**SECTION 13552**

# RAMP METER SIGNALS AND SIGNING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Furnish and install conduit, junction boxes, wire, grounding, and foundations. Install all state furnished items. Includes all materials, labor, workmanship, equipment, testing, documentation, and incidental items required to install and test a complete and operational Ramp Meter system as shown on the plans and details.

### 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 13591: Traffic Monitoring Detector Loop

J. Section 16525: Highway Lighting

### 1.3 REFERENCES

A. AASHTO M 31: 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 284: Epoxy Coated Reinforcing Bars

D. AASHTO Division II, Section 5

E. AASHTO Standard Specifications for Highway Bridges

F. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

G. ASTM A 153: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

H. ASTM A 307: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

I. American Iron and Steel Institute (AISI)

J. American National Standards Institute (ANSI)

K. Manual on Uniform Traffic Control Devices (MUTCD)

L. National Electric Code (NEC)

M. Underwriters Laboratories (UL)

## 1.4 SUBMITTALS

A. Samples of materials to the Engineer for approval when requested.

B. Provide all of the following submittals as described in Section 13551:
   1. Contractor Furnished Material and Equipment Lists
   2. Test Reports for the Cable & Conductor Test, the Local Field Operations Test, and the Thirty-Day Burn-In Test
   3. Completion Notice
   4. Compliance Certificate
   5. Manufacturer's Equipment Documentation
   6. As-Built Drawings

C. Local Field Operations testing is to be performed prior to the opening of all lanes to traffic.

## PART 2 PRODUCTS

### 2.1 FOUNDATION

A. Concrete: Class AA(AE) Concrete (Refer to Section 03055).

B. Reinforcing Steel: Coated steel (Refer to Section 03211).

### 2.2 RAMP METER SIGNAL ASSEMBLY

A. Signal Pole: Refer to Section 02892 and SL series Standard Drawings.

B. For 12-inch signal heads: Refer to Section 02892. Louvered back plate required. Signal head housing: yellow.

C. 8-inch 1 section signal head with red lens for enforcement. Signal head housing yellow. No back plate required.

D. Regulatory Sign: MUTCD R10-6; 24-inch x 36-inch.

E. For 8-inch signal heads: Refer to Section 02892. Louvered back plate required. Signal head housing yellow.

F. 24-inch x 18-inch VEHICLE PER GREEN Sign: Refer to AT series Standard Drawings.

G. Foundation Concrete: Class A(AE) Concrete (Refer to Section 03055).

### 2.3 MAST ARM SIGNAL ASSEMBLY

A. Signal Pole: Refer to SL series Standard Drawings.

B. For 12-inch signal heads: Refer to Section 02892. Louvered back plate required. Signal head housing yellow.

C. 60-inch x 36-inch VEHICLE PER GREEN EACH LANE Sign: Refer to AT series Standard Drawings.

D. Concrete: Class AA(AE) Concrete (Refer to Section 03055).

E. Reinforcing Steel: Coated steel (Refer to Section 03211).

## 2.4 ADVANCE FLASHING BEACON SIGN

A. Signal Pole: Refer to Section 02892 and SL series Standard Drawings.

B. Two 8-inch signal heads with yellow lens: Refer to Section 02892. Signal head housing: yellow. No back plate required.

C. Warning Sign: MUTCD W3-3 (modified for 2 lens ramp meter signal head), 36-inch x 36-inch.

D. 30-inch x 24-inch black on yellow METERING WHEN FLASHING Sign: Refer to AT series Standard Drawings.

E. Foundation Concrete: Class A(AE) Concrete (Refer to Section 03055).

## 2.5 BOLTS AND NUTS

A. Follow Section 02892. Refer to ASTM A 307.

## 2.6 WIRE

A. Follow Section 02892.

## 2.7 DETECTOR CIRCUIT

A. Follow Section 02892.

B. Consult the Engineer: Saw cut loops or pre-formed loops.

## 2.8 LUMINAIRE

A. Follow Section 02892 for luminaires installed on ramp meter signal pole.

B. Refer to Section 16525 for luminaires not installed on ramp meter signal pole.

## 2.9 GROUND ROD

A. Copper-coated steel as specified.

B. ANSI/UL 467

## 2.10 CONDUIT

A. Refer to Section 13553.

## 2.11 JUNCTION BOX

A. Refer to Section 13554.

## 2.12 ATMS CABINET

A. Refer to Section 13555.

## 2.13 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.

# PART 3 EXECUTION

## 3.1 PREPARATION

A. Load, transport, and install all state-furnished materials per the manufacturer's instructions and as shown in the plans.

B. 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.

C. Install all wiring, conduit, and junction boxes as shown on site plans and details.
   1. Field locate all conduit and junction boxes to avoid drainage areas and steep slopes whenever possible.
   2. Protect existing conductors while installing new conductors.

D. Connect the controller and all wires as specified by the manufacturer.

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. After installation, the exterior of all equipment must be free of all 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 of the edge of the shoulder. For Ramp Signal Assembly Details refer to AT series Standard Drawings.

D. Place Mast Arm Signal Assemblies 40 ft to 120 ft upstream of stop bar. For Mast Arm Details refer to AT series Standard Drawings.

E. Place Advance Flashing Beacon Assembly 350 ft to 375 ft upstream of stop bar. For Flashing Beacon Details refer to AT series Standard Drawings.

F. Excavation: Refer to Section 13551.

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, M111 or ASTM A 153 and AASHTO M31 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 SL series Standard drawings.

## 3.3 ANCHOR BOLTS

A. Refer to Section 13551.

## 3.4 SIGNAL POLES

A. Install the poles on new concrete bases. Apply rust, corrosion, and anti-seize protection to 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. Adjusting the anchor bolt nuts, plumb all steel poles to the vertical with all signal heads and signs installed.

F. Meet AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals for poles.

## 3.5 INSTALL WIRING

A. Refer to Section 13551.

B. Mark cabinet cables with vinyl electrical color-coding tape as specified in Table 1. Meet UL 510 (Lanes numbered from left to right – include HOV bypass as left lane).

**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<br>Red- Red indicative<br>Green- Green indicative<br>Blue- Enforcement (if present) or spare |

## 3.6 ADVANCE FLASHING BEACON SIGN

A. Follow Section 02891.

## 3.7 RAMP METER SIGNAL ASSEMBLY SIGN

A. Follow Section 02891.

## 3.8 INSTALL SIGNAL HEADS

A. Do not install signal heads at the intersection until it is ready for operation.

B. If turn on is not immediate, completely cover 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. Install 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.

B. For location of Presence and Discharge Loop refer to AT series Standard Drawings.

C. For saw cut loops, consult the Engineer: circular or octagon shaped.

## 3.10 INSTALL LUMINAIRE

A. Refer to Section 16525.

## 3.11 TESTING AND ACCEPTANCE

A. Perform a Detector Loop Inductance & Resistance Test as described in Section 02892. Submit Detector Loop Inductance & Resistance Test to the Engineer for acceptance.

B. Perform the Local Field Operations Test after all ramp meter elements, equipment and hardware, power supply, detection device (Refer to Section 13591) and connecting cabling have been installed.

1. Complete the Local Field Operations Test for Ramp Meters using the required form. Obtain UDOT's newest version of the form from the UDOT Web site. Refer to http://www.udot.utah.gov/index.php/m=c/tid=719.
2. Perform testing after all construction for the site has been completed and the final road surface has been constructed.
   a. It is not necessary for the communications installation to be completed at the time testing.
   b. It is not necessary that all stations be locally tested concurrently.

END OF SECTION