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B P A C 2015

Hamburg, 27th / 28th May 2015

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Wasser- und Schifffahrtsverwaltung des Bundes

Kiel Canal overview

Length ~100 km

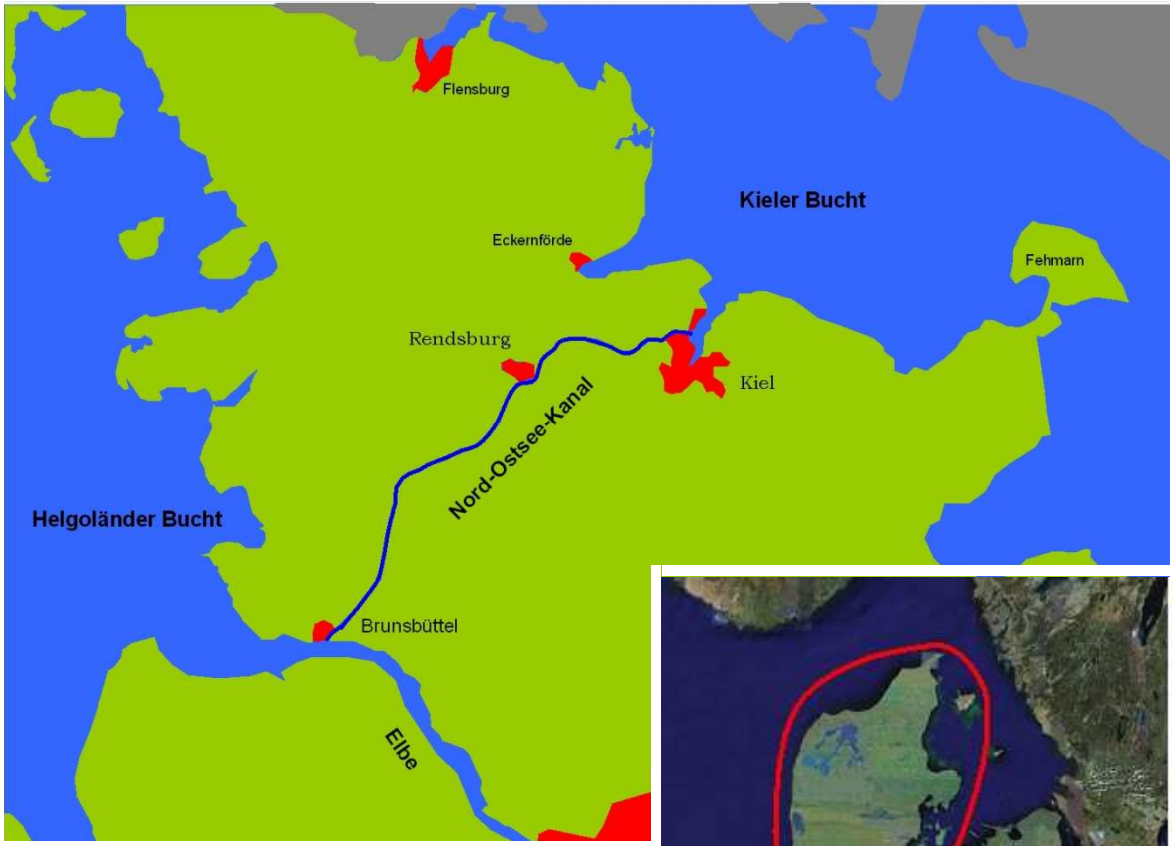
2 Lock groups with 4 lock chambers each

12 Sidings

12 Car ferries

10 (4) Bridges

2 Tunnel (Car tunnel and pedestrian tunnel)



Outstanding importance for the port of Hamburg

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Kiel Canal - overview

The **Kiel-Canal** as an european motorway of the seas has an outstanding importance in the connection of the Baltic range to Europe.

As a waterway it stands in a direct competition with the seaway from the **North Sea** to the **Baltic Sea** around Skagen

Different projects are in planning or were conducted to achieve in this competition.

With a total amount of 35.000 sea-going ships per year, the **Kiel-Canal** is the most frequented artificial waterway worldwide.

With a length of 100 kilometres between Brunsbüttel and Kiel, the canal connects the **Baltic Sea** and the **North Sea** via the Elbe-River.

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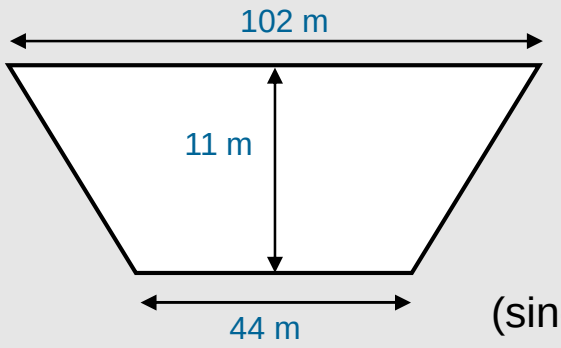
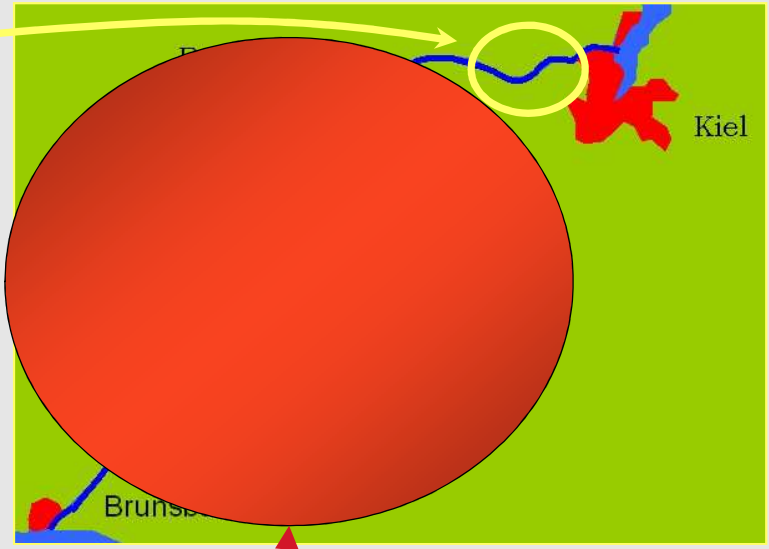
Kiel Canal – existing waterbed profiles

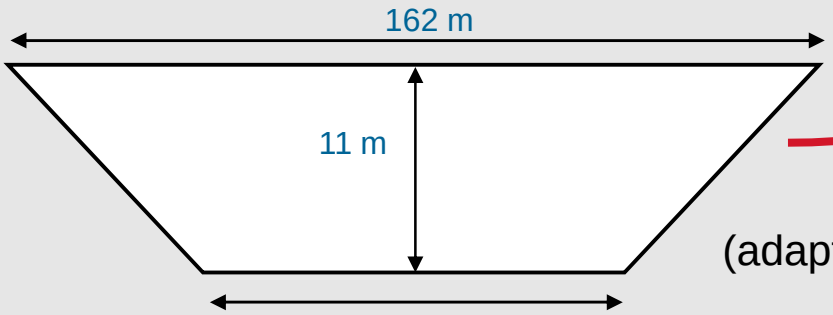
Profile km 80 to km 98



(since 1914)



Profile km 0 to km 80



(adapted from 1965 to 2000)

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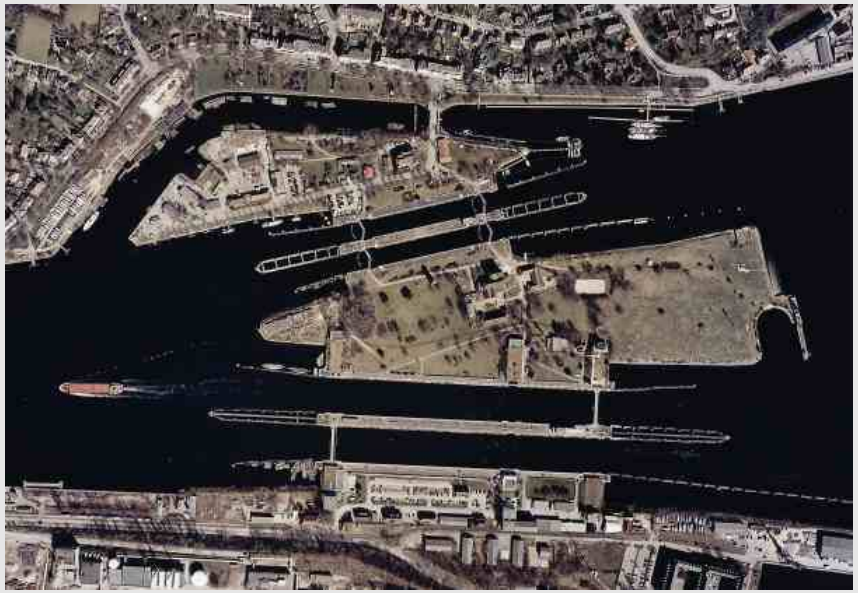
Kiel Canal – Locks



Locks: Principal dimensions (Brunsbüttel and Kiel-Holtenau)			
Old Locks	Length: 125m	Beam: 22m / 20m	Draught: 7m / 6.5m
New Locks	Length: 310m	Beam: 42m	Draught: 9.5m / 10.4m

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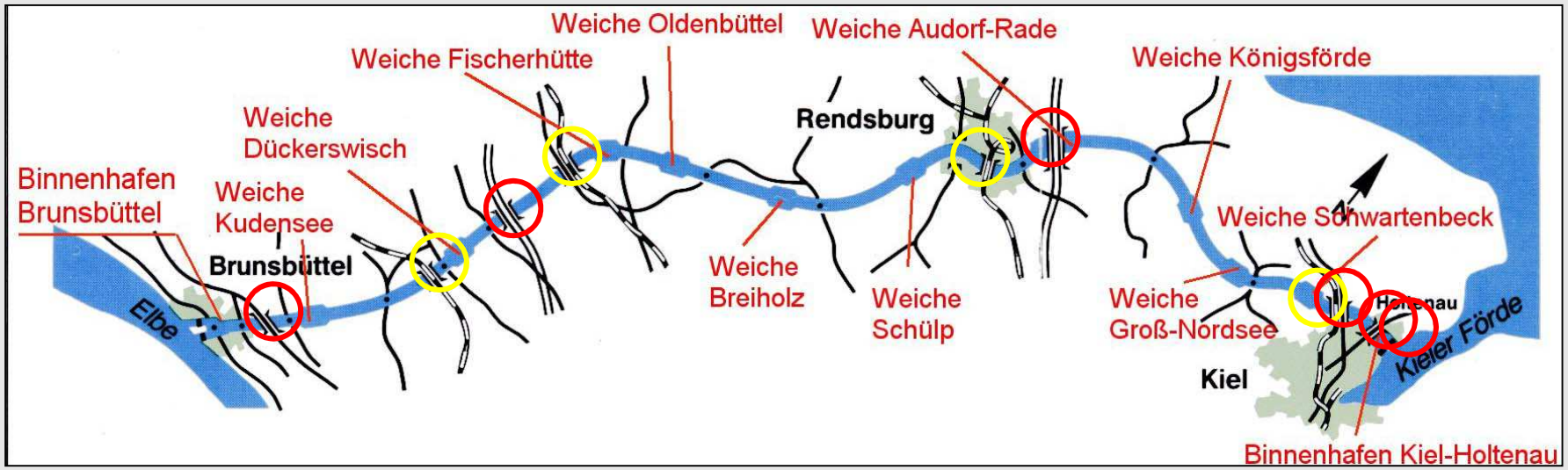
Kiel Canal – arrangement of bridges



Straßenhochbrücke Brunsbüttel	**km 6,123**	**Autobahnhochbrücke Rade**	**km 68,114**
Eisenbahnhochbrücke Hochdonn	**km 18,778**	**1. Eisenbahn- u. Straßen-Hochbrücke Levensau**	**km 93,478**
Autobahnhochbrücke Hohenhörn	**km 24,882**	**2. Straßenhochbrücke Levensau**	**km 93,581**
Eisenbahn- u. Straßen-Hochbrücke Grünental	**km 31,115**	**1. Straßenhochbrücke Holtenau**	**km 96,588**
Eisenbahnhochbrücke Rendsburg	**km 62,664**	**2. Straßenhochbrücke Holtenau**	**km 96,623**

Kiel Canal - Traffic

Since the late 1990's the passing traffic through the canal rose from **23.000 to 34.000** (43.000) ships per year, which carry 94 per cent (**94 million tons**) of the cargo. The local traffic (9.000 ships) to Brunsbüttel and Rendsburg Harbours carries about 6 per cent (**6 million tons**).

In the same time the average ship size doubled, so that the development of the carried tonnage outmatched the increasing number of ships.

According to a **prognosis of sea economy and traffic** this development will continue.

The world economic and finance crisis in 2008/2009 influenced the Kiel Canal development seriously but the raising of ships figures (number of vessels, gross tonnage and cargo carried) continued again in 2010.

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Kiel Canal - Data

Maximum ship‘s size:

Length **235 m** Width **32,5 m** Draught **7 m**

Smaller vessels (up to 160 m length and 27 m beam) maximum draught **9.5 m**

Traffic classification: 6 different size classes (1 smallest, 6 biggest)

Transit speed: 15 resp. 12 km/h

Transit time: 6.5 to 10 hours

Raise of 100 % of the gross tonnage in the last decade

30 % of all containers transshipped in the port of Hamburg are coming from or bound for the Baltic Countries and passing the Kiel Canal

Kiel Canal – ferry operations

The Kiel Canal Authority operates **14 ferry boats** at **12 ferry stations** over the entire canal.

This ferry services are kept upright to reconnect all previous road connections which were interrupted due to the construction of the artificial waterway Kiel Canal.

The ferry services have to operate in a 24-hour-service and are free of charge for the customers according to German law.

The maintenance of the ferry boats is conducted regulary at the Rendsburg shipyard, operated also by the Kiel Canal Authority.

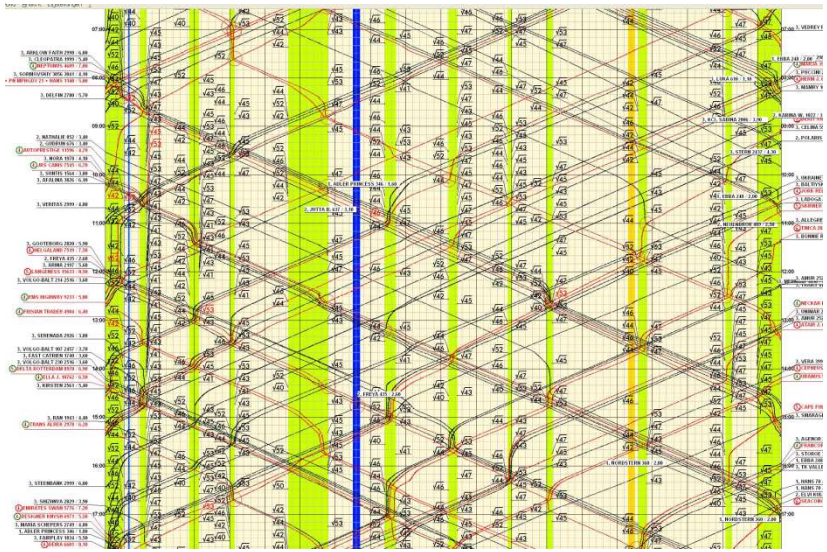
A new generation of ferrys is under development.

Kiel Canal - Vessel Traffic Services

To achieve the great amount of ships per year a modern computer aided **Vessel Traffic Management System** was introduced in 2006.

The **VTS-Centre** is located in Brunsbüttel, from there the whole **Kiel Canal** is supervised and the traffic is controlled.

Passages of vessels which are not able to pass each other on the narrow canal are carried out in **12 sidings** (especially extended areas equipped with dolphins)



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Kiel Canal – ship size classes

Size class	Ships			Towing units			
	length	beam	draught	length	beam	draught	
1	45 m 55 m	9,5 m 8,5 m	3,1 m 3,1 m	65 m	10 m	3,1 m	
2	65 m 85 m 105 m	13 m 11 m 9 m	3,7 m 3,7 m 3,1 m	85 m	13,5 m	3,7 m	**Especially dangerous ships with the dimensions of size class**
3	120 m 140 m	19 m 17 m	6,1 m 6,1 m	135 m	19 m	6,1 m	**1 und 2**
4	130 m 160 m	23,5 m 20,5 m	9,5 m 9,5 m	155 m	23 m	6,1 m	**3**
5	200 m 210 m	28 m 27 m	s. Tabelle s. Tabelle	185 m	27 m	9,5 m	**4 und 5**
6	235 m	32,5 m	s. Tabelle	Authorized extraoprdinary towing units			**6**

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Kiel Canal – ships and size groups

Size Group 1

Size Group 2

Size Group 3

Size Group 4

Size Group 5

Size Group 6

Kiel Canal – traffic flow regulations

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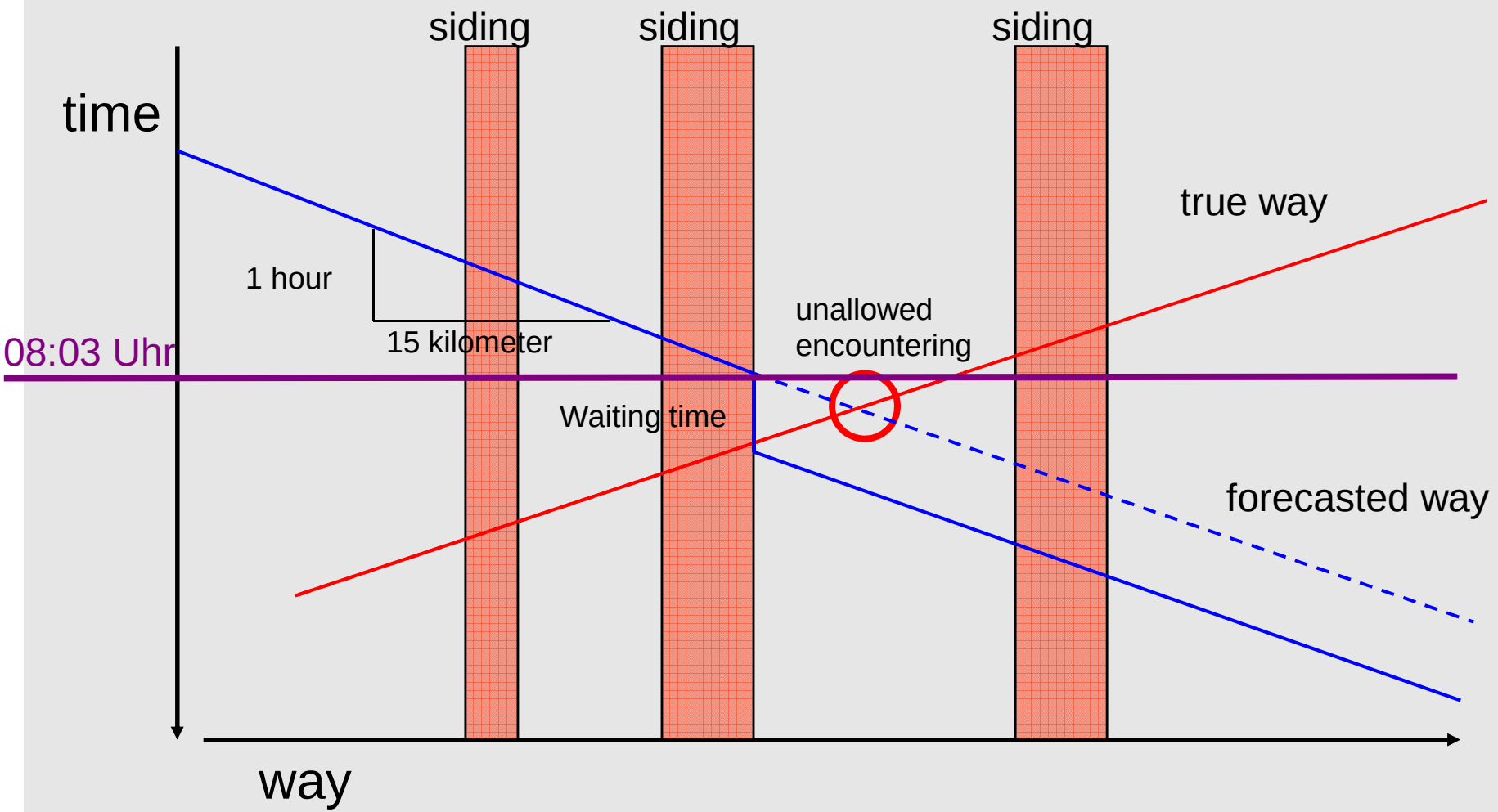
Area				Addition of Size Number
Siding				Unlimited
Not adapted areas				6
Adapted areas				8
a)	**Within the following draught limits or if the amount of added draughts does not exceed**			
	Size Number	Maximum draught	Max. draught added	
	4 und 4	7,5 m	14,0 m	
	5 und 3	7,9 m	-	
	6 und 2	-	-	
b)	Otherwise			7

Kiel Canal - Traffic control by time/way diagram



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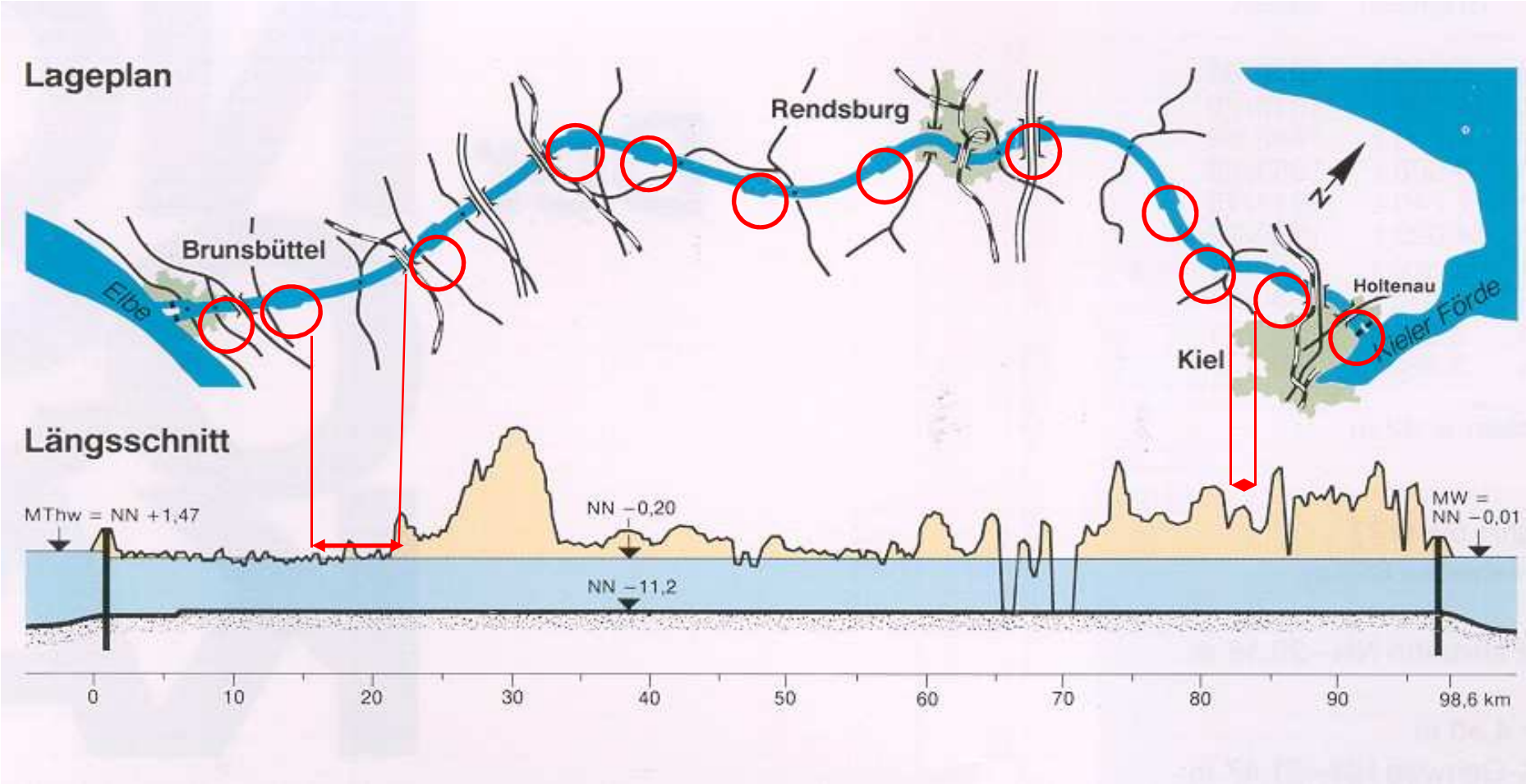
Kiel Canal – arrangement of sidings



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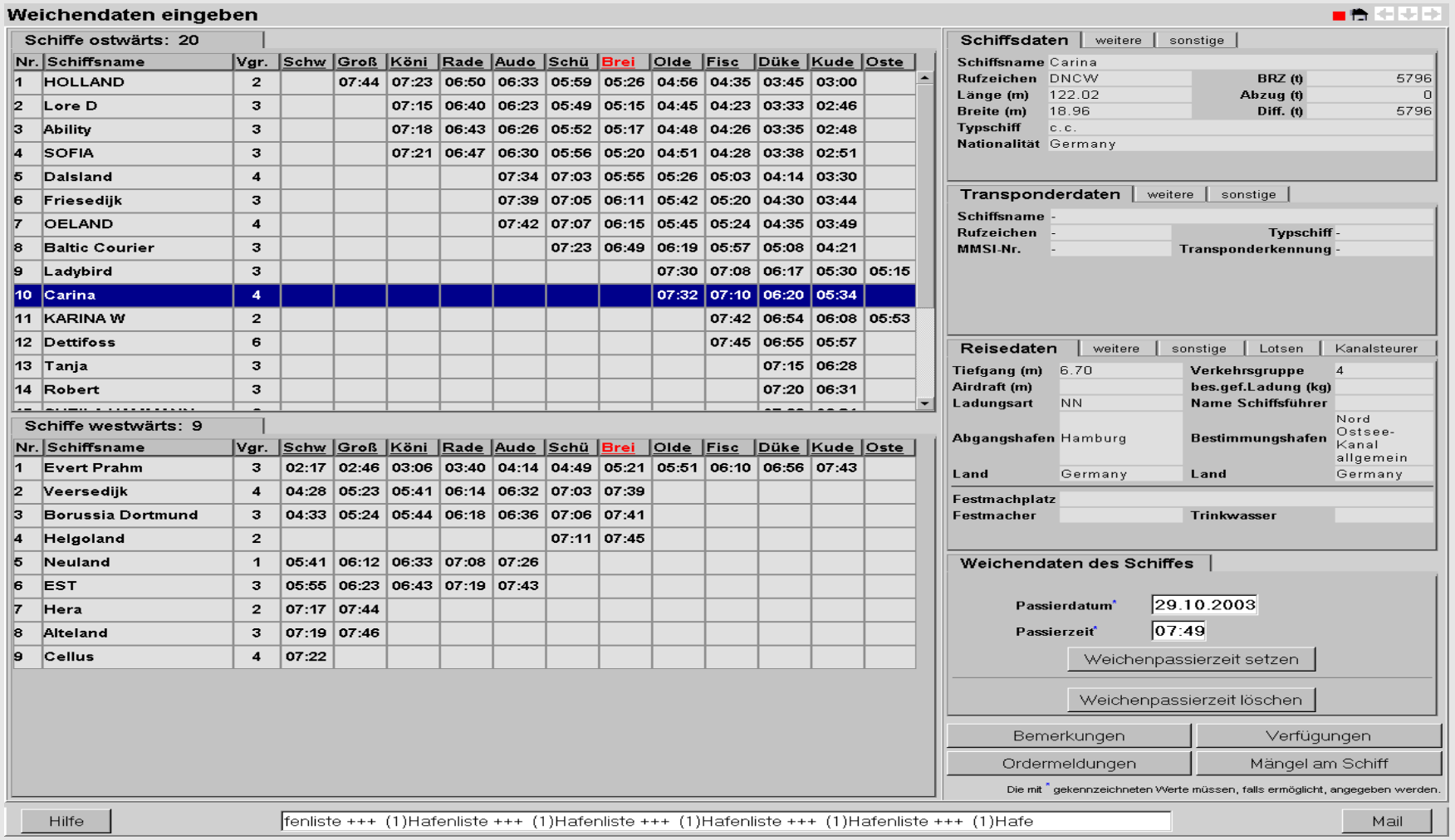
Kiel Canal – Ship Data Management System



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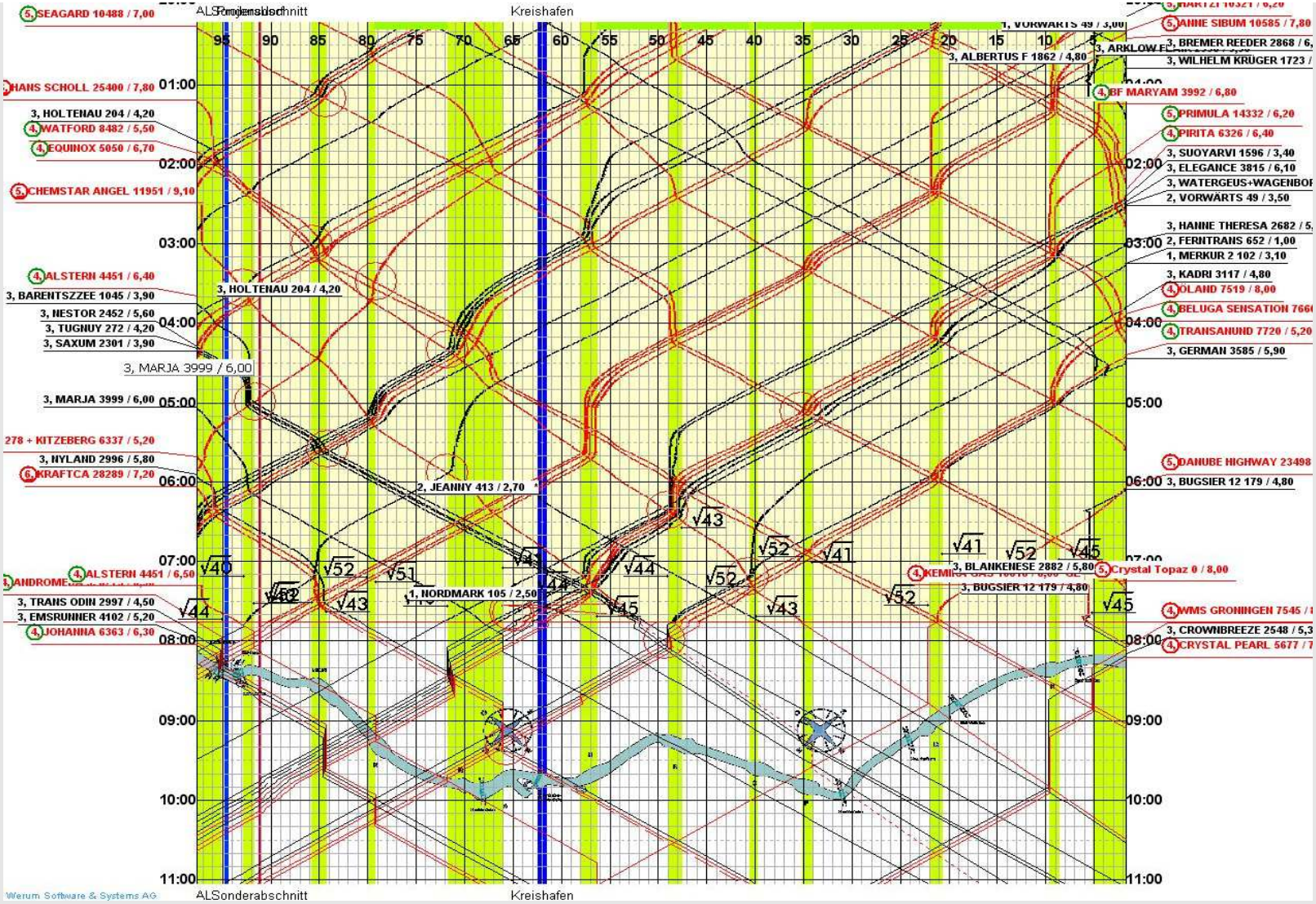
Kiel Canal – ships traffic diagram



Wir machen Schifffahrt möglich.

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Kiel Canal - ship passages

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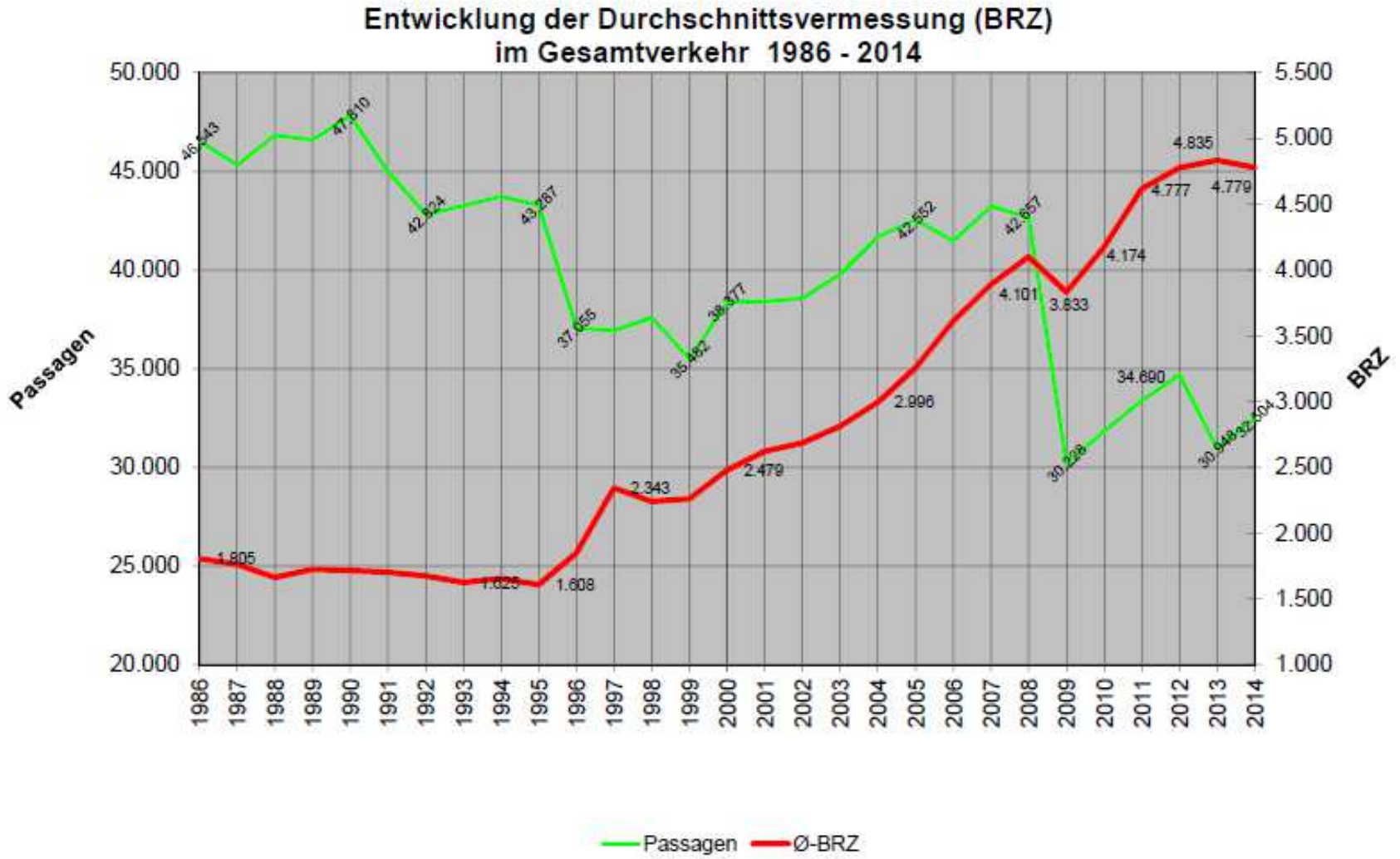
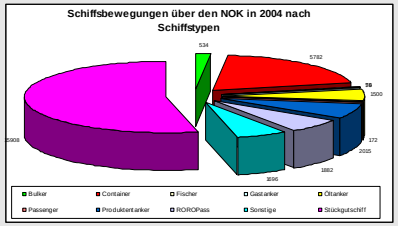
Kiel Canal - Traffic development



Kiel Canal – fleet structure and prognosis 2025

Number of passages in transit - prognosis

Schiffstyp	2004	2015	2020	2025	WR 04-25 in % p.a.
Verkehr über den NOK im Transitverkehr					
Bulker	534	1.115	1.231	1.316	4,4
Container	5.783	10.426	12.237	12.981	3,9
Fischer	59	48	50	49	-0,9
Gastanker	76	96	96	97	1,2
Öltanker	1.501	1.720	1.666	1.608	0,3
Passagier	172	171	168	166	-0,2
Produktentanker	2.015	2.770	2.957	3.111	2,1
ROROPass	1.882	2.458	2.435	2.400	1,2
Sonstige	1.696	1.749	1.783	1.805	0,3
Stückgutschiff	15.908	22.491	24.634	26.021	2,4
Summe	29.625	43.044	47.257	49.554	2,5



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Kiel Canal - Project Brunsbüttel Locks

An important project in improving the Canal for future demands represents the restoration of the two major locks in Brunsbüttel. In consequence of the increasing traffic it is not possible to conduct the renovation closing one of the lock chambers for years. Therefore the construction of a new single lock is necessary**.**

Major locks with 2 lock chambers;

(in service since 100 years)

depth of the sill -14 m NN

Minor locks with 2 lock chambers:

(in service since 120 years)

depth of the sill -10,20 m NN

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Newbuilding 5th Lock Chamber

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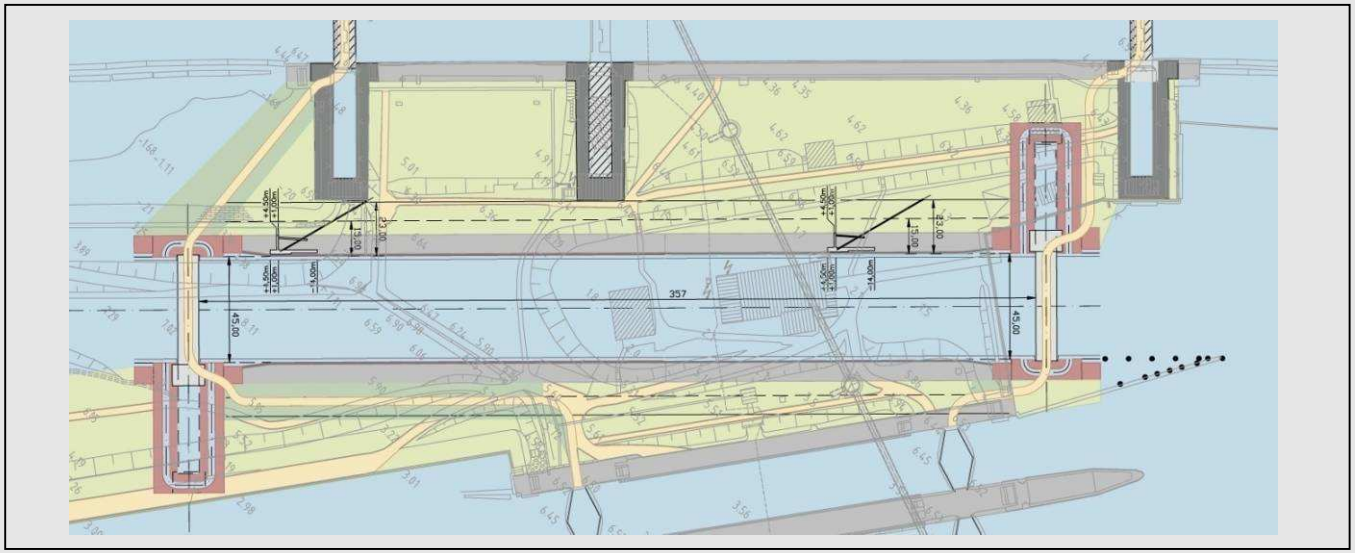
Lock plant today

Determining of position and size for the new lock

Preferred version

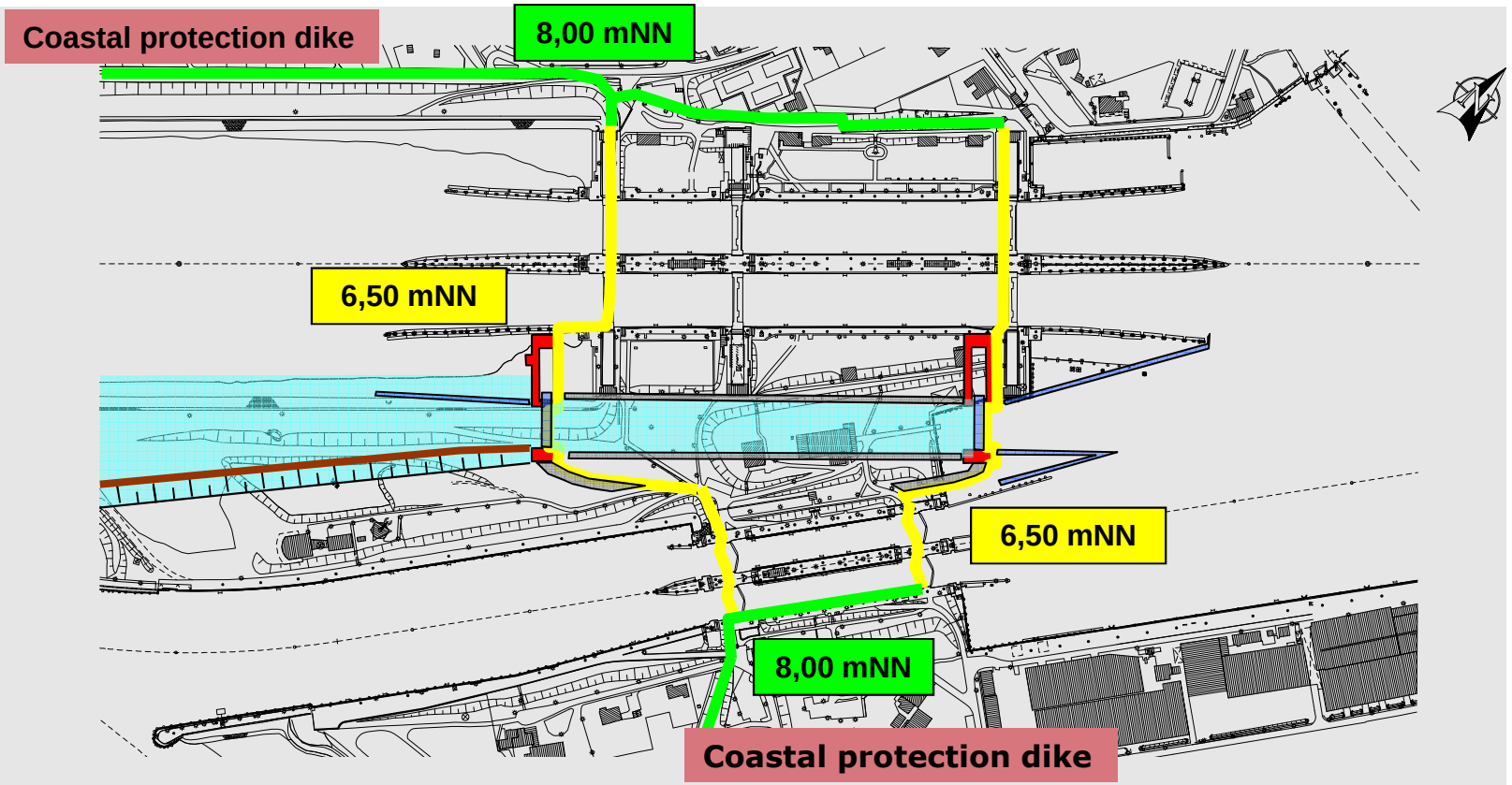


Version 4

Length: ca. 360 m

rel. Size: 109 %

High water protection / dike construction



Coastal protection for the future

Assignment of newbuilding

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11th of April 2014:
Assignment Lot 1

411.779.851,30 €

w&f Ingenieurbau aus Hamburg,
BAM Civiel bv aus Gouda NL,
w&f Spezialtiefbau aus Düsseldorf

May 2014:
Assignment Lot 2
abt. 62.000.000 €
DSD NOELL GmbH
Plauen Stahl Technologie

Newbuilding contract new lock chamber

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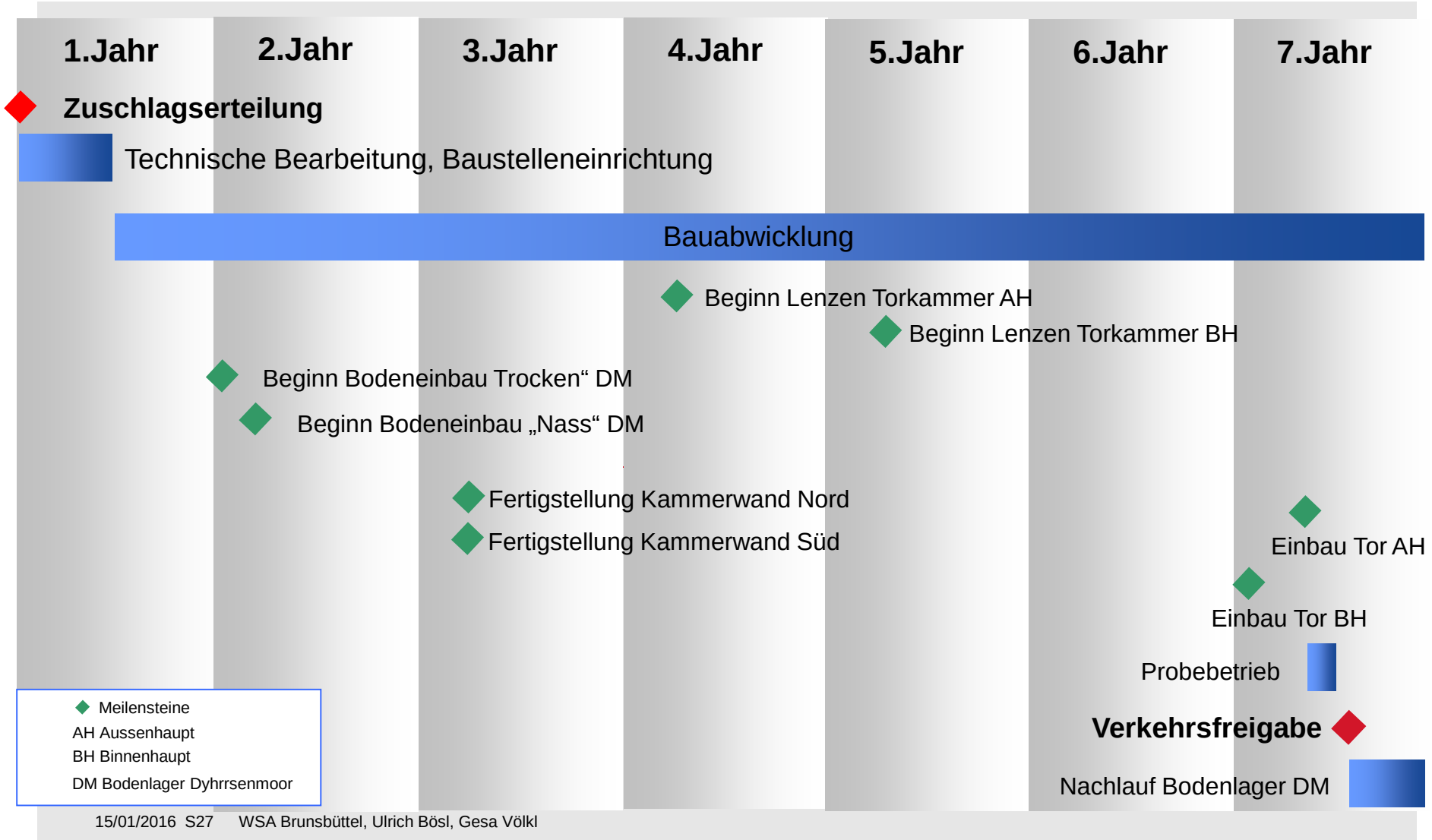
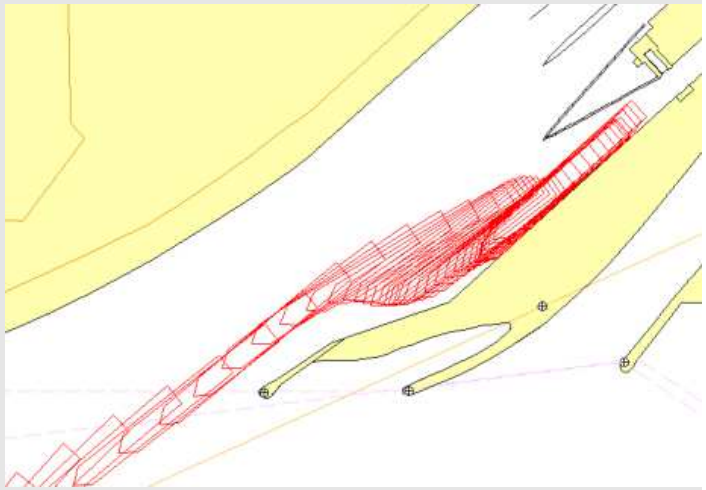
scheduled execution



Preparation works – nautical simulations

- Optimizing of safe and effective entering and leaving the locks
- Continuous maneuvring strategy
- Sufficient room for maneuvring (also under tug assistance)
- Staging concept for protection of locks



Challenge - Island position of construction site

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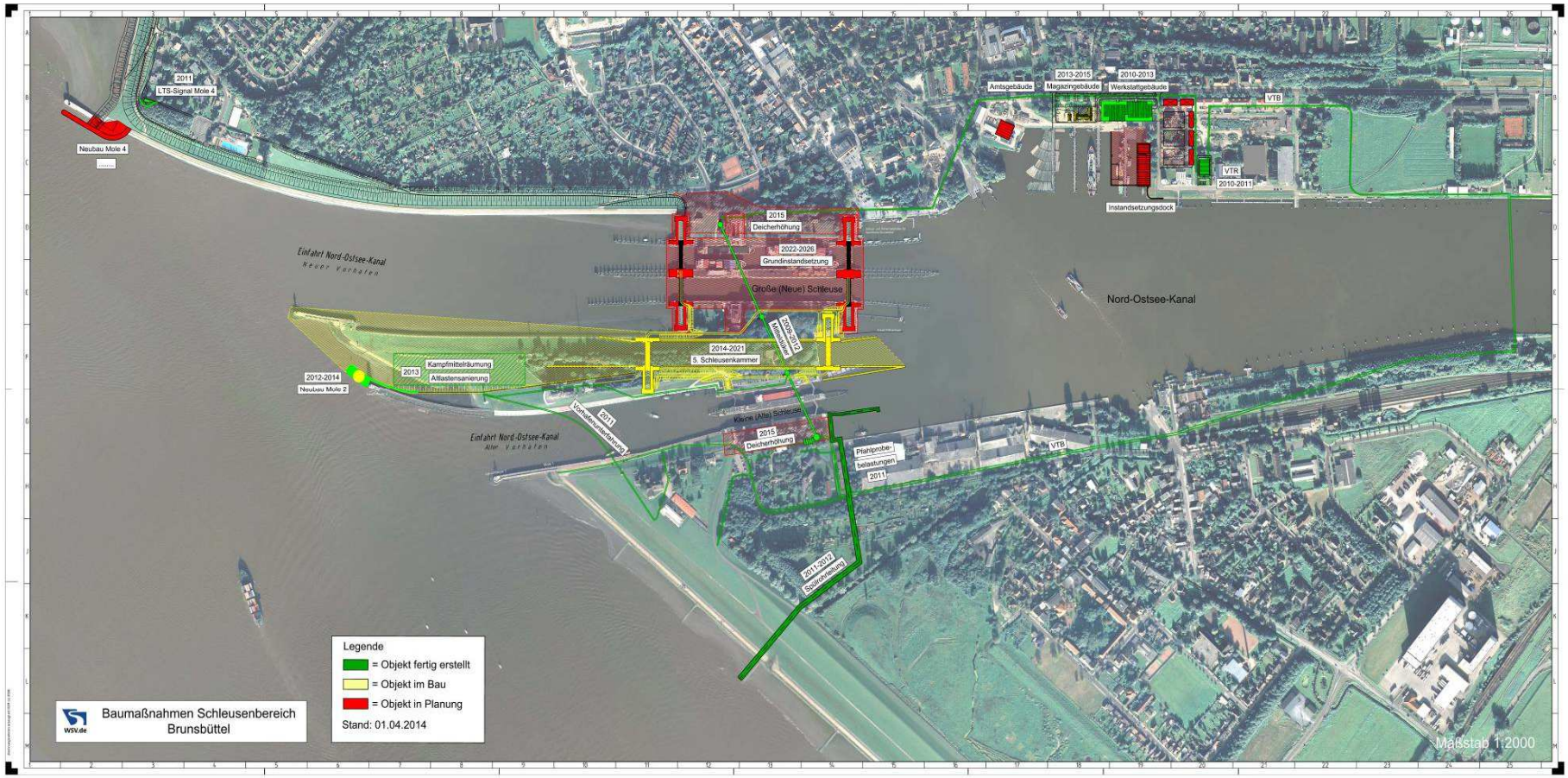
Several preparations works



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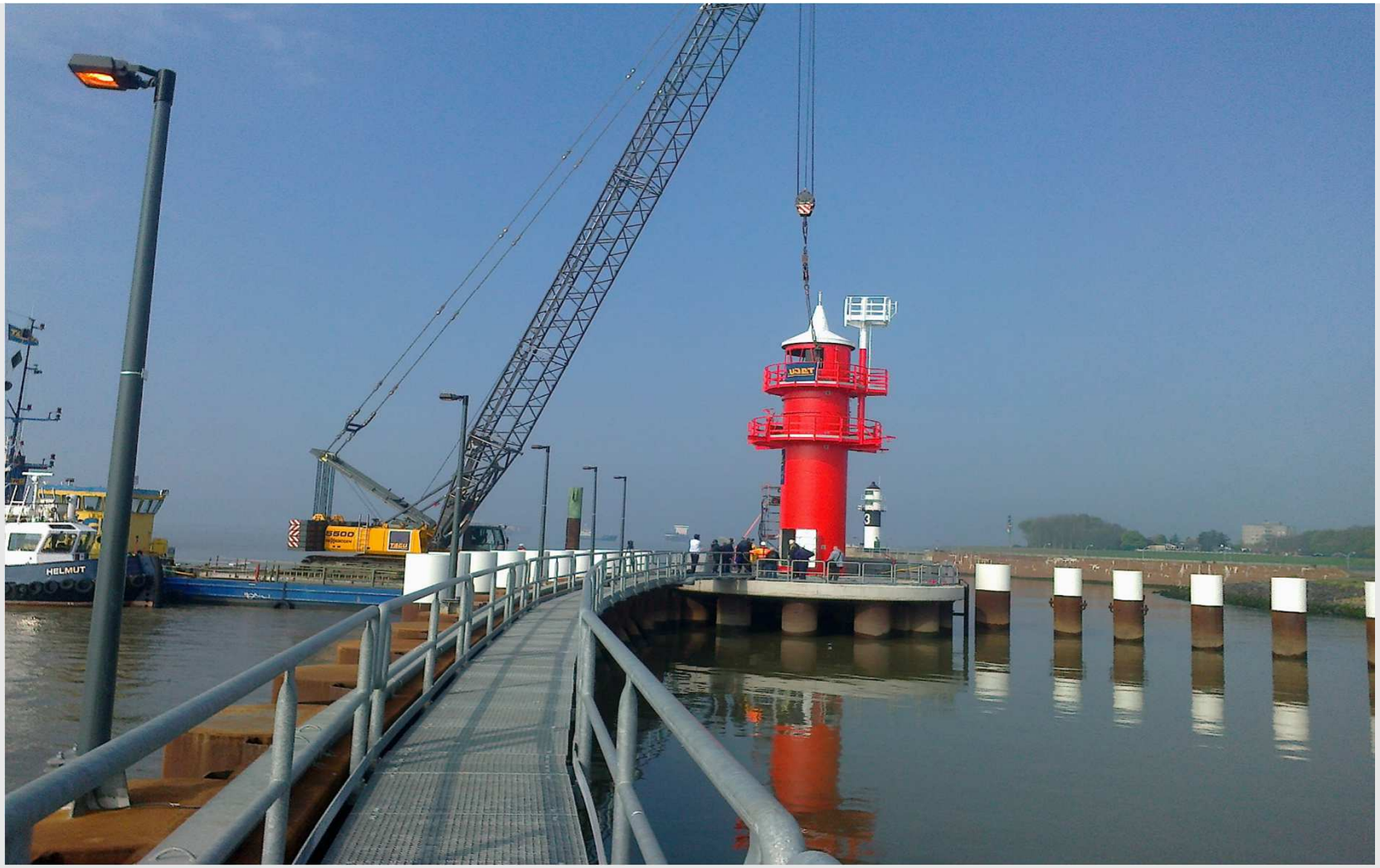
Preparation works - new lighthouse on extended mole 2



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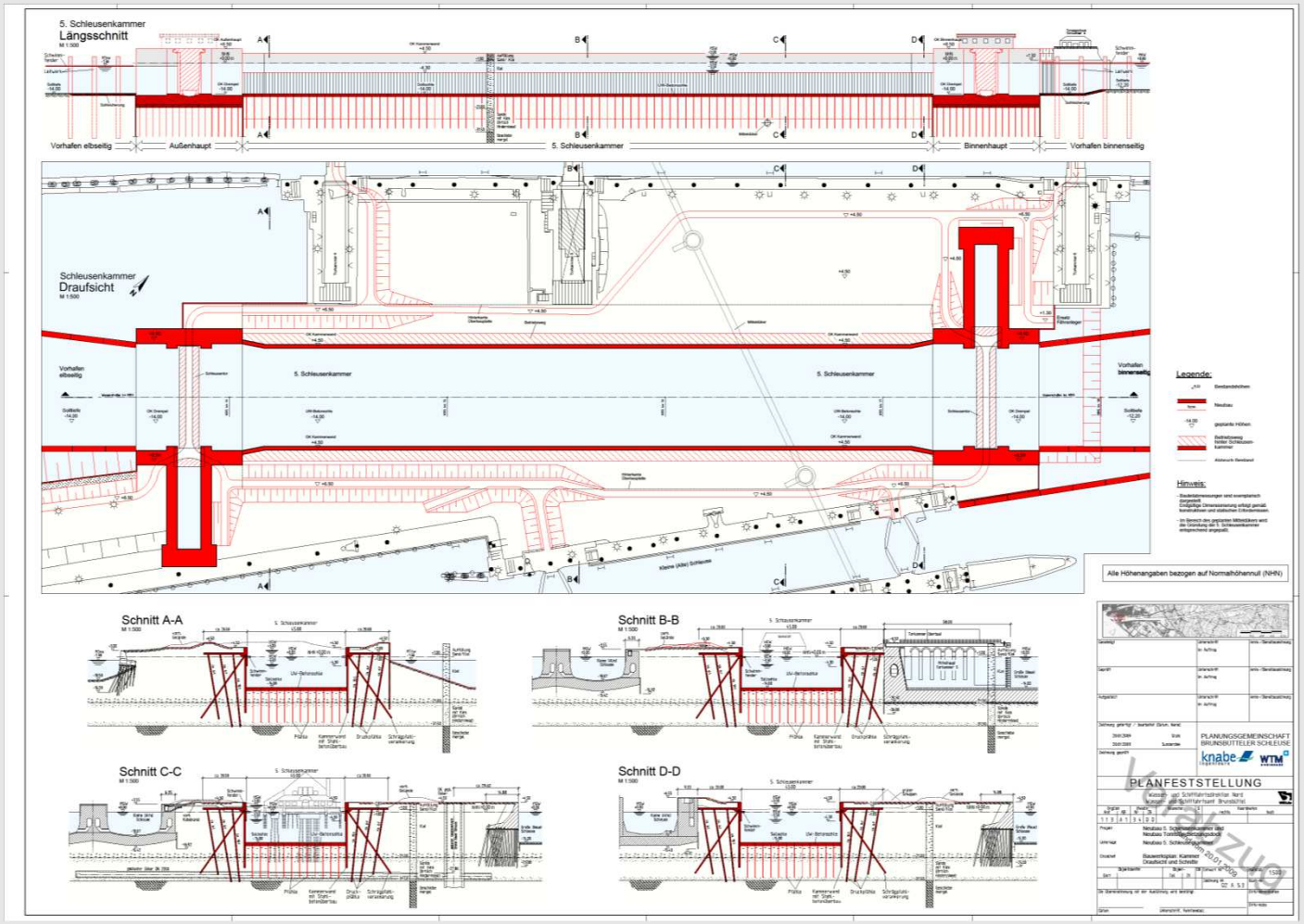
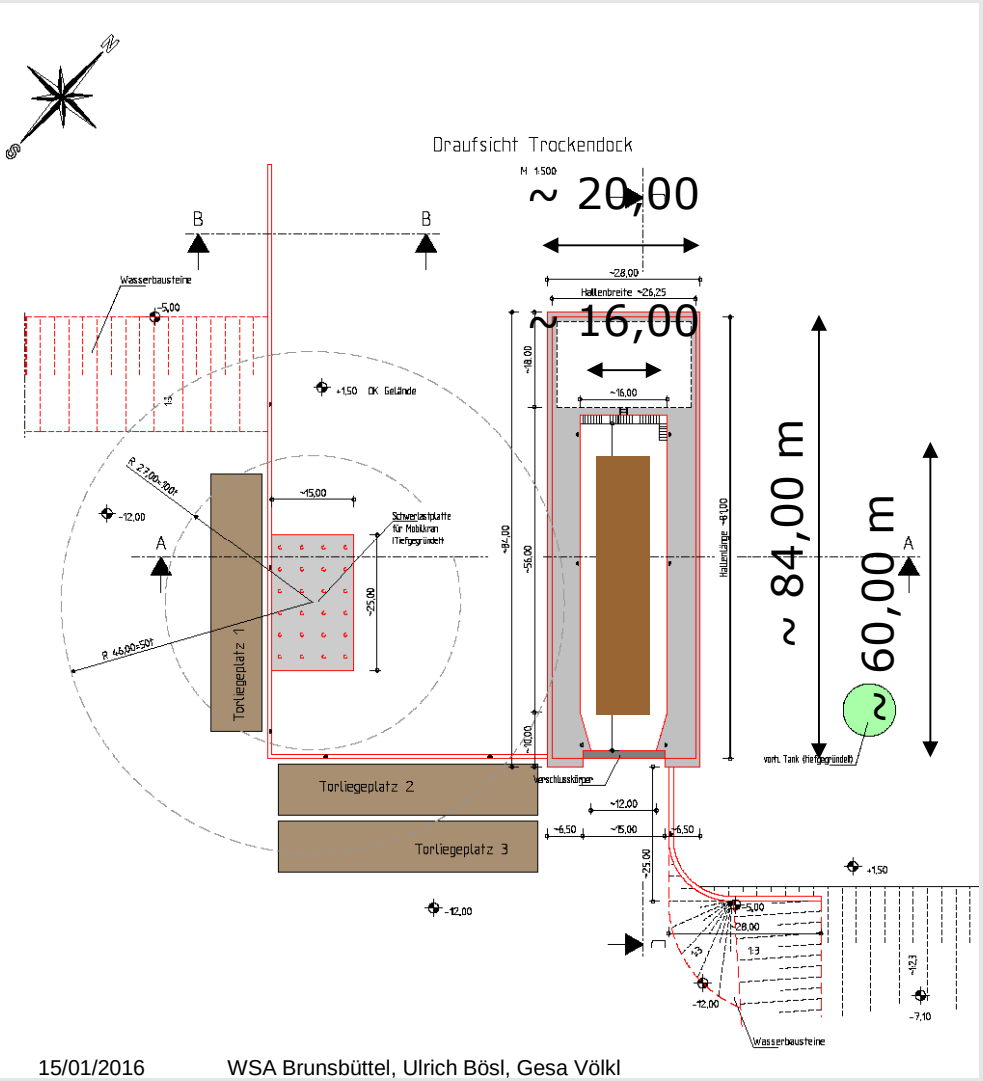
Air photograph April 2015

5th lock chamber - foundation



Newbuilding drydock for repair and maintenance of lock gates



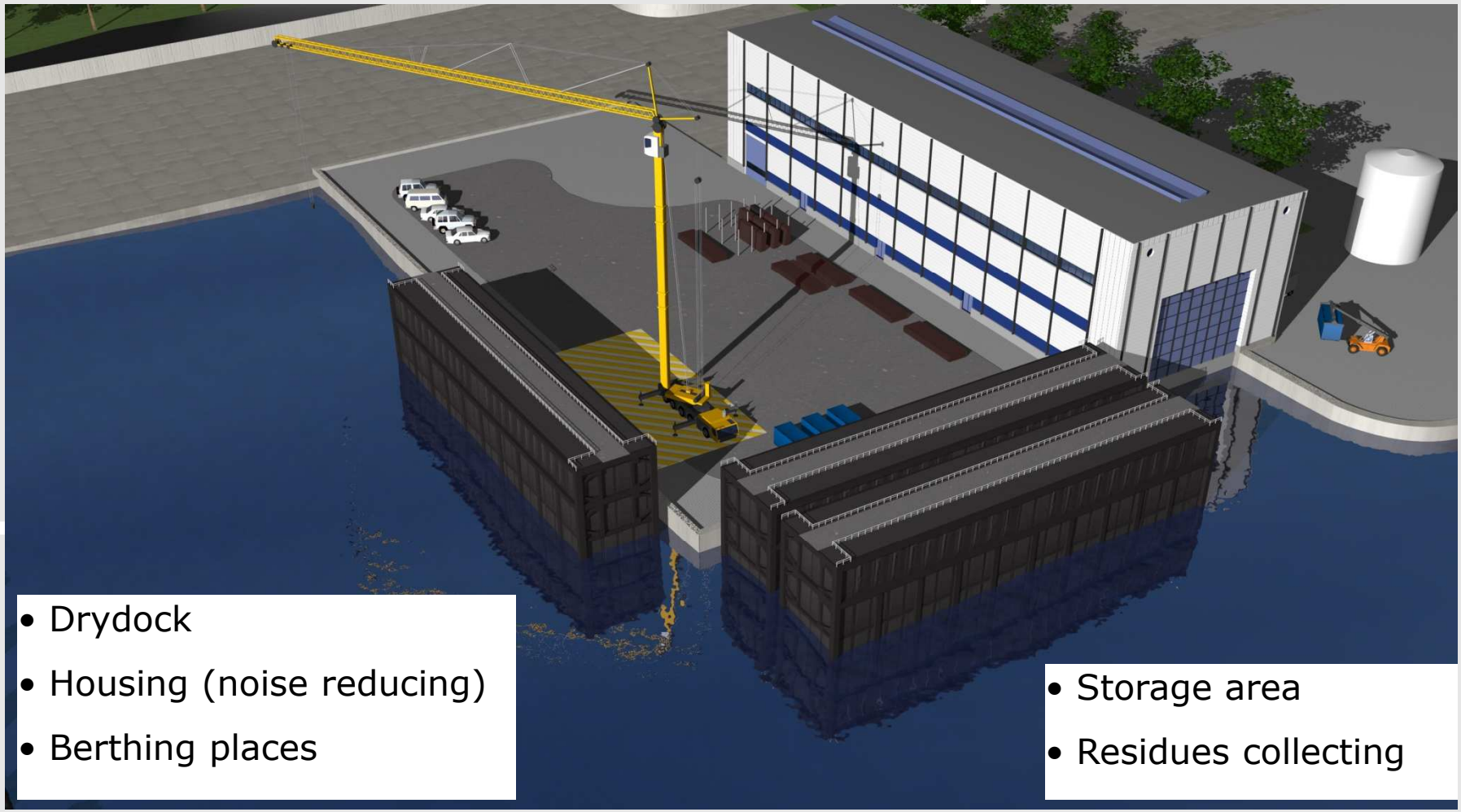
Abmessungen der Tore

L = ~ 50,00 m

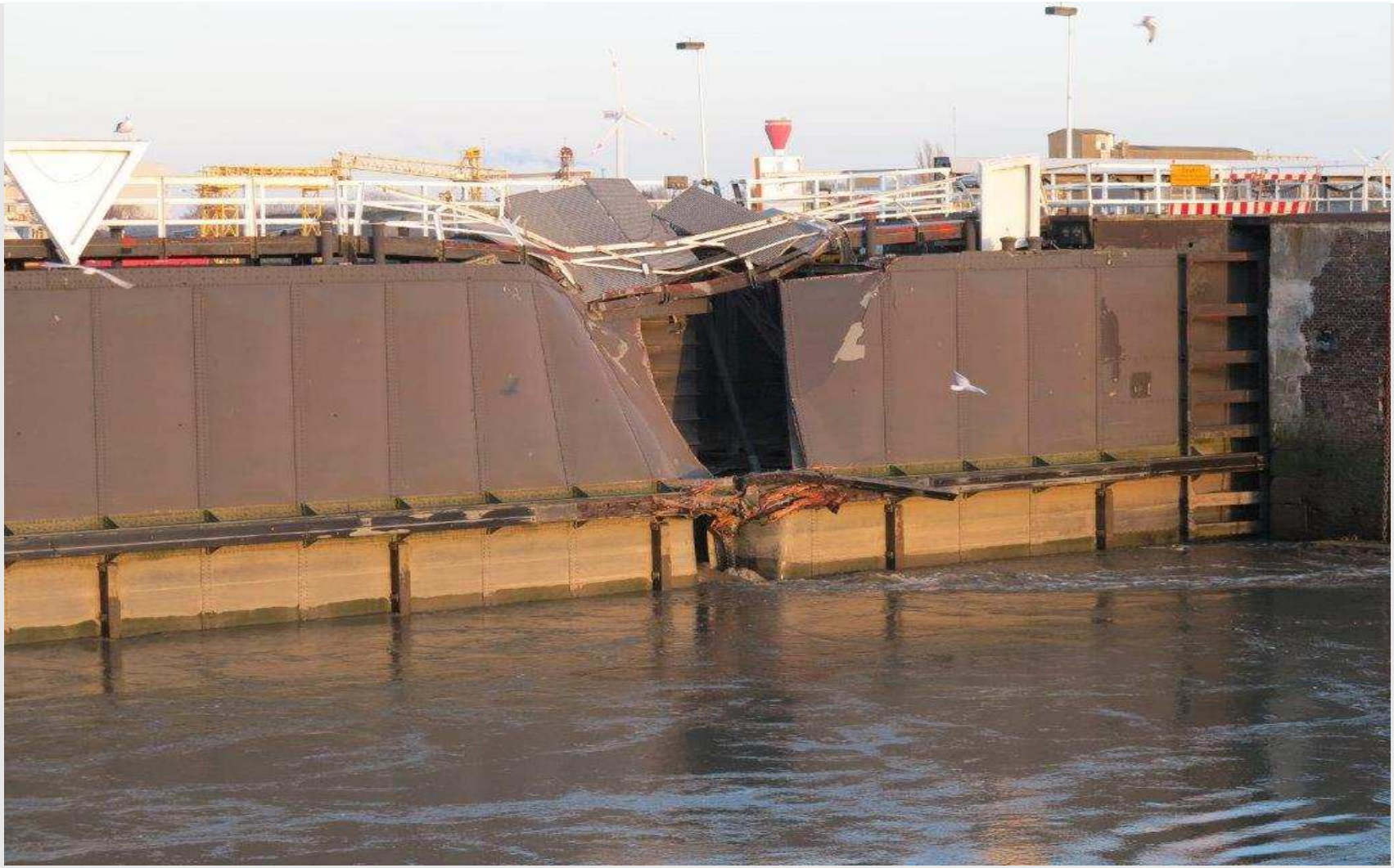
B = ~ 10,00 m

H = ~ 22,00 m

Newbuilding drydock for repair and maintenance of lock gates



Damage South Lock 17th of January 2015



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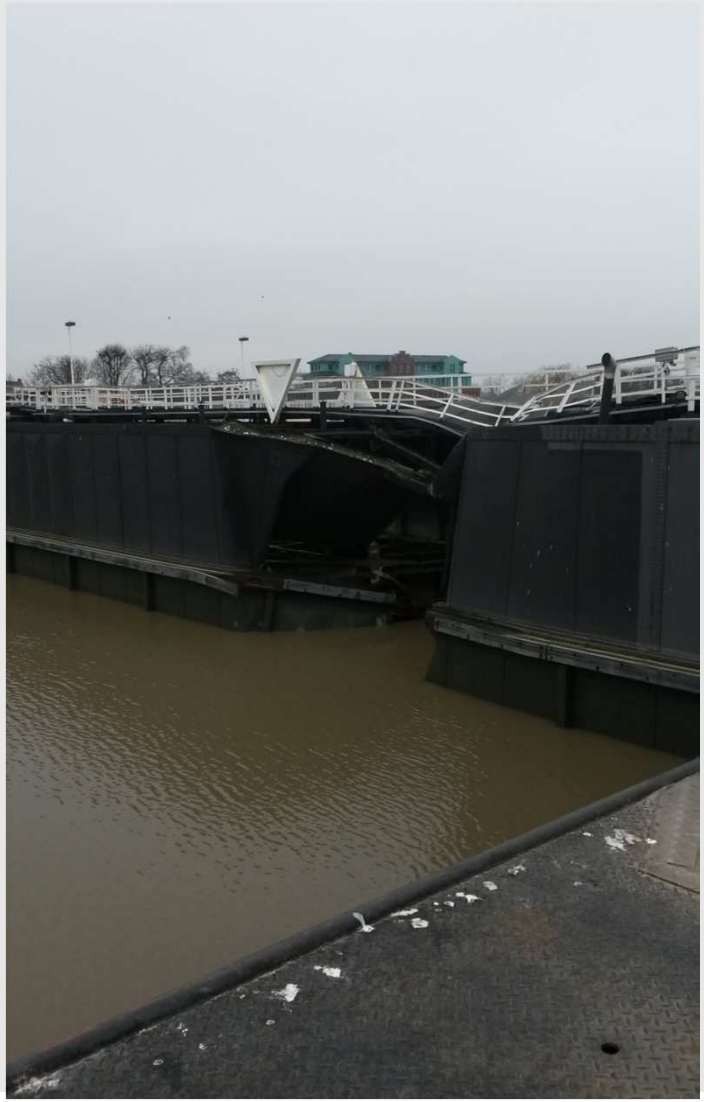
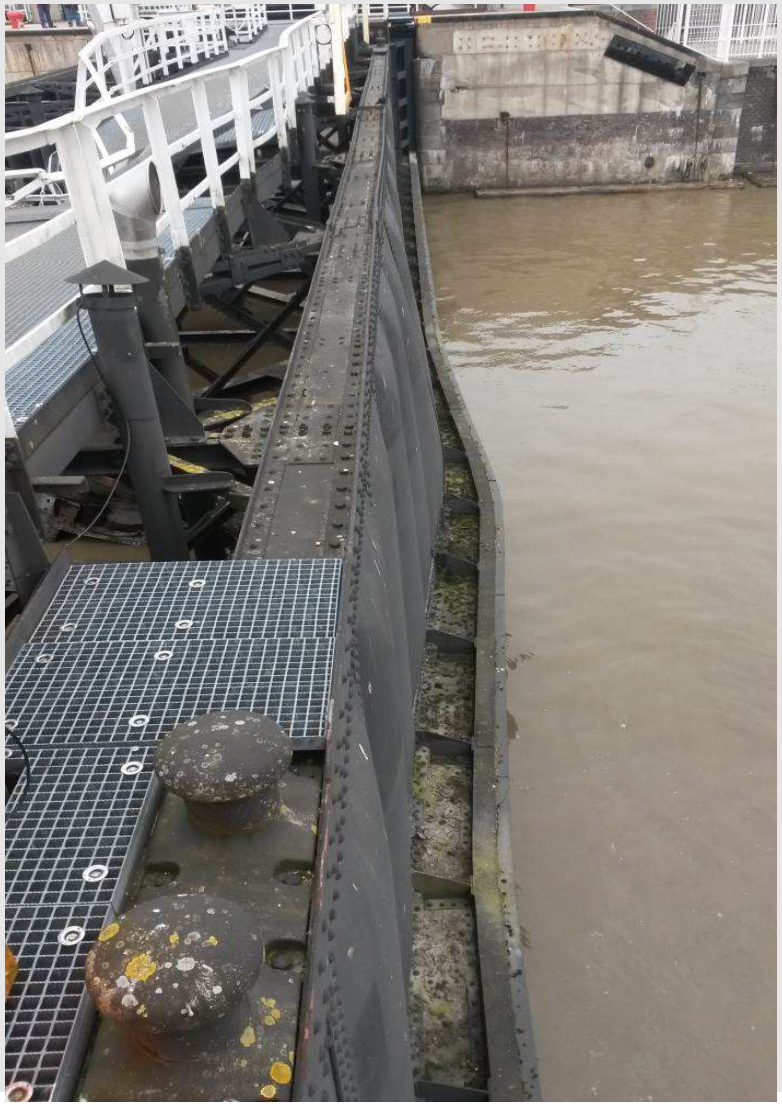
Damage North Lock 20th of March 2015





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Damage North Lock 20th of March 2015

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Future vision of locks at Brunsbüttel

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Kiel Canal - Project Enlargement

The largest ships able to pass the canal have the measurements (length/ beam/ draught [m])
235/32,5/7m or 175/24,5/9,5m

with a maximum air draught of **40m** due to the ten bridges crossing the canal.

As a further reaction to the rising traffic and enlarging ships and to face the future traffic developments it was decided to enlarge 15 kilometres of the **Kiel-Canal** from the Kiel lock group westward (bottleneck) for ships with Pan-Max-Size.

Aim:

enlargement of the maximum vessel size up to 280 m length, 32,5 m width, 9,5 m draught

Timetable:

legal planning approval procedure completed in 2014

Preparation works started now, construction period begin 2017/2018

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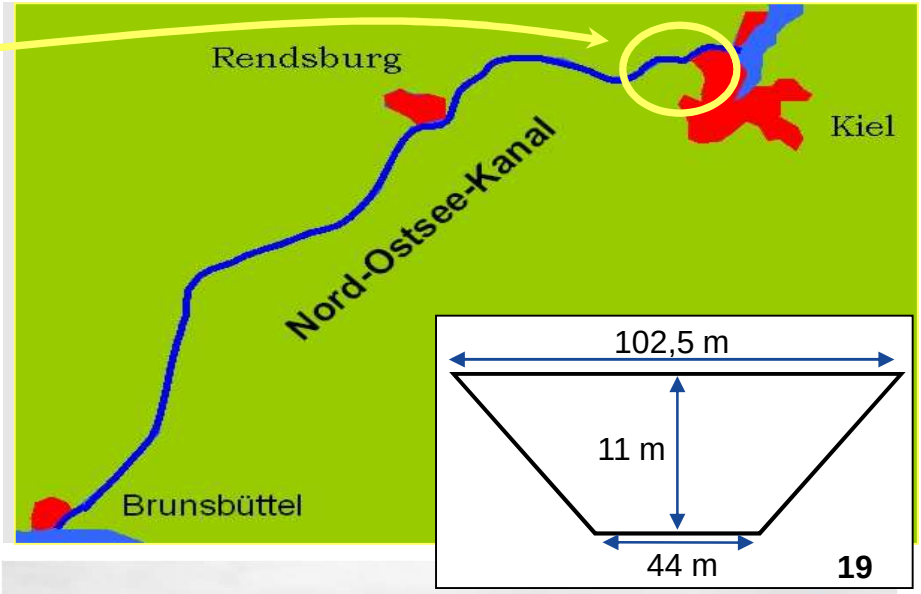
Kiel Canal - Project Enlargement (eastern part)

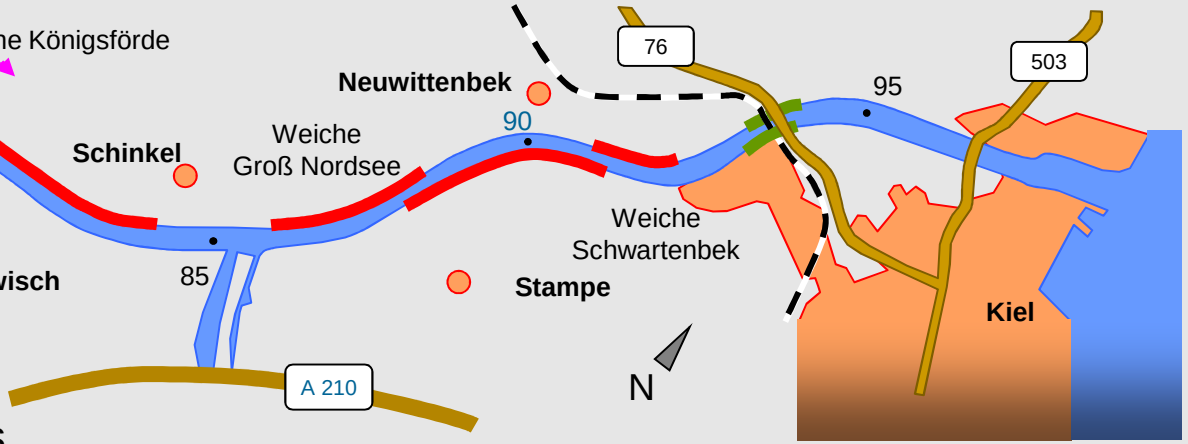
Eastern part NOK - km 80 - 94

- widening of the waterbed from 102.5m to 130m
- widening of the bottom from 44m to 70m
- widening of curve radius to 3000 m
- waterdepth remains unchanged at 11m

- **Enabling all ships transiting with a maximum draught of 9.5m**
- **Enabling similar encountering conditions for most of the canal**
- **Reducing respective stabilizing the transit time**

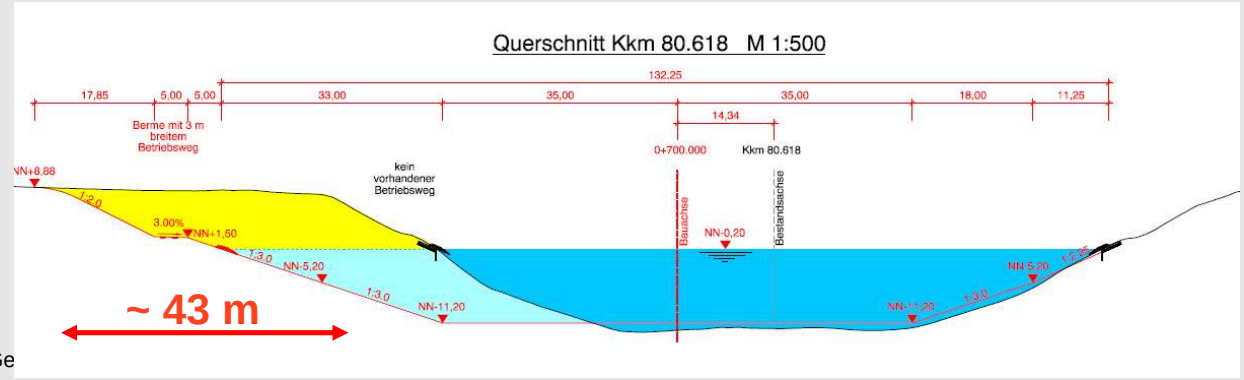


Kiel Canal - Project Enlargement (eastern part)



Essentials:

- dredging of inner curve banks
- 6,8 Mio m³ dredging material



Kiel Canal – Renewal of Levensau Road/Railroad Bridge

Bridge I:

Built 1892- 1894

District lane K27 /

Train lane Kiel – Flensburg

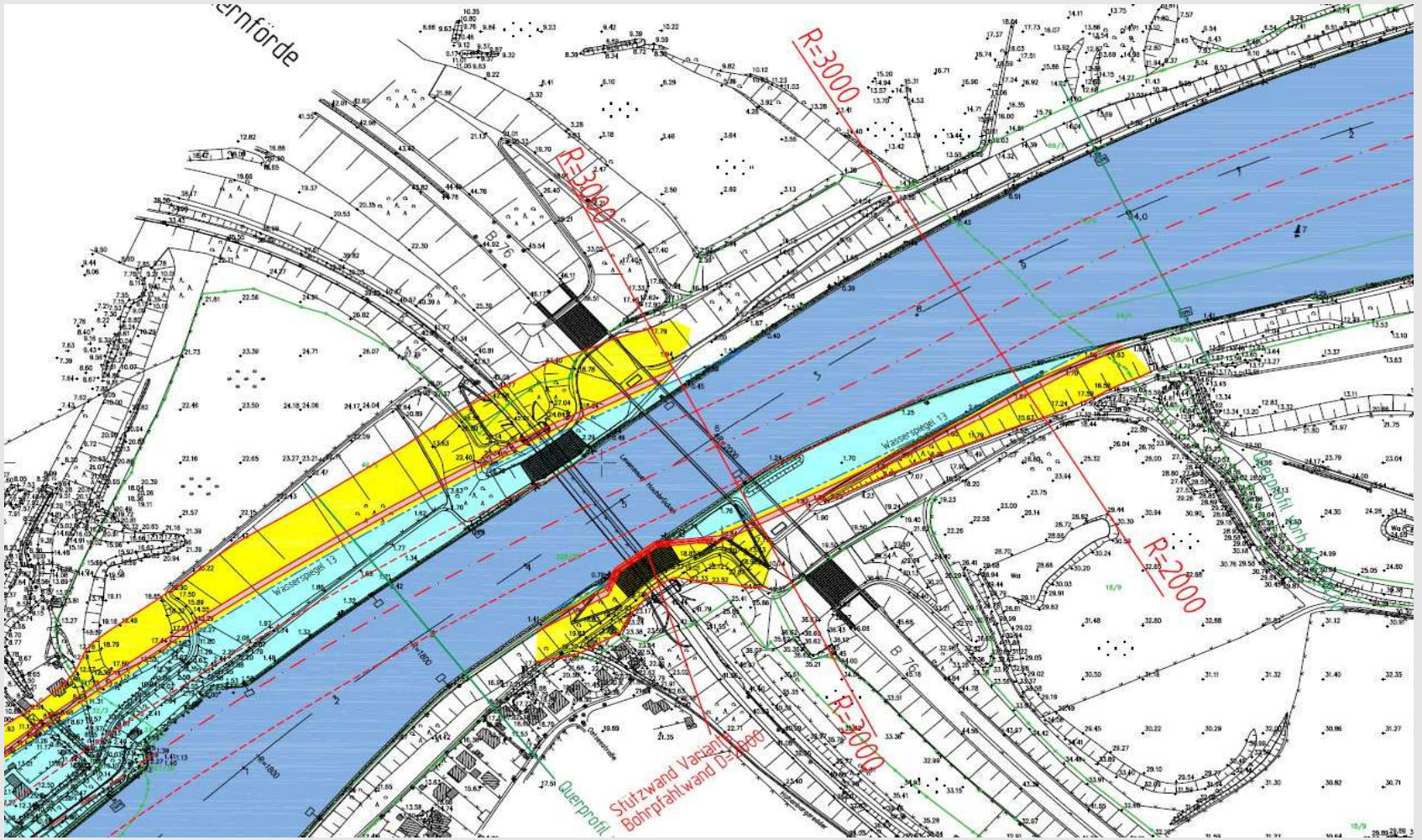
Bridge II:

Built 1983

Federal Road B76

Renewal of Levensau Road/Railroad Bridge

planned extension of the waterbed



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Kiel Canal - further challenges

Due to the dynamic development of maritime trade and traffic

- the total restoration of the lock-group in **Kiel-Holtenau** including an increased lock capacity and also

- the deepening of the entire waterway **Kiel Canal** are options of long-term planning.

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Deepening of the Canal including **adaption of sidings**

Determining of the dimensions for a Top Priority Unit (TPU)

TPU

L = bis 200m
B = bis 30m
T_{konstr} = bis 11m
tdw = 24-37.000t

- **Container**

Anteil Transit: 26,2%

L = 180-200m
B = ca. 30m
T_{konstr} = 10,5-11m
TEU = 1.500-2.000

- **Bulker**

Anteil Transit: 2,6%

L = 160-170m
B = ca. 26m
T_{konstr} = 10,5-10,8m
tdw = 28-31.000t

- Produktentanker

Anteil Transit: 6,2%

L = 170-185m
B = ca. 28m
T_{konstr} = 10,5-11m
tdw = 32-37.000t

- Stückgut

Anteil Transit: 52,8%

L = 170-190m
B = ca. 26m
T_{konstr} = 10,0-10,8m
tdw = 24-29.000t

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Thank you for your attention

Ulrich Bösl

Master Mariner

Head of Shipping Division

Kiel Canal Authority

Brunsbüttel

and

Kiel-Holtenau

ulrich.boesl@wsv.bund.de