

I-595 RFP Volume II - Technical Requirements
Division II, Section 3, Attachment 2
FTE's Tolling Infrastructure Support Requirements



Florida Department of Transportation
District 4

To Design, Build, Finance, Operate and Maintain
The I-595 Corridor Roadway Improvements Project
Final Version for Execution

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Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans With Disabilities Act
ANSI	American National Standards Institute
APWA	American Public Works Association
AVI	Automated Vehicle Identification
AWG	American Wire Gage
Cat6	Category 6
CCTV	Closed-Circuit Television
Cfm	Cubic Feet per Minute
DVR	Digital Video recorder
EIA	Electronic Industries Alliance
ETC	Electronic Toll Collection
FACBC	Florida Accessibility Code for Building Construction
FTE	Florida's Turnpike Enterprise
HDPE	High Density Polyethylene
HVAC	Heating, Ventilation and Air Conditioning
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITN	Invitation to Negotiate
LAN	Local Area Network
MOT	Maintenance of Traffic
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
ORT	Open Road Tolling
RFI	Request for Information
RFP	Request for Proposal
RU	Rack Units
SAE	Society of Automotive Engineers
SCADA	Supervisory Control And Data Acquisition
SMFO	Single-Mode Fiber Optic
SNMP	Simple Network Management Protocol
TCPIP	Transmission Control Protocol/Internet Protocol
TEC	Tolling Equipment Contractor
TIA	Telecommunication Industry Association
TPPPH	Turnpike Enterprise Plans Preparation and Practices Handbook
UL	Underwriters Laboratory
UPS	Uninterruptible Power Supply
WAN	Wide Area Network
WGU	Wire Grounding Unit

1.0 GENERAL REQUIREMENTS

1.1 Introduction

This document is intended for use by the Concessionaire in order to provide Florida's Turnpike Enterprise's (FTE) SunPass Open Road Tolling (ORT) infrastructure for the collection of tolls on the I-595 Express Lanes by FTE Toll Operations.

The specifications and requirements defined in this document establish criteria for the design and construction of all Tolling Infrastructure necessary to support FTE's SunPass ORT system.

The Concessionaires responsibility is to provide the required Tolling Infrastructure. This includes but is not limited to: gantries, associated signing, Tolling Equipment support buildings and related civil work, generator, communications, and utilities.

FTE's responsibility is to furnish, install, test, operate and maintain all SunPass ORT equipment. This includes but is not limited to: antennas, readers, vehicle separators/profilers, cameras, pavement loops, communication cabling, computer hardware, and Tolling Equipment racks.

1.2 General Information

Section 1 of this document relates to defining the expectation and responsibilities of the Concessionaire and those of FTE. This section provides details on the tolling infrastructure to provide the Concessionaire with a better understanding of what should be provided to be consistent with FTE's statewide Toll Operations.

Section 2 of this document provides design elements for toll infrastructure.

Section 3 of this document provides the minimum requirements and governing regulations of the tolling infrastructure.

Section 4 of this document provides design criteria that can be used by the Concessionaire.

Section 5 of this document provides criteria for construction of the tolling infrastructure.

Operations and Maintenance Requirements shall be addressed in Volume II, Division II, Section 4 – O&M Requirements portion of the RFP documents.

1.3 Use of SunPass Electronic Tolling

The Project shall use SunPass as the means of Electronic Toll Collection (ETC), with the requirements for the tolling infrastructure to support the operation of FTE SunPass ORT equipment. Failure to follow the requirements of this document could result in the inability to install the Tolling Equipment, degradation of equipment performance, additional costs in equipment installation and or maintenance. Failure to follow the provisions of this document could result in FTE not allowing the implementation of the SunPass ORT equipment. SunPass is a registered trademark of the FTE. The use of name, logo or reference to SunPass is restricted to those that have formed binding legal agreements with FTE.

The Concessionaire shall provide the tolling infrastructure as defined in this document and through coordination with FTE, to support the installation of SunPass ORT equipment. FTE shall provide design for the toll gantry and Tolling Equipment support building for the Concessionaire's use if desired. If not, improvements shall include, but not be limited to the design and construction of tolling gantries and companion equipment buildings for the mounting and housing of FTE's ORT tolling equipment as well as a communications network to support the data processing needs of the SunPass ORT system.

1.4 Coordination

Enhancements, modifications, and obsolescence of tolling equipment technology are common place and should be expected on every project. Therefore, some items in this document may need modification as technology changes or may require more detailed descriptions as the tolling infrastructure design progresses. It is critical and required that the Concessionaire following this document have extensive and frequent communication with FTE, especially with FTE Toll Operations. Required communication begins at the Project conceptual phase and continues on through the construction of the tolling infrastructure until the Project is open to traffic and all final punch list items have been completed by the Concessionaire. Communication should at a minimum include coordination meetings, requests for information, field visits, and plan submittals between FTE and the Concessionaire. The Concessionaire shall allocate at a minimum 21 consecutive calendar days for FTE to review and provide comments on each of the Concessionaire's phase submittals of concepts, plans, and other applicable documents in conjunction with the District's required review phases.

The signature gantry is the preferred gantry. Should the Concessionaire choose to use a custom designed gantry, then additional coordination and time shall be required for the new design beyond the standard time frames. A custom design shall meet or exceed all of the operational, aesthetic, safety, and access for toll maintenance personnel requirements provided by the standard signature gantry. Technical Special Provisions (TSP) applicable to a design other than the FTE Signature Gantry shall be the responsibility of the

Concessionaire, and shall meet all functionality and requirements contained within the TSP's for the Signature Gantry.

1.5 Tolling Equipment

FTE's Tolling Equipment Contractor (TEC) shall furnish, install, and test all Tolling Equipment on the gantry, in the pavement, and in the Tolling Equipment building, including but not limited to: antennas, readers, vehicle separators/profilers, cameras, pavement loops, communication cabling, computer hardware, and Tolling Equipment racks.

2.0 Design Elements

The tolling infrastructure elements as discussed herein shall be provided by the Concessionaire and coordinated with FTE.

- Tolling Site Location
- Gantry design, if Concessionaire proposes an alternative
- Fiber Reinforced Concrete Pavement
- Roadway Infrastructure
- Equipment Buildings
- Generator
- Communications
- Electrical
- Signing
- Accessibility

2.1 Tolling Site Location

The Tolling Site Location is where the tolling gantry is located and its immediate surrounding area. The Tolling Site Location shall be primarily placed to ensure optimum performance of the Tolling Collection System. To optimize the performance and operation of the Tolling Equipment, the Tolling Site Location shall have the following characteristics:

- Tangent roadway section - cross slope meets the requirements of FDOT PPM
- Curve roadway sections – Super elevation shall not exceed 4.2%
 - 3.33% (Maximum for four 12' lanes with two shoulders)
 - 4.17% (Maximum for two or three 12' lanes with two shoulders)
- Application of cross slope is from outside edge of travel to outside edge of travel
- Consult with FTE Toll Services for any slopes greater than 4.2%
- At grade roadway section preferred
- Roadway section in which uniform vehicle speeds above 45 mph are expected

- Constant roadway lane widths, (i.e. not merge or diverge roadway sections)
- Support horizontal and vertical alignment for unobstructed driver vision of the tolling point
- Support the installation of a non-steel reinforced concrete pavement section of 120'
- Support safe access of maintenance vehicles and personnel
- Support the construction and operation of a Tolling Equipment building. The maximum cable length between tolling gantry and the roadside racks in the equipment building is not to exceed 250'
- Site free from environmental concerns such as proximity to other large power sources, or communication towers. Failure to avoid this shall be brought to the attention of FTE such that a radio frequency spectrum analysis can be performed by the FTE TEC

A conceptual location has been identified for the I-595 project by FTE. This location, shown in the Indicative Preliminary Design (Line and Grade Concept) in the Reference Documents to this RFP package, is west of Flamingo Road and east of the westbound exit Ramp R-6. The Concessionaire may identify other suitable locations for coordination with FTE, if available. FTE shall approve any changes to the conceptual location and configuration as depicted in the Indicative Preliminary Design.

2.2 Gantry

Gantries provide for the physical attachment of Tolling Equipment as well as providing a visual indication to the customer of where the toll collection occurs.

The gantry structure and associated equipment bracketing must be sufficiently rigid or stiff to prevent excessive movement of Tolling Equipment and manufactured with material that is not susceptible to degradation by the elements or will interfere with the collection of electronic tolling. The structure must be able to resist movement of the camera/structure from forces related to wind, vibration or up drafts of wind from vehicles passing below.

The Concessionaire shall be responsible for locating the gantry and setting the critical work point elevations. All gantries shall have at least 20' of vertical clearance and 18'-18.5' vertical clearance to the lowest overhead Tolling Equipment. The gantry(s) must be 90 degrees to the lane striping under the gantry. Gantries must provide 12' longitudinal separation for the staggered mounting of the approach and departure sets of overhead Tolling Equipment.

The Concessionaire shall deploy the FTE Signature Gantry structure, or an equivalent structure that shall be approved by FTE, for the I-595 Express Lanes. The structure is composed of an overhead enclosed platform housing Tolling Equipment, which permits maintenance over non-stopping live traffic. The main characteristics and uses of the signature gantry are as follows:

- Maximum span width of 80' supports up to 4 Express Lanes and 2 shoulders
- Optional configurations are: dual column-supported
- Signature gantry provides 12' separation
- Maintenance is done over live traffic without lane closures and impacts to traveling public; reduced MOT costs associated with Express Lane closures; avoid closing lanes that cannot be easily closed for maintenance
- Supports reversible traffic locations
- Locations that warrant full camera or shoulder coverage

FTE has a standard signature gantry design. FTE will modify the standard design to meet the requirements for the Project. The Concessionaire shall site adapt the gantry to the proposed gantry location. The current location shown on the line and grade concept in the Reference Documents will require the use of an 80' span gantry (standard design). In the event that the Concessionaire changes the location of the gantry the span length could change. The standard gantry design has been modified by the FTE to incorporate the reversibility requirements for the installation of Tolling Equipment for eastbound and westbound toll collections. In addition to these modifications the Concessionaire shall provide a maintenance lift attached to the gantry for use of FTE Tolling Equipment maintenance personnel to access the gantry to perform maintenance of the Tolling Equipment. The lift shall be Alpha Manufacturing, Inc (AMI) model No. 1341 (Contact: Robert J. Hilsky at 407-293-6337) or an approved equal.

The FTE has provided 90% design plans to the Concessionaire for the standard gantry design and Tolling Equipment building. These plans are included in the Reference Documents. Upon selection of the final site location and confirmation of the span length, final plans for the standard signature gantry shall be provided by FTE. Concessionaire is responsible for site adaptation. Technical Special Provisions (TSP) shall accompany the Final Design plans.

If alternative gantry design is proposed by the Concessionaire, the Concessionaire shall be responsible for all plans preparation efforts for the Project.

2.2.1 Gantry Tolling Equipment

All Tolling Equipment will be furnished and installed by FTE's Tolling Equipment Contractor. The Concessionaire shall provide the structural support and bracket arms as shown on the standard drawings such that the TEC can attach the required equipment to the gantry. The Tolling Equipment shall be located on the gantry and include, but not be limited to the following:

- AVI antenna panel
- AVI reader module

- Closed circuit TV camera for security / remote observation / diagnostic troubleshooting
- Violation Enforcement System Camera
- Violation Enforcement System Illuminator, and light sensor
- VDAC (Vehicle Detection and Classification) overhead laser profiler

2.3 Roadway Infrastructure

The pavement section beneath the gantry will contain a series of sensitive inductive loops that assist in the overall tolling system functionality. These loops track, classify and determine the right time to photograph a vehicle for violation or video tolling enforcement. In order not to interfere with the inductive loop functionality, FTE requires the following:

- The pavement shall be concrete and:
 - Durable to ensure long life of loop systems
 - Light in color to optimize the performance of the VDAC overhead laser profiler
 - Appear as a unique section of the roadway to stand out as a tolling location
 - Designed using fiber reinforcement and fiber mesh
- Concrete pavement length shall be a minimum of 120' for lanes/shoulders (See Appendix A.2)
- The concrete pavement section shall not contain any steel, (reinforcing bar, mesh or dowels), nor shall any electro-magnetic field emitting wiring/cabling be located below the concrete slab
- The concrete pavement loop conduit layout shall be per Attachment A.2 “Loop and Conduit Layout”. The loop and conduit layout identifies the desired joint locations to avoid conflict with pavement loops, as well as conduit pop-up locations/sizes, and pull box quantities/locations
- The Concessionaire shall be responsible for the concrete pavement design and shall submit the design to FTE for review and concurrence
- Loops shall not be placed in bridge decks due to the large amount of steel

2.4 Equipment Buildings

The Concessionaire shall provide a secured building or structure suitable for housing the Tolling Equipment at the closest possible location (within 250', as described herein) to the toll gantry. The Concessionaire shall provide all electrical service and communication cabling from the gantry up to and into the equipment building. The building shall be environmentally controlled and will be monitored by FTE SunWatch. The building may be designed with either slab or raised flooring. For slab flooring, the conduits coming into the building shall terminate directly underneath the rack or be transitioned into overhead cable trays. For raised flooring, the conduit shall terminate directly underneath it. The number and

size of conduits shall not be changed. Building Layout and Conduit Requirements shall be as shown in the Tolling Equipment building plans provided by FTE. Any alternative design proposed by the Concessionaire is subject to FTE review and approval.

FTE will provide design of a standard Tolling Equipment building for Concessionaire use if desired. The Concessionaire may propose a modular building that conforms to stated functional requirements herein, subject to FTE and FDOT District Four approval.

2.5 Communications

All communication infrastructure and connectivity shall be provided by the Concessionaire. This includes a high-speed fiber optic network that connects the tolling location to nodes in the FTE toll collection network. The Concessionaire shall dedicate one buffer tube (Black Buffer), 12-strands of Single Mode Fiber Optic Cable, in each 96-strand backbone and inter-connect cable for FTE tolls use only.

FTE will provide and install all end communication equipment necessary to connect to the tolling system.

Reversibility

The Concessionaire shall develop, test, and implement a command and control specification for switching the Toll Collection System equipment's active direction of toll collection between eastbound and westbound directions. This command and control specification will require coordination with the FTE TEC through FTE Toll Operations and shall allow the TMC operators to check the status of lane controller at the tolling gantry and initiate processes resulting in a directional change to tolling. Topics to be coordinated include, but are not limited, to messaging protocols, content, and lengths; acknowledgement protocols; periodic polling for direction confirmation; subsystem health; and CRC (Cyclic Redundancy Check) checking.

Hardware

The Concessionaire shall provide and install all hardware for the communication backbone up to the communication equipment for the Toll Collection System. FTE's Tolling Equipment Contractor will provide and install necessary communication equipment to connect the Toll Collection System to the provided communication network. FTE requires the Concessionaire to complete the communication system such that it is operational prior to FTE's TEC 45 day effort to connect the communication system to the Toll Collection System.

Cabling

The Concessionaire shall provide all ITS communication cabling to integrate the Tolling Equipment building and the I-595 fiber optic backbone.

All toll communication cabling required between the equipment on the gantry and the Tolling Equipment building will be provided and installed by FTE.

Conduit

All conduit and cable trays required by all disciplines as defined in these requirements shall be provided by the Concessionaire.

2.6 Electrical

The Concessionaire shall provide all electrical service to the equipment building and gantry. The Concessionaire shall provide a backup generator for uninterrupted electrical service in the event of electrical service failures. The Concessionaire shall furnish, install, and maintain the backup generator system. FTE will install and maintain a UPS as part of the Tolling Equipment to provide conditioned back-up power in case of short duration electrical outages.

Revenue losses due to power outages and generator failure shall be the responsibility of the Concessionaire.

2.7 Signing

Signing related to the tolling shall be coordinated with FTE. The SunPass logo is a registered trademark and use of it is restricted requiring FTE approval. The reversible I-595 gantry must include display of two SunPass sign panels, one on each side of the gantry as shown in the standard plans. Other signing relating to the toll amounts and violation penalties must also be provided.

Should Concessionaire provide a custom gantry design, the size and placement of the SunPass logo shall be coordinated with FTE staff.

The ingress signing sequence containing the toll rate message, should be consistent with the sign layout for the I-95 Express Lanes facility. Appendix A.1 is representative of current ingress signing sequence for the I-95 Express Lanes. It shall be the Concessionaire's responsibility to coordinate the final sign design for I-595 with the I-95 Express Lanes project so as to minimize driver confusion.

2.8 Accessibility

The building shall be placed in location consistent with FTE design criteria and located as identified in the line and grade conceptual plans included in the Reference Documents. The buildings shall be accessible by maintenance vehicles as described later in this document.

3.0 MINIMUM REQUIREMENTS

3.1 Governing Regulations

The services performed by the Concessionaire shall be in compliance with all applicable Manuals and Guidelines included but not limited to those listed herein.

The most stringent criteria contained in any of the items defined as Contract Documents shall govern the design and construction. The Department reserves the right to interpret what constitutes the most stringent criteria within the Contract Documents.

3.1.1 Industry Standards

The components used by and workmanship completed by the Concessionaire shall be in accordance with industry standards. All components, supplies, installations and testing shall comply with the criteria defined in this document, the latest editions of the following standards, as applicable, and all other applicable standards and requirements:

- Bellcore Technical Advisories and technical requirements
- Florida Department of Transportation / Florida State University – Traffic Engineering Research Laboratory (TERL) - <http://potentia.eng.fsu.edu/terl/>
- FDOT Management Information Base (MIB) requirements
- FDOT Standard Specifications for Road and Bridge Construction dated 2007 including all supplemental specifications (online edition)
- The FDOT Minimum Specifications for Traffic Control Signals and Devices (MSTCD)
- The FDOT Roadway and Traffic Design Standards
- The Manual of Uniform Traffic Control Devices (MUTCD)
- The American Society of Testing and Materials (ASTM) standards
- Institute of Electrical and Electronic Engineers (IEEE) standards
- International Standards Organization (ISO) standards
- The American National Standards Institute (ANSI)
- The National Electrical Manufacturer Association (NEMA)
- The Underwriters' Laboratories (UL)
- The National Board of Fire Underwriters
- The Electrical Testing Laboratories (ETL)
- The Electronic Industries Association (EIA)
- The National Electrical Code (NEC)
- The Joint Electronic Device Engineering Council (JEDEC)
- The Radio-Electronics-Television Manufacturers Association (RETMA)
- The Lightning Protection Institute (LPI)

- The Rural Electrification Administration (REA)
- The International Radio Consultative Committee (CCIR)
- The International Telephone and Telegraph Consultative Committee (CCITT)
- The American Standard Code for Information Exchange (ASCII)
- The National Television Systems Committee (NTSC)
- The International Telecommunications Union (ITU)
- The Motion Picture Experts Group (MPEG)
- The Bureau of Radiological Health – Optical Radiation Hazard Specifications
- National Transportation Communications for ITS Protocol (NTCIP)
- The Telecommunications Industries Association (TIA)

If there is a conflict, the most stringent requirement shall apply to this project.

4.0 DESIGN CRITERIA

The following section is intended to be used for the development of design-build plans for the tolling facilities.

4.1 General

All gantry and gantry related design drawings and specifications other than the signature gantry are the responsibility of the Concessionaire.

4.1.1 Project Plans

All plans (including all component plans) and design are to be prepared in accordance with the latest standards in the following hierarchy: Turnpike Enterprise Plans Preparation and Practices Handbook (TPPPH), the Department's Roadway Plans Preparation Manual, and AASHTO. Deviations from this hierarchy must be approved in writing by the Department.

4.1.2 Project Specifications

The Department's Standard Specifications, Department's current memorandums, and the current editions of the Department's *Roadway Plans Preparation Manual* as amended by the TPPPH, Department's Flexible Pavement Design Manual, Department's Drainage Manual shall be used in the preparation of Design Documents. Plans and design documentation shall be accurate, legible and complete in design, drawn to the appropriate scale, and furnished in reproducible form on material acceptable to the Department.

4.1.3 Architecture

The Concessionaire shall prepare an Architectural Plans Package if an alternative building to the standard Tolling Equipment building provided with the signature Gantry Plans is proposed. This work effort includes the architectural design and structural analysis to complete the set of Architecture Plans, Structural Plans, Electrical Plans, Mechanical/Plumbing Plans and other necessary documents to provide a complete turnkey and seamless implementation. Plans shall be prepared in accordance with the latest standards of the Florida Building Code.

All building plans and design shall be prepared in accordance with the Florida Building Code, latest edition, including the applicable requirements of Florida Accessibility Code for Building Construction (FACBC) and Americans With Disabilities Act (ADA), the Department's current design standards, practices and requirements, and shall be accurate, legible, complete in design, drawn to appropriate scales and furnished in reproducible form. The Final Alternative Design Documents shall be submitted for FTE and FDOT District Four approval.

4.2 Gantry

Vehicle sensors and express lane CCTV monitoring and Tolling Equipment shall be mounted on overhead gantries, as defined in this criteria document and noted in the attached details. Design and construction of the gantries shall adhere to the minimum design and construction criteria as defined within this document.

It is the Concessionaire's responsibility to fabricate, and erect a gantry structure as shown on the FTE's provided plans or to design, engineer, fabricate and erect a gantry as shown on the Concessionaire's Construction Documents. The gantry shall have a wind effective projected area, geometry type, and features as depicted on the drawings and additional bracing or struts shall be added as deemed appropriate and at the discretion of the specialty Engineer of Record. All drilling tapping and anchors required for the erection shall be included in this work unless otherwise noted.

4.2.1 Vertical Clearance

The gantry shall have at least 20' of vertical clearance. Clearance between pavement and the Tolling Equipment shall be between 18'-18.5' over every lane, taking into account roadway superelevation. Maintaining vertical clearance requirements shall be attained by altering equipment arm lengths on the signature gantry.

4.2.2 Longitudinal Footprint

The overhead structure shall provide for a staggered pattern of overhead equipment. This staggered pattern requires the first set of equipment to be 12' in front of the second pattern. The leading first set is situated over the lane lines and the trailing set is centered on the lanes.

4.2.3 Rigidity

The gantry structure and associated equipment bracketing must be sufficiently rigid or stiff to prevent excessive movement of Tolling Equipment. The structure must be able to resist movement of the camera/structure from forces related to wind, vibration or up drafts of wind from vehicles passing below.

The overall structure, as well as individual equipment supports, shall provide rigidity preventing the attached cameras from vibrating with a velocity exceeding 10 inches/second in any direction.

4.2.4 Equipment Supports

The equipment supports shall be as rigid as the structure with no movement or torsion at the connection points and shall have sufficient bracketing connections to position equipment over each and every lane, lane line, and shoulder.

Tolling Equipment bracket fasteners should be provided with locking devices such that they cannot be loosened over time. All brackets and associate mounting hardware must be made from material that is conducive to the environment in which it is to be installed. Material shall not be susceptible to degradation by the elements or interfere with the collection of electronic tolling. The materials for all bracketing and fasteners shall be approved by FTE. The Concessionaire shall coordinate with FTE to obtain the necessary information about the equipment such that these fasteners can be included in the design.

Structure and/or bracketing connections shall be supplied that allow the low edge of the antenna to be no less than 18'-0" and no more than 18'-6" above the pavement. The Vehicle Detection and Classification (VDAC) laser beam shall originate approximately 23' above the pavement. The VDAC emits two beams (in profile view) with 10 degrees of separation, beam #1 vertical and beam #2 10 degrees in front of beam #1. Each beam encompasses a 30 degree arc (in elevation view). These beams shall not be obstructed below the VDAC unit.

4.2.5 Wiring

Cable trays, chases, and concrete encased conduits shall be provided by the Concessionaire, to allow the wiring to/from the overhead equipment to the equipment building.

The maximum cable distance between the overhead equipment and the AVI readers is 80'. This distance becomes critical when the readers are not physically mounted overhead, but mounted either on the gantry column or stored in the equipment building. The maximum cable length between tolling gantry and the roadside racks in the equipment building should not exceed 250'. Duct sizing and quantity shall be determined during design via coordination between FTE and the Concessionaire.

4.3 Roadway Infrastructure

The Concessionaire shall provide general roadway infrastructure modifications and improvements in order to implement Express Lanes as per the criteria defined in this section and per attached documents.

4.3.1 Loop Detection

The “smart” inductive loop arrays will be provided by FTE’s TEC. The loops will be saw cut in the cured concrete pavement by FTE’s Tolling Equipment Contractor. The design requires sets of equipment triggering and axle counting loops. Seven (7) sets of loops are required to accommodate I-595’s reversibility, plus the axle loops. The Concessionaire shall follow the criteria listed in Section 2.3, Roadway Infrastructure.

4.3.2 Conduit

All underground conduit runs shall be smooth wall, High Density Polyethylene pipe (HDPE). The HDPE pipe shall meet or exceed SDR 11 standards and the requirements as set forth in Sections 555, 557, and 783 of the FDOT Standard Specifications for Road and Bridge Construction, dated 2007, as amended. All communications conduits shall adhere to all applicable standards and specifications as defined by the Department.

The Concessionaire shall furnish conduits for lateral connections between the equipment building and ORT devices as defined in this document.

4.3.3 Pull Boxes

The Concessionaire shall install a minimum of one (1) fiber optic pull box with one (1) WGU pull box adjacent to the equipment building to facilitate the installation of fiber optic cable in and out of the equipment building from a fiber optic splice box as well as the gantry equipment. All pull boxes shall come with a reinforced concrete apron.

The Concessionaire will also be required to design and construct all required conduits and cabling infrastructure necessary to provide interconnection between the fiber optic mainline trunk and the equipment building, and between the gantry equipment and the equipment building.

All splice box, pull box and conduit design and construction shall strictly adhere to all applicable standards and specifications as defined by the Department.

4.4 Equipment Buildings

The roadside computer equipment (provided by FTE) shall be housed in the equipment building located at or near the base of the gantry. The equipment building shall provide an environmentally controlled facility for providing optimal equipment operating conditions and be fully accessible by FTE toll maintenance personnel. Volume II, Division II, Section 3, Attachment 1 – ITS Deployment Requirements details specific requirements for the

equipment buildings.

The equipment building shall be located such that the length of all copper CAT 6 cable installed from the equipment in the equipment building to all sensor and equipment terminations on the gantry served by that room should not exceed 250' in length.

4.4.2 Site

The equipment building shall not be located adjacent to areas that may be subject to the infiltration of water, steam, humidity, heat or other adverse atmospheric or environmental conditions. Avoid locations that are below water level or near ponding water as a result of rainfall events.

The equipment building shall be located away from sources of Electro Magnetic Interference (EMI) including electrical power supply transformers, motors, generators, Magnetic Resonance Imaging (MRI) and X-ray equipment, radio transmitters, radar transmitters, and induction heating devices to reduce interference with the communications cabling. The equipment building should not be adjacent to sources of constant, excessive, low or high frequency noise, such as air-handling equipment, pumps, generators, and the like.

Equipment and utilities not specifically required for the equipment building, including utility pipes, wiring, cabling, duct work or other electrical equipment shall not be located in or pass through the equipment building. This includes running through the equipment building ceiling or the under the equipment building.

4.4.3 Facility

General Configuration

The required general layout of the equipment building is presented in the Gantry Plans.

The two room layout is for the purpose of having a separate access for the Concessionaire for maintenance of the AC. If security is a concern, the Concessionaire may modify the design layout to house the generator.

For security purposes, the Tolling Equipment side of the building shall not be accessible to the Concessionaire, unless accompanied by FTE personnel.

Doors

Each of the two separate rooms that make up the equipment building shall have separate access doors swinging outward. Each door shall be made of steel with a cast-in steel frame. Each door shall be controlled by card access and have CCTV monitoring.

All doors and conduit openings shall be suitably protected and sealed to prevent the ingress of water, moisture, dust and wind driven rain.

Anti-Static

Anti-static pads shall be installed at the base of the front and rear of communication rack.

4.4.4 Conduit Entrance

All cabling required internally for the equipment building shall enter through the building floor slab in specifically located and sized conduit stub-outs. FTE has created a standard conduit entrance detail, which is presented in the Gantry Plans.

The Concessionaire shall incorporate all other conduit including, but not limited to lightning protection, mechanical, power, etc.

The conduits entering the building shall have plastic bushings (or comparable material) to prevent cables from being damaged when being pulled through conduits or shifting during use.

4.4.5 Equipment and Communication Racks

Tolling Equipment Racks

All Tolling Equipment related racks will be furnished and installed by FTE. Please see the Gantry Plans for number, sizes, and positioning of all FTE provided racks.

Communication Rack

All communication racks will be furnished and installed by the Concessionaire. Communications equipment and support hardware such as a fiber optic patch panel power supplies, UPS, and field switch shall be installed in Concessionaire furnished 19" EIA equipment racks (EIA 310-D, IEC 60297 and DIN 41494 SC48D), and configured in the equipment building as shown in the Gantry Plans. The Concessionaire furnished communications rack shall support 42 units and be 40" deep and include all mounting accessories and anchoring. This shall include side panels, front and rear doors, grounding, cable management, fans, power with power strips on its own service breaker, and any other material to make a complete communications rack. The Concessionaire shall provide a junction plate at the top of equipment rack and required cable runway to attach rack to cable trays.

Rails

The Concessionaire provided racks shall include adjustable front and rear equipment mounting rails. The equipment mounting rails shall be #12-24 or cage nut square opening style mounting. The adjustable equipment mounting rails will include printed rack unit numbering from top to bottom. The front and rear structural posts of the racks shall be capable of mounting vertical cable managers.

Mounting

The Concessionaire shall provide a metal frame for the mounting of all racks (FTE and Concessionaire's provided). The completed frame shall be affixed to the floor using drop-in anchors and 5/8" zinc-plated hex bolts, split and nonconductive flat washers.

Concessionaire supplied floor mounted open racks shall be secured from the top rail to the backboard in the room with a length of cable runway to prevent movement.

Concessionaire shall coordinate and receive approval from FTE prior to final installation.

Communication Rack Accessories

Power Strips

The Concessionaire provided Communication Rack shall include an integrated power strip. Power strips shall be NEMA compliant using straight blade or twist lock plug and shall be vertically or horizontally mounted. Power strips shall be 10, 16, 20 and 24 outlet options with 10' cords. Receptacles must be standard duplex or IEC. The power strips shall have black powder-coated finish. The vertical or horizontal power strip shall have 15, 20, and 30 A circuits and shall be capable of mounting directly to the rack or cabinet using mounting hardware or tool-less feature.

Shelves

Rack mounted shelves shall be one, two and three rack spaces and 19" wide. The shelves shall be front mounted, slide out or cantilevered versions.

Fans

The fans shall provide up to 300 cubic feet per minute (cfm) of exhaust.

Rack Frames

All rack frames shall be constructed of 12-gauge, cold-formed steel. All side panels and door panels shall be constructed of 14-gauge steel. The vented base shall be constructed of 16-gauge steel. The 19” electrical rack angles shall be constructed of 12-gauge steel.

Doors

All doors shall be equipped with grounding brackets and doorstop kits. Door hinges shall have a maximum opening range of 130-140 degrees. Hinge kits shall permit left or right side mounting. The racks shall be furnished with tamper-proof hinges and removable hinge pins.

The rack shall be provided with flush swing handles with tamper resistant locks on all doors. All locks shall be keyed to the same key with two sets of keys provided for each unit. Locks shall have a three-point latch mechanism.

Wall Panels

Solid side panels with hanger tabs shall be provided for easy alignment and assembly. Vents on front and rear panels shall be provided, along with wire entry access plates with dust-tight seals.

One metal shelf kit shall be furnished and installed per each rack unit. Each shelf shall be full width and depth of the rack angles and attach directly to the rack angles. One metal keyboard slide out drawer shall be furnished and installed per each rack unit.

Spare Equipment Racks

The Concessionaire shall follow the racking system configuration so that it allows for space for future equipment racks, as show in the Gantry Plans.

Conduit stub outs for these spare equipment cabinet locations shall be installed as noted in the detail sheets and properly capped for future use.

4.4.6 Cabling

The Concessionaire shall provide and install copper Ethernet cabling, where applicable, for interconnecting various hardware in an Ethernet network located in the equipment building. Additionally, the Concessionaire shall provide and install all items found in this section.

The Concessionaire shall furnish SMFO pigtails, Corning CCH-CP12-59-PO3RH with each interconnect center and shall provide pigtails containing connector panels that are a maximum of 6’ in length with a factory-assembled SC type connector on one end. Ensure SMFO pigtails meet the operating characteristics of the SMFO cable with which it is to be coupled.

Furnish duplex SMFO jumpers that are a minimum of 3' in length with factory-assembled SC x LC type connectors. Ensure SMFO jumpers meet the operating characteristics of the SMFO cable with which it is to be coupled.

Connectors

Provide RJ-45 connectors with gold wire conductors terminated according EIA/TIA-568-A/568-B standards. Provide connectors with eight contacts. Furnish connectors rated for Category 6 cable. Provide connectors with plastic bodies and with a NEXT of a Category 6 connector is 54 dB.

4.4.7 Cable Management

LAN Patch Panel

Furnish Category 6 LAN patch panel as shown in the plans. Provide a rack mounted panel occupying one rack unit. The patch panel shall meet TIA/EIA-568-B.2-1 Category 6 and ISO 11801 Class D standards. Furnish UL listed panels. The field wiring shall terminate on rear punch down blocks. All ports shall be RJ-45 eight-wire jacks.

Interconnect Center

Furnish compact, modular interconnect centers designed for rack mounting in equipment cabinets. Use Corning Preitum Housing PCH-04U 144 fiber interconnect. Provide splice trays that hold, protect, organize optical fibers, and secure fibers inside splice tray. Design and size the splice trays to be dielectric, to accommodate all fibers entering splice tray, and to provide sufficient space to prevent microbending of optical fibers. Provide connector panels with either SC or connectors.

Horizontal Cable Management for Equipment Racks

Horizontal Cable Management Panels shall be molded out of plastic and incorporate bend radius control throughout the fingers, pass through holes, and transitions between horizontal and vertical pathways. Front hinged cover shall open 180 degrees in up or down position. The panels shall mount to any standard EIA 19" rack.

Vertical Cable Management for Equipment Racks

The vertical cable manager shall be capable of mounting to EIA racks to manage cables on the front and rear of the rack. The manager shall be molded out of plastic and possess cable management fingers and pass through holes. The fingers shall provide integral bend radius control and be spaced so that the gaps between the fingers align with EIA rack spaces. The pass through holes shall provide bend radius control and slots that can be used for securing of

cable straps. The vertical manager shall have a dual hinged cover that can be opened to the left or right 110 degrees. The manager shall be able to accept wire retainers that can be snapped on to the cable management fingers.

Cable Trays

All horizontal cabling installed above the top elevation of equipment racks shall be placed in 12” cable trays. The cable trays shall be suspended from the ceiling and attached by bolted connections. All cable trays shall be located as shown in the equipment building detail sheets unless otherwise approved by FTE.

Provide splice trays that hold, protect, organize cables, and secure cables inside splice tray. Design and size the splice trays to be dielectric, to accommodate all fibers entering splice tray, and to provide sufficient space to prevent microbending of optical fibers.

4.4.8 Environmental

The buildings shall be furnished with two (2), heating-ventilation-air-conditioning (HVAC) units equipped with lead/lag control unit to periodically switch between the primary and secondary unit. The HVAC unit shall be sized as required for the equipment building size and equipment normal operation temperature requirements. Provide HVAC MODBUS TCPIP or BACnet/ip communication bus for eventual connection to FTE SCADA system.

4.4.9 Security

Security management system for the equipment building shall be provided by the Concessionaire.

1. The system shall be modular in nature, and will permit expansion in both capacity and functionality through the addition of controllers, card readers, workstations, or by increasing the number of cards and sensors.
2. The system shall incorporate the necessary hardware, software, and firmware to collect, transmit, and process alarm, commercial power loss, tamper and trouble conditions, access requests, and advisories in accordance with the security procedures of the facility. The system shall control the flow of authorized personnel traffic through the secured areas of the facility.
3. The system shall be fully integrated to the FTE’s existing Johnson Controls P2000 security server via WAN TCPIP connection. The Concessionaire shall furnish, install and maintain one (1) terminal controller for I-595 Tolling Equipment building. The terminal controller

shall be the Cardkey CK722 network controller (or approved equal), or the most recent released version of the aforementioned model. Equal must be fully compatible with FTE's Johnson Controls P2000 host without need for special or custom software or firmware.

4. The card reader shall be model iClass R40 (or approved equal).
5. The equipment building shall require (1) one S300-DIN-RDR2S 2-Door interface with Supervised Inputs (or approved equal). Equal must be fully integrated to CK722 controller without need for special or custom software or firmware.
6. Door locking hardware shall consist of US32D finish electric strike. Strike shall be fail secure 12 VDC continuous duty solenoid. Door outside trim shall be US32D finish with fixed lever handle and key cylinder momentary latch retract behavior (cannot be keyed to remain unlocked). A US32D latch guard shall be required to prevent access to latch bolt from the outside. Through bolt fastening is required.
7. CCTV Requirements I-595 Express Lanes' facilities
 - i. Cameras shall be located for viewing the exterior of the building doors and the building interior areas
 - ii. Video recording equipment shall consist of (1) eight channel Johnson Controls DVN 5000-IP (Version 2.7+) containing (1) terabyte of onboard fixed disk storage. The DVN shall be rack mounted at the first Tolling Equipment building that is put into production.
 - iii. All Tolling Equipment building cameras shall be manufactured by Axis Communications model 225FD cameras.
 - iv. All cameras will communicate and interface with the DVN 5000 via network TCPIP. Each IP camera will connect directly to the Tolling Equipment building network switch via CAT5E or higher network cabling. Camera power shall be furnished via POE (power over Ethernet).
 - v. Cat 5 or Cat 6 Surge suppression shall be furnished for all IP cameras that are mounted on the outside of the Tolling Equipment buildings.
 - vi. Cameras will communicate via a segregated Virtual Local Area Network (VLAN) to ensure tolls transaction data traffic is not adversely affected by video streaming.

4.4.10 Toll Operations equipment panelboard and control system (Clean power panelboard "C")

The Clean Power Panel board (Panel "C") that supplies power to the electronic Tolling Equipment shall be a POWERLINK - G3 Lighting Control system as manufactured by Square D Company. The complete system shall be enclosed in a conventional NEMA 1 panel board enclosure. The minimum requirements are for the panel to have a 100 ampere capacity rating, 30 branch circuit poles, and sub-feed lugs. The capacity rating, voltage, phase (1, 3), and number of branch circuits shall be adjusted to meet the specific site parameters. Twelve (12) single pole, 20A remote operated power switching devices shall be provided and installed in the panel. They shall be UL Listed for SWD, HACR, and HID use. 10BaseT Ethernet and RS485 communication ports shall be provided.

4.4.11 Monitoring

The equipment building shall include an integrated automated environmental monitoring system, provided by Concessionaire, that is controllable from multiple workstations located outside of the equipment room. The monitoring system shall detect and disseminate alarms for heat, smoke, fire and other detrimental environmental hazards and shall offer SNMP V3 traps, configurable that will comply with CA Unicenter.

The environmental monitoring system shall monitor at minimum the temperature and relative humidity. It should have historical trend capabilities. The historical data will be used to analyze seasonal changes and other outside influences. The temperature and humidity information is to be gathered from all areas of the equipment building using sensors. The monitoring system should have critical alarm capabilities. At the very least, the system should be set to notify when conditions move outside the set parameters. The monitoring system shall utilize SNMP protocol to integrate into overall tolling and ITS management systems.

The equipment building shall include carbon monoxide detectors sufficient to monitor and detect elevated carbon monoxide levels within the entire equipment building.

The monitoring of the Tolling Equipment building shall be provided by FTE's SunWatch.

4.4.12 Accessibility

The tolling infrastructure must also address the ingress and egress access to the structure for maintenance of the Tolling Equipment. Safety of the motorist and toll technicians shall be paramount in the layout design of the Tolling Site Location. The design shall provide space for 2 maintenance vehicles to access the gantry and Tolling Equipment building. Consideration for maintenance access shall be made during the design and shall be

coordinated with FTE. Sufficient maintenance access should be designed into the site plan to ensure safe ingress and egress as well as a safe area to service the Tolling Equipment building. FTE requires space for 2 maintenance vehicles per site.

4.4.13 Hardening

The building foundation requirements shall be the responsibility of the Concessionaire and must be approved by FTE. The foundation requirements shall meet or exceed FDOT requirements per Section 785 of the FDOT 2007 Standard Specifications for Road and Bridge Construction online version.

4.5 Communications

The Concessionaire is responsible for providing a redundant communication connection between the tolls network switch located in the equipment building and the FTE Boca Raton Data Center. This connection shall be through a permanent fiber optic connection to FTE's existing fiber outside plant along the Turnpike Mainline (S.R. 91) and the Sawgrass Expressway (S.R. 589). Concessionaire is responsible for the design and installation of a fiber optic communication path for integrating the equipment using existing as well as proposed fiber infrastructure. Volume II, Division II, Section 3, Attachment 1 – ITS Deployment Requirements details specific requirements for the communications on the Project.

4.5.1 Conduit and Cabling

The Concessionaire shall dedicate one buffer tube (Black Buffer), 12-strands of Single Mode Fiber Optic Cable, in each 96-strand backbone along I-595 and in each inter-connect cable between S.R. 91/I-595, S.R. 589/I-595, and I-95/I-595 for FTE tolls use only. The Concessionaire shall install two-2" conduits with one-24-strand SMFO cable from the closest backbone splice vault along I-595 to the Concessionaire provided rack mounted patch panel located in the tolls equipment building. All underground conduits shall be High Density Polyethylene (HDPE) and include warning tape, tone wire, and WGU's.

The Concessionaire shall perform all fiber optic conduit and cable installation and splicing to establish the communications path between the FTE backbone and toll communication equipment. The Concessionaire shall coordinate with FTE on the fiber optic installation and splicing activities.

At all new fiber optic cable installations, the Concessionaire shall install 100' of fiber optic slack cable in each splice vault. The Concessionaire shall install two-2" EMT conduits from the building penetration point to the Concessionaire provided communication rack. The 24-strand SMFO cable shall be installed in one of the two EMT conduits, with the other conduit

serving as a spare. All spare conduits shall have a pull string installed and shall be capped at either end of the run.

Dedicated toll communication fiber optic cable and conduit infrastructure shall be furnished, installed, terminated, and tested per FDOT Standard Specification for Road and Bridge Construction (on-line addition). FTE requires that the fiber cable be furnished, installed, terminated, and tested prior to the 45 day installation period for Tolling Equipment.

4.5.2 Hardware

The 24-strand SMFO is to be terminated in a Concessionaire furnished rack mounted pre-terminated patch panel inside the Concessionaire furnished Communications Rack located in the equipment building. The patch panel shall include the housing, splice trays, SC connector panels, and fan out kits necessary for a complete installation as described above.

4.5.3 Voice Communications

Telephone voice line service shall be provided by the Concessionaire prior to turning the equipment building over to the FTE Tolling Equipment Contractor. Concessionaire shall provide all required service equipment. The service shall be in the name of the Concessionaire/District, which is solely responsible for paying for the service.

4.6 *Electrical*

Electrical service is required to be provided by the Concessionaire. The electrical service should consist of single phase service with operating voltage of 120/240V and adequate amperage rating for the demand loads associated with the I-595 gantry structure.

4.6.1 Generator

Concessionaire shall furnish, install, and maintain the diesel backup generator system for uninterrupted electrical service in the case of electrical service failures.

It is estimated that the signature gantry for I-595 shall require approximately an 80 KW generator. It is the Concessionaire's responsibility to adequately size the generator to provide 100 percent facility backup power for at least 72 hours. Generator shall be fitted with automatic transfer switch configured to run after 30 seconds of power outage, and signal state via SNMP on Ethernet management card or approved equal. The Concessionaire shall evaluate and include in their design a method for reducing the noise impact to residences near proposed Tolling Equipment building locations caused by the power generators. The fuel tank shall contain a level sensing device capable of interfacing with FTE's SCADA. A transfer switch shall provide direct communications with FTE SCADA via MODBUS TCP/IP

or via discreet contact closure for all critical status indications. Volume II, Division II, Section 3, Attachment 1 – ITS Deployment Requirements details specific requirements for the generators on the Project.

4.6.2 UPS

A UPS provided, installed, and maintained by FTE for Tolling Equipment is required to provide continuous, clean electrical power to critical loads including Tolling Equipment. In the event of an input power failure, the UPS will supply power to the critical load for the specified battery time. UPS will be furnished by FTE with Ethernet SNMP management card.

This UPS is separate from the Concessionaire provided building UPS. Volume II, Division II, Section 3, Attachment 1 – ITS Deployment Requirements details specific requirements for the UPS on the Project.

4.6.3 Electrical Conduits

Conduits in the fiber reinforced concrete section used underneath the gantry structure shall be polyvinyl chloride (PVC). Rigid metallic conduit shall be used when installed exposed.

Conduits, pull/junction boxes, stub-ups, conductors, pull strings, etc. shall be provided for new Tolling Equipment from the equipment building to the new gantry structure and also within the equipment building. Information related to the number, size, type, positioning constraints, routing, etc. of the aforementioned items can be provided by FTE upon request.

Tolling Equipment conduit and wiring shall be incorporated into the gantry structure via conduit trays which run along the main members, to create a uniform appearance. There shall be a separation between power and data wiring per NEC requirements.

4.6.4 Surge Protection

The Concessionaire shall provide surge protective devices which shall include AC protection for main power and data/low voltage circuitry. The FTE's TEC will provide surge protectors for Tolling Equipment.

The Concessionaire shall provide two (2) 15 amp UPS supported dedicated circuits with two power strips at the tolls communications rack.

The Concessionaire shall provide adequate grounding and bonding of service electrical systems and equipment.

The Concessionaire shall provide lightning protection system for the equipment buildings. The grounding electrode system of the lightning protection system shall be bonded to the electrical service grounding electrode system.

The Concessionaire shall provide Tone Wire Grounding per FDOT Standard Specifications.

4.7 Signing

All toll infrastructure and SunPass signing will be provided by the Concessionaire. It shall be the Concessionaire's responsibility to provide Express Lanes signage that is consistent to the I-95 Express Lanes project in Miami-Dade and Broward Counties. It is the Concessionaire's responsibility during design phase to verify the signage that is actually implemented on the I-95 Express Lanes facility.

5.0 CONSTRUCTION CRITERIA

5.1 General

The FTE Tolling Equipment_Contractor (TEC) requires 45 calendar days to mobilize, install, and test the Tolling Equipment. Prior to turnover, the TEC and FTE Toll Operations' representatives shall be invited to construction meetings two to three months before the turnover date, or as necessary, to convey status and coordinate outstanding Tolling Equipment and communication issues remaining at the tolling sites.

Gantry and building sites shall be turned over by the Concessionaire at the beginning of the 45 day period.

The prerequisites for initiation of the 45 calendar day period is completion of buildings and gantries with all electrical (inclusive of security and CCTV), mechanical, architectural, communications work, and final inspection and acceptance of completed work. If there are remaining punch-list items at the time of the 45 calendar day period that do not affect the initiation or ongoing progress of the TEC and all parties (FTE, FTE's TEC, and Concessionaire) are agreeable in advance of the 45 calendar day period, then these items may be completed under the direction of the District's construction representatives.

Concessionaire's interruptions during this 45 calendar day period for FTE's TEC activities, must be approved no less than 48 hours in advance of the interruption. Interruptions shall be additive to the 45 calendar day Tolling Equipment installation and testing time.

5.2 Installation Requirements

5.2.1 Gantry

Fabrication

Gantry and supporting infrastructure must be fabricated with FTE approved material. All cutting and fabrication shall be performed in the shop. No alterations of any kind shall be allowed at the site. All field construction of the structure shall be made with bolts or pins. All components shall be number coded to match approved shop drawings.

Installation

Gantry assembly and installation shall be in accordance with the drawings and the gantry manufacturer's directions. The methods and sequences of the assembly shall be done in accordance with procedures established by the gantry manufacturer and as specified in the shop drawings.

The gantry shall be delivered to the site and erected in a clean condition, without scratches, dents or other types of damage or deterioration at the time of completion of installation. Protection shall be provided as required. The final clean up shall be the Concessionaire's responsibility.

Factory finishes shall be supplied in acceptable condition. Any cosmetic repairs to the finish shall be performed to the satisfaction of and at no cost to the Department.

The gantry manufacturer is to provide a "Maintenance/Inspection Manual" upon delivery and installation of the gantry structure. Review copy to be submitted to the Engineer of Record and the department for approval prior to final publication.

5.2.2 Equipment Buildings

Upon request FTE will provide documents containing a sample building TSP's (Technical Special Provisions).

5.2.3 Equipment Racks

Rack construction methods shall ensure an electrically bonded structure for ease of grounding. Install communications rack cabinet in location as shown in the Gantry Plans. Ground the rack to a building ground.

Electrical

The Concessionaire shall furnish and install all outlet strip and power cord as outlined in Volume II, Division II, Section 4. The Concessionaire shall furnish and install grounding bus bar system for the ground rack mounted electrical equipment and equip door with grounding studs.

The Concessionaire shall furnish and install cable management hardware for attachment vertically along the rack frame and horizontally between 19” rack angles. Cable management hardware shall run vertically up one rear rack frame and shall include six horizontal runs per rack. The hardware shall include cable organizers and clamps to provide strain relief and cable mounting.

5.2.4 Conduit

When conduits are installed by trenching or plowing methods, the conduits shall be bound at minimum 5’ intervals using tie-raps or other methods approved by the engineer to bind the conduits to eliminate the possibility of conduit twisting or weaving during installation.

5.3 Maintenance of Traffic

The Concessionaire is responsible for all maintenance of traffic (MOT) operations during all stages of the project including, but not limited to Tolling Equipment installation and high and low speed testing activities. During the MOT design, the Concessionaire shall closely coordinate with FTE on how the Tolling Equipment installation and testing MOT will be set up. Testing vehicles are required to perform continuous high speed passes under the gantry/tolling point, so special coordination with FTE and its TEC is extremely important for the development of an MOT set-up that allows for optimum equipment testing and commissioning processes. Once in construction, the Concessionaire and FTE’s TEC shall closely coordinate to ensure that the MOT mobilization and take-down activities take place when required by the TEC to allow for Tolling Equipment installation and testing.

The Concessionaire shall provide a minimum of 1,500’ of paved roadway (for both Express Lanes and shoulder) on each side of the gantry during the Tolling Equipment testing period. This length is necessary for the FTE Tolling Equipment Contractor to drive test vehicles at sufficient speed to properly conduct testing. It is estimated that the final 15 calendar days of the 45 calendar day Tolling Equipment and testing period will be allocated to vehicle testing. It is critical that vehicles other than those test vehicles under the control of the FTE TEC not intrude within the designated testing zone during test periods. FTE, FTE’s TEC and the Concessionaire shall coordinate prior to Tolling Equipment testing to ensure there is agreement on the length of the testing zone, agreeable terms for construction vehicle passage

(if necessary) and for what time durations. The length of pavement on either side of the tolling point for this testing shall be coordinated during field meetings.

5.3.2 Traffic Control Analysis

The Concessionaire shall design a safe and effective Construction Traffic Control Plan to move vehicular traffic during all phases of construction of tolling infrastructures, as an integral part of the overall Project MOT and Traffic Control Management Plans.

5.4 Testing and Acceptance

FTE and the TEC will perform the tolling equipment/system testing and acceptance by using their own testing team, drivers, and vehicles. The controlled testing process is mainly divided into two activities: low and high speed testing.

During low speed testing, the TEC will perform tolling equipment tuning tasks such as focusing and adjusting cameras, and regulating equipment frequencies and heights. Daytime roadway closures are required during low speed testing to verify particular daytime system functionality parameters such as image quality and focusing. FTE, and the Concessionaire must coordinate during the design and construction phases to provide for sufficient roadway daytime closures to complete low speed testing operations. Low speed nighttime testing is also required to test system and equipment parameters particular to the nighttime toll collection operations, such as vehicle illuminators, and camera image and focusing.

During high speed testing operations, vehicles will be performing many continuous high speed passes under the gantry/tolling point. System dynamics and accuracy are the main parameters tested in this phase. Both daytime and nighttime roadway closures are necessary to complete this testing phase.

5.5 Documentation

The Concessionaire shall provide all final documentation to the Department and FTE prior to final system acceptance. This shall include:

- As-Builts
- Operations and Maintenance Manuals
- Warranty Information

5.5.1 As-Builts

The Concessionaire shall provide as-built construction plans for the Tolling Equipment building, including detailed specifications and information regarding the inventory of

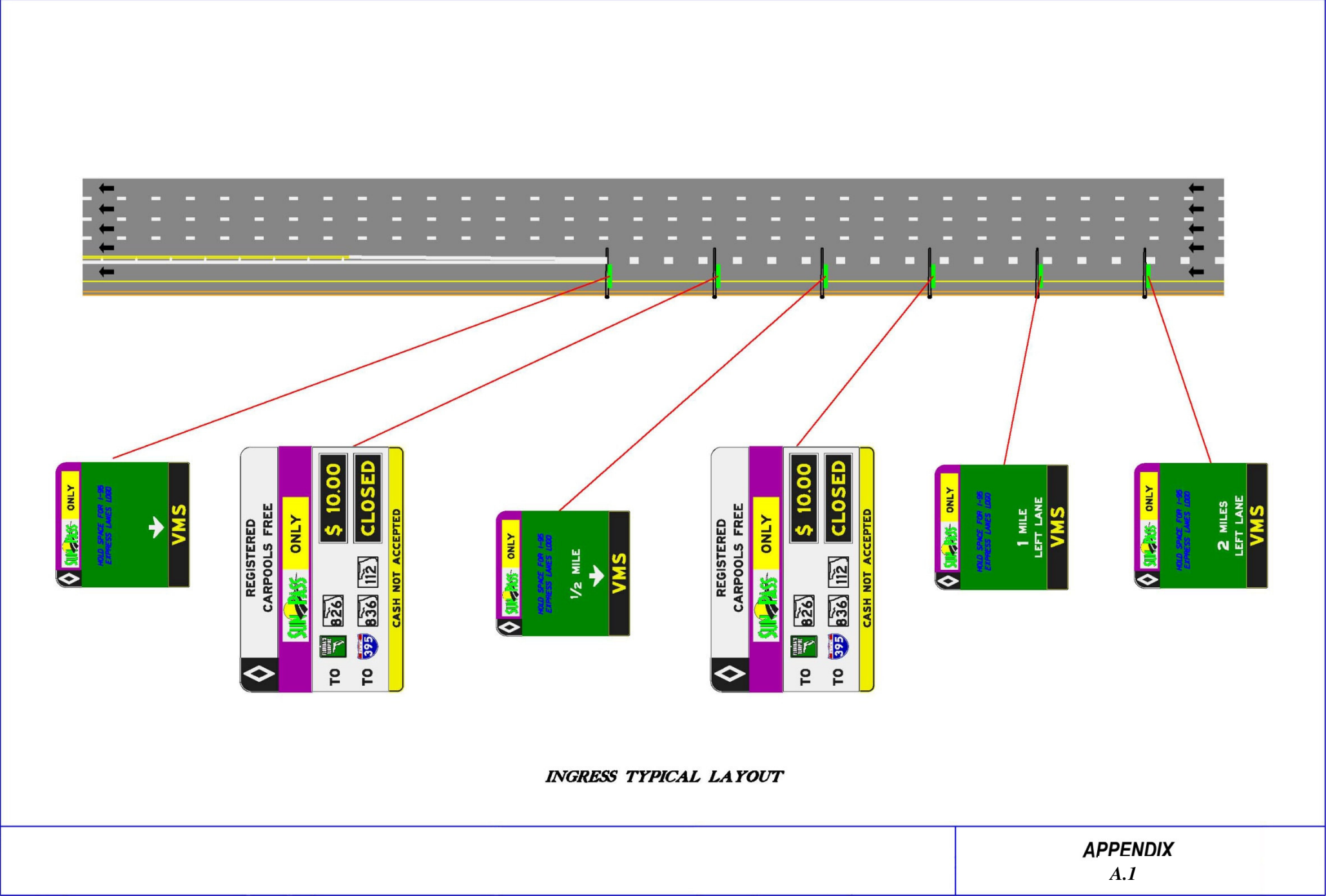
installed components by location and corresponding serial numbers. The plans shall include weight, dimension and structural loading information on the installed equipment building.

5.5.2 Operations and Maintenance Manuals

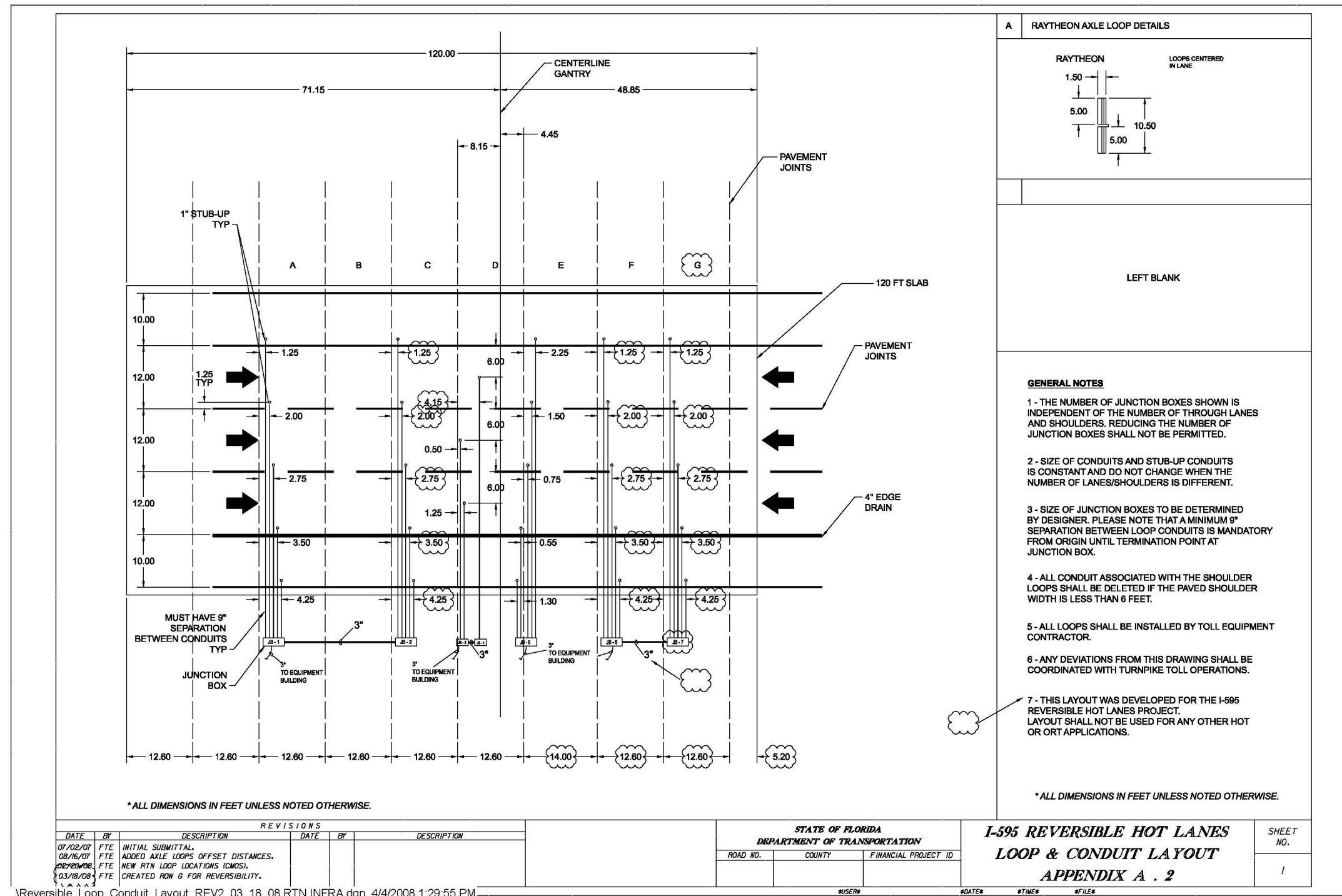
Three (3) full sets of Operation and Maintenance Manuals, including shop drawings, shall be provided after the installation has been completed. Any “as-built” changes shall be incorporated.

APPENDICES

- A.1 I-95 Express Lanes Conceptual Ingress Signing Layout
- A.2 Loop and Conduit Layout



A.1 I-95 Express Lanes Conceptual Ingress Signing Layout



A.2 Loop and Conduit Layout