

SECTION 661 TEMPORARY TRAFFIC SIGNALS AND TEMPORARY RAMP METERS

661.1 Description

- (1) This section describes furnishing, installing, maintaining, and removing bridge and intersection temporary traffic signals, and temporary ramp meters.

661.2 Materials

661.2.1 General

- (1) Furnish control cabinet, signal controller, and control equipment. Provide a cabinet with a Corbin #2 door lock and an access door that allows placing the controller in emergency flash. Provide keys to the access door to the engineer and law enforcement agencies as required. Supply a controller capable of executing the timing program supplied in this contract for this temporary traffic signal. The department may request changes to the timing intervals during the project as required by construction or traffic conditions. Make all engineer-requested changes within 24 hours.
- (2) If furnishing a digital controller, include a NEMA monitor. Test the monitor with an automated programmed testing system. Test monitor annually if used for more than one year. This test verifies that the monitor complies with the intersection requirements. Attach to the monitor a verification print out tape of the test, and provide a copy to the authority having jurisdiction of the intersection.
- (3) Furnish and install the temporary electrical service for temporary traffic signals according to the requirements of the applicable electrical utility. Provide an affidavit to the electrical utility in a timely manner so the electrical utility can schedule service turn on. If the control cabinet is not mounted on the electrical service pole, add a second electrical service disconnect to the outside of the control cabinet for the convenience of emergency personnel. If required, install the electrical service.
- (4) The contractor may furnish used traffic signal faces approved by the engineer before installation. Ensure that used equipment is clean, sound, free of holes or cracks, and watertight. Ensure that lens clarity is not compromised or, if using LED modules, that they conform to [658.2.3.2](#).

661.2.1.1 Wood Poles, Class 4

- (1) Furnish jack pine, Norway pine, or western red cedar poles conforming to ANSI 05.1.
- (2) Trim or shave poles by machine or hand to leave a smooth surfaced pole exterior.
- (3) Use marking code letters to provide the minimum information as follows: supplier's name or trademark, plant location and year of treatment, code letters denoting the pole species and preservative used, and class numeral and pole length. The engineer may refuse the pole upon inspection depending on the physical condition of the pole.
- (4) Burn above information legibly, permanently, and squarely on the face of each pole, 10 feet +/- 2 inches from the butt of each pole. Make these letters not less than 5/8 inch high.
- (5) Brand, hammer-stamp, or die-stamp these same 4 items into the bottom of each pole butt. Make these letters not less than 5/8 inch high. Attach a metal tag with these same 4 items to the wood pole.
- (6) Provide a definition sheet explaining all code letters and numbers to the engineer.

661.2.1.2 Cable

- (1) For traffic control cable, furnish 600 volt AC 14 AWG, solid copper conductor, according to IMSA 20-1.
- (2) Wire sizes called for under the various Cable bid items are minimum requirements; the department will determine if larger wire size is needed to keep the voltage drop below 5 percent.

661.2.1.3 Guy, Span, and Messenger Wire

- (1) Furnish 3/8-inch nominal diameter, 7-strand, zinc-coated steel wire conforming to ASTM A475, with a utility grade breaking strength of 15,400 pounds.

661.2.1.4 Guy, Span, and Messenger Wire Mounting Hardware

- (1) Furnish engineer-approved hardware consisting of the following: machine bolts, 1 1/2-inch curved square washers, straight to angle thimbleye bolts, thimble eyenuts, angle thimbleye eyes, ovaleye bolts, standard eye nuts, twisted loop dead-end grips, 3 bolt guy clamps, bolted deadends, serving sleeves, messenger hangers, drive hooks, sidewalk guy fittings, guy wire thimbles, guy strain insulators, guy safety markers, anchor rods, guy adapters, expanding anchors, and screw anchors.

- (2) Furnish 5/8-inch minimum diameter bolts with square nuts. For eye hardware, use dropforged steel. Use galvanized metal hardware.
- (3) For straight-line bolted deadends, furnish malleable iron with steel hardware and a minimum breaking strength of 11,500 pounds. Fasten to the span pole using an ovaleye bolt.
- (4) For twisted loop dead-end grips, furnish the same material as specified in [661.2.1.3](#). Use grips with a nominal diameter of 3/8 inch that accommodate 7-strand wire and have a minimum breaking strength of 11,500 pounds.
- (5) Furnish 3 bolt guy clamps having a minimum breaking strength of 11,500 pounds.
- (6) For guy strain insulators, furnish ANSI class 54-2 insulators with maximum wire diameter of 1/2 inch and minimum tensile strength of 12,000 pounds.
- (7) Separate sidewalk guy fittings by no more than 6 feet of 2-inch rigid metallic galvanized conduit. Attach the pole plate to the pole with one 5/8-inch machine bolt and two 1/2-inch by 4-inch minimum lag bolts.
- (8) For guy safety markers, use yellow or orange plastic a minimum of 7 feet long.
- (9) For anchor rods, furnish 5/8-inch minimum diameter rods with a minimum breaking strength of 11,500 pounds.
- (10) Use expanding anchors having a minimum expanded area of 125 square inches.
- (11) Use screw anchors having a minimum helix area of 78 square inches 10-inch diameter with a minimum rod diameter of 1 1/4 inches and 66 inches long.

661.2.1.5 Tether and Messenger Wire

- (1) Furnish 1/4-inch nominal diameter, 7-strand, zinc coated steel tether wire conforming to ASTM A475 with common grade breaking strength of 1900 pounds.

661.2.1.6 Temporary Traffic Signal Control Cabinet Base

- (1) Furnish a 3/4-inch by 4-foot by 6-foot sheet of exterior grade plywood for the base. Provide wooden stringers 4-inch square by a specified length as needed. Seal bases to prevent rodents from entering the cabinets.

661.2.1.7 Control Cabinet Approval

661.2.1.7.1 Department Maintained

- (1) Deliver cabinet assemblies for temporary signal operation to the department's electrical shop for testing. The shop is located at:
 - 3625 Pierstorff Street
 - Madison, WI 53704
- (2) Deliver the complete cabinet, including the controller, cabinet accessories, complete wiring diagrams, and related documentation, ready for installation in the field. Provide and deliver with the cabinet all required appurtenances to test the full functionality of the cabinet assemblies. If the department requires, demonstrate to, and instruct the department personnel in the use of all testing appurtenances. Contact the department's representative 48 hours before delivery to confirm delivery dates and times. The department will examine and test the cabinet assembly for up to 3 days, after which the contractor shall pick up the assembly. If the department finds that the assemblies are defective or unsuitable, or if the quality does not conform to acceptable standards, remove the unacceptable cabinet, correct all deficiencies, and deliver revised assemblies to the department as specified above. Do not install any assembly until it receives department approval.

661.2.1.7.2 Non-Department Maintained

- (1) Submit a certificate of compliance from the contractor or company that wired the cabinet certifying that the cabinet and equipment conform to the contract. Ensure that the certificate of compliance is on company letterhead, signed by an authorized company official, and is notarized. Submit copies to the region and to the department electrical engineer.
- (2) Demonstrate to the engineer that the installed controller is programmed and functions as designed, electronic components are in proper working condition, and the installation conforms to the contract.

661.2.2 Temporary Traffic Signals for Intersections

661.2.2.1 Tether Wire Mounting Hardware

- (1) Furnish galvanized wire rope tether wire clips, drive hooks, serving sleeves.

661.2.2.2 Signal Faces

- (1) Furnish the housing, visor, optical units, lenses, reflectors, and lamp receptacle conforming to ITE standards for adjustable face vehicle traffic control signal heads.
- (2) Furnish traffic signal lamps conforming to ITE standards for traffic signal lamps.

661.2.2.3 Span Wire and Tether Wire Signal Head Mounting Hardware

- (1) Furnish only fittings designed for span wire mounting applications. The contractor may also use these fittings for the tether wire connection, or the contractor may use a tether clamp assembly. Use hardware of unpainted aluminum or that is federal yellow in color. For traffic signal head mounting lock nuts, use 1 1/2-inch hexagon, galvanized malleable iron. Use nuts 1/2 inch thick and measuring 2 1/2 inches across flat to flat.
- (2) Use reinforcement plates, stiffener plates, or both, as the signal head manufacturer recommends.

661.2.3 Temporary Traffic Signals for Bridges

- (1) Furnish 4 x 6 wood posts conforming to [section 634](#).
- (2) Furnish LED modules as specified in [658.3.2](#).
- (3) Furnish mounting hardware referenced in [661.2.1.4](#), properly sized for wire diameter being used.
- (4) Furnish traffic signal mounting hardware as specified in [658.2.1](#).
- (5) If mounting the control cabinet to a wood pole or post, mount it with two 3/8-inch by 3-inch lag bolts.

661.2.4 Temporary Ramp Meters

661.2.4.1 Cable

- (1) For signal current carrying neutral condition, furnish 10 AWG, rated USE, RHH, RHW, copper single conductor, 600 volt AC, cross-linked polyethylene insulated. Ensure that the 10 AWG USE current carrying neutral wire is white in color.

661.2.4.2 Span Wire and Tether Wire Signal Head Mounting Hardware

- (1) Furnish fittings designed for span wire mounting applications. The contractor may also use these fittings for the tether wire connection, or the contractor may use a tether clamp assembly. Use hardware of unpainted aluminum or that is federal yellow in color. For traffic signal head mounting lock nuts, use 1 1/2-inch hexagon, galvanized malleable iron, class 150 pipe fitting. Use nuts 1/2 inch thick and measuring 2 1/2 inches across flat to flat.
- (2) Use reinforcement plates, stiffener plates, or both, as the signal head manufacturer recommends.

661.2.4.3 Splice Box

- (1) Furnish PVC or metal with a minimum size of 8 X 6 X 4-inch. Use a waterproof box with a hinged cover.

661.2.4.4 Signal Faces

- (1) Furnish the housing, visor, optical units, lenses, reflectors, and lamp receptacle conforming to ITE standards for adjustable face vehicle traffic control signal heads.
- (2) Furnish traffic signal lamps conforming to ITE standards for traffic signal lamps.

661.2.4.5 (Vacant)

661.3 Construction

661.3.1 General

- (1) Perform work according to the WSEC. Provide and install wood poles, posts, tether wire, messenger wire, tether wire hardware, messenger wire hardware, guy wire, span wire, guy wire hardware, and span wire hardware, traffic signal cable, traffic signal faces mounting hardware, electrical service, traffic signal faces, traffic signal faces with backplates, including providing, installing, and programming the controller with control cabinet as the plans show.
- (2) Request a signal inspection of the complete temporary traffic signal installation. Make this request to the engineer at least 3 working days before the requested inspection. Department region electrical personnel will perform the inspection.

- (3) The engineer will not grant turn on approval until the contractor corrects all discrepancies.

661.3.1.1 Wood Poles, Class 4

- (1) The engineer will determine final pole positions after marking the utilities.
- (2) Place the pole in the ground to no less than 1/5 of the pole's length as the plans show.
- (3) Remove all loose materials from the hole before setting the pole. Tamp all bank run gravel backfill every foot of fill. Before attaching span wires or messenger wires, rake all poles one foot at the top of the pole and guy if needed.
- (4) Review the plans before pole installation to ensure adequate pole height.

661.3.1.2 Wire and Cable

- (1) Ensure traffic signal cables and lighting cable contain the number of conductors indicated on the traffic signal wiring diagrams.
- (2) Attach all cables to the span wire or messenger wire, at 3-foot or less intervals with 4 wraps of a department-approved adhesive tape or UV resistant, outdoor rated nylon lock fasteners.
- (3) Install all cable in continuous lengths without splices in any cable run. Only splice cable on the pole. If any opening in the insulation occurs other than the end of the wire or cable, replace the wire or cable.
- (4) Make splices using a twist locked, wire nut, type connection. Point the spliced conductors upward and cover with plastic. Place the splice a minimum of 11 feet above finished grade level.
- (5) Feed all traffic signal cables to signal faces as the detail drawings show.
- (6) If anticipating freezing weather during the term of this contract, use weatherproof splice boxes.

661.3.1.3 Temporary Traffic Signal Control Cabinet Base

- (1) Attach the plywood to the stringers with nails or lag bolts. If using lag bolts, countersink the washer and the bolt head flush with the plywood surface. Arrange stringers to be underneath all 4 sides of the cabinet.
- (2) Secure the cabinet base using an anchor mounted on each corner and make flush with the top of the temporary cabinet platform.
- (3) For anchors, use 4-inch by 4-inch wood post, or a galvanized 1 5/8-inch by 1 5/8-inch channel with a minimum length of 3 feet. Secure the anchors to the cabinet base with lag bolts.

661.3.1.4 Maintenance

- (1) Maintain all minimum and maximum heights to the signal faces as the plans show. Verify the span heights throughout the project duration.
- (2) Place all signal faces as the plans show. Make every effort to give maximum visibility to all signals intended for view by the motoring public.
- (3) Provide the name, address, and telephone number of the persons qualified and assigned to maintaining the temporary traffic signal to the engineer, local police, and county sheriff, also, post this information on the temporary traffic signal control cabinet, and cover with weatherproof material. Ensure this persons is available 24 hours a day, 7 days a week, from the start of the project until the temporary traffic signal is not needed. Ensure that emergency calls are received by an individual and not by an answering machine.

661.3.2 Temporary Traffic Signals for Intersections and Temporary Ramp Meter

661.3.2.1 Tether Wire Mounting Hardware

- (1) Form loops on the end of the tether wire, hook over drive hooks, and hold in place using wire rope tether clips. Secure loose tether wire ends using serving sleeves.

661.3.2.2 Tether Wire

- (1) Keep all tether wire free of splices or kinks.
- (2) Install the tether wire at 17 feet to 19 feet over the roadway.
- (3) Install the tether wire in direct vertical alignment with the guy wire.
- (4) If no signal heads are attached between the span wire and tether wire, attach a tension control cable. Use the tension control cable to maintain minimum height. Use a tension control cable consisting of tether wire and wire rope tether wire clips. Use 1/4-inch galvanized U-bolts on both ends, top and bottom, of the tension control cable to prevent movement.

661.3.2.3 Wire and Cable

- (1) Ground all metallic parts including span, tether, and guy wire with hardware, light arms and luminaires, splice boxes and pole guards. Ground each electrically isolated assembly at one end by mechanically attaching (lug or split bolt) the equipment-grounding conductor (6 AWG stranded copper wire) that terminates at a 5/8-inch by 8-foot. grounding electrode installed at the wood pole base. For the equipment-grounding conductor use an exothermic weld or clamp to the grounding electrode. Ensure all grounding hardware is UL or NRTL listed.

661.3.2.4 Span Wire

- (1) Install the span wires free of any splices or kinks. Install the span wire mounted signal faces so the bottom is a maximum of 19 feet above the roadway (minimum height is 17 feet). Compute the vertical height of the span wire on the span pole using the following formula:

$$\mathbf{HD (0.05) + RC + HH = SH}$$

- (2) HD equals the horizontal distance between the span poles.
- (3) RC equals the roadway clearance. If lowering the proposed roadway under the span wire, use minimum clearance over the roadway value.
- (4) HH equals the head length (height) including all span wire mounting hardware.
- (5) SH equals the span wire height above the roadway.
- (6) To use the value SH from the formula, mark from the elevation of the roadway on the span pole and measure up the pole the distance SH from this mark. This is where the top span wire should dead end on the span pole.
- (7) Review the plans before pole installation to ensure adequate pole height due to grade changes.

661.3.2.5 Span Wire and Tether Wire Signal Head Mounting Hardware

- (1) Support each signal head by a span wire-mounting bracket and attach to the tether wire.
- (2) Feed all span wire signals through the top span wire-mounting bracket. Provide sufficient cable slack to enable moving the signal head along the span as the engineer directs. Neatly coil and attach the extra signal cable to the upper span wire until it is needed.
- (3) Mount the heads vertically and plumb.

661.3.2.6 Implementation and Removal

- (1) Before activating the temporary traffic signal or temporary ramp meter, verify the signal indications and operation of the signal to the engineer.
- (2) Upon acceptance of new signal and completion of work, the department will switch control of the intersection over to the permanent cabinet installation. Remove all signal cable and wires, wood poles, wood posts, control cabinet, control equipment, and incidental materials. Upon deactivation of the controller, call the electrical utility immediately for the temporary electrical service disconnect.
- (3) Remove the temporary traffic signal faces the same day the permanent traffic signal is turned on.
- (4) Immediately remove the wood poles and wood posts obstructing the view of the new permanent signal faces. Remove remaining wood poles and wood posts within 3 working days of new permanent signal activation.
- (5) Immediately after removing the wood poles and wood posts, backfill the holes, compacting every 12 inches with engineer-approved material.

661.3.2.7 Maintenance

- (1) Correct lamp outages within 24 hours of the reported outage.
- (2) Respond within one hour of notification to provide corrective action to any emergency such as but not limited to knockdowns, signal cable problems, and all controller equipment failures. If equipment becomes damaged or faulty beyond repair, replace it within one working day. In order to fulfill this requirement, maintain, in stock, sufficient amounts of materials and equipment to provide repairs. Replace the traffic signal control equipment including the cabinet, controller, and cabinet accessories within 4 hours.
- (3) All far through indications suspended on the span wire shall be located above the center of the controlled lane. The far right signal shall be mounted over the center of the right through lane. The far left turn signals shall be suspended straight ahead of the left turn lane.

661.3.3 Temporary Traffic Signals for Bridges

661.3.3.1 General

- (1) If the contract requires attaching the support cable to a bridge, protect the cable with rigid nonmetallic conduit.
- (2) If using trailer mounted traffic signals from the department's approved products list, provide a battery power supply with a solar powered charging system and a backup power source. Do not use gasoline powered equipment.
- (3) Maintain and operate the generators on a 24-hour a day, 7 days a week basis. This includes having a responsible contact person respond to the project site, within 1/2 hour of receiving a call, for any emergency to the electrical supply system.
- (4) If the temporary traffic signal is not operable, provide flaggers until normal operation resumes.
- (5) Furnish the electrical cable and the required electrical connections, conforming to the WSEC, to connect the generators to the temporary traffic bridge signal. The engineer will determine the location of the generators in the field.

661.3.3.2 Messenger Wire

- (1) Use 1/4-inch wire as specified in [661.2.1.5](#) or 3/8-inch wire as specified in [661.2.1.3](#).

661.3.3.3 Messenger Wire Hardware

- (1) Use dead-end hardware sized for the messenger wire used as the plans show.

661.3.3.4 Wood Posts

- (1) The engineer will determine final postpositions after marking the utilities.
- (2) Place 4 x 6 wood posts in the ground to no less than 1/5 of the post length or as the engineer directs.
- (3) Remove all loose materials from the hole before setting the post. Tamp all bank run gravel backfill every foot of fill.
- (4) Review the plans before post installation to ensure adequate post height.

661.3.3.5 Implementation and Removal

- (1) Before activating the bridge temporary traffic signal, verify the signal indications and operation of the signal to the engineer.
- (2) Upon completing the repair work on the bridge, and if the engineer determines the bridge temporary traffic signal is no longer needed, remove the signal cable, messenger wire, wood poles, wood posts, control cabinet, control equipment, and incidental materials. Upon deactivation of the controller, call the electrical utility immediately for the temporary electrical service disconnect.
- (3) Immediately after removing the wood poles and wood posts, backfill the holes with engineer-approved material. Compact the material in 12-inch lifts.

661.3.3.6 Maintenance

- (1) Immediately correct all LED outages.
- (2) Respond within one hour of notification to provide corrective action to any emergency such as but not limited to knockdowns, signal cable problems, and all controller equipment failures. If equipment becomes damaged or faulty beyond repair, replace it. In order to fulfill this requirement, maintain, in stock, sufficient amounts of materials and equipment to provide repairs. Replace the traffic signal control equipment including cabinet, controller, and cabinet accessories within 2 hours.

661.3.4 Temporary Ramp Meter

- (1) Notify the engineer 10 days before starting any temporary ramp meter work. The engineer will notify the region freeway operations personnel who will verify ramp timings and validate communications.
- (2) Load the timing parameters into the controller the department provides.
- (3) Minimum mounting height of the box is 11 feet. Ground splice box if made of metal.

661.4 Measurement

- (1) The department will measure the Temporary Traffic Signals for Bridges, Temporary Traffic Signals for Intersections, and Temporary Ramp Meter bid items as a single lump sum unit for each structure or intersection acceptably completed.

- (2) The department will measure Generators by the day acceptably completed, based on a 24 hours per day operation.

661.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
661.0100	Temporary Traffic Signals for Bridges (structure)	LS
661.0200	Temporary Traffic Signals for Intersections (location)	LS
661.0300	Generators	DAY
661.0700	Temporary Ramp Meter (location)	LS

- (2) Payment for the Temporary Traffic Signals for Bridges, Temporary Traffic Signals for Intersections, and Temporary Ramp Meter bid items is full compensation for providing, operating, maintaining, and repairing the complete temporary installation; and for removal. Payment also includes the following:

1. Furnishing and installing replacement equipment.
2. All utility charges for installation, disconnection, and energy service through project completion.
3. The cost of delivery and pick-up of the cabinet assemblies for department testing.

- (3) Payment for Generators is full compensation for providing, maintaining, and operating generators, including fuel and oil; for providing and locating a backup generator at the site; and for providing flaggers if required.