



**HERRENKNECHT**

**Pioneering Underground Technologies**

**Herrenknecht U-Park<sup>®</sup> – Technology - Advantages - Options**

# General idea of vertical shaft sinking machine

## General Focus:

- ▶ Safe and fast shaft installation in
- ▶ difficult ground conditions below
- ▶ ground water table.



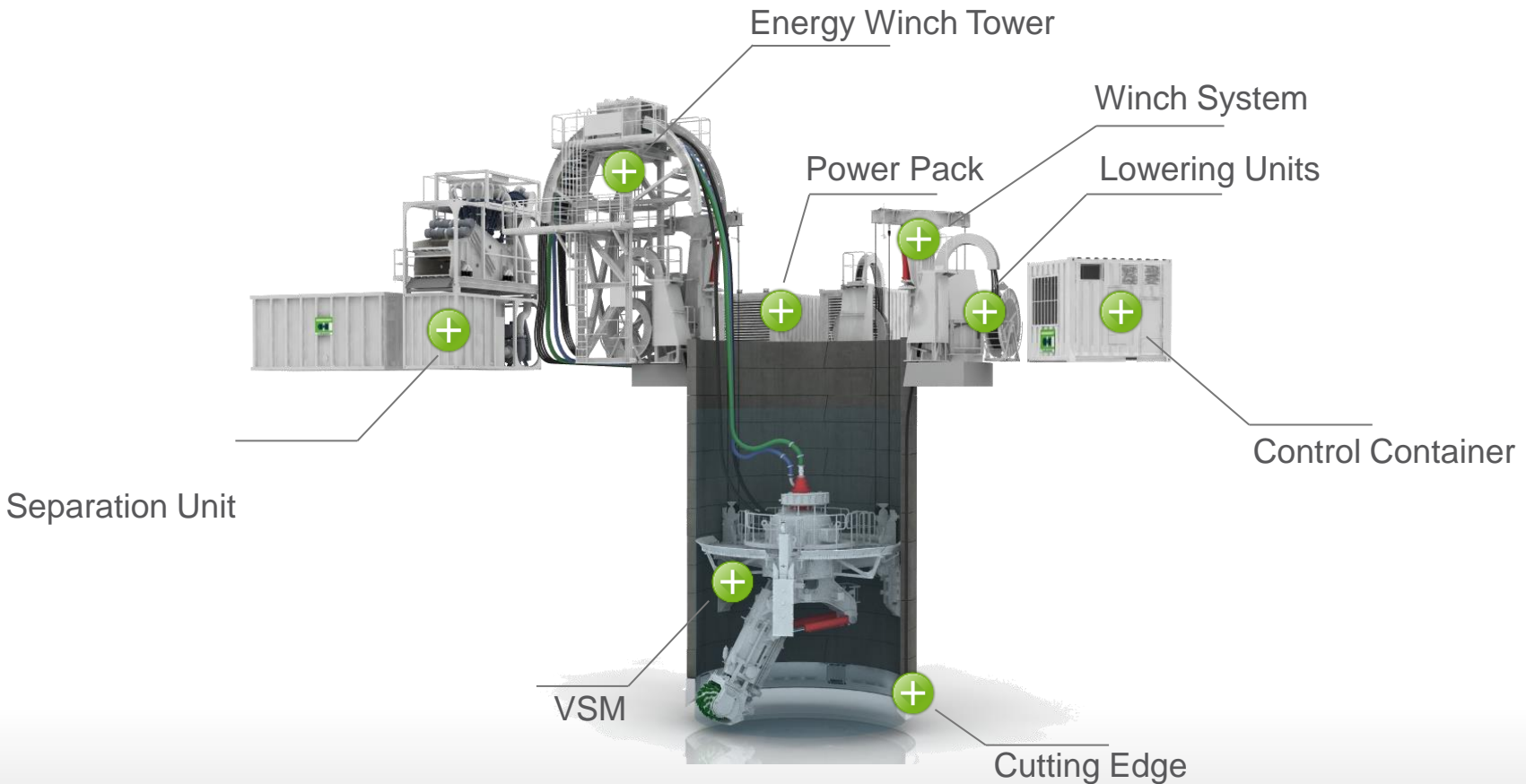
## Main Features:

- ▶ Permanent holding of shaft-lining and controlled sinking
- ▶ Small job site dimensions sufficient
- ▶ Fast Excavation by lining procedure from surface
- ▶ No lowering of groundwater table by under water excavation

## Benefits:

- ▶ More safety in shaft sinking
- ▶ Fast excavation saves time and money
- ▶ No ground water lowering saves time and money.
- ▶ Small Job Site Dimensions save Time and Money.

# Vertical Shaft Boring Machine VSM. Set-up of Equipment



# Vertical Shaft Boring Machine VSM. General View on Jobsite



# Vertical Shaft Boring Machine VSM. Diameter Range



- ▶ Shaft diameters for one VSM:
  - ▶ 4,5 - 9 Meter (ID)
  - ▶ 5,4 – 10 Meter (ID)
  - ▶ 8 – 12 Meter (ID)
  - ▶ 10 – 16 Meter (ID)
  - ▶ 12 – 18 Meter (ID)
- ▶ Shaft depth: References up to 85 Meter
  - ▶ Adjustable for different diameter
  - ▶ One machine can be used for different projects
  - ▶ VSM is one time investment for different shaft diameter in the future

# Vertical Shaft Boring Machine VSM. Cutting Drum



- ▶ Rock up to approx. 80 Mpa – 120 Mpa  
(weathering to be considered)



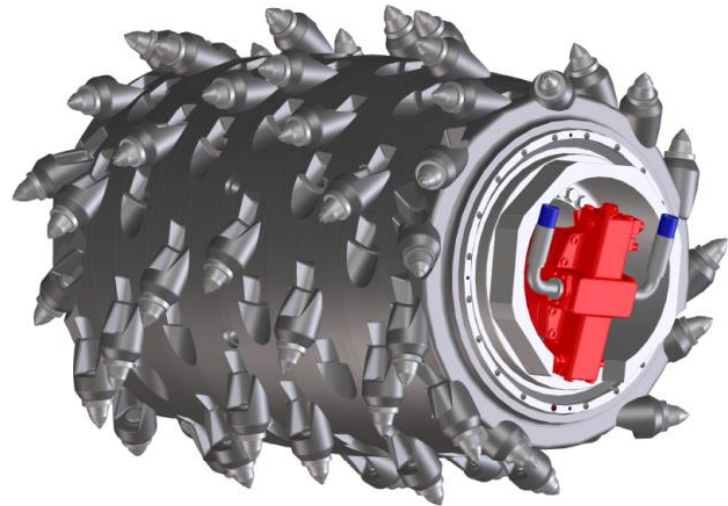
- ▶ Mixed soil



- ▶ Sand

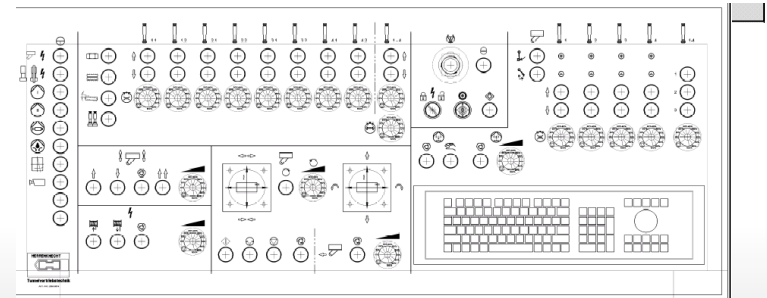
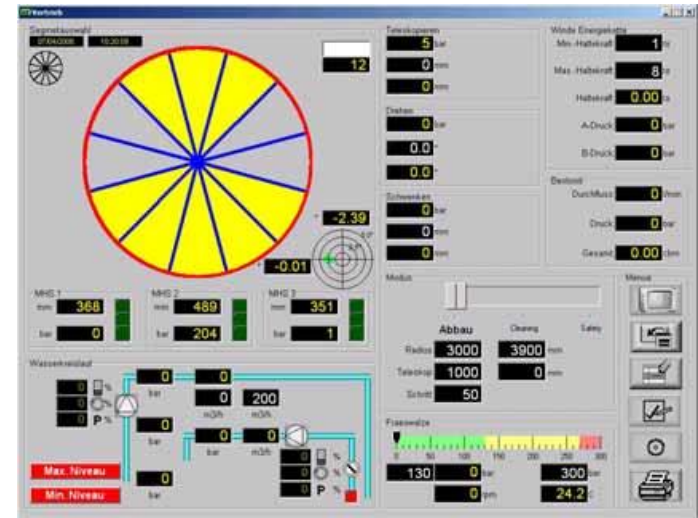


- ▶ Clay



# Vertical Shaft Boring Machine VSM. Control Cabin

- Visualization for Control of VSM and Lowering Unit



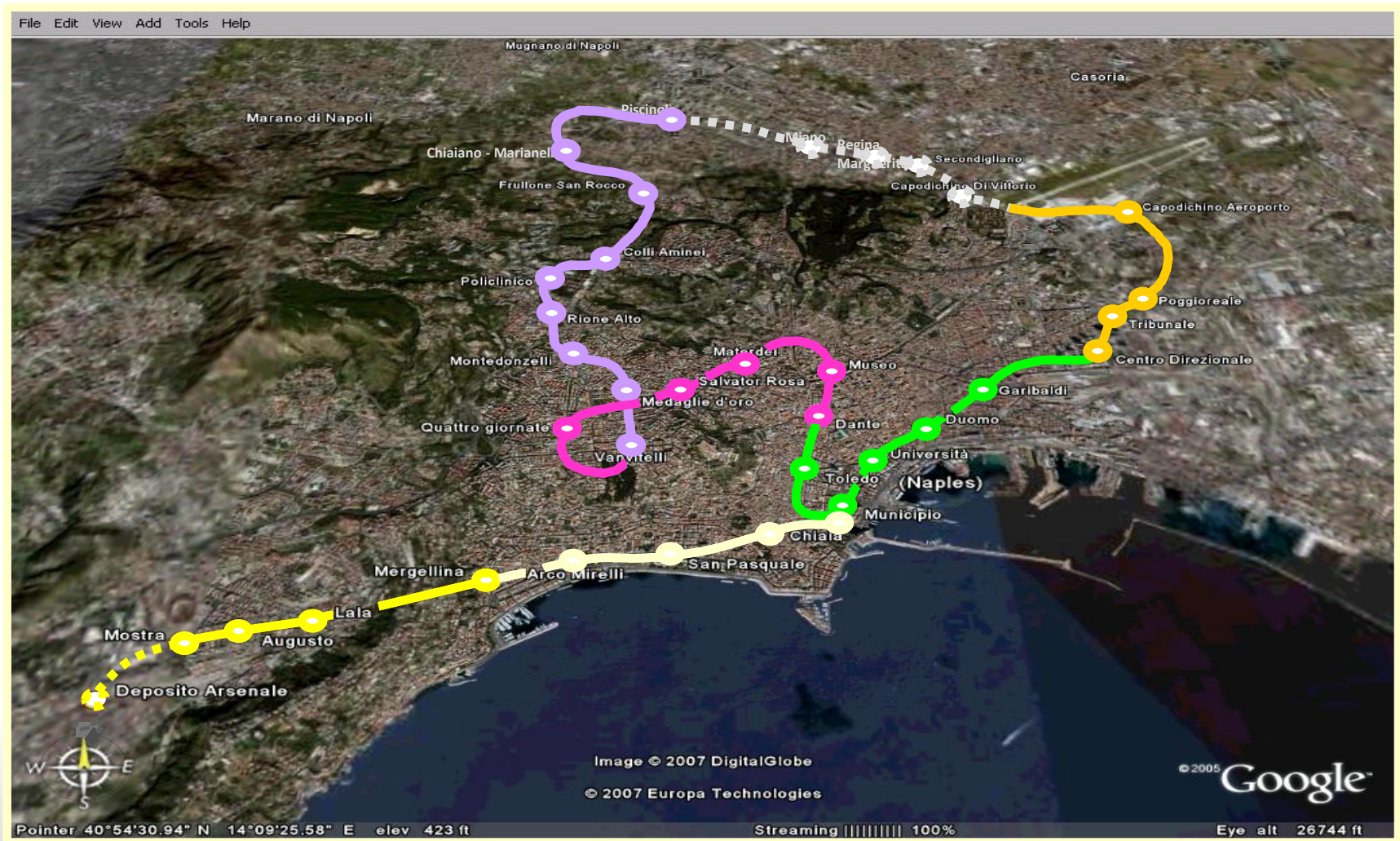
- Control panel

**Herrenknecht. Pioneering Underground Technologies**

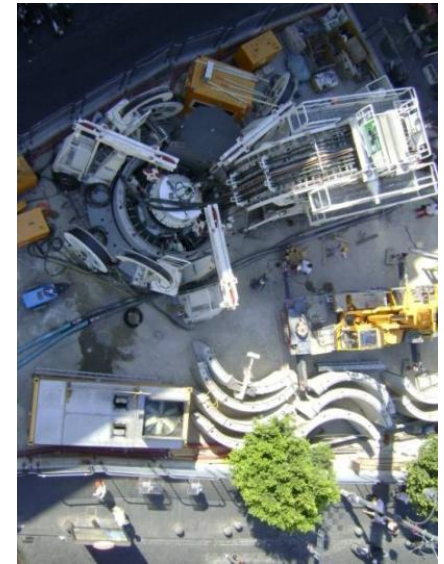
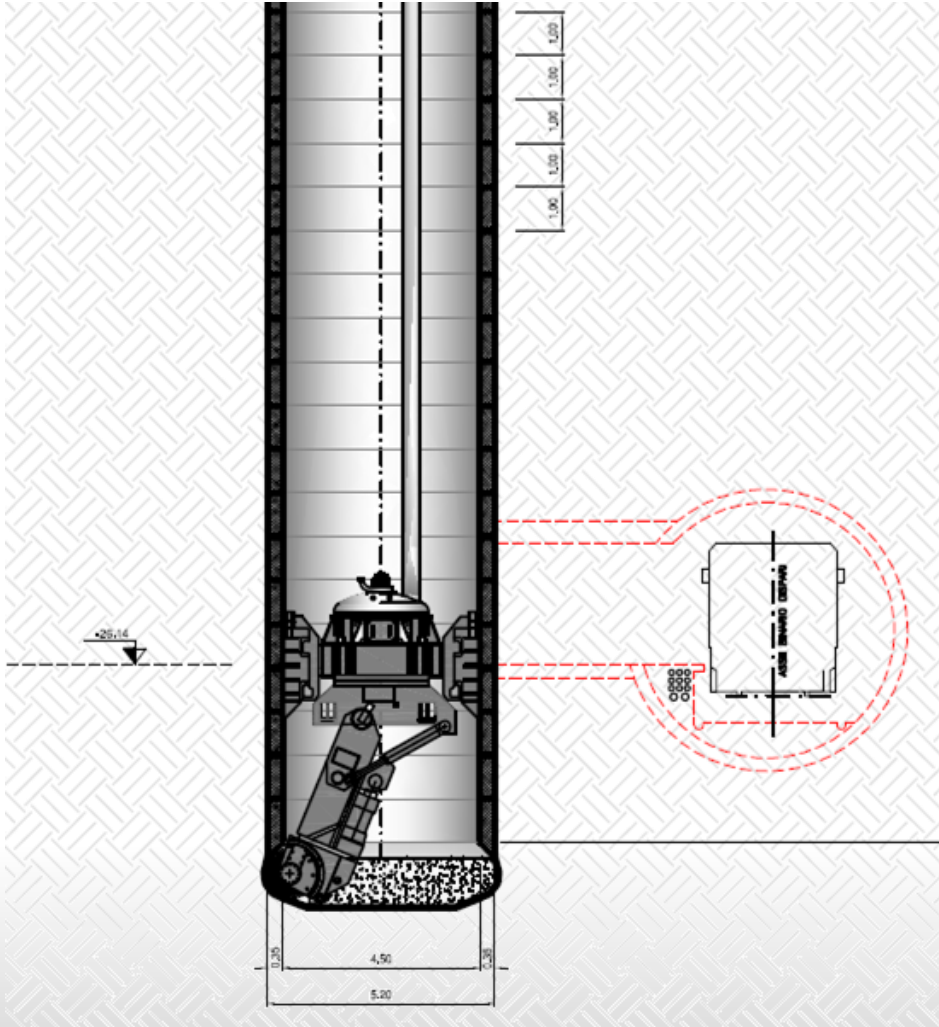




# Reference Projects – Metro Naples



# Reference Projects – Metro Naples



## Reference Projects – Metro Naples



- ▶ 10 ventilation shafts
- ▶ max. 50 meter depth
- ▶ min. jobsite dimensions
- ▶ approx. 1 shaft/month

# Reference Projects - Summary

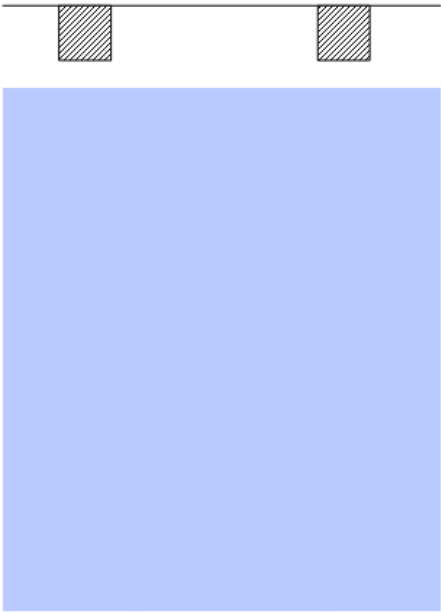
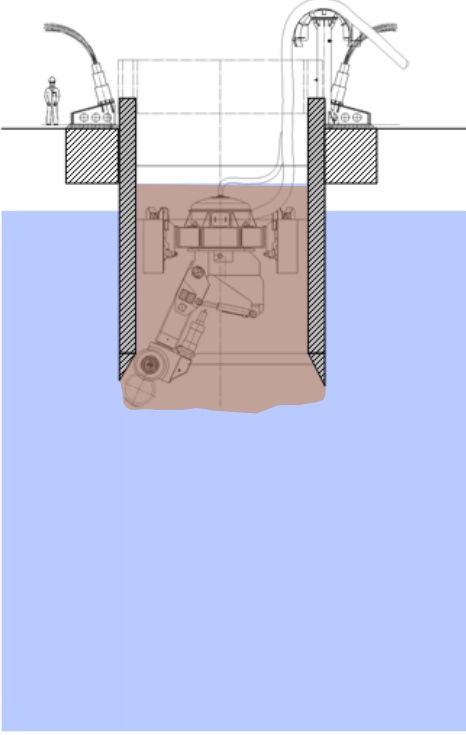
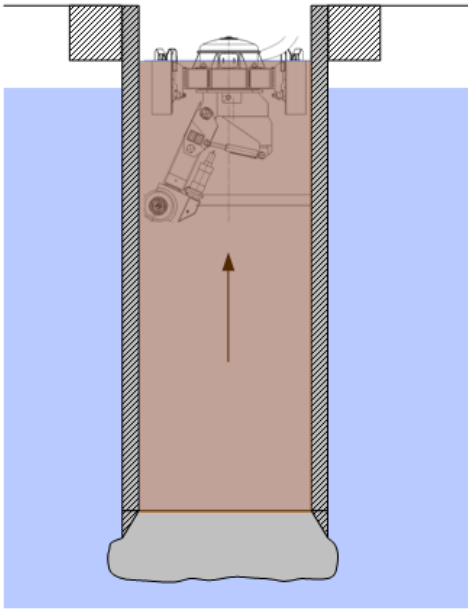


- ▶ References in different soil conditions from soft soil to medium rock
- ▶ References in challenging conditions: limited sites, settlement risk , high permeability
- ▶ References in diameter range from 4,5 to 13m inner diameter
- ▶ Shaft depth realized up to 180m
- ▶ Performance up to 5m / 12 hrs
- ▶ VSM Technology proven in 60 shafts of approx. 3000m of shaft sinking

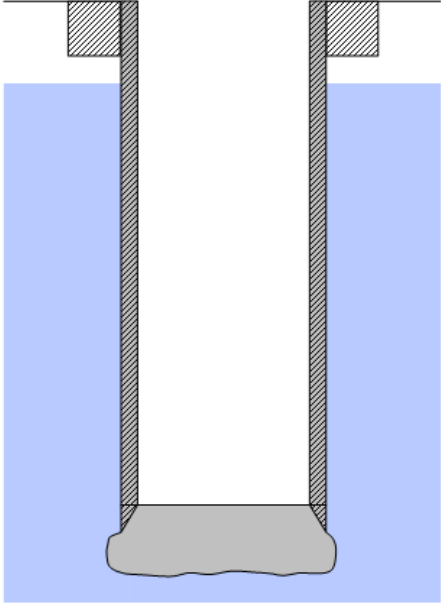
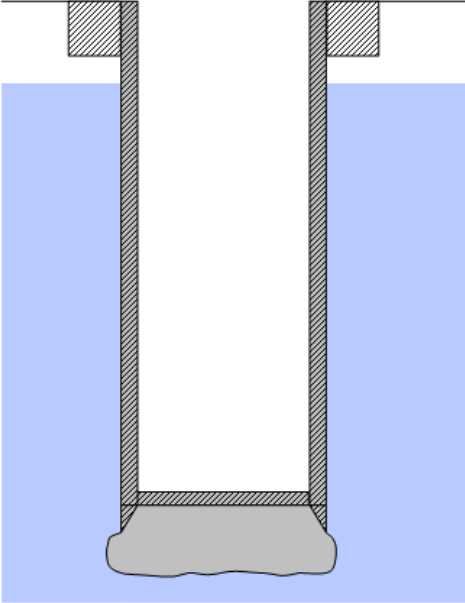
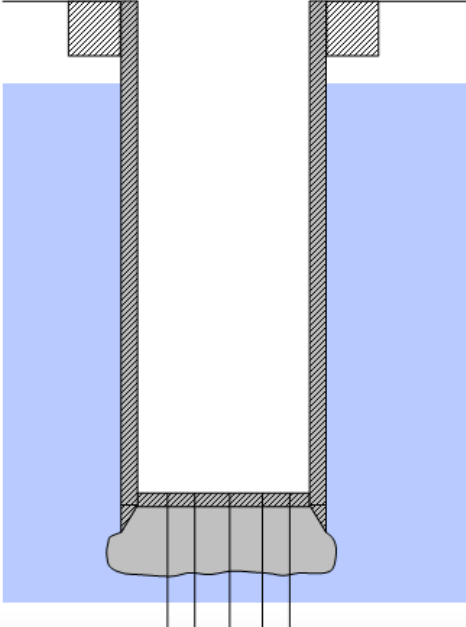


# Herrenknecht UBP-Underground Bike Parking Concept.

## Construction process.

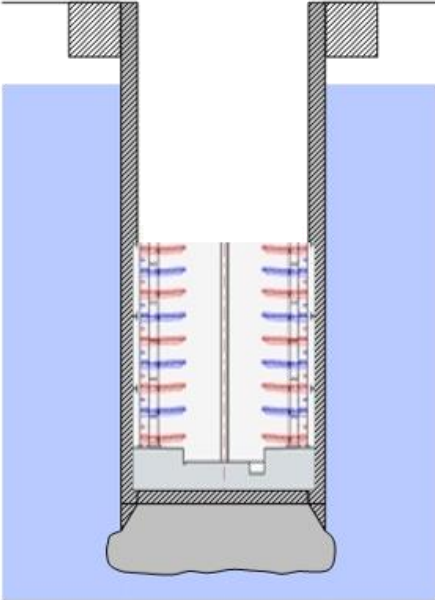
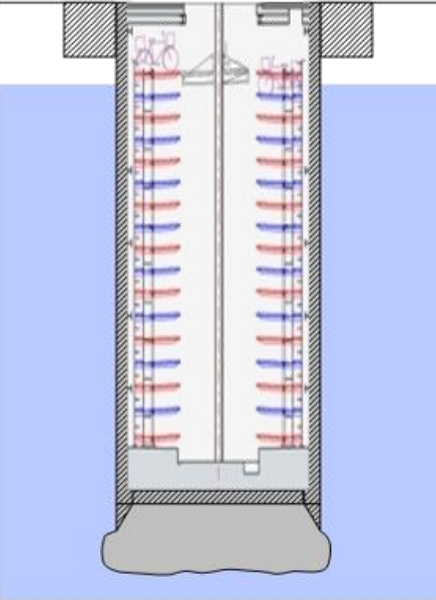
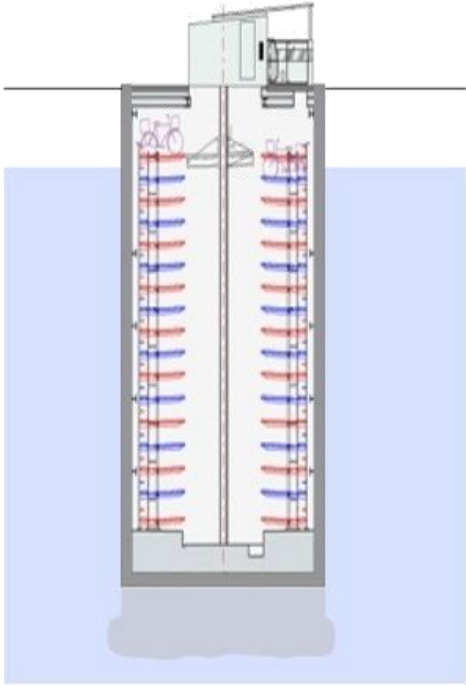
<b>Step 1</b> VSM Foundation	<b>Step 2</b> Shaft Sinking	<b>Step 3</b> Removing VSM
		
<ul style="list-style-type: none"> <li>- Construction of ring foundation</li> <li>- Positioning of strand cylinders</li> <li>- Ring foundations could be removed and reused for several shafts</li> </ul>	<ul style="list-style-type: none"> <li>- VSM is loosening the ground</li> <li>- Creating overcut and lubrication through shaft lining against friction</li> <li>- VSM is working under water level</li> </ul>	<ul style="list-style-type: none"> <li>- End depth is reached</li> <li>- VSM is removed/lifted by crane</li> <li>- Shaft is still filled with water</li> <li>- Inside higher water level than outside</li> <li>- Safety against base failure</li> <li>- Grouting the overcut through lubrication nozzles</li> </ul>

# Herrenknecht UBP-Underground Bike Parking Concept. Construction process.

<b>Step 4</b> Underwater Concrete	<b>Step 5</b> Bottom Plate	<b>Step 6</b> Anchoring
		
<ul style="list-style-type: none"><li>- Under water concrete plug</li><li>- no reinforcement or steel fiber reinforced</li><li>- Temporary construction against buoyancy</li><li>- Water will be pumped out</li></ul>	<ul style="list-style-type: none"><li>- Designed bottom plate</li><li>- Reinforced</li><li>- Permanent Construction</li></ul>	<ul style="list-style-type: none"><li>- In case of strong buoyancy</li><li>- Option of vertical anchoring</li></ul>

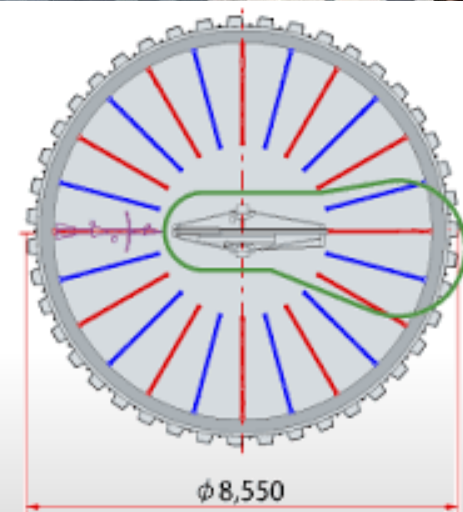
# Herrenknecht UBP-Underground Bike Parking Concept.

## Construction process.

<b>Step 7/1</b> Implementation Parking System	<b>Step 7/2 (parallel to 7/1)</b> Building Services	<b>Step 8</b> Surface Building
		
<ul style="list-style-type: none"> <li>- Dry shaft construction</li> <li>- Implementation of steel construction</li> <li>- Level per level</li> <li>- Vertical static load transfer</li> <li>- Vertical and horizontal dynamic load transfer</li> </ul>	<ul style="list-style-type: none"> <li>- Parallel to step 7/1 implementation of building services</li> <li>- Ventilation, heating/cooling, fire protection, service elevators etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction of surface plate</li> <li>- Transfer cabin</li> <li>- Counting/pricing system</li> <li>- Connection to public infrastructure</li> <li>- Architectural integration</li> </ul>

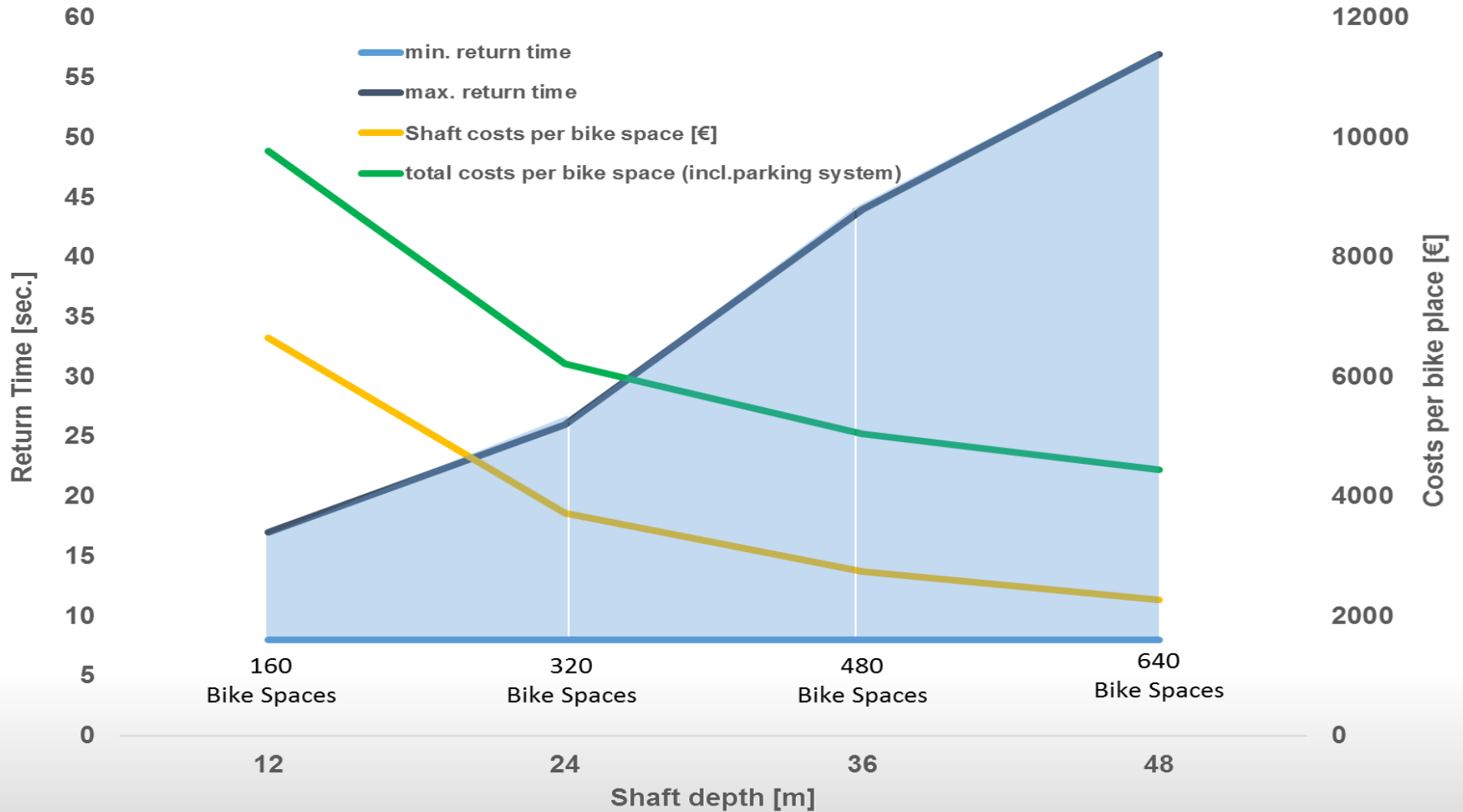


# Herrenknecht UBP-Underground Bike Parking Concept. Transfer cabins - new urban quality.



# Herrenknecht UBP-Underground Bike Parking Concept.

## Cost & time comparison shaft construction methods (ID 7,5m).



A woman wearing a red hard hat and a white shirt is looking upwards with a hopeful expression. She is positioned in a narrow, dimly lit tunnel, with a large, textured concrete pillar on the right side of the frame. The background is dark and textured, suggesting a tunnel interior.

**THINK  
POSITIVE!**

► **Together we are building our future.**