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Berlin 18.05.2011

- Dipl.-Ing. Sönke Meesenburg, WSD Nord

Kiel Canal - New Constructions

- **Enlargement of Eastern Part of Kiel Canal including Substitution of Levensau Bridge**
- **Deepening of Kiel Canal**
- **5. Lock for Brunsbüttel Lock Group**

Introduction of Kiel Canal

A good deal of information

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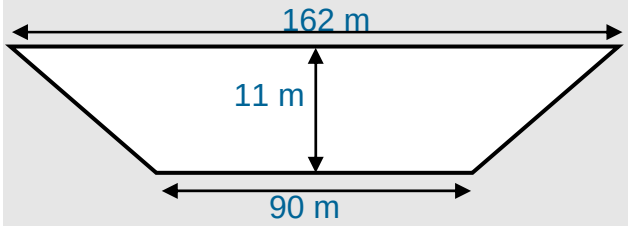
Average Profile

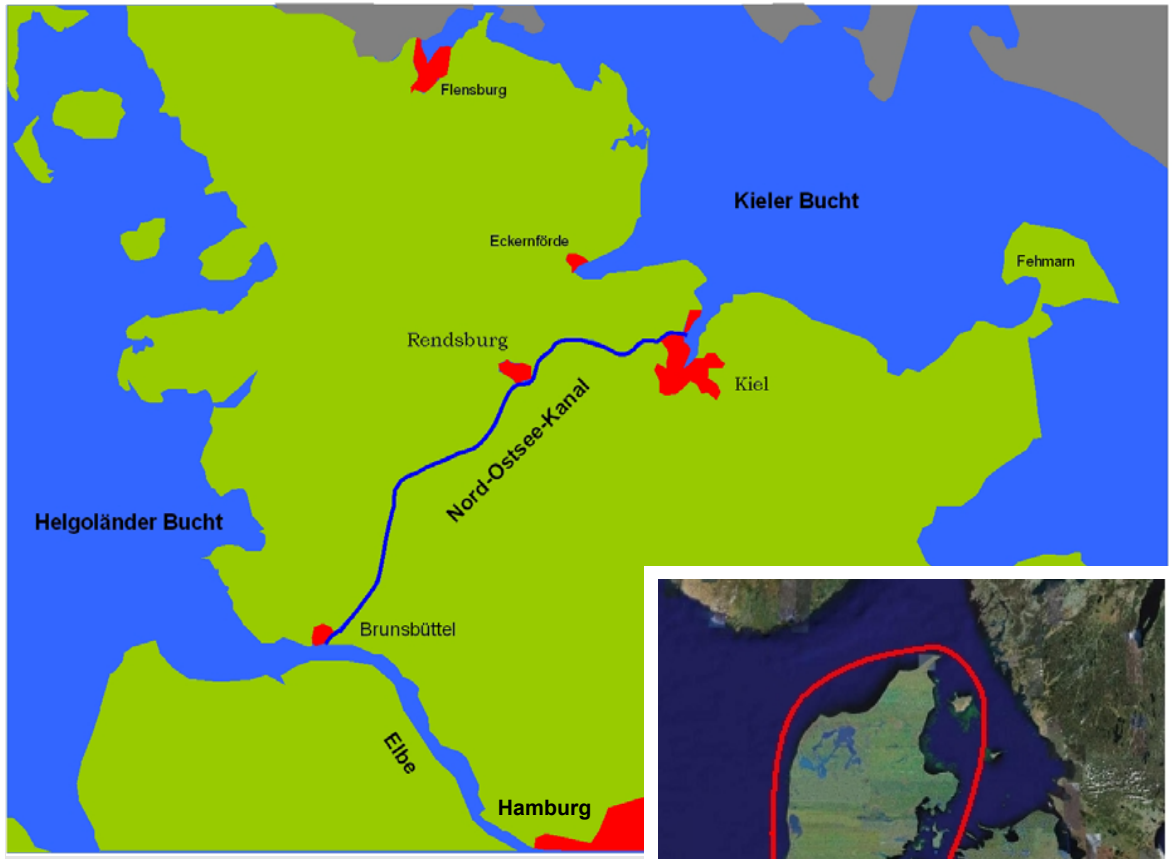


Width 162 m/90 m

Depth 11 m

Length 98.637 km

- Two lock groups in Kiel and Brunsbüttel
- 12 ships sidings
- 12 crossing car ferries
- two Tunnels
- 10 bridges (road and railroad)



Connecting the North Sea with the Baltic Sea via the River Elbe. Δ = 260 sm

Introduction of Kiel Canal

History

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Kaiser-Wilhelm-Kanal

Building Time: 1887-1895

Breadth 67 m / 22 m; Depth 9m

8900 workers

80 Million m³ to dispose

First enlargement:

Building Time: 1907-1914

Breadth 102 m / 44 m; Depth 11m

100 Million m³ to dispose

Nord-Ostsee-Kanal (since 1948)

Second enlargement:

Building Time: 1965-2000

Facts:

Breadth 162 m / 90 m; Depth 11m

50 Million m³ to dispose

Introduction of Kiel Canal

Traffic

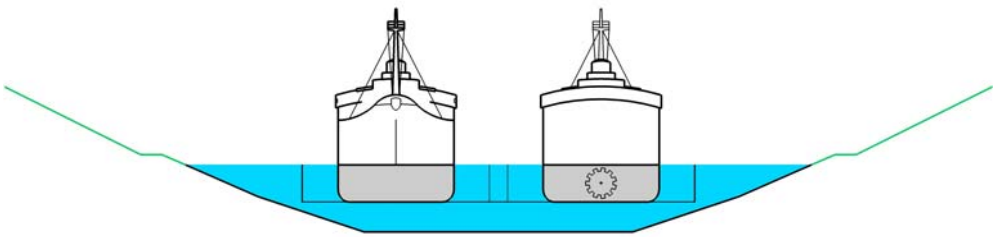
Maximum vessel sizes:
235 m / 32.2 m / 7 m (length/beam/draught)
175 m / 26 m / 9.5 m (length/beam/draught)

Maximum air draft: 40 m !

Ship classification in 6 size classes
(1 smallest, 6 biggest)

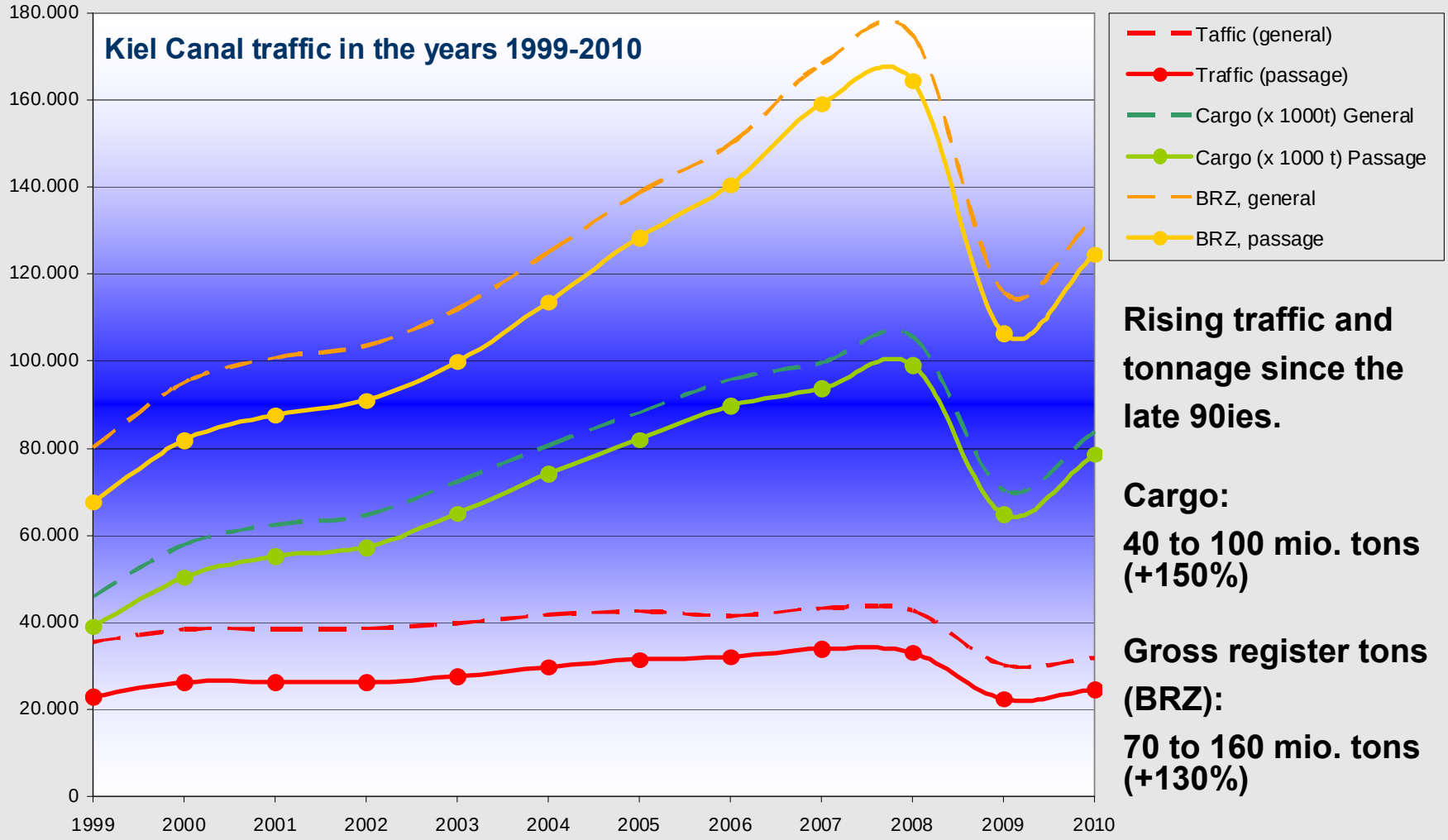
Passages regulated by summation of ships Classes (e.g. 6+2=8; Maximum in average profile)

Passages allowed in sidings for all classes



Introduction of Kiel Canal

Traffic - Statistics



Rising traffic and tonnage since the late 90ies.

Cargo:

40 to 100 mio. tons (+150%)

Gross register tons (BRZ):

70 to 160 mio. tons (+130%)

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- **Deepening of Kiel Canal**
- **5. Lock for Brunsbüttel Lock Group**

Project 1: Enlargement of Eastern Part of Kiel Canal

Bottleneck enlargement

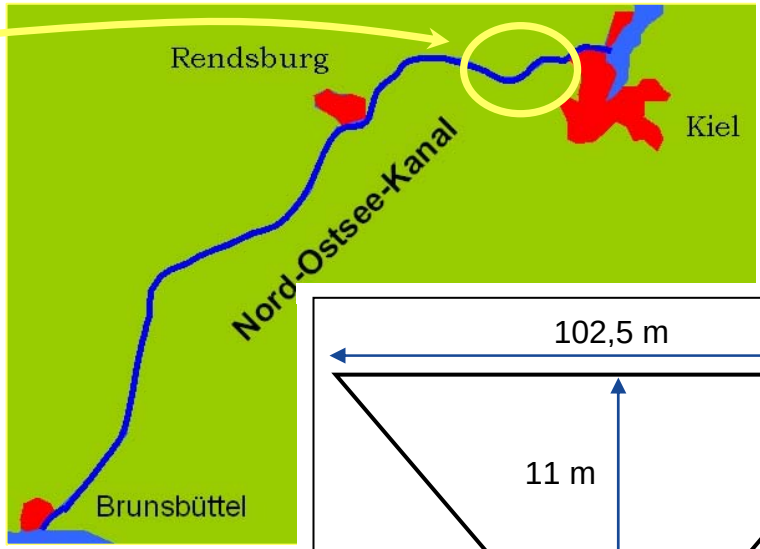
"Eastern Part" Kiel-Canal km 80-~~94~~

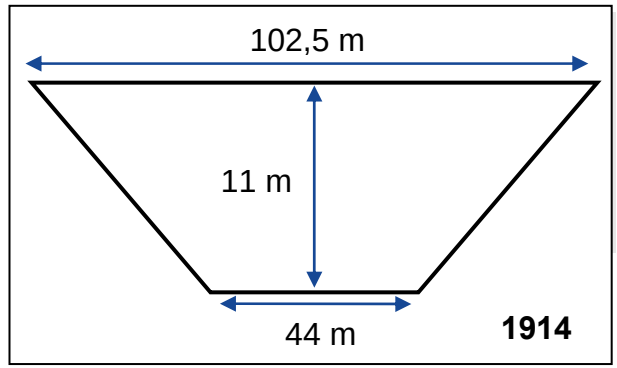
Situation:

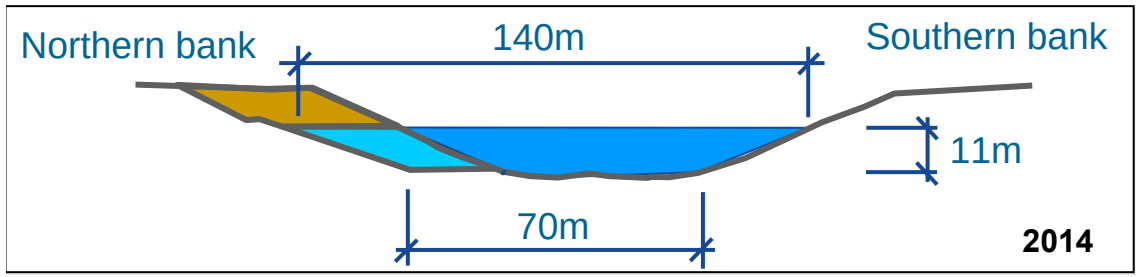
- **Average Profile of first enlargement 1914**
- **Restrictions for passing ships**
- **Bottleneck for larger ships**

Goals:

- **New maximum vessel (Pan-Max-Size) up to 280 m / 32.20 m / 9.50 m**
- **Improved conditions for passing ships**
- **Reduction of Canal travel time**







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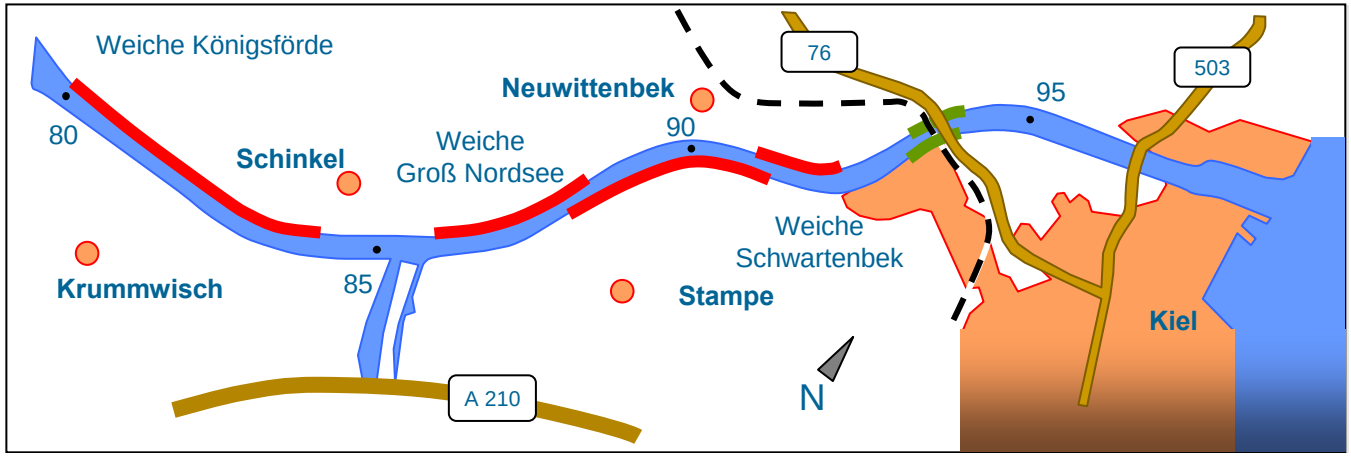
Project 1: Enlargement of Eastern Part of Kiel Canal

Bottleneck enlargement

Details:

- **New average profile**
  Width 140m/70m
  Depth 11m
- **Extension to the inner side of turns**
- **Radius min. 3000 m**
- **6.8 mio m³ soil to be disposed**
- **Substitution of Levensau Bridge**
- **All Construction works carried out under traffic**



Project 1: Enlargement of Eastern Part of Kiel Canal

Project approval procedure

263 comments and objections

Main Items:

- Noise of constructions and working hours per day
- Worry about damage to private property → Audit Procedures
- Legal concern regarding dumping of soil in the Baltic Sea

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Kiel Canal - New Constructions

- **Enlargement of Eastern Part of Kiel Canal including Substitution of Levensau Bridge**
- **Deepening of Kiel Canal**
- **5. Lock for Brunsbüttel Lock Group**

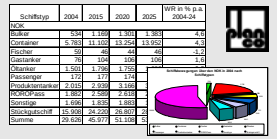
Projekt 2: Deepening of Kiel Canal

Planning Steps

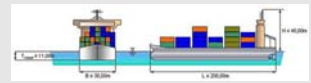
Stufen der Voruntersuchung

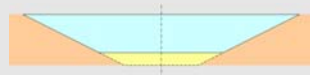
- Traffic Forecast 2025
- MPS - most benefitting Vessels
- Principle of Deepening
- Additional Measures – Curves and Sidings
- Quantity Survey and Cost Estimation
- Cost-benefit Ratio

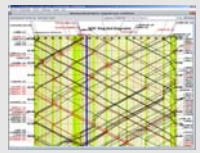
Project

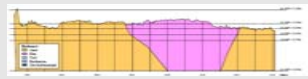


Schiffstyp	2004	2015	2020	2025	WR in % p.a. 2004-24
MOK					
Bulker	934	1.169	1.301	1.383	4,0
Containe	5.793	11.103	13.254	13.952	4,5
Fischer	58	46	44	46	-1,2
Gastanker	76	104	106	108	1,8
Oltanker	1.501	1.796	1.752		
Passenger	172	173	174		
Produktentanker	2.015	2.939	3.195		
RORO/Pass	1.982	2.589	2.618		
Sonstige	1.696	1.835	1.880		
Stückgutschiff	15.908	24.228	26.802		
Summe	29.626	45.977	51.108		







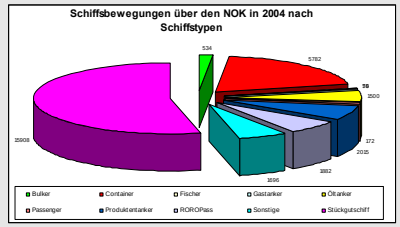


Projekt 2: Deepening of Kiel Canal

Traffic Forecast 2025

Number of Vessels in Transit

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



Vergleich: NOK Container-Passagen in 2008 = 9.295

Quelle: plan co

Most benefitting Vessels / MBV

Size determination of most benefitting vessels (MBV)

- **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

MBV

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

- **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}	=	10,0-10,6m
tdw	=	24-29.000t

Most benefitting Vessels / MBV

Exemples already in operation

- **Container**
  Anteil Transit: 26,2%

- **Bulker**
  Anteil Transit: 2,6%

- **Produktentanker**
  Anteil Transit: 6,2%

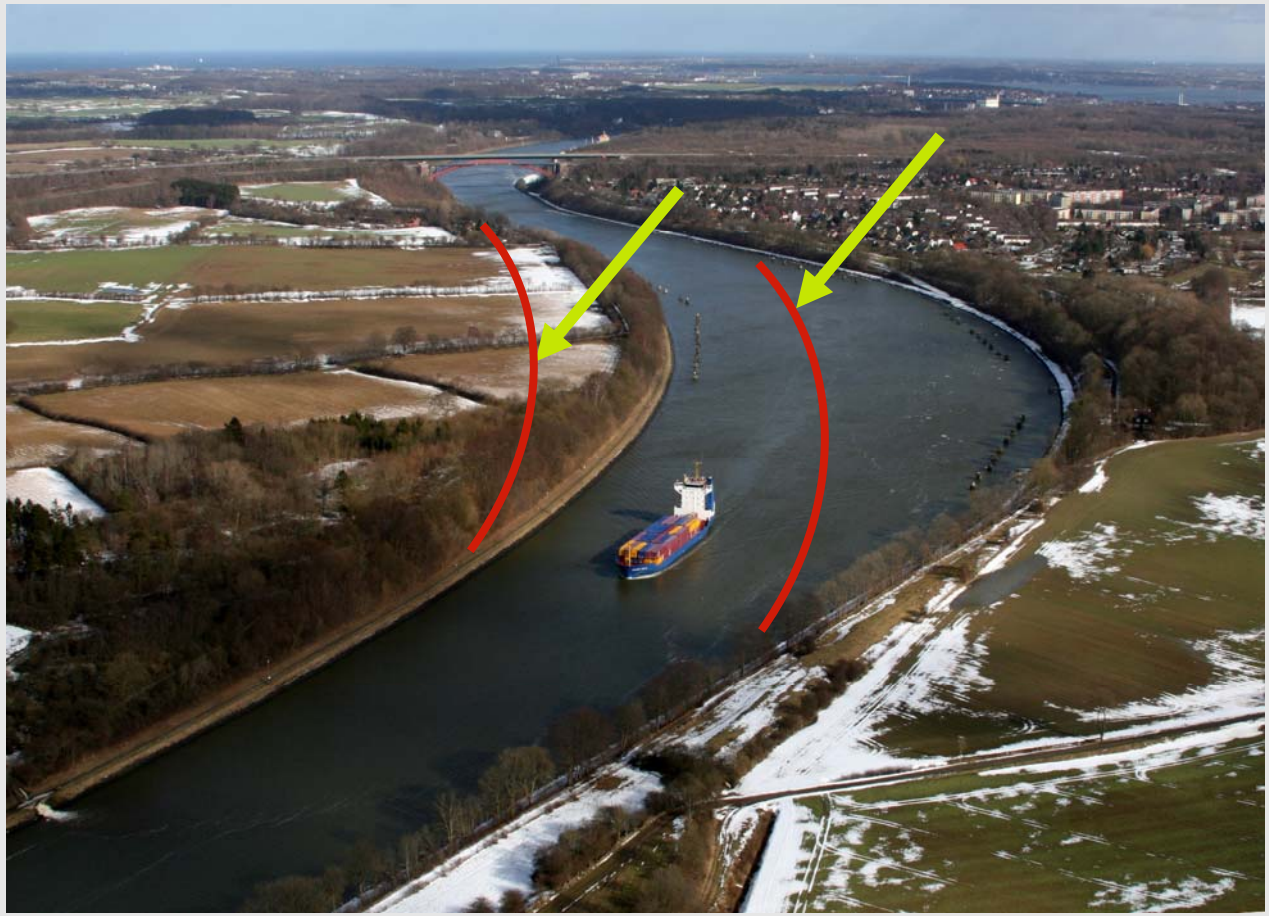
- **Stückgut**
  Anteil Transit: 52,8%

Projekt 2: Deepening of Kiel Canal

Curve optimization Schwartenbek

Curve Optimization Schwartenbek

with the abolition of the Siding in this curve as one option

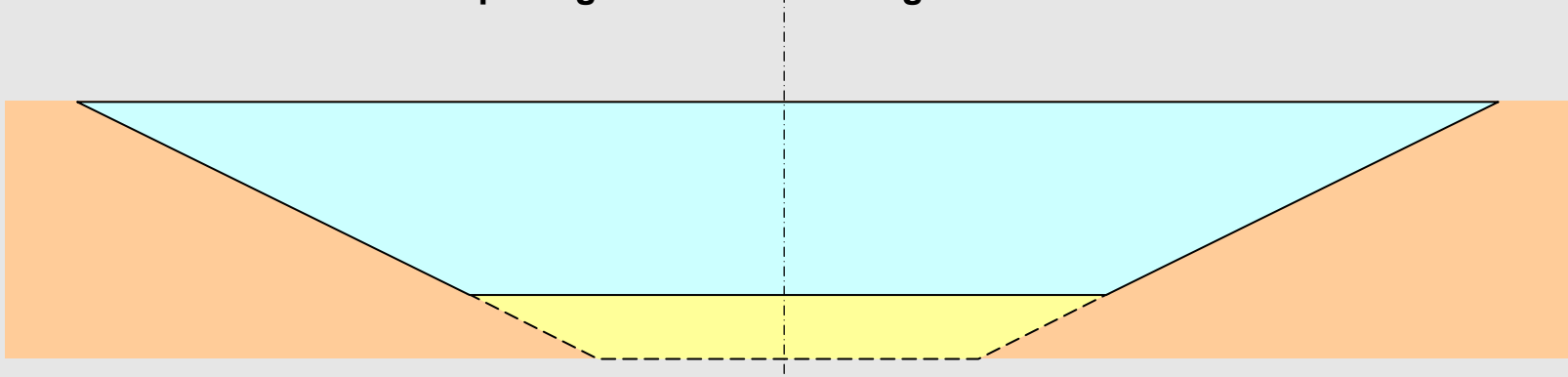


Projekt 2: Deepening of Kiel Canal

Deepening Principle

- Thorough studies lead to the Deepening Principle inside the existing cross section
- **Thus costs can be limited to about 140 Mio. € (Δ t + 1,0 m)**
- ~ 7.0 m³ of soil have to be removed and disposed
- Additional Measures (Curve- and Sidingoptimization) will cost another ~140 Mio. €

Deepening inside the existing cross section



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Project
Brunsbüttel lock group

Major locks with 2 lock chambers

- **Dedicated in 1914**

Main dimensions:

- **effective length 310 m**
- **effective width 42 m**
- **depth of the sill -14 mNN**

Minor locks with 2 lock chambers

- **Dedicated in 1895, restored in the 1980´s**

Main dimensions:

- **effective length 125 m**
- **effective width 22 m**
- **depth of the sill -10.20 mNN**

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Project
Brunsbüttel lock group

Modernization and restoration of the two major locks urgently needed.

Closure of these locks for several years.

Increasing traffic excludes lower service of the locks and forces the construction of a new single lock.

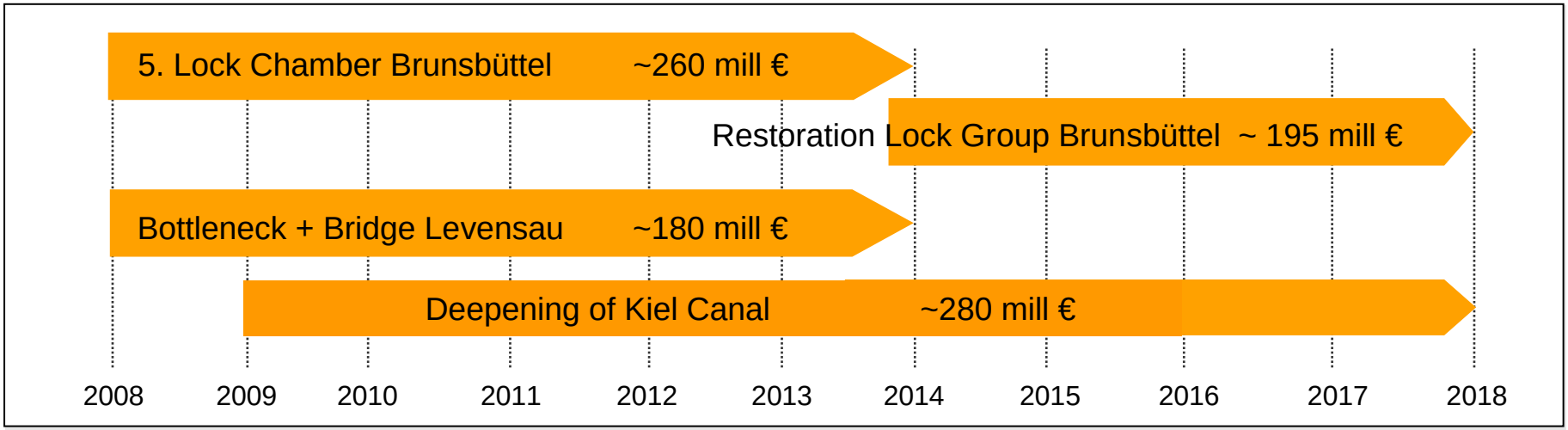
Main dimensions:

- **effective length 330 m**
- **effective width 42 m**
- **depth of the sill -14 mNN**
- **Costs approx. 310 mill. €**

Anticipated work for a new servicetunnel below whole lock group is nearly completed.

Preview

Further Challenges



Long Term Planning:

Planning of restoration and -if nessecary- capacitiy increase of lock group Kiel ordered in 2008 by the Federal Ministry of Transport, Building and Urban Affairs

Federal Ministry
of Transport, Building
and Urban Affairs

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Thank you for your attention!