Attachment 3.16c
TMS Interface Plan

495 EXPRESS LANES NORTHERN EXTENSION DESIGN-BUILD PROJECT

TRAFFIC MANAGEMENT SYSTEM INTERFACE PLAN

April 30, 2021

Transurban Project No.: PRJ00495

VDOT Project No.: 0495-029-419 (UPC 115401)

FHWA Project No.: NHPP-495-5(095)

Transurban

REVISION HISTORY

Revision	Date	Author	Reviewer	Notes
Rev. 0	09/30/20	PL	KR	Initial RFP Release
Rev. 1	04/30/21	KC	PL	Amended 4.2 for No Excuses Incentive

TABLE OF CONTENTS

1 Introduction

1.1 Description of Project

The 495 Express Lanes Northern Extension Project ("Project NEXT" or "Project") is an approximately two-mile extension of the 495 HOV/HOT Lanes (Express Lanes) in Fairfax County, Virginia. As shown in Figure 1 below, the Project will extend along Interstate 495 (I-495) from the current northern terminus of the 495 Express Lanes near Old Dominion Drive, (Route 738), to the vicinity of the George Washington Memorial Parkway (GWMP), and improvements to the Dulles Toll Road and GWMP interchanges and the northbound general purpose lanes. I-495 currently operates with four general-purpose lanes in each direction along the Project corridor, and a peak-period only shoulder lane in the northbound direction.

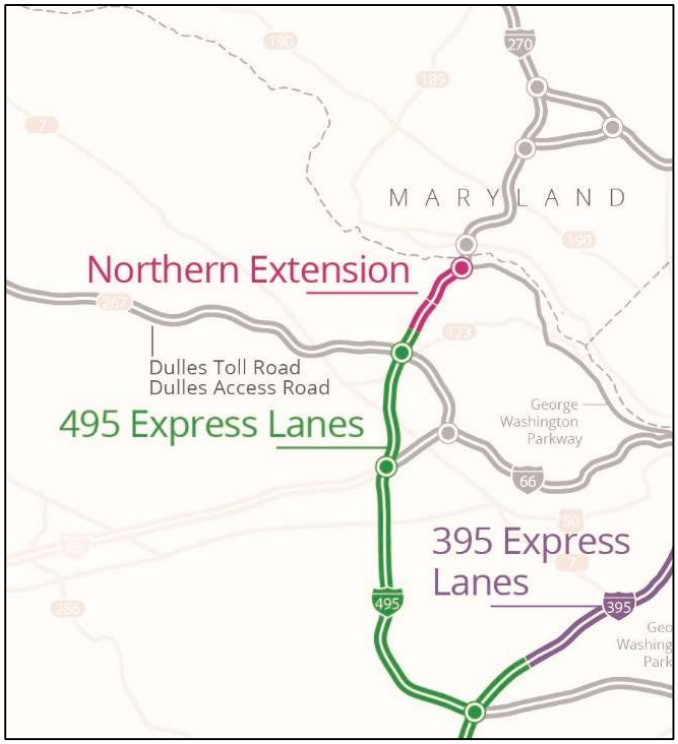

Figure 1. Project NEXT Location

The primary objective of the Project NEXT is to extend the High Occupancy Toll (HOT) lanes (Express Lanes) on I-495 further north to provide additional capacity in the corridor, which will be available at no charge to HOV 3+ vehicles, and open to other authorized vehicles for a user fee (toll). This extension will be subject to the same operating rules and regulations as the existing 495 Express Lanes, and when complete will operate as a single, fully-integrated 495 Express Lanes facility between the Springfield Interchange and the GWMP.

1.2 Project Structure

Figure 2 provides an overview of Project NEXT delivery structure and contracting relationships. The proposed project structure will require a collaborative approach between the Design-Builder and Traffic Management System (TMS) Subcontractor to ensure successful and timely delivery of the project.

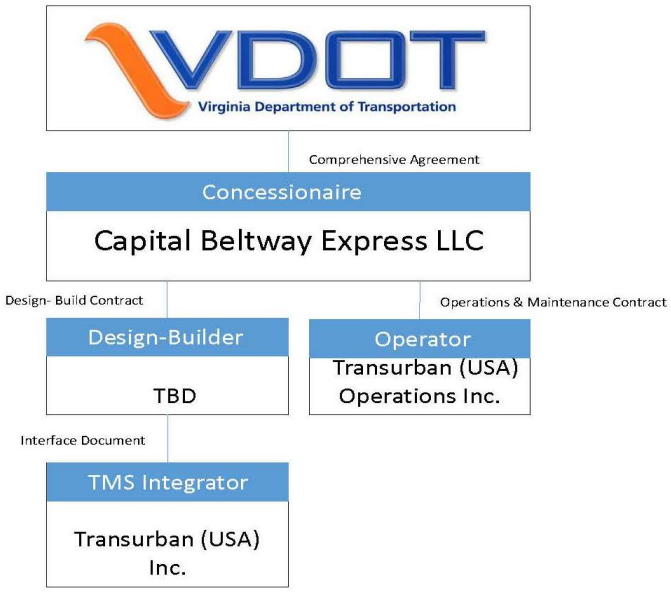

Figure 2. Project Contracting Structure

1.3 Capital Beltway Express LLC (Concessionaire)

Capital Beltway Express LLC (Concessionaire) will be responsible for the design and construction, and ongoing operations and maintenance of Project NEXT under the existing I-495 HOV/HOT Lanes Project Comprehensive Agreement with VDOT.

1.4 Design-Builder

Design-Builder will be the principal contractor under contract to Concessionaire to deliver the complete Project NEXT. The Design-Builder is responsible for providing the civil works and a number of component elements of the Traffic Management System (TMS), including all required civil infrastructure and TMS roadside equipment. The Design-Builder will be also responsible for interfacing with TMS Subcontractor throughout the project in relation to TMS systems integration and sub-system components.

1.5 TMS Subcontractor (Transurban (USA) Inc.)

Transurban (USA) Inc. will be the designated TMS Subcontractor under contract to the Design-Builder to provide systems integration and commissioning services. The TMS Subcontractor is responsible for upgrades and updates to the existing 495 Express Lanes electronic tolling and traffic management systems software necessary to operate Project NEXT, and integration and

commissioning of the new TMS roadside equipment provided by the Design-Builder into the 495 Express Lanes operating systems and operations center.

1.6 Document Purpose

The purpose of the TMS Interface Plan is to further define the specific scope of work responsibilities of the Design-Builder and the TMS Subcontractor for Project NEXT that form the basis for the design, installation/construction, turnover, testing, and integration of the various TMS component elements and to identify the interfaces and obligations between the two parties required to support the delivery of Project NEXT.

The Interface Plan establishes a framework for interface management and protocols to identify, coordinate and control the interfaces and interface points between the Design-Builder scope of services and TMS Subcontractor scope of services. This document will identify the division of responsibilities between the Design-Builder and TMS Subcontractor, as it pertains to the broader TTMS system delivery of the project, and define design responsibilities, information exchange, review process, notifications, and appropriate documentation and deliverables required for delivery of the TTMS as part of the overall complete project. This document does not address VDOT ITS equipment.

This TMS Interface Plan is included in the Design-Build Contract Technical Requirements and will be incorporated by reference into the TMS Subcontract between the Design-Builder and Transurban (USA) Inc.

1.7 Tolling and Traffic Management System Overview

Figure 3 provides an overview of the major elements and subsystems that comprise the tolling and traffic management system used for the 495 Express Lanes. A summary of each is provided below.

The **Tolling System** is used for collection and enforcement of tolls, and consists of electronic toll collection (ETC) roadside equipment located in the field, and ETC system and back office system (BOS) software and hardware located in the Express Lanes Operations Center. There are no additional toll points or tolling system upgrades included in the scope of Project NEXT.

The **Traffic Management System** provides a centralized platform for the traffic control room operators to manage the various TMS roadside equipment installed in the field. With the TMS, the operators monitor traffic conditions, and provide real time information to motorists to support roadway and en-route traffic management, and report and manage incidents along the Express Lanes. The TMS roadside equipment is located in the field and TMS software and hardware is located at the Express Lanes Operations Center. The TMS roadside equipment includes:

a. Dynamic message signs (DMS) to provide dynamic pricing and traveller information to motorists on the road,

b. Microwave vehicle detectors (MVDS) to collect traffic data, including volume, speed, and occupancy,

c. Closed circuit television (CCTV) cameras, and

d. Automated incident detection (AID) cameras,

The TMS roadside equipment also includes supporting infrastructure, such as cabinets, UPS (uninterrupted power supply) devices, generators, device enclosures, and network equipment.

The **Communications System** is comprised of a fiber optic backbone and Communications Network. The fiber optic backbone will run the length of the project, and provide redundant path to the Express Lanes Operations Center. .

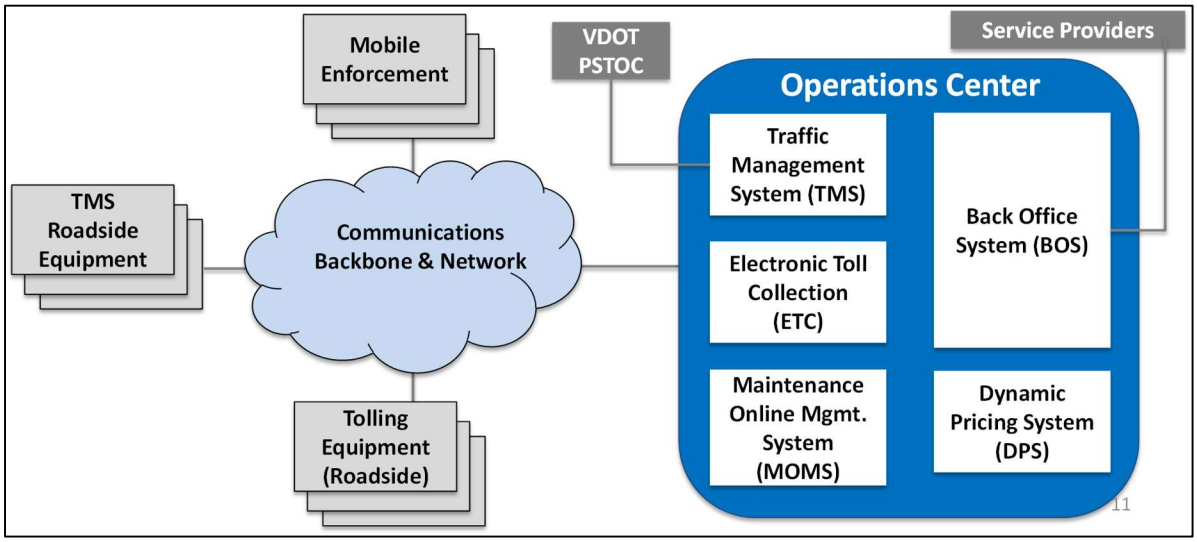

Figure 3. Express Lanes Systems Overview

1.8 Existing TMS Roadside Equipment

The Project also includes work by the Design-Builder related to the existing 495 Express Lanes communications network and TMS roadside equipment, which is integrated back to the Express Lanes Operations Center and the Traffic Management System. Requirements for this work are addressed in the NEXT Technical Requirements, Special Provisions and RFP Conceptual Plan documents.

1.9 Commitment to Work Collaboratively and Openly

Design-Builder and the TMS Subcontractor each commit to working together in a collaborative and open manner, in accordance with the applicable requirements of the NEXT Contract Documents and TMS Subcontract, to avoid conflicts and disputes. As a result, Design-Builder and the TMS Subcontractor agree to promptly notify the other, as well as Concessionaire, of: (a) any actual or perceived problems, concerns, issues, differences of opinion or conflicts in relation to the work on the Project, whether involving physical Site conflicts, workspace or schedule conflicts, or equipment and system performance conflicts; and (b) any other matter which may be contrary to the principles reflected in this Interface Plan.

1.10 Communications and Coordination Protocol

As a means of implementing the commitments noted in Section 1.9 above, the parties agree that they will participate in regular coordination meetings (at least monthly) and hold additional meetings as required during the Contract period to address open or unresolved issues related to TMS interfaces. One of the primary purposes of the coordination meetings is to create an environment whereby issues that could impact performance of either Design-Builder or the TMS Subcontractor are identified and brought to the attention of the Concessionaire and the other party at the soonest opportunity, and that such issues are resolved or mitigated in a timely manner. Design-Builder will be responsible for leading and administering these coordination meetings. Meeting shall be held at least monthly, with more frequent meetings as needed to accomplish to complete the TMS Work. Design-Builder will also be responsible for integrating the activities of the TMS Subcontractor into the Baseline Schedule and all updates to such schedule.

Design-Builder and the TMS Subcontractor recognize that their ability to perform work efficiently and effectively is dependent upon receiving timely and accurate information from the other party. Each agrees that it will give the other reasonable advance notice of its needs and/or requirements, and that the other party will reasonably attempt to meet the needs of the other party. Each party recognizes that there needs to be some flexibility in the submission and review/approval of their respective design documentation, and that if circumstances require adjustments to help the other party, the parties will make best efforts to accommodate the other party. It is expected that Design-Builder and the TMS Subcontractor will regularly update each other of their respective progress in completing design documents. Design-Builder will have primary responsibility for coordinating and administering the process of submitting and exchanging information (including but not limited to design documentation) with the TMS Subcontractor.

Design-Builder and the TMS Subcontractor recognize that it is possible that their ability to perform certain work may shift because of field progress. One of the primary functions of this communications and coordination protocol is to provide a framework for the parties to discuss these issues and obtain advance knowledge of any such issues. Design-Builder and the TMS Subcontractor each agree to provide the other with reasonable notice (3 calendar days) of any field delay issues, and the affected party will make best efforts to reasonably work around these issues. This is not intended to affect the contractual rights of any of the parties for Contract Price or Contract Time adjustments that may be due.

Design-Builder and the TMS Subcontractor further recognize that one of the critical issues for Project success is to deal effectively with the interface points between and among their respective work. While Design-Builder will have primary responsibility to schedule and coordinate these interfaces, it is understood that Design-Builder and the TMS Subcontractor will work together collaboratively and cooperatively to focus on this issue and to cooperate with each other to identify interfaces that could create problems and work cooperatively to resolve such problems.

2 Interface Roles and Responsibilities

Design-Builder will be responsible for managing, coordinating and scheduling the work related to the design, supply, installation, testing, and integration of the TMS roadside equipment and related infrastructure, including active coordination and engagement with TMS Subcontractor throughout the entire project duration.

Design-Builder will be responsible for ensuring that milestones and all related predecessor activities are being met and reviews are requested from TMS Subcontractor to meet schedule requirements. The TMS Subcontractor will be responsible for supporting the Design-Builder to complete integration of the TMS roadside equipment with the existing TTMS subsystems.

The scope of services related to the delivery of the TTMS for the project stakeholders are listed below. The responsibilities of the Design-Builder and the TMS Subcontractor are further defined for the design, construction and testing phases of the project.

A detailed scope split of Design-Builder and TMS Subcontractor activities is provided in **Appendix A**.

2.1 Concessionaire Responsibility

Concessionaire will provide oversight of the interface management between the Design-Builder and TMS Subcontractor to ensure that the civil works and TTMS scopes of services are properly coordinated and managed throughout all phases of the project delivery.

2.2 Design-Builder Scope

Design-Builder will be responsible for following scope of services related to the delivery of the TTMS:

a. overall management associated with the delivery of the TMS roadside equipment, including incorporating and integrating all necessary TMS activities and milestones related to the civil works-system interfaces into the Design-Builder's overall project schedule,

b. the design, supply and construction of all civil works necessary for the installation of TMS roadside equipment, including utilities (new service and relocations), drainage, foundations, structures (e.g. sign structures and/or poles), TMS roadside cabinets and enclosures, TMS equipment access points, and roadway barriers required to protect TMS equipment,

c. design, supply, installation, testing and commissioning of all power and communications cabling deemed necessary to support the TMS roadside equipment, structures and roadside cabinets,

d. the design, supply, installation and testing of TMS roadside equipment, including dynamic messaging signs, microwave traffic detectors, CCTV cameras, and automated incident detection cameras

e. the design, supply, installation, and commissioning of the fiber optic communications backbone along the entire project length and connections to the Express Lanes Operations Center, and

f. demonstration of the proper performance of the TMS roadside equipment, communications backbone and network and ancillary roadside equipment as part of testing and commissioning.

g. relocation of existing VDOT ITS and Concessionaire TMS roadside equipment located within the Project NEXT Right of Way that is affected by construction, including power and communication service to the equipment, and shall ensure that loss of functionality is minimized.

2.3 TMS Subcontractor Scope

TMS Subcontractor will be responsible for following scope of services related to TTMS:

a. coordinating with the Design-Builder to ensure all necessary TMS integration and testing activities and milestones related to civil works interfaces are properly incorporated and incorporated in the Design-Builder's overall project schedule throughout all phases of project delivery,

b. providing to the Design-Builder the technical and performance requirements and specifications for the TMS subsystem, including associated roadside equipment,

c. integrating the TMS roadside equipment with the existing Express Lanes traffic management software and other subsystems at the Express Lanes Operations Center, and

d. completing the overall integration, testing and commissioning of the Express Lanes Tolling and Traffic Management Systems needed for revenue operations.

2.4 Design Phase

2.4.1 Design-Builder Responsibilities

Design-Builder will be responsible for following scope of services related to the design:

a. coordinating and scheduling of design reviews with Concessionaire and TMS Subcontractor related to TMS equipment and systems delivery,

b. completing the Network Communication Design, as part of Design-Builder's final design efforts,

c. providing input to the System Requirements Review for the TMS roadside equipment specifications

d. providing the operating manuals and any training provided by the manufacturers for the TMS roadside equipment to be procured by the Design-Builder,

e. providing the Concessionaire and TMS Subcontractor a formal design and factory review of the typical TMS cabinets to be provided by Design-Builder,

f. developing a TMS Roadside Equipment Asset Database, to include all TMS roadside equipment and Communications Network. The Design-Builder will maintain all asset

location, configuration and other pertinent data in a single database. The database will be established as part of the design development and will be placed under configuration control during design process, and maintained through all phases of construction, installation, and turnover. Database will be maintained by Design-Builder and regularly updated and available to all parties. TMS Subcontractor will provide template for Design-Builder to setup initial TMS Roadside Equipment Asset Database,

g. Interdisciplinary coordination of all roadway elements, and roadside equipment to avoid potential conflicts during construction.

2.4.2 TMS Subcontractor Responsibilities

During the design phase, the TMS systems and components will undergo requirements definition phase, detailed system design, including a Baseline Design Review (BDR), Modified Design Review (MDR) and a Final Design Review (FDR), leading to a detailed Final System Design that meets the Technical Requirements and the TMS System Requirements specification. The timing of BDR, MDR and FDR will be based on the Design-Builder's schedule for approved design plans for TMS-related elements.

The TMS Subcontractor will be responsible for following scope of services related to design and will provide the following to the Design-Builder:

a. Network High Level Design document, which provides an overview for the design of the roadside Wide Area Network (WAN), bandwidth requirements, and data center networks,

b. L3 (layer 3) network configuration,

c. Network Detailed Design document, which provides detailed design of the network,

d. Requirements and template for TMS Roadside Equipment Asset Database, and

e. TMS roadside equipment configuration requirements.

2.5 Construction/Installation Phase

Design-Builder acknowledges that its Work may be affected by the carrying out of the work by the TMS Subcontractor performed within or near the Project Site, and shall ensure that the design, planning, programming and performance of work by both contractors are properly coordinated, taking into account their concurrent and sequential nature. In particular, the Design-Builder shall: a) plan, program and perform its Work so as to not unnecessarily interfere with or hinder the activities of the TMS Subcontractor and b) at all times take all reasonable steps to protect the TMS Subcontractor's Work from accidental damage caused by the Design-Builder's personnel and Work.

The Design-Builder shall allow the TMS Subcontractor access to the Project Site to the extent necessary or appropriate for TMS Subcontractor to simultaneously or progressively, as appropriate, carry out its obligations under the TMS Interface Plan. The Design-Build Work and the TMS Work, as applicable, shall be delivered in a fit-for-purpose condition such that the Design-Builder or TMS Subcontractor, as applicable, can integrate or tie-in its Work without modification, redesign or delay.

While on the Project Site, the TMS Subcontractor and its subcontractors shall at all times (a) adhere to the health, safety and security directions, procedures and guidelines established by Design-Builder (b) if required by Design-Builder, with respect to matters that deviate from the agreed schedule, confine their activities to a specified location on the Project Site or vacate the Project Site if the Design-Builder reasonably determines that the presence of TMS Subcontractor or its contractors and/or their activities are materially interfering with the performance of the Design-Build Work or creating an immediate and serious threat to public health, safety, security or the environment. In the event that the Design-Builder so confines or removes the TMS Subcontractor, it shall provide TMS Subcontractor with a reasonable, alternate time to conduct such activities.

2.5.1 Design-Builder Responsibilities

The Design-Builder will be responsible for the following activities related to construction:

a. establishing location and extent of utilities and services lines in the project area and notify TMS Subcontractor before TMS Subcontractor commences work in the field,

b. providing safe and secure access to the TMS work locations, including all Maintenance of Traffic (MOT), safe access, and any fencing and barricades. Design-Builder shall provide all labor materials and miscellaneous items required to install, maintain any required safety provisions relating to the TMS work,

c. maintaining clean project site and provide required access to TTMS work sites generally clear of mud, standing water, ice, and snow, and

d. coordinating with TMS Subcontractor to identify and provide temporary lay-down and staging areas within the vicinity of the project right of way for TMS work.

2.5.2 TMS Subcontractor Responsibilities

The TMS Subcontractor will be responsible for the following activities related to construction:

a. preventing mud or soil from TMS Subcontractor or its subcontractors' vehicles being tracked off project work site to any roadway, and

b. following the Design-Builder's safety rules and precautions for the Project Site.

2.6 Testing and Commissioning Phase

The testing and commissioning of the TMS will be achieved through the following test phases and activities. The purpose of the test phases is to validate that each subsystem, and combinations of subsystems, progressively meets the functional and performance requirements defined by System Requirements Specification and the Final System Design. Commissioning includes the systematic verification of each component or system of Project NEXT to ensure it is physically complete, checked, calibrated, and safe for initial operation. The TMS subsystems will follow a progressive commissioning and testing process, therefore reducing subsequent test phases from undergoing redundant tests performed in the previous phases.

2.6.1 Factory Acceptance Test (FAT)

All required FATs will be conducted by the Design-Builder for the TMS roadside equipment. The TMS Subcontractor will be provided an opportunity to witness and participate in any scheduled FATs.

The TMS Subcontractor will conduct the FAT for any necessary modifications to the Back Office System and the Traffic Management System at the Express Lanes Operations Center.

2.6.2 Incremental Installation and Level A and B Testing for TMS Roadside Equipment

Level A and B testing will be conducted by the Design-Builder.

Level A testing is to certify TMS roadside equipment installed by the Design-Builder is installed and fully operational in line with agreed design requirements as demonstrated by executed test procedures approved and witnessed by TMS Subcontractor.

Level B testing is to certify TMS roadside equipment is successfully integrated with Express Lanes communication network as demonstrated by executed test procedures approved and witnessed by TMS Subcontractor.

2.6.3 Integration and Level C Testing for TMS Roadside Equipment

Level C testing will be conducted by TMS Subcontractor to certify that TTMS systems at the Express Lanes Operations Center can communicate and control TMS roadside equipment as demonstrated by executed test procedures defined by TMS Subcontractor. TMS Subcontractor will be responsible for this test and the Design-Builder will provide support to TMS Subcontractor for successful and on-time execution of this test, including but not limited: troubleshooting of roadside equipment and network related issues, maintenance of traffic measures and safe access to the Site.

2.6.4 Training

Design-Builder will provide training on new or next generation Express Lanes TMS roadside equipment procured and installed by Design-Builder.

2.6.5 Integration Acceptance Test

The Integration Acceptance Test(s) will be conducted by TMS Subcontractor to validate that the fully integrated TTMS systems, in a normal operational environment, complies with the System Requirements Specification, Final System Design and other Contract Documents. TMS Subcontractor will be responsible for this test and the Design-Builder will provide support to TMS Subcontractor for successful and on-time execution of this test, including but not limited to promptly addressing items identified that are related to roadside equipment installed by Design-Builder.

2.6.6 User Acceptance Test

The User Acceptance Test will be conducted by the Concessionaire's Operations and Maintenance personnel to verify that the TTMS meets operational requirements and system functionality. The Concessionaire is responsible for the independent verification of the system prior to commissioning of the system after completion of IAT. Concessionaire will be responsible for this test and the Design-Builder and TMS Subcontractor will provide support to Concessionaire for successful and on-time execution of this test, including but not limited to promptly addressing

items identified that are related to roadside equipment installed by Design-Builder and TMS Subcontractor.

2.6.7 Operational Readiness

Design-Builder and TMS Subcontractor will coordinate and provide support to Concessionaire for Operational Readiness, including but not limited to promptly addressing items identified that are related to TMS roadside equipment installed and system updates by Design-Builder and TMS Subcontractor respectively.

2.6.8 Start-Up and Service Commencement (Toll Day 1)

Design-Builder and TMS Subcontractor will coordinate and provide support to Concessionaire for Start-Up and Service Commencement, , including but not limited to promptly addressing items identified that are related to roadside equipment installed by Design-Builder and TMS Subcontractor respectively.

2.6.9 Design-Builder Responsibilities

The Design-Builder shall support all testing and commissioning phases and activities as follows:

a. develop a Turnover Plan for the TMS roadside equipment that includes schedule for installation, Level A and B Testing, and documentation submission to TMS Subcontractor,

b. develop a Turnover Plan for the wide area network (WAN) communications network to address turnover and transition from HOV equipment to Express Lanes equipment,

c. provide TMS Roadside Equipment Asset Database (Draft and Final versions). The Draft Asset Database to be provided prior to TMS Subcontractor's Modified Design Review

d. develop test procedures to test the fiber optic backbone, communications network and the ancillary equipment,

e. conduct tests of the fiber optic backbone, communication network and ancillary equipment and provide test report as part of Turnover of the communications network and ancillary equipment as part of the Turnover to TMS Subcontractor,

f. conduct required FATs for the TMS roadside equipment,

g. develop Level A test procedures for the TMS roadside equipment,

h. conduct Level A and B test for the TMS roadside equipment and provide test report as part of the Turnover of the TMS roadside equipment to TMS Subcontractor for integration, and

i. coordinate and provide MOT to support TMS Subcontractor test activities, including Level C testing, IAT, UAT, Operational Readiness and Start-Up.

2.6.10 TMS Subcontractor Responsibilities

The TMS Subcontractor shall support testing and commissioning phases and activities as follows:

a. develop TTMS Test Strategy and Plan, to provide framework for the test strategy and commissioning strategy for the TTMS, and outlines sequence of testing and commissioning and preliminary schedule and milestone dates and related documentation and responsible and participating parties,

b. develop FAT, and IAT procedures related to TMS and systems integration,

c. conduct FAT, and IAT tests related to TMS and systems integration,

d. support UAT test conduct related to TMS and systems integration,

e. provide FAT, and IAT Test Reports related to TMS and systems integration,

f. support UAT Test Report development related to TMS and systems integration,

g. coordinate with Design-Builder to schedule and conduct Level C and IAT tests related to TMS and systems integration,

h. provide training on the TMS subsystems to Concessionaire personnel, and

i. develop Level B test procedure templates for the TMS roadside equipment.

3 Interface Management Process

Design-Builder and TMS Subcontractor will be responsible for implementing the interface management processes and procedures necessary to identify, control and manage the interfaces and interface points between parties' respective scopes of work related to overall TMS delivery.

These TMS interface management protocols will be used to ensure project stakeholders are aware of the required interfaces, and are working proactively to ensure that integration activities are focused on reducing the potential impacts to the Project cost, schedule, design quality, construction quality, or operations and maintenance of Project NEXT TMS.

3.1 Interface Protocols

Interface management shall include following protocols:

a. Design-Builder Representative and TMS Subcontractor Representative will identify technical representatives for interface activities throughout all phases of delivery, including design, construction, and testing and commissioning and start-up.

b. Design-Builder and TMS Subcontractor will exchange design information on a regular timely basis to facilitate the total project design.

c. Interface requirements and deliverables will be documented and placed under appropriate levels of configuration management, and available to Design-Builder and TTMS, as required.

d. Design-Builder will require TMS Subcontractor input and agreement prior to formal submission of deliverables to Concessionaire for components related to civil works infrastructure and TTMS system interface.

e. Design-Builder and TMS Subcontractor will provide a review period of 15 business days for documents exchanged between parties as part of the Interface Plan to allow adequate time for review, comments and updates by other parties of the agreement.

f. Design-Builder shall provide documentation to TMS Subcontractor a minimum of 1 week (5 business days) prior to scheduled reviews.

g. Design-Builder shall include TMS Subcontractor in scheduled project design reviews that may involve Concessionaire relating to TTMS components and/or interfaces.

3.2 Interface Documents

To facilitate coordination and collaboration between the project stakeholders, a series of interface documents will be developed as part of the project scope of work related to TTMS. These documents will ensure information is being exchanged and jointly coordinated throughout the entire project duration. This section identifies these documents and who is responsible for their respective development and delivery. Documents will typically involve multiple submissions, including draft and final versions.

3.2.1 Concessionaire Documents

a. Concept of Operations for Project NEXT, provided to Design-Builder and TMS Subcontractor

b. Business Rules and Requirements for Project NEXT, provided to TMS Subcontractor

c. Technical Requirements, provided to Design-Builder and TMS Subcontractor

d. TTMS Special Provisions and Equipment Sole Source List, provided to Design-Builder and TMS Subcontractor

e. UAT Test Procedures (Draft and Final) provided to the TMS Subcontractor

f. UAT Test Report (Draft and Final) provided to the TMS Subcontractor

3.2.2 Design-Builder Documents

a. Design-Builder's Project Schedule (e.g., Initial Baseline, Baseline, Regular Updates, and as required, Revised Baseline)

b. Design-Build Plans (Preliminary, Updated, 100% Approved for Construction, Design Changes)

c. TMS Roadside Equipment Asset Database (Preliminary, Regular Updates, Final)

d. TMS Cabinet Factory Review

e. TMS Roadside Equipment Turnover Plan (Draft and Final)

f. WAN Turnover Plan (Draft and Final)

g. TMS Roadside Equipment Level A and B Test Procedures (Draft and Final)

h. TMS Roadside Equipment Level A and B Test Report (Draft and Final)

i. Communications Backbone Test Procedures (Draft and Final)

j. Communications Backbone Test Report (Draft and Final)

k. Civil and TMS As-Builts (Draft and Final), provided to Concessionaire

3.2.3 TMS Subcontractor Documents

a. TMS Subcontractor's Project Schedule (e.g., Initial Baseline, Baseline, Regular Updates, and as required, Revised Baseline)

b. Network High Level Design Document as part of the System Requirements. Provides High Level Architecture, defined in the System Requirements Review.

d. Network Detailed Design Document (NDD), as part of Baseline Design Review

e. Template for TMS Roadside Equipment Asset Database

f. Template for Test Procedures for Level A & B Testing of TMS Roadside Equipment

g. TTMS Test Strategy & Plan

h. Level C Test Procedures for TMS Roadside Equipment

i. FAT Test Procedures (Draft and Final)

j. FAT Test Report and Results (Draft and Final)

k. IAT Test Procedures (Draft and Final)

l. IAT Test Report (Draft and Final)

4 Schedule

The Design-Builder shall consult with TMS Subcontractor when preparing the Initial Baseline Schedule, and shall include therein the specific work elements that the Design-Builder must complete before TMS Subcontractor can commence or complete performance of related elements of the TTMS Work. The Design-Builder shall accommodate the TMS Subcontractor's requests regarding scheduling and timing of TMS Subcontractor access necessary to complete the TTMS Work. Should there be any changes to the construction deadlines related to TTMS Work in the approved Baseline Schedule, the Design-Builder shall accommodate TMS Subcontractor's requests in relation to the revised schedule and use good faith efforts to provide sufficient lead time so as to allow the TMS Subcontractor a reasonable opportunity to work around the delay.

Design-Builder will incorporate, track, and update the following key activities in the Baseline Schedule and subsequent updates.

4.1 General

a. Design-Builder will provide notifications to TMS Subcontractor twenty-one (21) days prior to date of any design or factory reviews.

b. Design-Builder will provide documentation to TMS Subcontractor at least fourteen (14) days prior to scheduled date of design or factory review.

c. Design-Builder's Schedule will include interface milestones in support of the TMS Subcontractor's work. Appendix B includes a minimum list of interface milestones to be included in the Design-Builder's schedule. These activities and milestones will expanded as needed to support Design-Builder's project sequencing and to streamline coordination between Design-Builder's and TMS Subcontractor's work.

d. Turnover of the Communications Network is a predecessor activity to be completed prior to the turnover of TMS roadside equipment.

4.2 Post-TMS Roadside Equipment Turnover Handover Durations

a. Design-Builder will provide the all TMS roadside equipment to the TMS Subcontractor for integration, testing and commissioning no later than one hundred twenty (120) days before the Design-Builder's planned Service Commencement Date. For each day past one hundred twenty (120) days that the TMS roadside equipment is not made available to the TMS Subcontractor, the original allowance of one hundred twenty (120) days from the handover of TMS roadside equipment shall be increased on a "day by day" basis in the Baseline Schedule until the last TMS piece of roadside equipment is turned over to the TMS Subcontractor and ready for the commencement of Integration and Level C Testing of the TMS Scope of Work. All TMS roadside equipment must fully operational and have successfully completed Level A and B testing by this date in order to be accepted by the TMS Subcontractor.

b. Design-Builder may turn over TMS roadside equipment in advance. Early turnover of any or all TMS roadside equipment shall not obligate the TMS Subcontractor to commence field installation sooner than one hundred twenty (120) days before the Design-Builder's planned Service Commencement Date.

Appendix A

Detailed Division of Responsibilities between the Design-Builder and TMS Subcontractor

Traffic Management System

Class	Item	Who	Comment
Operational Configuration	Concept of Operations	CBE	Overall framework for the design and operation of the Express Lanes system (TMS and operations). Provided to DB designer to facilitate design development process.
Operational Configuration	TMS Requirements Layout	TMS	TMS Subcontractor to provide functional and performance requirements for TMS system and TMS roadside equipment. DB designer to finalize design and configuration based on TMS system requirements and overall civil design.
VDOT ITS	VDOT ITS Equipment and Structures	DB	Relocation/Replacement of Existing VDOT ITS roadside equipment and supporting infrastructure
Civil Works	Utilities	DB	Service connections and utility relocations necessary to install and operate TMS roadside equipment and associated infrastructure (e.g., lighting, cabinets, etc.)
Civil Works	Other Civil Works	DB	Necessary drainage, retaining walls, barrier structures, protective structures, and equipment access points.
Civil Works	Foundations for TMS Structures and Other Equipment Structures	DB	Footings and conduits necessary for communications and power cabling as per TMS Subcontractor and DB-provided equipment requirements.
Civil Works	Foundations for TMS Roadside Cabinets	DB	Footings and conduits necessary for communications and power cabling as per DB-provided equipment requirements.

Traffic Management System

Class	Item	Who	Comment
Communications & Cabling	Wide Area Communications Network and Cabling (Communications "Backbone")	DB	Redundant fiber optic telecommunication network along the full length of the Project, connected to all roadside cabinets. Minimum of two connections from this network to Express Lanes Operations Center.
Communications & Cabling	TMS Roadside Cabling	DB	All communications cabling for the TMS devices – from equipment (sensors) mounted on gantries/sign structures/poles/other to the junction box in the footing of the sign structures, then to the cabinets. Terminations of TMS equipment within roadside cabinets.
Electrical Power & Cabling	TMS Roadside Equipment Cabling	DB	Power supply and all distribution cabling and conduits necessary for the operation of the TMS roadside equipment and associated cabinets. Includes conduits and cabling from the junction box located in the footing of gantry to the cabinets. Placement, layout, and sizing of generators to provide temporary operating power and/or uninterrupted power supply equipment. Final design and installation of associated equipment, including site access.
TMS Roadside	Overhead and Dynamic Signage	DB	Quantity, placement, layout, sizing, and configuration of overhead and roadside dynamic message signs. Final design and construction of approved signage. Performance specifications and functional requirements provided by TMS Subcontractor to be confirmed and finalized by DB.
TMS Roadside	Closed Circuit TV Cameras (Pan-Tilt-Zoom and Fixed)	DB	Quantity, placement, layout, sizing, and configuration of CCTV cameras. Final design, installation, and site-testing of approved cameras configuration. Performance specifications and functional requirements provided by TMS Subcontractor to be confirmed and finalized by DB.

Traffic Management System

Class	Item	Who	Comment
TMS Roadside	Automated Incident Detectors	DB	Quantity, placement, layout, sizing, and configuration of AID devices. Final design, installation, and site-testing of approved AID configuration. Performance specifications and functional requirements provided by TMS Subcontractor to be confirmed and finalized by DB.
TMS Roadside	Microwave Traffic Detectors	DB	Quantities, placement, layout, sizing, and configuration of microwave traffic detectors. Final design, installation, and site-testing of approved sensor/detector configuration. Performance specifications and functional requirements provided by TMS Subcontractor to be confirmed and finalized by DB.
TMS Roadside	Network Equipment	DB	Quantities, placement, layout and sizing of Network Equipment. Final design, configuration, installation, and site-testing. Performance specifications and functional requirements provided by TMS Subcontractor to be confirmed and finalized by DB.
TMS Roadside	Wireless Communications Equipment	DB	Quantities, placement, layout and sizing of Wireless Communication Equipment. Final design, installation, and site-testing of approved configuration. Performance specifications and functional requirements provided by TMS Subcontractor to be confirmed and finalized by DB.
TMS Roadside	Sign Structures, Pole and/or Mounting Structures	DB	Placement, layout and installation of: ▪ TMS Sign Structures ▪ Monopoles and/or other mounting structures ▪ Lighting, including power supply Designed per specifications from TMS Subcontractor provided to DB, including clearances, loads, deflection, and specialized installation requirements.
TMS Roadside	Testing and Commissioning	DB	Required testing and commissioning of DB-installed roadside equipment. Includes Level A and Level B Testing.

Traffic Management System

Class	Item	Who	Comment
TMS Roadside	Manuals	DB	O&M manuals for DB-provided equipment and systems
TMS System	TMS Delivery and Integration	TMS	Delivery of TMS, including network and IT infrastructure and commissioning at the Express Lanes Operations Center. Integration of TMS roadside equipment with system. TMS testing, including the conduct of FAT and IAT, as well as UAT support.
TMS Roadside	Testing and Commissioning	TMS	Required testing and commissioning of DB-installed roadside equipment. Includes Level C Testing. TMS equipment and systems at Express Lanes Operations Center to be conducted by TMS Subcontractor.
TMS System	Training	TMS	Training for TMS Subcontractor-provided equipment and systems
Systems Engineering	Network Architecture and Configuration	TMS	Systems engineering for TMS systems, including network architecture, configuration management, system interface control, and systems integration
System Integration	End-to-end Integration	TMS	Development, integration and commissioning of the end to end integrated systems.

Key:

DB = Design-Builder

TMS = TMS Subcontractor

CBE = Concessionaire

Appendix B

Minimum List of TTMS Interface Milestones

1. Commencement of Design - TMS Roadside Equipment Layout and Communications Network
2. TMS Roadside Equipment Design Reviews – BDR, MDR and FDR
3. 100% Design - TMS Roadside Equipment Layout
4. 100% Design - Communications Network
5. Factory Acceptance Testing
6. Level A & B Testing (by Type of TMS Roadside Equipment) - Start and Finish
7. TMS Roadside Equipment Turnover Dates (by Type of TMS Roadside Equipment)