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| F.A.P. RTE.       | SECTION    | COUNTY           | TOTAL SHEETS   | SHEET NO. |
| 338/IL 59         | 2011-035-1 | DUPAGE           |                |           |
|                   |            |                  | CONTRACT 60P42 |           |
| FED.ROAD.DIST.NO. | ILLINOIS   | FED. AID PROJECT |                |           |

**Guided Horizontal Drilling System (HDD)**

The HDPE conduit shall be installed based on the use of a guided horizontal drilling system. A guided horizontal drilling system is a trench less technique that employs small diameter fluid jets and/or mechanical cutting tools attached to a flexible drill string to form a bore as the head is thrust forward. Steering in both the vertical and horizontal planes can be effected by controlling the orientation of fluid jets or a slanted face head. Soil conditions and obstructions vary the drilling direction; adjustments are made to keep the drill on-line to the receiving pit. Once the bore is accomplished the conduit section up to 24 inches in diameter shall be installed using the same equipment. The Contractor shall provide boring equipment to bore a minimum length of 20 feet and a maximum length of 1000 feet with varying depths of 2-foot 6inches min to 12-foot 6inches in depth max in one setup. The normal drilling depth of all pulls for 3,5or 6inch HDPE and for all configurations is approximately 5 to 6 feet below grade to top of conduit.

The drilling is accomplished in two steps. The first step consists of drilling a small diameter hole along a specific path. The second step consists of enlarging the pilot hole by a back reamer to the size required to install the conduit/ conduits. The first and second step may require several iterations to accomplish the proper diameter hole to install the duct. The position and location of the drilling operation is monitored with an above ground electronic locator and/or a remote guidance system.

The HDPE conduit sections consists of installing conduit sections of one duct, two ducts, three ducts, four ducts, or six ducts of solid coilable HDPE Conduit. The HDPE is supplied in 3 inch 13.5 SDR, 5 inch 13.5 SDR or 6 inch 13.5 SDR conduit of 450 feet to 500 feet on 10-foot diameter steel non-returnable reels or HDPE 3inch 13.5 SDR conduits of 1000 feet to 1500 feet on 12 feet to 15 foot diameter reels. The Contractor transports the HDPE to the work site, prepares entry pits, exit pits and turning pits at the work site, connecting pits to allow for fusion of the HDPE conduit is done, and the route is prepared, potholes are dug and completed along the route, all prep work is completed, and any adjustments are made to the alignment to miss all obstructions below and above grade, the final alignment is identified and chosen and then the HDPE is assembled into the desired sections, configurations and quantities and lengths. The HDPE shall then be installed. During the installation process the duct section rolls and twists resulting in a cross section not acceptable for connecting to any electrical facilities. The contractor shall correct this situation in the field by performing the following: the HDPE conduits ends shall be connected to a section of schedule 40 PVC or steel conduits, during the connection process the conduits are positioned, rotated and aligned to meet the cross section required by the specification and then connected to the electrical facilities for a complete system by the Contractor. The Contractor is not permitted to install HDPE 3inch SDR or HDPE 5 inch SDR or HDPE 6 inch SDR into any electrical equipment. The conduit to be used for entering equipment is steel conduit section or a section of schedule 40 PVC. HDPE in 40-foot straight sections and then butt fused together is not acceptable. The Contractor is advised 3inch, 5inch, and 6inch HDPE Conduit is furnished on non- returnable steel reels which must be disposed of off site by the contractor. The couplings, connections, materials, and tools to perform the butt fusion process are furnished by the Contractor.

Nominal pipe sizes only are indicated on the drawings and bid form. Outside diameter of pipe is generally 1 to 2 inches greater than the nominal pipe diameter.

Only HDPE conduit shall be installed by the Horizontal Directional Boring method by the Contractor. The 3inch, 5inch, and 6 inch SDR HDPE conduit on steel reels; couplings and connections except 3inch, 5inch or 6inch connections to schedule 40 PVC or steel conduit, which are furnished by the Contractor, are furnished by the City of Naperville and can be picked up at the city storage yard on Aurora Road. The inside duct diameter size is 5.62 inches for 6inch SDR 13.5 and is 4.75 inch for 5inch SDR 13.5 and is 2.75inch for 3inch SDR 13.5. The contractor is advised the wall thickness of HDPE conduit is usually thicker than the wall thickness of steel conduit or Schedule 40 PVC conduit. All duct sections shall be field assembled, cut, positioned, leveled, reamed, fillers inserted, aligned, fused, connected and are to be pulled in at the same time with warning tape and are continuous. The Contractor shall use a spreader tool furnished by the Contractor to reform the HDPE Conduit from oval to round to allow for the installing of couplings. Joining shall be performed by thermal butt fusion in accordance with the manufacturer's recommendations.

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**Guided Horizontal Drilling System (HDD) (Continued)**

The conduit, at the joined inner surface area, at the interface between schedule 40 PVC plastic or steel conduit is to be field milled to a smooth level connection from one material to another. This area shall be level and smooth to allow for the cable to pass with out being obstructed by a difference in conduit thickness or diameters. The Contractor is advised that the site preparation and the process of installing 1 duct, 2ducts, 3ducts, 4ducts or 6ducts of HDPE in a duct package, may require 2 pulls or more and may require additional work to complete the installation and is included in the pricing.

The Contractor at his expense may do exploratory soil borings to determine the existing soil conditions. This information is used to determine the best work method to use, lubricant requirements, determine soil classification, determine the size and type of equipment to use for the HDD operation, determine the auger type to use, speed of installation, and back pressure to help eliminate any frac out of any kind. All work of this type is limited to the City Right of Way. The Contractor is required to HDD bore through all types and classification of earth materials i.e.: sand, clay, clayey sand, peat, mud, muck, silt, water, sandy clay, cobbles, fissured rock, hard pan, splinter rock, gravel, stones, organic materials, and small boulders less than 8 inches in diameter. However, the City will make additional payment on a per linear foot basis of a duct package installed in solid rock for a complete job if the following is met. The city shall be informed when the solid rock is found. Failure to inform the city immediately may be cause for rejecting a claim of solid rock. Solid Rock is defined as having an RDQ of at least 70 or more and bigger than 8 inches in diameter to be classified as solid rock. The Contractor shall employ a materials laboratory, at the Contractors cost, with city approval to make this determination. The final decision is made by the City.

Solid rock, as referred to herein in connection with the classifying of excavation, shall comprise and include (1) 8" diameter or bigger boulders measuring 1 cubic yard or more in volume, (2) all rock material which is in ledges, bedded deposits and unstratified masses and which cannot be removed without drilling and blasting, and (3) conglomerate deposits which are so firmly cemented as to present all the characteristics of solid rock and which cannot be removed without drilling and blasting.

When solid rock layers have an overburden of material of common classification which cannot practically be stripped and handled separately from the solid rock and/or are interspersed with a material of common classification, the entire mass will be classified as solid rock if the solid rock constitutes an area of conduit which crosses under the surfaced portion of the highway or street, the installation shall be either tunneled, jacked, driven or bored under the surface.

The ducts are to be joined together, glued where applicable, fused, and installed with the total degree of bends (vertical and horizontal) not to exceed 235 degrees in 1000 feet. The Contractor is responsible for monitoring this requirement and reports any deviation to the city. The Contractor shall provide a smooth transition from HDPE to HDPE, from HDPE to steel, from HDPE to schedule 40 PVC conduits on the outside and inside of the duct at all connection points. The area at the interface of the connection shall be smooth to the touch without more than a 1/8-inch bead of material left after fusion on the inside of the pipe. Any ridge that is larger than 1/8 inch shall be removed and reconnected to insure the connection will not separate or be an obstruction for the cable pulling process. All connections shall fit uniformly, concrete encased at each connection with ready-mix, and with equal pressure being applied on all exterior conduit pieces and fittings. Connections may be tested in the field for pulling capability at the Contractors expense as directed by the Engineer. All ducts shall be inspected for roundness prior to installing. All ducts shall be pulled to the manufactures recommended tensions. Ducts that are necked down due to pulling or become separated shall be rejected. The 3inch SDR HDPE, 5-inch SDR HDPE, 6-inch SDR HDPE conduit that becomes oval shall be cut back a maximum of 7 feet or until the pipe becomes round or is rejected if more than 7 feet is to be cut off. The contractor shall record all depth, speed information as required on the forms provided, with special interest to the duct pulling tensions, torques and depths as installed. Each pull shall be documented and the form filled out by the contractor and given to the city. Any documentation missing may result in not obtaining approval for payment. All 11, 22, 30, 45 and 90 degree steel bends or schedule 40 PVC bends shall be installed by the machine aided trenching method/or hand dug using prefabricated manufactured type steel bends.

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**Guided Horizontal Drilling System (HDD) (Continued)**

The use of 5 inch and 6 inch steel bends for all angles above 5 degrees and 3 inch steel bends for angles at 90 degrees, shall be required at all angles in the line and as directed by the Engineer. The steel or plastic ducts and the area around the ducts (sometimes called turning pits) where bends are installed shall be supported by ready-mix 3000 pound concrete delivered to the location to provide sufficient strength to withstand a pull of 10,000 lbs and remain serviceable.

Please see the specifications and drawings for the number of 3, 5, and 6- inch ducts, configurations, route, lengths and types of formations to be installed. The Contractor shall coordinate all ingress and egress to the work site with the city prior to performing the work. This work may require the Contractor to provide a detail of the work to be done in a particular area with some down time and this is considered a normal working conditions. The Contractor shall install 3 inch, 5inch and 6-inch HDPE SDR 13.5 conduit under and along all street rights of way, easements or road crossings in the number, lengths and locations shown on the drawings. All splice pits; entry and exit pits, exploratory digging, potholing by machine or hand, turning pits and staging areas to make connections of the conduit are included in the work. All conduit staging areas, entry and exit pits, exploratory digging, potholing, turning pits and splice pits shall be approved by the City of Naperville before any work is started. Failure to get approval of the staging areas, entry and exit pits may result in moving an area or pit, abandoning an area or pit and starting over at another location all at the expense of the Contractor. If at the end of a day's work to install the HDPE conduit is not completed The Contractor shall follow the following guidelines: Equipment shall be disconnected from the rods and moved back to the contractor's storage area if the drilling machine is to be left over the weekend in some one's back yard. However, if the contractor can obtain approval from the property owner and the machine can be made safe to the general public the machine can stay. The Contractor shall abide by all permit restriction and work practice methods about leaving equipment out in the General Public.

The Contractor shall, by his won inspection and by careful examination, fully convince himself as to the accessibility of the site for performing the work. The Contractor shall be responsible for maintaining the access roads during the duration of construction. Any modifications to the construction limits shall be submitted by the Contractor to the Engineer for approval at least one week prior to making any modifications

All areas disturbed by the Contractor in constructing temporary access roads and ramps shall be regarded and restored to the pre-existing conditions, or as otherwise approved by the Engineer

All conduit staging area's, turning pits, or splice pits, entry and exit pits shall be identified in the field with stakes, dimensioned and recorded in the surveyor's field book records after the job is awarded to the Contractor. This information is part of the as Build's and documentation required.

The Contractor shall not at any time leave the work area with conduit protruding above the surface of the ground at equipment location sites, turning pits, exit pits, entry pits, access pits, or splice pits. The Contractor shall dig a ditch of sufficient size to push the conduit below the ground surface for later connection. The open ends of all sections of joined and/or installed pipe (not a service) shall be plugged at night to prevent animals or foreign material from entering the pipe line of pipe section.

Waterproof nightcaps of approved design may be used but they shall also be so constructed that they will prevent the entrance off any type of natural precipitation into the pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose. The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.

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|---------------------|---------------|------------------------|---|----------------------------|-------------------------|--|--|
| PROJECT TITLE       |               |                        |   | ROUTE 59 ROAD IMPROVEMENTS |                         |  |  |
| PROJECT DESCRIPTION |               |                        |   | DETAILS AND STANDARDS      |                         |  |  |
| ENGINEER            | DRAFTING DATE | MAP #                  | SCALE   |                            |                         |  |  |
| BCC                 | 5-11-12       | 4211,4212,4223         | N.T.S.  |                            |                         |  |  |
| GIS DESIGN BY       | DRAFTED BY    | AT&T JOINT AGREEMENT # | PROJECT #   |                            |                         |  |  |
| DL                  | PSM           | N/A                    | EU-12   |                            |                         |  |  |
| CHECKED BY          | APPROVED BY   | CAD FILE               | SHEET #   |                            |                         |  |  |
|                     |               | 0060648001D144.DWG     | 44 OF 63  |                            |                         |  |  |
| Naperville          |               |                        | Department of Public Utilities<br>Electric Division |                            | WORK REQUEST #<br>60468 |  |  |