

Trenchless Innovations from Germany



TRENCHLESS ASIA FOR SMART CITY

17th June 2016
Hong Kong



Dr.-Ing. Klaus Beyer
Executive Director

German Society of Trenchless
Technology e.V. (GSTT)



iSTT – International Society for Trenchless Technology

Approx. 3.500 members in approx. 55 countries (Societies in 27 regions)



Trenchless Innovations from Germany



- Inspection
- Repair / Renovation
- Renewal / New Construction



Trenchless Innovations from Germany



- Inspection
- Repair / Renovation
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TV-Inspection - Electronical sewer mirror FastPicture

made
in
Germany

The new **FastPicture** camera was developed to quickly monitor the condition of the sewer.

Technical Properties:

- **FULL HD** -camera (1920x1080)
- Zoom 360 x (30 x optical / 12 x digital)
- Battery and mains operation power supply
- Recording with digital recorder (H.264) by USB

Some new options :

- Tilt angle $-45^{\circ}/+90^{\circ}$
- Gas-sensor
- Additional HDMI output
- Changable battery
- Tripod und harness
- Holder for drop manhole
- Sun shade



TV-Inspection - Electronical sewer mirror FastPicture

made
in
Germany



TV-Inspection for small diameter HD pushing with water

made
in
Germany

Pan & tilt camera, turn off able

Operating range DN 80 – 200

Able to negotiate bends
45° from DN 80

Able to negotiate bends
87° from DN 100

Camera diameter
56 mm.

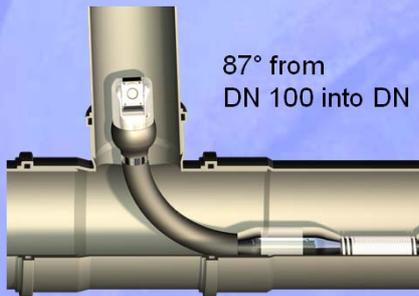


ritec

GSTT

TV-Inspection for small diameter HD pushing with water

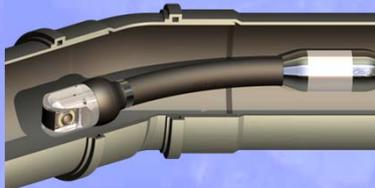
made
in
Germany



87° from
DN 100 into DN 100



45° from
DN 80 into DN 80



Pan & tilt camera head and
unimpeded view

ritec

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The MAC method (**M**ecanique d'**A**uscultation des **C**onduits) made in Germany

1. Find the weakness in waste water sewer
2. Determination of the suitable rehabilitation method for the sewer
3. Attend the rehabilitation procedure
4. Review the success of the rehabilitation procedure
5. Prove the long-term effect of the rehabilitation procedure

IKT GSTT

The MAC method (**M**ecanique d'**A**uscultation des **C**onduits) made in Germany

Specification of the MAC system:

- To gauge the deformation force and the deformation trajectory

global stiffness: $K_G = F/d_1$ Transfer factor: $\Omega = d_2/d_1$

- Measuring **different types** of sewers
- Size of sewers: useable by **DN 800** to **DN 1500**
- Various **materials**: concrete, brick or synthetic
- **Non-destructive** method of measurement

IKT GSTT

The MAC method (Mecanique d'Auscultation des Conduits)

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Germany

Target: Inspection and testing the stability of large pipes:



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Trenchless Innovations from Germany

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Germany

- Inspection
- Repair / Renovation
- Renewal / New Construction

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LATERAL PREPARATION SYSTEM

made
in
Germany

SEWER to LATERAL (STL)

WORLDWIDE UNIQUE SATELLITE SYSTEM
for cutting, inspection and cleaning
from main sewer (DN 200 mm – 600 mm)
to lateral (DN 100 mm – 150 mm)



Winner of the



NO DIG
AWARD 2015



IMS
Robotics

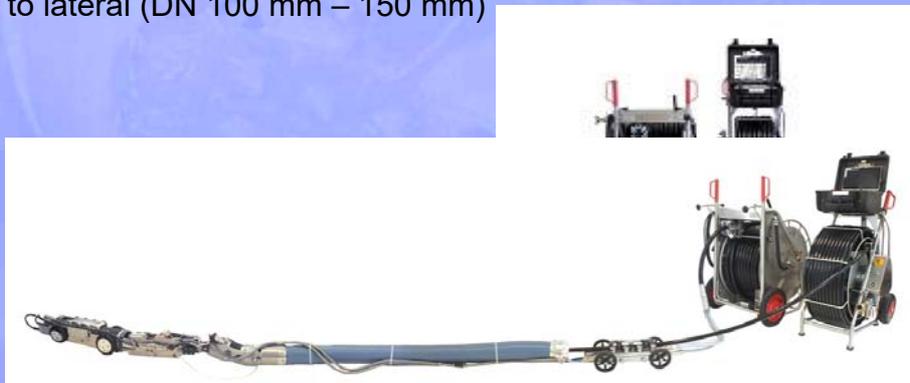
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LATERAL PREPARATION SYSTEM

made
in
Germany

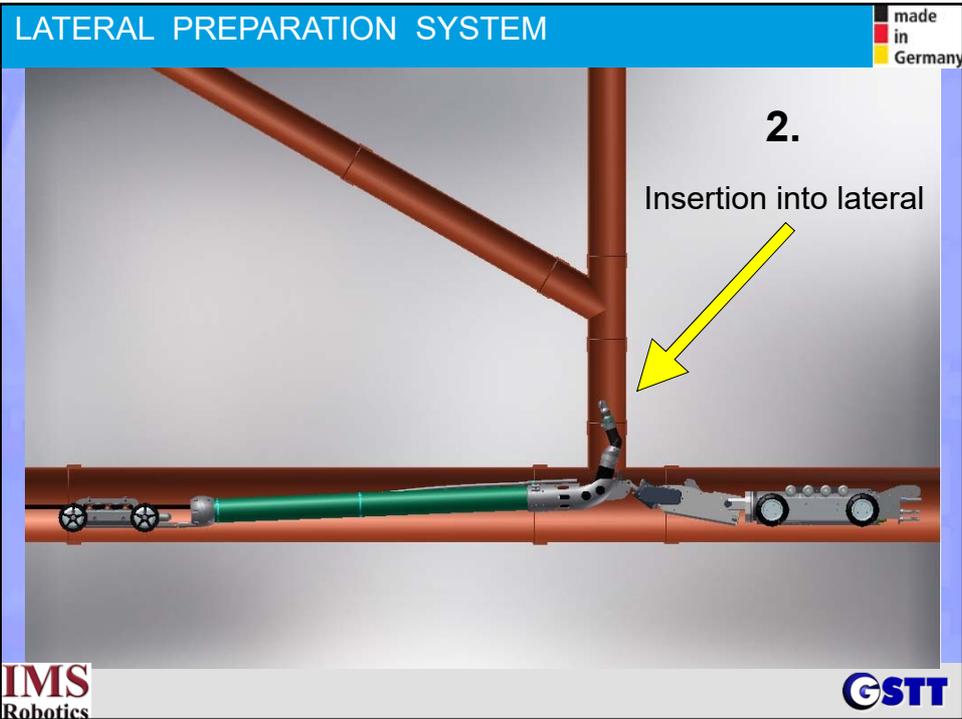
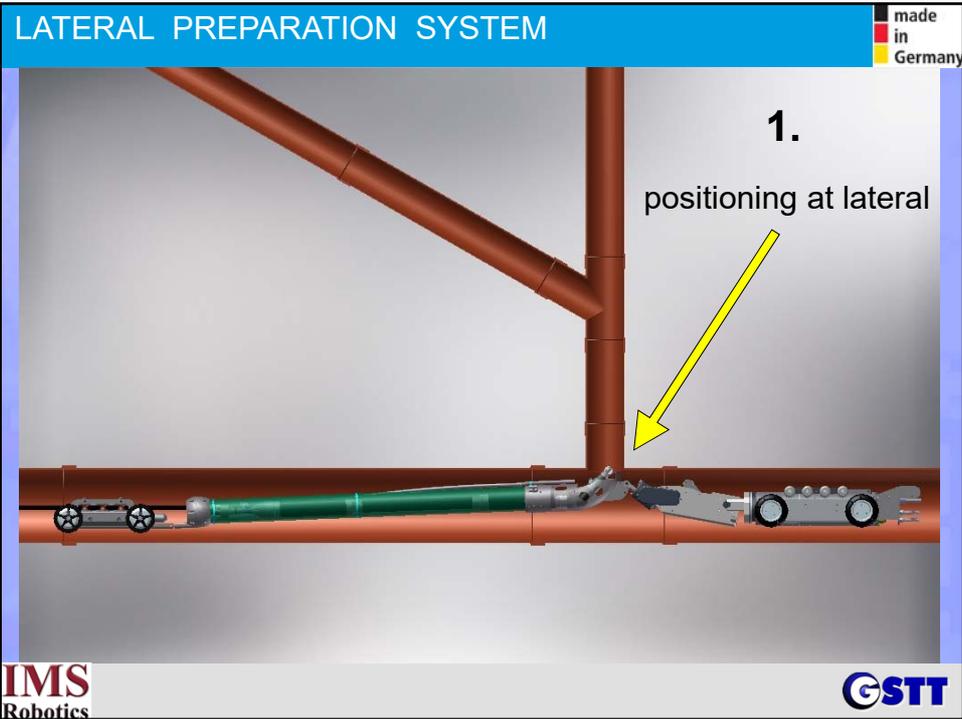
SEWER to LATERAL (STL)

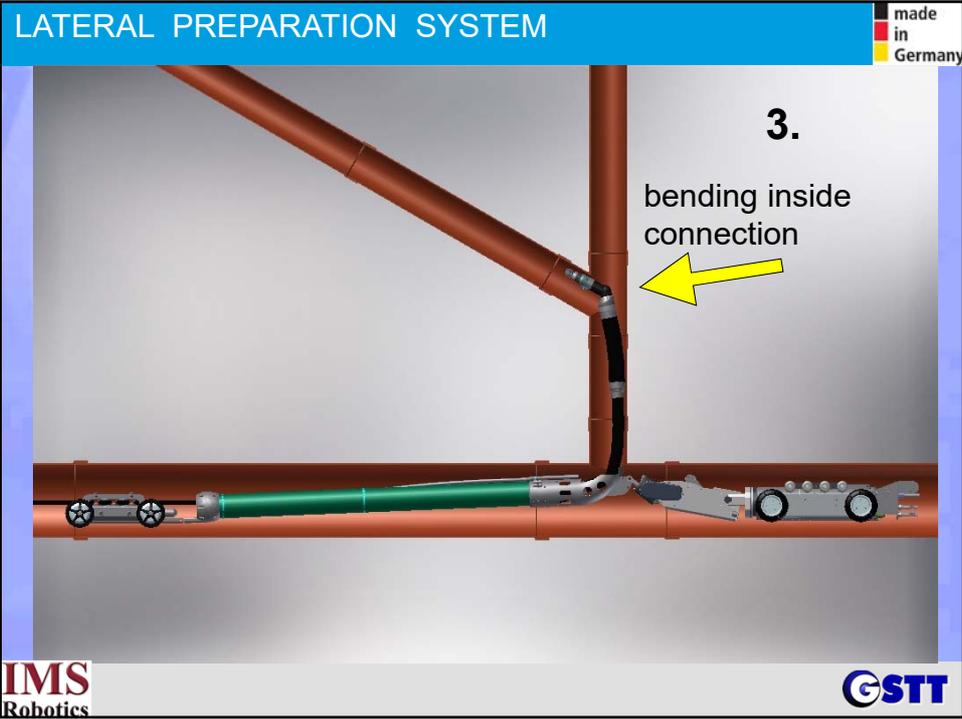
WORLDWIDE UNIQUE SATELLITE SYSTEM
for cutting, inspection and cleaning
from main sewer (DN 200 mm – 600 mm)
to lateral (DN 100 mm – 150 mm)



IMS
Robotics

GSTT





CIPP - Cured-in-place pipe rehabilitation up to 1800 mm



Alphaliner1800 for diameters up to DN 1800:

- Unique glass fibre material based on the innovative “Ultrapipe” ECR glass fibre
- Higher transparency, better and quicker curing
- Different layout of the random and transverse fibre orientation to create technical properties

Alphaliner1800	Technical data
Elastic modulus short-term value acc. DIN EN 1228	20380 MPa
Elastic modulus short-term value 5% quantile acc. DIN EN 1228	16304 MPa
Elastic modulus long-term value acc. DIN EN 1228	12445 MPa
Elastic modulus short-term value 5%- quantile acc. DIN EN ISO 178	13857 MPa
Bending strength short-term value 5% quantile acc. DIN EN ISO 178	280 MPa
Bending strength long-term value	213 MPa
Reduction factor 50 years	1,31 [-]
Wearout value as per CEN/TR 15729	0,23mm
Wear layer	0,5mm
Grouping DWA-M 144-3	MKG 24
DIBt approval	Z-42.3-447

RELINEEUROPE



CIPP - UV curing technology - Benefit of the undersize



- No wrinkles in deformed pipes and offsets.
- Lateral connections easily detected.
- Reduction and prevention of annular gaps between host pipe and the liner (corrosion in concrete pipes can increase its diameter).
- Static design formulas allow only very limited gaps. Annular gaps dramatically influence the loading capability of a CIPP.



CIPP - Cured-in-place pipe rehabilitation - expandability

made
in
Germany

Job site - Berolina-Liner ID 800 [32 inch] 11,0 mm wall thickness



Before installation of the Berolina-Liner After installation of the Berolina-Liner



CIPP - UV curing technology - highest mechanical properties

made
in
Germany

The innovative GRP-Liner for the trenchless rehabilitation of sewer pipes with the world's **highest** mechanical properties up to **DN 1600 mm**

- Extremely high mechanical properties
 - Better handling through lower weight
 - Shorter curing time
 - Even more economical
 - Approved by DIBt Z-42.3-350
- | | |
|---|----------------------------------|
| ▪ Short-term circumferential E-Modul (ring stiffness) | ≥ 20,500 N/mm ² |
| ▪ Long-term circumferential E-Modul (ring stiffness) | ≥ 16,000 N/mm² |
| ▪ Short-term bending E-Modul (three-point bending) | ≥ 16,800 N/mm ² |
| ▪ Short-term bending strength (three-point bending) | ≥ 270 N/mm ² |
| ▪ Long-term bending strength (three-point bending) | ≥ 210 N/mm ² |
| ▪ Reduction factor A after 10 000 h | 1.28 |
| ▪ Dimension range | DN 150 - 1,600 mm |
| ▪ Wall thickness in cured condition | 3 - 15 mm |



Also available with internal coating as solid ingredient:
SAERTEX-LINER® Premium Type S*



CIPP - UV curing technology for Drinking Water

made
in
Germany

SAERTEX-LINER® H₂O

The world's first curable GRP-Liner for the trenchless rehabilitation of potable water pipes: **Third party approved, environmentally friendly & sustainable!**

Structural classification of the Liner

- according to DIN EN ISO 11295 / AWWA M28

Certifications:

- NSF / ANSI Standard 61
- DVGW – W 270 and KTW Guideline,
- Ordinance 2914:2011

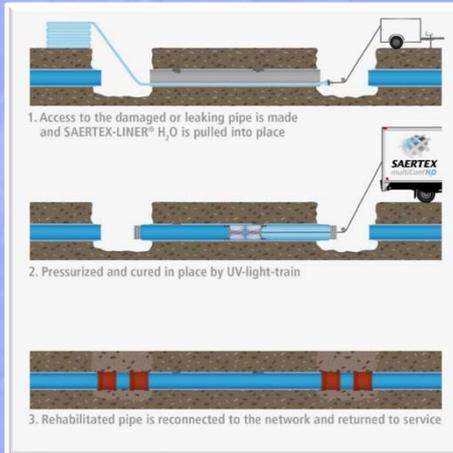
Due to high mechanical properties

- Very thin walls are used
- High pressure applications are possible

Diameter range

- 8 - 48 in (200 - 1200 mm)

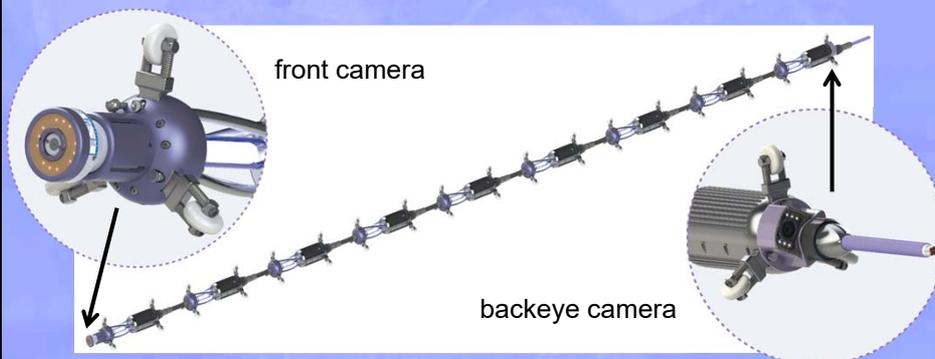
The Liner can withstand external and internal pressure, including a vacuum.



New UV System for Renovating Drinking-water Pipelines

made
in
Germany

With the revolutionary *nuVision* concept for light curing of drinking-water pipelines, I.S.T. is putting a patent-protected technology on the market that allows for cables up to 1,000 meters in length.



New UV System for Renovating Drinking-water Pipelines

made
in
Germany

nVision - All of the benefits at a glance:

- Revolutionary ignition technology
- Cables can be extended up to 1,000 meters
- Cuts the control cabinet size by more than half
- No temperature problems for the cable or cable drum
- Infinitely variable output of up to 2,000 watts per beam
- Simultaneous video recording of front and backeye camera images
- Optimal quality control for the curing process at every liner position
- The individual modules of the light chain can be plugged in anywhere
- BUS system for constant data transmission of all curing parameters



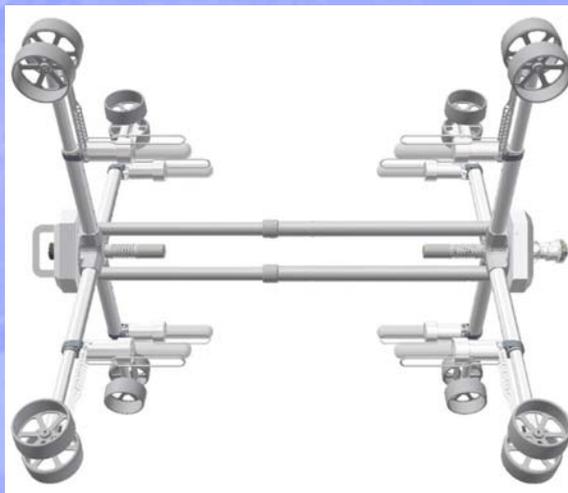
IBG
creating value

GSTT

UV-Core DN 1100 -1600

made
in
Germany

- Light core with 8 UV-bulbs
(opt. 16 UV-bulbs,
750 watts each)
- 1200 / 1500 watts
per bulb
- (12 KW total output)
- electric driven set-up
of the single core
- manual extension
for optimum
illumination



IBG HydroTech®
Cleaning • Robotic • WPT
Lining Systems

GSTT

UV-Patch System for short liners

made
in
Germany

allows the rehabilitation of
damaged pipe sections
From DN 150-600 (6" – 24")

- max. occupancy with short liners up to 100 cm (40")
- 3 UV-bulbs (250 watts each)
- articulated joint for better inserting through manhole into the channel
- curing time of only 8 minutes



IBG HydroTech[®]
Cleaning • Robotic • WPT
Lining Systems

GSTT

Multi Tophat cap placement-system

made
in
Germany

for lateral rehabilitation in main pipes from
DN 250-600 (10" – 24")

Flexible system to use for:

1. cold-curing top-hat profiles with silicate resins
2. top-hat profiles with epoxy resins (incl. heating shield)
3. UV-curing with UP-resin (polyester)



IBG HydroTech[®]
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Lining Systems

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STREET TO HOME

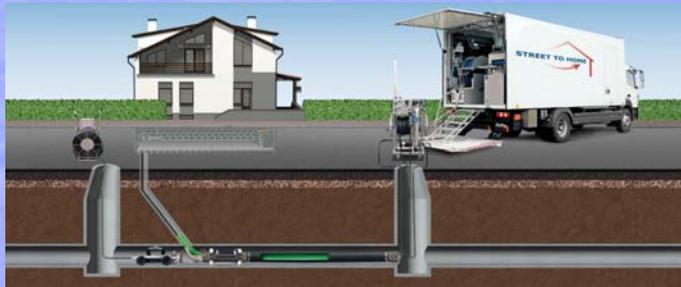
made
in
Germany

for lateral relining from of the main pipe

The system allows inverting GRP-Liner against flow direction with open-end-method :

Positioning unit and inversion unit are placed into the main pipe (> DN 250 relined) from two opposing manholes.

From there, after coupling of the units, the rehabilitation of the lateral (> DN100) is carried out.



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Lining Systems

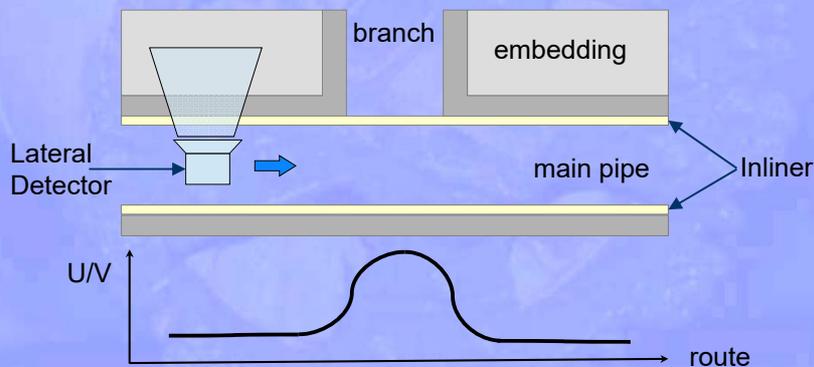
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CIPP – Lateral detector

made
in
Germany

IBAK – Lateral Detector Sensor system for locating branches in rehabilitated sewer pipes

Proceeding: An antenna is routed along the liner wall. The output signal of the sensor changes depending on the structure detected behind the wall.



IBAK
robotics

GSTT

IBAK – Lateral Detector Sensor system for locating branches in rehabilitated sewer pipes

With this innovative technology it is possible to locate and cut open branches (size DN 80 or larger) to be opened after liner insertion.



Gefördert durch:
Bundesministerium
für Wirtschaft
und Energie
aufgrund eines Beschlusses
des Deutschen Bundestages

IBAK – Lateral Detector Sensor system for locating branches in rehabilitated sewer pipes

The sections graphic from the camera inspection serves as basis

- it is not necessary to scan the entire pipe again.

It is possible to find dry branches as well as those with water behind the liner.

The operator receives a visual reference of where the optimal opening point is.

- 1st step: it can be marked with a marking device that is adapted on the cutter robot
- 2nd step: the cutter automatically moves to the optimal opening point, and thus it can be reliably opened



Gefördert durch:
Bundesministerium
für Wirtschaft
und Energie
aufgrund eines Beschlusses
des Deutschen Bundestages

Manhole rehabilitation technologies

made
in
Germany

cleaning
equipment



M-Coating ready
to begin, after
cleaning with the
TSSR

HERMES
TECHNOLOGIE 



Manhole rehabilitation technologies

made
in
Germany

motor
coating
equipment



**M-Coating
Automatical
shaft renovation**

Spray motor

- Thickness 5 – 100 mm
- Depth until 30 m
- Diameter 0.5 – 3,0 m
- Anticorrosion
- Structural renovation

HERMES
TECHNOLOGIE 



Manhole rehabilitation technologies

made
in
Germany

motar
coating



M-Coating after
partial coating with
ERGELIT

HERMES
TECHNOLOGIE 



Manhole rehabilitation technologies

made
in
Germany

Automatically coating of hybrid-silicate ombran CPS
in the case of biogenic acid corrosion



HS Coating Head







Trenchless Innovations from Germany

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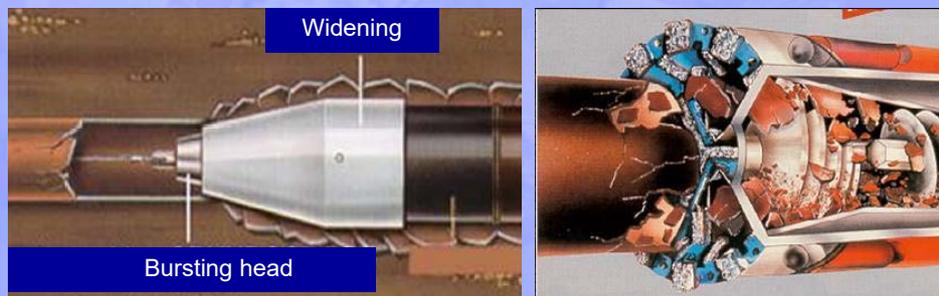
- Inspection
- Repair / Renovation
- Renewal / New Construction



PRT – Pipe Replacement Technology

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Germany

So far only pipe bursting and modified micro tunneling systems (pipe-eating method) are available for a pipeline corridor, trenchless replacement of old pipelines.



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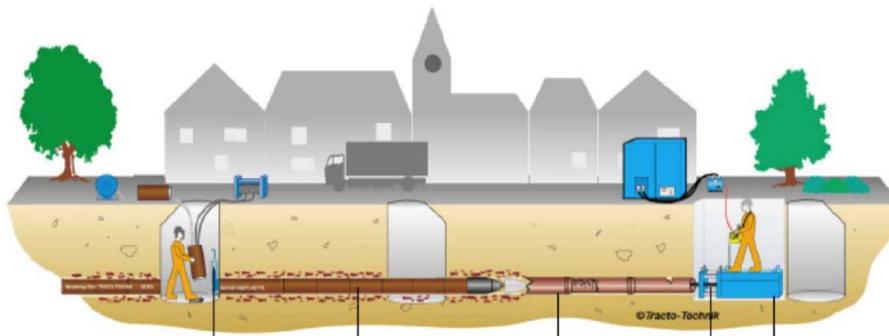


PRT – Pipe Replacement Technology

made
in
Germany

Pipe bursting method

A prerequisite to utilize this method is that the surrounding ground can be displaced; major increases of dimensions are often problematic or impossible.



Strech (tension) unit New pipe Old pipe Pull rod Static pulling device

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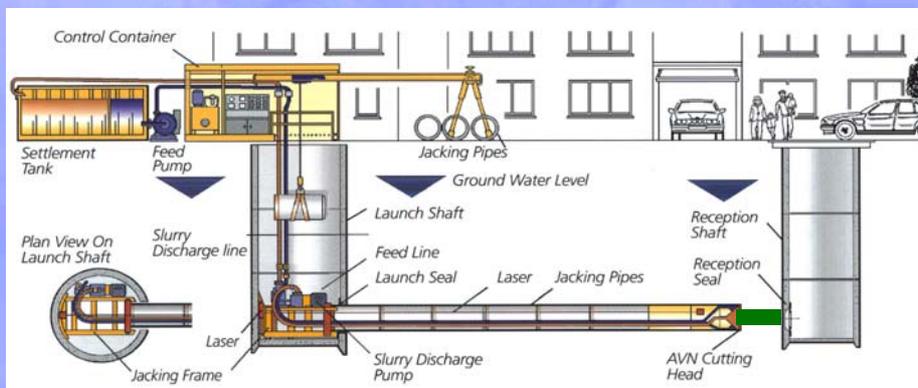
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PRT – Pipe Replacement Technology

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Germany

Pipe Eating systems

technical perfected systems
...but too long construction time



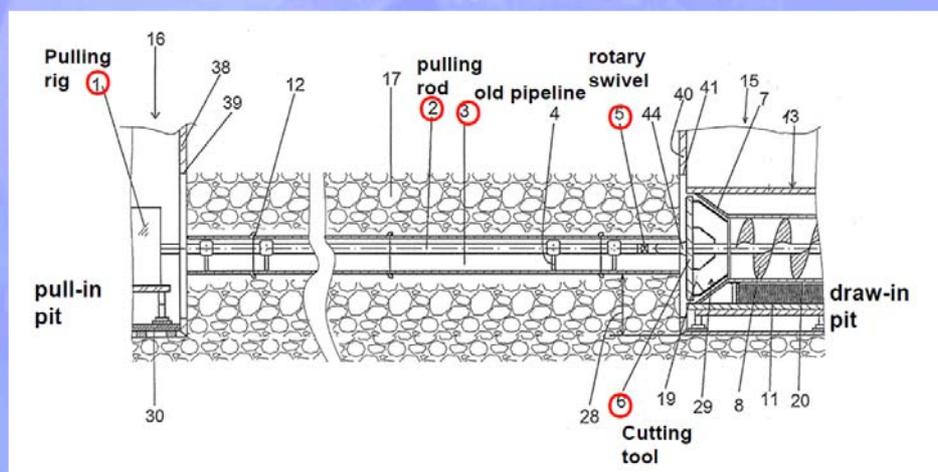
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Pipe Eating systems

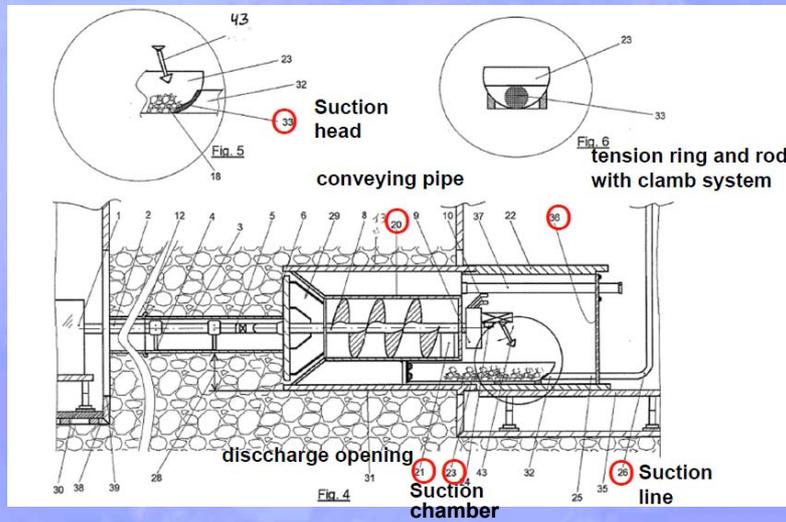
The new inventive technology will especially be utilized when regular pipe - bursting can no longer be applied, because the soil cannot be displaced or because a necessary dimension enlargement is not sufficient displaced, or respectively if there is a guideline that the old pipe must be removed completely.

With this new technology it is possible to lower the construction time by 60 - 80%.



PRT – Pipe Replacement Technology

made in Germany



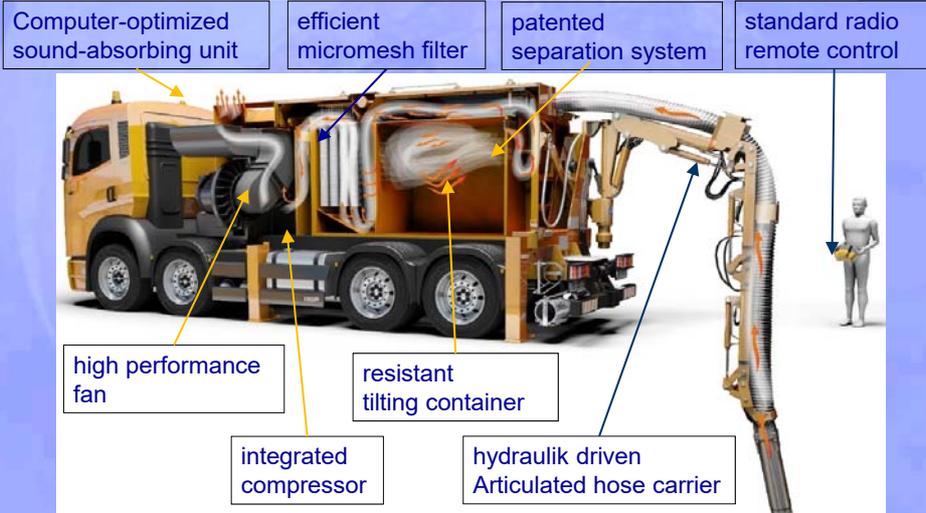
removal of drilled material is done with a suction excavator

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INGENIEUR CONSULTING



PRT – Pipe Replacement Technology

made in Germany



Suction Excavator - patented suction principle

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Suction Excavators – a wealth of applications made in Germany

BUILDING SECTOR			
	EMERGENCY SERVICE		
			TREE RENOVATION

Suction Excavators – a wealth of applications made in Germany

CIVIL ENGINEERING			
	DISPOSAL		
		CLEANING OF FLAT ROOFS	

Suction Excavators – a wealth of applications made in Germany

BUILDING RENOVATION

OPEN CAST MINING

CHEMICAL PLANTS

TRACK LAYING

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PRT – Pipe Replacement Technology made in Germany

Short pipe pulling

Clamb system

New short pipe

Cutting head

Pulling rod in the old pipe

Pulling rig

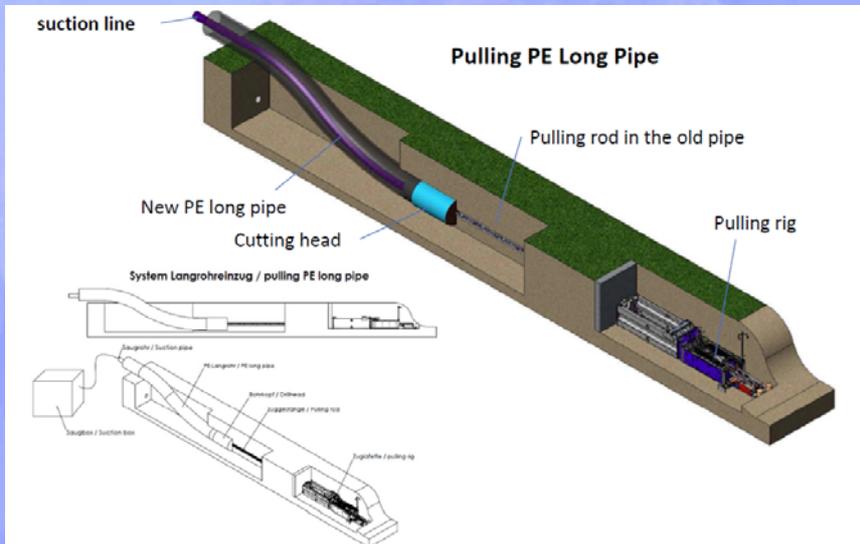
System Kurzrohrinzug / Short pipe pulling

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PRT – Pipe Replacement Technology

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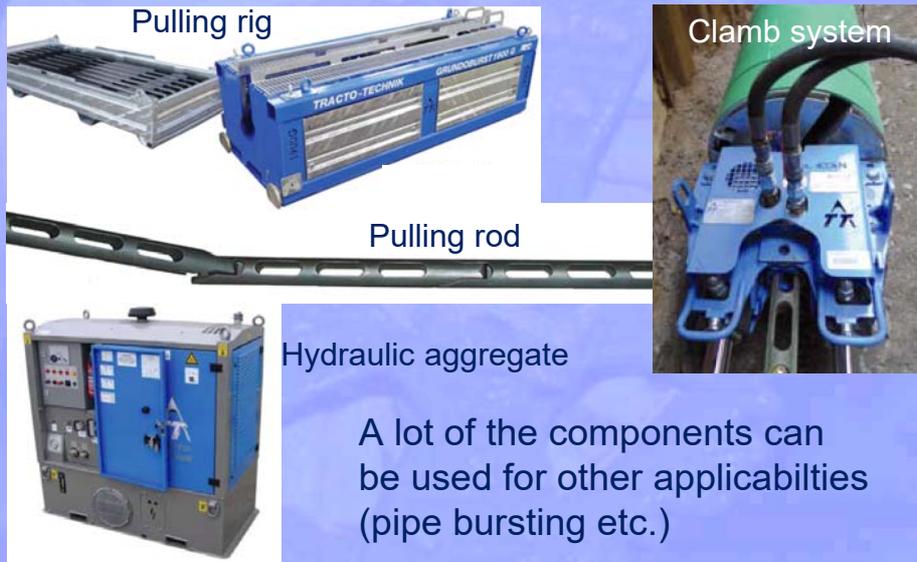


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PRT – Pipe Replacement Technology

made in Germany



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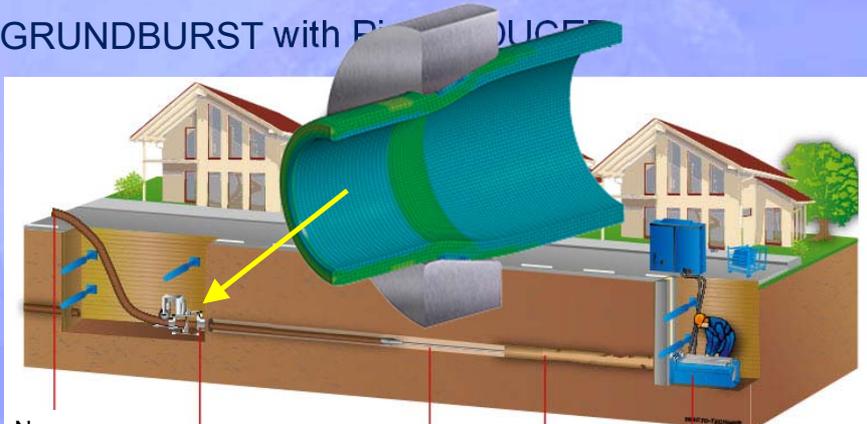


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PE close-fit pipe lining

made
in
Germany

GRUNDBURST with PipeREDUCER



New PE-pipe PipeREDUCER QuickLock rods old pipe GRUNDBURST rig

In the process of pulling in, the PE pipe string is reduced by 5 - 12 %, due to cold deformation. When the pulling-in operation is completed, the pipe string can relax against the wall of the old pipe in a close fit (memory effect).



GSTT

HDD - Rock Drilling Rig

made
in
Germany

with Prime Double Rod System and „on board“ pump

- HDD-Compact Rig for rock drilling equipped with double rod magazine
- First rock drilling rig in this high-performance category (> 50 t)
- Inner and outer rods are independently driven by two flotable rotary heads
- high torque (up to 90,000 kN)
- Use of any common locating system possible
- Application with standard drill pipes



Prime Drilling
HDD-Technology

GSTT

HDD - Rock Drilling Rig

made
in
Germany



 Prime Drilling
HDD-Technology

 GSTT

MDD – Rigs 0° - 90° (Multi Directional Drilling)

made
in
Germany

up to 5.000 kN pull force (500 t)
up to 120 kNm torque

Typical applications:

- recovery of inactive oil and gas wells
- recovery of operational wells (sidetracking)
- hydro-geological purposes
- production of other natural resources
- geological prospecting purposes
- exploration of crude hydrocarbons
- installation of pipelines
- mine rescue operations
- preliminary decontamination of coal beds
- preliminary decontamination of methane drainage
- arrangement of sea gates
- arrangement of discharge lines
- capital repairs of producing oil and gas wells

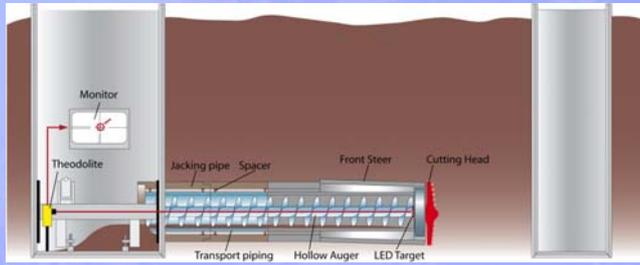


 Prime Drilling
HDD-Technology

 GSTT

Guided Auger Boring with Front Steer and Inner Pipe
 Transport inside of Hobas OD860

made
 in
 Germany

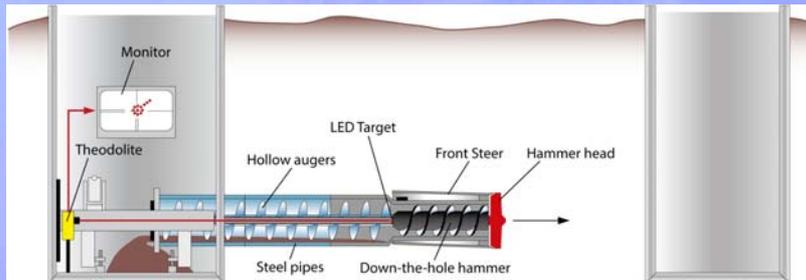


Bohrtec

GSTT

Guided Auger Boring with Front Steer and Optical Path in
 Extremest Ground Conditions

made
 in
 Germany



Bohrtec

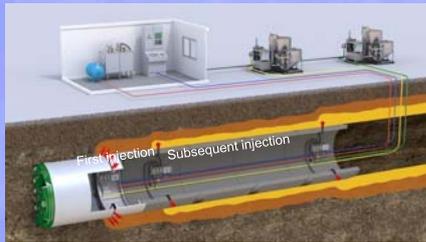
GSTT

Bentonite lubrication with VOLUME CONTROL

made
in
Germany

Advantages of volume control in lubrication:

- Optimizes lubrication volume on specific tunnel sections according to geology
- Controls distribution of bentonite along the tunnel
- reduces jacking forces
- minimizes the use of intermediate jacking stations
- saves time and money
- Visualization on control panel and reporting of bentonite volume, pressure and friction forces



CAMERA SYSTEM in excavation chamber

made
in
Germany

- Suitable for Utility Tunnelling machines ID 1600-3000
- Camera with cleaning system and lighting installed in the upper part of excavation chamber
- Visualization on monitor in control container
- Visual check of cutting tools and conditions in excavation chamber
- Better planning of tool exchange and man entry

Work safety:

- Evaluation of the tunnel face stability before man entry
- Monitoring of working personnel in the excavation chamber



ONE-STEP pipeline installation technologies - DIRECT PIPE®

made
in
Germany

- Trenchless:
use of Microtunnelling Slurry machine, Pipe Thruster in launch shaft
- Pipeline diameter range: 30" - 60"
- Possible crossing length:
up to 1,400 m depending on project conditions and diameter
- Approved for different pipeline coatings



ONE-STEP pipeline installation technologies - PIPE EXPRESS

made
in
Germany

- Semi-trenchless:
use of Microtunnelling machine (screw conveyor) and trenching unit,
Pipe Thruster in launch shaft
- Pipeline diameter range: 36" - 60"
- Possible drive length: up to 2,000 m
- Overburden: 0.5 - 2.5m
- Advance rates of up to 500 - 1,000 m/day





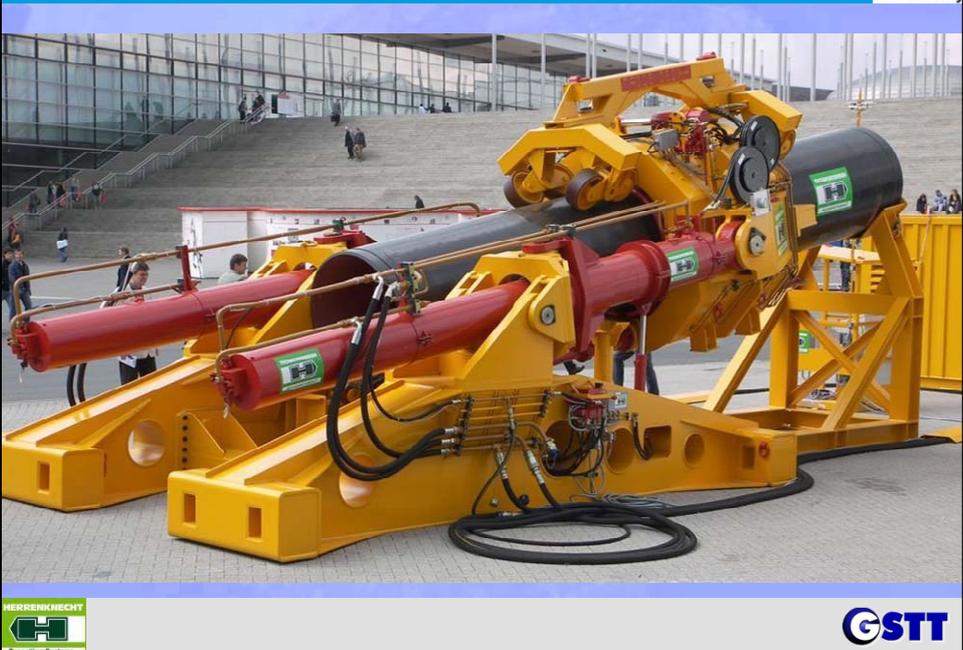
ONE-STEP pipeline installation technologies - PIPE EXPRESS

made
in
Germany



ONE-STEP pipeline installation technologies - Pipe Thruster

made
in
Germany



Jacking Pipes - vitrified clay pipes

made
in
Germany

INTERMEDIATE JACKING STATION FOR VITRIFIED CLAY JACKING PIPE DN 1200

- second Job site: Peine (Germany), Dungenbeck
- Length 260 m, DN 1200
- ground condition: gravel, sand and ground water level 0,5m under earth surfaces
- construction company: STRABAG Germany



**STEINZEUG
KERAMO**

GSTT

Jacking Pipes - vitrified clay pipes

Microtunnelling with slurry systems

- Bolzano Italy
- 1200 m DN 800
- Difficult soil conditions, gravel and big stones
- Reinforced concrete caisson shafts
- construction company: MAX BÖGL (branch Schwabach) Germany



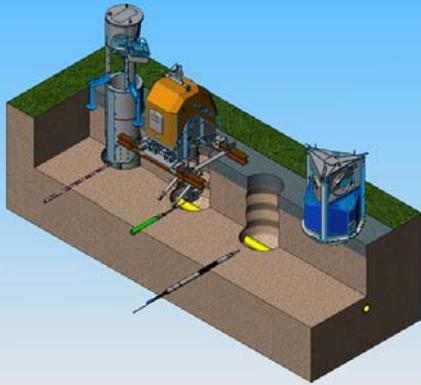
**STEINZEUG
KERAMO**

GSTT

Keyhole-Technology + Trenchless Technique

made
in
Germany

A Tiny Circle - the Construction Pit of the Future



Application range:

- installation of new property service connections with non-directional **GRUNDOMAT impact moles**
- installation of new property service connections with the directional drill rig **GRUNDOPIT-K**
- replacement of new property service connections with the cable winch **GRUNDOTUGGER**
- sleeve sealing of cast iron and steel lines
- repair of high pressure PE pipe lines
- insertion of survey slots
- pipe line inspection
- corrosion protection sacrificial anodes

Where the keyhole technique is applied, surface damage and consequential costs only too well known from open trench installation methods are insignificant. The performance of soil and surface works is safer, more productive and less elaborate. Inspection of the construction pit is not required.



Keyhole-Technology + Trenchless Technique

made
in
Germany

Establishing a keyhole using a core drill



- the core drill CD 650 bores a hole of 650 mm in diameter in the road surface.
- after all other jobs are done, the bore core yielded in this working step is reinserted into the road surface, fitting perfectly.
- a suction excavator takes up the soil covering the main line
- installation of the Pit K rig and performance of the bore with wall duct into the basement
- connection with the main line is carried out above the surface.



Trenchless Innovations from Germany



We invite you, to visit the NO DIG BERLIN 2017 in conjunction with WATER BERLIN INTERNATIONAL.
Here you can see life the newest Trenchless Innovations from Germany



Symposium and Exhibition
28 – 31 March 2017
www.NODIGBERLIN.com
Berlin Exhibition Grounds

More than 500 Visitors will
transported with 20 busses to
more than 15 sitesites



Trenchless Innovations from Germany



Questions?

Dr.-Ing. Klaus Beyer

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Thank you for your attention

Dr.-Ing. Klaus Beyer
Executive Director

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