



**INVITATION TO BID (ITB)**

**Contract #: O-1223**

**Construction Services for Control System and DMS Fiber Communications Upgrades**

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*ITB Issue Date & Cone of Silence Effective Date: 6/8/2023*

*ITB Addendum 1 Issue Date: 7/19/2023*

*ITB Response Due Date: 9/7/2023*

**RESPONSIBLE DEPARTMENT**

Brian Pickard, Director of Operations and Engineering

**PROCUREMENT DEPARTMENT**

Shannon Bush, Contracts and Procurement Manager

1104 East Twiggs Street, Suite 300

Tampa, Florida 33602

Telephone Number: (813) 272-6740

Email: [Procurement@tampa-xway.com](mailto:Procurement@tampa-xway.com)

**THE RESPONSIBILITY OF SUBMITTING A BID PROPOSAL PACKAGE IN RESPONSE TO THIS SOLICITATION DOCUMENT TO THEA ON OR BEFORE THE STATED DEADLINE SHALL BE SOLELY AND STRICTLY OF THE BIDDER. THEA SHALL IN NO WAY BE RESPONSIBLE FOR DELAYS CAUSED BY THE UNITED STATES MAIL, OR ANY OTHER DELIVERY SERVICE, OR CAUSED BY ANY OTHER OCCURRENCE.**

**BIDDERS SHALL READ THE SOLICITATION/CONTRACT DOCUMENTS IN THEIR ENTIRETY PRIOR TO SUBMITTING A BID PACKAGE.**

**BY SUBMITTING A BID PROPOSAL PACKAGE, THE BIDDER ACKNOWLEDGES THEY HAVE READ, UNDERSTAND, AND ACCEPT THE TERMS AND CONDITIONS TO BE MET AND THE CHARACTER AND QUALITY OF THE SCOPE OF WORK TO BE PROVIDED**

Legal Entity Name (Bidder): \_\_\_\_\_

Address of Bidder: \_\_\_\_\_

FEIN: \_\_\_\_\_

Name of Authorized Officer: \_\_\_\_\_ Title: \_\_\_\_\_

E-mail: \_\_\_\_\_ Phone Number: \_\_\_\_\_

**Attachments, Exhibits, and/or References not attached hereto will be supplied upon request and shared via a OneDrive File Share or in-person pickup of a flash drive at the THEA Headquarters office. Please contact the Procurement Office at [procurement@tampa-xway.com](mailto:procurement@tampa-xway.com) to request your link or flash drive.**

**Exhibits -**

- A. Scope of Work
- B. Bid Proposal Form
- C. Public Entity Crime
- D. Drug-Free Workplace
- E. Conflict of Interest Form and Affirmation
- F. Experience and References
- G. Insurance Requirements Coverages and Limits
- H. Acknowledgement of Receipt of Addendum and/or Letter of Clarification

**Attachments-**

- 1. ITS Plans - Control System & DMS Fiber Communications Upgrades ITS Plans, Dated 6/2/2023 (Addendum 1, Dated 6/30/2023)
- 2. Minimum Technical Requirements (MTR), Dated 6/2/2023 (Addendum 1, Dated 6/30/2023)

## **ADDENDUM NO. 1**

**PROJECT NAME: Construction Services for Control System & DMS Fiber Communications Upgrades**

**DATE OF ADDENDUM: 7/19/2023**

### **I. INTRODUCTION**

The Tampa-Hillsborough County Expressway Authority (THEA) is soliciting bid proposals from qualified firms to provide the labor, equipment, materials, tools, transportation, supplies, insurance, incidentals, mobilization, demobilization, and maintenance of traffic necessary to deploy system control and Dynamic Message Sign (DMS) fiber optic communications upgrades. The project location is along or near the THEA Lee Roy Selmon Expressway (S.R. 618), including sites on adjacent surface streets.

The title of the project is as follows: CONSTRUCTION SERVICES FOR CONTROL SYSTEM & DMS FIBER COMMUNICATIONS UPGRADES

ITS Plans included with this ITB show the intended path for placement of new fiber optic cabling and locations for site upgrades. These plans are schematic in nature and are for “reference only,” developed using previous ITS project plans, and no site survey was performed. Only limited field reviews have occurred to verify the veracity of existing conduit, and some locations may require construction of new conduit and/or pull boxes.

To provide as much information as possible for bid proposal preparation, the ITS Plans and Exhibit B include ~~estimated Tabulation of Q~~quantities ~~per pay item paid~~ ~~will be per actual~~ installed and ~~accepted quantity per pay item~~. No guarantee is implied or offered of conduit paths, locations of pull boxes, and total quantities to be procured/installed.

The Contractor is responsible to verify all quantities, field locate and verify conduit paths, pull box locations, and existing field conditions. Recently completed digital as-built information from the THEA ITS Fiber Data Collection and Characterization (PN: O-02121) project is being made available to bidders. Upon selection, the Contractor will be provided access to THEA digital as-built information that is expected to be available by June / July 2023 as described in Exhibit A, Scope of Work. Contractor shall submit daily reports indicating actual quantity of each pay item completed during the previous workday. These quantities shall be inspected/verified by THEA’s Construction Engineering Inspection (CEI) prior to invoicing.

### **II. INSTRUCTIONS TO BIDDERS**

1. THEA must receive all submittals at the location, date, and time identified in **Section VI., Schedule of Events**. Any submittal received after the stated time and date shall not be considered and may be returned only at the firm’s expense. It shall be the sole responsibility of the firm to have its package delivered to THEA. Facsimile submittals will not be accepted. Delay in delivery shall not be the responsibility of THEA.
2. Each firm shall examine all documents and shall determine all matters relating to the interpretation of such documents.

3. Joint proposals will not be accepted.
4. The following exhibits are required by THEA to be completed by the bidder and submitted as part of the Bid Proposal Package:
  - B. Bid Proposal Form
  - C. Public Entity Crime
  - D. Drug-Free Workplace
  - E. Conflict of Interest and Affirmation Statement
  - F. Experience and References
  - G. Insurance Requirements Coverages and Limits
  - H. Acknowledgement of Receipt of Addendum and/or Letter of Clarification
5. One (1) original combined pdf of the bid proposal package and the required forms above must be delivered to THEA's Procurement Department in one e-mail, clearly marked in the subject line, **"Invitation to Bid O-1223 Construction Services for Control System and DMS Fiber Communications Upgrades"**:

Procurement Office  
Procurement@tampa-xway.com  
1104 East Twiggs Street, Suite 300  
Tampa, FL 33602
6. Dividers between each section are allowed, and page numbers on the bottom of each page are required.
7. The ITB bid proposal response must clearly indicate the legal name, federal taxpayer identification number, address, and telephone number of the respondent firm. The person signing the ITB on behalf of the respondent firm must have the authority to bind the respondent firm to the submitted bid proposal.
8. THEA shall not be liable for any expenses incurred in the preparation of the bid proposal package.
9. THEA reserves the right to request resubmission or to re-advertise for all or any part of the work. THEA shall be the sole judge of the submittals and the resulting negotiated agreement that is in THEA's best interest, and THEA's decision shall be final.
10. The successful firm shall be required to execute an agreement, in form and content acceptable to THEA, indemnifying and holding harmless THEA, its officials, officers, employees, and agents from all claims.
11. Project Review and Examination:
  - a. Each respondent firm is expected to review the proposed Scope of Work, the Plans, the MTR and Specifications, and Special Provisions before submitting a bid proposal.
  - b. The Contractor is responsible for turnkey installation. It is the obligation of the respondent firm to field review and make their own on-site interpretation of all field / site conditions and all job sites, to field verify design requirements, quantities, any obstacles or constraints that may be encountered and temporary traffic control measures required.
  - c. **Coordinate with THEA for field reviews. A THEA representative will provide access points to confined space entry into the interstitials of the elevated REL bridge, as required.**



- d. The submission of a bid proposal will be considered prima facie evidence that the respondent firm has made such review and examination of the project.

12. Bid Security (i.e., Bid Bond) is required for this ITB process.

- a. Each Bid Proposal package must be accompanied by a bid guarantee in the form of a Certified Check, Cashier's Check, or by a Bid Bond in the amount of five percent (5%) of the base bid, but no less than \$1000.
- b. A Bid Bond must be prepared on the approved form, duly executed by the Respondent Firm as Principal and meeting the standards specified herein.
- c. The Authority's estimated budget for construction for this project is \$ 2.5 million.

13. CONE OF SILENCE

**Firms, their agents, or associates shall refrain from contacting or soliciting any THEA staff or members of the Board of Directors directly or indirectly regarding this ITB during the selection process. Failure to comply with this provision may result in the disqualification of the firm. All requests for clarification or additional information should be made in writing via email to: [Procurement@tampa-xway.com](mailto:Procurement@tampa-xway.com)**

**AT THE DISCRETION OF THEA, ANY VIOLATION OF THE REQUIREMENTS SET FORTH IN THIS SECTION SHALL CONSTITUTE GROUNDS FOR IMMEDIATE REJECTION OF THE BID PROPOSAL PACKAGE AND THE BIDDER SHALL BE DEEMED NON-RESPONSIVE.**

**III. QUALIFICATIONS:**

The bidder must include with its bid proposal package all completed required forms as indicated in Section II Instructions to bidders. Failure to submit all completed forms may cause for rejection at the sole option of THEA.

To be deemed qualified, the respondent firms must present proof that they are prequalified by the **Florida Department of Transportation (FDOT)** under FAC 14-22 for contractor's for Work Class:

16 – Intelligent Transportation Systems

A copy of the current Certificate of Qualification must be submitted with the respondent firm's bid proposal response.

The respondent firm's **bid proposal response** must **include and** demonstrate the following minimum qualifications and experience requirements:

- a. Minimum of five (5) years of similar project experience, qualified and trained personnel, and necessary and working equipment to furnish, install, integrate, test, manage (both project and subcontractors), and fully commission the required upgrades as specified in the contract documents.

It is acceptable to show multiple projects with one or more of the specified elements. It is not necessary to show a single project with all the required elements.

- b. Minimum of three (3) completed project examples demonstrating similar experience for the project manager (construction superintendent) and key/lead staff that will actually be performing the work for this Project.

- c. Provide written documentation of qualifications, certification(s) and similar experience for both company and proposed project manager and key/lead staff as part of the respondent firm's bid response. This will be used to determine if the respondent firm is qualified to perform this work.

The ~~proposed respondent firm must propose a full-time, qualified~~ Project Manager (Construction Superintendent) ~~must be full-time and have~~ing at least five (5) years of experience in performing and/or administering similar types of work (fiber-based networks, control systems integration, etc.) as this Project. The Project Manager must be the single point of contact as liaison with THEA during the procurement process and during the performance of this Project. The Project Manager must be the responsible person in charge of coordinating day-to-day work activities, schedules, payment applications, directing the Contractor's work forces, reports, day-to-day administrative matters, coordinating the SBE policy to achieve the established goals and other related items necessary to fulfill the requirements of the Contract.

All ~~proposed~~ key ~~proposed~~ personnel must be available and qualified with previous ~~similar~~ experience to perform the work as required. All personnel must be considered at all times, to be the employees, or agents of the respondent firm and not employees or agents of THEA. Procedures must be in place for prompt temporary replacement of absent employees and timely permanent replacement of staff vacancies.

~~THEA requirements for~~ Fiber Optic Infrastructure and Communications Network ~~qualifications:~~

- a. Proposed lead technical staff that will perform the fiber optic work on this Project must have a minimum of three (3) years of similar outside plant (OSP) project experience being proficient ~~with the installation, certification, integration, testing and commissioning of fiber optic infrastructure (fiber optic cabling, conduit, pull boxes, splice vaults, fiber patch panels, etc.), network communications equipment, fiber optic installation, communications network equipment, fiber optic installation, communications network equipment,~~ conduit proofing, ~~pull boxes,~~ splice enclosures, fusion splicers, OTDRs and other fiber test diagnostic equipment and tools as required on this project.
- b. The personnel assigned to actually perform the fusion splicing work and operation of the OTDR, etc. must be certified by the fiber splicer equipment manufacturer as being trained and proficient in the use of the equipment.
- c. The Contractor and/or its subcontractor(s) must have experience setting up, configuring, integrating and testing of network switches.

~~THEA requirements for System Control:~~

- ~~a. At least five (5) years of hands-on experience designing and implementing SCADA systems, PLC hardware and software, wiring and cabling.~~
- ~~b. Key staff working on this project must have Schneider Electric certification(s) and demonstrated experience working with a Schneider Electric PLC platform (Modicon M340, M580, etc.), or equivalent.~~
- ~~c. Experience in conducting training of operations and maintenance personnel in industrial PLC control systems application.~~

The respondent firm must demonstrate working experience with fiber optic infrastructure, network equipment, and a PLC platform (Schneider Electric Modicon M340, M580, etc.) – both PLC hardware and software.

#### IV. DOING BUSINESS IN THE STATE OF FLORIDA

All bidders shall be in good standing with and authorized to do business in the State of Florida. Furthermore, it is the responsibility of the bidder to confirm that all of its subcontractors are also in good standing and authorized to do business in the State of Florida as may be required pursuant to §607.1501, §605.0902, and §605.0905 Florida Statutes.

If a bidder is not required to register pursuant to Florida Statutes, the successful bidder shall be able to submit documentation demonstrating non-applicability of the statute.

THEA shall not execute an agreement if the successful bidder and subcontractors are not registered and in good standing to do business in the State of Florida as required by the referenced Florida Statutes.

#### V. SELECTION PROCESS

THEA intends to purchase the Product/Services from the responsible and responsive bidder. The selection process for this ITB will consist of the following.

Bid proposal packages will be evaluated on whether the bidder is responsible and responsive to this solicitation, with the objective of evaluating those bids and responses and to award a contract for the work to the firm with the **lowest total lump sum price**.

THEA will determine if the firm's bid is responsive and is a responsible bidder, in its sole and absolute discretion, considering all relevant facts and information. If it is determined the **lowest total lump sum price** is excessive, best offers are determined to be unreasonable or it is in THEA's best interest to do so.

A responsive team (Contractor and/or its' subcontractor(s)) must demonstrate and include in their bid proposal package their qualifications including a qualified project manager, key technical personnel and demonstrate similar experience with installing, splicing, configuration, integration, testing and commissioning of fiber optic infrastructure (fiber optic cabling, conduit, pull boxes, splice vaults, fiber patch panels, etc.) and network equipment. The proposed team must demonstrate experience working with ITS, Dynamic Message Signs (DMSs) and control system technologies. Proposed personnel must be certified for confined space entry work as indicated herein. A responsive team must demonstrate their qualifications and experience to meet the project requirements as specified in the ITB, MTR, ITS Plans and other contract documents.

#### **FINAL SELECTION:**

The **responsive** bidder with the **lowest total lump sum price** will be presented to THEA's Board of Directors for consideration and approval with a recommendation that the bidder be selected per the Schedule of Events below.

#### VI. SCHEDULE OF EVENTS

DATE	DESCRIPTION	LOCATION
June 8, 2023, by 5:00 PM	Advertisement Published	THEA Website & Demandstar
<del>June 30, 2023, by 9:00 AM</del> August 11	Deadline for Respondent's submission of questions to THEA	Email to <a href="mailto:Procurement@tampa-xway.com">Procurement@tampa-xway.com</a>

<del>July 14, 2023, by 5:00 PM</del> <b>August 17</b>	Deadline for THEA to respond to Respondent's questions	THEA Website & Demandstar
<del>August 4, 2023, by 10:30 AM</del> <b>September 7, 2023, by 9:00 AM</b>	Deadline for Submitting Bid Proposal Package	Email to <a href="mailto:Procurement@tampa-xway.com">Procurement@tampa-xway.com</a>
<del>August 4, 2023, @ 1:30 PM</del> <b>September 7</b>	Public Opening of Bid Proposal Packages	THEA Office 1101 E. Twiggs Street, Suite 300 Tampa, FL 33602
<del>August 8, 2023, by 5:00 PM</del> <b>September 8</b>	Post Notice of Intended Ranking	THEA Website & Demandstar
<del>August 28, 2023, @ 1:30 PM</del> <b>September 25</b>	Board Approval of Final Ranking & Award of Contract	THEA Office 1101 E. Twiggs Street, Suite 300 Tampa, FL 33602
<del>August 29, 2023, by 5:00 PM</del> <b>September 26</b>	Posting of Award of Contract	THEA Website & Demandstar

## VII. TERMS AND CONDITIONS

THEA reserves the right to reject all bid proposal packages, any bid proposal packages not conforming to this Invitation to Bid, and to waive any irregularity or informality with respect to any proposal. THEA further, reserves the right to request clarification of information submitted and to request additional information from one or more firms.

THEA requires that the bidder selected will not discriminate under the agreement against any person in accordance with federal, state, and local governments' regulations. THEA requires the bidder selected make an affirmative statement to the effect that their retention shall not result in conflict of interests with respect to THEA.

THEA requires that the bidder make an affirmative statement to the effect that they have not contacted, or attempted to contact, any member of the Board of Directors, or THEA staff, except as expressly permitted in the ITB.

## EXHIBIT A: SCOPE OF WORK

### 1. REL SYSTEM BACKGROUND

The Reversible Express Lanes (REL) system is a tolled system that is designed to carry one-way traffic in the predominant commuting direction for AM/PM peak travel times. The general operations call for the REL traffic to flow east to west in the AM and reversed in the PM to flow west to east. In addition, there are distinctive operations for weekends, special events and emergencies.

City of Tampa (COT) Operators, in coordination with THEA provide daily operation of the REL in Tampa, Florida. THEA and the COT staff are co-located at the THEA Transportation Management Center (TMC) located at Tampa Hillsborough Expressway Authority, 1104 East Twiggs Street, Tampa, FL 33602.

There are five (5) legacy Access Control Nodes (ACN) distributed control cabinets currently in the REL system, one at each point of ingress into the REL infrastructure including; 1) Downtown, 2) 34<sup>th</sup> Street, 3) 78<sup>th</sup> Street, 4) Rte. 301 and 5) Brandon area. **There is also an additional 6<sup>th</sup> ACN currently under construction as part of the East Selmon Slip Ramps project which is not part of this project.** The ACNs provide for a fiber-based Ethernet fault-tolerant communications network linking the THEA TMC to the field equipment (REL access control, ITS devices and subsystems) via the THEA fiber backbone system.

The REL system consists of a Closed-Circuit Television (CCTV) camera system for general surveillance for incident management; movable gates (warning and resistance barrier) operations for restricting and allowing access to the Expressway itself; and electronic Dynamic Message Signs (DMS) for both critical (Open/Closed) and non-critical (directional and information) and traffic signal interface for traffic preemption. The system enables automatic operations of the roadway system as well as providing for hybrid operations (automatic/ manual) and manual operations as required due to subsystem failure or at the operator's selection.

To provide a safe and clearly understandable system for the motorists, a very precise series of steps must be used by the operators at the THEA TMC to open, close, and reverse the REL system. These steps are actuated, controlled, and monitored by TMC staff using central software; referred to as the Access Control System (ACS) software. Redundant head-end servers located at the THEA TMC run the ACS software providing the supervisory control of all REL devices and monitoring and control of ITS/ATMS devices along the Selmon Expressway.

The original ACS software, DYNAC, was installed in 2005/2006 by Transdyn (now Kapsch) and was, upgraded in 2017 by the same company. THEA awarded a contract in 2022 to Teledyne FLIR ITS to upgrade functionality and replace the existing ACS software.

Currently, communications from the ACN to critical Changeable Message Signs and Variable Message Signs (herein after referred to as "DMS") and REL gates is via shielded # 14 to 16 AWG copper loop signal wire. Communications with a critical DMS is two-fold: from the ACS to Sign Controller via relay and actuated control and a feedback system from the Sign Controller to Programmable Logic Controller (PLC) at the ACN for safety interlock. As the THEA TMC activates REL movable gates to open or close to reverse traffic, the system is triggered to send a 24VDC signal to the relays (Commands Cable, copper signal wire) to activate the appropriate DMS stored message. Then the output relay sends a signal back (Monitoring Cable, copper signal wire) to provide confirmation that the message was posted.

Each ACN cabinet is also equipped with a Local Operator Interface (LOI) Panel that allows local manual operation in the event of communications loss with the TMC or the PLC is down.

Layer 2 managed field Ethernet switches (MFES) for ITS sites and Layer 3 ACN ring switches were upgraded in 2014 along with upgrades to an IP-based CCTV network. TMC Core Layer 3 switch is a stacked Brocade ICX series system. The critical DMSs were replaced with new Daktronics LED full color, full matrix signs and field cabinets in 2017.

## 2. DESCRIPTION OF WORK

This section provides a summary of the scope of work (SOW) to be performed in the Invitation to Bid (ITB) No. O-1223.

### a. Contract Documentation

The documents and attachments listed below are hereby incorporated into, and made part of, this ITB as though fully set forth herein. Bidders must meet the requirements and provide the work and materials described and specified in the following documents and all other requirements of this ITB:

#### i. ITS Plans (Attachment 1)

*Control System and DMS Fiber Communications Upgrades ITS Plans, 6/02/2023 (Addendum 1, Dated 6/30/2023).*

- The ITS Plans are schematic in nature based on available Authority ITS Plans and may not be reflective of existing as-built conditions that the Contractor may encounter. Only limited field reviews have occurred to verify the veracity and condition of existing conduit and pull boxes.

#### ii. Minimum Technical Requirements (MTR) (Attachment 2) (Addendum 1, Dated 6/30/2023).

The MTR is a supplement to the Florida Department of Transportation (FDOT) Standard Specifications and FDOT Design Standards.

#### iii. THEA General Provisions

#### iv. THEA Forms (Exhibits)

#### v. FDOT Standard Specifications for Road and Bridge Construction (Division II & III), Special Provisions and Supplemental Specifications herein after, referred to as FDOT Standard Specifications, latest edition, are incorporated by reference and can be found at the following website:

<http://www.fdot.gov/programmanagement/implemented/specbooks>

- SECTION 101 MOBILIZATION
- SECTION 102 MAINTENANCE OF TRAFFIC
- SECTION 633 COMMUNICATIONS CABLING
- SECTION 635 PULL, SPLICE AND JUNCTION BOXES
- SECTION 684 NETWORK DEVICES
- SECTION 690 REMOVE MISCELLANEOUS EQUIPMENT

#### vi. FDOT Standard Drawings, Latest edition, are incorporated by reference and can be found at the following website:

<https://www.fdot.gov/design/standardplans/current/>

- INDEX 102 MAINTENANCE OF TRAFFIC

- INDEX 630-001 CONDUIT INSTALLATION DETAILS
- INDEX 635-001 PULL & SPLICE BOX DETAILS

vii. **FDOT Design Manual (2022 FDM)**

<http://www.fdot.gov/roadway/FDM/>

b. **Other Documents and Information**

The following two documents / files are being provided with this ITB. Except as specifically set forth in the body of this ITB, these documents are being provided for reference and general information only. They are not being incorporated into and are not a part of the ITB, the contract documents or any other document that is connected or related to this Project except as otherwise specifically stated herein.

No information contained in these two documents / files are to be construed as a representation of any field condition or statement of facts upon which the Contractor can rely upon in performance of this contract. All information contained in these reference documents / files must be verified by a proper factual field investigation.

The respondent firm agrees that by accepting copies of, and using the documents and information; any and all claims for damages, time or any other impacts based on the documents and information are expressly waived.

- i. *THEA ACN Wiring Diagrams*, Transdyn, May 2005 – note that this wiring diagram is generic and not site specific. It represents the largest complement of each type of access control field equipment in the REL system.

~~Note that the Contractor will be responsible to develop a site specific wiring diagram for each ACN cabinet upgraded showing existing and proposed cabinet components, equipment and cabling.~~

- i. ~~Latest ITS Intelligent Transportation Systems\_21050616. kmz file~~

~~Upon selection, the Respondents Contractor will be provided with KMZ files and view-only access to THEA's ArcGIS instance of digital GPS-based as-built information included below. This system as-built information (see below) was recently completed and has a 1-meter positional accuracy and is expected to be available by June / July 2023.~~

- Conduit (size, location, number of cables)
- Cables (type – fiber and non-fiber media (e.g., twisted pair, coax, etc.)
- Fiber Optic pull boxes (length of slack looped, cable and equipment attributes, splice inventory and terminations)
- Fiber Optic vault details and attributes
- Fiber strand utilization
- Communications equipment and site attributes
- Cabinets and housings
- Devices (CCTV cameras, DMSs, barrier gates, warning gates, etc.)

c. **General Requirements**



- i. Provide all labor, equipment, materials, tools, transportation, supplies, insurance, incidentals, mobilization, demobilization and maintenance of traffic necessary to provide the System Control and DMS Fiber Optic Communications upgrades as required and specified in the Contract documents.
- ii. Length of Contract: Work performance duration is a maximum of **240 calendar days**. This includes active work only (at the time the Contractor starts work), and not material acquisition / procurement and fabrication.
- iii. All existing infrastructure, equipment and conditions must be field verified as to the character, quality, and quantity of work to be performed and materials to be furnished in the performance of the construction work.
- iv. The respondent firm must base their bid proposal solely on their field investigation, verification and review of field conditions, and notify the Authority of any deviations or disagreements found in the ITS Plans and drawings, the MTR and/or general conditions or existing field conditions.
- v. All necessary precautions must be taken during construction activities to avoid damage to the existing THEA system infrastructure and equipment, minimize THEA network downtime and protect the vehicular and pedestrian traffic and any appurtenant structures during all phases of construction.
  - It should be noted that downtime is for the Operations Network. The Tolls Network (the blue buffer tube) must not have any scheduled downtime. **The time window for scheduled THEA operations network downtime must only begin after 2:00 PM, and completed by 4:00 AM unless otherwise approved by the Authority. Liquidated damages will be assessed if not back online as specified herein.**

~~The Operations Network must be back online by 4 AM.~~

- Any **claims for** damage **due to** ~~caused by~~ the activities of the Contractor and/or its sub-contractors will be the responsibility of the Contractor and **all damages** will be repaired within 24 hours at no cost to the Authority.
  - **Any damage to existing infrastructure that is intended to be salvaged and re-used shall be repaired or replaced by the Contractor as determined by the Authority.**
- vi. All work sites must be maintained in a clean and safe condition. At the end of each workday, all sites must be verified to be free of debris and materials. Underground work will be covered if possible. If underground work sites must be left open, Contractor must use caution tape to clearly identify hazardous areas or an approved method to prevent injury to motorists and pedestrians. Any open ground or equipment in a travel way or clear zone must be protected by approved barriers and in compliance with FDOT maintenance of traffic (MOT) / temporary traffic control (TTC) standards.
  - vii. Any shop drawings must be submitted for approval by the Engineer of Record and the Authority.
- d. **Products and Materials: General**
- All products and materials provided must meet the following minimum products and materials requirements:
- i. All products and materials furnished and installed on this project must adhere to the FDOT Standard Specifications and the requirements set forth herein and in the ITS Plans and the MTR.



- ii. Utilize FDOT Approved Products List (APL) and Qualified Products List (QPL) unless otherwise described herein or specified in the ITS Plans or the MTR. All products provided and installed on this project must be submitted to the Authority for review and approval on a form to be provided by the Authority that includes the APL/QPL Certification Number and expiration date (as applicable).
- iii. The following list of pay item materials are shown on the ITS Plans. This listing is not intended to be all-inclusive, and it is the Respondent Firm's responsibility to incorporate into their bid proposal any additional items, which are called out in the plans and contract documentation or as needed.

101 1	Mobilization
102 1	Maintenance of Traffic
630 2 AB	Conduit (to repair possible damaged conduit section)
633 1121	Fiber Optic Drop Cable (to DMS cabinet), 12-strand (str.)
633 1122	Fiber Optic Drop Cable (to ACN cabinet), 24-strand
633 1123	Fiber Optic Distribution Cable, 72-strand
633 2 31	Fusion Splices
633 3 11	Splice Enclosures
633 3 12	Splice Trays
633 3 16	Fiber Patch Panels, Field Terminated ( <i>see Pay Item description in ITS Plans and MTR</i> )
633 8 6	Removal of multi-conductor Communications Cable (DMS command and monitoring shielded copper signal wires)
635 2 13	Fiber Optic Splice Vaults (30" x 60" Rectangular or 36" Round)
684 1 1	Managed Field Ethernet Switches
684 90 101	ACN Managed HUB Ethernet Switches
690 100	Removal of <del>PLCs</del> , MFESs, fiber patch panels and/or copper signal wiring in <del>ACN</del> -cabinets
<del>xxxx x</del>	<del>Programmable Logic Controllers (PLCs)</del>

Estimated pay item quantities are provided in the ~~Tabulation of Quantities sheets in the~~ ITS Plans and Exhibit B.

~~iv. All respondent firms must:~~

~~Submit a bid proposal based on these quantities. No guarantee is implied or inferred of total quantities to be procured/installed. THEA will pay actual quantities per pay item installed and accepted.~~

- ~~i. Fiber — per linear foot as measured by markings on cable (so as to include slack coils)~~
- ~~ii. Conduit — per linear foot as measured point to point horizontally (UG) and vertically (AG)~~
- ~~iii. PLCs, Pull boxes, MFESs, other network equipment — each~~
- ~~iv. All other work including MOT, mobilization, removal of equipment and materials, etc. is incidental and not paid separately~~

- ~~Submit daily reports indicating quantity of each pay item completed during the previous workday. These quantities must be inspected/verified by an Authority representative prior to invoicing.~~
- ~~Be responsible for final quantities.~~
- ~~Field verify all quantities.~~

e. **Communications Upgrades: Fiber Optic Infrastructure**

The following is a summary of minimum Fiber Optic Infrastructure upgrade requirements:

i. **Removal of Materials:**

~~i~~ Summary:

Work to be performed will include removal of the following materials, paid per the most recent FDOT Basis of Estimate (BoE) under the following pay items:

Pay Item	Work Description
633 8 6	<ul style="list-style-type: none"> <li>• <del>If needed (based on conduit proofing) to pull new fiber through,</del> Remove existing multi-conductor Communications Cable (DMS command and monitoring shielded copper signal wires) in existing conduit</li> </ul>
635 2 13	<ul style="list-style-type: none"> <li>• Remove existing fiber optic pull boxes – paid as part of replacement with new splice vaults</li> </ul>

See also pay item notes in the ITS plans.

ii. **New Materials and Work:**

~~i~~ Summary:

Work to be performed will include furnishing and installation of the following new materials, paid per the most recent FDOT BoE under the following pay items:

Pay Item	Work Description
630 2 AB	<ul style="list-style-type: none"> <li>• If required, provide new conduit for identified damaged or unusable sections (per conduit proofing)</li> </ul>
633 1123	<ul style="list-style-type: none"> <li>• Provide 72-strand SM fiber distribution cable in existing conduit (or new conduit if replacement of damaged conduit is needed)</li> <li>• See ITS Plans for proposed fiber path / running line</li> </ul>
633 2 31	<ul style="list-style-type: none"> <li>• Provide Fusion splices -- see ITS Plans for splice details</li> </ul>
633 3 11 633 3 12	<ul style="list-style-type: none"> <li>• Provide new splice enclosures in new fiber pull boxes – wall rack mounted. See ITS Plans for splice locations and details</li> <li>• Provide required splice trays</li> </ul>
635 2 13	<ul style="list-style-type: none"> <li>• Replace existing pull boxes with fiber optic splice vaults as shown on the ITS Plans</li> </ul>

See also the MTR for minimum technical requirements and pay item notes in the ITS Plans.

- iii. Except as noted in the ITS Plans or a field approved change, ~~it is the intent for~~ all fiber optic cable ~~to be will be~~ placed in existing conduit. Great care must be exercised to avoid damage to any existing cables that are to remain.
- iv. Some conduits and pull boxes may be located within the interstitials of segmented bridges on the elevated REL bridge.

A THEA representative will provide access points, but the Contractor must provide personnel that are certified for confined space entry for work in these locations.

v. Conduit Replacement

Only limited field reviews have occurred to verify the veracity of existing conduit and some locations may require construction of new conduit.

Proofing of existing conduit will be the responsibility of the Contractor.

- Use a rodder or other approved method from both ends of the damaged conduit to identify the approximate footage and location that needs repair. If the existing conduit is damaged or found to be unusable (not able to pull new cable through) or due to capacity (fill ratio) constraints, the Contractor must notify the Authority in writing where the unusable conduit is located and provide an estimate or quote for repairing the section by providing and installing new conduit. ~~Time spent in assessing and determining a new path, if required or needed, whether a different existing or new conduit installation shall be incidental to the fiber placement and contractor will not be compensated for time.~~
- If ~~FDOT~~ permitting is required for the repair of the said conduits, ~~the Contractor shall be responsible for filing any permit with the appropriate agency that activity will not be included in the Contractor's scope of work. However, T~~he Contractor must provide field sketches to the THEA Project Manager ~~to be~~ used for permitting purposes ~~for review and approval~~. Contractor must also discuss and/or meet on site with THEA's permitting agent if Contractor sketches do not provide adequate detail for permitting purposes.
- The Contractor must provide a quote to THEA's Project Manager for new conduit work including any concrete or asphalt replacement, landscaping, and MOT costs associated with the task. These items are to be considered incidental as part of any new conduit and/or pull boxes provided.
- If the quote is approved, the Contractor must provide new conduit as required.

vi. Pull Box Replacement

Due to the size of the existing pull boxes, there are some locations identified on the ITS Plans where removing and reinstalling larger fiber pull boxes / splice vaults will be required.

At these locations, the Contractor must complete the following steps:

- Verify that the integrity of existing cable remains intact when removing existing pull boxes and reinstalling larger pull boxes / splice vaults.
- In the event the Contractor identifies an existing pull box that is damaged, but not previously identified on the ITS Plans to be replaced, the Contractor must notify the THEA Project Manager in writing, and include pictures of the pull box needing replacement.

- The Contractor must also provide a quote to THEA's Project Manager for the replacement of said pull boxes including the replacement of any concrete, asphalt, sod or the repair of any other foundations when applicable, pea gravel to provide proper drainage, all spoils from pull box replacement, and MOT costs associated with the task. These items are to be considered incidental as part of any new pull box provided.
  - In the event sidewalk panels are cut, it is expected that the entire panel will be replaced.
  - In the event asphalt is cut, repair must be made according to industry standards.
- If the quote is approved, the Contractor must remove the existing pull box and replace as required.
- In the event permitting is required for the removal and replacement of said pull boxes, that activity will not be included in the Contractor's scope of work. However, the Contractor must provide field sketches to the THEA Project Manager to be used for permitting purposes. Contractor may also need to discuss and/or meet on site with THEA's permitting agent if Contractor sketches do not provide adequate detail for permitting purposes.

~~vii. Testing:~~

- ~~• Conduit OTDR testing of fiber optic cabling before and after installation:~~
  - ~~○ Pre-installation — while on the fiber reel~~
  - ~~○ Post-installation — after splicing and termination~~
  - ~~○ All testing conducted will be considered incidental to the fiber pay items~~
- ~~• See the MTR for minimum testing requirements.~~

f. **Site Upgrades: DMSs**

The following is a summary of minimum DMS site upgrade requirements:

i. **Removal of Materials:**

~~i.~~ Summary:

Work to be performed will include the removal of the following materials, paid per the most recent FDOT BoE under the following pay items.

Pay Item	Work Description
690 100	<ul style="list-style-type: none"> <li>• Disconnect copper signal wiring from the DCIO in DMS cabinet</li> <li>• Remove copper signal wiring from DMS cabinet</li> </ul>

See also pay item notes in ITS Plans.

ii. **New Materials and Work:**

~~ii.~~ Summary:

Work to be performed will include furnishing and installation of the following new materials, paid per the most recent FDOT BoE under the following pay items.

Pay Item	Work Description
633 1121	<ul style="list-style-type: none"> <li>12-strand SM fiber drop cable from new splice enclosure in new fiber pull box to new DMS cabinet 12-port FPP</li> </ul>
633 2 31	<ul style="list-style-type: none"> <li>Fusion splices – see ITS Plans for splice details</li> </ul>
633 3 11 633 3 12	<ul style="list-style-type: none"> <li>New Splice enclosure in new fiber pull box – wall rack mounted. See ITS Plans for splice locations and details</li> <li>Provide required splice trays</li> </ul>
633 3 16	<ul style="list-style-type: none"> <li>Rack mount 12-port SM FPP (Bulkhead 1) (with ST connectors) in the DMS cabinet. Utilize pre-terminated fiber pigtails with connector plates.</li> <li>Rack mount 6-port MM FPP (Bulkhead 2) (with ST connectors) in the DMS cabinet and re-terminate existing 6-strand tight buffer MM fiber device cable running between Auxiliary Sign Control Board in the sign enclosure to the DMS sign controller</li> </ul>
684 1 1	<ul style="list-style-type: none"> <li>New MFES, DIN rail mounted to recessed rack mounted panel</li> <li><del>Provide ControlbyWeb Web Relay I/O X-410 or approved equivalent and connect to the DCIO / J2 connector on DMS controller</del></li> <li>Cat-6 patch cables from MFES to existing DMS controller <del>and to the Web Relay I/O X-410</del></li> <li>Provide Fiber patch cables as required</li> </ul>
XXX 1 1	<ul style="list-style-type: none"> <li>Provide ControlbyWeb Web Relay I/O X-410 or approved equivalent and connect to the DCIO / J2 connector on DMS controller.</li> <li>Cat-6 patch cables from MFES to the Web Relay I/O X-410</li> </ul>

See also the MTR for minimum technical requirements and pay item notes in ITS Plans.

### iii. Network Equipment

Furnish and install new MFES: Siemens Ruggedcom RSG920P series (quantity = 1)  
(Model No.: 6GK6092-0PS23-OCA0-Z-A05+B05+D00+D00)

- Layer 2 (L2) switch with LAN Base s/w
- 12 x 10/100/1000 Mbps TX + 4 x 10/100/1000 TX PoE+ ports
- Panel (wall) mount kit
- Integrated Power Supply, AC power screw terminal block
- Uplink Port 17: one (1) SFP, 1000LX (or LX/LH or EX as required) Single-mode 1310 nm LC connector
- Uplink Port 18: one (1) SFP, 1000LX (or LX/LH or EX as required) Single-mode 1310 nm LC connector
- Uplink Ports 19 & 20: two (2) SFP, blank

Furnish and install one (1) new ControlbyWeb Web Relay I/O X-410 per DMS cabinet or approved equivalent.

Furnish and install Pepwave MAX 4G-LTE cellular routers (for temporary communications, see construction sequencing in this document) or approved equivalents at the DMS cabinets and ACN cabinets.

iv. Patch Cables:

Furnish and install new patch cables.

- Cat-6 Patch cables (quantity = 2) for each site
- Fiber Patch cables (quantity = 2) for each site

~~iv. Testing and Integration:~~

- ~~• Conduct OTDR end-to-end (FPP to FPP) fiber and network testing.~~
- ~~○ Coordinate with THEA's Systems Network Integrator for configuration and integration of MFES and Web Relay device.~~
- ~~○ All testing conducted and integration support provided will be considered incidental to the appropriate pay items (fiber and MFES).~~
- ~~▪ See the MTR for minimum testing requirements.~~

g. Site Upgrades: ACNs

The following is a summary of minimum ACN Cabinet upgrade requirements:

i. Removal of Materials:

~~i.~~ Summary:

Work to be performed will, include the removal of the following materials, paid per the most recent FDOT BoE under the following pay items.

Pay Item	Work Description
633 8 6	<ul style="list-style-type: none"> <li>• Remove existing shielded copper loop signal wire (command and monitoring cables) in existing conduit as shown on the ITS Plans</li> </ul>
690 100	<ul style="list-style-type: none"> <li><del>• Remove existing PLCs inside the ACN cabinets and replace with new PLCs.</del></li> <li>• Remove existing MFESs inside the ACN cabinets – replace with new switches</li> <li>• Remove existing fiber patch cables and replace with new patch cables</li> <li>• Remove existing Cat-5e patch cables (from PLC to MFES) and replace with new Cat-6 patch cable</li> </ul>

See also pay item notes in ITS Plans.

~~i.~~ Existing PLCs:

- ~~• Remove existing Schneider Electric Modicon Quantum processors and various modules and components. Existing wiring harnesses will be kept and re-used. The removal of the following components are to be considered incidental as part of the PLC pay item.~~

Equipment / Module	Description
<del>140-XBP-01000</del>	<del>10-slot chassis rack backplane</del>
<del>140-CPS-114-20</del>	<del>Power Supply 11A</del>
<del>140-CPU-113-02</del>	<del>Quantum CPU (586 Processor)</del>
<del>140-NOE-771-00</del>	<del>Ethernet Comm. Module</del>
<del>140-DDO-353-01</del>	<del>Discrete Input/Output (I/O) 24 VDC Output, 32 Points</del>
<del>140-DDI-353-00</del>	<del>Discrete I/O 24 VDC Input, 32 Points</del>

ii. **New Materials and Work:**

~~i-~~ Summary:

Work to be performed will, include furnishing and installation of the following new materials, paid per the most recent FDOT BoE under the following pay items.

Pay Item	Work Description
633 1121	<ul style="list-style-type: none"> <li>24-strand SM fiber drop cable from existing splice enclosure in existing splice vault to new ACN cabinet FPP. See the ITS Plans.</li> </ul>
633 2 31	<ul style="list-style-type: none"> <li>Fusion splices – see ITS Plans for splice details</li> </ul>
633 3 11 633 3 12	<ul style="list-style-type: none"> <li>Required splice trays in existing splice enclosure – see Plans for quantities</li> </ul>
633 3 16	<ul style="list-style-type: none"> <li>Panel / wall mount 24-port SM FPP in ACN cabinet – coordinate with THEA on placement. See ITS Plans and the MTR for details.</li> </ul>
684 90 101	<ul style="list-style-type: none"> <li>Replace existing MFES with a new wall/panel mounted Layer 3 Managed HUB Ethernet switch</li> <li>Cat-6 patch cord from MFES to new PLC</li> <li>Fiber patch cables as required</li> </ul>
<del>xxx 1 2</del>	<ul style="list-style-type: none"> <li><del>Replace existing PLC with new PLC system with software and hardware conversion solution</del></li> <li>Provide ControlbyWeb Web Relay Master (X-400 or X-600M) and Web Relay Expansion I/O (X-<del>1219S</del>, X-17S) or approved equivalent and connect to the network switch and existing 24VDC relays as shown on the Plans. <del>Contractor to develop site-specific ACN Wiring Diagrams.</del></li> <li>Configure &amp; wire Local Operator Interface panel and Web Relay devices for critical DMS message control and communications</li> </ul>

See also the MTR for minimum technical requirements and pay item notes in ITS Plans.

iii. **Network Equipment**

Furnish and install new Managed HUB Ethernet Switch: Siemens Ruggedcom RX1510 or RX1524 series (quantity = 1) as approved by THEA

(Model No: 6GK6015-0CM26-0DC0-Z A01+B36+C36+D01+E02)

- Layer 3 (L3) switch hardware with L3 Standard Edition software
- Panel (wall) mount kit

- AC power screw terminal block
- Two (2) 10/100/1000 TX RJ45 (2 ports each) line modules
- Two (2) 1000LX (or LX/LH or EX as required), SFP, Single-mode 1310 nm LC connector (2 ports each) line modules
- Coordinate with THEA on final placement of new MFES.

ii. ~~PLC Platform:~~

~~Furnish and install new Schneider Electric Modicon M580 Ethernet Programmable Automation Controllers (ePACs) as shown below. All quantities are per site to be paid for as part of the PLC pay item.~~

- ~~For Sites: 34 ACN, 78 ACN, DT ACN and 301 ACN (2 input module systems)~~

<del>Equipment/ Module</del>	<del>Quant</del>	<del>Description</del>
<del>BMENOC0321</del>	<del>1</del>	<del>M580 I/O Scanner Module, IP Forwarding, Ethernet/IP &amp; Modbus TCP, 3 ports - Coated</del>
<del>BMEP584040</del>	<del>1</del>	<del>Standalone M580 CPU level 40 - DIO &amp; RIO with 16 MB of internal memory, managing 16 Remote IO drops. Maximum number of network cards is 4.</del>
<del>BMEXBP0800</del>	<del>2</del>	<del>8 slot Ethernet rack backplane (chassis)</del>
<del>BMXCPS3500</del>	<del>2</del>	<del>AC Power supply 100-240 V, primary voltage limit: 85-264 V, 36 W</del>
<del>BMXDDI1602</del>	<del>4</del>	<del>Discrete 16-point input module, 24 V dc (pos.), current sink (logic pos.)</del>
<del>BMXDDO1602</del>	<del>2</del>	<del>Discrete 16-point output module, 24 V dc (pos.)</del>
<del>BMXXEM010</del>	<del>1</del>	<del>Protective cover for unused slot (set of 5)</del>
<del>BMXRMS004GPF</del>	<del>1</del>	<del>Modicon M580, SD flash memory card, 4 Go, for processor</del>
<del>BMXXBE2005</del>	<del>1</del>	<del>BACKPLANE EXTENDER KIT</del>

- ~~For Sites: BRN ACN (3 input module systems)~~

<del>Equipment/ Module</del>	<del>Quant</del>	<del>Description</del>
<del>BMENOC0321</del>	<del>1</del>	<del>M580 I/O Scanner Module, IP Forwarding, Ethernet/IP &amp; Modbus TCP, 3 ports - Coated</del>
<del>BMEP584040</del>	<del>1</del>	<del>Standalone M580 CPU level 40 - DIO &amp; RIO with 16 MB of internal memory, managing 16 Remote IO drops. Maximum number of network cards is 4.</del>
<del>BMEXBP0800</del>	<del>2</del>	<del>8 slot Ethernet rack backplane (chassis)</del>
<del>BMXCPS3500</del>	<del>2</del>	<del>AC Power supply 100-240 V, primary voltage limit: 85-264 V, 36 W</del>
<del>BMXDDI1602</del>	<del>6</del>	<del>Discrete 16-point input module, 24 V dc (pos.), current sink (logic pos.)</del>
<del>BMXDDO1602</del>	<del>2</del>	<del>Discrete 16-point output module, 24 V dc (pos.)</del>
<del>BMXXEM010</del>	<del>1</del>	<del>Protective cover for unused slot (set of 5)</del>
<del>BMXRMS004GPF</del>	<del>1</del>	<del>Modicon M580, SD flash memory card, 4 Go, for processor</del>
<del>BMXXBE2005</del>	<del>1</del>	<del>BACKPLANE EXTENDER KIT</del>

iii. ~~Retain legacy (existing) wiring:~~



~~The Contractor closely coordinate with Schneider Electric on the PLC upgrade process (2-step conversion: software and hardware) to Modicon M580 ePAC while retaining legacy (existing) field wiring.~~

~~iv. Hardware conversion:~~

- ~~• Provide a quick wiring adapter and swing arm assembly solution to eliminate re-wiring the existing I/O.~~
- ~~• Utilize a two (2) piece PLC I/O Chassis to allow the M580 ePAC system to fit within the same footprint and use the same mounting hardware as the Quantum backplane.~~
- ~~• Utilize I/O adapter assemblies that contains the translator unit and cable that will mount in the chassis and connect the Quantum field connector to the M580 I/O modules.~~
- ~~• For Sites: 34-ACN, 78-ACN, DT-ACN and 301-ACN provide the following:~~

<b>Equipment/ Module</b>	<b>Quant</b>	<b>Description</b>
990ADQUAX80100	2	<del>Evolution I/O adapter 140DAI/DDI*5300 to (2)BMXDAI/DDI160*2 ft.</del>
990ADQUAX80206	1	<del>Evolution I/O adapter 140DDO35301/35310 to (2)BMXDDO16*2 2 ft.</del>
990CHQUAX80100	1	<del>Evolution PLC I/O Chassis 140XBP01000 to BM*XBP without backplate</del>

- ~~• For Sites: BRN-ACN provide the following:~~

<b>Equipment/ Module</b>	<b>Quant</b>	<b>Description</b>
990ADQUAX80100	3	<del>Evolution I/O adapter 140DAI/DDI*5300 to (2)BMXDAI/DDI160*2 ft.</del>
990ADQUAX80206	1	<del>Evolution I/O adapter 140DDO35301/35310 to (2)BMXDDO16*2 2 ft.</del>
990CHQUAX80100	1	<del>Evolution PLC I/O Chassis 140XBP01000 to BM*XBP without backplate</del>

~~v. Software conversion:~~

- ~~• Utilize Unity M580 Application Converter (UMAC) utility to convert existing Quantum application program to M580 compatible code~~

~~Note: Schneider Electric has recently uploaded the original THEA PLC software and is programming the M580 for a new ACN site on another THEA contract. For this contract, the software conversion will need to be done for each existing ACN site. The Contractor will need to import the descriptors from the other project, but will need to fill in missing descriptors for I/O and logic that may be different (e.g., number and type of I/O devices at a particular site) depending on the specific ACN site.~~

- ~~• Utilize EcoStruxure Control Expert V15.1 or newer programming software to retain the existing PLC application program. Correct generated errors from UMAC and download to new PAC.~~

Equipment/ Module	Quant	Description
CEXSPUCZXSPAZZ	1	CONTROL EXPERT EXTRA LARGE (XL) SINGLE (1 user) E-License

iv. Patch Cables:

Furnish and install new patch cables.

- Cat-6 Patch cables (quantity = 2) for each site
- Fiber Patch cables (quantity = 4) for each site

~~vi. Testing and Integration:~~

- ~~• Conduct end-to-end (FPP to FPP) fiber, network and PLC subsystem testing.~~
- ~~• Coordinate with THEA's Systems Network Integrator for configuration and integration of Managed HUB Ethernet Switch and Web Relay devices.~~
- ~~• Coordinate with Teledyne FLIR to interface with the THEA ACS head-end software currently being upgraded. Provide PLC addresses and other requested items to FLIR to be assigned to the Cameleon ITS software. This will need to be included in the mock-up testing of the system prior to being installed and going live.~~
- ~~• All testing conducted and integration support provided will be considered incidental to the appropriate pay items for fiber, Managed HUB Ethernet Switch, and PLC.~~
- ~~• See the MTR for minimum testing requirements.~~

h. Integration and Testing:

i. Contractor to provide testing:

- Fiber Testing: conduct OTDR end-to-end (FPP to FPP) fiber testing before and after installation
  - Pre-installation – while on the fiber reel
  - Post-installation – after splicing and termination
- DMS Communications Testing:
  - Conduct testing to confirm the capability to remotely change and store DMS messages and monitoring DMS status over the fiber communications network.
  - Conduct testing to confirm the capability to select and activate DMS stored messages in both manual (LOI) and automatic (via the PLC) mode.
  - Coordinate with FLIR and Daktronics for testing.
- Test Plan: submit a Test Plan for review and approval by THEA prior to any testing.

ii. Contractor to coordinate with THEA or the designated point of contact in the completion of the following integration activities:

- THEA and THEA's Systems Network Integrator for set-up, configuration and testing of network switches

- THEA and THEA's Systems Network Integrator for set-up and testing of the Pepwave MAX 4G-LTE cellular routers (for temporary communications). See construction sequencing herein for additional details)
- Daktronics for interfacing and testing the Web Relays with the existing DMS controllers / DCIO relays for message selection
- Web Relay manufacturer for set-up and configuration of the web relays
- Schneider Electric for integration with the PLC
- Teledyne FLIR for integration and mock-up testing with ACS head-end software

iii. See the MTR for minimum full testing requirements

iv. All testing conducted and integration support provided will be, considered incidental to the appropriate pay items (fiber trunk and drop cables, MFES, web relays, temporary cellular routers/modems).

~~Testing:~~

~~————Conduit OTDR testing of fiber optic cabling before and after installation.~~

~~Pre-installation—while on the fiber reel~~

~~Post-installation—after splicing and termination~~

~~All testing conducted will be considered incidental to the fiber pay items~~

~~See the MTR for minimum testing requirements.~~

i. Training:

i. Conduct training for changing and storing messages and monitoring of DMS status

ii. All training conducted will be considered incidental.

iii. See MTR for minimum training requirements.

~~• Conduct PLC training~~

~~• All training conducted will be considered incidental to the PLC pay item.~~

~~• See the MTR for minimum training requirements.~~

j. **Construction Execution**~~Sequencing~~

#### Pre-Construction / Infrastructure Preparation Activities

i. Develop and submit a Construction Schedule to THEA for review and approval prior to any construction activities.

ii. Complete a field review / investigation, conduit proofing and review of digital as-built information.

1. Provide red-lines of the ITS Plans to reflect the field investigation, verification and review of field conditions and pay item quantities, and notify the Authority of any deviations or disagreements found in the ITS Plans and drawings, the MTR and/or general conditions or

existing field conditions. The red-lined ITS Plans shall be submitted to THEA for review and approval prior to construction activities.

2. Submit a proposed plan for conduit proofing to THEA for review and approval prior to proofing.
3. Prepare and submit a field report documenting the findings of the field review/investigation and conduit proofing to THEA for review and approval. The report shall include a plan to:
  - Remove pull boxes as shown on the Plans and replace them with new larger fiber pull boxes.
  - Repair any damaged conduit and/or pull boxes (per Contractor field review and conduit proofing) following THEA approvals and any permitting that may be required.
- iii. Perform repairs of any damaged infrastructure and installation of any new conduit and/or pull boxes, as required or needed.
- iv. Prepare and submit wiring schematics / diagrams of proposed equipment in the cabinets to THEA for review and approval prior to any construction activities.
- v. Prepare and submit MOT Plan for review and approval prior to construction activities.
- vi. Prepare and submit a Switchover Construction Plan clearly laying out a plan to transition and migrate DMS control and monitoring from copper to fiber.
  - a) The Plan must be reviewed and approved by THEA prior to the commencement of any construction activities.
  - b) Schedule only one (1) ACN and segment (DMS ring) to be switched over at one time.
  - c) Switchover plan must include the sequence of construction, configuration, integration, and testing to minimize network downtime, minimize risks and maximize safety.
  - d) Include a detailed description on the proposed plan to remove existing DMS copper signal wiring (command and monitoring) in existing conduit without damaging other cables in the conduit. Contractor has the option to install new fiber in existing conduit without the removal of existing copper signal wiring. If this option is taken provide a detailed description of how this would be accomplished to avoid damage during installation to the new fiber cable and any existing cables that are to remain.
  - e) The Plan must include a description of the installation of proposed equipment including the web relays, temporary cellular routers, configuration and integration of network equipment, integration with the existing PLC, LOI as well as existing 24VDC relays in the ACN and DMS cabinets. All DMSs must be communicating via the temporary cellular communications medium prior to the start of fiber installation and removal of control and monitoring signal copper wire.
- vii. Coordinate network downtime with Joe Ferreira of THEA and the THEA Systems Network Integrator, a minimum of two (2) weeks in advance of a scheduled THEA ITS network shutdown or system interruption.

Joe Ferreira  
Tampa Hillsborough County Expressway Authority  
1104 East Twiggs Street

Tampa, Florida 33602  
C: 813.442.4605  
[JoeF@tampa-xway.com](mailto:JoeF@tampa-xway.com)

- a) The time window for scheduled THEA operations network downtime must only begin after 2:00 PM, and completed by 4:00 AM unless otherwise approved by the Authority. The tolls network (the blue buffer tube) must not have any downtime.
  - b) Restore, a minimum of 30 minutes prior to the window ending, the network to a fully functional and operational network.
  - c) Refer to Maintenance of Traffic (MOT) requirements specified herein.
- ~~viii. Verify communications with the TMC prior to leaving a site.~~
- ~~ix. Switchovers must follow the sequence of construction to minimize network downtime, minimize risks and maximize safety.~~
- ~~x. Prepare and submit a Switchover Construction Plan clearly laying out a plan to transition and migrate DMS control and monitoring.~~
- ~~a) The Plan must be reviewed and approved by THEA prior to the commencement of any construction activities.~~
  - ~~b) Schedule only one (1) ACN and segment (DMS ring) to be switched over at one time.~~

~~Scheduled THEA approved network downtime.~~

- ~~• The segment must be fully restored with the new fiber optic communications operational before starting the next segment~~
- ~~• All DMSs must be communicating via the temporary cellular communications medium prior to the start of fiber installation and removal of control and monitoring signal wire.~~

Network Equipment Configuration

- i. Set-up and configuration of network equipment.
  - a) Set-up and configure ~~Furnish and install~~ Pepwave MAX 4G-LTE cellular routers (for temporary communications) and Controlbyweb web-controlled relays ~~as shown on the Plans~~ or approved equivalents at the DMS cabinets ~~as shown on the Plans and ACN cabinets.~~
    - Provide cellular routers and dual SIM cards compatible with **existing** THEA's Verizon Access Point Name (APN). Routers and SIM card(s) must be configured according to THEA security protocols and requirements.
    - Coordinate with **THEA** and THEA's Systems Network Integrator for set-up and testing of the cellular routers and cellular connections from the TMC to the DMSs.
    - ~~• Provide web-controlled relays to provide temporary peer-to-peer connections with the DMSs. Coordinate with the THEA's Systems Network Integrator to configure and test.~~
    - Propose placement of the **cellular router web-relay** equipment ~~and cellular modem~~ in the **DMS cabinets** to THEA for review and approval.

- b) Set-up and configure Controlbyweb web-controlled relays or approved equivalents at the DMS cabinets and ACN cabinets as shown on the Plans.
  - Provide web-controlled relays to provide temporary peer to peer connections with the DMSs.
  - Coordinate with web relay manufacturer for set-up and configuration and testing of web relays.
  - Propose final placement of the web relay equipment in the cabinets to THEA for review and approval. If any existing equipment is to be relocated in any of the cabinets, a proposed drawing must be developed and approved by THEA prior to moving equipment.
- c) Set-up and configure Network Switches (Layer 2 and 3) at the ACN and DMS cabinets as shown on the Plans.
  - Provide Layer 2 and 3 network switches as specified herein.
  - Coordinate with THEA and THEA's Systems Network Integrator for set-up and configuration of network switches using existing switch configuration files.
  - Propose final placement of the network equipment in the cabinets to THEA for review and approval. If any existing equipment is to be relocated in any of the cabinets, a proposed drawing must be developed and approved by THEA prior to moving equipment.

#### Demonstrate ~~Establish~~/ test Temporary Communications and Connection to DMS

- i. Demonstrate and test cellular communications and the web-controlled relay solution using a laptop (DMS controller) to establish connection with the THEA TMC network via the THEA firewall to the same switch as the Teledyne FLIR/DYNAC server.
  - a) Establish cellular communications from TMC to field sites - establish capability to manually control critical DMS open/close messages over the cellular communications.
  - b) Perform a system mock-up / bench test to demonstrate and test manual DMS open/close message control from the TMC as well as ACN Local Operator Interface (LOI) panel control from the ACN over the cellular communications link using a web-controlled relay. The Web Relay solution is to be installed in the ACN and DMS cabinets.
  - c) The existing DMS cabinet relays (DCIO) at the DMS site will remain and interface with the Web Relay device. Instead of electrical signals being transmitted over the command and monitoring signal wires they would be converted from Ethernet to electrical signals to actuate the local relays and change the sign message. They will provide the means to send voltages to the PLCs.
  - d) Coordinate and work with FLIR and Schneider Electric for testing.

#### Construction Sequencing

Once Pre-Construction and Network Equipment Configuration activities are completed and approved and Temporary DMS communications has been successfully bench tested the approved Switchover Plan will commence.

- i. Implement the MOT Plan, as required.
- ii. Install cellular routers and web relay devices in cabinets as shown on the Plans.
- iii. Establish temporary cellular TMC to DMS connection and demonstrate the ability to select DMS controller messages. Temporary communications will be established for 1 ACN and associated DMSs at one time while fiber infrastructure is being installed.
- iv. Once temporary DMS cellular network communications is operational then proceed with the following construction sequencing.

1. Remove existing FPP and network switch in ACN cabinet.
2. Install new fiber patch panels in DMS and ACN cabinets.
3. Install new network switches in ACN and DMS cabinets.
4. Install new fiber splice enclosures in new fiber pull boxes.
5. Remove existing DMS copper signal wire (command and monitoring) in existing conduit. As indicated in the Switchover Plan the Contractor has the option to install new fiber in existing conduit without removal of existing DMS copper signal wiring. Great care must be exercised to avoid damage to any existing cables to remain and new fiber cables to be installed.
6. Pull new fiber distribution (72 strand) and drop cables (12/24 strand). The design intent is to pull new fiber cable through existing conduit to the extent possible.
7. Splice and terminate per the ITS Plan splice and termination details.
8. Test the installed fiber plant. All fiber optic cable must be tested and approved by THEA before cut-over to fiber DMS communications is to commence. See MTR for testing requirements.
9. Re-wire / disconnect copper wiring for DMS control and monitoring, as required. Configure & wire Local Operator Interface panel, existing 24VDC relays and Web Relay devices for DMS message control and communications as shown in the Plan details
10. Furnish and install all patch cables (CAT-6 and fiber patch) for the devices in the cabinets as shown on the Plan details.
11. Cut-over to fiber and perform end-to-end systems testing from the TMC to the ACN and associated DMSs etc. Including both manual (via the LOI) and automatic control (via the PLC and TMC).
  - Contractor to coordinate testing schedule with THEA.
  - Coordinate with Schneider Electric, FLIR and the THEA Systems Network Integrator for all testing and integration.
  - See the MTR for testing requirements.

12. Once the testing is successfully completed, verified and approved by THEA, relocate the cellular routers to the next segment / corridor (sign ring) and repeat the sequence (iv / 1 to 11) for the next ACN and DMS segment / corridor.

~~ii. — Pre-assemble and test new PLC~~

~~iii. — Pre-assemble a new M580 rack and perform software conversion per Schneider Electric instructions and support to retain the existing Quantum logic software on the new PLC M580 platform. Coordinate and work with Schneider Electric on the conversion process.~~

~~iv. — Test using a system mock-up of the pre-assembled and pre-configured PLC to test and verify that the equipment, software and process is ready to implement prior to implementing in the field (going live).~~

~~v. — Coordinate with THEA to schedule time to set-up and test using a THEA ACS hybrid mock-up test system being used as part of the on-going ACS software upgrade project, if available.~~

~~The Contractor shall be responsible to fully test the proposed upgraded equipment and software prior to field installation and going live.~~

~~vi. — Configure new Layer 2 and Layer 3 network switches~~

~~vii. — Configure the new Layer 2 and Layer 3 network switches. Coordinate with the THEA Systems Network Integrator.~~

Field Infrastructure Preparation — while working on 1) to 4) above

~~viii. — Install new fiber patch panels in DMS and ACN cabinets.~~

~~ix. — If any equipment is to be relocated in any of the cabinets, a proposed drawing must be developed and approved by THEA prior to moving equipment.~~

System Preparation to go live — once 1) to 7) above are completed and operational.

~~x. — Once the first ACN / corridor is live and operational with DMSs being controlled using cellular communications and web-controlled relays then start the switchover procedures to fiber as follows:~~

~~i. — Implement approved MOT Plan, as required.~~

~~ii. — Remove pull boxes as shown on the Plans and replace them with new larger fiber pull boxes.~~

~~iii. — Repair any damaged conduit and/or pull boxes following THEA approvals and any permitting that may be required.~~

~~iv. — Remove existing copper signal wire in existing conduit.~~

~~v. — Pull new fiber distribution and drop cables~~

~~vi. — Splice and terminate per the ITS Plan splice and termination details~~

~~vii. — Test the installed fiber plant. All fiber optic cable must be tested and approved by THEA before cut-over to fiber communications is to commence.~~



- ~~viii. While fiber is being installed and tested power down existing PLC rack. Remove existing wiring harness from Quantum I/O modules.~~
- ~~ix. Remove existing PLC rack from the ACN cabinet including the Backplane, Power Supply and I/O modules.~~
- ~~x. Once removed install the pre-assembled and pre-configured PLC Hardware Conversion Rack (see 2 & 3 above) in the same rack location / footprint using a quick wiring adapter and swing arm assembly solution to eliminate re-wiring existing I/O. Re-establish wiring harness to new PLC platform. Coordinate and work with Schneider Electric on conversion process.~~
- ~~xi. Re-wire / disconnect wiring for DMS control and monitoring. Configure & wire Local Operator Interface panel and Web Relay devices for DMS message control and communications.~~
- ~~xii. Remove existing MFES in the ACN, and install new pre-configured Managed HUB Ethernet switch. Install the new pre-configured MFESs in the DMS cabinets.~~
- ~~xiii. Install all patch cables (Cat 6 and fiber patch) as required.~~
- ~~xiv. Verify Ethernet communications to the THEA TMC. Coordinate with the THEA Systems Network Integrator.~~
- ~~xv. Test the ACN PLC and DMS sign communications in accordance with the approved Test Plan and procedures. See the MTR for testing requirements.~~
- ~~xvi. Once the testing is successful and verified by an Authority official, restart the ACN and place online.~~
- ~~xi. Once 8) above is completed and operational, relocate the cellular routers to the next segment / corridor (sign ring).~~
- ~~Coordinate with the THEA ACS consultant (Teledyne FLIR) and the THEA Systems Network Integrator to establish communications on the next segment.~~
- ~~xii. Repeat this sequence for each individual ACN and segment / corridor~~

**k. Maintenance of Traffic (MOT) / Temporary Traffic Control (TTC) Requirements**

The following is a list of minimum MOT / TTC requirements:

- i. MOT/TTC must be provided by the Contractor during all set-up and takedown activities and work activities.

MOT to be performed by “MOT certified” staff in accordance with the latest edition of the Florida Department of Transportation (FDOT), Standard Specifications for Road and Bridge Construction, Section 102, Maintenance of Traffic.

Prepare and submit to the Authority a MOT Plan that is signed and sealed by a Professional Engineer whenever a deviation is anticipated from the most recent edition of the FDOT Standard Plans, Index 102.

- ii. All existing vehicular and pedestrian travel patterns for the Selmon Expressway and Brandon Parkway must be maintained at all times.

~~iii. Work to be performed between the hours of 7:00 AM and 5:00 PM Local Time, Monday through Friday and between the hours of 8:00 AM and 5:00 PM on Saturday.~~

- iii. Lane closures must only be permitted during the following off-peak hours and must accommodate daily reversal operations.
- Selmon Express local lanes and ramps: 9:00 AM- 3:00 PM and 7:00 PM to 5:00 AM
  - Reversible Expressway lanes and ramps: 9:00 AM- 3:00 PM and 7:00 PM to 5:00 AM
  - Reversal Operations: M-F 5:30 AM, 9:30 AM, 12:30 PM
- iv. Coordination with the Authority is required to ensure compliance with any special event or holiday schedules that may be in effect during the period of performance.
- v. The Contractor will be responsible for liquidated damages for failure to complete the work necessary to allow reopening of lane closures within the Contractor's MOT Plan.
- vi. Liquidated Damages: A damage recovery/user cost will be assessed against the Contractor if all lanes are not open to traffic during the times as shown in the Traffic Control Plans. Costs will be assessed beginning at the appropriate time as shown in the Traffic Control Plans and continue until all lanes are open as recorded by the THEA. This assessment will be in the following amounts:
- First 30 minutes and under: \$15,000.00
  - Each additional 30 minute period or portion thereof: \$2,500.00

Such costs will not exceed \$25,000.00 over a 24 hour period.

At the discretion of the THEA, damage recovery/user cost will not be assessed for failure to open traffic lanes if such cause is beyond the control of the Contractor, i.e., catastrophic events, accidents not related or caused by the Contractor's operations.

### 3. SUBMITTALS

The following is a list of minimum submittal requirements:

- a. Submittal Requirements:
- i. Organize each package of submittal data by pay item and include materials and components that are required for a given pay item into a single package.
  - ii. Clearly denote on the cut-sheets what is specifically being proposed. If multiple models/part numbers are contained on a submitted cut-sheet or brochure, clearly denote (mark) on the cut-sheet/brochure which model/part number(s) is being proposed.
  - iii. Clearly identify in the submittals any deviations from the Contract requirements and specifications. Provide a detailed description of the deviation with the reason for the change. The THEA reserves the right to reject any variation or change for any reason.
- b. Manufacturer Product Cut-sheets.

Submit to the Authority for approval prior to procurement the following material cut-sheets:

- i. Fiber optic cable (distribution and drop) – 12-str, 24-str and 72-str
- ~~ii. Fiber pull boxes – 24" x 36" x 30"~~
- ii. Splice vaults – 30" x 60" rectangular or 36" round

- iii. Conduit, as needed, as specified in the MTR
  - iv. Splice enclosures including splice trays and rack mounting hardware
  - v. Fiber patch panels and connectors, rack and wall mounted
  - vi. Managed field Ethernet switches (MFES) and mounting hardware
  - vii. Web Relay and cellular communications equipment
  - ~~viii. PLC equipment and components~~
- c. MOT Plan.
    - i. Prepare and submit to the Authority a MOT Plan that is signed and sealed by a Professional Engineer ~~whenever a deviation is anticipated from the most recent edition of the FDOT Standard Plans, Index 102.~~
  - d. ~~Shop~~ Drawings.
    - i. Prepare and ~~submit provide~~ drawings / schematics to the Authority for review and approval as ~~specified herein and any shop drawings to the Authority for approval for~~ any items of Work not fully detailed in the ITS Plans which require additional drawing(s) and coordination prior to construction.
    - ii. Provide layout / placement of web relay equipment and cellular routers in cabinets.
  - e. Test Plan.
    - i. Provide a test plan with procedures developed in conjunction with the manufacturer(s) for pre-installation tests, stand-alone tests, acceptance tests, and burn-in tests as specified herein.
    - ii. See the MTR for testing requirements.
  - f. Test Report Documentation.
    - i. Provide test report documentation as specified herein.
  - g. Construction Schedule.
 

Develop and submit a Construction Schedule to THEA for review and approval prior to any construction activities.
  - h. Warranty Requirements.
    - i. Provide warranties as specified in the MTR.
  - i. Training. ~~Plan and Schedule~~
    - i. ~~Provide a training plan and~~ Conduct training for DMS communications and messaging. See the MTR for training requirements.
  - i. Spare Parts.
    - i. Provide spare parts as specified in the MTR
  - j. As-Built Plans and Documentation.
    - i. Provide detailed red-lines of project ITS Plans of all constructed equipment and infrastructure including fiber routing, pull boxes, splice vaults, conduit, splicing locations, cabinet revisions /

modifications including any items moved or relocated, etc. Provide GPS coordinates / locations for all splices made.

- ii. Provide ~~site-specific ACN~~-cabinet wiring ~~schematics / diagrams for proposed equipment and upgraded cabinets.~~
- iii. Provide fiber splicing diagrams and utilization.
- iv. As-built plans and documentation must be reviewed and approved by THEA prior to completion of this project.

#### 4. EXECUTION

##### a. Work Sequence

- i. The project schedule must commence from the Notice to Proceed (NTP) date being Day One.
- ii. All contract work must be completed within **240 calendar days** of NTP as established by the Contractor's approved procurement schedule. This includes active work only, and not material acquisition / procurement and fabrication.

##### b. Issue Escalation

In the event issues arise during the execution of the work, the issue escalation and resolution will be processed as detailed herein. All issues shall be directed to ~~the THEA's Construction Engineering Inspection (CEI)~~ Project Manager (to be determined). The Contractor must provide all supporting documentation relative to the issue being escalated, and any documentation not provided in the initial contact with THEA's CEI Project Manager.

If the issue cannot be resolved by the CEI in coordination with the General Engineering Consultant (GEC) representing THEA as applicable, the GEC representing THEA will forward the issue to THEA's Director of Operations and Engineering who will coordinate with the GEC representing THEA and CEI, as applicable.

Each escalation level will have a maximum of five (5) calendar days (excluding weekends and THEA observed holidays) to answer, resolve, or address the issue. The five (5) calendar day period begins when each level in the issue escalation process has received all required supporting documentation necessary to arrive at an informed and complete decision. The five (5) calendar day period is a response time and does not infer resolution.

Questions asked by THEA may be expressed verbally and followed up in writing within one (1) calendar day (excluding weekends and THEA observed holidays). Responses provided by the Contractor may be expressed verbally and followed up in writing within one (1) working day.

Once a response is received from the Director of Operations and Engineering, the CEI will respond to the Contractor in a timely manner but not to exceed three (3) calendar days (excluding weekends and THEA observed holidays).

#### 5. MEASUREMENT AND PAYMENT

##### a. Pay Items.

- i. All work will be paid per the most recent FDOT BoE.

- ii. All labor, vehicles, equipment, materials, insurance, project management, supervision and administrative costs are included in the associated pay items
- b. Incidental work.
  - i. All other work for this project will be considered incidental to the above pay items and will not be paid separately. This includes but is not limited to work covered under the below FDOT specification sections
    - SECTION 104: PREVENTION, CONTROL, AND ABATEMENT OF EROSION AND WATER POLLUTION
    - SECTION 107: LITTER REMOVAL AND MOWING
    - SECTION 120: EXCAVATION AND EMBANKMENT

**EXHIBIT B**

**BID PROPOSAL FORM**  
**(Print this page on bidder's letterhead)**

Date: \_\_\_\_\_

TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)

Attention: Shannon Bush  
Contracts & Procurement Manager  
1104 East Twiggs Street, Suite 300  
Tampa, FL 33602

Subject: CONSTRUCTION SERVICES FOR CONTROL SYSTEM & DMS FIBER COMMUNICATIONS  
UPGRADES ~ ITB No. O-1223

Dear THEA:

Having carefully examined the Instructions to Bidders, Supplementary Instructions to Bidders, the terms of the contract, General Provisions, Supplementary General Provisions, Special Provisions and Technical Specifications, Plans or Drawings (if issued), of the above subject project and contract, as well as the premises and the conditions affecting the work, the undersigned proposes to furnish all labor and materials called for by them and equipment necessary and to accomplish the entire work within the time period indicated in accordance with the said documents for the prices presented in the price schedules included in this Bid Proposal Form.

The undersigned acknowledges that they understand the following conditions that within the price schedules any unit prices other than lump sum (i.e. EA, Ton, LF, Day, Month, CY, SY) and extended amounts indicated with brackets around the insertion lines are considered to be deducts or credits to the overall project cost. Calculations of price schedule extensions and price totals shall appropriately account for individual deductive and additive pay items.

**[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]**

## PRICE SCHEDULE - BASE BID

### CIVIL: GENERAL CONSTRUCTION

- C1. Providing all the labor, equipment, materials, tools, transportation, supplies, insurance, incidentals, mobilization, demobilization and maintenance of traffic necessary install CONTROL SYSTEM & FIBER OPTIC CABLE AND NETWORK EQUIPMENT upgrades per the attached ITS reference plans.

Pay Item	Description	Unit	Estimated ITS Plan Quantity	Unit Price	Bid Price
101-1	MOBILIZATION	LS	1		
102-1	MAINTENANCE OF TRAFFIC	LS	1		
630-2-11	CONDUIT, FURNISH & INSTALL, UNDERGROUND	LF	<i>Per Conduit Proofing</i>		
630-2-14	CONDUIT, FURNISH & INSTALL, ABOVEGROUND	LF	<i>Per Conduit Proofing</i>		
630-2-15	CONDUIT, FURNISH & INSTALL, BRIDGE MOUNTED	LF	<i>Per Conduit Proofing</i>		
633-1-121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF	11,808		
633-1-122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF	340		
633-1-123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	73,740		
633-2-31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA	234		
633-3-11	FIBER OPTIC CONNECTION H/W, SPLICE ENCLOSURE, F&I	EA	28		
633-3-12	FIBER OPTIC CONNECTION H/W, SPLICE TRAY, F&I	EA	41		
633-3-16	FIBER OPTIC CONNECTION H/W, PATCH PANEL, FT, F&I	EA	37		
633-8-6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	64,045		
635-2-13	FIBER SPLICE VAULT, F&I, 36" X 60" RECT OR 36" ROUND	EA	28		
684-1-1	MANAGED FIELD ETHERNET SWITCH, F&I	EA	35		
684-90-101	ACN MANAGED HUB ETHERNET SWITCH, F&I	EA	6		
690-100	REMOVE MISCELLANEOUS EQUIPMENT – PER SITE	PI	10		
XXX-1-1	WEB RELAY, F&I	EA	35		
XXX-1-2	WEB RELAY CONTROL, F&I	LS	5		
XXX-1-3	CELLULAR ROUTER, F&I	EA	13		
				<b>Bid Total</b>	

Quantities include spares as specified in MTR Section IV (4) Spare Parts.

\_\_\_\_\_  
Name of Firm

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Date

**Note:** THEA will provide “reference only” plans that show general path of fiber, locations of infrastructure and estimated pay items quantities. Recently completed digital as-built information is also being provided.

Respondents will be responsible to verify all quantities and submit a bid proposal based on these quantities. THEA will pay actual installed quantities per the latest FDOT BOE.

- i. Fiber – per linear foot as measured by markings on cable (so as to include slack coils)
- ii. Conduit – per linear foot as measured point to point horizontally (UG) and vertically (AG)
- iii. Splice vaults / Pull boxes, MFESs, fiber patch panels, web relays, other network equipment – each

**Firms MUST** acknowledge receipt of this Addendum by signing, dating and returning the completed Acknowledgement of Receipt of Addendum form **with the Firm’s proposal**.

All other items, conditions, and specifications in the ELOI document not specifically changed by the Addendum remain unchanged.

Firms failing to acknowledge the addendum issued may be deemed non-responsive to the ELOI.

Please send all questions to THEA’s Procurement Manager, Shannon Bush, via email at [Procurement@tampa-xway.com](mailto:Procurement@tampa-xway.com).

**A CLEAN COPY OF THE ITB O-1223 IS ATTACHED FOR YOUR REFERENCE.**



**EXHIBIT H**

**ACKNOWLEDGEMENT OF RECEIPT OF ADDENDUM and/or LETTER OF CLARIFICATION**

Were Addenda issued on this Solicitation?

- ☐ Yes  
☐ No

Were Letter of Clarification issued on this Solicitation?

- ☐ Yes  
☐ No

I (We) hereby acknowledge receipt of the following Addendum/Addenda issued in reference to this solicitation by listing the Addenda by number, date and signing the form:

Addendum	_____	Date:	_____
Addendum	_____	Date:	_____
Addendum	_____	Date:	_____

Letter of Clarification	_____	Date:	_____
Letter of Clarification	_____	Date:	_____
Letter of Clarification	_____	Date:	_____

**BIDDER:**

By: Authorized Signature

\_\_\_\_\_  
Printed Name of Signer

\_\_\_\_\_  
Title of Signer

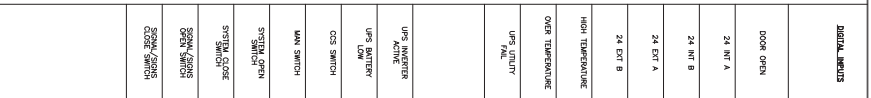
\_\_\_\_\_  
Date Signed

**[END OF ACKNOWLEDGMENT OF RECEIPT FORM]**







[illegible]

Atlanta, Georgia

ACCESS CONTROL NODE GENERIC WIRING DIAGRAM	SOURCE	306 NO.	3042
	NONE		
	CAD FILE NO.	SHT.	OF
	3042-2004-03	3	9
TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY REVERSIBLE EXPRESS LANE ITS	ISSUANCE NO.	REV.	
	3042-2004-03	A	

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The graph displays the relationship between 'FROM LINE' and 'TO LINE' for different 'COUNT' values. The data is organized into four main sections: 400, 410, 420, and 430. Each section contains a table of data points and a corresponding line plot. The 'FROM LINE' values range from 0 to 1000, and the 'TO LINE' values range from 0 to 1000. The 'COUNT' values are 400, 410, 420, and 430. The line plot shows a series of points connected by lines, with some points highlighted in red. The graph is titled 'FROM LINE' and 'TO LINE'.

COUNT	FROM LINE	TO LINE
400	FROM 05-400-1 (PT15)	4-01
	LINE 682	
	FROM 05-400-2 (PT15)	4-02
	LINE 683	
	FROM 05-400-3 (PT15)	4-03
	LINE 707	
	FROM 05-400-4 (PT15)	4-04
	LINE 709	
	FROM 05-400-5 (PT15)	4-05
	LINE 720	
410	FROM 05-410-1 (PT15)	4-06
	LINE 723	
	FROM 05-410-2 (PT15)	4-07
	LINE 724	
	FROM 05-410-3 (PT15)	4-08
	LINE 737	
	FROM 05-410-4 (PT15)	4-09
	LINE 750	
	FROM 05-410-5 (PT15)	4-10
	LINE 752	
420	FROM 05-420-1 (PT15)	4-11
	LINE 753	
	FROM 05-420-2 (PT15)	4-12
	LINE 770	
	FROM 05-420-3 (PT15)	4-13
	LINE 773	
	FROM 05-420-4 (PT15)	4-14
	LINE 784	
	FROM 05-420-5 (PT15)	4-15
	LINE 787	
430	FROM 05-430-1 (PT15)	4-16
	LINE 825	
	FROM 05-430-2 (PT15)	4-17
	LINE 826	
	FROM 05-430-3 (PT15)	4-18
	LINE 825	
	FROM 05-430-4 (PT15)	4-19
	LINE 826	
	FROM 05-430-5 (PT15)	4-20
	LINE 827	

DIGITAL INPUTS		FROM LINE		LINE		FROM LINE		LINE	
450	GATE 1 CLOSED	FROM CR-830-1 (P15)	4-17	21		NET POWER			
	GATE 1 OPEN	FROM CR-830-2 (P15)	4-18	22		NET WORK			
	GATE 2 CLOSED	FROM CR-834-1 (P15)	4-19	23		NET PROHIBIT			
	GATE 2 OPEN	FROM CR-834-1 (P15)	4-20	24		NET EMPLOYED			
460	GATE 3 CLOSED	FROM CR-830-1 (P15)	4-22	26		SPARE 10			
	GATE 3 OPEN	FROM CR-830-2 (P15)	4-23	27		PORTAL WAS CLOSED			
	GATE 4 CLOSED	FROM CR-838-1 (P15)	4-24	28		GMS 1 CLOSED			
	GATE 4 OPEN	FROM CR-838-1 (P15)	4-24	29		GMS 1 OPEN			
470	GATE 5 CLOSED	FROM CR-830-1 (P15)	4-25	30		GMS 2 CLOSED			
	GATE 5 OPEN	FROM CR-838-1 (P15)	4-26	32		GMS 2 OPEN			
	GATE 6 CLOSED	FROM CR-830-1 (P15)	4-27	33		GMS 3 CLOSED			
	GATE 6 OPEN	FROM CR-832-1 (P15)	4-28	34		GMS 3 OPEN			
	GATE 7 CLOSED	FROM CR-830-1 (P15)	4-29	35		GMS 4 CLOSED			
480	GATE 7 OPEN	FROM CR-830-1 (P15)	4-30	36		GMS 4 OPEN			
	NET DOWN	FROM CR-834-1 (P15)	4-31	37		GMS 5 CLOSED			
	NET UP	FROM CR-830-1 (P15)	4-32	38		GMS 5 OPEN			
490				39					

[illegible]

500	FROM LINE 0-JNT			TO LINE 0-JNT		DIGITAL SERVICES	
	FROM LINE 852	5-01	1	CMS 6	CLOSED		
	FROM CR-864-1 (PT-5)	5-02	2	CMS 6	OPEN		
	FROM CR-864-1 (PT-5)	5-03	3	CMS 7	CLOSED		
	FROM CR-864-1 (PT-5)	5-04	4	CMS 7	OPEN		
	FROM CR-864-1 (PT-5)	5-05	5	CMS 8	CLOSED		
	FROM CR-864-1 (PT-5)	5-06	6	CMS 8	OPEN		
	FROM CR-864-1 (PT-5)	5-07	7	CMS 9	CLOSED		
	FROM CR-870-1 (PT-5)	5-08	8	CMS 9	OPEN		
	FROM CR-870-1 (PT-5)	5-09	9				
	FROM CR-870-1 (PT-5)	5-10	10				
	FROM CR-870-1 (PT-5)	5-09	11	CMS 10	CLOSED		
	FROM CR-870-1 (PT-5)	5-10	12	CMS 10	OPEN		
	FROM CR-880-1 (PT-5)	5-11	13	CMS 11	CLOSED		
	FROM CR-880-1 (PT-5)	5-12	14	CMS 11	OPEN		
	FROM CR-880-1 (PT-5)	5-13	15	CMS 12	CLOSED		
	FROM CR-880-1 (PT-5)	5-14	16	CMS 12	OPEN		
	FROM CR-880-1 (PT-5)	5-15	17				
	FROM CR-880-1 (PT-5)	5-16	18				
	FROM CR-880-1 (PT-5)	5-17	19				
FROM CR-880-1 (PT-5)	5-18	20					
FROM CR-880-1 (PT-5)	5-19	21					
FROM CR-880-1 (PT-5)	5-20	22					
FROM CR-880-1 (PT-5)	5-21	23					
FROM CR-880-1 (PT-5)	5-22	24					
FROM CR-880-1 (PT-5)	5-23	25					
FROM CR-880-1 (PT-5)	5-24	26					
FROM CR-880-1 (PT-5)	5-25	27					
FROM CR-880-1 (PT-5)	5-26	28					
FROM CR-880-1 (PT-5)	5-27	29					
FROM CR-880-1 (PT-5)	5-28	30					
FROM CR-880-1 (PT-5)	5-29	31					
FROM CR-880-1 (PT-5)	5-30	32					
FROM CR-880-1 (PT-5)	5-31	33					
FROM CR-880-1 (PT-5)	5-32	34					
FROM CR-880-1 (PT-5)	5-33	35					
FROM CR-880-1 (PT-5)	5-34	36					
FROM CR-880-1 (PT-5)	5-35	37					
FROM CR-880-1 (PT-5)	5-36	38					
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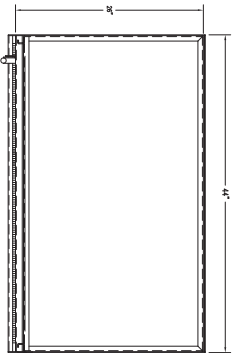




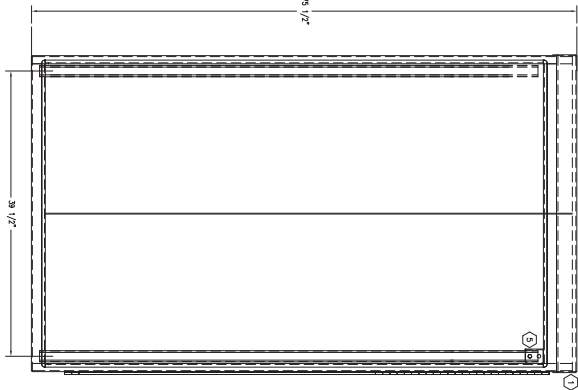




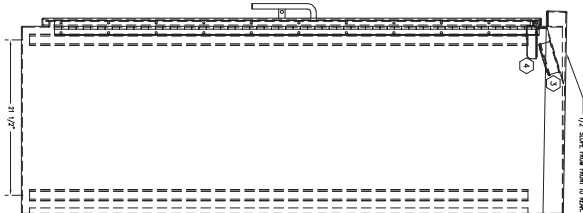




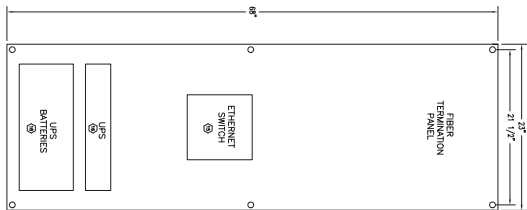
TOP VIEW



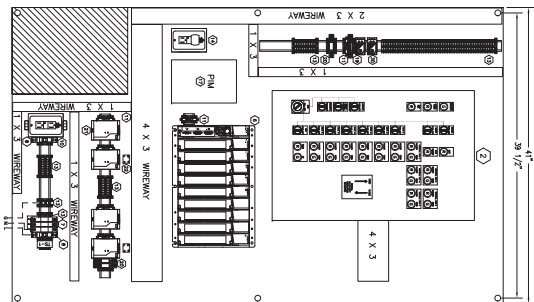
FRONT VIEW



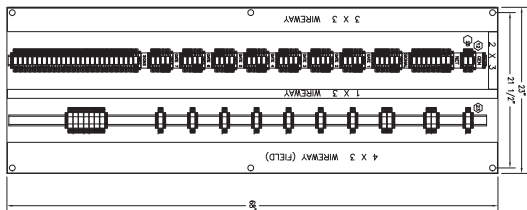
RIGHT SIDE VIEW



LEFT SIDE VIEW



CENTER SUB-PANEL



RIGHT SIDE SUB-PANEL

SOUTHERN MANUFACTURING CABINET ASSEMBLY:

- ENCLOSURE SIZE - 75.5"H x 44"W x 26"D
- MATERIAL SHEET ALUMINUM .125" (ALLOT 5032)
- MATERIAL SHEET ALUMINUM .125" (ALLOT 5032)
- SURFACE SHALL HAVE SHOOT NATURAL ALUMINUM MILL FINISH
- ENCLOSURE IS TO BE RATED NEMA 3R
- DOOR TO HAVE A CORBIN LOCK WITH A 3 POINT LOCKING SYSTEM
- DOOR TO HAVE A 3 POSITION DOOR STOP (90°/120°/180°)
- NO POLICE BOX/DOOR
- DOOR SWITCH BRACKET
- PROVIDE VENT SLOTS (1/8"x1") ON THE UNDERSIDE OF THE COVER
- VENT BRACKET ON DOOR AND BOTH SIDES
- FILTER BRACKET ON DOOR AND BOTH SIDES
- RUSH BRACKET ON DOOR AND BOTH SIDES
- ADD LIGHT BRACKET PER DRAWING
- ADD SUN-SHIELDS, 5 SIDES

NOTE:

THIS DRAWING IS THE PROPERTY OF SOUTHERN MANUFACTURING. IT IS TO BE USED FOR THE MANUFACTURE OF THE CABINET ONLY. IT IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF SOUTHERN MANUFACTURING. ANY VIOLATION OF THIS NOTICE WILL BE PROSECUTED TO THE FULL EXTENT OF THE LAW.

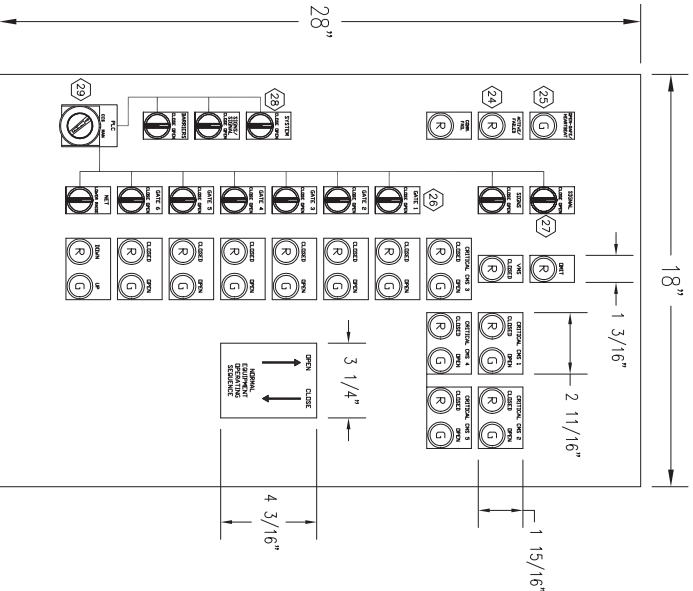
DESIGNED BY	CUMAZ
DRAWN BY	MAKIN
CHECKED BY	CUMAZ
DATE	04-06-05
REV.	A
ISSUED FOR APPROVAL	
DESCRIPTION	
BY	DATE
15	

TRANS-DYN  
Atlanta, Georgia

ACCESS CONTROL NODE	3042
PANEL LAYOUT	3042
TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY	3042-3004-01
REVERSIBLE EXPRESS LANE ITS	3042-3004-01
REV.	A



LOCAL OPERATING INTERFACE PANEL  
BRANDON VERSION



ACCESS CONTROL NODE  
BILL OF MATERIAL

TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY  
REVERSIBLE EXPRESS LANE ITS

3042-3004-03  
3042-3004-03

REV. 3

DESIGNED BY	CUMZ	CHECKED BY	CLMNH	DATE	24-06-25
ISSUED FOR APPROVAL		DATE	24-06-25	BY	CLMNH
DESCRIPTION		DATE	24-06-25	BY	CLMNH
NO.		REV.		DATE	
17					

Item No.	Qty.	Tag No.	Manufacturer	Model	Description
Panel Devices					
1	1	GENERIC	Southern Mfg.	Custom	Enclosure 22.5H x 44W x 28D, NEMA 3R
2	2	-	-	Custom	Rear Sub-panel 58H x 41W
3	2	FAN	Hobas	Custom	Side Sub-panel 58H x 21W
4	2	CAUTION	Hobas	CAUTION	Local Operator Interface Panel
5	1	SVI 301	Omron	2-1500-57K	Fan Kit (2x Fluorescent) With Door Switch
Sub Panel					
1	1	P.L.C. 130	Modicon	1768-A10	10 Slot Quantum Chassis
2	1	-	-	1400-S1-1450	Power supply 17A
3	1	-	-	1400-C1-1450	Control supply 17A
4	1	-	-	1400-C1-1450	Control supply 17A
5	1	-	-	1400-C1-1450	Control supply 17A
6	1	-	-	1400-C1-1450	Control supply 17A
7	1	-	-	1400-C1-1450	Control supply 17A
8	1	-	-	1400-C1-1450	Control supply 17A
9	1	-	-	1400-C1-1450	Control supply 17A
10	1	-	-	1400-C1-1450	Control supply 17A
11	1	-	-	1400-C1-1450	Control supply 17A
12	1	-	-	1400-C1-1450	Control supply 17A
13	1	-	-	1400-C1-1450	Control supply 17A
14	1	-	-	1400-C1-1450	Control supply 17A
15	1	-	-	1400-C1-1450	Control supply 17A
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25	1	-	-	1400-C1-1450	Control supply 17A
26	1	-	-	1400-C1-1450	Control supply 17A
27	1	-	-	1400-C1-1450	Control supply 17A
28	1	-	-	1400-C1-1450	Control supply 17A
29	1	-	-	1400-C1-1450	Control supply 17A
30	1	-	-	1400-C1-1450	Control supply 17A

TAMPA-HILLSBOROUGH  
EXPRESSWAY AUTHORITY

CONTRACT PLANS

PROJECT NO. O-1223

HILLSBOROUGH COUNTY

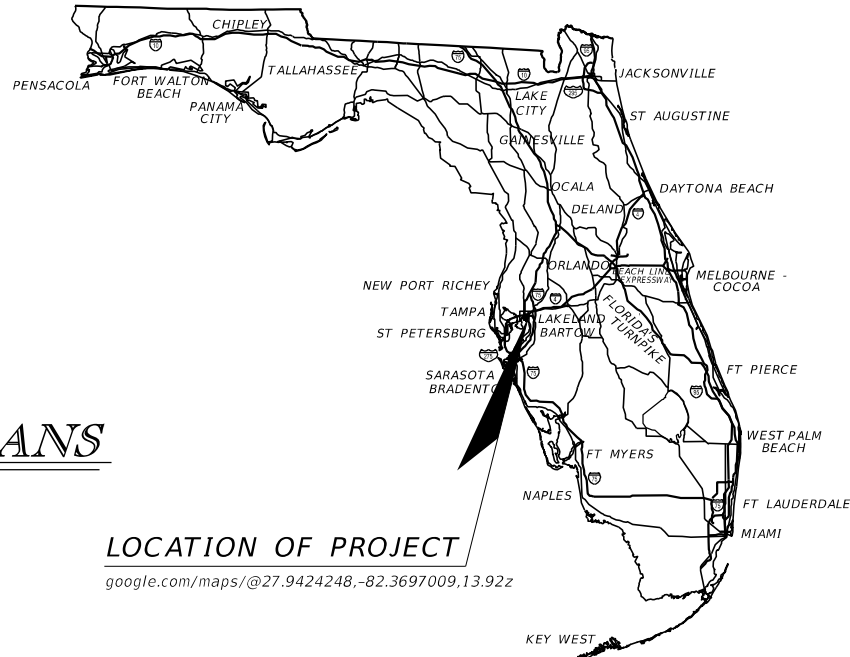
LEE ROY SELMON CROSSTOWN EXPRESSWAY  
STATE ROAD NO. 618

INTELLIGENT TRANSPORTATION SYSTEM PLANS

CONTROL SYSTEM AND DMS FIBER  
COMMUNICATIONS UPGRADES

INDEX OF INTELLIGENT TRANSPORTATION SYSTEM (ITS) PLANS

SHEET NO.	SHEET DESCRIPTION
IT-1	KEY SHEET
IT-2 THRU IT-4A	TABULATION OF QUANTITIES SHEETS
IT-5 THRU IT-6	LEGEND/GENERAL NOTES
IT-7 THRU IT-70	INTELLIGENT TRANSPORTATION SYSTEM PLANS
D1 THRU D-5	COMMUNICATIONS AND SYSTEM DETAILS
D-6 THRU D-13	FIBER SPLICE DETAILS



LOCATION OF PROJECT  
google.com/maps/@27.9424248,-82.3697009,13.92z

FINAL PLANS - SUBMITTAL  
JUNE 2, 2023

ADDENDUM 1 - SUBMITTAL  
JUNE 30, 2023

ENGINEER OF RECORD:

JEFFREY LAWRENCE, P.E., PTOE  
P.E. NO.: 42883  
KCI TECHNOLOGIES, INC.  
4041 CRESCENT PARK DRIVE  
TAMPA, FL 33578

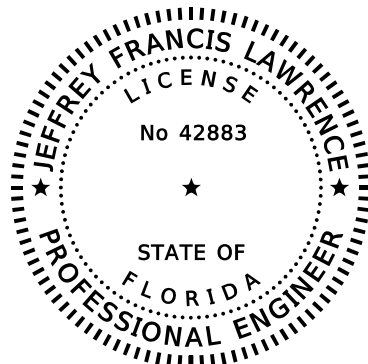
THEA PROJECT MANAGER:

JUDITH VILLEGAS, E.I.

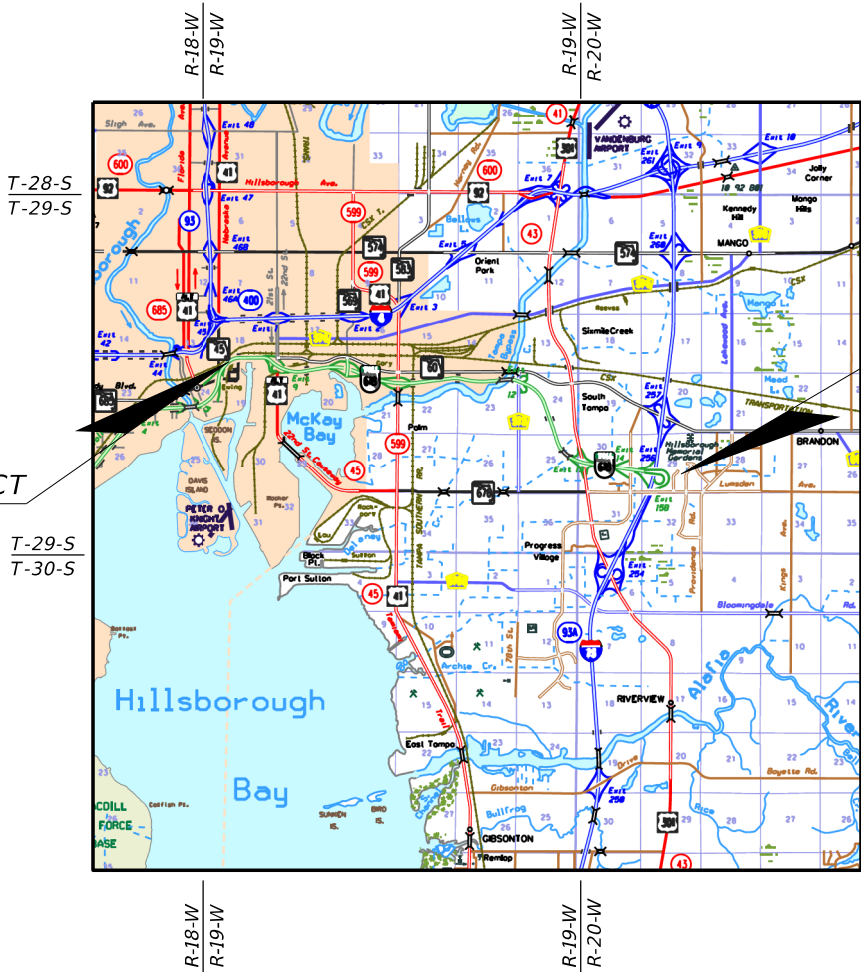
THIS ITEM HAS BEEN DIGITALLY  
SIGNED AND SEALED BY

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE  
NOT CONSIDERED SIGNED AND SEALED  
AND THE SIGNATURE MUST BE VERIFIED  
ON ANY ELECTRONIC COPIES.



CONSTRUCTION CONTRACT NO.	FISCAL YEAR	SHEET NO.
TBD	23	IT-1



GOVERNING STANDARD PLANS:

Florida Department of Transportation, FY 2022-23 Standard Plans for Road and Bridge Construction and applicable Interim Revisions (IRs).

Standard Plans for Road Construction and associated IRs are available at the following website: <http://www.fdot.gov/design/standardplans>

APPLICABLE IRs: NONE

Standard Plans for Bridge Construction are included in the Structures Plans Component

GOVERNING STANDARD SPECIFICATIONS:

Florida Department of Transportation, July 2022 Standard Specifications for Road and Bridge Construction at the following website: <http://www.fdot.gov/programmanagement/Implemented/SpecBooks>

PROJECT NO. O-1223  
INTELLIGENT TRANSPORTATION SYSTEM SHEETS: IT-1 - IT-4A, IT-6 - IT-9, IT-11, IT-16 - IT-19, IT-37, IT-38, IT-40, IT-41, IT-53 - IT-56, IT-58, IT-61, IT-63, IT-64, IT-66, IT-70 (REVISED 6-30-23)  
COMMUNICATIONS AND SYSTEM DETAILS SHEETS: D-2 - D-4 (REVISED 6-30-23)



TABULATION OF QUANTITIES

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-7		IT-8		IT-9		IT-10		IT-11		IT-12		IT-13					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS	1														1			
0102 1	MAINTENANCE OF TRAFFIC	LS	1														1			
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF	120		453		590				617						1,780			
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF					20										20			
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	524		2,754		3,020		1,220		1,460		1,290		1,435		11,703			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA	4		16		32				4						56			
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA	1		3		2				1						7			
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA	1		3		5				1						10			
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA	1		3		5				1						10			
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	294		2,007		1,980		1,070		1,477		1,090		1,285		9,203			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA	1		3		2				1						7			
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA	1		3		4				1						9			
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA					1										1			⚠
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI					2										2			
XXX 1 1	WEB RELAY, F&I	EA	1		3		4				1						9			
XXX 1 2	WEB RELAY CONTROL, F&I	LS					1										1			
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA					1										1			

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-14		IT-15		IT-16		IT-17		IT-18		IT-19		IT-20					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF					230		230		410		693				1,563			
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF											95				95			
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,228		1,340		1,734		1,354		1,369		1,695		1,166		9,886			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA					8		4				38				50			
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA					2						1				3			
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA					2		1				4				7			
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA					2		1		1		1				5			
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	1,028		1,090		1,214		1,184		1,479		1,190		966		8,151			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA					2						1				3			
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA					2		1		1						4			
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA											1				1			
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI											2				2		⚠	
XXX 1 1	WEB RELAY, F&I	EA					2		1		1						4			
XXX 1 2	WEB RELAY CONTROL, F&I	LS											1				1			
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA											1				1			


PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-21		IT-22		IT-23		IT-24		IT-25		IT-26		IT-27					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF																		
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF																		
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,241		1,307		1,331		1,292		1,355		1,226		1,300		9,052			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA																		
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA																		
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA																		
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA																		
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	1,091		1,107		1,131		1,092		1,105		1,026		1,100		7,652			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA																		
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI																	⚠	
XXX 1 1	WEB RELAY, F&I	EA																		
XXX 1 2	WEB RELAY CONTROL, F&I	LS																		
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA																		

REVISED				ENGINEER OF RECORD				TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			TABULATION OF QUANTITIES				SHEET NO.  IT-2
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578				ROAD NO.	COUNTY	FINANCIAL PROJECT ID					
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS							S.R. 618	HILLSBOROUGH						

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

TABULATION OF QUANTITIES

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-28		IT-29		IT-30		IT-31		IT-32		IT-33		IT-34					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL		
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF																		
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF																		
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,295		1,413		1,300		1,264		1,307		1,305		1,309		9,193			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA																		
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA																		
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA																		
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA																		
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	1,095		1,163		1,100		1,064		1,107		1,105		1,109		7,743			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA																		
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI																		<div>⚠</div>
XXX 1 1	WEB RELAY, F&I	EA																		
XXX 1 2	WEB RELAY CONTROL, F&I	LS																		
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA																		

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-35		IT-36		IT-37		IT-38		IT-39		IT-40		IT-41					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF					613		373				684		1,050		2,720			
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF					20								185		205			
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,054		1,363		1,406		1,830		1,598		1,393		1,522		10,166			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA					16		8				4		28		56			
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA							2				1		1		4			
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA					2		2				1		3		8			
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA					2		2				2		2		8			
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	804		1,213		1,489		1,303		1,348		1,527		1,957		9,641			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA							2				1		1		4			
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA					1		2				2		1		6			
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA					1								1		2			
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI					2								2		4			
XXX 1 1	WEB RELAY, F&I	EA					1		2				2		1		6			
XXX 1 2	WEB RELAY CONTROL, F&I	LS					1								1		2			
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA					1								1		2			

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-42		IT-43		IT-44		IT-45		IT-46		IT-47		IT-48					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL		
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF																		
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF																		
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,316		1,388		1,373		1,220		1,365		1,431		1,166		9,259			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA																		
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA																		
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA																		
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA																		
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	1,116		1,138		1,173		1,120		1,165		1,181		966		7,859			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA																		
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI																	1	
XXX 1 1	WEB RELAY, F&I	EA																		
XXX 1 2	WEB RELAY CONTROL, F&I	LS																		
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA																		

REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			TABULATION OF QUANTITIES	SHEET NO.	
DATE	DESCRIPTION		DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578	ROAD NO.	COUNTY		FINANCIAL PROJECT ID	IT-3
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH			

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

TABULATION OF QUANTITIES

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-49		IT-50		IT-51		IT-52		IT-53		IT-54		IT-55					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF									315		243		125		683			
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF									20						20			
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,374		1,312		1,372		1,426		3,049		1,366		1,003		10,902			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA									24		8		4		36			
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA									2		2		1		5			
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA									4		2		1		7			
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA									3		2		1		6			
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	974		1,112		1,122		1,026		1,984		959		728		7,905			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA									2		2		1		5			
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA									2		2		1		5			
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA									1						1			
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI									2						2			⚠
XXX 1 1	WEB RELAY, F&I	EA									2		2		1		5			
XXX 1 2	WEB RELAY CONTROL, F&I	LS									1						1			
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA									1						1			

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-56		IT-57		IT-58		IT-59		IT-60		IT-61		IT-62					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF	125		100		115						125				465			
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF																		
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,434		1,945		1,499		764		1,688		958				8,288			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA	4		4		4						4				16			
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA	1		1		1						1				4			
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA	1		1		1						1				4			
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA	1				1						1				3			
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	1,109		1,495		1,164		664		1,438		733				6,603			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA	1		1		1						1				4			
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA	1				1						1				3			
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI																	⚠	
XXX 1 1	WEB RELAY, F&I	EA	1				1						1				3			
XXX 1 2	WEB RELAY CONTROL, F&I	LS																		
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA																		

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-63		IT-64		IT-65		IT-66		IT-67		IT-68		IT-69					
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL
0101 1	MOBILIZATION	LS																		
0102 1	MAINTENANCE OF TRAFFIC	LS																		
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF	489		120				134		1,211		1,252		1,259		4,465			
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF																		
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	1,311		1,215				1,402								3,928			
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA	8		4				4								16			
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA	2		1				1								4			
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA	2		1				1								4			
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA	2		1				1								4			
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	1,050		1,035				1,136		1,111		1,152		1,109		6,593			
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA	2		1				1								4			
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA	2		1				1								4			
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA																		
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI																		
XXX 1 1	WEB RELAY, F&I	EA	2		1				1								4			
XXX 1 2	WEB RELAY CONTROL, F&I	LS																		
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA																		

REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			TABULATION OF QUANTITIES	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-4
6-30-23	△ REMOVED PLC; REVISED PAY ITEMS				S.R. 618	HILLSBOROUGH			

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

TABULATION OF QUANTITIES

PAY ITEM NO.	DESCRIPTION	UNIT	SHEET NUMBERS														TOTAL THIS SHEET		GRAND TOTAL	
			IT-70																	
			PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL	PLAN	FINAL		
0101 1	MOBILIZATION	LS																	1	
0102 1	MAINTENANCE OF TRAFFIC	LS																	1	
0633 1121	FIBER OPTIC CABLE, F&I, UNDERGROUND, 2-12 FIBERS	LF	132														132		11,808	
0633 1122	FIBER OPTIC CABLE, F&I, UNDERGROUND, 13-48 FIBERS	LF																	340	
0633 1123	FIBER OPTIC CABLE, F&I, UNDERGROUND, 49-96 FIBERS	LF	415														415		73,740	
0633 2 31	FIBER OPTIC CONNECTION, INSTALL, SPLICE	EA	4														4		234	
0633 3 11	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE ENCLOSURE	EA	1														1		28	
0633 3 12	FIBER OPTIC CONNECTION HARDWARE, F&I, SPLICE TRAY	EA	1														1		41	
0633 3 16	FIBER OPTIC CONNECTION HARDWARE, F&I, PATCH PANEL-FIELD TERMINATED	EA	1														1		37	
0633 8 6	MULTI-CONDUCTOR COMMUNICATION CABLE, REMOVE	LF	347														347		64,045	
0635 2 13	FIBER SPLICE VAULT, F&I, 30" X 60" RECTANGULAR OR 36" ROUND	EA	1														1		28	
0684 1 1	MANAGED FIELD ETHERNET SWITCH, FURNISH & INSTALL	EA	1														1		32	
0684 90101	ACN MANAGED HUB ETHERNET SWITCH, FURNISH & INSTALL	EA																	5	
0690100	REMOVE MISCELLANEOUS EQUIPMENT - PER SITE	PI																	10	
XXX 1 1	WEB RELAY, F&I	EA	1														1		32	
XXX 1 2	WEB RELAY CONTROL, F&I	LS																	5	
XXX-XXX-X	PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY	EA																	5	

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REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			TABULATION OF QUANTITIES	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578					
6-30-23	△ REMOVED PLC; REVISED PAY ITEMS				ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-4A
					S.R. 618	HILLSBOROUGH			

CABLING, CONDUIT AND PULL BOX NOTES

1. ALL EXISTING CONDUITS TO BE USED ON THIS PROJECT WILL BE PROOFED AND CLEARED BY THE CONTRACTOR BEFORE FOC INSTALLATION AND ENDS CAPPED AND SEALED AFTER INSTALLATION.
2. CABLE TO BE REMOVED MAY BE USED AS PULL STRING FOR NEW FIBER. LIVE CUT OVER MUST BE “COORDINATED WITH THEA”.
3. FIBER CABLING WILL NOT BE COILED INSIDE THE CABINET. FIBER CABLE SLACK MUST BE COILED IN THE FIBER PULL BOX OR SPLICE VAULT AS SHOWN ON THE PLANS.
4. COMMUNICATION CABLES WILL NOT OCCUPY THE SAME CABLE MANAGEMENT RACEWAY AS POWER CABLES.
5. ZIP TIES ARE NOT ALLOWED ON ANY COMMUNICATION CABLING. IF CABLES NEED TO BE SECURED OUTSIDE THE CABLE MANAGEMENT EQUIPMENT THEN VELCRO IS ACCEPTABLE FOR THIS PURPOSE.
6. NON-DUPLEX TYPE FIBER PATCH CORDS ARE NOT ALLOWED.
7. USE FACTORY TERMINATED AND POLISHED FIBER PATCH CABLES.
8. CATEGORY 6 CABLING NEEDED FOR DATA MUST BE INCIDENTAL TO THE HARDWARE BEING INSTALLED.
9. CONNECT THE NETWORK DEVICE WITH PATCH CABLES USING THE MINIMUM LENGTH REQUIRED PLUS ONE ADDITIONAL FOOT OF SLACK TO THE PATCH PANEL.
10. LABEL EACH PATCH CORD WITH THE SAME DESIGNATION AT BOTH ENDS FOR EASY IDENTIFICATION.
11. THE STACKING OF PULL BOXES IS NOT ALLOWED.
12. REFER TO FDOT STANDARD SPECIFICATIONS AND DRAWINGS FOR FIBER OPTIC CABLE, CONDUIT AND PULL BOX REQUIREMENTS.

PAY ITEM DESCRIPTION

1. GENERAL: ONLY LIMITED FIELD REVIEW HAS OCCURRED TO VERIFY THE VERACITY OF EXISTING CONDUIT AND SOME LOCATIONS MAY REQUIRE CONSTRUCTION OF NEW CONDUIT OR PULL BOXES. IF CONTRACTOR DISCOVERS EXISTING CONDUIT TO BE UNUSABLE DUE TO CAPACITY, DAMAGED, OR FDOT STANDARD REGARDING CO-LOCATION OR POWER AND COMMUNICATIONS CABLE, THE CONTRACTOR MUST IMMEDIATELY NOTIFY THEA AND COOPERATE IN ASSESSING AN APPROVED SOLUTION. TIME SPENT IN DETERMINING AN ALTERNATIVE SOLUTION MUST BE INCIDENTAL TO THE FIBER INSTALLATION AND PLACEMENT AND WILL NOT BE COMPENSATED FOR TIME.
2. 102-1: THIS PAY ITEM MUST INCLUDE ALL WORK AND MATERIAL NECESSARY TO IMPLEMENT THE MAINTENANCE OF TRAFFIC (MOT) PLANS.
3. 630-2-11: UNLESS OTHERWISE NOTED, UNDERGROUND (UG) CONDUIT WILL BE 2-INCH HDPE. ALL COUPLERS, CONNECTORS, HARDWARE, SUPPLIES AND EQUIPMENT REQUIRED FOR PLACEMENT OF UG CONDUIT IS INCIDENTAL TO THIS PAY ITEM.
4. 630-2-14: UNLESS OTHERWISE NOTED, ABOVE GROUND (AG) CONDUIT WILL BE 2-INCH GALVANIZED STEEL. ALL COUPLERS, CONNECTORS, HARDWARE, SUPPLIES AND EQUIPMENT REQUIRED FOR PLACEMENT OF AG CONDUIT IS INCIDENTAL TO THIS PAY ITEM.
5. 633-1-121 & 633-1-122: THIS PAY ITEM MUST BE FOR FIBER OPTIC DROP CABLES AT LENGTHS AS SHOWN ON THE PLANS INCLUDING SLACK COIL IN SPLICE VAULTS AND IN FIBER PULL BOXES AS SHOWN ON THE PLANS. NO SPLICING MUST BE PERFORM IN THE PATCH PANELS. ALL FIBER WILL BE PLACED IN EXISTING CONDUIT. WORK PERFORMED TO F&I THIS FIBER WILL BE PER THE MOST RECENT FDOT BASIS OF ESTIMATE (BoE). TESTING OF FIBER OPTIC CABLE INSTALLED MUST BE INCLUDED AND CONSIDERED INCIDENTAL TO THIS PAY ITEM.
6. 633-1-123: THIS PAY ITEM MUST INCLUDE FIBER OPTIC DISTRIBUTION CABLES AT LENGTHS AS SHOWN ON THE PLANS INCLUDING SLACK COIL IN SPLICE VAULTS AND IN FIBER PULL BOXES AS SHOWN ON THE PLANS. TESTING OF FIBER OPTIC CABLE INSTALLED MUST BE INCLUDED AND CONSIDERED INCIDENTAL TO THIS PAY ITEM. SLACK COILS MUST BE INCLUDED PER PLAN QUANTITY.
7. 633-2-31: THIS PAY ITEM MUST INCLUDE ALL FIBER OPTIC SPLICES AS REQUIRED. ALL MATERIALS, SPLICING EQUIPMENT, AND TESTING MUST BE INCLUDED AND CONSIDERED INCIDENTAL TO THIS PAY ITEM.
8. 633-3-11: THIS PAY ITEM MUST INCLUDE A SPLICE ENCLOSURE WALL MOUNTED IN SPLICE VAULTS AS SHOWN ON THE PLANS. INCLUDED ARE ALL MATERIALS AND INCIDENTAL COMPONENTS TO PROVIDE FOR A COMPLETE INSTALLATION.
9. 633-3-16: THIS PAY ITEM MUST INCLUDE A FIBER PATCH PANEL (FPP) AS SHOWN IN THE PLANS AND SPECIFIED IN THE MINIMUM TECHNICAL REQUIREMENTS (MTR). PROVIDE A FPP THAT INCLUDES FACTORY PRE-TERMINATED FIBER PIGTAILS WITH CONNECTOR PANELS UNLESS OTHERWISE APPROVED OR DIRECTED BY THE THEA. THE PAY ITEM MUST INCLUDE SPLICING OF PIGTAILS, FIBER JUMPER CABLES, AND ALL OTHER INCIDENTAL COMPONENTS AND MATERIALS TO PROVIDE A COMPLETE FIBER TERMINATION AS REQUIRED OR NEEDED BY THE PLANS, MTR, EQUIPMENT AND PATCH PANELS INSTALLED. THE FIBER DROP CABLE MUST BE PAID FOR SEPARATELY AND BE CONTINUOUS.
10. 635-2-13: THIS PAY ITEM MUST INCLUDE REMOVAL OF EXISTING PULL BOX. ALL INCIDENTAL CONCRETE REMOVAL AND REPLACEMENT, AS NECESSARY AND WHERE NOT SPECIFICALLY DENOTED IN THE PLANS. IN THE EVENT THAT INSTALLATION OF NEW SPLICE VAULT DAMAGES EXISTING SIDEWALK OR OTHER CONCRETE STRUCTURE, REMOVE DAMAGED SECTION TO THE NEAREST JOINT SUCH THAT NO REMAINING SECTION IS LESS THAT EXISTING WIDTH, AND REPLACE.
11. 684-1-1: THIS PAY ITEM MUST INCLUDE FURNISH AND INSTALL OF A MANAGED FIELD ETHERNET SWITCH AS SPECIFIED. INCLUDE ALL NECESSARY POWER SUPPLIES (AS REQUIRED) AND PATCH CORDS TO TERMINATE THE SIGN CONTROLLER, PROGRAMMABLE LOGIC CONTROLLER AND OTHER DEVICES TO THE SWITCH AS SHOWN ON THE PLANS. ALL SMALL FORM-FACTOR PLUGGABLE (SFPS) OPTICAL TRANSCEIVERS AS REQUIRED MUST BE INCLUDED IN THIS PAY ITEM. THE PROGRAMMING OF THE SWITCHES AND EQUIPMENT WITH IP ADDRESSES AND NETWORK CONFIGURATION SETTINGS WILL BE PROVIDED BY OTHERS.

12. ~~XXX-XXX-X: THIS PAY ITEM MUST INCLUDE THE FURNISH AND INSTALL OF A PROGRAMMABLE LOGIC CONTROLLER (PLC) ASSEMBLY INSIDE THEA ACCESS CONTROL NODES (ACN) AS SHOWN ON THE PLANS. INCLUDE ALL SOFTWARE, USER LICENSES, CHASSIS MODULES AND WIRING AS SPECIFIED ALONG WITH POWER SUPPLIES AND ALL OTHER INCIDENTAL MATERIALS AND COMPONENTS FOR A COMPLETE INSTALLATION.~~
12. XXX-1-1: THIS PAY ITEM MUST INCLUDE THE FURNISH AND INSTALL OF A WEB RELAY DEVICE AS SPECIFIED. INCLUDE ALL NECESSARY POWER SUPPLIES (AS REQUIRED) AND PATCH CORDS TO TERMINATE TO THE SWITCH AS SHOWN ON THE PLANS. COORDINATE AND WORK WITH THE WEB RELAY MANUFACTURER FOR SET UP AND CONFIGURATION OF THE DEVICE.
13. XXX-1-2: THIS PAY ITEM IS LUMP SUM AND INCLUDES THE FURNISH AND INSTALL OF WEB RELAY DEVICES INCLUDING CONTRBYWEB WEB I/O CONTROLLER AND EXPANSION MODULES AS SPECIFIED. INCLUDE ALL NECESSARY POWER SUPPLIES (AS REQUIRED). RIBBON CABLE, MOUNTING AND PATCH CORDS TO TERMINATE TO THE SWITCH AS SHOWN ON THE PLANS. COORDINATE AND WORK WITH THE WEB RELAY MANUFACTURER FOR SET UP AND CONFIGURATION OF THE DEVICES.

REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			LEGEND / GENERAL NOTES	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH			IT-6

LEGEND

- (A)

EXISTING 2-2" CONDUIT

633-8-6

EXISTING COMM CABLE REMOVE 'X' L.F.

633-1-123

72CT SM FOC, F&I, 'X' L.F.

PROOFING OF EXISTING CONDUIT
- (B)

EXISTING 2-2" CONDUIT

633-8-6

EXISTING COMM CABLE REMOVE 'X' L.F.

633-1-121

12CT SM FIBER DROP, F&I, 'X' L.F.

PROOFING OF EXISTING CONDUIT
- (C)

EXISTING FIBER PULL BOX (24" X 24")

633-1-123

72CT SM FOC, F&I, 'X' L.F.
- (D)

EXISTING FIBER PULL BOX (24" X 24")

633-1-121

12CT SM FIBER DROP, F&I, 'X' L.F.

EXISTING CMS ASSEMBLY CABINET (DT-C04) - STA. 23+70  

633-3-16

FIELD TERMINATED PATCH PANEL, F&I, 1 EA

684-1-1

MFES, F&I, 1 EA

XXX-1-1

WEB RELAY, F&I, 1 EA

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEETS D-9 THRU D-12 FOR SPLICE DETAILS.

633-2-31

FIBER OPTIC CONNECTION INSTALL, SPLICE, 4 EA

633-3-11

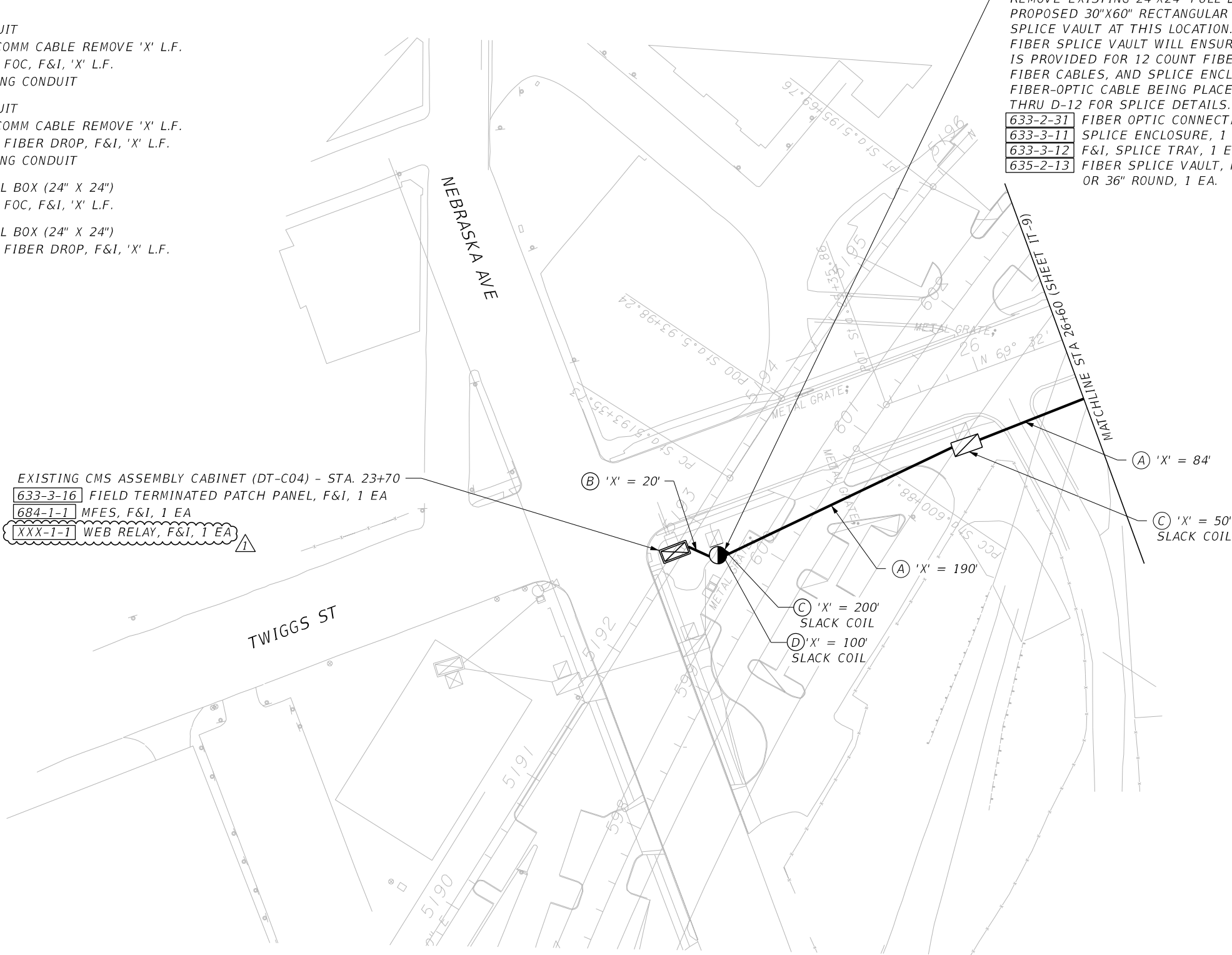
SPLICE ENCLOSURE, 1 EA

633-3-12

F&I, SPLICE TRAY, 1 EA

635-2-13

FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION		DATE	DESCRIPTION	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-7
6-30-23	1. REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH		
				JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578					

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

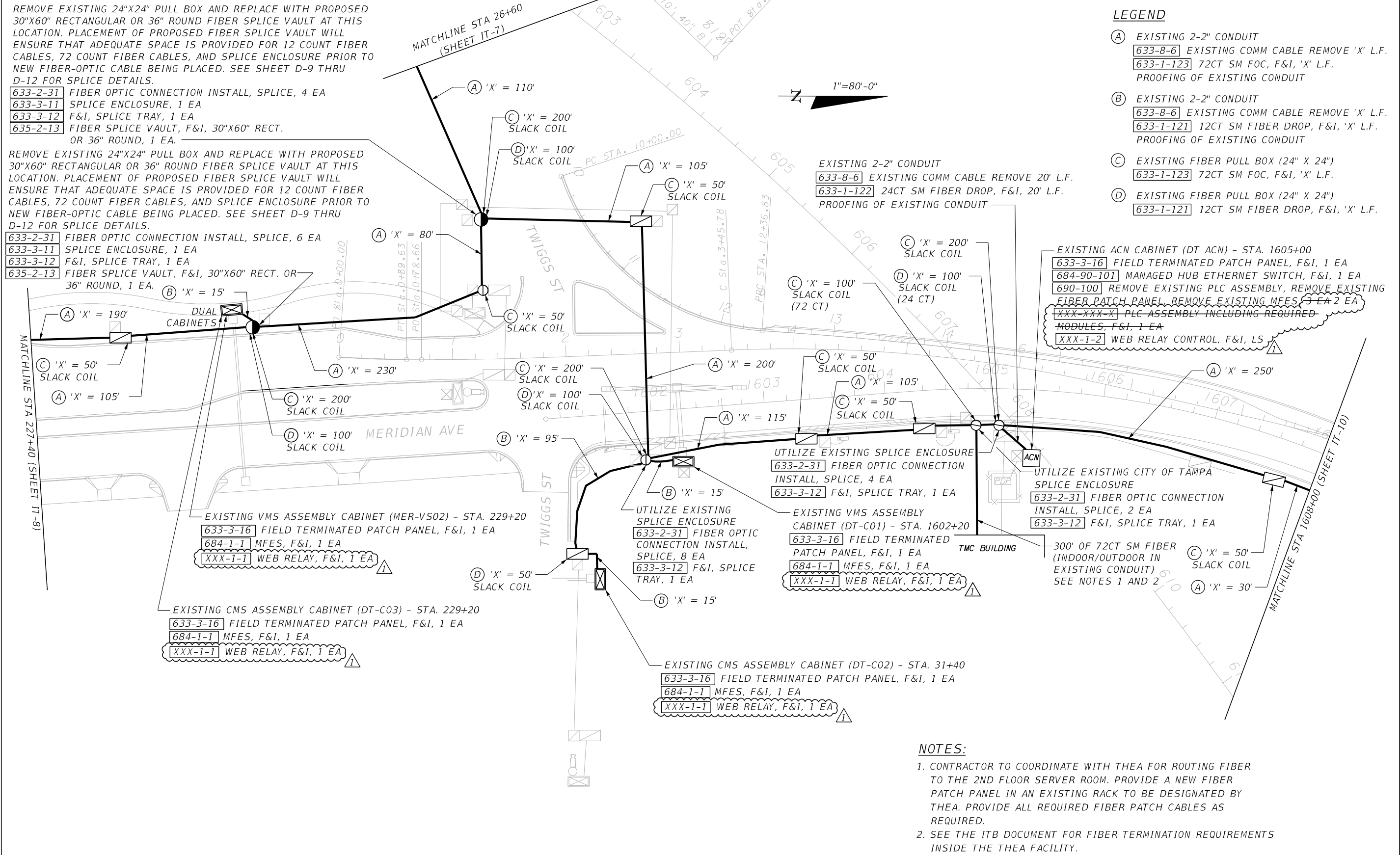


REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9 THRU D-12 FOR SPLICE DETAILS.

- 633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 4 EA
- 633-3-11 SPLICE ENCLOSURE, 1 EA
- 633-3-12 F&I, SPLICE TRAY, 1 EA
- 635-2-13 FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9 THRU D-12 FOR SPLICE DETAILS.

- 633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 6 EA
- 633-3-11 SPLICE ENCLOSURE, 1 EA
- 633-3-12 F&I, SPLICE TRAY, 1 EA
- 635-2-13 FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION  SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-9
6-30-23	⚠️ REMOVED PLC; REVISED PAY ITEMS				S.R. 618	HILLSBOROUGH			

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



LEGEND

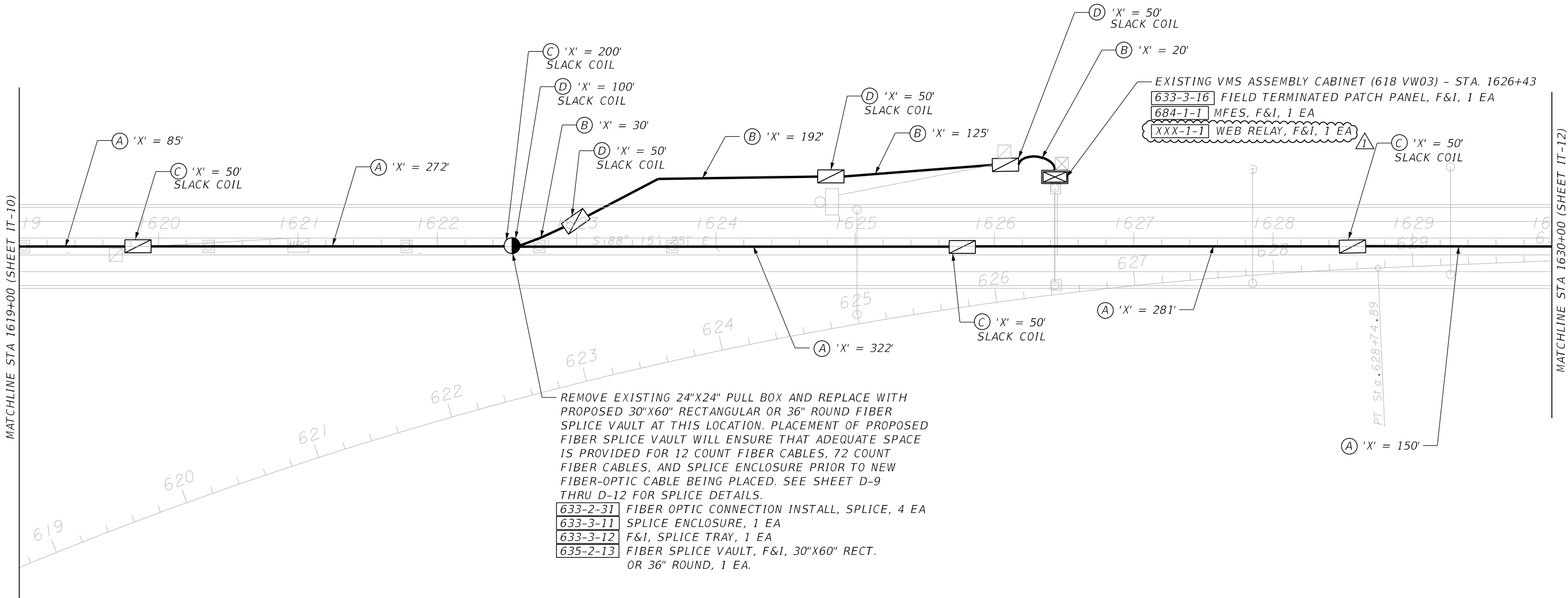
- (A)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D)

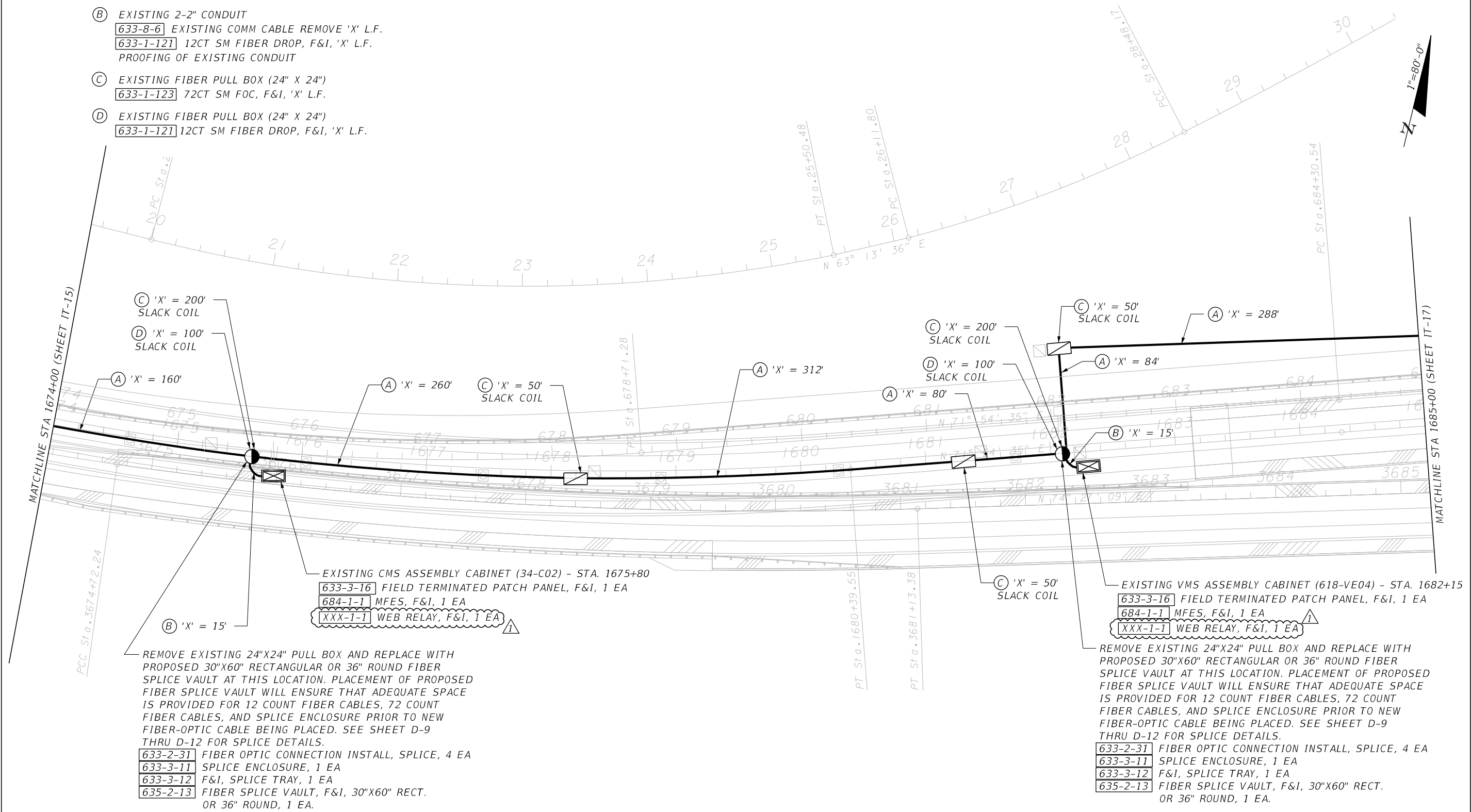
EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION		DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578				
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS								
					ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-11
					S.R. 618	HILLSBOROUGH			

LEGEND

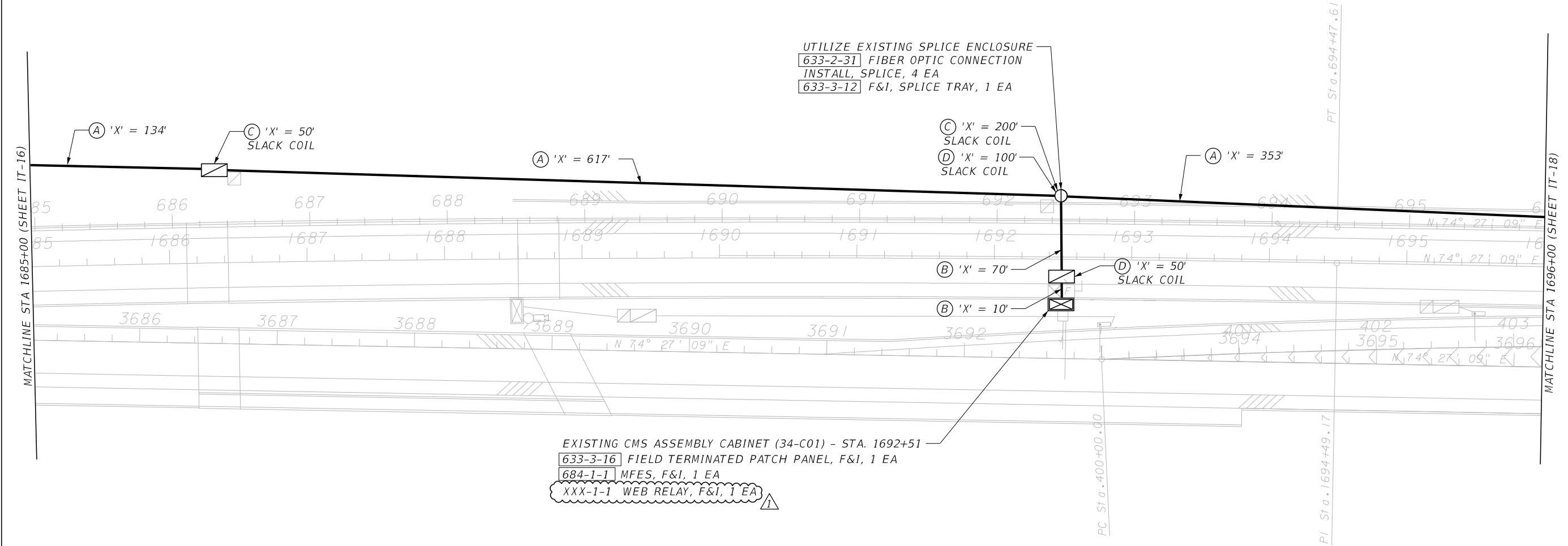
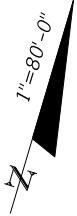
- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



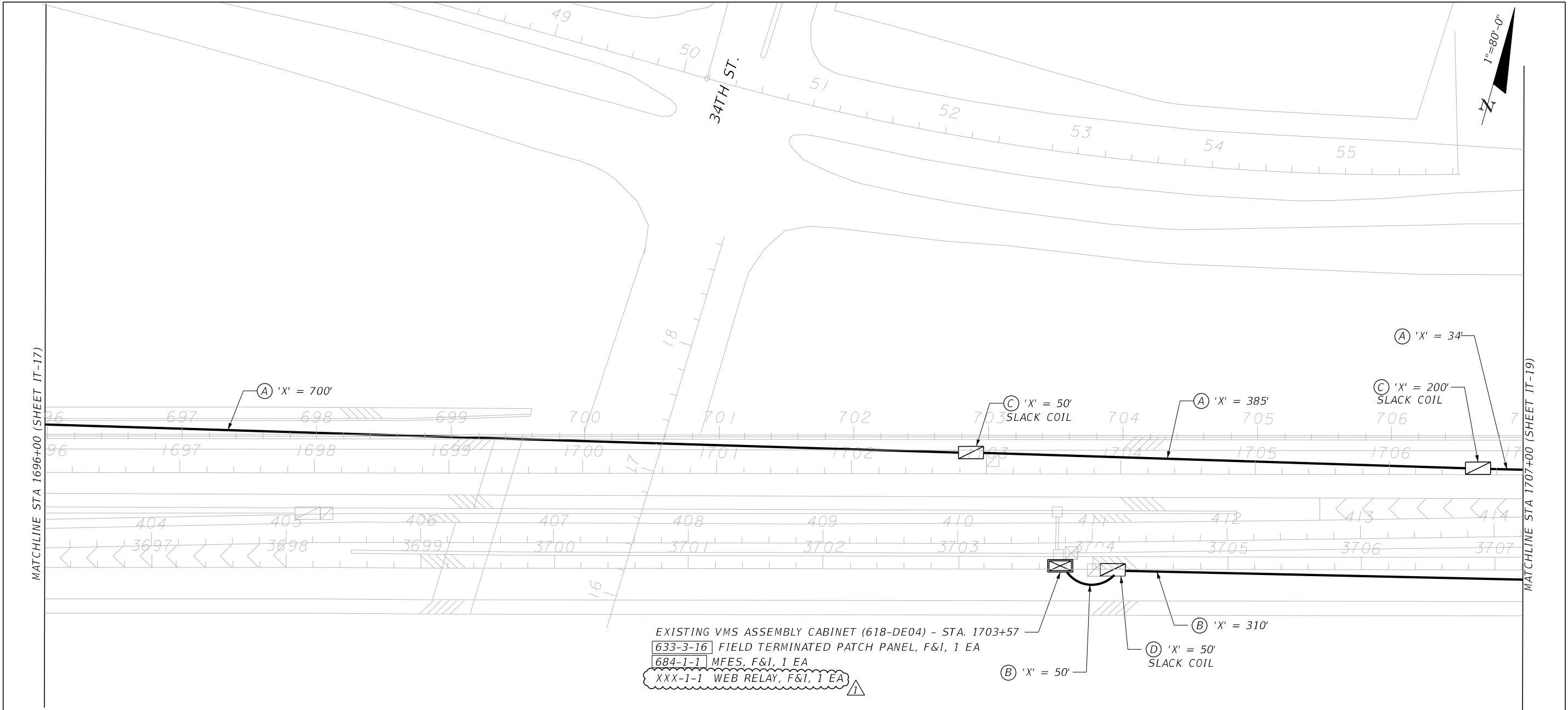
REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN		SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578						
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS				ROAD NO.	COUNTY	FINANCIAL PROJECT ID			IT-16
					S.R. 618	HILLSBOROUGH				

LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO. IT-17
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH	FINANCIAL PROJECT ID	



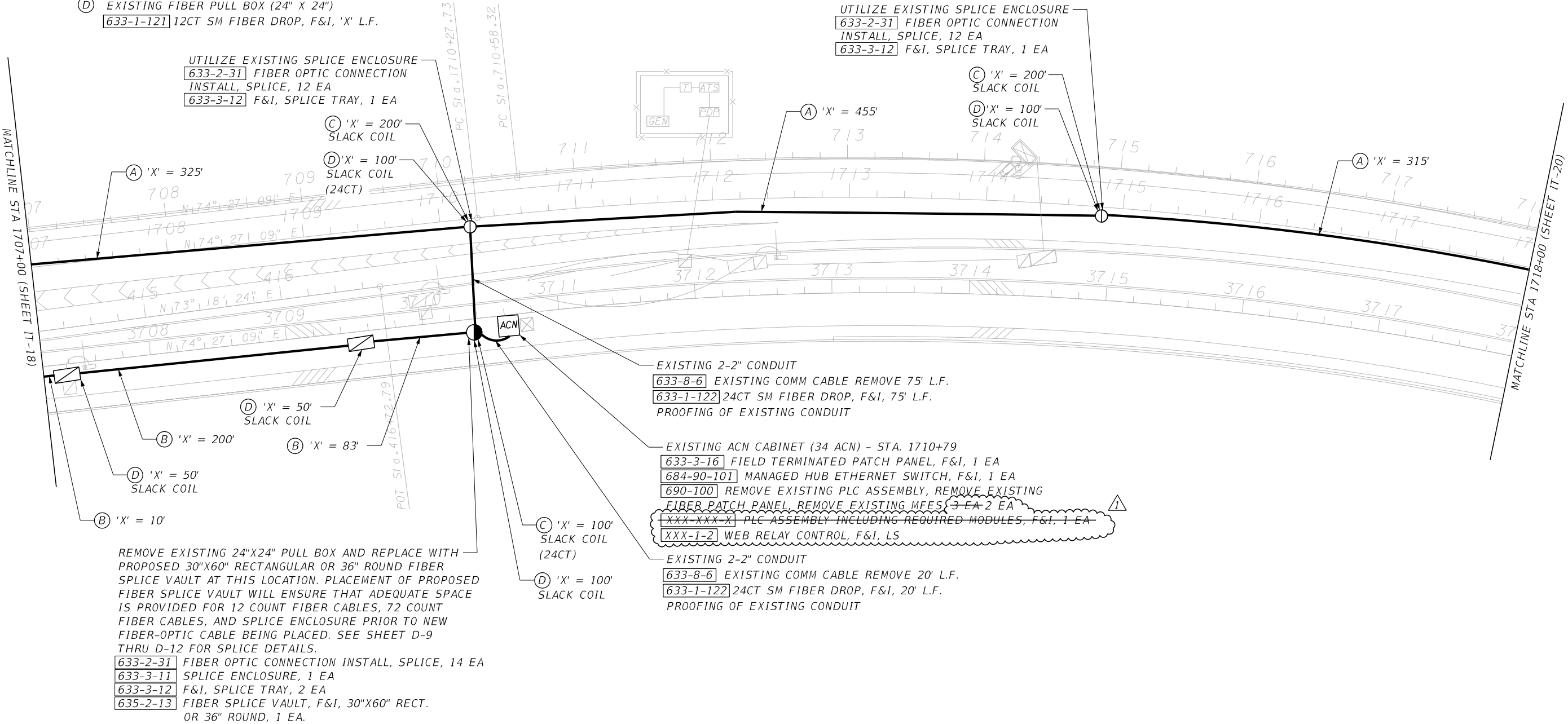
LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION						
6-30-23	REMOVED PLC; REVISED PAY ITEMS				ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
				JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578	S.R. 618	HILLSBOROUGH			IT-18

LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION		DATE	DESCRIPTION	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-19
6-30-23	▲ REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH		
				JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578					

LEGEND

(A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT

(B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT

(C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.

(D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

UTILIZE EXISTING SPLICE ENCLOSURE  
633-2-31 FIBER OPTIC CONNECTION INSTALL,  
SPLICE 16 EA  
633-3-12 F&I, SPLICE TRAY, 2 EA

(C) 'X' = 200'  
SLACK COIL

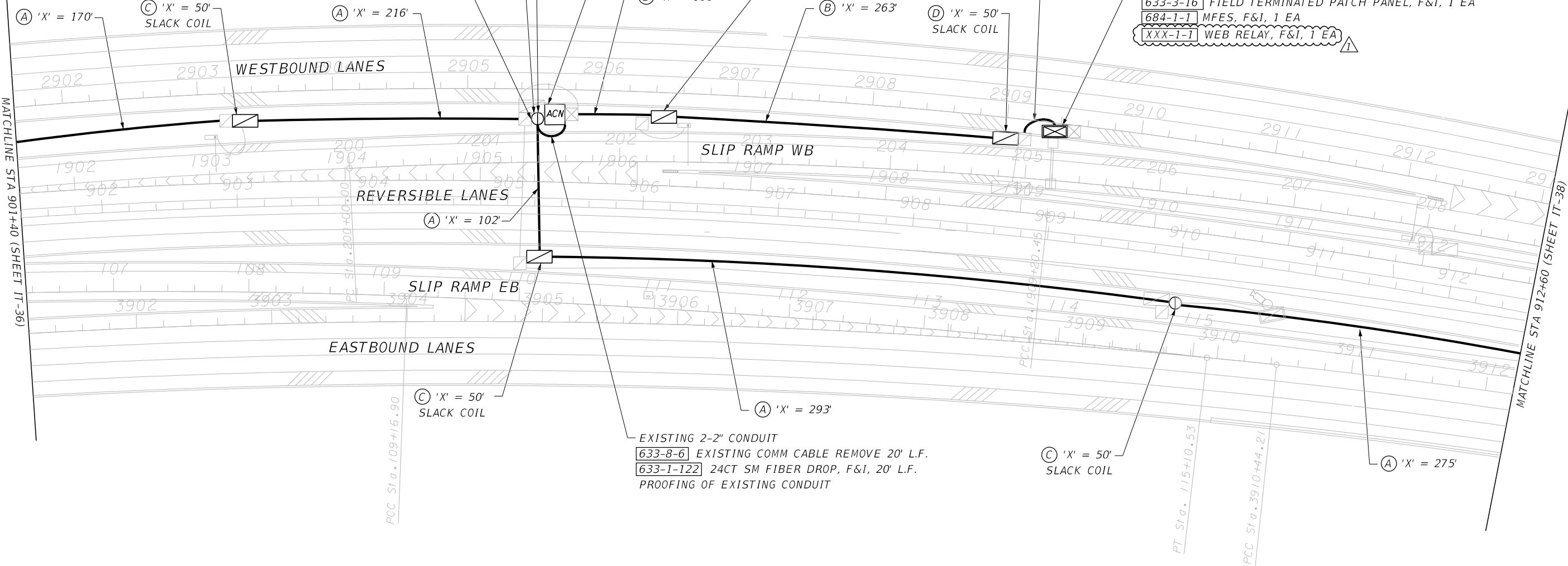
(D) 'X' = 100'  
SLACK COIL

EXISTING ACN CABINET (78-ACN) - STA. 1905+50  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-90-101 MANAGED HUB ETHERNET SWITCH, F&I, 1 EA  
690-100 REMOVE EXISTING PLC ASSEMBLY, REMOVE EXISTING  
FIBER PATCH PANEL, REMOVE EXISTING MFES, 3 EA 2 EA  
XXX-XXX-X PLC ASSEMBLY INCLUDING REQUIRED MODULES F&I, 1 EA  
XXX-1-2 WEB RELAY CONTROL, F&I, LS

(D) 'X' = 50'  
SLACK COIL

(B) 'X' = 50'  
SLACK COIL

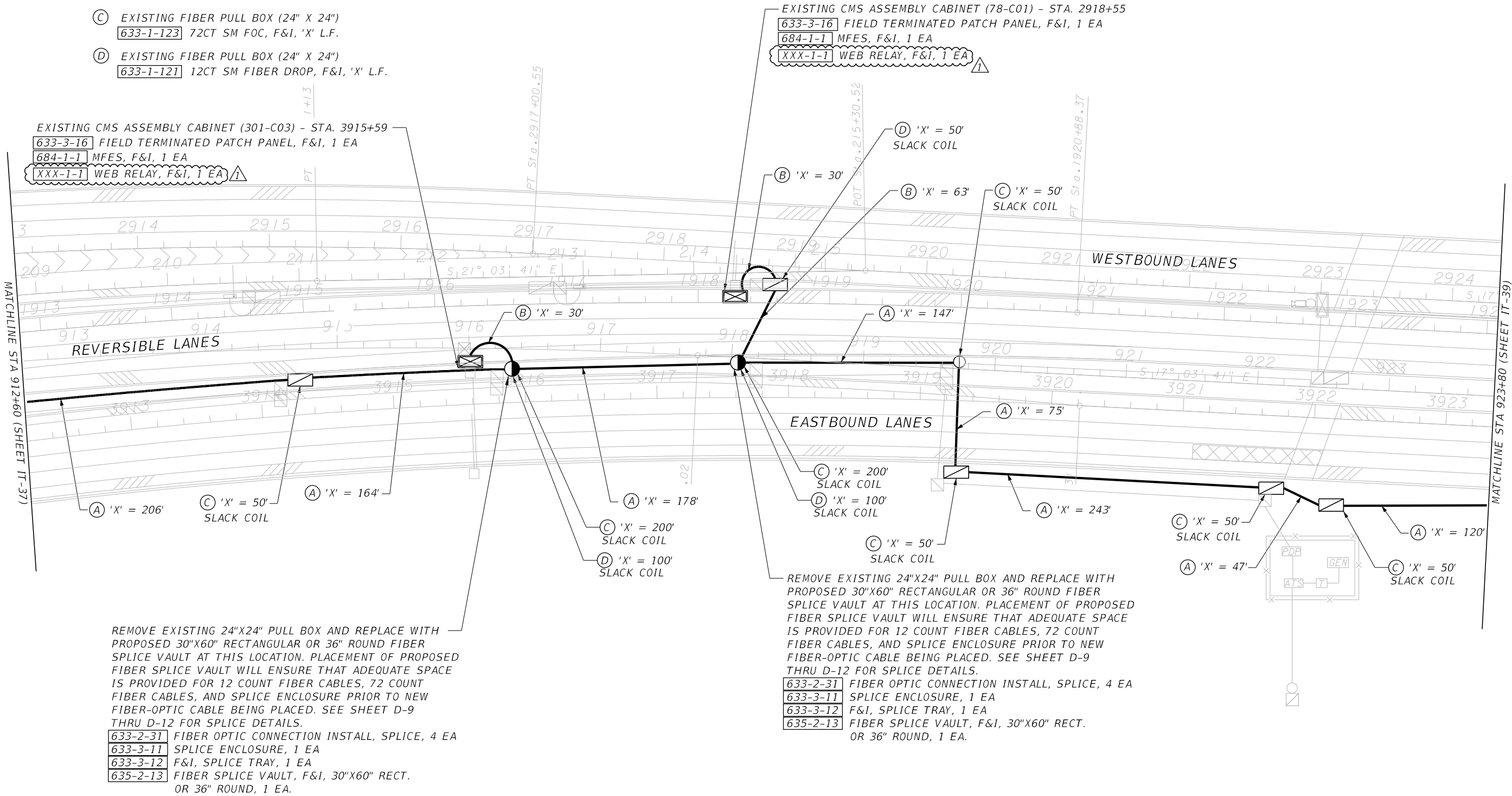
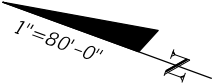
EXISTING VMS ASSEMBLY CABINET (618-DW05) - STA. 1909+15  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-1-1 MFES, F&I, 1 EA  
XXX-1-1 WEB RELAY, F&I, 1 EA



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO. IT-37
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH	FINANCIAL PROJECT ID	

LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.  IT-38
DATE	DESCRIPTION	DATE	DESCRIPTION						
6-30-23	REMOVED PLC; REVISED PAY ITEMS								

JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578			ROAD NO.	COUNTY	FINANCIAL PROJECT ID
			S.R. 618	HILLSBOROUGH	

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

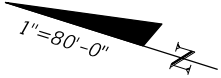
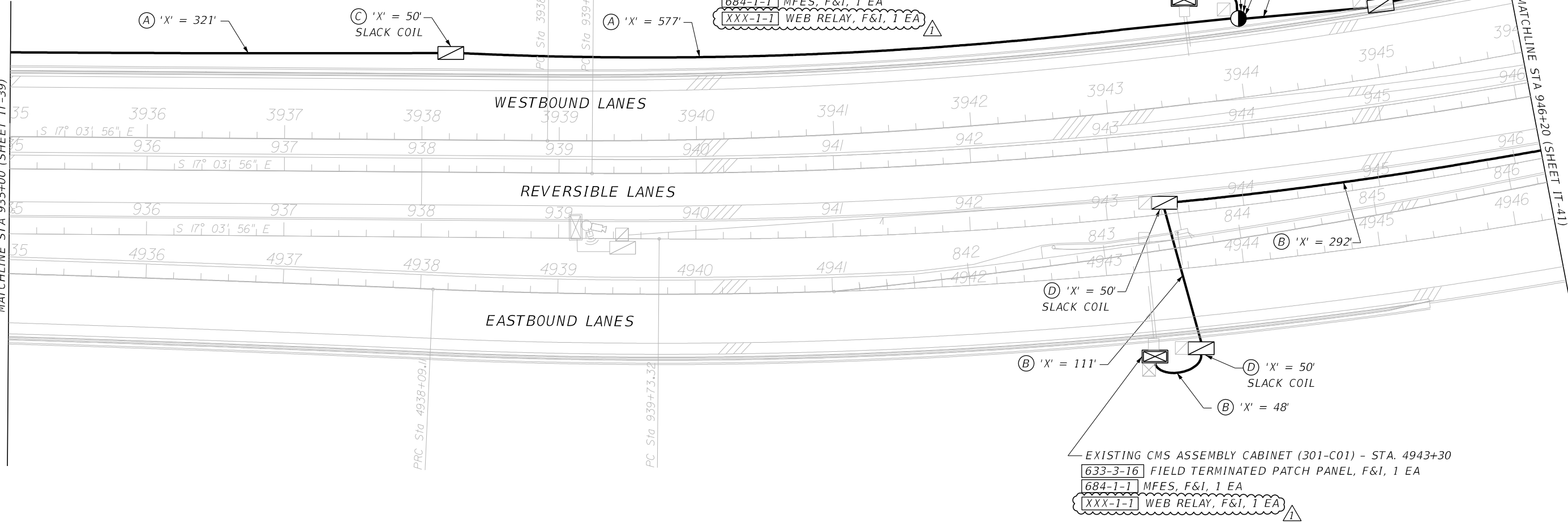
LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9 THRU D-12 FOR SPLICE DETAILS.

633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 4 EA  
633-3-11 SPLICE ENCLOSURE, 1 EA  
633-3-12 F&I, SPLICE TRAY, 1 EA  
635-2-13 FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.

EXISTING CMS ASSEMBLY CABINET (78-C02) - STA. 3943+63  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-1-1 MFES, F&I, 1 EA  
XXX-1-1 WEB RELAY, F&I, 1 EA



THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO. IT-40
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH		



LEGEND

(A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT

(B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT

(C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.

(D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

UTILIZE EXISTING SPLICE ENCLOSURE  
633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 12 EA  
633-3-12 F&I, SPLICE TRAY, 1 EA

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 140' L.F.  
633-1-122 24CT SM FIBER DROP, F&I, 140' L.F.  
PROOFING OF EXISTING CONDUIT

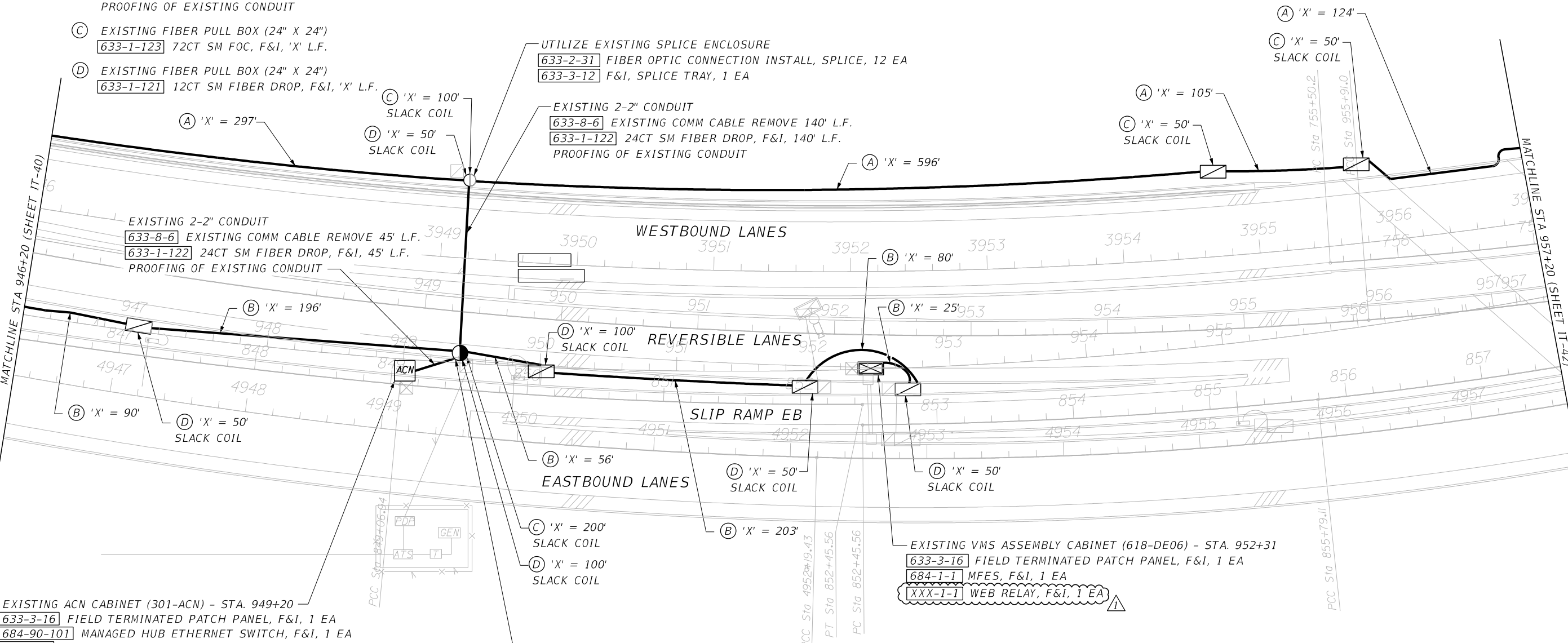
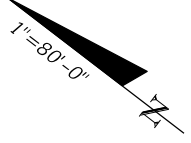
EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 45' L.F.  
633-1-122 24CT SM FIBER DROP, F&I, 45' L.F.  
PROOFING OF EXISTING CONDUIT

EXISTING ACN CABINET (301-ACN) - STA. 949+20  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-90-101 MANAGED HUB ETHERNET SWITCH, F&I, 1 EA  
690-100 REMOVE EXISTING PLC ASSEMBLY, REMOVE EXISTING  
FIBER PATCH PANEL, REMOVE EXISTING MFES, 3 EA 2 EA  
XXX-XXX-X PLC ASSEMBLY INCLUDING REQUIRED MODULES F&I, 1 EA  
XXX-1-2 WEB RELAY CONTROL, F&I, LS

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH  
PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER  
SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED  
FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE  
IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT  
FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW  
FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9  
THRU D-12 FOR SPLICE DETAILS.

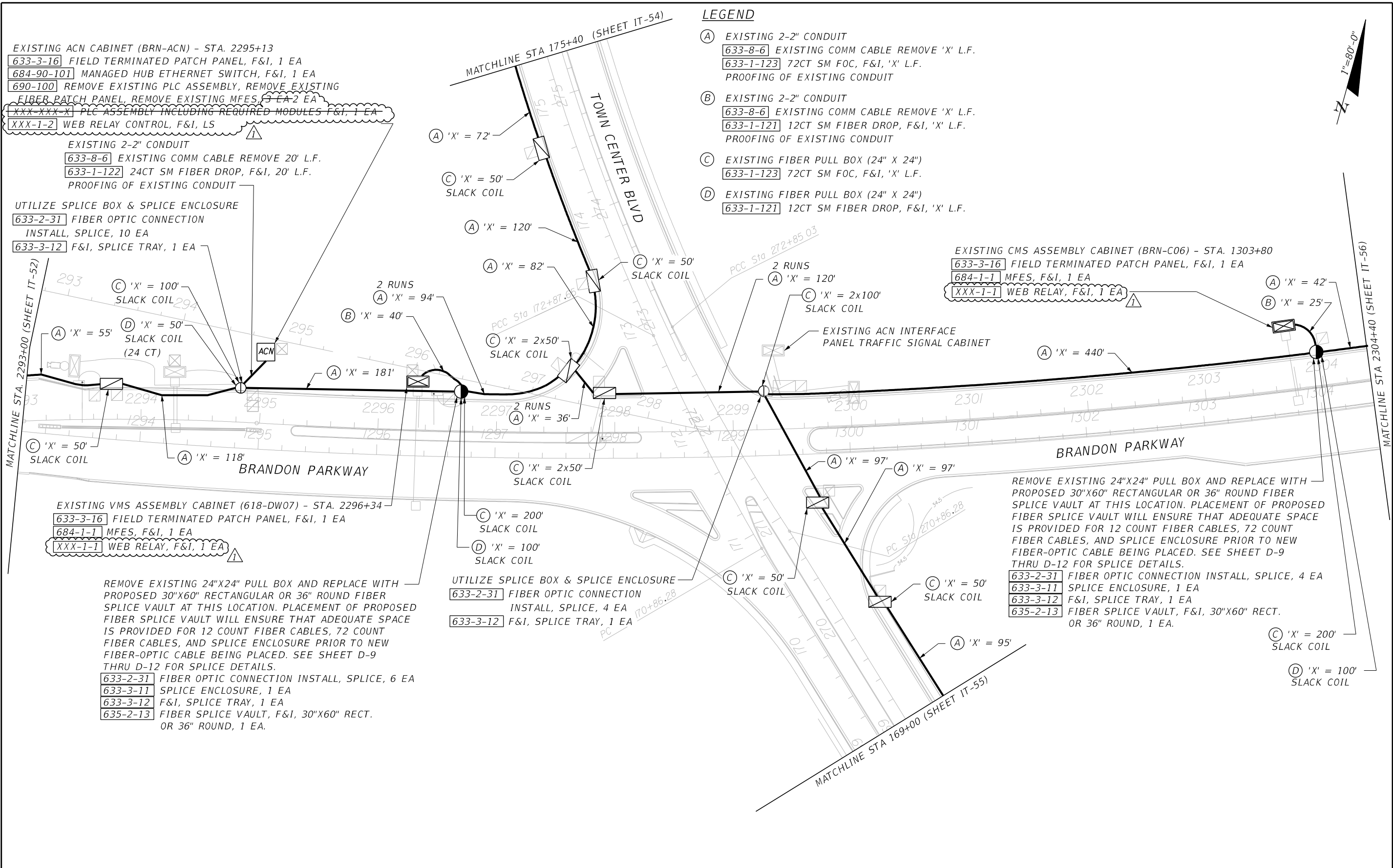
633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 16 EA  
633-3-11 SPLICE ENCLOSURE, 1 EA  
633-3-12 F&I, SPLICE TRAY, 2 EA  
635-2-13 FIBER SPLICE VAULT, F&I, 30"X60" RECT.  
OR 36" ROUND, 1 EA.

EXISTING VMS ASSEMBLY CABINET (618-DE06) - STA. 952+31  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-1-1 MFES, F&I, 1 EA  
XXX-1-1 WEB RELAY, F&I, 1 EA



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578					
6-30-23	⚠️ REMOVED PLC; REVISED PAY ITEMS				ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					S.R. 618	HILLSBOROUGH			IT-41

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

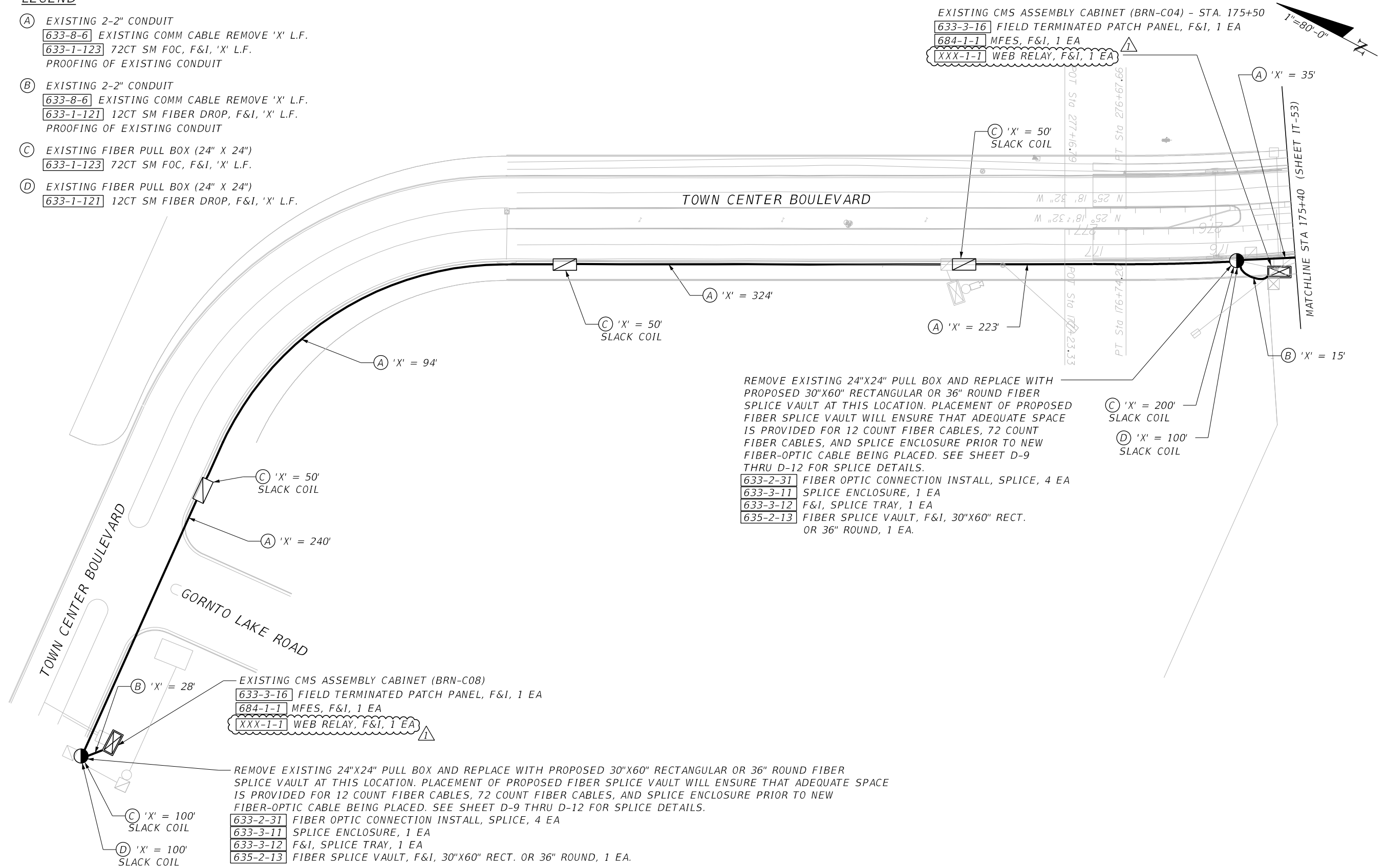
REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO. IT-53
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH		

(A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
 PROOFING OF EXISTING CONDUIT

(B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
 PROOFING OF EXISTING CONDUIT

(C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.

(D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		IT-54
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS				S.R. 618	HILLSBOROUGH			

LEGEND

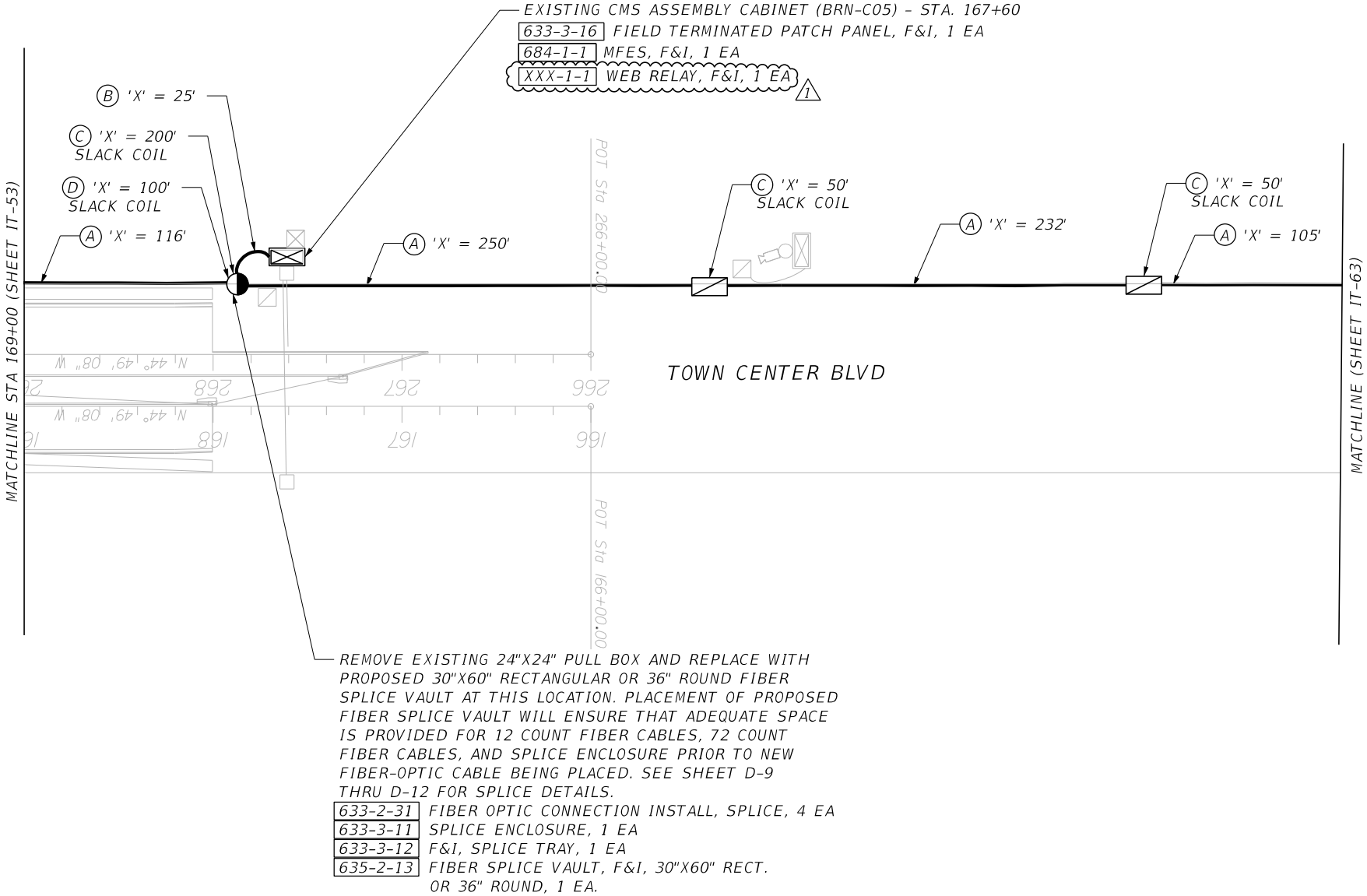
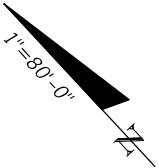
- (A)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH			IT-55

LEGEND

- (A)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9 THRU D-12 FOR SPLICE DETAILS.

633-2-31

FIBER OPTIC CONNECTION INSTALL, SPLICE, 4 EA

633-3-11

SPLICE ENCLOSURE, 1 EA

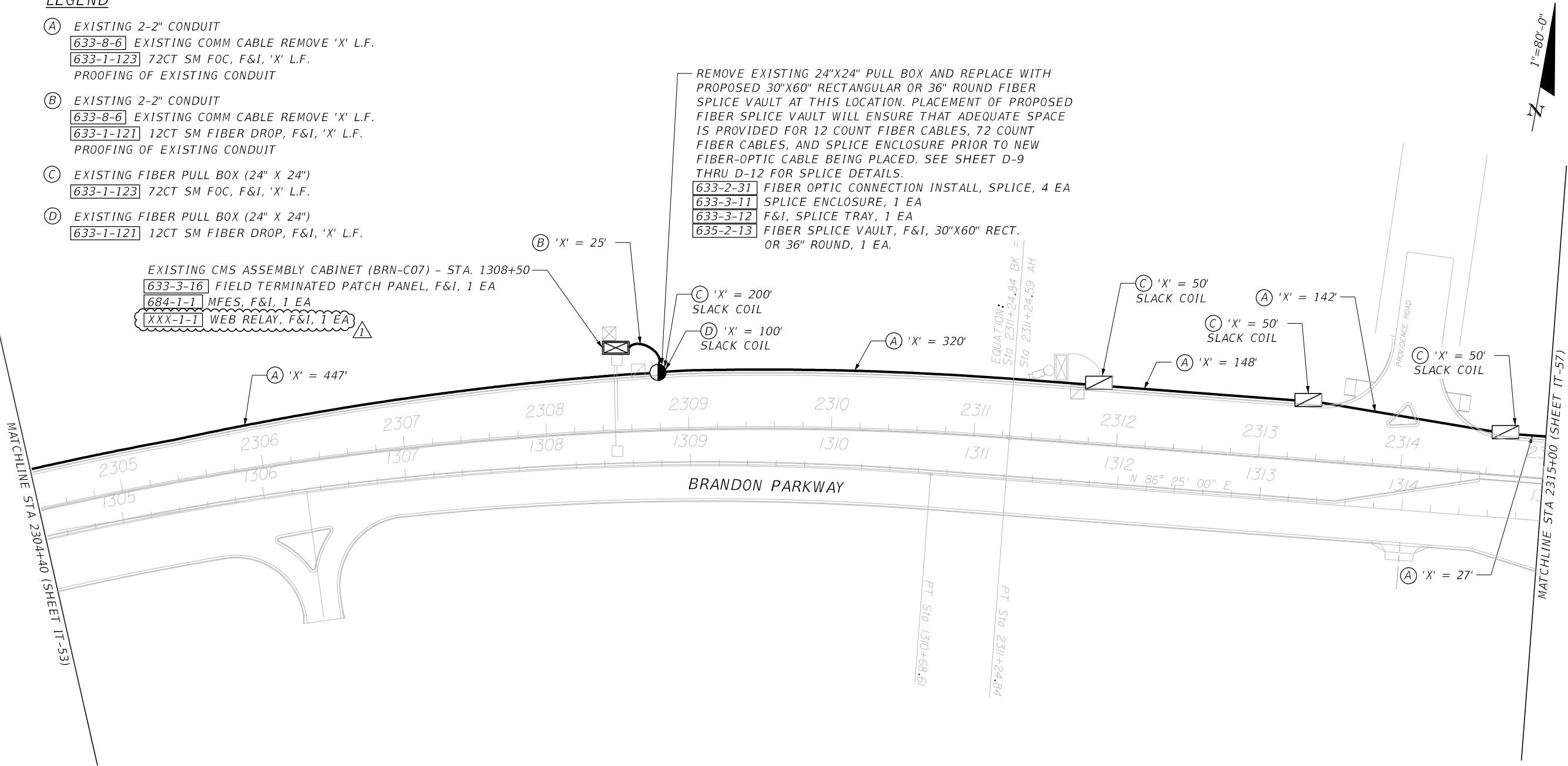
633-3-12

F&I, SPLICE TRAY, 1 EA

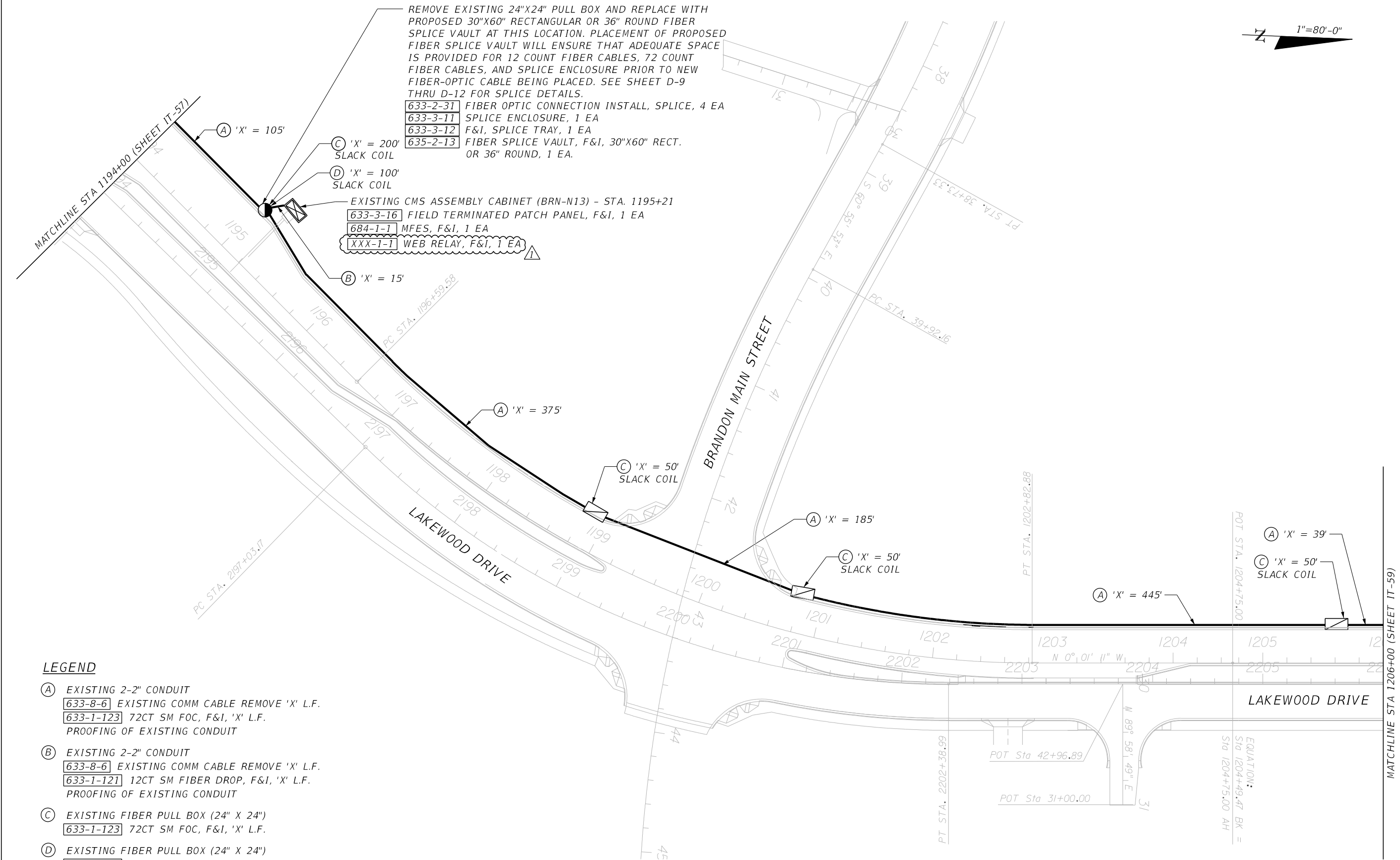
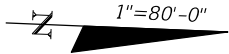
635-2-13

FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.

EXISTING CMS ASSEMBLY CABINET (BRN-C07) - STA. 1308+50  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-1-1 MFES, F&I, 1 EA  
XXX-1-1 WEB RELAY, F&I, 1 EA



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION			ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS			JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		S.R. 618	HILLSBOROUGH	FINANCIAL PROJECT ID	IT-56



**LEGEND**

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.  IT-58
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH	FINANCIAL PROJECT ID	

LEGEND

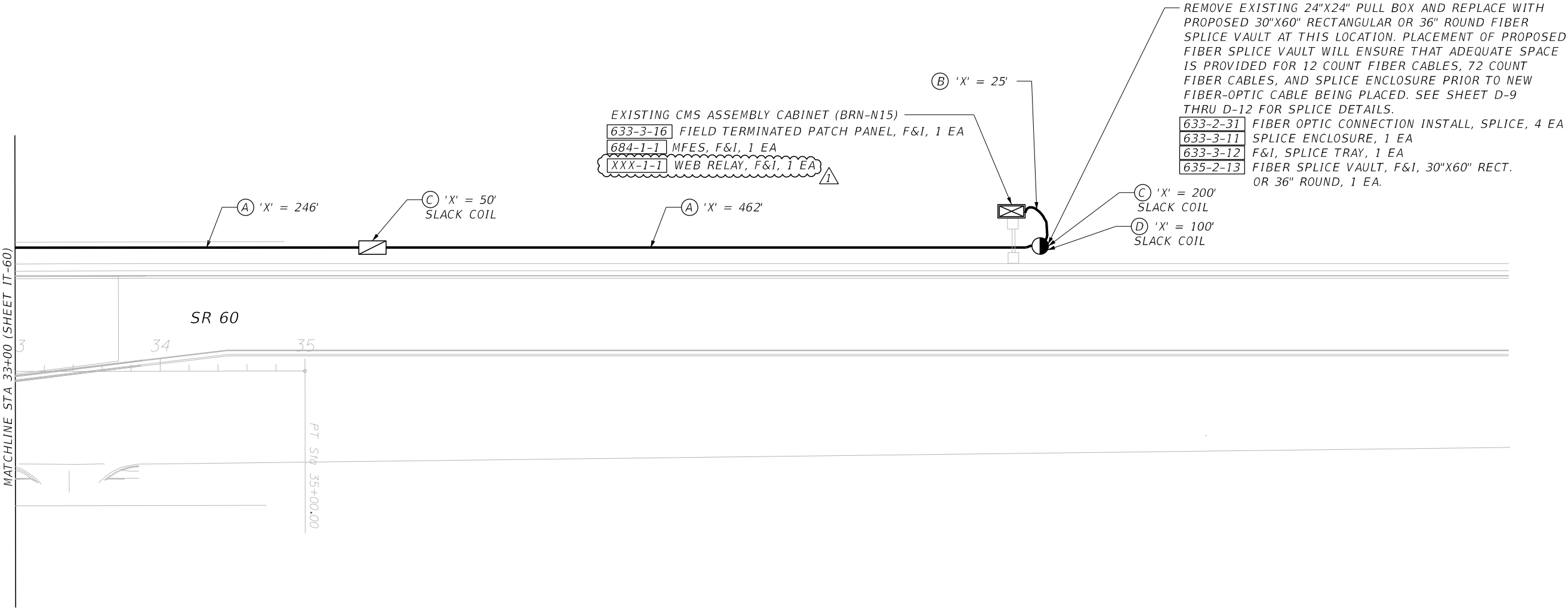
- (A)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.  IT-61
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
6-30-23	⚠ REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH			

LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9 THRU D-12 FOR SPLICE DETAILS.

633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 4 EA  
633-3-11 SPLICE ENCLOSURE, 1 EA  
633-3-12 F&I, SPLICE TRAY, 1 EA  
635-2-13 FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.

MATCHLINE (SHEET IT-55)

EXISTING CMS ASSEMBLY CABINET (BRN-N09) - STA. 176+44  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-1-1 MFES, F&I, 1 EA  
XXX-1-1 WEB RELAY, F&I, 1 EA

(D) 'X' = 50'  
SLACK COIL

(B) 'X' = 50'

(D) 'X' = 100'  
SLACK COIL

(C) 'X' = 200'  
SLACK COIL

(B) 'X' = 149'

(A) 'X' = 195'

(C) 'X' = 50'  
SLACK COIL

(A) 'X' = 301'

(C) 'X' = 50'  
SLACK COIL

(A) 'X' = 120'

REMOVE EXISTING 24"X24" PULL BOX AND REPLACE WITH PROPOSED 30"X60" RECTANGULAR OR 36" ROUND FIBER SPLICE VAULT AT THIS LOCATION. PLACEMENT OF PROPOSED FIBER SPLICE VAULT WILL ENSURE THAT ADEQUATE SPACE IS PROVIDED FOR 12 COUNT FIBER CABLES, 72 COUNT FIBER CABLES, AND SPLICE ENCLOSURE PRIOR TO NEW FIBER-OPTIC CABLE BEING PLACED. SEE SHEET D-9 THRU D-12 FOR SPLICE DETAILS.

633-2-31 FIBER OPTIC CONNECTION INSTALL, SPLICE, 4 EA  
633-3-11 SPLICE ENCLOSURE, 1 EA  
633-3-12 F&I, SPLICE TRAY, 1 EA  
635-2-13 FIBER SPLICE VAULT, F&I, 30"X60" RECT. OR 36" ROUND, 1 EA.

(C) 'X' = 200'  
SLACK COIL

(D) 'X' = 100'  
SLACK COIL

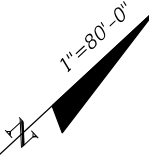
(B) 'X' = 40'

(A) 'X' = 50'

EXISTING CMS ASSEMBLY CABINET (BRN-N10) - STA. 166+94  
633-3-16 FIELD TERMINATED PATCH PANEL, F&I, 1 EA  
684-1-1 MFES, F&I, 1 EA  
XXX-1-1 WEB RELAY, F&I, 1 EA

TOWN CENTER BLVD

PROVIDENCE ROAD



MATCHLINE STA 177+40 (SHEET IT-62)

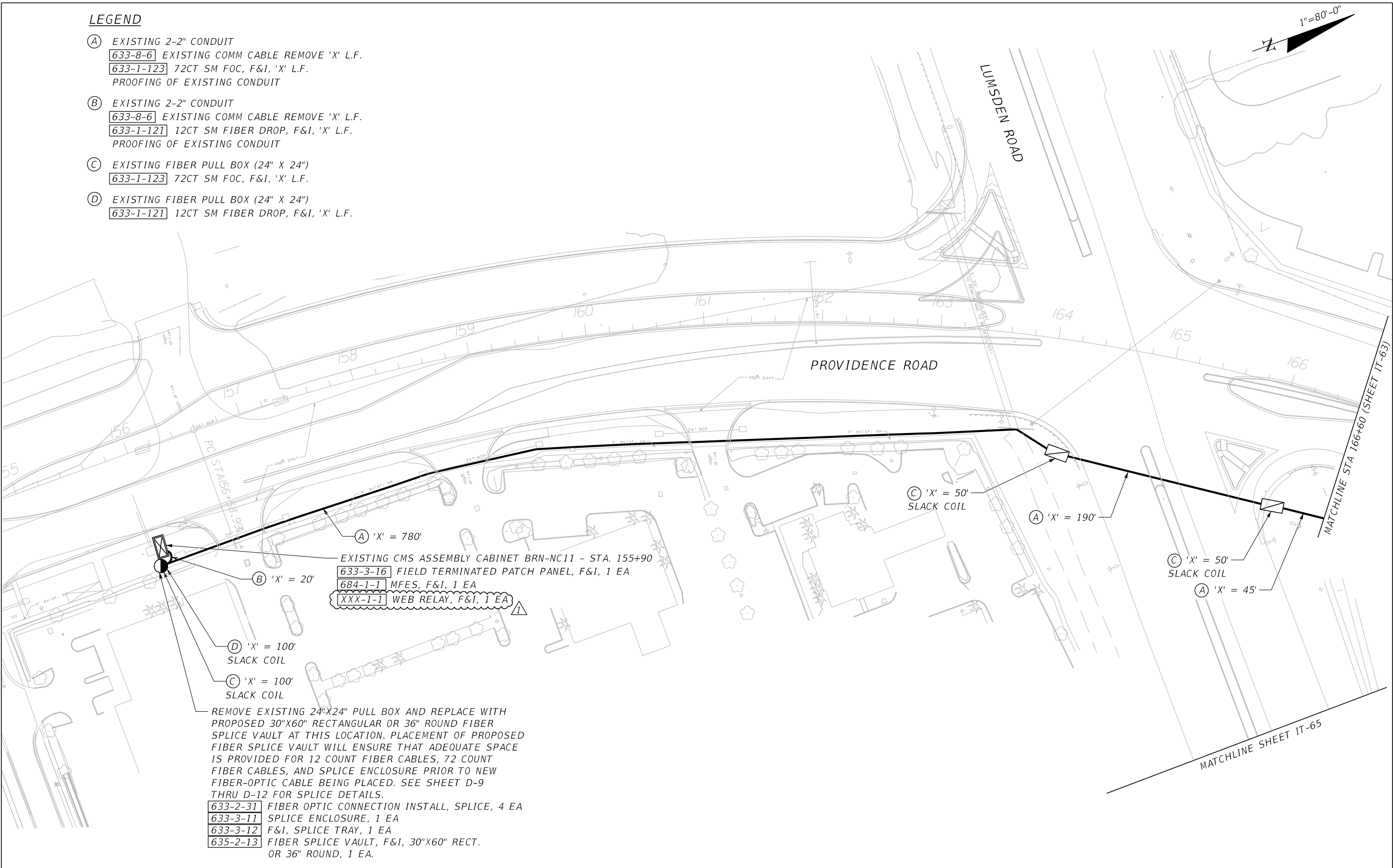
THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN		SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578						
6-30-23	⚠️ REMOVED PLC; REVISED PAY ITEMS				ROAD NO.	COUNTY	FINANCIAL PROJECT ID			IT-63
					S.R. 618	HILLSBOROUGH				



LEGEND

- (A) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B) EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C) EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D) EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO. IT-64
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH	FINANCIAL PROJECT ID	

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

LEGEND

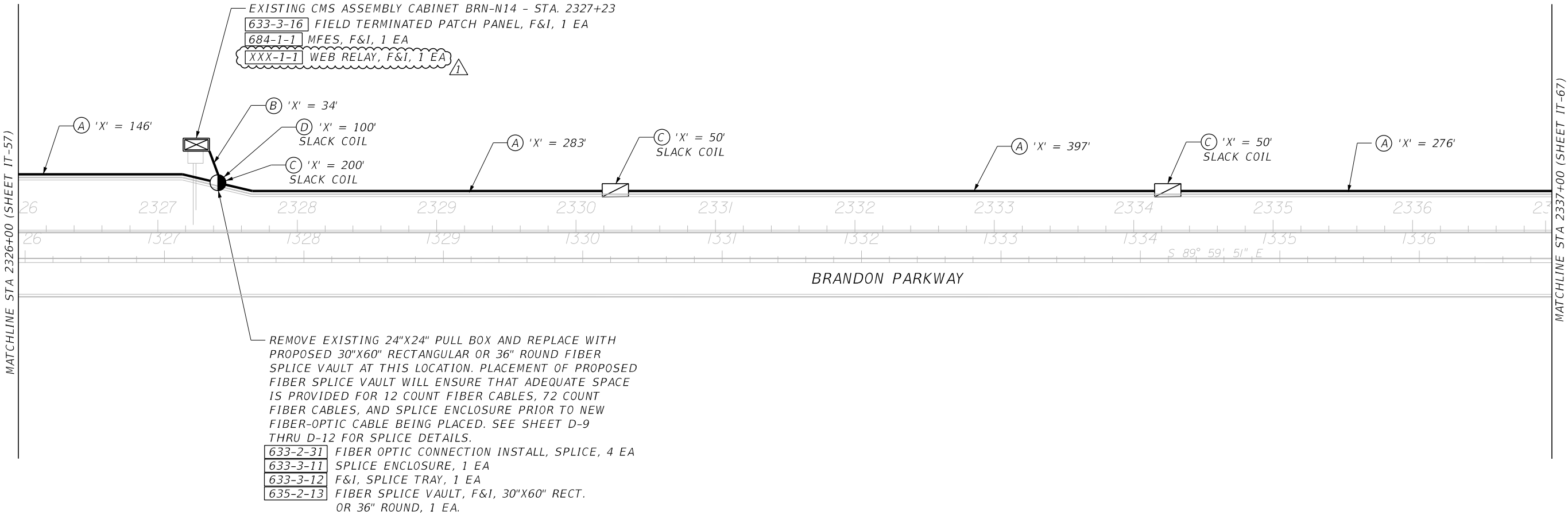
- (A)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (B)

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- (C)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- (D)

EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY		INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY		
6-30-23	△ REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH	FINANCIAL PROJECT ID	IT-66

LEGEND

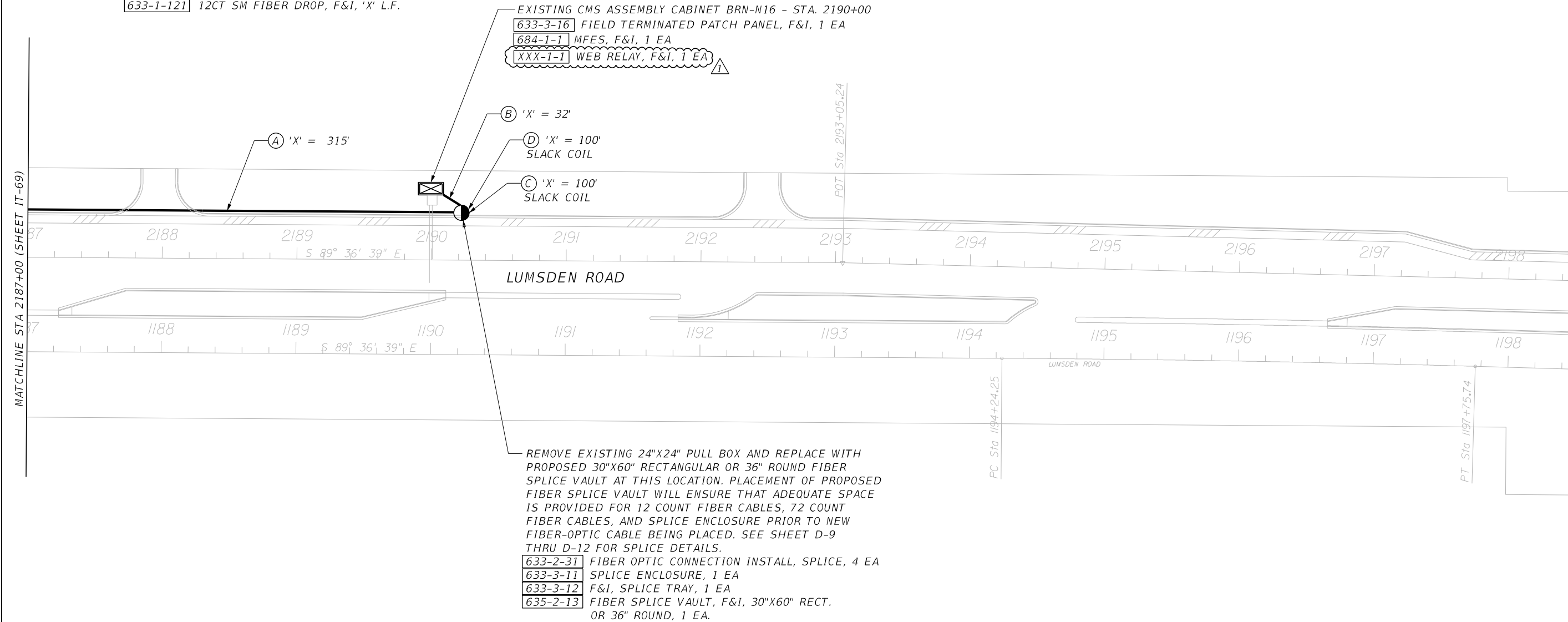
- A

EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-123 72CT SM FOC, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- B

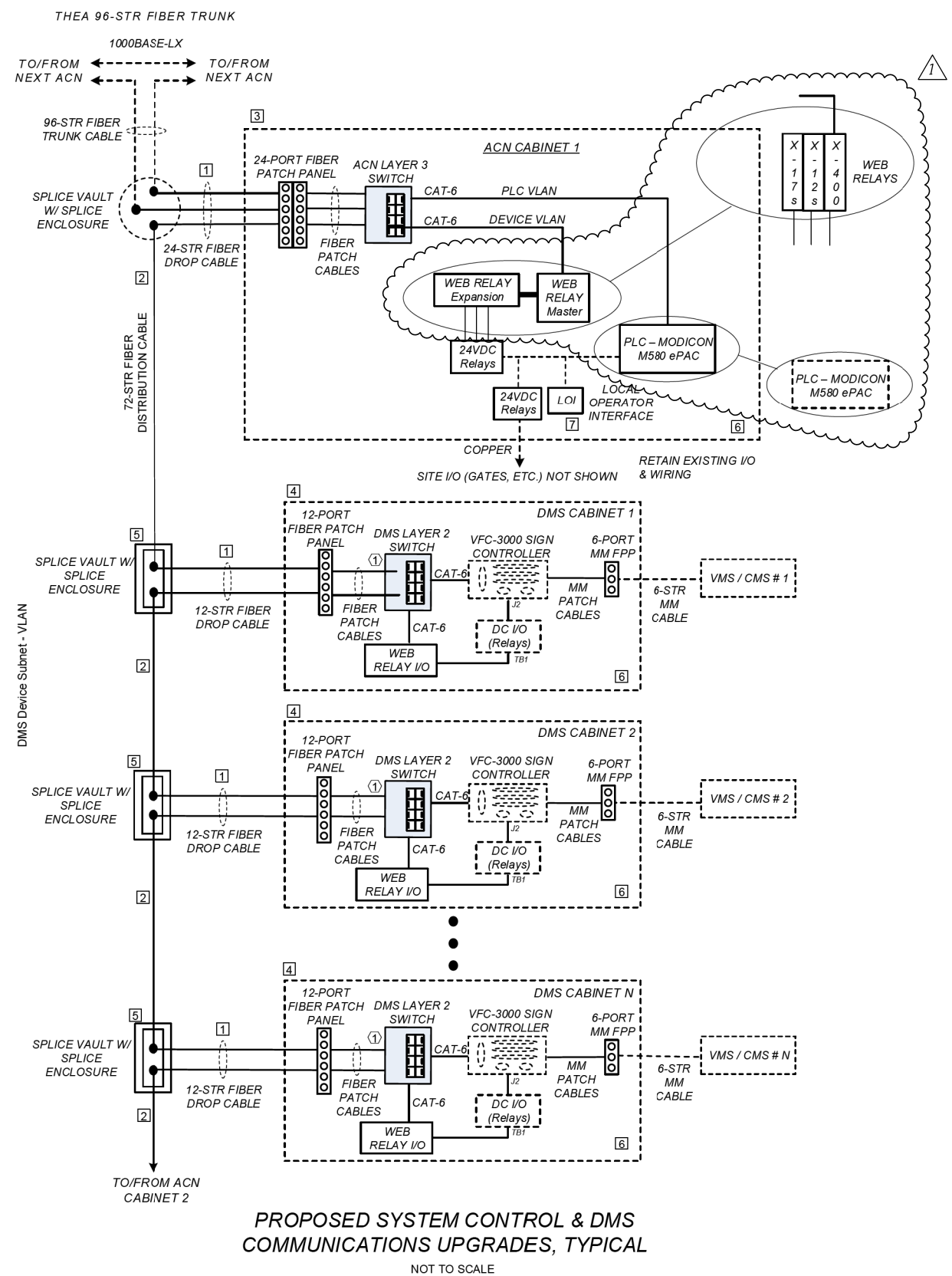
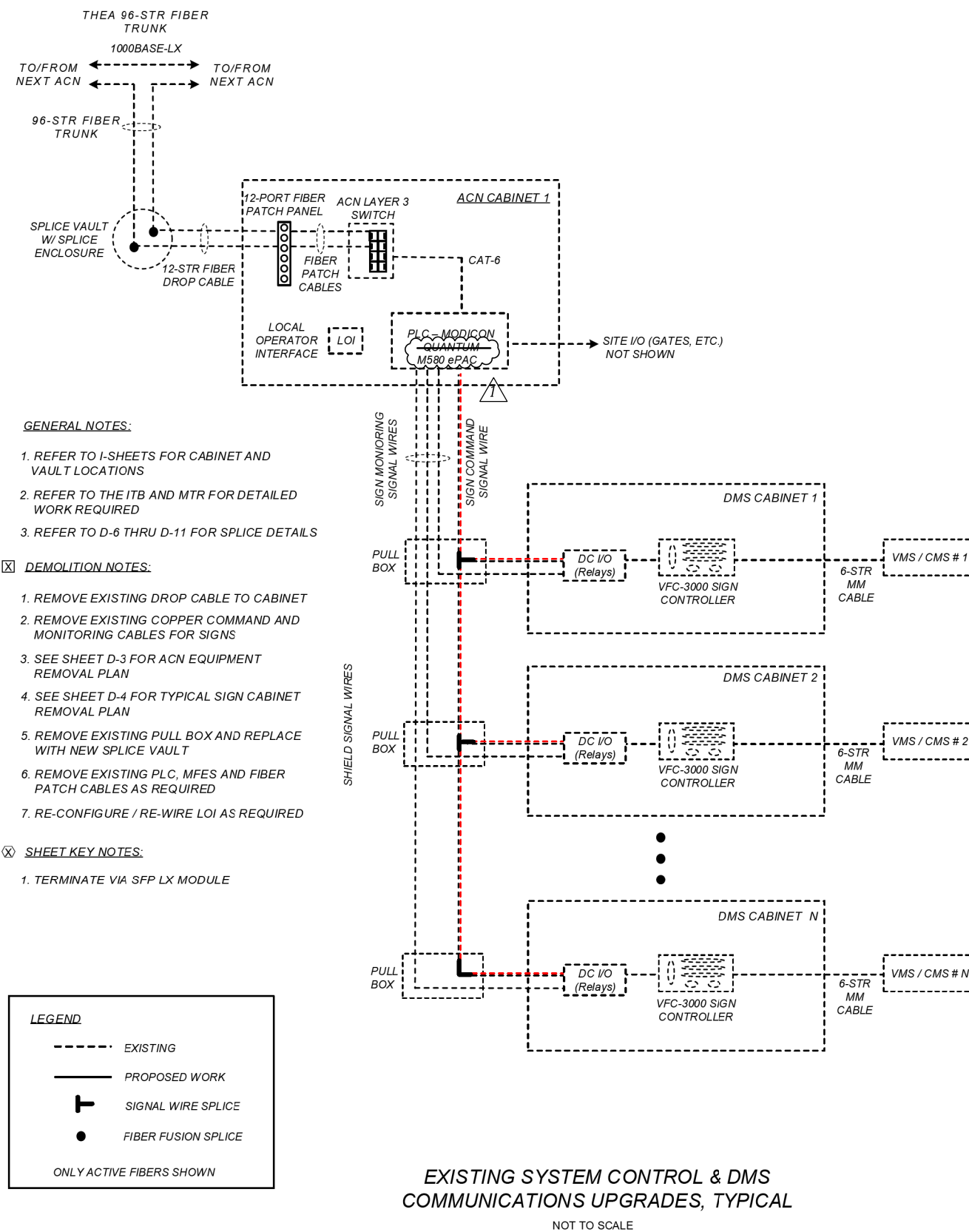
EXISTING 2-2" CONDUIT  
633-8-6 EXISTING COMM CABLE REMOVE 'X' L.F.  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.  
PROOFING OF EXISTING CONDUIT
- C

EXISTING FIBER PULL BOX (24" X 24")  
633-1-123 72CT SM FOC, F&I, 'X' L.F.
- D

EXISTING FIBER PULL BOX (24" X 24")  
633-1-121 12CT SM FIBER DROP, F&I, 'X' L.F.



REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			INTELLIGENT TRANSPORTATION SYSTEM PLAN	SHEET NO.  IT-70
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
6-30-23	REMOVED PLC; REVISED PAY ITEMS					S.R. 618	HILLSBOROUGH			



REVISIONS				ENGINEER OF RECORD	TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			FIELD SITE WIRING SCHEMATIC	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578	ROAD NO.	COUNTY	FINANCIAL PROJECT ID		D-2
6-30-23	△ REMOVED PLC; REVISED WEB RELAYS				S.R. 618	HILLSBOROUGH			

GENERAL SHEET NOTES

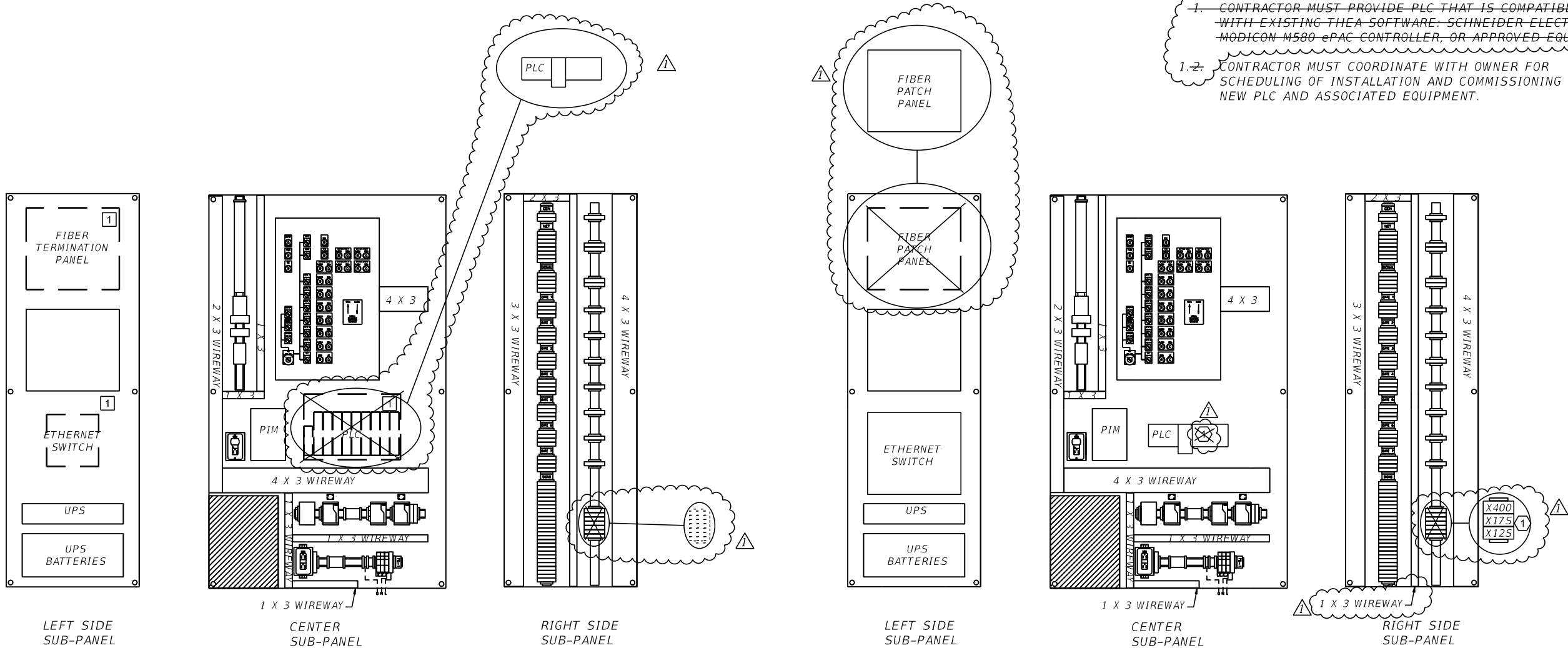
1. QUANTITY AND LAYOUTS OF EXISTING CABINETS MAY VARY.
2. SEE MTR FOR SPARE PARTS REQUIREMENTS.
3. ~~PLC SOFTWARE MUST HAVE 1 USER LICENSE TO THEA.~~
4. ~~CONTRACTOR MUST PROVIDE ELECTRONIC COPIES OF ALL SOFTWARE PROGRAM FILES, INCLUDING NATIVE PLC PROGRAMMING AND/OR CONFIGURATION.~~

DEMOLITION NOTES

1. DEVICES MUST REMAIN IN CABINET AND WIRED TO THE EXTENT POSSIBLE UNTIL ALL TESTING IS COMPLETED. REMOVE DEVICES AFTER APPROVAL.

SHEET KEY NOTES

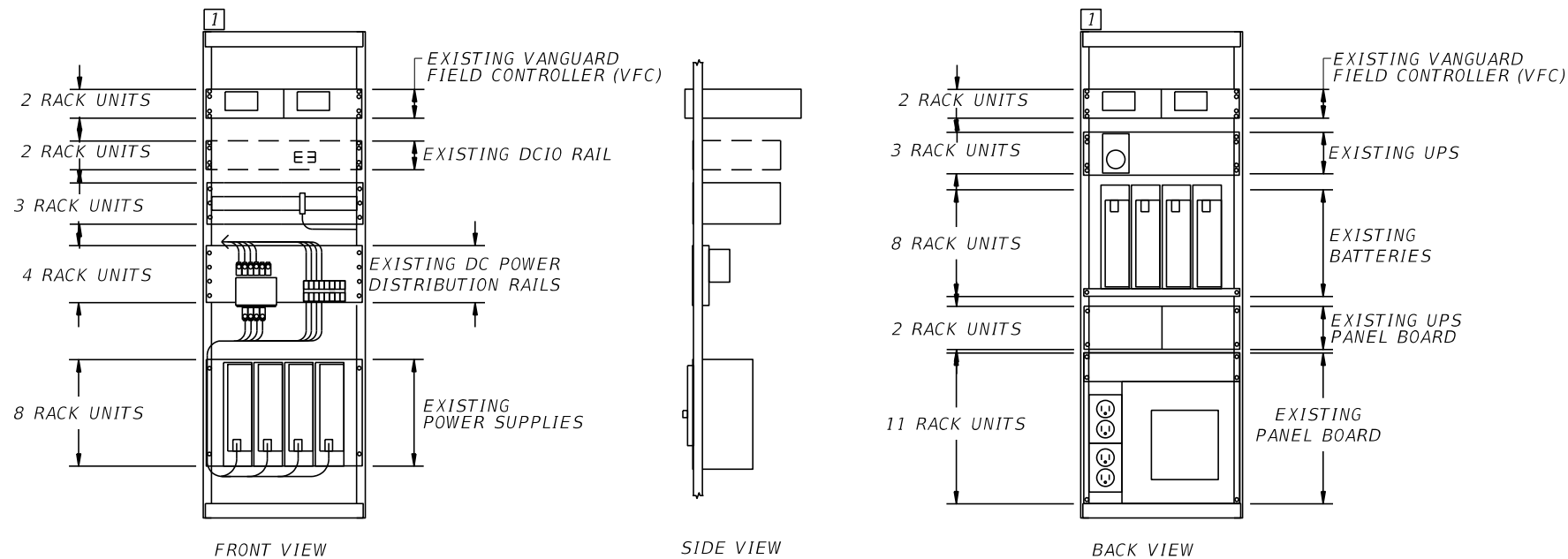
1. ~~CONTRACTOR MUST PROVIDE PLC THAT IS COMPATIBLE WITH EXISTING THEA SOFTWARE: SCHNEIDER ELECTRIC MODICON M580 ePAC CONTROLLER, OR APPROVED EQUAL.~~
- 1-2. CONTRACTOR MUST COORDINATE WITH OWNER FOR SCHEDULING OF INSTALLATION AND COMMISSIONING OF NEW PLC AND ASSOCIATED EQUIPMENT.



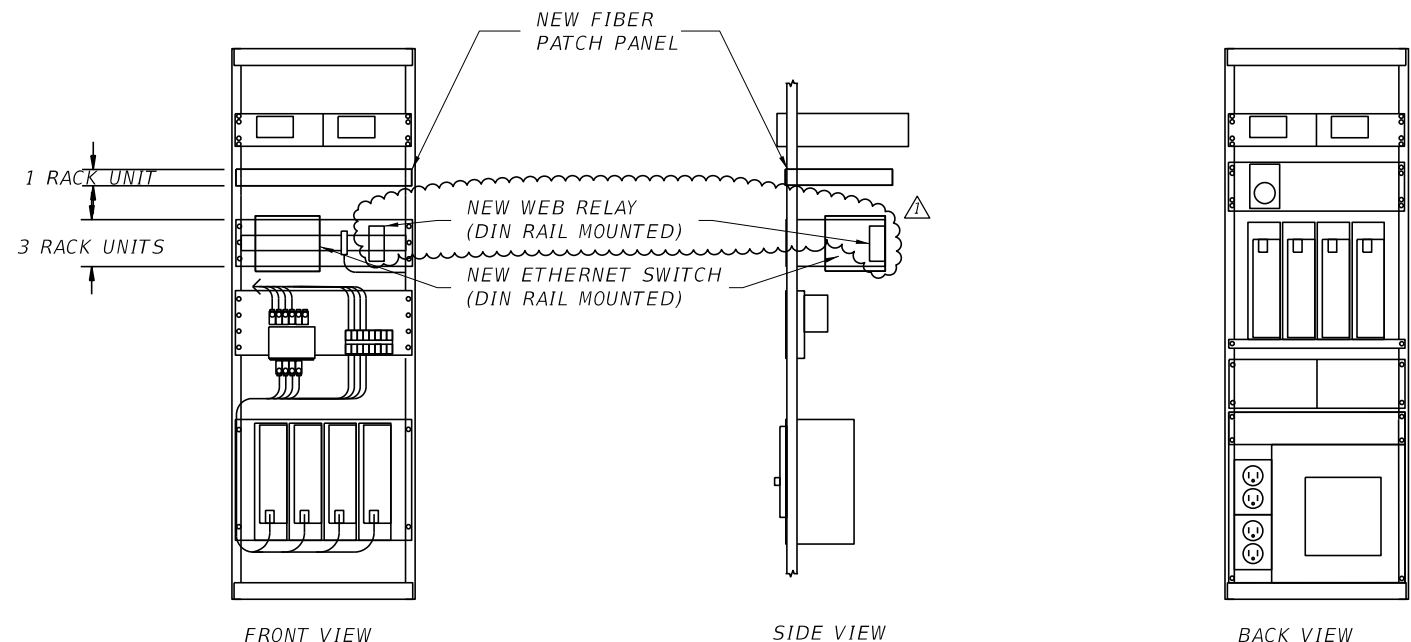
1 TYPICAL REMOVAL FROM ACN DIAGRAM  
SCALE: NONE

2 TYPICAL ACN NEW WORK DIAGRAM  
SCALE: NONE

REVISIONS				ENGINEER OF RECORD			TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION				ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
6-30-23	REMOVED PLC; REVISED WEB RELAYS			JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578			S.R. 618	HILLSBOROUGH		D-3
6/30/2023		12:00:46 PM								



1 TYPICAL REMOVAL FROM SIGN CABINET DIAGRAM  
SCALE: NONE



2 TYPICAL SIGN CABINET NEW WORK DIAGRAM  
SCALE: NONE

- GENERAL SHEET NOTES**
1. QUANTITY AND LAYOUTS OF EXISTING CABINETS MAY VARY.
  2. CONTRACTOR TO PROVIDE A SHOP DRAWING SHOWING THE PROPOSED LOCATION OF WEB RELAY EQUIPMENT.

- DEMOLITION NOTES**
1. DEVICES MUST REMAIN IN CABINET AND WIRED TO THE EXTENT POSSIBLE UNTIL ALL TESTING IS COMPLETED. REMOVE DEVICES AFTER APPROVAL.

REVISIONS				ENGINEER OF RECORD		TAMPA-HILLSBOROUGH EXPRESSWAY AUTHORITY			SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION			ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
6-30-23	△ REMOVED PLC; REVISED PAY ITEMS			JEFFREY LAWRENCE P.E., PTOE P.E. LICENSE NUMBER 42883 KCI TECHNOLOGIES, INC 4041 CRESCENT PARK DRIVE TAMPA, FL 33578		S.R. 618	HILLSBOROUGH		D-4

# ***Tampa-Hillsborough Expressway Authority***

## **Control System & DMS Fiber Communications Upgrades**



## **ATTACHMENT 2**

### **Minimum Technical Requirements (MTR)**

**Contract Number: O-1223**

Tampa-Hillsborough Expressway Authority (THEA)  
1104 East Twiggs Street, Suite 300  
Tampa, Florida 33602

June 2, 2023

*Addendum 1 Issue Date: 7/19/2023*

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## **I. DEFINITIONS, ACRONYMS AND ABBREVIATIONS**

The following technical acronyms and abbreviations are, used in this MTR, ITB and contract documents.

ACS:	Access Control System: Includes ACCS, ACN, Gate Controls and General Surveillance
ACCS:	Access Control Central Software: Gate Access Control and ITS System Software
ACN:	Access Control Node (Nodes, PLCs, gates, signs, CCTVs and signal timing controls)
ANSI:	American National Standards Institute
APL:	FDOT Approved Product List
AWG:	American Wire Gauge
BISCI:	Building Industry Consulting Service International
BRN:	Brandon
CCTV:	Closed-Circuit Television
CMS:	Changeable Message Sign
COT:	City of Tampa
CPU:	Central Processing Unit
dB:	Decibel
DIN:	Deutsches Institut fur Normung
DMS:	Dynamic Message Sign
DT:	Downtown
ePAC:	Ethernet Programmable Automation Controller
FDOT:	Florida Department of Transportation
FPP:	Fiber Patch Panel
GEC:	General Engineering Consultant
Gbps:	Gigabit per second
HMI	Human Machine Interface
I/O	Input / Output. Connections between PLCs and devices being controlled or monitored.
IEEE:	Institute of Electrical and Electronic Engineers
IMSA:	International Municipal Signal Association
IP:	Internet Protocol
ITB:	Invitation to Bid
ITS:	Intelligent Transportation Systems
ITU:	International Telecommunication Union

MB: Megabyte  
Mbps: Megabit per second  
MFES: Managed Field Ethernet Switch  
MOT: Maintenance of Traffic  
OSP: Outside Plant  
OTDR: Optical Time Domain Reflectometer  
PLC: Programmable Logic Controller  
POE: Power over Ethernet  
PPE: Personal Protective Equipment  
RAM: Random Access Memory  
RCDD: Registered Communications Distribution Designer  
REL: Reversible Express Lanes  
SFP: Small Form-Factor Pluggable (optical transceiver)  
THEA: Tampa Hillsborough Expressway Authority  
TMC: Traffic Management Center  
TTC: Temporary Traffic Control  
UI: User Interface  
UTP: Unshielded Twisted Pair  
VLAN: Virtual Local Area Network  
VMS: Variable Message Sign

## II. GENERAL REQUIREMENTS

### 1. INTRODUCTION

- a. The Contractor must obtain, meet or exceed all Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction (herein referred to as FDOT Standard Specifications), FDOT Standard Plans, THEA General Provisions, the ITS Plans and all other requirements provided in the ITB and minimum technical requirements (MTR).
- b. This MTR is a supplement to the FDOT Standard Specifications.
- c. All materials and equipment submittals, shop drawings, questions and work related to the contents of the ITS Plans, the ITB and this MTR must be reviewed and approved by the THEA or its designee.

### 2. GENERAL AND INSTALLATION REQUIREMENTS

Meet the following general and installation requirements:

- a. Furnish, install, test and provide integration support for all required device and communications infrastructure and network upgrades provided in this ITB.
- b. Work with the THEA, THEA's GEC, ~~FLIR ACS~~-(ACS consultant), ~~Schneider Electric (PLC integration)~~ and THEA's Network Systems Integrator as well as the DMS manufacturer (Daktronics) to configure, integrate and test the upgrades provided under this contract for a fully functional and operational system.
- c. Ensure that the provided infrastructure and devices are on the FDOT's Approved Product List (APL), unless otherwise specified on the Plans or these MTRs and are compatible with the THEA ACS, THEA ITS, and TMC.
- d. Utilize existing Access Control Node (ACN) and DMS cabinets.
- e. Utilize existing THEA conduit and pull boxes unless otherwise shown on the ITS Plans or found to be damaged or unusable when field verified.
- f. Some conduit and pull boxes may be located within the interstitials of segmented bridges on the elevated Reversible Express Lanes (REL). A THEA representative will provide access points but the Contractor must provide personnel that are certified for confined space entry for work in these locations. All confined space, PPE equipment, and all training is to be furnished by the Contractor.
- g. Field verify all quantities and proof existing conduit. Any damaged existing conduit and/or pull boxes must be repaired or replaced meeting FDOT standard specifications and plans as approved by the THEA. Pull boxes must be traffic rated.
- h. Verify all approved equipment placement and connections, risers, DMS ring network configurations, installation and splice plan prior to installation, splicing and termination.
- i. Coordinate all work and planned network shutdowns with the THEA. Provide the THEA with at least two (2) week notice prior to any shutdown.

- j. Keep existing system operational until planned switchover times. Do not disconnect or damage any existing equipment prior to switchovers.
- k. Provide Maintenance of Traffic (MOT) / Temporary Traffic Control (TTC) during all set-up and takedown activities and work activities, as required. Prepare and submit to the Authority a MOT Plan signed and sealed by a Professional Engineer whenever a deviation is anticipated from the most recent edition of the FDOT Standard Plans, Index 102.
- l. Other general notes and pay item descriptions are provided on the ITS Plans (General Notes sheets).

### **3. INDUSTRY STANDARDS AND GUIDELINES**

Meet the following industry standards and guidelines:

- a. Provide all infrastructure, devices and workmanship in accordance with industry standards.
- b. Follow the current edition of the following list of specific standards and guidelines that are to be utilized in the installation and testing for this Project. The list include industry standards organizations, FDOT design standards, specifications and manuals and building codes, as required and applicable. This list is representative only and is not meant to be all encompassing.
  - i. FDOT Standard Specifications for Road and Bridge Construction
  - ii. FDOT Standard Plans
  - iii. The Manual on Uniform Traffic Control Devices (MUTCD)
  - iv. Building Industry Consulting Service International (BICSI) RCDD and OSP
  - v. The American Society for Testing and Materials (ASTM) standards
  - vi. International Electrotechnical Commission (IEC)
  - vii. Institute of Electrical and Electronics Engineers (IEEE) standards
  - viii. International Standards Organization (ISO) standards
  - ix. The American National Standards Institute (ANSI)
  - x. The National Electrical Code (NEC)
  - xi. The National Electrical Manufacturers Association (NEMA)
  - xii. The National Fire Protection Association (NFPA)
  - xiii. The National Electrical Safety Code (NESC)
  - xiv. The Underwriters' Laboratories (UL)
  - xv. The Electrical Testing Laboratories (ETL)
  - xvi. The Electronic Industries Association (EIA)
  - xvii. The International Telecommunications Union (ITU)
  - xviii. The Telecommunications Industries Association (TIA)

### **III. MINIMUM TECHNICAL REQUIREMENTS**

#### **1. FIBER OPTIC CABLE & INFRASTRUCTURE**

Meet the following minimum fiber optic cable and infrastructure requirements:

##### **a. General Requirements**

- i. Review all Contract Documents and field verify for the proper cable types, connector types, and cable lengths based on final proposed routing and terminations to provide high quality performance.
- ii. All cabling must be of the type indicated in the ITS Plans and specified herein
- iii. All cabling must be of length that allows for slack (service loop) as specified in the ITS Plans for each run to accommodate potential future moves of equipment in the cabinet racks.
- iv. All cabling must be provided with cable management components to provide clear organization, routing and strain relief to prevent damage to cables as approved by the THEA.
- v. All cabling must be clearly labeled as approved by the THEA and neatly organized and secured, using cable management components as approved by the THEA.
- vi. Manufacturer recommended installation and minimum bend radius must be adhered to for all installed cables.
- vii. Monitor the fiber optic cable during installation to ensure that the maximum manufacturer cable pulling tension is not exceeded. A breakaway pulling swivel as recommended by the fiber cable manufacturer must be provided.

##### **b. Fiber Optic Cables and Components**

Meet the following minimum fiber optic cable requirements:

- i. Provide a 72-strand single-mode (SM) (OS2) fiber optic, outdoor, loose-tube, zero-dispersion, low-water peak, water-blocking, gel-free, distribution cable. For the 72-strand cable into the THEA TMC provide an indoor/outdoor rated cable.
- ii. Provide 24-strand single-mode (OS2) fiber optic, outdoor, zero-dispersion, low-water peak, gel-free, drop cables to ACN fiber patch panels
- iii. Provide 12-strand single-mode (OS2) fiber optic, outdoor, zero-dispersion, low-water-peak, gel-free, drop cables to DMS fiber patch panels
- iv. Provide fiber optic drop cables of the same type and manufacturer as the fiber optic distribution cable.
  - i. Comply with ITU-T G.652.D, 7 CFR parts 1755.900, 1755.901, and 1755.902, ANSI/ICEA S-87-640 and EIA/TIA 492-CAAB (OS2) standards.
- v. Provide attenuation coefficient of 0.35dB/km at 1310nm and 0.25dB/km at 1550nm.
- vi. Provide fiber optic cable that has been tested in accordance with TIA-455 as specified in ANSI/ICEA S-87-640 part 7 and part 8, resulting in no permanent change

in attenuation, no signs of water leakage, no mechanical damage to the cable, and no adverse effects to the jacket or fibers.

**c. Fiber Splicing and Fiber Splice Enclosure**

Meet the following minimum fiber splicing and fiber splice enclosure requirements:

- i. Ensure that the fiber optic cable is not twisted or curved in a manner that may compromise the integrity of the fiber optic cable or the fiber splice enclosure.
- ii. Loop individual fibers one full turn within the splice tray to avoid micro-bending.
- iii. Place buffer tubes and bare optical fibers such that there is no discernible tensile force placed upon them.
- iv. Provide fiber splice enclosures meeting the following minimum requirements:
  - Accept up to as many fiber-optic cables, as required or necessary, based on the fiber design and ensure that the cable entry ports can accommodate the cable outside diameters plus 10 percent to be installed on this Project, without compromising the waterproof characteristics of the splice enclosure.
  - Capable of being accessed, without disruption to the surrounding cables.
  - Fully sealed to protect fiber and splicing from water entry, including being submerged in standing water, and have been subjected to a water immersion test by the manufacturer. Splice enclosure integrity must be demonstrated by the Contractor and approved by the THEA.
  - Be made of thermoplastic material.
  - Be rodent proof, weather proof, water proof, chemical and UV resistant, re-enterable and re-sealable.
  - Comply with latest Telcordia GR-771 requirements for splice enclosures.
  - Employ reusable sealing materials (i.e., grommets, etc.) allowing multiple re-entrances without replacing any component.
  - Provide adequate interior space to accommodate and store slack for each fiber cable entering the splice enclosure without violating the minimum bend radius of the cable. All proposed facilities must be sized, designed and installed to accommodate maintenance activities as approved by the THEA.
  - Support fusion, inline and express configurations, as shown on the Plans and as required.
  - Enclosure to allow for an additional 50 percent future capacity.
  - Permit access to splice trays without kinking buffer tubes or micro-bending.
- v. Fusion Splicing:

- Use the fusion technique for all fiber optic cable splices and terminations. Use a fusion splicer to splice all optical fiber. Proposed fusion splicer must be submitted for approval by the THEA.
- Mechanical splicing is not allowed.

vi. Splice Personnel:

- All splicing personnel must be adequately trained for the fusion splicing, and must possess a fiber optic splicing certification from an industry recognized authority such as IMSA or ETA.

vii. Splice Equipment and Preparation:

- Provide splice enclosures, organizers and all other materials and incidentals, including cable end preparation; tools and procedures; compatible with the cable type being delivered.
- Support fusion splicing equipment with calibration records indicating a factory calibration within one (1) year preceding their use on this Project.
- Clean and calibrate fusion splicing equipment per the manufacturer's specifications and specifically adjusted to the fiber and environmental conditions at the start of each splicing shift.

viii. Splicing:

- Perform fusion splicing according to latest version of the cable manufacturer's and fusion splicer's procedures, accepted standards, codes, and practices; or as directed by the THEA.
- Fibers must not be fused or re-fused more than three (3) times.

ix. Splice Loss:

- Splice optical fibers using the fusion splice method and the mean (average) splice loss must not exceed 0.1dB.
- The mean splice loss is to be obtained by measuring the loss through the splice in both directions (bi-directional) and then averaging the resultant values.

x. Splice Protection:

- Protect each fusion-spliced fiber by housing the spliced fiber within a splice tray.
- Protect each spliced fiber in a heat shrinkable splice protection and water-proof sleeve with strength member.
- The protection sleeve must cover the splice and any bare fiber stripped of its coating.

d. **Fiber Patch Panels (FPP)**

Meet the following minimum fiber patch panel (FPP) requirements:

- i. Provide 12-port SM (bulkhead 1) and 6-port multi-mode (MM) (bulkhead 2) rack-mounted FPPs in all DMS cabinets.
  - Size the panel to terminate all strands entering the cabinet as shown on the ITS Plans.
  - Terminate the new 12-strand fiber drop cable in the 12-port FPP
  - Re-terminate the existing 6-strand tight buffer MM DMS device fiber optic cable running from Auxiliary Signal Control Board inside the sign enclosure to a MM 6-port FPP using ST connectors inside the DMS cabinet.
  - Furnish and install fiber jumper cable(s) as shown on the ITS Plans.
- ii. Provide wall-mounted 24-port SM FPP in the ACN cabinets. Re-splice and re-terminate fiber drop cables as required.
- iii. Provide 72-port SM rack-mounted FPP in the THEA TMC 2<sup>nd</sup> Floor Server Room.
  - Size the panel to terminate all strands entering the TMC in a 72-port FPP as shown on the ITS Plans.
  - Coordinate the specific THEA Server Room Equipment Rack to install the FPP.
  - Coordinate with THEA for routing of the 72-strand indoor/outdoor fiber cable from building entry to the Server Room. Two (2) existing conduits are available for access / entry into the building.
  - Furnish and install two (2) fiber jumper cable(s) or required by the THEA.
- iv. Size the panel to terminate all strands entering the cabinet as shown on the ITS Plans.
- v. Provide FPPs that include pre-terminated fiber pigtailed with connector panels unless otherwise approved or directed by the THEA.
  - Provide a complete assembly including: housing, front/rear lockable doors, pigtailed cassettes loaded with connector panels with factory terminated pigtailed, heat shrinks, protective tubing, routing clips and guides, grommets, cables ties for strain relief, blank panels, mounting hardware, and all other materials and components as needed to provide a complete FPP installation.
  - Provide pigtailed with strain relief and reinforcement at the point where the pigtail fans out.
  - Pigtailed must be factory terminated and tested and at least three (3) feet in length.
  - Provide access to field maintenance personnel from the front and rear, using fold-down, translucent and lockable doors.
  - Have rubber grommets or similar material to prevent the cable from contacting bare metal, as approved by the THEA.
- vi. Provide radius guides and strain relief for the incoming fiber optic cable(s) to maintain bend radius and protect the fibers.



- vii. Provide dust caps for all unused ports.
- viii. Manufacture in accordance with ISO-9001 quality assurance procedures.

**e. Fiber Optic Connectors**

Meet the following minimum fiber optic connector requirements:

- i. Certified fiber optic connectors as specified herein and as directed and approved by the THEA.
- ii. Provide fiber connectors that are Ultra Physical Contact (UPC) polished.
- iii. Provide industry standard approved connectors for single-mode optical fiber and meet or exceed the applicable provisions of TIA/EIA-455-4A related to fiber optic connectors and interfaces and meet the following requirements:
  - Operating temperature range of -40° to 165° F
  - Insertion loss (single connector) of  $\leq 0.4\text{dB}$  (max)
  - Maximum mated connector loss of  $\leq 0.75\text{dB}$  (max, per TIA/EIA-568-C.3)
  - Return loss (back reflection)  $\leq -55\text{dB}$  (UPC)
  - Mating Durability  $\leq 0.2\text{dB}$  (typ.) change, 250 mating cycles
  - Use factory-assembled and tested connectors
  - Install protective caps on all unmated connectors
- iv. Provide qualification/certification data from the manufacturer upon request by the THEA.

**f. Fiber Optic Patch (Jumper) Cables**

Meet the following minimum fiber optic patch cable requirements:

- i. Factory pre-assembled, pre-terminated duplex patch cables with an LC connector (for network switch) at one end and a ST connector (for patch panel) at the other end.
- ii. Fiber patch cables must be of the same fiber core size, and performance as the fiber optic cables provided for this Project.
- iii. Conform to ITU-T G.652.D, G.675.A and EIA/TIA 492-CAAB (OS2) standards
- iv. Provide duplex, zip-cord, riser-rated cables with two fibers and fiber connectors on each end.
- v. All fiber patch cables must be factory terminated and polished.
- vi. Provide with lengths as required with a minimum of one (1) foot slack between connected equipment. The Contractor must coordinate with the THEA prior to procurement of patch cables on final quantity and length of fiber patch cables for this Project.
- vii. Color must be orange for multimode and yellow for single-mode or as approved by the THEA.

- viii. Protect with dust caps on the connector ferrules.
- ix. Factory tested with test results for each mated pair of connectors.
- x. Provide with qualification / certification data from the manufacturer upon request by the THEA.

## 2. NETWORK COMMUNICATIONS

Meet the following minimum network requirements:

### a. General Requirements

- i. Procure, install, integrate and test all network equipment including, Layer 2 and Layer 3 network switches, existing THEA TMC Layer 3 switches, rack mounting hardware, power supplies, ~~Programmable Logic Controllers (PLCs), web relays, temporary cellular routers~~, Cat-6 patch cables, fiber patch cables, optic transceivers, and all other items specified herein to provide a complete network.
- ii. All network switch licensing and warranties must be provided and included in the price of the network device.

### b. DMS Network Requirements

Meet the following minimum DMS distribution network / local access layer requirements:

- i. Provide a THEA critical DMS access network that is comprised of 32 new ruggedized Layer 2 managed Ethernet access switches located in each DMS cabinet and five (5) new distribution Layer 3 switches located in the ACN cabinets and two (2) existing stackable Brocade ICX Layer 3 core routers located at the THEA TMC that currently operate at 1Gbps over fiber optic cable.
  - Provide overall routing, Virtual Local Area Network (VLAN) routing, network securities and access control policies, and routing protocols to the local access layer.
  - Connect Layer 2 MFESs in a ring type of architecture.
  - Limit the number of Layer 2 MFESs on a single fiber pair subnetwork (device control network) to a maximum of 13 to prevent network issues and optimize performance. At no time must the network demand on any Ethernet segment exceed 60 percent of the link capacity.
  - Provide a one (1) Gbps communications fiber pair ring that spans ACN cabinets for each group of Layer 2 MFESs.
- ii. Arrange the 32 field switches into five (5) separate Ethernet DMS device rings with each end of the ring connecting to a ruggedized ACN Layer 3 switch (see Detail Sheet D-1 in the ITS Plans).

Arrange the distribution switches in a manner that allows connectivity through trunk Ethernet ports on point-to-point links. Connect the distribution switches on each end to the Core router located at the THEA TMC. This will provide for redundant

paths for each of the five (5) field device rings and separate redundant paths for the distribution switches.

**Table: DMS Device Rings**

<b>DT Ring 1</b>	<b>34 Ring 2</b>	<b>78 Ring 3</b>	<b>301 Ring 4</b>	<b>BRN Ring 5</b>
1. CMS DT-C01	1. VMS 618-DE04	1. VMS 618-DW05	1. VMS 618-DE06	1. VMS 618-DW07
2. CMS DT-C02	2. CMS 34-C01	2. CMS 301-C03	2. CMS 301-C01	2. CMS BRN-C08
3. VMS MER-VS01	3. VMS 618-VE04	3. CMS 78-C01	3. CMS 78-C02	3. CMS BRN-C04
4. CMS DT-N06	4. CMS 34-C02			4. CMS BRN-C06
5. CMS DT-C05				5. CMS BRN-C07
6. CMS DT-C03				6. CMS BRN-N13
7. VMS-MER-VS02				7. CMS BRN-N15
8. CMS DT-C04				8. CMS BRN-N14
9. VMS 618-VW03				9. CMS BRN-N16
				10. CMS BRN-C05
				11. CMS BRN-N09
				12. CMS BRN-N10
				13. CMS BRN-NC11

- iii. Implement the Rapid Spanning Tree Protocol (RSTP) and Open Shortest Path First (OSPF) routing protocols for network switches at the distribution and local access layer to prevent infinite looping situations and facilitate rapid network recovery.

**c. Category-6 Patch Cable Requirements**

Meet the following minimum Cat-6 patch cable requirements:

- i. Provide Cat-6 patch cables as directed by the THEA meeting the following minimum requirements:
  - Compliant with ANSI/TIA-568-C.2 Cat-6 standard and UL 444.
  - Factory made, field assembled patch cords are not permitted.
  - Provide error-free performance up to 1 Gigabit Ethernet, full duplex.
  - Consist of eight insulated 22 to 24 AWG, solid copper conductors with polyolefin insulation, arranged in four color-coded twisted-pairs.
  - Equipped with modular 8-position plugs on both ends, wired straight through with standards compliant wiring.
  - Use modular RJ-45 male push-pull connectors with 8-position non-keyed and eight gold anodized pins.
  - Provide patch cables that are sized to prevent crimping, excess cable storage, coiling, looping, or wrapping. Coordinate with the THEA for final lengths.
  - Provide with, or without, color strain, relief boots providing snag proof design. Meet the flex test requirements of 1,000 cycles with boots and 100 cycles without boots.

- Provide connectors that can accept a minimum of 2,500 plug insertions without degradation of electrical or mechanical performance.
- Color will be yellow for Cat-6 UTP patch cables or as approved by the THEA.
- Be third-party ETL verified to ANSI/TIA-568-C.2 Cat-6 operations.
- Utilize cable that is UL verified.

d. **Managed Field Ethernet Switches (Layer 2, Access) Requirements**

The field network access switch must be *Siemens Ruggedcom RSG920P utility-grade Layer 2* switch (Model No: 6GK6092-0PS23-0CA0-Z-A05+B05+D00+D00) or approved equivalent meeting the following minimum requirements:

- Furnish and install one (1) MFES in each DMS cabinet.
- Provision with LAN Base licensing from the manufacturer providing Layer 2 switching features. Include all agent and management software and documentation.
- Ensure complete and seamless compatibility with the existing THEA ITS network and system without the use of protocol “wrappers” or “convertors” or “adaptors”. The THEA currently uses Brocade FCX / ICX series switches in the THEA TMC.
- Ensure that the configuration of MFESs is able to be downloaded and stored on a computer and later uploaded to the unit.
- Ensure that the configuration of MFESs meet and/or exceed the following minimum trouble shooting and diagnostic specifications:
  - Display the contents of a specified address.
  - Display information about hardware registers for a specified port.
  - Display configuration and status of physical and logical ports.
  - Display detailed information about RSTP (configuration and status).
  - Display active status of the unit.
- Meet the following minimum hardware requirements:
  - Minimum of 12 x 10/100/1000 Mbps TX + 4 x 10/100/1000 TX POE+ Ports
  - Uplink Port 17: one (1) SFP, 1000LX Single-mode 1310 nm LC connector
  - Uplink Port 18: one (1) SFP, 1000LX Single-mode 1310 nm LC connector
  - Uplink Ports 19 & 20: two (2) SFP, blank
  - Provide with LC connectors
  - Integrated single power supply, 120VAC direct, AC screw terminal block
  - Capable of being DIN-rail mounted to a rack mounted recessed panel allowing the cabinet door to close in the DMS cabinet or as approved by the THEA.
  - Is new and in the box from the manufacturer.

- Provide with passive cooling, no fans are permitted.
  - Provide with rubber dust caps or covers with insertion/removal handles that completely seal the port / slot opening for all unused copper and optical ports.
- vii. Meet the following performance and environmental features:
- Support operating temperature: -40 to +167 degrees F and relative humidity of 5 percent to 95 percent non-condensing.
  - Compliant with NEMA TS-2 environmental requirements
  - Designed per MIL-HDBK-217F reliability guidelines
  - Maximum switching bandwidth: 20Gbps full duplex
- viii. Support the following standards (latest version / release):
- IEEE 802.1Q-2005 (formerly 802.1s) Multiple Spanning Tree (MSTP)
  - IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
  - IEEE 802.1D Spanning Tree Protocol (STP)
  - IEEE 802.1x Port Access Authentication
  - IEEE 802.3ad Link Aggregation
  - IEEE 802.1p Quality of Service (QoS) / Class of Service (CoS) prioritization
  - IEEE 802.1Q Virtual LAN (VLAN)
  - IEEE 802.3x full duplex on 10BASE-T/TX and 1000BASE-T ports
  - IEEE 802.3 10BASE-T specification
  - IEEE 802.3u 100BASE-TX specification
  - IEEE 802.3ab 1000BASE-T specification
  - IEEE 802.3z 1000BASE-X specification
- ix. Support Layer-2 switching protocols including, but not limited to, the following (latest version / release):
- VLAN 802.1Q tagging
  - QoS
  - STP, RSTP, MSTP
  - Port rate limiting
  - Unicast and multicast traffic
  - Internet Group Management Protocol (IGMP) v1, v2, v3 Snooping
  - Broadcast storm filtering
- x. Support management capabilities including the following (latest version/release):
- Command Line Interface (CLI)
  - Hypertext Transfer Protocol Secure (HTTPS)

- Web User Interface (Web UI)
  - Remote Network Monitoring (RMON) I and II
  - Simple Network Management Protocol (SNMP) v1, v2c, v3
- xi. Support, at a minimum, the following security features (latest version / release):
- Passwords – Provide multi-level user passwords to secure and guard the switch against unauthorized configuration.
  - Secure Shell Protocol (SSH) / Secure Sockets Layer (SSL) – Extend capability of password protection to add encryption of passwords and data as they cross the network.
  - Enable / Disable Ports – Provide capability to disable ports so that traffic cannot pass.
  - Media Access Control (MAC) Based Port Security – Provide ability to secure ports on a switch so only specific ITS devices / MAC addresses can communicate through that port.
  - 802.1x Port Based Network Access Control – Provide ability to lock down ports on a switch so that only authorized users can communicate via that port.
  - SNMP, latest version – Provide encrypted authentication and access security.
- xii. Provide fiber optic patch cords in accordance with MTR Section III (1)(f) with integral optical attenuators for optical power control in accordance with the network switch manufacturer's recommendations.
- xiii. Warranty: Minimum 5 years

**e. Managed HUB Ethernet Switches (Layer 3, Distribution) Requirements**

The Managed HUB Ethernet switch must be *Siemens Ruggedcom RX1510 or RX1524 utility-grade Layer 3* switch (Model No: 6GK6015-0CM26-0DC0-Z A01+B36+C36+D01+E02) or approved equivalent meeting the following minimum requirements:

- i. Furnish and install one (1) Managed HUB Ethernet Switch in each ACN cabinet.
- ii. Provision with IP Base licensing from the manufacturer providing Layer 2/3 switching/routing features. Include all agent and management software and documentation and advanced feature license (with OSPF routing capability).
- iii. Ensure complete and seamless compatibility with the existing THEA ITS network and system without the use of protocol “wrappers” or “convertors” or “adaptors”. The THEA currently uses Brocade FCX / ICX series switches in the THEA TMC
- iv. Ensure that the configuration of Managed HUB Ethernet switches are able to be downloaded and stored on a computer and later to be uploaded to the unit.

- v. Ensure that the configuration of Managed HUB Ethernet switches meet and/or exceed the following minimum trouble shooting and diagnostic specifications:
  - Display the contents of a specified address.
  - Display information about hardware registers for a specified port.
  - Display configuration and status of physical and logical ports.
  - Display detailed information about RSTP (configuration and status).
  - Display active status of the unit.
- vi. Meet the following minimum hardware requirements:
  - Minimum of 12 x 10/100 Mbps TX Ports
  - Minimum of 4 x 1000 Mbps SFP ports
  - Provide with LC connectors
  - Integrated dual (redundant) load sharing power supplies, 120VAC direct
  - Capable of being panel-mounted to the wall of the ACN cabinet or as approved by the THEA.
  - Is new and in the box from the manufacturer.
  - Provide with passive cooling, no fans are permitted.
  - Provide with rubber dust caps or covers with insertion/removal handles that completely seal the port / slot opening for all unused copper and optical ports.
- vii. Meet the following performance and environmental features:
  - Support operating temperature: -40 to +167 degrees F and relative humidity of 5 percent to 95 percent non-condensing.
  - Compliant with NEMA TS-2 environmental requirements
  - Designed per MIL-HDBK-217F reliability guidelines
  - Maximum switching bandwidth: 10Gbps full duplex
- viii. Support the following standards (latest version / release):
  - IEEE 802.1Q-2005 (formerly 802.1s) Multiple Spanning Tree (MSTP)
  - IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
  - IEEE 802.1D Spanning Tree Protocol (STP)
  - IEEE 802.1x Port Access Authentication
  - IEEE 802.3ad Link Aggregation
  - IEEE 802.1p Quality of Service (QoS) / Class of Service (CoS) prioritization
  - IEEE 802.1Q Virtual LAN (VLAN)
  - IEEE 802.3x full duplex on 10BASE-T/TX and 1000BASE-T ports

- IEEE 802.3 10BASE-T specification
  - IEEE 802.3u 100BASE-TX specification
  - IEEE 802.3ab 1000BASE-T specification
  - IEEE 802.3z 1000BASE-X specification
- ix. Support Layer-2 switching protocols including, but not limited to, the following (latest version / release):
- VLAN 802.1Q tagging
  - QoS
  - STP, RSTP, MSTP
  - Port rate limiting
  - Unicast and multicast traffic
  - Internet Group Management Protocol (IGMP) v1, v2, v3 Snooping
  - Broadcast storm filtering
- x. Support Layer-3 routing protocols including, but not limited to, the following (latest version / release):
- Open Shortest Path First (OSPF) v2/v3
  - Virtual Router Redundancy Protocol (VRRP), v2/v3
  - Protocol Independent Multicast-Sparse Mode (PIM-SM)
  - Routing Information Protocol (RIP) v1 and v2
  - Multi-Protocol Label Switching (MPLS) routing
- xi. Support management capabilities including the following (latest version/release):
- Command Line Interface (CLI)
  - Hypertext Transfer Protocol Secure (HTTPS)
  - Web User Interface (Web UI)
  - Remote Network Monitoring (RMON) I and II
  - Simple Network Management Protocol (SNMP) v1, v2c, v3
- xii. Support, at a minimum, the following security features (latest version / release):
- Passwords – Provide multi-level user passwords to secure and guard the switch against unauthorized configuration.
  - Secure Shell Protocol (SSH) / Secure Sockets Layer (SSL) – Extend capability of password protection to add encryption of passwords and data as they cross the network.
  - Enable / Disable Ports – Provide capability to disable ports so that traffic cannot pass.



- Media Access Control (MAC) Based Port Security – Provide ability to secure ports on a switch so only specific ITS devices / MAC addresses can communicate through that port.
  - 802.1x Port Based Network Access Control – Provide ability to lock down ports on a switch so that only authorized users can communicate via that port.
  - SNMP, latest version – Provide encrypted authentication and access security.
- xiii. Provide fiber optic patch cables in accordance with MTR Section III (1)(f) with integral optical attenuators for optical power control in accordance with the network switch manufacturer's recommendations.
- xiv. Warranty: Minimum 5 years
- f. **Small Form-Factor Pluggable (SFP) Optical Transceiver**
- Meet the following minimum SFP requirements:
- i. Provide a dual-fiber SFP capable of LC single-mode (SM) fiber connection.
  - ii. Compliant with IEEE 802.3x 1000Base-LX and 1000Base-LX/LH or EX standards as required.
  - iii. Provide extended temperature (23 to 185 degrees F) range
  - iv. Interfaces with 1000Base-LX Ethernet Switch.

g. **Web Relays**

The Web Relays at the DMS cabinets must be Controlbyweb X-410 or approved equipment. Power supply and mounting hardware shall be provided.

The Web Relays at the ACN cabinets must be *Controlbyweb X400 (or X600M) Web Relay Master with X-12S and X-17S Web Relay Expansion I/O modules* or approved equivalent. Power supply, ribbon cable and mounting hardware shall be provided.

### 3. CONDUIT REQUIREMENTS

For any new conduit required on this project meet the following minimum requirements:

- a. Furnish and Install 2-inch, HDPE, underground (UG) conduit per the latest FDOT Standard Specification 630 including supplemental specifications in effect. Some sites have this work clearly defined. Only limited field review has occurred to verify the veracity of existing conduit and some locations may require construction of new conduit or pull boxes.

If the Contractor discovers existing conduit to be unusable due to capacity, damage, or FDOT standard regarding colocation of power and communications cable, the Contractor must immediately notify THEA and cooperate in assessing an approved new path. Time spent in determining a new path whether a different existing or new installation must be incidental to the fiber placement and the Contractor will not be compensated for time.

Work performed to furnish & install this underground conduit will be paid per the most recent FDOT Basis of Estimate (BoE) under pay item 630-2-11. Also see pay item notes in the ITS plans.

- b. Furnish and Install 2-inch, rigid galvanized steel, above ground (AG) conduit per the latest FDOT Standard Specification 630 including supplemental specifications in effect. Some sites have this work clearly defined. Only limited field review has occurred to verify the veracity of existing conduit and some locations may require construction of new conduit or pull boxes.

If the Contractor discovers existing conduit to be unusable due to capacity, damage, or FDOT standard regarding colocation of power and communications cable, the Contractor must immediately notify THEA and cooperate in assessing an approved new path. Time spent in determining a new path whether a different existing or new installation must be incidental to the fiber placement and the Contractor will not be compensated for time.

Work performed to furnish & install this above ground conduit will be paid per the most recent FDOT Basis of Estimate (BoE) under pay item 630-2-14. Any bridge mounted conduit will be paid under pay item 630-2-15. Also see pay item notes in the ITS plans.

#### ~~4. CONTROL SYSTEM UPGRADE REQUIREMENTS~~

~~The PLC must be *Schneider Electric Modicon M580 Ethernet Programmable Automation Controller (ePAC)* or approved equivalent meeting the following minimum requirements:~~

~~Refer to the ITB Section 2(g) for a detailed list of PLC materials and modules to be provided.~~

- ~~a. The PLCs must be a microprocessor based stand alone device designed for industrial environments.~~
- ~~b. Capable of a mix of logic, timing, counting, computation, library of preprogrammed subroutines, and loop control capabilities necessary for the unit process application.~~
- ~~c. PLCs must be complete and modular in design and capable of scalable expansion by adding modules of various functions (e.g. central processor, memory, power supplies, communication modules, interconnecting cables, analog and discrete I/O interfaces, etc.).~~
- ~~d. PLCs must collect data, perform process control functions and communicate with associated devices (e.g. remote I/O, HMIs, Drives, other PLCs, and the THEA TMC servers) as required to exchange process information along the network as specified in the Contract documents, or shown on the ITS Plans.~~
- ~~e. Able to download program from a remote THEA TMC workstation over the network, or locally programmed from a portable laptop computer.~~
- ~~f. All I/O modules will be hot swappable while the PLC is running.~~
- ~~g. Each PLC and its corresponding I/O modules, power supplies, communication modules, and peripheral components must be mounted inside suitable enclosures.~~
- ~~h. All I/O wiring from the field to the I/O modules must be terminated on terminal blocks in the enclosures.~~

- ~~i. Each PLC must be able to communicate to the THEA TMC computer over fiber-based Ethernet communications network.~~
- ~~j. Processors / CPUs:~~
  - ~~i. Provide an open architecture with direct Ethernet connection on the backplane allowing transparent access to data.~~
  - ~~ii. Provide a minimum of 16MB of internal user RAM.~~
  - ~~iii. Processor performance must be rated at least 30,000 instructions per millisecond.~~
  - ~~iv. Upon power loss, the PLC must insure memory is capable of being transferred to flash memory before PLC RAM powers down.~~
- ~~k. Firmware must be capable of being updated in the field using standard programming tools through a CPU service port, USB connector or over the Ethernet network.~~
- ~~l. Capacity:~~
  - ~~i. Each PLC must include provisions for expansion and must have 25 percent spare I/O handling, data, and programming memory capacity.~~
  - ~~ii. Each PLC enclosure must include a minimum of 20 percent spare rack space for the addition of future I/O modules.~~
  - ~~iii. Be able to 'hot swap' input/output modules while under power without impacting operation of PLC system or causing destruction of PLC modules, racks or power supplies.~~
- ~~m. Support the following minimum standards (latest version / release):~~
  - ~~i. International Electrotechnical Commission (IEC) 60068 Environmental Testing~~
  - ~~ii. IEC 61000 Electromagnetic Compatibility (EMC)~~
  - ~~iii. IEC 61131-2 Programmable Logic Controllers — Part 2 Equipment Requirements and Tests~~
  - ~~iv. IEC 61131-3 Programmable Logic Controllers — Part 3 Programming Languages~~
  - ~~v. IEC 61850 Communication Networks and Systems for Power Utility Automation~~
  - ~~vi. International Society of Automation (ISA) 71.04 Environmental Conditions for Process Measurement and Control System~~
  - ~~vii. NFPA 70 NEC~~
  - ~~viii. UL 508 Industrial Control Equipment~~
- ~~n. Environmental Requirements: PLCs must meet or exceed the following environmental requirements:~~
  - ~~i. Extended temperature range for outdoor locations -13 to +158°F.~~
  - ~~ii. Relative humidity: up to 95 percent non-condensing~~

#### 4. LABELING REQUIREMENTS

Meet the following minimum requirements:

- a. Provide labeling for fiber optic cabling (distribution and drops), cabinet FPPs, patch cables, and equipment (MFESs, ~~web relays~~ ~~PLCs~~) as shown on the ITS Plans, Details and specified herein.
- b. Furnish and provide labor, equipment, supplies and materials for providing all labeling as required on this Project.
- c. Submit a Labeling Plan to the THEA for review and approval. All wording and numbering schemes for labeling must be provided to the THEA for review and written approval prior to procurement or installation.
- d. Labeling equipment must be capable of generating permanent and secure labels (inside and outside) that are durable, long-lasting and resistant to UV, extreme temperatures, solvents, chemicals and moisture as required per label location. Labels and labeling must comply with TIA/EIA-606-A and UL 969 and as approved by the THEA.
- e. All labels must be printed or generated by a “mechanical device” (i.e., handheld/portable systems, or a tabletop laser, inkjet, or thermal-transfer printer). Handwritten labels are not acceptable.
- f. Must produce label size, color and contrast so that all label identifiers are easily read.
- g. Must include appropriate bold font without serifs and be upper case.
- h. Must be consistent, provide contrast and be permanently printed and clearly visible during the installation and normal maintenance of the infrastructure and equipment.
- i. Must provide labels affixed to cables that are flexible and allow for cable movements, bending and twisting.

## IV. EXECUTION

### 1. TESTING REQUIREMENTS

Meet the following minimum testing requirements:

#### a. General Testing

- i. Develop and submit a Test Plan and Procedures (with pass and fail criteria) and test results form for each test as part of the submittal process.
  - The test procedures must provide tests to verify and demonstrate full compliance with the ITS Plans, Details and MTRs and device functionality as specified herein.
  - Coordinate the development of the Test Plan and procedures with ~~FLIR the THEA—ACS—consultant~~, the THEA Systems Integrator and device manufacturer(s).
  - No testing must be allowed until the Test Plan and procedures are submitted for review and approved by the THEA.
  - Provide a written schedule for testing activities as specified herein.
- ii. Provide MOT during all testing activities, as required.
- iii. Provide and maintain all test equipment and software, made ready for use by the Contractor or the THEA.
  - Provide up-to-date calibration certification with dates and test parameters for all test equipment utilized in accordance with the manufacturer's recommended procedures.
- iv. Conduct all tests in the presence of the THEA, unless otherwise approved in writing by the THEA.
  - The THEA reserves the right to waive the right to witness certain tests. Neither witnessing of the tests by the THEA, nor the waiving of the right to do so, must relieve the Contractor of the responsibility to comply with the Project requirements.
- v. Submit a test report for all tests performed within 15 calendar days after the completion of the respective tests for review and approval by the THEA. Test results must include the following:
  - Test results with pass/fail criteria and test objectives
  - Cross reference to what Project requirement(s) were being tested or demonstrated/verified
  - Date of test
  - Start/end times of test
  - Location of test
  - Names and Signatures of testers and witnesses of the test

- Conditions during the test (i.e., weather conditions, etc.)
  - Any and all field notes provided by the tester
- vi. Replace or repair and retest all equipment and components that failed testing at no additional cost to the THEA.
  - vii. Time extensions for replacement, repair, and retesting, even if the manufacturer or other cause beyond the Contractor's control caused the failure, will not be granted.

**b. Fiber Communications Infrastructure Testing**

- i. OTDR test fiber cables prior to installation (on the reel) and after they have been installed, spliced and terminated (post-installation).
  - Reel fiber tests are to be compared with the manufacturer test data provided with the reels.
  - All post-installation fiber tests must use bi-directional averaging.
- ii. Perform visual inspections and testing on each fiber optic cable delivered to the job site prior to any de-spooling or installation of the fiber optic cable.
  - Notify the THEA of any visual abrasions, cuts, defects, or other observed physical abnormalities.
- iii. Use a factory launch and receive cable ("fiber launch box") for fiber testing. Indicate the length of the launch cable in test reports.
- iv. Set the pulse width setting of the OTDR to the lowest possible setting while allowing the full length of fiber optic cable to be measured for faults or reflective events.
- v. Perform and document end-to-end fiber tests (cabinet FPP to cabinet FPP).
- vi. Document and submit all test results to the THEA within 15 calendar days after the completion of the tests for review and approval by the THEA.
  - Test results must include documentation of any discrepancies found during testing, successful test completion dates, and equipment serial numbers.
- vii. Replace and re-test any materials which fail fiber communications testing.
- viii. All fiber test results must be reviewed and approved by the THEA prior to cable installation.
- ix. Provide OTDR trace software at no cost so that the THEA can review test files. Electronic PDF fiber test reports and the raw OTDR fiber test data files must be provided to the THEA.

**c. Stand-Alone Testing (SAT) / Hybrid Mock-up **Bench** Testing**

- i. Before connection to the network, the Contractor must provide stand-alone (start-up and diagnostic) testing for ~~all PLCs and~~ network switches, **web relays and temporary cellular routers** installed on this Project **at each cabinet** as described herein.

- Device boot-up / power-up and run built-in self-diagnostic tests.
  - Conduct visual inspection of device to confirm presence of all components, wiring and features specified by the Contract specifications and otherwise customarily provided by the manufacturer.
  - Contractor to coordinate and work with the THEA **Systems Network** Integrator in configuration and integration of the network switches and subsequent testing of the installed network switches and DMS device rings.
  - Switch testing - Run diagnostics on each field network switch to ensure that the switches are configured and connected properly and there are no bad ports or cables in the configuration prior to performing network system level tests.
  - Demonstrate that all network equipment installed on this Project has been configured as required and all other settings are set for optimal performance. It is the responsibility of the Contractor to ensure that the System is fully operational to the satisfaction of the THEA.
- ii. Test the web relays and switches integrated with a PLC, DMS controller, and I/O devices as part of a system mock-up / bench test.
1. Coordinate with THEA, FLIR and Schneider Electric to coordinate and perform these tests. These tests must be successfully conducted and approved by THEA prior to construction activities and going "live".
  2. Testing must demonstrate the capability change and store DMS messages in the DMS controller and monitor DMS status messages.
  3. Testing must demonstrate selection of stored DMS messages for both PLC automated control of I/O devices and local manual control of I/O devices using the Local Operator Interface (LOI) panel to ensure the integration of switches, web relays, existing 24VDC relays, PLC and I/O devices / sensors are functional and operational per the THEA's Concept of Operations and ACS software functional requirements related to REL operations (e.g., DMS messages, gates and other I/O devices are controlled and/or monitored as required).
  - ~~4. the PLC-based subsystem using a system mock-up of the pre-assembled and pre-configured PLC to test and verify that the equipment, software and process is ready to implement prior to implementing in the field (going live). Coordinate with THEA to schedule time to set up and test using a THEA ACS hybrid mock-up test system being used as part of the on-going ACS software upgrade project, if available. The Contractor shall be responsible to fully test the PLC-based subsystem prior to going live.~~
- iii. ~~The test procedures for the PLC subsystem must include, but not limited to, written descriptions on how tests will be performed and incorporate the following features:~~

~~1) verification of all I/O points on each display screen, 2) verification that alarms are generated, 3) ability to change set-points or to adjust control parameters with the proper security levels, 4) power failures, and 5) reports.~~

- ~~iv. Demonstrate both PLC automated control of I/O devices and local manual control of I/O devices using the Local Operator Interface (LOI) panel to ensure the hardware and software migration and all wiring provided is functional and operational per the THEA's Concept of Operations and ACS software functional requirements related to REL operations (e.g., DMS messages, gates and other I/O devices are controlled and/or monitored as required).~~
- ~~v. Demonstrate the capability of remotely changing DMS messages from the TMC and providing overall health status feedback of the DMS operations.~~
- ~~vi. Coordinate, and work with, the THEA ACS consultant and Systems Integrator in testing the PLC and DMS functionality.~~

~~**d. Communications Interim Field Subnet (IFS) Testing**~~

- ~~i. Prior to acceptance of any network communications equipment or field device connected to the communications network perform, and successfully complete, an Interim Field Subnet (IFS) test.~~

~~All SAT testing must be successfully completed on all devices before an IFS test can begin.~~
- ~~ii. Include in the IFS test all network communications devices in the Project including but not limited to, all field network switches, PLCs and DMS controllers and other communications network devices (Web Relay and cellular modem/router)~~
- ~~iii. Provide the Test Plan and procedures for review and approval by the THEA prior to testing any IFS activities.~~
- ~~iv. Furnish all test equipment and software necessary to perform the tests, including but not limited to laptop PC with web browser and network analysis software, temporary field switch or other compatible media converter, and all necessary patch cords.~~
- ~~v. Prior to conducting a scheduled IFS test, conduct a dry run test to ensure all preparations for the IFS test are complete. The THEA reserves the right to attend the dry-run test.~~
- ~~i. An IFS test must be conducted for each DMS device network ring (subnet), which is typically a group of DMS field sites connected to a fiber pair ring between ACN Layer 3 distribution switches and the THEA TMC Core Switch as shown on the ITS Plans.~~
- ~~vi. During the test, every network device must be pinged, probed by SNMP or equivalent status queries, logged into, and connected to by other methods as needed, to demonstrate that the equipment is functional, contains the proper base programming data, and is in the proper location.~~



e. **Conditional System Acceptance Testing**

- i. ~~Upon successful completion of the IFS testing,~~ Perform Conditional System Acceptance Testing to demonstrate that all PLCs ~~operations and DMSs are functional and operational through the communications network~~ ~~meet the requirements for this Project.~~
- ii. Prior to testing, demonstrate that every network device is accessible and present on the network by pinging, probing by SNMP or equivalent status queries, logged into, and connected to by any other methods as needed, to demonstrate that the network devices are functional, contain the proper base programming data, and is in the proper location.
  1. Test must be conducted for each DMS device network ring (subnet), which is typically a group of DMS field sites connected to a fiber pair ring between ACN Layer 3 distribution switches and the THEA TMC Core Switch as shown on the ITS Plans.
  2. Furnish all test equipment and software necessary to perform the tests, including but not limited to laptop PC with web browser and network analysis software, temporary field switch or other compatible media converter, and all necessary patch cords.
  3. Provide the Test Plan and procedures for review and approval by the THEA prior to testing activities.
- iii. Coordinate and work with ~~the~~ THEA, FLIR, Schneider Electric ~~the THEA ACS consultant~~ and THEA's Systems Network Integrator in testing the fiber network, web relays, DMS communications and support for ~~and~~ PLC operational and functional tests and DMS functionality.
  - ~~Demonstrate PLC operations remotely through the ACS software to ensure the hardware and software migration and all re-wiring provided is functional and operational per the THEA's Concept of Operations and ACS software functional requirements.~~
  - ~~Demonstrate DMS operations remotely through the ACS software to ensure that all DMS sites and device rings are fully functional and operational.~~
- iv. Document and submit all test results to the THEA within 15 calendar days after the completion of the tests for review and approval by the THEA.
  - Test results must include documentation of any discrepancies found during testing, successful test completion dates, and equipment serial numbers.

f. **30-Day Burn-In Testing**

- i. Upon successful completion of the Conditional System Acceptance Tests, a 30-day burn-in period will begin to demonstrate, verify and monitor that all PLCs, DMSs and network and control system upgrades are fully functional and operational.
- ii. Document all failures and subsequent diagnosis and repair. Provide the repair documentation to the THEA within two (2) days of completing the repair.

- iii. During the burn-in period perform incidental work such as touching up, cleaning of exposed surfaces, leveling and repair of sites, and other incidental maintenance work as may be deemed necessary by the THEA to ensure the effectiveness and neat appearance of the work sites.
- iv. During the burn-in period the THEA will maintain a “burn-in period punch list” that contains required Contractor actions but that the THEA does not define as a system failure.
  - Each burn-in period punch-list action item must be completed by the Contractor to the THEA’s satisfaction within seven (7) calendar days of Contractor notification of the action item.
- v. Provide full maintenance of the system during the burn-in period.

## 2. WARRANTY REQUIREMENTS

Meet the following minimum warranty requirements:

- a. Materials and equipment must have a manufacturer’s warranty (usual and customary) covering defects in assembly, fabrication, and materials.
- b. Warranty work must include all activities required by the Contractor, manufacturer, or the party designated by the manufacturer including maintenance, removal, and replacement of parts and materials during the period of support.
- c. Any material found to be in nonconformance must be repaired or replaced without cost to the THEA, the THEA’s designee, or maintaining agency; including all incidentals to the repair or replacement of the product.
- d. Provide the minimum equipment and materials warranty lengths as specified herein.
- e. Warranty periods must begin on the date of issuance of the Project Final Acceptance by the THEA.
- f. The manufacturers’ warranties must be continuous throughout the period and are fully transferable from the Contractor to the THEA.
- g. Provide maintenance support services and make any replacements required during the contract period and warranty period without additional charge for labor, equipment, parts, shipping, or other materials required.
- h. Provide support for all system components notwithstanding any supplier's warranties whether written or implied.
- i. Any software or firmware upgrades associated with the product must be supplied to the THEA at no cost during the warranty period.
- j. Any firmware or software upgrades must not degrade the original functionality of the product warranted.

## 3. TRAINING REQUIREMENTS

Meet the following minimum training requirements:

- a. Provide training for remote DMS operations including changing and storing of DMS messages.
- b. All training conducted will be considered incidental.
- ~~a. Provide training for the purpose of familiarizing the THEA's maintenance and operations staff with the use, maintenance and repair of all components of the PLCs.~~
- ~~b. The training sessions must be designed for maintenance and operations personnel with training that is specific to the system installed at the THEA's facility.~~
- ~~c. Provide a Training Plan for the THEA's review and approval. The Training Plan must include all course content and course materials for training session.~~
- ~~d. Provide trainer's certification and qualifications.~~
- ~~e. Provide a training schedule that outlines the time for the required training sessions and coordinates with the overall progress schedule.~~
- ~~f. Provide each training participant with a copy of the course material. Include in course material copies of both a comprehensive manual and the presentation material that will be used.~~
- ~~g. At a minimum, the training must cover the following topics:~~
  - ~~i. PLC System Hardware—General Familiarity~~
  - ~~ii. PLC Programming Software—General Familiarity and Advanced~~
  - ~~iii. Troubleshooting~~
  - ~~iv. Replacement of components~~

### 3. SPARE PARTS

Meet the following minimum spare part requirements:

- a. Provide a manufacturer recommended spare parts list with the following information provided as a minimum:
  - i. Contact information for the closest parts stocking location to the THEA.
  - ii. Critical spare parts must be identified as those parts being associated with long lead times and/or those being critical to the THEA's operation.
  - iii. Maintenance spares must be identified as being those parts required to regularly perform scheduled maintenance on all furnished equipment.
    - These spares must include, but must not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.
    - Spare parts must be provided for each type and size of unit installed.
  - i. Provide a minimum three (3) Layer 2 managed Ethernet switches and one (1) Layer 3 Managed HUB Ethernet switch as specified herein.
  - ii. Provide a minimum of six (6) LX SFPs and two (2) long distance SFPs as specified herein.

iii. Provide a minimum of five (5) Web Relay devices (for each model / kind) installed.

iv. ~~Provide the minimum spare parts recommended by the PLC manufacturer including the following:~~

<del>BMENOC0321</del>	<del>2</del>	<del>M580 I/O Scanner Module, IP Forwarding, Ethernet/IP &amp; Modbus TCP, 3 ports—Coated</del>
<del>BMEP584040</del>	<del>2</del>	<del>Standalone M580 CPU level 40—DIO &amp; RIO with 16 MB of internal memory, managing 16 Remote IO drops. Maximum number of network cards is 4.</del>
<del>BMEXBP0800</del>	<del>2</del>	<del>8-slot Ethernet rack backplane (chassis)</del>
<del>BMXCPS3500</del>	<del>2</del>	<del>AC Power supply 100-240 V, primary voltage limit: 85-264 V, 36 W</del>
<del>BMXDDI1602</del>	<del>2</del>	<del>Discrete 16-point input module, 24 V dc (pos.), current sink (logic pos.)</del>
<del>BMXDDO1602</del>	<del>2</del>	<del>Discrete 16-point output module, 24 V dc (pos.)</del>
<del>BMXXEM010</del>	<del>1</del>	<del>Protective cover for unused slot (set of 5)</del>
<del>BMXRMS004GPF</del>	<del>2</del>	<del>Medicon M580, SD flash memory card, 4 Gb, for processor</del>
<del>BMXXBE2005</del>	<del>2</del>	<del>BACKPLANE EXTENDER KIT</del>
<del>990ADQUAX80100</del>	<del>2</del>	<del>Evolution I/O adapter 140DAI/DDI*5300 to (2)BMXDAI/DDI160*2 ft.</del>
<del>990ADQUAX80206</del>	<del>2</del>	<del>Evolution I/O adapter 140DDO35301/35310 to (2)BMXDDO16*2 2 ft.</del>

b. Any manufacturer specific special tool, not normally found in an electrician's toolbox that is required to remove and install recommended or furnished spare parts must be furnished. At a minimum, the following must be provided:

- i. A PC-based configuration software tool and a minimum of one (1) communication interface cable for each type of cable required to connect a PC-based computer to the devices specified herein for configuration and programming.
- ii. Electronic configuration files, in a media format acceptable by the THEA (e.g. CD, USB stick, etc.), updated to an as-installed and commissioned state.

c. Spare parts must be properly marked and packaged for long-term storage. Printed circuit boards must be provided in separate anti-static containers.

d. Spare parts will be included and paid for under the appropriate pay item number.

#### 4. FINAL ACCEPTANCE / PROJECT CLOSE-OUT PROCESS

a. The Project will not be eligible for Final Acceptance until the Contractor has reached Substantial Completion and until successful completion of the 30-Day burn-in period.

Substantial Completion is defined for this Project as 100 percent of all fiber has been installed, spliced, terminated and tested; new pull boxes have installed; any new conduits have been installed; designated equipment and materials have been removed and discarded; and all new ~~PLCs~~, web relay devices, network devices and re-wiring work has been completed and fully tested, functional and operational.

- b. Final Acceptance must include successful completion, and approval, by the THEA of the following:
- i. All Project submittal documentation, including test reports, have been submitted and approved by the THEA.
  - ii. All electronic software and configuration files developed for the project in their native form have been submitted and approved by THEA.
  - iii. All 30-Day burn-in period punch-list items have been completed.
  - iv. All final cleanup requirements have been completed and field conditions restored to their original condition.
  - v. Final Inspection has been conducted and all associated punch list items have been addressed to the satisfaction of the THEA.
    - Request in writing the THEA's approval to start the final inspection a minimum of 15 calendar days prior to the requested start date.  
The THEA reserves the right to reschedule the start date if needed.
    - Field inspect and verify that all devices and components are in their correct final configuration and labeled
      - Fiber terminations at the Fiber Patch Panel
      - Network equipment
      - Web relays connections and wiring
      - Patch cable connections
      - ~~PLC connections and wiring~~
      - Labeling and site documentation
    - Repeat final inspection upon an unsuccessful or incomplete final inspection after the Contractor has made the necessary corrections. Fifteen calendar days must be allowed for the THEA to conduct a final inspection.
    - The THEA reserves the right to require, at no additional expense to the THEA, the attendance of a qualified technical representative of the equipment and/or software to attend the final inspection.
- c. Warranties.
- i. Ensure that all warranties are in place and transferred to the THEA as specified herein. All warranty documentation has been provided to the THEA.
- d. Training.
- i. Ensure that all training services have been successfully completed as specified herein.
- e. Spare Parts
- i. Delivery of spare parts / extra stock as specified herein and approved by the THEA.