Why Trenchless Technology?!
The German Society for Trenchless Technology advocates the pioneering trenchless technology that combines economic efficiency and environmental protection. This modern approach for installing underground supply lines can be utilized for drinking water, wastewater, gas, heating, telecommunications or electricity lines.

GSTT’s goal is to promote this modern technology that has been proven and tested worldwide since 30 years. Together with international partners, GSTT is continuously working on advancing the science and the practice of trenchless technology for the public and environmental benefit.
What happens here if a pipeline has to be repaired?

A look into the underground.

A pipework like a spider’s web.

Why trenchless?!
worst case……
….a big trench
….a big building site
…. a lot of traffic jam and environment pollution

Why trenchless?!

…or like this …

**NO DIG** technologies will be used!

why digging trenches…..

..if there are better solutions?!
Advantages of trenchless method, direct costs:

- reduction of roadway rubble
- reduction of excavation and transportation of soil
- reduction of repositioning of other pipelines
- reduction of groundwater lowering

Economic savings, indirect costs:

- reduction of traffic jam
- reduction of noise- and CO₂-Emission
- reduction of risk of accidents
- reduction of risk to damage close-by buildings
- less influence of residents
- protection of vegetation and groundwater

Why trenchless?!

Savings as a result from trenchless construction from 1984 bis 2016

Saving direct costs in new constructions in the sewer field in Berlin from 1984 - 2017:

- **75 Mio. €** could be saved and thus invested in other projects
- **1,47 Mio. m²** Road surface had to be broken and therefore not restored
- **2,7 Mio. m³** Soil had to be excavated and not reinstalled or transported and disposed
- **223,000 Truckloads** had not be transported through the city
- **238 Mio. m³** Groundwater had to be not promoted (~ water supply of Berlin for approximately 14 months)
Comparison equipment use

- Conventional: 1000 m DN 100
- HDD: 100 Transports with Trucks - 2

CO₂ Emission

- Offene Bauweise (Open Construction Method)
  - CO₂ emissions

- Grabenlose Bauweise (Pipeless Construction Method)
  - CO₂ emissions
### Project details:

**Application:** main sewer  
**Location:** city; 2 track road; left track; grass strip 3m  
**Length:** 250 m  
**Depth:** 4,50 m  
**Breadth:** 1,50 m  
**Pipes:** DN 600  
**Geology:** gravel/clay (density 1,70 t/m³)  
**Groundwater:** -  

<table>
<thead>
<tr>
<th>litre Petrol</th>
<th>2,33 kg CO₂ * / 2,37 kg CO₂ **</th>
<th>litre Diesel</th>
<th>2,64 kg CO₂ * / 2,65 kg CO₂ **</th>
</tr>
</thead>
<tbody>
<tr>
<td>(total burning)</td>
<td>Source: <em>Umweltbundesamt</em>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Conditions:

- **Site-condition:** good  
- **100% removal of excavated soil**  
- **Fuel consumption (litre/kWh):** (from register of construction equipment)  
- **Diesel consumption in l CO₂-emission in kg:**  
  \[3,154 \text{ kg CO}_2/\text{kg fuel} \times 0.82 \text{ kg/L (diesel)} = 2.64 \text{ kg CO}_2/\text{litre}\]  
- **Treatment of asphalt:** per 1 to ca. 7 - 8 l diesel

**Conventional method (70 days):**  
excavation + laying + backfilling + compaction: max. 4 m / day (without road surface)  
Road finishing machine max. working breadth 2 m

**Trenchless (40 days):**  
Capacity: ca. 4 pies (12 m) / day  
Starting pit: DN 3000/DA 3600; target pit: 2x DN2500/DA3000  
Construction time: 30 h
CO₂ Emission – Beispiel konventionelle Methode

register of construction equipment (konventionelle Methode)

<table>
<thead>
<tr>
<th>Betriebsdaten</th>
<th>Beschreibung</th>
<th>Leistung</th>
<th>Verbrauch</th>
<th>Formel der Leistung</th>
<th>Betriebszeit</th>
<th>Verbrauch Diesel in kg</th>
<th>CO₂ Ausstoß in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>パーティクルCKER</td>
<td>Räder</td>
<td>10,0 kW</td>
<td>0,16</td>
<td>650</td>
<td>12,8</td>
<td>8,320,0</td>
<td>33,8</td>
</tr>
<tr>
<td>LKW/Lastkran</td>
<td>200</td>
<td>0,14</td>
<td>601</td>
<td>22,4</td>
<td>11,222,4</td>
<td>59,1</td>
<td>29,927,1</td>
</tr>
<tr>
<td>LKW/Lastkran</td>
<td>140</td>
<td>0,14</td>
<td>20</td>
<td>17,9</td>
<td>368,4</td>
<td>47,3</td>
<td>948,2</td>
</tr>
<tr>
<td>Dumper</td>
<td>3,10 kW</td>
<td>0,16</td>
<td>740</td>
<td>5,6</td>
<td>1,568,0</td>
<td>14,8</td>
<td>4,139,0</td>
</tr>
<tr>
<td>Pfahlbohrer</td>
<td>1,71 kW</td>
<td>0,16</td>
<td>6</td>
<td>53,3</td>
<td>318,7</td>
<td>140,7</td>
<td>644,0</td>
</tr>
<tr>
<td>Schneidzylinder</td>
<td>0,80 kW</td>
<td>0,16</td>
<td>20</td>
<td>10,5</td>
<td>206,9</td>
<td>27,7</td>
<td>554,2</td>
</tr>
<tr>
<td>Tandem - Vibrationswalze</td>
<td>50</td>
<td>0,16</td>
<td>40</td>
<td>3,8</td>
<td>150,6</td>
<td>93,1</td>
<td>405,5</td>
</tr>
<tr>
<td>Explosionssteigerung</td>
<td>2,7</td>
<td>0,16</td>
<td>1</td>
<td>130</td>
<td>0,4</td>
<td>56,2</td>
<td>1,0</td>
</tr>
<tr>
<td>Doppelschneidzylinder / handgeführt</td>
<td>3,82 kW</td>
<td>0,16</td>
<td>325</td>
<td>0,7</td>
<td>234,0</td>
<td>1,9</td>
<td>617,8</td>
</tr>
</tbody>
</table>

59,23 t
### CO₂ Emission – Example trenchless method

#### register of construction equipment (trenchless)

<table>
<thead>
<tr>
<th>Betriebsdaten</th>
<th>Beschreibung</th>
<th>EBO 2001</th>
<th>Leistung</th>
<th>Verbrauch</th>
<th>Verbrauch Trenchless</th>
<th>CO₂ Ausbrüt in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anlageneinheit</td>
<td>Bem. ca. 40 Tage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stromaggregat - Leistung (200kW)</td>
<td>Kesselo</td>
<td>286</td>
<td>0,15</td>
<td>0,6</td>
<td>120</td>
<td>23,9</td>
</tr>
<tr>
<td>Stromaggregat - Stilstrick</td>
<td>Kesselo</td>
<td>286</td>
<td>0,15</td>
<td>0,2</td>
<td>170</td>
<td>5,0</td>
</tr>
<tr>
<td>Schaltschrank auf Festbetten</td>
<td>Kesselo</td>
<td>100</td>
<td>0,15</td>
<td>0,8</td>
<td>200</td>
<td>12,0</td>
</tr>
<tr>
<td>UMW / Muldenkipper</td>
<td>Kesselo</td>
<td>200</td>
<td>0,14</td>
<td>0,5</td>
<td>58</td>
<td>22,4</td>
</tr>
<tr>
<td>UMW / Drehkreiskipper</td>
<td>Kesselo</td>
<td>180</td>
<td>0,14</td>
<td>0,5</td>
<td>42</td>
<td>17,9</td>
</tr>
<tr>
<td>Pelleler</td>
<td>Kesselo</td>
<td>50</td>
<td>0,16</td>
<td>0,7</td>
<td>55</td>
<td>5,4</td>
</tr>
<tr>
<td>Doppelvertikutonatoren / handgeführt</td>
<td>Kesselo</td>
<td>5</td>
<td>0,16</td>
<td>0,3</td>
<td>5</td>
<td>0,7</td>
</tr>
</tbody>
</table>

**Total CO₂ Emission:** 22,25 t
CO₂ Emission - Example

trenchless method 22,2 tons CO₂
conventional method 59,2 tons CO₂

267 % more
CO₂ -Emission!

CO₂ Emission - Example

CO₂ -emissions due to traffic jam, conventional method:
100 cars / duration 15 minutes
(2,48 kg CO₂ / l - 10 l / h fuel consumption)
→ 0,62 t CO₂ (100 cars / 15 min)
→ 2,48 t CO₂ (100 cars / h)
→ 14,88 t CO₂ (2 x 3 h / day)
→ 74,44 t CO₂ (2 x 3 h x 5 days)
→ 1,041,60 t CO₂ (2 x 3 h x 70 days)
CO₂ Emission - Example

trenchless method 22.2 tons CO₂
conventional method 59.2 tons CO₂ + 1,041.6 tons CO₂

~ 5000 % more

CO₂ - Emission!

Overall view Trenchless Technologies

New Installation
  Geological Survey
  Semi Trenchless
    Wide Trench
    Narrow Trench
    Ploughing
    Vacuum Excavation
  Trenchless
    Directional Horizontal Drilling (HDD)
    Auger Boring
    Pipe Ramming
    Impact Moling
    Pilot Tube
  Location
    Ground Penetrating Radar
    Sonar
    Potholing

Trenchless Construction Technologies
  Renovation
    Non-structural
      Cement mortar Lining
      Epoxy Lining
      Polyurethane Lining
  Structural
    Close-fit Sliplining
    Tight in Pipe Lining (TIP)
    Slippining
    Spiral Wound Lining
    Glass-fibre reinforced CIPP Lining
    Felt CIPP Lining

Rehabilitation
  Condition Assessment
    CCTV
    Leak Detection
  Location
    Ground Penetrating Radar
    Sonar
    Potholing
    Sensor-based pipe run survey
  Replacement
    Pipe Bursting
    Pipe Splitting
    Pipe-Eating
    Pipe Extraction
    Joint Grouting
    Localised Sealing
    Potholing for Local Repair
    Repair with Sleeves
    Flood Grouting
  Repair
    Grinding and repair robots
Why Trenchless Technology ?!

3 Examples of the plurality of trenchless techniques:

For New Construction:
- HDD - Horizontal Directional Drilling (DN 25 – DN 1800)
- Microtunnelling (DN 250 – DN 4200)

For Rehabilitation:
- CIPP - Cured-in-place pipe rehabilitation (DN 50 – DN 1800)
Overall view Trenchless Technologies

Horizontal Directional Drilling (HDD)
Horizontal Directional Drilling (HDD)
Horizontal Directional Drilling (HDD)
Horizontal Directional Drilling (HDD)

- 300 m Länge – 15 t-Anlage
- 460 m Länge – 20 t-Anlage
- 800 m Länge – 100 t-Anlage
- 2100 m Länge – 450 t-Anlage

QUELLE: Tracto Technik
Horizontal Directional Drilling (HDD)
Microtunnelling with auger soil removal

Diagram showing the process of microtunnelling with auger soil removal.
Microtunnelling with slurry system
Microtunnelling with slurry system
CIPP - Cured-in-place pipe rehabilitation - Glas-Fibre-Liner Design

CIPP - Setup of the building site and preparation works
CIPP - Setup of the building site and preparation works

CIPP - Pull-in of the pre-liner
CIPP - Pull-in of the Glas-Fibre-Liner

CIPP - Expansion of the Glas-Fibre-Liner
CIPP - Curing process with UV-light train

CIPP - Cured-in-place pipe rehabilitation
Symposium and Exhibition  
26 – 28 March 2019  
www.NODIGBERLIN.com  
Fairground Berlin

**Sitevisiting** at 2017-03-30:  
approx. 500 visitors visit  
approx. 12 construction sites with  
Trenchless Technologies

---

**Dr.-Ing. Klaus Beyer**  
Executive Director  
German Society of Trenchless Technology E.V. (GSTT)