

SECTION 13552

RAMP METER SIGNALS AND SIGNING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install ramp meter signals and signing.
- B. Test the Ramp Meter System after installation.

1.2 RELATED SECTIONS

- A. Section 02891: Traffic Signs
- B. Section 02892: Traffic Signal.
- C. Section 03055: Portland Cement Concrete
- D. Section 03211: Reinforcing Steel and Welded Wire
- E. Section 13551: General ATMS Requirements
- F. Section 13553: ATMS Conduit.
- G. Section 13554: Polymer Concrete Junction Box
- H. Section 13555: ATMS Cabinet
- I. Section 16525: Highway Lighting.

1.3 REFERENCES

- A. AASHTO M 31M: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- B. AASHTO M 111: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.

- C. AASHTO M 284M: Epoxy Coated Reinforcing Bars.
- D. AASHTO Standard Specifications for Highway Bridges.
- E. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.
- F. American Iron and Steel Institute.
- G. American National Standards Institute (ANSI)
- H. ASTM A 153: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- I. ASTM A 307: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- J. National Electric Code (NEC).
- K. UL 510: Polyvinyl chloride, Polyethylene, and Rubber Insulating Tape

1.4 SUBMITTALS

- A. Two copies of the following to the Engineer 15 days after receiving a Notice to Proceed:
 - 1. List of equipment and materials (name of manufacturer, size, and identification number).
 - 2. Detailed shop drawing, wiring diagrams, and certifications.
 - 3. All manufacturers' warranties, guarantees, instruction sheets, and parts lists.
 - 4. Submit a testing plan to the Department for approval. Local Field Operations testing is performed prior to opening of all lanes to live traffic.
- B. Samples of materials to the Engineer for approval when requested.
- C. Results of all tests conducted.

1.5 ACCEPTANCE TESTING

- A. Conduct a Detector Loop Circuit Test per Section 02892, Part 1, article: Acceptance Testing, paragraph A. Submit Detector Loop Circuit Test to the Engineer for acceptance.

- B. Perform the following Local Field Operations Test. After all ramp meter elements, equipment and hardware, power supply, and connecting cabling have been installed, demonstrate the following:
 - 1. Conduct and document a local field operation test demonstrating that all hardware, cables, and connections operates correctly and in conformance with the manufacturer's requirements.
 - 2. Verify the power supply voltages and the functionality of the cabinet fans and heaters.
 - 3. Verify the ability of the controller to properly process lane volume, occupancy, and speed for each detection zone indicated in the plans.
 - a. Required accuracy for vehicle speed as recorded by the controller: +/- 3 mph.
 - b. Speed data is not required for ramp meter detection zones, and for entrance and exit ramp detection zones located on ramps originating or terminating at a crossroad intersection.
 - 4. Use test vehicles physically passing through the detection zones of any non-live lanes to simulate live traffic conditions.
 - a. Do not perform test until the Department has approved the testing plan.
 - b. Supply any necessary test vehicles if the testing is performed prior to opening of lanes to live traffic.
 - 5. Verify visually that each ramp meter detection zone properly registers a call to the controller when a vehicle passes through the detection zone.
 - a. Supply test vehicle if the testing is performed prior to opening of ramp meter to live traffic.
 - b. Verify that all entrance and exit ramp detection zones have been properly located in relation to the stop bar and crossroad, as indicated in the plans.
 - 6. Verify that:
 - a. All ramp meter signal heads and all advanced flashing beacon and meter-on signs properly respond to activation and deactivation control from the controller.

- b. Verify that all ramp meter signals and signs properly respond to metering plan changes from the controller.
 - 7. Perform testing after all construction for the site has been completed and final road surface has been constructed.
 - a. It is not necessary for the communications installation to be completed at the time of the test.
 - b. It is not necessary that all stations be locally tested concurrently.
 - c. Notify the Engineer 48 hours prior to testing. Submit written verification of testing results.
- C. Satisfy all additional testing requirements specific to the project.

PART 2 PRODUCTS

2.1 GENERAL

- A. Use electrical components as listed and defined by the NEC.

2.2 FOUNDATION

- A. Concrete: Class AA(AE) Concrete. Refer to Section 03055.
- B. Reinforcing Steel: Coated steel. Refer to Section 03211.

2.3 RAMP METER SIGNAL ASSEMBLY

- A. Signal Pole: Section 02892, Article: Signal Pole and Traffic Signal Light Support Arm; Standard Drawing SL-5.
- B. For 12 inch signal heads: Section 02892, Article: Traffic Signal Head, Paragraphs B through E. Louvered backplate required. Signal head housing: yellow.
- C. 8 inch 1 section signal head with red lens for enforcement. Signal head housing yellow. No backplate required.
- D. Regulatory Sign: R10-6; 24 inch x 36 inch.
- E. For 8 inch signal heads: Section 02892, Article: Traffic Signal Head. Louvered backplate required. Signal head housing yellow.

- F. 24 inch x 18 inch “1 VEHICLE PER GREEN” Sign: Standard Drawing AT-3.
- G. Foundation Concrete: Class A(AE) Concrete. Refer to Section 03055.

2.4 MAST ARM SIGNAL ASSEMBLY

- A. Signal Pole: Standard Drawing SL 1 and SL 2.
- B. For 12 inch signal heads: Section 02892, Article 2.5: Traffic Signal Head, Paragraphs B through E. Louvered backplate required. Signal head housing yellow.
- C. 60 inch x 36 inch “1 VEHICLE PER GREEN EACH LANE” Sign: Standard Drawing AT-3.
- D. Concrete: Class AA(AE) Concrete. Refer to Section 03055.
- E. Reinforcing Steel: Coated steel. Refer to Section 03211.

2.5 ADVANCE FLASHING BEACON SIGN

- A. Signal Pole: Section 02892, Article: Signal Pole and Traffic Signal Light Support Arm; Standard Drawing SL-5.
- B. Two-8 inch signal heads with yellow lens: Section 02892, Article: Traffic Signal Arm. Signal head housing: yellow. No backplate required.
- C. Warning Sign: W3-3, 30 inch x 30 inch.
- D. 30 inch x 24 inch black on yellow “METERING WHEN FLASHING” Sign: Standard Drawing AT-3.
- E. Foundation Concrete: Class A(AE) Concrete. Refer to Section 03055.

2.6 BOLTS AND NUTS

- A. Follow Section 02892, Article: Bolts and Nuts, Paragraphs A and B.

2.7 WIRE

- A. Follow Section 02892, Article: Wire, Paragraphs A through H.

2.8 DETECTOR CIRCUIT

- A. Follow Section 02892, Article: Detector Circuit, Paragraphs A through B.
- B. Consult the Engineer: Saw cut loops or pre-formed loops.

2.9 LUMINAIRE

- A. For luminaires installed on ramp meter signal pole, follow Section 02892, Article Luminaire, Paragraphs A through I.
- B. For luminaires not installed on ramp meter signal pole, refer to Section 16525.

2.10 GROUND ROD

- A. Copper-coated steel as specified.
- B. ANSI/UL 467.

2.11 MOUNTING BANDS AND BUCKLES

- A. As Specified.
- B. American Iron and Steel Institute, (AISI) Type 201.
- C. Universal Mounting Brackets for Signals mounted on mast arm.

2.12 STATE FURNISHED MATERIALS PICK UP

- A. Pick up all Department-furnished poles, anchor bolts, and signs at:
UDOT Complex
4501 South 2700 West
Salt Lake City, Utah 84114
- B. Contact Engineer at least 10 days prior to pick up.

PART 3 EXECUTION

3.1 PREPARATION

- A. Conform to the requirements of the NEC, current edition.
- B. Load, transport, and install all state-furnished materials per the manufacturer's instructions and as shown in the plans.
- C. Provide foundation, junction boxes, ground rod, grounding lug, conduit, signal heads, assemblies, and mounting devices, signs, and all additional equipment required for a complete and operational ramp meter system.
- D. Install all wiring, conduit, and junction boxes as shown on site plans and details.
 - 1. Field locate all conduits and junction boxes to avoid drainage areas and steep slopes whenever possible.
 - 2. Protect existing conductors while installing new conductors.
- E. Connect the controller and all wires as specified by the manufacturer.
- F. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, and electrical nuts, necessary to make the ramp meter system complete.
- G. After installation, the exterior of all equipment is free of all loose rust and mill scale, dirt, oil, grease and other foreign substances.

3.2 FOUNDATION

- A. All material and workmanship conforms to AASHTO's Standard Specifications for Highway Bridges.
- B. Prior to work, verify that the installation of the signal heads, mast arm, pole, and foundation in the location marked in the field has no conflict with existing utilities, underground and overhead. Comply with all utility and Blue Stakes requirements.
- C. Place Ramp Meter Signal Assemblies 2 ft downstream of the stop bar and 4 ft outside the edge of shoulder. For Ramp Signal Assembly Details, see Standard Drawing AT-5.

- D. Place Mast Arm Signal Assemblies 40 ft to 120 ft downstream of stop bar. For Mast Arm Details, see Standard Drawing AT-2.
- E. Place Advance Flashing Beacon Assembly 350 ft to 375 ft downstream of stop bar. For Flashing Beacon Details, see Standard Drawing AT-2.
- F. Excavation: Refer to Section 13551, General ATMS Requirements.
- G. Caissons conform to AASHTO Division II Section 5, Drilled Piles and Shafts. Caissons are drilled into either native soil or compacted fill.
 - 1. If formwork is required during drilling, the forms may be withdrawn during concrete placement.
 - 2. Cast the top of the caisson against the formwork for appearance.
- H. Place concrete directly into the excavation. Use minimum forming.
- I. Do not weld reinforcing steel, conduit, or anchor bolts; tie reinforcing steel and conduit securely in place.
- J. Coat all reinforcing steel to conform to AASHTO M284 or M111 and AASHTO M31M Grade 420, respectively. Coat the ends of cut reinforcing with approved epoxy coating.
- K. Use class AA(AE) for all cast-in-place concrete. Cap all conduits before placing concrete.
- L. Install weep hole in foundation per UDOT Standard drawing SL-4.

3.3 ANCHOR BOLTS

- A. Refer to Section 13551, General ATMS Requirements.

3.4 SIGNAL POLES

- A. Install the poles on new concrete bases. Apply rust, corrosion, and anti-seize protection at all threaded assemblies by coating the mating surfaces with an approved compound.
- B. Install pole with the hand hole facing away from traffic.

- C. Install ground rod per plans. NEC 250.
- D. All fasteners and attachment hardware for bands and other equipment: stainless steel.
- E. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, and electrical nuts, necessary to make the ramp meter system complete.
- F. Adjusting the anchor bolt nuts, plumb all steel poles to the vertical with all signal heads and signs installed.

3.5 INSTALL WIRING

- A. Follow Section 02892, Part 3, Article: Install Wiring, Paragraphs A through E.
- B. Mark cabinet cables with vinyl electrical color coding tape as specified in Table 1. Meet UL 510.

| TABLE 1 | | | |
|---------------------------------|----------------|---------------|------------------|
| Cables Marked with Colored Tape | | | |
| | Lane One | Lane Two | Lane Three |
| Ramp Meter Circuit | Blue | Red | Yellow |
| Detector Circuit | Blue | Red | Yellow |
| Advance Flashing Beacon Signal | Blue and White | Red and White | Yellow and White |

- C. Use Table 2 when connecting the conductors for ramp meter signal heads.

| TABLE 2 | |
|---------------------------|---|
| Color-Coded Conductors | |
| | All Lanes |
| Ramp Meter Signal Circuit | White- Neutral Red- Red indicative Green- Green indicative Blue- Enforcement (if present) or spare |

3.6 ADVANCE FLASHING BEACON SIGN

- A. Follow Section 02891, Traffic Signs.

3.7 RAMP METER SIGNAL ASSEMBLY SIGN

- A. Follow Section 02891, Traffic Signs.

3.8 INSTALL SIGNAL HEADS

- A. Do not install signal heads at the intersection until ready for operation.
- B. If turn on is not immediate, completely cover the signal heads with non-transparent, non-paper material tied securely around head.
- C. Install directed and veiled optically-programmed signals following the manufacturer's instructions. Mask each section of the signal with recommended manufacturer's materials.
- D. Use louvered back plates on those signal heads indicated. Use a minimum of four 0.12 inch stainless steel screws per section to mount the back plates, or according to manufacturer's instructions.
- E. Orient meter-on ramp signal toward vehicles approaching the intersection stop-bar. Side Signal Head: axis or indication parallel to roadway surface.

3.9 INSTALL DETECTOR LOOPS

- A. Follow Section 02892, Article: Install Detector Loops, Paragraphs A through F.
- B. For location of Presence and Discharge Loop, see Standard Drawing AT-5.
- C. For saw cut loops, consult the Engineer: circular or octagon shaped.

3.10 INSTALL LUMINAIRE

- A. Refer to Section 16525, Highway Lighting.

END OF SECTION