

SECTION 18200

SIGNAL LAYOUTS, STRUCTURES AND FOUNDATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section shall include disassembling, relocating and installing existing or new signals.
- B. Signal layouts, as specified herein, shall consist of foundations, signal heads, and all structures including ground-mounted masts, ladders, platforms, and all mounting hardware required to construct signals.
- C. Contractor shall furnish and install signals and marker lights as shown on the Contract Drawings at existing and new signal locations.

1.02 REFERENCE STANDARDS

- A. American Railway Engineering and Maintenance-of-Way Association (AREMA)
 - 1. Communications and Signals Manual of Recommended Practices (C&S Manual). When following the recommendations of the AREMA C&S Manual substitute the word "shall" for the word "should" in the applicable Manual Part.

1.03 DESIGN REQUIREMENTS

- A. Signal Foundation Structure: The Contractor is responsible for the foundation structure type selection and its design. The design of the signal foundation's structure and stability shall be in accordance with the AREMA. Design calculations shall be prepared by a licensed California professional civil engineer with a minimum of 5 years experience in the design of similar foundation structures.
- B. Signal aspect shall be distinct and unmistakable when viewed from a height of 7 to 12 feet above top of rail at a distance of 1,000 feet. Nominal sighting distance shall be 2,000 feet. Where unobstructed sighting distance for a standard signal arrangement is less than 2,000 feet, supply and install wide angle or spread lens and adjust the signal head for the maximum sighting range possible. Contractor shall provide the Engineer with written notification with any sighting problems and location of where spread or wide-angle lenses are installed

1.04 SUBMITTALS

- A. Submit shop drawings for each type of signal unit and each type of signal layout to be furnished by Contractor. Show all ladders, masts, bases, arms, and required mounting hardware. Show location and method of mounting the signals to the structure.
 - 1. Provide necessary dimensions, hardware, method of mounting signal structures, and material specifications for all items to be furnished.

- B. Submit shop drawings for each type structure foundation.
- C. Submit Contractor's Installation Procedure for approved. The procedure shall include a detailed description of installation activity and sufficient detail to allow the Engineer to determine the validity of the installation procedure.
- D. Submit design calculations for the signal cantilever/bridge foundation.

1.05 QUALITY ASSURANCE

- A. Signals, structures, and related hardware shall meet the recommendations of AREMA C&S Manual, Section 7, and applicable portions of Manual Part 3.2.5 where they do not conflict with any requirements specified herein
- B. Inspect each signal layout after it has been installed in the field. This inspection shall conform to the Contractor's Installation Procedure as accepted by the Engineer.
- C. Foundations shall meet all recommendations of AREMA C&S Manual Parts 14.4.1.A through 14.4.36 inclusive, where requirements of the AREMA Specifications do not conflict with any requirements specified herein.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Ship signal lamps or LEDs separately from the signal in which they will be used.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Furnish colorlight or searchlight signals, as indicated in the Contract Documents, and marker light assemblies. Signals and marker light assemblies shall be in accordance with Caltrain Engineering Standards.
- B. Furnish signal masts, signal cantilevers and signal bridges, as applicable, in accordance with Caltrain Engineering Standards.
- C. Furnish mounting brackets for marker light assemblies, ladders, junction boxes, housings, backgrounds, hoods and any other nuts, bolts, and associated hardware.
- D. Furnish foundations for signal masts, signal cantilevers, and signal bridges, as applicable, in accordance with Caltrain Engineering Standards.

2.02 SIGNALS

- A. Signal mounting shall conform to the Caltrain Engineering Standards.
- B. Signal lamps or LEDs shall be products specified in the Contract Documents or equal.

2.03 SIGNAL MASTS

- A. Mast assemblies for ground mounting shall conform to the Contract Drawings and Caltrain Engineering Standards.

2.04 SIGNAL BRIDGES AND CANTILEVERS

- A. Refer to the Contract Drawings for Signal Bridge and Cantilever requirements.
- B. The junction box shall have two terminals with insulated test links, as specified in Section 18360, Signal Systems Miscellaneous Products, for each cable conductor. Provide 10 percent spare terminals. Do not overcrowd terminals.
- C. Cable entry to the junction box shall be direct from the signal structure. External conduit construction is not acceptable. Provide an opening approximately four by six inches near the base of the signal structure under each junction box location to allow access for cable sealing at the foundation. Provide bolt-on access plate which will cover the opening under normal conditions.
- D. Locate junction box either at the base of a main support mast or on a main support mast at a height of between 3 and 5 feet above the finished grade level at the base.
- E. The method of routing cables from the junction box to each signal mounted on the structure shall be to route the cables within the tubular members of the structure to the greatest extent possible. Pull cables entirely through the structure members, mast, and signal mounting brackets, unless otherwise approved by the Engineer. To facilitate this, provide appropriate pull box locations as needed, located a maximum of 5 feet from each signal. Edges shall be smooth and rounded to accommodate cable installation. Provide a means to prevent entry of rodents and insects at the bases of the vertical masts without cable entrances.
 - 1. Use galvanized rigid steel conduit where wire is to be run external to the structural members, except as noted.
 - 2. Use flexible armored conduit to make the connection from the pull box to the individual signal heads.

2.05 SIGNAL FOUNDATIONS

- A. Furnish galvanized steel foundations complete with galvanized bolts, washers, nuts, and associated hardware. Galvanizing shall conform to Specifications Section 18360, Signal Systems Miscellaneous Products, and AREMA C&S Manual, Part 15.3.1.
- B. Construct galvanized steel foundations of steel angle and plate welded together. Foundations shall be constructed of 2-1/2 inch by 2-1/2 inch by 1/4-inch steel angle and 1/4 inch steel plate.
- C. Bolt spacing shall be to manufacturer's standards for the equipment to be supported by the foundation.
- D. Concrete Foundations: Cast-in-place in accordance with Section 03300, Cast-in-Place Concrete, or precast concrete as manufactured by Dixie Precast or equal.

PART 3 - EXECUTION

3.01 INSTALLATION - SIGNALS

- A. Contractor shall install signal layouts in locations as indicated on the Contract Drawings and as shown on the accepted shop drawings. No part of any signal layout shall conflict with Caltrain Engineering Standards, Code of Federal Regulations, Part 49, or CPUC rules and regulations.
- B. Locate signals centered between insulated joints, except where physically not possible. In such instances, Contractor shall submit a recommendation to the Engineer for approval.
- C. Center line of signal mast shall be 12 feet 0 inches from centerline of track unless a deviation from this is approved by the Engineer, as shown on the Contract Drawings or required to meet CPUC clearance requirements.
- D. Install signal units level and plumb on their foundations. Leveling nuts shall be used as shown on the Caltrain Engineering Standards.
- E. Install signal layouts in accordance with the applicable recommendations of AREMA Signal Manual, Part 7.4.1 and Caltrain Engineering Standards.
- F. Install platforms for each signal unit level.
- G. Align signals for maximum viewing distance before placing in service.
- H. Refer to Design Requirements herein regarding signal aspect and sighting distances. Install signals and verify sighting distances. Provide the Engineer with written notification with any sighting problems and location of where spread or wide-angle lenses are installed
- I. Mount signal heads on an offset arm as shown in Caltrain Engineering Standards. Signal heads shall also be able to swivel on the offset arm and be adjustable.
- J. Signal nomenclature shall be as shown on the Contract Drawings.
- K. The underground cable shall be dressed, potheaded, tagged, and terminated in the signal junction box as specified in Section 18360, Signal Systems Miscellaneous Products. The conductor size of the underground cables shall be at least as large as that shown in the Contract Drawings.
- L. Wiring from the junction box base to the signal heads shall be minimum No. 10 AWG copper stranded wire or larger as shown on the Contract Drawings.
- M. Install identification tags on each wire. These tags shall bear the nomenclature shown on the accepted Shop Drawings.
- N. Install signal cantilevers as shown on Contract Drawings.

3.02 INSTALLATION - SIGNAL BRIDGES AND CANTILEVERS

- A. Signal bridges and cantilevers shall be installed as shown on Contract Drawings.

3.03 INSTALLATION - FOUNDATIONS

- A. Install each foundation in accordance with the approved Contractor's Installation Procedure for each type of foundation, as herein specified, and as shown on the Contract Drawings. The absence of a specific task listing herein does not relieve the Contractor of the responsibility for providing a complete and functional installation.
- B. Refer to Section 01047, Utilities and Systems Coordination, for requirements for locating and protecting existing utilities. Advise the Engineer immediately if any utility or cable interferes with the foundation work. After locating an interference, allow 72 hours for the Engineer to relocate or mitigate the interference.
- C. Prior to placing steel foundations in the excavations, place and compact a crushed stone base in accordance with Section 02300, Earthwork.
- D. When placing foundations, exercise care and ensure that anchor bolts are not bent or threads damaged. Protect anchor bolt threads, washers, and nuts by applying friction tape or other accepted method satisfactory to the Engineer, until the unit to be supported is installed.
- E. After backfilling foundations, ensure that the foundation is plumb and level. Where galvanized steel foundations are installed, top of final grade shall be no more than 24 inches below top of foundation.
- F. Install foundations to the lines, grades and dimensions required as determined by the Contractor and accepted by the Engineer. Mounting bolts shall be of sufficient length to accommodate use of leveling nuts between the base of the equipment to be supported and the top of the foundation.
- G. Where marker lights are located on signals, install new signal foundations or adjust existing signal foundations so the top of the marker assembly is not more than distance above top of rail indicated in the Contract Documents.

3.04 PAINTING

- A. Touch up any damaged painted finish.

3.05 FIELD TESTS

- A. Make tests for proper operation and setting of lamp operating voltages in accordance with Section 18600, Signal Systems Testing.

END OF SECTION