

Construction and Material Requirements for Traffic Signal Installation

General Notes:

The Standard Specifications for State Road and Bridge Construction (2015) published by the Kansas Department of Transportation is referenced throughout these Standard technical Specifications and is referred to as the "KDOT Standard Specifications". When referenced herein, "KDOT Standard Specifications" shall not include KDOT Special Provisions unless specific reference is made to a KDOT Special Provision.

Construction:

See KDOT Standard Specifications, Section 814, "Electric Lighting Systems and Traffic Signals".

The Contractor shall provide an employee with Level II certification in Traffic Signal Installation by the International Municipal Signal Association (IMSA) to be present at the job site at all times. In place of a IMSA certified employee, the supervisor on site must have 5 years of direct experience in the construction of traffic signals. Adequacy of supervisor's experience level shall be approved by the project manager or the Traffic Operations Manager for the City of Topeka, prior to bidding for the work.

The local power company shall be notified by the Contractor prior to beginning work to determine the proper type and method of hook up for the particular location. The Contractor shall be responsible for all costs associated with the power hook up, including conduit, lead-in wire, service pole, meter landing etc., regardless of whether these costs have been listed on the bill of materials.

Locations for the signal poles, pedestals, service boxes, junction boxes and loop detectors shall be staked by the contractor. Staked locations shall be approved by the Engineer prior to construction of each item.

The plan locations of existing underground utilities are approximate and have not been independently verified. The Contractor shall determine the exact location of all existing utilities before beginning work. The Contractor shall be responsible for all damages caused by contractor's failure to exactly locate and preserve all underground utilities. Companies or agencies that have identified utilities in the vicinity of the construction site are shown in the plans.

The Contractor is responsible for all field-wiring, including the power hook-up to the control cabinet. The Contractor shall be responsible for extending all field wiring into the traffic control cabinet with appropriate labels. All wiring inside the control cabinet shall be performed by the Traffic Signal Technician of the City. The Contractor shall conform to all pertinent OSHA (Occupational Safety & Health Administration) regulations.

Materials:

All materials used in the fabrication or assembly of the items listed below shall be new and shall comply with the applicable parts of Section 1703 (Electric Lighting and Traffic Signal Equipment) of the KDOT Standard Specifications.

All signs, signals and markings shall conform to the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

See Section 1607 (Structural Steel) and Section 1608 (Structural Steel Tubing) of the KDOT Standard Specifications for the basis of acceptance of materials covered by these sections. See Section 1615 (Anchor Bolts for Structural Uses) of the KDOT Standard Specifications for the basis of acceptance of Anchor Bolts for Traffic Signal poles. If Type B certification is not provided according to Section 2601 (Materials Certification) of the KDOT Standard Specifications, the Engineer may require testing of the Anchor Bolts. Anchor Bolts for Controller Cabinets and Traffic Signal Pedestals shall meet the requirements of the latest edition of the American Society for Testing Materials (ASTM) Specifications A36 (Specification for Structural Steel) and will be visually accepted by the Engineer.

Major items of electronic equipment installed under this Contract shall be of the same type and consist of products provided by the same supplier in order to secure uniformity, single responsibility, and most satisfactory services.

Traffic Signal Specifications

I. General

A. Traffic Signal Improvement Policies:

The work included in this project may involve replacement and/or modification of traffic signal equipment for an existing Traffic Signal that is also currently in operation. The following policies are to be observed during the proposed modifications/improvements:

- (1) Existing Operation - the Contractor shall provide continuous operation of the Traffic Signals during the signal modifications and improvements except for shutdowns to allow for alteration as required for installation of the proposed improvements.
- (2) Periods of Disruption - some periods of disruption of existing Traffic Signal operation can be tolerated during installation of the proposed improvement; however, the Contractor shall coordinate any planned disruption of Signal operations with the Engineer a reasonable time in advance of such disruption of operations.
- (3) Disruption Times - planned disruption of signal operations shall be limited to hours between 9:00 am and 4:00 pm. The Signal controls shall be operable during all other periods.
- (4) Existing Wiring - all existing wiring within existing controller cabinets shall be identified by the Contractor and each conductor shall be properly labeled prior to de-energizing the existing controller to install the proposed modifications and improvements.

B. Salvaged Equipment:

- (1) Reinstalled - when salvaged equipment is to be reinstalled, the Contractor shall furnish and install all necessary materials and equipment including anchor bolts, nuts, washers, concrete etc. required to compliment the salvaged equipment in the new installation.
- (2) Not Reinstalled - when salvaged equipment is not to be reinstalled, they may be stored on site temporarily. The stored equipment shall be the responsibility of the Contractor until the Contractor delivers these to the City's Traffic Operations Section located at 927 NW Harrison Street.
- (3) Removal of Existing Bases - existing bases for traffic signal poles, pedestals, and controllers shall be removed a minimum of 24" below finish grade.
- (4) Service Boxes and Junction Boxes in turf areas shall be completely removed. Holes are to be filled and compacted with select soil. Junction Boxes in paved areas shall have lid and wiring removed and filled with concrete or asphalt.
- (5) After completion, wiring shall be removed if possible and conduit shall be abandoned in place.

C. Turn On:

- (1) System Turn-on - the signal system turn-on shall not occur on Fridays, weekends, or holidays and shall be completed prior to 3:00 pm on the day of the turn-on.
- (2) Supplier Representative - the supplier of control equipment shall have a representative present at the signal system turn-on.
- (3) A city signal technician will be present at turn-on. Call 785-368-3913 to arrange. Should turn-on takes longer than one hour due to Contractor error, the Contractor will be billed for the additional time at \$50.00 per hour.
- (4) When signals are replacing Stop signs, Traffic Signal will normally flash three days or as directed by the Engineer. "Turn-on" is considered when the signal goes into normal operation.

D. Guarantee:

All equipment furnished on a project by the Contractor shall be guaranteed against any imperfections in workmanship and materials. Should any defect develop under normal and proper operating conditions during a 30 day testing period following completion of all electrical apparatus hook-ups and prior to acceptance by the city, this malfunction shall be corrected by and at the expense of the Contractor, including all labor, materials and associated costs. The customary Manufacturer's Warranties shall be assigned to the maintaining agency.

II. 2070 Traffic Signal Control Systems

A. Vehicle Actuated Solid State Traffic Signal Controller:

- (1) The Traffic Signal Controller shall be a Model 2070L Advanced Transportation Controller (ATC).
- (2) The Traffic Signal Controller shall conform to the California Department of Transportation's "Transportation Electrical Equipment Specification (TEES), dated August 16, 2002, and as amended on October 27, 2003 and June 8, 2004".
- (3) TEES, Chapter 1, Section 2 - 9 shall be followed for the documented controller type.
- (4) The Traffic Signal Controller shall be version 2070 Lite unit. The Controller shall be physically compatible with 170E Controllers and cabinet facilities (covered in TEES, Chapter 9, Section 1).
- (5) The Controller Assembly shall consist of the following modules:
 - (a) 2070-1B: one circuit board CPU module (TEES, Chapter 9, Section 2)
 - (b) 2070-2A: Field I/O module for 170 cabinets with C1S, C11S and C12S (TEES, Chapter 9, Section 3; Chapter 10, Section 3)
 - (c) 2070-3B: Front Panel Module - 8x40 LCD display with two keypads (TEES, Chapter 9, Section 4)
 - (d) 2070-4A: 10 amp power supply module (TEES, Chapter 9, Section 5).
 - (e) 2070-7A: Serial communications module (TEES, Chapter 10, Section 2). Each Controller assembly shall have 2 of these modules installed.
- (6) Each Traffic Signal Controller shall be delivered with Local/Master Intersection Firmware installed. The Firmware shall be the latest version of Econolite's Oasis 2070 Master/Local with V-link Controller Firmware.
- (7) Connections - electrical connections from the Controller to the outgoing and incoming circuits shall be made by inserting multi-terminal plugs (MS type) into the associated plug receptacles, incorporated in the mounting frame or power supply panel. The Controller shall be replaceable with a similar unit without the necessity of disconnecting and reconnecting individual wires.
- (8) Voltage - the Controller System shall be designed to operate within the power range of 95 to 135 volts single phase AC at 60 Hz and in the temperature range of -30°F to +165°F.
- (9) Flasher - a solid-state, two circuit, jack-mounted flasher with a rated load of 15 amp per circuit shall be supplied. Where additional load is required, more than one flasher will be provided. The flasher shall flash at the rate of 50 to 60 flashes per minute and be filtered, if required to prevent radio interference. The transfer from the controller to the flasher shall occur at the beginning of the major street green indication.
- (10) Relays - when flashing relays are de-energized, the relays shall transfer signal light circuits from the controller unit to the flasher, permitting flashing yellow on the major street or highway and flashing red to be displayed on the minor street and at all left turn lane signals.

B. Power:

- (1) Conductor -Power Lead-in wire for intersection signalization shall be No. 6 American Wire Gauge single conductor cable for operation on a 600 volt maximum, and suitable for use at conductor temperatures not exceeding 165° F. Material, construction and tests shall be in accordance with the applicable requirements of the latest edition of the Insulated Power Cable Engineers' Association Standard S-66-524 (Cross-Linked-Thermoplastic-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy)
- (2) Copper Wire - Conductors shall be stranded, annealed coated copper wire. Before insulating or stranding, the copper wire shall meet the requirements of the latest edition of the American Society for Testing and Materials (ASTM) Standard B33 (Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes) for Coated Wire. Stranding shall be Class B, in accordance with the latest edition of ASTM B8 (Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard or Soft).
- (3) Insulation - Insulation shall consist of cross-linked Thermosetting Polyethylene, meeting the requirements of Column A of the Insulated Power Cable Engineers' Association and listed by the Underwriters' Laboratory as Type U.S.E. RHW - 165° F.

- (4) Service Circuit Breakers - the Contractor shall provide circuit breakers as shown on the plan for secondary power drop. The circuit breakers shall be single pole, molded case, of the size and trip rating as shown on the plan. The circuit breakers shall be provided in a suitable watertight enclosure provided with a hasp for a padlock. Padlock will be provided by others.
- (5) Grounding - all traffic signal poles, pedestals, controller cabinets and service circuit breakers shall be grounded by means of a no. 6 American wire gauge solid bare copper wire bolted to the inside of these devices with a half inch internal ground lug. All ground wires shall be attached by means of a ground clamp to a copper-clad steel rod. The ground rod shall be 5/8 inch diameter and 8 feet long. Ground rods at pole bases shall be a minimum of 2 feet from the pole base and a minimum of 1 foot below the ground surface.
- (6) Color Coding - all detector wires and cables shall be color coded according to one of the following methods: the method approved by the IMSA or method one for 2010 as approved by the insulated Power Cable engineers' association.
- (7) Excess Cable - a minimum of 6 feet of excess signal and detector lead-in cable shall be coiled in each service box.
- (8) Pole Wiring - each signal head shall have a separate run of signal cable from the terminal block in the pole to the signal head.

C. Multi-Conductor Cable:

- (1) General - all Conductor cable for intersection signalization and interconnection shall be No. 14 American Wire Gauge multi-conductor cable for operation on a 600 volt maximum, and suitable for use at conductor temperatures not exceeding 167° F. Material, construction and tests shall be in accordance with the applicable requirements of the latest edition of the International Municipal Signal Association Specification 19-1 for Polyethylene-insulated, Polyvinyl chloride signal cable.
- (2) Alternate - as an acceptable alternate, the Contractor may use multi-conductor, stranded cable meeting the requirements of the latest edition of the Insulated Power Cable Engineers' Association, Standard S-61-402 (thermoplastic insulated wire and cable for the transmission and distribution of electrical energy), and as follows:
 - (a) Stranding - Conductors shall be stranded, annealed uncoated copper or annealed coated copper. Copper wire, before insulating or stranding, shall meet the requirements of the latest edition of the American Society for Testing and Materials (ASTM) B33 (Specification for Tinned soft or Annealed Copper Wire for Electrical Purposes) for coated wire or ASTM B3 (Specification for soft or Annealed Copper Wire) for uncoated wire. Stranding shall be Class B, in accordance with the latest edition of ASTM B8 (Specification for Concentric-Lay-Stranded copper conductors, hard, medium hard or soft).
 - (b) Insulation - Insulation for the individual conductors shall consist of a 20 mil thickness of polyethylene and an insulation covering of polyvinyl chloride compound with a 10 mil thickness.
 - (i) Polyethylene - the polyethylene insulation shall meet the requirements of paragraph 3.9 of the latest edition of the Insulated Power Cable Engineers' Association Standard S-61-402 (Thermoplastic Insulated Wire and Cable for Transmission and Distribution of Electrical Energy) before application to the conductor, and paragraph 3.91 after application to the conductor.
 - (ii) Polyvinyl Chloride - the polyvinyl chloride insulation covering shall meet the requirements of Paragraph 4.3.1 of the latest edition of the Insulated Power Cable Engineers' Association Standard S-61-402 (Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy).
 - (c) Jacket - the overall Cable Jacket shall consist of a Polyvinyl Chloride compound which will provide a tough heat, moisture, ozone and flame resistant covering meeting the requirements of Paragraph 4.3.1 of the latest edition of the Insulated Power Cable Engineers' Association Standard S-61-402 (Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy).
 - (d) Jacket Thickness - the overall Jacket thickness shall be in accordance with Table 18, Part 4 of the latest edition of the Insulated Power Cable Engineers' Association Standard S-61-402 (Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy).

D. Detector Loop Wire:

- (1) General - the Conductor shall be soft drawn copper wire with Class C stranding per the latest edition of the American Society for Testing and Materials Specification B8 (Specification for Soft Annealed Copper Wire). The wires shall have Polyvinyl

					DRAWN BY: Shoeb Uddin.
4	10/30/20	MAJOR REVISONS	SU	KRE	APP'D BY: Kristi Ericksen.
3	3/25/09	ADDED OSHA NOTE UNDER "CONSTRUCTION"	CDR	LGV	
2	2/22/08	UPDATE TRAFFIC SPECIFICATIONS	KAP	LGV	
1	9/4/07	ADDED NOTE C-3 (TURN-ON)	CDR	LGV	
NO.	DATE:	REVISION	BY:	APP'D	



**STANDARD DETAILS
DT - 106**

**TRAFFIC SIGNAL
SPECIFICATIONS**

DATE: _____

PAGE: _____ OF _____

PROJECT: _____