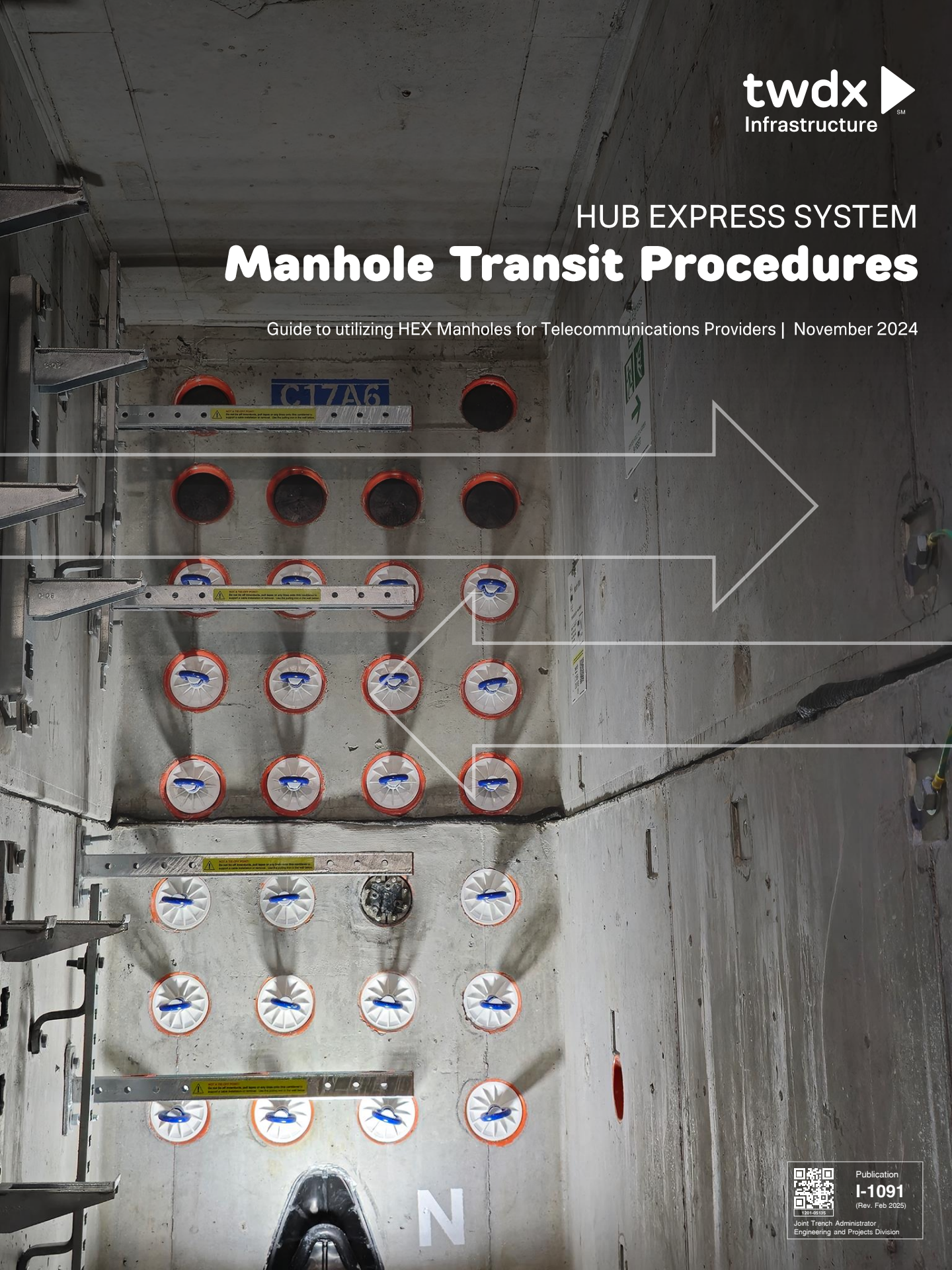


HUB EXPRESS SYSTEM Manhole Transit Procedures

Guide to utilizing HEX Manholes for Telecommunications Providers | November 2024



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Joint Trench Administrator
Engineering and Projects Division

HUB EXPRESS SYSTEM

Manhole Transit Procedures

Guide to utilizing HEX Manholes for Telecommunications Providers

<u>01</u>	Overview of Right of Transit in HEX Manholes	4
<u>02</u>	Manhole Work Standards	8
	Splice Case Installations	11
	Managing Cable Slacks	12
<u>03</u>	Access Procedures	14
<u>04</u>	Manhole Symbol Signs	17
<u>05</u>	Types of Manholes	21





01

Overview of Right of Transit in HEX Manholes

The Hub Express System (**HEX**) is a public utility infrastructure in Boston's Inner Belt for internet backbone networks and data centers. It consists of conduits used by multiple parties and users (referred to as "**Attachers**"), including customers renting duct space from the HEX system, public agency partners, as well as other utility owners and users, such as joint trench customers who also own or otherwise install their own conduits in the trench.

Internet networks frequently use HEX manholes to connect their networks in the public right-of-way, in addition to the numerous parties working in the duct system.

In order to support all of these uses in this high-density "front-haul" backbone telecommunications system, activities in HEX system manholes are highly regulated to prevent congestion and maximize network reliability for tenant customers.

UNDERSTANDING MINIMUM RIGHT OF TRANSIT

Every user of the HEX Conduit System is provided with a basic, nondiscriminatory **Minimum Right of Transit** in HEX manholes, as more closely defined below:

Minimum Right of Transit means:

Attachment by a cable television system or provider of telecommunications service to a HEX manhole for the purpose of continuous transit and passage of their transmission cable or wire through the HEX manhole as a right-of-way used for wire communications owned or controlled by TOWARDEX, as provided by 47 U.S. Code § 224, Mass. Gen. Laws ch. 166 § 25A, and in accordance with governing agreements and regulations established by TOWARDEX to manage the Hub Express System, including the Project Charter of the Hub Express System (PCHEX).



Minimum Right of Transit includes:

Subject to all rules and regulatory requirements in effect, including established TWDX Infrastructure policies and permits for accessing and working in HEX manholes, the right to access and attach cable used for telecommunications along the vault to continuously transit and thus "pass through" a HEX manhole from one arriving duct to another.

Minimum Right of Transit does NOT include:

- Placement of cable slacks, such as slack coils or any enclosure or device (such as splice case, terminal enclosure, splitter, junction or jointing box, etc.)
- Performing manhole breakout or installing innerducts, sub ducts or any pipes or conduit
- Installation of any non-standard equipment, any wires or ancillary facilities aside from the Attacher's cable used for transmission of their telecommunications service or cable television system (such as grounding rods or grounding wires, closed circuit monitoring systems, cameras or sensors, etc.)

CONVEYANCE OF MINIMUM RIGHT OF TRANSIT

Minimum Right of Transit over HEX manholes is automatically conveyed (self-executing) to a telecommunications Attacher by one of the following means:

- **Parties renting duct space in the HEX Mainline or attaching to a Joint Network Facilities (JNF) duct:**

Typically conveyed through a **Revocable License for Conduit Occupancy, Indefeasible Right of Use Agreement, or Revocable Consent.**

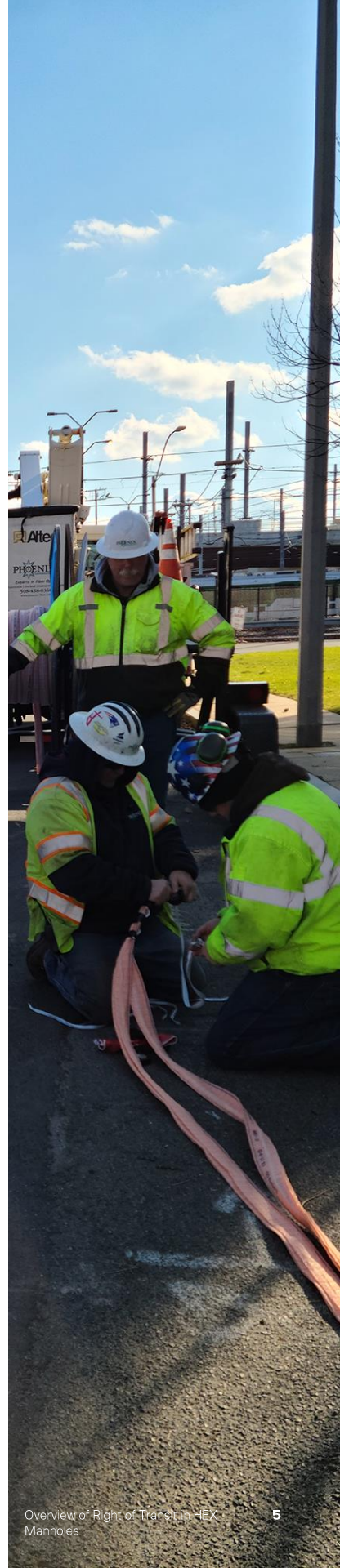
- **Parties building their own conduit into the HEX Common Trench (Joint Trench) or utilizing a shadow conduit:**

Usually conveyed through a **Manhole Transit License**, the terms of which can also be incorporated into the **Lead Company or Joint Build Agreement.**

- **Parties owning subsidiary lines which connect to a HEX manhole:**

Manhole Transit License is required.

It is important to understand that the Minimum Right of Transit entitles each user to the most basic access to HEX manholes for the explicit purpose of attaching telecommunications cable to pass through the manhole strictly in compliance with their respective agreements and HEX Conduit System regulations. **The Minimum Right of Transit does not entitle a user to install splice cases, store slack coils, or install conduits or innerducts in HEX manholes.** To support such activities, additional rights above the Minimum Right of Transit will first need to be licensed.



Additional Rights Above the Minimum Right of Transit

Prior to requesting the installation of any slack coils, splice cases, or performing any work that requires additional rights in excess of the Minimum Right of Transit, telecommunications Attachers should first refer to their respective governing agreements with TOWARDEX used to grant them access to the conduit system.

If the Attacher's existing agreement governing their access does not sufficiently convey the additional usage rights or access beyond the Minimum Right of Transit, the parties should then agree upon and execute a new **Manhole Transit License** or an amendment to their existing agreement to grant the proposed additional access to the facilities.

In all cases, even if permitted by an agreement, TWDX Infrastructure may exercise its delegated authority as provided under **PCHEX § 4, 220 CMR 45.03(1), and 47 USC § 224(c)(1)** to modify or deny an Attacher's request for installation or additional access, on a nondiscriminatory basis for valid reasons of insufficient capacity, reasons of safety, reliability, generally applicable engineering standards, or for good cause shown.

MANHOLE CONSIDERATIONS FOR NEW INSTALLATIONS

Whenever a telecommunications company proposes new installation or elects to participate in a HEX Joint Build Agreement, TWDX Infrastructure recommends each user to consider maintaining its splice cases outside of HEX manholes.

There are important reasons for this:

First, placing splice cases outside the manholes reduces congestion in the HEX transmission system, maximizing the space, and thus making Minimum Rights of Transit available for all parties to make cable attachments in the HEX Conduit System. HEX manholes are limited in space and must be shared not only with one particular user but also with other parties using the system. Splice cases and slack coils cause congestion, which hinders future installations by other conduit users and increases the risk of inadvertent network outages for conduit users when a crew working for one user attempts to access its splice case.

Additionally, having splice cases located outside of HEX manholes allows for more efficient management of costs and resources for everyone because future access to the user's splice case would not require coordination with TWDX Infrastructure to issue a permit and arrange on-site escorts and inspections, as no entry into HEX manholes would be required to perform work in the said splice case.

Coordination During a Joint Trench Construction

When proposing a joint trench, TWDX Infrastructure will collaborate with each customer to redirect their conduit out of the HEX Common Trench and over to their private handhole, incorporating tie-in interconnection facilities into the design as needed. In areas of congestion, TWDX Infrastructure may propose to the public authority the installation of an unmanaged "joint use" manhole, which operates independently from the HEX system and serves various joint trench parties. We may also suggest putting in a larger HEX mainline manhole (or two HEX mainline manholes running parallel to each other) to try to fit as many users in the smallest space possible.





02

Manhole Work Standards

The following work standards are established by TWDX Infrastructure to protect the HEX manhole facilities, meet the requirements of our public authority partners, and provide the necessary infrastructure for all telecommunications Attachers working in the HEX Conduit System to receive quality service without interruption.

CONDUITS AND INNERDUCTS

Duct Terminations into HEX Manholes:

All conduit terminations into HEX manholes require a structural review by TWDX Infrastructure, and work must be performed by an approved contractor. Further, Attachers bringing their own subsidiary lines into HEX manholes and users of JNF conduits, including city shadow or joint trench customers, must receive approval from TWDX Infrastructure for all innerduct installations in their respective conduits.

To prevent water and foreign gas intrusions into the vault, we require complete sealing of all penetrations into HEX manholes at all times.

Every innerduct terminating in a HEX manhole must also be cut in length, configured, and arranged in such a way that it can be sealed shut to maintain water tightness, and not compromise the waterproofing of the outer conduit. TWDX Infrastructure must approve each arrangement and method for terminating and sealing innerducts.

Permitted Innerducts in HEX Manholes

Typically, TWDX Infrastructure only allows fabric-based innerducts (like **MaxCell**), which allow you to fold and push the excess innerduct back into the conduit after cable installation, before sealing the outer conduit.

When proposing a rigid or corrugated innerduct (such as HDPE), we will require that the innerduct be cut sufficiently to permit the installation of a duct sealing device in the outer conduit. This may negatively affect cable placement, depending on the user's desired method of installation. **Therefore, to avoid any installation issues, we highly recommend that all utility owners bringing their own conduits or subsidiary lines into HEX manholes use fabric innerducts from MaxCell.**

Continuously rigid (smoothwall) HDPE innerducts can extend outward up to 2" from the receiving wall, provided they can hermetically seal with the cable inside. Corrugated innerducts are never allowed to protrude beyond the receiving wall or otherwise stick out through a duct seal.



In all cases, every installation of innerducts in HEX manholes will require an engineering review and prior approval by TWDX Infrastructure to ensure that the hermetic sealing of the underground vault is not compromised.

Attachers renting duct space from HEX Mainline are not allowed to run or install innerducts of any kind:

Instead, the conduit attachment license already includes the cost of an innerduct, and TWDX Infrastructure will typically provide the customer with a Licensor-owned MaxCell sleeve or facility of equivalent capacity for the installation.

CABLE INSTALLATIONS

Cable Installation Methods

The HEX Conduit System is designed and optimized for cable pulling tensions usually encountered and expected for dense MaxCell installations. For instance, the HEX Conduit System typically places manholes between 150' and 500', minimizing bends throughout the duct bank's route to achieve the highest density installation possible.

We advise customers to adhere to the manufacturer's guidelines from MaxCell to ensure a successful cable installation across the HEX Conduit System. Once the cable pull is complete, neatly fold and push the excess MaxCell at each manhole back into the outer conduit. TWDX Infrastructure will then install a specialized "multi-cable transit" duct seal, designed to completely seal the outer conduit with multiple cables coming through.

Installation of cable by blowing or jetting is not allowed in HEX manholes, as a continuous, rigid innerduct will need to be provided through manholes along the cable route.

This mode is not typically supported. We could only allow air blowing or water jetting installation in a limited, discontinuous manner from one HEX manhole to the next, and we must remove any excess innerduct to avoid interfering with the duct seal that TWDX Infrastructure will install to seal the manhole from water and gas intrusions. **Because excess innerduct removal will often compromise or otherwise affect future installation, we do not permit cable blowing or jetting in HEX manholes.**

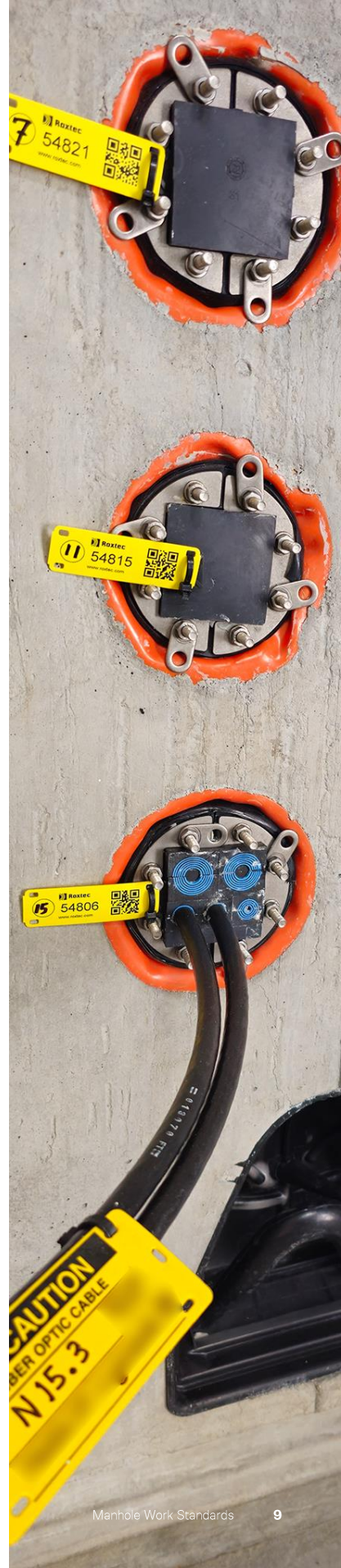
RECEIVING CABLES IN MANHOLES

Receiving Cable at the Manhole for Terminating into a Splice Case

100' to 110' of slack coil should be left at the manhole. TWDX Infrastructure will configure, route and rack the cable to the tenant's designated splice case bay. We recommend 150' of slack for planning mid-span (ring-cut) interceptions.

Cable Racking and Attachment Inside Manholes

TWDX Infrastructure must perform all cable dressing and installation or attachment of any cables, slack coils, etc. within HEX manhole structures.







SPLICE CASE INSTALLATIONS

Splice cases shall be installed in an area or bay specifically designated and assigned to each Attacher.

Manhole Splice Case Restrictions

Installation of splice cases is not permitted in cable vaults that have the following sign symbology installed: 

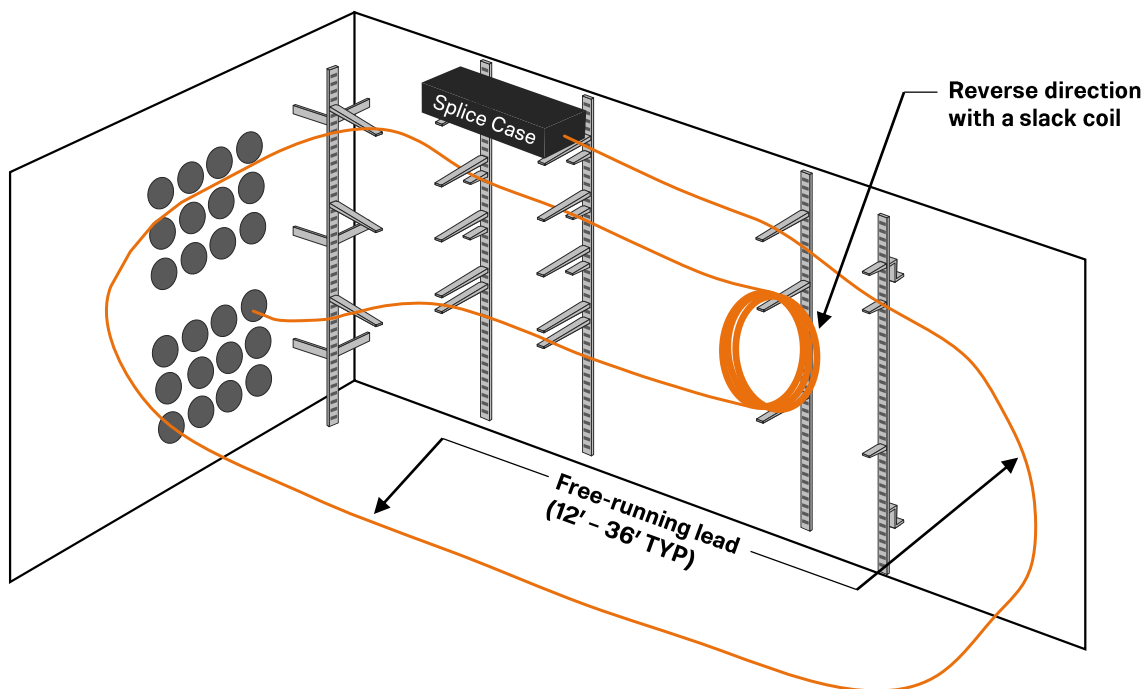
Only networks serving arriving laterals in the manhole are allowed to install splice cases when the following sign is present: 

Install the splice case so that its cables have 12'–36' of **free-running lead** wrapping around the manhole vault (See Figure 1). To reverse the direction of a leading cable, place a small slack coil at the assigned racking location.

The purpose of free-running leads is to allow line crews to easily access and bring up the splice case out of the manhole and into their work area without having to dismount or unfurl any accompanying slack coils in the cables leading into the splice case. This ensures quick and clean dismount and remount of splice cases in HEX manholes, while minimizing congestion and cable conflicts or entanglement between tenants.

TWDX Infrastructure or its approved contractor shall neatly rack the tenant's splice case and its accompanying free-running leads back to their designated racking positions upon completion of the tenant's splicing work.

Figure 1: Typical Splice Case Placement in HEX Manholes



Do not splice fibers in manholes. Do it outside.

No splicing work is allowed inside any manholes. Splice case shall be taken out of the manhole during the work and then reinstalled upon completion. Please also note that most HEX manholes are classified as **Permit Required Confined Spaces**. Federal law prohibits working inside HEX manholes without an approved entry permit at the work site (29 CFR § 1910.146(e)(3)).

MANAGING CABLE SLACKS

Excess cables may be stored by coiling them to eliminate slack. Small slacks should be loosely racked along the vault walls.

Slack Coiling

Coil up the excess fiber optic cable and mount the coil in the assigned racking position in the vault.

Important!

Slack coiling is only allowed for cables having a bend radius of ≤ 10 inches and to change the direction of a cable in the vault. Slack coils are NOT permitted for large diameter cables (cables having ≥ 1 " O.D., such as 1728F, 3456F, etc.).

Never run a cable through a slack coil!

Running a cable through the middle of a slack coil entangles and traps it against the other cable, preventing the other tenant from accessing their cable and necessitating costly relocations and repairs to remedy the situation. To resolve the conflict, the party that owns the offending cable that is running through the slack coil and injuring the other party will relocate its cable. For the purposes of **220 CMR 45.03(3)(c) to (3)(e)**, such relocation is considered a repair and emergency maintenance activity, not a modification or rearrangement to add new attachments, even if the injured party discovers the entanglement and injury to their cable plant during a work to add additional or new attachments.

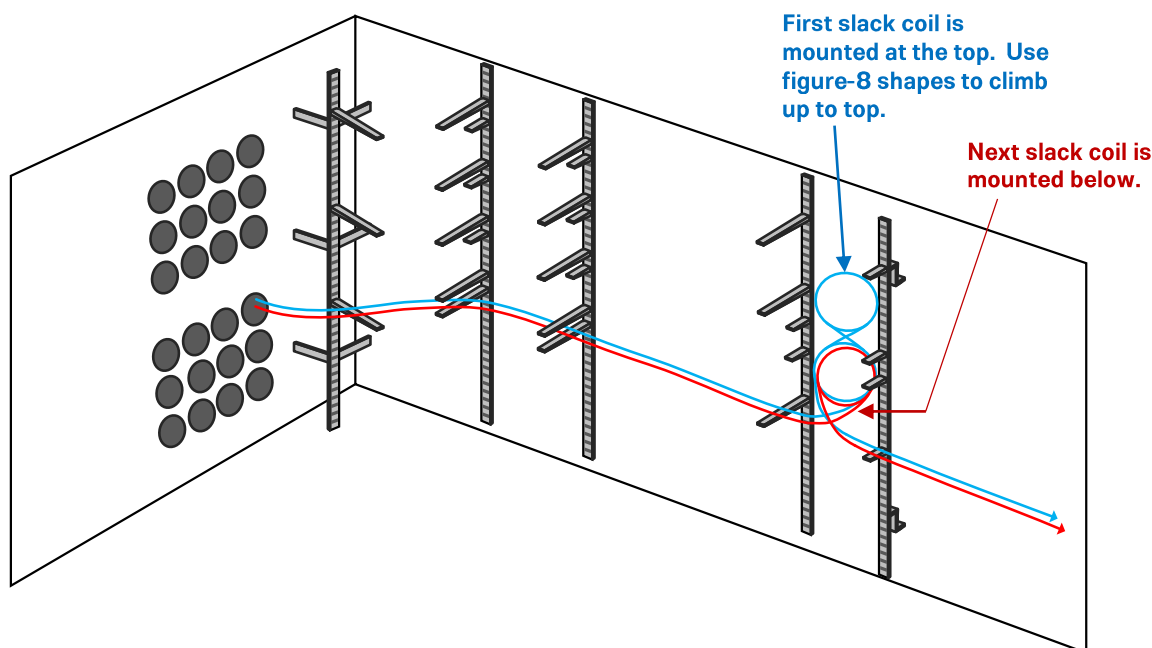
Stacking Multiple Slack Coils

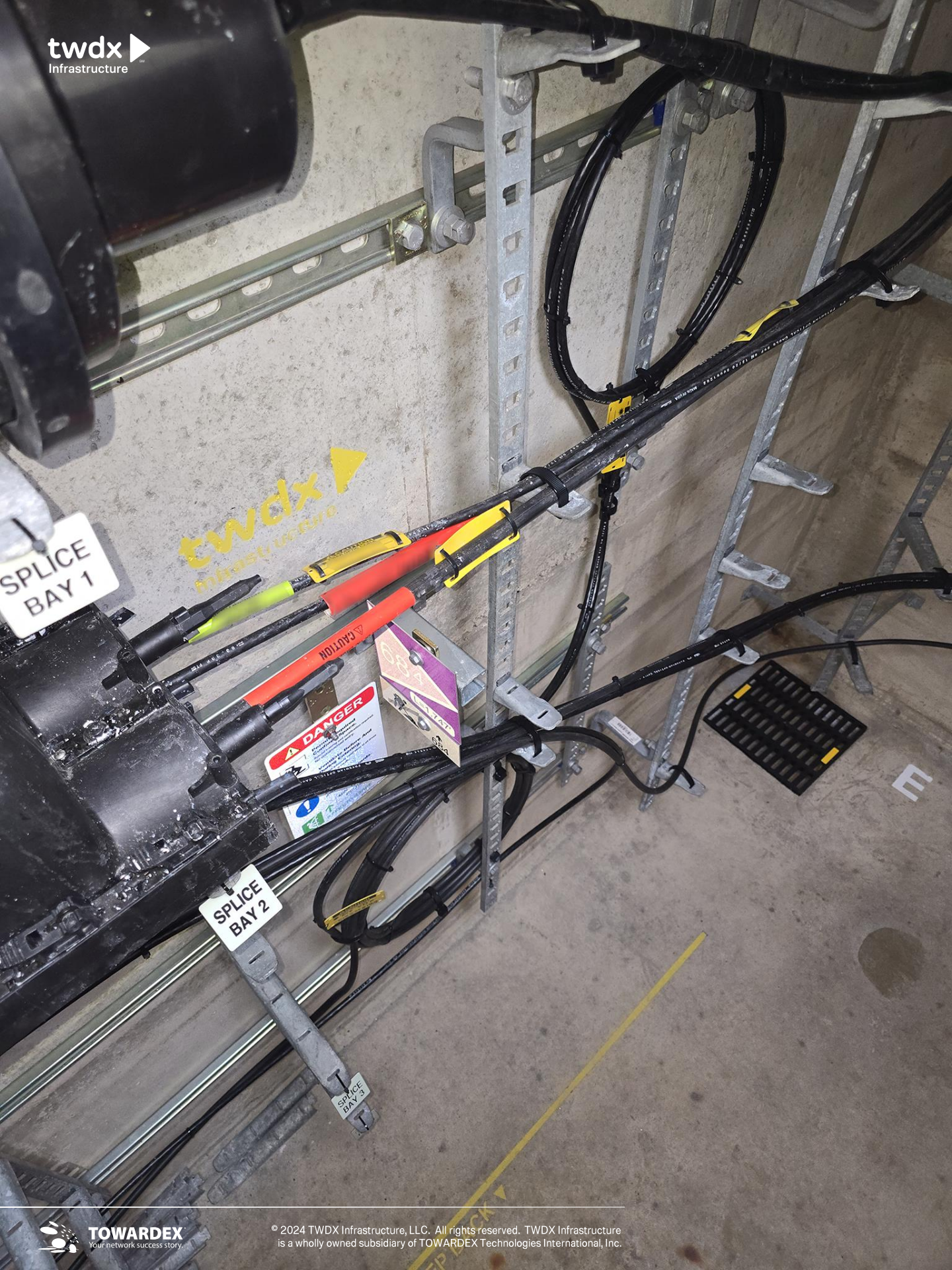
Organize and arrange slack coils in the racks by their bend radius sizes (i.e., coils of similar diameter should be stacked together on a cable rack). Mount the first slack coil at the top, using figure-eight shapes to climb up. Mount the next slack coil over the figure-eight shape below the first slack coil. (See Figure 2).

Tip

To change the racked height of a cable using its excess slack, create two slack coils in series using a figure-eight shape. The figure-eight loop allows you to climb up or down in height while maintaining the cable direction in the vault.

Figure 2: Stacking Multiple Slack Coils





SPLICE
BAY 1

twdx
Infrastructure

⚠ DANGER
High Voltage
Electrical
Shock Hazard
Do Not Touch
When Power is On
See Back Panel for
Safety Instructions

SPLICE
BAY 2

SPLICE
BAY 3

03

Access Procedures

Complete policies and procedures for entering HEX manholes are outlined under the section entitled *"Licensee Operating Rules and Regulations"* in the **Guide to Utility Conduit Licensing** publication on the TWDX Infrastructure [web site](#).

This section will discuss some of the most common procedures for entering and working in HEX manholes, for both Attachers and their contractors working in the HEX Conduit System.

PRE-ENTRY REQUIREMENTS

Insurance Requirements

All entities entering HEX manholes must provide insurance certificates in accordance with the requirements outlined in their respective agreements with TOWARDEX, which provide access to the HEX Conduit System.

Personal Protective Equipment (PPE) and Safety Training

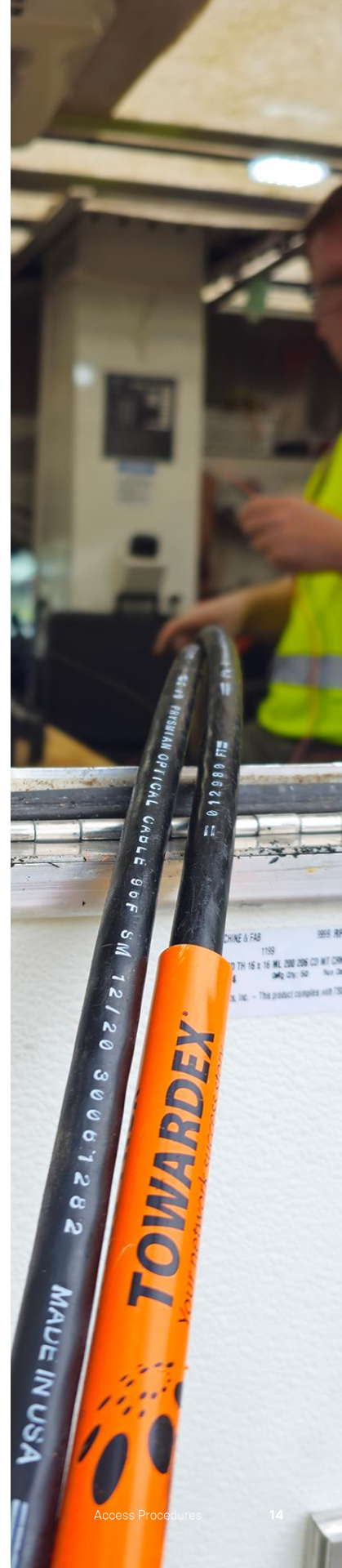
All personnel performing work at any HEX Conduit System work site must be wearing all necessary PPE at all times. This equipment shall include, at minimum, a hardhat and reflective safety vest meeting ANSI/ISEA 107 Class 2 High Visibility rating or higher, regardless of the scope and type of work being performed that involves the HEX system. Other safety equipment shall be added as required to perform the work in accordance with all local, state and federal requirements in effect.

All persons entering HEX manholes should be trained or briefed by an OSHA authorized training provider or safety instructor for working in permit required confined spaces.

Licensees of the HEX Mainline conduits are reminded that grossly negligent, willful or repeated violation of safety regulations is considered to be *Default in Covenants* under the **Revocable License for Conduit Occupancy**, and the Licensor may deny access, restrict or suspend Licensee's work in the Absolute Property, or for a good cause shown, terminate the License for cause by giving written notice in accordance with 220 CMR 45.03(3)(a).

TWDX Infrastructure will not permit work for any entities that are listed in the **OSHA Severe Violator Enforcement Program (SVEP)** Log. If an Attacher of the HEX Conduit System is listed on the SVEP Log, none of its employees will be permitted access for any reason. In such a situation, the Attacher may engage TWDX Infrastructure to provide field inspections and work forces at the Attacher's expense until it is delisted from SVEP.

Any previously approved contractor who is listed on SVEP will be removed from the Approved Contractor list.



ENTERING HEX MANHOLES

Forms Required

Prior to entering HEX manholes, the following forms must be submitted to TWDX Infrastructure for approval. Customers may use the Member Utility Portal to submit a new work request, or manually fill out the below forms and email them to cmc@towardex.com.

- [Form NC-2: Utility Work Permit](#)

Required to enter, access, or work in any HEX Conduit System facilities. TWDX Infrastructure must issue a Permit Number before any work can begin.

- [Form NC-7: Confined Space Entry Permit](#)

Required entry permit for entering any permit required confined spaces (such as manholes) across the HEX Conduit System. No work may commence until a Permit Number is issued by TWDX Infrastructure.

- [Form NB-5: Job Hazard Analysis](#)

Attach to Form NC-2 where applicable. If you're using the Member Utility Portal, you will be asked to check that you have identified job site hazards pertinent to your work request.

Emergency Entry and Access

TWDX Infrastructure Plantmaster should be called on all network failures 24 x 7 by calling the Joint Trench Helpdesk at **617-863-8325**. Tell the operator your company name and that you have a **HEX Emergency Alert** for immediate TWDX Infrastructure mobilization and response.

Opening Manholes

Under no circumstances shall any person enter a HEX manhole without a TWDX Infrastructure inspector on site, and at no time shall any HEX manhole remain unattended with its manhole cover open. Only after confirming that necessary safety precautions have been taken by the entrants and verifying permits will the inspector open the manhole and supervise work.

The Attacher will be responsible for and billed for any ancillary support costs (such as inspector costs) in accordance with their respective agreement with TOWARDEX that grants them access to the conduit system.

Understanding Secured Manholes

Starting in 2024, TWDX Infrastructure has begun securing critical infrastructure vaults and manholes across the HEX Conduit System using locking entrance keys. Locking bolts, with a controlled manufacturing inventory and unique keyways coded exclusively for the HEX Conduit System, secure these manholes. To open these manhole covers, a matching keyed driver is required, which is only available to TWDX Infrastructure inspectors, public agency partners, and emergency response teams.

After verifying permits and work site safety precautions in accordance with entry procedures, your TWDX Infrastructure inspector will unlock and open the manhole.





04

Manhole Symbol Signs

Every waterproof HEX installation that is large enough for crews to enter must display human-understandable signage and symbology to convey information across the conduit system. These signs help promote reliability for critical tenant network operations by providing reminders and pertinent information to maintenance workers.

The signs are organized into two categories: **Line Maintenance** and **Worker Safety Signs**:

LINE MAINTENANCE SIGNAGE



Control Point (CP) Markers

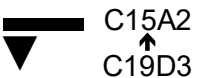
Notates location of the facility along the trench section (indicated by "L=" followed by the section length). CP notations are read out in hundred-foot increments. "2 6" means 260 LF or 2+60. The apex of the white-on-purple triangle points towards the line worker's catwalk, indicating their walking direction relative to the conduit system.

CP markers provide visual cues to the back-office AI when scoring as-built and field work photos uploaded by line crews.

Sectioning Markers

Limits of Work Authority:

Extends of the trench section covered by this facility acting as the CP.



Sectioning Interface:

Signifies demarcation from one HEX System Section to another (project sectioning). In this example, this is the last manhole on the "C19D3" conduit system, and the next manhole is in the "C15A2" system.



Joining Mainline Transmission:

This is the last manhole in an Open Access Lateral before joining the mainline transmission system. "C19BA" in this example is the HEX System Section for the trunk line which this manhole connects to.





Radio Communication Channel

Default radio channel used to communicate with inspectors above ground. Unless noted otherwise in the entry permit or in the field, inspectors will tune to the default radio channel.



Network Splice Point Restrictions

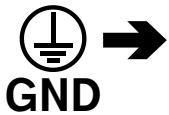
No Splice Cases:

Splice cases are not permitted in this manhole. Use the next available "Meet-Me" manhole to request application for a splice case installation.



Yield to Local Networks:

Splice cases in this vault are to be prioritized for networks serving local lateral connections arriving into the manhole. "Express" networks that pass through the manhole without serving any arriving laterals must use the next available "Meet-Me" manhole to apply for a splice case installation.



Earthing System

Points to the bonding terminal or point of connection to access grounding electrode in the manhole.

N

Receiving Wall Identifier

Receiving wall of each HEX manhole is identified by their general magnetic direction. "N" in this example means "North Wall."

Conduits arriving into each manhole are identified by their receiving wall and duct number. Examples:

"E15" means duct 15 arriving on East Wall.
"E15.4" means innerduct 4 inside duct E15.

C19BA
204 EB



Manhole Butterfly Diagram Link

Signage with QR code linking to the manhole butterfly drawing. Used by line crews to quickly review the manhole diagram using a mobile device.



WORKER SAFETY SIGNS



Emergency Exit Direction

Underground vaults or tunnels that are longer than 16 feet in any length must display directions leading to the nearest egress point. Emergency exit signage must be engineer-grade reflective at minimum and may optionally be self-luminating as required.



Emergency Rescue Muster Point

Muster point for emergency technical rescue and access by first responders. Rescue muster areas must be kept clear of debris and cables at all times



Confined Space

Permit Required Confined Space:

Indicates that this manhole has been classified as a permit space under 29 CFR § 1910.146.



Ventilation Required:

Maintain positive pressure ventilation (PPV) by using blowers to force fresh air into the space when crew is working inside.





04

Types of Manholes

Different types of manhole designs exist across the HEX Conduit System, optimized for unique site conditions and tenant network requirements at each location.

HEX MANHOLE TYPES

PB:

Size: 3'X3'X3'D to 5'X5'X5'D (TYP)

Waterproofing Level: None

Fireproofing Level: None

Pull box. Used only for facilitating attachment and removal for a passthrough cable transit. No slack coils of any kind (including restoration and mid-span) and no splice cases are permitted.

LPB:

Size: 3'X18'X7'D (TYP)

Waterproofing Level: 3.5 atm (51.4 PSI)

Fireproofing Level: None

Large pull box. Used to facilitate cable transit in heavy volumes (over 80 cables) with racking facilities for small restoration slack coils (<50' slack). No splice cases or mid-span coils are permitted.

TLM:

Size: 7'X5'X6.5'D, 10'X5'X7'D (TYP)

Waterproofing Level: 3.5 atm (51.4 PSI)

Fireproofing Level: None

Transmission Line Manhole. The standard "Swiss Army Knife" vault for HEX transmission sections, typically used for dividing up a large duct bank, connect interconnectors or distributor lines, or in areas of congestion. Modest amount of slack coils and between 2 to 6 splice cases are usually accommodated in these manholes.

MMH:

Size: 12'X6'X7'D, 10'X13'X8'D, 25'X6'X9'D (TYP)

Waterproofing Level: 3.5 atm (51.4 PSI)

Fireproofing Level: None

Meet-Me Hole. Heavy-class large underground vault to support cable transit in high volumes (over 56 cables) with racking facilities for medium amount of slacks and between 8 to 10 splice cases.



XMH:

Size: 4'X8'X6'D, 4'X8'X7'D (TYP)

Waterproofing Level: None

Fireproofing Level: UL1479 1 hr. F-Rating, EN45545 EI60/EI120

Explosion Protection Level: ATEX Ex e

Energized Cross Connection Manhole. Specialized demarcation manhole for cross connecting the HEX fiber optic system onto an electric transmission system. The manhole vault is designed to provide up to 1 hour of fire resistance, as well as isolation and retardation of flames spreading from the connected electric utility during an underground fire. During an explosion event communicating from the subtending electric utility, a specialized explosion-mitigating manhole assembly (EM3) relieves built-up pressure, restrains the cover, and then returns to the seated position once the pressure returns to normal. No slack coils of any kind and no splice cases are permitted.

ZMH:

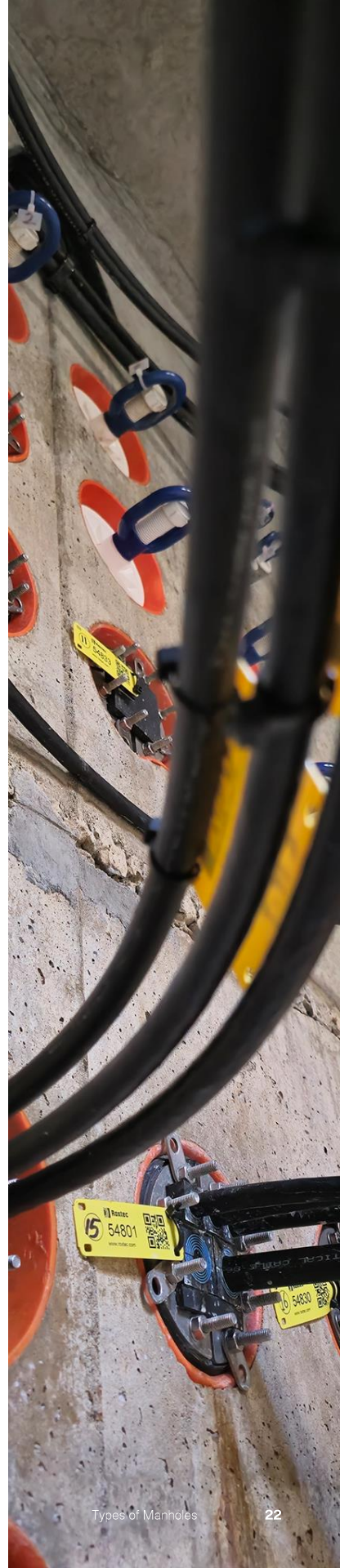
Size: 4'X4'X4'D to 12'X6'X7'D (TYP)

Waterproofing Level: None to 3.5 atm (51.4 PSI)

Fireproofing Level: UL1479 1 hr. F-Rating, EN45545 EI60/EI120

Zero Manhole directly facing a building MPOE. Installed at private properties for largescale **Open Access Laterals**, such as at data centers and internet interconnection hubs, where the HEX system has an easement from the property owner for the siting and continued management of the lateral. Depending on the size of the ZMH vault, restoration slacks may or may not be permitted. Splice cases are not permitted in these manholes.

Depending on size of the easement to site the duct system, more than one manholes may be installed at the private property. **However, only the last, final manhole interfacing with the in-building MPOE shall be ZMH.** Other manholes leading to the ZMH in the lateral easement area may be other types (such as TLM) depending on site-specific circumstances and agreement with the property owner.





NOT A TIE-OFF POINT!
Do not tie off innerducts, pull tapes or any lines onto this cantilever to support a cable installation or removal. Use the pulling iron in the wall below.

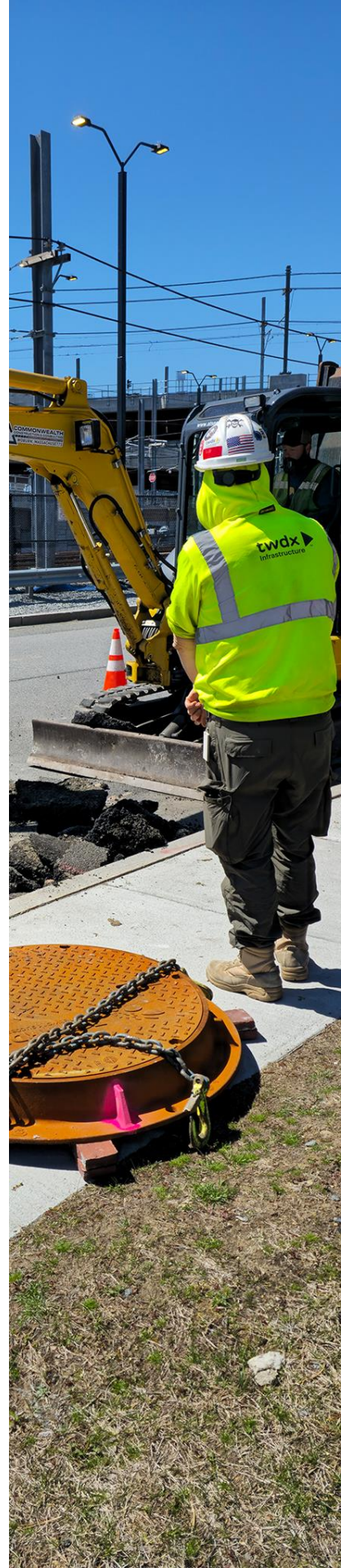
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MORE CONNECTED. MORE VALUE. INFRASTRUCTURE MEETS INTERCONNECTION

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