

ITS STRUCTURES DESIGN GUIDELINES

CS: Statewide

MICHIGAN ITS STRUCTURES DESIGN GUIDELINES

Design Guidance Preamble

The proceeding design guidance serves as an aid to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. It is expected when making significant or impactful deviations from the technical information from these guidance materials, that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the timeframes allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. MDOT Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

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6.01

INTRODUCTION

This guidance text addresses procedures involved in the design and plan preparation of intelligent transportation systems (ITS) structures including spun concrete poles, dynamic message sign (DMS) structures, environmental sensor station (ESS) towers, and communications towers on interstate/freeway, arterial, collector, and local road systems governed by the Michigan Department of Transportation (MDOT).

A major portion of this text is devoted to design items to be investigated for every project. However, other sections provide details on plan preparation and involvement of other agencies affected by the ITS projects. In general, the ITS Structures Design Guidelines is intended to be a single source reference for the MDOT design engineers and consultants assigned the responsibility of producing spun concrete pole, DMS structure, ESS Tower, or communications tower plans.

The design of ITS structures in Michigan is based on the **MDOT Standard Specifications for Construction (MDOT SSC)** and the **AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (AASHTO LRFDLTS)**. However, it is understood that sometimes adaptations and deviations may be necessary as these publications can be vague or leave decisions up to the judgement of the Engineer. This guidance text does not focus on ITS device selection or design. For ITS device selection and design, reference the **MDOT ITS Project Guidelines**.

As procedures and guidelines change, the ITS Structures Design Guidelines will be continually updated to keep the text as current as possible. These updates will describe the revision, explain the reason, serve as commentary, and assign the date of its implementation.

6.01.01

References

Where national standards or specifications (e.g., AASHTO, MUTCD) are referenced herein, the designer shall utilize the current edition, including all interim revisions, as formally adopted by the Federal Highway Administration (FHWA) in 23 CFR 625 (Design Standards for Highways) at the time of project scoping, unless otherwise directed by MDOT.

- A. **ITS Project Guidelines, MDOT**
- B. **Standard Specifications for Construction (SSC), MDOT**
- C. **Frequently Used Special Provisions (FUSPs), MDOT**
- D. **AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LRFDLTS)**
- E. **AASHTO LRFD Bridge Design Specifications (LRFDBDS)**
- F. **Geotechnical Manual, MDOT**
- G. **Preconstruction Process Documentation Manual (PPDM), MDOT**
- H. **Michigan Ancillary Structures Inspection Manual (MiASIM), MDOT**
- I. **Road Design Manual, MDOT**
- J. **Real Estate Procedure Manual, MDOT**
- K. **Scoping Manual, MDOT**
- L. **ITS Standards and Special Details, MDOT**

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6.01.02

Abbreviations and Definition of Terms

When the following abbreviations are used in the guidance text, they have the meanings listed below.

AASHTO	American Association of State Highway and Transportation Officials
FAA	Federal Aviation Administration
ITS	Intelligent Transportation Systems
LRFD	Load and Resistance Factor Design
MiOSHA	Michigan Occupational Safety and Health Administration
MDOT.....	Michigan Department of Transportation
ROW	Right-of-Way

Appurtenance – A miscellaneous device or attachment mounted to a structure that can include signs, antennae, and other devices.

Camera – A device that captures images or videos that can be mounted to a pole.

Clear Zone – The unobstructed, traversable roadside area provided beyond the edge of the through traveled way that allows a driver to stop safely or regain control of a vehicle that has left the roadway.

Communications Tower – A lattice tower structure that supports ITS infrastructure and communication antennae.

Drilled Shaft – A foundation type, constructed by placing concrete in a drilled hole with steel reinforcement.

Dynamic Message Sign (DMS) – Programmable electronic signs that are located along highways and provide real-time information to drivers.

Engineer – Person responsible for the design of the structure or review of design-related field submittals such as erection plans, or both.

Environmental Sensor Station (ESS) – a location along the roadway to host multiple sensors to detect various conditions, such as atmospheric, ground, hydraulic, and other environmental factors.

Gantry – A cantilever or truss overhead sign structure that is used to support a small dynamic message sign, typically for lane control purposes.

Light Pole – A steel or aluminum light standard shaft on a frangible or non-frangible base mounted to a concrete foundation with anchor bolts that often supports a light standard arm.

Right-of-Way (ROW) – The entire area reserved for the construction, operation, and maintenance of the roadway and the improvement of the roadside such as landscaping, sidewalks, pathways, or transit stops. ROW will either be free access or limited access. Limited access ROW is when the inherent right of access to a public highway by the abutting owner or occupant is acquired along with the title to the ROW.

Roadside – Portion of the ROW outside of the footprint of the roadway.

Sensor – A device that detects and measures changes in traffic or the environment that can be mounted to a structure.

Spun Concrete Pole – A high mast prestressed precast concrete pole used to support ITS infrastructure such as cameras and radar detectors.

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Strain Pole – A cantilever pole that utilizes anchor bolts to transfer load from the pole to a concrete foundation and often supports span wires carrying traffic signals, lighting, and other appurtenances.

Walkway – Horizontal steel structures with grating and supporting frame that provide walkable access to the DMS and supporting structure.

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6.02

ITS STRUCTURES SITE PLANNING

Site planning of ITS structures must follow and account for specifications outlined in the **MDOT Road Design Manual** and **MDOT ITS Project Guidelines**. Coordinate site planning with **MDOT's ITS Program Office**.

6.02.01

Project Scoping and Survey

Understanding the project scope is critical for the Engineer to establish what deliverables (e.g., permits, easement acquisition, design exceptions, etc.) are required. To ensure consistency across projects, the Engineer must follow the scoping process provided by the **MDOT PPDM Task Series 2100 – EPE Scoping Analysis** through **Series 2800 – Contamination Investigation** and review the tasks outlined in **Section 5.1 – Special Tasks for Intelligent Transportation Systems**. Furthermore, the Engineer must adhere to the scoping guidelines in the **MDOT Scoping Manual** and review **Section 3.7 – Intelligent Transportation Systems**.

Proper survey, specifically those related to ROW, utilities, sidewalks (if present), existing structures, and existing roadway geometry, is critical to ensure a project can provide what has been scoped. The Engineer must review **MDOT PPDM Task Series 3100 – Scope Verification** through **Series 3300 – Base Plan Preparation** before survey takes place so that consistent and thorough survey can be prescribed.

6.02.02

ITS Structure Types and Selection

Various structure types exist throughout Michigan for ITS applications. The following sections provide brief information on these structure types and their purpose.

A. DMS Structures

DMS support structures consist of a single vertical support with horizontal arms supporting electronic signs and access walkways. Additional arms may be mounted to the DMS structure to support various ITS devices. DMS support structures are galvanized steel structures mounted on a concrete foundation with anchor bolts. The DMS structure can be left-handed, right-handed, or double-sided to ensure proper viewing from the traveling public.

B. Spun Concrete Poles

Spun concrete poles are high mast prestressed precast concrete poles embedded in a concrete foundation and typically reach 85 feet in height. Spun concrete poles are often required to mount closed-circuit television (CCTV) cameras at the desired viewing angle and may support other ITS devices.

C. ESS Towers

An ESS Tower is a single vertical support of built-up steel or aluminum members supported on a concrete foundation with anchor bolts. Some towers are a combination of steel and aluminum members. They are three or four leg lattice structures and jointed to allow the structure to be lowered for maintenance. They support a variety of sensor attachments.

D. Others

Additional structures utilized for ITS infrastructure are discussed below:

1. Strain Pole – ITS devices are often mounted on strain poles at intersections. Refer to **Chapter 4** for details on steel strain pole structures.
2. Gantry – The gantry is an overhead sign support structure that can have lane control signs (LCS) and small DMS mounted to it. Gantries are most often used for lane control purposes.

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The design of overhead cantilever and truss sign support structures are discussed in **Chapter 3**.

3. Light Poles – ITS devices may be mounted on light standard shafts mounted on a concrete foundation with anchor bolts. Refer to **Chapter 5** for more details regarding light poles.

4. Communications Towers – Communications towers support ITS infrastructure and communication antennae. The tower structure consists of three main vertical supports, each mounted on a separate concrete foundation, that combine into a single vertical lattice member at higher elevations.

6.02.03

Right-of-Way Coordination

Place ITS structures within the ROW wherever possible. Coordinate with **MDOT Region Real Estate** staff early in the project schedule to determine real estate needs and impacts to the project schedule. Any temporary work outside the ROW requires a legal agreement such as a Consent or Temporary Construction Easement. The **Real Estate Services Section** of the **Development Services Division** or **Region Real Estate** will determine just compensation for the agreement which is offered to the property owner. Permanent ROW acquisition may also need to be considered. Review Chapter 16 of the **MDOT Real Estate Procedure Manual** for more details on ROW considerations during design.

6.02.04

Appurtenances

Multiple ITS devices and other appurtenances can be added to ITS structures including, but not limited to, cameras, sensors, antennae, lightning protection, and ITS cabinets. A multitude of devices may be mounted to a single ITS structure. Consider all of these during design.

DMS structures have specially designed mounting arms to hold multiple ITS device

additions to the main structure, as shown in special detail **ITS-034-Series**.

A. Cameras

Cameras are a common attachment to various types of ITS structures. The structure type used to support the camera is chosen depending on the intended use of the device and the available infrastructure in the area.

B. Sensors

Integral to the ITS network are sensors that collect various information on traffic and environmental factors. Many types of ITS sensors may be desired at a point along the roadway. The type of sensor will determine which ITS structures are available to support the necessary device.

C. ITS Cabinets

ITS cabinets may be pole-mounted or ground-mounted depending on the type of structure. Mount ITS cabinets to spun concrete poles and steel strain poles as shown in special detail **ITS-063-Series**. For DMS structures and ESS towers, the ITS cabinet is ground mounted as shown in special detail **ITS-062-Series**.

6.02.05

Construction Access

Show temporary access limits clearly on the design plans for work outside of the ROW. For further details on ROW coordination, see **Section 06.02.03**.

Trim vegetation if it interferes with construction access. Consider overhead utility lines that may impact ITS structure installation. Consider both lifting and setting the structure when defining construction stages. A 10-foot clearance is required throughout the entire installation process per MiOSHA's standards for construction safety and health and may impact pole sizing.

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Review the FAA pre-screening tool for Obstruction Evaluation/Airport Airspace Analysis to determine if the proposed construction or alteration requires notice to the FAA.

6.02.06

Inspection and Maintenance Access

Provide access for safe inspection and maintenance of the ITS structures. Do not place on steep slopes or in drainage ditches, and any lowering devices or walkways must be easily accessible. Ensure that vehicles have access to the site and a safe pull-off location is available. Consider whether an access drive or culvert should be constructed to traverse an existing ditch and allow for maintenance vehicles to reach the structure. **MDOT's Ancillary Structures Program** manages the inspection of these assets as outlined in the **MiASIM**.

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6.03

ITS STRUCTURE PLACEMENT

Refer to Chapter 3 of the **MDOT ITS Project Guidelines** for considerations regarding the placement of ITS infrastructure and project location coordination.

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6.04

STRUCTURAL DESIGN

Typically, a site-specific design is not required if the Engineer uses the existing special details from **MDOT's ITS Special Details website**. Verify the design of ITS structures meet all criteria outlined in the existing ITS special details presented in **ITS-030, ITS-031, ITS-032, ITS-033, ITS-052, ITS-053, and ITS-054-Series**. Any modifications to existing special details require review and approval from **MDOT's ITS Program Office**.

6.04.01

Foundations

The Engineer must use foundation details **ITS-032-Series** for DMS Sign Supports, **ITS-033-Series** for Spun Concrete Poles, and **ITS-053-Series** for ESS Towers. If the foundation design falls outside of these special details, refer to the following guidance. Review historic structure borings before new borings are obtained. If poor soils are shown, the Engineer must coordinate with **MDOT's Geotechnical Services Unit**. Follow requirements outlined in the **MDOT Geotechnical Manual** for all preliminary foundation investigations and new soil borings obtained. The designer must verify that no underground geotechnical anomalies are present in conflict with the ancillary structure foundation.

Drilled shafts serve as the standard foundation type for DMS structures and ESS towers. Follow all procedures outlined in Section 718 of **MDOT's Standard Specifications for Construction** for casing installation for drilled shaft foundations.

6.04.02

Design Specifications and Special Provisions

Design ITS structures according to the current edition of the **AASHTO LRFDLTS**. Reference

the most up to date standards and special details on **MDOT's ITS Special Details website** and **FUSPs**.

6.04.03

DMS Structures

ITS special details **ITS-030-Series** and **ITS-031-Series** for left-hand and right-hand sign placement, respectively, provide detailed design of DMS Support Structures. DMS structures use a drilled shaft foundation as outlined in special detail **ITS-032-Series**. The designer will need to determine an appropriate depth of the foundation depending on the soil borings. The height of the DMS vertical shaft is dependent on the vertical clearance of the sign.

6.04.04

Spun Concrete Poles

Typical spun concrete poles are designed to reach a height of 85 feet above ground and support several ITS attachments, including a CCTV camera and an ITS cabinet. Special Detail **ITS-033-Series** details the design of spun concrete pole structures. Spun concrete poles are embedded in a concrete foundation.

6.04.05

ESS Towers

Design ESS Towers according to ITS special detail **ITS-052-Series**. The drilled shaft foundation and conduit installation details are provided in special detail **ITS-053-Series**. All device attachments to the tower must be per the manufacturer specifications.

6.04.06

Other

The design of other ITS support structures such as cantilever or truss supports, strain poles, and light poles is covered in Chapters 3, 4, and 5, respectively.

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6.05

PLAN PREPARATION

6.05.01

Preliminary Plan Composition

Use the following list and ordering of sheets for the Preliminary Plan stage of ITS projects. ITS projects often overlap with roadwork or other rehabilitation and reconstruction projects. This list assumes no major work aside from the ITS infrastructure is included in the project:

- A. Title Sheet
- B. Project Information Sheet(s)
- C. Legend Sheet(s)
- D. Vicinity Sheet(s)
- E. Note Sheet(s)
- F. Survey Information Sheet(s)
- G. ITS Sheet(s)*
- H. Special Details Sheet(s)

*Use **Appendix A** – Guidelines for ITS Support Structures Plan Preparation as a reference for these sheets and MDOT's Online CAD Standards for guidance on setting up the CAD workspace.

At the Preliminary Plan stage, the ITS sheets must convey the location and communication path of the ITS infrastructure at a minimum. If multiple ITS structures are used, they must be called out in the plan view with locations of each type shown.

6.05.02

Final Plan Composition

Use the following list and ordering of sheets for the final plan stage of ITS projects.

This list assumes no major work aside from ITS infrastructure is included in the project:

- A. Title Sheet
- B. Project Information Sheet(s)
- C. Legend Sheet(s)
- D. Vicinity Sheet(s)
- E. Note Sheet(s)
- F. Miscellaneous Quantities Sheet(s)
- G. Survey Information Sheet(s)
- H. Construction Sheet(s)
- I. ITS Cross Section(s)*
- J. Communication Plan Sheet(s)
- K. ITS Detail Sheet(s)*
- L. Log of Borings Sheet(s)
- M. Special Details Sheet(s)

*Use **Appendix A** – Guidelines for ITS Support Structures Plan Preparation as a reference for these sheets. See the **MDOT Road Design Manual** for guidance on all other sheets.

6.05.03

Structural Details

The structural details provided in all special details mentioned in this guidance must be included. If a designer must deviate from the proposed guidance, they must contact the **MDOT Ancillary Structures Program** to verify the proposed design. The **MDOT ITS Program Office** and **Structural Fabrication Unit** must also be contacted for approval. The design of these details must be analyzed if modifications will impact the structural capacity.

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Appendix A – Guidelines for ITS Structures Plan Preparation

GUIDELINES FOR ITS STRUCTURES PLAN PREPARATION



FINAL ROW PLAN REVISIONS SUBMITTAL DATE:								 MDOT Michigan Department of Transportation	NO SCALE		DATE:	CS:		DRAWING	SHEET
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													TSC:		FILE: 106329_Legend_Sheet_1.dgn			

UTILITIES

COMBINED SEWER

- COMBINED SEWER
- COMBINED SEWER - TO BE ABANDONED
- COMBINED SEWER - OUT OF SERVICE
- COMBINED SEWER - TO BE REMOVED

COMMUNICATION

- CABLE - OVERHEAD
- CABLE - OUT OF SERVICE
- CABLE - MARKER
- CABLE - PEDESTAL
- FIBER OPTIC
- FIBER OPTIC - OUT OF SERVICE
- FIBER OPTIC - MARKER
- PHONE - OVERHEAD
- PHONE - OUT OF SERVICE
- PHONE - BOX
- PHONE - MANHOLE
- PHONE - PEDESTAL
- PHONE - POLE

FUEL / PETROLEUM

- OIL PIPELINE
- OIL PIPELINE - OUT OF SERVICE
- GAS - FILLER PIPE
- GAS - PUMP
- GAS - UNDERGROUND TANK
- OIL WELL
- PETROLEUM PIPELINE - MARKER
- PROPANE TANK

NATURAL GAS

- GAS LINE
- GAS LINE - OUT OF SERVICE
- MARKER
- VALVE
- WELL

SANITARY SEWER

- SEWER
- SEWER - TO BE ABANDONED
- SEWER - OUT OF SERVICE
- SEWER - TO BE REMOVED
- MANHOLE W/ COVER

WATER

- WATER MAIN
- WATER MAIN - TO BE ABANDONED
- WATER MAIN - OUT OF SERVICE
- WATER MAIN - TO BE REMOVED
- FIRE HYDRANT
- FIRE HYDRANT (ALT)
- IRRIGATION - CONTROL VALVE
- IRRIGATION - SPRINKLER HEAD
- SERVICE - METER
- SERVICE - SHUT OFF VALVE
- GATE VALVE + BOX
- GATE WELL (SP?)
- WATER WELL

UNIDENTIFIED EXISTING UTILITIES

- MARKER
- MANHOLE COVER
- PEDESTAL
- POLE
- SEWER CLEANOUT
- STRUCTURE BOTTOM
- UTILITY BOX

DRAINAGE

CULVERT

- CULVERT - EX
- CULVERT - PR
- END SECTION OPENING - EX
- END SECTION - PR
- OUTLET HEADWALL - PR
- PIPE / BOX CULVERT HEADWALL - PR

STORM SEWER

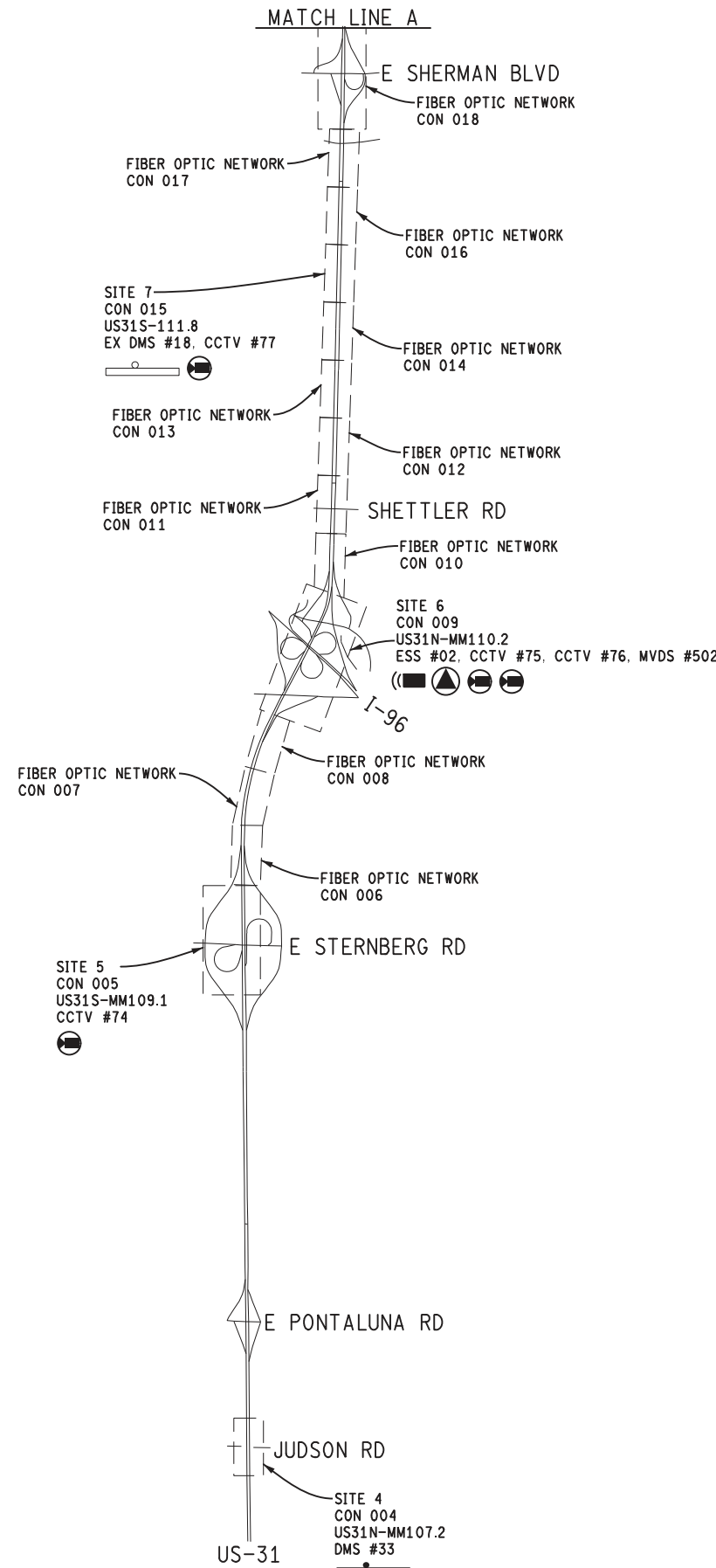
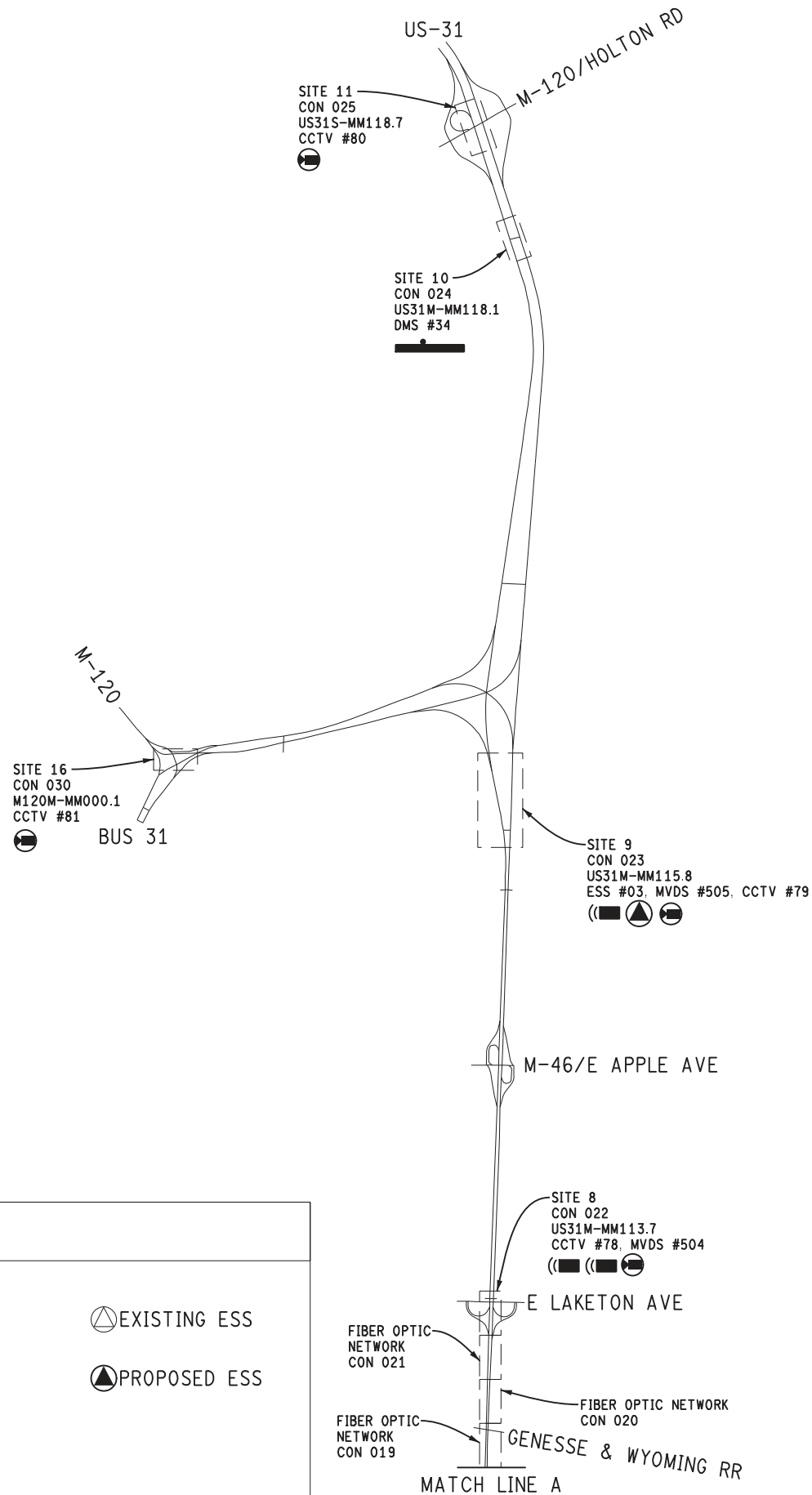
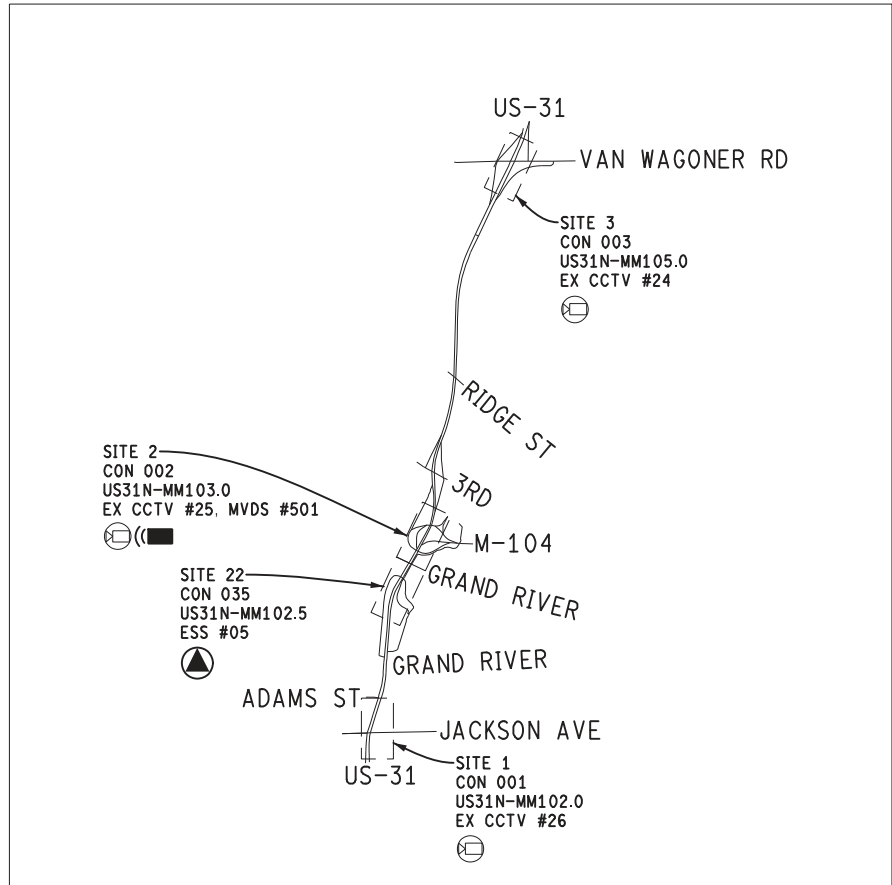
- SEWER - EX
- SEWER - PR
- CATCH BASIN W/ COVER
- MANHOLE W/ COVER
- MANHOLE BASE W/ RISER AND COVER
- MANHOLE TEE W/ RISER AND COVER
- DRAINAGE STRUCTURE NUMBER

UNDERDRAIN

- UNDERDRAIN - PR

SURFACE DRAINAGE

- DITCH CENTERLINE
- WATERS EDGE



LEGEND			
 EXISTING MVDS	 EXISTING SURVEILLANCE SYSTEM	 EXISTING DMS	 EXISTING ESS
 PROPOSED MVDS	 PROPOSED SURVEILLANCE SYSTEM	 PROPOSED DMS	 PROPOSED ESS
 SHEET LIMITS			

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
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VICINITY SHEET	
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GENERAL NOTES

UTILITIES

MISS DIG/UNDERGROUND UTILITY NOTIFICATION

For the protection of underground utilities and in conformance with Public Act 174 of 2013, the Contractor shall contact MISS DIG System, Inc. by phone at 811 or 800-482-7171 or via the web at either elocate.missdig.org for single address or rte.missdig.org, a minimum of 3 business days prior to excavating, excluding weekends and holidays.

MDOT's roadway lighting system, Intelligent Transportation Systems (ITS) and other miscellaneous electrical systems are not a part of Miss Dig. Contractors shall contact the following at least 5 business days in advance for staking requests. Note these are not emergency contacts for damage to utilities.

Grand Region:
MDOT Roadway Lighting, Traffic Signals, or other electrical systems staking should be Emailed on MDOT Form 5300B (<http://mdotcf.state.mi.us/public/webforms/public/5300B.pdf>) to: MDOT-Electrical-Staking@michigan.gov

Muskegon TSC: 231-767-9038 Ext. 310

Grand Haven Roadway Lighting:
Grand Haven Board of Power and Light: 231-646-6250 or Email to nwinsemius@ghblp.org

Kent, Ottawa and Muskegon Counties:
MDOT ITS systems including traffic cameras, changeable message signs, detection equipment, other sensors and related communication cables and equipment in, over, or along the roadway. ITS staking requests per the Special Provision for Protect ITS Infrastructure should be e-mailed on MDOT Form 5300 to: MDOT-ITS-Staking-Grand@michigan.gov

Telephone inquiries can be made at 616-451-3091.

OUT OF SERVICE UTILITIES

If plan information indicates an existing underground utility is or will be out of service within the limits of this contract, the Contractor is cautioned to treat such a line as if it were still in service and notify "Miss Dig" when working in the area of the out of service facility.

EXISTING WATER MAINS AND SEWERS

The Contractor shall be responsible for any damage to properly identified existing water mains and/or existing sewers during the construction of this project.

ROW / REAL ESTATE

LAWN SPRINKLER SYSTEMS AND LANDSCAPING

Owners of existing lawn sprinkler systems and/or landscaping shall be notified (in writing with a copy sent to the Engineer) by the Contractor two weeks in advance of any work to be done that will affect those systems and/or landscaping. If the property owner fails to relocate the lawn sprinkler system prior to the Contractor beginning work, and if the Contractor cuts the system during the construction, the Contractor shall cap the system pipe and witness the location of the cap with a wooden stake for the property owner's use. The Contractor shall place the salvaged sprinkler heads on the property owner's property. If the property owner fails to relocate the landscaping prior to the Contractor beginning work, the Contractor shall carefully salvage the landscaping items and stockpile them on the property owner's property for the property owner. Any other modification to the lawn sprinkler systems and/or landscaping is the responsibility of the owner and is not part of this contract. This work is included in other items of the project.

OLD PLANS

OLD ROAD PLANS

The following old road plans were referred to in the design of this project.
106327A, 100377A, 89731A

In addition, other old road plans that predate this project may be available. These plans may be reviewed in the Transportation Service Center (TSC) during normal working hours.

EARTHWORK

EARTHWORK

Earthwork quantities are computed based upon limited survey information. These quantities are for bidding purposes only and will be adjusted by the Engineer based upon actual field measurements.

SOIL EROSION MEASURES

Appropriate soil erosion and sedimentation control measures shall be in place prior to earth-disturbing activities. Place silt fencing to protect ditches and waterways during construction of conduit, handholes, and foundations as directed by the Engineer. Place turf establishment items as soon as possible on potential erodable slopes as directed by the Engineer. Critical ditch grades shall be protected with either sod or seed/mulch or mulch blanket as directed by the Engineer.

PAVEMENT

SOIL BORINGS AND/OR PAVEMENT CORES

The soil boring logs and/or pavement cores represent point information. No inference should be made that subsurface or pavement conditions are the same at other locations.

GUARDRAIL

GUARDRAIL AT BRIDGE APPROACH

Guardrail shall be extended parallel to the existing bridge railing until past the bridge approach curb & gutter before flaring to shoulder.

GUARDRAIL CONNECTIONS TO EXISTING GUARDRAIL

Connections of proposed guardrail to existing guardrail shall be field drilled. Any additional cost for this work shall be included in the pay item of the proposed guardrail.

GUARDRAIL POST HOLES

Posts placed within 3' of existing culverts shall be in drilled holes and shall not be driven.

TURF ESTABLISHMENT

SEED MIXTURE

The symbol for the permanent turf seed mixture on this project is symbol TDS.

REST AREA AND/OR LANDSCAPING

Existing vegetation shall not be damaged during construction operations, per the 2012 Standard Specifications for Construction.

Heavy equipment will not be allowed to work outside the slope stake lines in the wooded portion of the site. All equipment to be used must be approved by the engineer prior to beginning work.

Storage of equipment and materials will be restricted to areas designated by the Engineer. No equipment is permitted within the drip line of existing trees to remain.

Branches of all trees to be saved shall not be removed, or damaged by construction equipment. If removal of lower branches is necessary, contact Roadside Development or the Region Resource Specialist for proper methods.

Do not trench within the drip line of existing trees to remain unless specifically approved by the Engineer.

Contractor shall promptly restore any property damage at no expense to MDOT.

All raw fill or cut slopes will be covered with slope restoration according to the special provision and time limitations specified in section 816.03 of the 2012 Standard Specifications for Construction.

All excavated material will become the property of the contactor. Any excavated material not used on the project will be removed from the site and disposed of in accordance with section 205.03.P. of the 2012 Standard Specification for Construction and any applicable state and/or local ordinances.

Protect existing sidewalks from damage.

SIGNALS

PREVIOUS GENERAL NOTES

Some notes previously included in "General Notes" are now located within the Frequently Used Special Provision titled "Traffic Signal Work - Construction Methods".

MAINTAINING AGENCY CONTACT INFORMATION

- MDOT: Statewide Signal Shop (517-322-3360)

NOTIFICATIONS TO MAINTAINING AGENCIES

Contact MDOT (and any other maintaining agency) seven working days prior to start of construction and seven working days prior to signal activation.

PROJECT SPECIFIC NOTES

GENERAL

1. Splices in conductors will not be allowed at any location in the power system, unless otherwise noted.

2. The Contractor shall be responsible for returning all areas which are disturbed as a result of construction and installation of elements in this contract to their original state within 15 days of completion of work in that area, or as directed by the Engineer. The restoration of such areas will be paid for with the slope restoration contract items. The area of slope restoration shall be limited to four (4) feet parallel to each side of direct burial conduit and a 625 square foot area of excavation for each ITS handhole or device foundation. Any disturbance outside of these areas shall be restored at the Contractors' expense. No damage to ditches shall occur. Any ditches requiring restoration will be paid for with the Ditch Cleanout contract item, as directed by the Engineer.

3. At no time during the construction of this project will the Contractor be permitted to impact any Enhanced Mile Marker sign. Any sign damaged as a result of the Contractor's operations shall be replaced at the Contractor's expense, including surveying and staking the sign location.

4. The Contractor must field verify all device locations. The northing and easting coordinates provided will be used to determine approximate device location. Offsets given from edge of traveled lane, control points, and other existing features must be used to determine the exact location of the device. These offsets are to the centerline of the device/pole, unless noted otherwise. All device locations are subject to approval by the Engineer.

CONDUIT AND HANDHOLE INSTALLATION

1. 14AWG THHN solid copper wire shall be placed continuously in all underground conduit runs with fiber optic cable as a tracer wire. The tracer wire shall not be connected to any other electrical components and shall not have green insulation. All materials and labor associated with furnishing and installing the copper wire are considered included in the pay item "Tracer Wire".

2. Conduit sizes are shown as minimums. The Contractor may at his option and expense, use a larger size conduit than specified provided the larger size is continuous for the entire length of the run from outlet to outlet. Reducing couplings are not permitted. Changes in the conduit location and size on the project plans shall be documented by the Contractor and submitted to the project Engineer for approval prior to installation.

3. All direct buried conduits shall be Schedule 80 or equivalent.

4. Trenched conduits shall be separated by the use of a commercially available conduit spacer or approved equivalent for runs with three (3) or more conduits in the same trench.

5. Where expansion fittings are used on steel conduit, provide a bonding jumper of #6 AWG flexible wire or bond bushing.

6. Conduit expansion joints shall be installed on all new conduits that are crossing expansion joints on bridge structures and where conduit transitions from underground to above ground. They will not be paid for separately, but shall be included in the cost of the conduit.

7. After the installation of all cables and wire in conduit, conduit openings shall be plugged at both ends with a conduit sealant approved by the Engineer. No expanding foam sealant shall be used.

8. The phone number for the West Michigan Transportation Operations Center, (616) 451-8329, shall be printed on all above ground fiber optic markers.

TRENCHING

1. All trenching must be done in accordance with section 819 of the 2012 Standard Specifications for Construction. Trenches shall not be left open overnight (unless approved by the Engineer) and shall be backfilled to the satisfaction of the Engineer. If a trench must be left open overnight a minimum of 6 inches of backfill material shall be used as a protective cover to eliminate contraction of the conduit system. No additional payment shall be made for trenches left open overnight. The backfill material shall be removed by the Contractor upon the request of the Engineer if final inspection has not been made.

3. If trench widths less than 1 foot are proposed by the Contractor, approved compaction methods shall be used during backfill to prevent latent trench failures. The Contractor shall use grout or lean fill as approved by the Engineer in lieu of earth backfill.

BACKFILLING AND SURFACE RESTORATION

1. All surplus excavated material shall be removed and properly disposed within 48 hours by the Contractor outside of the right-of-way. After each excavation is complete the Contractor shall notify the Engineer for inspection and under no circumstances shall any underground materials or equipment be covered with fill without proper approval.

UNDERGROUND UTILITIES

1. If any parts of the freeway lighting system, traffic signal systems, ITS network, or other miscellaneous electrical systems are damaged during

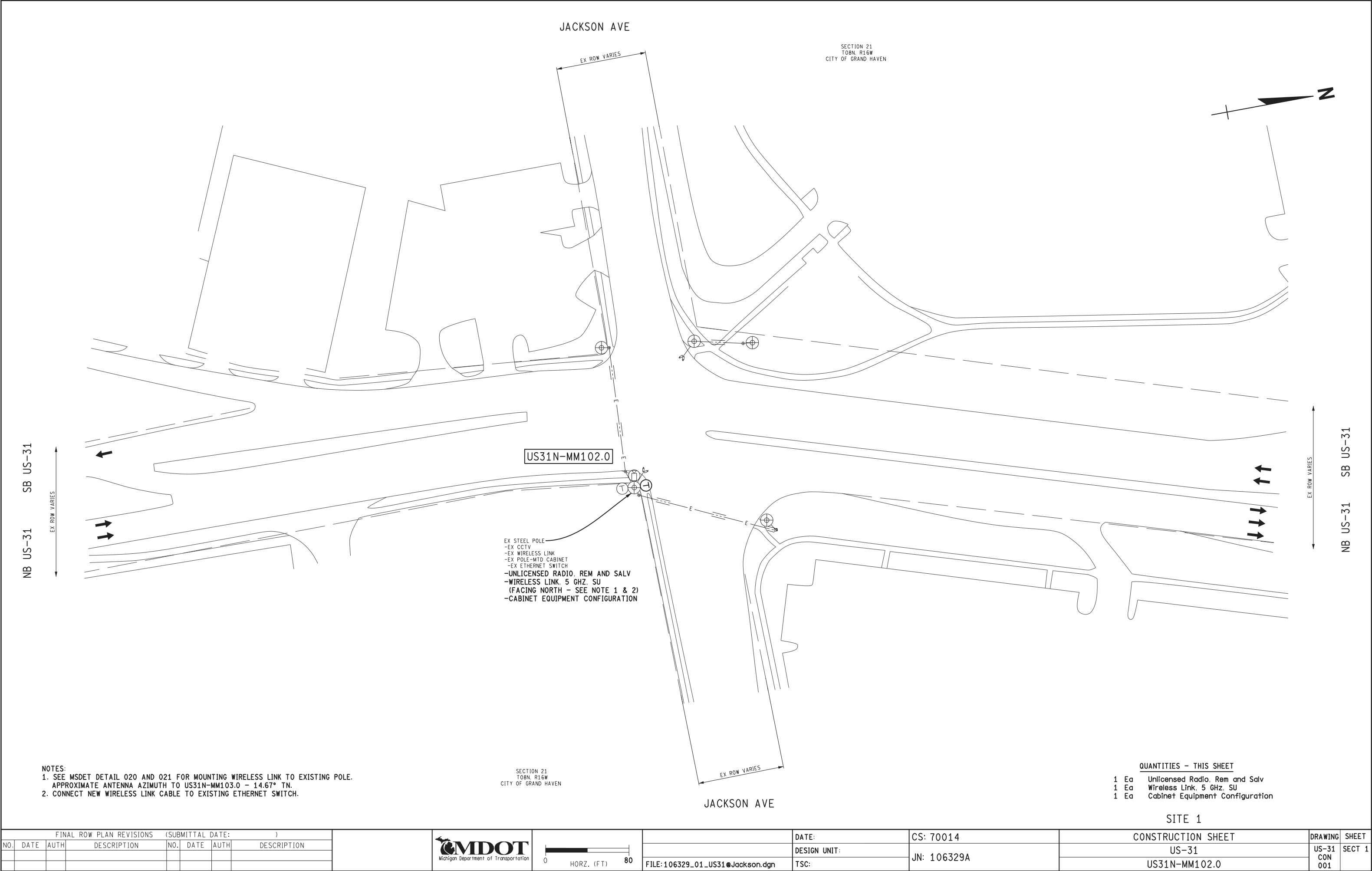
FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)									NO SCALE		DATE:	CS: 84923	NOTE SHEET	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:	JN: 106329A			
										FILE: 106329_Note_001.doc	TSC:				
												NOTE 001	SECT 1		

- construction, the Contractor shall contact the designated MDOT project representative immediately. The Contractor shall be responsible for all repairs including any expenses. The freeway lighting system, traffic signal systems, ITS network, or other miscellaneous electrical systems are to remain unless otherwise noted on the plans.
2. The plans show the best available underground facilities information as provided by the utility companies. Before beginning excavation, the Contractor shall field verify location and depth of existing underground utility systems. The Department will not be responsible for damage to any underground facilities caused by the Contractor.
3. Work required to locate existing underground facilities will only be paid for separately to install direct burial conduit, the cost for this work is included in the pay item “Exploratory Investigation, Vertical”. Work required to locate existing underground facilities will not be paid for separately to install directionally bored conduit, the cost for this work will be included in contract unit prices for directionally bored conduit.
4. Except as noted on the plans, direct burial conduit shall cross above existing underground utilities and directionally bored conduit shall cross below existing utilities.
5. Conduit runs shown on the project plans shall be changed to avoid underground obstructions as directed by the Engineer. The maximum bend of a conduit shall be 45 degrees, with the exception of pre-formed vertical sweeps, and the radius shall not be less than twelve times the inside diameter.
6. All underdrain outlets, outlet endings, culverts less than or equal to 24 inches in diameter, and fencing conflicting with the proposed design shall be removed and replaced by the Contractor as approved by the Engineer.
7. Minimum clearances must be maintained according to the Conduit Installation Details sheet.
8. Damage to underdrain outlets shall be repaired by the Contractor and this work is quantified on the miscellaneous quantities sheet.

TREES AND VEGETATION

1. Do not trench within the drip line of existing trees to remain unless specifically approved by the Engineer. No machinery, vehicles, equipment, stock pile of materials or aggregate of any kind shall be either stored or staged with the drip line of the any tree that will not be removed as part of the project. All remaining trees are to be protected from all equipment and activities as part of this project.
2. All proposed handhole locations and conduit routes that will require the removal of trees or clearing of brush shall be approved by the Engineer prior to the commencing of work. Trees with a diameter of 6 inches or greater, as specified in section 202.04A of the 2012 Standard Specifications for Construction, will not be removed.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)									NO SCALE		DATE:	CS: 84923	NOTE SHEET	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:	JN: 106329A			SECT 1
										FILE: 106329_Note_001.doc	TSC:			NOTE 002	



NOTES:
1. SEE MSDET DETAIL 020 AND 021 FOR MOUNTING WIRELESS LINK TO EXISTING POLE.
APPROXIMATE ANTENNA AZIMUTH TO US31N-MM103.0 - 14.67° TN.
2. CONNECT NEW WIRELESS LINK CABLE TO EXISTING ETHERNET SWITCH.

QUANTITIES - THIS SHEET		
1 Ea	Unlicensed Radio, Rem and Salv	
1 Ea	Wireless Link, 5 GHz, SU	
1 Ea	Cabinet Equipment Configuration	

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 106329_01_US31@Jackson.dgn

DATE:	CS: 70014
DESIGN UNIT:	JN: 106329A
TSC:	

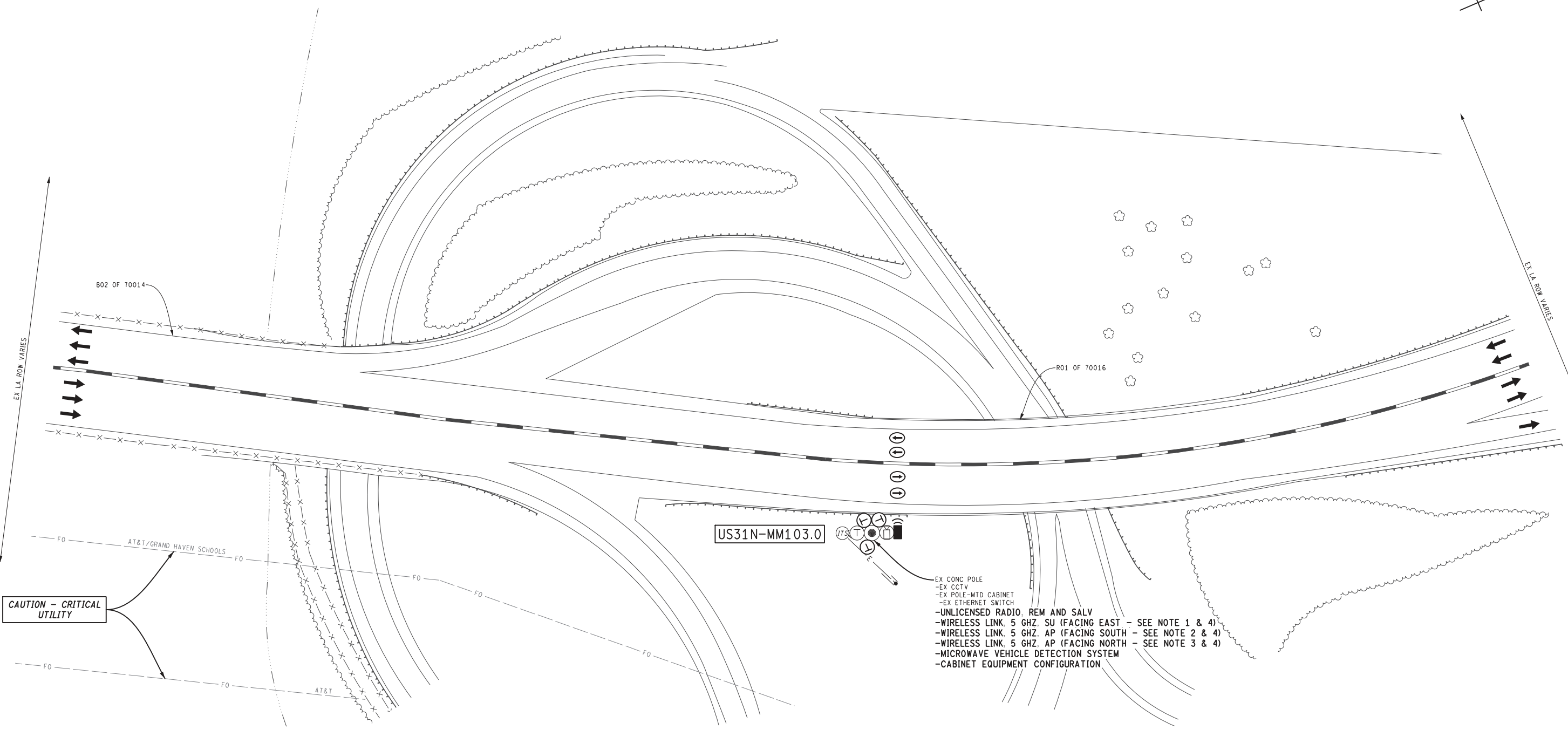
SITE 1		DRAWING	SHEET
CONSTRUCTION SHEET		US-31	SECT 1
US31N-MM102.0		US-31 CON 001	

SECTION 16
T08N, R16W
CITY OF FERRYSBURG



NB US-31 SB US-31

NB US-31 SB US-31



- NOTES:
1. SEE MSDET DETAIL 020 AND 021 FOR MOUNTING WIRELESS LINK TO EXISTING POLE. APPROXIMATE ANTENNA AZIMUTH TO I96W-MM007.7 - 79.30° TN.
 2. SEE MSDET DETAIL 020 AND 021 FOR MOUNTING WIRELESS LINK TO EXISTING POLE. APPROXIMATE ANTENNA AZIMUTH TO US31N-MM102.0 - 194.67° TN.
 3. SEE MSDET DETAIL 020 AND 021 FOR MOUNTING WIRELESS LINK TO EXISTING POLE. APPROXIMATE ANTENNA AZIMUTH TO US31N-MM105.0 - 12.05° TN.
 4. CONNECT NEW WIRELESS LINK CABLES TO EXISTING ETHERNET SWITCH.

SECTION 16
T08N, R16W
CITY OF FERRYSBURG

EB M-104

WB M-104

PINE ST

SITE 2

QUANTITIES - THIS SHEET		
1 Ea	Unlicensed Radio, Rem and Salv	
1 Ea	Wireless Link, 5 GHZ, SU	
2 Ea	Wireless Link, 5 GHZ, AP	
1 Ea	Cabinet Equipment Configuration	
1 Ea	Microwave Vehicle Detection System	

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)									 0 80 HORZ. (FT)		DATE:	CS: 70016	CONSTRUCTION SHEET		DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:	JN: 106329A	US-31		US-31 CON 002	SECT 1
													US31N-MM103.0			
											FILE: 106329_02_US31@M104.dgn	TSC:				

VAN WAGONER RD

SECTION 09
T08N, R16W
CITY OF FERRYSBURG

SECTION 09
T08N, R16W
SPRING LAKE TWP



NB US-31 SB US-31

EX LA ROW VARIES

NB US-31 SB US-31

EX LA ROW VARIES

US31N-MM105.0

- EX STEEL POLE
- EX CCTV
- EX POLE-MTD CABINET
- EX ETHERNET SWITCH
- UNLICENSED RADIO, REM AND SALV
- WIRELESS LINK, 5 GHZ, SU
- (FACING SOUTH - SEE NOTE 1 & 2)
- CABINET EQUIPMENT CONFIGURATION

- NOTES:
- SEE MSDOT DETAIL 020 AND 021 FOR MOUNTING WIRELESS LINK TO EXISTING POLE.
APPROXIMATE ANTENNA AZIMUTH TO US31N-MM103.0 - 192.05° TN.
 - CONNECT NEW WIRELESS LINK CABLES TO EXISTING ETHERNET SWITCH.

SECTION 09
T08N, R16W
CITY OF FERRYSBURG

SECTION 09
T08N, R16W
SPRING LAKE TWP

VAN WAGONER RD

QUANTITIES - THIS SHEET

- | | |
|------|---------------------------------|
| 1 Ea | Unlicensed Radio, Rem and Salv |
| 1 Ea | Wireless Link, 5 GHZ, SU |
| 1 Ea | Cabinet Equipment Configuration |

SITE 3

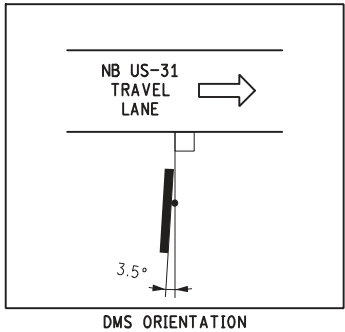
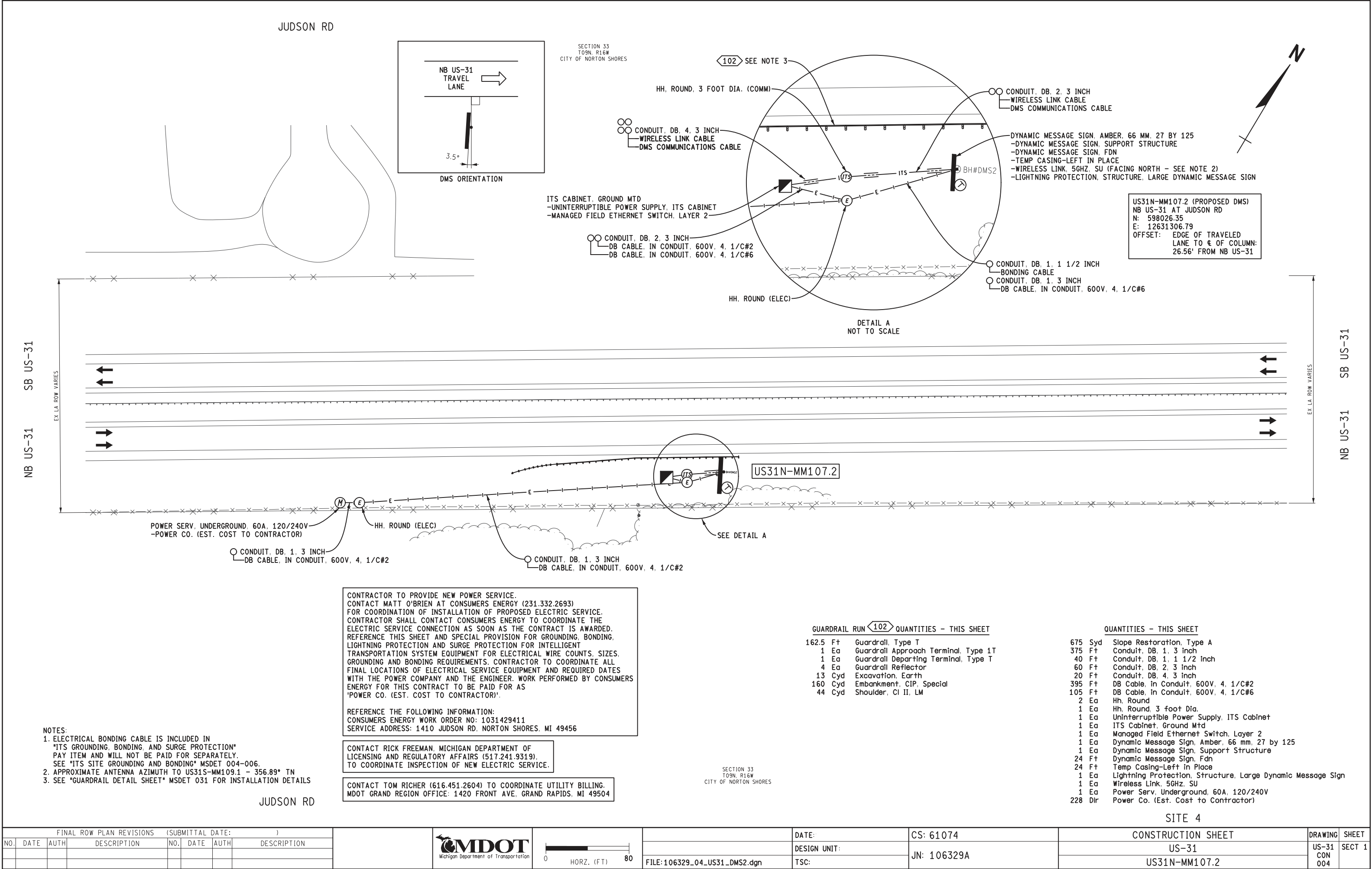
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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 106329_03_US31@VanWagoner.dgn

DATE:	CS: 70016
DESIGN UNIT:	JN: 106329A
TSC:	

CONSTRUCTION SHEET		DRAWING	SHEET
US-31		US-31	SECT 1
US31N-MM105.0		CON 003	



SECTION 33
T09N, R16W
CITY OF NORTON SHORES

102 SEE NOTE 3

HH, ROUND, 3 FOOT DIA. (COMM)

CONDUIT, DB, 4, 3 INCH
WIRELESS LINK CABLE
DMS COMMUNICATIONS CABLE

CONDUIT, DB, 2, 3 INCH
WIRELESS LINK CABLE
DMS COMMUNICATIONS CABLE

DYNAMIC MESSAGE SIGN, AMBER, 66 MM, 27 BY 125
-DYNAMIC MESSAGE SIGN, SUPPORT STRUCTURE
-DYNAMIC MESSAGE SIGN, FDN
-TEMP CASING-LEFT IN PLACE
-WIRELESS LINK, 5GHZ, SU (FACING NORTH - SEE NOTE 2)
-LIGHTNING PROTECTION, STRUCTURE, LARGE DYNAMIC MESSAGE SIGN

US31N-MM107.2 (PROPOSED DMS)
NB US-31 AT JUDSON RD
N: 598026.35
E: 12631306.79
OFFSET: EDGE OF TRAVELED
LANE TO C OF COLUMN:
26.56' FROM NB US-31

ITS CABINET, GROUND MTD
-UNINTERRUPTIBLE POWER SUPPLY, ITS CABINET
-MANAGED FIELD ETHERNET SWITCH, LAYER 2

CONDUIT, DB, 2, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#2
DB CABLE, IN CONDUIT, 600V, 4, 1/C#6

CONDUIT, DB, 1, 1 1/2 INCH
BONDING CABLE
CONDUIT, DB, 1, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#6

HH, ROUND (ELEC)

DETAIL A
NOT TO SCALE

US31N-MM107.2

SEE DETAIL A

POWER SERV. UNDERGROUND, 60A, 120/240V
-POWER CO. (EST. COST TO CONTRACTOR)

CONDUIT, DB, 1, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#2

CONDUIT, DB, 1, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#2

CONTRACTOR TO PROVIDE NEW POWER SERVICE.
CONTACT MATT O'BRIEN AT CONSUMERS ENERGY (231.332.2693)
FOR COORDINATION OF INSTALLATION OF PROPOSED ELECTRIC SERVICE.
CONTRACTOR SHALL CONTACT CONSUMERS ENERGY TO COORDINATE THE
ELECTRIC SERVICE CONNECTION AS SOON AS THE CONTRACT IS AWARDED.
REFERENCE THIS SHEET AND SPECIAL PROVISION FOR GROUNDING, BONDING,
LIGHTNING PROTECTION AND SURGE PROTECTION FOR INTELLIGENT
TRANSPORTATION SYSTEM EQUIPMENT FOR ELECTRICAL WIRE COUNTS, SIZES,
GROUNDING AND BONDING REQUIREMENTS. CONTRACTOR TO COORDINATE ALL
FINAL LOCATIONS OF ELECTRICAL SERVICE EQUIPMENT AND REQUIRED DATES
WITH THE POWER COMPANY AND THE ENGINEER. WORK PERFORMED BY CONSUMERS
ENERGY FOR THIS CONTRACT TO BE PAID FOR AS
'POWER CO. (EST. COST TO CONTRACTOR)'.

REFERENCE THE FOLLOWING INFORMATION:
CONSUMERS ENERGY WORK ORDER NO: 1031429411
SERVICE ADDRESS: 1410 JUDSON RD, NORTON SHORES, MI 49456

CONTACT RICK FREEMAN, MICHIGAN DEPARTMENT OF
LICENSING AND REGULATORY AFFAIRS (517.241.9319),
TO COORDINATE INSPECTION OF NEW ELECTRIC SERVICE.

CONTACT TOM RICHER (616.451.2604) TO COORDINATE UTILITY BILLING.
MDOT GRAND REGION OFFICE: 1420 FRONT AVE, GRAND RAPIDS, MI 49504

SECTION 33
T09N, R16W
CITY OF NORTON SHORES

- NOTES:
- ELECTRICAL BONDING CABLE IS INCLUDED IN
'ITS GROUNDING, BONDING, AND SURGE PROTECTION'
PAY ITEM AND WILL NOT BE PAID FOR SEPARATELY.
SEE 'ITS SITE GROUNDING AND BONDING' MSDT 004-006.
 - APPROXIMATE ANTENNA AZIMUTH TO US31S-MM109.1 - 356.89° TN
 - SEE "GUARDRAIL DETAIL SHEET" MSDT 031 FOR INSTALLATION DETAILS

GUARDRAIL RUN 102 QUANTITIES - THIS SHEET

162.5	Ft	Guardrail, Type T
1	Ea	Guardrail Approach Terminal, Type 1T
1	Ea	Guardrail Departing Terminal, Type T
4	Ea	Guardrail Reflector
13	Cyd	Excavation, Earth
160	Cyd	Embankment, CIP, Special
44	Cyd	Shoulder, CI II, LM

QUANTITIES - THIS SHEET

675	Syd	Slope Restoration, Type A
375	Ft	Conduit, DB, 1, 3 inch
40	Ft	Conduit, DB, 1, 1 1/2 inch
60	Ft	Conduit, DB, 2, 3 inch
20	Ft	Conduit, DB, 4, 3 inch
395	Ft	DB Cable, in Conduit, 600V, 4, 1/C#2
105	Ft	DB Cable, in Conduit, 600V, 4, 1/C#6
2	Ea	Hh, Round
1	Ea	Hh, Round, 3 foot Dia.
1	Ea	Uninterruptible Power Supply, ITS Cabinet
1	Ea	ITS Cabinet, Ground Mtd
1	Ea	Managed Field Ethernet Switch, Layer 2
1	Ea	Dynamic Message Sign, Amber, 66 mm, 27 by 125
1	Ea	Dynamic Message Sign, Support Structure
24	Ft	Dynamic Message Sign, Fdn
24	Ft	Temp Casing-Left in Place
1	Ea	Lightning Protection, Structure, Large Dynamic Message Sign
1	Ea	Wireless Link, 5GHz, SU
1	Ea	Power Serv, Underground, 60A, 120/240V
228	Dlr	Power Co. (Est. Cost to Contractor)

SITE 4

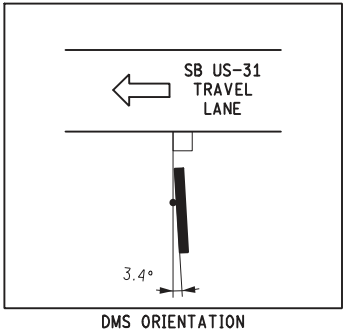
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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:	JN: 106329A	US-31		US-31 CON 004	SECT 1
													US31N-MM107.2			
											FILE: 106329_04_US31_DMS2.dgn	TSC:				

CONTRACTOR TO PROVIDE NEW POWER SERVICE.
CONTACT NICHOLAS PAGE AT CONSUMERS ENERGY (231.332.2640)
FOR COORDINATION OF INSTALLATION OF PROPOSED ELECTRIC SERVICE.
CONTRACTOR SHALL CONTACT CONSUMERS ENERGY TO COORDINATE THE
ELECTRIC SERVICE CONNECTION AS SOON AS THE CONTRACT IS AWARDED.
REFERENCE THIS SHEET AND SPECIAL PROVISION FOR GROUNDING, BONDING,
LIGHTNING PROTECTION AND SURGE PROTECTION FOR INTELLIGENT
TRANSPORTATION SYSTEM EQUIPMENT FOR ELECTRICAL WIRE COUNTS, SIZES,
GROUNDING AND BONDING REQUIREMENTS. CONTRACTOR TO COORDINATE ALL
FINAL LOCATIONS OF ELECTRICAL SERVICE EQUIPMENT AND REQUIRED DATES
WITH THE POWER COMPANY AND THE ENGINEER. WORK PERFORMED BY CONSUMERS
ENERGY FOR THIS CONTRACT TO BE PAID FOR AS
'POWER CO. (EST. COST TO CONTRACTOR)'.

REFERENCE THE FOLLOWING INFORMATION:
CONSUMERS ENERGY WORK ORDER NO: 1031427499
SERVICE ADDRESS: 1640 BECKER RD, MUSKEGON, MI 49445

CONTACT RICK FREEMAN, MICHIGAN DEPARTMENT OF
LICENSING AND REGULATORY AFFAIRS (517.241.9319),
TO COORDINATE INSPECTION OF NEW ELECTRIC SERVICE.

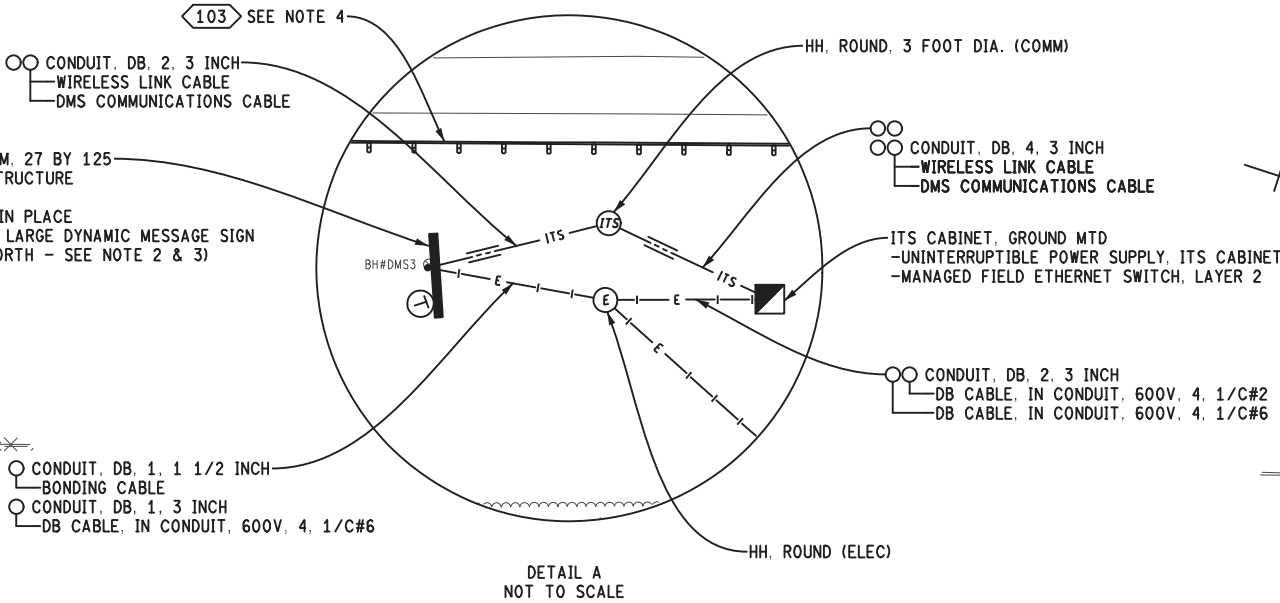
CONTACT TOM RICHER (616.451.2604) TO COORDINATE UTILITY BILLING.
MDOT GRAND REGION OFFICE: 1420 FRONT AVE, GRAND RAPIDS, MI 49504



SECTION 04
TION, R16W
MUSKEGON TWP

DYNAMIC MESSAGE SIGN, AMBER, 66 MM, 27 BY 125
-DYNAMIC MESSAGE SIGN, SUPPORT STRUCTURE
-DYNAMIC MESSAGE SIGN, FDN
-TEMP CASING-LEFT IN PLACE-LEFT IN PLACE
-LIGHTNING PROTECTION, STRUCTURE, LARGE DYNAMIC MESSAGE SIGN
-WIRELESS LINK, 5GHZ, SU (FACING NORTH - SEE NOTE 2 & 3)

US31M-MM118.1 (PROPOSED DMS)
NB US-31 AT M-120
N: 655637.28
E: 12634004.81
OFFSET: EDGE OF TRAVELED
LANE TO C OF COLUMN:
29.14' FROM SB US-31



SB US-31

NB US-31

EX LA ROW VARIES

EX LA ROW VARIES

SB US-31

NB US-31

- NOTES:
- ELECTRICAL BONDING CABLE IS INCLUDED IN
"ITS GROUNDING, BONDING, AND SURGE PROTECTION"
PAY ITEM AND WILL NOT BE PAID FOR SEPARATELY.
SEE "ITS SITE GROUNDING AND BONDING" MDET 004-006.
 - SEE ITS DETAIL 023 FOR MOUNTING WIRELESS LINK TO DMS.
 - APPROXIMATE ANTENNA AZIMUTH TO US31M-MM118.7 - 338.40° TN
 - SEE "GUARDRAIL DETAIL SHEET" MSCDET 030 FOR INSTALLATION DETAILS.

GUARDRAIL RUN 103 QUANTITIES - THIS SHEET

175	Ft	Guardrail, Type T
1	Ea	Guardrail Approach Terminal, Type 1T
1	Ea	Guardrail Departing Terminal, Type T
4	Ea	Guardrail Reflector
19	Cyd	Excavation, Earth
73	Cyd	Embankment, CIP, Special
48	Cyd	Shoulder, CI II, LM

QUANTITIES - THIS SHEET

930	Syd	Slope Restoration, Type A
295	Ft	Conduit, DB, 1, 3 inch
25	Ft	Conduit, DB, 1, 1 1/2 inch
50	Ft	Conduit, DB, 2, 3 inch
25	Ft	Conduit, DB, 4, 3 inch
80	Ft	Conduit, Directional Bore, 1, 3 inch
425	Ft	DB Cable, in Conduit, 600V, 4, 1/C#2
95	Ft	DB Cable, in Conduit, 600V, 4, 1/C#6
4	Ea	Hh, Round
1	Ea	Hh, Round, 3 foot Dia.
1	Ea	Uninterruptible Power Supply, ITS Cabinet
1	Ea	ITS Cabinet, Ground Mtd
1	Ea	Managed Field Ethernet Switch, Layer 2
1	Ea	Dynamic Message Sign, Amber, 66 mm, 27 by 125
1	Ea	Dynamic Message Sign, Support Structure
25	Ft	Dynamic Message Sign, Fdn
25	Ft	Temp Casing-Left in Place-Left in Place
1	Ea	Lightning Protection, Structure, Large Dynamic Message Sign
1	Ea	Wireless Link, 5GHz, SU
1	Ea	Power Serv, Underground, 60A, 120/240V
802	Dlr	Power Co. (Est. Cost to Contractor)

SITE 10

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 106329_24_US31_DMS3.dgn

DATE: CS: 61075
DESIGN UNIT: JN: 106329A
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CONSTRUCTION SHEET
US-31
US31M-MM118.1

DRAWING SHEET
US-31
CON
024
SECT 1

M-120/HOLTON RD

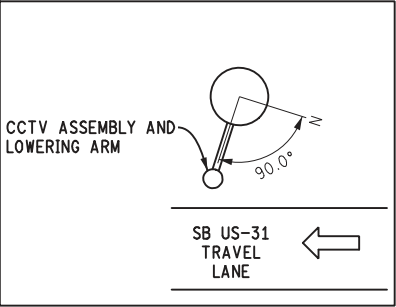
SECTION 04
T10N, R16W
MUSKEGON TWP

CONTRACTOR TO PROVIDE NEW POWER SERVICE.
CONTACT NICHOLAS PAGE AT CONSUMERS ENERGY (231.332.2640)
FOR COORDINATION OF INSTALLATION OF PROPOSED ELECTRIC SERVICE.
CONTRACTOR SHALL CONTACT CONSUMERS ENERGY TO COORDINATE THE
ELECTRIC SERVICE CONNECTION AS SOON AS THE CONTRACT IS AWARDED.
REFERENCE THIS SHEET AND SPECIAL PROVISION FOR GROUNDING, BONDING,
LIGHTNING PROTECTION AND SURGE PROTECTION FOR INTELLIGENT
TRANSPORTATION SYSTEM EQUIPMENT FOR ELECTRICAL WIRE COUNTS, SIZES,
GROUNDING AND BONDING REQUIREMENTS. CONTRACTOR TO COORDINATE ALL
FINAL LOCATIONS OF ELECTRICAL SERVICE EQUIPMENT AND REQUIRED DATES
WITH THE POWER COMPANY AND THE ENGINEER. WORK PERFORMED BY CONSUMERS
ENERGY FOR THIS CONTRACT TO BE PAID FOR AS
'POWER CO. (EST. COST TO CONTRACTOR)'.

REFERENCE THE FOLLOWING INFORMATION:
CONSUMERS ENERGY WORK ORDER NO: 1031427589
SERVICE ADDRESS: 2100 HOLTON RD, MUSKEGON, MI 49445

CONTACT RICK FREEMAN, MICHIGAN DEPARTMENT OF
LICENSING AND REGULATORY AFFAIRS (517.241.9319),
TO COORDINATE INSPECTION OF NEW ELECTRIC SERVICE.

CONTACT TOM RICHER (616.451.2604) TO COORDINATE UTILITY BILLING.
MDOT GRAND REGION OFFICE: 1420 FRONT AVE, GRAND RAPIDS, MI 49504



US31S-MM118.7 (PROPOSED CCTV)
SB US-31 AT HOLTON RD
N: 658664.83
E: 12632895.56
OFFSET: EDGE OF TRAVELED
LANE TO E OF POLE:
59.79' FROM SB US-31 ON RAMP

HAZARDOUS OR
FLAMMABLE MATERIAL

CAUTION - CRITICAL
UTILITY

CONDUIT, DIRECTIONAL BORE, 1, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#6

HH, ROUND (ELEC)

POWER SERV. UNDERGROUND, 30A, 120/240V
-POWER CO. (EST. COST TO CONTRACTOR)

CONDUIT, DB, 1, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#6

CONDUIT, DB, 1, 3 INCH
DB CABLE, IN CONDUIT, 600V, 4, 1/C#6

CONDUIT, DB, 1, 1 1/2 INCH
BONDING CABLE

HH, ROUND (ELEC)

DETAIL A
NOT TO SCALE

US31S-MM118.7

ITS CABINET, GROUND MTD
-UNINTERRUPTIBLE POWER SUPPLY, ITS CABINET
-DIGITAL VIDEO ENCODER, H.264
-MANAGED FIELD ETHERNET SWITCH, LAYER 2

CONDUIT, DB, 4, 3 INCH
CCTV COMPOSITE CABLE
(2) WIRELESS LINK CABLE

HH, ROUND, 3 FOOT DIA. (COMM)

CONDUIT, DB, 2, 3 INCH
CCTV COMPOSITE CABLE
(2) WIRELESS LINK CABLE

SPUN CONC POLE, TYPE A
-DRILLED SHAFT AND CONC SKIRT, CASED
-FLOWABLE FILL, SPUN POLE FDN
-LIGHTNING PROTECTION, POLE
-SURVEILLANCE SYSTEM, REMOTE SITE, TYPE A
-WIRELESS LINK, 5 GHZ, SU (FACING SOUTH - SEE NOTE 2)
-WIRELESS LINK, 5 GHZ, AP (FACING SOUTH - SEE NOTE 3)

S03 OF 61075

S04 OF 61075

SECTION 04
T10N, R16W
MUSKEGON TWP

M-120/HOLTON RD

NOTES:

- ELECTRICAL BONDING CABLE IS INCLUDED IN
'ITS GROUNDING, BONDING, AND SURGE PROTECTION'
PAY ITEM AND WILL NOT BE PAID FOR SEPARATELY.
SEE 'ITS SITE GROUNDING AND BONDING' MSDT 004-006.
- APPROXIMATE ANTENNA AZIMUTH TO US31S-MM118.1 - 158.04° TN
- APPROXIMATE ANTENNA AZIMUTH TO US31N-MM113.7 - 177.66° TN

QUANTITIES - THIS SHEET

500	Syd	Slope Restoration, Type A
35	Ft	Conduit, DB, 1, 3 inch
15	Ft	Conduit, DB, 1, 1 1/2 inch
15	Ft	Conduit, DB, 2, 3 inch
15	Ft	Conduit, DB, 4, 3 inch
170	Ft	Conduit, Directional Bore, 1, 3 inch
245	Ft	DB Cable, in Conduit, 600V, 4, 1/C#6
2	Ea	Hh, Round
1	Ea	Hh, Round, 3 foot Dia.
1	Ea	Surveillance System, Remote Site, Type A

QUANTITIES - THIS SHEET (CONT.)

1	Ea	Uninterruptible Power Supply, ITS Cabinet
1	Ea	Spun Conc Pole, Type A
1	Ea	Drilled Shaft and Conc Skirt, Cased
2	Cyd	Flowable Fill, Spun Pole Fdn
1	Ea	ITS Cabinet, Ground Mtd
1	Ea	Managed Field Ethernet Switch, Layer 2
1	Ea	Digital Video Encoder, H.264
1	Ea	Lightning Protection, Pole
1	Ea	Wireless Link, 5 GHz, SU
1	Ea	Wireless Link, 5 GHz, AP
1	Ea	Power Serv, Underground, 30A, 120/240V
130	Dir	Power Co. (Est. Cost to Contractor)

SITE 11

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



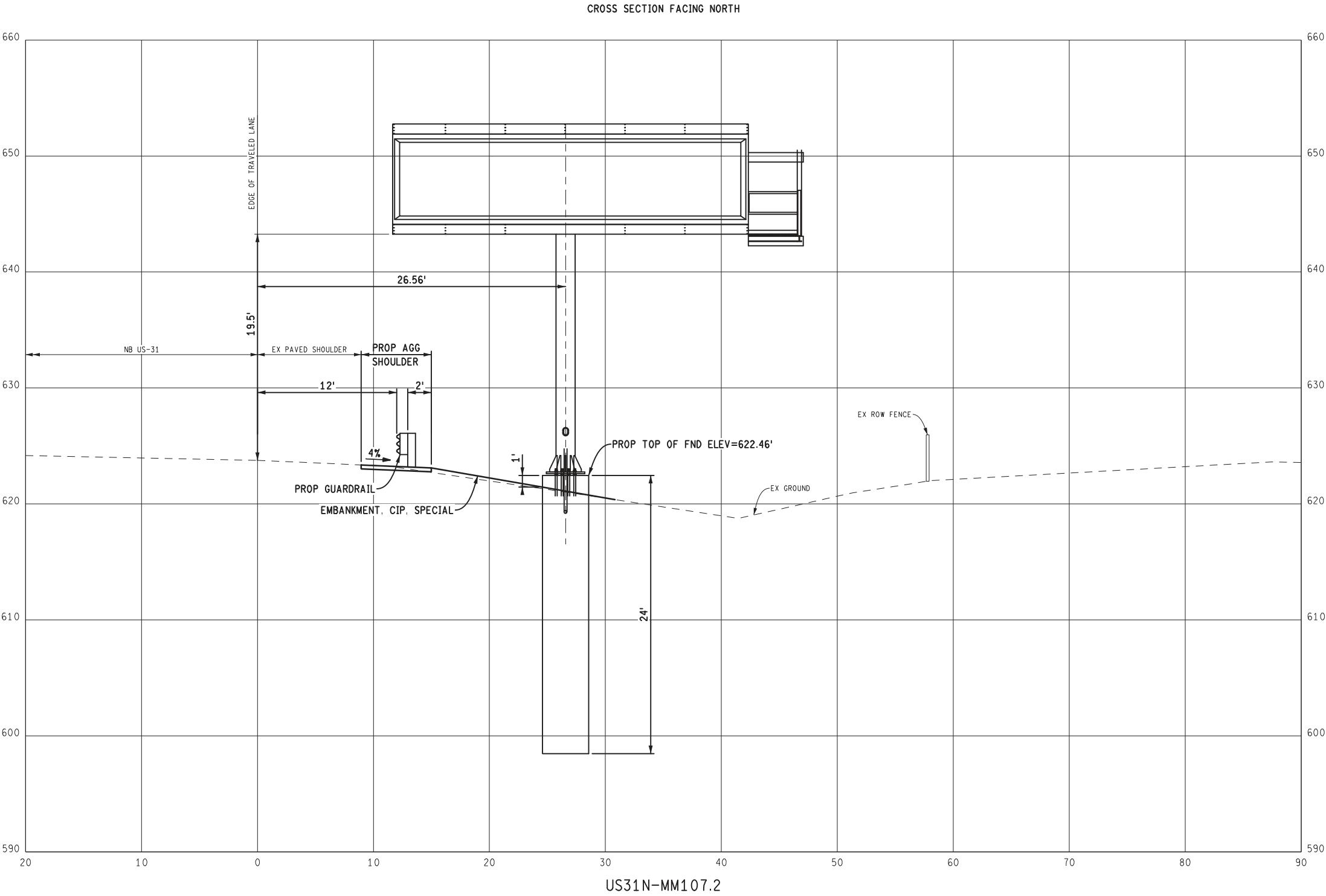
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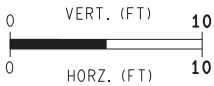
CS: 61075
JN: 106329A

CONSTRUCTION SHEET
US-31
US31S-MM118.7

DRAWING
US-31
CON
025
SHEET
SECT 1



FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 106329_XS2_DMS2.dgn

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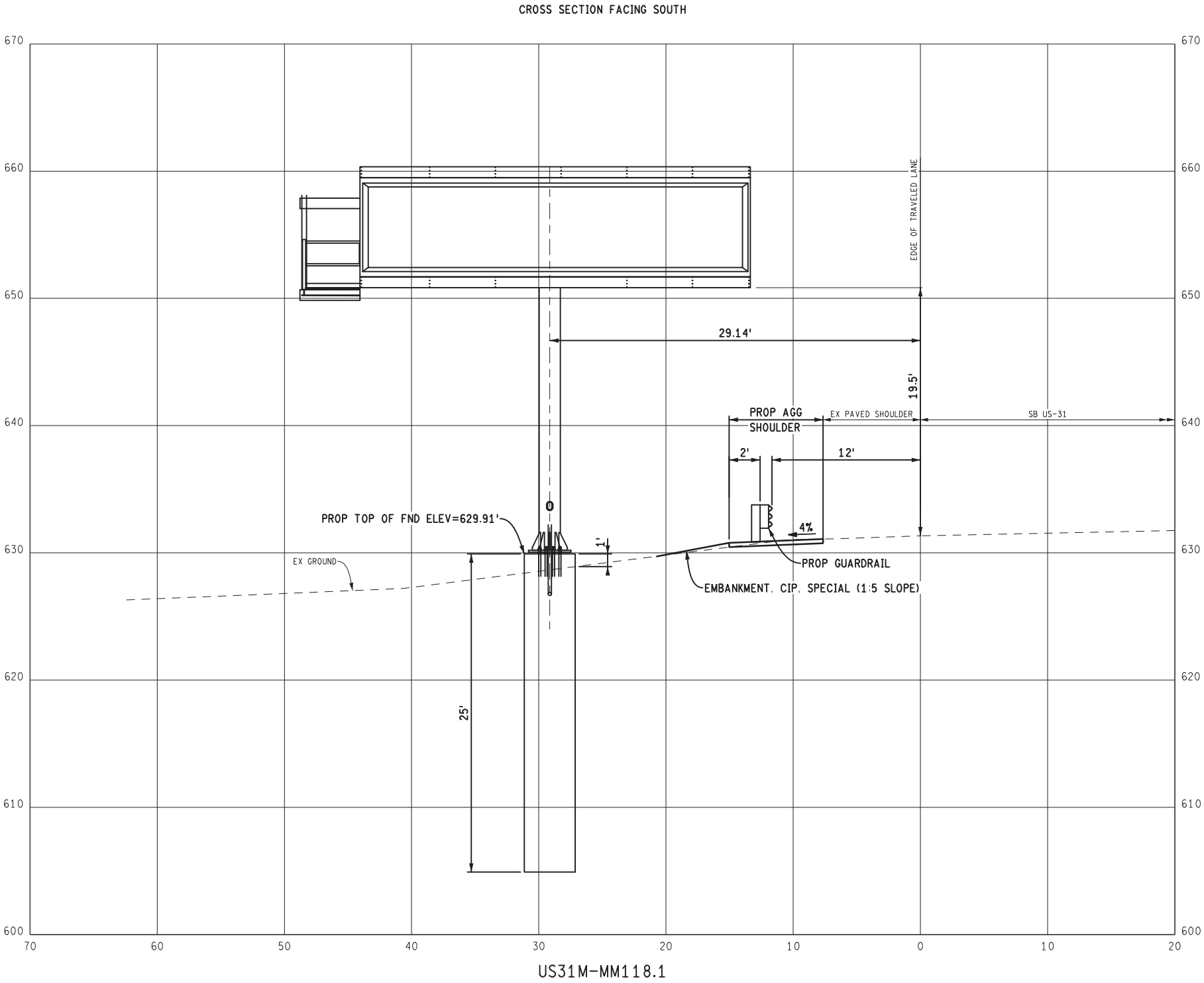
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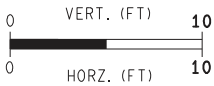
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JN: 106329A

CROSS SECTION SHEET		DRAWING	SHEET
US-31		US-31	SECT 1
US31N-MM107.2		XS 002	



FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
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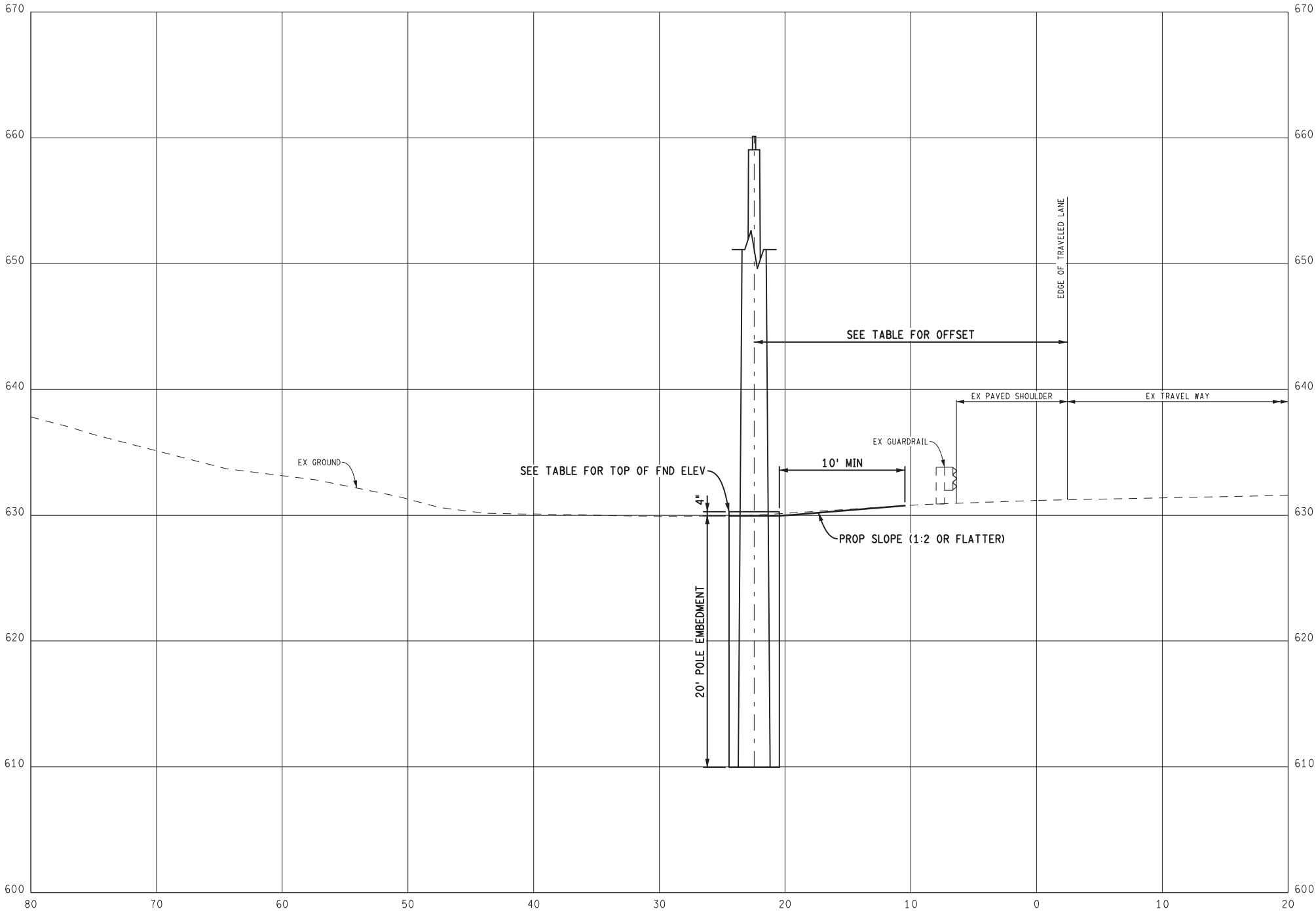


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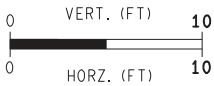
CS: 61075
JN: 106329A

CROSS SECTION SHEET		DRAWING	SHEET
US-31		US-31	SECT 1
US31M-MM118.1		XS 003	



SITE NAME	TOP OF FND ELEV	OFFSET
US31N-MM110.2	614.93'	45.44' FROM WB I-96 ON RAMP
US31M-MM113.7	657.82'	19.28' FROM NB US-31
US31M-MM115.8	626.06'	81.61' FROM NB US-31
US31S-MM118.7	643.17'	59.79' FROM SB US-31 ON RAMP
I96W-MM005.1	630.32'	22.47' FROM WB I-96
I96W-MM007.7	621.40'	53.35' FROM WB I-96
I96E-MM010.1	626.06'	82.79' FROM EB I-96
M120M-MM000.1	586.80'	86.00' FROM SB BUS US-31

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 106329_XS4_CCTV_Typ.dgn

DATE:
DESIGN UNIT:
TSC:

CS: 84923
JN: 106329A

CROSS SECTION SHEET
TYPICAL SPUN CONC POLE

DRAWING XS 004
SHEET SECT 1



The diagrams illustrate the required trench depth and base for different conduit configurations:

- SINGLE CONDUIT:** Shows a single conduit resting on a 6-inch minimum thick base of Class II granular material. The trench depth is indicated as 30 inches minimum cover.
- TWO CONDUITS:** Shows two conduits resting on a 12-inch minimum thick base of Class II granular material. The trench depth is indicated as 30 inches minimum cover.
- FOUR CONDUITS:** Shows four conduits arranged in a 2x2 grid, resting on a 12-inch minimum thick base of Class II granular material. The trench depth is indicated as 30 inches minimum cover. A conduit spacer is shown between the conduits.

Common labels across all diagrams include: GROUND LINE, TRENCH, BACKFILL MATERIAL, CONDUIT(S) AS SHOWN ON PLANS, and CLASS II GRANULAR MATERIAL.

TRENCHED OR PLOWED-IN CONDUIT INSTALLATION

NOTES:

1. MORE THAN TWO CONDUITS INSTALLED IN THE SAME TRENCH SHALL BE SEPARATED USING CONDUIT SPACERS. THE SPACERS SHALL BE USED TO MAINTAIN 2" OF VERTICAL AND HORIZONTAL SEPARATION BETWEEN CONDUITS.
2. CONDUIT INSTALLATION LOCATION AND METHOD ARE SUBJECT TO ENGINEER APPROVAL PRIOR TO BEGINNING WORK.

H	BEHIND GUARDRAIL POSTS	60"
H	FOUNDATIONS	36"
H	OUTSIDE EDGE OF PAVED SHOULDER	60"
H	BACK OF CURB	24"
H	CONCRETE BARRIERS	36"
H	RETAINING WALLS	36"
H	PARALLEL UTILITY RUNS*	24"
H	CENTERLINE OF DITCH	36"
V	BELOW ROAD AND SHOULDER SURFACE	72"
V	OVER/UNDER CULVERTS	12"
V	UTILITY CROSSINGS	24"
V	BOTTOM OF CONCRETE STRUCTURE	120"
V	BELOW STREAM OR CREEK	120"
V	BELOW SURFACE GRADE AT GUARDRAIL POSTS	84"

H= HORIZONTAL CLEARANCE TO NEAREST
EDGE OF CONDUIT.
V= VERTICAL CLEARANCE TO NEAREST
EDGE OF CONDUIT
*VERTICAL CLEARANCE OF 2' WILL BE
ALLOWED IN PLACE OF HORIZONTAL CLERANCE

MINIMUM CONDUIT CLEARANCES

ALL CONDUIT INSTALLATION TO FOLLOW THESE
MINIMUMS UNLESS OTHERWISE NOTED IN THE PLANS

The following items shall be labeling accordingly as they apply throughout the project.

<u>Device Type</u>	<u>Device Type Abbreviation</u>	<u>Device Label Required</u>
Air Conditioning	AC	
CCTV	CCTV	X
Cable Modem	CAMODM	X
Cellular Modem	CEMODM	X
Cabinet Monitor	CM	X
Controller, DMS	CNTR-DMS	X
Controller, Traffic Signal	CNTR-TS	X
Controller, Truck Parking Sign	CNTR-TP	X
Controller, Dynamic Trailblazing Panel	CNTR-DTP	X
Controller, Lane Control System	CNTR-LCS	X
Dehydrator	DHYD	X
Digital Video Encoder	DVE	X
Environmental Sensor, Air	ESAR	X
Environmental Sensor, Barometric Pressure	ESBP	X
Environmental Sensor, Precipitation	ESP	X
Environmental Sensor, Control Unit	ESS	X
Environmental Sensor, Sub-Surface	ESSS	
Environmental Sensor, Various	ESVR	X
Environmental Sensor, Visibility	ESVS	X
Environmental Sensor, Wind	ESWD	X
Ethernet Switch	ESW	X
Fiber Splice Enc.	FBRSP	X
Fiber Distribution Unit	FDU	X
Firewall	FW	X
I/O Module	IO	X
Media Converter	MEDIA	X
MVDS	MVDS	X
Power Supply, AC	PSAC	X
Power Supply, DC	PSDC	X
Radio	RADIO	X
Relay	RLY	X
Remote Processor Unit	RPU	X
Surge Suppression, AC	SGAC	X
Surge Suppression, CAT5	SGC5	X
Surge Suppression, Coax	SGCX	X
Surge Suppression, DC	SGDC	X
Surge Suppression, Serial	SGSR	X
UPS SNMP	SNMP	
Solar Panel	SOLAR	
Safety Switch	SSW	X
Switch	SWITCH	X
Terminal Server	TERM	X
Transformer	TRANS	
Lane Control Sign	LCS	X
Dynamic Trailblazing Sign	DTS	X
Truck Parking Sign	TPS	X
Travel Time Sign	TTS	X
Uninterruptible Power Supply	UPS	X
Variable Speed Sign	VSS	X
Radio - Wireless Interconnect Master	WIM	X
Radio - Wireless Interconnect Remote	WIR	X

Device Labeling

Label all devices in the ITS cabinet as shown in the table to the left. Include both the IP Address (for IP devices) and the site naming convention described below. Use ½" P-Touch label (vinyl) with black printing on white label, and a minimum font size of 5 point. Use the "ITS Common Name", excluding the cross street name, from the Asset Management Data Entry Form. Device #'s are only included for device with a device # greater than one (1).

- ITS Field Devices Label: ITS Field Equipment ID to be the "ITS Common Name" from the Asset Management Data Entry Form.

Examples:
I94E-MM123.4-DVE2
The second DVE at a site on EB I-94 at Mile Marker 123.4

M10S-MM005.4-EWS
The first Ethernet Switch on SB M-10 at Mile Marker 5.4

For sub-devices of a main device, power supply for MVDS, label as described below:

- Sub Device for ITS Field Device Label: (ITS Sub-device) – (ITS Device)
Examples:
TERM-MVDS
The Terminal Server 1 for MVDS1.

PSDC2-CCTV
The second DC power supply in the cabinet powering CCTV1.

ITS Cabinet Labeling

Label all ITS cabinets including splice cabinets per the MDOT Special Provision for "Basic Methods and Materials for Intelligent Transportation Systems Work". Use the "Site Common Name" from the Asset Management Data Entry Form

- ITS Field Cabinet Label:
Example:
I94M-MM123.4
The ITS Cabinet for a site at Mile Marker 123.4 in the median on I-94.
- Splice Cabinet Label
Example:
I94E-MM123.4SP
The Splice Cabinet for a site at Mile Marker 123.4 on eastbound I-94. The notation shall be used for pump stations and cabinets for the State of Michigan drop locations.

Cable Labeling																					
1. All cables starting and ending inside of the cabinet shall be labeled on both ends with an identical label. Use 1" for Cat5 cables or 1½" for fiber cable, self-laminating label (polyester or vinyl), and a minimum font size of 5 point. Labeling of other Cables inside of the ITS Cabinet shall follow the labeling scheme below. (Device From) – (Device To) — (Cable Type) Example: TERM-MVDS-TWP Twisted Pair cable from MVDS 1 to Terminal Server 1. Example: TERM3-MVDS2-TWP Twisted Pair cable from MVDS 2 to Terminal Server 3. <table> <tr> <th>Cable Type</th><th>Cable Type Abbreviation</th></tr> <tr> <td>COMPOSITE CABLE</td><td>CC</td></tr> <tr> <td>TWISTED PAIR</td><td>TWP</td></tr> <tr> <td>SERIAL</td><td>RS-485 RS-422</td></tr> <tr> <td>COAXIAL</td><td>COAX</td></tr> <tr> <td>MULTIMODE FIBER</td><td>MMFO</td></tr> <tr> <td>SINGLEMODE FIBER</td><td>SMFO</td></tr> <tr> <td>POWER CABLE</td><td>AC-120/240V DC – xxV</td></tr> </table>						Cable Type	Cable Type Abbreviation	COMPOSITE CABLE	CC	TWISTED PAIR	TWP	SERIAL	RS-485 RS-422	COAXIAL	COAX	MULTIMODE FIBER	MMFO	SINGLEMODE FIBER	SMFO	POWER CABLE	AC-120/240V DC – xxV
Cable Type	Cable Type Abbreviation																				
COMPOSITE CABLE	CC																				
TWISTED PAIR	TWP																				
SERIAL	RS-485 RS-422																				
COAXIAL	COAX																				
MULTIMODE FIBER	MMFO																				
SINGLEMODE FIBER	SMFO																				
POWER CABLE	AC-120/240V DC – xxV																				
2. Labeling of Ethernet (Cat5E) Cables in Cabinets Example: (Device From)-(Device To)-(Port #) UPS-ESW-04 Cat5E cable from UPS 1 to Ethernet Switch 1, Port 4. (Device From)-(Sub-Device to)-(Device To)-(Port #) PSDC2-RADIO-ESW-06 Cat5E cable from DC Power Supply 2 to Ethernet Switch 1, through Port 6, powering Radio 1.																					
Labeling Details for Fiber Deployments:																					
Fiber Device Description	Tape Size	# of Lines	Label Type	Example	Note																
Patch Panel *	½"	1 Line	P Touch	FDU-PPA	Patch Panel A in Fiber Hardware Assembly 01																
Patch Cord/Jumper* *	1½"	1 Line	Self-Laminating	FDU-A02-ESW-09-RX	Jumper cord from Patch Panel A, FDU 1, connector 02 to Ethernet Switch 01, Port 09, Receive (RX) fiber port.																
Duplex Patch Cord/Jumper **	1½"	1 Line	Self-Laminating	FDU-C01/C02-ESW-10	Jumper from Patch Panel C1, connectors 01 and 02, to Ethernet Switch , Port 10.																
Fiber Pigtail	1"	1 Line	Self-Laminating	BL-BL- W	Pigtail cable from the blue tube, blue fiber in the Fiber Optic Distribution Cable going west to cabinet 194E-MM122.4.																
Fiber Distribution Cable	1½"	2 Lines	Self-Laminating	I94E-MM1234-I94E-MM1224-FODC-24	Fiber Optic Distribution cable 01 on I-94 between Cabinet I94E-MM123.4 and I94E-MM122.4, with 24 strands.																
Fiber Trunk (Backbone) Cable	1½"	2 Lines	Self-Laminating	I94E-MM1234-I94E-MM1224-FOTC-60	Fiber Optic Trunk cable 01 on I-94 between Cabinet I94E-MM123.4 and I94E-MM122.4, with 60 strands.																
Fiber Partner Agency Cable	1½"	2 Lines	Self-Laminating	I94E-MM1234-I94E-MM1224-FOPC-24	Fiber Optic Partner Agency cable 01 on I-94 between Cabinet I94E-MM123.4 and I94E-MM122.4, with 24 strands.																

* Individual modules on the patch panel should be labeled and tied to key that references each port to a fiber strand.

** Note all jumpers shall be labeled on both ends with identical labels for easy tracking.

AS-LET PLAN REVISIONS								FOR INFORMATION ONLY		NO SCALE		DATE:	CS: 84923	ITS Cabinet Labeling Scheme	DRAWING	SHEET	
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION					DESIGN UNIT:	JN: 106329a			MSDET	SECT 1
												FILE: ITS Cabinet Labeling.pdf	TSC:		1 of 2	002	

Note: Place label on inside of door with cabinet name (ITS Common Name). At locations with multiple devices of the same type (2 MVDS) include the device type and # along with a description. Do not include the device # for the first device of that type.

I94E - MM123.4
MVDS - Eastbound Lanes
MVDS2 - Westbound Lanes
MVDS3 - Westbound Off Ramp
CCTV - Facing North
CCTV2 - Facing Interchange

CCTV Composite Cable:
CCTV-SG-CC
(Label at CLD)

CCTV:
I94E-MM123.4-CCTV

Surge Suppression:
SGSR-CCTV

Surge Suppression:
SGAC-CCTV

Surge Suppression:
SGCX-CCTV

Serial Data Cable:
SGSR2-SGSR-TWP

Surge Suppression:
SGSR2-CCTV

Surge Suppression:
SGCX2-CCTV

CCTV Serial Data Cable:
SGSR2-DVE-TWP

Digital Video Encoder:
I94E-MM123.4-DVE
IP: XXX.XXX.XXX.XXX

Cabinet Monitoring System:
I94E-MM123.4-CM
IP: XXX.XXX.XXX.XXX

UPS:
I94E-MM123.4-UPS
IP: XXX.XXX.XXX.XXX

Coaxial Cable:
SGCX2-SGCX-COAX

Power Cable:
SGAC2-SGAC-24V

CCTV Coaxial Cable:
SGCX2-DVE-COAX

CM-ESW-03
DVE-CCTV-ESW-01

Layer 3 Field Switch:
I94E-MM123.4-ESW
IP: XXX.XXX.XXX.XXX

TERM-MVDS-ESW-02

TERM2-MVDS2-ESW-04

CNTR-DMS-ESW-06

UPS-ESW-07

FDU-A01/A02-ESW-09

FDU-C01/C02-ESW-10

ITS CABINET: **I94E - MM123.4**

Terminal Server/ Power Supply:
TERM-MVDS
IP: XXX.XXX.XXX.XXX

Surge Suppression:
SGSR4-MVDS

MVDS Multiple TWP Cable:
TERM-SGSR4-TWP

Surge Suppression:
SGDC2-MVDS

MVDS Multiple TWP Cable:
TERM2-SGSR6-TWP

Surge Suppression:
SGDC4-MVDS2

Terminal Server/ Power Supply:
TERM2-MVDS2
IP: XXX.XXX.XXX.XXX

DMS Controller:
I94E-MM123.4-CNTR-DMS
IP: XXX.XXX.XXX.XXX

DMS Fiber Optic Single Mode Cable:
CNTR-DMS-DMS-SMFO

Surge Suppression:
SGSR3-MVDS

Vehicle Detector:
I94E-MM123.4-MVDS

Surge Suppression:
SGDC-MVDS

Power Cable:
SGDC2-SGDC-DC24V

Serial Data Cable:
SGSR6-SGSR5-TWP

Surge Suppression:
SGSR5-MVDS2

Vehicle Detector:
I94E-MM123.4-MVDS2

Surge Suppression:
SGDC3-MVDS2

Power Cable:
SGDC4-SGDC3-DC24V

DMS

DMS:
I94E-MM123.4-DMS

Fiber Distribution Unit:
I94-MM123.4-FDU

Patch Panel:
FDU-PPA

Patch Panel:
FDU-PPC

Proposed Fiber
Optic Pigtails
(See Pigtails Table)

MDOT Distribution
12 Strand Fiber Cable
Blue Tube

MDOT Distribution
12 Strand Fiber Cable
Orange Tube

MDOT Distribution
12 Strand Fiber Cable
Blue Tube

MDOT Distribution
12 Strand Fiber Cable
Orange Tube

Proposed 24 Strand MDOT
Distribution Fiber
Cable:
**I94E-MM123.4-
I94E-MM121.4-FODC-24**

Proposed 24 Strand MDOT
Distribution Fiber
Cable:
**I94E-MM123.4-
I94E-MM124.4-FODC-24**

PIGTAIL	CABLE	PATCH PANEL/PORT	COLOR	PIGTAIL LABEL
1	UPSTREAM	A01	(BL,BL)	BL-BL-W
2	UPSTREAM	A02	(BL,OR)	BL-OR-W
3	UPSTREAM	A11	(BL,RS)	BL-RS-W
4	UPSTREAM	A12	(BL,AQ)	BL-AQ-W
5	DOWNSTREAM	C01	(BL,BL)	BL-BL-E
6	DOWNSTREAM	C02	(BL,OR)	BL-OR-E
7	DOWNSTREAM	C11	(BL,RS)	BL-RS-E
8	DOWNSTREAM	C12	(BL,AQ)	BL-AQ-E

UPSTREAM CABLE

DOWNSTREAM CABLE

AS-LET PLAN REVISIONS

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: ITS Cabinet Labeling 2.pdf

DATE:

DESIGN UNIT:

TSC:

CS: 84923

JN: 106329A

ITS Cabinet Labeling Scheme

Example for I94E-MM123.4 on EB I-94

2 of 2

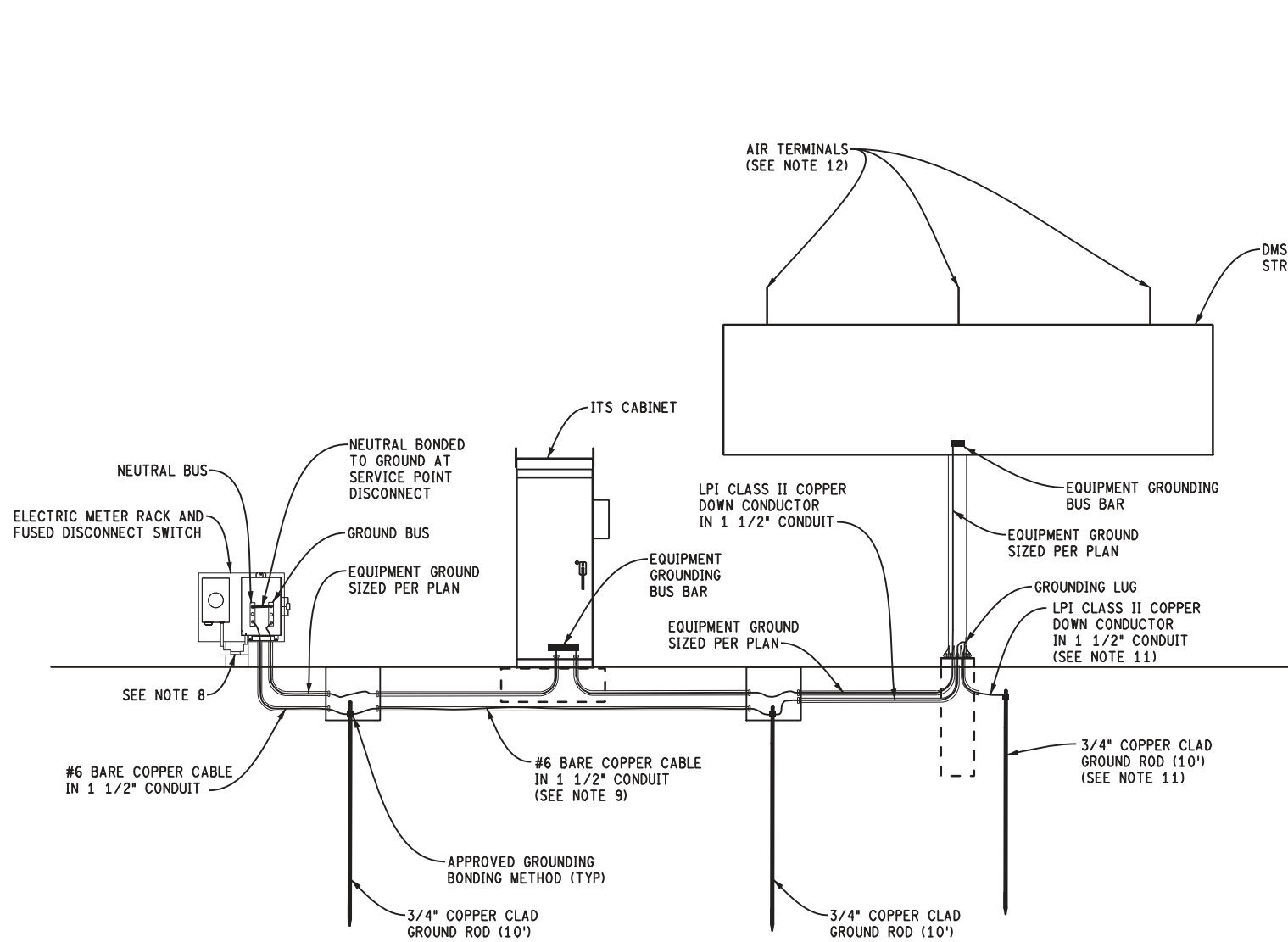
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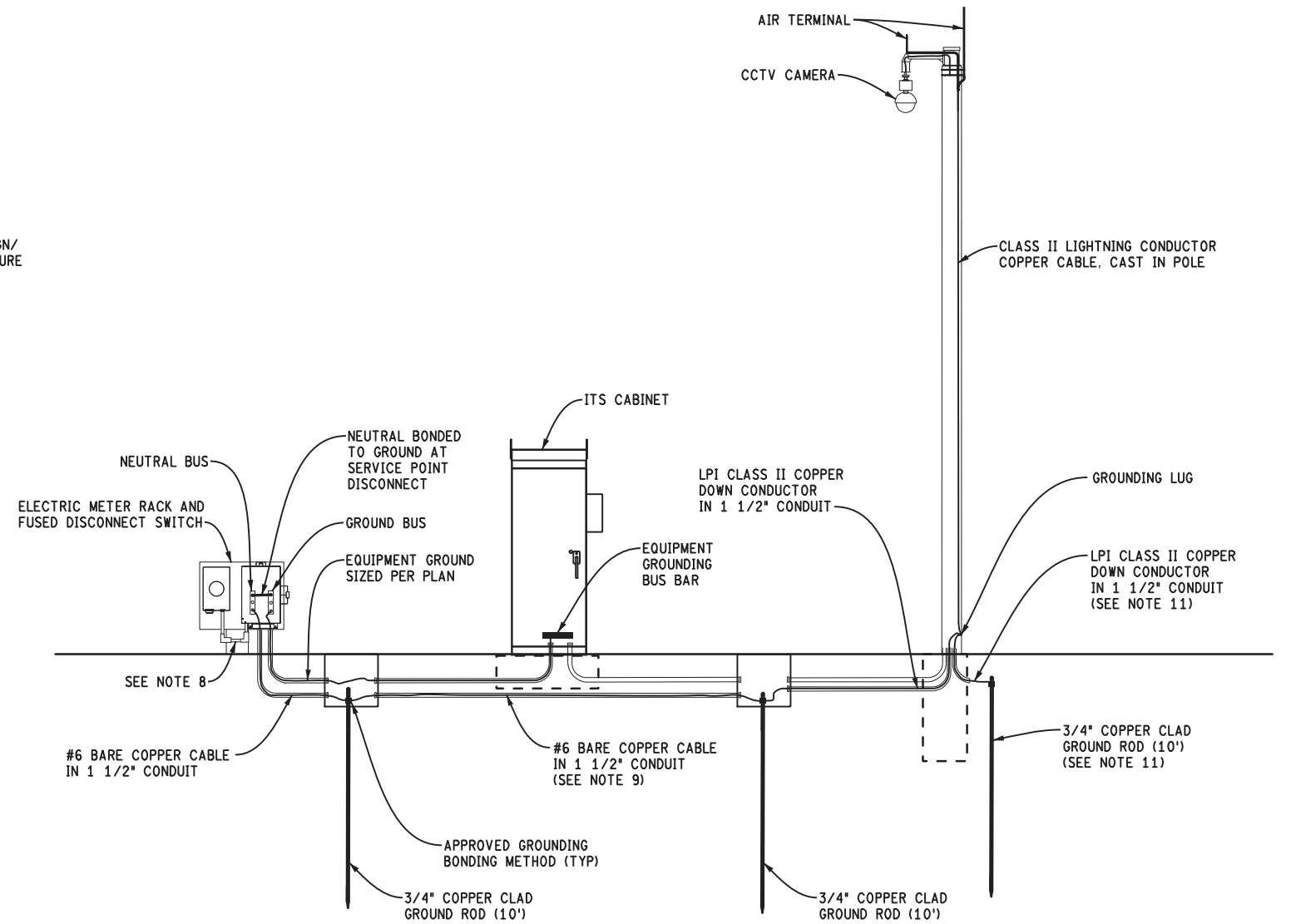
003

SHEET

SECT 1



ITS (DMS) SITE GROUNDING



ITS (CCTV CAMERA) SITE GROUNDING

NOTES:

1. FENCES AND OTHER METALLIC STRUCTURES WITH PATHS TO GROUND SHALL BE CONNECTED TO THE GROUNDING CONDUCTOR IF THEY ARE LOCATED WITHIN 25' OF THE GROUNDING ELECTRODE SYSTEM OR ANY OBJECT GROUNDED TO THE GROUNDING ELECTRODE SYSTEM. GROUNDING ELECTRODE SYSTEM CONNECTIONS TO FENCING SHALL BE MADE USING HEAVY DUTY TINNED LISTED PIPE CLAMPS DESIGNED FOR GROUNDING, STAINLESS STEEL HARDWARE, AND #2 TINNED COPPER CABLE.

2. GROUND ROD ELECTRODES NOT INSIDE A HANDHOLE SHALL BE BURIED TO A MINIMUM DEPTH OF 12 INCHES BELOW FINISHED GRADE. GROUND ROD ELECTRODES AT HANDHOLES SHALL BE INSTALLED INSIDE AT THE BASE OF THE HANDHOLE, KEEPING THE CONNECTION TO GROUND WIRE VISIBLE.

3. ALL EQUIPMENT GROUNDS SHALL BE PROPERLY CONNECTED TO A CHASSIS:
ALL PAINT AND OTHER COATINGS, INCLUDING GALVANIZATION, SHALL BE REMOVED PRIOR TO TERMINATION OF A GROUND. AFTER THE GROUND IS TERMINATED A NON-OXIDIZING COATING SHALL BE PAINTED OVER THE EXPOSED METAL SURFACES.

4. ALL GROUNDING DIAGRAMS ARE SCHEMATIC ONLY. DIAGRAM SHOWS MAIN BONDING JUMPERS, GROUNDING ELECTRODE CONDUCTORS, AND COMMON BONDING OF GROUNDING SYSTEMS. DIAGRAM DOES NOT SHOW THE GROUNDED CONDUCTOR (NEUTRAL) THAT IS ROUTED IN CONDUIT WITH POWER CONDUCTORS.
5. AT LEAST AN 8 INCH MINIMUM BENDING RADIUS SHALL BE MAINTAINED ON ALL LIGHTNING PROTECTION DOWN CONDUCTORS. THE ANGLE OF ANY BEND SHALL NOT BE MORE THAN 90 DEGREES.

6. LIGHTNING PROTECTION DOWN CONDUCTORS SHALL ALWAYS ROUTE AS STRAIGHT AS POSSIBLE.

7. WHENEVER POSSIBLE, LIGHTNING PROTECTION GROUND ROD ELECTRODES SHALL BE INSTALLED NO CLOSER THAN 2' FROM CONCRETE FOUNDATIONS.

8. RIGID GALVANIZED STEEL (RGS) CONDUIT MUST BE BONDED PER NEC AND LOCAL UTILITY REQUIREMENTS. USE OF BONDING BUSHINGS IS PREFERRED.

9. #6 COPPER BONDING CABLE AND 1 1/2" CONDUIT REQUIRED IF STRUCTURE OR POLE IS WITHIN 100 FEET OF THE METER RACK.

10. ALL BONDING CABLES MUST BE INSTALLED IN 1 1/2" SCHEDULE 80 PVC CONDUIT.

11. INSTALL ADDITIONAL GROUND ROD ELECTRODES AND LPI CLASS II COPPER DOWN CONDUCTOR AS NECESSARY TO MEET MINIMUM RESISTANCE REQUIREMENTS IN THE SPECIAL PROVISION FOR GROUNDING AND BONDING.

12. SEE DMS STRUCTURE DETAIL FOR CONNECTION OF AIR TERMINALS TO DMS HOUSING.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

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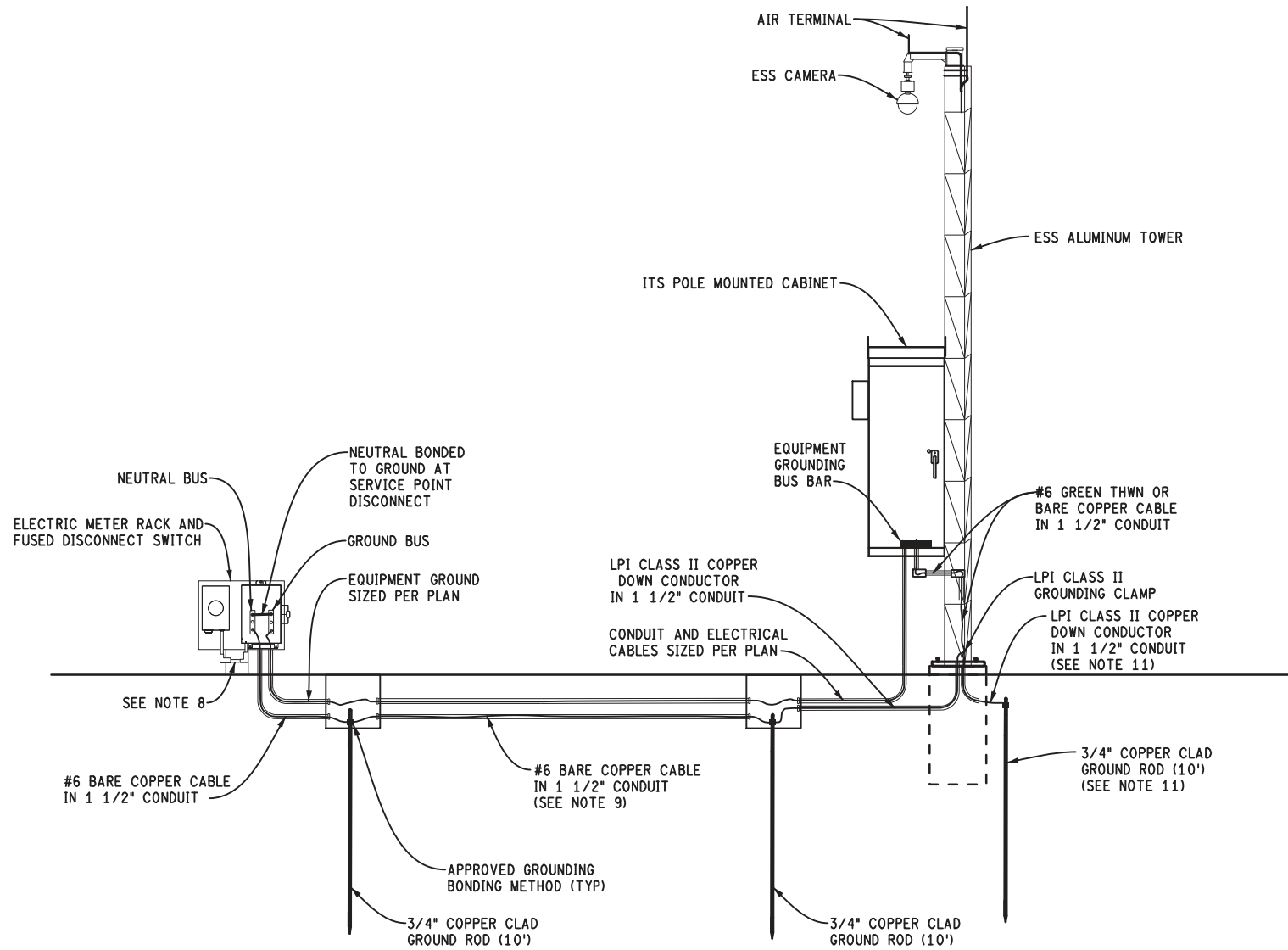
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JN: 106329A

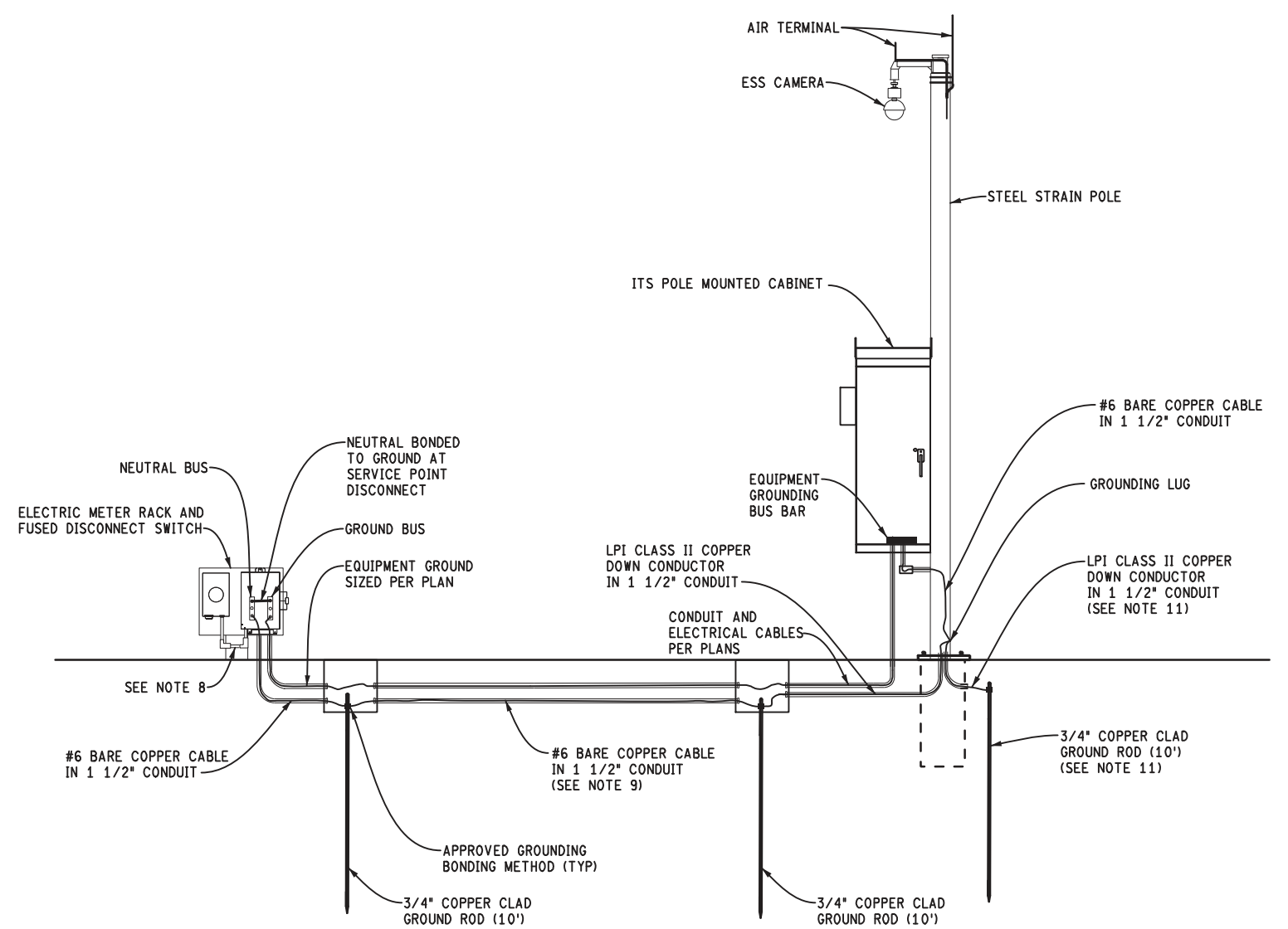
ITS SITE GROUNDING AND BONDING

SHEET 1 OF 3

DRAWING
MSDET 004
SHEET

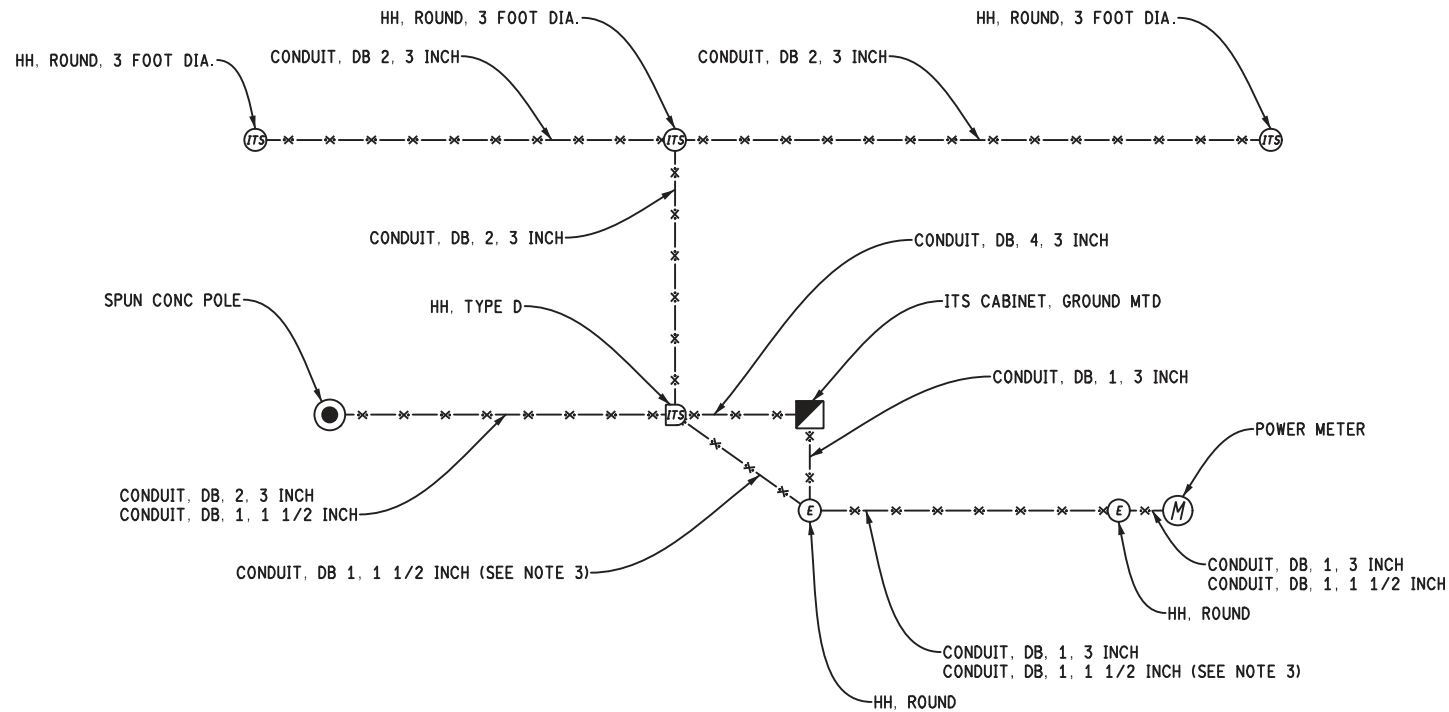


ITS/ESS SITE GROUNDING TOWER MOUNTED CABINET

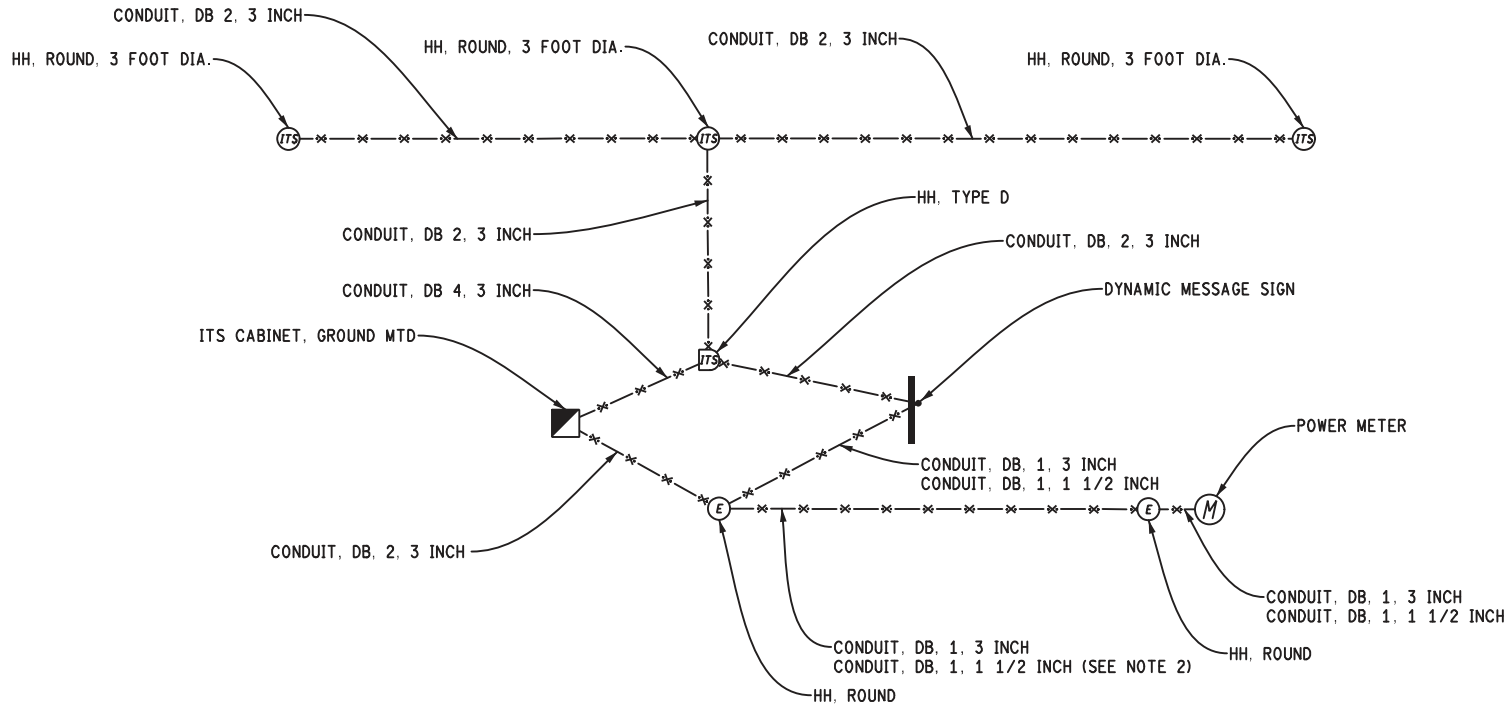


ITS/ESS SITE GROUNDING POLE MOUNTED CABINET

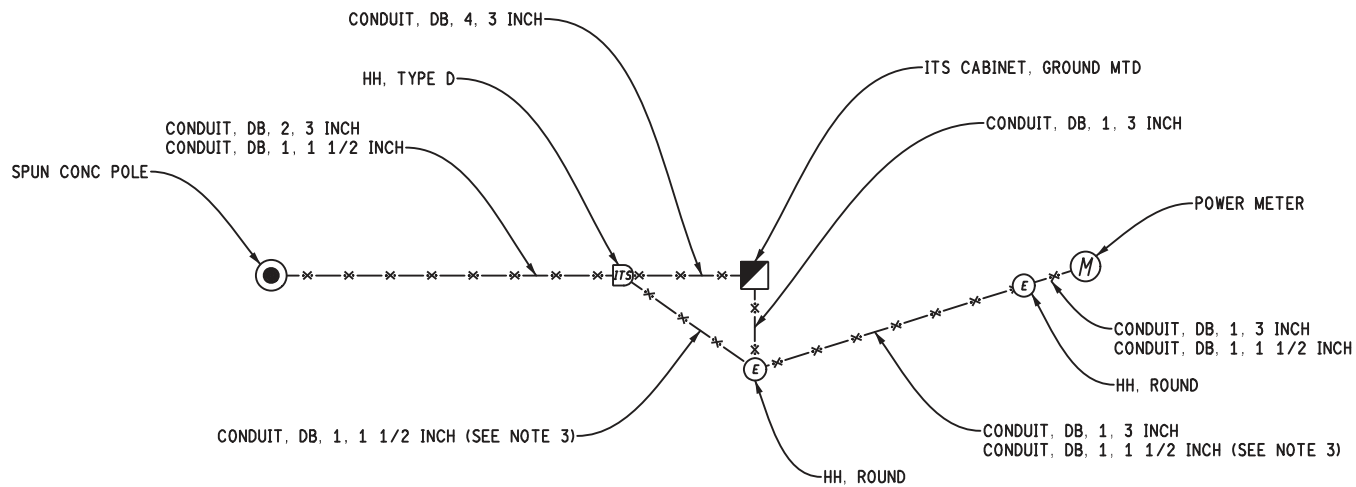
- NOTES:
1. FENCES AND OTHER METALLIC STRUCTURES WITH PATHS TO GROUND SHALL BE CONNECTED TO THE GROUNDING CONDUCTOR IF THEY ARE LOCATED WITHIN 25' OF THE GROUNDING ELECTRODE SYSTEM OR ANY OBJECT GROUNDED TO THE GROUNDING ELECTRODE SYSTEM. GROUNDING ELECTRODE SYSTEM CONNECTIONS TO FENCING SHALL BE MADE USING HEAVY DUTY TINNED LISTED PIPE CLAMPS DESIGNED FOR GROUNDING, STAINLESS STEEL HARDWARE, AND #2 TINNED COPPER CABLE.
 2. GROUND ROD ELECTRODES NOT INSIDE A HANDHOLE SHALL BE BURIED TO A MINIMUM DEPTH OF 12 INCHES BELOW FINISHED GRADE. GROUND ROD ELECTRODES AT HANDHOLES SHALL BE INSTALLED INSIDE AT THE BASE OF THE HANDHOLE, KEEPING THE CONNECTION TO GROUND WIRE VISIBLE.
 3. ALL EQUIPMENT GROUNDS SHALL BE PROPERLY CONNECTED TO A CHASSIS: ALL PAINT AND OTHER COATINGS, INCLUDING GALVANIZATION, SHALL BE REMOVED PRIOR TO TERMINATION OF A GROUND. AFTER THE GROUND IS TERMINATED A NON-OXIDIZING COATING SHALL BE PAINTED OVER THE EXPOSED METAL SURFACES.
 4. ALL GROUNDING DIAGRAMS ARE SCHEMATIC ONLY. DIAGRAM SHOWS MAIN BONDING JUMPERS, GROUNDING ELECTRODE CONDUCTORS, AND COMMON BONDING OF GROUNDING SYSTEMS. DIAGRAM DOES NOT SHOW THE GROUNDED CONDUCTOR (NEUTRAL) THAT IS ROUTED IN CONDUIT WITH POWER CONDUCTORS.
 5. AT LEAST AN 8 INCH MINIMUM BENDING RADIUS SHALL BE MAINTAINED ON ALL LIGHTNING PROTECTION DOWN CONDUCTORS. THE ANGLE OF ANY BEND SHALL NOT BE MORE THAN 90 DEGREES.
 6. LIGHTNING PROTECTION DOWN CONDUCTORS SHALL ALWAYS ROUTE AS STRAIGHT AS POSSIBLE.
 7. WHENEVER POSSIBLE, LIGHTNING PROTECTION GROUND ROD ELECTRODES SHALL BE INSTALLED NO CLOSER THAN 2' FROM CONCRETE FOUNDATIONS.
 8. RIGID GALVANIZED STEEL (RGS) CONDUIT MUST BE BONDED PER NEC AND LOCAL UTILITY REQUIREMENTS. USE OF BONDING BUSHINGS IS PREFERRED.
 9. #6 COPPER BONDING CABLE AND 1 1/2" CONDUIT REQUIRED IF STRUCTURE OR POLE IS WITHIN 100 FEET OF THE METER RACK.
 10. ALL BONDING CABLES MUST BE INSTALLED IN 1 1/2" SCHEDULE 80 PVC CONDUIT.
 11. INSTALL ADDITIONAL GROUND ROD ELECTRODES AND LPI CLASS II COPPER DOWN CONDUCTOR AS NECESSARY TO MEET MINIMUM RESISTANCE REQUIREMENTS IN THE SPECIAL PROVISION FOR GROUNDING AND BONDING.



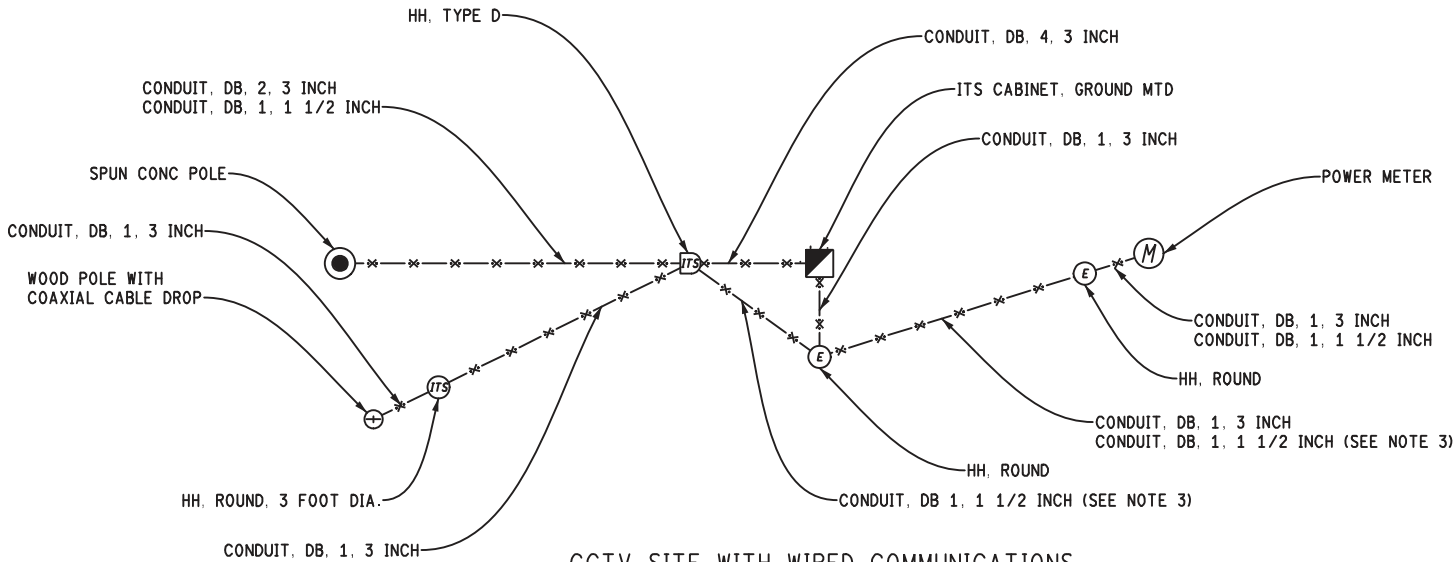
CCTV SITE WITH FIBER NETWORK



DMS SITE WITH FIBER NETWORK



CCTV SITE WITH WIRELESS COMMUNICATIONS



CCTV SITE WITH WIRED COMMUNICATIONS

NOTES

- 1 1/2 INCH CONDUIT TO BE USED FOR BONDING CABLE.
- INSTALL 1 1/2 INCH CONDUIT FOR BONDING CABLE IF DMS STRUCTURE IS WITHIN 100 FEET OF THE POWER METER RACK.
- INSTALL 1 1/2 INCH CONDUIT FOR BONDING CABLE IF SPUN CONCRETE POLE IS WITHIN 100 FEET OF THE POWER METER RACK.

TYPICAL ITS SITE CONDUIT LAYOUTS FOR BONDING CABLE

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: Grounding and Bonding2.dgn

DATE:
DESIGN UNIT:
TSC:

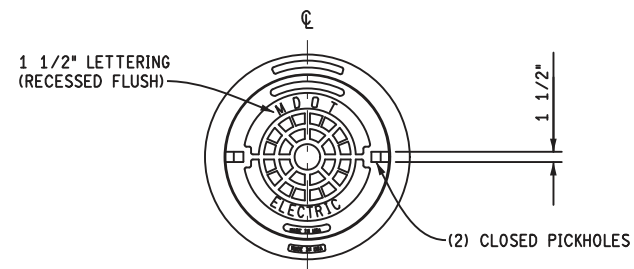
CS: 84923
JN: 106329A

ITS SITE GROUNDING AND BONDING

SHEET 3 OF 3

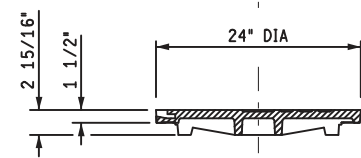
DRAWING
MSDET
006

SHEET
SECT 1



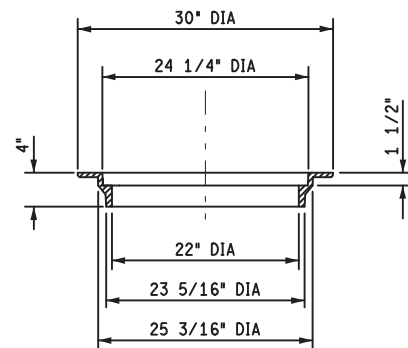
ITS ELECTRIC (ELEC) HANDHOLE COVER

NOT TO SCALE



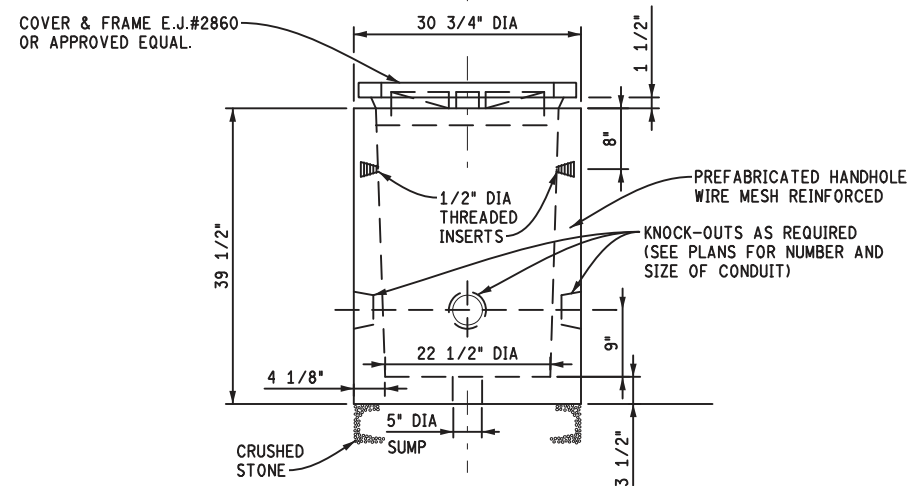
COVER SECTION

NOT TO SCALE



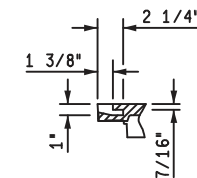
FRAME SECTION

NOT TO SCALE



SIDE VIEW OF ROUND HANDHOLE

NOT TO SCALE



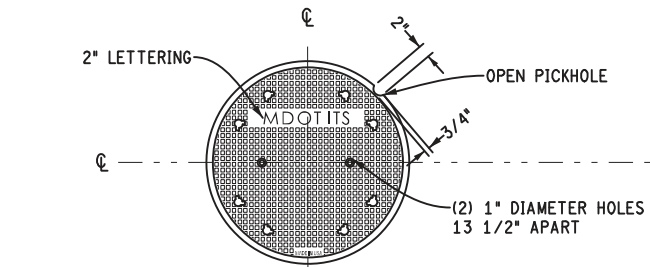
COVER PICKHOLE SECTION

NOT TO SCALE

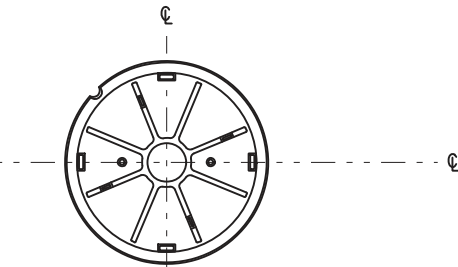
NOTES:

1. PROVIDE HANDHOLE AND COVER MEETING THE REQUIREMENTS OF AASHTO HS 20 FOR WHEEL LOADING.
2. CURRENT COVER AND FRAME FOR ROUND HANDHOLES ARE EAST JORDAN IRON WORKS PART NO. 2860 (COVER) AND 1120 (FRAME) OR APPROVED EQUAL, A.S.T.M. CLASS 30 GRAY IRON, HEAVY DUTY, APPROX. WT. 250 LB.
3. REFER TO CONSTRUCTION SHEETS FOR TYPE (COMM OR ELEC) OF COVER FOR EACH HANDHOLE.

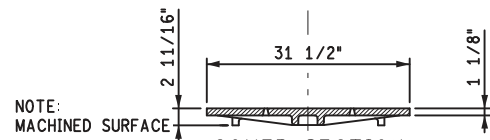
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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:			MSDET 007	SECT 1
FILE: Handhole, Round.dgn										TSC:	JN: 106329A	SHEET 1 OF 1			



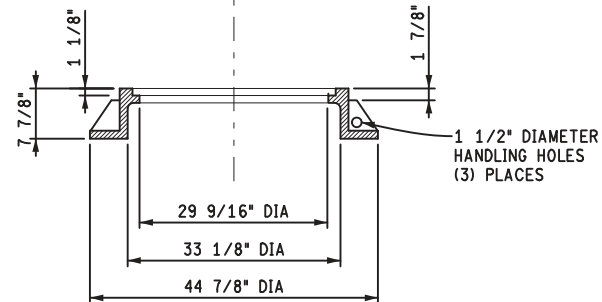
TOP VIEW OF COVER
NOT TO SCALE



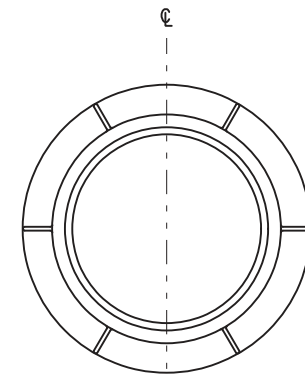
BOTTOM VIEW OF COVER
NOT TO SCALE



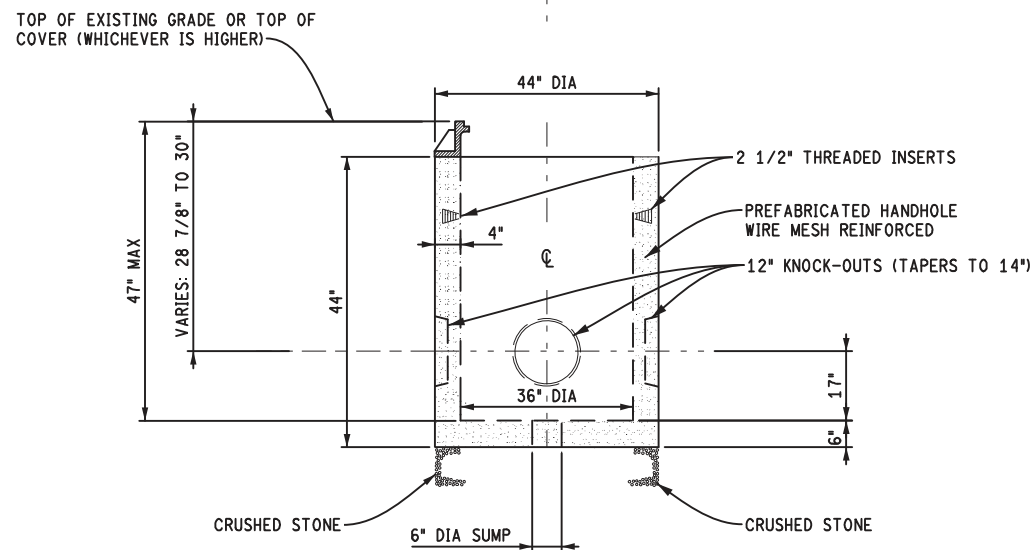
COVER SECTION
NOT TO SCALE



FRAME SECTION
NOT TO SCALE



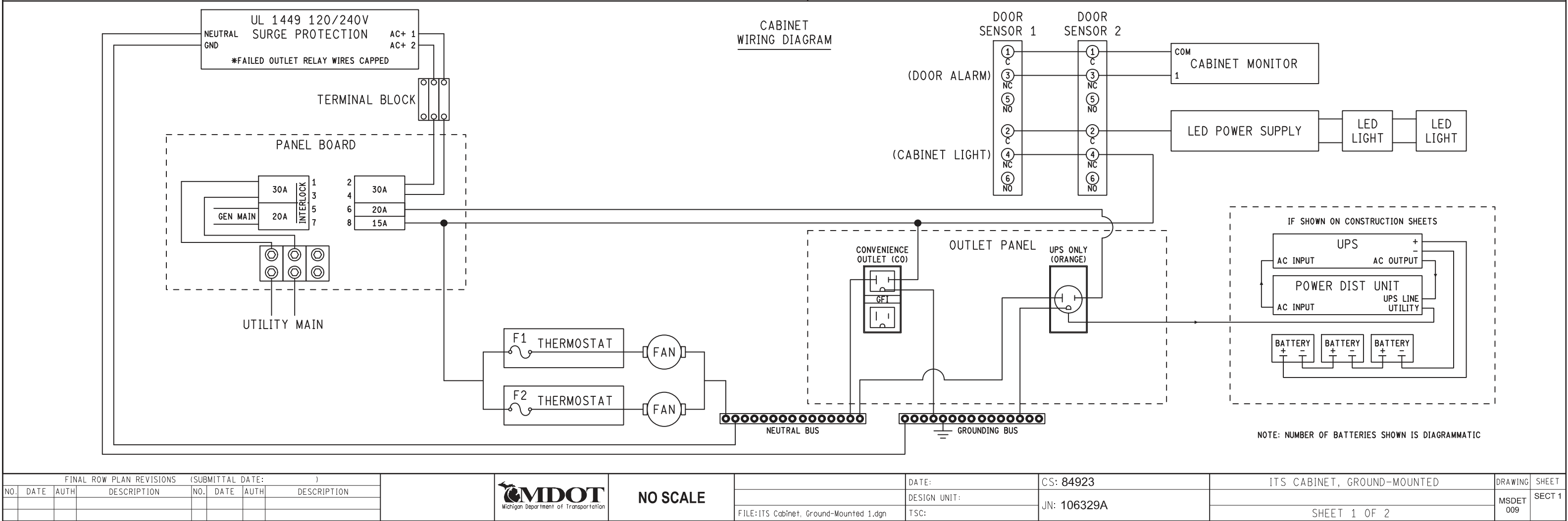
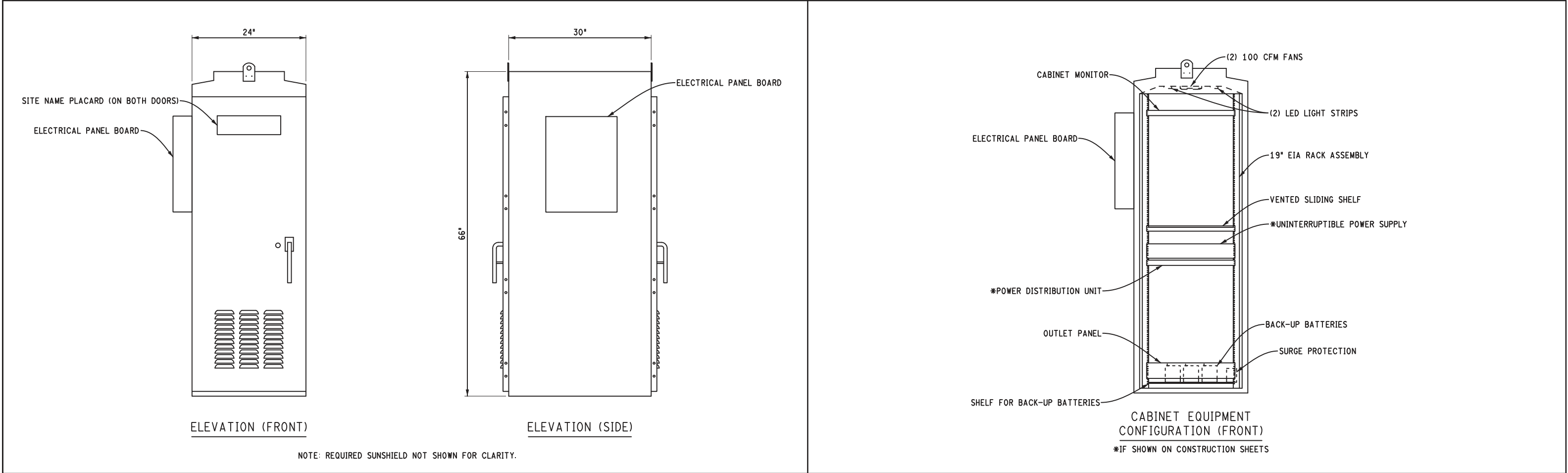
TOP VIEW OF FRAME
NOT TO SCALE

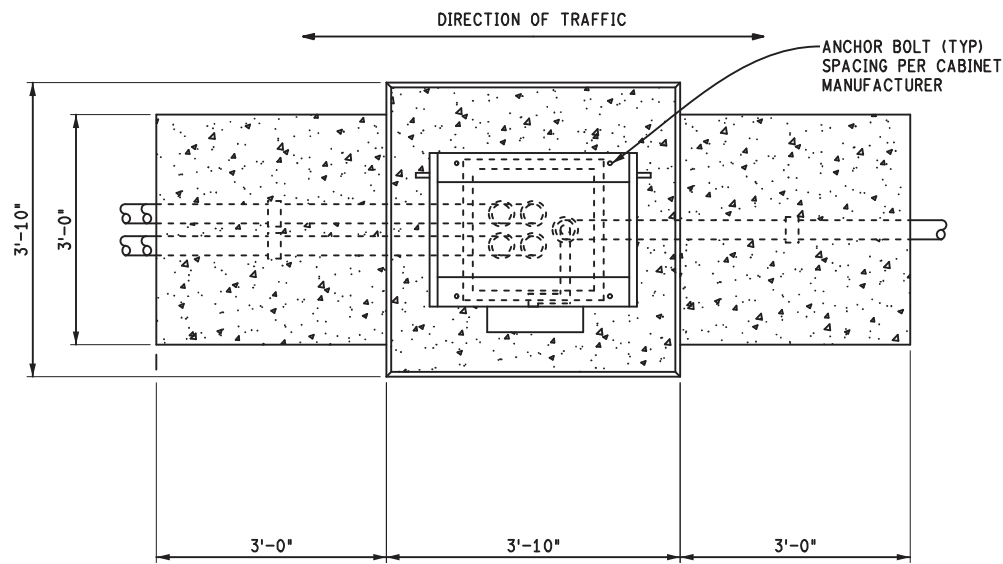


36" DIAMETER ROUND HANDHOLE SECTION
NOT TO SCALE

- NOTES:
1. PROVIDE HANDHOLE AND COVER MEETING THE REQUIREMENTS OF AASHTO HS 25 FOR WHEEL LOADING.
 2. CURRENT COVER AND FRAME FOR 36" ROUND HANDHOLES ARE EAST JORDAN IRON WORKS PART NO. 1220 OR APPROVED EQUAL, A.S.T.M. CLASS 30 GRAY IRON, HEAVY DUTY, APPROX. WT. 685#.

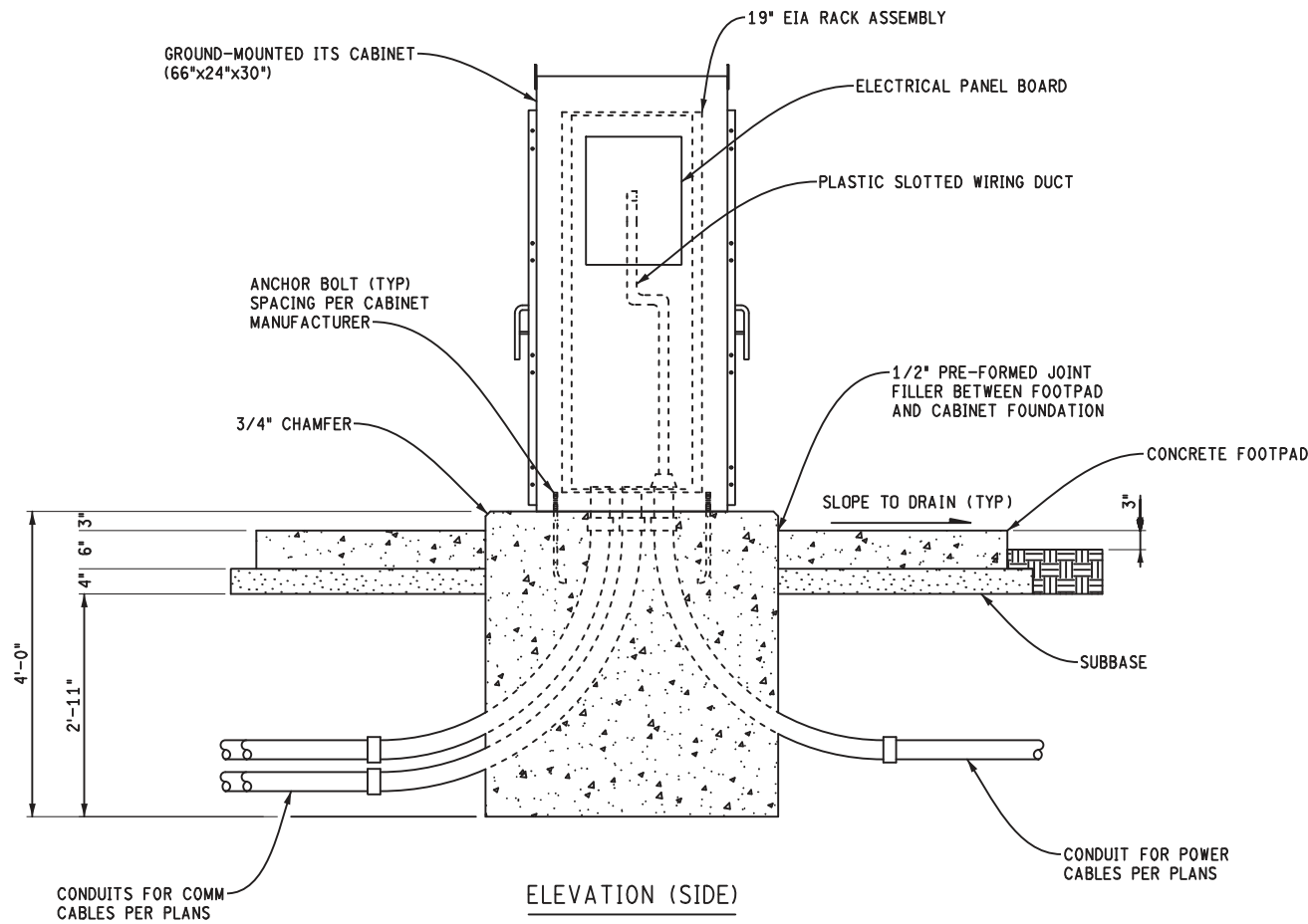
FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)								 NO SCALE	DATE:	CS: 84923	HANDHOLE, ROUND, 3 FOOT DIA.	DRAWING	SHEET				
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION							DESIGN UNIT:	JN: 106329A	MSDET 008	SECT 1
FILE: Handhole, Round, 3 foot dia.dgn								TSC:	SHEET 1 OF 1								



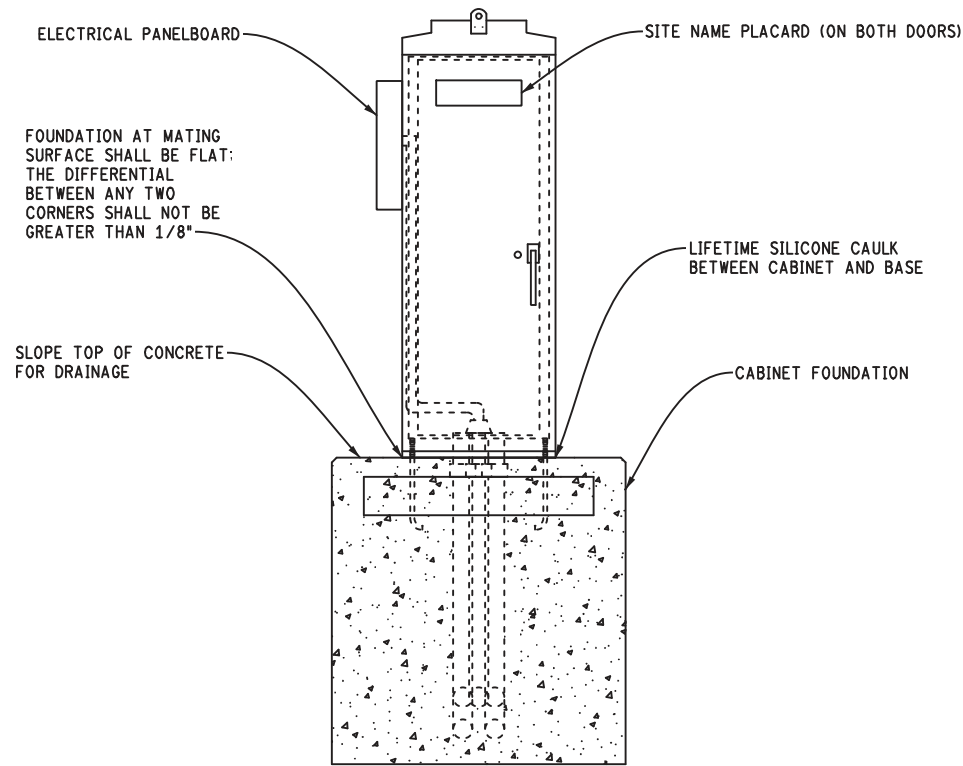


PLAN VIEW

- NOTES:
1. ADJUST THE ELEVATIONS OF CONCRETE FOOTPADS TO MEET THE SITE CONDITIONS.
 2. COMPACT THE SOIL BENEATH THE CONCRETE FOOTPAD AND AGGREGATE IN PLACE WITH A PLATE COMPACTOR OR OTHER COMPACTION METHOD APPROVED BY THE ENGINEER, PRIOR TO PLACING THE AGGREGATE.
 3. CONSTRUCT FOUNDATION PER 2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION, SECTION 820.03 (D).
 4. INSTALL THE NUMBER, SIZE, AND TYPE OF CONDUIT(S) FOR COMMUNICATIONS AND POWER AS SHOWN IN THE PLANS. DETERMINE THE APPROACH/ENTRY ANGLE TO FOUNDATION BASED ON SITE CONDITIONS. THE NUMBER AND LOCATION OF CONDUIT SWEEPS SHOWN IN THIS DRAWING ARE DIAGRAMMATIC.



ELEVATION (SIDE)



ELEVATION (FRONT)

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: ITS Cabinet, Ground-Mounted 2.dgn

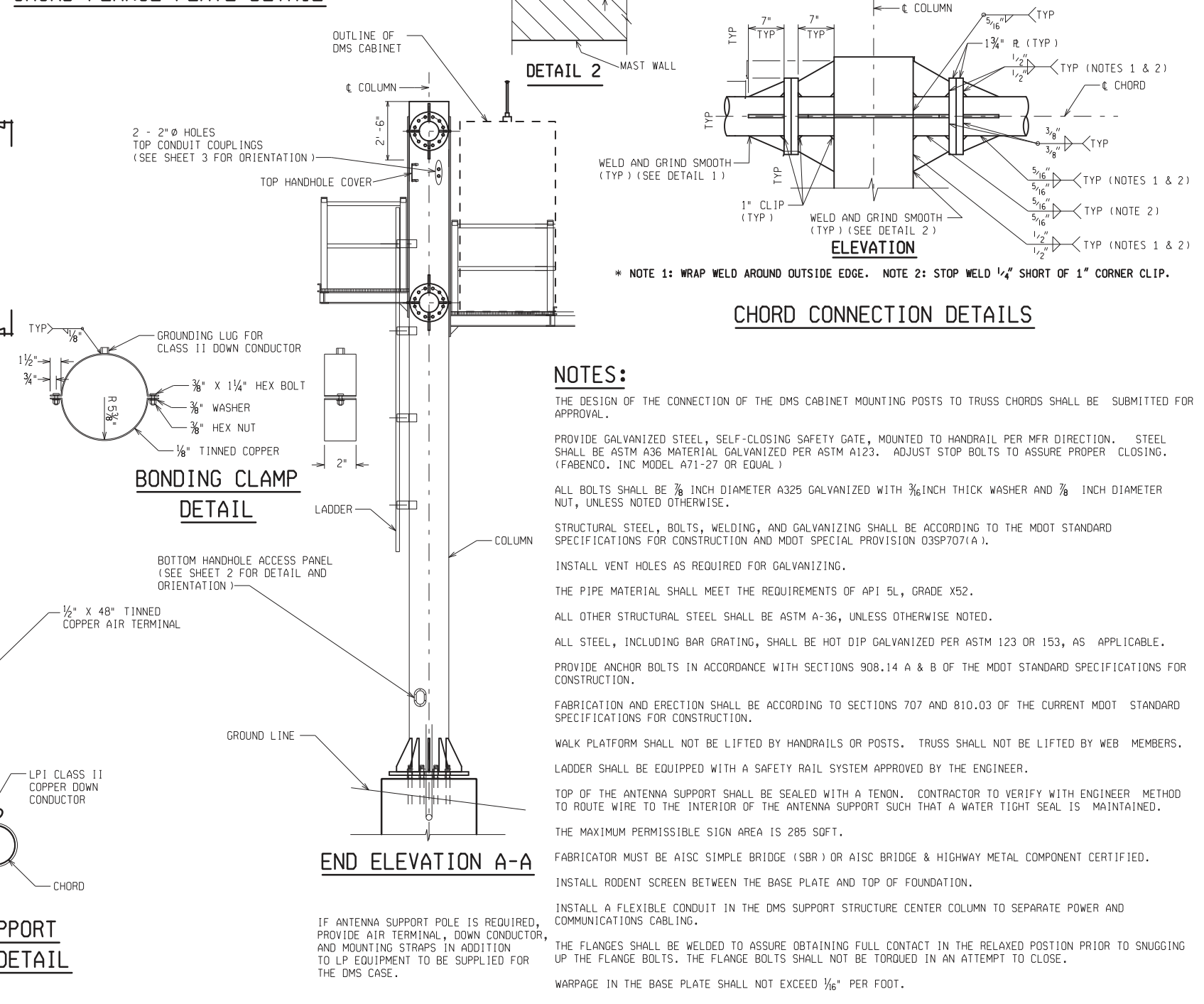
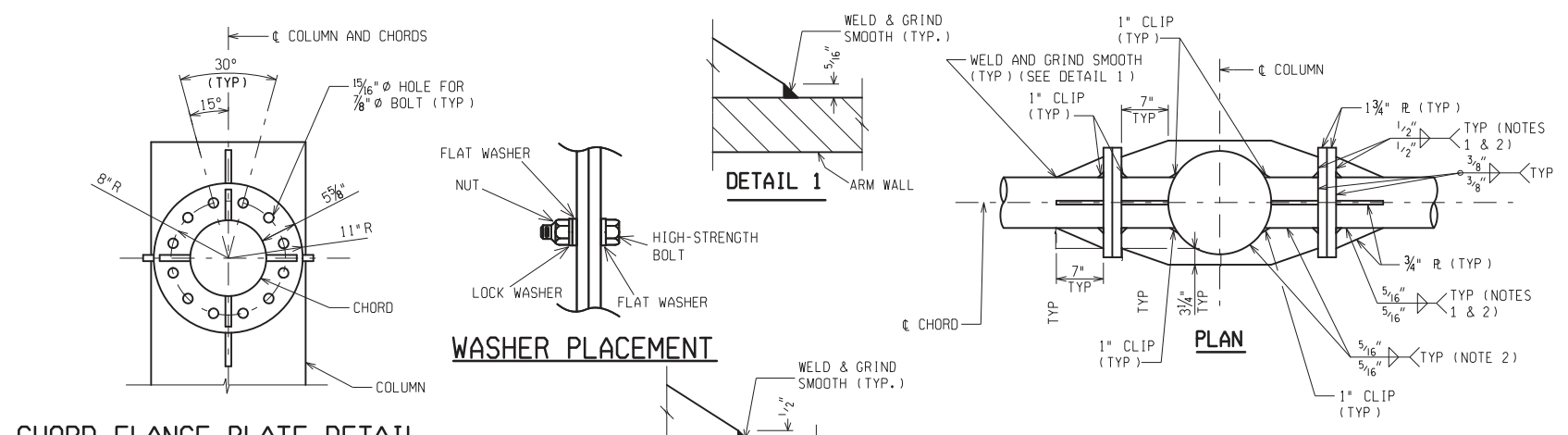
DATE:
DESIGN UNIT:
TSC:

CS: 84923
JN: 106329A

ITS CABINET, GROUND-MOUNTED

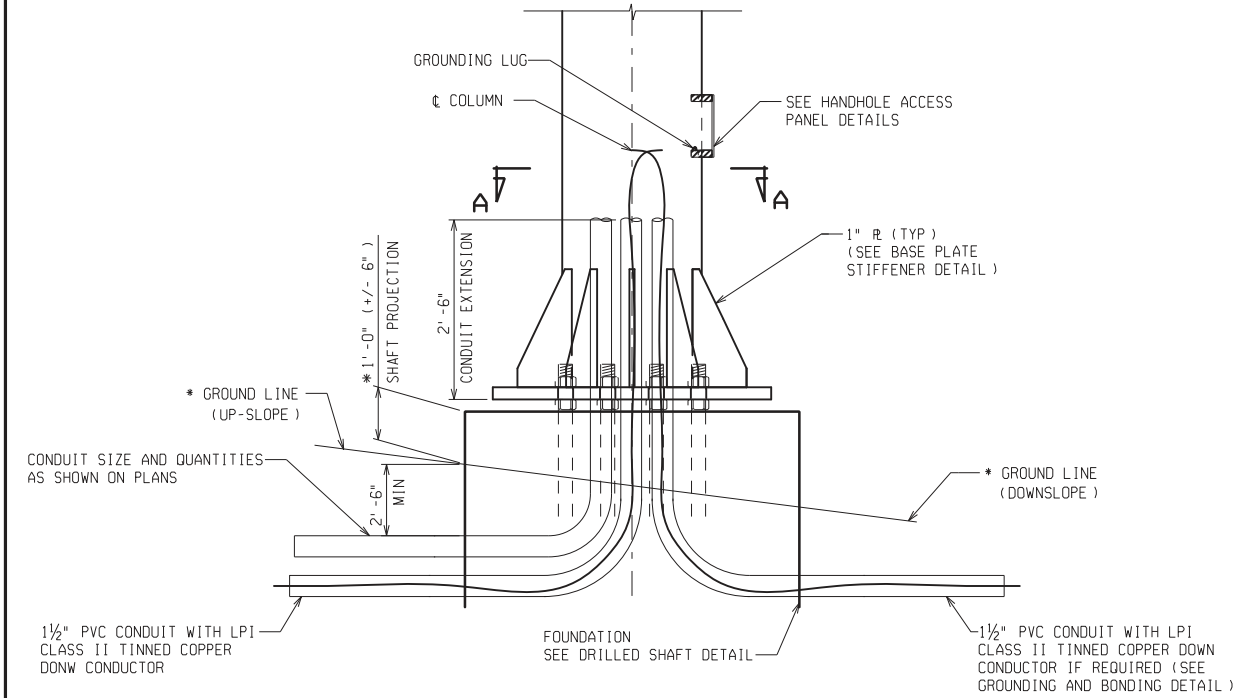
SHEET 2 OF 2

DRAWING SHEET
MSDET 010 SECT 1



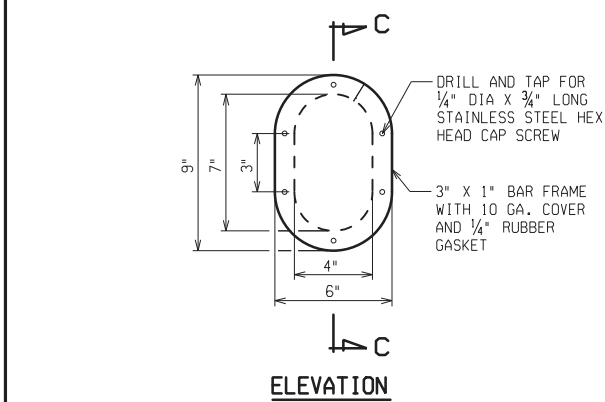
COLUMN HEIGHT		
DMS LOCATION	H	J
US31M-MM118.1	19.5'	21.5'

AS-LET PLAN REVISIONS								 MDOT Michigan Department of Transportation	NO SCALE		DATE:	CS: 84923	DMS SIGN SUPPORT	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:	JN: 106329A	LEFT SIDE ENTRANCE	MSDET	SECT 1
														011	
										FILE: LH Master DMS Structure Drawings.dgn	TSC:		SHEET 1 OF 4		

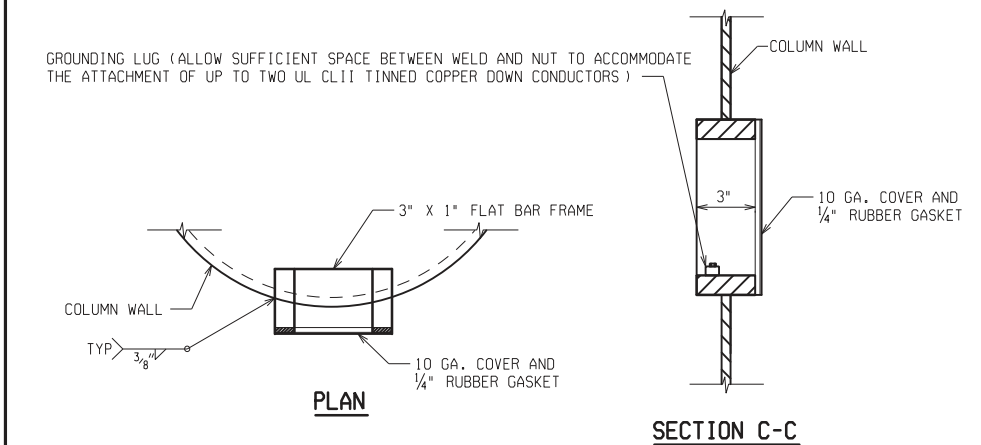


BASE PLATE ELEVATION

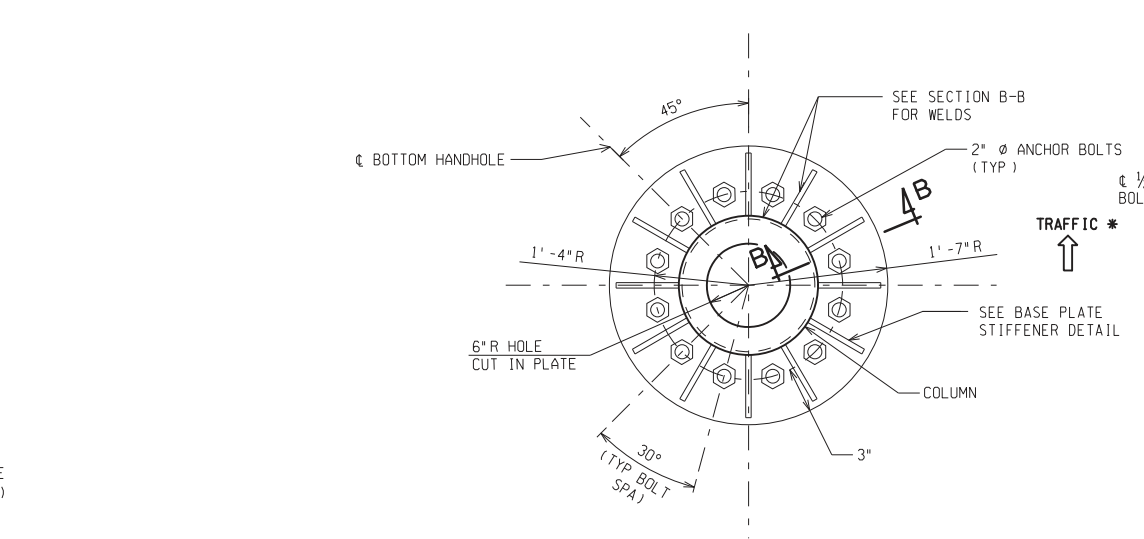
* THE SLOPE OF THE GROUND LINE AND MIN. SHAFT PROJECTION ARE FOR THE TYPE A DRILLED SHAFT. REFER TO SHEET 4 FOR DETAILS ON THE TYPE B DRILLED SHAFT.



HANDHOLE DETAILS

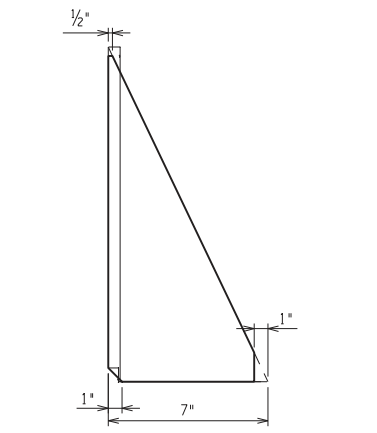


AS-LET PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION
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2							

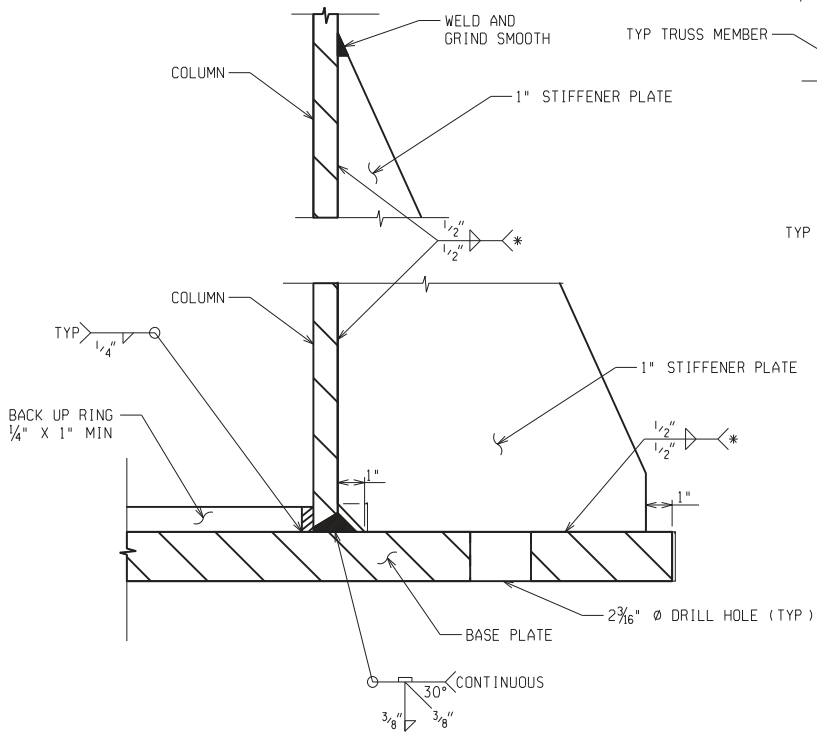


SECTION A-A

* POSITION BASE PLATE AND ANCHOR BOLTS SO THAT THE SIGN FACE IS ROTATED TOWARD TRAFFIC AT THE ANGLE SPECIFIED IN THE PLANS.

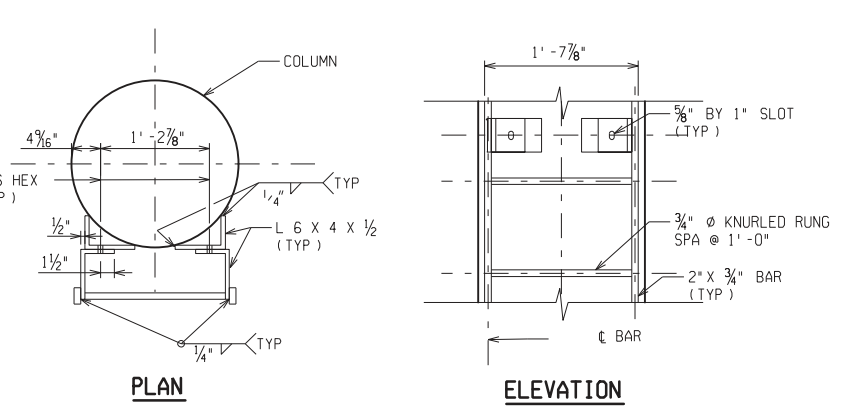


BASE PLATE STIFFENER

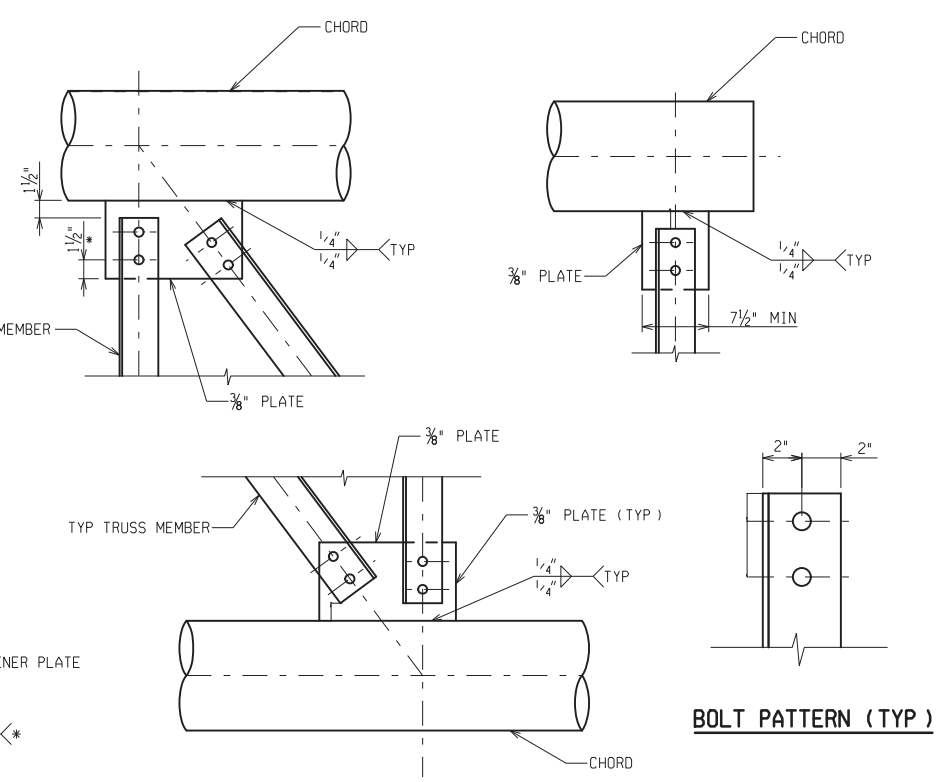


SECTION B-B

* WRAP WELD AROUND OUTSIDE EDGE. STOP WELD 1/4" FROM CORNER CLIP



LADDER ATTACHMENT DETAILS



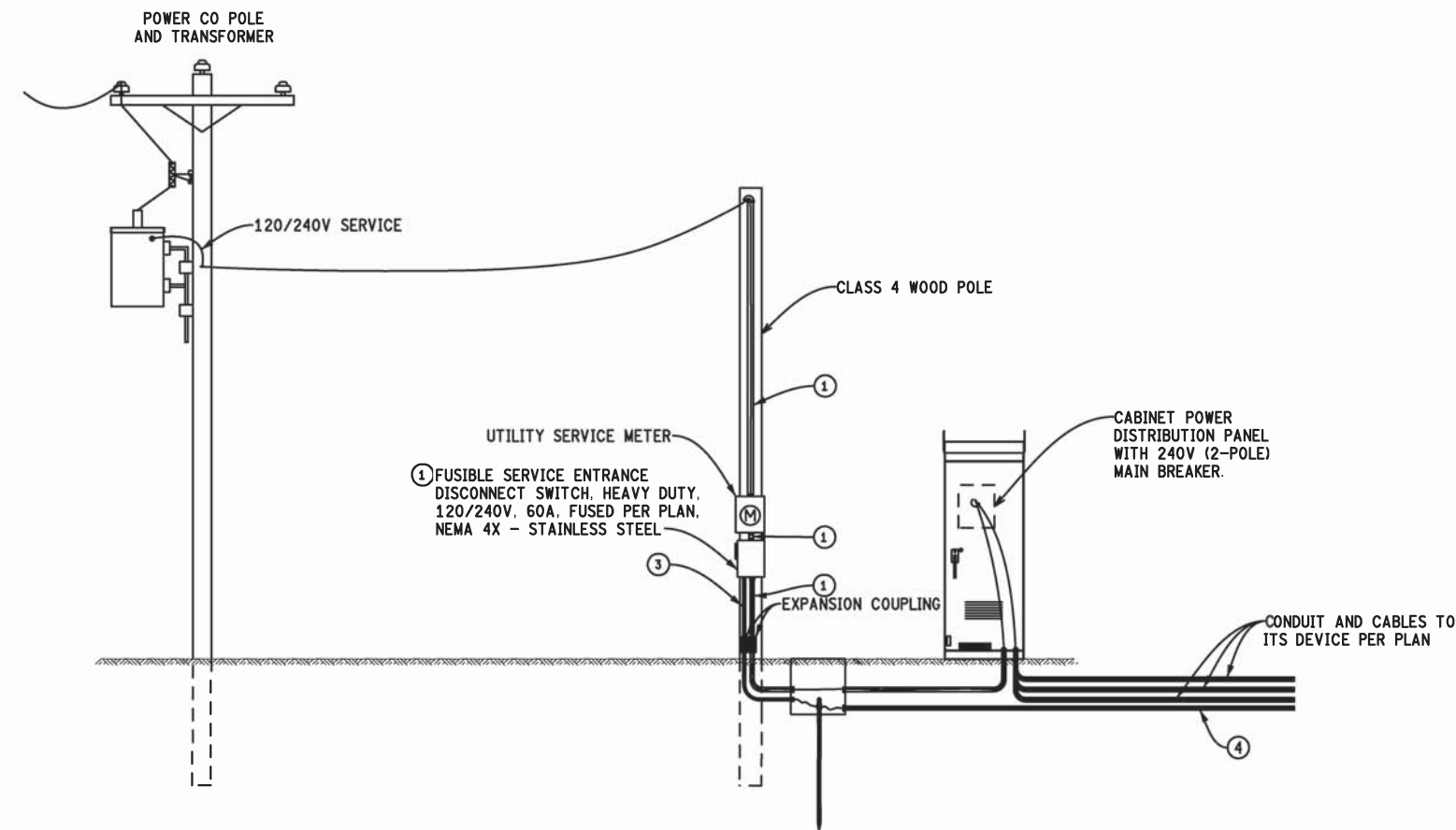
GUSSET PLATE CONNECTIONS

* TYPICAL MINIMUM EDGE DISTANCE

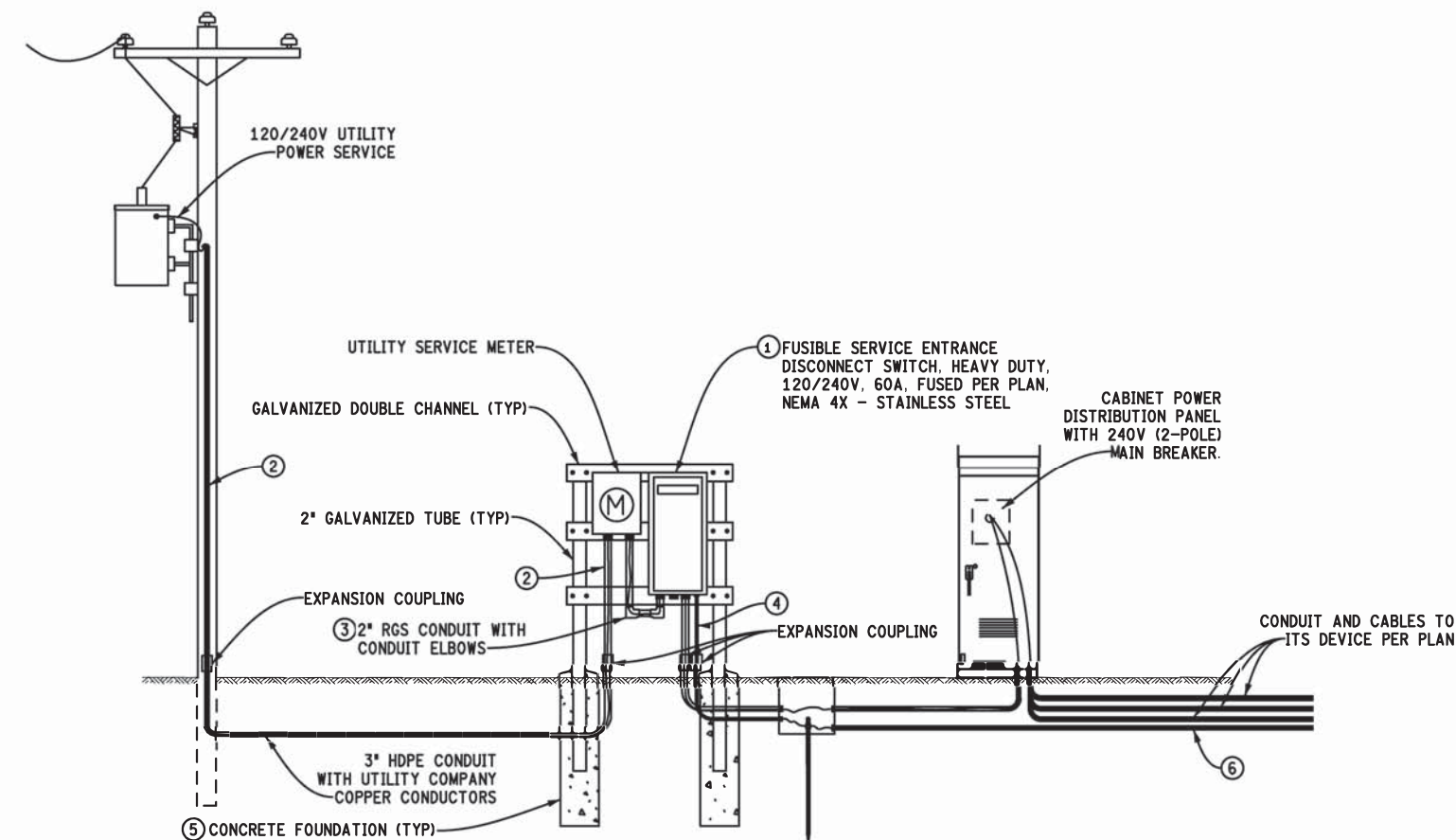
BONDING CLAMP INSTALLATION

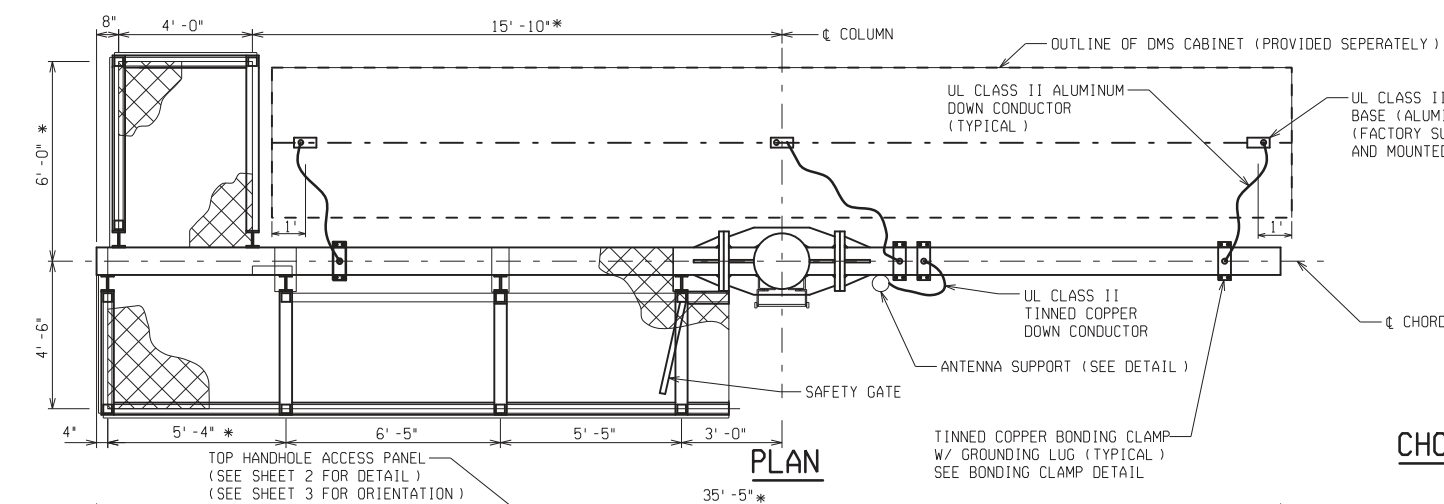
1. REMOVE GALVANIZING FROM SURFACE OF CHORD WHERE BONDING WILL TAKE PLACE.
2. AFTER GALVANIZING IS REMOVED APPLY CONDUCTIVE GREASE COMPOUND TO SURFACE.
3. ATTACH BONDING CLAMP TO THE CHORD, REMOVE EXCESS COMPOUND.
4. AFTER BONDING CLAMP HAS BEEN SECURED, APPLY COLD GALVANIZING PAINT. (SPRAY PAINT SHALL NOT BE ALLOWED)

DETAIL 1
POWER SERVICE, OVERHEAD
3 WIRE PLUS GROUND, 1 PHASE, PER PLAN

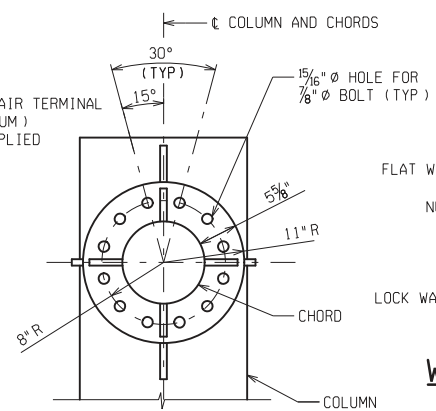


DETAIL 2
POWER SERVICE, UNDERGROUND
3 WIRE PLUS GROUND, 1 PHASE, PER PLAN

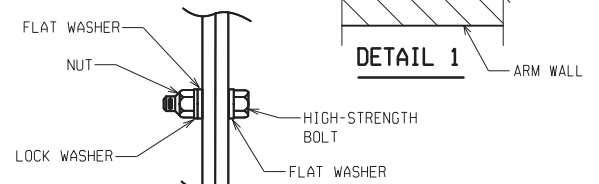




CHORD FLANGE PLATE DETAIL

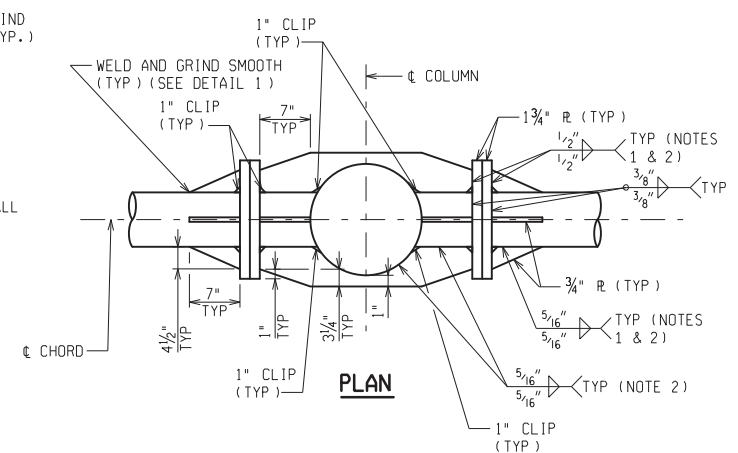


WASHER PLACEMENT

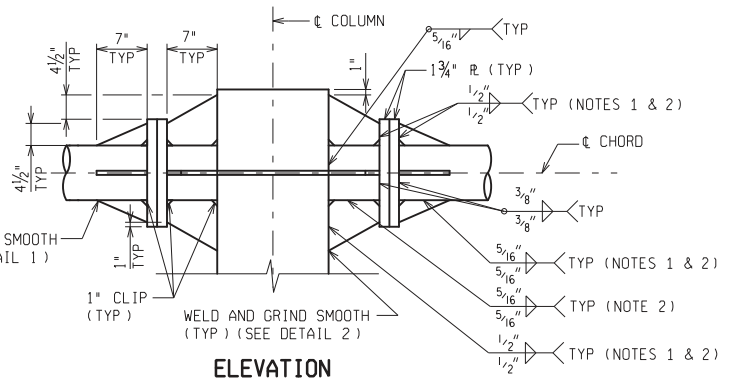


DETAIL 1

DETAIL 2



PLAN



*NOTE 1: WRAP WELD AROUND OUTSIDE EDGE. NOTE 2: STOP WELD 1/4" SHORT OF 1" CORNER CLIP.

CHORD CONNECTION DETAILS

NOTES:

THE DESIGN OF THE CONNECTION OF THE DMS CABINET MOUNTING POSTS TO TRUSS CHORDS SHALL BE SUBMITTED FOR APPROVAL.

PROVIDE GALVANIZED STEEL, SELF-CLOSING SAFETY GATE, MOUNTED TO HANDRAIL PER MFR DIRECTION. STEEL SHALL BE ASTM A36 MATERIAL GALVANIZED PER ASTM A123. ADJUST STOP BOLTS TO ASSURE PROPER CLOSING. (FABENCO, INC MODEL A71-27 OR EQUAL)

ALL BOLTS SHALL BE 7/8 INCH DIAMETER A325 GALVANIZED WITH 3/8 INCH THICK WASHER AND 7/8 INCH DIAMETER NUT, UNLESS NOTED OTHERWISE.

STRUCTURAL STEEL, BOLTS, WELDING, AND GALVANIZING SHALL BE ACCORDING TO THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MDOT SPECIAL PROVISION 03SP707(A).

INSTALL VENT HOLES AS REQUIRED FOR GALVANIZING.

THE PIPE MATERIAL SHALL MEET THE REQUIREMENTS OF API 5L, GRADE X52.

ALL OTHER STRUCTURAL STEEL SHALL BE ASTM A-36, UNLESS OTHERWISE NOTED.

ALL STEEL, INCLUDING BAR GRATING, SHALL BE HOT DIP GALVANIZED PER ASTM 123 OR 153, AS APPLICABLE.

PROVIDE ANCHOR BOLTS IN ACCORDANCE WITH SECTIONS 908.14 A & B OF THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.

FABRICATION AND ERECTION SHALL BE ACCORDING TO SECTIONS 707 AND 810.03 OF THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.

WALK PLATFORM SHALL NOT BE LIFTED BY HANDRAILS OR POSTS. TRUSS SHALL NOT BE LIFTED BY WEB MEMBERS.

LADDER SHALL BE EQUIPPED WITH A SAFETY RAIL SYSTEM APPROVED BY THE ENGINEER.

TOP OF THE ANTENNA SUPPORT SHALL BE SEALED WITH A TENON. CONTRACTOR TO VERIFY WITH ENGINEER METHOD TO ROUTE WIRE TO THE INTERIOR OF THE ANTENNA SUPPORT SUCH THAT A WATER TIGHT SEAL IS MAINTAINED.

THE MAXIMUM PERMISSIBLE SIGN AREA IS 285 SQFT.

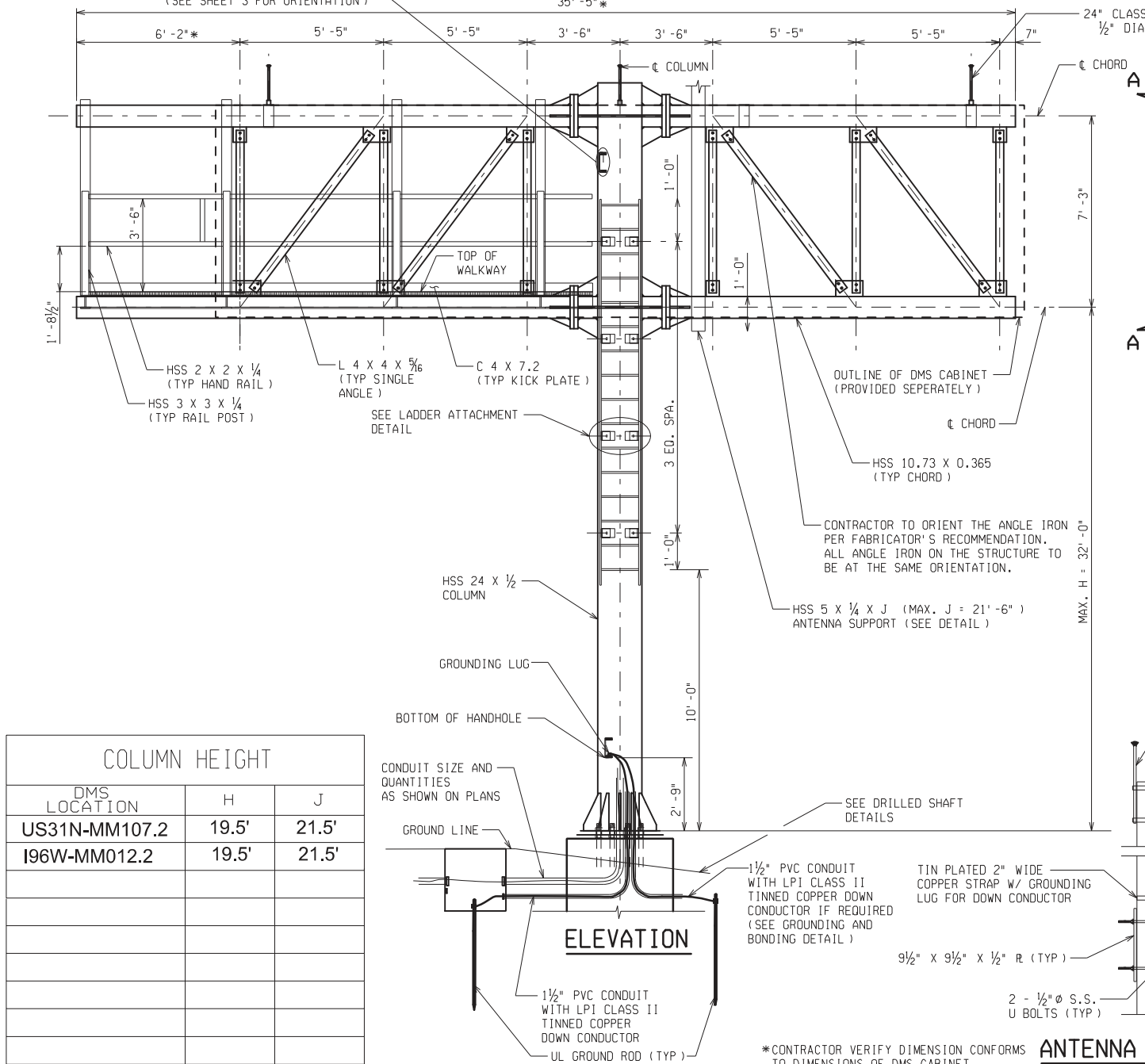
FABRICATOR MUST BE AISC SIMPLE BRIDGE (SBR) OR AISC BRIDGE & HIGHWAY METAL COMPONENT CERTIFIED.

INSTALL RODENT SCREEN BETWEEN THE BASE PLATE AND TOP OF FOUNDATION.

INSTALL A FLEXIBLE CONDUIT IN THE DMS SUPPORT STRUCTURE CENTER COLUMN TO SEPARATE POWER AND COMMUNICATIONS CABLING.

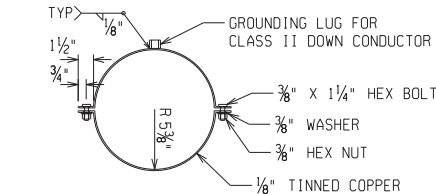
THE FLANGES SHALL BE WELDED TO ASSURE OBTAINING FULL CONTACT IN THE RELAXED POSTION PRIOR TO SNUGGING UP THE FLANGE BOLTS. THE FLANGE BOLTS SHALL NOT BE TORQUED IN AN ATTEMPT TO CLOSE.

WARPAGE IN THE BASE PLATE SHALL NOT EXCEED 1/16" PER FOOT.

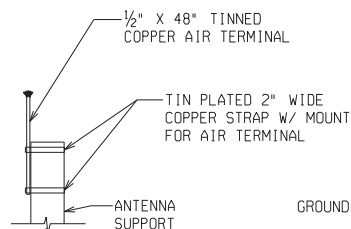


ELEVATION

BONDING CLAMP DETAIL



BOTTOM HANDHOLE ACCESS PANEL (SEE SHEET 2 FOR DETAIL AND ORIENTATION)



ANTENNA SUPPORT CONNECTION DETAIL

*CONTRACTOR VERIFY DIMENSION CONFORMS TO DIMENSIONS OF DMS CABINET.

END ELEVATION A-A

IF ANTENNA SUPPORT POLE IS REQUIRED, PROVIDE AIR TERMINAL, DOWN CONDUCTOR, AND MOUNTING STRAPS IN ADDITION TO LP EQUIPMENT TO BE SUPPLIED FOR THE DMS CASE.

COLUMN HEIGHT		
DMS LOCATION	H	J
US31N-MM107.2	19.5'	21.5'
I96W-MM012.2	19.5'	21.5'

AS-LET PLAN REVISIONS

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: RH Master DMS Structure Drawings.dgn

DATE:

DESIGN UNIT:

TSC:

CS: 84923

JN: 106329A

DMS SIGN SUPPORT

RIGHT SIDE ENTRANCE

SHEET 1 OF 4

DRAWING

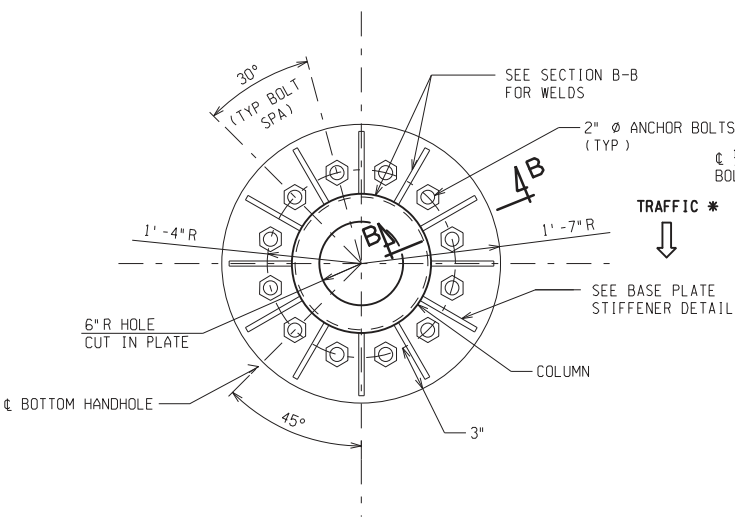
SHEET

MSDET 016

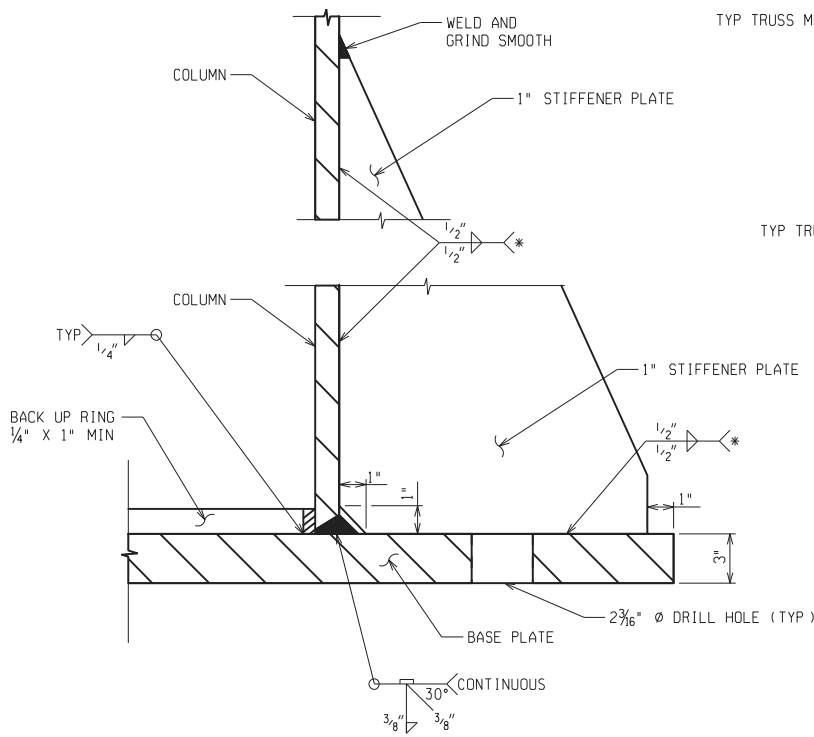
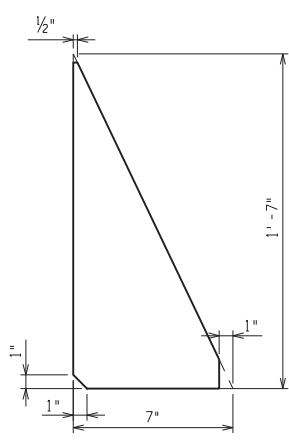
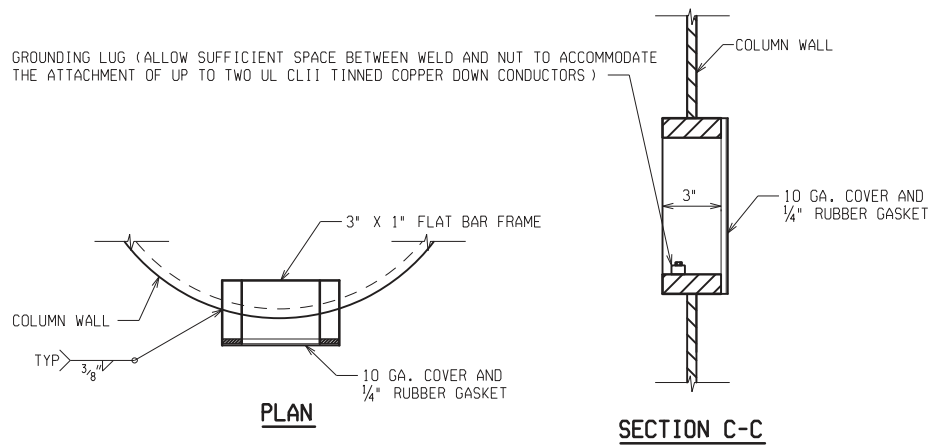
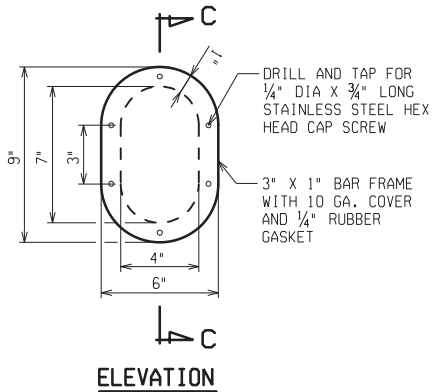
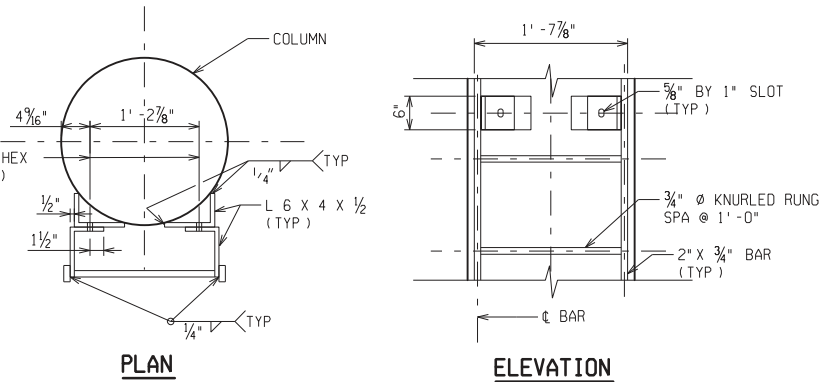
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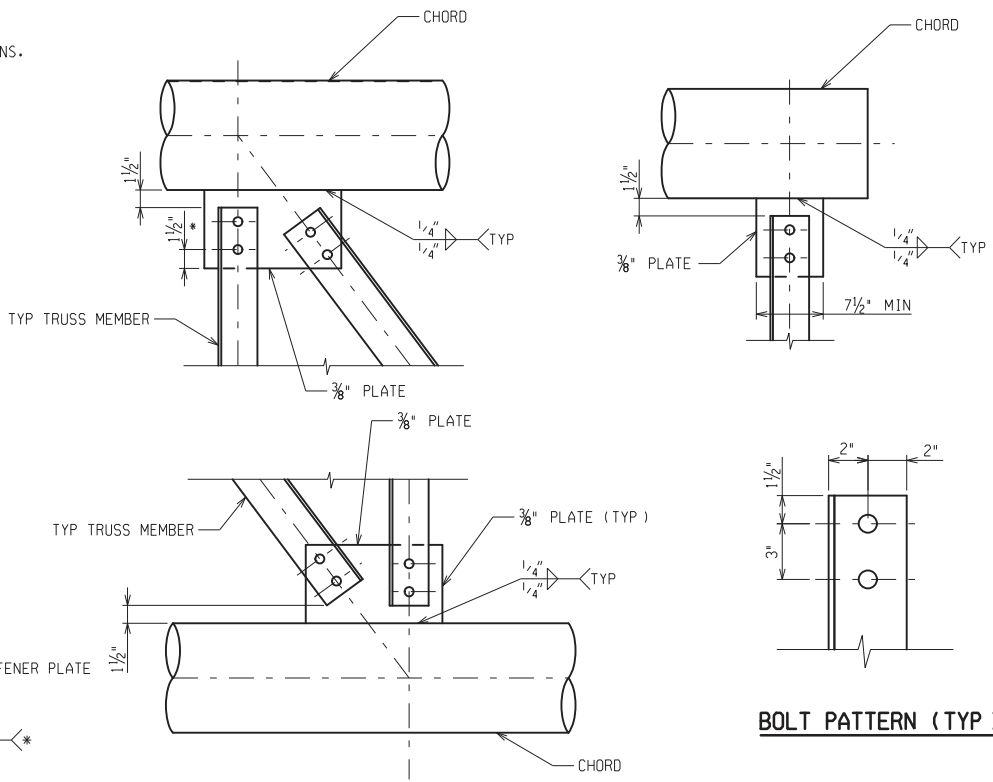
* THE SLOPE OF THE GROUND LINE AND MIN. SHAFT PROJECTION ARE FOR THE TYPE A DRILLED SHAFT. REFER TO SHEET 4 FOR DETAILS ON THE TYPE B DRILLED SHAFT.



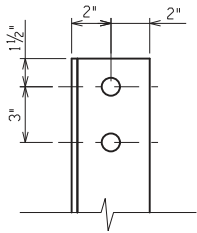
* POSITION BASE PLATE AND ANCHOR BOLTS SO THAT THE SIGN FACE IS ROTATED TOWARD TRAFFIC AT THE ANGLE SPECIFIED IN THE PLANS.



* WRAP WELD AROUND OUTSIDE EDGE.
STOP WELD 1/4" FROM CORNER CLIP



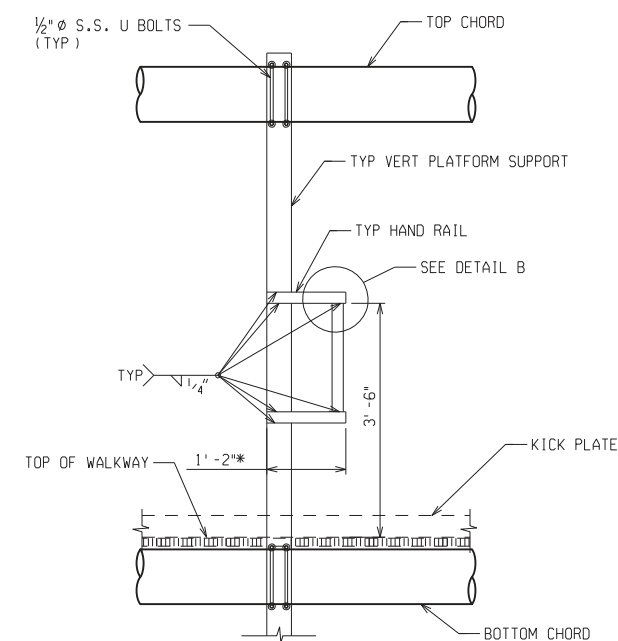
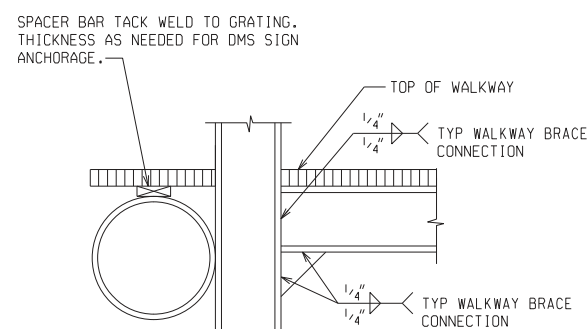
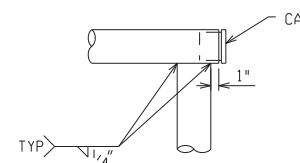
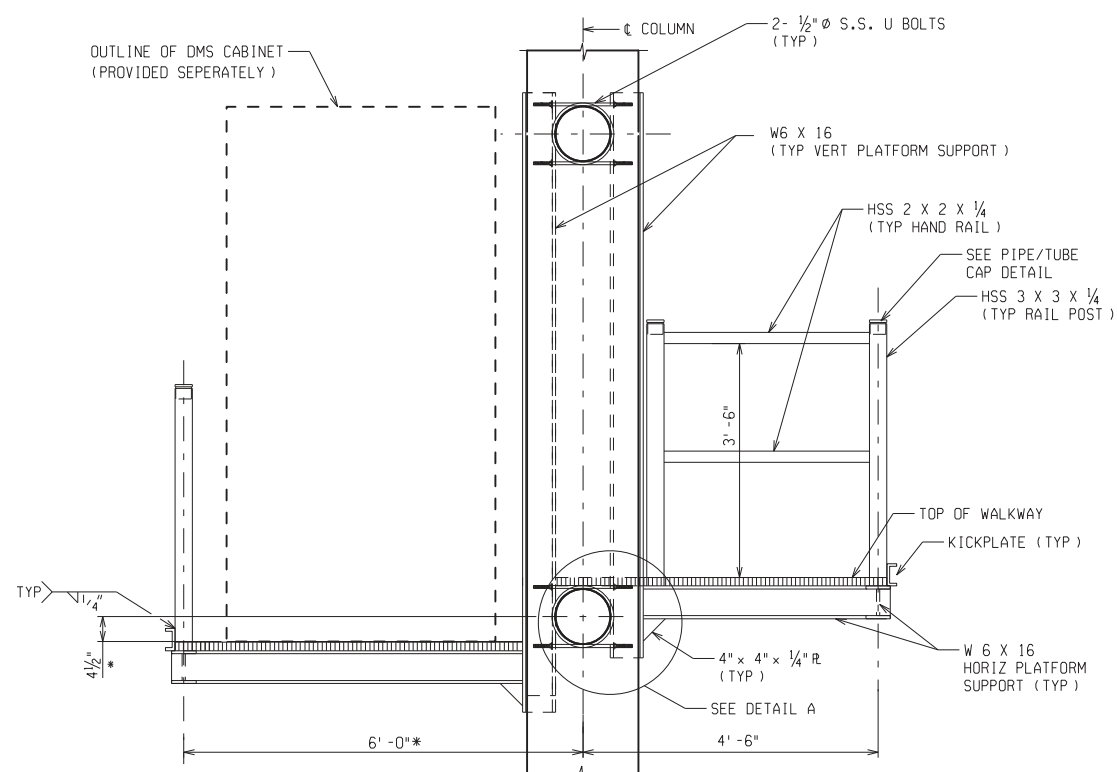
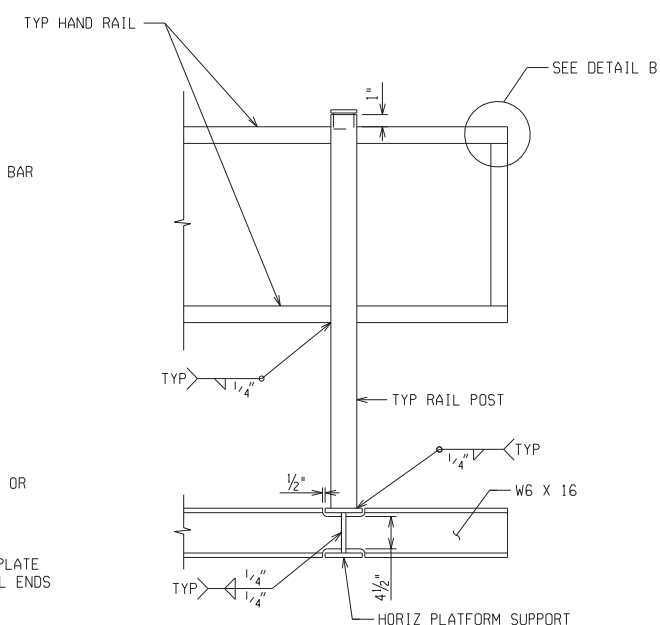
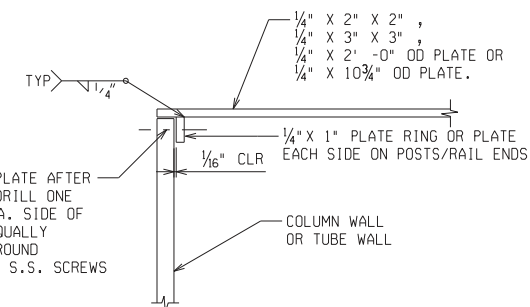
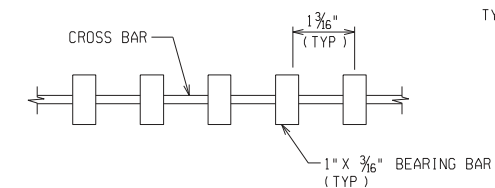
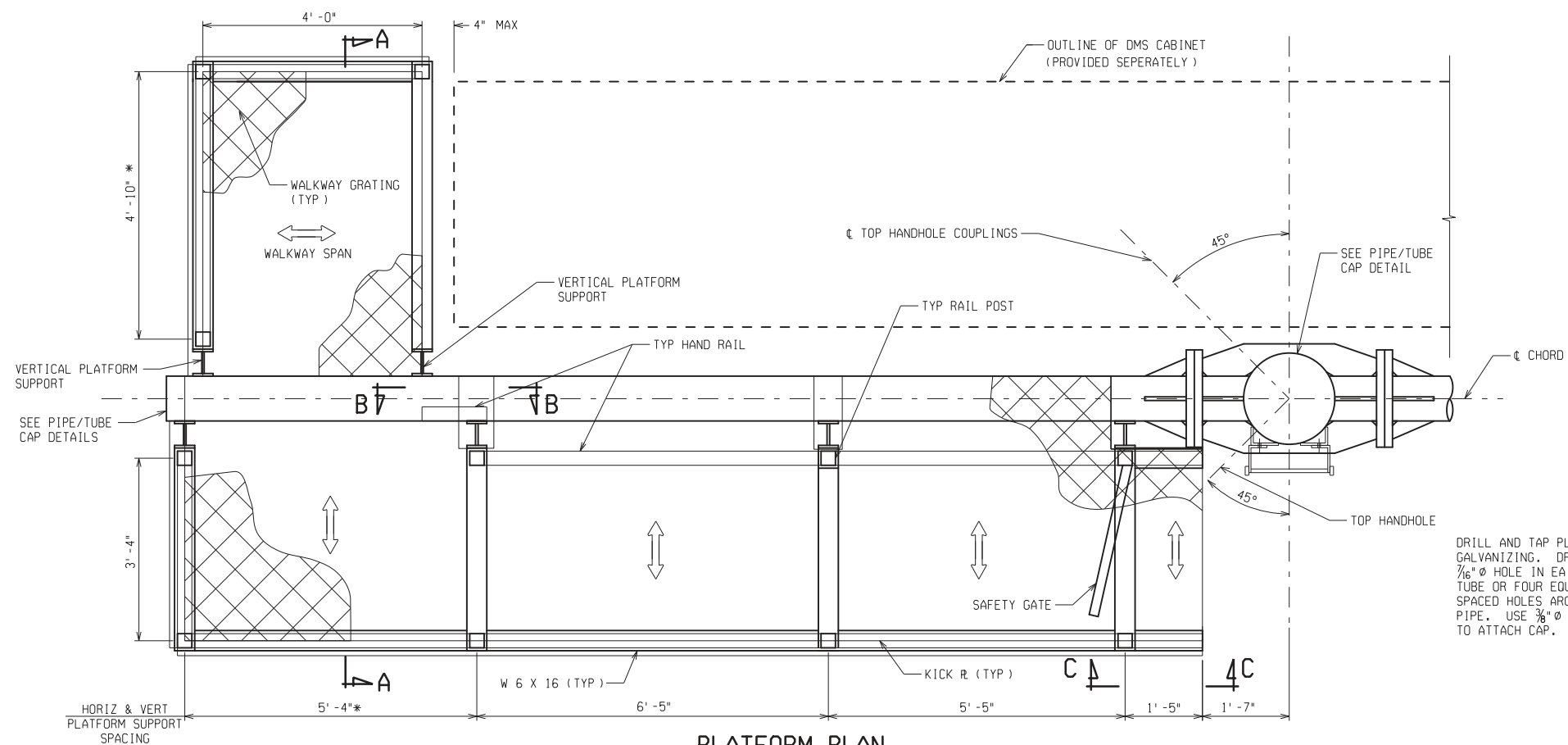
* TYPICAL MINIMUM EDGE DISTANCE



BONDING CLAMP INSTALLATION

1. REMOVE GALVANIZING FROM SURFACE OF CHORD WHERE BONDING WILL TAKE PLACE.
2. AFTER GALVANIZING IS REMOVED APPLY CONDUCTIVE GREASE COMPOUND TO SURFACE.
3. ATTACH BONDING CLAMP TO CHORD, REMOVE EXCESS COMPOUND.
4. AFTER BONDING CLAMP HAS BEEN SECURED, APPLY COLD GALVANIZING PAINT.
(SPRAY PAINT SHALL NOT BE ALLOWED)

AS-LET PLAN REVISIONS									NO SCALE		DATE:	CS: 84923	DMS SIGN SUPPORT	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT:	JN: 106329A	RIGHT SIDE ENTRANCE	MSDET	SECT 1
														017	
										FILE: RH Master DMS Structure Drawings.dgn	TSC:		SHEET 2 OF 4		



* CONTRACTOR VERIFY DIMENSION CONFORMS TO DIMENSIONS OF DMS CABINET.

AS-LET PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: RH Master DMS Structure Drawings.dgn

DATE:

DESIGN UNIT:	
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TSC:	
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CS: 84923

JN: 106329A

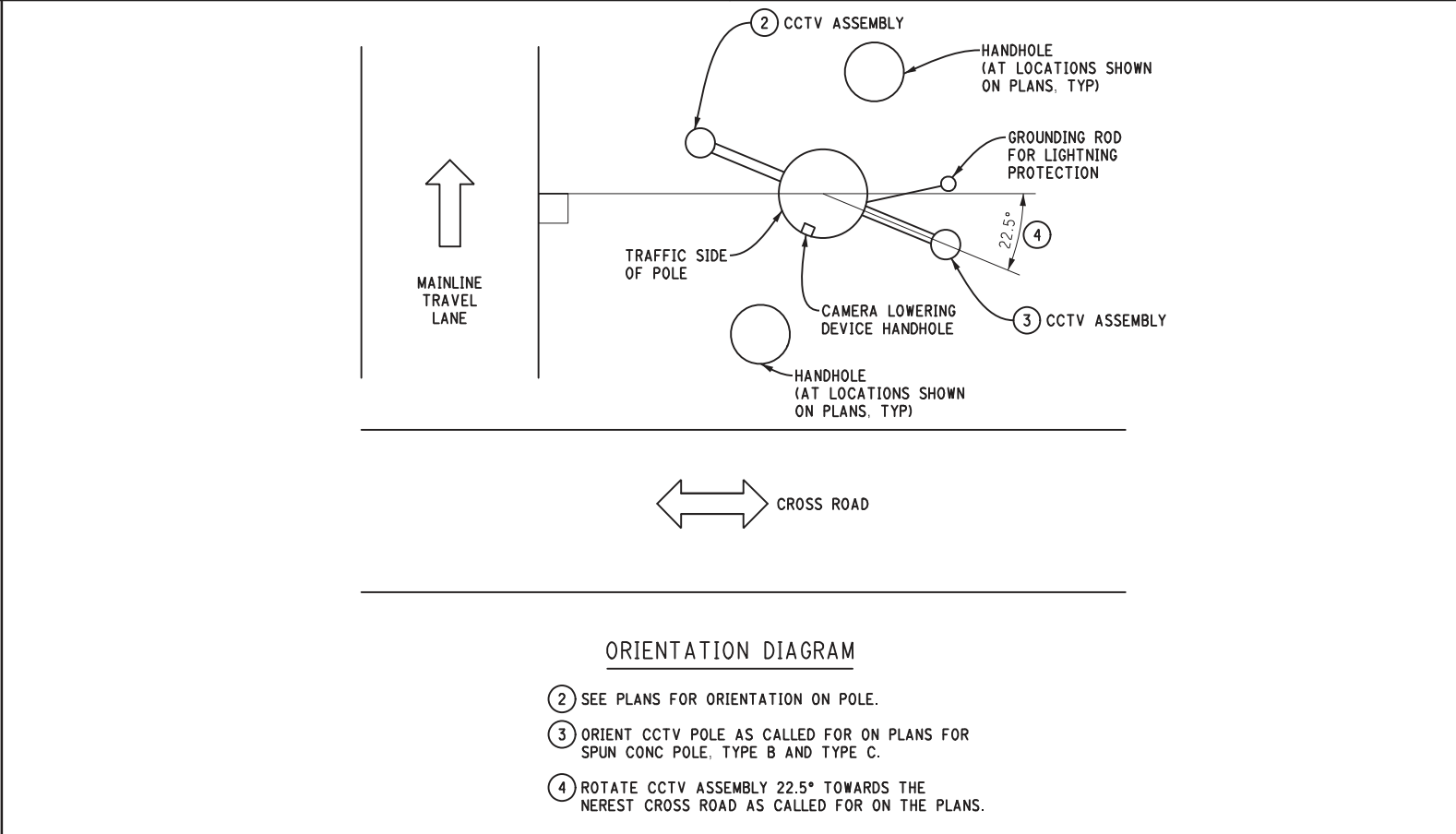
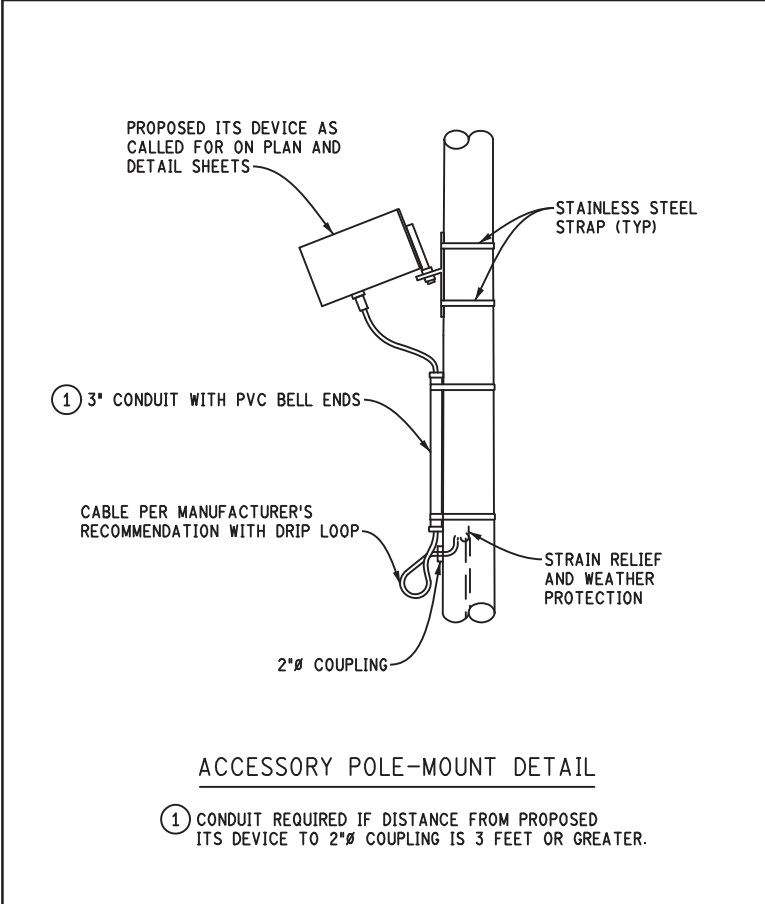
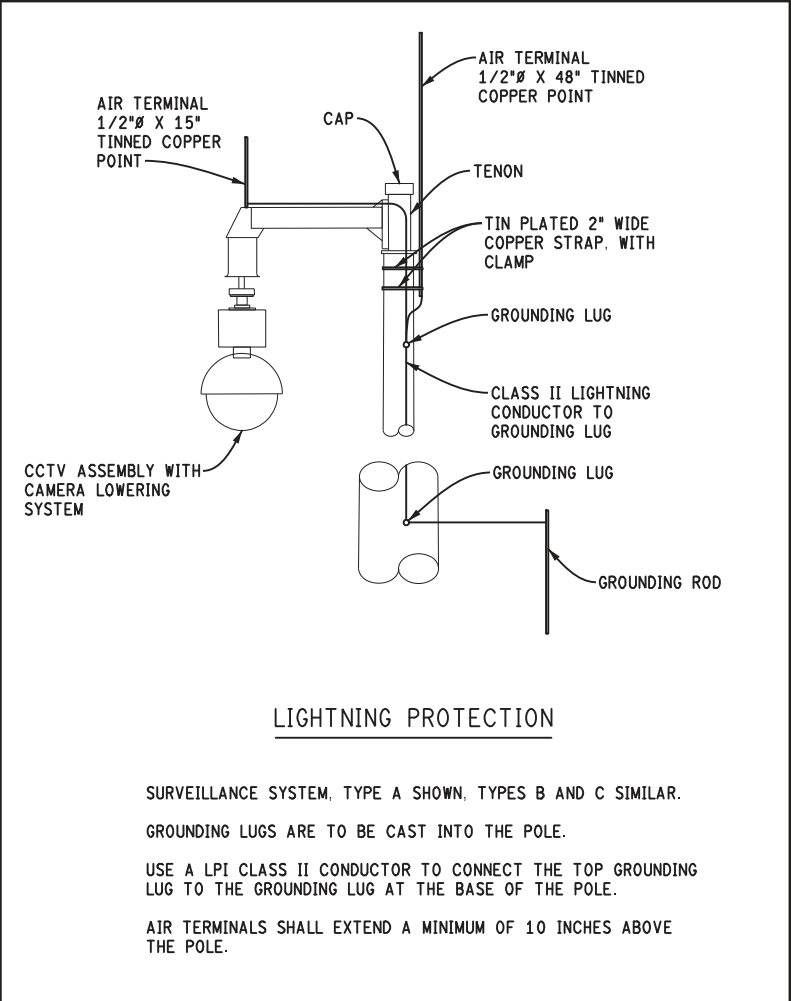
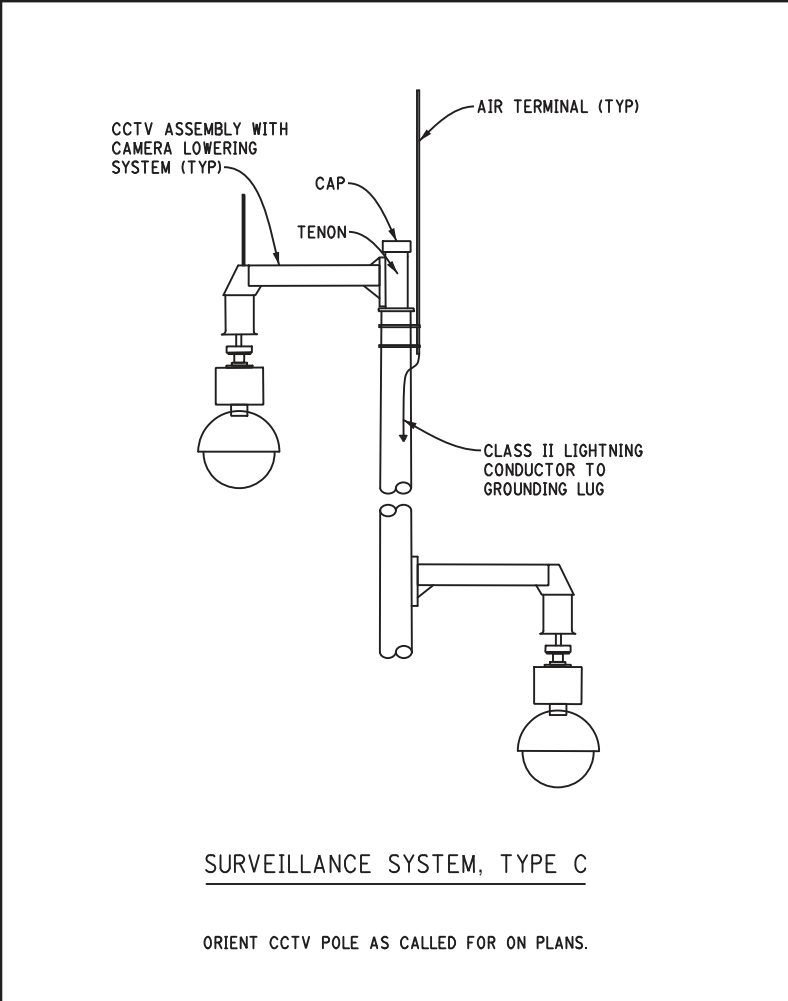
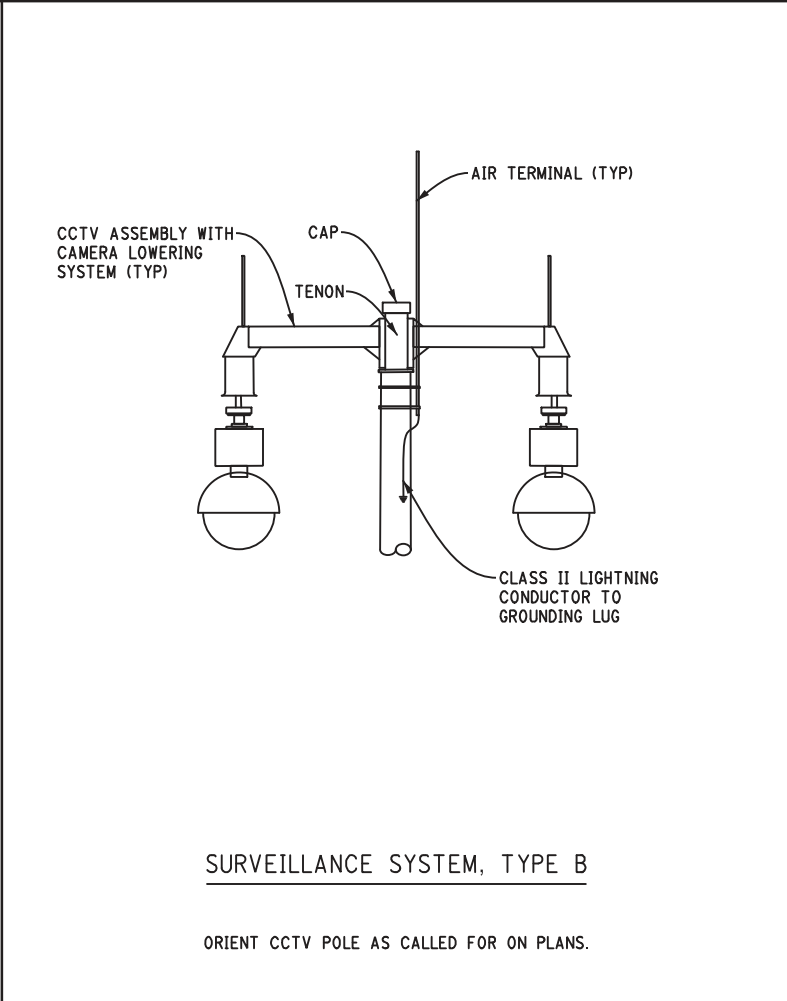
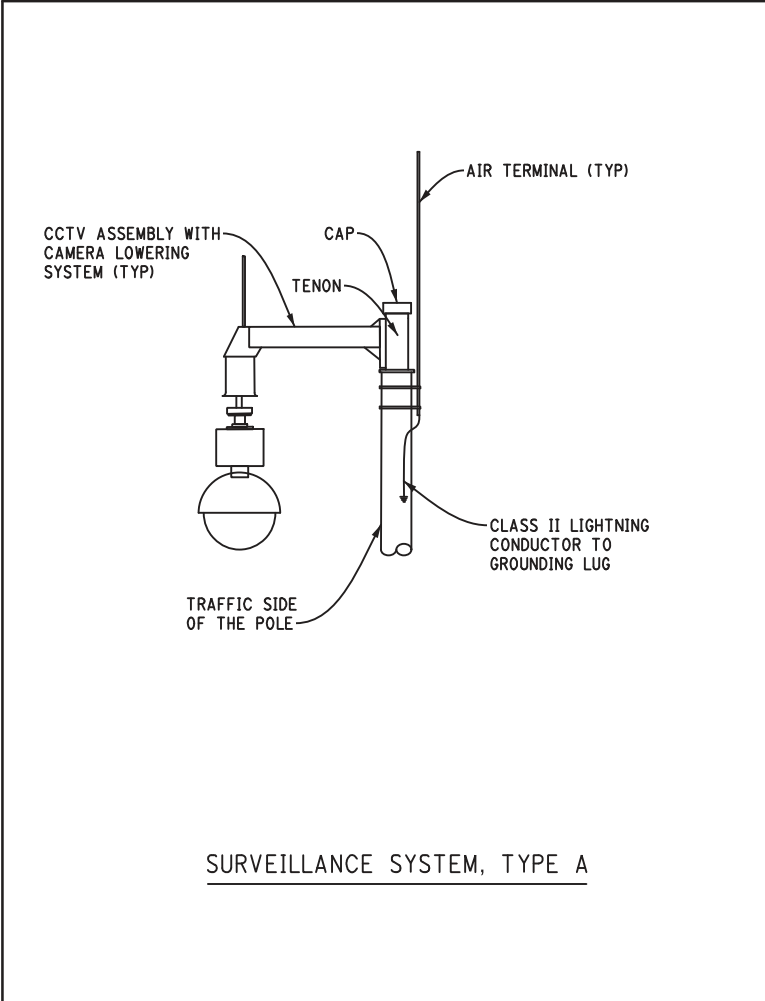
DMS SIGN SUPPORT

RIGHT SIDE ENTRANCE

SHEET 3 OF 4

	DRAWING	SHEET
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MSDET	SECT 1
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NOTES:

1. ALL CONDUITS AND DUCTS SHALL BE SEALED WITH A RUBBER FITTING OR A WEATHER HEAD.

2. ALL MOUNTING HARDWARE SHALL BE STAINLESS STEEL.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
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NO SCALE

DATE:

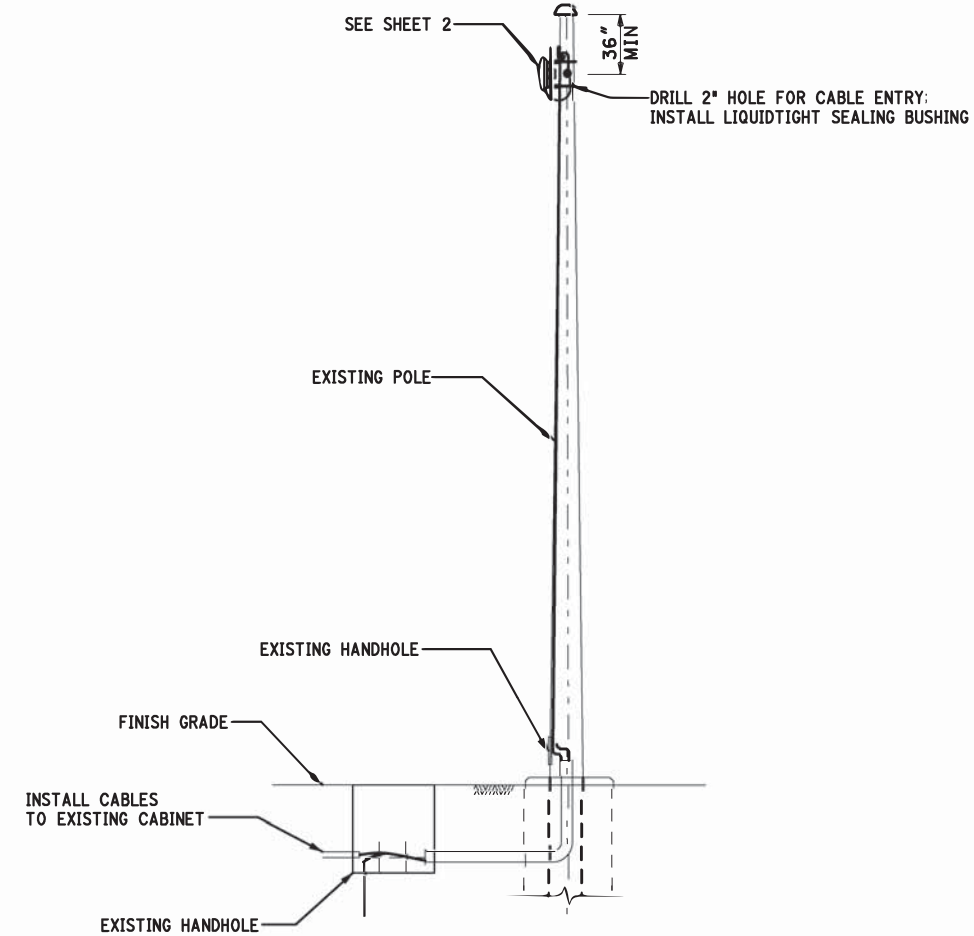
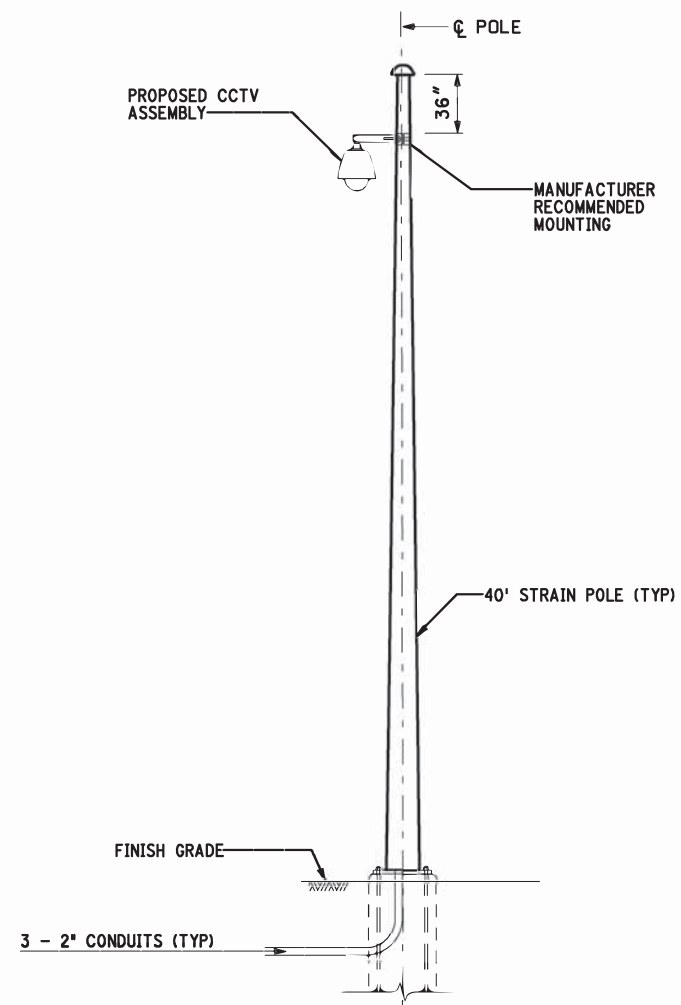
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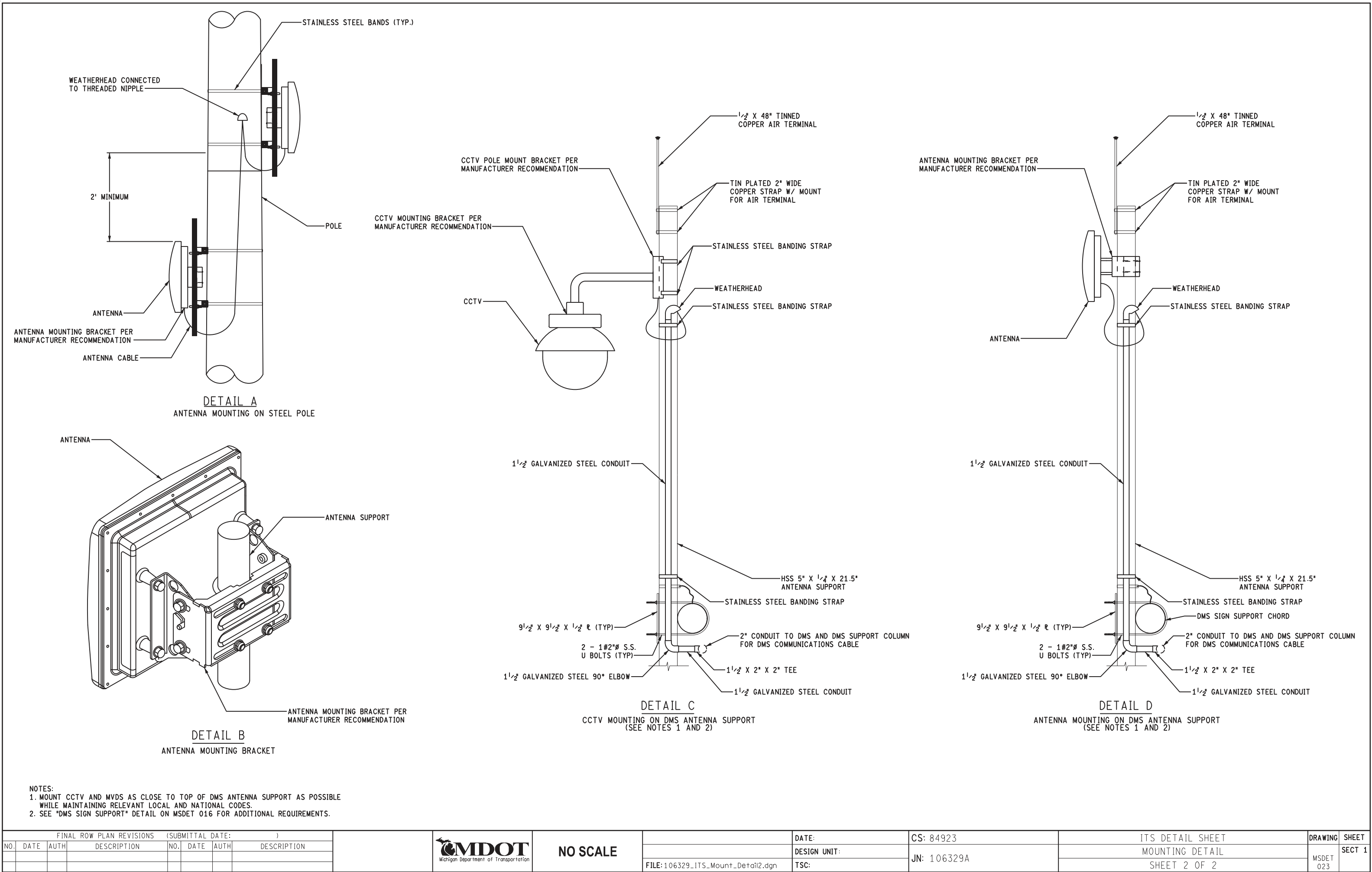
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JN: 106329A

SURVEILLANCE SYSTEMS		DRAWING	SHEET
SHEET 1 OF 1		MSDET 020	SECT 1



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									FILE:106329_ITS_Mount_Detail1.dgn	JN: 106329A	SHEET 1 OF 2	MSDET 022	
									TSC:				



- NOTES:
1. MOUNT CCTV AND MVDS AS CLOSE TO TOP OF DMS ANTENNA SUPPORT AS POSSIBLE WHILE MAINTAINING RELEVANT LOCAL AND NATIONAL CODES.
2. SEE "DMS SIGN SUPPORT" DETAIL ON MSDET 016 FOR ADDITIONAL REQUIREMENTS.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
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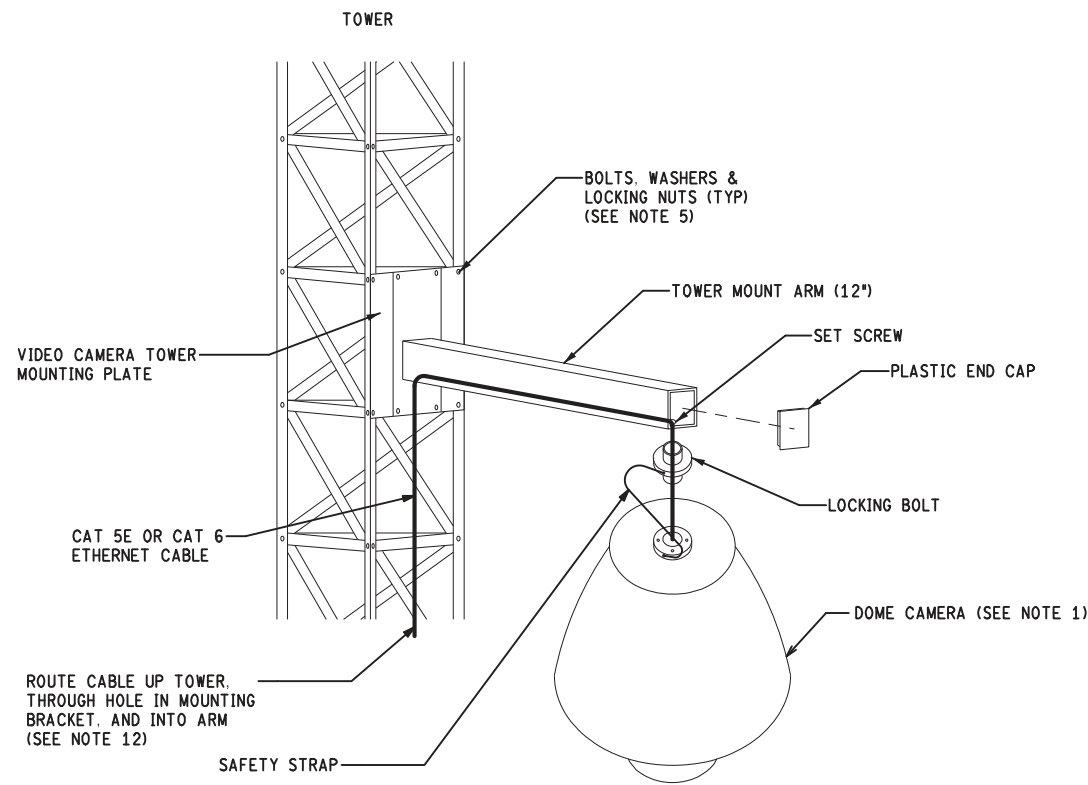
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TSC:

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JN: 106329A

ITS DETAIL SHEET
MOUNTING DETAIL
SHEET 2 OF 2

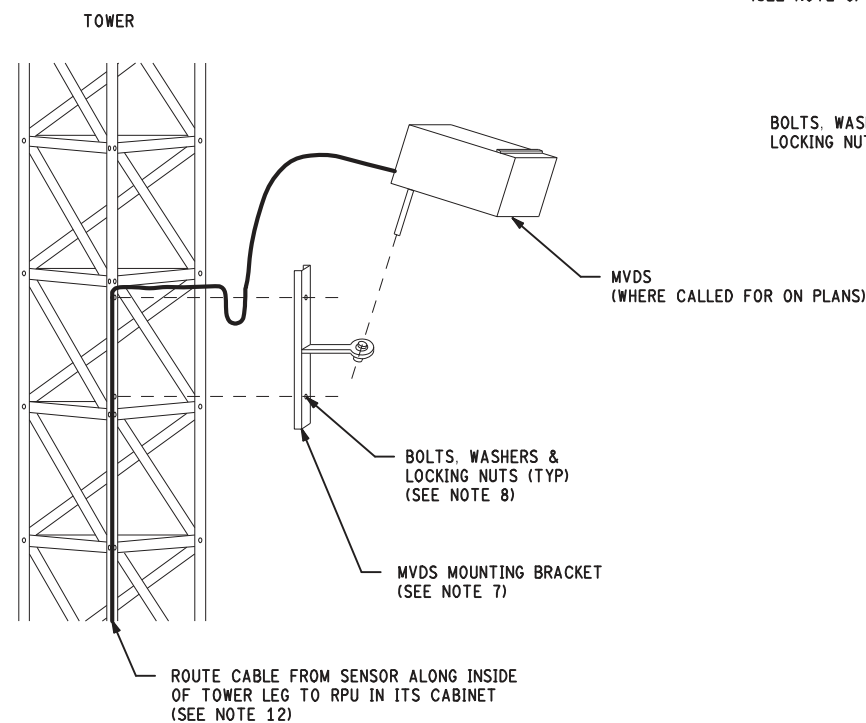
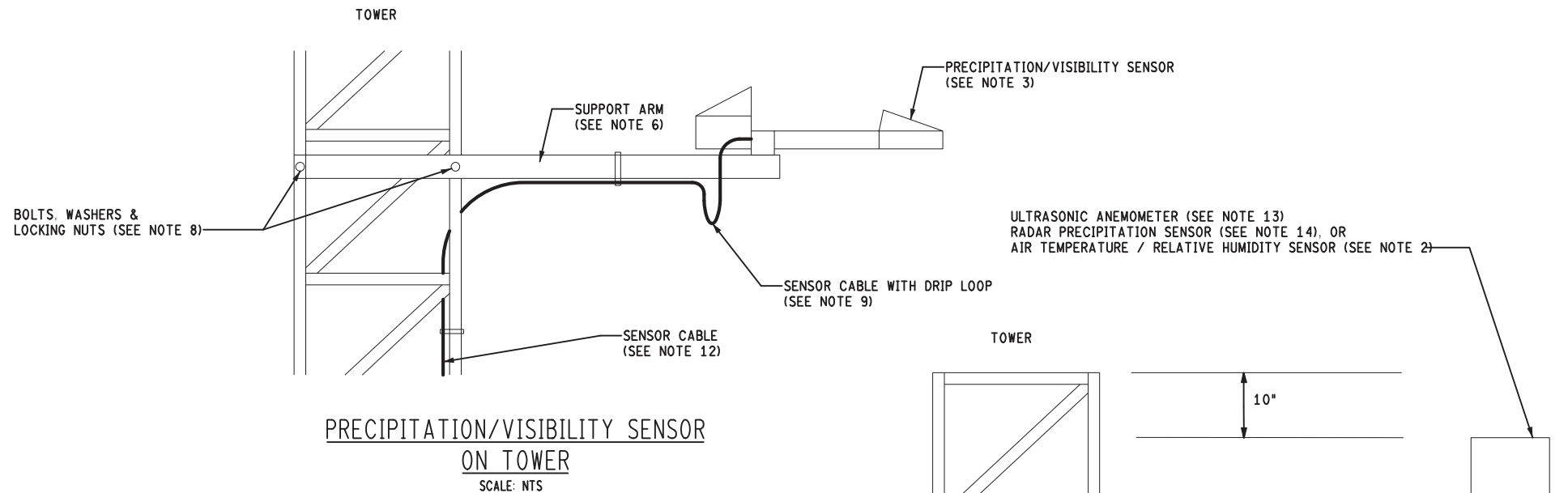
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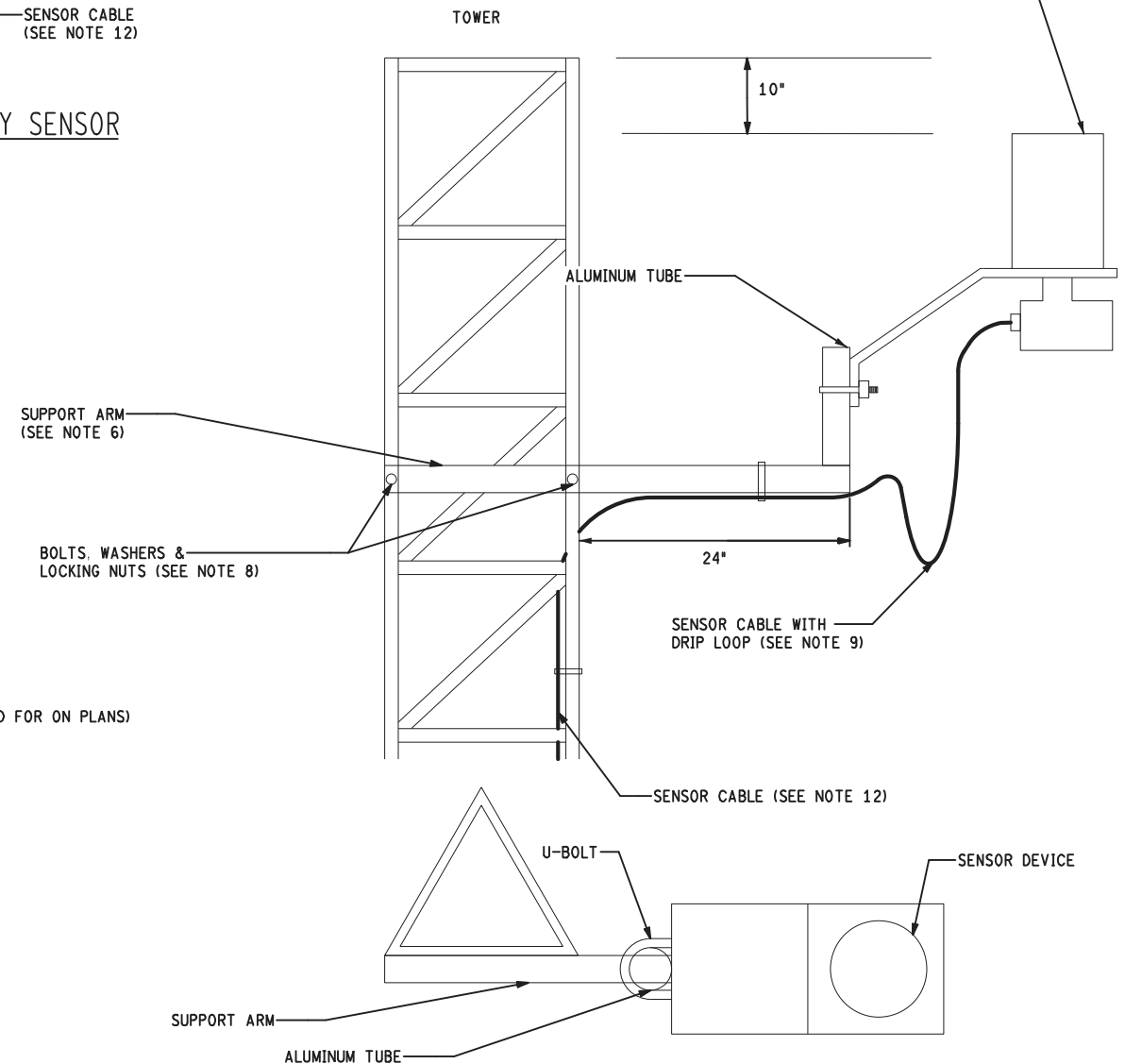
**VIDEO CAMERA MOUNTING
DETAIL ON TOWER**
SCALE: NTS

NOTES:

1. DOME CAMERA AND MOUNTING EQUIPMENT SHALL BE PAID FOR UNDER THE INTERNET PROTOCOL SURVEILLANCE SYSTEM, ENVIRONMENTAL SENSOR STATION PAY ITEM.
2. AIR TEMPERATURE/RELATIVE HUMIDITY SENSOR AND MOUNTING EQUIPMENT SHALL BE PAID FOR UNDER THE ATMOSPHERIC SENSOR, AIR TEMPERATURE/RELATIVE HUMIDITY PAY ITEM
3. PRECIPITATION/VISIBILITY SENSOR AND MOUNTING EQUIPMENT SHALL BE PAID FOR UNDER THE ATMOSPHERIC SENSOR, PRECIPITATION/VISIBILITY PAY ITEM.
4. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
5. ALL HARDWARE SHALL BE STAINLESS STEEL.
6. SUPPORT ARM SHALL BE ANGLE ALUMINUM.
7. MOUNTING PLATE SHALL BE SIZED ACCORDINGLY FOR FLUSH INSTALL ON TOWER FACE.
8. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.
9. EACH TOWER-MOUNTED SENSOR CABLE SHALL HAVE QUICK DISCONNECTS AT THE TOP AND BOTTOM OF THE TOWER.
10. ALL TIE WRAPS SHALL BE INSTALLED TO ENSURE THE CABLES ARE SECURELY TIED TO THE TOWER. TIE WRAPS SHALL BE WEATHER RESISTANT.
11. EQUIPMENT SHOWN ABOVE IS FOR DIAGRAMMATIC PURPOSES ONLY AND ARE NOT OF SPECIFIC PRODUCTS. CONTRACTOR SHALL PROCURE EQUIPMENT BASED ON THE SPECIFICATIONS IN THE PROPOSAL.
12. PROVIDE CABLE STRAIN RELIEF AS NECESSARY TO PREVENT THE CABLE FROM BEING DAMAGED.
13. ULTRASONIC ANEMOMETER AND MOUNTING EQUIPMENT SHALL BE PAID FOR UNDER THE ATMOSPHERIC SENSOR, ULTRASONIC WIND PAY ITEM.
14. RADAR PRECIPITATION SENSOR AND MOUNTING EQUIPMENT SHALL BE PAID FOR UNDER THE ATMOSPHERIC SENSOR, RADAR PRECIPITATION PAY ITEM.



**TYPICAL MICROWAVE VEHICLE DETECTION
SYSTEM (MVDS) MOUNTING DETAIL**
SCALE: NTS



SENSORS DETAIL ON TOWER
SCALE: NTS

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)													
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												SHEET 1 OF 1	



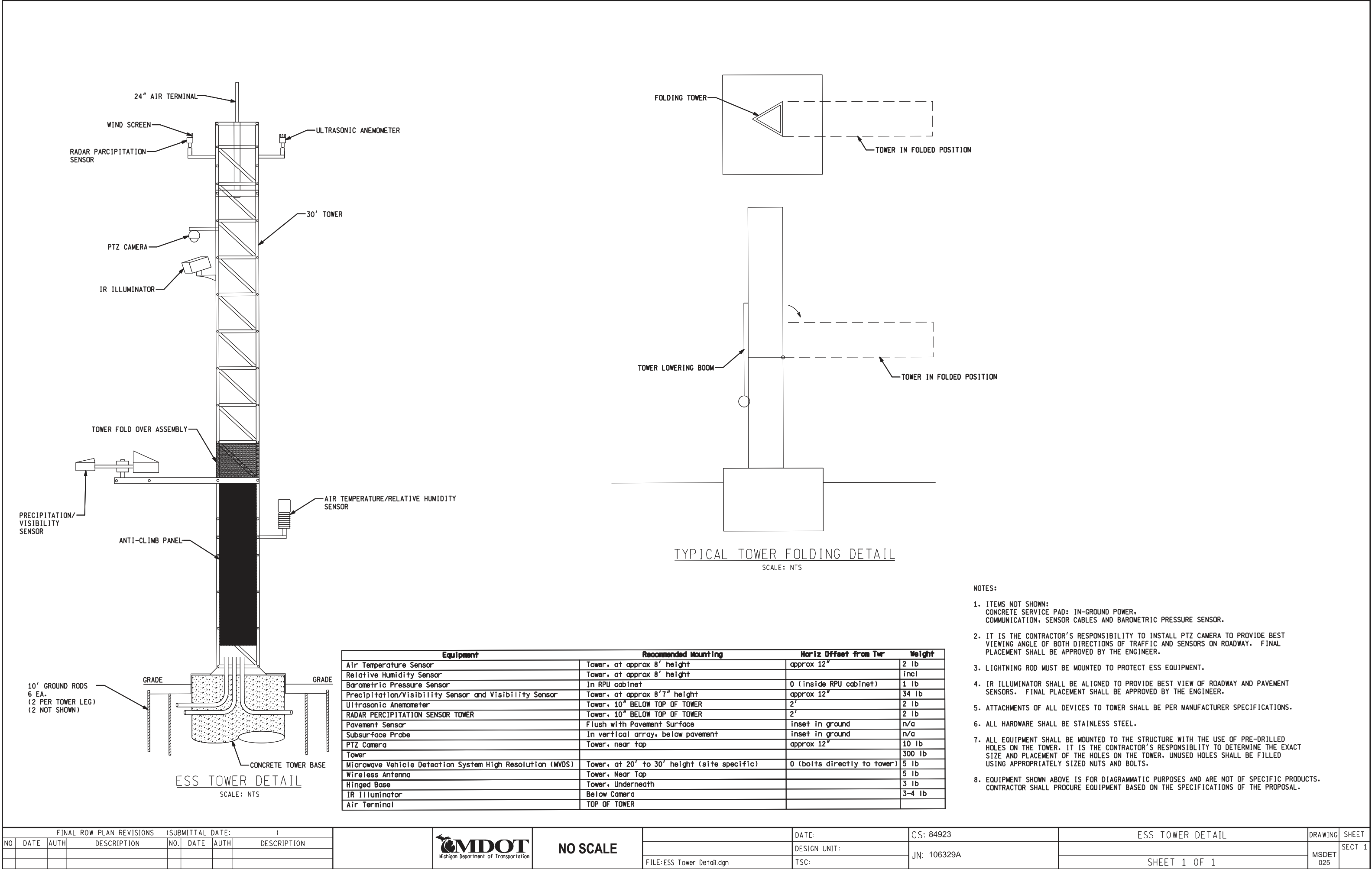
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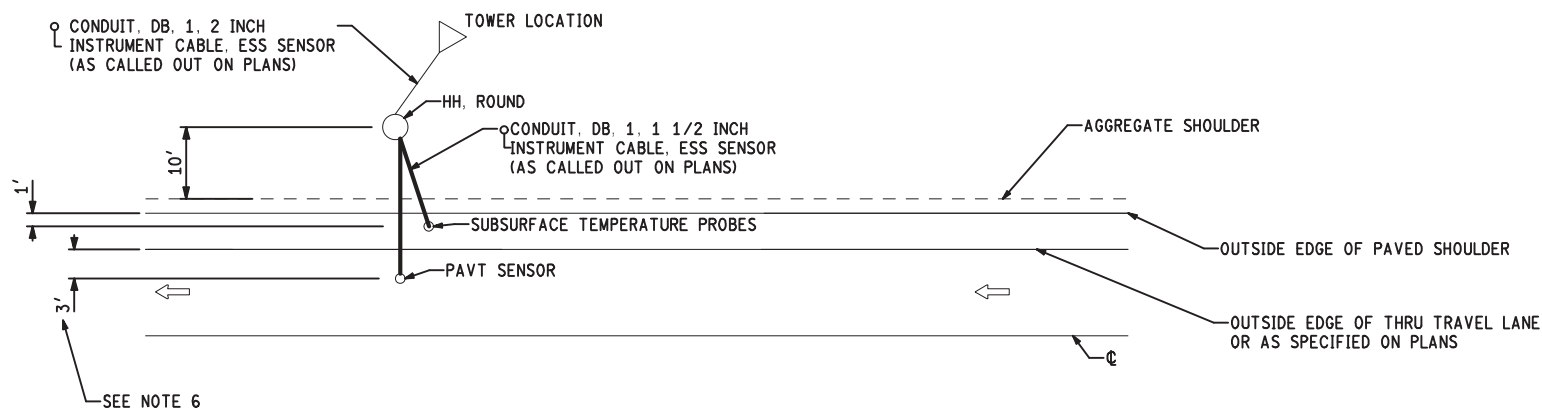
ESS SENSOR DETAIL

DRAWING SHEET

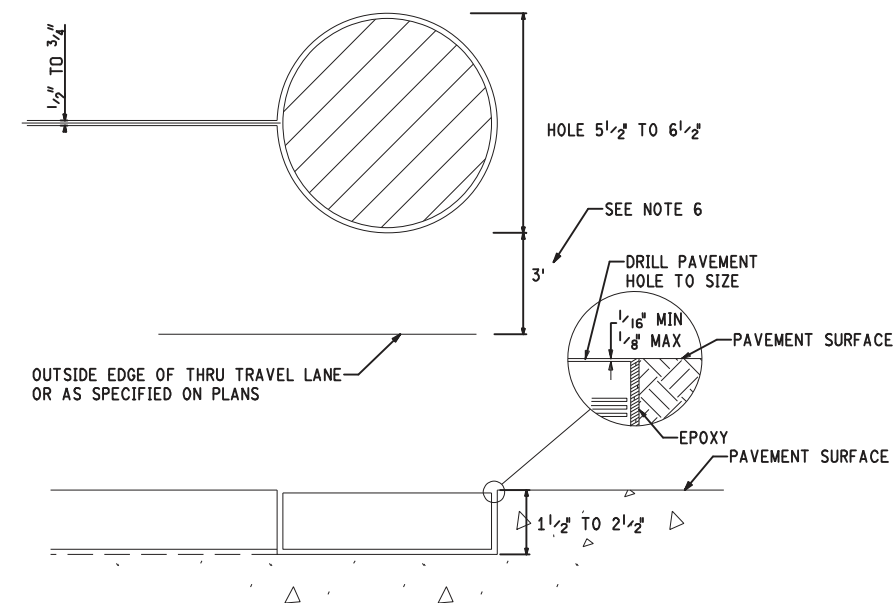


Equipment	Recommended Mounting	Horiz Offset from Tur	Weight
Air Temperature Sensor	Tower, at approx 8' height	approx 12"	2 lb
Relative Humidity Sensor	Tower, at approx 8' height		incl
Barometric Pressure Sensor	In RPU cabinet	0 (inside RPU cabinet)	1 lb
Precipitation/Visibility Sensor and Visibility Sensor	Tower, at approx 8'7" height	approx 12"	34 lb
Ultrasonic Anemometer	Tower, 10" BELOW TOP OF TOWER	2'	2 lb
RADAR PERCIPITATION SENSOR TOWER	Tower, 10" BELOW TOP OF TOWER	2'	2 lb
Pavement Sensor	Flush with Pavement Surface	inset in ground	n/a
Subsurface Probe	In vertical array, below pavement	inset in ground	n/a
PTZ Camera	Tower, near top	approx 12"	10 lb
Tower			300 lb
Microwave Vehicle Detection System High Resolution (MVDS)	Tower, at 20' to 30' height (site specific)	0 (bolts directly to tower)	5 lb
Wireless Antenna	Tower, Near Top		5 lb
Hinged Base	Tower, Underneath		3 lb
IR Illuminator	Below Camera		3-4 lb
Air Terminal	TOP OF TOWER		

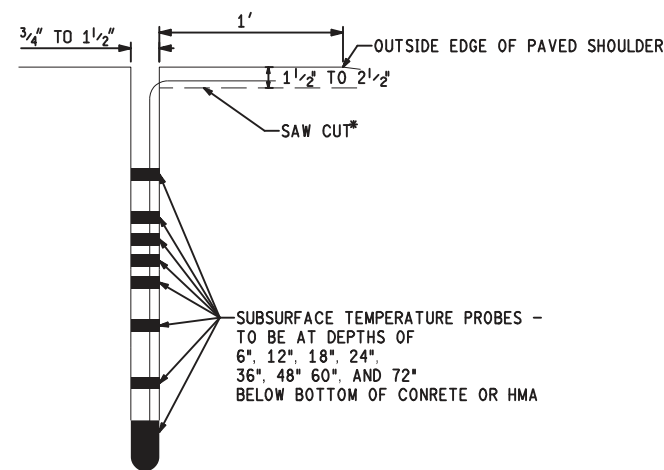
- NOTES:
- ITEMS NOT SHOWN:
CONCRETE SERVICE PAD: IN-GROUND POWER, COMMUNICATION, SENSOR CABLES AND BAROMETRIC PRESSURE SENSOR.
 - IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSTALL PTZ CAMERA TO PROVIDE BEST VIEWING ANGLE OF BOTH DIRECTIONS OF TRAFFIC AND SENSORS ON ROADWAY. FINAL PLACEMENT SHALL BE APPROVED BY THE ENGINEER.
 - LIGHTNING ROD MUST BE MOUNTED TO PROTECT ESS EQUIPMENT.
 - IR ILLUMINATOR SHALL BE ALIGNED TO PROVIDE BEST VIEW OF ROADWAY AND PAVEMENT SENSORS. FINAL PLACEMENT SHALL BE APPROVED BY THE ENGINEER.
 - ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
 - ALL HARDWARE SHALL BE STAINLESS STEEL.
 - ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.
 - EQUIPMENT SHOWN ABOVE IS FOR DIAGRAMMATIC PURPOSES AND ARE NOT OF SPECIFIC PRODUCTS. CONTRACTOR SHALL PROCURE EQUIPMENT BASED ON THE SPECIFICATIONS OF THE PROPOSAL.



TYPICAL ROAD SENSORS DETAIL
SCALE: NTS



TYPICAL PAVEMENT SENSOR, INVASIVE CONDITION
SCALE: NTS



TYPICAL SUBSURFACE TEMPERATURE PROBE
SCALE: NTS

NOTES:

1. SENSOR CABLES SHALL RUN FROM REMOTE PROCESSING UNIT (RPU) CABINET TO SENSOR WITHOUT SPLICES. HH, ROUND TO BE USED AS PULL BOXES FOR EASY INSTALLATION AND MAINTENANCE.
2. PAVEMENT CUT TO BE NORMAL SAW BLADE SIZE TO HOLD SENSOR CABLE. PAVEMENT CUT SHALL BE FILLED WITH APPROPRIATE FLEXIBLE SEALANT AS RECOMMENDED BY MANUFACTURER (3M DBR-6 OR APPROVED EQUAL). PAVEMENT CUT AND SEALANT SHALL BE PAID FOR UNDER THE SITE, RWIS, BASIC ESS PAY ITEM
3. ALL ESS SENSORS, EQUIPMENT AND INSTRUMENT CABLE, ESS SENSOR SHALL BE PAID FOR UNDER THE PAVEMENT SENSOR, INVASIVE CONDITION AND SUBSURFACE TEMPERATURE PROBE.
4. THE CONDITIONS OF THE MATERIALS UNDERNEATH THE ROADWAY SURFACE ARE UNKNOWN AND ANY COSTS INCURRED WHILE INSTALLING EQUIPMENT IN ROADWAY SHALL BE PAID FOR UNDER THE PAVEMENT SENSOR, INVASIVE CONDITION OR SUBSURFACE TEMPERATURE PROBE.
5. SUBSURFACE PROBE SHALL BE PLACED 1' FROM THE OUTSIDE EDGE OF SHOULDER. FINAL PLACEMENT SHALL BE APPROVED BY THE ENGINEER.
5. INVASIVE PAVEMENT SENSOR MUST BE A MINIMUM OF THREE FEET FROM EDGE OF TRAVEL LANE, OR AS RECOMMENDED BY THE MANUFACTURER.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
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NO SCALE

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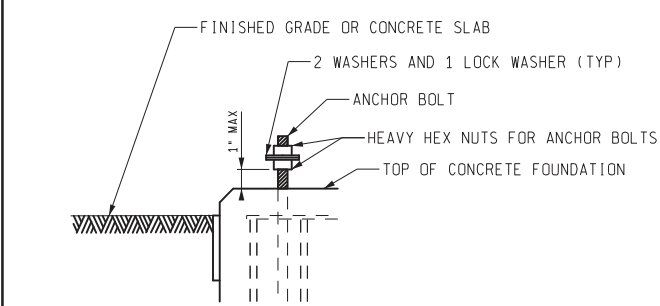
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JN: 106329A

ROAD SENSOR DETAIL
SHEET 1 OF 1

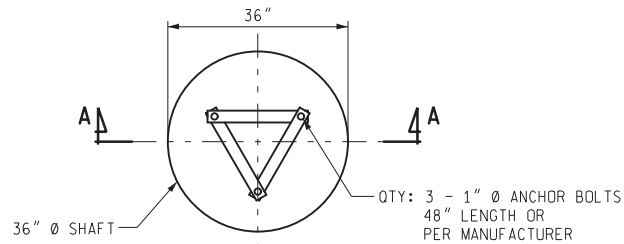
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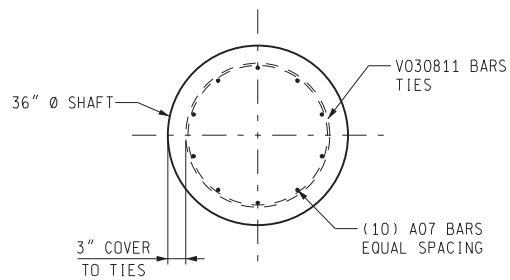
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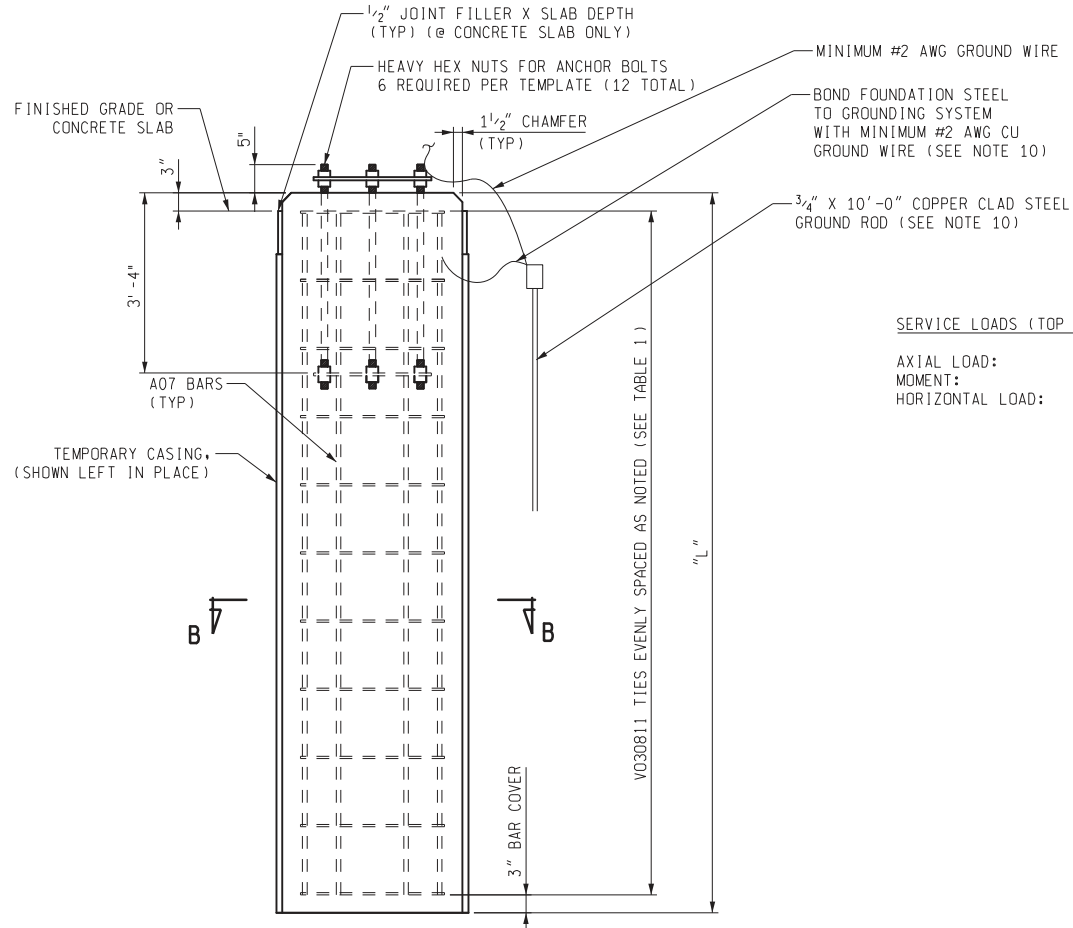
ANCHOR BOLT DETAIL
PARTIAL ELEVATION
CONDUITS NOT SHOWN IN THIS VIEW FOR CLARITY.



ESS DRILLED SHAFT
PLAN VIEW



ESS DRILLED SHAFT
SECTION B-B

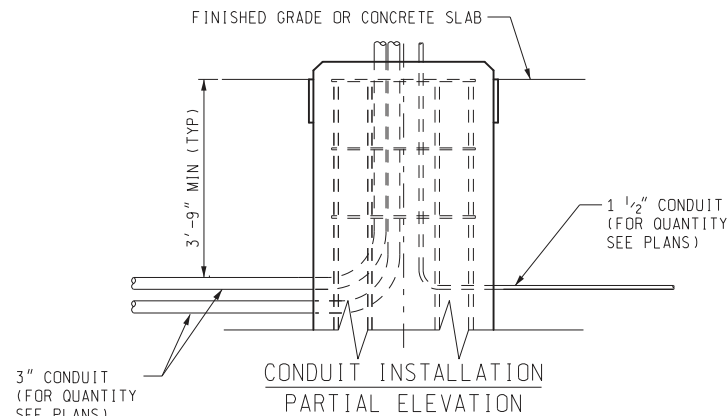
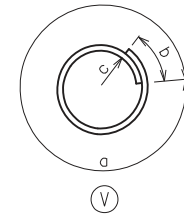
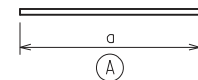


ESS DRILLED SHAFT
SECTION A-A
CONDUIT NOT SHOWN FOR CLARITY

SERVICE LOADS (TOP OF FOUNDATION):
AXIAL LOAD: 0.78 KIPS
MOMENT: 20.3 KIP-FT
HORIZONTAL LOAD: 1.08 KIPS

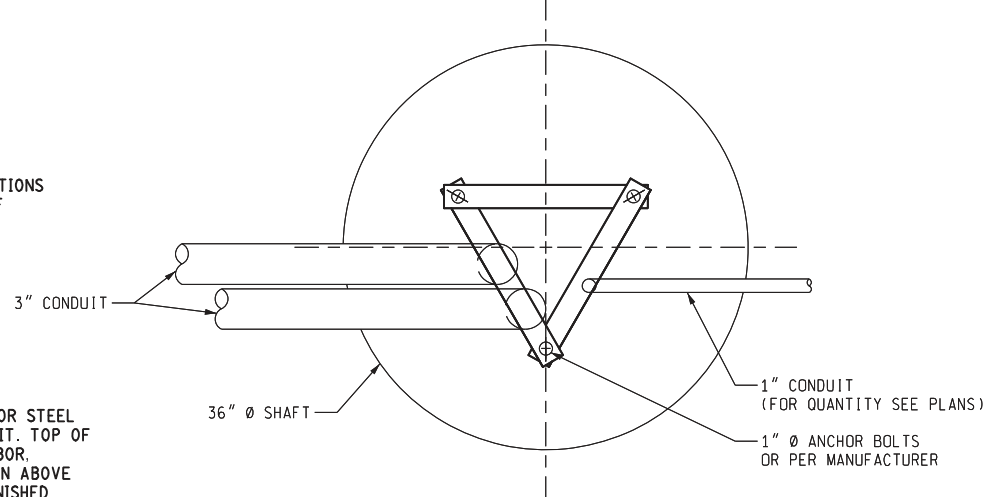
BAR SIZE
BAR LENGTH (FT)
BAR LENGTH (IN)
A064700
BAR SHAPE

BAR LEGEND



CONDUIT INSTALLATION
PARTIAL ELEVATION
ANCHOR BOLTS NOT SHOWN IN THIS VIEW FOR CLARITY.

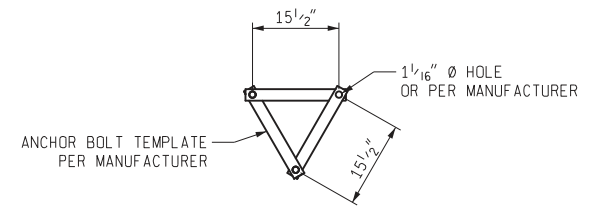
V03 BAR SPACING MAY BE ADJUSTED IN FIELD TO ACCOMMODATE CONDUIT SWEEP.



CONDUIT INSTALLATION PLAN

REINFORCEMENT STEEL NOT SHOWN FOR CLARITY

DRILLED SHAFT LENGTH	
EES LOCATION	L
US31N-MM110.2	20'
US31N-MM115.8	20'
I96W-MM018.5	20'
US31N-MM128.7	20'
US31N-MM102.5	20'
I196E-MM061.8	20'



ANCHOR BOLT TEMPLATE DETAIL
PLAN VIEW (2 REQ'D PER FOUNDATION)
NOTE: ALL DIMENSIONS TYPICAL

NOTES:

- ALL MATERIALS & CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
- CONTRACTOR MUST TAKE APPROPRIATE PRECAUTIONS TO PREVENT DAMAGING EXISTING STRUCTURES AND UTILITIES. ANY DAMAGE TO EXISTING STRUCTURES OR UTILITIES MUST BE REPAIRED AT THE CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE ENGINEER, INCLUDING ENGINEERING ANALYSIS AND REDESIGN, AND WITHOUT ANY EXTENSION OF THE COMPLETION DATES FOR THE PROJECT.
- ALL DISTURBED AREAS SHALL BE RESTORED IN ACCORDANCE WITH THE SPECIAL PROVISION FOR, "Slope Restoration, TYPE A". CONTRACTOR IS TO MINIMIZE THE AREAS OF DISTURBANCE AS MUCH AS IT IS PRACTICAL.
- CONCRETE MUST BE PROTECTED FROM FLOWING WATER AND DAMAGE FROM MECHANICAL EQUIPMENT AND NEARBY CONSTRUCTION VIBRATIONS. VIBRATIONS FROM CONSTRUCTION OPERATIONS (VIBRATORY CASING INSTALLATIONS, CONCRETE DEMOLITION, ETC.) WILL NOT BE PERMITTED WITHIN A RADIUS OF 25 FEET UNTIL THE CONCRETE HAS ATTAINED 75 PERCENT OF ITS SPECIFIED MINIMUM STRENGTH.
- CONCRETE MUST BE PROTECTED FROM STRENGTH REDUCTION CAUSED BY HEAT, FROST OR FREEZING ACTIONS PER SECTION 706.03 OF THE STANDARD SPECIFICATIONS.
- FINAL CONDUIT LOCATIONS AND HARDWARE INSTALLATION CONFIGURATION PLANS, INCLUDING WIRING CIRCUIT SCHEMATICS, TO BE SUBMITTED IN CONTRACTOR'S DRILLED SHAFT INSTALLATION PLANS FOR APPROVAL BY THE ENGINEER.
- CONDUIT MUST BE AS SPECIFIED IN SECTION 819 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
- SEE PLANS FOR TOP OF SHAFT ELEVATION. IN ORDER FOR CONDUIT TO ENTER FOUNDATION, CONTRACTOR MAY CUT HOLES IN THE STEEL CASING OR STEEL CASING MAY STOP AT THE CONDUIT ENTRANCE TO FOUNDATION. CUT HOLES MUST BE LOCATED, CUT AND FINISHED SO AS NOT TO DAMAGE CONDUIT. TOP OF FOUNDATION MUST BE FORMED SEPARATELY IF THE STEEL CASING STOPS AT THE CONDUIT ENTRANCE TO THE FOUNDATION. THE COST OF ALL LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO CUT HOLES IN THE STEEL CASING OR FORM, POUR, FINISH AND CURE THE PORTION OF THE FOUNDATION ABOVE THE CASING SHALL BE INCLUDED IN THE BID ITEM "Drilled Shaft, 30 inch". AT CONTRACTOR'S OPTION, THE CASING MAY STOP 1'-0" BELOW FINISHED GRADE ELEVATIONS.
- COBBLES, BOULDERS OR RIPRAP MUST NOT BE CLASSIFIED AS OBSTRUCTIONS.
- ALL GROUNDING WORK INCLUDING MATERIALS AND LABOR SHALL BE PAID FOR IN ACCORDANCE WITH THE SPECIAL PROVISION FOR "GROUNDING, BONDING, LIGHTNING PROTECTION AND SURGE PROTECTION FOR ITS EQUIPMENT".

REINFORCEMENT BAR & ANCHOR BOLT NOTES:

- REINFORCEMENT BARS FOR FOUNDATION SHALL BE GRADE 60 DEFORMED BARS AS SPECIFIED IN SECTION 905.03 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
- CONTRACTOR SHALL VERIFY ANCHOR BOLT PATTERN PRIOR TO FABRICATION OF ANCHOR BOLTS AND TEMPLATES.
- ANCHOR BOLTS ARE TO BE VERTICAL & POSITIONED AS SHOWN IN PLAN.
- TEMPLATE PLATES & ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED, ASSEMBLED, AND APPROVED BY MDOT PRIOR TO SHIPPING.
- DIAMETER OF BOLT HOLES IN TEMPLATES SHALL BE 1/16" LARGER THAN ANCHOR BOLT DIAMETER.
- INSTALL AND TIGHTEN BOLTS/NUTS ACCORDING TO SUBSECTION 810.03N OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, EXCEPT ADDITIONAL ONE-THIRD TURN AFTER SNUG CONDITION IS NOT REQUIRED.
- THE TEMPLATES SHALL BE WELL SUPPORTED, HORIZONTALLY LEVEL & FIRMLY ANCHORED IN PLACE FOR A MINIMUM OF 24 HOURS AFTER THE CONCRETE PLACEMENT IS COMPLETED.
- DUE CARE SHALL BE TAKEN DURING THE CONCRETE PLACEMENT TO AVOID DISPLACING THE ANCHOR BOLTS.
- NO HAMMERING ON OR CUTTING OF THE ANCHOR BOLTS OR TEMPLATES WILL BE ALLOWED. NO CHISELING OR DAMAGING OF GALVANIZED FINISH WILL BE PERMITTED.
- AFTER TOP TEMPLATE IS REMOVED, THREAD NUTS ON TO THE BOLT FLUSH WITH THE BOLT END TO PROTECT THREADS UNTIL FRAME IS ERECTED.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

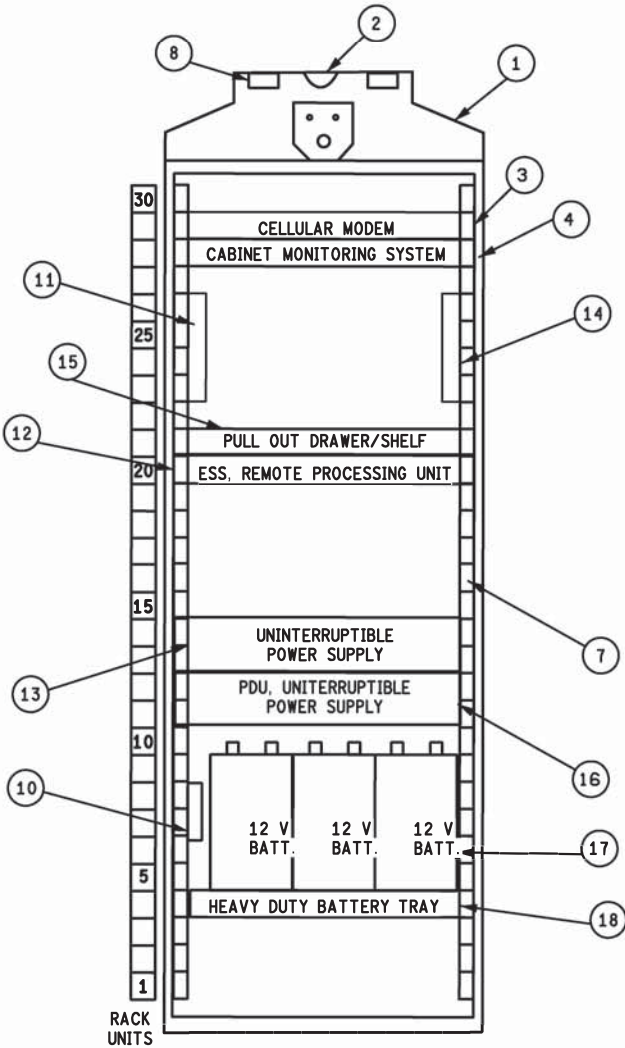
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SHEET 1 OF 1		MSDET 028	SECT 1

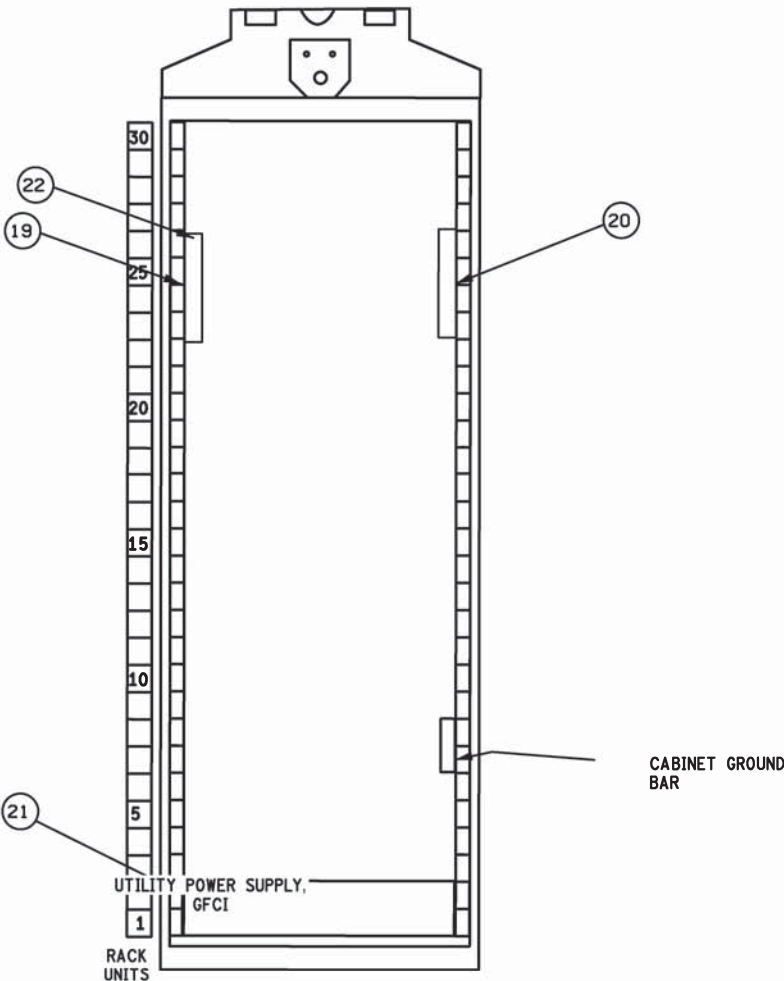
NOTES:

1. BILL OF MATERIALS ITEMS 11, 14, 19, 20 AND 22 ARE DIN RAIL MOUNTED.

BILL OF MATERIALS		
ITEM NO.	DESCRIPTION	QUANTITY
1	CABINET MODEL	1
2	CABINET FAN KIT	1
3	CELLULAR MODEM, 4G	1
4	CABINET MONITORING SYSTEM	1
5	CABINET R-4 INSULATION KIT	1
6	CABINET SUN SHIELD KIT	1
7	CABINET 19" RACK FRAME	1
8	CABINET LED LIGHTING KIT	1
9	CABINET ANCHOR BOLT KIT	1
10	CABINET GROUND BUS BAR KIT	1
11	MANAGED FIELD ETHERNET SWITCH, LAYER 3 SPECIAL	1
12	ESS, REMOTE PROCESSING UNIT	1
13	650 WATTS UPS	1
14	DIGITAL VIDEO ENCODER, H.264	1
15	PULLOUT DRAWER SHELF	1
16	POWER DISTRIBUTION UNIT, UPS	1
17	12 VOLT BATTERY	3
18	19" HEAVY DUTY BATTERY TRAY	1
19	MICROWAVE VEHICLE DETECTION SYSTEM	1
20	MANAGED FIELD ETHERNET SWITCH, LAYER 2	1
21	UTILITY POWER SUPPLY, GFCI	1
22	COMMUNICATION SURGE PROTECTION FOR MVDS	1



COMMUNICATIONS
CABINET RACK LAYOUT
FRONT VIEW



COMMUNICATIONS
CABINET RACK LAYOUT
REAR VIEW

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)			
NO.	DATE	AUTH	DESCRIPTION



NO SCALE

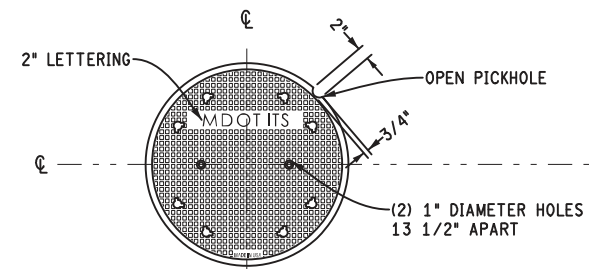
FILE: ITS-ESS Combined Cabinet.dgn

DATE:
DESIGN UNIT:
TSC:

CS: 84923
JN: 106329A

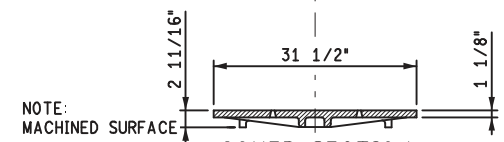
COMBINED ITS/ESS CABINET
SHEET 1 OF 1

DRAWING	SHEET
MSDET 029	SECT 1



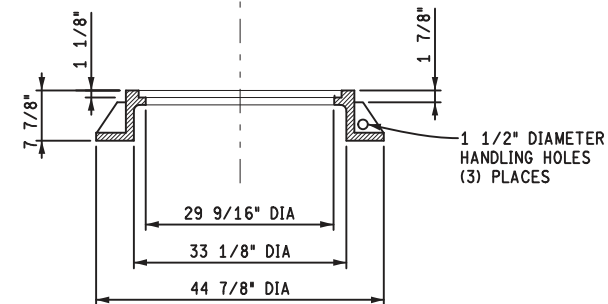
TOP VIEW OF COVER

NOT TO SCALE



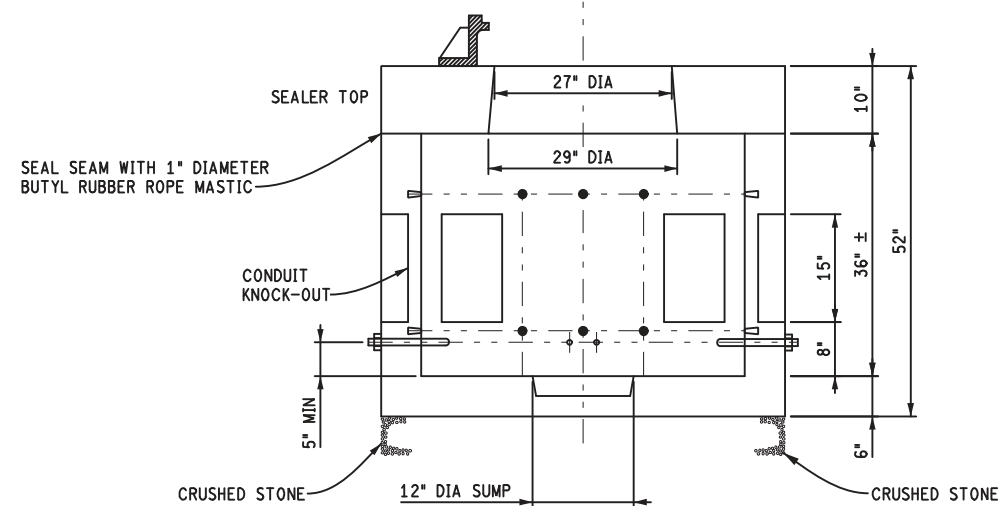
COVER SECTION

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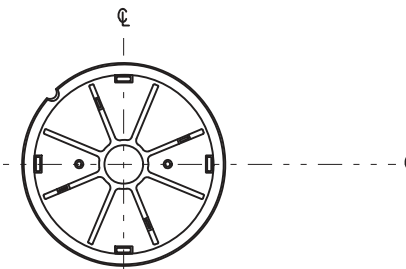
FRAME SECTION

NOT TO SCALE



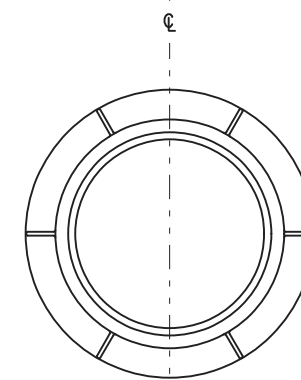
SIDE VIEW OF TYPE D HANDHOLE

NOT TO SCALE



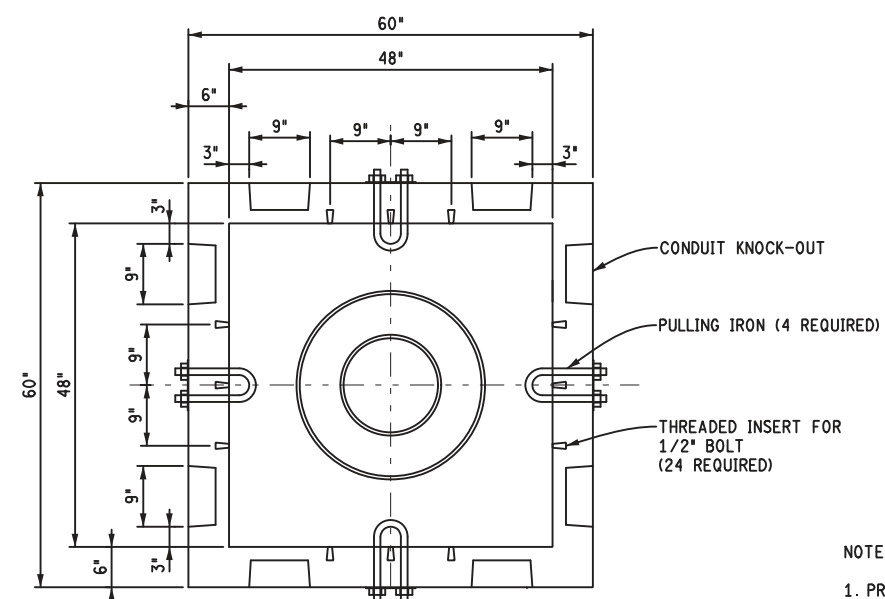
BOTTOM VIEW OF COVER

NOT TO SCALE



TOP VIEW OF FRAME

NOT TO SCALE



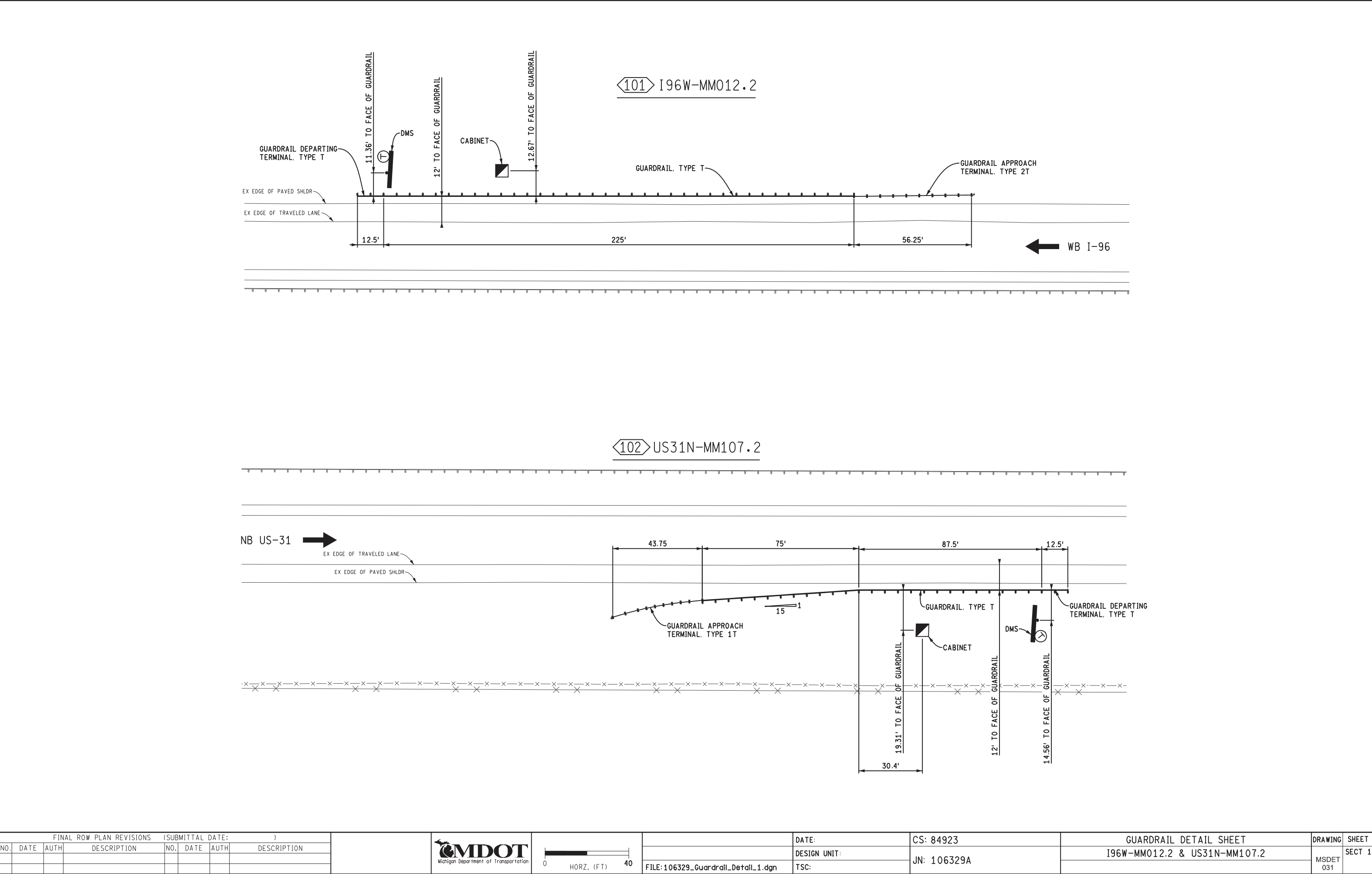
TOP VIEW OF TYPE D HANDHOLE

NOT TO SCALE

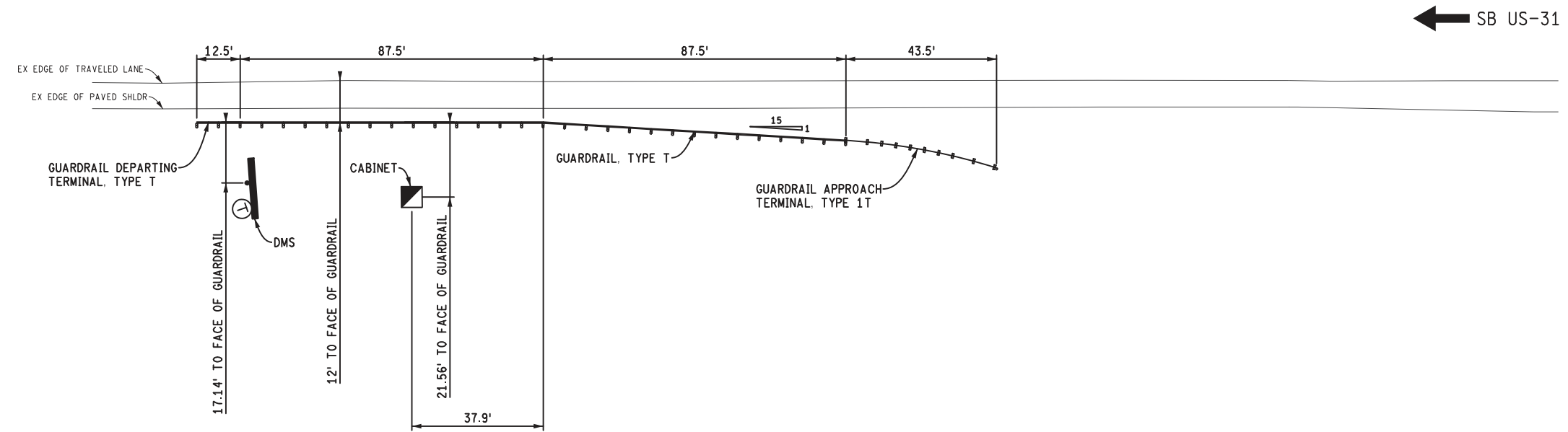
NOTES:

1. PROVIDE HANDHOLE AND COVER MEETING THE REQUIREMENTS OF AASHTO HS 25 FOR WHEEL LOADING.
2. CURRENT COVER AND FRAME FOR TYPE D HANDHOLES ARE EAST JORDAN IRON WORKS PART NO. 1220 OR APPROVED EQUAL, A.S.T.M. CLASS 30 GRAY IRON, HEAVY DUTY, APPROX. WT. 685#.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)								 NO SCALE	DATE:	CS: 84923	HANDHOLE, TYPE D	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DESIGN UNIT:	JN: 106329A	MSDET 030	SECT 1	
									TSC:				
									FILE: Handhole, Type D.dgn	SHEET 1 OF 1			



103 US31M-MM118.1



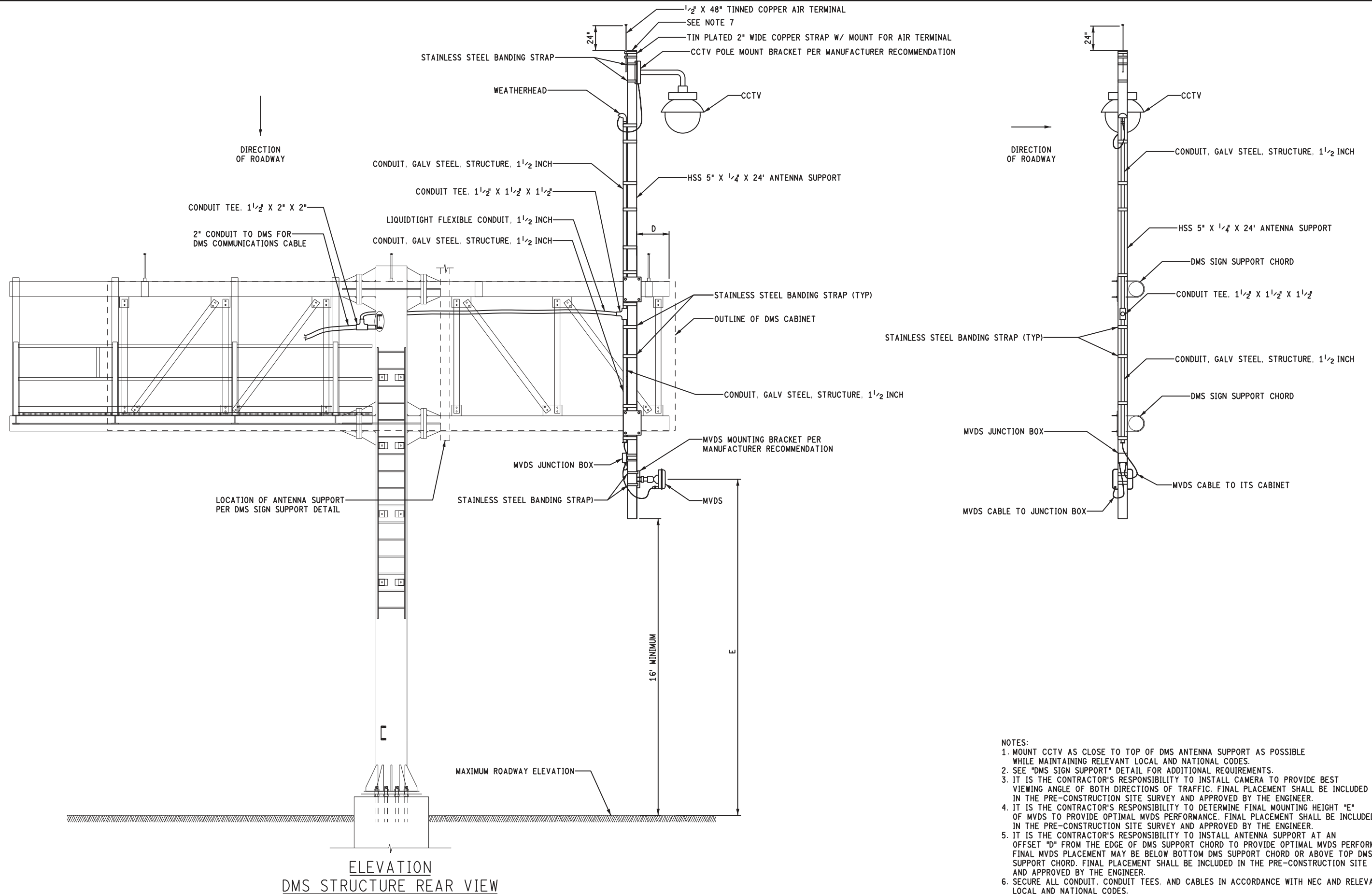
FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 106329_Guardrail_Detail_2.dgn

DATE:	CS: 84923
DESIGN UNIT:	JN: 106329A
TSC:	

GUARDRAIL DETAIL SHEET		DRAWING	SHEET
US31M-MM118.1		MSDET 032	SECT 1



FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)								ITS DETAIL SHEET				DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MOUNT CCTV AND MVDS ON DMS ANTENNA SUPPORT				MSDET	SECT
												033	



NO SCALE

	DATE:	CS: 84923	ITS DETAIL SHEET	DRAWING	SHEET
	DESIGN UNIT:	JN: 106329A	MOUNT CCTV AND MVDS ON DMS ANTENNA SUPPORT	MSDET 033	SECT
FILE: CCTV MVDS ANTENNA MOUNT.dgn	TSC:				