A wide-angle photograph of the Large Sea Lock in Emden, Germany. The lock is a long, narrow waterway with high concrete walls on both sides. A small white boat is visible in the middle of the lock. The sky is blue with some clouds. On the right side, there are some buildings and trees. The overall scene is bright and clear.

# Preservation instead of new construction - challenges and solutions

Planning of the repair and upgrading  
of the Large Sea Lock in Emden

# Agenda



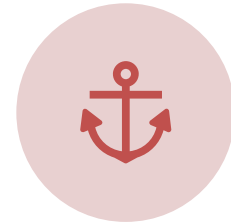
LOCATION &  
TECHNICAL DATA



CHALLENGE 1  
HISTORICAL BUILDING



CHALLENGE 2  
SEALEVEL RISE



CHALLENGE 3  
PORT ACESSEBILITY



PLANNING TEAM TASK

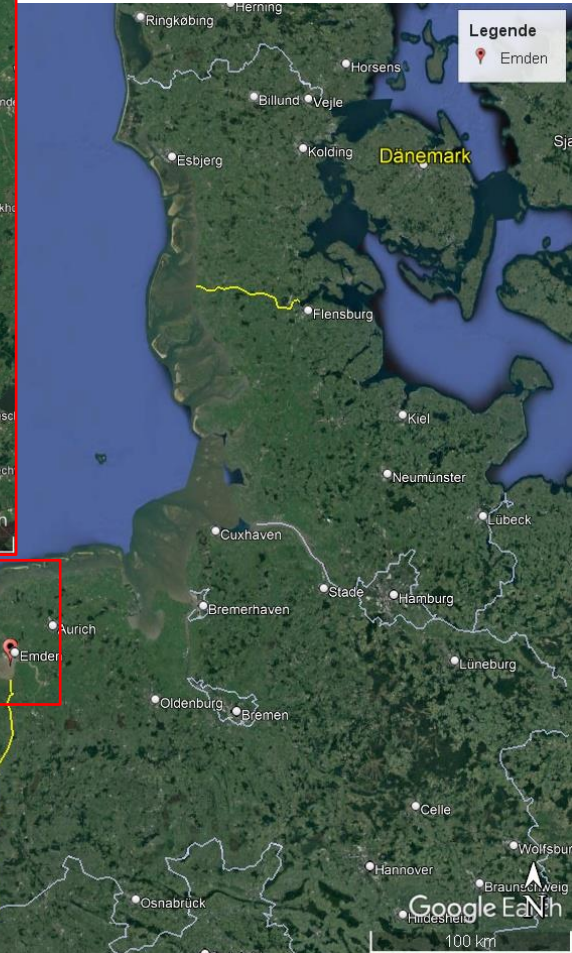
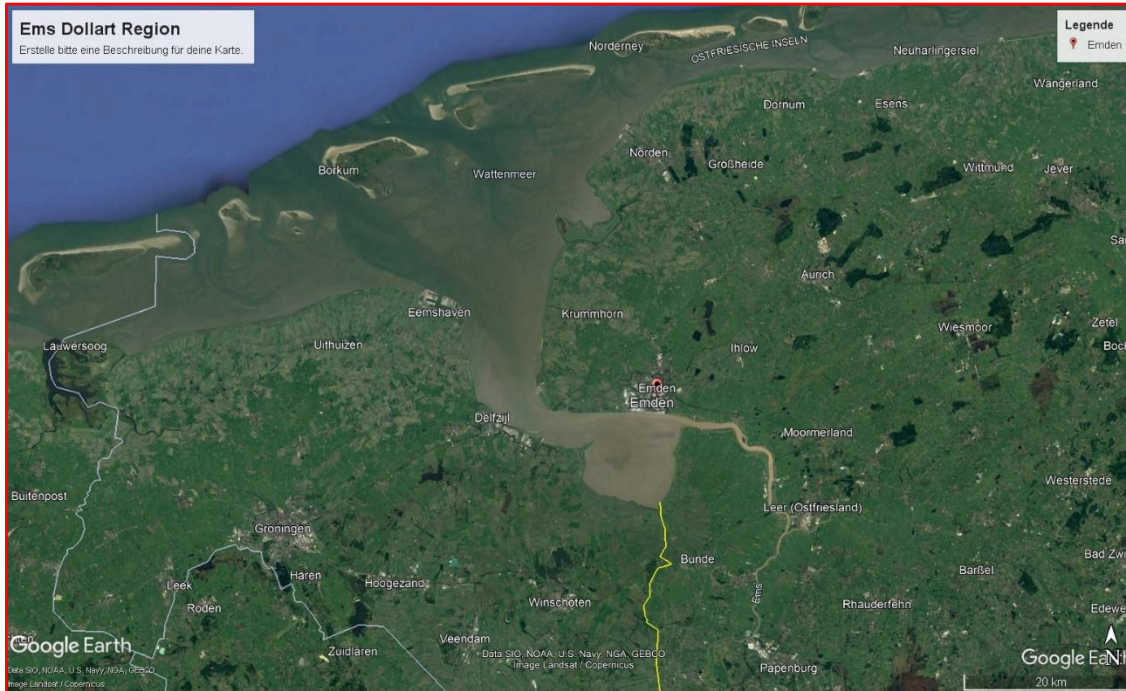


SOLUTIONS – INSIGHTS  
ON THE NEW ROLLER  
GATE



CONCLUSION AND  
OUTLOOK

# Location and technical data



# Location and technical data

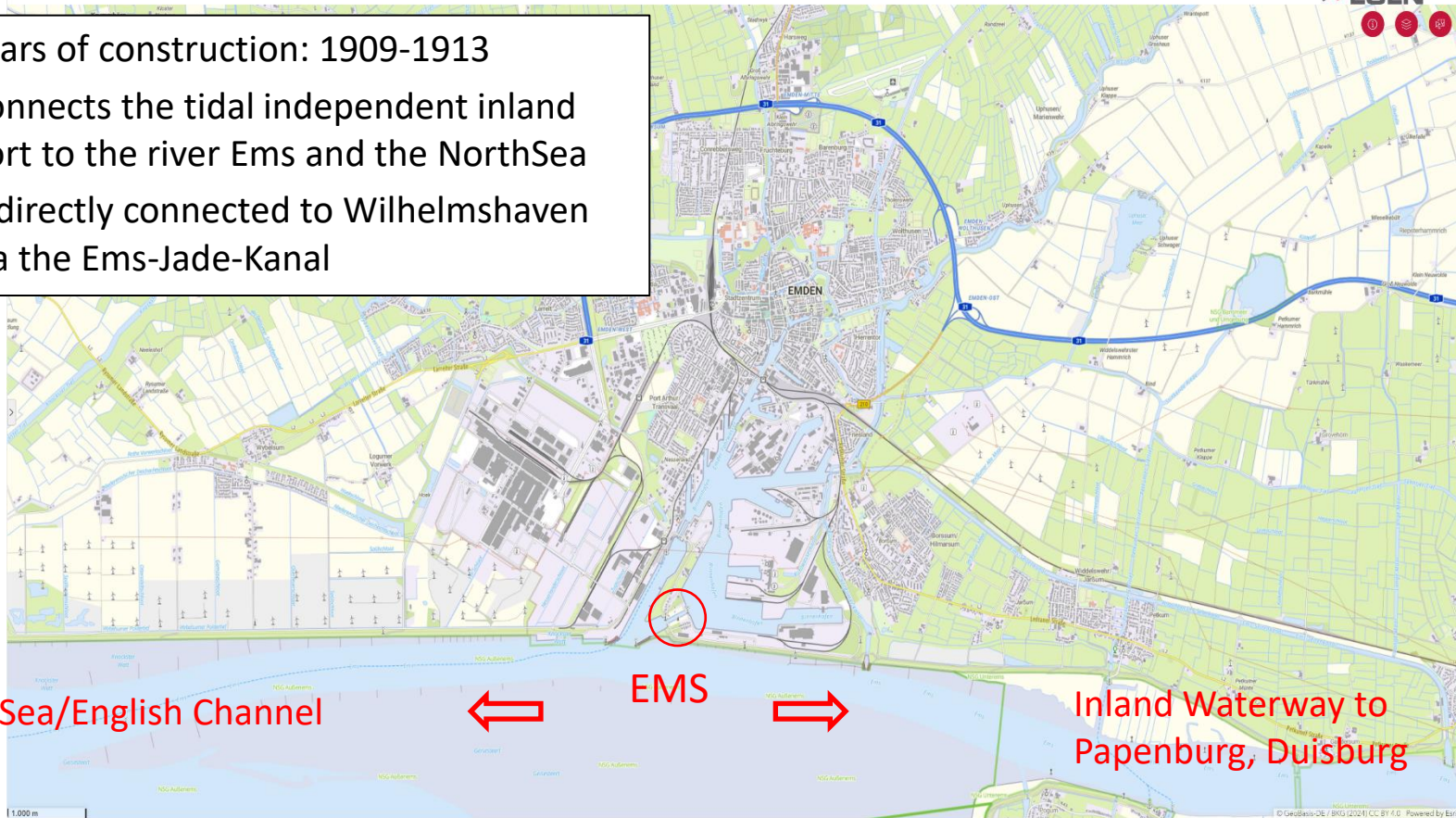
OpenGeoData

Digitale Topographische Karte 1: 100.000

Anmelden

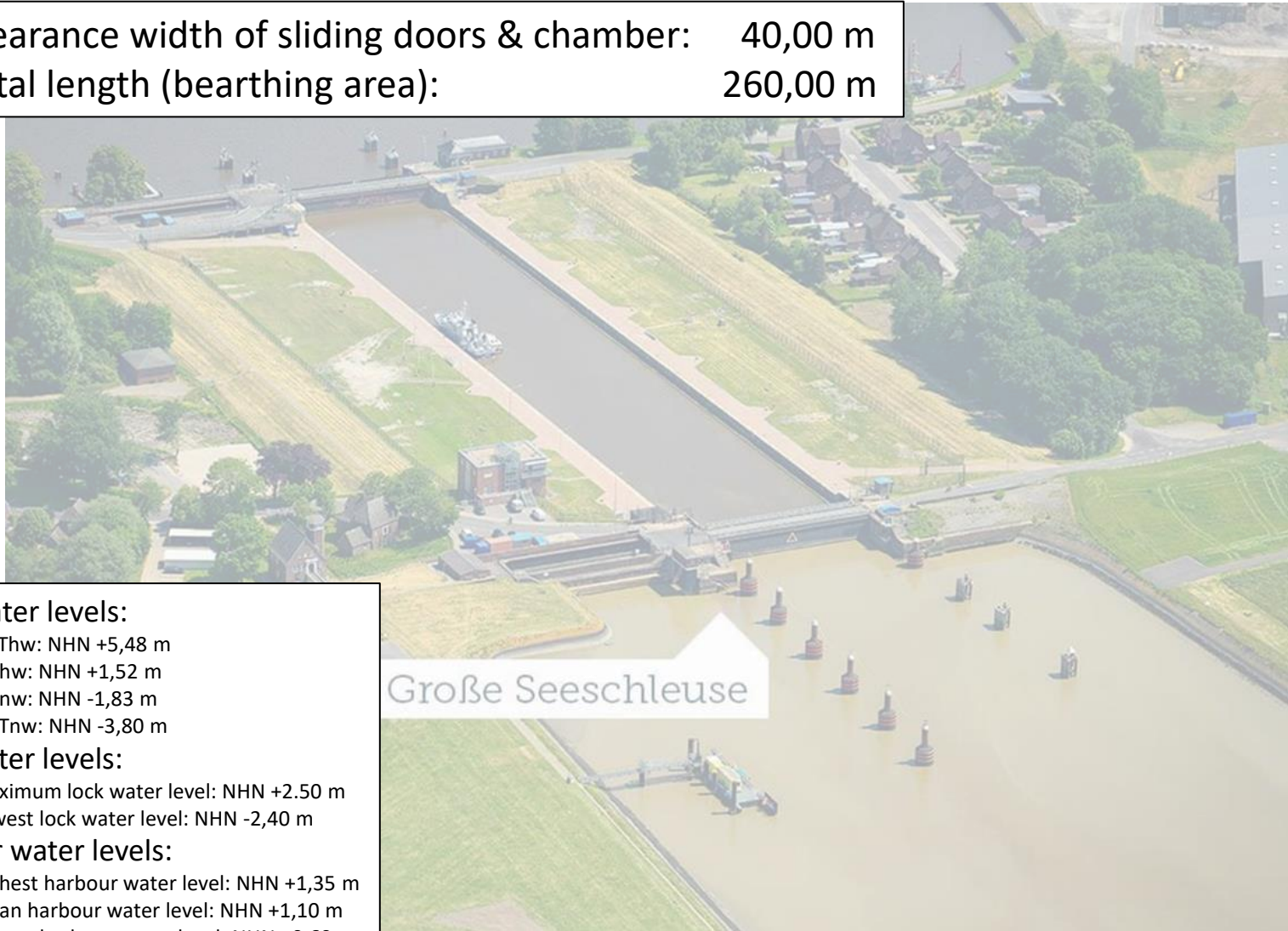
**LGLN**

- ❖ Years of construction: 1909-1913
- ❖ Connects the tidal independent inland port to the river Ems and the NorthSea
- ❖ Indirectly connected to Wilhelmshaven via the Ems-Jade-Kanal



# Location and technical data

- ❖ Clearance width of sliding doors & chamber: 40,00 m
- ❖ Total length (bearing area): 260,00 m



## ❖ Tidal water levels:

- ❖ HHThw: NHN +5,48 m
- ❖ MThw: NHN +1,52 m
- ❖ MTnw: NHN -1,83 m
- ❖ NNTnw: NHN -3,80 m

## ❖ Lock water levels:

- ❖ Maximum lock water level: NHN +2.50 m
- ❖ Lowest lock water level: NHN -2,40 m

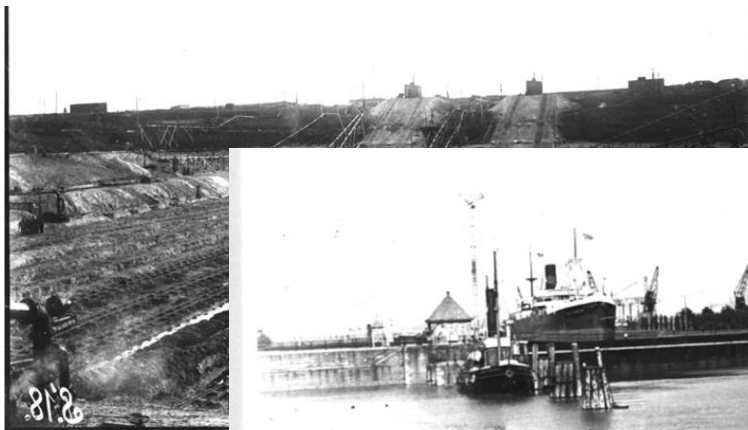
## ❖ Harbour water levels:

- ❖ Highest harbour water level: NHN +1,35 m
- ❖ Mean harbour water level: NHN +1,10 m
- ❖ Lowest harbour water level: NHN +0,60 m

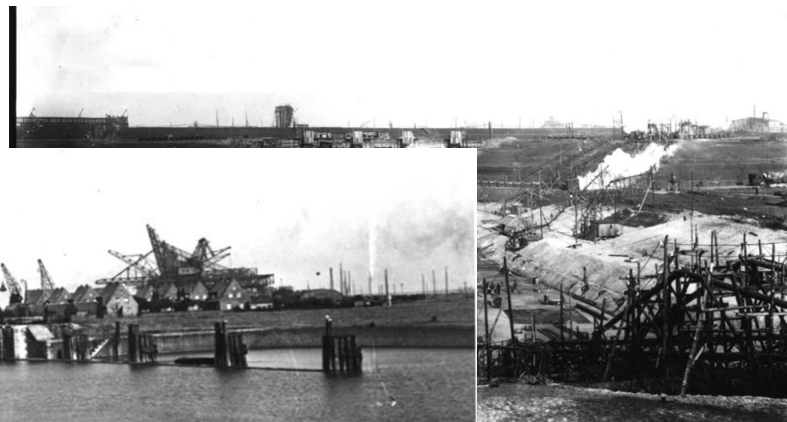
Source: NPorts/Falcon Crest Air 2023

# Challenge 1 – Historical Building

Historic; Working in adverse conditions



Baustelle  
1909

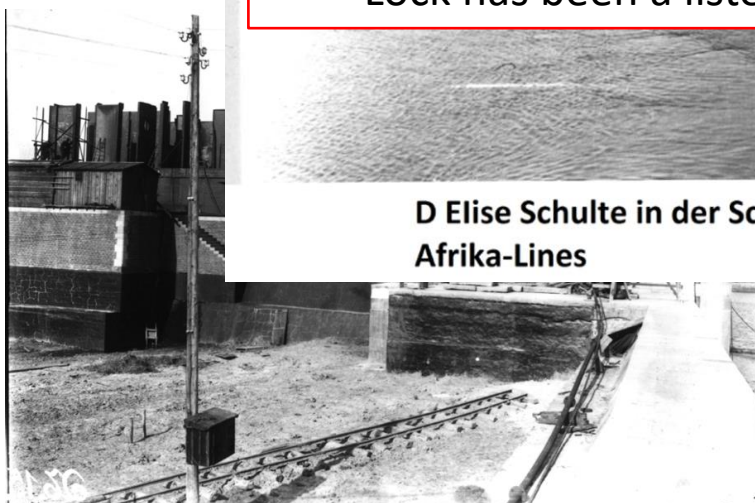


Benhauptes



Lock has been a listed building since 1988

D Elise Schulte in der Schleuse (A im Schornstein)  
Afrika-Lines



Montagearbeiten am Außenhaupt



Ausgeschwommenes Binnentor

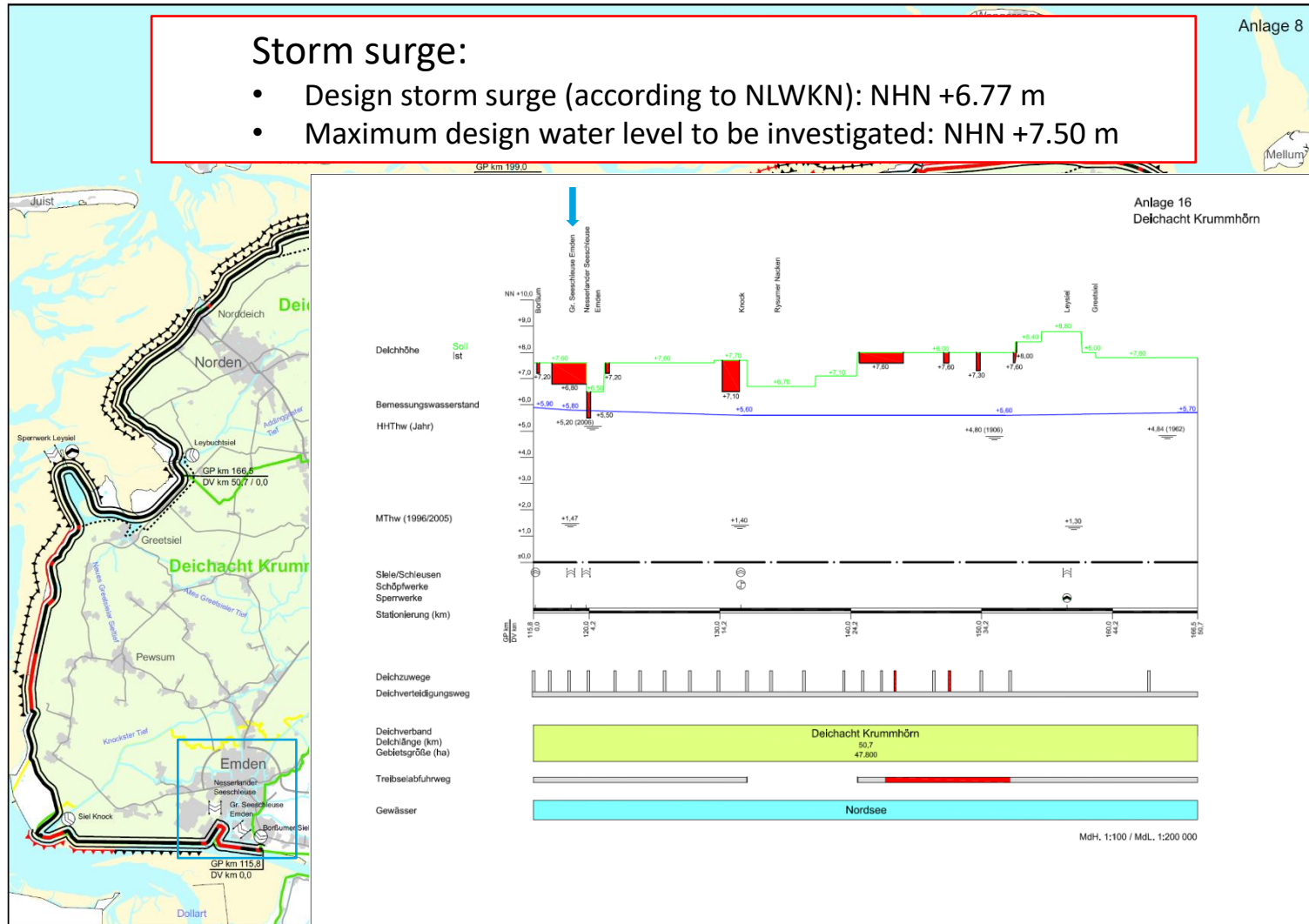
# Challenge 2 – Sealevel rise

Main Dikes and Storm surge barriers along Lower Saxony's Coast



Source: Generalplan Küstenschutz (03/2007)

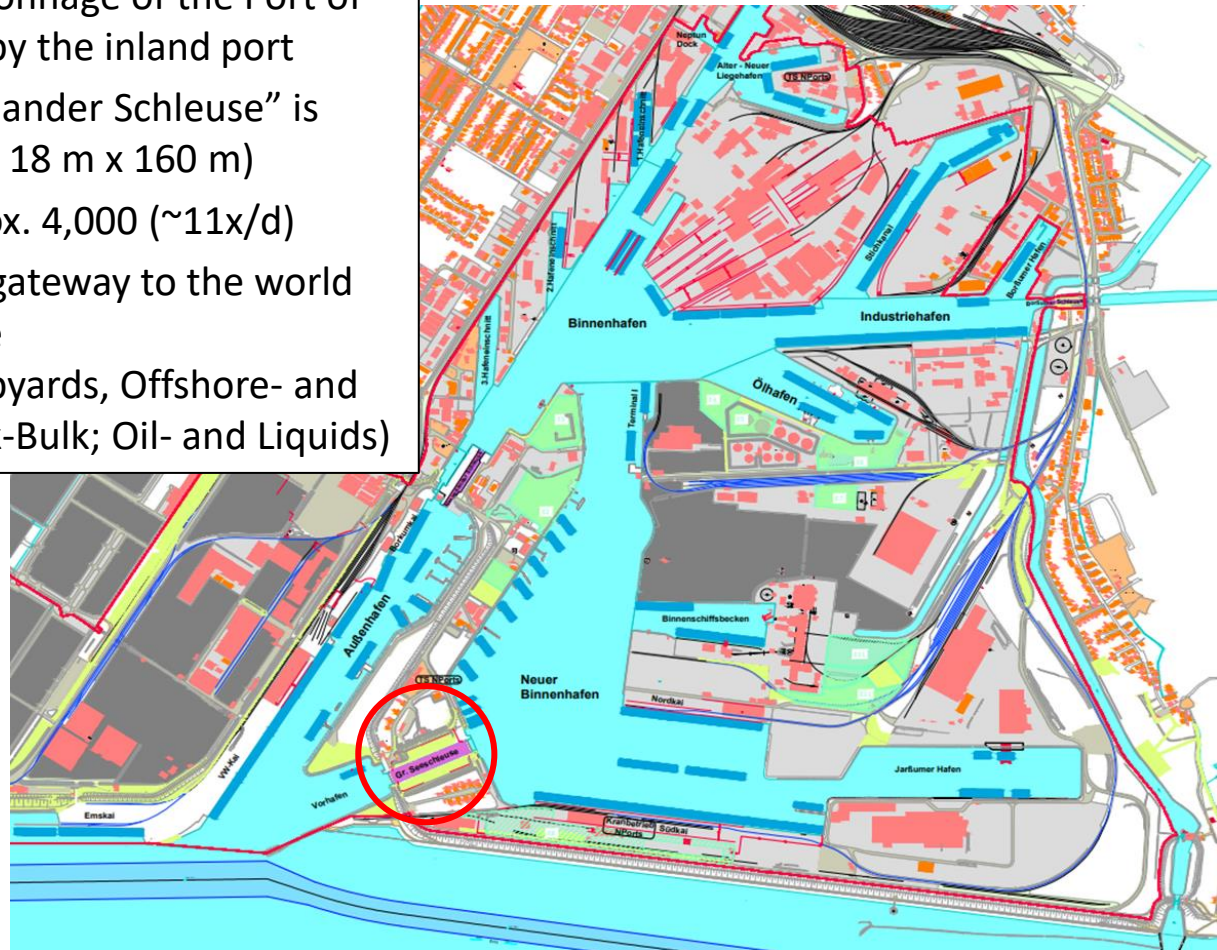
# Challenge 2 – Sealevel rise



Source: Generalplan Küstenschutz, NLWKN (03/2007)

# Challenge 3 – Port Accessibility

- ❖ 50-60% of the Total tonnage of the Port of Emden is generated by the inland port
- ❖ Second Lock “Nesserlander Schleuse” is limited in Size (W x L: 18 m x 160 m)
- ❖ Locks per year: approx. 4,000 (~11x/d)
- ❖ The most important gateway to the world for the local industrie (f.e. Volkswagen; Shipyards, Offshore- and Onshore Wind; Break-Bulk; Oil- and Liquids)



Source: NPorts GmbH & Co. KG

# Planning Team Task

## Operational problems for NPorts:

- Closure of the Nesserland lock in 2006 lead to increased ship traffic. Since 2000, annual locks have roughly doubled
- The structure is aging, and individual components are failing due to wear and tear
- Fluid mud attacks the constructions massively
- Inadequate design of the rails lead to damage of structure and components
- New, higher requirements for flood protection led to new design loads (statics)

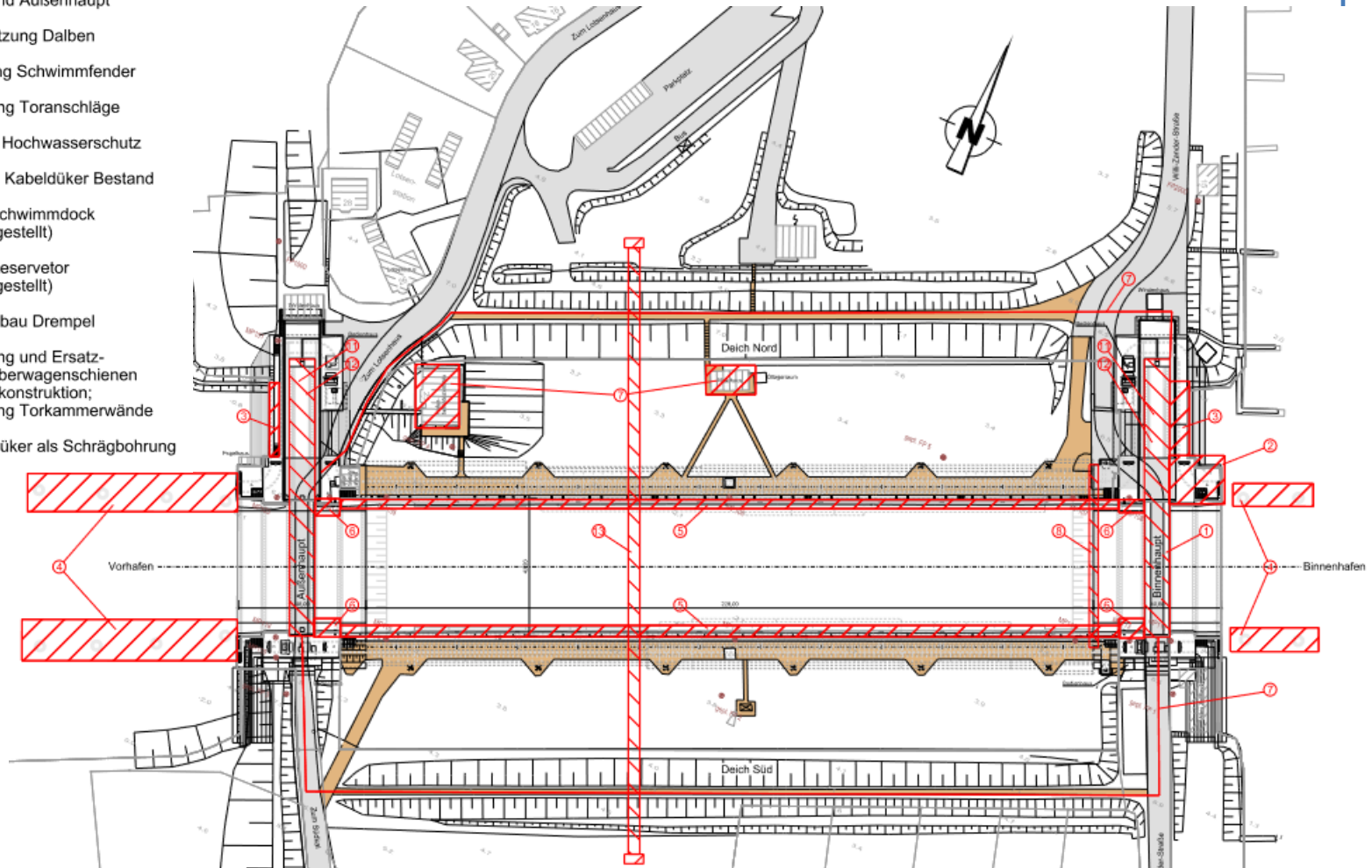
## Next steps required:

- Basic repair and renovation required after structural inspection!
- Results of the structural inspection ...

# Planning Team Task

## Baumaßnahmen:

- ① Erneuerung Schiebetore
- ② Verstärkung Binnenhauptpfeiler
- ③ Verstärkung Torkammerwand Binnen- und Außenhaupt
- ④ Instandsetzung Dalben
- ⑤ Erneuerung Schwimmfender
- ⑥ Verstärkung Toranschläge
- ⑦ Erhöhung Hochwasserschutz
- ⑧ Verfüllung Kabeldüker Bestand
- ⑨ Neubau Schwimmdock (nicht dargestellt)
- ⑩ Neubau Reservoir (nicht dargestellt)
- ⑪ Ersatzneubau Drempel
- ⑫ Verstärkung und Ersatzneubau Oberwagenschienen und Unterkonstruktion; Verstärkung Torkammerwände
- ⑬ Neubau Düker als Schrägbohrung

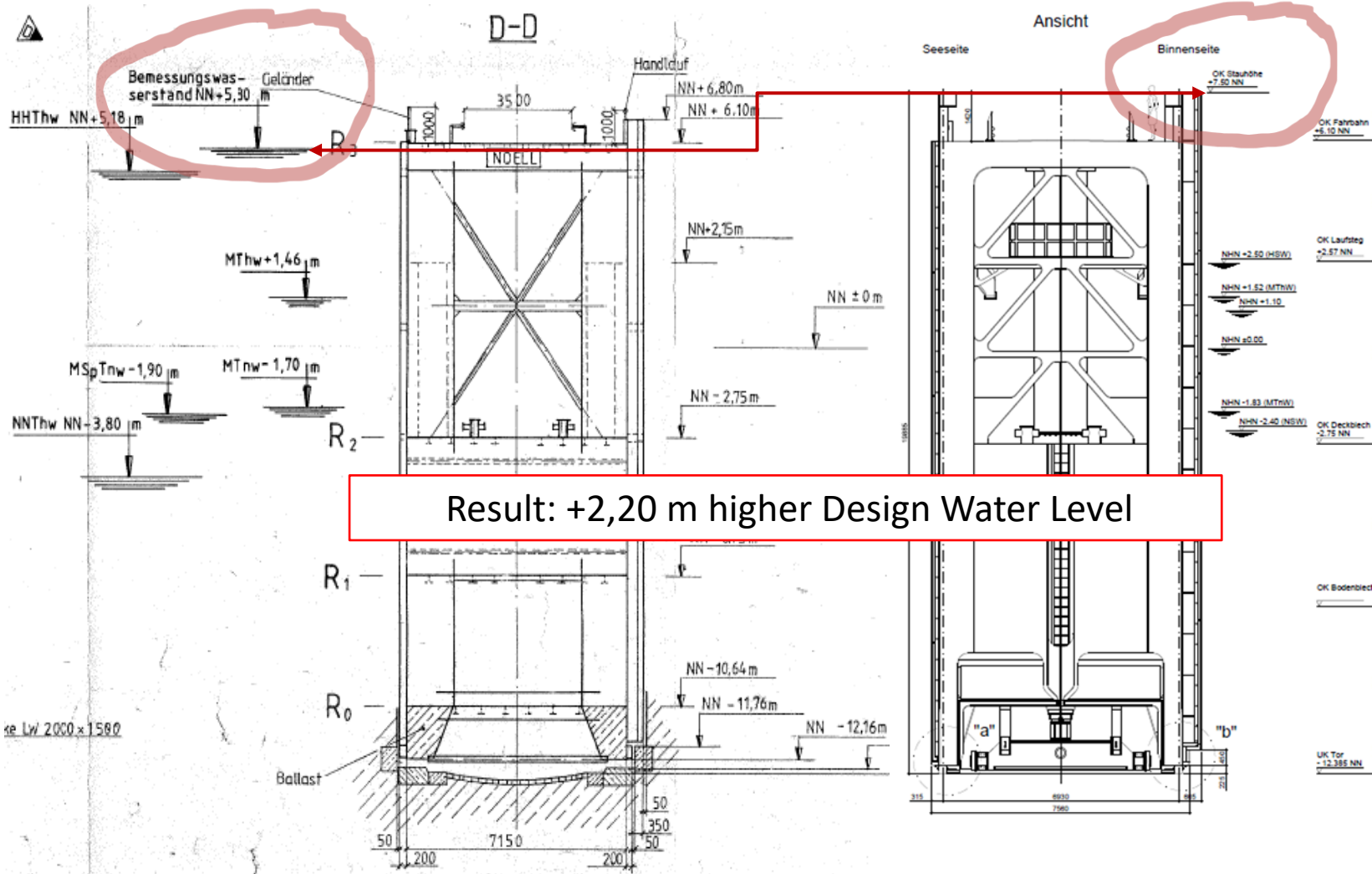


All conversions take place during operation or must only hinder operation minimally!

# Planning Team Task

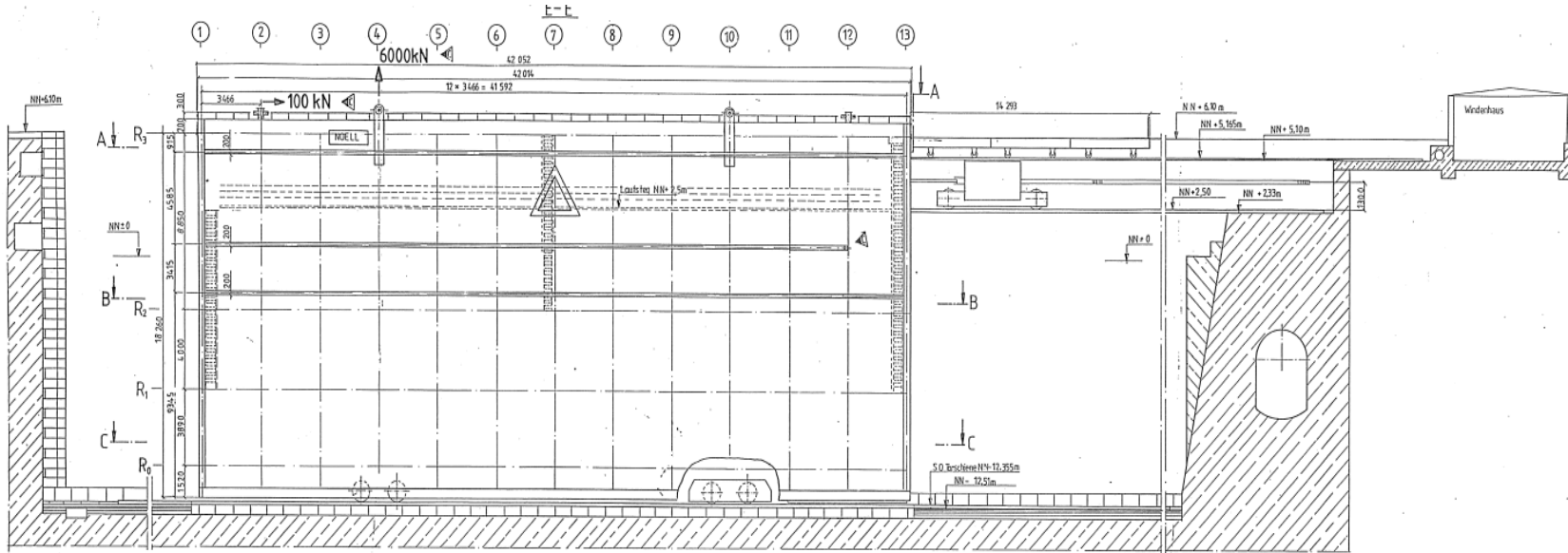
Design in 1993: +5.30 mNN

Design in 2021: +7,50 mNN

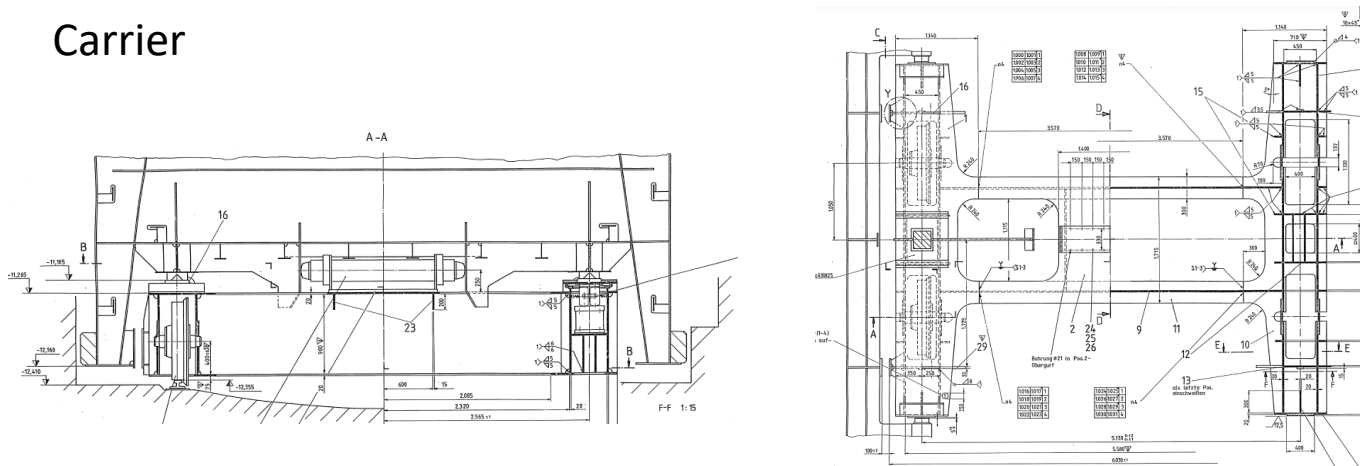


# Solutions – the new Roller Gate

Existing roller gate on 2 rail guided undercarriages



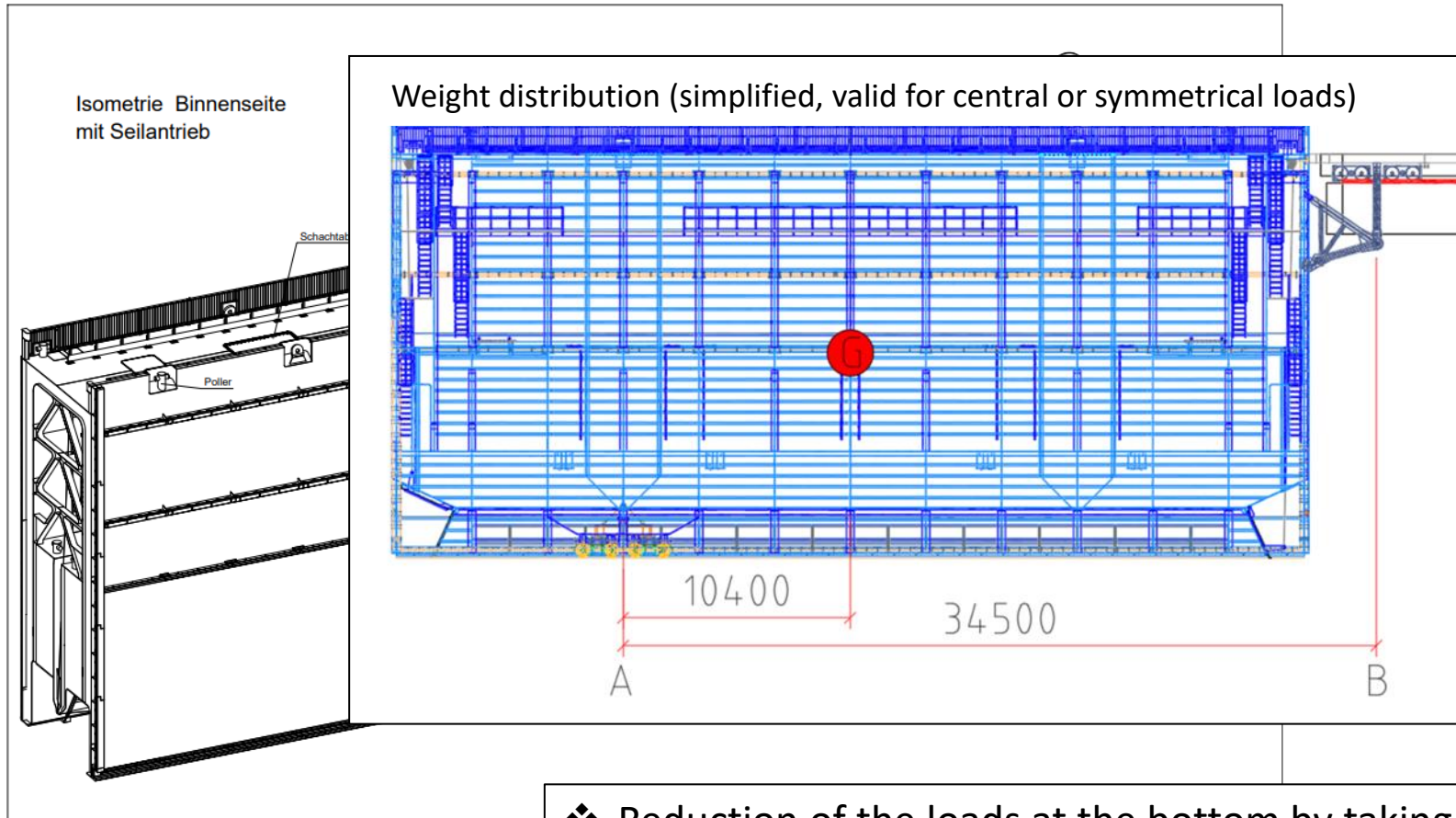
Carrier





# Solutions – the new Roller Gate

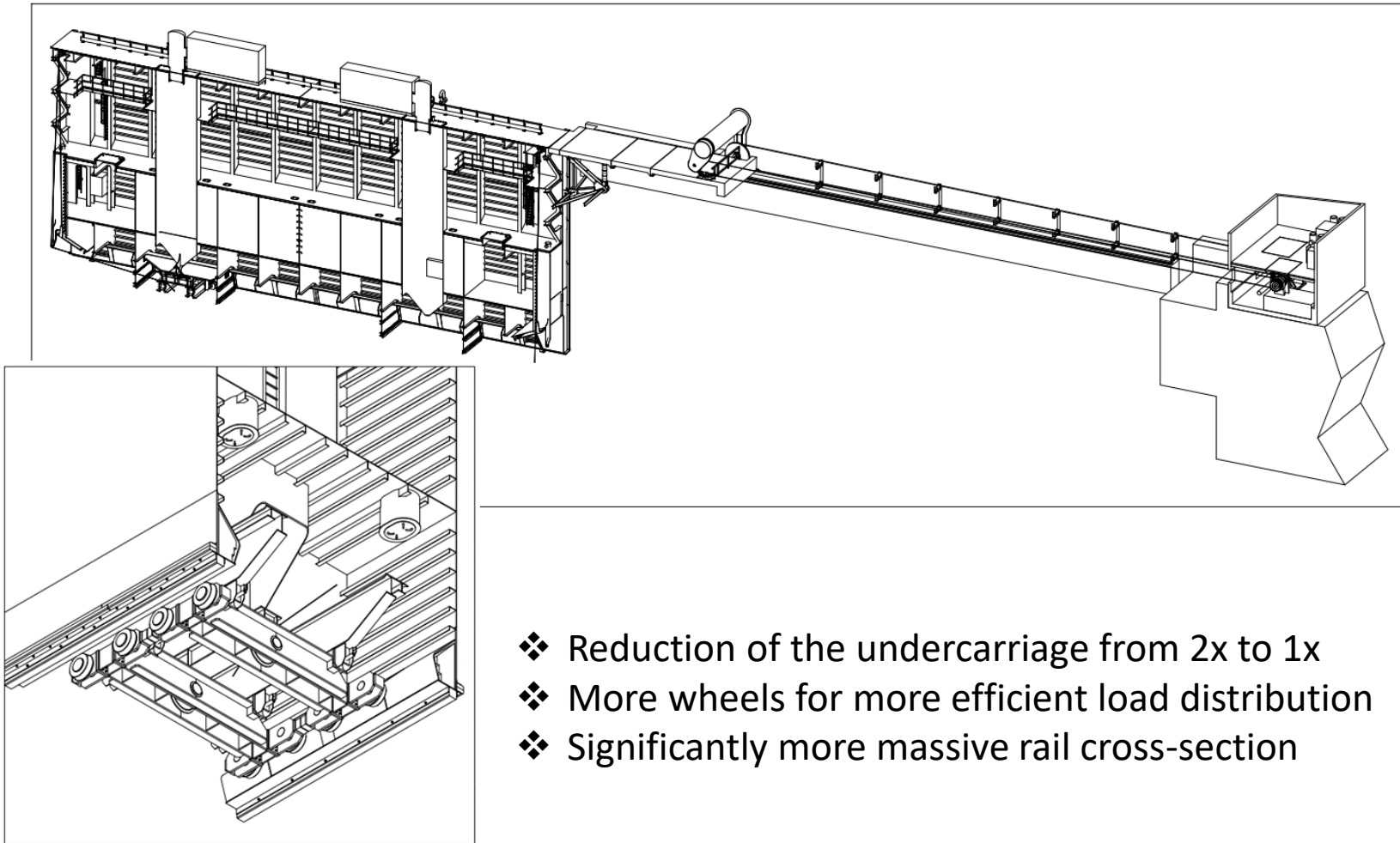
New planning: the wheelbarrow principle



❖ Reduction of the loads at the bottom by taking up the load at the top → wheelbarrow principle!

# Solutions – the new Roller Gate

New planning: the wheelbarrow principle



- ❖ Reduction of the undercarriage from 2x to 1x
- ❖ More wheels for more efficient load distribution
- ❖ Significantly more massive rail cross-section

# Conclusion and Outlook

## Conclusion

- Solid structures of the early 20 Century very reliable
- Difficulties rather with (moving/driven) hydraulic steel constructions
- Highest Impact from changed design conditions and increased number of movements
- Change of structural principle by operational concept leads to reduction of loads on the rail system although higher design loads
- Better accessibility and easier maintenance due to larger inspection chambers as well as accessibility of upper carrier above the water level

## Outlook

- 2024-2025 Construction of new roller gate for the conversion, mainly because of the new working rooms (pressure chambers) to replace the rails.
- Starting 2025 Renovation of the sliding chambers
- Updating the driving system from rack and hydraulic towards cables beginning 2026



Thank you for your attention!

