing Post with 2-1/4" Anchor
731-02-00100 Reflectorized Raised Pavement Markers
732-01-02080 Plastic Pavement Striping (24" Width) (Thermoplastic 125 mil)
732-02-02000 Plastic Pavement Striping (Solid Line) (4" Width) (Thermoplastic 90 mil)
732-02-02040 Plastic Pavement Striping (Solid Line) (8" Width) (Thermoplastic 90 mil)
732-03-02000 Plastic Pavement Striping (Broken Line) (4" Width) (Thermoplastic 90 mil)
732-03-02010 Plastic Pavement Striping (Dotted Line)(4" W)(2' L)(Thermo 90 mil)
732-03-02030 Plastic Pavement Striping (Dotted Line)(8" W)(2' L)(Thermo 90 mil)
732-04-01020 Plastic Pavement Legends and Symbols (Arrow - Straight)
732-04-01040 Plastic Pavement Legends and Symbols (Arrow - Double)
732-04-01080 Plastic Pavement Legends and Symbols (Arrow - Left Turn)
732-04-01100 Plastic Pavement Legends and Symbols (Arrow - Right Turn)
732-04-15020 Plastic Pavement Legends and Symbols (ONLY)
732-05-00100 Removal of Existing Markings
736-01-00100 Trenching and Backfilling
736-03-00100 Jacking or Boring for Conduit
736-04-00001 Signal Pole (Pedestal Pole)
736-05-30000 Signal Heads (3 Section, 12 inch Led Lens, R, Y, G)EACH 20

736-05-31001 Signal Heads (3 Sec, 12 inch Led Lens, LT. R, LT. Y, LT. G)
736-05-35001 Signal Heads (3 Sec, 12 inch Led Lens, RT. R, RT. Y, RT. G)
736-05-41000 Signal Heads (4 Section, 12" Led Lens, R, Y, LT. G, G)
736-05-55000 Signal Heads (5 Section, 12 inch Led Lens, R, Y, RT. Y, G, RT. G)
736-06-00100 Signal Service
736-06-00300 Signal Service with Separate Disconnect for Street Lights
736-06-00500 Signal Service Pedestal Disconnect
736-08-00102 Signal Controller (980 ATC, Type 2)(Furnish & Install)
736-10-00200 Underground Junction Box (Type E)
736-10-00300 Underground Junction Box (Type F)
736-10-00400 Underground Junction Box (Type G)
736-10-00600 Underground Junction Box (Type I)
736-10-00700 Underground Junction Box (Type J)
736-11-00200 Conduit (2" HDPE, Schedule 80)
736-11-00300 Conduit (3" HDPE, Schedule 80)
736-12-02006 Conductor (2c, #6 awg)
736-12-02014 Conductor (2c, #14 awg)
736-12-03006 Conductor (3c, 6 gauge / #6 awg)
736-12-06014 Conductor (6c, #14 awg)
736-12-10014 Conductor (10c, #14 awg)
736-15-02400 Signal Support (Foundation, 24 inch Minimum Diameter)
736-21-00000 LED Pedestrian Countdown Signal Head
737-05-00002 Painted Curbs
822-01-00100 Trenching and Backfilling
822-02-00300 Conduit w Conductors (PVC/HDPE) (1-1/4") (3#8 AWG XHHW-2 Conductors, 1#8 Bare Stranded Ground) (Underground)
822-02-00400 Conduit w Conductors (PVC/HDPE) (1-1/2") (3#4 AWG XHHW-2 Conductors, 1#4 Bare Stranded Ground) (Underground)
822-02-00500 Conduit w Conductors (PVC/HDPE) (2") 3#2 AWG XHHW-2 Conductors, 1#2 Bare Stranded Ground) (Underground)
822-02-00600 Conduit w Conductors (PVC/HDPE) (2-1/2") (3#1/0 AWG XHHW-2 Conductors) (Underground)
822-02-02300 Conduit w Conductors (Rigid Galv Steel) (1-1/4") (3#8 AWG XHHW-2 Conductors, 1#8 Bare Stranded Ground) (On Structure)
822-02-02500 Conduit w Conductors (Rigid Galv Steel) (2") (3#1/0 AWG XHHW-2 Conductors, 1#2 Green Ground) (On Structure)
822-02-02500 Conduit w Conductors (Rigid Galv Steel) (2") (3#2 AWG XHHW-2 Conductors, 1#2 Bare Stranded Ground) (On Structure)

822-02-02600 Conduit w Conductors (Rigid Galv Steel) (2-1/2") (3#1/0 AWG XHHW-2 Conductors) (On Structure)
822-04-00200 Jacked or Bored Casing (6" Dia) (PVC/HDPE)
822-05-02100 Light Pole (Aluminum, 35 Foot Mnt. Ht., 8' Single Truss Arm, Aluminum Break. Trans. Base, Conc. Drill Shaft, Conc. Mowing Apron)
822-07-02800 Luminaire (Lowmast, 180 Watt LED, 120 Volt, IES Medium, Cutoff, Type II Roadway Distribution, Single Fusing, UL Listed Grey)
822-08-00200 Electrical Service Point (Structure)
822-15-02100 Relocate Light Poles
822-16-00100 Underground Junction Box (12" x 12")
822-16-00300 Underground Junction Box (13" x 24")
822-16-00400 Underground Junction Box (17" x 30")
822-16-00400 Underground Junction Box (30" x 30")
822-19-00100 Modular Breakaway Cable System
822-20-00100 Disconnect (Service) (Fused)
822-21-00100 Duct Marker (Concrete)
822-22-00300 Underground Marker Tape (6")(Detectable)
NS-736-00001 GPS
NS-736-00003 Managed Ethernet Switch
NS-736-00130 TS-2 Traffic Signal Cabinet (Ground Mounted)
NS-736-00133 Battery Back-up System for Traffic Signals
NS-736-00135 2-Wire Accessible Pedestrian Pushbutton Detectors
NS-736-00136 2-Wire Accessible Pedestrian Pushbutton Cabinet Control
NS-DEV-73280 MMA Pavement Marking (Green Bike Lanes/Bike Boxes)
NS-ITS-01121 CCTV Camera Assembly, Furnish and Install with PTZ, Digital
NS-ITS-04020 Fiber Optic Cable, SM, Furnish & Install, 13-48 Fibers
NS-ITS-04035 Fiber Optic Fan Out Kits, SM, 12 Strand, Furnish & Install
NS-ITS-04180 Fiber Optic Connection, Install, Splice
NS-ITS-04200 Fiber Optic Connection, Termination, Furnish & Install
NS-ITS-04250 Fiber Optic Drop Cable, SM, 12 Strand, Furnish & Install
NS-ITS-04290 Fiber Optic Patch Cord, SM, 2 Strand, Furnish & Install
NS-ITS-04360 Fiber Optic Connection Splice Tray, Furnish & Install
NS-ITS-04425 Fiber Optic Connection Patch Panel, Outdoor, Furnish & Install
NS-ITS-05025 Splice Closure, Outdoor, Furnish & Install
NS-ITS-12000 Communications System Integration
NS-ITS-13200 As-Builts
TS-203-00006 Exploratory Excavation for Traffic Signal Foundation
TS-736-10300 Signal Support (Mast Arm Standard w/ 30 ft arm)
TS-736-10450 Signal Support (Mast Arm Standard w/ 45 ft arm)
TS-736-10500 Signal Support (Mast Arm Standard w/ 50 ft arm)

TS-736-10550 Signal Support (Mast Arm Standard w/ 55 ft arm)
TS-736-10600 Signal Support (Mast Arm Standard w/ 60 ft arm)
TS-736-10700 Signal Support (Mast Arm Standard w/ 70 ft arm)
TS-736-11250 Additional Mast Arm (25 ft. arm)
TS-736-11350 Additional Mast Arm (35 ft. arm)
TS-736-11450 Additional Mast Arm (45 ft. arm)
TS-736-12008 Luminaire Arm w/LED Luminaire (8 ft. arm)
TS-736-15002 GPS Based Traffic Signal Preemption System (With Existing Fiber Communication)
TS-736-36200 Video Detection System (6 Camera System)
TS-736-36200 Video Detection System (7 Camera System)
TS-742-60010 Fittings
TS-742-60011 Air Release/Vacuum Valve (2")
TS-742-60012 Unrestrained Joint Sewer Force Main (16")
TS-742-60013 Restrained Joint Sewer Force Main (16")
TS-742-60014 24" Jacked and Bored Casing Pipe Including Carrier Pipe

S.P. PROGRESS AND DISQUALIFICATION (10/18):

Part (a) of the third paragraph of 108.04.2 is deleted and replaced by the following:

(a) its progress on one project, which is either a calendar day project with greater than or equal to 60 calendar days or is a working day project with greater than or equal to 45 working days, is 50 percent or more behind the elapsed contract time. In such case, the contractor shall remain disqualified until progress is within 10 percent of the elapsed contract time. Or,

S.P. DETERMINATION AND EXTENSION OF CONTRACT TIME (CALENDAR DAY) (06-21):

Subsection 108.07, Determination and Extension of Contract Time, is amended to include the following:

108.07 is deleted and replaced with the following:

108.07 DETERMINATION AND EXTENSION OF CONTRACT TIME

The number of days allowed for completion of the work will be stated in the contract.

When the contract time is a fixed calendar date, it shall be the date on which all work on the project shall be completed.

The contract time for the work as awarded is based on the original quantities as defined in 102.05 and includes time to procure material, equipment and an adequate labor force to complete the work. If satisfactory fulfillment of the contract requires performance of work in greater quantities than those specified, or requires performance of extra work in accordance with 104.02 and the contractor requests additional contract time, the document authorizing or ordering alterations will show the number of additional days justified.

If the contractor finds it impossible, for reasons beyond the contractor's control, to complete the work within the contract time as specified or as extended in accordance with the provisions of this subsection, the contractor shall, at the time the delay occurs make written request to the engineer for an extension of time setting forth therein the reasons which justify granting the request. Such written request shall include an explanation of circumstances where delays resulted from action or inaction of the Department, plan errors, disagreements with the Department's interpretation of the plans and specifications, or other verifiable causes. Submit an adjusted project schedule demonstrating the impact on contract time. The adjusted schedule must include all previously approved extensions of contract time. If the request does not so conform, the contractor hereby agrees to and shall be deemed to have expressly waived any claim for such additional time. The contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the engineer finds that the work was delayed because of conditions beyond the control and without the fault of the contractor, the engineer may extend the contract time in such amount as conditions justify.

Upon satisfactory final inspection, daily time charges will cease.

The contractor shall document for each month of scheduled construction, the occurrence of adverse weather conditions having an impact on controlling items of work. An adverse weather day is a previously scheduled or normally scheduled work day on which rainfall, wet conditions or cold weather will prevent construction operations on the controlling work activity from proceeding for at least 5 continuous hours of the day or 65 percent of the normal work day, whichever is greater, with the normal working force engaged in performing the controlling item of work. If the contractor submits a written request for additional contract time due to adverse weather conditions, the contractor's request will be considered only after the Department agrees with the days and then only for adverse weather days in excess of the allowable number of days per month stated below. Adverse weather days will be documented by the Engineer and agreed upon monthly. Adverse weather days will be prorated for partial months when a work order or final inspection is issued other than the first or last of the month and agreed to by the Department. If the contractor is being considered for disqualification by the Department, an equitable adjustment in contract time may be made at the end of the original contract period, including all days added by approved change orders. Contract time will be adjusted by comparing the actual number of adverse weather days to the statistical number of adverse weather days over the specific time period per the table below. The resulting number of adverse weather days will be multiplied by 1.45 to convert to calendar days. Adjustments for adverse weather cannot result in a contract time reduction. Once adjusted, a new adverse weather day accounting will begin using the adverse weather conditions having an impact on the controlling items of work, in excess of the allowable number of days per month stated below. A second and final contract time adjustment will then be done at the final acceptance of the project. An adjustment in the contract time due to adverse weather will not be cause for an adjustment in the contract amount. There will be no direct or indirect cost reimbursement for excess adverse weather days.

The following are anticipated adverse weather days that the contractor shall include in each month of his calendar day construction schedule.

January 10 days	May 5 days	September 4 days
February 9 days	June 6 days	October 3 days
March 8 days	July 6 days	November 7 days
April 7 days	August 5 days	December 7 days

S.P. FAILURE TO COMPLETE ON TIME (05-22)

108.08 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is deleted and replaced with the following:

For each calendar day or working day, as specified for the project, that the work remains incomplete after expiration of the contract time, the sum specified in Table 108-1 will be deducted from payments for the work, not as a penalty but as stipulated damages, except for days DOTD directs in writing as no-work days.

Permitting the contractor to continue work after expiration of the contract time will not operate as a waiver by the Department of its rights under the contract. Contractor accepts, expressly assents, and does hereby confess judgment in favor of DOTD as to the daily charge amount set forth in Table 108-1.

Stipulated damages will be determined by the project's Original Contract Amount and the Average Daily Traffic (ADT) for the project's location. The ADT will be the traffic count as shown on the plans. When multiple traffic counts are shown on the plans, then the ADT will be the highest traffic count shown on the plans. The Original Contract Amount will be equal to the bid amount. The sum of Daily Charges (A) and (B) shown in Table 108-1 will be the assessed daily stipulated damages for each contract day after expiration of the contract time.

Table 108-1
Stipulated Damages

Original Contract Amount	**Daily Charge (A)**
Million Dollars	Dollars
0 - 1	500
>1 - 5	1,000
>5 -10	2,000
>10 - 15	4,000
>15 - 20	8,000
> 20	10,000
Traffic Volume	**Daily Charge (B)**
ADT[1] x 1000	Dollars
0 -10	500
>10 - 20	1,000
>20 - 30	2,000
>30 - 40	4,000
>40 - 50	8,000
>50	10,000

[1] For Project with no ADT given, $500 will be used as the Daily Charge (B) value.

The contractor will automatically be subject to an assessment of stipulated damages by the expiration of contract time on the project. At any time stipulated damages are assessed, such damages shall be assessed continuously until the cause of such assessment ends, regardless of intervening circumstances.

The amount of assessed stipulated damages will be deducted from payments for the work under the contract or from any payments on any other contract the contractor has with the Department. The contractor hereby waives any requirement of written notice of default prior to any deduction for stipulated damages from any payments. The contractor and the surety shall be solidarily liable for stipulated damages in excess of any remaining amounts due the contractor under the contract.

S.P. PAYMENT ADJUSTMENTS (06-22):

109 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended to add the following:

This project is designated for payment adjustments for asphalt cements, fuels, and steel in accordance with Subsection 109.09 as follows:

109.09 PAYMENT ADJUSTMENTS.

109.09.1 General: Payment for contract items indicated herein will be adjusted to compensate for cost differentials of Performance Graded (PG) asphalt cements, gasoline, diesel fuel, and steel when such costs increase or decrease more than 5 percent from the Department's established base prices for these items. The base price indices for asphalt cements, gasoline, diesel fuel, and steel will be the monthly price indices in effect at the time bids are opened for the project. The base price indices for asphalt cements will be as stated in 109.09.2. The base price index for gasoline and diesel fuel will be as stated in 109.09.3. The base price index for steel will be as stated in 109.09.4.

Payment adjustments will be made each monthly estimate period when a price index for this period varies more than 5 percent from its respective base price index. The monthly price indices to be used with each monthly estimate will be the price indices for the month in which the estimate period begins. No payment adjustment will be made for new pay items created by change order.

If the project is placed in default, payment adjustments will be based on the monthly price indices used for the last monthly estimate period prior to the project being placed in default, unless a monthly price index decreases in which case the lower monthly price index will be used.

If it is determined after completion of work on any eligible item that the total quantity paid to date must be adjusted to reflect more accurate quantity determinations, the Department will prorate the additional quantity to be added or subtracted over all previous estimate periods in which the item of work was performed in order to determine additional payment adjustments. If payment adjustments were made during any of these partial estimate periods, the prorated quantity added or subtracted will likewise have payment adjustments calculated and included.

109.09.2 Performance Graded (PG) Asphalt Cements: The base price index will be the monthly price index in effect at the time of bid opening as shown elsewhere herein. The monthly price indices will be the average, excluding the extreme outliers, of the unit prices for PG67-22, the average, excluding the extreme outliers, of the unit prices for PG70-22m, and the average, excluding the extreme outliers, of the unit prices for PG76-22m. The monthly prices for each of these asphalt materials will be F.O.B. refinery or terminal as determined from the quoted prices effective on the first calendar day of each month from suppliers of these materials. Suppliers considered are those who have requested to participate in the liquid asphalt index determination and have supplied materials on DOTD projects within the past twelve months. These suppliers and materials shall be listed on the Department's Approved Materials List (AML) and must be marketed in Louisiana. For Asphalt Cements not listed above, the following shall be considered equivalent for payment adjustments:

Pay Item Equivalents Eligible for Asphalt Payment Adjustment	
Performance Graded Asphalt Cement	**Equivalent PG Asphalt Cement for Payment Adjustment**
PG58-28	PG67-22
PG67-22	PG67-22
PG70-22m	PG70-22m
PG76-22m	PG76-22m
PG76-22rm	PG67-22

Payment adjustments will be made in accordance with the following formulas:

If Monthly Price Index exceeds Base Price Index,
$P_a = (A - 1.05B) \times C \times D \times (1.00 + T)$

If Base Price Index exceeds Monthly Price Index,
$P_a = (0.95B - A) \times C \times D \times (1.00 + T)$

Where:
P_a = Price adjustment (increase or decrease) for asphalt cement.
A = Monthly Price Index for respective PG67-22 PG70-22m, or PG76-22m in dollars per ton.
B = Base Price Index for respective PG67-22 PG70-22m, or PG76-22m in dollars per ton.
C = Tons of asphaltic concrete.
D = Percent of respective asphalt cement, per job mix formula, in decimals.
T = Louisiana sales tax percentage, in decimals.
(Note: Local tax is not considered)

The engineer will furnish the weights of asphalt concrete placed during the monthly estimate period with the respective asphalt cement content, excluding the asphalt content in reclaimed asphalt pavement (RAP) as per job mix formula. If the asphalt cement content changes during the estimate period, the respective weight of asphalt concrete produced at each cement content will be reported.

All contract pay items using PG58-28, PG67-22 PG70-22m, PG76-22m, and PG76-22rm shall be eligible for payment adjustments of asphalt materials; except no payment adjustment will be made for contract pay items under Section 510-01 series "Pavement Patching", Section 510-03 series "Pavement Joint Repair", Section 510-04 series "Pavement Patching", Section 507 "Asphalt Surface Treatment", Section 707 Asphalt Concrete Curbs, and Section 725 Temporary Detour Roads, nor for any emulsions or cutbacks.

Item 510-02, Pavement Widening, and all contract pay items under Sections 501 (excluding tack coat), and 502, will be eligible for payment adjustments of asphalt materials. No payment adjustment will be made for other asphalt materials, including emulsions and cutbacks.

The base price indices for asphalt cements, gasoline, and diesel fuel will be posted on the DOTD internet website before the 3rd calendar day of each month, excluding Saturdays, Sundays, and legal holidays at the following URL:

http://wwwapps.dotd.la.gov/engineering/lettings/lac_price_index/priceindices.aspx.

109.09.3 Gasoline and Diesel Fuel: The base price index for this project will be the monthly price index in effect when bids are opened for the project. The monthly price index will be the closing price for unleaded gasoline and No. 2 diesel fuel provided for the U.S. Gulf Coast area as posted on the U.S. Energy Information Administration Web Site effective on the first working day of each month or as determined by Louisiana Department of Transportation and Development.

Payment adjustment will be made in accordance with the following formulas:

If Monthly Price Index exceeds Base Price Index,

$$P_a = (A - 1.05B) \times Q \times F$$

If Base Price Index exceeds Monthly Price Index,

$$P_a = (0.95B - A) \times Q \times F)$$

Where:

P_a = Price adjustment.

A= Monthly Price Index in dollars per gallon.

B= Base Price Index in dollars per gallon.

Q= Pay Item Quantity (Pay Units).

F = Fuel Usage Factor Gal /Pay Unit.

The following is a listing of contract pay items that are eligible for payment adjustment and the fuel usage factors that will be used in making such adjustment. Contract items that expand the items listed herein by use of letter or number designations are also eligible for gasoline and diesel fuel price adjustments; for example:

Item 601-01-00100, Portland Cement Concrete Pavement 8 inches thick.

ELIGIBLE CONTRACT PAY ITEMS & FUEL USAGE FACTORS FOR FUEL PAYMENT ADJUSTMENT[7]					
ITEM NO.	PAY ITEM	UNITS	MIN. ORIGINAL CONTRACT QUANTITY FOR PAY ADJUSTMENT	FUEL USAGE FACTORS	
				Diesel[2]	Gasoline
203-01[1]	General Excavation	gal/cu yd	10,000 cu yd	0.29	0.15
203-02	Drainage Excavation	gal/cu yd	10,000 cu yd	0.29	0.15
203-03[1]	Embankment	gal/cu yd	10,000 cu yd	0.29	0.15
203-04	Nonplastic Embankment	gal/cu yd	10,000 cu yd	0.29	0.15
203-07	Borrow (Vehicular Measurement)	gal/cu yd	10,000 cu yd	0.29	0.15
301-01	Class I Base Course	gal/cu yd	3,000 cu yd	0.88	0.57
301-02	Class I Base Course (" Thick)	gal/sq yd	50,000 sq yd	0.04	0.03
302-01	Class II Base Course	gal/cu yd	3,000 cu yd	0.88	0.57
302-02	Class II Base Course (" Thick)	gal/sq yd	50,000 sq yd	0.04	0.03
303-01	In-Place Cement Stabilized Base Course ("Thick)	gal/sq yd	50,000 sq yd	0.04	0.03
303-03	In-Place Cement Treated Base Course (" Thick)	gal/sq yd	50,000 sq yd	0.04	0.03
304-02	Lime Treatment (Type B)	gal/sq yd	50,000 sq yd	0.04	0.03
304-03	Lime Treatment (Type C)	gal/sq yd	50,000 sq yd	0.04	0.03
304-04	Lime Treatment (Type D)	gal/sq yd	50,000 sq yd	0.04	0.03
305-01	Subgrade Layer (" Thick)	gal/sq yd	50,000 sq yd	0.04	0.03
401-01	Aggregate Surface Course (Net Section)	gal/cu yd	3,000 cu yd	0.88	0.57
401-02	Aggregate Surface Course (Adjusted Vehicular Measurement)	gal/cu yd	3,000 cu yd	0.88	0.57
501-01	Thin Asphalt Concrete (Dense Mix)	gal/ton	1000 ton	2.40[3]	0.2
501-02	Thin Asphalt Concrete (Coarse Mix)	gal/ton	1000 ton	2.40[3]	0.2

501-03	Thin Asphalt Concrete (OGFC)	gal/ton	1000 tons	2.40[3]	0.2
502-01	Asphalt Concrete	gal/ton	1000 ton	2.40[3]	0.2
502-02	Asphalt Concrete	gal/cu yd	500 cu yd	4.80[4]	0.4
502-03	Asphalt Concrete (" Thick)	gal/sq yd	10,000 sq yd	0.13[5,6]	0.01[6]
502-04	Asphalt Concrete (SMA) Wearing Course	gal/ton	1000 ton	2.40[3]	0.2
510-02	Pavement Widening	gal/sq yd	3,000 sq yd	0.86	0.24
601-01	Portland Cement Concrete Pavement (" Thick)	gal/sq yd	15,000 sq yd	0.11	0.15

1. If project has both 203-01 & 203-03, only the item with larger quantity is eligible.
2. For fuel adjustment purposes, the term "diesel" shall represent No. 2 or No. 4 fuel oils or any of the liquefied petroleum gases, such as propane or butane.
3. If natural gas or coal is used instead of diesel for aggregate drying and heating the fuel usage factor shall be 1.67 gal/ton.
4. If natural gas or coal is used instead of diesel for aggregate drying and heating the fuel usage factor shall be 3.34 gal/cu yd.
5. If natural gas or coal is used instead of diesel for aggregate drying and heating the fuel usage factor shall be 0.09 gal/sq yd.
6. Per inch of thickness.
7. No fuel adjustment will be allowed for waste oil.

109.09.4 Steel: The base price index will be the monthly price index in effect at the time of bid opening as shown elsewhere herein. The monthly price indices will be the US Bureau of Labor Statistics Series Report WPU101702. The monthly prices for each of these steel materials will be the final accepted published number per the link on the DOTD website. The payment adjustment will be based on the monthly price index at the time of stockpile payment or the date of installation if no stockpile payment is made. Price Adjustment for steel items will only be eligible for projects with an original contract time of more than 120 calendar days.

Payment adjustments will be made in accordance with the following formulas:

If Monthly Price Index exceeds Base Price Index,

$$P_a = (A - 1.05B) \times F \times (1.00 + T)$$

If Base Price Index exceeds Monthly Price Index,

$$P_a = (0.95B - A) \times F \times (1.00 + T)$$

Where:

P_a = Price adjustment (increase or decrease) for steel.
A = Monthly Price Index for respective WPU101702.
B = Base Price Index for respective WPU101702.
F = Material Factor
T = Louisiana sales tax percentage, in decimals.
(Note: Local tax is not considered)

A line-item adjustment will be made on the last progress estimate prior to the final estimate for each applicable pay item.

The following is a listing of contract pay items that are eligible for payment adjustment and the material factors that will be used in making such adjustment.

ELIGIBLE CONTRACT PAY ITEMS & MATERIAL FACTORS FOR STEEL PAYMENT ADJUSTMENTS				
ITEM NO.	**PAY ITEM**	**UNITS**	**LBS/QUANTITY**	**MATERIAL FACTOR**
601-01	Portland Cement Concrete Pavement _____in. Thick	SQYD		
704-01	Guard Rail	LNFT	11.44 lbs/LF	(11.44 x LF)/2000
704-02	Guard Rail (Double Faced)	LNFT	22.88 lbs/LF	(22.88 x LF)/2000
704-03	Blocked Out Guard Rail	LNFT	7.84 lbs/LF	(7.84 x LF)/2000
704-04	Blocked Out Guard Rail (Double Faced)	LNFT	15.68 lbs/LF	(15.68 x LF)/2000
704-05	Guard Rail Anchor Sections (Trailing End)	LNFT	7.84 lbs/LF	(7.84 x LF)/2000
704-06	Guard Rail Bridge Attachments	LNFT	11.44 lbs/LF	(11.44 x LF)/2000
704-07	Guard Rail Transitions	LNFT	9.64 lbs/LF	(9.64 x LF)/2000
729-09	Mounting (Overhead Truss) (Ground Mounted)*	EACH	X lbs	X/2000
736-04	Signal Pole (Size and Type)*	EACH	X lbs	X/2000
803-01	Drilled Shaft (Diameter)**	LNFT	X lbs	X/2000

804-01	Precast Concrete Piles (Size)	LNFT	Various	
-00200	14”	LNFT	5.53 lbs/LF	(5.53 x LF)/2000
-00300	16”	LNFT	7.57 lbs/LF	(7.57 x LF)/2000
-00400	18”	LNFT	7.80 lbs/LF	(7.80 x LF)/2000
-00600	24”	LNFT	14.72 lbs/LF	(14.72 x LF)/2000
-00600	24” Voided	LNFT	12.64 lbs/LF	(12.64 x LF)/2000
-00700	30” Voided	LNFT	18.59 lbs/LF	(18.59 x LF)/2000
-00800	36” Voided	LNFT	23.76 lbs/LF	(23.76 x LF)/2000
804-03	Steel Piles (Type and Size)**	LNFT	X lbs/LF 10.68t(D-t)xLF	X/2000
805-08	Precast-Prestressed Concrete Girders (Type)*	LNFT	X lbs X lbs/LF	X/2000 (X x LF)/2000
806-01	Deformed Reinforcing Steel	LB	X lbs	X/2000
807-01	Structural Metalwork (Grade)**	LB	X lbs	X/2000
810-01	Concrete Bridge Railing (Type)	LNFT	27.87 lbs/LF	(27.87 x LF)/2000
813-01	Concrete Approach Slabs (Cast-in-Place)	SQFT	26.25 lbs/SQFT	(26.25 x SF)/2000
822-05	Light Pole (Type)*	EACH	X lbs	X/2000
822-06	High Mast Pole (Type)*	EACH	X lbs	X/2000

* Pounds of steel based on shop drawings. Shop drawings must include total weight of all steel items in each pay item.

**Pounds of steel based on plan sheet theoretical weight or as shown in the Summary of Quantity Table.

***Pounds of steel for H-pile is based on the lbs/LF of the specified type. Pounds of steel for cylinder pile is based on the outside diameter (D in inches) and thickness (t in inches)

S.P. Clearing and Grubbing (09-21)

201 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

201.03 is deleted and replaced with the following:

201.03 GENERAL CONSTRUCTION REQUIREMENTS.

Trees designated to remain shall be preserved and protected by means of limited impact, or special treatment as directed by the Project Engineer. When Significant trees are encountered, the Project Engineer shall refer to the Significant tree EDSM I.1.1.21 for action.

Excavation, trenching or storing of materials, equipment or supplies within the dripline of any tree to remain is not permitted. Any required trimming shall be supervised on site by a Louisiana licensed arborist and performed in accordance with ANSI A300 and ANSI Z133 standards. Repair damage to bark, trunks, limbs, or roots of vegetation marked to remain using horticultural and arborist practices as established by the International Society of Arboriculture (ISA) under the supervision of a Louisiana licensed arborist at no direct pay. The arborist shall be licensed in Louisiana by the Department of Agriculture and Forestry and must follow the Louisiana Commission Horticulture Law, §117. Professional and Occupational Standards and Requirements, Section E.9, "Recommendations and pruning practices shall meet the standards outlined in the *Arborists' Certification Study Guide* published by the International Society of Arboriculture". Do not fell trees outside of the right-of-way. Damage outside the right-of-way caused by the contractor's operations shall be the contractor's responsibility.

A current list of licensed arborists may be obtained from: Louisiana Department of Agriculture and Forestry website: http://www.ldaf.state.la.us/.

The last paragraph of 201.04 is deleted and replaced with the following:

Trees which are located within the DOTD right-of-way, and which are designated to remain, shall have their branches which are overhanging the roadway, removed to a height of 20 feet. Trees outside of the right-of-way shall have their branches which are overhanging the roadway, removed to a height of 20 feet. In both cases, pruning cuts shall be made as warranted using arborist pruning practices as established by the International Society of Arboriculture (ISA) and under the supervision of a Louisiana licensed arborist.

S.P. Pavement, Base Courses, Walks, and Curbs (11-21):

Section 202 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

202.03.1 Pavement, Base Courses, Walks, and Curbs is deleted and replaced with the following:

202.03.1 Pavement, Base Courses, Walks, and Curbs:

Pavements, base courses, walks, curbs, and gutters, designated for removal shall be disposed of in accordance with these specifications and as directed. Removal of pavement structure shall include all pavement and base course, including base materials under curb, shoulder surfacing, and embankment at no additional pay, unless otherwise noted.

When the existing shoulder underdrain at the pavement edge is to remain in place and in service but removal of the shoulder surfacing and base is required, do not damage the existing shoulder underdrains. Damaged shoulder underdrains shall be satisfactorily repaired at no direct pay.

S.P. Excavation and Embankment (05-21)

Section 203 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

The first paragragh of 203.05 is deleted and replaced with the following:

203.05 Borrow.

Borrow is defined as soils required for construction of embankments or other portions of the work in excess of soils obtained from excavation. Obtain borrow from an approved source and use in accordance with 203.06. Excavate, haul, place and compact borrow in accordance with 203.07.5.Make arrangements for obtaining borrow at no direct pay.

203.14.6 is deleted and replaced with the following:

203.14.6 Borrow (Vehicular Measurement):

The material will be measured by the cubic yard in approved hauling vehicles at the point of delivery in accordance with 109.01. This item includes performing the excavation, hauling, embankment, and grading work necessary for construction of the project.

S.P. LIGHTWEIGHT AGGREGATE FOR NON-PLASTIC EMBANKMENT (03/19):

Section 203.09.1 is deleted and replaced with the following:

203.09.1 Materials:

Non-plastic embankment material shall comply with 1003.12 when lightweight aggregate is specified. Otherwise, non-plastic embankment shall comply with 1003.02.

S.P. HIGH STRENGTH GEOTEXTILE FABRIC (06/19):

Section 203 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

203.11.3 Construction Requirements is amended to include the following:

203.11.3.1 Construction Requirements for High Strength Geotextile Fabric: Construction requirements for high strength geotextile fabric are as indicated in 203.11.3 with the following modifications and additions:

Submit a high strength geotextile fabric installation plan for review. The high strength geotextile fabric shall fit the prepared ground contours prior to placement of embankment. High strength geotextile fabric shall be rolled out flat in the principal strength direction of the material. Adjacent rolls and roll ends shall be overlapped a minimum of 36 inches or sewn. Sewing of laps may be required as determined by the engineer. High strength geotextile fabric shall be installed in accordance with all manufacturers' recommendations.

203.15 PAYMENT is amended to include the following:

Item No.	Pay Item	Pay Unit
203-08-00200	Geotextile Fabric (High Strength) (Type 1)	Square Yard
203-08-00210	Geotextile Fabric (High Strength) (Type 2)	Square Yard

203-08-00220	Geotextile Fabric (High Strength) (Type 3)	Square Yard

S.P. Class II Base Course (10-22)

Section 302 of the 2016 *Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

302.01 is deleted and replaced with the following:

302.01 DESCRIPTION

Furnish and place Class II base course on a prepared surface in accordance with these specifications, in conformity with the lines, grades, thickness, and typical sections shown on the plans or established by the engineer. Control the selection, placement, mixing and compaction of materials so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankment and Base Course*.

Unless approved otherwise in writing, use the same base course material throughout the project in accordance with these specifications.

Immediately prior to application of base course on existing pavement, remove raised pavement markers at no direct pay.

When asphalt concrete or portland cement concrete is specified on the plans, the total thickness of asphalt concrete or portland cement concrete shall be the thickness as indicated on the plans.

When the base course material is not specified on the plans, any of the following types may be used:

1. Soil Cement
2. Crushed Stone
3. Asphalt Concrete on Embankment Layer
4. Recycled Portland Cement Concrete
5. Blended Calcium Sulfate

For Asphalt Concrete on Embankment Layer, the top half of the base course thickness shall be asphalt concrete. The remaining thickness of the base shall be the same type and construction as the top layer of the underlying embankment, treated layer, or subgrade, or in accordance with Section 203 for placement on existing ground. Do not place raw, untreated material between a treated layer and the asphalt concrete layer.

In areas that are inaccessible for mixing and compacting, such as in turnouts, crossovers, and other isolated or irregular areas, full depth portland cement concrete or full depth asphalt concrete base course may be used in lieu of the specified Class II base course material with approval.

When portland cement concrete is used, unless otherwise specified or approved by the engineer, the minimum thickness shall be 6 inches.

Portland cement concrete shall be in accordance with Section 706, except as follows. Portland cement concrete thickness tolerances shall be in accordance with Section 601 and corrected in accordance with 302.12.2.3. Portland cement concrete width corrections shall be in accordance with 302.12.3.1. Any pay adjustment in portland cement concrete shall be in accordance with Table 901-5.

A bond breaker is required between portland cement concrete base and portland cement concrete pavement. A bond breaker shall consist of a double application of curing compound or 2 layers of polyethylene sheeting. A 3 inch scored joint will be made to control cracking in the concrete base. The scored joints should be placed at the required surface joint locations. No load transfers will be required in the base slab.

Drainage of all existing and constructed pavement structures shall be maintained at all times during construction at no additional cost to the Department. When base course is permeable, provide a base drain outlet consisting of non-plastic embankment (stone) and geotextile fabric, or as specified in the plans, in accordance with 203.09.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements. In order to meet air quality standards, the contractor may be required to use central plant mixing of cement treated mixtures in dust sensitive areas at no direct pay. The contractor may use other types of Class II base course in dust sensitive areas at no direct pay.

302.02.2 is deleted and replaced with the following:

302.02.2 Portland Cement:

Use Type I, II or IL portland cement. The quantity of cement used shall be supported by proof of delivery.

302.02.4, Asphalt Concrete Base Course is deleted.

302.13 and 302.14 are deleted and replaced with the following:

302.13 MEASUREMENT.

The quantities of Class II base course for payment will be the design volumes or areas specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions and compacted thickness of the completed base course shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are necessary.

Geotextile fabric used beneath the base course will not be measured for payment.

Base drain outlets will be measured for payment per each.

302.14 PAYMENT.

Payment for Class II base course will be made at the contract unit price, adjusted as specified in 302.12 and the following provisions, which includes furnishing and placing required base course materials, portland cement, blended hydraulic cement, water, asphalt curing membrane, and prime coat.

Any payment adjustment in asphalt concrete shall be in accordance with Section 502 and shall apply to the cubic yard total quantity of base course when payment is by cubic yard. For other materials, when making payment adjustments for more than one deficiency, they shall be cumulative.

Payment for geotextile fabric will be included in the contract unit price for base course.

Payment for base drain outlet will be made under the contract unit price per each and include excavation, furnishing and placing non-plastic embankment (stone) material, geotextile fabric, and all incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
302-01	Class II Base Course	Cubic Yard
302-02	Class II Base Course ____ in Thick	Square Yard
302-03	Base Drain Outlet	Each

S.P. Traffic Maintenance Surfacing (09-22)

Section 402 of the the 2016 *Louisiana Standard Specifications for Roads and Bridges* is deleted and replaced with the following:

Section 402

Traffic Maintenance Surfacing

402.01 DESCRIPTION.

Furnish and construct surfacing for maintenance of traffic on driveways, pipe crossings, short-term traffic on raw embankment, slope corrections, or other disturbed roadway sections as directed and in accordance with the following requirements.

402.02 MATERIALS.

Furnish any of the following types of materials complying with the following sections and subsections and in accordance with the following requirements. Other materials must be approved in advance by the engineer.

Stone	1003.01 & 1003.05.1
Recycled Portland Cement Concrete	1003.01.3.1 & 1003.05.1
Reclaimed Asphalt Pavement	1003.01.3.2 & 1003.05.3
Asphalt Concrete [1]	502
Flowable Fill [2]	710

[1] All asphalt mixes in Section 502 will be allowed for surfacing materials.
[2] Flowable fill surface shall meet the excavatable requirements of Table 710-1.

402.03 EQUIPMENT.

Furnish and maintain equipment necessary to produce a finished product meeting the requirements of these specifications. Obtain approval of equipment prior to use.

402.04 CONSTRUCTION REQUIREMENTS.

Satisfactorily place, shape, compact, and maintain areas requiring traffic maintenance surfacing. When directed, reuse the aggregate material at adjacent locations when the material can be reasonably shifted by blading. When directed, material shall be loaded, hauled, and reused. Unless otherwise directed by the project engineer, remove and dispose of traffic maintenance surfacing when no longer necessary. Dispose in accordance with Section 202.

402.04.1 Surfacing:

Use traffic maintenance surfaces in accordance with Table 402-1 at the posted speed limit during construction. Aggregate surface is allowed on the roadway mainline only when all aggregate table criteria are met. Hard surface is required when any hard surface table criteria is met on mainline or non-mainline roadway elements or as directed in the plans.

Hard surface will be either asphalt concrete or excavatable flowable fill with a minimum thickness of 6 inches. Surfacing shall be uniform and smooth. Surfacing shall meet a 1/2 inch longitudinal tolerance with a 10-foot static straight edge and shall properly drain. Asphalt concrete surfaces shall have a minimum of 89 percent of maximum dry density.

Should a contractor's operation or sequence of construction extend the time an aggregate surface remains in place under traffic beyond four weeks, hard surfacing will be at no additional pay.

Should a contractor's operation or sequence of construction necessitate the use of aggregate in areas requiring hard surface, place the hard surface within 48 hours. Placement of aggregate surfacing in this case will be at no direct pay.

Table 402-1
Traffic Maintenance Criteria

Surface Type	ADT	Posted Speed, mph	Time Surfacing to Remain In Place Under Traffic
Aggregate	≤5000	≤45	≤4 weeks [1]
Hard Surface	>5000	>45	>4 weeks

[1] Time may be extended with approval of the Project Engineer.

402.05 MEASUREMENT.

Aggregate used for traffic maintenance surfacing will be measured at the point of delivery by the cubic yard in approved hauling vehicles in accordance with 109.01. No adjustment factor will be used.

Hard surfacing will be measured by the square yard at the roadway location.

402.06 PAYMENT.

Payment for traffic maintenance surfacing, maintained and subsequently removed, when required, will be made at the contract unit prices per cubic yard or per square yard.

Aggregate materials reused by blading to adjacent locations will be at no expense to the Department. Aggregate material reloaded, hauled, and re-used will be paid at 50 percent of the contract unit price.

Payment will be made under:

Item No.	Pay Item	Pay Unit
402-01	Traffic Maintenance Surfacing (Aggregate) (Vehicular Measurement)	Cubic Yard

402-02	Traffic Maintenance Surfacing (Hard)	Square Yard

S.P. Tie-Ins (07-22)

502 of the 2016 *Supplemental Specifications Book* (08-22) for the 2016 *Louisiana Standard Specifications for Roads and Bridges* is amended to include the following:

502.08.3.3 Tie-Ins:

Joints for tie-ins to existing portland cement concrete pavement, and other roadway elements identified in the plans or by the Engineer, shall be paid under the appropriate pay item. Unless otherwise specified, joints shall be cut 1/2-inch by 1/2-inch in the installed asphalt directly adjacent to the existing roadway element, filled with hot poured sealant in accordance with section 1005.

S.P. Milling Asphalt Pavement (07-22)

509 of the 2016 *Supplemental Specifications Book* (08-22) for the 2016 *Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

509.03 is amended to include the following paragraph:

The contractor shall saw cut a joint the depth of the required milling at all tie-in locations of roadway, side-streets, turnouts, and drives paid for under the appropriate pay item, and remove existing materials, leaving a clean, vertical face.

S.P. Joints, Seals, and Sealants (08-20)

601.03.8 of the 2016 *Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

Paragraph 1 is deleted and replaced with the following:

Saw and seal joints according to Standard Plans CP-01. Tie-ins to existing roadway elements, including pavements, walks, drives, and incidental paving, shall be made with an expansion joint unless otherwise specified, at no additional pay. Saw cuts required to provide a clean, vertical face for tie-ins shall be made at no additional pay.

S.P. Longitudinal Butt Joint (Type LBJ) (03/22)

Section 601 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

601.03.8.8.8. is deleted and replaced with the following:

601.03.8.8.8 Longitudinal Butt Joint (Type LBJ):

Construct longitudinal butt joints when adding lanes of pavement. Place deformed tie bars of the specified length, size, spacing, and material perpendicular to longitudinal butt joints. Do not coat tie bars with asphalt or other material or enclose in tubes or sleeves.

Install tie bars in clean, moisture-free holes, drilled into the existing pavement approximately 1/8 inch larger than the diameter of the tie bar. Use a Type I, Grade 3 epoxy from the Epoxy Resin Systems Approved Materials List.

Mix the epoxy in accordance with the manufacturer's recommendations, with no fillers or extenders added. Using a caulking gun or other approved method, inject sufficient epoxy to fill the void between the tie-bar and hole. Rotate the bar while inserting to ensure complete coverage with no voids as verified by epoxy squeezing out when the bar is inserted. Prevent bars from being disturbed until epoxy has sufficiently cured. Place epoxy using manufacturer's temperature limitations but do not apply epoxy when ambient temperature is below 40°F.

S.P. Transverse Butt Joint (Type BJ) (03/22)

Section 601 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

601.03.8.8.9 is deleted and replaced with the following:

601.03.8.8.9 Transverse Butt Joint (Type BJ):

Construct transverse butt joints when extending existing pavement. Place smooth dowel bars of the specified length, size, coating, spacing, and material perpendicular to transverse butt joints.

Install dowel bars in clean, moisture-free holes, drilled into the existing pavement approximately 1/8 inch larger than the diameter of the dowel bar. Use a Type I, Grade 3 epoxy from the Epoxy Resin Systems Approved Materials List.

Mix the epoxy in accordance with the manufacturer's recommendations, with no fillers or extenders added. Using a caulking gun or other approved method, inject sufficient epoxy to fill the void between the dowel bar and hole. Rotate the bar while inserting to ensure complete coverage with no voids as verified by epoxy squeezing out when the bar is inserted. Prevent bars from being disturbed until epoxy has sufficiently cured. Place epoxy using manufacturer's temperature limitations but do not apply epoxy when ambient temperature is below 40°F.

Establish joint sealant reservoir in accordance with plan details (See CP-01).

S.P. Manholes, Junction Boxes, Catch Basins, and End Treatments (01-22)

Section 702 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is deleted and replaced with the following:

702.01 DESCRIPTION. Construct, install, and adjust manholes, junction boxes, catch basins, culvert end treatments, and safety ends in accordance with these specifications and in conformity with lines and grades shown on the plans or established.

702.02 MATERIALS. Materials shall comply with the following sections and subsections:

Cast-in-Place Concrete (Class M)	901
Portland Cement	1001.01
Asphaltic Varnish	1008.03
Reinforcing Steel	1009.01
Precast Reinforced Concrete Drainage Units	1016
Frames, Grates, and Covers for Manholes, Catch Basins, and Junction Boxes	1013.05, 1013.06
Geotextile Fabric	1019

The contractor may furnish structures of either cast-in-place concrete or precast concrete units.

702.03 QUALITY ASSURANCE. Manufacturing plants will be inspected periodically for compliance with specified manufacturing methods. Material samples will be randomly obtained for laboratory testing for verification of manufacturing lots.

Materials will be subject to inspection at any time during the work.

702.04 CONSTRUCTION REQUIREMENTS. Construct all cast-in-place structures in dry or dewatered areas, unless otherwise directed. Provide dewatering, shoring and bracing needed to comply with OSHA requirements at no cost to the Department. Remove logs, stumps, and other undesirable material.

702.04.1 Manholes, Junction Boxes, and Catch Basins: Concrete construction shall conform to Section 805. Cure exposed surfaces of concrete in accordance with 805.06 for at least 48 hours.

Furnish and install precast and/or cast-in-place concrete units in accordance with Standard Plan PC-01. If precast concrete units are used, verify the location of existing pipes and existing pipe inverts. For structures in unpaved areas allowed to be completely precast, verify top elevation of grate or cover. Prior to construction, submit shop drawings indicating all verified dimensions, elevations, and openings for precast units to the engineer for review. Conform to 801.05.3.1 for precast concrete. Submit a Certificate of Compliance, inspected, approved, and stamped by the manufacturer, to the Engineer for acceptance.

Cast precast concrete units with the specified number and size of pipe openings required for the drainage system; however, if additional pipe connection openings are required during construction, make such openings. If the need for additional openings is discovered after the fabrication of the precast units, the extra work required to make such openings will be paid in accordance with 109.04. If the need for additional openings is discovered prior to fabrication of the precast units, make such openings at no additional cost. Any damaged units are to be replaced or satisfactorily repaired, as determined by the Engineer, at no additional cost.

Set precast units to established grade within ± 1/2 inch. Seal joints for sectional precast units with flexible plastic gasket material complying with 1016.01.1 and install to form a watertight seal. Wrap the joints of precast units with geotextile fabric a minimum of 18 inches on each side of the joint. Lap the ends of the fabric at least 10 inches. Secure the edges and ends of the cloth.

Conduit sections shall be flush on the inside of structure wall and project outside sufficiently for proper connection with the next conduit section. Grout neatly and tightly around conduit.

When grade adjustments of existing structures are specified, remove the frames, covers, and gratings and reconstruct the walls as required. Clean the frames and reset at required elevation. Thoroughly clean metal parts and place in good repair. In lieu of resetting, manhole structures may be adjusted by means of approved metal adjustment rings.

When conversions of existing structures are specified, remove the frames, covers, and gratings and reconstruct the walls as required. Place new frames, covers, and gratings at required elevation.

When contract documents call to remove and replace the frame and cover of existing structures, remove and replace as specified or as directed by the engineer. Reconstruct the walls and reset at required elevation.

Clean new structures of silt, debris or other foreign matter. Coat non-galvanized metal parts of new or adjusted structures with asphaltic varnish meeting the requirements of 1008.03 or jet black metal work paint satisfactory to the engineer.

Backfill the structure in accordance with 701.08.

Dispose of excavated material not satisfactory for backfill and surplus material in accordance with 202.02.

702.04.2 Culvert End Treatments: Construct culvert end treatments to control erosion at the ends of cross drains and side drains in accordance with these specifications, the plans, and as directed. Submit designs other than those shown on the plans for approval.

702.04.2.1 Concrete Toe Wall Placement: Cast-in-place toe walls shall conform to 805.05 and plan details.

702.04.2.2 Geotextile Fabric Placement: Place geotextile fabric in accordance with 712.03.1.

702.04.2.3 Sacked Concrete (Wet-Batched) Placement:

Revetment: Wet-batched sacked concrete revetments shall conform to the requirements of Section 712. Begin placement of sacked concrete at the toe of the revetment and progress to the end of the pipe. Comply with the compressive strength requirements of Section 901 for Class R concrete.

Toe Wall: Stack sacks as indicated on the plans.

702.04.2.4 Sacked Concrete (Dry-Batched) Placement:

Revetment: Dry-batched sacked concrete revetments shall conform to the requirements of Section 712. Begin placement at the toe of the revetment and progress to the end of the pipe. Submit a certificate of compliance from the supplier of the dry-batched revetment with each shipment showing the proportions of cement and sand used (or other approved aggregates). Mix the contents of the package with water as required to produce a slump of 2 to 5 inches. Comply with the compressive strength requirements of Section 901 for Class R concrete.

Toe Wall: Stack sacks as indicated on the plans.

702.04.2.5 Stone Placement: Stone revetment shall conform to the requirements of Section 712.

702.04.3 Culvert Safety Ends: Furnish and install safety ends on cross drains and side drains in accordance with these specifications, the plans, and as directed. Submit designs other than those shown on the plans for approval.

Fabricate and place reinforcing steel in accordance with Section 806.

Cast-in-place or precast concrete shall comply with Section 805.

Bolt pipe runners in place as shown on the plans. Cast bolts into the plastic concrete or place in approximately 1-inch diameter holes and epoxy in place using an Approved Materials List anchor system as directed.

702.04.4 Frames, Grates, and Covers for Manholes, Catch Basins, and Junction Boxes: Metal units shall comply with the following requirements:

1. Gray and ductile iron castings shall comply with 1013.06.1.
2. Steel castings shall comply with 1013.05.
3. Structural steel shall comply with 1013.01 and rivet steel shall comply with 1013.02.
4. Galvanizing shall comply with ASTM A123.

702.05 MEASUREMENT. Measure new,adjusted, and converted junction boxes, manholes, catch basins per each. Measure culvert end treatments, and safety ends per each. Remove and replace of frame and cover will be measured per each.

Excavation and backfill required for installation of these units will not be measured for payment.

Dewatering, shoring and bracing needed to meet OSHA requirements are considered incidental to the work and will not be measured for payment.

Geotextile fabric will not be measured for payment.

702.06 PAYMENT. Payment for new,adjusted and converted junction boxes, manholes, and catch basins will be made at the contract unit price per each which will include all materials, tools, equipment, labor and incidentals necessary to complete the work. Culvert end treatments and safety ends will be made at the contract unit price per each which will include all materials, tools, equipment, labor and incidentals necessary to complete the work.

Payment for remove and replace of frame and cover will be made at the contract unit price per each and will include all required adjustments as well as all materials, tools, equipment, labor, and incidentals necessary to complete the work.

The concrete in cast-in-place manholes, junction boxes, catch basins, and culvert end treatments and safety ends will be identified by lots and will be subject to pay adjustments in accordance with Table 901-5 and Note 1 therein. Acceptance for each precast concrete manhole, junction box, and catch basin lot will be in accordance with the requirements of Standard Plan PC-01. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

Payment will be made under:

Item No.	Pay Item	Pay Unit
702-01	Junction Boxes	Each
702-02	Manholes	Each
702-03	Catch Basins	Each
702-04	Adjust/Convert_____	Each
702-05	Cross Drain End Treatment	Each
702-06	Side Drain End Treatment	Each
702-07	Cross Drain Safety End	Each
702-08	Side Drain Safety End	Each

S.P. Tie-Ins (08-20)

706.03.5.4 of the 2016 *Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

Paragraph 1 is deleted and replaced with the following:

Unless otherwise specified, expansion joints shall be installed at all tie-ins. All work required for tie-ins, including saw cuts required to provide a clean, vertical face, shall be provided at no additional pay.

S.P. Concrete Walks, Drives, and Incidental Paving (10-21)

Section 706 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

706.03.7 is deleted and replaced with the following:

706.03.7 Detectable Warning Surface for Ramps and At-Grade Sidewalk Intersections: When sidewalks intersect with roadways, equip the sidewalk with a detectable warning system consisting of raised truncated domes as a transition between the sidewalk and the street as required by the Americans With Disabilities Act, 28 CFR § Part 36, ADA Standards for Accessible Design. Install detectable warnings (truncated domes) on the ramp surface over the full width of the ramp throat for a distance of 24 inches in the direction of travel from the back of the curb. Also install detectable warnings (truncated domes) on at-grade sidewalks intersecting with roadways for a distance of 24 inches in the direction of travel from the end of the sidewalk. Detectable warning surfaces may be added to at-grade sidewalks intersecting with driveways at the discretion of the designer or Project Engineer. Lay out truncated domes on a square or radial grid

In accordance with Section 705.1.3 of the ADA Accessibility Standards, detectable warning surfaces shall contrast visually with adjacent walking surfaces either light-on-dark, or dark-on-light.

706.04 is deleted and replaced with the following:

706.04 MEASUREMENT. Quantities of concrete walks, drives, and incidental paving slabs for payment will be the design quantities as specified on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if design errors are proven or if design changes are made. Design areas are based on the horizontal dimensions shown on the plans. Excavation, backfill, reinforcing steel, and joint materials will not be measured for payment.

Curb ramps, including the detectable surface warning system, will be measured per square yard. Removal of existing sidewalk required to build curb ramps, will not be measured for payment.

Detectable surface warning systems for at-grade sidewalk intersection will not be measured for payment.

706.05 is deleted and replaced with the following:

706.05 PAYMENT. Payment for concrete walks, drives, and incidental paving will be made on a lot basis at the contract unit price per square yard, adjusted in accordance with the following provisions. Payment for each lot will be made in accordance with table 901-5. Size, sampling, and testing of each concrete lot shall be in accordance with the materials sampling manual.

Payment for curb ramps, including the detectable surface warning system, will be made at the contract unit price per square yard and shall include, but not be limited to, curb transitions, detectable warning system, gutter, landing, and base.

Payment will be made under:

Item No.	Pay Item	Pay Unit
706-01	Concrete Walk	Square Yard
706-02	Concrete Drive	Square Yard
706-03	Incidental Concrete Paving	Square Yard
706-04	Curb Ramps	Square Yard

S.P. PERMANENT SIGNS (09/18):

Section 729 Permanent Signs of the 2016 Standard Specifications and the supplemental specifications thereto is amended as follows:

Section 729.02 Materials is deleted and replaced with the following:

729.02 MATERIALS.

Other than recycled aluminum sign panels and blanks, all materials shall be new stock conforming to the following:

729.02.1 Sign and Marker Sheeting:

Sheeting material for sign panels, delineators, barricades, and other markers shall comply with Section 1015. Sheeting background and legends shall be compatible types and convey the full manufacturer's warranty and shall comply with 1015.05.1.

729.02.2 Ferrous Metal:

Ferrous metals shall comply with 1015.02.1. Reinforcing steel shall comply with Section 1009. Ferrous metal, except reinforcing steel, shall be galvanized in accordance with Section 811.

1. U-channel posts shall comply with 1015.02.1.3.
2. Square tubing shall comply with 1015.02.1.4.

729.02.3 Aluminum:

Aluminum alloys for structural members shall comply with 1015.02.2. Aluminum sign panels shall comply with 1015.04.1.

729.02.4 Fittings:

Structural bolts, nuts, washers, and miscellaneous hardware shall comply with 1015.02.3.

729.02.5 Guard Rail:

Guard rail materials for dead end road installations shall comply with Section 1010.

729.02.6 Timber:

Treated piling and timber for barricades in dead end road installations shall comply with Section 1014.

729.02.7 Concrete:

Concrete shall be Class M complying with Section 901.

729.02.8 Deleted

729.02.9 Silk Screen Paste, Overlay Film and Digital Printing:

Silk screen paste, Overlay film and Digital Printing shall comply with sheeting manufacturer's recommendations and with 1015.07.

Section 729.03.1 Sign Face Design and Fabrication is deleted and amended as follows:

Fabricate signs of Types A, B, D, and E; overhead signs; and sign face overlay panels in accordance with the MUTCD, the *Standard Highway Signs Booklet*, and the signing detail sheets of the plans with the exception of a fluorescent yellow background color for the signs shown below:

Sign Code	Description
W1-1R & W1-1L	Turn
W1-2	Curve
W1-3R & W1-3L	Reverse Turn
W1-4R & W1-4L	Reverse Curve
W1-5R & W1-5L	Winding Road
W1-6R & W1-6L	One Direction Large Arrow
W1-7	Two Direction Large Arrow
W1-8R & W1-8L	Chevron Alignment
W1-10R & W1-10L	Horizontal Alignment
W1-11	Hairpin Curve
W1-15	270 Degree Loop
W13-1P	Advisory Speed (English)

Furnish shop drawings of sign faces for Types D and E, overhead signs, sign overlay panels, and for any non-standard sign faces of Types A and B not provided by the Department. Obtain approval of shop drawings from the Interstate Guide Sign Engineer before sign face fabrication begins. The use of shop drawings is only allowed by the fabricator for whom the shop drawings are approved.

Section 729.04 Fabrication of Aluminum Sign Panels is amended as follows:
Add the following Section:

729.04.3.4 Digital Printing:

Comply with Section 1015.07.4.

S.P. PERMANENT SIGNS (02/19):

Section 729 Permanent Signs of the 2016 Standard Specifications and the supplemental specifications thereto is amended as follows:

Section 729.07 Acceptance of Signs is deleted and replaced with the following:

729.07 ACCEPTANCE OF SIGNS

After the installation of signs is complete, the Department's Sign Inspection Team will perform an inspection to ensure conformance with applicable plans, standards and project specifications. When specular reflection is apparent on any sign, adjust its positioning to eliminate the condition. Follow-up inspections may be conducted prior to acceptance, at the discretion of the Department's Sign Inspection Team.

Clean signs before the time of inspection. Reflective sheeting shall be free of cuts, scratches, breaks, or other defects. Replace or repair nonstandard or otherwise unacceptable signs and traffic control devices as directed. Correct damage that is discovered at the time of the sign inspection.

S.P. PLASTIC PAVEMENT MARKINGS (11-20):

Section 732 is deleted and replaced with the following:

Section 732 Plastic Pavement Markings

732.01 DESCRIPTION.

Furnish and place reflective pavement markings of hot applied thermoplastic or preformed (cold or hot applied) plastic at the locations shown on the plans. Plastic pavement markings include stripes, gore markings, lines, legends, and symbols.

732.02 MATERIALS.

732.02.1 Thermoplastic Markings and Glass Beads:

Thermoplastic marking material shall be a plastic compound reflectorized by internal and external application of glass beads. Comply with 1015.10 and 1015.13. Width, thickness, and color of markings shall be as specified. Black thermoplastic pavement markings shall require skid-resistant filler in lieu of glass beads.

732.02.2 Preformed Plastic Marking Tape:

Comply with 1015.11.

732.02.3 Surface Primer:

Provide a single component surface primer or two component epoxy sealer for the appropriate application in accordance with 732.03.5.

732.02.4 Glass Beads:

Glass beads for standard (flat) thermoplastic markings shall be in accordance with 1015.13.

732.03 CONSTRUCTION REQUIREMENTS.

732.03.1 Equipment for Standard (Flat) Thermoplastic Marking Material:

Applicators shall produce sharply defined lines and provide means for cleanly cutting off stripe ends and applying broken lines.

For new 90 mil application, equipment shall consist of an extrusion die or a ribbon gun that simultaneously deposits and shapes lines at a thickness of 90 mils or greater on the pavement surface.

When restriping 90 mils thickness onto existing thermoplastic markings, only a ribbon gun shall be used.

For 40 mils, only a spray application will be allowed.

732.03.2 Weather Limitations:

Do not apply markings if moisture is present, or when the surface temperature or ambient temperature is below 50°F.

732.03.3 Cleaning of Surfaces:

Surfaces, including ramps and gore areas, on which markings are to be applied must be cleaned of all materials that may reduce the bond. Maintain surfaces in a clean dry condition until placement of markings.

If placing 40 mil thickness striping over existing striping on portland cement concrete remove flaking or peeling material to the satisfaction of the engineer prior to thermoplastic application. After markings are cleaned, properly dispose of striping debris and residue.

732.03.4 Removal of Existing Markings:

Do not obliterate markings by painting with asphalt binder or other material. Remove markings by methods that will not damage the pavement or bridge deck. Removal shall be to such extent that 75 percent of the pavement surface or bridge deck under the markings is exposed.

Remove temporary pavement markings to the satisfaction of the project engineer prior to thermoplastic marking operations.

Remove all markings made in error or not conforming to the traffic operation in use to the satisfaction of the engineer. After markings are cleaned, properly dispose of striping debris and residue.

732.03.5 Application of Surface Primer:

Do not allow traffic over primed areas before applying thermoplastic.

When applying 90 mil thermoplastic, use a two component epoxy sealer prior to placement of thermoplastic materials on portland cement concrete surfaces and oxidized asphalt.

When applying 40 mil thermoplastic, use a single component surface primer on portland cement concrete surfaces.

When applying preformed thermoplastic, use primer in accordance with manufacturer's recommendations.

732.03.6 Application of Markings:

Finished markings shall be continuous and uniform in shape, with clear and sharp dimensions. Finished lines shall have well defined edges and be free of waviness. Lines should be squared off at each end without excessive mist or drip. A tolerance of + 1/2 inch and -1/8 inch from the specified width will be allowed, provided the variation is gradual. Transverse variations up to 1 inch will be allowed provided the variation does not increase or decrease at the rate of more than 1/2 inch in 25 feet. Measurements will be taken as an average through any 36-inch section of line. Offset longitudinal lines approximately 2 inches from longitudinal joints. Remove lines not meeting these tolerances and replace at no cost to the Department in accordance with 732.03.4.

732.03.6.1 Thermoplastic Markings:

Use 90 mils for lane lines, edge lines, black contrast, gore markings and 125 mils for crosswalks, stop lines, words, and symbol markings or as indicated in plans.

Apply glass beads to the molten surface of completed stripes by either a single drop application for 40 mil thermoplastic markings, or a double drop application for 90 mil or greater thermoplastic markings. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night. For a 40 mil single drop application, the contractor has discretion on which beads to use in order to meet the retroreflectivity requirements. For the first drop of a 90 mil double drop application, use Type 4 beads at a minimum rate of 211 pounds per mile based on a 4-inch solid line. The type of bead for the second drop is at the contractor's discretion; however, a smaller bead is typical. Black thermoplastic pavement markings require skid-resistant filler in lieu of glass beads.

732.03.6.2 Preformed Plastic Markings:

Apply preformed plastic markings in accordance with the manufacturer's recommendation.

732.03.7 Field Testing of Roadway Markings:

The contractor and the Department will field test the pavement markings in accordance with 1015.10, 1015.11, and Table 732-1. Failure to meet these requirements will require the contractor to replace the portion of the material shown to be out of specification as directed by the engineer at no cost to the Department.

Take initial retroreflectivity readings within 7 to 30 days of application with a DOTD inspector present. Any readings taken after the 30 days will be considered initial readings and must meet the same requirements as initial readings. Upon completion of testing, the DOTD inspector will immediately take possession of a copy of the retroreflectivity readings in either a hard copy ($8^1/_2$ inches x 11 inches) or electronic format on a USB drive, as noted below. Additionally, provide documentation to the Department that the instrument has been calibrated in accordance with the manufacturer's requirements, including the required annual factory calibration.

The Department reserves the right to inspect the striping and take additional readings six months to one year after the date of installation for the one year warranty.

For each material type, take a different set of readings in accordance with Table 732-1. Provide the data to the Department electronically in Microsoft Excel® format downloaded from the reflectometer data. Each spreadsheet shall have a header that states all of the following:

1. Project number;
2. Date material installed;
3. Type of material installed;
4. Interstate: Specify the route and direction and show the beginning mile-point to ending mile-point, of material installed; and,
5. State Route: Specify the route and direction. Also specify X number mile from intersection to X number mile from intersection, of material installed. (*Ex.* Route US 61 South; 0.10 Mile South of Old Hammond Highway to 0.2 Mile South of I-12).

The format for the excel spreadsheet shall be (description, date, each reading, and average reading per segment). In the description cell, the format shall be Route (*i.e.*, LA, US, or I), Direction (*i.e.*, N, S, E, or W), Mile Point, and Color (W or Y).

Examples:

LA 115; W; 23; Y
I-10; S; 4; W

Table 732-1
Field Testing of Plastic Pavement Markings

Length of Roadway (Segment)	Minimum Required Readings
Less than 1 mile	10 evenly spaced readings per line
1 mile to 6 mile	10 evenly spaced readings per line for each 1-mile segment
Greater than 6 mile	5 evenly spaced readings per line for each 1-mile segment
Stop Bars, Cross Walks, Chevrons, Hash Marks, and Legends and Symbols	Visual nighttime inspection only
8-inch Lines (Parallel to Roadway)	5 readings per line

General Notes:

1. Take readings on each line and color separately except when adjacent lines are applied at the same time, which are considered one line. Alternate readings between each line.
2. Additional readings shall be taken if a defect is noticed by the engineer.
3. Take readings on dry, clean roadways.
4. Collect data in the direction lines were applied except for yellow centerlines on two lane roadways. For yellow centerlines on two lane roadways, collect data against the direction lines were applied.
5. On broken lines, no more than two readings shall be taken per stripe, with readings 20 inches from ends of marking. This does not apply if using a vehicle mounted mobile unit.
6. Acceptance will be based on the average of each set of readings for each line segment.
7. Failure of the average reading for any segment to meet the specified minimum values will require replacement or be subject to payment adjustments as determined by Table 732-2.
8. Asphalt Surface Treatment projects will not be tested for retroreflectivity, but will be visually inspected at night for acceptance by the engineer.
9. No reflectance readings are required for black, red, or blue thermoplastic pavement markings.

732.03.8 Guarantee:

All work performed in accordance with this section shall be guaranteed in accordance with 104.05.

732.04 MEASUREMENT.

732.04.1 Plastic Pavement Striping:

Plastic striping will be measured by the linear foot or mile, as specified, exclusive of gaps.

732.04.2 Plastic Pavement Legends and Symbols:

Plastic legends and symbols will be measured per each legend or symbol. Each symbol includes all letters, lines, bars, or markings necessary to convey the message at each location.

732.04.3 Removal of Existing Markings:

Where removal is indicated on plans or otherwise required, removal will be measured in centerline miles and include removal of all existing markings in both directions, including travel lanes, shoulders, and ramps. Measurement will only be made once, regardless of phasing requirements, and only in locations where removal is required.

Removal of pavement markings will include removal of lane lines, edge lines, gore markings, legends, symbols, raised pavement markers, and disposal of debris, unless indicated otherwise in the plans.

732.05 PAYMENT.

Payment for the completed and accepted quantities of plastic pavement markings and removal of existing markings will be made at the contract unit prices, which include all labor, materials, equipment, and incidentals necessary to complete the work.

Table 732-2
Thermoplastic Payment Adjustment for Initial Retroreflectivity

Contract Unit Price [1], %	White (mcd\lux\sq m)		Yellow (mcd\lux\sq m)	
	40 mil	90 mil or greater	40 mil	90 mil or greater
100	250	> 425	175	> 300
90	230	375 - 425	165	250 – 300
80	220	360 - 374	155	220 - 249
50	200	340 - 359	150	200 - 219
Restripe	<200	< 340	<150	< 200

1. The payment requirements are based on the project total average of all test segments (on a route) for initial reading for white and yellow separately in accordance with Table 732-1. Payment adjustments will be based on each identifiable route within the contract.

Payment will be made under:

Item No.	Pay Item	Pay Unit
732-01	Plastic Pavement Striping (____inch Width)	Linear Foot
732-02	Plastic Pavement Striping (Solid Line) (____inch Width)	Linear Mile
732-03	Plastic Pavement Striping (Broken/Dotted Line) (____inch Width)	Linear Mile
732-04	Plastic Pavement Legends and Symbols (Type)	Each
732-05	Removal of Existing Markings	Linear Mile

S.P. VEHICLE LOOP DETECTOR INSTALLATION (08-20):

Section 736 of the Louisiana Standard Specification for Roads and Bridges is amended as follows:

736.17 is deleted and replaced with the following:

736.17 VEHICLE LOOP DETECTOR INSTALLATION.

Contact the Engineer at least 14 days prior to the anticipated vehicle loop detector installation in order to achieve final approval of the loop layout from the District Traffic Operations Engineer (DTOE). Loop layout will not be accepted until installation of permanent striping is complete in the vicinity of the loop.

Saw slots in the pavement for installation of vehicle detector loop wire in the configuration, dimensions, and combinations as approved by the DTOE Cut an extension from the loop to the pavement edge to permit wire routing to an adjacent pullbox through a 1/2-inch conduit. Clean slots of loose material. The Engineer will examine and approve the depth of each loop slot for conformance with the plans before the contractor places the loop wires in the slot. Carefully place wires in the slot. The number of turns of wire installed for each loop shall be as required on the plans. Carefully push the wire into the slots with a blunt tool to avoid damaging the insulation. No splices will be permitted in the loop installation except in the pull-box, conduit fittings, or pole. Install wires from the pavement to the controller box inside a conduit as shown on the plans.

Uniformly twist wire installed from the pavement edge to the splice at 2 to 5 turns per foot. Splice the loop ends to a lead-in cable. Contact the Engineer at least 14 days prior to the anticipated installation of wires from the pavement to the controller box in order to achieve final approval of the connections from the DTOE. Connect the lead-in cable inside the controller cabinet. Splice the wires inside the junction box using an approved connector, then encapsulate with an approved electrical insulating waterproof epoxy as shown on the plans.

Completely fill the slots to within 1/8 inch of the pavement surface with an approved sealant in accordance with Table 1020-1.

S.P. Painted Curbs and Islands (05/21)

Section 737 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

737.01 is deleted and replaced with the following:

737.01 DESCRIPTION.

Furnish and apply reflective white or yellow paint for pavement striping, legends, symbols, curbs, and islands in accordance with plan details, the MUTCD, and these specifications.

Table 737-1 is deleted and replaced with the following:

Table 737-1
Field Testing of Painted Pavement Markings

Length of Roadway (Segment)	Minimum Required Readings
Less than 1 mi	10 evenly spaced readings per line[a, c]
1 to 6 mi	10 evenly spaced readings per line for each 1 mi segment [a, c]
>6 mi	5 evenly spaced readings per line for each 1 mi segment [b, c]
Stop Bars, Cross Walks, Chevrons, Hash Marks, Legends and Symbols, Curbs and Islands	Visual nighttime inspection only
8 inch Lines (Parallel to Roadway)	5 readings per line [b, c, d]

a. Report average of 10 readings per line segment.
b. Report average of 5 readings per line segment.
c. Additional readings shall be taken if deemed necessary by the engineer.
d. Only initial readings are required.

General Notes:

1. Take readings on each line and color separately except as indicated below.
2. Adjacent lines applied at the same time are considered one line. Alternate readings between each line.
3. Take readings on dry, clean roadways.
4. Collect data in the direction lines were applied except for yellow centerlines on two lane roadways. For yellow centerlines on two lane roadways, collect data against the direction lines were applied.
5. On broken lines (skip striping), no more than two readings shall be taken per stripe, with readings 20 inches from ends of marking. If using a vehicle mounted mobile unit this does not apply.
6. Acceptance will be based on the average of each set of readings for each line segment.
7. Failure of the average reading for any segment to meet the specified minimum values will require replacement, corrective action or be subject to payment adjustments specified in Table 737-2.
8. Limits of replacement will be determined by the engineer.
9. Asphalt Surface Treatment projects will not be tested for retroreflectivity, but will be visually inspected at night for acceptance by the engineer.
10. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night.

737.06 is amended to include the following:

737.06.3 Curbs and Islands

Painted Islands will be measured by the square yard. The area of the island will be measured to include the plan view width of the curb to the toe of the curb.

Painted Curbs will be measured by linear foot.

737.07 is deleted and replaced with the following:

737.07 PAYMENT.

Payment for painted traffic striping, curbs, islands, legends, and symbols will be made at the contract unit prices.

Payment will be made under:

Item No.	Pay Item	Pay Unit
737-01	Painted Traffic Striping (Solid Line)	Mile
737-02	Painted Traffic Striping (Broken Line)	Mile
737-03	Painted Traffic Striping (Solid Line)	Linear Foot
737-04	Pavement Legends and Symbols	Each

737-05	Painted Curbs	Linear Foot
737-06	Painted Islands	Square Yard

S.P. LIGHTWEIGHT AGGREGATE BACKFILL FOR STRUCTURAL EXCAVATION (03/19):

Section 802.04 is amended by adding the following after paragraph 1:

Backfill material shall comply with 1003.12 when lightweight coarse aggregate backfill is specified.

S.P. LIGHTWEIGHT AGGREGATE BACKFILL FOR EARTH RETAINING SYSTEMS (03/19):

Section 802.05.2.3 part 4 is amended by adding the following at the end:

Backfill material shall comply with 1003.12 when lightweight coarse aggregate backfill is specified.

S.P. SAMPLING AND TESTING (05/21)

Section 901.05 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended to include the following:

901.05 SAMPLING AND TESTING

Perform sampling and testing in accordance with the Department's “Materials Sampling Manual and Testing Procedures Manual”. Furnish necessary materials for testing at no direct pay.

For pumped concrete, sample at the discharge end of pump.

For truck mixers, sample for acceptance at midbatch.

Provide a storage chamber for temporary storage of the department's cylinders, at no additional cost to the department. The chamber shall provide an environment that prevents loss of moisture, maintain temperature within a range of 60 to 80 degrees fahrenheit, and be equipped with a continuously recording thermometer accurate to plus/minus 2 degrees fahrenheit. For mixtures with a specified strength of 6,000 psi or greater, the curing temperature shall be between 68°F – 78°F. Provide data from the thermometer as directed. Locate the chamber so that cylinders are not subject to vibration. The chamber shall be of sufficient size to store the required number of cylinders in a manner satisfactory to the engineer. Provide multiple chambers as necessary. The engineer will approve the location and number of chambers prior to start of operations.

S.P. INTERNALLY CURED CONCRETE (ICC) (01/21):

901.06.1 of 2016 Louisiana Standard Specifications for Roads and Bridges is amended to include the following:

901.06.1.2 Internally Cured Concrete:

Internally Cured Concrete (ICC) may be used for all structural concrete. All provisions of Section 901 shall apply to ICC, unless otherwise specified herein. ICC is concrete that contains sufficient water within the mixture to cure the concrete from the inside out. ICC will incorporate saturated lightweight aggregate as a portion of the fine aggregate volume within the concrete. The absorbed water within the saturated lightweight fine aggregate, which is not part of the mixing water, provides internal moisture that is slowly released to the hydrating cement within the paste matrix of the placed concrete. ICC has been shown to inhibit autogenous shrinkage and early age cracking of the placed concrete.

901.06.1.2.1 Materials:

Materials and mix proportions shall be in accordance with Section 901, and this specification:

Apply Structural and Minor Structural Concrete requirements per Table 901-3. All strength and surface resistivity requirements for Structural and Minor Structural concrete apply. Lightweight fine aggregate (sand) shall be in accordance with Section 1003.08.1.1.

Replace a portion of the fine aggregate (sand) of the mixture with 250 pounds of saturated lightweight fine aggregate on a volume for volume basis.

Determine surface moisture and absorption values for adjusting batch quantities using the centrifuge method and in accordance with DOTD TR 123. Provide a Certificate of Analysis for the mix design with verification reports for each identifiable pour of cast-in-place concrete and for each half-day's production of precast concrete elements.

901.06.1.2.2 Shipping and Storage:

Construct the lightweight fine aggregate stockpile at the production facility so as to maintain uniform moisture content throughout the pile. Prior to ICC production, the lightweight fine aggregate shall undergo a period of wetting and draining. Wet the lightweight fine aggregate stockpiles utilizing a sprinkler system or other approved method to continuously and uniformly apply water to soak the stockpiles for a minimum of 48 hours or until the moisture content can consistently be maintained above the absorption value. If steady rain of comparable intensity occurs, the sprinkler system may be turned off. At the end of the wetting period, the lightweight fine aggregate stockpiles shall be allowed to adequately drain to establish a uniform moisture content equal to the determined absorption value immediately prior to being used in ICC production. Maintain wetting and drainage by means necessary such as manipulation of the lightweight fine aggregate stockpile to maintain a uniform internal moisture content so that free water does not have time to drain down into the lower lightweight fine aggregate to change the water/cement ratio. Visually monitor and control the transfer of the lightweight fine aggregate so that free water does not have time to drain down into the lower lightweight fine aggregate. Do not exceed the maximum water/cementitious ratio for a batched load of ICC.

901.06.1.2.3 Curing:

When ICC is used for cast-in-place (CIP) bridge decks, apply the curing requirements in Section 805.06.4 except the specified number of wet curing days is 7 and Type 2 white-pigmented membrane curing compound is not required. When ICC is used for other CIP concrete, apply water cure method in Section 805.06.1 except the specified number of wet curing days is 6. When ICC is used for precast concrete members, apply curing requirements in Section 805.09.4 except the specified number of wet curing days is 2 and if used, the steam cure method shall be in accordance with 805.09.4.1.

S.P. INTERNALLY CURED ADMIXTURE (ICA) (06/22):

901.06.1 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended to include the following:

901.06.1.3 Internal Curing Admixture:

In lieu of the requirements of 901.06.1.2, internal curing admixture (ICA) is an approved substitution. All provisions of Section 901 shall apply to ICA, unless otherwise specified herein. An ICA listed on the AML shall be used.

ICA method uses an ASTM C494 Type S certified liquid admixture that retains 95% of the mix water using nano-silica to trap moisture for hydrating the cement within the paste matrix of the placed concrete.

Submit to the Project Engineer a written request for approval to use ICA and alternate curing method no less than 7 days prior to concrete placement. Field trial batches are required to verify that the laboratory mix design produced in the field is acceptable using mix trucks accepted for use on the project. Perform Quality Control testing using a Department accepted certified lab.

Perform the following minimum tests and actions upon discharge from the mix truck:

1. Air content
2. Slump
3. Unit weight
4. Preparation of compressive strength test cylinders
5. Surface Resistivity

Verification testing may be performed by the Department.

901.06.1.3.1 Materials:

Conform to Structural and Minor Structural Concrete requirements of Table 901-3, with the exception that the water-cementitious ratio (w/c) of the concrete mix shall be 0.45 to 0.47. Conform to all strength and surface resistivity specifications for Structural and Minor Structural Concrete.

In addition to the submittal requirements of 901.06.1, proposed concrete mix designs shall be submitted to a representative from the ICA manufacturer for approval.

The concrete mixture shall be verified to be fully wetted before adding ICA to the load. ICA shall be applied directly to the plastic concrete in the mixing truck. The plastic concrete shall be brought to the rear of the mixing drum to ensure proper application. Under no circumstance shall the ICA be allowed to touch the inside surface of the mixing drum. Submit for review a Certificate of Analysis for the mix design verifying the dosage rate and compatibility of ICA with all concrete components including other admixtures.

Submit for record a certification from the ICA manufacturer approving the contractor to add ICA to the concrete. A representative from the ICA manufacturer shall be present when adding ICA to the concrete, and a trial batch of fresh concrete shall be presented to the manufacturer's representative for approval. Submit for record a Certificate of Analysis for the mix design with verification reports for each identifiable pour of cast-in-place concrete.

901.06.1.3.2 Shipping and Storage:

Admixtures shall be shipped in air tight containers that are clearly labeled and accompanied by Safety Data Sheets. Admixtures must be stored without direct sunlight exposure and at safe temperature ranges between 40 and 130 degrees Fahrenheit or as per supplier's recommendations and technical data sheets.

901.06.1.3.3 Placement:

Concrete shall be handled and placed according to 805.05 with the following exceptions:

A representative from the manufacturer shall be present during concrete finishing.

The contractor must submit for record a certification from the manufacturer approving finished concrete containing ICA.

Water shall not be applied to the plastic concrete surface for any reason.

Products marketed as "evaporative retardants" or " evaporation reducers" shall not be used for any reason.

Remove and replace at no cost to the Department any ICA concrete placed using methods not consistent with the requirements of this subsection.

901.06.1.3.4 Curing:

Concrete shall be wet cured in accordance with 805.06.

S.P. Coarse Aggregates (04/22):

Section 901 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

901.08.5.2 Coarse Aggregates is deleted and replaced with the following:

901.08.5.2 Coarse Aggregates:

Ensure that coarse aggregates, except for combined gradations for Types B and D, are the grade specified in Table 901-3 and comply with the requirements of 1003.08.2.

S.P. ASPHALT CEMENT, EMULSIONS, AND ADDITIVES (07-22)

1002 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

Table 1002-3 is deleted and replaced with the following:

Table 1002-3
Performance Graded Asphalt Cements

Property	AASHTO Test Method	PG76-22rm [1, 6]	PG 76-22m	PG 70-22m	PG 67-22	PG58-28
		Spec.	Spec.	Spec.	Spec.	Spec.
Tests on Original Binder:						
Rotational Viscosity @ 135°C, Pa·s [2]	T 316	3.0-	3.0-	3.0-	3.0-	3.0-
Dynamic Shear, 10 rad/s, G*/Sin Delta, kPa	T 315	1.00+ @ 76°C	1.00+ @ 76°C	1.00+ @ 70°C	1.00+ @ 67°C	1.00+ @ 58°C
Dynamic Shear, 10 rad/s, Phase Angle, °	T 315	75°- @ 76°C	75°- @ 76°C	---	---	---
Flash Point, °C	T 48	232+	232+	232+	232+	232+
Solubility, % [3]	T 44	N/A	99.0+	99.0+	99.0+	99.0+
Separation of Polymer, 163°C, 48 hours, degree C difference in R & B from top to bottom [4]	ASTM D7173 T 53	---	2-	2-	---	---
Tests on Rolling Thin Film Oven Residue:	T 240					
Mass Change, %	T 240	1.00-	1.00-	1.00-	1.00-	1.00-
Dynamic Shear, 10 rad/s, G*/Sin Delta, kPa	T 315		---	---	2.20+ @ 67°C	2.20+ @ 58°C
Multiple Stress Creep Recovery (MSCR), Jnr(3.2 kPa) @ 67°C	T 350	0.5-	0.5-	1.0 - 2.0	---	---
Multiple Stress Creep Recovery (MSCR), % Recovery (3.2 kPa) @ 67°C	T 350	Meets curve [5]	Meets curve [5]	15	---	---

Ductility, 25°C, 5 cm/min, cm	T 51	---	---	---	90+	---
Tests on Pressure Aging Vessel Residue:	R 28					
Dynamic Shear, @ 26.5°C, 10 rad/s, G* Sin Delta, kPa	T 315	6000-	6000-	6000-	5000-	5000- @ 19°C
Bending Beam Creep Stiffness, S, MPa @ -12°C.	T 313	300-	300-	300-	300-	300- @ -18°C
Bending Beam Creep Slope, m value,@ -12°C	T 313	0.300+	0.300+	0.300+	0.300+	0.300+ @ -18°C

[1]Tank mixers are required. Submit written documentation of tank cleaning annually to the Materials Laboratory. Submit written certificates of analysis from the asphalt binder supplier confirming rubber source and size distribution of rubber used. Furnish to the Materials Laboratory.

[2]The rotational viscosity will be measured to determine product uniformity. The rotational viscosity measured by the supplier shall be noted on the Certificate of Delivery. A binder having a rotational viscosity of 3.0 Pa·s or less will typically have adequate mixing and pumping capabilities. Binders with rotational viscosity values higher than 3.0 Pa·s should be used with caution and only after consulting with the supplier as to any special handling procedures and guarantees of mixing and pumping capabilities.

[3]Not all polymers are soluble in the specified solvents. If the polymer modified asphalt digested in the solvent will not pass the filter media, a sample of the base asphalt used in making the polymer modified asphalt should be tested for solubility. If the solubility of the base asphalt is at least 99.0%, the material will be considered as passing.

[4]Prepare samples per ASTM D7173. Determine softening point of top and bottom per AASHTO T 53. Not required when crumb rubber is used.

[5]As defined in AASHTO M 332.

[6]Use a maximum of 10% crumb rubber.

1002 of the *2016 Louisiana Standard Specifications for Roads and Bridges* is amended as follows:

Table 1002-5 is deleted and replaced with the following:

Table 1002-5
Non-Tracking Tack Coats – Cold Applied

Property	AASHTO Test Method	NTSS-1HM		CBC-1HT	
		100% Pay	**50% Pay or Remove and Replace[1]**	**100 % Pay**	**50% Pay or Remove and Replace[1]**
Viscosity, Saybolt Furol @ 25°C, s	T 59	15 - 150	---	10 - 150	---
Storage Stability, 24 Hour, %	T 59	1.0-	---	1.0-	---
Settlement, 5 Days, %	T 59	5.0-	---	---	---
Residue by Distillation3, %	T 59	50+	49-	50+	49-
Oil Distillate, %	T 59	1.0-	---	1.0-	---
Sieve Test, (Retained on the 850 µm), %2	T 59	0.3-	---	0.3-	---
Tests on Residue					
Penetration @ 25°C, 100g, 5s, dmm	T 49	20-	---		
Softening Point, Ring and Ball, °C	T 53	65+	64-		
Solubility, %	T 44	97.5+	---	---	---
DSR @ 82°C; G*/Sin δ, 10 rad / s, kPa	T 315	1.00+	0.99-	---	---
Multiple Stress Creep Recovery (MSCR), 64°C, Jnr (3.2 kPa)	T 350	---	---	2.0-	> 2.0

1 At the Chief Engineer's option.
2 Sieve tests may be waived if no application problems are present in the field.
3 For CBC-1HT only: Exception to T59 Distillation – Bring the temperature on the lower thermometer slowly to 350°F. Maintain at this temperature for 20 minutes. Complete total distillation in 60 +/- 5 minutes from the first application of heat.

Table 1002-12 is deleted and replaced with the following:

Table 1002-12
Non-Tracking Hot Applied Polymer (NTHAP) Tack Coat

Property	Test Method	Min.	Max.
Rotational Viscosity @ 149 °C, Pa·s	AASHTO T316	----	3.0*
Penetration @ 25 °C , dmm	ASTM D5	----	25
Softening Point, °C	ASTM D36	70	125
Original DSR @ 82 °C , G*/sin δ, kPa	AASHTO T315	1.0	----
Creep Stiffness, m-value @ 0 °C on original binder	AASHTO T313	0.285	----

* Rotational viscosity shall be waived if material can be successfully applied in the field.

S.P. Aggregates (11/21):

Section 1003 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

1003.01.2.2 Magnesium Sulfate Soundness is deleted and replaced with the following:

1003.01.2.2. Magnesium Sulfate Soundness:

For source approval of stone and gravel, the maximum soundness loss is 15 percent when subjected to 5 cycles of the magnesium sulfate soundness test. RPCC will not be tested for soundness.

1003.01.3.1 Recycled Portland Cement Concrete, (RPCC) is deleted and replaced with the following:

1003.01.3.1 Recycled Portland Cement Concrete, (RPCC):

RPCC shall be from an approved source listed in the SiteManager® Producer/Supplier List. RPCC shall be crushed portland cement concrete screened and/or graded to meet the requirements of the specification for the intended use. For source approval, the raw material feedstock, the crushing operation, the quality control program, and the stockpiles will be inspected and approved by the District Laboratory Engineer. Quality must be maintained in order to retain source approval status. RPCC used for Interstate projects shall be stored in dedicated stockpiles used solely for one specific project. The RPCC for non-Interstate projects shall be stored in working stockpiles that are separate, identifiable, and have a minimum quantity of 5000 cubic yards. Stockpiles shall be reasonably free of asphalt concrete overlay material, reinforcing steel, joint material, base course material and other debris.

S.P. LIGHTWEIGHT AGGREGATE FOR INTERNALLY CURED CONCRETE (ICC) (01/21):

Section 1003 is amended as follows:

1003.08.1.1 is amended to include the following:

1003.08.1.1 Lightweight Aggregate for Internally Cured Concrete (ICC):

Lightweight fine aggregate (sand) shall be from an expanded clay, shale, or slate lightweight aggregate source listed on the Approved Materials List and shall be free from excess foreign matter. Comply with Table 1003-16 for required gradation:

Table 1003-16 is deleted and replaced with the following:

Table 1003-16
Gradation for Portland Cement Concrete Fine Aggregate

Application	U.S. (Metric) Sieve Size	Percent Passing By Weight (Mass)

Portland Cement Concrete Sand	3/8 inch (9.5 mm) No. 4 (4.75 mm) No. 16 (1.18 mm) No. 50 (300 µm) No. 100 (150 µm) No. 200 (75 µm)	100 95 - 100 45 - 90 7 - 30 0 - 7 0 - 3
Fine Lightweight Aggregate for ICC	3/8 inch (9.5 mm) No. 4 (4.75mm) No. 16 (1.18 mm) No. 50 (300 µm) No. 100 (150 µm)	100 65-100 15-80 0-35 0-25

S.P. Limestone Aggregate (04/22):

Section 1003 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

1003.08.2 Coarse Aggregate is amended to include the following:

1003.08.2.3 Limestone Aggregate:

Limestone aggregate with a minimum Polish Value of 24 can be used on bridge decks receiving a tined surface finish.

S.P. Backfill (06/21)

Section 1003 of the 2016 Louisiana Standard Specifications for Roads and Bridges is amended as follows:

1003.11 is deleted and replaced with the following:

1003.11 BACKFILL.

Stone shall comply with 1003.03.1. Recycled portland cement concrete, RPCC, shall comply with 1003.03.2.

S.P. LIGHTWEIGHT AGGREGATE FOR EMBANKMENT, BACKFILL OF STRUCTURAL EXCAVATION, AND EARTH RETAINING SYSTEMS (11/18):

Section 1003 is amended to include the following:

1003.12 LIGHTWEIGHT AGGREGATE FOR EMBANKMENT, BACKFILL OF STRUCTURAL EXCAVATION, AND EARTH RETAINING SYSTEMS:

Lightweight aggregate shall be from the Approved Materials List. Lightweight aggregate shall consist of cubicle fragments which are of uniform density and are free from foreign matter.

Lightweight aggregate backfill shall provide a minimum internal friction angle (φ) of 34 degrees and comply with the following table.

Lightweight Coarse Aggregate Gradation

U.S. Sieve Size	Percent Passing
3/4 inch	100
1/2 inch	90-100
3/8 inch	40-80
No. 4	0-15
No. 8	0-5

Lightweight aggregates shall show an abrasion loss of not more than 40 percent when tested in accordance with DOTD TR 111. The unit weight (mass) (AASHTO T19) of lightweight coarse aggregate shall not exceed 55 pounds per cubic foot, dry loose measurement. If the unit weight (mass) of any shipment of lightweight coarse aggregate differs by more than 10 percent from that of the sample submitted for acceptance tests, the shipment shall be rejected.

S.P. SIGNS AND PAVEMENT MARKINGS (02/19):

Section 1015 Signs and Pavement Markings is deleted and replaced with the following:

Section 1015 Signs and Pavement Markings

1015.01 GENERAL REQUIREMENTS.

Signs and pavement markings materials shall comply with these specifications, the plans and the MUTCD. When directed, the contractor shall furnish and prepare samples for testing in accordance with Department instructions.

1015.02 METALS.

1015.02.1 Ferrous Metals:

1015.02.1.1 Structural Steel:

Structural steel for posts, stringers, framing and miscellaneous steel shall comply with AASHTO M 270, Grade 36. Steel shall be galvanized in accordance with 811.08.

1015.02.1.2 Steel Pipe:

Steel pipe or tubing for structures shall be Schedule 40 (STD) complying with ASTM A53, Type E or Type S Grade B, or hot formed tubing complying with ASTM A36 and ASTM A501.

1015.02.1.3 U-Channel Steel Posts for Small Signs, Markers, and Delineators:

Posts shall be steel of the flanged channel type shown on the plans, galvanized after fabrication in accordance with 811.08. Before fabrication, posts shall be within 3.5 percent of the specified weight.

Posts shall be fabricated from steel complying with either ASTM A499, Grade 60 with chemical properties conforming to ASTM A1 for 91 lb/yd or heavier rail steel, or ASTM A576, Grade 1080 with 0.10 to 0.20 percent silicon. Holes 3/8 inch in diameter shall be drilled or punched through the middle of each post on one inch centers for the full length of the post.

1015.02.1.4 Square Tubing for Small Signs, Markers, and Delineators:

The square tubing shall conform to ASTM A1011, Grade 50 for hot rolled carbon steel, structural quality. The average minimum tensile strength after cold-forming is 60,000 psi. The cross section of the square tubing shall be a square tube formed and carefully rolled to size and shall be welded by high frequency resistance welding and externally scarfed to agree with corner radii and dimensional tolerances shown in the DOTD Roadside Traffic Sign Standard Details. It shall be manufactured from hot-dipped galvanized steel conforming to ASTM A653, G90, Structural Quality, Grade 50, Class 1. The weld shall be hot zinc coated after the scarfing operation. The steel shall be coated with a chromate conversion coating and a clear organic polymer topcoat.

Perforated sign posts shall be 2 inches x 2 inches square tubing for the upright sign post and 2 1/4 inches x 2 1/4 inches x 3 feet shall be used for anchoring into soil using wet concrete in accordance with the Roadside Traffic Sign Standard Plans.

1015.02.1.5 Square Tubing Breakaway Supports, Hardware and Related Accessories:

These items shall meet the specifications in DOTD Roadside Traffic Sign Standard Details. The breakaway support shall be a Kleen-Break Model 425 post coupler manufactured by Xcessories Squared.

1015.02.2 Aluminum Alloy:

Structural members shall be aluminum complying with ASTM B221 or ASTM B429, Alloy 6061-T6.

Miscellaneous aluminum shall comply with ASTM B209, Alloy 6061-T6.

1015.02.3 Connectors:

1015.02.3.1 Structural Bolts, Nuts and Washers:

High strength bolts shall comply with ASTM A325, and other bolts shall comply with ASTM A307, Grade A or Grade B. Bolts shall have hexagonal heads and include two flat washers and one lock washer and one hexagonal-head nut. Bevel washers, where required, shall be wrought steel. Bolts, nuts and washers shall be galvanized in accordance with ASTM A153 or by an approved mechanical galvanizing process complying with ASTM B695 that provides the same coating thickness.

Anchor bolts shall comply with ASTM F1554. Anchor bolts shall be hot dip galvanized in accordance with ASTM A153.

Stainless steel bolts shall comply with ASTM F593, alloy groups 1, 2, or 3 (except alloys 303 or 303 Se), with a minimum tensile strength of 70,000 psi.

1015.02.3.2 Fasteners:

Use vandal resistant aluminum alloy fasteners with brasier heads complying with ASTM B316, Alloy 2024-T4, to attach Interstate, Louisiana, and U.S. shields to the sign panel.

1015.03 FLEXIBLE POSTS.

Flexible posts for delineators shall be from the Approved Materials List.

1015.04 SIGN PANELS.

Flat sign panels shall be marked on the front bottom edge with MUTCD code, initials of the manufacturer and the date. Extruded panels shall be marked on the back in accordance with the standard plans.

1015.04.1 Permanent Sign Panels:

New and recycled flat panels shall be 0.080 inch thickness aluminum sheets or plates complying with ASTM B209, Alloy 6061-T6 or Alloy 5052-H38.

New and recycled extruded aluminum panels shall comply with ASTM B221, Alloy 6063-T6 and after fabrication, shall have a flatness equal to or less than 0.031 inch per foot of length and 0.004 inch per inch of width. The traceability paperwork shall be maintained and available from the fabricator for 7 years.

1015.04.2 Temporary Sign Panels:

Substrate for barricade panels shall be rigid thermoplastic. Substrate for portable signs shall be new or recycled aluminum, wood or plastic. Substrate for post mounted signs shall be new or recycled aluminum, wood, rigid thermoplastic or aluminum clad low density polyethylene plastic.

1015.04.2.1 New or Recycled Aluminum:

Aluminum sheeting shall be 0.080 inch thickness complying with ASTM B209, Alloy 6061-T6 or Alloy 5052-H38.

1015.04.2.2 Wood:

Plywood sheeting of exterior type grades either High Density Overlay or Medium Density Overlay are acceptable for use provided the following requirements are met.

Panels shall be a minimum of 5/8 inch thick, shall comply with the latest American Plywood Association specifications, and shall be identified with the APA edge mark or back stamp to verify inspection and testing. Prior to application of reflective sheeting, the surface shall be abraded with steel wool or fine sandpaper, and wiped thoroughly clean. The surface shall dry a minimum of 8 hours prior to application of sheeting. Cut edges of plywood panels shall be sealed with an approved aluminum pigmented polyurethane sealer.

1015.04.2.3 Plastic:

Plastic substrate for barricade panels and signs shall be as follows:

1015.04.2.3.1 Fiber Reinforced Vinyl (PVC):

The substrate shall have a nominal composite thickness of 0.04 inches and be bonded to an approved retroreflective material by the manufacturer.

1015.04.2.3.2 Rigid Thermoplastic:

Rigid thermoplastic substrate shall consist of either High Density Polyethylene (HDPE) or High Density Polycarbonate (HDPC). The rigid thermoplastic for barricade panels shall be hollow core HDPE or HDPC with a minimum thickness of 0.625 inch. The thermoplastic for sign panels shall be 0.40 inch thick thin wall, fluted substrate or 0.625 inch thick blow molded substrate. Substrates shall be sufficiently rigid to maintain a flat face and shall be capable of attachment to the sign mounting in such a manner as not to crush or otherwise deform the substrate. Reflectorized sheeting applied to rigid thermoplastic shall have its manufacturer's approval for use on the substrate.

1015.04.2.3.3 Aluminum Clad Low Density Polyethylene (AL/LDPE) Plastic:

The aluminum clad low density polyethylene plastic substrate shall be 0.080 inch thick. The substrates shall be sufficiently rigid to maintain a flat face and shall be capable of attachment to the sign mounting in such a manner as not to crush or otherwise deform the substrate. Reflectorized sheeting applied to aluminum clad low density polyethylene shall have its manufacturer's approval for use on this substrate.

1015.05 REFLECTIVE SHEETING.

1015.05.1 Permanent and Temporary Standard Sheeting:

Reflective sheeting shall be one of the following standard types as specified on the plans and complying with ASTM D4956 except as modified herein. Reflective sheeting shall be from the Approved Materials List.

Type III - A high-intensity retroreflective sheeting. This sheeting is typically encapsulated glass-bead retroreflective material.

Type IV - A “high-intensity” retroreflective sheeting, typically used for permanent highway signing, construction zone devices and delineators. This sheeting is typically a unmetalized microprismatic retroreflective element material.

Type V - A “super high-intensity” retroreflective sheeting, typically used for delineators. This sheeting is typically a metalized microprismatic retroreflective element material.

Type VI - An elastomeric, high-intensity retroreflective sheeting without adhesive. This sheeting is typically a vinyl microprismatic retroreflective element material.

Type VIII – A “super high-intensity” retroreflective sheeting, typically used for permanent highway signing, construction zone devices and delineators. This sheeting is typically an unmetalized microprismatic retroreflective element material.

Type IX – A "super high-intensity" retroreflective sheeting, typically used for permanent highway signing, construction zone devices and delineators. This sheeting is typically an unmetalized microprismatic retroreflective element material.

Type XI – A "super high-intensity" retroreflective sheeting, typically used for permanent highway signing, construction zone devices and delineators. This sheeting is typically an unmetalized microprismatic retroreflective element material.

1015.05.2 Deleted

1015.05.3 Deleted

1015.05.4 Adhesive Classes:

The adhesive required for retroreflective sheeting shall be Class 1 (pressure sensitive) as specified in ASTM D4956.

1015.05.5 Accelerated Weathering:

Reflective sheeting, when processed, applied, and cleaned in accordance with the manufacturer's recommendations, shall perform in accordance with the accelerated weathering standards in Table 1015-4.

Table 1015-4
Accelerated Weathering Standards[1]

Type	Retroreflectivity[2]				Colorfastness[3]	
	Orange/ Fluorescent Orange		All colors, except Orange/ Fluorescent Orange		Orange/ Fluorescent Orange	All colors, except Orange/ Fluorescent Orange
III	1 year	80[4]	3 years	80[4]	1 year	3 years
III (for drums)	1 year	80[4]	1 year	80[4]	1 year	1 year
V	1 year[5]	80[6]	3 years[5]	80[6]	1 year[5]	3 years[5]
VI	1/2 year	50[7]	1/2 year	50[7]	1/2 year	1/2 year
IV, VIII, IX, XI	1 year	80[8]	3 years	80[8]	1 year	3 years

1. At an angle of 45° from the horizontal and facing south in accordance with ASTM G7 at an approved test facility in Louisiana or South Florida.
2. Percent retained retroreflectivity of referenced table after the outdoor test exposure time specified.
3. Colors shall conform to the color specification limits of ASTM D4956 after the outdoor test exposure time specified.
4. ASTM D4956, Table 4.
5. If outdoor weathering data is not available, artificial weathering according to ASTM D4956, Supplemental Requirement S3 may be used.
6. ASTM D4956, Table 6.
7. ASTM D4956, Table 7.
8. ASTM D4956, Tables 5, 8, 9, and 10.

Reflective sheeting for signs, when processed, applied, and cleaned in accordance with the manufacturer's recommendations shall perform outdoors in accordance with the performance standards in Table 1015-5.

Table 1015-5
Reflective Sheeting Performance Standards

Type	Retroreflectivity[1] — Durability[2]				Colorfastness[3]
	Orange/ Fluorescent Orange		All colors, except Orange/Fluorescent Orange		
III	3 years	80[4]	10 years	80[4]	3 years
IV, VIII, IX, XI	3 years	80[5]	10 years	80[5]	3 years

1. Percent retained retroreflectivity of referenced table after installation and acceptance and the field exposure time specified.
2. All sheeting shall maintain its structural integrity, adhesion and functionality after installation and the field exposure time specified.
3. All colors shall conform to the color specification limits of ASTM D4956 after installation and the field exposure time specified.
4. ASTM D4956, Table 4.
5. ASTM D4956, Tables 5, 8, 9, and 10.

Table 1015-5a
Permanent Signs Reflective Sheeting

	Background	Legend
	ASTM D4956	
All Permanent Signs except for Overhead Mounted	Type IV	Type IV
Overhead Mounted Signs	Type IV [1]	Type VIII or XI [2]

1. Sign sheeting used for backgrounds of overheads mounted signs shall meet but not exceed an ASTM D4956 type with retroreflectivity performance in excess of Type IV
2. Use a uniform sheeting type for legends on signs of the same support.

1015.05.6 Temporary Signs, Barricades, Channelizing Devices, Drums and Cones:

1015.05.6.1 Temporary Signs:

On all roadways, fabricate the warning construction signs using fluorescent orange reflective sheeting meeting and/or exceeding ASTM D 4956 Type IV.

1015.05.6.2 Barricades:

Reflective Sheeting shall meet or exceed the requirements of ASTM D 4956, Type III.

1015.05.6.3 Vertical Panels:

Reflective sheeting for vertical panels used to channelize or divide traffic shall meet or exceed the requirements of ASTM D 4956, Type III.

1015.05.6.4 Drums and Supercones:

Reflective sheeting for drums and supercones shall meet or exceed the requirements of ASTM D 4956, Type III, and the Supplementary Requirement S2 for Reboundable Sheeting as specified in 1015.05.6.

1015.05.6.5 Traffic Cones:

Reflective sheeting for traffic cones shall meet or exceed the requirements of ASTM D4956, Type III or VI.

1015.05.7 Sheeting Guaranty:

The contractor shall provide the Department with a guaranty from the sheeting manufacturer stating that if the retroreflective sheeting fails to comply with the performance requirements of this subsection, the sheeting manufacturer shall do the following:

Table 1015-6
Manufacturer's Guaranty-Reflective Sheeting

Type	Manufacturer shall restore the sign face in its field location to its original effectiveness at no cost to the Department if failure occurs during the time period[1] as specified below		Manufacturer shall replace the sheeting required to restore the sign face to its original effectiveness at no cost to the Department if failure occurs during the time period[1] as specified below
	Orange/ Fluorescent Orange	Digital printing and all sheeting colors, except Orange/Fluorescent Orange	Digital printing and all sheeting colors, except Orange/Fluorescent Orange
III	<3 years	<7 years	7 - 10 years
IV, VIII, IX, XI	<3 years	<7 years	7 - 10 years

1. From the date of installation and acceptance.

Replacement sheeting for sign faces, material, and labor shall carry the unexpired guaranty of the sheeting for which it replaces.

The sign fabricator shall be responsible for dating all signs with the month and year of fabrication at the time of sign fabrication.

1015.06 NON-REFLECTIVE SHEETING.

1015.06.1 General Requirements:

Non-reflective sheeting film shall consist of an extensible, pigmented, weather-resistant plastic film. Face side of film shall be supported and protected by a paper liner which is readily removable after application without the necessity of soaking in water or other solvents. Colors shall match visually and be within the limits shown in Table 11 of ASTM D4956.

1015.06.2 Adhesive Requirements:

Sheeting shall have a pre-coated pressure sensitive adhesive backing, which may be applied without additional coats on either sheeting or application surface. Adhesive shall comply with ASTM D4956, Class 1 (pressure sensitive).

1015.06.3 Physical Characteristics:

The film shall be readily cut by normal fabricating methods without cracking, checking or flaking. Applied film shall be free from ragged edges, cracks, and blisters. The material shall have demonstrated its ability to withstand normal weathering without checking, cracking, or excessive color loss.

1015.07 SIGN ENAMELS, PAINTS, SILK SCREEN PASTE, OVERLAY FILM, AND DIGITAL PRINTING.

1015.07.1 Sign Enamels and Paints:

These shall be applied in accordance with the sheeting manufacturer's recommendations. Final appearance as well as materials used shall be subject to approval.

1015.07.2 Silk Screen Paste:

Silk screen paste shall be mixed at the factory, well ground to a uniform consistency and smooth texture, and shall be free from water and other foreign matter. It shall dry within 18 hours to a film that does not run, streak, or sag. Paste which has livered, hardened, or thickened in the container, or in which pigment has settled out so that it cannot be readily broken up with a paddle to a uniform usable consistency, will be rejected. Thinner shall be used in accordance with the sheeting manufacturer's recommendations.

Paste shall have proper pigmentation and consistency for use in silk screen equipment. The material shall produce the desired color and the same retroreflectivity values as required for reflective sheeting of the same type and color when applied on reflective sheeting background. Paste shall meet the quality and test requirements for appearance, coarse particles, and moisture and water resistance as specified for sign paints.

1015.07.3 Overlay Film:

Transparent electronic cuttable overlay film shall produce the desired color and the same retroreflectivity values as required for reflective sheeting of the same type and color when applied on reflective sheeting background.

1015.07.4 Digital Printing:

Use digital printing systems that are part of an integrated component system including appropriate software and drivers, recommended and supported by a sheeting manufacturer listed on the Approved Materials List. Perform digital printing operations in accordance with the recommendations of the manufacturer of the retroreflective sheeting being used to produce the signs. Use digital printing system listed on the Approved Materials List.

Process messages before applying the sheeting to the base panel.

Finished signs shall have a UV-protective clear overlay applied to the entire face of the sign. Overlay shall be part of an integrated component system as recommended by the retroreflective sheeting manufacturer. Fluorescent orange work zone signs printed with black ink only do not require an overlay.Completed printed surface shall have sharp edges, be free of bubbles, blemishes, streaks or spotted areas, and show good workmanship.

Digital printing shall produce the desired color and the same retroreflectivity values as required for the reflective sheeting of the same type and color when applied on reflective sheeting background.

1015.08 TEMPORARY PAVEMENT MARKINGS.

1015.08.1 Temporary Tape:

Temporary tape shall comply with ASTM D4592, Type I (removable) or Type II (non-removable) and shall be from the Approved Materials List.

1015.08.2 Painted Stripe:

Paint shall be an approved traffic paint complying with 1015.12. Glass beads for drop-on application shall comply with 1015.13.

1015.08.3 Temporary Raised Pavement Markers (Tabs):

Shall be flexible reflective tabs having a nominal width of 4 inches. The markers shall be yellow with amber reflective area on both sides. The body of the marker shall consist of a base and vertical wall made of polyurethane or other approved material and shall be capable of maintaining a reasonable vertical position after installation. The initial minimum Coefficient of Luminous Intensity at an entrance angle of -4 degrees and an observation angle of 0.2 degrees shall be 230 mcd/lx when measured in accordance with ASTM E810.

The reflective material shall be protected with an easily removable cover of heat resistant material capable of withstanding and protecting the reflective material from the application of asphalt at temperatures exceeding 325°F.

1015.09 RAISED PAVEMENT MARKERS.

Markers shall be either non-reflectorized or reflectorized, as specified. Markers shall be from the Approved Materials List.

1015.09.1 Non-Reflectorized Markers:

1015.09.1.1 Description:

Non-reflectorized markers shall consist of an acrylonitrile butadiene styrene polymer or other approved material, and shall be approximately 4 x 6-inches.

1015.09.1.2 Physical Requirements:

Markers shall comply with the compressive strength requirements of ASTM D4280. The color shall be in accordance with the plans and the MUTCD.

1015.09.2 Reflectorized Markers:

Reflectorized markers shall comply with ASTM D4280, Designation H and Designation F. The type and color shall be in accordance with the plans and the MUTCD. The markers shall be either standard or low profile. Standard markers shall have a base dimension of 3 x 3-inches and a maximum height of 0.80 inches. Low profile markers shall have a base dimension of 3 x 2-inches and a maximum height of 0.60 inches.

1015.09.3 Adhesive:

1015.09.3.1 Epoxy Adhesive:

Epoxy adhesive shall be Type I or II epoxy resin system complying with 1017.03.

1015.09.3.2 Bituminous Adhesive:

The adhesive shall conform to ASTM D4280 (any type) for asphalt surfaces and D4280 Type II or Type III for concrete surfaces and shall be from the Approved Materials List.

1015.10 THERMOPLASTIC PAVEMENT MARKINGS.

1015.10.1 Description:

This specification covers hot-sprayed, hot-extruded, ribbon gun, and preformed thermoplastic compound for pavement markings on asphalt or portland cement concrete pavement. Thermoplastic marking material shall consist of an alkyd based formulation. Non-preformed material shall be manufactured so as to be applied by spray 40 mils thick or extrusion 90 mils thick or greater to pavement in molten form, with internal and surface application of glass spheres, and upon cooling to normal pavement temperature, shall produce an adherent, reflectorized pavement marking of specified thickness and width, capable of resisting deformation. Black thermoplastic pavement markings shall require skid-resistant filler in lieu of glass beads. Black thermoplastic pavement markings shall have identical material properties to their white thermoplastic counterparts with the exception of color.

For yellow thermoplastic material, the type and amount of yellow pigment shall be at the option of the manufacturer, providing all other requirements of this specification are met. However, the pigment for yellow thermoplastic shall be lead free and shall meet the regulatory level of nonhazardous waste as defined by 40 CFR § 261.24 when tested in accordance with EPA Method 1311, Toxicity Characteristics Leaching Procedures. The manufacturer shall provide certification that the material provided meets these requirements.

1015.10.2 Suitability for Application:

Thermoplastic material shall be a product especially compounded for pavement markings. Markings shall maintain their original dimension and placement and shall not smear or spread under normal traffic at temperatures below 140°F. Markings shall have a uniform cross section. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night. Pigment shall be evenly dispersed throughout the material thickness. The exposed surface shall be free from tack and shall not be slippery when wet. Material shall not lift from pavement in freezing weather. Cold ductility of material shall be such as to permit normal movement with the pavement surfaced without chipping or cracking.

1015.10.3 Standard (Flat) 90 mil or Greater Thermoplastic Pavement Markings:

White and yellow thermoplastic shall be from the Approved Materials List and comply with AASHTO M 249 as modified herein. All other colors are not required to be from the Approved Materials List.

1015.10.3.1 Color:

1015.10.3.1.1 Laboratory Performance:

The yellow thermoplastic shall comply with the requirements of Table 1015-7 when tested in accordance with ASTM E1349.

Table 1015-7
Color Specification Limits (Daytime)

Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.4756	0.4517	0.4985	0.4779	0.5222	0.4542	0.4919	0.4354

(The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with Standard 2° Observer and Standard Illuminant D65.)

1015.10.3.1.2 Field Performance:

The Department may take initial daytime color and luminance factor (Y%) readings, as required by the engineer, within 7 to 30 days after installation to verify compliance with ASTM D6628.

1015.10.3.2 Whiteness Index:

White thermoplastic shall have a minimum whiteness index of 40 when tested according to ASTM E313.

1015.10.3.3 Retroreflectivity:

All retroreflectivity readings shall be measured with a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle as detailed in ASTM E1710.

For 90 mil thermoplastic, the initial retroreflectance for the in-place 4 inch lines marking shall have a minimum value of 425 mcd/lux/sq m for white and 300 mcd/lux/sq m for yellow. The Department may take readings on 4 inch lines before the expiration of the Guarantee Period in accordance with 104.05. Readings shall be at least 325 mcd/lux/sq m or greater for white and 200 mcd/lux/sq m or greater for yellow.

Only white and yellow markings require reflectivity testing.

In lieu of measurements, the engineer shall determine by visual nighttime inspection that stop bars, cross walks, chevrons, hash marks, legends and symbols have sufficient reflectance. For 8 inch lines for gores and turn lanes, the initial retroreflectance for the in-place marking shall meet 250 mcd/lux/sq m for white.

1015.10.3.4 Friction Resistance:

Thermoplastic markings shall have a minimum initial friction resistance number of 45 British Pendulum Number (BPN) when tested in accordance with ASTM E303.

1015.10.4.5 Composition:

The material shall meet the following composition requirements:

	White (% by weight)	Yellow (% by weight)
Glass Spheres	40 percent minimum	40 percent minimum

The intermixed glass spheres contained in the thermoplastic material shall conform to AASHTO M 247. The proportion of intermixed glass spheres shall be 50% Type I and 50% Type III.

1015.10.4 Standard (Flat) 40 mil Thermoplastic Pavement Markings:

Materials shall comply with AASHTO M 249 as modified herein. The meltdown temperature for all laboratory tests shall be 375°F ± 3°F.

1015.10.4.1 Composition:

The material shall meet the following composition requirements:

	White (% by weight)	Yellow (% by weight)
Binder	25 percent minimum	25 percent minimum
Glass Spheres	30 percent minimum	30 percent minimum

The intermixed glass spheres contained in the thermoplastic material shall conform to AASHTO M 247 Type I.

1015.10.4.2 Color:

1015.10.4.2.1 Laboratory Performance:

The yellow thermoplastic shall comply with the requirements of Table 1015-7, “Color Specification Limits (Daytime)” when tested in accordance with ASTM E1349.

1015.10.4.2.2 Field Performance:

The Department may take initial daytime color and luminance factor (Y%) readings, as required by the engineer, within 7 to 30 days after installation to verify compliance with ASTM D6628.

1015.10.4.3 Softening Point:

After heating the marking compound for 4 hours ± 5 min. at 375°F ± 3°F and testing in accordance with ASTM E28, the material shall have a minimum softening point of 190°F as measured by the ring and ball method.

1015.10.4.4 Indentation Resistance:

The material, when tested in accordance with ASTM D2240, Shore Durometer, A2, shall not exceed 40 when tested at 115°F ± 3°F.

1015.10.4.5 Retroreflectivity:

All retroreflectivity readings shall be measured with a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle as detailed in ASTM E1710.

For 40 mil thermoplastic, initial retroreflectance for the in-place marking shall have a minimum of 250 mcd/lux/sq m for white and 175 mcd/lux/sq m for yellow. The Department may take readings before the expiration of the Guarantee Period in accordance with 104.5. Readings shall be at least 200 mcd/lux/sq m or greater for white and 125 mcd/lux/sq m or greater for yellow.

1015.10.4.6 Friction Resistance:

Thermoplastic markings shall have a minimum initial friction resistance number of 45 British Pendulum Number (BPN) when tested in accordance with ASTM E303.

1015.10.5 Preformed Thermoplastic Pavement Markings

White and yellow preformed thermoplastic shall be from the Approved Materials List and comply with AASHTO M 249 as modified herein. All other colors are not required to be Approved Materials List products. Preformed thermoplastic shall be a minimum of 125 mils thick prior to application.

1015.10.5.1 Color

1015.10.5.1.1 Laboratory Performance:

Yellow preformed thermoplastic shall comply with the requirements of ASTM D6628.

1015.10.5.1.2 Field Performance:

The Department may take initial daytime color and luminance factor (Y%) readings, as required by the engineer, after 7 days and within 30 days after installation to verify compliance with ASTM D 6628.

1015.10.5.2 Softening Point:

After heating the preformed thermoplastic material and testing in accordance with AASHTO T 250, the material shall have a minimum softening point of 200° F.

1015.10.5.3 Friction Resistance:

Preformed thermoplastic markings shall have a minimum initial friction resistance number of 45 BPN when tested in accordance with ASTM E303.

1015.10.5.4 Retroreflectivity:

All retroreflectivity readings shall be measured with a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle as detailed in ASTM E1710.

In lieu of measurements, the engineer shall determine by visual nighttime inspection that preformed thermoplastic pavement markings have sufficient reflectance.

1015.11 PREFORMED PLASTIC PAVEMENT MARKING TAPE.

1015.11.1 General:

Preformed plastic pavement marking tape shall be from the Approved Materials List and shall comply with ASTM D4505 Retroreflectivity Level I or Level II, except as modified herein. The marking tape shall be Class 2 or 3. The type and color shall be in accordance with the plans and the MUTCD.

1015.11.2 Thickness:

All preformed plastic pavement marking tape shall have a minimum overall thickness of 0.060 inches when tested without the adhesive.

1015.11.3 Friction Resistance:

The surface of the Retroreflectivity Level II preformed plastic pavement marking tape shall provide a minimum friction resistance value of 35 BPN when tested according to ASTM E303. The surface of the Retroreflectivity Level I preformed plastic pavement marking tape shall provide a minimum friction resistance value of 45 BPN when tested according to ASTM E303. Friction values will be calculated for the Retroreflectivity Level I material with a raised surface pattern as defined in ASTM D4505 by averaging values taken at downweb and at a 45 degrees angle from downweb.

1015.11.4 Retroreflective Requirements:

The preformed plastic pavement marking tape shall have the minimum initial specific luminance values shown in Table 1015-8 when measured in accordance with ASTM D4061.

Table 1015-8
Specific Luminance of Preformed Plastic Tape

Type	Observation Angle, degrees	Entrance Angle, degrees	Specific Luminance (mcd/sq m/lx)	
			White	Yellow
Retroreflectivity Level I	1.05	88.76	500	300
Retroreflectivity Level II	1.05	88.76	250	175

1015.11.5 Durability Requirements:

The Retroreflectivity Level I preformed plastic pavement marking tape shall show no appreciable fading, lifting or shrinkage for at least 4 years after placement for longitudinal lines and at least 2 years after placement for symbols and legends.

The Retroreflectivity Level I preformed plastic pavement marking tape shall also retain the following reflectance values for the time period detailed in Table 1015-9.

Table 1015-9
Retained Specific Luminance for Retroreflectivity Level I Preformed Plastic Pavement Marking Tape

Time	Observation Angle, degrees	Entrance Angle, degrees	Specific Luminance (mcd/sq m/lx)	
			White	Yellow
1 year	1.05	88.76	400	240
3 years (2 years for symbols and legend)	1.05	88.76	100	100

1015.11.6 Plastic Pavement Marking Tape Guaranty (Retroreflectivity Level I):

If the plastic pavement marking tape fails to comply with these performance and durability requirements withinthe warranty timeframe shown in Section 104.05for Retroreflectivity Level I, the contractor shall replace the plastic pavement marking material in accordance with Section 104.05.

1015.12 TRAFFIC PAINT.

The contractor shall use water-borne traffic paint. Each paint container shall bear a label with the name and address of manufacturer, trade name or trademark, type of paint, number of gallons, batch number and date of manufacture.

Paints shall be from the Approved Materials List. Paints shall show no excessive settling, caking or increase in viscosity during 6 months of storage, and shall be a suitable consistency for standard spray gun application.

An infrared curve shall be generated in accordance with DOTD TR 610 and compared with the standard curve made during the initial qualification process.

For yellow paint material, the manufacturer shall determine the type and the amount of yellow pigment, providing the final product meets all of the requirements of this specification. However, the pigment for yellow paint shall be lead free and shall meet the regulatory level of non-hazardous waste as defined by 40 CFR § 261.24 when tested in accordance with EPA Method 1311, Toxicity Characteristics Leaching Procedures. The manufacturer shall provide certification that the material provided meets these requirements.

1015.12.1 Water Borne Traffic Paint:

This material shall be a rapid setting waterborne compound suitable for use with hot application equipment. The paint shall contain Dow Fastrack HD-21A, Arkema DT-400 acrylic emulsion, or approved equal. The material shall meet the requirements of Table 1015-10 and Table 1015-11.

Table 1015-10
Water Borne Traffic Paint Physical Properties

Property	Test Method	Requirements Min.	Max.
pH	ASTM E70	9.9	—
Viscosity, at 25°C Krebs Unit	ASTM D562	78	95
Drying Time, minutes[1]	ASTM D711	—	10
Total Solids, % by mass	ASTM D2369	73	79
Percent Pigment[2]	ASTM D3723	55	62
Non-volatiles in Vehicle, % by weight	ASTM D215	43	—
Weight per Gallon, lb/gal	ASTM D1475	—	—
White		13.7	—
Yellow		13.1	—
Daylight Reflectance, %	ASTM E1349		
White		80	—
Yellow		50	—
Fineness of Grind	ASTM D1210	3	—
Color	3	Pass	
Shelf Life, months		12	—
Pigment Composition	4	Pass	
Infrared Spectroscopy (IR)	DOTD TR 610	Pass	

1. Drying time to no track - Paint applied at 15 mils (375 µm) wet on the road surface with paint heated to 120-150°F (50-65°C) shall not show tracking when a standard size automobile crosses in a passing maneuver at 3 minutes.
2. Do not apply any theoretical empirical factors in determining the percent of the paint. Do not calculate percent pigment by adding back the burned-off organic constituents of the pigment.
3. Color (without glass beads) - Yellow paint shall comply with the requirements of Table 1015-11 when tested in accordance with ASTM E1349. White shall be a clean, bright, untinted binder.
4. The white paint shall contain a minimum of 1.0 pound per gallon (120 g/L) of rutile titanium dioxide (Ti02) as determined using DOTD TR 523. The rutile titanium dioxide shall comply with ASTM D476.

Table 1015-11
Water Borne Traffic Paint Color Specification Limits (Daytime)

Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.493	0.473	0.518	0.464	0.486	0.428	0.469	0.452

(The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with Standard 2° Observer and Standard Illuminant D65.)

1015.12.2 Initial Retroreflectivity:

All retroreflectivity readings shall be measured with a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle as detailed in ASTM E1710.

For traffic paint, initial retroreflectance shall have a minimum of 250 mcd/lux/sq m for white and 175 mcd/lux/sq m for yellow. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night.

1015.12.3 Initial Daytime Color and Luminance Factor:

For traffic paint, test the initial daytime color and luminance factor (Y%) according to ASTM D6628. The Department may take readings 7 to 30 days after installation to verify compliance with ASTM D6628.

1015.13 GLASS BEADS FOR PAVEMENT MARKINGS.

Glass beads for use with painted traffic striping and flat thermoplastic striping shall conform to the specification requirements of AASHTO M 247, as modified herein.

1015.13.1 Moisture Resistance-Flow Characteristics:

The beads shall not absorb moisture in storage. They shall remain free of clusters and lumps and shall flow freely from the dispensing equipment.

1015.13.2 Gradation:

Glass beads shall meet the gradation requirements of AASHTO M 247 for the specified Type, when tested in accordance with ASTM D1214.

1015.13.2.1 Painted Traffic Striping:

Glass beads for permanent painted traffic striping shall meet the gradation requirements of AASHTO M 247 Type 3. For temporary painted traffic striping, the contractor may determine which beads to use provided the line is reflective for the expected line life. Table 1015-12, "Gradation of 1.9 Refractive Index Glass Beads" may be used as an alternate on chip seal.

Table 1015-12
Gradation of 1.9 Refractive Index Glass Beads

U.S. SIEVE (METRIC SIEVE)	PERCENT PASSING
No. 18 (1.00 mm)	95-100
No. 20 (850 µm)	85-95
No. 30 (600 µm)	40-85
No. 40 (425 µm)	20-45
No. 50 (300 µm)	0-5

1015.13.2.2 Flat Profile Thermoplastic Striping:

Drop-on beads for flat profile thermoplastic striping shall meet the gradation requirements of Table 1015-13 as determined by the thickness of the striping specified.

Table 1015-13
Types of AASHTO M 247 Glass Beads used for Flat Profile Thermoplastic Striping[1]

THICKNESS	NUMBER OF BEAD DROPS	APPLICATION #1	APPLICATION #2
40 mil spray	Single Drop	AASHTO M247 Type 2 or Table 1015-12 or Contractor's discretion[2]	Not required
90 mils or greater	Double Drop	AASHTO M247 Type 4	AASHTO M 247 Type 1 or Table 1015-12 or Contractor's discretion[2]

1. Materials not designated in AASHTO M 247 require approval from the engineer.
2. Materials used at the contactors discretion shall meet the retroreflectance requirements.

1015.13.3 Roundness:

Beads shall have a minimum of 75 percent true spheres when tested according to ASTM D1155, Method A. AASHTO M247 Type 3 and 4 beads shall have a minimum of 80 percent true spheres when tested by ASTM D1155, Method A.

1015.13.4 Angular Particles:

The beads shall have no more than 3 percent angular particles per screen.

1015.13.5 Refractive Index:

The beads shall have a minimum refractive index of 1.50 when tested by the liquid immersion method. Beads conforming to Table 1015-12 shall have a minimum refractive index of 1.90.

1015.13.6 Glass Bead Coating:

All beads except Type 1 shall be coated with an adhesion assuring coating when tested in accordance with AASHTO M 247. The smaller AASHTO M 247 Type 1 beads shall also be coated to provide free flowing characteristics when tested in accordance with AASHTO M 247.

1015.13.7 Packaging and Marking:

The beads shall be packaged in moisture proofed containers. Each container shall be stamped with the following information: Name and address of manufacturer, shipping point, trademark or name, the wording "Embedment Coated Glass Beads," type, weight, lot number and the month and year of manufacture.

1015.13.8 Heavy Metal Limits:

Glass beads shall not contain more than 75 parts per million of inorganic arsenic when tested using EPA Method 6010B in conjunction with EPA Method 3052 for sample preparation.

S.P. Pipe Connections to Precast Units (07/21)

Section 1016 of the Louisiana Standard Specifications for Roads and Bridges is amended as follows:

1016.01.6 is deleted and replaced with the following:

1016.01.6 Pipe Connections to Precast Units:

For all type pipe connections to precast units, except yard drain pipes and underdrains, use concrete collars or resilient connectors conforming to ASTM C923, at no direct pay. For concrete collar connections, each pipe opening shall be 4±1/2 inches larger than the outside diameter of the pipe for which it is provided. For resilient connectors, provide manufacturer's certified statement that the connector conforms to ASTM C923, accompanied by a copy of the test report.

S.P. COOPERATION WITH UTILITIES (11/16):

Subsection 105.06 of the Standard Specifications is amended to include the following.

Utility facilities will be removed, relocated, adjusted or abandoned in accordance with agreements between the City of Baton Rouge-Parish of East Baton Rouge and utility owners listed below. Starting dates for such work will be determined by the engineer and may be different for each utility and may not be underway concurrently with the contractor's work or with other utility relocations. Utility relocations can be within the construction limits covered by this contract. The furnishing of the following estimated completion times for utility work is for information purposes only and will not relieve the contractor of any requirements of this subsection nor will it preclude the granting of contract time credits in accordance with the provisions of this subsection. A utility company calendar day shall be the same as defined in Subsection 101.03 of the standard specifications.

UTILITY OWNER	Estimated Calendar Days After Right-Of-Way Is Clear
AT&T Louisiana 5550 S Sherwood Forest Blvd Baton Rouge, LA 70816	0
The Baton Rouge Water Company Post Office Box 96016 Baton Rouge, LA 70896	0
COX 7401 Florida Blvd Baton Rouge, LA 70806	0
Entergy 5755 Choctaw Drive Baton Rouge, LA 70805	0
LUMEN 5758 Essen Lane Baton Rouge, LA 70810	0
Uniti Fiber 110 East Coleman Avenue Hammond, LA 70401	Utility has been relocated

N.S. SAW CUTTING PORTLAND CEMENT CONCRETE PAVEMENT (11-16):

1. DESCRIPTION

This item consists of furnishing all equipment, labor, materials and incidentals to perform saw cutting of existing portland cement concrete pavement as shown on the plans or as directed by the Project Engineer.

2. MEASUREMENT

The saw cutting will be measured and paid at the contract unit price per inch depth of cut times the linear foot of cut.

3. PAYMENT

Payment will be made at the contract unit price under:

Item No.	Pay Item	Pay Unit
NS-600-00220	Saw Cutting Portland Cement Concrete Pavement	Inch Depth-Linear Foot

N.S. GPS (07-17):

1. DESCRIPTION.

This item shall consist of furnishing and installing a NEMA compliant GPS KIT time device on a traffic signal controller cabinet and connecting the GPS to the controller in accordance with the plans, and the manufacturer's installation requirements. This specification also sets forth the minimum requirements for a solid-state traffic control GPS KIT time device to work in accordance with controllers meeting requirements of the Louisiana Department of Transportation and Development Traffic Control Standard Number 18A latest revision.

2. MATERIALS.

Vacant.

3. EQUIPMENT.

The GPS KIT shall contain all needed equipment to connect and mount the GPS to a NEMA compliant controller and cabinet. Once installed the GPS shall supply the controller with the time and date. All communication between the GPS and Controller shall meet all NEMA protocols. The status of the GPS unit shall be given through the controller screen.

3.2 Warranty:

The equipment shall be supplied with a minimum of a one year manufacturer warranty. All warranty periods shall begin at the date of acceptance by the Department.

4. CONSTRUCTION REQUIREMENTS.

The GPS shall communicate directly to the local controller, master controller and the system software described in the Louisiana Department of Transportation and Development Traffic Control Standard Number 18A latest revision without the need of any external devices other than the GPS device. The GPS shall be installed according to the manufacturer's recommendations. The seal between cabinet and GPS shall be waterproof.

5. MEASUREMENT.

This item will be measured per each GPS installed, which includes all labor, materials, tools, equipment, and incidentals necessary to complete the work.

6. PAYMENT.

Payment for the GPS will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-736-00001	GPS	Each

N.S. MANAGED ETHERNET SWITCH (08-21):

1.0 DESCRIPTION.

Furnish and install an Managed Ethernet Switch in the signal controller cabinet for Ethernet peripheral devices in accordance with the plans, the the latest edition of Louisiana Standard Specifications for Roads and Bridges, this specification, and as directed by the Engineer.

The following Sections are referenced within this Specification:

Equipment Submittals	736.05

2.0 MATERIALS.

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance.

The Managed Ethernet Switch shall have the following characteristics:

1. Consistent with IEEE 802.3 standards.
2. Capable of 10/100/1000, Full/Half Duplex auto-negotiation, include a minimum of six Ethernet 10/100/1000 RJ45 ports.
3. MAC address storage capability.
4. "Store-and-Forward" switching capability.
5. Ability to restrict bandwidth usage on attached devices by way of MAC address or by way of IP address.
6. Accessible from anywhere on the common Network by way of Telnet, HTTP, or SNMP.
7. Minimum extended temperature range of -40 ºF to +180 ºF and a humidity range of 10 percent to 90 percent non-condensing.
8. Include, at a minimum, a LED for power and a LED for 10/100/1000 connection status (for each port).
9. All copper ports shall be type RJ-45 and shall auto-negotiate for speed (i.e., 10/100/1000Base), duplex (i.e., full or half) and polarity. All 10/100/1000BaseTX ports shall meet the Category 5 specifications and shall be compliant with the EIA/TIA-568-A standard pinouts.
10. Support the Layer 2+ management features commonly found in managed non-environmental Ethernet switches. These features shall include, but not be limited to:
    a. The STP healing rate shall meet or exceed specifications published in the IEEE 802.1 standard.
    b. The RSTP healing rate shall meet or exceed specifications published in the IEEE 802.1 standard.
    c. The switch shall support port-based VLANs that meet or exceed specifications as published in the IEEE 802.1 standard.
    d. The forwarding/filtering rate shall be a minimum of 14,880 packets per second (PPS) for 10 Mbps and 148,800 PPS for 100 Mbps and 1,488,000 PPS for 1000 Mbps.
    e. Minimum 8-kilobit MAC address table.
    f. Support, at a minimum, Version 2 of the Internet Group Management Protocol (IGMP).

g. Include the electronics required for Simple Network Management Protocol (SNMP V2). The switch shall be accessed using the resident EIA-232 management port, a telecommunication network or the Trivial File Transfer Protocol (TFTP).
h. Support remote monitoring (RMON) groups 1, 2, 3, 9.
i. Support management via Telnet and Web.
j. Support the TFTP, Link Layer Discovery Protocol (LLDP), the Network Time Protocol (NTP), and the Simple Network Time Protocol (SNTP).
k. Support Broadcast Rate Limiting.
l. Include integrated AC power supply.

3.0 SUBMITTALS.

Equipment submittals shall conform with 736.05.

4.0 CONSTRUCTION REQUIREMENTS.

Install the Managed Ethernet Switch in the traffic signal controller cabinet at the location shown on the plans and according to the manufacturer's recommendations. The contractor is responsible for connecting all Ethernet compatible devices and making sure all are functioning properly. The inputs/outputs shall be to a traffic signal controller and comply with the National Electrical Manufacturers Association (NEMA) type C or D detector rack or 170 input file rack standards.

5.0 WARRANTY.

The Managed Ethernet Switch shall be warranted for a 5 year period.

6.0 MEASUREMENT.

Managed Ethernet Switch will be measured per each, which includes all materials, tools, equipment, labor, and incidentals required to install each fully functioning Ethernet switch.

7.0 PAYMENT.

Payment for Managed Ethernet Switch will be made at the contract unit price per each, which will be full compensation for performing all work as described in this specification.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-736-00003	Managed Ethernet Switch	Each

N.S. TS-2 TRAFFIC SIGNAL CABINET (02-16):

1. DESCRIPTION.

This specification sets forth the minimum requirements for furnishing and installing a TS-2 Traffic Signal Cabinet.

The TS-2 cabinet assembly shall be able to house a NEMA TS-2, Type 1 or 2 controller unit.

2. EQUIPMENT.

The system shall be a preapproved product listed on the LADOTD Traffic Operations Approved Product List 155 (TOAPL 155):

http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Operations/Traffic_Services/Pages/Traffic_Operations_Approved_Products_List.aspx

Manual:

A manufacturer's equipment and operations manual shall be submitted to the Engineer.

3. CONSTRUCTION REQUIREMENTS.

The cabinet shall be installed as directed by the Engineer and per the manufacturer's recommendations

4. MEASUREMENT.

At a minimum, the assembly shall include, but not be limited to:

- TS-2 Traffic Signal Cabinet (Ground Mounted)
- Shall be a preapproved product listed on the LADOTD Traffic Operations Approved Product List 155 (TOAPL 155).
- Configuration 4 (16 position) as defined by NEMA TS-2 clause 5.3.
- Sixteen (16) load switches.
- Eight (8) flash transfer relays.
- Flasher.
- Card rack(s).
- Malfunction Maintenance Unit (MMU).
- 24 volt external power supply.
- Any necessary mounting hardware.
- Concrete foundation (See Plans and LADOTD Traffic Signal Details)
- Labor and incidentals for a fully operational system.

TS-2 Traffic Signal Cabinet (Pole Mounted)

- Shall be a preapproved product listed on the LADOTD Traffic Operations Approved Product List 155 (TOAPL 155).
- Configuration 3 (12 position).
- Twelve (12) load switches.
- Six (6) flash transfer relays.
- Flasher.
- Card rack(s).
- Malfunction Maintenance Unit (MMU).
- 24 volt external power supply.
- Any necessary mounting hardware.
- Labor and incidentals for a fully operational system.

MMU for TS-2 Traffic Signal Cabinet

- Separate MMU furnished and installed into an existing cabinet.
- Shall be a preapproved product listed on the LADOTD Traffic Operations Approved Product List 155 (TOAPL 155).

5. PAYMENT.

Payment for TS-2 Traffic Signal Cabinet will be paid at the contract price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-736-00130	TS-2 Traffic Signal Cabinet (Ground Mounted)	Each
NS-736-00131	TS-2 Traffic Signal Cabinet (Pole Mounted)	Each
NS-736-00132	MMU for TS-2 Traffic Signal Cabinet	Each

N.S. BATTERY BACK-UP SYSTEM FOR TRAFFIC SIGNALS (01-21):

1.0 DESCRIPTION.

This specification sets forth the minimum requirements for a complete emergency battery back-up system for use at traffic signals utilizing Light Emitting Diode (LED) signal heads; blank out no turn signs, and pedestrian signal heads.

The BBS shall provide emergency power to a traffic signal in the event of a power failure or interruption.

2.0 MATERIALS.

The system shall be a preapproved product listed on the LADOTD Traffic Operations Approved Product List 14 (TOAPL 14):

http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Operations/Traffic_Services/Pages/Traffic_Operations_Approved_Products_List.aspx

The Battery Back-up System (BBS) shall include, but not be limited to the following:

1. External Cabinet
2. Integrated Power Transfer Switch
3. Batteries
4. Inverter/Charger
5. Mounting Hardware
6. Wiring

A manufacturer's equipment and operations manual shall be submitted to the Engineer.

3.0 CONSTRUCTION REQUIREMENTS.

The system shall be installed as directed by the Engineer and per the manufacturers' recommendations.

4.0 MEASUREMENT.

The Battery Back-up System for Traffic Signals will be measured per each and shall include, but not be limited to the external cabinet, integrated power transfer switch, batteries, inverter/charger, mounting hardware, wiring, labor and incidentals for a fully operational system.

5.0 PAYMENT.

Payment for Battery Back-up System for Traffic Signals will be paid at the contract price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-736-00133	Battery Back-up System for Traffic Signals	Each

N.S. ACCESSIBLE PEDESTRIAN PUSHBUTTON DETECTOR SYSTEM (APS) (05-16)

1. DESCRIPTION.

This item provides for furnishing and installing Accessible (Audible/Tactile) Pedestrian Pushbutton Detectors. The components of the pedestrian detection system include pushbuttons, pedestrian actuation signs, electronics, wiring, and mounting hardware.

A 4 Wire APS consists of a power supply mounted in the pedestrian head connected by a 4 conductor cable to the associated 4 Wire Accessible Pedestrian Push Button mounted on the pole.

The 2 Wire APS consists of up to 12 Accessible Pedestrian Push Buttons connected to a Central Control Unit (CCU) mounted in the Traffic Signal Cabinet. By interfacing with the Central Control Unit with the traffic control cabinet the Accessible Push Buttons may provide the following features:

1. Confirmation of button push via latching LED, sound, and vibrotactile bounce.
2. Direction of travel (with extended button push).
3. Standard locating tone during Don't Walk (and clearance if desired).
4. Cuckoo, chirp, or standard voice message during walk.
5. Vibrating button during walk.
6. Standard locating tone, custom sound, or verbal countdown during PED clearance.
7. All sounds automatically adjust to ambient over 60dB range.
8. Most sounds can have minimum and maximum volume independently set.
9. All sounds are synchronized.
10. Extended button push can turn on, boost volumes, and/or mute all sounds except those on activated crosswalk.
11. Special emergency messages available.
12. Custom message and sound options definable by customer

2. MATERIALS.

Accessible (Audible/Tactile) Pedestrian Pushbutton Detector: The accessible pedestrian pushbutton detector must consist of all electronic control equipment, wiring, mounting hardware, pushbuttons, and pedestrian actuation signs designed to provide both a pushbutton with a raised, vibrating tactile arrow on the button as well as a variety of audible indications for differing pedestrian signal functions.

1. Electronic Control Equipment: The accessible pedestrian pushbutton detector must include electronic control equipment that is programmable and adjustable using a laptop computer or vendor supplied programmer. Electronic control equipment must be able to be installed within a traffic controller cabinet or within a pedestrian signal housing. Electronic control equipment installed within a traffic controller cabinet must allow the use of up to 16 pushbuttons (4 maximum per channel) with a single traffic controller cabinet. The accessible pedestrian pushbutton detector must receive timing from Walk and Don't Walk signals.
2. Audible Messages: Audible messages must be programmable. All audible messages and tones must emanate from the accessible pedestrian pushbutton housing. The accessible pedestrian pushbutton detector must utilize digital audio technology. The system shall have, at a minimum, three programmable locator tones. The accessible pedestrian pushbutton detector must have independent minimum and maximum volume limits for the Locator Tone, Walk, and Audible Beaconing features. The Wait message must only annunciate once per actuation.
3. Pushbutton locator tone: The accessible pedestrian pushbutton detector must provide independent ambient sound adjustment for the locator tone feature. The accessible pedestrian pushbutton detector must allow the locator tone to be deactivated.
4. Vibrating Pushbutton (VPB): The accessible pedestrian pushbutton detector must include a Vibrating Pushbutton (VPB). The VPB must be a single assembly containing an ADA compliant, vibro-tactile, directional arrow button, weatherproof audible speaker and pedestrian actuation sign with optional placard Braille messages. The VPB tactile arrow must be 2 inches in length, be field adjustable to two directions, and require no more than 5 pounds of applied force to activate.
5. Conflict Monitoring: The accessible pedestrian pushbutton detector must monitor the Walk condition for conflict operation. The accessible pedestrian detector system must disable the Walk functionality if a conflict is detected.
6. Cabinet Control Unit (CCU): The accessible pedestrian pushbutton detector may include a CCU for interfacing and connecting the system. The CCU shall have labeled LED indicators for each channel operation. The CCU must reset upon loss of internal communication.

Inputs and Outputs: All inputs and outputs must use Mil-Spec Multipin connectors.

1. Inputs: Walk and Don't Walk inputs must be optically isolated 80-150 volts AC/DC, 5mA max. General purpose inputs must be optically isolated 10- 36 volts AC/DC, 10mA max.
2. Outputs: Outputs must be optically isolated 36 volts AC/DC peak, 300mA solid state fused contact closures. CCUs must include a normally open relay contact fault output.

Communication: The CCU must include an Ethernet interface. The CCU must have an integral web server that provides information on audible/tactile pedestrian-pushbutton detector status, access to event logs, and provides for remote Configuration of accessible pedestrian pushbutton detector system options. VPBs must include an Ethernet, serial, or USB programming interface.

Electrical: All wiring must meet applicable NEC requirements. The accessible pedestrian pushbutton detector must operate using a nominal input voltage of 120 volts alternating current (VAC). If any device requires nominal input voltage of less than 120 VAC, furnish the appropriate voltage converter.

Accessible pedestrian pushbutton detector control electronics that are mounted in a pedestrian signal head must be able to receive power from the Walk and Don't Walk circuits of the signal head. Voltage at the pushbutton shall not exceed 24 VAC.

Mechanical: Equipment must be permanently marked with manufacturer name or trademark, part number, date of manufacture, and serial number. Do not use self-tapping screws on the exterior of the assembly.

Ensure that all parts are made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal. Ensure that all assembly hardware, including nuts, bolts, external screws and locking washers less than 5/8 inch in diameter, are Type 304 or 316 passivated stainless steel. Stainless steel bolts, screws and studs must meet ASTM F593. Nuts must meet ASTM F594. All assembly hardware greater than or equal to 5/8 inch in diameter must be galvanized. Bolts, studs, and threaded rod must meet ASTM A307. Structural bolts must meet ASTM A325.

Enclosures must have a NEMA 4X rating. Pushbutton housings for intersections must be black.

Environmental: Ensure equipment performs all required functions during and after being subjected to the environmental testing procedures described in NEMA TS2,

Sections 2.2.7, 2.2.8, and 2.2.9.

Warranty.
Shall adhere to Section 104.05 as a minimum.

3. CONSTRUCTION REQUIREMENTS.

Install pedestrian detectors at the locations and in a manner as shown in the Plans. Ensure all detectors are the same manufacturer and model.

Pushbuttons mounted on wood poles must be serviced by a conduit riser. Pushbuttons mounted on steel or aluminum (poles, pedestals, or posts) must be serviced by wiring inside the pole.

A R10-3e 9” x 12” pedestrian actuation sign with LADOTD Type X sheeting must be included with each pushbutton assembly, unless otherwise specified on the plans. Tactile arrows of accessible pedestrian pushbuttons must align parallel with the direction of the crossing.

The Engineer will direct any variation from the locations shown. When mounting, place the detector housing or saddle in complete contact with the pole or controller cabinet. When a post is required in the installation of the pedestrian detector, restore the area around the post to its original condition or as required by the Plans.

4. MEASUREMENT.

The Contract unit price for 2-wire Accessible Pedestrian Pushbutton Detectors, will be paid per each, and will include the pedestrian actuation sign, APS push button station, all mounting hardware, wiring, materials and equipment, and all labor and miscellaneous materials necessary for a complete and accepted installation.

The Contract unit price for 2-wire Accessible Pedestrian Pushbutton Control Unit, will be paid per each, and will include the Accessible Pedestrian Pushbutton Control Unit, all mounting hardware, wiring, materials and equipment, and all labor and miscellaneous materials necessary for a complete and accepted installation.

The Contract unit price for 4-wire Accessible Pedestrian Pushbutton Detectors, will be paid per each, and will include the pedestrian actuation sign, APS push button station, all mounting hardware, wiring, materials and equipment, and all labor and miscellaneous materials necessary for a complete and accepted installation.

Payment for poles, pedestals, and posts will be made under their respective pay item numbers.

5. PAYMENT.

Payment for the Accessible Pedestrian Pushbutton Detectors and Accessible Pedestrian Pushbutton Cabinet Control Unit will be paid at the contract price per each.

Payment will be made under:

Item No.	Pay Item	PayUnit
NS-736-00135	2-Wire Accessible Pedestrian Pushbutton Detectors	Each
NS-736-00136	2-Wire Accessible Pedestrian Pushbutton Cabinet Control Unit	Each
NS-736-00137	4-Wire Accessible Pedestrian Pushbutton Detectors	Each

N.S. METHYL METHACRYLATE (MMA) PAVEMENT MARKINGS (01-21):

1.0 DESCRIPTION.

This work consists of installing pavement markings 90 mils thick (minimum), which are composed of a combination of methyl methacrylate, glass beads, and anti-skid aggregate. Methyl Methacrylate (MMA) are two-component liquid pavement marking materials that consist of a MMA resin (pigmented) and a catalyst applied at a 98:2 ratio, by weight.

The following sections and subsection are referenced within this specification.

104.05 Guarantee and Warranty of Contractor's Work
1015 Signs and Pavement Markings

2.0 MATERIAL.

Materials shall be stored per manufacturer's recommendations.

Materials shall meet the requirements of Table-1 of this specification.

Supplier shall submit a Certificate of Analysis with test results demonstrating the supplied batches meet the requirements of Table 1.

Table-1
Physical Properties and Test Methods

Parameter	White	Yellow	Test Methods

No track at 77°F	30 minutes max	30 minutes max	ASTM D711
Adhesion	Min. 200 psi or substrate failure	Min. 200 psi or substrate failure	ASTM D4541, ASTM D4796, or ASTM D7234
Shore Hardness	Min. 50D after 24 hours	Min. 50D after 24 hours	ASTM D2240
Friction Resistance	Minimum initial 45 BPN	Minimum initial 45 BPN	ASTM E303
Daylight Reflectance	Min. 75	Min. 45	ASTM E1349
Chemical Resistance	Cured markings shall be resistant to calcium chloride, sodium chloride, fuels, oils and UV effects		Cure 3 days – motor oil, diesel, automatic transmission fluid, salt, anti-freeze

2.1 Field Performance:

Take initial daytime color and luminance factor (Y%) readings in the presence of the Engineer, after 7 days and within 30 days after installation to verify compliance with ASTM D6628 for white and yellow, and the following table for green.

Daytime Chromacity for Green Markings							
1		2		3		4	
x	y	x	y	x	y	x	y
0.230	0.754	0.266	0.500	0.367	0.500	0.444	0.555

2.2 Retroreflectivity:

In lieu of measurements, a visual nighttime inspection of stop bars, cross walks, chevrons, hash marks, bike lanes/bike boxes (if glass beads are applied), legends and symbols will be performed to verify sufficient reflectance.

2.3 Glass Beads:

Use glass beads per manufacturer's recommendations. Post applied glass beads shall have a coating recommended by the MMA paint manufacturer to improve bead retention in the stripe.

Drop on glass beads shall be applied at a rate necessary to meet nighttime visual requirements noted above and shall not reduce skid resistance below 45 BPN when tested by ASTM E303.

3.0 SUBMITTALS.

At the preconstruction conference, contractor shall furnish certifications that the installers are manufacturer-certified for the specific striping material and method being used.

Prior to construction, contractor shall furnish a Certificate of Compliance or Certificate of Analysis, as required herein, for each materials component.

Prior to construction, submit a single Certificate of Compliance from the manufacturer of the marking material, for each material combination, certifying the glass beads and anti-skid aggregate, as furnished, provides the durability, retroreflectivity, and skid resistance specified.

3.1 Pre-Striping Meeting:

15 days before starting pavement marking installation, meet with the Engineer for a pre-striping meeting. At this meeting, do the following:

1. Furnish a striping schedule showing areas and timing of work, placing materials and the Traffic Control Plans to be used.
2. Discuss placement of materials, potential problems.
3. Discuss work plan at off ramps, on ramps and intersections.
4. Discuss material handling procedures.
5. Provide copies of the manufacturer's installation instructions and copies of the Material Safety Data Sheets.

3.2 Measurement During Construction:

Verify dimensional requirements, recording the station of each verification location, and submit to the Engineer within 24 hours for review. Test adhesion a minimum of once per project for each combination of striping type and substrate type in accordance with ASTM D4541, D4796, or D7234. This testing shall be performed in the presence of the Engineer, with results and narrative explanation reported to the engineer.

4.0 EQUIPMENT.

Use equipment designed and capable of properly mixing at the place and time of application and approved by the manufacturer for the type of product being installed.

Use manual or automatic application equipment. Use stencils or extruders to form sharply defined markings.

5.0 CONSTRUCTION.

5.1 Disposal of Waste:

Waste material(s) are the Contractor's property. This includes grindings and removed marking material. Do not dispose of or store waste material(s) on State property. Dispose of waste material(s) according to applicable Federal, State, and local regulations.

5.2 Preparation of Surface:

Prepare the roadway surface to receive pavement markings in accordance with 732.03.3 of the LSSRB and in accordance with the manufacturer's warranty requirements, with the Engineer making the final determination when there are discrepancies. Completely remove contaminants, such as dirt, loose asphalt, curing agents, and surface oils before applying pavement marking material.

Newly placed asphalt surfaces shall be allowed to age in accordance with the manufacturer's recommendations prior to application of markings or as directed by the Engineer.

Concrete must be fully cured in accordance with the manufacturer's recommendations prior to application of markings or as directed by the Engineer. Curing compounds must be removed before applying the pavement marking material.

Ambient temperature and pavement surface temperatures shall be in accordance with the manufacturer's recommendations.

5.3 Application Requirements:

Markings shall be applied in accordance with manufacturer's recommendations and as accepted by the Engineer.

Do not place the pavement markings on longitudinal pavement joints.

Do not place the pavement markings if moisture is present on the surface.

Markings shall only be applied when pavement temperature is greater than 40°F and less than 105°F.

5.4 Tolerances:

1. Length of Stripe. ±2 inches.
2. Width of Stripe. ±1/8 inch.
3. Lane Width. ±4 inches from the width shown on the Plans.
4. Stripes on Tangent. Do not vary more than 1 inch laterally within a distance of 100 feet when using the edge of the stripe as a reference.
5. Stripes on Curves. Uniform in alignment with no apparent deviations from the true curvature.
6. All Stripes. Keep the center of the stripe within planned alignment.

7. Double Stripes. ±1/4 inch.
8. Thickness. 90 to 180 mils, measured from the pavement surface. Measure the thickness in three locations for each legend, and other items as determined by the Engineer.

If it is determined that the material is being placed too thin, the beads are not properly placed, the anti-skid aggregate is not visible, or otherwise not to specification, make immediate adjustments to correct the problem.

Pavement markings may be determined unacceptable for reasons determined by the Engineer, including:

1. Markings are not straight or wide enough.
2. Thickness of line is not uniform.
3. Thickness of line is less than specified.
4. Material is uncured.
5. Material blackens or is inconsistent in color.
6. Edge of the markings is not clear cut and free of overspray.
7. Reflective elements are not properly embedded.
8. Visual nighttime performance of the markings is unacceptable.
9. Anti-skid aggregate is not visible in the marking material during application and in the dried surface.
10. Markings exhibit poor adhesion.
11. Color is not as specified.

Perform repairs using equipment similar to the equipment initially used to place the materials. Do not perform repairs in a "patch work" manner. If more than one repair is required in a single 500-foot section, grind and repair the entire section.

6.0 MEASUREMENT.

MMA pavement legends and symbols using letters, numbers, and arrows will be measured on a unit basis of each with each separate phrase or symbol constituting a unit.

MMA pavement striping will be measured by the linear foot.

MMA green bike lanes/bike boxes will be measured by the square yard.

There will be no measurement for overruns of material caused by the variation of the gradation of the asphalt or additional material required to achieve the thickness specified on open graded pavement.

7.0 PAYMENT.

Payment for the completed and accepted quantities of plastic pavement markings and removal of existing markings will be made at the contract unit prices, which include all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-DEV-732	MMA Pavement Striping (Dotted)(__ inch Width)(_' L)	Linear Foot
NS-DEV-732	MMA Pavement Striping (Solid Line)(__ inch Width)	Linear Foot
NS-DEV-732	MMA Pavement Striping (Broken Line)(__ inch Width)	Linear Foot
NS-DEV-732	MMA Pavement Legends and Symbols (Type)	Each
NS-DEV-732	MMA Pavement Marking (Green Bike Lanes/Bike Boxes)	Square Yard

N.S. CCTV CAMERA ASSEMBLY (01-19):

1. DESCRIPTION.

This item consists of furnishing, installing, or furnishing and installing a Closed Circuit Television (CCTV) Camera Assembly and all appurtenances required for the connection to and operation with the existing ITS in accordance with plan details, these specifications, and as directed by the Project Engineer.

2. MATERIALS.

All equipment shall be new and constructed using current industry standards and techniques to assure high reliability and minimum maintenance. The contractor shall submit for review, prior to installation, a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The components of the CCTV camera assembly described by this specification shall consist of the following:

1. Camera imaging unit
2. Pan tilt unit
3. Camera housing
4. Mounting and wiring

3. CONSTRUCTION REQUIREMENTS.

The Contractor shall be required to assemble and install all necessary material and equipment and to furnish a working CCTV Camera Assembly in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the Contractor.

3.1 Camera Imaging Unit.

The camera imaging unit shall be a digital signal processing (DSP) color video camera of solid-state design and shall meet or exceed the following specifications:

The frame frequency shall be 30 frames per second (± 1 frame). The system shall be capable of providing clear, low-bloom and low-lag video pictures under all conditions from bright sunlight to nighttime scene illumination. Color quality shall be maintained by a continuous "through the lens" automatic white balance system for color temperatures from 2,850 degrees K to greater than 5100 degrees K with less than 10 IRE units unbalanced.

Table I
CCTV Camera Technical Requirements

Description	Specification
Environmental	-40°C to +75°C Ambient, Humidity 100% Relative, internal moisture at sealing shall be 10% or less
Power	120 VAC (plus or minus 10 percent), 50/60 Hz
Aspect Ratio	4:3 (width to height)
Resolution	Capable of 1,920 x 1,080; 640 x 360 @ 3x dig. zoom
Picture Elements	1920 (H) by 1080 (V), minimum
Focal Length	4.4 mm to 132 mm (optical) to 264 mm (2X digital), minimum
Lens Zoom	30X Lens with electronic image stabilization f1.4 (w) f 4.6 (t)
Mode	Day/Night switchover: day (color) / night (mono), manual or auto
Angle of View	63.4 degrees to 2.1 degrees (optical), to 0.7 degrees (8X digital), minimum
Focus Distance	0.01m(wide angle) to 1.0 m (telephoto), minimum
Focus	Automatic with manual override by remote command selection

Iris	Automatic with manual override by remote command selection
Gamma	0.45, minimum
AGC	0 to 48 dB, minimum
Signal to Noise Ratio	50 dB weighted, AGC off
Sensitivity	1.0 lux @ 1/60 sec. (color day); 0.1 lux @ ¼ sec. (color day); 0.01 lux @ ¼ sec (mono night)
Analog Video Output	NTSC, EIA-170A, 1V p-p at 75 Ohms, unbalanced
Imager	Compensating Interline transfer micro-lens CCD sensor with mosaic-type color filter, progressive scan
Image Area	¼ inch format, 3.6mm (H) by 2.7mm (V), maximum
Integration	Long term from 1/60 second to ¼ second minimum, automatic with manual override by remote command selection, and with internal frame refresh buffer
Electronic Shutter	Automatic exposure period with manual override by remote command, selection with a range of 1/60 second to 1/10,000 second, minimum
Alarms	Text, up to three (3) lines, controlled by remote command selection. Remote control shall be provided to select blinking display mode, continuous display mode, alarm display enable, and alarm display disable, and to enter and edit alarm text
OSD/Camera ID	Programmable and up to two (2) lines each, 40 character long. Messages – ID characters are white with black border bottom, left or right. Message shall contain options for free form text, date/time, and preset. ID message capability shall be set, controlled, and edited in the device configuration.
Presets	256 pan, tilt, zoom, and focus presets
Control	Addressable RS-422 and IP, compatible with device-controlling software and systems already owned by LADOTD and installed in the intended area of operation
Privacy Zones	8 programmable zones for video blanking
Digital Video	H.264 and MJPEG compression in accordance with ITU-T H.264 standard and ISO/IEC MPEG-4AVC standard (formally ISO/IEC 14496-10-MPEG-4 Part 10, Advanced Video Coding). UDP. video multicasting. •Resolution – 352x240 (CIF), 720x480, 1280x720 (720p), 1920x1080 (1080p)

	•Frame rate – 1fps to 30fps (NTSC) •Video bandwidth – 256kbps to 8Mbps •Dual H.264 video streams with independent configurations
Digital IP network	•IP addressable (static and DHCP) including IP, subnet mask, and gateway •Set time via NTP •HTTP webserver interface for video playback /control and device configuration •Protocols supported: TCP, UDP, IPv4, ICMP, DNS, IGMPv2/v3, DHCP, RTP, RTSP, NTP, NTCIP
Connections	1-RJ 45(digital/IP Ethernet), 1-BNC (analog). 1-EIA232/422/485 (control)

3.2 Pan Tilt Unit

3.2.1 General Requirements:

Each camera assembly shall have a weatherproof pan-and-tilt unit. The pan/tilt unit shall have a connector that attaches the enclosure mechanically and electrically. Gold plated electrical pin connectors shall be provided to ensure reliable contact. Movement gears shall require no lubrication and be corrosion resistant to ensure long life. Drive motors shall be capable of instantaneous reversing and shall have overload protections. The pan/tilt shall have follower (preset) potentiometers. Braking shall be provided, in both pan and tilt movements, to enable fast stop and reversal and to prevent drifting. Limit switches or stops shall be provided to limit the range of vertical and horizontal movements, and shall have the functionality to be adjusted individually.

The pan-and-tilt unit shall have seals and gaskets to protect the motors, gears, and cables. Seals and gaskets shall be resistant to ozone, ultraviolet radiation, and other pollutants inherent to all local environmental conditions.

Technical Requirements	
Pan	360 degrees continuous pan
Pan speed	80 degrees/second (no load condition)
Tilt	0 – 90 degrees down, Auto flip at 90 degrees or 360 degrees continuous rotation
Tilt speed	20 degrees/second (no load condition)
Preset speed	> 120 degree/second preset, at 0.1 percent accuracy
Digital position feedback	Yes

3.4 CTV Camera Housing

The camera housing shall be sealed and pressurized with dry nitrogen and rated NEMA 4X and IP67.

All outdoor camera enclosures housings shall withstand hose-directed water, exposure to sand, dust, fungus, and salt atmosphere per MIL-E-5400T, Paragraphs 3.2.24.7, 3.2.24.8, and 3.2.24.9.

All connections shall be watertight. The housing shall be corrosion resistant and tamperproof housing.

Except for the viewing window, the enclosure shall be constructed from 6061-T6 standard aluminum. A copper plated spring-steel ring shall be used to ensure electrical bonding of the rail assembly and components to the camera housing. The housing exterior shall be finished by pretreatment with conversion coating and baked enamel paint.

Internal wiring shall be properly labeled. A gas-tight connector shall be used at the rear plate of the housing. Wiring to the connector shall be sealed with silicon or potting compound.

The internal humidity of the housing shall be sealed in such a manner that internal humidity is at a level that does not cause moisture damage to the components or allow condensation on the components or lens. .

The viewing window shall be constructed in such a way that unrestricted camera views can be obtained at all camera and lens positions.

The camera/lens/housing shall be assembled and tested, and configured only by the camera manufacturer at the camera manufacturer facility. The camera shall have been adjusted for color balance and lens tracking/focus, and all configurable items shall have been properly set per specifications. Each camera/lens/housing delivered to the project site shall be accompanied with a written certification of assembly and configuration from the camera manufacturer. This certification shall serve as manufacturer's documentation that the assembly and configuration of the camera/lens/housing equipment was performed. A sample certification document shall be furnished as part of the materials submittal data.

3.5 Mounting And Wiring

Mount the CCTV camera assembly securely to the camera poles to withstand winds loads of up to 160 mph. Refer to plan details for camera positioning, orientation, and configurations.

All wiring and connections shall be provided to power, communications, and control/data from the CCTV camera assembly to the ITS cabinet.

3.6 Required Testing

Prior to partial or final acceptance and system testing, the site requiring a CCTV camera assembly shall undergo Commissioning Testing:

Purpose

Commissioning testing shall be performed for each site. The primary purpose is to ensure that the installed site components operate in a local environment and meet all requirements' definitions and specifications.

The commissioning testing is a validation that all site installed equipment and material function according to the manufacturer's specification, the technical requirements, and specifications contained herein.

Test Approach

The Department will provide a commissioning test plan, based on the approved submitted product, during construction that the contractor shall follow.

The engineer and other designated principals will witness the testing to provide quality assurance. The results of each test step in the script shall be assessed using pass/fail designators. At the successful completion of each commissioning test for a particular site, the site will be deemed commissioned.

The contractor shall provide to the Project Enginner and have on site, during the commissioning testing, all applicable documentation concerning the devices being tested and used.

Commission Test Entry and Exit Criteria

The following criteria shall be met before test entry of each site and completion of the commission test: Entry Criteria

All required site components shall be installed.

Sites shall be inspected and tested for operational anomalies. All vendor documentation and all vendor and/or proprietary software and hardware shall be ready for validating the site installed components.

Preliminary as-built plans have been submitted and accepted. Exit Criteria

Each commission test activity has been evaluated via a pass/fail designator.

The results of the commissioning test shall have been provided to the Project Engineer with a course of action for resolving any anomalies.

All equipment and material discrepancies, inconsistencies, shortages, and failures to meet the project requirements and specifications have been identified, documented, and have a resolution, and/or agreed-upon schedule of resolution.

In the event of a requirement deficiency requiring repair or replacement of any component, the Project Engineer may require a repeat test by revisiting the applicable script.

Six (6) copies of the commissioning test results shall be submitted to the Project Engineer within 15 calendar days of test completion for review and acceptance. System integration testing with the site shall proceed only after written acceptance notification is received from the engineer.

4. MEASUREMENT.

CCTV Camera Assembly, Furnish & Install with PTZ, Analog/Digital will be measured per each and will include providing the camera imaging unit, pan tilt unit, mounting and wiring, connections, and hardware, factory and manufacturing inspection, testing, storage, packaging, shipping, warranty, work, equipment, appurtenances, all labor, equipment, materials, and incidentals as required to effect the full operation and control of CCTV Camera Assembly, Furnish & Install with PTZ, Analog as detailed on the plans and as described in these specifications complete in place and ready for use.

CCTV Camera Assembly, Furnish with PTZ, Analog/Digital will be measured per each and will include providing the camera imaging unit, pan tilt unit, mounting and wiring, connections, and hardware, factory and manufacturing inspection, testing, storage, packaging, shipping, warranty, equipment, appurtenances, and incidentals required to furnish a CCTV Camera Assembly, Furnish with PTZ, Analog as described in these specifications.

CCTV Camera Assembly, Install with PTZ, Analog/Digital will be measured per each and will include providing the mounting and wiring, connections, and hardware, factory and manufacturing inspection, testing, storage, packaging, shipping, warranty, work, equipment, appurtenances, all labor, equipment, materials, and incidentals as required to effect the full operation and control of CCTV Camera Assembly, Install with PTZ, Analog as detailed on the plans and as described in these specifications complete in place and ready for use.

5. PAYMENT.

Payment for CCTV Camera Assembly shall be made at the contract unit price per each.

Payment shall be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-01000	CCTVCamera Assembly, Furnish with PTZ, Analog	Each
NS-ITS-01001	CCTVCamera Assembly, Furnish with PTZ, Digital	Each
NS-ITS-01120	CCTVCamera Assembly, Furnish & Install with PTZ, Analog	Each
NS-ITS-01121	CCTVCamera Assembly, Furnish & Install with PTZ, Digital	Each
NS-ITS-01240	CCTVCamera Assembly, Install with PTZ, Analog	Each
NS-ITS-01241	CCTVCamera Assembly, Install with PTZ, Digital	Each

N.S. FIBER OPTIC CABLE (12-21):

1.0 DESCRIPTION.

This Item consists of furnishing and installing Fiber Optic Cable and all appurtenances required for the ITS in accordance with plan details, the 2016 Louisiana Standard Specifications for Roads and Bridges, this specification, and as directed by the engineer.

The following sections and subsections are referenced within this specification:

Removing Structures and Obstructions	Section 202
Backfill	736.21

2.0 MATERIALS.

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance.

Submit, prior to installation, a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The component of the fiber optic communications system described by this specification shall consist of the following:

1. Fiber optic cable

3.0 FIBER OPTIC CABLE REQUIREMENTS

3.1 STRAND SINGLE MODE CABLE:

3.1.1 GENERAL REQUIREMENTS:

Provide strand optical fiber cable with the fiber count as indicated on the plans and with characteristics as specified herein. All fiber strands shall conform to the requirements detailed herein.

The maximum attenuation for each cabled single mode fiber shall be 0.36 dB/km at 1310 nm and 0.22 dB/km at 1550nm. The attenuation at the water peak (1383 nm) shall not exceed 0.36 dB/km. The maximum dispersion shall be less than 3.5 ps/(nm•km) from 1285nm to 1330nm and less than 18 ps/(nm•km) at 1550 nm.

All optical fibers shall be proof tested by the fiber manufacturer to a minimum load of 0.7 GN/m2 (100 kpsi).

Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-A, “Optical Fiber Cable Color Coding.”

The cabled fiber shall support Gigabit Ethernet (GbE) operation according to the 1000Base-LX (1310 nm region) specifications up to 5000 meters in accordance with the GbE standard. The cable fiber shall support laser-based 10 Gigabit Ethernet (10 GbE) operation according to the 10GBase-L (1310 nm) and 10GBase-E (1550 nm) specifications for distances of 10 km, 25 km, and 40 km respectively.

3.1.2 CABLE CONSTRUCTION:

Cable characteristics are single mode, jacket, rated for installation in conduit, shall be suitable for direct burial, and shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1992.

Fiber optic cable provided under this specification shall be of a totally dielectric construction. Optical fibers shall be arranged in a loose tube configuration. Fibers must be matched clad.

The fiber strands shall not be colored with solvent-based inks.

All cables shall have a central strength member that shall consist of a dielectric, glass reinforced plastic rod. All cables shall also contain either one or two ripcords. Buffer tubes shall be reverse oscillate stranded along the central strength member.

The dielectric strength member shall be non-nutritive to fungus, electrically nonconductive, and free from dirt and foreign matter. Water blocking yarn(s) shall be applied longitudinally along the central member during stranding.

All materials used in the fiber cable shall be non-reclaimed, free from foreign matter consistent with good manufacturing practices, and shall not degrade cable components or accepted connectors, closures, tapes and other materials used with the fiber cable.

All fibers, coatings, plastic tubes and jackets shall be continuous and free from roughness, porosity, bubbles, splits, blisters, voids and inclusions, consistent with good manufacturing practices.

Cable jackets shall be marked with manufacturer's name, sequential meter or foot markings, month and year, or quarter and year of manufacture, and a telecommunication handset symbol, as required by Section 350G of the National Electrical Safety Code (NESC). The actual length of the cable shall be within 0+/-1% of the length markings. The print color shall be white; with the exception that cable jackets containing one or more coextruded white stripes shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

If the initial marking fails to meet the specified requirements (i.e., improper text statement, color, legibility, or print interval), the cable may be re-marked using a contrasting alternate color. The numbering sequence shall differ from the previous numbering sequence, and a tag shall be attached to both the outside end of the cable and to the reel to indicate the sequence of re-marking. The preferred re-marking color shall be yellow, with the secondary option being blue.

Each fiber or group of fibers shall be free-floating within the tubes such that all mechanically or environmentally induced stress placed upon the cable is de-coupled from the fibers. The buffer tubes shall contain a water-swellable yarn for water blocking protection or embedded water blocking material (preferred). The water blocking material shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. The buffer tube shall be gel-free. The optical fiber shall not require cleaning before placement into a splice tray or fan out kit. The nominal outer diameter of the buffer tube shall be 2.5 mm. The buffer tube shall be polypropylene.

All cables must be able to withstand a minimum bending radius of 10 times cable diameter under no load and 20 times cable diameter under load, without affecting performance characteristics of the cable.

The shipping, storage, and operating temperature range of the cable shall be -40 °C to +70 °C. The installation temperature range of the cable shall be -30 °C to +70 °C.

3.1.2.1 BACKBONE CABLE:

All cables shall be sheathed with a circular extrusion of medium density polyethylene (MDPE) and shall be suitable for direct burial. The minimum nominal jacket thickness shall be approximately 1.3 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The fiber cable shall have a tensile rating of 600-lb. (2670 N).

3.1.2.2 DROP CABLE:

Cables shall be sheathed with flame retardant polyvinyl chloride (PVC) and shall be an all dielectric construction. The nominal jacket thickness shall be 1.4mm and shall be applied directly over the tensile strength members. The PVC jacket shall contain carbon black to provide UV protection and shall not promote the growth of fungus. The cable shall meet the requirements of the National Electrical Code Section 770 for Non-Plenum Applications – Applicable Flame Tests: ANSI/UL 1666 and shall be rated OFNR.

The cable shall be of gel-free, loose tube construction with up to 12 buffer tubes wrapped around a dielectric central strength member. All fiber(s) shall be contained within buffer tubes, and each buffer tube shall have an inside diameter much greater than the total diameter(s) of the fiber(s) it supports.

The maximum pulling tension shall be 2700 N (600 lbf) during installation (short term) and 810 N (180 lbf) long term installed.

4.0 GENERAL REQUIREMENTS.

The fiber installer shall be certified in fiber installation by Corning Cable Systems or accepted equal.

Assemble and install all necessary material and equipment and furnish a working fiber optic cable in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

Field verify final equipment locations with the engineer. Plans are diagrammatic and indicate the general arrangement of devices and work included in these documents. Final placement and arrangement are the responsibility of the contractor.

During the installation of the underground systems, removal of brush, trees, fencing, and other obstructions within the right-of-way shall comply with Section 202 of the standard specifications and shall be paid for separately under that section. Landscaping shall be restored to original or better condition if disturbed.

Upon request by the Department, the Arrange for the manufacturer to grant access to the manufacturing facility for all products specified herein.

5.0 FIBER OPTIC CABLE INSTALLATION.

Generally accepted practices and standards for installing fiber optic cable and electrical conductors shall be followed during the installation. All appropriate precautions to prevent cable kinks and breaks shall be followed. The cable manufacturer's specifications regarding tensile strength, pulling capacity, and bending radius, etc. shall not be violated. Plan details provide a diagram illustrating the route that each cable will take from origin to destination.

All specifications provided by the cable manufacturer along with all procedures and standards provided in this document must be followed. Appropriate standards for buried installation of cable shall be followed in laying-in and routing the fiber cable. Documents such as Lucent Technologies, Outside Plant Systems, and Outside Plant Engineering Handbook provide guidance on proper installation procedures. Plan details provide a typical illustration of how the fiber is routed. During installation of the fiber optic cable, care must be taken so that the cables do not kink or bend excessively in a manner that diminishes the cable transmission capability. Note that the cable is to be terminated, spliced, or both at specific locations. Maximum pulling tensions of all cables and conductors shall not exceed manufacturer's recommendations. Use pulling lubricants recommended by the manufacturer or friction reducing pulling sleeves when necessary to install cable.

During installation of the optical fiber cable, a minimum of 50 feet-0 inches of slack shall be coiled within each underground pullbox. Drop locations for future connectivity shall have a minimum of 200 feet-0 inches of slack coiled within each underground pullbox or as noted in the plans.

At each underground pullbox, label every cable entering and leaving. Labels shall be permanent, plastic, wrap-around type that contains a minimum of 20 typed characters. Specific label content shall be determined with the engineer using designations as detailed on the plans and shall be typed.

6.0 QUALITY CONTROL PROVISION.

All cabled optical fibers shall be 100% attenuation tested using an optical source-power meter test set (i.e., power meter test). The attenuation of each fiber shall be provided with each cable reel and shall meet the requirements of the fiber specification parameters as specified herein.

All cable once on the reel shall have Optical Time Domain Reflector (OTDR) reports generated at the factory prior to shipment, at the delivery location prior to installation, and on-site after installation. Cable provided under this specification must produce equivalent OTDR reports at each test point.

7.0 REFERENCES, STANDARDS, LISTING, AND CODES.

For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

The cable manufacturer shall support industry standards such as Bell Communications Research (Bellcore), Electronic Industries Association (EIA), Telecommunications Industry Association (TIA), International Telecommunications Union (ITU), International Electromechanical Commission (IEC), Rural Utilities Service (RSU, formerly-REA), American Society for Testing and Material (ASTM) and the Building Industry Consultant Services (BICSI) Telecommunications Distribution Methods Manual. In addition, product supplied by the cable manufacturer shall meet all applicable standards of the above organizations and well as the reference standards listed in Table 1.

It is required that the cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

All work and equipment shall be designed, manufactured, and tested in accordance with the latest applicable standards for the equipment specified. Where these specifications differ from the requirements of the stated standards, these specifications shall govern.

In addition to the requirements of these specifications, material and workmanship shall meet or exceed all requirements of the applicable portions of the latest editions of the standards and codes listed below. The fiber optic cable shall further meet or exceed those applicable standards not stated herein but referenced by the below standards or their applicable sections. The standards list includes, but is not limited to, the following:

Table 1: Fiber Optic Industry Standards

Industry Standard / Code	Description
ASTM D 1248 (2005)	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1603 (2006)	Standard Test Method for Carbon Black in Olefin Plastics
ASTM D 1765 (2010)	Standard Classification System for Carbon Blacks Used in Rubber Products
ASTM D 3349 (2006)	Standard Test Method for Absorption Coefficient of Carbon Black Pigmented Ethylene Plastic
ASTM E 29 (2009)	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
BELLCORE	Issue 1, September 1994
GR-20-CORE (2010)	Generic Requirements for Optical Fiber and Fiber Optic Cable

Industry Standard / Code	Description
EIA/TIA-455-3 (2009)	Procedure to Measure Temperature Cycling Effects on as Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components
EIA/TIA-455-24 (2000)	Water Peak Attenuation Measurement of Single Mode Fibers
EIA/TIA-455-25 (2002)	Impact Testing of Fiber Optic Cables and Cable Assemblies
EIA/TIA-455-28 (2005)	Method for Measuring Dynamic Tensile Strength of Optical Fibers
EIA/TIA-455-29 (1999, w/d superseded by TIA-455-176-A)	Refractive Index Profile Transverse Interference Method
EIA/TIA-455-31 (2005)	Fiber Tensile Proof Test Method
EIA/TIA-455-33 (2005)	Fiber Optic Cable Tensile Loading and Bending Test
EIA/TIA-455-37 (2005)	Low or High Temperature Bend Test for Fiber Optic Cable
EIA/TIA-455-41 (2001)	Compressive Loading Resistance of Fiber Optic Cable
EIA/TIA-455-46 (1990, w/d in 2003)	Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
EIA/TIA-455-47 (1990, w/d superseded by TIA-455-177, 2003)	Output Far-Field Radiation Pattern Measurement
EIA/TIA-455-51 (w/d superseded by TIA-455-204, 2000)	Pulse Distortion Measurement of Multimode Glass Optical Fibers Information Transmission Capacity
EIA/TIA-455-58 (2001)	Core Diameter Measurement of Graded-index Optical Fibers Information Transmission Capacity
EIA/TIA-455-59 (superseded by TIA-455-78, 2002)	Measurement of Fiber Point Discontinuities Using an OTDR
EIA/TIA-455-61 (superseded by TIA-455-78, 2002)	Measurement of Fiber or Cable Attenuation Using an OTDR
EIA/TIA-455-62 (2003)	Measurement of Optical Fiber Macrobend Attenuation

Industry Standard / Code	Description
EIA/TIA-455-76 (1993, w/d with no superseded doc)	Method for Measuring Dynamic Fatigue or Optical Fibers by Tension
EIA/TIA-455-78 (2002)	Spectral Attenuation Cutback Measurement for Single-Mode Optical Fibers
EIA/TIA-455-80 (2003)	Measuring Cutoff Wavelength of Uncabled Single-Mode Fiber by Transmitted Power
EIA/TIA-455-82 (1992)	Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable
EIA/TIA-455-85 (2005)	Fiber Optic Cable Twist Test
EIA/TIA-455-86 (2005)	Fiber Optic Cable Jacket Shrinkage
EIA/TIA-455-89 (1998)	Fiber Optic Cable Jacket Elongation and Tensile Strength
EIA/TIA-455-97 (Draft)	Procedure for Measuring Static Fatigue of Optical Fibers in Two-Point Bending
EIA/TIA-455-98 (2000)	Fiber Optic Cable External Freezing Test
EIA/TIA-455-104 (2005)	Fiber Optic Cable Cyclic Flexing Test
EIA/TIA-455-111 (2003)	Procedure for the Measurement of Optical Fiber Curl
EIA/TIA-455-113 (1997, R2001)	Polarization-Mode Dispersion Measurement for Single-Mode Optical Fibers by Wavelength Scanning
EIA/TIA-455-164 (1991, w/d no superseding doc)	Single-Mode Fiber, Measurement of Mode Field Diameter by Far-Field Scanning
EIA/TIA-455-167 (1992, w/d no superseding doc)	Mode Field Diameter Measurement-Variable Aperture Method in the Far-Field
EIA/TIA-455-168 (1999, w/d superseded by TIA-455-175, 2003)	Chromatic Dispersion Measurement of Multimode Graded-Index and Single-Mode Optical Fibers by Spectral Group Delay Measurement in the Time Domain
EIA/TIA-455-170 (1998, w/d no superseding doc)	Cable Cutoff Wavelength of Single-Mode Fiber by Transmitted Power
EIA/TIA-455-173 (1990)	Coating Geometry Measurements, Side View
EIA/TIA-455-175 (2003)	Chromatic Dispersion Measurement of Single-mode Optical Fibers by the Differential Phase Shift Method
EIA/TIA-455-176 (2003)	Method for Measuring Optical Fiber Cross-Sectional Geometry by Automated Grey-Scale Analysis
EIA/TIA-455-177 (2003)	Numerical Aperture Measurement of Graded-Index Optical Fibers

Industry Standard / Code	Description
EIA/TIA-455-178 (2003)	Measurement of Strip Force Required for Mechanically Removing Coatings from Optical Fibers
EIA/TIA-455-181 (2001)	Lightning Damage Susceptibility Test for Fiber Optic Cables with Metallic Components
IEC 60793-1 (1992, superseded by IEC 60793-1-1, -2, -3, -4, -5)	International Standard (Optical Fibers) – Part1: Generic Specification
-A1A	Refractive Index Profile
-A3	Near Field Light Distribution
-B1	Optical Fiber Proof Test
-C1A	Cut-back Technique
-C1C	Insertion Loss Technique
-C2A	Impulse Response
-C5C	Cromatic Dispersion Measurement of Optical Fibers by the Differential Phase Shift Method
-C7B	Cable Cut-off Wavelength Measurement of Single Mode Fiber
-C9A	Mode Field Diameter Measurement Direct Far-Field Scanning Method
-C9B	Mode Field Diameter Measurement – Variable Aperture Method in the Far-Field
-C11	Macrobending Sensitivity
IEC 60794-1 (1996, w/d superseded by IEC 60794-1-1, 1-2, 2001)	International Standard (Fiber Optic Cables) – Part1: Generic Specification

8.0 TESTING REQUIREMENTS

8.1 GENERAL REQUIREMENTS:

DOTD shall have accessibility to the manufacturing plant to witness manufacture and testing of fiber optic cable.

The manufacturer shall provide a representative to witness field-testing of installed fiber optic cable.

Final inspection and acceptance of the multiple fiber optic cable installations shall be at the discretion of the Department. Complete testing as described below, and provide the Department with documentation related to such testing. Testing shall be in accordance with the standards and regulations previously referenced by these specifications.

Prepare a statement of methodology for all testing procedures that shall be used for this installation. This statement shall be provided in advance to the Department for review and acceptance by the engineer. In addition to accepting procedures, the engineer must also accept all data forms that shall be used to record results of pre and post installation testing as well as link loss budget calculations. Once testing is complete, all test results recorded on accepted data forms, and signed by the contractor, shall be provided to the engineer in 3-ring binder(s) labeled and tabbed for each test segments for review and acceptance.

In addition to the guidance provided above, all testing shall be performed in accordance with industry standards bodies and generally accepted methods that were previously documented. Testing shall also comply with the specific industry standards provided by the fiber optic cable specification.

Before beginning any excavation, Determine the location of any electrical lines, drainage, utility, and other underground facilities in the vicinity and shall conduct his work in such a manner as to avoid damage to it. Precautions shall be taken to ensure that the conduit is located to avoid conflict with proposed guard rail, sign posts, or any other miscellaneous structures.

Repair any broken or damaged underground facilities.

Backfilling of trenches shall be with usable soil in accordance with Subsection 736.21 of the standard specifications, placed and compacted to at least the density of the surrounding ground at no direct pay.

It is the intent of the design to hold to an absolute minimum the number of total fiber optic cable fusion splices. Locations of allowed fusion splices are as indicted on the plans or at the location accepted by the engineer. Ensure that a sufficient amount of fiber optic cable is included per run in order to avoid unnecessary splices.

Install pull rope in every spare or vacant conduit installed as part of this project.

8.2 TESTS REPORTS:

All fiber test reports shall be printed from the testing unit interface and management software. Original data files (a CD with the electronic files pulled from the testing unit and PDF files of the printed reports) shall be supplied with each report submittal. Proof of the latest certification of the test unit shall be included in all reports. All test units to be used on this project shall have been certified by the manufacturer within 12 months prior to the date the test is performed. Reports shall be properly labeled (i.e., cable segment, buffer tube, fiber, and Tx & Rx locations) and organized for review. All test shall be performed in both 1310nm and 1550nm wavelengths.

Each report printout shall contain the following information:

1. Software name and version
2. Date and time stamp of when the test was taken
3. Date and time stamp of when the report was printed
4. OTDR reports
    a. Graph of dB versus linear feet (i.e., signature trace) with events identified on the graph. View shall be zoomed to clearly show the beginning and end of the fiber segment.
    b. Summary of events by:
        i. Type
        ii. Location
        iii. Event - event (dB & dB/km, respectively)
        iv. Loss (dB)
        v. Reflectance (dB)
        vi. Overall (end-to-end) loss (note this is theoretical loss)
5. Power meter test report
    a. Link loss budget calculation (note hand/program calculations are required as this is not typically a print out from the test unit software. If test unit is programmed to perform budget calculation, a screen capture of attenuation settings shall be submitted with results)
    b. System loss from Tx to Rx (note this is actual attenuation, loss)
    c. Wavelength

8.3 TESTS PERFORMED AT MANUFACTURING FACILITY:

Certified test reports shall be provided for each shipping reel of cable. The manufacturer shall document and certify the results of all factory tests and compliance with the performance requirements. Certified test reports shall include but not be limited to the power meter test reports for maximum attenuation for each cabled fiber, bandwidth, maximum billable length, actual shipped length, ordered length and OTDR test reports. Certificates of compliance are not acceptable. A written quality assurance/quality control manual shall be implemented and maintained to ensure full compliance with all requirements of this specification.

Testing shall be performed in accordance with the procedures outlined in the previously mentioned standards. These tests shall be performed at the factory and certified test results shall be provided to the Department in accordance with those standards.

8.4 TESTS PERFORMED IMMEDIATELY UPON DELIVERY:

At the time of delivery, fiber optic cable tests as outlined shall be performed in the presence of the Contractor, a Department representative, and the manufacturer's representative. Once the tests are complete, and the results are satisfactory to all representatives present, the equipment and materials shall then become the responsibility of the Contractor for installation.

Once off-loaded from the delivery vehicle, each reel of fiber optic cable shall be subjected to an OTDR test. Every fiber strand in each cable shall be tested end to end with an OTDR which is compatible with wavelength and fiber type. Testing shall measure attenuation and length, verify continuity, and discover anomalies. Should an accurate measurement not be obtained from one end of a cable strand, the test shall be run from the opposite end. Tested loss per kilometer shall not exceed the loss provided in the manufacturer's certification data and as required by these specifications. In the event that loss per kilometer does exceed that of the manufacturer's certification data and these specifications, the cable reel shall be rejected and returned to the manufacturer.

Test reports shall be submitted to the engineer within 48 hours after test completion. Failure to submit test reports before the prescribed deadline may require that the test be re-administered or cable rejected.

8.5 TESTS PERFORMED SUBSEQUENT TO INSTALLATION:

Following installation as directed per the plans but prior to splicing and permanent termination, each fiber optic cable strand shall be subjected to OTDR tests and one pair of fibers from each buffer tube shall be power meter tested to confirm that the system's actual performance meets the requirements of the system's link loss budget. Should an accurate measurement not be obtained from one end of a cable strand, the OTDR test shall be run from the opposite end. Follow manufacturer's loss guidelines for connectors, splices, and single mode fibers. Cables failing to meet specifications for all fiber strands once installed will be rejected and replaced.

Test reports shall be submitted to the engineer within 5 business days after test completion. Failure to submit test reports before the prescribed deadline may require that the test be re-administered or cable rejected.

8.6 TESTS PERFORMED SUBSEQUENT TO SPLICING AND TERMINATION:

Following splicing and termination of fiber optic cable, both power meter and OTDR tests shall be repeated for each strand dedicated for project communications (i.e., lit fibers). Tests shall be performed for the full length of the installation from Hub/TMC terminations to field cabinet terminations. OTDR test shall be run for both directions.

Tested loss per kilometer shall not exceed the link loss budget calculations accepted by the engineer. In the event that link loss (per power meter test results) does exceed that of the link loss budget calculations, replace cable, splices, and/or terminations as required to bring the test results within the calculated budget. Testing shall be rerun as required to prove the link loss is within the calculated budget.

Test reports shall be submitted to the engineer within 5 business days after test completion. Failure to submit test reports before the prescribed deadline may require that the test be re-administered.

9.0 STORAGE, PACKAGING, AND SHIPPING.

Provide a secure indoor storage facility for the duration of the storage period.

Cables shall be shipped on heavy-duty reels. The distance between the cable and the outer edge of the reel flange shall not be less than 2 inches.

Cable ends shall be sealed with heat shrink end caps and both ends of the cable shall be exposed to facilitate testing on the reel.

Reels shall be shipped in upright position on edges of flanges. Any reels laid on flanges shall be returned. Reels shall not be stored on sides of flanges (laying flat) or stored stacked on each other.

All reels shall be wrapped with a protective paper or cardboard wrap to expose any damage that may have occurred during transportation.

Standard industry practices for storage, handling, and shipping shall be adhered to when not covered in these specifications.

Due to long fiber pulls, it may be necessary for the contractor to supply multiple fiber reels to complete a run. When connecting multiple reels to complete a run, reel-to-reel butt splices shall be provided at locations already identified in the plans as requiring a splice closure and as approved by the engineer.

The reel tag shall include the following information:

1. Cable number
2. Gross weight
3. Shipped cable length in feet
4. Project name and number
5. Manufacturers product number
6. Date cable was tested
7. Manufacturers order number
8. Cable length markings - Top (inside end of cable) and Bottom (outside end of cable)
9. Item number
10. Loss budget for each fiber strand w/in each fiber optic cable

The reel (one flange) marking shall include:

1. “Manufacturer”
2. An arrow indicating proper direction of roll when handling
3. Ship to address
4. Manufacturer cable number
5. Cable length in feet
6. Gross package weight inclusive of cable, reel and protective covering
7. Project name and number
8. Fork lift handling illustration
9. The text “DO NOT SHIP REEL ON SIDE”

Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:

1. Manufacturer Cable Number
2. Manufacturer Product Number
3. Manufacturer Factory Order Number
4. Customer Name
5. Customer Cable Number
6. Mark for Information
7. Ordered Length
8. Actual Shipped Length

9. Loss budget for each fiber strand within each fiber optic cable segment
10. Bandwidth Specification

10.0 WARRANTY.

The manufacturer of the specified fiber optic cable shall provide a written and documented ten (10) year warranty on materials and workmanship to the Department effective from the date of commission of said fiber optic cable.

In the event that the fiber optic cable, or any portion thereof, should fail due to workmanship or materials within the ten (10) year warranty period, the warranty shall provide that the manufacturer shall supply the Department with new replacement fiber optic cable of equal or greater kind and quality and meeting all of the applicable specifications herein, at no charge to the Department.

Cable manufacturer must provide recommended Splicing and Termination Instructions and procedures as part of the warranty.

11.0 MEASUREMENT.

For furnish and install pay items, Fiber Optic Cable, SM, and Fiber Optic Drop Cable, SM will be measured in units of linear feet and be paid for at the contract unit price per linear foot. The price shall be full compensation for furnishing and installing fiber optic cable and fiber optic drop cable and for all labor, equipment, testing, tools and incidentals necessary to complete the work.

For install only pay items, Fiber Optic Cable, SM, will be measured in units of linear feet and be paid for at the contract unit price per linear foot. The price shall be full compensation for installing fiber optic cable and for all labor, equipment, testing, tools and incidentals necessary to complete the work.

For furnish only pay items, Fiber Optic Cable and will be measured in units of linear feet and be paid for at the contract unit price per linear foot. The price shall be full compensation for furnishing fiber optic cable.

12.0 PAYMENT.

Payment for Fiber Optic Cable will be made at the contract unit price per linear foot.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04020	Fiber Optic Cable, SM, Furnish & Install, 13-48 Fibers	Linear Foot
NS-ITS-04060	Fiber Optic Cable, SM, Furnish & Install, 2-12 Fibers	Linear Foot
NS-ITS-04100	Fiber Optic Cable, SM, Furnish & Install, 49-96 Fibers	Linear Foot
NS-ITS-04101	Fiber Optic Cable, SM, Install	Linear Foot
NS-ITS-04250	Fiber Optic Drop Cable, SM, 12 Strand, Furnish & Install	Linear Foot
NS-ITS-04251	Fiber Optic Drop Cable, SM, 12 Strand, Furnish	Linear Foot

N.S. FIBER OPTIC FAN OUT KIT (05-17):

1. DESCRIPTION.

This Item consists of furnishing and installing fiber optic fan out kits and all appurtenances required for the ITS in accordance with plan details, these specifications, and as directed by the engineer.

2. MATERIALS.

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation, a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The components of the fiber optic communications system described by this specification shall consist of the following:

Fiber optic fan out kits

3. CONSTRUCTION REQUIREMENTS.

The contractor shall assemble and install all necessary material and equipment and furnish a working fiber optic fan out in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

Upon request by the Department, the contractor shall arrange for the manufacturer to grant access to the manufacturing facility for all products specified herein.

FAN OUT KIT

A. GENERAL REQUIREMENTS

Buffer tube fan outs shall be used when fiber optic drop cable is required to be connectorized as indicated on the plans. Whip style fan outs for loose tube cable shall be provided in either a six or twelve fiber configuration. The 900 um fan out assembly shall be color coded to match the fiber color scheme. The fan out shall be a minimum of 25 inches in length. The fan out shall consist of a two piece snap together body which locks the fan out to the buffer tube. Fan outs shall be rated for outdoor use within a temperature range of -40 F to +158 F.

No epoxy, heat shrink tubing, glue, or field sub-assembly shall be necessary to install the fan out. Buffer tube fan outs shall be used where fiber is terminated inside a fiber distribution panel. Fan out kits shall be from the same manufacturer as the fiber cable.

B. INSTALLATION DESCRIPTION AND LOCATIONS

See plan sheets and general notes for site or project specific information regarding installation of this item.

4. MEASUREMENT.

Fiber optic fan out kits, SM, will be measured per each and will include providing all labor, equipment, materials, and incidentals required for the furnishing and installation of a fiber optic fan out kit as detailed on the plans and as described in these specifications and includes the fan out kit, installation of the kit on the drop cable, factory and manufacturing inspection, testing, storage, packaging, shipping, warranty, and all work, equipment, and appurtenances as required to effect the full operation and control of the fiber optic fan out kit complete in place and ready for use.

5. PAYMENT.

Payment for fiber optic fan out kits work shall be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04035	Fiber Optic Fan Out Kits, SM, 12 Strand, Furnish & Install	Each
NS-ITS-04037	Fiber Optic Fan Out Kits, SM, 6 Strand, Furnish & Install	Each

N.S. FIBER OPTIC SPLICE (05-17):

1. DESCRIPTION

This Item consists of furnishing and installing a fiber optic splice and all appurtenances required for the ITS in accordance with plan details, these specifications, and as directed by the engineer.

2. MATERIALS

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation, fiber optic splicing diagrams for the backbone and drops and a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The component of the fiber optic communications system described by this specification shall consist of the following:

1. Fiber optic splices
2. Fiber optic splicing diagrams

3. CONSTRUCTION REQUIREMENTS

The contractor shall assemble and install all necessary material and equipment and furnish a working fiber optic splice in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

The contractor shall field verify final equipment locations with the engineer. Plans are diagrammatic and indicate the general arrangement of devices and work included in these documents. Final placement and arrangement are the responsibility of the contractor.

Upon request by the Department, the contractor shall arrange for the manufacturer to grant access to the manufacturing facility for all products specified herein.

3.1 FIBER OPTIC CABLE FUSION SPLICE AND SELECTIVE SPLICE POINTS

A. GENERAL REQUIREMENTS

Prior to any fiber splicing, the fiber optic splicing diagrams for the backbone, subtending and drops shall be submitted and accepted.

Refer to plan details for specific fibers being spliced and those being expressed.

The loss through any one fusion splice shall be 0.07 dB or less.
The complete fusion splice points for the fiber optic cable shall occur only within pullboxes as designated by the engineer. At each of these points, a submersible splice enclosure suitable for a minimum of 72 fusion splices shall be utilized. This enclosure shall allow for installation of a fiber optic drop cable that shall be routed to the termination point. Industry accepted standards and manufacturer's specifications shall be followed for installation of splice enclosures and fusion splices.

Fusion splicing shall be utilized for all splices and manufacturer's specifications for equipment and fiber cable shall be followed.

B. TOTAL CABLE FUSION SPLICE POINTS

All fiber optic cables shall be continuous with no total cable splices. Full butt splices are allowed only due to the physical limitations of the length of fiber that can be placed on the reel. Payment for butt splices due to the physical imitation of the reel, are included as part of the backbone fiber.

The electrically conductive path used for continuity and grounding of the splice closure metallic components shall be capable of withstanding an AC current of 1000 Amperes for 20 seconds.

The closure shall show no evidence of water intrusion into the compartment containing fiber splices after it is immersed in water and subjected to 10 freeze/thaw cycles. The splice closure shall show no evidence of water penetration following exposure to a 20-foot water head for a period of 7 days. The splice closure shall show no evidence of corrosion following exposure to acidified saltwater for a period of 90 days.

4. MEASUREMENT

Fiber optic connection splice will be measured in units of each splice installed which includes all labor, materials, diagrams, equipment, tools and incidentals necessary to complete the work.

5. PAYMENT

Payment for fiber optic slice work will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04180	Fiber Optic Connection, Install, Splice	Each

N.S. FIBER OPTIC CONNECTION TERMINATION (05-17):

1. DESCRIPTION.

This Item consists of terminating fiber optic drop cable and all appurtenances required for the ITS in accordance with plan details, this specification, and as directed by the engineer.

2. MATERIALS.

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The component of the fiber optic communications system described by this specification shall consist of the following:

Fiber optic terminations

3. CONSTRUCTION REQUIREMENTS.

The contractor shall assemble and install all necessary material and equipment and furnish a working fiber optic termination in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

The contractor shall field verify final equipment locations with the engineer. Plans are diagrammatic and indicate the general arrangement of devices and work included in these documents. Final placement and arrangement are the responsibility of the contractor.

Upon request by the Department, the contractor shall arrange for access to the manufacturing facility for all products specified herein.

FIBER OPTIC CABLE TERMINATION POINTS

A. GENERAL REQUIREMENTS

The loss through any terminus connector pair shall be 0.5 dB or less. Reflectance shall be below -45 db.

Acceptable fiber optic connectors shall be SC or LC and are referenced in this specification as connectors. The contractor shall verify that connector type is compatible with hardware fiber ports. Industry standards related to fiber termination shall be followed. Connectors shall have pre-radiused zirconia ceramic ferrule, connector body, blue shroud, black or blue 3.0 mm and a 900um boots. Connectors shall be compatible with mechanical, two part heat cure epoxy and anaerobic adhesive assembly methods.

Connectors shall be used throughout the fiber optic system installation for terminating fibers and for jumping between termination points, unless otherwise required by a network device. Fusion splicing shall be utilized for all splices and manufacturer's specifications for equipment and fiber cable shall be followed.

Manufacturer's specifications for terminating the fiber cable and for utilization of the termination device shall be followed. In addition, industry standard practices for fiber termination shall also be followed. Plan details provide termination diagrams for each termination point and a numbering scheme for the fiber cables that will be followed throughout the layout of the network.

Each strand of each cable being terminated shall be appropriately labeled with origination and destination information, when defined.

B. INSTALLATION DESCRIPTION AND LOCATIONS

See plan sheets and general notes for site or project specific information regarding installation of this item.

4. MEASUREMENT.

Fiber optic connection, termination will be measured per each and will include providing all labor, materials, equipment, tools and incidentals necessary to complete the work as detailed on the plans and as described in these specifications.

5. PAYMENT.

Payment for fiber optic connection, termination work will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04200	Fiber Optic Connection, Termination, Furnish & Install	Each

N.S. FIBER OPTIC PATCH CORD (05-17):

1. DESCRIPTION.

This Item consists of furnishing and installing fiber optic patch cords and all appurtenances required for the ITS in accordance with plan details, these specifications, and as directed by the engineer.

2. MATERIALS.

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation, fiber optic splicing and termination diagrams for the backbone and drops and a complete set of shop drawings of all the equipment and components listed below and included as part of the installation

The component of the fiber optic communications system described by this specification shall consist of the following:

1. Fiber optic patch cord
2. Fiber optic splicing diagrams
3. Fiber optic termination diagrams

3. CONSTRUCTION REQUIREMENTS.

The contractor shall assemble and install all necessary material and equipment and to furnish a working fiber optic patch cord in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

The contractor shall field verify final equipment locations with the engineer. Plans are diagrammatic and indicate the general arrangement of devices and work included in these documents. Final placement and arrangement are the responsibility of the contractor.

Upon request by the Department, the contractor shall arrange for the manufacturer to grant access to the manufacturing facility for all products specified herein.

STRAND SINGLE MODE CABLE – PATCH CORD (2, 4, OR 8 COUNT)

A. GENERAL REQUIREMENTS

Contractor shall provide strand optical fiber cables with the fiber count as indicated on the plans (2, 4, or 8) and with characteristics as specified herein. All fiber strands shall conform to the requirements detailed herein.

The maximum attenuation for each single mode fiber shall be 0.65 dB/km at 1310 nm and 0.50 dB/km at 1550 nm. The attenuation at the water peak (1383 nm) shall not exceed 0.65 dB/km. The maximum dispersion shall be less than 3.5 ps/(nm•km) from 1285nm to 1330nm and less than 18 ps/(nm•km) at 1550nm.

All optical fibers shall be proof tested by the fiber manufacturer to a minimum load of 0.07 GN/m2 (100 kpsi).

B. CABLE CONSTRUCTION

Standard single mode patch cord shall be installed from the termination point patch panel to the edge device (e.g., Ethernet switch, video encoder, contact closure transceiver, etc).

All patch cords used for system configuration shall be compatible with fiber types and connectors specified herein. Patch cords shall be yellow in color (single mode) and shall incorporate buffered fiber, aramid yarn strength members, and an outer jacket. Part number, manufacturer, and lot number shall be imprinted on the jacket.

All fiber optic patch cords provided under this contract shall be of a totally dielectric construction. Patch cords shall be arranged in a tight-buffer configuration.

The fiber strands shall not be colored with solvent-based inks.

Patch cords in a duplex configuration, 2 fibers, shall be have an outer polyvinylidene fluoride (PVDF) jacket and manufactured together with a heat-shrink prior to the fan out. Patch cords configurations containing more than 2 fibers may be sheathed with a flame retardant polyvinyl chloride (PVC) jacket.

C. QUALITY CONTROL PROVISION

All cabled optical fibers shall be 100 percent attenuation tested. The attenuation of each fiber shall be provided with each cable reel and shall meet the requirements of the fiber specification parameters as specified herein.

All cable once on the reel shall have Optical Time Domain Reflector (OTDR) reports generated at the factory prior to shipment, at the delivery location prior to installation, and on-site after installation. Cable provided under this specification must produce equivalent OTDR reports at each test point.

D. INSTALLATION DESCRIPTION AND LOCATIONS

See plan sheets and general notes for site or project specific information regarding installation of this item.

E. REFERENCES, STANDARDS, LISTING, AND CODES

For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

The cable manufacturer shall support industry standards such as Bell Communications Research (Bellcore), Electronic Industries Association (EIA), Telecommunications Industry Association (TIA), International Telecommunications Union (ITU), International Electromechanical Commission (IEC), Rural Utilities Service (RSU, formerly-REA), American Society for Testing and Material (ASTM) and the Building Industry Consultant Services (BICSI) Telecommunications Distribution Methods Manual. Materials provided under this Specification must be new and must be provided by manufacturers regularly engaged in the production of such products.

It is required that the cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

All equipment shall be designed, manufactured, and tested in accordance with the latest applicable standards for the equipment specified. In some instances, these specifications go beyond the requirements of the stated standards. Where these specifications differ from the requirements of the stated standards, these specifications shall govern.

In addition to the requirements of these specifications, material and workmanship shall meet or exceed all requirements of the applicable portions of the latest editions of the standards and codes listed below. The fiber optic cable shall further meet and/or exceed those applicable standards not stated herein but referenced by the below standards and/or their applicable sections. The standards list includes, but is not limited to, the following:

Industry Standard / Code	Description
ASTM D 1248	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics
ASTM D 1765	Standard Classification System for Carbon Blacks Used in Rubber Products
ASTM D 3349	Standard Test Method for Absorption Coefficient of Carbon Black Pigmented Ethylene Plastic
ASTM E 29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
BELLCORE GR-20-CORE	Issue 1, September 1994 Generic Requirements for Optical Fiber and Fiber Optic Cable
EIA/TIA-455-3	Procedure to Measure Temperature Cycling Effects on as Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components
EIA/TIA-455-24	Water Peak Attenuation Measurement of Single Mode Fibers
EIA/TIA-455-25	Impact Testing of Fiber Optic Cables and Cable Assemblies
EIA/TIA-455-28	Method for Measuring Dynamic Tensile Strength of Optical Fibers
EIA/TIA-455-29	Refractive Index Profile Transverse Interference Method
EIA/TIA-455-31	Fiber Tensile Proof Test Method
EIA/TIA-455-33	Fiber Optic Cable Tensile Loading and Bending Test
EIA/TIA-455-37	Low or High Temperature Bend Test for Fiber Optic Cable
EIA/TIA-455-41	Compressive Loading Resistance of Fiber Optic Cable
EIA/TIA-455-46	Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
EIA/TIA-455-47	Output Far-Field Radiation Pattern Measurement
EIA/TIA-455-51	Pulse Distortion Measurement of Multimode Glass Optical Fibers Information Transmission Capacity
EIA/TIA-455-58	Core Diameter Measurement of Graded-index Optical Fibers Information Transmission Capacity

Industry Standard / Code	Description
EIA/TIA-455-59	Measurement of Fiber Point Discontinuities Using an OTDR
EIA/TIA-455-61	Measurement of Fiber or Cable Attenuation Using an OTDR
EIA/TIA-455-62	Measurement of Optical Fiber Macrobend Attenuation
EIA/TIA-455-76	Method for Measuring Dynamic Fatigue or Optical Fibers by Tension
EIA/TIA-455-78	Spectral Attenuation Cutback Measurement for Single-Mode Optical Fibers
EIA/TIA-455-80	Measuring Cutoff Wavelength of Uncabled Single-Mode Fiber by Transmitted Power
EIA/TIA-455-82	Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable
EIA/TIA-455-85	Fiber Optic Cable Twist Test
EIA/TIA-455-86	Fiber Optic Cable Jacket Shrinkage
EIA/TIA-455-89	Fiber Optic Cable Jacket Elongation and Tensile Strength
EIA/TIA-455-97	Procedure for Measuring Static Fatigue of Optical Fibers in Two-Point Bending
EIA/TIA-455-98	Fiber Optic Cable External Freezing Test
EIA/TIA-455-104	Fiber Optic Cable Cyclic Flexing Test
EIA/TIA-455-111	Procedure for the Measurement of Optical Fiber Curl
EIA/TIA-455-113	Polarization-Mode Dispersion Measurement for Single-Mode Optical Fibers by Wavelength Scanning
EIA/TIA-455-164	Single-Mode Fiber, Measurement of Mode Field Diameter by Far-Field Scanning
EIA/TIA-455-167	Mode Field Diameter Measurement-Variable Aperture Method in the Far-Field
EIA/TIA-455-168	Chromatic Dispersion Measurement of Multimode Graded-Index and Single-Mode Optical Fibers by Spectral Group Delay Measurement in the Time Domain
EIA/TIA-455-170	Cable Cutoff Wavelength of Single-Mode Fiber by Transmitted Power
EIA/TIA-455-173	Coating Geometry Measurements, Side View
EIA/TIA-455-175	Chromatic Dispersion Measurement of Single-mode Optical Fibers by the Differential Phase Shift Method

Industry Standard / Code	Description
EIA/TIA-455-176	Method for Measuring Optical Fiber Cross-Sectional Geometry by Automated Grey-Scale Analysis
EIA/TIA-455-177	Numerical Aperture Measurement of Graded-Index Optical Fibers
EIA/TIA-455-178	Measurement of Strip Force Required for Mechanically Removing Coatings from Optical Fibers
EIA/TIA-455-181	Lightning Damage Susceptibility Test for Fiber Optic Cables with Metallic Components
IEC 793-1	International Standard (Optical Fibers) – Part1: Generic Specification
-A1A	Refractive Index Profile
-A2	Near Field Light Distribution
-B1	Optical Fiber Proof Test
-C1A	Cut-back Technique
-C1C	Insertion Loss Technique
-C2A	Impulse Response
-C5C	Cromatic Dispersion Measurement of Optical Fibers by the Differential Phase Shift Method
-C7B	Cable Cut-off Wavelength Measurement of Single Mode Fiber
-C9A	Mode Field Diameter Measurement Direct Far-Field Scanning Method
-C9B	Mode Field Diameter Measurement – Variable Aperture Method in the Far-Field
-C11	Macrobending Sensitivity
IEC 794-1	International Standard (Fiber Optic Cables) – Part1: Generic Specification

4. MEASUREMENT.

Fiber optic patch cord, SM, 2 Strand, 4 Strand, and 8 Strand will be measured in units of each fiber optic patch cord furnished and installed including all labor, materials equipment, tools and incidentals necessary to complete the work.

5. PAYMENT.

Payment for fiber optic patch cords will be made at the contract unit price per each. Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04290	Fiber Optic Patch Cord, SM, 2 Strand, Furnish & Install	Each

N.S. SPLICE TRAY (05-17):

1. DESCRIPTION

This Item consists of furnishing and installing a splice tray and all appurtenances required for the ITS in accordance with plan details, these specifications, and as directed by the engineer.

2. MATERIALS

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The component of the fiber optic communications system described by this specification shall consist of the following:

Fiber optic splice tray

3. CONSTRUCTION REQUIREMENTS

The contractor shall assemble and install all necessary material and equipment and furnish a working fiber optic splice tray in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

The contractor shall field verify final equipment locations with the engineer. Plans are diagrammatic and indicate the general arrangement of devices and work included in these documents. Final placement and arrangement are the responsibility of the contractor.

Upon request by the Department, the contractor shall arrange for the manufacturer to grant access to the manufacturing facility for all products specified herein.

3.1 SPLICE TRAYS

Splice trays shall be provided by the same manufacturer as the splice closure for new splice closure installations. When identified in the plans that new splice trays are required for an existing splice closure, the contractor shall provide splice trays that shall work within the existing splice closure using the same methodology, connections, firmness, and supports as existing splice trays. New splice trays for existing splice closures shall be of same manufacturer of the splice closure when available.

Splice trays shall contain strain relief for the buffer tube and adequate area for bare fiber slack storage and management. Splice trays shall accommodate the use of single fiber heat shrink, mechanical, or ribbon heat shrink splices.

Spliced fibers shall not be subjected to a bend radius smaller than 30 mm (1.2 inches). Buffer tubes shall not be subjected to a bend radius smaller than 38 mm (1.5 inches).

4. MEASUREMENT

Fiber optic connection splice tray will be measured in units of each.

5. PAYMENT

Payment for fiber optic connection splice tray work will be made at the contract unit price per each. The price will be full compensation for furnishing and installing the splice tray and for all labor, materials, equipment, tools and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04360	Fiber Optic Connection Splice Tray,Furnish & Install	Each

N.S. FIBER OPTIC CONNECTION PATCH PANEL, OUTDOOR (05-17):

1. DESCRIPTION.

Fiber optic connection patch panel, outdoor, shall be manufactured and constructed in accordance with the plans, these specifications, and as directed by the engineer.

2. MATERIALS.

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation, a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The component of the patch panel described by this specification shall consist of the following:

Patch Panel

3. CONSTRUCTION REQUIREMENTS.

Shop drawings detailing the patch panel and appurtenances shall be submitted to the engineer for review and acceptance. The patch panel in conjunction with a drop cable serves as the attachment point from the communications device (i.e. ethernet switch, fiber transceiver, etc.) to the fiber optic trunk cable.

The patch panel shall be comprised of a closet connector housing and panel for terminating the fiber. The closet connector housing shall accept the fiber drop cable, allow for tie downs, fiber break outs, splicing, fanouts, cross connects, and patching panel for terminations for a minimum of 12 fibers per panel. The housing shall be wall or rack mountable. The housing shall be constructed of a black metal housing.

The panel shall be of the same manufacturer as the connector housing. The panel shall connect to the housing using two simple snap connectors. The panel shall be type SC, LC or ST based on the communications equipment to be connected. The panel shall be free from debris, dust, or any material that could interfere with the fiber connection. Each connection point on the panel shall be sealed using a dust cap.

Upon request by the Department, the contractor shall arrange for the manufacturer to grant the Department’s staff or its representative access to the manufacturing facility for all products specified herein.

4. MEASUREMENT.

Fiber optic connection patch panel will be measured per each and will include providing all labor, equipment, materials, and incidentals required for the furnishing and installation of a patch panel as detailed on the plans and as described in these specifications and includes the patch panel, installation, factory and manufacturing inspection, testing, storage, packaging, shipping, warranty, and all work, equipment, and appurtenances as required to effect the full operation and control of the fiber optic connection patch panel complete in place and ready for use.

5. PAYMENT.

Payment for fiber optic connection patch panel outdoor work will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-04425	Fiber Optic Connection Patch Panel,Outdoor, Furnish & Install	Each

N.S. SPLICE CLOSURE, OUTDOOR (05-17):

1. DESCRIPTION

This Item consists of furnishing and installing a splice closure, outdoor and all appurtenances required for the ITS in accordance with plan details, these specifications, and as directed by the engineer.

2. MATERIALS

All equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance. The contractor shall submit, prior to installation, fiber optic splicing and termination diagrams for the backbone and drops and a complete set of shop drawings of all the equipment and components listed below and included as part of the installation.

The component of the fiber optic communications system described by this specification shall consist of the following:

1. Fiber optic splice closure

3. CONSTRUCTION REQUIREMENTS

The contractor shall assemble and install all necessary material and equipment and furnish a working fiber optic splice closure in accordance with these plans and specifications and compatible with the requirements of the ITS. All items that are required to complete the installation and ensure an operational ITS shall be supplied by the contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the contractor are the responsibility of the contractor.

The contractor shall field verify final equipment locations with the engineer. Plans are diagrammatic and indicate the general arrangement of devices and work included in these documents. Final placement and arrangement are the responsibility of the contractor.

Upon request by the Department, the contractor shall arrange for the manufacturer to grant access to the manufacturing facility for all products specified herein.

3.1 SPLICE CLOSURE (OUTDOOR)

The splice closure housing shall be non-metallic. It shall be resistant to solvents, stress cracking, and creep. The housing materials shall also be compatible with chemicals and other materials to which they might be exposed in normal applications.

The optical fiber closure shall be capable of accepting any optical fiber cable used in interoffice, outside plant, and building entrance facilities.

The optical fiber closure shall be available in distinct sizes to accommodate a variety of cable entries as specified in the table below:

Cable Capacity	**Canister (Butt) Configuration**		**Branch (In-Line) Configuration**	
	Express Entries/ Max. Cable Diameter (mm)	**Drop Port Entries/ Max. Cable Diameter (mm)**	**Express Entries/ Max. Cable Diameter (mm)**	**Drop Port Entries/ Max. Cable Diameter (mm)**
Large	2/32	6/25	4/32	12/25
Medium	2/25	4/18	4/25	8/18
Small	2/20	3/15	4/20	6/15

The splice closure shall be re–enterable. The closure end cap shall be capable of accepting additional cables without removal of the sheath retention or strength member clamping hardware on previously installed cables or disturbing existing splices. The optical fiber splice closure shall provide a single clamping mechanism to prevent pistoning of the central member or strength members and to prevent cable sheath slip or pullout.

The splice closure shall have appropriate hardware and installation procedures to facilitate the bonding and grounding of metal components in the closure and the armored cable sheath. The cable bonding hardware shall be able to accommodate a copper conductor equal to or larger than a #6 AWG.

The closure shall accommodate splice trays suitable for single fiber, single fiber heat shrink, mechanical, or ribbon heat shrink splices.

The required splice closure (small) shall accommodate up to 72 single fiber splices or 144 ribbon fiber splices using 12-fiber ribbons. The medium sized closure shall accommodate up to 288 single fiber splices or 432 ribbon fiber splices. The large closure shall accommodate up to 480 single fiber splices or 864 ribbon fiber splices.

The installation of the splice closure shall not require specialized tools or equipment, other than those normally carried by installation crews.

A bond clamp shall remain firmly attached to the cable armor sheath while under a tensile load of 9-kg (20 lbf). Following removal of the load, there shall be no evidence of clamp loosening or damage to the cable sheath, armor, or clamp that would reduce its current carrying capacity as required by the AC fault test.

4. MEASUREMENT

Splice closure, outdoor will be measured in units of each.

5. PAYMENT

Payment for splice closure, outdoor work will be made at the contract unit price per each. The price will be full compensation for furnishing and installing the splice closure, outdoor and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-05025	Splice Closure, Outdoor, Furnish & Install	Each

N.S. COMMUNICATIONS SYSTEM INTEGRATION (01-18):

1. DESCRIPTION.

This Item provides for communication system integration. The contractor is required to assemble and install all necessary material and equipment and to furnish a complete and operational ITS in accordance with these plans, the 2016 Louisiana Standard Specifications for Roads and Bridges, these specifications, and as directed by the engineer. All items that are required to complete the installation shall be secured by the contractor.

2. MATERIALS.

The component of the Intelligent Transportation System described by this specification shall consist of the following:

Communications system integration

3. CONSTRUCTION REQUIREMENTS.

The contractor shall obtain the necessary technical and engineering assistance from the manufacturer of the individual field devices to ensure that all components of the ITS operate and function as specified and intended.

The integration of each of the field devices deployed as part of this ITS is one of the most critical aspects of this project. As part of this contract, the contractor shall attend a pre-construction meeting as well as developmental meetings throughout the course of this project. A review and acceptance meeting shall be held upon completion. Close coordination by the contractor with the Department, during the communications system integration phase is required. The contractor shall fully integrate the ITS field devices required by the plans and their associated specifications into a fully communicating system as called for in these plans and specifications and as directed by the engineer.

The contractor shall obtain the necessary technical and engineering assistance from the manufacturer of the individual field devices and communications equipment to ensure that all components of the system are configured at the field equipment sites, at the communications aggregation site, and at the TMC to provide a fully operational and functional ITS as specified in the plans and intended. Integrator and installer shall be currently CCIE certified in routing and switching and proof shall be provided of this certification prior to installation and system integration.

All IP addresses for communications equipment shall be requested from the DOTD ITS Section. At a minimum, the contractor shall provide the following as part of communications system integration:

1. Establish fully functional and tested wireless Ethernet links between locations identified in the plans.
2. Establish a fully functional fiber optic cable network tested and ready for use as identified in the plans.

3.1 Wide Area Ethernet Network

Contractor shall submit to the engineer for review and acceptance a communications integration plan that details the configuration, settings, and all appropriate information required to explain and depict the new system arrangement. A meeting shall be scheduled by the Contractor with all involved parties for the purpose of discussing the communications integration plan and for overall coordination.

Without exception, the existing optical switch configuration shall not be modified without prior consent from the engineer. Advanced warning of 28 days minimum shall be submitted to the engineer for review and acceptance prior to the commencement of any system integration and a meeting with all involved parties shall be held for coordination purposes.

The contractor shall coordinate directly with the ITS Maintenance and Communications Engineer, or his designee for network configuration.

The communication field local loops shall be an Ethernet based network transported at Gigabit Ethernet. The encoded video streams and all data derived from each field local loop shall be integrated into this Ethernet network.

4. MEASUREMENT.

Communications system integration will be measured per lump sum for the furnishing and installing an integrated communications system as detailed in the plans and as described in the specifications. Included in this item is the establishment of a complete and operational ITS as described and all work, equipment, and appurtenances as required to effect the full operation and control of communications system integration complete in place and ready for use.

5. PAYMENT.

Payment for communications system integration work will be made at the contract lump sum price, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
NS-ITS-12000	Communications System Integration	Lump Sum

N.S. DOCUMENTATION (05-17):

1. DESCRIPTION.

Documentation shall be supplied for all equipment and components of the ITS in accordance with these plans, these specifications, and as directed by the engineer. The manuals supplied for hardware, peripherals, and modems shall be from the original source. The manuals shall be comprehensive, easy to use and understand, and completely descriptive of the product.

2. MATERIALS.

The component of the documentation required for the intelligent transportation system described by this specification shall consist of the following:

A manual containing a general description and detailed operating and installation instructions shall be provided for each different type or model of equipment. This manual shall also contain instructions for possible modification to the equipment within the capability of the equipment. Ten (10) copies of the manual shall be provided for each model of equipment.

Manuals for the following shall be provided in hard copy format and on Department accepted electronic media:

1. Programming
2. Integration of the systems
3. Interfaces
4. Operations manual

Manuals for all equipment shall contain the following:

1. Technical descriptions
2. Operating instructions
3. Theory of operation
4. Detailed schematic diagrams
5. Assembly drawings
6. Wiring diagrams
7. Troubleshooting procedures to assist the maintenance staff in the identification and isolation of malfunctions
8. Parts list

3. CONSTRUCTION REQUIREMENTS.

The contractor shall be required to provide all necessary manuals, drawings, diagrams and other documentation as detailed in this specification.

1. Training Documents

Formal classroom training and "hands-on" operations training shall be provided for personnel designated by the Department. A minimum of sixteen (16) hours each for both operational training and maintenance training shall be provided. Training shall be provided on software operations, all other ITS components, and overall functionality of the ITS. The contractor shall submit a training syllabus and schedule for review and acceptance by the project engineer.

Site – The Department will provide adequate on-site or near site facilities for the specified training. The contractor shall advise if any special provisioning is necessary for the facility, and the Department will attempt to provide it (i.e., visual and audio equipment).

Documentation - The contractor shall deliver two sets of training documents for each trainee. Preliminary training manual shall be provided to the Department for review and comment. Any revisions required will be noted and shall be implemented by the contractor.

Training Description - The contractor shall submit a description of the proposed training program prior to the beginning of training. The description shall include:

1. Length of training period for each type of trainee.
2. At what point in the schedule said training will take place.
3. Facility needs and aids required from the Department.
4. Qualification of personnel to be trained.

Documentation shall be provided by the contractor. Any documentation used for both training needs and future ITS operating and maintenance needs shall be supplied in accordance with quantities specified in each of the training and documentation sections.

Documentation Ownership - All training materials shall become the property of the Department.

Training shall be completed prior to the start of the Demonstration Period.

2. <u>Operational Training</u>

The Department requires the contractor to train twelve operators to operate and manage the ITS. This training will be coordinated with and accomplished with others providing training on use of the ITS control software and hardware. These operators shall be trained for two different levels of operation.

A. Trainer Level:
   An unspecified number of Department employees (operators) shall be trained by the contractor such that they can train other operators to manage and operate the ITS. These same operators shall also be exposed to the detailed software and hardware characteristics of the ITS operations.

B. Operator Level:

An unspecified number of Department employees other than those above shall be trained by the contractor such that they will be able to manage and operate the ITS. As operators, these personnel shall be able to carry out all modes of operation that normally originate from the central control center. Future operators that fit this category of personnel shall be trainable by the trainer described above.

Training for the operation of the ITS shall include a detailed explanation and hands on training of the workings of all components of the new ITS.

C. Maintenance Training

The Department requires the contractor to train at least ten (10) Maintenance Personnel to maintain the ITS. These personnel shall be trained for sustaining operation of all ITS equipment by providing preventive, required emergency maintenance and repairs. As part of the maintenance-training program, the contractor shall include:

1. Operational training.
2. Instruction in ITS hardware and software debugging and troubleshooting.
3. Instruction on all monthly and preventative maintenance and warranty requirements.
4. Instruction on repair of all serviceable equipment.
5. Instruction on tools, test equipment and testing procedures.
6. Instruction on documentation required to maintain warranties.

Training for maintenance personnel shall include detailed field level troubleshooting and bench repair of all customer serviceable equipment.

D. Operator's Manuals

A manual containing a general description and detailed operating and installation instructions shall be provided for each different type or model of equipment. This manual shall also contain instructions for possible modification to the equipment within the capability of the equipment. Ten (10) copies of the manual shall be provided for each model of equipment.

Manuals for the following shall be provided in hard copy format and on Department accepted electronic media:

1. Programming.
2. Integration of the systems.
3. Interfaces.
4. Operations manual.
5. Manuals for all equipment shall contain the following:
6. Technical descriptions.

7. Operating instructions.
8. Theory of operation.
9. Detailed schematic diagrams.
10. Assembly drawings.
11. Wiring diagrams.
12. Troubleshooting procedures to assist the maintenance staff in the identification and isolation of malfunctions.
13. Parts list.

E. Maintenance Procedures Manuals

A manual containing detailed preventive and corrective maintenance procedures shall be provided for each different type or model of equipment. Systematic field and bench troubleshooting procedures shall be included, as shall normative waveforms and test voltages as applicable. A detailed parts list shall be included. For each part, its circuit or pictorial identifications shall be shown, as shall all necessary rating information and a manufacturer and associated model or part number. The list shall also include cross-references to parts numbers of other manufacturers who make the same replacement part. Ten (10) manuals shall be provided for each model of equipment.

F. Equipment Assembly Drawings

A pictorial drawing showing the physical location and identification of each component shall be provided for each different electronic assembly and each different subassembly of each assembly. These drawings shall be included in the maintenance procedure manuals.

G. Cabinet and Rack Wiring Diagrams

A wiring diagram shall be provided for each different cabinet, equipment rack, junction box containing wire terminals, and twisted wire pair cable termination box identified by location. If the diagrams are in manual form, ten (10) manuals shall be provided for each distinct cabinet and equipment rack. Drawings shall be in the form of mylars, with two such mylars provided for each distinct type of cabinet, rack, junction box, and twisted wire pair cable termination box. If the same diagram serves more than one location, it shall be labeled with all appropriate locations. If a set of drawings is provided, each serving more than one location, a separate mylar shall be included that shows a cross index by location and drawing.

H. Electrical Schematic, Wiring, and Logic Diagrams

An electrical schematic, wiring diagram and a logic diagram shall be provided for each different type or model of equipment supplied by the contractor. A stage-by-stage explanation of the circuit theory shall be provided with the circuit wiring diagrams. If the diagrams are in manual form, ten (10) manuals shall be provided for each distinct model of equipment. Drawings shall be in the form of mylars, with two such mylars provided for each distinct model of equipment. If the same diagram serves more than one location, it shall be labeled with all appropriate locations. If a set of similar drawings is provided, each showing more than one location, a separate mylar shall be included that shows a cross-index by location and drawing.

Schematic wiring diagrams of all electrical components and electronic circuit board schematic diagrams of all electronic components shall also be provided to the Department.

I. ITS Connection Diagrams

Connection diagrams for the entire ITS, including block diagrams, terminal numbers, and conductor and fiber color codes for the work performed by the contractor, shall be cross referenced to correlate with existing wiring diagrams and shall be addenda thereto. Two mylars of each drawing shall be furnished.

J. Wiring Diagrams

Each ITS field equipment site shall be furnished with a complete set of reproducible wiring diagrams. An instruction card laminated in plastic shall be included in each ITS cabinet.

K. As-Builts

As-built plan sheets shall be accepted by the engineer. The as-built plans shall include the fully inclusive plan set as provided by DOTD with markups clearly identifying the “as installed” condition. As-builts shall be submitted in full size (36 inch x 22 inch) on bond and in electronic format, scanned to PDF or accepted equal. Color scans may be required if reproductions from the electronic file are illegible. In addition to the plan layouts, As-builts shall also include the following:

1. Communication equipment configuration settings/diagrams
2. Network diagrams
3. Fiber allocation diagrams
4. Specifications catalog
5. Final accepted ITS field equipment shop drawings

The specifications catalog shall use 3-ring binders with all the manufacturer specifications and/or shop drawings for the specific make/model of the ITS field equipment site components, ITS System Components, vendor software, communications plant, power components, and general electrical components installed and/or integrated with as part of this project. Sheet sizes are limited to 8.5 inch x 11 inch or 11 inch x 17 inch (tri-folded with title block to the top). The specifications catalog shall refer back to the As-Built Plans for each applicable location of installation.

The contractor shall prepare an electronic file, whether Microsoft Excel 2002 or later spreadsheet, ESRI ArcView GIS shape file or accepted equal, containing all ITS field equipment poles, cabinets, power sources, and pullbox location latitude and longitude coordinates in NAD 83. Required latitude and longitude coordinates shall be obtained closest to center of the element as possible with handheld device accuracy (within 10 feet of actual). The electronic file shall be provided with the as-built plans.

4. MEASUREMENT

Training, training documents, and operating document will be measured per lump sum and will include conducting training courses and providing manuals as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

Wiring diagrams will be measured per lump sum and will include providing all wiring diagrams as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

Equipment assembly drawings will be measured per lump sum and will include providing all equipment assembly drawings as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

Cabinet and rack wiring diagrams will be measured per lump sum and will include providing all cabinet and rack wiring diagrams as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

Electrical schematic, wiring, and logic diagrams will be measured per lump sum and will include providing all electrical schematic, wiring, and logical diagrams as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

ITS connection diagrams will be measured per lump sum and will include providing all ITS connection diagrams as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

As-Builts will be measured per lump sum and will include providing all as-built plans and supporting documentation as described in the specifications. Included in this item is the documentation in hard copy(ies) and electronic format.

6. PAYMENT

Payment for documentation shall be made at the contract lump sum price.

Payment shall be made under:

Item No.	Pay Item	PayUnit
NS-ITS-13000	Training Documents	Lump Sum
NS-ITS-13020	Operational Training	Lump Sum
NS-ITS-13040	Maintenance Training	Lump Sum
NS-ITS-13060	Operator's Manuals	Lump Sum
NS-ITS-13080	Maintenance Procedures Manual	Lump Sum
NS-ITS-13100	Wiring Diagrams	Lump Sum
NS-ITS-13120	Equipment Assembly Drawings	Lump Sum
NS-ITS-13140	Cabinet & Rack Wiring Diagrams	Lump Sum
NS-ITS-13160	Electrical Schematic,Wiring, & Logic Diagrams	Lump Sum
NS-ITS-13180	ITS Connection Diagrams	Lump Sum
NS-ITS-13200	As-Builts	Lump Sum

TS-Items:

These items are described in the Technical Special Provisions as included elsewhere in the construction proposal and in the plans.

Payment will be at the contract unit price under the following:

TS-203-00006 Exploratory Excavation for Traffic Signal Foundation

TS-702-00126 48" Sanitary Sewer Manhole
TS-736-10300 Signal Support (Mast Arm Standard w/ 30 ft arm)
TS-736-10450 Signal Support (Mast Arm Standard w/ 45 ft arm)
TS-736-10500 Signal Support (Mast Arm Standard w/ 50 ft arm)
TS-736-10550 Signal Support (Mast Arm Standard w/ 55 ft arm)
TS-736-10600 Signal Support (Mast Arm Standard w/ 60 ft arm)
TS-736-10700 Signal Support (Mast Arm Standard w/ 70 ft arm)
TS-736-11250 Additional Mast Arm (25 ft. arm)
TS-736-11350 Additional Mast Arm (35 ft. arm)
TS-736-11450 Additional Mast Arm (45 ft. arm)
TS-736-12008 Luminaire Arm w/LED Luminaire (8 ft. arm)
TS-736-15002 GPS Based Traffic Signal Preemption System (With Existing Fiber Communication)
TS-736-36200 Video Detection System (6 Camera System)
TS-736-36200 Video Detection System (7 Camera System)
TS-742-60010 Fittings
TS-742-60011 Air Release/Vacuum Valve (2")
TS-742-60012 Unrestrained Joint Sewer Force Main (16")
TS-742-60013 Restrained Joint Sewer Force Main (16")
TS-742-60014 24" Jacked and Bored Casing Pipe Including Carrier Pipe
TS-742-60024 Force Main Tie-in (16")
TS-742-61006 Sanitary Sewer Pipe (12") (PVC)
TS-742-80109 Sand-Aggregate for Secondary Backfill

S.P. CONTRACT TIME (11/16):

The entire contract shall be completed in all details and ready for final acceptance in accordance with 105.17.2 within **five hundred (500) calendar** days.

Prior to assessment of contract time, the contractor will be allowed 30 calendar days from the date stipulated in the Notice to Proceed to commence with portions of the contract work including but not limited to assembly periods, preparatory work for materials fabrications such as test piles, or other activities which hinder progress in the beginning stages of construction. Prior to issuance of the Notice to Proceed, the Department will consider extending the assembly period upon written request from the contractor justifying the need for additional time.

The contractor shall be responsible for maintenance of traffic from the beginning of the assembly period. During the assembly period, the contractor will be allowed to do patching and other maintenance work necessary to maintain the roadway with no time charges when approved by the engineer.

If the contractor begins regular construction operations prior to expiration of the assembly period, the assessment of contract time will commence at the time construction operations are begun.

EFFECTIVE DATE: (08/22)

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS

(FOR 2016 STANDARD SPECIFICATIONS)

TABLE OF CONTENTS

PART I – GENERAL PROVISIONS

PART II – EARTHWORK AND SITE PREPARATION

PART III – BASE COURSES

PART IV – SURFACE COURSES

PART V – ASPHALT PAVEMENTS

PART VI – RIGID PAVEMENT

PART VII – INCIDENTAL CONSTRUCTION

PART VIII – STRUCTURES

PART IX – PORTLAND CEMENT CONCRETE

PART X – MATERIALS

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS

The 2016 Louisiana Standard Specifications for Roads and Bridges and supplemental specifications thereto are amended as follows.

PART I – GENERAL PROVISIONS

SECTION 101 – GENERAL INFORMATION, DEFINITIONS, AND TERMS:

Subsection 101.01 – Voice/Mood and References (03/20), Page 2

101.01 is deleted and replaced with the following:

101.01 VOICE/MOOD AND REFERENCES.

101.01.1 Active Voice/Imperative Mood: This specification book uses the active voice/imperative mood when describing the contractor's responsibility, or the bidder's responsibility prior to award of contract. The subject of a sentence written in the active voice/imperative mood is not explicitly stated. For example: "Provide competent supervision" is taken to mean "the Contractor is required to provide competent supervision."

101.01.2 References: Section and Subsection titles and headings provide reference only, not interpretation.

A cross-reference to a specific Subsection of these specifications includes all general requirements of the Section of which the Subsection is a part.

Unless specified by year or date, cited publications refer to the most recent issue, including interim publications, in effect on the first date of advertisement for bids.

SECTION 105 – CONTROL OF WORK:

Subsection 105.02.1 – Plans (07/19), Page 41

The first paragraph of 105.02.1 is deleted and replaced with the following:

The contractor will be furnished, without charge, a maximum of 5 sets of half-scale plans, and when requested, a maximum of 3 full-scale plans. When plans include standard plans by reference only, copies of standard plans will be furnished, by request, with the same maximums described above without charge.

SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC:

Subsection 107.19 – Contractor's Responsibility for Work (03/18), Page 85

The first sentence of the second paragraph of 107.19 is deleted and replaced with the following:

1. Guard rail, impact attenuators, cable barriers, and other such devices shall be repaired as soon as possible after damage.

PART II – EARTHWORK AND SITE PREPARATION

SECTION 202 – REMOVING OR RELOCATING STRUCTURES AND OBSTRUCTIONS:

Subsection 202.02 – General Construction Requirements (06/19), Pages 116 and 117

202.02 is deleted and replaced with the following:

202.02 GENERAL CONSTRUCTION REQUIREMENTS. Remove and dispose of all portions of structures or obstructions on the right-of-way, except items for which other provisions have been made for removal or relocation. When specified, remove structures and appurtenances that extend beyond the right-of-way or that are entirely on private property. Materials deemed salvageable by the engineer shall be carefully disassembled and care shall be taken to preserve the condition of the salvaged materials before and during transportation to the designated facility. Upon delivery to the designated facility, they shall be unloaded and neatly arranged at specified storage areas as directed by the engineer. When no storage sites are specified, deliver salvaged materials to the nearest DOTD maintenance unit. Dispose of materials not specified to be salvaged off the project right-of-way outside the view of the traveling public with written permission of the property owner on whose property the material is placed. DOTD reserves the right to refuse material prior to delivery for any reason or if not in usable condition upon delivery. Any material refused shall then be deemed unsalvageable and disposed of accordingly. Furnish copies of agreements (including rights of entry, etc.) with property owners to the engineer prior to beginning of work. The agreement must contain language holding the department harmless regarding any liabilities of the contractor or property owners. A certificate of release from the property owner will be required before final acceptance. Fill holes left by structure removal or the removal of materials associated with contaminated soils or sites by blading the area with surrounding soil or backfilling with soil complying with 203.06.1. Compact to a condition similar to the surrounding soils or as directed.

If any fuel storage tanks or other environmentally sensitive or contaminated sites are located during construction, stop construction activity in the immediate vicinity of the environmentally sensitive or contaminated site and notify the project engineer who in turn will notify the Department's Materials and Testing Section immediately for guidance. Testing and clean-up by the contractor shall be coordinated with the Materials and Testing Section.

The Department reserves the right to eliminate work items in accordance with 104.02.4.

SECTION 203 – EXCAVATION AND EMBANKMENT:

Subsection 203.06.7 – Soils for Soil Cement In-Place Cement Stabilization or Treatment (04/18), Page 132

203.06 is amended to include the following:

203.06.7 Soils for Soil Cement In-Place Cement Stabilization or Treatment: Soils to be used for in-place cement stabilization or treatment shall be in accordance with Subsection 302.02.1

PART III – BASE COURSES

SECTION 301 – CLASS I BASE COURSE:

Subsection 301.01 – Description (08/22), Pages 152 and 153

301.01 is deleted and replaced with the following:

301.01 DESCRIPTION. Furnish and place Class I base courses on a subgrade layer conforming to Section 305 in accordance with these specifications and in conformance with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the engineer. Control the selection, placement, mixing, and compaction of materials so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankments and Base Course.*

Unless approved otherwise in writing, use the same type of Class I base course throughout the project in accordance with these specifications.

When asphalt concrete or portland cement concrete is specified on the plans, the total thickness of asphalt concrete or portland cement concrete shall be the thickness as indicated on the plans.

When the base course material is not specified on the plans, any of the following types may be used:

1. Soil Cement
2. Crushed Stone
3. Asphalt Concrete on Embankment Layer
4. Recycled Portland Cement Concrete
5. Blended Calcium Sulfate

For Asphalt Concrete on Embankment Layer, the top half of the base course thickness shall be asphalt concrete. The remaining thickness of the base shall be the same type and construction as the top layer of the underlying embankment, treated layer, or subgrade, or in accordance with Section 203 for placement on existing ground. Do not place raw, untreated material between a treated embankment and the asphalt concrete layer.

In areas that are inaccessible for mixing and compacting, such as in turnouts, crossovers, and other isolated or irregular areas, full depth portland cement concrete or full depth asphalt concrete base course may be used in lieu of the specified Class I base course material with approval.

When portland cement concrete is used, unless otherwise specified or approved by the engineer, the minimum thickness shall be 6 inches.

Portland cement concrete shall be in accordance with Section 706 except as follows. Portland cement concrete thickness tolerances shall be in accordance with Section 601 and corrected in accordance with 301.16.2.2. Portland cement concrete width corrections shall be in accordance with 301.16.3.2. Any pay adjustment in portland cement concrete shall be in accordance with Table 901-5.

A bond breaker is required between portland cement concrete base and portland cement concrete pavement. A bond breaker shall consist of a double application of curing compound or 2 layers of polyethylene sheeting. A 3 inch scored joint will be made to control cracking in the concrete base. The scored joints should be placed at the required surface joint locations. No load transfers will be required in the base slab.

Drainage of all existing and constructed pavement structures shall be maintained at all times during construction at no additional cost to the Department. When base course is permeable, provide a base drain outlet consisting of non-plastic embankment (stone) and geotextile fabric, or as specified in the plans, in accordance with 203.09.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust-sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements. In order to meet air quality standards, the contractor may be required to use central plant mixing of cement treated mixtures in dust sensitive areas at no direct pay. The contractor may use other types of Class I base course in dust sensitive areas at no direct pay.

Subsection 301.02.4 – Asphalt Concrete Base Course (08/22), Pages 153 and 154

301.02.4 is deleted.

Subsection 301.03.4 – Automatic Finishing Machine (08/22), Page 156

The last sentence of 301.03.4 is deleted and replaced with the following:

The approved automatic finishing machine shall be capable of operating from an erected stringline or Global Positioning System (GPS) and laser system, and be capable of automatically controlling grade and cross slope conforming to 502.09.2.3.

Subsection 301.09 – Grade and Cross-Slope Control (08/22), Page 160

301.09 is deleted and replaced with the following:

301.09 GRADE AND CROSS-SLOPE CONTROL. Unless otherwise specified, construct Class I Base Courses (except asphalt concrete) to the required grade and cross slope, using an automatic finishing machine controlled from an erected stringline or GPS and laser system conforming to 502.09.2.3.

Subsection 301.17 – Measurement (08/22), Pages 167 and 168

301.17 is deleted and replaced with the following:

301.17 MEASUREMENT. The quantities of Class I base course for payment will be the design volumes or areas specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions and theoretical compacted thickness of the completed base course shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, plan errors are proven, or design changes are necessary.

Base drain outlets will be measured for payment per each.

Subsection 301.18 – Payment (08/22), Page 168

301.18 is deleted and replaced with the following:

301.18.PAYMENT. Payment for Class I base course will be made at the contract unit price, adjusted as specified in 301.16 and the following provisions, which include furnishing and placing required base course materials, portland cement, portland-pozzolan cement, water, grade control, asphalt curing membrane, and prime coat.

When the density test value for the section falls below 95.0 percent, a payment adjustment will be applied in accordance with Table 301-1.

Failure to add the specified amount of cement in soil cement will result in a payment adjustment in accordance with Table 301-3 below. For materials other than asphalt concrete, payment adjustments that are made for more than one deficiency shall be cumulative. Any payment adjustment in asphalt concrete shall be in accordance with Section 502 and shall apply to the cubic yard total quantity of base course.

Table 301-3
Payment Adjustment Schedule

	Percent of Contract Unit Price			
	100	90	80	50 or Remove and Replace [1]
Cement content (Percent by dry weight) less than required	0.0 – 0.1	0.2 – 0.4	0.5 – 1.0	more than 1.0

[1.] At the option of the Chief Engineer.

Payment for base drain outlet will be made under the contract unit price per each and include excavation, furnishing and placing non-plastic embankment (stone) material, geotextile fabric, and all incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
301-01	Class I Base Course	Cubic Yard
301-02	Class I Base Course ____in Thick	Square Yard
301-03	Class I Base Course for Shoulders	Cubic Yard
301-04	Class I Base Course for Shoulders _____in Thick	Square Yard
301-05	Base Drain Outlet	Each

SECTION 303 – IN-PLACE CEMENT STABILIZED AND TREATED BASE COURSES:

Subsection 303.04 – Preparation of Roadbed (04/20), Page 185

303.04 is amended to include the following sentence between the second and third paragraph:

If only shoulder stabilization has been performed, the paving operation shall commence within 7 calendar days of stabilization.

PART IV – SURFACE COURSES

SECTION 401 – AGGREGATE SURFACE COURSE:

Subsection 401.07.1 – General (12/17), Page 217

401.07.1 is deleted and replaced with the following:

401.07.1 General: Place material and shape by suitable means. Compact with an approved roller. Continue to shape and compact until the surface conforms to the required sections and has a tight, uniform surface free from ruts and waves.

PART V – ASPHALT PAVEMENTS

PART V – ASPHALT PAVEMENTS:

Part V – Asphalt Pavements (11/21), Pages 224 – 305

Part V – Asphalt Pavements is deleted and replaced with the following:

Section 501
Thin Asphalt Concrete Applications

501.01 DESCRIPTION.

501.01.1 General: Furnish and construct a finish course of asphalt concrete mixture in conformance with these specifications and in conformance with the lines, grades, thicknesses, and typical sections shown on the plans or established. A finish course is defined as a 501 thin lift mix placed over a 502 asphaltic concrete pavement or a Portland cement concrete pavement.

Comply with Section 503 and the Application of Quality Assurance Specifications for Asphalt Concrete Mixtures (QA Manual).

Use a DOTD certified laboratory accredited by AMRL, CMEC, or other accreditation agency approved by DOTD.

These specifications apply to all asphalt concrete thin lift mixtures with typical plan thicknesses between ¾ inches and 1½ inches. The following mixtures are further described herein and as shown on the plans:

1. Dense Mix – traffic volumes less than 3,500 ADT.
2. Coarse Mix – all traffic volumes. Can be substituted in place of Dense Mix without change order.
3. Open Graded Friction Course (OGFC) – all traffic volumes, typically specified for use on Interstate Highway System. Can be substituted in place of Coarse Mix or Dense Mix applications without change order.

Use the same mixture type throughout the project length unless approved otherwise by the Project Engineer.

501.01.2 Quality Assurance: Work shall meet the requirements of this section and be subject to acceptance by the Department. Exercise quality control as defined in 101.03. When these specifications are not being met and satisfactory control adjustments are not being made, discontinue operations and notify the Project Engineer immediately until proper adjustments and uniform operations are established. The contractor will have a quality control program independent of the Department's testing and ensure that the requirements of the job mix formula (JMF) are being achieved and that necessary adjustments provide the specified results.

Do not begin daily plant operations unless the contractors' Certified Asphalt Concrete Plant Technician (Level 2 or Level 3) is at the plant. When the plant is in operation, have a Certified Asphalt Concrete Plant Technician at the plant or jobsite.

501.02 MATERIALS. Comply with applicable subsections listed herein. Sample and test in accordance with the Material Sampling Manual and the test procedures described in Table 502-1.

Keep accurate records including proof of deliveries of materials for use in these processes. Ensure that materials comply with the following Sections and Subsections and as specified in this section:

Asphalt Cement	1002
Anti-Strip Additives	1002.02.1
Aggregates	1003.01 & 1003.06
Hydrated Lime	1018.02
Crumb Rubber	1002.02.2
Mix Release Agent	1018.10
Mineral Filler	1003.06.6
Fibers	1002.02.5
Reclaimed Asphalt Pavement (RAP)	1003.01 & 1003.06.5

501.02.1 Tack Coat: Ensure that tack coat meets the requirements of Section 1002. Apply tack coat as described in 501.09.1. Application rates are defined in Table 501-1. Use emulsions listed in the Approved Materials List.

For dense mixtures, apply a NTSS-1HM, CBC-1HT, SS-1H, CSS-1H, CSS-1HP, or a hot applied non-tracking tack (NTHAP).

For coarse and OGFC mixtures, apply a Polymer Emulsion Tack (PET) or hot applied non-tracking tack (NTHAP).

501.02.2 Asphalt Cement: Comply with Table 501-1. If the asphalt cement does not comply with the requirements of Section 1002 notify the Project Engineer and cease mix production until proper asphalt material is supplied. Allow grade substitution as specified for Level 1 wearing course in Section 502. PG76-22rm may also be substituted for PG76-22m.

501.02.3 Additives:

501.02.3.1 Anti-Strip: Use anti-stripping additives from a source listed on the Approved Materials List. Add anti-strip at a minimum rate of 0.6 percent or a rate approved by the District Lab Engineer. Increase the anti-strip additive or change to different additive as needed to meet Loaded Wheel Test (LWT) requirements. Discontinue production until satisfactory adjustments are made when the amount of anti-strip additive is not in accordance with the approved JMF.

501.02.3.2 Hydrated Lime: When used, specify rate of hydrated lime additive on the Job Mix Formula. Add hydrated lime additive at a minimum of 1.5 percent and thoroughly mix with aggregates in conformance with 503.05.5. Hydrated lime may be added as mineral filler in accordance with 503.05.4 and 1003.06.6.

501.02.3.3 Waste Tire Rubber Additive: When used, crumb rubber may be pre-blended or, with approval by the Materials Laboratory, may be blended at the plant. The maximum rubber replacement is 10 percent by weight of asphalt.

When blending crumb rubber at the contractor's plant, add crumb rubber to a PG 67-22 material on the Approved Materials List. Add 30 mesh (or finer) crumb rubber as required to meet grade PG 76-22rm. Comply with 1002.02.2.

501.02.4 Aggregates: Use aggregate from Approved Material List. For Coarse Mix and OGFC, use aggregate with a maximum water absorption of 2 percent as reported on the Approved Material List and verified by the District Lab Engineer. Use aggregate that meets requirements of 1003.06. Submit a Certificate of Analysis with the JMF to the District Laboratory Engineer indicating conformance to Table 501-2.

501.02.5 Mineral Filler: If used, meet the requirements of 1003.06.6.

501.02.6 Fibers: When required to prevent draindown, use cellulose or mineral fiber, meeting the requirements of 1002.02.5. When used, add fibers at a rate sufficient to prevent draindown with a minimum rate of 0.1 percent by weight (mass) of mixture.

501.02.7 Reclaimed Asphalt Pavement (RAP): Keep reclaimed asphalt pavement separate from other materials at the plant in such a manner that will allow for Department inspection and acceptance. Keep stockpiles uniform and free of soil, debris, foreign matter and other contaminants. Allowable RAP percentages are defined in Table 501-1. Screen or crush RAP, prior to use, to pass a 1-inch sieve.

501.02.8 Natural Sand: When used, meet the requirements of Table 501-1 and 1003.06.3.

501.03 DESIGN OF THIN ASPHALT CONCRETE MIXTURES AND JOB MIX FORMULA (JMF) APPROVAL. Submit an aggregate gradation that conforms to Table 501-1 along with the Certificates of Analysis required in 501.02.4. Aggregate friction rating for coarse mix and OGFC will be in accordance with Table 502-3.

Design dense and coarse mixtures to midpoint of voids using the gyratory requirements of Table 501-1. For design of OGFC mixtures, the full range of void requirements is allowed. Report the corresponding asphalt content on the JMF. Design and report mix temperatures between 300^0F and 350^0F on the JMF. At minimum, all design submittals will include the recommended materials proportions, extracted gradation, recommended mix and compaction temperatures, and supporting design data. Submit the recommended JMF electronically through a Department approved data system as designated by the Department for District Laboratory Engineer acceptance. No mixture will be produced until the proposed JMF has been accepted. Prior to JMF approval, present a Certificate of Analysis showing aggregate physical properties conforming to Table 501-2.

Once a plant is producing an acceptable JMF, keep JMF production within the specified tolerances. Changes will be reviewed and accepted by the District Laboratory Engineer as necessary. A change in the asphalt cement source will require testing for Moisture Susceptibility using Loaded Wheel Test (LWT) in accordance DOTD TR 332. An acceptable mix design may not be changed to eliminate or add the use of crumb rubber without submitting a new JMF.

The Project Engineer may require a new mix design when acceptance requirements are not being met or plant quality data indicates non-compliance.

501.04 LOT SIZES. A lot is a segment of continuous production of asphalt concrete mixture from the same JMF produced for the Department at a specific plant, delivered to a specific DOTD project. A lot is defined as 2400 tons of mixture production, a sublot is 800 tons. The final sublot may be increased up to 50 percent of the last sublot with the mutual agreement of the contractor and Project Engineer.

501.05 JOB MIX FORMULA (JMF) VALIDATION AND APPROVAL. The Department and contractor will jointly test plant mix to validate each JMF and accept each JMF whenever a plant begins initial operations for the Department in a specific plant location, or whenever a plant experiences a change in materials or change in source of materials (other than asphalt cement), or when there are significant changes in equipment, such as the introduction of a new crusher, drum mixer, burner, etc. All JMF's shall be re-validated a minimum of every 2 years. Re-validation may consist of reviewing ongoing production data.

Validate the JMF on the first 1200 tons (3-400 ton sublots) of production for a project by meeting the requirements of Table 501-1. With mutual agreement of the contractor and the Department, a fourth sample may be taken during validation. This sample may be used in place of the first validation plant sample for purposes of determining lot averages and establishing JMF targets.

During the validation process or when a new asphalt cement source is used, the Asphalt District Inspector (ADI) will collect a sample of loose mixture and a sample of asphalt cement to send to the central laboratory for GPC testing.

The District Laboratory and Contractor shall jointly test three sublots for theoretical maximum specific gravity (G_{mm}), percent air voids, percent asphalt cement content, and extracted aggregate gradation. The JMF is considered conditionally validated if the following parameter individual test results meet the design specification limits.

1. Theoretical Maximum Specific Gravity (G_{mm}),
2. Percent Air Voids at N_{design},
3. Percent Asphalt Content by Ignition,
4. Extracted Gradation,
5. Percent Draindown (if required)

The production can continue during conditional validation. The JMF is considered validated with passing LWT results. If any failure occurs, adjust mix and revalidate. If second failure occurs, redesign the mix.

Upon validation of the JMF, the average of results for the validation lot will become the JMF target values to be used with production tolerances in Table 501-3.

501.06 PLANT QUALITY CONTROL. Exercise quality control over all materials and their assembly, design, processing, production, hauling, laydown and associated equipment to ensure compliance with Table 501-3 and all other specifications herein. At the end of each production day, notify the District Lab Engineer (DLE) and the DOTD Asphalt District Inspector (ADI) of the next scheduled mix production run and placement. Keep accurate records, including proof of deliveries of all materials used in this process.

For plant quality control, a lot is defined as 2400 tons of continuously produced mixture from one JMF. Obtain a sample of plant mixture and test the mixture once every sublot using a random sampling approach. Minimum quality control testing for each sublot is as follows:

<u>Loose Mix</u>

1. Theoretical Maximum Specific Gravity, G_{mm}
2. % Asphalt Cement Content
3. Extracted Gradation
4. % Crushed
5. Dust to Asphalt Ratio
6. Temperature
7. Draindown (1/lot when required)

<u>Compacted Specimen, N_{design}</u>

1. % Air Voids, V_a

Age all loose mix tested for Gmm or volumetrics for one hour in accordance with AASHTO R30 prior to testing.

For each lot, report all quality control data to the Department's Certified Plant Inspector. Increased quality control sampling or control charts may be requested by the Project Engineer if mixture problems develop.

501.07 PLANT ACCEPTANCE. The Department will perform all plant acceptance and verification testing to meet the Materials Sampling Manual requirements. All Department inspection procedures, including sampling and testing, form the basis for acceptance of asphaltic concrete. Sampling and testing shall be accomplished following a stratified sampling plan in accordance with the Materials Sampling Manual and specified test procedures.

The Department will take samples or perform tests as outlined in these specifications, to ensure that the asphaltic concrete conforms to Department standards, which include job mix limits, material properties, and surface deviations. For plant acceptance, a sublot is defined as 800 tons and a lot is defined as 2400 tons of continuously produced mixture from one JMF. Obtain a sample of plant mixture and test the mixture once every sublot using a random sampling approach. Minimum plant acceptance testing for each sublot is as follows:

Loose Mix

1. Theoretical Maximum Specific Gravity, G_{mm}
2. Extracted Gradation
3. Temperature
4. Draindown (1/lot when required)

Sample and test the mixture for Moisture Susceptibility using LWT every 10,000 tons.

Take corrective action or cease production if the lot average for each test result does not fall within the production tolerances, listed in Table 501-3, when applied to the JMF validated targets or if the LWT results do not meet specifications. The District Laboratory Engineer may require re-validation of the mix when the averages of the acceptance data indicate repeated non-compliance with the specified limits or tolerances.

501.08 ROADWAY OPERATIONS. Meet the requirements of 502.08 except as modified herein.

501.08.1 Weather Limitations: Ensure that Thin Asphalt Concrete complies with the weather limitations of 502.08.1 except that both the surface and ambient temperatures shall be a minimum of 60°F.

Do not place OGFC when ambient temperatures are predicted to drop below freezing, 32°F, within a three-day forecast period by the U.S. National Weather Service (NWS).

501.08.2 Surface Preparation: Protect and cover manhole covers, drains, grates, catch basins and other such utility structures. Cut back all vegetation at the road edge. Sweep the surface clean of dust, dirt, caked clay, and loose foreign material. Remove any existing raised pavement markers prior to asphalt concrete overlay operations. Payment for removal of pavement markings will be included with the applicable asphalt item.

501.09 HAULING, PAVING AND FINISHING. Meet the requirements of 502.09 except as modified herein. Use fully sealed tarps on all loads. Load haul trucks to minimize segregation.

501.09.1 Application of Tack Coat: Before constructing the thin lift, apply an approved asphalt tack coat in accordance with Section 501.02.1. Apply all tack coat emulsions using a spray paver meeting the requirements of 503.15.1, or apply hot applied non-tracking tack (NTHAP) using a power asphalt distributor meeting the requirements of 503.13.1. Spray tack coat uniformly and accurately across the paving width and monitor the rate of spray. Determine the tack coat application rate by road conditions and mix type. Meet the undiluted asphalt emulsion application rate in Table 501-1. Any change to the tack coat application rate (increase or decrease) in Table 501-1 must be approved by the Project Engineer.

501.09.2 Placement: Place mixtures in accordance with processes and equipment described in Section 503. Deliver material to the paver at a uniform rate and in an amount within the capacity of paving and compacting equipment. Adjust the paver speed and number of trucks to maintain continuous paving operations. Keep the height of material in front of the screed at a uniform height.

Ensure the pavers are designed and operated to place mixtures to required line, grade and surface tolerance without resorting to hand finishing.

501.09.3 Paving: Place and compact the mixture to plan thickness. Place a smooth uniform mat over the full lane width.

501.09.4 Compaction: Comply with 502.10 except as modified herein. Compact the mixture applying a minimum of 3 passes over a single point on the road using a double drum steel wheel roller of sufficient weight to properly seat the aggregate without crushing. Roll longitudinal joints directly behind the paving machine. Do not vibrate except at transverse joints. Accomplish final compaction with a second roller. Compact and finish before the mixture temperature falls below 180°F.

501.10 ROADWAY QUALITY ASSURANCE. The Project Engineer will verify that the tack coat application rate meets the requirements of Table 501-1 and check the mixture yield.

Do not place asphalt concrete exhibiting deficiencies before placement such as segregation, contamination, lumps, non-uniform coating, excessive temperature variations, alignment deviations, variations in surface temperature or other deficiencies, apparent on visual inspection.

Poor construction practices such as handwork, improper truck exchanges, improper joint construction, or other deficiencies, apparent on visual inspection, will not be accepted.

501.10.1 Opening to Traffic: Do not open the new pavement to traffic or allow any roller to sit idle on the pavement until the rolling operation is complete and the material has cooled to a temperature where the mat will not be damaged by traffic.

501.10.2 Smoothness: Furnish equipment specified in 502.12.1. Measure IRI in accordance with DOTD TR644 using a DOTD certified inertial profiler before and after placement. Meet Table 501-5 requirements. Ensure a maximum transverse deviation of 1/8 inch and maximum longitudinal deviation of 1/4 inch using a 10 foot metal static straight edge. Correct by grinding at no direct pay at the direction of the Project Engineer.

Perform quality control for surface tolerance as needed. Measure initial and final IRI in the presence of the DOTD certified inspector and submit each data in accordance with 502.12.5 to the DOTD certified inspector at the time of collection.

501.11 MEASUREMENT. Measure the Thin Asphalt Concrete applications by the ton. Measure the tack coat in accordance with Section 504.

501.12 PAYMENT. Payment for Thin Asphalt Concrete mixture will be made at the contract unit price per ton which includes furnishing all required materials, labor, equipment, tools and incidentals necessary for designing and producing the mixtures, preparing the surfaces on which the mixtures are to be placed, hauling the mixtures to the work site, and placing and compacting the mixtures. Production of mix that is not eligible for 100 percent payment will not be allowed on a continuous basis.

Asphalt tack coat will not be a pay item and will be considered incidental to the 501 item. However, if the Project Engineer adjusts the application rate of tack coat from that specified by the contract document, payment for the asphalt mixture will be increased or decreased based on the difference in the applied quantity of asphalt emulsion shown on paid invoices (total of charges). The contractor shall provide copies of paid invoices for this determination. Payment will be subject to the payment adjustment schedules as shown in Table 501-4.

Payment adjustments will be assessed on a per lot basis. The percent payment for the roadway lot will be the lowest value of the payment adjustment parameters for that lot.

A separate payment adjustment for IRI will be applied per travel lane to the theoretical tonnage of each lane for the entire length of the project in accordance with Table 501-5.

Payment for removal of pavement markings will be included with the applicable asphalt item.

Payment will be made at the contract unit price under:

Item No.	Pay Item	Pay Unit
501-01	Thin Asphalt Concrete (Dense Mix)	Ton
501-02	Thin Asphalt Concrete (Coarse Mix)	Ton
501-03	Thin Asphalt Concrete (OGFC)	Ton

Table 501-1
Asphalt Mix Design Requirements

Mix Type	Dense Mix	Coarse Mix	OGFC
Asphalt Cement Grade	PG 70-22	PG 70-22m	PG 76-22m
Gyratory Revolutions, AASHTO T 312	50	75	50
Minimum AC content, %	4.5	4.5	6.5
Air Voids, % [1]	4-6	6-8	18-24[2]
Natural Sands, Max. %	15	0	0
Dust/ Asphalt Ratio	0.6-1.6	---	---
RAP, Max %	10	0	0
LWT rut depth, 12 mm (max) @ no. passes, DOTD TR 332[3]	12,000	20,000	5000
Draindown, % max, ASTM D6390	---	0.15	0.30
Min. Tack Coat Undiluted (or NTHAP) Application Rate, gal/sq.yd. (0.40 gal/sq.yd maximum)	0.08[4]	0.15	0.15
% Passing 3/4 inch	100	100	100
% Passing 1/2 inch	100	75-100	85-100
% Passing 3/8 inch	90–100	—	55-75
% Passing No. 4	—	25-40	10-25
% Passing No. 8	35-70	19-28	5-13
% Passing No. 16	20-50	—	—
% Passing No. 200	2.0-10.0	2.0-5.5	2.0-4.0

[1] Design target voids at mid-point of void requirement. Full range allowed for OGFC.
[2] As computed using the measure of the physical volume (weight of compacted specimen)/ (height of compacted specimen x area of the compacted specimen).
[3] Compact LWT specimen to the mid-point of design void requirement, OGFC to 18% voids.
[4] If bleeding, ponding or slipping are evident, this rate may be reduced to a minimum of 0.04 gallon/square yard with a minimum 0.02 gallon/square yard residual with approval of the Project Engineer.

Table 501-2
Aggregate Physical Properties

Test	Method	Coarse Mix and OGFC	Dense Mix
Micro Deval, % loss max[1]	AASHTO T-327	18	—
Flat and Elongated Ratio; 3:1, % Max.	ASTM D4791	25	—
Coarse Aggregate Angularity, % Crushed, Double Faced, Min.	DOTD TR 306	90	—
Sand Equivalent, Min.	DOTD TR 120	—	40
Fine Aggregate Angularity (FAA), Min.	DOTD TR 121	45	40
Friction Rating		I, II[2]	I, II, III

[1] Micro Deval target applies to each individual aggregate.
[2] See Table 502-3.

Table 501-3
Production Tolerances

Sieve % Passing	Production Tolerances
3/4 inch	±4
1/2 inch	±4
3/8 inch	±4
No. 4	±4
No. 8	±3
No. 16	±2
No. 30	±2
No. 50	±2
No. 200	±1.5
A/C by Ignition, %	±0.2
Mix Temperature, ^{0}F	±25
G_{mm}	±0.015
Air Voids, %	Meet design
Dust/Asphalt Ratio	Meet design

Table 501-4
Payment Adjustment Schedules

Plant:	**Percent of Contract Unit Price per Lot**			
	100%	**90%**	**80%**	**50% or Reapplication[1]**
Theoretical Maximum Specific Gravity (G_{mm}) Average Deviation from Validated JMF Target Value	≤0.015	>0.015 - 0.020	>0.020 - 0.025	>0.025
Limits on Extracted Aggregate, Average Deviation from Table 501-3, JMF Validated Target[2]				
No. 4 Sieve	≤ 4.0	>4.0 - 5.0	> 5.0 - 6.0	> 6.0
No. 200 Sieve[3]	≤ 1.5	>1.5 - 2.0	> 2.0 - 2.5	> 2.5
Roadway:				
Tack Coat Undiluted (or NTHAP) Application Rate, gal/sq.yd. Coarse Mix and OGFC	≥0.15	<0.15 - 0.08	<0.08 - 0.04	< 0.04

[1] Reduced pay or reapplication at the contractor expense shall be As directed by the Chief Engineer.
[2] Gradation pay adjustment applies to coarse and OGFC mixtures only.
[3] For OGFC and Coarse Mix, if the No. 200 sieve is above maximum design limit, apply at 90% adjustment or the computed adjustment from the deviation, whichever is greater.

Table 501-5
Smoothness Payment Adjustment Schedules

Percent of Contract Unit Price per Travel Lane for final IRI			
	100%	**90%**	**50% or Reapplication[1]**
Initial IRI of ≤ 65	≤ 65	>65-73	> 73
Initial IRI > 65 to 81	≤ 65	≤10% greater than initial measure	> 10% greater than initial measure
Initial IRI > 81	≥ 20% reduction from initial measure	<20% reduction from initial measure	greater than initial measure

[1] As directed by the Chief Engineer.

Section 502
Asphalt Concrete Mixtures

502.01 DESCRIPTION.

502.01.1 General: Furnish and construct asphalt concrete mixtures in conformance with these specifications, the lines, grades, thicknesses, and typical sections in the plans.

Comply with Section 503 and the Application of Quality Assurance Specifications for Asphalt Concrete Mixtures (QA Manual).

Use a DOTD certified laboratory accredited by AMRL, CMEC, or other accreditation agency approved by DOTD.

502.01.2 Lift Description and Mixture Types: The wearing course is defined as the final lift placed. The binder course is defined as the lift placed prior to the final lift as defined in the plans. When a Section 501 thin lift mix is used in conjunction with construction of 502 mixtures, it is a finish course.

Mainline mixtures include wearing, binder, and base courses for travel lane, ramps and turnouts greater than 300 feet, interstate acceleration/deceleration lanes, turn lanes, and the two center lanes for airports.

Minor mixes include mixture used for bike paths, crossovers, curbs, detour roads, driveways, guardrail widening, islands, joint repair, leveling, medians, parking lots, shoulders, turnouts, ramps less than or equal to 300 feet, patching, widening, miscellaneous handwork, and any other mixture that is not mainline.

Stone Matrix Asphalt (SMA) is a plant produced hot mix asphalt concrete wearing course for high traffic applications that is a rut resistant hot mix design with stone on stone contact.

502.02 MATERIALS. Comply with applicable Part X subsections listed herein. Sample in accordance with the Materials Sampling Manual and ensure testing in accordance with the procedures listed in Part X and Table 502-1. Keep accurate records, including proof of deliveries of all materials used in asphalt concrete mixtures. Furnish copies of these records to the Project Engineer upon request.

Aggregates	1003.01 & 1003.06
Anti-Strip Additives	1002.02.1
Asphalt Cement	1002
Crumb Rubber	1002.02.2
Hydrated Lime	1018.02
Fibers	1002.02.5
Mineral Filler	1003.06.6
Mix Release Agent	1018.10
Reclaimed Asphalt Pavement (RAP)	1003.01 & 1003.06.5
Warm Mix Additives	1002.02.4

Table 502-1
Test Procedures for Asphalt Concrete

Description	Test Method
Specific Gravity and Density of Compressed Asphalt Mixtures	DOTD TR 304
Theoretical Maximum Specific Gravity, G_{mm}	DOTD TR 327
Asphalt Cement Content, P_b	DOTD TR 323
Mechanical Analysis of Extracted Aggregate	DOTD TR 309
Moisture Content of Loose HMA	DOTD TR 319
Degree of Particle Coating (plant requirement)	AASHTO T-195
Bulk Specific Gravity and Absorption	AASHTO T 84, T 85
Coarse Aggregate Angularity, % Crushed (Double Faced)	DOTD TR 306
Fine Aggregate Angularity	DOTD TR 121
Flat and Elongated Particles	ASTM D 4791
Sand Equivalent	DOTD TR 120
Mixture Conditioning (Aging) of HMA Mixtures	AASHTO R 30
Superpave Volumetric Mix Design	AASHTO M 323
Preparing Gyratory Samples	AASHTO T 312
Asphalt Cement Draindown	ASTM D 6390
Longitudinal Profile Using Automated Profilers	DOTD TR 644
Thickness and Width of Base and Subbase	DOTD TR 602
Loaded Wheel Tester (LWT)	DOTD TR 332
Semi-circular Bend Test (SCB)	TR 330

502.02.1 Asphalt Cement: Comply with Table 502-2. If the asphalt cement does not comply with the requirements of Section 1002, notify the Project Engineer and cease mix production until proper asphalt material is supplied.

Table 502-2
Asphalt Cement Usage

Location	Mix Level	Asphalt Grade Required[1]	Substitutions Allowed[2]	
			Lower Grade	Higher Grade
Mainline Wearing & Binder	1	PG 70-22m	PG 67-22 with traffic volume < 3500 ADT	PG 76-22rm, PG 76-22m
Mainline Wearing & Binder	2 and SMA[3]	PG 76-22m PG 76-22rm	PG 70-22m with Hydrated Lime	
Base	1	PG 67-22	PG 58-28[4]	PG 76-22rm, PG 76-22m, PG 70-22m
Minor Mixes including Leveling	ALL	PG 67-22		PG 76-22rm, PG 76-22m, PG 70-22m

[1] For single lift overlay, match grade of overlay.
[2] Asphaltic mixtures using substitutions are required to meet all design requirements for the original design level in Table 502-6 or Table 502-6b.
[3] Only PG76-22m and PG76-22rm are allowed for SMA.
[4] When more than 25% RAP is used, PG 58-28 is required.

502.02.2 Additives:

502.02.2.1 Anti-Strip: Add anti-strip additive at the minimum rate of 0.6 percent by weight of asphalt cement or a rate approved by the District Lab Engineer. Anti-strip will be thoroughly mixed in-line with the virgin asphalt cement at the plant. Increase the anti-strip additive or change to different additive as needed to meet Loaded Wheel Test, LWT, requirements. Discontinue production until satisfactory adjustments are made when the amount of anti-strip additive is not in accordance with the approved JMF.

502.02.2.2 Hydrated Lime: When used, specify rate of hydrated lime additive on the Job Mix Formula. Add hydrated lime additive at a minimum of 1.5 percent and thoroughly mix with aggregates in conformance with 503.05.5 as required to meet LWT requirements.

502.02.2.3 Waste Tire Rubber Additive: When used, crumb rubber may be pre-blended or, with approval by the Materials Laboratory, may be blended at the plant. The maximum rubber replacement is 10 percent by weight of asphalt.

When blending crumb rubber at the contractor's plant, add crumb rubber to a PG 67-22 material on the Approved Materials List. Add 30 mesh (or finer) crumb rubber as required to meet grade PG 76-22rm. Comply with 1002.02.2

502.02.2.4 Latex Additive: When added at the contractor's plant, blend a minimum of 1.0 percent residual latex by weight of asphalt cement to a PG 67-22 material on the Approved Material List, and in accordance with Section 503. Meet PG 70-22m requirement using pre-qualified asphalt material and latex.

502.02.2.5 Warm Mix Asphalt Additives: When used, add only approved warm mix chemical additives. Foaming with water is allowed.

502.02.3 Aggregates: Use aggregates from Approved Material List. Blend aggregates to meet Section 502 and Section 1003.

502.02.3.1 Friction Ratings: Friction ratings for aggregates are determined in accordance with 1003.01.2.4. Table 502-3 describes the friction ratings and corresponding usage allowed for the current average daily traffic (ADT) shown on the plans. Friction rating requirements apply to the mainline wearing course only, unless a finish course is applied. If a finish course is applied, then the friction rating requirements do not apply to wearing course.

Table 502-3
Aggregate Friction Rating

Friction Rating	Allowable Usage[1,2]
I	All mixtures
II	All mixtures
III	All mixtures, except mainline wearing courses with current plan Average Daily Traffic (ADT) greater than 7000
IV	All mixtures, except mainline wearing courses

[1] When ADT is greater than 7000, blending of Friction Rating III aggregates and Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses at the following percentages. At least 30 percent by weight (mass) of the total aggregates shall have a Friction Rating of I, or at least 50 percent by weight (mass) of the total aggregate shall have a Friction Rating of II. The Friction Rating I and Friction Rating II aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36 mm) sieve.

[2] When the average daily traffic (ADT) is less than 2500, blending of Friction Rating IV aggregates with Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses at the following percentages. At least 50 percent by weight (mass) of the total aggregate in the mixture shall have a Friction Rating of I or II. The Friction Rating I and Friction Rating II aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36 mm) sieve.

502.02.3.2 Reclaimed Asphalt Pavement (RAP): Keep reclaimed asphalt pavement separate from other materials at the plant in such a manner that will allow for Department inspection and acceptance. Keep stockpiles uniform and free of soil, debris, foreign matter and other contaminants. Allowable RAP percentages are defined in Table 502-6 (or Table 502-6b for ADT ≤ 1000). Screen or crush RAP, prior to use, to pass the 1-inch sieve. RAP is not allowed in Airport or SMA.

502.02.3.3 Mineral Filler: When used, comply with the requirements of 1003.06.6. May be used to control draindown.

502.02.3.4 Natural Sand: When used, meet the requirements of Table 502-6 (or Table 502-6b for ADT ≤ 1000) and 1003.06.3.

502.02.3.5 Fibers: When required to prevent draindown, use cellulose or mineral fiber, meeting the requirements of 1002.02.5. When used, add fibers at a rate sufficient to prevent draindown with a minimum rate of 0.1 percent by weight (mass) of mixture.

502.02.3.6 SMA Aggregate: Aggregates for SMA are to be clean durable crushed stone with a minimum of 50 percent of the coarse aggregate having a friction rating of I with the remaining percentage meeting friction rating II or III. Alternately, 100 percent of the coarse aggregate will meet a friction rating of II. Fine aggregate for SMA will be 100 crushed manufactured sand.

All materials used for SMA production are to be on the Approved Materials List.

502.03 DESIGN OF ASPHALT MIXTURES AND JOB MIX FORMULA (JMF) APPROVAL. Design all asphalt mixtures for optimum asphalt content in compliance with the mix design in accordance with DOTD Quality Assurance Manual, AASHTO M323, AASHTO M325 for SMA, and the requirements of Table 502-6 (or Table 502-6b for ADT ≤ 1000).

At minimum, all design submittals must include the recommended materials proportions, extracted gradation, recommended mix and compaction temperatures, and supporting design data. Submit the proposed JMF electronically through a Department approved data system, at least 7 days prior to use, as designated by the Department for District Laboratory Engineer acceptance. No mixture shall be produced until the proposed JMF has been accepted.

Indicate the optimum mixing and compaction temperatures as suggested by the asphalt binder supplier on the JMF. Mix temperatures are recommended by the asphalt supplier as determined by rotational viscosity or other means. Warm Mix Asphalt technology may be used to reduce this temperature and must be noted on the JMF. Warm mix asphalt may be substituted with a minimum production temperature of 275°F.

Once a plant is producing an acceptable JMF, keep JMF production within the specified tolerances. Changes will be reviewed and accepted by the District Laboratory Engineer as necessary. An acceptable mix design may not be changed to eliminate or add the use of crumb rubber without submitting a new JMF.

The Project Engineer may require a new mix design when roadway acceptance requirements are not being met or plant quality data indicates non-compliance.

502.03.1 Mixtures Design Substitutions: Changes in design level will not be allowed on the roadway.

The 3/4-inch Nominal Maximum Size (NMS) wearing course may be substituted for binder course but not substituted for base course. The 1-inch NMS binder course may be substituted for base course.

The 1/2-inch NMS wearing course may be substituted for incidental paving, Level A. Shoulders may be any mixture type shown in Table 502-4 regardless of design level except that shoulder wearing must be a 1/2-inch or 3/4-inch NMS mixture.

Apply all specification requirements for the substituted mixture with the following exceptions: When wearing course is substituted for binder course, Table 502-3 does not apply. The amount of RAP allowed is in accordance with the originally specified mixture.

Frictional aggregate requirements apply to final surface only. RAP is allowed in accordance with the original mixture specified, not the substituted mixture. When a 501 finish course and a 502 wearing course are required on a project, allowable RAP percentage for wearing may be increased by 5 percent.

502.04 LOT SIZES. A lot is a segment of continuous production of asphalt concrete mixture from the same JMF produced for the Department at a specific plant, delivered to a specific DOTD project. A lot is defined as 5000 tons of mixture production, a sublot is 1000 tons. The final lot size may be extended one sublot with the mutual agreement of the contractor and Project Engineer.

A lot may be terminated prior to 5000 tons with the mutual agreement of the contractor and Project Engineer for any of the following reasons:

1. The interval between continuous production exceeds 7 calendar days
2. A new job mix formula is accepted
3. The final lot is less than 5,000 tons
4. The total project quantity is less than 5,000 tons
5. A payment adjustment will be applied to the portion of the lot already produced, provided adjustments have been made to bring the asphaltic concrete into compliance with specifications.

502.04.1 Mainline Mix Type Uses: Mainline mixture uses include wearing, binder, and base courses for travel lane, ramps and turnouts greater than 300 feet, interstate acceleration/deceleration lanes, turn lanes, and the two center lanes for airports.

502.04.2 Minor Mix Type Uses with Density Requirement: Minor mixture uses requiring density include bike paths, crossovers, parking lots, patching, widening greater than 2.5 feet, uniform leveling thicker than 1.5 inches, tapers, and shoulders.

502.04.3 Minor Mix Type Uses without Density Requirement: Minor mixture uses not requiring density include curbs, detour roads, driveways, guardrail widening, islands, joint repair, spot leveling, medians, turnouts less than 300 feet, and mix uses not listed above. Make compaction effort to the satisfaction of the Project Engineer.

502.05 JOB MIX FORMULA VALIDATION AND APPROVAL. The Department and contractor will jointly test plant mix to validate each JMF. A JMF for mainline mixture will be validated whenever a plant begins initial operations for the Department in a specific plant location, whenever a plant experiences a change in materials or change in source of materials (other than asphalt cement), or when there are significant changes in equipment, such as the introduction of a new crusher, drum mixer, burner, foaming device, etc. Meet all applicable requirements of Table 502-6 (or Table 502-6b for ADT $\leq$ 1000). All JMF's will be re-validated a minimum of every 2 years. Re-validation may consist of reviewing ongoing production data.

For all mixes, a change in the asphalt cement grade or asphalt cement source does not require re-validation, but will meet all applicable requirements of Table 502-6 (or Table 502-6b for ADT $\leq$ 1000).

JMF's for minor mixtures do not require validation; however, use the first five quality control sublots to establish targets for production tolerances. The District Lab Engineer may reestablish targets for minor mixtures using production data.

The validation lot will be the first portion of production of a new JMF between 1000 and a maximum of 2000 tons of mixture produced. Divide the validation lot quantity into five sublots (typically 400 tons each) and sample using a random sampling approach. Obtain one sample of plant mixture for each sublot. With mutual agreement of the contractor and the Department, an sixth sample may be taken during validation. This sample may be used in place of the first validation plant sample for purposes of determining lot averages and establishing JMF targets.

During the validation process or when a new asphalt cement source is used, the Asphalt District Inspector (ADI) will collect a sample of loose mixture and a sample of asphalt cement to send to the central laboratory for GPC testing.

Report the mean, standard deviation, Quality Index and percent within limits (PWL) of the test results in accordance with the QA manual. The JMF is considered conditionally validated if the following parameters are 71 percent within limits of the JMF and meet the specifications.

1. Theoretical Maximum Specific Gravity (G_{mm}),
2. Percent G_{mm} at $N_{initial,}$
3. Percent passing the No. 8 and No. 200 sieves,
4. Percent Air Voids at $N_{design,}$ and
5. VFA.

The averages of all other validation tests shall meet the specifications limits in Table 502-4 and Table 502-6 (or Table 502-6b for ADT $\leq$ 1000). The production can continue during conditional validation. The JMF is considered validated with passing LWT results.

If any parameter falls below 71 PWL or the validation average falls outside of specifications, adjust mix and revalidate. If the second attempt does not meet specifications, redesign the mix. Upon validation of the JMF, the average of results for the validation lot will become the JMF target values to be used with production tolerances in Table 502-4.

502.05.1 Payment for Validation Lot: A validation lot is represented as an individual lot; the density requirement in Table 502-5 will still apply to any validation lot that fails to validate. Perform roadway acceptance in accordance with 502.11, except only one acceptance core is required per sublot, and pay in accordance with 502.15.

502.06 QUALITY CONTROL AND PLANT ACCEPTANCE. All quality control information, plant records, etc. will be considered part of the Department's acceptance decision. Exercise quality control over all materials and their assembly, design, processing, production, hauling, laydown and associated equipment to ensure compliance with Table 502-4 and all other specifications herein. At the end of each production day, notify the District Lab Engineer (DLE) and the DOTD Asphalt District Inspector (ADI) of the next scheduled mix production run and placement. All testing data will be entered into the DOTD data management software by the end of the work shift that it was performed.

For plant quality control, a sublot is defined as 1000 tons and a lot is defined as 5000 tons of produced mixture from one JMF that is consecutively sent to a single project (this tonnage may or may not be continuous at the plant). Obtain a sample of plant mixture and test the mixture once every sublot using a random sampling approach. Minimum quality control testing for each sublot is as follows:

Loose Mix

1. Theoretical Maximum Specific Gravity, G_{mm}
2. % Asphalt Cement Content
3. Gradation
4. % Crushed
5. Temperature, and
6. % Moisture content (1 per day per JMF)

Compacted Specimen, N_{design}

1. % G_{mm} at $N_{initial}$
2. % Air Voids, Va
3. % VMA
4. % VFA, and
5. % G_{mm} at N_{max} (1 per 5 sublots)

Age all loose mix tested for G_{mm} or volumetrics for one hour in accordance with AASHTO R30 prior to testing. Age all warm mix for two hours.

Determine the G_{mm} for each sublot. The plant sublot G_{mm} will be utilized in the determination of the plant air voids and the density of the corresponding roadway sublot.

Determine the rolling five test results average and standard deviation for aggregate gradation, asphalt content, air voids, VFA, VMA, and G_{mm}. Take corrective action or cease production when the latest rolling five test results show:

1. Air voids or G_{mm} fall below 71 PWL; or
2. Average VMA, VFA, average asphalt content, or average gradation for the No. 8 or No. 200 sieve is outside of specification limits

The full range of gradation mix tolerances applied to the validated JMF will be allowed even if they fall outside the control points. The District Laboratory Engineer may require termination or re-validation of the JMF when the average of the Quality Control data indicates non-compliance with the specified limits or tolerances.

Measure the moisture content of the cold feed aggregates daily in accordance with DOTD TR 403. The moisture content of the final mixture, measured daily, shall not exceed 0.3 percent by weight (mass) when tested in accordance with DOTD TR 319.

502.07 PLANT INSPECTION AND AUDITS. All Department inspection procedures, including sampling and testing, and the contractor's quality control data form the basis for acceptance of the asphalt mixture. The Department's Certified Asphalt Plant Inspector will randomly visit and inspect asphalt plants, sample and test material, and review documentation to ensure conformance to specification requirements. In particular, the inspector will take a minimum of the following samples which may be tested for verification:

Loose Mix

1. Theoretical Maximum Specific Gravity, G_{mm},
2. % Asphalt Cement Content,
3. Gradation, and
4. % Crushed

Compacted Specimen, N_{design} (Using contractor's equipment)

1. % G_{mm} at Ninitial,
2. % Air Voids, Va,
3. % VMA,
4. % VFA, and
5. Loaded Wheel Testing (LWT) every 20,000 tons of production per JMF.

The inspector will review contractor data and documentation. The inspector will check the plant equipment, lab equipment and plant operations. The inspector will sample asphalt cement working tank and or transport during random plant visits and will obtain random asphalt cement transport samples as requested by the Materials Lab.

Failure to maintain production tolerances listed in Table 502-4 and specification limits listed in Table 502-6 (or Table 502-6b for ADT ≤ 1000) for five sublots may result in increased sampling, reduced pay, or removal and replacement of the asphalt mixture, decertification of the technician, and/or decertification of the plant. Correct deficiencies or cease operations.

502.08 ROADWAY OPERATIONS.

502.08.1 Weather Limitations: Apply asphalt concrete mixtures on a dry surface when the ambient temperature is above 50°F for wearing courses and 40°F for base and binder courses. Material in transit, or a maximum of 100 tons in a surge bin or silo used as a surge bin, at the time plant operation is discontinued may be placed. All mixture placed is expected to perform satisfactorily and meet specification requirements. Inclement weather will be sufficient reason to terminate or not begin production.

When base course mixtures are placed in plan thicknesses of 2 3/4 inches or greater, disregard temperature limitations provided all other specification requirements are met. When a wearing course is substituted for a binder course mixture, apply the temperature limitation for binder course.

502.08.2 Surface Preparation: Maintain the surface being covered. Acceptance is required for each surface prior to placement of subsequent surface.

Roadway slope shall be established at the base course level unless otherwise authorized by the Project Engineer. The absolute minimum lift thickness placed shall be 1/4 inch greater than the nominal maximum aggregate size as shown on Table 502-6 (or Table 502-6b for ADT ≤ 1000). Failure to meet minimum thickness is subject to removal.

502.08.2.1 Cleaning: Sweep the surface to be covered clean of dust, dirt, caked clay, caked material, vegetation, and loose material by revolving brooms or other mechanical sweepers supplemented with hand equipment as directed. Remove excess joint filler from the surface by an approved method when mixtures are to be placed on portland cement concrete pavement or previously overlaid portland cement concrete. Remove any existing raised pavement markers prior to asphalt concrete overlay or SMA operations. Payment for removal of pavement markings will be included with the applicable asphalt item.

Wash the surface with water in addition to brooming, when brooming alone does not adequately clean the surface.

When tack coat is exposed to traffic for more than one (1) calendar day, becomes contaminated, or degrades due to inclement weather, reapply the tack coat at the initial recommended rate at no direct pay.

502.08.2.2 Applying Tack Coat:

502.08.2.2.1 Existing Pavement Surfaces: Before constructing each course, apply an approved asphalt tack coat in accordance with Section 504. Protect the tack coat and spot patch as required.

502.08.2.2.2 Raw Aggregate Base Course and Raw Embankment Surfaces: Apply an approved asphalt prime coat to unprimed surfaces, or protect in-place prime coat and spot apply prime coat as required, in accordance with Section 505.

502.08.2.2.3 Cement and Lime Stabilized or Treated Embankment and Base Course Surfaces: Apply an approved asphalt curing membrane when none is in place, or protect the in-place curing membrane and spot apply, as required, with asphalt material in accordance with Section 506.

502.08.2.2.4 Other Surfaces: Cover contact surfaces of curbs, gutters, manholes, edges of longitudinal and transverse joints, and other structures with a uniform coating of an approved asphalt tack coat complying with Section 504 before placing asphalt mixtures.

502.08.3 Joint Construction:

502.08.3.1 Longitudinal Joints: When constructing longitudinal joints, set the screed to allow approximately 2 inches onto the adjacent pass. Use approved 10-foot static straight edge to maintain no greater than 1/8-inch deviation in grade. Make necessary correction in joint before continuing operations. Offset longitudinal joints in one layer over those in the layer below by a minimum of 3 inches; however, keep the top layer joint 6 inches to 9 inches from the centerline of two lane highways. Offset 6 inches to 9 inches from lane lines when the roadway is more than two lanes. Construct the narrow strip first.

502.08.3.2 Transverse Joints: Construct transverse joints by milling or hand forming paper butt joints. Use an approved 10-foot static straightedge to identify the location to be cut back to maintain no greater than a 1/8-inch deviation in grade. Lightly tack the cut face of the previously placed mat before fresh material is placed. Rest the screed on shims that are approximately 25 percent of lift thickness placed on the compacted mat. Provide an adequate crew to form transverse joints. Additionally, meet the transverse joint surface tolerance requirements of Table 502-5. Make necessary corrections to the joint before continuing placement operations.

Offset transverse joints in succeeding lifts by at least 3 feet.

502.09 HAULING, PAVING AND FINISHING. Transport mixtures from the plant and deliver to the paver at a temperature no cooler than 25°F below the lower limit of the approved job mix formula. The minimum temperature for WMA going through the paver is 245°F. Send no loads so late in the day that completion of spreading and compaction of the mixture cannot be completed during daylight, unless artificial lighting has been approved and is on site.

Load haul trucks to minimize segregation.

Place each course of asphalt mixture in accordance with the specified lift thickness shown in Table 502-6 (or Table 502-6b for ADT ≤ 1000).

With the Project Engineer's approval, motor patrols may be used to level isolated depressions in the initial layer, provided this construction does not result in unsatisfactory subsequent lifts.

502.09.1 Coordination of Production: Coordinate and manage plant production, transportation of mix and placement operations to achieve a high quality pavement. Provide sufficient hauling vehicles to ensure continuous plant and roadway operations. The Project Engineer will order a halt to operations when sufficient hauling vehicles are not available.

On final wearing course construction under traffic with pavement layers of 2 inches compacted thickness or less, the contractor will be permitted to pave one travel lane for a full day and the adjacent travel lane the next work day. When the adjacent travel lane is not paved the next work day and the longitudinal joint is exposed to traffic for more than 3 calendar days, and it has been determined that the roadway edge is not true to line and grade as previously constructed, cut back the entire length of exposed longitudinal joint to lift thickness to a vertical edge and heavily tack unless a notch wedge device is used. When pavement layers are greater than 2 inches compacted thickness, place approximately 1/2 of each day's production in one lane and the remainder in the adjacent lane unless an approved notched wedge device is used.

Protect pavement from traffic until it has sufficiently hardened to the extent the surface is not damaged.

502.09.2 Paving Operations: When placing the final two lifts of asphalt concrete on the roadway travel lanes, use a material transfer vehicle (MTV) as described in 503.14. During continuous paving, maintain temperature of the mixture constant. At no time shall there be more than 50°F difference in temperature as measured in 300 linear feet of paving or 25°F across the full paved width. All mixtures shall flow through the paver hopper. Lift into the hopper any mixture dropped in front of the paver or reject such material and cast it aside. Deliver material to the paver at a uniform rate and in an amount within the capacity of paving and compacting equipment. Adjust the paver speed and number of trucks to maintain one truck waiting in addition to the one at the paver in order to maintain continuous paving operations. Maintain a uniform height of material in front of the screed.

Keep the paver steady and in constant alignment during mix transfer. Maintain a level of mix higher than the paver hopper feed slats at all times.

Use pavers and operators capable of placing mixtures to required line, grade and surface tolerance without resorting to hand finishing.

Construct longitudinal joints and edges along established lines. Utilize some form of longitudinal control for the paver to follow, preferably a string line. Position and operate the paver to closely follow the established line. Correct irregularities in alignment by trimming or filling directly behind the paver. Check the texture for uniformity after each load of material has been placed. Check the adjustment of screed, feed screws, hopper feed, etc., frequently and adjust as required to assure uniform spreading of the mix to proper line and grade and adequate compaction. When segregation of materials or other deficiencies occur, suspend paving operations until the cause is determined and corrected.

Correct surface irregularities directly behind the paver. Hand placement will be allowed in accordance with 502.09.3 for surface repair, taking care never to cast material over the fresh surface.

Discontinue paving operations when any screed control device malfunctions during binder or wearing course placement operations. When malfunctions occur, limit material through the paver to that which is in transit. Assume responsibility of meeting all specifications and yield requirements, and bear the cost of any overrun during malfunctions. Do not resume paving operations until the malfunction is fixed.

When paving operations are interrupted, remove and replace at no direct pay, mixture that has cooled below the point that it cannot be finished, or compacted to meet specifications. When additional mix is required to increase superelevation in curves, the use of automatic slope control is optional. However, ensure slope by measuring with a slope board. Allow the Project Engineer use of the slope board upon request.

Use the traveling reference plane method of construction for airport runways unless designated otherwise on the plans. Unless the erected string line is required or directed, use the 27-foot (minimum) traveling reference plane method of construction for roadway travel lanes. The requirements of 502.09.2.1, 502.09.2.2, and 502.09.2.3 shall apply for mechanical pavers.

502.09.2.1 Additional Requirements for SMA: Mixture temperature upon entry into the MTV will not be below 300°F. Paver speed is to be constant and not exceed 25 feet per minute or as directed by the Project Engineer.

502.09.2.2 Traveling Reference Plane: Obtain approval of the traveling reference plane method before use. After the initial paving strip of each lift is finished and compacted, place adjacent paving strips to the grade of the initial paving strip using the traveling reference plane or shoe device to control grade and a slope control device to control cross slope.

On multilane pavements, the initial paving strip and the sequence of lane construction will be subject to approval.

When both outside edges of the paving strip being placed are flush with previously placed material, do not use the slope control device. A grade sensor is required for each side of the paver.

In superelevated curves, the cross slope shall be changed from that specified for tangents to that specified for superelevation in gradual increments while the paver is in motion so a smooth transition in grade is obtained. This change in cross slope shall be accomplished within the transition distance specified.

This is the minimum acceptable method and the contractor must meet or exceed current surface tolerance specifications.

502.09.2.3 Erected Stringline: Use the erected stringline method in isolated areas as directed by the Project Engineer. This method may be used on the first lift of asphalt when the underlying new or reconstructed bases do not have grade control requirements. Equip pavers for roadway travel lanes with automatic screed and slope control devices when used with an erected stringline.

An erected stringline shall consist of a piano wire or approved equal stretched between stakes set at no greater than 25-foot intervals. Tension the stringline between supports so that there is less than 1/8-inch variance between supports when the sensor is in place. If required, place the initial paving strip of the first lift constructed using an erected stringline referenced to established grade. When permitted, mixtures required to level isolated depressions may be placed without automatic screed control. Subsequent lifts may be constructed by use of the traveling reference plane, provided surface and grade tolerances are met on the previous lift.

Only one grade sensor and the slope control device are necessary for roadways with a normal crown on tangent alignment. Superelevated curves will require the use of two grade sensors and two erected stringlines to obtain proper grade and slope; however, when the automatic screed control device is equipped with a dial or other device which can be conveniently used to change the cross slope in small increments, superelevated curves may be constructed using this device and one erected stringline.

After the initial paving strip of the first lift is finished and compacted, lay adjacent paving strips using an approved traveling reference plane.

502.09.2.4 Without Automatic Screed Control: When permitted, pavers without automatic screed control may be used for pavement patching, pavement widening, paved drives and turnouts.

502.09.3 Hand Placement: When the use of mechanical finishing equipment is not practical, the mix may be placed and finished by hand to the satisfaction of the Project Engineer. During paving operations, material shall be thoroughly loosened and uniformly distributed. Material that has formed into lumps and does not break down readily will be rejected. Check the surface before rolling and correct irregularities.

502.10 ROLLING AND COMPACTION.

502.10.1 General: After placement, uniformly compact mixture by rolling while still hot, to a density that complies with Table 502-5. If continuous roller operation is discontinued, move rollers to cooler areas of the mat where they will not leave surface indentations. The use of steel wheel rollers in the vibratory mode, which result in excessive crushing of aggregate, will not be permitted.

Utilize experienced operators when rolling the mixture using consistent rolling sequences and uniform methods to achieve specified density and smoothness. Uniformly overlap preceding passes of individual roller passes to ensure complete coverage of the paving area. Do not tear or crack the mat by varying the roller speed, amplitude, vibration frequency or other roller operation. Operate non-vibrating steel wheel rollers with drive wheels toward the paver. Correct any operation causing displacement, tearing or cracking of the mat.

Prohibit use of equipment, which leaves tracks or indented areas that cannot be corrected in normal operations or fails to produce a satisfactory surface. Stop use of equipment resulting in accumulation of material and subsequent shedding of accumulated material into the mixture or onto the mat.

Keep rollers of steel wheel rollers properly moistened without excess water to prevent adhesion of mixture to rollers.

Maintain adequate heat for pneumatic tire rollers to prevent mix from adhering to tires. Operate the pneumatic tire roller at a contact pressure which will result in a uniform, tightly knit surface. Keep the pneumatic tire roller approximately 6 inches from unsupported edges of the paving strip; however, when an adjacent paving strip is down, overlap the adjacent paving strip approximately 6 inches.

Vibratory rollers may be used provided they do not impair the stability of the pavement structure or underlying layers. Vibratory rollers shall not be used on the first lift of asphalt concrete placed over the asphalt treated drainage blanket. When mix is placed on newly constructed cement or lime stabilized or treated layers, do not use vibratory rollers until base is approved by the Project Engineer and not for at least 5 days after such stabilization or treatment.

It is the responsibility of the contractor to determine the number, size, and type of rollers to sufficiently compact the mixture to the specified density and surface smoothness. Ensure that the rolling equipment is capable of maintaining the pace of the paver and conforms to 503.16.

The surface of mixtures after compaction shall be smooth and true to cross slope and grade within the tolerances specified. Remove mixtures that become loose, broken, contaminated or otherwise defective and replace with fresh hot mixture compacted to conform to the surrounding mixture.

Excessive rippling of the mat surface will not be accepted. Ripples are small bumps in the pavement surface which usually appear in groups in a frequent and regular manner. No more than 12 ripples or peaks will be allowed in any 100-foot section. Rippling indicates a problem with the paving operation or mix that requires immediate corrective action by the contractor; otherwise cease operations. Correct unacceptable areas at no direct pay.

After rolling, ensure that newly finished pavements have a uniform, tightly knit surface free of cracks, tears, roller marks or other deficiencies. Correct deficiencies at no direct pay and adjust operations to correct the problem. This may require the contractor to adjust the mix or furnish additional or different equipment.

502.10.2 SMA Compaction: SMA mixture is to be rolled immediately after placement by two steel wheel breakdown rollers capable of rolling the entire width of the mat in one pass. The rollers are to have a minimum weight of 10 tons. Rollers are to use high frequency and low amplitude. The mastic is not allowed to migrate to the surface. Rolling will continue until all roller marks are eliminated and the minimum density is obtained. Rolling operations will cease when the mat has cooled to 220°F and traffic will not be allowed on the roadway until the mix has cooled to 140°F or less.

502.10.3 Hand Compaction: Along forms, curbs, headers, walls and at other places inaccessible to rollers, compact the mixture uniformly to the satisfaction of the Project Engineer with approved hand tampers or mechanical tampers, conforming to 503.17.

502.11 ROADWAY ACCEPTANCE. Acceptance testing for pavement density and dimensional tolerances will be conducted on that portion of the lot placed on each contract. Acceptance testing for surface tolerance will be conducted upon completion of mainline paving.

Do not place asphalt concrete mixture exhibiting deficiencies such as segregation, contamination, lumps, non-uniform coating, excessive temperature variations, or other deficiencies apparent on visual inspection.

Correct and/or replace at no direct pay any asphalt concrete mix exhibiting deficiencies, such as segregation, contamination, alignment deviations, variations in surface texture and appearance or other deficiencies, apparent on visual inspection. Poor construction practices such as handwork, improper truck exchanges, improper joint construction, or other deficiencies, apparent on visual inspection, will be corrected at no direct pay.

502.11.1 Density by Pavement Cores: Obtain pavement samples from each sublot within 24 hours after placement. When this falls on a day the contractor is not working, sampling will be done within 3 calendar days. Sample at locations determined by the Project Engineer using random number tables shown in DOTD S605.

When the sampling location determined by random sampling falls within areas that are to be replaced or within 18 inches of the unsupported pavement edge, another random sampling location will be used.

Take cores, approximately 6 inches in diameter, with an approved core drill. Furnish samples cut from the completed work. Replace removed pavement with hot or cold mixture and refinish during the work day coring is performed at no additional pay. Sample in the presence of the Project Engineer's representative. Do not use cores less than 1 3/8 inches thick upon extrusion for payment determination. For transport by parties other than DOTD representatives, ensure that the acceptance cores are transported in accordance with the quality assurance manual. Any evidence of tampering with the acceptance cores during transport by contractor or third party will result in the cores being rejected and additional pavement samples being required.

The Project Engineer or his representative will transport cores in approved transport containers. When allowed, the contractor or third party will transport in an approved, tamper proof transport container.

There are typically five sublots for each lot. Mainline and minor mixes may be in the same lot/ sublot. Divide each of the sublots into two segments of approximately equal tonnage. For each sublot segment, the Department will determine sample locations using random sampling approach. Obtain one acceptance core at the designated sample location, obtain one quality control core approximately 12 inches in the direction of travel from the acceptance core. If the sublot segment has mainline mix uses, the acceptance cores will be taken from the mainline portion. A typical lot will have 10 acceptance cores and 10 quality control cores. Record the location and mix use of each core taken.

If a sublot has both mainline and minor uses, at least one acceptance core is required to represent the minor mix type. If the lot has any mixture used for mainline, a minimum of three cores is required to represent the mainline portion. Take additional acceptance cores randomly from the respective portions as needed to meet these requirements. Take additional quality control cores approximately 12 inches in the direction of travel from the any additional acceptance core collected.

In the presence of the Department roadway inspector, the contractor will perform the following: cutting, extracting, trimming, and cleaning the roadway cores. The Department roadway inspector will immediately take possession of the acceptance core. The contractor may transport the acceptance cores to the District Laboratory provided that the acceptance cores are transported in accordance with the quality assurance manual.

For projects with less than 250 tons, the job mix formula, materials, and plant and paving operations shall be satisfactory to the Project Engineer. Sampling and testing requirements may be modified by the Project Engineer and payment adjustment for deviations waived.

502.11.1.1 Testing of Roadway Cores: The District Laboratory will calculate the density of each acceptance roadway core using the bulk specific gravity (Gmb) of the core and the maximum specific gravity (Gmm) of the corresponding plant sublot. The percent density requirement for each mix use is shown in Table 502-5.

The contractor will calculate the density of each quality control core using bulk specific gravity (G_{mb}) of the core and the maximum specific gravity (G_{mm}) of the corresponding plant sublot.

All roadway acceptance and quality control core results will be submitted using the approved DOTD software. All core result determination shall be completed within 3 calendar days of the cores being extracted and placed in DOTD custody. The only exception is if the 3 calendar days fall on a weekend or legal holiday.

502.11.1.2 Verification of G_{mm}: Within two calendar days after the contractor timeframe to dispute roadway core densities (24 hours after the completion and reporting of all roadway core data) or after a roadway core density dispute is settled, one acceptance core tested by the Department will be randomly selected for verification of the theoretical maximum specific gravity, Gmm. If the verification Gmm is not within ± 0.024 of the average plant Gmm reported for the lot, notify the contractor and randomly select one core from each of the other sublots for verification. If the average verification Gmm is not within ± 0.024 of the average plant Gmm reported for the lot, notify the District Laboratory Engineer and the average Gmm determined by verification for the lot will be used to calculate percent density for all sublots in the lot.

A sample of a core broken down for G_{mm} verification will be sent to the DOTD Central Materials Laboratory for GPC testing at a rate of one per project or every 20,000 tons of a JMF.

Cores will be retained for a period of 10 days after density is reported.

502.11.1.3 Contractor Dispute: The contractor may dispute the results of acceptance core (Gmb) tests or verification of Gmm tests performed in a District laboratory. If the contractor believes that a District laboratory test result is in error, the contractor will substantiate the reason for the belief that the test result is in error and document the reasons in writing. The contractor will submit the written dispute to the Project Engineer and the DOTD Asphalt Technology Lab (ATL) manager. If the Project Engineer and DOTD ATL manager agree that there is sufficient reason to question the test result, the acceptance samples will be taken for testing by the DOTD ATL.

The contractor may dispute acceptance core (G_{mb}) test results within one business day of notification of the final acceptance core (G_{mb}) test result. A representative of the DOTD ATL will take possession of the acceptance cores of any disputed sublot. A DOTD ATL representative independent of the project may test the cores at any laboratory that is AASHTO R18 accredited.

The contractor may dispute verification of G_{mm} test results, within one business day of notification of the average G_{mm} verification test result. A representative of the DOTD ATL laboratory will take possession of the remaining acceptance cores from the District laboratory. A DOTD ATL representative independent of the project may perform G_{mm} testing at any laboratory that is AASHTO R18 accredited.

If the original District laboratory test results are found to have been accurate, the contractor shall bear a cost of $1,000 per sublot disputed for the additional core (G_{mb}) testing and evaluation or $1,000 for G_{mm} verification testing and evaluation. Such costs shall be deducted from any monies owed to the Contractor.

If the original District laboratory test results are found to be in error, the ADI and District Laboratory Engineer will investigate the cause of the error.

502.11.1.4 Minor Mix without Density: This minor mix shall have a neat, uniform appearance and be compacted by methods to the satisfaction of the Project Engineer. Plant quality control data will be submitted using the approved DOTD software. Any mixture placed while quality control data indicates the mixture is out of specification is subject to removal at the option of the Project Engineer.

502.11.2 Density by Non-Destructive Technologies (NDT): In addition to all required quality control testing, contractors may submit quality control density measurements collected using DOTD approved non-destructive technologies (NDT) in accordance with the quality assurance manual. Density measurements reported by NDT devices will be for informational purposes only, such as, to provide supporting documentation for a dispute claim. Density measurements reported by NDT devices will not be used in place of any required quality control or quality assurance testing.

502.11.2.1 Equipment and Operation: Use a non-destructive technologies (NDT) device meeting requirements of AASHTO T-343 or AASHTO T-355.

When performing NDT tests, set the device in the single reading and shallow penetration modes. A density measurement will consist of the average of five readings taken in accordance with the reading pattern described by the manufacturers procedure manual. Take readings where the pavement surface is flat and no surface moisture is evident. Use brush to clear loose particles from contact area.

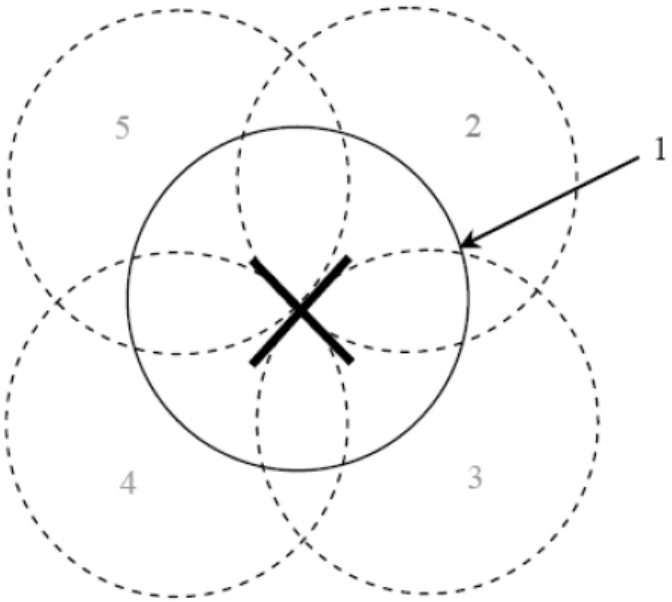
Verify the NDT device operation daily using the standardization plate issued with the gauge. Follow the Manufacturer's instructions for performing the standardization. Ensure each day's standardization result is within the limits established by the manufacture.

502.11.2.2 NDT Device Off-set Procedures: Prior to using NDT device measurements, an offset will be determined for each JMF, for each project. This offset will be established during mixture validation in the presence of DOTD personnel. On days when a control strip is being placed, the DOTD personnel must witness the contractor's personnel standard count procedure. The NDT device will be used to determine an average density from random locations determined by the DOTD personnel. The frequency of testing will be 20 locations within the validation lot. The center location of the device readings will be marked. Core specimens will be extruded from marked location after all NDT reading are conducted at that location. The device readings will be compared with the core densities in order to establish a working offset. The offset will be specific to that device, for that JMF, for that project. In the event that the JMF changes, or a new device is used, a new offset must be established.

Off-set procedures should be followed as listed below:

1. Contractor and DOTD technicians should jointly verify all NDT parameters for each device:
    a. Successful self-test at start up
    b. JMF G_{mm}
    c. Lift thickness
    d. Test mode
    e. Target density
    f. Correct any issue(s) prior to proceeding with field confirmation

2. DOTD personnel will select a random site on the mat:
    a. Location of random spots will be recorded
3. NDT readings should be taken in single mode and reading pattern should follow the 5-point star



method as seen below.

4. The QA gauge operator will conduct 50 NDT density tests, 5 readings at each of the 10 random core locations within the validation lot. The 5 readings from each location will be averaged into a single density measurement for that location.
5. Density gauge readings will be recorded on paper and in the density gauge if possible.
6. Follow core sampling, trimming, handling and transport procedures outlined in section 502.11.1.
7. The off-set will be determined by subtracting the device density from the core density. An average offset is determined using the 10 locations. The off-set will be applied on subsequent lots of the same JMF, with the same device, during the construction of the project.

502.11.2.3 Roadway Testing Procedures: There are typically five sublots for each lot. Mainline and minor mixes may be in the same lot/ sublot. Divide each of the sublots into two segments of approximately equal tonnage each. For each sublot segment, the Department will determine sample locations using random sampling approach. The department will obtain one acceptance device density reading (average of 5 spot readings) at the designated sample location. The contractor will obtain one quality control device density reading (average of 5 spot readings) approximately 12 inches in the direction of travel from the acceptance reading. If the sublot segment has mainline mix uses, the acceptance reading will be taken from the mainline portion. A typical lot will have 25 acceptance readings and 25 quality control readings. Record the location and mix use of each reading taken.

The NDT density readings will be entered into an approved DOTD software. The off-set value determined during validation will be applied in the software and reported. All result determination shall be completed within 1 calendar day. Differences between the Contractor's quality control and the Department's quality assurance density results will be considered acceptable if within ± 1.3%.

One destructive field core will be cut from the roadway every lot for offset verification. The location will be determined randomly by DOTD.

502.11.2.4 Disputed NDT Device Readings: In the event of a questionable NDT device reading, a core will be extracted from the center location of the 5 readings. The core density will replace that NDT device reading for determination of pay. If the core density is found to be unacceptable, the roadway inspector will isolate the questionable section with the NDT device. Corrective action or reduction in pay may be associated with the section.

502.12 SURFACE TOLERANCE EQUIPMENT, QUALITY CONTROL, ACCEPTANCE, MEASUREMENT AND PAYMENT ADJUSTMENT. Measure the top two lifts of the mainline travel lanes with an DOTD certified inertial profiler. Maintain record of intermediate measures of smoothness quality as described herein. Final acceptance will be based on the last measurement taken on the final wearing course of the travel lanes. Measurement of the center two lanes will be required for airports. Constantly monitor equipment, materials, and processes to ensure that surface tolerance requirements are met.

502.12.1 Equipment: For longitudinal surface tolerance quality control testing and acceptance testing on mainline wearing and binder courses, furnish and use a DOTD certified inertial profiler. DOTD certified profilers will have a DOTD decal indicating the date of certification and profiler system parameter settings. Measure longitudinal surface profile in inches per mile in accordance with DOTD TR 644 and report as the International Roughness Index (IRI).

Verify the profiler system parameter settings before each run. Demonstrate the daily set up procedure and pre-operation tests in accordance with the manufacturer's procedures and DOTD TR 644. Ensure that a copy of the manufacturer's setup, pre-operation, and general operating procedures for measuring surface tolerance are available at all times during measurement.

For transverse smoothness, cross slope, and grade testing, furnish a 10-foot metal static straightedge and electronic or static level for quality control and for Department use. The straightedge and level will also be used for longitudinal quality control testing for mainline wearing course, mainline binder course, and minor wearing course (bike paths, detour roads, parking lots, and shoulders).

502.12.2 Longitudinal Surface Tolerance Quality Control: Within 7 calendar days of placement, for mainline wearing and binder courses, run the certified profiler. View the raw data with ProVAL to determine IRI for each wheelpath. Make corrections to operation and/or mixture to ensure that the overall ride and individual bump requirements are met. Ensure that the following quality requirements are met:

1. Produce IRI which meets the requirements for 100 percent pay in accordance with Table 502-8. Continued surface tolerance penalties are not allowed.
2. Correct all individual bumps which are more than longitudinal value specified in Table 502-5 when tested with a 10-foot metal static straightedge. The Rolling Straightedge Simulation in ProVAL may be used to help identify these bumps.
3. Correct ripples to the satisfaction of the Project Engineer. Report the Rolling Straightedge Simulation for areas with 12 or more small, regular (less than 1/4 inch) bumps in a 100-foot section or for any areas in question.

Minor mixes shall comply with Table 502-5. For minor mixes, use the 10-foot metal static straightedge to check for conformance to specifications.

502.12.3 Transverse Smoothness, Cross Slope, and Grade: The Department will test the surface of the binder and wearing courses at selected locations for conformance to the surface tolerance requirements of this subsection and Table 502-5.

502.12.3.1 Transverse Smoothness: Areas with surface deviations in excess of specification limits shall be isolated and corrected in accordance with 502.12.4. Control the transverse surface finish.

502.12.3.2 Cross Slope: When the plans require the section to be constructed to a specified cross slope, take measurements at selected locations using a stringline, a slope board, an electronic or static level mounted on a 10-foot metal static straightedge, or other comparable device. Control the cross slope for each lane to comply with the tolerances shown in Table 502-5. Make corrections in accordance with 502.12.4.

502.12.3.3 Grade: When the plans require the pavement to be constructed to a specified profile grade, test for conformance at selected locations, using a stringline or other comparable device. Control grade variations so that the tolerances shown in Table 502-5 are not exceeded. Grade tolerances shall apply to only one longitudinal line, such as the centerline or outside edge of pavement. Make corrections in accordance with 502.12.4.

502.12.4 Correction of Deficient Areas: Correct areas as required in 502.12.2 and 502.12.3 and those not meeting Table 502-5. Correct wearing and binder courses as defined in this subsection at no direct pay. In lieu of grinding, the Project Engineer may penalize the contractor $1000 per individual bump specified in Table 502-5 or per "Ripple" as defined in 502.12.2.

502.12.4.1 Deficiencies in Mainline Wearing Course: Correct deficiencies in the final wearing course by:

1. by diamond grinding and applying a light tack coat; or
2. by furnishing and placing a supplemental layer of wearing course mixture at least 1½ inches compacted thickness for the full width of the roadway meeting specification requirements; or
3. by removing and replacing mixture.

If the supplemental layer does not meet specification requirements of Table 502-5, remove and replace or correct it by other methods approved by the Project Engineer.

For areas that will not be improved by grinding such as minor dips, extreme vertical curves, or other areas that are not exempt as measured with a 10 feet metal static straight edge, the Project Engineer may waive the requirement to grind as specified in 502.12.4.

502.12.4.2 Deficiencies in Mainline Binder Courses: Correct deficiencies in binder course: longitudinal, transverse, cross slope, and grade to meet specification requirements by diamond grinding, by milling, or by removing and replacing mixture. Make corrections before subsequent courses are constructed.

502.12.4.3 Deficiencies in Minor Mixes: Correct deficiencies in minor mixes by diamond grinding or approved method at the Project Engineer's direction.

502.12.5 Longitudinal Surface Tolerance Acceptance: Measure the top two lifts of the mainline travel lanes with a DOTD certified inertial profiler. Final acceptance will be based on the last measurement taken on the final wearing course of the travel lanes. Measurement of the center two lanes will be required for airports.

Measure surface tolerance at the completion of the project, or an approved portion of the project in accordance with 105.17.1, and after all corrections have been made in accordance with 502.12.2. Measure the mainline wearing course continuously from start to finish in the direction of travel. The measurement shall be performed by the contractor in the presence of the DOTD certified inspector. The measurement may also be made by the Materials and Testing Section or by a private company approved by the Department. Report one IRI measurement in inches per mile for the entire project or an approved portion of the project. Although grinding may be waived by the Project Engineer, the measured roughness will still contribute to the total IRI for the project. A stand-alone pay adjustment factor will be determined in accordance with 502.15.

Place a start and stop mark at the beginning and end of each travel lane so that measurements can be rerun by the Department if needed. To ensure that the contractor has corrected deficiencies, the Department may spot check for 1/4 inch bumps in accordance with 502.12.2. Partial acceptance due to phasing, sequence of construction, or unavoidable lengthy delay may not exceed 100 percent pay. However, payment exceeding 100 percent for this section of roadway will only be allowed if the smoothness re-measured at the completion of the project meets the requirements of Table 502-8.

For mainline category D measure and submit IRI data to the DOTD certified inspector before starting paving operations.

The DOTD certified inspector will be present for acceptance IRI measurements and will immediately receive a copy of the raw data, the ".erd file" and any files with information about the project, the operator, the equipment, the settings, daily pre-operation results, and a copy of the IRI results via USB flash drive provided by the contractor. In addition to the data transferred by USB storage device, provide to the DOTD certified inspector a paper copy of the IRI report. Acceptance for the project will be in accordance with Tables 502-8, based on the data. The Department may elect to perform and utilize independent ride quality measurements for acceptance at any time.

502.12.5.1 Exclusions: Acceptance IRI measurements shall be taken in its entirety, without exclusions. The Department will then review the profile report obtained for each lane of the mainline wearing course. In special cases or extenuating circumstances, the Project Engineer may isolate or exclude sections of the profile. These include the following:

1. Bridge ends, and sections that are within 150 feet of bridge ends;
2. Outside wheelpath of curb and gutter sections that require adjustment in order to maintain adequate drainage;
3. Manholes, catch basins, valve and junction boxes;
4. Street intersections or rail road crossings of a different grade;
5. Structures located in the roadway which cause abrupt deviations in the profile;
6. Transitions to and from ramps and turn lanes and sections within 200ft of the limits of the project if the limits begin or end at an intersection;
7. Sections where the Project Engineer determines that attaining smoothness is beyond the contractor's reasonable control.

Exclusions will not be used to simply isolate sections of road that are in poor condition when the project is let. The roughness in excluded areas will not be included in the total IRI used for payment purposes. All bumps shall be corrected in the excluded areas to meet the requirements of 502.12.2. The quantity of asphalt represented by the length excluded will not receive a pay adjustment for surface tolerance.

502.12.6 Surface Tolerance Measurement: Measure and report the average IRI of mainlines lane prorated for the entire project.

502.13 DIMENSIONAL REQUIREMENTS. Ensure that mixtures conform to the following dimensional requirements only. No other acceptance tests will be required for these mixtures. Over-thickness and over-width will be accepted at no direct pay.

502.13.1 Thickness: For mixture specified for payment on cubic yard or square yard basis, thickness of mixtures will be determined by the Department in accordance with DOTD TR 602. Under-thickness shall not exceed 1/4 inch.

Correct area under-thickness in excess of 1/4 inch to plan thickness at no direct pay. Furnishing and placing additional mixture in accordance with 502.12.4.1. Correct excesses of 1/2 inch for category D, Table 502-8. When grade adjustments do not permit placing additional mixture, remove the deficient under-thickness area and replace at no additional pay.

For mixtures specified for payment on a per ton basis, thickness of mixtures will be determined by the plans, Table 502-6 (or Table 502-6b for ADT ≤ 1000), and that agreed to with the Project Engineer. Under thickness shall not exceed 1/2 inch. Removal and replacement of deficient under-thickness area(s) or other approved remediation agreed to by the Project Engineer will be at no direct pay.

502.13.2 Width: The width of completed courses will be determined in accordance with DOTD TR 602. Correct under-widths by furnishing and placing additional mixture to a minimum width of 1 foot and plan thickness at no direct pay.

502.14 MEASUREMENT. Measure asphalt concrete by the ton of 2,000 pounds from printed weights as provided in Section 503. Provide stamped printer tickets with each truckload of material delivered denoting JMF number and plant tonnage. Material lost, wasted, rejected or applied contrary to specifications will not be measured for payment.

Any NDT performed shall not be measured for payment.

Removal of pavement markings will be considered incidental to the associated asphalt pay item and will not be measured for pay.

Estimated quantities of asphalt concrete shown on the plans are based on 110 lb/sq yd/inch thickness. The measured quantity of asphalt mixtures will be multiplied by the following adjustment factors to obtain the pay quantity.

Theoretical Maximum Specific Gravity, (G_{mm}) (DOTD TR 327)	**Adjustment Factor**
2.340 - 2.360	1.02
2.361 - 2.399	1.01
2.400 - 2.540	1.00
2.541 - 2.570	0.99
2.571 - 2.590	0.98

The adjustment factor for mixtures with theoretical maximum specific gravities less than 2.340 or more than 2.590 will be determined by the following formulas:

Theoretical maximum specific gravity less than 2.340:

$$F = \frac{2.400}{S}$$

Theoretical maximum specific gravity more than 2.590:

$$F = \frac{2.540}{S}$$

where,

F = quantity adjustment factor

S = theoretical maximum specific gravity of mixture from approved job mix formula

502.14.1 Volume or Area Measurement: The quantities for payment will be the design quantities specified in the plans and adjustments thereto. Design quantities will be adjusted when the Project Engineer makes changes to adjust the field conditions or when design changes are necessary. Design quantities are based on the horizontal dimensions and compacted thickness of the completed course shown on the plans.

502.15 PAYMENT.

502.15.1 Payment General: Payment for all mixes will be at the contract unit price of asphalt mixture accepted on the roadway. Payment for asphalt concrete will include furnishing all required materials, producing the mixtures, preparing the surfaces on which the mixtures are placed, hauling the mixtures to the work site, and placing and compacting the mixtures. Any NDT performed will be considered incidental to the associated asphalt pay item. When the mix does not meet requirements, payment adjustments shall be assessed. Production of mix that is not eligible for 100 percent payment will not be allowed on a continuous basis. When test results demonstrate that payment adjustments are necessary, satisfactory mixture and compaction adjustments shall be made, or production shall be discontinued. All calculations for percent payment adjustments will be rounded to the nearest one (1) percent. Payment for removal of pavement markings will be considered incidental to the associated asphalt pay item. Payment adjustments will be cumulative and determined in accordance with 502.14 and the QA Manual.

502.15.2 Payment for Mixture with Density Requirements:

502.15.2.1 Mainline Mixtures: For all mainline mixtures, adjustments in contract unit price for roadway density as required by Table 502-5 and will be based on PWL using Table 502-9 and Table 502-10 for all acceptance cores with mainline uses in the lot. This payment adjustment will be applied to the mainline tonnage and contract unit price.

In addition, for mainline wearing course, a separate pay adjustment for surface tolerance based on Table 502-8 shall apply for all travel lanes based on the theoretical mainline lane quantity and contract unit price.

The theoretical quantity is computed by using the plan width, the plan thickness, and the total length of travel lanes, without exclusion areas.

502.15.2.2 Mainline Mixtures (≤1000 ADT): Pay for Mainline mixtures with ADT ≤ 1000 may, at the contractor's request at the preconstruction conference, be determined using the average method. Otherwise, pay will be determined as per Section 502.15.2.1. When the average method is being used, the average of the acceptance cores for mainline use for each sublot will be used to determine the sublot pay adjustment using Table 502-7 and the density requirement in Table 502-5. The final pay adjustment for the lot will be determined using a weighted average on tonnage. When using the average method for pay of mainline mixtures, each individual mainline core density must be equal to 90.5 percent density or greater. Segments not meeting the individual core minimum density criteria will have additional cores taken at the direction of the Project Engineer to identify the localized deficient area. The localized deficient area will incur a 50 percent pay adjustment or be subject to removal and replacement at no direct cost to the Department at the discretion of the Chief Engineer.

502.15.2.3 Minor Mixtures: Pay will be determined on the average of acceptance cores for minor use per sublot and the pay of all sublots in the lot will then be averaged to determine the final pay for each lot. Adjustments in contract unit price for roadway density as required by Table 502-5 and will be based on sublot average for minor uses using Table 502-7.

502.15.2.4 Lots with Mainline and Minor: Determine pay using 502.15.2.1 and 502.15.2.2 for the respective uses. Compute the final lot pay percentage for percent density using a weighted average by mix use for the tonnage of the lot. Tonnage representing minor mixture without density requirements is treated as 100 percent pay for purposes of the weighted average.

502.15.3 Payment for Tack: Tack coat as required in 502.08.2.2 "Applying Tack Coat" will be considered incidental to the 502 item. If the Project Engineer adjusts the application rate of tack coat from that specified by the contract document, payment for the asphalt mixture will be increased or decreased based on the difference in the applied quantity of asphalt emulsion shown on paid invoices (total of charges). The contractor shall provide copies of paid invoices for this determination.

502.15.4 Payment Adjustment for Asphalt Cement: A payment adjustment of 50 percent of the 502 item will apply to areas of mixture placed that do not meet specification but are within one asphalt grade of the specification. Mixture placed that exceeds one lower grade difference in specification will be subject to removal and replacement at no direct cost to the Department at the discretion of the Chief Engineer.

The DOTD Central Materials Laboratory and the DOTD Asphalt Technology Laboratory will evaluate the roadway and the contractor's documentation to isolate the area of mixture placed with the lower asphalt grade.

502.15.5 Payment Adjustment for Surface Tolerance: For mainline wearing course, apply a percent payment adjustment as described in Table 502-8 for the total theoretical quantity of tons represented in each lane of the mainline wearing course. Apply the adjustment to the total theoretical quantity and contract unit price.

The total theoretical quantity is computed by using the total length of lanes, the plan thickness, and the plan width, excluding shoulders, minor mixes, and excluded areas as described in 502.12.5.1.

This pay adjustment is in addition to the pay adjustments for density as described in 502.15.2.

502.15.6 Payment for Erected Stringline: When the use of an erected stringline is not specified, but directed by the Project Engineer, an additional payment of $3500 per contract plus $0.25 per linear foot will be made for mixtures placed by the erected stringline method. When the use of an erected stringline is specified, no additional payment will be made.

Payment will be made under:

Item No.	Pay Item	Pay Unit
502-01	Asphalt Concrete	Ton
502-02	Asphalt Concrete	Cubic Yard
502-03	Asphalt Concrete, (Inches Thick)	Square Yard
502-04	Asphalt Concrete (SMA) Wearing Course	Ton

Table 502-4
Plant Produced Asphalt Mixture Requirements and Tolerances

	REQUIREMENTS FOR EXTRACTED ASPHALT CEMENT AND AGGREGATE GRADATION						
U.S. (Metric) Sieve % Passing	½ inch SMA	3/8 inch Nominal	½ inch Nominal	¾ inch Nominal	1 inch Nominal	1.5 inch Nominal	Production Tolerances
2 inch	–	–	–	–	–	100	± 4
1 ½ inch	–	–	–	–	100	90 – 100	± 4
1 inch	–	–	–	100	90 – 100	89 Max.	± 4
¾ inch	100	–	100	90 – 100	89 Max.	–	± 4
½ inch	90 – 100	100	90 – 100	89 Max.	–	–	± 4
3/8 inch	75 Max.	90 – 100	89 Max.	–	–	–	± 4
No. 4	24 – 34	89 Max.	–	–	–	–	± 4
No. 8	16 – 28	32 – 67	29 – 58	26 – 49	23 – 45	19 – 41	± 3
No. 16	–	–	–	–	–	–	± 2
No. 30	12 – 25	–	–	–	–	–	± 2
No. 50	11 – 22	–	–	–	–	–	± 2
No. 100	–	–	–	–	–	–	± 2
No. 200	7 – 13	4.0 – 10.0	4.0 – 10.0	3.0 – 8.0	2.0 – 7.0	1.0 – 6.0	± 0.7
Extracted Asphalt, %	6.0 Min.	–	–	–	–	–	± 0.2
Mix Temperature	–	–	–	–	–	–	± 25˚F

Table 502-5
Asphalt Pavement Requirements

Density, Minimum Percent of Theoretical Maximum Specific Gravity (%Gmm), AASHTO T209 Method C				
Mainline, SMA	93.5			
Mainline	92.0			
Minor with density	90.0			
Surface Tolerance Variation[1]	Longitudinal[2] inches	Transverse[2] inches	Cross Slope[2] inches [%]	Grade[3] inches
Mainline Wearing Courses, Category A, B	1/4	1/8	3/8 [0.3]	1/2
Mainline Wearing Courses, Category C	1/4	1/4	1/2 [0.4]	1/2
Mainline Wearing Courses, Category D	1/2	1/2	3/4 [0.6]	3/4
Mainline Binder Courses	1/4	1/2	3/4 [0.6]	3/4
Minor Mixes[4]	3/8	3/8	3/4 [0.6]	3/4
Bike Paths, Detour Roads and Parking Lots	1/2			
Shoulder, Ramps < 300’	1/2			

[1]Mainline categories based on Table 502-8.
[2]Based on 10 feet, using 10-foot static straightedge and static or electronic level.
[3]Applicable only when profile grade is specified.
[4]Except bike paths, detour roads, parking lots, shoulders, and ramps less than 300 feet.

Table 502-6
Asphalt Concrete General Criteria

Nominal Max., Size Agg.	0.5 inch (12.5 mm)			0.75 inch (19 mm)			1.0 inch (25 mm)				1.5 inch (37.5 mm)	SMA
Type of Mix	Incidental Paving[1]	Wearing Course		Wearing Course	Binder Course		Binder Course		Base Course	ATB[7]	Base Course	Wearing
Level[2]	A	1	2	2	1	2	1	2	1	1	1	2
Coarse Agg. Angularity, % Crushed, (Double Faced), Min. %	55	75	95	95	75	95	75	95	75	75	75	98
Fine Agg. Angularity, Min. %	40	40	44	44	40	44	40	44	40	40	40	45
Flat and Elongated Particles (5:1), Max. %	10											5[9]
Sand Equivalent, Min. %	40	40	45	45	40	45	40	45	40	40	40	NA
Natural Sand - Max. %	---	15		15			15			25	25	0
Asphalt Binder		Table 502-2, (3% minimum for Asphalt Treated base (ATB), 6% min for SMA)										
RAP, Max. % of Mix[3]	25	20	20	20	25	25	25	25	35	35	35	0
	Compacted Mix Volumetrics											
VMA @ N_{design}, Min. %	13.5	13.5	13.5	12.5	12.5	12.5	11.5	11.5	11.5	n/a	10.5	16.0
Air Voids @ N_{design}, %[4]		(2.5-4.5); (no limit for ATB)										
VFA @ N_{design}, %[5]		(69-80); no limit for ATB; no maximum for SMA										
$N_{initial}$ 90% max.[6] (Gyrations)	7	7	7	7	7	7	7	7	7	n/a	7	7
N_{design} 96.5±1 % (Gyrations)	55	55	65	65	55	65	55	65	55	30	55	65
N_{max} 98 % max. (Gyrations)	90	90	105	105	90	105	90	105	90	n/a	90	65
LWT, max. rut-design, mm @ # passes, @ 50^0C	10 @ 10,000	10 @ 20,000	6 @ 20,000	6 @ 20,000	10 @ 20,000	6 @ 20,000	10 @ 20,000	6 @ 20,000	12 @ 20,000	10 @10,000	12 @ 20,000	6 @ 20,000
Dust/Effective Asphalt Ratio, %	0.6 – 1.6											
SCB, min, Jc, KJ/m^2 @ 25^0C	---	0.5	0.6	0.6	0.5	0.6	0.5	0.6	---	---	---	0.6
Design Lift Thickness, inch[8]	≤2.0	1.5–2.0		1.5–2.0	2.0–3.0		2.5–4.0		≥2.5	≥3.0	≥4.0	1.5-2.0

[1]May be used for minor mix uses (except patching and widening), airports, and other incidental items approved by the Project Engineer. (May be used as a standard roadway mix for local governments.)
[2]Mixtures designated at Level 1F and 2F shall meet the requirements of Level 1 and 2, respectively. Additionally, Level 1F and 2F shall meet the friction rating requirements in Table 502-3 for travel lane wearing courses.
[3]RAP is not be allowed for airports or SMA.
[4]Air voids mix design target is a 3.5 percent.
[5]Mix design minimum VFA is 72.0%, Mix design minimum VFA for PG76-22rm is 75.0%, and 71% for 25 mm NMS mixtures.
[6]For Level 1 mixtures, $N_{initial}$ shall be 91.0% max. For Level A mixes, $N_{initial}$ shall be 92.0% max.
[7]Asphalt Treated Base (ATB) may be used for patching of base material, for shoulder <3500 ADT and maintenance widening; when used achieve average density of 90% of G_{mm} as measured per minor mix table.
[8]Absolute minimum of lift thickness across width equal to 1/2 inch lower than minimum lift thickness.
[9]Also must meet a maximum of 25 percent at a 3:1 ratio.

Table 502-6b
Asphalt Concrete General Criteria (<1000 ADT)

Nominal Max., Size Agg.	0.375 inch (9.5 mm)		0. 5 inch (12.5 mm)	
Type of Mix	Incidental Paving[1]	Wearing Course	Incidental Paving[1]	Wearing Course
Coarse Agg. Angularity, % Crushed, (Double Faced), Min. %	55	75	55	75
Fine Agg. Angularity, Min. %	40	40	40	40
Flat and Elongated Particles (5:1), Max. %	10			
Sand Equivalent, Min. %	40	40	40	40
Natural Sand - Max. %	---	20	---	15
Asphalt Binder		Table 502-2		Table 502-2
RAP, Max. % of Mix[2]	25	20		20
	Compacted Mix Volumetrics			
VMA @ N_{design}, Min. %	15.0	15.0	14.0	14.0
Air Voids @ N_{design}, %[3]		2.5-4.5		2.5-4.5
VFA @ N_{design}, %[4]		72-80		72-80
N_{design} 96.5±1 % (Gyrations)	40			
N_{max} 98 % max. (Gyrations)	40			
LWT, max. rut-design, mm @ # passes, @ 50^{0}C	10 @ 10,000	10 @ 15,000	10 @ 10,000	10 @ 15,000
Dust/Effective Asphalt Ratio, %	0.6 – 1.6			
SCB, min, Jc, KJ/m^2 @ 25^{0}C	---	SCB, min, Jc, KJ/m^2 @ 25^{0}C	---	SCB, min, Jc, KJ/m^2 @ 25^{0}C
Design Lift Thickness, inch[5]	≤2.0	Design Lift Thickness, inch[5]	≤2.0	Design Lift Thickness, inch[5]

[1]May be used for minor mix uses (except patching and widening), airports, and other incidental items approved by the Project Engineer. (May be used as a standard roadway mix for local governments.)
[2]RAP is not be allowed for airports or SMA.
[3]Air voids mix design target is a 3.5 percent.
[4]Mix design minimum VFA is 72.0%, Mix design minimum VFA for PG76-22rm is 75.0%
[5]Absolute minimum of lift thickness across width equal to 1/2 inch lower than minimum lift thickness.

Table 502-7
Payment Adjustment Schedule for Minor Mixture and Low (≤1000) ADT Mainline Mixture

Parameter	Percent of Contract Unit Price per Lot		
	100	90	50 or Remove[1]
Average Roadway Density of Lot, % G_{mm}	≥ Lower Limit	-0.1 to -0.9 below lower limit	-1.0 or greater below lower limit

[1]At the option of the Chief Engineer

Table 502-8
Payment Adjustment Schedules for Longitudinal Surface Tolerance, Maximum International Roughness Index, Inches per Mile

Percent of Contract Unit Price per Travel Lane	**102%**	**100%**	**98%**	**80%**	**50% or Remove[1]**
Category A [2] All Interstate and Three or More Lift Construction	<45	<65	65-85	86-105	>105
Category B[2] Two Lift Overlays Over Milled Surface and Two Lift Overlay Over Improved Base	<55	<75	75-95	95-115	>115
Category C Two lift Overlay Over Existing Surface, Single-Lift Overlays with Surface Prep., and Single Lift Overlays Over Milled Surfaces or Improved Base	<55	<85	85-110	111-130	>130
Category D Single-Lift Overlays Over Unimproved Surfaces[3,4]	N/A	20% Reduction	0% - 19% Reduction	N/A	IRI Increase

[1] At the option of the Chief Engineer
[2] Remove and replace any individual 0.05-mile segment having an average greater than 150 in/mile. Removal and replacement will be at the direction of the Chief Engineer. This note does not apply to excluded areas.
[3] A project with an unimproved surface has no surface preparation item.
[4] IRI measurements taken before and after construction.

Table 502-9
Quality Index Values for Estimating Percent Within Limits (PWL)[1,2]

PWL	n = 3	n = 4	n = 5 - 6	n = 7 - 9	n = 10 - 12	n = 13 -15 or greater
99	1.16	1.47	1.68	1.89	2.04	2.14
98	1.15	1.44	1.61	1.77	1.86	1.93
97	1.15	1.41	1.55	1.67	1.74	1.80
96	1.15	1.38	1.49	1.59	1.64	1.69
95	1.14	1.35	1.45	1.52	1.56	1.59
94	1.13	1.32	1.40	1.46	1.49	1.51
93	1.12	1.29	1.36	1.40	1.43	1.44
92	1.11	1.26	1.31	1.35	1.37	1.38
91	1.10	1.23	1.27	1.30	1.32	1.32
90	1.09	1.20	1.23	1.25	1.26	1.27
89	1.08	1.17	1.20	1.21	1.21	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.04	1.04
84	1.02	1.02	1.02	1.01	1.00	1.00
83	1.00	0.99	0.98	0.97	0.96	0.96
82	0.98	0.96	0.95	0.94	0.93	0.92
81	0.96	0.93	0.92	0.90	0.89	0.89
80	0.94	0.90	0.88	0.87	0.85	0.85
79	0.92	0.87	0.85	0.83	0.82	0.82
78	0.89	0.84	0.82	0.80	0.79	0.78
77	0.87	0.81	0.79	0.77	0.76	0.75
76	0.84	0.78	0.76	0.74	0.72	0.72
75	0.82	0.75	0.73	0.71	0.69	0.69
74	0.79	0.72	0.70	0.67	0.66	0.66
73	0.77	0.69	0.67	0.64	0.63	0.62
72	0.74	0.66	0.64	0.61	0.60	0.59
71	0.71	0.63	0.60	0.58	0.57	0.56
70	0.68	0.60	0.58	0.55	0.54	0.54
69	0.65	0.57	0.55	0.53	0.51	0.51
68	0.62	0.54	0.52	0.50	0.48	0.48
67	0.59	0.51	0.49	0.47	0.46	0.45
66	0.56	0.48	0.46	0.44	0.43	0.42
65	0.53	0.45	0.43	0.41	0.40	0.40
64	0.49	0.42	0.40	0.38	0.37	0.37
63	0.46	0.39	0.37	0.35	0.35	0.34
62	0.43	0.36	0.34	0.33	0.32	0.31
61	0.39	0.33	0.31	0.30	0.30	0.29
60	0.36	0.30	0.28	0.27	0.26	0.26
59	0.32	0.27	0.25	0.24	0.24	0.23
58	0.29	0.24	0.23	0.21	0.21	0.21
57	0.25	0.21	0.20	0.19	0.18	0.18
56	0.22	0.18	0.17	0.16	0.16	0.15
55	0.18	0.15	0.14	0.13	0.13	0.13
54	0.14	0.12	0.11	0.11	0.10	0.10
53	0.11	0.09	0.08	0.08	0.08	0.08
52	0.07	0.06	0.06	0.05	0.05	0.05
51	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00

[1] For negative values of Qu or QL. PWLU or PWLL is equal to 100 minus the tabular PWLU or PWLL.
[2] If the value of QU or QL does not correspond exactly to a value in the table, use the next higher value.

Table 502-10
Payment Adjustment for Mainline Pavement Density (PWL)

Roadway Density PWL	Percent Payment
81-100	100
71-80	98
61-70	90
51-60	80
≤50	50 or remove

Section 503
Asphalt Concrete Equipment and Processes

503.01 DESCRIPTION. This section specifies requirements for the certification of asphalt concrete plants and paving equipment. It includes methods and equipment for handling and storing materials, producing asphalt concrete, and transporting and placing asphalt concrete at the job site.

The Department's publication entitled "Application of Quality Assurance Specifications for Asphalt Concrete Mixtures" is hereby made a part of this specification by reference.

503.02 PLANT EQUIPMENT.

503.02.1 General: Provide equipment and processes to proportion aggregates, additives and asphalt cement in accordance with the approved Job Mix Formula (JMF). When the automatic adjustments or other critical control and shutoff devices are not functioning, do not operate the plant. Operate the plant with clean, easily accessible, and accurate thermometers, scales and meters. Immediately repair, replace, or recalibrate equipment when faulty operation is detected.

Provide a system with positive weight control of cold aggregates fed by a belt scale or other device interlocked with the asphalt measuring system to maintain required proportions of combined aggregates and asphalt cement. Heat, dry and mix aggregates with asphalt cement to produce a homogeneous mixture in which all aggregate particles are uniformly coated. Use approved methods to discard the first and last output of the plant after each interruption. Place discarded material in a separate dedicated area.

Digitally display the total quantities and the rates of production of every material used on a DOTD project.

503.02.2 Certification and Calibrations: The Department will certify plants furnishing asphalt mixtures every two years with current Departmental procedures or when any major component is repaired, replaced or upgraded. The plant owner is required to report any major component upgrades to the District Laboratory Engineer. Forward all documentation available upon request by the Department. All plant components and processes are subject at any time to inspection and approval by the District Laboratory Engineer. The plant owner is required every 90 days to have the laboratory gram scales, ignition oven scales, truck platform scales, and weight batchers tested, inspected, and calibrated by a qualified independent scale service or the Weights and Measures Division, Louisiana Department of Agriculture and Forestry.

Within 10 working days of the 90 days plant scale recalibration, the Certified Asphalt Concrete Plant Technician, in accordance with 503.09, will verify calibration of the plant's cold feed bins, RAP feed bins, weight bridges, asphalt pump, and additives measuring devices to stated DOTD standards. The Certified Asphalt Concrete Plant Technician shall notify the DOTD certifying District Laboratory two days prior to plant calibration.

Provide a plant site laboratory conforming to 722.02 as a part of the plant facilities at no direct pay, except as modified herein. Each plant laboratory shall have a minimum floor space of 400 square feet. Laboratories are to be provided for all Quality Assurance testing. Calibrate, verify and document all laboratory equipment according to the procedures, test methods, and frequency in accordance with the current "LADOTD Laboratory Equipment Manual."

503.03 AGGREGATES.

503.03.1 Stockpiles: Store aggregates at the plant site so that no intermixing, segregation, pooling of water or contamination will occur. Ensure that gradation and other properties of aggregate in stockpiles are combined in proper proportions so that the resulting combined gradation will meet the requirements of the approved JMF.

503.03.2 Cold Feed Bins: Blend and proportion all aggregates in cold feed bins.

Provide cold aggregate bins of sufficient size to store the amount of aggregates required for continuous plant operation. Provide a cold bin feed system capable of uniformly delivering the maximum number of required aggregate sizes in their proper proportion. Extend partitions between bins a minimum of 1 foot above the top of bins sufficient to prevent intermixing of aggregate sizes. Do not use the partition as part of the bin.

Calibrate the cold feed system based on the weight of bin material. Feed material from a bin through the individual orifice and bypass to a container to be weighed, or over the calibrated weigh bridge. Calibrate material from each bin separately. Calibrate with manufacturer's recommended procedures and keep records on file. The calibration process shall be part of the contractor's quality control.

Provide an automatic plant no flow alarm and shutoff to cease operations when any aggregate bin becomes empty or flow is interrupted for 20 seconds. If repeated no flow indications are evident, cease operations until continuous flow can be maintained. Provide belt scales for conveyor systems and calibrate accordingly.

When more than one cold bin feeder is used, operate each as a separate unit. Integrate the individual controls with a master control for all materials.

503.03.3 Moisture: Make provisions for introducing the latest moisture content of the cold feed aggregates into the belt weighing system, thereby correcting the conversion of wet aggregate weight to dry aggregate weight. Digitally display dry weight of the aggregate flow in appropriate units.

503.03.4 Screens: Provide a static screen system on top of the fine sand cold feed bin system and the RAP bin system, to ensure removal of objectionable material.

When a belt scale is used, provide a vibrating scalping screen between the cold bin system discharge and the belt scale. Size the screens to remove all oversize aggregate and other objectionable material.

503.03.5 Reclaimed Asphalt Pavement (RAP): If RAP is used, provide a separate cold feed system. Include a scalping screen, bin, feeder belt, and weigh bridge which is fully integrated with the cold feed system and asphalt cement supply system. Calibrate this system in accordance with 503.02.2 and 503.03.2. Add RAP to the dryer in a location as recommended by the manufacturer so that it does not expose the material to direct flame.

503.04 ASPHALT CEMENT.

503.04.1 Working Tank: Provide an asphalt cement working tank capable of uniformly heating the material, under positive control, to the required temperature as recommended by the supplier by methods approved by the District Laboratory Engineer. Provide an asphalt circulating system of adequate size to ensure proper and continuous circulation (except while asphalt is being measured). Equip new tanks with paddle-type mixers or agitators which keep the material in motion and minimize prolonged exposure to the heating source. Maintain the proper mixing temperature of the asphalt. Heat and insulate pipelines and fittings. Provide a sampling spigot in each tank and/or the supply line. Place strainers or screens between the working tank and mixing unit to filter undesirable material. Fix a thermometer graduated in 5°F increments and having an accuracy of ±5°F in the asphalt feed line at an approved location near the discharge valve at the mixer unit to indicate the temperature of asphalt from storage.

503.04.2 Measurement: Measure the asphalt cement either by weight or volume. Ensure that all scales and meters are calibrated and accurate to 0.5 percent. Display by percent the rate of flow of asphalt cement and the total quantity used.

503.04.2.1 Weight Measurement: Provide scales reading to the nearest pound.

503.04.2.2 Volume Measurement: Measure the asphalt cement by volume using a positive displacement pump and record in digital form to the nearest gallon. Periodically check by weight the quantity of asphalt cement delivered. Continuously display in digital form the corrected rate of asphalt cement delivery and the total quantity delivered. Ensure measurement during production is accurate to within 1.0 percent.

503.05 ADDITIVES. When additives are used, digitally display the rate of flow and the total quantity used for each. Provide meters accurate to 0.5 percent.

503.05.1 Anti-Strip: Provide a recirculation anti-strip additive storage tank producing uniform heat with an indicating thermometer at an approved location near the tank discharge point. Place a thermometer graduated in 5°F increments and having an accuracy of ±5°F at an approved point near the anti-stripping tank discharge point before the meter. Disperse anti-strip additive directly into the asphalt feed line at a location between the asphalt control valve and the end of the asphalt discharge line. Ensure that the anti-strip delivery system continuously delivers the proper amount of material and in correct proportion to the asphalt cement. This system must be equipped with a no-flow indicator, which triggers a light or alarm in the control room and an alarm in the plant lab when the anti-strip material is not flowing. If the anti-strip flow is stopped or interrupted for more than 5 minutes, discontinue production until the system is repaired. The equipment shall include a positive displacement accumulating meter which accumulates and displays materials used, and reads to the nearest 0.25 gallon. Additionally, provide a measuring dip stick and a chart correlating tank quantity with the height of anti-strip liquid.

503.05.2 Plant Blending: Equipment required to introduce crumb rubber modifier, latex, or warm mix additives is described herein. Submit a proposed plant equipment diagram to the District Laboratory Engineer for review and forward a copy to the Materials Engineer. Provide written confirmation from the equipment manufacturer that the quantity and type of mixers are appropriate for the proposed materials and flow rates. When modifying asphalt liquid binder at the contractor's plant to meet a new grade of asphalt, provide a Dynamic Shear Rheometer (DSR) for on-site quality control testing.

The District Laboratory Engineer will inspect the plant facilities.

503.05.2.1 In-Line Blending: Provide a sampling spigot in line after the point of mixing and prior to anti-stripping introduction. When modifying the binder with additives, use a totalizing meter to measure the quantity of additive in a similar manner as anti-strip.

503.05.2.2 Single Tank Batch Blending: A single tank system consists of a single blending tank used to blend crumb rubber modifiers. Provide a 20,000-gallon capacity tank or greater, which serves as both a mixing liquid tank and working liquid tank. Continuously mix the liquid and crumb rubber or other additive with paddle type mixers, auger type mixers, or shear mills to properly blend and maintain suspension. Provide a safe and easily accessible sampling spigot.

503.05.2.3 Multiple Tank System: A multiple tank system consists of a blending tank feeding into a working tank used to blend crumb rubber modifiers. The blending tank may be batch or continuous with metered feed controls to accurately maintain proper ratios of crumb rubber or other additive to neat asphalt binder liquid. Properly agitate the mixture in the working tank with paddle type mixers or auger type mixers to maintain suspension of the modified liquid. Provide a safe and easily accessible sampling spigot.

503.05.3 Warm Mix Additives: Provide necessary equipment in accordance with the manufacturer's recommendations and submit a proposed plant equipment diagram to the District Laboratory Engineer for review. Forward a copy to the Materials Engineer.

503.05.3.1 Foaming Using Water Injection: Provide an approved foamed asphalt injection system flow diagram upon request. Provide a control room indicator when using the water injection system.

503.05.3.2 Chemical Additives: Chemical additives are supplied by the liquid supplier, by mixing in the working tank, by in-line blending, or by introducing as an anti-strip. Provide a system that continuously records the quantity of additive used.

503.05.4 Mineral Filler: Proportion mineral filler separately from a bin equipped with an adjustable feed in accordance with Subsection 503.03.2, which can be accurately and conveniently calibrated and be interlocked with the aggregate. The feeder shall accurately proportion the mineral filler and provide a constant flow of material. For continuous drum mixer plants introduce the mineral filler, if used, to the mix at an approved location sufficiently in advance of the addition of the asphalt cement.

503.05.5 Hydrated Lime: When hydrated lime additive is mixed with aggregate on the belt feed, interlock and synchronize the hydrated lime additive equipment with cold feed controls. Equip the system with an automatic no flow indicator that will automatically shut the plant down when a malfunction causes an improper supply of additive or water. Equip the hydrated lime additive system with the following:

1. A separate bulk storage bin with a vane feeder or other approved feeding system that can be readily calibrated. The system shall provide for easy sampling of additive and verification of the quantity dispensed by weight (mass). Ensure the feeder system continuously records the total amount of additive dispensed.
2. An approved spray bar, capable of spraying the composite aggregate with potable water before the addition of hydrated lime additive, when the moisture content of the composite aggregate falls below 3 percent. Ensure the approved equipment and methods consistently maintain the aggregates in a uniform, surface wet condition.
3. An approved pug mill after the cold feed system and before the belt scale.

Dispense the hydrated lime additive directly into the pug mill and composite aggregate. Uniformly blend the additive with the composited aggregate before exiting the pug mill. Obtain the District Laboratory Engineer's review of the process and equipment used for mixing the lime additive and aggregate. Ensure that no less than the required amount of additive is continuously blended with the aggregate.

503.05.6 Fibers: Use a separate feed system to accurately proportion and uniformly distribute the required quantity of mineral fibers into the mixture. Interlock the proportioning device with the aggregate feed or weigh system to maintain the correct proportions for all rates of production. Control the fiber proportion to within ±10 percent of the amount of fibers required. Equip the system with an automatic no flow indicator that will automatically shut the plant down when a malfunction causes an improper supply of fiber. For drum plants, add the fiber adjacent to the asphalt cement discharge location.

503.06 DRUM. Equip the drum with automatic burner controls that continuously agitate aggregates during heating and drying. Provide equipment capable of heating and drying aggregates to meet specifications in the necessary quantities to supply the mixing unit continuously at its operating capacity and at a specified temperature and acceptable moisture content. Slope the drum and maintain flights in accordance with manufacturer's recommendations.

Produce a uniform blend at the specified production rate, with rapid and complete asphalt coating of aggregate. As a minimum, completely coat 95 percent of the coarse aggregate particles retained on the No. 4 sieve when tested in accordance with AASHTO T195.

Process the mixture at the temperature specified on the approved JMF and within ±25°F of the optimum mixing temperature at the discharge. Equip the drum with a thermometer or other temperature device to monitor the discharge temperature of the mix. Use temperature recording device or thermometers graduated in maximum 10°F increments with an accuracy of ±5°F and a sensitivity capable of detecting a change of at least 10°F per minute.

503.07 DUST COLLECTION SYSTEM. Return the fines from the dust collection system at a uniform and regulated rate near the asphalt cement discharge.

503.08 STORAGE AND LOADING OF ASPHALT CONCRETE MIXTURES.

503.08.1 Mix Conveyors: Transport the mix directly from plant to the storage silos or surge bin system by means of an enclosed continuous type conveyor system designed to prevent spillage and match the production rate of the plant. Deliver the mixture to the storage silo or surge bin within ±15°F of plant discharge temperature.

503.08.2 Storage Silos and Surge Bins: Use approved storage silos or surge bins for storing asphalt concrete mixtures.

Ensure that the use of storage silos or surge bins conform to the limitations on retention time, type of mixture, heater operation, bin atmosphere, bin level or other characteristics set forth in these specifications and other requirements stated in granting approval of these facilities. Affix an indicator device to each bin, visible to the loading operator, which is activated when material in the bin drops below the top of the sloped portion. Maintain mixtures above this level during production, except when the plant is not in operation.

When the mixture is placed into a silo or bins through a surge device, provide an automatic warning system to audibly warn the operator of a gate malfunction. Ensure silo or bin unloading gates are either clam shell gates operating under gravity feed or other approved gates that will not cause segregation or be detrimental to the mix.

503.08.2.1 Storage Silos: Maintain a uniform mixture temperature without localized heating. Maximum allowable overnight storage time is 18 hours, provided the silo has an oil sealed discharge gate. The Department may approve additional storage time provided test results and other data indicate that the additional storage time is not detrimental to the mix.

503.08.2.2 Surge Bins: Maintain the mixture at a temperature not less than 25°F below the optimum mixing temperature on the JMF. Do not store the mixture over night.

503.08.2.3 Loading and Sampling: Use haul trucks conforming to 503.11.

Provide a sturdy secured metal sampling platform, with protective rails, at least 30 square feet in area, and set at the proper height to easily obtain a sample. Protect the sampling platform from loaded trucks with barrier rail.

Equip the plant with an approved pressurized system capable of spraying a uniform coating of an approved asphalt mix release agent into the haul unit bed prior to loading. Do not use diesel as a mix release agent.

503.09 SCALES AND METERS.

503.09.1 Scales: Provide scales and meters accurate to ±0.5 percent of the indicated load. Design, construct and install scales and meters so that operations do not affect their accuracy. Calibrate in accordance with 503.02.2. Measure all asphalt concrete mixtures by weigh hoppers or truck platform scales to determine weight for pay.

503.09.2 Weigh Hoppers: Provide weigh hoppers to weigh the mixture or individual material components. Provide hoppers that do not leak or cause segregation. Suspend weigh hoppers from calibrated springless dial scales or load cell scales. Equip the weigh hopper with an approved automatic printer system that will print the certified tare weight of the truck, each batch weight, and total weight of mixture loaded into the truck.

503.09.3 Platform Scales: Provide truck platform scales of sufficient length to weigh the entire unit transporting the mix. Weigh the truck empty to determine tare weight prior to mixture loading. Equip scales with an approved automatic printer system that will print the tare weight as well as the total weight of the unit and the mix.

503.09.4 Printers: Inform the Department in the event of a breakdown of the printing mechanism. Discontinue operations until the printer is repaired or replaced.

503.10 PAVING EQUIPMENT. The Department will inspect primary roadway equipment, including Material Transfer Vehicle (MTV), asphalt distributors, pavers, and rollers, at the start of each project.

503.11 HAUL TRUCKS. The Department will certify haul truck and trailers with a maximum of three trailer combinations for legal payload and volume. Comply with load restrictions in accordance with 105.14. Use trucks having tight, clean, and smooth beds. Spray beds daily or as often as directed with an approved asphalt mix release agent.

Provide a canvas or vinyl cover large enough to completely cover the top and extend over the sides of the bed to protect the mixture from the weather or loss of heat. Use sufficient tie-downs to hold the cover.

Discharge the mixture in a continuous manner so the spreader apron of the paver or MTV will not be overloaded. If the truck or paver is causing surface tolerance penalties or excessive bumps, discontinue its use.

Change equipment or operations when size, speed and condition of trucks interfere with orderly paving operations.

Equip haul trucks used for asphalt surface treatments with a mechanism to provide a positive connection to the aggregate spreader.

503.12 ASPHALT MILLING MACHINE. Use an approved self-propelled milling machine or grinder equipment for milling asphalt surfacing. Provide equipment with sufficient power, traction and stability to remove the thickness of asphalt concrete necessary to provide profile grade and cross slope uniformly across the surface. Provide milling equipment capable of controlling grade or cross-slope from an erected stringline, shoe device or approved traveling reference plane that will accurately reflect the average grade of the surface on which it is to be operated and have an automatic system for controlling cross slope at a given rate. The drum shall be round and true with sufficient number of teeth to yield a uniform and fine textured surface. Equip the milling machine with means to control dust created by the cutting action. Provide adequate loading equipment to immediately remove materials cut from the surface and discharge the cuttings into a truck or on the shoulder as specified or directed.

503.13 ASPHALT DISTRIBUTORS. Provide equipment that ensures even distribution of the asphalt or asphalt emulsion across the entire pavement area at the specified rate as measured per ASTM D2995.

503.13.1 Distributors: The asphalt cement distributor shall be capable of maintaining the allowable variation from any specified rate within ±0.02 gallons per square yard. Equip the distributor with a height adjustable spray bar with spray nozzles recommended by the manufacturer. Assure that the end nozzle over the roadway edge provides a sharp line of asphalt material parallel to the direction of travel. Ensure nozzles remain clean and free from blockage.

Provide means for an accurate and rapid determination of the control and amount of asphalt materials being applied per square yard of surface. Equip the distributor with thermometers to indicate the temperature of the material in the tank. Equip the distributor with a hand-held spray attachment for applying asphalt materials to areas inaccessible with the spray bar.

Within 12 months prior to use, calibrate the asphalt distributor in accordance with ASTM D 2995. Provide the ASTM calibration and furnish the Project Engineer an accurate and satisfactory calibration record prior to beginning the work. The Project Engineer may at any time require verification of calibration accuracy of the asphalt distributor in accordance with ASTM D 2995.

503.14 MATERIAL TRANSFER VEHICLE (MTV). When placing the final two lifts of asphalt concrete on the roadway travel lanes, use a material transfer vehicle (MTV) or lightweight MTV to deliver mixtures from the hauling equipment to the paving equipment, and to minimize thermal and material segregation of the hot mix asphalt concrete.

Ensure that the MTV provides additional mixing of the asphalt concrete mixtures and then deposits the mixture into the paving equipment hopper to reduce segregation and facilitate continuous production. At a minimum, provide an MTV with a high capacity truck unloading system, which will receive mixtures from the hauling equipment; a 20-ton storage bin in the MTV to continuously mix the mixture prior to discharge to a conveyor system; a discharge conveyor, with the ability to swivel, delivering the mixture to a paving equipment hopper while allowing the MTV to operate from an adjacent lane. If the weight of the MTV is determined by the Project Engineer to cause settlement or movement in the base or sub-base, discontinue use. When a malfunction occurs in the MTV during lay-down operations, immediately discontinue plant operations and do not resume until the MTV malfunctions have been remedied. Mixtures in the silo (≤ 100 tons) or materials in transit may be placed.

Due to the weight of the loaded MTV, apply the following restrictions at bridge crossings:

1. Abide by posted weight limits.
2. Prior to crossing a bridge, be as near empty as possible.
3. Do not move across a bridge with any other vehicles being on the bridge.
4. Move on a bridge only within the limits of the travel lanes and do not move on the shoulders of the bridge.
5. Move at a speed no greater than 5 miles per hour when crossing a bridge.

503.14.1 Lightweight MTV: The lightweight MTV has a smaller capacity, is more fuel efficient and may be used in lieu of the MTV. Lightweight MTV's must meet all requirements of the 503.14 MTV and as modified herein. Use a Thermal Profile System in accordance with section 503.14.3 at all times when a lightweight MTV is used in lieu of the MTV. Discontinue use of lightweight MTV when thermal segregation is observed.

The requirement of the 20-ton storage hopper is waived for all lightweight MTVs. The approved remixing methods for lightweight MTV's are:

1. Counter rotating augers,
2. Offset gravity transfer conveyor chute, or
3. Twin interlaced augers.

A tracked or high flotation tires are required for the undercarriage of the MTV to facilitate low ground pressure (< 55 psi).

503.14.2 Windrow Paving: Windrow paving is allowed with the use of an MTV and Thermal Profile System. Equip the MTV with a windrow head attachment capable of removing 95 percent of the mixture off the pavement. Use a Thermal Profile System meeting 503.14.3.

503.14.3 Thermal Profile System: The Thermal Profile System may be used on all projects. The Thermal Profile System is a device capable of continuously recording the temperature of the full width of pavement as the mixture exits the paver with constant record of the GPS location and distance traveled. The system requirements include the capability to provide the Project Engineer with the thermal profile of every roadway sublot and roadway lot.

Mount the system with a recording device to the back of the paver. Provide capability of instant review of data on project site at any time keeping permanent record of all temperature and location data daily.

503.15 PAVERS. Use pavers with an automatic grade control device (dual grade may be required) and slope control devices for use with an approved traveling reference plane or erected stringline, as directed.

Use pavers capable of placing mixtures within specified tolerances. Use a screed or strike-off assembly to distribute the mixture over the entire paving strip. The width of the paving strip must be acceptable to the Project Engineer. Use screed, including screed extensions, to place mixtures that are uniform in appearance and quality. Adjust the screed assembly to provide the required cross section. Equip the screed (including screed extensions) with a heater and a vibrator.

Use a paver insert hopper, in conjunction with the MTV, with a minimum capacity of 5 tons (5 Mg).

Equip pavers with hoppers adequately designed and maintained to prevent spillage. Equip pavers with augers to place the mix evenly in front of the screed, including extensions. Equip pavers with a quick and efficient steering device capable of traveling both forward and in reverse. Provide pavers capable of spreading mixes to required thickness without segregation or tearing.

For shoulder construction or other incidental applications, use modified pavers or widening machines when permitted.

Use auger assembly extensions when screed extensions in excess of 2 feet on a side are to be continuously used in the pavement operation. Extend such auger extensions to within 2 feet of the end of the screed. With approval, the use of an auger extension with screed extensions in excess of 2 feet on one side may be waived for transitions, taper sections and similar short sections.

Do not use a strike-off assembly or boxed extension for paving within the traveled way, except when approved for short irregular sections or non-typical sections.

Ensure that the vibratory screed crowns the pavement with adjustable extensions to accommodate the desired pavement profile.

503.15.1 Spray Paver: Spray pavers are designed to distribute the tack coat immediately before placing the asphalt mixture. Comply with 503.13.1 and ensure that spray pavers evenly distribute the tack coat and apply and level thin asphalt concrete concurrently at a rate of 30 to 92 feet per minute. Do not allow a wheel or other part of the paving machine to come in contact with the tack coat before the hot mix asphalt concrete wearing course is applied. Equip the spray paver to include a receiving hopper, feed system, insulated storage chamber for the tack coat, spray bar, tanks with calibrated load cells, and a variable width heated screed unit.

503.16 COMPACTION EQUIPMENT.

503.16.1 General: Provide self-propelled compaction equipment capable of reversing without backlash. Establish a rolling pattern and provide the number, type and size of rollers sufficient to compact the mixture to the specified density and surface smoothness.

503.16.2 Steel Wheel Rollers: Use either vibratory or non-vibratory steel wheel rollers. Equip the roller with wheels that are true to round and equipped with suitable scrapers and watering devices. Design vibratory rollers for asphalt concrete compaction having separate controls for frequency, amplitude and propulsion.

503.16.3 Pneumatic Tire Rollers: Use treadless tires that are the same size and ply rating, and inflated to a uniform pressure not varying more than ±5 psi between tires. Equip tires with scrapers to prevent adhesion of mixture. The Project Engineer may require additional cleaning and water apparatus on tires if material adhesion is detrimental to the mat.

503.16.4 Equipment for Asphalt Surface Treatments (AST):

503.16.4.1 Pneumatic Tire Rollers for AST: Use a minimum of two self-propelled rollers, weighing at least 12 tons each. Tires shall be smooth tread, of the same size and ply rating. Inflate to a minimum uniform tire pressure of 60 psi, unless damage occurs. The Project Engineer may require a reduction in roller pressure to prevent damage to the aggregate or underlying base course. Wheels shall not wobble and shall be aligned so that the gaps between tires on one axle are covered by tires of the other axle.

503.16.4.2 Power Broom or Blower for AST: Use a power revolving broom or power blower to clean the surface of dust, dirt, mud, and loose or excess material.

503.16.4.3 Aggregate Spreader for AST: Use a self-propelled, pneumatic tire power spreader designed, equipped, and operated to spread aggregate uniformly at the designated rate within the limits of the desired roadway width. The aggregate spreader shall be capable of maintaining an allowable variation from the specified rate within ±0.5 pounds per square yard or ±0.25 pounds per square yard for expanded clay.

Calibrate the aggregate spreader in accordance with ASTM D 5624.

503.16.4.4 Vacuum-Sweeper for AST: Provide a vacuum-sweeper when there is a dusting problem, as determined by the Project Engineer.

503.17 MISCELLANEOUS EQUIPMENT AND HAND TOOLS. Provide power revolving brooms or power blowers that are maintained and in satisfactory working condition.

In areas that are inaccessible to conventional rollers, use satisfactory mechanical compaction equipment, or hot hand tampers. Tamping tools may be used for compacting edges.

Section 504
Asphalt Tack Coat

504.01 DESCRIPTION. Prepare and treat existing asphalt or portland cement concrete pavement surfaces with asphalt material in accordance with these specifications and in conformity with the lines and grades shown on the plans or established.

504.02 ASPHALT MATERIALS. Use an undiluted asphalt emulsion Grade NTSS-1HM, CBC-1HT, CRS-2P, CSS-1H, SS-1H or PET or a hot applied non-tracking tack (NTHAP) as required by Section 501, Section 502, Section 507, and as listed on the Approved Materials List and comply with Section 1002.

504.03 WEATHER LIMITATIONS. Do not apply asphalt tack coat on a wet surface or when the ambient air temperature is below 40°F. For full depth patching, do not place asphalt tack coat when ambient air temperature is below 35°F.

504.04 EQUIPMENT. Provide equipment for applying asphalt material and prepare the surface to be tacked. Apply with equipment conforming to 503.13.1 and 503.15.1. A hand-held pressure nozzle may be used for tack coat application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet or less.

504.05 SURFACE PREPARATION. Clean the pavement surface by sweeping or other approved methods. Satisfactorily clean edges of existing pavements that will form joints with new pavement before tack coat is applied.

504.06 APPLICATION. Uniformly apply asphalt tack coat to a clean dry surface with no bare areas, streaks or puddles with an asphalt distributor at a rate in accordance with Table 504-1. If bleeding, ponding, or slipping are evident, these rates may be reduced to a minimum of 0.04 gallon/square yard with a minimum 0.02 gal/sq yd residual with approval of the Project Engineer.

Table 504-1
Section 502 Asphalt Tack Coats

Surface Type	Rate[1,3]; Gal/Sq yd
Existing Surface Treatment[2]	0.12
New Hot Mix	0.06
Existing Hot Mix	0.09
Portland Cement Concrete	0.09
Milled	0.08

[1]Rates are minimum rates of undiluted asphalt emulsion.
[2]Section 507 Asphalt Surface Treatment Type E Interlayer does not require a tack coat.
[3]Minimum rate for hot applied non-tracking tack (NTHAP) is 0.08 gal/sq yd for all surface types in Table 504-1.

The minimum application temperature of the emulsified asphalt Grades NTSS-1HM, CBC-1HT, CRS-2P and Polymer Emulsion Tack (PET) is 160°F and Grades CSS-1H and SS-1H, is 70°F, or as recommended by the manufacturer. For hot applied non-tracking tack (NTHAP) the minimum application temperature is as recommended by the manufacturer.

Apply tack coat in such manner as to cause the least inconvenience to traffic. Traffic is not permitted on tacked surfaces prior to application of the mixture placement. The contractor will be permitted to apply the tack coat one calendar day prior to the mixture laydown for non-traffic areas. However, when tack coat has been damaged or contaminated by dirt, dust or mud, clean the surface and apply tack coat again prior to the mixture laydown at no direct pay. Reapply tack coat to previously tacked surfaces exposed to damage or due to inclement weather at no direct pay.

504.07 MEASUREMENT. Asphalt tack coat will not be measured for payment and is considered incidental to the associated asphalt concrete pay item; however, it will be measured by the gallon in-place using a calibrated stick and/or charts on level ground at the application temperature described in 504.06 for specification compliance.

504.08 PAYMENT. Payment of asphalt tack coat will not be made; however, the associated asphalt pay items will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials.

Section 505
Asphalt Prime Coat

505.01 DESCRIPTION. An asphalt prime coat is used to seal newly constructed unbound and/or un-stabilized base courses. Prepare and treat a surface with asphalt material in conformance with these specifications and in conformity with lines shown on the plans or established.

505.02 ASPHALT MATERIALS. Prime coat shall be cutback asphalt Grade MC-30, MC-70, or AEP Emulsified Asphalt complying with Section 1002.

505.03 WEATHER LIMITATIONS. Do not apply MC-30 and MC-70 materials on a wet surface. Do not apply asphalt prime coat when ambient air temperature is less than 35°F in the shade.

505.04 EQUIPMENT. Provide the necessary equipment for proper construction of the work. Apply with equipment conforming to 503.13.1. A hand-held pressure nozzle may be used for prime coat application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet or less.

505.05 SURFACE PREPARATION. Shape the surface to be coated to required grade and section. Assure that the surface is free from ruts, corrugations, segregated material or other irregularities, and compact to required density. Delays in priming may necessitate reprocessing or reshaping to provide a smooth, compacted surface.

505.06 APPLICATION. Extend prime coat 6 inches beyond the width of surfacing shown on the plans. Do not apply the prime coat until the surface has been satisfactorily prepared.

Apply prime coat at the rates and temperatures shown in Table 505-1.

Table 505-1
Prime Coats

Asphalt Grade	Application Rate Gal/Sq Yd		Application Temperature °F	
	Min.	Max.	Min.	Max
MC-30	0.25	0.30	60	120
MC-70	0.25	0.30	100	180
AEP	0.25	0.30	60	120

505.07 PROTECTION. After prime coat has been applied, cure for a minimum of 24 hours before placing the mixture. Keep traffic off the surface until the prime coat has properly cured, unless otherwise permitted by the Project Engineer.

If traffic is permitted, spread approved granular material, as directed by the Project Engineer, over the prime coat at no direct pay.

Maintain the prime coat intact. When required, thoroughly clean the primed surface prior to the placement of mixture.

Where the prime coat has failed, clean the failed area and reapply prime coat to the unbound surface at no direct pay. When the prime coat is generally unsatisfactory, reapply prime coat to the unsatisfactory surface at no direct pay.

505.08 MEASUREMENT AND PAYMENT. Asphalt prime coat will not be measured for payment; however, the associated asphalt pay items' payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Payment for surface preparation will be made under other items.

Section 506
Asphalt Curing Membrane

506.01 DESCRIPTION. The Asphalt Curing Membrane is used to cure treated or stabilized base/subgrade layers. Apply and maintain an asphalt curing membrane to the surface of cement or lime treated or stabilized materials in compliance with these specifications or as directed.

506.02 MATERIALS. Asphalt for curing membrane shall be an emulsified asphalt or an emulsified petroleum resin (EPR-1) complying with Section 1002. Water shall comply with 1018.01.

506.03 WEATHER LIMITATIONS. Do not apply asphalt curing membrane when the temperature is below 35°F, unless otherwise permitted by the Project Engineer.

506.04 EQUIPMENT. Provide and maintain the necessary equipment for proper construction of this work. Apply with equipment conforming to 503.13.1. A hand-held pressure nozzle may be used for application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet or less. A gravity flow distribution system will be allowed.

506.05 SURFACE PREPARATION. Assure that the surface to which curing membrane is to be applied is free from ruts, corrugations, loose material or other irregularities.

506.06 APPLICATION. Apply the asphalt curing membrane immediately upon completion of final finishing of the final lift of the surface. Uniformly apply the emulsified asphalt curing membrane in accordance with Table 506-1. Emulsified asphalt may be further diluted with water, to a maximum of 1 part water to 1 part undiluted asphalt emulsion, and applied in multiple passes of the distributor. The total amount of asphalt material applied such that the residual amount of asphalt material equals a minimum of 0.10 gallon per square yard. Remove extraneous material which has collected on the base before additional application of asphalt curing membrane. Maintain and repair the surface before additional applications.

Table 506-1
Asphalt Curing Membrane

Curing Membrane Type	Application Rate[1] Gal/Sq Yd	Application Temperature[2] °F
	Min.	Min.
EPR-1[3]	0.20	70
Emulsified Asphalt[4]	0.10	70

[1]Rates are minimum rates of undiluted asphalt emulsion.
[2]Minimum application temperature or as recommended by the manufacturer.
[3]Undiluted EPR shall consist of 5 parts water and 1 part resin concentrate and comply with Section 1002.
[4]Shall comply with Section 1002.

506.07 PROTECTION. After the curing membrane has been applied, keep public and construction traffic off the surface until the curing membrane has properly cured, unless otherwise directed by the Project Engineer. Maintain the curing membrane at no direct pay until the mixture has been placed. When traffic is permitted, apply additional curing membrane at intervals to protect and cure the surface at no direct pay.

506.08 MEASUREMENT AND PAYMENT. Asphalt curing membrane will not be measured for payment; however, the associated asphalt pay items' payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Water will not be measured for payment.

Section 507
Asphalt Surface Treatment

507.01 DESCRIPTION. This work consists of furnishing properly distributed asphalt material followed by a uniform application of aggregate for building a riding surface, improving the surface friction of a roadway, sealing cracks in the roadway, reducing the rate of oxidation of a surface mixture, or as an interlayer to delay or reduce the occurrence of reflective cracking.

Asphalt Surface Treatment (AST), sometimes referred to as "chip seal," consists of a specified emulsion applied "cold" or polymer modified asphalt material applied "hot," at the temperature range specified in Table 507-1 for cold applications or Table 507-2 for hot applications, respectively. The application rates of asphalt material and aggregates will vary with aggregate size and existing roadway conditions but, for bid purposes only, shall meet the requirements of Table 507-1 or Table 507-2. The Project Engineer will review the actual application rates.

507.02 MATERIALS.

507.02.1 Asphalt: Use asphalt materials complying with Section 1002 that are Approved Material List products. Comply with Table 507-1 or 507-2.

Take samples of asphalt material in the presence of the Project Engineer's representative. The Project Engineer's representative will immediately take possession of the samples.

507.02.2 Aggregates: Aggregates shall comply with 1003.07 and Table 1003-15. Use Approved Material List aggregates shown herein or as designated on the plans.

For hot applications, pre-coat aggregates with a paving grade asphalt cement or a cationic emulsion. For pre-coated aggregates, the residual asphalt content shall be a minimum of 1.4 percent by weight of the aggregate for high absorption aggregates and 0.5 percent minimum by weight for low absorption aggregates as defined in AASHTO T84. The pre-coat applicator shall certify the quantities of pre-coat used in the process. Ensure that the pre-coated aggregate flows freely. The gradation requirements apply to the aggregate after pre-coating. Submit a gradation Certificate of Analysis with each aggregate shipment of 1000 cubic yards or each project, whichever is less. If an emulsion is used for pre-coating, cure the stockpiled pre-coated aggregate prior to use.

507.03 EQUIPMENT. Provide asphalt distributors, pneumatic tire rollers, power brooms or blowers, aggregate spreaders, and vacuum sweepers in accordance with Section 503. Calibrate and maintain the necessary equipment for proper construction.

Keep storage tanks, piping, booster tanks, distributors, and all other equipment used in delivering, storing, or handling asphalt materials clean and in good operating condition.

507.03.1 Power Asphalt Distributor: Provide a computer operated asphalt distributor in accordance with 503.13.1.

507.03.2 Pneumatic-tire Rollers: Use self-propelled rollers, weighing at least 12 tons each in accordance with 503.16.4.1.

507.03.3 Power Broom or Blower: Use a power revolving broom or power blower in accordance with 503.16.4.2.

507.03.4 Aggregate Spreader: Use a self-propelled, pneumatic tire power spreader in accordance with 503.16.4.3.

507.03.5 Vacuum-Sweeper: Provide a vacuum-sweeper when there is a dusting problem in accordance with 503.16.4.4.

507.03.6 Haul Trucks: Provide haul trucks in accordance with 503.11.

507.04 WEATHER LIMITATIONS. Do not apply AST if any of the following conditions occur:

1. Wet or moist surface. Consider the pavement to be excessively moist when it is visibly wet or when a one square foot piece of polyethylene film condenses moisture after being tightly placed on the pavement surface for 15 minutes;
2. Rain has occurred within 24 hours (for hot applied AST only);
3. The air temperature or pavement surface temperature in the shade is less than 60°F; or
4. The air temperature is predicted by the National Weather Service to fall below 60°F within 24 hours after placement.

507.05 PREPARATION OF EXISTING SURFACE. Potholes and surface depressions will be repaired by the Department prior to the asphalt surface treatment work unless shown otherwise on the plans.

Prepare existing surface at no direct pay unless otherwise specified on the plans. Immediately prior to application of the asphalt material, clean and de-grass existing pavements over the full width to be treated. Remove any existing raised pavement markers prior to asphalt concrete overlay operations. Payment for removal of raised pavement markers will be included with the applicable asphalt item. Sweep the pavement with a power broom or blower to remove all loose material. Clean areas not reached by the power broom or blower by hand brooming or blowing.

If used, ensure that the prime coat or curing membrane, is satisfactorily cured and maintained in accordance with Section 505 and Section 506 prior to application of AST.

Obtain the Project Engineer's acceptance of the surface prior to application of AST.

507.06 APPLICATION. After the existing surface has been properly prepared, apply asphalt material and aggregates in the amounts determined by the contractor and accepted by the Project Engineer, and in the sequence specified herein.

Apply and spread asphalt surfacing at the temperatures and sequences given in Table 507-1 or 507-2. The quantities of material given in Table 507-1 or 507-2 may be adjusted by the Project Engineer as field conditions warrant. The type and condition of the surface being covered will affect the required application rate of asphalt material. Use the quantities as recommended by the contractor and accepted by the Project Engineer. Establish the actual rates during the first asphalt and aggregate application.

Before the asphalt surface treatment operation begins, calibrate and set the flow rates of the distributor and spray bar along with the aggregate spreader at a remote location offsite in a manner acceptable to the Project Engineer. Aggregate spread rates may be adjusted by the Project Engineer. It should be noted that after the aggregate spreader passes, the aggregate should never cover 100 percent of the roadway surface. The asphalt coated surface should be visible between the aggregates. Strike off aggregate trucks at the loading area for proper material yield measurements.

The aggregate spreader shall follow immediately behind the asphalt distributor. Make the initial pass with the rollers immediately following the aggregate spreader before the emulsion breaks.

507.06.1 Asphalt Material: In general, the rate of asphalt is increased if the road is absorbent, badly cracked, or coarse, and is decreased if the road is smooth and flushed with asphalt. Guidelines for adjusting the rate of asphalt emulsion in gallons per square yards are shown in Table 507-3.

Do not allow the length of spread of asphalt material to exceed that which can be covered by aggregate within approximately one minute.

Apply asphalt material at a uniform rate for the full width of treatment unless otherwise directed by the Project Engineer. Keep the application of asphalt material consistently within ±0.02 gallons per square yard, otherwise stop construction and recalibrate the distributor to the satisfaction of the Project Engineer.

Adjust the height of the spray bar and the angle of the nozzles so that individual spray fans do not interfere with each other and uniform double or triple coverage is achieved. Maintain a minimum of 100 gallons of asphalt material in the distributor during operation.

Adjust and maintain one of the special spray nozzles at the ends of the spray bar to provide a sharp edge for the asphalt material on the edge of the roadway surface being covered. When the application is less in width than the length of the spray bar, move these special nozzles to provide the specified edge lines.

When any nozzle becomes blocked during application of asphalt material, immediately stop the flow of material and clean the nozzles. When the Project Engineer directs that application be made over less than the full width of the roadway at a time, slightly overlap adjacent treatments longitudinally. Operate the distributor along a marked edge to keep the surface treatment in proper alignment.

To secure uniform distribution at the transverse junction of two treatments, stop the distributor promptly before the flow decreases. Place building paper or other suitable material over the end of the previous application. Start the joining application on the building paper. Satisfactorily remove and dispose building paper in accordance with Section 202 or as directed. Do not burn building papers.

During application of asphalt material, do not splatter adjacent pavements, structures, and trees with asphalt material. Do not clean or discharge the distributor into ditches, borrow pits, on shoulders or along the right-of-way.

Remove excess asphalt material at the junction between distributor loads or correct satisfactorily. Areas of the surface to be treated, which are not covered with asphalt material directly from the distributor shall be covered by means of a hand-held spray attachment equipped with nozzles.

507.06.2 Aggregates: Begin aggregate spreading operations immediately after the application of the asphalt materials. Place all aggregates for hot applications in a surface dry condition. Apply aggregate material within approximately one minute after application of the asphalt material.

Uniformly spread aggregate over the full width of asphalt material with one pass of the spreading equipment and with the application being sharply defined at edges. Do not drive equipment on uncovered asphalt material. When necessary to obtain uniform coverage, hand broom the surface.

Hand spreading will be permitted in conjunction with self-propelled spreaders over areas inaccessible to spreaders. Cover asphalt material with the appropriate rate of aggregate before rolling.

507.06.3 Multiple Applications: When multiple applications are to be placed, allow a minimum of 48 hours to elapse between each successive application of emulsions. Successive hot applications can be placed without delay.

507.06.4 Interlayers: An interlayer shall be Type E as specified herein and may be placed on raw or stabilized base, on a milled surface, between lifts of asphalt, or over existing portland cement concrete pavement which will be overlaid with asphalt. Use a liquid application rate that corresponds to the proper aggregate size given in Table 507-1 or 507-2 as adjusted by the Project Engineer to meet existing conditions. Do not place asphalt concrete on an emulsion surface treatment for a minimum of five days after application. Hot applied interlayers may be overlaid immediately.

507.07 ROLLING AND BROOMING AGGREGATE MATERIAL. Roll the surface immediately after spreading the aggregate material using a minimum of three pneumatic tire rollers. Make the first pass within approximately one minute of spreading the aggregate. Proceed rolling in a longitudinal direction, beginning at the outer edges of the application.

Make a minimum of three (3) passes over a single point. Complete all rolling within 1/2 hour after aggregate material has been spread. Immediately correct any deficiencies or damage in the aggregate material detected during rolling and reroll as directed. Continue rolling aggregate material until uniform coverage has been obtained. Roll the remaining applications as specified for the first application. Do not use a steel wheel roller.

Lightly broom or blow the surface to remove loose material. Completely remove all loose material from all roadway surfaces, including paved shoulders. If the Project Engineer determines the amount of loose material is excessive, pick it up and remove from the project instead of brooming onto the adjacent slopes.

507.08 PROTECTION. Traffic shall not be allowed on the surface until the aggregate has been placed, rolled, and, if necessary, lightly broomed or blown. For cold applications, lightly broom or blow each treatment beginning the next morning, and continue removing loose aggregate up to final acceptance of the project, if necessary.

Distribute aggregate material over the surface to absorb any free asphalt, covering any area deficient with aggregate material, and roll as directed at no direct pay. Do not displace embedded material during maintenance. When placing lightweight aggregate and a dusting problem occurs, use a vacuum sweeper without the sweeper engaged to remove loose aggregate. Loose aggregate material will not be permitted on the surface and shall be promptly removed.

507.09 MEASUREMENT. The quantities of asphalt material and aggregate incorporated into the completed and accepted asphalt surface treatment will be measured separately. Design quantities are based on horizontal dimensions. Design quantities will be adjusted when the Project Engineer makes changes to adjust to field conditions. Each size aggregate will be measured by the square yard per application. Asphalt material will be measured in the distributor by the gallon at application temperatures.

507.10 PAYMENT. Payment for placement and maintenance of asphalt materials and aggregates will be made at the contract unit prices, subject to the payment adjustment provisions of Section 1002 for specification deviations of asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Payment for removal of pavement markings will be included in this pay item.

Payment will be made under:

Item No.	Pay Item	Pay Unit
507-01	Asphalt Material (type)	Gallon
507-02	Aggregate (size)	Square Yard

Table 507-1

Asphalt Surface Treatment (AST) Requirements (Cold Application)

	Course No.	AST TYPE A		AST TYPE B		AST TYPE C	AST TYPE D			AST TYPE E (Interlayer)
Aggregate		Lightweight, Crushed Stone		Lightweight, Crushed Stone		Lightweight, Crushed Stone	Lightweight, Crushed Stone, Crushed Gravel			Crushed Stone, Crushed Gravel
Agg. Friction Rating		I, II		I, II, III		I, II, III	I, II, III, IV			I, II, III, IV
Asphalt Emulsion		CRS-2P		CRS-2P		CRS-2P	CRS-2P			CRS-2P
Application Temp. Minimum		160˚F		160˚F		160˚F	160˚F			160˚F
Application Temp. Maximum		175˚F		175˚F		175˚F	175˚F			175˚F
Number of Applications		2	1	2	1	1	3	2	1	2
Asphalt Emulsion[1] Application Rates Per Course	1	0.39	0.41	0.39	0.31	0.41	0.46	0.39	0.31	0.39
	2	0.29	–	0.29	–	–	0.36	0.29	–	0.29
	3	–	–	–	–	–	0.26	–	–	–
Aggregate Size and Application Rates Per Course[2]	1	S2-0.0111	S2-0.0111	S2-0.0111	S3-0.0075	S2-0.0111	S1-0.0200	S2-0.0111	S3-0.0075	S2-0.0111
	2	S3-0.0075	–	S3-0.0075	–	–	S2-0.0111	S3-0.0075	–	S3-0.0075
	3	–	–	–	–	–	S3-0.0075	–	–	–

[1]Application rates are in gallons of asphalt emulsion per square yard of AST.

[2] Size aggregate and application rates. For example, S2 is Size 2 aggregate and 0.0111 is the application rate in cubic yards of aggregate per square yard of AST. S1A may be used in lieu of S1. Aggregate sizes for AST are shown in Table 1003-15.

Table 507-2

Asphalt Surface Treatment (AST) Requirements (Hot Application)

	Course No.	AST TYPE A		AST TYPE B		AST TYPE C	AST TYPE D			AST TYPE E (Interlayer)
Aggregate		Lightweight, Crushed Stone		Lightweight, Crushed Stone		Lightweight, Crushed Stone	Lightweight, Crushed Stone, Crushed Gravel			Crushed Stone, Crushed Gravel
Agg. Friction Rating		I, II		I, II, III		I, II, III	I, II, III, IV			I, II, III, IV
Asphalt Cement[1]		PAC-15		PAC-15		PAC-15	PAC-15			PAC-15
Application Temp. Minimum		300˚F		300˚F		300˚F	300˚F			300˚F
Application Temp. Maximum		360˚F		360˚F		360˚F	360˚F			360˚F
Number of Applications		2	1	2	1	1	3	2	1	2
Asphalt Cement[2] Application Rates Per Course	1	0.30	0.31	0.30	0.24	0.31	0.36	0.30	0.24	0.30
	2	0.23	–	0.23	–	–	0.28	0.23	–	0.23
	3	–	–	–	–	–	0.20	–	–	–
Aggregate Size and Application Rates Per Course[3]	1	S2-0.0111	S2-0.0111	S2-0.0111	S3-0.0075	S2-0.0111	S1-0.0200	S2-0.0111	S3-0.0075	S2-0.0111
	2	S3-0.0075	–	S3-0.0075	–	–	S2-0.0111	S3-0.0075	–	S3-0.0075
	3	–	–	–	–	–	S3-0.0075	–	–	–

[1]See Table 1002-11.
[2]Application rates are in gallons of asphalt cement per square yard of AST.
[3]Size aggregate and application rates. For example, S2 is Size 2 aggregate and 0.0111 is the application rate in cubic yards of aggregate per square yard of AST. S1A may be used in lieu of S1. Aggregate sizes for AST are shown in Table 1003-15.

Table 507-3
Asphalt Emulsion Adjustment Rate

Existing Surface Condition	**Adjustment rate in Gallons/Sq Yd**
Black, flushed asphalt	-0.10 to -0.06
Smooth, non-porous	0.00
Absorbent, porous, oxidized	0.03 to 0.09

Section 508
Vacant

Section 509
Milling Asphalt Pavement

509.01 DESCRIPTION. Remove asphalt concrete surfacing by milling in accordance with these specifications and in conformity with the average depth, width, grade, cross-slope and typical sections shown on the plans or as established.

509.02 EQUIPMENT. Use an approved self-propelled milling machine or grinder for milling asphalt surfacing in accordance with 503.12.

509.03 CONSTRUCTION REQUIREMENTS. Prior to milling, pavement surface shall be clean, free of debris, properly de-grassed, and swept if necessary.

Pavement surfaces resulting from milling operations shall be of uniform texture, grade and cross slope and free from loose material. Re-mill surfaces not meeting these requirements at no direct pay. Uneven, undulating surfaces will not be accepted. If ridges are excessive, the Project Engineer may require additional milling, replacement of milling machine teeth, or other corrective action. Limit the maximum depth of milling to 2 inches per day when traffic is being maintained. Maintain a maximum 2-inch depth at milling edge of embankment at all times

Use a minimum length 25-foot traveling reference plane on the first pass of the milling machine. A shoe device may be used on adjacent passes.

When the entire roadway width has not been milled to a flush surface by the end of a work period, resulting in a vertical or near vertical longitudinal face exceeding 2 inches in height, slope this longitudinal face as directed. Place smooth transitions at transverse joints prior to restoring to traffic by milling or by using an asphalt concrete mix. Do not use RAP. Transitions shall be a minimum length of one linear foot per 1/4 inch of the milled depth. Make provisions at drives and turnouts to maintain local traffic.

Remove asphalt concrete next to structures or in small irregular areas that cannot be removed by the milling machine by other acceptable methods.

Provide drainage of milled areas, as necessary, by cutting through the shoulder to the ditch on the same day that adjacent milling is performed. After the roadway is completed, but prior to any required shoulder overlay, restore areas where drainage cuts are made in-kind, in accordance with Section 203, 401, 510, or 602.

The milling operation shall not precede the subsequent paving operation by more than 5 calendar days. Delay in starting the paving operations that causes a further degradation in the milled surface shall be corrected by the contractor by additional milling or providing leveling at no additional pay.

Severe raveling or degradation of the milled surface that occurs shall be reported to the Project Engineer in writing with station locations identified. The Project Engineer will direct corrective action.

Place temporary pavement markings prior to opening the roadway to traffic in accordance with Section 713.

Immediately haul, or as agreed upon by the Engineer, all reclaimed asphalt pavement (RAP) material to be retained by the Department for its recycling program, or by other government entities to the storage facility indicated on the plans and stockpile as directed. The contractor may also be required to retain a specified percentage or quantity of the RAP generated by the project.

Make required joint repairs prior to milling. Complete pavement patching before milling, unless additional areas requiring patching are exposed by the milling. Perform pavement patching and joint repair in accordance with Section 510. The initial face of a butt joint can match the radius of the cold planing milling drum. No true vertical face is required.

509.04 MEASUREMENT. The Department will measure milling by the square yard of asphalt concrete surfacing satisfactorily removed. No additional measurement will be made for multiple passes required to achieve total milling depth shown on the plans. Measurement of contractor retained RAP will be by the cubic yard, theoretical in-place plan quantity, and will be credited to the Department by treating it as a negative quantity in the Schedule of Pay Items.

Should the project generate more RAP than the original bid quantity; either by error in original quantity, extending the project limits, or any other reason; the contractor will receive the extra RAP generated at the original ratio of contractor retained bid quantity to DOTD retained RAP.

Should the project generate less RAP than the original quantity; either by error in original quantity, reducing the limits of the project, or any other reason; the contractor will receive the full amount of the original RAP quantity that was bid on or the full quantity of the RAP generated, whichever is less.

509.05 PAYMENT. Payment for milling of asphalt pavement will be made at the contract unit price per square yard, which includes the costs for removing, hauling and stockpiling of RAP material. The value of the RAP material retained by the contractor will be credited to the Department at the contract unit price for the retained material. The Department makes no assurances regarding the quality of existing asphalt pavement to be milled. No adjustment in payment related to quality of existing pavement to be milled will be made to either the contractor or the Department.

Drainage cuts placed through the shoulders, drop off transitions and transitions at transverse joints will be at no additional pay. Restore areas where drainage cuts are made in-kind, in accordance with Section 203, 401, 510, or 602, at no additional pay.

Payment for temporary pavement markings will be included under appropriate pay items.

Payment will be made under:

Item No.	Pay Item	Pay Unit
509-01	Milling Asphalt Pavement	Square Yard
509-02	Contractor Retained Reclaimed Asphalt Pavement	Cubic Yard

Section 510
Asphalt Concrete Pavement Patching, Widening, and Joint Repair

510.01 DESCRIPTION. Use asphalt concrete to patch, widen and repair joints of existing concrete pavements, asphalt concrete pavements, and composite pavements in accordance with these specifications and in conformity with the lines, grades and typical sections shown on the plans or as directed.

510.02 MATERIALS. Use any type of asphalt concrete mixture for patching and widening listed in Section 502, other than 1/2 inch nominal maximum size mixtures. For joint repair, use Incidental Paving Asphalt Concrete (Level A) complying with Section 502. Use asphalt tack coat complying with Section 504.

510.03 EQUIPMENT. Furnish equipment that meets the specification requirements in Section 503 for the types of material used.

510.04 GENERAL CONSTRUCTION REQUIREMENTS. Remove existing surfacing and base materials by sawcutting and perform all required excavation for patching and widening. Sawcuts shall be for the full depth of the pavement along the perimeter of the pavement to be removed as marked by the Project Engineer. Sawcuts shall be made with a diamond bladed concrete concrete saw for the full depth of patch if patching is performed on the final riding surface. Patching performed on underlying surface can be full depth sawed with a rock saw or milled out with a roto-mill or stabilizer, unless otherwise specified in plans. When through traffic is maintained, place the pavement widening material, or fill and compact open areas or trenches at the end of each day's operations. Under-thickness in excess of 1/2 inch will be corrected at no direct pay.

Excavate and dispose of the excess material beyond the right-of-way in accordance with Section 202 at no direct pay. Uniformly compact the subgrade.

For joint repair, clean contact surfaces of existing pavement and apply a thin, uniform layer of approved asphalt tack coat prior to placing asphalt mixture in the joint.

Patch and widen with asphalt concrete conforming to Section 502 except that priming of the subgrade will not be required. Clean contact surfaces of pavement and apply a uniform layer of approved asphalt tack coat before placement of asphalt concrete. Do not overlay patches for a minimum of 5 calendar days.

Spread, finish, and compact the asphalt concrete leaving the surface smooth and slightly above the edge of existing pavement. To provide lateral support, the contractor may construct temporary berms of excavated material against the outside edge of widening strips prior to rolling. If outside edges of widening strips are not edged up by the end of the work day, place super cones or drums on a maximum of 100-feet centers at no direct pay.

510.05 MEASUREMENT.

510.05.1 Patching: The Department will measure patching of pavement by the square yard or ton of existing pavement designated to be removed and replaced. Saw-cutting, removal of existing surfacing, base course, required excavation, and application of tack coat will not be measured for payment.

510.05.2 Widening: The quantities of widening for payment will be the design areas in square yards or ton as shown on the plans and adjustments thereto. Adjust design quantities if the Project Engineer makes changes to adjust to field conditions. Design quantities are based on the horizontal dimensions shown on the plans. No measurement for payment will be made for widening placed outside the dimensions shown on the plans unless dimensional requirements were re-established by the Project Engineer due to field conditions. Required excavation, removal of existing pavement and base course, asphalt tack coat and disposal of removed material will not be measured for payment. Measure the thickness and width in accordance with DOTD TR 602.

510.05.3 Joint Repair: The Department will measure joint repair by the ton of asphalt concrete used to fill the joint. Measurement will be made in accordance with 502.14.

510.06 PAYMENT.

510.06.1 Patching: Payment for pavement patching will be made at the contract unit prices per square yard or ton, subject to the following provisions:

Payment adjustments for deficiencies in asphalt concrete and asphalt materials will be applied at 1/2 the contract unit price for pavement patching. Asphalt concrete will be subject to the payment adjustment provisions of Section 502, Table 502-7 with 4-inch cores allowed.

When the Project Engineer orders additional thickness of patching in excess of plan thickness, payment for the additional thickness will be made as follows. When patching is on a square yard basis, the value per inch thickness will be calculated by dividing the contract unit price per square yard by the plan thickness. Thickness of patches will be measured from the surface that exists at the time of patching. Payment for the additional thickness will be made at 50 percent of the value per inch thus determined.

When the Project Engineer approves of an under-thickness of patching less than plan thickness, a deduction in payment will be made. The value per inch will be calculated by dividing the contract unit price per square yard by the plan thickness. This deduction per inch of under-thickness will be made at 50 percent of the value per inch.

When payment for patching is made per ton, no adjustment in unit price will be made for additional thickness or under-thickness. Any patching that develops or is required between the time of initial patching operations and the placement of the first lift of asphalt concrete will be paid for at the contract unit price. Any patching required due to base failure after placement of the first lift of asphalt concrete will be paid for at twice the contract unit price.

510.06.2 Widening: Payment for pavement widening will be made at the contract unit price per square yard or ton. Over-widths will be accepted at no additional pay. Correct under-widths by furnishing and placing additional asphalt concrete to a minimum width of 1 foot and plan thickness at no direct pay. Payment adjustments for deficiencies in asphalt concrete and asphalt materials will be applied at 1/2 the contract unit price for pavement widening. Asphalt concrete will be subject to the payment adjustment provisions of Section 502.

510.06.3 Joint Repair: Payment for pavement joint repair will be made at the contract unit price per ton.

Payment will be made under:

Item No.	Pay Item	Pay Unit
510-01	Pavement Patching	Square Yard
510-02	Pavement Widening	Square Yard
510-03	Pavement Joint Repair	Ton
510-04	Pavement Patching	Ton
510-05	Pavement Widening	Ton

PART VI – RIGID PAVEMENT

SECTION 601 – PORTLAND CEMENT CONCRETE PAVEMENT:

Subsection 601.03.8.7 – Dowel Bars (10/18), Pages 314 and 315

601.03.8.7 is deleted and replaced with the following:

601.03.8.7 Dowel Bars: Dowel bars shall have a uniformly round cross section and shall be saw-cut, smooth, and free of burrs, projections, and deformations. Dowel bars shall be coated in accordance with 1009.03.

Place dowel bars in approved basket assemblies or by an approved mechanical device that is capable of accurately placing the dowels to the proper depth and alignment. Position dowel bars parallel to the pavement centerline, and parallel to the surface without any skew of individual bars.

Carefully and thoroughly consolidate the concrete around the dowel bars. When using a mechanical insertion device for placement, firmly hold dowel bars in position during the consolidation process so that the bars do not move when released in the concrete by the mechanical insertion device.

Accurately and securely, mark the transverse centerline of the in-place dowel bars prior to sawing the transverse contraction joint over the dowels.

Provide an approved expansion tube on each bar used in expansion joints. The tube shall fit the dowel bar tightly and the closed end shall be watertight. Locate dowel bar placement as shown on the plans.

For plastic coated dowel bars, with the approval of the engineer, repair all slightly damaged coatings of dowel bars by lightly oiling or greasing; otherwise replace.

SECTION 602 – PORTLAND CEMENT CONCRETE PAVEMENT REHABILITATION:

Subsection 602.09 – High Early Strength (HES) Concrete Pavement Full and Partial Depth Patching (07/19), Pages 334 and 335

602.09 is deleted and replaced with the following:

602.09 HIGH EARLY STRENGTH (HES) CONCRETE PAVEMENT FULL AND PARTIAL DEPTH PATCHING. When specified or when construction conditions merit opening patched areas to traffic before concrete is fully cured, and approved by the engineer, high early strength concrete (HES) shall be used in accordance with Section 902.

Texture the patch surface to match the texture of adjoining pavement. If pavement is to be overlaid, only-drag finish the patched surface. The finished patched surface shall meet the surface finish requirements of 601.03.11 except the finished patched surface profile shall meet a maximum 1/4 inch deviation using an approved minimum 10-foot metal static straightedge.

Subsection 602.16.3.2 – Consistency (04/19), Page 342

602.16.3.2 is deleted and replaced with the following:

602.16.3.2 Consistency: The slurry shall be of such consistency that the efflux time from the flow cone, when tested in accordance with ASTM C939, is 12 to 18 seconds for undersealing, and 15 to 26 seconds for slabjacking.

Subsection 602.16.5 – Dowel Bar Retrofit (10/18), Page 343

Paragraph 1, 2, and 3 of 602.16.5 is deleted and replaced with the following:

602.16.5 Dowel Bar Retrofit: Install coated 1 1/2 inch diameter by 18-inch long plain round dowel bars into slots cut across and through existing concrete pavement transverse joints. Remove the existing portland cement concrete pavement from the slots and retro fit the dowel bars across the pavement joints. Fill the voids surrounding the dowel bars with a rapid setting concrete patching material on the AML. Saw and seal the transverse joints as required in the plans.

All work shall conform to the plans, and the following requirements.

Patented processes or devices for simultaneous cutting of slots for dowel bar retrofitting shall conform to 107.03.

Subsection 602.16.5.2 – Construction Requirements (10/18), Page 344

Paragraph 6 of 602.16.5.2 is deleted and replaced with the following:

When using plastic coated dowel bars, lightly oil or grease the dowel bars prior to placement. The bar chairs shall provide a minimum of 1/2-inch clearance between the bottom of the dowel bar and the bottom of the slot. Center the dowel bars over the transverse joint. Place the bar in the middle of the slot to the depth shown on the plans, parallel to the roadway centerline and the roadway surface. The chairs shall hold the dowel bar securely in place during placement of the patching mix.

PART VII – INCIDENTAL CONSTRUCTION

TABLE OF CONTENTS:

Sections 741, 742, 743, and 744 (08/22), Page 350

Items 741, 742, 743, and 744 are deleted and replaced with the following:

SECTION 701 – CULVERTS AND STORM DRAINS:

All Subsections (07/20), Pages 351 – 363

701 is deleted and replaced with the following:

Section 701
Culverts and Storm Drains

701.01 DESCRIPTION. Furnish, install, and clean pipe, pipe arch, storm drains, and sewers, also referred to as culverts or conduits, in accordance with these specifications and in conformity with the lines and grades shown on the plans or as established by the engineer.

701.02 MATERIALS. Materials shall comply with the following sections and subsections:

Usable Soil	203.06.1
Selected Soil	701.08.1
Plastic Soil Blanket	203.10
Flowable Fill	710
Portland Cement Concrete	901
Mortar	1001.03
Stone	1003.03.1
Recycled Portland Cement Concrete	1003.03.2
Granular Material	1003.09
Bedding Material	1003.10
Thermoplastic Pipe	1006
Split Plastic Coupling Bands	1006.06
Plastic Yard Drain Pipe	1006
Gasket Material	1016.01.1
Reinforced Concrete Pipe	1016.02
Reinforced Concrete Pipe Arch	1016.03
Bituminous Coated Corrugated Steel Pipe and Pipe Arch	1007.02
Structural Plate for Pipe, Pipe Arch and Arch	1007.04
Corrugated Aluminum Pipe and Pipe Arch	1007.05
Coupling Bands	1007.09, 1007.08.1
Reinforcing Steel	1009
Geotextile Fabric	1019

701.02.1 Side Drain Pipe or Side Drain Pipe Arch: When an item for Side Drain Pipe or Side Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch in conformance with Sections 1006, 1007, or 1016, as indicated by the pay item, unless otherwise specified.

701.02.2 Cross Drain Pipe or Cross Drain Pipe Arch: When an item for Cross Drain Pipe or Cross Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch in conformance with Sections 1006, 1007 or 1016, as indicated by the pay item, unless otherwise specified.

701.02.3 Storm Drain Pipe or Storm Drain Pipe Arch: When an item for Storm Drain Pipe or Storm Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch in conformance with Sections 1006 or 1016, as indicated by the pay item, unless otherwise specified.

701.02.4 Yard Drain Pipe: When an item for Yard Drain Pipe is included in the contract, furnish thermoplastic pipe in accordance with Section 1006 unless otherwise specified.

701.02.5 Material Type Abbreviations:

701.02.5.1 Reinforced Concrete Pipe:

RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch

701.02.5.2 Corrugated Metal Pipe:

CAP	Corrugated Aluminum Pipe
CAPA	Corrugated Aluminum Pipe Arch
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch
BCCSP	Bituminous Coated Corrugated Steel Pipe
BCCSPA	Bituminous Coated Corrugated Steel Pipe Arch

701.02.5.3 Thermoplastic Pipe (TPP):

TPP	Thermoplastic Pipe
PVCP	Polyvinyl Chloride Pipe
RPVCP	Ribbed Polyvinyl Chloride Pipe
CPEPSW	Corrugated Polyethylene Pipe Single Wall
CPEPDW	Corrugated Polyethylene Pipe Double Wall
CPPPDW	Corrugated Polypropylene Pipe Double Wall

701.02.6 Joint Type Abbreviations:

T1	Type 1 Joint
T2	Type 2 Joint
T3	Type 3 Joint

701.02.7 Quality Assurance for Pipe: Manufacturing plants will be periodically inspected for compliance with specified manufacturing methods, and material samples will be randomly obtained for laboratory testing for verification of manufacturing lots. Materials approved at the manufacturing plant will be subject to visual acceptance inspections at the jobsite or point of delivery.

701.02.8 Pipe Definitions: Flexible pipe consists of all corrugated metal and thermoplastic pipe.

701.03 EXCAVATION. For all trench excavation, ensure that the sides of the trench are stable, as evidenced by the sides of the trench being able to maintain a vertical cut face. Consider the sides unstable if fissures develop in the face of or adjacent to the open excavation; if the edge of the excavation subsides; if material ravels, spalls, or slumps from the face of the excavation; or if the bottom of the excavation bulges or heaves. In all cases of apparent distress, or when the trench excavation exceeds 5 feet in depth, sloping, benching, and shoring will be required in accordance with the OSHA trench safety standards, 29 CFR § 1926 (P). Consider these and any more stringent trench safety standards as minimum contract requirements.

Submission of bid and subsequent award of contract will serve as certification that all trench excavation in excess of 5 feet will be in compliance LA R.S. 48:251.1.

Consider all available geotechnical information when designing the trench excavation safety system, including groundwater. Evaluate trench stability due to the effects of surcharge loads from adjacent structures, stored materials and equipment, or traffic. Ensure that excavated material is placed a sufficient distance back from the trench edge to preclude material from falling back into the trench, otherwise provide an adequate retention system.

Ensure that the bottom width of a pipe trench provides at least 18 inches of clearance on each side of the pipe. For flexible pipe with a diameter greater than or equal to 48 inches provide, a minimum of 24 inches of clearance on each side of the pipe. In accordance with 202.02, satisfactorily dispose of surplus excavated material that does not conform to the requirements of 203.06.1. Control rainfall runoff or excess moisture by proper selection of backfill materials, dewatering sumps, wells, well points, or other approved procedures during excavation, bedding installation, over-excavated trench backfilling, pipe placement, and pipe backfill.

701.03.1 Over-Excavation: When encountering unsuitable material as defined in 203.04, or a stable, non-yielding foundation cannot be obtained at either the established pipe grade or at the grade established for placement of the bedding, remove unstable or unsuitable material below this grade and replace with granular material complying with 1003.09, bedding materials complying with 1003.10, or Type A backfill complying with 701.08.1. Place all granular backfill materials below the established pipe or bedding grade in lifts less than 8 inches thick. Compact sufficiently with a dynamic mechanical hand compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

When encountering rock, remove the rock below grade and replace it with granular material, bedding materials, or Type A backfill. Provide a compacted earth cushion thickness under the pipe of at least 1/2 inch per foot of fill height over the top of the pipe with a minimum thickness of 8 inches. Place all granular backfill materials below the established pipe or bedding grade in lifts less than 8 inches thick. Sufficiently compact with a dynamic mechanical hand operated compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

Materials used to backfill in an over-excavated portion of a trench do not require encasement in a geotextile fabric.

701.04 FORMING PIPE BED. When specifying bedding material, construct in accordance with Section 726. Materials allowed for bedding shall comply with 1003.10 or may be type A backfill materials. When specifying bedding materials, perform additional excavation below established pipe grade and place the bedding material in lifts less than 8 inches thick. Lightly compact with a vibratory plate compactor over the surface of each lift then scarify 3 inches deep minimum 1/3 pipe diameter wide.

When the bottom of the pipe is not laid in a trench but constructed above natural soils, construct a uniform bed as specified for the bottom of a trench.

In lieu of removing and replacing unstable soil with granular material, bedding material, or Type A backfill material, a cabled articulated concrete block mattress meeting the requirements of Section 712 may be used with a 6-inch layer of bedding material between the pipe and the mattress installed in accordance with Section 726. Excavate the trench to a depth 6 inches plus the thickness of the mattress below the grade line of the pipe. Join adjacent mattress segments together to form a continuous supporting foundation beneath the pipe to the satisfaction of the engineer.

701.05 LAYING PIPE. Begin laying pipe at the downstream end of the line. Ensure that the pipe is in contact with the foundation throughout its length. Place bell or grooved ends of pipe and outside circumferential laps of riveted metal pipe facing upstream. Place riveted seam metal pipe with longitudinal laps at sides. Pipes in each continuous line shall have the same wall thickness. Handle metal pipes provided with lifting lugs only by these lugs.

After laying pipe and before placing backfill, the engineer will inspect the pipe for alignment, grade, integrity of joints, and coating damage.

701.06 JOINING PIPE.

701.06.1 Joint Usage: Joints types shall be selected in accordance with Table 701-1 and the roadway classification provided in the plans.. If the roadway classification is not provided in the plans, use Type 3 joints for all cross drain applications other than on local roads. Unless otherwise directed or specified, joint types for connecting side roads shall match the mainline roadway classification.

Table 701-1
Joint Type Selection

Joint Type	Application	Roadway Classification
Type 1 (T1)	Side Drain	All roadway classifications
Type 2 (T2)	Cross drains	2-lane Collector roadways and Local roadways
Type 3 (T3)	Cross drains	Freeways, Ramps, Arterials and multi-lane Collector roadways
	Storm drains, flumes, siphons, other watertight systems	All roadway classifications

701.06.2 Concrete Pipe: Concrete pipe may be either bell and spigot or tongue and groove. Join pipe sections so that ends are fully entered and inner surfaces are flush and even.

Use an approved mechanical pipe puller for joining pipes over 36 inches in diameter. For pipe 36 inches or less in diameter, use any approved method for joining pipe that does not damage the pipe.

Joints shall comply with 1016.01.1 and 1018.03. Seal with gasket material installed in accordance with the manufacturer's recommendations.

701.06.3 Metal Pipe: Firmly join metal pipe by coupling bands. Center bands over the joint.

For Type 1 joints, place approved gasket material in one corrugation recess on each side of the joint at the coupling band and on each band connection in such manner to prevent leakage.

When Type 2 or 3 joints are specified, join metal pipe sections as follows:

701.06.3.1 General: Seal band joints with gasket material. Place gasket material in accordance with the plan details.

701.06.3.2 Circular Section: Connecting bands shall be of an approved design. Install in accordance with plan details.

701.06.3.3 Arch Section: Connecting bands shall be a minimum of 12 inches wide for a pipe arch less than 36 inches round equivalent diameter, and a minimum of 21 inches wide for pipe arch 36 inches round equivalent diameter and greater. Connect bands at the ends by approved angle or strap connections. Use two-piece connecting bands for a pipe arch 36 inches round equivalent diameter and greater.

701.06.4 Thermoplastic Pipe: Joints for thermoplastic pipe shall be bell and spigot or split coupling bands.

701.06.4.1 Bell and Spigot Type Joint System: Join pipe sections so that ends are fully entered and inner surfaces are flush and even.

Use any approved method for joining pipe that does not damage the pipe.

After joints approval, seal with a rubber gasket material complying with 1007.08.4.1.

701.06.4.2 Split Coupling Type Joint System: Split coupling bands shall comply with all dimensional and material requirements of 1006.07. Center the bands over the joint. Secure the split coupling band to the pipe with a minimum of five stainless steel or other approved corrosion resistant bands.

After joints approval, seal with gasket material. Place gasket material in the first two corrugation recesses on each side of the pipe connection. Also place gasket material on each band connection to prevent leakage. When using flexible thermoplastic gasket material, it shall be a minimum of 1/2 inch in size. Tighten the bands to create overlap of the band and adequately compress the gasket material.

701.06.5 Connections: Use approved connections when joining new pipes to existing pipes. When using concrete collars to extend the ends of existing pipes that have been damaged construct the concrete collars in accordance with plan details, the applicable requirements of Section 901, and as directed. Wrap pipe joints with geotextile fabric before pouring concrete and in accordance with Section 1019.

701.06.6 Geotextile Fabric Wrapped Pipe Joints: For concrete, metal, and thermoplastic pipes, use Types 2 and 3 joints wrapped with geotextile fabric for a minimum of 12 inches on each side of the joint for pipe 36 inches or less in diameter and a minimum of 18 inches on each side of the joint for pipe greater than 36 inches in diameter. Wrap the ends of the fabric around the circumference of the pipe and overlap at least 10 inches. Secure the edges and ends of fabric for the entire circumference of the pipe.

701.07 RELAYING PIPE. If specified or directed, remove existing pipes and relay suitable sections as specified for new pipes.

701.08 BACKFILLING.

701.08.1 General: Prior to backfilling, remove pipes found to be damaged or out of alignment or grade; reinstall or replace.

Type A backfill material shall be stone, recycled portland cement concrete, or flowable fill.

Type B backfill materials are select soils. Select soils are natural soils with a maximum PI of 20, a maximum liquid limit of 35, and a maximum organic content of 5 percent. Soils with a silt content of 50 percent or greater and also a PI of 10 or less will not be allowed. Where Type B backfill materials are called for, Type A backfill materials may be substituted.

When using corrugated metal pipe, the backfill material shall be tested and shall have a resistivity greater than 1500 ohm-cm and a pH greater than 5 when tested in accordance with DOTD TR 429 and DOTD TR 430 respectively.

When using Type A backfill material, place geotextile fabric to surround this backfill in accordance with 726.03 between the aggregate backfill material and all other natural or placed soils in the trench or embankment. Take care to prevent damage to geotextile fabric during placement of backfill material. For concrete pipe, enclose not only the initial backfill with the fabric, but wrap the fabric over the top of the pipe with at least 12 inches of overlap.

When using a trench box or trench sheeting in unstable soils and/or for worker safety, and when moved during backfilling operations, immediately fill and provide additional compaction of the disturbed zone of backfill to the satisfaction of the engineer.

Initial backfill is a structural backfill encasing the pipe from the bottom of the pipe to the springline for concrete pipe and to a point one foot above the top of the pipe for flexible pipe. Final backfill is not a structural backfill. Final backfill extends from the top of the initial backfill to the top of the subgrade in cut areas or to the top of existing ground in fill areas. Consider and treat any fill required above the final backfill as embankment.

Backfill shall be placed and compacted in accordance with the plan details.

701.08.2 Pipes Subject to Construction Traffic: Construct the embankment or pipe backfill to a minimum height of 24 inches over the pipe before allowing heavy construction equipment to cross the installation. Where practical, do not construct installations with less than 24 inches of cover over the top of the pipe until after completing the heavy hauling over the pipe location. After completion of hauling operations, remove excess cover material. Remove and reinstall or replace, pipe damaged by hauling and backfilling operations at no direct pay.

701.08.3 Placement and Compaction: For all pipes, culverts, and conduits under paved and unpaved areas, where using Type A and Type B backfill material, thoroughly hand compact the Type A and Type B backfill under the pipe haunches and then dynamically compact in layers not exceeding 12 inches compacted thickness. Initially compact under the haunches of the pipe by hand tamping or other acceptable means, until reaching a level in which the dynamic tamping can commence. Compact each lift using a hand operated, dynamic mechanical compaction device over the surface of each lift. Verify satisfactory installation and performance, in accordance with 701.08.6. If using flowable fill, furnish, place, and consolidate in accordance with Section 710. Control placement operations during initial backfill operations without damage to protective coatings on metal pipes. Repair damaged coatings at no additional pay.

701.08.4 Deleted

701.08.5 Placement and Compaction- Trenchless or Partial Trench Condition: All pipes, culverts, drains, and conduits placed with any portion of the pipe above existing ground shall comply with 701.08.1, 701.08.2, 701.08.3; 701.08.4 shall be for the portion of the pipe within a trench and the portion of the pipe not constructed in a trench. The initial and final backfill of that portion of pipe above existing ground and not within a trench shall be constructed to such a width that the requirements for placement, compaction, and density are met.

701.08.6 Density Requirements: Under all paved areas which are to be under traffic, determine the maximum dry density of the backfill material, excluding flowable fill, in accordance with DOTD TR 415 or TR 418. Determine in-place density in accordance with DOTD TR 401. Place backfill, excluding flowable fill, at or near optimum moisture content in accordance with DOTD TR 415 or TR 418. Compact each layer by approved methods prior to the placement of a subsequent layer. The engineer will approve the compaction method upon validation that such method, including moisture control, will achieve at least 95 percent of maximum dry density in accordance with DOTD TR 401. Density testing on subsequent backfill layers may be waived by the engineer if installation has been in accordance with approved compaction methods and performance has been continuously satisfactory.

Under all unpaved areas, place initial and final backfill and compact evenly along the length of the culvert, pipe, or drain. Compact layered backfill to at least the density of the adjoining existing soils or the compaction required of the laterally adjoining layers of soil immediately outside the trench for embankment installations. Place and compact initial and final backfill at or near optimum moisture content in accordance with DOTD TR 415 or TR 418.

701.09 INSPECTION OF PIPES. After completion of embankment and prior to roadway surfacing, the engineer shall inspect pipes for proper alignment and integrity of joints. Correct any misaligned pipe or defective joints at no direct pay.

701.09.1 Thermoplastic Pipe: Test installed thermoplastic pipe to ensure that vertical deflections do not exceed 5.0 percent. Maximum allowable deflections shall be governed by the mandrel requirements stated herein.

Perform deflection tests no sooner than 30 calendar days after installation and compaction of backfill. Clean the pipe and inspect for offsets and obstructions prior to testing.

For pipe 36 inches and less in diameter, pull a mandrel through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel must be approved by the Department. Use of an unapproved, mandrel or a mandrel altered or modified after approval mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe is over-deflected.

Unless otherwise permitted, uncover over-deflected pipe and, if not damaged, reinstall. Do not reinstall damaged pipe. Remove and replace with new pipe. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any over-deflection, shall be removed and replaced with new pipe.

Use a rigid, nonadjustable, odd-numbered leg (minimum 9 legs) mandrel having a length not less than its nominal diameter or 24 inches, whichever is less. The minimum diameter at any point shall be 5.0 percent less than the base inside diameter of the pipe being tested. The mandrel shall be fabricated of steel, aluminum, or other approved material fitted with pulling rings at each end. The nominal pipe size and outside diameter of the mandrel shall be verified prior to pulling the mandrel through the pipe. Furnish a suitable carrying case.

For pipe larger than 36 inches in diameter, determine deflection by a method approved by the engineer. If a mandrel is selected, the minimum diameter, length, and other requirements shall conform to the above requirements.

Conduct mandrel testing in the presence of the engineer. Mandrel testing shall be at no direct pay.

701.09.2 Metal Pipe: If the inside diameter of metal pipe or rise dimension of metal pipe arch deflects more than 5.0 percent from original dimensions, remove and reinstall the metal pipes or pipe arches, unless they do not rebound or are damaged. Remove pipes or pipe arches which are damaged or do not rebound; and replace at no direct pay. Measurement of deflection will be made by the engineer away from rerolled ends.

701.10 CLEANING PIPES.

701.10.1 Existing Pipes: Clean designated pipes of soil, debris, and other materials to the invert of the pipe by approved methods that will not damage the pipes. Satisfactorily repair all damage caused by the contractor's operations at no direct pay.

Dispose of removed soil, debris, and other materials in accordance with 202.02 or as otherwise approved in writing.

701.10.2 Contractor Installed Pipes: Prior to final acceptance, clean pipes of all debris and soil to the invert of the pipe at no direct pay.

Dispose of removed soil, debris, and other materials in accordance with 202.02 or as otherwise approved in writing.

701.11 STUBBING AND PLUGGING PIPES. Construct pipe plugs with Class R concrete complying with Section 901. Thickness of plug and method of construction shall be as directed.

When stubbing new pipes are to be stubbed into new or existing pipes or other structures, make the connection with approved mortar complying with 1001.03.

701.12 MEASUREMENT.

1. The length of new and re-laid pipe will be measured in linear feet along the pipe from end to end unless stated otherwise.
2. Pipe tees, elbows, and other fittings will be measured per each fitting. The length of pipe in such fittings will be included in the pay length measurement of pipes of which they form a part.
3. Excavation required for pipe installation will not be measured for payment, except as otherwise specified in 203.14 and 701.12.10.
4. Furnishing and placing backfill material below existing ground level for pipes will not be measured for payment. Backfill material needed to complete backfill above natural ground and around pipes that extend above natural ground will be measured for payment under applicable earthwork items. When specifying flowable fill, measure for payment in accordance with Section 710.

5. Plugging and stubbing of pipes will not be measured for payment.
6. Cleaning existing pipes will be measured by the length of pipe cleaned and accepted.
7. Concrete collars will be measured per each.
8. Dewatering of excavated areas will not be measured for payment.
9. Special shoring and bracing (depth > 5 feet), needed in addition to OSHA requirements for trench safety, will be measured by the square foot of wall area.
10. Trench excavation safety protection (depth > 5 feet) will be measured by the length of trench having a depth > 5 feet below natural ground.
11. Geotextile fabric will not be measured for payment.

701.13 PAYMENT. Payment for concrete and metal pipe will be made at the contract unit price per linear foot of the types and sizes specified, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

When thermoplastic pipe is shown on the plans or elected to be used by the contractor, payment will be made at the contract unit price per linear foot of the types and sizes specified in accordance with the payment schedule of Table 701-2.

Table 701-2
Payment Schedule for Thermoplastic Pipe

Percent Payment	Stage of Completeness
75	After placement and backfill has been completed
25	After the pipe has met vertical deflection requirements in accordance with 701.09.1

Payment for fabricating pipe tees, elbows, and other fittings will be made at the contract unit price per each fitting.

When unstable conditions are encountered, the additional excavation will not be measured for payment; however, the additional materials furnished and placed for the pipe foundation will be measured and paid for as follows:

1. Granular Materials: Payment will be made under the embankment item. The net section volume of the materials will be multiplied by 3 to determine the pay volume. When the contract does not include a pay item for embankment, payment will be made in accordance with 104.02.
2. Bedding Material: Measurement and payment will be made in accordance with Section 726. When the contract does not include a pay item for bedding material, payment will be made in accordance with 104.02.
3. Trench Excavation Safety Protection: When excavation depths exceed 5 feet from natural ground, safety precautions for excavations in compliance with OSHA are required and will be paid per linear foot of trench. When the contract does not include a pay item for trench excavation safety protection, payment will be made in accordance with 104.02.
4. Payment for cleaning existing pipes will be made at the contract unit price per cleaned linear foot.
5. Payment for concrete collars will be made at the contract unit price per each.
6. Payment for special shoring and bracing will be made at the contract unit price per square foot of wall area.

Payment will be made under:

Item No.	Pay Item	Pay Unit
701-01	Cross Drain Pipe	Linear Foot
701-02	Cross Drain Pipe Arch	Linear Foot
701-03	Storm Drain Pipe	Linear Foot
701-04	Storm Drain Pipe Arch	Linear Foot
701-05	Side Drain Pipe	Linear Foot
701-06	Side Drain Pipe Arch	Linear Foot
701-07	Yard Drain Pipe	Linear Foot
701-08	Relaying Pipe	Linear Foot
701-09	Pipe Fittings	Each
701-10	Reinforced Concrete Pipe (Extension)	Linear Foot
701-11	Reinforced Concrete Pipe Arch (Extension)	Linear Foot
701-12	Corrugated Metal Pipe (Extension)	Linear Foot
701-13	Corrugated Metal Pipe Arch (Extension)	Linear Foot
701-14	Cleaning Existing Pipes	Linear Foot
701-15	Concrete Collar	Each
701-16	Thermoplastic Pipe (Extension)	Linear Foot
701-17	Trench Excavation Safety Protection (Depth >5 feet)	Linear Foot
701-18	Special Shoring and Bracing (Depth >5 feet)	Square Foot

SECTION 704 – GUARDRAIL:

Subsection 704.02 – Materials (12/17), Page 373

704.02 is deleted and replaced with the following:

704.02 MATERIALS. Materials shall comply with the following sections and subsections:

Portland Cement Concrete (Class A1)	901
Reinforcing Steel	1009
Metal Beam Guardrail	1010.09
Guardrail Posts and Blockout	1010.10
Guardrail Hardware	1010.11
Wire Rope and Fittings for Highway Guardrail	1010.12

Welding shall comply with Section 809.

SECTION 705 – FENCES:

Subsection 705.03 – General Construction Requirements (05/18), Pages 376 and 377

705.03 is deleted and replaced with the following:

705.03 GENERAL CONSTRUCTION REQUIREMENTS. Conform to Section 201 when clearing and grubbing for fence installation.

Confine operations to the area adjacent to right-of-way lines and within the right-of-way.

Where breaks in a run of fencing are required, and at intersections with existing fences, make appropriate adjustment in post spacing for the type closure indicated.

Place wood posts with small end up. When posts, braces, or anchors are to be embedded in concrete, install temporary braces as required to hold posts in proper position until concrete has set sufficiently to hold posts. Do not install fencing material on posts or place strain on bracing set in concrete for 72 hours after concrete has been placed. Set tops of posts to required grade and alignment. Cutting of wood post tops will be allowed only when approved. Treat cut ends with 2 applications of the same type preservative used for post treatment. Stretch wire taut.

Install ground rods along each segment of new or rebuilt fence in conformance with plan details.

SECTION 707 – CURBS AND GUTTERS:

Subsection 707.12.2 – Portland Cement Concrete (05/18), Page 386

707.12.2 is deleted and replaced with the following:

707.12.2 Portland Cement Concrete: The portland cement concrete in the curbs and/or gutters will be identified by lots and shall be subject to payment adjustments per linear foot in accordance with Table 901-4 for Class A1 concrete and Table 601-3 for Type B & D concrete. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

SECTION 713 – TEMPORARY TRAFFIC CONTROL:

Subsection 713.02 – Materials (08/21), Page 403

713.02 is deleted and replaced with the following:

713.02 MATERIALS. Materials for temporary signs, barricades, barriers, and related devices shall comply with the following sections and subsections:

Portland Cement Concrete	901
Reinforcing Steel	1009.01
Backing Material	1015.04.2
Reflective Sheeting	1015.05
Sign Enamels, Paints, Silk Screen, Overlay Film, and Digital Printing	1015.07
Temporary Pavement Markings	1015.08
Raised Pavement Markers & Adhesive	1015.09
Thermoplastic Pavement Markings	1015.10
Traffic Paint	1015.12
Barricade Warning Lights	1018.13

713.02.1 Temporary Pavement Markings: Temporary pavement markings shall be a minimum of 4 inches wide.

713.02.2 Reflective Sheeting: Reflective sheeting requirements for temporary signs, barricades, channelizing devices, drums, and cones shall comply with 1015.05.6

Subsection 713.07 – Pavement Markings (08/21), Page 407

Table 713-1 is deleted and replaced with the following:

Table 713-1
Temporary Pavement Marking[1,2]

		Two-Lane Highways	Undivided Multilane Highways	Divided Multilane Highways
Short Term	Required Striping that must be in place at the end of each day of paving and maintained until replaced with other short term or long term markings.	Centerlines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers
		"Do Not Pass" and "Pass With Care" signs, as required	Double yellow centerline	
	Required Striping that must be in place, within 72 hours of removal or overlay of permanent striping, and maintained until replaced with either long-term striping or permanent striping.	Centerlines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers
		No passing zone markings	Double yellow centerline	Edge lines
		Edge lines	Edge lines	
Long Term	Required Striping that must be in place within 30 days of removal or covering of permanent striping and maintained until permanent striping is installed.	Standard 10-foot long centerlines on 40-foot center	Standard 10-foot long lane lines on 40-foot center with raised pavement markers[3]	Standard 10-foot long lane lines on 40-foot center with raised pavement markers[3]
		No passing zone markings	Double yellow centerline with raised pavement markers[3]	Legends & Symbols
		Legends & Symbols	Legends & Symbols	
		Edge lines	Edge lines	Edge lines

[1]On all asphalt surface treatments, that are open to traffic, temporary reflectorized raised pavement markers (tabs) on 20-foot centers shall be used in lieu of the 4-foot tape on 40-foot centers.
[2]All work will be stopped and time will continue to be charged if the required markings in this table are not in place and maintained throughout the indicated time periods. Work will only resume after all required markings are in place and approved by the Project Engineer
[3]Raised Pavement Markers only to be applied on concrete surfaces when required in plans.

Subsection 713.07.1 – Short-term Pavement Markings (08/21), Pages 407 and 408

713.07.1 is deleted and replaced with the following:

713.07.1 Short-term Pavement Markings: Provide short-term pavement markings on all pavement surfaces under traffic according to Table 713-1.

When short-term pavement markings require no-passing zone markings or double yellow centerlines, use any of the temporary pavement markings listed in 713.02.

Removal of short-term pavement markings is only required on the final surface, unless otherwise indicated in the plans or required in order to avoid conflicting markings due to phasing.

Subsection 713.07.2 – Long-term Pavement Markings (08/21), Page 408

713.07.2 is deleted and replaced with the following:

713.07.2 Long-term Pavement Markings: Provide long-term pavement markings according to Table 713-1 and in accordance with plan details and standard plans. Layout work for exact location of markings will only be required on the final wearing surface.

These markings include all of the pavement markings listed in 713.02.

Subsection 713.11.2 – Temporary Pavement Markings (08/21), Page 419

The first paragraph of 713.11.2 is deleted and replaced with the following:

When the contract does not include a pay item for Temporary Pavement Markings, provision of these markings will be considered by the Department to be for the convenience of the contractor and will not be measured for payment. When the contract includes an item for Temporary Pavement Markings, these markings will be measured by the linear foot, mile, per each, or as specified and will include acceptable furnishing, placing, maintenance, and removal.

SECTION 724 – RUMBLE STRIPS:

Subsection 724.04 – Measurement (10/18), Page 457

The first paragraph of 724.04 is deleted and replaced with the following:

The quantity of Rumble Strips (Centerline or Shoulder/Edge) to be paid for will be the plan quantity in miles, constructed and accepted. The plan quantity will be determined based on the roadway length. Shoulder/edge rumble strips shall be measured per each shoulder. No deduction will be made for gaps.

SECTION 731 – RAISED PAVEMENT MARKERS:

All Subsections (08/18), Pages 479 – 481

731 is deleted and replaced with the following:

Section 731
Raised Pavement Markers

731.01 DESCRIPTION. Furnish and place raised pavement markers in accordance with the plans.

The contractor shall be responsible for field layout and alignment of raised pavement markers. Existing pavement striping shall generally be used as a guide in determining raised marker locations. Any required striping will be placed prior to installation of raised pavement markers.

731.02 MATERIALS.

731.02.1 Markers: Markers shall comply with 1015.09. Use the same product throughout the project. Mix epoxy components and dispense adhesive in accordance with manufacturer's recommendations.

731.02.2 Epoxy Adhesive: Epoxy resin adhesive system shall comply with 1017.03.

731.02.3 Bituminous Adhesive: Bituminous adhesive shall comply with 1015.09.3.2.

731.03 CONSTRUCTION REQUIREMENTS.

731.03.1 Weather Limitations: Do not apply markers if moisture is present.

731.03.1.1 Epoxy Adhesive: When using a standard set adhesive, do not apply markers at ambient air temperatures less than 50°F. When using a rapid set adhesive, do not apply markers at ambient air temperatures less than 35°F. When using a rapid set adhesive, application of markers will be permitted at ambient air temperatures between 35°F and 50°F, provided the adhesive is adequately heated to obtain proper viscosity for mixing and application, and is also identified as a rapid set type on container labels and Certificates of Delivery.

731.03.1.2 Bituminous Adhesive: Apply markers when the ambient air temperature reaches 35°F or greater, or in accordance with the manufacturer's recommendations.

731.03.2 Removal of Markers: Remove markers, when required, by methods that will not damage the pavement surface. Repair damage to pavement surface at no cost to the Department. After removing the markers, the debris and residue shall become the property of the contractor and be disposed of properly.

731.03.3 Cleaning of Surfaces: Surfaces, including ramps and gore areas, on which markers are to be applied must be cleaned of all materials that may reduce the bond of adhesive. Maintain surfaces in a clean dry condition until placement of markers.

731.03.4 Application of Markers: Do not place pavement markers on joints.

Place markers with bituminous adhesive on asphalt surfaces. Place markers with epoxy resin adhesive, or bituminous adhesive on portland cement concrete surfaces.

Apply markers to surfaces with adhesive in sufficient quantity to be slightly outside the entire perimeter of the marker.

731.04 MEASUREMENT. Raised pavement marker installation will be measured per each marker furnished, placed, and accepted.

Raised pavement marker removal will be measured per centerline miles (project length) including shoulders and ramps.

731.05 PAYMENT. Payment for installation of raised pavement markers will be made at the contract unit prices per each. Payment for removal of raised pavement markers will be made at the contract unit price per linear mile. Payment will include all labor, materials, equipment, and incidentals necessary to complete the work.

Item No.	Pay Item	Pay Unit
731-01	Non-reflectorized Raised Pavement Markers	Each
731-02	Reflectorized Raised Pavement Markers	Each
731-03	Removal of Raised Pavement Markers	Linear Mile

SECTION 740 – CONSTRUCTION LAYOUT:

Subsection 740.02 – Construction Requirements (08/20), Pages 526 and 527

740.02 is deleted and replaced with the following:

740.02 CONSTRUCTION REQUIREMENTS. Establish all lines and grades and stake out all project work, including sufficient vertical and horizontal control points for utility relocations for use by the Department and others.

The project survey control and horizontal alignment are based on the Louisiana State Plane Coordinate System. The construction plans and/or right-of-way map depicts the coordinates and datum of sufficient survey control points to establish or re-establish horizontal control throughout the length of the project. Employ such methods as approved by the Project Engineer for the location of the project alignment and other necessary survey control points in accordance with currently acceptable surveying standards and practices. When required, the Department will also provide one bench mark on or near the project for vertical control. Verify the values of any intermediate bench marks shown on the plans, by checking against the bench mark established by the Department for vertical control.

Employ qualified engineering and surveying personnel experienced in layout and construction of highways and bridges to correctly establish and keep complete and comprehensive records (field books or approved electronic files) of all lines and grades necessary from initial layout to final acceptance. Provide sufficient qualified staff, of at least one employee, on site during utility relocation periods. Provide any necessary survey work to ensure there are no utility conflicts with required construction. Provide daily documentation of utility relocation activities for incorporation into the project diaries.

The contractor shall be liable for the accuracy of the initial layout and all subsequent alignment and elevations and shall, at no additional pay, rebuild, repair or make good any portion of the work found to be incorrectly positioned either horizontally or vertically at any time before final acceptance. Notify the Engineer, in writing, immediately of any apparent errors in the plans. Compute and provide template grades to the Engineer. In order to obtain pipe order lengths, provide the appropriate grades to the Engineer two weeks in advance of the work.

Numbered notebooks for recording of all lines and grades will be provided by the Department and shall be properly indexed and cross referenced by the contractor before return to the Engineer for submittal with the final estimate. Computer generated printouts will be allowed when approved.

Set stationing for overlay projects using an approved measuring device that is accurate to 0.1 percent. Place stakes every 100 linear feet and maintain throughout construction.

When existing markings are to be removed or covered, or obliterated in such manner that the existing layout can no longer readily be determined in the field and the plans do not provide a proposed layout for pavement markings for the entire roadway or any section of roadway, then the existing pavement markings shall be recorded and submitted to the Engineer as the Existing Pavement Markings Layout for review.

All existing signs, including those being removed or replaced, must be documented in an inventory and should include the station and offset, sign type and condition, and submitted to the Engineer as the Existing Signs Inventory for review. The inventory must be in an acceptable format for use by the Project Engineer.

The Existing Pavement Markings Layout and the Existing Signs Inventory shall be submitted at least 7 days prior to the start of construction and may be used by the Project Engineer in conjunction with the District Traffic Operations Engineer in its entirety or in a modified version as the final pavement marking layout.

The installation of pavement markings shall not proceed until approval is granted by the District Traffic Operations Engineer.

PART VIII – STRUCTURES

SECTION 803 – DRILLED SHAFTS:

Subsection 803.03.3.2 – Testing Consultant (04/20), Page 566

803.03.3.2 is deleted and replaced with the following:

803.03.3.2 Testing Consultant: Use an experienced independent Testing Consultant that has been accepted by the Engineer prior to testing. Submit the consultant qualifications and the specifications for the test equipment to the Engineer prior to beginning drilled shaft installation. Perform all integrity testing and analyses under the supervision of a Registered Professional Engineer in the State of Louisiana.

A minimum of 3 years of experience in field testing and analyses of CSL test results is required for the CSL consultant.

The Thermal Integrity Profiling (TIP) testing consultant shall demonstrate 1 year of experience in TIP testing and an additional 5 years of experience with other nondestructive drilled shaft testing methods.

Subsection 803.03.5.1 – Integrity Test Report (04/20), Page 568

803.03.5.1 is deleted and replaced with the following:

803.03.5.1 Integrity Test Report: Provide as one document all integrity testing results, including CSL, TIP, and other Non-destructive Testing (NDT) results, along with all Shaft Construction Logs for the tested shaft. Testing results shall be in accordance with 803.05.11. For TIP testing, include any variation in temperature between wires, indicating cage misalignment and insufficient concrete cover as established using the thermal gradient. Follow ASTM D7949 Standard Test Methods for Thermal Integrity Profiling for minimum TIP report requirements.

Subsection 803.05.11 – Integrity Testing (04/20), Page 578

803.05.11 is amended to include the following:

803.05.11 Integrity Testing: Non-destructive Testing (NDT), other than CSL or TIP, shall be performed in accordance with the plans and specifications. Test all drilled shafts, test shafts, and technique shafts using CSL when any of the following conditions occur:

1. Shaft is constructed with the placement of concrete through slurry.
2. Full-length casing is used to prevent water from entering the shaft.
3. Testing is specified in the plans.
4. Testing is required by the Engineer.

Perform TIP testing on drilled shafts, test shafts, and technique shafts in addition to, or instead of, CSL testing only as directed in the plans.

Subsection 803.05.11.1.3 – Testing Procedures (04/20), Page 579

The first paragraph of 803.05.11.1.3is deleted and replaced with the following:

Use the submitted and accepted Testing Consultant to perform CSL testing. Provide drilled shaft construction logs to the Testing Consultant.

Subsection 803.05.11.2 – Thermal Integrity Profiling (TIP) Testing (04/20), Page 579

803.05.11.2 is deleted and replaced with the following:

803.05.11.2 Thermal Integrity Profiling (TIP) Testing:

803.05.11.2.1 Testing Equipment: The TIP testing equipment shall be capable of performing the following functions and conform to ASTM D7949:

1. Perform TIP testing by measuring the heat generated by curing concrete placed in a shaft and comparing the expected temperature to the temperature at a given location.

2. Measure temperature using thermal wires tied to the shaft cage at various locations around the perimeter. Instrument the shaft and perform testing in accordance with ASTM D7949 Standard Test Methods for TIP of Concrete Deep Foundations.
3. Use method B of ASTM D7949.

803.05.11.2.2 Testing Procedures:

1. Contractor Assistance: Provide cooperative assistance, suitable access to the shafts to be tested, and labor as required to assist the TIP Consultant in performing the required tests. Prior to testing, provide the shaft lengths, thermal wire lengths and positions, and dates of shaft construction to the TIP Consultant. Coordinate with TIP Consultant to install the necessary TIP equipment prior to concreting the shaft.
2. Shaft Preparation: Attach thermal sensors to the reinforcing cage and align with longitudinal reinforcement. Space wires uniformly. Tie wires to reinforcing cage every 3 feet. Stretch wires tight and ensure there is minimal slack. The minimum number of wires installed shall be as specified below:

Table 803-7

Shaft Diameter, D (feet)	Minimum Number of Thermal Wires
D < 4.0	4
4 < D < 5.5	5
5.5 < D < 7.0	6
7.0 < D < 8.0	7
8.0 < D < 9.0	8
9.0 < D < 10.0	10
10.0 < D < 11.0	11
11.0 < D < 12.0	12

3. TIP Testing Procedure: Connect thermal sensors to recording apparatus. Document the measurement location in the shaft of each thermal sensor. Start recording data within 2 hours of completion of concrete placement. Transfer data to display apparatus upon completion of data collection.

Subsection 803.05.11.3.3 – TIP Test Results (04/20), Page 581

803.05.11.3 is amended to include the following:

803.05.11.3.3 TIP Test Results: The Geotechnical Engineer of Record will evaluate the TIP test results and determine whether the shaft construction is acceptable. Allow 7 working days for the evaluation to be conducted after receipt of the final TIP test results. If additional NDT is required in the plans, such as CSL, shafts will not be accepted until all required NDT is complete. The Geotechnical Engineer will evaluate the TIP test results for anomalies to determine if any defects may be present that need to be further investigated. Additional NDT testing may be required to determine the extent and severity of any defects. If the Geotechnical Engineer determines that the shaft is unacceptable based on TIP testing or other NDT, the shaft shall be considered defective.

Subsection 803.06.11 – Thermal Integrity Profiling (TIP) (04/20), Page 589

803.06 is amended to include the following:

803.06.11 Thermal Integrity Profiling (TIP): Measure the Thermal Integrity Profiling test per each drilled shaft tested and accepted.

Subsection 803.07.11 – Thermal Integrity Profiling (TIP) (04/20), Page 591

803.07 is amended to include the following:

803.07.11 Thermal Integrity Profiling (TIP): Payment for the Non-Destructive Test (Thermal Integrity Profiling) will be made at the contract unit price per each drilled shaft tested and shall include all labor, materials, equipment, and incidentals necessary to perform the required installation of instrumentation and testing services performed by Testing Consultant, and testing reports by TIP Consultant.

803-11	Thermal Integrity Profiling (Diameter)	Each

SECTION 804 – PILES:

Subsection 804.05 – Pile Driving Equipment (03/21), Page 597

804.05 is amended to include the following:

804.05 PILE DRIVING EQUIPMENT. Provide pile driving equipment including crane, hammer, leads, and template capable of handling and driving piles 25 percent longer than the plan pile lengths.

Subsection 804.06.1.2 – Abutment (End Bent) Fill (04/21), Page 599

804.06.1.2 is deleted and replaced with the following:

804.06.1.2 Abutment (End Bent) Fill:

Construct the embankment at bridge ends to full height in accordance with 813.03 before driving affected piles. Drive piles through compacted embankment using prebored holes with a minimum depth equal to the compacted embankment height at the prebored location. Prebore holes for pile driving in accordance with 804.07. If a surcharge has been placed, drive affected piles after settlement monitoring is complete and the surcharge has been removed.

SECTION 805 – STRUCTURAL CONCRETE:

Subsection 805.03.5 – Steel Stay-in-Place Forms (04/19), Page 623

The number 7 bullet of 805.03.5 is deleted and replaced with the following:

7. Repair damage to galvanized surfaces on the metal forms or the visually exposed surfaces of the support angles in accordance with 811.08.1.

Subsection 805.06 – Curing (09/21), Page 628

The first paragraph of 805.06 is deleted and replaced with the following:

Cure precast concrete in accordance with 805.09.4. Use wet cure method for all other concrete unless specified otherwise herein.

Subsection 805.06.1 – Wet Cure Method (09/21), Pages 628 and 629

805.06.1 is deleted and replaced with the following:

805.06.1 Wet Cure Method: Use water conforming to 1018.01. Begin curing immediately after concrete placement. Keep exposed surfaces damp by applying water with a fog nozzle (fogging operation) until the surface has set sufficiently to support covering materials. Maintain a layer of high humidity above the concrete surface and minimize water loss in the mix after placement and before application of covering materials. Do not allow large water droplets that drip from nozzle to fall onto plastic concrete.

After concrete surface finishing and when the surface is sufficient to support the covering materials, cover exposed concrete with two layers of pre-wet burlap, or combination of one layer of pre-wet burlap and one layer of polyethylene or other acceptable blanket materials. Secure covering materials to stay in contact with the concrete at all times. After placement, keep the concrete continuously wet for at least 7 curing days for cast-in-place concrete.

Subsection 805.06.2 – Membrane Cure Method (09/21), Page 629

805.06.2 is deleted and replaced with the following:

805.06.2 Membrane Cure Method: Membrane Cure Method using a curing membrane in accordance with 1011.01 may be substituted for Wet Cure Method for curing concrete in minor drainage structures.

Cover or shield exposed reinforcing steel and construction joint surfaces to prevent coating with curing membrane. Wet cure construction joint surfaces.

Apply curing membrane uniformly to surfaces. Apply curing membrane to exposed surfaces as soon as bleed water and other surface moisture has disappeared. Apply curing membrane to formed surfaces immediately after form removal. Do not apply curing membrane during rainfall or to surfaces with standing water. If rain falls on newly-coated concrete before the film has dried sufficiently to resist damage, or if the film is damaged or deficient, immediately apply a new coat of curing membrane to affected surfaces.

Apply curing membrane under pressure using mechanical sprayers using the method and rate recommended by the curing membrane manufacturer, but using a rate of not less than 1 gallon per 100 square feet of surface area. Use the fully atomizing type of spraying equipment with a tank agitator. Immediately, prior to, and during application, thoroughly mix the curing membrane, stirring continuously by mechanical methods.

Hand spraying is allowed on small irregular widths or shapes and on surfaces exposed by form removal. Thoroughly agitate the curing membrane prior to placing in the sprayer.

Apply the curing membrane in one or two applications. If the curing membrane is applied in two applications, apply the second application no more than 30 minutes after first application.

After final application of curing membrane, the membrane surface should have the appearance of a blank white sheet of paper.

Subsection 805.06.4 – Bridge Deck Curing (09/21), Page 629

805.06.4 is deleted and replaced with the following:

805.06.4 Bridge Deck Curing: Cure bridge decks using only Wet Cure Method with the following requirements:

Immediately after deck placement, and until completion of surface finishing, apply fogging operation in accordance with 805.06.1.

Immediately after surface finishing, apply Type 2 white-pigmented membrane curing compound to exposed surfaces in accordance with 805.06.2.

When concrete has set sufficiently to support covering materials without marring the surface, cover the concrete with first layer of pre-wet burlap with minimum length sufficient to cover the bridge deck from side to side of the concrete placement. Provide soaker hoses at a maximum of 10-foot intervals for additional soaking of the initial covering to cover the full width of the concrete placement. Overlap covering edges at least 12 inches. Do not allow initial wetting of burlap to dry before soaker hoses are in place and operational. Operate soaker hoses continuously to keep the initial covering saturated. Place second layer of pre-wet burlap or pre-wet burlap laminated with polyethylene over the initial covering and soaker hoses. Overlap covering edges at least 12 inches. Secure covering materials in place during the 7 curing days by taping and weighting the edges where they overlap or are vulnerable to movement by wind.

Close deck to all traffic, including vehicles of the contractor, until wet cure is completed and the concrete has attained at least 4000 psi compressive strength.

Subsection 805.07 – Removal of Forms and Falsework (09/21), Page 630

805.07 is deleted and replaced with the following:

805.07 REMOVAL OF FORMS AND FALSEWORK. Remove forms and falsework without overstressing or damaging the concrete, and in such a manner that will permit concrete to uniformly and gradually take stresses due to its own weight. Remove forms and falsework without causing concrete distortion.

Side forms may be removed after one curing day provided they are no longer resisting forces and if permitted by the Engineer. Curing days are as defined in 805.06. For cast-in-place concrete, forms and falsework supporting the weight of concrete may be removed when concrete attains the compressive strength requirements in Table 805-6. For slip formed concrete, Table 805-6 does not apply.

Removal of forms does not relieve the wet curing requirements of 805.06.1. Form curing method of 805.06.3 will cease upon removal of forms and other means of wet curing shall immediately be implemented, to the satisfaction of the Engineer, for the remainder of the required curing duration.

For precast concrete, forms and falsework may be removed when concrete attains the minimum strength requirements of Table 805-6, with the exception of non-prestressed box culverts, catch basins, junction boxes, end treatments, and temporary precast barriers, for which Table 805-6 does not apply.

Table 805-6 is deleted and replaced with the following:

Table 805-6
Removal of Forms and Falsework
Strength Requirements

Concrete Class	Compressive Strength, psi
A1, MASS (A1), and S	4000
A2 and MASS(A2)	6000
A3 and MASS(A3)	8500
M	2700
P1	3600
P2	5100
P3	6000

Table 805-7 is deleted.

Table 805-7
Forms and Falsework Removal Schedule
Cast-in-Place and Precast Non-Prestressed Concrete

The contents of this table are deleted.

Subsection 805.09.4 – Curing (09/21), Page 635

Paragraph 1, 2, 3, and 4 of 805.09.4 is deleted and replaced with the following:

805.09.4 Curing: Cure concrete in accordance with 805.06, Section 901, and as amended by this section.

Cure non-prestressed members for three curing days using steam cure method or wet cure method. Cure prestressed members until concrete reaches release strength using steam cure method or wet cure method.

Furnish and install two recording thermometers reporting time-temperature relationship for each 200 feet of bed.

Use thermocouple cure for all Class P2 and P3 concrete or when specified in the contract.

Subsection 805.09.4.2 – Wet Cure Method (09/21), Page 636

805.09.4.2 is deleted.

Subsection 805.09.4.3 – Combined Steam and Wet Cure Method (09/21), Page 636

805.09.4.3 is deleted.

Subsection 805.09.4.4 – Membrane Cure Method (09/21), Page 636

805.09.4.4 is deleted and replaced with the following:

805.09.4.4 Membrane Cure Method: Use Membrane Cure Method as an interim short term curing method for plastic concrete.

Maintain concrete in a surface saturated condition using foggers until finishing is complete. Immediately after finishing, apply curing membrane in accordance with 805.06.2.

When concrete has set sufficiently to prevent marring the surface, apply Steam Cure Method or Wet Cure Method for the remainder of the required cure time.

SECTION 807 – STRUCTURAL METALS:

Subsection 807.05.2.4 – Bolted Parts (04/19), Page 667

The number 4 bullet of 807.05.2.4 is deleted and replaced with the following:

4. When metallic thermal spray coatings are specified, conform to 811.08.2.

SECTION 811 – PAINTING AND PROTECTIVE COATINGS:

Subsection 811.03 – Materials (10/19), Pages 689 – 691

811.03 is deleted and replaced with the following:

811.03 MATERIALS. Materials shall comply with the following sections or subsections:

Paints	1008
Cold Tar Epoxy-Polyamide Paint	1008.04
Cold Galvanizing Repair Compound	1008.05
Maintenance Overcoating of Steel Bridges	1008.08

Unless otherwise specified, use a Zinc Paint System from the Approved Materials List for painting new and existing metals to be painted. Provide organic zinc primer compatible with the inorganic zinc primer as a repair and stripe coat component. Provide an intermediate coat compatible with both the inorganic and organic zinc primers. The paint supplier will certify at the time of paint approval, the materials (primers & intermediate coats) are compatible and will not affect the performance of the whole system as tested by NTPEP.

Show the paint system to be used on shop or working drawings. Use only one paint system from one manufacturer for the entire structure without modifications. Top coat colors shall be as defined in Table 811-1. When spot painting or zone painting existing metals, match existing top coat color.

Table 811-1
Top Coat Colors for Painting Metalwork

Description	SAE AMS-STD-595A Color Number
Black	17038
Silver	17178
Dark Bronze	30040
Weathered Steel	30045
Khaki	30372
Gray	36463

Provide a gloss finish for top coat. The Color Numbers in Table 811-1 are for pigment color matching purposes only.

Provide coating systems with visibly contrasting color tint for each full coat and stripe coat.

Provide anti-skid surface, compatible with the paint system and recommended by the manufacturer unless otherwise specified, on stair treads, walkway surfaces, platforms, and landings.

Coating materials shall not be used until the Project Engineer has inspected the materials and each batch of paint has been accepted by the DOTD Materials and Testing Section.

811.03.1 Abrasives: Use properly sized abrasives to achieve the required cleanliness and surface profile. Use abrasives meeting the requirements of SSPC-AB1, Mineral and Slag Abrasives; SSPC-AB2, Cleanliness of Recycled Ferrous Metallic Abrasives; or SSPC-AB3, Newly Manufactured or Re-Manufactured Steel Abrasive. Do not introduce any contamination that interferes with the coating application and performance, including chlorides and other salts.

For field applications, abrasives delivered to project site shall be new and conform to SSPC-AB3. Once used during the work, abrasives may be recycled provided the resulting conductivity and cleanliness conform to SSPC-AB2. Select a sample from each recycling machine in use and conduct the water-soluble contaminant and oil content tests outlined in SSPC-AB2 at least one time each week or more frequently, if directed. Conduct the non- abrasive residue and lead content tests as directed by the Project Engineer. If test results do not meet requirements, notify the Project Engineer immediately, remove and replace the abrasive, clean the recycling equipment, and conduct tests each day to confirm the equipment is functioning properly. Return to the weekly testing interval when directed.

811.03.2 Caulk: Unless otherwise specified, use caulks that are paintable, compatible with the coating system, and recommended by the coating manufacturer. Provide caulk conforming to Federal Specification TT-S-00230C, Type II, Class A. For painted metalwork, use caulk colored to contrast the color of the intermediate and top coats. For unpainted and painted sections of weathering steel, use caulk colored to match the color of the weathered steel in accordance with Table 811-1.

811.03.3 Penetrating Sealer: Use low viscosity 100 percent solids un-pigmented epoxy recommended by the coating manufacturer.

811.03.4 Rust Preventative Compound: Use a Class 3 rust preventative compound meeting the requirements of Military Specification MIL-C-11796C, Corrosion Preventative Compound, Petrolatum, Hot-Applied.

811.03.5 Soluble Salts Test Kit: Use a soluble salts test kit in accordance with SSPC-Guide 15 utilizing Multi-Step Ion-Specific Methods. Ensure the test patch/cell or sleeve creates a sealed, encapsulated environment during ion extraction and is suitable for testing all structural steel surfaces. A Fully Automated Conductivity Measuring System may be allowed, subject to acceptance by the Project Engineer.

811.03.6 Thinners, Solvents, and Cleaners: Use thinners, solvents, and cleaners listed on the coating manufacturer's product data sheet. For overcoating systems, use thinners, solvents, and cleaners that do not damage the existing coating system or inhibit the performance of the newly applied coatings.

SECTION 813 – CONCRETE APPROACH SLABS:

Subsection 813.03.5.1 – High Early Strength Concrete (02/19), Pages 731 and 732

813.03.5.1 is deleted and replaced with the following:

813.03.5.1 High Early Strength Concrete: When specified or when determined by the Project Engineer that construction conditions merit opening concrete approach slabs to traffic before concrete is fully cured, high early strength concrete (HES) shall be used in accordance with Section 902.

SECTION 816 – BRIDGE DRAINAGE SYSTEMS:

Subsection 816.02 – Materials (11/18), Page 745

The first paragraph of 816.02 is deleted and replaced with the following:

Materials shall comply with the plans and specifications and the following:

Culverts and Storm Drains	701.02
Manholes, Junction Boxes, Catch Basins, and End Treatments	702.02
Bedding Material	726.02
Structural Concrete	805.02
Deformed Reinforcing Steel	806.02
Structural Metals	807.02
Painting and Protective Coatings	811
Metals	1013
Stainless Steel Bolts	1013.08

SECTION 817 – TEMPORARY WORKS:

Subsection 817.03.1.1 – Temporary Detour Bridge (07/18), Pages 748 and 749

The first sentence of the second paragraph of 817.03.1.1 is deleted and replaced with the following:

Conform to Section 803 for drilled shafts, Section 804 for piles, Section 810 for bridge railings, and Section 704 for guardrails.

The first sentence of the fifth paragraph of 817.03.1.1 is deleted and replaced with the following:

Remove the detour bridge in accordance with 202.03. Remove piling completely.

Subsection 817.03.2.4 – Cofferdams (07/18), Page 750

The second sentence of the fourth paragraph is deleted and replaced with the following:

Conform to 105.19.

Subsection 817.03.2.7 – Temporary Detour Bridge (07/18), Page 754

817.03.2 is amended to include the following:

817.03.2.7 Temporary Detour Bridge: Conform to 817.03.1.1. All submittals shall be for review. Design temporary detour bridge in accordance with the latest version of AASHTO LRFD Bridge Design Specifications. Design all bents in the channel for the local scour depth shown on the plans. Provide as-designed bridge rating for HL-93 Inventory and HL-93 Operating. Refer to the LA DOTD Bridge Design and Evaluation Manual for as-designed rating requirements. Submit all design and rating calculations.

Provide detour bridge drawings and erection drawings. Include general bridge layout showing plan and elevation views. Include current ground line along detour centerline and water elevation at the time of construction. Provide superstructure and substructure details. Include pile types, lengths, and locations, and any other details required to construct the detour bridge.

When prefabricated steel bridge systems are used, submit the assembly and installation instructions from the original manufacturer a minimum of 90 days prior to installation. Construct in accordance with the original manufacturer's specifications and recommendations, and as specified in the plans and in the accepted submittals. A representative from the original manufacturer must be present at the project site and oversee the assembly and installation of the first erected span. Upon completion of the installation and prior to allowing vehicular traffic, submit for record a letter from the original manufacturer certifying that the bridge has been properly installed.

When prefabricated bridge systems are used, apply asphalt concrete overlay in accordance with the original manufacturer's specifications and recommendations, and Section 502. Do not apply asphalt concrete overlay if the manufacturer supplies deck panels with an epoxy anti-skid surface. Do not use an epoxy anti-skid surface and an asphalt concrete overlay surface in conjunction on the same bridge. Do not supply open grid decking.

Subsection 817.04.1 – Temporary Detour Bridge (07/18), Page 755

The first paragraph of 817.04.1 is deleted and replaced with the following:

Temporary detour bridge will be measured by the square foot and shall include all materials and labor required for construction of the temporary detour bridge, all striping, wearing surface, maintenance of the detour bridge, continual removal of debris accumulation, removal of the detour bridge, and restoration of the project site to the satisfaction of the Project Engineer. Square foot measurement will be made by multiplying the clear roadway width by the length of the bridge from beginning bridge joint at abutment to ending bridge joint at abutment along the centerline of the bridge.

SECTION 822 – ELECTRICAL SYSTEMS:

Subsection 822.05.1 – Pole Installation (11/18), Page 871

822.05 is amended to include the following:

822.05.1 Pole Installation: Poles shall be installed, leveled, and plumbed in accordance with the accepted manufacturer's pole drawings and approved methods. Unless shown otherwise on the plans, extend anchor bolts a minimum of 1/4 inch above the nut or as recommended by the manufacturer, whichever is greater. Where indicated in the plans, the space between the top of the foundation and the bottom of the pole base (or flange) shall be grouted with a non-shrink grout mixture in accordance with 1018.04 and neatly troweled to the contour of the pole base. A pvc drain pipe shall be inserted through the grout to provide ventilation and drainage from the interior of the pole base.

Subsection 822.11.5 – Light Poles (11/18), Page 877

822.11.5 is deleted and replaced with the following:

822.11.5 Light Poles: Light poles will be measured per each pole furnished and installed, which will include the pole, decals, ownership plate, wiring and connections to circuit conductors, grounding electrode, ground clamp, exothermic weld, base assembly, and all hardware and appurtenances required for a complete installation. When an aluminum pole is installed, oxide-inhibiting compound is required.

Subsection 822.11.6 – High Mast Poles (11/18), Page 877

822.11.6 is deleted and replaced with the following:

822.11.6 High Mast Poles: High mast poles will be measured per each pole furnished and installed, which will include the pole, luminaire ring, lowering assembly, drive assembly, wiring, electrical connections, fuses, grounding electrode, ground clamp, exothermic weld, mounting hardware, grout in accordance with 1018.04, and all hardware and appurtenances required for a complete installation.

PART IX – PORTLAND CEMENT CONCRETE

SECTION 901 – PORTLAND CEMENT CONCRETE:

Subsection 901.06.1.1 – Self-Consolidating Concrete (05/19), Page 918

901.06.1 is amended to include the following:

901.06.1.1 Self-Consolidating Concrete: Self-consolidating concrete (SCC) may be used for precast members, drilled shafts, and light pole foundations. SCC may be used for cast-in-place structural concrete as permitted by the Bridge Design Engineer Administrator.

SCC is concrete that is highly flowable, non-segregating concrete that can spread into place, fill the formwork, and encapsulate reinforcement without mechanical consolidation. This concrete leads to better surface finishes in precast operations and better consolidation around steel rebar.

901.06.1.1.1 Materials: Use concrete as indicated by the plans. A combined aggregate gradation in accordance with 1003.08.3 is required with the exception of the maximum allowable aggregate size of ½ inch. SCC shall have a slump flow spread measurement as measured by ASTM C1611 as shown in Table 901-1A. The SCC shall have a visual stability index rating (VSI) of 1 or 0 as measured according to ASTM C1611 Appendix. SCC being placed in an underwater condition shall incorporate a viscosity modifying admixture (VMA) incorporated in the mixture complying with ASTM C494.

Table 901-1A

Type of Construction	Range of Slump Flow Values
	Inches
Precast Members	20-30
Drilled Shafts/Light Pole Foundations	20-24
Cast-in-Place Structural Concrete	20-30

901.06.1.1.2 Consolidation: Mechanical consolidation is not typically necessary for SCC. However, internal vibrators shall be available on site to be used when internal vibration is needed, as determined by the Engineer, to prevent formation of a cold joint due to delays in placement, or if the concrete has a lower than expected slump flow. Internal vibration is not allowed for drilled shafts. If the vibratory action adversely effects the concrete, as determined by the Engineer, then the concrete shall be removed and replaced at no cost to the Department.

Subsection 901.06.2 – Quality Control Tests (05/19), Page 918

901.06.2 is amended to include the following:

For Self-Consolidating Concrete, perform slump flow spread measurement testing and visual stability index rating (VSI), in the presence of the Engineer, in lieu of slump testing and at the same required frequency as slump testing.

Subsection 901.07 – Substitutions (06/18), Page 920

Table 901-2 is deleted and replaced with the following:

Table 901-2
Portland Cement Concrete Mixture Substitutions

Structural Class[1]	**Substitute**
A1	No Substitutions
A2	No Substitutions
A3	No Substitutions
P1	P2, P3
P2	P3
P3	No Substitutions
S	No Substitutions
MASS(A1)	No Substitutions
MASS(A2)	No Substitutions
MASS(A3)	No Substitutions
Minor Structure Class[1]	
M	A1, B, D
R	A1, B, D, M
Pavement Type[1,2]	
B	D
D	B
E	No Substitutions

[1]The substituting mixture shall meet the requirements of Table 901-3 for its class or type. The substituting mix shall meet the strength requirements of the original mix.
[2]If approved by the engineer, small irregular areas of paving projects using Types B or D concrete may be substituted with Class A1 concrete.

Subsection 901.08.2 – Cementitious Material Substitution (06/20), Page 921

Paragraph 5 of 901.08.2 is deleted and replaced with the following:

When ASR mitigation is required, use 30% Class F Fly Ash, 50% GGBFS, or a ternary mixture containing both Class F Fly Ash and GGBFS at a minimum replacement rate of 50%.

The maximum substitution rate for ternary mixtures containing Type I, II, III, or IL portland cement is 70 percent of cement. When using Type IP or IS portland cement, the maximum substitution rate for ternary mixtures is 40 percent. Ternary combinations using both class C and F fly ash are allowable. When using fly ash ternary mixtures, replace portland cementwith class C and class F fly ash in equal amounts. When using combinations of GGBFS and fly ash, the amount of GGBFS must be equal to or greater than the amount of fly ash.

Subsection 901.13 – Acceptance and Payment Schedules (11/19), Page 931

901.13 is deleted and replaced with the following:

901.13 ACCEPTANCE AND PAYMENT SCHEDULES. Acceptance and payment schedules in Table 901-4 and Table 901-6 apply to all cast-in- place structural portland cement concrete. Tables 901-3 and 901-6 apply to Classes P1, P2, and P3; whereas, Table 901-4 does not apply. Acceptance and payment schedules in Table 901-5 apply to all minor structure portland cement concrete. Acceptance and payment schedules for portland cement concrete pavement are shown in Table 601-3 of Section 601.

Table 901-3 – Master Proportion Table for Portland Cement Concrete (12/21), Page 932

Table 901-3 is deleted and replaced with the following:

Table 901-3[12]

Master Proportion Table for Portland Cement Concrete

	Average[8] Compressive Strength, psi at 28 days	Grade of Coarse Aggregate[1]	Surface Resistivity[2,13] (kΩ-cm)	Maximum Water/Cementitious Ratio, lb/lb	Air Content (Percent by volume)[3]	Slump Range[5], inches		
						Non- Vibrated[4]	Vibrated	Slip Form Paving[6]
Structural Class [7]								
A1	4,500	57M, 67, 89M[9], B,D	18	0.45	2 - 7	2-5	2-4[4]	N/A
A2	6,500[11]	57M, 67, 89M[9], B,D	18[11]	0.45	2 - 7	2-5	2-4[4]	N/A
A3	9,000[11]	57M, 67, 89M[9], B,D	18[11]	0.36	2 - 7	2-5	2-4[4]	N/A
P1	6,000[8]	57M, 67, 89M[9], B,D	18	0.44	2 - 7	N/A	2-6[10]	N/A
P2	8,500[8]	57M, 67, 89M[9], B,D	18	0.40	2 - 7	N/A	2-6[10]	N/A
P3	10,000[8]	57M, 67, 89M[9], B,D	18	0.40	2 - 7	N/A	2-6[10]	N/A
S	4,500	B, D	18	0.53	2 - 7	6-8	N/A	N/A
MASS(A1)	4,500	B, D	18	0.53	2 - 7	N/A	2-4[4]	N/A
MASS(A2)	6,500[11]	B, D	18[11]	0.46	2 - 7	N/A	2-4[4]	N/A
MASS(A3)	9,000[11]	B, D	18[11]	0.36	2 - 7	N/A	2-4[4]	N/A
Minor Structure Class [7]								
M	3,000	57M, 67, 89M[9], B,D	N/A	0.56	2 - 7	2-5	2-4[4]	1-2.5
R	1,800	57M, 67, B,D	N/A	0.70	2 - 7	2-5	2-4[4]	N/A
Pavement Type [7]								
B	4,000	B, D	N/A	0.53	2 - 7	N/A	2-4	1-2.5
D	4,000	B, D	N/A	0.53	2 - 7	N/A	2-4	1-2.5
E	4,000	57M, 67, 89M[9], B,D	N/A	0.40	2 - 7	N/A	2-4	1-2.5

N/A – Not Applicable

[1] Combined aggregate gradation shall comply with the requirements of 1003.08.2.

[2] Value based on a 4-inch X 8-inch cylinder tested at 28 days of age.

[3] See 901.08.3.

[4] Allow an 8-inch maximum slump when high-range water reducers or superplasticizers are used.

[5] Additional allowance in slump range to be approved by the Construction Engineer Administrator.

[6] Also slump range for other concrete placed by extrusion methods.

[7] See 901.08.1 for allowable types of cement.

[8] P1, P2, P3 values shown represent the minimum compressive strengths allowed for all test cylinders.

[9] Grade 89M coarse aggregate shall be used only when specified or permitted.

[10] No more than 2-inch slump differential for any design placement. Allow 8-inch maximum when high-range water reducers or superplasticizers are used.

[11] Average Compressive Strength, psi and Resistivity (kΩ-cm) at 56 days.

[12] Dry-cast concrete for concrete pipe is exempt from Table 901-3. See Section 1016 specifications.

[13] Resistivity requirements do not apply to Class A1 concrete used for curb, curb and gutter, or as a substitute for Class M.

Table 901-4 – Acceptance and Payment Schedules Cast-In-Place Structural Concrete (10/19), Page 933

Table 901-4 is deleted and replaced with the following:

Table 901-4
Acceptance and Payment Schedules
Cast-In-Place Structural Concrete

Average Compressive Strength per Lot, psi (28 to 31 days)[3]	
Class A1, S & MASS (A1)	**Percent of Contract Unit Price[1]**
4500 & above	100
4301 - 4499	98
4000 - 4300	90
below 4000	50 or remove and replace[2]
Class A2, & MASS (A2)	
6500 & above	100
6301 - 6499	98
6000 - 6300	90
below 6000	50 or remove and replace[2]
Class A3, & MASS (A3)	
9000 & above	100
8801 – 8999	98
8500 - 8800	90
below 8500	50 or remove and replace[2]

[1]When concrete is part of an item or not a direct pay item, lot sizes, sampling, and acceptance testing for the required quantities will be in accordance with 805.11. The value for each cubic yard required will be assessed at $350 for the purpose of applying payment adjustment percentages. The amount of payment adjustment for the quantity of concrete involved will be deducted from payment. Acceptance and payment schedules shall apply to the contract item itself for cast-in-place piling.

[2]When the average compressive strength of **any batch in a lot** is less than the specified strength a prompt investigation will be made. If concrete is allowed to remain in place by the Chief Engineer, payment will be based on 50 percent of the contract price unless associated cylinders were improperly molded or tested and investigative core strength results are above design strength (f'c). If concrete is not allowed to remain in place, the identifiable deficient areas shall be removed and replaced at no direct pay.

[3]Average Compressive Strength for A2 and A3 shall be taken at 56 to 59 days.

Table 901-6 – Acceptance and Payment Schedules Structural Concrete (12/21), Page 934

Table 901-6 is deleted and replaced with the following:

Table 901-6
Acceptance and Payment Schedules
Structural Concrete

Surface Resistivity per Lot, kΩ-cm (28 to 31 days)[3]	
Class A1, A2, A3, S, P1, P2, P3, & MASS(A1,A2,A3)	**Percent of Contract Price[2]**
18.0 & above	100
16.5 – 17.9	98
15.0 – 16.4	90
below 15.0	50 or remove and replace[1]

[1]When the average surface resistivity is less than 15.0 kΩ - cm, an investigation will be made. If concrete is allowed to remain in place by the Chief Engineer, payment will be based on 50 percent of the contract price. Any cores obtained in these investigations are for evaluation purposes only. Payment will be based on original acceptance samples.

[2]When concrete is part of an item or not a direct pay item, the value for each cubic yard of concrete required will be assessed at $350 for the purpose of applying payment adjustment percentages. The amount of payment adjustment for the quantity of concrete involved will be deducted from payment.

[3]Surface resistivity for A2, A3, MASS(A2), and MASS(A3) shall be taken at 56 to 59 days.

SECTION 902 – HIGH EARLY STRENGTH CONCRETE:

All Subsections (10/19), Page 934

Part IX is amended to include the following:

Section 902
High Early Strength Concrete

902.01 DESCRIPTION. This section specifies requirements for High Early Strength Concrete (HES), including methods for handling, sampling, testing, placing, and curing HES. HES shall be used when conditions merit the early opening to traffic of concrete pavements and bridge approach slabs, as specified in contract documents or as determined by the Engineer. All work shall be in accordance with the general requirements of the pay item associated with the use of HES unless otherwise specified herein.

902.02 MATERIALS. For pavement patching, use a rapid patching material that is on the AML or a Type B, D, or E concrete mixture. For bridge approach slabs, use Class A1 concrete. All HES mixtures shall conform to Section 901 with the following exceptions:

1. Type III cement is allowed.
2. Do not use chloride-type accelerators.
3. Surface Resistivity requirements do not apply to HES.
4. Type B or Type D may be substituted for the Class A1 concrete on approach slabs, but will be paid in accordance with Table 901-4 for Class A1 concrete.

Use the maturity method for compressive strength determination according to ASTM C1074. If any of the mix components change (material sources or mix proportions change by more than ±5%; admixture dosages change by more than ±20%), a new maturity curve must be developed and verified. Submit the HES mix design, trial batch results, and maturity curves to the Engineer for review.

Verify by trial batch that the proposed HES mix achieves the compressive strength specified in Table 901-3, and the appropriate early opening strength specified in 902.04.1 within the time frame specified in the contract documents.

Trial batch requirements may be waived, with written approval from the District Laboratory Engineer, for previously approved mix designs when all materials and proportions of the proposed design exactly match the previously approved mix design materials.

902.03 CONSTRUCTION REQUIREMENTS. Follow the manufacturer's or supplier's recommendations on mixing and placing HES unless otherwise specified in the contract documents or by the Engineer. Place the concrete continuously to prevent formation of cold joints. Promptly finish the concrete. Immediately after finishing, apply curing compound at one gallon per 50 square feet, resulting in a consistent surface appearance that roughly resembles the color of a blank sheet of white paper.

902.04 TESTING FOR OPENING TO TRAFFIC. A minimum of two wireless maturity sensors are to be placed in each identifiable concrete pour per mix design, for compressive strength determination with the use of maturity curves.

To verify the sensor results, a minimum of four concrete cylinders for the first placement and, thereafter, for every 1000 square yards of concrete placed or every month of concrete placement shall be made according to DOTD TR 226 and tested in accordance with DOTD TR 230. For bridge approach slabs, a minimum of four concrete cylinders per distinct approach slab placement shall be made and tested in accordance with the requirements of this section.

When the results of testing the verification cylinders vary from the maturity curve results by more than negative 10%, then the mix design shall no longer be used until a new maturity curve has been developed, and accepted by the Engineer.

The frequency of verification may be increased at the discretion of the Engineer.

902.04.1 Early Opening to Traffic: For early opening to traffic, attain the minimum compressive strength of 3000 psi for bridge approach slabs and 2000 psi for paving applications within the lane closure time frame specified in the plans, contract documents or where construction conditions merit, as determined by the Engineer.

When the mix does not achieve the minimum required compressive strength specified in the required time frame, its use shall be discontinued until the cause can be determined to the satisfaction of the Engineer. When this occurs for two placements, the Engineer may determine the mix to be invalid and require a new mix design to be accepted before work continues, at no additional cost or time to the department.

902.05 ACCEPTANCE TESTING. Acceptance for compressive strength will be in accordance with the requirements of the pay item associated with the use of HES. If the results of the testing for opening to traffic meet the minimum requirements for compressive strength of the pay item associated with the use of HES, then these results may be used in lieu of acceptance testing with the approval of the Chief Construction Engineer.

PART X – MATERIALS

SECTION 1001 – PORTLAND CEMENT AND CEMENTITIOUS MATERIALS:

Subsection 1001.04 – Fly Ash and Natural Pozzolans (06/20), Page 936

1001.04 is deleted and replaced with the following:

1001.04 FLY ASH AND NATURAL POZZOLANS. Use fly ash from the Approved Materials List. Comply with AASHTO M 295 for Class C and Class F. Comply with ASTM C618 for Class N. Alkali content calculated in accordance with DOTD TR 531 shall not exceed 3.0 percent by weight.

SECTION 1002 – ASPHALT CEMENT, EMULSIONS, AND ADDITIVES:

Subsection 1002.02.2 – Crumb Rubber (07/18), Page 938

1002.02.2 is deleted and replaced with the following:

1002.02.2 Crumb Rubber: Waste Tire Rubber must be pre-qualified by the Materials Laboratory. The maximum size of rubber particles shall be 30 mesh crumb (90-100 percent passing the No. 30 sieve) with a maximum replacement of 10 percent by weight of asphalt material.

SECTION 1003 – AGGREGATES:

Subsection 1003.01.1 – Test Methods (03/21), Page 951

Table 1003-1 is deleted and replaced with the following:

Table 1003-1
Aggregate Test Procedures

Property	Test Procedure
Deleterious Materials	DOTD TR 119
Flat and Elongated Particles	ASTM D4791
Magnesium Sulfate Soundness	AASHTO T 104
Los Angeles Abrasion	AASHTO T 96
Alkali-Silica Reactivity (Chemical Method)	ASTM C289
Alkali Reactivity (Mortar-Bar Method)	ASTM C1260
Reactivity of Concrete Aggregates	AASHTO R80
Alkali Reactivity of Carbonate Rocks (Rock-Cylinder Method)	ASTM C586
Organic Impurities	AASHTO T 21
Unit Weight	AASHTO T 19
Specific Gravity & Absorption of Fine Aggregate	AASHTO T 84
Specific Gravity & Absorption of Fine Lightweight Aggregate	DOTD TR 123
Specific Gravity & Absorption of Coarse Aggregate	AASHTO T 85
Polish Value	AASHTO T 278 and T 279
Amount of Material Finer than the No 200 (75 μm) Sieve	DOTD TR 112
Sieve Analysis (Gradation)	DOTD TR 113
pH of Soil and Water	DOTD TR 430
pH of Aggregates	DOTD TR 122
Atterberg Limits (LL, PL, & PI)	DOTD TR 428
Organic Content	DOTD TR 413
Percent Crushed	DOTD TR 306
Mechanical Analysis of Extracted Aggregate	DOTD TR 309
Sand Equivalent	DOTD TR 120
Fine Aggregate Angularity	DOTD TR 121
Micro-Deval	AASHTO T 327
Moisture Sensitivity (TSR)	DOTD TR 322
Mortar Strength	AASHTO T 71
Methylene Blue	AASHTO TP 57-99
Abrasion of Lightweight Coarse Aggregate	DOTD TR 111
Determining Chloride Content and Organic Additive for PCC	DOTD TR 643
Chemical Analysis	ASTM C114
Potential Carbonate Reactivity	ASTM C1105
Potential Alkali-Silica Reactivity	ASTM C1293
Clay Lumps and Friable Particles	AASHTO T 112

Subsection 1003.01.2.3 – Los Angeles Abrasion (03/21), Page 952

1003.01.2.3 is deleted and replaced with the following:

1003.01.2.3 Los Angeles Abrasion: For coarse natural aggregates, lightweight aggregates and RPCC source approval, maximum Los Angeles abrasion loss is 40.0 percent. The Los Angeles abrasion loss for lightweight aggregates will be calculated in accordance with DOTD TR 111.

Subsection 1003.01.4.1 – Alkali Silica Reactivity (ASR) of Sands and Gravels in Portland Cement Concrete (03/21), Page 954

1003.01.4.1 is deleted and replaced with the following:

1003.01.4.1 Alkali Silica Reactivity (ASR) of Sands and Gravels in Portland Cement Concrete: For source approval, aggregates for use in portland cement concrete are tested for alkali silica reactivity properties in accordance with ASTM C1260, using a portland cement from the Department's Approved Materials List. Aggregates categorized as "innocuous" (non-reactive, less than 0.10% expansion) are allowed without restriction. If ASTM C1260 designates aggregates as "potentially deleterious," (greater than or equal to 0.10% expansion but less than or equal to 0.20% expansion) then use a mixture with cementitious substitution as specified for ASR mitigation in Section 901.08.2. If ASTM C1260 results exceed 0.20%; aggregates must be further evaluated by means of ASTM C1293 to determine reactivity. If ASTM C1293 results are less than 0.04% expansion, the aggregate is considered "innocuous". If ASTM C1293 results are greater than or equal to 0.04% expansion; the aggregate is considered "reactive". Concrete mixtures incorporating aggregates designated as "reactive" will not be allowed. The aggregate source will not be given a concrete user code until this evaluation is complete. Aggregates must wait a minimum of 6 months after a failing ASTM C1293 result, to resubmit the material for evaluation; a passing ASTM C1293 must be submitted with request for re-certification.

Subsection 1003.01.4.2 – Alkali Carbonate Reactivity (ACR) and Alkali Silica Reactivity (ASR) of Limestone in Portland Cement Concrete (03/21), Page 954

1003.01.4.2 is deleted and replaced with the following:

1003.01.4.2 Alkali Carbonate Reactivity (ACR) and Alkali Silica Reactivity (ASR) of Limestone in Portland Cement Concrete: For source approval, limestone aggregates for use in portland cement concrete will be evaluated for alkali carbonate reactivity (ACR) and alkali silica reactivity (ASR) utilizing AASHTO R80. If the aggregate's chemical composition (Cao/Mgo ratio vs Al2O3) plots outside of the diverging lines of the CSA A23.2 - 26A chart; the aggregate is considered non-expansive for ACR. Aggregate shall then be checked for ASR. If ASTM C1260 designates aggregates as "potentially ASR deleterious," (greater than or equal to 0.10% expansion but less than or equal to 0.20% expansion) then use a mixture with cementitious substitution as specified for ASR mitigation in Section 901.08.2. If ASTM C1260 results exceed 0.20%; aggregate must be further evaluated by means of ASTM C1293 to determine ASR reactivity. If ASTM results are less than 0.04% expansion, the aggregates are considered "innocuous". If ASTM C1293 results are greater than or equal to 0.04% expansion; the aggregate is considered reactive and will not be allowed in concrete mixtures. If the aggregate plots inside of the diverging lines of the CSA A23.2 - 26A chart; then the aggregate in considered "potentially ACR expansive" and shall be further appraised by ASTM C1105 testing. If ASTM C1105 results are less than 0.03%, then aggregates are considered "innocuous". If ASTM C1105 results are greater than or equal to 0.03% expansion; the aggregate is considered "ACR reactive". Concrete mixtures incorporating aggregates designated as "ASR reactive and/or ACR reactive" will not be allowed. The aggregate source will not be given a concrete user code until these evaluations (ASTM C1260, Chemical composition plot of CSA A23.2 - 26A chart and/or ASTM C1105/C1293) are complete. Aggregates must wait a minimum of 6 months after a failing ASTM C1105 and/or ASTM C1293 results, to resubmit the material for evaluation; passing ASTM C1293 and/or ASTM C1105 results must be submitted with request for re-certification.

Subsection 1003.05.2 – Sand-Clay-Gravel (09/19), Page 959

1003.05.2 is amended by deleting the phrase "For material passing the No. 40 (425 μm) sieve, comply with the following after lime treatment:" and replacing with the following:

For material passing the No. 40 (425 μm) sieve, comply with the following prior to lime treatment:

Subsection 1003.07 – Aggregates for Asphalt Surface Treatment (08/18), Page 961

Table 1003-15 is deleted and replaced with the following:

Table 1003-15
Asphalt Surface Treatment Aggregates Percent Passing

		Size 1		Size 2	Size 3
U.S. Sieve	Metric Sieve	Slag or Stone Aggregate (Size No. 5)	Crushed Gravel[2] or Lightweight Aggregate	All Aggregate (Size No. 7)	All Aggregate (Size No. 8)
1 1/2inch	37.5 mm	100	100	—	—
1 inch	25.0 mm	90-100	95-100	—	—
3/4 inch	19.0 mm	20-55	60-90	100	—
1/2 inch	12.5 mm	0-10	—	90-100	100
3/8 inch	9.5 mm	0-5	0-15	40- 80	85-100
No. 4	4.75 mm	—	0-5	0-15	10-40
No. 8	2.36 mm	—	—	0-5	0-10
No. 16	1.18 µm	—	—	—	0-5
No. 200	75 µm1	0-1	0-1	0-1	0-1

1. The percentage passing the No. 200 (75 µm) sieve shall be 0 - 2 percent for crushed aggregate when the materials finer than the No. 200 (75 µm) sieve consist of dust fraction from crushing and handling, essentially free of clay.
2. Uncrushed gravel may be used for Size 1 aggregate if more than one application of Asphalt Surface Treatment is required.

Subsection 1003.10 – Bedding Material (04/18), Page 965

Table 1003-21 is deleted and replaced with the following:

Table 1003-21
Gradation for Bedding, Sand-Aggregate

US Sieve Size	Percent Passing by Weight (Mass)
1 1/2 inches	95-100
No. 4	30-50
No. 10	20-45
No. 200	0-10

SECTION 1006 - THERMOPLASTIC PIPE (TPP):

All Subsections (11/20), Pages 979 and 980

1006 is deleted and replaced with the following:

Section 1006
Thermoplastic Pipe (TPP)

1006.01 GENERAL. Thermoplastic pipe and joint systems for cross drains, storm drains, and side drains shall be from the Approved Materials List. Thermoplastic pipe for underdrains and yard drains shall be perforated or non-perforated, as specified, and shall be from the Approved Materials List. Perforations, if specified, shall comply with AASHTO M252 for polyethylene pipe and with AASHTO M330 for polypropylene pipe.

1006.02 POLYVINYL CHLORIDE PIPE (PVCP). PVCP and gasket materials shall comply with AASHTO M278 or ASTM D3034, SDR 35.

1006.03 RIBBED POLYVINYL CHLORIDE PIPE (RPVCP). RPVCP may be either open profile or dual wall construction in accordance with the specified ASTM standards. Pipe and gasket materials shall comply with ASTM F794 or ASTM F949, Series 46 with UV inhibitors. The resin shall have a minimum cell classification of 12454-C in accordance with ASTM D1784.

1006.04 CORRUGATED POLYETHYLENE PIPE SINGLE WALL (CPEPSW). CPEPSW shall be perforated and shall comply with AASHTO M252, Type C. Perforations shall comply with AASHTO M252. Do not use CPEPSW as shoulder outlet underdrain pipe.

1006.05 CORRUGATED POLYETHYLENE PIPE DOUBLE WALL (CPEPDW). When used for cross or side drains, CPEPDW pipe and gasket materials shall comply with AASHTO M294, Type S, with a minimum resin cell classification of 435400C in accordance with ASTM D3350.

When used for plastic underdrain pipe, the pipe and joint system shall comply with AASHTO M252.

When used for yard drain pipe, the pipe and joint system shall comply with AASHTO M252, Type S, with a minimum resin cell classification of 424420C in accordance with ASTM D3350, or AASHTO M294, Type S, with a minimum resin cell classification of 435400C in accordance with ASTM D3350.

1006.06 CORRUGATED POLYPROPYLENE PIPE (CPPP).

1006.06.1 Corrugated Polypropylene Pipe Double Wall (CPPPDW): When used for storm drains, cross drains, side drains, or yard drains, the CPPPDW pipe, fittings, and gasket materials shall comply with AASHTO M330, Type S.

1006.06.2 Corrugated Polypropylene Pipe Triple Wall (CPPPTW): When used for storm drains, cross drains, side drains, or yard drains, the CPPPTW pipe, fittings, and gasket materials shall comply with AASHTO M 330, Type D.

1006.07 JOINT SYSTEMS FOR THERMOPLASTIC PIPE (TPP). Use pipe and joint systems from the Approved Materials List. Joint systems shall comply with 1018.03. A Type 2 or 3 joint system may be substituted for a Type 1 joint system; a Type 3 joint system may be substituted for a Type 2 joint system.

When using split coupling bands, use one piece that is composed of the same material as the pipe. The bands shall be the same thickness as the base pipe. The width of the band shall be equal to one-half the diameter of the pipe but a minimum of 12 inches wide.

Thermoplastic pipe gaskets shall be a part of a pipe/gasket system designed by the manufacturer and shall be from the Approved Materials List (AML), and comply with ASTM F477.

SECTION 1008 – PAINTS:

Subsection 1008.02 – Zinc Paint Systems (10/19), Pages 985 and 986

1008.02 is deleted and replaced with the following:

1008.02 ZINC PAINT SYSTEMS. The zinc paint system shall be from the Approved Materials List. Each system will be tested in accordance with AASHTO R 31. Zinc paint systems shall conform to the specification requirements of AASHTO R 31. All zinc paint systems shall meet the performance requirements listed in the latest Northeast Protective Coating Committee (NEPCOAT) Acceptance Criteria for New and 100 percent Bare Existing Steel for Bridges. The latest acceptance criteria can be found on the NEPCOAT website at www.nepcoat.org under the Qualified Products for Protective Coatings for New and 100 percent Bare Existing Steel for Bridges document.

Paint used on projects will be sampled and tested and shall comply with the following requirements:

Table 1008-1
Zinc Paint System Properties

Property	Test Method	Tolerance[1]
Pigment Content.	ASTM D2698	±2.0%
Density	ASTM D1475	±0.25 lbs/gal (±0.03 kg/l)
Solids Content	ASTM D2369	±2.0%
Non-volatile in Vehicle Content	ASTM D2698	±2.0%
Viscosity	ASTM D562	±5 KU
Dry to Touch	ASTM D1640	±10%
Dry Through	ASTM D1640	±10%
Sag, Lenetta	ASTM D4400	±10%
Infrared Spectrum	DOTD TR 610	Match Original[2]

[1]Target Values shall be established by the Materials and Testing Section upon qualification of the paint system.
[2]Standards for infrared spectrum shall be kept on file and compared to project samples for acceptance purposes.

Unless specified otherwise, the topcoat shall be tinted to match color 36463 from SAE AMS-STD-595A for non-weathering steel, and tinted to match color 30045 from SAE AMS-STD-595A for weathering steel.

Subsection 1008.08 – Maintenance Overcoating of Steel Bridges (10/19), Pages 989 and 990

1008.08 is deleted and replaced with the following:

1008.08 MAINTENANCE OVERCOATING OF STEEL BRIDGES. Use an overcoat system from the Approved Materials List. For source approval, a field trial is required, which consists of a three year side-by-side comparison between the new overcoat system and a corrosion inhibiting alkyd paint "control" system. Both systems shall overcoat a red lead paint system and/or approved alternate system. The new overcoat paint system shall perform as well or better than the control system in the areas of blistering, rusting, fading, chalking, and adhesion. Alternate testing programs such as NTPEP and NEPOVERCOAT will be allowed if approved by the Materials Engineer Administrator.

Paint used on projects will be sampled and tested and shall comply with the following requirements:

Table 1008-6
Paint Overcoat System Properties

Property	Test Method	Tolerance[1]
Pigment Content	ASTM D2698	±2.0%
Density	ASTM D1475	±0.25 lbs/gal (±0.03 kg/l)
Total Solids Content	ASTM D2369	±2.0%
Non-volatile in Vehicle Content	ASTM D2698	±2.0%
Viscosity	ASTM D562	±5 KU
Dry to Touch	ASTM D1640	±10%
Dry Through	ASTM D1640	±10%
Sag, Lenetta	ASTM D4400	±10%
Infrared Spectrum	DOTD TR 610	Match original[2]

[1]Target values shall be established by the Materials and Testing Section upon qualification of the paint system.

[2]Standards for infrared spectrum shall be kept on file and compared to project samples for acceptance purposes.

Unless specified otherwise, the topcoat shall be tinted to match color 36463 from SAE AMS-STD-595A for non-weathering steel, and tinted to match color 30045 from SAE AMS-STD-595A, for weathering steel.

SECTION 1009 – REINFORCING STEEL, STRAND, AND WIRE ROPE:

Subsection 1009.03.1 – Pavement Dowel Bars (10/18), Page 992

1009.03.1 is deleted and replaced with the following:

1009.03.1 Pavement Dowel Bars: Steel dowel bars shall comply with 1009.01.1, 1009.01.2, or 1009.01.3. Dowels shall have a uniformly round cross section and shall be saw cut, smooth and free of burrs, projections and deformations.

When, plastic coated dowels are being used, coated dowel bars shall be undercoated with an adhesive and given an outer coat of polypropylene or polyethylene. Coated dowel bars shall comply with AASHTO M 254. Type B coatings shall meet the requirements of ASTM A 775. Any damage to Type B coated dowels shall be repaired in accordance with ASTM A 775. For PCCP, place coated dowel bars in approved dowel bar assemblies in accordance with the plans.

Prior to placement of concrete, ensure dowel bars are entirely covered with an approved bond breaker that is one of the following:

1. Paraffin based lubricant, either Dayton Superior DSC BB-Coat or Valvoline Tectyl 506
2. White-pigmented curing compound conforming to ASTM C309, Type 2, Class A, with 22% minimum nonvolatile compound consisting of 50% paraffin wax
3. Any other bond breaker that is submitted with documentation sufficient to validate that it is equal to the above alternatives. Any approved equal must be reviewed and approved through the DOTD Materials Laboratory prior to use.

The use of oil-based or asphalt-based bond breakers is prohibited.

SECTION 1011 – CONCRETE CURING MATERIALS, ADMIXTURES, SPECIAL FINISHES, MODIFIERS, AND FIBER REINFORCEMENTS:

All Subsections (10/19), Pages 998 - 1000

1011 is deleted and replaced with the following:

Section 1011
Concrete Curing Materials, Admixtures, Special Finishes, Modifiers, and Fiber Reinforcements

1011.01 CURING MATERIALS.

1011.01.1 Liquid Membrane-Forming Compounds: This material shall comply with ASTM C309 and shall be from the Approved Materials List. Allowable types are Type 2 white-pigmented or Type 1-D, clear or translucent with a fugitive dye, as specified.

1011.01.2 Moist Cure Materials:

1011.01.2.1 Sheet Material: Use sheet materials for curing concrete meeting the physical and performance requirements of ASTM C171.

1011.01.2.2 Burlap Cloth: Use burlap cloth made from Jute or Kenaf complying with AASHTO M 182, Class 3.

1011.02 ADMIXTURES.

1011.02.1 Physical Requirements: Use concrete admixtures from the Approved Materials List in conformance with ASTM C494, ASTM C260, ASTM G109, and ASTM C1582, as applicable.

1011.02.2 Chemical Requirements: The contribution of chloride ion resulting from the addition of admixtures to the concrete shall not exceed 0.02 pound per cubic yard of concrete, when tested in accordance with DOTD TR 643.

1011.02.3 Acceptance Testing: The admixture shall be tested by analytical infrared (IR) spectroscopy in accordance with DOTD TR 610. The IR spectrum shall compare favorably to the standard IR spectrum of the original material tested and on file at the Materials and Testing Section. The percent solids by weight, determined in accordance with DOTD TR 524, shall not deviate more than ±10 percent from that of the original approved material and shall not exceed the manufacturer's stated limits. Tests to determine rate of hardening, compressive strength or other properties may be made at any time during the work to ensure continued compliance with these specifications.

1011.03 SPECIAL FINISH FOR CONCRETE. Use material from the Approved Materials List. The material shall provide a uniform-textured finish complying with these specifications. Follow the manufacturer's recommendation for method of mixing, method of application, and rate of application, except that the rate shall not exceed 60 square feet per mixed gallon. Modifications to the manufacturer's recommendations will not be permitted.

Use a one-component coating system containing pigments, sand, and resins. The coating shall contain fungicides to prevent the growth of mildew, mold, etc. Unless specified otherwise, color of the material when applied to the test panel shall match color 36463 from SAE AMS-STD-595A.

For project samples, comply with Table 1011-1.

Table 1011-1
Special Finish Sample Acceptance

Property	Test Method	Specifications Acceptance[1]
Density	ASTM D1475	Target Value ±0.25 lbs/gal
Viscosity	ASTM D562	Target Value ±5 KU
Dry to Touch	ASTM D1640	Target Value ±10%
Dry Through	ASTM D1640	Target Value ±10%
Solids percent	ASTM D2369	Target Value ±2%
Volatile percent	ASTM D2369	Target Value ±2%
Infrared Spectrum	DOTD TR 610	[2]

1. Target Values shall be established by the Materials Section upon qualification of the paint system.
2. Standards for infrared spectrum shall be kept on file and compared to project samples for acceptance purposes

For source approval, comply with the following:

1. The average number of cycles to failure shall be not less than 50 cycles when tested in accordance with ASTM C666, Method A. Test specimens shall show no flaking, cracking, spalling or loss of bond.
2. The material shall be unaffected except for slight chalking or discoloration when exposed to 1000 hours of accelerated weathering using UV-B lamps in accordance with ASTM G154.

1011.04 MODIFIERS.

1011.04.1 Formulated Latex: Use a styrene butadiene latex modifier produced in the United States at a proportion no greater than 24.5 gallons per cubic yard of concrete.

Use a latex modifier that is non-toxic, film-forming, and a polymeric emulsion of which 90 percent of the non-volatiles are styrene butadiene polymers. Use a modifier that is homogeneous, uniform in composition, and free from chlorides. Conform to chemical and physical properties specified in Table 1011-2, when tested in accordance with the requirements of FHWA Report No. RD-78-35.

Table 1011-2
Formulated Latex Modifier Chemical and Physical Properties

Property	Value or Range	Testing Standards
Butadiene Content	30% - 40%	FHWA 4.A.1
Solids	46% - 53%	FHWA 4.A.2
pH	8.5 - 12	FHWA 4.A.4
Coagulum	0.10% (max.)	FHWA 4.A.5
Surface Tension	50 dynes/cm (max.)	FHWA 4.A.8
Particle Size:		
Mean Angstrom	1400 - 2500	FHWA 4.A.9
Median Angstrom	1400 - 2500	FHWA 4.A.9
Distribution	Unimodal	FHWA 4.A.9
95% Range Angstrom	2000 (max.)	FHWA 4.A.9
Freeze-thaw Stability (% coagulum after 2 cycles)	0.10 (max.)	FHWA 4.A.10
Concrete Slump (in.)	Greater than standard	ASTM C143
Concrete Air Content (%)	9% (max.)	ASTM C231
Time for 50% Slump Loss	+/- 25% standard	ASTM C143
Concrete Compressive Strength (24 hr and 28 day) (psi)	75% standard (min.)	ASTM C39
Compressive Strength Loss (28 - 42 day)	20% (max.)	ASTM C39
Concrete Flexural Strength (24 hr and 28 day) (psi)	Greater than standard	ASTM C78
Flexural Strength Loss (28 - 42 day)	25% (max.)	ASTM C192
Deicer Scaling (50 cycles) / Median Grading:		
Median Grading	3 (max.)	FHWA 4.B.6
Worst Rated	Below 5	FHWA 4.B.6
Chloride Permeability (95% absorbed):		
1/16 - 1/2 in (% Cl-)	0.320 (max.)	FHWA 4.B.7
1/2 - 1 in (% Cl-)	0.064 (max.)	FHWA 4.B.7

1011.05 FIBER REINFORCEMENTS.

1011.05.1 Physical Requirements Fiber: Use fibers from the Approved Materials List.

Fibers shall comform to ASTM C1116 (with the exception of ASTM C666 for Freeze/Thaw which is not required) and each fiber type's subsequent ASTM standard:

1. Steel Fibers: ASTM A820 (Steel Fibers shall comply with the "Buy American" clause).
2. Glass Fibers: ASTM Cl666 (prove ASR resistance).
3. Polyolefin Fibers: ASTM D7508.
    a. Minimum tensile strength of macro-synthetic fibers shall be 50 ksi when tested in accordance with ASTM D3822.
    b. Macro-synthetic fibers shall have an aspect ratio (L/D) between 50 and 150.
    c. Micro-synthetic fibers shall produce a minimum of 50% or greater reduction in Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete when tested in accordance with ASTM Cl579.
4. Natural Fibers: ASTM D7357.

Fibers and their dosage shall obtain a minimum residual strength ratio (Re_3) of 25%, when tested in accordance to ASTM C1609.

Fibers shall have a fixed length and aspect ratio, and any changes in either parameter shall be approved by the Department.

SECTION 1016 – CONCRETE PIPE AND PRECAST REINFORCED CONCRETE DRAINAGE UNITS:

Subsection 1016.06 – Precast Reinforced Concrete Manholes, Catch Basins, Junction Boxes, and Safety Ends (02/19), Pages 1038 and 1039

1016.06 is deleted and replaced with the following:

1016.06 PRECAST REINFORCED CONCRETE MANHOLES, CATCH BASINS, JUNCTION BOXES, AND SAFETY ENDS. Comply with the dimensions shown on the plans, and the following:

Circular precast concrete manholes shall comply with ASTM C478, except that Class A1 concrete shall be used.

Square or rectangular precast concrete catch basins, junction boxes and drain manholes shall comply with ASTM C858, except that Class A1 concrete shall be used and surface resistivity requirements do not apply.

Precast safety ends shall comply with 702.04.3.

Portland cement concrete shall attain a minimum compressive strength of 4500 psi before shipping of the units.

Castings for frames, grates and covers shall comply with 1013.05 for steel and shall comply with 1013.06 for gray iron or malleable iron castings. Galvanization shall conform to ASTM A123.

1016.06.1 Casting Concrete: When multiple castings are to be made using the same forms, the use of metal forms are required. Concrete shall be placed into each sectional unit without interruption and shall be consolidated to force the concrete into the corners of forms and prevent formation of stone pockets or cleavage planes.

1016.06.2 Reinforcement: Reinforcement shall be as shown on the plans, and shall not vary more than 1/4 inch from the positions shown, except at pipe connections. Cover on reinforcement shall not be less than that shown on the plans.

SECTION 1017 – EPOXY RESIN SYSTEMS:

Subsection 1017.02 – Epoxy Resin Adhesives (General Use) (10/19), Page 1042

Table 1017-1 is deleted and replaced with the following:

Table 1017-1
Epoxy Resin Adhesives

		Type I		Type II		Type III		Type IV		Type V		Type VI & Type VII	
Property	**Test Method**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
Compressive Strength, psi	DOTD TR 705												
3 hours		—	—	—	—	1000	—	—	—	—	—	—	—
24 hours		5000	—	—	—	3000	—	5000	—	—	—	—	—
Tensile Bond Strength, psi	DOTD TR 706												
24 hours (dry cure)		350	—	—	—	250	—	350	—	—	—	—	—
72 hours (moist cure)		—	—	150	—	—	—	—	—	150	—	—	—

SECTION 1018 – MISCELLANEOUS MATERIALS:

Subsection 1018.03.1 – General (11/20), Pages 1044 and 1045

1018.03.1 is deleted and replaced with the following:

1018.03.1 General: All pipe joint systems and materials shall be approved by the Materials Engineer Administrator. For source approval on all pipes exceeding 12 inches in diameter and for all concrete drainage units, joint types are determined by hydrostatic joint testing in accordance with Table 1018-1, with the modifications of 1018.03.2.

Table 1018-1
Joint Type Determination

Type of Pipe	Test Method
Concrete Pipe and Drainage Units	ASTM C443
Metal Pipe	AASHTO M36
Thermoplastic Pipe – CPEPDW	AASHTO M294
Thermoplastic Pipe – PVCP	AASHTO M278 or ASTM D3034
Thermoplastic Pipe – RPVCP	ASTM F794 or ASTM F949
Thermoplastic Pipe – CPPPDW	AASHTO M330
Thermoplastic Pipe – CPPPTW	AASHTO M330

SECTION 1019 – GEOTEXTILE FABRIC AND GEOCOMPOSITE SYSTEMS:

Subsection 1019.01.1 – General Requirements (06/19), Page 1051

1019.01.1 is amended to include the following:

High strength geotextile fabric required under roadway embankment shall be manufactured from high-tenacity polyester yarns which are woven into a stable network. The fabric shall be inert to biological degradation and resistant to chemicals encountered naturally in soils, alkalis, and acids. Prior to installation, a Certificate of Analysis shall be submitted indicating each lot meets specification criteria. The contractor shall send samples to an accredited third party lab or require it from the manufacturer to test materials for compliance with performance requirements. High strength geotextile fabric is not required to be on the AML.

Subsection 1019.01.2 – Detailed Requirements (06/19), Page 1053

Table 1019-1 is deleted and replaced with the following:

Table 1019-1
Geotextile Fabrics

		Requirements									
		Classes							Types		
Property	**Test Method**	**A**	**B**	**C**	**D**	**S**	**F**	**G**	**1**	**2**	**3**
AOS, Metric Sieve, µm, Max.	ASTM D4751	300	300	300	212	600	850	850	850	—	—
Grab Tensile, N, Min.	ASTM D4632	330	400	580	800	800	400	400	—	—	—
% Elongation @ Failure, Min.	ASTM D4632	—	—	50	50	—	—	—	—	—	—
% Elongation @ 200 N, Max.	ASTM D4632	—	—	—	—	—	—	50	—	—	—
Burst Strength, N, Min.	ASTM D3787	440	620	930	1290	1390	—	—	—	—	—
Puncture, N, Min.	ASTM D4833	110	130	180	330	330	—	—	—	—	—
Trapezoid Tear Strength, N, Min.	ASTM D4533	110	130	180	220	220	—	—	—	—	—
Permittivity, $Sec.^{-1}$, Min.	ASTM D4491	1.0	1.0	1.0	1.0	0.2	0.01	0.01	0.2	—	—
Grab Tensile Strength Retained after weathering 150 h, UVA lamps, %, Min	ASTM D4632 ASTM G154	70	70	70	70	70	—	—	—	—	—
Grab Tensile Strength Retained after weathering 500 h, UVA lamps, %, Min	ASTM D4632 ASTM G154	—	—	—	—	—	70	70	—	—	—
Strength @ Ultimate, kN/M	ASTM D-4595	—	—	—	—	—	—	—	140	390	650
Strength @ 5% Strain*, kN/M	ASTM D-4595	—	—	—	—	—	—	—	52	130	250
Long-term Design Strength, kN/M	GRI-GT7	—	—	—	—	—	—	—	66	195	290

*Minimum value shown in table must be met unless otherwise approved by the engineer

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (*see* 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action

within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:
(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than $10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding (29 CFR 5.5)

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records (29 CFR 5.5)

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or

subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees (29 CFR 5.5)

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the

corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility (29 CFR 5.5)

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1 of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1 of this section. 29 CFR 5.5.

* $27 as of January 23, 2019 (See 84 FR 213-01, 218) as may be adjusted annually by the Department of Labor; pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990).

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 of this section. 29 CFR 5.5.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1 through 4 of this section. 29 CFR 5.5.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term “perform work with its own organization” in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance

with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.326.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.326.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant

who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is

submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(a) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(b) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(c) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier

subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B)
This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
REQUIRED CONTRACT PROVISIONS
FEMALE AND MINORITY PARTICIPATION IN CONSTRUCTION

The following notice shall be included in, and shall be a part of, all solicitations for offers and bids on all federal and federally assisted construction contracts or subcontracts in excess of $10,000 to be performed in geographical areas designated by the director of OFCCP. Execution of the contract by the successful bidder and any subsequent subcontracts will be considered the contractor's and subcontractor's commitment to the EEO provisions contained in this notice.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

AREA	PARISH OR COUNTY	GOAL (%)
	FEMALE PARTICIPATION	
-	All Covered Areas	6.9
	MINORITY PARTICIPATION (UNDER NEW ORLEANS PLAN)	
-	* See Note Below	20 to 23
	MINORITY PARTICIPATION (NOT UNDER NEW ORLEANS PLAN)	
1	Jefferson LA, Orleans LA, St. Bernard LA, St. Tammany LA	31.0
2	Assumption LA, Lafourche LA, Plaquemines LA, St. Charles LA, St. James LA, St. John the Baptist LA, Tangipahoa LA, Terrebonne LA, Washington LA, Forrest MS, Lamar MS, Marion MS, Pearl River MS, Perry MS, Pike MS, Walthall MS	27.7
3	Ascension LA, East Baton Rouge LA, Livingston LA, West Baton Rouge, LA	26.1
4	Concordia LA, East Feliciana LA, Iberville, LA, Pointe Coupee LA, St. Helena LA, West Feliciana LA, Adams MS, Amite MS, Wilkinson, MS	30.4
5	Lafayette LA	20.6
6	Acadia LA, Evangeline LA, Iberia LA, St. Landry LA, St. Martin LA, St. Mary LA, Vermillion LA	24.1
7	Calcasieu LA	19.3
8	Allen LA, Beauregard LA, Cameron LA, Jefferson Davis LA, Vernon LA	17.8
9	Grant LA, Rapides LA	25.7
10	Avoyelles LA, Bienville LA, Bossier LA, Caddo LA, Claiborne LA, DeSoto LA, Natchitoches LA, Red River LA, Sabine LA, Webster LA, Winn LA	29.3
11	Ouachita LA	22.8
12	Caldwell LA, Catahoula LA, East Carroll LA, Franklin LA, Jackson LA, LaSalle LA, Lincoln LA, Madison LA, Morehouse LA, Richland LA, Tensas LA, Union LA, West Carroll LA,	27.9

*These goals apply only to those contractors signatory to the New Orleans Plan and only with respect to those trades which have unions participating in said Plan. The New Orleans Plan Covered Area is as follows: The parishes of Orleans, Jefferson, St. Bernard, St. Tammany, St. Charles, St. John the Baptist, Plaquemines, Washington, Terrebonne, Tangipahoa (that area east of the Illinois Central Railroad), Livingston (that area southeast of the line from a point off the Livingston and Tangipahoa Parish line adjacent from New Orleans and Baton Rouge), St. James (that area southeast of a line drawn from the Town of Gramercy to the point of intersection of St. James, Lafourche and Assumption Parishes), and Lafourche.

These goals are applicable to all the contractor's construction work (whether or not it is federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor is also subject to the goals for both its federally involved and non-federally involved construction.

The contractor's compliance with the Executive Order and the regulations in 41 CFR 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor, or from project to project, for the purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Regional Administrator of the Office of Federal Contract Compliance Programs (555 Griffin Square Building, Dallas, TX 75202) within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and geographical area in which the contract is to be performed.
4. As used in this Notice and in the contract, the "covered area" is that area shown in the foregoing table in which the project is located.

The following Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246) shall be included in, and shall be a part of, all solicitations for offers and bids on all federal and federally assisted construction contracts or subcontracts in excess of $10,000. Execution of the contract by the successful bidder and any

subsequent subcontracts will be considered the contractor's and subcontractor's commitment to the EEO provisions contained in these Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246).

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

1. As used in these specifications:
    a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
    b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
    c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941.
    d. "Minority" includes:
        i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
        ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
        iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
        iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. If the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, he shall include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation.
3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is required to comply with his obligations under the EEO clause, and to make good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractor or subcontractors toward a goal in an

approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals.

4. The contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any OFCCP office or from federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer either minorities or women, shall excuse the contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.

7. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications will be based on his effort to achieve maximum results from its actions. The contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign 2 or more women to each construction project. The contractor shall ensure that all foremen, superintendents and other on-site supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment with specific attention to minority or female individuals working at such sites or in such facilities.
b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to

community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the contractor has taken.

d. Provide immediate written notification to the Director when the union or unions with which the contractor has a collective bargaining agreement has not referred to the contractor a minority person or woman set by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting his EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as superintendent, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than 1 month prior to the date for the acceptance of

applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above describing the openings, screening procedures and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women, and where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR 60-3.

l. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling its obligations under 7a through 7p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female workforce participation, makes a good faith effort to meet his goals and timetables and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

9. A goal for minorities and a separate goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the contractor may be in violation of the Executive Order if a group is employed

in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally, the contractor may be in violation of the Executive Order if a minority group of women in underutilized).

10. The contractor shall not use the goals or affirmative action standards to discriminate against any person because of race, color, religion, sex or national origin.

11. The contractor shall not enter into a subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The contractor, in fulfilling his obligations under these specifications, shall implement specific affirmative actions steps, at least as extensive as the standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors will not be required to maintain separate records.

15. Nothing herein shall be construed as a limitation on the application of other laws which establish different standards of compliance or on the application of requirements for hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

16. In addition to the reporting requirements set forth elsewhere in this contract, the contractor and subcontractors holding subcontracts (not including material suppliers) in excess of $10,000

shall submit for every month of July during which work is performed, employment data as contained under Form FHWA-1391 in accordance with instructions included thereon.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
REQUIRED CONTRACT PROVISIONS

SPECIFIC EQUAL EMPLOYMENT OPPORTUNITY RESPONSIBILITIES

1. General

    a. Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal employment opportunity as required by Executive Orders 11246 and 11375 are set forth in Required Contract Provisions (Form FHWA-1273) and these Supplemental Specifications which are imposed pursuant to Section 140 of Title 23, U.S.C., as established by Section 22 of the Federal Aid Highway Act of 1968. The requirements set forth herein shall constitute the specific affirmative action requirements for project activities under this contract and supplement the EEO requirements set forth in the Required Contract Provisions.
    b. The contractor shall work with the Department and the Federal Government in carrying out EEO obligations and in their review of his activities under the contract.
    c. The contractor and all his subcontractors holding subcontracts not including material suppliers, of $10,000 or more, shall comply with the following minimum specific requirement activities of EEO. The EEO requirements of Executive Order 11246, as set forth in the Federal-Aid Policy Guide 23 CFR 230A, are applicable to material suppliers as well as contractors and subcontractors. The contractor shall include these requirements in every subcontract of $10,000 or more with such modification of language as necessary to make them binding on the subcontractor.

2. EEO Policy

    The contractor shall accept as his operating policy the following statement which is designed to further the provision of EEO to all persons without regard to their race, color, religion, sex or national origin, and to promote the full realization of EEO through a positive continuing program:

    It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color or national origin. Such action shall include employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship and on-the-job training.

3. EEO Officer
   The contractor shall designate and make known to the Department an EEO Officer who shall have the responsibility for and must be capable of effectively administering and promoting an active contractor EEO program and who must be assigned adequate authority and responsibility to do so.
4. Dissemination of Policy
   a. All members of the contractor's staff who are authorized to hire, supervise, promote and discharge employees, or who recommend such action, or who are substantially involved in such action, shall be made fully cognizant of and shall implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions shall be taken as a minimum:

      i. Periodic meetings of supervisory and personnel office employees shall be conducted before the start of work and then at least once every 6 months, at which time the contractor's EEO policy and its implementation shall be reviewed and explained. The meetings shall be conducted by the EEO Officer or other knowledgeable company official.

      ii. All new supervisory or personnel office employees shall be given a thorough indoctrination by the EEO Officer or other knowledgeable company official covering all major aspects of the contractor's EEO obligations within 30 days after their reporting for duty with the contractor.

      iii. All personnel who are engaged in direct recruitment for the project shall be instructed by the EEO Officer or appropriate company official in the contractor's procedures for locating and hiring minority group employees.

   b. To make the contractor's EEO policy known to all employees, prospective employees and potential sources of employees, i.e., schools, employment agencies, labor unions (where appropriate), college placement officers, etc., the contractor shall take the following actions:

      i. Notices and posters setting forth the contractor's EEO policy shall be placed in areas readily accessible to employees, applicants for employment and potential employees.

      ii. The contractor's EEO policy and the procedures to implement such policy shall be brought to the attention of employees by means of meetings, employee handbooks or other appropriate means.

5. Recruitment
    a. When advertising for employees, the contractor shall include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements shall be published in newspapers or other publications having a large circulation among minority groups in the area from which the project work force would normally be derived.

    b. The contractor shall, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants, including, but not limited to, State employment agencies, schools, colleges and minority group organizations. To meet this requirement, the contractor shall, through his EEO Officer, identify sources of potential minority group employees and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.

    If the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with equal employment opportunity contract provisions. (The U.S. Department of Labor has held that where implementation of such agreements has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)

    c. The contractor shall encourage his present employees to refer minority group applicants for employment by posting appropriate notices or bulletins in areas accessible to all such employees. In addition, information and procedures with regard to referring minority group applicants shall be discussed with employees.

6. Personnel Actions

    Wages, working conditions and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff and termination, shall be taken without regard to race, color, religion, sex or national origin. The following procedures shall be followed.

    a. The contractor shall conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

    b. The contractor shall periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor shall periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor shall promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor shall promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, shall attempt to resolve such complaints, and shall take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor shall inform every complainant of all of his avenues of appeal.

7. Training and Promotion

a. The contractor shall assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship and job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. If the Supplemental Specifications for Job Training are provided under this contract, this subparagraph will be superseded as indicated in Attachment 2.

c. The contractor shall advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor shall periodically review the training and promotion potential of minority group and women employees and shall encourage eligible employees to apply for such training and promotion.

8. Unions

If the contractor relies in whole or in part upon unions as a source of employees, the contractor shall use his best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent shall include the procedures set forth below:

a. The contractor shall use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.
b. The contractor shall use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex or national origin.
c. The contractor shall obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the Department and shall set forth what efforts have been made to obtain such information.
d. If the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor shall, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex or national origin, making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The U.S. Department of Labor has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) If the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these specifications, such contractor shall immediately notify the Department.

9. Subcontracting
   a. The contractor shall use his best efforts to solicit bids from and utilize minority group subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of minority-owned construction firms from the Department.
   b. The contractor shall use his best efforts to ensure subcontractor compliance with their EEO obligations.
10. Records and Reports
   a. The contractor shall keep such records as necessary to determine compliance with the contractor's EEO obligations. The records kept by the contractor shall indicate:

i. the number of minority and nonminority group members and women employed in each work classification on the project,
ii. the progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and women (applicable only to contractors who rely in whole or in part on unions as a source of their work force),
iii. the progress and efforts being made in locating, hiring, training, qualifying and upgrading minority and female employees, and
iv. the progress and efforts being made in securing the services of minority group subcontractors with meaningful minority and female representation among their employees.

b. All such records must be retained for a period of 3 years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the Department and the Federal Highway Administration.

c. The contractor shall submit an annual report to the Department each July for the duration of the project, indicating the number of minority, women and nonminority group employees currently engaged in each work classification required by the contract work. This information shall be reported on Form PR-1391. If job training is required, the contractor shall furnish Form DOTD 03-37-0014.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
REQUIRED CONTRACT PROVISIONS
ON-THE-JOB TRAINING

The Louisiana Department of Transportation and Development (LADOTD) has partnered with the Louisiana Associated General Contractors (LAGC) to ensure that on-the-job training is provided on a voluntary basis by contractors performing work on LADOTD's federally assisted construction projects.

The LAGC has committed that its member contractors will enroll a minimum of 20 trainees statewide during the period July 1 through June 30 annually. It is anticipated that this annual training goal will be increased in future years as participation in the program grows.

The LADOTD on-the-job training program will be monitored by the Compliance Programs Section. At all times it will be the responsibility of the contractor to comply with the Job Training Supplemental Specifications. LAGC will provide support to their member contractors in the area of on-the-job training as they would in any contractual activity. LAGC has committed to assisting contractors in areas such as recruitment, record keeping, graduation certificates, and ongoing encouragement of contractors to participate in the training program. LAGC has expressed their willingness to work with LADOTD and FHWA in making the contracting industry as strong as possible in all areas, including on-the-job training.

Non-LAGC members are encouraged to participate in the LADOTD on-the-job training program. No aspect of the LADOTD/LAGC partnership is designed to eliminate the right of any non-LAGC member to participate in the training program described in these specifications. If any non-LAGC member does not utilize a previously approved training program, he/she is directed to develop and submit a training program to LADOTD for approval by LADOTD and FHWA.

Although training under this contract is not limited to minorities and females, contractors should be aware that one of the objectives of the training program is to increase the participation and skills of minorities and females in highway construction. Contractors must exert good faith efforts to comply with the Equal Employment Opportunity contract requirements governing recruitment and upgrading when seeking to fill vacancies in the work force and select candidates for the training program. Adequate documentation of good faith efforts should be maintained and submitted to the Compliance Programs Section Training Program Manager (TPM) when requested.

These supplemental specifications are in implementation of 23 USC 140(a). Training under this contract shall be optional to the successful bidder, provided the item for which training is requested is less than 70 percent complete. If the contractor elects to provide training under the contract as established in these specifications, he may submit a written request to the project engineer with a copy to the Construction Section. A plan change will be prepared to incorporate a pay item using the trainee hours stated in the Special Provisions elsewhere herein. Training will only be reimbursed after the approval of this plan change.

It is intended that training under these supplemental specifications be in crafts directly related to highway construction. Therefore, training in classifications such as clerk-typist, secretary, bookkeeper, fireman, office engineer, estimator, timekeeper, and unskilled or common laborer will not be approved for participation under these supplemental specifications.

No employee shall be employed as a trainee in any classification in which he/she has successfully completed a training course leading to journey person status or in which he/she has been employed as a journey person. The contractor shall satisfy this requirement by completing the Contractor's Trainee Enrollment & Interview Form for each potential trainee. The completed form shall be electronically submitted to the TPM for review and approval.

The contractor will be reimbursed $3.00 per hour of training provided in accordance with an approved training program. Reimbursement will be made for training hours in excess of the number specified herein. This reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other sources do not specifically prohibit the contractor from receiving other reimbursement. The contractor will be reimbursed for the number of trainee hours actually trained on the project in accordance with these supplemental specifications.

The contractor will be credited for each trainee employed on the project that is currently enrolled or becomes enrolled in an approved training program and will be reimbursed for such trainees as provided in these supplemental specifications.

The minimum length and type of training for each classification selected by the contractor will be established in the training program approved by the Department, Federal Highway Administration (FHWA), and/or Office of Federal Contract Compliance Programs (OFCCP). The Department, FHWA, and/or OFCCP will approve a program if it is reasonably calculated to meet the Equal Employment Opportunity obligations of the contractor and to qualify the average trainee for journey person status in the classification concerned by the end of the training period. Apprenticeship programs registered with the U. S. Department of Labor, Bureau of Apprenticeship and Training or with a state apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the U. S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training will also be considered acceptable if it is being administered in a manner consistent with the equal employment obligations of federal-aid highway construction contracts.

It is normally expected that a trainee will begin training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his/her work classification or until he/she has completed the training program.

Enrollment of trainees in excess of the required number will be permitted, with approval, to allow the contractor to maintain the required continuous effort to complete the training of individual trainees.

Trainees will be paid at least 60 percent of the appropriate minimum journey person's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent of the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by these supplemental specifications.

The contractor, prior to the start of training, shall provide written notice to each person to be trained under these supplemental specifications of that person's designation as a trainee, the training program and classification under which training will be provided, the length of the training program, and the hourly wage rate to be paid to the trainee. This requirement shall be fulfilled by use of the Contractor's Trainee Enrollment & Interview Form.

Upon graduation, the contractor shall issue the trainee a certification showing the type and length of training satisfactorily completed along with a permanent photo identification card designating the bearer as a graduate journey person of the appropriate training program.

The contractor shall electronically submit the Contractor's Trainee Enrollment & Interview Form for each employee on the project who is enrolled as a trainee in an approved training program or apprenticeship program. The trainee enrollments shall be submitted to the TPM within the first payroll period in which each trainee or apprentice is assigned to the project.

In order to collect the $3.00 per hour reimbursement for training, the contractor shall electronically submit to the project engineer's office each week that training is conducted on the project the Contractor's OJT Weekly Reporting Form attached to the certified payroll. Submission of the certified payroll is completed through the AASHTOWare (CR&L) program and must be without error or exceptions.

At any time during the life of the project, provided that the item for which training is requested is less than 70 percent complete, a subcontractor may elect to train. The subcontractor should follow the steps described above in order to participate in the on-the-job training program. If the subcontractor does not utilize a previously approved training program, he/she is directed to develop and submit a training program to the TPM for approval by LADOTD and FHWA.

Contractors are to train according to their work force needs and as training opportunities exist on a project. If a trainee graduates from a training classification, training opportunities no longer exist in the approved classification, or a contractor's work force needs change, a trainee could be enrolled in a different classification. The Contractor's OJT Change Form is to be used when these circumstances necessitate enrolling a current trainee or a graduate in a new classification. Multiple enrollments of an individual should not be used to diminish the objectives of these specifications, but to enhance the trainee's career growth, benefit the contractor's operations, and improve the contracting industry overall.

All required forms can be found along with the instructions on the LADOTD website on the Compliance Program's On the Job Training page and the Construction Letting Information page under Doing Business with DOTD.

It is the goal of the LADOTD/LAGC partnership to maintain a voluntary on-the-job training program, but revisions to the program may be deemed necessary should participation fall below acceptable levels.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

REQUIRED CONTRACT PROVISIONS FOR DBE PARTICIPATION IN FEDERAL AID CONSTRUCTION CONTRACTS (DBE GOAL PROJECT)

A. AUTHORITY AND DIRECTIVE: The Code of Federal Regulations, Title 49, Part 26 (49 CFR Part 26) as amended and the Louisiana Department of Transportation and Development's (DOTD) Disadvantaged Business Enterprise (DBE) Program are hereby made a part of and incorporated by this reference into this contract. Copies of these documents are available, upon request, from DOTD Compliance Programs Office, P. O. Box 94245, Baton Rouge, LA 70804-9245.

B. POLICY: In accordance with 49 CFR Part 26.13, it is the policy of the DOTD that it shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of any United States Department of Transportation (US DOT) financially assisted contracts or in the administration of its DBE program or the requirements of 49 CFR Part 26. The DOTD shall take all necessary and reasonable steps under 49 CFR Part 26 to ensure nondiscrimination in the award and administration of US DOT assisted contracts. The DBE program, as required by 49 CFR Part 26 and as approved by US DOT, is incorporated by reference in this agreement. Implementation of this program is a legal obligation and failure to carry out its terms shall be treated as a violation of this agreement. Upon notification of failure to carry out the approved DBE program, the US DOT may impose sanctions as provided for under 49 CFR Part 26 and may, in appropriate cases, refer the matter for enforcement under 18 U.S.C. 1001 and/or the Program Fraud Civil Remedies Act of 1986 (31 U.S.C.3801 et seq.).

C. DBE OBLIGATION: The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor must carry out applicable requirements of 49 CFR Part 26 in the award and administration of US DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the DOTD deems appropriate.

The preceding policy and DBE obligation shall apply to this contract and shall be included in the requirements of any subcontract. Failure to carry out the requirements set forth therein shall constitute a breach of contract and, after notification by DOTD, may result in termination of the contract, a deduction from the contract funds due or to become due the contractor or other such remedy as DOTD deems appropriate. The contractor is encouraged to use the services offered by banks in the community which are owned and controlled by minorities or women when feasible and beneficial. The term DBE is inclusive of women business enterprises (WBE) and all obligations applicable to DBE shall apply to firms certified and listed as WBE.

D. FAILURE TO COMPLY WITH DBE REQUIREMENTS: All contractors and subcontractors are hereby advised that failure to carry out the requirements set forth above shall constitute a breach of contract and, after notification by DOTD may result in rejection of the bid; termination of the contract; a deduction from the contract funds due or to become due the contractor; or other such remedy as DOTD deems appropriate. Failure to comply with the DBE requirements shall include but not be limited to failure to meet the established goal and/or failure to submit documentation of good faith efforts; failure to exert a reasonable good faith effort (as determined by DOTD) to meet established goals; and failure to realize the DBE participation set forth on approved Form CS-6AAA and attachments. Failure to submit Form CS-6AAA and attachments and/or reasonable good faith efforts' documentation within the specified time requirements will result in the Department taking the actions specified in Heading G(6) below. The utilization of DBE is in addition to all other equal opportunity requirements of the contract. The contractor must include the provisions in Sections B, C and D of these provisions in subcontracts so that such provisions will be binding upon each subcontractor, regular dealer, manufacturer, consultant, or service agency.

E. ELIGIBILITY OF DBE: For convenience, DOTD provides a list on its website of firms that have been certified as eligible to participate as DBEs on US DOT assisted contracts. This list is not an endorsement of the quality of

performance of the firm but is simply an acknowledgment of the firm's eligibility as a DBE. The Louisiana Department of Transportation makes no representations of the accuracy or completeness of this list on any particular date or time. Contractors considering the use of a particular DBE subcontractor are advised to obtain documentation of certification status from that subcontractor.

F. COUNTING DBE PARTICIPATION TOWARD DBE GOALS: DBE participation toward attainment of the goal will be credited on the basis of total subcontract prices agreed to between the contractor and subcontractors for the contract items or portions of items being sublet as reflected on Form CS-6AAA and attachments, in accordance with the DOTD DBE Program, and the following criteria.

(1) Credit will only be given for use of DBEs that are certified by the Louisiana Unified Certification Program. Certification of DBEs by other agencies is not recognized.

(2) The total value of subcontracts awarded for construction and services to an eligible DBE is counted toward the DBE goal provided the DBE performs a commercially useful function. The contractor is responsible for ensuring that the goal is met using DBEs that perform a commercially useful function.

The contractor shall operate in a manner consistent with the guidelines set forth in the DOTD DBE Program. A commercially useful function is performed when a DBE is responsible for the execution of a distinct element of work by actually managing, supervising, and performing the work in accordance with standard industry practices except when such practices are inconsistent with 49 CFR Part 26 as amended, and the DOTD DBE Program, and when the DBE receives due compensation as agreed upon for the work performed. To determine whether a DBE is performing a commercially useful function, the DOTD shall evaluate the work subcontracted in accordance with the DOTD DBE Program, industry practices and other relevant factors. When an arrangement between the contractor and the DBE represents standard industry practice, if such arrangement erodes the ownership, control or independence of the DBE, or fails to meet the commercially useful function requirement, the contractor will not receive credit toward the goal.

(3) A DBE prime contractor may count only the contract amount toward DBE participation for work he/she actually performs and for which he/she is paid. Any subcontract amounts awarded to certified DBEs by a DBE prime will also be credited toward DBE participation provided the DBE subcontractor performs a commercially useful function.

(4) A contractor may count toward the DBE goal 100 percent of verified delivery fees paid to a DBE trucker. The DBE trucker must manage and supervise the trucking operations with its own employees and use equipment owned by the DBE trucker. No credit will be counted for the purchase or sale of material hauled unless the DBE trucker is also a DOTD certified DBE supplier. No credit will be counted unless the DBE trucker is an approved subcontractor.

(5) A contractor may count toward the DBE goal, when a DBE performs as a participant in a joint venture, the total dollar value of the contract equal to the distinct, clearly defined portion of work within the contract that the DBE performs with its own forces. The joint venture agreement must include a detailed breakdown of the following:

a. Contract responsibility of the DBE for specific items of work.

b. Capital participation by the DBE.

c. Specific equipment to be provided to the joint venture by the DBE.

d. Specific responsibilities of the DBE in the control of the joint venture.

e. Specific manpower and skills to be provided to the joint venture by the DBE.

f. Percentage distribution to the DBE of the projected profit or loss incurred by the joint venture.

(6) A contractor may count toward the DBE goal only expenditures for materials and supplies obtained from DBE suppliers and manufacturers in accordance with the following:

a. The DBE supplier assumes actual and contractual responsibility for the provision of materials and supplies.

b. The contractor may count 100 percent of expenditures made to a DBE manufacturer provided the DBE manufacturer operates or maintains a factory or establishment that produces on the premises the materials or supplies obtained by the contractor.

c. The contractor may count 60 percent of the expenditures to DBE suppliers, who are regular dealers but not manufacturers, provided the DBE supplier performs a commercially useful function in the supply process including buying the materials or supplies, maintaining an inventory, and selling materials regularly to the public. Dealers in bulk items such as steel, cement, aggregates and petroleum products are not required to maintain items in stock, but they must own or operate distribution equipment. The DBE supplier must be certified as such by DOTD.

d. A DBE may not assign or lease portions of its supply, manufactured product, or service agreement without the written approval of the DOTD.

(7) A contractor may count toward the DBE goal reasonable expenditures to DBE firms including fees and commissions charged for providing a bona fide service; fees charged for hauling materials unless the delivery service is provided by the manufacturer or regular dealer as defined above; and fees and commissions for providing any bonds or insurance specifically required for the performance of the contract.

(8) The contractor will not receive credit if the contractor makes direct payment to the material supplier. However, it may be permissible for a material supplier to invoice the contractor and DBE jointly and be paid by the contractor making remittance to the DBE firm and material supplier jointly. Prior approval by DOTD is required.

(9) With prior approval from the Compliance Programs Office, a DBE firm may lease equipment from a Prime Contractor. However, if a DBE firm leases equipment from a Prime Contractor, work performed with that equipment shall not be counted towards the achievement of the contract DBE goal. If a DBE firm has received approval from the Compliance Programs Office to lease a specialized piece of equipment from the prime contractor that they are currently performing work for on a specific project, goal credit will be decided in accordance with the Code of Federal Regulations.

Lease agreements are required for any equipment leased by a DBE subcontractor before its use on the project and the lease agreement must be related to that specific project. All lease agreements, including signatures, must be submitted to the Compliance Programs Office in advance of use on the project. Upon receipt of any completed lease agreements, including signatures, the Compliance Programs Office staff will review and render a decision, after Department process is completed.

(10) The contractor will not receive credit toward the DBE goal for any subcontracting arrangement contrived to artificially inflate the DBE participation, as determined by the Department.

G. AWARD DOCUMENTATION AND PROCEDURE: This project has specific DBE goal requirements set forth in the Special Provision for DBE Participation in Federal Aid Construction Contracts. The bidder by signing this bid certifies that:

(1) The goal for DBE participation prescribed in the special provisions shall be met or exceeded and arrangements have been made with certified DBE or good faith efforts made to meet the goal will be demonstrated.
(2) Affirmative actions have been taken to seek out and consider DBEs as potential subcontractors. Bidders must contact DBEs to solicit their interest, capability, and prices in sufficient time to allow them to respond effectively, and must retain, on file, proper documentation to substantiate their good faith efforts.
(3) Form CS-6AAA, "Attachment to Form CS-6AAA", and, if necessary, good faith effort documentation must be submitted to the DOTD by 5:00 p.m. on the due date which is set forth in the "apparent bid results" and "bid results" posted on the Department's website. Submittals must be entered online at http://wwwapps.dotd.la.gov/administration/compliance/cs6aaa/home.aspx . If necessary, the Good Faith Effort Documentation Form will also be filled out online at this time. Once reviewed and after the CS-6AAA is approved, an email will be sent back to the prime contractor to obtain the required signatures. After signatures are obtained, the entire document must then be sent electronically to dotdcs6aaacompliance@la.gov prior to 5:00 p.m. on the specified date required. The CS-6AAA form with original signatures must be submitted to the DOTD with all other documents also required for contract execution and approval.

Should a bidder protest or appeal any matter regarding the bidding or award of a contract in accordance with Subsection 102.13 of the 2016 Standard Specifications (Subsection 102.13 of the 2006 Louisiana Standard Specifications) after the scheduled time of bid opening, the Department will immediately suspend the time requirement for submission of Form CS-6AAA and Attachments until further notice and will notify all parties involved of the suspension. Once the protest has been resolved the Department will notify the low bidder and issue a date for submission of Form CS-6AAA and Attachments.

All attachments to Form CS-6AAA shall include:

a. The names of the DBE subcontractors that will actually participate in meeting the contract goal; and

b. A complete description of the work to be performed by the DBE including the specific items and portions of items of work, quantities, and unit price(s) of each item; and

c. The total dollar value of each item that can be credited toward the contract goal; and

d. Any assistance to be provided to the DBE; and

e. The original signature of each DBE and the contractor attesting that negotiations are in progress and that it is the intention of the parties to enter into a subcontract within 60 calendar days from the time the contract is finalized between the contractor and DOTD.

It shall be the bidder's responsibility to ascertain the certification status of designated DBEs. An extension of time for submittal of Form CS-6AAA and Attachments will not be granted beyond the stated time. Questionable technical points will be cleared with the DOTD Compliance Programs Office within the time period allowed. If the documentation required is not provided in the time and manner specified, DOTD will take the actions specified in Heading (6) below.

(4) If the apparent low bidder is not able to meet the DBE goal, the DBE participation which has been secured to meet a portion of the goal shall be listed on the Form CS-6AAA and attachments. They must be completed and submitted in accordance with Heading (3) above by the specified date. Documentation of adequate good faith efforts to meet the remainder of the goal must be submitted with the forms. Examples of good faith efforts are shown in Section J.

The DOTD's evaluation of good faith efforts in the pre-award stage will focus primarily on efforts made prior to submittal of the bid. For consideration, good faith efforts shall include the requirements listed in these provisions as well as other data the contractor feels is relevant.

(5) Form CS-6AAA and attachments, and documentation of good faith efforts, when appropriate, will be evaluated by the Compliance Programs Director in the selection of the lowest responsible bidder. The information provided must be accurate and complete. The apparent low bidder's proposed attainment of the DBE goal and/or demonstration of good faith efforts will be considered in the award of the contract.

(6) An apparent low bidder's failure, neglect, or refusal to submit Form CS-6AAA and attachments committing to meet or exceed the DBE goal and/or documentation of good faith efforts, shall constitute just cause for the DOTD to reject the bid, pursue award to the next lowest bidder, or re-advertise the project. The original apparent low bidder will be declared irregular and will not be allowed to bid on the project should re-advertisement occur.

(7) The bidder has the right to appeal the DOTD's findings and rulings to the DOTD Chief Engineer. The bidder may present information to clarify the previously submitted documentation. The decision rendered by the DOTD Chief Engineer will be administratively final. There shall be no appeal to the US DOT. If the DOTD Chief Engineer does not rule in favor of the original apparent low bidder, the new apparent low bidder must submit, in detail, its subsequent proposed DBE participation within the time specified on the notification from the Project Control Engineer.

(8) Agreements between the bidder and the DBE, whereby the DBE agrees not to provide subcontracting quotations to other bidders, are prohibited.

H. POST AWARD COMPLIANCE

(1) If the contract is awarded on less than full DBE goal participation, such award will not relieve the contractor of the responsibility to continue exerting good faith efforts. The contractor must submit documentation of good faith efforts, which can be found at http://wwwapps.dotd.la.gov/administration/compliance/cs6aaa/home.aspx, with requests to sublet prior to approval of subcontracting work being performed on the project.

(2) The contractor shall establish a program which will effectively promote increased participation by DBE in the performance of contracts and subcontracts. The contractor shall also designate and make known to the DOTD a liaison officer who will be responsible for the administration of the contractor's DBE program.

(3) The contractor must enter into subcontracts or written agreements with all DBEs identified on Form CS-6AAA and attachments for the kind and amount of work specified. The subcontracting requirements of the contract will apply. DOTD requires that all DBE subcontracts or agreements be made available upon request.

(4) The contractor must keep each DBE informed of the construction progress schedule and allow each DBE adequate time to schedule work, stockpile materials, and otherwise prepare for the subcontract work.

(5) At any point during the project when it appears that the scheduled amount of DBE participation may not be achieved, the contractor must provide evidence demonstrating how the goal will be met.

(6) If the contractor is unable to demonstrate to the DOTD's satisfaction that it failed to achieve the scheduled DBE participation due to reasons other than quantitative under runs or elimination of items contracted to DBE and that good faith efforts have been used to obtain the scheduled contract participation, the DOTD may withhold an amount equal to the difference between the DBE goal and the actual DBE participation achieved as damages.

(7) When the DOTD has reason to believe the contractor, subcontractor, or DBE may not be operating in compliance with the terms of these DBE provisions, to include, but not be limited to the encouragement of fronting, brokering, or not providing a commercially useful function, the DOTD will conduct an investigation of such activities with the cooperation of the parties involved. If the DOTD finds that any person or entity is not in compliance, the DOTD will notify such person or entity in writing as to the specific instances or matters found to be in noncompliance. Commercially Useful Function is evaluated on a project by project basis.

At the option of the DOTD, the person or entity may be allowed a specified time to correct the deficiencies noted and to achieve compliance. In the event that the person or entity cannot achieve compliance, or fails or refuses to do so, the DOTD reserves the right to initiate administrative action against the contractor which may include but not be limited to terminating the contract; withholding a percentage of the contractor's next partial payment equal to the shortfall amount until corrective action is taken; or other action the DOTD deems appropriate. The contractor has the right to appeal the DOTD's finding and rulings to the DOTD Chief Engineer.

The contractor may present additional information to clarify that previously submitted. Any new information not included in the original submittal will not be used in the final determination. The decision rendered by the DOTD Chief Engineer will be administratively final.

(8) To ensure that the obligations under subcontracts awarded to subcontractors are met, the DOTD will review the contractor's efforts to promptly pay subcontractors for work performed in accordance with the executed subcontracts. The contractor must promptly pay subcontractors and suppliers, including DBEs, their respective subcontract amount within thirty (30) calendar days after the contractor receives payment from DOTD for the items satisfactorily performed by the subcontractors in accordance with 49 CFR Part 26.29(a). The contractor shall provide the DBE with a full accounting to include quantities paid and deductions made from the DBE's partial payment at the time the check is delivered. **Retainage may not be held by the contractor.** Delay or postponement of payment to the subcontractor may be imposed by the contractor only when there is evidence that the subcontractor has failed to pay its labor force and suppliers for materials received and used on the project. Delay or postponement of payment must have written approval by the Project Engineer. Failure to promptly pay subcontractors shall constitute a breach of contract and after notification by the DOTD may result in (1) a deduction from the contract funds due or to become due the contractor, (2) disqualification of a contractor as non-responsive, or (3) any other such remedy under the contract as DOTD deems appropriate. All subcontracting agreements made by the contractor shall include the current payment to subcontractors' provisions as incorporated in the contract. All disputes between contractors and subcontractors relating to payment of completed work shall be referred to the DBE/SBE Oversight Committee. Members of the DBE/SBE Oversight Committee are: the Deputy Chief Engineer; the DOTD Compliance Programs Director; and an FHWA Division Representative.

(9) The contractor must meet the requirements of Subsection 108.01 Subletting of Contract, and must submit DOTD Forms OMF-1A, Request to Sublet and OMF-2A, Subcontractor's EEO Certification. The OMF-1A and OMF-2A (if applicable) forms must be entered online at https://wwwapps.dotd.la.gov/administration/compliance/omfweb/login.aspx. After submittal, all signatures must be obtained and then the entire document must be scanned and emailed to dotdomf1acompliance@la.gov for review and approval. These forms must be approved by DOTD before any subcontract work is performed by any subcontractor, including all DBEs that appear on the CS-6AAA.

(10) DOTD reserves the right to withhold any partial payment from the contractor when it is determined that a DBE is not performing a commercially useful function or that achievement of the goal is in jeopardy. Payment may be withheld in the amount of the DBE goal that is in jeopardy until either the contractor submits to DOTD a revised plan for achieving the contract goal and the plan is approved, or the DBE goal amount in question has been met.

(11) The DOTD will monitor the contractor's DBE involvement during the contract, the level of effort by the contractor in meeting or exceeding the goal requirements in the contract, the contractor's attempts to do so, and the efforts in soliciting such involvement. If, at the completion of the project, the contractor has failed to meet the DBE goal and has not demonstrated good faith efforts or obtained a waiver or reduction of the goal, DOTD will withhold an amount equal to the difference between the DBE goal and the actual DBE participation achieved as damages.

I. SUBSTITUTIONS OF DBE FIRMS AFTER AWARD

(1) The contractor must conform to the scheduled amount of DBE participation.

(2) Contract items designated to be performed by the DBE on Form CS-6AAA and attachments shall be performed by the designated DBE or DOTD approved substitute. Substitutions of named DBE shall be approved in writing by the DOTD Compliance Programs Section. Substituted DBE shall not commence work until the contractor is able to demonstrate that the listed DBE is unable to perform because of default, overextension on other jobs, or other acceptable justification. It is not intended that a contractor's ability to negotiate a more advantageous contract with another subcontractor be considered a valid basis for change. Substitution of DBE will be allowed only when the DBE is unable to perform due to default, overextension on other jobs, or other similar justification. Evidence of good faith efforts exerted by the contractor must be submitted to DOTD for approval. Pay items of work eliminated from the project should not diminish the contractor's efforts to meet the DBE goal.

(3) Under no circumstances can a contractor perform work originally designated to be performed by a DBE without prior written approval from the DOTD Compliance Programs Section.

(4) When a listed DBE is unwilling or unable to perform the items of work specified in the Form CS-6AAA and attachments, the contractor must immediately notify the DOTD Compliance Programs Section.

When a contractor's request to be relieved of the obligation to use the named DBE results in a DBE Goal shortfall, the contractor must immediately take steps to obtain another certified DBE to perform an equal amount of allowable credit work or make documented good faith efforts to do so. The new DBE's name and designated work must be submitted to the DOTD in accordance with Section H(9) above, prior to proceeding with the work.

If the contractor is unable to replace a defaulting DBE with another DBE for the applicable item, a good faith effort shall be made to subcontract other items to DBEs for the purpose of meeting the goal. The DOTD Compliance Programs Section will determine if the contractor made an acceptable good faith effort in awarding work to DBE firms. The DOTD Compliance Programs Section may allow a waiver or adjustment of the goal as may be appropriate, depending on individual project circumstances. Any disputes concerning good faith efforts will be referred to the DBE/SBE Oversight Committee.

J. GOOD FAITH EFFORTS: Good faith efforts are required by the contractor when the DBE goals established for a contract are not met, or at anytime during the contract when achievement of the DBE goal is in jeopardy. It is the contractor's responsibility to provide sufficient evidence for DOTD to ascertain the efforts made. The contractor must demonstrate adequate good faith efforts to meet the contract goal by utilizing DBE participation prior to award and during the life of the contract. Good faith efforts include personal contacts, follow-ups and earnest negotiations with DBEs. DOTD will consider, at a minimum, the following efforts as relevant, although this listing is not exclusive or exhaustive and other factors and types of efforts may be relevant:

(1) Efforts made to select portions of the work to be performed by DBEs in order to increase the likelihood of achieving the stated goal. It is the contractor's responsibility to make a sufficient portion of the work available to subcontractors and suppliers and to select those portions of work or materials consistent with the availability of DBE subcontractors and suppliers to assure meeting the goal for DBE participation. Selections of portions of work are required to at least equal the DBE goal in the contract.

(2) Solicits a reasonable number of DBEs interested in participation in the contract as a subcontractor, regular dealer, manufacturer, or consultant for specific items of work. The contractor shall provide notice to a reasonable number of DBEs that their interest in the contract is being solicited, with sufficient time to allow the DBEs to participate effectively. The contractor shall seek DBEs in the same geographic area from which it generally seeks subcontractors for a given project. If the contractor cannot meet the goal using DBEs from the normal area, the contractor shall expand its search to a wider geographic area.

(3) Demonstrated efforts made to negotiate in good faith with interested DBEs for specific items of work include:

a. The names, addresses and telephone numbers of DBEs contacted. The dates of initial contact and whether initial solicitations of interest were followed up personally, by mail, or by phone to determine the DBE interest.

b. A description of the information provided to DBEs regarding the nature of the work, the plans and specifications and estimated quantities for portions of the work to be performed.

c. A statement of why additional agreements with DBEs were not reached.

d. Documentation of each DBE contacted but rejected and the reasons for rejection. All bids and quotations received from DBE subcontractors whether verbal or written, and the contractor's efforts to negotiate a reasonable price must be submitted. Rejecting a DBEs bid because it was not the lowest quotation received will not be satisfactory reason without an acceptable explanation of how it was determined to be unreasonable. A statement that the DBEs quotation was more than the contractor's bid price for an item or items will not be acceptable.

e. Copies of all bids and quotations received from DBE subcontractors and an explanation of why they were not used.

f. Scheduling meetings to discuss proposed work or to walk the job-site with DBE.

g. Informing DBE of any pre-bid conferences scheduled by the DOTD.

h. Assisting DBE in obtaining bonding, insurance, or lines of credit required by the contractor.

i. Evidence of DBEs contacted but rejected as unqualified, accompanied by reason for rejection based on a thorough investigation of the DBEs capabilities.

j. Any additional information not included above which would aid the DOTD in evaluation of the contractor's good faith efforts.

(4) The following are examples of actions that will not be accepted as justification by the contractor for failure to meet DBE contract goals:

a. Failure to contract with a DBE solely because the DBE was unable to provide performance and/or payment bonds.

b. Rejection of a DBE bid or quotation based on price alone.

c. Failure to contract with a DBE because the DBE will not agree to perform items of work at the unit price bid.

d. Failure to contract with a DBE because the contractor normally would perform all or most of the work in the contract.

e. Rejection of a DBE as unqualified without sound reasons based on a thorough investigation of their capabilities.

f. Failure to make more than mail solicitations.

K. RECORD KEEPING REQUIREMENTS: The contractor shall keep such records as are necessary for the DOTD to determine compliance with the DBE contract obligations. These records shall include the names of subcontractors, including DBEs; copies of subcontracts; the type of work being performed; documentation such as canceled checks and paid invoices verifying payment for work, services, and procurement; and documentation of correspondence, verbal

contacts, telephone calls, and other efforts to obtain services of DBEs. When requested, the contractor shall submit all subcontracts and other financial transactions executed with DBEs in such form, manner and content as prescribed by DOTD. The DOTD reserves the right to investigate, monitor and/or review actions, statements, and documents submitted by any contractor, subcontractor, or DBE.

L. REPORTING REQUIREMENTS: The contractor must enter monthly online payment reports on DBE involvement. At the conclusion of each estimate period the contractor must enter DBE payments for the previous month's reporting period. These payment reports are required until all DBE subcontracting activity is complete and paid for. Payment reports are required regardless of whether or not DBE activity has occurred in the monthly reporting period. Information on entering these DBE payments can be found at http://wwwsp.dotd.la.gov/Inside_LaDotd/Divisions/Administration/Compliance/Pages/Subcontractor_Payments.aspx.

Upon completion of all DBE participation, the contractor must submit an original, notarized form CP-2A, DBE/SBE Final Report, to the DOTD Compliance Programs Section with a copy to the project engineer detailing all DBE subcontract payments. The CP-2A form can be obtained at http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Administration/Compliance/Pages/DBE_Admin_Unit.aspx. When the actual amount paid to DBEs is less than the award amount, a complete explanation of the difference is required. If the DBE goal is not met, documentation supporting good faith efforts must be submitted. Failure to submit the required reports will result in the withholding of partial payments to the contractor until the reports are submitted. All payments due to subcontractors which affect DBE goal attainment must be paid by the contractor before the DOTD releases the payment/performance/retainage bond.

The DOTD reserves the right to conduct an audit of DBE participation prior to processing the final estimate and at any time during the work.

M. APPLICABILITY OF PROVISIONS TO DBE BIDDERS: These provisions are applicable to all bidders including DBE bidders. The DBE bidder is required to perform at least 30 percent of the work of the contract with its own work force in accordance with the terms of the contract, normal industry practices, and the DOTD DBE Program. If the DBE bidder sublets any portion of the contract, the DBE bidder must comply with provisions regarding contractor and subcontractor relationships. A DBE prime contractor may count only the contract amount toward DBE participation for work that he/she actually performs and any amounts awarded to other certified DBE subcontractors that perform a commercially useful function.

"General Decision Number: LA20230013 01/06/2023

Superseded General Decision Number: LA20220013

State: Louisiana

Construction Type: Highway

Counties: Ascension, Calcasieu, Cameron, East Baton Rouge, East Feliciana, Grant, Iberville, Lafayette, Livingston, Pointe Coupee, Rapides, St Helena, St Martin, West Baton Rouge and West Feliciana Counties in Louisiana.

HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number Publication Date
0 01/06/2023

ENGI0406-001 10/28/2010

	Rates	Fringes
Mechanic	$ 25.40	8.05

LABO0207-001 07/01/2006

Calcasieu and Cameron Counties

	Rates	Fringes
LABORER: Common or General	$ 12.79 **	1.73

LABO0762-004 01/01/2005

Grant, Lafayette, and Rapides Counties

	Rates	Fringes
LABORER: Common or General	$ 11.00 **	3.50

LABO1177-003 09/01/2005

Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, St. Martin, West Baton Rouge, and West Feliciana Counties

	Rates	Fringes
LABORER: Common or General	$ 15.00 **	2.77

SULA2011-005 08/17/2011

	Rates	Fringes

CARPENTER, Includes Form Work....$ 18.22 4.48

CEMENT MASON/CONCRETE FINISHER...$ 20.03 4.24

IRONWORKER, REINFORCING.....$ 17.49

Power equipment operators:
Asphalt Paver.....$ 17.20 4.97
Backhoe/Excavator/Trackhoe..$ 16.13 **
Broom/Sweeper.....$ 14.05 **
Bulldozer.....$ 16.40
Crane.....$ 24.30
Grader/Blade.....$ 15.88 **
Milling Machine.....$ 15.38 ** 2.14
Roller (Asphalt and Dirt
Compaction).....$ 14.29 ** 4.23
Trencher.....$ 14.38 **

Truck drivers:
Dump Truck.....$ 12.69 **
Water Truck.....$ 13.79 **

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at

https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates

the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

STATE OF LOUISIANA

DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

PLANS OF PROPOSED STATE HIGHWAY

STATE PROJECT NO. H.012232
FEDERAL AID PROJECT NO. H012232

LA 3064 to LA 1248 PHASE II
DIJON DRIVE EXTENSION
EAST BATON ROUGE PARISH

The following technical special provisions have been prepared by or under the direct supervision of the licensed Civil Engineer whose seal/stamp appears below.

TS-203-00006 Exploratory Excavation for Traffic Signal Foundation

EXPLORATORY EXCAVATION FOR TRAFFIC SIGNAL FOUNDATION

DESCRIPTION:

Furnish all labor, materials, supplies, equipment, tools and transportation to perform exploratory excavation at the proposed traffic signal pole locations as indicated on the construction plans and as directed by the Project Engineer. The exact location and elevation of critical utilities which may be in conflict with proposed traffic signal pole foundation locations will be determined through exploratory excavation. Traffic signal pole foundation locations to be adjusted as directed by the Project Engineer to avoid utility conflicts. Utilities are to be designated and marked using a Quality Level B (CI/ASCE 38-02) and located with test holes using a Quality Level A (CI/ASCE 38-02). Stamped and signed engineering drawings of the utility locations are to be submitted to the Project Engineer.

CONSTRUCTION REQUIREMENTS:

Designate and mark existing utilities (Quality Level B) by reviewing the construction plans, and available records provided by the Project Engineer and obtained from the various utility companies. All known utilities are to be marked within a 10-foot radius of the proposed signal pole foundation locations. Furnish three (3) sets of stamped and signed engineering drawings and a CADD file of the findings.

Excavate test holes as directed by the Project Engineer at the proposed locations of traffic signal poles and one on each utility within a 10-foot radius of the center of the signal pole foundation location. The test hole at the center of the mast arm shall be to full depth. Probe to at least 10 feet of depth. Use minimally intrusive excavation techniques which ensure the safety of the excavation, the integrity of the utility line to be measured, and the integrity of other lines which may be encountered during excavation. The excavation shall be by means of air- and/or water-assisted vacuum excavation equipment manufactured specifically for this purpose.

Excavation of Test Holes:

1. Clear the test hole area of surface debris.
2. In paved areas, neatly cut and remove existing pavement. Each cut shall not exceed 225 square inches unless otherwise approved.
3. Excavate the test hole. The nominal diameter of the test hole shall not exceed 15 inches unless otherwise approved.
4. Expose the utility only to the extent required for identification and data collection purposes.
5. Avoid damage to lines, wrappings, coatings, cathodic protection or other protective coverings and features.
6. Hand-dig as needed to supplement excavation and to ensure safety.
7. Revise the test hole location as necessary to positively expose the utility.
8. Store excavated material for re-use or disposal at an approved location near the project, as appropriate.

Measure and/or record the following information on an appropriately formatted test hole data sheet that has been sealed and dated by Contractor:

1. Difference in elevation of top and/or bottom of the utility and the above ground mark to a vertical accuracy of +/- 0.05 feet
2. Field sketch showing horizontal location referenced to a minimum of two (2) swing ties to physical structures existing in the field.
3. Approximate centerline bearing of utility line.
4. Outside diameter of pipe, width of duct banks, and configuration of multi- conduit systems.
5. Utility structure material composition, when reasonably ascertainable.
6. Other pertinent information as is reasonably ascertainable from test hole.
7. Provide northing and easting coordinates for each traffic signal pole foundation location

Site Restoration:

1. Replace bedding material around exposed utility lines.
2. Backfill and compact the excavation in a manner acceptable to the Project Engineer. Re-use excavated material with appropriate compaction.
3. As applicable, provide permanent pavement restoration within the limits of the original cut using materials, compaction, and pavement thickness equal to that found.
4. For excavations in unpaved areas, restore disturbed area as nearly as practicable to pre-existing conditions.
5. Furnish and install permanent surface marker (e.g., P.K. nail, peg, steel pin, or hub) directly above the center of the traffic signal foundation and the centerline of each utility within a 10-foot radius of the foundation location.

Produce an electronic drawing of the findings using the proper line work and symbols, refer to DOTD CADD standards. The test holes are to be labeled with a northing and easting coordinate and test hole information is to be shown in tabular form. An electronic file with the contractor's findings should be provided to the Project Engineer to be included in the as-built drawings. Three (3) sets of engineering drawings complete with engineering seal and signature are to be submitted to the Project Engineer.

MEASUREMENT:

Exploratory Excavation for Traffic Signal Foundation will be measured per each proposed traffic signal foundation and will include all excavation, backfill, replacement of removed pavement, shoring, bracing, materials, equipment, and labor necessary to furnish these services.

PAYMENT:

Payment will be made at the contract unit price per each:

ItemNo.	PayItem	PayUnit
TS-203-0006	Exploratory Excavation for Traffic Signal Foundation	Each

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

PLANS OF PROPOSED STATE HIGHWAY

FEDERAL PROJECT NO. H012232
STATE PROJECT NO. H.012232

LA 3064 TO LA 1248 PHASE II
DIJON DRIVE EXTENSION

EAST BATON ROUGE PARISH

The following technical special provisions have been prepared by or under the direct supervision of the licensed Civil Engineer whose seal/stamp appears below.

Item No.	Pay Item	Pay Unit
TS-736-10200	Signal Support (Mast Arm Standard w/ 20 ft. Arm)	Each
TS-736-10250	Signal Support (Mast Arm Standard w/ 25 ft. Arm)	Each
TS-736-10300	Signal Support (Mast Arm Standard w/ 30 ft. Arm)	Each
TS-736-10350	Signal Support (Mast Arm Standard w/ 35 ft. Arm)	Each
TS-736-10400	Signal Support (Mast Arm Standard w/ 40 ft. Arm)	Each
TS-736-10450	Signal Support (Mast Arm Standard w/ 45 ft. Arm)	Each
TS-736-10500	Signal Support (Mast Arm Standard w/ 50 ft. Arm)	Each
TS-736-10550	Signal Support (Mast Arm Standard w/ 55 ft. Arm)	Each
TS-736-10600	Signal Support (Mast Arm Standard w/ 60 ft. Arm)	Each
TS-736-10650	Signal Support (Mast Arm Standard w/ 65 ft. Arm)	Each
TS-736-10700	Signal Support (Mast Arm Standard w/ 70 ft. Arm)	Each
TS-736-10750	Signal Support (Mast Arm Standard w/ 75 ft. Arm)	Each
TS-736-11200	Additional Mast Arm (20 ft. arm)	Each
TS-736-11250	Additional Mast Arm (25 ft. arm)	Each
TS-736-11300	Additional Mast Arm (30 ft. arm)	Each
TS-736-11350	Additional Mast Arm (35 ft. arm)	Each
TS-736-11400	Additional Mast Arm (40 ft. arm)	Each
TS-736-11450	Additional Mast Arm (45 ft. arm)	Each
TS-736-11500	Additional Mast Arm (50 ft. arm)	Each
TS-736-12008	Luminaire Arm w/ LED Luminaire (8 ft. arm)	Each
TS-736-12015	Luminaire Arm w/ LED Luminaire (15 ft. arm)	Each

Sarah Paul Edel 7-18-22
Name: Sarah Paul Edel Date
Discipline: Civil Engineer

STATE OF LOUISIANA
SARAH PAUL EDEL
License No. 34384
PROFESSIONAL ENGINEER
CIVIL ENGINEERING

TRAFFIC SIGNAL SUPPORT WITH MAST ARM ASSEMBLY (07/22) (H.012232)

DESCRIPTION.

Furnish and install necessary materials, equipment, and labor to install a Traffic Signal Support with Mast Arm Assembly including the drilled shaft foundation, steel traffic signal pole, mast arm of a length as shown on the plans, and luminaire arm if required by the plans (herein referred to as a Mast Assembly). This includes any Additional Mast Arms of a length as shown on the plans for the purpose of creating a Dual Mast Arm Assembly and/or for locations where a new mast arm is to be installed on an existing signal pole. This also includes any additional luminaire arms as shown on the plans for the purpose of providing intersection lighting. The intent of this specification is to provide traffic signal foundations, poles and mast arms that are in compliance with the Department of Transportation and Drainage of the City of Baton Rouge and Parish of East Baton Rouge Standard Plans and Specifications.

MATERIALS.

Materials shall comply with the City-Parish Specifications 906 & 1021 sections and subsection with the exception of the following Materials which shall comply with the following LADOTD section and subsections:

Traffic Signals	736
Portland Cement Concrete Class S	901
Reinforcing Steel	1009.1

The Mast assembly shall include galvanized steel strain and mast arm poles and shall be furnished in accordance with the official construction plans. The Mast assembly shall include the foundation, the mast, and the arm and shall be in accordance with City Parish 906 Standard Plans.

REGULATIONS AND CODE.

Contractors shall have a IMSA Traffic Signal Level 1 certified technician at all times at each work location and a IMSA Traffic Signal Level 2 certified technician to work in the cabinet for all signal work.

GENERAL REQUIREMENTS.

Verify the practicality of the location, elevation, and orientation of foundations for poles and pedestals prior to ordering materials. Locations must be approved by Project Engineer prior to ordering. Provide minimum clearances for traffic signal poles and apparatus in accordance with the MUTCD. Locate poles a minimum of 24 inches outside the barrier curb or a minimum of 10 feet outside the edge of the travel lane. Any deviation must be approved by the Engineer.

DRAWINGS AND EQUIPMENT SUBMITTALS.

Prior to ordering/fabrication, electronically submit to the Engineer and Resident Project Representative, for approval, a PDF formatted letter on company letterhead for equipment submittals and detailed shop drawings for each Mast Assembly to be furnished.

Included in this submission shall also be detailed drawings for the Mast assembly foundation. These drawings shall show quantities and types of reinforcing, sizes, and placement of anchor rods and physical dimensions of the foundation. In addition, design calculations for each pole and foundation shall be provided.

Show the project number, project location, project limits, pay item description, pay item number, manufacturer's name, and model number on each sheet. Each drawing shall also show the material specifications for each component proposed for use. All welds shall be identified by types and sizes.

MEASUREMENT.

Signal Support (Mast Arm Standard w/ xx ft. Arm) will be measured per each installed and accepted. Measurement will include the pole foundation, pole, mast arm, base assembly, and anchor bolts. Additional Mast Arm (xx ft. arm), will be measured per each installed and accepted. Measurement will include the additional mast arm and all required materials, tools, equipment, labor, and incidentals required to install the arm to the pole described above and as indicated on the plans.

PAYMENT.

Payment for Signal Support (Mast Arm Standard w/ xx ft. Arm), Additional Mast Arm (xx ft. arm), and Luminaire Arm (xx ft.) and will be made at the contract unit prices, which includes all materials, tools, equipment, labor, and incidentals necessary to complete the work as described above or as noted in the plans.

Payment will be made at the contract unit price per each:

Item No.	Pay Item	Pay Unit
TS-736-10200	Signal Support (Mast Arm Standard w/ 20 ft. Arm)	Each
TS-736-10250	Signal Support (Mast Arm Standard w/ 25 ft. Arm)	Each
TS-736-10300	Signal Support (Mast Arm Standard w/ 30 ft. Arm)	Each
TS-736-10350	Signal Support (Mast Arm Standard w/ 35 ft. Arm)	Each
TS-736-10400	Signal Support (Mast Arm Standard w/ 40 ft. Arm)	Each
TS-736-10450	Signal Support (Mast Arm Standard w/ 45 ft. Arm)	Each
TS-736-10500	Signal Support (Mast Arm Standard w/ 50 ft. Arm)	Each
TS-736-10550	Signal Support (Mast Arm Standard w/ 55 ft. Arm)	Each
TS-736-10600	Signal Support (Mast Arm Standard w/ 60 ft. Arm)	Each
TS-736-10650	Signal Support (Mast Arm Standard w/ 65 ft. Arm)	Each
TS-736-10700	Signal Support (Mast Arm Standard w/ 70 ft. Arm)	Each
TS-736-10750	Signal Support (Mast Arm Standard w/ 75 ft. Arm)	Each
TS-736-11200	Additional Mast Arm (20 ft. arm)	Each
TS-736-11250	Additional Mast Arm (25 ft. arm)	Each
TS-736-11300	Additional Mast Arm (30 ft. arm)	Each
TS-736-11350	Additional Mast Arm (35 ft. arm)	Each
TS-736-11400	Additional Mast Arm (40 ft. arm)	Each
TS-736-11450	Additional Mast Arm (45 ft. arm)	Each
TS-736-11500	Additional Mast Arm (50 ft. arm)	Each
TS-736-12008	Luminaire Arm w/ LED Luminaire (8 ft. arm)	Each
TS-736-12015	Luminaire Arm w/ LED Luminaire (15 ft. arm)	Each

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

PLANS OF PROPOSED STATE HIGHWAY

FEDERAL PROJECT NO. H012232
STATE PROJECT NO. H.012232

LA 3064 TO LA 1248 PHASE II
DIJON DRIVE EXTENSION

EAST BATON ROUGE PARISH

The following technical special provisions have been prepared by or under the direct supervision of the licensed Civil Engineer whose seal/stamp appears below.

Item No.	Pay Item	Pay Unit
TS-736-15001	GPS BASED TRAFFIC SIGNAL PREEMPTION SYSTEM (NO EXISTING FIBER COMMUNICATION)	Each
TS-736-15002	GPS BASED TRAFFIC SIGNAL PREEMPTION SYSTEM (WITH EXISTING FIBER COMMUNICATION)	Each

Sarah Paul Edel 7-18-22
Name: Sarah Paul Edel Date
Discipline: Civil Engineer

TRAFFIC SIGNAL EMERGENCY VEHICLE PREEMPTION SYSTEM (07/22) (H.012232):

DESCRIPTION:

This item consists of furnishing all necessary equipment, labor and materials required to install GPS Based Emergency Vehicle Preemption at a signalized intersection in accordance with the plans and the following requirements. The system including all software, equipment, and components shall be fully compatible with the Emergency Vehicle Preemption System currently in use by the East Baton Rouge Parish Traffic Management Center (Glance Priority and Preemption System by AI) and shall provide the following key requirements:

1) The system shall track emergency response vehicles and provide preemption and priority requests to the traffic signal controller.
2) The system shall be fully functional and compatible with all existing traffic signal controller models (Trafficware ATC, and TS2) currently in use by the City-Parish.
3) A web based configuration utility shall provide an easy way to program of preemption and priority zones.
4) The system shall use the GPS position of the vehicle to determine when to send a preemption request to the traffic signal controller based on a user defined preemption and priority zones.
5) The system shall be capable of configuring preemption and priority requests for more than 120 seconds before the vehicle reaches the intersection.
6) The system shall have redundant communication from the in-vehicle devices to the traffic signal field devices using 900MHz radio, and 4G cellular communications and be capable of being upgraded to 5G when it becomes available.
7) The system shall display the real time cabinet fault status of the traffic signal locations, should a user defined fault occur.
8) The system shall issue autonomous real time alerts regarding user defined faults via SMS and email to personnel based on a user defined schedule.
9) The system shall operate with cloud hosted software with user web based access, and with no software or IT infrastructure for the City-Parish to install or maintain. The system shall be capable of being transitioned to a locally hosted system server as a future option should the City-Parish wish to pursue it. The client user interface shall be browser based, with no software to be installed on client computers except for a standard browser.
10) The monitoring of the preempt system shall assure that the in-vehicle and the traffic signal field devices) are functioning correctly and that the system will be available when required.
11) The field devices must be capable of receiving secure wireless software and security updates. The wireless updates shall allow new features to be installed remotely without having to physically go to the field devices to perform the update.

MATERIALS.

It is a requirement that the TSPRMS operate independent of the brand/type of intersection controller deployed at the intersection. The TSPRMS contractor shall install a small field device into each intersection cabinet which connects to the terminal strip in the cabinet (via a wiring harness) and enables the system to function independently of controller operation. The TSPRMS Field Device shall conform to the following requirements:

a. The field device shall function correctly between -30° F and +165° F.
b. The field device shall be a 1U rack mount device and suitable for placement in a traffic cabinet with all connections on the rear of the device and all LED indicators, power and selector switches on the front.

c. The field device shall be provided with appropriately rated connections that allow the device to be exchanged by unplugging connectors without the use of tools.
d. The field device shall incorporate an integrated GPS, cellular modem, and Ethernet fiber port.
e. The configuration of the field device shall be accomplished by accessing the internal web server with a browser. It shall be possible to configure the device without any special software.
f. The field device shall be powered via a standard 120Vac input power.
g. The field device shall allow for the routing of the controller configuration packets to and from the controller (either by Ethernet or serial communications) for each type of controller utilized by the Agency (Trafficware ATC and TS2). In this way, it shall be possible to configure the controller, and utilize the controller specific software to interrogate the controller. The TSPRMS shall provide the communication pipe which allows this to be accomplished.
h. The field device shall utilize field initiated communications. This allows for a low cost cellular data plans to be used with infrequent polling. However, when an abnormal event occurs and is detected by the field device, then the device will immediately initiate the transfer of a data packet to the TSPRMS to enable real-time alerting of response personnel to take place.
i. For field devices that are to be installed at field locations with existing high resolution fiber communication to the Advanced Traffic Management Center, there shall be the option to reduce cellular data transmissions in order to reduce the cost of those specific field devices.
j. The field device shall, within the 1U size limitation required above, include a battery and battery charging/monitoring circuit to allow the TSPRMS to function correctly even when all power to the intersection has failed. The battery shall continue to power the field device for a minimum of five hours (5) after all power has failed to the intersection.
k. The field device shall incorporate an integrated GPS which will allow the device to geolocate itself on the map without configuration.
l. The field device shall operate without requiring a static IP address. The only configuration required at the device is to enter the URL of where the TSPRMS central software is hosted.
m. In the event that the communication to the TSPRMS central software is interrupted or is not available, the field device shall store any events that occur in internal memory and forward these events automatically to the TSPRMS when communication is restored. In this way, a complete record of events at the device can be maintained even if communication is interrupted for a period. The system will store a minimum of 5,000 events.
n. The field device shall utilize HTTP and HTTPS protocols and XML data structures for communications with the TSPRMS. In this way, the data will be open for future expansion and competition. The use of secret proprietary protocols is not permitted.
o. The field device shall include Ethernet communications with an RJ45 connector.
p. The field device shall not use self-tapping screws.
q. The field device shall have powered coated aluminum enclosures.
r. The field device shall include weather proof external antennas.

REGULATIONS AND CODE.
Contractors shall have a IMSA Traffic Signal Level 1 certified technician at all times at each work location and a IMSA Traffic Signal Level 2 certified technician to work in the cabinet for all signal work.

GENERAL REQUIREMENTS.
The TSPRMS contractor shall configure the system and reports, and train the Agency in the correct operation of the system to enable the Agency to utilize the TSPRMS for the objectives outlined above.

Traffic Engineering Division shall be given a seven (7) days advance notice of testing and activation of the intersection preemption device and shall have a representative on site. Testing of equipment shall ensure that the preemptions are operating properly and safely. Specific items to be checked include (but are not limited to) the following:

a. Each approach to the intersection shall be set up such that the proper Emergency Vehicle Preempt (EVP) is activated and calls the proper phasing combination
b. EVPs shall NOT be set to nor default to "Flash in dwell"
c. When applicable, the RAIL preempt shall be tested to ensure that the RAIL preempt has priority over any and all EVPs (EVPs shall not override RAIL preempts and RAIL preempts shall override any and all active EMPs)

DRAWINGS AND EQUIPMENT SUBMITTALS.

Prior to ordering/fabrication, electronically submit to the Engineer and Resident Project Representative, for approval, a PDF formatted letter on company letterhead for equipment submittals for all components to be furnished.

Show the project number, project location, project limits, pay item description, pay item number, manufacturer's name, and model number on each sheet. Each drawing shall also show the material specifications for each component proposed for use. All welds shall be identified by types and sizes.

MEASUREMENT.

The system will be measured per each intersection and shall include all necessary equipment, furnished and installed, to provide emergency vehicle preemption at each traffic signal intersection shown in the plans. This item will be measured per each and shall include, but not be limited to: the preemption intersection device, all communication equipment needed to establish communication links to the controller cabinet and the system, mounting hardware, wiring, labor and incidentals for each preemption system installed, tested, and accepted. Activation, integration, and testing of each device to ensure full operation with the existing Emergency Vehicle preemption system shall also be required prior to acceptance.

PAYMENT.

Payment for GPS Based Traffic Signal Preempt and Remote Monitoring System work will be made at the contract unit prices, which includes all materials, tools, equipment, labor and incidentals necessary to complete the work.

Payment will be made at the contract unit price per each:

Item No.	Pay Item	Pay Unit
TS-736-15001	GPS BASED TRAFFIC SIGNAL PREEMPTION SYSTEM (NO EXISTING FIBER COMMUNICATION)	Each
TS-736-15002	GPS BASED TRAFFIC SIGNAL PREEMPTION SYSTEM (WITH EXISTING FIBER COMMUNICATION)	Each

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

PLANS OF PROPOSED STATE HIGHWAY

FEDERAL PROJECT NO. H012232
STATE PROJECT NO. H.012232

LA 3064 TO LA 1248 PHASE II
DIJON DRIVE EXTENSION

EAST BATON ROUGE PARISH

The following technical special provisions have been prepared by or under the direct supervision of the licensed Electrical Engineer whose seal/stamp appears below.

Item No.	Pay Item	Pay Unit
TS-736-36200	VIDEO DETECTION SYSTEM (3 CAMERA SYSTEM)	Each
TS-736-36200	VIDEO DETECTION SYSTEM (4 CAMERA SYSTEM)	Each
TS-736-36200	VIDEO DETECTION SYSTEM (4 CAMERA SYSTEM WITH 4 INTEGRATED RADAR UNITS)	Each
TS-736-36200	VIDEO DETECTION SYSTEM (5 CAMERA SYSTEM)	Each
TS-736-32000	VIDEO DETECTION SYSTEM (6 CAMERA SYSTEM)	Each
TS-736-32000	VIDEO DETECTION SYSTEM (7 CAMERA SYSTEM)	Each
TS-736-32000	VIDEO DETECTION SYSTEM (8 CAMERA SYSTEM)	Each

Sarah Paul Edel 7-22-22

Name: Sarah Paul Edel Date
Discipline: Civil Engineer

TRAFFIC SIGNAL VIDEO DETECTION CAMERA SYSTEM WITH INTEGRATED RADAR DETECTION (07/2022) (H.012232)

DESCRIPTION:

General

A Video Detection Camera (VDC) system may be used to provide real time detection of vehicles on the roadway. The VDC system shall relay the presence detection to the signal controller in real time and shall operate in NEMA TS-1 and TS-2 signal controller cabinets. The Integrated Radar Detection System shall provide advanced detection (Volume/Density Detection) to the signal controller cabinets.

The VDC system shall support Ethernet communications for transfer of video and data. Using a client-server relationship, the VDC system shall provide a communications interface into the existing communication server application. This shall be accomplished using standard TCP/IP network protocols. It shall be possible to remotely view real time operation of the VDC system with visible detection zones to indicate on / off state of detector zone.

VDC System Hardware: The VDC system shall consist of the following components:

1) Video Detection Camera (Sensor)
2) Integrated Radar Unit & Video Detection Camera (Sensor)
3) Modular (rack-mount) communications panel

The video detection camera shall have resolution of at least 480p (720x480 pixels) video in real time to detect vehicles and extract traffic data and transmit the detector outputs without noise to degrade video detection. The camera shall have minimum of 10x optical zoom without affecting the detection zone. It shall provide streaming video with detector overlay.

The Detection system shall have an integrated radar unit to be used to detect vehicles, bicycles, and pedestrians up to 600'. The Radar unit shall share the same enclosure as the camera and have only one mount power/communications point.

The modular communications panel shall plug directly into a NEMA detector rack. It will use standard inputs and outputs to communicate with the traffic signal controller. The wiring termination panel shall provide transient voltage protection for the cabinet interface and the video detection camera using fuses. It shall provide connection to the local user via a USB port, and a 10/100 Mbps Ethernet port and a DHCP capable Wi-Fi access point.

The Video Detection camera shall utilize an Ethernet cable to provide power and communications from the Communications Panel to the Video Detection Camera using IEEE standard Power over Ethernet (PoE) protocol. Power filtration and surge suppression for the PoE connections shall be provided as part of the system.

VDC System Software: The VDC system software shall provide, but not be limited to, the following applications: diagnostics, TCP/IP addressable, streaming video, programmable video detection using Boolean logic and vehicle counts. The detection shall be reliable under all lighting and weather conditions. The system shall allow secure, remote access for configuration, maintenance and video streaming.

Video Streaming: The VDC system shall have the ability to stream video via management software in quad view or through third party applications on a tablet, smartphone or laptop.

Detection Zone Programming: Detection zones shall be user programmable, superimposed on image of approach. Each zone shall be user defined, shall provide flashing overlay to indicate on / off state and programmable using Boolean logic. Detection zone types shall be, but not be limited to, the following: vehicular and bicycle presence and counts, and differentiation by lane or wrong way detection.

All detection zone overlays and label data can be shown or hidden based on user's needs. If the video image is lost or becomes unusable by the VDC system, the outputs of the VDC shall place a failsafe recall on the affected phase or phases.

Data Collection: The collection of data, counts, alarms, etc. shall not interfere with the normal operation of the VDC system. The data collected shall include, at a minimum; vehicle counts per zone, turning movements independent of the zone, average speeds, vehicle lengths, pedestrian counts, and bicycle counts. The VDC software shall be able to retrieve the collected data for a specified period of time and save into a standard file format.

Power: The VDC shall operate normally over an input voltage range of 120 VAC at 60 Hertz (HZ). Power consumption shall be no more than sixteen (16) watts. No supplemental surge suppression shall be required outside the cabinet.

Environmental: The VDC shall operate at temperatures -30° F to +165° F and shall be capable of operating within weather conditions in Louisiana. It must be constructed so as to be water proof to the IP67 standard. It shall conform to the NEMA TS-2 standard. The VDC mount shall withstand 130mph wind load.

Installation and Training: The supplier of the VDC system shall supervise the installation and programming, as needed by the contracting agency. The supplier will provide training to the contracting agency as needed or as contracted to do so. A User's Guide and Tech Notes will be made available with the supplied equipment digitally.

Warranty, Service and Support:
All VDC system components shall be warranted for a minimum of three (3) years. All software/firmware updates will be provided free by the system supplier for the life of the unit. A technical support phone number shall be provided by supplier for free technical support for the life of the system.

REGULATIONS AND CODE:
Contractors shall have a IMSA Traffic Signal Level 1 certified technician at all times at each work location and a IMSA Traffic Signal Level 2 certified technician to work in the cabinet for all signal work.

GENERAL REQUIREMENTS:
The VDC system contractor shall configure the system and reports.

Traffic Engineering Division shall be given a seven (7) days advance notice of testing and activation of the VDC system and shall have a representative on site. Testing of equipment shall ensure that the VDC are operating properly and safely. Specific items to be checked include (but are not limited to) the following:

a. Each approach to the intersection shall be set up with Traffic Signal Video Detection.
b. The Main Street with speed limits 45 mph or higher shall be equipped with a Camera with integrated radar system.

c. The Side Street approach shall be equipped with a camera without integrated radar unless the side street is an arterial with a speed limit of 45 mph or higher.

d. All approaches should be programmed to detect and count vehicles as well bicycles.

DRAWINGS AND EQUIPMENT SUBMITTALS:

Prior to ordering/fabrication, electronically submit to the Engineer and Resident Project Representative, for approval, a PDF formatted letter on company letterhead for equipment submittals for all components to be furnished.

Show the project number, project location, project limits, pay item description, pay item number, manufacturer's name, and model number on each sheet. Each drawing shall also show the material specifications for each component proposed for use. All welds shall be identified by types and sizes.

MEASUREMENT:

The system will be measured per each intersection and shall include all necessary equipment, furnished and installed, to provide emergency vehicle preemption at each traffic signal intersection shown in the plans. This item will be measured per each and shall include, but not be limited to: the preemption intersection device, all communication equipment needed to establish communication links to the controller cabinet and the system, mounting hardware, wiring, labor and incidentals for each preemption system installed, tested, and accepted. Activation, integration, and testing of each device to ensure full operation with the existing Traffic Signal vehicle detection system shall also be required prior to acceptance.

PAYMENT:

Payment for Traffic Signal vehicle detection system with integrated work will be made at the contract unit prices, which includes all materials, tools, equipment, labor and incidentals necessary to complete the work. Each system will contain two integrated radar units unless otherwise noted.

Payment will be made at the contract unit price per each:

Item No.	Pay Item	Pay Unit
TS-736-36200	VIDEO DETECTION SYSTEM (3 CAMERA SYSTEM)	Each
TS-736-36200	VIDEO DETECTION SYSTEM (4 CAMERA SYSTEM)	Each
TS-736-36200	VIDEO DETECTION SYSTEM (4 CAMERA SYSTEM WITH 4 INTEGRATED RADAR UNITS)	Each
TS-736-36200	VIDEO DETECTION SYSTEM (5 CAMERA SYSTEM)	Each
TS-736-32000	VIDEO DETECTION SYSTEM (6 CAMERA SYSTEM)	Each
TS-736-32000	VIDEO DETECTION SYSTEM (7 CAMERA SYSTEM)	Each
TS-736-32000	VIDEO DETECTION SYSTEM (8 CAMERA SYSTEM)	Each

STATE OF LOUISIANA

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

PLANS OF PROPOSED STATE HIGHWAY

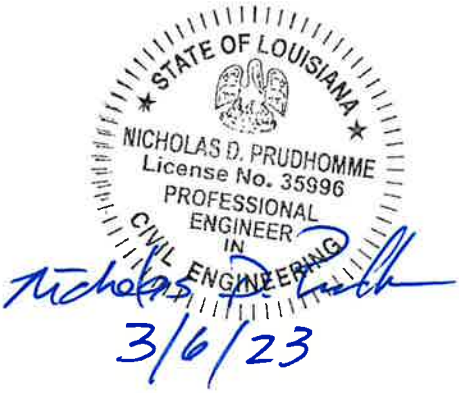
FEDERAL AID PROJECT NO. H012232
STATE PROJECT NO. H.012232

LA 3064 TO LA 1248 PHASE II
DIJON DRIVE EXTENSION
EAST BATON ROUGE PARISH

The following non-standard specifications have been prepared by or under the direct supervision of the licensed Civil Engineer whose seal/stamp appears below.
Any reference to "QPL" in these special provisions refers to the Qualified Products List for the City of Baton Rouge/Parish of East Baton Rouge.

Special Provisions:

P17.801 – Excavation, Backfilling, and Compaction for Sanitary Sewers and Related Structures
P17.801a – Sand-Aggregate for Secondary Backfill
P17.802 – Gravity Sewer Pipe
P17.803 – Sewer Manholes
P17.804 – Sewer Force Mains
P17.814 – Smoke Testing
P17.817 – Jack and Bored Pipe/Casing
P17.822 – Protective Coating
P17.1001 – Aggregates
P17.1002 – Cement, Lime, and Water
P17.1005 – Portland Cement Concrete
P17.1006 – Reinforcing Steel
P17.1008 – Concrete Curing Materials, Admixtures, and Finish Coating
P17.1011 – Structural Metals
P17.1016 – Sewer Pipe
P17.1017 – Precast Concrete Sewer and Drain Units
P17.1019 – Valves and Appurtenances



Nick Prudhomme, P.E.	March 6, 2023	Civil Engineering
Name	Date	Discipline

SECTION	DOTD ITEM NO.	DESCRIPTION	UNITS
801a	TS-742-80109	Sand-Aggregate for Secondary Backfill	Cubic Yard
802	TS-742-61006	Sanitary Sewer Pipe (12”) PVC	Linear Feet
803	TS-702-00126	Sanitary Sewer Manhole (48”)	Each
804	TS-742-60010	Fittings	Pound
	TS-742-60011	Air Release/Vacuum Valve (2”)	Each
	TS-742-60012	Unrestrained Joint Sewer Force Main (16”)	Linear Foot
	TS-742-60013	Restrained Joint Sewer Force Main (16”)	Linear Foot
	TS-742-60024	Force Main Tie-In (16”)	Each
817	TS-742-60014	24” Jacked and Bored Casing including Carrier Pipe	Linear Foot

SPECIAL PROVISION P17.801
EXCAVATION, BACKFILLING, AND COMPACTION
FOR SANITARY SEWERS AND RELATED STRUCTURES

P17.801.01 DESCRIPTION: This Work shall include, but not necessarily be limited to, excavation and trenching operations to install pipe, manholes, pump stations, and other structures and all related work such as shoring, bracing, water handling, and miscellaneous clearing and grubbing; filling and grading under and around sanitary sewer structures; and all backfilling, compaction, grading, import of backfill material, disposal of surplus and unsuitable materials.

P17.801.02 GENERAL:

a. All work shall be performed in compliance with L.R.S. 40:1749.11-22, "Louisiana Underground Utilities and Facilities Damage Prevention Law", OSHA regulations and applicable codes, ordinances, and standards of governing authorities having jurisdiction.

b. Open excavations, including incomplete manholes and pump stations, shall be barricaded and posted with operating warning lights in accordance with Federal, State and local requirements.

c. Public and private structures, utilities, driveways, sidewalks, pavements, and other facilities shall be protected from damage caused by settlement, lateral movement, undermining washout, construction activities, and other hazards created by these operations. All settlement or other damage caused by the Contractor's operations shall be repaired within 7 days, or the facilities shall be replaced, at the Contractor's sole expense and at the discretion and direction of the Engineer. This includes the warranty period as well.

P17.801.03 MATERIALS:

a. Definitions:

1. **Sanitary Sewer Bedding/Backfill Materials:** Bedding and initial backfill material shall be a sand-aggregate mixture. The aggregate shall be free of angular stones that could score, crack, or puncture the pipe. The sand-aggregate mixture shall meet the following gradation:

Sieve Size	Percent Passing
1-1/2 inch	95-100
No. 4	30-50
No. 10	20-45
No. 200	0-10

2. **Usable Excavated Soils:** Usable excavated soils shall have a maximum PI of 25 and a maximum organic content of 5 percent. Soils with a silt content of 50 percent or greater and also a PI of 10 or less will not be allowed. Soil shall be tested at Owner's option by the Owner's testing lab. Usable excavated material may be neatly stockpiled at the site where designated by the Engineer provided there is an

area available that will not interfere with the Owner's access nor inconvenience traffic or adjoining property owners.

3. **#610 Stone Backfill:** The 610 Stone shall be one hundred percent quarried material. The stone shall pass the ASTM soundness test and abrasion test. Soundness loss shall not exceed fifteen percent when subjected to five cycles of the magnesium sulfate soundness test in accordance with AASHTO 104. The stone shall show an abrasion loss of not more than forty percent when tested in accordance with AASHTO 96. The 610 Stone backfill shall meet the following gradation:

Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	90-100
3/4 inch	70-100
No. 4	35-65
No. 40	12-32
No. 200	5-12

4. **#57 Stone Backfill:** The stone shall be one hundred percent quarried material. The stone shall pass the ASTM soundness test and abrasion test. Soundness loss shall not exceed fifteen percent when subjected to five cycles of the magnesium sulfate soundness test in accordance with AASHTO 104. The stone shall show an abrasion loss of not more than forty percent when tested in accordance with AASHTO 96. The 57 Stone backfill shall meet the following gradation:

Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	90-100
1/2 inch	25-60
No. 4	0-10
No. 8	0-5
No. 200	0-1

5. **Imported Clay Fill:** Where shown on the Drawings or as directed by the Engineer, clay shall be imported from a borrow site approved by the Engineer. Soils meeting the Unified Soil Classification CL and free of organic material are acceptable clay fill. The clay material shall have the following properties:

   i. Maximum Liquid Limit of 50
   ii. Maximum Plasticity Index of 30
   iii. Organic content less than 5%.

6. **Geotextile Fabric:** The geotextile fabric shall consist of a nonwoven geotextile fabric Class B, C, or D, as contained in the latest edition of the LADOTD QPL.

7. **Controlled Low-Strength Material (CLSM)**: CLSM shall consist of Type I Portland Cement, Class C or F Fly Ash, sand, and water in the following proportion per cubic yard:

   i. Portland Cement 50 pounds
   ii. Fly Ash – Class C or F 125 pounds

iii. Sand	2900 pounds
iv. Water	50 to 65 gallons

Mixing and hauling equipment shall conform to Section SP.P17.1005.

8. **Select Imported Material**: Selected soils are natural soils with a maximum PI of 20, maximum Liquid Limit of 35, and a maximum organic content of 5 percent. Soils with a silt content of 50 percent or greater and also a PI of 10 or less will not be allowed. Any select material used to supplement or replace unusable excavated soil shall meet these requirements and must be approved by the Engineer.

9. **Granular Material:** Granular material shall be non-plastic and siliceous material, and shall comply with the following gradation:

Sieve Size	Percent Passing
1/2 inch	100
No. 10	75-100
No. 200	0-10

b. **General:** The Contractor shall notify the Engineer of the source of each material. At the request of the Engineer, the Contractor shall furnish for testing and approval a representative sample of each material weighing approximately fifty (50) pounds, at least ten (10) calendar days prior to the date of anticipated use of such material.

Select materials shall be furnished as required from approved off-site sources and hauled to the site. Disposal of unsuitable material is specified in Section SP.P17.801.07.

c. **Structural Fill:** Structural fill shall be used below spread footing foundations, slab-on-grade floors, and other portions of structures. Structural fill material shall be as defined on the drawings. If not defined elsewhere in the Contract Documents acceptable structural fill materials are non-expansive clay with a Plasticity Index between 10 and 25, a maximum Liquid Limit of 45, less than 5% organics, and free of degradable material or debris. Well-graded crushed stone aggregate such as an ASTM D1241 gradation C stone may also be acceptable.

Any structural fill material encountered during the excavation may be stored in segregated stockpiles for reuse. All material that, in the opinion of the Engineer, is not suitable for reuse shall be handled as specified herein for disposal of unsuitable materials.

d. **Trench Backfill:** Backfill methods for trenches, as shown on the Contract Documents, are classified into three zones, bedding, initial backfill, and secondary backfill. Bedding and initial backfill material shall be the sand-aggregate mixture as described in Section SP.P17.801.03.a.1. Secondary backfill material shall be as follows:

In locations where any part of the trench pay limit (as defined on the Contract Documents) falls under existing asphaltic or PCC roadways and/or existing parking lots, the secondary backfill shall be:

1. #610 Stone material in dry trenches,
2. #57 Stone in wet trenches or in wet trench bottoms,
3. #610 Stone material above the groundwater line in wet trenches,
4. CLSM when shown on the Contract Documents or as directed by the Engineer.

In locations where any part of the trench pay limit (as defined on the Contract Documents) falls within 10 feet of an existing major structure foundation, the edge of an existing road/shoulder/back of curb, or under the limits of a future asphaltic or PCC roadway/parking lot to be constructed subsequent to sanitary sewer installation; the secondary backfill shall be the sand-aggregate mixture as described in Section SP.P17.801a. In these situations, the sand-aggregate material shall be placed and compacted to within 3.5 feet of the surrounding grade, and usable excavated soils or select imported fill shall be placed and compacted for the remainder of the backfill to surrounding or specified grade.

e. In areas outside those described above, secondary backfill material shall consist of usable excavated soils supplemented by select imported fill or the materials listed above to replace unsuitable excavated soil.

f. **Manhole and Pump Station Bedding and Backfill:** Bedding material used below base foundations of manhole and pump station structures shall be #57 stone material, encapsulated in geotextile fabric. The material shall be placed in maximum 12 inch lifts with each lift rodded and vibrated to orient the stone and eliminate voids to create uniform bedding support for the pipe.

The manhole and pump station structures shall be backfilled with granular material or as specified on the Plans. In the case of manholes within existing or planned roadways alignments, the granular material shall be placed and compacted to within 2 feet of the surrounding grade, and #610 stone shall be placed and compacted for the remainder of the backfill to surrounding or specified grade. In the case of manholes located in unimproved surface areas, the granular material shall be placed and compacted to within 2 feet of the surrounding grade, and useable excavated soil shall be placed and compacted for the remainder of the backfill to surrounding or specified grade.

g. **Geotextile Fabric:** In trenches requiring the use of #57 Stone, this material shall be encapsulated in geotextile fabric. Geotextile fabric shall be class B, C, or D.

h. **Controlled Low-Strength Material (CLSM):** CLSM shall be used to backfill trenches where shown on the Drawings or as directed by the Engineer.

P17.801.04 PRE-INSTALLATION INSPECTION PROCEDURE: Prior to the start of any pipe laying activities, the Contractor shall perform proposed pipe installation procedures for inspection purposes at the location shown on the Drawings or as determined by the Engineer. Contractor shall submit all relevant submittals and have received approval from Engineer prior to scheduling of pre-installation inspection procedure. The purpose of this inspection is to demonstrate how the trench will be excavated, the bedding will be placed, and the initial and secondary backfill placed and compacted. In addition, at the time of the final surface restoration for paved areas, a mock-up pavement restoration sample will be performed. At least one mock-up will be performed for each type of pavement

restoration (asphalt and PCC) required on the Project. This mock-up will demonstrate how the pavement will be restored in accordance with the Contract Documents and serve as the standard required for all remaining pavement restoration for the Project.

a. At a minimum, the following pre-installation inspections are required:

    1. Linear pipeline projects – Contractor shall lay first 200 linear feet of pipe.

    2. Rehabilitation projects – Contractor shall perform first 4 point repairs (2 under pavement and 2 outside of pavement). Also first 200 linear feet of removal and replacement of pipe.

b. The pre-installation inspection procedure shall be as follows:

    1. Contractor shall schedule timing of the pre-installation inspection with the Engineer and provide a minimum 72 hour notice prior to inspection.

    2. Contractor shall layout pavement removal limits in agreement with the Engineer and perform pavement removal as specified.

    3. Contractor shall excavate trench as specified.

    4. Pipe bedding shall be placed and compacted in bottom of trench as specified.

    5. Pipe sections shall be placed on pipe bedding in trench as specified.

    6. Initial and secondary backfill shall be placed and compacted as specified. The in-place density shall be measured after each lift of initial and secondary backfill as specified. Additional lifts of initial and secondary backfill shall not be placed until the previous lift has met the specified density. If tests on a lift of backfill show that the specified density is not obtained, the Contractor shall increase the amount of coverages, decrease the lift thicknesses or obtain a different type of compactor until the specified densities are obtained.

    7. The Contractor shall demonstrate to the Engineer precautions taken to maintain the compaction of the backfill when moving the trench box.

    8. Pipe deflection shall be measured 48 hours after the completion of backfilling. The maximum deflection shall be as specified. If the pipe deflection exceeds the specified deflection, the installation shall be judged to not meet this Section and the Contractor shall repeat the pre-installation inspection procedure.

    9. After concurrence of the procedures, the Contractor may continue work. The Contractor shall use the pipe pre-installation procedure, which no exception was taken by the Engineer, for the installation of the pipeline. If during the course of work, it is determined that the established procedure is not producing the specified results, the Contractor shall repeat the pre-installation inspection procedure to determine a new installation procedure which will produce the desired results and is acceptable to the Engineer. The Contractor shall repeat as many times as necessary,

the pre-installation inspection procedure at no cost to the Owner.

10. The Contractor shall submit in writing to the Engineer, the established procedure in such detail that it can be followed and repeated consistently by any personnel change that may occur throughout the project. Any change to the established procedure, including but not limited to means, methods, or equipment shall require another successful pre-installation inspection procedure and revised detailed procedure write-up before additional pipe installation.

c. Contractor shall schedule timing of the pavement restoration mock-up with the Engineer and provide a minimum 72 hour notice prior to mock-up. Contractor shall remove temporary surfacing and base, install and finish permanent pavement restoration as specified. After concurrence of the procedures and final pavement restoration product, the Contractor may continue pavement restoration work. This mock-up pavement restoration will serve as the established standard for all remaining pavement restoration for the Project.

P17.801.05 PLACEMENT OF FILL:

a. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.

b. Material placed in fill areas shall be deposited within the lines and to the grades shown on the Contract Documents or as directed by the Engineer, making due allowance for settlement/shrinkage of the material. Fill shall be placed only on properly prepared surfaces that have been inspected and approved by the Engineer. If sufficient fill material is not available from excavation on site, the Contractor shall provide select material as may be required.

c. Fill shall be brought up in substantially level loose lifts of maximum of eight (8) inches in depth and compacted throughout the site, starting in the deepest portion of the fill. During the process of dumping and spreading, all roots, debris, and other objectionable material shall be removed from the fill areas. The entire surface of the Work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. All fill materials shall be placed and compacted "in-the-dry."

d. Where trench backfill and compaction work is following pipe laying or where the entire area of the backfilling cannot be completed with full area lifts, the trench backfill will be benched.

1. Benches shall be a maximum of three lifts tall.

2. Benches shall be separated by a minimum 8 foot horizontal distance.

e. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

f. Fill shall not be placed against concrete structures until they have been in place a

minimum of fourteen (14) days or have been shown to reach a minimum of 75% of their design compressive strength.

P17.801.06 EXCAVATION: Excavation consists of removal and handling of material encountered when establishing required grade elevations in accordance with the Contract Documents.

a. **Trench Excavation:** Excavation of trenches required for the installation of pipes and ducts shall be made to the depths required to accommodate placement of bedding material as shown in the Contract Documents. Widths shown on the Contract Documents are the established pay limits and may be adjusted to provide appropriate room for bracing, supporting, and dewatering facilities if necessary with prior approval of the Engineer. Excavation outside the established pay limits shall be at no additional cost to the Owner.

b. **Additional Excavation:** When excavation has reached required subgrade elevations, notify the Engineer or his representative who will make an inspection of conditions. If unsuitable, unsatisfactory bearing materials are encountered at the required subgrade elevation, carry excavation deeper and replace the additional excavated material with #57 Stone wrapped in geotextile fabric or CLSM as directed by the Engineer. Sand-aggregate bedding shall then be placed and compacted over the #57 Stone separated by the geotextile fabric or placed and compacted over the CLSM.

   Removal of unsuitable material and its replacement as directed beyond the authorized limits will be paid on the basis of the Contract Documents.

c. **Excavation for Pipelines, Manholes, Pump Stations and Structures:** Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection, or as shown on the Contract Documents.

   Care shall be taken not to disturb the bottom of excavation. Trim bottoms to required lines and grades to leave solid base to receive required bedding material. The pipe or duct shall be evenly supported on the bedding material. Bell holes shall be made as required.

   The bottom of the excavations shall be firm and dry. Sides of excavations are to be maintained in a safe condition until the completion of backfilling.

P17.801.06.1 Shoring and Bracing in Excavations:

a. The Contractor shall be fully responsible for designing, constructing, and maintaining cofferdams consisting of shoring and bracing, as required, to support the sides of excavations to prevent any movement which could in any way reduce the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing utilities, and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the shoring, but if voids are formed they shall be immediately filled with suitable material (either useable excavated soils or selected imported material if approved by Engineer), compacted by hand or mechanical means to condition judged visually comparable to condition of adjoining native soil.

b. As part of the submittal of schedules and other data indicating the plan of Work, the Contractor shall provide drawings of the planned supporting system (including the sequence of installation and removal). This submittal is not for review by the Engineer but for informational purposes only. The Engineer shall use the schedule in tracking the progress of the Work. The drawings shall be stamped by a Professional Engineer licensed in the State of Louisiana and be of sufficient detail to adequately disclose the method of operation that the Contractor plans to use for each of the various stages of construction. The Work shall not begin until such drawings are reviewed and any questions posed by the Engineer have been adequately addressed by the Contractor.

c. Wooden trench shoring for pipes is not to be withdrawn when driven below mid-diameter of any pipe, and no wood shoring shall be cut off at a level lower than two (2) feet above the top of any pipe or no more than two (2) feet below natural ground, unless otherwise directed by the Engineer.

d. All steel trench shoring and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, existing utilities, existing piping, or personnel and property. Care shall be taken not to disturb or otherwise injure any finished facility. All voids left or caused by withdrawal of shoring shall be immediately refilled with **Sanitary Sewer Bedding/Backfill Materials as defined herein** and rammed/compacted with tools especially adapted for that purpose, by hydraulic compaction, or as otherwise directed.

e. The right of the Engineer to order shoring and bracing left in place shall not be construed as creating any obligation on the Engineer's part to issue such orders. In addition, the Engineer's failure to exercise this right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or on the Work occasioned by negligence or other cause, growing out of a failure on the part of the Contractor to leave in place sufficient shoring and bracing to prevent any caving or moving of the ground.

f. The Contractor may construct the cofferdams and shoring outside the neat lines of the foundation for pipes and manholes, unless indicated otherwise, to the extent deemed desirable for the planned method of operation so long as it does not encroach on areas outside the limits of the Work. Shoring shall be plumb and securely braced and tied in position. Shoring, bracing, and cofferdams shall be adequate to withstand all pressures

to which the existing or new structure or excavation will be subjected. Pumping, bracing, and other work within the cofferdam shall be done in a safe manner and shall avoid disturbing any completed construction. The Contractor shall provide the necessary clearances and dimensions to correct any movement or bulging that may occur.

g. The Contractor shall maintain shoring and bracing in excavations regardless of time period excavations will be open and shall carry down shoring and bracing as excavation progresses.

h. As an alternate to shoring, the Contractor is authorized to utilize an OSHA approved mechanical trench box or slide-rail system, the size and construction of which shall be designed for the intended depth/loads. Documentation of the trench box or slide-rail system shall be submitted to the Engineer for informational purposes only.

P17.801.06.2 Dewatering, Drainage and Flotation:

a. The Contractor shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems necessary for handling groundwater and surface water encountered during construction of structures, pipelines, and compacted fills. The Contractor is responsible for providing temporary power for any pumping operation that may be required.

b. The Contractor is responsible for complying with the requirements and obtaining necessary permits of all agencies having jurisdiction and control over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Because the review and permitting process may be lengthy, the Contractor is required to take early action to pursue and submit for the required approvals so that construction is not delayed beyond that represented to the Engineer.

c. Prior to excavation, the Contractor shall submit detailed drawings and design calculations descriptive of the proposed means and method of dewatering and maintaining dry conditions to the Engineer. This submittal shall be prepared and sealed by a professional engineer licensed in the State of LA. The Contractor shall be responsible for the satisfactory performance of the system and for correcting any disturbance of natural bearing of soils or damage to structures caused by the dewatering system or by interruption of the continuous operation of the system as specified.

d. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding, and base course in-the-dry (no standing water in the trench). In addition, the Contractor shall make the final twenty-four (24) inches of excavation for this work in-the-dry, and not until the groundwater level is a minimum of twelve (12) inches below proposed bottom of excavation. The Contractor shall provide means and methods to control the potential for excavation base instability from either excess hydrostatic water pressures or basal heave in the design of their shoring system.

e. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to promptly remove and dispose of all water entering

excavations and shall keep such excavations dry to obtain a satisfactory undisturbed subgrade foundation condition. Dewatering shall be required until the fill, structure, or pipes to be built have been completed to the extent that they will not be floated or otherwise damaged by allowing water levels to rise or return to natural elevations.

f. Wellpoints or larger wells may be required, with the approval of the Engineer, for predrainage of the soils prior to final excavation for deeper below-ground structures or piping, and for maintaining the lowered groundwater level. If so, this system shall be designed by a professional engineer licensed in the State of LA. A copy of the subsurface characterization, calculations, layout, and narrative descriptive of operation through removal and/or abandonment shall be submitted for information and comment. After comment has been offered and questions answered, the Contractor may proceed with installation. Wellpointing and larger wells shall be maintained until construction has been completed to such an extent that the structure, pipeline, or fill will not be floated or otherwise damaged. Wellpoints or larger wells shall be surrounded by suitable filter sand and no fines shall be removed by pumping. The Contractor may be required to demonstrate the adequacy of the proposed system and filter sand by means of a test installation at the direction of the Engineer. Discharge water shall be clear, with no visible soil particles in a one-quart sample.

g. If requested by the Engineer, the Contractor's proposed method of dewatering shall include a minimum of two (2) each 2-inch diameter, Schedule 40 PVC operating groundwater observation wells, with factory slotted screen and appropriate sand pack. The observation wells shall be screened within each stratum to be dewatered at each structure as directed by the Engineer. A bentonite seal and grout shall be provided above the screened depth to the surface. Observation wells are to be used to determine/monitor the water level during construction of the structure. Locations of the observation wells shall be at structures and along pipelines as approved by the Engineer and at no additional cost to the Owner. During backfilling and construction, water levels shall be measured in observation wells at frequencies as directed by the Engineer. Contractor shall be responsible for maintaining and repairing/replacing damaged observation wells during the project. Removal or abandonment of observation wells shall be as directed by the Engineer.

h. While dewatering for new construction in the vicinity of existing structures, depletion of the groundwater level underneath these existing structures may cause settlement of within the site footprint and at some distance beyond the footprint. To avoid this settlement, the groundwater level under these structures shall be maintained by appropriate methods. In conditions where dewatering in excess of 20 gpm for over 24 hours is anticipated, a professional engineer specializing in geotechnical engineering should evaluate the potential for settlements created by dewatering that may be detrimental to existing structures. This evaluation should include an investigation of the specific soil and groundwater conditions to a depth of at least 2 times the depth of the excavation including the permeability and compressibility of the various soil strata (either by direct measurement or by empirical methods), an interpretation of the water table drawdown at the location of any potentially affected structure(s), the duration of the dewatering program, and the resulting amount of settlement that will be created at the structure(s).

P17.801.07 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL: If at the time of excavation it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extras will be considered for the stockpiling or double handling of excavated material. Unsuitable and surplus excavated materials, unless specified otherwise, shall become the property of the Contractor. Contractor shall remove and dispose of unsuitable or surplus material off of the project site at an appropriate disposal site approved by the Engineer. Unsuitable material includes all paving removed for the Work.

P17.801.08 BACKFILLING AROUND STRUCTURES, MANHOLES, PUMP STATIONS AND PIPELINES:

a. All backfill shall be placed in layers having a maximum thickness of eight (8) inches in loose state and shall be compacted as specified in SP.P17.801.09 of this Section.

b. Backfilling shall be carried up evenly on all walls of an individual structure simultaneously. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength as described previously. Backfilling shall be subject to approval by the Engineer.

c. Backfilling shall be carried up evenly on both sides of the pipeline. Contractor shall take special care to ensure proper support, compaction and elimination of voids under the haunches of the pipe.

d. In the case of trenches across or along roadways with open ditch drainage refer to subsection SP.P17.801.011c for backfill and protection of roadside ditch sloped areas.

e. In locations where pipes pass through structure walls, the Contractor shall take the following precautions to consolidate the backfilling up to an elevation of at least one (1) foot above the bottom of the pipes:

    1. Place sand-aggregate bedding and initial backfill in such areas for a distance of not less than three (3) feet either side of the centerline of the pipe in level loose layers not exceeding eight (8) inches in thickness. Compact each layer.

    2. Place and thoroughly compact adjacent layers simultaneously.

f. The final finished surface of filled areas shall be graded to smooth, true lines, strictly conforming to grades indicated on the grading plan, and no soft spots or uncompacted areas will be allowed in the Work.

g. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure, and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling. Contractor shall take precautions as to not disturb the compaction of the backfill when removing the bracing.

g. Controlled Low Strength Material placement will cause hydrostatic uplift pressure on the pipe in cases where bedding and initial backfill material may not be used. Therefore, the Contractor shall anchor the pipe to remain on its intended alignment and grade.

Contractor shall submit to the Engineer a pipe anchorage plan for the use of CLSM backfill. The plan shall include at a minimum:

1. Anchor/ballast material,
2. Size and weight of each,
3. Required spacing
4. Dams to confine the CLSM

At a minimum the anchorage shall be located at the pipe joints and midpoints. The anchoring/ballasting system shall be designed and stamped by a Professional Engineer licensed in the State of Louisiana. In addition to the anchorage system the CLSM shall be placed in incremental lifts around the pipe. Each lift shall be allowed to attain partial set before placing the next lift. The recommended incremental lifts are as follows:

1. First lift = 1/4 pipe outer diameter (OD)
2. Second lift = 1/3 OD
3. Third lift placed to the pipe crown
4. Remainder of backfill may be placed in one lift

Anchoring system is not required when bedding and initial backfill material is used in accordance with Standard Plan 801-01.

P17.801.09 COMPACTION:

a. **General:** Contractor shall control soil compaction during construction and obtain the minimum required percentage of the maximum dry densities as specified herein and as shown on the Contract Documents. **Soil compaction with a backhoe bucket or any other heavy apparatus not designed specifically for soil compaction is not allowed**. The Contractor shall maintain the backfill for a period of one year after Final Acceptance and shall restore any backfill that fails and repair any pavement or other structures, which may be damaged as a result of backfill failure. It shall be the Contractor's responsibility to notify the Engineer in writing that the compaction tests as required can be performed.

The frequency for density tests will be a minimum of one test per lift per 100 linear feet of trench excavation and one randomly selected test per 2,500 square feet of excavation for open areas. If the density tests indicate that the Work does not meet specified density requirements, the Engineer may require additional density tests to determine the extent of the deficient Work at the Contractor's expense. The Contractor will not be allowed an extension of Contract Time as a result of any density testing. The Contractor shall be required to remove, replace and compact deficient Work at no additional cost to the Owner.

It is the Contractor's responsibility to provide equipment and labor as needed to achieve the required compaction as specified herein. Should the rates of compaction fall below the values specified herein; the Engineer has the right to instruct the Contractor to alter his work and/or to provide different equipment to assure that the required backfill quality is consistently achieved. Any decision by the Engineer to forgo such instructions shall in no way relieve the Contractor of his responsibility to provide backfill of the specified quality.

b. **Percentage of Maximum Density Requirements:** Compact subgrade, and fill materials to not less than the following percentages of maximum dry density as determined in accordance with ASTM 698, the Standard Proctor Test.

1. **Structural Fill below Spread Footing Foundations, Slabs-on-Grade, and other Portions of Structures**: Structural fill shall be place in horizontal lifts not exceeding eight-inch (8") loose thickness, or less if necessary to obtain proper compaction. Moisture content shall be within 3% of optimum as determined in accordance with ASTM D698, with stability present. Clay structural fill shall be compacted full depth to a minimum of 95 percent of the maximum dry density. Granular structural fill, with less than 5% passing the No. 200 Sieve shall be compacted full depth to at least 75% of the relative density as determined by ASTM D4253 and D4254.

2. **Manholes, Pump Stations, Structures, and Buildings:** Areas adjacent to structures shall be compacted with vibratory mechanical compaction equipment approved by the Engineer. Compact eight-inch (8") loose lifts to a minimum of 95 percent of the maximum dry density as determined by ASTM D698. Moisture content of backfill material shall be within 3% of optimum as determined in accordance with ASTM D698. Granular backfill, with less than 5% passing the No. 200 Sieve, shall be compacted to at least 75% of the relative density as determined by ASTM D4253 and D4254.

   The #57 stone bedding shall be placed in maximum 12" loose lifts, rodded and vibrated to orient the stone and eliminate voids to create uniform bedding support for the pipe, with the material compacted to 100% of the materials maximum dry rodded weight in accordance with ASTM C29.

3. **Compaction of Bedding and Initial Backfill Material:** Bedding and initial backfill shall be compacted. Compact eight-inch (8") loose lifts to a minimum of 95 percent of the maximum dry density as determined by ASTM D698. Bedding material will be rodded and vibrated to orient the stone and eliminate voids to create uniform bedding support for the pipe. Bedding material will not be compacted until rodding is complete. Moisture content of bedding and initial backfill material shall be within 3% of optimum as determined in accordance with ASTM 698.

4. **Compaction of Backfill Directly Under Existing Pavements:** Secondary backfill directly under existing pavements (roadways and parking lots) shall be #610 Stone material and placed in loose layers of eight (8) inches and compacted. Backfill shall be compacted with vibratory compaction equipment to not less than 95 percent of the maximum dry density as determined by ASTM D698. Moisture content of

backfill material shall be within 3% of optimum as determined in accordance with ASTM 698.

5. **Compaction of Backfill Near Existing Structures and Pavements or Directly Under Future Pavements:** Secondary backfill within 10 feet of an existing structure foundation, the edge of an existing road/shoulder/back of curb, and/or directly under the limits of a future asphaltic or PCC roadway/parking lot to be constructed subsequent to sanitary sewer installation shall be bedding and initial backfill (sand-aggregate) material. In this situation the sand aggregate material shall be placed and compacted to within 3.5 feet of the surrounding grade, and usable excavated soils or select imported fill for the remainder of the backfill to surrounding or specified grade. Both materials shall be placed in loose layers of eight (8) inches and compacted. All backfill shall be compacted with vibratory compaction equipment to not less than 95 percent of the maximum dry density as determined by ASTM D698. Moisture content of backfill material shall be within 3% of optimum as determined in accordance with ASTM 698.

6. **Unsuitable Subgrades or Wet Trench Bottoms:** If trench bottoms contain unsuitable subgrades, muck bottoms, or wet bottoms that cannot be pumped dry, then at the direction of the Engineer, #57 Stone encapsulated in geotextile fabric, shall be used in accordance with the Standard Detail 801-01. #57 Stone shall be placed and compacted in lifts suitable to provide a suitable, non-yielding working surface for the required construction operations.

7. **Compaction of All Other Backfill:** Where a trench is in open ground and the backfill is not influenced by loading conditions, secondary backfill shall be as shown on the Contract Documents and compacted in loose layers of eight (8) inches and compacted to a minimum 90 percent of the maximum dry density. If the Contractor is unable to dry the excavated soil to an appropriate moisture content in order to achieve the required rate of compaction, he shall request authorization from the Engineer to deem the excavated soil as unusable and replace with imported select material for backfill. The final surface shall be left in a condition equal to that originally found at the start of the Work. The backfill shall be finished over the trench flush with the ground surface. The Contractor will add backfill material monthly during the contract duration and during the warranty period to compensate for settlement and erosion.

c. **Moisture Control:** Contractor shall condition subgrade or fill material to moisture content sufficiently near optimum to accommodate compaction meeting the required percent compaction. When the material is too dry to be compacted efficiently, the Contractor shall uniformly apply water to soil material and thoroughly mix the soil to achieve moisture content near the optimum level to facilitate compaction. Contractor shall remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

d. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum compaction as required for any material.

P17.801.10 GRADING:

a. **General:** Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades as are required or shown on the Contract Documents.

b. **Grading Outside Building Lines:** Grade areas adjacent to building lines, as shown on the Drawings, to drain away from structures and to prevent ponding. Finish surface free from irregular surface changes and to within not more than 0.10 feet above or below the required elevation.

c. **Grading Surface of Fill under Building Slabs:** Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of one-half inch when tested with a ten (10) foot straightedge.

d. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed by the Engineer, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the prosecution or condition of the Work.

e. The Engineer reserves the right to make adjustments or revisions in lines or grades if found necessary as the Work progresses, in order to obtain satisfactory construction.

P17.801.11 MAINTENANCE:

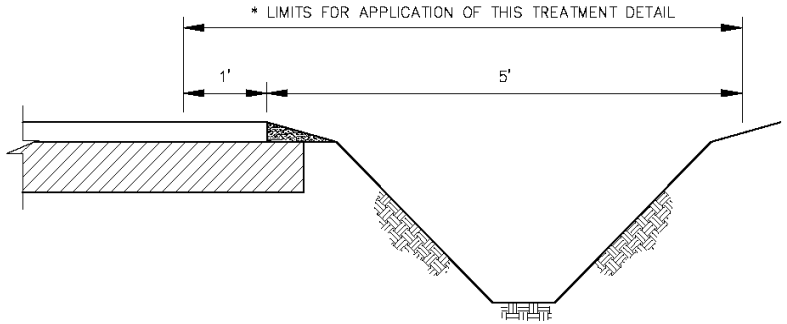
a. **Protection of Graded Areas:** Protect newly graded areas from traffic and erosion. Keep areas free of trash and debris and repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

b. **Protection of Sloped Areas:** If a fill section or backfilled trench zone falls within a sloped area then Contractor shall place an erosion control blanket over the slope. Areas requiring an erosion control blanket shall be approved prior to placement. After materials are placed and spread, lumps, stones, roots and other foreign matter shall be removed from the area. Erosion control blanket shall be placed in a timely manner to prevent erosion.

c. **Protection of Roadside Ditch Sloped Areas:** In the case of roadways with open ditch drainage - when any portion of a sewer (sanitary or storm) excavation trench limit falls within 1 foot inside or 5 feet outside the pavement edge the Contractor shall place and compact Imported Clay Fill for the length of the trench excavation as shown on the Roadside Ditch Slope Stability Treatment Detail included at the end of this Section.

After placement and compaction of the clay material, a layer of topsoil shall be placed on the slope. The topsoil shall be seeded and fertilized. Once the topsoil has been seeded and fertilized the Contractor shall overlay the topsoil with an Erosion Control Mat. The Contractor shall maintain existing roadside slopes, ditch side slopes and ditch flow lines by undercutting existing grades for placement of the clay fill and topsoil. The cost of the topsoil, seeding, and erosion control matting shall be included in the Imported Clay Fill pay item.

d. **Reconditioning Compacted Areas:** Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.



(1) EXISTING PAVEMENT BASE TO REMAIN

(2) EXISTING ASPHALTIC CONCRETE SURFACING TO REMAIN

(3) REQUIRED FULL DEPTH ASPHALT CONCRETE BASE (PG 64-22)

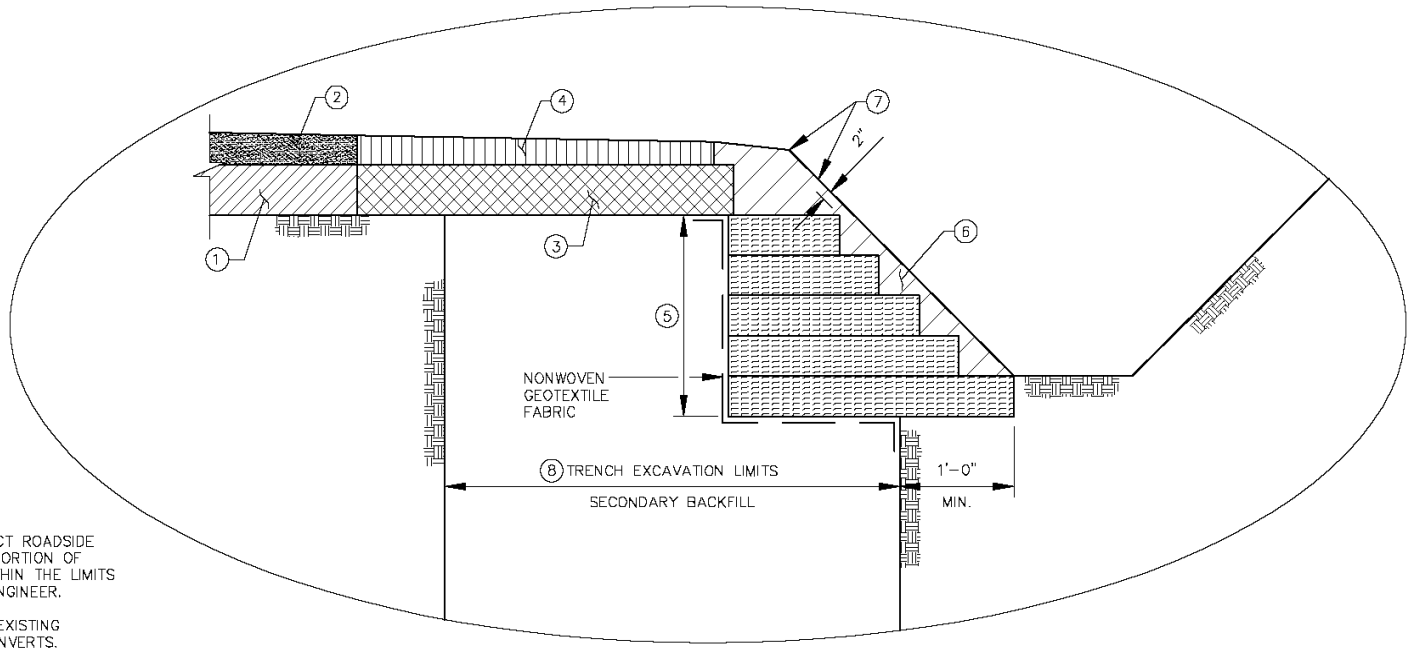
(4) REQUIRED ASPHALTIC CONCRETE SURFACING (TYPE B MIX, (PG-76-22M) 4" MIN. DEPTH)

(5) REQUIRED COMPACTED CLAY, 8" LOOSE LIFTS. THE COST OF IMPORTING, PLACING, AND COMPACTING THE CLAY SHALL BE INCLUDED IN THE PRICE PER CUBIC YARD FOR IMPORTED CLAY FILL

(6) REQUIRED TOPSOIL (SEEDED PER SPECIFICATION SECTION 903)

(7) REQUIRED EROSION CONTROL BLANKET

(8) SEWER PIPE REPAIR EXCAVATION (SEE STANDARD PLAN 801-01)



NOTES:

1. *CONTRACTOR SHALL CONSTRUCT ROADSIDE DITCH TREATMENT WHEN ANY PORTION OF TRENCH EXCAVATION FALLS WITHIN THE LIMITS SHOWN, OR AS DIRECTED BY ENGINEER.
2. CONTRACTOR SHALL MAINTAIN EXISTING ROADSIDE SLOPES AND DITCH INVERTS.
3. PLACEMENT AND COMPACTION OF CLAY, TOPSOIL (INCLUDING SEED) AND EROSION CONTROL BLANKET SHALL BE INCLUDED IN THE IMPORTED CLAY FILL PAY ITEM.

ROADSIDE DITCH SLOPE STABILITY TREATMENT DETAIL

N.T.S.

SPECIAL PROVISION P17.801a
SAND-AGGREGATE FOR SECONDARDY BACKFILL

P17.801a.01 SCOPE OF WORK: This Work shall include all instances of the sand-aggregate mixture as described in Section SP.P17.801.03.a.1 when used as secondary backfill. These instances include locations where any part of the trench pay limit (as defined on the Contract Documents) falls within 10 feet of an existing major structure foundation, the edge of an existing road/shoulder/back of curb, or under the limits of a future asphaltic or PCC roadway/parking lot to be constructed subsequent to sanitary sewer installation.

P17.801a.02 MATERIALS: When used as secondary backfill, the sand-aggregate mixture shall meet the following gradation:

Sieve Size	Percent Passing
1-1/2 inch	95-100
No. 4	30-50
No. 10	20-45
No. 200	0-10

P17.801a.03 MEASUREMENT: Measurement for sand-aggregate mixture for secondary backfill shall be the in-place measure of the number of cubic yards of secondary backfill required to be used as needed and as authorized by the Engineer.

P17.801a.04 PAYMENT: Payment for this item will be full compensation for sand-aggregate mixture required as secondary backfill furnished transported, placed, and compacted as shown in the Contract Documents and not specifically included under other Bid Items.

P17.801a.05 PAY ITEMS:

Technical Specifications Sanitary Sewer Systems

Payment will be made under:

Item No.	Item	Unit
TS-742-80109	Sand-Aggregate for Secondary Backfill	Cubic Yard

SPECIAL PROVISION P17.802
GRAVITY SEWER PIPE

P17.802.01 DESCRIPTION: This Work shall consist of furnishing all labor, materials, equipment, and incidentals required to remove and dispose of existing gravity sewer pipe if required, perform point repairs, remove and replace repairs and install new gravity sanitary sewer lines and fittings.

All work shall comply with the following requirements. All Section and Subsection references refer to the following requirements.

a. NS Items (Special Provisions) found in this contract.
b. 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
c. Special Provisions to the 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
d. City of Baton Rouge/Parish of East Baton Rouge Standard Details
   http://brprojects.com/design-and-construction-resources/standard-details/
e. City of Baton Rouge/Parish of East Baton Rouge Master Specifications
   http://brprojects.com/design-and-construction-resources/master-specifications/
f. City of Baton Rouge/Parish of East Baton Rouge of Environmental Services Wastewater Qualified Products List
   http://brprojects.com/baton-rouge-sso-program/design-construction/wastewater-qualified-products-list/

P17.802.02 MATERIALS: Materials shall conform to the following Sections and Subsections:

a. Plastic Pipe	SP.P17.1016.01.1
b. Ductile Iron Pipe	SP.P17.1016.01.2
c. Steel Pipe	SP.P17.1016.01.3
d. Fiberglass Reinforced Polymer Pipe	SP.P17.1016.01.4

When a foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in the United States. Certification from any other source is not acceptable. Furnish copies of test reports to the Engineer for review. Cost of testing shall be borne by the Contractor.

Contractor shall provide sewer pipes with the inside diameter shown on the Contract Documents. Diameters shown on the Drawings and listed in the pay items represent the required inside diameters, regardless of pipe material.

When an item for gravity "Sewer Pipe" is included in the contract, the Contractor has the choice to select from the following list of pipe materials in accordance with the specified inside diameters:

- Less than 18” (inside diameter) – PVC, HDPE and Ductile Iron
- 18” up to but not including 21” (inside diameter) – PVC, HDPE, Ductile Iron, or FRP
- 21” up to and including 24” (inside diameter) – PVC, HDPE, FRP, Ductile Iron, or Large Diameter Closed Profile PVC
- 27” up to and including 54” (inside diameter) – HDPE, FRP, Large Diameter Closed Profile PVC, or Ductile Iron
- Greater than 54” (inside diameter) – FRP or Ductile Iron

P17.802.03 SUBMITTALS:

a. The Contractor shall submit to the Owner prior to receiving the Notice to Proceed at the pre-construction meeting, a list of materials to be furnished and the names of the suppliers.

b. The Contractor shall submit for approval, complete, detailed shop drawings of all pipe and fittings.

c. The Contractor shall submit and shall comply with the pipe manufacturer's recommendations for handling, storing and installing pipe and fittings.

d. The Contractor shall submit pipe manufacturer's certification of compliance with these Contract Documents.

P17.802.04 CONSTRUCTION:

P17.802.04.1 Open Trench: Trenching construction consists of trench excavation, bedding, laying of pipe on grade, backfill, compaction, grading and incidentals in accordance with Section SP.P17.801.

P17.802.04.1.1 Pipe Laying: Pipe shall be handled, stored, and laid in accordance with the manufacturer's instructions and as specified as follows:

a. During pipe laying, trenches shall be kept dry. After each day's operations, and at other times when pipe laying is discontinued for more than one (1) hour, ends of the pipe shall be capped or plugged until pipe laying is resumed.

b. Pipe laying shall not advance backfilling by more than 100 feet without approval by the Engineer.

c. The pipes and fittings shall be so laid in the trench that after the sewer is completed, the interior surface of the bottom thereof shall conform accurately to the line and grade shown in the Contract Documents. Pipe laying shall begin at downstream end of line. Bell or groove ends of pipe shall be placed facing upstream. Bell holes shall be excavated to assure that only the pipe barrel shall bear upon the trench bedding material. No blocking under the pipe will be permitted.

d. Extreme care shall be used when handling and installing pipe and fittings. Under no circumstances shall pipe or fittings be dropped either into the trench or during unloading. The interior of the pipe shall be thoroughly cleaned of oil, dirt, and foreign matter, then closely inspected for damage to coatings, walls, bells, gaskets, and ovality, prior to installation. Nonconforming or damaged pipe, gaskets, or coatings shall not be installed.

e. When necessary to cut and machine all pipe in the field, the appropriate tools as recommended by the pipe manufacturer, shall be used. A "full insertion mark" shall be provided on each field cut pipe end. Field-cut pipe shall be beveled with a beveling tool specifically made for the pipe material.

f. The Contractor shall make every effort to conform to the line and grade of the plans. The grade shown on the Plans is that of the invert to which the Work must conform. The Owner reserves the right to make adjustments to the grades and slopes to fit actual field conditions.

g. After completion of pipe installation, no sag in the line greater than the maximum allowed sag tolerances noted in the Standard Plan 802-01 shall be acceptable. Any section of pipe that does not conform to these specifications shall be replaced or re-laid at the contractor's expense.

P17.802.04.1.2 Pipe Jointing: The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench. Joints and gaskets shall comply with Subsection SP.P17.802.02 and the relative pipe material. Workmen who are certified by the pipe manufacturer to join the pipe shall only perform pipe jointing. They should perform the work as follows:

a. Expend extreme care to keep the bells of the pipe free from dirt and rocks so joints may be properly assembled without overstressing the bells.

b. Provide lubricant, place and drive home newly laid sections. Use of backhoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by the Engineer.

c. Install pipe to "full insertion mark" where provided.

P17.802.04.2 Trenchless: Trenchless construction consists of technologies and methods utilized for installing sewer pipelines and services with minimal surface disruption and destruction resulting from excavation. Trenchless Construction shall conform to the following sections:

Jacked & Bored Pipe / Casing	SP.P17.817

P17.802.04.3 Remove and/or Abandonment of Existing Gravity Sewer Pipe: This section addresses the removal and/or abandonment of the existing gravity sewer pipe and all appurtenances which are being removed (or abandoned) as detailed on the Contract Documents.

a. Abandon Sewer Pipe: If an existing sewer pipe is shown to be abandoned in place on the Contract Documents, the Contractor shall be responsible for evacuating or "swabbing" the existing sewer pipe of all sewage before it is abandoned. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality. Subsequently, the entire length of the pipe shall be filled with flowable fill and capped as noted on the Drawings or as directed by the Engineer.

b. Plug and Abandon Sewer Pipe: If an existing sewer pipe is shown to be plugged and abandoned in place on the Contract Documents, the Contractor shall be responsible for evacuating or "swabbing" the existing sewer pipe of all sewage before it is abandoned. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the LA Department of Environmental Quality. Subsequently, the pipe shall be plugged approximately 18 inches into each end of the pipe and capped as noted on the Drawings or as directed by the Engineer.

c. Remove Sewer Pipe: If an existing sewer pipe is shown to be removed on the Contract Documents, the Contractor shall completely remove the sewer pipe. The removal trench shall be backfilled in accordance with the provisions of Section SP.P17.801 or as directed by the Engineer. The Contractor shall be responsible for evacuating or "swabbing" the existing sewer pipe of all sewage before it is removed. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality.

d. Remove and/or Abandon Sewer Pipe:

1. If an existing sewer pipe is shown as remove and/or abandon in place on the Contract Documents, the Contractor has the option to either completely remove the sewer pipe or abandon the sewer pipe. The Contractor shall be responsible for evacuating or "swabbing" the existing sewer pipe of all sewage before it is abandoned or removed. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality.

2. If removed, the removal trench shall be backfilled in accordance with the provisions of Section SP.P17.801 or as directed by the Engineer.

3. If abandoned, the entire length of the pipe shall be completely filled with flowable fill.

P17.802.05 NEW PIPE-EXISTING PIPE CONNECTIONS: Connections between existing and new pipe, with the exception of HDPE pipe, shall be jointed with non-shear repair couplings conforming to ASTM C425 and ASTM C1173. The stainless steel shear rings and clamping bands used in conjunction with the molded rubber sleeve shall conform to ASTM A 240 Series. When using the non-shear repair coupling, the gap between the two pipes shall be no more than ¼".

When non-shear repair couplings are not available for a particular size or material, connections between existing and new pipe shall be jointed using flexible elastomer couplings with a 300 stainless steel band for each end and adjusting screws capable of sustaining an applied torque in excess of 80 inch-pounds. When dissimilar pipe materials are joined, the Contractor shall use flexible couplings that are resistant to the corrosive action of the soils and sewage, and that provide a permanent watertight joint.

Connections between existing and new HDPE pipe shall be jointed with HDPE electrofusion couplings in accordance with subsection SP.P17.1016.01.1.2. Prior to ordering materials, Contractor shall check existing pipe diameters and take care to provide matching pipe and coupling to make proper connection.

P17.802.06 PIPE-MANHOLE CONNECTIONS: All sewer pipe shall be connected to new manholes with either flexible rubber boot connectors or integrally cast flexible connectors installed in accordance with the manufacturer's instructions. Then the opening on the inside and outside of the manhole shall be grouted (non-shrink) if necessary, to achieve a watertight seal.

For existing manhole connections, pipe shall be connected with a hydraulic cement material having a set time of no more than two (2) minutes; compressive strength of 600 psi at one (1) hour, 1,000 psi

at twenty-four (24) hours; bond of 40 psi at one (1) hour, 80 psi at twenty-four (24) hours. These requirements apply whether it is a connection to an existing sanitary sewer manhole or connections through a storm water conflict manhole, junction box, or inlet.

In the case of HDPE pipe, in addition to the flexible manhole connectors and non-shrink grout, electrofusion flex restraints shall be permanently attached to the pipe to prevent movement. HDPE flex restraints shall be in conformance with subsection SP.P17.1016.01.1.2.

P17.802.07 SERVICE LATERAL CONNECTIONS: Connections between the existing service lateral and the new/rehabilitated sewer main line shall be in accordance with the Contract Documents. Existing sewer service lateral and house connections shall be adjusted as required avoiding conflicts with the new Work. New pipe and fittings shall be furnished and installed as necessary and in accordance with the Contract Documents.

a. Service lateral connections located within the limit of a rehabilitation method or repair are required to be replaced (regardless of construction method) in both directions up to the property line with a clean-out and pad installed at the property line. Construction shall be in accordance with the appropriate typical drawings in the Contract Documents.

b. Service lateral vertical connection stacks shall be required in accordance with the Contract Documents.

c. New service lateral terminations, required prior to private service connection and cleanout installation, shall be required in accordance with the Contract Documents and stubbed a minimum of 3 feet above ground and capped.

d. In association with mainlines previously rehabilitated with CIPP lining:

    1. Connections between the service lateral and a main line, which has previously been repaired by a CIPP lining process, shall be made with six (6)- inch Flexible saddle wyes with corrosion resistant series 300 stainless steel clamps capable of sustaining an applied torque of 60 inch-pounds. In cases where a vertical stack is repaired, the PVC saddle wye shall be used in place of the flexible wye.

    2. Host pipe shall be removed to expose the full circumference of the CIPP liner around the wye connection, to allow for installation of the saddle with a sealant product such as Hydrophilic Water Stop. The interface between pipe and CIPP liner shall be sealed around the entire circumference of the wye connection with an approved non-shrink grout.

e. In association with Slip Lining:

    1. After the liner pipe has been inserted in the host pipe, given the appropriate relaxation period, and secured in the upstream and downstream manhole, all existing services shall be reconnected. A portion of the host pipe, at the liner pipe around each service connection shall be removed to expose the liner pipe

to provide adequate working space for making the new service connection. The Contractor shall reconnect the services to the liner pipe using compressive-fit service connections such as Inserta-Tee or approved equal.

2. Prior to backfilling, the portion of the host pipe removed for service reconnection shall be sealed to preclude migration of the backfill material into the annular space or loss of grout material during grouting of the annular space between the liner pipe and host pipe. This area may be sealed with an approved non-shrink grout or the portion of host pipe removed may be replaced and grouted.

f. In association with HDPE (HDPE Pipe or Lining Material):

1. The method of saddle connection to the main line shall be by Gasketed Electrofusion Branch Saddles by Central Plastics, or approved equal in conformance with subsection SP.P17.1016.01.1.2. Personnel certified by a manufacturer of polyethylene pipe in the proper methods of installing electrofusion fittings shall carry out installation of electrofusion saddles in strict conformance with the manufacturer's printed instructions. Installation shall include all equipment, labor, materials, and incidentals. Saddle material shall be compatible with the main line pipe or lining material.

P17.802.08 ACCEPTANCE TESTS FOR NEW PIPE: Installed sewer lines shall pass one or more of the following tests performed by the Contractor as directed by the Engineer. Contractor shall perform the test in the presence of the Engineer or his representative. Any removal or replacement of temporary or final surface restoration by the Contractor to investigate leaks shall be done so at no additional cost to the Owner.

P17.802.08.1 Leakage Tests: Sewer lines shall be tested for leakage as follows:

Low Air Pressure Test - manhole to manhole reach of pipe for sewer pipe 36" in diameter and smaller; individual joints for sewer pipe larger than 36" in diameter

Infiltration Test - for sewer pipe greater than 36" in diameter with groundwater equal to or greater than 2 feet above top of pipe (with approval of Engineer)

Exfiltration Test - for sewer pipe greater than 36" in diameter with groundwater less than 2 feet above top of pipe (with approval of Engineer)

P17.802.08.1.1 Low Air Pressure Test: This practice defines the proper procedures for acceptance testing of installed gravity sewer pipe using low-pressure air, to provide assurance that the pipe, as installed, is free from significant leaks. Included are requirements for equipment accuracy, safety precautions, line preparation, test method, and minimum holding times. Applicable sections of ASTM F1417 shall also apply.

a. For Pipes 36" in Diameter and less (Manhole to Manhole Reach)

1. Only lines tested after backfilling to final grade will be considered for acceptability. Acceptance will be dependent on a passing test. However, the installer as a presumptive test to determine the condition of the line prior to

backfilling may also use this test. During sewer construction, all service laterals, stubs and fittings into the sewer test section shall be properly capped or plugged to prevent air loss that could cause an erroneous air test result. It may be necessary and is always advisable for the Contractor to restrain gasketed caps, plugs, or short pipe lengths with bracing stakes, clamps, and tie-rods or wire harnesses over the pipe bells.

2. Unless otherwise specified, the Contractor shall furnish all the necessary equipment and be responsible for conducting all low-pressure air tests. In addition, the Contractor shall be responsible for any necessary repair work on sections that do not pass the test at no additional cost to the Owner.

3. The Engineer shall witness all low-pressure air tests and verify the accuracy and acceptability of the equipment utilized. The Engineer will inform the Contractor regarding acceptable methods of repair in the event one or more sections fail to pass the low-pressure air test.

4. Ensure that all plugs are installed and braced to prevent blowouts. As an example of the hazard, a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psig, and a force of 2,250 pounds is exerted on a 24- inch plug by an internal pressure of 5 psig. The Contractor must realize that sudden expulsion of a poorly installed plug, or of a plug that is partially deflated before the pipe pressure is released, can be very dangerous. For this reason, it is recommended that every plug be positively braced against the manhole walls, and that no one be allowed in the manhole adjoining a line being tested while as pressure is maintained in the line.

5. Internal pressure of more than 9 psig shall not be permitted except for leak location equipment where the plugs are firmly tied together. Contractor should verify maximum allowable pressure recommended by pipe manufacturer.

6. Use either mechanical or pneumatic plugs. All plugs shall be designed to resist internal testing pressures without the aid of external bracing or blocking. However, the Contractor shall internally restrain or brace the plugs to the manhole wall as an added safety precaution throughout the test.

7. Air test gauges shall be laboratory-calibrated test gauges, and if required by the Engineer, shall be recalibrated by a certified laboratory prior to the leakage test.

Air gauges shall have a size and pressure range appropriate for the pipe being tested.

8. All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valve set no higher than 9 psig to avoid over-pressurizing and displacing temporary or permanent plugs. As an added safety precaution, the pressure in the test section should be continuously monitored to make certain that it does not, at any time, exceed 9 psig. (It may be necessary to apply higher pressure at the control panel to overcome friction in the air supply hose during pressurization.)

9. To facilitate test verification by the Engineer, all air used shall pass through a single, above ground control panel. The aboveground air control equipment shall include a shut-off valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psi. The continuous monitoring gauge shall be no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of plus or minus 0.04 psi. Two separate hoses shall be used to: 1) connect the control panel to the sealed line for introducing low-pressure air, and 2) a separate hose connection for constant monitoring of air pressure build-up in the line. This requirement greatly diminishes any chance for over-pressurizing the line.

10. If pneumatic plugs are utilized, a separate hose shall also be required to inflate the pneumatic plugs from the above ground control panel.

11. After a manhole-to-manhole reach of pipe has been backfilled to final grade and compacted, prepared for testing, and a 24-hour waiting period has elapsed, the plugs shall be placed in the line at each manhole and secured.

12. The Contractor is advised to seal test all plugs before use. Seal testing may be accomplished by laying one length of pipe on the ground and sealing it at both ends with the plugs to be checked. The sealed pipe should be pressurized to 9 psig. The plugs shall hold against this pressure without bracing and without any movement of the plugs out of the pipe. No persons shall be allowed in the alignment of the pipe during plug testing. It is advisable to plug the upstream end of the line first to prevent any upstream water from collecting in the test line. This is particularly important in high groundwater situations.

13. When plugs are being placed, the pipe adjacent to the manhole shall be visually inspected to detect any evidence of shear in the pipe due to differential settlement between the pipe and the manhole. A probable point of leakage is at the junction of the manhole and the pipe, and this fault may be covered by the pipe plug, and thus not revealed by the air test.

14. Low-pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig. If the groundwater table is above the sewer being tested, the air pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer, up to a maximum of 9.0 psig. After a constant pressure of 4.0 psig (greater than the average groundwater back pressure) is reached, the air supply shall be throttled to maintain that internal pressure for at

least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

15. When temperatures have been equalized and the pressure stabilized at 4.0 psig (greater than the average groundwater backpressure), the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than the average backpressure of any groundwater over the pipe). At a reading of 3.5 psig, timing shall commence with a stopwatch.

16. If the time shown for the designated pipe size and length (see Table 8-1 1.0 PSIG Air Test Pressure Drop) elapses before the air pressure drops 0.5 psig, the section undergoing test shall have passed. The test may be discontinued once the prescribed time has elapsed even though the 0.5 psig drop has not occurred. If the pressure drops 0.5 psig before the appropriate time shown in Table I has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.

17. If the section fails to meet these requirements, the Contractor shall determine at their own expense the source, or sources, of leakage, and shall repair or replace all defective materials or workmanship to the satisfaction of the Engineer. The extent and type of repair, which may be allowed, as well as results, shall be subject to the approval of the Engineer. The completed pipe installation shall then be retested and required to meet the requirements of this test.

TABLE 8-1
1.0 PSIG Air Test Pressure Drop

Pipe Diameter	Minimum Time Lapse (min:sec)							
Inch	*100 ft*	*150 ft*	*200 ft*	*250 ft*	*300 ft*	*350 ft*	*400 ft*	*450 ft*
4	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33

b. For Pipes Larger than 36” in Diameter (Individual Joint Testing):

1. Individually test each sewer pipe joint with an approved joint air testing apparatus to an air pressure of 4.0 psig. If the groundwater table is above the sewer being tested, the air pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer, up to a maximum of 9.0 psig unless otherwise restricted by pipe manufacturer's recommendation.

2. The testing apparatus shall be positioned within the pipe in such a manner as to straddle the joint to be tested.

3. The apparatus packer ends shall be expanded so as to isolate the joint from the remainder of the pipe and create a void area between the packer and the pipe joint. The ends of the testing device shall be expanded against the pipe in accordance with the manufacturer's recommendations.

4. After void pressure is observed to be equal to or greater than the required test pressure, the air flow shall be stopped. If the void pressure drops by more than 1.0 psi within 15 seconds, the joint will have failed the test.

5. Upon completing the testing of each individual joint, the packer shall be deflated with the void pressure meter continuing to display void pressure. Contractor shall note and record the pressure display reading before each joint test. Should the void pressure meter fail to drop to 0.0 (±0.5) psig, Contractor shall make necessary equipment repairs to provide for an accurate void pressure reading.

P17.802.08.1.2 Infiltration Test: Where the natural groundwater is 24 inches or more above the top of a section of pipe, the Contractor shall measure the flow of water in the pipe and the rates of seepage and infiltration. Contractor shall measure the flow rate by using a calibrated weir. The Contractor shall leave the weir in the line until the flow rate has stabilized. The Contractor is responsible for verifying the groundwater level by providing sight gauges in manholes or digging test holes at suitable locations.

a. The total seepage and infiltration of groundwater as determined by the test shall in no case exceed 50 gallons per 24 hours per inch-mile of pipe.

b. Make infiltration tests on all sewer construction before placing the lines in service and before making any connections to other sewers.

c. If the amount of infiltration into the sewer(s) is in excess of the maximum quantity specified above, then repair the joints, relay the sewer (if necessary), or perform other remedial construction, at the Contractor's expense, in order to reduce groundwater infiltration to within the specified limits.

P17.802.08.1.3 Exfiltration Test: Where the groundwater is not 24 inches or more above the top of the pipe section being tested, the Contractor shall perform an exfiltration test.

a. The Contractor shall bulkhead the pipe below the lower manhole of the section being tested with a pneumatic plug or other device. Insert a vent pipe 48 inches long in the stopper of the upper end of that section. Then fill the lower manhole with water, or add water until there is a minimum of 4 feet over the upper end; make certain that all

air is forced out through the vent tube.

b. Contractor will measure the drop in the level of the water in the manhole due to exfiltration over a specific time and calculate the water loss due to exfiltration. The total exfiltration shall not exceed that specified above for infiltration.

P17.802.08.2 Mandrel Test (Plastic & Fiberglass Pipe): Pipe shall not exceed a deflection of more than 5%. Unless otherwise directed by the Engineer, after pipe has been backfilled for at least 30 days, a mandrel sized at 95% of the inside pipe diameter shall be pulled through pipe.

P17.802.08.3 Smoke Test:

a. All new sewer lines including service laterals with diameters up to & including 15 inches shall be smoke tested prior to backfilling in accordance with Section SP.P17.814.

b. At the discretion of the Owner, a final smoke test shall be performed a minimum of nine (9) months after final acceptance up to the end of the twelve (12) month warranty period.

c. Leaks detected during smoke testing must be repaired as part of the Work and shall be considered incidental to and included in the cost of Work.

P17.802.09 SANITARY SEWER PIPE REPAIRS:

P17.802.09.1 Point Repair: A Point Repair is the task of excavating to a pipe and performing a corrective measure to repair a defect on a length of sewer pipe less than or equal to twenty (20) feet long. Point repairs shall address, but not be limited to, cracked pipe, broken pipe, faulty tap, protruding tap, sheared joint, dropped joint, or other similar conditions.

P17.802.09.2 Remove and Replace: Remove and Replace is the task of excavating to a pipe and performing a corrective measure to repair a defect on a length of sewer pipe as designated on the Contract Documents. Remove and Replace operations shall address, but not be limited to, cracked pipe, broken pipe, faulty tap, protruding tap, sheared joint, dropped joint, or other similar conditions.

P17.802.09.3 Trenchless Point Repair: A Trenchless Point Repair is the task of providing a localized trenchless sealing and structural repair to a defect on a length of sewer pipe less than or equal to three (3) feet long with an internally installed stainless steel repair sleeve. Trenchless Point repairs shall address, but not be limited to, leaking joints, cracked pipe, broken pipe, deformed pipe, or other similar conditions where excavation is not practical due to surface conflicts.

P17.802.09.3.1 Design: The design of the stainless steel repair sleeves shall be in accordance with AWWA Manual 11 standards for design of Flexible Tunnel Liners. The repair sleeve shall be structurally designed to carry 5psi uniformly distributed hydraulic working load having a minimum factor of safety of 2.5 after 100-year chemical erosion of stainless steel material has been subtracted. Corrosion tables based on Stainless Steel Industry reports shall be used for calculating general surface erosion of the stainless steel plate thickness over the required 100-year service life due to corrosion. Calculations prepared by a Licensed Professional Engineer shall be submitted containing structural design, calculated effect of ovality and calculated structural effect of a 100- year chemical erosion of the structural element.

Where repair sleeve is fully enclosed in the damaged host pipe, the structural element of the sleeve shall be designed for 5psi hydraulic load with a minimum 2.5 factor of safety.

Where repair sleeve is expected to come in direct contact with the surrounding soil in excess of one third of the sleeve length, the structural element of the sleeve shall be designed for a hydraulic load of 10psi using a minimum 2.5 factor of safety. In lieu of a single sleeve, it is permissible to use a double sleeve assembly consisting of two single sleeves with 5psi capacity each joined together by a manufacturer approved resin matrix as a load transfer medium.

In case the host pipe has become oval, not exceeding 10 percent out of round, the repair sleeve with wall thickness of next thicker gauge from the one specified for standard repair sleeves shall be used.

P17.802.09.3.2 Materials:

a. Sleeve: The structural component of the repair device shall be 316 stainless steel in the form of sleeves of the required length to cover the repair. The inner diameter reduction of the host pipe shall not exceed one (1) inch.

b. Sealant: Only manufacturer specified resin with physical properties set out by the requirements of the structural design shall be used. The sealant must be appropriate for transmitting all external loads to the stainless steel structural core, providing adequate support for the structural core against buckling and bonding the device in place.

    1. Sealing Grout: The sealant used shall be as specified by the manufacturer for sealing infiltration.

    2. Structural Grout: The sealant used shall be as specified by the manufacturer and shall be capable of transmitting all external loads to the structural core of the repair sleeve. If any infiltrating water is present, infiltration shall be sealed prior to installation of sleeve using structural grout.

P17.802.09.3.3 Installation:

a. The entire process of transporting and installing the sleeve shall be recorded on digital media and a copy provided to the Engineer at the completion of each sewer section.

b. The sewer must remain in full operation during the repair process allowing for a maximum of 5 minutes of flow interruption.

c. In case of offset joints, bells, and deformed or irregular pipe with disarranged pipe pieces, the pipe bore shall be opened by application of a hydraulic expander.

d. Pipe deformation shall be reversed back to the round configuration and repair sleeves installed capable of restoring the full structural capacity of the host pipe.

e. In case the host pipe has completely collapsed and re-rounding is not possible without complete removal of the damaged pipe parts, an opening at least equal to the inside diameter of the host pipe must be cleared through the debris and the repair devices

capable of sustaining the full soil load extended throughout the collapsed area at least 12 inches into the undamaged pipe.

f. When a cracked host pipe has formed randomly directed elements the host pipe must be re-rounded with the repair sleeve, or the re-rounding must be completed before installing a sleeve, in the backfill is compacted too tight around the pipe. In this case re-rounding should be accomplished by using a hydraulic jack before the sleeve is inserted.

g. The repair must extend at least 8" into undamaged pipe or joint adjacent to both extremities of the damage. If access to the line is limited such that shorter than specified sleeves must be used, or the length exceeds the manufacturer standard sleeve lengths, two or more sleeves shall be used with an overlap where two adjacent sleeves meet following manufacturer specified standards for overlapped repair sleeves.

h. Upon completion of the repair, the entire sewer section shall be inspected and the inspection recorded on digital media at no additional cost to the Owner. This video inspection shall be submitted to the Engineer for verification of work quality and completion of repair.

P17.802.09.3.4 Acceptance:

a. All stainless steel sleeve locks have been engaged.

b. All the pre-measured grout supplied by the manufacturer has been applied to each stainless steel sleeve as specified by the manufacturer.

c. All host pipe leaking joints, cracks and holes are fully covered by the repair sleeve.

d. The entire pipe damage has been repaired per these specifications.

P17.802.09.4 Smoke Testing: Smoke Testing shall be performed on each mainline or service lateral repair once all repairs are complete on a segment and prior to backfill according to Section SP.P17.814 of the Specifications.

P17.802.10 MEASUREMENT:

a. **Sewer Pipe**: Measurement of new pipe shall be made from center of manhole to center of manhole as identified on the Contract Documents. Quantities of pipe for payment will be the contract quantities, adjusted as required due to plan errors or plan changes. Excavation, bedding, backfill, compaction, testing, and bypass flow are included in the measurement of new pipe.

b. **Rehab Sewer Pipe:** Measurement for the removal of existing sewer pipe and its replacement with sewer rehab pipe shall be made on a linear foot basis of pipe installed. Measurement will be made to the nearest whole foot for the various diameters listed in the Bid Form. When tying into a manhole or manholes, measurement will be to the inside face of the manhole structure. It is recognized that the Contractor must purchase pipe material at the minimum manufactured length based on the pipe material used; therefore, the unit bid price shall be based on a

minimum main line length of six (6) feet at each point repair and will be recorded accordingly by the Engineer's field representative. Excavation, bedding, backfill, and compaction are NOT included in the measurement of sewer rehab pipe.

c. **Connections to Existing Manholes:** Connections to existing manholes (sanitary sewer manhole or storm water conflict/junction/inlet box) will be measured each for the connections required.

d. **Adjusted Sanitary Sewer Service Lateral Connections:** Adjusting existing services will be measured each for the service adjustments required and includes up to twenty (20) feet of adjusted sewer service lateral to avoid conflict with new utility. Excavation, bedding, backfill, compaction, testing, and bypass flow are included in the measurement of new pipe.

e. **Sewer Service Lateral:** Measurement of new service lateral shall be made from the nearest outside edge of the mainline or lateral connection stack to the limits of the sanitary sewer clean-out as identified on the Contract Documents. Quantities of service lateral for payment will be the contract quantities, adjusted as required due to plan errors or plan changes. Measurement for sewer service laterals shall be made to the nearest linear foot of pipe installed.

f. **Sewer Service Lateral Connection Stack:** Measurement of new service lateral connection stack shall be made from top outside edge of the mainline to the top of the stack as identified on the Contract Documents. Quantities of service lateral connection stack for payment will be the contract quantities, adjusted as required due to plan errors or plan changes. Measurement for sewer service lateral connection stacks shall be made to the nearest vertical foot of pipe installed.

g. **Sewer Service Lateral Termination:** Measurement for the sewer service lateral termination shall be the actual count of termination assemblies installed and accepted.

h. **Non-Shear Couplings:** Non-shear couplings will be counted each for the diameter required.

i. **Electrofusion Couplings:** Electrofusion couplings for jointing existing HDPE pipe to new HDPE pipe will be counted each for the diameter required.

j. **Sanitary Sewer Clean-out:** Measurement for the sanitary sewer clean-out shall be the actual count of clean-outs installed and accepted.

k. **Service Lateral Mainline Connection Associated with CIPP:** Measurement for the service lateral mainline connection associated with mainline that has been previously rehabilitated with a CIPP liner shall be the actual count of each service lateral connection installed and accepted.

Excavation, bedding, backfill, and compaction associated with this item shall be paid for under the Sewer Point Repair Excavation, Backfill, and Compaction item by the appropriate depth range in accordance with Section SP.P17.801. The pay limit length for this excavation, bedding, backfill, and compaction shall be limited to 6 feet at the depth range of the mainline beginning at the backside mainline excavation width pay

limit. The pay limit width of excavation shall be the trench pay limit as shown on the Contract Documents.

l. **Service Lateral Mainline Connection Associated with Slip Lining:** Measurement for the service lateral mainline connection associated with slip lining shall be the actual count of each service lateral connection installed and accepted.

Excavation, bedding, backfill, and compaction associated with this item shall be paid for under the Sewer Point Repair Excavation, Backfill, and Compaction item by the appropriate depth range in accordance with Section SP.P17.801. The pay limit length for this excavation, bedding, backfill, and compaction shall be limited to 6 feet at the depth range of the mainline beginning at the backside mainline excavation width pay limit. The pay limit width of excavation shall be the trench pay limit shown on the Contract Documents.

m. **Service Lateral Mainline Connection Associated with HDPE:** Measurement for the service lateral mainline connection associated with HDPE pipe or lining material shall be the actual count of each service lateral connection installed and accepted.

Excavation, bedding, backfill, and compaction associated with this item shall be paid for under the Sewer Point Repair Excavation, Backfill, and Compaction item by the appropriate depth range in accordance with Section SP.P17.801. The pay limit length for this excavation, bedding, backfill, and compaction shall be limited to 6 feet at the depth range of the mainline beginning at the backside mainline excavation width pay limit. The pay limit width of excavation shall be the trench pay limit as shown on the Contract Documents.

n. **Abandon Sewer Pipe:** Abandonment of gravity sewer pipe will be measured on a lump sum basis or by the cubic yard of flowable fill required to complete all work indicated on the Contract Documents and as provided in the bid form. Abandonment shall include any equipment, cleaning, flowable fill throughout the full length of pipe, and disposal in accordance with the plans and specifications.

o. **Plug and Abandon Sewer Pipe:** Plug and abandonment of gravity sewer pipe will be measured on a lump sum basis upon completion of all work indicated on the Contract Documents. Plug and abandonment shall include any equipment, cleaning, disposal and flowable fill required to cap the pipe ends in accordance with the plans and specifications.

p. **Remove Sewer Pipe**: Removal of gravity sewer pipe will be measured on a lump sum basis upon completion of all removal work indicated on the Contract Documents including appurtenances. Removal work shall include any equipment, cleaning, disposal, trenching, and backfilling required to remove the existing gravity sewer pipe in accordance with the plans and specifications.

q. **Remove or Abandon Sewer Pipe**: Removal or abandonment of gravity sewer pipe will be measured on a lump sum basis upon completion of all removal work indicated on the Contract Documents. Removal work shall include any equipment, cleaning, disposal, trenching, and backfilling required to remove the existing gravity sewer pipe in accordance with the plans and specifications. Abandonment in-place with this item shall include insertion of flowable fill throughout the full length of pipe.

r. **Trenchless Point Repair:** Measurement for trenchless point repair shall be made on a linear foot basis of sleeve installed. Measurement will be made to the nearest whole foot for the various diameters listed in the Bid Form.

P17.802.11 PAYMENT:

a. **Sewer Pipe:** Payment for this Item will be full compensation for equipment, excavation, bedding, backfill, compaction, pipe, fittings, removal and disposal of existing sewer pipe and/or manholes if necessary, plugging, sewer flow control, traffic control, connections to new manholes, connections to service lateral, laying, jointing, cleaning new pipe, and testing, in accordance with the Contract Document. Sand-aggregate for bedding and initial backfill material and useable excavated soil for secondary backfill, as shown on City-Parish Standard Detail 801-01 shall be included in this pay item. When required, special bedding and backfill material such as #57 Stone Backfill, #610 Stone Backfill, CLSM Backfill, Sand-Aggregate for Secondary Backfill, and Select Material for Backfill required for Work associated with Sewer Pipe will be paid for under the relative pay item in Section SP.P17.801.

b. **Rehab Sewer Pipe:** Payment for this Item will be full compensation for pipe, fittings (excluding non-shear couplings), plugging, removal and disposal of existing sewer pipe, sewer flow control, connections to existing pipe and service lines, laying, jointing, and cleaning new pipe, smoke testing of the repair, in accordance with the Contract Documents. Payment will be made for new pipe only when it is installed in the ground. No payment shall be made for pipe stored on the site but not yet installed. This item shall be used in conjunction with point repairs or remove and replace rehabilitation only. Excavation, bedding, backfill, and compaction required for Work associated with Rehab Sewer Pipe will be paid for under the relative pay item in Section SP.P17.801.

c. **Connections to Existing Manholes:** Payment for this Item will be full compensation for all equipment, labor, materials required to connect the pipe to an existing manhole (sanitary sewer manhole or storm water conflict/junction/inlet box).

d. **Adjusted Sanitary Sewer Service Lateral Connections:** Payment for this item shall be full compensation for all equipment, labor, excavation, bedding, backfill, compaction, pipe, fittings, removal and disposal of existing sewer pipe if necessary, plugging, sewer flow control, traffic control, materials, and testing required to adjust up to twenty (20) feet of sanitary sewer service connections in accordance with the Contract Documents.

e. **Sewer Service Lateral:** Payment for this Item will be full compensation for equipment, excavation, bedding, backfill, compaction, pipe, fittings, removal and disposal of existing sewer pipe if necessary, plugging, bypass pumping, traffic control, laying, jointing, cleaning new pipe, and testing, in accordance with the Contract Document. Sand-aggregate for bedding and initial backfill material and useable excavated soil for secondary backfill, as shown on City-Parish Standard Detail 801-01 shall be included in this pay item. When required, special bedding and backfill material such as #57 Stone Backfill, #610 Stone Backfill, CLSM Backfill, Sand-Aggregate for Secondary Backfill, and Select Material for Backfill

required for Work associated with Sewer Pipe will be paid for under the relative pay item in Section SP.P17.801.

f. **Sewer Service Lateral Connection Stack:** Payment for this item shall include all material, labor, pipe, fittings, bedding material.

g. **Sewer Service Lateral Termination:** Payment for this Item will be full compensation for SDR 35 PVC pipe, PVC fittings, and PVC cap.

h. **Non-Shear Couplings:** Payment for this Item will be full compensation for all equipment, labor, and materials required to install non-shear couplings.

i. **Electrofusion Couplings:** Payment for this Item will be full compensation for all electrofusion couplings, equipment, labor, and materials required to install electrofusion couplings.

j. **Sanitary Sewer Clean-out:** Payment for this Item will be full compensation for SDR 35 PVC pipe, PVC fittings, PVC clean-out fittings, cast iron frame and cover, and 24" square concrete pad surrounding the top of the clean-out.

k. **Service Lateral Mainline Connection Associated with CIPP:** Payment for this item will be full compensation for removal of host pipe (as required), saddle wyes, all fittings, grout, smoke testing, all equipment, labor, and materials.

l. **Service Lateral Mainline Connection Associated with Slip Lining:** Payment for this item will be full compensation for removal of host pipe (as required), compressive-fit service connection, patching of host pipe, grout, all fittings, smoke testing, all equipment, labor, and materials.

m. **Service Lateral Mainline Connection Associated with HDPE:** Payment for this item will be full compensation for electrofusion branch saddles, all fittings, smoke testing, all equipment, labor, and materials.

n. **Abandon Sewer Pipe:** Payment for this Item will be full compensation for equipment, bypass pumping, connections, cleaning, disposal and flowable fill, in accordance with the Contract Document.

o. **Plug and Abandon Sewer Pipe:** Payment for this Item will be full compensation for equipment, bypass pumping, connections, cleaning, disposal and flowable fill at the pipe ends (18 inches min.), in accordance with the Contract Document.

p. **Remove Sewer Pipe**: Payment for this Item will be a lump sum full compensation for equipment, bypass pumping, connections, cleaning, excavation, backfill and delivery/disposal, in accordance with the Contract Document. Payment will be made for removed pipe.

q. **Removal or Abandon Sewer Pipe**: Payment for this Item will be a lump sum full compensation for equipment, bypass pumping, connections, cleaning, excavation, backfill, delivery/disposal, and flowable fill throughout full length of pipe, in accordance with the Contract Document. Payment will be made for removed pipe

and/or completely filled abandoned pipe.

r. **Trenchless Point Repair:** Payment for this item will be full compensation for sewer flow control, public notification, traffic control, sewer pipe cleaning, repair device, installation of the repair device, pre- and post-construction CCTV inspection, and clean-up in accordance with the Contract Documents.

P17.802.12 PAY ITEMS:

Technical Specifications Sanitary Sewer Systems

Payment will be made under:

Item No.	Item	Unit
TS-742-61006	Sanitary Sewer Pipe (12”) PVC	Linear Feet

SPECIAL PROVISION P17.803
SEWER MANHOLES

P17.803.01 DESCRIPTION: This Work consists of removal and disposal of existing manholes, if necessary, and furnishing and constructing new precast concrete sanitary sewer manholes, drop lines, and adjusting existing manholes. Manholes shall be constructed of specified material to the sizes, shapes and dimensions and at the locations and elevations shown on the Drawings. The expectation is that all new manholes will be completely sealed, thereby, eliminating infiltration and exfiltration from the manhole.

All work shall comply with the following requirements. All Section and Subsection references refer to the following requirements.

a. NS Items (Special Provisions) found in this contract.
b. 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
c. Special Provisions to the 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
d. City of Baton Rouge/Parish of East Baton Rouge Standard Details
   http://brprojects.com/design-and-construction-resources/standard-details/
e. City of Baton Rouge/Parish of East Baton Rouge Master Specifications
   http://brprojects.com/design-and-construction-resources/master-specifications/
f. City of Baton Rouge/Parish of East Baton Rouge of Environmental Services Wastewater Qualified Products List
   http://brprojects.com/baton-rouge-sso-program/design-construction/wastewater-qualified-products-list/

P17.803.02 MATERIALS:

a. Materials shall conform to the following Sections and Subsections:

Portland Cement Concrete	SP.P17.1005
Reinforcing Steel	SP.P17.1006.01
Frames and Covers	SP.P17.1011.05
Precast Concrete Manhole Units	SP.P17.1017.01

b. Manhole walls, transitions, conical sections, and base shall conform to the requirements of ASTM C 478 for the depths indicated on the Contract Documents. Conical sections shall be designed to support cast iron frames and covers under an AASHTO HS-20 loading. Axial length of sections shall be selected to provide the correct total height required with the fewest joints.

c. Riser rings shall be precast concrete or cast iron.

   1. Concrete riser rings shall be free from cracks, voids and other defects and shall conform to ASTM C 478. Concrete riser rings shall be of a nominal thickness of not less than four (4) inches and not more than six (6) inches for reconstruction and/or adjustment of the manhole frame and cover. Joints shall also be externally wrapped with an external seal wrap as specified in Section SP.P17.803.04.7.

   2. Cast iron riser rings shall conform to the latest edition of AASHTO M306. Cast iron riser rings shall be used for adjustment of the manhole frame and cover of less than four (4) inches. Joints shall also be externally wrapped with an external

seal wrap as specified in Section SP.P17.803.04.7.

d. Manhole joint types may be either tongue and groove, confined groove, or single offset joint, and shall be sealed accordingly with either a flexible soil-tight butyl mastic gasket or flexible watertight rubber gaskets conforming to ASTM C 990 or C 443 respectively.

e. Prior to backfilling, rubber external seal wraps shall be applied to each manhole section joint, riser rings and frame in accordance with Subsection SP.P17.803.04.7.

f. Conical sections shall be concentric, unless otherwise specified. Where the manhole barrel diameter is greater than 48 inches, a flat slab transition, concentric unless otherwise specified, may be used to transition to 48 inch diameter riser sections. Underside of the transition shall be at least 7 feet above the top of the bench.

g. Sewer pipe to manhole barrel section connections shall be sealed with resilient connectors complying with ASTM C 923. Mechanical devices shall be stainless steel.

h. Concrete manholes shall include the following protective admixtures:

1. Crystalline Waterproofing Additive:
    i. Concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. The system shall cause the concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete from deterioration due to harsh environmental conditions.

    ii. Crystalline waterproofing additive shall include an approved coloring that will tint the finished concrete as proof of additive. Coloring must be provided by the additive manufacturer.

    iii. Installer of crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.

    iv. Crystalline waterproofing additive shall be added to concrete mix at time of batching, and dosage rates and installation shall be in accordance with manufacturer's recommendations.

    v. Crystalline waterproofing additive shall be as manufactured by Xypex Chemical Corporation or approved equal.

2. Anti-microbial Additive:

    i. Antimicrobial additive shall provide long term prevention of bacterial corrosion if concrete in Microbial Induced Corrosive (MIC) sanitary sewer environments. It shall render the concrete uninhabitable for bacteria growth.

    ii. The liquid antibacterial additive shall be an EPA registered material. Product must include an approved coloring that will tint the finished concrete as proof of additive. Coloring must be provided by the additive

manufacturer.

iii. Installer of anti-microbial additive shall be certified by the manufacturer or manufacturer's representative in writing.

iv. The additive shall be added into the concrete mix water to insure even distribution throughout the concrete mixture. The amount to be used shall be as recommended by the manufacturer of the antibacterial additive. This amount shall be included in the total water content of the concrete mix design.

v. The anti-microbial additive shall have successfully demonstrated prevention of MIC in sanitary sewers for ten or more years. Anti-microbial additive shall be as manufactured by Conshield Technologies or approved equal.

Any patching or grout materials used on the interior of the manhole after casting must also include the both admixtures.

i. All interior surfaces (including benches) of new sanitary sewer manholes at force main entry locations, one manhole upstream and downstream of force main entry locations, and other locations shown in the Drawings, shall be given an interior protective coating in accordance with Section SP.P17.822.

j. Cast-iron frames, covers, and riser rings shall be completely coated with an environmentally safe, water-based asphaltic coating which is non-toxic, non-flammable, colorless, and dries to a hard black finish. This coating shall be applied to the casting prior to the installation of the external seal wrap.

P17.803.03 SUBMITTALS:

a. Complete product data on all standard manhole bottoms, riser sections (concrete and steel), cone sections, frames and covers, concrete and steel riser rings, rubber boots and external seal wrap shall be submitted.

b. The precast concrete producer shall submit a mix design for each strength and type of concrete that will be used, regardless of whether listed on the QPL or not. Submitted mix designs shall include the quantity, type, brand and applicable data sheets for all mix design constituents as well as documentation indicating conformance with this specification.

c. If required by the Contract Documents, the manhole epoxy liner system manufacturer's literature (cut sheets) describing the system, material/chemical properties, material handling and storage requirements, mixing and proportioning requirements, maximum pot life, MSDS sheets, environmental requirements for application and worker safety requirements shall be submitted.

d. Written certification by the protective admixture manufacturers stating the precast manufacturer is approved to install the admixtures specified shall be submitted.

e. Written certification by the manhole liner system manufacturer stating the installation

Contractor is approved to install the liner system specified shall be submitted.

f. Written certification from the liner product manufacturer that each of the proposed liner and patching products are compatible with each other shall be submitted.

g. Detailed instructions and methodology for finishing all pipe and manhole connections to prevent infiltration and exfiltration shall be submitted.

h. Detailed methodology and materials for repairing surface imperfections or minor chipping of manhole structures shall be submitted

i. Wastewater Flow Control/Bypassing Plan shall be submitted.

j. Traffic Control Plan with site Contractor's telephone numbers for emergencies and copies of any necessary permits for lane closures shall be submitted.

k. Epoxy liner and vacuum test results shall be submitted to Engineer.

P17.803.04 CONSTRUCTION:

P17.803.04.1 Excavation, Bedding, and Backfill: Excavation, bedding, backfill, and compaction required for the installation of manholes shall be in accordance with Section SP.P17.801 and as shown in the Contract Documents.

P17.803.4.2 Precast Concrete Manholes:

a. Base for precast manholes may be either precast or cast-in-place. Cast-in-place bases shall be used for manholes built over existing sewer lines only. If base is cast-in-place, lowermost precast unit shall be set in place at the time base is poured; additional precast units shall not be placed until 24 hours after base is poured. Concrete for base and channel formation shall be 6A4000 concrete conforming to Section SP.P17.1005 and shall include admixtures described in subsection SP.P17.803.02h. If required for the manhole, interior of cast-in-place base must field coated in accordance with Section SP.P17.822.

b. Precast manhole structures shall have a normal plant-run finish produced in forms that impart a smooth finish to concrete. Surface holes smaller than 1 inch caused by air bubbles, form joint marks, and minor chips are acceptable. Fill air holes greater than 1 inch in width or 1/4 inch in width that occur in high concentration (more than one per 2 sq. inch). Major or unsightly imperfections, honeycombs, exposed reinforcing steel, exposed aggregate, or structural defects are not permitted.

c. Protective admixture tint shall be uniform in color and appearance throughout wall thickness of precast concrete structure. If cross-sectional views of precast concrete structure, such as pipe cutouts or across joints, are not available for visual inspection or do not provide satisfactory evidence of color uniformity, at the request of the Engineer, the Contractor shall have the structure cored to provide evidence. Coring and repair shall be at no cost to the Owner. Any unapproved coatings or paints applied to the manhole structure may be cause for rejection of the manhole by the Engineer.

d. For manholes requiring an epoxy protective coating on the interior surface: surface preparation and protective coating shall be in accordance with Section SP.P17.822. Manholes may be coated "in the shop" prior to delivery to project site. Any damage to the protective coating during shipping or installation shall be repaired by the Contractor in accordance with the manufacturer's recommendations at no additional cost to the Owner. Upon completion of manhole and pipe installation the protective coating shall be free of bugholes, pinholes, and continuous across the section joints. Coating shall extend over the top rim of the cone opening by one inch.

e. Manholes shall be constructed such that their walls are plumb. The spigot end of the precast sections shall be set at the top of each section.

f. Gaskets and gasket seats shall be cleaned of dirt and debris just prior to placing precast units.

g. If holes must be cut in precast units, they shall be cored or drilled for proposed mains 18 inches in diameter or smaller. Manholes requiring larger pipe connections may be enlarged using a jack hammer, but must be neatly grouted to provide an airtight seal.

h. There shall be at least 12" horizontal clearance between adjacent pipes.

All inverts shall be of 4000 psi concrete meeting the requirements of Section SP.P17.1005 of these specifications and include the anti-microbial additive. The invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in directions of flow through the inlet shall be made to a true curve with as large a radius as the size of the inlet will permit.

P17.803.4.3 Manhole Drop Connections: If inlet pipe enters the manhole 2 feet above the manhole invert or higher, an external drop line is required and shall comply with details in the Contract Documents. The drop line shall be of the same material as that of the inlet pipe and one nominal pipe size smaller (minimum 8 inch diameter). Backfill drop assembly with #610 Stone Backfill material. Extend the bedding material a minimum of 4 inches outside bells.

P17.803.4.5 Riser Rings, Frames, and Covers:

a. The top of the manhole frame will be at the finished grade of the pavement or 3-inches above the ground surface in accordance with the details of the Contract Documents.

b. In paved areas the frame and cover should match the slope and crown of the finished pavement.

c. Concrete riser rings shall be set in a full bed of mortar. Mortar shall be struck smooth on the inside of the manhole using a hard trowel followed by a sponge float. An epoxy system designed for metal-to-metal adhesion shall be used to connect individual cast iron riser rings and the cast iron riser rings to the frame.

P17.803.4.6 Stainless Steel Insert: A stainless steel insert shall be installed in manholes located in areas below the base flood elevation as shown on the Contract Documents.

P17.803.4.7 External Seal Wrap:

a. Riser Rings and Frame: The sewer manhole riser rings and frame shall be externally sealed with rubber seal wraps or mechanically locked corrugated rubber seals.

    1. Rubber seal wraps:

        i. Rubber seal wraps and required band widths shall conform to ASTM C 877 (Type I – Rubber and Mastic Bands).

        ii. The number of bands required will depend on the number of adjusting rings needed. A minimum 3 inch overlap below the cone-riser ring joint shall be required. A 2 inch overlap shall be required to fold over the frame base to seal the frame-riser ring joint. If there are more adjusting rings per installation there will be a requirement for an additional band. Each additional band will overlap the upper band by two inches.

    2. Mechanically locked corrugated rubber seals:

        i. The frame seal shall remain flexible throughout a 25 year design life. The sleeve portion of the seal shall be corrugated with a minimum unexpanded vertical height of 10 inches and be capable of being mechanically locked to the base flange of the manhole frame casting.

        ii. The sleeve and any extension shall be made from high quality EPDM rubber suitable for both above and below grade applications. Minimum thickness of rubber sleeve and extension shall be 0.085 inches. Rubber material shall conform to the applicable material requirements of ASTM C 923 and have a hardness (durometer) of 45±5.

        iii. The sealing area that compresses against the base flange of the manhole frame casting and the chimney or cone shall have a series of sealing fins to facilitate a watertight seal. The top compression band shall be "C" shaped to uniformly compress and mechanically lock the sleeve into the base flange of the manhole frame casting. Both the top and bottom compression bands shall have a take-up mechanism capable of developing a minimum of 400 lbs. of torque.

    3. The external seal shall be installed after the adjusting rings are set and all castings are coated.

b. Riser Section Joints:

    1. Each manhole section joint shall be sealed with an external rubber seal wrap conforming to ASTM C 877 (Type I – Rubber and Mastic Bands, Type II – Plastic Film and Mesh Reinforced Mastic Bands, or Type III – Chemically-Bonded Adhesive Butyl Bands).

    2. The seal shall be designed to prevent leakage of water through the joint sections of a manhole.

3. Any excess joint sealant material or gaskets that protrudes on the outside of the manhole section joint shall be removed prior to the installation of the external rubber seal wrap.

c. The external seal wrap shall be installed in accordance with the details of the Contract Documents and the manufacturer's recommendations.

P17.803.05 ACCEPTANCE TESTING:

P17.803.5.1 Air Vacuum Test: After completion of manhole construction, wall sealing, and backfilling, the Contractor shall conduct a vacuum test as follows:

a. All manholes are to be vacuum tested following backfill and compaction. The ring and lid casting assembly shall be installed prior to testing. The testing equipment shall consist of a gasoline-powered vacuum pump with sufficient vacuum hose length and a test head of proper size to fit the inside opening of the manhole. The test head shall be equipped with an inflatable rubber bladder to affect the seal to the manhole, an air pressure gauge, and a safety valve for filling the bladder, a 30-inch Hg liquid-filled vacuum gauge, a double air exhaust manifold with quarter turn ball valves, three bolt-on feet, and a bridge assembly with height adjustment rod.

b. Contractor shall plug all pipe openings, taking care to securely brace the plugs and the pipe. The plugs shall be placed a minimum of 6 inches beyond the manhole wall.

c. With the vacuum tester in place, inflate the compression to affect a seal between the vacuum base and the structure. Connect the vacuum pump to the outlet port with the valve open and evacuate the manhole to 10 inches Hg (0.3 bar) for 48-inch diameter manholes and 5 inches Hg (0.15 bar) for 60-inch and greater diameter manholes.

d. Close vacuum inlet/outlet ball valve, disconnect the vacuum pump, and monitor the vacuum for the specified time period. If the vacuum does not drop in excess of 1-inch Hg over the specified time period, the manhole if considered acceptable passes the test. If the manhole fails the test, identify the leaking areas by removing the head assembly, coating the interior surfaces of the manhole with a soap and water solution, and repeating the vacuum test for approximately thirty seconds. Once the leaks have been identified, complete all necessary repairs by sealing the leaks of the manhole to the satisfaction of the Engineer, and repeat test procedures until satisfactory results are obtained.

Vacuum Test Timetable			
Depth (Feet)	Manhole Diameter (Inches)		
	48"	60"	72"
4'	10 sec.	13 sec.	16 sec.
8'	20 sec.	26 sec.	32 sec.
12'	30 sec.	39 sec.	48 sec.
16'	40 sec.	52 sec.	64 sec.

20’	50 sec.	65 sec.	80 sec.
24’	60 sec.	78 sec.	96 sec.
*T	5.0 sec.	6.5 sec.	8.0 sec.
*Add extra testing time “T”, for each additional 2-foot depth. (The values listed above have been extrapolated for ASTM designation C924-85.)			

e. The Owner reserves the right to reject any and all manholes that do not pass vacuum testing requirements, and replacement shall be at the Contractor’s expense. A significant number of leaks on a single manhole or significant number of manholes leaking shall be considered as a basis for rejection and replacement of manholes.

P17.803.5.2 Epoxy Liner Test:

a. Wet Film Thickness Gage: During application a wet film thickness gage, meeting ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to check coating thickness.

b. Holiday Detection: After a minimum of 24 hours following completion, the lining system shall be spark tested to assure a pinhole-free lining. Defects shall be marked and repaired per the manufacturer’s instructions. The holiday detector shall be a Tinker Razor Model AP/W or an approved equal. Reference NACE RPO 188-99 for performing holiday detection. Manhole repair shall not be measured for payment when required as surface preparation for a manhole lining rehabilitation operation.

c. Adhesion Test: A minimum of 10% of the manholes coated shall be tested for adhesion/bond of the coating to the substrate. Testing shall be conducted in accordance with ASTM D7342-05.

P17.803.06 MEASUREMENT:

a. **Sanitary Sewer Manholes:** Manholes constructed will be measured as a unit by manhole diameter.

b. **Adjusting Sewer Manholes:** This item will be measured as a unit.

c. **Manhole Drop Lines:** Drop lines will be measured by line diameter per vertical foot of drop from the invert of the main line entering the manhole.

d. **Abandon Sewer Manholes:** Manholes to be abandoned shall be measured as a unit.

e. **New Manhole Protective Coating:** Measurement for payment of this Item shall be based on the actual number of vertical feet of manhole wall rehabilitated for a standard four-foot diameter manhole. Where manhole diameter is significantly different from the standard (i.e., 5’ or 6’) then the vertical footage shall be adjusted for pay purposes accordingly, to account for the additional square footage of area requiring rehabilitation (i.e., 5’ diameter = 1.25 x vertical footage of standard; 6’ diameter = 1.50 x vertical footage of standard, etc.). In like manner, structures that are discovered to have geometric shapes other than circular shall be adjusted as above to provide a consistent method of accounting for the actual square footage of area requiring rehabilitation of walls. All other aspects of measurement shall remain as indicated. All measurements

shall be as specified or made by conventional means with accuracies consistent with field conditions and common practice. Should a discrepancy in measurement exist which is greater than ten percent (10%), the Item in question shall be re-measured by both the Contractor and the Engineer for verification.

P17.803.07 PAYMENT:

a. **Sanitary Sewer Manholes:** Payment for new manholes include materials, labor, excavation, bedding, backfill, compaction, removal and disposal of existing manhole (if required), new manhole, geotextile fabric, rings, frames, covers (frame and cover type as shown on drawings), external seals, venting pipes (as required by the drawings), concrete admixtures, connections with pipe, and testing.

b. **Adjusting Sewer Manholes:** Payment for adjusted sewer manholes shall include materials, labor, excavation, bedding, backfill, compaction, riser rings, removal and replacement of existing frame and cover, external seals, and testing.

c. **Manhole Drop Lines:** Payment for drop lines shall include all material, labor, pipe, fittings, hardware, removal and disposal of existing manhole drop line (if required), and bedding material.

d. **Abandon Sewer Manholes:** Payment for abandoned manholes include materials, labor, excavation, backfill, compaction, pipe plug(s), drilling of manhole base, removal and disposal of existing manhole, manhole frame and cover 3 foot minimum below grade.

e. **New Manhole Protective Coating:** Payment of the unit price amount bid for this Item shall be full compensation for all labor, materials, equipment, surface cleaning and preparation, patching and/or grouting, cementitious underlayment, sewer flow control, traffic control, and testing.

P17.803.08 PAY ITEMS:

Technical Specifications Sanitary Sewer Systems

Payment will be made under:

Item No.	Item	Unit
TS-702-00126	Sanitary Sewer Manhole (48”)	Each

SPECIAL PROVISION P17.804
SEWER FORCE MAINS

P17.804.01 DESCRIPTION: This Work shall consist of furnishing all labor, materials, equipment, and incidentals required to remove and dispose of existing sewer force mains if required, and install new sanitary sewer force main pipelines, fittings and taps of existing lines. The Contractor shall be responsible for safely storing materials needed for the Work until they have been incorporated into the completed Project. Contractor shall keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

When an item for "Sewer Force Main" is included in the contract, the Contractor has the option of furnishing either ductile iron pipe or PVC pipe, unless otherwise noted.

All work shall comply with the following requirements. All Section and Subsection references refer to the following requirements.

a. NS Items (Special Provisions) found in this contract.
b. 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
c. Special Provisions to the 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
d. City of Baton Rouge/Parish of East Baton Rouge Standard Details
   http://brprojects.com/design-and-construction-resources/standard-details/
e. City of Baton Rouge/Parish of East Baton Rouge Master Specifications
   http://brprojects.com/design-and-construction-resources/master-specifications/
f. City of Baton Rouge/Parish of East Baton Rouge of Environmental Services Wastewater Qualified Products List
   http://brprojects.com/baton-rouge-sso-program/design-construction/wastewater-qualified-products-list/

P17.804.02 MATERIALS: Materials shall conform to the following Sections and Subsections.

Sanitary Sewer Bedding Material	SP.P17.801.03
Sanitary Sewer Backfill Material	SP.P17.801.03
Polyvinyl Chloride (PVC) Pipe and Fittings	SP.P17.1016.02.1
High Density Polyethylene (HDPE) Pipe and Fittings	SP.P17.1016.02.2
Ductile Iron Pipe and Fittings	SP.P17.1016.02.3
Valves	SP.P17.1019.07

P17.804.03 SUBMITTALS:

a. Action Submittals:

1. Traffic Control Plan (if required)

2. Pipe:

i. Information on gasket polymer properties.
ii. Application methods, application requirements, and chemical resistance data for coating and lining products.
iii. Fitting data sheets.

iv. Joint and fitting restraints.

3. Air Release/Vacuum Valves:

i. Product data sheets for make and model.
ii. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
iii. Maximum recommended test pressure; maximum and minimum recommended working pressures of air release/vacuum valves, isolation valves, flanges, connecting piping, and fittings.
iv. Recommended seating materials for specified operating pressures.

4. Valves:

i. Shop Drawings:
ii. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
iii. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
iv. Sizing calculations for open-close/throttle and modulating valves.

b. Informational Submittals:

1. Pipe:

i. Certificates:

1. Manufacturer's Certificate of Compliance for each type of pipe that products furnished meet requirements of this section.
2. Manufacturer's written recommendations for pipe handling and installation.

ii. Field Leakage Testing Plan: Submit at least 15 days in advance of the testing and include at least the following:

A. Testing dates.
B. Piping systems and sections to be tested. Must conform to maximum test section limits provided in the Contract Documents.
C. Test type.
D. Method of isolation.
E. Method of conveying water from source to system being tested.
F. Calculation of maximum allowable leakage for piping section(s) to be tested.
G. Method for disposal of test water, if applicable.

2. Air Release/Vacuum Valves:

i. Manufacturers' Instructions:

A. Installation and testing of products specified.
B. Pipeline tapping and service saddle installation.

ii. Operation and maintenance data.

3. Valves:

i. Tests and inspection data.
ii. Operation and Maintenance Data.
iii. Manufacturer's Certificate of Proper Installation.

4. Tapping:

i. Submit qualifications of the personnel who will perform the tapping operation:

A. Foreman shall have a minimum of five years experience in tapping pressurized lines.
B. Operator shall have at least one year experience in operating the tapping machine on taps of similar pipe material.

5. If a tap is required, a detailed description of the entire pipe tapping procedure, including detailed plan of excavation, traffic control plan, preparations prior to making the tap, the tapping procedure, procedure for connecting new lateral, backfill of the site and surface restoration shall be submitted for approval prior to beginning the work. The Engineer's review of the excavation procedure will be for general progress of the work and shall not be construed as an approval of the structural adequacy of the excavation's stabilization system.

6. If a tap and/or tie-in is required on prestressed concrete force main pipe, a representative from the pipe manufacturer must be present.

P17.804.04 PRODUCTS:

a. All products used will be selected from the Qualified Products List (QPL) or approved equal. They may also be visually inspected by the Engineer at the Site for conformance to the Specifications. At Engineer's discretion, Contractor may be required to supply certified mill tests, samples, or other suitable form of verification that the material meets the required specifications.

b. Provide sewer force main pipes with Ductile Iron Pipe (DIPS) diameters shown on the Contract Documents. Diameters shown on the Drawings and listed in the pay items represent the required DIPS diameters, regardless of pipe material, unless otherwise noted.

c. The Work shall not begin until all submittals have been reviewed and approved. Also, the Work shall not begin until all of the equipment and materials required to perform the Work are in the possession of the Contractor.

P17.804.05 CONSTRUCTION:

a. All Work shall be performed in compliance with L.R.S. 40:1749.11-22, "Louisiana Underground Utilities and Facilities Damage Prevention Law", OSHA regulations and applicable codes, ordinances, and standards of governing authorities having jurisdiction. All such work shall be adequately described in the Traffic Control Plan.

b. Open excavations shall be barricaded and posted with warning lights in accordance with State and local requirements. Structures, utilities, sidewalks, pavements, and other facilities shall be protected from damage caused by settlement, lateral movement, undermining washout, and other hazards created by earthwork operations.

P17.804.05.1 Trenching, Bedding and Backfill: Trenching, bedding and backfill shall be as specified in Section SP.P17.801.

P17.804.05.2 Installation:

a. Pipe: Force mains shall be installed at the lines and grades required by the Contract Documents. All fittings shall be at the required locations and the spigots well centered in the bells and fully engaged as evidenced by pipe witness marks.

1. Pipe laying shall begin at downstream end of line. Bell ends of pipe shall face upstream. Bell holes shall be provided at each joint to permit the joint to be constructed properly and supported along its full length of the pipe by the trench bedding. Allowing the pipe to be "bridged" by the bell is not acceptable.

2. Pipe laying shall not advance backfilling by more than 100 feet without approval by the Engineer.

3. Restrained joints shall be used at canal crossings, horizontal and vertical bends, tees, crosses, valves and other specified locations.

4. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other approved means. This provision shall apply during lunch as well as overnight. If water is in the trench, the plug shall remain in place until the trench is pumped completely dry.

5. In all cases walking or working on the completed pipelines, except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The backfilling of the trench and tamping of the backfill shall be carried on simultaneously on both sides of the pipe to ensure the completed pipeline will not be disturbed and injurious side pressures do not occur.

6. All PVC, Ductile Iron and HDPE pipe shall be installed with a 12-gauge stranded copper wire attached to the pipe for tracing purposes and polyethylene utility marking tape one foot above the pipe. Utility marking

tape shall be green in color with black lettering and read "CAUTION – BURIED SEWER LINE BELOW". Approved waterproof mechanical copper connectors shall be used for all splicing.

7. Unless otherwise indicated by the Contract Documents, all force mains shall have at least 36 inches of cover. The Engineer shall approve any exceptions.

8. Contractor shall provide and use tools and facilities that are satisfactory and that will allow the Work to be done in a safe and convenient manner. Suitable equipment shall be used to lower all pipe and fittings into the trench one piece at a time. Each piece shall be lowered carefully so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances shall force main materials be dumped or dropped.

9. Pipes and fittings shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., which may have accumulated within them. After the pipe has been lowered, all unnecessary materials shall be removed from it. Before any pipe is laid, the outside of its spigot end and the inside of its bell shall be cleaned and left dry and oil-free.

10. Pipe shall be cut so fittings can be inserted in a workmanlike manner and without any damage to the pipe. The manufacturer's recommendations shall be followed concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis. A "chop" saw shall be used for ductile iron pipe, PVC and HDPE pipe. The Engineer may consider other methods for 12-inch diameter and larger pipe. After cutting ductile iron pipe, the Contractor shall touch up the epoxy lining to the satisfaction of the Engineer.

11. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor more than 75 percent of that recommended by the pipe manufacturer and shall be approved by Engineer. Bend fittings shall only be used when the pipe deflections are inadequate, according to manufacturer's recommendations, or as directed by Engineer. Pipe bending of PVC pipe shall not be allowed, fittings or joint deflections shall be utilized.

12. Except for HDPE pipe, joint restraints shall be installed wherever the force main changes direction (at tees and bends), at dead ends, or at any other point recommended by the manufacturer or required by Engineer. Restrained joints for ductile iron and PVC force main shall be in accordance with Section SP.P17.1016.02.

13. All pipe shall be jointed in the exact manner specified by the manufacturer of the pipe and jointing materials.

14. Air release/vacuum valves shall be located at all high points on the pipeline

as shown on the Contract Documents or as directed by Engineer.

15. Force main outlets shall be installed in manholes as shown on the Contract Documents.

16. Under no circumstance shall pipe laid on blocks be permitted.

17. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat workmanlike manner, using pipe wrap, without damage to the pipe or components to leave a smooth end at right angles to the axis of the pipe. Flame cutting of pipe will NOT be allowed.

18. Connections of force main into manhole shall be in accordance with subsection SP.P17.802.06 and as shown on City-Parish Standard Detail 804-01.

b. Air Release/Vacuum Valve Installation shall:

1. Be in accordance with manufacturer's printed instructions.

2. Orient valve in vault for easy access.

3. Replace valves that drip or do not function properly.

4. Valve shall be placed inside a valve manhole as shown on the Contract Documents.

c. Valve Vault:

1. Place operator access as shown on the Contract Documents.

2. Install finished grade at top of vault to conform to slopes and elevations of adjacent ground and grade to drain away from vault.

3. Valve vaults shall be required for valves 20 inches or larger. Valves smaller than 20 inches shall be buried in accordance with Section SP.P17.1019.

d. Valves: Valves used shall comply with the requirements of the Contract Documents. The Contractor shall not substitute size, type, manufacturer, or material without the approval of the Engineer. The Contractor shall record GPS coordinates (+/- 1 meter accuracy) based on the La. State Plane Coordinate System (south), for each valve installed and submit to the Engineer. All information below only applies if the specified type or criteria is identified in the Contract Documents.

1. Flange Ends:

i. Flanged valve bolt holes shall straddle vertical centerline of pipe.
ii. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

2. Screwed Ends:

    i. Clean threads by wire brushing or swabbing.
    ii. Apply joint compound.

e. PVC Valves:

    a. Install using solvents approved for valve service conditions.

    b. Valve Installation and Orientation:

        i. General:

            A. Install valves so handles operate from fully open to fully closed without encountering obstructions.
            B. Install valves in location for easy access for routine operation and maintenance.
            C. Install valves per manufacturer's recommendations.

f. Gate and Ball Valves:

    a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished grade, unless otherwise shown.

    b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finished grade, unless otherwise shown.

g. Eccentric Plug Valves:

    a. Unless otherwise restricted or shown on Contract Documents, install valve as follows:

        i. Liquids with suspended solids service with horizontal flow: Install valve with stem in horizontal position with plug up when valve is open. Install valve with seat end upstream (flow to produce unseating pressure).
        ii. Liquids with suspended solids service with vertical flow: Install valve with seat in highest portion of valve (seat up).

h. Check Valves:

    a. Install valve in horizontal or vertical flow (up) piping to open in the direction of flow.

    b. Install swing check valve with shaft in horizontal position.

i. Extension Stem for Valve Operator: Where the depth of the valve is such that its centerline is more than 3 feet below grade, furnish an operating extension stem with 2-

inch operating nut to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Extension stem shall be pinned to the operating nut; set screws are not acceptable.

j. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of the valve.

k. Floor Box and Stem: Steel extension stem length shall locate operating nut in floor box.

Warranty: Should defects appear under proper use within a period of 1 year after the sewer force main has been accepted by the Owner, caused solely by faulty manufactured, material or workmanship, the Contractor shall repair or replace the sewer force main at no additional cost to the Owner.

P17.804.06 CONNECTIONS TO PIPELINES: This Work shall consist of locating and excavating to an existing pipeline and all connection operations. Tapping is the act of connecting to a pressurized pipeline and Tie-in is the connection to a re-routed or inactive pipe. The Work includes any shoring and bracing necessary to protect the pipeline and surrounding property and structures, both public and private. Such excavation stabilization as is necessary shall comply with Section SP.P17.801.

a. Locate all connections so that no portion of the sleeve or saddle, as applicable, will be located within five feet of the end of the segment of pipe being tapped.

b. Contractor shall notify the Engineer prior to any connection to be performed.

P17.804.06.1 Tapping:

a. Proper precautions shall be taken to instruct the workmen of the correct procedures to be used for tapping pipelines under pressure. Performed incorrectly, this action could result in serious injury and/or property damage. The Contractor shall be responsible for all claims of damage or loss resulting from improper taps. Contractor shall also indemnify the Owner from any damage claims.

b. Depending on the location of the proposed tap, the Engineer may require that the tapping operation be performed during periods of lowest operating pressure. The Contractor shall coordinate his operations through the Engineer to ensure that the tapping operation is performed during periods that least impact the Owner's operation of the pipeline.

c. The Engineer shall be notified at least 48 hours in advance of the start of each tapping session at the site. The excavation and other preparatory work shall be complete prior to the performance of the tap. Work shall be coordinated with the Engineer so that any operational changes that may be required during the actual tapping operation can be planned. The Owner shall be given a second notification with as much advance notice as possible of the date that the tap will be made, but in no case shall this notification be less than 24 hours before beginning the actual tapping operations.

d. All tapping sleeves shall be installed in accordance with the instructions supplied by the sleeve manufacturer on the pipe at the location authorized by the Engineer or indicated

by the Contract Documents.

e. The tapping assembly shall be aligned properly to prevent damage to the tapping valve and sleeve or saddle during insertion and withdrawal of the cutter head. The operation shall be supported on solid earth and this support shall be protected throughout the tapping operation.

P17.804.06.2 Tie-in:

a. Prior to Tie-in Contractor shall pressure test new force main in accordance with Section P17.804.08.

b. After the pipeline is de-pressurized, the Contractor may proceed with connection operations.

c. The pipeline shall be cleaned of all residual materials and properly prepared for the connection fitting assemblies. These assemblies shall create the appropriate size connection as shown on the Contract Documents.

d. Connections must be performed according to the manufacturer's recommendations with the appropriate fitting for the existing pipe.

P17.804.06.3 Backfill and Restoration of the Site: Excavation, backfill and associated functions shall be performed as per the Contract Documents and in accordance with the direction outlined in relevant portion of Section of SP.P17.801.

P17.804.07 REMOVAL AND/OR ABANDONMENT OF EXISTING FORCE MAIN: This section addresses the removal and/or abandonment of the existing force main and all appurtenances which are being removed (or abandoned) as detailed on the Contract Documents.

a. Abandon Force Main: If certain portions of the existing force main are shown to be abandoned in place on the Contract Documents, the Contractor shall be responsible for evacuating or "swabbing" the existing force main pipe of all sewage before it is abandoned. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality. Subsequently, either the entire length of the pipe shall be completely filled with flowable fill and capped as noted on the Contract Documents or as directed by the Engineer.

b. Plug and Abandon Force Main: If an existing sewer force main is shown to be plugged and abandoned in place on the Contract Documents, the Contractor shall be responsible for evacuating or "swabbing" the existing sewer pipe of all sewage before it is abandoned. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality. Subsequently, the pipe shall be plugged approximately 18 inches into each end of the pipe and capped as noted on the Drawings or as directed by the Engineer.

c. Remove Force Main: If certain portions of the existing force main are shown to be removed on the Contract Documents, the Contractor shall completely remove the force main and appurtenances. The removal trench shall be backfilled in accordance with the

provisions of Section SP.P17.801 or as directed by the Engineer. The Contractor shall be responsible for evacuating or "swabbing" the existing force main pipe of all sewage before it is removed. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality.

d. Remove and/or Abandon Force Main:

1. If certain portions of the existing force main are shown as remove and/or abandon in place on the Contract Documents, the Contractor has the option to either completely remove the force main and appurtenances or abandon the force main. The Contractor shall be responsible for evacuating the existing force main pipe of all sewage before it is abandoned or removed. This sewage shall be treated as hazardous material and disposed of using the proper criteria from the La. Department of Environmental Quality.

2. If removed, the removal trench shall be backfilled in accordance with the provisions of Section SP.P17.801 or as directed by the Engineer.

3. If abandoned, the entire length of the pipe shall be completely filled with flowable fill.

e. The force main appurtenances which are removed shall be delivered to the Department of Public Works or otherwise properly disposed of as directed the Engineer.

f. Demolish and remove existing concrete structures to three feet minimum below surrounding grade. Fill remainder of structure with sand, using care to ensure that all voids are filled.

P17.804.08 ACCEPTANCE TESTS: Upon completion of backfilling, pipelines shall pass the following tests.

a. Pipe:

1. All newly installed and backfilled pipe shall be subjected to a leakage test, conducted in the presence of Engineer.

2. Test pressure shall be 150 percent of system operating pressure based on pressure as measured at the most elevated point in pipeline or 100 psi, whichever is greater.

3. The force main shall be slowly filled with water, and the specified test pressure shall be applied (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a pump connected to the pipe in a manner satisfactory to Engineer.

4. The Contractor shall furnish all necessary apparatus to perform pressure testing including but not limited to the pump, water, pipe, temporary valves, temporary fittings, connections, gauges, and thrust restraints and blocking. Thrust collars shall be used to restrain the force main where needed to restrain the pipe near the

blind flange required for testing. The required number of thrust collars would be dependent on the magnitude of the thrust force to be restrained and the allowable load per collar. The Contractor shall be responsible to design the thrust collar based on the soil conditions at the collar location. The Contractor shall submit thrust restraint calculations for approval. The Contractor may elect to install restrained joint force main of adequate length to restrain the pipe for testing purposes at no additional cost to the Owner. The Contractor may choose to test at points shown to be restrained on the plans (within the stipulated testing limits), however any thrust restraints or restrained joint force main beyond the limit shown on the plans required for testing purposes will be at no additional cost to the Owner.

5. Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, Contractor shall make taps at the points of highest elevation before testing, and shall insert plugs after the test has been completed.

6. The leakage test shall be conducted by measuring, through a calibrated meter, the amount of water which enters the test section for a period of at least 2 hours. No installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

   For PVC Pipe:

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

   L = allowable leakage, gallons/hour
   N = number of joints in length of pipe
   tested D = nominal diameter of the pipe,
   inches

   P = average test pressure during the leakage test, psig

7. The following table has been developed for the commonly used sizes of ductile iron pipe and PVC pipe with nominal laying lengths of 20 feet, under a test pressure of 150 psi. The leakage formulas above may be used when conditions differ from those stated parameters.

Allowable Leakage Per 100 Feet (gallons/hour)		
Pipe Diameter (Inches)	**Ductile Iron Pipe**	**PVC Pipe**
4	0.033	0.033
6	0.050	0.050
8	0.066	0.066
12	0.099	0.099
16	0.132	0.132
Greater than 16	Use formula above.	Use formula above.

8. For HDPE Pipe:

   i. Make-up Water Allowance: Maximum allowable make-up water at conclusion of test phase shall not exceed recommended amounts stated in the following table. The table is based on test pressure equal to 1.5 times pressure class of pipe. If lower pressure is used for test, allowances shall be reduced by ratio of test pressure to pressure class of pipe.

Make-Up Water Allowance for Test Phase (U.S. Gallons per 100 feet of Pipe)		
Nominal Pipe Size (inches)	**1-Hour Test (gallons)**	**2-Hour Test (gallons)**
3	0.10	0.15
4	0.13	0.25
6	0.30	0.60
8	0.50	1.0
10	0.75	1.3
12	1.1	2.3
14	1.4	2.8
16	1.7	3.3
18	2.2	4.3
20	2.8	5.5
24	4.5	8.9
28	5.5	11.1
32	7.0	14.3
36	9.0	18.0

   ii. Note: No observed leaks.

8. Any cracked or defective pipes or fittings discovered in consequence of this leakage test shall be replaced with sound material in the manner specified at no cost to Owner. The test shall be repeated until the results are satisfactory to the Engineer.

b. Valves:

1. Air Release Valve:

   i. May be either tested while testing pipelines, or as a separate step.
   ii. Isolation valves shall be in open position during pipeline test.

2. Isolation Valves: Test that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other.

3. Air Release/Vacuum Valves: Inspect valves as pipe is being filled to verify venting and seating is fully functional.

4. Verify leak-free performance during testing.

5. Valve Test and Inspection:

   i. Valve may be either tested while testing pipelines, or as a separate step.
   ii. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
   iii. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.

c. Tap Testing: No testing other than the pressure test is required. However, the testing requirements for the connection pipeline shall include testing of the restrained joint section, including the connection to the tapping valve. The entire tapped connection shall be visually inspected and any visible leaks repaired. Testing shall be in accordance with the requirements described as noted above.

d. Any removal or replacement of temporary or final surface restoration by the Contractor to investigate leaks shall be done so at no additional cost to the Owner.

P17.804.09 MEASUREMENT:

a. **Sewer Force Main:** Sewer force main pipe (ductile iron, PVC and HDPE) for payment will be the contract quantities, adjusted as required due to plan errors or plan changes. Measurement for new sewer force main pipe shall be made by type and diameter of pipe to the nearest linear foot installed.

b. **Restrained Joint Sewer Force Main:** Restrained joint sewer force main pipe (ductile iron or PVC) for payment will be the contract quantities, adjusted as required due to plan errors or plan changes. Measurement for restrained joint sewer force main pipe shall be made by type and diameter of pipe to the nearest linear foot installed.

c. **Valves**: Valves will be measured per each including the valve box and fittings. Air Release/Vacuum valves will be measured per each according to its size as detailed in the drawings, including all appurtenances described herein and the air release/vacuum valve manhole.

d. **Abandon Force Main:** Abandonment of force main will be measured on a lump sum basis upon completion of all work indicated on the Contract Documents. Abandonment shall include any equipment, cleaning, and flowable fill throughout the full length of pipe in accordance with the plans and specifications.

e. **Plug and Abandon Force Main:** Plug and abandonment of force main will be measured on a lump sum basis upon completion of all work indicated on the Contract

Documents. Plug and abandonment shall include any equipment, cleaning, and flowable fill required to cap the pipe ends (18 inches min.) in accordance with the plans and specifications.

f. **Remove Force Main**: Removal of force mains will be measured on a lump sum basis upon completion of all removal work indicated on the Contract Documents including appurtenances. Removal work shall include any equipment, trenching, and backfilling required to remove the existing force main in accordance with the plans and specifications.

g. **Remove or Abandon Force Main**: Removal or abandonment of force mains will be measured on a lump sum basis upon completion of all removal work indicated on the Contract Documents including appurtenances. Removal work shall include any equipment, trenching, and backfilling required to remove the existing force main in accordance with the plans and specifications. Abandonment in-place with this item shall include insertion of flowable fill throughout the full length of pipe.

h. **Force Main Tap:** Force main taps will be measured per each tap and diameter as indicated on the Contract Documents.

i. **Force Main Tie-In:** Force main tie-ins will be measured per each tie-in and diameter as indicated on the Contract Documents.

j. **Fittings:** Fittings will be measured by published fitting weights, minus accessories, (in pounds or tons as specified in the Bid Item) in accordance with AWWA C110 published fitting weights.

P17.804.10 PAYMENT:

k. **Sewer Force Main:** Payment for this Item will be full compensation for equipment, excavation, bedding, pipe, connections, testing (see SP.P17.804.08) and backfill, in accordance with the Contract Document. Sand-aggregate for bedding and initial backfill material and useable excavated soil for secondary backfill, as shown on City-Parish Standard Detail 801-01 shall be included in this pay item. When required, special bedding and backfill material such as #57 Stone Backfill, #610 Stone Backfill, CLSM Backfill, Sand- Aggregate for Secondary Backfill, and Select Material for Backfill required for Work associated with Sewer Pipe will be paid for under the relative pay item in Section SP.P17.801.

l. **Restrained Joint Sewer Force Main:** Payment for this Item will be full compensation for equipment, excavation, bedding, restrained joint pipe, connections, restrainer glands, testing (see SP.P17.804.08) and backfill, in accordance with the Contract Document. Sand-aggregate for bedding and initial backfill material and useable excavated soil for secondary backfill, as shown on City-Parish Standard Detail 801-01 shall be included in this pay item. When required, special bedding and backfill material such as #57 Stone Backfill, #610 Stone Backfill, CLSM Backfill, Sand-Aggregate for Secondary Backfill, and Select Material for Backfill required for Work associated with Sewer Pipe will be paid for under the relative pay item in Section SP.P17.801.

m. **Valves**: Payment for this Item will be made at the contract unit prices for equipment, excavation, valve box, connections, testing, limestone bedding and backfill, and geotextile fabric, in accordance with the Contract Document. In the case of air release/vacuum valves, the valve manhole, frame and cover, and tee connection are also included. Payment will be made at the contract unit prices for each complete valve assembly.

n. **Abandon Force Main:** Payment for this Item will be full compensation for equipment, bypass pumping, abandonment of valve vaults, connections, cleaning, and flowable fill throughout the full length of pipe, in accordance with the Contract Document. Payment will be made for completely filled pipe only.

o. **Plug and Abandon Force Main:** Payment for this Item will be full compensation for equipment, bypass pumping, abandonment of valve vaults, connections, cleaning, and flowable fill at the pipe ends (18 inches min.), in accordance with the Contract Document.

p. **Remove Force Main**: Payment for this Item will be a lump sum full compensation for equipment, bypass pumping, removal of valve vaults, connections, cleaning, excavation, backfill and delivery/disposal, in accordance with the Contract Document. Payment will be made for completely removed pipe and appurtenances.

q. **Removal or Abandon Force Main**: Payment for this Item will be a lump sum full compensation for equipment, bypass pumping, removal/abandonment of valve vaults, connections, cleaning, excavation, backfill, delivery/disposal, and flowable fill throughout the full length of pipe, in accordance with the Contract Document. Payment will be made for removed pipe and/or completely filled abandoned pipe.

r. **Force Main Tap:** Payment for this Item will be full compensation for equipment, labor, excavation, bedding, tapping sleeve and tapping valve, testing and backfill, in accordance with the Contract Document.

s. **Force Main Tie-in:** Payment for this Item will be full compensation for equipment, labor, excavation, bedding, pipe, fittings, connections, testing and backfill, in accordance with the Contract Document.

t. **Fittings:** Payment for this item will be full compensation for all fittings, and accessory kits, in accordance with the Contract Document.

P17.804.11 PAY ITEMS:

Technical Specifications Sanitary Sewer Systems

Payment will be made under:

Item No.	Item	Unit
TS-742-60010	Fittings	Pound
TS-742-60011	Air Release/Vacuum Valve (2”)	Each

TS-742-60012	Unrestrained Joint Sewer Force Main (16”)	Linear Foot
TS-742-60013	Restrained Joint Sewer Force Main (16”)	Linear Foot
TS-742-60024	Force Main Tie-In (16”)	Each

SPECIAL PROVISION P17.814
SMOKE TESTING

P17.814.01 SCOPE OF WORK: Sanitary sewer line sections, at locations designated by the Engineer or his authorized representative, shall be smoke tested to locate significant defects which are causing or could cause infiltration/inflow, soil erosion, and degradation to the existing sanitary sewer system or other underground utilities and surface structures.

All new or repaired main line or service lateral connections must be smoke tested and the Engineer will field determine which other new or repaired pipe segments are to be smoke tested prior to backfilling.

All work shall comply with the following requirements. All Section and Subsection references refer to the following requirements.

a. NS Items (Special Provisions) found in this contract.
b. 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
c. Special Provisions to the 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
d. City of Baton Rouge/Parish of East Baton Rouge Standard Details
   http://brprojects.com/design-and-construction-resources/standard-details/
e. City of Baton Rouge/Parish of East Baton Rouge Master Specifications
   http://brprojects.com/design-and-construction-resources/master-specifications/
f. City of Baton Rouge/Parish of East Baton Rouge of Environmental Services Wastewater Qualified Products List
   http://brprojects.com/baton-rouge-sso-program/design-construction/wastewater-qualified-products-list/

P17.814.02 PRODUCTS:

a. Nontoxic, odorless, non-hazardous, and non-staining smoke generators (bombs or liquid smoke) shall be used to produce smoke for testing.

b. Smoke shall be blown by a "squirrel cage" or other approved blower located on top of a central manhole. Blower pressure should be adequate to force smoke throughout the isolated line section and to the ground surface through cracks, channels, improper jointing, etc. Minimum blower free fan delivery is 1,500 cfm.

c. Sand bags and/or plugs with permanently attached identification tags shall be placed at each end of the test section to prevent smoke from escaping through the manholes and adjacent sewer lines.

d. Color, digital photographs with a minimum resolution of four (4) mega pixels or greater shall be taken of all locations where smoke is observed at the ground surface. The camera shall record a date and time directly onto the photo. Each photographic file generated shall be saved in a _.JPEG file format using the manhole reference number, distance to the upstream manhole, and the physical address as the naming convention. These files will be recorded on a computer compact disk (CD) or digital video disk (DVD) and delivered to the Owner. A sample of a file name in the proper format is:

253-00012_299_12345_Maple.jpeg
Manhole No _ Dist_Hse No_Street _.file ext.

e. All data pertinent to the smoke testing will be recorded on the smoke testing log form using the proper inspection coding as provided by the Owner. This form shall be submitted to and remain in the possession of the Owner after a section of line has been tested.

P17.814.03 PREPARATION:

a. Contractor's testing schedule shall consider the unique conditions of the test site such as (but not limited to):
    1. Cross connected storm/sanitary sewers
    2. Heavy flow sections
    3. Traffic patterns

b. If work is to be performed in a roadway, the Contractor shall perform necessary traffic control, conform to DPW rules and regulations, and the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD). Lane closures will require a permit from the DPW Traffic Division.

P17.814.04 METHODS:

a. Only sewer line segments on the upstream and downstream side of the blower shall be tested on a single set-up.

b. Smoke shall be introduced into a manhole and then blown into the connecting sewer lines.

c. All visible leaks, including those from collection lines, service laterals, drainage structures, and manholes within the road right-of-way or servitude, shall be recorded on the smoke testing log form. The information listed below shall be included on the log form:

    1. Upstream and downstream manhole numbers
    2. Manhole depths
    3. Direction of flows
    4. Location of sandbags and plugs
    5. Sketch showing leak location and distance and offset from the upstream manhole
    6. Street address nearest the detected leak
    7. Leak type that clearly describes the leak
    8. Smoke quantification
    9. Surface cover
    10. Properly identified color photograph of inflow source shall be attached to reporting form.

d. Visible smoke on private property shall be photographed and recorded by address.

e. Public notification and coordination with the City's Police and Fire Departments shall be accomplished according to the following:

1. At least 7 days prior to the test of any line segment and prior to beginning the testing, the Contractor shall go door-to-door to distribute an Owner approved Homeowner Notification Door Knocker describing the smoke testing.

2. On the day of test, prior to commencing operations, Contractor shall knock on the doors of all structures potentially impacted by the testing to personally notify occupants. Also Contractor shall notify the appropriate authorities prior to the beginning of any smoke testing and will be responsible for maintaining close coordination with the local Police and Fire Departments regarding the smoke tests.

3. Contractor shall maintain multiple copies of the MSDS sheets of smoke products on site for to respond to all inquiries.

f. Smoke tests shall not be performed when the smoke coming out of the ground may be blown away so quickly as to escape visual detection.

g. Smoke testing shall not be performed during wet weather or saturated ground conditions.

h. For Physical Inspection Contracts, all smoke testing shall be performed after the sewer lines and manholes have been cleaned and televised.

i. The Contractor will be solely responsible and held liable for any claims or damages arising from the lack of public notification, and coordination with the City Police and Fire Departments.

P17.814.05 INSPECTION: The Engineer or his duly authorized representative shall witness all smoke testing, and review smoke testing log forms submitted to the Engineer. The log forms shall be available on the next work day following the performance of the test.

P17.814.06 MEASUREMENT: Measurement for smoke testing to identify leak locations shall be made on a linear foot basis from the center of the upstream manhole to the center of the downstream manhole. Only line segments directly upstream and downstream of the blower are to be tested on a single set- up. The length of the line segments tested per smoke test set-up shall be approximately 600 linear feet.

P17.814.07 PAYMENT: Payment for smoke testing will be full compensation for smoke bombs, liquid smoke, blower usage, sand bagging, plugging, smoke test logs, public notification, and photos in accordance with the Specifications.

No direct payment will be made for smoke testing in conjunction with acceptance testing of sewer point repair or in conjunction with warranty item work.

SPECIAL PROVISION P17.817
JACKED AND BORED PIPE / CASING

P17.817.01 DESCRIPTION: The Work covered by this Section includes furnishing all labor, materials and equipment required to jack and bore pipe and/or casings to properly complete construction as described herein as directed by the Engineer and/or as shown on the Contract Documents.

When an item for "Sewer Force Main" is included in the contract, the Contractor has the option of furnishing either ductile iron pipe or PVC pipe, unless otherwise noted.

All work shall comply with the following requirements. All Section and Subsection references refer to the following requirements.

a. NS Items (Special Provisions) found in this contract.
b. 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
c. Special Provisions to the 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
d. City of Baton Rouge/Parish of East Baton Rouge Standard Details
   http://brprojects.com/design-and-construction-resources/standard-details/
e. City of Baton Rouge/Parish of East Baton Rouge Master Specifications
   http://brprojects.com/design-and-construction-resources/master-specifications/
f. City of Baton Rouge/Parish of East Baton Rouge of Environmental Services Wastewater Qualified Products List
   http://brprojects.com/baton-rouge-sso-program/design-construction/wastewater-qualified-products-list/

P17.817.01.1 Insurance: If a railroad crossing is required, the Contractor shall obtain the appropriate insurance and permits as required by the owner of the railroad at no additional cost to the Owner.

P17.817.01.2 General:

a. If available, interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site.

b. Pipe and casing installation shall be performed in a way that will not interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the bore. The Contractor shall be responsible for all settlement resulting from boring operations and shall repair and restore damaged property to its original or better condition at no additional cost to the Owner.

c. The face of the excavation shall be protected from the collapse of the soil into the pipe or casing.

d. Design of the jacking/receiving pit and required bearing loads to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the bore shown on the Contract Documents are the minimum lengths required. The length of the bore may

be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right-of-way and construction easements, bore lengths less than the nominal 20 foot length may be necessary.

e. Contractor shall dewater during installation in accordance with Section SP.P17.801.

P17.817.02 MATERIALS: Contractor shall comply with all manufacturers' recommendations for the approved products.

P17.817.02.1 Sewer Pipe: Acceptable materials used for direct boring of sanitary sewers without a casing are as follows:

a. Ductile Iron pipe and joints to be in accordance with Section SP.P17.1016.01.2 for gravity sewer applications and Section SP.P17.1016.02.3 for force main applications.

b. Fiberglass Reinforced Polymer (FRP) pipe and joints to be in accordance with Section SP.P17.1016.01.6 for gravity sewer applications.

Polyethylene (HDPE) butt-welded and fused joints to be in accordance with Section SP.P17.1016.01.1.2 and SP.P17.1016.02.2 for gravity sewer applications and force main applications respectively.

P17.817.02.2 Casing:

a. Unless otherwise required by the agency having jurisdiction, the casing shall be welded steel pipe meeting ASTM A53, Grade B, and have a minimum yield strength of 35,000 psi. The exterior of the casing pipe shall be coated with coal tar epoxy or bituminous asphalt. Minimum wall thickness shall be as shown in the following table:

Table of Minimum Wall Thickness for Steel Casing Pipe for Cooper E80 Loading		
Carrier Pipe Nominal Diameter	**Min. Casing Pipe Diameter (O.D.)**	**Min. Thickness**
6	12	0.250 inch
8	16	0.281 inch
10	20	0.344 inch
12	24	0.375 inch
14	28	0.438 inch
16	30	0.469 inch
18 - 20	36	0.531 inch
21 - 24	42	0.625 inch
30	48	0.688 inch
36	54	0.781 inch
42	60	0.844 inch
48	66	0.938 inch

b. The wall thickness shown above shall be increased to the nearest standard size.

c. The Contractor shall increase casing pipe wall thickness if required due to jacking force load and/or length.

d. Where carrier pipe nominal diameter is greater than 48 inches, then minimum casing pipe diameter (O.D.) shall be great enough to provide a minimum 3 inch radial clearance between the casing pipe and the "bell" O.D. of the carrier pipe. Thickness design shall be calculated by a professional engineer licensed in the state of Louisiana and submitted to the Owner for approval.

P17.817.02.3 Carrier Pipe (Within Casing): The carrier pipe shall be the same material as the sanitary sewer pipeline, unless otherwise directed by Engineer. All pressure carrier pipes shall be restrained jointed in the casing.

P17.817.02.4 Grout Holes: For casing pipes larger than 36 inches in diameter, Contractor may choose to furnish casing pipe with 2-inch diameter threaded grout holes or nipples at centerline and crown for pressure grouting. Spacing of grout holes shall not exceed 5 feet.

P17.817.02.5 Grout for Filling Voids Outside of Casing Larger than 36 Inches in Diameter: Neat cement grout with a minimum compressive strength of 500 psi.

P17.817.02.6 Welding of Casing Pipe:

a. Connect each section of the casing with a full penetration butt weld around the entire circumference of the joint, to achieve a water tight joint. Welding requirements shall be in accordance with ANSI/AWWA C206 and develop the full strength of the casing wall. Welding procedures shall be required for, at a minimum, longitudinal and girth or special welds for pipe cylinders, casing joint welds, reinforcing plates, and grout coupling connections.

b. Welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the type of materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the casing or pipeline. Machines and electrodes similar to those used in the Work shall be used in qualification tests. The Contractor shall be responsible for all material and bear the expense of qualifying welders.

P17.817.02.7 Casing Spacers: Casing spacers shall be sized sufficiently to provide a minimum clearance of two (2) inches between outside of carrier pipe bells or couplings and inside of casing. The spacers shall consist of the following components:

a. Spacer Band Material: Minimum 14-gauge steel band of either Type T-304 stainless steel or Carbon steel coated with fusion bonded epoxy or PVC coating.

b. Spacer Liner Material: Ribbed liner of PVC or EPDM rubber designed to overlap the edges of the spacer band and prevent slippage. Liner shall have a minimum thickness of 0.090 inches and a hardness of 85-90 durometer "A".

c. Spacer Width: As recommended by spacer manufacturer for the specific application. Minimum width shall be 8 inches. Manufacturer's approval in writing shall be required for installations exceeding 300 feet in length, carrier pipes in excess of 48 inches in diameter or multiple carrier pipes in casing.

d. Spacer Risers and Runners must be:

    1. Risers must be minimum 10-gauge steel risers of same material and requirements as spacer band. Risers shall be MIG welded to spacer band and prior to coating. Risers must be suitable for supporting the weight of carrier pipe.

    2. Runners shall be manufactured of an abrasion resistant material having a low coefficient of friction (0.1 to 0.6) and designed to support the carrier pipe without damage or excessive wear. Runner material shall be of glass reinforced polyester or nylon and have a minimum compressive strength of 18,000 psi (ASTM D 695).

e. All hardware and fasteners shall be stainless steel.

f. Hardwood skids shall NOT be used in place of manufactured casing spacers.

g. Fill material is not required in the annular space.

P17.817.02.8 Casing End Seals: End seals shall be made of synthetic rubber, conical shape, pull-on or wrap-around style with Type 304 stainless steel bands. For carrier pipe greater than 24 inches in nominal diameter the annular space between the carrier pipe and the casing pipe at the ends shall be bricked in conjunction with the end seals.

P17.817.03 SUBMITTALS:

a. Documentation that pipe and/or casing pipe material including the standard to which it is manufactured, outside diameter, wall thickness, joint configuration, and certificate of compliance certifying that the pipe and/or casing pipe meets these specifications.

b. Details of casing spacers, including manufacturer's recommended spacing.

c. Details of end seals for casing.

d. Dewatering Plan, if required.

P17.817.04 EQUIPMENT: Contractor shall utilize equipment and methods designed to install pipe and/or casing as shown in the Contract Documents. Operation of equipment shall be performed by qualified personnel, experienced in this type of work. Selected equipment shall be capable of accurate alignment and grade control, and shall protect against subsidence or other disturbance of ground, existing utilities, existing road surface, railroad facilities and existing structures.

P17.817.05 PREPARATION: Confirm location of all known existing utilities prior to start of jacking/receiving pit excavation and pipe installation. The Contractor shall provide the detailed layout required to keep the bore on grade. Notify the Engineer no less than 7 working days before beginning shaft excavation. Before beginning construction of jacking/receiving pit, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities. Place fencing, gates, lights, and signs, as necessary around shafts and staging areas to provide for public safety. When preparing to install casing pipe, verify casing pipe minimum wall thickness is adequate for anticipated jacking loads.

P17.817.06 INSTALLATION:

P17.817.06.1 Jacking/Receiving Pit: Methods of construction for jacking/receiving pits shall be such as to ensure the safety of the Work, Contractor's employees, the public, existing utilities, and adjacent property and improvements, whether public or private and shall comply with specifications in Section SP.P17.801. Provide complete groundwater control for excavations at all times. Perform jacking/receiving pit excavations using appropriate excavation or large hole drilling methods, as required. Inspect shaft/pit excavations daily to check safety of excavation and structural integrity of support system. Open excavations shall conform to all federal, state, and local requirements. Once initiated jacking operations shall continue without interruption, to prevent pipe from becoming firmly set in the embankment.

P17.817.06.2 Lubrication of Exterior of Pipe and/or Casing: Bentonite slurry may be used to lubricate exterior of pipe and/or casing during installation. Use of water to facilitate removal of spoil is permitted; however, water jetting is not allowed.

P17.817.06.3 Boring: The boring shall be accomplished by means of auguring to the size, line and grade shown on the Contract Documents or as directed by Engineer. The diameter of the bore shall be minimal to complete the jack and boring operations. Re-drill pilot hole when bore does not meet specifications.

P17.817.06.4 Jacked and/or Bored Pipe and/or Casing: Bore hole diameter shall not exceed outside diameter of casing by more than one (1) inch. When unstable soil conditions are found to exist, conduct boring operations in a manner that will not be detrimental to facility being crossed. Horizontal line tolerance is two (2) inches, maximum. Vertical line tolerance is two (2) inches maximum. A means of steering the pipe or casing must be provided to ensure allowable tolerance can be achieved. The Contractor must measure and record progress at all times to confirm that these tolerances are achieved. For casing: Weld sections of casing pipe together to provide watertight joints by operators qualified in accordance with the American Welding Society Standard Procedures. These welds shall be continuous, complete joint penetration butt joint wields as required for rigid and watertight connections. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing. If it is necessary to abandon a bored hole, remedial measures shall be taken by the Contractor, subject to review by the Engineer of facility being crossed. If required grade tolerance has not been achieved, correct grade using casing spacers of varying height per manufacturer's recommendations.

P17.817.06.5 Monitoring of Surface Movement: Perform a preconstruction survey of road surface or railroad tracks. Contractor shall record horizontal coordinates and elevations. Mark location of where measurements were taken. Monitor movement of road surface or railroad tracks on a daily basis and provide results to the Engineer. Stop operations if movement exceeds ¼ inch and immediately notify the Engineer.

P17.817.06.6 Grouting Jacked and/or Bored Casings: Overcutting in excess of one (1) inch shall be remedied by pressure grouting the entire length of the installation. Should appreciable loss of ground occur during jacking or boring operations, Contractor shall backpack all voids promptly. Fill all remaining voids upon completion of operations: such filling or backpacking shall be with grout unless otherwise approved.

P17.817.06.7 Installation of Carrier Pipe within Casing: Entire length of casing shall be installed complete and inspected and approved by Engineer before any carrier pipe is placed therein. Repair defects in casing pipe or leakage at joints. Install a minimum of three casing spacers to each length of carrier pipe in such a manner that electrical continuity will not occur between casing pipe and carrier pipe. Spacers shall be placed on each side of each joint and at 8-foot maximum spacing between joints. Check each joint makeup and pipe segment prior to pushing carrier pipe segments into casing. When the carrier pipe is a ductile iron or PVC pressure pipe install restrained joint pipe or mechanical joint with restrainers within limits of casing and jacking/receiving pit excavations on both ends, unless otherwise directed by the Engineer. Casing end seals shall be provided at the end of the casing pipe after installation of the carrier pipe.

P17.817.06.8 Casing Pipe and Carrier Pipe Annular Space: The annular space shall be left empty, unless otherwise directed by the Engineer.

P17.817.06.9 Removal of Jacking/Receiving Pit Support System: Remove support elements, except those required by Engineer to remain in place, from excavation. In addition, remove support elements as needed to install the pipeline. Removal of support system shall be performed in a manner that will not disturb or harm adjacent construction or facilities. Fill voids created by removal of support system with clean sand, flowable fill, or a similar fill material approved by Engineer.

P17.817.06.10 Backfilling of Jacking/Receiving Pit: Seal jacking/receiving pit opening and backfill at shafts when no longer required.

P17.817.06.11 Installation of Casing by Open Cut: In specific cases, as specified in the Contract Documents or as approved by the Engineer, it may be acceptable to install a casing by open cut trenching methods. Installation of the casing shall be in accordance with Section SP.P17.802. Carrier pipe installation shall be in accordance with Section SP.P17.817.06.7.

P17.817.07 MEASUREMENT:

a. **Jacked and/or Bored Casing:** Measurement for the installation of jacked and bored casing shall be made horizontally, on a linear foot basis, for various sizes listed in the Bid Form.

b. **Jacked and/or Bored Pipe:** Measurement for the installation of jacked and bored pipe shall be made horizontally, on a linear foot basis, for various sizes listed in the Bid Form.

c. **Trenched Casing:** Measurement for the installation of casing by open cut trenching methods shall be made horizontally, on a linear foot basis, for various sizes listed in the Bid Form.

P17.817.08 PAYMENT:

a. **Jacked and/or Bored Casing:** Payment for this item shall be full compensation for all labor, materials, submittals, equipment, casing, carrier pipe, restrained joints, spacers, end seals, excavation of the jacking/receiving pits (complete in place), bedding, backfill and compaction, traffic control, disposal of excess materials, surface restoration (including sawcutting, pavement removal and replacement), and surveying information required in this specification.

b. **Jacked and/or Bored Pipe:** Payment for this Item shall be full compensation for all labor, materials, submittals, equipment, pipe, restrained joints, excavation of the jacking/receiving pits (complete in place), bedding, backfill and compaction, traffic control, disposal of excess materials, surface restoration (including sawcutting, pavement removal and replacement), and surveying information required in this specification.

c. **Trenched Casing:** Payment for this item shall be full compensation for all labor, materials, submittals, equipment, casing, carrier pipe, restrained joints, spacers, end seals, excavation, bedding, backfill and compaction, traffic control, disposal of excess materials, and surveying information required in this specification.

P17.817.09 PAY ITEMS:

Technical Specifications Sanitary Sewer Systems

Payment will be made under:

Item No.	Description	Units
TS-742-60014	24” Jacked and Bored Casing including Carrier Pipe	Linear Foot

SPECIAL PROVISION P17.822
PROTECTIVE COATING

P17.822.01 SCOPE OF WORK: The Contractor shall provide surface preparation and protective coatings, complete and in place, in accordance with the Contract Documents.

All work shall comply with the following requirements. All Section and Subsection references refer to the following requirements.

a. NS Items (Special Provisions) found in this contract.
b. 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
c. Special Provisions to the 1997 City of Baton Rouge, Parish of East Baton Rouge Standard Specifications for Public Works Construction
d. City of Baton Rouge/Parish of East Baton Rouge Standard Details
   http://brprojects.com/design-and-construction-resources/standard-details/
e. City of Baton Rouge/Parish of East Baton Rouge Master Specifications
   http://brprojects.com/design-and-construction-resources/master-specifications/
f. City of Baton Rouge/Parish of East Baton Rouge of Environmental Services Wastewater Qualified Products List
   http://brprojects.com/baton-rouge-sso-program/design-construction/wastewater-qualified-products-list/

P17.822.02 GENERAL:

a. References - The following is a list of standards which may be referenced in this Section:

   1. American Water Works Association (AWWA):

      i. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied.

      ii. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

      iii. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

      iv. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.

   2. Applicable sections of NACE International (NACE)(approved for field performance testing).

   3. NSF International (NSF): 61, Drinking Water System Components - Health Effects.

   4. Applicable standard of The Society for Protective Coatings (SSPC) (approved for field performance testing)

   5. ACI305R - Hot Weather Concreting.

6. ACI 503R - Use of Epoxy Compounds for Coating Concrete.

7. ASTM B 117 – Standard Practice for Operating Salt Spray Apparatus

8. ASTM C 109 - Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

9. ASTM C 579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes

10. ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

11. ASTM C 868 - Standard Test Method for Chemical Resistance of Protective Linings

12. ASTM D 1014 – Standard Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates

13. ASTM D 4138 - Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means (approved for field performance testing)

14. ASTM D 4060 – 10 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

15. ASTM D 3359 Method B – Standard Test Methods for Measuring Adhesion by Tape Test (approved for field performance testing)

16. ASTM D4285 - Standard Test Method for Indicating Oil or Water in Compressed Air

17. ASTM D 7234 – Test Method for Pull-off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers (approved for field performance testing)

18. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers (approved for field performance testing)

19. ASTM D 4585 - Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation

20. ASTM D 4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings

21. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

22. ASTM D4285 - 83(2012) Standard Test Method for Indicating Oil or Water in

Compressed Air

23. ASTM G 210 - Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus

24. International Concrete Repair Institute (ICRI) Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion (approved for field performance testing)

25. National Association of Corrosion Engineers International, NACE RP 0188 - Discontinuity (Holiday) Testing of Protective Coatings.

26. National Association of Pipe Fabricators, NAPF 500-03 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Location Receiving Special External Coatings and/or Special Internal Linings (approved for field performance testing)

b. Definitions

1. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

2. MDFT: Minimum Dry Film Thickness.

3. MDFTPC: Minimum Dry Film Thickness per Coat.

4. Coverage: Total minimum dry film thickness in mils or square feet per gallon.

5. Mil: Thousandth of an inch.

6. PSDS: Paint System Data Sheet.

7. SFPG: Square Feet per Gallon.

c. The following surfaces shall not be protective coated:

1. Concrete, unless required by items on the concrete coating schedule below or the Drawings.

2. Stainless steel

3. Machined surfaces

4. Grease fittings

5. Glass

6. Equipment nameplates

7. Platform gratings, stair treads, door thresholds, and other walk surfaces unless specifically indicated to be coated.

d. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show or extend the limits of coating schedules, to show exceptions to the schedules, or to clarify or show details for application of the coating systems.

P17.822.02.1 Compliance with Environmental Regulatory Requirements: Contractor shall comply with all current Federal, State, and Local environmental laws and regulations, including, but not limited to the laws and regulations of the U.S. Environmental Protection Agency (USEPA) and LA Dept. of Environmental Quality.

P17.822.02.2 Protection of Work: The Contractor shall be responsible for any and all damage to his Work or the work of others during the time his Work is in progress.

P17.822.02.3 Right of Rejection: The Owner shall have the right to reject all material or Work that is unsatisfactory and require the replacement of either or both at the expense of the Contractor.

P17.822.02.4 Pre-job Conference: Prior to commencing Work, a pre-job conference shall be held for the purpose of reviewing and clarifying the painting and coating requirements of the Project. The Contractor, coating applicator, Coating Manufacturer's representative, Engineer and Engineer's third-party assurance inspector shall be present. This meeting shall be scheduled upon completion of coating shop drawing review but at least 7 days prior to surface preparation. A schedule of work to be accomplished will be established.

P17.822.02.5 Warranty: Contractor shall provide a one (1) year warranty against failure of any kind of all coatings. Warranty period shall commence on the date of final acceptance. Failure of any coating during the warranty period shall be repaired by the Contractor who shall absorb all costs related to the accepted repair of the coating. All defective Work shall be repaired in accordance with this Specification and to the satisfaction of the Engineer.

P17.822.03 SUBMITTALS:

a. Submittals shall include the following information and be submitted at least 30 days prior to protective coating work:

1. **Coating Materials List:** Six copies of a coating materials list showing the Manufacturer and the coating number keyed to the coating systems herein.

2. **Coating Manufacturer's Information:** For each coating system to be used, the following data:

i. Coating Manufacturer's Paint System Data Sheet (PSDS) for each system proposed, including statements on the suitability of the material for the intended use.

ii. Technical and performance information that demonstrates compliance

with the system performance and material requirements.

iii. Coating Manufacturer's instructions and recommendations on surface preparation and application.

iv. Colors available for each product (where applicable).

v. Compatibility of shop and field applied coatings (where applicable).

vi. Material Safety Data Sheet for each product used.

3. **Reference Panels:**

i. Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of sandblast specified herein, prepared to specified requirements.

ii. Provide panel representative of the steel used and prevent deterioration of surface quality.

iii. The panels will be used as a reference for quality control inspections by the engineer.

4. Provide five (5) references that show that the coating subcontractor has previous successful experience with the indicated or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the painting subcontractor provided the protective coating.

b. **Quality Control Submittals**:

1. Factory Applied Coatings: Manufacturer's certification stating factory applied Coating system meets or exceeds specified requirements.

2. If the manufacturer of finish coating differs from that of the shop primer, provide both manufacturers' written confirmation that materials are compatible.

3. Manufacturer's written instructions and special details for application of each system.

4. Contractor's Quality Control Plan in accordance with subsection SP.P17.822.04.

5. Contractor's Daily Activity Reports in accordance with subsection SP.P17.822.04.

c. **Manufacturer's Certification:** For all coating systems, the Contractor shall require the coating manufacturer to certify in writing to the following:

1. The manufacturer's representative has provided on-site instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.

2. The manufacturer's representative has personally observed and endorsed the

start of surface preparation, mixing and application of the coating materials.

3. Written certification from the selected coating product manufacturer must be provided for each of the specified coating systems. This certification shall clearly state the product, applicator and site-specific service conditions when the manufacturer certifies their acceptance of the applicator. This certification is to be submitted with the coating product shop drawings. Shop drawings will be deemed incomplete without this certification.

d. **Mockup**:

1. Before application of any coating or coating system, a performance mockup approved by the manufacturer shall be provided by the Contractor. The performance mockup shall finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details. The mockup shall be subjected to all field performance testing stipulated.

2. After Engineer review and Manufacturer approval, mockup area shall serve as a standard for similar work throughout the project.

3. Accepted mockup area may remain as part of the Work.

P17.822.04 QUALITY CONTROL: Quality control of the Work is solely the responsibility of the Contractor. The Engineer's third-party quality assurance inspector and/or the manufacturer's representative are not meant to serve as the Contractor's quality control.

a. The Contractor shall complete his own quality control such as spark testing (Low and High voltage), Dry Film Thickness, adhesion, and others in accordance with the manufacturer's recommendations prior to requesting a final inspection by the Engineer and manufacturer's representative.

b. The Contractor shall submit a Quality Control Plan as part of the shop drawing review process including but not limited to the following:

1. Provide documented evidence of qualified personnel.
2. Surface preparation procedure such as methodology, abrasive media to be used, blast pressure and source

3. Methods and/or equipment for environmental and atmospheric controls.
4. Protective coating application such as methodology, mixing, thinning, etc.
5. Examination, measurements or tests to be conducted.
6. Verification and acceptance criteria for individual tests.
7. Mandatory inspection surveillance points, witness points, and hold points.
8. Methods for documenting inspection findings.
9. Methods to identify conformance or rejection of work in process.
10. Methods to ensure that corrective actions are re-inspected.
11. Criteria for final acceptance

c. The Contractor is required to maintain daily (typed) activity reports. Copies of these reports shall be submitted to the Engineer on a weekly basis. Copies of these reports shall also be available onsite. Items including but not limited to the following shall be logged on a daily basis.

1. Personnel on site.
2. Ambient conditions in close proximity of actual application including but not limited to humidity, ambient temperature, surface temperature and dew point starting at the commencement of the work, every two hours after and at the completion of the work.
3. Surface conditions.
4. Work performed.
5. Batch numbers and amount of coating materials applied.
6. Inspections made and actions taken to correct nonconforming work.

P17.822.05 PRODUCTS:

P17.822.05.1 General:

a. **Suitability:** The Contractor shall use suitable coating materials as recommended by the Manufacturer. The materials used shall be designed, manufactured and intended for industrial, water, and wastewater industries.

b. **Compatibility:** In any coating system only compatible materials from a single Manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

c. **Containers:** Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, expiration date, and name of manufacturer, all of which shall be plainly legible at the time of use.

d. **Colors:** All colors and shades of colors of all coats of paint shall be as indicated or selected by the Owner. If not specifically indicated on Drawings, color shall be as designated below. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the Owner.

Raw Sewage Piping	Green or Gray
Sludge Piping	Brown
Gas Piping	Red
Potable Water Supply Piping	Blue
Non-Potable Water Piping	Orange
Gas or Liquid, Fuel	Red
Heating Piping and Ducts	Aluminum
Elect. Equip. and Conduits	Light Gray
Mechanical Equip., Exposed Interior & Exterior	Dark Gray
Mechanical Equip., Submerged or Intermittently Submerged	Black
Compressed Air Piping	White
Chlorine Gas or Solution Piping	Yellow
Plumbing Drains and Submerged Surfaces	Black
Structural Steel, Interior & Exterior	Pastel Green, Cream Blue, or as Directed
Safety Equipment or Cabinets	Jade Green
Pump Room, Walls and Ceilings	White
Masonry, Interior and Exterior	Pastel Green, Cream, Blue, or as Directed
Masonry and Concrete Normally Unexposed or Submerged	Black

e. **Products:**

1. Contractor shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets the indicated requirements and is equivalent or better in the following properties:

    i. Quality

    ii. Durability

    iii. Resistance to abrasion and physical damage

    iv. Life expectancy

    v. Ability to recoat in future

    vi. Solids content by volume

    vii. Dry film thickness per coat

    viii. Compatibility with other coatings

ix. Suitability for the intended service

x. Resistance to chemical attack

xi. Temperature limitations in service and during application

xii. Type and quality of recommended undercoats and topcoats

xiii. Ease of application

xiv. Ease of repairing damaged areas

xv. Stability of colors

2. Protective Coating Materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for water and wastewater services. The Contractor shall provide the Engineer with the names of not less than 10 similar applications of the proposed manufacturer's products that comply with these requirements.

P17.822.05.2 Industrial Coating Systems:

a. **System 1 – Alkyd Enamel:** High quality, gloss, long oil alkyd finish shall have a minimum solids content of 49 percent by volume. Primer shall be as recommended by manufacturer.

1. Prime coat (DFT = 2 mils).

2. Finish coats (two or more, Total DFT = 4 mils).

3. Total system DFT = 6 mils.

Products must meet or exceed the following ASTM tests:

1. Primer Requirements:

i. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
ii. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, rusting or delamination of film. No more than a 1/64" rust creepage at scribe after 1,500 hours exposure.
iii. Humidity: ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 5,000 hours exposure.

2. Topcoat Requirements:

i. Exterior Exposure: ASTM D1014 Exposed at 45 degrees facing south, Florida exposure – Requirement: No more than 85% gloss loss after one year exposure.

ii. UV Exposure: ASTM D 4587 QUV (UVA Bulb, Cycle 4) – Requirement: No less than 90% gloss retention after 2,000 hours exposure.

b. **System 7 – Acrylic Latex:** Single component, exterior grade, water based acrylic latex shall have a minimum solids content of 35 percent by volume. Prime coat shall be as recommended by manufacturer. The coating material shall be available in the ANSI safety colors.

1. Prime coat DFT = 2 mils, as recommended by manufacturer.
2. Finish coats (2 or more, Total DFT = 4 mils).
3. Total system DFT = 6 mils.

Products shall be suitable for application to the intended substrates including galvanized metal, aluminum, polyvinyl chloride (pvc), plastic, and fiberglass.

c. **System 8 – Epoxy, Equipment:** Two component, polyamidoamine cured epoxy coating material shall provide a recoatable finish that is available in a wide selection of colors. The coating material shall have a minimum solids content of 66 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning.

1. Prime coat DFT = 3-5 mils.
2. Prime coat, where shop applied, DFT = 3-5 mils, universal primer.
3. Finish coats (2 or more), Total DFT = 6-10 mils.
4. Total system MDFT = 9-12 mils.

Products must meet or exceed the following ASTM tests:

1. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
2. Abrasion: ASTM D 4060 (CS-17 wheel, 1,000 gram load) – Requirement: No more than 140 mg loss after 1,000 cycles.
3. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, or delamination of film. No more than 1% rusting on the plane and no more than 1/16" rust creepage at scribe after 6,700 hours exposure.
4. Humidity: ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 10,000 hours exposure.

d. **System 9 – Epoxy plus polyurethane top coat:** Two component, polyamidoamine cured epoxy coating material shall provide a recoatable finish that is available in a wide

selection of colors. The coating material shall have a minimum solids content of 67 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning. The top coat shall be a two-component aliphatic polyurethane coating material. It shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering, and contain a minimum solids content of 66 percent by volume.

1. Ferrous Metal System:

    i. Prime coat DFT = 3-5 mils.

    ii. Prime coat, where shop applied. DFT = 3-5 mils

    iii. Intermediate epoxy coat DFT = 3-5 mils.

    iv. Top coat, polyurethane DFT = 2.5-3 mils.

    v. Total system DFT = 8.5-12 mils.

2. Ductile Iron System:

    i. Prime coat DFT = 4-6 mils.

    ii. Prime coat, where shop applied. DFT = 4-6 mils

    iii. Intermediate epoxy coat DFT = 5-6 mils.

    iv. Top coat, polyurethane DFT = 2.5-3 mils.

    v. Total system DFT = 11.5-15 mils.

Products must meet or exceed the following ASTM tests:

1. Primer Requirements:

    i. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
    ii. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, or delamination of film. No more than 1% rusting on the plane and no more than 1/16" rust creepage at scribe after 6,700 hours exposure.
    iii. Humidity: ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 5,000 hours exposure.

2. Topcoat Requirements:

    i. Exterior Exposure: ASTM D1014 Exposed at 45 degrees facing south, Florida exposure – Requirement: No more than 85% gloss loss after one year exposure.

ii. UV Exposure: ASTM D 4587 QUV (UVA Bulb, Cycle 4) – Requirement: No less than 90% gloss retention after 2,000 hours exposure.

e. **System 10 – Acrylic, Concrete:** The acrylic coating material shall be a single component, industrial grade, high molecular weight, waterborne acrylic material with a solids content of at least 35 percent by volume. The filler-sealer shall be a two-component epoxy masonry sealer for wet and exterior exposure, with a solids content of at least 64 percent by volume. Either a two-component epoxy block filler or three component cementitious acrylic block filler that are suitable for interior and exterior exposure as recommended by the coating system manufacturer shall be used to fill holes and patch the concrete surface after abrasive blasting.

1. Prime coat (filler-sealer), applied in two coats to the entire surface and worked into the surface with a squeegee to achieve a smooth, void-free surface

2. Finish coats (2 or more), Total DFT = 6-8 mils.

Products must meet or exceed the following requirements:

1. Filler Surfacer Requirements:

i. Adhesion: ASTM D 7234 – No less than 300 psi per pull, three trials.

2. Topcoat Requirements:

i. Humidity: ASTM D 4585 – No blistering, cracking, loss of adhesion or color change after 2,000 hours exposure.
ii. Wind Driven Rain: Federal Test Method TT-C-555B, Section 4.4.7.3 – No water damage or dampness visible on back of light weight block after 48 hours.

f. **System 11 – Aliphatic Polyurethane, Concrete:** Two component aliphatic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering, and contain a minimum solids content of 66 percent by volume. The filler-surfacer shall be as recommended by the manufacturer and shall be used to provide a smooth surface for the epoxy intermediate coat. The filler-sealer is applied to the entire concrete surface and worked into the concrete surface with a wide blade putty knife or squeegee. The intermediate coat shall be a high-build epoxy coating with a minimum solids content of 67 percent by volume.

1. Surfacer = Filler-surfacer shall be applied to the entire surface and worked into surface defects and bugholes to achieve a smooth, void-free surface. (Total DFT = Minimum of 1/16" above highest peak of the substrate).

2. Intermediate coat = 4-6 mils.

3. Finish coat = 2-3 mils.

4. Total system DFT = 6-9 mils.

Top Coat Polyurethane Products must meet or exceed the following ASTM tests:

1. Adhesion: ASTM D 7234 – Requirement: No less than 300 psi per pull, three trials

2. Abrasion: ASTM D 4060 (CS-17 wheel, 1,000 gram load) – Requirement: No more than 116 mg loss after 1,000 cycles

g. **System 12 – Aliphatic Polyurethane, Fiber Glass:** Two-component aliphatic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering. A primer, tie coat, or mist coat shall be used as recommended by the manufacturer.

1. Prime coat (Tie coat).

2. Finish coats (2 or more, Total DFT = 3 mils).

P17.822.05.3 Submerged and Severe Service Coating Systems

a. **System 100 – Amine Cured Epoxy:** High build, polyamine cured, epoxy resin shall have a solids content of at least 80 percent by volume, and shall be suitable for long-term immersion service in municipal wastewater.

1. Prime coat = 3-5 mils.

i. Note: Surface shall be scarified by blasting with fine abrasive if more than 60 days has elapsed between application of the prime coat and the intermediate coat (or between any subsequent coats).

2. Intermediate coat = 5-7 mils.

3. Finish coats = 5-7 mils.

4. Total coats = 13-19 mils.

100% Epoxy Products must meet or exceed the following ASTM tests.

1. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.

2. Abrasion: ASTM D 4060 (CS-17 Wheel, 1,000 gram load) – Requirement: No more than 120 mg loss after 1,000 cycles.

3. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, rusting or delamination of film. No more than a 1/32" rust creepage at scribe after 1,500 hours exposure.

b. **System 101 – Cold-Applied Tape:** Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consist of a primer layer, inner layer tape (50 mils), and an outer layer tape (30 mils). Total system DFT = 80 mils.

c. **System 106 – Fusion Bonded Epoxy:** The coating material shall be a 100 percent powder epoxy, certified as compliant with NSF Standard 61, applied in accordance with the ANSI/AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines, except that the surface preparation shall be as specified in the coating system schedule of this Section. The coating shall be applied using the fluidized bed or electrostatic spray process.

1. Coating DFT = 16 mils.

2. For coating of valves, DFT - 12 mils.

3. Liquid Epoxy: For field repairs, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a Total DFT of 15 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

d. **System 108 – Epoxy, Concrete:** The coating material shall be a polyamine cured epoxy material suitable for long-term immersion in water and wastewater and for service where subjected to occasional splash and spillage of water and wastewater treatment chemicals. The finish coating material shall have a minimum solids content of 100 percent by volume. The filler-surfacer shall be either a miniumum 85 percent solids amine-cured epoxy material with silica and inert fillers or an epoxy-modified cementitious surfacer as recommended by the coating system manufacturer.

1. Filler-surfacer, applied to the entire surface and worked into surface defects and bugholes to achieve a smooth, void-free surface. (Total DFT = Minimum of 1/16" above the highest peak of the substrate)

2. Finish coat: New Sewer Manholes (2 or more, DFT = 60 – 80 mils) All other Structures (2 or more, DFT = 100 – 125 mils)

Products must meet or exceed the following ASTM tests:

1. Filler-surfacer Requirements:

   i. Compressive Strength: ASTM C 579 – Requirement: No less than 5,000 psi.
   ii. Tensile Strength: ASTM C 496 – Requirement: No less than 600 psi, 28 days.
   iii. Adhesion: ASTM D 7234 – No less than 300 psi per pull, three trials.

2. Epoxy Liner Requirements:

   i. Chemical Resistance:
      A. ASTM C 868 – Requirement: No blistering, cracking, softening, swelling or loss of adhesion or gloss after 60 days immersion in 25 percent sulfuric acid at 100□F, or
      B. Severe Wastewater Analysis Testing Apparatus (SWAT) ASTM G 210 – Requirement: No blistering, cracking, checking or loss of adhesion. Initial impedance greater than 10.0 (log-Z) at 0.01 Hz (ohms cm²). No less than a final log-Z electrical impedance of 8.5 at 0.01 Hz (ohms cm²) after 28 days. (Thickness of tested sample to be no more than 20% greater than the maximum film thickness requirement outlined in the specification).

   ii. Impact: ASTM D 2794 – Requirement: No visible damage after 88 in-lbs.
   iii. Adhesion: ASTM D7234 No less than 300 psi per pull, three trials
   iv. Abrasion: ASTM D 4060 – Requirement: No more than 120 mg loss after 1,000 cycles.

e. **System 109 – Coal Tar Epoxy:** Amine or polyamide cured coal tar epoxy coating material with 70% minimum volume solids content for exterior surfaces of buried concrete structures. A filler-surfacer shall be applied after abrasive blasting and prior to the finish coating as recommended by the manufacturer.

   1. Finish coat (2 or more), MDFT = 16-20 mils.

P17.822.05.4 Special Coating Systems:

a. **System 200 – PVC Tape:** Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils.

b. **System 204 – Water-Retardant:**

   1. Two coats (or single coat if manufacturer recommends in writing) of a clear, non-staining, silane-modified-siloxane masonry water-retardant material. The water-retardant system after application shall be provided with not less than a five-year warranty on the performance of the product.

2. Surfaces shall be cleaned with a chemical cleaner approved by the manufacturer and power wash. Surfaces shall be clean and dry before application of the material. Method and rate of application shall be in accordance with manufacturer's published instructions. A manufacturer's representative shall be present during applications if necessary for warranty.

c. **System 205 – Polyethylene Encasement:** Refer to subsection SP.P17.1016.02.3.1. Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

d. **System 208 – Aluminum Metal Isolation:** Two coats of a high build polyamide epoxy paint. Total thickness of system DFT = 8 mils.

e. **System 209 – Alkyd-Wood:** Industrial quality, gloss or semi-gloss, medium long oil alkyd coating material with a minimum solids content of 49 percent by volume. Primer shall be an alkyd primer as recommended by the manufacturer.

1. Prime coat DFT = 3 mils.

2. Finish coats (two or more, Total DFT = 3 mils).

3. Total system DFT = 6 mils.

f. **System 210 – Acrylic-Wood:** Single component, water-based acrylic latex coating material with a fungicide additive and a minimum solids content of 35 percent by volume. Primer shall be an alkyd primer as recommended by the manufacturer.

1. Prime coat DFT = 2 mils.

2. Finish coats (two or more, Total DFT = 6 mils).

3. Total system DFT = 8 mils.

g. **System 211 – Acrylic-Drywall:** Single component, water-based acrylic latex coating material with a fungicide additive and a minimum solids content of 35 percent by volume. Primer shall be a PVA sealer as recommended by the manufacturer.

1. Prime coat DFT = 1.5 mils.

2. Finish coats (two or more, Total DFT = 6 mils).

3. Total system DFT = 7.5 mils.

P17.822.06 EXECUTION:

P17.822.06.1 Manufacturer's Services: The Contractor shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable or associated with the manufacturer's products.

a. Coating manufacturer's representative shall be present at site for each structure to be coated as follows:

   1. Manufacturer's representative shall attend the Pre-job Conference.

   2. All required inspection hold points as described in subsection SP.P17.822.06.15(c)(5).

   3. To verify full cure of coating prior to coated surfaces being placed into immersion service.

   4. As required to resolve field problems attributable to or associated with manufacturer's product.

b. Manufacturer's representative shall provide the Contractor and Engineer with documentation of site visit listing observations made and deficiencies, if any, that are to be corrected. Contractor shall submit documentation to Engineer.

c. Contractor shall provide Manufacturer's representative with ample prior notice before being required on site.

P17.822.06.2Workmanship:

a. Skilled craftsmen and experienced supervision shall be used on all Work.

b. Coating materials shall be applied evenly in strict accordance with manufacturer's recommendations.

c. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.

d. The Contractor shall protect the public and the Work against disfigurement by paint materials and damage caused by surface preparation. The Contractor shall be responsible for damage caused by the Contractor's operations to vehicles, persons or property, including plants and animals, and shall provide protective measures to prevent such damage. Paint stains that result in an unsightly appearance shall be removed or obliterated by the Contractor. All damage to surfaces resulting from the Work shall be cleaned, repaired, and refinished to original condition.

e. All Work shall be subject to final acceptance by the Owner. The Contractor shall correct Work that does not comply with the Contract Documents. Acceptance is based on Contractor's documented evidence of compliance and successful field performance

tests approved by the Engineer.

P17.822.06.3 Storage, Mixing, and Thinning of Materials:

a. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

b. Shelf Life: All protective coating materials shall be used within the manufacturer's recommended shelf life.

c. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

P17.822.06.4 Preparation for Coating:

a. **General:** All surfaces to receive protective coatings shall be cleaned as indicated prior to application of coatings. The Contractor shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.

b. **Protection of Surfaces not to be Coated:** Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations. All hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

c. **Protection of Painted Surfaces:** Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

P17.822.06.5 Surface Preparation Standards:

a. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

    1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or

steam.

2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. White Metal Blast Cleaning (SSPC-SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.

7. Near-White Blast Cleaning (SSPC-SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

8. Power Tool Cleaning to Bare Metal (SSPC-SP11): Removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. The surface profile shall not be less than 1 mil (25 microns).

P17.822.06.6 Metal Surface Preparation (Ungalvanized):

a. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

b. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grit.

c. All oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 - Solvent Cleaning prior to blast cleaning.

d. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.

e. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag. Automated blasting systems shall not be used for surfaces that will be in submerged service. Metal shot or grit shall not be used for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned to be one with hard, sharp cutting crushed slag.

f. The abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.

g. The Contractor shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

h. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil and moisture separators that remove at least 95 percent of the contaminants.

i. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.

j. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

k. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.

l. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2 or SSPC-SP3 be used.

m. Shop applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

n. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

P17.822.06.7 Surface Preparation for Galvanized Ferrous Metal:

a. Remove all soluble and insoluble contaminants and corrosion. Remove all storage stains per Section 6.2 of ASTM D6386. Abrasive blasting all surfaces per ASTM D 6386 to achieve a uniform anchor profile of 1.0 - 2.0 mils.

b. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

P17.822.06.8 Surface Preparation of Ferrous Surfaces with Existing Coating, Excluding Steel Reservoir Interiors:

a. **General:** All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.

b. **Abrasive Blast Cleaning:** The Contractor shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not indicated in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, with the remaining thickness of existing coating not to exceed 3 mils.

c. **Incompatible Coatings:** If coatings to be applied are not compatible with existing coatings the Contractor shall apply intermediate coatings per the paint manufacturer's recommendation for the indicated coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

d. **Unknown Coatings:** Coatings of unknown composition shall be completely removed prior to application of new coatings.

e. **Water Abrasive or Wet Abrasive Blast Cleaning:** Where specified or where job site conditions do not permit dry abrasive blasting for industrial coating systems due to dust or air pollution considerations, water abrasive blasting or wet abrasive blasting may be used. In both methods, paint-compatible corrosion inhibitors shall be used, and coating application shall begin as soon as the surfaces are dry. Water abrasive blasting shall be done using high-pressure water with sand injection. In both methods, the equipment used shall be commercially produced equipment with a successful service record. Wet blasting methods shall not be used for submerged and severe service coating systems unless indicated.

P17.822.06.9 Concrete and Concrete Block Masonry Surface Preparation:

a. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.

b. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC-SP1 before abrasive blast cleaning.

c. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper.

d. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.

e. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.

f. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device.

P17.822.06.10 Plastic, Fiber Glass and Non-ferrous Metals Surface Preparation:

a. Plastic and fiber glass surfaces shall be sanded or brush off blast cleaned prior to solvent cleaning with a chemical compatible with the coating system primer.

b. Non-ferrous metal surfaces shall be solvent-cleaned SSPC-SP1 followed by sanding or brush-off blast cleaning SSPC-SP7.

c. All surfaces shall be clean and dry prior to coating application.

P17.822.06.11 Architectural Concrete Block Masonry:

a. The mortar surfaces shall be cured at least 14 days before surface preparation work is started.

b. Dust, dirt, grease, and other foreign matter shall be removed prior to abrasive blasting.

c. The masonry surfaces shall be prepared in accordance with the material manufacturer's printed instructions.

P17.822.06.12 Shop Coating Requirements:

a. Unless otherwise indicated, all items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the indicated or selected color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

b. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.

c. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. The Contractor shall require the manufacturer of each such piece of

equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

d. For certain small pieces of equipment, the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

e. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being topcoated, or less time if recommended by the coating manufacturer.

f. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.

g. The Contractor shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

P17.822.06.13 Application of Coatings:

a. The application of protective coatings to steel substrates shall be in accordance with SSPC-PA1 - Paint Application Specification No. 1.

b. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The Contractor shall schedule such inspection with the Engineer in advance.

c. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

d. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

e. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.

f. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

g. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

h. Coatings shall not be applied under the following conditions:

1. Temperature exceeding the manufacturer's recommended maximum and minimum allowable.

2. Dust or smoke laden atmosphere.

3. Damp or humid weather.

4. When the substrate or air temperature is less than 5 degrees F above dewpoint.

5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.

6. When wind conditions are not calm.

i. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychometric tables.

j. Unburied steel piping shall be abrasive blast cleaned and primed before installation.

k. Sealing cut ends of coated or lined pipe and/or coating field repairs to pipe and fittings shall be performed in accordance with the manufacturer's recommendations.

l. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust free.

P17.822.06.14 Curing of Coatings:

a. General: The Contractor shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section; whichever is the most stringent, prior to placing the completed coating system into service.

b. Ventilation: In the case of enclosed areas, forced air ventilation, using heated air, if necessary, may be required until the coatings have fully cured.

c. Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of steel reservoirs and enclosed hydraulic structures. During application and curing periods, continuously exhaust air from a manhole in the lowest shell ring, or in the case of an enclosed hydraulic structure, from the lowest level of the structure using portable ducting. After all interior coating operations have been completed, provide a final curing period for a minimum of 10 days, during which the forced ventilation system shall operate continuously. For additional requirements, refer to the specific coating system requirements in Section SP.P17.822.05 above.

P17.822.06.15 Shop and Field Inspection and Testing:

a. General: The Contractor shall give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

b. All such work shall be performed only in the presence of the Engineer, unless the Engineer has granted prior approval to perform such work in its absence.

c. Inspection: Inspection by the Engineer, or the waiver of inspection of any particular portion of the Work, shall not relieve the Contractor of its responsibility to perform the Work in accordance with these Specifications.

1. Applicator shall be responsible for and maintain an active site-specific quality control program, monitored by the applicators inspector who shall be knowledgeable of coating inspection methods, test procedures and corrective measures for items found to be in nonconformance. The site-specific quality control program shall insure and document compliance with the job specifications in all facets of surface preparation, coating/lining application, cure and final inspection.

2. The applicator shall provide the Engineer with documentation of inspections and testing performed. The documentation shall include weather conditions at the start and end of each application, test results and specific locations examined to confirm.

3. Audits may be performed by the Engineer or a third party designated by the Engineer to confirm that inspections have been performed in a thorough and proper manner.

4. Applicator shall correct work that is not acceptable, verify corrective actions have been completed and submit documentation of such inspection prior to requesting a follow-up audit.

5. Contractor's Inspector Responsibilities:

i. Verify that surface preparation and application of coatings or coating systems are as specified at all specific inspection hold points as outlined below and other points as directed by the Engineer:

A. Completion of Surface preparation.
B. Completion of first coat.
C. Completion of second coat.
D. Completion of each subsequent coat.

Note1: Nonconformance discovered during quality control inspection may at the Engineer’s discretion require additional coating performance inspection hold points and/or testing to establish compliance.

Note 2: Applicator shall notify the Engineer in writing 48 hours prior to the required inspection hold point.

Note 3: Staging and/or scaffolding used for the work shall not be removed before the work has been examined and approved by all

parties.

ii. Verify coatings and other materials are as specified.

iii. Verify compressor air supply is clean and free of contaminants prior to start of blast cleaning per ASTM D4285 blotter test.

iv. Verify Dry Film Thickness (DFT) of each coat and total DFT of each coating system are as specified using wet film and dry film gauges. DFT measurements shall be performed per SSPC PA-2 including gage calibration to compensate for surface profile. DFT is the thickness of record. Destructive testing may be required to measure DFT.

v. Verify each coating is properly cured in accordance with manufacturer's instructions.

vi. Coating Defects: Visually examine coatings for film characteristics or defects that would adversely affect performance or appearance of coating including dust, dirt or overspray inclusions, runs, sags, pinholes, blisters, finish coat overspray, mud cracks, and even in color and appearance.

vii. Daily Reports: The Contractor is required to maintain typed daily activity reports that are to be submitted to the Engineer on a weekly basis in accordance with subsection SP.P17.822.04.

d. Scaffolding shall be erected and moved to locations where requested by the Engineer to facilitate inspection. Additional illumination shall be furnished to cover all areas to be inspected.

e. The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gages shall be made available for the Owner's use at all times while coating is being done, until final acceptance of such coatings. The Contractor shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the Engineer.

f. Testing Equipment:

1. Provide magnetic type dry film thickness gauge to test coating thickness specified in mils.

2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities.

3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness.

g. Testing:

1. Evaluation of blast cleaned surface preparation work will be based upon visual comparison of the blasted surfaces with SSPC-Vis1 photographic standard samples available from SSPC.

2. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.

3. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.

4. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188.

5. All other approved applicable field performance testing.

6. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

h. Unsatisfactory Application:

1. If the item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.

2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.

3. Repair defects in accordance with written recommendations of coating manufacturer.

4. Damaged Coatings, Pinholes, and Holidays:

i. Feather edges and repair in accordance with recommendations of paint manufacturer.

ii. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.

iii. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched

appearance.

P17.822.06.16 Coating System Schedules – Ferrous Metals:

a. Coating System Schedule, Ferrous Metal - Not Galvanized:

	Item	Surface Prep.	System No.
FM-1	All indoor surfaces, except those included below.	For Ferrous Metal: Commercial blast cleaning SSPC-SP6 For ductile pipe: Clean as required to remove all soluble surface contaminants. Abrasive blast all surfaces to be coated in accordance with NAPF 500-03-04 to remove a insoluble surface contaminant and to achieve a minimum surface profile of 1.5 mils.	(8) Epox
FM-2	All outdoor surfaces, except those included below.	For Ferrous Metal: Commercial blast cleaning SSPC-SP6 For ductile pipe: Clean as required to remove all soluble surface contaminants.	(9) Epoxy plus polyurethane topcoat

		Abrasive blast all surfaces to be coated in accordance with NAPF 500-03-04 to remove all insoluble surface contaminants and to achieve a minimum surface profile of 1.5 mils.	
FM-3	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged in utility water or wastewater including all surfaces lower than 2 feet above high water level in hydraulic structures, and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).	For Ferrous Metal: White metal blast cleaning SSPC-SP5. For ductile pipe: Clean as required to remove all soluble surface contaminants. Abrasive blast all surfaces to be coated in accordance with NAPF 500-03-04 to remove all insoluble surface contaminants and to achieve a minimum surface profile of 1.5 mils.	(100) amine-cured epoxy
FM-6	Buried small steel pipe.	Removal of dirt, grease, oil	(200) PVC tape
FM-7	Ferrous surfaces in water passages of all valves 4-inch size and larger, exterior surfaces of submerged valves.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-8	Ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge size of 4 inches or larger.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-9	Ferrous surfaces of sleeve-couplings.	Solvent cleaning SSPC-SP1, followed by white metal blast cleaning SSPC-SP10	(106) fusion-bonded epoxy
FM-10	All ferrous surfaces of sluice gates, flap gates, and shear gates, including wall thimbles.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-11	Buried surfaces that are not indicated to be coated elsewhere.	Near white metal blast cleaning SSPC-SP10	(100) amine-cured epoxy
FM-19	Buried pipe couplings, valves, and flanged joints (where piping is ductile or	Brush-off blast cleaning SSPC-SP7	(205) polyethylene encasement

cast iron, not tape-coated), including epoxy-coated surfaces.

b. **Coating System Schedule, Ferrous Metal - Galvanized:** Pretreatment coatings, barrier coatings, or washes shall be applied as recommended by the coating manufacturer. All galvanized surfaces shall be coated, except for chain link fencing.

	Item	Surface Prep.	System No.
FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Solvent cleaning SSPC-SP1 Followed by SSPC-SP7	(7) Acrylic latex

P17.822.06.17 Coating System Schedule, Non-ferrous Metal, Plastic, Fiber Glass:

a. Where isolated non-ferrous parts are associated with equipment or piping, the Contractor shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-SP1	(7) Acrylic latex
NFM-3	Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal.	Solvent cleaned SSPC-SP1	(208) aluminum metal isolation
NFM-6	Buried non-ferrous metal pipe.	Removal of dirt, grease, oil	(200) PVC tape

P17.822.06.18 Coating System Schedule – Concrete:

	Item	Surface Prep.	System No.
C-1	All indoor surfaces where indicated in Contract Documents.	Per Section SP.P17.822.06.9	(10) acrylic,concrete

C-2	Interior surfaces of pump station wet wells, and various wastewater treatment plant structures as indicated in Contract Documents. **Note:** The floors and the bottom six (6) inches of the interior wet well walls only are not required to be coated.	Per Section SP.P17.822.06.9	(108) epoxy, concrete
C-3	Interior surfaces of new wastewater manholes and as indicated in Contract Documents.	Per Section SP.P17.822.06.9	(108) epoxy, concrete
C-4	Buried exterior surfaces of various wastewater treatment plant structures as indicated in Contract Documents.	Per Section SP.P17.822.06.9	(109) coal tar epoxy, concrete
C-5	Buried exterior surfaces of as indicated in Contract Documents.	Per Section SP.P17.822.06.9	(109) coal tar epoxy, concrete

P17.822.06.19 Coating System Schedule – Concrete Block Masonry:

	Item	Surface Prep.	System No.
CBM-1	All surfaces, indoors and outdoors, where indicated in Contract Documents.	Per Section SP.P17.822.06.9	(10) acrylic, concrete

P17.822.06.20 Coating System Schedule – Miscellaneous Surfaces:

	Item	Surface Prep.	System No.
MS-1	Wood, indoors and outdoors.	Per manufacturer's printed instructions	(209) alkyd-wood

P17.822.07 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS:

a. **Warranty Inspection:** A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. All personnel present at the Pre-job Conference shall attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the Engineer. The Engineer may, by written notice to the Contractor, reschedule the warranty inspection to another date within the one-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the Contractor is not relieved of its responsibilities under the Contract Documents.

P17.822.08 MEASUREMENT AND PAYMENT: No measurement or direct payment will be made for protective coatings.

SPECIAL PROVISION P17.1001
AGGREGATES

P17.1001.01 GENERAL: Aggregates shall be from a source listed in the QPL.

P17.1001.01.1 Abrasion Resistance and Soundness: Maximum soundness loss of aggregate shall be 15% when subjected to 5 cycles of magnesium sulfate soundness test by AASHTO T 104. Coarse aggregates for portland cement concrete and asphalt concrete shall show an abrasion loss of not more than 40% when tested by AASHTO T 96.

P17.1001.01.2 Physical Properties: Physical properties shall be determined in accordance with test methods shown:

Property	Test Method
Deleterious Materials	DOTD TR 119
Unit Weight	AASHTO T 19
Specific Gravity & Absorption of Coarse Aggregate	AASHTO T 85
Specific Gravity & Absorption of Fine Aggregate	AASHTO T 84
Polish Value	AASHTO T 278 & T 279
Amount of Material Finer than No. 200 Sieve	DOTD TR 112
Sieve Analysis (Gradation)	DOTD TR 113
Liquid Limit	DOTD TR 428
Plasticity Index	DOTD TR 428

P17.1001.02 AGGREGATES FOR PORTLAND CEMENT CONCRETE AND MORTAR:

P17.1001.02.1 General: When tested in accordance with ASTM C 289, C 586 and C 1260, aggregates potentially reactive with cement alkalies will be restricted to use with cement containing 0.6% or less alkalies (sodium oxide equivalent).

P17.1001.02.2 Fine Aggregate: Fine aggregate shall be sand in which deleterious substances do not exceed the following:

Property	Maximum %
Coal and Lignite	0.25
Clay Lumps	0.05
Clay Lumps & Friable Particles	3.00

Fine aggregate subjected to colorimetric test for organic impurities (AASHTO T 21) which produces a color darker than Organic Color No. 3 shall be subjected to mortar strength test (AASHTO T 71). Mortar shall show a minimum compressive strength of 95% of reference mortar.

Fine aggregate shall conform to the following gradations:

CONCRETE SAND

U. S. Sieve	% Passing
3/8"	100
No. 4	95-100
No. 16	45-90
No. 50	7-30

No. 100	0-7
No. 200	0-3

MORTAR SAND

U. S. Sieve	% Passing
No. 4	100
No. 8	95-100
No. 100	0-25
No. 200	0-10

P17.1001.02.3 Coarse Aggregate: Coarse aggregate shall be gravel, stone or crushed concrete. The amounts by weight of deleterious substances shall be as follows:

Property	Maximum %
Clay Lumps	0.05
Clay Lumps & Friable Particles	3.0
Iron Ore	2.0[1]
Coal & Lignite	1.0[1]
Sticks (Wet)	0.05
Total Clay Lumps & Friable Particles, Iron Ore, Coal & Lignite, and Wood	5.0

[1]Aggregate used in concrete railings shall be free from coal, lignite and iron ore.

Coarse aggregate shall conform to the following gradations:

% Passing U.S. Sieve	Grade A	Grade B	Grade D[1]	Grade F	Grade P[2]
2 1/2"	---	---	100	---	---
2"	---	100	90-100	---	---
1 1/2"	100	85-100	---	---	---
1"	90-100	---	35-70	---	---
3/4"	---	35-70	---	100	100
1/2"	25-60	---	10-30	90-100	90-100
3/8"	---	10-30	---	---	20-55
No. 4	0-10	0-5	0-5	15-60	0-10
No. 8	0-5	---	---	0-15	0-5
No. 16	---	---	---	0-5	---
No. 200	0-1	0-1	0-1	0-1	0-1

[1]Crushed stone only.
[2]For slip form of concrete curb if allowed by the project engineer.

If material finer than No. 200 sieve consists of dust from crushing, essentially free of clay, this percentage shall be 0-2. If total material passing No. 200 sieve from coarse and fine aggregates does not exceed 5%, material passing No. 200 sieve from crushed coarse aggregate may be increased to 3%.

P17.1001.03 BASE AND SUBBASE AGGREGATES:

P17.1001.03.1 Base Stone: This material shall consist of crushed stone or crushed concrete and shall conform to the following gradation:

U. S. Sieve	% Passing
1 1/2"	100
1"	90-100
3/4"	70-100
No. 4	35-65
No. 40	12-32
No. 200	5-12

Material passing No. 40 sieve shall conform to the following:

	Maximum
Liquid Limit	25
Plasticity Index	4

P17.1001.03.2 Sub-base Stone: This material shall consist of crushed stone or crushed concrete and shall conform to the following gradation:

U. S. Sieve	% Passing
2"	100
1 1/2"	90-100
1"	20-55
3/4"	0-15
3/8”	0-5

P17.1001.04 SURFACE COURSE AGGREGATES:

P17.1001.04.1 Stone: This aggregate shall consist of crushed stone or crushed concrete and shall conform to the following gradation:

U. S. Sieve	% Passing
1 1/2"	100
3/4"	50-100
No. 4	35-65
No. 40	10-32
No. 200	3-15

Material passing No. 40 sieve shall conform to the following:

	Maximum
Liquid Limit	25
Plasticity Index	4

P17.1001.04.2 Gravel: Gravel shall be free of sticks and other foreign material, and shall be graded as follows:

U. S. Sieve	% Passing
1 1/2"	95-100
No. 4	0-15
No. 200	0-2

P17.1001.05 ASPHALT CONCRETE AGGREGATES:

These aggregates shall be assigned a Friction Rating as shown in Table 1001-1 and indicated in QPL 2.

Table 1001-1

Aggregate Friction Rating

Friction Rating	Description
I	Aggregates that have a Polish Value of greater than 37 or demonstrate the ability to retain acceptable friction numbers for the life of the pavement.
II	Aggregates that have a Polish Value of 35 to 37 or demonstrate the ability to retain acceptable friction numbers for the life of the pavement.
III	Aggregates that have a Polish Value of 30 to 34 or demonstrate the ability to retain acceptable friction numbers for the life of the pavement.
IV	Aggregates with a Polish Value of 20 to 29.

P17.1001.05.1 Gravel, Stone, Slag and Crushed Concrete: The amount of clay lumps and friable particles shall not exceed 5% by weight.

P17.1001.05.2 Coarse Sand: Coarse sand shall be free from vegetative and other foreign matter.

P17.1001.05.3 Fine Sand: Fine sand shall be free from vegetative and other foreign matter. Fine sand shall be nonplastic with a maximum of 25% passing No. 200 sieve.

P17.1001.05.4 Screenings: Screenings shall be made by crushing aggregates which conform to requirements for coarse aggregates in Subsection SP.P17.1001.01. Screenings shall meet the following gradation requirements.

U. S. Sieve	% Passing
3/8"	100
No. 4	85-100

P17.1001.05.5 Reclaimed Asphalt Concrete: Stockpiles of reclaimed asphalt concrete shall be approved prior to use. Stockpiles shall be uniform and free of soil, debris, foreign matter and other contaminants. Reclaimed material shall pass a 2" sieve.

P17.1001.05.6 Mineral Filler: Mineral filler shall be limestone dust, pulverized hydrated lime, portland cement, or cement stack dust. Mineral dust collected in bag houses or by other dust collectors at asphalt concrete plants is not classified as mineral filler. Cement stack dust shall be material collected from waste gases discharged through a collector of a cement plant. Mineral filler shall conform to the

following gradation:

U. S. Sieve	% Passing
No. 30	100
No. 80	95-100
No. 200	70-100
No. 270	60-100

P17.1001.06 BEDDING MATERIAL: Bedding materials shall be a sand-aggregate mixture. Aggregate in the mixture shall be gravel, stone or crushed concrete. The mixture shall be free of foreign matter and shall be graded as follows:

U. S. Sieve	% Passing
1 ½"	95-100
No. 4	30-50
No. 10	20-45
No. 200	0-10

P17.1001.07 BACKFILL SAND: Sand for backfilling trenches and structures shall be non-plastic siliceous material, graded as follows:

U. S. Sieve	% Passing
½"	100
No. 10	75-100
No. 200	0-10

P17.1001.08 RIPRAP: Riprap shall be crushed stone or crushed concrete. The smallest dimension shall be at least 1/3 the largest dimension. Crushed concrete shall be free of protruding steel reinforcement.

Riprap shall be graded as follows:

Table 1001-2
Riprap
Gradation

Riprap Class [1]	Stone Size lb	Spherical Diameter [2] ft	Percent of Stone Smaller Than
2 lb	10	0.51	100
	4	0.38	40-100
	2	0.30	15-50
	0.75	0.22	0-15
10 lb	50	0.88	100
	20	0.65	50-100
	10	0.51	15-50
	5	0.41	0-15

30 lb	140 60 30 10	1.24 0.94 0.74 0.51	100 42-100 15-50 0-15
Riprap Class [1]	Stone Size lb	Spherical Diameter [2] ft	Percent of Stone Smaller Than
55 lb [3]	275 110 55 20	1.50 1.11 0.88 0.63	100 42-100 15-50 0-15
130 lb [3]	650 260 130 40	2.00 1.46 1.17 0.79	100 45-100 15-50 0-15
250 lb [3]	1250 500 250 80	2.50 1.83 1.46 1.00	100 45-100 15-50 0-15
440 lb [3]	2200 900 440 130	3.00 2.23 1.76 1.17	100 40-100 14-50 0-15
1000 lb [3]	5000 2000	4.00 2.91	100 45-100
	1000 300	2.31 1.55	10-50 0-15

[1]The stone size used to define the Riprap Class is the minimum median stone size for the stone class. The minimum thickness of a riprap layer shall be no less than 18 inches or the spherical diameter of the maximum stone size in the Riprap Class (D_{100}) if greater.

[2]Spherical diameters of riprap classes up to 30 lb are based on a solid weight of 140 lb/cu ft. Spherical diameters of riprap classes above 30 lb are based on a solid weight of 155 lb/cu ft.

[3]Recycled portland cement concrete may not be used in these riprap classes.

SPECIAL PROVISION P17.1002
CEMENT, LIME, AND WATER

P17.1002.01 PORTLAND CEMENT: Portland cement shall be from a source listed in the QPL and shall conform to AASHTO M 85 with the following exceptions:

(a) Type I(B) and I(C) cement are defined as Type I cement with fineness requirements modified as follows:

	Fineness (sq m/kg)	
Turbidimeter Test	Type I(B)	Type I(C)
Average value, max.	200	255
Max. value, any 1 sample	210	265
Air Permeability Test		
Average value, max.	360	460
Max. value, any 1 sample	380	480

(b) Alkali content, calculated as sodium oxide equivalent, shall not exceed 0.6% by weight for all types of cement.

P17.1002.02 MASONRY CEMENT: Masonry cement shall conform to ASTM C 91.

P17.1002.03 LIME: Lime shall be hydrated lime or quicklime from a source listed in the QPL or blended lime.

(a) Hydrated Lime shall conform to ASTMC C 207, Type S, except that maximum free moisture shall be 1.5%.

(b) Quicklime shall conform to the following chemical requirements:

Minimum CaO + MgO:	90% by weight of total material
Maximum MgO:	8% by weight of total material

Quicklime shall be protected from contact with moisture prior to testing, shall be free flowing and shall be graded so that 100% will pass a 3/8" sieve. When quicklime is used in a slurry the gradation shall be a minimum of 95% passing the 3/4" sieve.

(c) Blended Lime: Blended lime shall contain at least 68% calcium oxide, and shall be reasonably free of deleterious substances.

P17.1002.04 WATER: Water suitable for human consumption may be used in mixtures with portland cement or lime without testing. Water obtained from other sources, when tested by AASHTO T 26, shall meet the following requirements.

	% By Weight (Max.)
Alkali	0.1
Solids (Organic)	0.1
Solids (Inorganic)	0.4
Salt (NaCl)	0.5
Sugar, Oil, or Acid	0.0

SPECIAL PROVISION P17.1005
PORTLAND CEMENT CONCRETE

P17.1005.01 GENERAL: Portland cement concrete shall consist of aggregates, portland cement and water combined to meet requirements of Table 10-11.

Mix types shall be used as follows:

Class	Use
5B3000	Base course
5.5B3800 or 5.25D3800	Pavements, walks, drives, revetments, curbs, etc.
6A4000	Structural concrete (except bridge superstructures)
7F4000	When specified or permitted
6.5A4200	Bridge superstructures
7A4400	Underwater concreting
6.5A5000	Prestressed concrete piles and girders
4A1800 or 4B1800	Sacked concrete

P17.1005.02 MATERIALS: Materials shall conform to the following Subsections:

Portland Cement	SP.P17.1002.01
Aggregates	SP.P17.1001.02
Admixtures	SP.P17.1008.02
Water	SP.P17.1002.04

P17.1005.03 HANDLING AND STORAGE OF CEMENT: Cement shall be transported in watertight conveyances and stored in silos or other approved facilities so that cement will be protected from dampness or water intrusion. Material which has become contaminated, partially set or containing lumps of caked cement shall not be used. When bagged cement is permitted, handling and storage shall be as directed.

Different brands or types, or the same brand or type from different mills, shall not be mixed or used alternately. This requirement may be waived in case of plant breakdown during production to allow concrete to be furnished from another plant to finish placement in progress.

P17.1005.04 HANDLING AND STORAGE OF AGGREGATES: Equipment and methods for stockpiling aggregates shall be such that no detrimental degradation or segregation of aggregate will result, no appreciable amount of foreign material will be incorporated into aggregate, and there will be no intermingling of materials.

Stockpiles of aggregates shall be well drained and shall have uniform moisture content.

Material shall not be added to working faces of stockpiles during operations.

Different grades and types of aggregates shall be stored in separate stockpiles.

Aggregates shall be handled from stockpiles or other sources to the batch plant so as to secure uniform grading of material. Aggregates that have become segregated or contaminated shall not be used. Aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or placed in bins for drainage. Transport containers may be used as bins when drainage is provided. Coarse aggregates in stockpiles that have dried to the extent that aggregates absorb mixing water shall be saturated with water.

P17.1005.05 QUALITY CONTROL OF CONCRETE: The contractor shall be responsible for quality control of materials, for initial determination and necessary subsequent adjustments in proportioning of materials, and for providing suitable equipment for determination of aggregate gradation, moisture, air content, slump, temperature, and trial mixes as necessary. Testing and analysis of the mix for quality control, the setting of dials, gages, scales or meters, adjusting batch weights, and accurate batching shall be the responsibility of the contractor.

The contractor shall provide the following DOTD certified personnel: Authorized Concrete Batcher, Authorized Concrete Field Tester, and Certified Concrete Technician. An Authorized Concrete Batcher shall perform batching operations. A Certified Concrete Technician shall be present at plant or jobsite when plant is in operation. Daily plant operations shall not begin unless the Authorized Concrete Batcher or Certified Concrete Technician is at the plant. Tests for gradation, moisture and adjusted batch weights shall be completed and shall be within specification limits before batching.

The Certified Concrete Technician shall design concrete mixes, make adjustments in batch weights for moisture content, perform necessary adjustments in proportioning of materials, and shall perform tests necessary for control of the mix within specification requirements. If a Certified Concrete Technician is not available at the jobsite, an Authorized Concrete Field Tester will be allowed to perform control tests for slump and report results to the Certified Concrete Technician. The use of an Authorized Concrete Field Tester will not relieve the Certified Concrete Technician from performing the remaining duties as outlined in these specifications.

(a) **Mix Design:** When requested, the contractor shall submit a proposed mix design giving intended sources of materials and mix design for concrete to be furnished. No concrete shall be produced until the mix design has been approved.

When unusual materials necessitate tests on trial mixes, the contractor shall conduct trial mixes and submit test results for slump, air content and 28-day compressive strength.

(b) **Quality Control Tests:** The contractor shall be responsible for determining gradation and moisture content of aggregates used and

for testing the mixture at the jobsite for slump and temperature. The mix produced shall conform to the approved mix design, except that variations will be permitted within specified control limits for individual samples.

(c) **Mix Adjustments:** The contractor may vary the ratio of fine to coarse aggregate, but in no case shall it be varied so as to materially affect the specified cement factor.

The mix produced shall be uniform and within specification limits.

When slump, mix temperature, or gradation measurements indicates that the mix may fall outside tolerance limits, the contractor shall immediately make adjustments to keep the mix within specified limits.

P17.1005.06 COMPOSITION OF CONCRETE:

(a) **Cement:** Allowable types of cement are as follows:

	Cement Types
Cast-in-Place Concrete (Non-Prestressed)	Type I, I(B) or II
Prestressed or Precast Concrete	Type I, I(B), I(C), II or III

(b) **Admixtures:** When approved, a water-reducing admixture may be used; however, no air-entraining admixture or fly ash will be permitted.

When air temperature is above 70°F, water-reducing admixture shall be the set-retarding type; when air temperature is 70°F or below, water-reducing admixture shall be the normal set type.

(c) Water:
Free water shall include all water entering the mix with aggregate, except water absorbed by aggregate.

(d) **Aggregate:** Coarse aggregate shall be the grade specified in Table 10-11.

(e) **Slump:** Mixtures shall have slumps within the ranges shown in Table 10-11 when tested by AASHTO T 119. The engineer may authorize an increase in maximum slump for concrete in walls and diaphragms less than 8" thick.

(f) **Compressive Strength:** Concrete mixtures shall provide compressive strengths not less than as specified in Table 10-11.

P17.1005.07 EQUIPMENT:

(a) Concrete plant and hauling equipment shall be DOTD certified. Sufficient plant capacity and transporting equipment to ensure delivery at required rate shall be provided. Rate of concrete delivery shall provide for proper handling, placing and finishing of concrete and maintain a workable surface. Methods of

delivering and handling concrete shall facilitate placing with a minimum of rehandling and without damage to structure or concrete.

(b) **Plant Equipment:** Materials shall be incorporated into mix by methods which will ensure uniform distribution. The amount of each material used in mix shall be recorded and certified by the Authorized Concrete Batcher or Certified Concrete Technician.

(1) **Measuring Devices:** Materials shall be measured by weighing except where other methods are authorized.

Fine aggregate and each size of coarse aggregate shall be weighed on scales, separately or cumulatively, in weigh hopper from separate bins. If cement is used in bulk, a separate scale system shall be used.

Batch plants may be equipped to proportion materials by automatic weighing devices.

Provisions shall be made for removal of overload from hopper by operator.

Individual aggregates shall be batched within 2%, and total weight of aggregate shall be within 1% of required weight.

Cement shall be within 1% of required weight. Cement in standard bags need not be weighed; however, when bag cement is used, quantities of aggregates for each batch shall be sufficient for 1 or more full bags of cement.

Mixing water shall be measured by volume or weight. Quantity of admixtures shall be measured within $\pm$ 3%. Admixtures shall be mechanically dispensed in a liquid state with mixing water. A separate dispensing device shall be provided for each mixture.

(2) **Ticket Printer System:** When an automatic ticket printer system is used, it shall be tamper-proof and shall print time of batching, amount of water, batch weights, moisture content of aggregate, and quantities of admixtures. Moisture content of aggregate or quantities of admixtures may be added to printed ticket by the Authorized Concrete Batcher or Certified Concrete Technician when automatic system does not have these capabilities. During a breakdown, quantities shall be determined by visual observation and certified as stated above.

When an automatic ticket printer system is not used, quantities and batching information shall be determined by visual observation, recorded, and certified correct by the Authorized Concrete Batcher or Certified Concrete Technician.

Records of batches shall show batch number, day, month, year, and time of day to the nearest minute. Maximum quantity of water that can be added at jobsite shall be shown on batch ticket. The engineer shall be provided with a copy of batch records identified with lot number and mix design number.

(c) **Hauling Equipment:** Hauling equipment shall be watertight and capable of discharging concrete at a controlled rate without segregation.

(1) **Truck Mixer:** Truck mixer shall be revolving drum type, equipped with pressurized, calibrated tanks for carrying a portion of mixing water.

Only the prescribed amount of water shall be placed in tank unless tank is equipped with a device by which quantity of water added can be verified.

Truck mixers shall have electrically or mechanically actuated revolution counters by which number of revolutions may be verified.

Truck mixer shall have attached thereto a metal plate on which is marked uses for which equipment is designed, maximum rated capacity of drum in terms of concrete volume, and rotation speed for both agitating and mixing speeds.

Truck mixers shall be equipped with means for accurately measuring amount of water used in each batch.

(2) **Agitator Hauling Equipment:** Agitators shall have blades or paddles to agitate mix and prevent segregation. Covers shall be provided when directed.

Agitator shall have attached thereto a metal plate on which is marked uses for which equipment is designed, maximum rated capacity in terms of concrete volume, and agitation speed.

(3) **Non-Agitator Hauling Equipment:** Bodies of nonagitating hauling equipment shall be smooth, mortartight, metal containers. Covers shall be provided when directed.

(d) **Portable Mixers:** Portable mixers shall have minimum capacity of 1 cubic yard and be capable of uniformly mixing and discharging concrete without segregation.

P17.1005.08 BATCHING AND MIXING:

(a) **General:** Concrete shall be mixed in a mixer of a type which will ensure uniform distribution of materials.

Pick-up and throw-over blades or mixing paddles in mixing unit shall be replaced when worn beyond limit recommended by manufacturer. The contractor shall have available a copy of manufacturer's design, showing dimensions and arrangements of blades in reference to original height and depth.

Mixing operations shall begin within 30 minutes after cement is added to aggregate. When cement is charged into a mixer drum containing surface-wet aggregate and air temperature is over 90°F, or when high early strength cement is used, this limit shall be reduced to 15 minutes. When mixing operations are interrupted, mixer shall be cleaned. Contents of mixer shall be removed from drum before materials for a succeeding batch are placed therein. Materials composing a batch shall be deposited simultaneously in an operating mixer. A portion of mixing water shall enter in advance of cement and aggregates. No mixer having a rated capacity of less than 1 cubic yard shall be used nor shall a mixer be charged in excess of its

rated capacity. Minimum size batch shall be 1 cubic yard.

Temperature of concrete mixture shall not exceed 90°F.

(b) **Central Plant and Site Mixing:** Concrete shall be mixed for at least 50 seconds. Mixer shall have a timing device which will automatically lock discharge lever when drum has been charged and release it at end of mixing period. Mixer shall be operated at a drum
speed for which it has been designed as shown on manufacturer's name plate on mixer.

(c) **Truck Mixing:** Aggregates and cement shall be measured and charged into drum at proportioning plant.

Size of batch in truck mixers shall not exceed capacity of mixer as stated by manufacturer and stamped on a metal plate on mixer. When a truck mixer is used for complete mixing, each batch shall be mixed for 70 to 130 drum revolutions at rate of rotation designated as mixing speed by manufacturer. Any additional mixing shall be at agitating speed. All materials, including mixing water, shall be in mixer drum before actuating revolution counter or taking initial reading.

When prescribed amount of water is added at batch platn and slump is on the low side at jobsite, it will be permissible to add a minimum of 75% of mixing water at batch plant and remaining mixing water at jobsite. Water added at jobsite may be added in 1 or 2 increments with additional mixing of 20 to 30 revolutions at designated mixer speed for each increment; however, total of 130 revolutions shall not be exceeded.

(d) **Partial Mixing at Central Plant:** When partial mixing is allowed at a central plant, mixing time at plant may be reduced to 30 seconds. Mixing shall be completed in a truck mixer at mixing speed. Mixing time in truck mixer shall be 10 to 70 revolutions.

(e) **Time Limitations:** Maximum time from addition of cement to mix to complete discharge of concrete shall be 90 minutes when transport is by truck mixer or agitator. Maximum time from addition of cement to mix to complete discharge of concrete shall be 45 minutes when transport is by non-agitator truck. In hot weather maximum time may be reduced by the engineer.

(f) Hauling Equipment: Wet batches of concrete may be transported in a truck mixer, agitator or other approved equipment. Maximum volume of mixed concrete transported in an agitator and agitation speed shall be in accordance with manufacturer's rating.

TABLE 10-11
PORTLAND CEMENT CONCRETE MIXTURES

Class	Min. Cement Content 94-lb Bags/C.Y.	Min. 28-day Compressive Strength, psi	Coarse Aggregate Grade	Slump (inches)	
					Slip-Formed
5B3000	5.0	3000	B	2-5	1-2
5.5B3800	5.5	3800	B	2-5	1-2
5.25D3800	5.25	3800	D	2-5	1-2
6A4000	6.0	4000	A	2-5	---
7F4000	7.0	4000	F	2-6	---
6.5A4200	6.5	4200	A	2-5	---
7A4400	7.0	4400	A	6-8	---
6.5A5000	6.5	5000	A	2-6	---
4A1800	4.0	1800	A	2-5	---
4B1800	4.0	1800	B	2-5	---

SPECIAL PROVISION P17.1006
REINFORCING STEEL

P17.1006.01 REINFORCING STEEL: Reinforcing steel for bridges shall be Grade 60; in other structures, deformed bars No. 3 thru No. 6 shall be Grade 40 or 60; No. 7 and larger shall be Grade 60. No. 2 bars need not be deformed. Deformed bars shall conform to Headings (a), (b) or (c) below. Wire conforming to Heading (d) below may be used in lieu of No. 2 bars when furnished in size W 5.

(a) Billet-Steel Bars shall conform to ASTM A615.

(b) Rail-Steel Bars shall conform to ASTM A 616.

(c) Axle-Steel Bars shall conform to ASTM A 617.

(d) Cold-Drawn Steel wire shall conform to ASTM A 82 with the following amendment: For material testing over 110,000 psi tensile strength in high strength applications such as spirals and ties, the 25% minimum reduction in area shall be reduced 5% for each 10,000 psi increment of tensile strength exceeding 110,000 psi.

(e) Welded Steel Wire Fabric shall conform to ASTM A 185.

(f) Epoxy Coated Reinforcing Steel shall conform to AASHTO M 284 and shall be a product listed on the QPL.

P17.1006.02 SPIRAL REINFORCING: Spiral reinforcing shall conform to Subsection SP.P17.1006.01 (a), (b),
(c) or (d).

P17.1006.03 TIE BARS: Tie bars shall conform to Subsection SP.P17.1006.01 (a), (b) or (c). Tie bars to be bent and restraightened during construction shall be Grade 40.

P17.1006.04 DOWEL BARS: Dowel bars shall be plain steel bars conforming to Subsection SP.P17.1006.01 (a), (b) or (c). Dowels shall have a uniformly round cross section and shall be saw cut, smooth and free of burrs and projections.

Dowel bars shall be plastic coated in accordance with AASHTO M 254, Type A.

P17.1006.05 STEEL STRAND FOR PRETENSIONING: Strand for pretensioning shall conform to ASTM A 416.

P17.1006.06 BARS FOR POST-TENSIONING: Bars shall be steel conforming to ASTM A 722 having a minimum modulus of elasticity of 25,000,000 psi, and shall be equipped with wedge-type end anchorages which will develop minimum specified ultimate bar stress on nominal bar area.

P17.1006.07 PARALLEL WIRE ASSEMBLIES FOR POST-TENSIONING: Assemblies shall consist of parallel wire of specified number and size Wire shall be high tensile strength, hard-drawn, stress-relieved and uncoated. Wire shall conform to ASTM A 421, Type WA.

SPECIAL PROVISION P17.1008
CONCRETE CURING MATERIALS, ADMIXTURES, AND FINISH COATING

P17.1008.01 CURING MATERIALS:

(a) **Liquid Membrane-Forming Compounds:** This material shall conform to AASHTO M 148 and be a product listed in the QPL. Types shall be Type 2 white-pigmented or Type 1-D, clear or translucent with a fugitive dye, as specified.

(b) Burlap Cloth shall conform to AASHTO M 182, Class 3.

(c) Waterproof Paper shall conform to AASHTO M 171.

(d) White Polyethylene Sheeting shall conform to AASHTO M 171.

(e) Combined Burlap and White Polyethylene Sheeting shall conform to AASHTO M 171.

P17.1008.02 ADMIXTURES: Concrete admixtures shall be products listed in the QPL.

(a) **Water-Reducing Admixtures:** These admixtures shall conform to ASTM C 494, Type A.

(b) **Water-Reducing, Set-Retarding Admixtures:** These admixtures shall conform to ASTM C 494, Type D.

(c) **Set-Accelerating Admixtures:** These admixtures shall conform to ASTM C 494, Type C, and shall contain no chlorides.

P17.1008.03 APPLIED FINISH COATING: This material shall be a product listed in the QPL and shall provide a uniform, fine-textured finish.

Material shall consist of a water-based coating containing pigments, texturizers, resins and water. Coating shall contain fungicides to prevent growth of mildew, mold, etc. No field additions to coating will be permitted.

SPECIAL PROVISION P17.1011
STRUCTURAL METALS

P17.1011.01 STRUCTURAL STEEL: Structural steel shall conform to ASTM A 709 for the following grades:

Type of Steel	Grade
Structural Carbon Steel	36
High-Strength, Low-Alloy Structural Steel	50
High-Strength, Low-Alloy, Corrosion Resistant Structural Steel	50 W
Quenched-Tempered, Low-Alloy Structural Steel	70 W
High-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding	100

P17.1011.02 RIVET STEEL:

(a) Structural Rivet Steel shall conform to ASTM A 502, Grade 1.

(b) High Strength Rivet Steel shall conform to ASTM A 502, Grade 2.

P17.1011.03 COPPER BEARING STEEL: Copper-bearing steel shall contain at least 0.2% copper.

P17.1011.04 STEEL CASTINGS:

(a) Steel castings shall conform to ASTM A 27, Grade 70-36.

(b) High strength steel castings shall conform to ASTM A 148.

(c) Chromium alloy steel castings shall conform to ASTM A 743, Grade CA-15.

P17.1011.05 IRON CASTINGS: Iron castings to be true to pattern in form and dimensions and free form pouring faults, sponginess, cracks, blowholes and other defects in positions affecting their value for service intended. Castings shall be boldly filleted at angles, and rises shall be sharp and perfect. Castings shall be cleaned of scale and sanded to a smooth, clean, uniform surface.

a. Gray Iron Castings shall conform to the latest edition of AASHTO M 306.

b. Malleable Castings shall conform to ASTM A 47, Grade 32510.

c. Ductile Iron Castings shall conform to ASTM A 536, Grade 60-40-18.

P17.1011.06 STEEL BEARING PILES: Steel bearing piles shall conform to ASTM A 709, Grade 36.

P17.1011.07 SHEET PILES: Steel sheet piles shall conform to ASTM A 328. Aluminum sheet piles shall conform to ASTM B 221, Alloy 6061-T6 or 6063-T6 or ASTM B 209, Alloy 3064-H34.

P17.1011.08 STEEL PIPE PILES: Steel pipe piles shall conform to ASTM A 252, Grade 2.

P17.1011.09 SHEAR CONNECTORS: Shear connector studs shall be Type B studs conforming to ANSI/AASHTO/AWS D 1.5-88.

P17.1011.10 CONCRETE ANCHOR STUDS: Concrete anchor studs for end dam plates, bearing plates or other concrete anchorage shall be Type A studs conforming to ANSI/AASHTO/AWS D 1.5-88.

P17.1011.11 BOLTS, NUTS AND WASHERS:

(a) **Carbon Steel Bolts, Nuts and Washers (Except High Strength Bolts):** Bolts shall conform to ASTM A 307, Grade A or B. Nuts shall conform to ASTM A 563. Circular washers shall conform to ASTM F 436.

(b) **High Strength Bolts, Nuts and Washers:** Bolts, nuts and washers shall have plain surface finish.

(1) Bolts shall conform to ASTM A 325 or A 490, as specified. For ASTM A 325 bolts, Type 1 bolts shall be used.

(2) Nuts shall conform to ASTM A 563, Grade DH or ASTM A 194, Grade 2H.

(3) Circular washers shall conform to ASTM F 436.

(c) **Galvanization:** Galvanization shall conform to ASTM A 153.

P17.1011.12 RAILING PIPE: Pipe for railings and other structural uses shall be galvanized steel pipe conforming to ASTM A 53.

SPECIAL PROVISION P17.1016
SEWER PIPE

P17.1016.01 GRAVITY SEWER PIPE: Contractor shall provide sewer pipes with the inside diameter shown on the Contract Documents. Diameters shown on the Drawings and listed in the pay items represent the required inside diameters, regardless of pipe material.

P17.1016.01.1 Plastic Pipe: Pipe may be any of the following types:

P17.1016.01.1.1 Polyvinyl Chloride (PVC) Pipe and Fittings:

a. Polyvinyl chloride sewer pipe shall be green in color.

P17.1016.01.1.1.1 PVC for Direct Bury Application:

a. Solid Wall PVC

1. Pipe shall be of solid-wall construction and be available in laying lengths not exceeding 20 feet.

2. Pipe 15" diameter or smaller shall conform to ASTM D 3034; pipe larger than 15" diameter shall conform to ASTM F 679.

3. Material for PVC pipe from 4” to 15” shall conform to the requirements of ASTM D 1784 for cell classifications 12454. Material for PVC pipe from 18” to 36” shall conform to the requirements of ASTM D 1784 for cell classifications 12364 or 12454. Maximum filler content shall be 10 percent.

4. All pipe shall have an SDR of 35 and a minimum pipe stiffness of 46 psi when tested in accordance with ASTM D 2412. Where pipe depth is greater than 12 ft., provide pipe in SDR 26 with minimum pipe stiffness of 115 psi.

5. Joints shall be an integral bell and spigot-type with solid cross section elastomeric or rubber gasket ring conforming to ASTM D 3212. Gaskets shall meet the requirements of ASTM F 477. Use elastomeric factory installed gaskets to make joints flexible and watertight. Lubricant for rubber-gasketed joints shall be water soluble, non-toxic, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets. The manufacturer shall test a sample from each batch conforming to the requirements of ASTM D 2444.

6. All sewer fittings and accessories shall conform to the requirements of ASTM F 1336 and ASTM D 3034 or ASTM F 679 and shall have bell and/or spigot compatible with pipe. The stiffness of the fittings shall not be less than the stiffness of the adjoining pipe.

b. Large Diameter Closed Profile PVC (21” – 54” only)

1. PVC closed profile pipe shall be permitted for 21” through 54” direct bury gravity sewer pipe.

2. The pipe shall meet the requirements of ASTM F-1803, Closed Profile, and have a smooth interior and effectively smooth exterior. Fittings shall be fabricated from pipe meeting these standards.

3. Pipe and fittings shall be fabricated from PVC compounds meeting the minimum requirements of cell classification 12364 as defined by ASTM D-1784.

4. Joints shall have an integral bell and spigot with an elastomeric gasket and shall conform to the requirements of ASTM D-3212 and ASTM F-477. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. The use of putty, fillers, rubber or plastic inserts or wedges to form either the inner or outer wall of the pipe will not be allowed on spigots or bells. Jointing shall be accomplished in accordance with the manufacturer's recommendations.

5. PVC closed profile pipe shall be designed to provide a minimum pipe stiffness value of 60 psi for all sizes when tested in accordance with ASTM D- 2412.

6. Each pipe length and fitting shall be clearly marked with the name of the manufacturer, nominal size, cell classification, ASTM designation F-1803, pipe stiffness designation "PS-60", and manufacturer's date code.

7. Handling and storage shall be in accordance with the pipe manufacturer's recommendations.

P17.1016.01.1.1.2 Non-metallic Restrained Joint PVC:

a. Pipe shall be manufactured only from water distribution pipe and couplings conforming to AWWA C900 (4-inch through 12-inch) and AWWA C905 (14-inch through 48-inch). The restrained pipe joint system shall meet all short and long-term pressure test requirements of AWWA C900 and AWWA C905, respectively.

b. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4 degrees F., in accordance with the requirements of ASTM D2837.

c. Nominal outside diameters and wall thicknesses of thrust-restrained pipe shall conform to the requirements of AWWA C900 and AWWA C905. Pipe shall be furnished in standard lengths of 20 feet.

d. PVC pipe shall be in accordance with Table 1016-1.

e. Green or white pipe shall be supplied, unless otherwise agreed upon at time of purchase.

f. Pipe and couplings shall be made from unplasticized PVC compounds having minimum cell classification of 12454, as defined in ASTM D1784.

g. Pipes shall be joined using non-metallic couplings which have been designed as an integral system for maximum reliability and interchangeability. High-strength flexible

thermoplastic splines shall be inserted into mating precision-machined grooves in the pipe and coupling to provide full 360-degree restraint with evenly distributed loading. No external pipe-to-pipe restraining devices, which clamp onto or otherwise damage the pipe surface as a result of point-loading, shall be permitted.

h. Couplings shall be designed for use at the rated pressures of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage requirements of ASTM D3139.

i. Every pipe and machined coupling shall pass AWWA C900/C905 hydrostatic proof test requirements.

j. Pipe shall be legibly and permanently marked in ink with the following information:

1. Manufacturer and Trade Name

2. Nominal Size and DR Rating / Pressure Class

3. Hydrostatic Proof Test Pressure (NSF-61)

4. Manufacturing Date Code

P17.1016.01.1.1.3 Fusible Polyvinylchloride (FPVC) Pipe:

a. Fusible PVC pipe shall be permitted for only 4" through 16" diameter gravity sewer pipe.

b. All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784.

c. Fusible polyvinylchloride pipe shall conform to ASTM D3034 or ASTM F679.

d. Fusible polyvinylchloride pipe may instead conform to AWWA C900 or AWWA C905, if applicable. Testing shall be in accordance with AWWA standards for any of these pipe types. If the AWWA standards are used, pipe diameters shall be in Ductile Iron Pipe Sizes (DIPS).

e. Rework material shall be allowed per ASTM D3034, ASTM F679, AWWA C900 or AWWA C905 standards.

f. All pipe shall have an SDR of 35 and a minimum pipe stiffness of 46 psi when tested in accordance with ASTM D 2412. Where pipe depth is greater than 20 ft., provide pipe in SDR 26 with minimum pipe stiffness of 115 psi.

g. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

h. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.

i. Fusible polyvinylchloride pipe shall be green in color for wastewater use.

j. Pipe generally shall be marked per AWWA C900 or AWWA C905, and shall include as a minimum:

1. Nominal pipe size

2. PVC

3. Dimension Ratio, Standard Dimension Ratio or Schedule (omit for ASTM D3034 or ASTM F679 pipe)
4. Pipe legend or stiffness designation, or AWWA pressure class, or standard pressure rating for non-AWWA pipe

5. AWWA Standard designation number or pipe type for non-AWWA pipe (omit for ASTM D3034 or ASTM F679 pipe)

6. Extrusion production-record code

7. Trademark or trade name

8. Cell Classification 12454 and/or PVC material code 1120 may also be included.

k. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

l. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed with the following minimum requirements:

1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.

4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process.

m. Handling and storage shall be in accordance with the pipe manufacturer's recommendations.

P17.1016.01.1.2 High Density Polyethylene (HDPE) Pipe and Fittings:

a. HDPE Pipe for gravity sewers shall be as specified in Section SP.P17.1016.02.2.

b. HDPE Pipe for gravity sewers shall also have a light interior color.

c. Electrofusion Fittings: Fittings shall be made of HDPE material in accordance with subsection SP.P17.1016.02.2a. Electrofusion (EF) fittings shall have a manufacturing standard of ASTM F 1055.

1. These fittings shall be supplied with an integral identification resistor and an ISO compliant 24 bit barcode which is recognized by fusion processors to set the proper fusion parameters.

2. The electrofusion processor used must be capable of reading and storing the input parameters and the fusion results for later download to a record file which will be made available to the Engineer.

3. These fittings, such as EF couplings, gasketed EF sewer saddles, and EF flex restraints, shall be for use with pipe conforming to ASTM D 2513/3035, F-714, and with butt fittings comforming to ASTM D 3216 as applicable.

4. Fittings shall have a pressure rating equal to the pipe unless otherwise specified.

5. ASTM F2620 and the pipe manufacturer's recommended procedure shall be observed for butt fusion and saddle fusion joints.

6. ASTM F1290 and the electrofusion fitting manufacturer's recommended joining procedure shall be observed for electrofusion joints.

7. Field fusion joints shall be made by qualified fusion technicians. Qualification of the fusion technician shall be demonstrated by evidence of certified training within the past year, specific to the fusion joint type and equipment to be utilized for the project.

P17.1016.01.2 Ductile Iron Pipe: Ductile Iron Pipe for gravity sewers shall be as specified in Section SP.P17.1016.02.3.

P17.1016.01.3 Steel Pipe: Pipe less than 6" diameter shall be galvanized steel pipe conforming to ASTM A 53, Type E or S, Grade A.

Pipe 6" diameter and larger shall conform to AWWA C 200, Class 125. Fittings shall conform to AWWA C 208. Pipe and fittings shall be coal-tar lined and coated in accordance with AWWA C 203.

P17.1016.01.4 Fiberglass Reinforced Polymer (FRP) Pipe:

a. The pipes shall be manufactured in accordance with ASTM D3262. Pipe materials shall conform to the following:

1. Resin Systems: The manufacturer shall use only approved polyester resin systems with a proven history of performance of in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.

2. Glass Reinforcements: The reinforcing glass fibers to be used to manufacture the components shall be of the highest quality commercial grade of glass filaments suitably treated with binder and sizing compatible with impregnating resins.

3. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

4. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally affect the performance of the product.

5. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufacturers and be suitable for the service intended.

b. The internal liner resin shall be suitable for service as sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements of ASTM D 3681.

c. Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 46 psi.

d. The pipe shall be field connected with glass reinforced plastic sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness. The joints shall utilize elastomeric sealing gaskets and meet the performance requirements of ASTM D4161.

e. Fittings: Flanges, elbows, reducers, tees, and other fittings shall be capable of withstanding operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass fiber reinforced overlays.

f. Pipe shall be supplied in nominal lengths of 20 feet. Shorter and custom lengths will be supplied as defined by the project requirements. The minimum wall thickness shall be per the manufacturer's design in accordance with ASTM D3567. Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/8".

P17.1016.01.5 Vitrified Clay Pipe (VCP) for Microtunneling and Pipe-Jacked Tunnels:

a. Vitrified clay pipe and joints for jacking and microtunneling pipe shall conform to ASTM C 700 and ASTM C 1208.

b. Joints: All VCP joints shall consist of watertight seat, an elastomeric sealing element, a sleeve, and a load distribution medium (compression disc).

1. Elastomeric Sealing Gaskets: Gaskets shall conform to the requirements

ASTM C 1208 and the test requirements of ASTM D 395, D 412, D 471 and D 573.

2. All sleeves shall bridge between pipe sections. Stainless steel joint sleeves/couplings shall meet the requirements per grade 316L of ASTM A240\240M.

3. Water tightness: Joints shall be fully watertight and shall develop the full strength of the pipe. Sealing elements shall be bonded to the bearing surface or shall be positively positioned in a recess. The manufacturer shall certify the joints to be watertight to exceed the maximum project design water head pursuant to ASTM C 828, Standard Test Methods for Low Pressure Air Testing of Vitrified Clay Pipe Lines.

4. Load Distribution Medium: All joints shall be equipped with a load distribution medium (i.e., Plywood spacer or compression disc) which shall distribute the jacking force uniformly around the pipe's jacked bearing surface. All load distribution mediums shall prevent the jacking load from being concentrated on a specific area (i.e., Point loading) of the pipe that would result in damage or failure to the pipe. The width of the compression disc shall not exceed the maximum wall thickness of the pipe, nor shall it extend into the flow line or inhibit the installation of the sleeve onto the spigot end of the connecting pipe.

5. When the pipes are assembled, the joints shall not extend beyond the pipes outside surface and shall not restrict installation during jacking.

6. Joint deflection shall be in strict accordance with manufacturer's recommendations.

c. Clay pipes shall meet applicable standards when tested in accordance with ASTM C 301.

P17.1016.01.6 Fiberglass Reinforced Polymer (FRP) Pipe for Micro tunneling and Pipe-Jacked Tunnels (<u>NOT APPLICABLE FOR S.P. NO. H.012232</u>):

a. The pipes shall be manufactured in accordance with ASTM D3262. Pipe materials shall conform to the following:

1. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been collected from applications of a composite material of similar construction and composition as the proposed product.

2. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade glass filaments with binder and sizing compatible with impregnating resins.

3. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

4. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally effect the performance of the product.

5. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufacturers and be suitable for the service intended.

b. Pipe manufacturing process to result in a dense, nonporous, corrosion-resistant, consistent composite structure. Do not use stiffening ribs or rings.

c. The internal liner resin shall be suitable for service as sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases. Pipe shall meet or exceed requirements of ASTM D 3681.

d. Joints: All FRP joints shall consist of watertight seat, an elastomeric sealing element, a sleeve, and a load distribution medium (compression disc). All FRP joints shall meet the performance requirements of ASTM D 4161 and conform to the following:

1. Seat: The seat shall be formed at the time of fabrication or machined after fabrication and shall be watertight when assembled and combined with an elastomeric sealing element.

2. Elastomeric Sealing Gaskets: Gaskets shall conform to the requirements of ASTM F 477.

3. All sleeves shall bridge between pipe sections. Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings.

4. Load Distribution Medium: All joints shall be equipped with a load distribution medium (i.e., Plywood spacer or compression disc) which shall distribute the jacking force uniformly around the pipe's jacked bearing surface. All load distribution mediums shall prevent the jacking load from being concentrated on a specific area (i.e., Point loading) of the pipe that would result in damage or failure to the pipe. The width of the compression disc shall not exceed the maximum wall thickness of the pipe, nor shall it extend into the flow line or inhibit the installation of the sleeve onto the spigot end of the connecting pipe.

5. The joint shall have the same outside diameter as the pipe so when the pipes are assembled; the joints are flush with the pipes outside surface and does not restrict the installation during jacking.

6. Allowable joint deflection shall be in strict accordance with the manufacturer's recommendations.

e. Fittings: Flanges, elbows, reducers, tees, and other fittings shall be capable of withstanding operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass fiber reinforced overlays.

f. Dimensions and Tolerances: All dimensions and sizes of pipe shall conform to the following:

1. Diameters: The actual outside diameter of the pipes shall be in accordance with Table 3 of ASTM D 3262 for gravity sewers.

2. Lengths: The pipe standard length will be approximately 10 feet. A maximum of 10 percent of the lengths, excluding special order pipes, may be supplied in random lengths.

3. Wall Thickness: The minimum average wall thickness shall be the stated design thickness. The minimum single point thickness shall not be less than 90 percent of the stated design thickness.

4. End Squareness: Pipe ends shall be square to the pipe axis.

5. Tolerance of Fittings: The tolerance of the angle of an elbow and the angle between the main and leg of a wye or tee shall be plus or minus 2 degrees. The tolerance on the laying length of a fitting shall be plus or minus 2 inches.

g. Stiffness Classes: Stiffness class of FRP pipe shall satisfy design requirements, but shall not be less than 46 psi. Stiffness class of FRP in a pipe jacking operation shall be governed either by the ring deflection limitations or by a pipe design providing longitudinal strength required by the jacking method and shall satisfy design requirements stated below:

    1. Pipe stress calculations based on jacking loads shall be performed to conform with Section 819 - Microtunneling and Pipe Jacked Tunnels.

    2. Ring deflection calculations shall be performed accordance to AWWA-M5 for fiberglass pipe in buried applications, to ensure that predicted pipe deflection will be less than 5 percent under long-term loading conditions (soil prism load) for the highest density of soil overburden and surcharge loads. Deflection on calculations shall be prepared using long- term (drained) values for soil parameters contained in the geotechnical investigation report for the Project, or other site-specific data obtained by the Contractor as approved by the Engineer.

P17.1016.01.7 Polymer Concrete Pipe for Microtunneling and Pipe-Jacked Tunnels (<u>NOT APPLICABLE FOR S.P. NO. H.012232</u>):

a. Polymer Concrete Pipe (PCP) for use in microtunneling/tunneling installations for sanitary sewers shall be manufactured in accordance with ASTM D 6783-02.

    1. Minimum compression strength of 13,000 psi is required. The pipe-jacking load for the pipe shown on the Drawings shall be determined by the contractor for the geotechnical and other specific conditions of this project. Do not use stiffening ribs or rings.

b. Wall Resin: The polyester wall resin used to bond the aggregate material shall be isophthalic, orthophthalic, or other approved resin with a minimum tensile elongation of two (2) percent. The resin content shall be no less than 9 percent by weight. The resin used shall have a proven history of performance in chemical solutions in a sanitary sewer environment ranging from pH 1.0 to pH 10.0.

c. Aggregate: All PCP shall be comprised of aggregates that have a maximum grain size of 5/8 inch and sand that contains a maximum grain size of 0.08 inches. The filler material shall be a quartzite powder. All aggregate, sand, and filler material shall be washed and dried prior to fabrication. All aggregate and sand materials used in fabrication of the pipe shall be of like material and mined from the same source.

d. Joints: All PCP joints shall consist of watertight seat, an elastomeric sealing element, a sleeve, and a load distribution medium (compression disc). All PCP joints shall meet the performance requirements of ASTM D 4161 and conform to the following:

1. Seat: The seat shall be formed at the time of fabrication and shall be watertight when assembled and combined with an elastomeric sealing element. Seats shall not be ground after fabrication.

2. Elastomeric Sealing Gaskets: Gaskets shall conform to the requirements of ASTM F 477.

3. All sleeves shall bridge between pipe sections. Stainless steel joint sleeves/couplings shall meet the requirements of ASTM A 276.

4. Water tightness: Joints shall be fully watertight and shall develop the full strength of the pipe. Sealing elements shall be bonded to the bearing surface.

5. Load Distribution Medium: All joints shall be equipped with a load distribution medium (i.e., Plywood spacer or compression disc) which shall distribute the jacking force uniformly around the pipe's jacked bearing surface. All load distribution mediums shall prevent the jacking load from being concentrated on a specific area (i.e., Point loading) of the pipe that would result in damage or failure to the pipe. The width of the compression disc shall not exceed the maximum wall thickness of the pipe, nor shall it extend into the flow line or inhibit the installation of the sleeve onto the spigot end of the connecting pipe.

6. The joint shall have the same outside diameter as the pipe so when the pipes are assembled, the joints are flush with the pipes outside surface and does not restrict the installation during jacking.

7. No joint deflection of any amount shall be allowed.

e. Dimensions and Tolerances: All dimensions and sizes of pipe shall conform to the following:

1. Length: The typical pipe lengths shall have nominal dimensions of 3 feet, 6 feet or a maximum length of 10 feet.

2. Minimum wall thickness: The minimum wall thickness shall be as needed to support the anticipated jacking forces with a factor of safety of 3.0 at the joints.

3. Out of straight: Pipes shall not deviate from straight by more than 0.06 inch

per linear foot. Measurement shall be taken by measuring the gaps between the pipe wall and a straightedge placed along any longitudinal line on the pipe's exterior surface.

4. Out of round: The inside and outside diameters shall not vary from a true circle by more than 1.0 percent of its designed diameter. The out-of- round dimensions are the difference between the maximum and minimum diameters measured at any one location along the barrel. The compression disk shall be installed in the bell end of the pipe at the factory as part of the manufacturing process.

5. Out of square: The ends of the pipe shall be perpendicular to the straight long axis with a tolerance of 0.125 degrees.

6. Diameter: All diameters for PCP pipe shall be in accordance with tolerances specified by Table 2 in ASTM D 6783-02.

P17.1016.02 FORCE MAIN SEWER PIPE:

a. Contractor shall provide sewer force main pipes with Ductile Iron Pipe (DIPS) diameters shown on the Contract Documents. Diameters shown on the Drawings and listed in the pay items represent the required DIPS diameters, regardless of pipe material, unless otherwise noted.

P17.1016.02.1 Polyvinylchloride (PVC) Pipe and Fittings:

a. PVC pressure pipe (4-inch through 36-inch) shall conform to the applicable requirements of AWWA C900 and the additional requirements herein.

b. The pipe shall be of the diameter and pressure class indicated, shall be furnished complete with rubber gaskets, shall be provided as required in the Contract Documents.

c. Materials used in manufacture of the pipe shall be tested in accordance with the requirements of this Section and the applicable ASTM and AWWA standards.

d. Joints for the buried PVC pipe shall be an integral bell manufactured on the pipe employing a rubber ring joint. The bell shall be the same thickness as of the pipe barrel, or greater thickness. Where indicated, restrained joint pipe shall be ductile iron pipe or PVC pipe with approved Mechanical Joint (MJ) restrainer glands.

e. Joint deflection at the joint shall not exceed 75 percent of the maximum deflection recommended by the manufacturer. No deflection of the joint shall be allowed for joints that are over-belled or not belled to the stop mark.

f. PVC pipe shall be in accordance with the following table:

TABLE 1016-1
PVC PRESSURE PIPE
DATA

WALL CONSTRUCTION	MANUFACTURER	AWWA DESIGNATION	SDR (MAX)	DIAMETER SIZE RANGE
Solid	See QPL	AWWA C900 (235 psi)	DR 18	4" to 12"
		AWWA C900 (165 psi)	DR 25	14" to 36"

g. Fittings shall be ductile iron conforming to the requirements of AWWA C153 or AWWA C110 and shall have a minimum pressure rating of 250 psi. Bends, tees and other ductile iron fittings shall be restrained with the use of an approved Mechanical Joint restrainer gland or other means as indicated in the Contract Documents. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.

h. All ductile iron fittings shall be lined and coated with Ceramic Epoxy: Protecto-401 by Induron Protective Coatings, Series 431 PermaShield by TNEMEC, Permox-CTF by Permite, or approved equal.

i. Each fitting shall be clearly labeled to identify its size and pressure class.

j. Gaskets shall meet the requirements of ASTM F477. Use elastomeric factory-installed gaskets to make joints flexible and watertight. Lubricant for rubber-gasketed joints shall be water soluble, non-toxic, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

k. Polyvinyl chloride sewer force main pipe shall be green in color.

P17.1016.02.1.1 Fusible Polyvinylchloride (FPVC) Pipe:

a. Fusible PVC pipe shall be permitted for only 4" through 16" diameter sewer force main pipe.

b. Fusible polyvinylchloride pipe shall conform to AWWA C900.

c. Rework material shall be allowed per AWWA C900 standards.

d. Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

e. Fusible polyvinylchloride pipe shall be manufactured in a standard 20', 30' or 40' nominal length.

f. PVC pipe shall be in accordance with Table 1016-1.

g. Fusible polyvinylchloride pipe shall be green in color for wastewater use.
Pipe generally shall be marked per AWWA C900, and shall include as a minimum:

1. Nominal pipe size
2. PVC
3. Dimension Ratio, Standard Dimension Ratio or Schedule
4. AWWA pressure class
5. AWWA Standard designation number
6. Extrusion production-record code
7. Trademark or trade name
8. Cell Classification 12454 and/or PVC material code 1120 may also be included.

h. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

i. Connections and Fittings:

1. Connections shall be defined in conjunction with the coupling of project piping, as well as the tie-ins to other piping systems.

2. Ductile Iron Fittings:

i. Fittings shall be ductile iron conforming to the requirements of AWWA C153 or AWWA C110 and shall have a minimum pressure rating of 250 psi. Bends, tees and other ductile iron fittings shall be restrained with the use of an approved Mechanical Joint restrainer gland or other means as indicated in the Contract Documents. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.

ii. All ductile iron fittings shall be lined and coated with Ceramic Epoxy: Protecto-401 by Induron Protective Coatings, Series 431 PermaShield by TNEMEC, Permox-CTF by Permite, or approved equal.

iii. Each fitting shall be clearly labeled to identify its size and pressure class.

3. Fusible Polyvinyl Chloride Sweeps or Bends:

i. Fusible polyvinyl chloride sweeps or bends shall conform to the same sizing convention, diameter, dimensional tolerances and pressure class of the pipe that they are joining together.

ii. Fusible polyvinyl chloride sweeps or bends shall be manufactured from the same fusible polyvinyl chloride pipe being used for the

installation, and shall have at least 2 feet of straight section on either end of the sweep or bend to allow for fusion of the sweep to the pipe installation.

iii. Standard fusible polyvinyl chloride sweep or bend angles shall not be greater than 22.5 degrees, and shall be used in nominal diameters ranging from 4 inch through 16 inch.

j. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed with the following minimum requirements:

1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.

4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process.

k. Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed with the following minimum requirements:

1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.

4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process.

l. Handling and storage of the pipe shall be in accordance with the pipe manufacturer's recommendations.

P17.1016.02.1.2 Small Diameter PVC Pipe and Fittings:

a. Small diameter PVC pressure pipe (1 ½-inch through 3-inch) shall be Schedule 40, Iron Pipe Size (IPS) conforming to ASTM D 1785 and the additional requirements herein.

b. Materials used in manufacture shall have a Cell Class of 12454 as identified in ASTM D 1784.

c. PVC Schedule 40 (IPS) fittings shall conform to ASTM D 2466.

d. Small diameter Schedule 40 PVC pipe shall be bell end x plain end type except when plain end is necessary between two fittings. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent conforming to ASTM D 2564.

e. Small diameter PVC sewer force main pipe shall be white in color.

P17.1016.02.2 High Density Polyethylene (HDPE) Pipe and Fittings:

a. Polyethylene pipe shall be made from HDPE material having a material code of PE3408 or higher. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE345464C (345464E for gray HDPE pipe).

b. Pipe and Fittings: The pipe shall meet the requirements of AWWA C906. Pipe shall be in ductile iron pipe sizes (DIPS). The pressure rating shall be 160 psi with a maximum dimension ratio (DR) of 11. Laying lengths shall be 40-ft standard.

c. Pipe and fittings shall be marked as prescribed by AWWA C906. Pipe markings shall include nominal size, OD base (ie: 12-inch ductile iron pipe sizing, DIPS), dimension ratio, pressure class, AWWA C906, manufacturer's name, manufacturer's production code including day, month, and year extruded, and manufacturer's plant and extrusion line.

d. Workmanship: Furnish pipe and fittings that are homogeneous throughout and free from visible defects such as foreign inclusions, concentrated ridges, discoloration, pitting, varying wall thickness, cracks, holes, foreign material, blisters, and other deformities. Pipe with gashes, nicks, abrasions, or any such physical damage which may have occurred during storage and/or handling, which are larger/deeper than 10% of the wall thickness shall not be used and shall be removed from the construction site. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

e. HDPE sewer force main pipe shall have a green colored stripe on along the exterior length of the pipe.

f. Connections and Fittings:

    1. Connections shall be defined in conjunction with the coupling of project piping, as well as the tie-ins to other piping systems.

    2. MJ (Mechanical Joint) Adapters are to be used when connecting HDPE pipe to Ductile Iron Fitting. MJ Adapters are manufactured in standards

IPS and DIPS sizes for connecting IPS sized or DIPS sized polyethylene pipe to mechanical joint fittings and appurtenances that meet AWWA C111.

3. Ductile Iron Fittings:

   i. Fittings shall be ductile iron conforming to the requirements of AWWA C153 or AWWA C110 and shall have a minimum pressure rating of 250 psi. Bends, tees and other ductile iron fittings shall be restrained with the use of an approved Mechanical Joint restrainer gland or other means as indicated in the Contract Documents. Ductile iron fittings and glands must be installed per the manufacturer's guidelines.

   ii. All ductile iron fittings shall be lined and coated in accordance with Section P17.1016.02.3.

   iii. Each fitting shall be clearly labeled to identify its size and pressure class.

   iv. Gaskets shall meet the requirements of ASTM F477. Use elastomeric factory-installed gaskets to make joints flexible and watertight. Lubricant for rubber-gasketed joints shall be water soluble, non-toxic, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

P17.1016.02.3 Ductile Iron Pipe and Fittings:

a. Lined and polyethylene-wrapped ductile iron pipe shall conform to AWWA C150 and C151, subject to the supplemental requirements in this Section. The pipe shall be of the diameter and class indicated, and shall be provided complete with rubber gaskets, specials, and fittings as required under the Contract Documents. Nominal pipe laying lengths shall be 20 feet.

b. Fittings shall be ductile iron conforming to the requirements of AWWA C153 or AWWA C110 and shall have a minimum pressurerating of 250 psi.

c. All pipe shall have a minimum pressure rating as indicated in Table 1016-2, or higher ratings as indicated in the Contract Documents.

TABLE 1016-2
MINIMUM PRESSURE CLASS

PIPE SIZES (inch)	PRESSURE CLASS (psi)
4–12	350
14–20	250
24	200

30–64	150

d. The Contractor shall legibly mark specials 24-inches in diameter and larger in accordance with the laying schedule and marking diagram. Each fitting shall be marked at each end with top field centerline.

e. Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing on the Contract Drawings. The locations of correction pieces and closure assemblies are shown on the Contract Drawings. Any change in location or number of said items shall only be as accepted by the Engineer.

f. Interior Linings:

1. Preparation: Brush-off blast cleaning conforming to SSPC-SP7.

2. Liner thickness: Minimum 40 mils, for pipe barrel interior.

3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.

4. Acceptable Lining Materials shall be Ceramic Epoxy: Protecto-401 by Induron Protective Coatings, Series 431 PermaShield by TNEMEC, Permox-CTF by Permite, or approved equal. Interior lining shall be applied in accordance with the manufacturer's recommendations.

5. Contractor shall seal cut ends, touch-up, or repair interior lining in accordance with manufacturer's recommendations.

g. Exterior Coating: – Exterior pipe coating shall be in accordance with Section 822.

h. All buried piping, fittings, steel lugs, rods, brackets, clamps and other metal components shall be polyethylene encased in accordance with subsection P17.1016.0 2.3.1.

i. The pipe shall be designed, manufactured, tested, inspected, and marked according to AWWA C150 and C151 except where modified by this Section. The pipe and fittings shall be of the diameter and class indicated.

j. Ductile iron pipe and fittings shall be furnished with mechanical joints, push-on joints, flanged joints, or restrained joints as required. Mechanical and push-on joints including accessories shall conform to AWWA C111.

k. Flanged joints shall conform to AWWA C115. Flanged joints shall not be used in underground installations except within structures. Where threaded flanges are provided, the pipe wall thickness under the cut threads shall not be less than the calculated net thickness required for the pressure class of the pipe. All flanged piping shall be a thickness Class 53, per AWWA C115. All flanged joints shall be furnished

with a minimum 1/8-inch, thick red rubber or styrene butadiene rubber gasket. The bolts and nuts shall be teflon coated high strength low alloy steel per AWWA C111 with head and nut dimensions as specified in ANSI B18.2. For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended.

l. Restrained joints shall be commercially available units provided by American Ductile Iron Pipe, U.S. Pipe, or approved equal. Joint restraining devices that impart point loads and/or wedging action on the pipe wall as a means of joint restraint shall not be allowed unless there are no other options for joint restraint available. Under such circumstances, the Contractor may propose such devices provided the following conditions are met and the request is made as a substitution:

    1. A statement from the pipe manufacturer is provided accepting the use of the retaining devices and indicating that the use of such devices will in no way affect the warranty of the pipe and/or the performance of thepipe.

    2. The manufacturer of the device and the pipe manufacturer jointly provide instruction on the proper installation of the device to the personnel installing the units and provide certification to the Owner that the installers are adequately trained in the installation of the units and that all warranties are in full affect for the project.

    3. The devices shall be MegaLug Model 1100 as manufactured by EBAA Iron or approved equal.

m. For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself, will provide watertight joints under all operating conditions when properly installed. The Contractor shall require the pipe manufacturer to submit details complete with significant dimensions and tolerances and also to submit performance data indicating that the proposed joint has performed satisfactorily under similar conditions. In the absence of a history of field performance, the results of a test program shall be submitted.

P17.1016.02.3.1 Polyethylene Encasement:

a. Submittals:

    1. Product Data: Submit product data for proposed film and tape for approval. Product shall be manufactured from virgin polyethylene, shall not be recycled and shall be purchased new for the project, clean, sound and without defects. Product shall comply with ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.

    2. Quality Assurance Plan: Submit quality assurance plans for film manufacturing and field application.

        i. Film Manufacturing: The manufacturer of polyethylene film for corrosion protection encasement of ductile iron pipe shall have a verifiable quality control system to assure that film is produced from only virgin polyethylene

and that it complies with all requirements of this specification. Documentation of Quality Control procedures and test results shall be submitted and shall be made available for inspection for at least one year. A current ISO certificate may be used in lieu of other quality control documentation.

ii. Field Application: The contractor shall develop, and submit for approval, a comprehensive Quality Assurance Plan for installation of polyethylene encasement. Address all aspects of material and pipe handling, bedding, preparation of pipe surface, film installation and anchoring, service taps and backfill. Include written procedures to be used by installers.

iii. Manufacturer's Certification: Submit polyethylene film manufacturer's certification of compliance with this subsection. The polyethylene film manufacturer shall provide a notarized statement from an officer of the company that the film meets the inspection and all applicable material specifications of this specification. The manufacturer's statement of compliance must be verifiable. Statements from distributors or contractors shall not be accepted in lieu of a statement from the original manufacturer of the polyethylene film.

iv. Installer Qualifications: Polyethylene encasement shall only be installed by qualified persons who have been trained in the proper installation and handling procedures. Qualified persons shall be those that have had training and experience in the installation of polyethylene encasement for corrosion protection of ductile iron pipe. Such persons may be qualified by the Ductile Iron Pipe Research Association, ductile iron pipe manufacturers or engineering/inspection firms who offer training courses in the proper method(s) of installation. Proof of qualifications shall be submitted with the shop drawings and shall be provided to project inspectors upon request.

b. Materials:

1. V-Bio Enhanced Polyethylene Encasement:

i. Polyethylene encasement shall meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.

ii. Polyethylene encasement shall consist of three (3) layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight (8) mils (0.008 in.).

iii. The inside surface of the polyethylene wrap to be in contact with the ductile pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion (MIC) and a volatile corrosion inhibitor to control galvanic corrosion.

2. Polyethylene Tape: Provide 1½-inch wide, plastic-backed, adhesive tape for fitting and anchoring the encasement. Acceptable tapes are Fulton No. 355, Polyken No. 900, Scotchwrap No. 50, or other approved tape. Fulton Tie Strips are an approved alternative to tape. For patching or repairing the polyethylene film, use only polyethylene tape.

c. Installation:

1. Polyethylene encasement for corrosion protection of ductile iron pipe shall be installed in accordance with ANSI/AWWA C105/A21.5 and as required by the Contract Documents.

2. The wrap shall be overlapped one (1) foot in each direction at the joints and secured in place around the pipe with approved polyethylene tape.

3. All installations shall be carried out by personnel trained and equipped to meet these various requirements.

P17.1016.02.4 Small Diameter Stainless Steel Pipe and Fittings:

a. Small diameter stainless steel pipe (1 ½-inch through 3-inch) shall be Type 316, Schedule 40, Iron Pipe Size (IPS) conforming to ASTM A 312 and the additional requirements herein.

b. Small diameter stainless steel fittings shall be Type 316, Class 150 with FNPT connections on each end conforming to ANSI B1.20.1 unless designated otherwise.

c. Gray stainless steel PTFE thread seal tape shall be used on all connections.

d. The transition from stainless steel discharge piping to PVC force main piping shall be made with a PVC female adapter, socket x FNPT.

SPECIAL PROVISION P17.1017
PRECAST CONCRETE SEWER UNITS

P17.1017.01 PRECAST CONCRETE MANHOLES:

a. Precast reinforced concrete manhole sections, transitions, conical sections, and base shall conform to ASTM C 478 and shall be designed for an AASHTO HS-20 loading. Frames and covers shall conform to Subsection SP.P17.1011.05. Lifting inserts shall be embedded in manhole walls; through-wall holes will not be permitted.

b. Pipe connection openings shall be 4"$\pm$1/2" larger than pipe O.D.

c. Sewer manhole bases shall have paved inverts, and sewer manhole sections shall have rubber gasket joints conforming to ASTM C 990 or C 443.

d. Sewer manholes shall be externally sealed with rubber seal wraps conforming to ASTM C 877 (Type III – Chemically-Bonded Adhesive Butyl Bands).

SPECIAL PROVISION P17.1019
VALVES AND APPURTENANCES

P17.1019.01 GENERAL: Valves shall have manufacturer's name and pressure rating cast in raised letters.

a. All valves to include operator, actuator (handwheel, chain wheel, extension stem, floor stand, or operating nut), chain, wrench, and accessories to allow a complete operation from the intended operating level.

b. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

c. Valve same size as adjoining pipe, unless otherwise called out on the Drawings or in the Supplements.

d. Valve ends to suit adjacent piping.

e. All valves shall have no leakage (drop-tight) in either direction at the valve rated design pressure unless otherwise allowed for this section or in the stated valve standard.

f. Size operators and actuators to operate valve for the full range of pressures and velocities.

g. Valve to open by turning counterclockwise.

h. Factory mount operator, actuator, and accessories.

i. Above ground gate and plug valves, 18” and less, shall have a handwheel operated worm gear actuator unless specified otherwise in the Contract Documents. Exposed valves whose operator is five (5) feet or higher above surface from which valve will be manipulated shall be furnished with chainwheel operators.

j. Valve vaults shall be required for underground gate valves 14 inches and smaller and for plug valves 20 inches or smaller as shown on the Contractor documents. Valves larger than described above, shall be direct buried.

k. Direct buried valves shall have mechanical joint ends with a PVC valve box and cast iron valve box cover. Box shall be a single joint of 6-inch AWWA C900 PVC cut to required depth. The cast iron valve box cover shall be provided with the word “SEWER” cast in raised letters. One 6-foot long T-handle wrench with 2-inch square nut end shall be provided for each project. Boxes not in pavement shall be set in a 4-inch thick, 2-foot square concrete slab.

P17.1019.02 MATERIALS:

a. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

b. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.

c. Stainless steel Alloy 18-8 may be substituted for bronze.

P17.1019.03 FACTORY FINISHING:

a. Epoxy Lining and Coating:

1. Use where specified for individual valves described herein. Lining in accordance with AWWA C550 unless otherwise specified. Coating to be the same material and application process as the lining.

2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.

3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

P17.1019.04 GATE VALVES:

a. **Gate Valve 3-Inches and Smaller (Non-rising Stem):** All-bronze, screwed bonnet, packed gland, single solid wedge gate, Class 125 rated 200 psi CWP, complies with MSS SP-80 Type 1.

b. **Gate Valve 3-Inches and Smaller (Rising stem):** All-bronze, screwed bonnet, packed gland, single solid wedge gate, Class 125 rated 200 psi CWP, complies with MSS SP-80 Type 2.

c. **Gate Valve 3-Inches and Smaller (for Type 1A Station):** Type 316 stainless steel, Class 200, handwheel operated non-rising valve stem and FNPT connections.

d. **Resilient Seated Gate Valve 3-Inches to 36-Inches:** Ductile iron body, resilient seat, bronze stem and stem nut, ANSI Class 125 flanged ends, non-rising stem, in accordance with AWWA C509 or AWWA C515, full port, fusion-epoxy coated inside and outside per AWWA C550, NSF Standard 61 certified where used for potable water service.

e. **Resilient Seated Gate Valve 3-Inches to 36-Inches, for Buried Service:** Ductile iron body, resilient seat, bronze stem and stem nut, mechanical joint ends, non-rising stem, in accordance with AWWA C509 or AWWA C515, 2-inch operating nut, full port, fusion epoxy coated inside and outside per AWWA C550, NSF Standard 61 certified where used for potable water service.

P17.1019.05 PLUG VALVES: Valves shall be full port (100% port area), nonlubricated eccentric type with resilient faced plugs. Valves shall be in accordance with AWWA C 517. Valves shall be epoxy lined and coated. Minimum pressure rating shall be 175 psi for less than 14-inch valves; 150 psi for valves 14-inch and larger.

a. Flanges shall be faced and drilled to ANSI 125/150-lb standard; mechanical joint ends shall conform to AWWA C 111 or C 153; and threaded ends shall be NPT.

b. Body shall be cast iron conforming to ASTM A 126, Class B or ductile iron. Plug cast iron with round or rectangular port of no less than 100% of connecting pipe area and coated with Buna-N and seats welded nickel.

c. Plug stem shall be of one-piece construction and made of ASTM A126 Class B Cast Iron or ductile iron with a resilient facing per ASTM D2000-BG and ANSI/AWWA C 517 requirements. Radial shaft bearings shall be of self-lubricating type 316 stainless steel. The top thrust bearing shall be Teflon. The bottom thrust bearing shall be Teflon or Type 316 stainless steel or bronze, stem seal multiple V-rings, or U-cups with O-rings of nitrile rubber, grit seals on both upper and lower bearings. Cover Bolts shall be corrosion resistant with zinc plating.

d. Direct buried valves shall have vaults valve boxes as specified in Subsection SP.P17.1019.01 and shall have a remote position indicator in valve box showing position of valve. A stainless steel or aluminum centering and I.D. plate shall be provided showing direction of opening and number of turns to open for each valve.

e. Buried or submerged valves and actuators shall have sealed shafts and watertight gasketed housing covers.

P17.1019.06 CHECK VALVES:

a. **Rubber Flapper Swing Check Valves (4-Inch and Larger):** Valves shall be rubber flapper type with long body, flanged ends (ANSI B16.1, Class 125) and minimum 150-lb pressure rating. Valves shall be epoxy lined and coated.

1. The valves shall be designed, manufactured and tested in accordance with AWWA C508.

2. The valve body shall have full flow equal of nominal pipe diameter at any point through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. The top access port shall be full sized to allow removal of the disc without removing the valve from the pipeline.

3. The disc shall be of one-piece construction, precision molded with an integral o-ring type sealing surface that contains steel and nylon reinforcements.

4. Backflow capabilities shall be provided by means of a screw type backflow actuator. The valve will be provided with proximity switch to detect valve position, equipped with EYS condulet seal fitting.

5. The valve body and cover shall be ASTM A126, Class B cast iron or ductile iron. The disc shall be Buna-N, ASTM D2000-BG.

6. The valve shall be cycle tested 1,000,000 times with no sign of wear or distortion to the valve disc or seat.

b. **Stainless Steel Check Valves (3-Inch and Smaller):** Valves shall be Type 316 stainless steel inline swing type with FNPT ends and minimum 200 psi rating.

1. The valve body shall have full flow equal of nominal pipe diameter at any point through the valve.

2. The disc shall be of one-piece construction, Type 316 stainless steel.

3. A removable cap shall be provided for easy access to internal components.

P17.1019.07 QUICK CONNECT COUPLINGS: Couplings shall be Dover Corporation OPW Division Model 733-DL (threaded, 2-inch and less) or 733-LDS (flanged, 2-1/2-inch to 4-inch) coupler with Model 634A plug or approved equal.

P17.1019.08 COMBINATION AIR VALVE: Valves shall be suitable for sewage service; combine the operating functions of both an air and vacuum valve and an air release valve. The air and vacuum portion shall automatically exhaust air during filling of a system and allow air to re-enter during draining or when a vacuum occurs. The air release portion shall automatically exhaust entrained air that accumulates in system. The valve shall be a single body unit with air and vacuum valve and an air release valve in a single housing.

a. Rated working pressure shall be 150 psi minimum. Combination air valves on systems where the pump shutoff head exceeds 100 feet shall have a rated working pressure of 250 psi.

b. Materials:
   1. Body: Shall be 316 stainless steel or glass reinforced nylon.
   2. Covers: Shall be 316 stainless steel or corrosion resistant composite materials.
   3. Internals: Shall be 316 stainless steel or corrosion resistant composite materials.

c. 2-inch and smaller valves shall be NPT screwed inlet connection and 3-inch and larger valves shall be ANSI Class 125 flanged inlet connections.

d. The valve shall be supplied with back flushing attachments including hose assembly, nipples, ball or plug valves (as required by Contract Documents), and quick couplings. The hose assembly shall be removable and not a permanent fixture on the valve.

e. Fitted with body blowoff valve.

f. All combination air valves with a 3-inch or larger inlet shall be nominal with the same inlet versus outlet sizing.

g. The valve manufacturer shall provide a written two-year warranty for the entire valve including the body, cover, float, and all internal parts. The valve warranty shall include corrosion coverage for all valve parts.

P17.1019.09 CORPORATION STOPS: Corporation stops shall be ¾-inch Mueller Company H-

15029, or approved equal, for 100 psi test pressure.

P17.1019.010 RESTRAINED FLANGE COUPLING ADAPTERS: Flange coupling adapters shall be ductile iron, meeting or exceeding ASTM A 536, grade 65-45-12 with factory fusion bonded epoxy coating. Gaskets shall be Nitrile-Buna N (NBR) compounded for sewer service per ASTM D2000. Hardware shall be 316 stainless steel. Joint restraining devices that impart point loads and/or wedging action on the pipe wall as a means of joint restraint shall not be allowed unless there are no other options for joint restraint available. Restrained flange coupling adapter shall be Alpha FC by Romac Industries or approved equal.

P17.1019.011 FLEXIBLE COUPLINGS: Flexible couplings shall be either split type or sleeve type.

a. Split couplings shall be used with interior piping and, when specified, with exterior piping.

    1. Couplings shall be mechanical type for radius groove piping. Couplings shall mechanically engage and lock grooved pipe ends in a positive couple and allow for deflection, contraction and expansion.

    2. Couplings shall consist of ASTM A47, Grade 32510 iron housing clamps in 2 or more parts, a chlorinated butyl composition sealing gasket with a "C" shaped cross-section and internal sealing lips projecting diagonally inward, and 2 or more oval track head bolts with hexagonal nuts conforming to ASTM A 183 to assemble clamps.

b. Victaulic type couplings may be used in lieu of flanged joints for non-buried applications only.

    1. Pipes shall be radius grooved as specified for use with couplings.

    2. Flanged adapter connections shall be Victaulic Vic Flange Style 741 or approved equal.

c. Sleeve couplings used with buried piping shall be Dresser Style 38 or Style 40, or approved equal, with high strength low alloy steel bolts and nuts. Steel shall meet AWWA Standard C111. Couplings shall be furnished with pipe stop removed and gaskets of a composition suitable for exposure to domestic sewage.

d. Where indicated on the Drawings, restrained flexible couplings shall consist of a flexible coupling, ductile iron spool pieces with tie rods and flange clamps in accordance with the Contract Documents, to provide thrust restraint at the joint.

P17.1019.012 DIAPHRAGM SEALS: Diaphragm seals shall be installed on pressure gage or pressure switch connections where specified.

a. Seal shall be thread attached to piping and pressure sensing devices. Seals shall be 316 stainless steel, with neoprene sleeve and ethylene glycol and water fill. Seals shall be 2-inch size and shall be mounted with a 2-inch isolation ball valve on the pipeline side and have a ¾ inch flushing ball valve on the opposite side. Seals shall be Red Valve series 42 (horizontal mount), series 742 (vertical mount), or approved equal.

The pressure sensing device(s) shall be factory mounted.

b. Full circle sensing seals that insert between adjacent pipe flanges, such as Red Valve Company Series 40 Flanged Sensor or approved equal, may be used in lieu of seal specified above. The pressure sensing device shall be factory installed on the seal.

P17.1019.013 UNIONS: Unions for pipe less than 2 ½-inch shall be galvanized malleable iron, 150-lb class. Unions for 2 ½-inch or larger pipe shall be flange pattern, galvanized, 125-lb class. Unions shall be gasketed.

P17.1019.014 MECHANICAL WALL SEALS: Seals shall consist of an adjustable modular bolted, synthetic rubber and plastic sealing element. Sealing element shall be Thunderline Corporation Link-Seal or approved equal. Hardware shall be for corrosive service. Sleeves for use with seals shall be Schedule 40 steel pipe with waterstop approximately 2 inch wide and ¼ inch thick welded around periphery of pipe and galvanized.

P17.1019.015 HOSE END FAUCETS: Faucets for potable water shall be Zurn Model Z-1385, or approved equal, with removable key.

P17.1019.016 PRESSURE GAGES: Each pressure gage shall be direct mounted, fiberglass reinforced polypropylene case, glycerine filled, with a 4 ½-inch diameter dial with a clear acrylic window, $^{3}/8$

inch shut-off valve, and a bronze pressure snubber. Provide diaphragm seals between shut-off valve and pressure gage on lines with non-nuclear matter in suspension or solution. Gages shall be weatherproofed. Face dial shall be white finished aluminum with black graduations and figures and shall be dual scale (psi and ft of H2O).

Each suction or discharge line shall have H.O. Trerice Company Series 450, or approved equal, gages of minimum sizes as follows with changes required by pump shutoff head shown on pump station data table for each installation:

Pump	**Suction**	**Discharge**
Centrifugal	-15 (-35) to 15 (35) psi (ft)	0 to 60 (138) psi (ft)
Submersible	NA	0 to 60 (138) psi (ft)

P17.1019.017 REDUCED PRESSURE BACKFLOW PREVENTERS: Reduced pressure principle backflow preventers shall be listed by the University of Southern California – Foundation for Cross Connection Control and Hydraulic Research (USC-FCCCHR) as having met the requirements of ASSE 1013 and ANSI/AWWA C511. A Watts Model 909 QTS backflow preventer or approved equal shall be provided on potable water supply to pump station, and shall have a strainer and ball type isolation valve.

P17.1019.018 DIAPHRAGM AND FLAP CHECK VALVES: These valves are for use on wet well end of valve pit drain piping. Diaphragm check valves shall be Red Valve Series TF-2 or approved equal. Compression bands for attaching valves shall be stainless steel. Flap valves shall be Clow Figure No. F-3016 or approved equal.

P17.1019.019 OPERATORS AND ACTUATORS:

a. Manual Operators:

1. General:

i. For AWWA valves, operator force not to exceed the requirements of the applicable valve standard. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under any operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.

ii. Operator self-locking type or equipped with self-locking device.

iii. A position indicator shall be provided on all above ground valves.

iv. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rods with internally threaded bronze or ductile iron nut.

2. Exposed Operator:

i. Galvanized and painted handwheels.

ii. Cranks on gear type operators.

iii. Chain wheel operator with tiebacks, extension stem, floor stands, and other accessories to permit operation from normal operation level.

iv. Valve handles to take a padlock, and wheels a chain and padlock

3. Buried Operator:

i. Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut.

ii. Buried operators on valves 2-inches and smaller shall have cross handle for operation by forked key.

iii. Where the depth of the valve is such that its centerline is more than 3 feet below grade, furnish an operating extension stem with 2-inch operating nut to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Extension stem shall be pinned to the operating nut; set screws are not acceptable.

iv. Enclose moving parts of valve and operator in housing to prevent contact with the soil.

v. Design buried service operators for quarter-turn valves to withstand 450 foot-pounds of input torque at the FULLY OPEN or FULLY

CLOSED positions, grease packed and gasketed to withstand a submersion in water to 10 psi.

b. Electric Motor Actuators (20-inch and larger, unless specified otherwise):

1. Electric Motor Actuators shall be provided for each plug valve at the specified pump stations.

i. The actuators will comply with the latest version of AWWA C542.

ii. The actuators will be sized to 1 -1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.

iii. Controls integral with the actuator and fully equipped as specified in AWWA C542.

2. Actuator Operation – General

i. Suitable for full 90-degree rotation of quarter-turn valves.

ii. Provide manual override option.

iii. Open/close indication.

iv. Operate from FULL CLOSED to FULL OPEN positions or the reverse in 30 seconds.

3. Modulating (M) Service:

i. Size motors for continuous duty.

ii. Feedback potentiometer, or equivalent, and integral electronic positioner/comparator circuit to maintain valve position.

iii. HAND-OFF-AUTO (Local-Off-Remote) Selector Switch, pad lockable in each position:

A. Integral OPEN-STOP-CLOSE momentary pushbuttons with seal-in circuits to control valve in HAND (Local) position.
B. 4 to 20 mA dc input signal to control valve in AUTO (Remote) position.
C. Auxiliary contact that closes in AUTO (Remote) position.
D. Valve shall open upon loss of signal, unless otherwise indicated.

iv. Ac motor with solid state reversing starter or dc motor with solid state reversing controller, and built-in overload protection. Controller capable of 600 starts per hour.

4. Actuator Power Supply:

i. 480 volts, three-phase, or 240 volts, three-phase, as indicated on the drawings.

ii. Control power transformer, 120-volt secondary.

iii. Externally operable power disconnect switch.

5. Enclosure:

i. As defined in NEMA 250, Type 7.

ii. Contain 120-volt space heaters, if required to prevent condensation.

6. Limit Switch:

i. Single-pole, double-throw (SPDT) type, field adjustable, with contacts rated for 5 amps at 120 volts ac.

ii. Each valve actuator to have a minimum of two auxiliary transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.

iii. Housed in actuator control enclosure.

7. Manufacturer and Product: Flowserve Limitorque; Model LY or approved equal.

Louisiana
Department of Transportation
and
Development

Traffic Control Standard
Number 18A

Traffic Signal Control System

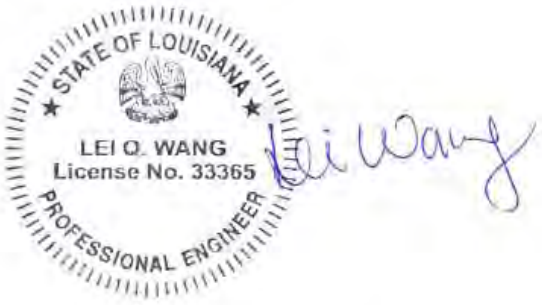


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Table of Contents

INTRODUCTION

This specification sets forth the minimum requirements for traffic signal control system which is a complete electrical device mounted in a cabinet for controlling the operation of a traffic signal. A shelf-mounted, digital, solid-state traffic controller with peripheral equipment in the controller cabinet of the type specified shall be furnished with time-based coordination, closed-loop system communication/coordination, multiple railroad/fire preemption sequences, and hardwired/telemetry interconnect capable of operating as both a master and secondary.

The signal controller unit shall be based on the requirements of NEMA Standards Publication No. TS-2, 1998. Controller sequencing referenced in this standard for diamond intersections emulates the design and standards from the Texas Department of Highways and the Texas Transportation Institute. The controller should have a database that conforms to Section 3.5 of the current NEMA NTCIP specifications. The cabinet shall be based on the requirements of NEMA Standard Publication No. TS-1 -1989.All components and accessories shall comply with the NEMA testing requirements and a Certification of Compliance shall be presented with each bid for that equipment being offered. The operational requirements herein extend the requirement of NEMA controllers and supersede NEMA where differences occur. All equipment and operational characteristics specified herein shall be provided, except where noted

Pole mounted, Actuated TS2 Controller with Type 3E cabinet (Stock #: 14-06-3596):
A signal controller assembly contains a signal controller timer unit and all other necessary peripheral equipments in type 3E cabinet for a pole mounted application.
Ground mounted, Actuated TS2 Controller with Type 6E cabinet (Stock #: 14-06-3576):
A signal controller assembly contains a signal controller timer unit and all other necessary peripheral equipments in type 6E cabinet for a ground mounted application.
TS 2 with Ethernet port, 8 Phase Signal Controller Timer Unit (Stock #: 14-06-2730):
A signal controller timer unit with an Ethernet port on the front panel with no internal communication module card unless noted on the plan.
Twisted Pair Communications Module (Stock #: 14-06-2880):
An internal twisted pair interconnect modem as specified in section 3.0.
External RS232 fiber communication module (Stock #: 14-06-2881):
An external fiber interconnect modem as specified in section 3.0.
Internal Ethernet Communications Module (Stock #: 14-06-2882):
An internal ethernet interconnect modem as specified in section 3.0.

1.0 CLOSED-LOOP COMPUTER OPERATING SYSTEM

The closed-loop central operating system shall be a traffic management program for hard-disk supported IBM personal computers and compatible equipment which creates a system network using the principle system components. The software shall operate using Microsoft's Windows operating system. The software shall be programmed resident for the operating system.

1.1 Software Description

The software shall be loaded into the specified personal computer and operationally verified by the supplier. Back-up software shall be supplied on a compact disk or digital CD.

The software shall be licensed to the agency for its use on a single computer or each computer specified in the system. Software improvements and enhancements to the supplied version shall be furnished to this agency at no additional cost. Software is supplied when indicated on the plans for a state job and will be specific to a highway district and must be compatible with existing software in place.

Programming displays, on the PC screen, shall aid the operator in entering data from the PC keyboard. These displays shall be arranged in using a tool bar format. The main tool bar shall allow the user to select a major function. A sub-tool bar shall be allowed for selection of a specific area within that function when it exists.

The central computer software shall provide rapid movement through menus, sub-menus and data base pages and limited only by the operating speed of the computer. Returning to the main menu or sub-menu shall be selected by pressing a single key.

Menus and sub-menus shall not contain mnemonics or codes for descriptions. Additional screens shall be provided where necessary to explain keyboard procedure. All icons that are defined within a tool bar shall be described in a help line as the cursor is placed over that icon.

Traffic engineering terminology shall be used throughout the programming displays. Display organization and data entry approach shall allow system operators to program the central computer without using reference cards or manuals.

1.2 Software Features

Once the computer power-up routine is complete, the system shall be in monitor mode. It shall be possible for the operator to exit this mode and enter the user mode, and vice-versa.

In monitor mode, central computer shall continue to monitor events even if the printer is off-line. Upon restoration of the printer, it shall print a hard-copy of events occurring prior to and during printer off-line.

Central computer software shall provide:

a. Dynamic Displays
b. System Printouts
c. Data Base Management
d. Security
e. Directories
f. Data Back-up

1.3 Dynamic Displays

Central computer shall display the following in real-time color graphics selected from the menus:

a. Intersection Display
b. System Map Display

All text data shall be displayed in traffic engineering terms. Mnemonics shall be acceptable; however, the need for reference guides and manuals shall not be acceptable. All information shall be simultaneously and continuously displayed until canceled by the operator. Displays shall not affect system on-street operation. The displays shall have a minimum one second resolution.

1.3.1 Intersection Display

The central computer shall display the operation of any selected intersection controller within any selected system.

Each display shall be user-created to indicate the intersection configuration, including any "T" and standard diamonds, on a single screen display. The intersection display shall show as a minimum:

a. Intersection configuration layout for all possible phasing of intersection controllers including overlaps.

b. All vehicle signal indications, (R,Y,G) for each active phase.

c. All pedestrian signal indications: walk, flashing and solid don't walk, for all 16 active phases.

d. Vehicle and pedestrian detector actuation for each displayed phase.

e. Cycle, offset, split or plan in effect.

f. Arterial master and intersection controller identifier numbers, including intersection street names.

g. Central computer and local intersection controller time of day (TOD) clocks.

The display shall include dynamic statuses of the arterial master and the intersection controller. Arterial master status shall consist of operational status, cycle, offset, split, plan in effect, cycle length, cycle countdown, and status of special functions. System control mode status shall include manual, external, time-of-day, or traffic responsive operation. This status shall indicate whether the system is operating under plan, time-base coordination, or time-base backup.

Intersection controller dynamic data shall consist of operational status; non-interconnected coordination, coordination offset value, or free/plan indicator; split values based on cycle and split in effect; preemption status; and diagnostic indications. Operational status shall include on-line, off-line, failed, or disabled. If the intersection controller is off-line or failed, the conditions causing that failure shall also be displayed. All diagnostic indications having alarm status shall be shown flashing. Alarms, preempt call numbers, and preemptor in effect shall also be shown. If preempt is in a flashing operation, it shall be displayed as flashing.

1.3.2 System Map Display

System Map Display shall provide geometric layout of the system for a minimum of 32 intersections simultaneously and show real time display. The display shall also indicate the relative placements for a minimum of sixteen system detectors. Any intersection shall be selected to present a full screen display as stated in Section 2.3.1.

A map editor shall permit the user to lay-out the intersections in their relative physical relationship to each other, place the system detectors anywhere along the approaches, and number the intersections appropriately. Five-legged intersections, central business district layouts (CBD), and angled approaches shall be possible.

A text editor shall permit the user to create a minimum of 50, 20-character strings and place them on the display. This feature shall allow labeling streets, detector identification, or other points-of-interest. All text would preferably be placed at any angle on the screen. For instance, street names shall follow the angle of the drawn street (horizontal, vertical, or diagonally), if desired.

Display data shall include current system operating parameters, special function status, cycle countdown, zone control mode of operation, and consolidated intersection status.

Consolidated intersection status shall indicate if an intersection is on-line, free, has a coordination fault, is in preemption or flash, or has a communication failure.

1.4 System Printouts

System printouts present system readiness and operational status and are used for analyzing system performance. The printouts shall be divided into four categories: Computer Events, Event Reports, Status Reports, and Logs, as detailed in this specification.

1.4.1 Computer Events

The central computer shall provide a monitor mode of operation to receive status change and operating failure event reports from any arterial master or isolated controllers.

Events shall be allowed for display on the central computer terminal or printed as a hard copy when they are received. Events shall consist of system identification, time and date of event occurrence, device identification (if device diagnostic event), and event description.

The central computer shall store events in a hard disk file to produce event reports, as needed. It shall be possible to transfer event files to a storage diskette for historical record keeping. Event files shall be removed from hard disk after file transfer to storage diskette to prevent overflowing the hard disk.

1.4.2 Event Reports

Event report capability shall be provided for events occurring on one day, or group of days, from central computer files on the hard disk or storage diskette.

A directory search capability shall be provided that lists all event files for any system by date, on the selected disk drive. If one day is selected, the date shall be entered directly or by directory search. Directory search shall be used to select dates for event reports for a group of days.

It shall be possible to display and print events as received or sorted by event type. If event type selected is for a system device, it shall be possible to specify all devices or a single device.

Menus shall be provided to facilitate event type selection. Program operation shall allow interactive operation for preparing an event report for any combination of event type and system device.

1.4.3 Status Reports

Status reports shall be generated by the arterial master controller in response to a manual command by the operator at the central computer. These reports shall present an immediate record of system operational status on the central computer display. Provision shall be made for hard copy printout.

1.4.4 Logs

Detector data shall be processed by the central computer. Real-time logs shall be printed as received by the central computer while in the monitor mode. System detector logs shall be scheduled, formatted, and sent from the arterial master.

1.5 Database Management

1.5.1 Programming Displays

A database management program shall exchange and update data with arterial master and intersection controller. Each arterial master and intersection controller shall have separate database programming pages. These pages shall contain all the programming options unique to each controller type.

Once database management is selected from the main menu, a sub-menu shall be presented listing the database pages available for programming. It shall be possible for the user to scroll through the data pages of a sub-menu or enter and exit a data page without waiting for data to fill the page. For example, page up and page down functions shall permit the operator to go from page 1 to 30, within 5 seconds.

All programming entries shall primarily consist of numerical values, YES/NO or ON/OFF entries. During program entry, the new data shall over-write the old data. If the data is in error, changes shall not be permitted and the user shall be alerted by either an error message on the display or a warning tone.

1.5.2 Upload/Download

All devices shall use upload/download techniques for database programming. The arterial master shall employ an additional database programming method through direct data entry.

Upload/download shall transfer the entire programmable database from/to the arterial master or any intersection controller via the arterial master, with the exception of intersection controller preemptor and overlap configuration.

All upload/download data shall use block transfer techniques, and shall be verified by block check-sum and word parity. Non-verified data shall cause termination of the upload/download with no data transfer taking place. It shall not be possible to load erroneous interval and configuration information to the controller.

Upload techniques shall not cause the system or intersection controller to go off-line. Traffic control operation shall remain intact in all respects.

The program shall compare the database of any arterial master or intersection controller to the database on file following an upload. The compare function shall be executed by simple keyboard technique and shall identify any differences between loaded and file data. The system operator shall be able to correct, use, or substitute data values, and proceed with further comparison.

1.5.3 Backup Database

Data from the backup files shall be read and verified for programming EEPROMs to be installed in intersection controllers and arterial masters.

1.5.4 Auto Print

Selection to automatically print any or all arterial master or intersection controller databases that are stored in the central computer shall be provided. Selection eliminating intersection controllers which are not in service when all intersection controllers are selected for printing shall be provided.

The system shall print only pages within a database that contain data. Pages with no user-entered data shall be skipped. If a database is selected for printing, but is not found on the central computer hard disk, it shall be noted on a separate sheet of the print.

1.6 Security

System security at the central computer shall be ensured through three levels of access. The levels shall be as follows:

a. Supervisor
b. Data change
c. Viewer

The supervisor and data change levels shall have separate access codes that must be entered prior to making database changes.

The supervisor level shall permit access code number assignments and database changes. Data change level shall permit database changes. If an incorrect code is entered, database changes are denied. Viewer level shall not permit any database changes.

1.7 Directories

System and intersection directories shall include location of arterial masters and associated intersection controllers by name or number.

System directory text shall describe each of the systems. A system name may be entered and shall identify the system in menus, report titles, and arterial master database pages.

Intersection directory text shall list intersection names and telephone numbers for each associated arterial master. An intersection name may be entered and shall identify the intersection in menus, intersection displays, and intersection database pages.

The user shall assign names to the intersection controller alarm inputs. These names shall identify alarms in event reports. Each alarm name shall be a maximum of twenty characters.

1.8 Database Backup and Restore

The system shall include an option for making backup copies on diskettes of the database files contained in the central computer. All files required to restore the system to operation without the need to re-enter data shall be included on the backup diskette.

The central computer's files containing records of event and buffeted data shall be saved on hard disk when received from the arterial master. Provision for transferring computer files to storage diskettes shall be included. After transfer to storage diskette, monitor files shall be removed from the hard disk by a user selected command. Storage diskette files shall allow for data analysis by the same report programs used for files on hard disk.

1.9 Software Maintenance Agreements

The software agreement for licensing to the Department shall be in force upon the acceptance by the vendor to supply equipment and software to the Department either by purchase order or construction project and must be compatible with the existing controllers in the field for a minimum of the last five (5) years. Minimum 6 USB security keys shall be provided. Replacement USB keys shall be made available to the Department.

1.9.1 Performance

The vendor shall warrant that the software will perform according to the specifications without end and provide free updates to be compatible with a new operating system if needed.

1.9.2 CPU Limitations

The vendor shall agree that it will be the Department's option to use the software on upgraded equipment at any time and use the software on backup equipment for a limited time. The limits of use shall be as previously stated.

1.9.3 Backup Provisions

The vendor shall agree that the Department will utilize off-site storage for the software and backup files. Copies of these files shall be made by the Department as needed within the operational guidelines previously stated.

1.9.4 Operational Restrictions

The vendor shall agree that the Department will utilize the software to monitor any system within the Department's responsibility.

1.9.5 Maintenance Standards

The vendor shall agree to supply the Department with updates to the software. If the updates require upgrading of the Department's equipment, the vendor will provide the source codes to the Department for the version of software provided to the Department.

1.9.6 Source Codes

The vendor shall deliver the source code and documentation to the Department to be used in the event of failure to provide support to the software. A viable holding arrangement will be considered as an alternate method for source code to be delivered to the Department at no cost to the Department. This option shall be stated on the order, plans, or other purchase agreements for the controllers, otherwise will not be required.

2.0 SYSTEM COMMUNICATIONS

This section specifies the minimum requirements for signal system communication functions. The controller unit shall communicate with a system master controller, central computer (for isolated intersections), or portable computer connected directly to the controller. Internal settings, including coordination, shall be accessible via an external Hayes compatible modem through the RS-232 interface. The controller unit shall receive system master commands and data transmissions. In addition, it shall transmit the controller unit status, database, and system detector information to the system master. All alarms provided shall be accessible through the RS-232 port by remote interrogation and by automatic dialing initiated by the controller unit.

2.1 System Commands

The communication shall allow the controller unit to receive, as a minimum, the following commands:

a. The coordination pattern (selects the cycle, offset, and split)
b. Time of day and date
c. Special function commands (minimum of four)
d. Free and flash mode command patterns
e. Control of the local system on a specified master controller
f. Request for local status

2.2 Status Data

The status of each of the following functions shall be transmitted from each controller in response to a status request from any monitoring device:

a. Green and yellow status for all phases and overlaps
b. Walk and pedestrian clearance status for all phases
c. Vehicle and pedestrian detector status (8 pedestrian and 64 vehicle detectors)
d. Phase termination status
e. Local Cycle time
f. Coordination status
g. Conflict flash status
h. Local flash status
i. Preempt activity and calls
j. Volume and occupancy data from a minimum of 16 system detectors
k. Status of four user-defined alarms
l. Zone map display data

2.3 Upload/Download

The communication shall provide the capability to upload/download the entire intersection data base to/from a monitoring personal computer. When desired, only a single screen of data can be sent and received from the intersection.

2.4 Operation

Communication shall operate from communication ports on the front of the controller. The controller unit shall communicate with a system master/secondary controller, central computer, portable computer, GPS unit and/or the conflict monitor with RS-232 serial ports accessible through DB-25S connectors. The reserve connector pin assignments shall be as follows:

Pin #	Designation
1	Frame Ground
2	Transmit Data
3	Receive Data

4 Request to Send
5 Clear to Send
6 Data Set Ready
7 Signal Ground
8 Data Carrier Detect
20 Data Terminal Ready
22 Ring Indicator

The baud rate of each port shall be keyboard selectable for any one of the following rates: 600, 1200, 2400, 4800, 9600, 14.4K, 19.2K, 28.8K, 33K, and 57.6K. The port shall be configured for an eight (8) bit word, one (1) start, one (1) stop bit and no parity.

The communication path shall use a twisted pair of wires. These may be leased lines (Type 3002, voice grade, unconditioned), radio modem, or dedicated cable.

Communication timers shall be programmable from 0 to 9.9 seconds.

The controller unit shall be programmable via keyboard with a user assigned, unique address identifying both the master and the local intersection controller. Both the master and local intersection databases shall be contained in one hardware unit.

2.5 Intra-System Communication

Intra-system communication shall be achieved through one of the four RS-232 serial ports defined herein and an external modem. The twisted pair internal modem, external fiber modem or the internal Ethernet module shall not be provided with order unless specified elsewhere.

The four RS-232 ports shall be defined as the follows:

Port 1 – System UP port for communications to the central software package and/or communications to another sub-master/local controller.

Port 2 – System DOWN port for communications to another sub-master/local controller.

Port 3 – PC/Print port for communications to a PC and/or serial device such as a GPS and/or conflict monitor.

Port 4 – Aux port for communications to the conflict monitor and/or GPS device.

2.5.1 Twisted Pair Communications Module (Stock #: 14-06-2880)

The Controller shall have the capability of containing an internal frequency shift keying (FSK) TS2 modem card that is integral to the controller and compatible with the existing field controllers and controllers in the LADOTD inventory for a minimum of the last five (5) years. A 4800 baud model and a 9600 baud model shall both be available. These items may be listed as separate line items on the bid documents and/or maybe required in the controller unit as specified by the bid documents. The modem module shall interface to the CPU board via a ribbon cable and shall contain a locking device to prevent accidental unplugging. The unit shall be easily serviceable for ease of maintenance and programming. Both the 4800 baud and 9600 baud modems shall be capable of both full and half duplex operations. An end of line option and a high sensitivity option shall be user programmable per unit.

2.5.2 External RS232 fiber communication module (Stock #: 14-06-2881)

The external fiber modem shall be shelf mount and compatible with the current approved LA DOTD signal controller. It shall be for single mode fiber. The standard connection shall be ST type with RS-232, RS-422 and RS 485 interface. The modem shall operate from -40 C to +74 C. Loss budget shall not be more than 30 dB and bit error rate shall not be more than 1 in 10^9. Self diagnostic functions with 16 X 2 Character visual screen display are required.

2.5.3 Internal Ethernet Communications Module (Stock #: 14-06-2882)

The Controller shall have the capability of containing an internal Ethernet module that connects to the CPU board via a ribbon cable. The ribbon cable and Ethernet module shall contain a locking device to prevent accidental unplugging. The unit shall be easily serviceable for ease of maintenance and programming. The internal Ethernet module shall be an independent module that can be added to any controller on this contract. The bid documents shall state if the module is to be included with each controller unit or supplied as a separate line item on the bid.

2.5.4 GPS Interface

The controller firmware for both the On-Street Field Master and the Local controller shall be capable of polling a GPS device for time sync updates a minimum of twice per hour. One of the four (4) programmable RS232 ports provided on the front panel of the controller shall act as a direct interface to the GPS device. If required on the bid documents and / or plans and specifications, one (1) GPS kit consisting of one (1) GPS with cabinet mounting plate and interface cable shall be provided with each cabinet assembly. The GPS interface shall be compatible with the existing controllers in the field and in the inventory for the LADOTD for a minimum of the past five (5) years.

2.6 Radio System Communication (Inter-System) – (When Specified)

The data radio modem system is for microprocessor based control equipment. The modem is external to any other equipment in the controller cabinet and at the terminus and shall be provided for data transmission and indicated on the plans. The modem shall provide half or full duplex communications. The modem shall connect directly to the controller in accordance with these standards for the auto dial modem stated above.

The Department will provide the necessary management to obtain a study for interference on the above mentioned radio frequencies, coordinate the frequency to be used, and apply for licensing to use the frequency. The equipment shall operate at the assigned frequency and the supplier/contractor shall make the necessary adjustments for correct operation.

2.6.1 Radio Modem

The modem shall meet the environmental requirements of NEMA TS-2 TYPE 2 and be a maximum dimension of 4 inches high x 12 inches wide x 12 inches deep. Indicators shall be provided on the front of the modem indicating carrier detect, transmit data, and receive data. The following shall be the operating characteristic of the modem:

TABLE 18A-2
RADIO MODEM CHARACTERISTICS

FUNCTION	CHARACTERISTIC
Frequency Range:	173 MHz or 940 MHz range (Capable of: 138-174 MHz, 406-430 MHz, 450-475 MHz, 928-960 MHz).
Temperature Range:	-30° to +60° C.
Operating Voltage:	120/240 VAC
Transmission Mode:	16F3, 16F9, 15F2
Modulation: (Receive and Transmit)	FSK, Frequencies, 2100 Hz - mark, 1300 Hz - space.
RF connector:	Type N Female
Data connector:	RS-232-C, 9-pin
Sensitivity:	-107 dbm (1.0μV) for BER_$1x10^{-3}$ over the voltage and temperature range.
Decoder type:	PLL FSK Demodulator
Carrier Attack Time:	_ 10mS
Turn Around Time:	10mS Maximum
Power Output:	2 watts extendable to 20 watts, 100% duty cycle.
Frequency Stability:	±5 ppm on all frequencies.
Harmonic Distortion:	5 % Maximum
Compliances:	FCC Part 15, EIA RS-316B, and RS-232-C, as applicable.

2.6.2 Antenna

The antenna shall be connected to the modem by transmission cable. The antenna shall be a directional Yagi with a minimum of 9 Db gain and five elements. The mounting shall adapt to a 1-1/2 or 2 inch mount.

2.6.3 Antenna Tower

The contractor (for projects) shall provide a tower for mounting the antenna at the site as shown on the plans. The height of the tower shall be determined from the frequency coordination study. The tower shall be erected in accordance with the most

current version of AASHTO standard specifications for structural supports, highway signs, luminaires and traffic signals.

2.6.4 Central Office Radio Terminal

Additional labor shall be provided by the project contractor to install the antenna on the Department's tower, the cable from the antenna to the modem, and the necessary hardware to complete the installation as designated on the plans. The radio modem and auto-dial modem shall be installed in a single 19 inch rack mounting system or on a wall mountable shelf. Mounting equipment and hardware shall be provided by the contractor. The Department will supply one RJ-11C jack for the dial modem and the necessary 120 VAC outlet for the equipment adjacent to the installation as designated by the Department.

The installation shall include lightning protection on the incoming RF cable in accordance with good engineering practices.

2.6.5 Telephone Terminal Boards (For Information Only)

The following equipment will be installed into the existing PBX equipment for telephone lines needed to implement the system communication. All other equipment specified shall work with this equipment to complete the system's communications. This equipment will be installed in and manufactured by Rolm Telecommunication Company.

TABLE 18A-3
TELEPHONE TERMINAL EQUIPMENT

TYPE EQUIPMENT	MODEL
16-channel coder	#8551E
16-channel decoder	#8552A
8 channel line interface	#85540A

This equipment will be installed by the Department and made ready for the completion of the system.

3.0 SIGNAL CONTROLLER TIMER UNIT (Stock #: 14-06-2730)

This specifications set forth the minimum requirements for a shelf-mounted sixteen (16) phase full-actuated solid state controller unit with internal Time-Based Coordination (TBC), railroad / fire (emergency vehicle) preemption, diamond intersection operation, and closed loop master/secondary operation in a traffic signal controller assembly and cabinet assembly.

The controller unit shall meet the requirements of NEMA Standards Publication TS 2 1998 (TS 2), latest edition. Where a difference occurs, these requirements shall govern. TS 2 Type 2 interface shall be provided as standard unless specified otherwise.

3.1 General Requirements

The controller unit shall be microprocessor based with additional solid state electronics components for memory and data entry of all timing and traffic control functions described herein. The hardware provided shall meet the NEMA temperature requirements certified by an independent laboratory. A resident program shall start the controller operating when power is first applied, without a failure, providing the functionality described herein. The controller unit shall begin using each programmed data for the first occurrence of the event requiring the data and after data is loaded into memory. All units shall be capable of both master and secondary operations as described by these specifications.

The controller unit shall be shelf mountable enclosure containing electronics and hardware for processor/display, input/output interface, system communications, and power supply functions. The enclosure shall be constructed of sheet aluminum and a maximum of 15 inches wide x 10-1/2 inches high x 10 inches deep. All exterior surfaces shall be finished with a durable protective coating or anodized. Model and serial number shall be permanently attached and/or displayed on the frame of the enclosure.

The controller unit shall provide electronic circuitry to monitor the operation of the microprocessor. Processor and circuitry faults shall be detected and shall set the voltage monitor output FALSE then indicate an error message on the front panel display.

The controller unit power supply shall provide for isolation and protection against power surges, generate all regulated voltages for internal and external use, and provide power monitoring control signals. The minimum power output shall be 24 watts @ 24 VDC. Additional protection shall be designed into the power supply for radio-frequency interference filtration including a differential and common mode noise filter. Fuse protection shall be provided for the 115 VAC input and 24 VDC power output. These fuses shall be mounted on or accessible from the front of the controller without removing the panel held by fasteners requiring tools for removal.

All timing shall be referenced to the 60 Hertz input power. This reference shall control all timing of the controller unit.

A power retaining component, “super cap”, shall be provided for maintaining the time-of-day clock and temporary data storage during a primary power outage. The component shall provide sufficient voltage supply for a power interruption of forty-eight hours. Lead-acid and Ni-Cad batteries are not acceptable.

3.1.1 Keyboard

The programming of the controller shall be accomplished using a keyboard and shall include vehicle, pedestrian, and preemptor calls during test. The keyboard shall be located on the front panel of the controller unit. The keyboard shall be socket mounted for easy maintenance.

The keyboard contacts shall be constructed to be environmentally sealed, highly resistive to oil, dust, water, and most harsh environments and have a minimum rated lifetime of one million operations per key. All keys shall provide positive tactile feel and/or sound to the user.

All keys shall be clearly labeled indicating their function. Numerical keys shall be arranged in a standard telephone pattern. Keys used for YES/NO or ON/OFF entries shall be appropriately labeled. Additionally, data entry control and cursor keys shall clearly indicate their function.

Cursor keys shall provide directional movement of the cursor to any data entry position desired. The cursor keys shall auto-repeat if depressed for longer than one second, to facilitate locating a data entry.

3.1.2 EEPROM Data Module

User programmed settings and intersection configuration data shall be stored in an electrically erasable programmable read only memory (EEPROM). The device shall have the ability to be reprogrammed a minimum of 1500 times. Sectional programming of the EEPROM for each data entry shall be acceptable only if the manufacture guarantees the life of the EEPROM under normal use for a period of 10 years.. Designs using a battery to maintain user data entries shall not be acceptable. Additional requirements concerning data references are found in section 8.5.

To facilitate data transfer from one controller unit to another, the EEPROM device shall be mounted on a sub-module (Data Module). The Data Module shall connect to the processor/display module via a DIN type printed circuit connector.

3.1.3 Firmware

The firmware shall be stored in a Flash ROM. The firmware (proprietary software) updates shall be accomplished by using upload/download unit connected to the controller's RS - 232 port (storage in Flash ROM). It shall not be necessary to physically replace hardware components to update the firmware. Connecting the upload/download unit to a communications port on the controller and transferring the new firmware from files on the PC and a Palm handheld device to the controller's programmable read only memory (PROM) shall accomplish the update procedure. The components shall accept a minimum of one thousand (1000) firmware updates. The following components shall be supplied to accomplish the firmware update:

1. PC and Palm handheld compatible software program to accomplish the transfer with a verification routine.
2. One (1) copy of instruction manual for the entire process.

The update process shall be accomplished at a transfer rate of ninety six hundred (9600) baud.

If the requirements of this section conflict with any provision of this specification (TCS 18A), the requirements of this section shall rule. No provision of this specification shall relieve the vendor of supplying a controller that meets the requirements.

3.1.4 Display

A liquid crystal display (LCD) shall be provided on the front panel of the controller unit to display programming and operational status information. The display shall be clearly readable in bright sunlight or dim artificial light without shading the display. The contrast of the display shall be adjustable. If after the Department's evaluation that this requirement is not met, backlighting shall be provided. It shall contain a minimum of four (4) lines with forty (40) alphanumeric characters per line. The display shall have an expected continuous life cycle of ten years while operating in the NEMA temperature range or be replaced by the supplier at no cost to the Department.

The display shall have two (2) modes of operation, dynamic and programming. The dynamic mode shall display operational status information, while the programming mode shall display user-programmable information. The normal display shall be either blank or a dynamic display as stated below.

The dynamic displays shall provide a visual status of the real-time controller unit operations. Data entry shall be prevented without a display indicating the location for the data and the data that will be entered in this mode. Data entry during this display is acceptable only as an extra method, not as the primary data entry method. The dynamic displays shall be accessible via the front panel keyboard. The following status displays shall be specific to each of the major functions of the controller unit.

The controller timing displays shall be a dynamic display that indicates ring, phase, and coordination status information. Ring status shall include phase timing, current interval and time remaining for both rings, simultaneously. Status messages shall include current vehicle and pedestrian intervals, reasons for phase termination, and Max timer in effect.

Phase status shall indicate the current phase(s) timing and which phase(s) is next to time, vehicle/pedestrian call/recall information and preemptor calls.

The coordinator status display shall indicate the command source, current cycle/offset/split, local/system cycle count, commanded/actual offset, and offset correction. This display shall provide co-ordination relationship to phase operation in real time and be a single display.

The preemptor status display shall indicate calls, preemptor active, and delay period timing. Also indicated shall be preemptor timing, the phase(s) timing while in preemption, interval, and time remaining on the interval.

The detector status display shall indicate activity for all detectors. The display shall indicate detector calls as they are processed by the controller unit.

- Programming Displays

The programming displays shall aid the operator to enter data from the keyboard. These displays shall be arranged in a menu format. The main menu shall allow the user to select one of the major functions of the controller unit. A sub-menu is permissible to display selection of a specific area within that function. Cursor keys shall allow the user to move up, down, left, or right through the data of the menu.

Multiple data entries shall be shown at the same time to facilitate programming. It shall be possible to return to the main menu or sub-menu by a maximum of two (2) key strokes.

English language and traffic engineering terminology shall be used throughout the programming displays. Display organization and data entry method shall allow traffic engineers or technicians to program the controller unit without using reference cards or manuals. Mnemonic usage shall be minimized and limited to recognized traffic engineering terms.

All programming entries shall consist of numerical values, YES/NO, ON/OFF, TRUE/FALSE, logical 1's/0's entries. During program entry, the new data shall be displayed as it is entered from the keyboard. For quick entry of data, a repeating or copy function shall be provided. If the data is in error, the user shall be alerted by an error message on the display. Previously programmed entries shall remain until valid data is entered.

3.1.5 Programming

The programming methods shall not affect normal operation of the controller unit.

Download flexibility shall permit individual transfer of each major programmable category or the entire data base at one time.

Controller unit programming shall be accomplished by the following methods:

a. Front panel keyboard through menu access.

b. Downloading data from a LA DOTD computer with Windows software system (including lap-top) running the appropriate software and using the controller unit terminal interface directly or via a dial-up modem.

c. Data module transfer from one controller unit to another as specified in firmware section.

3.1.6 Programming Security

A four digit code shall be user selected, and stored in EEPROM, for one level of programming security. Display features shall be available without the need to employ the access code. The controller unit shall be supplied with the codes preset to all zeros (0000).

If the access code has not been entered and a data entry attempt is made, then a prompt, requesting the access code, shall appear. Once entering the code, the screen shall revert to the previous display and data entry shall be permitted. The code shall not appear on the screen at any time. No further access code entries shall be required.

When the access code is required for data entry, the controller unit shall automatically set the locked access mode following a period of keyboard inactivity for eight minutes.

The access code shall be changeable only if the previous access code has been

entered. Additionally, it shall be possible to prevent changing the access code from the keyboard.

3.1.7 Memory Clear

A memory clear function from the keyboard shall not be permitted for the user to clear data entries. Default values shall be entered by the user to supersede previously programmed data.

3.1.8 Interface Connectors and Printed Circuit Boards

All interface connectors shall be accessible on the front of the controller unit and rigidly secured to the controller by the shell of the connector. Three MS-type connectors (A, B, C), meeting the pin assignment and interface requirements of the NEMA Standard shall be provided. A fourth connector, identified as the D connector shall be provided for auxiliary inputs and outputs as specified within this standard.

Four (4) RS232 ports shall be provided for communications with the system software, portable download/upload unit, conflict monitor and intra-system communications. These four (4) ports shall be keyboard-assignable for any of the communications functions. All four (4) ports shall be RS-232 serial port accessible through both DB-25 and DB-9, twenty-five pin and nine pin, subminiature, dual-inline connectors. An Ethernet jet port shall be provided. Additional ports required for closed loop secondary operation shall be supplied, if necessary to support the vendor's standard closed-loop application software. Each unit shall support all necessary communication ports for both master and secondary operation.

One SDLC port shall be provided per unit in compliance with NEMA TS-2, 1998 specifications.

All connectors shall be mounted a minimum 1-1/2 inches apart providing hand working room for comfortable installing and removing of the mating connectors.

All inputs and outputs to the controller unit shall conform to the applicable interface and environmental requirements of the NEMA Standard.

All printed circuit boards shall meet, as a minimum, the requirements of the NEMA Standard. In addition, they shall also meet the following requirements:

a. All plated-through holes and circuit traces shall be plated with solder to protect exposed copper. Any wire jumpers included on circuit boards shall be placed in plated-through-holes that are specifically designed to contain them. Circuit track corrections by track cuts and jumpers that are tack soldered to circuit tracks are not acceptable.

b. Both sides of the printed circuit board shall be covered with a solder mask material.

c. The circuit reference designation for all components shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards.

d. All electrical mating surfaces shall be gold-flashed.

e. All ICs, 14 pin and up, shall be installed in machine tooled grade sockets meeting these requirements. All sockets shall be AUGAT-8XX-AG11D or approved equal, meet UL specification 94V-0, be constructed with two-piece, machined contacts and close-ended to eliminate solder wicking. The outer sleeve shall be brass with tin or gold plating and tapered to allow easy IC insertion. The inner contact shall be beryllium copper sub-plated with nickel and plated with gold. Surface mount components not on sockets shall not be allowed.

3.1.9 Service Equipment (to be provided when stated on order)

The controller unit design shall use printed circuit boards that plug into an internal harness array and/or connector plug within the unit. All circuit boards shall be mounted vertically. Transformers, capacitors, and transient suppressor components are exempt from the above requirement.

The controller unit design shall allow easy removal or replacement of a circuit board. All printed circuit boards shall be keyed to prevent improper installation.

The controller unit enclosure shall be constructed to allow complete disassembly using hand or standard screwdriver operated fasteners. The unit shall be designed for adequate accessibility to troubleshoot and test one side of any circuit board while the unit is still in operation. If testing cannot be accomplished with boards in their assigned position then extender boards or cables may be used. Only one board at a time shall be required to be moved during testing.

One set of cables and/or extender boards shall be provided with each order of ten controllers, two sets for twenty controllers, with a maximum of three sets of cable or extender boards.

One portable controller testing facility shall be provided with each order of ten controllers, two for twenty controllers, and a maximum of three for more than thirty controllers.

The testing facility shall provide switches for testing all NEMA inputs and LED's for all NEMA outputs. In addition, indicators and switches shall be provided for testing all the requirements within this standard except for the communication ports and/or RS-232 connectors.

The facility shall be contained within a weather proof enclosure, with quick release closure latches, and have a carrying handle. All harnesses shall be provided with the standard A, B, and C harnesses permanently wired within the enclosure. The additional harnesses shall be connected within the enclosure with a circular plastic connector meeting the requirements for type and pin assignment for the fourth connector installed in the cabinet. All standard NEMA functions shall be permanently labeled for each indication and switch. All additional inputs and outputs shall be identified with overlays which can be labeled identifying the function.

All servicing equipment shall be identified and documentation shall be provided which includes wiring diagrams and schematics.

3.2 System Master Capabilities Design Requirements

The system master shall be a microcomputer device that shall control and supervise a minimum system of twenty intersection controllers. It shall provide the communications link between the central computer and each of the intersection controllers within the system. The system master shall be assigned a unique identification number for communications on the same link with other system masters. An optional method for providing system master operation is to include the master operation as part of the software within the secondary controller. This option shall require the operation of the traffic signal control and system master without interference between them. Priority shall be given to the traffic signal control and operation as defined in this section.

Each master shall generate system commands to its associated intersection controllers, either in response to prevailing traffic conditions analyzed by system master using detectors information or by time-of-day scheduling, external command inputs, or manual inputs.

The central plans shall be constructed with the following minimum options:

a. 48 patterns with a unique cycle length per pattern
b. From one to four offsets per pattern
c. Selection of one split per pattern from a table of 32 programmable splits
d. Selection of one sequence per pattern from a table of 16 programmable sequences.
e. Pattern 254 (NTCIP) causes the intersection to operate in free.
f. Pattern 255 (NTCIP) causes the intersection to flash as programmed internally

The reference point for all cycles shall be programmable by the user. Normally it is initialized to midnight.

A minimum of 48 patterns will be provided. Each pattern can make all the selections as defined in Section 3.5 of the NTCIP NEMA protocol.

The system master shall monitor the operation of all the associated intersection controllers, communication paths, local detectors, and system detectors. User programmable reporting alarms shall initiate failure reports to the designated terminals from a list of user identification numbers. A minimum of four terminals shall be assignable.

System master shall provide:

a. Traffic Plan Selection
b. Crossing Arterial Synchronization
c. Diagnostics
d. Events
e. Logs
f. Reports
g. Data Entry

Alternative crossing arterial synchronization shall be accomplished by using the master synchronization reference point. The operating cycles having the same cycle length will be referenced to the same point. An additional interface method shall be used to operate both

arteries on the same cycle length. Associated system control shall also be included for mutual coordination.

3.2.1 Traffic Plan Selection

The traffic plan shall be selected on a priority basis. The priority order shall begin with the highest being:

a. Manual commands
b. Central System commands
c. Time-of-day/day-of-week/week-of-year scheduled commands
d. Traffic responsive commands.

- Traffic Responsive Operation

Traffic plans shall be automatically selected in response to real-time system detector input data. These commands shall be transmitted to, received and implemented by the intersection controllers within the master's system.

A minimum of 48 system detector inputs shall be provided and each, if selected, shall be processed into scaled values used for volume, density, and occupancy data. The volume and occupancy scale factors shall be user-specified and programmable through the keyboard into the master for each detector; otherwise a default value of zero shall be entered. Each detector shall be user-programmable as one of two directions or crossing direction.

Detector data shall be processed to provide a value representing traffic conditions for each function. The process shall include:

a. Data computations resulting in values accurately representing vehicle volume (vehicle/hour), occupancy (time detected), and density (vehicle/mile).

b. Comparison of computed values determining the relative volume and density for traffic conditions detected and assigned to directions as stated above.

c. Accumulation of detection values over a user programmable time interval, evenly divided into a minimum of ten sampling periods, shall provide smooth transitions into selected programs designed by the Department to progress traffic through the system. Functional requirement for this process is to select a cycle, offset, and split from user specified values of detector data.

d. User-specified adjustment factors for each function shall be used to make the detector data be within 50 to 100 percent of selected vehicle density characteristic.

Function values shall be compared to user-specified threshold values for traffic plan selection. Plan selections shall not oscillate between plans which have numerically close values. A method of hysteresis shall be used to prevent oscillation.

Ranges for six traffic volume and occupancy levels shall be programmable and used for comparing the master's computed volume and

occupancy level from the overall detector data. Level one shall be associated with light traffic with no coordination and level six shall be associated with heavy traffic. Twelve programmable thresholds shall be provided for the master's comparison values to implement plan selection based upon its computed values.

Arterial directional preference shall be determined by computing directional detector data. The magnitude of the difference and directional preference shall be compared to user programmed threshold values to select and implement directional or average offsets.

Split selection shall be based on user assigned system or phase detector data. Programmable weighing of each detector data, as stated above, shall be used by the master for computing each detector adjusted data. The master shall implement the appropriate split by comparing the main street and cross street data. Programmable values shall be used for selecting four levels of increasing values and four levels of decreasing values. If an error condition is detected, the selection shall default to average or user specified value.

Based on the master's computed detector data levels, a user-specified traffic plan shall be selected as the traffic responsive plan. If computed level or computed offset cannot be determined because of detector failures, a default plan shall be implemented from TOD plan or from TBC.

Each traffic plan contains a programmed split command for that plan. Alternately, it shall be possible to select splits and special function commands for user-specified plans based on split demand function values. Four split/special function combinations shall be available.

- Time-Of-Day/Day-Of-Week/Week-Of-Year Schedule

Time-of-day scheduling shall be controlled by an internal clock, accurate to the power line frequency. In the event of a power failure, the clock shall be maintained for a minimum of 72 hours. Leap year shall be automatically compensated for and daylight savings time shall be programmable for date of occurrence. A minimum of 24 user-defined programs shall operate on a daily, weekly, and yearly basis.

TOD programming shall follow Section 3.5 of the NEMA NTCIP specifications.

Programmable entries shall include:

a. Day-program assignment
b. Start time
c. Traffic pattern (cycle, offset, split, special functions, free, plan command)
d. Traffic responsive plan enable
e. Traffic responsive plan override of TOD
f. Sample period interval
g. Sample period log interval

h. Detector log interval

The arterial master shall update time and date in all intersection controllers in a system a minimum of once every hour.

The arterial master shall include a time comparison feature. This feature shall indicate the need to update the master clock after being compared with the reference clock in the central personal computer. It would be preferred to enable a clock reset from the central computer to update the master clock with the time from the central computer.

- External Commands

External commands shall be received from a remote source such as another arterial master. These control signals shall be used to initiate an external plan. Alternatively, the external command inputs shall be used for crossing arterial synchronization. External commands shall override TOD and traffic responsive operation.

- Manual Entry

Manual entry from the front panel keyboard or a remote source shall provide the highest priority of plan selection. It shall be the default program if traffic responsive operation fails and a TOD plan is not specified.

- Pattern Mode Entry (Test Command)

Mode commands shall allow selection of any defined pattern. Intersection controllers may contain the same or different programs which shall allow sub-system coordination or independent operation under time-base control.

- Diagnostics

Diagnostic tests shall be continuous checks performed on system detector data, communications, and communication connected devices. Detected faults shall produce event failures at the arterial master and the central computer.

Failures shall be displayed on the arterial master. A fault isolation routine, selected from the front panel keyboard, shall identify the failed device. The operator shall have the ability to display all fault conditions on command.

- Power Fail Restart

Following a power interruption, the arterial master shall update the clock and bring itself on-line automatically and gain control of the system.

- Device Event Reports

If operating in a system, diagnostic failures shall be reported to the central computer as events. The following devices shall be monitored:

a. Communication

b. Local intersection controllers
c. System detectors
d. Local detectors

Report events shall verify system master and local intersection controller responses. Communication tests can be a specific test or results from normal evaluation during operation and shall be as follows:

a. System Master Test - A system master test failure shall occur when the master does not respond to central computer commands. If a response is received within three seconds following a failure, the failure condition shall automatically clear, restoring system master/computer service.

b. Local Intersection Controller Communication Test - A local intersection controller communication failure shall occur when valid data is not received by the master for five seconds. If data is received within five seconds following a local intersection controller communication failure, the failure condition shall automatically clear, restoring local intersection controller communications.

Local intersection controller events shall indicate CMU flash, local and commanded flash, cycle fail, coordination alarm, local and commanded free, coordination error, preempt, and user-designated events:

a. CMU flash - If intersection controller status indicates CMU flash for a period in excess of a user-programmable period of 0-30 seconds, the intersection controller shall fail and a CMU flash event shall be recorded.

b. Local Flash - If intersection controller status indicates CMU flash is OFF and flash is not commanded from the arterial master, the intersection controller shall be considered off-line and a local flash event shall be recorded.

c. Commanded Flash - If intersection controller status indicates flash, CMU flash is OFF, and flash is commanded from the arterial master, the intersection controller shall be considered off-line and a commanded flash event shall be recorded.

d. Cycle Fail - If intersection controller status remains in the same phase with opposing phase calls for two cycles during coordination or three minutes if the system is free, the intersection controller shall be failed and a cycle fail event shall be recorded.

e. Coordination Event - If intersection controller status indicates a coordination alarm condition, the intersection controller shall be failed and a coordination event condition shall be recorded.

f. Local Free - If intersection controller status indicates a free condition and free is not commanded from the arterial master, the intersection controller shall be considered off-line and a local free event shall be recorded.

g. Commanded Free - If intersection controller status indicates a free condition and free is commanded from the arterial master, the intersection controller shall be considered off-line and a commanded free

event shall be recorded.

h. Coordination Error - If intersection controller status indicates a coordination error condition, the intersection controller shall be considered off-line and a coordination error event shall be recorded.

i. Preempt - If intersection controller status indicates a preempt condition, the intersection controller shall be considered off-line and a preempt event shall be recorded.

j. Event 1/Event 2 - If intersection controller status indicates an event 1 or event 2 condition, the intersection controller shall feed back user-designated alarm information and an event 1 or event 2 shall be recorded.

- Detector Diagnostics

System detector diagnostics shall check for maximum presence, minimum presence, excessive counts, and no activity. If a system detector is diagnosed as failed or in error, then data supplied by that device shall be automatically eliminated from system computations.

Local detectors shall be checked for maximum presence and no activity only.

Detector diagnostics shall be performed each minute. Diagnostic periods shall vary depending on the diagnostic test.

Maximum presence events shall be generated by a continuous detector call during a user-specified diagnostic period. The diagnostic period shall be user-selected from 0-30 minutes.

Excessive count events shall be generated if a detector volume count is greater than or equal to a user-specified excessive count threshold. The diagnostic period shall be user-selected from 0-30 minutes.

No activity events shall be generated if vehicle counts are not received during a user-specified diagnostic period. The diagnostic period shall be user-selected from 0-255 minutes.

Detectors shall be failed when its operation is not within the specified criteria. A detector that begins functioning within the specified limits shall be returned to a non-failed status and its input used by the controller.

- Monitor Events

Status changes and operating failure events at any intersection controller or arterial master shall be recorded by the arterial master at the time of failure or event occurrence. Events shall be reported to the central computer on a priority basis.

Reporting priority shall be selected by event or failure. It shall be programmable as: immediate, report with higher priority, or not at all.

Two telephone number entries shall be programmable from the central computer for reporting events to central computer and for reporting device failures to another maintenance computer or terminal. Device failure reports shall be transmitted to the designated computer or terminal only when

scheduled by a TOD entry.

If the central computer is busy or off-line, a reporting arterial master shall repeatedly attempt to call at a preset retry interval in the range of 3 - 15 minutes.

Reporting shall be selected for directing all events to a central computer and maintenance computer or terminal when this capability is selected. Printed events shall consist of the following categories:

a. Program and TOD changes
b. System events
c. Device diagnostics

- Program and TOD Changes

Program and mode changes shall occur automatically as a result of traffic responsive plan computations, TOD scheduling, external, and manual commands. Program and mode event changes shall include the following:

a. In-effect program change
b. Traffic responsive program change
c. Special function change
d. Time-of-day interval change
e. Controller command TOD change

- System Events

System events shall be arterial master self diagnostics. The diagnostic messages shall include:

a. Power-off (Comm-failure)
b. Power-on (Comm-failure)
c. Power interrupt
d. Clock error
e. Backup

Power-off event shall be stored in memory and reported when power is restored.

Power-on event shall report the time and date that power is restored. Time and date information shall be accurate if power is off less than 72 hours.

Power interrupt event shall report when power was off for less than one second.

Clock error event shall report when time and date information is different from the central computer reference. This event shall automatically occur whenever power was off greater than 72 hours. A clock error event shall inhibit TOD operation and scheduled reports until the clock has been reset and is functioning correctly.

Backup event shall indicate a data change in the arterial master memory. All memory shall be automatically re-initialized with a backup data base to allow continued operation.

- Device Diagnostics

  All device diagnostic failures shall be reported as events. Refer to Section 4.3 for diagnostic descriptions.
- Real-Time Detector Logs

  Real-time logs shall provide the operator with a permanent record of system detector data. Real-time logs shall consist of the following categories:
  a. System detector log
  b. Sample period log
- System Detector Log

  System detector logs shall show actual volume, and occupancy for user-specified system detectors. Volume shall be the number of vehicle counts accumulated, while occupancy shall be the actual percentage of time that vehicle presence was detected during a 15-minute log period.

  Detector data intervals shall be user-specified by TOD scheduling. The user shall be capable of enabling and disabling the real-time log without affecting previous entries. At the end of the interval, the arterial master reports the log to the central computer for printing. The log shall not be stored on hard disk.
- Sample Period Log

  Sample period logs shall show computed parameters used in determining the traffic responsive plan selection. The sample period log interval shall be user-specified as a multiple from 1-6 sample periods by TOD scheduling.

  If the default log period is programmed to be zero, the sample period log shall be reported when there is a change in the computed traffic responsive program. The user shall be capable of enabling and disabling sample period logs without affecting previous entries. The sample period log is reported to the central computer for printing. The log shall not be stored on hard disk. The sample period log shall consist of the following:
  a. Scaled volume and occupancy for enabled system detectors
  b. Scaled volume and occupancy for detector groups with assigned detectors
  c. Current value of each program selection function
  d. Smoothed value of each program selection function
  e. Computed program selection values
  f. Selected traffic responsive plan program
  g. In-effect program and cycle length

  Additionally, the printout shall identify groups that have not been assigned and parameters containing errors.

3.2.2 Status Reports

Manually commanded status reports shall be provided to allow the operator at the central computer an immediate record of system operations. Reports shall consist of the following categories:

a. System status
b. Controller failure summary
c. System detector failure summary
d. Current 15-minute system detector log

- System Status

System status report shall describe the system operating conditions. The report shall be a concise printout including the following:

a. Traffic responsive program (computed values)
b. Traffic responsive plan
c. Program-in-effect and source
d. Special function status
e. Communication status:
    1. System master communication failure
    2. Local intersection controller communication failure
f. Intersection controller status:
    1. On-line
    2. Off-line
    3. Failed
g. System detector status:
    1. On-line
    2. Failed
h. Local detector status:
    1. Failed

Local detectors shall be identified by intersection controller number and assigned phase. Intersection controller off-line shall indicate a disabled intersection controller or a non-coordinated intersection controller due to the following conditions: preemption, coordination error, local free, commanded flash, or local flash.

- Intersection Controller Failure Summary

Intersection controller failure summary shall identify failed intersection controller(s) and probable cause(s). Probable failure causes shall be as follows:

a. Communication
b. Cycle failure
c. CMU flash
d. Coordination alarm

- System Detector Failure Summary

System detector failure summary shall identify failed system detector(s) and probable cause(s). The possible failure causes shall be as follows:

a. Communication
b. No activity
c. Maximum presence
d. Excessive counts

- Current Detector Log

Current detector log shall show actual volume and occupancy recorded during the last log period. Volume shall be the number of vehicle counts accumulated while occupancy shall be the actual percentage of time a vehicle presence was detected. This data shall be indicated per detector.

- Stored Events

Stored events shall be a report of the last events stored in the arterial master (up to 255). These events shall be printed in the order recorded. If the event storage memory becomes full, the newest event over-writes the oldest event.

3.2.3 Coordination/System Operation Commands

The controller unit shall provide coordination functions to control intersection cycle lengths, system offset relationships, and phase split timing. The coordinator shall perform these functions by internally manipulating the appropriate controller unit inputs. The controller unit shall be programmable for selecting these functions as output during all modes of coordination, controller unit designated as master, secondary or isolated.

Coordination functions shall be provided as a standard controller unit feature. These functions shall be included in the equipment and software provided. Hardwired inputs and outputs for coordination functions shall be through isolation relays, specified elsewhere, and shall be binaurally encoded on the respective cycle and split input lines. The voltage on the hardwired interconnect shall be 120VAC. The input lines shall have no active inputs for cycle one and split one. Cycle four and split four shall be activated by both the cycle two and three or splits two and three inputs being active respectively. Offsets one through three shall be only activated one at a time by the synchronization pulse being superimposed upon active line. The offset line shall operate by using a continuous high (120VAC) interrupted by a low for three seconds at the coordination point. Only one offset line shall be operated at a time. The remainder of the required system operations is not required to operate within a hardwired system.

Alternate methods to the cycle-split concept of coordination shall be evaluated based upon providing programmable time distribution to control vehicle movements within system parameters for traffic progression. A minimum of sixteen “programs”

of the alternate method shall be provided and controlled by the inputs specified and shall meet the requirements for coordination.

- Transition Cycles

The controller unit shall provide a smooth and orderly transition during operational changes in both free and coordinated operations. No skipping of through movement phases shall be allowed when changing a sequence from a lead-lag to a lag-lead.

- Free to Coordinated Transition

During the free to coordinated transition, the controller unit shall complete a pick-up cycle before entering the coordinated mode. The pick-up cycle shall begin upon receipt of a sync pulse and a valid coordination command. During the pick-up cycle, the coordinator shall service all non-coordinated phase calls in normal sequence until entering the coordinated phase(s).

- Coordination Command Transfer

The coordination command shall contain the system cycle, offset, and split. Command changes shall be implemented concurrent with a sync pulse. The cycle and split command shall take effect when the local zero point of the existing cycle is reached. Command transfers shall not stop the sequencing of the phases during the change except as noted elsewhere in this standard.

The coordinator shall provide five cycles. Each cycle shall have a minimum programmable cycle length from 10-255 seconds, in 1-second increments.

Coordination timing shall be synchronized to the leading edge of the system sync pulse (master zero). This point shall serve as the reference for all offset timing.

The coordinator shall check for the proper occurrence of the system sync pulse, once each cycle. If a sync pulse does not occur, the coordinator shall self-sync and continue to operate with the last set of coordination commands.

Self-synchronization shall continue for a minimum of two cycles. If a sync pulse does not occur within the self sync period, the coordinator shall revert to the non-interconnected coordination mode.

- Hardwired Interconnect

The controller shall provide for external inputs to be used for coordination. These inputs shall be connected to the wiring for the special connector described elsewhere in this standard.

The coordinator shall provide a minimum of one offset per pattern. Each offset shall be programmable within the cycle in 1-second increments from 30 to 254 seconds.

The offset shall be defined as seconds from the beginning of the master cycle counter to the beginning of the local cycle counter. When entering splits according to the NTCIP format, it shall be possible to select that the coordinated phase begins with the local zero point or ends with the local zero point. Time of day will be used to sync the master cycle counter within the local controller. The master cycle count

shall be seconds past the programmed reference, modulo of the current selected cycle length.

The coordinator shall provide offset correction through the following methods:

a. Shortway Offset Seeking

Shortway seeking shall establish an offset within the shortest number of cycles by either lengthening or shortening the cycle length. The method provided by the manufacturer shall continue sequencing the phases until the programmed offset is established and shall be limited to a maximum of four cycle lengths. Any method that causes the controller to lose coordination or force to dwell and require the coordination to begin a second re-sync routine will not be acceptable. The controller shall be cable of programming four (4) phases per pattern that cannot be shortened by this method.

Offset changes shall be accomplished by lengthening only if the reduction of the current cycle length is shorter than the sum of the controller unit's minimum vehicle interval lengths. In addition, all offset corrections shall be programmable to be lengthened only.

b. Dwell

The controller shall dwell in the coordinated phase if this method of offset seeking is selected. The sequence will begin in the first cycle after the offset is established and within the programmed permissive and force-off parameters for that cycle.

- Split

The controller unit shall provide one unique splits for each cycle which shall equal a total of 48. Each split shall have the capability of having two unique forces off points per phase for use during special coordinated operations. Each split shall provide a split interval for each phase of the controller unit. Each split interval shall be programmable in seconds within the cycle length timing in 1 second increments.

a. Split Intervals.

Split interval settings shall determine the maximum time, including vehicle clearance (yellow and red) for a non-coordinated phase, or minimum time for a coordinated phase during the cycle. These times shall be controlled by establishing a force-off point for each phase within the cycle. Force-off points shall be determined from the phase timing values and split interval settings. Force-offs shall meet NEMA requirements and continue to be applied until the phase is terminated. An optional method shall be provided to allow two unique force off points per phase that are user programmable.

b. Coordinated Phase Split Extension.

During coordination, an option shall be programmable to operate the

coordinated phase(s) as actuated or non-actuated. If the coordinated phase is actuated, vehicle detections shall permit the coordinator to extend a phase beyond the normal yield point. Extended coordinated phase green shall be selected in seconds or terminated by a force-off setting for that phase. Selection of the CNA I and/or II operation per cycle will meet the non-actuated operation with the selected phase remaining green until the programmed force-off for that phase is reached.

- Permissive Periods

Permissive periods shall be timed in seconds within the cycle length and provided for each cycle or program to control the time period when the coordinated phase is released to service calls on the non-coordinated phases.

a. Yield Point.

The yield point shall be defined as the point within the cycle when the hold input is released on the coordinated phase and the controller unit is allowed to service calls on non-coordinated phases. A force-off point shall be applied at the time the hold is released, unless a force-off has been programmed for this phase.

The yield point shall begin from the coordinated phase split interval and pedestrian clearance plus vehicle clearance time. The coordinated phase pedestrian clearance period shall always begin at the yield point regardless of calls on the non-coordinated phases.

b. Permissive Periods

All permissive period timing shall begin at the yield point. A minimum of three programmable permissive periods shall be provided. The vehicle portion of each permissive period shall be a programmable timed interval within the cycle length. An automatic pedestrian permissive period shall be allowed for phases following the coordinated phase(s). Each permissive period shall be programmable for selecting phases that would operate during this period. This function shall operate as follows:

a. During the first permissive period, the controller unit shall answer only vehicle or pedestrian calls on the phase(s) following the coordinated phase in the programmed sequence. If the controller unit yields to a call during this period and the all remaining phases are allowed during this period, then other permissive periods shall be inhibited. All remaining calls shall be served in programmed sequence.

b. The second and third permissive periods shall be programmable for beginning and ending after the yield point. During each permissive period the controller unit shall answer calls on each period's programmed phase(s).

c. An alternate method for the permissive period operation

described above will be considered. The principle guide lines for controlling phase time shall be followed.

c. Single Permissive Period

Single permissive period shall become operational by eliminating the second and third permissive periods as described above. This single permissive period shall be similar to the first permissive period, except that the controller unit shall answer calls on any phase in order of the programmed sequence during the permissive period.

3.2.4 Cycle Programming

In addition to cycle length, offsets and splits, the following functions shall be programmable on a per cycle basis. Alternate methods of function selection shall be controlled by cycle, split, and offset inputs.

- Coordinated Phases

Coordinated phases shall be selected for each cycle. If the coordinated phase assignments are changed when transferring between cycles, the coordinator may operate in the free mode until completing a pick-up cycle.

The coordinated phases shall normally operate in the non-actuated mode during coordination. However, it shall be possible to select the coordinated phases to remain in the actuated mode.

- Phase Sequence

The controller unit shall normally use a standard quad phase sequence. The controller shall be programmable to select the phase sequence by selecting cycle and split. The phase sequencing shall be selected from the sequences specified previously. The free mode phase sequence shall be programmable from the keyboard and not restricted to be one of the coordinated sequences.

- Phase Omit

Phase omit(s) shall be selected during each cycle or program. Additionally, a phase shall be omitted if its split interval value, for the current split, is zero.

3.2.5 Crossing Artery Control

The coordinator shall be programmable for crossing artery synchronization by implementing dual coordinated phases at an intersection(s). The coordinator shall be programmable for two coordinated phases in a ring assignable to primary or secondary coordination. Phase(s) shall assigned to a secondary coordinator shall time the green of the phase until the force off occurs or shall be controlled by call to non-actuated operation.

In addition, the coordinator shall output a crossing artery sync pulse indicating

the beginning of the crossing artery phase split interval. This signal shall be used to establish the master zero for the crossing artery system master.

Dual coordination shall also force a selected crossing artery split to be used. This feature shall optimize a particular split in each cycle for dual coordination.

See Section 5.0 for alternate coordination methods and additional artery control.

3.2.6 Free

The coordinator shall provide a free mode of operation. During this mode, all coordination control shall be removed from the controller unit.

Free mode shall be selected by coordination commands, external input, or keyboard entry. Additionally, the coordinator shall revert to free mode when active controller unit inputs, or functions, would interfere with coordination. These inputs or functions shall include the following:

a. Manual Control Enable
b. Stop Time
c. Automatic Flash
d. Preemption

3.2.7 Manual Control

The controller unit shall allow entry of manual override commands from the keyboard. Manual commands shall permit individual selection of any cycle, any offset, any split or selection of the complete coordination command. When a manual cycle is selected, the sync pulse shall be generated by the time based control section of the controller unit.

3.2.8 Program Control

The alternate method of coordination shall provide manual control that shall select 1 of 16 programs.

3.2.9 Modes of Interconnect

The coordinator shall be capable of operating with any of the following interconnect types:

a. Internal Time Based Coordination
b. Telemetry
c. Hardwired
d. IP addressable

The non-interconnected coordination mode shall also serve as a backup mode to communication or hardwired interconnect.

The coordinator shall be compatible with electromechanical pre-timed interconnect which provides the sync pulse superimposed on the offset lines.

3.2.10 Master Coordinator

The coordinator shall output the coordination commands, including sync. This feature shall permit the controller unit to be used as a time-of-day master in a hardwired electromechanical pre-timed interconnected system. This feature shall be included in all controllers and shall not have restricted use.

3.3 Time-Based Control/Non-Interconnected Coordination

The controller unit shall include time based control. This capability shall be a standard feature and shall include the additional modules and/or software.

3.3.1 Clock/Calendar

The controller unit shall provide a time-of-day (TOD)/99 year clock. The clock shall be programmed for current time (hour, minute, and second), date (month, day, and year), day of week, and week of year. This clock shall be used for all time based control functions.

- Clock Accuracy

The TOD clock shall use the power line frequency as a time base. When power is removed, the time shall be maintained by a crystal oscillator.

The oscillator shall maintain the time to within + 0.005%, as compared to the Universal Mean Coordinated Time Standard. This accuracy shall be maintained over the NEMA Standard temperature range regardless of the number or rate of power failures.

The controller unit shall maintain the TOD clock during power outages for a minimum of 48 hours.

- Time and Date Entry

Time and date information shall be entered in the controller unit through the following methods:

a. The controller unit keyboard
b. Computer via RS-232 port
c. Updated via system communications

- Leap Year and Daylight Savings Time

The TOD clock shall automatically compensate for leap year changes. Daylight savings time changes shall be programmable to occur on a selected week or be omitted if not programmed.

3.3.2 Time Based Control

- Program Format

Time based control shall utilize a yearly program format. The program shall select from a minimum of 60 programs with cycle, offset, and split operations assignable to a day, days of the week, weekend or any one of, selection of more than one or all 52 weeks in the year.

- Holidays

There shall be a minimum of 35 holiday or exception-day programs. Each holiday-program shall be assignable to occur on a specific month and day. Holiday-programs shall override the current day-program.

Each holiday-program shall be selected to repeat the following year.

- Program Selection

Each program shall permit selection of the following functions:

a. Day program assignment, (Month/Week/Day)
b. Start time, (Hour/Min/Sec)
c. Program, (Cycle/Offset/Split)
d. Control of a minimum of four Special Function outputs
e. Flash
f. Max 1 or 2
g. Free
h. Phase sequence

The cycle/offset/split/sequence or free commands, selected by a program step, shall serve as the coordination program only when the controller unit is operating as a TOD master or operating with time based coordination.

Remaining program step functions shall take effect immediately when the program step becomes active.

- Manual Program Selection

It shall be possible to manually force any of the program steps to override the current program step. The forced step shall be entered from the keyboard and shall remain in effect until removed or until the next programmed step.

3.3.3 Non-Interconnected Coordination

- Re-sync Time

When operating in the non-interconnected coordination mode, a programmable synchronization time shall be used as the beginning time for all cycles. All cycles shall be reset to zero, each day, at this time.

- Synchronization Point

The synchronization point will be calculated as defined in the NTCIP standard. Computing this point was described in the coordination section. Computing the synchronization point based on event changes or similar methods will not be accepted.

3.4 Local Capability Design Requirements

The controller unit shall provide the actuated control functions and operations required by Sections 2, 13 and 14 of the NEMA Standard. In addition, it shall provide the features described in the following paragraphs.

3.4.1 Phase Sequence

The phase sequence of the controller unit shall be programmable in any combination of sixteen phases to achieve phase reversal individually or by pairs, one to four independent or concurrent timing rings, multiple rings allowing selection of four-phase operated as a concurrent group, or coordination of two rings and one sequential ring divided by one barrier. Sequencing shall be selected by cycle program or timing plan. Selection of the required sequences shall be programmable from any of the following:

a. Full NEMA and NTCIP operation
b. Select a program number for an established phase sequence
c. Select one to four timing rings, with concurrent or sequential phase assignment
d. Select three or four phase diamond

Specific sequences required by the Department shall be selected from the above operation. Program for selecting phases shall include provisions to disable phases with each program, (phase on - off). Alternate sequences may be used to satisfy the above requirements however mutual coordination of the separate rings will be required. All controller units shall provide these sequences.

Diamond sequences shall include two operational sequences for interstate ramp interchanges. The operation of the controller unit as a 4 phase, and 3 phase diamond shall be keyboard selected and the standard timing function required by NEMA TS1 shall be provided for each phase. The configuration shall operate as two independent four phase rings. There shall be two mutually exclusive inputs as defined in Appendix (pins 12 and 13) that will force the controller unit into 3 phase or 4 phase operation. Additional circuits in this harness shall be for controller and cabinet interlock. Pin 35 listed in Appendix shall be a ground true controller interlock output. The controller shall assert this output when it is present and powered on. Pin 42 listed in Appendix shall be a ground true cabinet interlock input. This input shall be internally pulled up to 24VDC and the controller shall sense this input and operate only when it is present. Special clearance intervals shall be pre-

timed programmable and shall be activated within the sequence shown. This shall be overridden while under computer control, TBC control, or by the inputs defined below. Figure 18A-4 illustrates the assignment of phase numbers to the traffic movements. The additional detector inputs shall be provided with these controllers as stated in the pin assignment for the connector.

- Four Phase Diamond Operation

The normal sequence of operation shall be phase 2/5 → 4/5 → 1/6 → 1/8.

The point at which operation may be switched from 4 phase to 3 phase operation shall occur by forcing the sequence into concurrent left turns (inside clearance during Ø1 and Ø5).

The loop detector layout for 4 phase diamond operation shall be as defined in Figure 18A-5. Each detector input shall be to the phase shown and provide the normal phase timing required by NEMA TS1. The controller unit software shall provide the additional logic for Detector Circuit operation in the following description:

a. Detector Circuit #1 -
   1. Shall extend phase 1/6 if phase 1/8 is called.
   2. Shall call phase 2/5 if phase B overlap is not green and phase 4/5 is not called.
   3. Extend intervals inside left turn clearance interval.

b. Detector Circuit #2 -
   1. Shall extend phase 2/5 if phase 4/5 is called.
   2. Shall call phase 1/6 if phase A overlap is not green and phase 1/8 is not called.
   3. Extend intervals inside left turn clearance interval.

c. Detector Circuit #3 (45P) and #4 (45S) -

   During the phase 4/5 red condition the 45P detector shall always be active and the phase 45S detector shall always be inactive. A phase 4/5 green plus a phase 1/6 call plus a 0.2 second gap in 45P detection shall disable the 45P detector and enable the 45S detector until the phase 4/5 signal changes to yellow. The circuits then switch back to normal - 18P active and 18S inactive until the condition is repeated.

d. Detector Circuits #5 (18P) and #6 (18S) -

   During the phase 1/8 red condition the 18P detector shall always be active and the phase 18S detector shall always be inactive. A phase 1/8 green plus a phase 2/5 call plus a 0.2 second gap in 18P detection shall disable the 18P detector and enable the 18S detector until the phase 1/8 signal changes to yellow. The circuits then switch back to normal - 18P active and 18S inactive until the condition is repeated.

e. Detector Circuits #7 (25S) and #8 (16S) -

   The phase 2/5 detector circuit shall always be active during phase 2/5 red. A phase 25 green plus a 0.2 second gap in detector 25S shall disable this circuit until loss of phase 2/5 green.

   The phase 1/6 detector circuit shall always be active during phase 1/6

red. A phase 1/6 green plus a 0.2 second gap in detector 16S shall disable this circuit until loss of phase 1/6 green.

The 0.2 second gaps mentioned above shall be keyboard programmable from 0 to 3.0 seconds in 0.10 second increments or smaller.

The phase 45P detector shall always extend phase 4 during phase 4/6 interval.

The phase 45P detector shall always extend phase 8 during phase 8/2 interval.

An indication shall be provided for both the 45P detector circuit and the 18P detector circuit to indicate when they are active. When a circuit becomes inactive, the indication shall go out and stay out until it again becomes active.

f. Concurrent Timing Requirements -

Refer to Figures 18A-3 for the following descriptions.

The clearance interval phase 4/6 when sequencing from phase 4/5 to 1/6 shall time concurrently with phase 6, however phase 6 may not terminate green until phase 4 yellow interval has timed out.

The clearance interval phase 2/8 when sequencing from phase 1/8 to phase 2/5 shall time concurrently with phase 2, however phase 2 may not terminate green until phase 8 yellow interval has timed out.

All left to right internal clearance (Ø1/ Ø5) times from phase 4/5 to phase 1/8 shall use the same timing settings for minimum green, extension, max green, yellow clearance, and red clearance.

All right to left internal clearance (Ø5/ Ø1) times from phase 1/8 to phase 4/5 shall use the same timing settings for minimum green, extension, max green, yellow clearance, and red clearance.

Separate timing settings for minimum green, extension, max green, yellow clearance and red clearance shall be provided for each of the two external clearance intervals (Ø2/ Ø8 and Ø4/ Ø6 from Ø1/ Ø8 to Ø2/ Ø5 and Ø4/ Ø5 to Ø1/ Ø6).

- Three Phase Diamond Operation

a. Sequence

The controller unit shall be keyboard selected for 3 phase diamond operation. The normal sequence of operation shall be, except as modified below, 4/8 → 2/6 → 1/5.

The point at which operation may be switched from 3 phase to 4 phase operation shall be from phase 1/5 to 4 phase inside clearance interval phase 1/5.

The path from 4/8 to 2/6 shall be keyboard selected and selected by the TBC (on a time of day basis) for one of the five possible phase combinations of lead/lag left turn clearance movements. These possible phase combinations shall be permitted when individual phase gap time expires.

4/8 → 4/6 → 2/6

4/8 → 4/5 → 2/6
4/8 → 2/6
4/8 → 2/8 → 2/6
4/8 → 1/8 → 2/6

The path from 2/6 to 1/5 shall be keyboard selected and selected by the TBC (on a time of day basis) for either 2/6 → 1/6 → 1/5 or 2/6 → 2/5 → 1/5.

The path from 2/6 to 4/8 shall always be through 1/5 and terminated simultaneously. The sequencing shall be flexible and phases shall be terminated bases on traffic actuation and gaps programmed for the phase.

b. Detector Operation

The loop detector layout for 3 phase diamond operation shall be as defined in Figure 18A-6.The 1P detector shall function as a phase 2 calling detector during phase 4 and as a phase 1 extending detector during phase 2.

The 5P detector shall function as a phase 6 calling detector during phase 8 and as a phase 5 extending detector during phase 5.

3.4.2 Timing Intervals – All Sequences

The controller shall be programmable for the following timing parameters and any of the selected sequences. Each phase shall be timed independently and special clearance phasing described in the diamond sequence may be timed by group.

The following timed intervals shall be programmable in the minimum range for each interval: Guaranteed minimum time shall be provided for each phase, overlap, and preempt yellow. Minimum values shall not be changeable or overridden from the programming sources listed in this specification. Guaranteed minimum interval value shall be three seconds. Maximum Green Intervals.

The controller unit shall provide two maximum green intervals per phase, however three are preferable. Maximum intervals shall be selected by either time-of-day or external input.

TABLE 18A-4 TIMING INTERVALS

INTERVAL	RANGE (SEC.)	INCREMENT (SEC.)
Vehicle passage	0-25.5	0.1
Yellow clearance	3-25.5	0.1
Red clearance	0-25.5	0.1
Added initial min. green	0-25.5	0.1
Red revert	0-25.5	0.1
Minimum gap	0-25.5	0.1
Delay/extend detector timing	0-25.5	0.1
Walk	0-255	1.0
Pedestrian clearance	0-255	1.0
Time before gap reduction	0-255	1.0
Time to reduce gap	0-255	1.0
Min initial green	0-255	1.0
Maximum added initial green	0-255	1.0
Overlap timing	0-25.5	0.1
Maximum green I, II & III	0-255	1.0
Maximum green extension interval	0-255	1.0

3.4.3 Maximum Green Extension

The controller unit shall be capable of extending a phase maximum green time by continuous vehicle demand. If the phase terminates by expiration of the maximum time for one successive cycle, then its maximum green time in effect (Max 1 or Max 2) shall automatically be extended by a maximum green extension interval. The maximum green time shall be increased, until it equals Max 3, on each successive cycle that the phase green is terminated by the Max 1 or 2. If the phase gaps out for one successive cycle, then the maximum green time shall return to the original Max 1 or 2 value.

An alternate method for providing active traffic responsive timing shall use the volume/occupancy system detectors capability assignment to the phase detector. A preprogrammed cycle plan shall be initiated for providing timing modification to meet the traffic demand.

3.4.4 Volume Density Intervals

Each phase shall have volume density intervals conforming to NEMA standards.

3.5 Overlaps

The controller unit shall provide sixteen internally generated overlaps: Each overlap may be programmable as standard or protected/permissive. The capability shall be provided for reassignments of a minimum of four phase outputs to overlap operation shall be in the software for implementing special sequencing requirements and shall not require rewiring the controller signal outputs on the back-panel.

3.5.1 Overlap Timing

Green, yellow and red timing intervals shall be provided for each overlap. These intervals shall permit the overlap to remain green after terminating the parent phase in addition to providing separate yellow and red clearance intervals for the overlap. A programmable feature shall provide a selection of sequencing that would hold all phases red or advance to the next serviceable phase green after the parent phase has terminated and the overlap timing is in effect. In either selection the next serviceable phase interval shall not begin timing until the overlap times have expired. Overlaps shall be controlled by the parent phase if the overlap timing intervals are not programmed. The overlap sequence shall never violate the conventional green, yellow, red sequence under any circumstance. This timing operation shall be provided during all operational requirement herein specified. Any conflicting operation with this timing requirement shall supersede the timing extensions.

Overlap programming flexibility shall permit the user to assign the timed overlap to follow any parent phase(s).

3.5.2 Multi-Overlap Operation

The controller unit shall be capable of eight overlaps including the standard four and assigning four phase outputs as overlaps. If a phase output is assigned as an overlap then it shall function as a standard overlap and programmed in the EEPROM. Changing these overlap assignments shall be programmed from the keyboard of the controller unit and provide warning of the impending sequence change.

3.5.3 Recall Functions

The controller unit shall provide the following programmable features for each phase.

a. Locking/Non-locking detector memory
b. Vehicle recall
c. Pedestrian recall

d. Maximum recall
e. Soft recall - Locking/Non-locking memory

Soft recall shall return the controller unit to the programmed phases in the absence of all other calls.

3.5.4 Initialization

The controller unit shall permit power start and external start to be individually programmed by phase and interval. Start intervals shall be green, yellow, red, all red or flash. During a power start condition, the controller unit shall be programmable for a timed display of an all red or flash interval before the selected start phase(s) and intervals are displayed. Data reference shall be made to the data in the EEPROM. An error shall keep the controller non-operational until the error is corrected. Resets shall be initiated to correct data integrity and begin the controller operating.

3.5.5 Last Car Passage

The controller unit shall provide guaranteed passage operation on a per phase basis. When selected, this feature shall provide a full passage (vehicle extension) interval when a phase gaps out with a gap in effect less than the passage time. The phase shall terminate after the passage interval expires.

3.5.6 Dual Entry

The controller unit shall provide both single and dual entry operation. When selected, dual entry shall cause the controller unit to insure that one program selected phase is timing in each ring. If calls do not exist in a ring when a barrier is crossed, the controller shall select a programmed compatible phase and operate it concurrently with the phase or phases that have calls. When the selected controller sequence is non-NEMA, then an acceptable method of calling a compatible phase is the use of vehicle detector switching.

3.5.7 Conditional Service

The controller unit shall provide a programmable conditional service feature when the controller is operated in the standard NEMA sequence. When selected, the controller unit shall service only one odd numbered phase during a sequence, once normal service to that phase has been completed and enough time for additional service exists on the concurrent even phase. The odd phase (left turn) shall be serviced if the vehicle clearance time of the terminating even phase plus a conditional service minimum green is less than or equal to the time remaining on the maximum green timer of the even phase which is still timing.

A conditional service, minimum green time shall be programmable for each phase. This interval shall insure a minimum green if the phase is conditionally served.

The controller shall be programmable to re-service the even phase after conditionally serving an odd phase following the same guidelines stated above. Once an even phase has been conditionally re-serviced, the odd phase shall not be conditionally served again until returning to the concurrent group that is timing.

3.5.8 Pedestrian Functions

The controller unit shall provide the following additional pedestrian functions:

a. Actuated phase rest in walk
b. Pedestrian clearance protection during manual control
c. Exclusive pedestrian occurring once at a programmable point within each of the previously required sequences

3.5.9 Backup Protection

Programming shall be provided to inhibit re-service of odd phases within the same concurrent group. When programmed, backup protection shall take priority before conditional service.

3.5.10 Simultaneous Gap Termination

The controller unit shall provide a programmable simultaneous gap termination feature. When programmed, phases in both rings must gap out together in order to terminate the green interval and cross the barrier.

3.6 Detector Input Functions

3.6.1 Design Requirements

The controller unit shall provide a minimum of sixteen vehicle detector inputs. Each input shall be assignable to any single phase or group of phases and be programmable for type of function (detector switching).

Detectors 1 through 8 shall meet the NEMA standards for vehicle detector inputs into phases 1 through 8. Remaining detectors shall utilize inputs assigned to the auxiliary functions in the D connector as specified in the appendix.

3.6.2 Detector Input Programming

All vehicle detector input shall be user-programmable for vehicle calls to any or all of the eight phases in the controller. Each shall be selected for multiple applications identified in the following descriptions in addition to the vehicle call inputs. The controller shall include a minimum of three programming plans selected by TOD or cycle/split/offset for assignment of the programmable feature of each detector input.

3.6.3 Standard Detector Input

All inputs shall default to standard operation, providing one call per actuation and shall be assigned to each phase, (i.e. det 1 to phase 1, det 2 to phase 2, etc.).

3.6.4 Delay and Extend Detector Input Timing

A minimum of sixty-four (64) detector inputs shall be programmable to delay a vehicle call to the assigned phase(s). The delay timer shall have a range from 0 to 25.5 seconds. The timing shall begin upon activation of the input to the controller. If the input remains when the time has expired then the input shall be directed to the phase(s). The timing shall be reset when the input is removed. The delay timing function shall be inhibited during the selected phase green interval.

A minimum of sixty-four detector inputs shall be programmable for extending the vehicle call to the assigned phase. The extend timer shall have a range from 0 to 25.5 seconds. The extending time shall begin upon removal of the input to the controller and will extend the call to the phase until the expiration of the programmed time.

3.6.5 Phase Extending Detector Input

All inputs shall be programmable to extend assigned phase or phases green interval timing and once programmed this input will not call the phase for service. All input shall be programmable to switch assigned phases during a programmed red interval and begin extending the assigned phase green interval.

3.6.6 Call Detector Programming

All inputs shall be programmable to call assigned phase or phases during its red interval and not extend the green time from any actuation.

3.7 Preemption

The controller unit shall provide a minimum of five priority/non-priority preemption sequences. This capability shall be a standard controller unit feature and shall be provided within the modules and software. All required features specified above shall be available and programmable within the preemption operation.

3.7.1 Priority/Non-Priority Preemptor Design Requirements

Each of the five priority/non-priority preemptor shall be capable of railroad, fire lane, or emergency vehicle preemption sequences. Any one of the following conditions shall be selected to occur during preemption.

a. Hold phase green
b. Limited phase service, following track clearance
c. All red

d. Flash

- Preemptor Call Priority

Preemptor shall be selected as priority or non-priority. Lowest numbered priority preemptor shall have highest priority and will override a higher numbered priority preemptor calls. A minimum of two preemption phases shall be give equal priority and override higher numbered preempts. Additionally, priority preemptor calls shall override all non-priority preemptor calls. Non-priority preemptor calls shall be serviced in the order received.

- Preemptor Call Memory

Each preemptor shall provide a programmable locking memory feature for preemptor calls. The preemptor in the non-locking mode shall not service a call when it is received and dropped during the delay time.

3.7.2 Priority/Non-Priority Preemptor Timing

The following preemptor timing features shall be provided for each of the priority/non-priority preemptor inputs.

- Preemptor Timing Intervals

All preemptor timing intervals shall be programmable from 0-60 minutes in 1 minute increments, 0-255 seconds in 1-second increments, or 0-25.5 seconds in 0.1-second increments, as indicated for each of the following.

- Delay Time

The delay time interval shall inhibit the start of the preemption sequence for a specified duration. This interval shall begin timing immediately after receiving a preemption call. (0-255 sec., 1 sec increments)

- Duration Time

Each preemptor shall provide a programmable minimum and maximum duration time that a preemptor shall be active, (Min: 0-255 sec., 1 sec. increments, Max: 0-60 mins, 1 min. increments).

- Minimum Times

Phase timing at the beginning of a preemption sequence shall be controlled by the programmable minimum times before advancing to the next sequential interval. Preemptor minimum times shall be programmable for the following intervals:

a. Green / Pedestrian Clearance (0-255 sec., 1 sec. increments)
b. Yellow (3-25.5 sec, 0.1 sec. increments)
c. Red (0-25.5 sec. 0.1 sec. increments)

- Pedestrian Timing

If a phase is timing a walk interval at the beginning of a preemption sequence, then the phase shall advance immediately to the preemption pedestrian clearance. A selectable timing interval shall be provided to time the minimum pedestrian clearance through the vehicular yellow interval, or alternately advance immediately to vehicular yellow.

During preemption, pedestrian indicators shall be user selected to be solid don't walk, blank, or operational during preemption.

- Overlap Timing

Overlaps shall be programmed to operate with the phase(s) or to clear to red then remain red during preemption. Overlaps terminating or forced to terminate when a preemption sequence begins, shall be selectable to time the preemptor minimum yellow and red clearance times or to time programmed overlap timing specified in Section 8.3.

- Track Clearance

Each preemptor sequence shall provide user-programmable green, yellow and red track clearance intervals. Track clearance shall begin timing immediately after the preemptor minimum red interval, (Section 10.2.4).

A minimum of two (2) phases shall be selected as track clearance phases. During the track clearance period, the selected phases shall time the track clearance green, yellow and red intervals once, and then advance to the next programmed interval (Section 10.2.8).

If track clearance phases are not selected, the track clearance intervals shall be omitted from the preemption sequence.

- Limited Sequence

The limited sequence program shall be user selected and begin immediately after track clearance. It shall remain in effect until preemptor duration time, phase minimum times has elapsed, or preemptor call has been removed.

- Limited Sequence Phases

Any active phase, except a track clearance phase(s), shall be selected for operating during limited sequence operation. Those phases not selected shall remain red during preemption. The controller unit shall remain in all red interval during the limited sequence interval when no phases are selected for operation during limited sequence.

If flash is selected for the limited sequence interval, up to two permissive phases shall be selected to flash yellow. The remaining phases shall flash red. Overlaps associated with the phases flashing yellow shall also flash yellow unless they have been forced to terminate in which case they shall remain dark. Flashing shall occur by controlling the appropriate load switch driver outputs.

- Limited Sequence Timing

During the limited sequence interval, the selected phase(s) shall operate normally (as outside of preemption). When preemption is exited, the current phase shall terminate after minimum green time is expired.

If any limited sequence intervals are programmed with zero timing, the equivalent interval time of the controller unit shall be used.

- Exit Phases

Two permissive exit phases shall be selected to time after the preemption sequence has been completed. These phases shall serve as transition phases to return the controller unit to normal operation. Exit phases shall time their normal programmed interval times.

Additionally, it shall be possible to program exit calls on any of the phases used in normal operation. Phases programmed as exit phases shall be served first, while exit calls on the remaining phases shall be served in normal sequence.

3.7.3 Preemptor Active Output

A preemptor active output shall be provided for the five priority/non-priority preemptor. The output shall be set to ON when the preemption sequence begins and shall remain ON for the duration of the sequence.

3.7.4 Power Interruption

If a preemptor call is active when power is restored to a controller unit, the voltage monitor output shall be set to FALSE, placing the intersection into the flashing mode of operation. Additionally, if external start is applied during a preemption sequence, the intersection shall be placed into the flashing mode of operation. The flashing mode of operation shall remain in effect until the preemptor call has been removed or the preemptor maximum duration time has elapsed. The controller shall begin operating as described by NEMA during power interruption.

3.7.5 Preemptor Stop Time

A stop time input shall stop the timing of the current active preemptor. The stop time input shall normally be controlled by the conflict monitor unit.

3.8 Automatic Flash

The controller unit shall provide automatic flash selection per the requirements of the Manual on Uniform Traffic Control Devices. The flash phases shall be programmable through the keyboard and flashing shall be controlled by changing the controller outputs to the load switches from the normal sequencing of three outputs to a flashing output to one selected output. The controller shall be programmable for selecting the indication which will flash. Automatic flash shall be selected by external input, system command, or time-of-day from the

internal time base clock. Two flashing controls shall be provided that alternate and shall be program selected for assignment as needed to each phase that will prevent a yellow/yellow conflict.

4.0 CONFLICT MONITOR

The conflict monitor shall conform to NEMA TS-1, Section 6, in addition to the requirements of this specification. A twelve (12) channel monitor shall be provided with the controller as required on the order or plans. The conflict monitor shall be compatible with the communications requirements for the current approved controllers. Each conflict monitor shall utilize and be provided with a programming card specified in the above mentioned NEMA standards.

4.1 Mechanical Design

The frame shall be completely enclosed within sheet aluminum housing with a durable protective finish. The housing shall be removable for service to the internal circuitry.

The programming card shall be inserted through the front panel of the conflict monitor. Card guides should be provided for aligning the edge connector of the card with the mating jack. The cards shall be removable without use of tools or disassembling of the housing.

All printed circuit boards shall meet, as a minimum, the requirements of the NEMA Standard. In addition, they shall also meet the following requirements:

a. All plated-through holes and circuit traces shall be plated with solder to protect exposed copper. Any wire jumpers included on circuit boards shall be placed in plated-through-holes that are specifically designed to contain them. Circuit track corrections by track cuts and jumpers that are tack soldered to circuit tracks are not acceptable.

b. Both sides of the printed circuit board shall be covered with a solder mask material.

c. The circuit reference designation for all components shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards.

d. All electrical mating surfaces shall be gold-flashed.

e. All ICs 14 pin and up shall be installed in machine tooled grade sockets meeting these requirements. All sockets shall be AUGAT-8XX-AG11D or approved equal, meet UL specification 94V-0, be constructed with two-piece, machined contacts and close-ended to eliminate solder wicking. The outer sleeve shall be brass with tin or gold plating and tapered to allow easy IC insertion. The inner contact shall be beryllium copper sub-plated with nickel and plated with gold.

4.2 Electrical Design

Liquid crystal displays shall be provided for displaying load switch outputs during

normal operation, operations selected from a menu, and fault sensed. When a fault is detected, the display shall present two displays, sequentially, one showing all load switch outputs at the time of the fault detection, and one showing the specific fault and date/time detected.

Circuitry shall be provided to detect sequential failure and indicate the channel on which the failure occurred. This feature shall be programmable to select either enable or disable for each channel. The following shall be failure indicated as sequential failures:

a. Yellow indication on for less than 2.5 seconds.
b. No yellow indication after green.
c. Simultaneous display of two or more indications within the same signal head, except as allowed by the MUTCD.
d. Combinations of any above.

All solid state components shall be mounted on printed circuit boards. The electronic components and printed circuit board(s) shall comply with the requirements outlined for the controller in Section 7.10 of this standard.

The conflict monitor shall be capable of recording and holding in memory (logs) the last ten conflicts detected and the last ten power failures. The time and date shall be indicated for each conflict and power failure. The memory shall be non-volatile during power loss and meet the requirements for the controller in Section 7.3, excluding Section 7.3.1. A log of the sequence of 20 events prior to a fault detection shall be retrievable prior to resetting the monitor and accessible through the communication port.

Each conflict monitor will be supplied with a 4-foot RS-232 cable with male connectors on each end. The monitor shall have a 9 pin communication port on the front of the monitor. The communication port shall be as defined herein, compatible with EIA-RS-232 standards for connection to a portable computer, printer, or other electronic devices. Communications shall be full or half duplex using FSK transmissions. The data transmission rate shall be selected baud. Control of the port shall be selected in menu form on the monitor display or request through the communication port. Data transfer to other electronic devices shall be provided with download commands from the device.

The monitor display shall present a selection menu for various data and programs available. This shall include, but not limited to, date and time set, review of programmed permissive phases and various logs.

4.3 Communication

The conflict monitor shall generate a report to the controller each time a change in status occurs. The report shall include the following as a minimum:

a) The configuration of the programming card.
b) The channels which have the NEMA plus features enabled.
c) A listing of the phases which are monitored for short yellow times.

Additionally, the conflict monitor shall store and report at least five (5) failures containing the information listed above when interrogated directly via the portable download/upload unit.

The report shall list at least the last five (5) failures from the monitor which contain the following:

a) Time of the occurrence of the failure.
b) The channels (Green, Yellow, Red and Walk) active at the time of the failures.
c) The status of the CVM input and the +24 V 1 and 2 inputs.
d) The type of failure (conflict, switch failure, red failure, etc.)

The conflict monitor will be capable of transmitting (via RS-232 port) an ASCII report to the controller unit.

The conflict monitor shall provide three (3) reports for interrogation. The first is an ASCII record of all data entries and programming card configurations. The second is an ASCII formatted record of all failures and each power on/off cycle. The last ten of these failure records will be available in report form. The third report will be a sampling report and will contain the twenty (20) samples of all of the inputs to the conflict monitor. Each sample will be taken at 0.1 second intervals so that the last two (2) seconds of real-time outputs of the load switches can be viewed.

Each of the reports will have the appropriate headings and will consist of ASCII lines of not greater than eighty (80) characters so that a clear presentation of the data can be viewed from the screen of a notebook computer using the standard ASCII character codes.

The monitor port shall be programmed in the following format:

a) Standard EIA-232 convention
b) Each word shall be eleven (11) bits long: eight (8) data bits, one (1) start bit, one (1) stop bit, no parity.
c) 2400 to 9600 baud
d) The note book or traffic controller unit will send a message of one byte to the monitor requesting each of the reports. After the one-byte message, the controller will issue an XON command to start the data flow. The data flow can be stopped with an XOFF command at any time.

The data sent to the notebook or controller unit in response to the request message will be the ASCII report requested. The last byte sent by the monitor will be an EOT (End Of Text- 04H).

If the controller issues an XOFF during a reporting request, the monitor will stop the data flow. If an XON is not issued within 30 seconds, the monitor will time out and set its pointer to the beginning of the report.

The next XON will then start at the beginning of the requested report. A report will also perform the XOFF function to the conflict monitor.

Definitions of the requests are as follows:

Request report 1: 31H
Request report 2: 32H

Request report 3:	33H
XON (DC1)	11H
XOFF (DC3):	13H

5.0 SOLID STATE SIGNAL LOAD SWITCHES

The load switches shall follow those standards previously set forth. In addition to those, each load switch shall have indicators on the front showing the input state of operation with the indicators vertically aligned and the red input on top, yellow in the middle, and green below.

6.0 SIGNAL FLASH TRANSFER RELAY

The transfer relays shall be electro-mechanical and shall be energized during normal sequential operation of the traffic signals with the operational switch in the normal position. This relay shall be de-energized when the indications are to be flashing. The relay shall transfer the field signal circuits to the flashing circuits and energize the flasher.

6.1 Physical Design

The relay shall be enclosed in a transparent case for protection against dust, dirt and other foreign objects. The case shall be a maximum of 2.671 inches high, 2.375 inches wide and 1.75 inches deep. The insulated base shall extend 0.625 inch from the case and shall be 1.990 inches wide and 1.120 inches deep. The contacts of the plug shall be flat blades arranged in two (2) parallel rows, 0.475 inch apart with the flat side of the blades in line with the row. The contacts of the plug shall be 0.250 inch wide, 0.060 inch thick, and extend past the insulated base 0.520 inch. Each row shall have four (4) contacts. The base shall be keyed with a pin that has a diameter of 0.156 inch and extend past the insulated base 0.685 inch. The pin shall be centered between the row of contacts and centered in line with contacts 5 and 6 of the plug. The contacts of the plug shall be numbered for wiring purposes, from 1 through 8. The top row shall be consecutively numbered from left to right using the odd numbers and the bottom row shall be consecutively numbered from left to right using even numbers.

6.2 Electrical Design

The relay coil shall be rigidly supported by the insulated base. The contacts shall be 2 Form C, rated at 20 Amps, and shall be 3/8 inch diameter, silver cadmium-oxide. The relay's life shall be 5 million mechanical operations and 100,000 electrical operations. Each contact shall be rated for power bus control and 1 KW tungsten at 120 VAC. The coil shall be 110 VAC and shall pick up at 80% of nominal voltage. Maximum power requirement of the coil shall be 10 VA. The relay shall be wired and the socket pin assignments arranged according to the following table:

TABLE 18A-5
TRANSFER RELAY WIRING

PIN	FUNCTION	PIN	FUNCTION
1	Relay Coil	5	Common Circuit #1
2	Relay Coil	6	Common Circuit #2
3	NC Circuit #1	7	NO Circuit #1
4	NC Circuit #2	8	NO Circuit #2

The base, relay, and enclosure shall have a minimum rating of 1500 volts.

7.0 SOLID STATE FLASHER

The flasher shall comply with NEMA TS-1, Section 8 and Section 7.2.3.2. The flasher shall be a two circuit flasher rated at 15 amps per circuit. (Type 3).

8.0 VEHICLE AND PEDESTRIAN DETECTORS

Vehicle detectors shall be fully digital, microprocessor designed, auto-tune, card rack mounted and have four channels of detection per card, Type 8. Unless otherwise noted the detectors shall be provided with the order for cabinet assembly. Detector units shall conform to applicable environmental, functional, dimensional, and design required in NEMA TS 1, Section 15. The amplifier shall not consume more than 385 ma of current at the rated voltage. Delay and extension timings shall meet this standard when the order or plans require the detector to have such timing. Each channel shall have an erasable, write-on surface for channel identification.

Pedestrian detectors shall be of an approved model accepted by the Department under the appropriate Traffic Control Standard. Each order or plans shall identify the type and quantity of detectors in each cabinet.

8.1 Sensitivity and Accuracy

Detector units shall conform to NEMA TS1, Section 15. Each detector shall be accurate for detecting all vehicles from motorcycles to tractor-trailer combinations which ordinarily travel public streets and highways and are comprised of sufficient conductive material, suitably located to permit recognition and response by the detector system. There shall be a minimum of sixteen selected sensitivity ranges located on the front of the unit for each channel. The range of sensitivity shall be, nominally, between 0.00 % - 1.250% change in total loop inductance.

8.2 Operation Modes

Each channel shall be self-tuning in accordance with the NEMA standards. Response time for compensation from extended detection, re-tuning to track the changing electrical

characteristics of the loop and recovery from power interruption shall be accomplished within 50 milliseconds. Each channel shall have an on and off switch. Each detector card shall have a momentary push switch to reset all channels.

8.3 Fail Safe

The detector shall operate when sensor loop shorted to ground or not in good condition. The unit shall generate a continuous call when re-tuning failed sensor loop or failed detector unit.

8.4 Control Voltage

All controls shall be DC voltage in accordance with the NEMA standards. The control circuit from the delay/extension feature shall follow this requirement.

8.5 Control Switches

All switches, connectors, and fuses shall be located on the front of the card. Each switch shall be permanently labeled to identify its function. Each position shall be labeled to identify its mode of operation. Each mode of operation shall be simple to program with one switch position assigned to one function.

8.6 Printed Circuit Board Design

The PC board shall be in accordance with NEMA TS1 Section 15. All pressure contracts shall be gold flashed. All components mounted and soldered to the PC board shall be easily removed and replaced without causing damage to the board or traces. Each individual PC board shall be identified by manufacturer and a serial number or part number clearly stamped or etched on the board. All PC boards shall be coated with an epoxy or approved equal type material to prevent erratic performance due to high humidity, condensation and growth of fungus and mildew. This coating will not cover the component on the board, but once the components are in place, they and the soldered joints shall be covered with a moisture and fungus proof, clear type of acrylic lacquer. This coating shall not be injurious to the board or components and shall not interfere with the repair of the circuitry or the replacement of components.

8.7 Pedestrian Detector Isolation

Two - two channel pedestrian isolation circuit boards shall be provided. There shall be two circuits using optical and transformer isolation designed and tested for a minimum of 2500 volts D.C. between the inputs and outputs. Each circuit shall recognize a minimum 5 millisecond switch closure between conductor pairs from the pedestrian push button operated on a maximum of 5 volts and 20 milliamps. Transient protection shall be on the input and shall withstand a 10 microfarad capacitor charged to 2,000 volts to be discharged between input pins or between input pin and chassis ground. When the input switch closure occurs,

the circuitry shall close the pedestrian call circuit between the controller input and logic ground and remain closed for a minimum of 100 milliseconds or the time the pedestrian push button is closed, whichever is larger. Additional circuits shall be provided to maintain isolation, lock the pedestrian actuation, and reset when an input from the DC level from the controller activates the walk and raises the potential of the field circuit from five volts to 24 volts. Each board shall have a fused power supply. Output status indicators shall be located on the front panel for each channel. A three position switch shall be provided on the front of the unit for each input circuit and provide "on", "off", and momentary "on". Alternate designs will be reviewed at the time of bid for pedestrian actuation and annunciator located at the pedestrian push button.

The card shall fit into the vehicle detector card rack. The dimension characteristics shall follow the Type 7 card detectors standards Section 15 in NEMA TS1 1989.

8.8 Pedestrian Isolation Card Connector

The isolation card shall be designed with an edge connector. The connector shall be 22 position, dual inline type connector with the following position assignments:

TABLE 18A-6
PEDESTRIAN ISOLATION CARD CONNECTOR ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION
2A/1	SPARE/CH 1 ØWALK	N	AC(+) 120 V
B/2	SPARE/CH 2 ØWALK	P	SPARE
C	SPARE	R	SPARE
D	INPUT #1	S	SPARE
E	INPUT COMMON	T	SPARE
F	OUTPUT #1 (COLLECTOR)	U	SPARE
H	OUTPUT #1 (EMITTER)	V	SPARE
J	INPUT #2	W	OUTPUT #2 (COLLECTOR)
K	INPUT COMMON	X	OUTPUT #2 (EMITTER)
L	CHASSIS GROUND	Y	SPARE
M	AC (-) 120 V	Z	SPARE

8.9 Detector Card Rack

Detector card racks shall be designed to fit top and bottom card guides for four-four channel detector cards. Two-two channel isolation cards, a power supply and two-four

channel detector cards shall be installed in type 6E cabinets.

The housing shall be constructed of 5052 aluminum alloy of a minimum thickness 0.062 inch with a protective coating (painted or anodized). Removable covers shall be provided on top, bottom, and back allowing access to the internal hardware and circuitry. Each cover shall be easily removable with the use of conventional hand tools.

The dimension of the rack in Type 3E cabinet shall be approximately 10 inches wide, 6 inches high and 9 inches deep and in Type 6E cabinet shall be approximately 14 inches wide, 6 inches high and 9 inches deep. The rack shall be mounted on the inside of the door of Type 3E cabinets as shown in drawing 18A-1 and attached to the bottom shelf in Type 6E cabinet, hinged to swing out to provide access to the rear assembly without removing the shelf(s).

The card rack for Type 3E cabinets shall be as above except: the top shall be rain proof with a drip edge to prevent water from running across the lower side of the top and into the rack and shall have a power supply, two - four channel detector cards positions, and two - two channel isolation cards. These shall be wired as follows: first card detector to vehicle call input 1 through 4, second card detector to special detector inputs 1 through 4, first isolator card to pedestrian detector inputs phases 2 and 4, and second isolator to preemptions 1 and 2. The power supply shall meet the dimensional requirement of a four channel card rack detector type 8, operate on 120 VAC, 60 Hz, and the AC+ into the power supply shall be fused. The fuse shall be located on the supply card, permanently labeled indicating the fuse and size. The supply shall meet NEMA specifications and provide 24 VDC, 385 ma, regulated as specified in NEMA TS-2-1998, Section 15.2.6.2. A power indicator and a fuse shall be provided on the front of the supply for each output. A pull handle shall be on the front of the unit. The power supply shall be located on the left side of the rack when viewed from the front. DC voltage from the power supply shall not be supplied to the isolator positions.

The rack shall be wired with a separate power cord and individual wires to each card position. The power cord shall have each wire identified with a sleeve marked, DR-AC+, DR-AC-, and DR-Gr, and terminated with a spade terminal connected to the terminal for the controller power. Each module slot shall be wired directly to the card edge connector with color coded harness. The harness shall meet the requirements for wiring elsewhere in this standard. Each detector lead in from the field wiring shall be a twisted pair. A sufficient amount of slack in the wiring harness shall allow the rack to be moved for visual inspection and mechanical repairs. The wiring shall be cabled together into a harness, attached to the back right side (viewed from the front) with an approved cable clamp, and routed to the back and detector panel.

The cards in the rack shall be numbered from left to right viewed from the front in order to identify the position function. For Type 6E cabinets, the first position will be the power supply; the second, a four channel detector for phases 1, 2, 3, and 4; the third, a four channel detector for phases 5, 6, 7, and 8; the fourth, a four channel detector for special detectors 1, 2, 3, and 4; the fifth, a four channel detector for special detectors 5, 6, 7, and 8; and the sixth and seventh, each two channel isolation card for pedestrian detection to phase 2, 4, 6, and 8 respectively. For Types 3E cabinets, the first position will be the power supply; the second, a four channel detector for phases 1, 2, 3, and 4; the third position, a four channel detector for special detectors 1, 2, 3, and 4; the fourth and fifth position each a two channel isolation card for pedestrian detection to phase 2 and 4, and preemption input to 1 and 2.

Wiring from each detector and isolator output shall be directly to and terminated to the front of the back panel at their associated terminals of the controller. The control circuit wiring for each detector and isolator input shall be made directly from the associated terminals of the controller. The wiring for the field input to the card rack shall be terminated with the associated terminal on the detector panel. Each wire from the card rack to the back panel shall be terminated using a spade type compression terminal and an identification sleeve identifying each as follows: Detector position one, VD-1-1, VD-1-2, VD-1-3, and VD-1-4; the input to these card positions shall be identified as: VD-1-1G, VD-1-2G, VD-1-3G, and VD-1-4G. The remainder of the detector wiring shall be identified in a similar manner. The pedestrian detector isolator cards outputs shall be identified as: Isolator position nine: PD-1-1 and PD-1-2, the inputs: PD-1-1W and PD-1-2W. The other isolator shall be identified similarly using PD-2-, etc.

9.0 MECHANICAL CONSTRUCTION OF ENCLOSURES (Also in TCS 36)

Cabinets shall be designed for NEMA TS1 operation and the following specifications.

9.1 General requirements

The cabinet shall be constructed of sheet or cast aluminum alloy. The sheet aluminum alloy shall be ASTM No. 5052-H32 or equivalent, and shall have a minimum sheet material thickness of approximately 1/8 inch.

The cast aluminum alloy shall be ASTM No. 356-75 or equivalent. Flat cast surfaces exceeding 12 inches in both directions shall be a minimum of ¼ inch (0.25 inches) in thickness. Flat cast surfaces not exceeding 12 inches in both dimensions shall be a minimum 3/16 inch (0.1875 inches) in thickness.

Outline dimensions shall be as shown in Table 18A-7. All dimensions are outside of cabinet and in inches exclusive of hinges, handles, overhang(s), vent housing and adapters. Cabinet heights are measured to the lowest point of the top surface of the cabinet. The combined overhangs of the top of the cabinet shall not exceed 4 inches.

Unpainted aluminum cabinets shall be fabricated from mill finished material and shall be cleaned with appropriate methods that will remove oil film, weld black, mill ink marks and render the surface clean, bright, smooth and non-sticky to the touch.

TABLE 18A-7
CABINET DIMENSIONS

CABINET TYPE	WIDTH	HEIGHT	DEPTH
3E (14-06-3596)	22 (-0 + 15%)	55 (-0 + 10%)	15 (-0 + 15%)
6E (14-06-3576)	44 (-0 + 10%)	68 (-0 + 15%)	24 (-0 + 15%)

9.2 Cabinet construction and testing requirements

Cabinets shall be manufactured to prevent the accumulation of water on its top surface and slope in a manner to drain water to the back side of the cabinet. The highest point of the top surface shall be limited to a maximum of six (6) inches added to the overall height of the cabinet.

9.2.1 Shelves

Cabinets shall be provided with a minimum of two shelves in Type 3E, and three shelves for Type 6E to support control equipment. Type 3E cabinet shall have provisions for positioning the shelf between 10 inches from the bottom and within 8 inches from the top. Type 6E cabinet-shall have provisions for positioning shelves between 24 inches of the bottom of the cabinet and to within 8 inches of the top of the cabinet in increments of not more than 2 inches. The adjustment of the shelves shall be accomplished by using small hand tools. Rivets are not acceptable. All shelves shall have a raised back edge to stop equipment from passing the back edge of the shelf. This edge shall be a minimum of ½ inch from the rear wall of the cabinet and be constructed from one continuous piece of metal.

All cabinets shall have a 1-1/2 inch drawer, mounted directly beneath the lowest shelf. This drawer shall have a hinged top cover and shall be capable of storing documents and miscellaneous equipment. The drawer shall open and close smoothly. Drawer dimensions shall make maximum use of the available depth offered by the cabinet and controller shelf, and shall have approximately the same width as the corresponding back panel. The bottom of the drawer shall have drain holes sufficient to drain any amount of accumulated water in the drawer.

9.2.2 Doors

- Main Cabinet Door

  Cabinets shall have a single hinged main door which permits access to all equipment within the cabinet and visual inspection of all indicators and controls. Unless otherwise specified, the door shall be hinged on the right side of the cabinet as viewed from the outside facing the cabinet door opening. Type 4 cabinets shall have two main doors equally dividing the height of the cabinet front with clearances at top, middle, and bottom.

- Hinges

  All cabinet doors shall incorporate suitable hinges utilizing stainless steel hinge pins. Hinges shall be protected to prevent being removed or dismantled when cabinet door is closed. Attachment to the cabinet shall produce a smooth finish, protruding fasteners are not acceptable.

- Door Stop

Each cabinet shall be provided with a door stop which holds the door open at positions of 90° ± 10° and 170° ± 10°. A means shall be provided to minimize accidental release of the door stop. Type 7 cabinets shall have the door stop located at the bottom of the door and all other cabinets shall have the stop located at the top of the door.

- Locking Mechanism

All cabinets shall incorporate a main door lock constructed of nonferrous or stainless steel materials, which shall operate with a traffic industry conventional #2 key. A minimum of one key shall be included with each main cabinet door lock.

A three - point lock on the strike edge of the door shall be provided with all types of cabinets except when specified to be different on the order or plans. The three (3) points of the lock shall be located at the top, bottom, and middle of the strike edge of the door. The lock shall prevent operation of the mechanism when in the locked position.

The door handle shall rotate inward from the locked position so that the handle does not extend beyond the perimeter of the door at any time. The operation of the handle shall not interfere with the key, police door or any other cabinet mechanism or projection. The handle shall have the mechanical strength to operate the mechanism and shall be made from non-corrosive material.

Cabinets with three-point lock shall be provided with a means of externally padlocking the mechanism. A minimum 3/8 inch diameter lock shackle shall be accommodated. The lock shaft shall be 5/8 inches in diameter.

- Door Opening

The main door opening of all cabinets shall open on and be centered within the front side having the width dimensions listed in the previous table and shall be at least 69% of the area of the side. Necessary clearances shall be provided allowing unrestricted movement of the door from closed position to open position. The door shall seal against a minimum of one inch wide neoprene sponge gasket with tight seams. The top gasket shall be the width of the door, the side gaskets shall begin below the top gasket and the bottom gasket shall be within the side gaskets. A gasket retaining ring shall be installed on the inside of the gasket.

9.2.3 Cabinet Structural Tests (mounting shall withstand the following):

- Hinges and Door

The hinge and door assembly shall be of sufficient strength to withstand a load of 30-pound-per-vertical-foot of door height. This load shall be applied vertically to the outer edge of the door when it is opened to the 90 degree position. There shall be no permanent deformation or impairment of the door, locking mechanism, or door seal function after the load is removed. A stiffener shall be installed the width and at mid height of the door. The door panel shall be flat after fabrication.

- Door Stop

Both the door and door stop mechanisms shall be of sufficient strength to withstand a simulated wind load of 5 pounds per square foot of door area applied independently to the inside and outside surfaces without failure, permanent deformation, or any major movement of the door positions. For test purposes, a test load shall be applied to the vertical midpoint of the outer edge of the door at a right angle to the plane of the door. The test load shall equal one half of the calculated wind load. The force shall be applied first on the inside edge, then on the outside edge. These tests shall be performed with the door at 90degree and 170 degree positions.

- Lock

The door handle and associated cabinet locking mechanism shall withstand a torque of 100-foot lbs. applied in a plane parallel with the door to the handle in the locked position. The door handle and the external padlock mechanism shall meet the same requirement without the internal locking mechanism securing the handle.

- Shelves and Drawer

Shelves shall support a load equivalent to 2 pounds per inch of length without deforming more than 1%. The test load shall be applied at two points, 6 inches to each side of the shelf's center, with the shelf installed in the cabinet. The drawer shall support up to 50 pounds in weight when fully extended.

- Equipment Protection

Cabinets are intended to provide protection for the housed equipment. Prying open or dismantling the doors, walls, or tops, shall be prevented with the cabinet securely closed.

When completely and properly installed, cabinets shall have provision for rain water drainage. The cabinet shall not permit water to enter the equipment cavity above any live part, insulation, or wiring.

- Rain Test

All cabinets shall be designed to meet the requirements of the following tests. To insure realistic testing, the enclosure and enclosed equipment shall be mounted as intended for use.

A continuous water spray, using as many nozzles as required, shall be applied against the entire top and all exposed sides of the enclosure for 10 minutes at a minimum rate of 18 inches per hour of equivalent rain at an operating pressure of 4 to 5 pounds per square inch. The distance of the nozzles to the cabinet shall be a minimum of 36 inches and a maximum of 48 inches and located above the top edge of the cabinet.

The enclosure is considered to have met the requirement of this test if there is no significant accumulation of water within the enclosure and no water is visible on the live parts, insulation materials, or mechanism parts.

A rain test which is performed in accordance with Underwriters Laboratories, Inc., "Rain Tests of Electrical Equipment, Bulletin of Research #23, September, 1941", is considered to be equivalent to this test.

9.3 Cabinet construction and testing requirements Police Compartment

A hinged police compartment door shall be mounted on the outside of the main cabinet door. The door shall permit access to a police panel compartment for operation of switches defined elsewhere in these standards. The compartment shall be constructed to restrict access to exposed electrical terminals or other equipment within the cabinet. The door shall seal against a neoprene sponge gasket in the same manner as stated above for the main door.

Space shall be allowed for the switch controls and storing of the manual control cord in the police panel compartment with the door closed. The minimum internal dimensions shall be 3-1/2 inches high, 6-3/4 inches wide and 2 inches deep. Additionally, the volume shall be not less than seventy (70) cubic inches.

Police doors shall be equipped with a lock which can be operated by a police key, Corbin Type Blank 04266, or equivalent. A minimum of one key shall be included for the police compartment of each cabinet.

The police compartment shall be located above the bottom of the main door as shown in the following table:

TABLE 18A-8
POLICE COMPARTMENT LOCATION

CABINET TYPE	LOCATION
3E	2.5" ± 10% from bottom and left of center, see Drawing #18A-1
6E	39" ± 10%

9.4 Cabinet Mounting

9.4.1 Pole Mounted Cabinets, Type 3E

The cabinets shall be provided with provisions to attach a pole bracket to a reinforcement plate permanently mounted to the back, top, and center of the cabinet. The reinforcement to the cabinet shall be designed to support the weight of the cabinet and the equipment intended to be contained within and the structural loads referred to in this specification. The minimum width of the adapter shall be six (6) inches wide and three (3) inches high, tolerance of both -0 inch, +6 inches. Two 3/8 inch holes shall be drilled through the cabinet, within the reinforced area, 2 inches from center line of the width of the cabinet. Countersink each hole on the outside of the cabinet for flat head screws. Install two 5/16" flathead screws in the mounting holes with the top of the screw heads to be flush with the surface of the cabinet wall.

The cabinet shall be pre-drilled for two (2), 3 inch wire entrance holes, one in the top and one in the bottom, both at the back edge and centered on the width of the cabinet and one (1) 2 inch entrance hole adjacent to the 3-inch hole on the bottom as shown in the attached drawing. Three hubs shall be provided with Types 2 and 3 cabinets. The hubs shall centered on the entrance holes and attached to the cabinet using four (4) 5/16 inch-18-tpi by 1-1/2 inch long hex head bolts, with lock washers and hex nuts. The hubs and cabinet shall be pre-drilled for mounting the hubs to the cabinet with the above mentioned bolts using a bolt pattern of 2-1/8 inches centered on a line perpendicular to the back of the cabinet, by 3-3/4 inches parallel to the back of the cabinet. The centers of the bolt pattern on the hub and the wire entrance hole shall coincide. The location of the hubs shall allow minimum clearance for box end wrenches to fit onto the nuts within the cabinet.

9.4.2 Pedestal mounted cabinets, Type 3E

When specified on the order or plans the requirement for a pedestal mounted cabinet shall meet the following requirements. The specified cabinet shall be provided and equipped with a reinforced bottom, ¼" aluminum plate, and a slip fit adapter for attachment to a standard 4-inch inside diameter pipe. The bottom of the cabinet shall be provided with an access hole for cable (min. 4 inches) and mounting holes for the adapter located in the center of the bottom. The adapter shall be bolted to the cabinet with 5/8" bolts and fitted on a 6-1/2" bolt circle. The attachment to the standard 4-inch pipe shall be secured with four (4) square headed set screws.The holes drilled for pole mounting hardware and wiring shall be covered with gaskets and blank hubs.

9.4.3 Base mounted cabinets, Type 6E

The anchors bolt shall mount in each corner of the cabinet and shall be approximately located in a rectangular pattern of 18 ½ inches by 40 5/8 inches.

Anchor bolts for base mounted cabinets shall be ¾ inch diameter and 16

inches long. A 90° bend with a 2-inch leg on one end and a minimum of 3 inches with a UNC-10 thread shall be provided. Anchor bolts shall be steel with hot dipped galvanized finish. Each anchor bolt shall be furnished with one (1) ¾ inch UNC-10 HDG steel nut and one (1) ¾ inch HDG flat steel washer. Four (4) anchor bolts shall be provided with each Type 6E cabinet.

10.0 AUXILIARY EQUIPMENT

10.1 Fan and cooling system

All cabinets shall be equipped with a cooling system of sufficient capability to pass the test described in NEMA TS1-2.2.04. The fan shall be capable of operating continuously for a minimum of 6000 hours in a 122°F (50°C) environment without need for after-installation maintenance and deliver 100 CFM in free air. The fan shall be thermostatically controlled by switching the 120 VAC supply to the fan. The thermostat shall be field adjustable to switch on and off at any temperature between 70° and 160°F.

The exhaust shall be vented through the upper portion of the cabinet. All ventilation shall be rain-tight and shall prevent any water from dripping into the cabinet.

The cooling system shall be constructed to allow cleaning of the vents, screens and fan. Fasteners for removing panels to gain access to perform the above requirement of cleaning shall be removable with the use of simple hand tools, except as noted in Section 11.2.

An additional duplex receptacle (for use with communications modems) shall be mounted and wired in the upper left side of the cabinet assembly. This receptacle shall be wired on the load side of the 20 amp circuit breaker.

10.2 Air Filter

The cabinet shall be equipped with a secured, replaceable filter for the incoming ventilation air. The air filter shall be removable without the use of tools. The filter size shall be: 7-1/2 inches high x 7 inches wide x 1 inch deep for the Type 3E cabinets, and 14 inches high x 25 inches wide x 1 inch deep for Type 6E cabinets. The filter shall have clearly indicated on it the size and direction of air flow. A metal grid shall be on both sides of the filter. The filter shall meet ASHRAE standard 52-76 for disposable, Type II, glass fiber air filters. The air resistance shall be 0.08 inch WC, measured on 24 inches x 24 inches sample at 300 FPM. The efficiency of the filter shall be a minimum of 75 percent.

10.3 Cabinet Light

A fluorescent bulb and fixture shall be installed in cabinet Types 3E. The fixture shall be mounted against the cabinet top and the strike edge for the door. The fixture shall not extend beyond the strike edge at the top of the cabinet and shall not restrict the opening of the door. Mounting supports shall be on the front of the cabinet. The fixture shall have an on/off switch mounted on the side of the fixture. The fluorescent bulb shall be a F8T5WW.

A fluorescent bulb and fixture shall be installed in cabinet Type 6E, and when specified in other cabinets. The fixture shall be within the upper 3 inches from the top and toward the

door side of the cabinet. It shall illuminate the interior of the cabinet without hampering the vision of service personnel while inspecting the cabinet. The fluorescent bulb shall be a 15 watt, T-12, 18 inches in length. The fixture shall be of a sturdy construction to hold and operate the above mentioned bulb. For Type 6E the cabinet light shall be turned on when the cabinet door is opened and turned off when the cabinet door is closed.

10.4 Cabinet Hubs

The hubs for the cabinets shall be cast aluminum, ASTM B-108 and those standard specifications referenced therein. The bolt pattern shall be as detailed in the Figure 18A-1. The blank shall be a flat plate, ¼ inch thick. All other hubs shall have a conduit threaded collar that shall be a minimum of 2 inches from the base of the hub. The threaded opening shall be centered within the 3-3/4 inches dimensions of the hub with outside edge of the threaded collar in line with the base of the hub. All hubs shall be provided with stainless steel bolts casted into the hub. The outside of the hub shall provide a smooth design. On the hubs with larger threaded collar(s), the bolting pattern shall be maintained. The following table describes the designations and type of hubs that will be specified on the order or plans.

TABLE 18A-9 (verify with current design details)
CABINET HUB DESCRIPTION

TYPE	OPENING(S) SIZE	OPENING DESCRIPTION
Blank	-0-	no opening, flat plate, ¼" minimum thickness
Single	¾ in.	one opening, ¾" conduit thread
Single	1 in.	one opening, 1" conduit thread
Single	1-1/2 in.	one opening, 1-1/2" conduit thread
Single	2 in.	one opening, 2" conduit thread
Single	2-1/2 in.	one opening, 2-1/2" conduit thread
Single	3 in.	one opening, 3" conduit thread
Double	¾ in.	two openings, ¾" each conduit thread
Double	1 in.	two openings, 1" each conduit thread

10.5 Pole Mounted Cabinet Clamp

A pole clamp shall be provided with the controller cabinet Type 3E for mounting the cabinet to the pole. The clamp shall be cast aluminum meeting the requirements for the cabinets and designed to hold the weight of the mentioned cabinets and the equipment contained within. The design shall provide four contact points with the pole and shall be adjustable for pole diameters from 10 inches to 12 inches. The clamp shall be divided into two parts, one half to be attached to the cabinet and the other half to be installed on the

"back" side of the pole. The clamp shall have a slotted opening for coupling the clamp together using 5/8-inch galvanized all thread bolts and nuts. The clamp shall have a flat surface area, 4-1/2 inches x 2 inches minimum that attaches to the cabinet. Two (2) 5/16 inch - 18 tpi, drilled and tapped holes spaced 4 inch center to center shall be centered within the flat area. The flat area shall space the back of the cabinet a minimum of 2 inches from the pole.

- Pole Mounted Cabinet Adapter

  When specified, an adapter shall be provided, excluding lag bolts or steel bands. The adapter shall be conformable for mounting to round poles with a 4-1/2 inches or larger diameter. Material for the adapter shall be comparable with aluminum alloy 6061 and have the mechanical strength to hold the weight and loading requirements for the cabinet. The adapter shall accommodate lag bolts up to ½ inch and steel banding up to 1 inch wide. The adapter shall have the same mounting bolt pattern and wire way requirement as the hubs stated in Section 17.12.4. The adapter shall be mounted to the cabinet using the same mounting bolts as the hubs, and additional gaskets shall be used between the cabinet, hub, and adapter.
- Adapter Slip-fit, 4-Inch pipe.

  The adapter shall slip-fit to a standard 4-inch pipe and shall secure to the pipe with four (4) square headed set screws. The adapter shall be made of cast aluminum or steel designed to hold the weight of the cabinet and the loading characteristics required for the cabinet. The length of the adapter shall be approximately 8 inches long. The adapter shall be attached to the cabinet with 5/8-inch bolts and fitted on a 6-1/2-inch bolt circle.

10.6 Cabinet Interior Panels

10.6.1 General Requirements

All panels shall be made from structural grade sheet aluminum equal to 2024 or 5052 aluminum alloy. Approval from the Department is needed if different material than listed above is used for the panels. The panels shall be attached to the cabinet walls with bolts, nuts, and washers specified elsewhere in this standard. Each panel shall be completely removable or capable of folding down from the cabinet wall without the need to remove any other panel or shelf so that inspections and repairs may be made behind each panel. All panels shall be grounded to the cabinet using a braided copper conductor equaling #6 AWG. All panels shall be sized to fit within the minimum dimension of the cabinet it is specified for as listed in Table 18A-7.

10.6.2 General Wiring Design Requirements

The inspection and repair of any panel shall not require disconnecting or removing wires. When multiple panels are required in the cabinet then the cable shall follow a single route and shall be from the detector/auxiliary panel to back panel to power panel to police panel. Cabling shall conform to the previously stated

requirements for servicing each panel. Cable(s) shall be secured to the panels at the point where it leaves and/or enters each panel. The cable shall be secured to the cabinet wall with a cable clamp at two (2) points equally spaced between the panels on the above stated route. Wiring requirements for ventilation, temperature monitoring, and cabinet lighting shall be from the power panel to each device and shall be neat and in accordance with good wiring practices. A separate, parallel cable route shall be used from the field terminal to the back panel solid state load relay outputs.

10.6.3 Identification of Components, Terminals, and Connectors

Each terminal position, sockets, switches, filters, relays, and fuses shall be permanently labeled by painting, printing or engraving directly onto the panel or terminal strip identifying the position number and/or function of the terminal or device (paper labels of any type will not be accepted). Each harness shall be permanently labeled to identify function or connector with only the following:

TABLE 18A-10
HARNESS LABELS

HARNESS	LABEL	HARNESS	LABEL
NEMA Connector A	"A"	Controller	A
NEMA Connector B	"B"	Controller	B
NEMA Connector C	"C"	Controller	C
Controller Connector D	"D"	Controller	D
Conflict Monitor	"G"	Conflict Monitor	G
Conflict Monitor	"H"	Conflict Monitor	H

10.6.4 Implementation of Equipment Capabilities

The wiring between the panels shall connect the functional inputs and outputs needed to implement the operational capabilities of the equipment and requirements of this standard. Input circuits to the controller for external controls shall not be wired: i.e.; hold, omit, force off, CNA I&II, control status bids, phase next, phase on, phase check, red omit, pedestrian recycle, max I&II, max inh. There shall be no discrete circuit, components or active devices attached to any panel or cabinet wall except as specified. Printed circuit boards are not allowed on any panel.

10.7 Back Panel

The back panel shall be located on the lower half of the back cabinet wall. The controller and conflict monitor harnesses shall be terminated on the upper portion and shall be secured to the top left corner of this panel with non-chafing cable clamps as described

elsewhere in this standard. All wires shall be installed for the D and E connector functions listed in the appendix, between terminal positions and a receptacle on the back panel. The receptacles shall be square flange, with sockets connector, permanently mounted on the back panel, D receptacle - AMP206438-1, E receptacle - AMP2064038-1. The D connector on the harness shall be an AMP 206437-1 or an exact equivalent. An E harness connected to the Emergency Vehicle Detection System shall be provided with the EVDS equipment. The E connector on the harness shall be an AMP 206039-1 or an exact equivalent. The pins and sockets shall be gold finished. (Engineering note: EVDS equipment is specified in a separate document. All cabinets provided to DOTD shall be equipment to receive the EVDS equipment and provide the required functions as stated elsewhere in these standards.)

The wires from the controller harnesses, panel mounted receptacle, and other required devices shall be grouped by associated functions and terminated individually at a position on a terminal strip, (example - all inputs, by cycle, offset ... etc.). The terminal blocks and cabling for each harness shall be separate and have no wires crossing others from a different harness. Each terminal position shall be permanently identified with the associated function in the connecting equipment. Wiring to this panel from other equipment specified elsewhere in this specification shall be given extra lengths to allow movement between controller terminal positions for field changes.

All harnesses shall be 5 feet long from the point that is held by the cable clamp to the connector on the free end. The connector on the free end of the harnesses shall be a designated connector by the manufacturer. Any additional connectors and harnesses necessary to implement the controller and system operations specified herein shall be supplied by the manufacture meeting this standard.

For Type 3E cabinets, the panels shall be constructed in accordance with LA DOTD drawings #18A-3. The harnesses for Type 3E cabinets shall be 3 feet long from the point that is held by the cable clamp to the connector free end.

10.7.1 Connectors

Controller and monitor harnesses shall utilize Mil-C-26482 Series 1 and AMP CPC type series 2 connectors. The controller harness connectors shall be as described elsewhere in this standard. The monitor harness connectors shall be as follows:

TABLE 18A-11
MONITOR CONNECTORS

MONITOR Number of Channels	CONNECTOR
12 Connector A	MS 3116F-22-55SZ
12 Connector B	MS 3116F-16-26S

10.7.2 Harness Wire Termination

The monitor's signal input channels and voltage monitoring circuits shall be terminated on the appropriate terminals. The following shall be terminated at one position in all cabinets: harness wiring listed in NEMA-TS-1, Section 13 except as noted above, each input and output of the load switches, input and output of the controller, and the output of the flash transfer relays. The terminal blocks shall be either single row feed-through or double row type (electrical requirements described elsewhere in this standard). Exceptions to the requirement for single position termination for each wire are AC-, chassis ground, logic ground and flashing outputs. Listed below are the minimum terminals required for each:

a. Logic Ground - Three (3) adjacent positions.

b. AC- - a separate copper or brass multi-terminal bus bar shall be mounted near the lowest portion of the panel, adjacent to and horizontally aligned with the signal field terminals. It shall be insulated from the cabinet and connected to AC- on the power panel with a single #6 AWG insulated wire. The bus bar shall be sized to accept 5 - #14 AWG solid wires at each terminal and shall have a minimum of 12 positions. This bus shall be used to terminate all the neutral circuits from cable wired to the signal heads.

c. Flashing outputs - each circuit of the transfer relay shall have different flashing circuits.

All terminations shall be grouped by function as listed in NEMA TS-1 Standards, Section 13, Tables 13-1 and 13-2. The signal load switch inputs shall be terminated below all other controller and monitor harness termination.

Panels for cabinet Type 3E shall only have terminations of all voltage, monitoring, and coordinator circuits of the controller. The controller load switch controls shall be wired to the load switch receptacle and other requirements shown in drawings #18A-3. A single harness shall contain the circuits for A and B connectors. The connectors shall be offset along the end of the harness by 6 inches. Load switches shall be provided as follows: eight (8) switches, four phase, two (2) overlaps, two (2) pedestrians (Additional details shown on drawing #18A-3).

Type 6E cabinets shall have overlap outputs "A" through "D" wired respectively to load switches 9 through 12. Wiring shall be arranged on the back panel to facilitate connecting the pedestrian outputs to the load switch inputs by moving wires, without adding wire, connectors, or terminal blocks.

(Engineering Note: The only controller outputs and load switch

inputs circuits that are to be terminated on terminal strips are those circuits used for overlap and pedestrian indications. In accordance with the specification these circuits shall be provided to change the inputs of these load switches from either overlap or pedestrian outputs. In addition this will allow the reset circuit for pedestrian isolator cards to be terminated with the correct controller output. This requirement shall be for both the Type 6E cabinets. In reference to logic ground within the cabinets this notation shall apply to all circuits. All reference to logic ground shall be through connector "A" of the controller. In cases where specific controls are used in connector "D", then logic ground of this harness may be used. In all cases logic ground through any connector shall be the same reference within the controller.)

When specified on order or plans, overlaps shall be terminated at different positions than specified above.

10.7.3 Load Switches and Flash Transfer Relays

Signal load switches shall be provided, one for each phase and each overlap. When specified, additional positions and load switches shall be provided for four pedestrian signals in line with the load switches previously specified. All flash transfer relays shall be located on the back panel, adjacent to the load switches. A solid state flasher shall be provided and located as stated below.

The position of the load switches, flashers, and transfer relays shall be between the terminals for the load switch inputs and outputs. In Type 3E cabinets the position of the load switches, flashers, and transfer relays shall be in accordance with drawings #18A-3. The area above the load switches and flasher shall be open to allow the ventilation to flow freely away from the load switches.

The AC+ for the signal load switches shall be terminated as previously specified and be capable of carrying 60 amps, equally distributed to each signal load switch from a terminal strip on the back panel.

The transfer relays shall be operated directly by the voltage to transfer the signal operation from sequential to flashing. No intermediate relay shall be used between the transfer relays and signal operate/flash circuit. The transfer relays shall be energized during normal operation to connect the signal load switches to the field terminals.

10.7.4 Signal Field Circuits

The output from the load switches shall be located on the lowest terminal strip at the bottom of the back panel. Wiring from the signal heads shall be terminated separately for each indication and there shall be no internal cabinet wiring terminated on the same terminal. The inputs and outputs of the flash transfer relay shall be terminated above and adjacent to the load switch outputs. The arrangement of these terminal strips shall allow the selection of either red or yellow signal indications to flash without needing to un-solder or solder connections. The number of signal

circuits which will be transferred to flashing circuits shall equal the maximum number of load switch positions specified. No wiring shall be installed on the terminal for the field wiring.

10.7.5 Power Panel

The power panel shall be mounted on the lower right inside of the cabinet. It shall receive a single phase, 120 VAC, 60 Hz electrical service and shall have three (3) separate terminals for terminating the wires from the service source. This panel shall provide the power required and necessary functions, including cabinet ground, to each panel. The service terminals shall be a mechanical compression type, sized to accept a wire range from #8 to #2 AWG, stranded wire. A ground bus bar shall be located on the lower portion of this panel and terminate all ground circuit within the cabinet. All ground circuits shall be designed for a single path to the ground bar and no ground loops shall be created. The ground bus bar shall be a separate copper or brass multi-terminal bus bar. It shall be mounted directly to the panel and connected to chassis ground input terminal with a single #6 AWG green insulated wire. The bus bar shall be sized to accept 5 - #14 AWG solid wires at each terminal and shall have a minimum of 12 positions. This bus shall be used to terminate all the ground circuits from cable wired to the signal heads. All internal ground wiring to this bar shall be on one end using a maximum of 4 positions.

The power panel components for Type 3 cabinets shall be incorporated on the back panel. Both neutral and ground bus bars shall be located conveniently for installing field wiring. All other requirement mentioned above shall be adhered to. Switches shall be located for easy reach and away from energized parts. (Details shown on drawing #18A-3)

- Control Switches

  The following switches shall be located on the power panel and shall perform the functions listed below and labeled as shown:

  a. Cabinet light - ON/OFF - this switch shall control the AC+ to the cabinet light specified elsewhere in this standard. For Types 2, 3, and 4 cabinets the switch shall be part of the fixture.

  b. Test - FLASH/AUTO - The “flash position” of this switch shall allow the signal indications to flash and the control equipment to cycle in its normal manner. The “auto” position will not affect the normal operation of the equipment.

- Breakers

  Breakers shall be provided in each type of cabinet. The AC+ power shall have one input and shall be bussed to three (3) separate circuits. The breakers shall be a single pole, molded case, screw mounted on this panel with two (2) #10 screws on a 4-1/2-inch pattern. Each breaker shall indicate visually that

the breaker has been tripped. The following are the functions and labels for each breaker:

a. Controller power - ON/OFF - this shall be rated for ten amps and control the AC+ power to the controller and conflict monitor. (filtered and suppressed)

b. Main Power - ON/OFF - this shall be rated for 60 amps and control the AC+ power into the cabinet for all equipment. The power for the auxiliary circuits shall not be controlled by this switch.

c. Detector Panel Power - ON/OFF - this shall be rated for 10 amps and control the AC+ power to the detector panel used for interconnect relay outputs. This circuit shall not be used for detector card rack and shall not be connected to the suppressor on the power panel.

d. Auxiliary Power - ON/OFF - this shall be rated for 20 amps and control the AC+ power to the ventilation fan, cabinet light, and convenience outlet. (filtered)

- Surge Protection and Filtration

The power for the control equipment shall be protected by a RFI line filter and high voltage surge arresters. The line filter shall be rated at 60 amps on each AC+ and AC- line. Terminals on the filter shall be for suppression on the main power, neutral, and ground; and separate terminals for line in and out, neutral out supplying the controller and detector panel power to the breakers. The filter shall attenuate signals both from line to load and load to line. The attenuation in both directions shall be a minimum of 50 decibels over the frequency range of 200 KHz to 75 MHz. The impulse life of the protector shall be capable of operating 20 times at peak current. The clamp voltage shall be 340 volts at 20K amps and shall respond to over voltage conditions within 300 nanoseconds. The minimal capability of the protector shall be to discharge a single impulse with a wave shape of 8/20 and current to be 20K amps on each side to ground. The insulation resistance between line to ground shall be 100 mega-ohms.

- Signal Bus Operation

The signal bus power shall be switched individually by normally opened solid state relays rated a minimum of 60 amps, control voltage 120 VAC (Crydon series 1 - A2475 or equal). The solid state relay shall operate within the NEMA temperature range by de-rating the device and using necessary heat sinks. All switches are specified elsewhere and the circuit design shall limit the switched current to 10 amps max.

- Convenience Outlet

The receptacle shall be a feed through, ground fault interrupter type, 20 amps, duplex receptacle. The receptacle shall have three (3) wires from the device to the appropriate terminal on the power panel, (Ground, AC-, and

AC+). The feed through shall supply power to the fan and light.

The convenience outlet installed in Type 3E cabinets shall be mounted on the door. The electrical details shall meet the following requirements and details in drawing 18A-3. The convenience outlet in Type 6E cabinets shall be mounted on the power panel.

- Power Panel Isolation

A clear, non-breakable, ¼-inch Lexan insulating cover shall be used to shield all open connections and not cover any switch, breaker levers, terminals blocks, bus bars, or convenience outlet. The cover shall be secured in place with screw fasteners and be removable by hand or simple hand tools.

- Generator Bypass Assembly

The cabinet assembly for both Type 3E and Type 6E shall come with the capability to accept a Generator connection to supply complete power to the traffic cabinet. When an external power source is connected, the traffic cabinet shall automatically transfer the AC line current from the external generator. When the external power is removed, the transfer relay will automatically transfer back to the normal AC power, without disruption to the signal operations.

The generator plug shall be a 30 amp, three-prong, flanged male, twist-lock connector. The connector shall be a Hubbel model # 2615 or equivalent, and shall be mounted internally in the cabinet, and accessible through it's own locking access door. The generator access door shall utilize the same type lock and key mechanism for the police door referenced in this specification under section 17.7.6 Police Compartment. A dust cover for both the police key and the generator wire shall be provided on the generator access door. The generator access door shall be mounted flush with the cabinet assembly and shall be hinged for easy access by maintenance personnel.

- Space for "Future" UPS system

Sufficient shelf (third shelf) space shall be provided in the Type 6E cabinet assembly for a "Future" UPS system. Two (2) battery shelves shall be provided that shall be mounted in the bottom of the cabinet assembly on each side of the interior of the cabinet. These shelves shall be easily removable for maintenance and shall hold two (2) 80 AMP type batteries each.

10.8 Detector and Auxiliary Control Panels

A detector panel shall be provided in cabinet Types 3E and located on the left inside wall of the cabinet. The terminals and wires for detector card inputs, controller vehicle detector input test switches, remote communications, and additional functional inputs/outputs

specified shall be on this panel. The upper portion of this panel shall be used for mounting any required terminal blocks. The middle of the panel shall be for vehicle/pedestrian test button and control circuit and field wiring terminals. A six (6) position terminal block with suppressor shall be positioned on the bottom of the panel for communications. There shall be no splices in the wiring.

A separate panel shall be provided for the auxiliary controls including relay bases for interconnection controls, isolating the field circuits and the controller inputs.

10.8.1 Auxiliary Control Function (supplied only if specified on the bid documents and / or plans and specifications, Type 3E cabinets and when specified with any other cabinet)

This panel shall be located on the left lower inside wall of all cabinets, below the detector panel when present, and shall be separate from other panels. Relay bases shall be mounted at the top of this panel and the quantity of bases shall be supplied that will provide the functions required or as indicated on the order. The relays bases shall be wired isolating the field wiring and the controller inputs/outputs for hardwired interconnect. Field wiring will be terminated at fuse blocks, specified elsewhere in this standard. Additional wiring requirements are given below. The relay bases shall be for two-pole octal relays and have screw terminals for all relay pins. The required functions for hardwired interconnect are; resets, cycles, splits, free, flash, and remote common. Wiring from the interconnect terminations described above shall not be included with any wiring or harnesses on the detector panel.

A terminal block shall be provided below the relay bases where the following are to be terminated. Power for this panel shall be supplied by a separate breaker on the power panel. A minimum of three adjacent positions shall be provided for each AC+, AC-, and ground. This power shall be used for supplying master interconnect power and providing power to external equipment. This power shall not be used for equipment power within the cabinet. Logic common from the controller shall also be terminated on a terminal strip. Controller system operations for dials 2, 3, and 4, split 2, 3, and 4, and offset 1, 2, 3, and 4, shall be terminated on the back panel as stated within this standard. Each system operation terminal shall be wired to the front side of the terminal blocks on the back panel and terminated using a compression spade lug to the inputs of the controller. Each wire shall be identified with a sleeve marked, D-2, D-3, D-4, SP-2, SP-3, SP-4, O-1, O-2, O-3, and O-4 respectively. Two terminal positions shall be provided for free in and out, and two positions for flash in and out. Wiring shall be provided for each, one for free and one for flash, from these terminals to the terminals on the front of back panel, terminated using compression spade lugs. Each identified with a sleeve, free marked FR and flash marked FL. This panel shall conform to drawing 18A-3 of this standard.

(Engineering Note: For railroad preemption inputs, we intended to use the pedestrian isolator cards between field and controller inputs. For hardwired interconnect controls, we will move the wiring on the back panel for master or

secondary operation. Similar methods of moving wires will be used to implement other required functions as needed.)

10.8.2 Detector Panel for Type 3E Cabinet

The detector panel shall be located on the inside right wall of Type 3E cabinets. The panel shall have terminal positions for the specified field input circuits. The wiring requirements stated above shall be followed. Terminals shall be provided for eight (8) vehicle and four (4) pedestrian detector input circuits.

The card rack shall follow the specified requirements elsewhere stated, however positions shall be provided for one power supply, two-four channel vehicle detector cards, and two pedestrian isolator cards. The wiring for the rack shall be formed to follow the hinge of the door without damage to the wiring.

10.8.3 Detector Panel Test Switches

Detector test switches shall be provided on all detector panels. These switches shall be positioned in between the terminal blocks for the field wiring and adjacent to the input of the channel that the switch is for. Access to the switches shall not be interfered with wires or suppressor. Each switch shall be a momentary push button, normally open switch. There shall be a switch for each detector channel supplied in the cabinet and for each pedestrian call circuit (2 for 4-phase, and 4 for 8-phase), as per this specification, order, plans, or any addendum. Each switch shall be permanently labeled with the nomenclature of the function it provides (Ø # or Ø ##). The function of the switches shall be to place a logic ground on the controller vehicle, pedestrian, and system detector inputs. The wiring shall be terminated on the front of the back panel at the associated controller input terminal. A compression type spade lug shall be use and each wire marked with a identification sleeve as follows: VB-Ø1, VB-Ø2, VB-Ø8, PB-Ø2, PB-Ø4, etc.

10.8.4 Field Wiring - Detector and Auxiliary Panels

The loop lead-in, pedestrian field push button shall be terminated on the sides of the detector panel, the communications shall be terminated on the bottom of the detector panel, and the interconnect and field inputs/outputs shall be terminated on the bottom of the auxiliary panel. Each channel, vehicle and pedestrian, shall be terminated at two adjacent positions for inputs. On the auxiliary panel six NON type fuse holders and one remote common terminal shall be positioned on the bottom of the panel for hardwired interconnect.

The specified lightning protection shall be connected to the designated field terminals.

10.8.5 Communication Harnesses

All additional harnesses required for connecting the modem, line drivers, controller, master, and system hardware in addition to the specified connectors shall be provided and terminated in a fashion required by the manufacturer. Additional harnesses shall not negate any harness specific by this standard. Approval of these harnesses shall be obtained from the Department.

10.8.6 Lightning Protection

All detector and data field wiring shall be terminated on the required terminal block. Minimum voltage clamping shall be 30 volts for both differential and common mode. Current carrying capabilities shall be 400 amps in differential mode and 1000 amps in common mode. Response time for detector protection shall be 40ns and for data lines shall be 1 to 5 ns. The devices shall be mounted to the panel and the leads terminated on each field terminal.

All 120 volt field circuits shall be protected on the equipment side of the fuse by a surge protector. Operating line voltage shall be 120VAC, peak surge trip point for 600 volts/microsecond impulse shall be less than 890 volts. Response time shall be less the 200 nanosecond at 10KV/microsecond. Surge handling ability shall be 20K amps. The device shall be mounted on the grounding stud adjacent to the protected terminal.

10.8.7 Police Panel

The police panel shall be located in the police compartment previously specified and provide switches which are accessible when the police compartment door is opened. The following list of switches shall be located on this panel and be wired to their appropriate circuits to provide the functions identified below:

a. Flash Control Switch - Flash/Normal - this switch shall control the signal output from the controller to cause them to flash in the “Flash” position and to initialize the controller to the start-up phase unless the conflict monitor has detected a conflict. If the monitor has placed the equipment on flash, then this switch shall be inactive. The “Normal” position of the switch shall cause no effect to the signal circuits and shall allow the control equipment to function in its prescribed manner.

b. Signal Shut-Down - On/Off - the “On” position of this switch shall allow the signals to operate in normal manner. The “Off” position of the switch shall cause the signal indications to become dark, regardless of whether the signals were flashing or operating normally and to initialize the controller to the start up phase unless the conflict monitor has detected a conflict.

c. Manual Control - Auto/Manual - All necessary wiring, (manual control enable, interval advance, logic ground) shall be routed to the panel and terminated. A switch shall be provided only when specified and switch the

function of the controller from normal operation in the "Auto" position to a manual advance operation in the "Manual" position by a manual push button to advance the controller in accordance with the NEMA standards. In addition to the switch, a manual control shall be provided. The cord shall be terminated on a terminal strip attached to the back of the police panel. The cord shall be weatherproof and coiled, having a maximum retracted length of eight inches and a minimum extended length of five feet. The cord shall be attached to the panel with a cable clamp, and fitted with strain relief bushing at the point it is routed through a five-eighths inch hole in the panel. The manual control shall be on the free end of the cord. The manual control and the connection to the cord shall be weatherproof. A hand grip shall be constructed for normal use by being held in one hand and a momentary contact switch can be activated with the thumb. This control shall be operable between the above mentioned lengths.

The back of the panel shall have an aluminum shield to prevent personnel from accidentally coming in contact with the terminals of the switches or terminal strip. With the cover in place, it shall provide visual inspection of the back of the panel and shall not interfere with any equipment when the main door is closed.

11.0 CABINET WIRES AND WIRING

The wiring in the cabinet shall withstand the environmental temperature range as stated in NEMA TS-1. The insulation shall remain flexible over the temperature range and will not begin melting, causing the insulation to reduce in thickness. The insulation shall meet Specification MIL-W-16878D, 105 degrees, 600V, (MIL), heat resistant, polyvinylchloride or approved equal. The wire shall be 600 volts and color coded according to the following list:

TABLE 18A-12
WIRING COLOR CODE

HARNESS	COLOR
Controller harness and wiring	Blue
Conflict monitor Harness and wiring	Red
Detector, preemptor, and interconnect wiring	Yellow
All AC+	Black
All AC-	White
All Controller Logic Ground	White/Black Stripe or White/Green Stripe
All Chassis Ground	Green

The wire shall be stranded copper and sized to carry 125% of the design current and a minimum #22AWG. All signal circuit wiring shall meet the above stated size and be a minimum of #16AWG.

All circuits shall be wired using a single conductor; therefore, parallel wiring is not an acceptable method of meeting wire size requirements as stated above. The wires shall be terminated individually by a solder less compression type spade lug appropriately sized or by soldering. All wiring shall be installed having a zero tension after installation.

Wire bundles shall be held in cable form by lacing tape, spiral wrap, or plastic sheathing. The lacing tape shall be flat, braided nylon and 0.090 inch wide, equal to ICO-Rally type LTN-2. The spiral wrap shall be correctly sized to fit the wire bundle and be a weather-resistant polyethylene equal to Panduit spiral wrapping. The insulating tubing shall be clear colored and sized to fit the wire bundle, equal to Alpha PVC-105 plastic tubing. Cable ties are restricted from use on cable bundles between panels and equipment harnesses. Cable ties may be used to bundle wire on panels only. Cable ties shall be self-locking and have properly applied tension according to the manufacturer's specifications. The ties shall be weather resistant nylon equal to T & B ties (MX series).

12.0 CABINET MECHANICAL AND ELECTRICAL HARDWARE

All hardware shall meet the environmental requirements of the controller. All fastening devices, (bolts, washers, screws, etc.), shall not rust when exposed to weather. These shall be hot dipped galvanized, stainless steel or brass. All electrical hardware shall be sealed and electrical contacts protected against moisture and corrosion.

12.1 Terminal Blocks

Terminal blocks shall be multiple terminal, one piece, rated at a minimum of 300 VDC for all 24 VDC control circuit terminations and a minimum of 600 VDC for all 120 VAC circuits. All field terminal blocks shall be multiple terminal, one piece, rated a 600 VDC and 20 amps. Exceptions to the above requirement for 600 VDC terminal blocks used with the 120 VAC terminations are the 120 VAC terminations of the controller, monitor, and detectors, which are permitted to be terminated on a 300 VDC terminal block. Another exception is where intermixing terminal blocks would result from the above requirement then the block to be used shall be determined by the voltage of the largest number of terminations on that block. The minimum current rating of all terminal blocks shall be 15 amps unless otherwise specified. The minimum amperage for the 120 VAC termination on the power panel shall be 60 amps. Any contradiction between circuit description and hardware restriction shall be resolved by using the larger requirement specified.

In addition to the above requirements for voltage terminations a minimum size screw shall be used. The terminal blocks shall have a minimum screw of #6 for low voltage circuits for the electronic equipment and #8 for all field termination. The power terminal shall be a barrel type screw tightened lug.

12.2 Wiring Terminals

All compression terminals shall be constructed with a base material of fine grade high conductive copper per QQ-C-576 and tin plated per MIL-T-10727 plating process for durable corrosion resistance against salt spray and most chemical fumes. The insulation shall be

made of vinyl. The terminal shall be installed with tooling recommended by the manufacturer to meet the performance requirements of MIL-T-7928. The use of ring or spade terminals is not being precluded by the above requirement. Each terminal shall be correctly sized to fit the wire and terminal screw.

All soldered connections shall be made using the designed temperature for the solder being used and the location of the connection. The connection shall be made preventing a cold solder joint and excessive winking of the solder into the wire. The insulation of the wire shall not be damaged by excessive overheating at any point on the wire.

12.3 Multiple Pin Connectors

All multiple pin connectors shall be wired in accordance with the connector manufacturer's recommendations or applicable MIL specifications. The type of connector shall be in accordance with this standard, NEMA TS-2 TYPE 2, and as listed below.

Unused sockets and pins shall not be installed in the D connector. A cable clamp designed for each connector shall be installed securely to prevent excessive strain on the wires from being transmitted to the contacts inside the connector housing.

12.4 Switches

All switches, except the detector push button test switches, shall be heavy duty toggle switches and meet the MIL-MS-35059 Series Standards, rated at 20 Amps/125 VAC. The level shall have a seal for sand, dust, and 15-foot water submersion. The terminals shall be threaded for screws and have a tinned finish. Mounting shall be by two (2) hex nuts and two (2) internal-tooth, lock washers on a ½-inch shank through which the toggle lever is mounted. The number of poles and lever positions shall be determined by the applications previously stated.

12.5 Load Switches and Relay Bases

The load switch and the flash transfer relay sockets shall be rigidly mounted on the back panel. The insulating ridge on the front of the socket shall be reinforced with a metal mounting ring designed by the manufacturer of the socket. This ring shall be secured to the socket with a minimum of two (2) screws and the ring fastened to the panel. Both sockets shall a minimum current rating of 15 amps, individual contacts, voltage rating of 1750 volts rms, pre-grounded, or grounding pin connected to chassis ground.

All relay bases used for special circuits specified previously, and not otherwise specified, shall be rated a 300 VDC and 10 Amps. Bases shall be front-panel mounted and shall have a closed back for insulation from the panel. The socket shall be octal and wired to barrier type terminals permanently numbered. Terminal screws shall be tinplated, #6-32 with captive nuts, and shall accept #20 to #12 AWG wire.

12.6 Cable Clamps

All cable clamps shall have a metal loop and cushion made with a general purpose neoprene. The metal shall be aluminum 20204-T4 or stainless steel per Specification MIL-S-6721, annealed (321 or 347). The neoprene shall meet AMS Specification 3209. The clamp shall be sized to grip the cable it is being used on without damaging any insulation.

12.7 Fuses and Holders

All fuses located on the all removable electronic equipment shall be a ¼ inch by 1-1/4 inch glass tube fuse rated at a minimum of 125 VAC. All panel mounted fuses shall be U.L. Class "H" fuses rated at 250 VAC, fast acting. Fuses shall be provided and equal to Type NON 0-30 Amps.

The fuse holder shall be constructed of a general purpose phenolic material U.L. listed for 250 VAC. The fuse holders shall have barriers on each side of the fuse and shall have a screw type terminal.

12.8 Relay and Motor Suppressor

A suppressor shall be installed on all AC relay coils and motor inputs. The suppressor shall be a series resistor-capacitor, 100 ohms-0.1 microfarad, and rated for 600 volts.

12.9 Identification Sleeves

Identification sleeves shall be supplied on specified wires. The sleeve shall have the required identification printed or typed with a minimum size of pica-pitch 10. The sleeve shall be installed on the sire providing a self-laminating protective shield over the legend. Acceptable material shall be transparent, 3.5 mil, vinyl film with acrylic pressure sensitive adhesive. The operating temperature range shall be -40° C to 80° C. The size of the label shall provide sufficient area for the printed identification.

Application of the sleeve onto the wire shall be neat and smooth completely protecting the identification label.

13.0 TESTING

A test(s) shall be performed on the cabinet containing the completely assembled equipment and control equipment by the manufacturer prior to shipment. Malfunctions or defects shall be corrected and the equipment retested. The complete log beginning with the first test, showing the results of the all tests, shall be delivered with the equipment. The manufacturer shall furnish certification with the documentation required in Section 24, stating that the results of the test are true and accurate and stating the name and title of the person conducting the test. The test shall require the operation of the equipment with each signal circuit connected to an incandescent load of at least 600 watts. The equipment shall operate sequentially and continuously for at least 48 hours, as stated above, in an environment having a minimum temperature of 140°F.

The complete system, including all local controllers, cabinets, on-street master controller, and

modems shall be assembled and interconnected at the point of manufacture.

The system shall be completely performance tested and a written test report submitted in the documentation required in Section 24. The Engineer reserves the right to an on-site system inspection at the point of manufacture to witness the system operation and the performance test of the system.

After installation and debugging of all central control equipment, local controllers, detectors, communications, and other system hardware and software elements, the system shall be required to complete a 30 day period of acceptable operation. The system test shall fully and successfully demonstrate all system functions using live detector data and controlling all system-controlled intersections.

14.0 TRAINING

Formal classroom training and "hands-on" operations training shall be provided for personnel designated by this agency. The engineering, operations and maintenance training shall take place at locations within the state of Louisiana designated by this agency. The technician training shall take place at the manufacturer's facility. Classroom training shall be given for the engineering, operations and maintenance sessions.

Three (3) training sessions are required during the contract period. Two (2) maintenance sessions, one (1) engineering session shall be given. The engineering session shall provide for a maximum of twenty-five (25) people. Each maintenance session shall provide for a maximum of fifteen (15) people. Copies of course materials shall be supplied to and retained by each attendant. Training shall occur after delivery of initial order, but before one year after date of final acceptance of initial order. The manufacturer shall submit for each type of session, syllabuses to the Traffic Signal Engineer for approval before classes are scheduled.

14.1 Maintenance Training

Training for maintenance personnel shall include detailed, field level troubleshooting and basic interrogation of the controller unit. The training shall consist of two (2) sessions. One (1) session shall be remedial and one (1) session shall cover more advanced material. Each session shall be three (3) days in length. Course content shall emphasize information required to successfully pass the below specified tests.

Maintenance personnel shall be tested by the vendor as to their ability to repair and/or diagnose simulated failures, and to gather basic information about a particular controller unit (i.e., min time, conflicting and non-conflicting phases, etc.). There shall be at least ten (10) controller/cabinet configurations per session type. Cabinets, controllers and miscellaneous materials shall be supplied by the Department. Wiring and programming necessary to conduct the tests shall be performed by the vendor. The vendor shall recommend at least ten (10) simulated failures, timing schemes and other configurations to be used for each type of test. The Department shall supply the vendor with the final, approved test configurations, however, the vendor shall not be required to perform more than six (6) hours of wiring or programming in development of the test configurations.

Final test questions shall be supplied by the Department. A Department representative will be present at all time to assist the vendor in administering the test.

14.2 Engineer Training

Training for engineering personnel shall focus on implementing traffic engineering data with the controller. The manufacturer shall provide one (1) two-day session for a maximum of twenty –five (25) participants.

The first day of the session shall emphasize implementing traffic engineering data and include, at a minimum the following:

a. Programming an actuated, coordinated controller based on intersections provided by the Department.
b. Theory and operation of volume density operation and associated programming methods.
c. Theory and operation of three- and four-phase diamond sequencing and associated programming methods.

The second day of the session shall emphasize basic operation and interrogation of the controller. The training topics shall include as a minimum:

a. How to enter commands (System software, utilities, and disk management)
b. Operation of all devices
c. Generation and editing of arterial master and intersection controller databases
d. Uploading/downloading of arterial master and intersection controller databases
e. Procedure for enabling dynamic displays
f. Explanation of the communication system

15.0 WARRANTY

The system equipment shall be warranted for a minimum of one year. All warranty periods shall begin at the date of acceptance by the Department.

15.1 Documentation

Detailed technical information on material being offered shall be supplied with the bids for equipment directly shipped to the Department and with the material submittal for equipment being installed on projects. Information shall be for all items required by this specification and on the order or in the plans.

Manuals shall be supplied for all equipment and components of the system. The manuals supplied for software, peripherals, and modems shall be from the original source. The manual shall be comprehensive, easy to use and understand, and completely descriptive of the product.

15.2 Closed Loop System Operation Manual

a. Step-by-step system installation procedures

b. Operating instructions
c. System set-up procedures
d. Explanations and descriptions of data entry procedures
e. Menu item descriptions

15.3 Equipment Manual

a. Technical descriptions
b. Operating instructions
c. Theory of operation
d. Detailed schematic diagrams
e. Assembly drawings
f. Wiring diagram
g. Troubleshooting procedures to assist the maintenance staff in the identification and isolation of malfunctions
h. Parts list

15.4 Cabinet Wiring

Complete wiring details shall be shown on the drawings. The drawings shall use the same nomenclature to identify the various components as referred to in this standard. If no name was mentioned in this standard then a reasonable nomenclature shall be used. A legend shall be provided on all drawings identifying acronyms and symbols. Two (2) drawings shall be provided with each cabinet. The DOTD specification shall be followed when supplying documentation for projects.

APPENDIX

PIN/SOCKET ASSIGNMENTS FOR D CONNECTOR ON BACK PANEL

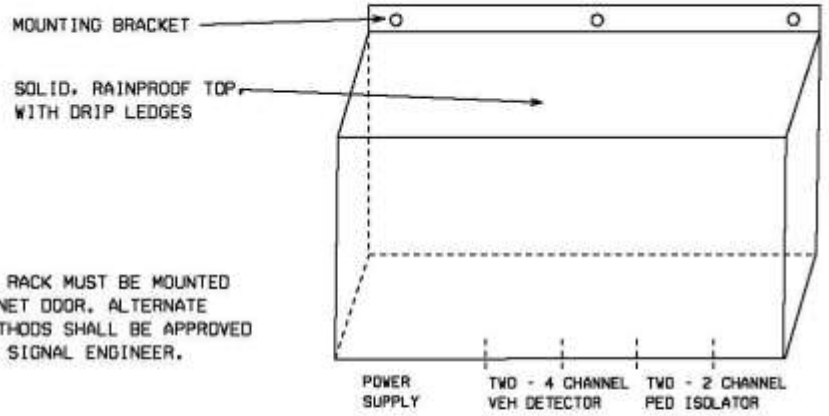
PIN	FUNCTION
1	OFFSET 1 IN
2	CYCLE 2 IN
3	CYCLE 3 IN
4	FLASH IN
5	OFFSET 2 IN
6	OFFSET 3 IN
7	INTERCONNECT FREE
8	SPLIT 2 IN
9	SPLIT 3 IN
10	SPL FUNCTION 2 OUT (TBC)
11	COMPUTER ON-LINE
12	THREE PHASE DIAMOND SELECT
13	FOUR PHASE DIAMOND SELECT
14	RESERVED
15	RESERVED
16	EXT RESYNC INPUT
17	MASTER SELECT
18	SYNC INPUT
19	PREEMPT 1 IN
20	PREEMPT 2 IN
21	PREEMPT 3 IN
22	PREEMPT 4 IN
23	PREEMPT 5 IN
24	PREEMPT INTERLOCK
25	SYSTEM DET. 1/DETECTOR 45P INPUT
26	SYSTEM DET. 2/DETECTOR 25S INPUT
27	SYSTEM DET. 3/DETECTOR 18P INPUT
28	SYSTEM DET. 4/DETECTOR 16S INPUT
29	SYSTEM DET. 5/DET. #2b-1P INPUT
30	SYSTEM DET. 6/DET. #2a INPUT
31	SYSTEM DET. 7/DET. #1b-5P INPUT
32	SYSTEM DET. 8/DET. #1a INPUT
33-34	SPARE
35	CONTROLLER INTERLOCK DIAMOND
36	COMP. SEL 1
37	COMP. SEL 2
38	COMP. SEL 3
39-41	SPARE (DO NOT USE)
42	CABINET INTERLOCK DIAMOND
43	SPL FUNCTION 1 OUT (TBC)
44	SPLIT 3 OUT
45	SPLIT 2 OUT
46	INTERCONNECT FREE OUT
47	OFFSET 3 OUT
48	OFFSET 2 OUT
49	FLASH OUT
50	CYCLE 3 OUT
51	CYCLE 2 OUT
52	OFFSET 1 OUT
53	+24 VDC
54	LOGIC GROUND
55	CHASSIS GND
56	RESERVED
57	RESERVED

PIN/SOCKET ASSIGNMENTS FOR E CONNECTOR ON BACK PANEL

PIN	FUNCTION
1	AC+
2	AC-
3	CHASSIS GROUND
9	PREEMPT 1
10	PREEMPT 2
11	PREEMPT 3
12	PREEMPT 4
13	PREEMPT 5
15	LOGIC GROUND

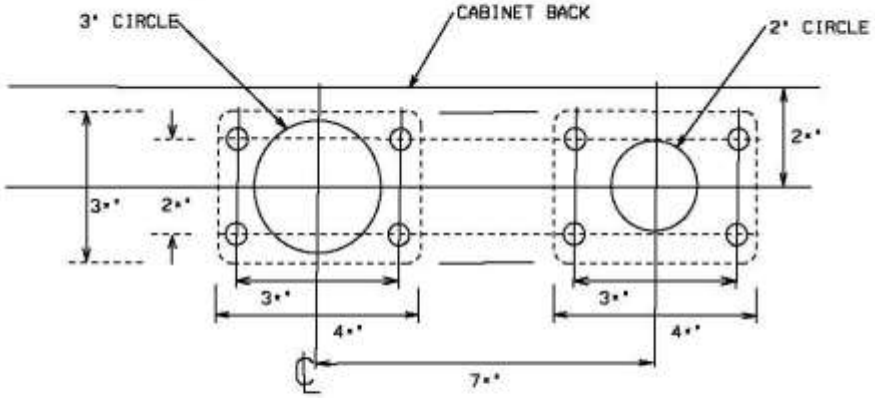
DETECTOR CARD RACK MOUNTING SCHEME

TYPE 3 CABINET ONLY

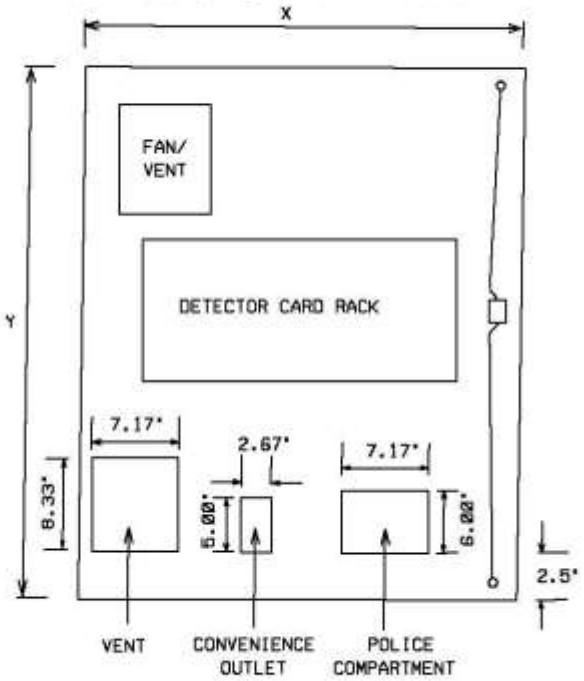


NOTE: CARD RACK MUST BE MOUNTED ON THE CABINET DOOR. ALTERNATE MOUNTING METHODS SHALL BE APPROVED BY THE DOTD SIGNAL ENGINEER.

TYPE 2 & 3 CABINET BOTTOM - PLAIN VIEW



PANEL DETAIL (TYPE 3 CABINET DOOR)



NOTES: DIMENSIONS DEFINE MAXIMUM AREA THAT SHALL BE USED BY ALL COMPONENTS AND MOUNTING HARDWARE FOR THAT DEVICE OR COMPARTMENT.

VENT, CONVENIENCE OUTLET, POLICE COMPARTMENT AND LOCK ARM SHALL BE EVENLY SPACED ACROSS THE WIDTH OF CABINET DOOR.

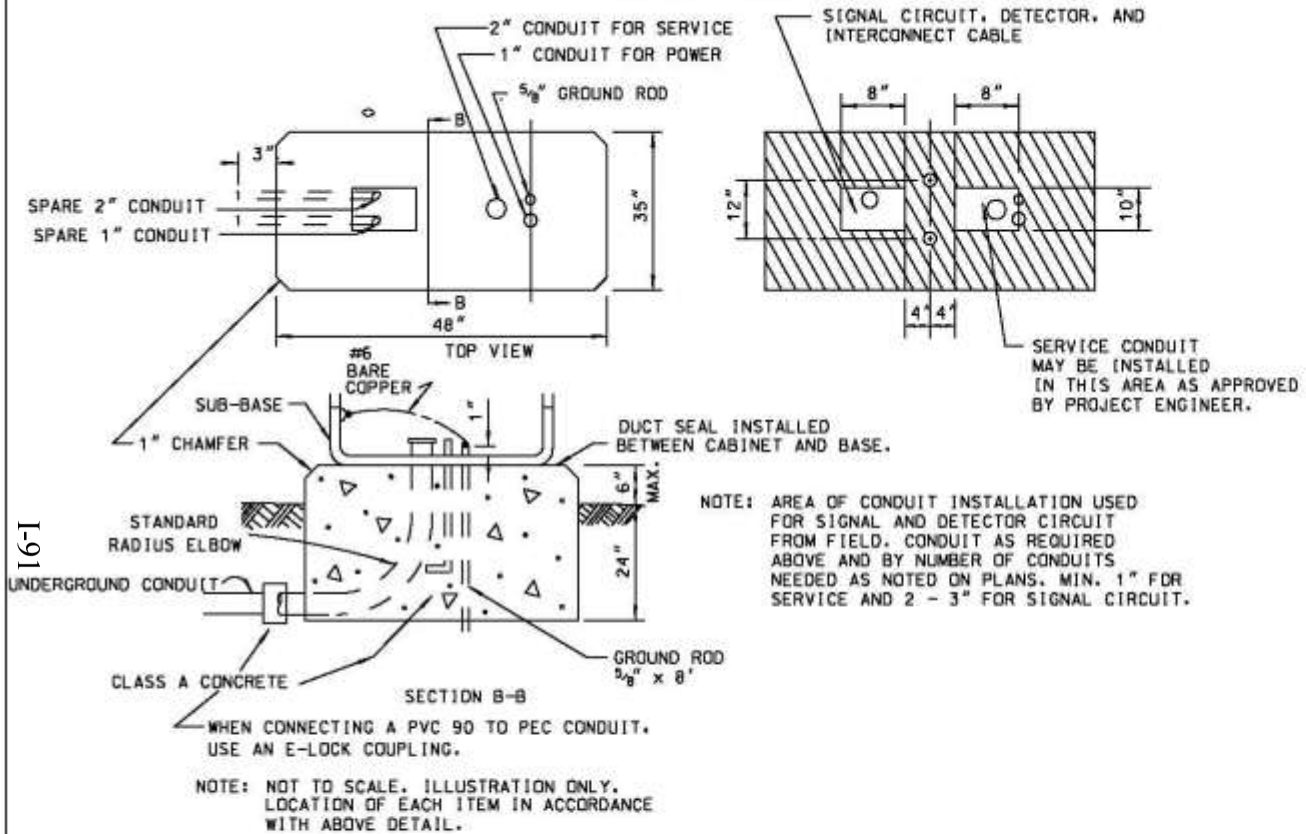
FOR X AND Y DIMENSIONS, SEE TCS 18A.

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
CABINET DOOR MOUNTING SCHEME
REVISION DATE: 07/16/2009

FIGURE NO. 18A-1

CONTROLLER FOUNDATION

NOTE: FOR TYPE 5, 6, AND 7 CABINETS
D.O.T.D. - T.C.S. #18



WHEN CONNECTING A PVC 90 TO PEC CONDUIT, USE AN E-LOCK COUPLING.

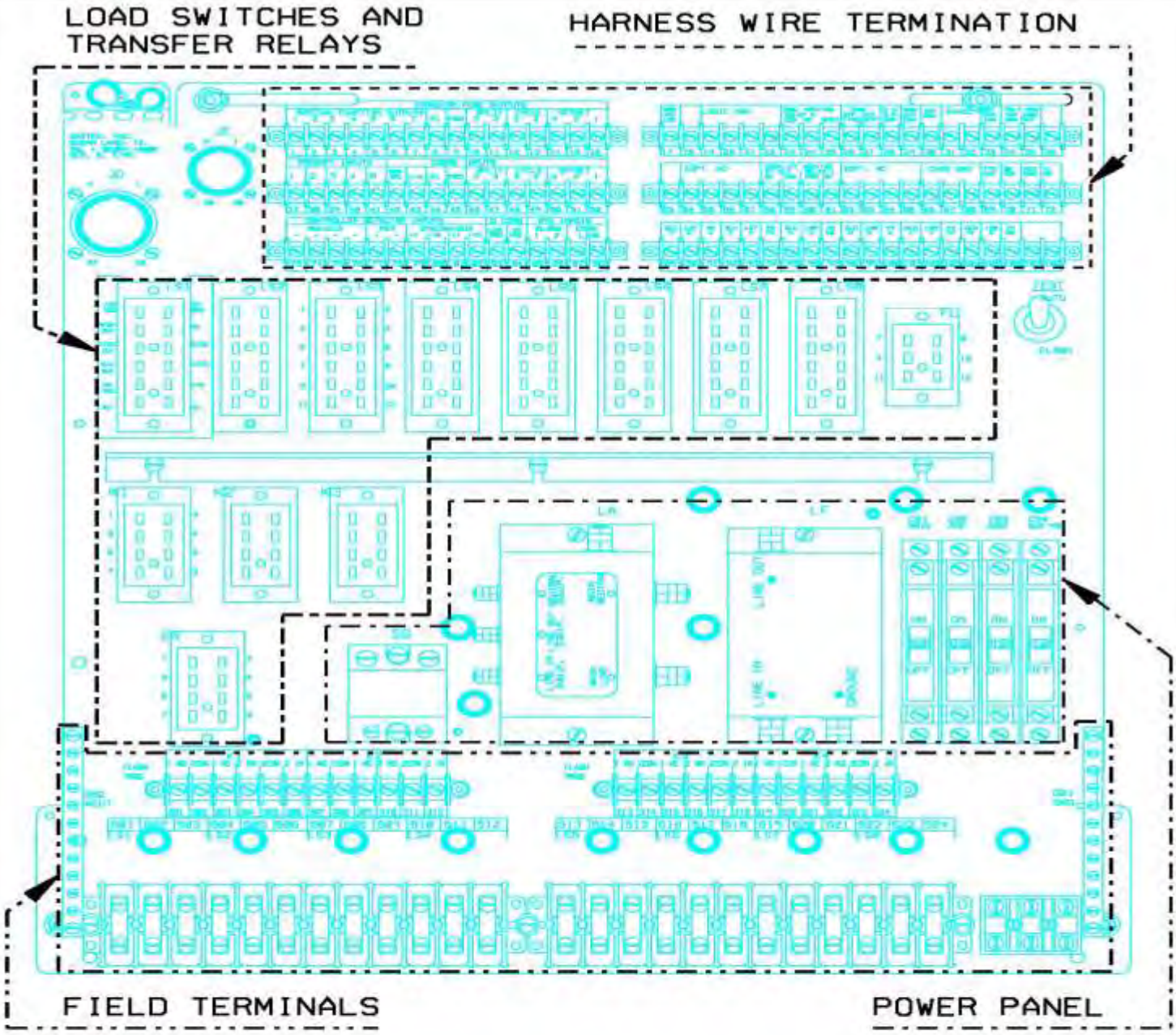
NOTE: NOT TO SCALE. ILLUSTRATION ONLY. LOCATION OF EACH ITEM IN ACCORDANCE WITH ABOVE DETAIL.

NOTE: AREA OF CONDUIT INSTALLATION USED FOR SIGNAL AND DETECTOR CIRCUIT FROM FIELD. CONDUIT AS REQUIRED ABOVE AND BY NUMBER OF CONDUITS NEEDED AS NOTED ON PLANS. MIN. 1" FOR SERVICE AND 2 - 3" FOR SIGNAL CIRCUIT.

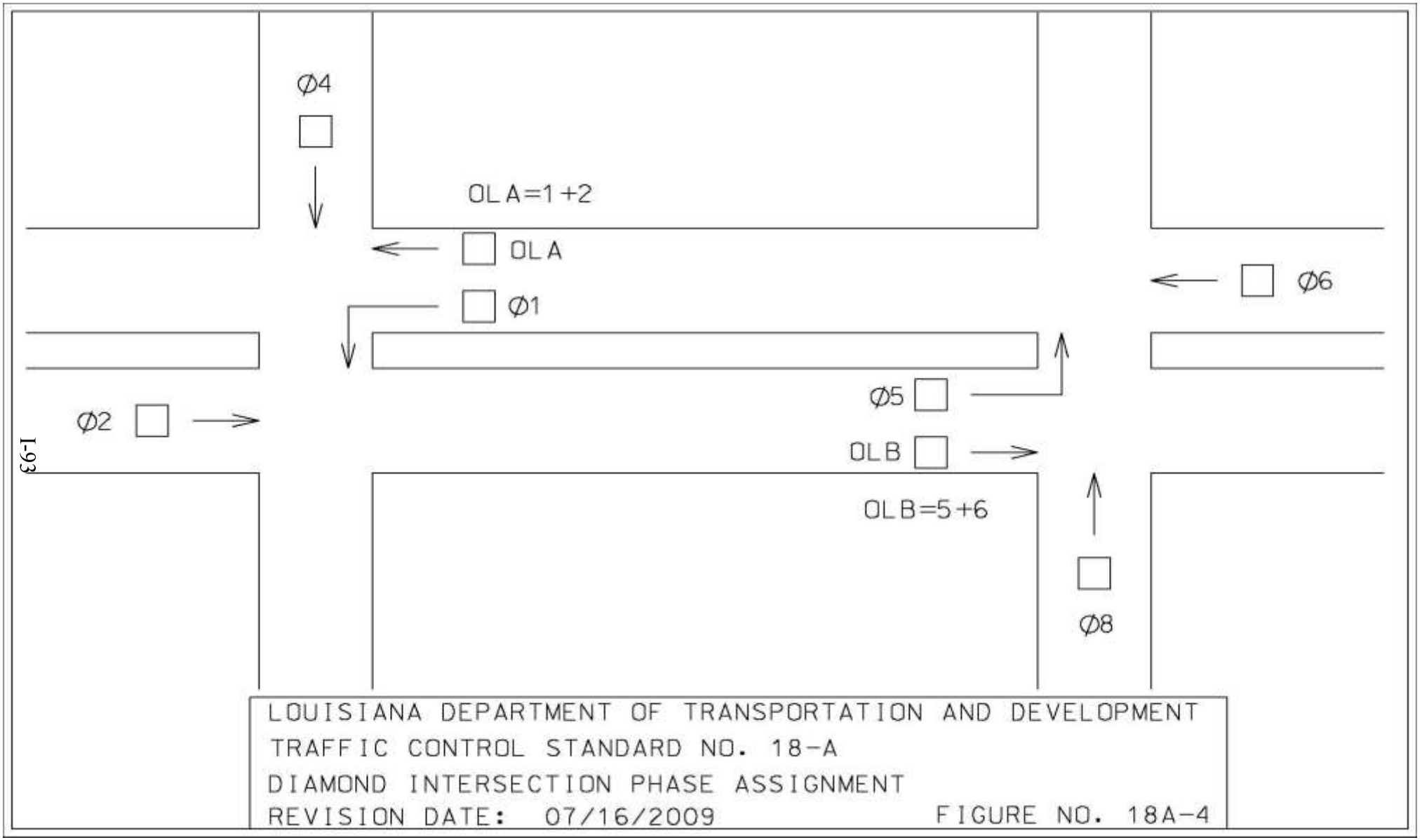
NOTES:

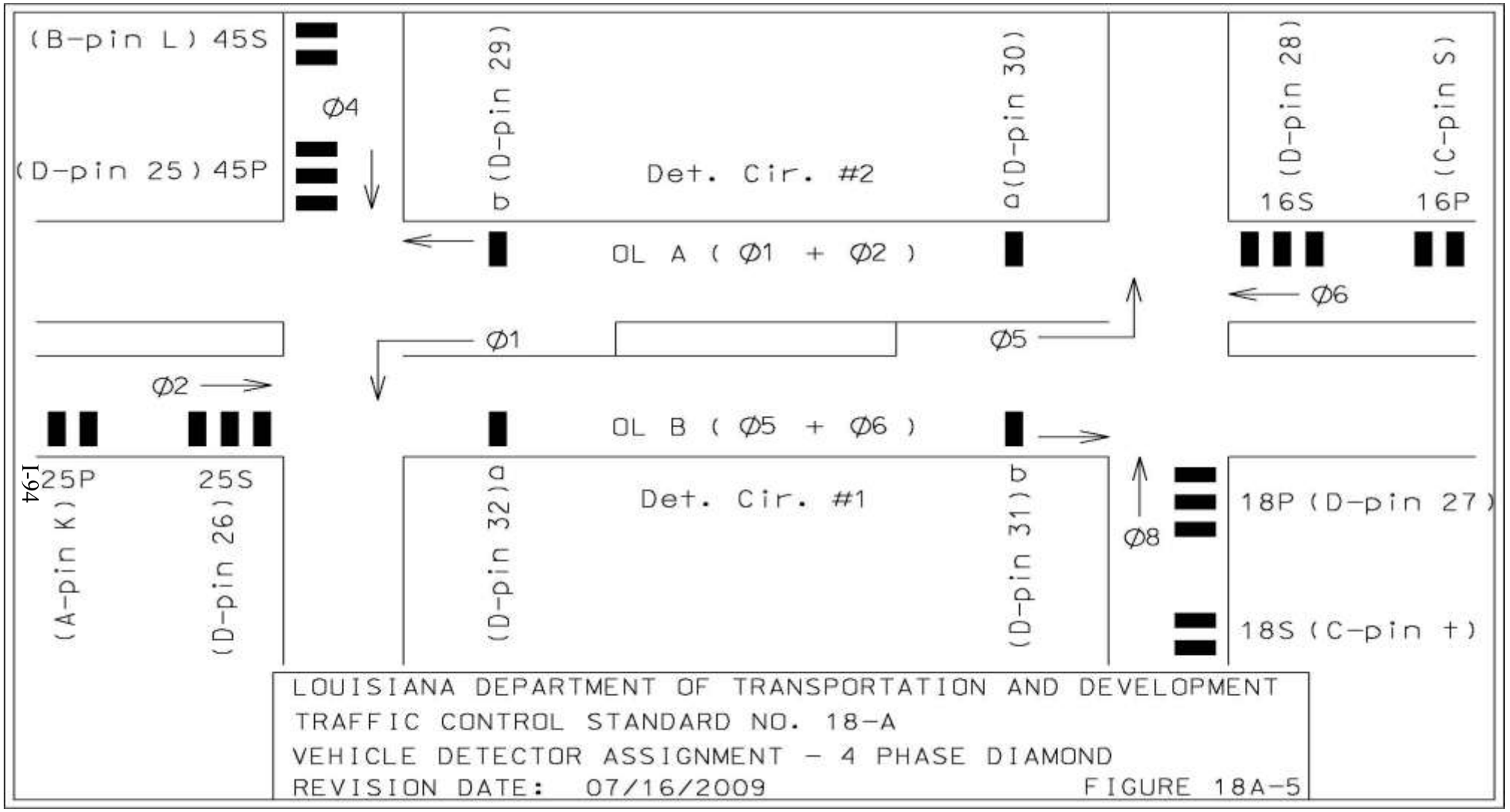
1. ALL GROUND MOUNTED CONTROLLERS TO HAVE SPARE 2" CONDUIT STUBBED OUT 24" BELOW GRADE & 24" OUT FROM BACK OF CABINET IN ADDITION TO OTHER REQUIRED. CONDUITS. SPARE CONDUIT SHALL BE CAPPED.
2. ALL EXPOSED CONCRETE EDGES SHALL HAVE A 1" CHAMFER.
3. ALL CONDUIT, GROUND ROD AND ANCHOR BOLTS SHALL BE INSTALLED WITH 1" ± 1/2" EXPOSED ABOVE BASE.
4. CONTROLLER FOUNDATION SHALL BE MARKED TO SHOW THE LOCATION AND DIRECTION OF ALL SPARE CONDUIT.
5. FOUNDATION SHALL BE ORIENTATED AS SHOWN ON THE PLANS. TYPICALLY, DOOR SIDE SHALL BE AWAY FROM TRAFFIC.
6. #6 AWG BARE COPPER WIRE ON GROUND ROD, ONE SIDE TO BE CONNECTED TO GROUND LUG ON PANEL.

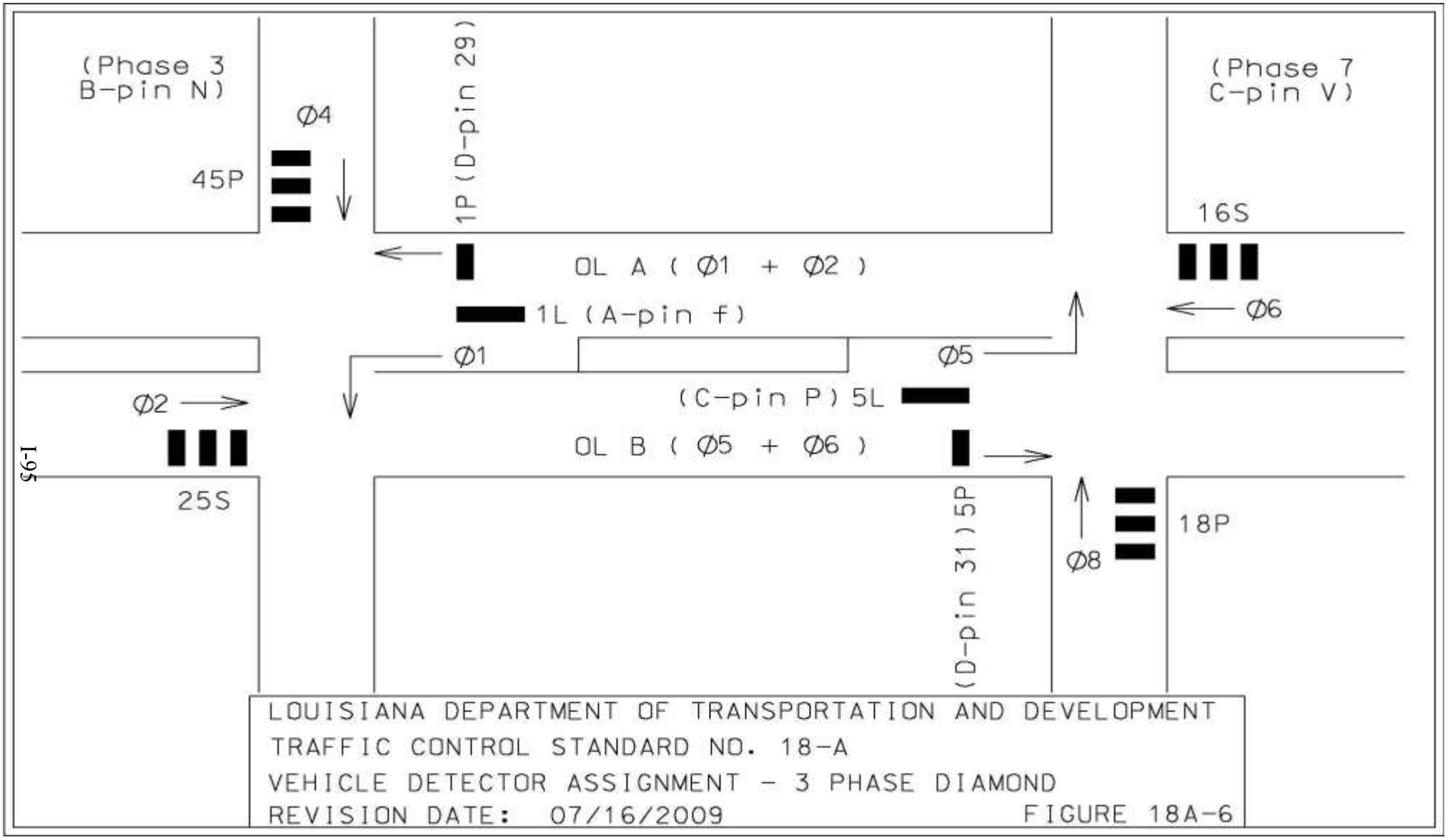
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
CONTROLLER FOUNDATION
REVISION DATE: 07/16/2009 FIGURE NO. 18A-2



LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
CABINET BACK PANEL MOUNTING SCHEME
REVISION DATE: 07/16/2009 FIGURE NO. 18A-3


Ø4
OLA=1+2
OLA
Ø1
Ø6
Ø5
Ø2
OLB
I-93
OLB=5+6
Ø8
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
DIAMOND INTERSECTION PHASE ASSIGNMENT
REVISION DATE: 07/16/2009
FIGURE NO. 18A-4


(B-pin L) 45S
Ø4
(D-pin 25) 45P
b (D-pin 29)
Det. Cir. #2
a(D-pin 30)
16S (D-pin 28)
16P (C-pin S)
OL A (Ø1 + Ø2)
Ø6
Ø1
Ø5
Ø2
OL B (Ø5 + Ø6)
25P (A-pin K)
25S (D-pin 26)
(D-pin 32)a
Det. Cir. #1
(D-pin 31) b
Ø8
18P (D-pin 27)
18S (C-pin +)
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
VEHICLE DETECTOR ASSIGNMENT - 4 PHASE DIAMOND
REVISION DATE: 07/16/2009
FIGURE 18A-5


(Phase 3
B-pin N)
Ø4
45P
1P (D-pin 29)
(Phase 7
C-pin V)
16S
OL A (Ø1 + Ø2)
1L (A-pin f)
Ø6
Ø1
Ø5
Ø2
(C-pin P) 5L
OL B (Ø5 + Ø6)
I-65
25S
(D-pin 31) 5P
Ø8
18P
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
VEHICLE DETECTOR ASSIGNMENT - 3 PHASE DIAMOND
REVISION DATE: 07/16/2009
FIGURE 18A-6

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

CONSTRUCTION PROPOSAL INFORMATION FOR

FEDERAL AID PROJECT

STATE PROJECT NO. H.012232
LA 3064 TO BLUEBONNET BLVD. PHASE II
ROUTE I-10
EAST BATON ROUGE PARISH

BID BOND

A Bid Bond is required when the bidder's total bid amount as calculated by the Department in accordance with Subsection 103.01 is greater than $50,000. *(See Section 102 of the Specifications)*

_____, as Principal (Bidder) and _____, as Surety, are bound unto, City of Baton Rouge-Parish of East Baton Rouge, (hereinafter called the Contracting Agency) in the sum of five percent (5 %) of the bidder's total bid amount as calculated by the Department for payment, of which the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, as solidary obligors.

Signed and sealed this _____ day of _____, 20_____.

The condition of this obligation is such that, whereas the Principal has submitted a bid to the Contracting Agency on a contract for the construction of **STATE PROJECT NO. H.012232, FEDERAL AID PROJECT NO. H012232, LA 3064 TO BLUEBONNET BLVD. PHASE II, located in EAST BATON ROUGE PARISH, NHS ROUTE I-10, NON-NHS ROUTES LOCAL ROADS,** if the bid is accepted and the Principal, within the specified time, enters into the contract in writing and gives bond with Surety acceptable to the Contracting Agency for payment and performance of said contract, this obligation shall be void; otherwise to remain in effect.

Principal (Bidder or First Partner to Joint Venture)	If a Joint Venture, Second Partner
By _____	By _____
Authorized Officer-Owner-Partner	Authorized Officer-Owner-Partner
_____	_____
Typed or Printed Name	Typed or Printed Name

_____
Surety

By _____ (Seal)
Agent or Attorney-in-Fact

_____
Typed or Printed Name

To receive a copy of the contract and subsequent correspondence / communication from LA DOTD or the contracting agency, with respect to the bid bonds, the following information must be provided:

Bonding Agency or Company Name	Address
Agent or Representative	Phone Number / Fax Number

11/16
Form AC-2A

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0001	201-01-00100	Clearing and Grubbing		LUMP SUM
		_____ Dollars _____ Cents		
0002	202-01-00100	Removal of Structures and Obstructions		LUMP SUM
		_____ Dollars _____ Cents		
0003	202-02-00010	Removal of Dead End Road Installation	1.000	EACH
		_____ Dollars _____ Cents		
0004	202-02-02020	Removal of Asphalt Pavement	142.800	SQYD
		_____ Dollars _____ Cents		
0005	202-02-05000	Removal of Building (26,500 SQFT Structure Near Sta. 161+50, Rt.)	1.000	EACH
		_____ Dollars _____ Cents		
0006	202-02-06060	Removal of Concrete Catch Basin	6.000	EACH
		_____ Dollars _____ Cents		
0007	202-02-06100	Removal of Concrete Walks and Drives	6,418.000	SQYD
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0008	202-02-06140	Removal of Curbs (Concrete)	1,690.000	LNFT
		_____ Dollars _____ Cents		
0009	202-02-12000	Removal of Fence	811.000	LNFT
		_____ Dollars _____ Cents		
0010	202-02-32140	Removal of Pipe (Storm Drain) (See EXISTING PIPE REMOVAL Table)	980.000	LNFT
		_____ Dollars _____ Cents		
0011	202-02-32500	Removal of Portland Cement Concrete Pavement	371.000	SQYD
		_____ Dollars _____ Cents		
0012	202-02-38200	Removal of Signs	13.000	EACH
		_____ Dollars _____ Cents		
0013	202-02-40100	Removal of Traffic Signal Equipment		LUMP SUM
		_____ Dollars _____ Cents		
0014	203-01-00100	General Excavation	27,987.000	CUYD
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0015	203-03-00100	Embankment	131,159.000	CUYD
		_____ Dollars _____ Cents		
0016	203-04-00300	Nonplastic Embankment (Stone)	7.000	CUYD
		_____ Dollars _____ Cents		
0017	203-08-00100	Geotextile Fabric	59.000	SQYD
		_____ Dollars _____ Cents		
0018	203-11-00100	Settlement Plate Installation and Monitoring	10.000	EACH
		_____ Dollars _____ Cents		
0019	204-02-00100	Temporary Hay Bales	630.000	EACH
		_____ Dollars _____ Cents		
0020	204-05-00100	Temporary Sediment Check Dams (Hay)	2.000	EACH
		_____ Dollars _____ Cents		
0021	204-06-00100	Temporary Silt Fencing	7,885.000	LNFT
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0022	302-02-06070	Class II Base Course (6" Thick) (Crushed Stone or Recycled Portland Cement Concrete) _____ Dollars _____ Cents	1,741.200	SQYD
0023	302-02-08020	Class II Base Course (8" Thick) (Crushed Stone) _____ Dollars _____ Cents	21,876.300	SQYD
0024	302-02-08570	Class II Base Course (8-1/2" Thick) (Crushed Stone or Recycled Portland Cement Concrete) _____ Dollars _____ Cents	1,227.600	SQYD
0025	304-01-00100	Lime _____ Dollars _____ Cents	57.190	TON
0026	304-05-00100	Lime Treatment (Type E) _____ Dollars _____ Cents	4,034.000	SQYD
0027	402-01-00101	Traffic Maintenance Surfacing (Aggregate) (Vehicular Measurement) _____ Dollars _____ Cents	100.000	CUYD
0028	502-01-00100	Asphalt Concrete _____ Dollars _____ Cents	5,929.500	TON

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0029	601-01-00100	Portland Cement Concrete Pavement (8" Thick) _____ Dollars _____ Cents	698.900	SQYD
0030	601-01-00300	Portland Cement Concrete Pavement (9" Thick) _____ Dollars _____ Cents	540.600	SQYD
0031	601-01-00500	Portland Cement Concrete Pavement (10" Thick) _____ Dollars _____ Cents	944.100	SQYD
0032	601-03-00700	Portland Cement Concrete Shoulder (8" Thick) _____ Dollars _____ Cents	383.800	SQYD
0033	601-03-01100	Portland Cement Concrete Shoulder (10" Thick) _____ Dollars _____ Cents	242.800	SQYD
0034	701-01-01143	Cross Drain Pipe (72" RCP/RPVCP) _____ Dollars _____ Cents	522.000	LNFT
0035	701-01-02220	Cross Drain Pipe (60" RCP or 72" CMP) _____ Dollars _____ Cents	120.000	LNFT

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0036	701-03-01002	Storm Drain Pipe (15" RCP/RPVCP) _____ Dollars _____ Cents	1,324.000	LNFT
0037	701-03-01022	Storm Drain Pipe (18" RCP/RPVCP) _____ Dollars _____ Cents	2,696.000	LNFT
0038	701-03-01042	Storm Drain Pipe (24" RCP/RPVCP) _____ Dollars _____ Cents	427.000	LNFT
0039	701-03-01062	Storm Drain Pipe (30" RCP/RPVCP) _____ Dollars _____ Cents	145.000	LNFT
0040	701-03-01082	Storm Drain Pipe (36" RCP/RPVCP) _____ Dollars _____ Cents	308.000	LNFT
0041	701-03-01092	Storm Drain Pipe (42" RCP/RPVCP) _____ Dollars _____ Cents	511.000	LNFT
0042	701-03-01120	Storm Drain Pipe (54" RCP) _____ Dollars _____ Cents	218.000	LNFT

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0043	701-03-01160	Storm Drain Pipe (72" RCP) _____ Dollars _____ Cents	323.000	LNFT
0044	701-03-02140	Storm Drain Pipe (Outfall) (54" CMP) _____ Dollars _____ Cents	28.000	LNFT
0045	701-04-01100	Storm Drain Pipe Arch (42" Equiv. RCPA) _____ Dollars _____ Cents	107.000	LNFT
0046	701-04-02040	Storm Drain Pipe Arch (Outfall) (24" Equiv. CMPA) _____ Dollars _____ Cents	46.000	LNFT
0047	701-07-00100	Yard Drain Pipe (4") _____ Dollars _____ Cents	518.000	LNFT
0048	701-14-00100	Cleaning Existing Pipes _____ Dollars _____ Cents	570.000	LNFT
0049	701-17-00100	Trench Excavation Safety Protection (Depth >5 feet) _____ Dollars _____ Cents	9,036.000	LNFT

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0050	702-02-00100	Manholes (MH-06) _____ Dollars _____ Cents	15.000	EACH
0051	702-03-00100	Catch Basins (CB-01) _____ Dollars _____ Cents	11.000	EACH
0052	702-03-00500	Catch Basins (CB-06) _____ Dollars _____ Cents	36.000	EACH
0053	702-03-00600	Catch Basins (CB-07) _____ Dollars _____ Cents	2.000	EACH
0054	702-03-00700	Catch Basins (CB-08) _____ Dollars _____ Cents	13.000	EACH
0055	702-03-01000	Catch Basins (CB-2TOP02) _____ Dollars _____ Cents	1.000	EACH
0056	702-04-00200	Adjusting Catch Basins _____ Dollars _____ Cents	1.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0057	702-04-01000	Capping Existing Catch Basin or Manhole	1.000	EACH
		_____ Dollars _____ Cents		
0058	703-01-00100	Shoulder Underdrain Systems	5,914.000	LNFT
		_____ Dollars _____ Cents		
0059	706-01-00100	Concrete Walk (4" Thick)	3,158.500	SQYD
		_____ Dollars _____ Cents		
0060	706-01-00300	Concrete Walk (6" Thick)	440.800	SQYD
		_____ Dollars _____ Cents		
0061	706-02-00200	Concrete Drive (6" Thick)	542.700	SQYD
		_____ Dollars _____ Cents		
0062	706-03-00300	Incidental Concrete Paving (6" Thick)	61.100	SQYD
		_____ Dollars _____ Cents		
0063	706-03-00700	Incidental Concrete Paving (10" Thick)	71.100	SQYD
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0064	706-04-00110	Curb Ramps (Type 6) _____ Dollars _____ Cents	34.700	SQYD
0065	707-01-00100	Concrete Curb _____ Dollars _____ Cents	992.900	LNFT
0066	707-03-00100	Combination Concrete Curb and Gutter _____ Dollars _____ Cents	11,415.400	LNFT
0067	708-01-00100	Right-of-Way Monument _____ Dollars _____ Cents	32.000	EACH
0068	711-01-05000	Riprap (130 lb, 24" Thick) _____ Dollars _____ Cents	352.000	SQYD
0069	711-04-00100	Geotextile Fabric _____ Dollars _____ Cents	352.000	SQYD
0070	713-01-00100	Temporary Signs and Barricades _____ Dollars _____ Cents		LUMP SUM

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0071	713-02-00100	Temporary Pavement Markings (4" Width) _____ Dollars _____ Cents	158.000	LNFT
0072	713-02-00500	Temporary Pavement Markings (24" Width) _____ Dollars _____ Cents	24.000	LNFT
0073	714-01-00100	Slab Sodding (Bermuda Grass) _____ Dollars _____ Cents	3,281.000	SQYD
0074	717-01-00100	Seeding _____ Dollars _____ Cents	206.000	LB
0075	718-01-00100	Fertilizer _____ Dollars _____ Cents	6,885.000	LB
0076	719-01-01080	Plants (Tree) (Balled and Burlapped) (3 inch cal) (Live Oak) _____ Dollars _____ Cents	30.000	EACH
0077	719-01-01080	Plants (Tree) (Balled and Burlapped) (3 inch cal) (Nutall Oak) _____ Dollars _____ Cents	22.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0078	719-01-01080	Plants (Tree) (Balled and Burlapped) (3 inch cal) (Sweetbay Magnolia) _____ Dollars _____ Cents	18.000	EACH
0079	719-01-01080	Plants (Tree) (Balled and Burlapped) (3 inch cal) (Wilow Oak) _____ Dollars _____ Cents	27.000	EACH
0080	722-01-00100	Project Site Laboratory _____ Dollars _____ Cents	1.000	EACH
0081	726-01-00100	Bedding Material _____ Dollars _____ Cents	1,324.900	CUYD
0082	727-01-00100	Mobilization _____ Dollars _____ Cents		LUMP SUM
0083	729-01-00100	Sign (Type A) _____ Dollars _____ Cents	464.500	SQFT
0084	729-01-00101	Sign (Type A)(Install) _____ Dollars _____ Cents	130.000	SQFT

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0085	729-04-00100	Sign (Type D) _____ Dollars _____ Cents	140.200	SQFT
0086	729-06-00100	Sign (Overhead Mounted) _____ Dollars _____ Cents	70.000	SQFT
0087	729-08-00100	Mounting (2 1/2" Size Post) _____ Dollars _____ Cents	11.000	EACH
0088	729-08-00200	Mounting (3 1/2" Size Post) _____ Dollars _____ Cents	4.000	EACH
0089	729-08-00600	Mounting (W6 x 12 Size Post) _____ Dollars _____ Cents	8.000	EACH
0090	729-08-00700	Mounting (W8 x 18 Size Post) _____ Dollars _____ Cents	2.000	EACH
0091	729-13-00100	Mounting (Bridge Fascia Mounted) _____ Dollars _____ Cents	1.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0092	729-22-00100	Square Tubing Post with 2-1/4" Anchor	7.000	EACH
		_____ Dollars _____ Cents		
0093	731-02-00100	Reflectorized Raised Pavement Markers	918.000	EACH
		_____ Dollars _____ Cents		
0094	732-01-02080	Plastic Pavement Striping (24" Width) (Thermoplastic 125 mil)	1,478.000	LNFT
		_____ Dollars _____ Cents		
0095	732-02-02000	Plastic Pavement Striping (Solid Line) (4" Width) (Thermoplastic 90 mil)	3.174	MILE
		_____ Dollars _____ Cents		
0096	732-02-02040	Plastic Pavement Striping (Solid Line) (8" Width) (Thermoplastic 90 mil)	0.695	MILE
		_____ Dollars _____ Cents		
0097	732-03-02000	Plastic Pavement Striping (Broken Line) (4" Width) (Thermoplastic 90 mil)	1.716	MILE
		_____ Dollars _____ Cents		
0098	732-03-02010	Plastic Pavement Striping (Dotted Line)(4" W)(2' L)(Thermo 90 mil)	0.084	MILE
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0099	732-03-02030	Plastic Pavement Striping (Dotted Line)(8" W)(2' L)(Thermo 90 mil)	0.350	MILE
		_____ Dollars _____ Cents		
0100	732-04-01020	Plastic Pavement Legends and Symbols (Arrow - Straight)	3.000	EACH
		_____ Dollars _____ Cents		
0101	732-04-01040	Plastic Pavement Legends and Symbols (Arrow - Double)	5.000	EACH
		_____ Dollars _____ Cents		
0102	732-04-01080	Plastic Pavement Legends and Symbols (Arrow - Left Turn)	19.000	EACH
		_____ Dollars _____ Cents		
0103	732-04-01100	Plastic Pavement Legends and Symbols (Arrow - Right Turn)	8.000	EACH
		_____ Dollars _____ Cents		
0104	732-04-15020	Plastic Pavement Legends and Symbols (ONLY)	2.000	EACH
		_____ Dollars _____ Cents		
0105	732-05-00100	Removal of Existing Markings	0.087	MILE
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0106	736-01-00100	Trenching and Backfilling	2,765.000	LNFT
		_____ Dollars _____ Cents		
0107	736-03-00100	Jacking or Boring for Conduit	3,245.000	LNFT
		_____ Dollars _____ Cents		
0108	736-04-00001	Signal Pole (Pedestal Pole)	1.000	EACH
		_____ Dollars _____ Cents		
0109	736-05-30000	Signal Heads (3 Section, 12 inch Led Lens, R, Y, G)	20.000	EACH
		_____ Dollars _____ Cents		
0110	736-05-30004	Signal Heads (3 Section, 12 inch Led Lens, R, R, Y)	5.000	EACH
		_____ Dollars _____ Cents		
0111	736-05-31001	Signal Heads (3 Sec, 12 inch Led Lens, LT. R, LT. Y, LT. G)	10.000	EACH
		_____ Dollars _____ Cents		
0112	736-05-35001	Signal Heads (3 Sec, 12 inch Led Lens, RT. R, RT. Y, RT. G)	3.000	EACH
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0113	736-05-41000	Signal Heads (4 Section, 12" Led Lens, R, Y, LT. G, G) _____ Dollars _____ Cents	3.000	EACH
0114	736-05-55000	Signal Heads (5 Section, 12 inch Led Lens, R, Y, RT. Y, G, RT. G) _____ Dollars _____ Cents	3.000	EACH
0115	736-06-00100	Signal Service _____ Dollars _____ Cents	1.000	EACH
0116	736-06-00300	Signal Service with Separate Disconnect for Street Lights _____ Dollars _____ Cents	1.000	EACH
0117	736-06-00500	Signal Service Pedestal Disconnect _____ Dollars _____ Cents	2.000	EACH
0118	736-08-00102	Signal Controller (980 ATC, Type 2)(Furnish & Install) _____ Dollars _____ Cents	3.000	EACH
0119	736-10-00200	Underground Junction Box (Type E) _____ Dollars _____ Cents	1.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0120	736-10-00300	Underground Junction Box (Type F)	22.000	EACH
		_____ Dollars _____ Cents		
0121	736-10-00400	Underground Junction Box (Type G)	3.000	EACH
		_____ Dollars _____ Cents		
0122	736-10-00600	Underground Junction Box (Type I)	8.000	EACH
		_____ Dollars _____ Cents		
0123	736-10-00700	Underground Junction Box (Type J)	3.000	EACH
		_____ Dollars _____ Cents		
0124	736-11-00200	Conduit (2" HDPE, Schedule 80)	3,360.000	LNFT
		_____ Dollars _____ Cents		
0125	736-11-00300	Conduit (3" HDPE, Schedule 80)	4,200.000	LNFT
		_____ Dollars _____ Cents		
0126	736-12-02006	Conductor (2c, #6 awg)	250.000	LNFT
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0127	736-12-02014	Conductor (2c, #14 awg)	170.000	LNFT
		_____ Dollars _____ Cents		
0128	736-12-03006	Conductor (3c, 6 gauge / #6 awg)	765.000	LNFT
		_____ Dollars _____ Cents		
0129	736-12-06014	Conductor (6c, #14 awg)	2,940.000	LNFT
		_____ Dollars _____ Cents		
0130	736-12-10014	Conductor (10c, #14 awg)	9,225.000	LNFT
		_____ Dollars _____ Cents		
0131	736-15-02400	Signal Support (Foundation, 24 inch Minimum Diameter)	1.000	EACH
		_____ Dollars _____ Cents		
0132	736-21-00000	LED Pedestrian Countdown Signal Head	2.000	EACH
		_____ Dollars _____ Cents		
0133	737-05-00002	Painted Curbs	179.000	LNFT
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0134	740-01-00100	Construction Layout _____ Dollars _____ Cents		LUMP SUM
0135	822-01-00100	Trenching and Backfilling _____ Dollars _____ Cents	6,676.000	LNFT
0136	822-02-00300	Conduit w Conductors (PVC/HDPE) (1-1/4") (3#8 AWG XHHW-2 Conductors, 1#8 Bare Stranded Ground) (Underground) _____ Dollars _____ Cents	3,403.000	LNFT
0137	822-02-00400	Conduit w Conductors (PVC/HDPE) (1-1/2") (3#4 AWG XHHW-2 Conductors, 1#4 Bare Stranded Ground) (Underground) _____ Dollars _____ Cents	1,812.000	LNFT
0138	822-02-00500	Conduit w Conductors (PVC/HDPE) (2") 3#2 AWG XHHW-2 Conductors, 1#2 Bare Stranded Ground) (Underground) _____ Dollars _____ Cents	5,832.000	LNFT
0139	822-02-00600	Conduit w Conductors (PVC/HDPE) (2-1/2") (3#1/0 AWG XHHW-2 Conductors) (Underground) _____ Dollars _____ Cents	150.000	LNFT
0140	822-02-02300	Conduit w Conductors (Rigid Galv Steel) (1-1/4") (3#8 AWG XHHW-2 Conductors, 1#8 Bare Stranded Ground) (On Structure) _____ Dollars _____ Cents	20.000	LNFT

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0141	822-02-02500	Conduit w Conductors (Rigid Galv Steel) (2") (3#1/0 AWG XHHW-2 Conductors, 1#2 Green Ground) (On Structure) _____ Dollars _____ Cents	30.000	LNFT
0142	822-02-02500	Conduit w Conductors (Rigid Galv Steel) (2") (3#2 AWG XHHW-2 Conductors, 1#2 Bare Stranded Ground) (On Structure) _____ Dollars _____ Cents	80.000	LNFT
0143	822-02-02600	Conduit w Conductors (Rigid Galv Steel) (2-1/2") (3#1/0 AWG XHHW-2 Conductors) (On Structure) _____ Dollars _____ Cents	20.000	LNFT
0144	822-04-00200	Jacked or Bored Casing (6" Dia) (PVC/HDPE) _____ Dollars _____ Cents	628.000	LNFT
0145	822-05-02100	Light Pole (Aluminum, 35 Foot Mnt. Ht., 8' Single Truss Arm, Aluminum Break. Trans. Base, Conc. Drill Shaft, Conc. Mowing Apron) _____ Dollars _____ Cents	36.000	EACH
0146	822-07-02800	Luminaire (Lowmast, 180 Watt LED, 120 Volt, IES Medium, Cutoff, Type II Roadway Distribution, Single Fusing, UL Listed Grey) _____ Dollars _____ Cents	36.000	EACH
0147	822-08-00200	Electrical Service Point (Structure) _____ Dollars _____ Cents	1.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0148	822-15-02100	Relocate Light Poles	1.000	EACH Dollars Cents
0149	822-16-00100	Underground Junction Box (12" x 12")	36.000	EACH Dollars Cents
0150	822-16-00300	Underground Junction Box (13" x 24")	8.000	EACH Dollars Cents
0151	822-16-00400	Underground Junction Box (17" x 30")	2.000	EACH Dollars Cents
0152	822-16-00400	Underground Junction Box (30" x 30")	1.000	EACH Dollars Cents
0153	822-19-00100	Modular Breakaway Cable System	36.000	EACH Dollars Cents
0154	822-20-00100	Disconnect (Service) (Fused)	1.000	EACH Dollars Cents

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0155	822-21-00100	Duct Marker (Concrete) _____ Dollars _____ Cents	10.000	EACH
0156	822-22-00300	Underground Marker Tape (6")(Detectable) _____ Dollars _____ Cents	6,676.000	LNFT
0157	NS-600-00220	Saw Cutting Portland Cement Concrete Pavement _____ Dollars _____ Cents	21,755.000	INLF
0158	NS-736-00001	GPS _____ Dollars _____ Cents	3.000	EACH
0159	NS-736-00003	Managed Ethernet Switch _____ Dollars _____ Cents	3.000	EACH
0160	NS-736-00130	TS-2 Traffic Signal Cabinet (Ground Mounted) _____ Dollars _____ Cents	3.000	EACH
0161	NS-736-00133	Battery Back-up System for Traffic Signals _____ Dollars _____ Cents	3.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0162	NS-736-00135	2-Wire Accessible Pedestrian Pushbutton Detectors	2.000	EACH
		_____ Dollars _____ Cents		
0163	NS-736-00136	2-Wire Accessible Pedestrian Pushbutton Cabinet Control	1.000	EACH
		_____ Dollars _____ Cents		
0164	NS-DEV-73280	MMA Pavement Marking (Green Bike Lanes/Bike Boxes)	24.000	SQYD
		_____ Dollars _____ Cents		
0165	NS-ITS-01121	CCTV Camera Assembly, Furnish and Install with PTZ, Digital	1.000	EACH
		_____ Dollars _____ Cents		
0166	NS-ITS-04020	Fiber Optic Cable, SM, Furnish & Install, 13-48 Fibers	3,440.000	LNFT
		_____ Dollars _____ Cents		
0167	NS-ITS-04035	Fiber Optic Fan Out Kits, SM, 12 Strand, Furnish & Install	4.000	EACH
		_____ Dollars _____ Cents		
0168	NS-ITS-04180	Fiber Optic Connection, Install, Splice	68.000	EACH
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0169	NS-ITS-04200	Fiber Optic Connection, Termination, Furnish & Install	48.000	EACH
		_____ Dollars _____ Cents		
0170	NS-ITS-04250	Fiber Optic Drop Cable, SM, 12 Strand, Furnish & Install	1,120.000	LNFT
		_____ Dollars _____ Cents		
0171	NS-ITS-04290	Fiber Optic Patch Cord, SM, 2 Strand, Furnish & Install	6.000	EACH
		_____ Dollars _____ Cents		
0172	NS-ITS-04360	Fiber Optic Connection Splice Tray, Furnish & Install	7.000	EACH
		_____ Dollars _____ Cents		
0173	NS-ITS-04425	Fiber Optic Connection Patch Panel, Outdoor, Furnish & Install	4.000	EACH
		_____ Dollars _____ Cents		
0174	NS-ITS-05025	Splice Closure, Outdoor, Furnish & Install	2.000	EACH
		_____ Dollars _____ Cents		
0175	NS-ITS-12000	Communications System Integration		LUMP SUM
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0176	NS-ITS-13200	As-Builts		LUMP SUM
		_____ Dollars _____ Cents		
0177	TS-203-00006	Exploratory Excavation for Traffic Signal Foundation	9.000	EACH
		_____ Dollars _____ Cents		
0178	TS-702-00126	48" Sanitary Sewer Manhole	15.000	EACH
		_____ Dollars _____ Cents		
0179	TS-736-10300	Signal Support (Mast Arm Standard w/ 30 ft arm)	2.000	EACH
		_____ Dollars _____ Cents		
0180	TS-736-10450	Signal Support (Mast Arm Standard w/ 45 ft arm)	1.000	EACH
		_____ Dollars _____ Cents		
0181	TS-736-10500	Signal Support (Mast Arm Standard w/ 50 ft arm)	1.000	EACH
		_____ Dollars _____ Cents		
0182	TS-736-10550	Signal Support (Mast Arm Standard w/ 55 ft arm)	4.000	EACH
		_____ Dollars _____ Cents		

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0183	TS-736-10600	Signal Support (Mast Arm Standard w/ 60 ft arm) _____ Dollars _____ Cents	2.000	EACH
0184	TS-736-10700	Signal Support (Mast Arm Standard w/ 70 ft arm) _____ Dollars _____ Cents	1.000	EACH
0185	TS-736-11250	Additional Mast Arm (25 ft. arm) _____ Dollars _____ Cents	1.000	EACH
0186	TS-736-11350	Additional Mast Arm (35 ft. arm) _____ Dollars _____ Cents	1.000	EACH
0187	TS-736-11450	Additional Mast Arm (45 ft. arm) _____ Dollars _____ Cents	1.000	EACH
0188	TS-736-12008	Luminaire Arm w/LED Luminaire (8 ft. arm) _____ Dollars _____ Cents	2.000	EACH
0189	TS-736-15002	GPS Based Traffic Signal Preemption System (With Existing Fiber Communication) _____ Dollars _____ Cents	2.000	EACH

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0190	TS-736-36200	Video Detection System (6 Camera System) _____ Dollars _____ Cents	1.000	EACH
0191	TS-736-36200	Video Detection System (7 Camera System) _____ Dollars _____ Cents	1.000	EACH
0192	TS-742-60010	Fittings _____ Dollars _____ Cents	1,123.000	LB
0193	TS-742-60011	Air Release/Vacuum Valve (2") _____ Dollars _____ Cents	3.000	EACH
0194	TS-742-60012	Unrestrained Joint Sewer Force Main (16") _____ Dollars _____ Cents	2,487.000	LNFT
0195	TS-742-60013	Restrained Joint Sewer Force Main (16") _____ Dollars _____ Cents	211.000	LNFT
0196	TS-742-60014	24" Jacked and Bored Casing Pipe Including Carrier Pipe _____ Dollars _____ Cents	65.000	LNFT

Proposal ID: H.012232.6 **Project(s):** H.012232.6

SECTION: 1 General Items

Proposal Line Number	Item ID	Description Unit Price (In Words or Numerals, Ink or Typed)	Approximate Quantity	Unit of Measure
0197	TS-742-60024	Force Main Tie-in (16")	1.000	EACH
		_____ Dollars _____ Cents		
0198	TS-742-61006	Sanitary Sewer Pipe (12") (PVC)	2,196.000	LNFT
		_____ Dollars _____ Cents		
0199	TS-742-80109	Sand-Aggregate for Secondary Backfill	610.000	CUYD
		_____ Dollars _____ Cents		

Section: 1 **Total:** _____._____

Total Bid: _____._____

CONSTRUCTION PROPOSAL SIGNATURE AND EXECUTION FORM

THIS FORM, THE SCHEDULE OF ITEMS, AND THE PROPOSAL GUARANTY MUST BE COMPLETED AS INDICATED AND SUBMITTED TO THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (DOTD) TO CONSTITUTE A VALID BID

STATE PROJECT NO. **H.012232**

FEDERAL AID PROJECT NO. **H012232**

NAME OF PROJECT **LA 3064 TO BLUEBONNET BLVD. PHASE II**

I (WE) HEREBY CERTIFY THAT I (WE) HAVE CAREFULLY EXAMINED THE PROPOSAL, PLANS AND SPECIFICATIONS, INCLUDING ANY AND ALL ADDENDA, AND THE SITE OF THE ABOVE PROJECT AND AM (ARE) FULLY COGNIZANT OF ALL PROPOSAL DOCUMENTS, THE MASTER COPY OF WHICH IS ON FILE AT DOTD HEADQUARTERS IN BATON ROUGE, LA., AND ALL WORK, MATERIALS AND LABOR REQUIRED THEREIN, AND AGREE TO PERFORM ALL WORK, AND SUPPLY ALL NECESSARY MATERIALS AND LABOR REQUIRED FOR SUCCESSFUL AND TIMELY COMPLETION OF THE ABOVE PROJECT AND TO ACCEPT THE SUMMATION OF THE PRODUCTS OF THE UNIT PRICES BID ON THE SCHEDULE OF ITEMS ATTACHED HERETO AND MADE A PART HEREOF MULTIPLIED BY THE ACTUAL QUANTITY OF UNIT OF MEASURE PERFORMED FOR EACH ITEM, AS AUDITED BY DOTD, AS FULL AND FINAL PAYMENT FOR ALL WORK, LABOR AND MATERIALS NECESSARY TO COMPLETE THE ABOVE PROJECT, SUBJECT TO INCREASE ONLY FOR PLAN CHANGES (CHANGE ORDERS) APPROVED BY THE DOTD CHIEF ENGINEER OR HIS DESIGNEE. THIS BID IS SUBMITTED IN ACCORDANCE WITH THE GENERAL BIDDING REQUIREMENTS IN THE CONSTRUCTION PROPOSAL AND ALL SPECIAL PROVISIONS, PLANS, SUPPLEMENTAL SPECIFICATIONS, AND THE LOUISIANA STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES (2016 EDITION). I (WE) UNDERSTAND THAT THE SUMMATION OF THE PRODUCTS OF THE UNIT PRICES BID ON THE SCHEDULE OF ITEMS MULTIPLIED BY THE ESTIMATED QUANTITY OF UNIT OF MEASURE FOR EACH ITEM, ALONG WITH ANY OTHER FACTORS SPECIFIED TO BE APPLICABLE SUCH AS CONSTRUCTION TIME AND/OR LANE RENTAL, SHALL BE THE BASIS FOR THE COMPARISON OF BIDS. I (WE) UNDERSTAND THAT THE SCHEDULE OF ITEMS MUST CONTAIN UNIT PRICES IN ENGLISH WORDS OR NUMERALS AND THAT THE SCHEDULE OF ITEMS SUBMITTED AS PART OF THIS BID IS ON THE FORM SUPPLIED BY DOTD IN THE BID PROPOSAL. MY (OUR) PROPOSAL GUARANTY IN THE AMOUNT SPECIFIED FOR THE PROJECT IS ATTACHED HERETO AS EVIDENCE OF MY (OUR) GOOD FAITH TO BE FORFEITED IF THIS BID IS ACCEPTED BY DOTD AND I (WE) FAIL TO COMPLY WITH ANY REQUIREMENT NECESSARY FOR AWARD AND EXECUTION OF THE CONTRACT, AS WELL AS, SIGN AND DELIVER THE CONTRACT AND PAYMENT/PERFORMANCE/RETAINAGE BOND AS REQUIRED IN THE SPECIFICATIONS.

NONCOLLUSION DECLARATION (APPLICABLE TO FEDERAL-AID PROJECTS)

I (WE) DECLARE UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE UNITED STATES AND THE STATE OF LOUISIANA THAT I (WE) HAVE NOT DIRECTLY OR INDIRECTLY, ENTERED INTO ANY AGREEMENT, PARTICIPATED IN ANY COLLUSION, OR OTHERWISE TAKEN ANY ACTION IN RESTRAINT OF FREE COMPETITIVE BIDDING IN CONNECTION WITH THE CONTRACT FOR THIS PROJECT NOR VIOLATED LA. R.S. 48:254.

BIDDER'S DBE GOAL STATEMENT (APPLICABLE TO DBE GOAL PROJECTS)

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS A DISADVANTAGED BUSINESS ENTERPRISE (DBE) GOAL PROJECT IN ACCORDANCE WITH THE DBE PROVISIONS OF THIS CONTRACT, THE BIDDER ASSURES DOTD THAT HE/SHE WILL MEET OR EXCEED THE DBE CONTRACT GOAL, OR IF THE BIDDER CANNOT MEET THE REQUIRED DBE GOAL, THE BIDDER ASSURES DOTD THAT HE/SHE HAS MADE AND CAN DOCUMENT GOOD FAITH EFFORTS MADE TOWARDS MEETING THE GOAL REQUIREMENT IN ACCORDANCE WITH THE CONTRACT AND DBE PROGRAM MANUAL INCORPORATED HEREIN BY REFERENCE.

THE APPARENT LOW BIDDER SHALL COMPLETE AND SUBMIT TO THE DOTD COMPLIANCE PROGRAMS OFFICE, FORM CS-6AAA AND ATTACHMENT(S) AND, IF NECESSARY, DOCUMENTATION OF GOOD FAITH EFFORTS MADE BY THE BIDDER TOWARD MEETING THE GOAL, WITHIN FIVE CALENDAR DAYS AFTER THE OPENING OF BIDS FOR THIS PROJECT. RESPONSIVENESS OF INFORMATION SUPPLIED IN THIS SECTION OF THIS CONSTRUCTION PROPOSAL SIGNATURE AND EXECUTION FORM IS GOVERNED BY THE DBE REQUIREMENTS INCLUDED WITHIN THE SPECIFICATIONS AND DBE PROGRAM MANUAL.

NON PARTICIPATION IN PAYMENT ADJUSTMENT STATEMENT

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION 109.09 AS BEING SUBJECT TO PAYMENT ADJUSTMENT AS PROVIDED IN THE SPECIFICATIONS, THE BIDDER HAS THE OPTION OF REQUESTING EXCLUSION FROM SAID PAYMENT ADJUSTMENT PROVISIONS THAT ARE ESTABLISHED BY SPECIAL PROVISION ELSEWHERE HEREIN.

IF THE BIDDER DESIRES TO BE EXCLUDED FROM THESE PAYMENT ADJUSTMENT PROVISIONS,

THE BIDDER IS REQUIRED TO MARK HERE ☐

FAILURE TO MARK THIS BOX PRIOR TO BID OPENING WILL CONSTITUTE FORFEITURE OF THE BIDDER'S OPTION TO REQUEST EXCLUSION.

BUILD AMERICA BUY AMERICA ("BABA") PROVISIONS OF THE INFRASTRUCTURE INVESTMENT AND JOBS ACT ("IIJA") PROJECTS (APPLICABLE TO FEDERAL-AID PROJECTS)

IF DESIGNATED BY SPECIAL PROVISION THAT THE BUILD AMERICA BUY AMERICA ("BABA") PROVISIONS OF THE INFRASTRUCTURE INVESTMENT AND JOBS ACT ("IIJA") AS DEFINED IN PL 117-58, ENACTED ON NOVEMBER 15, 2021, APPLY TO THIS PROJECT, THE BIDDER CERTIFIES THAT THEY HAVE READ, UNDERSTAND, AND WILL COMPLY WITH THE DOTD BABA SPECIAL PROVISIONS. FURTHERMORE,THE BIDDER UNDERSTANDS THAT THESE SPECIAL PROVISIONS APPLY TO ANY AND ALL PORTIONS OF THIS PROJECT, INCLUDING SUBCONTRACTED PORTIONS AND THAT THE BIDDER CERTIFIES THAT THEY WILL IDENTIFY DOMESTIC SOURCES OF BABA-COVERED PRODUCTS AND PROVIDE CERTIFICATION DOCUMENTATION OF BABA-COMPLIANCE AS SET FORTH IN THE BABA SPECIAL PROVISIONS..

THE APPARENT LOW BIDDER SHALL COMPLETE AND SUBMIT THE DOTD'S BIDDER'S BUILD AMERICA, BUY AMERICA CERTIFICATION FORM PROVIDED WITH THEIR CONTRACT DOCUMENTS.

STATE PROJECT NO. **H.012232**

BIDDER SIGNATURE REQUIREMENTS (APPLICABLE TO ALL PROJECTS)

THIS BID FOR THE CAPTIONED PROJECT IS SUBMITTED BY:

Name of Principal (Individual, Firm, Corporation, or Joint Venture)

If Joint Venture, Name of First Partner

If Joint Venture, Name of Second Partner

(Louisiana Contractor's License Number of Bidder or First Partner to Joint Venture)

(Louisiana Contractor's License Number of Second Partner to Joint Venture)

(Business Street Address)

(Business Street Address)

(Business Mailing Address, if different)

(Business Mailing Address, if different)

(Area Code and Telephone Number of Business)

(Area Code and Telephone Number of Business)

(Telephone Number and Name of Contact Person)

(Telephone Number and Name of Contact Person)

(Telecopier Number, if any)

(Telecopier Number, if any)

ACTING ON BEHALF OF THE BIDDER, THIS IS TO ATTEST THAT THE UNDERSIGNED DULY AUTHORIZED REPRESENTATIVE OF THE ABOVE CAPTIONED FIRM, CORPORATION OR BUSINESS, BY SUBMISSION OF THIS BID, AGREES AND CERTIFIES THE TRUTH AND ACCURACY OF ALL PROVISIONS OF THIS PROPOSAL, INCLUSIVE OF THE REQUIREMENTS, STATEMENTS, DECLARATIONS AND CERTIFICATIONS ABOVE AND IN THE SCHEDULE OF ITEMS AND PROPOSAL GUARANTY. EXECUTION AND SIGNATURE OF THIS FORM AND SUBMISSION OF THE SCHEDULE OF ITEMS AND PROPOSAL GUARANTY SHALL CONSTITUTE AN IRREVOCABLE AND LEGALLY BINDING OFFER BY THE BIDDER.

(Signature)

(Signature)

(Printed Name)

(Printed Name)

(Title)

(Title)

(Date of Signature)

(Date of Signature)

CONTRACTOR'S TOTAL BASE BID $ _____

IT IS AGREED THAT THIS TOTAL, DETERMINED BY THE BIDDER, IS FOR PURPOSES OF OPENING AND READING BIDS ONLY, AND THAT THE LOW BID FOR THIS PROJECT WILL BE DETERMINED FROM THE EXTENSION AND TOTAL OF THE BID ITEMS BY DOTD.

CS-14AA
01/23