

SECTION 690

GENERAL PROVISIONS FOR COMMUNICATIONS

690.01 – UNDERGROUND CONSTRUCTION SPECIFICATIONS

A. Duct Placement Guidelines

This project entails placement of a single 2” SDR 11 HDPE duct and pull-through existing duct. The Contractor is responsible to provide all duct, handholes, locate posts, locate wire, and pull rope as part of its installation responsibilities. The HDPE Duct part number referenced in “Section 300 – Proposal” references a duct that includes a mule tape for cable installation. The Contractor will be required to provide all mule tape necessary for cable installations whether it be included with the duct at the time of purchase or provided and installed separately. All ducts will be placed on the routes identified in the attached CAD Plans. All ducts must maintain a minimum horizontal clearance zone of 24” when paralleling other underground utilities with the exception of water and sewer (storm and sanitary) mains where parallel runs must maintain 60” horizontal clearance.

All underground ducts must be placed a minimum of 36” below finished grade wherever possible. Instances where the duct must be placed at a shallower or drastically deeper depth must be brought to the attention of the Project Manager prior to installation.

The Owner’s Project Manager will be on site to coordinate actual placement. Routes will be marked with the use of paint and flags when necessary. The Contractor must not place duct along the route without first reviewing the individual areas with the Project Manager. This measure is designed to avoid instances where the new duct may encroach the restricted clearance zones of other utilities or extend outside the Right-of-Way. Contractor must ensure that route and right-of-way markings remain visible to avoid unnecessary re-marking trips/additional costs.

All exposed duct ends must be covered with a temporary plug or adequately sealed with duct tape to prevent the ingress of dirt, water, and debris prior to the installation of the cable, locate wire, and mule tape.

B. Handhole Placement Guidelines

The Contractor may be required to place new handholes as referenced on the CAD plans. All handholes are already purchased and available for pick up by the Contractor at the City of Wauwatosa Public Works Facility located at 11100 W. Walnut Road. The Contractor will not be responsible for purchasing and handholes for this project. See the included CAD drawings for placement location of the handholes.

The handholes must sit parallel with adjacent streets, buildings, or other structures and must be flush with all surrounding surfaces, and if installed on a slope or grade the handhole must follow the contour of the grade as much as possible. All handholes must be placed a minimum of 12” from the edge of a sidewalk, curb, or

driveway approach. When a handhole is to be placed next to another handhole, a minimum of 24" of separation from edge to edge is required.

The installed handholes must sit atop a 12" bed of $\frac{3}{4}$ " washed, crushed stone for drainage – pea gravel or other stone smaller than $\frac{3}{4}$ " is not an acceptable base for drainage. All fill around the handhole must be mechanically compacted in 12" layers to within 8" from the top to prevent settling.

Inside each new handhole the Contractor will be required to install a single 5' long by $\frac{1}{2}$ " diameter copper clad ground rod. The ground rod must not protrude more than 5" above the surface of the crushed stone bed. After ground rod installation, the Contractor must equip the top with a conductor clamp that will allow the Contractor to tie a #12 AWG UL TYPE USE 2/RHH/RHW-2 Outdoor rated PVC jacketed stranded copper locate wire to the end.

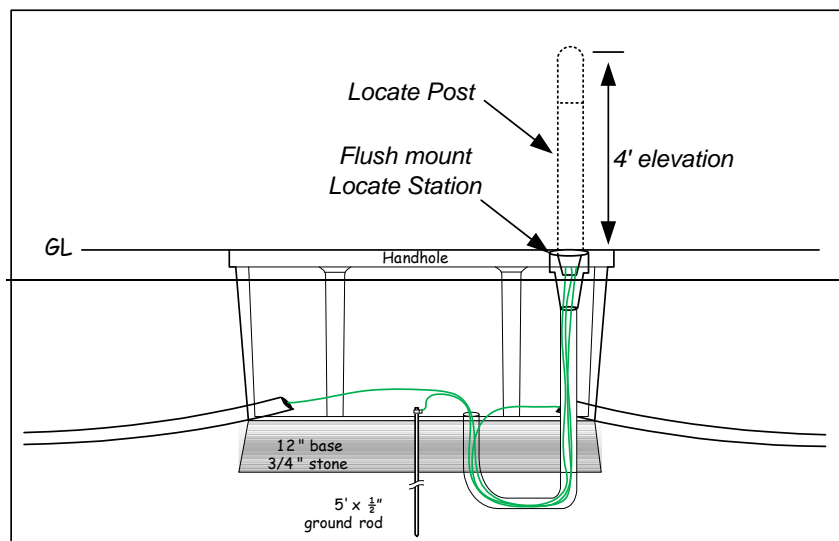
C. Locate Post Placement Guidelines

The Contractor may be required to install locate posts adjacent to handholes identified on the CAD Drawings. The Locate Posts will be used to access the locate wires for future locating purposes.

Between the handhole and locate post the contractor must install a short length of 1-1/4" underground plowduct. This will facilitate the installation of the locate wires into the post from the handhole.

At no time will a locate post be installed in a location where it impedes or can be damaged by the removal of the handhole lid.

Detail Drawing of Handhole and Locate Post Installation



D. Fiber Optic Cable Installation Guidelines

The Contractor can install the fiber optic cable by hand or with the use of pneumatic/hydraulic installation equipment. However, the means of installation, the

Contractor must take care to not exceed the cable's maximum pulling tension (typically 600lbs). The Contractor must utilize sheaves and a breakaway/swivel device at all times while installing the fiber optic cables. Multiple swivels must be used; one for the cable, and another set 8" back from the first for the mule tape. Cable guide placed on end of duct while pulling cable is preferred.

At each handhole the Contractor must store a minimum of 150 feet of cable slack (unless otherwise noted on the CAD Plans) neatly coiled and stored upright in the handhole and labeled at each end with a permanent label, identifying the Cable's owner and identifying the specific cable strand count. Suitable labels for this purpose are Panduit #PST-FO.

Following cable, locate wire, and mule tape installation, all occupied ducts must be plugged using a split plug appropriately sized to accommodate the cable diameter – do not use foam, putty, or tape to permanently plug any duct. All spare ducts must only contain mule tape for future installations and be sealed using properly sized duct plugs.

Contractor may have to re-deploy for Cable Pulling and Splicing due to fiber availability.

E. Locate Wire Installation Guidelines

All locate wires can be installed outside the duct so long as the wire used is suitable for installation outside of duct. A suitable locate wire for this purpose is identified in "Section 300 – Proposal".

F. Mule Tape Installation Guidelines

The Contractor will be required to install a single 1,800 lb. mule tape within the plowduct with the locate wire and fiber optic cable.

690.02 – INTERIOR CONSTRUCTION SPECIFICATIONS

A. Above Ground Exterior to Interior Transition

In instances where the underground plowducts extend to the exterior of a building whose entry point is above grade, the Contractor is required to transition below grade from each plowduct to a Galvanized Rigid Steel pipe that extends up the side of the exterior wall to an elevation shown on the accompanying Interior Drawings. At the below-grade transition point where the rigid pipe meets the plowduct, the Contractor must utilize a watertight fitting that is rated for underground use (Shur-Lock SL 602C 200 or approved equivalent). The Project Manager must approve the final location of building risers.

At the top of the rigid pipe run, the Contractor must core a 2" hole into the building and install a 12"x12"x6" NEMA 3R rated pull box over the hole and aligned so the building core is situated at the top of the pull box. The core into the building must be sleeved with EMT. Interior EMT extending to a termination room can extend through the core to satisfy this sleeve requirement, however instances where Interior EMT is not being placed the Contractor must sleeve the core with EMT and securely fasten

the sleeve to the exterior pull box and inside the building. All sleeves/EMT ends must be equipped with collared fittings to avoid cable damage.

The Contractor must install a 1/2" Rigid Steel pipe stubbed below the ground level to the elevation noted on the attached interior drawings. This pipe will house the locate wire that runs back to the nearest locate post or housing along the plowduct path. At the bottom of this 1/2" pipe the Contractor must install a steel single gang outdoor outlet box with waterproof cover. A 12" coil of locate wire must be housed inside the single-gang outlet box.

All exterior pipes and boxes must be securely fastened to the building wall with anchors and fastening hardware suitable for a permanent installation into the materials comprising the wall.

B. Interior EMT Installation

Where any conduit penetrates any interior concrete/block wall cores, the Contractor must seal around the conduit with mortar.

Where the interior conduit passes through any non-concrete/block wall the Contractor must create a hole through the wall only large enough for the conduit to pass through, then seal around the conduit with ASTM E814 (UL 1479) approved fire stop materials.

Prior to cutting or coring into or through any building structure that could be deemed as "building support structure" the Contractor must obtain permission from the Project Manager.

The Contractor must take all necessary precautions to prevent activation of building alarms, such as fire or security. Conduits that enter rooms that are sealed for the sake of Halon release systems must be sealed to ensure that the room's integrity is maintained.

At each end, and along the interior conduit path approximately every 10 feet, the Contractor must label the EMT with a warning label identifying the contents as a fiber optic cable. Suitable labels are Panduit's #PCV-FOB.

Along the interior EMT conduit path the contractor may be required to install various sizes of Type 1 pull boxes fitted with a screw cover for pulling assistance, duct access, and cable storage. Pull Box location and size is detailed on each building's Interior Piping Drawing. At every pull box (and building entry box) the contractor must use screw type fittings to attach the conduit to the box.

The interior conduit will need to be bonded to a ground point at each building. The Project Manager will determine the ground points. Cable used to Bond the EMT to the Building Ground Electrode will be no smaller than a #6 AWG Stranded copper and must have a green jacket suitable for interior use.

C. Interior Cable Installation

At each site the cable will be installed within existing cable tray to an existing data rack. At some point within the cable tray, NEMA box, or cabinet as defined on the Interior plans in each building the Contractor must store a 30' expansion loop.

Following the installation of the fiber optic cable through the exterior and interior EMT conduit, the Contractor must seal the conduit ends (where the EMT enters the outside pull box and where the EMT enters the termination room) with ASTM E814 (UL 1479) approved fire stop materials.

690.03 – CABLE SPLICING, TERMINATION, AND TESTING SPECIFICATIONS

A. Cable Pre-Acceptance Testing

Prior to release to the Contractor, the Owner will require the Contractor crews to perform "pre-acceptance testing" with an Optical Time Domain Reflectometer (OTDR) on each fiber optic cable. The pre-acceptance testing will verify the performance of the cable prior to it being released into the Contractor's possession. Pre-acceptance testing must be performed on every cable strand at 1310nm and 1550nm only from the exposed end of the cable.

Pre-acceptance tests are intended to identify damaged strands, macro-bends, and strand breaks. Because of this, test results must be clean, i.e. no events being reported that are not there. Poor BFA mating, dirty BFA interface, etc. will cause dirty traces that report multiple events which are not there. Care must be taken to set up the BFA and OTDR parameters to eliminate these events.

Test results must be provided to and approved by the Project Manager prior to release of the cable to the Contractor for installation. Pre-acceptance testing should be completed within the first 5 business days of receipt.

B. Outdoor Fusion Splicing

The Contractor will be required to Fusion Splice the fiber optic cables at each of the splice points identified on the CAD Plans.

C. Indoor Fiber Termination

All cable terminations will be performed by splicing factory terminated single strand fiber optic cable pigtailed to the ends of the outdoor fiber optic cables. The Contractor will be required to install all Owner-provided Termination and Splice equipment as well as route all pre-terminated pigtailed between devices.

D. Fusion Splicing Equipment

All cable strand splicing will be performed using a fusion splice machine that is capable of splicing within a 0.2dB loss tolerance and equipped with either live monitoring or a Local Injection Detection (LID) testing system, thus ensuring the splice quality while the splice is set up in the machine.

All splices will be protected with appropriate fusion splice sleeves fitted with steel-reinforcing rod(s) (provided by the Contractor).

E. Cable Testing

Following the splicing and termination procedures the Contractor will be required to test each strand using an OTDR and Power Meter Light Source (PMLS) at 1310nm and 1550nm. Each terminated strand will be tested between the sites along the ring with both devices at both wavelengths. This totals 8 tests per strand. **All OTDR tests must be performed using a launch cable that is at least 500 meters in length and with an event threshold setting of equal to or less than 0.01db per event.** This will allow the inspector to review the initial connector interface and all splices or anomalies that register greater than 0.01 along the trace.

F. OTDR Viewing Software

Prior to the OTDR testing the Contractor must provide a copy of the OTDR viewing software that can allow a user to electronically review the test results.

G. Test Documentation

Following the OTDR testing the Contractor must provide the Owner with one electronic copy of each test performed. Prior to testing, the Contractor will be provided with the strand identification and labeling plan, the electronic copies of the test results must match the labeling scheme provided to the Contractor.

Following the PMLS testing, the Contractor must provide the Owner with test results showing the total link loss between each site along with the average loss for each strand. The test results must be provided on any Windows® compatible electronic spreadsheet.

H. Optical Loss Budget

The Contractor will be provided with optical link budgets for each installed cable strand. Budget losses are calculated using the total link loss between sites, and then averaging the result of both directions using the parameters identified in Table 1 below. The test results provided to the Project Manager must confirm that 100% of all installed strands perform within the optical loss budget and within the specific tolerances for individual events identified in Table 1 below.

Note that even though a link loss test may show a loss that is within the optical budget, any event shown by the OTDR report that exceeds its thresholds listed in Table 1 will result in a failed test result and must be remedied prior to system acceptance by the Owner. Instances where individual tolerances cannot be met must be reviewed with the Project Manager prior to completion.

Table 1

Event	Wavelength	Threshold (dB)
Coupler Loss	1310nm	0.4dB
	1550nm	0.4dB
Splice Loss	1310nm	0.2dB
	1550nm	0.2dB
Cable Attenuation	1310nm	.35dB/Km
	1550nm	.25dB/Km

690.04 – EQUIPMENT AND MATERIAL STORAGE

The Contractor will be required to store all equipment to include vehicles, machines, tools, consumables and other work-related materials off-site during times when work is not being performed in the immediate vicinity.

690.05 – PROJECT FOREMAN

The Contractor must assign one Foreman to the Project who will take instruction for all Prime and Subcontracted crews. This Foreman must be on site and act as the single point of contact for the appointed Project Manager until the Project is completed.

690.06- Encroachment, Excavation and Obstruction Permits

The Contractor must abide by all permitting ordinances, restrictions, and municipal codes. Any permitting authority restoration, guidelines, and requirements supersedes any provisions in this document.

690.07-Underground Utility Locating

The Contractor must abide by WI State Statute § 182.0175 which outlines the responsibility of the Contractor when excavating on or near underground facilities. The Contractor must have all underground utilities, private or otherwise, located during the course of construction at their expense. The Contractor must notify Digger's Hotline three (3) days or more prior to commencement of any underground excavation. The Contractor may not perform work for the Owner under any Digger's Hotline locate ticket other than its own.

The Contractor must work with Private property owners to ensure all private utilities on private property are properly located. Private facilities may not be registered with Diggers Hotline therefore prior to any work being performed on private property the Contractor will be required to notify the proper personnel to have any private facilities located.

All underground utility locations shown are approximate. Utility information was provided in response to planning locate requests. Construction contractor is responsible for determining the location of municipal, and private utilities; complete repair of any and all damages & restoration incurred shall be at the expense of the contractor. Facility placement subject to change upon field locate completion. Right-of-way is depicted based on field observations and the latest state and county records available. This data has been prepared, in part, by information furnished by others. While the information is believed to be reliable, Multimedia Communication & Engineering, Inc. (MC&E) assumes no responsibility for the accuracy of this data for any errors, or omissions that may have been incorporated into it as a result of incorrect information provided to MC&E.

690.08-Soil Condition/Depth of Installation Clause

The Contractor must inform the Project Manager immediately upon discovery of any underground conditions such as limestone or boulder fields that adversely affect its ability to drill or otherwise excavate through an area or at the specified depth to the extent where additional resources not included in its price are deemed necessary. The Project

Manager and Contractor Foreman together will determine the need for additional resources and costs. If granted, approval for the additional expenses will be delivered in the form of a Change Order from the Owner prior to continuation in that area. Additional charges for placement of the duct at a depth deeper than 36" for the sake of avoiding utilities or other obstructions will typically not be granted.

690.09-Worksite Safety

The Contractor is responsible for the safety of all persons and property inside the construction zone. This entails deploying proper barricades, traffic control plans, and/or flagmen to protect vehicles and pedestrians passing by or through the work zone, along with ensuring that equipment operators utilize ground spotters when necessary.

Open ground must be properly barricaded at all times that the Contractor is not in the immediate vicinity of the open ground. Open ground areas that are to remain open overnight or over any extended period of time must be barricaded in a fashion that will make the open area easily detectable and avoidable by passersby.

Potholes/core holes in the immediate vicinity of the work zone during working hours can be covered with a cone; however, Type II barricades must be placed over any pothole left open overnight. Steel plates over street or sidewalk cores, or the temporary replacement of cores, are the only acceptable means by which to cover the core hole when the Contractor is not physically on-site performing work.

All work areas, both interior and outdoor, must remain clean and free of all rubbish and tools not in use at all times. At the end of each workday, the Contractor must clean the worksite and secure all equipment and tools.

Worksite safety procedures must follow and comply with the guidelines and requirements of all applicable Municipal and OSHA standards.

690.10-Traffic Control Plan

The Contractor must provide an approved Traffic Control Plan consistent with the guidelines set forth in the WDOT Manual on Maintenance Work Zone Traffic Control Guidelines for all construction being performed.

690.11-Excavations

Excavations shall not remain open in excess of three (3) calendar days unless specific permission is obtained from the Owner prior to the third day.

In all streets, alleys, sidewalks or other public ways, whether improved or unimproved, all excavated material shall be removed, and the trench shall be completely backfilled with sand or gravel, unless permission is obtained from the Owner to use excavated material for backfill.

Contractor must not disturb any right-of-way markers, property pins, or survey markers. If disturbed, the pin or marker will need to be reset by a certified land surveyor at the contractor's own expense.

690.12-Hard Surface Potholing

The Contractor will be allowed to mechanically core through hard surface streets to locate existing utilities provided that the restoration of the core be performed per the Municipal Regulations For Filling Cuts or Excavations.

Potholing is not allowed in sidewalks and ADA compliant or non-compliant pedestrian ramps. Any hard surface excavations within any sidewalk or ramp panels will result in the Contractor's replacement of the entire panel, along with adjacent panels at the Contractor's expense. Each panel replacement will be inspected by the City.

At no time can the Contractor perform any excavation that undermines the adjacent intact surfaces, thereby making vertical mechanical compaction impossible and creating future potential for subsurface failure.

690.13-Restoration Guidelines

Restorations must follow the specific guidelines set forth by the City of Wauwatosa and as shown on the plans. **All costs for restoration are incidental to the individual bid items.**

690.14-Erosion Control Policy

Any prolonged open excavations or standing debris piles may require erosion control practices such as sandbagging around the area or placing hay bales around the area. The permitting authority will determine the need for such barriers on a case by case basis.

The Contractor must employ good housekeeping practices that will prevent the ingress of any excavated materials into the Municipal storm water system. This includes properly covering storm sewer inlets with DOT Filter Fabric (DOT Type FF, not felt or silt fence material) near areas where excavation and directional drilling operations occur. DOT Type C Inlet protection standards apply (2x4 across back of inlet with DOT Filter Fabric over inlet held in place by inlet cover).

Municipal Erosion Control Applications may be necessary for any areas where excavation beyond that of bore pits, utility locates, and handhole placement occurs. At no time can spoils or other debris be stored or piled in the street gutter.