CHAPTER 12 HANDHOLES, PULLING VAULTS, AND JUNCTION BOXES

HANDHOLES, PULLING VAULTS, AND JUNCTION BOXES

The standards and requirements for handholes, pulling vaults, and junction boxes are presented in this chapter.

12.1 Handholes and Pulling Vaults

12.1.1 FUNCTIONS AND REQUIREMENTS

Handholes and pulling vaults perform several important functions:

- Provide drainage for the conduit system so that freezing water does not damage the conduit or wires.
- Provide a location for bending the conduit run without damaging the wires.
- Provide a junction for conduits coming from different directions. In lighting applications where a splice is required by contract documents, the two or three-way underground handhole splice will also be included.
- Facilitate pulling wires for fairly long distances.
- Provide access to the system for maintenance.

Figure 12-1: Fiber Optic Pulling Vault

Figure 12-2: Interior of Handhole

Handholes must be MnDOT approved handholes and must be listed on the Approved/Qualified Products List (APL) for signals.

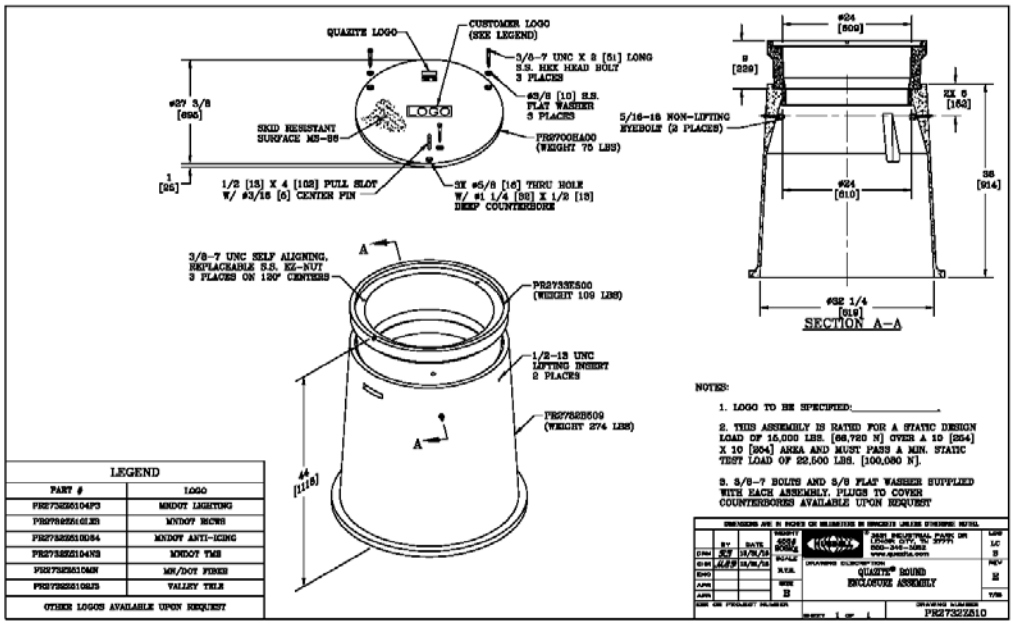
Figure 12-3: Wire Pulling

When pulling vaults and fiber optic splice vaults are installed and fiber optic cable is spliced in the vault, a drain system to open air with a marked head wall is required.

Figure 12-4: Fiber Splice Vault with Headwall Drain System

Fiber optic pulling vaults and RTMC fiber optic splice vaults must be MnDOT approved fiber optic pulling and splice vaults and must be listed on the APL for traffic management systems/ITS.

Figure 12-5: MnDOT Approved Handholes



12.1.2 HANDHOLE INSTALLATION

Handholes must be installed at the locations staked by the engineer and in accordance with the contract documents. Special attention must be paid to handhole installation. Repairing or replacing damaged handholes is a difficult and costly task. Handholes that are not installed properly are a continuous maintenance problem. They get hit by plows or settlement occurs around the handhole due to improper compaction.

Before installation begins the inspector must examine each handhole to ensure:

- Handholes meet requirements outlined in the contract documents.
- No physical damage such as cracks or chips.
- Avoid placing any handholes in the sidewalk pedestrian access route (PAR) or maintenance access route (MAR) due to the tight tolerances of ADA requirements at the walking surface.

Figure 12-6: Proper Installation Height

The bottom of each handhole must be set on a compacted 3 feet diameter by 1 foot deep aggregate drain bed. Use MnDOT Standard Specifications for Construction 3149.2H - Coarse Filter Aggregate.

Excavation for each handhole must be backfilled around the installed handhole and the backfill material must be like in kind to the adjacent soils and compacted to approximately the same density. The cover must be in place prior to backfilling around the handhole.

If required by contract documents, handholes must have a concrete pad supporting the cover casting. The specific pad requirements shall be constructed as specified in the contract documents.

Before any work on handhole installation begins the inspector and the contractor must know some basic information such as the overall height of the handhole with ring and cover. This information is needed for excavating the hole to the correct depth. The handhole with ring and cover should be set flush with the surrounding grade.

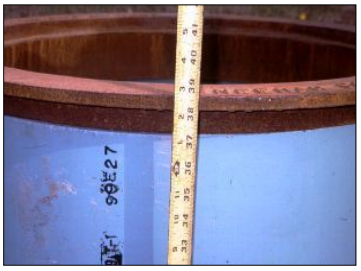


Figure 12-7: Measuring Height of Handhole

ADA office terminology used to describe sidewalks used by pedestrians:

- PAR - Public Access Route
- MAR - Maintenance Access Route

Handholes placed in a PAR must be set within 1/4 inch of finished grade to be in compliance with ADA requirements.

Not all surfaces finished with bituminous or concrete are considered sidewalk (PAR or MAR). Before handhole installation determine if the location is in what is considered the PAR.

Figure 12-8: Engineer Staking for Handhole Location

Key points to remember:

- Handholes must be installed at the location specified in the contract documents and as staked by the engineer or their representative.
- The tops of the handholes or the grade must be set as directed by the engineer.
- Handholes must be backfilled after the frame and cover has been installed onto the handhole.
- It may be necessary to install handholes in low areas to facilitate drainage of the conduit system.
- On lighting projects additional handholes must be approved by the engineer.
- Handholes must be installed an adequate distance from existing structures to allow for proper compaction.
- If existing handholes are to be used in a new system the contractor must clean all the debris from the existing handholes before pulling any wires.

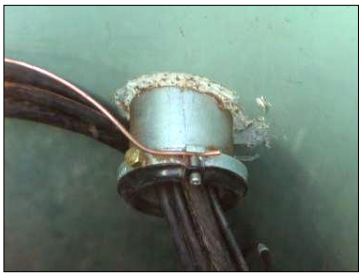


Figure 12-9: Conduit Termination inside a Handhole

- Conduits terminating in handholes must extend two inches to three inches beyond the inside wall of the handhole.
- After the handholes and conduit are installed the sides of each handhole must be made watertight. Use a “material-compatible caulking compound or other sealing material compatible with handhole and conduit material, to the engineer’s satisfaction”.
- Bushings and bonding wire (when required) must be installed and then the conduit ends must be capped until the wires are pulled.

If a lighting plan calls for a hand hole or pulling vault to be installed there must be a conduit stub out in accordance with Specification 2545.3E.

The stub out must be a 2-inch conduit and a minimum of 36 inches long. End bells must be installed on both open ends of the conduit.

Figure 12-10: Conduit Stub Out

12.1.3 HANDHOLE TYPES

There are two types of handholes presently in use by MnDOT:

1. **Handholes Non-Deliberate Heavy Vehicular Traffic**
   Only use Department-approved handholes listed on MnDOT's APL under signals.
   Emboss —MnDOT Signals on the cover for traffic control signal projects.
   Emboss —MnDOT Lighting on the cover for lighting projects.
   Emboss —MnDOT TMS on the cover for ITS projects.
2. **Handholes Deliberate Heavy Vehicular Traffic**
   Only use handholes in accordance with Standard Plate 8117 which are in full compliance with Article 314.30 of the NEC.
   Handholes shall meet the requirements of —AASHTO H-20 Deliberate Vehicular Traffic Applications.
   Emboss —MnDOT Signals on the cover for traffic control signal projects.
   Emboss —MnDOT Lighting on the cover for lighting projects.
   Emboss —MnDOT TMS on the cover for ITS projects.

Handholes Non-Deliberate Heavy Vehicular Traffic

An ANSI/SCTE 77 rated handhole is used. This would include sidewalk (PAR or MAR) installations. Contractors should always avoid installing handholes in the PAR or MAR for ADA compliance reasons.

ANSI/SCTE 77 handholes that are Tier 15 rated, in compliance with ADA requirements, in compliance with the National Electrical Code (NEC) Section 314.30, and listed on MnDOT's APL can be used in sidewalks (PAR & MAR).

The contractor must refer to the contract documents for handhole installation requirements.

Figure 12-11: Handholes for Non-Deliberate Heavy Vehicular Traffic

TIER 15 Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	Vertical Lateral	Design Load Test Load Design Load Test Load	66.7 kN 100.1 kN 38.3 kPa 57.5 kPa	15000 pounds 22500 pounds 800 pounds/sq.ft. 1200 pounds/sq.ft. (2400/3600 pounds/ lateral load plate)

Figure 12-12 ANSI Design/Test Loads for Tier 15

Handholes for Deliberate Heavy Vehicular Traffic

Handholes for Deliberate Heavy Vehicular Traffic should be constructed in accordance with Standard Plate 8117 (See Figure 12-13). This hand hole should only be used when the designer must install a handhole in the roadway driving surface. This handhole should only be used as a last resort when the designer is developing the construction plan.

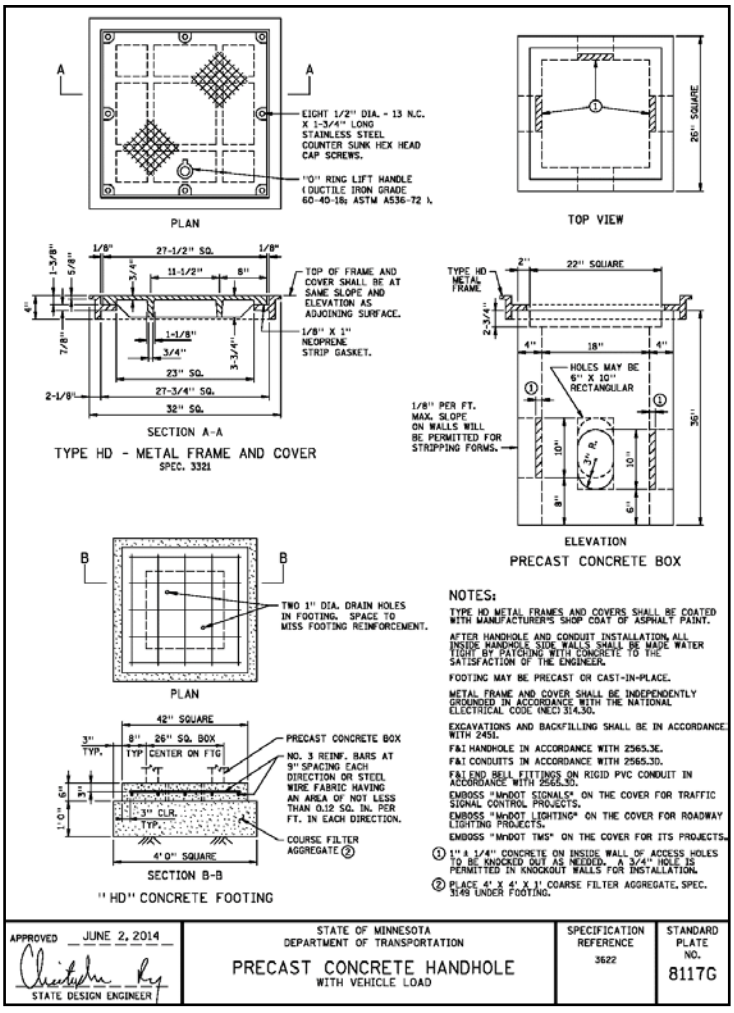


Figure 12-13: Precast Concrete Handhole Deliberate Vehicular Traffic

12.1.4 BALL LOCATORS

MnDOT, including the RTMC, require "ball locators" in handholes. Ball locators should be installed on a 3/4 inch PVC conduit so the ball will be within six inches from the top of the handhole. When specified in the contract documents, ends of conduits (without handholes) will require “ball locators” in both signal and lighting systems. The installation requirements for handholes and ball locators are addressed in the contract documents 2565.3.

Figure 12-14: Handhole Ball Locator. (Ball on a Stick)

12.2 Junction Boxes for Traffic Control Signals and Lighting

Junction boxes for traffic control signals and lighting systems must be as specified in the contract documents.

12.2.1 JUNCTION BOXES ON BRIDGES

Junction boxes attached to a bridge must be NRTL listed, approved for wet locations and sized according to the NEC.

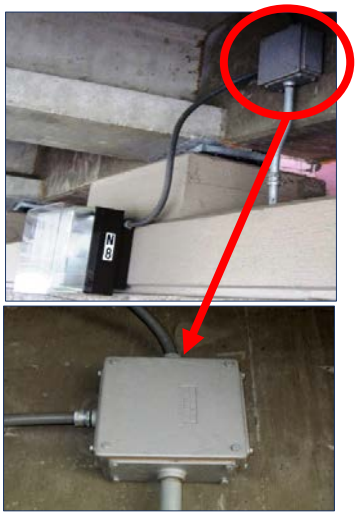


Figure 12-15: Junction Box Attached to Bridge

The liquid tight flexible non-metallic conduit used for underpass luminaires shall be type LFNC-B and shall not have a metallic integral reinforcement.

Suggested Standard Electrical Junction Box Sizes on Bridges

Traffic control signal junction boxes:

- 12” x 12” x 8” ID: conduit size is 2”
- 24” x 24” x 8” ID: conduit size is 3” or 4”

Lighting system junction boxes:

- Underpass luminaire j-boxes (largest conduit is 1”)
- Meet the requirements of the NEC.

Boxes where conductors are 6 AWG or smaller and conduit is larger than 1”:

- 12” x 12” x 8” ID: conduit size is 2”
- 24” x 24” x 8” ID: conduit size is 3” or 4”

Straight pulls - Use 8 times the largest conduit size if conductors are 4 AWG or larger:

- 16” X 16” X 8”: conduit size is 2”
- 24” X 24” X 8”: conduit size is 3”
- 32” X 32” X 8”: conduit size is 4”
- 12” X 12” X 8”: conduit size is 2”
- 18” X 18” X 8”: conduit size is 3”

Angle pulls or where there are splices - use six times the largest conduit size where conductors are 4 AWG or larger:

- 24” X 24” X 8”: conduit size is 4”

The above standard sizes are based on cubic inches to allow for the number of wires, on conduit size to allow cable pulling and routing space, and to meet the requirements of the NEC.

Notes:

- These are based on the most common situations and selected from the standard sizes available from manufacturers.
- Standard sizes available from manufacturers range from 4” x 4” x 3” to 36” x 36” x 12”.
- Loop splice kits and lighting cable splices were also considered in the cubic inch measurement.
- Junction boxes must meet the current NEC requirements.

12.2.2 NATIONAL ELECTRICAL CODE REQUIREMENTS FOR BOX SIZES

ARTICLE 314.16:

- For conductors size 6 AWG and smaller and cables containing 6 AWG and smaller conductors.
- This section requires that boxes meet a volume in cubic inches based on the sizes of individual conductors.
- (14 AWG wire = 2 cu in each) This section applies mostly to signals because all the conductors are 6 AWG or smaller except for service laterals.

ARTICLE 314.28:

- For conductors size 4 AWG and larger and cables containing 4 AWG and larger conductors.
- This section requires box sizing to be based on the sizes and number of conduits connected to a box.
- This section applies mostly to lighting because typically MnDOT uses 4 AWG or larger conductors except when feeding underpass luminaires.
- There are two conditions listed in this section; straight pulls and angle pulls.
- For straight pulls the box length is required to be eight times the size of the largest conduit.
- For angle pulls the box length is required to be six times the size of the largest conduit.

12.2.3 JUNCTION BOX INSTALLATION

Junction boxes for both traffic control signal systems and lighting systems must be installed as required by the contract documents.

12.3 Chapter 12 Resources

- Standard Plates
- MnDOT Standard Specifications for Construction

THIS PAGE INTENTIONALLY LEFT BLANK