

SPECIAL PROVISION

EP 000---ADD

ADD ALTERNATE ITEMS

The Contractor's attention is directed to the information presented below regarding additive alternate infrastructure items to be considered by the CRRMA for this Streetcar project. Add alternates are additional items of work that may be awarded as part of the contract if the bids come within the budget specified in the contract.

Additive Alternate items below are listed in no particular order. All items shall be furnished and installed as shown in construction plans and details or as designated by the project Owner (or Owner's representative)

1. Furnish and installing transit shelters at designated stop locations. The item will be measured and paid for as indicated elsewhere in the following project specification documents:
 - Shelters EP-STOPS
2. Furnish and installing waste receptacles at stop locations as designated by the Owner or Owner's Representative. The item will be measured and paid for as indicated elsewhere in the following project specification documents:
 - Waste Receptacles EP-STOPS
3. Furnish and installation of Sun Metro information holders at stop locations as shown in construction plans and details and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:
 - Transportation Information Holder EP-STOPS
4. Furnish and installation of the Blockout area and Sun Metro Logo Panel at stop locations as show in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:
 - Sun Metro Logo Panel EP-STOPS
- 5 – 7. Furnish and installation of irrigation systems at stop locations as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:
 - Irrigation System (location A) TxDOT specification 170 6006
 - Irrigation System (location B) TxDOT specification 170 6007
 - Water Meter EP-LAND
- 8 – 9. Furnish and installation of tree grates at stop locations as shown in construction plans and details or as designated by the Owner. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

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- Grates

EP-LAND

10. Furnish and installation of trees at stop locations as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- Plant Material (30 gallon Tree)

TxDOT specification 192 6024

11. Furnish and installation of vegetation barriers at stop locations as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- Vegetation Barrier

TxDOT specification 192

12. Furnish and installation of aggregate for ground cover at stop locations as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- Loose Aggregate for Ground Cover

TxDOT specification 1005 6001

13. Maintenance of trees and vegetation planted in accordance with this contract until final acceptance of the project. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- PLANT MAINTENANCE

TxDOT specification 192 6001

~~14. Performance of and oversight over public information duties connected with construction activities for the El Paso Streetcar Project. The item will be measured and paid for as indicated elsewhere in the following project specification documents:~~

- ~~○ Public Information~~

~~EP-PUBLIC INFORMATION~~

~~15. Coordination with the project Owner, Owner's Representative, and utility Point of Contact (POC) regarding the adjustment and relocation work of any known and unknown utility infrastructure relocations required within the project limits of construction for subsurface and above ground utilities. The item will be measured and paid for as indicated elsewhere in the following project specification documents:~~

- ~~○ Utility Coordination~~

~~EP-UTILITY COORDINATION~~

14. Furnish and installing of drill shafts in support of Additive Alternate Decorative Light Poles (Non-OCS) at locations indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. DRILL SHAFT (RDWY ILL POLE) (30 IN)

TxDOT Specification 416 6029

15 – 16. Furnish and installation of conduit in support of the placement of Additive Alternate Decorative Light Poles (Non-OCS) and Joint Use OCS Poles (Standard LED and Dark Sky Compliant) as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- b. CONDUIT (PVC)(SCHD 40)(2")

TxDOT Specification 618 6023

- c. CONDUIT (PVC)(SCHD 40)(2") (BORE)

TxDOT Specification 620 6024

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17 – 18. Furnish and installation of electrical wiring in support of the placement of Additive Alternate Decorative Light Poles (Non-OCS) and Joint Use OCS Poles (Standard LED and Dark Sky Compliant) as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- ELEC CONDR (NO.10) BARE TxDOT Specification 620 6005
- ELEC CONDR (NO.10) INSULATED TxDOT Specification 620 6006

19. Furnish and installation of junction boxes in support of the placement of Additive Alternate Decorative Light Poles (Non-OCS) and Joint Use OCS Poles (Standard LED and Dark Sky Compliant) as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. JUNCTION BOX TxDOT Specification 624

20. Furnish and installation of LED illumination fixtures compliant with the City of El Paso's "Dark Sky" ordinance, on Joint-Use OCS poles at locations indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. Joint Use OCS Poles (Dark Sky Compliant) EP-LUMINAIRE

21. Furnish and installation of standard, LED illumination fixtures on Joint-Use OCS poles at locations indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. Joint Use OCS Poles (Standard LED) EP-LUMINAIRE

22. Furnish and installation of "City of El Paso Style Decorative Light Poles" at stop locations as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. Decorative Light Poles (Non-OCS) EP-LUMINAIRE

23. Furnish and installation of banner arm assemblies as shown in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. Banner Arm Assembly EP-ARM

24. Furnish and installation of embedded rail special trackwork (turnouts) at the site of the proposed Maintenance and Storage Facility (MSF) as indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. MSF STORAGE TURNOUT 3 UNITS EP-TRACK 34 11 23.33

25. Furnish and installation of Additive Alternate embedded rail storage track at the proposed Maintenance and Storage Facility (MSF) as indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. EMBEDDED TRACK CONSTRUCTION EP-TRACK 35 11 29.10

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26. Furnishing and installation of 8" reinforced concrete paving at the proposed Maintenance and Storage Facility (MSF) as indicated in construction plans and details. The item will be paid for as indicated elsewhere in the following project specification documents

- a. CONC PVMT (JOINTED-CPCD)(8") (EP-MSF) 32 13 13

27. Furnish and installation of Additive Alternate Overhead Contact System (OCS) for electrification of Additive Alternate embedded rail track at the proposed streetcar maintenance and storage facility (MSF) as indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. OVERHEAD CONTACT SYSTEM (COMPLETE IN PLACE) EP-SYSTEM

28. Furnish and installing of drill shafts in support of Additive Alternate OCS pole placement at the proposed maintenance and storage facility (MSF) as indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. DRILL SHAFT (36 IN) EP-SYSTEM 34 23 71

29. Removal of existing asphalt paving and/or stabilizing base material in support of full depth roadway reconstruction activities as indicated in construction plans and details. The items will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. REMOVE STAB BASE AND ASPH PAV (6"-20") TxDOT Specification 105 2039

30. Furnish and installation of asphaltic 2" pavement overlays at "Mill and Overlay" locations as indicated in construction plans and details. The items will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. D-GR HMA TY-C SAC-A PG70-23 TxDOT Specification 341 6026

31. Furnish and installation of full depth base material and asphaltic pavement as indicated in construction plans and details. The items will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. FL BS (CMP IN PLC)(TYA GR1-2) (FNAL POS) TxDOT Specification 247 6041
- b. D-GR HMA TY-C SAC-A PG70-23 TxDOT Specification 341 6026

32. Removal of the existing asphaltic pavement to a depth of 2" as indicated at "Mill and Overlay" additive locations in construction plans and details. The items will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. SALV,HAUL& STKPL RCL APH PV (VAR DEPTH) TxDOT Specification 305 2014

33. Furnish and installation of pavement sealer as indicated in construction plans and details. The item will be measured and paid for as indicated elsewhere in the following project specification documents:

- a. FOG SEAL (CSS-1H) TxDOT Specification 315 6004

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The Proposer should note that Additive Alternate items of work may be awarded in lieu of base bid items, if the bids come within the budget specified in the contract. Unless otherwise indicated, the quantity of Incremental Additive Alternate items will be equal to the quantity of Base Bid item to be replaced. When completing the Unit Price Schedule for Additive Alternate items in Form G, the Proposer shall enter a unit cost for the Additive Alternate item equal to the unit price differential of the Additive Alternate item minus the Base Bid item(s) being replaced.

Construction items identified below may be installed in place of Base Bid I items if the construction bids come within the budget specified in the contract:

34. Furnishing and installation of full width, 8.5" reinforced concrete paving in lieu of partial width, full depth asphaltic pavement along Santa Fe Street, from station 18+40.84 to 36+12.82, as shown in construction plans and details. The item will be paid for as indicated elsewhere in the following project specification documents

- CONC PVMT (CONT REINF-CRCP)(8.5") TxDOT specification 360 6011

- 35 – 38. Furnishing and installation of Ornamental (Decorative) style Overhead Contact System (OCS) Poles in lieu of standard tapered style OCS poles as shown in construction plans and details. Four project segments have been identified for Additive installation of Ornamental OCS poles: 1) Kansas Street, from Paisano Drive to Father Rahm Avenue, 2) Father Rahm Avenue, from Kansas Street to Santa Fe Street, 3) Kansas Street, from Franklin Street to Paisano Drive, and 4) Oregon Street, from Glory Road to Franklin Street. The item will be paid for as indicated elsewhere in the following project specification documents:

- Ornamental OCS Poles EP-SYSTEMS

39. Furnishing and installation of a wrought iron perimeter fence at Traction Power Substation (TPSS) locations as identified in construction the plans in lieu of Base Bid TxDOT Specification Item 550 – Chain Link Fence (Install) (6'). The item will be paid for as indicated elsewhere in the following project specification documents:

- Wrought Iron Fence EP – IRON Fence

SPECIAL SPECIFICATION

EP-UTL COORD RELO

Utility Coordination & Relocation

1. Description.

- A. This section describes the coordination and relocation work of any known and unknown utility infrastructure relocations required within the project limits of construction for subsurface and above ground utilities.
- B. This specification does not relieve the Prime Contractor (Contractor) of his responsibility to contact the utility clearance services prior to excavation.
- C. The Contractor maintains overall responsibility of the total project, including the performance and coordination of all sub-contractors for any utility infrastructure relocations and/or adjustments required to complete the project as intended by the contract documents. In addition to the Contractor's responsibility, this specification does not relieve any sub-contractors of their responsibility to contact the utility clearance services prior to excavation, which includes surface ground spots of buried utilities and utility exposures through the use of excavation, as required by the contract.
- D. The procedures presented in this Section include guidelines for the Contractor to coordinate with the Owner, Owner's representative, and utility Point of Contact (POC). The List of Utility POCs is located on the Drawings, Sheet Codes U100 through U133. This list is not all inclusive and it's the responsibility of the Contractor to determine other POC's as necessary during the course of the project, including utility infrastructure that may be exposed during construction and is not indicated in the drawings.
- E. The Contractor shall set up and coordinate a "Utility Coordination Meeting" in conjunction with the project Kick Off meeting with all utility POCs to discuss the project and scheduling requirements, a minimum of thirty (30) days prior to the beginning of major construction activities.
- F. The Contractor shall assign an individual (Utility Coordinator) within its organization to oversee and coordinate all utility relocations and/or adjustments. ~~The Utility Coordinator shall have minimum of 4 years of similar urban roadway and urban utility construction experience over the last 5 years. The individual performing the Utility Coordinator role may perform multiple roles on the project. Provide the contact information for the Contractor's Utility Coordinator to the attendees of the Utility Coordination Meeting. The Utility Coordinator's resume shall be submitted and approved by the Owner prior to the beginning of construction.~~
- G. The Contractor shall send all utility POCs an approved updated schedule as directed by the Contract documents and submittal process.
- H. Any amendment to the project schedule shall be sent to the utility POCs once approval is received from the Owner.
- I. The Contractor shall notify each designated utility POC of operations in the vicinity of their respective utility a minimum of forty-eight (48) hours prior to work occurring in that area.
- J. Locate the infrastructure and appurtenances described in the Contract. Notify the Engineer if the infrastructure described in the Contract cannot be found.

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- K. Contractor shall be aware that utility relocations and or adjustments may impede the Contractor's construction progress in certain specific locations. Contractor shall be prepared to adjust its work activities until the utility work is completed. Any work stoppage at a utility conflict location shall not impede construction progress. If construction impediment is imminent, the Contractor shall coordinate with the Owner and provide an adjusted schedule for approval.
- L. All relocated utilities shall be installed per the depth below grade or the height above grade for that specific utility type, according to the standards of the City of El Paso and those of each utility company.
- M. Contractor shall coordinate with El Paso Electric Company (EPEC) POC for all locations where EPEC relocations and or adjustments are to be completed by EPEC that also include customer service connections. Contractor shall use its electrical sub-contractor and coordinate with EPEC where the Contractor's electrical sub-contractor shall complete all customer service connections resulting from EPEC's relocations and or adjustments of its infrastructure.
- N. The Utility Coordinator shall keep copies of all TXDOT permits on site at all times. Copies of the permits will be delivered to the Contractor during the pre-construction meeting.
- O. Consult the Drawings, Sheet Codes U134 through U138 for a list of known utility conflicts and known designations. Four different scenarios for resolving the conflicts are listed below:
 - a. Utilities adjusted prior to infrastructure Contractor NTP
 - i. Meet with the utility POCs to verify that the required adjustments have been made. Coordinate construction activities adjacent to their respective utilities. Determine if the utility requires specific qualifications and/or an on-site representative for specific quality assurance.
 - ii. Proceed with construction activities with notification to the utility company and include adequate specified oversight and safety measures to protect against any damage and or disturbance of the utility infrastructure during construction activities, as well as measures to protect the Contractor's personnel.
 - b. Utilities adjusted after NTP, but before construction activity begins at that specific location.
 - i. Meet with the utility POCs to coordinate construction activities adjacent to their respective utilities. Coordination includes schedule and scope of the Contractor's work. Determine if the utility requires specific qualifications and/or an on-site representative for specific quality assurance.
 - ii. Verify if the utility in question is active, inactive, or abandoned in place.
 - iii. Proceed with construction activities with notification to the utility and proper specified oversight.
 - c. Utilities to be adjusted by the Utility owner during infrastructure construction at that specific location.
 - i. Meet with the utility POCs to coordinate construction activities adjacent to respective utilities that are still in conflict with the project. Coordination includes schedule and scope of the Contractor's work. Determine if the utility requires specific qualifications and/or an on-site representative for specific quality assurance. Verify if the utility in question is active, inactive, or abandoned in place.
 - ii. Proceed with construction activities with notification of the utility and proper specified oversight.
 - d. Unknown Utilities discovered after NTP that require relocation, adjustment, and/or protection.
 - i. Verify if the utility in question is active, inactive, or abandoned in place.

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- ii. Contractor to adjust its work in the vicinity of and adjacent to the location of the unknown utility to avoid any work stoppage. Immediately contact Owner and the utility POCs to determine the nature, utility ownership and function of the unknown utility. The Contractor shall protect the utility. Any damage inflicted by the Contractor shall be repaired by the Contractor.
- iii. Meet with the utility POCs to coordinate construction activities adjacent to their respective utilities. Determine if the utility requires specific qualifications and/or an on-site representative for specific quality assurance.
- iv. Where an abandoned underground piped utility is found, it shall be cut and plugged with 6 inches (150 mm) of concrete (in accordance with Specification Item 420, "Concrete Substructures") brick and mortar (in accordance with Specification Item 465, "Junction Boxes, Manholes, and Inlets") or a precast stopper grouted in place. The Contractor shall provide all means, methods and equipment to complete cutting and plugging, including trash pump(s) for dewatering of the pipeline during cutting operations. Contractor shall coordinate with applicable utility company to confirm such lines are fully abandoned prior to cutting.
- v. Proceed with construction activities with approval of the utility and proper specified oversight.

2. Materials.

- a. None included in this section

~~3.—Measurement and Payment. The work performed by the Contractor's Utility Coordinator in this specification will be measured on a lump sum basis.~~

~~4.3. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the lump sum price bid for "Utility Coordination". The work performed, materials furnished and all labor, tools equipment and incidentals necessary to complete the work under this Item will not be measured or paid for directly, but will be considered subsidiary to the various bid Items of the contract.~~

SPECIAL SPECIFICATION**EP-PUBLIC INFO****Public Information Specification****1. Project Description**

The El Paso Streetcar Project links the International Bridges, downtown, the Cincinnati Entertainment District and University of Texas at El Paso. The project complements several initiatives in El Paso including Sun Metro Brio, "CBD" streetscape improvements, and Southwest University Park. Construction would consist of approximately 4.8 miles of track, 27 streetcar stops, related street improvements, and a vehicle maintenance & storage facility near the existing Sun Metro Downtown Transfer Center, plus the refurbishment of President's Conference Committee (PCC) streetcars.

2. Scope of Work/Work Plan--Public Information Support

The Public Information Consultant (PIC) will perform public information duties connected with construction activities for the El Paso Streetcar Project during the project, a time period anticipated to be 30 months. The level of effort required to complete this job is estimated to average 50 hours per month.

The primary contacts for the PIC will be the Contractor and the Owner. CRRMA is providing oversight over all public information/involvement plans and activities to facilitate communication and ensure smooth functioning of those activities on the project. CRRMA will approve all public information/involvement activities and materials with input from Sun Metro.

The PIC will begin work when the Contractor receives Notice to Proceed. At that time, the PIC will begin contacting corridor businesses and residents, and other key project stakeholders to begin the timely distribution of project information.

The Contractor shall submit the qualifications to the Owner for approval prior to the PIC commencing work.

3. PIC Qualifications

Minimum requirements:

- Shall be bilingual (English and Spanish)
- Shall have a thorough understanding of basic public involvement/public information concepts and practices, as well as extensive experience using these practices in successful public involvement/outreach campaigns and activities
- Shall have experience working on government projects in a public involvement/outreach role.

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- Shall have experience working with construction contractors and an understanding of the construction process
- Shall have knowledge of local (El Paso) community issues and concerns regarding streetcar project (understanding of those in favor of project as well as those opposed).

Briefly outline your experience in these areas and list contact information for at least three professional references who can verify the listed experience.

Scope of Work Activities:

- Prepare Public Information Plan Submittal for review by Owner.
- Coordinate with the Contractor and Owner to stay up-to-date on construction activities, schedules and Maintenance of Traffic plans.
 - Attend, at minimum, every other weekly construction meeting to identify and resolve stakeholder issues. Coordinate daily during construction with the Contractor and/or Owner to stay informed of construction activities.
- Meet with residents and businesses along corridor to discuss construction activities, gather comments and address concerns. Initiate and maintain communications with key stakeholders for the duration of the project, through personal visits, by telephone, or by email.
- Develop and maintain comprehensive mailing and contact lists for use in distributing project materials and informing stakeholders.
- Provide construction updates
 - Work with the Contractor to compile construction update reports outlining scheduled construction activities at least one week in advance and distributed each week to the Owner and others identified during the course of the project.
 - Provide regular updates of construction activities that affect traffic or access to residences and/or businesses to directly impacted stakeholders who request notification, and other stakeholders identified by CRRMA or the Contractor.
 - Compile and package project-related information for distribution to news media through the Owner.
- Organize and attend public activities and meetings.
 - Schedule, organize, advertise, and facilitate a “meet the contractor” open house in coordination with Owner and the Contractor
 - Organize and facilitate a construction-safety-related activity or assembly with nearby schools and pedestrian/bicycle advocacy organizations to highlight any safety concerns and inform individuals about construction.
- Attend neighborhood, community, local government and other meetings to provide project information and record stakeholder comments and concerns.

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- Prepare a construction information flier to be distributed to residents and businesses along the corridor to inform them of planned construction activities and the schedule for those activities.
- Prepare, produce and distribute at least two newsletters to inform project stakeholders during, and at the end of construction. The newsletters will describe construction activities and work schedules, and include additional information that will improve the construction experience for stakeholders.
- Develop/update content for the project website that includes project background, information about upcoming construction activities, frequently asked questions, and contact information.
- Provide a dedicated contact phone with a message machine for stakeholder contacts during the course of the project. Follow up on all stakeholder concerns within 24 hours.
- Provide project progress reports on public involvement/public information activities.
 - Compile and submit a detailed report with each invoice to the Owner that includes at minimum:
 - An overview of public information and public involvement activities
 - A record of all stakeholder contacts
 - A record of all stakeholder questions and concerns
 - A record of all responses and resolutions to stakeholder questions and concerns
- Compile and distribute a Summary Report at the conclusion of construction to the Owner that includes at minimum:
 - An overview of public information and public involvement activities from the beginning to the end of the project.
 - An analysis of what worked well and what did not work well concerning public information and public involvement during the project.
 - A database of project contacts including the names, addresses, phone numbers and email addresses of all project stakeholders.
- Assume other public information and public involvement duties as needed and requested by CRRMA and the Construction Contractor.

All materials prepared for public distribution must be approved by the Owner and the Contractor before distribution. Materials must be prepared and presented in Spanish and English (use of simultaneous translation as applicable).

4. Materials.

- a. None included in this section

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5. **Measurement.** The work performed by the Contractor's PIC in this specification will be measured on a lump sum basis.
6. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the lump sum price bid for "Public Information".

12. Bonded insulated joint kits shall be in accordance with Section 34 11 93.10 except for any insulated joints supplied as part of the special trackwork units described in Section 34 11 23.33.
13. Insulating membrane shall be as specified herein.
14. Any and all other Material necessary to provide a complete installation.

B. Elastomeric Grout

1. Type 1 elastomeric grout shall be used around rail and under base plates as a rail support material. The Shore A hardness shall be between 80-85 when measured in accordance with ASTM D 2240.
2. Type 2 elastomeric grout shall be used for filling and sealing rail joints, bond wires, rail boot transitions and electrical track boxes equipment surrounds. Type 2 elastomeric grout may be used at other locations where stray current control is required, but may not be used in locations where rail support is needed. The shore A hardness shall be between 65-75 when measured in accordance with ASTM D2240.
3. Elastomeric grout shall be a two-component polyurethane material or approved equal consisting of a resin and a suitable hardener, mixed on site per manufacturer's instructions. Elastomeric grout shall be subject to the approval of the Engineer.
4. Provide certification that the cured elastomeric grout possesses hard, elastic, vibration and sound absorbing properties and provides the level of track-to-earth electrical resistance, all as specified herein.
5. Elastomeric grout shall be Icosit KC330 grout, Dural 435 grout or approved equal.

C. Insulating Membrane - Insulating membrane shall be PVC/Elvaloy Nylon-Reinforced Isolation Membrane as supplied by Ironhorse Engineering or approved equal. The material shall be durable and shall not compress under train loads to the point where concrete cracking occurs. The primary purpose of the insulating membrane is to protect surrounding utilities from stray current for the life of the installation (30 years). As such, the membrane shall have a minimum volume resistivity of 1x10¹² Ohms-cm when tested in accordance with ASTM D 257.

D. Insulated Support Ties Assembly

1. Insulated support ties with nylon fasteners shall be furnished complete for assembly of rail and rail boot.
2. Support ties shall be similar to IHECO (Iron Horse Engineering Co.) Part Number 12.334 steel ties or approved equivalent. Steel ties shall have a minimum width of 5 inches (125mm) and length from 84in to 90in to support the rail seat and shall have bending properties equivalent to a C 5x9 channel per ASTM A36 steel. Ties shall be

SPECIAL SPECIFICATION

EP-TWC

TRAIN TO WAYSIDE COMMUNICATIONS SYSTEMS

34 71.29.10



P. R. Bhakta, P.E.

1.00 Scope - This work consists of designing, furnishing, and installing Train to Wayside Communications (TWC) Systems, as specified herein and in the Contract Drawings, at the locations shown on the Contract Drawings.

1.01 Functional Requirements by Location

The following is a description of the functional requirement for TWC at each loop location.

Oregon Street at Wyoming Avenue

Loop and Interrogator TWC-1

The new TWC loop located immediately south of the Oregon Street/Yandall Avenue intersection shall provide a call to the traffic signal at the intersection of Oregon Street with Wyoming Avenue whenever the lead cab of a train passes over the loop. This TWC call will result in the traffic signal at the Oregon Street/Wyoming Avenue intersection extending the existing through phase on Oregon Street until the lead cab of the train reaches loop TWC-2.

Loop and Interrogator TWC-2

Whenever the transponder of a train is over the new loop TWC-2 (located at the stopbar of the Oregon Street/Wyoming Avenue intersection), a call for Signal SC-1 and a preemption call to the traffic signal controller at the intersection of Oregon Street with Wyoming Avenue shall begin. The preemption sequence will begin immediately after completion of the normal Wyoming Avenue traffic signal phase. During the preemption sequence, the traffic signal controller shall provide a streetcar only phase (all-red at the intersection). Signal SC-1 will be programmed to provide the following displays:

- White Horizontal Aspect, indicating that the preemption sequence has not begun and the streetcar is not allowed to proceed.
- White Vertical Aspect, indicating that the preemption sequence has begun and the streetcar is allowed to proceed through the intersection.

Loop and Interrogator TWC-3

The new loop TWC-3, located within the intersection of Oregon Street and Wyoming Avenue, shall provide a cancel to the traffic controller for the previously called preemption whenever the transponder

in the cab transmits a checkout. Upon checkout, Signal SC-1 will return to a White Horizontal display.

Stanton Street at Franklin Avenue

Loop and Interrogator TWC-4

An operator of a Streetcar on Franklin Avenue will proceed through the Franklin Avenue/Mesa Street intersection until the front end of the streetcar is on TWC-4 (located mid-block) where the vehicles transponder can transmit a route code to TWC-4.

At this location, the Streetcar route code shall be preset to allow the vehicle to request a mainline track (primary route) to Franklin Avenue or a diverging track (secondary route) to Stanton Street from Franklin Avenue without additional operator input. Under a primary route call, the Streetcar will be allowed to proceed through the intersection during the next green phase on Franklin Avenue. Under a secondary route call, the streetcar will proceed to TWC 4a located at the intersection of Stanton Street with Franklin Avenue and wait there. Under either condition, the streetcar will proceed according to the Train signal SC-2. SC-2 will be programmed to provide the following displays:

- White Horizontal Aspect, indicating that - No route call to the signal system is present, or the switch points are not aligned or locked.
- White Vertical Aspect, indicating that - The streetcar is allowed to proceed and the switch points are aligned and locked for the primary route.
- White Diagonal Aspect, indicating that - The streetcar is allowed to proceed and the switch points are aligned and locked for the secondary route.

A blocking circuit will prevent the switch from moving while the streetcar is negotiating the switch. When the streetcar activates the blocking circuit, Train signal SC-2 will return to display the White Horizontal Aspect.

Loop and Interrogator TWC-4a

Whenever the transponder of a train is over the new loop TWC-4a (located at the stopbar of the Franklin Avenue/Stanton Street intersection), a call for Signal SC-2a and a preemption call to the traffic signal controller at the intersection of Franklin Avenue with Stanton Avenue shall begin. The preemption sequence will begin immediately after completion of the normal Stanton Street traffic signal phase. During the preemption sequence the traffic signal controller shall provide a streetcar only phase (all-red at the intersection), during the preemption sequence, Signal SC-2a will be programmed to provide the following displays:

- White Horizontal Aspect, indicating that the preemption sequence has not begun and the streetcar is not allowed to proceed.
- White Vertical Aspect, indicating that the preemption sequence has begun and the switch points are aligned and locked for the primary route.
- White Diagonal Aspect, indicating that - The streetcar is allowed to proceed and the switch points are aligned and locked for the secondary route.

Under normal traffic signal operations at the Franklin Avenue/Stanton Street intersection or a primary

route movement by the streetcar, Signal SC-2a will mirror the operations of the traffic signal and display a white vertical aspect while the traffic signal is green on Franklin Avenue and display a white horizontal aspect while the traffic signal is red on Franklin Avenue.

Loop and Interrogator TWC-5

The new TWC loop TWC-5, located within the intersection of Stanton Street and Franklin Avenue, shall provide a cancel to the traffic controller for the previously called preemption whenever the transponder in the cab transmits a checkout. Upon checkout, Signal SC-2a will return to a White Horizontal display. Note that if the streetcar is making a secondary route movement, no additional input will be accepted at loop TWC-4 until checkout occurs.

4th Avenue at Santa Fe Street

Loop and Interrogator TWC-6

Whenever the transponder of a train is over the new loop TWC-6 (located at the stopbar of the Santa Fe/4th Avenue intersection), a call for Signal SC-3 and a preemption call to the traffic signal controller at the intersection of Santa Fe Street with 4th Avenue and the turnout to the maintenance facility shall begin.

At this location (TWC-6), the Streetcar route code shall be preset to allow the vehicle to request a mainline track (primary route) to Santa Fe Street. A call for a diverging track (secondary route) to the maintenance facility from Santa Fe Street can be made using the CALL pushbutton and a valid track route code on the TWC control head mounted on the operator's console. Under either a primary route or a secondary route call, the streetcar will proceed through the intersection during an all-red phase at the intersection which will occur after completion of the normal 4th Avenue traffic signal phase. Under either condition, the train will proceed according to the Train signal SC-3. SC-3 will be programmed to provide the following displays:

- White Horizontal Aspect, indicating that - No route call to the signal system is present, or the switch points are not aligned or locked.
- White Vertical Aspect, indicating that - The streetcar is allowed to proceed and the switch points are aligned and locked for the primary route.
- White Diagonal Aspect, indicating that - The streetcar is allowed to proceed and the switch points are aligned and locked for the secondary route.

Loop and Interrogator TWC-7

The new loop TWC-7, located within the intersection of Santa-Fe Street and 4th Avenue, shall provide a cancel to the traffic controller for the previously called preemption whenever the transponder in the cab transmits a checkout. Upon checkout, Signal SC-3 will return to a White Horizontal aspect.

Loop and Interrogator TWC-8

The new loop TWC-8, located within the intersection of Santa-Fe Street and 3rd Avenue, shall provide a call to the rail controller to return the switch on Santa-Fe Street between 3rd and 4th Streets back to the primary route position whenever the transponder in the cab transmits a checkout.

A blocking circuit will prevent the switch from moving while the streetcar is negotiating the switch. When the streetcar activates the blocking circuit, Train Signal SC-3 will return to display the White Horizontal Aspect.

Santa Fe Street at Overland Avenue

Loop and Interrogator TWC-9

The new loop TWC-9, located immediately north of the Santa Fe Street/Paisano Drive intersection shall provide a call to the traffic signal at the intersection of Santa Fe Street with Overland Avenue whenever the lead cab of a train passes over the loop. This TWC call will result in the traffic signal at the Santa Fe Street/Overland Avenue intersection extending the existing through phase on Santa Fe Street until the lead cab of the train reaches loop TWC-10.

Loop and Interrogator TWC-10

Whenever the transponder of a train is over the new loop TWC-10 (located at the stopbar of the Santa Fe Street/Overland Avenue intersection), a call for Signal SC-4 and a preemption call to the traffic signal controller at the intersection of Santa Fe Street with Overland Avenue shall begin. The preemption sequence will begin immediately after completion of the normal Overland Avenue traffic signal phase. During the preemption sequence, the traffic signal controller shall provide a streetcar only phase (all-red at the intersection) Signal SC-4 will be programmed to provide the following displays:

- White Horizontal Aspect, indicating that the preemption sequence has not begun and the streetcar is not allowed to proceed.
- White Vertical Aspect, indicating that the preemption sequence has begun and the streetcar is allowed to proceed through the intersection.

Loop and Interrogator TWC-11

The new loop TWC-11, located within the intersection of Santa-Fe Street and Overland Avenue, shall provide a cancel to the traffic controller for the previously called preemption whenever the transponder in the cab transmits a checkout. Upon checkout, Signal SC-4 will return to a White Horizontal display.

Stanton Street at Baltimore Drive

Loop and Interrogator TWC-12

The new loop TWC-12, located immediately north of the Stanton Street/Cincinnati Drive intersection shall provide a call to the traffic signal at the intersection of Stanton Street with Baltimore Drive whenever the lead cab of a train passes over the loop. This TWC call will result in the traffic signal at the Stanton Street/Baltimore Drive intersection extending the existing through phase on Stanton Street until the lead cab of the train reaches loop TWC-13.

Loop and Interrogator TWC-13

Whenever the transponder of a train is over the new loop TWC-13 (located at the stopbar of the Stanton Street/Baltimore Drive intersection), a call for Signal SC-5 and a preemption call to the traffic signal controller at the intersection of Stanton Street with Baltimore Drive shall begin. The preemption sequence will begin immediately after completion of the normal Baltimore Drive traffic signal phase. During the preemption sequence, the traffic signal controller shall provide a streetcar only phase (all-red at the intersection), while Signal SC-5 provides an indication allowing the train to proceed through the intersection. Signal SC-5 will be programmed to provide the following displays:

- White Horizontal Aspect, indicating that the preemption sequence has not begun and the streetcar is not allowed to proceed.
- White Vertical Aspect, indicating that the preemption sequence has begun and the streetcar is allowed to proceed through the intersection.

Loop and Interrogator TWC-14

The new loop TWC-14, located within the intersection of Stanton Street and Baltimore Drive, shall provide a cancel to the traffic controller for the previously called preemption whenever the transponder in the cab transmits a checkout. Upon checkout, Signal SC-5 will return to a White Horizontal display.

1.02 Submittals

Submit the following items in accordance with these specifications

A. Shop drawings for the following items:

1. Each TWC interrogator, showing the functions performed by the interrogator and the model numbers and the location of every electronic rack, electronic circuit card, and power supply.
2. Layout drawings of each interrogator cabinet showing, the location of all equipment in the cabinet and the cabinet's method of attachment in the signal case.

B. Product data for the following items:

1. TWC interrogators
2. Interrogator lead cable
3. Traffic signal controller cable
4. Power connection cable
5. TWC loop wire
6. TWC cabinets
7. TWC cabinet heaters
8. Tuning filters, if required
9. Loop joint sealant
10. Loop sealant backer rod

11. Blocking circuits and associated equipment

C. Operations and Maintenance Manuals. These manuals shall include:

1. The as-installed and tested configuration of each TWC interrogator, showing the functions performed by the interrogator and model numbers and location of every electronic rack, electronic circuit card, and power supply.
2. As-installed layout drawings of each interrogator cabinet showing the location of all equipment in the cabinet.
3. The as-installed location and size of each TWC loop and blocking circuit.
4. A description of the TWC system and a description of each and printed circuit card and/or electronic module complete with part numbers, theory of operation, and test requirements.
5. Installation and test procedures for the TWC system and loop tuning procedures.
6. 10 copies of each manual shall be submitted.

Materials

1.10 General

The Streetcar system shall be equipped with a Train-to-Wayside communications system. The streetcars shall be equipped with TWC transponders mounted on the front end of the car body, between the front bumper and front truck. The TWC system shall use a wayside interrogator to excite a wayside loop antenna with approximately 0.1 A, at frequencies between 80 kHz and 120 kHz.

The TWC wayside loop antennas located between the rails are installed in figure 8 patterns to minimize the affect of streetcar propulsion currents. The current in each wayside TWC loop generates an electromagnetic field which is detected by the car-carried TWC transponder located on each streetcar. Upon receipt of the wayside TWC interrogation signal, the car-carried transponder transmits a 19-bit data message back to the wayside loop. The transmission from the car-carried transponder is also between 80 kHz and 120 kHz.

The Contractor shall furnish and install the wayside portion of the TWC system in accordance with the requirements described in this Section. The wayside TWC equipment to be furnished and installed shall consist of the following:

- A. TWC Loops and blocking circuits installed in the pavement, between the rails, at locations shown on the Contract Drawings.
- B. Unless otherwise noted, interrogators will be located in the traffic signal controller cabinet of the impacted intersection to control loop(s).
- C. Interrogator leads connecting the loops and blocking circuits to the interrogator, including all additional cabling, filters, tuning devices, and junction boxes necessary to accomplish the function requirements described herein and shown in the Contract Drawings.
- D. Traffic signal controller leads, and power supply connections, as indicated on the Contract Drawings.

E. Operations and Maintenance Manuals.

1.11 TWC Data Requirements

The contractor shall furnish and install wayside TWC equipment to provide for the accurate reception and processing of 19-bit data message from the car based transponders. The Contractor shall provide the wayside interrogators capable of processing the information from the streetcars via the wayside loop antennas in the format depicted in Table 1 (Sample Truth Table) below.

1.12 Loop Antennas (TWC Loops) and Blocking Circuits

The loop antenna TWC Loops) shall consist of one turn of AWG #12 XHHW polyethylene jacketed traffic signal loop wire.

In order to mitigate the effects of inductive coupling between the current in the rails and the loop, each loop shall be installed in a figure "8" pattern.

Loops dimensions are shown in the Traffic Signal Plans.

The loop shall be connected to the TWC interrogator by the interrogator lead and loop connecting unit, as described below.

The contractor shall be responsible for both design and installation of the Blocking Circuits. Blocking Circuits shall be installed and connected to the switch control cabinets per manufacturer's recommendations.

TABLE 1
DATA CODE FORMAT (SAMPLE TRUTH TABLE)

	TRANSPONDER DATA BIT -																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Binary Weight		1	2	4	8	16	32	64			1	2	4	8	16	32			64
Lead Cab	L	R	R	R	R	R	R	R	P	C A N	T	T	T	T	T	T	S	S	T
Logic Level	1	X	X	X	X	X	X	X			X	X	X	X	X	X			X
Right																		1	
Left																	1		
Pre-empt ("Call")									1										
Cancel										1									

TRAIN/WAYSIDE COMMUNICATION SYSTEM LEGEND

AA	=	Binary 128
BB	=	Binary 256
CC	=	Binary 512
C=	=	Car Number (0 through 99)
E	=	End-of-Train (Signal from Tail Lamps)
L	=	Lead Cab (Front End)
NL	=	Non-Lead Cab (Intermediate Cab or Trailing Cab)
P	=	Preempt or "CALL"
CAN	=	Cancel
R=	=	Route Number (0 through 99)
S	=	Track Switch Control (Left or Right)
SP	=	Spare
T	=	Train Number (00 through 99)
X	=	High or Low Logic Level (Left LSB, Right MSB)
1	=	High Logic Level
0	=	Low Logic Level

1.13 Interrogators

The interrogator includes all of the wayside control equipment necessary to query a transponder, and to successfully receive and decode the data messages from that transponder. The interrogator also includes all of the interface circuitry, raceway, and cabling necessary to meet the functional requirements described herein and shown on the Contract Drawings.

The interrogator shall:

- A. Transmit a 30 kHz. to 100 kHz. signal via the loop antenna, to, activate any transponders within the range of that loop antenna. The transmitted signal shall be a burst of 30 kHz. to 100 kHz. RF energy, lasting for a few milliseconds. This tone burst shall be repeated once every 25 to 100 milliseconds.
- B. Receive data messages from the transponder if a transponder is in range of the loop.
- C. Check the received data messages for the presence of a proper start code and a stop code.
- D. Provide for the comparison between two successive data messages and validation only after they have been found to be identical. If the data message meets the requirements, a strobe signal shall be generated which shall enable transfer of the data to an output buffer.
- E. Provide for the data from the output buffer to be transmitted to application circuit cards. These cards shall provide relay contact closure(s) enabling the appropriate traffic signal controller and track switch control equipment to act upon the message transmitted from the train. The particular application outputs required vary with location and are shown in the Contract Drawings, and described herein.
- F. Provide for future changes in route codes and streetcar operating philosophy, by being capable of being re-configured so as to respond differently to different route codes through only the removal/addition of diodes in the decoder circuitry.

The wayside interrogator shall be modular in nature and manufactured to fit on a standard 19" rack configuration. All electronic circuitry, with the exception of the power supply, shall be on removable printed-circuit cards.

The design of the interrogator shall allow the placement of loop antennae anywhere from 0 to 1350 feet from the interrogator rack.

Interrogator output relay contacts shall be rated for 0-24 VDC at 0-0.2 amperes and 125 VAC at 0-0.2 amperes.

1.14 Interrogator Power Supplies

Each interrogator shall include its own integral power supply(s). The Contractor shall furnish and install all cabling, raceway, protective devices, and coordination necessary with the Engineer, the City of El Paso, and the utility as appropriate to power this equipment. Supplied power will be commercial, single phase 120 VAC.

1.15 Expandability

The basic functional requirements for the TWC system at this time involve providing outputs for calling routes. However, the TWC equipment must also be capable of being expanded to include

additional outputs. Each interrogator rack must contain sufficient backplane wiring, power supply capacity, and two spare printed-circuit board sockets to allow for additional buffered relay outputs to call additional routes, or traffic light pre-emption requests.

In the event that an interrogator rack controls more than one loop antenna, that interrogator rack shall contain sufficient capacity to provide three additional outputs, described above, for each loop.

1.16 Interrogator and Traffic Signal Controller Leads

The interrogator lead and the loop connecting unit shall extend from the loop antenna to the interrogator. It shall be constructed in accordance with manufacturer's recommendations, and shall include any necessary amplifiers, tuning devices, filters, and junction boxes.

All cabling used in the traffic signal controller and power supply connection leads shall be suitable for direct burial in wet and dry application, and designed for a 30 year life in that application. Conductors shall be #14 AWG minimum. All cable used in the interrogator and power supply connection leads shall be submitted to and approved by the Engineer. Lead cable shall be in a shielded, twisted pair cable, with a polyethylene overall outer jacket.

Interrogator lead cable shall be AWG #14 (minimum), polyethylene insulated copper conductors suitable for direct burial in wet and dry application, and designed for a 30-year life in that application. Interrogator lead cable shall be continuous from interrogator terminal strip to the loop connecting unit. All cable purchased for use as interrogator lead cable shall be submitted to the Engineer for approval.

1.17 TWC Loop Joint Sealant

The TWC loop joints shall be sealed using back-up rods and sealant. The sealant shall be Edco 2094 Loop Epoxy Sealant with a uniform gray color or an approved equal. The backer shall be compressible polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam, or other flexible, permanent, non-absorptive material and shall be recommended for compatibility with the sealant by the sealant manufacturer.

1.18 Listing and Labeling

Electrical equipment and material shall be listed and labeled for the purpose for which it is used by Underwriters Laboratories, Factory Mutual, CSA, ETL or equivalent nationally recognized testing laboratory.

Those materials or assemblies that do not bear an independent testing label shall meet the special approval criteria established by the State and local electrical codes.

Construction

1.40- TWC Interrogator Installation

Each interrogator shall be installed in the signal case in its cabinet, at the locations shown in the Contract Drawings.

The Contractor shall prepare and submit shop drawings for each location, detailing the cabinet size, mounting detail and location, electrical and grounding connections to be used and bill of materials for the Engineer approval.

The Contractor shall perform all work required to make the power supply connection, including, as required, addition of breakers, raceway, and rearrangement of existing connections.

The cabinet shall be primed and painted as specified on the Contract Drawings.

1.41 Interrogator, Power Supply, and Traffic Signal Controller Lead Installation

All cables shall run continuously without splicing from termination point to termination point. The Contractor shall carefully determine the length of cable necessary to reach from termination point to termination point. Splicing of cable at any location other than those shown on the Drawings is not permitted. Splicing of cable in raceway, pullboxes, junction boxes and underground vaults, manholes and handholes is not permitted.

Cable shall not be pulled through any intermediate junction box, pullbox, vault, manhole, handhole or any other opening in the raceway or duct, unless specifically required by the Engineer. The necessary length of cable to be installed will be pulled from one junction box, pullbox, vault, manhole, handhole, or traffic signal controller cabinet to next junction box or manhole and the immediate length of cable to be installed in the next raceway or duct shall be carefully stored in a manner that will allow that length of cable to be safely pulled into the next raceway or duct. The Contractor's proposed storing methods shall be subject to approval by the Engineer.

At all termination points, any cable that is not immediately terminated shall be sealed with an approved end cap to prevent moisture or dirt from entering the cable end. Tape shall not be permitted to seal the cable end. The cable end shall remain sealed until termination takes place. Cables that are not immediately terminated shall have 3 feet of slack. Slack is defined as the length of cable extending out of the cabinet opening when the cable is held straight outward.

1.42 TWC/Signal System Integration

The Contractor shall provide systems integration and testing in accordance with City approved test plans and procedures, with accompanying check lists and test witness sign off sheets. The City of El Paso traffic signal system is comprised of 170 type controllers running Bi Tran Systems QuicNet Pro 233 RV2 software.

- A. Signal System integration tests shall be conducted and performed by the Contractor upon completion of all required system interconnections.
- B. After completion of the Contractor provided system integration testing, the Contractor, with City support, will perform a complete System Integration Test prior to pre-revenue service operations. The Contractor shall also:
 - Assist City personnel with troubleshooting of field problems and provide continued education about the Signal System equipment during this period.

- Correct any problems encountered during systems integration testing at no cost to the City.
- Submit all field test data to the City Engineers for review and approval.

C. The final phase of the contract shall be to provide technical support to the City after the streetcar system has been placed into revenue service. The Contractor shall provide on-call maintenance support to the City for issues that may be beyond the expertise of the City maintenance staff.

D. Upon successful completion of System Integration Tests, the integrated system shall be phased over for City use. The Commissioning process, once completed, shall be coincident with the City's acceptance of the materials, equipment, goods and services provided by the Contractor. The Contractor shall prepare a system checklist, delineating all work performed including design approvals, test completion reports, as-built drawings and manuals, spare parts records, training reports, and related materials reflecting the status of the entire signal system.

1.43 Turn-On Procedure

Upon completion of all TWC work at a specific location, the Contractor shall notify the Engineer that the installation is ready for turn-on. Following such notification, and upon completion of all other associated work by the City, the City shall schedule turn-on for each intersection.

Representatives of both installation Contractor and TWC and related equipment manufacturers shall be in attendance at each turn-on.

Training Program

1.50 Training Program

The Contractor shall develop a training program for the City's maintenance and engineering personnel, technicians, supervisors and management personnel. The program shall include, but not be limited to:

- A. Performance objectives that state the expected behavior, the conditions under which performance will occur, and the measures and standards to be applied.
- B. Lesson plans, including the sequence of activities, an outline of context and a summary of learning strategies to be used (e.g., classroom presentation, hands-on practice, audio/video presentation, etc.).
- C. Methods and criteria for evaluating performance, including an objective grading system to report progress of trainees, Grading shall be kept confidential and furnished only to personnel designated by the City.
- D. Resources required, such as equipment and shop space.
- E. A schedule for delivery of training courses to all designated personnel from the City. The size and location for the training must be approved in advance by the City.

1.51 Training Materials

Provide materials to support the training courses, including: instruction guide, training aids, student workbooks, and operation and maintenance manuals.

- A. Instructor Guide: Provide instructor guides containing: course outline, agendas, objectives, lesson plans, training aids, presentation guidelines, suggested discussion questions, and criteria for measuring student performance.
- B. Training Aids: Provide training aids such as mock-ups, scale models, and overhead transparencies or Power Point slides. All training aids shall be of durable construction and shall become the property of the City. Verify that any equipment or tools used during training are in good working condition both before and after the training sessions.
- C. Student Workbooks: Provide student workbooks that include course objectives, a course agenda, schedule of sessions, copies of overhead transparencies, lecture outlines and any additional printed material used during the course.

1.52 Class Lectures/Presentations

Provide experienced trainers who are knowledgeable about the subject matter. Trainers must be able to answer questions and give detailed explanations and demonstrations. All presentations shall be made in English.

- A. Operational training shall be provided in the following areas:
 - Communication equipment operation.
 - Test equipment operation.
- B. General maintenance and repair training shall be provided for Communications Equipment.
- C. The Contractor shall designate the total number of hours allocated for training of each work group listed below: the minimum shall not be less than:
 - Eight (8) hours for management personnel/supervisors. The maximum class size shall be up to six (6) people.
 - 24 hours for maintenance and engineering personnel and technicians for a class size of up to five (10) people.
 - Eight (8) hours for operation personnel with a maximum class size of up to 10 people.

ADDENDUM 3 - JULY 24, 2015

Measurement and Payment

1.60 Measurement

Train-to-Wayside Communication Systems will be measured by the LS per each intersection.

1.61 Payment

Train to Wayside Communications Systems will be paid for by the Lump Sum per each intersection as follows:

- Oregon Street at Wyoming Avenue
- Stanton Street at Franklin Avenue
- 4th Avenue at Santa Fe Street
- Santa Fe Street at Overland Avenue
- Stanton Street at Baltimore Drive

This price will be full compensation for furnishing all materials, equipment, labor, and incidentals necessary to complete the work specified in the plans and this specification, including integration and training elements indicated. The price excludes trenching, conduit, and conductors for the system elements as shown in the traffic signal layout plans.

END OF SECTION

SPECIAL SPECIFICATION

EP-SYSTEMS

Systems

- 1. Description.** Construct the Overhead Contact System (OCS) and Traction Power Substations (TPSS) for the El Paso Streetcar Project in El Paso, Texas, as shown on the plans and the attached specifications. Perform Baseline and Revenue Stray Current Testing, as described in the attached specifications.
- 2. Materials.** All materials furnished and all construction methods utilized will be in accordance with the plans, details, and attached specifications.
- 3. Measurement.** The Overhead Contact System will be measured by the lump sum. The OCS spare parts as indicated in the attached specifications will be measured by the lump sum. The Traction Power Substations will be measured by each substation complete in place. The TPSS spare parts indicated in the attached specifications will be measured by the lump sum.

4. Payment.

- a. **Traction Power Substation.** The work performed and materials furnished in accordance with this item and measured as provided for under "Measurement" will be paid at the unit price bid for "TPSS" for the locations specified ("A1", "A2", "A3", "A4", "S1") and "TPSS – Spare Parts". This price will be full compensation for furnishing all materials, equipment, labor, and incidentals necessary to complete the work specified in the attached specifications (listed under Section 5 "Attached Specifications") and plans.

The following items related to the civil work related to the traction power substations will be paid for separately as indicated elsewhere in the project documents and as follows:

Foundations:	TxDOT Item 420 "Concrete Structures"
Removals:	TxDOT Item 104 "Removing Concrete"
	TxDOT Item 105 "Removing Stabilized Base and Asphalt Pavement"
Sidewalk:	TxDOT Item 531 "Sidewalk"
Curb:	TxDOT Item 529 "Concrete Curb, Gutter, and Combined Curb and Gutter"
Boring of the feeder duct under Mesa Street:	
	TxDOT Item 476 "Jacking, Boring, or Tunneling Pipe or Box"
Perimeter Fence:	Item EP-IRON FENCE "Installation of Wrought Iron Fence and Gates at TPSS"

- b. **Overhead Contact System.** The work performed and materials furnished in accordance with the Overhead Contact System and measured as provided for under "Measurement" will be paid at the unit price bid for "OCS System – Complete in Place"

ADDENDUM 3 - JULY 24, 2015

and “OCS System – Spare Parts”. This price will be full compensation for furnishing all materials, equipment, labor, and incidentals necessary to complete the work specified in the attached specifications (listed under Section 5 “Attached Specifications”) and plans.

The lump sum payment for “OCS System – Complete in Place” shall be based on the installation of plain OCS tubular steel poles in accordance with Section 34 23 37 “OCS Tubular Steel Poles”. The lump sum payment for “OCS System – Complete in Place” shall not include Ornamental Poles as specified in the plans and in Section 34 23 37.11 “OCS Pole Ornamentation”. The incremental cost for the Ornamental Poles as shown in the plans shall be paid for separately.

The following items associated with the OCS poles will be paid for separately as follows:

Foundations: TxDOT Item 416 “Drilled Shaft Foundations” (Also refer to 34 23 71 OCS Pole Foundations for additional requirements)

Banner Arms: Item EP-ARM “Banner Arm Assembly”

LED Lighting Fixtures: Item EP-LUMINAIRE “Special Illumination”

Light Arm Attachments: Subsidiary to Item EP-LUMINAIRE “Special Illumination”

Incremental Cost for the Ornamental Poles

- c. **Baseline and Revenue Stray Current Testing.** The work associated with the baseline and revenue stray current testing will not be paid for separately but considered subsidiary to the pertinent bid items.

5. Attached Specifications.

TRACTION ELECTRIFICATION SYSTEM

DIVISION 01 GENERAL REQUIREMENTS

01 11 00 Systems Summary of Work

01 31 19 Systems Project Meetings

~~01 32 13 Scheduling of Work~~

01 33 10 Systems Submittal Procedures

01 42 00 Systems References

~~01 43 00 Systems Quality Assurance~~

01 46 00 Systems System Assurance

01 78 23 Systems Operation and Maintenance Data

01 78 39 Systems Project Record Documents

01 79 00 Systems Demonstration and Training

DIVISION 05 METALS

05 05 00 Common Work Results for Metals

DIVISION 09 FINISHES

09 67 25 Dielectric Epoxy Flooring

DIVISION 22 PLUMBING

22 45 19 Self Contained Eyewash Equipment

DIVISION 26 ELECTRICAL

26 05 00 Common Work Results for Electrical

26 05 10 Common Work Results for Systems Conductors and Cable

26 05 19 Low-Voltage Conductors and Cable

26 05 26 Grounding and Bonding

26 05 29 Hangers and Supports for Electrical Systems

- 26 05 33 Raceway and Boxes
- 26 05 43 Underground Ducts and Raceways for Electrical Systems
- 26 12 16 Dry-Type Transformers
- 26 24 13 Switchboards
- 26 24 16 Low-Voltage Panelboards
- 26 50 00 Lighting

DIVISION 34 TRACTION POWER

- 34 11 05 Systems Rail Bonding
- 34 21 05 Common Work Results for Traction Electrification System (TES)
- 34 21 16 TPSS Enclosures
- 34 21 19 DC Switchgear
- 34 21 23 Transformer-Rectifier Unit
- 34 21 25 TPSS DC Control Power
- 34 21 31 Substation Automation System (SAS)
- 34 21 33 Rail-Voltage Monitoring and Grounding System
- 34 21 40 DC Disconnect Switches
- 34 21 46 Traction Power DC Contactor Panel
- 34 21 50 DC Surge Arresters
- 34 21 73 TE System Studies
- 34 21 80 TES Spare Parts and Special Tools
- 34 21 90 Traction Electrification System Testing

OVERHEAD CONTACT SYSTEM

DIVISION 34.23 OCS OVERHEAD TRACTION POWER

- 34 23 10 OCS Description and General Requirements
- 34 23 11.01 OCS Glossary of Standard Terms
- 34 23 35.99 OCS Pole Painting
- 34 23 37 OCS Tubular Steel Poles (See payment clause above)
- 34 23 37.11 OCS Pole Ornamentation (See payment clause above)
- 34 23 40 OCS Wire and Cable
- 34 23 50 OCS Assemblies, Components and Fittings
- 34 23 64 OCS Special Tools
- 34 23 66 OCS Spare Parts
- 34 23 70 OCS Installation
- 34 23 71 OCS Pole Foundations
- 34 23 72 OCS Tubular Pole Installation
- 34 23 77 OCS Surge Arrester Installation
- 34 23 78 OCS Disconnect Switch Installation
- 34 23 80 OCS Testing
- 34 23 90 OCS Installation Records
- 34 23 96 OCS Installation and Maintenance Manuals
- 34 23 97 OCS Maintenance Staff Training

BASELINE AND REVENUE STRAY CURRENT TESTING

- 26 24 90 Baseline and Revenue Stray Current Testing

CAMINO REAL REGIONAL MOBILITY AUTHORITY

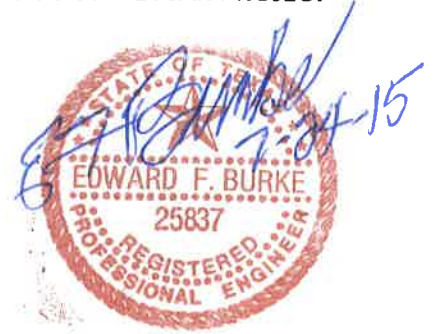
EL PASO STREETCAR PROJECT

URS Corporation
TBPE Firm Registration No. F-3162

SPECIAL SPECIFICATION

EP-LUMINAIRE

Special Illumination



1. Description. Furnish and install the following items to provide illumination throughout the project:

Provide the following at streetcar stops where the light poles are not joint use Overhead Contact System (OCS) poles:

- Decorative light pole with 2 luminaire extension arms
- LED light fixtures
 - Standard Type
 - Dark Sky Compliant Type

Provide the following at joint use OCS poles used at streetcar stops and located throughout the project:

- LED light fixtures
 - Standard Type
 - Dark Sky Compliant Type
- Decorative OCS poles are identified and paid for separately as indicated elsewhere in the project documents. Attachment assemblies (luminaire extension arms) connecting the LED light fixtures to the OCS poles are subsidiary to the LED light fixture.

The LED Luminaire shall be designed for ease of maintenance and shall incorporate a plug-in electrical module for connection of the LED light source to the service voltage. The acorn shaped luminaire shall contain a precision optical system that maximizes post spacing while maintaining uniform illumination.

2. Materials. Special materials for fixtures shall be as follows:

Optical System (Standard Type Only). The optical system shall consist of a precisely molded thermal resistant glass refractor and top reflector mounted within the decorative aluminum banding. The top refractor shall redirect over 50% of the upward light into the controlling refractor while allowing a soft uplight component to define the acorn shape of the luminaire. The lower reflector shall use precisely molded prisms to maximize pole spacing. Asymmetric and symmetric light distributions shall be available.

Luminaire Housing. The cast aluminum luminaire housing provides an enclosure for the plug-in electrical module. Stainless steel fasteners shall secure all internal components including the prismatic refractor. The slip fitter shall accept a 3" by 2-7/8" to 3-1/8" O.D. tenon.

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Luminaire Housing/Door. The luminaire door shall open with minimum use of tools and be retained on a hinge.

Electrical module. The electrical components shall be mounted on an aluminum plate that is removable with minimum use of tools. A matching multi-conductor plug shall connect to the receptacle in the luminaire housing to complete the wiring.

Finish. The luminaire shall be finished with polyester power paint to ensure maximum durability. The luminaire shall be suitable for outdoor service.

- LED Driver – 100 watts (525mA)
- Color temperature – 4K (4000 Series CCT)
- Voltage – Auto-sensing voltage (347 thru 480VAC)
- Housing Color – Green
- Optics – Asymmetric
- Trim Color – Gold
- Decorative Trim – Band, Medallions & Spike Finial

Wattage. Actual wattage may differ by +10%/-10% at operating temperature.

Post. The lighting post shall consist of a one-piece fluted tapered pole, pole top tenon, anchor bolts and base plate. The post shall be welded to the square steel base plate. Refer to the part indicated below for additional material and performance characteristics.

Aesthetic and Performance Characteristics. The streetcar stop light pole, luminaire arms, and fixtures shall follow the aesthetic and performance characteristics of the standard City of El Paso decorative style as indicated on the plans and the following product:

LED Light Fixture (Standard): Holophane WAUE1004KAHN3G2 or approved equivalent

LED Light Fixture (Dark Sky Compliant): Holophane WAUE1004KAHN3G2 with Option "F" (Full Cover) or approved equivalent

Decorative Light Pole with two luminaire extension arms: Holophane LB33-4-1/2T DECO EXTENSION ANDG (MOD) - FL210-700A180-P9-FP-HH-LAB - AB-27-4 - AN24CSBCADG or equivalent

3. Measurement and Payment.

LED Fixtures. This Item will be measured by each at the unit price bid for "LED Fixture (Standard)" and "LED Fixture (Dark Sky Compliant)". This price will be full compensation for furnishing all materials, equipment, labor, and incidentals necessary to complete the work specified in the plans.

ADDENDUM 3 - JULY 24, 2015

Scenario A and B. (Locations other than Streetcar Stops). For light fixtures on Joint-Use OCS poles at locations other than streetcar stops, the conductor within the OCS pole will be incidental to the LED fixture. Junction boxes at these locations will be quantified based on 1 junction box per location and paid for separately under TxDOT Item 624 "Ground Boxes". Proposed conductor and conduit extensions (or tie-ins with existing conductors or conduit) from the Joint-Use OCS pole to the proposed junction box from the existing light will be paid for separately in accordance with TxDOT Item 618 "Conduit" and TxDOT Item 620 "Electrical Conductors". This price will be full compensation for furnishing all materials, equipment, labor, and incidentals necessary to complete the work specified in the plans.

Scenario C (Streetcar Stop Locations Only). For fixtures on Joint Use OCS poles at streetcar stop locations and standalone decorative light poles at streetcar stop locations, the conductor within the pole will be subsidiary to the LED Fixture. Proposed conductor and conduit from the Joint-Use OCS pole or standalone decorative light poles to the proposed junction box from the existing light will be quantified as indicated in the Electrical Conduit Runs Plans and paid for separately in accordance with TxDOT Item 618 "Conduit" and TxDOT Item 620 "Electrical Conductors". The junction boxes will be paid separately (under TxDOT Item 624 "Ground Boxes") and quantified as indicated in the Electrical Conduit Runs Plans.

Decorative Pole. This item will be measured by each at the unit price bid for "City of El Paso Style Decorative Light Pole" and shall include the 2 luminaire attachment arms and aesthetic caps. This price will be full compensation for furnishing all materials, equipment, labor, and incidentals necessary to complete the work specified in the plans. Note that this clause applies to standalone light poles at streetcar stops and not Joint-Use OCS poles. Refer to OCS plans and specifications for details related to Decorative OCS poles.

Removal of Existing Illumination Assemblies/Partial Demolition of Foundation. The removal of existing illumination assemblies and partial demolition of the luminaire foundation that is required to install the junction box and associated tie ins shall not be measured or paid for separately but shall be considered subsidiary to the junction box item.