Horizontal Directional Drilling (HDD) with DI Pipe

“To the man who only has a hammer in the tool kit, every problem looks like a nail.”

Abraham Maslow

Pipe-on-Supports

Fittings
Ball and Socket Joint

Subaqueous Crossings

Why DIP for HDD?
- Strength for installation & operating loads
- Flexible restrained joints
- Hydraulic advantages
- Installation options (assembled-line & cartridge)
- Locating pipe
- No effect with temperature change/ creep
- No inventory/ training issues
- Pipe wall impermeable to VOC’s
- Proven Longevity

Pre-construction Planning
- Preliminary Studies
  - Landscape along proposed route - Video
  - Existing utilities and structures
  - Sub-surface explorations
- Legal Acquisitions
  - Right of Way Permits
  - Permits for removal of trees, shrubs
  - Environmental Permits
- Public Relations
  - Keep property owners informed and up to date
  - Plan for proper storage of materials, equipment, etc.
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Pilot Hole

Set-up Workspace & Equipment
• Survey route and establish entry and exit pit locations
• Set-up drill-rig, power-pack, mud system and navigation system

Set-up Workspace & Equipment

Drill Pilot Hole
• Various steerable drill heads used based on soil type
• Walk-over or wire-line type navigation used during drilling
Drill Pipe
Wash Pipe
Reamer
Preream

Typically required for larger pipe diameters
Hole diameter 1-1/2 times the product pipe diameter

19-inch Back Reamer
**Pullback**

- Installation of product pipe
- Reamer may be used ahead of pipe to maintain clear hole opening
- Drilling fluid (mud slurry) used to lubricate product pipe

**DI Restrained Joints for HDD**
DI Restrained Joints for HDD

Gasket Materials Available for DIP

<table>
<thead>
<tr>
<th>Description</th>
<th>Max. Service Temp. (°F)</th>
<th>Common Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBR (Styrene Butadiene)</td>
<td>150° 120°</td>
<td>Fresh Water, Sea Water Sanitary Sewage</td>
</tr>
<tr>
<td>EPDM (Ethylene-Propylene Diene Monomer)</td>
<td>250° 225°</td>
<td>Fresh Water, Sea Water Sanitary Sewage</td>
</tr>
<tr>
<td>Nitrile (NBR) [Acrylonitrile Butadiene]</td>
<td>150° 120°</td>
<td>Hydrocarbons, Fuel, Oils, Grease, Chemicals</td>
</tr>
<tr>
<td>Neoprene® (CR) [Polychloroprene]</td>
<td>200° 200°</td>
<td>Fresh Water, Sea Water Sanitary Sewage</td>
</tr>
<tr>
<td>Viton®, Fluorel® (FKM)</td>
<td>300° 225°</td>
<td>Hydrocarbons, Acids, Vegetable Oils, Petroleum Products, Elevated Temperatures</td>
</tr>
</tbody>
</table>

Consult pipe manufacturers for pertinent recommendations.

Assembled-Line Method (String-out Method)

Cincinnati, Ohio
Jackson, Michigan
216 feet of 20-inch, 2005 Horizontal Directional Drill Project with 12-inch, Polyethylene Encased Ductile Iron Pipe

Valparaiso, Indiana
September 20, 2001
Normal, Illinois
230 feet of 8-inch

HDD Project with 340 feet of 8-inch, RJ DI Pipe
Camelback Bridge
Normal, IL
July, 2003

Minimum Allowable Radius of Curve

<table>
<thead>
<tr>
<th>Maximum Allowable Joint Deflection (degrees)</th>
<th>Minimum Allowable Radius of Curve - 18 ft pipe (feet)</th>
<th>Minimum Allowable Radius of Curve - 20 ft pipe (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.00</td>
<td>340</td>
<td>380</td>
</tr>
<tr>
<td>3.25</td>
<td>317</td>
<td>352</td>
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<tr>
<td>3.50</td>
<td>295</td>
<td>330</td>
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<tr>
<td>3.75</td>
<td>275</td>
<td>305</td>
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<tr>
<td>4.00</td>
<td>258</td>
<td>285</td>
</tr>
<tr>
<td>4.25</td>
<td>243</td>
<td>270</td>
</tr>
<tr>
<td>4.50</td>
<td>229</td>
<td>255</td>
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<tr>
<td>4.75</td>
<td>217</td>
<td>241</td>
</tr>
<tr>
<td>5.00</td>
<td>205</td>
<td>230</td>
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</table>
"The polyethylene encasement used in the HDD installations was intact at every excavation point, and we had 30 excavations of pulled pipe for installation of taps, fire hydrants, and valves. So there’s no question of the polywrap making it though the pull."

Steve Gerdes – Water Director, Normal
Orion Township, Michigan  
(300, 600 & 1,000 feet of 12-inch)

Carmel, Indiana  
(40 feet of 12-inch)

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<th>MAXIMUM END PULL</th>
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**Table 1: Pulling Force**

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<th>Pipe Size (Feet)</th>
<th>Max. Pulling Force (kips)</th>
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<tr>
<td>4</td>
<td>9,123</td>
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<tr>
<td>6</td>
<td>16,427</td>
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**Table 2: Specifications**

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Meridian, MS

Pittsfield Twp, MI
30,000 feet - 8 inch

San Marcos, Texas
1,200’ – 30”

DI Restrained Joints for HDD

5. CONCLUSIONS AND LESSONS LEARNED

By October 2010 over 50,000 feet of 8-inch diameter iron pipe was installed using HDD and over 30,000 feet of 12-inch water main was established using CFR. All the water main installed for this project was tested and accepted by November 2010.

As completion of the project the top three Township priorities were met. Considering safety was the number one priority. Township employees, turbine staff and both contractors had very few (less than 3) in the project. By avoiding long trenches and chartering construction traffic in the roads, typically associated with open cut excavation, many hazards were removed from the construction site. The second Township priority of true preservation was accomplished by only using only six times on a project with tree lined streets, the community was extremely satisfied with the minimal impact to the existing green environment. The amount of road restoration costs caused by CFR and HDD saved the Township an estimated $50,000, not to mention the community issues associated with open cutting and congestion with multiple utilities.

One of the primary concerns at the beginning of the project was to ensure that the polyethylene encasement made it through HDD process. While excavating the new water main to install 36” saw cut was concerned to put in when not a single instance was observed where the polyethylene encasement had been peeled or torn from the pipe, confirming that when properly installed, polyethylene encasement is a reliable means for corrosion protection in HDD applications.

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DUCTILE IRON PIPE
THE RIGHT DECISION