



RowaTrain

Self-driving trackless supply logistic system

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Managing Director



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RowaTrain – Dr. Alberto Belloli





Stakeholders

Project: Brenner Base Tunnel
Construction lot Tulfes-Pfons

Owner: BBT SE



Contractors: ARGE Tulfes Pfons
Strabag SE
Salini Impregilo S.p.A.



Construction Supervision: ÖBA Pini & Partner



Logistics partner: Rowa Tunnelling Logistics AG



Self Driving

These days, everyone talks about self-driving, especially in the automotive industry.

In the tunneling and mining industries, the future belongs to automation too.



Trackless heading supply

In the past 20 years, so-called Multi-Service-Vehicles developed to a valid and efficient alternative to conventional track bound supply trains, especially for short, large-diameter tunnel headings.



RowaTrain: Self-driving trackless supply logistic system



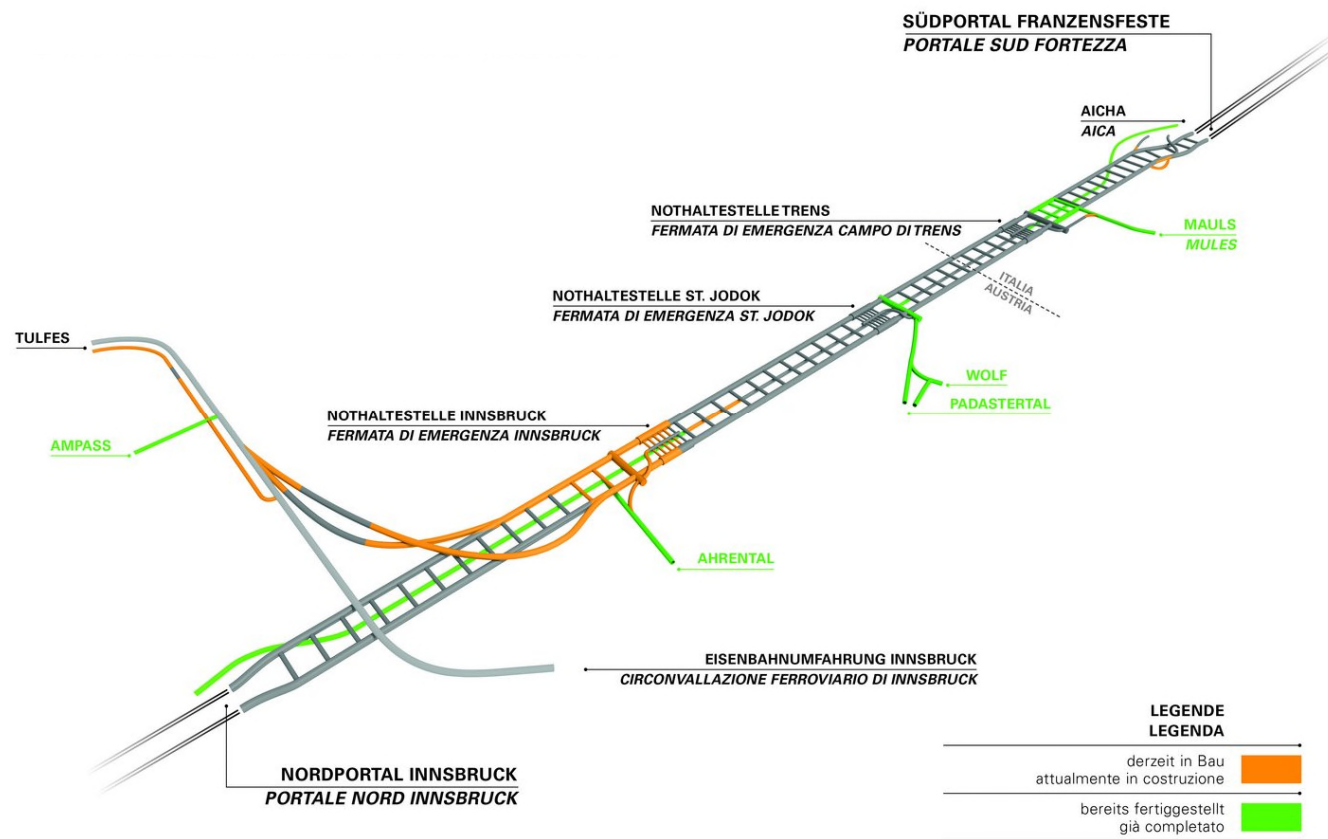


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TECHNICAL
PRODUCT/EQUIPMENT
INNOVATION
- OF THE YEAR -



Brenner Base Tunnel



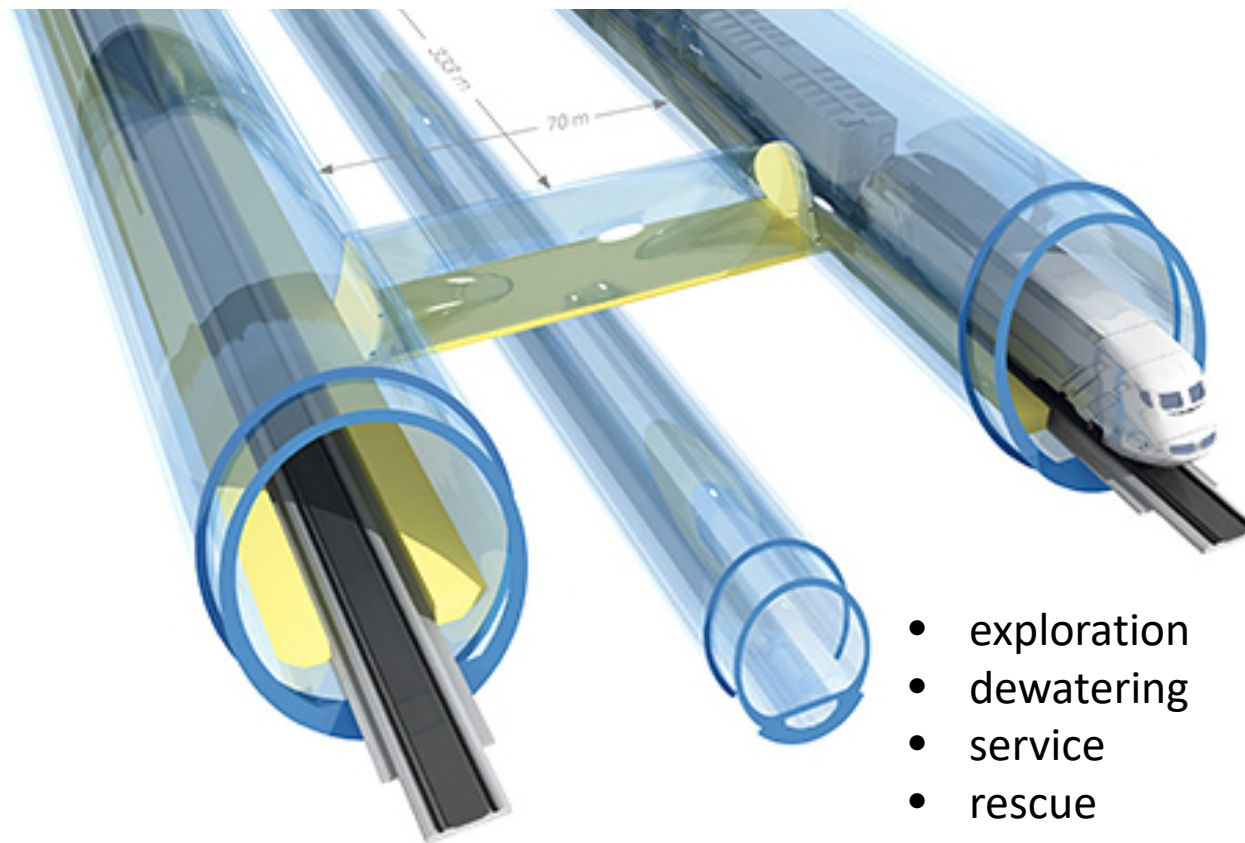


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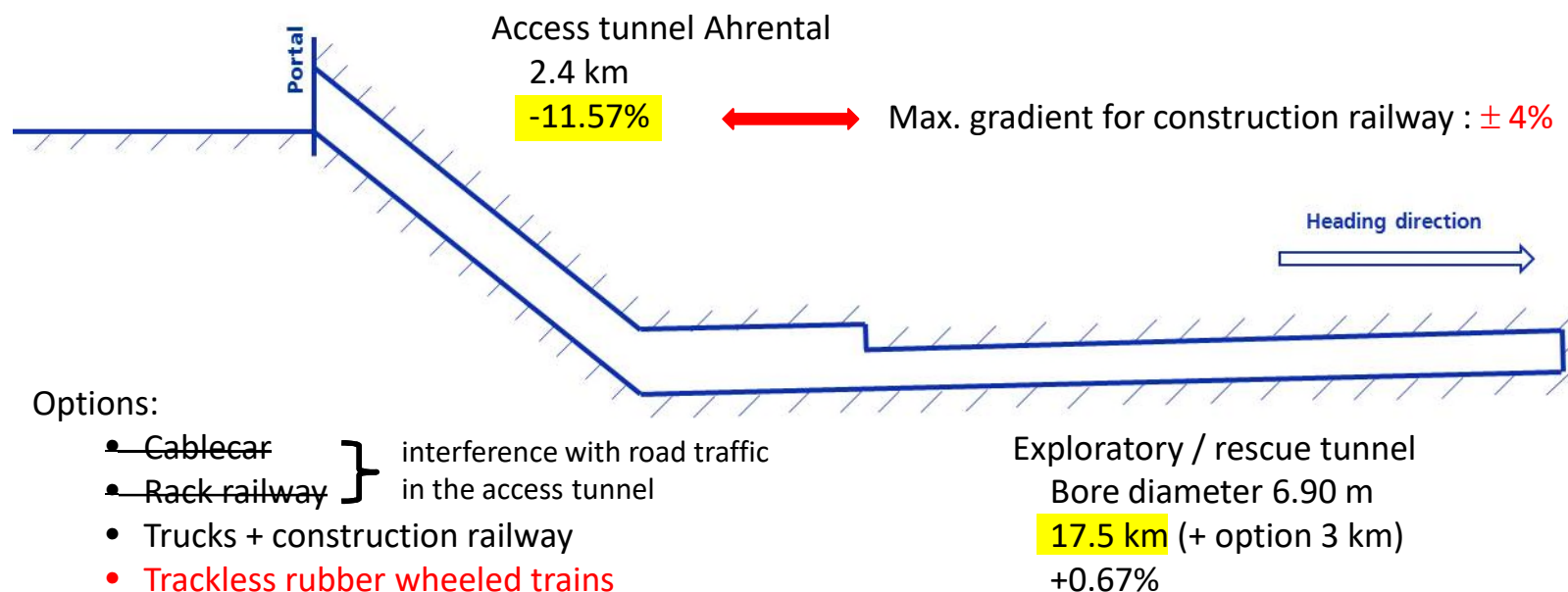


Brenner Base Tunnel



Construction lot Tulfes-Pfons

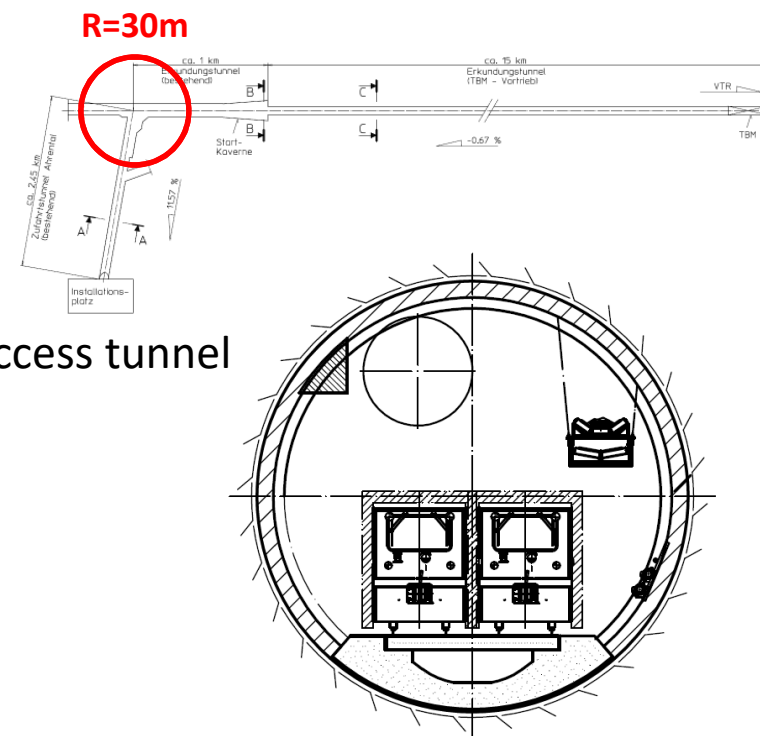
Longitudinal section



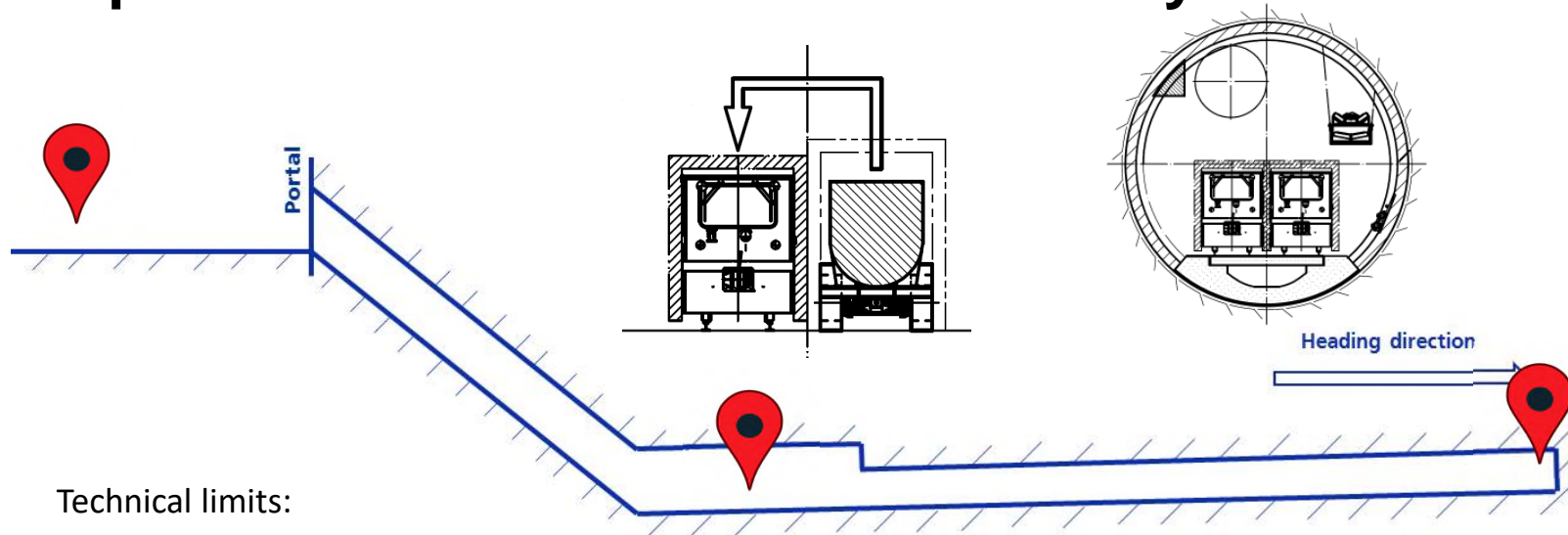
Construction lot Tulfes-Pfons

Additional challenges

- Long drives up to 20 km
 - Speed
 - Number of vehicles / personnel
- Corner R=30m at the bottom of the access tunnel
- Limited cross section for crossing
- Design freeze of TBM / backup
 - Transloading points defined



Option 1: Truck + construction railway

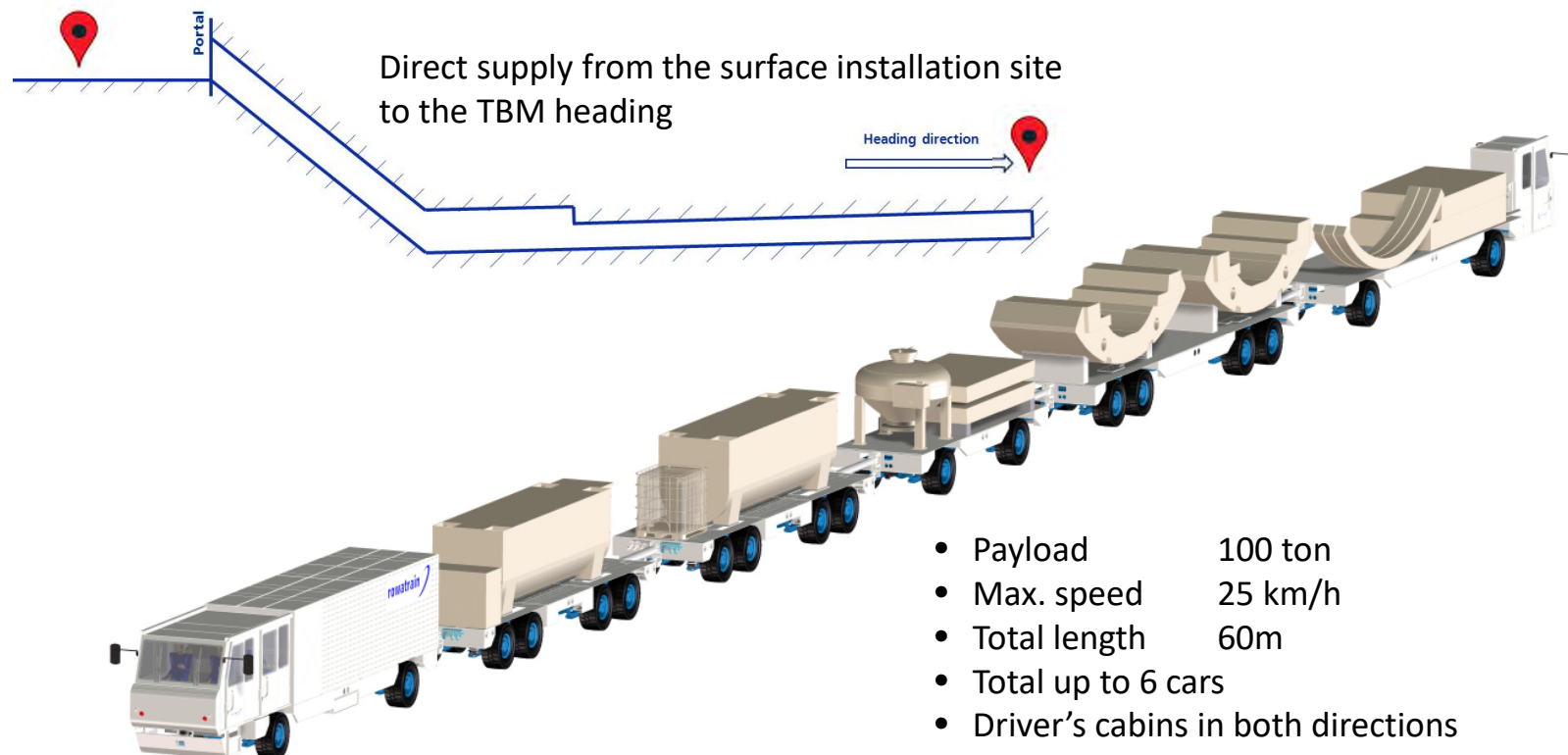


Technical limits:

- Gradient -11.57% demanding for regular trucks
- Very limited space for transloading
- Backward drive for the trucks
- No space for maintenance of the rolling stock
- Impact on cycle times
- Safety concerns



RowaTrain – mastering steep gradient & high speed



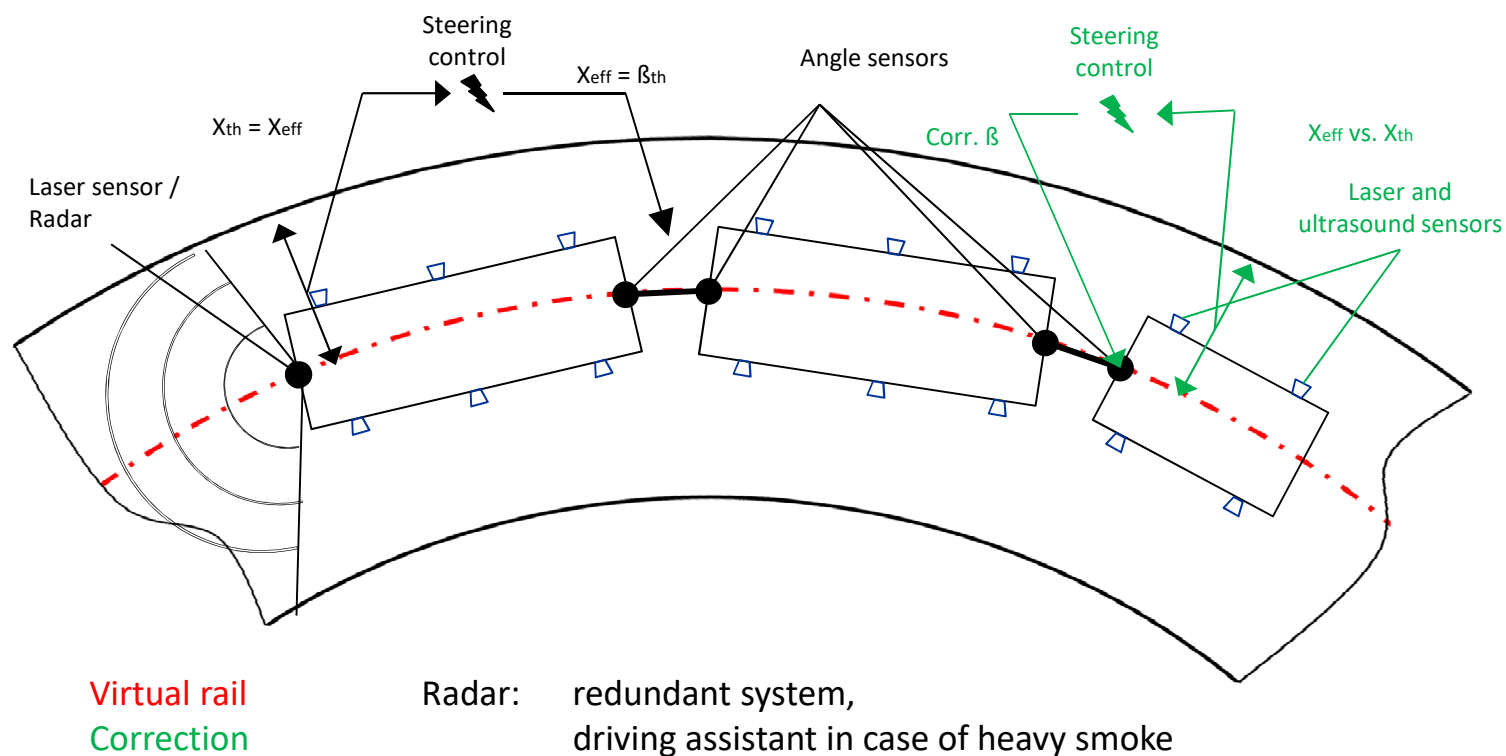


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Virtual rail

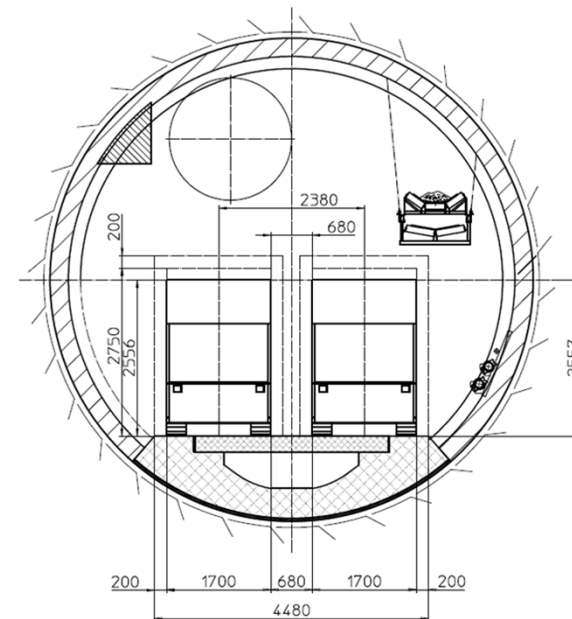
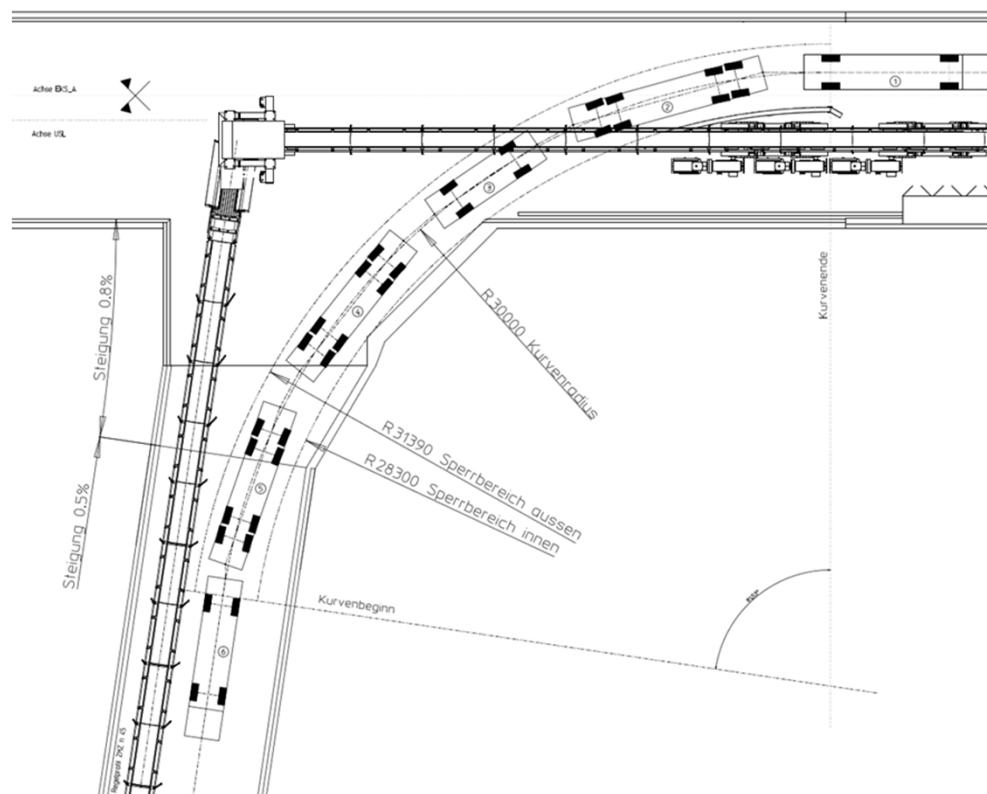


Driving assistant & self-driving capability

- Guarantee the directional stability for trains up to 60 m length
- Assist crossing operation
- Automatic entry into the backup of the TBM
- Obstacle recognition
- Safe stop in case of:
 - Technical issues
 - Mayor deviation from the calculated trajectory
 - Potentially hazardous traffic situations



Driving assistant & self-driving capability



Driving assistant & self-driving capability





Driving assistant & self-driving capability



Enhanced safety

- Eliminates material transloading
 - Eliminates track construction and dismantling
 - Diesel-hydraulic system manages traction and braking requirements (in particular in the access tunnel @ -11.57% , total weight 120 ton)
 - Driving assistant and self-driving capability, even under heavy smoke conditions
- } Notorious sources for accidents / injuries / casualties



Increased productivity

- Successfully in operation since mid 2016.
More than 50% (8'500m) of the rescue tunnel excavated
- No railtrack required
- Best daily advance rate > 61m (@ 10'500m from the portal)
World record for an open gripper TBM (6.90 m dia)
- Monthly advance rates in the order of 800m



Lower investment costs

Trucks + construction railway

Railtrack (double track)*

Rolling stock (4 trains)*

Trucks (access tunnel)

Adaption of the cavern

Equipment for material
transloading

(EUR 8'000'000.00) 133%

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4 RowaTrains

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(EUR 6'000'000.00) 100%

* incl. loco and track buy-back

Lower operation costs (44 months)

Trucks + construction railway

Truck drivers

Personnel for material
transloading

Loco drivers

(EUR 10'890'000.00) 275%

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RowaTrain drivers

(EUR 3'960'000.00) 100%

Maintenance (spare parts and manpower):

+++

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Increased flexibility

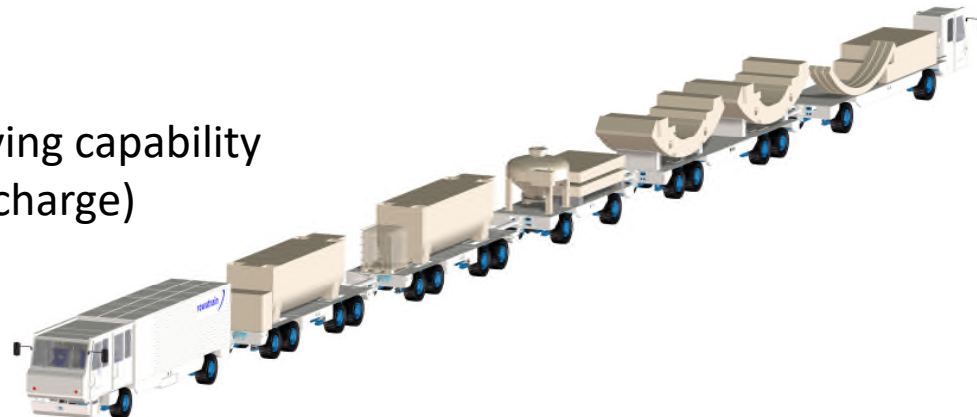
- Modular system
 - Configure trains as needed
 - Recombine cars for maintenance



- Trackless driving concept
 - Adaption to changing conditions / needs
 - No interference with other traffic; on surface / underground
- Maintenance on surface

Superior to standard MSV

- RowaTrain cuts down the operating costs by
 - Reducing the number of drivers
 - Simplifying maintenance
- max. speed 25 km/h
- max. length 60m
- max. payload 100 ton
- Driving assistant & self-driving capability (despite having a driver in charge)



Innovation:

Combines existing technologies

to provide new / enhanced functionalities

which satisfy a specific need

Is replicable at economic cost

and widely accepted

RowaTrain:

Combines existing technologies

to provide a logistics system, which

- enhances health & safety
- increases productivity
- simplifies maintenance

Allows direct supply of the TBM over long distance and steep slope

Cuts down investment and operating costs

Is successfully operated since mid 2016 with impressive performance (over 61m /day; 800m / month). 8'500m (>50%) excavated to date