

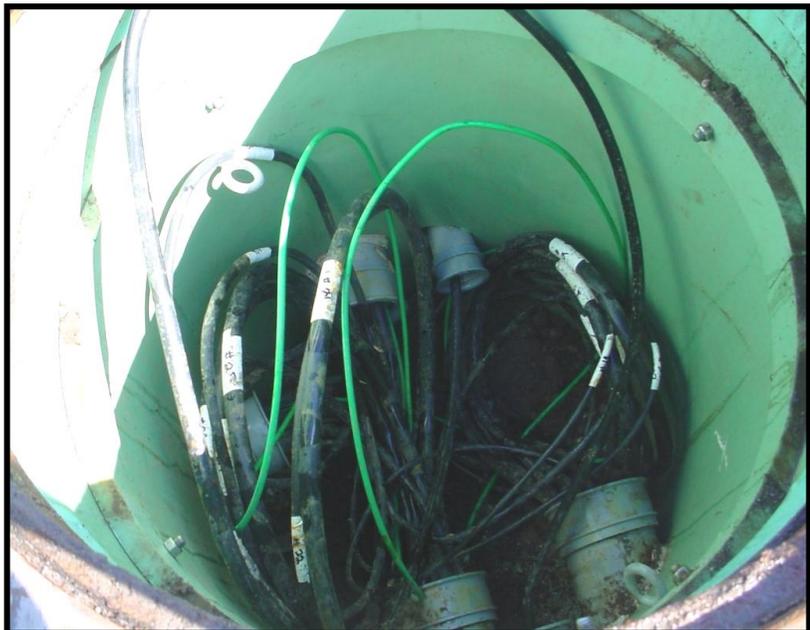
# HANDHOLES, PULLING VAULTS AND JUNCTION BOXES



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.

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



When pulling 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.

Fiber optic pulling vaults must be MnDOT approved fiber optic pulling vaults and must be listed on the Approved/Qualified Products List (APL) for Traffic Management Systems/ITS.



When fiber optic splice vaults are installed a drain system to open air with a marked head wall is required.

RTMC fiber optic splice vaults must be MnDOT approved fiber optic splice vaults and must be listed on the Approved/Qualified Products List (APL) for Traffic Management Systems/ITS.



## Handhole Installation

Handholes must be installed at the locations staked by the Engineer and in accordance with the Contract Documents.

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 (PAR or MAR) due to the tight tolerances of ADA requirements at the walking surface.

The bottom of each handhole must be set on a compacted 3 feet diameter by 1 foot deep aggregate drain bed. Use MnDOT 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, all handholes must have a concrete pad supporting the cover casting. The specific pad requirements must be 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.



ADA Office Terminology used to describe sidewalks used by pedestrians:

PAR - Public Access Route

MAR - Maintenance Access Route

Handholes set in a sidewalk (PAR or MAR) must be set within  $\frac{1}{4}$  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 sidewalk.

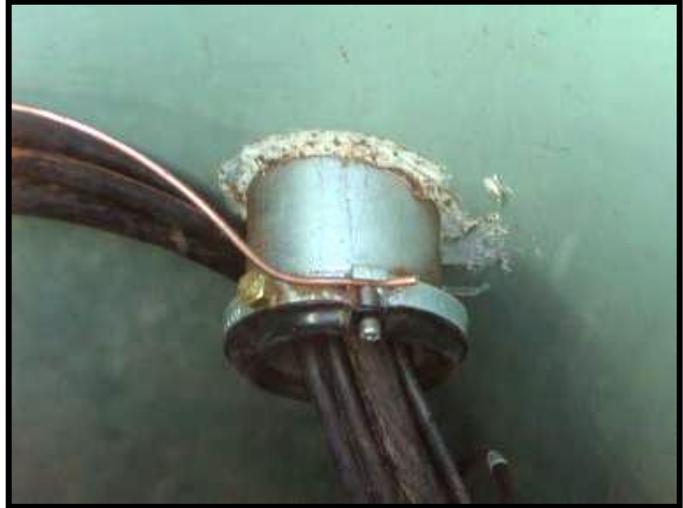
Key points to remember:

- 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.
- Conduits terminating in handholes must extend 2 inches to 3 inches (50 millimeters to 75 millimeters) beyond the inside wall of the handhole.



- After the handholes and conduit are installed the sides of each handhole must be made watertight. 2565.3E states, “material-compatible caulking compound or other sealing material compatible with PVC or other type handholes, to the Engineers 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 roadway lighting Plan calls for a hand hole or pulling vault to be installed there must be a conduit stub out in accordance with 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



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.

## HANDHOLES 3819

**A Handholes Non-Deliberate Heavy Vehicular Traffic**

Only use Department-approved handholes listed on MnDOT's Approved/Qualified Products List under —Signals.

Emboss —MnDOT Signals on the cover for traffic control signal projects.

Emboss —MnDOT Lighting on the cover for roadway lighting projects.

Emboss —MnDOT TMS on the cover for ITS projects.

**B 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.

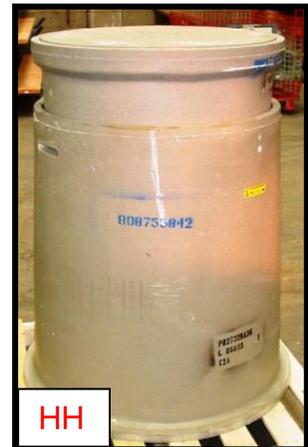
Emboss —MnDOT Lighting on the cover for roadway lighting projects.

Emboss —MnDOT TMS on the cover for ITS projects.

There are actually 3 types of handholes presently in use by MnDOT.

Handholes for Non-Deliberate Heavy Vehicular Traffic has two options.

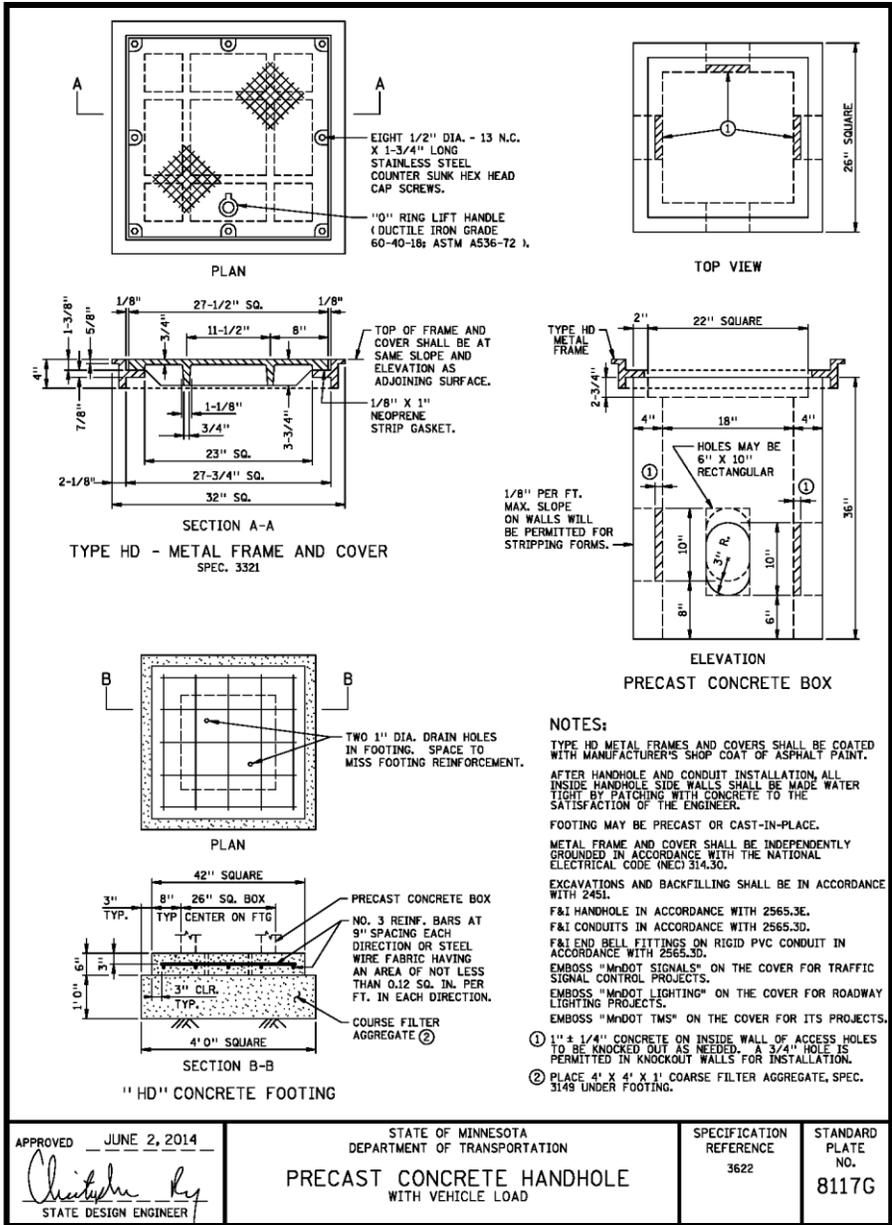
- (1) A NRTL listed polymer concrete handhole used everywhere except when it would be installed in a sidewalk (PAR or MAR). The designation on a signal plan would be HH.



- (2) The other option is a PVC handhole with a polymer concrete ring and cover which should only be used in a PAR or MAR. The designation on a signal plan would be HHS.



Handholes for Deliberate Heavy Vehicular Traffic has only one option.



This handhole should be constructed in accordance with Standard Plate 8117. 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.

**POLYMER CONCRETE HANDHOLES**

MnDOT has made a major change to approved handholes for use on traffic control signals and roadway lighting projects.

All older versions of approved handholes have been removed from the MnDOT approved/qualified products list.

The new hand holes are ANSI/SCTE 77 listed and labeled.

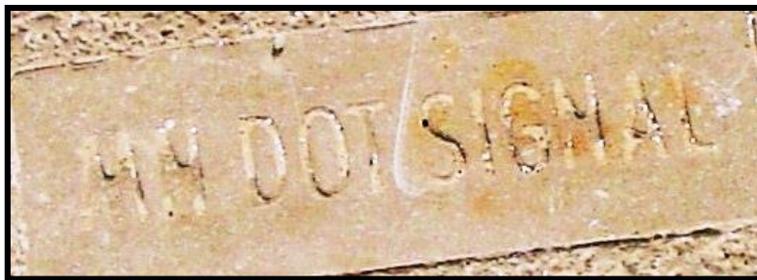
They are Tier 22 rated and in compliance with the National Electrical Code Section (NEC) 314.30

APPLICATION	LOADING REQUIREMENTS			
Light Duty Pedestrian Traffic Only	Vertical	Test Load	13.3kN	3000 pounds
TIER 5 Sidewalk applications with a safety factor for occasional non-deliberate vehicular traffic	Vertical	Design Load	22.2 kN	5000 pounds
	Lateral	Test Load	33.3 kN	7500 pounds
TIER 8 Sidewalk applications with a safety factor for non-deliberate vehicular traffic	Vertical	Design Load	35.6 kN	8000 pounds
	Lateral	Test Load	53.4 kN	12000 pounds
TIER 15 Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	Vertical	Design Load	66.7 kN	15000 pounds
	Lateral	Test Load	100.1 kN	22500 pounds
TIER 22 Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	Vertical	Design Load	100.1 kN	22500 pounds
	Lateral	Test Load	150.1 kN	33750 pounds
AASHTO H-20 Deliberate vehicular traffic applications.	Certified precast concrete, cast iron, or AASHTO-recognized materials.			

**Table 1 – Design / Test Loads**

The new handholes can be used in sidewalks (PAR & MAR) however the ring and cover must meet ADA requirements. An easier solution would be to use an HHS handhole in a PAR or MAR. The contractor should avoid installing handholes regardless of type in the PAR or MAR due to the tight walking surface tolerances required by ADA.

The Contractor must refer to the Contract Documents for handhole installation requirements.



Drilling holes in polymer concrete handholes may be accomplished as shown below.

TECH INFO

## Hole Cutting Instructions

### Methods for Cutting Holes in Hubbell Enclosures:

#### Hole Saw

1. Drill a 7/8" pilot hole with a carbide tipped masonry drill.
2. Drill hole using a diamond tipped masonry hole saw.
  - This is the preferred method from engineering.
  - Estimated drilling time is 1 - 1.5 minutes.
3. Wood cutting hole saw may be used on Quazite FRP and PenCell HDPE enclosures (15 - 20 seconds).
4. Depending on the box, cutting these holes from the inside or outside may work better. Cutting on a smooth flat area of the wall vs. a ribbed uneven area works best.



#### Knockout Punch Driver

##### 1. Set up the punch

- 1.01 Slide the die over the pull rod.
- 1.02 Insert pull rod into pilot hole.
- 1.03 Thread the punch onto the pull rod.

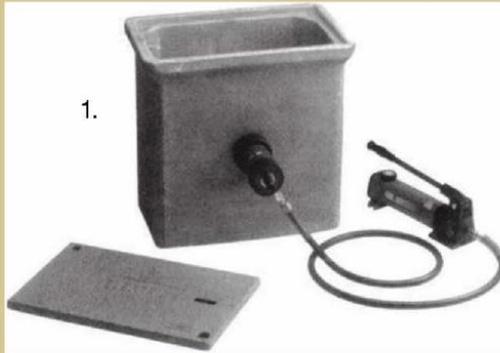
##### 2. Punch hole and remove

- 2.01 Operate hand pump until the punch penetrates the surface.
- 2.02 Open pump release valve.
- 2.03 Remove the slug.

#### NOTES:

- 1) Quazite UL Listed enclosures with holes drilled in the field may qualify for UL Listing as long as the holes do not exceed more than 25% of the area of each sidewall and as long as the holes do not cut into a structural reinforcing rib, corner, or box lip.
- 2) Quazite FRP enclosures, follow the same guideline as #1 above.
- 3) PenCell HDPE enclosures, we recommend never removing more than 20% of the total area of any wall.

Contact your representative if there are any questions.



MnDOT including the RTMC require "ball locators" in handholes. When specified in the Contract Documents, ends of conduits (without handholes) will require "ball locators" in both signal and lighting systems.

Ball locators should be installed on a 3/4 inch PVC conduit so the ball will be within 6 inches from the top of the handhole (Ball on a Stick).



The installation requirements for handholes and ball locators are addressed in the Contract Documents. 2565.3E

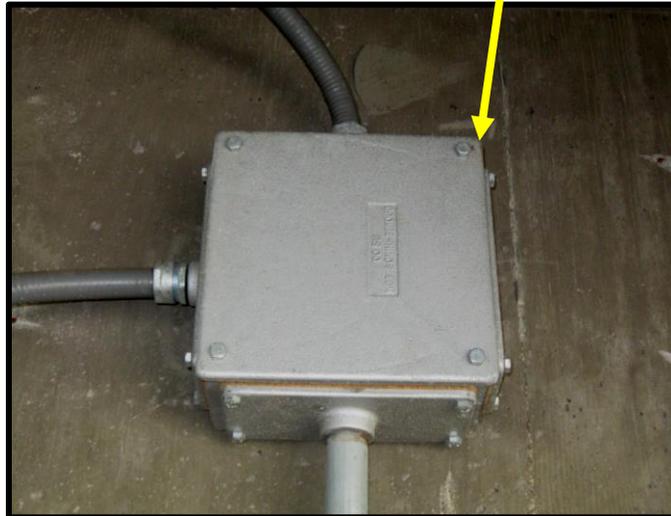
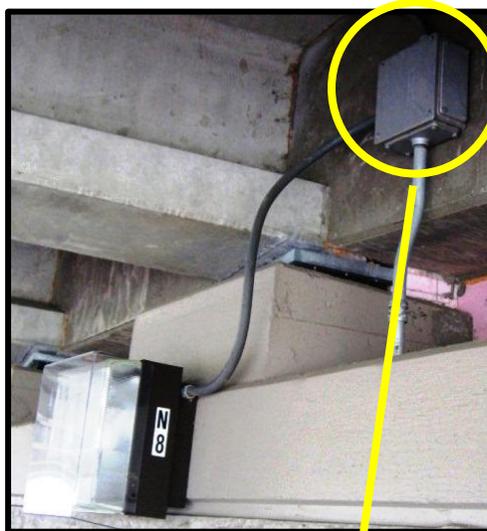


**JUNCTION BOXES FOR SIGNALS AND ROADWAY LIGHTING - 3838**

Junction boxes for traffic control signals and roadway lighting systems must be as specified in the Contract Documents.

**3838.2A Metal Junction Boxes Attached to a Bridge**

Shall be NEMA Type 4 galvanized cast iron boxes with covers.



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

Junction boxes must be attached to concrete using masonry anchorages or powder actuated studs with the required hardware to permit removal of the junction box.

**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")
- 8 1/2" x 8 1/2" x 4" ID: Minimum Size allowed as per MnDOT Spec Book (3838.2B)

**Boxes where conductors are #6 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 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 6 times the largest conduit size where conductors are #4 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 National Electrical Code (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
- In addition all junction boxes must meet current MnDOT specs and the current NEC requirements

**National Electrical Code Requirements that Apply to Box Sizing:****Article 314.16:**

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

**Article 314.28:**

- For conductors size # 4 and larger and cables containing # 4 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 we use #4 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 8 times the size of the largest conduit
- For angle pulls the box length is required to be 6 times the size of the largest conduit

**Junction Box Installation**

Junction Boxes for both traffic control signal systems and roadway lighting systems must be installed as required by the Contract Documents.