

Trenchless Innovations from Germany

made in Germany



Dr.-Ing. Klaus Beyer
Executive Director

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

GSTT

Trenchless Innovations from Germany

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World Trenchless Congress
25th September 2017, Medellin



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GSTT

*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 over 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.*

Approx. 3.500 members in approx. 55 countries (Societies in 28 regions)



- Inspection
- Repair / Renovation
- Renewal / New Construction

- Inspection
- Repair / Renovation
- Renewal / New Construction

CCTV-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°/+90°
- Gas-sensor
- Additional HDMI output
- Changable battery
- Tripod und harness
- Holder for drop manhole
- Sun shade



CCTV-Inspection for smal diameter HD pushing with water

made
in
Germany

Pan & tilt camera, turn off able

Operating range DN 80 – 200

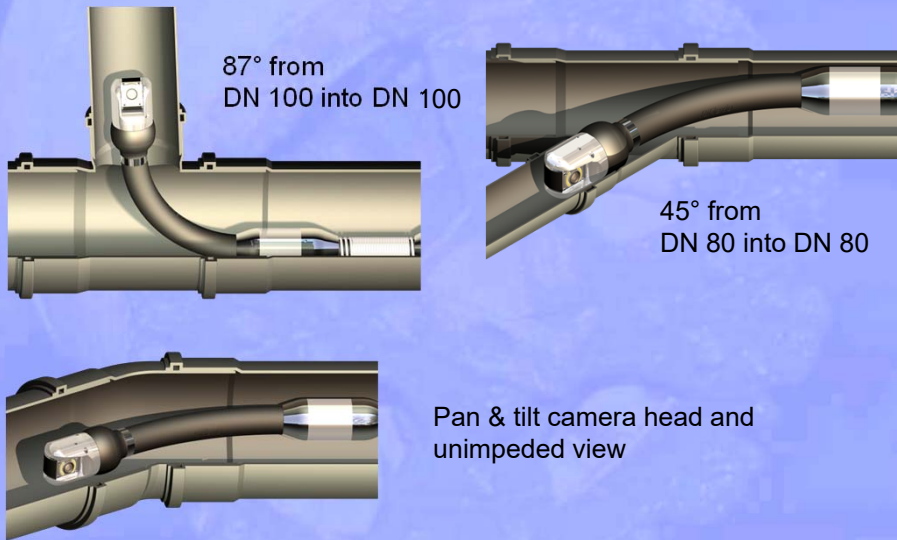
Able to negotiate bends
45° from DN 80

Able to negotiate bends
87° from DN 100

Camera diameter
56 mm.



CCTV-Inspection for smal 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 **GSTT**

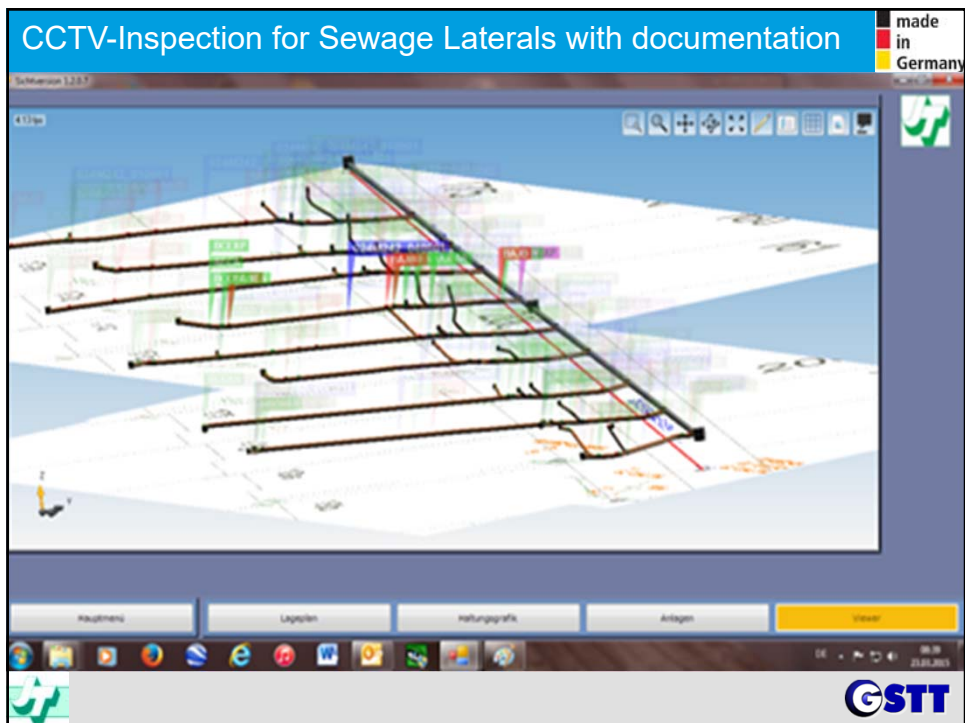
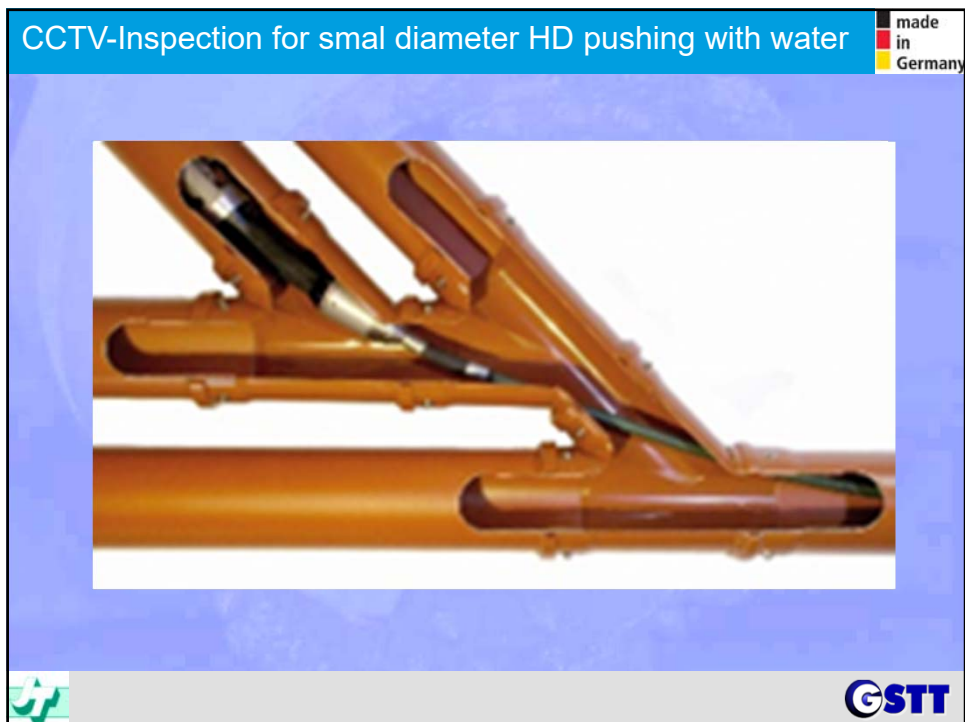
CCTV-Inspection for Sewage Laterals with documentation made in Germany



Lindauer Schere & ASYS 3D
(scissors from the German town Lindau)

- bendable pan and tilt colour camera for the holistic recording and documentation of lateral sewer
- Retractable guide device allows always a free and clear camera image
→ completely panned by
- 90° degrees and circled 360 degrees
- Inspection of branched pipe systems from DN 100 to DN 200
- Range up to 40 m in the lateral pipe (pushing technology)
- Range up to 120 m in the lateral pipe (water high pressure technology)
- **3D-seawage measurement ASYS 3D**

A **GSTT**



Trenchless Innovations from Germany



- Inspection
- Repair / Renovation
- Renewal / New Construction



LATERAL PREPARATION SYSTEM



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



LATERAL PREPARATION SYSTEM

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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)



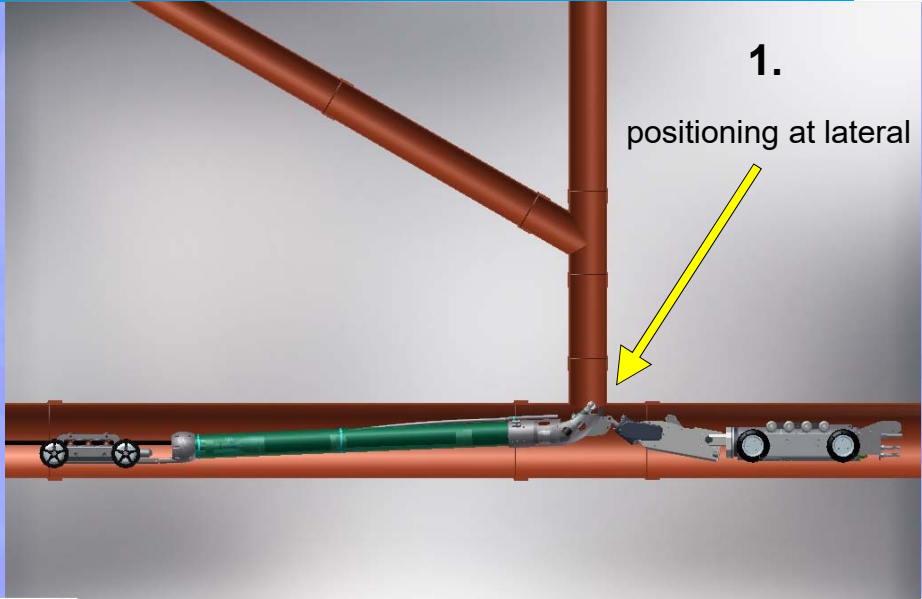
IMS
Robotics

GSTT

LATERAL PREPARATION SYSTEM

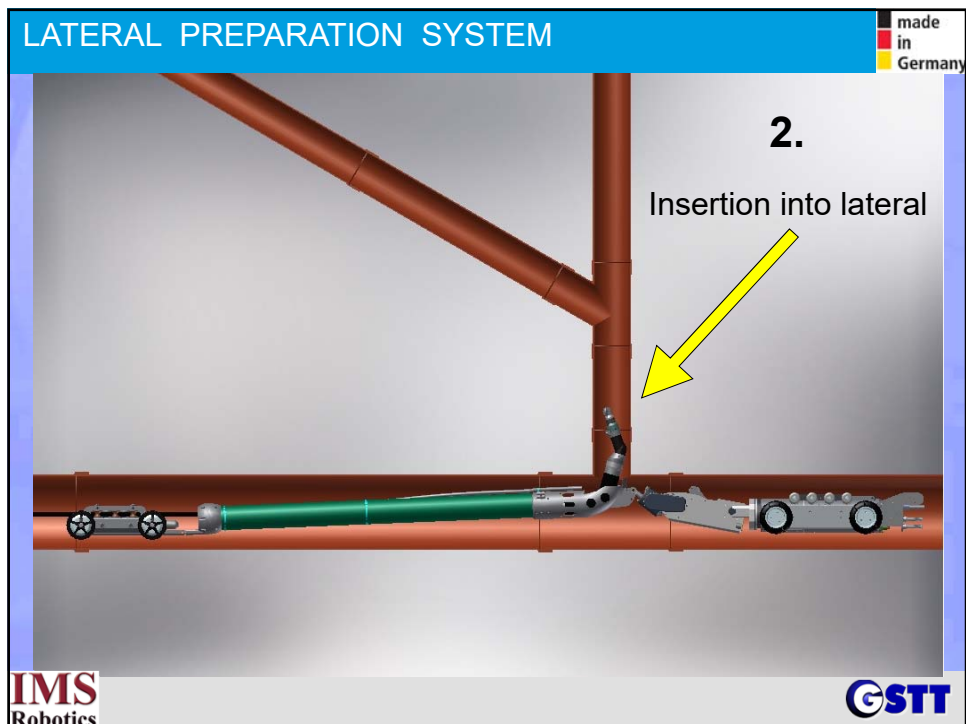
made
in
Germany

1.
positioning at lateral



IMS
Robotics

GSTT





CIPP - Cured-in-place pipe rehabilitation with double wall

made in Germany

Alphaliner500G with double wall construction:

- A special, patented double wall construction
- Extremely tight, resin rich back wall with closed foil shell
- Covering of the structural load-bearing core of the Alphaliner
- Protection against environmental influences
- Perfect long-term safety
- Extension of the service life
- DIBt approval Z-42.3-447

Double wall and outer film
Structural thickness –
Statically relevant element
Defined wear protection layer
Removable inner film

RELINEEUROPE®

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



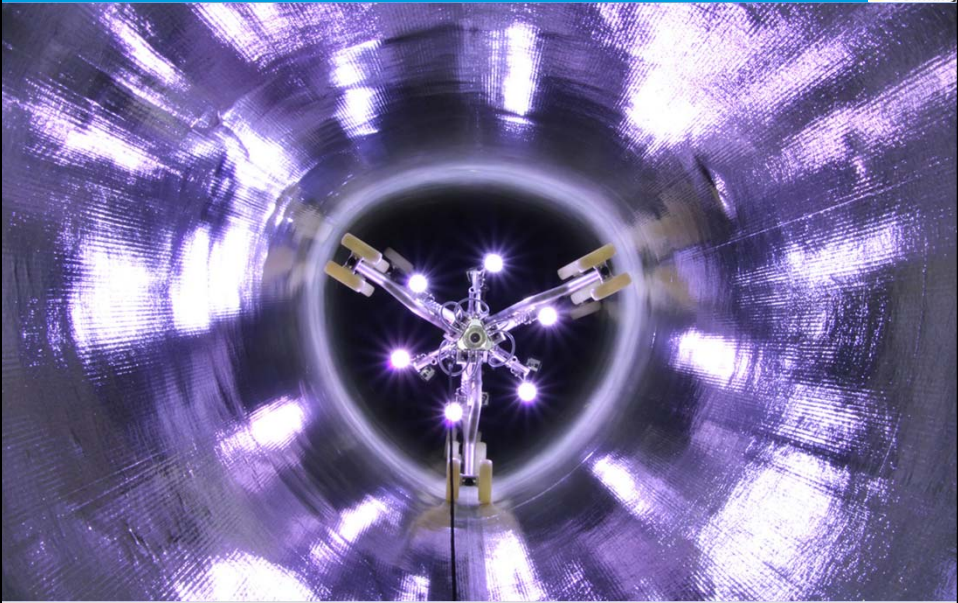

Before installation of the Berolina-Liner After installation of the Berolina-Liner

SL 11.1 m HR 3:00 HP -0°↑

BKP **GSTT**

UV – Light -Train

made in Germany



IMPREG **GSTT**

CIPP - UV curing technology for Drinking Water



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

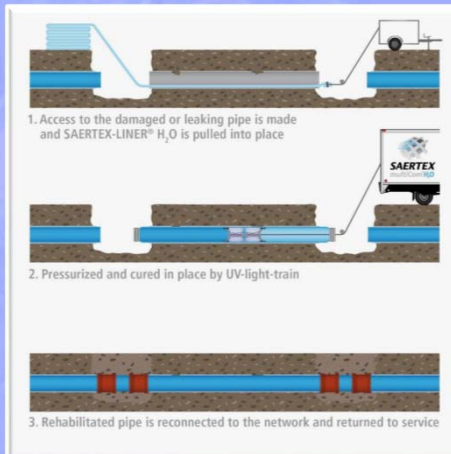
Due to high mechanical properties

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

Diameter range

- 8 - 48 in (200 - 1200 mm)

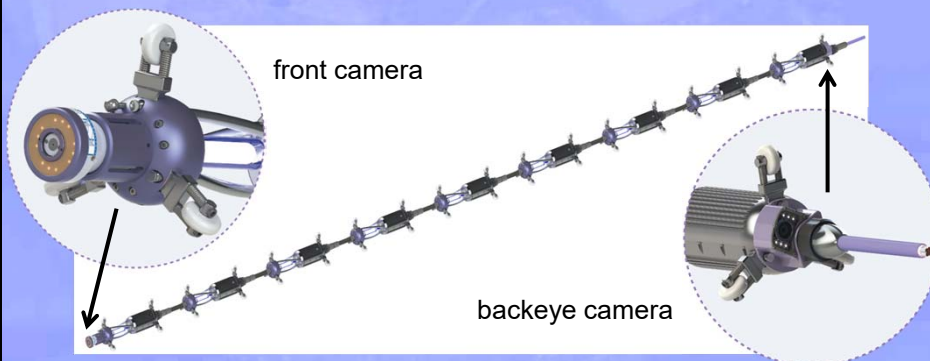
The Liner can withstand external and internal pressure, including a vacuum.



New UV System for Renovating Drinking-water Pipelines



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.

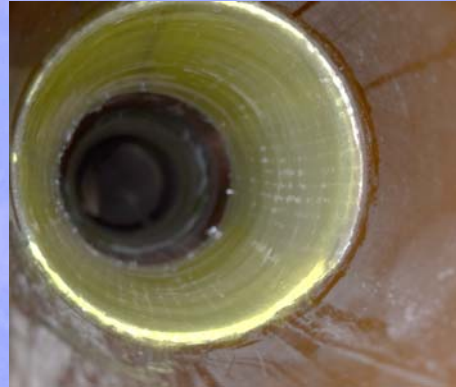


UV-Patch System for short liners



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



Multi Tophat cap placement-system



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)



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.



IBG HydroTech®
Cleaning • Robotic • WPT
Lining Systems

CSTT

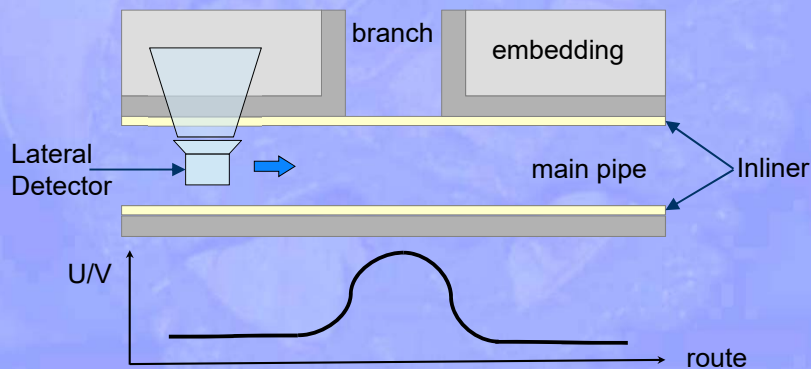
CIPP – Lateral detector

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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


CSTT

CIPP – Lateral detector




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

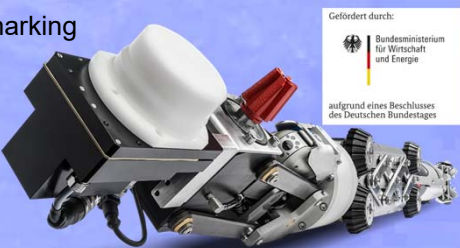



CIPP – Lateral detector



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

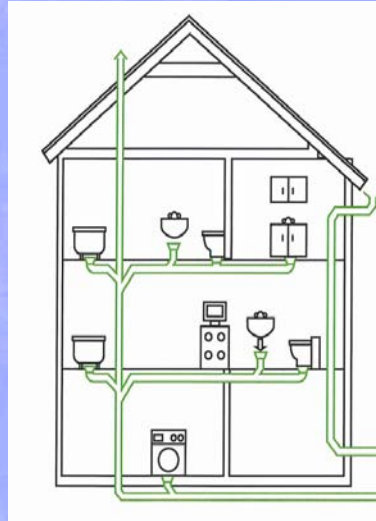
aufgrund eines Beschlusses des Deutschen Bundestages

pipe rehabilitation with spraying method for small diameter

made
in
Germany

- Spray-Liner® is innovative and combines specific techniques and materials of pipe renovation.
- This patented spraying method allows to renovate sewage pipes with inner diameters starting from 34 mm, horizontally or vertically.
- Spray-Liner renovates without any demolition or excavation work.
- clean, rapid and cost-effective.
- It can be used for inhouse rehabilitation or laterals

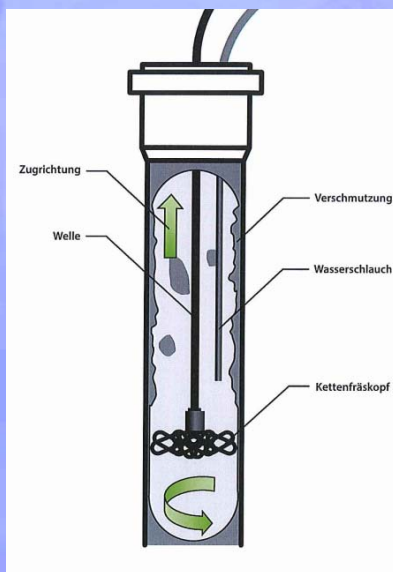


spray-liner®

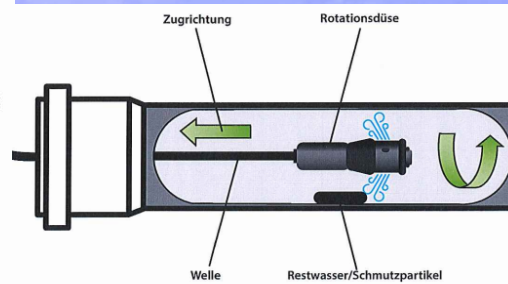
GSTT

pipe rehabilitation with spraying method for small diameter

made
in
Germany



Cleaning
before



spray-liner®

GSTT

pipe rehabilitation with spraying method for small diameter

made
in
Germany

Excellent for pipe
diameters from 34mm
to 155mm
Can also be used in
combination with liners



sprayliner

GSTT

Manhole rehabilitation technologies

made
in
Germany

cleaning
equipment



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

HERMES
TECHNOLOGIE




GSTT

Manhole rehabilitation technologies

made
in
Germany

motar
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



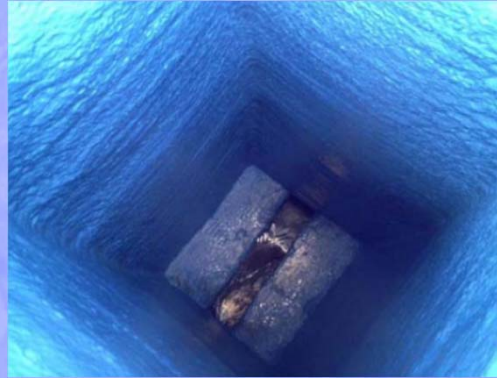
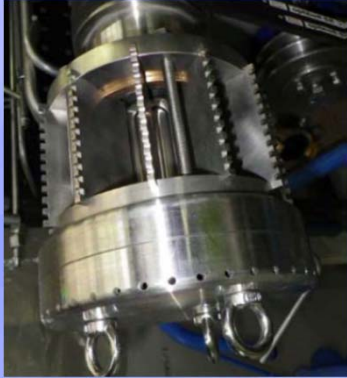


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Manhole rehabilitation technologies



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



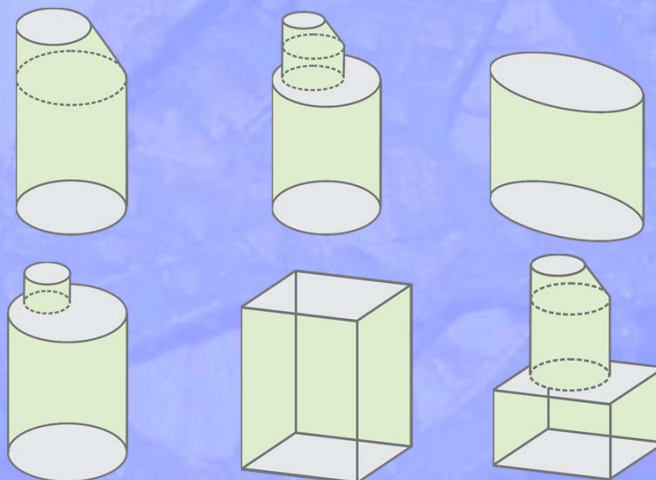
HS Coating Head



Manhole rehabilitation technologies



GRP – Liner with UV curing technology
in different shapes of usual manholes



Manhole rehabilitation technologies

made
in
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VERTILINER®

CSTT

Manhole rehabilitation technologies

made
in
Germany



VERTILINER®

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Trenchless Innovations from Germany



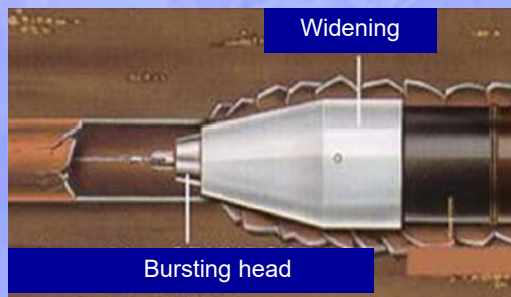
- Inspection
- Repair / Renovation
- Renewal / New Construction



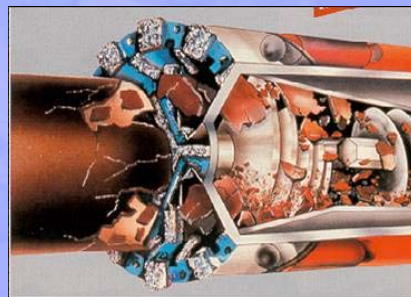
PRM – Pipe Replacement Method



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



pipe bursting



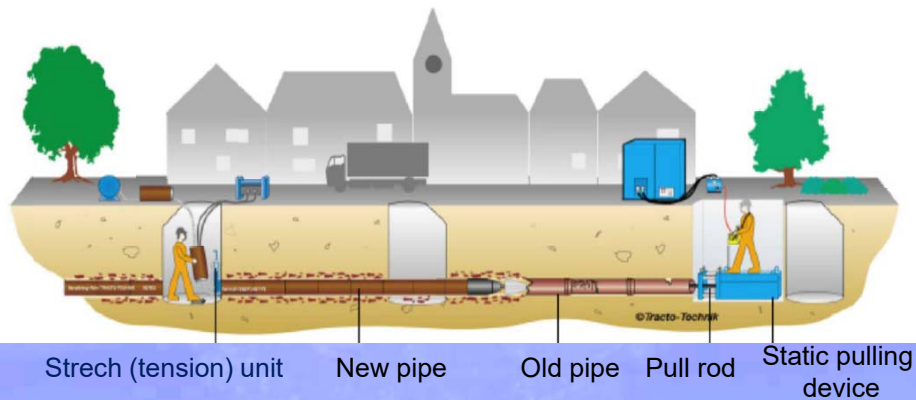
pipe eating

PRM – Pipe Replacement Method

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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.



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INGENIEUR CONSULTING

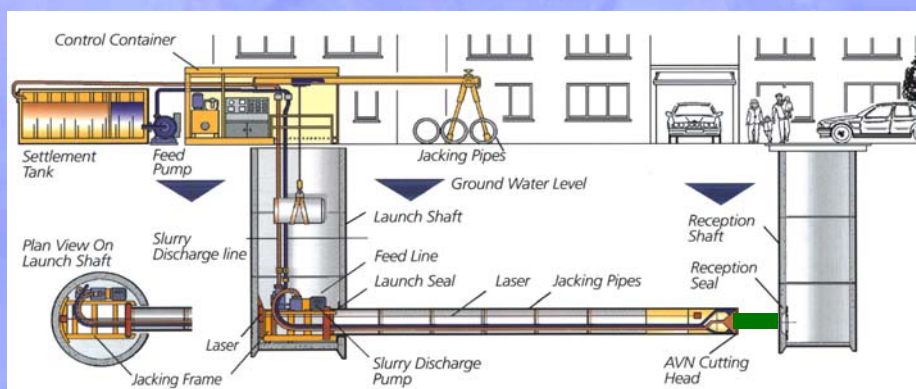
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PRM – Pipe Replacement Method

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Pipe Eating systems

technical perfected systems
...but too long construction time



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PRM – Pipe Replacement Method



An Example: Advance length 60 meters, d = days

Pipe-eating method with slurry system:

set up 3.5 d, pipe eating 6.0 d, dismantling 2.0 d Σ 11.5 d

Pipe-eating method with guided auger system:

set up 2.5 d, pipe eating 6.0 d, dismantling 1.5 d Σ 10 d

The new Invention method with short pipes*:

set up 1.0 d, pulling process 2.5 d, dismantling 0.5 d Σ 4 d

*for example polymer concrete jacking pipe

The new Invention method with PE Long pipes:

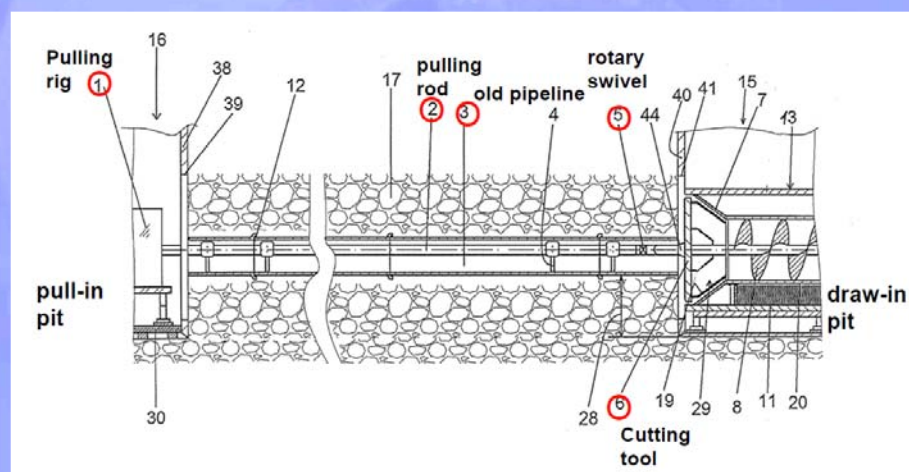
set up 1.0 d, pulling process 1.0 d, dismantling 0.5 d Σ 2.5 d

60 % - 80 % lower construction time!

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PRM – Pipe Replacement Method

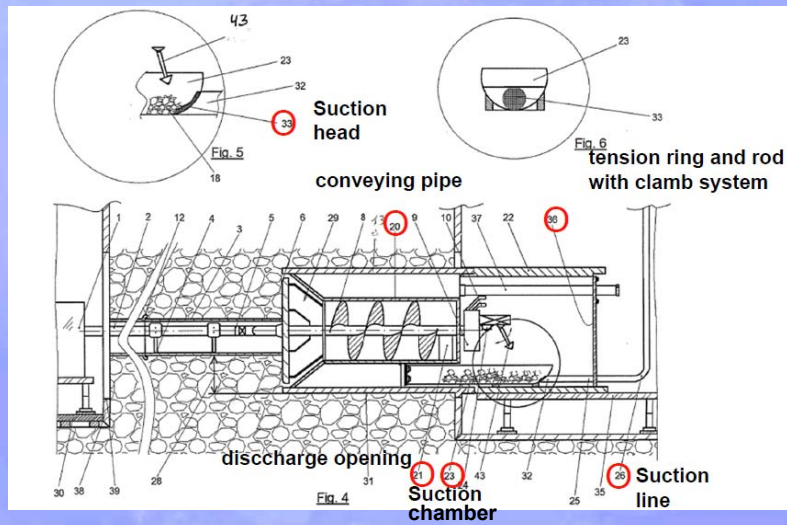


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PRM – Pipe Replacement Method

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removal of drilled material is done with a suction excavator

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PRM – Pipe Replacement Method

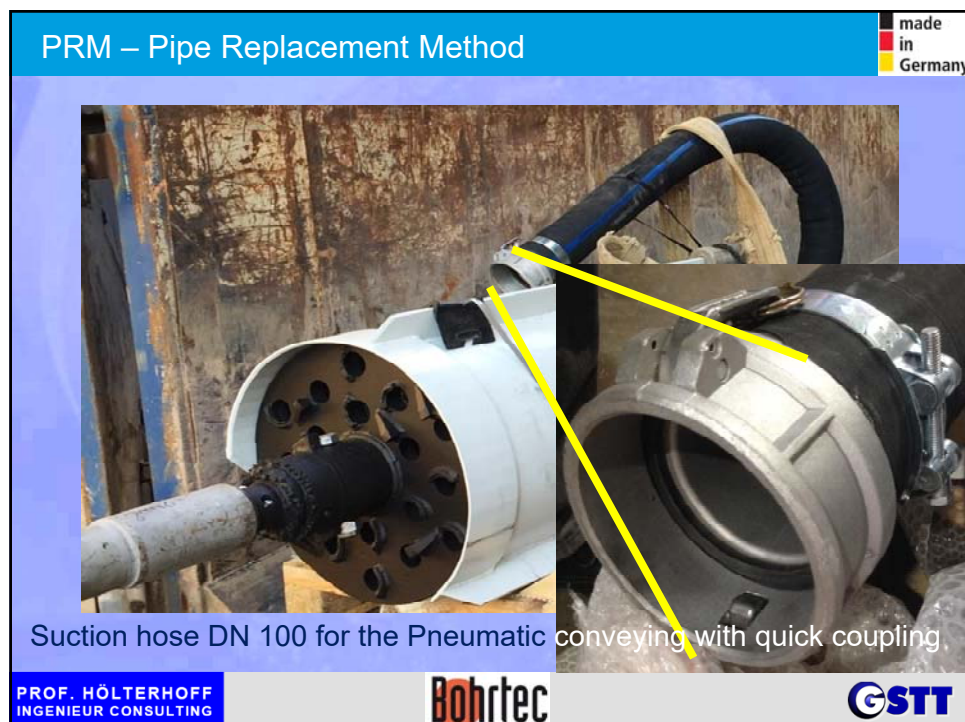
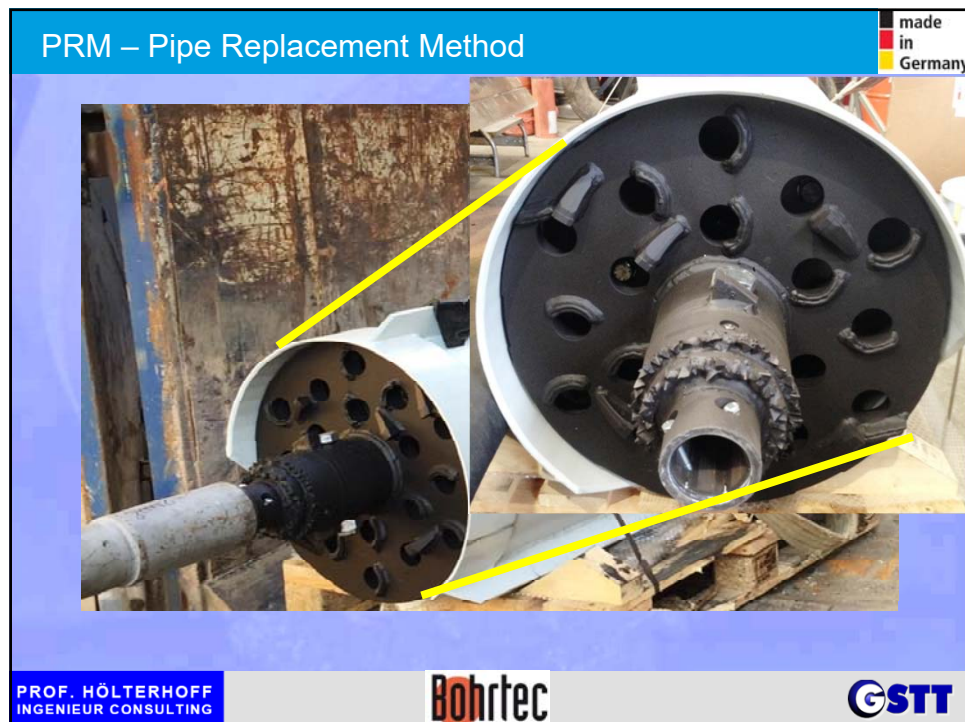
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Bohrtec

GSTT



PRM – Pipe Replacement Method made in Germany

The diagram shows a yellow truck-mounted suction excavator. The components are labeled as follows:

- Computer-optimized sound-absorbing unit
- efficient micromesh filter
- patented separation system
- standard radio remote control
- high performance fan
- resistant tilting container
- integrated compressor
- hydraulik driven Articulated hose carrier

Suction Excavator - patented suction principle

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Suction Excavators – a wealth of applications made in Germany

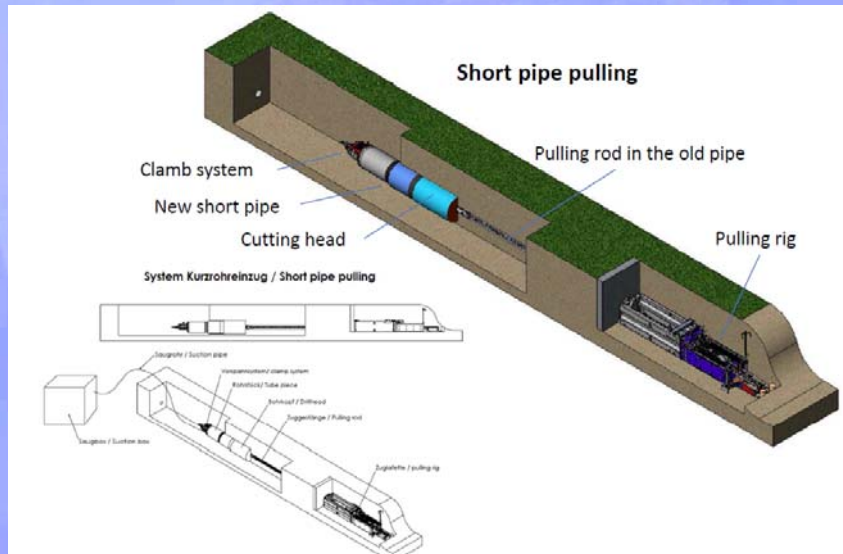
The collage shows various applications of suction excavators:

- CIVIL ENGINEERING**: A worker in an orange suit is using a suction excavator to dig a trench.
- DISPOSAL**: A worker in an orange suit is using a suction excavator to dispose of debris.
- CLEANING OF FLAT ROOFS**: A worker in an orange suit is using a suction excavator to clean a flat roof.

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PRT – Pipe Replacement Technology

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Germany

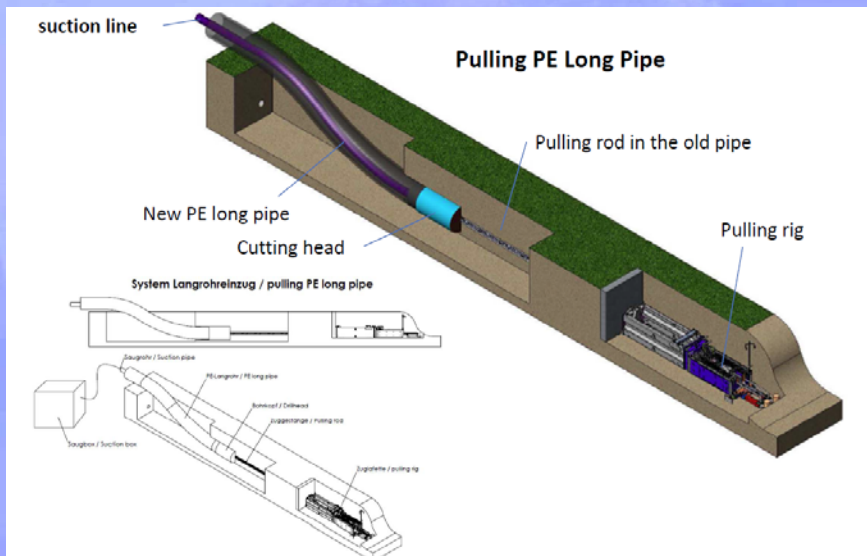


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PRT – Pipe Replacement Technology

made
in
Germany



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PRM – Pipe Replacement Method

made
in
Germany



Pulling rig

Pulling rod



Clamp system



Hydraulic aggregate

A lot of the components can be used for other applicabilities (pipe bursting etc.)

PROF. HÖLTERHOFF
INGENIEUR CONSULTING



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High speed pipe and cable ploughing technology for open te

made
in
Germany



winch rope of up to 130 m length

Hydraulic spider plough unit

pulling winch,
pulling force up to 160 t

For power and broadband cables over long distances as well as **water and gas pipes** up to 355 mm Ø OD (in soft soils up to 450 mm Ø OD). Daily performance (meters installed) with a ploughing unit can **exceed 5.000 m** with only a small start and construction pit.

FRANK
FÖCKERSPERGER

GSTT

High speed pipe and cable ploughing technology for open te

made
in
Germany

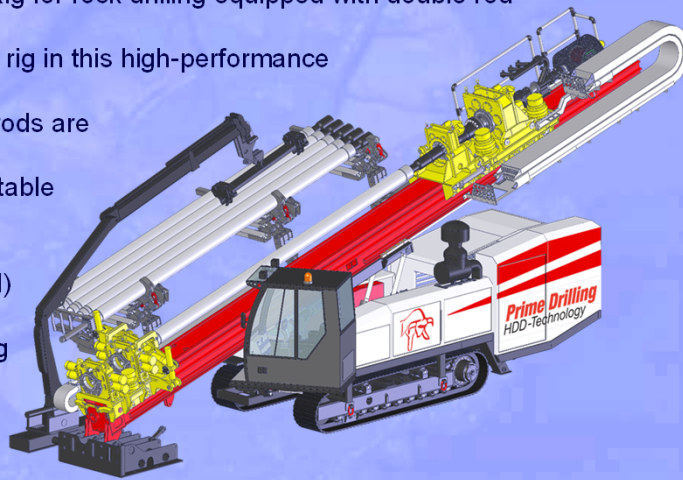


HDD - Rock Drilling Rig

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 flutable 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

CSTT

HDD - Rock Drilling Rig

made
in
Germany

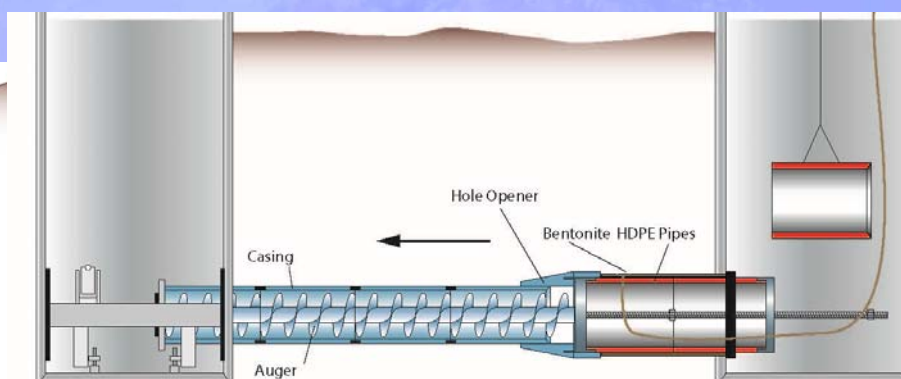


Prime Drilling
HDD-Technology

GSTT

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

made
in
Germany



Bohrtec

GSTT

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

made
in
Germany



Bohrtec

GSTT

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

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Here the construction as a pedestrian umbrella underpass



Bohrtec

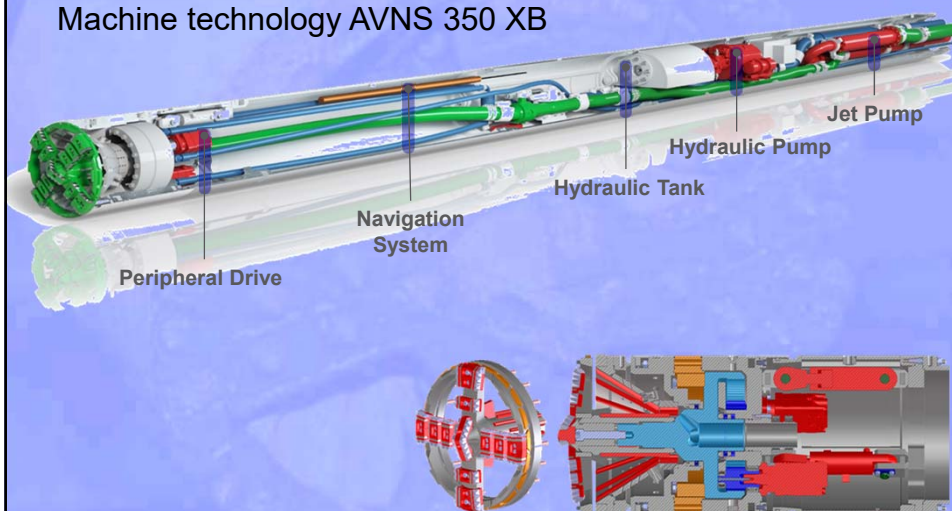
GSTT

Requirements by Transition System Operator (TSO).

- Limited job site, construction roads, preparation area
- No heavy equipment between launch and reception point
- Steerable installation of casing pipes for AC & DC lines
- Length: 1.000m – 1.500m
- Depth: 1,5 m to 4 m, constant
- Diameter: approx. DN 250 – DN 400
- Casing material: plastic, non-conductive, e.g. PEHD
- Distance between lines: 1 m – 2 m, constant



Machine technology AVNS 350 XB



Principle

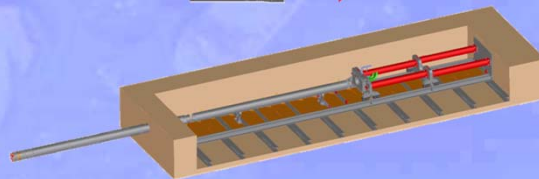
1. Pilot Bore with steel pipes



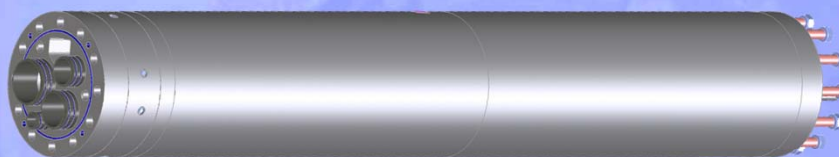
2. Removal of machine, jacking frame turned by 180°



3. Mounting of a pullhead for pull-in of casing pipe

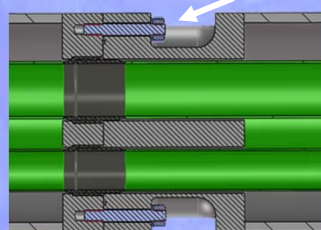


Steel pilot pipes & connection principle



Pilot pipe length: 9 m

Interlocking position for Jacking frame

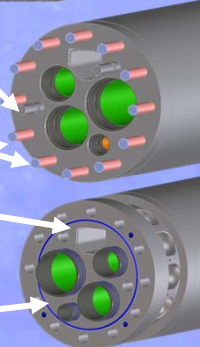


Guide pin

12 x M30 bolt

Cable channel

Seal



Jacking Pipes - vitrified clay pipes



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



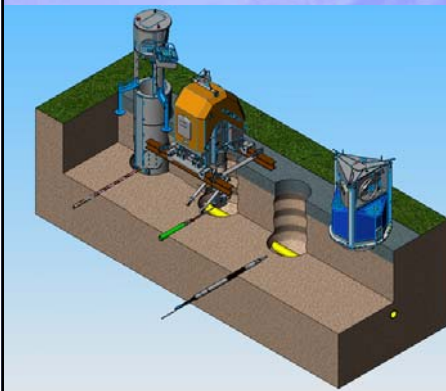
**STEINZEUG
KERAMO**



Keyhole-Technology + Trenchless Technique



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

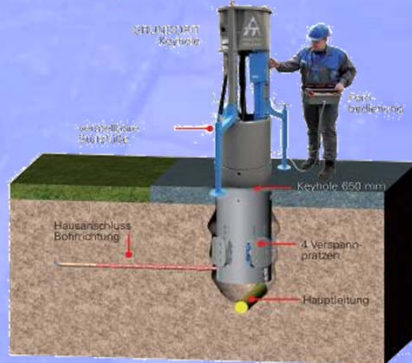
Where the keyhole technique is applied, surface damage and consequential costs only too well known from open trench installation methods are insignificant. The performance of soil and surface works is safer, more productive and less elaborate. Inspection of the construction pit is not required.



Keyhole-Technology + Trenchless Technique



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

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Trenchless Innovations from Germany

Thank you for your attention

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