Infrastructure Enhancement and Traffic Mitigation Program

Design Guidelines

CITY OF BATON ROUGE
PARISH OF EAST BATON ROUGE

Department of Transportation and Drainage

Submitted by

MOVEBR PROGRAM MANAGEMENT TEAM

Capacity Improvements – CSRS
Community Enhancements – Stantec

***Revised* May 2020**

Revision Control Log

Revision	Date Issued	Description of Changes	Pages Affected
Revision 1	4/30/2020	Revisions to TOC; Section 1: minor wording edit; Section 2: minor edits to survey deliverables; Section 3: minor wording edits; Section 5: addition of standards, utility locate requirements, and green infrastructure requirements; Section 6: edits to software requirements, design year volumes, design speed and classification reference, pedestrian crosswalk warrant analysis, and vehicle path analysis for signal phasing; Section 7: additional reference for functional classification and design speed and additional reference for crosswalks at non-stop controlled locations; Section 8: minor edits to green infrastructure and detention design; Section 9: addition of Sequence of Construction description; Section 10: added qualifier for local bridge vehicle load and guardrail information; Section 11: various edits to Green Infrastructure Typologies, including some additional practice exhibits; Section 12: minor edits to the references; Attachments: revised PDR (Att. A), & added MOVEBR Corridor Survey Checklist (Att. D)	Multiple

Contents

Attachments

Abbreviations

Abbreviations	Word or Words
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines
AISC	American Institute of Steel Construction
AM	Access Management
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BOC	Back of Curb
BDEM	LADOTD Bridge Design and Evaluation Manual
BUG	Backlight, Uplight, and Glare
CBR	California Bearing Ratio
CFR	Code of Federal Regulations
CMP	Corrugated Metal Pipe
CORS	Continuously Operated Reference Station
C-P	City of Baton Rouge and Parish of East Baton Rouge
CPT	Cone Penetration Test
DES	City-Parish Department of Environmental Services
DPW	City-Parish Department of Public Works
DTD	City-Parish Department of Transportation and Drainage
DTM	Digital Terrain Model
EA	Environmental Assessment
EDSM	LADOTD Engineering Directives and Standards Manual
EE	Environmental Evaluation
EF	Environmental Findings
EIS	Environmental Impact Statement

EOR	Engineer of Record
ESA	Environmental Site Assessment
FAMA	Fire Apparatus Manufactures' Association
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration, Department of Transportation
FOC	Face of Curb
FONSI	Finding of No Significant Impact
Ft.	Foot or Feet
GIS	Geographic Information System
GPS	Global Positioning System
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
H&H	Hydrology and Hydraulics
HUD	U.S. Department of Housing and Urban Development
IES	Illuminating Engineering Society
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
ITE	Institute of Traffic Engineers
JD	Jurisdictional Determination
LCS	Lighting Control System
LDEQ	Louisiana Department of Environmental Quality
LED	Light-Emitting Diodes
Lux	Luminous Flux (unit of illuminance measure)
LFRD	Load and Resistance Factor Design
MASH	Manual for Assessing Safety Hardware
MOE	Measures of Effectiveness
MPO	Metropolitan Planning Organization
MSEW	Mechanically Stabilized Earth Wall
Max	Maximum
Min	Minimum
MTC	MOVEBR Technical Committee
MUC	MOVEBR Program Utility Coordinator

MUTCD	Manual on Uniform Traffic Control Devices
NACTO	National Association of City Transportation Officials
NAD	North American Datum
NAVD	North American Vertical Datum
NCHRP	National Cooperative Highway Research Program
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NGS	National Geodetic Survey
NRCS	National Resources Conservation Service
OPUS	Online Positioning User Service (NGS)
PC	Point of Curvature
PCE	Programmatic Categorical Exclusion
PDR	Project Design Report
PIH	Plan In Hand
phf	Peak Hour Factor
PM	Project Manager
PMT	Program Management Team
POC	Point along Curve
POT	Point along Tangent
P-PM	Program Project Manager
PROWAG	Public Rights-of-Way Accessibility Guidelines
psf	Pounds Per Square Foot
PT	Point of Tangency
ROW	Right-of-Way
SOV	Solicitation of Views
SUE	Subsurface Utility Engineering
TA	Technical Advisory
TBM	Temporary Bench Mark
TIN	Triangular Irregular Network
TMC	Turning Movement Counts
TTC	Temporary Traffic Control
UDC	City-Parish Unified Development Code

USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USCS	Unified Soil Classification System
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
WRP	Wetland Reserve Program

1 Introduction

1.1. MOVEBR Vision

MOVEBR will be the industry standard of excellence in delivering transportation solutions that will move our region in a safe, sustainable manner and further enhance strong neighborhoods, communities, and economic vitality for all residents of East Baton Rouge.

1.2. Purpose

To help facilitate the implementation of the MOVEBR vision, this document was developed to provide guidelines for the design of Transportation Infrastructure, including Complete Streets, Green Infrastructure, Americans with Disabilities Act (ADA) Compliance, and flexibility to accommodate future mobility options (e.g. bike-sharing, ride-hailing, car-sharing, scooter-sharing, microtransit) associated with the City of Baton Rouge and Parish of East Baton Rouge (C-P) MOVEBR Program. These guidelines are provided for guidance and to ensure consistency in the design approach used by various design Engineers and are intended for use on all projects. Some State Routes, however, will require compliance with Louisiana Department of Transportation and Development (LADOTD) design guidelines.

While the purpose of these guidelines is to ensure uniformity, it is not intended to stifle the Engineer's creativity, design innovation, and ingenuity. Adaptations to or deviations from the design guidelines can be proposed via the design deviation process described in the following sections. Engineers are ultimately responsible for their design, and this responsibility is in no way diluted or absolved by these guidelines. Throughout this document the term "Designer" is used to refer to the design professional responsible for preparation of various aspects related to the design of MOVEBR projects. Depending on the specific work aspect it may refer to the Engineer, Surveyor, Environmental Scientist, Landscape Architect, etc.

If the Designer finds inconsistencies, or if inconsistencies should develop during design (necessitated by site-specific and/or project-specific considerations and constraints), the Designer shall immediately notify the Program Project Manager (P-PM) of the findings, recommendations, and reasons for such recommendations. As stated, Designers are ultimately responsible for their designs and shall resolve all conflicts, inconsistencies, errors, and omissions in the guidelines to ensure that designs meet accepted professional standards.

The MOVEBR Technical Committee (MTC) will provide oversight for design decisions and to address ongoing Program technical issues, including but not limited to updates or revisions to these design guidelines. The MTC at a minimum will consist of one or more members from the individual Program Management Teams (PMT) (Capacity Improvement and

Community Enhancement), the Department of Transportation and Drainage (DTD) Chief Design and Construction Engineer, and the DTD Chief Traffic Engineer.

1.3. Project Design Reports & Guideline Deviations

1.3.1. C-P Project Design Reports

The design criteria and guidelines described in this document are established at the programmatic level based on federal, state, and local standards and policies, and C-P desired design elements and best practices. Realizing each project will have its own unique project site conditions, constraints, and funding limitations, selection of design criteria values and implementation of certain design elements will vary from project to project.

A Project Design Report (PDR) template was developed to consistently document selection of design criteria values and design element implementation decisions. The template is provided as Attachment A. Since the MOVEBR Program Design Guidelines are prescriptive for certain design values and Complete Street design elements but allow ranges for others, it is necessary to document why a particular design value and/or Complete Street design element is implemented or not implemented on a project.

The information below details the process for submitting the PDR.

Preliminary PDR

a. The Preliminary PDR, signed by the Engineer of Record (EOR), is to be prepared in the Preliminary Engineering Design Study phase and should be submitted as an intermediate submittal (30%) for review

b. The **preliminary** status in the top right corner should be checked for this submittal

c. P-PM will present to MTC for review and comment

d. MTC comments to the Preliminary PDR will be sent back to the EOR by the P-PM

e. The EOR shall revise the Preliminary PDR to adjudicate any comments and follow up with P-PM for any outstanding concerns

f. The Preliminary PDR will be recorded in the project file and utilized for further development of the Design Study deliverable

Final PDR

a. The Final PDR, signed by the EOR, is to be included with the final Design Study submittal

b. The **final** status in the top right corner should be checked for this submittal

c. P-PM will present to MTC for final review and comment

d. MTC comments to the Final PDR will be sent back to the EOR by the P-PM along with the comments for the Design Study submittal

e. The EOR shall revise the Final PDR to adjudicate any comments and return, signed and sealed, to P-PM for Program approval and signatures (P-PM, MTC Facilitator, and Chief Engineer(s))

f. The Final PDR will be recorded in the project file and utilized in design and development of the project Final Plans

Revisions to Final PDR

a. A Revised PDR is required when one or more design criteria has changed from the Final signed PDR

b. The **revised** status in the top right corner should be checked for this submittal

c. A brief description of the revision should be described in the Description of Project Improvements box

d. A separate, more detailed description and analysis of revision should be attached if required

e. Only values that have changed should be filled in, all other fields should be left blank

f. P-PM will present to MTC for final review and comment

g. MTC comments to the Revised PDR will be sent back to the EOR by the P-PM

h. The EOR shall revise the Final PDR to adjudicate any comments and return, signed and sealed, to P-PM for Program approval and signatures (P-PM, MTC Facilitator, and Chief Engineer(s))

i. The Revised PDR will be recorded in the project file and utilized in the relative design and development of the project Final Plans

Signatures

Recommended by:

a. Engineer of Record – Engineer signing the plans

b. MOVEBR Program – Project Manager

c. MOVEBR Technical Committee - Facilitator

Approved by:

a. DTD Chief Design and Construction Engineer

b. DTD Chief Traffic Engineer

1.3.2. Guideline Deviations

The Engineer may on occasion prefer to deviate from the guidelines for specific reasons. This deviation could be prompted by conflicts in the document, a design concept or a feature that the Engineer believes is better or more cost-effective than the proposed improvement, or the development of a new process or material. In such cases, the Engineer shall immediately bring this matter to the attention of the P-PM, who will review project-specific deviations for recommendation to the MTC. The Engineer shall also request permission to deviate from the standards by completing and submitting the "Deviation from Program Design Guidelines" form included in the Attachment B of this document. The proposed deviation may be accepted as presented, accepted with identified changes, or denied. Acceptance or rejection of the design exception will ultimately rest with the DTD Chief Design and Construction Engineer and/or Chief Traffic Engineer.

Any approved design exceptions that deviate from the minimum design criteria will also be documented in the PDR. Refer to Attachment C for MTC process flowchart for review of PDR and Guideline Deviations.

State Route Projects

To eliminate the need for two separate design reports on any given project, the LADOTD Design Report for Minimum Design Guidelines shall be utilized for any MOVEBR project that is currently a state route and not planned for transfer to the C-P, and for any MOVEBR project that is currently a C-P route and planned for transfer to the LADOTD. In addition, if a

design exception is needed on a state route, the Engineer will be required to follow the LADOTD design waiver/exception process.

For any MOVEBR project that is currently a state route but planned for transfer to the C-P and for any MOVEBR project that is currently a C-P route, the MOVEBR PDR and guideline deviation process shall be utilized.

2 Corridor Survey

2.1. General

The Surveyor shall follow the current standards of practice as outlined in the Laws and Rules of the Louisiana Professional Engineering and Land Survey Board in conducting surveys as required for the proper design and layout of the project. As such, all work shall adhere to modern surveying theory, practice, and procedures. All MOVEBR project surveys shall be performed in English units and in accordance with all principles and objectives set forth in the latest version of the LADOTD *Location and Survey Manual*. In addition, for C-P Routes, current industry accepted surveying standards and methods, as approved by the PMT and DTD, may be utilized.

Feature table code lists and symbols shall be consistent with those included in the latest edition of *The Survey Feature Code Guide Book* produced by LADOTD Location and Survey Section, Survey Automation.

2.2. Control

Control surveys are required to establish primary and secondary control points from which all subsequent project operations are performed. This establishes a common, consistent network of physical points to serve as the basis for controlling horizontal and vertical positions of roadway projects and improvements. Use of GPS equipment is the preferred method of control establishment. Use of conventional total station traverse equipment and methods may be allowed depending on actual field conditions.

The horizontal and vertical control for a project should be planned concurrently so that both types of surveys can use the same permanent monumentation whenever practicable. Primary Control monuments shall be set in relatively safe locations and constructed of stable and permanent materials. These monuments should be placed in locations where they will be GPS observable and where the possibility of their destruction during the time period of the project survey and construction will be minimized. Secondary Control monuments shall be placed in convenient locations for the survey work to minimize traversing from control to the worksite, but not necessarily in locations that will survive construction activities. Primary Control monuments shall be established in sufficient density and locations as to facilitate quick and accurate replacement of any destroyed Secondary Control.

All control point monuments shall be 18" x 1/2" iron rods with plastic caps that are set in 4" PVC sleeves filled and encased in concrete or permanent marking (scribed "X")

in existing stable concrete pavement or structure. All control points shall be referenced by state plane coordinates and/or with three offset points provided.

In the event that the survey is being performed for a segment of roadway that will connect to an adjacent project, the Surveyor shall set two control points between the two projects outside of the construction limits so to have two common control points and a common bearing for both projects.

Depending on the type of project and project specific requirements, the survey control requirements described in this document may be modified through coordination with and approval of the P-PM.

2.2.1. Horizontal Control

Horizontal positions shall be referenced to the Louisiana State Plane Coordinate System (South Zone1702), North American Datum of 1983 (NAD83), 2011 or latest readjustment or realizations. When two or more datums are encountered on a project, additional survey may be required to determine their relationship. Horizontal control survey shall be performed to a minimum 2nd Order, Class II survey accuracy standard (1:20,000).

A minimum of three Primary Control points shall be established by GPS survey observations on all projects. The Primary Control monuments shall be established at each end of the project and at least one additional point set along the project. The positioning of Primary Control points shall be performed using static GPS survey method and dual frequency survey grade GPS equipment.

The Secondary Control points, derived from the Primary Control, serve to fill in between the Primary Control on a project and will be used for the engineering and property acquisition work required for the project. These points are generally within the limits of the project and are considered expendable but recoverable. These points may be established either by GPS observations or conventional total station traverse procedures depending on actual field conditions. Secondary control traverses, level runs and GPS baselines shall begin and end on different Primary Control points, with the rationale of creating independent loops to verify the accuracy of the survey. Number and location of overall control points shall be established so each control monument is inter-visible with at least two other control monuments.

A horizontal control sketch shall be submitted to the P-PM. All traverse points shall be included in the sketch along with Primary Control monument description from the National Geodetic Survey (NGS) website. Calculations and reduced data shall be sent to the P-PM for approval prior to initiation of topographic survey.

2.2.2. Vertical Control

Elevations shall be referenced to the North American Vertical Datum of 1988 (NAVD 88) and the most current geoid at the time of the initial survey. Surveyor may use EBR 88 monuments if convenient. When two or more datums are encountered on a project, additional survey may be required to determine their relationship. Primary vertical control shall be established by utilizing either survey grade dual frequency GPS receivers or by conventional differential leveling devices depending on actual field conditions of the project survey. Vertical control survey shall be performed to a minimum 3rd Order survey accuracy standard which requires the closure to be within 0.05 ft. x square root of the distance in miles.

When feasible, vertical control shall be established at all horizontal control points. Additional temporary bench marks (TBMs) should be set to densify vertical control to provide convenient control for topographic and construction purposes. TBMs shall meet the following minimum requirements:

c. A TBM shall be set approximately every 500 ft.

d. TBMs shall be located to minimize disturbance by construction activities, to be clear of traffic, and accessible.

e. When feasible, a TBM shall be set at each major structure.

f. When set in a pole or tree, TBM shall be of sufficient material as to not bend such as a cotton spindle or railroad spike. 60D nails are not acceptable materials.

Surveyor shall be required to tie the survey centerline to an approved vertical monument at each end. If a vertical monument is not available at either end of the survey, then the Surveyor must get permission to run a closed loop using one approved vertical monument. In general, a line of levels shall begin and end on a published United States Geologic Survey (USGS) or NGS benchmark of 3rd Order or better accuracy or on Primary Control points with NAVD 88 elevations derived from GPS observations.

A vertical control report shall be submitted. All vertical control points, including TBM's, shall be included in the report along with any benchmark monument description from the NGS website. Calculations and reduced data shall be sent to P-PM for approval prior to initiation of topographic survey.

2.2.3. Future Datum

The North American Datum of 1983 (NAD83) and North American Vertical Datum of 1988 (NAVD88) have been the standard for surveying datums in recent history. However, NGS will replace NAD 83 and NAVD 88 with a new geometric reference frame and geopotential datum in as early as 2022. Once the new datum has been released, a revision to these guidelines may be needed.

2.3. Survey Limits

The limits of the survey shall be a minimum of 50 feet beyond the proposed right-of-way (ROW) and a minimum of 300 feet beyond both the beginning and end of the project. The beginning and end of project shall be coordinated between the P-PM and the Designer. Surveys shall extend a minimum of 200 feet along intersecting side streets from the project centerline.

Stationing should typically begin with 10+00 or 100+00 and shall proceed from south to north and from west to east on project routes. In some cases, it may make sense to continue stationing from other plans or adjacent projects already under construction or completed. This should be discussed with the P-PM, and a decision made prior to beginning survey activities. Surveys shall include a minimum of 200 feet on intersecting side streets from the project centerline.

The Designer shall submit a sketch of the proposed survey limits to the P-PM prior to initiation of the topographic survey.

2.4. Topographic Survey

Prior to beginning topographic survey, the Surveyor shall prepare a Topographical Survey Location Map, for P-PM approval, to document the proposed locations for the topographic field survey. The map(s) shall meet the following requirements:

a. Size of Survey Location Map shall be 11"x17" in PDF format.

b. Map shall at minimum include:

    i north arrow,

    ii approximate plan scale,

    iii aerial photography,

iv street names,

v dimensions from nearest intersecting streets,

vi proposed roadway (including complete street elements),

vii proposed Green Infrastructure improvements, and

viii initial proposed ROW limits.

Section 1.05 of the LADOTD *Location and Survey Manual* is referenced as the guide for locating and identifying topographic features for MOVEBR projects. The required positional accuracy for topographic features is shown in the Table below.

Topographic Item	Horizontal (ft.)	Vertical (ft.)
Class 1 1. Bridge structures (when bridge is to remain as part of construction project) 2. 200 ft. along roadway, both ends of bridge 3. Top of railroad rails 4. Pavement under overpass structures (and 200 ft. either direction of overpass) 5. All grade ties (ramps and local streets), 100 ft. either direction of overpass)	0.05	0.02
Class 2 Any other hard surfaces such as roadway pavements, parking lots, buildings, curbs, drainage structures, etc.	0.08	0.08
Class 3 Ground and break line shots for preparation of DTM, and other topographic features.	0.20	0.20

Table 2-1: Topographic Survey Accuracy

Cross sections at a maximum of 100 feet perpendicular to the centerline must be collected. Cross section for urban area projects may require maximum 50 feet intervals. Cross sections should extend at least 50 feet beyond the proposed ROW lines. In addition, a cross section at 25 feet perpendicular to the centerline shall be collected at a horizontal distance of 100 feet upstream and downstream of the proposed Green Infrastructure practice footprints. Cross sections should include, at a minimum, building and/or property line, top of curb, bottom of curb, edge of parking lane, and centerline spot elevations with additional spot elevations taken as needed to document breaks in grade on the side of the street where the Green Infrastructure practice is located.

If cross sections are to be created by a Digital Terrain Model (DTM), Triangular Irregular Network (TIN), or other means, the total station must take cross section shots perpendicular to the project centerline on the station. The Surveyor shall show adequate random points and break lines to ensure that the TIN accurately represents the ground surface. Break lines may be required even when the ground shows no obvious discontinuity. Special attention should be given in the development of break lines in the area of bridges or other structures, under bridges, drainage features, etc. Spacing and placement of spot shots shall be made to ensure accuracy of the DTM.

Other factors influencing the frequency of cross sections include the presence of intersections, extent of driveway and turnout construction, ADA related work, drainage improvements, etc. Note that where a cross section may not be required at a property ramp or driveway, a perpendicular profile is required at the centerline of the ramp/driveway in order to design the new property ramp or driveway.

Surveyor shall make sufficient field ties to existing property corners and utility lines to approximate the location of the existing ROW line and utility lines. It is not the intent of this item to require that Surveyor perform any excavation to determine the location of any utilities. However, utilities "potholed" by utility owners or C-P representatives must be properly located and shown on plans by the Designer.

The survey shall also include, but not be limited to, the staking of centerline reference points when required and when physically and safely possible. Where this is not possible, survey shall include the running of all ground traverses necessary to compute and establish centerline. These reference points shall meet the following minimum requirements:

a. Reference points set along the existing roadway centerline at every PC, PT, and at no more than every 1,000 feet along Point along Curve (POC) and Point along Tangent (POT).

b. Reference points shall be 18" x 1/2" iron rods with plastic caps in earthen material, a P-K nail in asphalt material, and an "X" scribed in concrete materials.

c. Each reference point shall be referenced by state plane coordinates and/or with three offset points provided.

2.5. GPS Data Collection

GPS data collectors shall be set at five second intervals. Positional data for survey control points may be derived by GPS observations using the NGS Continually Operating Receiver Stations (CORS) or by differential observations using published control stations and benchmarks approved by PMT (see Control section above). If

NGS CORS network is used, observations must be for at least four continuous hours per station and the data reduced using the NGS OPUS website.

Surveyor shall establish three inter-visible stations to complete a GPS observation set. A GPS observation set, or a published control station must be established at least at the beginning, the end of the project centerline, and one intermediate. Surveyor shall submit original data files and corrected data files to P-PM for approval prior to initiation of the topographic survey.

2.6. Utility Locations

All utilities within the project limits, above and below ground, shall be located. Establishment of utility ownership shall also be included. Utility locates will be to Quality Level D or C services as defined by CI/ASCE Standard 38-02. The Designer should proceed as follows:

a. Designer shall collect record utility drawings and utility inventory from the Program Management Team (PMT).

b. Surveyor shall contact Louisiana (LA) One Call and individual utility companies to request they mark (paint and/or flagging) their underground facilities in the field. Surveyor shall survey and collect all visible utilities and utility markings, and identify them in the survey plans.

c. Surveyor shall submit to the P-PM ticket number(s) received from LA One Call as verification of the request for utility locations.

d. If utilities are not marked in the field by LA One Call the surveyor shall contact P-PM and provide information on companies that have not marked utilities in the field.

e. If there are known utilities not located by LA One Call, Designer shall use record drawings to draw utilities in the survey plans and note that those utilities were approximated from the record drawings.

2.7. Deliverables

a. Survey Control Report including horizontal control drawing and vertical control bench mark level notes and tabulations.

b. Point list in PNEZD or PNZDA format (Point Number, Northing, Easting, Elevation, Description and Attribute) as a csv file (comma separated values).

c. Raw survey data files.

d. Utility contact information and LA One Call ticket numbers.

e. Field Roll or Plan and profiles broken into 22" x 34" sheets with a symbology legend (on first sheet), and all headwalls and drainage structures labeled with material type, size, and inverts in PDF format. Vertical profiles showing the existing centerline ground surface, drainage pipes, pipeline crossings, utilities, ditch centerlines, and other critical information.

f. AutoCAD or Microstation electronic drawing file showing all collected data in three dimensional coordinates along with the required pen setting files.

g. MOVEBR Corridor Survey Checklist (refer to Attachment D)

2.8. Reference Publications

a. ASCE. (2003). *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE Standard 38-02*. Reston, VA: American Society of Civil Engineers.

b. FGDC. (2002). *Geospatial Positioning Accuracy Standards, PART 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management*. Reston, VA. Federal Geographic Data Committee.

c. LADOTD. (1987). *Location and Survey Manual*. Baton Rouge, LA: Louisiana Department of Transportation and Development Location and Survey Section.

d. LADOTD. (1999). *The Survey Feature Code Guide Book*. Baton Rouge, LA: Louisiana Department of Transportation and Development Location and Survey Section.

3 Utility Coordination and Relocations

3.1. Program Utility Coordination

The MOVEBR Program Utility Coordinators (MUC) have preliminarily coordinated with utility companies to request known utility existence along project corridors, servitude/ROW information, record drawings, and any other information they could provide. This information was utilized to assist with prioritizing and budgeting the projects. Any utility information gathered under this preliminary effort will be provided to the Designer at the pre-proposal meeting. It should be noted however that this information is not purported to be all available information and as such may only be considered a starting point for potential utilities existing within the project limits.

3.2. Designer Utility Coordination

It is the Designer's responsibility to design a constructible project that does not yield delays during construction. Historically, unknown utilities and utility conflicts are the most common source of unforeseen conditions resulting in construction delays and budget overruns. For each project, the Designer shall develop final plans to include all known utility information and locations, both horizontal and vertical, through use of all available information and due diligence.

The Designer shall utilize the preliminary information provided by the Program along with any visual evidence gathered from field investigations to aid in the development of the Preliminary Engineering Design Study. Alternate alignments shall consider effects on utilities and potential utility relocation requirements. If the Designer is not able to design around an existing utility, then typically the utility will have to be relocated, adjusted, or otherwise protected. Utilities requiring relocation will normally need to be accommodated within the required ROW and should be considered when determining the required ROW limits.

The Designer should contact Louisiana One Call and request field utility locate tickets for the project limits and have the markings surveyed to include in the 30% plan set. Designers will contact the individual utility owners for updated project specific information. Designers will also contact private utility owners, City Parish representatives (sewer force mains, traffic fiber), and LADOTD (traffic fiber optic lines, etc.). Designers are cautioned that some projects may have the same type utilities with multiple owners/jurisdictions, i.e.; sewer lines near Zachary may have portions under the jurisdiction of The City of Zachary and portions under C-P Department of Environmental Services (DES); water ownership may transition between Baton Rouge Water Co., or the City of Zachary.

3.3. Utility Requirements for Design Progress Submittals

At various intervals, as specified in the contract for professional services, the Designer shall submit plans for review by the PMT and distribution to utility companies for their use in preparation of their relocation plans, cost estimates and Articles of Agreement. Submittals shall at a minimum occur at the 30%, 60%, ACP (90%) and Final Plan stages. This section describes utility effort expectations for each design deliverable milestone.

3.3.1. 30% Design

Plans submitted at this design milestone shall include the topographical survey, showing all known utilities. The Designer shall submit LA One Call tickets obtained for the survey. Designer should ensure that all utility owners identified by LA One Call ticket are marked in field and make the MUC aware of any issues with utility owners not marking for "surveying" tickets. Designer must also research other available sources such as Parish records, as-built plans, sewer wye records, etc. to obtain all available utility information and locations both horizontal and vertical, and whether in existing road ROW or private servitudes.

3.3.2. 60% Design

Plans submitted at the 60% design milestone shall include the Utility Space Allocation Plan and the Utility Conflict Matrix (See Attachment E). If a Hydraulic (50%) Submittal is required between 30% and 60% design milestones, then the Utility Space Allocation Plan and Utility Conflict Matrix shall be included in that specific submittal. If pertinent utility information to the design of the project is not available, the Designer may request SUE Services and discuss with the P-PM and MUC to validate that it is a good candidate for full SUE services.

The Utility Space Allocation Plan shall be developed by the Designer in coordination with the P-PM and MUC. This plan shall show the existing and proposed location of all utilities to be relocated. The Utility Space Allocation Plan shall also include location and size of any proposed signal mast foundations and location of proposed Green Infrastructure practices (see Section 11: Green Infrastructure). The required information should be presented on the drainage plan/profile sheets to better identify any potential underground conflicts.

The Designer shall document on the Utility Conflict Matrix all potential utility conflicts and proposed resolutions.

Upon submittal by the Designer, the MUC will provide plans and conflict matrix to utility owners for comment. They will identify their facilities and advise on any errors in the survey as well as advise on clearance/protection requirements. This set will be provided to the utility owners for review prior to the Plan-In-Hand.

3.3.3. Plan-in-Hand Meeting

A Plan-In-Hand meeting (PIH) shall be scheduled between 60% and 90% design. The utility owners will be invited and the MUC shall also attend and facilitate productive communication with utilities. The meeting shall include a review of all utility locations both horizontal and vertical to determine if additional relocations are required or if further design changes can be made to accommodate the existing location of the utility. Following the PIH meeting, the Designer shall update the Utility Space Allocation Plan and Utility Conflict Matrix to ensure all conflicts are noted with the proposed resolution determined. This document will be provided to all stakeholders. Utility owners will be asked to provide appropriate remarks to be followed up in final design. Utility owners will also advise on order, requirements and realistic timeframes for relocation.

3.3.4. ACP (90%) Design

As plans are further detailed, the Designer will make every effort to avoid any additional conflicts with utilities. The Designer shall ensure that the utilities scoped to relocate can fit in their allotted relocation space. Required clearances and constructability must be reviewed and coordinated with the utility owners. The decision to require relocation will be finalized. SUE information if deemed necessary previously, will be provided to the Designer for consideration/incorporation in this submittal. The MUC will provide plans to the utility owners that have utilities to be relocated, requesting that paperwork, relocation agreements, and design be started.

The MUC will facilitate a Relocation Meeting with the affected utility owners, Designer, and P-PM to address where the utilities will go, logistical (order of relocation) requirements that may affect the project, and scheduling of relocation efforts.

The Designer shall update the Utility Conflict Matrix identifying all known possible utility conflicts and resolutions. The final Utility Space Allocation Plan shall be submitted to the P-PM for review and discussion to ensure all conflicts have been addressed and resolution determined. The MUC will also review the plans to ensure that utility references are clear as well as ensuring that the relocation plans have the proper call outs that can be adequately verified in the field during relocations.

3.3.5. 100% Final Design

The Final Design Submittal should see all known possible utility conflicts resolved, and appropriate utility space allocations accounted for. The MUC will provide the final plan set to the utility owners to be included in relocation agreements and also coordinate with the utility owners to determine appropriate costs and finalize the relocation agreements that will be executed by the utility company and the C-P.

3.4. Miscellaneous Requirements

The Designer shall take care in checking for utility conflicts, both overhead and underground, and shall provide adequate separation. Consult with power and other overhead utility companies for required minimum clearances.

The Designer shall check C-P maps showing location of signal interconnect systems and locate in field to determine potential conflicts with construction. Traffic signals must remain in service during construction.

If relocations require design of sanitary sewers and appurtenances, Designer shall do so in accordance with C-P DES Design Requirements, The Recommended Standards for Wastewater Facilities (latest edition) and the Louisiana State Sanitary Code (latest edition). Materials and details shall be in accordance with the latest C-P Standard Sewer Specifications and Standard Plans.

These C-P DES Design Requirements can be found at the following website: http://brprojects.com/baton-rouge-sso-program/design-construction/design-resources

3.5. Reference Publications

a. ASCE. (2003). *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE Standard 38-02*. Reston, VA: American Society of Civil Engineers.

b. LADOTD. (1987). *Location and Survey Manual*. Baton Rouge, LA: Louisiana Department of Transportation and Development Location and Survey Section.

c. LADOTD. (2009). *Road Design Procedures and Details*. Baton Rouge, LA: Louisiana Department of Transportation and Development Road Design Section.

4 Environmental Assessments

4.1. Environmental Review Needs Determination

4.1.1. Purpose

This section presents guidelines for determining the level of environmental compliance required for each of the MOVEBR program projects through the design phase. The Designer will be provided the following information from the P-PM: project ownership and funding information, the proposed roadway alignment, the ROW requirements, programmed improvements, alternatives to be evaluated.

4.1.2. Compliance Needs by Project Ownership and Funding

Projects located on C-P owned ROW, do not require a connection with a State Highway, and which will remain owned and maintained as C-P infrastructure, do not have any coordination requirements with the LADOTD or FHWA unless funding is provided by the LADOTD or FHWA. Projects that are fully funded by the MOVEBR tax proceeds need not comply with the FHWA's National Environmental Policy Act (NEPA) guidance or require any LADOTD approvals or permits. Compliance with federal and state permitting regulations (e.g., the federal Clean Water Act, and USACE Section 404 wetland permitting guidelines, USACE Section 408 public works alterations permit), and C-P directives (e.g., ASTM Phase I Environmental Site Assessments) will be required, however. Use of any federal funds will trigger compliance with NEPA regulations of the source federal entity (e.g., HUD, FHWA, or other).

Projects located on, or which have a connection with, a State Highway, and which are fully funded by either state funds or the MOVEBR C-P tax proceeds, must obtain an LADOTD permit and complete a LADOTD environmental evaluation (EE) or Environmental Finding (EF) in accordance with the project's context and intensity of impacts. EE and EF evaluations of state funded actions include compliance in accordance with Phase I ESA guidelines, among others. The latest version of the LADOTD Environmental Determination Checklist provides further guidance on information and analysis needs for these evaluations. The Designer should meet with the P-PM at the onset of all such evaluations to discuss the context of the project and confirm the analysis scope and LADOTD expectations. The need for a USACE Section 404 permit or other federal permit/action or funding contribution would trigger the requirement to comply with the NEPA regulations of the federal entity with jurisdiction of the action/permit/funding.

Projects that will, or may receive FHWA funds, or require improvements to a federal highway or intersection (e.g., US 61, US 190) will require compliance with FHWA's NEPA guidelines and LADOTD Stage 1 Planning/Environmental Manual of Standard Practice. The Designer should meet with the P-PM at the onset to discuss the context of the project and confirm the analysis scope and LADOTD expectations.

Projects that receive federal funding from non-FHWA sources, regardless of ROW ownership, will require compliance with NEPA regulations of the federal funding entity. The Designer should meet with the P-PM at the onset to discuss the context of the project and confirm the analysis scope and federal entity NEPA compliance expectations.

Extent of Project ROW Ownership and Improvements/Connections	Funding Type ►Environmental Compliance Need
C-P Road Only	C-P / Non-LADOTD State ►No NEPA or LADOTD-Permitting Federal ►NEPA
State Route Involved	C-P or LADOTD ►LADOTD-Permitting Federal ► NEPA
Federal Route Involved	C-P or LADOTD ► NEPA Federal ► NEPA

Table 4-1: Environmental Compliance Need Based on Funding Type

4.2. Wetland Delineation and Permit Application

4.2.1. Purpose

This section presents guidelines for performing wetland delineations and preparing Section 404 permit applications for MOVEBR Program projects. The location of the proposed project shall be provided separately. The Designer will be provided the following information from the MOVEBR Program Management Team (PMT): the proposed roadway alignment, the right-of- way requirements, and alternatives to be evaluated.

4.2.2. Wetland Delineation

Wetlands within the project area will be delineated utilizing the latest approved U. S. Army Corps of Engineers (USACE) guidelines and requirements. USACE Wetland Delineation Manual (Technical Report Y-87-1) and the 2010 Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Atlantic and Gulf Coastal Plain

Region (Version 2.0). Wetland boundaries will be surveyed and recorded using a handheld GPS unit with sub-meter accuracy. In acknowledgment of a Special Public Notice from the USACE New Orleans District dated December 4, 2018, flagging will have to be completed in the field for all data points and aquatic resources referenced in the wetland delineation in accordance with the appropriate flagging sequence. A sufficient number/location of data points will be taken to represent the wetland/upland status of the entire investigation area.

The information to be consulted includes, but is not limited to: TrueColor photographs, infrared photographs, LiDAR maps, National Wetland Inventory maps, Natural Resources Conservation Services (NRCS) published soil surveys or NRCS's Web Soil Survey, and USGS quadrangle maps. On-site field investigations will be performed to determine whether wetland vegetation, hydric soils, and hydrology are present to support the determination of the presence of a jurisdictional wetland area using the appropriate GIS field equipment. The presence of ponds, lakes, ditches and/or stream crossings shall be documented and shall be designated as "Other Waters", or as appropriate. The *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin System) will be used to classify observed wetlands and watercourses (Cowardin et al, 1979). This classification was reprinted in 1992 and is now the U.S. Fish & Wildlife Service (USFWS) standard for describing wetland habitat types.

If a bridge is included within the scope of the project, Designer shall provide the necessary information for submittal to the U.S. Coast Guard (USCG) and FHWA, as appropriate, to obtain a navigability determination.

The Designer will coordinate with the National Resources Conservation Service to determine the location of any Wetland Reserve Programs (WRP) in the project area. If the project impacts a WRP property, the Designer will notify the P-PM immediately. All WRPs in the area will be mapped in the Environmental Summary.

A delineation report summarizing the proposed project, including exhibits clearly defining the extent of the project will be prepared and submitted for PMT review. A wetland map showing the extent of the wetlands within the property boundaries, flagging key map of data point collection, photo location and direction map, project boundary overlain on TrueColor aerial imagery, infrared for all reasonable available years, United States Geologic Survey (USGS) Topographic map, NRCS Hydric Rating by map unit, and LiDAR/Elevation mapping will be included as exhibits in the report. Digital copies of the shapefiles used to create all onsite features will also be included in the deliverable.

The USACE will use these maps to make their Jurisdictional Determination (JD) for the project. This report shall also include completion of the Routine Wetland Determination Data Forms – Atlantic and Gulf Plain Region, site photographs clearly showing soil sample profiles next to appropriate Munsell color chart, percentage of ground cover and canopy, and four cardinal directions. A summary of the quantity

of wetlands and "Other Waters" impact shall be provided in acreage and linear feet as appropriate. It should be noted that the data collected for the JD submittal cannot be older than 12 months of the date of submittal. Failure to provide accurate information will result in the withdrawal and return of the JD Request,

4.2.3. USACE Permit Application Preparation

The Designer shall prepare permit applications for fill in jurisdictional wetland areas as directed by the PMT. Such activities will include the following: Preparation of Application for Department of the Army Permit (33 CFR 325) using the latest approved format of Engineering Form 4345, including quantification and types of fill to be deposited into jurisdictional areas; Preparation of exhibits to be submitted with the Form including, but not limited to:

a. Site Location

b. Proposed Action

c. Wetland Impacts, including plan and profile view noting details of dredge/fill locations, materials and quantities

d. Copy of Approved or Preliminary JD granted

Designer shall coordinate with the P-PM to determine adjacent property owners, typical section to be utilized, and other standard details to be included on the application. Designer shall submit draft to PMT for review and comment.

If the project does not qualify for a Nationwide Permit, the Section 404 permit may be publicly noticed for 30 days. During this period, the Designer will work with the Department of Environmental Quality to obtain the Water Quality Certification for the project, as well as consider with the P-PM a pre-application consultation with the USACE for the purpose of understanding the USACE's data needs and likely mitigation ratios that will be required. After the 30-day notice period, the Designer will work with any agency or private citizen to answer any comments about the proposed roadway improvement. The Designer will try to further avoid or minimize impacts to aquatic resources through design alternatives. The final stage of the permit application process will be working with the USACE to purchase mitigation credits or develop mitigation projects to offset any unavoidable wetland impact from the proposed work. A final permit to perform the work will then be issued to the client.

4.3. Phase I Environmental Assessment

4.3.1. Purpose

This section presents guidelines for performing Phase I Environmental Site Assessments (ESAs) for MOVEBR Program projects. The guidelines cover ESAs for projects planned within C-P ROW or on C-P property. They also address ESA requirements for property acquisitions. These guidelines generally follow the procedures established in ASTM E 1527, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. Note: ASTM E 1527 was last updated in 2013, and subject to an additional update in the next year.

The ASTM Standard E 1527 allows the User, C-P, to qualify for the innocent landowner, contiguous property owner or bona fide prospective purchaser limitations on liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). In order for the User to qualify for these landowner liability protections under CERCLA and EPA's AAI Final Rule, the User has the responsibility to make the Environmental Professional aware of known environmental site conditions that may be material to identifying Recognized Environmental Conditions. The User should provide the following as applicable:

a. Environmental clean-up liens filed or recorded against the site

b. Activity and use limitations

c. Actual or specialized knowledge and experience

d. Analysis of the fair market value against low purchase price, if not contaminated

Designers will conduct a Phase I Environmental Site Assessment in accordance with the latest version of the ASTM E 1527 standard. Designer is required to adhere to all applicable requirements of the standard, including but not limited to direction by a qualified Environmental Professional, documentation, use of historical sources, current environmental database search, environmental lien search, and report format. The Phase I Environmental Site Assessment (ESA) has four components: Records Review, Site Reconnaissance, Interviews, and Report.

Designer shall note the location of known or suspected small-, medium- and large-quantity generators and other facilities listed on all required database reviews. Where no information on such facilities is found in databases, Designer shall note same and notify the P-PM by letter. These instances shall be included in the report and the potential for constituting a "recognized environmental condition" shall be assessed.

As per the ASTM standard, residential dwellings are not included within the scope of the ESA. However, where visible, Designers shall note the following on residential property: wastewater discharges to roadside ditches, above ground tanks, stressed vegetation, chemical sheen, or other indicators of potential "recognized environmental conditions."

Designer shall review commercially available databases to determine locations of features that may constitute "recognized environmental conditions" and observe such features subsequently in the field. Designer shall provide a recommendation and define the next course of action(s), such as Phase II ESA and sampling work plan, etc. The draft Phase I ESA report shall be submitted to the PMT for review and comment.

4.3.2. Report

The Phase I ESA report shall include all items required by ASTM E 1527. It is also required that one figure be included in the report that shows locations of all listed sites within the ASTM-listed database radii distances from any portion of the project ROW. It should be noted that Phase I ESA reports are only good for one year; however, acquisition projects require an update if not used within 180 days. An updated Phase I ESA includes a current environmental database, site reconnaissance, interview, and report.

All reasonably ascertainable historical reference maps shall be reviewed to include but not limited to Sanborn® maps, historical USGS topographic and historical aerial photographic maps. Any two reference maps shall be dated no less than five years apart. At least one photograph shall be dated within ten years of the project year. Aerial photographs in the report shall be annotated with easily recognized geographic features without obscuring the proposed road project.

4.4. Noise Impact Study

4.4.1. Purpose

This section presents guidelines for performing noise impact studies for the MOVEBR Program. The location of the proposed project shall be provided separately. The Designer will be provided the following information from the PMT: the proposed roadway alignment, the ROW requirements, and alternatives to be evaluated.

4.4.2. Noise Impact Study

Noise analysis and reporting shall comply with the latest LADOTD Highway Traffic Noise Policy (July 2011) and FHWA Noise regulations found at 23 CFR 772. Further guidance

on the procedures and methods can be found at https://www.fhwa.dot.gov/environment/noise/.

The LADOTD Highway Traffic Noise Policy is applies to all federal highway projects and other projects that receive federal aid funds or are otherwise subject to FHWA approval, as well as with the construction of new control of access roadways that are funded through LADOTD with no FHWA involvement. Projects for which a noise study will be required by LADOTD are projects applicable to LADOTD's Highway Traffic Noise Policy that are also Type I projects as described therein, which are generally all projects that provide additional vehicular capacity or include substantial vertical or horizontal changes in alignment.

The Parish may also require a noise study for projects that have no federal or LADOTD involvement. The Designer should meet with the P-PM at the onset of project in order to assess the need and coordination process for any noise study. Possible project considerations that may require a noise analysis by the DTD include projects on C-P routes where a new alignment or new travel lane will be constructed, or where the horizontal or vertical alignment of the roadway is substantially changed relative to existing conditions.

The latest LADOTD Highway Traffic Noise Policy (July 2011 or later) applies to all noise study coordination, analysis and documentation activities. Generally, the Designer will initiate the study by submitting a noise protocol for approval prior to initiating field measurements and modeling. The Designer will then conduct a reconnaissance of the project area to confirm location of potentially impacted residents, businesses, and other receptors; perform a document search to ascertain the existence of planned, designed and programmed activities; and acquire field measurements of noise levels. Noise samples will be measured with an ANSI Type 1 or Type 2 meter or per the latest LADOTD policy. The latest approved version of the FHWA Traffic Noise Model (Version 2.5) will be used for noise impact analysis. The Designer will then build and validate model accuracy; model noise for each alternative requiring modeling for existing, build and design year; determine highway traffic noise levels for each alternative for the peak-hour; determine noise impacts at sensitive receptors; including a comparison of impacts for the existing condition, build year and design year; and determine the reasonableness and feasibility of noise abatement measures in accordance with latest LADOTD policy. Construction noise shall also be considered in accordance with LADOTD policy.

A separate noise report is required with all required noise studies. The report shall outline the methodology used and include a description of the model used. The analysis will include documentation of the input data assumptions; identification of other noise sources in the corridor; discussion of modeled noise levels for each alternative, including exhibits showing receptor sites and noise contour; discussion (with a table) of traffic noise impacts resulting from existing condition, build year and design year; abatement measures considered and whether they were reasonable and feasible. The report should contain a completed copy of all applicable LADOTD

worksheets in LADOTD's latest Highway Traffic Noise Policy, as well as an Appendix with digital model inputs and outputs for each run.

4.5. NEPA Compliance

4.5.1. Purpose and Applicability

This section presents guidelines for complying with the NEPA and FHWA's related regulations when required due to project ownership and funding (see above guidance). Should funding from other federal entities (e.g., HUD) be used on the project, compliance with the NEPA regulations of the source federal entity will be required. The Designer should seek guidance from the P-PM if any non-FHWA federal funding will be received for use on a project.

NEPA is a process law, prescribing a multi-disciplined approach for federal agencies to assess the effects on the human and natural environments of their federal actions and the use of their federal funds. There are several possible classes of NEPA compliance based on anticipated effects to the environment. Some actions are categorically excluded from compliance (i.e., Programmatic Categorical Exclusions or PCEs or Categorical Exclusions or CEs) as they will not have individual or cumulative significant effects, while other actions with known significant effects must be evaluated and documented in an Environmental Impact Statement (EIS). Actions where effects are unknown at the onset must be evaluated and documented initially in an Environmental Assessment (EA).

While the NEPA compliance classification must be determined by the lead agency (e.g., LADOTD) individually for each project, generally, projects that add capacity or require substantial new rights of way are classified as EAs, and most project enhancements (e.g., construction of bicycle and pedestrian lanes, paths and facilities; landscaping; installation of fencing, pavement markings, acquisition of scenic easements, and other improvements that do not require notable additional rights-of-way) are classified as CEs. Actions that are classified as CEs and PCEs are described in the 2019 Programmatic Agreement Between the Federal Highway Administration, Louisiana Division and the Louisiana Department of Transportation and Development Regarding the Processing of Actions Classified as Categorical Exclusions for Federal-Aid Highway Projects.

Within the context of an FHWA NEPA evaluation, the Designer is also required to consider LADOTD's Complete Streets compliance in a collaborative, context-sensitive manner towards the goal of delivering better projects for the communities affected and for the state as a whole. The location of the proposed project shall be provided separately. The Designer will be provided the following information from the PMT: the proposed roadway alignment, the ROW requirements, projected traffic counts for the existing, build, and design years, and alternatives to be evaluated.

4.5.2. NEPA Analysis and Documentation

4.5.2.1. Non-FHWA Compliance

Guidance from the P-PM should be sought if federal funding other than FHWA will be used for implementing a project (e.g., HUD funding). Should such funding be used, compliance with that federal funding entity's NEPA regulations will be required, which will be different from FHWA's requirements that are described below.

4.5.2.2. FHWA Compliance

Should the project scope allow classification as a PCE or CE per 23 CFR 771.117(c) and the 2019 LADOTD/FHWA Programmatic CE Agreement, the latest Environmental Determination Checklist must be completed for coordination with LADOTD. It is possible that additional information may be needed if all conditions of the 2019 LADOTD/FHWA Programmatic CE Agreement are not met.

In the unlikely event that potentially significant impacts are projected during the CE or EA analysis, the Designer should seek guidance immediately from the P-PM as it is possible that the project classification must change to be an Environmental Impact Statement. Guidance for an FHWA EIS is excluded from this document.

For projects whose scopes do not meet the 23 CFR 771.117(c) descriptions for categorical exclusions, and which will either be funded by FHWA or involve a federal route, NEPA classification should initially be an EA compliant with FHWA guidelines. The EA process and document shall be prepared in accordance with the FHWA's *Guidance for Preparing and Processing Environmental and Section 4(F) Documents*, (FHWA Technical Advisory - T 6640.8A, i.e., the TA), the LADOTD's *Stage 1 Planning/Environmental Manual of Standard Practice*, and all applicable laws, rules, guidance, and regulations. Care should be taken to make the EA documentation concise and reader-friendly, with generous use of graphics and tables to enhance reader understanding.

While the FHWA TA provides good guidance on the specific content of NEPA documents, information typically included in an FHWA EA document includes:

a. **Environmental Determination Checklist**. Ensure that the latest version is used.

b. **Mitigation and Commitments**. Required permits are identified and mitigation defined to the extent possible.

c. **Project Description**. Describe the Action's location and context.

d. **Purpose and Need**. The purpose and need statement is essential. What is the reason for the project and why is it needed are two questions that should be asked and answered in every NEPA document.

e. **Alternatives**. A reasonable range of alternatives that addresses the purpose and need are identified. If an alternative does not meet the purpose and need, it is not considered reasonable. The "do-nothing" or "no-build" alternative is always evaluated and compared against the proposed action.

f. **Impacts**. An analysis and evaluation of the effects on the environment for each of the identified alternatives is performed. Alternatives are refined to avoid or minimize their effects, and the direct, indirect, and cumulative effects of the final alternatives are documented.

g. **Comments and Coordination**. Coordination with stakeholders, including public involvement events, are summarized. Coordination occurs throughout the process and is important in identifying issues, alternatives, and mitigation.

The Designer will be required to coordinate as needed with the P-PM and the roadway Designer during the completion of the EA and subsequent design of the project. Special technical studies and coordination (e.g., cultural resources, noise impact, biological/wetland resources) may be required by LADOTD based on the context and intensity of the anticipated effects of the project, and as required by law and FHWA EA guidance. The Designer should meet with the P-PM at the onset of the EA in order to assess the process and level of detail needed for each issue and resource assessment.

4.6. Other Requirements

4.6.1. Project Management and Coordination

If an FHWA EA is required, the Designer must develop a reasonable, preliminary 12-15-month schedule that assumes 30-calendar-day commenting periods for all agency reviews. The schedule must be submitted for approval by the LADOTD, and should assume at least the following activities:

a. Solicitation of Views Distribution;

b. Stakeholders Comments on Purpose and Need/Range of Alternatives;

c. Special Studies Complete;

d. Stakeholder Comments on Alternatives Development and Screening;

e. Stakeholder Comment on Preferred Alternative;

f. preliminary EA Submittal;

g. EA Distribution;

h. Public Hearing; and

i. Revised EA/FONSI Distribution.

Records must be completed, distributed and retained for all meetings and other key communications that serve a meaningful role in important LADOTD and FHWA decisions. These records, Quality Control review documentation, and key data supporting important decisions should be retained in the project files. At the end of the NEPA study, the NEPA decision document (i.e., CE or EA/FONSI), permits obtained, agency agreements, line and grade documentation, project costs, mitigation needs and commitments, all digital data (on CDs) and key supporting physical files must be organized and submitted in binders to the P-PM.

4.6.2. Stakeholder Engagement

For FHWA EAs, the Designer will be required to engage federal and state agencies, parish and municipal governments, elected officials, businesses, non-governmental entities, and the public in planning and decision making. The required LADOTD public involvement process is prescribed in 2015 LADOTD *Public Involvement Procedures for Stage 1 Environmental Process* (LADOTD PI Process). Typical methods to obtain stakeholder input include a Solicitation of Views (SOV) distribution, public meetings, comment requests on documents, and public hearings. Other methods including websites, "virtual" meetings, web meetings, and telephone hotlines may also be useful. FHWA CEs generally require only an SOV, while FHWA EAs require an SOV, public meeting, and public hearing. The Designer may be responsible for making arrangements for these agency and public engagement events, including selection of location, dates and times; preparation of public notices; invitation letters; preparation of appropriate exhibits; and preparation of technical presentation and handouts. The Designer may be required to advertise notices of the Public Open House/Meetings and Public Hearings in the Baton Rouge *Advocate* in accordance with the LADOTD PI Process. Text of notices, including exhibits, handouts, and presentations for Public Meetings/Open Houses and Hearings, will be provided to the PMT at least one month prior to the anticipated Public Open House/Meeting date and for Public Hearings, at least two months prior to the anticipated date. Upon approval of the public notice, the Designer will email the notice to entities on the contact list, state and EBRP SOV lists, radio and television stations, and LADOTD for posting on the LADOTD website.

The PMT will conduct the Public Open House/Meetings and Public Hearings in conjunction with the Designer, who will be responsible for the technical presentation and will have knowledgeable persons present to address public questions. The Designer will be responsible for obtaining the verbatim transcripts of the Public Open House/Meetings and Public Hearing public comments in accordance with LADOTD PI Process. Copies of the transcript sufficient for the latest LADOTD distribution list – along with an electronic copy will be submitted to the P-PM for distribution.

All comments received during the official commenting periods will become part of the record for that engagement event. All comments received outside of official commenting periods will be retained for the project record and considered by the Designer and LADOTD, as they are received. Official comments received at the EA Public Hearing will be specifically addressed in the revised EA/FONSI. After approval by the PMT and the LADOTD, and when the FHWA has approved the Finding of No Significant Impact (FONSI), required copies of the EA with FONSI will be provided to the P-PM.

4.7. Reference Publications

a. FHWA. (1987). *Guidance for Preparing and Processing Environmental and Section 4(F) Documents*, FHWA Technical Advisory T 6640.8A, US Department of Transportation – Federal Highway Administration. https://www.environment.fhwa.dot.gov/Legislation/NEPA/guidance_preparing_env_documents.aspx#ea

b. LADOTD. (2015). *Public Involvement Procedures for Stage 1 Environmental Process.* (As contained in the LADOTD's *Stage 1 – Planning/Environmental Manual of Standard Practice*). Baton Rouge, LA: Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_DOTD/Divisions/Engineering/Environmental/Stage_1/Stage%201%20Manual%202018.pdf

c. LADOTD. 2018. *Stage 1 – Planning/Environmental Manual of Standard Practice*. Baton Rouge, LA: Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_DOTD/Divisions/Engineering/Environmental/Stage_1/Stage%201%20Manual%202018.pdf

d. LADOTD. 2019. Programmatic Agreement Between the Federal Highway Administration, Louisiana Division and the Louisiana Department of Transportation and Development Regarding the Processing of Actions Classified as Categorical Exclusions for Federal-Aid Highway Projects. Baton Rouge, LA: Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_DOTD/Divisions/Engineering/Environmental/Documents/Programmatic%20Categorical%20Exclusions_4-23-19.pdf

e. *Section 404 of the Clean Water Act*, (33 U.S.C. 1344)

f. ASTM International. (2013). *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, ASTM E1527-13*. West Conshohocken, PA. American Society for Testing and Materials International.

g. ASTM International. (2011). *Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process, ASTM E1903-11*. West Conshohocken, PA. American Society for Testing and Materials International.

h. USACE. (1987). *Corps of Engineers Wetland Delineation Manual*. Vicksburg, MS. U.S. Army Corps of Engineers, Waterways Experiment Station.

i. USACE. (2018). *MVN Wetland Delineation Report Requirements*. U.S. Army Corps of Engineers, New Orleans District. http://www.mvn.usace.army.mil/Missions/Regulatory/Jurisdiction-Wetlands/

j. USACE. (2010). *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)*. Vicksburg, MS. U.S. Army Corps of Engineers, Engineer Research and Development Center.

k. USACE. (2016). *Regulatory Guidance Letter 16-01: Types of Jurisdictional Determinations*. U.S. Army Corps of Engineers. https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Guidance-Letters/https

5 Geotechnical Engineering

5.1. Geotechnical Services

This section describes minimum requirements and expectations for geotechnical services performed on MOVEBR projects. These guidelines are intended as an overview of expectations and may not be all-inclusive.

5.1.1. Geotechnical Investigation Location Map

Prepare a Geotechnical Investigation Location Map in PDF format, for PMT approval, to document the boring or testing location, method of investigation, and proposed depth. The map(s) shall meet the following requirements:

a. Size of Geotechnical Investigation Location Map shall be 11"x17".

b. Map shall include north arrow, approximate plan scale, aerial photography, and street names.

c. Map shall include symbols and a legend to designate the approximate location of boring and percolation tests. Borings shall be labeled with "B-#" and percolation tests shall be labeled with "T-#" designations.

d. Map shall include dimensions from nearest intersecting streets to boring or test locations.

e. Map shall include proposed roadway, complete streets, and Green Infrastructure improvements.

5.2. Subsurface Exploration

The following are the requirements for subsurface explorations for roadway, bridge, Green Infrastructure, signals, and other project features:

a. Boring locations, depths, sampling procedures, and laboratory testing shall be assigned in coordination with the design team and PMT. Boring spacing should generally conform to FHWA's *Geotechnical Aspects of Pavements Reference Manual* for pavement borings, AASHTO *LRFD Bridge Design Specifications,* latest edition, and the City of Baton Rouge and Parish of East Baton Rouge Department of Public Works Standard Plans for bridges, retaining walls, and other structure

features. Cone Penetration Tests (CPTs) or other insitu testing may be used to supplement soil borings.

b. Obtain required rights-of-entry, traffic control, and utility locates prior to drilling. The driller shall use all means necessary to verify utility location prior to drilling. The driller shall contact Louisiana One Call, individual utility companies, and local municipalities to locate underground facilities. The P-PM may also have existing project utility information.

c. Drill and sample soil borings:

    i to complete a soil profile(s) for the roadways, embankments, bridges, retaining walls, signals, or other project features.

    ii for proposed bridge, retaining wall, or other structure sites to a required depth to design an appropriate foundation or verify State, City, and Parish standards.

d. Soil boring depths shall be:

    i a minimum of six feet below the proposed roadway sub-grade elevation in cut sections, sections at grade, and sections requiring less than two feet of fill. In sections requiring two feet or more fill, the soil boring depths should be increased, as necessary, to adequately assess settlement and stability, in addition to pavement design.

    ii at least two times the width of the foundation below the proposed tip/bottom of the foundation for structures.

e. Core existing roadway and record the roadway pavement and base section materials and thicknesses.

f. The spacing and depths of the soil borings could vary if unusual soils are encountered such as muck or unstable soils. Additional borings may also be required to determine the depth and horizontal limits of any unusual soil conditions.

g. Soil boring spacing and depths may vary depending on the condition of the existing pavement and availability of existing subsurface information.

h. For pavement rehabilitation projects, borings should be in the existing pavement (preferably within the existing wheel path to identify subgrade issues).

i. For widening projects, half of the borings should be in the existing pavement and the other half under the proposed widening.

j. Use split spoon sampling with the Standard Penetration Test (AASHTO T206, ASTM D 1586) for roadway base or granular soils and Shelby tube sampling (AASHTO T207, ASTM D 1587) for cohesive soils. Other methods may be necessary to improve recovery or minimize disturbance.

k. The soil borings shall be sampled continuously within the upper 10 feet, five foot intervals to 60 feet, and 10 foot thereafter. All soil samples should be visually classified according to the AASHTO classification system for roadway borings. Use USCS classification for all other borings. Use dual classifications were borings are used for both roadway and structures.

l. A qualified soils technician shall be present in the field during drilling operations to classify and sample the soils and prepare a log of each boring. Field logs shall be prepared and include the visual classification of soils, estimated soil relativity density and consistency descriptions, color, strata breaks, boring depths, sampling and drilling methods, drill rig and hammer information, date performed, groundwater observations, blow counts, sampling depth intervals and methods, percent recovery, soil boring coordinates and estimated elevation, and other pertinent information.

m. Exploratory borings shall be backfilled according to LDEQ or local requirements at the completion of drilling and sampling. Pavement cores shall be patched with asphalt cold patch.

n. The split spoon soil samples shall be placed and labeled in air-tight containers to prevent loss of moisture. Tube samples should be sealed in the field and extruded in the laboratory. Field extrusion is recommended when cohesive samples are medium stiff or stiffer in consistency and can be handled and transported with less potential disturbance.

o. All samples shall be placed in protective boxes to prevent rolling and bumping, and protected from changes in moisture content, shock, vibration, temperature extremes and chemical changes during transport to the laboratory. Soil samples shall be transported to the laboratory daily, where feasible.

p. After extrusion of the sample, samples should be wrapped in plastic wrap and stored in air-tight containers. It is recommended the designated tests be performed as soon as possible. When tests cannot be performed immediately following extrusion, samples should be waxed. Medium stiff or stiffer soils may, alternatively, be preserved by wrapping in plastic wrap, aluminum foil, and placed in a plastic bag. Store all remaining soil samples for six months, or as directed.

q. Extrusion should be performed as soon as feasible, at a minimum within five days of field sampling. Moisture Contents and Extrusion Logs should be performed within seven days of field sampling. Samples not designated for Index or Physical tests shall be waxed within seven days of extrusion. Index and physical tests shall begin within 15 days of field sampling.

In addition to the requirements above, the following are the requirements for subsurface explorations for consideration of Green Infrastructure features:

a. Drill and sample soil borings to obtain soil permeability, classification, and subsurface lithology for Green Infrastructure design. The purpose of this subsurface exploration is to identify any hydraulically limiting layers, such as shallow clay or groundwater areas.

b. Perform at least one soil boring and one infiltration test within the footprint of each Green Infrastructure location. For larger practices, an additional soil boring and infiltration test should be performed for every 100 linear feet of the practice. A borehole/falling head infiltration test shall be used.

c. Soil boring depths shall be a minimum 10 feet below the proposed subgrade elevation. Infiltration test depths shall be a minimum five feet below the proposed subgrade elevation.

d. The spacing and depths of the soil borings could vary if unusual soils are encountered such as muck or unstable soils. Further, addition borings could also be required to determine the depth and horizontal limits of any unusual soil conditions such as "running" sands or a high seasonal or permanent groundwater table.

e. Auger drilling techniques (ASTM D 1452) are generally adequate to obtain disturbed soil samples for classification and laboratory testing. However, if adequate soil samples are not being obtained, a split-spoon sampler (AASHTO T206, ASTM D 1586) or thin-wall Shelby tubes (AASHTO T207, ASTM D 1587) could be required.

f. The soil borings shall be sampled and visually classified on one feet intervals. A representative soil sample shall be obtained for each soil type per boring. The soil samples shall be placed and labeled in air-tight containers to prevent loss of moisture. The samples shall be placed in protective boxes for transported to the laboratory. Soil samples shall not be stored more than one week in the field.

g. All borings shall be abandoned in accordance with local environmental regulations.

h. A qualified soils technician shall be present in the field during drilling operations to classify and sample the soils and prepare a log of each boring. The boring logs shall include the classification of soils, strata breaks, boring depths and other pertinent information.

5.3. Laboratory Testing

Laboratory tests shall be performed to determine the engineering properties of the soils recovered in the soil borings. The following laboratory tests shall be performed as assigned by the Geotechnical Engineer. This list is not all inclusive and is the Geotechnical Engineer's responsibility to assign the appropriate testing based on the soil conditions and project features. Corresponding ASTMs shall be used, as appropriate.

a. Materials Finer Than 75-μm (No. 200 sieve) in Mineral Aggregates by Washing (AASHTO T 11)

b. Sieve Analysis of Fine and Coarse Aggregates (AASHTO T 27)

c. Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test (AASHTO R 58)

d. Particle Size Analysis of Soils (AASHTO T 88)

e. Determination of Liquid Limits, Plastic Limits and Plasticity Index of Soils (AASHTO T 89/T 90)

f. Unconfined Compressive Strength of Cohesive Soil (AASHTO T 208)

g. Permeability of Granular Soils (Constant Head) (AASHTO T 215)

h. One-Dimensional Consolidation Properties of Soils (AASHTO T 216)

i. Determination of the Strength of Soil-Lime Mixtures (AASHTO T 220)

j. Determining Expansive Soils (AASHTO T 258)

k. Laboratory Determination of Moisture Content of Soils (AASHTO T265)

l. Determination of Organic Content in Soils by Loss on Ignition (AASHTO T 267)

m. Family of Curves—One-Point Method (AASHTO T 272)

n. Determining Minimum Laboratory Soil Resistivity (AASHTO T288)

o. Determining pH of Soil for Use in Corrosion Testing (AASHTO T 289)

p. Determining Water-Soluble Sulfate Ion Content in Soil (AASHTO T 290)

q. Determining Water-Soluble Chloride Ion Content in Soil (AASHTO T 291)

r. Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression (AASHTO T 296)

s. Consolidated, Undrained Triaxial Compression Test on Cohesive Soils (AASHTO T 297)

t. Determining the Resilient Modulus of Soils and Aggregate Materials (AASHTO T 307)

u. Grain-Size Analysis of Granular Soil Materials (AASHTO T 311)

5.4. Engineering Analysis and Final Report

The results of the geotechnical investigation shall be presented in a final report. Each report shall include a summary of the field investigations, boring logs, laboratory testing, and laboratory testing summary reports. The report shall also include a description of engineering analyses, results, and geotechnical recommendations for development of construction documents for roadway, bridge, retaining wall, and other project features.

Further detail is provided below:

Soil Profile – A soil profile shall be presented on a horizontal and vertical scale delineating the different soil strata for each roadway and structure feature. The soil profile shall include AASHTO Classifications with soil type graphic, blow counts, and all laboratory test results of all soil types.

Graphical Boring Logs – Graphical logs of the borings shall include the AASHTO soil classification based on lab testing, visual classifications, soil relativity density and consistency descriptions, color, strata breaks, boring depths, sampling and drilling methods, drill rig and hammer information, date performed, groundwater observations, blow counts, sampling depth intervals and methods, percent recovery, soil boring coordinates and elevation, results of all laboratory tests, and other pertinent information. A boring location map shall also be included with the boring logs.

Green Infrastructure - The analysis should include a summary of the soil characteristics, water table, and limiting zone as it relates to infiltration capacity and Green Infrastructure

design. The report should provide a recommendation for or against infiltration for each test area.

Engineering Analyses and Recommendations – Pavement design recommendations shall include areas requiring undercut due to unsuitable materials, unstable soils, and swelling soils. Pavement recommendations shall be provided based on traffic and roadway design criteria furnished by the PMT. Provide recommendations for roadway base aggregates, excavation below subgrade, soil improvement alternatives such as chemically treating (with lime, fly ash or soil cement) or soil reinforcement with geo-synthetic fabric. Where required, evaluate the stability of cut and fill slopes, embankment settlement, bearing capacity, geotechnical pile capacity, lateral earth pressures, retaining wall stability and deformation, deep foundation design including foundation settlement, scour, lateral loading and deflections, downdrag, settlement induced bending, load tests, driveability analyses, temporary measure designs, and other pertinent analyses. Design should generally conform to the LADOTD Road Design Manual, LADOTD Pavement Design Guide, AASHTO LRFD Bridge Design Specifications for bridges, retaining walls, and other structure features, and State, C-P standards.

5.5. Reference Publications

a. AASHTO. (2017). *LRFD Bridge Design Specifications, 8th ed*. Washington, DC. American Association of State Highway and Transportation Officials.

b. AASHTO. (1988). *Manual on Subsurface Investigations*. Washington, DC. American Association of State Highway and Transportation Officials.

c. AASHTO. (2013). *Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 33rd ed*. Washington, DC. American Association of State Highway and Transportation Officials.

d. ASTM International Standards

e. EBR C-P. (latest version). Standard Plans. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

f. FHWA. (2006). *Geotechnical Aspects of Pavements Reference Manual*. U.S. Department of Transportation Publication No. FHWA NHI-05-037. Washington, DC. U.S. Department of Transportation, Federal Highway Administration, National Highway Institute

g. LADOTD. (2011 or latest edition). *Materials Testing Procedures Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Materials and Testing Section.

http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Materials_Lab/Pages/Menu_TPM.aspx

h. LADOTD. (2009). *Roadway Design Procedures and Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Road Design Section. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Pages/Road-Design-Manual.aspx

i. LADOTD. (2016). *Standard Specifications for Roads and Bridges*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Engineering Division.

j. LADOTD. (latest version). Standard Plans. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Standard_Plans/Pages/default.aspx?RootFolder=%2FInside%5FLaDOTD%2FDivisions%2FEngineering%2FStandard%5FPlans%2FStandard%20Plans%2FStandard%20Plans&FolderCTID=0x012000759B9DC184A87A4E8BAEACED94697A67&View={6CA8D877-4BA0-45CA-83B0-350384A89137}

k. LADOTD. (1999). *Geotechnical Engineering Design Guide No. 8, Mechanically Stabilized Earth Wall (MSEW) Design Guide*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Pavement & Geotechnical Design.

l. LADOTD. (2013). *Pavement Design Guide*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

m. LADOTD. (2016). *Driven Pile Design & Verification Using LRFD*. Baton Rouge, LA - Louisiana Transportation Conference. Jesse Rauser, P.E. – Louisiana Department of Transportation and Development. http://www.ltrc.lsu.edu/ltc_16/survey16_thanks.html

n. LADOTD. (2016). *Drilled Shaft Design and Construction Practice*. Baton Rouge, LA - Louisiana Transportation Conference. James Melton, P.E. and Chris Nickel, P.E. – Louisiana Department of Transportation and Development. http://www.ltrc.lsu.edu/ltc_16/survey16_thanks.html

6 Traffic Operations and Design

6.1. Traffic Operations

This section describes requirements and expectations for design of traffic operations performed on MOVEBR projects. These guidelines are intended as an overview and may not be all-inclusive. In addition, not all requirements described may be necessary on every project. Designer shall coordinate with P-PM early in the project to determine exact traffic operations design scope required.

6.2. Traffic Design Report Meetings

6.2.1. Traffic Design Report Scope Meeting

The Traffic Design Report Scope meeting may include the following topics:

a. Project scope limits

b. Purpose and need of project

c. Type of traffic data and list of intersections, median openings and driveways to collect traffic data

d. Highway Capacity Manual based Software for analyses such as HCS or Synchro software

e. Number of alternatives to be analyzed or have second contract if alternatives are not known until existing operations and safety analyses are performed

The scope meeting may include determining the dates and location of all traffic data tube and turning movement counts, determining number of peak periods (am, noon, weekday, pm and/or weekend), initial and final data collection report deliverables, demand count methodology, turn lane storage length calculation methodology, traffic equipment, quality control plan, schedule and contract time. The Traffic Design Report Contract shall define all the agreed upon decisions made at the Traffic Design Report Scope meeting.

6.2.2. Traffic Design Report Progress Meetings

Progress meetings and/or conference calls should be held throughout the project at milestones suggested by the DTD Chief Traffic Engineer and/or LADOTD Traffic Engineering Process and Report website.

6.3. Traffic Design Report

The purpose of the Traffic Design Report is to verify or modify conceptual intersection geometry (i.e. number of turn lanes and storage requirements) and to develop signal timing plans for signalized intersections within the project. The Traffic Design Report should follow the LADOTD Traffic Engineering Process and Report for State Routes and intersections as well as local road projects that intersect with State Routes. The Traffic Design Report shall be provided as part of the Design Study prepared for the project and may contain the following tasks. The Traffic Design Contract should define which of the following tasks will be performed.

6.3.1. Project Description

A brief description of the project should be provided describing the limits of the project as well as the specific intersections included in the Traffic Design Report. In addition, the purpose and need of the Traffic Design Report should be described in this section.

6.3.2. Existing Traffic Data

Some projects may have some or all of the Existing Traffic Counts performed by others. Existing traffic counts shall be collected at critical intersections, as identified by the Traffic Design Contract. Existing and Final Data Collection Reports will follow the LADOTD guidelines for State Routes for tasks defined in the Traffic Design Report Contract. Some or all the following tasks may be required for Existing Traffic Data.

6.3.2.1. Traffic Volume Counts with Classification

Traffic volume counts with classification shall be conducted at locations defined in the Traffic Design Report Contract for 7-days and / or 48 hours in 15-minute intervals. Vehicle classification categories should comply with the guidelines established by FHWA. The data may be reported in three categories: automobiles (classes 1-3), buses / Single Unit (classes 4-7) and trucks (classes 8-13) as defined at the Traffic Design Report Contract. Traffic volumes counts may be set for approach volumes at intersections and / or bi-directional on roadway segments for Average Daily Traffic volumes as defined at the Traffic Design Report Contract. Tube counts are typically used to collect the traffic volume count data but other types of equipment may be used upon approval.

6.3.2.2. Turning Movement Counts

Weekday traffic turning movement counts (TMCs) shall be performed on a Tuesday, Wednesday and / or Thursday during school and university sessions and non-holiday weeks. TMCs will include vehicles, bicycles and pedestrians counts. The turning movement count data shall include peak hour factor and separate passenger vehicles from school buses / commercial vehicles. The data shall be reported in 15-minute intervals. Peak hour TMCs shall be performed for all intersections that will have capacity analyses performed as defined in the Traffic Design Report Contract. Typically, the critical road intersections will be analyzed. However, other intersections to be analyzed may also include driveways or median openings as defined in the Traffic Design Report Contract. The turning movement counts for non-critical intersections such as driveways may include only the vehicles entering and exiting the driveway and exclude the mainline movements upon approval and should be confirmed at the scope meeting.

6.3.2.3. Unmet Demand Counts

Unmet Demand counts will be performed during the TMCs for each movement. The methodology should be approved Prior performing TMCs.

6.3.2.4. Fifteen Minute Counts

Fifteen Minute counts will be performed during the peak hour. These counts are typically for traffic volume purposes only and are converted to a peak hour volume. 15-Minute shall be performed for intersections that will not require capacity analyses. These intersections typically include low volume road intersections, driveways and/or median openings as defined in the Traffic Design Report Contract. These volumes may be used when developing alternatives that will restrict the existing access and will be required to be redistributed on the alternative network.

6.3.2.5. Peak Hour Observation

Peak hour observation will follow the LADOTD guidelines for State Routes.

6.3.2.6. Geometric Field Review

Geometric field review will follow the LADOTD guidelines for State Routes.

6.3.2.7. Radar Speed Study

Speed studies will be performed with radar and will follow the LADOTD guidelines for State Routes.

6.3.2.8. Travel Time Runs

Travel Runs will follow the LADOTD guidelines for State Routes.

6.3.3. Existing Safety Analyses

Safety analyses will follow the LADOTD guidelines for State Routes. Safety analyses will include results from the LADOTD CATScan tool, crash report documentation, collision diagram and crash analysis summary as defined at the scope meeting.

6.3.4. Implementation Year and Design Year Traffic Volumes

Implementation and Design Year traffic volume procedures will be defined at the scope meeting and will follow the LADOTD guidelines unless directed otherwise. Implementation Year is typically 3 years from the year that existing traffic data is collected. Implementation Year volumes are typically used for traffic signal design timing parameters. Design Year (Design Life) is typically 20 years from the Implementation Year. Design Year volumes are typically used for lane usage and storage length design. Some projects may only require Design Year volumes which should be confirmed during the scope meeting to be held prior to contract negotiations.

Growth rates will be applied to existing volumes to develop Implementation and/or Design Year No Build volumes. The growth rate is typically calculated by using ADT volumes from the following two Capital Region Planning Commission (CRPC) Metropolitan Planning Organization Travel Demand Models:

a. Base Year Model (Typically Year 2015)

b. Future Plan Year Model (Typically Year 2042)

The volumes from these models will only be used for growth rate calculations and will not be used for actual design year volumes. The growth rate, methodology and supporting documentation must be submitted and approved by the P-PM prior to Design Year analyses. The calculation information including the TransCAD screenshots depicting selected ADT volumes will also be included in the appendix of the final report. All supporting documentation shall list the source of the data where applicable.

AM and PM No Build Future Plan Year Models (Base + E+C Only Model / Typically year 2042) may be considered as well to develop Design Year traffic volume turning movements for road extension projects. The ratio of AM and PM Peak turning movements from the No Build and Build TransCAD models may be applied to the calculated Design Year volumes. The turning movement volumes from these TransCAD models will not be used for actual design year turning movement volumes. A mesoscopic model may be

considered to develop AM and PM Peak ratios as well upon approval at the scope meeting.

Alternative Design Year volumes such as alternatives that will include proposed medians will require the redistribution of the No Build Design Year volumes.

6.3.5. Existing and No Build Capacity Analyses

Before Existing and No Build Capacity Analysis begins, a design year volume map shall be submitted and approved. In addition, software shall be approved prior to analyses. If oversaturated conditions as defined in the Highway Capacity Manual exist, or if equations do not exist in HCM, then microsimulation should be used or Highway Capacity Software (HCS) using 15-minute interval analyses as defined at the scope meeting. The use of microsimulation software for analyses for intersections and roadway segments shall be approved by the P-PM at the scope meeting and follow LADOTD Guidelines. All existing condition microsimulation models should be calibrated with documentation in accordance to LADOTD requirements. Measures of Effectiveness (MOEs) for microsimulation models shall follow LADOTD guidelines as defined at the scope meeting.

The existing conditions will evaluate the intersections and the roadway segments defined in the Traffic Design Report Contract based on existing peak hour volumes and existing geometry. Intersection and roadway analyses and Measures of Effectiveness (MOEs) should be identified in the Traffic Design Report Contract. The Design Year No Build conditions shall evaluate the intersections and roadway segments defined in the Traffic Design Report Contract based on design year peak hour volumes and existing geometry. All existing and no build electronic analyses files will be submitted with the Design Report. Percent Heavy vehicles should be implemented per each turning movement for HCS analyses.

The existing analyses and Measures of Effectiveness (MOEs) may include the following for HCS analyses:

a. Intersections

    i Volume-to-capacity (v/c) ratio for each movement

    ii 95th percentile queue lengths for each movement

    iii Control Delay for each movement and approach (seconds/vehicle)

b. Roadway Segments

    i Density (flow rate [pc/mi/ln] (Level of Service (LOS))

ii Free flow speed

iii Actual average speed

c. Weaving

i Weaving area segment speed (MPH)

ii Weaving segment density (pc/mi/ln, LOS)

d. Ramps merge and diverge

i Density (flow rate [pc/mi/ln] (Level of Service (LOS))

ii Speeds of ramp influence area (MPH)

iii Speeds of outer lane (MPH)

6.3.6. Alternative Capacity Analyses

Alternative analyses may include some or all the following steps as defined in the Traffic Design Report Contract:

a. Tier 1 Analyses – Screening of Initial List of Alternatives

b. Tier 2 Analyses - Refined List of Alternatives

c. Tier 3 Analyses - Preferred Alternatives

6.3.6.1. Tier 1 Analyses

Tier 1 Analyses will identify a preliminary list of alternatives for further investigation that address the purpose and need while considering project constraints. The FHWA Capacity Analysis for Planning of Junctions (CAP-X) excel software tool or other tools upon approval may be used to compare interchange and/or non-interchange alternatives. The CAP-X excel software tool is designed to be simple with input of only design year peak hour traffic volumes and number of lanes. Alternatives should be compiled in a matrix to compare operations, ROW, cost, number of conflict points, environmental impacts, adjacent property owner impacts, and other impacts. Tier 1 will include redistributed volume maps as needed. Tier 1 results should be approved prior to performing Tier 2 alternative analyses.

6.3.6.2. Tier 2 Analyses

Tier 2 Analyses will be performed on the refined list of alternatives developed from Tier 1 screening analyses. Tier 2 analyses will require more evaluation to identify the preferred list of alternatives. Evaluation may include preliminary traffic analyses, preliminary conceptual layouts, preliminary cost, estimated ROW requirements, safety analyses, estimated environmental and social impacts. Tier 2 analyses will also include an alternative comparative evaluation matrix. Tier 2 safety analyses may include an explanation of the correctable crash improvements for each alternative.

6.3.6.3. Tier 3 Analyses

Tier 3 Analyses will include additional analyses for the preferred alternative. The Tier 3 analyses may include a more detailed geometric layout, striping and sign layout, and/or signal plans.

6.3.7. Access Justification Report

Access Justification Reports will follow the LADOTD guidelines for projects with interchange modifications.

6.3.8. Preferred Alternative Layout

The intersection(s) and roadway segment geometric layouts as well as intersection traffic control for the preferred alternative should be illustrated in the Traffic Design Report. The number of turn lanes and thru lanes will be based on the MOE results from the design year peak hour analyses for intersections and roadway segments. The suggested Design Year Level of Service is D or better for the mainline and level of service E or better for the side street but must be approved at kickoff meeting. The suggested Levels of Service may also be readdressed once the alternative analyses are performed. Some projects may require the Implementation Year Layout have less capacity than the Design Year Layout due to funding constraints. Under these circumstances, ROW should be recommended to accommodate the Design Year Layout. Roundabout alternative analyses should follow the DOTD Roundabout Sidra Settings Brochure and include design life analyses.

All electronic alternative analyses files will be submitted with the Design Report.

6.3.9. Turn Lane Storage Lengths

Geometric layouts for intersection and roadway segments should be based on design year peak hour traffic volumes. The analyses should be performed using approved software in accordance with the *Highway Capacity Manual* (6TH Edition or latest version) unless otherwise approved in writing. All assumptions on input data shall be documented in the Traffic Design Report. These shall include, but not be limited to, the peak hour factor

(phf), percent trucks per each movement, arrival type, right turns on red, lane width, shoulder width, etc. In addition to the MOE analyses, recommended left and right turn lane storage lengths shall be included in the Traffic Design Report based on the following parameters:

a. Speed

b. Taper length

c. Deceleration length

d. 95th % queue

The deceleration length should begin at the taper and end at the back of the design year 95th % queue as defined in Figure 9-32 in the AASHTO's *Policy on Geometric Design of Highways and Streets (AASHTO Green Book)*, 7th Edition, 2018 (page 9-95) as well as shown on the following LADOTD link:

http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Traffic_Engineering/Design%20Development/Typical%20Turn%20Lane%20Design.pdf

6.3.10. Road Classification and Design Speed Limit

The Traffic Design Report shall include the road classification (functional and contextual) and design speed that will be used for the final proposed road design layout. Refer to Section 7.2: Design Guidelines Framework for road classifications and design speed.

6.3.11. Traffic Signal and Pedestrian Crosswalk Warrants Analyses

The Traffic Design Report will include warrants for all proposed traffic signals. The DTD Chief Traffic Engineer must approve all proposed traffic signals prior to design. A traffic signal warrant analysis using MUTCD Warrant 1A 100% and Warrant 7 will be performed for existing and/or alternative intersections defined in the Traffic Design Report Contract. LADOTD may require warrants for each of the seven days for any new full access signalized intersections based on EDSM VI.2.1.6 and as defined in the Traffic Design Report Contract meeting.

The Traffic Design Report will include recommendations for all crosswalk and pedestrian traffic signal equipment locations. The DTD Chief Traffic Engineer must approve all proposed crosswalk and pedestrian traffic signal equipment locations prior to design. Proposed pedestrian crosswalk locations on State Routes should meet the requirements in the LADOTD Traffic Engineering Manual 3B.2. All proposed crosswalk locations on State Routes must be approved by LADOTD prior to design.

6.3.12. Traffic Signal Timing Analyses

Intersection signal timing analyses shall be performed based on implementation year traffic volumes and recommended design year geometry. Typical signal timing plans to be developed may include the AM, Noon and PM peak period plans. Additional signal timing plans such as midday, weekend, special event or evacuation can also be developed based on the Traffic Design Report Contract. These signal timing plans shall include cycle lengths, phase sequence, green split times and clearance intervals for each applicable phase. If the project contains multiple signalized intersections, the signal timing plans shall also include an offset for progression purposes.

The signal timing analysis shall be performed using approved software in accordance with Highway Capacity Manual (Sixth Edition or latest version). Coordination/Progression Analyses shall be performed using approved software such as Synchro Tru-Traffic (formerly TS/PP-Draft) or PasserII-02. The signal timing procedures, including cycle lengths, green times, and clearance calculations, shall be in accordance with the LADOTD *Signal Design Manual*, (May 13, 2015 or latest version).

All assumptions on input data shall be documented in the Traffic Design Report. These shall include, but not be limited to, the peak hour factor (phf), percent trucks, arrival type, actuated phases, right turns on red, lane width, volumes, minimum green times, clearance times, phase sequence and pedestrian/bicycle variables.

The Traffic Design Report shall include vehicle path (AutoTURN or other) analysis for signal phasing to show the distance between vehicles when simultaneous lefts are allowed either during coordination or free operation. The minimum distance between vehicles shall be 10 feet unless approved otherwise. The design vehicle shall be approved prior to the vehicle path analysis. The illustrated movements showing the distance between vehicles shall be included in the appendix of the report.

6.3.13. Findings and Recommendations

The findings of the Traffic Design Report shall be provided in a bound format. The bound Traffic Design Report shall include a conceptual layout showing the number of roadway segment lanes, intersection traffic control and intersection layouts with turn lane storage length requirements for all intersections defined in the Design Report Contract. All corresponding documentation and analyses shall be provided as part of this bound report.

In addition, all recommended signal warrants and signal timing plans for all signalized intersections within the limits of the project shall be included in the Traffic Design Report. All corresponding documentation and analyses shall be provided as part of this bound report.

6.4. Traffic Signal Design Meetings

6.4.1. Traffic Signal Design Scope Meeting

The Traffic Signal Design Scope meeting may include the following topics:

a. Signal equipment requirements (signal heads, pole foundations, emergency vehicle equipment, vehicle detection, controllers, computers, software etc.)

b. Signal equipment pay items (C-P, LADOTD)

c. Fiber design requirements

d. Fiber equipment pay items (C-P, LADOTD) (fiber, patch panels, ethernet switch, splice enclosure, Hub equipment, etc.)

e. Coordination with LADOTD ITS Division for existing fiber tie in requirements

The Traffic Signal Design Contract shall define all the agreed upon decisions made at the Traffic Signal Design Scope meeting.

6.4.2. Traffic Signal Design Progress Meetings

Progress meetings should be held throughout the project at milestones suggested by the DTD Chief Traffic Engineer.

6.5. Traffic Signal Design

Traffic signal design will be in accordance with the latest approved version of the Manual on Uniform Traffic Control Devices, Louisiana Department of Transportation and Development Traffic Signal Manual, LADOTD and C-P Standard Plans, and LADOTD and C-P Standard Specifications.

6.5.1. Existing Survey

The initial set of preliminary signal plans will show the existing survey. This set of plans will be used for the PIH. Once the pole locations are established, the remaining sets of signal plans can hide the layers showing the existing survey unless the pole locations are changed.

6.5.2. Conduit

Separate conduit systems will be used for signal equipment conductors, fiber, power conductors, and streetlight conductors.

6.5.3. Vehicle Detection

Vehicle detection will be used at all signalized intersections. Specific type of vehicle detection (loops, magnetometers, video etc.) will be decided at the scope meeting.

6.5.4. Signal Poles

Permanent signal support type shall be mast arm poles. The poles should be placed at locations to minimize existing utility relocations and away from new known utilities (sewer, drainage structures etc.) Luminaires may be included on mast arms as directed by the DTD Chief Traffic Engineer. For state intersections, the plans shall note the signal foundation design zones as defined by the website link on LADOTD TSD-06.

(http://ladotd.maps.arcgis.com/home/webmap/viewer.html?webmap=60d2d5495792439fb97f24529bc7ae97)

6.5.5. Traffic Signal Heads

Signal housing color will be defined by LADOTD standards for all state roadways and yellow for C-P routes. All signal faces will have 12" diameter L.E.D. lamps with backplates. Flashing yellow signal heads may be used only as directed by the DTD Chief Traffic Engineer and/or LADOTD on State Routes.

6.5.6. Internally Illuminated Signs

Only Railroad Blankout signs will be internally illuminated for intersections near railroads.

6.5.7. Interconnect

For corridors with multiple signalized intersections or potential for future signals, fiber communications infrastructure needs to be considered during the design phase for proper signal operation.

The signal plans should include design notes for the signal subcontractor for other pay items such as Removal of Signal Equipment, Removal of Existing Aerial Interconnect, Removal of Structures, Clearing and Grubbing, Mobilization, Temporary Signs and Barricades, Traffic Signal Controller Software, Computer Equipment, Work Zone Police Officers, and Signal Head Tunnel Visors.

C-P standard specifications and standard plans will be used for all C-P roadway intersections, and LADOTD standard specifications and standard plans will be used at all state roadway intersections.

6.5.8. Right-of-Way for Signal Equipment

Proposed ROW should be considered for all signal equipment including signal pole foundations and traffic signal controllers. Additional ROW such as corner clips may be required in areas with limited space for utility relocations or where there is a possibility of unmarked and/or abandoned underground utilities such as old abandoned BellSouth lines.

6.6. Traffic Signal Plans

Traffic signal plans will be prepared in accordance with the MOVEBR Signal Design Check List in Attachment F. Traffic signal layout sheets identifying the location of foundations for signal poles and controller cabinets shall be established prior to the initial preliminary plan submittal. The mast arm pole foundation and controller cabinet locations shall be established in consideration for horizontal and vertical clearances to existing and relocated utility lines, in addition to consideration of keeping pedestrian, bicyclist and transit facilities clear from obstruction.

The initial preliminary plan submittal will be used for PIH and will include the survey and items shown on the MOVEBR Signal Design Check List, item 4. Signal Design Layout (for each intersection).

Supplemental specifications to the C-P standard specifications shall be developed to provide for separate pay items for all traffic signal items in lieu of the lump sum pay item. Traffic signal plans for all state intersections shall conform to the latest LADOTD TSI format. The latest format should be confirmed at the kickoff meeting.

6.7. Traffic Markings and Signs

All pavement markings and signs shall be in accordance with the latest approved version of the Manual on Uniform Traffic Control Devices for Streets and Highways and LADOTD and C-P Standard Plans and Specifications. C-P Standard Plan 905-02 shall be used for pavement marking details for C-P roadways, and LADOTD PM-01 will be used for pavement marking details on state roadways. All permanent markings for both C-P and State roadways shall be thermoplastic, and the LADOTD traffic sign details will be used for all projects.

6.8. Reference Publications

a. AASHTO. (2018). *A Policy on Geometric Design of Highways and Streets, 7th Edition*. Washington, DC. American Association of State Highway Transportation Officials.

b. EBR C-P. (latest version). *Standard Plans*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

c. EBR C-P. (latest version). *Standard Specifications for Public Works Construction*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division

d. FHWA. (2009 or latest approved edition). *Manual on Uniform Traffic Control Devices for Streets and Highways*. US Department of Transportation, Federal Highway Administration

e. ITE. (2009 or latest edition). *Traffic Control Devices Handbook*. Institute for Transportation Engineers, Editor: Robert K. Seyfried.

f. ITE. (2016). *Traffic Engineering Handbook*. John Wiley and Sons Inc., Authors: Brian Wolshon and Anurag Pande.

g. LADOTD. (2015 or latest edition). *Traffic Signal Design Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

h. LADOTD. (latest version). *Traffic Signal Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Standard_Plans/Pages/default.aspx?RootFolder=%2FInside%5FLaDOTD%2FDivisions%2FEngineering%2FStandard%5FPlans%2FSpecial%20Details%2FSpecial%20Details%2FTraffic&FolderCTID=0x012000B45DF4ABE71813419EF4AF62EBF6A9F3&View={818530E6-561D-4F7C-A684-91AEF628795A}

i. LADOTD. (latest version). *Standard Plans*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Standard_Plans/Pages/default.aspx?RootFolder=%2FInside%5FLaDOTD%2FDivisions%2FEngineering%2FStandard%5FPlans%2FStandard%20Plans%2FStandard%20Plans&FolderCTID=0x012000759B9DC184A87A4E8BAEACED94697A67&View={6CA8D877-4BA0-45CA-83B0-350384A89137}

j. LADOTD. (2016). *Louisiana Standard Specifications for Roads and Bridges*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

k. LADOTD. (2010 or latest edition). *Traffic Control Standard, Number 18A, Traffic Signal Control System*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

l. LADOTD. (2019). *Typical Turn Lane Design Guideline*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Traffic_Engineering/Design%20Development/Typical%20Turn%20Lane%20Design.pdf

m. TRB. (2016). *Highway Capacity Manual, 6th Edition*. Washington, DC. Transportation Research Board, National Research Council.

7 Road Design and Complete Streets

7.1. Purpose

The intent of this section is to provide the design guidelines for roadways to be constructed under the MOVEBR Program. It includes a discussion of the design guidelines for the major elements associated with roadway design but is not intended to contain all aspects or information required for roadway design. Additional information required should be obtained from the publications listed under Section 7.10: Reference Publications located at the end of this section. Furthermore, additional C-P directed requirements and/or deviations may be provided on a project by project basis and will be presented and discussed at the project kickoff meeting. Chosen design values for each design element will be documented in the PDR in accordance to Section 1.3: Project Design Reports and Guideline Deviation Process.

7.2. Design Guidelines Framework

The design criteria were developed from a framework that was established through consideration of the MOVEBR vision statement, FutureBR (e.g. future land use plans and character areas), current and anticipated functional classifications, current and future contextual classifications based on current AASHTO guidance, design speed, access management principles, and the selection of the appropriate design vehicle.

7.2.1. Functional Classification

The functional classification of each project was established by the agency having jurisdiction (LADOTD, C-P DTD) based on several criteria. During prioritization phase of the MOVEBR projects, data regarding the functional classification of each project was collected and it was determined that there were very slight differences in roadways classified as collectors and arterials, sometimes seemingly arbitrary differences. The proposed road design functional classification should follow the existing road functional classification and shall be approved prior to proceeding with design. The existing road functional classification may be found at the following link:

https://www.arcgis.com/home/webmap/viewer.html?webmap=a37461260bec43dea7bcbf6b710a662e

Future land use changes and enhancements in connectivity may also affect currently identified functional classifications. Therefore, functional classification, although important in the regional sense for planning the transportation network, was given less priority in terms of decision-making and developing design guidance for MOVEBR.

Instead, more focus was directed towards each roadway considering its function in the context of the setting it exists in.

7.2.2. Contextual Classifications

In the past, geometric design criteria contemplated only two contexts – urban and rural. More recently with their latest edition of the AASHTO *Policy on Geometric Design of Highways and Streets,* has broadened this set of contexts to include three types for urban areas and two for rural areas. The five contexts identified in the AASHTO Policy are as follows:

1. Urban Core
2. Urban
3. Suburban
4. Rural town
5. Rural

These contexts are defined based on density of development, land uses, and building setback requirements. See NCHRP Report 855 for additional information.

1. *Urban Core Context* includes the highest density, with mixed land uses within and among predominantly high-rise structures, and with small building setbacks. The urban core context is found predominantly in the central business districts and adjoining portions of major metropolitan areas. On-street parking is often more limited and time restricted than in the urban context. Substantial parking is in multi-level structures attached to or integrated with other structures. Sidewalks are present nearly continuously, with pedestrian plazas and multi-level pedestrian bridges connecting commercial and parking structures in some locations. Transit corridors, including bus and rail transit, are typically common and major transit terminals may be present. Driver speed expectations are low and pedestrian/bicyclist flows are high.

Figure 7-1: Florida Street at Seventh Street in Baton Rouge, LA (Source: Lynn Maloney-Mujica, HNTB)

One MOVEBR project is located in an urban core context, so it is recommended that the use of the Urban/Walkable 2-Lane and Urban/Walkable 4-Lane Complete Streets Typical Sections and guidelines apply to urban core context.

2. *Urban Context* has high development density, mixed land uses, and prominent destinations. On-street parking and sidewalks are generally more common than in the suburban context. Urban locations often include multi-story and low to medium rise structures. In small and medium sized communities, the central business district may be more of an urban context than an urban core context. Driver speed expectations are generally lower and pedestrian/bicyclist flows are higher than suburban areas. Transit service is also generally greater in urban areas.

Figure 7-2: Florida Street at North Acadian Thruway in Baton Rouge, LA (Source: Lynn Maloney-Mujica, HNTB)

A few MOVEBR projects are located in an urban context; therefore, typical sections and corresponding design criteria for the urban context were developed and included in these guidelines (see Urban/Walkable 2-Lane and Urban/Walkable 4-Lane Complete Streets Typical Sections).

3. *Suburban Context* applies to roads and streets, typically within the outlying portions of urbanized areas, with low to medium development density and mixed land uses. Drivers usually have higher speed expectations than the urban and urban core contexts. Pedestrians and bicyclist flows are higher than in the rural context but may not be as high as found in urban and urban core areas.

Figure 7-3: Hooper Road in Central, LA (Source: Google Earth Pro)

The majority of MOVEBR projects are located in a suburban context; therefore, typical sections and corresponding design criteria for the suburban context were developed and included in these guidelines (see Suburban 2-Lane, Suburban 3-Lane, and Suburban 4-Lane Complete Streets Typical Sections).

4. *Rural Town Context* applies to roadways in rural areas located within developed communities. Rural towns generally have low development densities with diverse land uses and sidewalks in some locations. Rural towns may include residential neighborhoods, schools, industrial facilities, and commercial main street business districts.

Figure 7-4: Pride-Port Hudson Road in Zachary, LA (Source: Google Earth Pro)

A few MOVEBR projects are located in a rural town context; therefore, a typical section and corresponding design criteria for the rural town context was developed and included in these guidelines (see Rural 2-Lane Complete Streets Typical Section).

5. *Rural Context* applies to roadways in rural areas that are not within a developed community.

There are no MOVEBR projects in the rural context.

7.2.3. Design Speed

Speed plays a critical role in the cause and severity of crashes. There is a direct correlation between higher speeds, crash risk, and the severity of injuries, as shown in the following table:

SPEED (MPH)	STOPPING DISTANCE (FT)*	CRASH RISK (%)†	FATALITY RISK (%)†
10–15	25	5	2
20–25	40	15	5
30–35	75	55	45
40+	118	90	85

* Stopping Distance includes perception, reaction, and braking times.

† Source: Traditional Neighborhood Development: Street Design Guidelines (1999), ITE Transportation Planning Council Committee 5P-8.

Figure 7-5: Correlation between speed and crash risk

As per the AASHTO *Policy on Geometric Design of Highways and Streets*, topography, anticipated operating speed, adjacent land use, and roadway classification (functional and contextual) should be considered when developing the design speed for the proposed road design.

Operational (posted) speeds will be considered when developing the design speed. Anticipated operational speeds shall be confirmed with the DTD Chief Traffic Engineer and based on East Baton Rouge Parish Code.

Existing speed zones within the city limits can be found in Title 11- Chapter 26, Section 11:336 at the following link:

https://library.municode.com/la/baton_rouge,_east_baton_rouge_parish/codes/code_of_ordinances?nodeId=TIT11TRCO_CH26SCDESTRETI_S11_336SPZOCI

For unknown speed zones or projects outside of the city limits, the operational speed can be based Title 11 – Chapter 27, Section 11:350 at the following link:

https://library.municode.com/la/baton_rouge,_east_baton_rouge_parish/codes/code_of_ordinances?nodeId=TIT11TRCO_CH27RUOUON_S11_350STHIREACADRESPREPA

Higher design speeds often suggest larger curve radii, wider travel lanes, on-street parking restrictions, guardrails, and wide clear zones. Therefore, to enhance safety of all road users, the intent of these Design Guidelines is to consider design that encourages lower operating speeds of vehicles. Lower design speeds reduce observed speeding behavior, providing a safer place for people to walk, park, and drive. Lower speeds can be designed for by implementing certain elements within a corridor that discourage higher speeds. Speed reduction design strategies mostly consist of visual cues and an increase in "sight friction". Sight friction is a term used to describe how the introduction of certain elements along a roadway can alter how the driver perceives and responds to the road itself. MOVEBR projects may consider such examples of traffic calming strategies as:

a. Narrower lane widths,

b. Roadside landscaping,

c. Curb extensions,

d. Shorter signal cycle lengths and / or slower signal progression

e. Medians,

f. Lane shifts/chicanes,

g. Roundabouts,

h. Reduced building setbacks,

i. Street trees

j. On-street parking.

When traffic calming measures such as those listed above are implemented, these design features can have an effect on the general operating speed of vehicles and can contribute to the improved mobility of other modes of transportation along the corridor, which is now recognized as achieving a desired "Target Speed". Design Speeds have been identified by C-P DTD for each type of Contextual Classification on the MOVEBR project list to achieve a desired operating speed and is intended to serve as a guide for the design approach to each project.

In line with the MOVEBR vision of improving safety, the C-P desires slower operating speeds for urban and suburban environments where pedestrians, bicyclists, and transit users are anticipated or may be currently using the roadway. The typical sections developed for each contextual classification also indicate the desired operating speed. Refer to Attachment G for the typical sections developed.

7.2.4. Access Management

Access Management (AM) is the proactive management of vehicular access points to land parcels adjacent to all manner of roadways and promotes safe and efficient use of the transportation network. AM encompasses a set of techniques that roadway owners can use to control access to highways, major arterials, and other roadways (Source: FHWA Office of Operations website). These techniques include:

a. *Access Spacing*: increasing the distance between traffic signals improves the flow of traffic on major arterials, reduces congestion, and improves air quality for heavily traveled corridors. However, traffic signals can provide protected non-motorized user crossing opportunities, so Designers are cautioned against taking a one-size fits all approach. The Designer should assess local land use plans and consider local community needs of the transportation facilities before determining signal spacing requirements.

b. *Driveway Spacing*: Fewer driveways spaced further apart allows for more orderly merging of traffic and presents fewer challenges to pedestrians, bicyclists, and drivers.

c. *Driveway Configuration*: full access driveways can influence the flow of traffic and increase congestion and delays, particularly in the proximity of signalized

intersections. Converting the configuration of driveways near these areas can improve the overall operation of signalized intersections and reduce conflict points between vehicles, pedestrians, bicycles, and transit, thereby improving the mobility and safety.

d. *Dedicated Turning Lanes and Roundabouts*: dedicated left- and right-turn, indirect left-turns and U-turns, and roundabouts keep through-traffic flowing. Roundabouts provide an opportunity to reduce an intersection with many conflict points or a severe crash history (T-bone crashes) to one that operates with significantly fewer conflict points and less severe crashes (sideswipes) if they occur. A left turn lane should be provided at all median openings.

e. *Median Treatments*: a non-traversable median is the most effective means to regulate access and reduce crashes. Median treatments do not prevent access to property, but rather provide right-in, right-out access which is a safer maneuver for motorists.

f. *Right-of-Way Management*: as it pertains to R/W reservation for future widenings, good sight distance, access location, and other access-related issues.

AM provides an important means of maintaining mobility of vehicular traffic. It calls for effective ingress and egress to a facility, efficient spacing and design to preserve the functional integrity, and overall operational viability of street and road systems. AM is closely tied to functional classification as shown below.

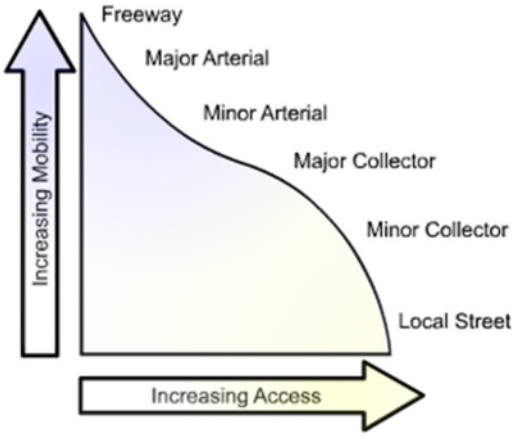


Figure 7-6: Mobility and Access in relation to Functional Classifications

For high mobility facilities with undeveloped and/or vacant land use with existing low access, access management strategies should be included as part of the design to maintain traffic flow into the future and reduce the potential for crashes. This is particularly necessary on 2-lane and 3-lane sections without raised medians.

7.2.5. Design Vehicle

Key controls in geometric highway design are the physical characteristics and the proportions of vehicles of various sizes using the roadway. Designers should consider the largest design vehicle that is likely to use that facility with considerable frequency or a design vehicle with special characteristics appropriate to a particular location in determining the design of such critical features such as curb radii at intersections and radii of turning roadways.

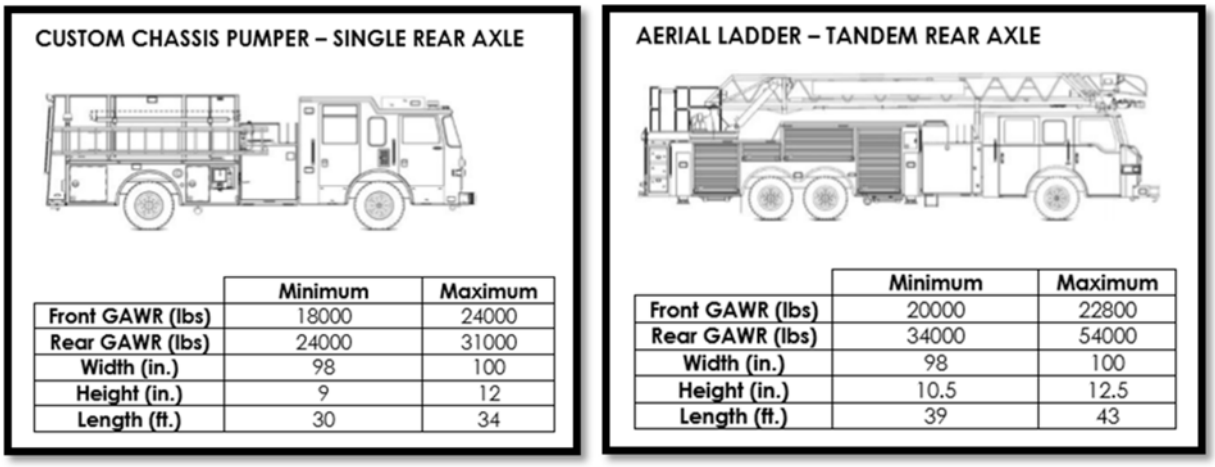
Contextual classification along with intended function of a roadway should be used in determining the design vehicle. For the purposes of the MOVEBR design guidelines, the design vehicle has been determined for each contextual classification, however the following design vehicles should be considered to establish minimum turnout radii at intersections and U-turns:

a. City-Bus – used for transit corridors in the Urban/Walkable character area (see AASHTO Green Book, latest edition for additional information)

b. School Bus (S-BUS40) – used for suburban corridors where school buses, garbage trucks, and fire trucks are frequent (see AASHTO Green Book, latest edition for additional information)

c. Firetruck Custom Chassis Pumper – Single Rear Axle (see TC009-1 Emergency Vehicle Size and Weight Guide for additional information; includes 1996 Freightliner Engine 14 stationed at Harding, Engine 15 responds to Riverbend and student apartments south of LSU campus, Hazardous Materials 96 stationed at 555 Government Street, Rescue Response 93 stationed at Fire Station 13 on Sharp Road)

d. Firetruck Aerial Ladder Tandem Rear Axle (see TC009-1 Emergency Vehicle Size and Weight Guide for additional information; includes 2000 Freightliner Aerial 6 100 foot stationed at Fire Station 13 on Sharp Road)



	Minimum	Maximum
Front GAWR (lbs)	18000	24000
Rear GAWR (lbs)	24000	31000
Width (in.)	98	100
Height (in.)	9	12
Length (ft.)	30	34

	Minimum	Maximum
Front GAWR (lbs)	20000	22800
Rear GAWR (lbs)	34000	54000
Width (in.)	98	100
Height (in.)	10.5	12.5
Length (ft.)	39	43

Figure 7-7: Firetruck Design Vehicles (Source: FAMA – Emergency Vehicle Size and Weight Guide)

Designers should use judgement in determining specific intersection designs as to not be too conservative in the design vehicle or the assumed wheel path. Designers should also ensure that the Firetruck Aerial Ladder Rear Axle design vehicle can be accommodated at intersections. Since emergency vehicles have priority at all intersections, it should be assumed that the vehicle can use the full width of the intersection traveled way to accomplish a maneuver if necessary. Over-designing intersection turnout radii can result in higher turning speeds, presenting higher crash risk for vulnerable road users.

In some cases, larger design vehicles may require consideration due to the functional purpose of some MOVEBR roadway projects. Factors such as designated truck routes, proximity to freeway interchange locations, or roadways that provide access to large commercial businesses or industrial facilities.

7.3. Complete Streets

Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. A Complete Streets approach integrates people and place in the planning, design, construction, operation, and maintenance of our transportation networks. This helps to ensure streets are safe for people of all ages and abilities, balance the needs of different modes, and support local land uses, economies, cultures, and natural environments (Source: *www.smartgrowthamerica.org*). The MOVEBR Program has developed design guidelines that aim to institutionalize the Complete Streets policy by accommodating pedestrians, bicyclists, and transit users, regardless of age and ability. The intent is to improve mobility for all modes of transportation to the extent practical and feasible to do so.

7.3.1. Pedestrian Facility Design

Sidewalks should provide adequate space for anticipated demand. Anticipated demand can be estimated by observing current pedestrian activity, current and planned land use, and context. The likelihood of people walking in urban areas is higher than suburban areas and the likelihood of people walking along roadways in suburban areas is higher than rural areas. In other words, the higher the pedestrian demand, the wider the sidewalk may need to be to accommodate it. However, the Designer should assess each project and determine the appropriate width. Consideration of spot locations where utility conflicts may exist and are not avoidable will be considered on a case-by-case basis. However, if the minimums specified in the design guidelines cannot be met, justification shall be provided in the Project Design Report. In any case, sidewalk widths must meet the minimum requirements established.

Sidewalks on all projects shall be compliant with the Public Rights-of-Way Accessibility Guidelines (PROWAG) to ensure access to the built environment for people with disabilities. PROWAG establishes design requirements for the construction and alteration of facilities subject to the law. These enforceable standards apply to places of public accommodation, commercial facilities, and state and local government facilities (Source: *www.access-board.gov*). LADOTD's PED-01 includes specific details of intersection treatments for visually and mobility impaired persons.

Crosswalks should also be provided at regular intervals. Crosswalks designate space for pedestrians so motorists can anticipate crossing activity. All crosswalks installed must meet the requirements in the Manual on Uniform Traffic Control Devices (MUTCD). High visibility crosswalks enhance safety for pedestrians crossing the roadway and are desirable at all non-stop controlled crossings. Midblock crossings may be considered on a project-by-project basis. Refer to the C-P DPW Standard Plans for additional details on crosswalk design.

7.3.2. Americans with Disabilities Act (ADA)

The ADA ensures access to the built environment for people with disabilities. The ADA Standards establish design requirements for the construction and alteration of facilities subject to the law. These enforceable standards apply to places of public accommodation, commercial facilities, and state and local government facilities (Source: *www.access-board.gov*).

The LADOTD ADA Transition Plan and EBR ADA Transition Plan should be referenced for any existing deficiencies already identified. It is envisioned that within the limits of all MOVEBR projects, any existing deficiencies are addressed and include ADA accommodations to the fullest extent possible, including but not limited to the following strategies:

a. Connectivity improvements between segments

b. Accessible Pedestrian Signals that include audible cues;

c. No right turns on red;

d. Curb cuts that align with the marked crosswalk (as opposed to those directed towards the middle of the intersection);

e. Truncated domes or other tactile warning devices;

f. Proper drainage design to eliminate puddling of water at the ADA ramp and crosswalk;

g. High visibility crosswalk markings; and

h. Bus stop landings that are accessible and connected to the sidewalk.

Designers shall use PROWAG and ADAAG when determining what accommodations will be provided in their projects. When there is conflicting or ambiguous guidance, PROWAG shall be used. LADOTD's PED-01 includes specific details of intersection treatments for visually and mobility impaired persons.

7.3.3. Bicycle Facility Design

Bicycle facilities should be designed with safety in mind. Depending on the context, traffic volume and speed of the adjacent travel way, the type and width of separation may change as shown in the chart below.

This information was considered in the development of the typical sections and the following bicycle facility recommendations:

1. Shared Lane or Bike Boulevard – shared lanes are created by road markings and are used to indicate shared use by vehicles and bicyclists. Shared lanes are not recommended for any MOVEBR project, unless traffic calming measures are implemented, and vehicle design speeds are 20 mph or lower.

2. On-Street Bike Lane (Buffer Preferred) – a portion of the roadway that has been designated by signs and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes do not include a physical barrier (e.g. bollards, medians, raised curbs) that restricts encroachments of motorized vehicles. Bike lanes are recommended for MOVEBR projects where vehicle design speeds are 30 mph or lower.

3. Separated Bike Lane or One-way Raised Cycle Track – a bicycle facility that is vertically separated from motor vehicle traffic. Direction of travel is always in the same direction as vehicular traffic. Furniture zones may buffer the cycle track from vehicular traffic or from sidewalks. One-way Raised Cycle Tracks are recommended for MOVEBR projects where vehicle design speeds exceed 30 mph.

7.3.4. Furniture Zones

Furniture zones are provided on urban and suburban streets to formally allocate space for Green Infrastructure, lighting, street furniture, or utilities. The furniture zone may also include, but are not limited to, one or a combination of the following features:

a. Bike racks

b. Park benches

c. Garbage receptacles

d. Mailboxes, magazine racks, or similar furniture

e. Utility poles, light poles, and traffic signalization poles

f. Landscaping

g. Certain Green Infrastructure practices (see Section 11: Green Infrastructure for more info)

h. Fire hydrants

i. Signs.

See Standard Typical Sections (Attachment G), Section 11: Green Infrastructure, and Section 12: Street Lighting for more detailed information. Street furniture shall be considered and approved on a case-by-case basis pending the context of the roadway and the approval of the C-P DTD. Designers should take care when dealing with placement of these furniture zone features regarding lateral offset requirements and potential conflicts such as tree roots, wiring for lighting, and subsurface drainage.

7.4. Design Guidelines

Roadway contextual and functional classifications have been determined for each of the projects in the MOVEBR Program as shown in table on the next pages. Using these classifications and state or local jurisdiction, the roadway design shall be in accordance with either the MOVEBR Design Guidelines or the LADOTD Minimum Design Standards.

The following table provides preferred guidelines for the design elements to be used on the C-P routes for each of the roadway classifications. Any design variations to these preferred guidelines will be in accordance with the most recently adopted version of AASHTO's *A Policy on Geometric Design of Highways and Streets* and Owner direction. Furthermore, all design variations must receive written approval from the MTC. All selected values for the design criteria shall be coordinated with the P-PM and documented in the Project Design Report in accordance with Section 1.3: Project Design Reports and Guideline Deviation Process for each MOVEBR project.

CITY OF BATON ROUGE/PARISH OF EAST BATON ROUGE ROADWAY DESIGN AND COMPLETE STREETS GUIDELINES

Item	Urban/Walkable 4-lane	Urban/Walkable 2-lane	Suburban 4-lane	Suburban 3-lane	Suburban 2-lane	Rural 2-lane
Mobility	Medium	Low	High	Medium	Medium	Medium
Access	Medium	High	Low	Medium	Medium	Medium
Design Speed[1] (mph)	30	25	40	35	30	40
Typical Design Vehicle[2]	SU	SU	WB-50	SU	SU	SU
Width of Travel Lanes (ft.)	10	10	11	11	11	11
Width of Shoulders (ft.) - (edge of travel lane to FOC)						
Inside (ft.)	1	NA	1	NA	NA	NA
Outside (ft.)	1 to 4	1 to 4	2 to 4	1 to 4	2 to 4	8 w/ rumble stripe
Lateral Offset[3] (ft.)						
Non-Tangent Sections (ft.)[4]	6	6	3	6	6	shoulder
Tangent Sections (ft.)[4]	4	4	3	4	4	
Clear Zone[5]	*Refer to Chapters 3 & 10 of AASHTO Roadside Design Guide*					
Width of Median (ft.)						
Raised (ft.) - w/ Approval	8	NA	28	12	NA	NA
Depressed (ft.) - "Green" Preferred	8	NA	28	-	NA	NA
TWLTL (ft.)	NA	NA	NA	12	NA	NA
Pavement Cross Slope[6] (%)	2	2	2.5	2	2	2.5
Foreslope (max.)	4:1	4:1	4:1	4:1	4:1	4:1
Backslope (max.)	3:1	3:1	3:1	3:1	3:1	3:1
Pedestrian Facility (ft.)						
Furniture Zone (ft.) (from BOC)	6	6	6	6	6	-
Sidewalk[7] (ft.)	6	6	5	5	5	-
Bike Facility (ft.)						
Bike Lanes (ft.)	5	5	-	-	-	shoulder
Buffered Bike Lanes (ft.)	-	8	-	-	-	
Cycle Tracks - raised (ft.)	-	6.5	5	6.5	6.5	
Stopping Sight Distance (ft.)	200	155	305	250	200	305
Maximum Superelevation (%)	4	4	4	4	4	8
Minimum Radius (ft.)						
With Normal Crown (ft.)	343	204	791	527	343	5410
With Reverse Crown (ft.)	267	164	577	399	267	3133
With Full Superelevation	250	154	533	371	250	444
Maximum Longitudinal Grade (%)	5	5	5	5	5	5
Minimum Vertical Clearance						
Roadway	16.5	16.5	16.5	16.5	16.5	16.5
Pedestrian Bridge	20	20	20	20	20	20
Trails/Bikeway	12	12	12	12	12	12
Railroad	*See LADOTD Bridge Design and Evaluation Manual for Guidance*					

[1] Design Speeds were set to target lower speeds for improved ped/bike safety and mobility

[2] When SU is standard design vehicle, consideration shall be given for a firetruck (see Section 7.2.5) at intersections and U-turns. Actual Design Vehicle to be determined on case by case basis related to classification counts

[3] Measured from Face of Curb or Shoulder

[4] Values shown are preferred values; absolute minimum value allowed is 1.5 ft.

[5] When clear-zone distances suggested in Table 3-1 of AASHTO Roadside Design Guide cannot be provided on curbed roadways, fixed objects shall be placed as far from travel way as practical, but no closer than the required lateral offset

[6] State routes require 2.5% cross slope in all cases

[7] If adjacent to curb (no furniture zone), add 2 ft. to required sidewalk width

Figure 7-8: Road Design and Complete Streets Guidelines

The design elements to be used on State Routes shall follow the latest version of the LADOTD Design Guidelines. Any exceptions to these preferred guidelines will be in accordance with the latest adopted version of AASHTO's *A Policy on Geometric Design of Highways and Streets* and DTD direction, and receive written concurrence from the MTC. All selected values for the design criteria shall be coordinated with the LADOTD Project Coordinator and P-PM and documented in the Design Report provided by LADOTD.

7.5. Standard Typical Sections

Using the design guidelines framework described, standard typical sections were developed to identify minimum design criteria and elements to be included in all MOVEBR projects. Full exhibits of each standard typical section can be found in Attachment G. The typical sections were established with ideal conditions in mind and the Designer is expected to use engineering judgement when deviating from the typical section. However, if any design criteria minimums are not met or any design elements are not included in a project, the Designer shall provide written justification and state reason(s) for not meeting each minimum or excluding each design element. This will be included in the Project Design Report (see Section 1.3: Project Design Reports and Guideline Deviation Process). The following typical sections were developed:

1. Urban/Walkable 4-lane
2. Urban/Walkable 2-lane, Option 1 (On-Street Parking with Protected Bike Lane)
3. Urban/Walkable 2-lane, Option 2 (On-Street Parking with Buffered Bike Lane)
4. Suburban 4-lane, Option 1 (Reverse Crown, Median Bioswale)
5. Suburban 4-lane, Option 2 (Normal Crown, Wet Retention)
6. Suburban 3-lane
7. Suburban 2-lane
8. Rural 2-lane

1. Urban/Walkable 4-lane

The Urban/Walkable 4-lane section depicts a street with dense mixed land development uses and shallow building setbacks. High-speed movement of motorized vehicles is discouraged on this facility type and an emphasis on safety is a key focus for non-motorized users such as pedestrians, bicyclists, wheelchair users, or transit users.

Crosswalks should be provided across at street crossings. Crosswalks located at non-stop controlled location shall be marked with a high-visibility material and pattern. In addition, hybrid beacons, rapid flash beacons, medians, and other safety counter-measures suggested in the NACTO *Urban Street Design Guide* and FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* should be considered by the Designer at these locations. Due to the lower desired vehicle operating speed of 30 mph, lane widths are narrow, bikes are accommodated by a raised separation adjacent to the street, and high pedestrian activity is accommodated by wide sidewalks. Street trees and lighting should be provided in the furniture zone and care should be taken when determining space allocation requirements. The furniture zone may also include but are not limited to bike racks, park benches, garbage receptacles, planter boxes/rain gardens, fire hydrants, or signs. On-street parking can be provided intermittently by reducing the furniture zone and median widths. It is recommended that on-street parking be prohibited within sight lines of intersections. Curb extensions are recommended at intersections to enhance visibility of people walking or wheeling across the street as well as to implement traffic calming measures that support lower desired vehicle operating speeds.

2. Urban/Walkable 2-lane (Options 1 and 2)

The Urban/Walkable 2-lane section depicts a street with dense mixed land development uses and shallow building setbacks. Very little of this land use currently exists in the Baton Rouge area with the exception of the Central Business District and a few developments scattered across the Parish. However, the UDC provides geographical boundaries of urban overlay districts and as redevelopment occurs, this type of land use is anticipated to be more prominent in the future. High-speed movement of motorized vehicles, transit, and on-street parking is discouraged on this facility type and an emphasis on safety is a key focus for non-motorized users such as pedestrians, bicyclists, or wheelchair users. Crosswalks should be installed on every urban block. Crosswalks located at non-stop controlled location shall be marked with a high-visibility material and pattern. In addition, hybrid beacons, rapid flash beacons, medians, and other safety counter-measures suggested in the NACTO *Urban Street Design Guide* and FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* should be considered by the Designer at these locations. Due to the lower desired vehicle operating speed of 25 mph, lane widths are narrow, bikes are accommodated on-street, and high pedestrian activity is accommodated by wide sidewalks. Street trees and roadway lighting should be provided in the furniture zone and care should be taken when determining space allocation requirements. The furniture zone may also include but are not limited to bike racks, park benches, garbage receptacles, planter boxes/rain gardens, fire hydrants, or signs.

3. Suburban 2-lane

The Suburban 2-lane section depicts a street with low to medium land development density and deep building setbacks. Vehicular operating speeds of 30 mph provide a safer travel environment for non-motorized users. Crosswalks should be spaced at ¼ mile

minimum. Crosswalks located at non-stop controlled locations shall be marked with a high-visibility material and pattern. In addition, hybrid beacons, rapid flash beacons, medians, and other safety counter-measures suggested in the NACTO *Urban Street Design Guide* and FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* should be considered by the Designer at these locations. Street trees and lighting should be provided in the furniture zone and care should be taken when determining space allocation requirements. The furniture zone may also include but are not limited to bike racks, park benches, garbage receptacles, planter boxes/rain gardens, fire hydrants, or signs.

4. Suburban 3-lane

The Suburban 3-lane section depicts a street with low to medium land development density and deep building setbacks. This type of facility is commonly found in mixed residential/commercial areas. Moderate vehicular operating speeds of 35 mph require more separation for non-motorized users. The continuous two-way left-turn lane promotes greater vehicular mobility by separating left-turning traffic from through movements. Crosswalks should be spaced at a minimum of ¼ mile. Crosswalks located at non-stop controlled locations shall be marked with a high-visibility material and pattern. In addition, hybrid beacons, rapid flash beacons, medians, and other safety counter-measures suggested in the NACTO *Urban Street Design Guide* and FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* should be considered by the Designer at these locations. Street trees and lighting should be provided in the furniture zone and care should be taken when determining space allocation requirements. The furniture zone may also include but are not limited to bike racks, park benches, garbage receptacles, planter boxes/rain gardens, fire hydrants, or signs.

5. Suburban 4-lane (Options 1 and 2)

The Suburban 4-lane section depicts a street with low to medium land development density and deep building setbacks. This type of facility is commonly found in commercial areas. Higher vehicular operating speeds of 40 mph require more separation for non-motorized users. The median section between opposing travel lanes enhances safety by creating separation for opposing traffic, a refuge space for non-motorized users wishing to cross the street, and increased potential for Green Infrastructure to help with drainage concerns. Crosswalks should be spaced at a minimum of ¼ mile. Crosswalks located at non-stop controlled locations shall be marked with a high-visibility material and pattern. In addition, hybrid beacons, rapid flash beacons, medians, and other safety counter-measures suggested in the NACTO *Urban Street Design Guide* and FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* should be considered by the Designer at these locations. Street trees and lighting should be provided in the furniture zone and care should be taken when determining space allocation requirements. The furniture zone may also include but are not limited to bike racks, park benches, garbage receptacles, planter boxes/rain gardens, fire hydrants, or signs.

6. Rural 2-lane

The Rural 2-lane section depicts a roadway with low land development density and deep building setbacks. Higher vehicular target speeds of 40 mph or more require more separation for non-motorized users. The 8-foot shoulder with intermittent rumble stripes provides a buffered space for bicyclists and an audible cue for drivers that inadvertently leave the travel lane. Due to the low likelihood of high pedestrian activity, sidewalks are not typically recommended but may be considered on a case-by-case basis. Fixed objects, including trees, should be removed from the clear zone to provide adequate sight lines and improve driver safety. (see AASHTO Roadside Design Guide for additional information).

7.6. Horizontal Alignment

Horizontal alignments should be as consistent and direct as possible while accounting for adjacent property and community value preservation. Horizontal curves shall be utilized for all deflections in horizontal alignments. Minimum radii will be in accordance with the Road Design and Complete Streets Guideline Table shown in Section 7.4: Design Guidelines for all C-P routes.

Designers should attempt to provide minimum horizontal curve lengths of at least 500 ft. where possible.

Required lane width transitions for all roadways will be calculated based upon the following formulas:

$L = (w)\ (s)$, for design speeds ≥ 45 mph

$L = \frac{(w)\ (s)^2}{60}$, for design speeds < 45 mph

Where: L = Taper Length (ft.)
w = width of widening (ft.),
s = design speed (mph).

Required shoulder width transitions for all roadways will be 1/3 of the length (L) calculated for lane width transitions in the above formulas.

It is preferred that the transitions in number of lanes should be accomplished using reverse curves with degrees of curvature appropriate for the design speed of the roadway. These lengths should be approximately equal to the lengths calculated using the formulas shown for lane width transitions. It is acceptable to use straight line tapers in lieu of reverse curves for C-P routes only.

This criterion also applies if widening is required for development of left turns at intersections. Straight-line tapers are used to develop left turns once full widening is obtained. The taper rate should be between 8:1 and 15:1 for design speeds of 30 mph and 50 mph, respectively. Right turn lanes are generally developed using straight line tapers at the 8:1 and 15:1 ratio criterion. Turn lane storage lengths should be provided to accommodate the number of vehicles likely to accumulate during the critical period without blocking through lanes as determined by traffic analysis. Turn lane storage length shall be determined as described in Section 6: Traffic Operations and Design.

Straight-line tapers are preferred for lane drop situations. Lane drop transition lengths shall be as calculated for lane width transitions above.

7.7. Vertical Alignment

The vertical alignment should be designed in concert with the horizontal alignment and consistent with the existing topography. The Designer should strive for a balance between cut and fill quantities while also taking into consideration factors such as sequence of construction, maintenance of traffic, and ROW impacts.

The maximum allowable grades for the selected design speed are shown in the C-P and LADOTD design standards. The minimum grade for curbed roadways is 0.4 %, and a 0.0 % grade is allowed for uncurbed roadways. In superelevation transition areas, gutter and edge of pavement elevations should be checked to ensure a gutter grade of 0.4% is provided for curbed roadways and a 0.2% is provided for uncurbed roadways. The Designer should refer to Chapter 3 of the latest edition of AASHTO's *A Policy on Geometric Design of Highways and Streets* for more on the effective maximum relative gradient.

Symmetric parabolic vertical curves are to be used at vertical alignment deflections. Design controls for crest and sag curve are based upon stopping sight distance. The length of vertical curve is calculated as L=KA, where K is the rate of vertical curvature and A is the algebraic difference in the grades. The values of K for both crest and sag curves can be found in the latest edition of AASHTO's *A Policy on Geometric Design of Highways and Streets.*

The minimum length of vertical curve shall be equal to L_{min} = 3v, where v is the design speed in mph. For appearance and site conditions longer curves should be provided. However, for curbed roadways, the curve length should not provide a K value that exceeds 167 in order to provide proper roadway drainage.

7.8. Superelevation

Urban roadways should normally be designed such that superelevation is not required, however if required, the maximum superelevation used for urban (or suburban) roadways

is 4.0%. Maximum superelevation for rural roadways is 8.0%. The total superelevation transition length is calculated using the formula:

$$L = \frac{(SC)\ (W)\ (\text{Lane Factor})}{(\text{Max. Relative Slope})}$$

Where SC is the total change in cross slope, W is the lane width. The lane factor and maximum relative slope are shown in the following tables.

Design Speed (mph)	Maximum Relative Slope
15	1:128
20	1:135
25	1:143
30	1:152
35	1:161
40	1:172

No. of Lanes Rotated	Lane Factor
1	1.00
1.5	1.25
2	1.50
2.5	1.75
3	2.00
3.5	2.25

Table 7-1: Maximum Relative Slope and Lane Factor Values for Superelevation

Generally, the rotation should be about the centerline or profile grade line, but the Designer should select the most appropriate point to provide the most pleasing and functional result. Vertical curve lengths of 100 ft. are used at all breaks in pavement edge profiles. Approximately 80% of the superelevation transition length should be placed on the tangent section preceding the curve.

7.9. Intersections

Intersection design should be in accordance with the latest edition of the AASHTO *A Policy on the Geometric Design of Highways and Streets*. Generally, major intersections should be designed for the typical design vehicle listed in the Road Design and Complete Streets Guidelines Table (Fig. 7-9), unless site conditions require the need for larger vehicles. Simple connections to local roads will be considered turnouts and designed in

accordance with the urban standards shown in Figure 6-5 of the LADOTD *Roadway Design Procedures and Details.*

Goals during intersection design include but are not limited to:

a. Reduce vehicle speeds

b. Provide appropriate number of lanes and lane assignments

c. Provide channelization that is intuitive to drivers

d. Provide accommodations for the design vehicles

e. Meet the needs of all road users, including pedestrians, bicyclists, and transit riders, where applicable

f. Provide appropriate sight distance and visibility for the design speed

Special attention should be given by the Designer to intersection grading, particularly at signalized intersections where the main street cross slope is maintained through the intersection. If not properly graded, the vehicles traveling on the cross street through the intersection on a green phase may experience an uncomfortable "ramping" experience. The intent should be to provide smoother grading at the intersection for driver comfort and safety, while still accommodating proper drainage.

Sight distance requirements at intersections will be in accordance the latest edition of the AASHTO *A Policy on the Geometric Design of Highways and Streets*. Intersections shall be checked for obstructions within the appropriate sight triangle based upon design speed and type of traffic control used at the intersection.

Median openings on State Routes shall be designed in accordance with LADOTD standards. The design of the median openings for the C-P routes will be based upon traffic volumes, roadway characteristics, and the type of turning vehicles. Designs shall meet the requirements of the Median Openings section of Chapter 9 of the AASHTO *A Policy on the Geometric Design of Highways and Streets*. Median openings should be provided at roadway intersections and major developments. At locations other than street intersections, median openings should be spaced no less than approximately 1,200 feet.

Driveways will be provided in accordance with the LADOTD Driveway Standards for State roadways and in accordance with the DPW Standards for C-P roadways. On high volume State roadways with frequent driveways, the Designer should consider providing radius designs similar to DPW Standards in lieu of driveway flares.

7.10. Reference Publications

a. AASHTO. (2018). *A Policy on Geometric Design of Highways and Streets, 7th Edition*. Washington, DC. American Association of State Highway Transportation Officials.

b. EBR C-P. (latest version). *Standard Plans*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

c. EBR C-P. (latest version). *Standard Specifications for Public Works Construction*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division

d. FHWA. (2018 or latest approved edition). *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations*. US Department of Transportation, Federal Highway Administration

e. FHWA. (2009 or latest approved edition). *Manual on Uniform Traffic Control Devices for Streets and Highways*. US Department of Transportation, Federal Highway Administration

f. ITE. (2016). *Traffic Engineering Handbook*. John Wiley and Sons Inc., Authors: Brian Wolshon and Anurag Pande.

g. LADOTD. (2009). *Roadway Design Procedures and Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Road Design Section. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Pages/Road-Design-Manual.aspx

h. LADOTD. (2017). *Minimum Design Guidelines*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Pages/Memoranda.aspx

i. LADOTD. (2015 or latest edition). *Traffic Signal Design Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

j. LADOTD. (latest version). *Standard Plans*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Standard_Plans/Pages/default.aspx?RootFolder=%2FInside%5FLaDOTD%2FDivisions%2FEngineering%2FStandard%5FPlans%2FStandard%20Plans%2FStandard%20Plans&FolderCTID=

0x012000759B9DC184A87A4E8BAEACED94697A67&View={6CA8D877-4BA0-45CA-83B0-350384A89137}

k. LADOTD. (2016). *Louisiana Standard Specifications for Roads and Bridges*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

l. LADOTD. (2010 or latest edition). *Traffic Control Standard, Number 18A, Traffic Signal Control System*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

m. LADOTD. (2019). *Typical Turn Lane Design Guideline*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Traffic_Engineering/Design%20Development/Typical%20Turn%20Lane%20Design.pdf

n. NACTO. (2014). *Urban Bikeway Design Guide*. New York, NY. National Associations of City Transportation Officials.

o. NACTO. (2013). *Urban Street Design Guide*. New York, NY. National Associations of City Transportation Officials.

p. TRB. (2016). *Highway Capacity Manual, 6th Edition*. Washington, DC. Transportation Research Board, National Research Council.

q. USAB. (latest edition). *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*. Washington, DC. U.S. Access Board. https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag

r. USAB. (2011 proposed guidelines - anticipated for adoption in near future). *Proposed Rights-of-Way Guidelines*. Washington, DC. U.S. Access Board. https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines

8 Hydrology and Hydraulics

8.1. General

The following is the hydrologic and hydraulic (H&H) design criteria and design guidelines. The H&H design of the drainage systems must account for site conditions. Design constraints, such as the depth of the outfall, existing land use, environmental issues, utility conflicts, and backwater flooding, may cause the Designer to adjust the design. The design objectives are: to maintain the existing flow pattern, to have a minimal impact on the drainage system, and to protect the infrastructure. The Designer shall investigate where potential opportunities exist for water quality measures and stormwater mitigation element incorporation, such as Green Infrastructure and/or detention basins.

In the MOVEBR Program, there are State Routes (LADOTD) and C-P routes. In general, the design criteria and design guidelines are the same; however, there are some differences in the methodology. For State Routes, Designer shall strictly follow the drainage design guidelines for LADOTD.

8.2. Hydrology and Discharge Calculations

8.2.1. Rainfall Data

For C-P and State Routes the LADOTD *2011 Hydraulics Manual* will be used for rainfall intensity and duration.

8.2.2. Peak Flow Calculations

8.2.2.1. C-P Routes:

a. Small drainage areas (1 acre or less), use 3.0 cfs / acre.

b. Areas from 1 to 300 acres, the Rational Method as defined in the LADOTD *2011 Hydraulics Manual* shall be utilized with the following requirements:

i Times of Concentration

1 Minimum Times of Concentration for Unimproved, Rural, and Low-Density Residential areas shall be 30 minutes

2 Minimum Times of Concentration for Business/Commercial areas shall be 20 minutes

3 For Projects that incorporate bioswales and other water quality enhancements an additional 5 minutes shall be added to the minimum Times of Concentration noted above

ii Runoff Coefficients, "C" (Considering Future Development)

1	Business:	Downtown Areas	0.9
		Neighborhood	0.7
2	Residential:	Single Family	0.4
		Multi-Family	0.6
		Apartments	0.7
3	Unimproved Areas:		0.3

c. Areas greater than 300 acres but less than 2000 acres, use the NRCS (SCS) method. Use the TR55 method to calculate the time of concentration (overland flow, shallow flow, and channel or pipe flow).

d. HEC-HMS will be used for areas greater than 2000 acres. East Baton Rouge Department of Public Works will provide a model, if available. If a new hydrological model is used, the unit hydrograph method and loss rate method must be approved by the PMT.

8.2.2.2. Green Infrastructure:

a. Green Infrastructure practices shall be designed to provide static storage for at least one inch of precipitation over the contributing impervious drainage area, or maximum extent practicable. This is calculated as follows:

i Static Storage Required (CF) = Impervious Drainage Area (SF) * (1.0 inch) * (1 foot/12 inches)

b. Static storage shall account for all void space within the various stormwater media and shall exclude storage above the overflow elevations. If soils do not allow for infiltration below the orifice outlet, static storage may not be accounted for below the orifice. Typical void space for the stormwater media are as follows:

i Stone – 40%

ii Sand – 30%

iii Soil – 20%

iv Pipe – 92%

c. In all cases, the Green Infrastructure practices shall be designed to safely convey or bypass the 10-year, NRCS Type II design storm and work as a system with the proposed or existing drainage system.

d. Each Green Infrastructure practice shall be considered offline from the proposed or existing drainage system. In the event that the Green Infrastructure practice is overwhelmed, clogged, or blocked, the inflow system shall also be designed as the outflow bypass into the drainage the system.

e. Green Infrastructure practices shall be designed to accommodate a drain-down time of 24 to 72 hours. Vegetated surface practices shall have a drain-down time of less than 24 hours and the entire system shall have a drain-down time of less than 72 hours. This drain-down time helps to ensure that the stormwater runoff has time to properly filter through the practice and that the volume is available for the next precipitation event. In addition, accounting for a maximum drain-down time of 72 hours helps to reduce public health concerns associated with standing water. Maximum surface ponding depths vary per practice.

8.2.2.3. State Routes:

a. The LADOTD *2011 Hydraulic Manual* will be used to compute peak flow.

b. Storm Sewer systems (urban design) uses the Rational Method.

c. Cross drains and bridges: for small drainage areas less than 2000 acres, use the NRCS (SCS) method; for areas greater than 2000 acres, use the USGS procedure.

8.3. Curb and Gutter with Subsurface Drainage System

The following requirements applies to both C-P and State Routes.

8.3.1. Design Storm Frequency

A 10-year design storm frequency shall be used except for C-P routes, when contributing inlet drainage areas are less than 1.0 acre a value of 3 cfs/acre shall be used. Since Green Infrastructure systems, if utilized, will connect to the subsurface drainage system, the above design storm criteria should be used in the design of Green Infrastructure systems. Refer to Section 11: Green Infrastructure for more information.

8.3.2. Inlet Spacing

To reduce the number of curb inlets, the over the curb drainage area should be limited to approximately 100 feet behind the curb. When the drainage area is greater than 100 feet behind the curb, try to capture stormwater behind the curb. A minimum longitudinal roadway slope for curbed roadways is 0.6% is desired and a minimum slope of 0.4% is required. Curb inlets shall be located as follows:

a. within 200 ft of a high point in grade

b. on the upstream side of intersections. The inlets shall be placed outside the radii of curb returns and upstream of pedestrian crossings.at all sag locations.

c. within 40 ft of the sag on arterial routes a flanker inlet shall be required

d. at locations upstream of driveways to minimize conflicts

e. upgrade of bridges

f. at all points where the roadway cross slope reverses from a negative to a positive on roadways requiring super elevation

No stormwater runoff shall be allowed to enter the roadway gutter from large impervious area outside the limits of the roadway ROW. This flow must be collected prior to the flow reaching the ROW. The allowable spread is half the width of the outside travel lane (typically 7.0 feet). A typical design for inlet spacing should have curb inlets on approximately 150 feet intervals but depends on site specific conditions.

Special attention should be given to the type and orientation of grating specified for grate inlets to be used in pedestrian and bike path and usage areas (refer to C-P Standard Plan No. 702-99).

8.3.3. Storm Drain Design

The outfall for a storm drain system is usually a cross drain structure or a bridge. The design water surface elevation for the storm drain system is for a 10-year discharge. The design water surface elevation shall be computed using normal depth calculations. The hydraulic grade line should be one foot or more below the gutter elevation and the hydraulic grade line will be shown on the plan / profile sheets.

The storm drain system design needs to be coordinated with the design of any Green Infrastructure systems (See Section 11: Green Infrastructure)

8.4. Cross Drain Structures

The following requirements applies to both C-P and State Routes.

a. Design Storm Frequency - A 50-year design storm frequency shall be used for all cross drains.

b. Allowable Headwater Elevation - The allowable headwater elevation is one foot below the outside edge of the travel lane or one foot below the gutter grade line. The allowable headwater elevation is a design guideline for selection of a size cross drain or for extending an existing cross drain. The hydraulic analysis of the drainage impact must also be considered in sizing a cross drain (see Drainage Design Impact Analysis).

c. Hydraulic Analysis - HEC-RAS will be used to model the existing and the proposed cross drains. The model reach should begin approximately 200 feet downstream of the cross drain and end approximately 200 feet upstream. The model should have a minimum of 4 cross sections downstream of the cross drain. The normal depth method shall be used as the downstream boundary condition.

d. Drainage Design Impact Analysis - Cross drain structures and bridges will be analyzed to determine the impact of the drainage design. The water surface profile for the existing and the proposed cross drain will be used to quantify the impact of the design. The design objective is to have a minimal impact on the drainage system. The Designer must consider the potential that exists to create an upstream or downstream drainage impact. Extending or replacing an existing cross drain with the same size structure will cause an upstream drainage impact. Increasing the size of an existing cross drain may cause a downstream drainage impact. When applicable, a ponding adjustment factor for ponding at the design point (Table 1.4 - LADOTD *2011 Hydraulic Manual*) should be applied to the peak discharge calculation. The ponding adjustment factor can be different for the design conditions.

The Designer shall evaluate the drainage impact of the proposed design. If the increase in the water surface elevation is contained within the channel, the impact of the design may be acceptable, however no significant increase in water surface is the goal. The Designer should consider the economic impact of the design based on the current land use. If the drainage impact of the design is unacceptable either upstream or downstream, drainage improvements to the outfall may be necessary. When the Designer recommends drainage improvements to an outfall channel beyond the ROW of the road project, the P-PM should be notified.

8.5. Hydraulic Design for Bridges

The following requirements applies to both C-P and State Routes.

a. Design Storm Frequency - The design storm frequencies used for bridges are 50-year and 100-year. The 50-year discharge will be used for the hydraulic analysis and hydraulic performance of the existing and the proposed bridge. The 100-year discharge will be used to determine the low chord elevation.

b. Allowable Head Loss - The head loss or differential head should be less than 0.5 feet. The allowable head loss is a design guideline. Other factors, such as the hydraulic performance of the existing bridge and the drainage impact analysis, should also be considered when the design of the bridge is based on the hydraulic performance.

c. Low Chord Elevation - The minimum low chord elevation should be 1.0 feet above the 50-year water surface elevation and at or above the 100-year water surface elevation. If the bridge is located in an area subject to backwater flooding, the low cord elevation should be at or above the 100-year flood elevation.

d. Bridge Channel Geometry - The channel cross section at the bridge should be a trapezoidal section with a bottom width approximately equal to the bottom with of the existing channel and side slopes of 3h to 1v or flatter. The bridge channel cross section should be stable. If the existing bridge has scour and bank erosion problem, the design of the bridge channel section should address this issue. In some cases, the channel geometry may determine the length of the bridge.

e. Scour Analysis - The scour analysis will use the overtopping discharge or the 500-year discharge. If the overtopping discharge is greater than the 500-year discharge, use the 500-year discharge. Pier and contraction scour will be computed in accordance with *Federal Highway Administration Hydraulic Engineering Circular No. 18* (HEC-18). *HEC-RAS*, using the WSPRO bridge routing, will be used to compute the scour. Bridge abutments will be protected with a flexible revetment. Abutment scour is not applicable. If the total computed scour

(pier scour + contraction scour) is less than 5.0 feet, use a minimum scour depth of 5.0 feet.

8.6. Minimum Road Grade

The following requirements applies to both C-P and State Routes.

The majority of the MOVEBR Projects are widening existing roads. Existing design constraints, such as intersecting roads and driveways, may control road grades. The FEMA Flood Base Flood Elevation, FEMA Flood Insurance Study and recorded inundation should be investigated. When practical, the minimum road grade should be the greater of 1.0 feet above the 50-year flood elevation or record inundation elevation. Projects in flood plains are to be analyzed for potential adverse upstream impacts when the proposed project will result in roadway elevation that is higher than existing ground elevation.

8.7. Detention

The following requirements applies to both C-P and State Routes.

Some projects may be selected to incorporate detention to mitigate any adverse additional runoff that the project creates due to increase of impervious surfaces. The detention goals will be scoped during preliminary design meetings based on project constraints, project's location within the watershed, and other objectives are also considered.

The following criteria will used on projects needing supporting detention calculations:

a. SCS based hydrograph methods will be used for detention calculations. Detention Analysis will be based on 10yr, 24-hr and 25yr 24-hr design events. A 100yr 24-hr storm routing will be required for evaluation of emergency weir design.

b. Detention calculations need to consider possible impacts of varying tailwater on the ponds control structure.

c. Any dry ponds should have min 3% bottom slopes and concrete flumes to facilitate properly draining pond to keep dry in between rain events.

d. Wet ponds are to be at least 5 ft. deep.

e. Pond side slopes above normal pool are to be no steeper than 4:1. Pond slopes below normal pool cannot be steeper than 2:1

f. Pond berms should not be located within overbank conveyance zones of streams that would result in adverse impacts to upstream properties.

g. Sufficient access servitudes and/or ROW should be provided to allow for access and maintenance of pond.

h. Emergency weirs are required to allow pond to accommodate 100yr design year event without water overtopping pond berm.

i. Detention ponds shall be designed to drain to full capacity within a maximum of 48 hours from the beginning of the storm event.

8.8. Fill Mitigation

The following requirements applies to both C-P and State Routes.

Some projects may be selected to incorporate fill mitigation to offset any additional fill that that would be placed in 100yr flood plain. The fill mitigation goals will be scoped during preliminary design meetings based on project constraints, project's location within the watershed, and other objectives are also considered.

The following criteria will used on projects needing supporting fill mitigation calculations:

a. Where lakes are excavated, the volume of dirt removed from below the normal pool level of the lake or normal pool of receiving stream cannot be credited as compensatory storage.

b. Compensatory storage credit must be hydraulically connected to floodplain.

c. When fill mitigation is achieved within the project limits, a before and after grading plan shall be provided to show floodplain storage for both before and post construction.

d. When fill mitigation is achieved by use of off-site excavation, calculations are required to show that the location of the excavation site relative to the project and within the watershed will not increase upstream calculated base flood elevation.

8.9. Specifications

C-P routes will use the East Baton Rouge Parish Standard Plans and Specifications

For State Routes:

a. Cross drain pipes and storm drains will be shown on plans as a storm drain pipe. Driveway culverts will be shown as side drain pipes.

b. Bedding and backfill will be in accordance with East Baton Rouge Parish DPW, Engineering Divisions Standard Plans 701-01. Bedding and backfill material shall not be a pay item. Bedding and backfill (no direct pay) shall be included with the unit cost for storm drain pipe and side drain pipe.

c. To reduce the chance of conflicts with utilities and to reduce the required ROW, curb inlets (single and double) will be shown as a special detail. East Baton Rouge Parish Department of Public Works Standard Plans numbers 702-03 and 702-04 will be used for the structural details. Grates, frames, and covers for catch basins and manholes shall use the LADOTD Standard Plan MC-01.

8.10. Reference Publications

a. EBR C-P. (latest version). *Standard Plans*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

b. EBR C-P. (latest version). *Standard Specifications for Public Works Construction*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division

c. FHWA. (2012). *Evaluating Scour at Bridges, Fifth Edition, HEC-18*. U.S. Department of Transportation, Federal Highway Administration.

d. LADOTD. (2011). *2011 Hydraulics Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Hydraulics Section.

e. LADOTD. (2009). *Roadway Design Procedures and Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Road Design Section. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Pages/Road-Design-Manual.aspx

f. LADOTD. (2015 or latest edition). *Traffic Signal Design Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

g. LADOTD. (latest version). *Standard Plans*. Baton Rouge, LA. Louisiana Department of Transportation and Development. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Standard_Plans/Pages/default.aspx?RootFolder=%2FInside%5FLaDOTD%2FDivisions%2FEngineering%2FStandard%5FPlans%2FStandard%20Plans%2FStandard%20Plans&FolderCTID=0x012000759B9DC184A87A4E8BAEACED94697A67&View={6CA8D877-4BA0-45CA-83B0-350384A89137}

h. LADOTD. (2016). *Louisiana Standard Specifications for Roads and Bridges*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

i. LADOTD. (2017 or latest version). *Bridge Design and Evaluation Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Bridge Design Section.

9 Construction Maintenance of Traffic

9.1. Temporary Traffic Control

The critical function of Temporary Traffic Control (TTC) is to provide for the reasonably safe and effective movement of road users (including pedestrians and bicycles) through or around construction work zones while reasonably protecting road users, workers, equipment, and emergency responders to traffic incidents. TTC will be in accordance with the latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways*. The latest Temporary Traffic Control Details from the LADOTD should be used for all projects on State Routes. Current C-P Traffic Control Standards will be used on C-P routes.

Proper design of work zone TTC should include the following principles:

a. Plan should provide safety for motorists, pedestrians, bicyclists, workers, equipment, and law enforcement/emergency responders.

b. Road user movement should be inhibited as little as practical.

c. Motorists, pedestrians, and bicyclists should be guided in a clear and distinct manner while approaching, traversing through, and leaving the TTC work zone.

d. Attention should be given to the maintenance of roadside safety during the varying sequence of construction.

9.2. Maintenance of Traffic

The sequence of Construction and Maintenance of Traffic plans should carefully consider both horizontal and vertical distances between existing travel lanes and proposed construction. Both impact constructability of the project as well as safety of the traveling public and construction workers. Typical cross sections should be shown to clearly indicate the proposed conditions.

Special consideration should be given to nearby facilities, such as schools, churches, etc., that cause special traffic generation.

For Portland Cement Concrete roadways, the sequence of construction drawings should consider the proposed joint locations. Therefore, Sequence of Construction Drawings should be superimposed on the Joint Layout Sheets.

If existing traffic signals are found to be in conflict with proposed roadway improvements, temporary traffic signals may need to be erected. Video detectors may also be required during construction in order to maintain proper operation of the signals. The contractor will be responsible for maintaining all traffic signal equipment during construction. If temporary traffic signals are necessary, temporary wooden signal poles will be allowed to be used.

Sequence of Construction plans should not be considered suggested and the plans shall include a note stating that contractors are not to deviate from the Sequence of Construction shown in the plans unless they receive written approval from the LADOTD or C-P DTD.

9.3. Sequence of Construction Plans

The Sequence of Construction/TTC plan describes the actions to be taken by the contractor to safely construct the roadway while minimizing traffic impacts and conveying traffic safely through a work zone. The plans may include, but are not limited to, general notes, phase notes, phase typical sections, phase plan sheets, temporary signalization plans, special details, and temporary cross sections.

Sequence of Construction/TTC plans are required on all road projects. The information provided on these plans may consist of nothing more than notes and references to the relevant Temporary Traffic Control Standard Details or may be as elaborate as detailed individual phase layouts using plan sheets and intersection layout sheets. Information must be provided to inform the contractor of the following:

a. location of the centerline, pavement edge, curb line, shoulder;

b. placement of temporary pavement markings;

c. lane configurations;

d. arrows are to be used to indicate traffic flow and direction;

e. temporary widening and/or diversions if required to maintain adequate width for traffic and provide sufficient work area;

f. required detour identification;

g. locations of work zone signs and any other temporary work zone traffic control devices (including changeable message signs, advanced warning arrow panels, barriers, crash cushions, temporary signals, etc.);

h. layouts and placement of channelizing devices;

i. work to be accomplished during the individual phases of construction;

j. lane closures, consideration of detours, and other restrictions that apply;

k. considerations for nighttime illumination of construction area;

l. regulatory speed limits for each phase;

m. project specific requirements such as school zones, railroads, waterborne vessels, etc.;

n. temporary signalization plans (if required); and

o. temporary drainage required to adequately drain the road and maintain existing offsite drainage during all construction phases.

The Designer should begin the sequence planning early enough to determine if additional ROW and/or temporary construction servitudes will be needed for construction. These needs shall be communicated with the P-PM and MOVEBR ROW Manager as early as possible.

9.4. Pedestrian Safety

The Designer should keep in mind with their design that the pedestrian traffic affected by TTC zones may vary in their makeup from young, elderly, and people with disabilities. Pedestrian specific traffic control devices and strategies are needed whenever sidewalks or travel paths are closed or disrupted by construction, maintenance, or utility operations. Temporary facilities shall be detectable and include accessibility features. These facilities and controls should direct pedestrian flow concisely and safely through or around the work zone.

Pedestrian Safety Considerations

a. Avoid pedestrian conflicts with work construction vehicles, equipment, and operations.

b. Avoid any direct conflicts with traffic flow through or around the work site.

c. Provide a safe, convenient travel path that mimics the most desirable characteristics of sidewalks or footpaths.

d. Provide pedestrians protection for potential injuries and a clearly defined travel path without unexpected changes.

9.5. Reference Publications

a. AASHTO. (2018). *A Policy on Geometric Design of Highways and Streets, 7th Edition*. Washington, DC. American Association of State Highway Transportation Officials.

b. AASHTO. (2011). *Roadside Design Guide, 4th edition*. Washington, DC. American Association of State Highway Transportation Officials.

c. EBR C-P. (latest version). *Standard Plans (905-01 – 905-30)*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

d. EBR C-P. (latest version). *Standard Specifications for Public Works Construction*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

e. FHWA. (2009 or latest approved edition). *Manual on Uniform Traffic Control Devices for Streets and Highways*. US Department of Transportation, Federal Highway Administration

f. LADOTD. (2009). *Roadway Design Procedures and Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Road Design Section. http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Pages/Road-Design-Manual.aspx

g. LADOTD. (latest version). *Temporary Traffic Control – Special Details Sheets TC00 – TC16*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

h. LADOTD. (2016). *Louisiana Standard Specifications for Roads and Bridges*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

10 Structural Design

10.1. Bridge Structures

The design specifications for MOVEBR projects are the AASHTO "LRFD Bridge Design Specifications, latest edition as implemented by LADOTD, with current interim specifications, the LADOTD Bridge Design and Evaluation Manual (BDEM), and other specifications listed below under Referenced Publications. The loading requirements, materials and required strengths for bridges designed for the MOVEBR are included the LADOTD BDEM. Construction specifications will be as per LADOTD Standard Specifications for State Highways and as per C-P Standard Specifications for C-P Roadways.

10.1.1. Bridge Types

Bridge types shall consist of cast-in-place concrete slab spans or precast prestressed quad beam or Louisiana Girders (LG's). Precast concrete slab bridges may be required on C-P bridges only. Steel girders could be used when bridges cannot meet design height restrictions with prior approval.

Design Criteria

a. Vehicle Live Load:

    i All C-P bridges shall be designed for the AASHTO Design Vehicular Live Load (HL-93). Consideration shall be given to use of LADV-11 for C-P bridges if the project route is designated as a truck permit route or has a high truck percentage. Final decision will be made by the DTD Chief Design and Construction Engineer.

    ii All State bridges shall be design for the Louisiana Design Vehicle Live Load 2011 (LADV-11).

    iii The use of the live load vehicle shall be indicated on the bridge general notes sheet under design criteria.

b. Bridge decks shall be cast-in-place reinforced concrete for all bridge girder type bridges with a minimum 8" concrete deck thickness.

c. Design criteria for railroad bridges or underpasses will be project specific and coordinated with railroad owner.

d. All bridges shall be designed for an additional 25 psf for a future 2" asphalt wearing surface overlay.

e. In accordance with LADOTD's BDEM, all bridge railings will meet AASHTO's MASH criteria.

f. For bridges with curbed roadway approaches and sidewalks, the curb and sidewalk shall be carried through the bridge and a crashworthy bridge barrier rail meeting NCHRP 350 or AASHTO MASH shall be used. If on a non-NHS route, a NCHRP 350 combination rail system may be used. LADOTD has a standard plan for this detail that can be used.

g. Bridge railings shall meet AASHTO MASH criteria and shall be either test level 3 (TL-3) F-shape, 32-inch height concrete barriers for all C-P bridges or test level 4 (TL-4), 36-inch height single slope concrete barriers for all state bridges. LADOTD has current standard plans on these MASH barriers.

h. For design speeds less than or equal to 45 mph, refer to LADOTD EDSM II.3.1.3 and II.3.1.4. LADOTD Standard Plans for MASH guardrail should utilized along with the LADOTD approved materials list (AML) for MASH end treatments for both State and C-P applications. The DOTD Bridge Design and Evaluation Manual, Part 2, Volume 4 also has a good safety section for guardrail that should be referenced. Revisions to the guardrail standards are also noted in LA DOTD Bridge Design Technical Memorandums should also be referenced.

i. Bridge substructure shall consist of reinforced concrete pile bents with precast prestressed concrete piles.

j. Approach slabs shall follow LADOTD standards as per the LADOTD BDEM, Part 2, Volume 1, 2.5.2.4 – Rideability.

10.1.2. Plan Preparation and Design

Bridge plan sheets are to be as shown in the LADOTD BDEM and are to be developed in accordance with the LADOTD BDEM except that since the MOVEBR Program has combined the process of preliminary and final plans, items normally required for preliminary plans will be developed at the 30% stage. Design normally required at 30% Final Plans will be required for the plan-in-hand submittal.

LADOTD standard plans and details will be used in the preparation of plans for MOVEBR bridge projects where appropriate. Discussion regarding stamping responsibility for use of LADOTD standard plans and details on non-State Routes and projects should be had during fee proposal scoping.

10.1.2.1. Additional Required Design Deliverables and Software:

a. LADOTD Bridge form for design criteria for each bridge project. See Chapter 3, Part I, LADOTD BDEM for form to use.

b. Software from LADOTD approved list as per the LADOTD Bridge Design QC-QA website.

c. Follow LADOTD BDEM, Part 1, Chapter 3 for QC/QA for Bridge Plans and Calculations

10.1.3. Bridge Load Ratings

The structural rating of bridges will be required as part of the bridge design scope of services. The ratings will be in accordance the LADOTD BDEM and by reference, AASHTO *The Manual for Bridge Evaluations*. A table as described in BDEM Part II.V5 Ch 6A1.1 is to be shown in general notes of plans.

Load ratings for each bridge are to use AASHTOWare Load rating software as required by LADOTD for state and non-state bridges unless software cannot rate a specific bridge type.

All as-designed load ratings shall be performed in accordance with LADOTD Bridge Design and Evaluation Manual, Part 2, Volume 5, Bridge Evaluation/Rating. Load rating calculations, rating summary sheet, software files, and QA/QC are to be documented and turned in as stated in this Section of the manual. If there is a change in the bridge design during construction based on shop drawings or plan changes, the as-built load rating should be updated and submitted also.

10.2. Miscellaneous Structures

Retaining wall standard details for heights up to 6 feet are available from LADOTD (RW-01) and C-P (601-01) Other cast-in-place retaining walls and Mechanically Stabilized Earth Walls (MSEW) should be designed in accordance with the latest edition, AASHTO LRFD Bridge Design Specifications, Section 11 and with LADOTD Geotechnical Design Section requirements. LADOTD Geotechnical Section maintains an approved MSE wall supplier list on their website under forms and downloads. The MSE Geotechnical Design guide 8 and retaining wall approval procedure is also shown on their website to be referenced.

10.3. Reference Publications

a. AASHTO. (2017 or latest edition adopted by LADOTD). *LRFD Bridge Design Specifications*. Washington, DC. American Association of State Highway and Transportation Officials.

b. AASHTO. (2018 or latest edition adopted by LADOTD). *The Manual for Bridge Evaluation*. Washington, DC. American Association of State Highway and Transportation Officials.

c. ACI. (2019). *ACI 318-19 Building Code Requirements for Structural Concrete and Commentary*. Farmington Hills, MI. American Concrete Institute.

d. AISC (2017). *Steel Construction Manual, 15th Edition*. Chicago, IL. American Institute of Steel Construction.

e. EBR C-P. (latest version). *Standard Specifications for Public Works Construction*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Department of Public Works Engineering Division.

f. LADOTD. (2017 or latest edition). *Bridge Design and Evaluation Manual*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Engineering Division, Bridge Design Section.

g. LADOTD. (1999). *Geotechnical Engineering Design Guide No. 8, Mechanically Stabilized Earth Wall (MSEW) Design Guide*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Pavement & Geotechnical Design.

h. LADOTD. (2016). *Standard Specifications for Roads and Bridges*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Engineering Division.

i. LADOTD. (latest version). *Bridge Design Standard Plans and Special Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

j. LADOTD. (latest version). *Hydraulic Special Details*. Baton Rouge, LA. Louisiana Department of Transportation and Development.

k. LADOTD. (latest versions). *Bridge Design Technical Memoranda*. Baton Rouge, LA. Louisiana Department of Transportation and Development, Bridge Design Section.

11 Green Infrastructure

11.1. Overview

Green infrastructure is a resilient approach to managing stormwater runoff that aims to protect, restore, and mimic the natural water cycle. Green Infrastructure employs vegetated, nature-based practices that are engineered to increase infiltration, evapotranspiration and transpiration to enhance water quality. The traditional approach to stormwater management focuses on collecting stormwater runoff in a closed pipe network and conveying it away from developed areas to be managed elsewhere. Conversely, Green Infrastructure aims to treat stormwater as a resource and to manage stormwater runoff at its source with vegetated practices and storage systems. In this way, Green Infrastructure provides social and environmental benefits beyond stormwater management, such as improved air and water quality, improved habitat, reduced surface temperature and urban heat island effect, and improved health outcomes. In addition, Green Infrastructure can be used to optimize the storage capacity of existing infrastructure, while providing an amenity with aesthetic value.

As part of the project delivery process, a diverse group of planners and engineers were consulted, including the PMT and associated experts, BREC, and Baton Rouge Green, to develop guidance on Green Infrastructure uses and installation. The *EBR Stormwater Drainage Masterplan and Stormwater Best Management Practices for East Baton Rouge Parish – Master Development Program* were also referenced during the development of this guidance.

11.2. Planning for Green Infrastructure

Planning for Green Infrastructure helps to identify and prioritize project opportunities, but also to identify potential stakeholders. As these projects are located within the public ROW, project stakeholders could include, but are not limited to, adjacent property owners, community groups and organizations, utility companies, other local or state agencies, and private organizations. Engaging these stakeholders early in the process will contribute to the long-term success of the systems and practices utilized throughout the life of the MOVEBR Program.

11.2.1. Planning Strategy and Approach

All planning efforts should be completed within the Design Study phase. The main objectives of the planning process are to identify and prioritize Green Infrastructure opportunity areas and stakeholders and to provide recommendations for Green Infrastructure implementation.

11.2.2. Planning Methodology

For every MOVEBR project, a planning level analysis shall be performed to determine the most effective area within the project limits to implement Green Infrastructure and to identify existing constraints that may impact the design. The selection and design of Green Infrastructure practices are dependent on the site-specific conditions, such as the underlying soil and water conditions, contributing drainage area, and site programming. An existing site analysis shall be performed as outlined below.

a. **Step 1: Perform Watershed Drainage Analysis**

A watershed drainage analysis shall be conducted using the GIS base map and template provided by the program manager. The drainage area for all street-based inlets within the proposed project limits should be delineated with polygons in GIS to identify the potential Green Infrastructure capture area. Note, when performing the watershed drainage analysis, off-street drainage should be considered with delineation of impervious and pervious areas. Impervious drainage areas that are less than 5,000 SF shall be documented but excluded from the balance of the analysis since it would be cost-prohibitive to manage these areas with Green Infrastructure.

b. **Step 2: Consider Longitudinal Slope of Roadway**

Green Infrastructure systems can be cost-prohibitive to construct on terrain with slopes that exceed 5%. For this reason, average roadway longitudinal slope shall be calculated for each inlet drainage area. Longitudinal roadway slopes that exceed 5% shall be documented but excluded from the balance of the analysis.

c. **Step 3: Identify Conceptual Green Infrastructure Footprint**

During this step, conceptual Green Infrastructure footprints are added to the GIS map. The following guidelines shall be used when siting Green Infrastructure systems:

i Green Infrastructure systems shall be sited within the sidewalk, roadway shoulder, roadway parking lane, or roadway median areas and placed directly upstream of existing inlets where feasible to maximize drainage capture. Footprints shall not extend into travel lanes.

ii Green Infrastructure systems shall consider the proximity to adjacent structures, foundations, utilities, streetlights, and other street furniture that will remain during construction. At a minimum, Green Infrastructure practices shall be sited at a horizontal distance of at least five (5) feet from adjacent structures, foundations, utilities, streetlights, and other street furniture.

iii The loading ratio, or ratio of contributing impervious drainage area to footprint area, is a critical component of Green Infrastructure design. Conceptual Green Infrastructure systems shall be designed for a loading ratio in the range of 10:1 – 25:1.

d. **Step 4: Perform Existing Site Review**

The existing site review includes both a site walk and desktop analysis. The site walk will help to confirm drainage boundaries and to identify any surface features that may indicate a conflict in the design phase. The site walk shall be documented with a photographic log and site notes.

The desktop analysis shall include a review of historic land uses, aerial photographs, historic maps, soil surveys, or other available information in areas considered for Green Infrastructure. If available, the existing site review shall also consider groundwater elevations in the proximity to the Green Infrastructure practices. Site history will be important in understanding the potential for soil and water contamination and infiltration.

e. **Step 5: Prioritize Green Infrastructure Systems**

Green Infrastructure opportunity areas shall be prioritized based on the following priority chart with highest priority given to the opportunity areas with the highest weighted score (i.e. scoring weight multiplied by priority value). For example, a drainage area of 13,000 SF would carry a weighted score of 0.60 because the scoring weight is 30% and medium priority drainage areas have a value of two.

Description	Scoring Weight	Lowest Priority (Value = 1)	Medium Priority (Value = 2)	Highest Priority (Value = 3)
Drainage Area	30%	5,000 SF - 10,000 SF	10,000 SF – 15,000 SF	>15,000 SF
Loading Ratio	40%	25:1-35:1	18:1 – 25:1	< 18:1
Street Slope	30%	4% - 5%	2% to 4%	< 2%

Table 11-1: Opportunity Priority Chart

11.2.3. Planning Phase Deliverables

The required deliverables for the planning phase are as follows:

a. GIS-based aerial map(s) of project limits with existing known utilities, inlets, street furniture, landscaping, building structures, and property lines shown with an overlay of potential Green Infrastructure opportunity footprint areas. A drainage area shall be delineated for each opportunity area with a breakdown of

impervious and pervious drainage area in square feet, potential footprint area, loading ratio, longitudinal street slope, and any other design considerations that shall be considered. An example planning phase map is provided below for reference.

b. Planning Study Report outlining project opportunities areas, existing site review results with photographic log, and prioritization chart for Green Infrastructure opportunity areas.

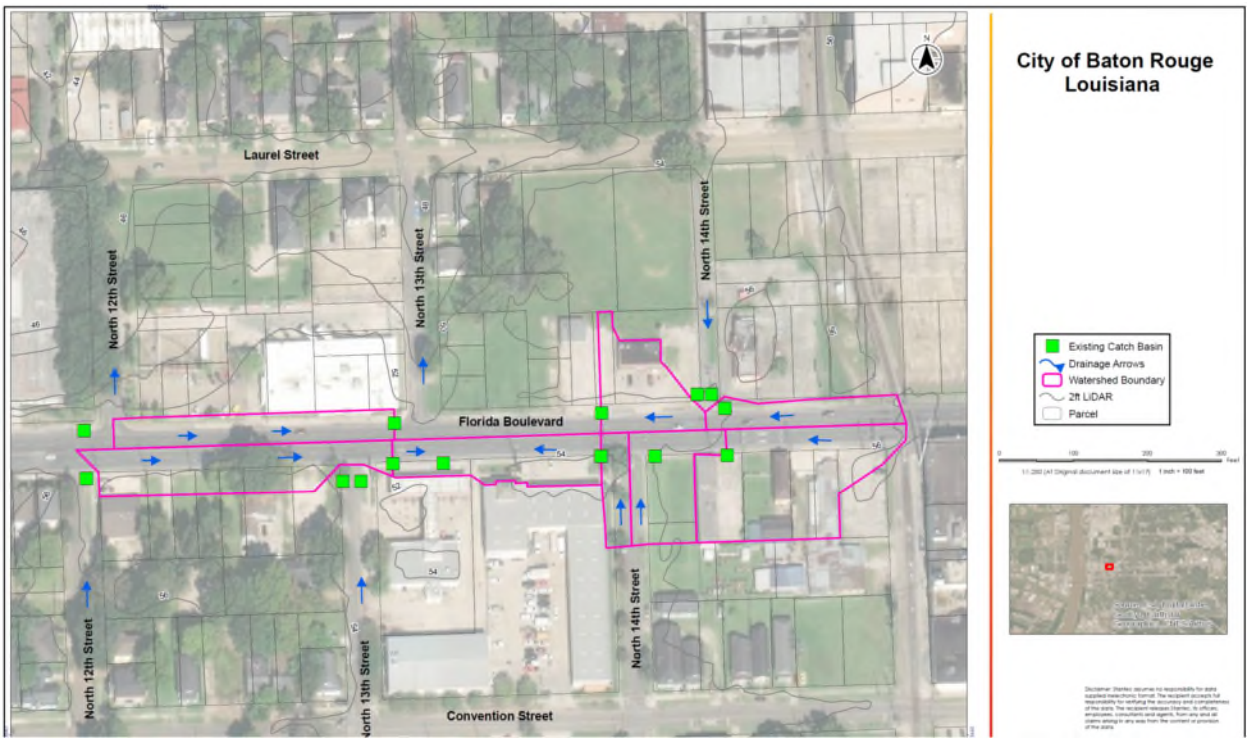


Figure 11-1: Planning Phase Map

11.3. Design of Green Infrastructure

During the final design phase, the Green Infrastructure opportunities that were identified during the design study/planning phase are further developed from conceptual (i.e. preliminary sketches) to final designs (i.e. construction documents). The main objectives of the design phase are to maximize drainage capture from impervious surfaces while balancing the project cost and goals. The final design phase starts with a detailed topographic survey and geotechnical investigation and ends with a set of fully developed construction documents. The design phase includes reviews at 30%, 60%, 90%, and is concluded with the 100% design submittal. This section starts with an overview of each Green Infrastructure typology and is followed by design methodology and project requirements for each phase of design.

11.3.1. Green Infrastructure System Overview

Below is an overview of the Green Infrastructure practices that have been pre-approved for the MOVEBR projects. Full exhibits of each Green Infrastructure system typology are included in Attachment H. The Designer is encouraged to consult the MOVEBR *Green Infrastructure Details and Siting Diagrams* as well.

11.3.1.1. Porous Pavement

Overview

Porous pavements are at-grade stormwater management systems that are designed to collect, treat, and temporarily store stormwater runoff. Porous paving systems provide the structural support of conventional pavement but are designed to allow stormwater runoff to infiltrate through the pavement and into a below-grade stone or soil storage basin. Once inside the stone storage basin, stormwater is detained and either infiltrated into the subgrade or slowly released back into the existing storm system after the peak of the storm has passed.

Porous pavement comes in a variety of materials including paver blocks, porous concrete, and porous asphalt. Porous pavement is typically not appropriate for travel lanes or surfaces with heavy vehicular traffic loads due to the subgrade preparation and smoothness required for travel lanes. As such, porous pavement shall be limited to the sidewalks and bike lanes. In a porous pavement system, the surface is restored to the same elevation such that the impact to the existing pavement and available programming space is minimal. For this reason, porous pavement may be a good option for areas with dense programming or where other Green Infrastructure practices are not feasible.

Siting Guidelines

Porous pavements can be installed in the sidewalks and bike lanes.

Benefits

a. Practice is below-grade and does not impact the primary use of the space.

b. Porous pavement systems are relatively shallow and may be ideal for areas with a high groundwater table or other limiting zone.

c. The system does not require an inlet as water flows freely through the surface.

Design Considerations

a. The design shall consider proximity to adjacent buildings and structures and shall include waterproofing where necessary.

b. Porous pavement systems shall be designed to maintain a loading ratio of 5:1 or less.

Figure 11-2: Porous Pavement Typology

11.3.1.2. Streetside Tree Trench

Overview

Streetside Tree Trenches are below-grade stormwater management systems that are designed to collect, treat, and temporarily store stormwater runoff. Stormwater runoff is directed to the practice through a new inlet. If a porous pavement surface is used over the streetside tree trench, stormwater runoff is also directed to the below-grade storage through the pavement surface that is situated directly above the trench. Once inside the practice, stormwater is detained and either infiltrated into the subgrade or slowly released back into the existing storm system after the peak of the storm has passed. The below-grade storage is comprised of clean-washed stone and an engineered soil media. The trench shall be designed to accommodate street trees to maximize benefits for the project. However, there may be instances where tree plantings are not feasible, which may include, but not necessarily limited to sight line obstructions, utility conflicts, and ROW constraints. Modular storage units are recommended for these trees as they provide the

structural support and open design that is ideal for larger soil volumes to support tree growth and to provide added water quality benefits.

Streetside tree trenches can be placed within the sidewalk along the roadway curbing or set back from the roadway to allow for a step-out zone or bike lane between the roadway and sidewalk areas. In a streetside tree trench, the surface is restored to the same elevation such that the impact to the existing pavement and available programming space is minimal. For this reason, a streetside tree trench may be a good option for an area with dense programming.

Siting Guidelines

a. Streetside tree trenches can be installed in the sidewalks and bike lanes.

b. Ideal location is directly upstream of an existing inlet.

Benefits

a. Practice is below-grade and does not impact the primary use of the space.

b. Provides aesthetic improvements to streetscape.

c. Provides habitat for wildlife.

d. Sequesters carbon and reduces urban heat island effect.

Design Considerations

a. The design shall consider proximity to adjacent buildings and structures and shall include waterproofing where necessary.

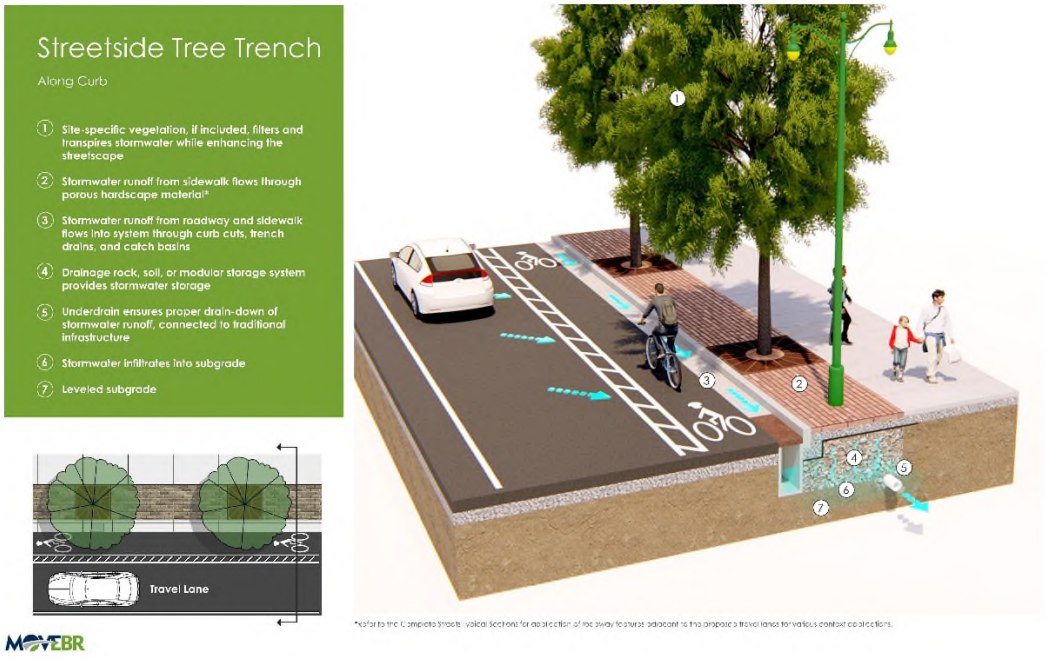
b. Streetside tree trenches shall be designed to maintain a loading ratio of 10:1 or less.

c. The design shall consider the width of the walkway and ensure that a minimum walking zone width of six feet is maintained at tree pit locations. The minimum tree pit area is four feet by four feet by three feet deep.

d. Tree pits shall be placed at least two feet from the face of curb for roadways with on-street parking to allow for a step-out area.

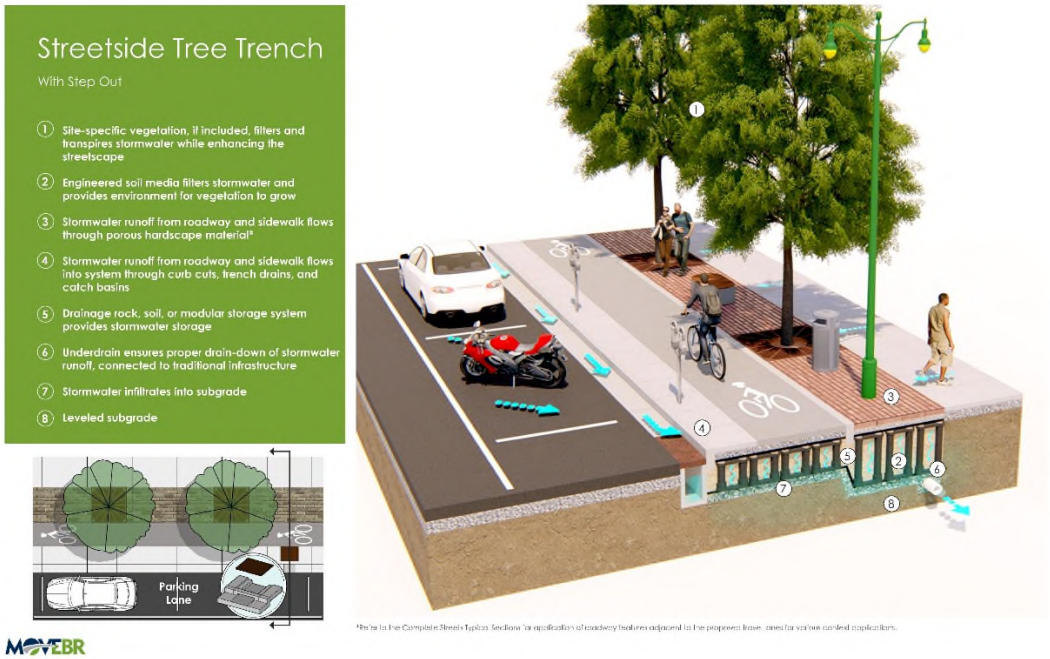
e. The landscape design shall consider vehicular sight distances at intersections and driveway locations.

f. Modular storage units are recommended to support tree growth.



*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

Figure 11-3: Streetside Tree Trench (along curb) Typology



*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

Figure 11-4: Streetside Tree Trench (with step out) Typology

11.3.1.3. Bioswale

Overview

Bioswales are linear vegetated stormwater management systems that are designed to collect, treat, convey, and temporarily store stormwater runoff. Bioswales consist of a vegetated swale drainage course with surface storage situated above a below-grade system of engineered soil media and stone storage. Stormwater runoff is directed to the surface of the practice through curb cuts, trench drains, inlets, or overland sheet flow. Once inside the practice, stormwater is filtered through the vegetation and engineered soil media and collected in the below-grade stone storage system. The stormwater is detained and either infiltrated into the subgrade or slowly released back into the existing storm system after the peak of the storm has passed. Check dams are recommended at intervals within the bioswale for longitudinal slopes greater than two percent to allow for water to slow down and to encourage infiltration along the length of the practice. Bioswales provide an aesthetic improvement to the middle or edge of the roadway.

Siting Guidelines

Bioswales shall be situated in roadway medians and/or along the edge of pavement.

Benefits

a. Provides aesthetic improvements to streetscape.

b. Provides habitat for wildlife.

c. Sequesters carbon and reduces urban heat island effect.

Design Considerations

a. Bioswales shall be designed to maintain a loading ratio of 25:1 or less.

b. The landscape design shall consider vehicular sight distances. In addition, the landscape design shall be set back from the roadway edge by at least five feet.

c. Bioswales with longitudinal slopes greater than two percent shall include check dams to encourage infiltration along the length of the practice.

d. Curb cuts shall be designed to reduce water from ponding within the travel lanes. They shall be placed at minimum every 25 feet along the length of the bioswale.

e. Median bioswales shall be designed to limit surface ponding to 12 inches.

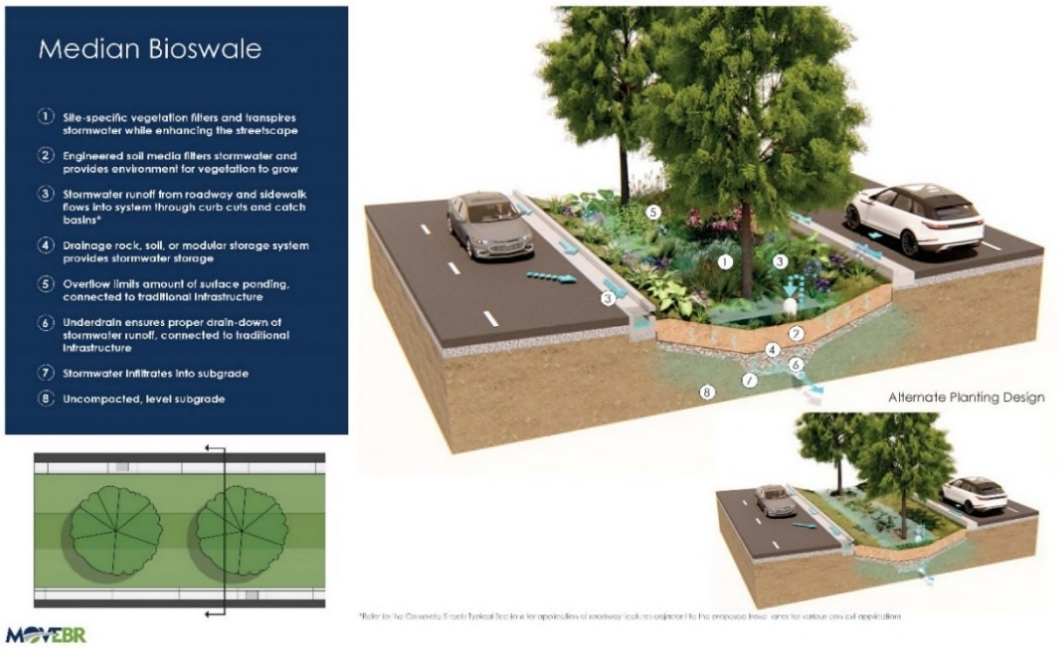


Figure 11-5: Median Bioswale Typology

Figure 11-6: Streetside Bioswale Typology

11.3.1.4. Grass Channels

Overview

Grass channels are linear, vegetated stormwater management systems that are designed to collect and convey stormwater runoff. Grass channels consist of a vegetated swale drainage course with surface storage, but do not have a subsurface filtration or storage component. For this reason, grass channels should be limited to applications where bioswales are infeasible due to subsurface conditions or site limitations only.

Stormwater runoff is directed to the surface of the practice through curb cuts, trench drains, inlets, or overland sheet flow. Check dams are recommended at intervals within the channel for longitudinal slopes that exceed two percent to allow for water to slow down and to encourage infiltration along the length of the practice.

Siting Guidelines

Grass channels shall be situated in roadway medians or along the roadside.

Benefits

a. Provides aesthetic improvements to streetscape.

b. Provides modest amount of runoff filtration and volume attenuation.

Design Considerations

a. Grass channels shall be designed to maintain a loading ratio of 25:1 or less.

b. The landscape design shall consider vehicular sight distances. In addition, the landscape design shall be set back from the roadway edge by at least five feet.

c. Grass channels shall include check dams for longitudinal slopes that exceed two percent to encourage infiltration along the length of the practice.

d. Curb cuts shall be designed to reduce water from ponding within the travel lanes. They shall be placed at minimum every 25 feet along the length of the grass channel.

Figure 11-7: Grass Channel Typology

11.3.1.5. Stormwater Planter

Overview

Stormwater planters are vegetated stormwater management systems that are designed to collect, treat, and temporarily store stormwater runoff. Stormwater planters consist of a contained vegetated system with surface storage over a below-grade system of engineered soil media and stone storage. Stormwater runoff is directed to the surface of the practice through curb cuts, trench drains, inlets, or overland sheet flow. Once inside the practice, stormwater is filtered through the vegetation and engineered soil media and collected in the below-grade stone storage system. The stormwater is detained and either infiltrated into the subgrade or slowly released back into the existing storm system after the peak of the storm has passed.

Stormwater planters can be placed within the sidewalk along the roadway curbing or set back from the roadway to allow for a step-out zone or bike lane between the roadway and sidewalk areas. Stormwater planters create a physical buffer between pedestrians and vehicular traffic which improves the pedestrian experience of the corridor. They also create an opportunity to provide landscaping beyond street trees.

Siting Guidelines

a. Stormwater planters can be installed in the furnishing zone of sidewalks.

b. Ideal location is directly upstream of an existing inlet.

Benefits

a. Provides aesthetic improvements to streetscape.

b. Provides habitat for wildlife.

c. Sequesters carbon and reduces urban heat island effect.

Design Considerations

a. The design shall consider proximity to adjacent buildings and structures and shall include waterproofing where necessary.

b. Stormwater planters shall be designed to maintain a loading ratio of 25:1 or less.

c. The design shall consider the width of the walkway and ensure that a minimum walking zone width of six feet is maintained at tree pit locations. In addition, the design shall account for periodic access from the street. The minimum planter width is four feet and the maximum planter length is 40 feet, with a minimum of four feet clear space between two adjacent planter systems.

d. Stormwater planters shall be placed at least two feet from the face of curb for roadways with on-street parking to allow for a step-out area.

e. The landscape design shall consider vehicular sight distances at intersections and driveway locations.

f. The top of the planting media in the stormwater planter shall be set at a level grade below the elevation of the adjacent sidewalk and roadway. The maximum depth of the curb extension, as measured from the adjacent pavement/walking surface to the top of the planting media shall not exceed 15 inches.

g. Stormwater planters shall be designed to allow for surface ponding in the range of six to 12 inches.

h. Stormwater planters shall be designed with a concrete edge barrier. Gaps of two inches in length, placed 10 feet on center, shall be placed along the concrete edge barrier from the sidewalk side to allow for drainage into the planter.

i. Where space allows, the concrete edge barrier can be replaced with 4H:1V side slopes.

Figure 11-8: Stormwater Planter (along curb) Typology

Figure 11-9: Stormwater Planter (with step out) Typology

11.3.1.6. Curb Extension

Overview

Curb extensions are vegetated stormwater management systems that are designed to collect, treat, and temporarily store stormwater runoff. Curb extensions consist of a contained vegetated system that protrudes into a parking lane or shoulder of a roadway and can also extend into the furnishing zone of the sidewalk. The practice consists of surface storage over a below-grade system of engineered soil media and stone storage. Stormwater runoff is directed to the surface of the practice through curb cuts, trench drains, inlets, or overland sheet flow. Once inside the practice, stormwater is filtered through the vegetation and engineered soil media and collected in the below-grade stone storage system. The stormwater is detained and either infiltrated into the subgrade or slowly released back into the existing storm system after the peak of the storm has passed. Curb extensions can be located at a corner or mid-block, depending on the site-specific configuration.

Siting Guidelines

a. Curb extensions are located within roadway parking lanes or shoulders and can extend into the furnishing zone of sidewalks.

b. Ideal location is directly upstream of an existing inlet.

Benefits

a. Provides aesthetic improvements to streetscape.

b. Provides habitat for wildlife.

c. Sequesters carbon and reduces urban heat island effect.

d. At pedestrian crossings, curb extensions can be used to narrow the roadway width. This encourages slower vehicular speeds and reduces the pedestrian crossing distance, thereby providing a safer crossing for pedestrians.

Design Considerations

a. The design shall consider proximity to adjacent buildings and structures and shall include waterproofing where necessary.

b. Curb extensions shall be designed to maintain a loading ratio of 25:1 or less.

c. The design shall consider the width of the walkway and ensure that a minimum walking zone width of six feet is maintained behind the curb extension.

d. Curb extensions shall extend six feet into the roadway and can extend into the furnishing zone of the adjacent sidewalk.

e. As curb extensions protrude into the roadway, a truck turning analysis shall be performed to confirm that turning maneuvers will not be adversely impacted with the design. Refer to Section 7 for more information related to design vehicles for this analysis.

f. The landscape design shall consider vehicular sight distances at intersections and driveway locations.

g. The top of the planting media in the curb extensions shall be set at a level grade below the elevation of the adjacent sidewalk and roadway. The maximum depth of the curb extension, as measured from the adjacent pavement/walking surface to the top of the planting media shall not exceed 15 inches.

h. Curb extensions shall be designed to allow for surface ponding in the range of six to 12 inches.

i. Curb extensions shall be designed with a concrete edge barrier. Gaps of two inches in length, placed 10 feet on center, shall be placed along the concrete edge barrier from the sidewalk side to allow for drainage into the planter.

j. Where space allows, the concrete edge barrier can be replaced with 4H:1V side slopes.

Figure 11-10: Curb Extension (mid-block) Typology

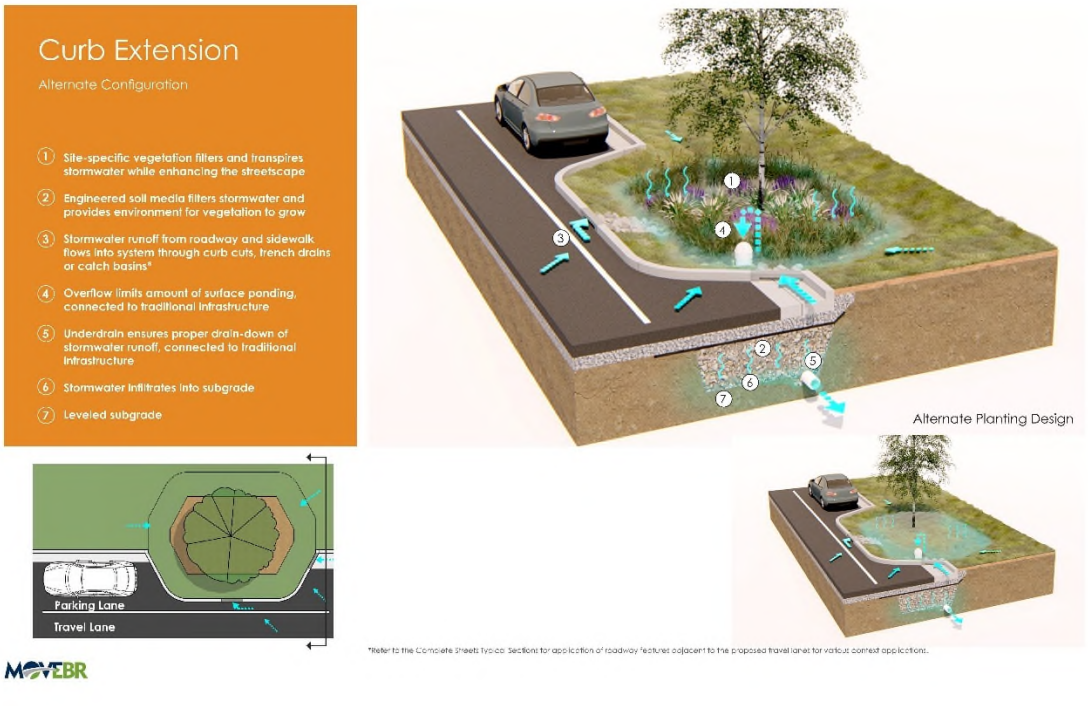


Figure 11-11: Curb Extension (Alt. Configuration) Typology

Figure 11-12: Curb Extension (corner) Typology

11.3.2. Green Infrastructure Typology

The MOVEBR program management team has developed the below guidelines for Green Infrastructure typology and placement based on the roadway contextual and functional classification identified in Section 7: Road Design and Complete Streets.

There may be several possible Green Infrastructure solutions that can be applied to the roadway section. Where practical, vegetated surface practices (median bioswales, stormwater planters, and curb extensions) shall be prioritized over subsurface practices (streetside tree trenches and porous pavement). Porous pavement as a standalone Green Infrastructure practice shall be given the lowest priority.

Roadway Classification	Recommended Green Infrastructure Practice Typology and Location							
	Sidewalk / Outside Edge of Roadway					Roadway Median		Parking Lane or Shoulder
	Porous Pavement	Streetside Tree Trench	Stormwater Planter	Streetside Bioswale	Grass Channel	Median Bioswale	Grass Channel	Curb Extension
Urban Walkable	•	•	•	•	•	•	•	•
Suburban	•	•	•	•	•	•	•	
Rural Town				•	•			

Table 11-2: Green Infrastructure Practice Typology and Location

11.3.3. Topographic Survey

A topographic survey shall be performed as outlined in Section 2: Corridor Survey. The topographic survey shall serve as the base file for all design work in this phase.

11.3.4. Geotechnical Investigation

A geotechnical investigation shall be performed as outlined in Section 5: Geotechnical Engineering. The geotechnical investigation report shall be reviewed to identify any potential water or soil conditions that could impact the Green Infrastructure design. This could include, but is not limited to, contamination issues, limiting zones such as a high groundwater table or unstable soil conditions, or soil characteristics as they relate to the potential for infiltration.

Where feasible, Green Infrastructure practices shall be designed to allow stormwater runoff to infiltrate into the ground and subgrade, effectively removing stormwater runoff from the storm system.

Green Infrastructure practices shall be designed for detention if the tested infiltration rate is less than 0.50 inches per hour, or as directed by a qualified Geotechnical Engineer. Further, a minimum vertical separation of two feet is required from the bottom of the system to any limiting zone such as a clay lens, or high groundwater condition.

11.3.5. Design Criteria

The following section outlines design criteria that shall be applied for Green Infrastructure designs.

11.3.5.1. Required Horizontal and Vertical Offsets

Green Infrastructure designs shall account for proper horizontal and vertical offsets to ensure that the practice is not situated within a structural-bearing plane. At a minimum, Green Infrastructure practices shall be sited at a horizontal distance of at least five feet from adjacent structures and shall include waterproofing measures when placed within a horizontal distance of 10 feet, with larger offsets used if warranted.

When placed adjacent to utility structures and mains, the Designer shall maintain a minimum horizontal offset of at least three feet and a vertical offset of at least 18 inches as measured from the outside edge of the utility to the Green Infrastructure practice, with larger offsets used if warranted. A minimum horizontal offset of five feet shall be maintained from all other street furniture that will remain, including light poles, utility poles, and traffic signals.

Streetside tree trenches and stormwater planters shall be placed at least 2 two feet from the face of curb for roadways with on-street parking to allow for a step-out area. In addition, the designs shall consider the width of the walkway and ensure that a minimum walking zone width of six feet is maintained at tree pit or planter locations. Refer to Section 7.4 for more information regarding walking zone widths.

11.3.5.2. System Footprint

Green Infrastructure design footprints shall be designed to meet the following loading ratios, or ratio of contributing impervious area to footprint area:

Green Infrastructure Typology	Maximum Loading Ratio
Porous Pavement	5:1
Streetside Tree Trench	10:1
Bioswale	25:1
Grass Channel	25:1
Stormwater Planter	25:1
Curb Extension	25:1

Table 11-3: Green Infrastructure Maximum Loading Ratios by Typology

11.3.5.3. System Depth

Green Infrastructure designs shall be designed with a maximum system depth, as measured from the most upstream point of the excavation to bottom of system, of six feet. The underdrain must be situated to provide gravity flow to the existing storm system.

11.3.5.4. Material Depths

A minimum of three feet of soil media is required within vegetated Green Infrastructure systems where trees are proposed. If trees are not included in the design, vegetated Green Infrastructure designs shall account for a minimum of two feet of soil media.

11.3.5.5. System Function

All systems shall be fitted with an underdrain of at least four inches in diameter, regardless if the system is designed for infiltration or detention. If the system is designed for infiltration, a cap can be placed on the end of the underdrain at its downstream connection to an existing inlet or junction box. This allows for the system to be modified over time if the system becomes clogged or is not infiltrating as designed.

11.3.5.6. Design Storm and Calculations

Refer to Section 8: Hydrology and Hydraulics for the design storm and calculation requirements.

11.4. Design Phase Scope of Work and Deliverables

The following section outlines the required Green Infrastructure deliverables for each stage of the project design. This is not an all-inclusive description of deliverables, but only deliverable requirements as it relates specifically to Green Infrastructure design.

11.4.1. 30% Design

At the initiation of the 30% design, the Designer shall coordinate with the P-PM to finalize the topographic survey and geotechnical investigation as it relates to the Green Infrastructure design. Once this work is complete, the Designer shall review the conceptual Green Infrastructure opportunity areas identified in the design study/planning phase and modify the designs, as needed, based on the topographic survey and geotechnical investigation.

11.4.2. 50% Hydraulic Submittal

From a Green Infrastructure design standpoint, the 50% design submittal shall include, at a minimum:

a. 50% Plans including a Site Plan, Design/ Utility Space Allocation Plan, and a Design Drainage Map.

    i The 50% Site Plan shall document the layout and materials for the proposed Green Infrastructure practice. The Site Plan shall document surface features only with horizontal offsets from existing surface features.

    ii The 50% Design/Utility Space Allocation Plan shall document all existing utilities, proposed Green Infrastructure layout and associated structures and piping, and the underdrain/overflow connection to the existing stormwater infrastructure. The plan notes shall document the design footprint and offsets from existing utilities. Utility conflicts shall be avoided wherever possible and shall be clearly identified on the plans and the Utility Conflict Matrix.

    iii The 50% Design Drainage Map shall document the delineated drainage area to the Green Infrastructure practice with a summary of system footprint and loading ratio.

b. 50% design calculations shall include drainage area, system footprint, loading ratio, storage volume, and storm sized managed.

c. Schematic-Level estimate of construction costs for the Green Infrastructure practice and associated site work.

11.4.3. 60% Design (Plan-In-Hand Submittal)

The 60% design submittal shall include revisions or corrections generated by any comments from the 30% design review and shall include, at a minimum:

a. 60% Plans including a Site Plan, Design/Utility Space Allocation Plan, Design Drainage Map, Grading Plan, Turning Analysis (for curb extensions only), Landscape Plan, and Construction Details.

    i The 60% Site Plan and Design/Utility Space Allocation Plan shall be updated with additional design information and include modifications from 50% submittal review comments.

    ii The 60% Grading Plan shall document existing and proposed spot elevations at all critical points, including, but not limited to, centerline, edge of parking lane, bottom and top of curb, top of soil, and sidewalk elevations on a grid with a maximum horizontal width of 25 feet.

iii The 60% Autoturn Analysis shall document existing and proposed surface design features, properly coordinated with proposed intersection controls from the striping and signing plan (i.e. stop sign, yield, or controlled intersection), lane designations (i.e. shoulder, parking lane, or travel lane), roadway classifications, direction of traffic, and critical design vehicle(s). The intent of this plan is to document that the proposed curb extension will not negatively impact the traffic patterns.

iv The 60% Landscape Plan shall document the proposed planting schedule, both in plan view and tabulation format.

v The 60% Design Drainage Map shall document the delineated drainage area to each inlet of the Green Infrastructure practice with a summary of system footprint and loading ratio.

vi The 60% Construction Details shall include details for all pertinent aspects of the Green Infrastructure construction and landscape design.

b. 60% design calculations and report to document inlet type and sizing, critical elevations that are used in design, drainage area, system footprint, loading ratio, storage volume, drain-down time, and storm size managed.

c. 60% Engineer's Opinion of Probable Construction Cost for the Green Infrastructure practice and associated site work.

Once approved by the PMT, the 60% design set shall be submitted to public utilities and agencies for review.

11.4.4. 90% Design (ACP Submittal)

The 90% design submittal shall include revisions or corrections generated by any comments from the 60% design, PIH meeting, and utility reviews and shall include, at a minimum:

d. 90% Plans including the Site Plan, Design/Utility Space Allocation Plan, Grading Plan, Turning Analysis (for curb extensions only), Landscape Plan, Design Drainage Map, and Construction Details updated with additional design information and any modifications from 60% submittal and PIH review comments.

e. 90% design calculations and report to document inlet type and sizing, critical elevations that are used in design, drainage area, system footprint, loading ratio, storage volume, drain-down time, and storm sized managed.

f. 90% Engineer's Opinion of Probable Construction Cost for the Green Infrastructure practice and associated site work. This will also include a complete breakdown of quantities per the standard pay items.

g. Project specifications or special provisions for Green Infrastructure system.

11.4.5. 100% Design (Final Plan Submittal)

The100% design submittal is the final submittal of all documents noted below:

a. Final Construction Documents including a Site Plan, Design/Utility Plan, Grading Plan, Turning Analysis (for curb extensions only), Landscape Plan, Design Drainage Map, and Construction Details.

b. Final Design calculations and report to document inlet type and sizing, critical elevations that are used in design, drainage area, system footprint, loading ratio, storage volume, drain-down time, and storm size managed.

c. Final Engineer's Opinion of Probable Construction costs for the Green Infrastructure practice and associated site work. This will also include the final breakdown of quantities per the standard pay items.

d. Final project specifications or special provisions for Green Infrastructure system.

11.5. Reference Publications

a. BR Green. *Baton Rouge Green's Tree Selection Guide for Urban and Suburban Landscapes*. Baton Rouge, LA. Baton Rouge Green. http://batonrougegreen.com/wp-content/uploads/2017/08/BRG-Tree-Selection-Guide.pdf

b. EBR C-P. *Code of Ordinances (Ord. No. 15933, § 1, 4-8-15)*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge. https://library.municode.com/la/baton_rouge,_east_baton_rouge_parish/codes/code_of_ordinances?nodeId=TIT2STALSIBASE_CH1GE_PTVCOST_S2_90COSTADCO

c. EBR C-P. (2019). *Unified Development Code*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Planning Commission. https://www.brla.gov/706/Unified-Development-Code

d. EBR C-P. (2018). *FUTUREBR, A Vision for East Baton Rouge Parish*. Baton Rouge, LA. City of Baton Rouge and Parish of East Baton Rouge, Planning Commission. https://www.brla.gov/662/FUTUREBR

e. EBR Bicycle and Pedestrian Masterplan and Safety Action Plan (anticipated fall 2019) http://ebrpedbike.org/

f. HNTB. (2018). *EBR Stormwater Masterplan Implementation Framework*. Baton Rouge, LA. HNTB Corporation. https://www.brla.gov/DocumentCenter/View/5357/Stormwater-Master-Plan-PDF

g. LaDOTD Complete Streets Policy (2016) http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Highway_Safety/Complete_Streets/Misc%20Documents/cs-la-dotpolicy.pdf

h. LaDOTD Minimum Design Guidelines (2017) http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Memoranda/Minimum%20Design%20Guidelines.pdf

i. LSU. (2005). *The Selection, Planting and Care of Urban Trees - Native Tree Growing Guide for Louisiana*. Baton Rouge, LA. Louisiana State University Agriculture Center. https://www.lsuagcenter.com/NR/rdonlyres/F5E6FA92-D84F-4716-9176-355A62765838/18167/pub2926NativeTreeGuide.pdf

j. NACTO. (2017). *Urban Street Stormwater Guide*. New York, NY. National Association of City Transportation Officials.

k. USAB. (latest edition). *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*. Washington, DC. U.S. Access Board. https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag

l. USAB. (2011 proposed guidelines - anticipated for adoption in near future). *Proposed Rights-of-Way Guidelines*. Washington, DC. U.S. Access Board. https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines

12 Street Lighting

12.1. Purpose

The intent of this design guideline is to give direction on design of safe roadway lighting for all users (pedestrians, bicyclists, motorists and transit riders of all ages and abilities) and to provide methods and values to compare existing and proposed lighting replacements. The Illuminating Engineering Society (IES) of North America provides recommended guidance on street lighting design in a document called Recommended Practice 8, Roadway Lighting (RP-8). The IES RP-8 is intended to provide guidance for designing new continuous lighting systems for roadways and streets; however, local agencies are not required to adopt IES recommended practices.

12.2. Backlight, Uplight, Glare Rating System

The IES, based on the luminaire classification system (LCS) infrastructure included in TM-15-11, uses the BUG (Backlight-Uplight-Glare) rating system. It provides a numerical rating of a luminaire based on the photometric distribution as tested by the manufacturer. The BUG rating system was proposed due to its availability to evaluate luminaire distributions in the context of the impact of light emitted in the various solid angles of the LCS as they apply to light trespass, skyglow and glare issues, and was intended to replace the IES vertical cutoff classification system.

The three components of BUG ratings are illustrated below:

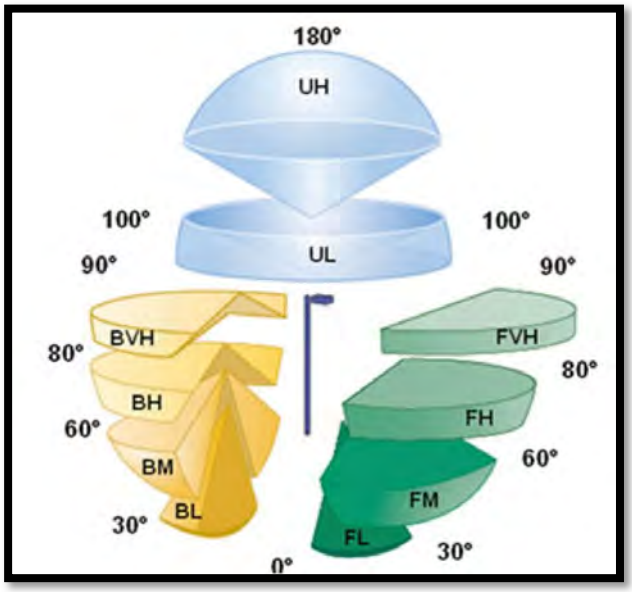


Figure 12-1: Components of BUG Rating System

Zone	Description
UH	Uplight High
UL	Uplight Low
BVH	Backlight Very High
BH	Backlight High
BM	Backlight Medium
BL	Backlight Low
FVH	Forward Light Very High
FH	Forward Light High
FM	Forward Light Medium
FL	Forward Light Low

Table 12-1: BUG Rating Zones

Backlight can create unwanted light trespass on adjacent sites. The B rating takes into account the amount of backlight in the low (BL), medium (BM), high (BH) and very high (BVH) zones, which are in the direction of the luminaire opposite from the area intended to be lighted. Uplight causes artificial sky glow. Lower uplight (UL) causes the most sky glow and negatively affects professional and academic astronomy. Upper uplight (UH) not reflected off a surface is mostly energy waste. The U rating defines the amount of light emitted into the upper hemisphere with greater concern for the light at or near the horizontal angles (UL). Glare can be distracting or even visually disabling. The G rating takes into account the amount of front light in the high (FH) and very high (FVH) zones and the amount of back light in the high (BH) and very high (BVH) zones.

A higher BUG rating means that more light is emitted in the higher solid angles and the allowable rating increases with higher lighting zones. This guide does not provide BUG limitations. The design guideline will specify recommended BUG rating requirements for particular installations. If an exception to the stipulated requirements is needed, the Designer will submit the calculations with a description of why the design exception is warranted.

12.3. Color Temperature

The LED color temperatures is required to be 4000K, and is based on visibility, matching existing installations, and preference. There have also been concerns from the medical community and LADOTD about the presence of blue wavelengths in higher color temperature light sources.

12.4. Uniformity & Veiling Luminance

Uniformity (maximum to minimum or average to minimum) goals exist for both the illuminance and luminance performance methods for new installations. A uniformity ratio (maximum to minimum) goal of eight is to be used for street classifications that do not have a higher goal, such as minor street with low pedestrian conflict area which has uniformity ratio (maximum to minimum) goal value of 10. Maximum uniformity ratio (maximum to minimum) takes precedence over average uniformity (average to minimum) because the value can be field verified.

Veiling luminance is a luminance that is superimposed on the retinal image which reduces its contrast. It is this veiling effect produced by bright sources or areas in the visual field that results in decreased visual performance and visibility. The veiling luminance ratio goals outlined in Table 3 in RP-8 is the maximum veiling luminance divided by the average luminance. Goals for this value range between 0.3 and 0.4.

Uniformity goals take precedence over veiling luminance ratio goals. Calculation results within 10% of the goal for Veiling Luminance are considered to meet the goal.

12.5. Light Loss Factors

The table below outlines the light loss factors recommended for all lighting calculations:

	Luminaire Dirt Depreciation	Luminaire Lumen Depreciation	Total Light Loss Factor
LED	0.9	0.85	0.765
HPS	0.9	0.9	0.81
LPS	0.9	0.85 (0.7 for 180W)	0.765 (0.63 for 180W)

Table 12-2: Light Loss Factors

12.6. Lighting Design Guide

Illuminance Method - Recommended Values						
Roadway & Pedestrian Conflict Area		Pavement Classification (Minimum Maintained Average Values)			Uniformity Ratio E_{avg}/E_{min}	Veiling Luminance Ratio $L_{v,max}/L_{avg}$
Road	Pedestrian Conflict Area	R1 lux/fc	R2 & R3 lux/fc	R4 lux/fc		
Major	High	12.0 / 1.2	17.0 / 1.7	15.0 / 1.5	3.0	0.3
	Medium	9.0 / 0.9	13.0 / 1.3	11.0 / 1.1	3.0	0.3
	Low	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	3.0	0.3
Collector	High	8.0 / 0.8	12.0 / 1.2	10.0 / 1.0	4.0	0.4
	Medium	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	4.0	0.4
	Low	4.0 / 0.4	6.0 / 0.6	5.0 / 0.5	4.0	0.4
Local	High	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	6.0	0.4
	Medium	5.0 / 0.5	7.0 / 0.7	6.0 / 0.6	6.0	0.4
	Low	3.0 / 0.3	4.0 / 0.4	4.0 / 0.4	6.0	0.4

Table 12-3: Design Guide (Source: RP-8 Table 3)

Straight Street				
	Average Luminance	Average Uniformity Ratio Lavg/Lmin	Max Uniformity Ratio Lmax/Lmin	Max Veiling Luminance RatioLV LVmax/Lavg
Local, low	0.3	6.0	10.0	0.4
Major, medium	0.9	3.0	8.0	0.3

Intersection		
	Average Illuminance	Eavg/Emin
Major/local, medium	2.0	3.0

Table 12-4: Design Guide (Source: RP-8 Table 9)

The summary standards below are generalized. Specific design circumstances may call for variations. All illumination designs must fall within guidelines established by IES/ANSI RP-8. See also AASHTO *Roadway Lighting Design Guide*. The Designer is required to check for local ordinances regarding illumination standards. Where local standards differ from this guide, the more stringent governs. If Interstate ramps include roundabouts, that portion of the illumination must comply with lighting for roundabouts.

a. Electrical Service shall be 120/240 volts, single phase, center grounded. 480 volts acceptable at interstate interchanges only (LADOTD standard voltage).

b. Voltage drops shall be limited to 5% maximum as measured form the furthest load to the point of service and 3% for individual circuits.

c. Light pole heights shall not exceed 30 feet

d. Lamp Lumens shall be 250-watt equivalent. The equivalent shall meet the nominal delivered lumens while reducing the wattage by a minimum of 50%.

e. Consideration shall be given to efficacy of the fixture over time in the environment it is to be installed in. A light loss factor of 0.85 should be used in all calculations.

f. Light fixtures shall include seven pins. The photocell pin shall be specified.

g. 20kVA surge suppressor shall be included in lighting system

12.7. Reference Publications

a. AASHTO. (2018). *Roadway Lighting Design Guide*. Washington, DC. American Association of State Highway Transportation Officials.

b. IES. (2018 or latest edition). *Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting (ANSI-IES RP-8-18)*. Illuminating Engineering Society.

c. IES. (2011 or latest edition). *TM-15-11 Luminaire Classification System for Outdoor Luminaires.* Illuminating Engineering Society.

13 ROW Surveying and Mapping

13.1. General

ROW survey and mapping services shall be performed in accordance with the MOVEBR *Right-of-Way Manual* except that ROW required for LADOTD State Routes shall conform to all principles and objectives set forth in the latest issue of LADOTD's Location and Survey Manual and currently acceptable surveying standards and methods as approved by the PMT. ROW recordation maps required for State Routes shall meet all the LADOTD format requirements.

13.2. Scope

Deed abstracts are obtained on all properties fronting on the proposed route prior to the engineering/surveying firms commencing work. The surveying firms shall utilize these deed abstracts to properly and accurately define the existing ROW lines. This phase of the ROW mapping process, the Existing Property Line Survey, is performed very early in the process; it is performed concurrently with the Design Study and Corridor Survey.

Once the Design Study is complete, the Designer may be authorized to begin development of the final construction plans. At this point in the design process, it is very important for the Designer to have full knowledge of the existing ROW lines. As the final alignment is adopted, special attention should be paid to the existing ROW lines such that wherever possible an existing ROW line can be held without creating required parcels that have a narrow width.

When the horizontal and vertical geometry have been established and reviewed, the Designer should begin the ROW mapping preparation. The Surveyor should first review the full abstracts that are provided by the PMT to confirm the accuracy of placement of existing property lines as well as depicting any existing easements noted in the abstract or reference maps.

13.3. Deliverables

In order to assist and expedite the appraisal process, the Designer shall provide the "Base Set" of ROW maps to the PMT in accordance with the Base Right-of-Way Map Checklists (Exhibit 5-1) of the Right-of-Way Manual. This set will first be submitted with all required items including the graphical taking lines and excluding the metes and bounds calls for review and checking by the PMT. Once the graphical taking lines have been approved, the Surveyor can proceed with completing the "Right of Way Acquisition Set", which includes the metes and bounds computations.

The acquisition set contains much more information than is typically included in a set of ROW maps. The purpose of this information is to provide tangible measuring points for the appraisers and agents to use in completing their work. The "Acquisition Set" also includes information from the construction plan regarding the roadway geometry and features for reference purposes while in the field so that the agents and appraisers do not have to carry both maps and construction plans to the field.

At the completion of the ROW mapping process, the Surveyor will deliver the "Recordation Set" of ROW maps to the PMT in accordance with the Acquisition & Recordation Right-of-way Checklist (Exhibit 5-2) of the Right-of-Way Manual. The purpose of creating the "Recordation Set" is to provide a permanent record in the courthouse that is consistent with the standards followed by other agencies. If the "Acquisition Set" were to be recorded, it may be difficult to read and understand due to the large volume of information it contains.

13.4. Reference Publications

a. LADOTD. (1987). Location and Survey Manual. Baton Rouge, LA. Louisiana Department of Transportation and Drainage, Location and Survey Section.

b. LADOTD. (2014). *Addendum "A" to the Location and Survey Manual, Property Surveys and Right-of-Way Maps*. Baton Rouge, LA. Louisiana Department of Transportation and Drainage, Location and Survey Section.

c. MOVEBR Program. (2019 or latest version) *ROW Manual*.

Attachment A
MOVEBR Program Design Report

Project Design Report

Date: _____

Project Information:

Project Name:	
C.P. Project No.	
State Project No.	
Route Type:	*Check all that apply:* ☐ C.P. Route ☐ State/Federal Route — *Intersects w/:* ☐ State/Federal Route ☐ Other MOVEBR Project ☐ Other Entity Project
Program Work Type:	*Check all that apply:* ☐ Capacity ☐ Corridor Enhancement ☐ Sidewalk ☐ ADA Compliance
Funding Sources:	*Check all that apply:* ☐ MOVEBR ☐ State ☐ Federal
Route Includes:	*As applicable:* ___No. of Bridges ___No. of Railroad Crossings ___No. of Intersections

Status: ☐ Preliminary ☐ Final ☐ Revised

Description of Project Improvements to be made:

Provide attachments if necessary

Design Variance Request Summary (see page 2):

Provide attachments if necessary

Summary of Challenge(s) to be Addressed:

Provide attachments if necessary

Complete Streets Accommodations:

Check all that apply:

☐ Pedestrians ☐ Bicyclists ☐ Transit Riders ☐ On-Street Parking

Explanation if any will not be accommodated:

Traffic and Safety:

Current Roadway ADT (Year)	
Design Roadway ADT (Year)	
K	
T	
TDDHV	
Total Average Calculated Delay/Day without Project?	
Pedestrian Activity (Low, Medium, High)	
Bicycle Activity (Low, Medium, High)	
History of Abnormal High Vehicle Crash Sections/Intersections?	
History of crashes with Pedestrians/Bicycles?	

Green Infrastructure Needs and Opportunities:

Summary Explanation:

Traffic Control/Constructability Considerations:

Summary Explanation (Provide attachments if necessary):

Recommended by:

Engineer of Record:	Company:
Signature:	Date:

MOVEBR Program Project Manager:	Company:
Signature:	Date:

MOVEBR Technical Committee Facilitator:	Company:
Signature:	Date:

Approved by:

DTD Design and Construction Chief Engineer:	
Signature:	Date:

DTD Chief Traffic Engineer:	
Signature:	Date:

Proposed Design Criteria Values/Classification:

Typical Section to be Used:	☐ Urban / Walkable 4-Lane	☐ Urban / Walkable 2-Lane	☐ Suburban 4-Lane	☐ Suburban 3-Lane	☐ Suburban 2-Lane	☐ Rural 2-Lane

Item	Preferred Value	Proposed Value	Variance Need?	Justification (Provide attachments if necessary)
Mobility (Low, Medium, High)				
Access (Low, Medium, High)				
Design Speed (MPH)				
Design Vehicle (Type)				
Width of Travel Lanes (ft.)				
Width of Shoulders (ft.) (edge of travel lane to FOC)				
Inside				
Outside				
Lateral Offset (ft.)				
Non-Tangent Sections (ft.)				
Tangent Sections (ft.)				
Clear Zone (Ref. Chapters 3 & 10 of AASHTO Roadside Design Guide)				
Width of Median (ft.)				
Raised (ft.) - w/ Approval				
Depressed (ft.) - "Green" Preferred				
TWLTL (ft.)				
Pavement Cross Slope (%)				
Foreslope (max.)				
Backslope (max)				
Pedestrian Facility (ft.)				
Furniture Zone (ft.) (from FOC)				
Sidewalk (ft.)				
Bike Facility (ft.)				
Bike Lanes (ft.)				
Buffered Bike Lanes (ft.)				
Cycle Tracks - raised (ft.)				
Stoping Sight Distance (ft.)				
Maximum Superelevation (%)				
Minimum Radius (ft.)				
with normal crown (ft.)				
with reverse crown (ft.)				
with full superelevation				
Maximum Longitudinal Grade (%)				
Minimum Vertical Clearance				
Roadway				
Pedesrian Bridge				
Trails/Bikeway				
Railroad Crossing Impact? (Yes/No) *(Refer to LADOTD Bridge Design and Evaluation Manual as well as railroad owner design guidance)*	*If yes, explain location, operating railroad to be crossed, and anticipated improvements.*			

Attachment B
Deviation from Program Design Guidelines Form

Deviation from Program Design Standards

Request No.:

Date:

Project Name/No.:

Engineer:

Affected Documents:

[Please provide full description of the Program Design Criteria and/or required element from which deviation or change is requested. Include affected guideline or specification section and/or subsection, drawing number, etc., to enable the City-Parish and Program Manager to fully and easily understand the element from which deviation is proposed.]

Proposed Change:

[Please provide a detailed description of proposed change. Attach sketches, specification or other applicable material which fully describes the scope of your proposal.]

Reason for Request:

[Please provide complete documentation and justification for this Request. Include description of project impact, cost-effectiveness analysis if applicable, and any other supporting data and analysis that will facilitate evaluation.]

Date by Which Approval is Requested: [Please explain why]

Impact of Proposal On:

a: Design Schedule & Cost

[Please explain as necessary]

b: Construction Schedule & Cost

[Please explain as necessary]

c: Public and/or Business Impacts

[Please explain as necessary]

Remarks:

[Please include any other information and/or concerns not covered above.]

SIGNED:

_____

[Project Manager]

[Name of Engineering Firm]

RECOMMENDED:

_____

[Program Project Manager]

☐ **APPROVED:**

☐ **CONDITIONALLY APPROVED:**
(SEE ATTACHED FOR CONDITIONS)

_____

[C-P DTD Chief Engineer]

_____

[C-P TED Chief Engineer]

☐ **DENIED:**

_____

[C-P DTD Chief Engineer]

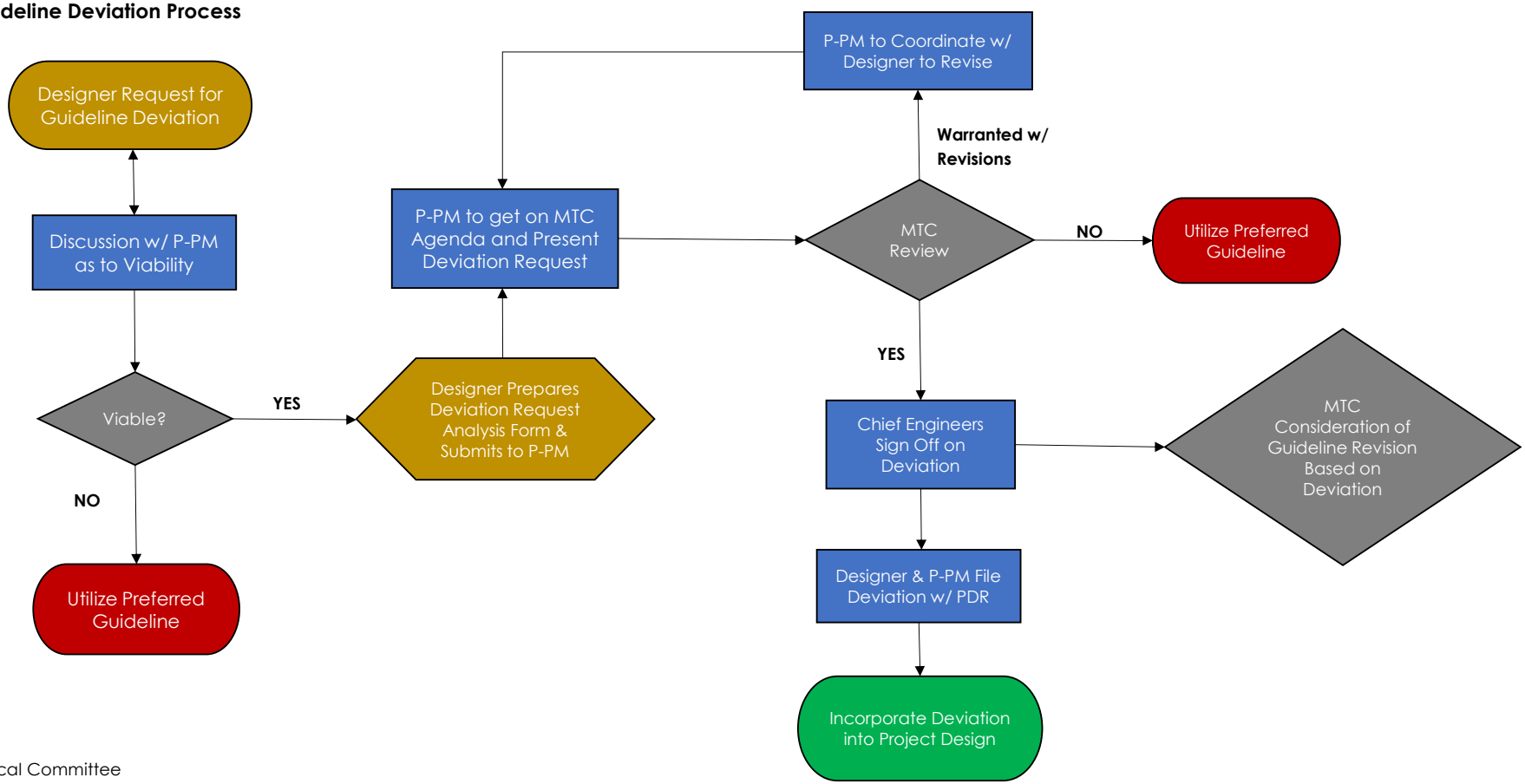
_____

[C-P TED Chief Engineer]

Additional Information/Explanation from MOVEBR Technical Committee:

Attachment C
MTC Process Flowchart for Review of PDR and Guideline Deviations

MOVEBR PDR & Guideline Deviation Process



NOTES:

MTC - MOVEBR Technical Committee

PDR - Project Design Report

PDR would follow similar process at Design Study (30% intermediate) Submittal, Design Study Final Submittal, and any Revisions

Example Deviations:

- Steeper foreslope
- Narrower sidewalk
- Elimination of a pedestrian or Bicycle Facility
- Different Design Storm
- Less than minimum vertical clearance

Attachment D
MOVEBR Corridor Survey Checklist

CORRIDOR SURVEY CHECK LIST

Control Survey:

1. Horizontal Control sketch and Vertical Control report submitted to MOVEBR P-PM

   YES NO NA _____

2. Submittal of level notes to all control points and TBMs

   YES NO NA _____

3. Control point monuments shall be 18"x ½" iron rods with plastic caps that are set in 4" PVC sleeves filled and encased in concrete or permanent marking (scribed "X") in existing stable concrete pavement or structure.

   YES NO NA _____

4. Elevations shall be referenced to the North American Vertical Datum of 1988 (NAVD 88) and the most current geoid

   YES NO NA _____

5. A TBM shall be set approximately every 500 feet

   YES NO NA _____

6. A line of levels shall begin and end on a published USGS or NGS benchmark of 3rd order or on Primary Control Points with NAVD88 elevations derived from GPS observations

   YES NO NA _____

7. All PC, PT, and PI labeled with Northing and Easting

   YES NO NA _____

8. Show bearings along alignment between all PC, PT, and PI

   YES NO NA _____

9. BOP and EOP labeled with Northing and Easting

   YES NO NA _____

Topographical Survey:

1. Topographical survey location map previously provided?

   YES NO NA _____

2. Survey location map in 11"x17" in PDF format?

   YES NO NA _____

3. Map shall include at minimum:
   a. North arrow YES NO NA _____
   b. Approximate plan scale YES NO NA _____
   c. Aerial photography YES NO NA _____
   d. Street names YES NO NA _____
   e. Dimensions from nearest intersecting streets

      YES NO NA _____

   f. Proposed ROW lines (including Complete Streets)

      YES NO NA _____

   g. Proposed green infrastructure improvements

      YES NO NA _____

   h. Initial proposed ROW limits YES NO NA _____

4. Cross sections at a max of 100 feet perpendicular to the centerline?

   YES NO NA _____

5. Cross sections extend at least 50 feet beyond proposed ROW?

   YES NO NA _____

6. Cross sections should include at minimum:
   a. Building and/or property line

      YES NO NA _____

   b. Top of Curb YES NO NA _____
   c. Bottom of Curb YES NO NA _____
   d. Edge of parking lane YES NO NA _____
   e. Centerline spot elevations YES NO NA _____
   f. Additional spot elevations to document breaks in grade on the side of the street where the green infrastructure practice is located

      YES NO NA _____

7. Cross section frequency:
   a. At every 100 feet YES NO NA _____
   b. At extent of driveway and turnout construction
      YES NO NA _____
   c. At ADA related work YES NO NA _____
   d. At drainage improvements YES NO NA _____

Utilities:

1. All known utilities shown in survey?

   YES NO NA _____

2. Any utilities noted as approximated from record drawings?

   YES NO NA _____

3. LA One Call ticket numbers listed in notes?

   YES NO NA _____

Deliverables:

1. Point list in PNEZD or PNZDA format (point, number, northing, easting, elevation, description and attribute) as a csv file (comma separated values)

   YES NO NA _____

2. Raw survey data files

   YES NO NA _____

3. Utility contract information and LA One Call tickets numbers

   YES NO NA _____

4. Field roll or plan/profiles broken into 22"x34" sheets with a symbology legend (on first sheet) and all headwalls, and drainage structures labeled with material type, size, and inverts in pdf format. Vertical profiles showing the existing centerline ground surface, drainage pipes, pipeline crossings, utilities, ditch centerlines, and other critical information

   YES NO NA _____

5. AutoCAD or Microstation electronic drawing file showing all collected data in three dimensional coordinates along with the required pen setting files

   YES NO NA _____

6. Control Drawing YES NO NA _____

7. Level Notes to ALL control and TBMs

   YES NO NA _____

8. Alignment on plans YES NO NA _____

9. Show all TBMs on plans YES NO NA _____

10. Raw Data YES NO NA _____

_____

Consultant Project Manager

_____

Consultant Quality Manager

This signature confirms I have reviewed the MOVEBR design guidelines and all requirements are included, with a completed checklist.

Attachment E
Utility Conflict Matrix

UTILITY CONFLICT MATRIX

Project #:
Description:
Status:
Reviewer:
Date:

Conflict #	Utility Agency/ Owner (UAO)	Plan Sheet #	Alignment	Station (From C/L Project)	To	Station (From C/L Project)	Offset (ft)	Side	Facility Description (Material, Type, Number, Size)	Conflict Description (Possible or Actual) & Notes	Test Hole Recommended (Y/N)	Test Hole #	Depth @ Test Hole	Recommended Conflict Resolution
1	Jeff. Parish Sewer	5	Smith Rd. C/L	39+03		N/A	5	LT	10" Sewer Gravity Main	Drainage Structure #926 crosses Sewer Main	N	N/A	N/A	Review inverts and pipe sizes. Designer to to design around.
2/13	AT&T Transmission	6	Smith Rd. C/L	826+37		N/A	NIA	LT	Fiber Optic	Manhole #752 in conflict with Fiber Optic Line	N	N/A	N/A	Designer recommends relocation due to numerous conflicts with proposed drainage
3	AT&T Transmission	6,11	Smith Rd. C/L	827+78		N/A	65	RT	Fiber Optic	Manhole #212 is near *and* Drainage Pipe #211 is in conflict with Fiber Optic Line	N	N/A	N/A	Designer recommends relocation due to numerous conflicts with proposed drainage
4	Zayo Confirmed. Also possibly Cox, Harbor Comm, Uniti Telecom, Century Link, Verizon, or Sprint.	7	Smith Rd. C/L	63+23		N/A	50	LT	Fiber Optic	30" Drainage Pipe #613 crosses Fiber Optic Line	N	N/A	N/A	Per discussion with Zayo Group represetative on 4/9/19, this is a Zayo line. Also, rep. advised that several other utility companies run along this route as well. Designer will attempt to design around this utility.
5	Jeff. Parish Sewer Department	7	Smith Rd. C/L	63+50		N/A	50	LT	Sewer Gravity Main	30" Drainage Pipe #613 crosses Sewer Main	N	N/A	N/A	Review inverts and pipe sizes. Designer to attempt to design around.
6	Entergy Electric	7	Smith Rd. C/L	63+60		N/A	50-85	LT	Underground Power	Drainage Structures #612, 611, and 610 are adjacent to Underground Power. Drainage Structure #609 crosses Underground Power.	N	N/A	N/A	Designer reccomends relocation. Cannot design around.
7	Atmos Energy	7	Smith Rd. C/L	63+60		N/A	50-85	LT	Gas Line	Drainage Structures #612, 611, and 610 are adjacent to Gas Line. Drainage Structure #609 crosses Gas Line.	N	N/A	N/A	Designer reccomends relocation. Cannot design around.
8	Atmos Energy	351	Smith Rd. C/L	N/A		N/A	N/A	RT	20"-30" Gas Line	Based on District 02 LADOTD utility meeting on 4/17/19, Atmos identified a 20-30' gas line appears in conflict with numerous piles here. This would be a major conflict as the line feeds a major part of the parish and cannot be easily relocated.	N	N/A	N/A	Atmos to positively locate the line and provide designer/LADOTD with location. Further discussion on this conflict is required.
9	Jeff. Parish Water Department	3	CL Existing Causeway	N/A		N/A	N/A	N/A	14" Water Line	Water line is in conflict with multiple western proposed piles.	Y	1	4.0'	Relocate Utility
10	Zayo Group	3	CL Existing Causeway	N/A		N/A	N/A	N/A	1.25" Fiber Line	Fiber is in conflict with piles south of Lausat.	N	N/A	N/A	Relocate Utility
11	Jeff. Parish Water Department	3	Ramp NS	N/A		N/A	N/A	N/A	14" Water Line	Water line is in conflict with proposed piles.	1'	4 & 5	1.4-4.2'	Relocate Utility
12	Jeff. Parish Water Department	3	Ramp SN	N/A		N/A	N/A	N/A	18" Water Line	Water line is in conflict with proposed piles.	Y	6	3.0'	Relocate Utility
13	Jeff. Parish Water Department	3	CL Existing Causeway	N/A		N/A	N/A	N/A	18" Water Line	Water line is near or in conflict with proposed piles.	Y	13 & 14	3.0-6.2'	Discuss with owner allowable clearances.
14	Jeff. Parish Water Department	4	Ramp EN	N/A		N/A	N/A	N/A	36" Water Line	Water line is near or in conflict with proposed piles.	Y	9 & 10	5.6-6.8'	Relocate Utility
15	Jeff. Parish Water Department	4	Ramp EN	N/A		N/A	N/A	N/A	14" Water Line	Water line is near or in conflict with proposed piles.	Y	7	6.7'	Relocate Utility
16														
17														
18														
19														
20														

Attachment F
MOVEBR Signal Design Checklist

MOVEBR Signal Design Check List

Enter YES, NO or N/A (not applicable) Only.
All "NO" entries must be corrected or justified in detail.

Signal design plans may include the following items:

1. Title Sheet
2. General Notes/Construction Notes Sheet
3. Summary of Quantities Sheets
4. Signal Layout (for each intersection)
5. Signal Wiring Diagram (for each intersection)
6. Signal Timing Time of Day Plans (for each intersection)
7. Signal Timing Free Operation Plan (for each intersection)
8. Traffic Counts/ Detector Chart
9. Emergency Vehicle Preemption Phasing
10. Traffic Signal Equipment and Fiber Quantities
11. Fiber Optic Interconnect Sheets
12. Fiber Termination Diagram
13. Fiber Communication Diagram
14. Fiber Splicing Termination Diagram
15. C-P and/or LADOTD Standard Details
16. C-P and/or LADOTD Standard Signal Specifications
17. Special Details
18. Special Provisions
19. Construction Estimate (Excel format)
20. Traffic Signal Inventory Forms (excludes existing survey)

General:

_____ Full Size Plan Sheet Dimensions and border: defined in road design guidelines

_____ Full Size Signal Layout Suggested Scale

_____ 1" = 20' (graphical bar scale on each signal layout sheet)

_____ 1" = 100' (graphical bar scale on each interconnect layout sheet)

_____ Half Size Plan Sheet Dimensions: 11"x17"

_____ Half Size Signal Layout Suggested Scale

_____ 1"= 40' (signal layout sheet) (unless directed otherwise)

_____ 1"= 200' (interconnect sheets) (unless directed otherwise)

_____ All text must be a minimum of .1" in height when plotting to half scale

_____ All preliminary plan sheets shall have Preliminary Not For Construction, Engineer's License & Revised Date for each submittal

_____ All final plan sheets shall have Engineer's Seal, Signature & Final Submittal Date

_____ LADOTD Preliminary Access Connection Request Form (Traffic Signal Permit) to be performed by EBR Parish

General C-P Title Block Information on Design Sheets:

_____ Title Block (lower right corner)

_____ "TRAFFIC SIGNAL PLANS" on top line above title area

_____ Title area: Top two lines for intersection name and/or State Highway

_____ Title area: Third line for Project Number

_____ C-P information

_____ Consultant information

_____ Designed/Checked

_____ Detailed/Checked

_____ Scale

_____ Revised Date for each submittal

_____ Project File Block (upper right corner)

_____ Project Number

_____ Parish

_____ Sheet No.

1. Title Page (may not apply to signal plans inserted within a set of construction plans)

_____ Vicinity & Location Map & North Arrow

_____ All text must be a minimum of 0.1" in height when plotting to half scale

_____ Project Number (s)

_____ Project Name

_____ Identify participating authorities (C-P, LADOTD, FHWA)

_____ Date

_____ Sheet Index, Standard Detail Index, Special Detail Index

_____ Approval Signatures

_____ Type of Construction

_____ Survey information – if applicable

_____ Edition of Standard Specifications – if applicable

2. General Notes Sheet (as needed)

_____ Reference C-P and/or LADOTD Standard Specifications to be used on project

_____ Reference Special Provisions to be used on project

_____ Signal equipment notes as needed

_____ Signal Controller/Cabinet – Specifies installation and type

_____ Fiber equipment notes as needed

_____ Communication notes for fiber tie ins to existing fiber

_____ Equipment removal notes as needed

_____ Note stating the signal foundation design zones as defined by the website link on LADOTD TSD-06. (http://ladotd.maps.arcgis.com/home/webmap/viewer.html?webmap=60d2d5495792439fb97f24529bc7ae97)

_____ Note all Information Sources used in the design such as surveys etc. performed by others

3. Summary of Quantities Sheet

_____ The signal quantities will be shown on the overall quantities sheet as well as broken out within the signal plans for the signal subcontractor. See Item 10. Traffic Signal Equipment and Fiber Quantities below for the general suggested list of quantities.

4. Signal Design Layout (for each intersection)

_____ The initial preliminary set of plans will show only the proposed signal design layout with the existing survey information listed below. This initial set of plans will be used at the plan in hand. Existing TSIs will also be submitted with the initial preliminary set of plans. Once the pole locations are confirmed (at the plan in hand), the survey layers can be hidden for further submittals unless poles are relocated.

_____ Existing Survey information (for initial preliminary set of plans for plan in hand):

_____ North Arrow and graphical bar scale

_____ Easements and Rights-of-way (ROW) lines shown and labeled

_____ Existing roadways and driveways (street names, centerline, edge of pavement, widths, type of pavement, curb lines, type of curb, handicap ramps, ditches)

_____ Location of existing pavement markings (stop bars, pedestrian crosswalks, arrows, etc.)

_____ Location of existing sidewalks

_____ Existing Structures (such as fences, buildings, trees etc.)

_____ Existing Utilities (such as utility poles, water mains, gas mains, fire hydrants, water valves, telephone lines, telephone junction boxes, sanitary sewer lines, sanitary sewer manholes, storm drain lines, catch basins)

_____ Existing Signal poles

_____ Existing Junction boxes

_____ Existing Signal controller

_____ Existing Signal Electrical Service

_____ Existing Post and pole mounted signs (location and type of all regulatory signs)

_____ Existing Signal conduit (if proposed to be utilized in new design)

_____ Existing Signal heads

_____ Posted Speed Limit for each approach

_____ Proposed Signal Design Layout information:

_____ Traffic Signal Inventory (TSI) Number

_____ Signal controller cabinet – location

_____ Signal electrical Service – pole location

_____ Signal electrical Service – pedestal location

_____ Signal generator Service – location

_____ Streetlight/luminaire electrical Service – pole location

_____ Streetlight/luminaire electrical Service – pedestal location

_____ Junction Boxes with concrete aprons – type and location

_____ Mast Arm/Strain Poles/pedestals/luminaires – location, length (The pole locations shall be established in consideration for horizontal and vertical clearances to existing and relocated or new utilities.)

_____ Signal heads – number, orientation, location

_____ Signal head height

_____ Signal head backplate note

_____ Signal head housing color note

_____ Signs – number, location, orientation

_____ Street name signs - location and type

_____ Post mounted signs – number, location, orientation

_____ Pedestrian push button – location

_____ Emergency vehicle pre-emption locations

_____ Vehicle detectors – location, type (loops, video, magnetometer etc.), phase number

_____ Lane number

_____ Underground signal conduit – locations, type installation

_____ New striping – location and type - (stop bars, pedestrian crosswalks etc. as required)

_____ Surveillance Cameras – as required

_____ New handicap ramps – as required

_____ Note on any known Utility Relocation – as required

_____ Note on any clearing and grubbing location – as required

_____ Signal Design Layout Legend

_____ Legend for all lines and symbols specific to match each layout sheet (i.e. legends may vary among the various layout sheets in a set of plans)

_____ Existing and Proposed Symbols for each layout

_____ Sign Layout Diagram

_____ Proposed and Existing regulatory signs to remain (legend, sign type, MUTCD designation, legend, and size)

_____ Street Name Signs (size, color, street names and block numbers)

_____ Signal Head Indications Diagram

_____ Legend number, type (3-section, 5- section, etc.), quantity for each type, lens type and size, signal housing color

5. Signal Wiring Diagram (for each intersection)

_____ Signal Wiring Diagram with letter codes (start from outer conduit and end at controller)

_____ Signal Heads

_____ Pedestrian Signal Heads

_____ EVD

_____ Pedestrian push buttons

_____ Vehicle Detectors

_____ Signal electrical Service – pole

_____ Signal electrical Service – pedestal

_____ Signal generator Service

_____ Streetlight/luminaire electrical Service – pole

_____ Streetlight/luminaire electrical Service – pedestal

_____ Surveillance Cameras

_____ Signal Controller

_____ Other electric devices (such as illuminated blank out signs) as required

_____ Wiring Diagram Schedule Chart

_____ Letter code

_____ Type of cable

_____ Quantity of cable

_____ Overhead, Inside Pole or Jack or Bored, Trenched

_____ Number and size of conduit including spare conduit for signal conductors

_____ Number and size of conduit for streetlight/luminaires

_____ Wiring Diagram Layout Legend

_____ Legend for all lines and symbols specific to match each layout sheet (i.e. legends may vary among the various layout sheets in a set of plans)

6. Signal Timing Time of Day Plans (for each intersection)

_____ TOD System Operation Schedule (24 hours/7 days per week)

_____ Primary Sequence matches Traffic Design Report

_____ Protected (solid arrow) and/or Permitted left turn phase (dashed arrow)

_____ Max (typ. Max Inhibit for TOD plans)

_____ Plan numbers, cycle length, offset

_____ NEMA phasing /ring

_____ Overlaps/Parent Phase note

_____ Splits (seconds)

_____ Controller Pattern/Split/Action/Sequence number

_____ Coordinated phase

_____ Signal Face Number, indications, phase assignment and overlaps for each signal head

_____ ROW for each signal head indication for each phase

_____ Clearance Intervals

_____ Emergency Flash

_____ Coordinated TSIs

7. Signal Timing Free Operation Plan (for each intersection)

_____ Free Operation Parameters

_____ Phase mode (STD8 etc.)

_____ Force Off (Float Fixed)

_____ Movement Description/ NEMA phase numbers and direction arrows

_____ MIN GREEN (MIN I)

_____ GAP, EXTENSION

_____ MAX GREEN I (MAX I)

_____ MAX GREEN II (MAX II)

_____ YELLOW CLEARANCE (YEL) (Calculations must be provided)

_____ RED CLEARANCE (RED) (Calculations must be provided)

_____ WALK (WALK)

_____ PED CLEARANCE (P CLR)

_____ ADDED INITIAL GREEN

_____ MAXIMUM INITIAL

_____ TIME BEFORE REDUCTION

_____ TIME TO REDUCE

_____ REDUCE BY

_____ MIN GAP

_____ DYNAMIC MAX LIMIT

_____ DYNAMIC MAX STEP

_____ RECALL

_____ PEDESTRIAN CALL

_____ LOCK CALLS

_____ SOFT RECALLS

_____ REST IN WALK

_____ DUAL ENTRY

_____ ADDITIONAL CONTROLLER SETTINGS (ex. STOP IN WALK)

_____ Free Operation Phasing when all phases/overlaps are called (primary sequence)

_____ NEMA phasing /ring

_____ Signal Face Number, indications, phase assignment and overlaps for each signal head

_____ ROW for each signal head indication for each phase

_____ Clearance Intervals

_____ Emergency Flash

_____ Protected (solid arrow) and/or Permitted left turn phase (dashed arrow)

_____ Max (typ. Max1 for FO)

_____ Controller Sequence number

_____ Controller Pattern (typ. 254) Action (typ. 10)

_____ Free Operation Schedule (24 hours/7 days per week)

_____ Overlaps/Parent Phase note

8. Traffic Counts/ Detector Chart

_____ Peak Hour Volumes Diagram (AM, Noon and PM peaks)

_____ Vehicle Detection Installation chart

_____ Detection number, delay, extend, phase equipment, lane number, size, type

_____ Misc. notes

9. Emergency Vehicle Preemption Phasing

_____ Railroad Preemption Timing

_____ Signal Face Number, indications, for each signal head for Track clearing, Preemption, and Return To

_____ Phase sequence

10. Traffic Signal Equipment and Fiber Quantities

_____ Sum of Overall Quantities (pay item, description, unit, quantity)

_____ Individual Intersection Quantities (pay item, description, unit, quantity)

_____ Interconnect Quantities (pay item, description, unit, quantity)

_____ Other pay items for signal subcontractor may include Removal of Signal Equipment, Removal of Existing Aerial Interconnect, Removal of Structures, Clearing and Grubbing, Mobilization, Temporary Signs and Barricades, Traffic Signal Controller Software, Computer Equipment, Work Zone Police Officers, Signal Head Tunnel Visors.

_____ If traffic equipment installation is lump sum, the signal equipment and fiber items will still need to be itemized and shown on the signal plans for each intersection and interconnect layout.

11. Fiber Optic Interconnect Sheets

_____ Layout

_____ North Arrow and graphical bar scale

_____ Survey information as described in the LADOTD Signal Design Manual

_____ Aerial background

_____ Suggested three rows on one sheet using 1"=100' scale full size

_____ All text must be a minimum of 0.1" in height when plotting to half scale

_____ Proposed Interconnect Design

_____ Signal controller cabinet – location

_____ Interconnect Line (Type)

_____ Show drop cable between mainline fiber trunk line and controller (Type)

_____ Show splice locations

_____ Show communication ties into existing Fiber Trunk line – as required

_____ Conduit (Number, Size, Type, Min. Depth)

_____ Conduit Installation (Jack or Bored, Trenched)

_____ Junction Boxes (Type)

_____ Buried Cable Warning Sign (Size, Legend, Color, Location)

_____ Interconnect Legend

12. Fiber Termination Diagram

_____ Indicate fiber terminations in ITS HUB Sites as needed and as directed by LADOTD ITS Division

_____ Indicate Cable number, Buffer number, Fiber number, and Direction of continuation

13. Fiber Communication Diagram

_____ Illustrate overview of the existing fiber optic patch panels and ethernet switch at the Hub and the new fiber equipment (gigabit ethernet switch, patch panel etc.) in each new controller as needed and directed by LADOTD ITS Division

14. Fiber Splicing Termination Diagram

_____ Illustrate the new fiber equipment (gigabit ethernet switch, patch panel etc.) and the optical splice enclosure details in each new controller

_____ Indicate Fiber optic color code, Cable number, Buffer number, Fiber number, and Direction of continuation

15. C-P and/or LADOTD Standard Detail Sheets

_____ Provided by respective agency

16. C-P and/or LADOTD Standard Signal Specification

_____ Provided by respective agency

_____ Pay Items must match items listed in Item 10 above.

17. Special Detail Sheets (as required)

_____ Provided by design engineer as needed

_____ Engineer's Seal, Signature & Date

18. Special Provisions (as required)

_____ Provided by design engineer as needed

_____ Engineer's Seal, Signature & Date

19. Estimated Probable Cost of Construction for Traffic Signal and Fiber Equipment

_____ The Estimate Probable Cost of Construction for Traffic Signal and Fiber Equipment will be performed in an Excel file.

_____ If traffic equipment installation is lump sum, the cost estimate will still be the same itemized pay items listed in Item 10. Traffic Signal Equipment and Fiber Quantities above.

_____ Excel Format

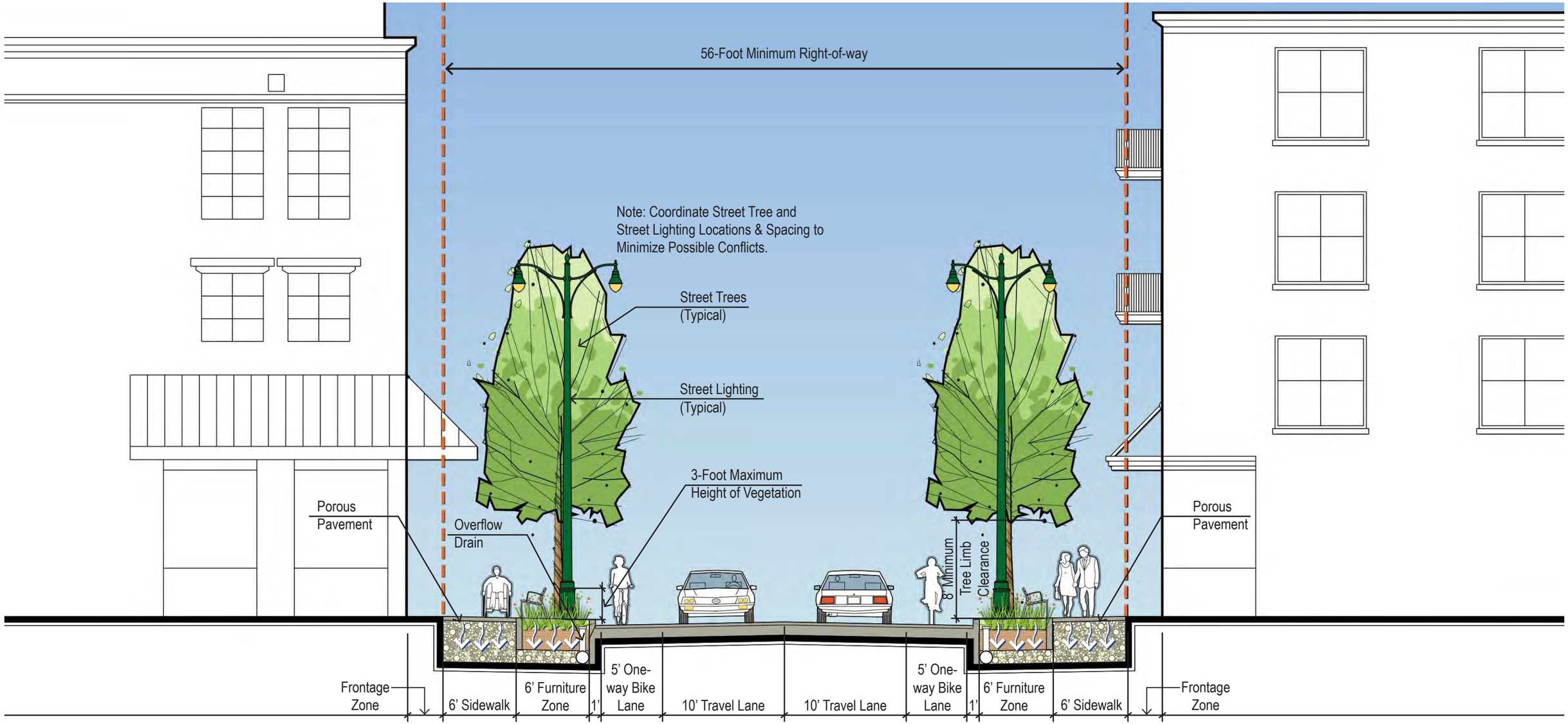
_____ Column Headers: Pay Item, Description, Unit, Intersection Name, Fiber (separate column for fiber quantities), Quantity Total, Unit Cost, Total Cost

20. Traffic Signal Inventory (TSI) Forms

_____ Original TSI forms to be submitted with first preliminary plan submittal to be used during plan in hand

_____ Consultant to create updated TSI forms within 3 weeks after final plans approved

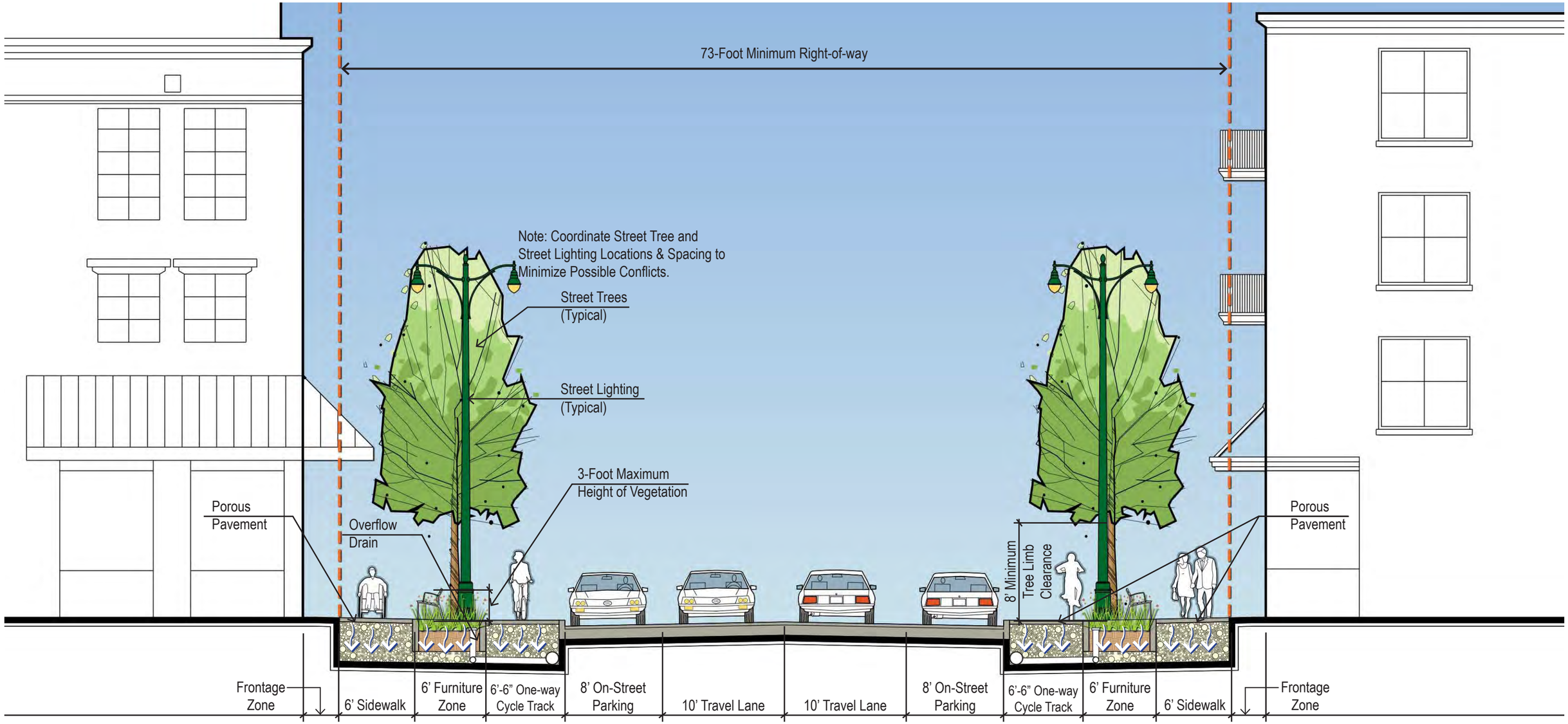
Attachment G
Standard Typical Sections



URBAN/WALKABLE 2-LANE (Option 1: No On-Street Parking)

SCALE: 1/8" = 1'-0"

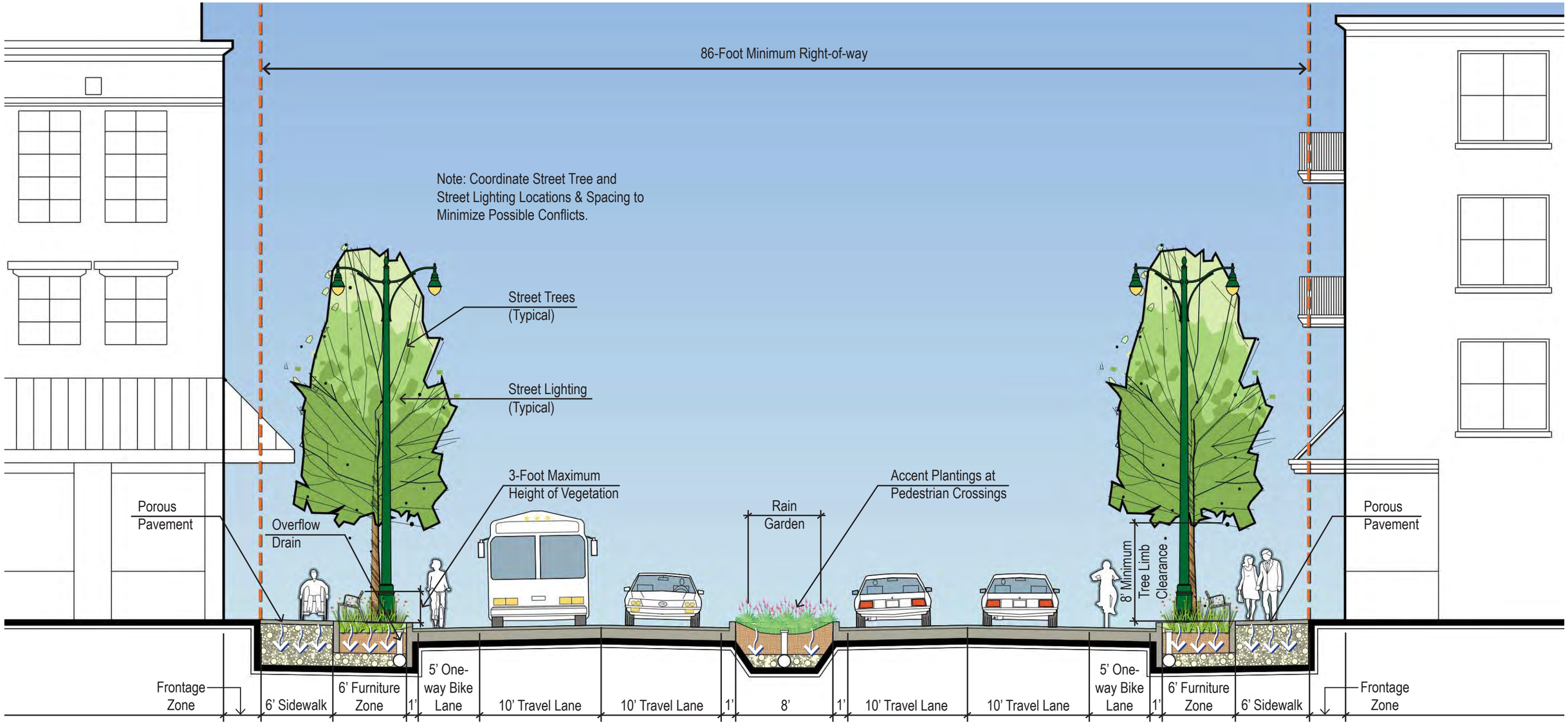
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
Low	High	SU	25-MPH	10-Feet	1-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot; Rain Gardens Preferred; 1.5-Foot Minimum Lateral Offset for Fixed Objects	5-Foot Wide On-Street Bike Lanes with Bike Boxes at Intersections	6-Foot Wide Sidewalk	2.0%	NA	NA



URBAN/WALKABLE 2-LANE (Option 2: With On-Street Parking)

SCALE: 1/8" = 1'-0"

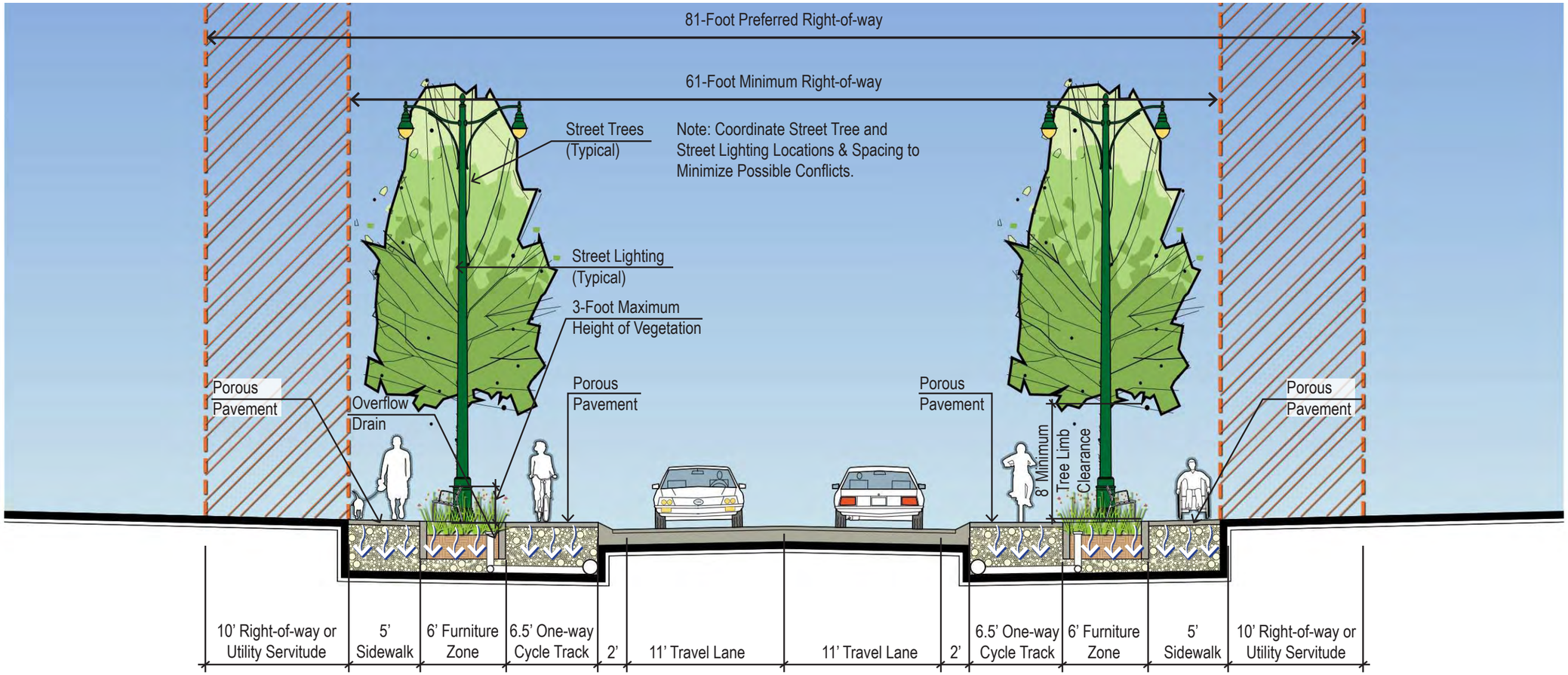
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
Low	High	SU	25-MPH	10-Feet	8-Foot On-Street Parking Areas	6-Foot; Rain Gardens Preferred; 1.5-Foot Minimum Lateral Offset for Fixed Objects	6-Foot 6-Inches Wide Protected with Bike Boxes at Intersections	6-Foot Wide Sidewalk	2.0%	NA	NA



URBAN/WALKABLE 4-LANE

SCALE: 1/8” = 1’-0”

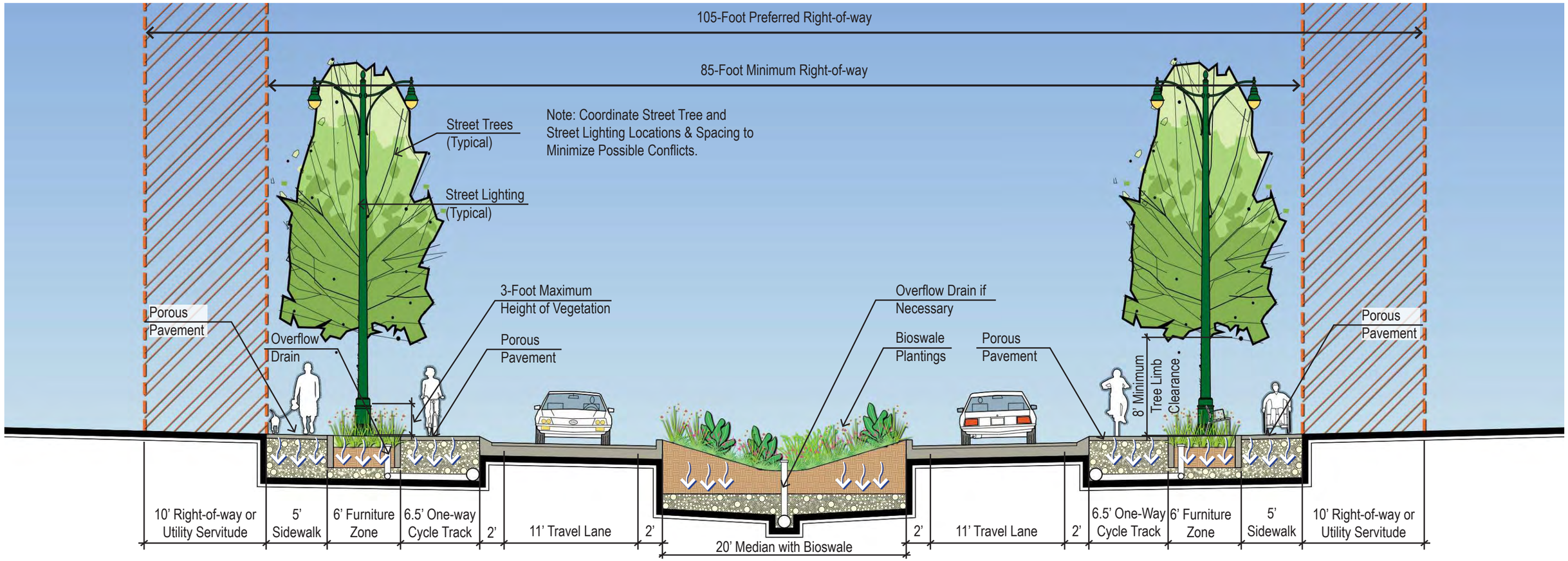
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
Medium	Medium	SU	30-MPH	10-Feet	1-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot; Rain Gardens Preferred; 1.5-Foot Minimum Lateral offset for Fixed Objects	5-Foot Wide On-Street Bike Lanes with Bike Boxes at Intersections; Buffer Preferred	6-Foot Wide Sidewalk	2.0%	8-Foot Minimum	At Signalized Intersections (Urban Blocks)



SUBURBAN 2-LANE

SCALE: 1/8” = 1’-0”

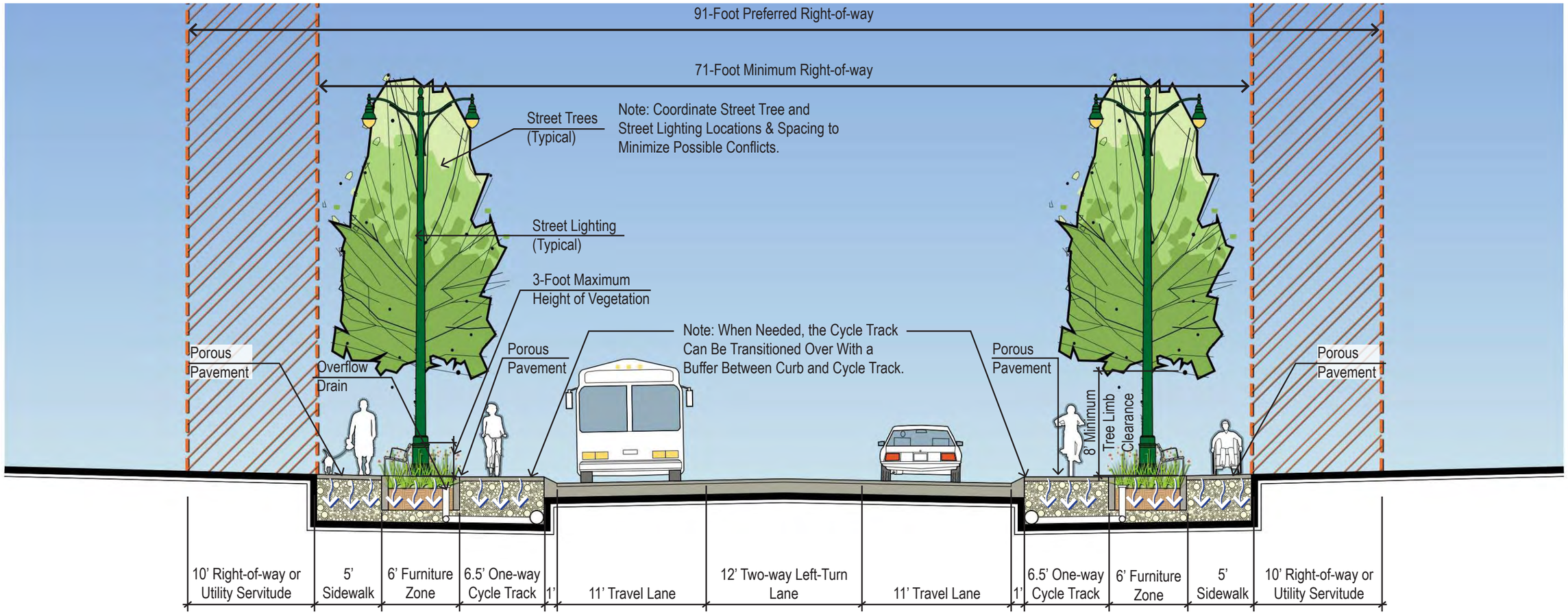
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
Medium	Medium	SU	30-MPH	11-Feet	2-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot Preferred; Rain Garden Preferred; 1.5-Foot Minimum Lateral offset for Fixed Objects	6-Foot 6-Inches One-way Cycle Track	5-Foot Wide Sidewalk	2.0%	N/A	N/A



SUBURBAN 2-LANE (Option 2: With Median Bioswale)

SCALE: 1/8” = 1’-0”

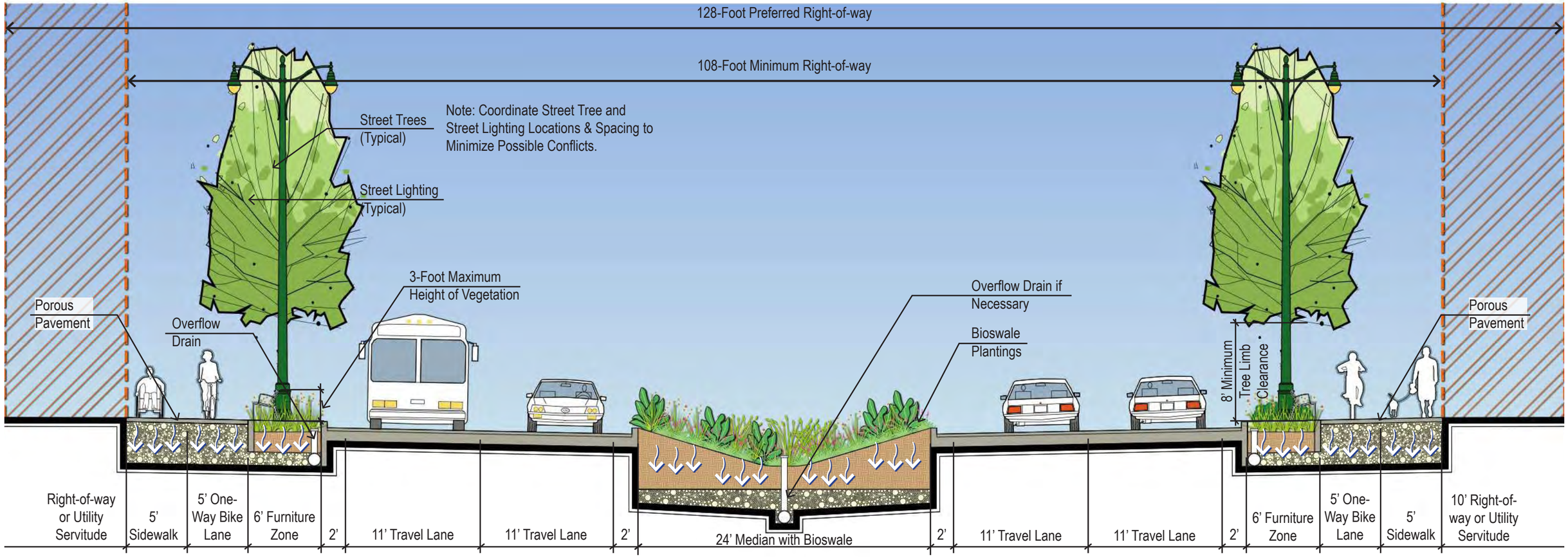
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
Medium	Medium	SU	30-MPH	11-Feet	2-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot Preferred; Rain Garden Preferred; 1.5-Foot Minimum Lateral offset for Fixed Objects	6-Foot 6-Inches One-way Cycle Track	5-Foot Wide Sidewalk	2.0%	20-Foot Wide Preferred	0.5-Mile With Offset Lefts



SUBURBAN 3-LANE

SCALE: 1/8" = 1'-0"

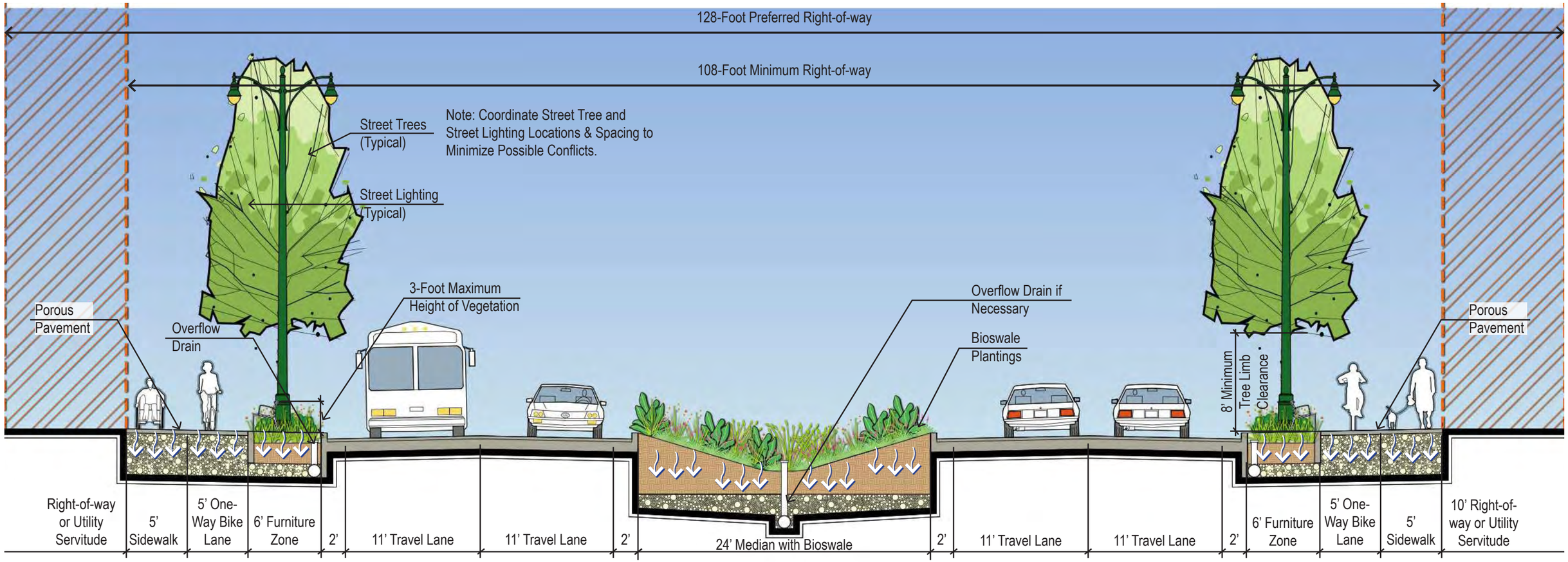
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	TWO-WAY LEFT-TURN LANE WIDTH	MEDIAN OPENING SPACING
Medium	Medium	SU	35-MPH	11-Feet	1-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot Preferred; Rain Gardens Preferred; 1.5-Foot Minimum Lateral offset for Fixed Objects	6-Foot 6-Inches One-way Cycle Track	5-Foot Wide Sidewalk	2.0%	12-Foot	N/A



SUBURBAN 4-LANE (Option 1: "Reverse Crown" With Median Bioswale)

SCALE: 1/8" = 1'-0"

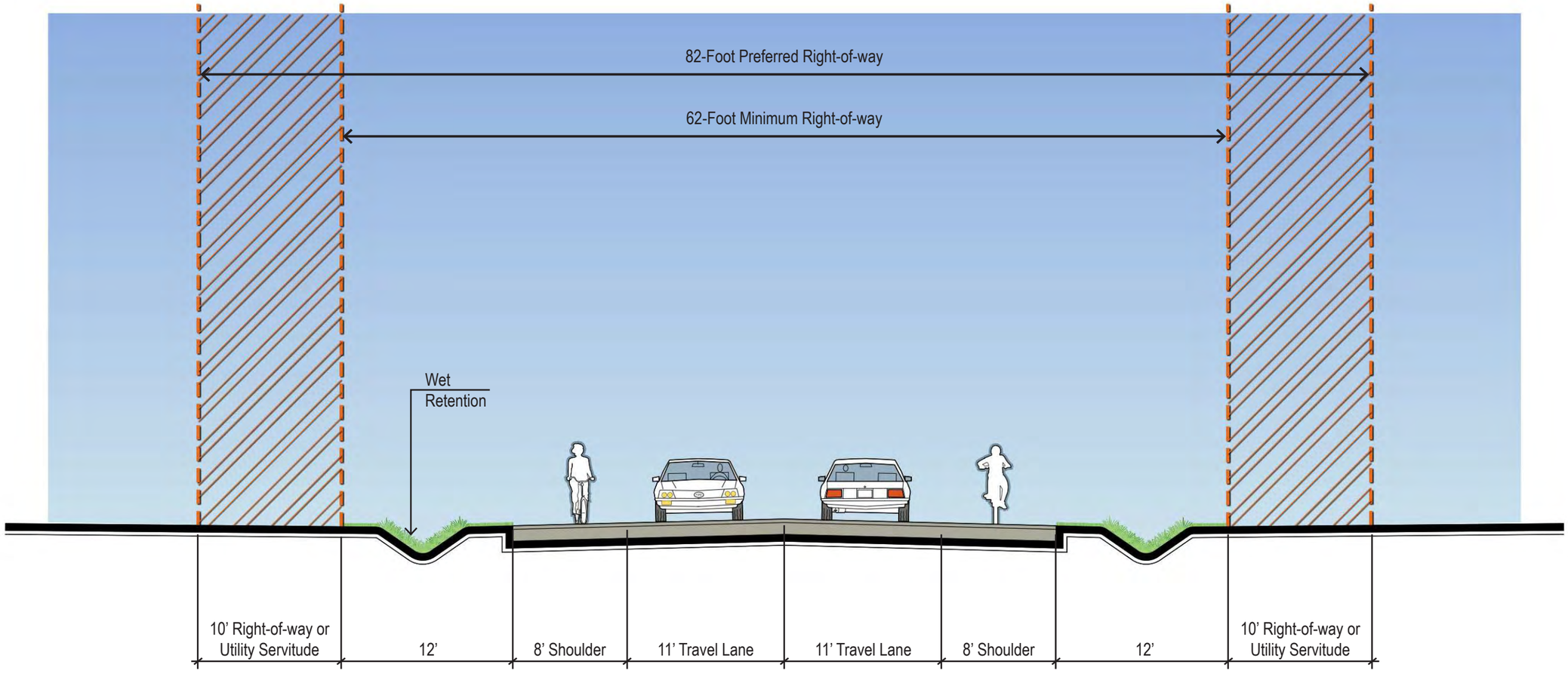
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
High	Low	WB-50	40-MPH	11-Feet	2-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot; Rain Gardens Preferred; 3-Foot Minimum Lateral Offset for Fixed Objects	One-way 5-Foot Bike Lane	5-Foot Wide Sidewalk	2.5%	28-Foot Wide Preferred	0.5-Mile With Offset Lefts



SUBURBAN 4-LANE (Option 2: "Normal Crown" With Median Bioswale)

SCALE: 1/8" = 1'-0"

MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	FURNITURE ZONE	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
High	Low	WB-50	40-MPH	11-Feet	2-Foot (Edge of Travel Lane to BOC; Curb and Gutter)	6-Foot; Rain Gardens Preferred; 3-Foot Minimum Lateral Offset for Fixed Objects	One-way 5-Foot Cycle Track	5-Foot Wide Sidewalk	2.5%	28-Foot Wide Preferred	0.5-Mile With Offset Lefts



RURAL TOWN 2-LANE

SCALE: 1/8” = 1’-0”

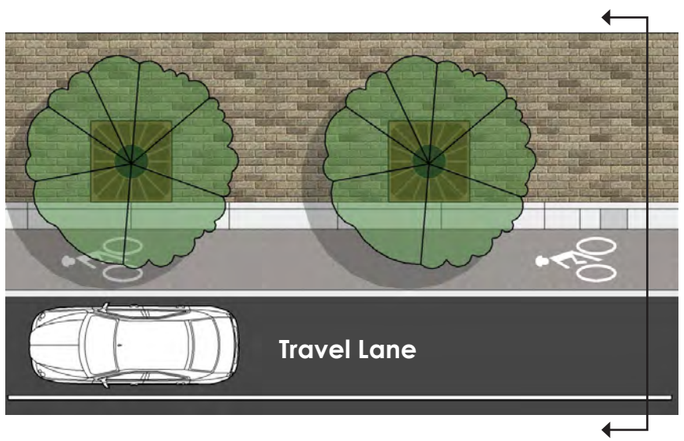
MOBILITY	ACCESS	DESIGN VEHICLE	DESIGN SPEED	LANE WIDTH	SHOULDERS	ROADSIDE BUFFER	BIKE FACILITY	PEDESTRIAN	CROSS SLOPE	MEDIAN WIDTH	MEDIAN OPENING SPACING
High	Low	SU	40-MPH	11-Feet	8-Foot Wide With Rumble Stripe - Note: Rumble Stripe Will Need To Be Intermittent To Allow Bikes To Move In & Out of Lanes (To Turn Left, Pass, Etc.)	Shoulder	Shoulder	N/A	2.5%	N/A	N/A

Attachment H
Standard Green Infrastructure System Typology

Porous Pavement

Sidewalk & Bicycle Lane

1. **Site-specific vegetation filters and transpires stormwater while enhancing the streetscape**
2. **Stormwater runoff from roadway, bicycle lane and sidewalk flows through porous hardscape material***
3. **Excess stormwater runoff flows into system through trench drains and catch basins**
4. **Drainage rock, soil, or modular storage system provides stormwater storage**
5. **Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure**
6. **Stormwater infiltrates into subgrade**
7. **Leveled subgrade**



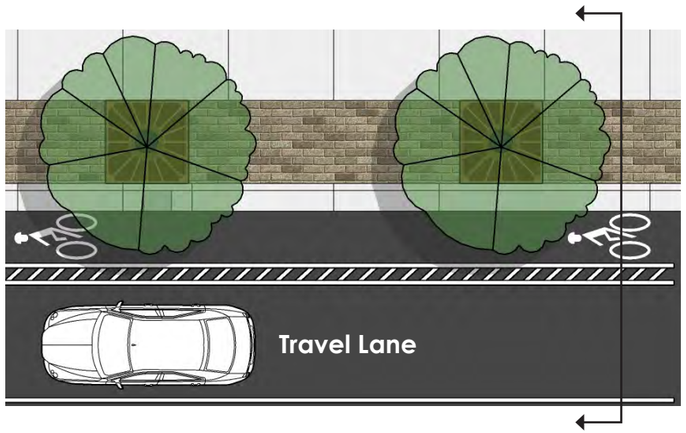
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

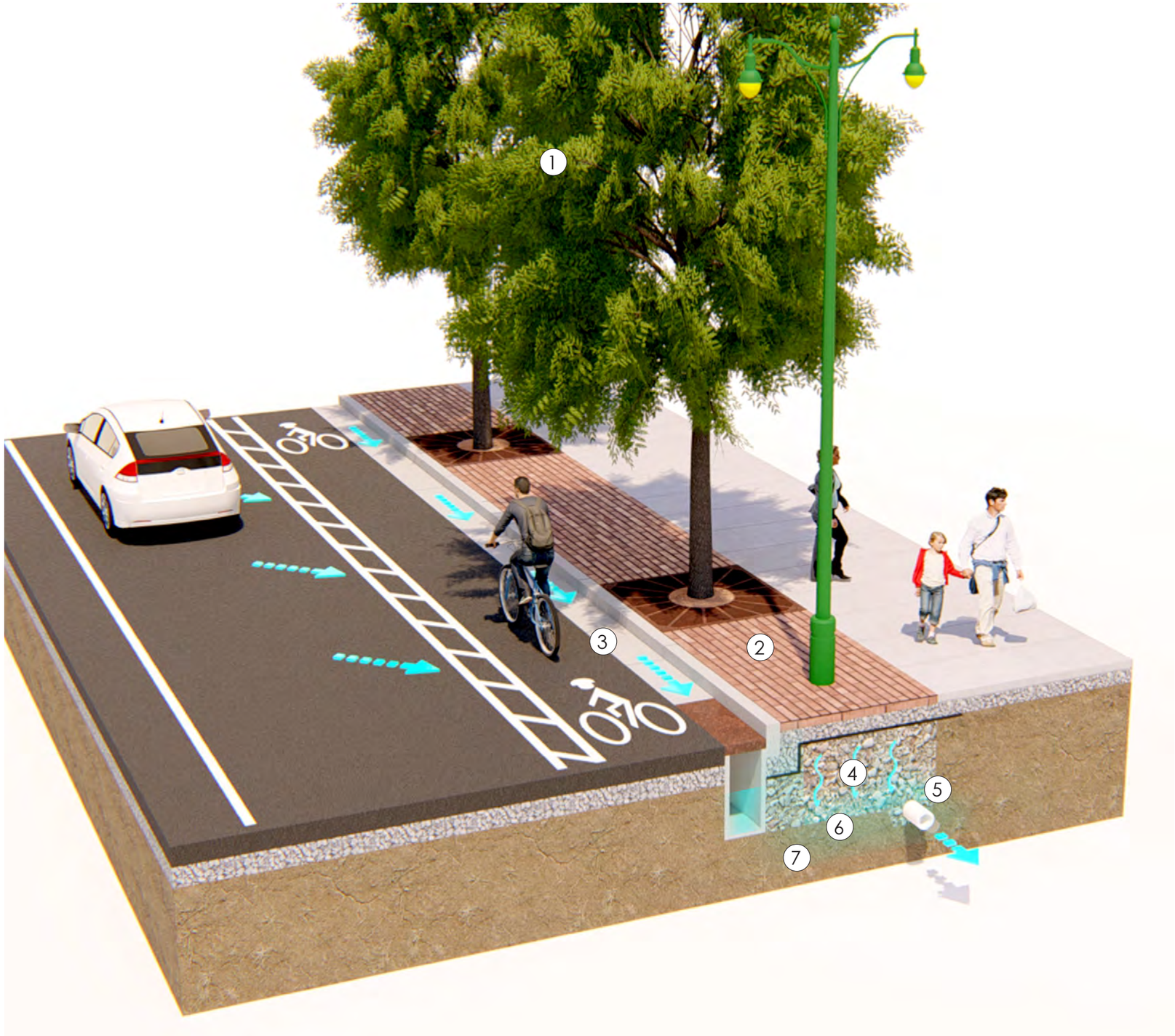
MOVEBR

Streetside Tree Trench

Along Curb

1. Site-specific vegetation, if included, filters and transpires stormwater while enhancing the streetscape
2. Stormwater runoff from sidewalk flows through porous hardscape material*
3. Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains, and catch basins
4. Drainage rock, soil, or modular storage system provides stormwater storage
5. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
6. Stormwater infiltrates into subgrade
7. Leveled subgrade





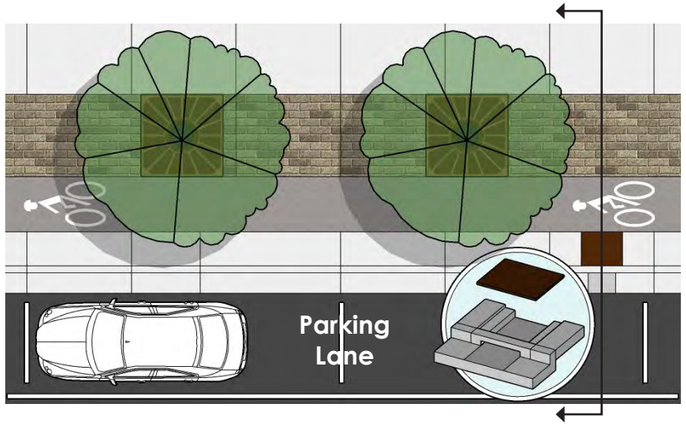
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

MOVEBR

Streetside Tree Trench

With Step Out

1. Site-specific vegetation, if included, filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and sidewalk flows through porous hardscape material*
4. Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains, and catch basins
5. Drainage rock, soil, or modular storage system provides stormwater storage
6. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
7. Stormwater infiltrates into subgrade
8. Leveled subgrade

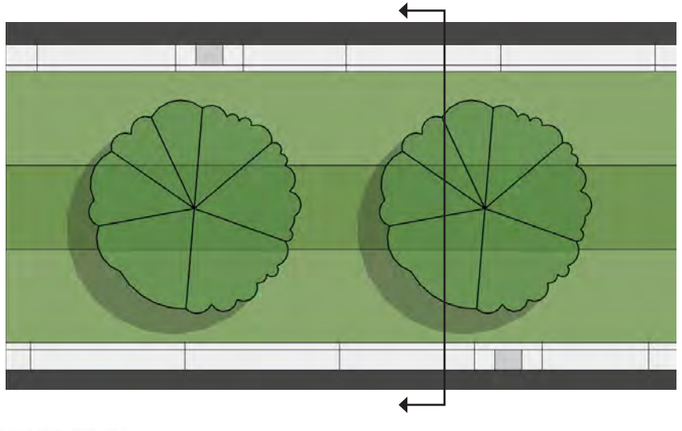


*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

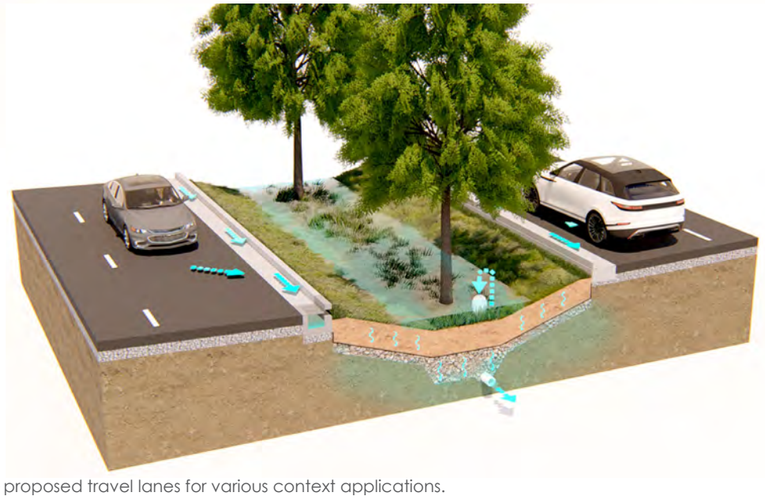
MOVEBR

Median Bioswale

1. Site-specific vegetation filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and sidewalk flows into system through curb cuts and catch basins*
4. Drainage rock, soil, or modular storage system provides stormwater storage
5. Overflow limits amount of surface ponding, connected to traditional infrastructure
6. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
7. Stormwater infiltrates into subgrade
8. Leveled subgrade



Alternate Planting Design



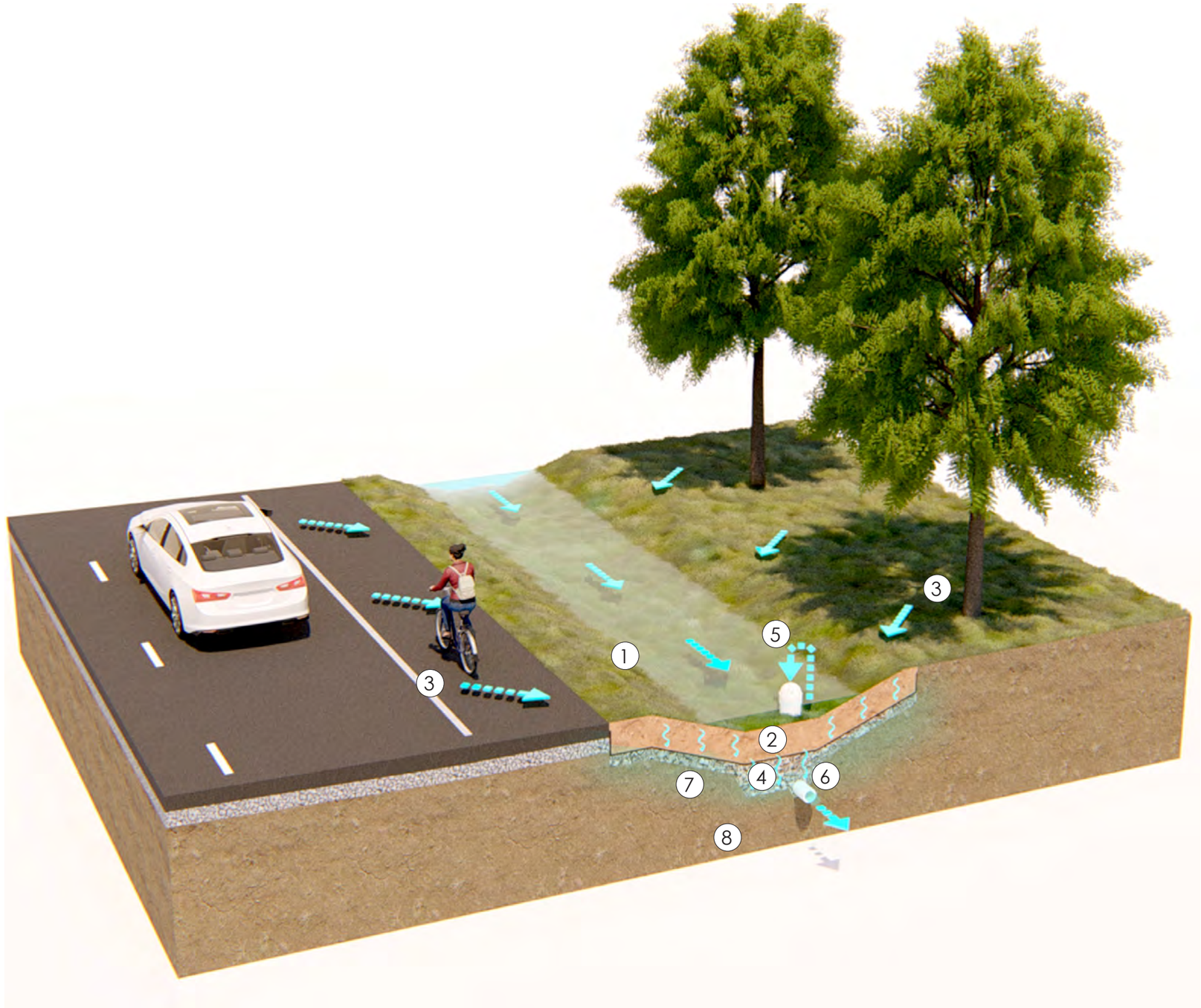
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

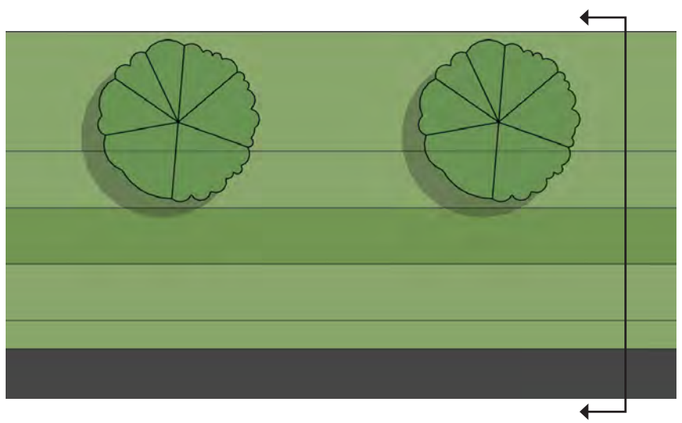
MOVEBR

Streetside Bioswale

(Curbless)

1. Site-specific vegetation filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and surrounding landscape flows into system via overland flow
4. Drainage rock, soil, or modular storage system provides stormwater storage
5. Overflow (Optional) limits amount of surface ponding, connected to traditional infrastructure
6. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
7. Stormwater infiltrates into subgrade
8. Leveled subgrade



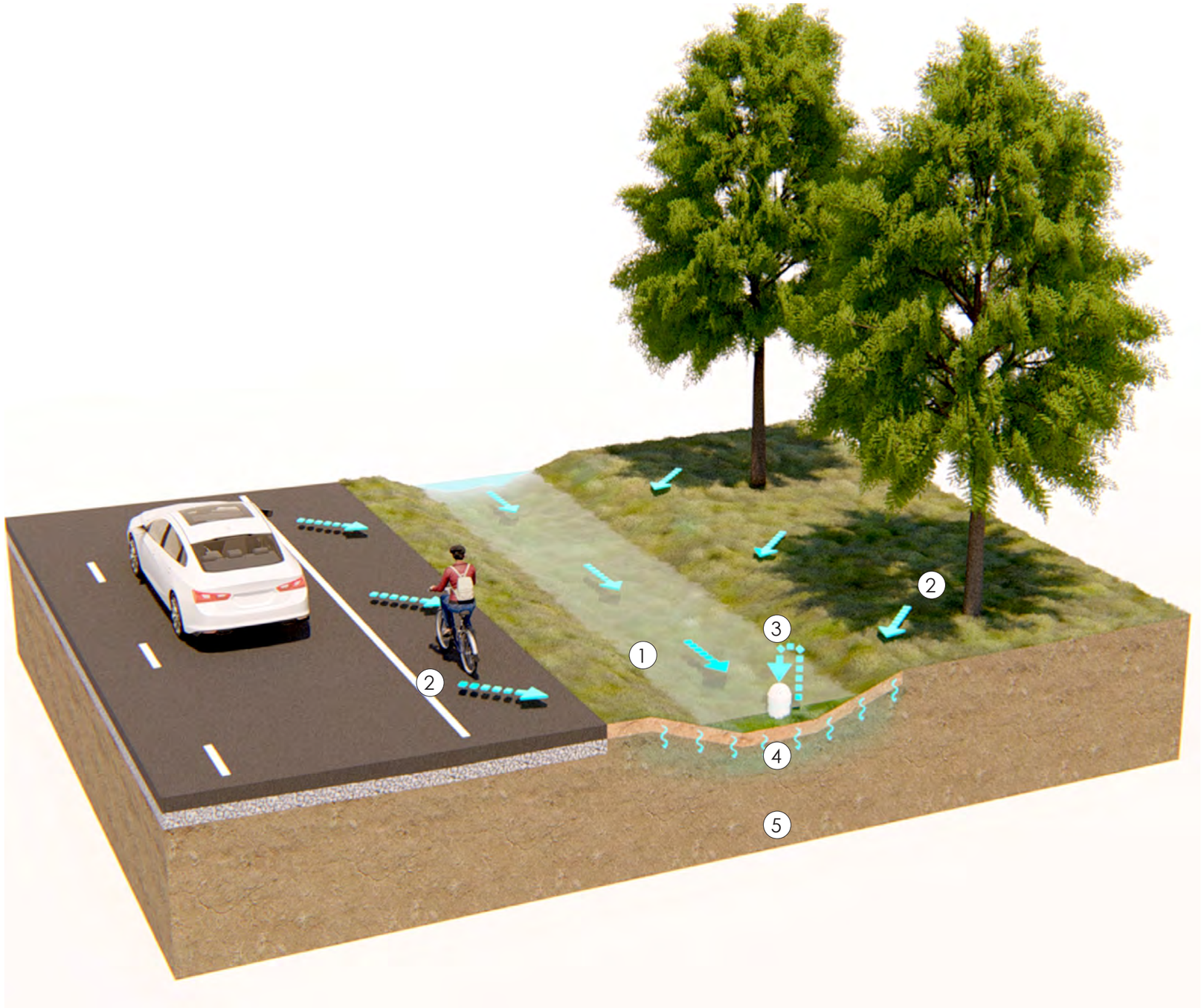


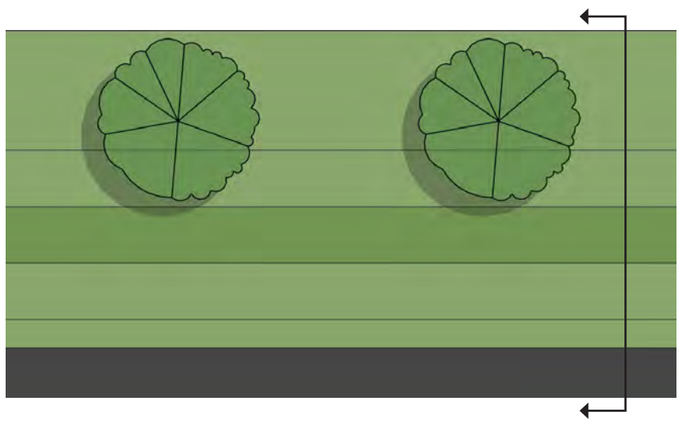
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

Grass Channel

(Roadside Ditch)

1. **Site-specific vegetation filters and transpires stormwater while enhancing the streetscape**
2. **Stormwater runoff from roadway flows into system via overland flow**
3. **Overflow (Optional) limits amount of surface ponding, connected to traditional infrastructure**
4. **Stormwater infiltrates into subgrade**
5. **Leveled subgrade**





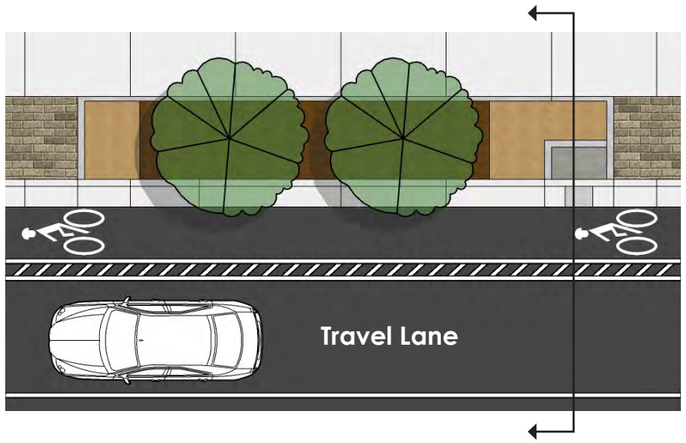
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

MOVEBR

Stormwater Planter

Along Curb

1. Site-specific vegetation filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains or catch basins*
4. Overflow limits amount of surface ponding, connected to traditional infrastructure
5. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
6. Stormwater infiltrates into subgrade
7. Leveled subgrade



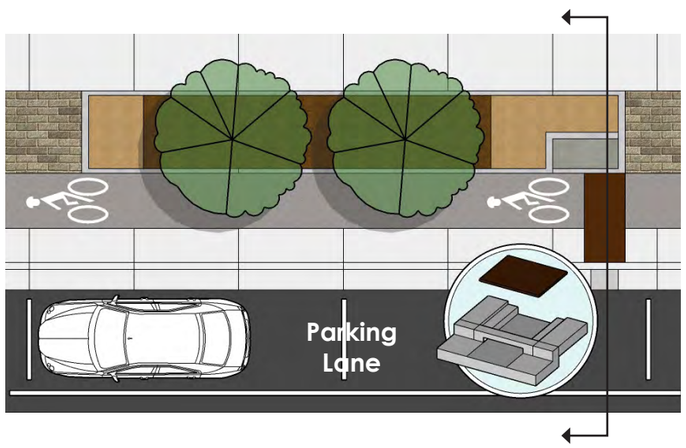
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

MOVEBR

Stormwater Planter

With Step Out

1. Site-specific vegetation filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains, and catch basins*
4. Overflow limits amount of surface ponding, connected to traditional infrastructure
5. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
6. Stormwater infiltrates into subgrade
7. Leveled subgrade



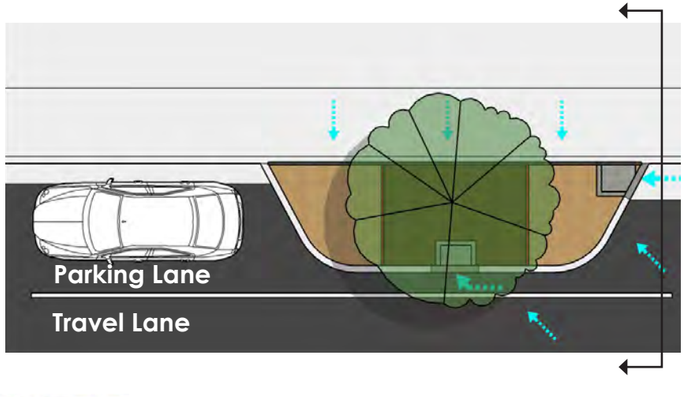
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

MOVEBR

Curb Extension

Mid-block

1. Site-specific vegetation filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains or catch basins*
4. Overflow limits amount of surface ponding, connected to traditional infrastructure
5. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
6. Stormwater infiltrates into subgrade
7. Leveled subgrade



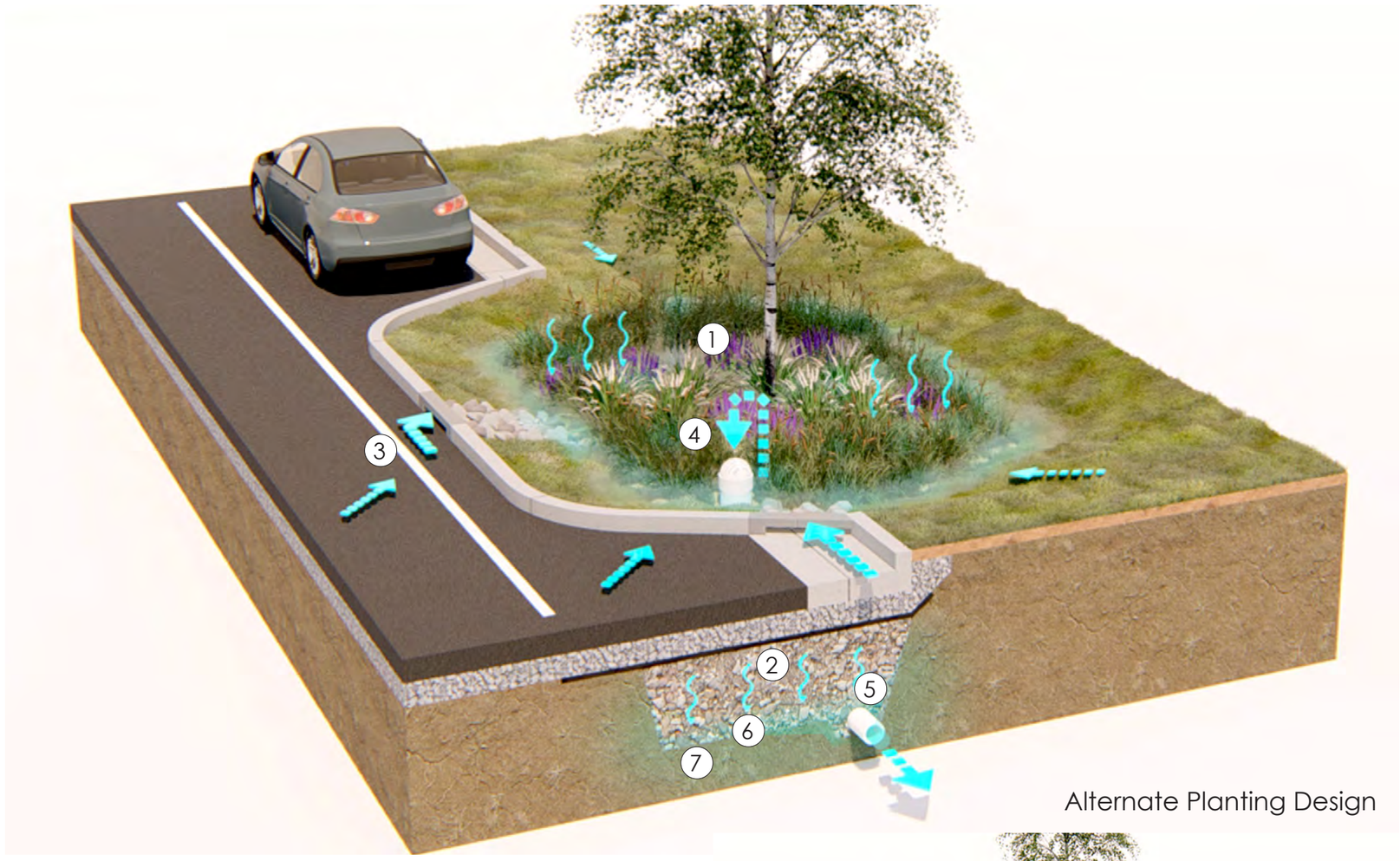
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

MOVEBR

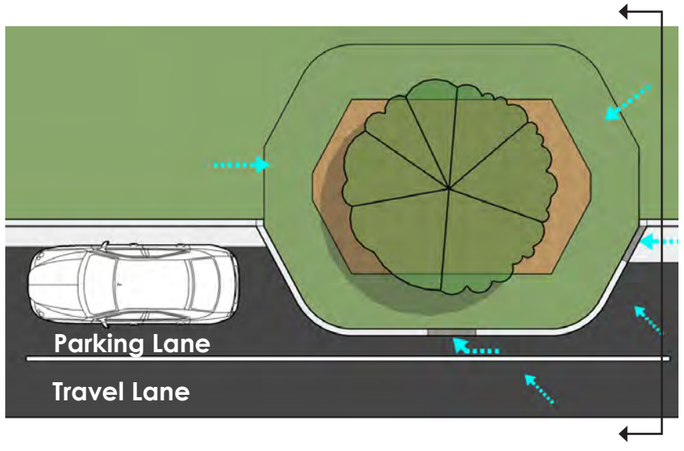
Curb Extension

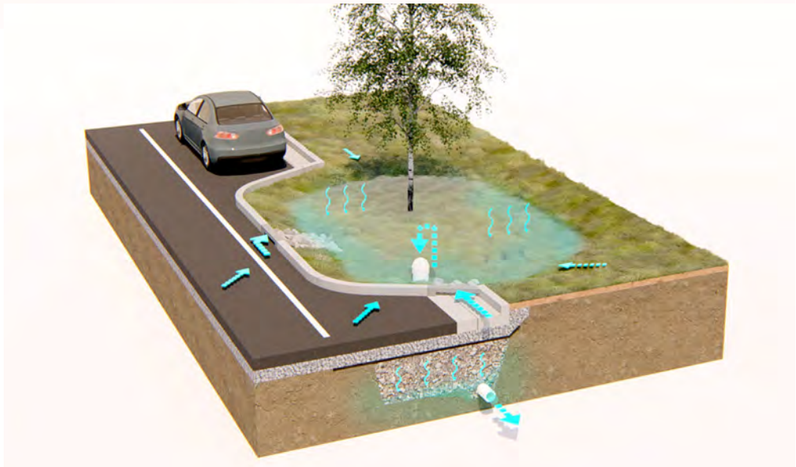
Alternate Configuration

1. **Site-specific vegetation filters and transpires stormwater while enhancing the streetscape**
2. **Engineered soil media filters stormwater and provides environment for vegetation to grow**
3. **Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains or catch basins***
4. **Overflow limits amount of surface ponding, connected to traditional infrastructure**
5. **Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure**
6. **Stormwater infiltrates into subgrade**
7. **Leveled subgrade**



Alternate Planting Design





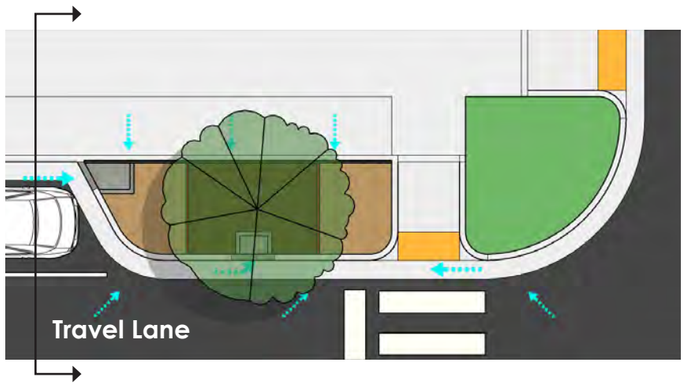
*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.

MOVEBR

Curb Extension

Corner

1. Site-specific vegetation filters and transpires stormwater while enhancing the streetscape
2. Engineered soil media filters stormwater and provides environment for vegetation to grow
3. Stormwater runoff from roadway and sidewalk flows into system through curb cuts, trench drains, and catch basins*
4. Overflow limits amount of surface ponding, connected to traditional infrastructure
5. Underdrain ensures proper drain-down of stormwater runoff, connected to traditional infrastructure
6. Leveled subgrade
7. Reduced pedestrian crossing distance



*Refer to the Complete Streets Typical Sections for application of roadway features adjacent to the proposed travel lanes for various context applications.