TBM vs Microtunneling: When and Where to Use It

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Agenda

- Overview of Akkerman
- Overview of Slurry Microtunneling
- Slurry Microtunneling Technology
- Five Questions to Answer: When, Where and Why
- Question & Answers
Slurry Microtunneling Boring Machine (MTBM) Systems
Overview of Slurry Microtunneling

Microtunneling is a process that uses remotely controlled pipe jacking to directly install product pipe underground with tight line and grade tolerances.

- Remotely Controlled
- Accurately Guided
- Pipe Jacked
- Continuously Supported Face
Overview of Slurry Microtunneling

- Slurry Microtunneling developed by the Japanese in the early 1970’s.
- Slurry Microtunneling introduced in the United States in mid 1980’s.
- Akkerman launched first Slurry Microtunneling system in 1995.
- Currently thousands of Microtunneling systems exist globally.
Overview of Slurry Microtunneling

Although originally designed to replace small diameter open sewers in urban areas with underground gravity sewers, Slurry Microtunneling is currently used for a multitude of installations.

- Urban Interceptors
- Highway Crossings
- Railroad Crossings
- Runway Crossings
- Ocean Outfalls
- Utilities
- Lake Taps
Overview of Slurry Microtunneling
MTBM Boring Head

Diameters from 30-94.5” OD (762 – 2,400 mm) and can be outfitted with increase kits to match product pipe.

MTBM is electrically powered with a variable frequency drive.

Equipped with a project appropriate cutter face for soft ground, mixed ground and rock.

The active laser guidance system is placed inside the MTBM and reports alignment statistics to the operator in the control container.

Spoil removal takes place via closed slurry system to a separation tank.
The control container houses the control console, slurry pump control, MTBM drive motor and bulkhead for electrical and communication connections.

The operator controls all MTBM system functions from this console.
MTBM Control Container
MTBM Jacking Frames

Keiman jacking frames are designed to provide high-capacity specifications while minimizing launch shaft requirements. Jacking frames utilize keyhole type index advancing with high flow retract and winch return to optimize drive efficiency.

Keyhole jacking frames will install 10ft (3m) pipe joints standard and can be extended to accommodate longer pipe joints.
**MTBM Jacking Frame**

<table>
<thead>
<tr>
<th>Keyhole Frame Model</th>
<th>Max. Pipe OD</th>
<th>Thrust Capacity</th>
<th>Min. Shaft Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT860K</td>
<td>60” (1,524 mm)</td>
<td>800 ton @ 8,000 psi (726 mt @ 550 bar)</td>
<td>16’ (4.9 m)</td>
</tr>
<tr>
<td>MT875K</td>
<td>75” (1,905 mm)</td>
<td>MT8102K can be increased to 1,200 ton (1,090 mt)</td>
<td>20’ (6.1 m)</td>
</tr>
<tr>
<td>MT890K</td>
<td>90” (2,286 mm)</td>
<td></td>
<td>20’ (6.1 m)</td>
</tr>
<tr>
<td>MT8102K</td>
<td>102” (2,591 mm)</td>
<td></td>
<td>24’ (7.3 m)</td>
</tr>
</tbody>
</table>
MTBM Accessories
BM vs Microtunneling

How do we know When, Where and Why?

What are the ground conditions?
What is the tunnel diameter required?
What is the maximum drive length?
What is the accuracy required?
What is the depth of installation?
What are the ground conditions?

Lurry Microtunneling is most suitable for saturated, flowing and pressurized soil. Wide range of ground conditions from sands to rock. Mixed face ground conditions with cobbles and boulders suitable with proper tooling and machine configurations. Very low blow count (N-Value) conditions can be difficult.
What is the tunnel diameter required?

Kkerman MTBM diameter range from 30-94.5in (760mm-2400mm) OD increase kit assemblies available for diameter adjustments to various product pipes.
What is the maximum drive length?

Typical drive lengths for slurry microtunneling is up to around 1000 lineal feet. Extended drive lengths with potential curves possible with upgraded components such as enhanced guidance systems. Ancillary equipment such as Intermediate Jacking Stations (IJS), additional slurry pumps and guidance system technology are factors.
4. What is the accuracy required?

- Slurry microtunneling is designed to achieve the tight line and grade tolerances required for gravity flow installations.
- Akkerman MTBM systems utilize an active laser guidance system with simultaneous feedback to the operator.
- Guidance system reports horizontal & vertical position, MTBM roll, yaw and projected position.
Rifle Barrel Straight Installation
5. What is the depth of installation?

- Slurry microtunneling technology minimizes surface footprints to minimize launch shaft requirements.
- Shaft diameters of 16ft (4.8m) can accommodate up to 60in (1.5m) diameter pipe at lengths up to 10ft (3m)
Akkerman began manufacturing slurry microtunneling systems for the domestic market in 1995. We are the only U.S. manufacturer of this type of equipment. MTBMs direct install pipe from 30-94.5” (760 – 2,400 mm) OD. The MTBM pipe jacking process is remotely controlled and laser guided. Typically used in ground conditions below the water table where personnel entry is not permitted. Minimizes ground surface settlement. Installs: reinforced concrete, steel casing, fiberglass, centrifugally cast fiberglass reinforced polymer mortar, polymer concrete, clay, ductile iron, any other jacking pipe.
# Slurry Microtunneling vs. TBM

<table>
<thead>
<tr>
<th>Slurry Microtunneling</th>
<th>Versus</th>
<th>Tunnel Boring Machines (TBMs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slurry microtunneling requires a higher initial investment, experienced crew is</td>
<td>General</td>
<td>The TBM is accurate, installs a wide range of pipe sizes in varied geology, low cost of operation</td>
</tr>
<tr>
<td>necessary, use is diameter dependent, water tight shaft with pit seals, no face</td>
<td></td>
<td>and a quick learning curve with minimal training, face access for cutter head service and</td>
</tr>
<tr>
<td>access, best way to install pipe in geology under the water table, can be used in</td>
<td></td>
<td>obstruction removal, not water tight, can not be used in gaseous/explosive ground</td>
</tr>
<tr>
<td>gaseous/explosive ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-94.5” (760 – 2,400 mm)</td>
<td>Diameter Range</td>
<td>48 – 94.5” (1,200-2,400 mm)</td>
</tr>
<tr>
<td>Active, laser</td>
<td>Guidance System</td>
<td>Passive, laser</td>
</tr>
<tr>
<td>16’ (4.8 m)</td>
<td>Minimum Shaft Size</td>
<td>22.5’ (6.8 m)</td>
</tr>
<tr>
<td>Slurry separation equipment allows faster installations, minimized exposure to</td>
<td>Spoil Management</td>
<td>Conveyor and haul unit system must be emptied every 10 inches, limits diameter, length and</td>
</tr>
<tr>
<td>hazards</td>
<td></td>
<td>productivity</td>
</tr>
<tr>
<td>Most suitable for saturated and flowing materials and pressurized soil</td>
<td>Ground Conditions</td>
<td>Most suitable for conditions allowing personnel entry</td>
</tr>
</tbody>
</table>
**GBM vs. Slurry Microtunneling**

<table>
<thead>
<tr>
<th>Guided Boring Machine (GBM)</th>
<th>Versus</th>
<th>Slurry Microtunneling</th>
</tr>
</thead>
<tbody>
<tr>
<td>The GBM system offers a low cost of operation, a small work area and minimal crew training, can use pilot tubes for obstacle detection</td>
<td>General</td>
<td>Slurry microtunneling requires a higher initial investment, experienced crew is necessary, use is diameter dependent, water tight shaft with pit seals</td>
</tr>
<tr>
<td>4-48” (100-1,200 mm)</td>
<td>Diameter Range</td>
<td>30-94.5” (760 – 2,400 mm)</td>
</tr>
<tr>
<td>Active, theodolite</td>
<td>Guidance System</td>
<td>Active, laser</td>
</tr>
<tr>
<td>8’ (2.4 m)</td>
<td>Minimum Shaft Size</td>
<td>16’ (4.8 m)</td>
</tr>
<tr>
<td>Auger/dirt bucket system</td>
<td>Spoil Management</td>
<td>Slurry separation equipment</td>
</tr>
<tr>
<td>Displaceable with pilot tubes, non-displaceable with use of eliminator tooling, non-pressurized soils</td>
<td>Ground Conditions</td>
<td>Most suitable for saturated and flowing materials</td>
</tr>
</tbody>
</table>
# Microtunneling Chart

## Akkerman Slurry Microtunneling Systems

<table>
<thead>
<tr>
<th>Ground Conditions</th>
<th>Common Base Machine Sizes</th>
<th>Common Drive Lengths</th>
<th>Common Guidance System</th>
<th>Minimum Shaft Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>High ground water table</td>
<td>30 - 94.5 in. OD* (762 - 2,400 mm)</td>
<td>1,000 ft. (305 m)</td>
<td>Laser activated</td>
<td>Min. shaft = 16 ft. (4.8 m)</td>
</tr>
<tr>
<td>Wide range from sand to rock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Akkerman standard sizes can be customized to suit project needs.*