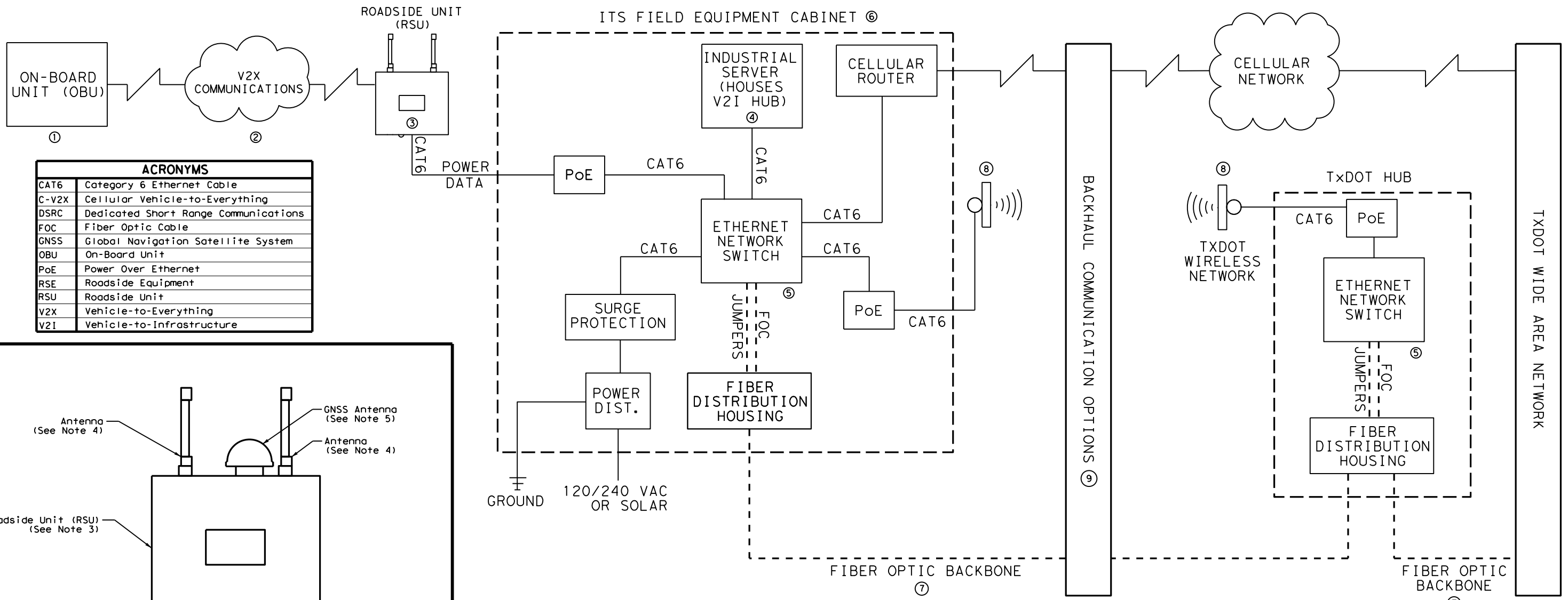
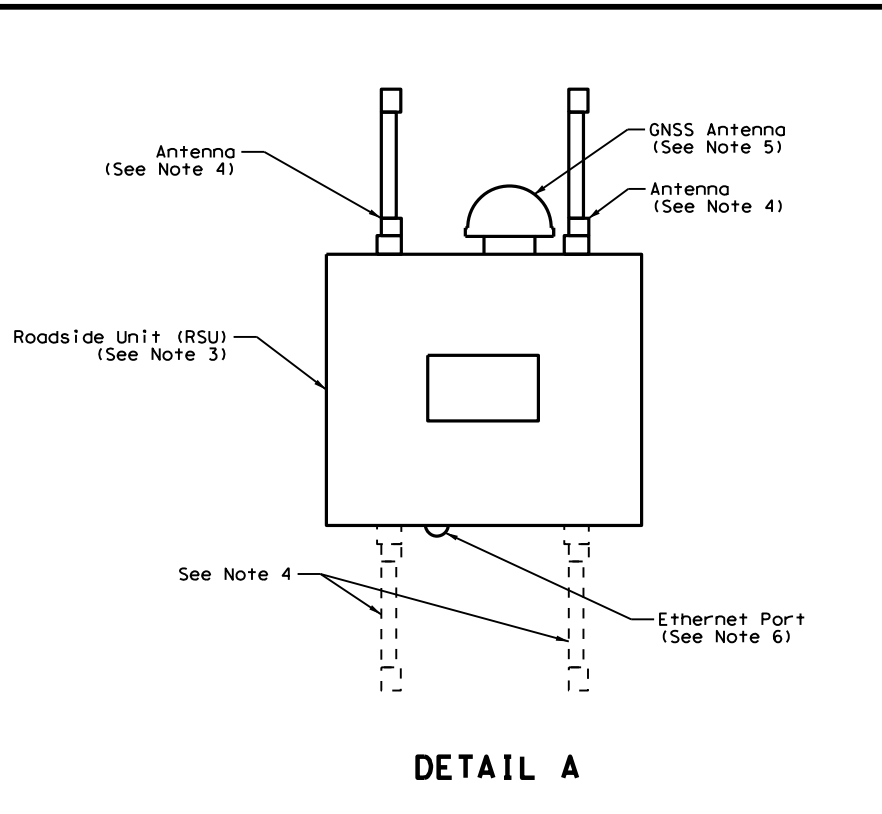


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ACRONYMS	
CAT6	Category 6 Ethernet Cable
C-V2X	Cellular Vehicle-to-Everything
DSRC	Dedicated Short Range Communications
FOC	Fiber Optic Cable
GNSS	Global Navigation Satellite System
OBU	On-Board Unit
PoE	Power Over Ethernet
RSE	Roadside Equipment
RSU	Roadside Unit
V2X	Vehicle-to-Everything
V2I	Vehicle-to-Infrastructure



ROADSIDE EQUIPMENT SYSTEM ARCHITECTURE

GENERAL NOTES:

1. Mounting bracket(s), extension arms, antennas, cabling and PoE injector are incidental to the roadside unit. All items not listed, shown, or otherwise noted, but necessary for a complete installation, are paid for under other items.
2. ITS equipment at each cabinet varies by location. See plans for further detail.
3. Roadside unit equipment, mounting options, and capabilities vary by manufacturer.
4. Refer to manufacturer installation instructions regarding proper placement of Vehicle to Everything (V2X) Communications antennas. Antennas vary by manufacturer. Weatherproof antennas and cable entry points according to manufacturer instructions.
5. Global Navigation Satellite System (GNSS) Antenna design varies by manufacturer. Install according to manufacturer instructions.
6. Attach ethernet cable with coupler according to manufacturer instructions.

REFERENCE KEY NOTES:

- ① On-Board Unit (OBU) is located in the vehicle and may consist of physical hardware or mobile device. The OBU communicates SAE J2735 messages to Roadside Unit (RSU) along the roadside.

- ② V2X communications includes Dedicated Short Range Communications and Cellular Vehicle-to-Everything (C-V2X) communications. Refer to IEEE 802.11p, FCC Rule 47 CFR-Part 90-Subpart M, and FCC Rule 47 CFR-Part 95-Subpart L standards when utilizing Dedicated Short Range Communications. Refer to 3GPP Release 14 and 15, or latest release, standards when utilizing C-V2X communications.
- ③ RSU located along the roadside of access controlled facilities to send and receive messages from OBU located inside vehicle.
- ④ Vehicle-to-Infrastructure Hub converts NTCIP messages to SAE J2735 messages and vice versa. Refer to the Vehicle-to-Infrastructure Hub Deployment Guide authored by USDOT (FHWA-JPO-18-644).
- ⑤ Ethernet switch equipment at each location may vary. Field hardened Ethernet switch required.
- ⑥ Locate RSU equipment inside existing or proposed ITS field equipment cabinets. Cabinets may be pole or ground mounted. See plans for type, size, and location of cabinet. Refer to TxDOT ITS cabinet standards and specifications.
- ⑦ Refer to Special Specification, "Intelligent Transportation System (ITS) Fiber Optic Cable."
- ⑧ Refer to Special Specification, "Intelligent Transportation System (ITS) Radio."
- ⑨ See plans for cellular router, fixed wireless, or fiber communication backhaul specified.

SHEET 1 OF 5



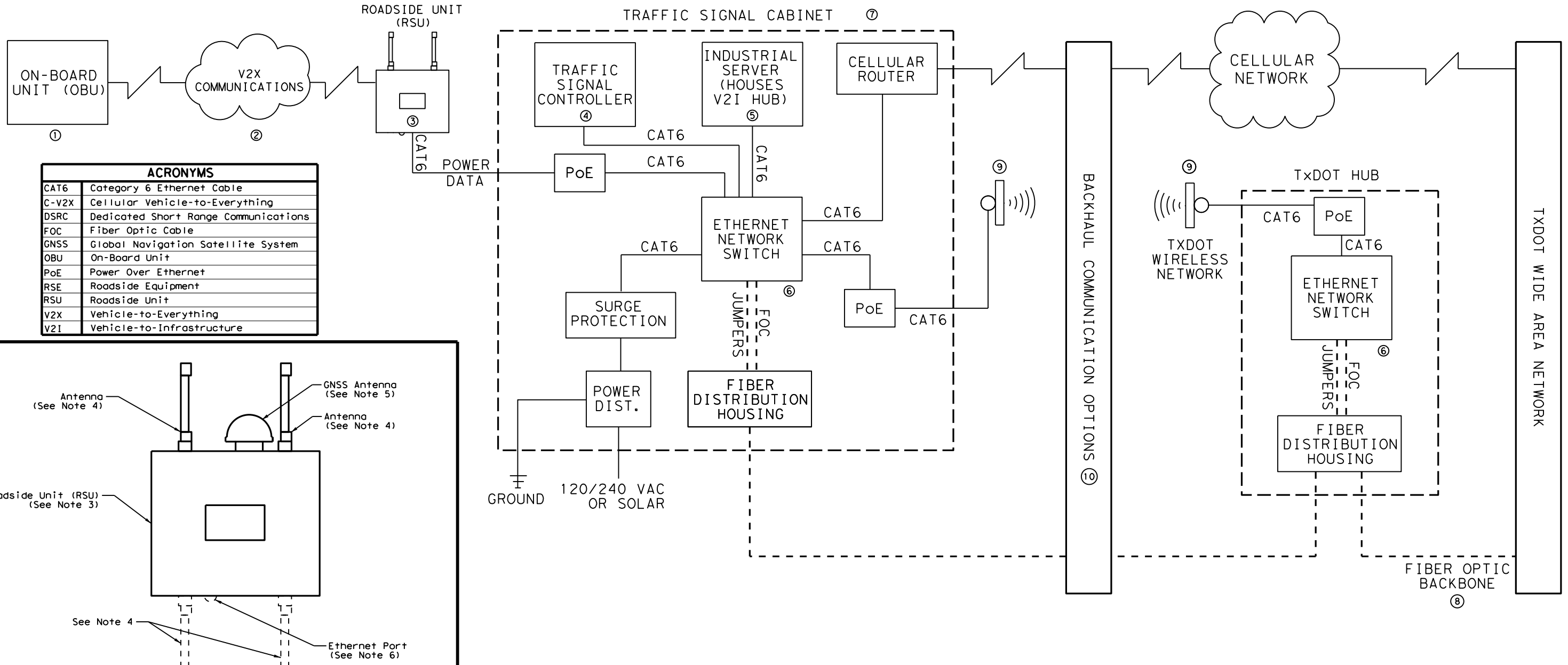
ROADSIDE EQUIPMENT SYSTEM ARCHITECTURE (ACCESS CONTROLLED)

RSE (1) -21

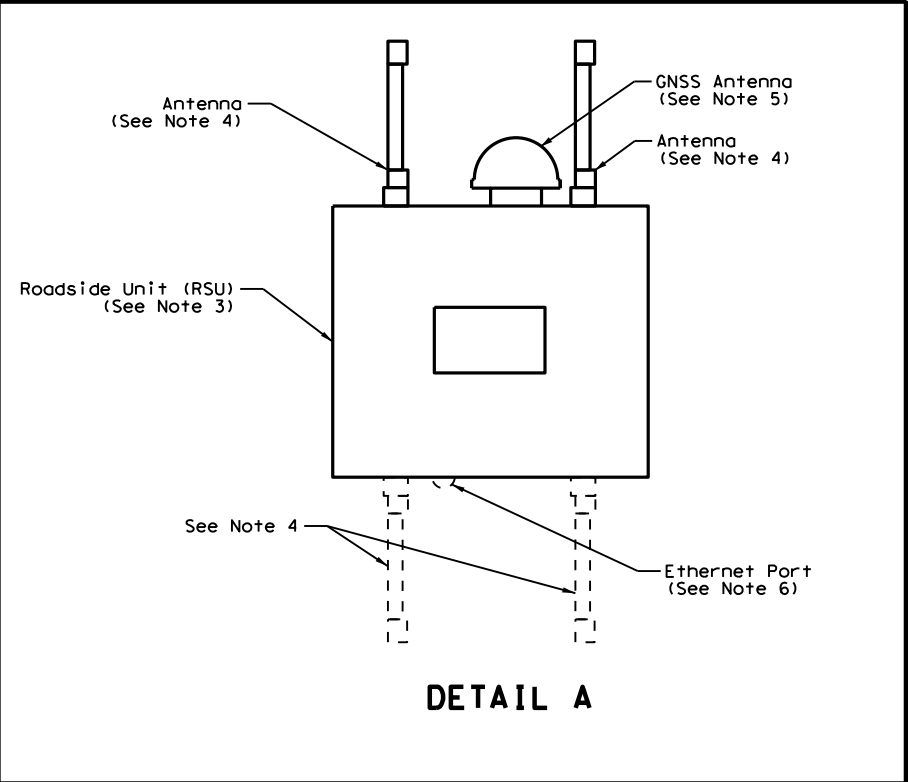
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DATE: FILE:



ACRONYMS	
CAT6	Category 6 Ethernet Cable
C-V2X	Cellular Vehicle-to-Everything
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OBU	On-Board Unit
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RSE	Roadside Equipment
RSU	Roadside Unit
V2X	Vehicle-to-Everything
V2I	Vehicle-to-Infrastructure



ROADSIDE EQUIPMENT SYSTEM ARCHITECTURE

GENERAL NOTES:

- Mounting bracket(s), extension arms, antennas, cabling and PoE injector are incidental to the roadside unit. All items not listed, shown, or otherwise noted, but necessary for a complete installation, are paid for under other items.
- ITS equipment at each cabinet varies by location. See plans for further detail.
- Roadside unit equipment, mounting options, and capabilities vary by manufacturer.
- Refer to manufacturer installation instructions regarding proper placement of V2X Communications antennas. Antennas vary by manufacturer. Weatherproof antennas and cable entry points according to manufacturer instructions.
- Global Navigation Satellite System (GNSS) Antenna design varies by manufacturer. Install according to manufacturer instructions.
- Attach ethernet cable with coupler according to manufacturer instructions.

REFERENCE KEY NOTES:

- On-Board Unit (OBU) is located in the vehicle and may consist of physical hardware or mobile device. The OBU communicates SAE J2735 messages to Roadside Unit (RSU) along the roadside.

- V2X communications includes Dedicated Short Range Communications and Cellular Vehicle-to-Everything (C-V2X) communications. Refer to IEEE 802.11p, FCC Rule 47 CFR-Part 90-Subpart M, and FCC Rule 47 CFR-Part 95-Subpart L standards when utilizing Dedicated Short Range Communications. Refer to 3GPP Release 14 and 15, or latest release, standards when utilizing CV2X communications.
- RSU located along the roadside of non-access controlled facilities to send and receive messages from OBU located inside vehicle.
- Traffic signal controller at signalized intersection cabinet may vary. Refer to Vehicle-to-Infrastructure Hub Deployment Guide for guidance (FHWA-JPO-18-644) regarding compatibility.
- Vehicle-to-Infrastructure Hub converts NTCIP messages to SAE J2735 messages and vice versa. Refer to the Vehicle-to-Infrastructure Hub Deployment Guide authored by USDOT (FHWA-JPO-18-644).
- Ethernet switch equipment at each location may vary. Field hardened Ethernet Switch required.
- Locate RSU equipment inside existing or proposed ITS field equipment cabinets. Cabinets may be pole or ground mounted. See plans for type, size, and location of cabinet. Refer to TxDOT ITS cabinet standards and specifications.
- Refer to Special Specification, "Intelligent Transportation System (ITS) Fiber Optic Cable."
- Refer to Special Specification, "Intelligent Transportation System (ITS) Radio."
- See plans for cellular router, fixed wireless, or fiber communication backhaul specified.

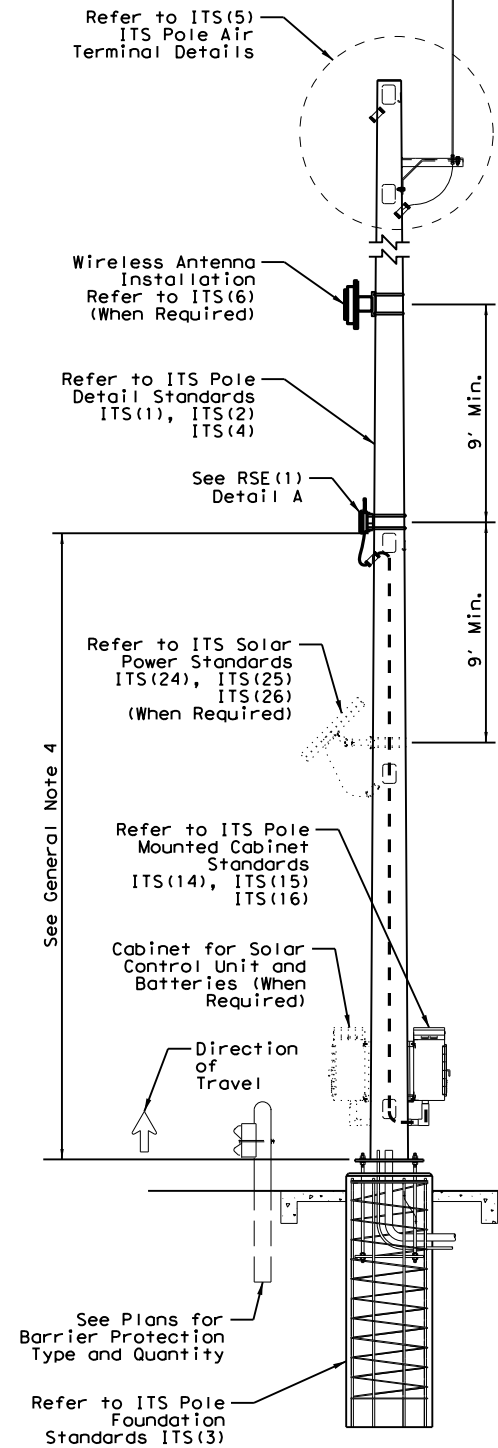


ROADSIDE EQUIPMENT SYSTEM ARCHITECTURE (NON-ACCESS CONTROLLED)

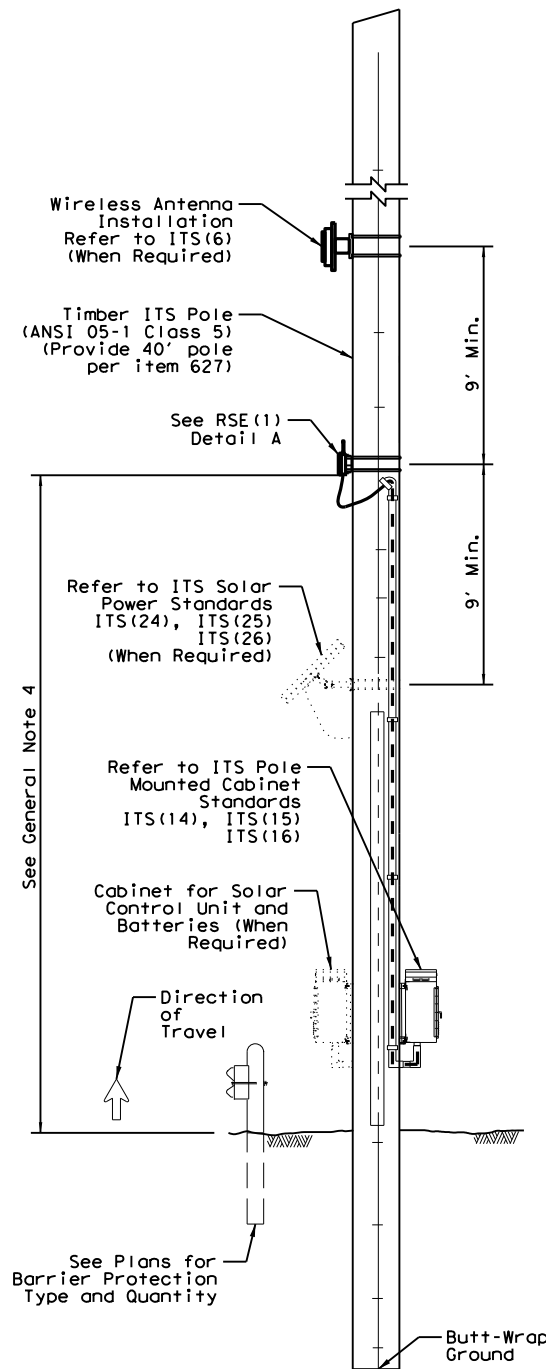
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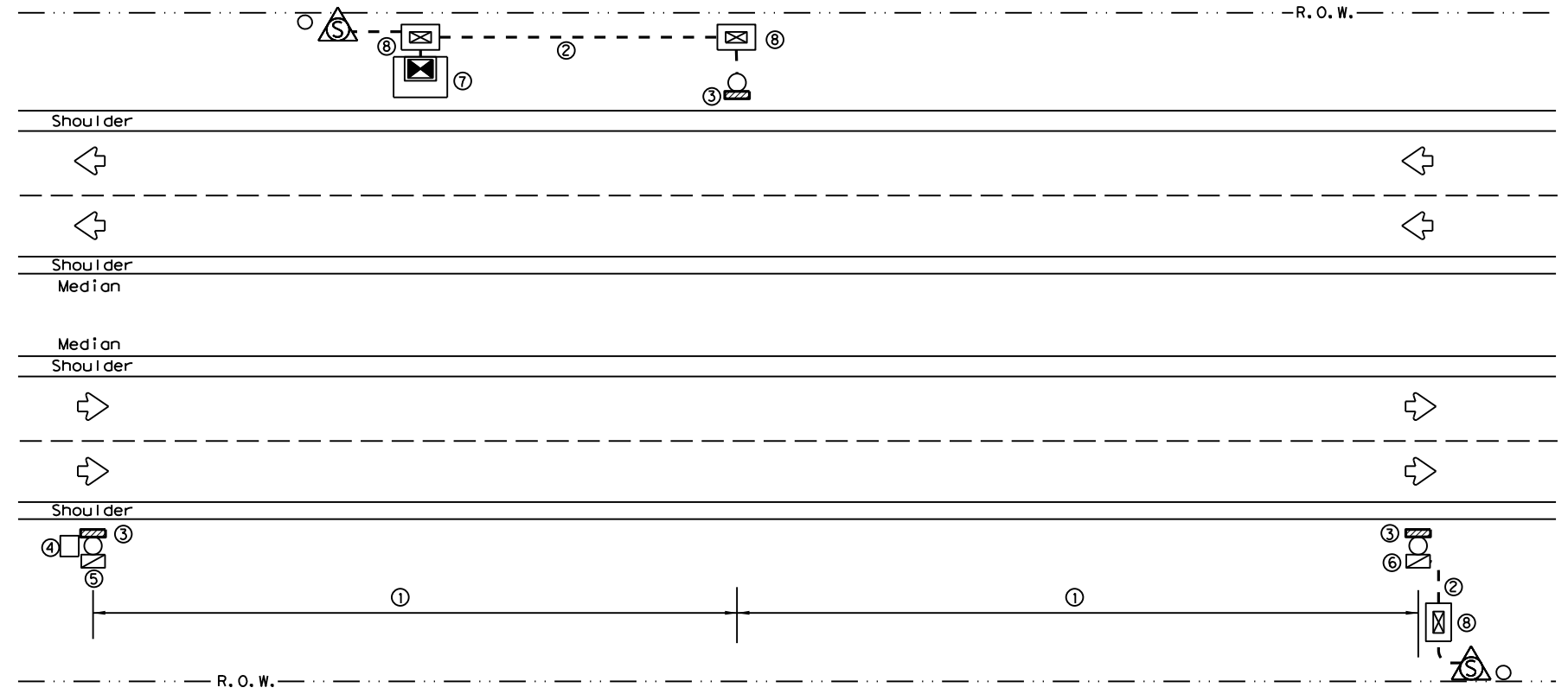
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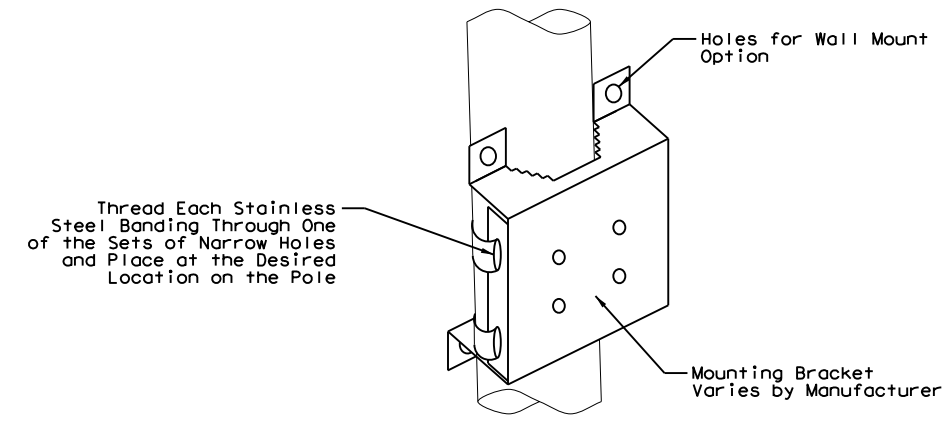
STEEL ITS POLE



TIMBER ITS POLE



LAYOUT VIEW



DETAIL A

GENERAL NOTES:

1. Mounting bracket(s), extension arms, antennas, cabling and PoE injector are incidental to the roadside unit. All items not listed, shown, or otherwise noted, but necessary for a complete installation, are paid for under other items.
2. Drawings are intended to be a general guideline for roadside unit placement and are illustrative only. Actual site conditions may vary.
3. All existing equipment is to remain operational when installing at an existing ITS site.
4. Height of the roadside unit shall not exceed 26 feet. Refer to manufacturer recommendations for optimum mounting height.

REFERENCE KEY NOTES:

- ① Recommended maximum spacing between units is 1,000 ft. Minimum spacing and number of units to cover area is dependent on the results of V2X radio frequency study.
- ② If cable length greater than 328 feet, use mid-span injector located at ground box or pole base to extend cable. See plans for conduit type, size, location, and quantity.
- ③ Roadside unit placement is illustrative only. Refer to manufacturer recommendations for ideal placement with respect to the roadway surface and coverage zone. Distance of ITS pole from edge of pavement must be 6.5 ft minimum. Recommendation is to use a pole extension bracket arm to place roadside unit closer to roadway if existing ITS pole is more than 6.5 ft away from edge of pavement. Mount roadside unit at least 9 ft minimum away from other devices if collocating on same pole.
- ④ Refer to Standard ITS(24), ITS(25), and ITS (26) for solar power details.
- ⑤ 12 VDC ITS pole cabinet with solar power option. Refer to Standards RSE(1), ITS(14), ITS(15), ITS(16), and ITS(17).
- ⑥ 120 VAC ITS pole cabinet with conventional power option. Refer to Standards RSE(1), ITS(14), ITS(15), ITS(16), and ITS(17).
- ⑦ 120 VAC ITS ground mounted cabinet with conventional power option. Refer to Standards RSE(1), ITS(20), ITS(21) and ITS(23).
- ⑧ Refer to Standards ITS(37) and ITS(38) or ITS(39) and ITS(40) for ground box details. See plans for ground box size, type, and location.

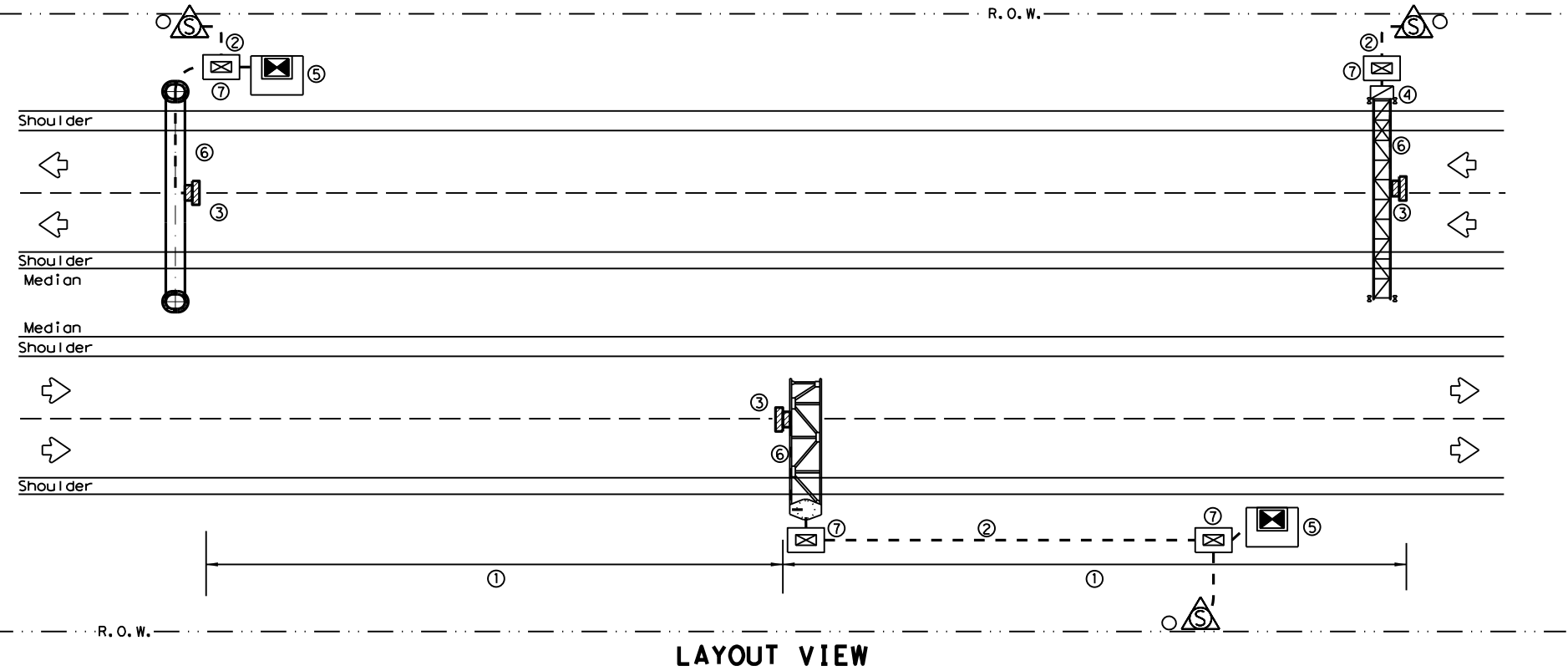
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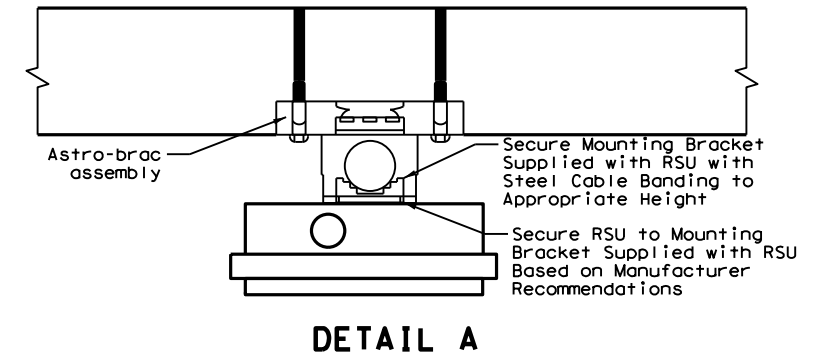
**ROADSIDE EQUIPMENT
ITS POLE
INSTALLATIONS
(ACCESS CONTROLLED)
RSE (3) - 21**

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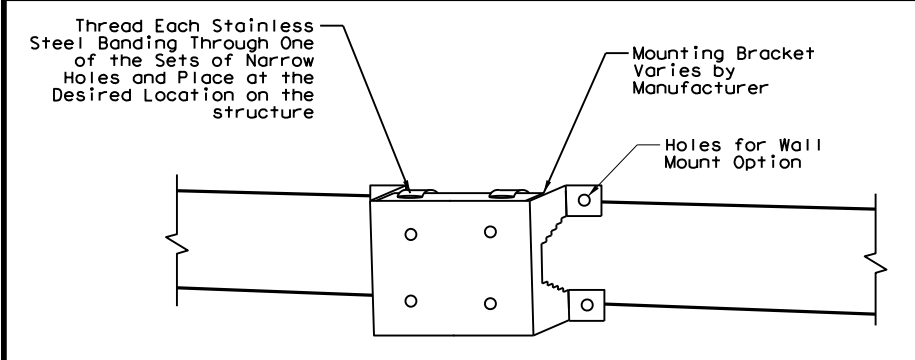
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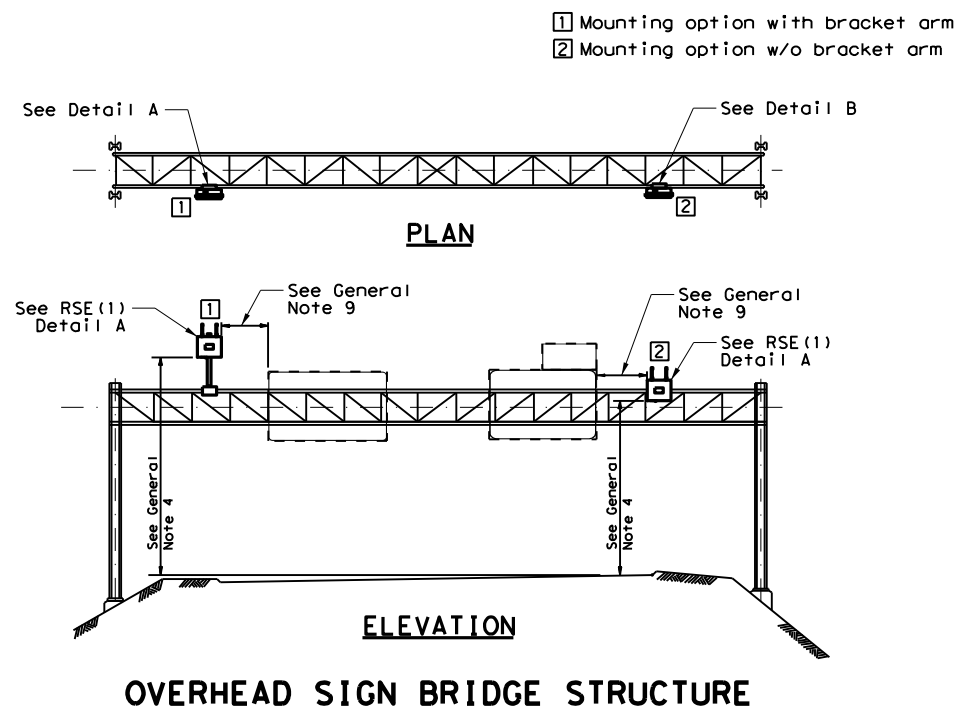
LAYOUT VIEW



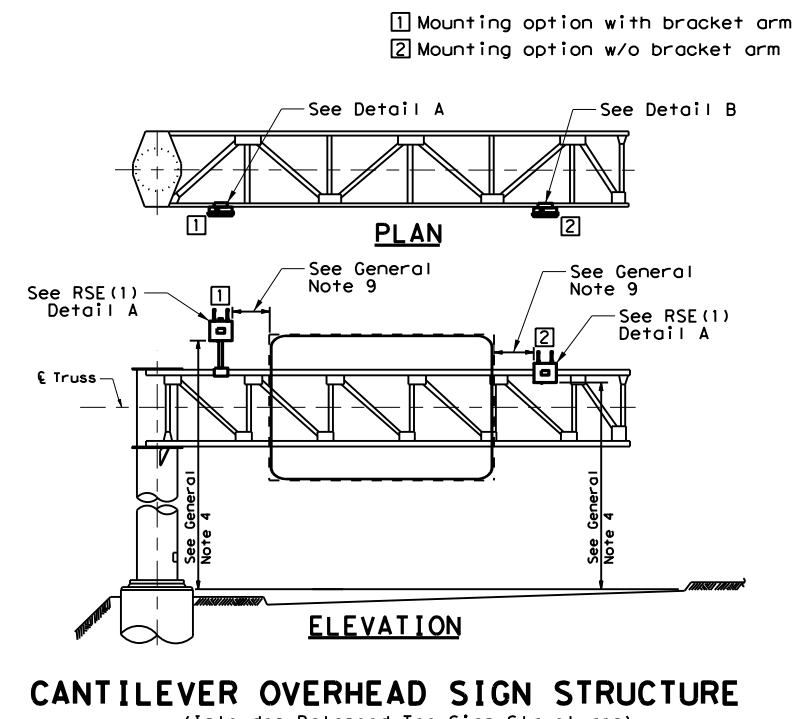
DETAIL A



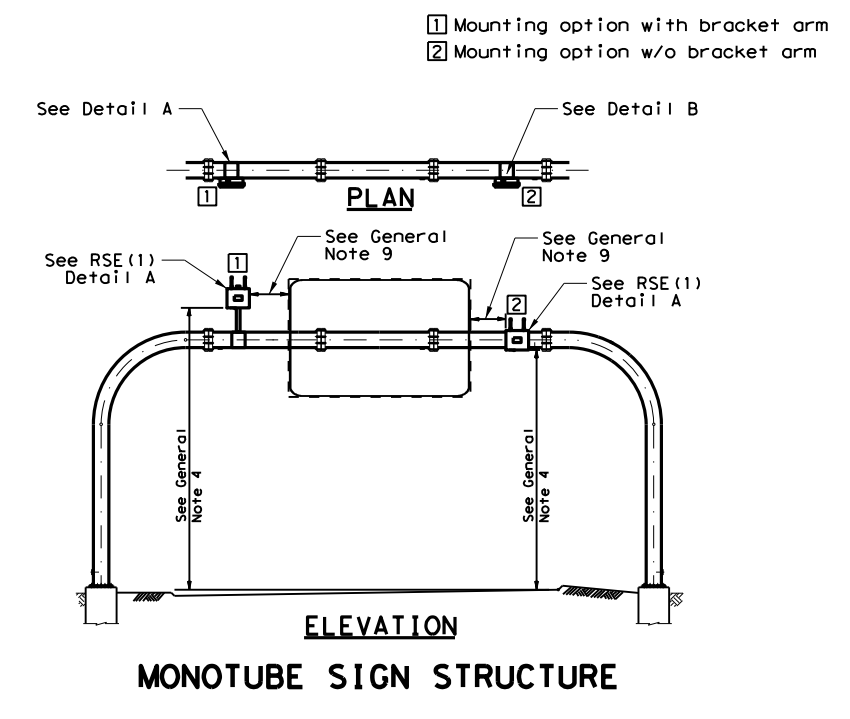
DETAIL B



OVERHEAD SIGN BRIDGE STRUCTURE



CANTILEVER OVERHEAD SIGN STRUCTURE
(Includes Balanced-Tee Sign Structures)



MONOTUBE SIGN STRUCTURE

SHEET 4 OF 5

GENERAL NOTES:

1. Mounting bracket(s), extension arms, antennas, cabling and PoE injector are incidental to the roadside unit. All items not listed, shown, or otherwise noted, but necessary for a complete installation, are paid for under other items.
2. Drawings are intended to be a general guideline for roadside unit placement and are illustrative only. Actual site conditions may vary.
3. All existing equipment is to remain operational.
4. Height of the roadside unit shall not exceed 26 feet. Refer to manufacturer recommendations for minimum height.
5. Roadside unit equipment, mounting options, and capabilities vary by manufacturer.
6. Refer to the manufacturer installation instructions regarding proper placement of Dedicated Short Range Communications antennas. Antennas for additional capabilities (e.g. Cellular-Vehicle-To-Everything, Wi-Fi) varies by manufacturer. Weatherproof antennas and cable entry points according to manufacturer instructions.
7. Global Navigation Satellite System (GNSS) Antenna design varies by manufacturer. Install according to manufacturer instructions.

REFERENCE KEY NOTES:

1. Recommended maximum spacing between units is 1,000 ft. minimum spacing and number of units to cover area is dependent on the results of V2X radio frequency study.
2. If cable length greater than 328 feet, use mid-span injector located at ground box or pole base to extend cable. See plans for conduit type, size, location, and quantity.
3. Roadside unit placement is illustrative only. Refer to manufacturer recommendations for ideal location over roadway. Mount roadside unit at least 9 ft minimum away from other devices if collocating.
4. 120 VAC overhead sign bridge cabinet with conventional power option. Refer to Standards RSE(1) and ITS(14), ITS(15), or ITS(16) for cabinet size and type. Refer to Standard ITS(17) for cabinet mounting details.
5. 120 VAC ITS ground cabinet with conventional power option. Refer to Standards RSE(1) and ITS(20), ITS(21), and ITS(23).
6. Roadside unit cable is to be routed through structure leg. Refer to Standards ITS(8), ITS(10), or ITS(12).
7. Refer to Standards ITS(37) and ITS(38) or ITS(39) and ITS(40) for ground box details. See plans for ground box size, type, and location.

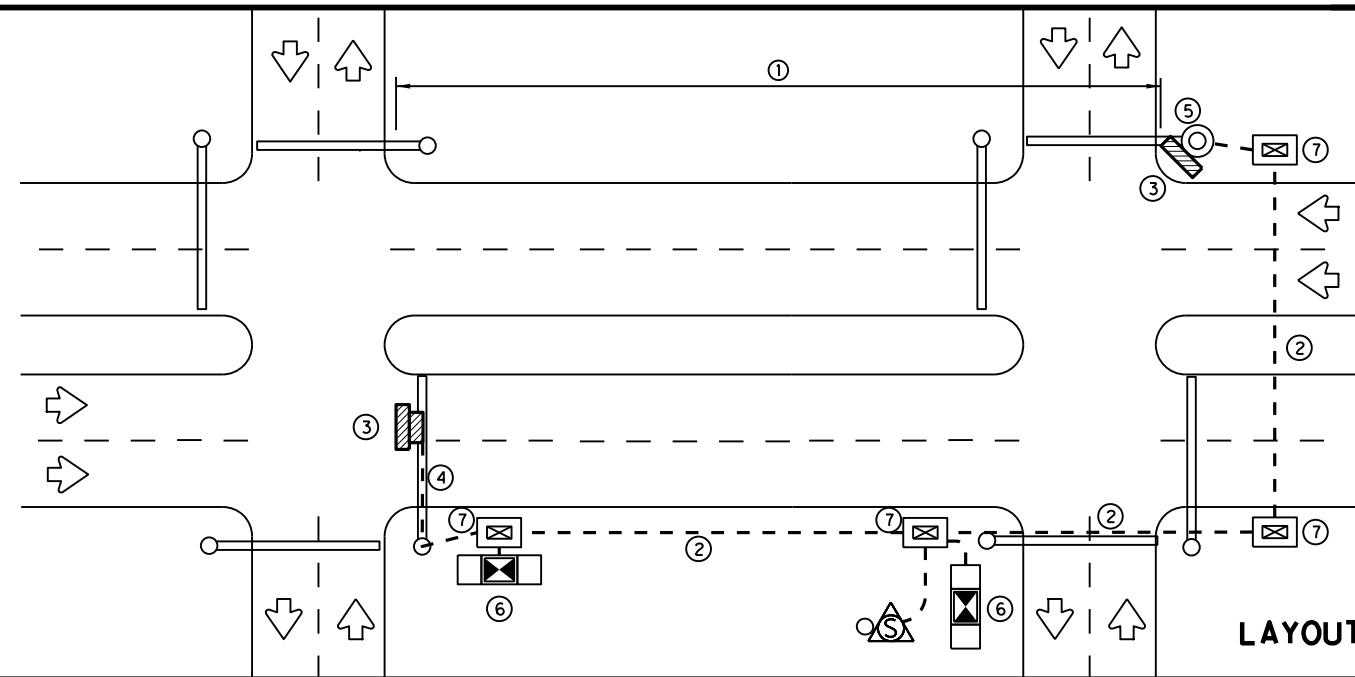
Texas Department of Transportation
Traffic Safety Division Standard

**ROADSIDE EQUIPMENT
OSB-COSS-MS
INSTALLATIONS
(ACCESS CONTROLLED)
RSE (4) - 21**

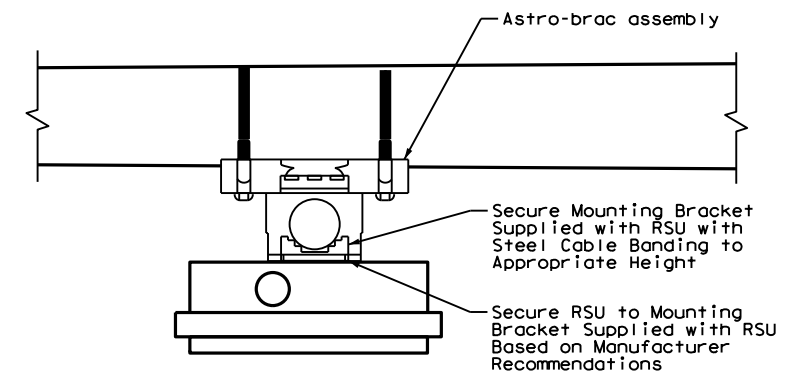
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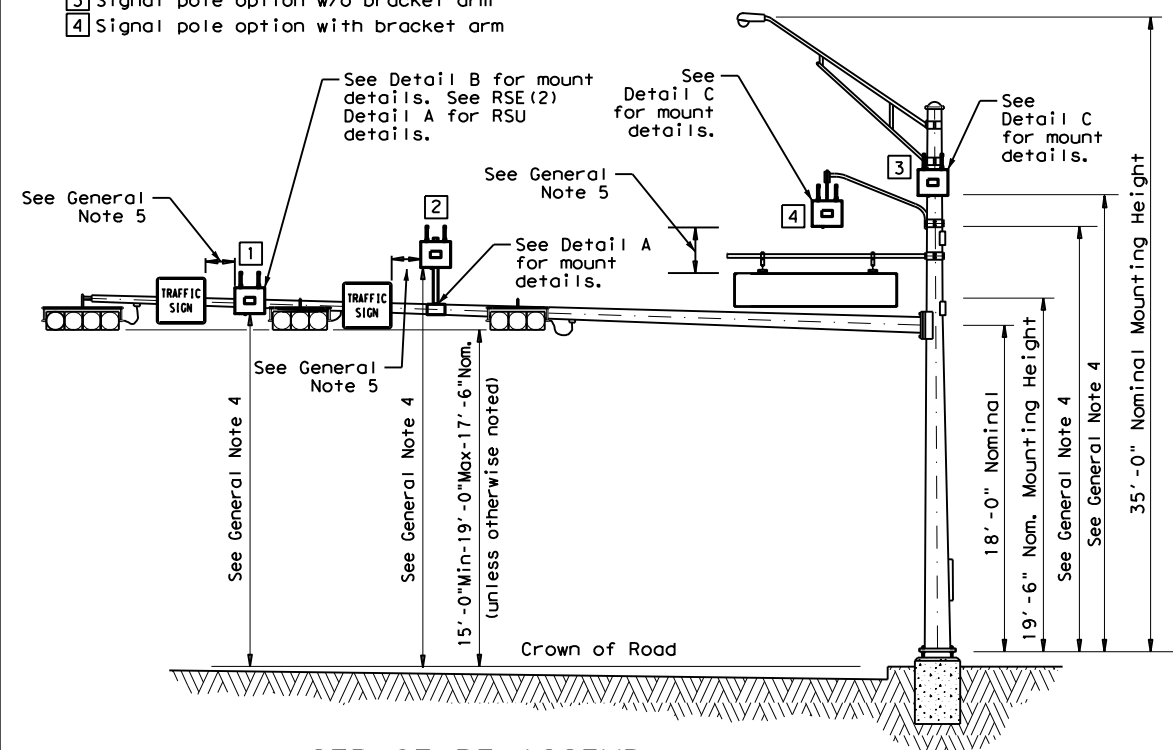


LAYOUT DETAIL

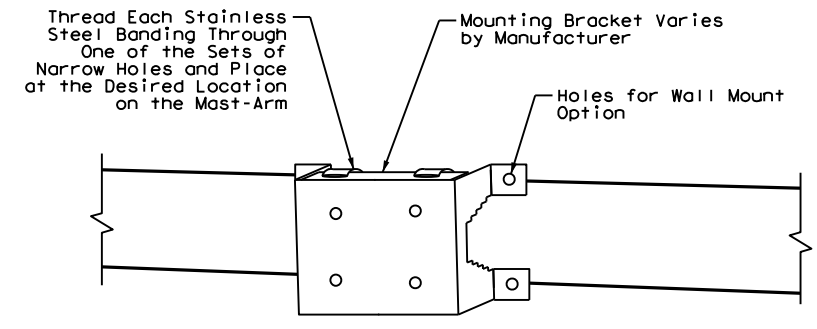


DETAIL A

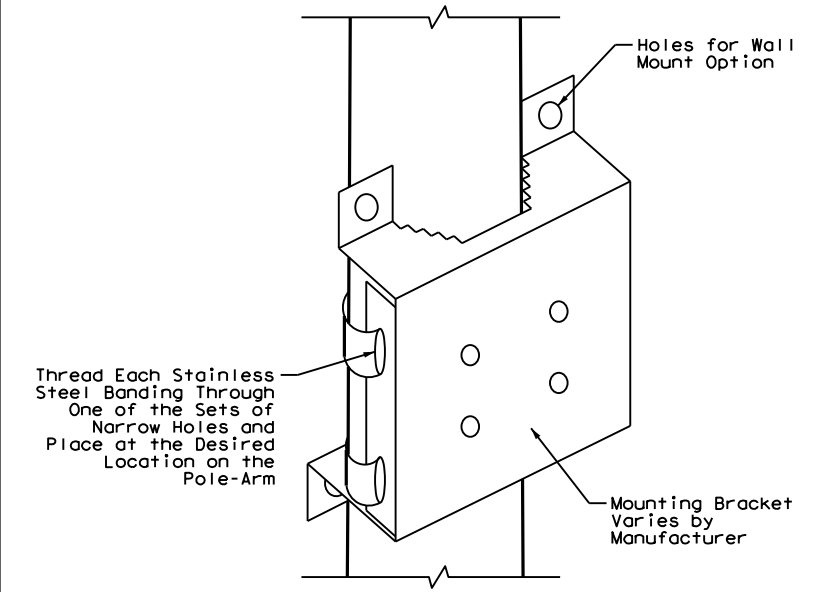
- 1 Mast-arm option w/o bracket arm
- 2 Mast-arm option with bracket arm
- 3 Signal pole option w/o bracket arm
- 4 Signal pole option with bracket arm



STRUCTURE ASSEMBLY



DETAIL B



DETAIL C


SHEET 5 OF 5

GENERAL NOTES:


1. Mounting bracket(s), extension arms, antennas, cabling and PoE injector are incidental to the roadside unit. All items not listed, shown, or otherwise noted, but necessary for a complete installation, are paid for under other items.
2. Drawings are intended to be a general guideline for roadside unit placement and are illustrative only. Actual site conditions may vary.
3. All existing equipment is to remain operational.
4. Height of the roadside unit shall not exceed 26 feet. Refer to manufacturer recommendations for minimum height.
5. Maintain 12" minimum separation between RSU and existing signage.

REFERENCE KEY NOTES:

- ① Spacing and number of units to cover area is dependent on the results of V2X radio frequency study.
- ② If cable length greater than 328 feet, use mid-span injector located at ground box or pole base to extend cable. See plans for conduit type, size, location, and quantity.
- ③ Roadside unit placement is illustrative only. Refer to manufacturer recommendations for ideal location at intersection.
- ④ Follow manufacturer recommendations for roadside unit mounting distance away from mast arm. Mount roadside unit at least 9 ft minimum away from other devices if collocating.
- ⑤ Follow manufacturer recommendations for roadside unit mounting distance away from signal pole. Mount roadside unit at least 9 ft minimum away from other devices if collocating.
- ⑥ 120/240 VAC traffic cabinet with conventional power. Refer to standard RSE(2), ITS(20) and ITS(23).
- ⑦ Refer to standards ITS(37) and ITS(38) or ITS(39) and ITS(40) for ground box details. See plans for ground box size, type, and location.



 Texas Department of Transportation



 Traffic Safety Division Standard

**ROADSIDE EQUIPMENT
 TRAFFIC SIGNAL POLE &
 MAST ARM INSTALLATIONS
 (NON-ACCESS CONTROLLED)
 RSE (5) - 21**

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