

**Texas Department of Transportation  
Technical Provisions  
IH 635 Managed Lanes Project  
Book 2A**

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# 1 GENERAL

## 1.1 Project Scope

The IH 635 Managed Lanes Project consists generally of the reconstruction of main lanes to provide the General Purpose Lanes, the construction of Managed Lanes, construction of new Frontage Roads and reconstruction of existing Frontage Roads, installation of necessary tolling infrastructure, the establishment of a Managed Lane tolling operation, and the maintenance and operation within an approximately 17 mile portion of the IH 635 and IH 35E corridors in Dallas County, Texas.

The Project consists of four Sections as described in Section 1.2. Attachment 01-1A presents diagrams that define the longitudinal limits of the Project on the IH 635 and IH 35E corridors. The Project Right of Way (ROW) establishes the lateral limits of the Project.

The limits for Construction Work and Operations and Maintenance (O&M) Work differ. Specific limits of the Construction Work within the longitudinal limits of the Project are shown in Attachment 01-2A. Specific limits of the O&M Work within the longitudinal limits of the Project are shown in Attachment 01-3A.

## 1.2 Project Requirements

### 1.2.1 General Requirements

The Developer's design schematic of the Project shall illustrate the lane configuration to provide the Project's functionality. The Developer's design schematic of the Project shall be consistent with the locations of grade separations and access points illustrated in the latest approved design schematic provided in the Reference Information Documents (RID) and allow for the Ultimate Configuration. The Developer's design schematic shall be consistent with the traffic flow patterns illustrated in the latest approved design schematic and the lane configuration diagrams described herein. The Project ROW shall be illustrated on the Developer's design schematic of the Project.

Changes in alignments or other elements proposed by the Developer, to the extent that they require an evaluation for compliance with the NEPA Approvals and possibly re-evaluations, and delays associated with such re-evaluations, will be at the Developer's risk as set forth in Section 6.2.3 of the Agreement.

Approval by TxDOT to the Developer's design schematic of the Project shall be a condition of NTP2.

The Project comprises four Sections as described in Section 1.2.2. These are:

- a) IH 635 Section;
- b) IH 635/IH 35E Interchange;
- c) IH 35E Section; and
- d) IH 635/US 75 Interchange.

It is anticipated that certain components of Work, including certain signing, pavement marking, Intelligent Transportation System components, tolling infrastructure, buildings and enclosed facilities, necessary for operating the Project, will be located outside the Project limits.

The Developer shall provide to TxDOT, in compliance with 23 USC 106(h), a Project Management Plan within 30 days after NTP1 and a financial plan within 30 days after NTP1 and every year thereafter until Final Acceptance.

### ***1.2.2 Design-Build (DB) Phase Requirements***

The Developer shall refer to Attachment 01-2A for specific limits of the Project's Construction Work.

The Developer shall design and construct all roadways and associated infrastructure necessary to provide the Project in accordance with the Developer's design schematic of the Project, Environmental Approvals and related design schematics as approved by TxDOT and the Federal Highway Administration (FHWA). The Developer may incorporate existing physical infrastructure in the design, construction and/or reconstruction of the facilities for this Project, provided the Work meets the requirements of the CDA upon Service Commencement. All Design Work and Construction Work shall be in compliance with the Technical Provisions and Good Industry Practice.

The Developer shall coordinate with TxDOT, adjacent Governmental Entities or third parties as appropriate to determine the design criteria, standards, and specifications of those components of the Work which the Developer will construct or reinstate but are maintained by others.

For any components of Work which potentially or actually impact the infrastructure of any Governmental Entity or other third party entity, the Developer's design shall conform to the design requirements of such entity.

Any existing infrastructure impacted by Work and remaining in place after such Work is completed shall be reinstated as soon as possible after such Work is complete.

The Developer shall design and construct any components of the Dallas North Tollway (DNT) to TxDOT design criteria standards and specifications. The Developer shall submit DNT design layout and design plans to TxDOT. TxDOT review for approval shall be a maximum of 21 days.

#### **1.2.2.1 IH 635 Section**

The IH 635 Section extends along IH 635 from east of the IH 635/IH 35E Interchange centerline (CL) IH 635 Managed Lane (ML) station (STA) 10593+00) to east of Merit Drive (CL IH 635 ML STA 413+71.78). Station limits provided in Section 1 are based on the re-evaluated design schematic provided in the RID.

The requirements for the IH 635 Section are to design and:

- a) Construct the Managed Lanes from west of Denton Drive (CL IH 635 ML STA 10593+00) to approximately 200 ft east of Merit Drive (CL IH 635 ML STA 413+71.78).
- b) Reconstruct the main lanes to provide General Purpose Lanes from Denton Drive (CL IH 635 ML STA 10596+18.75) to approximately 400 ft west of Merit Drive (BL IH 635 eastbound (EB) STA 407+17.14 and BL IH 635 westbound (WB) STA 408+33.79).
- c) Construct or reconstruct access ramps between Managed Lanes, General Purpose Lanes and Frontage Roads.



- d) Construct or reconstruct continuous Frontage Roads on both sides of IH 635, consisting of new or reconstructed Frontage Roads from Harry Hines Boulevard to approximately 400 ft west of Merit Drive.
- e) Reconstruct cross streets to the extent required, including Denton Drive, Josey Lane, Webb Chapel Road, Marsh Lane, Rosser Road, Valley View Lane, Midway Road, Welch Road, Montfort Drive, Preston Road, Hillcrest Road and Park Central Boulevard.
- f) Reconstruct main lanes of the Dallas North Tollway (DNT) and portions of the DNT interchange impacted by the Work.
- g) Reconstruct the Joe Ratcliff pedestrian walkway.
- h) Reconstruct Forest Lane from its intersection with the EB Frontage Road to IH 635, to 473 ft west of the centerline of Josey Lane.
- i) Construct associated High Occupancy Vehicle (HOV) declaration zones.
- j) Construct all other Work required for these roadways, bicycle facilities and pedestrian facilities.

### 1.2.2.2 IH 635/IH 35E Interchange

The IH 635/IH 35E Interchange portion includes IH 635 from Luna Road (CL IH 635 ML STA 10512+01.84) to west of this interchange and IH 35E from north of this interchange to Valwood Parkway (CL IH 35E STA 823+00).

The requirements for the IH 635/IH 35E Interchange are to design and:

- a) Construct elevated Managed Lanes direct connectors Southbound (SB) IH 635-Loop 12 & IH 35E and Northbound (NB) IH 35E-IH 635, for the NB IH 35E/Loop 12 to EB IH 635 and the WB IH 635 to SB IH 35E/Loop 12 traffic movements. The limits extend from Crown Road (CL IH 35E Back STA 1153+81.75/Ahead STA 684+00) on IH 35E, to the back of gore of the proposed General Purpose Lanes on IH 635 (BL EB General Purpose Lanes STA 56+91.43 and BL WB General Purpose Lanes STA 61+82.92). These ramps will connect to the northern ends of the elevated direct connectors to be constructed along IH 35E.
- b) Construct adjustments to preserve the operational roadway connections between IH 35E and IH 635 for all existing travel lanes except the HOV lane on the existing WB IH 635 to SB IH 35E direct connector.
- c) Construct the Managed Lanes from approximately 2400 ft east of Luna Road (CL IH 635 ML STA 10564+00) to west of Denton Drive (CL IH 635 ML STA 10593+00).
- d) Reconstruct, to the extent required to preserve the functionality, the existing main lanes on the IH 635 Section through the IH 635/IH 35E Interchange from east of Luna Road to Denton Drive (CL IH 635 ML STA 10596+18.75). This Work includes widening of the existing IH 635 main lanes to provide access to the Managed Lanes.
- e) Construct the IH 35E SB to IH 635 EB direct connector from the existing IH 35E SB to IH 635 EB connector to the proposed IH 35E NB to IH 635 EB connector.
- f) Construct the IH 635 WB to IH 35E NB direct connector from the proposed IH 635 WB to IH 35E SB connector to the existing IH 635 EB to IH 35E NB connector.
- g) Construct the relocated NB IH 35E-Valley View Lane exit ramp (CL IH 35E STA 736+67.67 to STA 751+59.50).
- h) Construct the relocated the Harry Hines Boulevard-IH 35E NB entrance ramp (CL IH 35E STA 755+64.87 and 784+12.58).

- i) Construct the relocated IH 35E NB - Valwood Parkway exit ramp (CL IH 35E STA 790+65.97 to STA 799+99.39).
- j) Construct the relocated Valley View Lane-IH 35E NB entrance ramp (CL IH 35E STA 805+87.39 to STA 822+76.63).
- k) Reconstruct, to the extent required to preserve the functionality, the existing main lanes of IH 35E through the IH 635/IH 35E Interchange. Work includes widening of the existing NB main lanes and frontage road to accommodate the relocated ramps north of the interchange.
- l) Construct associated High Occupancy Vehicle (HOV) declaration zones.
- m) Construct all other Work required for these roadways.

At the IH 635/IH 35E Interchange, the Project provides an interim configuration. The interim configuration shall be designed to provide for the Ultimate Configuration of this interchange and the Ultimate Configuration's functionality as illustrated in the lane configuration diagrams provided in the RID, in a manner which minimizes impacts to the pre-existing physical infrastructure, to the infrastructure of the interim configuration, and to traffic operations during the future construction of the Ultimate Configuration.

### 1.2.2.3 IH 35E Section

The IH 35E Section extends along IH 35E from Joe's Creek (CL IH 35E STA 984+18.10) and from Northwest Highway on Loop 12 (CL Loop 12 STA 1498+60.73) to Crown Road (CL IH 35E Back STA 1153+81.75/Ahead STA 684+00).

The requirements for the IH 35E Section are to design and:

- a) Construct elevated Managed Lane direct connectors SB IH 635-Loop 12 & IH 35E and NB IH 35E-IH 635 within the IH 35E corridor adjacent to the existing General Purpose Lanes. The SB IH 635-Loop 12 & IH 35E connector begins at Northwest Parkway on Loop 12 (CL Loop 12 STA 1498+60.85) and the NB IH 35E-IH 635 begins north of Joe's Creek on IH 35E (CL IH 35E 992+95.53). They connect to the IH 635/IH 35E interchange direct connectors.
- b) Construct direct connector SB IH 635-IH 35E from the SB IH 635-Loop 12 & IH 35E connector to IH 35E north of Joe's Creek (CL IH 35E STA 985+58.37).
- c) Construct direct connector NB Loop 12 & IH 35E-IH 635 from Northwest Highway on Loop 12 (CL Loop 12 STA 1498+50.37) to the NB IH 35E-IH 635 connector.
- d) Construct ramps north of Walnut Hill Lane between the Frontage Roads and the elevated direct connectors. The NB ramp extends from CL IH 35E STA 1097+31.32 to 1123+02.55. The SB ramp extends from CL IH 35E STA 1099+22.27 to STA 1124+01.83.
- e) Construct the relocated southbound Loop 12/IH 35E-Northwest Highway exit ramp.
- f) Construct the SB Loop 12 frontage road from approximately 380' north of Northwest Highway (CL Loop 12 STA 1503+33) to the SB Loop 12/IH 35E – Northwest Highway exit ramp.
- g) Construct the relocated NB IH 35E-Northwest Highway exit ramp and the Northwest Highway-SB IH 35E entrance ramp.
- h) Construct the SB Frontage Road from Joe Field Lane to Walnut Hill Lane, and the NB Frontage Road from Walnut Hill Lane to the entrance ramp to the NB elevated direct connector.

- i) Construct improvements, to cross streets including Northwest Highway, Lombardy Lane, Manana Drive, Walnut Hill Lane and Merrell Road, to the extent required to provide the direct connectors and ramps.
- j) Construct adjustments to existing access ramps as necessary to provide the elevated direct connectors to accommodate existing traffic movements.
- k) Construct associated HOV declaration zones.
- l) Construct all other Work associated with these roadways, bicycle facilities and pedestrian facilities.

For the IH 35E Section, including the IH 35E/Loop 12 interchange, the Project provides an interim configuration. The interim configuration shall be designed to provide for the Ultimate Configuration of the IH 35E Section and the Ultimate Configuration's functionality as illustrated in the lane configuration diagrams provided in the RID, in a manner which minimizes impacts to the pre-existing physical infrastructure, to the infrastructure of the interim configuration, and to traffic operations during the future construction of the Ultimate Configuration.

#### **1.2.2.4 IH 635/US 75 Interchange**

The IH 635/US 75 Interchange portion extends along IH 635 from the eastern limit of the IH 635 Section to the center of the Greenville Avenue overpass.

The requirements for the IH 635/US 75 Interchange are to design and:

- a) Construct and reconfigure travel lanes and ramps which change the pre-existing HOV travel lanes on IH 635 between US 75 and Greenville Avenue to Managed Lanes, and provide full connectivity between the Managed Lanes and General Purpose Lanes of the IH 635 Section with all the travel lanes of IH 635 east of Greenville Avenue (other than Frontage Roads). This Work includes the construction near to Greenville Avenue of access from the EB Managed Lanes to the EB General Purpose Lanes, and from the EB General Purpose Lanes to the pre-existing HOV travel lanes to the east; and of access from the WB pre-existing HOV travel lanes to the east to the WB General Purpose Lanes, and from the WB General Purpose Lanes to the WB Managed Lanes.
- b) Construct tolling infrastructure as required to implement operation of the existing reversible direct connector between IH 635 and US 75 as a Managed Lane and for the HOV connectors with TI Boulevard.
- c) Construct associated HOV declaration zones.
- d) Construct all other Work associated with these facilities.

#### **1.2.3 Operations and Maintenance (O&M) Work Requirements**

The Developer shall undertake O&M Work for all Sections of the Project as described herein. The Developer shall refer to Attachment 01-3A for specific limits of the Project's O&M Work.

##### **1.2.3.1 IH 635 Section**

The Developer shall undertake O&M Work for the IH 635 Section within the entire Project ROW, including the infrastructure existing prior to Construction Work, during Construction Work, and following Service Commencement in accordance with Section 8.3 of the Agreement. The Developer shall undertake O&M Work on all the travel lanes.

### **1.2.3.2 IH 635/IH 35E Interchange**

The Developer shall undertake O&M Work in the zone of Construction Work and for constructed components. As and when appropriate, O&M Work shall be undertaken during Construction Work and following Service Commencement.

### **1.2.3.3 IH 35E Section**

The Developer shall undertake O&M Work in the zone of Construction Work. As and when appropriate, O&M Work shall be undertaken during Construction Work and following Service Commencement.

Tolling of the Managed Lanes on the IH 635 WB to IH 35E NB and IH 35E SB to IH 635 EB direct connectors in the IH 635/IH 35E Interchange shall cease on December 31, 2029. All other requirements of the CDA shall remain in effect. The Developer shall be required to carry out all Work necessary to transition the IH 635/IH 35E Interchange direct connectors to a non-toll configuration.

### **1.2.3.4 IH 635/US 75 Interchange**

The Developer shall undertake O&M Work:

- a) For the IH 635 Managed Lanes;
- b) For the whole of the reversible direct connector between IH 635 and US 75; and
- c) For the HOV connectors with TI Boulevard.

The Developer shall configure and operate the reversible direct HOV connector between IH 635 and US 75 as follows:

- a) From 6:30 a.m. to 9:00 a.m. on Business Days, in the direction from US 75 to IH 635.
- b) From 3:00 p.m. to 6:30 p.m. on Business Days, in the direction from IH 635 to US 75.

The Developer shall operate the reversible direct connector between IH 635 and US 75 in accordance with the requirements of Section 18.5.

## 2 PROJECT MANAGEMENT

Section 1 of the Technical Provisions describes the Design-Build (DB) phase and Operating Period for the Project.

### 2.1 Project Administration

No additional requirements.

#### 2.1.1 Project Schedule

No additional requirements.

##### 2.1.1.1 General Requirements

The Project Schedule shall be used by the Parties for planning and monitoring the progress of the Work, as well as serving to determine the amount due to the Developer for a progress payment, if applicable.

The scheduling software employed by the Developer shall be compatible with the current and any future scheduling software employed by TxDOT. TxDOT's current software in use is Primavera P4. Compatible, as used in this Section 2.1.1.1, shall mean that the Developer-provided electronic file version of the Project Schedule may be loaded or imported by TxDOT using TxDOT's scheduling software with no modifications, preparation or adjustments.

All Project Schedules shall comply with the following:

- a) Include all Schedule Activities.
- b) Identify planned dates for start and completion of construction in any area.
- c) Tie all phases of Work together logically to present a total Critical Path Method (CPM) schedule in one electronic file.
- d) Include the Milestone Schedule Deadlines.
- e) Cost load all Payment Activities.
- f) Cost load any Schedule Activities that are required to provide an aggregate cost for associated Payment Activities.
- g) Ensure that cost loaded activities are at a level of detail that allows assigned quantities to be commodity specific for consistent unit pricing.
- h) Identify Schedule Activities with a Float of less than ten Days as critical Schedule Activities.
- i) Constrain only the Schedule Activities that represent any Milestone Schedule Deadlines with a "start on or before" or "finish on or before" constraint.
- j) Include the components as described below:
  - Activity identification – The Developer shall use unique and consistent activity identification numbers, textual descriptions and codes in all Project Schedule Submittals. Each Schedule Activity shall have a detailed, concise description of the Work represented by the activity title. Descriptions will indicate definable items of Work typically starting with a verb. The activity identification numbers relating to a specific activity title or description shall remain unchanged and connected to the original activity title or description throughout the duration of the Work. Payment Activity identification numbering should contain one or more characters that uniquely identify them as Payment Activities. A Schedule

Activity's description may only be changed to clarify a Schedule Activity's scope. The scope or purpose of a Schedule Activity shall not be changed except through a Change Order, or Compensation or Relief Event.

- Early and late dates – Early dates shall be based on proceeding with the Work as early as allowed in the CDA Documents. Late dates shall be based on completing the Work required for Service Commencement, even if the Developer anticipates early achievement of Service Commencement.

All Project Schedules must be displayed per the following:

- a) Schedule Activities shall be shown on their early dates.
- b) The critical path shall be highlighted in red on all schedules to distinguish critical Schedule Activities from other Schedule Activities and Float shown for all Schedule Activities.
- c) The Project Schedule shall be organized consistent with the Work Breakdown Structure (WBS). Each Schedule Activity shall be mapped to one and only one of the WBS elements. The Developer shall further develop and detail the base WBS included as Attachment 02-1A to a minimum of Level VI for all Construction Work and a minimum of Level V for all other Work to ensure a clear understanding of the Project and the CDA requirements. The elements of WBS Level IV under the Level III Construction element shall be consistent with items listed in Section I of Form P submitted with the Developer's Proposal. The Developer shall submit its developed WBS to TxDOT for approval as a condition of NTP2.
- d) The Project title and data date shall be displayed on all schedules, charts and diagrams. A legend shall be provided on all schedules, charts and diagrams, which indicate the various symbols used and their meanings.

### **2.1.1.2 Required Submittals**

#### **2.1.1.2.1 Baseline Schedule**

The preliminary Project Baseline Schedule shall be the Project Schedule until the Project Baseline Schedule is accepted by TxDOT. The Project Baseline Schedule shall be a detailed CPM schedule based on the preliminary Project Baseline Schedule set forth in Exhibit 10 of the Agreement. The Developer shall submit the Project Baseline Schedule to TxDOT no later than 90 Days following NTP1. TxDOT will review the Project Baseline Schedule within 28 Days of submission. In the event that TxDOT does not accept the Project Baseline Schedule, the Developer shall revise and resubmit it. For each resubmission of the Project Baseline Schedule, TxDOT will review it within 21 Days of resubmission.

Once the Project Baseline Schedule has been accepted by TxDOT, it can only be revised with TxDOT's acceptance of a proposed Revised Project Baseline Schedule. When summarized, the Project Baseline Schedule shall be such that the sum of Payment Activity prices therein equals the sum of Payment Activity prices in the preliminary Project Baseline Schedule

The Developer shall submit to TxDOT a Revised Project Baseline Schedule within 14 Days after each Change Order, Relief Event or Compensation Event is executed. All approved Change Orders, Relief Events and Compensation Events shall be incorporated into the originally planned execution of the Work. TxDOT will confirm in writing the acceptance of each Revised Project Baseline Schedule. The accepted Project Baseline Schedule or current accepted Revised Project



Baseline Schedule shall remain in force until a subsequent Revised Project Baseline Schedule is accepted by TxDOT.

**2.1.1.2.2 Project Status Schedule Updates**

The Developer shall submit to TxDOT Project Status Schedule Updates to reflect the current status of the Project including recovery schedules, schedule revisions due to Relief Event Determinations, and approved Change Orders. The Project Status Schedule Update shall be submitted as part of the monthly Progress Report.

The data date for use in calculating the Project Status Schedule Update shall be the first day of the following month. The Project Status Schedule Update shall accurately reflect updated progress to the status date, forecast finish for in-progress Schedule Activities and reforecast early dates and late dates for remaining Schedule Activities. If any actual dates are changed or corrected in any following month, a narrative must be included providing explanation of the change.

**2.1.1.2.3 Renewal Work Schedule**

No additional requirements.

**2.1.1.2.4 Schedule of Values**

Within ninety days after NTP1, and concurrent with the Project Baseline Schedule, the Developer shall submit to TxDOT a complete Schedule of Values for all Payment Activities as described below for TxDOT's approval. No payment by TxDOT from the Public Funds Amount, if applicable, will be made until the Schedule of Values is approved by TxDOT. Attachment 02-2A provides an example Schedule of Values.

The following pertains to presentation of the Schedule of Values:

- a) The Payment Activities shall be organized and grouped according to the approved WBS with subtotals for each WBS item at each WBS Level. There can be one or more Payment Activities for each of the lowest (terminal) WBS elements in the WBS. For example, earthwork (WBS Level VI) could have one Payment Activity or multiple Payment Activities that roll up costs to the WBS Level VI element.
- b) The Schedule of Values shall contain for each Payment Activity from the Project Baseline Schedule, the activity unique identification number, the activity description, the quantity, the applicable unit, unit price and scheduled value.
- c) The Developer's project management, administration, design, contingencies and any allowance for inflation, profit and financing, as well as indirect site costs such as site cleanup and maintenance; temporary roads and access; off site access roads; and security shall be prorated through all Payment Activities so that the sum of all the Schedule of Values line items equals the Total Project Construction Cost.

If it becomes necessary to add, combine, eliminate or modify any Payment Activities due to changes in the Work, a revised Schedule of Values as derived from a revised Project Baseline Schedule, shall be submitted 14 days after the respective Change Order, Relief Event or Compensation Event is executed, for acceptance by TxDOT.

#### **2.1.1.2.5 Progress Report**

Each month, beginning with the first full month after NTP2, the Developer shall submit to TxDOT the Progress Report. The Developer shall submit the Progress Report by close of business within seven Days following prior month's end. An electronic and printed copy of the entire Progress Report shall be submitted to TxDOT.

The Progress Report shall contain a narrative which shall include the following information:

- a) Describe progress for each Section and the Project as a whole, including all phases of Work. Identify start date and completion dates on major areas of Work. Group the information based on the WBS.
- b) Summarize QA/QC findings.
- c) List any Change Orders that were identified or executed during the period. Include their status.
- d) Identify any Relief Events or Compensation Events that were accepted during the period.
- e) Identify Schedule Activities planned for the upcoming period.
- f) Identify problems and issues that arose during the period and issues that remain to be resolved.
- g) Summarize resolution of problems/issues raised in previous progress reports or resolved during the period.
- h) Identify Critical Path issues and proposed resolution.
- i) Provide a report on the Milestone Schedule Deadlines showing the schedule dates for the immediate prior month and current month. A narrative is required to explain why the dates have changed for variances greater than 30 Days.
- j) Provide monthly expenditure projection curves for the total Project.
- k) Identify requested and/or required TxDOT or Independent Engineer actions for the next month.
- l) Provide digital progress photographs that accurately depict Project progress as outlined in the progress report narrative.

The Project Status Schedule Update shall be provided as part of the Progress Report using the following print outs:

- a) Gantt chart sorted by Work areas indicating the physical status of all Schedule Activities as of the date of the update and comparing the Developer's progress to planned progress;
- b) Gantt chart showing all critical Schedule Activities, sorted by early start dates;
- c) Ninety-day look ahead Gantt chart showing all upcoming Submittals from the Developer and approvals required by TxDOT or Governmental Entities;
- d) Ninety-day look ahead Gantt chart grouped by WBS and sorted by early start dates; and
- e) Gantt chart that clearly identifies the longest path sorted by early start dates.

If requested by TxDOT, the Developer shall make all corrections to the monthly Progress Report and resubmit. If the Developer does not agree with TxDOT's comments, the Developer shall provide written notice of disagreement within seven Days from the receipt of the comments.



#### ***2.1.1.2.6 As-Built Schedule***

Upon completion of the Punch List, the Developer will submit the Project Status Schedule Update identified as the “as-built schedule”. The “as-built schedule” shall reflect the exact manner in which the Work up to Final Acceptance and described by the CDA Documents was actually performed (including start and completion dates, Schedule Activities, actual durations, sequences and logic). The “as-built schedule” shall be signed and certified by the Developer’s Project Manager and the Developer’s scheduler as being a true record of when the Work was actually performed. The “as-built schedule” that TxDOT determines is correct and complete will be accepted as a condition of Final Acceptance.

#### **2.1.1.3 Revisions**

If it becomes necessary to add, combine, eliminate, or modify Payment or Schedule Activities to reflect modifications to the Work, such changes shall be made through a Change Order, Compensation or Relief Event that has been provided by TxDOT, and therefore reflected in the Project Schedules. Revisions to the Project Schedule and consequent realignment of funds between Payment Activities may be requested by the Developer through a Change Request, Compensation or Relief Event Notices.

#### **2.1.1.4 Time Impact Analysis**

As part of a Relief Request as set forth in Section 13.1.2 of the Agreement the Developer shall submit to TxDOT a written time impact analysis illustrating the influence of each Relief Event. Each time impact analysis shall include a fragmentary network demonstrating how the Developer proposes to incorporate the change, delay, or Developer request into the current Project Status Schedule Update.

The time impact analysis shall demonstrate the time impact to each and every affected Schedule Activity in the current Project Status Schedule Update utilizing the most recent schedule update as the basis for the analysis. The date of the most recent schedule update shall be a date prior to the date the change is given to the Developer, the date the delay occurred, or the date the Developer submits a request for a change. The event times used in the time impact analysis shall include the most recent schedule update, or as adjusted by mutual agreement.

The time impact analysis Submittal shall include the details of the change, including added, changed or deleted data for Schedule Activities and logic. If the current Project Status Schedule Update is revised subsequent to submittal of a time impact analysis but prior to its acceptance, the Developer shall promptly indicate in writing to TxDOT the need for any modification to its time impact analysis.

Delays shall not automatically mean that an extension of any milestone is warranted or due to the Developer. TxDOT will accept time extensions associated with Relief Events only to the extent that time adjustments to the Schedule Activity or Activities affected by the change or delay exceeds the total (positive or zero) Float of a critical Schedule Activity (or path) and extends the affected Milestone Schedule Deadline(s). In the case of multiple lines of negative Float, the change or delay must cause the affected path to exceed all others before a time extension will be granted.

The Developer shall submit one printed Gantt chart including all Schedule Activities affected by the time impact analysis, grouped and sorted by WBS and compared to the current Project

Schedule Baseline. In addition, the Developer shall provide one electronic backup of the Project Schedule with the time impact analysis and a comprehensive narrative for each Relief Request.

The Developer shall incorporate the results of the Relief Event Determination from TxDOT into the Project Status Schedule Update for the next progress report.

#### **2.1.1.5 Recovery Schedule**

If the Work is delayed on any Critical Path item for a period which exceeds the greater of either thirty Days in the aggregate or that number of days in the aggregate equal to five percent of the days remaining until Service Commencement, the next Project Status Schedule Update shall include a recovery schedule demonstrating the proposed plan to regain lost Project Schedule progress and to achieve Service Commencement by the specified date.

If a recovery schedule is required hereunder, the Developer shall have no right to receive settlement of a Payment Request until such time as the Developer has prepared and TxDOT has accepted such recovery schedule.

#### **2.1.2 Document Management**

In the provision of a document management system, the Developer shall:

- a) Use data systems, standards and procedures compatible with those employed by TxDOT and implement any new operating practices required as a result of TxDOT's amendments to any such systems, standards and procedures.
- b) Provide a secure location for any interface as may be provided by TxDOT, such that only authorized users have access and that it is protected from loss theft, damage, unauthorized or malicious use.
- c) Employ appropriate standards and procedures, and train Developer personnel to operate any TxDOT data management system which TxDOT may require in connection with the Project.
- d) Provide a mechanism for the electronic transfer of meta data along with the associated portable document format (PDF) images for uploading into an Electronic Document Management System (EDMS) employed by TxDOT.
- e) Provide TxDOT with procedures and software for accessing all Project-related documents as a component of the Developer's obligations under Section 9.3.3.3 of the Agreement.

All Project-related documents shall be searchable and legible. The minimum document data properties that are to be captured are listed in Attachment 02-3A.

In the Project Management Plan, the Developer shall describe:

- a) Methods by which all Project-related documents will be uniquely coded and retrievable in a user friendly format.
- b) The routing, filing, control and retrieval methods for all documents.
- c) Methods to facilitate sharing of data including procedures and software for accessing all Project-related documents.
- d) All documents and data elements that will support records required by Attachment 02-3A. These data elements shall include as a minimum: document class, document type/subtype, document name, form number, TxDOT records series item number,

TxDOT agency item number, TxDOT records series title, TxDOT retention period, turnover media, turnover frequency, submission type, special requirements, and remarks.

To allow for disaster recovery, the Developer shall back-up and store all Project-related documents in a secure off-site area.

### ***2.1.3 TxDOT Facilities and Space Requirements***

The Developer, the Independent Engineer, and TxDOT shall co-locate for the Term of the Agreement to facilitate Project coordination and daily communication. The definition of co-locate for this Agreement is office spaces meeting the conditions of this Technical Provision that are within close proximity to each other along or adjacent to the Project within one mile of the Project ROW. The Developer shall provide TxDOT and the Independent Engineer office space (i.e. available for occupancy) within thirty Business Days of issuance of NTP1. The location, condition, and amenities of the office space for TxDOT and the Independent Engineer are subject to TxDOT's prior written approval.

The Developer shall, as part of the Project:

- a) Provide and pay for all office space, facilities, equipment, services, and services necessary for TxDOT and the Independent Engineer to monitor the Work.
- b) Maintain the Project office space for at least 180 Days after the Term of the Agreement or until otherwise agreed to by TxDOT in writing.
- c) After the Term of the Agreement, provide disposal or removal of all facilities and any site restoration needed for the Project.

The office space and equipment provided by the Developer for TxDOT and the Independent Engineer shall be in good and serviceable condition, at least of the same quality as those of the Developer's Project office, at all times. The Developer and TxDOT shall participate in a facility condition survey prior to and at the completion of occupancy.

During phases of active construction including the initial build, capacity improvements, and major rehabilitation work and for 180 days thereafter, the Developer shall provide office space for one TxDOT employee per \$100 million in construction value (minimum one employee) and space for three Independent Engineer employees per \$100 million in construction value (minimum three employees). The \$100 million dollar value shall increase in compliance with the base toll rate cap increase methodology outlined in Exhibit 4 to the CDA for future Construction Work. Number of employee calculations shall be rounded to the next highest integer (i.e. \$320 million/\$100 million = 3.2, provide space for four employees). At all other times and for 180 days following the end of the Term, the Developer shall provide office space for two TxDOT employees and four Independent Engineer employees. All such office space shall be in a permanent structure.

Personal office areas shall be at least 150 square feet per person. Each office space (i.e. TxDOT space or Independent Engineer space), shall include:

- a) One enclosed conference room at least 400 sq ft;
- b) One enclosed conference room at least 600 sq ft;
- c) One lockable enclosed space for storage/filing at least 400 sq ft;
- d) An enclosed inside space for storage of equipment at least 100 sq ft;

- e) A computer/phone equipment room in accordance with Good Industry Practice and a minimum of 100 sq ft;
- f) At least one male restroom with one toilet, one urinal and two sinks for every twelve male employees and at least one female restroom with one toilet and one sink for every six female employees. Number of employee calculations shall be rounded to the next highest integer (i.e. 27 females = 4.5, provide five toilets and five sinks)
- g) A combination break and lunch room area at least 400 sq ft that includes a sink, a full size refrigerator, microwave and dish washer, and a bottled water dispenser with water delivery service; and
- h) A reception area at least 450 sq ft.

The reception area, restroom, conference room, and break and lunch rooms for TxDOT and Independent Engineer personnel shall be separate from each other and the Developer's facilities.

The Developer shall, as part of the Project:

- a) Secure a well-graded site that has an access road, a parking area, and building space that meets all local building code requirements;
- b) Obtain all site permits;
- c) Provide all utility services;
- d) Provide a parking area for each facility for the intended number of occupants plus visitor spaces to accommodate stake holders who may visit the offices for meetings. The parking area shall be reasonably level and have an all-weather paved surface and all-weather paved access;
- e) Provide an outside climate-controlled shed of at least 150 sq ft at each facility for storage of small tools and equipment for the exclusive use of TxDOT and the Independent Engineer. Provide separate sheds for TxDOT and the Independent Engineer;
- f) Provide at least two building entrance/exits for each building, each secured with a door lock plus a dead-bolt lock. TxDOT and Independent Engineer space shall be separated from each other and from the Developer's space by doors that are lockable from both sides;
- g) Appropriate signing; and
- h) Ensure that the site and office space complies with all requirements for buildings of similar size and use.

For the TxDOT and Independent Engineer office space, the Developer shall provide and pay for:

- a) Potable water (hot and cold) and sewer service;
- b) Electricity service and interior overhead lighting that meet OSHA standards and building and electrical code requirements for office space, with minimum electrical circuit capacity of twenty amperes and with at least two duplex electrical receptacles in each personal office area;
- c) Heating, ventilation, and cooling systems capable of maintaining temperatures between 65 and 70 degrees Fahrenheit in all spaces throughout the year;
- d) Daily janitorial service (except on Saturdays, Sundays and Holidays), including maintenance of trash containers and trash pickup service;
- e) Maintenance of the exterior areas, including the access to parking areas, that keeps them neat, clean, in good repair, and safe;
- f) Exterior security lighting that is automatically activated at low light levels to maintain at least two foot-candles of lighting within the fenced office site;

- g) 24-hour security patrol service or a silent watchman-type security system;
- h) Hard-wire high-speed internet access in each personal office area, including all service charges; and
- i) Telephone service with at least one outside line (with voice-mail service) for each personal office area assigned to the office and at least two lines dedicated to fax service. Telephone service and number of outside lines for a reception area shall be in accordance with Good Industry Practice for the number of employees in the office. The Developer shall be responsible for all charges.

The Developer shall provide, install, and maintain the following equipment, in working order, for the TxDOT and Independent Engineer's office spaces:

- a) Computers, Peripherals and Software
  - The Developer shall provide one computer and monitor including all necessary peripherals for each personal office area and the reception area. The computers shall be equipped with all necessary software required to perform TxDOT and Independent Engineer functions for the Project. The computers, monitors and peripherals shall be at least equal to the ones used by the Developer's staff.
  - The Developer shall provide one computer multi-media projector for each of TxDOT and the Independent Engineer.
- b) Telephones
  - At least one touch-tone telephone for each personal office area, each with a status indicator, access to all outside lines, and conference-call capability; and including speakers for the telephones in the enclosed offices rooms
  - At least one touch-tone conference telephone with satellite microphones for each conference room, each with a status indicator, and access to all outside lines, and conference-call capability;
  - Provide transportable cellular telephones and components such as batteries, cases, AC/DC chargers and other chords as needed, for each employee. The Developer shall be responsible for all service charges.
- c) Servers

The Developer shall provide data and document control servers with sufficient speed and capacity to perform TxDOT and Independent Engineer functions for the Project. Each individual computer shall be networked to all servers.
- d) Copier and Fax Equipment
  - Access to a full-scale color plotter capable of handling 36x24 and 11x17 plots
  - One high-speed laser computer printer capable of handling 11x17 prints
  - One high-speed color printer capable of handling 11x17 prints
  - One high-speed color photocopy machine capable of handling 11x17 prints and one facsimile transmission machine
  - One color scanner capable of handling 11x17 prints

All equipment shall be replaced and updated at least once every three years or when the Developer upgrades, whichever comes first. A multipurpose piece of equipment

capable of meeting multiple parts of the requirements above will be considered to meet the requirements.

e) Furniture

- One locking desk with three drawers or one desk with a three-drawer locking file cabinet for each employee office or cubicle;
- One office desk chair on wheels for each desk provided;
- One straight back office guest chair for each desk provided;
- Reception desk and chair, four guest chairs, one coffee table and one end table for the reception area;
- One conference table and chairs of sufficient quality and quantity as of Developer conference room;
- Break and lunch room furniture including tables and chairs; and
- File cabinets for storage rooms
- Two full wall, magnetic whiteboards, one full wall pin board and one projection screen in each conference room
- One whiteboard in each employee office minimum size 4 ft x 3 ft.

f) Premise wiring

- Developer shall provide and install the complete voice/data communications cabling system, which includes but is not limited to the EMT conduit, bridle rings, pull boxes, category 5e UTP cable, category 5e “RJ-45” UTP receptacles, category 3 “RJ-11” UTP receptacles, receptacle boxes, cover plates, and multi-mode fiber optic cable. All cable shall be routed, terminated, labeled and tested. Voice and data circuits shall be installed in conjunction with ISD and TxDOT Department of Information Resources staff.
- Developer shall certify and state supplied components as functional before installation and will bear all responsibility for replacement of parts at work commencement
- Developer shall prepare test plan and submit before installation, test installed system and supply test results, and will conform to all industry standard testing procedures
- Developer shall terminate all category 5e UTP cable in 66M150 punch down blocks for voice cabling and shall terminate all category 5e UTP data cable in data patch panels within the wiring closet
- Each drop will contain two data ports with RJ45 connectors and two voice ports with RJ11 connectors
- Developer will provide all materials, as needed and required, to complete the installation of the cable plant which shall include all cable, connectors, patch panels, equipment rack(s), patch cables, face plates, punch down blocks, fiber optic cable and other miscellaneous materials

The Developer shall also provide all office supplies including copier paper, toners, pens, pencils, notepads and other miscellaneous office supplies.

If any Developer-provided office space, facility, or equipment is damaged, destroyed, or stolen during the Project duration, Developer shall (at its own expense, except as noted herein) repair it,

replace it, and/or otherwise restore it to its original condition within five Business Days after the occurrence of such damage or loss.

If any loss or damage has been caused as a direct result of willful misconduct of TxDOT or the Independent Engineer's personnel, TxDOT will reimburse Developer for the actual, reasonable, and documented costs of the repair, replacement, and/or restoration prior to the Term of the Agreement.

## **2.2 Quality Management**

No additional requirements.

### **2.2.1 General Requirements**

No additional requirements.

### **2.2.2 Quality Terminology**

No additional requirements.

### **2.2.3 Quality Management Organization**

No additional requirements.

### **2.2.4 Quality Policy**

No additional requirements.

### **2.2.5 Systems and Procedures**

No additional requirements.

### **2.2.6 Inspection and Testing**

No additional requirements.

### **2.2.7 Responsibility and Authority of Developer Staff**

No additional requirements.

### **2.2.8 Design Quality Management**

No additional requirements.

#### **2.2.8.1 Design Submittals**

The Developer shall prepare and provide all Project related Submittals and documents using English units of measure.

The Developer shall furnish all Submittals by electronic copy in accordance with Section 2.1.2. Unless otherwise stated in the CDA Documents, the Developer shall provide to TxDOT four paper copies and a single electronic copy of each Submittal and at the same time provide to the Independent Engineer four paper copies and a single electronic copy of each Submittal. Each Submittal shall have the signature of an authorized representative of the Developer, unless otherwise expressly stated for a particular Submittal. The electronic copy shall be in a suitable



format (e.g. PDF) or in the format in which the Work was originally created unless stated otherwise in the CDA Documents.

The Developer shall include with each Submittal a transmittal cover sheet in a form acceptable to TxDOT.

The minimum sheet size for the Submittals shall be 8.5 inches by 11 inches. The maximum sheet size shall be 36 inches by 120 inches. Every page in a Submittal shall be numbered in sequence.

Each Submittal shall be assigned a unique, sequential number, clearly noted on the transmittal cover sheet. Original Submittals shall be assigned a unique numeric Submittal number. Revised Submittals shall bear an alphanumeric designation which consists of the unique Submittal number assigned to the original Submittal followed by a letter of the alphabet to represent that it is a subsequent Submittal of the original.

Any changes made on a revised Submittal, other than those made or requested by TxDOT, shall be identified and noted on the revised Submittal.

Design deliverables shall include a title block, consistent with the standard Project drawing format established as part of the Quality Management Plan, with the following information:

- a) Date of issuance and including all prior revision dates
- b) Contract title and number
- c) The names of the Developer and applicable Affiliates.
- d) Stage of development
- e) Reference to applicable Technical Documents and Amendments
- f) If required, review and acceptance or approval from a Governmental Entity, prior to submission to TxDOT
- g) Review stamp
- h) Action block space - All deliverables shall include a sufficient blank space in which the Developer may indicate the action taken, indicating their review and approval.
- i) When calculations accompany drawings in a Submittal, cross-references from the body of the calculations to the individual drawing to which the pages of the calculations pertain.
- j) Organization of the CAD drawings and associated documents in a logical manner, having a uniform and consistent appearance, and clearly depicting the intention of the design.

#### **2.2.8.2 Record Drawings and Documentation**

No additional requirements.

#### **2.2.9 ROW Survey Quality Management**

No additional requirements.

#### **2.2.10 Construction Quality Management**

Section 2.2.10 of Book 2B is replaced with the following:

Developer shall construct the Work in accordance with the Released for Construction Documents together with the relevant requirements and specifications of the CDA Documents.



The construction Quality Management Plan shall contain detailed procedures for the Developer's quality control and quality assurance activities. Developer's construction operations must incorporate quality processes as part of its Quality Management Plan, including planned systematic activities undertaken by a party independent of the construction process. Developer is to undertake all quality control, quality assurance, and performance verification testing in accordance with the Quality Management Plan and the requirements set out in the CDA Documents.

### **2.3 Operations Management**

No additional requirements.

### **2.4 Maintenance Management**

No additional requirements.

### **2.5 Environmental Management**

No additional requirements.

### **2.6 Public Information and Communications**

No additional requirements.

### **2.7 Safety Plan**

Section 24 includes Project specific requirements for the Safety Plan.

### **2.8 Management of Communications between Developer and TxDOT**

No additional requirements.

### **2.9 Right of Way Acquisition Management**

No additional requirements.

### **2.10 Cost Management**

For requirements, see Book 1.

### 3 PUBLIC INFORMATION AND COMMUNICATIONS

#### 3.1 General Requirements

No additional requirements.

#### 3.2 Administrative Requirements

##### 3.2.1 *Public Information and Communications Plan*

In developing the Public Information and Communications Plan (PICP), the Developer shall make the additional appropriate provisions to achieve the following:

- a) Public Liaison
  - Provide public information which facilitates alternative trip planning during construction.
  - Develop, disseminate and display timely, high quality, innovative, user-friendly, accurate and appropriate community information concerning the Project. This shall include exhibits showing subsurface portal locations, ancillary facility locations, and aesthetic treatments.
  - Conduct media/group tours at appropriate times/stages.
  - Response and action to invitations to attend meetings and other events.
- b) Customer Groups
  - Address the Project specific concerns of special interest groups within Customer Groups, to include interests in emergency services vehicle access, business owner and patron driveway access, delivery access, changes to bicycle and pedestrian access, and changes to mobility access associated with the Americans with Disabilities Act (ADA).
  - The Developer shall conduct noise wall workshop meetings with affected property owners in the vicinity of a proposed noise wall. The Developer shall determine if the affected property owners choose to accept the proposed noise wall. The limits or height of the proposed noise wall shall not be modified based on the property owners input. The Developer shall notify each affected property owner of the workshop a minimum of 30 days prior to the workshop date.
- c) Media

Develop and implement communications plans that anticipate and attempt to minimize traffic impacts of special and seasonal events that may draw large crowds through the Project limits. Such events may include special performances in unique venues adjacent to the corridor, public demonstrations, protests, etc.

##### 3.2.2 *Public Information Coordinator*

Additional responsibilities of the Public Information Coordinator shall include:

- a) Develop and implement a data management program to facilitate the collection, access and distribution of timely communication materials. The data management program is intended to provide an information repository of Customer Group

feedback to facilitate identification of best practices, resulting in the continuous improvement of the PICP.

- b) Develop a program to educate and train presenters who will organize and manage meetings with the Customer Groups.

### **3.2.3 Public Information Office**

The Developer shall maintain a Public Information Office throughout the Term. The minimum hours of operation for this office shall be as follows:

- a) Prior to Service Commencement

- Monday – Friday 7:00 AM – 7:00 PM
- Saturday 7:00 AM – 5:00 PM
- Sunday Closed

- b) All other times

- Monday – Friday 8:00 AM – 6:00 PM
- Saturday 8:00 AM – 4:00 PM
- Sunday Closed

The Public Information Office shall have a readily available room or rooms capable of hosting community/stakeholder meetings. The room(s) shall be convenient for, accessible to, and facilitate attendance by Customer Groups.

The Developer shall provide reasonable access to the Project to give TxDOT-selected Customer Groups the opportunity to view the construction and operations.

The Developer shall provide a 24-hour manned telephone response line during the Design-Build (DB) phase.

### **3.2.4 Customer Groups**

No additional requirements.

### **3.2.5 Public Meetings**

The Developer shall establish the frequency of public meetings based upon the Developer's data gathering and analysis of public feedback.

The PICP shall establish a list of potential, conveniently located meeting locations for public information and meetings.

The Developer shall bear all costs associated with public meetings.

### **3.2.6 Meeting Minutes**

No additional requirements.

### **3.2.7 Emergency Event Communications**

No additional requirements.

**3.2.7.1 Lane Closures**

For planned lane closures and emergency event lane closures, as appropriate, the Developer shall coordinate lane closures that may affect crossing TxDOT facilities with appropriate TxDOT area offices to ensure no conflicts occur. The Developer shall provide the advance notification of all lane closure notices to the appropriate TxDOT area office. TxDOT will provide appropriate contacts and information upon request.

**3.2.8 Disseminating Public Information**

The Developer's methods for the preparation and distribution of materials regarding Project related subjects shall also include highway advisory radio (HAR) and video news release (VNR). The Developer may choose to use additional delivery methods as appropriate.

The Developer shall develop and implement a marketing plan to make the Customer Groups aware of the Project web site.

The public web site shall provide for question and feedback opportunities for public communication.

## **4 ENVIRONMENTAL**

### **4.1 General Requirements**

No additional requirements.

### **4.2 Environmental Approvals**

#### ***4.2.1 New Environmental Approvals and Amended TxDOT-Provided Approvals***

No additional requirements.

#### ***4.2.2 TxDOT Review and Approval of Developer Submissions***

No additional requirements.

#### ***4.2.3 TxDOT-Provided Approvals***

The TxDOT-Provided Approvals are:

- a) Environmental Assessment: Loop 12 From Spur 408 to IH 35E and IH 35E From Spur 482 to IH 635, Dallas County, CSJ 0581-02-077 and 0196-03-137, February 2002
- b) Environmental Assessment: Interstate Highway (IH) 635 From: Luna Road To: US 75, Dallas County, CSJ: 2374-01-068 and 2374-07-046, April 2004.
- c) “Finding of No Significant Impact, Loop 12: From Spur 408 to I.H. 35E and I.H. 35E from Spur 482 to I.H. 635,” December 11, 2002
- d) “Finding of No Significant Impact, U.S. 75/I.H. 635 Interchange,” October 22 1993; supplemental Categorical Exclusion for additional High Occupancy Vehicle Facilities, April 1997; and Re-evaluation, January 31 2001
- e) “Finding of No Significant Impact, I.H. 635 (LBJ Freeway – West Section): From Luna Road to U.S. 75,” April 29, 2004
- f) Re-evaluation of the Environmental Assessment and FONSI for the Loop 12 / IH 35E Corridor: From Spur 408 to IH 635, Anticipated March 2008.
- g) FONSI Re-Evaluation for IH 635 from Luna Road to US 75 Anticipated March 2008.
- h) Categorical Exclusion Re-Evaluation for the IH 635/US 75 Interchange Anticipated March 2008.

### **4.3 Comprehensive Environmental Protection Program (CEPP)**

The CEPP shall include a compilation of environmental team resumes as an additional component part. If a tunnel is constructed the CEPP shall include a Tunnel Emissions Mitigation Plan as an additional component part.

#### ***4.3.1 Environmental Management System (EMS)***

No additional requirements.

#### ***4.3.2 Environmental Compliance and Mitigation Plan (ECMP)***

The commitments mentioned in TP 4.3.2 and its subsections are part of the Environmental reevaluation document. In case of miss match between the commitments, of the two documents, the stringent and superior of the two commitments will apply.

The Developer shall restore and stabilize disturbed areas in accordance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping, seeding and replanting with seeding specifications that are in compliance with Executive Order 13112.

#### **4.3.2.1 Compliance Action Plan (CAP)**

The Compliance Action Plan (CAP) shall include construction noise mitigation measures and the triggers for initiating mitigation measures.

#### **4.3.2.2 Environmental Permits, Issues, and Commitments (EPIC) Sheets**

The Developer shall include on the EPIC Sheets the permits, issues and commitments required to ensure that any discharge from the Project site into a sanitary sewer system complies with appropriate codes and standards of the sanitary sewer owner.

#### **4.3.2.3 Clean Water Act - Sections 404 and 401: Waters and Wetlands of the United States**

The Developer shall undertake and be fully responsible for all the obligations of TxDOT identified in the October 26, 2006 letter from the Department of the Army, Fort Worth District, Corps of Engineers authorizing Nation Wide Permit 14, “Linear Transportation Crossings” and the September 26, 2006 USACE Nationwide Permit Preconstruction Notification (Revised) including obtaining extensions and reauthorizations.

#### **4.3.2.4 Clean Water Act - Sections 402: Texas Pollutant Discharge Elimination System (TPDES)**

No additional requirements.

#### **4.3.2.5 State Listed Species and Unregulated Habitat**

The Developer shall mitigate according to the Environmental Assessments listed in Section 4.2.3 within the IH 35E/IH 635 interchange or other TxDOT approved sites.

#### **4.3.2.6 Endangered Species Act and Fish and Wildlife Coordination Act**

The Developer shall provide 5.52 acres of woodland mitigation based on requirements listed in Table 4-1A.

**TABLE 4-1A Woodland Mitigation**

Bur Oak ( <i>Quercus macrocarpa</i> )	30-35 ft. o.c.	10 per acre	
Chinkapin Oak ( <i>Quercus muehlenbergii</i> )	30-35 ft. o.c.	5 per acre	
Shumard Red Oak ( <i>Quercus shumardii</i> )	30-35 ft. o.c.	5 per acre	Check branching structure to avoid Pin Oak hybrids.
Pecan ( <i>Carya illinoensis</i> )	30-35 ft. o.c.	10 per acre	Use native variety if available. Plant B&B trees from Jan.15 to Mar.15, containerized from Sep.15 to Apr.15.
Possumhaw Holly ( <i>Illex decidua</i> )	15-20 ft. o.c.	12 per acre	Specify female plants (3:1).
Mexican Plum ( <i>Prunus mexicana</i> )	15-20 ft. o.c.	12 per acre	
Common Persimmon ( <i>Diospyros virginiana</i> )	15-20 ft. o.c.	12 per acre	Specify female plants (3:1).
Carolina Buckthorn ( <i>Rhamnus caroliniana</i> )	15-20 ft. o.c.	12 per acre	
Flameleaf Sumac ( <i>Rhus lanceolata or Rhus copallina</i> )	15-20 ft. o.c.	12 per acre	Specify female plants (3:1).

Notes:

1. The exact species composition may be adjusted due to commercial availability or site specifics; however, the total number of plants shall remain at 30 large trees and 60 small trees/shrubs per acre (90plants per acre minimum).
2. Large trees shall be 1" to 2" caliper at planting; small trees and shrubs shall be 6' to 8' in height at planting. Standard TxDOT planting details shall be used.

**4.3.2.7 Traffic Noise**

The Developer shall construct the noise walls in the early construction phases of the Project to help minimize construction noise. Prior to initiating Construction Work on any portion of Frontage Roads, Managed Lanes or General Purpose Lanes located in the vicinity of a portion of a required noise wall, the Developer shall construct the said portion of required noise wall. The Developer shall provide Noise walls listed in Table 4-2A.

TABLE 4-2A Noise Walls

Noise Wall No.	Location	Station Range <sup>[1]</sup> (Baseline)	Height <sup>[2]</sup>	Length
1	Between Webb Chapel Road and Marsh Lane along the eastbound frontage Road	Sta. 102+44 to Sta. 146+35 (FRLBJEBW)	8'-12' <sup>[3]</sup>	4400'
2	Between Webb Chapel Road and Marsh Lane along the westbound frontage Road	Sta. 116+74 to Sta. 148+24 (FRLBJWBW)	10'	3148'
3	Between Marsh Lane and Rosser Road along the eastbound frontage Road	Sta. 148+04 to Sta. 175+26 (FRLBJEBW)	9'	2723'
4	Between Marsh Lane and Rosser Road along the westbound frontage Road	Sta. 149+38 to Sta. 174+45 (FRLBJWBW)	9'	2510'
5	Between Rosser Road and Midway Road along the eastbound frontage Road	Sta. 176+14 to Sta. 203+62 (FRLBJEBW)	8'	2765'
6	Between Rosser Road and Midway Road along the westbound frontage Road	Sta. 175+13 to Sta. 191+78 (FRLBJWBW)	8'	1655'
7	Between Havenside Dr and Crestline Av along the eastbound frontage Road	Sta. 216+75 to Sta. 219+86 (FRLBJEBW)	9'	311'
8	Between Crestline Avenue and Welch Road along the eastbound frontage road	Sta. 220+35 to Sta. 230+75 Sta. 230+92 to Sta. 234+87 Sta. 235+00 to Sta. 237+07 (FRLBJEBW)	8'-10' <sup>[4]</sup>	1640'
9	Between Welch Road and Drexelwood Drive along the eastbound frontage Road	Sta. 238+19 to Sta. 247+70 (FRLBJEBW)	9'	950'
10	Between Drexelwood Drive and the DNT along the eastbound frontage Road.	Sta. 248+47 to Sta. 263+54 (BL635EB)	9'	1610'
11	Between Copenhill Road and Hughes Drive along the westbound frontage Road.	Sta. 327+09 to Sta. 334+50 (FRLBJWBE)	9'	740'
12	Between Hughes Drive and Ridgeview circle along the westbound frontage Road	Sta. 335+17 to Sta. 338+86 (FRLBJWBE)	9' <sup>[5]</sup>	369'
13	Between Ridgeview circle and Hillcrest Road along the westbound frontage Road	Sta. 357+59 to Sta. 358+50 Sta. 359+14 to Sta. 361+84 Sta. 362+43 to Sta. 367+61 (FRLBJWBE)	8'-11' <sup>[6]</sup>	884'
14	Between Hillcrest Road and Coit Road along the westbound frontage Road	Sta. 396+10 to Sta. 401+20 (BL635WB)	9'	509'

## Notes:

1. Station limits and Geopak alignment names shown in parenthesis are based on the re-evaluated design schematic provided in the RID.
2. Height transitions shall be based on the 6" maximum rise/fall criteria per 75' length of wall.
3. From East to West; ±3289' of wall length is 8' tall (minimum) and ±1111' is 12' tall (minimum).
4. From East to West; ±263' of wall length is 8' tall (minimum) then ±748' is 10' tall (minimum) and ±629' is 8' tall (minimum).
5. Proposed length is 410' but only 369' is needed to provide room for a proposed driveway connection to an existing Alley.
6. From East to West; ±120' of wall is 8' tall (minimum) then ±276' is 9' tall (minimum) then ±312' is 10' tall (minimum) and ±176' is 11' tall (minimum).

#### 4.3.2.8 Well Impacts and Requirements

No additional requirements.

#### 4.3.2.9 Cultural Resource Studies

No additional requirements.



**4.3.2.10 Public Involvement**

No additional requirements.

**4.3.2.11 Floodplain Requirements**

The Developer shall be responsible for obtaining a Corridor Development Certificate (CDC) as required from the local floodplain/CDC administrator for any development within the Trinity River floodplain designated as a regulatory zone.

**4.3.2.12 Standard Operating Procedures**

The Developer shall develop standard operating procedures for the following activities and include them in the ECMP:

- a) Controlling dust during construction;
- b) Mitigating vibration during construction;
- c) Mitigating light intrusion on adjacent properties; and
- d) Complying with jurisdictional waters and wetlands permits.

**4.3.3 Environmental Protection Training Plan (EPTP)**

No additional requirements.

**4.3.3.1 EPTP Scope and Content**

No additional requirements.

**4.3.3.2 EPTP Participation**

All non-administrative employees shall be afforded the opportunity to receive training and training materials.

**4.3.3.3 EPTP Schedule**

No additional requirements.

**4.3.4 Hazardous Materials Management Plan (HMMP)**

No additional requirements.

**4.3.5 Communication Plan (CP)**

No additional requirements.

**4.3.6 Construction Monitoring Plan (CMP)**

The CMP shall include the following provisions: Prior to NTP2, the Developer and TxDOT shall jointly inspect existing facilities, structures, and environmentally sensitive areas in the vicinity of the Site but not included as part of the Work. The Developer shall provide a minimum 2-week advance notice to TxDOT of this joint inspection. This inspection shall document the pre-construction condition of vegetation, streets, sidewalks, landscaping, residential and commercial property, creeks, storm drainage and infrastructure. The purpose of the inspection is to provide a point of reference from which TxDOT can determine if any facility, structure, and environmentally sensitive area damaged during the Work is restored to its pre-construction

condition. The Developer shall document the inspection with a report that shall include photographs, sketches, maps, and narratives clearly depicting the pre-construction Site condition.

All photographs shall be of archival quality and shall be accompanied by a caption describing the date; time of day, location and direction in photograph was taken. If the photograph shows existing damage, the damage must be clearly shown and noted in the caption. All sketches and maps must be no larger than 11” x 17.” All photographs must be 4” x 6” or larger.

The post award inspection shall inspect the municipal separate storm sewer system located within and adjacent to the Site. During the inspection, the Developer shall note the following:

- a) Storm drains, culverts, swales and other components of the municipal separate storm sewer system that Developer verified as free of floatable trash, silt, debris, and functioning as originally intended.
- b) Storm drains or culverts that do not function or appear not to function as originally intended.
- c) Siltation of culverts, concrete swales, and other components of the municipal separate storm sewer system.
- d) The presence of construction on adjacent, up-gradient, or down-gradient properties. If construction on other properties is noted, Developer shall photographically document the general condition of these properties and their compliance with storm water regulations.
- e) Pre-existing off-site tracking from the Site or surrounding properties.
- f) Potential pre-existing contamination (i.e., any areas of soil discoloration or distressed vegetation).
- g) Any other pre-existing condition that, by its nature, could be construed as a violation of the TPDES General Construction Permit.

Following construction of the Project, Developer shall conduct a yearly inspection to monitor and repair any of the above mentioned deficiencies in the storm water system.

#### **4.3.7 Recycling Plan**

No additional requirements.

#### **4.3.8 Tunnel Emissions**

If applicable the Developer shall develop and implement a Tunnel Emissions Mitigation Plan. The plan shall be prepared by personnel with at least 5 years of air pollution control and monitoring experience. The plan shall describe the actions the Developer shall undertake to monitor and control emissions from portals and ventilation exhaust. The plan shall demonstrate that tunnel emissions do not violate National Ambient Air Quality Standards (NAAQS) or cause harmful emissions of hazardous air pollutants or air contaminants. Hazardous air pollutants and air contaminants shall be as defined by federal or State regulations. The Developer shall submit the plan to TxDOT for at least 365 days prior to opening the tunnels to traffic.

### **4.4 Environmental Personnel**

No additional requirements.

#### **4.4.1 Environmental Compliance Manager (ECM)**

The ECM shall be an employee of an independent firm not Affiliated with the Developer. Developer shall not have the ability to relieve the ECM of his or her duty without the written consent of TxDOT. Should the Developer desire to replace the ECM, the Developer shall submit the resume of a replacement candidate. The replacement candidate shall be available full time within 30 days after delivery of TxDOT's written acceptance. In the absence of the Environmental Compliance Manager, the Hazardous Materials Manager shall act as an interim ECM.

The ECM candidate's experience shall include the following:

- a) Developing and managing a storm water pollution prevention plan;
- b) Developing and managing a hazardous substance and petroleum products management plan;
- c) Implementing environmental mitigation plans;
- d) Providing environmental and personal protection training; and
- e) Monitoring compliance with Section 404 Permit conditions.

The ECM's qualifying experience must include an understanding of:

- a) The scope and terminology of American Society for Testing and Materials (ASTM) E 1527-05, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process;" and
- b) Provisions of the TPDES Construction General Permit (TXR150000).

#### **4.4.2 Environmental Training Staff**

The ECM shall be responsible for selecting the Environmental Training Staff. The Environmental Training Staff shall train the Environmental Compliance Inspectors (ECIs) Environmental Training Staff members shall have at least one year of experience providing environmental compliance inspection for urban freeway construction.

#### **4.4.3 Environmental Compliance Inspectors (ECIs)**

The ECIs shall have at least one year operational control experience of Storm Water Pollution Prevention Plan activities.

#### **4.4.4 Cultural Resource Management Personnel**

The ECM shall designate personnel in the event that a need arises for renewed activities to comply with cultural resources laws.

#### **4.4.5 Natural Resource Biologist**

The ECM shall designate personnel in the event that a need arises for renewed activities to comply with cultural resources laws.

#### **4.4.6 Project Water Quality Specialist**

The Water Quality Specialist shall have verifiable experience implementing storm water pollution prevention plans in the State of Texas and be able to demonstrate a working knowledge of National Pollutant Discharge Elimination System (NPDES) requirements applicable to the Project.

#### **4.4.7 Hazardous Materials Manager**

The Hazardous Materials Manager shall have verifiable leaking petroleum storage tank investigation and remediation experience within the State of Texas.

### **4.5 Property Access**

To fulfill the obligation of the TxDOT-Provided Approvals to maintain current access during and after construction the Developer shall make reasonable efforts to minimize the inconvenience to vehicles, bicycles and pedestrians during the Term of Agreement. The Developer shall maintain access to adjacent properties during construction and ensure that visibility of businesses remains unchanged.

### **4.6 Dust Control**

The Developer shall institute dust control measures to minimize air quality impacts. The measures shall be adjusted as necessary based on construction traffic, forecasted wind speeds, and persistent dry weather conditions.

### **4.7 Asbestos Containing Materials (ACM)**

It is the Developer's responsibility to identify, inspect, notify, amend notifications as necessary, pay notification fees and abate asbestos found on any structure, including but not limited to bridges and buildings, in accordance with appropriate or relevant regulations or guidance.

It is the Developer's responsibility to identify, inspect, notify, amend notifications as necessary, pay notification fees and abate asbestos found on any structure, including but not limited to bridges and buildings, in accordance with appropriate or relevant regulations or guidance.

## **5 THIRD PARTY AGREEMENTS**

### **5.1 General Requirements**

TxDOT currently has agreements with Governmental Entities along the Project corridor to define the construction, maintenance and operation of traffic signals, illumination and roadway maintenance. The Developer is responsible for providing TxDOT and Governmental Entities with all information necessary to fulfill TxDOT's responsibilities under these agreements. Existing agreements with Governmental Entities for traffic signals, roadway illumination and municipal maintenance, and agreements with other third parties, are discussed in the following paragraphs.

### **5.2 Traffic Signals**

Current responsibilities for operation and maintenance of traffic signals along the corridor are defined by the agreements in Attachment 05-1A. These agreements require the city to control signal timing and to maintain the signals. TxDOT has also entered into an agreement with the City of Dallas to operate and maintain the temporary traffic signals for the Project prior to Service Commencement. With the exception of services provided in association with the requirement for payment under Article 5.D. of the agreements, the Developer shall reimburse TxDOT the costs of electrical power, operation and maintenance services provided by the city for existing and future traffic signals within the Project limits and in accordance with current and subsequent agreements between TxDOT and a city. The Developer shall make payment to TxDOT within 30 days from receipt of TxDOT's request for payment.

The Developer shall submit plans and specifications for proposed signal work to the city and shall secure the city's written consent in accordance with the form required by the agreement between TxDOT and the city. The consent shall form part of the Released for Construction Documents.

TxDOT has entered into an agreement, for the City of Dallas to provide two full time equivalent engineers on the Project. The Developer shall reimburse the costs for City of Dallas staff to TxDOT. Such costs shall not exceed \$300,000 per annum. City staff will represent the City of Dallas's interest in terms of conducting reviews and providing comments on and approvals of the Developer's traffic signal components of Work, and developing and implementing traffic signal timing in the vicinity of the Project corridor. The Developer will provide appropriate office space and equipment for City staff at the Project site. This requirement shall end six months after Service Commencement.

TxDOT has entered into an agreement, for the City of Farmers Branch to provide one full time equivalent engineer on the Project. The Developer shall reimburse the costs for City of Farmers Branch staff to TxDOT. Such costs shall not exceed \$150,000 per annum. City staff will represent the City of Farmers Branch's interest in terms of conducting reviews and providing comments on and approvals of the Developer's traffic signal components of Work, and developing and implementing traffic signal timing in the vicinity of the Project corridor. The Developer will provide appropriate office space and equipment for City staff at the Project site. This requirement shall end six months after Service Commencement.

The respective responsibilities of the Cities, the Developer and TxDOT for the operation, maintenance and costs of traffic signals before and after Service Commencement are outlined in Tables 05-1A, 05-2A, and 05-3A. The requirements of Attachment 05-1A shall have precedence over Tables 05-1A, 05-2A, and 05-3A.

**TABLE 05-1A Existing Traffic Signal Responsibilities**

City	Developer	TxDOT
Maintains and operates signals including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Invoicing TxDOT</li> </ul>	Reimburses TxDOT for costs including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Energy</li> </ul>	Pays City for costs including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Energy</li> </ul>

**TABLE 05-2A Temporary Traffic Signal Responsibilities**

City	Developer	TxDOT
Reviews and approves Developer’s temporary signal design plans	Temporary signal design plan including signal timing and installation including traffic switches	Reviews Developer’s temporary signal design plans
Maintains and operates signals including: <ul style="list-style-type: none"> <li>• Signal timing implementation and adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Invoicing TxDOT</li> </ul>	Reimburses TxDOT for costs including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Energy</li> </ul>	Pays City for costs including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Energy</li> </ul>

**TABLE 05-3A Permanent Traffic Signal Responsibilities**

City	Developer	TxDOT
Reviews and approves Developer’s permanent signal design plans	Permanent signal design plans including signal timing and installation	Reviews Developer’s permanent signal design plans
Maintains and operates signals including: <ul style="list-style-type: none"> <li>• Signal timing implementation and adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Invoicing TxDOT</li> </ul>	Reimburses TxDOT for costs including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Energy</li> </ul>	Pays City for costs including: <ul style="list-style-type: none"> <li>• Signal timing adjustments</li> <li>• Signal Maintenance</li> <li>• Emergency call response</li> <li>• Energy</li> </ul>

### 5.3 Roadway Illumination

The Developer shall construct, operate, maintain and provide energy for the illumination for the Managed Lanes and General Purpose Lanes. The Developer shall assume the operation, energy costs and maintenance of the existing General Purpose Lanes illumination system from the Operating Commencement Date.

It is anticipated that some municipalities may request continuous illumination along the Frontage Roads within the Project corridor. Should this occur, new agreements between TxDOT and the municipalities will be required. The Developer will be able to review and comment on these agreements and any additional Work associated with these agreements will be considered a TxDOT Change. It shall be the Developer's responsibility to coordinate with and provide reasonable accommodations to the third party (municipality) to carry out the operations and maintenance obligations as specified in the agreements.

#### **5.4 Municipal Maintenance Agreements**

Current responsibilities for municipal maintenance of State Highway routes within the Project corridor are defined by the agreements provided in Attachment 05-3A. The Developer shall execute the TxDOT's responsibilities and duties as defined by these agreements. The Developer shall coordinate the necessary arrangements directly with the municipality for additional maintenance of State Highway routes within the municipality's jurisdiction if so required by the Work.

#### **5.5 Dallas Area Rapid Transit (DART) Memorandum of Agreement**

TxDOT has entered into a Memorandum of Agreement between DART and TxDOT, provided as Attachment 05-4A, which defines the terms governing the construction of drainage structures across DART right-of-way.

#### **5.6 Other Affected Third Parties**

The Work interfaces with facilities of third parties. It is the responsibility of the Developer to coordinate the Work with all third parties potentially affected by the Work. The Developer shall prepare a plan which describes how it will mitigate the impact of the Work upon potentially impacted third parties.

#### **5.7 Other Transportation Projects**

Transportation projects within the North Central Texas Council of Government (NCTCOG) metropolitan area are tracked through the Transportation Improvement Program. The Transportation Improvement Program is a staged, multiyear program of projects approved for funding by federal, state, and local sources within the Dallas-Fort Worth area. Every two to three years, the NCTCOG, in cooperation with the TxDOT, local governments, and transportation agencies, develops a new Transportation Improvement Program. The 2004 – 2006 and 2006 – 2008 Transportation Improvement Programs are available on-line from the NCTCOG at <http://www.nctcog.org/trans/tip/>.

Presently, dependent upon available funding, TxDOT is planning two projects along the IH 35E corridor. They are:

CSJ: 0196-03-223

Title: Construct SB frontage road and entrance and exit ramps

Limits: Lombardy Lane to Spur 482 (Storey Road)

Type of work: Grading, paving, storm sewer, signs, pavement markings, structures

CSJ: 0196-03-249

Title: Construct frontage road and entrance and exit ramps

Limits: Crown Road to Joe Field Road

## **6 UTILITY ADJUSTMENTS**

### **6.1 General Requirements**

No additional requirements.

#### ***6.1.1 When Utility Adjustment is Required***

No additional requirements.

#### ***6.1.2 Certain Components of the Utility Adjustment Work***

##### **6.1.2.1 Protection In Place**

The Developer shall be responsible for Protection in Place of all Utilities impacted by the Project (including any Utilities remaining in place, any Utilities installed during the course of the Work, and any Early Adjustments) as necessary for their continued safe operation and structural integrity and to otherwise satisfy the requirements described in Section 6.2.1 - Standards.

##### **6.1.2.2 Early Adjustments**

TxDOT has initiated action to relocate the TXU transmission line located west of IH 35E within the IH 635/IH 35E Interchange. The relocation shall be completed no later than December 31, 2008. Any adjustment to the proposed TXU transmission line by the Developer shall be at the Developer's expense and is not eligible for reimbursement.

##### ***6.1.3 Reserved***

No additional requirements.

##### ***6.1.4 Agreements Between Developer and Utility Owners***

No additional requirements.

##### ***6.1.5 Recordkeeping***

No additional requirements.

## **6.2 Administrative Requirements**

### ***6.2.1 Standards***

No additional requirements.

### ***6.2.2 Communication***

No additional requirements.

### ***6.2.3 Utility Adjustment Team***

No additional requirements.

### ***6.2.4 Real Property Matters***

No additional requirements.



## **6.3 Design**

No additional requirements.

### ***6.3.1 Developer’s Responsibility for Utility Identification***

The Developer shall prepare and submit to TxDOT, no later than 30 days after NTP2, the Utility Strip Map showing the information obtained and/or confirmed pursuant to this Section. The scale of the Utility Strip Map shall be 1 inch = 100 feet.

### ***6.3.2 Technical Criteria and Performance Standards***

In all circumstances, longitudinal Utility installation beneath Frontage Road pavements or shoulders must receive prior written TxDOT approval.

### ***6.3.3 Utility Adjustment Concept Plans***

No additional requirements.

### ***6.3.4 Utility Adjustment Plans***

The Developer shall submit Utility Adjustment Plans after TxDOT has provided the Developer with Utility Adjustment Concept Plan review comments.

#### **6.3.4.1 Plans Prepared by the Developer**

No additional requirements.

#### **6.3.4.2 Plans Prepared by the Utility Owner**

No additional requirements.

#### **6.3.4.3 Design Documents**

No additional requirements.

#### **6.3.4.4 Certain Requirements for Underground Utilities**

No additional requirements.

#### **6.3.4.5 Utility Assemblies**

No additional requirements.

## **6.4 Construction**

### ***6.4.1 Reserved***

No additional requirements.

### ***6.4.2 General Construction Criteria***

No additional requirements.

### ***6.4.3 Inspection of Utility Owner Construction***

No additional requirements.

**6.4.4 Scheduling Utility Adjustment Work**

No additional requirements.

**6.4.5 Standard of Care Regarding Utilities**

No additional requirements.

**6.4.6 Emergency Procedures**

Developer shall provide Emergency procedures with respect to disruption of utility service in the PMP.

**6.4.7 Utility Adjustment Field Modifications**

No additional requirements.

**6.4.8 Switch Over to New Facilities**

No additional requirements.

**6.4.9 Record Drawings**

No additional requirements.

**6.4.10 Maintenance of Utility Service**

No additional requirements.

**6.4.11 Traffic Control**

The reference to Construction Traffic Management Plan shall mean Traffic Management Plan.

**6.5 Deliverables**

No additional requirements.

## **7 RIGHT OF WAY (ROW)**

### **7.1 General Requirements**

#### **7.1.1 Property Agreements**

If the Developer obtains a Property Agreement to facilitate design, construction, operation or maintenance, in relation to the Project, the Developer shall provide a copy of the agreement to TxDOT.

In order to reconstruct the Joe Ratcliff pedestrian walkway, the Developer shall obtain agreements from property owners to accommodate the re-construction.

#### **7.1.2 Parcels to Acquire**

TxDOT shall provide the Developer with access to the Project Right of Way (ROW) parcels shown on Attachment 07-1A on behalf of the State prior to December 31, 2008 or NTP2, whichever is earlier.

#### **7.1.3 TxDOT Owned Properties**

Descriptions and locations of TxDOT owned properties available for conditional use by the Developer are provided in Attachment 07-2A. The Developer has elected to use the following TxDOT owned properties:

The first property, the Welch site, is located at the northwest corner of Welch Road and IH 635 and will be made available to the Developer for the duration of the Work. The Welch site may be used for the permanent facilities to operate and maintain the Project, as well as monitor and control tunnel operations. If the Developer chooses the Welch site for sinking a shaft for tunnel construction activities, the shaft may remain only if used for ventilating or servicing the completed tunnel facilities, otherwise the Developer shall backfill the excavation.

The second property, the Churchill Way site, at the former Dallas Area Rapid Transit (DART) Park and Ride at Churchill Way will be made available to the Developer for use during the Design-Build (DB) phase of the Work. No construction or industrial activities including fabrication, material storage or vehicle maintenance shall be permitted on the Churchill Way property. For as long as deemed necessary by TxDOT, the Developer shall provide TxDOT continuous access to the traffic control center and parking lot located at the southeast corner of the property.

The third property, the High Five site, a parcel along US 75 at the southeast corner of the IH 635 and US 75 interchange, will be made available to the Developer during the DB phase of the Work. All Developer activities planned for the US 75 property at the interchange shall:

- a) Be confined to northern half of the property (north of the electric substation);
- b) Leave trees or other woody vegetation throughout the southern half of the property undisturbed;
- c) Leave woody vegetation along the channel or bank of Cottonwood Creek undisturbed;
- d) Not cause the removal of any existing stream crossings;

- e) Not cause the installation of any stream crossings along Cottonwood Creek. The Developer shall not disturb any portion of the Cottonwood Creek channel or bank; and
- f) Screen storage and fabrication yards from view from adjacent accesses and Frontage Roads.

The Developer shall use and maintain the selected TxDOT owned properties in accordance with the following conditions:

- a) The use of these three properties is limited to providing Project-related services exclusively for the Project. The properties may not be used by the Developer for any other business or commercial service.
- b) Prior to thirty days before NTP2, the Developer shall submit a master plan for each property to TxDOT. The Developer shall not access the property prior to TxDOT approval of the plan.
- c) The master plan shall include:
  - The facilities that the Developer plans to construct.
  - The areas dedicated to fabrication, material storage, roadways, vehicle parking, vehicle maintenance, construction offices as well as temporary debris or waste accumulation.
  - The location of all existing and planned overhead and underground Utilities.
  - The location of all fire lanes, emergency access points, security fencing and lighting.
- d) The Developer may only use the selected properties for the purposes shown on the master plan.
- e) Following its approval by TxDOT, the Developer shall implement the master plan for each property. Any subsequent revisions to any master plan shall also be submitted to TxDOT for approval prior to such revisions being implemented by the Developer.
- f) The Developer shall be responsible for obtaining any permit required by the State or other Governmental Entities to remodel, construct or occupy buildings on any of the three properties. The Developer will bear the cost to remodel, construct or occupy any buildings on the properties.
- g) Vehicle movement on any of the three properties shall be confined to the parking areas and roadways shown on the master plan.
- h) The Developer shall provide a hard all weather surface for the roadways and parking areas shown on the plan.
- i) Each of the properties shall be maintained in a neat and presentable condition.
- j) The Developer shall provide for any insect and rodent control.
- k) Inoperable vehicles shall not remain on the properties for more than fourteen days.
- l) The Developer shall ensure that all utility service(s) is/are terminated when appropriate.
- m) The Developer shall vacate the Churchill Way and High Five sites within 30 days of Service Commencement.
- n) The Developer shall return each property used for the Project to neat and presentable condition as directed by TxDOT. At a minimum the Developer shall return each property in the same condition as when access was provided.

## **7.2 Administrative Requirements**

### **7.2.1 Standards**

No additional requirements.

### **7.2.2 Software Requirements**

No additional requirements.

### **7.2.3 ROW Acquisition Plan**

No additional requirements.

### **7.2.4 Schedule and Review Procedures**

No additional requirements.

### **7.2.5 Developer's Project ROW Scope of Services**

No additional requirements.

### **7.2.6 Acquisition Process Summary**

No additional requirements.

### **7.2.7 ROW Personnel Qualifications**

Developer's ROW Acquisition Manager shall have at least five years experience managing the acquisition of transportation right of way projects for a condemning authority, be licensed as a real estate salesman or broker pursuant to the Texas Real Estate Act or rules established by the Texas Real Estate Commission, be familiar with appraisal and appraisal report review pursuant to the Uniform Standards of Professional Appraisal Practice (USPAP), and be familiar with the Uniform Act and applicable Laws of the State of Texas.

Each Appraiser and appraisal reviewers shall be licensed and certified in the State of Texas and shall have a minimum of five years experience in appraising real property for eminent domain purposes, including partial taking appraisal, partial taking appraisal review and expert witness testimony. He or she must also have been actively and continuously engaged for at least three years immediately preceding his or her selection for this Project in appraisal work primarily in Collin, Dallas, Denton, Ellis, Kaufman, Navarro, and Rockwall County(ies), Texas. The appraisers and the appraisal reviewers shall have separate and distinct duties, and appraisers must be employed by different firms from the appraisal reviewers. Each appraiser shall be required to submit three samples of previous appraisal work prepared for eminent domain purposes. All appraisers preparing and signing appraisals must be approved by TxDOT before performing any appraisals on the Project. If required by TxDOT, the appraiser will be required to demonstrate his/her skills at expert witness testimony.

Each land planner shall have a minimum of five years experience in land planning and expert witness testimony in eminent domain proceedings. He or she must also have been actively and continuously engaged for at least three years immediately preceding his or her selection for this Project in land planning work primarily in Collin, Dallas, Denton, Ellis, Kaufman, Navarro, and Rockwall County(ies), Texas. There shall be a minimum of two land planners who will be available to assist appraisers and provide complete land plans.

Each relocation agent shall have a minimum of three years experience in relocation assistance for right of way projects pursuant to the Uniform Act. A relocation agent's responsibilities shall include the following: Determination of eligibility of all displacees, contacting all displacees and informing them of their benefits, maintaining a file of all documentation concerning the relocation of the displacees, and extending all relocation assistance advisory services.

Each ROW negotiator shall be licensed either as a real estate sales person or broker pursuant to the Texas Real Estate Act or rules established by the Texas Real Estate Commission, and shall be familiar with appraisal and appraisal report review pursuant to the USPAP. The negotiator shall have a minimum of three years experience in right of way negotiations. The ROW negotiator's responsibilities shall include the following: contact with property owners on the Project to discuss the acquisition of property needed for the Project, maintain complete and accurate files of all transactions and contacts with the property owners and/or their representatives, and actively work toward a joint resolution to acquire the property with the property owner.

Each real estate attorney shall be licensed by the State of Texas and shall have at least five years experience in title review and curative matters. The real estate attorney's responsibilities shall include the following: coordinate and clear all title issues, and compliance assistance with State and federal acquisition requirements for the properties acquired for the Project.

ROW personnel shall have at least three years experience in title review and curative matters. ROW personnel's responsibilities shall include, but not be limited to the following: maintain complete and accurate files of all transactions and contacts with the property owners and/or their representatives, coordinate and clear all title issues and assist at closing the properties acquired for the Project.

#### ***7.2.8 Developer Conflict of Interest***

No additional requirements.

#### ***7.2.9 Meetings***

No additional requirements.

#### ***7.2.10 Documentation and Reporting***

No additional requirements.

#### ***7.2.11 Developer Responsibility for Costs***

No additional requirements.

#### ***7.2.12 Responsibilities of TxDOT***

No additional requirements.

#### ***7.2.13 TxDOT Project Monitor/Reviewer***

No additional requirements.

#### ***7.2.14 Responsibilities of the Office of the Attorney General***

No additional requirements.

### **7.3 Pre-Acquisition Activities**

No additional requirements.

#### ***7.3.1 Project ROW Surveying and Mapping***

No additional requirements.

#### ***7.3.2 Additional Reporting Requirements***

No additional requirements.

#### ***7.3.3 Title Services***

No additional requirements.

#### ***7.3.4 Introduction to Property Owners***

No additional requirements.

#### ***7.3.5 Appraisals***

No additional requirements.

##### **7.3.5.1 Appraisal Services**

No additional requirements.

##### **7.3.5.2 Appraisal Review**

No additional requirements.

#### ***7.3.6 Project ROW Acquisition Package Approval***

No additional requirements.

### **7.4 Acquisition Activities**

No additional requirements.

#### ***7.4.1 ROW Negotiations***

No additional requirements.

#### ***7.4.2 Relocation Assistance***

No additional requirements.

#### ***7.4.3 Closing Services***

No additional requirements.

#### ***7.4.4 Condemnation Support***

No additional requirements.

**7.4.5 Clearance/Demolition of Project ROW**

No additional requirements.

**7.4.6 Property Fence**

No additional requirements.

**7.4.6.1 Property Fencing for Public Properties**

No additional requirements.

**7.4.6.2 Property Fencing for Private Properties**

No additional requirements.



## 8 GEOTECHNICAL

### 8.1 General Requirements

Geotechnical investigation, analysis, and design as specified in this Section shall also apply to tunnels, tunnel ancillary facilities, and buildings.

### 8.2 Design Requirements

The Developer is responsible for all analyses, designs, detailing, clearances, and tolerances of components to ensure that components meet all form, fit, and functional requirements necessary for satisfactory operation of the indicated elements of the Project in accordance with Good Industry Practice.

#### 8.2.1 *Subsurface Geotechnical Investigation by Developer*

The Developer shall utilize drilling and field investigation measures that safeguard groundwater from contamination, and shall be responsible for any mitigation or restoration associated with the geotechnical investigation program.

The Developer shall prepare and amend, as needed, geotechnical engineering reports documenting the assumptions, conditions, and results of the geotechnical investigation and analysis, including the following:

- a) The report(s) shall ensure that adequate investigation, testing, analysis, design, mitigative measures and construction planning are applied to assess and provide for the effects of swell pressures from expansive soil and rock materials on foundations and earth retaining structures. They shall address all design features and facility characteristics that could affect expansive soil behavior.
- b) The report(s) shall provide design and construction parameters derived from geotechnical investigation and analysis for tunnels and tunnel ancillary facilities.
- c) The report(s) shall assess the corrosion potential of the soil and rock materials and conditions that will be encountered, and the impacts to planned surface and subsurface facilities.

#### 8.2.2 *Pavement Design*

The design of roadway pavement shall provide at a minimum:

- a) The pavement shall be designed for the current functional highway classifications. The functional highway classifications are provided in Table 08-1A.
- b) Assessment of requirements for subgrade stabilization or modification.
- c) For pavement sections located within tunnels and subsurface facilities, no combustible materials shall be allowed in the pavement design.
- d) For all concrete pavements and bridge decks, longitudinal joints shall be located within six inches of a lane line.
- e) The Developer shall obtain appropriate Governmental Approvals for all Developer constructed roadways beyond the Developer's responsibilities for maintenance.

**TABLE 08-1A Functional Highway Classifications**

<b>Classification</b>	<b>Roadway</b>
Urban Interstate	General Purpose Lanes, Managed Lanes, direct connectors, ramps, Frontage Road/cross street by-passes
Urban Other Principal Arterial	Harry Hines Boulevard, Marsh Road, Midway Road, Preston Road
Urban Minor Arterial	Frontage Roads, Josey Lane, Webb Chapel Road, Hillcrest Road
Urban Collector	Denton Drive, Rosser Road, Welch Road, Montfort Drive, Park Central Drive

### **8.2.3 Geotechnical Instrumentation**

For subsurface Managed Lanes, the Developer is responsible for developing a geotechnical instrumentation program, including plans and specifications as necessary, to monitor surface and subsurface components, prior to and during construction, in response to ground and groundwater conditions. The performance of the following components shall be included:

- a) structures;
- b) buildings and enclosed facilities;
- c) tunnels and subsurface facilities, and
- d) Utilities.

The geotechnical instrumentation program shall monitor the safety and adequacy of the design and construction approach, and shall permit appropriate modifications or remedial action if necessary.

### **8.2.4 Preconstruction Survey Requirements**

The Developer shall develop appropriate procedures and plans for and shall perform a pre-construction survey(s) of the Project Right of Way (ROW) and immediate vicinity to identify facilities or structures that could be affected by movements initiated by Project construction activities. The survey(s) shall accurately establish the structural condition of the identified facilities or structures prior to commencing construction in the vicinity of these facilities or structures.

## **8.3 Construction Requirements**

### **8.3.1 Construction Impacts**

When performing construction activities under or adjacent to existing structures or Utilities, the Developer shall limit vertical settlements and ground deformations so as to not damage structures, including foundation elements, and/or Utilities. For those occurrences involving TxDOT's structures and Utilities, the Developer shall coordinate excavation activities with TxDOT. For those occurrences involving third party structures and Utilities, the Developer shall coordinate excavation activities in accordance with Sections 5 and 6.

### **8.3.2 *Geotechnical Instrumentation***

The Developer shall install instrumentation and perform instrumentation readings, data collection, analyses, record keeping, and preparation of interim and summary reports. The Work shall include overall interpretation of monitoring data necessary to provide for safe construction and operations, and to permit timely implementation of proper remedial measures, when and as required, to prevent damage to structures, facilities and Utilities.

Following Service Commencement, the Developer shall be responsible for identifying and monitoring geotechnical instrumentation that is required for evaluating the long-term performance of the constructed facilities, and shall do so until a point at which he demonstrates that geotechnical conditions will no longer impact the Work.

#### **8.3.2.1 *Instrument Decommissioning***

The Developer's instrumentation plans and procedures shall contain appropriate procedures for salvage, abandonment, or removal of instrumentation that are compliant with ROW and easement requirements and with all applicable regulations.

### **8.3.3 *Noise and Vibration Monitoring Requirements***

The Developer shall assess and monitor the effect of noise and vibration caused by all construction upon structures, facilities, and neighbors to the ROW.

## **8.4 *Deliverables***

### **8.4.1 *Final Design Documents***

The Developer shall submit to TxDOT the results of the preconstruction survey required herein, prior to beginning construction of any portion of the Project to which the preconstruction survey results are applicable.

### **8.4.2 *Record Drawings and Documentation***

At the end of the Term, the Developer shall submit to TxDOT, as part of the Record Drawings, all instrumentation plans as described herein, and all installation and monitoring records developed over the Term of the Project.

## **9 LAND SURVEYING**

### **9.1 General Requirements**

No additional requirements.

#### **9.1.1 *Right-of-Entry***

No additional requirements.

#### **9.1.2 *Survey by TxDOT***

In performing surveys for other adjoining projects, TxDOT may need to verify and check the Developer's survey work. The Developer shall coordinate with TxDOT the Developer's planned construction activities. The Developer shall notify TxDOT within 2 Business Days if TxDOT stakes and marks are altered or disturbed.

### **9.2 Design Requirements**

#### **9.2.1 *Units***

No additional requirements.

#### **9.2.2 *Survey Control Requirements***

The Developer shall be granted access to the Dallas Fort Worth Virtual Verification Stations network and TxDOT control monumentation within 5 Days of written request.

##### **9.2.2.1 *Permanent Survey Control Network***

The Developer shall establish and maintain a permanent survey control network. The control network shall consist of monuments set in intervisible pairs at a spacing of no greater than 2 miles. Monuments shall be permanent and stable as defined in Section 663.17 of the General Rules of Procedures and Practices of the Texas Board of Professional Land Surveying (TBPLS). The Developer shall replace all existing survey monuments and control points disturbed or destroyed. The Developer shall make all survey computations and observations necessary to establish the position of all other control points based on the primary control provided.

##### **9.2.2.2 *Permanent Survey Control for Subsurface Managed Lanes***

The Developer shall place permanent and stable monuments as defined in Section 663.17 of the General Rules of Procedures and Practices of the TBPLS set in intervisible pairs at a spacing of no greater than 2000 feet.

#### **9.2.3 *Conventional Method (Horizontal & Vertical)***

##### **9.2.3.1 *Horizontal Accuracy Requirements for Conventional Surveys***

The TxDOT Dallas County Grid to Surface Scale Factor of 1.000136506 shall be used to convert Grid Coordinates from the Texas State Plane Coordinate System, North American Datum (NAD) 83, North Central Zone (4202), English units, US survey foot.

### **9.2.3.2 Vertical Accuracy Requirements for Conventional Surveys**

Criteria shall apply equally to all subsurface elements throughout the Project.

### **9.2.4 Right of Way Surveys**

No additional requirements.

### **9.2.5 Survey Records and Reports**

The Developer shall produce a horizontal and vertical control report including coordinate listing, maps showing control, preparation of standard TxDOT data sheets for all primary control, monument description and location description of all primary and secondary survey control points installed, marked and referenced along with a listing of the existing control used to create the installed control points. Control from adjoining, incorporated, or crossed roadway projects, which are currently in design, will be located and a comparison of the horizontal and vertical values will be shown. The Developer shall provide survey records and reports to TxDOT upon request.

### **9.2.6 Mapping**

All Developer acquired supplemental and additional mapping or ground topographic mapping to meet the Project requirements will be incorporated into a base mapping file and be shown on all survey, engineering, and ROW products referencing the base map. This would include, but is not limited to, soil borings, new improvements, changes to improvements, marked or visible Utilities, drainage structures, drainage areas obscured by vegetation or structures, areas outside the current mapping, areas requiring more accurate topographic information, or due to a change in the ROW configuration or alignment. Up-to-date ground topographic mapping shall be delivered to TxDOT upon request.

## **9.3 Construction Requirements**

### **9.3.1 Units**

No additional requirements.

### **9.3.2 Construction Surveys**

No additional requirements.

## **9.4 Deliverables**

### **9.4.1 Final ROW Surveying and Mapping**

No additional requirements.

### **9.4.2 ROW Monuments**

No additional requirements.

### **9.4.3 Record Drawings and Documentation**

The Developer shall submit the following as part of the Record Drawings and as a condition of Service Commencement:

- a) A listing of all primary and secondary control coordinate values, original computations and other records including Global Positioning System (GPS) observations and analysis made by the Developer
- b) Copies of all survey control network measurements, computations, unadjusted and adjusted coordinate and elevation values; and
- c) Survey records and survey reports.

The Developer shall produce reports documenting the location of the as-built alignments, profiles, structure locations, Utilities, and survey control monuments. These reports shall include descriptive statements for the survey methods used to determine the as-built location of the feature being surveyed. The Developer's as-built data shall include the coordinate types (x, y, and/or z) and feature codes in the same format in which the preliminary construction data was generated. Where data has been provided to the Developer from TxDOT in an x, y, z coordinate format, the Developer shall provide TxDOT with data in an x, y, z coordinate format. Where data has been provided to the Developer from TxDOT in an x, y only coordinate format, or z only coordinate format, the Developer shall provide TxDOT with data in an x, y only coordinate format, or z only coordinate format.

## 10 GRADING

### 10.1 General

No additional requirements.

### 10.2 Preparation within Project Limits

The second paragraph of Section 10.2 Book 2B shall be deleted.

Existing buildings within the Project Right of Way (ROW) that are not occupied by the Developer shall be removed within 30 Days after the start of Construction Work. TxDOT has entered into agreements with certain Property owners not impacted by the Work. These agreements will allow the owner to remain in a building for a defined time. The Developer shall coordinate all building removals with TxDOT.

### 10.3 Slopes and Topsoil

The Developer's grading shall comply with the following guidelines:

- a) The Developer shall provide stable slopes for areas outside the Developer's limits of maintenance. For slopes steeper than 4:1, the Developer shall be required to submit to TxDOT slope stability analyses that demonstrate the adequacy of the Developer's designs.
- b) Where existing IH 635 and IH 35E General Purpose Lanes or Frontage Road pavements are being overlaid, but not widened, the Developer may leave existing slopes in place, with TxDOT approval. The Developer shall be required to smoothly transition from the slope criteria contained herein to the existing slopes on IH 635 and IH 35E.

### 10.4 Sodding

No additional requirements.

### 10.5 Deliverables

#### *10.5.1 Released for Construction Document*

Slope stability analyses, if needed, shall be submitted to TxDOT for approval with the released for Construction Documents.

## 11 ROADWAYS

### 11.1 General Requirements

The Developer shall design and construct all roadway elements necessary to fulfill the requirements and functionality of the Project. The design shall also accommodate the Ultimate Configuration within the Project limits.

#### 11.1.1 Roadway Elements

The proposed roadway lane functionality for the Project is depicted in the re-evaluated schematic, as provided in the Reference Information Document (RID). The proposed roadway lane functionality for the Ultimate Configuration is provided in the latest approved design schematics and the lane configuration diagrams, as provided in the RID.

The following requirements shall be met:

- a) The limits of Project construction shall minimize impacts to the design, construction and traffic operations during construction of the Ultimate Configuration. The Developer's design shall accommodate the Ultimate Configuration based on the requirements of the CDA Documents.
- b) The Developer's final horizontal and vertical design for the Project's roadways shall accommodate the geometric design of the Ultimate Configuration in the environmentally approved schematic plans.
- c) The Developer shall provide entrance and exit ramps that meet proposed access to Frontage Roads and cross streets in accordance with the Interstate Access Justification (IAJ) report provided in Attachment 11-1A.
- d) The Developer shall provide space to accommodate a potential Dallas Area Rapid Transit (DART) tunnel north of the IH 635 centerline between Midway Road and Preston Road. The DART tunnel envelope is defined in Attachment 01-2A.
- e) The Developer shall provide operational declaration lanes for High Occupancy Vehicles (HOV).

#### 11.1.2 Revisions

Where changes to the roadway geometrics result in revisions to the Project ROW, the Developer is responsible for the initiation and progression of all environmental and public involvement processes in coordination with TxDOT. The Developer shall perform all ROW services that are necessitated by proposed changes, in accordance with the CDA Documents.

The IH 635 corridor vertical alignments may be raised up to five feet above the respective existing grade between the Webb Chapel centerline and the east end of construction tie-in at the High Five limits near Merit Drive.

### 11.2 Design Requirements

#### 11.2.1 Control of Access

No additional requirements.



**11.2.2 Roadway Design Criteria**

Book 2B, Table 11-1 is not applicable to this Project. The Developer shall complete the design of the Project roadways in a manner that meets or exceeds the requirements shown in Table 11-1A.

**TABLE 11-1A Roadway Geometric Design Criteria<sup>[1]</sup>**

Description	General Purpose Lanes	Managed Lanes Tunnels	Surface and Depressed Managed Lanes
<b>Design Speed</b>	60 mph	60 mph	60 mph
<b>Horizontal Alignment</b>			
Control Location	Centerline/Inside edge of lane	Inside edge of lane	Centerline/Outside edge of lane
Stopping Sight Distance (SSD)	570 ft	570 ft	570 ft
Minimum Radius <sup>[2]</sup>	2210 ft	2210 ft	2210 ft
Superelevation	e(max) = 6%	e(max) = 6%	e(max) = 6%
Equivalent Max Relative Slope (Max Relative Gradient)	1:222 (0.45%)	1:222 (0.45%)	1:222 (0.45%)
<b>Vertical Alignment</b>			
Maximum Grade	3.00%	3.00%	3.00%
Minimum Grade	0.50%	0.50%	0.50%
Crest Curve K-Value	151	151	151
Sag Curve K-Value	136	136	136
<b>Vertical Clearance<sup>[3]</sup></b>			
Under Bridge Structure/In Tunnels	16.5 ft	16.5 ft	16.5 ft
Under Sign Structure	16.5 ft	16.5 ft	16.5 ft
<b>Cross Sectional Elements</b>			
Lanes-per direction	Schematic		
Lane Widths			
Thru Lanes	12 ft	12 ft	12 ft
Usable Shoulder Widths			
Inside	10 ft	2 ft <sup>[4]</sup>	2-lane: 2 ft
			3-lane: 4 ft
Outside	10 ft	10 ft <sup>[4]</sup>	2-lane: 8 ft
			3-lane: 10 ft
Cross Slope			
Lanes	2.00% <sup>[5]</sup>	2.00%	2.00%
Shoulder	2.00% <sup>[5]</sup>	2.00%	2.00%
Median			
Type	Flush	N/A	Flush
Width	24 ft <sup>[6]</sup>	N/A	10 ft
Side Slopes			
Within Clear Zone	6:1	N/A	6:1
Outside Clear Zone	4:1	N/A	4:1
Clear Zone Width	30 ft	N/A	30 ft

**TABLE 11-1A Cont.**

Description	Frontage Roads (FR)	Cross Streets
<b>Design Speed</b>	45 mph	45 mph
<b>Horizontal Alignment</b>		
Control Location	Outside edge of lane	Centerline
Stopping Sight Distance	360 ft	360 ft
Minimum Radius	665 ft <sup>[2]</sup>	940 ft
Superelevation	e(max) = 4%	e(max) = 4%
Equivalent Max Relative Slope (Max Relative Gradient)	1:185 (0.54%)	1:185 (0.54%)
<b>Vertical Alignment</b>		
Maximum Grade	6.00%	6.00%
Minimum Grade	Uncurbed: 0.50%	Curbed: 0.35%
	Curbed: 0.35%	
Crest Curve K-Value	61	61
Sag Curve K-Value	79	79
<b>Vertical Clearance<sup>[3]</sup></b>		
Under Bridge Structure	16.5 ft	16.5 ft
Under Sign Structure	16.5 ft	16.5 ft
<b>Cross Sectional Elements</b>		
Lanes (per direction)	Schematic	
Lane Widths		
Thru Lanes	11 ft	11 ft
Turning Lanes	11 ft	11 ft
U-turns	20 ft	20 ft
Usable Shoulder Widths (uncurbed)		
Inside	On grade: 6 ft	N/A
	On structure: 8 ft	
Cross Slope		
Lanes and Shoulder	2.00%	2.00%
Median		
Type	N/A	Raised
Width	N/A	4 and 8 ft
Curb Offset		
Inside	1 ft	1 ft
Outside	1 ft	1 ft
Side Slopes		
Within Clear Zone	24:1	24:1
Outside Clear Zone	4:1	4:1
Clear Zone Width	Curbed: 1.5 ft	Curbed: 1.5 ft
	Uncurbed: 10 ft	

**TABLE 11-1A Cont.**

Description	Ramps and FR/Cross Street By-Passes	Direct Connectors
<b>Design Speed</b>	45 mph	50 mph
<b>Horizontal Alignment</b>		
Control Location	Outside edge of lane/ Inside edge of lane	Outside edge of lane
Stopping Sight Distance	360 ft	425 ft
Minimum Radius <sup>[2]</sup>	830 ft	1055 ft
Superelevation	e(max) = 6%	e(max) = 6%
Equivalent Max Relative Slope (Max Relative Gradient)	1:185 (0.54%)	1:200 (0.50%)
<b>Vertical Alignment</b>		
Maximum Grade	5.00%	5.00%
Minimum Grade	0.50%	0.50%
Crest Curve K-Value	61	84
Sag Curve K-Value	79	96
<b>Vertical Clearance<sup>[3]</sup></b>		
Under Bridge Structure/In Tunnels	16.5 ft	16.5 ft
Under Sign Structure	16.5 ft	16.5 ft
<b>Cross Sectional Elements</b>		
Lanes-per direction	Schematic	
Lane Widths		
Thru Lanes	14 ft	Single Lane: 14 ft Multiple Lanes: 12 ft
Usable Shoulder Widths		
Inside	At grade: 2 ft <sup>[7]</sup>	1 & 2-lane: 4 ft
	Retained fill/Structure: 4 ft <sup>[7]</sup>	3-lane: 8 ft
Outside	At grade: 6 ft <sup>[7]</sup>	1 & 2-lane: 8 ft
	Retained fill/Structure: 8 ft <sup>[7]</sup>	3-lane: 10 ft
<b>Cross Slope</b>		
Lanes	2.00%	2.00%
Shoulder	2.00%	2.00%
<b>Side Slopes</b>		
Within Clear Zone	6:1	Elevated: N/A      6:1
Outside Clear Zone	4:1	Elevated: N/A      4:1
Clear Zone Width	16 ft	Elevated: N/A      20 ft

Notes:

- Functional highway classifications are provided in Technical Provision 8.
- The minimum radii criteria are based on roadways designed with superelevation except for cross streets.
- Vertical clearance for pedestrian overcrossings shall be 17.5 feet.
- Sight distance criteria may require greater shoulder widths.
- For three or more General Purpose Lanes, cross slope shall be increased to 2.5% for the third lane and any additional pavement beyond the third lane. The minimum radii criteria are based on roadways designed with superelevation.
- The General Purpose Lanes median applies to sections where the Managed Lanes are in tunnel sections.
- If sight distance restrictions are present due to horizontal curvature, the shoulder width on the inside of the curve may be increased to 8' and the shoulder width on the outside of the curve decreased to 2' (at-grade) or 4' (structure).

The Developer shall meet the criteria shown in Table 11-2A for specific cases as listed below:

## a) Vertical grade

- Eastbound (EB) General Purpose Lanes (BLLBJEB) between stations 342+30 and 359+00.
- Westbound (WB) General Purpose Lanes (BLLBJWB) between stations 229+90 and 237+00 and stations 342+30 and 359+00.
- Managed Lanes (CLMLRE) from stations 10579+60 to 10590+60, 41+20 to 57+10, and 341+80 to 357+00.
- Southbound (SB) IH 635 – Loop 12 & IH 35E connector (RPSB35DC) (or WB IH 635 to SB 35/Loop 12) between stations 1037+80 and 1043+60.
- Northbound (NB) IH 35E – NB frontage road Valley View exit ramp (RPN35VV1) between stations 18+50 and 23+20.
- WB IH 635 – WB frontage road Preston Road exit ramp (RPWBFR) from station 11+94.41 to 15+40.
- EB frontage road – EB Managed Lanes entrance ramp (RPEBFRHOV) located west of Hillcrest from station 12+20 to 25+86.
- WB frontage road between WB frontage road by-pass and Park Central Drive from WB GP (BL635WB) station 385+45 to 390+23.

## b) Horizontal radius

- Managed Lanes (CLMLRE) between stations 10576+57.45 and 10588+49.81.
- WB IH 635 – NB IH 35E direct connector (CONNWBLBJ) between station 10547+40.58 and station 10561+01.54 or should we say curve CONNWBLBJ-5 as shown in the re-evaluated schematic.
- SB IH 35E – EB IH 635 direct connector (RPEB635DC) between stations 106+86.77 to 124+68.29.
- NB DNT – EB IH 635 ramp (RPNDNTEB) between stations 10+39.36 to 15+61.31
- EB frontage road to ramp NB DNT - EB IH 635 ramp (RPDNTEB) between stations 10+00 and 10+73.77 and stations 12+31.30 to 15+70.19.
- SB DNT – WB IH 635 ramp (RPSDTWB) between stations 42+62.71 and 47+50.64.
- Josey Lane – where it ties to the existing alignment on the south side of IH 635.
- Rosser Road and Welch Road – where they tie to the existing alignment on the north side of IH 635.
- Midway Road – where it ties to the existing alignment.
- Park Central Drive.

## c) K-values

- EB frontage road between EB GP (BL635EB) stations 377+30 and 388+93.
- WB frontage road between WB GP (BL635WB) stations 382+42 and 391+83.

Station limits and Geopak alignment names provided in Section 11 are based on the re-evaluated design schematic provided in the RID.

TABLE 11-2A

Description	Minimum Radius	Maximum Grade	Curve K-value
Frontage Roads	N/A	8.00%	Crest: 44 Sag: 37
General Purpose Lanes	1340 ft	4.00%	N/A
Managed Lanes	1340 ft	4.00%	N/A
Direct Connectors	835 ft	6.00%	N/A
Ramps and FR/Cross Street By-Passes	660 ft	6.00%	N/A
Midway Road and Rosser Road	675 ft	N/A	N/A
Josey Lane, Welch Road and Park Central Drive	300 ft	N/A	N/A

If the re-evaluated schematic utilizes values that do not meet the criteria in Table 11-1A and are not included in the lists provided in Section 11.2.2 a), b) and c), then values better than or equal to those may be utilized in their respective locations. If the latest approved design schematics for the Ultimate Configuration elements utilize values that do not meet the criteria in Table 11-1A, then values better than or equal to those may be utilized in their respective locations.

#### 11.2.2.1 Superelevation

All roadway elements shall meet the requirements of Table 11-1A. Existing superelevation in areas where ramps are to connect to existing pavement may be retained at existing superelevations. Pavement widening may be constructed by extending the existing pavement cross slope. Superelevation transitions shall be designed and constructed such that zero percent cross-slopes will not occur on bridges or on grades flatter than 0.35 percent.

The Developer may maintain the existing pavement normal crown in overlay sections but it shall not be flatter than 1.5 percent. At normal crowns pavement widening adjacent to existing pavement, shall be constructed on a 2 percent cross slope. The transition from existing cross slope to 2 percent shall occur within 1-foot of the closest lane line to the roadway widening.

#### 11.2.2.2 Deviations

Any deviations from the criteria in Table 11-1A that are not included in the lists provided in Section 11.2.2 a), b) and c) and those utilized in the re-evaluated schematic will require TxDOT review and comment. TxDOT in its sole discretion will determine if the deviation may be considered a design exception based on the controlling criteria listed below:

- a) Design speed
- b) Lane width
- c) Shoulder width
- d) Bridge width
- e) Structural capacity
- f) Horizontal alignment
- g) Vertical alignment
- h) Grades
- i) Stopping sight distance
- j) Cross slope

- k) Superelevation
- l) Vertical clearance

**11.2.3 Miscellaneous Roadway Design Requirements**

The Developer shall submit an IAJ report to TxDOT and FHWA for approval where proposed changes in ramp physical gore locations are greater than 50 feet. The physical gore is located at the intersection of roadway surfaces.

The Developer shall provide raised concrete islands where applicable to provide refuge for crossing pedestrians.

The Developer shall provide declaration lanes for High Occupancy Vehicles (HOV) at entrances into the Managed Lanes that meet or exceed the requirements in Table 11-3A. A declaration lane is optional for the specific entrances into the Managed Lanes as listed below:

- The Webb Chapel Road by-pass ramp (RPEWCBP) entrance to the WB IH 635 – NB IH 35E connector (CONNWBLBJ); and
- The WB General Purpose Lanes entrance to CONNWBLBJ.

**TABLE 11-3A Declaration Area Design Criteria**

Description	Minimum
Transition Taper Ratio	50:1 <sup>[1]</sup>
Declaration Zone Length	100 ft
Right Lane Width (HOV Declaration)	11 ft <sup>[2]</sup>
Left Lane Width (All Others)	11 ft <sup>[2]</sup>
Usable Shoulder Width	1 ft <sup>[3]</sup>
Median (Flush)	1 ft

Notes:

1. Taper length is based on the center of the travel lane for the controlling side. The taper transitions for both lanes shall occur within the same longitudinal limits.
2. The lane widths shall be 12 feet for the entrance into the EB Managed Lanes, which is located on the west side of the IH 635/IH 35E interchange.
3. The NB IH 35E-IH 635 Connector (RPNB35DC) and the NB LP 12 & IH 35E-IH635 Connector (RPNB12DC) shall have at a minimum a 2 ft usable shoulder. The SB IH 35E-IH 635 Connector (RPEB635DC) and west entrance into the managed lanes shall have 4 ft inside and 8 ft outside shoulders.

**11.3 Construction Requirements**

All driveways must be reconstructed to equal or better standards including methods, materials, and geometries.

## **12 DRAINAGE**

### **12.1 General Requirements**

The Developer shall design and construct drainage systems that provide a well-drained corridor and a safe environment.

It is the Developer's responsibility to determine the final location and appropriate size for all drainage features needed for the interim configuration and the Ultimate Configuration.

Interim configuration drainage systems shall be sized and located in such a manner as to accommodate the Ultimate Configuration.

If existing drainage patterns are revised during the Project design, then the Developer shall design and construct a solution that does not adversely impact property owners outside the ROW.

### **12.2 Administrative Requirements**

#### ***12.2.1 Data Collection***

No additional requirements.

#### ***12.2.2 Coordination with Other Agencies***

The Developer shall coordinate with the regulatory agencies to obtain all water-related permits required for construction of the Project including the Corridor Development Certificate.

The Developer shall provide to the local flood plain administrators all information and technical data needed to obtain Letters of Map Revision (LOMR) from the Federal Emergency Management Agency (FEMA).

### **12.3 Design Requirements**

The Developer shall provide for conveyance and/or storage for storm events that meet or exceed the design frequency criteria as provided in Attachment 12-1A, IH 635 Drainage Criteria Manual, to maintain passable roadways and prevent adverse impacts to the Project or adjacent properties. The Developer shall provide a drainage system that maintains or improves existing drainage patterns and conditions.

The drainage design for the Project shall be in accordance with Attachments 12-1A and Attachment 12-2A, amendment for the IH 635 Drainage Criteria Manual.

#### ***12.3.1 Surface Hydrology***

##### **12.3.1.1 Design Frequencies**

The Developer shall use the design frequencies listed in Attachment 12-1A's Table 4.2.1 except for IH 35E south of Crown Road, where the Developer shall use the design frequencies listed in Table 12-1.

All driveway culverts shall be designed for the 10-year frequency at a minimum.

Roadside channels, as defined in the Attachment 12-1A, shall be designed to the same frequency as their complementary storm sewer systems.

#### **12.3.1.2 Hydrologic Analysis**

The Developer shall perform hydrologic analyses for the design of drainage features for the interim and Ultimate Configurations. The Developer shall select the appropriate hydrologic method based on the criteria in Attachment 12-1A.

For IH 35E south of Crown Road, the Developer shall design for the future changes in land use that may affect the magnitude of runoff. Land use should be estimated based on fully developed conditions.

#### **12.3.2 Storm Sewer Systems**

The Developer shall perform hydraulic analyses for the design of storm drainage systems for the interim and Ultimate Configurations according to the provisions in Attachment 12-1A. Design shall be based on these analyses.

In the design of the storm sewer systems, starting water surface elevations in the outfall channels shall be based on the frequencies provided in Attachment 12-1A.

##### **12.3.2.1 Pipes**

No additional requirements.

##### **12.3.2.2 Ponding**

The requirements in Book 2B shall be replaced by Attachment 12-1A.

#### **12.3.3 Stormwater Storage Facilities**

No additional requirements.

#### **12.3.4 Hydraulic Structures**

The Developer shall conduct an assessment of stream stability and scour for cross drainage structures where applicable.

##### **12.3.4.1 Culverts**

The Developer shall use the criteria in Attachment 12-1A for hydraulic design criteria of culverts. Backwater from culvert headwaters shall remain at least one foot below the edge of finished pavement of the roadway low point or at an elevation that allows the storm sewer hydraulic grade line requirements of Attachment 12-1A to be met, whichever is more stringent.

##### **12.3.4.2 Bridges**

The Developer shall use the criteria in Attachment 12-1A for hydraulic design criteria of bridges.

###### **12.3.4.2.1 Methods Used to Estimate Flows**

No additional requirements.



#### ***12.3.4.2.2 Design Frequency***

The Developer shall use the design frequencies listed in Attachment 12-1A's Table 4.2.1.

The Developer shall provide a scour analysis in accordance with FHWA's Hydraulic Engineering Circular No. 18 - Evaluating Scour at Bridges for all new bridges. If necessary, the Developer shall provide countermeasures for any instability and scour problems in accordance with FHWA's Hydraulic Engineering Circular No. 23 Bridge and Scour and Stream Instability Countermeasures.

#### ***12.3.4.2.3 Hydraulic Analysis***

The Developer shall use the criteria in Attachment 12-1A for hydraulic design criteria of bridges.

#### ***12.3.4.2.4 Bridge/Culvert Waterway Design***

The Developer shall model FEMA flows in order to meet the National Flood Insurance Program (NFIP) criteria and requirements. However, the Developer must size structures based on flows determined in accordance with the requirements of Book 2A, Section 12.3.1.2.

#### ***12.3.4.2.5 Bridge Deck Drainage***

The bridge deck drainage system shall outlet at the bottom of the substructure either into a storm sewer system or into an open channel and in no case shall this drainage be allowed to discharge against any part of the structure.

#### ***12.3.4.2.6 Drainage Report for Major Stream Crossings***

Major stream crossings shall be considered as those provided in Table 4.2.1 of Attachment 12-1A and any waterway listed on a FEMA Flood Insurance Study or requiring a bridge class structure, which is defined as any bridge or a culvert with a total opening width greater than or equal to twenty feet. Any other waterway will be by default a minor stream crossing.

## **12.4 Construction Requirements**

No additional requirements.

## **12.5 Deliverables**

No additional requirements.

## **12.6 Drainage Easements**

The Developer shall submit drainage easement delineations to TxDOT for review and comment prior to the start of the acquisition process.

## 13 STRUCTURES

### 13.1 General Requirements

No additional requirements.

### 13.2 Design Requirements

#### 13.2.1 Design Parameters

Design for all structural elements, unless noted, shall be based on the Load Resistance Factor Design (LRFD) methodology as presented in the most recent AASHTO LRFD Bridge Design Specifications, including all interim revisions.

Segmental bridges shall additionally conform to the requirements of AASHTO Guide Specifications for Design and Construction of Segmental Bridges.

Pedestrian bridges shall additionally conform to the requirements of AASHTO Guide Specifications for Design of Pedestrian Bridges.

The Developer shall proportion bridge spans to avoid uplift at supports.

Protective/containment fencing shall be required at the Joe Ratcliff pedestrian bridge. The developer shall coordinate the location and limits of the protective/containment fencing with TxDOT.

An owner's transportation master plan is not included in the reference documents. The applicable designation is the current Metropolitan Master Plan of the North Central Texas Council of Governments (NCTCOG). This plan is to be found on the NCTCOG web site [www.nctcog.org](http://www.nctcog.org).

#### 13.2.2 Bridge Design Loads and Load Ratings

a) Live Loads

All roadway bridges and bridge class culverts shall be designed to accommodate the following live loads:

An HL-93 truck or a tandem truck plus lane load as defined in the AASHTO LRFD specifications shall be utilized for bridges except pedestrian bridges.

Pedestrian bridges and sidewalks of vehicular bridges shall be loaded in accordance with requirements in the AASHTO LRFD Bridge Design Specifications and the AASHTO Guide Specifications for Design of Pedestrian Bridges. In addition, all pedestrian bridges shall also be designed for an AASHTO H-10 truck live load (as defined in the AASHTO Standard Specifications for Highway Bridges, 17th edition) to account for maintenance and emergency vehicles.

b) Additional Loads

Bridges (except pedestrian bridges) shall also be designed to accommodate a minimum future overlay load of 25 psf.

Load ratings shall be provided in accordance with AASHTO's Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges instead of AASHTO's Manual for Condition Evaluation of Bridges as required by Book 2B.

### ***13.2.3 Bridge Decks and Superstructure***

The Developer shall design sidewalks to meet the criteria of the AASHTO Roadside Design Guide.

The type of bridge shall not be restricted to those typically used by TxDOT. Other types and components may be used, but will be allowed only if:

- a) They have been accepted for general use by the Federal Highway Administration (FHWA); and
- b) The Developer can demonstrate that the design of the bridge type and components will meet the functional requirements of the Project.

Modular joints shall be used when anticipated movement exceeds 5 inches and shall be designed and tested for fatigue loading.

Box girders shall be accessible without impacting traffic below. The Developer shall size the inside depth of steel, cast-in-place concrete or concrete segmental box girders with due consideration to interior inspection. The Developer shall provide adequate access openings into all cells of the girders to facilitate all inspection and maintenance activities.

Segmental bridges shall additionally conform to the following:

- a) Segmental bridge decks shall use deck protection systems to prevent infiltration of corrosive agents into reinforcing in the superstructure. The deck protection system used shall be such that cracking is minimized and adequate bond strength is developed with the superstructure.
- b) If monolithically cast overlay is used as part of the deck protection system, the Developer shall develop fully engineered design guidelines for the thickness of the monolithic concrete removed and replaced in a manner that keeps distress and changes in surface profile at the time of concrete removal to levels that do not reduce the structural integrity of the structure.
- c) All expansion joints shall be sealed or drained. External tendons, if used, shall be protected with a water-tight duct jointing system.
- d) The design, detail and construction of segmental bridges shall provide for the easy addition of supplemental post-tensioning.

### ***13.2.4 Bridge Foundations***

Integral abutments, where the superstructure is structurally framed (either completely or partially) into the abutment, shall not be permitted. Mechanically Stabilized Earth (MSE) walls shall not serve as structural foundations for bridges on the Project and shall not be subjected to vertical loads from the bridges. Bridge approach slabs shall be designed and constructed to mitigate settlement immediately behind abutment backwalls.

### ***13.2.5 Bridge Railings and Barriers***

As referenced in Book 2B, the current list of standard TxDOT railings is shown in the table below:

**TRAFFIC RAILS**

<b>Std Name</b>	<b>Description</b>
T101	Steel Post with W-Beam (27" tall)
T203	Concrete Parapet w/5 Ft Openings (27" tall)
T221	Concrete Parapet (32" tall)
T401	Concrete Parapet w/Stl Post and Rail (33" tall)
T402	Concrete Parapet w/Stl Post and Rail (42" tall)
T411	Conc Traf Rail w/windows(Tx Classic)(32" tall)
T501	Concrete Safety Shape (32" tall)
T502	T501 w/Multiple Drain Slots (32" tall)
T503	Precast T501 w/Anchor Bolts (32" tall)
T504	Precast T501 for Box, Slab & Dbl-T Bms (32" tall)
T6	Steel Post w/Doubled W-Beams (27.125" tall)
T77	Steel Post w/Two Elliptical Pipes (33" tall)
HT	Heavy Truck Traffic Rail (50" tall)
SSTR	Single Slope Traffic Rail (36" tall)

**COMBINATION RAILS**

<b>Std Name</b>	<b>Description</b>
C203	T203 w/Steel Pipe Rail (42" tall)
C221	T221 w/Steel Pipe Rail (42" tall)
C402	T402 w/Steel Pipe Rail (42" tall)
C411	Comb Rail w/windows (Tx Classic) (42" tall)
C501	T501 w/Steel Pipe Rail (42" tall)
C502	C501 w/Multiple Drain Slots (42" tall)

**MISCELLANEOUS RAILS**

<b>Std Name</b>	<b>Description</b>
T101RC	Retrofit Guide for T101 on Curbs
T1-101R	Retrofit (Convert T1 to T101)
T2/T201TR	Guide for T2/T201(Retrofit Thrie-Beam Transition)
T202TR	Guide for T202 (Retrofit Thrie-Beam Transition)
T501R	T501 Retrofit Guide
T6R	T6 Retrofit Guide
TRF	Traffic Rail Foundation
PR1	Pedestrian Rail, (42" tall)
PR2	Pedestrian Rail, (42" tall)
PR3	Pedestrian Rail, (43.75" tall)
BR3	Pedestrian/Bicycle Rail, (55.75" tall)
B221	T221 w/Chain Link Fence (Bicycle) (68" tall)

**13.2.6 Retaining Walls**

The type of wall shall not be restricted to those typically used by TxDOT. Other types and components may be used, but will be allowed only if:

- a) They have been accepted for general use by FHWA; and
- b) The Developer can demonstrate that the design of the wall type and components shall meet the functional requirements of the Project.

The Developer shall not use steel modular walls on this Project. Modular walls employing interlocking blocks shall not be used where surcharge loads from vehicular traffic are present.

The design of wall structures shall take into account live load surcharges. The Developer shall apply the appropriate live loading condition (vehicular, heavy rail, transit etc.) that each wall is subjected to. These live load surcharges shall be based on the latest AASHTO LRFD specifications, American Railway Engineering and Maintenance of Way Association (AREMA) specifications, or the requirements of the specific railroad and transit owner/operator, as appropriate.

The retaining wall layout shall address slope maintenance above and below the wall.

**13.2.7 Noise/Sound Walls**

No additional requirements.

**13.2.8 Drainage Structures**

The Developer shall apply the following:

- a) An HL-93 truck or a tandem truck plus lane load as defined in the AASHTO LRFD specifications shall be utilized for all structures.
- b) When holes are required to be drilled through concrete structures at headwalls, etc. a coring device shall be used.

### ***13.2.9 Sign, Illumination, and Traffic Signal Supports***

No additional requirements.

## **13.3 Construction Requirements**

No additional requirements.

### ***13.3.1 Concrete Finishes***

All concrete surfaces that do not have aesthetic treatments shall have a uniform texture and appearance. Color treatment, where required as an aspect of the aesthetic treatment of the concrete, shall be uniform in appearance. Ordinary Surface Finish (as defined by the TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges: 2004) shall be applied to the following as a minimum:

- a) Inside and top of inlets
- b) Inside and top of manholes
- c) Inside of sewer appurtenances
- d) Inside of culvert barrels
- e) Bottom of bridge slabs between girders or beams
- f) Vertical and bottom of surfaces of interior concrete beams or girders.

### ***13.3.2 Structural Metals***

No additional requirements.

### ***13.3.3 Steel Finishes***

Except for weathering steel, all structural steel shall be protected. The color for structural steel paint shall conform to the aesthetic scheme of the Project.

If weathering steel is used, the Developer shall protect all components of the structure that are susceptible to corrosion and/or staining from weathering steel run-off.

## **13.4 Deliverables**

The Developer shall obtain National Bridge Inventory (NBI) numbers from TxDOT for all bridges and bridge class culverts. The NBI numbers shall be shown on the applicable layout sheets of the Final Design Documents.

## 14 RAIL

### 14.1 General Requirements

Section 14.1 of Book 2B is not applicable to the Project.

This Section consists of the requirements to coordinate, design and construct all railroad/transit elements of the Project. It is the Developer's responsibility to identify each railroad and transit owner/operator in the Project corridor.

The operating railroad shall mean the individual railroad and transit owner/operator.

### 14.2 Railroad Design Standards

The design for all railroad/transit elements of the Project shall be based on the most recent American Railway Engineering and Maintenance of Way Association (AREMA) and the requirements of operating railroad.

All work involving railroad companies, work on railroad Right of Way (ROW), and the development and execution of railroad programs shall be in accordance with State and federal law and the practices, guidelines, procedures and methods contained in the TxDOT Traffic Operations Manual, Railroad Operations Volume as amended per Attachment 14-1A. Additionally, the requirements of the owner of each facility crossed shall be compared to the requirements in the TxDOT manual, and the most restrictive criteria shall be utilized.

The structural design of any Utilities, including drainage structures, installed by the Developer and crossing a rail line, shall be in accordance with the operating railroad's design criteria.

### 14.3 Project Work Affecting Railroad Operations

The design and installation of all railroad warning devices and traffic signals shall be coordinated with the appropriate Governmental Entities and operating railroads.

#### *14.3.1 Railroad Agreement*

The Developer is responsible for preparing all agreements necessary to construct or modify any facility within the railroad's/transit's ROW including design document review and approval. TxDOT shall negotiate and execute all the agreements prepared by the Developer.

#### *14.3.2 Agreement for Construction, Maintenance and Use of Right of Way*

The Developer's responsibility in this regard shall extend to include transit owners/operators.

#### *14.3.3 Operation Safety*

The Developer's responsibility in this regard shall extend to include transit owners/operators.

#### *14.3.4 Railroad Right of Entry Agreement*

The Developer's responsibility in this regard shall extend to include transit owners/operators.

***14.3.5 Developer Right of Entry Agreement***

The Developer shall incorporate access requirements for regular railway and transit maintenance activities, inspection, repair, and emergency response.

***14.3.6 Insurance Requirements***

No additional requirements.

**14.4 Construction Requirements**

The Developer's responsibility in this regard shall extend to include transit owners/operators.

**14.5 Deliverables*****14.5.1 Final Design Document***

Executed railroad agreement documents and the various attachments shall be submitted as part of the Final Design Documents.



## 15 AESTHETICS AND LANDSCAPING

### 15.1 General Requirements

The Developer shall provide adjacent Governmental Entities the opportunity to enhance aesthetic and landscaping features consistent with the requirements herein. The capital and maintenance costs of the adjacent Governmental Entity improvements shall be the responsibility of the adjacent Governmental Entity.

The Developer shall provide a roadway corridor with continuity and an aesthetic scheme that is comprehensive and thorough.

### 15.2 Administrative Requirements

The Developer shall address the following aesthetic and landscaping Elements related to finish, shape, color, and texture in the Aesthetics and Landscaping Plan:

- a) Road tunnels (if applicable)
- b) Trees, shrubs and other plant materials
- c) Riprap
- d) Storm water quality facilities

#### 15.2.1 *Aesthetic Concepts*

Section 15.2.1 of Book 2B is voided and replaced with the following:

- a) The Developer shall prepare and submit two aesthetic concepts that provide a design intent of a modern, fast paced, and motion concept to TxDOT. These concepts shall be used by the Developer to create the overall look of the Project. It shall be understood that these concepts may need to be adapted to site specific conditions.
- b) The Developer shall meet and review the proposed aesthetic concepts with TxDOT. After the meeting the Developer shall prepare a final aesthetic concept and submit it to TxDOT for approval. The approved aesthetic concept shall be incorporated into the Aesthetics and Landscaping Plan for TxDOT approval.

#### 15.2.2 *Aesthetic and Landscaping Plan*

The Developer shall prepare the Aesthetics and Landscaping Plan in conformance with the Project's final aesthetic concept. It shall address all the aesthetics elements of the Project and shall include:

- a) All plans, sections, elevations, perspectives, isometrics, etc., as needed to fully communicate the aesthetic treatment and approach to aesthetic elements including: walls, noise walls, bridges, traffic rail, and signage structures.
- b) A master plan that will convey the layout of the various roadway conditions, i.e. location of subsurface and at-grade roadways, bridges, cantilevered structural sections, etc.
- c) Drawings showing locations of site specific elements, e.g. fences, signage, colored lighting, potential locations of community involvement improvements, etc.
- d) Drawing showing the location of Utilities as they relate to the location of aesthetic improvements. The Developer shall provide composite drawings showing potential conflicts for proposed improvements.

This Aesthetics and Landscaping Plan shall be presented in the following format:

- a) 11x17 format
- b) Front sided only
- c) Eight paper copies, in color
- d) Eight CD copies, with guidelines in portable document format (PDF)
- e) Eight CD copies with a 3D animation of the Project corridor. The animation shall provide a drive through the entire corridor. The animation shall start on IH 35E south of Loop 12 and shall terminate east of US 75. The animation shall have a visual drive through of both the general purpose lanes and of the managed lanes. At a minimum the animation will show the following components:
  - Textures and colors
  - Aesthetic concepts as provided by the Developer
  - Form, shapes, and scale
  - Ramp conditions
  - Landscaping
  - Roadway conditions as per the engineered solution

The Developer shall prepare this animation as part of the Aesthetic and Landscaping Plan. The video shall focus on aesthetic treatment and final appearance.

The Aesthetics and Landscaping Plan shall be incorporated into the final engineering design.

### ***15.2.3 Personnel***

The Landscape Architect shall engage with an Architect for the development of concepts for control facilities, ventilation stacks, and building structures. The Architect shall also have a minimum of five years experience in designing facilities for similar uses and size.

## **15.3 Design Requirements**

### ***15.3.1 Aesthetics Principles and Strategies***

In addition to the requirements of Book 2B, the Developer shall address the following aesthetics principles, requirements and strategies:

- a) The requirement to preserve rock outcroppings to the greatest extent possible shall be omitted
- b) All plant material shall be drought tolerant, shall have a history of success in similar conditions

### ***15.3.2 Walls***

The Developer shall clearly detail and identify how wall patterns shall be incorporated into the chosen design solution.

The roadside face of noise walls shall have a consistent appearance throughout their length. The side of the noise walls facing away from the roadway may vary based upon community input gathered by the Developer.

### ***15.3.3 Bridges and Other Structures***

Bridge aesthetics shall be classified as either cross street underpasses or overpasses, and include all elements such as bridge abutments, bridge rails, fencing, bents, and all other related structures. Enhancements to bridges shall comply with the overall design intent. The Design for all substructure columns for cross street overpasses and underpasses shall have a consistent appearance on the same and adjacent structures in accordance with Good Industry Practice.

Architectural monuments may be provided at center bents as a part of the aesthetic concepts. The location and layout of these architectural monuments shall be provided in the Aesthetics and Landscaping Plan and incorporated into the final engineering design.

### ***15.3.4 Trees, Shrubs, and Other Plant Materials***

Vegetation, other than erosion control measures, provided as a part of the Developer's Aesthetics and Landscaping Plan shall be identified separately from vegetation incorporated as part of adjacent Governmental Entity coordination..

In order to monitor and control weeds, the Developer shall provide weed control measures in the Aesthetic and Landscape Plan.

### ***15.3.5 Color Pallet***

If color is applied, or integral, the Developer shall apply colors with a minimum two color pallet system. If the natural color of concrete is used as the primary color, a minimum three color pallet system consisting of primary, secondary and accent colors shall be used, and the concrete element shall include an architectural finish to mitigate the variations in color between successive concrete pours.

As part of the Aesthetics and Landscaping Plan, the Developer shall submit a plan that indicates where each color is to be applied. This plan can be diagrammatic in nature, but shall list each element and its colors. In addition to integrated colors, painting, and staining, the Developer may use colored lighting in selected areas to add color.

### ***15.3.6 Fencing***

If fencing is provided as part of the design solution, the Developer shall incorporate the requirements of the railroad/transit agency to produce a design that fits both the design intent of the corridor and the functional requirements of the railroad and transit owners/operators.

### ***15.3.7 Signs and Signage Structures***

All signs and sign structures shall have a consistent appearance and character throughout the corridor.

### ***15.3.8 Control Buildings***

The Developer shall provide a minimum of two design concepts for all building structures constructed by the Developer with the Aesthetic and Landscaping Plan. The control facilities, vent stacks, power centers, or any other structure that requires the seal of a Registered Architect, shall require the production of these concepts.

### ***15.3.9 Tunnel Aesthetics***

Tunnel aesthetic encompasses all structures designated as road tunnels and shall be addressed in the Aesthetics and Landscaping Plan.

### ***15.3.10 Storm Water Quality Facilities***

The Developer may use water treatment facilities, detention ponds or any other water detention areas as a location for tree mitigation. Tree mitigation shall be in accordance with the environmental commitments and Section 15.3.4.

## **15.4 Construction Requirements**

The Developer shall provide to TxDOT a minimum of 10 feet by 10 feet mock up of each panel pattern selected for approval by TxDOT. The mock up does not have to be a solid panel, the mock up can be made of four 5 feet by 5 feet panels to provide a total of 10 feet by 10 feet mock up. The sample panels shall be placed on site a minimum of 90 days in advance of starting construction of textured concrete surfaces. All sample panels shall be representative of the actual panel that will be placed on the proposed walls and shall contain colors as described herein. The purpose of the samples will be to test the effect of the colors chosen. Primary, secondary and accent colors shall be displayed. This requirement supersedes the requirements of Book 2B.

## **16 SIGNING, DELINEATION, PAVEMENT MARKING, SIGNALIZATION, AND LIGHTING**

### **16.1 General Requirements**

The second sentence of Section 16.1 of Book 2B shall be deleted.

In addition to Technical Provision Section 16, key requirements in regard of signing, delineation, pavement marking, signalization, and lighting can be found elsewhere in the CDA Documents.

Developer shall construct, operate and maintain all signing, delineation, pavement marking, signalization, and lighting for the Project unless stated otherwise in the CDA Documents. Developer shall be responsible for the cost of power to all signs, traffic signalization and illumination for the Project unless stated otherwise in the CDA Documents.

### **16.2 Administrative Requirements**

#### *16.2.1 Meetings*

No additional requirements.

### **16.3 Design Requirements**

The Developer shall design all signing, delineation, pavement marking, signalization, and lighting in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

#### *16.3.1 Final Design*

The Developer shall prepare a Preliminary Operational Signing Schematic for review and approval by TxDOT and Federal Highway Administration (FHWA) prior to NTP2.

#### *16.3.2 Permanent Signing and Delineation*

##### **16.3.2.1 Guide, Regulatory, Warning, Recreational, Cultural Interest and Emergency Management Signs**

Any requirements for electric service shall be coordinated by the Developer with the applicable Utility Owners.

#### *16.3.3 Project Signs - Outside the Project ROW*

No additional requirements.

#### *16.3.4 Advance Toll Information Signs*

No later than six months prior to Substantial Completion, the Developer shall provide to TxDOT for review and approval an Advance Toll Information Signing Schematic.

#### *16.3.5 Third-Party Signs*

No additional requirements.

### ***16.3.6 Sign Support Structures***

No additional requirements.

### ***16.3.7 Permanent Pavement Marking***

No additional requirements.

### ***16.3.8 Permanent Signalization***

#### **16.3.8.1 Traffic Signal Requirements**

New or modified traffic signal equipment shall conform to the regional Intelligent Transportation System (ITS) architecture and existing interconnected traffic signal systems.

#### **16.3.8.2 Traffic Signal Timing Plans**

The Developer shall design signal timing plans for all new and modified signals. Signal timing and phasing plans at diamond interchanges shall conform to the coordinated signal phasing and timing of the corridor.

#### **16.3.8.3 Traffic Signal Warrants**

No additional requirements.

#### **16.3.8.4 Traffic Signal Support Structures**

No additional requirements.

#### **16.3.8.5 Traffic Signal Systems**

The Developer shall provide communication interconnection (hardware and software) between new or modified signals and any other traffic signal system within a distance of one mile from the new or modified signal.

### ***16.3.9 Permanent Lighting***

The first sentence of Section 16.3.9 of Book 2B shall be deleted.

Developer shall provide continuous roadway lighting along the General Purpose Lanes, Managed Lanes, ramps, and cross streets within the Project limits.

## **16.4 Construction Requirements**

No additional requirements.

### ***16.4.1 Permanent Signing & Delineation***

The Developer shall meet the following minimum retroreflectivity values for installed signs:

Sign Color	Sheeting Type (ASTM D4956-04)						Additional Criteria
	I	II	III	VII	VIII	IX	
White on Green	W*; G ≥ 7	W*; G ≥ 15	W*; G ≥ 25	W ≥ 250; G ≥ 25			Overhead
		W ≥ 120; G ≥ 15				Ground-mounted	
Black on Orange or Black on Yellow	W*; G ≥ 7	W ≥ 50; G ≥ 50				See Note 1	
	Y*; O*	W ≥ 75; G ≥ 75				See Note 2	
White on Red	W ≥ 35; R ≥ 7					See Note 3	
Black on White	W ≥ 50					-	
NOTES:							
The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m2 measured at an observation angle of 0.2 and an entrance angle of -4.0°.							
1 For text and fine symbol signs measuring at least 1200 mm (48 in) and for all sizes of bold symbol signs							
2 For text and fine symbol signs measuring less than 1200 mm (48 in)							
3 Minimum Sign Contrast Ratio ≥ 3:1 (white retroreflectivity ÷ red retroreflectivity)							
* This sheeting type should not be used for this color for this application.							
<b>Bold Symbol Signs</b>							
W1-1, -2 – Turn and Curve	W4-1 – Merge	W11-6 – Snowmobile Crossing					
W1-3, -4 – Reverse Turn and Curve	W4-2 – Lane Ends	W11-7 – Equestrian Crossing					
W1-5 – Winding Road	W4-3 – Added Lane	W11-8 – Fire Station					
W1-6, -7 – Large Arrow	W4-5 – Entering Roadway Merge	W11-10 – Truck Crossing					
W1-8 – Chevron	W4-6 – Entering Roadway Added Lane	W12-1 – Double Arrow					
W1-10 – Intersection in Curve	W6-1, -2 – Divided Highway Begins and Ends	W16-5p, -6p, -7p – Pointing Arrow Plaques					
W1-11 – Hairpin Curve	W6-3 – Two-Way traffic	W20-7a – Flagger					
W1-15 – 270 Degree Loop	W10-1, -2, -3, -4, -11, -12 – Highway-Railroad Advance Warning	W21-1a – Worker					
W2-1 – Cross Road	W11-2 – Pedestrian Crossing						
W2-2, -3 – Side Road	W11-3 – Deer Crossing						
W2-4, -5 – T and Y Intersection	W11-4 – Cattle Crossing						
W2-6 – Circular Intersection	W11-5 – Farm Equipment						
W3-1 – Stop Ahead							
W3-2 – Yield Ahead							
W3-3 – Signal Ahead							
<b>Fine Symbol Signs – Symbol signs not listed as Bold Symbol Signs</b>							
<b>Special Cases</b>							
W3-1–Stop Ahead: Red retroreflectivity ≥ 7							
W3-2–Yield Ahead: Red retroreflectivity ≥ 7, White retroreflectivity ≥ 35							
W3-3–Signal Ahead: Red retroreflectivity ≥ 7, Green retroreflectivity ≥ 7							
W3-5–Speed Reduction: White retroreflectivity ≥ 50							
For non-diamond shaped signs such as W14-3 (No Passing Zone), W4-4p (Cross Traffic Does Not Stop), or W13-1, -2, -3, -5 (Speed Advisory Plaques), use largest sign dimension to determine proper minimum retroreflectivity level.							

#### ***16.4.2 Permanent Pavement Marking***

The Developer shall meet the following minimum retroreflectivity values for edge line markings, center-line/no passing barrier-line, and lane lines when measured anytime after three days but not later than 10 days after application:

- a) Type I, Thermoplastic, Pavement Markings:
  - White markings: 250 millicandelas per square meter per lux (mcd/m<sup>2</sup>/lx)
  - Yellow markings: 175 mcd/m<sup>2</sup>/lx
- b) Type II, Paint & Beads, Pavement Markings:
  - White markings: 175 mcd/m<sup>2</sup>/lx
  - Yellow markings: 125 mcd/m<sup>2</sup>/lx

#### ***16.4.3 Permanent Signalization***

No additional requirements.

#### ***16.4.4 Permanent Lighting***

No additional requirements.

### **16.5 Deliverables**

#### ***16.5.1 Permanent Signing & Delineation***

No additional requirements.

#### ***16.5.2 Permanent Pavement Marking***

No additional requirements.

#### ***16.5.3 Permanent Signalization***

No additional requirements.

#### ***16.5.4 Permanent Lighting***

No additional requirements.

#### ***16.5.5 Advance Toll Information Signs***

The Developer shall prepare and submit to TxDOT, as part of the Final Design Documents, an Advance Toll Information Sign plan that includes all components related to Managed Lanes.

#### ***16.5.6 Inspection and Acceptance Testing***

The Developer shall provide to TxDOT, as part of the Final Design Documents, an Acceptance Test Plan (ATP) for all traffic signals and illumination. This ATP shall also be submitted to the appropriate local Governmental Entity. The Developer shall conduct testing in accordance with the ATP and document these results to show conformance.



## **17 INTELLIGENT TRANSPORTATION SYSTEMS**

### **17.1 General Requirements**

The Developer shall be responsible for the planning, design, installation, maintenance, and operation of safe and functional Intelligent Transportation System (ITS) for the Project using Good Industry Practice. The Developer shall maintain ITS interoperability over the Term of the Agreement with DalTrans and other Governmental Entities. The ITS shall be coordinated with the Electronic Toll Collection System (ETCS) such that the communication requirements of the ETCS system are accommodated.

The functionality of the ITS shall be such that command and control of appropriate field devices is shared with appropriate Governmental Entities.

#### ***17.1.1 Concept of Operations***

The ITS shall operate under the North Texas Regional ITS Architecture and Center-to-Center (C2C) concept of operations. The ITS shall be a Traffic Management Center (TMC) for the Project corridor to support mobility equally along both the Managed and General Purpose Lanes. Communication and interoperability shall be achieved with other TMCs in the region, including DalTrans, such that with appropriate privileges, access to data, command, control and information sharing can occur among centers. All communication and access of information shall occur in near real-time (within logistical restraints).

All components of the ITS shall conform to the provisions of the National Transportation Communication for ITS Protocol (NTCIP).

### **17.2 Design Requirements**

No additional requirements.

#### ***17.2.1 ITS Communications Requirements***

No additional requirements.

#### ***17.2.2 Conduit***

No additional requirements.

#### ***17.2.3 Closed Circuit Television (CCTV) Cameras***

A system of cameras shall provide 100% viewing coverage within the Project limits as well as along intersecting cross streets. The system of cameras shall accurately identify all vehicle(s) involved in an Incident or Emergency, the extent of vehicle(s) damage, and if applicable the likelihood of personal injury. Operation of the cameras shall result in no visual delay in response of the camera pan/tilt/zoom by a user.

The Developer shall participate in the regional data and video communications system (RDVCS) for video exchange with TxDOT and appropriate Governmental Entities.

### **17.2.3.1 Equipment**

The Developer shall provide all the equipment necessary for TxDOT secondary control of all CCTV cameras. The method of secondary control shall be in accordance with TxDOT standards and specifications.

### **17.2.4 Vehicle Detection**

The spacing requirement for vehicle detection sensors in Book 2B, Section 17.2.4 shall be replaced with a spacing requirement of no greater than half a mile.

Vehicle detection sensors shall determine vehicle speed for each vehicle passing the sensor. The Developer shall provide TxDOT the raw speed data (volume and speed) for the General Purpose Lanes and the Managed Lanes for each vehicle detection sensor. The raw speed data shall be provided upon TxDOT request.

The existing TxDOT data collection site just west of US 75 (M-1906) shall also be kept operational during the Term of the Agreement.

### **17.2.5 Dynamic Message Signs (DMS)**

The DMS shall operate as part of an overall regional system. The Developer shall provide TxDOT the ability to provide limited DMS messaging. The TxDOT messaging hierarchy protocol is provided as Attachment 17-1A.

The Developer shall place DMS, for General Purpose Lane traffic and incident management messaging, approximately 1-mile in advance of major interchanges using good industry practices on each approach within the Project limits. Major interchanges include the interchanges at IH 35E and Loop 12, IH 635 and IH 35E, IH 635 and Dallas North Tollway, and IH 635 and US 75.

### **17.2.6 Lane Control Signals (LCS)**

LCS shall be provided for each lane in the subsurface Managed Lanes, subsurface Managed Lanes approaches and tunnel portals of the Project and shall be stationed in both travel directions in conjunction with on and off ramps and at intermediate locations based on sight distance and design speed. The maximum spacing shall not be greater than one half mile. This requirement supersedes the spacing requirement for lane control signals in Book 2B, Section 17.2.6. LCS shall support the Developer's lane closure procedure.

### **17.2.7 Over height Vehicle Detection System**

The Developer shall provide an over height vehicle detection system in advance of all access points to any proposed tunnel portal or confined access area with restricted height clearance. The system placement shall be far enough in advance of the restricted area to allow detected over height vehicles to receive sufficient notice that it is in violation of clearance height criterion and to allow the driver of the vehicle to safely merge into appropriate lanes so as not to enter the area.

### **17.2.8 Lane Closure System**

A lane closure system shall be provided to control or restrict traffic according to the Incident Management Plan (IMP) or the Emergency Response Plan (ERP).

### ***17.2.9 Communications Systems***

Throughout the Project limits, functional ITS communication components shall be provided, including the Regional ITS Backbone and all the ITS field devices. For each functional application, a separate physical conduit system shall be provided with appropriate interface connections.

a) **Field Devices**

The Developer shall provide a communications system to all field devices such that operation is time and event driven. In addition to ITS field devices, the communication system shall accommodate all of the data needs for the ETCS. Sufficient conduit shall be provided to accommodate the current communication demands and a minimum 25% additional capacity.

b) **Regional ITS Backbone System**

The Developer shall provide a fiber optic backbone communication system the entire length of the Project limits for use exclusively by TxDOT as part of the North Texas Regional ITS Communication System. This fiber optic system shall be in addition to the ITS network of the Developer, with connection points occurring at either end of the project limits. The Developer's ITS will have connections at the same locations as the fiber optic cable communication system so that it can be connected to the regional C2C ITS.

### ***17.2.10 Systems Integration***

The Developer shall be responsible for integration of the ITS into a functional operative system such that real time traffic management of the corridor occurs on a continual basis.

## **17.3 Construction Requirements**

### ***17.3.1 General***

The Developer shall provide all electrical service for all components of the ITS including being responsible for the payment of all associated fees for the Term of the Agreement.

### ***17.3.2 Salvaging Existing Items***

No additional requirements.

### ***17.3.3 Existing ITS Relocation***

No additional requirements.

## **17.4 Deliverables**

### ***17.4.1 Final Design Document***

The Developer shall provide an ITS Implementation Plan as part of the Final Design Documents to demonstrate system interoperability with other TMCs in the region as well as compatibility with the operational procedures for command and control of devices, sharing of data, and priority control that various parties will assume under different operating conditions of the corridor and surrounding roadway system. The ITS Implementation Plan shall include the following:

a) **Functional design plan;**

- b) Communications analysis report;
- c) Operational and requirements report; and
- d) Acceptance Test Plan (ATP).

The functional design plan shall show each device's relationship in the overall functional design of the ITS and proposed roadway system. This functional design plan shall include the location of devices, technology and functional specifications of devices and any unique design elements that are necessary to achieve the desired functionality or space restrictions.

The communications analysis report shall document the communications design. This report shall show all ITS field devices, their flow through all communications mediums, and throughput within the ITS. This shall include communications between any Supervisory Control and Data Acquisition (SCADA) system, DalTrans, and other involved parties. The report shall contain a narrative describing the information to be transmitted as well as a high level plan for its use. Communications diagrams shall be provided showing the location of any communication hubs (existing or proposed), any planned fibers (source as well as identification tag), modem/transceiver equipment planned at field equipment cabinets, and other equipment deemed necessary to functionally operate the ITS.

The operational and requirements document for the ITS shall describe the functional capability of the system and the method and level of integration. The document shall describe in detail the design of the system, hardware and software to be utilized, functional capabilities, command and control, data sharing capabilities and priority use of devices by multiple agencies. In developing the operational and requirements document, the Developer is required to hold scoping meetings with TxDOT such that requirements are defined to achieve interoperability with other TMCs and priority logic and information for command and control and data sharing is created to enable effective management and incident response along the corridor as well as regionally.

For each component of the ITS, an ATP shall assure proper operation, control and response of each device meeting the functional requirements. The Developer shall implement the ATPs and provide certified documentation that its requirements have been met prior to operational use of the ITS.

As part of the ATP, the Developer shall prepare a system acceptance procedure prior to start of construction to assure proper operation, control and response of each device as part of the overall ITS including the overall operating system and software. The Developer will conduct the procedure and provide certification that the ITS effectively meets the required functional requirements. The Developer shall provide this certification prior to the use of the ITS for service.

The Developer shall provide the CCTV secondary control equipment and design to TxDOT for approval a minimum of six months prior to Service Commencement.

#### ***17.4.2 Record Drawings and Documentation***

The Record Drawings shall include the construction drawings as well as catalog sheets for all equipment and components. The Developer shall maintain for the duration of the Operating Period, records of all updates and modifications to the system.

For each component of the ITS all computer codes and software shall be available to TxDOT.

## 18 TRAFFIC CONTROL

### 18.1 General Requirements

The general requirements shall apply for the entire Term.

Frontage Roads shall be designed and constructed to minimize the impact to adjacent properties. It shall be the responsibility of the Developer to gain approval from the appropriate Governmental Entity or property owner on each intersecting street or driveway closure.

During all phases, temporary or existing Intelligent Transportation System (ITS) equipment, street lights, and traffic signals shall remain in operation such that the new and existing equipment operate as a coherent system.

### 18.2 Administrative Requirements

#### 18.2.1 Traffic Management Plan

The Traffic Management Plan (TMP) shall be required for the entire Term. The TMP shall address the minimization of the construction impact to the traveling public, neighborhoods and businesses in the corridor. The TMP shall include procedures to communicate TMP information to the Public Information Coordinator for the purpose of notifying the public. The primary consideration of the TMP must be safety of the traveling public and employees of the Developer and other third parties working in the corridor.

The procedures stated in the TMP for obtaining acceptance from applicable Governmental Entities for traffic pattern modifications shall include procedures for obtaining acceptance for travel lane shifts on Frontage Roads, ramps, side streets, cross streets and approaches to intersections.

#### 18.2.1.1 Maintenance of Traffic

The Developer, as part of its scheduling and sequencing of Work activities, shall establish completion dates that identify maintenance of traffic (MOT) activities associated with major changes of configuration of lanes, ramps, connectors, cross streets, bridges or other major traffic movements. Failure to complete the activities by not opening new travel lanes, not restoring traffic to original movements within the established number of days or not maintaining the minimum number of open lanes will result in liquidated damages as noted in Exhibit 21 of Book 1.

#### 18.2.1.2 Road User Costs

The Developer shall incur road user costs (RUC) in the form of Lane Rental Charges (LRCs) and/or Noncompliance Points under the following circumstances.

LRCs in the form of liquidated damages as set forth in Exhibit 21 of the Agreement shall be applied to closures of, or widths that are less than those permitted for, General Purpose Lanes as described in this [Section 18](#).

Noncompliance Points will apply for closures in excess of MOT obligations on Frontage Roads, cross streets and connectors.

### 18.2.1.3 Lane Closure Notices

Seven Days prior to the publication of any notices or placement of any traffic control devices associated with lane closures, detour routing or other change in traffic control requiring lane closures, the Developer shall issue a Lane Closure Notice (LCN) to TxDOT and affected Governmental Entities.

For a LCN utilizing a non-TxDOT controlled facility, the Developer must secure concurrence in writing from the controlling Governmental Entity.

A LCN shall contain the estimated date, time, duration, and location of the proposed work.

If an emergency condition should occur, a LCN shall be provided to TxDOT within 2 Days after the event. For non-TxDOT controlled facilities, the Developer shall immediately notify the controlling Governmental Entity. The Developer shall keep TxDOT informed of any and all changes or cancellations of proposed lane closures prior to the date of their implementation.

### 18.2.1.4 Coordination Meetings

The Developer shall participate in coordination meetings scheduled by others. These meetings shall include those of the existing LBJ Traffic Management Committee convened by Texas Transportation Institute (TTI) and coordination meetings with other Governmental Entities.

## 18.3 Design Requirements

### 18.3.1 Traffic Control Plans

Traffic Control Plans are required for DB phase, Renewal Work, Operation and Maintenance (O&M) Work during the Term of the Agreement. The Periods A, B, C and D referenced in Section 18 are described in Exhibit 21 of the Agreement.

Continuous access for public safety vehicles and emergency routes must be maintained throughout the corridor and adjacent properties. Minimum temporary lane widths will be 11 ft. for the General Purpose and Managed Lanes and 10 ft. for Frontage Roads, cross streets and other streets and roadways.

The following mobility constraints apply for the DB phase:

- a) General Purpose Lane Closures: IH 635 - Luna Road to US 75
  - A minimum of four General Purpose Lanes in each direction must remain in service during Periods A, B and C, with the current Frontage Road accessibility. The Developer may reduce the General Purpose Lanes of IH 635 at the intersection with the Dallas North Tollway (DNT) to three lanes in each direction, with the fourth lane forced to exit onto the DNT, for up to a 24 month time period. The reduction to three General Purpose lanes is prohibited during approved closure periods for the connector ramps between IH 635 and the DNT.
  - A minimum of three General Purpose Lanes in each direction must remain in service during Period D.
  - The Developer will not be allowed to close two consecutive entrance ramps or two consecutive exit ramps at any time. The Developer shall provide ramps for

entrance and exit for each direction at Marsh Lane, Midway Road, Preston Road and Hillcrest Road at all times. The Developer shall provide entrance and exit ramps in each direction for all cross streets that do not have access via frontage road for a distance greater than one-mile.

- Periods C and D will be allowed to switch ramps, switch traffic, hang beams, or similar significant operations.
- Where continuous Frontage Roads are in operation during construction, no entrance or exit ramp shall be closed for more than a day without providing a temporary ramp.
- No more than one lane of a Frontage Road shall be closed in each direction, except during Period D when a continuous lane must remain open.

b) General Purpose Lane Closures: IH 35E – Loop 12 to North of IH 635

- A minimum of five General Purpose Lanes in each direction must remain in service during Period A and B with the current Frontage Road accessibility.
- A minimum of four General Purpose Lanes in both directions must remain in service during Period D.
- A minimum of four General Purpose Lanes in each direction must remain in service during Band C times.
- The existing HOV lane operations in both directions must remain in operation during Peak Periods. Closure of the HOV lanes outside of the Peak Periods must be coordinated with the Dallas Area Rapid Transit.
- Existing entrance and exit ramp access must be maintained to cross streets at all times.
- Periods C and D will be allowed to switch ramps, switch traffic, hang beams, or similar significant operations.

c) Connectors

- If Limited Access Highway to Limited Access Highway connectors are proposed for closure, a connector closure request shall be prepared and submitted to TxDOT for Approval prior to closure of the connector. The connector closure request shall demonstrate the need for the closure relative to construction staging and provide supporting traffic analysis indicating detour routing, capacity analysis and proposed improvements along the detour route(s) and other impacted roads to accommodate the additional traffic.
- The Dallas Parkway and Inwood Road facilities in the vicinity of the intersection of IH 635 with the DNT shall remain fully operational during periods Periods A, B, and C. Limited closures may be allowed during Period D.
- Closure of the IH 635 and DNT loop ramps shall be limited to Period D. A connector closure request shall be prepared and submitted to TxDOT for Approval prior to closure of a loop ramp.

d) Additional Constraints during the DB phase:

The Project scheduling and phasing shall also take account of:

- Existing Frontage Roads – Once construction begins on a section of a Frontage Road, the Developer has 180 days to complete or restore to existing capacity including driveways and intersecting roads. A section of a Frontage Road is



defined as a portion of the Frontage Road on one side of IH 635 between successive cross streets. The cross streets are shown in Table 18-1A.

- Dallas North Tollway (DNT) General Purpose Lanes – For reconstruction of the portion of the DNT General Purpose Lanes, within the project limits, three through lanes of the DNT in each direction shall be kept open at all times. LRCs will apply to any closures of the portion of DNT General Purpose lanes, within the Project limits, that reduce the DNT availability to less than three lanes in each direction.
- Roads crossing over/under IH 635 - The Developer shall maintain the minimum number of lanes open as in Table 18-1A. Reductions in capacity for successive cross streets will not be allowed simultaneously without the appropriate Governmental Entity approval. The Developer will have the time frames noted in Table 18-1A to restore the existing capacity noted in the table, including all approaches.
- Roads intersecting the Frontage Roads may not be closed unless alternative access exists or is provided. When alternative access cannot be provided, an intersecting road may be closed with TxDOT Approval. The Developer shall work diligently to complete construction activities and re-open an intersecting road that has been closed.
- Driveways shall not be closed unless alternative access exists or is provided. Temporary driveways must be constructed to accommodate its normal traffic type and load.
- Shoulders along the freeway section both inside and outside may be eliminated as part of the Traffic Control Plan. A minimum one foot offset to the nominal face of the barrier shall be maintained.
- For construction east of US 75, the Developer shall ensure that all existing General Purpose Lanes, Frontage Roads and connector ramps are open at all times, except during Period D when one General Purpose Lane per direction may be closed.



TABLE 18-1A DB Phase Construction - Minimum Number of Lanes and Sequence Duration For Cross Streets and Frontage Roads

Days to Restore Existing Capacity	Cross Street	Type	EXISTING U-Turn @ X-street	Proposed U Turn	Existing				During Construction			
					N Bound	S Bound	E-Bound	W Bound	N Bound	S Bound	E-Bound	W Bound
90	Emerald @ LBJ	Underpass		E TO W	T	T	L-R		T	T	L-R	
180	Harry Hines @ LBJ	Underpass		E TO W; W TO E	L-T-T-R	T-T	TL-TR	L-TLR	T-T-R	T-T	TL-TR	L-TLR
180	Denton Rd @ LBJ	Underpass	W TO E	W TO E	R-T-L	T	L-T-TR	TL-TR	L-TR	T	TL-TR	TL-TR
270	Josey @ LBJ	Underpass		E TO W; W TO E	T-T-TR	T-T-TR	L-TL-TR	TL-TR-R	T-T-R	T-T-R	L-TLR	TL-TR
270	Webb Chapel @LBJ	Underpass		E TO W; W TO E	T-T-T-TR	T-T-T-R	L-T-T-R	L-TL-T-R	T-T-R	T-T-R	L-TL-R	L-TLR-R
270	Marsh Lane @LBJ	Overpass		E TO W; W TO E	T-T-T-T	T-T-T-R	L-TL-R	L-TLR-R	T-T-R	T-T-R	L-TLR	TLR-R
180	Rosser @ LBJ *	Overpass			T	T	0	0	T	T	0	0
270	Valley View @ LBJ	Underpass				T-T	T			T	T	
270	Midway @ LBJ	Underpass	E TO W; W TO E	E TO W; W TO E	T-T-T-TR	T-T-T-T-R	LU-TL-T-R	L-TL-TR-R	T-T-R	T-T-T-R	L-TL-TR	LT-TR-R
180	Welch @ LBJ	Overpass		E TO W; W TO E	T-TR	T-TR	TR-TL	TL-TR	T-R	T-TR	TL-TR	TL-TR
180	Montfort @ LBJ	Overpass	E TO W; W TO E	E TO W; W TO E	T-T-TR	T-T-TR	TL-T-TR	TL-T-R	L-T-T	T-T-R	TL-TR	TL-TR
360	Preston @ LBJ	Overpass	E TO W; W TO E	E TO W; W TO E	T-T-T-T	T-T-T-T-R	L-TL-TR-R	UL-TL-TR-R	T-T-R	T-T-T-R	L-TL-TR	TL-T-R
270	Hillcrest @ LBJ	Underpass	E TO W; W TO E	E TO W; W TO E	T-T-T-T	T-T-T-T-R	L-TL-T-R	L-TL-TR-R	T-T-R	T-T-T-R	L-TL-R	TL-TR
270	Park Central @ LBJ	Underpass	E TO W		T-TR		TR-TL	TL-T	T-R		TR-TL	T-L
180	Joe Ratcliff Walkway @ LBJ	Overpass							OPEN DURING SCHOOL			
	Crown @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Royal @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Merrell @I 35	Underpass			Open	Open	Open	Open	#	#	#	#

TABLE 18-1A DB Phase Construction - Minimum Number of Lanes and Sequence Duration For Cross Streets and Frontage Roads

Days to Restore Existing Capacity	Cross Street	Type	EXISTING U-Turn @ X-street	Proposed U Turn	Existing				During Construction			
					N Bound	S Bound	E-Bound	W Bound	N Bound	S Bound	E-Bound	W Bound
	Walnut Hill @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Manana @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Lombardy @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Northwest Hwy @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Northwest Hwy @ Loop 12	Underpass			Open	Open	Open	Open	#	#	#	#
	Harry Hines/Conn N LBJ @ I 35	Underpass			Open	Open	Open	Open	#	#	#	#
	Valley View @ I 35	Underpass	S TO N: N TO S	S TO N: N TO S	Open	Open	Open	Open	#	#	#	#
	Valwood Parkway	Underpass	S TO N: N TO S	S TO N: N TO S	Open	Open	Open	Open	#	#	#	#

Table Notes:

T= thru lane, R= right turn lane, L= left turn lane, TR= combination lanes thru and right, TL= combination lanes thru and left,

U= turn lane, LU= combination lanes left and u-turn; S= south, N= north, E= east, W= west

I 635 is considered east and west; I 35E is considered north and south

\* Bridge must be open on school days

# Cross streets may only be temporally closed during Period C and D for safety reasons

### ***18.3.2 Additional Traffic Control Design Considerations***

During the DB phase, the Developer can propose additional cross street closures during Periods A and B. These closures must be justified through documentation that demonstrates an acceptable detour routing plan of traffic, acceptable level of service along detour routes, access to abutting and corridor land uses, public safety impacts, and the impact the lane closures would have on accelerating the opening of additional capacity.

Ramp metering as a form of traffic management shall not be allowed.

The following Vehicle Classifications, as defined in Exhibit 4 of the Agreement, will not be permitted to use the reversible direct connector between IH 635 and US 75:

- a) Large Trucks with one trailer;
- b) Large Trucks with more than one trailer; or
- c) Special Vehicles.

Hazardous Materials traffic shall not be permitted to use the reversible direct connector between IH 635 and US 75.

## **18.4 Construction Requirements**

These requirements shall apply throughout the Term.

### ***18.4.1 Developer Responsibility***

No additional requirements.

### ***18.4.2 Access***

The Developer shall coordinate with Dallas Area Rapid Transit (DART) and provide information to transit users of alternative transit stop locations including directional signage.

### ***18.4.3 Detours***

All detours shall be designed to handle the appropriate volume and speed of traffic.

### ***18.4.4 Lane Closures***

Except due to Incidents or Emergencies, unless otherwise approved by TxDOT in writing, Developer shall not allow or permit lane closures on the General Purpose Lanes during the following periods:

- a) The Saturdays and Sundays occurring between the Thanksgiving and New Years Day holidays;
- b) The day before and the day after Thanksgiving;
- c) The day before and the day after Christmas Day; and
- d) New Years Day.

The above-described restrictions shall apply from 8:00 am of the above described starting day through 10:00 pm on the ending day unless otherwise specified.

Frontage Roads serving retail property shall maintain original capacity from November 15 to January 2 each year during the DB phase and Renewal Work.

The TMP shall identify practices and processes for managing the safe ingress and egress of construction vehicles in the work zone.

#### **18.4.4.1 Pavement Markings**

The Developer will be required to remove existing pavement markings that conflict with temporary or permanent pavement markings. These pavement markings shall be removed by any method that does not materially damage the surface or texture of the pavement. Pavement marking removal by over-painting is prohibited.

#### **18.4.4.2 Reinstatement of Utility Cuts**

After installation of drainage structures, storm sewers, or any other public or private Utility facility by open cut beneath existing pavements carrying traffic during construction, the pavement shall be restored to provide a normal satisfactory riding surface.

#### **18.4.4.3 Hauling Equipment**

The Developer shall keep traveled surfaces used in its hauling operations clear and free of dirt or other debris that would hinder the safe operation of roadway traffic.

Rubber-tired equipment shall be used for moving dirt or other materials along or across paved surfaces.

Where the Developer moves any equipment not licensed for operation on public highways on or across any pavement, the Developer shall protect the pavement from all damage caused by such movement. Any damage caused by the operation of the Developer shall be repaired at the expense of the Developer.

All haul routes utilizing any street of an adjacent Governmental Entity must be approved in writing in advance by the appropriate Governmental Entity prior to use.

The Developer shall submit to TxDOT a Haul Route Plan that shall incorporate these requirements.

#### **18.4.4.4 Final Clean-Up**

The Developer shall clear and remove from the site all surplus and discarded materials and debris of every kind and leave the entire Project in a smooth and neat condition, after any construction process.

#### **18.4.5 Stockpiles**

Barricades and warning signs are to be placed at stockpiles to adequately warn motorists of a hazard in accordance with TMUTCD. All material stockpiles shall not be located within the clear zone of any traveled lane, unless positive protection is provided.

### **18.5 Traffic Control after Service Commencement**

The requirements described in Section 18.5 shall apply after Service Commencement.

All lane closures shall be in conformance with the TMUTCD. For Renewal Work on the Frontage Roads and cross streets, Table 18-1A requirements shall also apply, except that for Renewal Work the number of Days to restore existing capacity shall be 20 percent fewer Days

than the number of Days to restore existing capacity stated for the DB phase. Frontage Roads shall have a minimum lane width of 11 feet during Renewal Work. Periodic and routine maintenance and activities associated with remediation or repair of a Defect on Frontage Roads or cross streets shall be conducted in Period D or at times agreed with TxDOT and local Governmental Entities.

**18.5.1 Managed Lanes and General Purpose Lanes Availability**

The overall lane availability requirements for the Managed Lanes and the General Purpose Lanes are the same. No preference or differentiation of availability between Managed Lanes and General Purpose Lanes shall occur except as described in the obligations required in this Section 18.5.

Managed Lanes and General Purpose Lanes shall have minimum lane availability according to Table 18-2A – Managed and General Purpose Lane Availability. The lane availability is measured as the percentage of total time during each Period for each type of lane that all the travel lanes of the Project are fully open. Shortfalls of lane availability shall be excused only for events that are beyond the Developer’s control and are not due to any act, omission, negligence, recklessness, willful misconduct, breach of contract or Law or violation of a Governmental Approval of any of the Developer-Related Entities, and further provided that such events could not have been avoided by the exercise of caution, due diligence or reasonable efforts by Developer, upon providing to TxDOT adequate written evidence thereof..

A snow and ice event shall be deemed to commence on a Section when, at any location on the traveled lanes, the road surface temperature is less than or equal to 34F and moisture is present; or snow starts to fall; or ice forms. A snow and ice event shall be deemed to end when, on the traveled lanes, there is no snow; or ice; or the surface temperature rises above 34F. Where the road surface temperature is below 34F and there is no moisture present a snow and ice event shall be deemed not to exist.

**TABLE 18-2A – Managed and General Purpose Lane Availability**

Period A and Period B	Period C	Period D	During a snow and ice event
100%	98%	96%	50%
<p>Note 1 – Managed and General Purpose Lane availability shall be as stated in Table 18-2A; except that the reversible direct connector between IH 635 and US 75 may be closed to traffic for a maximum of one hour during any single Period B, Period C or Period D for the sole purpose of meeting the operational requirements of <u>Section 1.2.3.4</u>.</p> <p>Note 2 – Lane closures for Emergency repairs are to be excluded from calculations of lane availability during Period D.</p> <p>Note 3 – Lane closures for Category 1 Hazard Mitigation of Defects caused by third party Incidents are to be excluded from calculations of lane availability.</p> <p>Note 4 – Lane closures jointly agreed by TxDOT, the Independent Engineer and Developer for joint inspection or third party operations are to be excluded from calculations of lane availability.</p> <p>Note 5 – Lane availability during a snow and ice event shall apply to the entirety of a Section.</p>			

Lane availability for all portions of the Work including Frontage Roads, on-ramps, off-ramps, interchange connector ramps, side streets and shoulders shall be as stated in Table 18-2A – Managed and General Purpose Lane Availability. Operating travel lanes that are of reduced width shall be deemed as not providing lane availability. During Period D, shoulders that are closed or are of reduced width shall be excluded for calculations of lane availability.

The lane availability for each of the Periods shall be calculated and reported monthly following the Service Commencement Date. Lane availability shall be calculated using the following formula:

$$\frac{\sum P_n \times \sum L_n \times \sum P_n (un)}{\sum P_n} \times 100 = \% \text{ lane availability}$$

Where:

- $\sum P_n$  is the total time for each Period between Service Commencement Date and the reporting date.
- $\sum L_n$  is the total number of lane closures in each Period between Service Commencement Date and the reporting date. Adjacent closed lanes are deemed separate lane closures.
- $\sum P_n(un)$  is the total time for each Period between Service Commencement Date and the reporting date that there was unavailability of lane(s).

During Period D, static or rolling closures of no more than 15 minutes duration will not be deemed shortfalls of lane availability, subject to adherence to the other requirements of Section 18.5.1.

The Developer may close one or more Segments of the Managed Lanes between 10 pm and 6:00 am the following day on Monday through Thursday, 12:00 midnight on Friday through 8:00 am on Saturday, and 12:00 midnight on Saturday through 8:00 am on Sunday provided that the General Purpose Lanes are not closed due to Developer action. Such closures will be deemed not to be reductions in lane availability.

If lane availability during Periods C and D as reported each month exceeds the minimum lane availability, then the hours of lane availability provided above the minimum requirement may be accumulated and spent during Renewal Work, subject to the overall lane availability percentages at any time remaining at or above the percentages stated in Table 18-2A, and adherence to the other requirements set forth in Section 18.5.1.

In addition to the above, the Developer shall meet the following requirements with TxDOT review for Renewal Work, operations, and maintenance:

- a) The maximum distance of any single continuous General Purpose Lanes closure shall be 2.0 miles.
- b) The minimum distance between successive closures of General Purpose Lanes shall be 5.0 miles.
- c) Closures to on-ramps and off-ramps from General Purpose Lanes to Frontage Roads shall be limited such that at any one time, in each roadway direction, there shall be a maximum of one on-ramp and/or off-ramp closure within a 1.5 mile distance.

- d) For periodic maintenance, routine maintenance and activities associated with Category 2 Defects, no more than two General Purpose Lanes shall be closed at any one time, in each roadway direction during D times. The General Purpose Lanes shall maintain all ramp access to and from the Frontage Roads. No A, B or C time closures are allowed.
- e) For activities associated with remediation or repair of Category 1 Defects, no more General Purpose Lanes shall be closed at any one time, in each roadway direction, than is necessary to undertake the work. Further, at least two General Purpose Lanes shall be available at any one time, in either roadway direction, unless the reason for the work activity is such as to make this obligation impractical. The General Purpose Lanes shall maintain all ramp access to and from the Frontage Roads.
- f) For Renewal Work, no more General Purpose Lanes shall be closed at any one time, in each roadway direction, than is necessary. Further, at least two General Purpose Lanes shall be open at any one time, in each roadway direction. The General Purpose Lanes shall maintain all ramp access to and from the Frontage Roads. The Managed Lanes shall be fully operational and toll free in the sections of the Managed lanes to which the General Purpose Lanes traffic is required to divert.

Noncompliance Points as set forth in Exhibit 21 of the Agreement will apply for failure to meet these lane availability requirements.

A lane availability performance report shall be prepared every quarter (i.e. three month period) and submitted to TxDOT within 15 days of the end of the quarter. This report shall identify all lane closures including the location (by lane type, lane identification and end stations), closure commencement (time of day and date), closure duration, closure length (in feet), and the maximum extent of congested traffic (in miles) that resulted from the closure. The type of closure (rolling lane, static lane, Fire/Department of Public Safety (DPS) blockage, etc.) is also to be recorded along with the reason for the closure (maintenance, Incident, weather, etc.) and the safety precautions used to protect the workers and the traveling public.

The lane availability report shall record the lane availability achieved for each of the categories in Table 18-2A in terms of daily, weekly, monthly and quarterly periods and shall describe and shall illustrate the trends of lane availability measured over the Operating Period for all monthly, quarterly and annual periods.

## 19 MAINTENANCE

### 19.1 General Requirements

No additional requirements.

#### *19.1.1 General Maintenance Obligations*

The requirements of this Section, Attachment 19-1A - Performance and Measurement Table Baseline of Book 2A and Book 2B, and Attachment 19-2A Amendments Sheets are applicable to the Project. The maintenance of the Managed Lanes and the General Purpose Lanes is to be treated in an identical manner.

#### *19.1.2 Developer's Obligation to Remedy and Repair*

For Category 1 Defects, the Developer shall take necessary action such that the hazard to Users is mitigated within the period given in the column entitled "Category 1 Hazard Mitigation" in the Performance and Measurement Table, and shall permanently remedy the Defect within the period given in the column entitled "Category 1 Permanent Remedy" in the Performance and Measurement Table.

For Category 2 Defects, the Developer shall undertake the permanent repair within the period specified in the column entitled "Category 2 Permanent Repair" in the Performance and Measurement Table.

The Developer's obligation is to remedy and repair the Project as a preventative measure, including Renewal Work not scheduled in the Developer's annually recurring highway maintenance and repair program. The Developer shall use the results of the inspections described in his Maintenance Management Plan (MMP) and other relevant information to determine, on an annual basis, the Residual Life of each Element of the Project. From this, the Developer shall determine the scope of the Renewal Work Schedule. Renewal Work shall be performed at the point in time necessary to establish a Useful Life for each Element that will avoid deterioration of any Element to the extent that such deterioration would result in the failure to comply with a Performance Requirement.

#### *19.1.3 TxDOT's Obligation to Remedy and Repair*

In the period between the Proposal due date and the start of Operations and Maintenance (O&M) Work for each Section, TxDOT will be responsible for operation and maintenance of each Section as set forth in Section 8.3 of the Agreement. TxDOT will reasonably perform the type of routine maintenance of each Element Category which is normally included as an annually recurring cost in the TxDOT highway maintenance and repair budgets including repairs required to restore asset condition following accidents and Incidents. TxDOT is not obligated to extend the Residual Life of any Element through reconstruction, rehabilitation, restoration, renewal, or replacement.

#### *19.1.4 Transition of Maintenance*

The Developer shall coordinate with TxDOT to achieve a smooth transition of maintenance activities from TxDOT. The Developer shall assume full responsibility for all maintenance activities for each Section as described in Section 8.3 of the Agreement.



## 19.2 Maintenance Management Plan (MMP)

### 19.2.1 Additional Requirements

The MMP shall address, but shall not necessarily be limited to, the following:

- a) Maintenance and service manual
- b) Spare parts
- c) Inventory control
- d) Maintenance Management Information System (MMIS) functionality
- e) Software maintenance
- f) Special tools and equipment
- g) Defect tracking and corrective action
- h) Reliability and maintainability analysis
- i) Vendors for equipment and maintenance services

The Developer shall include in the MMP how the following specific obligations are implemented:

- a) Preventative Maintenance
  - The minimum standards shall be as determined by the equipment manufacturer's recommended maintenance schedule and operating procedures.
- b) Maintenance and Service Manual
  - The Developer shall outline the procedure for the development and subsequent updating of a Maintenance and Service Manual in both printed and electronic file format (portable document format (PDF)). This document shall be comprehensive and shall include, but not be limited to, detailed technical maintenance and servicing descriptions for all major and safety critical components as well as equipment that is specialized to meet the needs of this Project. Preventive maintenance schedules, testing and trouble shooting techniques, corrective measures, both temporary and permanent, the location and availability of support services, point to point component wiring schematics and logic signal flows, assembly and disassembly drawings, including exploded view drawings, shall be included.
  - Standard service manuals for unmodified commercial products are acceptable for inclusion in the MMP provided that they contain details and accurate information in order to properly service the specific equipment supplied under this Agreement. Large size diagrams and mechanical assembly diagrams need not be reduced or incorporated into the manual if these drawings are delivered with the manuals.
- c) Spare Parts and Inventory Levels

The Developer shall maintain a comprehensive, accurate, and auditable parts and spares inventory adequate to address the maintenance obligations. This information contained in the inventory shall be compatible with the Maintenance Management Information System (MMIS) as described in Section 19.3.3.
- d) Maintenance Records

- The Developer shall outline the preparation of quarterly Work Plans together with one year and five year Work Plans. The five year Work Plan is to be updated each year and include all renewal activities. The one year Work Plans shall be updated every quarter and shall include a rolling 12-month Work Plan.
- In respect of this requirement a Work Plan means a detailed plan that identifies all maintenance activities that will be undertaken during a specified period, including a schedule of the associated road closures expected.

### ***19.2.2 Standard of Remedy or Repair***

The remedy or repair of any Element shall meet or exceed the standard identified in the column entitled “Target” in the Performance Measurement Table and an O&M Record shall be created by Developer to verify that this requirement has been met.

### ***19.2.3 Accident Reduction Program***

The Developer is to implement an accident monitoring and reduction program. The TxDOT Wet Weather Accident Reduction Program (WWARP) is included as a reference document.

### ***19.2.4 Highway Conditions Report (HCR) System***

The Developer is required to report highway and weather conditions every workday morning by 8:10 a.m. and update the information as needed to TxDOT and include this information on the Developer’s web page.

The following types of information are to be reported:

- a) local national weather service forecasts;
- b) highway conditions which close travel in one direction for more than four hours or create hazardous travel including construction or maintenance sites, roadway or right of way damage, major accidents or hazardous spills; and
- c) weather-related events which may cause unsafe driving conditions such as ice, sleet, snow, floods, high winds or hurricanes.

### ***19.2.5 Renewal of Elements***

Elements are to be renewed when any of the following conditions are evident:

- a) The Asset Condition Score of an Element is below 3 as described in Table 19-1BA, except for asphalt and concrete pavement.
- b) For asphalt and concrete pavement, rehabilitation must be initiated when the pavement condition rating of any one-mile continuous segment falls below 75 or the International Roughness Index (IRI) is greater than 140.
- c) The “reliability” is less than 99.9% for any safety critical Element. Such an Element is one that, should it fail, the safe operation of the Project would be in jeopardy or an immediate or imminent safety hazard would result.
- d) The “reliability” is less than 90% Element other than a safety critical Element.
- e) The Element ceases to function, or dies (as in the case of certain landscaping).
- f) The frequency of repair is higher than that recommended in the manufacturer’s preventive maintenance schedule.

For the avoidance of doubt “reliability” is calculated as the in-service time over a prescribed time period. For example, if an Element is out of service for 20 days of 365 days, its “reliability” is 94.5% (i.e.  $(365 - 20)/365 \times 100\%$ ). The reliability measurement is made over a moving 365 days.

All renewed Elements shall meet all applicable code requirements and industry design standards at the time of Renewal Work.

#### ***19.2.6 Change of Use or Technology Changes***

During the Term, Elements may require a change of use from the original intentions, e.g. an office space may become a computer server room, or a parking lot may need to be modified to accommodate larger vehicles through re-striping and curb line alterations. For any such change of use or modification of use, the Developer must outline the reason for the change, how the original use will be accommodated or the reason why the original use is no longer required and provide the total cost of ownership implications of the change.

During the Term, Technology Enhancements will occur for certain Elements. It is the Developer’s responsibility to implement Technology Enhancements as set forth in [Section 12.1.3](#) of the Agreement and applicable [Sections](#) of the Technical Provisions, and such that the overall system capabilities are achieved.

#### ***19.2.7 Mitigation for Severe Weather Events***

In addition to the obligations of [Section 19.1.1](#) to monitor and observe weather and weather forecasts and to proactively deploy resources accordingly for weather events, the Developer’s MMP shall establish the means by which all the Project’s trafficked roadway types are to be managed to minimize delays and safety hazards in the event of any severe weather event.

### **19.3 Highway Location and Data Requirements**

#### ***19.3.1 Texas Reference Marker System (TRMS)***

No additional requirements.

#### ***19.3.2 Establishment of Auditable Sections***

No additional requirements.

#### ***19.3.3 Maintenance Management Information System (MMIS)***

In the MMIS, the information for bridges shall include National Bridge Inventory (NBI) sheets.

The MMIS shall be fully populated and operational prior to the Operating Commencement Date and kept updated and operational for the duration of the Agreement.

### **19.4 Performance Requirements**

No additional requirements

### **19.5 Inspections**

**19.5.1 Inspection Frequency**

No additional requirements

**19.5.2 Inspection Standards**

No additional requirements

**19.5.3 General Inspections**

No additional requirements

**19.5.4 Specialist Inspections**

In addition to the requirements of Section 19.5 of Book 2B the following Specialist Inspections shall also be conducted.

**TABLE 19-1AA Specialist Inspections**

Element	Frequency
Fire Protection Systems including tunnel ventilation systems if applicable.	Simulation test every six months to assure that a safety critical system behaves as needed even when sub-components fail.
Subsurface Managed Lanes (including civil, structural, mechanical systems, electrical systems)	Frequency and scope of inspections shall be based on the FHWA manuals for inspection, maintenance and rehabilitation of Highway and Rail Tunnels. Additional requirements for mechanical and electrical system components shall be incorporated.
Structural Connections	Quarterly inspections of embedded connections supporting equipment or structural members.

**19.5.5 Developer Audit Inspections**

The Developer shall complete initial inspections of existing facilities, comprising existing infrastructure and Existing Improvements, within 90 days after Operating Commencement Date, in accordance with the requirements of Section 19.5.7.

**19.5.6 Asset Condition Score by Developer**

Table 19-1BA replaces Table 19-1B of Book 2B.

**Table 19-1BA Asset Condition Score Criteria for Element Categories**  
(Reported quarterly for each Element Category for all inspected Auditable Sections)

Score	Criteria
5	<ul style="list-style-type: none"> <li>• Targets for individual Elements are almost entirely met (95% to 100% compliance with the relevant Targets for each Element within each Auditable Section), and</li> <li>• Is fully functional and in nearly new condition, meeting or exceeding Performance Requirement.</li> </ul>
4	<ul style="list-style-type: none"> <li>• Targets for individual Elements are substantially met (less than 95% compliance and 90% or greater compliance with the relevant Targets for each</li> </ul>

	<p>Element within each Auditable Section), and</p> <ul style="list-style-type: none"> <li>• Is functional and in good condition, meeting Performance Requirement.</li> </ul>
3	<ul style="list-style-type: none"> <li>• Targets for individual Elements are mostly met (less than 90% compliance and 75% or greater compliance with the relevant Targets for each Element within each Auditable Section), and</li> <li>• Is in fair condition, but suggesting need for early replacement, renewal or repair of individual Element and/or maintenance or operation improvement action to meet Performance Requirement.</li> </ul>
2	<ul style="list-style-type: none"> <li>• Targets for individual Elements are barely met (less than 75% compliance and 50% or greater compliance with the relevant Targets for each Element within each Auditable Section), or</li> <li>• In poor condition demonstrating need for immediate replacement, renewal or repair of individual Element and/or immediate change to PMP.</li> </ul>
1	<ul style="list-style-type: none"> <li>• Targets for individual Elements are not met (less than 50% compliance with the relevant Targets for each Element within each Auditable Section), or</li> <li>• In very poor condition demonstrating need for immediate replacement, renewal or repair of individual Element and/or immediate change to PMP.</li> </ul>

Notes to Table 19-1BA:

1. The Asset Condition Score for any Element Category shall be determined by the lowest percentage compliance for any Element within the Element Category. The calculation of percentage compliance is demonstrated by the following example:  
 Assume there are 520 Auditable Sections, of these 5%, or 26 are audited each quarter. There are eight Targets to be assessed for Element “pavement markings”. There are therefore,  $8 \times 26 = 208$  measurement records for pavement markings. If 200 of these measurement records meet the Target, there would be 96% compliance and an Asset Condition Score of five assigned for that Element. However, if one of the remaining Elements in the Element Category achieves only 90% compliance, the Asset Condition Score would be four.
2. The mean of the Asset Condition Scores across Elements in any Element Category is calculated to 1 decimal point and also recorded.
3. Where a measurement record relates to a service measured over time or an Element that is not represented in more than 25% of Auditable Sections then the Asset Condition Score will be based on the total service and not a 5% random sample. This applies to the performance measurement of Element Categories: Structures, Traffic Signals, Incident Response, Customer Service, Snow and Ice Control, Facility Buildings and Toll Equipment or other Element Categories meeting the above criteria identified following establishment of the Auditable Sections.
4. Pavement Condition Score is a component of Asset Condition Score for Element Category “Pavement”, but Pavement Condition Score shall also be reported annually for the entire Project.
5. Developer acknowledges that Asset Condition Score is a mechanism to benchmark the performance of the Project against the performance of other similar facilities and that TxDOT may, during the Term, alter the Asset Condition Score criteria to reflect Good Industry Practice.
6. “Mean” in this context shall be the arithmetic mean.

Each Asset Condition Score of less than three or a mean Asset Condition Score across Elements of less than 3.5 (for any Element Category) is deemed a Noncompliance (see Exhibit 21 of the Agreement)

### ***19.5.7 Existing Infrastructure and Existing Improvements***

If the Asset Condition Scores for each Element Category of existing facilities demonstrate that the Performance Requirements are not being achieved, the Developer shall prepare and submit to the Independent Engineer and TxDOT for their review and comment a Work Plan for the existing facilities that demonstrates how the Performance Requirements for each Element will be fully met and maintained within 24 months after the baseline date of 90 days after the Operating Commencement Date with the exception of sub-elements 1.2, 1.3, 1.4, 1.5 and 2.1 which shall be fully met and maintained within 60 months of NTP2. In any event the Pavement Condition Score for sub-element 1.2 shall be no less than 50 and for sub-element 2.1, the free cross-sectional area shall not be less than 70%. In addition, all Category 1 Defects are to be corrected within the response times stated in the Performance Measurement Table regardless of minimum Asset Condition Score requirements.

After an asset has been constructed, re-constructed or renewed, the Developer is to maintain the Elements in accordance with the Performance and Measurement Table.

### ***19.5.8 Temporary Ramps and Diversions***

For Frontage Road Auditable Sections that will require modification for the provision of temporary ramps or diversions during Major Construction and/or Renewal Work, a minimum Asset Condition Score of 2 and a minimum mean Element compliance score of 2.5 is allowed. The Asset Condition Score and mean Element compliance score shall be restored to at least 3 and 3.5 respectively prior to Service Commencement following and/or completion of Renewal Work.

## **19.6 Handback Requirements**

### ***19.6.1 Residual Life Methodology***

Developer shall prepare and submit to TxDOT for approval a Residual Life Methodology, 60 months before the due date for Handback. The inspection requirements and Residual Life Methodology requirements identified in the Table 19-2A – Residual Life Table are minimum requirements. This Submittal shall contain the evaluation and calculation criteria to be adopted for the calculation of the Residual Life at Handback of all Elements of the Project. The scope of any Residual Life testing shall be included, together with a list of all independent Residual Life testing organizations, proposed by the Developer. These organizations shall be on TxDOT's approved list, have third party quality certification, and be financially independent of Developer and not be an Affiliate.

TxDOT's approval of the Residual Life Methodology, including the scope and schedule of inspections, shall be required before commencement of Residual Life Inspections.

### ***19.6.2 Residual Life Inspections***

Inspections and testing shall be performed with appropriate coverage such that the results are representative of the whole Project as described in the Table 19-2A - Residual Life Table.

TxDOT shall be given the opportunity to witness any of the inspections and/or tests and shall be provided with a minimum of ten Business Days notice prior to the performance of any such tests. The Developer shall deliver to TxDOT, within ten Days after it is created, the output data arising from any testing and any interpretation thereof made by the testers.

In the event that the Developer fails to undertake inspections within the relevant time periods described below, TxDOT shall be entitled to undertake or arrange the relevant inspections itself, following 30 Days written notice to Developer.

a) First Inspection

Between 57 and 60 months before the end of the Term, the Developer shall perform a Residual Life Inspection (the ‘First Inspection’), including all Elements set forth in the Residual Life Table.

Within 30 Days following performance of the First Inspection, the Developer shall submit to TxDOT the findings of the inspection, including Residual Life test results, the report of the independent testing organization(s), the Developer’s Residual Life calculations and Developer’s calculation of Residual Life at Handback for all Elements.

b) Second Inspection

Between 15 and 18 months before the end of the Term, the Developer shall perform a second Residual Life Inspection (the ‘Second Inspection’) including all Elements set forth in the Residual Life Table.

The Second Inspection shall be performed for all Elements of the Project whether or not the Developer has undertaken Renewal Work for a particular Element in the period since the First Inspection.

Within 30 Days following the performance of the Second Inspection, the Developer shall submit to TxDOT the findings of the inspection, including Residual Life test results, the report of the independent testing organization(s), the Developer’s Residual Life calculations and the Developer’s calculation of Residual Life at Handback for all Elements of the Project.

c) Final Inspection

Not later than 90 Days before the end of the Term, the Developer shall perform a final Residual Life Inspection (the ‘Final Inspection’) including all Elements within the Project, whether or not the Developer has undertaken Renewal Work for a particular Element in the period since the First and Second Inspections.

Within 30 Days following performance of the Final Inspection, the Developer shall submit to TxDOT for review and approval the findings of the inspection, including Residual Life test results, the report of the independent testing organization(s), the Developer’s Residual Life calculations and the Developer’s calculation of Residual Life at Handback for all Elements of the Project.

### ***19.6.3 Renewal Work Schedule at Handback***

The Renewal Work Schedule for each of the five years before Handback shall include, in addition to any other requirements specified in the CDA Documents:



- a) The Developer’s calculation of Residual Life for each Element calculated in accordance with the Residual Life Methodology and taking into account the results of the inspections set forth above.
- b) The estimated cost of the Renewal Work for each Element at the end of its Residual Life.

#### ***19.6.4 Residual Life and Useful Life Requirements***

Table 19-2A replaces Table 19-2 of Book 2B. For any Element in Table 19-2A:

- a) Where a Residual Life at Handback is specified, the Residual Life at Handback shall be equal to or greater than the period set forth.
- b) Where a Useful Life is specified in place of a Residual Life at Handback, the Useful Life created at the time of its last replacement, renewal, reconstruction, restoration or rehabilitation before the end of the Term shall be equal to or greater than the period set forth in the column entitled “Useful Life”, and the Renewal Work Schedule shall estimate the cost of the next Renewal Work (after the end of the Term) on the assumption that such Renewal Work will be performed in order to create a new Useful Life of the same duration.



**TABLE 19-2A Residual Life Table**

Managed Lanes	-	10	Pavement inspections shall be undertaken by independent testing organizations.	RLM shall be capable of calculation of Residual Life for each 0.1 mile Auditable Section.  For a nominal 10 year Residual Life at Handback, 85% of Auditable Sections shall have a Residual Life exceeding 10 years, and no Auditable Section shall have a calculated Residual Life of less than 5 years.)
General Purpose Lanes	-	10	Inspections shall provide a continuous or near-continuous record of Residual Life in each lane. Where the inspection method does not provide a continuous record of Residual Life, the number of valid measurements in each Auditable Section shall be sufficient to give a statistically valid result.	
Ramps/direct connectors	-	10		
Frontage/access roads	-	10		
Local/collector roads	-	10	Inspections shall be repeatable to an agreed level of accuracy and inspection contracts shall include an agreed proportion of inspections to verify accuracy.  Inspections shall include ride quality, skid resistance and rutting.	
Reinforced concrete	50	-	Inspections of structures shall be undertaken by independent testing organizations.	RLM shall:  Draw on historical asset maintenance records, inspection and test histories for each structure.  Take account of TxDOT and FHWA records of other structures on the network with similar characteristics.  Include an assessment of load carrying capacity based on the original structural design calculations, the as built drawings and results of load deflection tests where appropriate.
Pre-stressed concrete	50	-	Inspections shall follow the latest inspection guidelines (as they apply at the relevant date that the testing is undertaken) recognized by TxDOT.	
Structural steelwork	50	-		
Weathering steel	50	-	A close examination shall be made of all parts of each structure.	
Corrugated steel	50	-	Non-destructive tests shall be undertaken appropriate to the type of structure. These shall include the measurement of	

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Corrosion protection for structural steelwork	-	5	structural deflection under calibrated load, the identification and measurement of de-lamination in bridge decks, the measurement of chloride and carbonation profiles from surface to reinforcement and/or tendon level, and the in-situ strength testing of concrete Elements.  Testing of steel structures shall include the depth of corrosion and/or the measurement of remaining structural thickness for hidden and exposed parts.  All lengths of weld shall be tested for cracking at key areas of structural steelwork.	Take account of any trends in asset deterioration to determine the rate of deterioration and to predict the future condition of individual Elements and the entire structure.
Deck surfacing	-	10		
Deck joints	-	5		
Bearings	-	30		
Railing	50	-		
Sign/signal gantries (structural Elements)	50	-		
Retaining walls	50	-		
Traffic signal poles	-	8		
High mast lighting	-	25		
<b>Buildings and Enclosed Facilities</b>				
Structural elements	50	-	Inspections shall comply with Good Industry Practice.	RLM shall draw on historical asset maintenance records, inspection and test histories for each building and maintenance facility.
Roofing	-	15		

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Installation and Finishes	25	-		
Building Mechanical Equipment (Plumbing & HVAC)  Bathroom Fixtures Piping Valves, Pumps, Pipe Drinking Fountains Insulation Domestic Water Heaters Fuel Oil Storage Tank Embedded/Buried Pipe Boilers Flue/Chimneys Chillers/Condensers Heat Pumps Air Handlers Ventilators Unit Heaters Ductwork/Grilles Air Compressors Elevators Freeze Protection	- - - - - - - 40 - - - - - - - 40 - - -	20 20 15 15 15 15 20 - 20 10 15 10 15 10 15 - 15 30 15	Inspections shall be based upon Good Industry Practice and manufacturers' inspection requirements.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.
Building Mechanical Equipment (Fire Suppression)  Sprinkler Piping Valves & Fittings Clean Agent Systems Standpipe	25 - - -	- 20 20	Inspections shall be based upon Good Industry Practice, manufacturers' inspection requirements and applicable NFPA Standards.  Inspection shall be undertaken by a qualified Fire Protection Engineer or person(s) having NICET Level III certification.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Exhaust/Pressurization Fans	-	20		
Fire Rated Doors	-	15		
Fire Extinguishers	-	15		
Fire Pumps/Motors	-	10		
	-	20		
Building Electrical Systems				
Switchgear, HV	-	25	Inspections shall be based upon Good Industry Practice and manufacturers’ inspection requirements.  Inspection of electrical systems shall be undertaken by qualified individuals (NETA or equivalent for electrical, NICET for Fire alarm, other) and performed in accordance with NFPA 70B, as a minimum.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.
Switchgear, LV	-	30		
Transformer, HV, Liquid	-	40		
Transformer, HV, Dry	-	30		
Transformer, LV, Liquid	-	40		
Transformer, LV, Dry	-	30		
Circuit Breaker, HV	-	25		
Circuit Breaker, LV	-	30		
Switch - Non Loadbreak	-	30		
Transfer Switch	-	25		
Motor Drive, Inverter Type	-	20		
Motor Starter, Controller, LV	-	18		
Contactors, LV	-	18		
Cable, HV	-	45		
Cable, LV	-	40		
Wire, LV	-	30		
Wire, Signal	-	25		
Wire, Control	-	35		
Wire, Grounding	-	50		
Raceway, Interior	-	60		
Raceway, Exterior	-	40		
Raceway, Encased	-	50		
Generator, Diesel	-	25		
UPS, Static	-	15		
UPS, Rotary	-	20		

**TABLE 19-2A Residual Life Table**

Batteries, Wet (UPS)	-	10		
Fire Alarm	-	15		
CCTV	-	10		
Telecommunications	-	10		
SCADA	12	-		
SCADA Software, Integrated with ITS	7	-		
Building Automation	-	15		
Building Automation Software Integrated with ITS	10	-		
Lighting, Interior	-	20		
Lighting, Exterior	-	15		
Wiring Devices, LV	-	20		
	10	-	Inspections shall comply with Good Industry Practice.	RLM shall be based on the manufacturer's or supplier's recommended component life, together with records of the performance of similar equipment from Developer or TxDOT records.
Underground storm sewer systems	50	-	Inspection of storm sewer systems shall include closed circuit TV inspection of all buried pipe work.	RLM shall draw on historical asset maintenance records, inspection and test histories for each Element of the drainage system.
Culverts	50	-	Groundwater level monitoring at selected locations will be required to provide assurance through the RLM of a 10 year	Developer shall include a methodology to determine the

**TABLE 19-2A Residual Life Table**

Ditches	-	10	Residual Life for groundwater interceptor drains.	Residual Life of filter drains designed to intercept groundwater.
Inlets	25	-		
Outfalls	-	10		
Earthwork slopes	50	-	For embankment and cut slopes a risk based inspection procedure shall be adopted following Good Industry Practice.  Deformation monitoring will be required to provide assurance through the RLM of a 50-year Residual Life.	RLM shall draw on historical asset maintenance records, inspection and test histories for each ancillary Element.
Metal beam guard rail	-	10	Inspections of all ancillary items shall be undertaken by personnel having adequate training on modes of failure, risk assessment and observational skills.	
Concrete barrier	-	20		
Impact attenuators	-	20		
Lighting columns	-	10		
Overhead signs	-	5		

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Traffic signals housings and mountings	-	8		
Fences	-	10		
Manhole covers, gratings, frames and boxes	-	10		
Curbs and gutters	-	10		
Luminaries	-	5		
Roadside traffic signs	-	5		
Pavement markings	-	5		
Delineators	-	5		
<b>Tunnels and Tunnel Ancillary Facilities</b>				
Reinforced concrete	50	-	Inspections of structures shall be undertaken by an independent testing organization.  Inspection scope shall be determined by the inspecting organization but as a minimum shall be based upon FHWA	RLM shall:  Draw on historical asset maintenance records, inspection and test histories for each structure.  Include an assessment of load carrying capacity based on the original structural design calculations, the as built drawings
Precast concrete segments	50	-		
Structural steelwork	50	-		

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Walkway Railing	50	-	requirements as defined in the Highway and Rail Transit Tunnel Inspection guidelines (as they apply at the relevant date that the testing is undertaken).	and results of load deflection tests where appropriate. Take account of any trends in asset deterioration to determine the rate of deterioration and to predict the future condition of individual Elements and the entire structure.
<b>Subsurface Managed Lanes (Mechanical and Electrical Systems)</b>				
Ventilation and Egress Pressurization Systems (Mechanical)  Tunnel jet fans Tunnel centrifugal fans Tunnel centrifugal fan motors Pressurization fans Tunnel vent dampers Control system Control system software Tunnel environmental monitoring system	25 35 - - 25 10 10 -	- - 25 20 - - - 10	Inspections shall be based upon Good Industry Practice, manufacturers’ inspection requirements and applicable FHWA requirements and NFPA Standards.  Special testing shall be conducted for all motor operated systems and equipment vibration.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.



**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Electrical System Components				
Switchgear, HV	-	20	Inspections shall be based upon Good Industry Practice, manufacturers’ inspection requirements and applicable FHWA requirements and NFPA Standards.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.
Switchgear, LV	-	25		
Transformer, HV, Liquid	-	40		
Transformer, HV, Dry	-	20		
Transformer, LV, Liquid	-	40		
Transformer, LV, Dry	-	25		
Circuit Breaker, HV	-	30		
Circuit Breaker, LV	-	25		
Switch - Non Loadbreak	-	20		
Transfer Switch	-	15		
Motor Drive, Inverter Type	-	10		
Motor Drive, Inverter Type integrated w/ITS or SCADA	10	-		
Motor Starter / Controller, LV	10	-		
Tunnel Lighting Controller	10	-		
Contact, LV	-	10		
Cable, HV	-	45		
Cable, LV	-	35		
Wire, LV	-	25		
Wire, Signal	-	20		
Wire, Control	-	25		
Wire, Grounding	-	50		
Raceway, Exposed	-	40		
Raceway, Encased	-	50		
UPS, Static	-	10		
UPS, Rotary	-	15		
Batteries, Wet (UPS)	-	7		
Fire Alarm	12	-		
CCTV	-	7		
CCTV, Integrated w/ITS	7	-		

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Electrical System Components (continued)  Telecommunications Telecommunications Integrated w/ITS SCADA SCADA Software Integrated w/ITS Lighting, Roadways Lighting, Enclosed Area Wiring Devices, LV Fireproofing, Applied	-  7 10 7 - - - 50	7  - - - 25 15 12 -		
Fire Protection Systems  Standpipe & Sprinkler/Deluge Piping Valves & Fittings Emergency Egress Doors	30 - -	- 15 15	Inspections shall be based upon Good Industry Practice, manufacturers’ inspection requirements and applicable FHWA requirements and NFPA Standards.  Inspection shall be undertaken by a qualified Fire Protection Engineer or person(s) having NICET Level III certification.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.

**TABLE 19-2A Residual Life Table**

Element Category	Residual Life at Handback (yrs)	Useful Life (yrs)	Inspection Requirements	Residual Life Methodology (RLM) Requirement
Tunnel and Storm Water Drainage and Pumping Systems  Pumps Pipe, Valves, & Fittings Roadway Piping & Drains Gas Detection System Level Control System Station Ventilation Hoists Access Hatches Overhead Doors Plumbing (pipe, fixtures, etc.)	- - 50 - - - - - - -	15 15 - 7 7 10 20 20 10 20	Inspections shall be based upon Good Industry Practice, manufacturers’ inspection requirements and applicable FHWA requirements and applicable NFPA Standards.  Inspection of all buried and embedded pipe shall include inspection by CCTV.	Draw on historical inspection, maintenance and rehabilitation records for system components, including life cycle and durability analysis.

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## 20 BICYCLE AND PEDESTRIAN FACILITIES

### 20.1 General Requirements

Developer shall maintain and keep operational all bicycle and pedestrian facilities during construction and throughout the term of the agreement.

### 20.2 Design Requirements

#### 20.2.1 *Bicycle Facilities*

The Developer's design shall accommodate existing and proposed bikeweb and veloweb facilities published by the North Central Texas Council of Governments.

The Developer's facilities shall meet the requirements of the AASHTO Guide for the Development of Bicycle Facilities.

#### 20.2.2 *Pedestrian Facilities*

The existing Joe Ratcliff pedestrian walkway located between Webb Chapel Road and Marsh Lane is to be reconstructed as part of the Work. During completion of the Work, pedestrian use of the Joe Ratcliff walkway may be stopped on a continuous basis for a maximum period of 3 months, to coincide with summer break from schools.

Prior to NTP2, the Developer shall conduct an inventory of all existing sidewalks and footpaths.

Developer shall design, construct, and maintain sidewalks along the frontage roads and side streets as follows:

- a) There is evidence of pedestrian traffic (either pedestrians are observed, there is a beaten down path, or significant potential exists for pedestrians to walk in the roadway); or
- b) The frontage road or side street is located on a route to a school or a transit route.

## **21 ELECTRONIC TOLL COLLECTION SYSTEM REQUIREMENTS**

### **21.1 General Requirements**

Section 21.1 of Book 2B is replaced with the following:

In the Electronic Toll Collection System Plan (ETCSP), the Developer shall set forth an Electronic Toll Collection System (ETCS) design and the necessary approach, procedures, and methods for implementing an Open Road Tolling (ORT) Managed Lanes ETCS. TxDOT's approval of the ETCSP shall be a condition of Service Commencement.

The Developer shall design, develop, implement, operate, and maintain a Managed Lanes ETCS.

### **21.2 Design Requirements**

No additional requirements.

### **21.3 ETCS Design and Operational Criteria**

#### ***21.3.1 ETCS Infrastructure Requirements***

Section 21.3.1 of Book 2B is replaced with the following:

The Developer shall determine the ETCS infrastructure needed to satisfy the ETCS functional requirements set forth in Section 21.3.2. The ETCS infrastructure shall accommodate safe and secure access to all ETCS components for maintenance and repairs.

#### ***21.3.2 ETCS Functional Requirements***

Section 21.3.2 of Book 2B is replaced with the following subsections.

##### **21.3.2.1 Vehicle Occupancy**

The system shall distinguish between single occupancy vehicles (SOV) and high occupancy vehicles (HOV) through the use of declaration lanes. The Developer shall identify all declared HOV user transactions. The Developer shall provide TxDOT and the tolling services Contractor all HOV transaction information required to calculate an HOV discount payment.

##### **21.3.2.2 Vehicle Classification**

The system shall accurately detect and classify every vehicle that passes through one or more tolling zones.

See Exhibit 4 of the Agreement for a list of User Classifications.

##### **21.3.2.3 User Transactions**

The system shall create one transponder transaction or video transaction per User per trip.

A transaction consists of at least: (1) a transponder ID and/or a video image set, (2) the date and time of first and last transponder read locations, (3) the declaration data, i.e. whether a vehicle is a HOV or SOV, and (4) the toll charged to the User.

If it is necessary for data from multiple toll points to be correlated to create a transaction, the Developer shall perform all of the work required to assemble a complete transaction. If data does not exist to support all segments of a multi-segment trip, the developer may not create transactions for unsubstantiated segments.

The system shall assign the toll due based on: (1) the vehicle occupancy and classification as determined in the lane, (2) the number of Segments traveled during the trip, and (3) the User's time of entry into the each Segment.

Whether a User travels through one Segment and exits the Managed Lane System or travels through consecutive Segments without exiting the Managed Lane System, the toll charged for each Segment shall be based upon the time of the User's entry into each Segment.

The system shall charge each User no more than the last toll displayed to the User prior to the User's entry into a Segment of the Managed Lanes.

If a motorist passes a toll rate sign and the rate increases prior to their passing through the tolling zone, the motorist is charged a toll that is equal to, or less than, the toll that was displayed to him on the toll rate sign.

All transactions for vehicles classified as Automobiles without trailers, as defined in Exhibit 4 of the CDA, that do not have occupancy declaration information shall be HOV transactions.

#### **21.3.2.4 Image Capture**

For video transactions, the system shall capture images of the vehicle's front and rear license plates.

The system shall use Optical Character Recognition (OCR) software to identify the license plate number and jurisdiction of issue.

#### **21.3.2.5 Enforcement**

Enforcement of HOV shall be carried out by parties other than the Developer. The Developer shall coordinate with the enforcement entity and provide all necessary declaration data including User Classification, time of entry, location of entry, undiscounted toll, and vehicle identification data associated with the transponder account.

##### **21.3.2.5.1 Enforcement Zones**

Developer shall provide enforcement zones as follows:

An enforcement zone shall consist of an area for occupancy enforcement technology and a parking area for at least one law enforcement vehicle. Enforcement vehicle shall mean automobiles unless otherwise approved by TxDOT. The parking area shall not be within a shoulder.

At least one enforcement zone shall be located within each Segment in each direction. Enforcement zones shall be located so that each vehicle that enters the Managed Lanes, via a declaration lane, must pass through an enforcement zone prior to exiting the Managed Lanes.

#### **21.3.2.5.2 Enforcement Technology**

The ETCS shall communicate vehicle occupancy declaration data to enforcement personnel. The data shall be adequate and sufficient to enable enforcement personnel to distinguish between vehicles declared as HOV and SOV.

The ETCS may use a variety of methods to communicate vehicle occupancy declaration data to enforcement personnel. Examples include (1) the use of beacon lights, located at the enforcement zone, to indicate previous User declaration actions, (2) the use of Personal Digital Assistant (PDA) or similar technology by enforcement personnel to receive User declaration data from the ETCS, (3) the use of an automated occupancy detection system, and (4) manual, visual enforcement at the declaration zones. TxDOT may also approve other means of enforcement.

If the enforcement solution that TxDOT directs the Developer to use includes equipment for enforcement personnel, the Developer shall provide equipment for up to 20 persons, as defined by TxDOT.

#### **21.3.2.5.3 Enforcement System Upgrades**

The Developer shall identify new, reliable, and automated occupancy detection technology as it becomes available.

The Developer shall upgrade the HOV enforcement system with technologies agreed upon by TxDOT and the Developer.

#### **21.3.2.6 Dynamic Pricing**

The system shall have the ability to dynamically calculate toll rates in real-time based upon current Managed Lanes traffic speed and volume information.

### **21.4 Advance Toll Information Signs**

Section 21.4 of Book 2B is replaced by the project requirements for Advance Toll Information Signs in Section 16.5.5.

### **21.5 ETC System Performance Requirements**

Section 21.5, of Book 2B is replaced by the following:

The ETCS performance requirements set forth in Table 21-1A shall apply at all times and throughout a vehicle speed range of 1 to 100 mph, with the exceptions of classification and image capture, for which the stated tolling performance requirements shall be achieved for a speed range of 5 to 100 mph. ETCS performance requirements shall apply to all vehicles whether they are traveling closely together or far apart.

**TABLE 21-1A - Tolling Performance Requirements**

<b>Ref</b>	<b>Parameter</b>	<b>Requirement</b>	<b>Measurement Method</b>	<b>Performance Requirement</b>
1	Transaction creation success rate	For all vehicles passing through the tolling zone, the ETCS shall produce an appropriate transponder transaction or video transaction, complete with vehicle occupancy declaration information.	The success rate shall mean the total number of correct toll transactions recorded by the ETCS expressed as a percentage of the total number of vehicles passing through the tolling zone.	>99.80%
2	Transponder read success rate	For all vehicles passing through the tolling zone and carrying a valid, properly-mounted transponder, the ETCS shall correctly read each transponder.	The success rate shall mean the number of correct transponder reads, expressed as a percentage of all vehicles passing through the tolling zone and carrying a valid, properly-mounted transponder.	>99.90%
3	License plate image readability and reliability success rate	For all video transactions, the license plate images produced by the image capture system shall be human-readable and reliably contain images from which both plate number and issuing jurisdiction can be read.	The success rate shall mean the number of video transactions including at least one human-readable plate image from which both plate number and jurisdiction of issue are reliably discernable, <i>i.e.</i> can be converted unambiguously to text by an operator, expressed as a percentage of the total number of video transactions (excluding plate images for ineligible vehicles, <i>see Note 1</i> ).	>98.00%



**TABLE 21-1A - Tolling Performance Requirements**

Ref	Parameter	Requirement	Measurement Method	Performance Requirement
4a	Vehicle occupancy declaration data transmission success rate <i>(for solutions that send each HOV declaration data set).</i>	For all HOV transactions, the ETCS shall transmit the vehicle occupancy declaration data to enforcement personnel prior to or as the respective vehicle passes through an enforcement zone.	The success rate shall mean the number of correctly transmitted declaration data sets expressed as a percentage of the total number of HOV transactions.	>99.90%
4b	Vehicle occupancy declaration data transmission success rate <i>(for solutions that send specific declaration data sets on request).</i>	For all designated, or requested, HOV transactions, the ETCS shall transmit the vehicle occupancy declaration data to enforcement personnel prior to or as the respective vehicle passes through an enforcement zone.	The success rate shall mean the number of correctly transmitted declaration data sets expressed as a percentage of the total number of requested data sets.	>99.90%

Note 1: Ineligible vehicles are those for which a video image is obtained that due only to one or more of the following conditions cannot be reliably read by the human eye:

- a) The vehicle either has no license plate or it is not mounted in the legally required position;
- b) The license plate is covered by dirt or snow rendering it unreadable;
- c) The license plate is damaged, bent or broken rendering it unreadable;
- d) The license plate is blocked by an object carried by the vehicle (such as a plate frame, overhanging cargo or a trailer towing ball); or
- e) The license plate is blocked by something in the lane such as a person or another vehicle.

On an annual basis, the Developer shall conduct a performance audit to verify that system reliability and accuracy has not degraded over time and the ETCS continues to satisfy the functional and performance requirements. The performance audit shall include (1) the analysis of previous year-to-date transaction and maintenance data and (2) controlled tests, using statistically significant test samples, conducted by using test vehicles. TxDOT may choose to perform ad hoc operational testing as part of the performance audit.

No more than 30 days after the performance audit has been completed, the Developer shall submit a report of the results. The report shall include, at least, the following:

- a) A summary of the overall testing methodology and test results;
- b) An explanation of, and remedy for, any system deficiencies and/or degradations; and
- c) An appendix containing the detailed test procedures, results, and data used in evaluating the system's operational performance.

TxDOT may also, at its sole discretion and at any time, require the Developer to provide the information necessary to show that the Developer is meeting the performance requirements described herein.

## 22 OPERATIONS

### 22.1 General Requirements

The first sentence of 22.1 of Book 2B is replaced with the following: “The responsibility of the Developer for operations Work will begin on the Operating Commencement Date and continue for the Term of the Agreement.”

### 22.2 General Operations Obligations

In addition to the requirements of Book 2B, at least 60 days prior to NTP2, the Developer shall submit the Operations Management Plan (OMP) to TxDOT. The OMP shall be developed to a level appropriate for operations prior to Service Commencement. Approval of the OMP by TxDOT shall be a condition of NTP2. The Developer shall develop and submit for approval by TxDOT the OMP as required by Book 2B prior to Service Commencement.

### 22.3 Operation of the Project

#### 22.3.1 Corridor Management

The Developer shall coordinate with TxDOT to achieve a smooth transition of operations activities from TxDOT. The Developer shall assume full responsibility for all operations activities for each Section as described in Section 8.3 of the Agreement.

#### 22.3.2 Condition Preservation

No additional requirements.

#### 22.3.3 Patrols

Patrol personnel must specifically have knowledge of Incident management, the sub-surface safety systems and training on typical sub-surface hazards such as confined space, fume and smoke dissipation.

The record of a patrol shall include details of the weather conditions, road surface condition and any unusual features of the method of inspection.

#### 22.3.4 ITS Operations

This supersedes the first four paragraphs of the Book 2B Section 22 requirements.

The Developer shall have primary access to and control of all Dynamic Message Signs (DMSs), Closed Circuit Television (CCTV), and vehicle detection systems placed on and data/video generated from the main lanes and frontage road lanes in addition to vehicle detector data, DMS status data, and CCTV video generated by systems placed on the main lanes and frontage road lanes. The Developer shall provide TxDOT with secondary access to the same.

Primary access is defined as the Traffic Management Center (TMC) that operates and maintains the deployed Intelligent Transportation System (ITS) equipment and establishes, assigns, and controls the access privileges to the ITS networks, computers, data and operations. Secondary access is defined as the network user that is allowed to operate and control the equipment of the ITS system.

The remainder of Book 2B Section 22.3.4 applies.

### **22.3.5 Traffic Control and Incident Management**

The Operations Management Plan (OMP) shall address the mobility requirements of the Project. Lane closures, for repair and reconstruction during the Term of the Agreement, shall conform to the Texas Manual on Uniform Traffic Control Devices (TMUTCD). The OMP shall also address traffic control for Emergencies and Incidents.

As a part of the OMP, the Developer shall prepare an Incident Management Plan (IMP) that meets the requirements of Section 24 and that includes the following items:

- a) Procedures to identify Incidents and notify Emergency Services providers and establish traffic control for Incident management activities in a timely manner;
- b) Procedures for removal of stalled, broken down, wrecked or otherwise incapacitated vehicles from the travel lane, including coordination with Emergency Services/law enforcement;
- c) Procedures for clean up of debris, oil, broken glass, etc. and other such objects foreign to the roadway surface;
- d) Procedures to communicate IMP information to Developer's public information personnel and notify the public of traffic issues related to Incidents in keeping with the requirements of Section 3 – Public Information and Communications; and
- e) Descriptions of contact methods, personnel available, and response times for any Emergency condition requiring attention during off-hours.

The IMP shall be submitted to TxDOT for approval as a condition of NTP2.

Additional to the requirements of Book 2B Section 22.3.5, the Developer shall cause a trained member of staff to be on standby 24 hours a day seven days a week to coordinate the Developer's response to any Incident or Emergency. The Developer shall assist Emergency Services to minimize danger, disruption or delay to the public and pollution of watercourses or groundwater.

The Developer shall attend to Incidents with trained personnel, equipped to carry out the functions required in this Section, in accordance with the obligations stated in the Performance and Measurement Table.

The Developer shall provide services for automobile towing of Users' light and heavy vehicles at the Users' expense.

Where an Incident or Emergency has an effect on the operation of the Project, Developer shall clear obstructions and repair damage to the Project, under the supervision of Law enforcement agencies if necessary, such that the Project is returned to normal operating standards and safe conditions as quickly as possible. Where liquid or soluble material spills are involved, the Developer shall take all necessary measures to minimize pollution of watercourses or groundwater. Where structural damage to highway structures is suspected, the Developer shall cause that a suitably qualified bridge engineer or specialist inspector is available to evaluate the structure and to advise on temporary repairs and shoring needed to provide safe clearance of the Incident or Emergency. Where such an Incident or Emergency involves a personal injury, the Developer shall not remove any vehicle or other item that may assist the investigation until authorized to do so by jurisdictional law enforcement agencies.

The Developer shall not reopen any area of the Project which has been closed, until all appropriate safety and traffic management measures have been completed.

The Developer shall appoint a Traffic Safety Officer and one or more deputies to make all arrangements necessary for safety and traffic control including the provision and operation of recovery vehicles for breakdowns. The Developer shall cause the Traffic Safety Officer or one of his/her deputies to be on site at all times when safety and traffic management measures are proceeding and to be readily available at all times to deal with matters related to safety and traffic control.

#### **22.3.6 Policing**

No additional requirements.

## **23 BUILDINGS AND ENCLOSED FACILITIES**

### **23.1 General Requirements**

#### ***23.1.1 Scope of Work***

The Developer shall provide all buildings necessary to operate and maintain the Project in accordance with the requirements herein and Good Industry Practice. Buildings and enclosed facilities may include but are not limited to Maintenance Facilities and the Customer Service Center (CSC).

Buildings and enclosed facilities located inside the Project ROW and within State owned property shall be designed and built in accordance with the current codes and regulations of the Governmental Entity adjacent to the property location. Municipal ordinances regulating construction, including requirements for approvals, permits, etc., will not apply to facilities undertaken on property owned by the State; however, the Developer shall coordinate with appropriate Governmental Entities at relevant service connections.

### **23.2 Design Requirements**

The Developer shall plan all required buildings and enclosed facilities to meet the functional requirements of the Project.

The Developer shall determine which Technical Documents (or portions of) will be applied to the design of buildings and enclosed facilities covered herein.

#### ***23.2.1 Environmental Objective***

For buildings with occupied spaces, the Developer shall achieve the goals of Leadership in Energy and Environmental Design (LEED™) V 2.2 Silver Certification.

#### ***23.2.2 Floor Flatness***

For buildings with occupied spaces, floors on grade and elevated floors are to be engineered and constructed to achieve the following degree of floor flatness (Ff), when measured in accordance with American Society for Testing and Materials (ASTM) E 1155 – 1996:

- a) Specified Overall Value: Ff 25
- b) Minimum Localized Value: Ff 17

Floors on grade are to be engineered and constructed to achieve the following degree of floor levelness (Fl), when measured in accordance with ASTM E 1155-1996:

- a) Specified Overall Value: Fl 20
- b) Minimum Localized Value: Fl 15

#### ***23.2.3 Interior Design Criteria***

For buildings with occupied spaces, the Developer shall provide finished interiors and fixtures as required to function properly for planned occupancies.

The acoustic performance/background noise shall meet the following criteria:

- a) Provide interiors that maintain ambient sound levels in occupied spaces in accordance with the following, and within the Guideline Criteria for Heating Ventilation and Air Conditioning (HVAC)-Related Background Sound in Rooms, as defined in ASHRAE HVAC Applications Handbook, 2003.

- Executive offices: NC 20-30
- Conference rooms: NC 25-30
- Semiprivate office: NC 30-35
- Large open office: NC 35-45
- Open office: NC 40-45

#### ***23.2.4 Mechanical***

The Developer shall provide mechanical systems appropriate for the intended functions of the facility(ies).

#### ***23.2.5 Electrical***

The Developer shall provide electrical systems appropriate for the intended functions of the facility(ies).

#### ***23.2.6 Lightning/Surge Protection***

The Developer shall provide lightning protection for the protection of all structures, buildings, equipment and areas exposed to the effects of lightning. The recommendations of NFPA 780 shall be considered required and the determination for the need for lightning protection on any particular structure, building or area shall be based on the results of a lightning risk assessment in accordance with Annex L of NFPA 780.

#### ***23.2.7 Security and Life Safety***

Interior spaces used to house Critical Operations shall be located inboard of exterior walls and designed to prevent debris from entering operations areas. Exterior equipment that supports Critical Operations must be protected from flying debris. Additional security and life safety requirements are defined in Section 24.

### **23.3 Deliverables**

#### ***23.3.1 Record Drawings and Documentation***

Record Drawings shall include as-built drawings, specifications, and shop drawings necessary to completely describe the constructed Project, and with sufficient detail to adequately locate constructed elements.

## **24 FIRE, SECURITY AND LIFE SAFETY**

### **24.1 General Requirements**

This Section establishes the minimum technical and procedural requirements for the fire, security and life safety aspects of the Project.

TxDOT has established a Fire, Security and Life Safety Committee (FSLSC) that has been active since December 2004. Active FSLSC members include representatives from fire, police, Emergency Services, and motorist assistance agencies along the Project alignment. Other law enforcement agencies at the county, State, and federal level are routinely kept abreast of committee activities. It is the intent of TxDOT that the FSLSC maintains an active role in providing important input to the development of a safe and secure Project.

#### ***24.1.1 Developer Responsibilities***

The Developer shall be responsible for the safety and security of its personnel and for providing safe and secure Project facilities for the general public.

The Developer shall formally establish and adhere to policies, procedures, processes, and guidelines related to safety and security, and they shall be documented as required herein. Further, the Developer is responsible for completing the Work in a safe manner, and for creating a safety and health awareness environment among all personnel involved in the Work.

As a principal consideration, the Developer shall incorporate fire protection, security and life safety features, equipment, and requirements into the design and functionality of all facilities included in the Project.

The Developer shall initiate and conduct, or otherwise participate in training, meetings, and on committees that are related to fire, security and life safety during all phases of the Work.

### **24.2 Administrative Requirements**

#### ***24.2.1 Participating Agencies***

As necessary to meet the requirements of the Project, the Developer shall coordinate with and seek input from the appropriate Participating Agencies. Representatives from some of the Participating Agencies listed below are actively involved on the FSLSC. Whether in committee form, or on an individual basis, the Developer is responsible for initiating and sustaining the necessary coordination and may seek assistance from TxDOT if the required interaction is not reciprocated.

The Developer shall collaborate with Governmental Entities and organizations, including but not limited to the agencies listed in Table 24-1A, on issues related to fire, security, and life safety.



**TABLE 24-1A – List Of Participating Agencies**

<b>Participating Agencies</b>	<b>Active member of FSLSC (Y/N)</b>
Local Fire-Rescue – Dallas, Farmers Branch, Garland, Mesquite	Y
Local EMS – Dallas, Farmers Branch, Garland, Mesquite	Y
Local Police Department – Dallas, Farmers Branch, Garland, Mesquite	Y
Dallas County Sheriff’s Office	Y
Texas Department of Public Safety (Highway Patrol)	Y
Federal Bureau of Investigation (FBI)	Y
Hospital Systems and Disaster Medical service – Dallas, Farmers Branch, Garland, Mesquite	N
Red Cross, Salvation Army, and similar agencies	N
Building Department – Dallas, Farmers Branch, Garland, Mesquite	N
Public works and Sanitation Department (e.g., bridges, streets, sewers) – Dallas, Farmers Branch, Garland, Mesquite	N
Utility companies – TXU (Electric); AT&T (Telephone); Atmos (Gas); Water Supply (Dallas, Farmers Branch, Garland, Mesquite)	N
Local Transportation Companies – Dallas Area Rapid Transit (DART); private companies	Y
Private industry with heavy construction equipment available	N
Environmental Protection Agencies – Local (Dallas, Farmers Branch, Garland, Mesquite); State, Federal	N
Towing Companies	N
Highway Operators - TxDOT; Texas Turnpike Authority (TTA)	Y
U.S. Coast Guard	N
Military	N
Federal Aviation Administration (FAA)	N
Federal Emergency Management Agency (FEMA)	N
Department of Homeland Security (DHS)	N
Dallas County Medical Examiner	N
Dallas County Sheriff’s Courtesy Patrol	Y
Independent Engineer	N

**24.2.2 Technical Documents**

Not used

**24.2.3 Safety Plan**

All members of the Developer’s team shall adhere to the Developer's Safety Plan. Further to the requirements set forth in Section 2 of Book 2B, the Developer shall meet the following Safety Plan content and preparation requirements.

The Safety Plan shall expand on the preliminary Safety Plan submitted by the Developer at Proposal. The Developer shall take full account of the unique attributes of this Project in preparing the Safety Plan, including but not limited to, the highly urban environment, the heavy traffic conditions, potentially extensive subsurface construction and facilities, and the size and scope of the Project and those affected by it. The Safety Plan must cover all phases of the Work, and shall be reviewed, evaluated, and updated as often as necessary to reflect relevant changes during the Term of the Agreement. It shall incorporate, or be incorporated by; the controlling management and/or operations plan(s) in effect at any given time in the Project.

The Safety Plan shall contain, as a minimum, the following provisions.

a) Safety Management

The personnel and responsible staff who will implement, maintain, and enforce the Safety Plan rules and policies shall be identified. As a minimum, the Developer shall provide a full time on-the-job Safety Manager meeting the qualifications outlined below. In addition, the Developer's safety management shall also have the minimum additional designated personnel identified below.

The Safety Manager's qualifications, as a minimum, shall include:

- 15 years of progressive safety management experience on complex heavy civil projects;
- Designation as a Certified Safety Professional (CSP);
- Completed the OSHA 40-hour Safety and Health Course (OSHA 500);
- Training and current certification for CPR and First Aid;
- Possess verifiable competency in the construction safety disciplines related to the Work to be performed and/or retain fulltime competent persons required by State and Federal safety standards;
- Training in the development and presentation of safety training programs and meetings; and
- Knowledgeable in safety incentive programs

As part of the Developer's safety management, all Work shifts shall have, as a minimum, an onsite shift safety representative. The shift safety representative shall have the following minimum qualifications:

- Three years of progressive safety experience and general competency in the construction safety disciplines related to the Work
- Completed the OSHA 10-hour Safety and Health Course
- Training and current certification for CPR and First Aid

The Safety Plan shall define the role and responsibilities of the Safety Manager and safety staff, the hierarchical relationship between the Safety Manager and other managers, supervisors, and employees, and how responsibility and accountability for safety will be incorporated at all levels.

A clearly stated policy shall be provided that articulates the obligations of all personnel in adhering to the policy.

Clear goals shall be established and communicated, for safety, security, and health, including defined objectives for meeting the goals.

Requirements for evaluating the effectiveness of policies and measuring success in meeting the goals and objectives of the Safety Plan shall be set forth. An environment and means for continuous evaluation and improvement shall be established to achieve the Safety Plan goals and to identify deficiencies so that the goals and objectives can be revised as needed.

A process through which all Incidents, Emergencies, accidents, and injuries are reported, investigated, and documented shall be established. In addition, provision shall be made that investigation of all accidents be conducted by a trained accident investigator.

b) Worksite and Jobsite Analysis

Procedures and requirements shall be established for a comprehensive baseline worksite survey for safety, security, and health issues. In addition, requirements shall be established to involve employees in periodic update surveys, performing routine job hazard analyses, and conducting regular site safety, security, and health inspections so that new or previously missed hazards and hazard control failures, are identified.

A reliable system shall be provided that allows employees to notify management personnel about conditions that appear hazardous, and to receive timely and appropriate responses, without fear of reprisal.

Procedures shall be established to investigate accidents and "near miss" Incidents so that their causes and means of prevention can be identified. The procedures shall provide a means for analyses of injury and illness trends so that patterns with common causes can be identified and prevented.

c) Hazard Prevention and Personal Safety

Methods and procedures shall be provided to identify and detail all hazards that may be encountered by employees while performing the Work. Practices and procedures shall be developed and implemented to address prevention of identified hazards. A communications protocol shall be established to ensure all employers and employees are aware of hazards in all areas and how to deal with them appropriately. Means shall be provided to evaluate all anticipated and unanticipated activities, and address potential hazards related to these activities.

Means shall be provided to ensure employees understand and comply with safe work practices and procedures through training, positive reinforcement, correction of unsafe performance, and if necessary, enforcement through a clearly communicated disciplinary system.

The Developer shall handle Hazardous Materials in compliance with Section 7.9 of the Agreement and the applicable requirements of the Technical Provisions.

d) Training

Methods shall be established to identify, develop, and provide relevant training for employees and supervisors designed to ensure that all employees understand and are aware of the hazards to which they may be exposed, and are aware of the proper methods for avoiding the hazards.

Methods shall be established to identify, develop, and provide supervisory training programs to ensure supervisors understand the key role they play in job site safety

and to enable them to carry out their safety and health responsibilities effectively; to analyze the work under their supervision to anticipate and identify potential hazards; and to maintain physical protection in their work areas, including the establishment of policies that ensure each employee is provided with the equipment necessary to complete assigned tasks safely.

Procedures shall be provided to plan and prepare for Emergencies, and to conduct training and Emergency drills, as required.

- e) Drug Free Work Zone
- Policies and procedures shall be provided to require adherence to a 100% drug/alcohol free work zone. Policies and procedures shall be established for pre-employment, post-accident, and random testing for drugs and alcohol.
- f) Incident and Emergency Management
- The Developer shall provide comprehensive policies and procedures pertaining to Incident and Emergency planning, response, mitigation, and recovery. Policies and procedures for safety during Incidents and Emergencies shall also be addressed. This Section shall be coordinated with the requirements of Section 24.2.4, herein, and Book 2A, Sections 18.3, 18.4, and 22.3.5. In addition, the requirements of Book 2B, Sections 3.2.7 and 22.3.5 shall be incorporated. The Developer shall establish procedures to achieve at a minimum, the following:
- Maintain communication for the exchange of information between Developer, TxDOT, and other involved agencies.
  - Develop coordinated support through interaction with local, State, and federal governmental entities, as well as other entities, for safe and efficient construction.
  - Discuss and coordinate Emergency response, traffic control, security, and operational issues affecting construction of the Project, and associated system feeders and exits.
  - Update Participating Agencies regarding status of construction of the Project, and associated system feeders and exits, to assure safe and timely response to Emergency events. As a minimum, this shall include off-site and on-site traffic routing changes, and changes to job site access, fire suppression system modifications and in-service availability of standpipes or fire suppression water supply, and changes in the Work that may create a greater likelihood of occurrence of a particular type of Emergency.

#### ***24.2.4 Incident Management Plan (IMP)***

As a part of the Developer's Operations Management Plan (OMP), a comprehensive IMP shall be developed and documented to ensure that the Developer has considered, planned, addressed, and trained for all likely natural and man-made events or situations that are Incidents or Emergencies, and has established protocols, procedures, and guidelines to mitigate the impacts, and respond to and recover from all such events. In the IMP, the Developer shall clearly distinguish between events or situations considered as either Incidents or Emergencies. The Developer shall prepare the IMP and its subcomponents in coordination with and input from the Participating Agencies that are responsible for resolving Emergency events. The Developer shall submit the IMP as a part of the Project's OMP Submittal.

When developing the IMP, the vital nature of this Project corridor to the region shall be considered, and provisions shall address how the Developer's operations will be integrated into Emergency preparedness protocols of the region, including, but not limited to meeting the requirements of the DHS.

The IMP shall be comprehensive in addressing all potential Incidents and Emergencies in the Project corridor for all phases of the Project, and as a minimum shall include all of the requirements identified in Section 22.3.5. In addition, the IMP shall address the methods and systems available for identification of Incidents or Emergencies, operational procedures to support and facilitate timely response to and resolution of Emergency events, and coordination with Participating Agencies to facilitate fire-fighting operations, Emergency Services response, support of law enforcement activities, traffic management, medical evacuation planning and Emergency alert notification planning.

The IMP shall identify formal points of contact with the appropriate Participating Agencies and establish requirements for notifying Emergency Services, including protocol for keeping Emergency Services informed of the latest Project conditions affecting Emergency response and recovery.

The Developer shall include at a minimum, the following in the IMP:

- a) Evidence of compliance with the requirements of Section 24.3.4 c), herein.
- b) Response and access plan(s) for all identified Emergency scenarios.
- c) The physical attributes (e.g. fire department connections, emergency only access points), technology, and equipment that will be utilized, and how it will be utilized, when resolving Incidents and Emergencies.
- d) Command and control protocol, including location(s) for command post(s), a command structure for the identified Emergency scenarios and supervision and coordination of personnel, equipment, and resources.
- e) Provisions and protocol for communications.

To optimize the execution of the IMP, a regular program of training, exercises, and drills shall be established and conducted for all Developer personnel and Participating Agencies responsible for resolving Incidents and Emergencies. The frequency and scope of training shall be established in cooperation with the Participating Agencies. Dated signatures of executives authorized to sign for each Participating Agency, included as a separate page of each exercise and/or drill package, shall be evidence of participation and concurrence with scope and content.

The IMP and/or its subcomponents shall be reviewed, evaluated, and updated as necessary based on changes in the Project, the Developer's operations, regional changes impacting Emergency preparedness, or changes in how Participating Agencies interact with this Project. The IMP shall be reviewed, evaluated, and updated at least once within the 12 months following the implementation date, and at least once every two years thereafter. The plan shall be revised in a timely manner to correct deficiencies identified by the evaluation.

Dated signatures of executives authorized to sign for each Participating Agency, included as a separate page of the IMP, shall be evidence of participation and plan concurrence. Updates to the IMP shall be approved and accepted in like manner.

### **24.2.5 Fire, Security and Life Safety Committee (FSLSC)**

A FSLSC has been established. The FSLSC is composed of representatives from some of the Participating Agencies listed herein.

- a) The Developer shall convene the FSLSC, or representative portions thereof, for the purpose of discussion, coordination, and input regarding the requirements, procedures, and other aspects of safety and security of the Project.
- b) The Developer shall clearly outline its proposed process in the Project Management Plan (PMP), including meeting schedules, for convening the FSLSC. The Developer shall further articulate how they will use and incorporate FSLSC input into the various phases of the Work. The frequency and schedule of proposed meetings shall be determined based on Project status and to maximize attendance of the appropriate Participating Agencies, and shall not be held on weekends or holidays.
- c) The tasks and function of the FSLSC will vary during the Project development, commissioning and other pre-revenue activities such as training and drills, but in general the following objectives shall be maintained:
  - Establish an interactive forum whereby the Developer can receive the necessary input on design and procedural issues related to fire, security and life safety in order to meet the Agreement requirements.
  - Develop coordinated support through interaction with local, State, and federal Governmental Entities, as well as other entities, for safe and efficient operation of the Project.
  - Discuss and coordinate design, construction, and operational issues affecting the Project.
  - Review Emergency procedures to assure safe and timely response to abnormal operating conditions.
  - Support Emergency preparedness drills to test the Emergency systems, validate procedures, and identify procedural deficiencies.
  - Provide input to and comment on the IMP.
- d) The Developer shall distribute meeting notes to committee members, whether an attendee or not, in a timely manner and provide for comment and input prior to formal recording of results.

## **24.3 Design Requirements**

### **24.3.1 Design Principles and Performance Requirements**

The fire, security and life safety performance requirements are to minimize risk to life and injury to people from fires, security events, Incidents, and natural disasters; minimize property loss; limit the economic, operational, social, and environmental impacts of fires and explosions; and ensure that appropriate physical-security measures are taken to minimize losses to people, supplies, equipment, and material from both man-made and natural threats.

### **24.3.2 Safety in Design**

The Developer shall demonstrate that all components of the Project can be safely constructed; operated; maintained; and demolished or otherwise decommissioned, backfilled and/or removed

when no longer required. This requirement may be accomplished by means of a comprehensive risk assessment.

#### **24.3.3 Systems Design Requirements**

Fire suppression and fire alarm systems shall be designed by a Fire Protection Engineer.

#### **24.3.4 Fire Protection and Life Safety Factors**

Fire protection and life safety requirements include the following:

- a) **Emergency Access and Response Time Requirements**  
The Developer shall design, operate, and/or provide facilities and/or equipment for all travel lanes that allow Emergency response personnel to reach any point in the travel lanes with apparatus and equipment necessary for resolving the Emergency event in accordance with NFPA 1710, 4.1.2.1(2) through (4). Response time shall be as defined in NFPA 1710, 3.3.37.4, and in accordance with NFPA 1710, 4.1.2.2.

Any technology and/or equipment required to achieve the Emergency response time requirements shall be provided, installed, and maintained by the Developer.

In the methodology of achieving the response time requirements, the Developer shall include provision to allow Emergency responders to effectively and efficiently deploy apparatus and equipment at the Emergency location.

- b) **Emergency Services Communications**  
The Developer shall provide the capability for seamless interagency two-way radio communications among all Participating Agencies responding to an Emergency, utilizing each agency's radio communications equipment, from all points within the Project.

The Developer shall provide the infrastructure for all Participating Agencies with responsibility for Emergency response, to communicate with their individual dispatch facilities, and between their mobile response units, from all points within the Project. As a minimum, one Dallas Fire duplex channel, one Dallas Fire simplex channel, two Dallas Emergency Services duplex channels, and one channel to permit communication between Dallas Fire and all law enforcement agencies that may respond to an Emergency, or the equivalent configuration at the time of installation, shall be provided.

The Developer shall provide the capability for Dallas Fire Rescue and Dallas Police to utilize their on-board Mobile Data Computers (MDCs) on apparatus and vehicles operating from all points within the Project.

The Developer shall provide a fully functional telemetry communications link between field Emergency Services units and the BioTel Emergency Medical Services System to facilitate delivery of pre-hospital Emergency Services from all points within the Project.

- c) **Fire Protection**  
The Developer shall ensure that all fire department connections (FDCs) provided at grade to supply and/or supplement the water supply for standpipe systems, or FDCs provided for automatic fire sprinkler systems, comply with the following dimensional requirements:



- All FDCs shall be within 50 feet of an all weather surface or approved fire lane.
- All FDCs for standpipes and sprinkler systems shall be within 400 feet of an approved fire hydrant.

The Developer shall provide fire hose connection threads meeting the criteria prescribed by the fire agency having responsibility for Emergency response to the jobsite or facility.

d) Computer Assisted Dispatch

The Developer shall coordinate with each Participating Agency to provide Global Positioning System (GPS) coordinates for the Project roadways as required for overlay into Computer Assisted Dispatch systems.

Coordination shall begin early in the Work to account for changes on the Project roadways that will affect Computer Assisted Dispatch systems during all phases of the Project. GPS information shall be provided, as required, for Participating Agencies to update and maintain their systems to reflect corridor changes.

e) Railroad, Commuter Rail, and Light Rail Safety

The Developer shall comply with all railroad and transit owners'/operator's directives requiring worker training, notification of proposed work, and safety precautions to ensure a safe working zone in the vicinity of live tracks.

#### ***24.3.5 Control of Hazardous Materials Traffic***

The requirements of Section 24.3.5 shall apply for the Term of the Agreement.

As appropriate, the Developer shall conform to the North Central Texas Council of Governments (NCTCOG) Hazardous Materials truck routes requirements.

The OMP shall establish and implement Hazardous Materials traffic routing information or access criteria for components including, but not limited to, route detours, carrier notification, signage, Intelligent Transportation System (ITS) and escape facilities.

The Work shall be configured such that the current Hazardous Materials routing system on both the IH 635 and the IH 35E corridors is maintained. As part of the OMP, the Developer shall describe in detail the approach to be used in maintaining this designation, including any physical and systems features, operational procedures, and other means determined to be necessary. The Developer shall coordinate with the appropriate Participating Agencies in establishing these requirements.

Hazardous Materials traffic shall not be permitted on any part of the Managed Lanes system.

#### ***24.3.6 Communication Systems***

The Developer shall design and specify all required materials, components, software, and programming necessary to provide fully functional communication systems for Emergency response activities, for safe and efficient operations, and to support maintenance personnel. Communications include, but are not limited to; amplitude modulation (AM)/frequency modulation (FM) rebroadcast systems, two-way emergency response radio systems, and personnel telephone systems.

- AM/FM Rebroadcast



Through the use of normal automobile radios, the general public shall be capable of receiving standard AM/FM rebroadcast while traveling throughout the Project. The highway advisory radio (HAR) system shall be supplied with continuous programming having a signal strength in conformance with Federal Communications Commission (FCC) regulations.

In the subsurface Managed Lanes, the rebroadcast system shall be designed to permit interruption and override of all rebroadcasted AM and FM radio signals to convey instructions to motorists for traffic and emergency response instructions. All override programming shall originate at a location determined in coordination with the Participating Agencies. The system shall provide a specified number of radio stations (determined in coordination with the Participating Agencies) and retransmit these stations within all the required limits of the Project.

No degradation of the two-way radio system shall be permitted by the rebroadcast system.

- **Two-way Radio Communications**

A two-way radio communications system shall be provided throughout the Project for continuous two-way radio communication between police, fire, Emergency services, maintenance personnel, and others as deemed necessary. All subsurface areas shall have coverage by this system to generate, receive, and re-transmit radio signals at the respective Participating Agency's frequency. Repeaters shall be provided to provide two-way radio communications between any points in the subsurface Managed Lanes and their respective central dispatchers for Participating Agencies.

Fixed station equipment shall be controlled from a centralized console and must be compatible with all Participating Agencies. Redundancy in the system, its electrical supply and support facilities shall be provided to preclude the loss of function due to a single occurrence of physical damage or equipment failure, and all equipment shall be designed to conform to FCC rules and regulations.

## **24.4 Construction Requirements**

Jobsite electrical system installations shall be designed by a Registered Professional Engineer, and installation shall be managed, inspected, and verified by a licensed Master Electrician.

All construction personnel must receive safety training pertinent to the construction environment and receive certification of such from the Developer's Safety Manager prior to commencing work activities.

The Developer shall establish, and incorporate into the Safety Plan, safety indoctrination procedures and/or equipment for all visitors and tour groups.

### **24.4.1 Emergency Access**

The Developer shall provide unobstructed all-weather Emergency response access to within 150 feet of all construction areas. In no case shall an Emergency access be less than 12 feet wide. The access shall terminate at both ends at a public way, or be provided with a turn around configuration.

**24.4.2 Use of Explosives**

Blasting or explosives shall not be used for any purpose in any part of the Work.

**24.5 Deliverables**

The Developer shall submit the Safety Plan prior to NTP2.

The Developer shall submit the IMP as a part of the OMP Submittal.

## **25 DEPRESSED MANAGED LANES**

### **25.1 General Requirements**

All elements of the Depressed Managed Lanes shall be designed and constructed in accordance with the requirements herein and Good Industry Practice, in order to provide the general public a safe, reliable and aesthetically-pleasing facility.

### **25.2 Design Requirements**

#### **25.2.1 Technical Documents**

The Developer shall determine which Technical Documents (or portions of) will be applied to the design of facilities covered herein. Technical Documents referred to herein after are intended to establish basic standards, and include:

- a) “Building Code Requirements for Structural Concrete” and Commentary (ACI 318/318R) published by the American Concrete Institute (ACI)
- b) American Institute of Steel Construction, Inc. (AISC) “Manual of Steel Construction – Load and Resistance Factor Design”
- c) “Minimum Design Loads for Buildings and Other Structures” American Society of Civil Engineers (ASCE) 7-02
- d) International Building Code (IBC) with local amendments

#### **25.2.2 Structural Requirements**

The structural components of the Depressed Managed Lanes shall conform to the requirements of Section 13, and the following additional requirements.

As part of the design of all structural components of the Depressed Managed Lanes, the Developer shall address, as a minimum, the durability of these structures with respect to additives, material types, material strength, fabrication and curing techniques, reinforcement cover, construction and erection procedures, and corrosion control.

##### **25.2.2.1 Dimensional Requirements**

The Developer is responsible for determining the actual excavation requirements for the Depressed Managed Lanes. Vehicle clearance envelope dimensions shall be based on the requirements found in Section 11.

##### **25.2.2.2 Excavation Requirements**

Excavation shall be accomplished utilizing mechanical excavation methods. The use of explosives is prohibited.

##### **25.2.2.3 Longitudinal Joints**

Approach slabs or structural bridging must be considered for use between elements founded on different foundation types. If longitudinal joints are to be provided within any driving surfaces, they shall be located within 6” of a lane line.

#### **25.2.2.4 Support for Miscellaneous Elements**

Structural support design and detailing for miscellaneous elements shall follow the same rigorous requirements of the primary structure. Connection design and details shall be such that degradation of the connection is prohibited. Miscellaneous elements may include signage, aesthetic features, lighting, piping, raceways, miscellaneous electrical equipment and roadway monitoring equipment. Loads and support requirements shall be coordinated with the manufacturers of provided equipment.

#### **25.2.3 Mechanical Systems Requirements**

The mechanical systems and components of the Depressed Managed Lanes shall conform to the following requirements.

##### **25.2.3.1 Roadway Environment**

The Developer shall design Depressed Managed Lanes such that:

- a) The carbon monoxide (CO) and oxides of nitrogen (NO<sub>x</sub>) concentrations in the Depressed Managed Lanes shall be below maximum acceptable levels during all traffic conditions, including congested, stopped and normal flowing. During these traffic conditions, the CO level shall be below 50 ppm, the nitrogen dioxide (NO<sub>2</sub>) level shall be below 3 ppm, and the nitrogen oxide (NO) level shall be below 25 ppm.
- b) A tenable environment is provided for motorists evacuating the Depressed Managed Lanes during an Emergency.
- c) The Depressed Managed Lanes shall be equipped with monitoring equipment/sensors to monitor the Depressed Managed Lanes atmosphere/environment for CO and NO<sub>x</sub>.

The Developer shall use Computational Fluid Dynamics (CFD) modeling to demonstrate that the aforementioned environments of the Depressed Managed Lanes are maintained under congested, stopped, and normal flowing traffic, and under any possible fire Emergency event in the Depressed Managed Lanes. The fire size heat release and smoke generation rates based on the Developer's assessment of expected vehicles, and assuming a minimum 30 MW hydrocarbon fire for 4 hours, shall be used as input parameters to the CFD modeling for fire Emergencies at any location within the Depressed Managed Lanes.

If the CFD analysis indicates that during the evacuation phase of a fire Emergency event a tenable environment for evacuating motorists is not achievable with natural ventilation, mechanical ventilation shall be provided in accordance with NFPA 502. The mechanical ventilation system shall be monitored and manually operated, or shall be automatically activated.

The Developer shall include details of his approach to providing for evacuating motorists in the IMP.

##### **25.2.3.2 Drainage**

The Depressed Managed Lanes drainage systems shall prevent the Depressed Managed Lanes from flooding, shall not contribute to flooding of other Project elements, and shall meet the requirements of [Section 12](#). The drainage system shall prevent water from exceeding the Developer's design ponding width anywhere on the roadway cross section. Ponding on travel lanes is prohibited.

### 25.2.3.3 Fire Protection

The Developer shall adhere to the following requirements for fire protection as applicable to the design:

a) Fire Protection Systems - General Requirements

The Developer is responsible to determine the requirements for all fire protection systems and its components. The Developer shall coordinate and establish responsibility, protocol and executable procedures with the Participating Agencies for all fire protection systems.

Fire protection and suppression features shall include standpipe systems, portable fire extinguishers, fire hydrants, fire department connections (FDCs), and fire hose valve stations. The fire extinguishers, hydrants, FDCs, and fire hose valve stations shall be protected from physical and heat damage.

The Developer shall provide permanent signage for FDCs and fire hose valve stations. Signage shall be developed in conjunction with the FSLSC and in accordance with NFPA 14 and NFPA 502.

All fire suppression equipment and components shall be reviewed by the FSLSC. FDCs and hose valve coupling threads shall be coordinated with and be compatible with those used by the fire agency having the Emergency response responsibility. FDCs and fire hydrants shall be located and arranged so that hose lines can be attached to the inlets without interference with any nearby objects or other fire department connections. Section 24 provides further details of these requirements.

b) Fire Protection Systems – Depressed Managed Lanes

Standpipe system(s) shall be designed, installed, and maintained as a Class 1 system(s) in accordance with NFPA 502, NFPA 14, and NFPA 25.

Approved water supplies and standpipe systems shall be provided to the Depressed Managed Lanes for fire suppression that can provide the flow, pressure, and system components in accordance with the requirements of appropriate Governmental Entities and Participating Agencies. Should the Developer elect to provide a dry standpipe system, the system shall be provided in accordance with the requirements herein. Fire hose valve connections, if used, shall be installed in both directions of the Depressed Managed Lanes, and be protected from vehicular impact.

If a “wet” system (e.g. water main) is provided, the Developer shall design and locate the system so as to protect the integrity of all structural, foundation and geotechnical systems. The preferred location of such a system is within the median of the Depressed Managed Lanes. Fire hose connections for this system shall be accessible from the traffic lanes on both sides of the median, and be protected from vehicular impact.

c) Standpipe Systems

In the event the Developer decides to use a dry standpipe system the following shall apply:

- The standpipes shall be installed along the length of the Depressed Managed Lanes to allow fire department personnel access to fire hose valves for fire fighting at the roadway level.

- Fire hydrants and FDCs shall be installed at grade to allow fire department personnel to charge the standpipe without entering the depressed areas. The water supplied to the standpipe shall be of sufficient capacity to provide minimum capacity for 1-hour.
- FDCs for each standpipe shall be installed remote from each other; preferably at both ends of the standpipe such that the standpipe can be filled from either of the two locations. Standpipes shall be a minimum of 4-inches in diameter and be fabricated from galvanized steel.
- The lengths of standpipes shall permit fill times of 6 minutes or less.
- Fire hose valves shall be spaced at a maximum interval of 275-feet along each standpipe and between standpipes.
- Combination air relief vacuum valves shall be installed at each end and the high point of each standpipe to allow complete and rapid filling and draining.
- To the extent the dry standpipe system is remotely controlled or activated, the system shall be monitored in accordance with NFPA 14 and NFPA 72.
- Provisions for complete draining of the standpipes shall be provided.

d) Fire Hydrants

A fire hydrant, meeting the requirements of Dallas Water Utilities, shall be provided at each of the following locations (if one is not already present):

- Within 400' of each FDC to a standpipe system.
- Within 400' of the FDC to each sprinkler system.
- The fire hydrant locations determined by the Developer shall be coordinated with the other disciplines as necessary to eliminate accessibility or use impediments with other elements including roadways, fencing, gates, and buildings.
- The Developer is required to coordinate with the FSLSC during the design development.

e) Fire Hydrant Water Supply

The adequacy of the water supply(ies) shall be verified by fire hydrant tests prior to placing the systems in operation. The water supply system shall meet the requirements of NFPA 14 for standpipe systems.

Street mains shall be sized to carry the design flow, but in no case shall they be less than six inches in diameter.

Pressure regulating valves shall not be used in fire water supply mains, except by special permission of the FSLSC. Meters shall not be installed in fire water supply mains.

Where connections are made to a public water system, the Developer shall guard against possible contamination of the public water supply, and comply with the requirements of the Dallas Water Utilities.

#### ***25.2.4 Electrical Systems Requirements***

Electrical systems and components specified herein include the following:

- a) Power supply and distribution to include Utility service, distribution systems, transformers, utilization voltage switchgear, panelboards, motor controls, normal power systems, standby power systems, essential power systems, emergency power systems, circuit protective devices, control systems, and grounding, as required to serve all electrically powered or controlled systems.
- b) Lighting systems.
- c) Communications systems to include telephone, closed circuit television and radio systems.
- d) Miscellaneous systems including lightning protection, cathodic protection, and subsurface raceway systems.

#### **25.2.4.1 Electrical Systems Design**

The physical layout and arrangement of electrical systems shall incorporate features for ease of routine and major maintenance of equipment and shall include provisions to maintain full operation of critical electrical systems during component replacement without compromising redundant design features.

All materials and equipment shall conform to Underwriters Laboratories, Inc (UL) Standards where such standards apply and shall be listed. Where a UL listing is not applicable or not available, other equivalent listings shall be provided.

Electrical systems shall be designed, approved, permitted, and built in accordance with the current codes and regulations of the Governmental Entity where the facility or system is located.

All equipment shall be applied within their ratings such that the manufacturers' warranties remain in effect. In addition, the following design conditions shall apply:

- a) The Developer shall select one or more electrical retail energy providers to supply the electrical energy needs, except where existing energy agreements must remain in place as required by other requirements of the Technical Provisions or the CDA agreement. On-site energy sources for the purpose of supplying stand-by, essential or emergency loads shall be permitted.
- b) The Developer shall meet the requirements of Sections 5 and 6 for provision of Utility service and shall coordinate with the electrical delivery Utility and the selected retail energy provider(s) to establish Work limits, interface locations, availability of service and all other requirements for electrical supply from the Utility. All costs imposed by the electrical Utility as a requirement to supply the Project shall be the responsibility of the Developer.
- c) Where electrical raceways are installed embedded in concrete, buried in earth or otherwise concealed by substantial building or structural elements, spare raceways equal to a minimum of 25% of the in-use quantity of raceways (for cable tray, 25% of the available fill) shall be provided for future, unidentified use. The 25% requirement shall be applied individually to raceway systems by system or function. Excluded from this requirement are raceways that serve end devices. When calculating the future unidentified spare raceways, the in-use raceways shall include all raceways in place at Substantial Completion with wiring installed, plus spare raceways identified by and reserved for use by the Developer to meet the Developer's design or construction phasing. Future unidentified spare raceways shall be labeled as such on design Submittals, as-built drawings and physically in the field.



- d) All electrical systems work shall be fully coordinated with other engineering, architectural and environmental aspects of the Project, and shall be integrated to the extent necessary to physically and functionally support the Project requirements.

#### **25.2.4.2 Electrical Power Source**

The Developer shall design the electrical systems to provide power at a suitable voltage for all required loads. The design shall provide electrical power under all conditions to each load defined by the Developer and as required by applicable Technical Documents.

#### **25.2.4.3 Electrical Power Distribution**

The Developer shall provide electrical power distribution in accordance with the following:

- a) The Developer shall be responsible for incorporating the design intent of all electrical systems that have been addressed herein and shall employ commonly accepted and ANSI standard voltages in accordance with Good Industry Practice.
- b) Electrical interlocks shall be provided as necessary to fulfill all operational conditions, and mechanical interlocks shall be provided for personnel safety during all operational and maintenance conditions.
- c) The distribution system protection scheme shall be provided to prevent a fault on any primary feeder or primary equipment from disabling any other equipment.

#### **25.2.4.4 Electrical Load Classification**

The electrical power system shall be arranged to serve all classification of loads including normal, standby, essential and emergency, as required. The sources for these loads shall have adequate capacity to supply the design demand load without need for load shedding or selective load pick-up.

- a) Normal loads shall be all loads that are not defined as standby, essential, or emergency.
- b) Standby loads shall be those loads classified as such by codes or regulations.
- c) Essential loads shall be those loads that are deemed, by the Developer, to offer enhanced operations, safety and protection through their continued availability during a total loss of commercial Utility electrical supply and are not classified as emergency or standby.
- d) Emergency loads shall be those loads legally required and classified as emergency to meet the requirements of the Agreement. All emergency loads shall be reviewed by the FSLSC. Emergency loads are supplied by an emergency system meeting the requirements of NFPA 70, NESC C2, IEEE 446 and NFPA 502. Emergency loads shall be connected to the distribution system such that emergency loads are automatically connected to the emergency source upon loss of Utility derived source(s) or shall be continuously supplied by the emergency source. In addition, the emergency source shall be permanently installed and continuously monitored for derangement or inability to serve the emergency loads.
- e) The load classification of any particular device, equipment or system shall meet the requirements of the Technical Documents and as modified by the Technical Provisions. Where there is a discrepancy between the classifications, the more stringent classification shall apply.



#### 25.2.4.5 Illumination

The Developer shall provide fully functional lighting systems for the Depressed Managed Lanes. Lighting systems shall be complete, operational, and designed in accordance with the following:

- a) The lighting system design shall be based on equipment and materials suitable for the operating environment and be comprised of components providing for ease of maintenance and repair. Dissimilar metals shall be adequately isolated from each other to prevent galvanic chemical reactions from occurring that may reduce the life of the lighting system.
- b) All components of the lighting system shall be designed with consideration of ease in maintenance of the lighting system while limiting lane closures and impacts to Operations.
- c) The lighting systems shall not create spurious radio frequency emissions in excess of Federal Communications Commission (FCC) limits in any licensed frequency band.

In addition, normal and emergency lighting shall be provided for nighttime, and where determined by the Developer, for daytime conditions as required to provide a safe visual driving environment for the motorist.

Where the Developer determines that daytime lighting is required, calculation concepts and methods shall be based on ANSI/IESNA RP-22. Where the Developer determines that a safe visual environment can be provided with nighttime only lighting, the lighting design shall be in accordance with ANSI/IESNA RP-8.

The following Depressed Managed Lanes lighting requirements shall apply:

- a) Where required to mitigate unsafe levels of discomfort or disability glare that may be experienced by motorists at varying times of day and for different times of the year resulting from daylight penetration into the Depressed Managed Lanes, daytime lighting shall be provided.
- b) Where required, daytime lighting shall be furnished to provide the motorist with the ability to safely navigate between lanes with varying levels of daylight penetration resulting from covered and uncovered lanes.
- c) Where required, daytime lighting shall be provided to accommodate driver eye adaptation necessary to mitigate the “black hole effect” which could occur when drivers approach the Depressed Managed Lanes from an uncovered roadway.
- d) A lighting control system shall be incorporated to increase or decrease lighting levels within the Depressed Managed Lanes for varying times of the day and for different times of the year.
- e) An emergency lighting system shall be provided, where required, for all Depressed Managed Lanes including entrance and exit ramps.

#### 25.2.4.6 Grounding and Lightning/Surge Protection

The Developer shall provide a complete and coordinated grounding and bonding system for the protection of all applicable systems, equipment and personnel on the Project. These systems shall include, but not limited to: grounding and bonding for personnel safety, static dissipation, electronic equipment grounding, grounding electrodes, and equipment grounding conductors.

The Developer shall provide transient voltage surge suppression to meet the equipment manufacturer’s recommendations.

The Developer shall provide lightning protection in accordance with the requirements of Section 23.

#### **25.2.4.7 Closed Circuit Television (CCTV) System**

The CCTV system shall be in accordance with Section 17.2.3, and the cameras shall provide 100% viewing coverage of the Depressed Managed Lanes roadway.

### **25.3 Construction Requirements**

#### **25.3.1 Construction Impacts**

When performing subsurface construction under or adjacent to existing structures or utilities, belonging either to TxDOT or a third party, the Developer shall limit settlement and ground deformations so as to not damage structures including foundation elements and/or utilities either visibly or structurally, and shall comply with the requirements for a pre-construction survey and geotechnical instrumentation and monitoring.

The Developer shall establish and document allowable settlement and ground and structure deformation criteria based on Good Industry Practice. In establishing these criteria, the Developer shall coordinate with adjacent property owners and third parties. The Developer is responsible for complying with the established criteria, and for mitigation resulting from deviation from agreed on criteria.

### **25.4 Deliverables**

#### **25.4.1 Final Design Documents**

- a) For the Depressed Managed Lanes, the Developer shall provide Final Design Documents in accordance with the Agreement and other Sections of the Technical Provisions.
- b) Composite Drawings  
The Developer shall prepare composite drawings, at a minimum showing locations of conduits, drains, pull boxes, manholes, light fixtures, ventilation equipment, cable troughs, signage attachments, Closed Circuit Television (CCTV) camera attachments and conduit, stand pipes, fire hose connections, communication devices, pump station equipment and support items, sumps, and recessed fire extinguishers.

#### **25.4.2 Record Drawings and Documentation**

Record Drawings at a minimum shall include as-built drawings, specifications, and shop drawings necessary to completely describe the constructed Project.

## 26 TUNNELS AND TUNNEL ANCILLARY FACILITIES

### 26.1 General Requirements

The provisions of this Section pertain to all tunnels and tunnel ancillary facilities, including cut and cover tunnels, mined tunnels, tunnel portals, utility rooms, emergency exits, cross passageways, ventilation shafts, niches, pump stations, power centers, and the Operations Control Center (OCC) and the Alternate Operations Control Center (AOCC).

All elements of the facilities covered herein shall be designed and constructed in accordance with the requirements herein and Good Industry Practice, in order to provide the general public a safe, reliable and aesthetically-pleasing facility.

### 26.2 Design Requirements

The Developer shall classify all subsurface roadway configurations as road tunnel, in accordance with NFPA 502, or as non-tunnel.

As part of the design of all subsurface structures, the Developer shall address, as a minimum, the durability of these structures with respect to additives, material types, material strength, fabrication and curing techniques, reinforcement cover, construction and erection procedures, waterproofing, and corrosion control.

#### 26.2.1 Dimensional Requirements

The Developer is responsible for determining the actual excavation requirements for tunnels and tunnel ancillary facilities. Vehicle clearance envelope dimensions shall be based on the requirements found in Section 11. Interior space within tunnels, outside of the vehicle clearance envelope, shall include space for National Fire Protection Association (NFPA) 502 related fire and life safety equipment, lighting, signage and any other necessary tunnel elements. Tunnel internal dimensions shall also include provisions for the safety walkway and pedestrian clearance envelope as described herein.

#### 26.2.2 Technical Documents

The Developer shall apply the National Fire Protection Association (NFPA) 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways, as amended in Attachment 26-1A.

The Developer shall determine which additional Technical Documents (or portions of) will be applied to the design of facilities covered herein. Technical Documents referred to herein after are intended to establish basic standards, and include:

- a) “Building Code Requirements for Structural Concrete” and Commentary (ACI 318/318R) published by the American Concrete Institute (ACI)
- b) American Institute of Steel Construction, Inc. (AISC) “Manual of Steel Construction – Load and Resistance Factor Design”
- c) “Minimum Design Loads for Buildings and Other Structures” American Society of Civil Engineers (ASCE) 7-02
- d) International Building Code (IBC) with local amendments
- e) US Department of Transportation, Federal Highway Administration (FHWA) “Road Tunnel Design Guidelines” PR#50-52-3349

### **26.2.3 Design Loads**

The Developer shall consider all forms of loading including but not limited to initial/temporary, long-term, cyclical, transient, hydrostatic, equipment, vibratory and impulse.

For mined tunnel excavations, the Developer shall design initial support systems and final linings for all anticipated ground responses and loading conditions.

### **26.2.4 Excavation Requirements for Tunnels and Tunnel Ancillary Facilities**

Excavation shall be accomplished utilizing mechanical excavation methods. The use of explosives is prohibited.

The Developer shall classify excavations for the tunnels and tunnel ancillary facilities per 29 CFR 1926.800(h).

### **26.2.5 Initial Support Requirements for Mined Tunnels**

Initial support shall be designed to ensure safe openings during construction, suitable for the required duration to permit construction of the final linings, and shall be installed in such a way as to provide the required clearances to permit the installation of waterproofing systems and final lining systems to specified tolerances.

Initial support systems shall be designed to control ground deformations, and to limit vertical settlements and impacts to third parties.

### **26.2.6 Final Lining Requirements for Mined Tunnels**

The final lining shall be designed to meet the functional requirements of the Project as a minimum, and shall be compatible with all excavations and intersections, initial support systems, waterproofing systems, mechanical and architectural finishes, and permanent tunnel and shaft systems.

Shotcrete shall not be used as a final lining component for road tunnels.

The Developer shall determine the acceptable alignment and tolerance limits for placement of the final linings including deviations in lining thickness, line, grade, plumbness and smoothness, as necessary to maintain all specified internal clear dimensions.

### **26.2.7 Waterproofing Requirements**

Based on all hydrological, geological, or geotechnical studies and field or laboratory tests necessary for design, the Developer is responsible for developing an integrated waterproofing and drainage system that provides the minimum performance characteristics listed below. As a condition for Substantial Completion the Developer must demonstrate compliance with the requirements herein.

- a) Use of a spray-on waterproofing system shall not be allowed.
- b) The maximum allowable groundwater infiltration rate after installation of the final lining shall be in accordance with the following:
  - 0.0050 gal/ft<sup>2</sup>/day for a reference section 50 feet in length
  - 0.0025 gal/ft<sup>2</sup>/day for a reference section 500 feet in length

- No dripping water from infiltration shall be allowed to fall on the travel lanes of the tunnels.
  - No dripping water from infiltration shall be allowed to fall on equipment, safety walkways, emergency egress stairways or other areas that could result in damage to facilities or provide for unsafe conditions.
- c) The Developer's waterproofing system design shall ensure adequate requirements for geometric profile and smoothness per manufacturer's instructions so as not to void any warranty provided by the manufacturer.
  - d) The Developer shall provide a waterproofing system designed to remove groundwater with adequate redundancy (material type, wall thickness, flow area, etc.) to account for deterioration due to corrosion and blockage due to debris and calcification.
  - e) The Developer shall repair leaks prior to installation of tunnel finishes.
  - f) Waterproofing shall be maintained at all necessary penetrations including but not limited to those for utilities, duct banks and manholes.
  - g) Waterproofing that is placed over the roof structure of cut and cover tunnels shall be covered by a protection system or method that ensures that the waterproofing system is not damaged by equipment or backfilling operations.

#### ***26.2.8 Fire Resistance and Endurance***

All structural components for road tunnels shall be designed or provided with appropriate fire protection based upon being capable of withstanding the time-temperature curve as described in NFPA 502, Chapter 7.3. Only inorganic fireproofing materials will be acceptable. All fireproofing materials and systems shall conform to ASTM E136 or equivalent standard. Fire rating performance tests of fireproofing materials and systems shall be in accordance with ASTM E119.

#### ***26.2.9 Fire Protection and Life Safety Factors***

Throughout design, the factors delineated in NFPA 502, Chapter 4.3.1 shall be evaluated when applying tunnel life safety requirements. Additional requirements are as follows:

- a) **Prohibited Vehicles in Road Tunnels**  
The following Vehicle Classifications, as defined in Exhibit 4 of the Agreement, will not be allowed in road tunnels:
  - Large Trucks with one trailer
  - Large Trucks with more than one trailer
  - Special Vehicles

Hazardous Materials traffic shall not be permitted in road tunnels.
- b) **Tunnel Exit Doors**  
The Developer shall provide tunnel emergency egress doors that comply with NFPA 502 and NFPA 101.
- c) **Tunnel Evacuee Management**  
The Developer shall provide a safe tunnel evacuee refuge area at grade, which shall be directly accessible from the tunnel emergency egresses in the event of an Emergency requiring evacuation of the tunnel. The refuge area shall be designed per NFPA 502, Chapter 7.14.6 for exit discharge and street access requirements, and

adequately sized to accommodate evacuees based on identified Emergency events and the probable number of evacuees. An alternate evacuee refuge area or safe relief from the primary refuge area shall be identified, and the Developer shall establish procedures in the ERP to use or otherwise transfer evacuees to this area, if necessary, in times of an Emergency.

- d) **Emergency Access and Response Time Requirements**  
Utilizing Emergency exits for access to tunnel Emergencies will not be allowed as a means of achieving the Response Time requirements of Section 24.
- e) **Emergency Responder Communications**  
The Developer shall provide the infrastructure for all Participating Agencies with Emergency response responsibility to communicate via two-way radio with the OCC and AOCC, utilizing each agency's radio communications equipment from all points within the Project.

The Developer shall provide “drop-line” telephones between the OCC and AOCC, and each Emergency response agency with primary response responsibilities on the Project to facilitate Emergency response communications.

The Developer shall provide high-speed internet access capability to facilitate Emergency communications in the area of the OCC and AOCC that is designated for the Incident management team as defined in NFPA 1561, 3.3.20.

- f) **Alternative Fuels**  
The Developer shall consider the impacts of alternative fuels on his design and operation of the tunnels, per NFPA 502, Annex G.
- g) **Tunnel Safety Walkway**  
In addition to Emergency egress requirements of NFPA 502, the Developer shall install a safety walkway the entire length of road tunnels in accordance with NFPA 502, Chapter 7.14.7.2 (2) and (3).
- h) **Safety Walkway Railing**  
The safety walkway railing shall be designed using industry standard loadings, dimensioned per standard rail dimensional requirements, and be fabricated from a material suitable for the intended application. All openings in the walkway railing shall be coincident with toeholds or gripped surfaces in/on the walkway, shall provide hand grips on railing surfaces, and shall provide a minimum of 2'-6" clear opening.

### ***26.2.10 Welding***

Welding shall be in accordance with the requirements of Section 13.3.2, Book 2B.

### ***26.2.11 Support for Miscellaneous Elements***

Structural support design and detailing for miscellaneous elements shall follow the same rigorous requirements of the primary structure. Connection design and details shall be such that degradation of the connection is prohibited. Miscellaneous elements may include, but are not limited to jet fans, signage, aesthetic features, lighting, piping, raceways, miscellaneous electrical equipment and roadway monitoring equipment. Loads and support requirements shall be coordinated with the manufacturers of provided equipment.

### **26.2.12 Tunnel Finishes**

The Developer shall provide finishes that meet the aesthetics requirements and that assist driver orientation, create a safe driving environment, and provide for quick identification and use of tunnel life safety features, including emergency exits and cross passageways.

Tunnel finishes may include, but are not limited to tunnel wall finishes, all concrete surfaces, ceiling surfaces, safety walkway railing, all doors and hardware, fire alarm pull stations, hose cabinets and components, telephones, signage, strobe lights, covers and plates for pull boxes, and any other item contributing to the finished look.

All finish materials shall be durable, impact resistant (to the extent possible), corrosion resistant, graffiti resistant, and shall be easily cleaned and maintained, readily replaceable with like parts, fire resistant and compatible with lighting requirements throughout the Term. All tunnel wall finishes shall be made of fire resistant materials that produce limited smoke, and shall be American Society for Testing and Materials (ASTM) E84 Class A, with a flame spread of 25 (or less) and smoke development of 100 (or less).

#### **26.2.12.1 Concrete Finishes**

The Developer shall specify smoothness criteria governing the allowable amplitude and wavelength of variations from the theoretical shape of precast or cast-in-place final concrete surfaces to ensure a suitable substrate for tunnel wall finishes.

At a minimum, no surface deviation greater than ¼” per 10 ft length of tunnel or subsurface structure measured longitudinally with a ten foot straight-edge will be allowed.

Exposed concrete surfaces not receiving tunnel wall finishes shall have a uniform texture and appearance. Color treatment on these surfaces, where required as an aspect of the aesthetic treatment of the concrete shall be stained in-place after erection or placement.

For cast-in-place and/or precast concrete final tunnel linings, utilize concrete placement methods that produce optimum compaction and a smooth surface without voids, honeycombs, or irregularities.

All voids or irregularities of exterior concrete surfaces shall be repaired prior to application of tunnel wall finishes. The Developer shall utilize repair materials and methods that permanently repair the damaged areas.

#### **26.2.12.2 Tunnel Wall and Ceiling Finishes**

Interior tunnel walls shall be finished, at a minimum, from the top of the safety walkway (or top of traffic rail) to just beyond the vertical limit of the vehicle clearance envelope. The finish material may be directly applied to the prepared structural surface or mounted via a rigid, lightweight panel system. Items including but not limited to conduits, piping, cable trays, cables and wires shall not be visible on the finished wall surfaces of the road tunnels. Cabinets, plates and covers in the road tunnels shall be flush or located in a wall niche. Surface mounting of these items may be permitted on the ceiling of the road tunnels and in tunnel ancillary facilities provided that they do not interfere with the operational function and maintenance.

The tunnel wall finish system and components shall be water and corrosion resistant. The finish substrate or support framing shall accommodate mounting to uneven concrete surfaces and shall



provide for an even exposed surface with no noticeable misalignment between adjacent and adjoining components. In addition, finish components shall be sized to accommodate the ease of placement and removal while not compromising their apparent flatness and alignment. Further, the wall finish system shall be arranged and placed to minimize joint widths.

If the Developer chooses to use utility chases behind panel finished surfaces, all concealed components shall be fire rated in accordance with American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL) and NFPA 502. All penetrations to accommodate passage of conduits/wiring shall be provided with the necessary component parts to prohibit damage and to maintain waterproofing.

If a panel system is used, it shall not be considered part of the fire resistance rating assembly for tunnel walls. Fire resistance for a tunnel panel system shall be a 2 hour minimum based on the Developer's design fire size, and certified by UL or equivalent rating agency.

The panel system shall allow for movement between adjacent tunnel liner segments with no visible alteration to the exposed panel surfaces. Panels shall be easily mounted and dismounted, while concealing panel fasteners where possible to minimize visual impacts. Where the tunnel concrete walls are curved, wall panels shall be curved to concentrically match.

Wall and ceiling surfaces shall provide a reflectance that is compatible with the Developer's lighting scheme, and does not emit glare or adversely impact driver visibility of the road and life safety amenities.

### **26.2.12.3 Life Safety Related Signage**

All materials and component parts of the life safety related signage shall be corrosion resistant, and shall be mounted in an orderly and finished manner.

Signage for life safety elements including, fire protection connections, fire alarm pull stations, equipment cabinets, telephones, cross passageways, and egress stairwells shall be clearly visible and/or legible from moving vehicles and comply with NFPA. All such signage shall be coordinated with and reviewed by the Fire, Security and Life Safety Committee (FSLSC).

Illuminated emergency egress signage shall be provided at all egress doors/stairs and cross passageway locations. All signage shall be mounted in a location that clearly identifies the exit and is clearly visible from the roadway. Emergency egress signage shall be marked in accordance with NFPA 502.

The Developer shall consider limited access and egress, sight distance, and driver instincts in confined environments to develop a safe and functional layout and design of all signage.

### **26.2.13 OCC and AOCC Requirements**

The Developer shall be responsible for the planning and design of the OCC and AOCC. These facilities shall meet the requirements of [Section 23](#) and the following additional requirements:

- a) OCC  
The OCC will serve as the control, monitoring, and communication center for tunnel systems and operations, and shall be located within 5 miles of the IH 635/DNT interchange. The OCC shall be designed and constructed in accordance with NFPA



502, Chapter 12 and organized, sized and equipped to accommodate the needs and intended functions, and at a minimum shall have the following components:

- Control room with operator workstations
- Restrooms adjacent to the control room
- Viewing area
- Offices
- Conference rooms
- Training rooms
- Incident Command Center (ICC) with equipment and systems as required by the Participating Agencies.
- Reserved Incident Commander parking
- Delivery loading/unloading areas
- Internal/external communications systems with the Incident Commander, Fire Dispatch, Police Dispatch, other local responders and Developer responding assets
- Rest rooms
- Storage areas
- Kitchenette/break room
- Janitor room
- Electronic equipment rooms (Closed Circuit Television (CCTV), telecommunications, radio, computer, etc.)
- Alternate source generator area with fuel capacity for a minimum of 36 hours of continuous operation.
- Electrical and mechanical equipment rooms (switchgear, uninterruptible power supplies, batteries, air handling equipment, fire suppression, etc.)
- Preferred and alternate electrical sources shall be provided for the OCC in accordance with Section 28, and in addition shall be furnished with an on-site generator supply to provide power in the event of a total loss of Utility supplied commercial power sources. The preferred electrical power source for the OCC shall be independent of the preferred electrical power source for the AOCC.
- Video feeds from the Intelligent Transportation System (ITS)

b) AOCC

An alternate command center shall provide backup support if the OCC is out of service, and shall be located at a site that is physically separated a minimum of one mile from the OCC. In addition to the requirements of NFPA 502, Chapter 12, the AOCCer shall be organized, sized and equipped to accommodate the needs and intended functions, and at a minimum shall have the following components:

- Control room with operator workstations
- ICC capability
- Reserved Incident Command parking
- Internal/external communications systems with Incident Commander, Fire Dispatch and Police Dispatch
- Restrooms
- Electronic equipment rooms (CCTV, telecommunications, radio, computer, etc.)
- Alternate source generator area with fuel capacity for a minimum of 36 hours of continuous operation.

- Electrical and mechanical equipment rooms (switchgear, uninterruptible power supplies, batteries, air handling equipment, fire suppression, etc.)
  - Preferred and alternate electrical sources shall be provided for the AOCC in accordance with Section 28, and in addition shall be furnished with an on-site generator supply to provide power in the event of a total loss of Utility supplied commercial power sources.
  - Video feeds from the ITS
- c) ICC
- An ICC shall be located within the OCC and AOCC, and shall be available for use by Emergency response personnel in the event of an Emergency. The Developer shall coordinate with the Participating Agencies to determine the arrangements for the Incident Commander. The minimum ICC facility requirements include the following:
- 500-sf minimum floor area for the OCC
  - 100-sf minimum floor area for the AOCC
  - Clear line of sight to OCC or AOCC operator(s)
  - Communications with OCC or AOCC operator(s)
  - Internet communications
  - Display wall to attach emergency operations planning material

## 26.3 Construction Requirements

### 26.3.1 General Requirements - Mined Tunnel

The Developer shall install initial ground support in a timely manner to maintain safe working conditions.

The Developer shall perform full periphery mapping of all exposed underground excavations in accordance with ASTM D 4879, Standard Guide for Geotechnical Mapping of Large Underground Openings in Rock, or an equivalent method, and prepare a report summarizing the findings.

The initial and final ground support systems shall be installed to control ground deformations, and to limit settlements and impacts to third parties.

The Developer is responsible for providing a construction (temporary) ventilation system to maintain adequate atmospheric conditions in underground excavations. This ventilation system shall perform in accordance with the requirements of 29 CFR 1926.800.

The Developer shall monitor underground excavations for hazardous gasses in accordance with 29 CFR 1926.800.

### 26.3.2 Underground Construction Surveying

All underground excavations shall be surveyed, as the work progresses, to ensure that excavations are within acceptable limits of deviation for line and grade. Surveying operations shall meet the provisions of Section 9, and the following requirements:

- a) Surveying systems shall be augmented with appropriate methods and equipment as required for typical underground practice.
- b) Establish a secondary survey control system consisting of horizontal and vertical reference points for constructing the tunnels and ancillary facilities, and for placing the final concrete lining.
- c) Employ survey procedures and equipment that are in accordance with the TxDOT Survey Guide. All horizontal and vertical control accuracy shall meet Conditions I as defined by the TxDOT Survey Guide.

### **26.3.3 Construction Impacts**

When performing subsurface construction under or adjacent to existing structures or utilities, belonging either to TxDOT or a third party, the Developer shall limit settlement and ground deformations so as to not damage structures including foundation elements and/or utilities either visibly or structurally, and shall comply with the requirements for a pre-construction survey and geotechnical instrumentation and monitoring.

The Developer shall establish and document allowable settlement and ground and structure deformation criteria based on Good Industry Practice. In establishing these criteria, the Developer shall coordinate with adjacent property owners and third parties. The Developer is responsible for complying with the established criteria, and for mitigation resulting from deviation from agreed on criteria.

## **26.4 Fire, Security and Life Safety Requirements**

The Developer shall meet the requirements of Section 24 and the following additional fire protection and life safety requirements:

### **26.4.1 Safety Plan**

The Developer's Safety Manager (or designated competent person) shall have the following safety credentials related to tunnel construction:

- a) Minimum seven years of safety management experience on tunneling projects, including both cut & cover and mined/bored tunnels
- b) Mine Safety and Health Administration (MSHA) tunnel rescue training certification, or equivalent

In addition, as part of the Developer's safety management, all Work shifts shall have a designated tunnel rescue team. All tunnel rescue team members shall have MSHA tunnel rescue training certification, or equivalent.

### **26.4.2 Emergency Response Plan (ERP)**

For all tunnels, emergency response planning shall be in accordance with the applicable sections of NFPA 502, Chapter 12. Further, all underground construction shall be conducted in accordance with 29 CFR 1926.800. The Developer shall anticipate and plan for Emergencies that could occur during the construction of tunnels, as well as during the Operating Period. Based upon identified potential Emergencies, the Developer shall prepare an ERP (as a subcomponent of the IMP), in coordination with Participating Agencies with responsibility for resolving Emergency events. Recognizing the unique Emergency events and response requirements related to construction and operations, the ERP shall be organized to distinctly address each phase of

underground Work. In addition to the requirements of the IMP herein, as a minimum, the ERP shall include, but not limited to the following additional items:

a) Tunnel Construction

This section of the ERP shall address the distinct requirements related to the construction of tunnels, including but not limited to:

- Identification of potential Emergencies
- Executable response plans for each identified Emergency
- Comprehensive listing and details of all life safety equipment
- Identification of and deployment procedures for underground rescue teams

b) Tunnel Operations

This section of the ERP shall address the distinct requirements related to tunnels during the operations Work, including but not limited to:

- Compliance with NFPA 502, Chapter 12. In addition, the Developer shall use the Emergency Response Plan Outline in NFPA 502, Annex F as a guide in organizing the ERP.
- If a dry standpipe system is installed for fire protection, the Developer shall incorporate the following procedures into the ERP to supplement the fill time requirements of NFPA 502, Chapter 9, and minimize any potential gap between fill time and Emergency Response Time.

Upon evidence of a fire, (i.e., visible smoke and/or fire in the tunnel), the Developer shall open, remotely, the deluge and exhaust valve(s) of the affected standpipe zone(s) to begin filling the standpipe. Concurrently, the Developer shall notify Dallas Fire-Rescue Dispatch of the fire and its location.

The Developer shall coordinate with Dallas Fire-Rescue to establish response initiation procedures for instances where a fire Emergency is reported through 911, or other means. In such instances where the Developer may not initially be aware of the event, these procedures shall be executed for verification of the Emergency and operation of the standpipe fill valves if fire or smoke is showing in the tunnel.

The standpipe shall be filled such that water will be provided at all hose valves in the zone(s) actuated, and shall provide adequate pressures and flowrates that are acceptable to the appropriate Participating Agencies.

All affected standpipes shall be fully serviced and placed in normal standby operation within two hours of release by the Incident Commander.

Restoration of standpipes shall include following in sequential order.

- The Developer shall manually reset each affected deluge valve at the valve site.
- Monitoring capability of each deluge valve shall be reset and verified.
- The affected standpipe(s) shall be drained by Developer.

- The Developer shall charge the affected standpipes(s) with air and reset the system for monitoring.

c) Plan Concurrence

The Developer shall obtain dated signatures of authorized executives from each Participating Agency, included as a separate page of the ERP, as evidence of planning participation and concurrence. Updates to the ERP shall be validated in like manner.

## 26.5 Deliverables

### 26.5.1 Final Design Documents

- a) The Developer shall submit to TxDOT, as part of the Final Design Documents, a design report which shall be a complete documentation of all Project components covered by this provision. At a minimum, the report shall discuss all technical aspects of the design effort including but not limited to the following:

- Design approach
- Methods of analysis
- Load cases evaluated
- Design assumptions and technical justification (including geotechnical parameters, structural parameters, and durability considerations used in the analysis)
- Structural design approach and procedures, codes, standards, references and sketches as necessary
- A finalized sequence and schedule for all planned underground construction
- Details of excavation methods and equipment
- Details of ground support types
- Details of initial ground support types
- Details of the final lining design
- Details of the final structural component design
- Details showing components and details of the chosen integrated waterproofing and drainage system and the extent of waterproofing, including boundary conditions, treatment around penetrations, splices and terminations
- Details or documentation showing the extent and location of fire protection, thickness and fire resistance rating for each fireproofing application or system, and fire protection ratings of each structural component and whether the component is restrained or unrestrained as specified in UL Fire Resistance Directory
- Specifications, including the list of anticipated shop drawings to be provided

b) Composite Drawings

The Developer shall prepare composite drawings showing locations of, but not limited to, the following elements; conduits, drains, pull boxes, manholes, light fixtures, ventilation equipment, cable troughs, signage attachments, Closed Circuit Television (CCTV) camera attachments and conduit, dry stand pipes, fire hose connections, cross passageway elements, emergency exit elements, communication devices, pump station equipment and support items, sumps, recessed fire extinguishers, railings and doors.

**26.5.2 Record Drawings and Documentation**

- a) **Geotechnical Mapping of Underground Structures**  
The Developer shall provide detailed geotechnical maps of all exposed excavated surfaces for mined tunnels and associated underground structures. The maps shall indicate sizes and shapes of openings, stationing, detailed descriptions of geologic discontinuities, locations and descriptions of groundwater inflows, locations of initial support elements and locations of geotechnical instrumentation.
- b) **Record Drawings** at a minimum shall include as-built drawings, specifications, and shop drawings necessary to completely describe the constructed Project.

## 27 TUNNEL MECHANICAL SYSTEMS

### 27.1 General Requirements

This Section identifies the technical requirements of mechanical systems for tunnels and ancillary facilities. All elements of the tunnel mechanical systems shall be designed, furnished and installed in accordance with the requirements herein and Good Industry Practice.

#### 27.1.1 Scope of Work

The Work specified in this Section consists of designing, furnishing, installing, testing and commissioning all specified and necessary mechanical systems and components for the tunnels and tunnel ancillary facilities including the Operations Control Center (OCC) and the Alternate Operations Control Center (AOCC).

### 27.2 Design Requirements

The Developer shall perform engineering analyses and classify all subsurface configurations as road tunnel, in accordance with NFPA 502, or as non-tunnel and apply the appropriate Technical Documents. In all cases, the Developer shall design and provide the necessary mechanical features to provide an appropriate environment during all Emergency and non-emergency operating modes.

The mechanical systems layout shall incorporate features that allow for manufacturer's recommended preventative and corrective maintenance on and removal/replacement of the mechanical systems and equipment.

#### 27.2.1 Technical Documents

The Developer shall determine which Technical Documents (or portions of) will be applied to the design of all mechanical systems covered herein. Technical Documents referred to herein after are intended to establish basic standards, and include:

- a) Air Movement and Control Association International, Inc. (AMCA) 210, Laboratory Methods Of Testing Fans for Aerodynamic Performance Rating
- b) AMCA 250, Laboratory Methods of Testing Jet Tunnel Fans for Performance
- c) AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data
- d) AMCA 500-D, Laboratory Methods of Testing Dampers for Rating
- e) AMCA 500-L, Laboratory Methods of Testing Louvers for Rating
- f) National Fire Protection Association (NFPA) 10, Standard for Portable Fire Extinguishers
- g) NFPA 13, Standard for the Installation of Sprinkler Systems
- h) NFPA 14, Standard for the Installation of Standpipe and Hose Systems
- i) NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
- j) NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
- k) NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
- l) NFPA 80, Standard for Fire Doors and Other Opening Protectives
- m) NFPA 101, Life Safety Code<sup>®</sup>
- n) NFPA 502, Standard for Road Tunnels, Bridges, and Other Limited Access Highways, as amended in Attachment 24-1A

- o) NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities

### **27.2.2 Mechanical Systems Design**

The requirements of this Section shall apply to tunnels and tunnel ancillary facilities including tunnel ramps, pump stations, utility rooms, cross passageways, emergency egresses and ventilation structures and shafts. The requirements for the OCC and AOCC are specified in Section 27.2.3.

All mechanical systems and equipment shall be suitable for the intended application and within the manufacturer's warranted ratings. Operating environments with adverse conditions shall be taken into account (e.g., high temperature, adverse winds, gasses, soot and smoke, explosive, and highly corrosive atmospheres).

#### **27.2.2.1 Tunnel Ventilation System**

The Developer shall design a tunnel ventilation system that:

- a) Maintains carbon monoxide (CO) and oxides of nitrogen (NO<sub>x</sub>) concentrations below maximum acceptable levels during all non-emergency traffic conditions, including congested, stopped and normal flowing. During these traffic conditions, the tunnel ventilation system shall maintain the CO level below 50 ppm, the nitrogen dioxide (NO<sub>2</sub>) level below 3 ppm, and the nitrogen oxide (NO) level below 25 ppm.
- b) Maintains the apparent temperature of the tunnel environment below 105°F or below the apparent temperature outside the tunnel during normal, stopped, and congested traffic.
- c) Provides a tenable environment for motorists evacuating the tunnel during an Emergency. The environmental parameters (air temperature, CO level, visibility, radiation heat flux, air velocities, and noise levels) described in NFPA 502, Annex's A, B and C shall be considered and shall not be exceeded.
- d) Assists fire rescue and fire extinguishing operations.
- e) Removes and controls smoke and heated gases that result from fire Emergencies within the tunnel to assist in the evacuation and rescue of motorists in the tunnel to meet NFPA 502 requirements.
- f) Is based on a design fire size as determined by an assessment of the expected type of vehicles utilizing the tunnel but shall not be less than 30MW. The heat release rate and smoke generation rate for the design fire size shall be selected in accordance with NFPA 502, Annex A.
- g) Provides redundant tunnel ventilation fans per NFPA 502, Chapter 10.6.

The following requirements shall apply to the ventilation equipment and the ventilation system.

- a) The tunnel ventilation system shall include all fans, motors, cooling systems, dampers, equipment condition monitoring devices, and associated appurtenances necessary for the complete installation, operation and maintenance of the ventilation system. All tunnel ventilation equipment and systems must be factory and field tested for compliance with NFPA 502 and AMCA 210, 250, 301, 500-D and other applicable standards.
- b) If ventilation shafts/buildings are provided, they shall be equipped with axial or centrifugal fans for fresh air intake and exhaust of tunnel air as determined by the Developer. The ventilation shafts shall be located and designed to prevent short-



circuiting of the exhaust air back into the tunnel, and to prevent the tunnel exhaust air from entering the intakes of neighboring building HVAC systems. The Developer shall locate tunnel ventilation air intakes as high as practically possible with bottom of the louvers at a minimum of eight feet above grade. The ventilation shafts at grade shall be located, sized and designed to be secure, and shall be in strict accordance with the noise, environmental air quality and tunnel emissions requirements of Section 4.

- c) Jet fans, if provided, shall be reversible and equipped with sound attenuators that reduce jet fan noise to 85 dBA at a location five feet above the roadway and 30 feet from the outlet of the fan.
- d) Centrifugal, axial, and jet fans shall be rated in accordance with the latest edition of AMCA Standard 210, "Laboratory Methods of Testing Fans for Rating Purposes" or AMCA Standard 250, "Laboratory Methods of Testing Jet Tunnel Fans for Performance", as applicable.
- e) The sound power level ratings of all fans shall comply with the latest revision AMCA Standard 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data."
- f) Fans and dampers that are directly exposed to the tunnel environment or the tunnel exhaust shall be designed to meet the NFPA 502 Chapters 10.6 and 10.7 temperature requirements. A representative jet fan shall be tested at the elevated temperature in Chapter 10.6 of NFPA 502 to verify fan design prior to installation of jet fans in tunnels.
- g) All fan power curves shall not exceed 100% of the motor rating at any point for design condition air density. The brake horsepower for reverse flow shall not exceed the brake horsepower for forward flow.
- h) Tunnel ventilation fan dampers shall be heavy duty, industrial parallel blade type. Dampers and louvers shall be rated in accordance with AMCA 500-D and 500-L, respectively.

#### **27.2.2.2 Tunnel Ventilation Control System**

The capability to monitor and operate the tunnel ventilation system fans, motors and dampers shall be provided at the nearest ventilation control structure, remotely at the OCC, and at the AOCC, through the Supervisory Control and Data Acquisition (SCADA) system.

The Developer shall provide a fully functional automatic tunnel ventilation control system with operating modes as necessary to maintain the aforementioned tunnel environment under congested, stopped, and normal flowing traffic, and a semi-automatic control system for any possible fire Emergency event in the tunnel. Tunnel ventilation system operating modes shall be determined by computational fluid dynamics (CFD) modeling of anticipated environmental conditions within the tunnels. The design fire size heat release and smoke generation rates established in NFPA 502 shall be used as input parameters to the CFD modeling at any location within the tunnels. The modeling shall also determine airflows at typical outside ambient air temperatures such that each tunnel ventilation system operating control mode can be field tested and commissioned using airflow testing in the tunnels using outside ambient air. Longitudinal smoke/airflow tests are required for the verification of all Emergency operating mode configurations.

The tunnels shall be equipped with monitoring equipment/sensors to monitor and control the tunnel atmosphere/environment for CO, NO<sub>x</sub>, temperature, humidity, and visibility. The

monitoring and control systems shall be integrated such that the tunnel ventilation system response is activated based on the threshold levels established by the Developer.

If ventilation shafts are provided, they shall be equipped with monitoring equipment/sensors to monitor the ventilation shafts for emissions for CO and NO<sub>x</sub> concentration levels, temperature, and humidity.

### **27.2.2.3 Cross Passageways and Emergency Egress Pressurization**

Tunnel cross passageways and/or emergency egress stairways shall be pressurized in accordance with the requirements of NFPA 101, Section 7.2.3.9. The force required to open egress doorways shall not exceed that specified in NFPA 502, Chapter 7.14.5.5. The requirements of Section 27.2.2.1.a) b) and c) herein shall be met for all cross passageways and emergency egresses.

### **27.2.2.4 Tunnel Drainage Systems**

All water discharge from tunnel drainage systems must be pretreated and monitored as required by the appropriate Governmental Entity, and may only be discharged with proper permit(s).

The Developer shall coordinate and establish responsibility, protocol and executable procedures as necessary to meet the remote monitoring and control requirements herein for all active drainage systems.

#### **a) Tunnel Drainage Systems**

The Developer shall provide a tunnel drainage system that will collect all tunnel influent, treat the influent, monitor, and discharge the effluent from the tunnel without exceeding the Developer's design ponding width anywhere on the roadway cross section. Ponding on travel lanes is prohibited. The tunnel drainage system shall prevent spills of hazardous or flammable materials from propagating along the roadway of the tunnel. The tunnel drainage system shall minimize water from tunnel washing operations from traversing the roadway at any location along the tunnel alignment. The drainage system shall have sufficient capacity to remove fire-fighting water, storm water, tunnel wash water, carryover from the tunnel approach trench drains, vehicle drippings, and ground water infiltration from the roadway and tunnel. The travel lanes of the roadway shall not be used as a conveying system for water.

The tunnel drainage system design shall incorporate the following:

- The tunnel drainage system shall be designed in accordance with the requirements of NFPA 502. Pipe and fittings for tunnels and adjacent spaces shall be suitable for a tunnel environment and meet the NFPA 502, NFPA 820 and International Plumbing Code (IPC) requirements.
- Corrosion control measures shall be provided for buried pipes in accordance with the National Association of Corrosion Engineers (NACE) corrosion control standards.
- Where drainage can not be directed to a gravity system, drainage shall be directed to pump stations located at the low points of the tunnels or tunnel approaches.
- Pump station hazardous spaces shall be classified per NFPA 70. Pump station equipment shall be suitable for the applicable space hazardous classification (e.g., equipment located in wet wells or spaces that potentially will have

explosive levels of hydrocarbons shall be explosion proof). Systems, equipment and components installed in wet wells shall be designed to fully exclude moisture, abrasive material, corrosive gases, and all other matter that may contribute to wear.

- The pump station access hatches or panels shall not be located in travel lanes of the roadway. Access hatches or panels may be located in the shoulder lane and must be designed to handle anticipated traffic loadings.
- All pump stations shall be monitored and have override control connected to the tunnel SCADA system for remote control. Wet well atmospheric monitoring systems, ventilation, station telemetry systems and other elements for a complete and operable pumping system shall be provided. In addition, all pump stations shall provide means for settling of sediment and skimming of floating materials; shall have an automatic pump operating control system, water level detection and control, and alarm signals to annunciate locally and at a “remote” control location in the event of water level being too low or too high. The pump bay shall have submersible, non-clogging, non-overloading, centrifugal type pumps that provide adequate redundant capacity to pump 100% of the Developer’s calculated design flow with a failure of one pump. The automatic pump control system shall provide for equal operating time for each pump and prevent pumps from overheating. The water level detection system installed in the wet well shall be intrinsically safe, mercury free and suitable for the wet well environment. The piping system shall be designed to provide scour velocities with a single pump running and shall be designed to handle the flow from all pumps running at the same time.
- A wet well ventilation system, designed in accordance with NFPA 820, suitable for a moisture and corrosive environment shall be provided that is capable of providing a minimum of 12 air changes per hour. This system shall be provided with controls that will operate the ventilation system automatically based on time of day and concentration levels of hydrocarbon vapor and manually locally.
- A hydrocarbon based vapor detection system shall be provided that provides an alarm in the event petroleum vapors are present in the drainage system, shall start fresh air supply upon high hydrocarbon levels, and shall shut down all pumps should hydrocarbon levels exceed a safe value. The alarm shall annunciate locally and be connected to the tunnel SCADA system for remote annunciation to a “remote” control location.

b) Tunnel Approach Ramps Drainage

The tunnel approach ramps drainage systems shall collect storm water from all tunnel approaches (entrances and exits) including any open roadways or portal ramps directly connected to the tunnel roadways, such that the storm water is prevented from entering the tunnels on the roadway surface.

### 27.2.2.5 Fire Protection for Tunnels

The Developer shall meet the general requirements for fire protection systems in Section 25, and the following additional requirements:

- a) Fire protection and suppression features shall include, but not be limited to, standpipe systems, fire hose cabinets, portable fire extinguishers, fire hose valve stations and smoke/heat alarm systems. The fire extinguishers and fire hose valve stations shall be protected from physical and heat damage.

- b) Security intrusion alarm notification shall be provided to a 24-hour remote monitoring and control location that shall identify the location and type of enclosure breached for immediate response or maintenance.
- c) A standpipe system shall be provided for all road tunnels on the Project. Standpipe system(s) shall be designed, installed, inspected, and maintained as a Class 1 system(s) in accordance with NFPA 14 and NFPA 502, Chapter 9. If a dry standpipe system is used, the following standpipe system requirements shall apply:
- The standpipe system shall be a semiautomatic system that includes a deluge valve(s) incorporated into each standpipe zone, which can be automatically actuated from a “remote” control location to fill the standpipe system with water. It is acknowledged that the semiautomatic feature is not in strict compliance with the requirements of NFPA 14. The semiautomatic filling feature shall be immediately activated at the "remote" location upon notification of an incident requiring water supply.
  - The fire alarm system shall monitor the position of all isolation, sectionalization and cross connection valves in the standpipe system and shall provide for immediate remote operation. Securing water to the standpipe system shall be coordinated with the appropriate participating agencies, and shall be in the control of the Incident Commander.
  - The semiautomatic standpipe system shall be arranged and designed such that it will fill the applicable standpipe section with water in accordance with the time limits specified in NFPA 502. The standpipe system shall be designed to provide fire protection for all reasonable event scenarios. The Developer shall demonstrate to the FSLSC how the standpipe can be isolated, cross connected and provide protection under different event scenarios. The remainder of the requirements listed in NFPA 14 and NFPA 502 for semiautomatic dry standpipe systems shall be applied as necessary.
  - An air supply system shall be provided per NFPA 14 to pressurize the dry standpipe system.
  - A high/low air pressure alarm system shall be provided for the standpipe system and shall provide remote annunciation to the monitoring and control location when air pressures reach a minimum of 10 psig and a maximum 40 psig.
- d) Tunnel fire detection shall be provided in accordance with the requirements of NFPA 502, Chapter 7.
- e) Portable fire extinguishers for road tunnels shall be provided in accordance with NFPA 502, Chapter 7.
- f) Fire hydrants and fire hydrant water supply shall meet the requirements of Section 25.

### **27.2.3 OCC and AOCC Requirements**

Mechanical systems for the OCC and AOCC shall meet the requirements of Section 23, and be designed, approved, permitted, and built in accordance with the current codes and regulations of the Governmental Entity where the facility or system is located.

## **27.3 Construction Requirements**

The Construction Work shall incorporate features that allow maintenance to be performed per manufacturer's recommendations, with minimum impact on Project performance.

The Developer shall provide and execute a testing and commissioning plan with procedures for all tunnel mechanical systems and equipment to assure the systems and each of their components functions and operates as intended. The Developer is responsible for obtaining certificates of equipment compliance with NFPA 502 and this Section, and be able to demonstrate full system and each system component performance meeting all fire and life safety requirements.

The Developer shall keep all records and reports of witnessed and un-witnessed factory tests. The Developer is responsible for providing detailed test procedures and reports of factory testing, field testing and commissioning activities of mechanical and life safety systems, and keeping all related documentation. The Participating Agencies may witness the tests and participate in system commissioning, and shall be informed of such tests no less than three weeks prior to the test date. The fire protection systems shall be tested in accordance with the requirements of the applicable NFPA standard. Each and every mode of mechanical system operation shall be commissioned. The Developer shall test and commission mechanical systems for ancillary facilities and provide required documentation.

### ***27.3.1 Nameplates***

All major components of mechanical equipment shall have, as a minimum, the manufacturer's name, address, and catalog number, model, style or type on a nameplate securely attached to the item of equipment in an area accessible to normal visual demands by maintenance and service personnel. A unique alphanumeric identifier shall be assigned to each major component and/or piece of equipment. Nameplates shall be provided to serve for the life of the equipment.

The nameplate attached to the mechanical equipment shall have the identifying label of the organization concerned with product evaluation, and by labeling the manufacturer indicates compliance with appropriate standards and/or performance specified herein and by the Developer.

## **27.4 Deliverables**

### ***27.4.1 General Requirements***

The deliverables shall be comprehensive in addressing, as a minimum, all the specified and necessary mechanical systems for tunnels and tunnel ancillary facilities including the OCC and AOCC.

### ***27.4.2 Design Submittals***

The Developer shall submit to TxDOT, as part of the Final Design Documents, a design report, which shall be a complete documentation of all Project components covered by this provision. At a minimum, the report shall discuss all technical aspects of the design effort, including the following:

- a) Design assumptions, approach and procedures, Technical Documents, design criteria and calculations, computer modeling analyses, references, and sketches.
- b) A Project alignment layout drawing(s) showing the tunnel ventilation system components and their locations along the Project alignment. Provide ventilation stack/facility/building drawings that show the Developer's design of the tunnel ventilation system. Provide monitoring control and detection systems drawings. Provide sections, details, control diagrams, mode tables and other drawings to a sufficient level of detail.

- c) Drawings showing the fully coordinated tunnel drainage system components including pump stations, inlets, piping and the effluent receiving system connections along the Project alignment.
- d) Fully coordinated drawings and riser diagrams, showing the tunnel fire protection system components including, but not limited to, fire hose valve stations, fire department connection locations, fire hydrants and their locations along the Project alignment.
- e) A Project alignment layout drawing(s) showing the tunnel ancillary facilities and their proposed locations along the Project alignment. Provide individual drawings of the facilities clearly indicating the spaces and their functions. Show the design requirements for the mechanical systems (HVAC, plumbing, & fire protection) such that the systems' conformance to the functional requirements of the technical provisions can be verified.
- f) A finalized sequence and schedule for all planned mechanical construction, and interfaces with other Project construction activities. Testing, commissioning and start-up requirements shall be included.
- g) Details of finalized layouts, equipment support locations, hardware embedments, and references with the structures, including block-out and sleeves for the mechanical equipment.
- h) Details of all components and equipment comprising the mechanical systems and related infrastructure.
- i) Comprehensive specifications addressing the functional requirements and detailed execution information described in the Technical Provisions, and detailing all material, equipment, and product requirements for all systems covered herein. A list of anticipated shop drawings Submittals shall be included.
- j) Details or documentation showing the extent and location of fire protection.

#### ***27.4.3 Record Drawings and Documentation***

The Developer shall submit to TxDOT, as part of the Record Drawings, all final shop drawings, all mechanical as-built drawings, as-built specifications, complete systems and systems components testing, commissioning and start-up reports. All construction documentation, internal and external training documentation, operation and maintenance manuals, manufacturer warranties and certificates, list of spare parts and Governmental Entities' permits shall also be submitted.



## 28 TUNNEL ELECTRICAL SYSTEMS

### 28.1 General Requirements

This Section identifies the technical requirements of electrical systems for tunnels and tunnel ancillary facilities. All elements of the tunnel electrical systems shall be designed and constructed in accordance with the requirements herein and Good Industry Practice. The tunnel electrical systems shall be capable of supporting long-term operations, technological advancements and accommodate ease of maintenance.

#### 28.1.1 Scope of Work

The Work specified in this Section consists of designing, furnishing, installing, testing and commissioning all specified and necessary electrical systems and components for the tunnels and tunnel ancillary facilities including the Operations Control Center (OCC) and the Alternate Operations Control Center (AOCC). At a minimum, the tunnel electrical systems shall include the following systems:

- a) Power supply and distribution to include Utility service, distribution systems, transformers, utilization voltage switchgear, panelboards, motor controls, normal power systems, standby power systems, essential power systems, emergency power systems, circuit protective devices, control systems, and grounding.
- b) Tunnel lighting systems.
- c) Communications systems to include telephone, closed circuit television and radio systems.
- d) Infrastructure requirements for ITS.
- e) Fire alarm and detection systems including manual pull stations.
- f) Intrusion detection and access control systems
- g) Supervisory Control and Data Acquisition (SCADA) systems
- h) Miscellaneous systems to include, but not limited to: lightning protection, cathodic protection, interior, exterior underground and subsurface raceway systems.

### 28.2 Design Requirements

The electrical system design shall be coordinated with other disciplines, the appropriate Governmental Entities and Participating Agencies.

#### 28.2.1 Design Parameters

The Developer shall determine which Technical Documents (or portions thereof) apply to the design, installation and use of tunnel electrical systems. Technical Documents referred to herein after are intended to establish basic standards, and include:

- a) GL-6, Roadway Lighting Design Guide
- b) CIE 088, Guide for the Lighting of Roads and Tunnels and Underpasses
- c) Institute of Electrical and Electronic Engineers, Inc. (IEEE) Std 141, IEEE Recommended Practice For Electric Power Distribution For Industrial Plants
- d) IEEE Std 241, IEEE Recommended Practice For Electrical Power Systems In Commercial Buildings
- e) IEEE Std 242, IEEE Recommended Practice For Protection And Coordination Of Industrial And Commercial Power Systems

- f) IEEE Std 399, IEEE Recommended Practice For Industrial And Commercial Power Systems Analysis
- g) IEEE Std 446, IEEE Recommended Practice For Emergency And Standby Power Systems For Industrial And Commercial Applications
- h) IEEE Std 902, IEEE Guide For Maintenance, Operation, And Safety Of Industrial And Commercial Power Systems
- i) Illuminating Engineering Society of North America (IESNA) RP 1, American National Standard Practice for Office Lighting
- j) IESNA RP 8, Standard Practice for Roadway Lighting
- k) IESNA RP 22, Standard Practice for Tunnel Lighting
- l) IESNA HB-9-00, Lighting Handbook
- m) International Electrical Testing Association (NETA), Acceptance Testing Specifications for Electrical Power Equipment Distribution and Systems
- n) National Fire Protection Association (NFPA) 70B, Recommended Practice for Electrical Equipment Maintenance
- o) NFPA 502, Standard for Road Tunnels, Bridges, and Other Limited Access Highways, as amended in Attachment 24-1A
- p) NFPA 780, Standard for the Installation of Lightning Protection Systems

Electrical systems shall be designed, approved, permitted, and built in accordance with the current codes and regulations of the Governmental Entity where the facility or system is located.

### ***28.2.2 Design Conditions***

The physical layout and arrangement of tunnel electrical systems shall incorporate features for ease of routine and major maintenance of equipment and shall include provisions to maintain full operation of critical electrical systems during component replacement without compromising redundant design features.

All materials and equipment shall conform to Underwriters Laboratories, Inc (UL) Standards where such standards apply and shall be listed. Where a UL listing is not applicable or not available, other equivalent listings shall be provided.

All equipment shall be applied within their ratings such that the manufacturers' warranties remain in effect. In addition, the following design conditions shall apply:

- a) The Developer shall select one or more electrical retail energy providers to supply the electrical energy needs of the tunnel and tunnel ancillary facilities, except where existing energy agreements must remain in place as required by other requirements of the Technical Provisions or the CDA agreement. On-site energy sources for the purpose of supplying stand-by, essential or emergency loads shall be permitted in accordance with other requirements of the Technical Provisions.
- b) The Developer shall meet the requirements of Sections 5 and 6 for provision of Utility service and shall coordinate with the electrical delivery Utility and the selected retail energy provider(s) to establish Work limits, interface locations, availability of service and all other requirements for electrical supply from the Utility. All costs imposed by the electrical Utility as a requirement to supply the Project shall be the responsibility of the Developer.
- c) All sources and their distribution systems shall have sufficient capacity to supply the electrical system design demand load. The design demand load shall include the sum of the Developer's as-built electrical system demand load at Substantial Completion



plus 20% additional capacity, with the load measured in megavolt-amperes (mVA). When calculating the Developer's as-built electrical system demand load, any future capacity required to satisfy the Developer's design or construction phasing shall be included. The portion of the Developer's as-built demand load serving tunnel ventilation or tunnel stormwater pumping systems (if applicable) may be excluded from the 20% additional capacity calculation where the Developer can demonstrate that future expansion of these systems is not logical for the Project. Where required to meet the demand, utilization voltage levels, or other requirements of the Agreement, multiple sources at multiple locations shall be permitted.

- d) Electrical system design and installation shall be suitable for operation in the environment in which it is installed, including adverse conditions such as high temperature, high winds, gasses, soot, smoke, explosive and highly corrosive atmospheres, and others. It is the Developer's responsibility to identify and classify all adverse environments.
- e) Where electrical raceways are installed embedded in concrete, buried in earth or otherwise concealed by substantial building or structural elements, spare raceways equal to a minimum of 25% of the in-use quantity of raceways (for cable tray, 25% of the available fill) shall be provided for future, unidentified use. The 25% requirement shall be applied individually to raceway systems by system or function. Excluded from this requirement are raceways that serve end devices. When calculating the future unidentified spare raceways, the in-use raceways shall include all raceways in place at Substantial Completion with wiring installed, plus spare raceways identified by and reserved for use by the Developer to meet the Developer's design or construction phasing. Future unidentified spare raceways shall be labeled as such on design Submittals, as-built drawings and physically in the field.
- f) All electrical systems work shall be fully coordinated with other engineering, architectural and environmental aspects of the Project, and shall be integrated to the extent necessary to physically and functionally support the Project requirements.

### **28.2.3 Electrical Power Source**

The Developer shall design the electrical systems to provide power at a suitable voltage for all required loads. The design shall provide electrical power under all conditions to each load defined by the Developer and as required by applicable Technical Documents. The following conditions shall apply:

- a) The Developer shall provide and maintain at least two separate sources of power, in accordance with the requirements of NFPA 502, to all life safety and/or emergency loads throughout the tunnel, at all times. Preferred power source(s) shall consist of a Utility derived source. Alternate power sources, consisting of a Utility derived source or on-site supply as permitted, shall be utilized to ensure the continuity of power in the event that the preferred power source becomes unavailable. The preferred and alternate power sources shall be independent such that a failure of any single point on the electrical system shall not disable both power sources.
- b) Preferred and/or alternate sources shall be furnished to all loads in accordance with their load classification indicated herein.
- c) Where Utility derived sources are utilized to satisfy the reliability (two-source) requirements of NFPA 502, Chapter 11.5, each source shall have the capacity to supply the total tunnel design demand load and be independent of one another. In order to qualify as an independent source, each source shall originate from a different Utility substation and extension of these sources to the Utility source interface point

with the Project shall remain independent and configured such that a single event on the Utility system shall not render both sources unavailable. The Developer shall demonstrate by certification or engineering analysis that the two Utility sources are independent and meet the requirements of NFPA 502.

- d) The OCC and the AOCC shall have fully operational capability to monitor, operate, and control all required systems and equipment remotely from the tunnel proper, and shall include the equipment and systems necessary to conduct these functions.

#### ***28.2.4 Electrical Power Distribution***

The Developer provide a distribution system such that a single event within the electrical system cannot render unavailable both the preferred and alternate power sources as delivered to the load. For loads furnished with preferred and alternate power sources, these sources shall be made available to the loads by automatic means, and transfer between these sources shall be automatic. All automatic transfer switching shall take place as close to the load as is practical.

Where multiple Utility derived sources are provided, the power distribution system shall be based on a primary selective system with both a preferred and alternate power source made available to all distribution substations serving the Project. In addition:

- a) The Developer shall be responsible for incorporating the design intent of all electrical systems that have been addressed herein and shall employ commonly accepted and ANSI standard voltages in accordance with Good Industry Practice.
- b) All switchgear assemblies and components shall be applied in accordance with IEEE, ANSI, and National Electrical Manufacturers Association (NEMA), and shall have the required short circuit and impulse withstand capability to operate safely.
- c) All primary and secondary switchgear, motor controllers, and control devices shall be designed and equipped to accommodate the required SCADA functions of remote monitoring and control, and annunciation of system conditions.
- d) Electrical interlocks shall be provided as necessary to fulfill all operational conditions, and mechanical interlocks shall be provided for personnel safety during all operational and maintenance conditions.
- e) The interrupt rating of protection devices shall be determined based on the Developer's calculated fault currents, so as to operate safely under all conditions of use.
- f) The distribution system protection scheme shall be provided to prevent a fault on any primary feeder or primary equipment from disabling any other equipment
- g) Tunnel ventilation and stairwell pressurization fan starters and disconnect switches shall be monitored to annunciate an open switch condition or out-of-service operating mode. In addition, source feeders arranged to provide redundant sources of supply to jet fans within a single ventilation zone or to individual jet fans serving a redundant fan set shall be physically and electrically separated from each other from source to load.
- h) If ventilation shafts/structures are provided, no two adjacent ventilation fans, or successive ventilation structures within a common ventilation zone shall have their preferred source served from a common source. In addition, all source feeders arranged to provide redundant sources of supply to fans located in ventilation structures serving a ventilation zone shall be physically and electrical separated from each other from source to load.

### **28.2.5 Electrical Load Classification**

The electrical power system shall be arranged to serve four distinct classifications of loads: normal, standby, essential and emergency. The sources for these loads shall have adequate capacity to supply the design demand load without need for load shedding or selective load pick-up.

- a) Normal loads shall be all loads that are not defined as standby, essential, or emergency.
- b) Standby loads shall be those loads classified as such by codes or regulations. They are required to be supplied by two separate and distinct sources of power. Standby loads may be supplied by the standby or emergency systems provided that they are designed and installed to meet the requirements of those systems.
- c) Essential loads shall be those loads that are deemed, by the Developer, to offer enhanced operations, safety and protection through their continued availability during a total loss of commercial Utility electrical supply and are not classified as emergency or standby. Essential loads shall be primarily served by the Utility as the preferred source and backed-up by an on-site alternate source during a total loss of the respective preferred supply. The sources for essential loads shall be permanently installed, and shall be arranged for temporary continued operations during planned or unplanned downtime.
- d) Emergency loads shall be those loads legally required and classified as emergency to meet the requirements of the Agreement. All emergency loads shall be reviewed by the FSLSC. Emergency loads are supplied by an emergency system meeting the requirements of NFPA 70, NESC C2, IEEE 446 and NFPA 502. Emergency loads shall be connected to the distribution system such that emergency loads are automatically connected to the emergency source upon loss of Utility derived source(s) or shall be continuously supplied by the emergency source. In addition, the emergency source shall be permanently installed and continuously monitored for derangement or inability to serve the emergency loads.
- e) The load classification of any particular device, equipment or system shall meet the requirements of the Technical Documents and as modified by the Technical Provisions. Where there is a discrepancy between the classifications, the more stringent classification shall apply.
- f) The Developer shall prepare and provide a document proposing the Developer's classification, by load type, of all devices, equipment and systems on the Project with justification and explanation.

### **28.2.6 Illumination**

The Developer shall provide fully functional lighting systems for the tunnel and tunnel ancillary facilities. This Section includes lighting requirements for tunnel and tunnel ancillary facilities. Roadway lighting requirements are presented in Section 16, and lighting requirements for the Depressed Managed Lanes are presented in Section 25. Ramps and approaches leading into or out of tunnels shall meet the requirements of this Section to the extent necessary to comply with the Technical Documents and as determined by the Developer.

All lighting systems shall be complete, operational, and designed in accordance with the following:

- a) The lighting system design shall be based on equipment and materials suitable for the operating environment and be comprised of components providing for ease of

maintenance and repair. Dissimilar metals shall be adequately isolated from each other to prevent galvanic chemical reactions from occurring that may reduce the life of the lighting system.

- b) All components of the lighting system shall be designed with consideration of ease in maintenance of the lighting system while limiting lane closures and impacts to Operations.
- c) The lighting systems shall not create spurious radio frequency emissions in excess of Federal Communications Commission (FCC) limits in any licensed frequency band.

#### **28.2.6.1 Tunnels and Ancillary Facilities Lighting Requirements**

Normal and emergency lighting systems shall be provided for all tunnel roadways including entrance and exit ramps; and all tunnel ancillary facilities including cross passageways, Emergency egress structures, utility rooms, and pump stations in accordance with NFPA 502 and ANSI/IESNA RP-22. The following tunnel performance requirements shall apply:

- a) Road tunnel lighting shall be of a linear type, glare free, organized in a logical manner, and serve as a visual guide to lead the motorist along the road ahead. Point source lighting may be utilized in threshold and transition zones to supplement linear lighting and meet the requirements of ANSI/IESNA RP-22.
- b) Road tunnel fixtures shall exhibit the ability to withstand high water pressures resulting from roadway tunnel washing machines and shall carry a suitable listing. All luminaries within the tunnel shall be UL listed accordingly.
- c) Flicker effect shall be avoided by the Developer in the tunnel lighting design.
- d) The tunnel luminance criteria for all zones shall be designed according to the requirements of ANSI/IES RP-22. Light levels in each of the tunnel zones shall be increased or decreased as required during daily operation. A luminance meter and control system shall be incorporated to facilitate these lighting changes. The controls system shall exclude rapid changes in lighting levels due to temporary weather conditions.
- e) The emergency lighting system serving tunnels shall be in accordance with NFPA 502.

#### **28.2.6.2 OCC and AOCC Lighting Requirements**

Normal and emergency lighting systems shall be provided for all interior spaces and exterior areas for purposes of work, task and safety lighting in accordance with ANSI/IESNA HB-9-00.

#### **28.2.7 Communication Systems**

The Developer shall provide communications systems for road tunnels in accordance with the requirements of Section 24, and shall make all communication systems available at the OCC and AOCC. In addition, the following requirements for a personnel telephone system shall apply:

- a) Personnel Telephone System  
A hard-line telephone communication system shall be provided between the OCC, AOCC, the tunnels, and all other ancillary facilities and spaces supporting the tunnel. This system shall provide direct, dependable and reliable communications. As a minimum all utility rooms, egress stairways, cross passageways, pump stations and power centers shall be equipped with telephone hand sets and further, for multi-level spaces, a telephone handset shall be provided on each level requiring regular access

for maintenance. The system shall be arranged to continue operation under all operating configurations and shall be single fault tolerant.

### **28.2.8 Closed Circuit Television (CCTV) System**

The Developer shall provide a fully functional CCTV system to remotely monitor the tunnel roadway in real time. In addition to the requirements herein, the system shall be in accordance with Section 17.2.3. The CCTV system in road tunnels shall also serve as one of the two means of fire detection in accordance with NFPA 502, be UL listed for fire detection and provide 100% viewing coverage of the tunnel roadway at all times. Video detection technology shall be used and the video output shall be displayed at the OCC and AOCC in a manner consistent with the zoning of the camera positions. The system shall automatically select the four cameras nearest to an activated manual pull station for display on a dedicated monitor. A dedicated video recorder shall be provided that shall automatically start recording upon actuation of the fire alarm. The following additional CCTV camera requirements shall apply:

- a) Video display shall be provided at the OCC and AOCC. The video display shall be fully functional and include, but not limited to screens, supporting hardware, cabling, video processors, and all necessary accessories to provide an integrated video display system. The OCC/AOCC operator shall be able to control all displays and provide selection and switching of multiple sources for display.
- b) The design shall allow the operator to manually override the video input to the display and recorder, and to manually initiate video recording.
- c) The design shall provide the option of recording other video signals and provide a minimum of four simultaneous video signals to be selected for recording manually control operation of the recorder.
- d) All components of the CCTV cameras located in tunnels shall be designed with consideration to serviceability and prevention of vapor, dust, temperature and water jet sprays consistent with tunnel washing activities and environments.
- e) Primary control of the cameras serving the tunnel shall reside with the Developer for the purpose of Incident Command and control or other critical activities. Monitoring and secondary control of these cameras shall be by TxDOT. Access to cameras and camera views shall be controlled to prevent unauthorized viewing of sensitive Project areas and events.

### **28.2.9 Fire Detection and Alarm Systems**

The design shall provide for all required materials, components, software, and programming necessary to provide a fully functional system of fire detection and annunciation for the tunnels and tunnel ancillary facilities including the OCC and AOCC. The system shall include intelligent type fire alarm control panels and associated peripherals. Fire detection shall be automatic except where manual systems are indicated in the Technical Provisions or Technical Documents. All fire detection and alarm systems shall meet the requirements of NFPA 72, and shall be coordinated with and reviewed by the FSLSC. The fire detection and alarm systems shall meet the following:

- a) Fire detection and alarm systems in road tunnels shall be designed based on 24-hour monitored operations where automatic fire detection is not required or provided. The fire detection systems shall be designed to employ two separate forms of detection, identify or locate a fire, and shall include a manual pull station system. No glass shall be used in manual fire alarm pull stations.
- b) Tunnel ancillary facilities shall be designed with automatic fire detection systems.

- c) All fire protection valves in or serving the tunnel shall be designed for supervision by the SCADA system and this monitoring shall be in addition to the standard requirements for UL listed fire alarm control panel type supervision and release. For hose valves, the design shall provide for monitoring of the valve station doors by the SCADA system.
- d) All fire alarm control panels in or serving the tunnels shall be monitored by the SCADA system for alarms and system trouble and be supervised in accordance with NFPA 72.

### ***28.2.10 Intrusion Detection/Access Control System (IDACS)***

The Developer shall provide a fully functional intrusion detection/access control system to continuously monitor and control all people movements within the monitored tunnel ancillary facilities. Methods and devices for detection shall be selected to suit the environment in which they are installed. Devices shall include, but not be limited to: door contacts, motion detectors, tamper switches, cameras, card readers, intercommunication devices, and other devices appropriate for the type of coverage required. As a minimum, the intrusion detection/access control system shall be provided to:

- a) All areas to which the entry by unauthorized persons could cause disruption to or delay the Developer's operations, particularly operation of the tunnel, and facility/buildings
- b) All areas to which the entry by unauthorized persons could result in the personal injury to those persons or others.
- c) Provide a high probability of detection and annunciate system status, alarm, and diagnose information at the OCC and AOCC. As a minimum, alarm annunciation shall provide location, address of device, nature of the alarm, time and date, and alarm priority.
- d) Have a minimum 25% spare capacity of detection points and indication outputs.
- e) Include CCTV coverage to visually detect intruders upon alarm notification
- f) The system shall include provisions to monitor the integrity of the IDACS against unauthorized access and tampering including system wiring, enclosures, screens and power supplies.

### ***28.2.11 SCADA System***

The Developer shall provide a fully functional SCADA system to continuously monitor and/or control the tunnel and tunnel related ancillary facilities, equipment and systems, including but not limited to; electrical and ventilation equipment, carbon monoxide (CO) and hydrocarbon monitoring systems, fire protection systems, drainage systems, lighting systems, and emergency response radio systems. In addition, the SCADA system shall provide the hardware and software for operator interfaces, data archival and retrieval, and integration with all other necessary systems, including the ITS. The system shall be designed for uninterrupted operation and shall employ a fail-safe network topology throughout the SCADA system. In addition, the following shall apply:

- a) The system shall be designed to accommodate an increase in monitoring and control points, and all equipment except the actual monitoring/control devices shall be redundant.
- b) The system shall send required signals to the OCC and AOCC for processing while providing full functionality under all operating conditions, including allowance for modifications and repair. In addition, SCADA equipment in non-environmentally



controlled areas shall be designed to operate without the need for active cooling or heating support, or shall be housed in enclosures that have redundant environmental control powered from emergency supplies.

- c) The design shall eliminate vulnerability to a single point failure, adequately handle all anticipated transaction volumes, and accept future hardware and software growth.
- d) Data processing shall be redundant. Dual servers and disk arrays are required and must be programmed for automatic failover and recovery without loss of function.

### ***28.2.12 Grounding and Lightning/Surge Protection***

The Developer shall provide a complete and coordinated grounding and bonding system for the protection of all applicable systems, equipment and personnel in the tunnel and tunnel ancillary facilities in accordance with Section 25.

## **28.3 Construction Requirements**

The Developer is responsible for procuring, testing, installing and commissioning fully functional electrical systems to meet the performance requirements herein and fully support the functional demands of the Project. The construction Work shall incorporate features that allow maintenance to be performed with minimal impact on Project performance, and shall incorporate features that will support a high level of reliability such that operation of the Project is not affected by any single electrical failure.

The Developer shall provide and execute a testing and commissioning plan and procedures for all electrical systems and equipment to assure the systems and components function and operate as intended. The Developer is responsible for furnishing certificates demonstrating equipment compliance with the Technical Documents and in particular, compliance with the fire, smoke, elevated temperature and survivability requirements of NFPA 502 as it applies to tunnels, and this Section.

The Developer shall keep all records and reports of all test results including witnessed and un-witnessed factory tests, field tests and manufacturer test data. The Developer is responsible for providing field tests and commissioning of life safety systems and other testing as required by the Technical Documents, and for keeping all related documentation. The Developer shall enable Participating Agencies to witness and participate in system commissioning, and shall inform all interested parties of such tests no less than three weeks prior to the test date.

### ***28.3.1 Nameplates***

All major components of electrical equipment shall have, as a minimum, the manufacturer's name, address, and catalog number, model, style or type on a nameplate securely attached to the item of equipment in an area accessible to normal visual demands by maintenance and service personnel. A unique alphanumeric identifier shall be logically assigned to each major component and/or piece of equipment. Nameplates shall be provided to serve for the life of the equipment.

The nameplate attached to the electrical equipment shall have the identifying label of the organization concerned with product evaluation, and by labeling the manufacturer indicates compliance with appropriate standards and/or performance specified herein, required by the Technical Documents or by the Developer.

## **28.4 Deliverables**

#### **28.4.1 General Requirements**

The deliverables shall be comprehensive in addressing, qualifying and demonstrating compliance with the Project requirements for all electrical systems required to support the Project.

The Developer shall demonstrate compliance with all factory and field testing requirements and commissioning of all electrical systems equipment.

#### **28.4.2 Design Submittals**

The Developer shall submit to TxDOT, as part of the Final Design Documents, a design report, which shall be a complete documentation of all Project components covered by this provision. At a minimum, the report shall discuss all technical aspects of the design effort, including but not limited to, the following:

- a) Design approach and methods of analysis
- b) Provisions for retail energy, electrical load classification, and power supply and distribution approach and methodology
- c) Design assumptions and criteria for all electrical systems
- d) A one-line diagram of the tunnel electrical systems, including the identification of all utility tie-in points and the location of the utility substation with breaker numbers; electrical schematics identifying all interlocks, permissive and protective devices; and detailed schematics of the SCADA, fire detection & protection, communications and intrusion detection systems
- e) Electrical design approach and procedures, Technical Documents, operational & maintenance manuals, specifications, references, and sketches as necessary
- f) A finalized sequence and schedule for all planned electrical construction, and interfaces with other Project construction activities. Testing and start-up requirements shall be included.
- g) Details of finalized layouts and structural details, sign support locations, hardware embodiments, and references with the structures, including block out and sleeve for the electrical traffic management system, telecommunication, and other utility openings.
- h) Details of all components and equipment comprising the electrical systems and related infrastructure.
- i) Details of all lighting, including delineation of zones within the tunnel and all systems and controls.
- j) Details showing the extent of waterproofing, including boundary conditions, treatment around penetrations, splices and terminations.
- k) Comprehensive specifications addressing the functional requirements and detailed execution information described in the Technical Provisions, and detailing all material, equipment, and product requirements for all systems covered herein.
- l) Details or documentation showing the extent and location of fire protection, thickness and fire resistance rating for each fireproofing application or system.

#### **28.4.3 Record Drawings and Documentation**

The Developer shall submit to TxDOT, as part of the Record Drawings, all final shop drawings, all electrical as-built drawings, as-built specifications, complete systems and systems components testing, commissioning and start-up reports. All construction documentation, internal and external training documentation, operation and maintenance manuals, manufacturer warranties and certificates, list of spare parts and Governmental Entities' permits shall also be submitted.