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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

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

**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
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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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
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

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

263 comments and objections
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**Kiel Canal - New Constructions**

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- 5. Lock for Brunsbüttel Lock Group
Projekt 2: Deepening of Kiel Canal

**Planning Steps**

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

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Bulker</td>
<td>534</td>
<td>1.115</td>
<td>1.231</td>
<td>1.316</td>
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<td>10.426</td>
<td>12.237</td>
<td>12.961</td>
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<td>59</td>
<td>48</td>
<td>50</td>
<td>49</td>
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<td>Gastanker</td>
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<td>96</td>
<td>96</td>
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<td>1.720</td>
<td>1.666</td>
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<td>168</td>
<td>166</td>
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<td>Produktentanker</td>
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<td>2.957</td>
<td>3.111</td>
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<tr>
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<td>22.491</td>
<td>24.634</td>
<td>26.021</td>
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<td>Summe</td>
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<td>43.044</td>
<td>47.257</td>
<td>49.554</td>
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Vergleich: NOK Container-Passagen in 2008 = 9.295
## Projekt 2: Deepening of Kiel Canal

### Most benefitting Vessels / MBV

#### Size determination of most benefitting vessels (MBV)

<table>
<thead>
<tr>
<th>MBV</th>
<th>Container</th>
<th>Bulker</th>
<th>Stückgut</th>
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<tbody>
<tr>
<td>L</td>
<td>(180-200)m</td>
<td>(160-170)m</td>
<td>(170-190)m</td>
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<tr>
<td>B</td>
<td>ca. (30)m</td>
<td>ca. (26)m</td>
<td>ca. (26)m</td>
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<tr>
<td>(T_{\text{konstr}})</td>
<td>(10,5-11)m</td>
<td>(10,5-10,8)m</td>
<td>(10,0-10,6)m</td>
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<td>TEU</td>
<td>(1,500-2,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>bis (200)m</td>
<td>(24-31,000)t</td>
<td>(24-29,000)t</td>
</tr>
<tr>
<td>B</td>
<td>bis (30)m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(T_{\text{konstr}})</td>
<td>bis (11)m</td>
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<td></td>
</tr>
<tr>
<td>tdw</td>
<td>(28-31,000)t</td>
<td></td>
<td>(24-29,000)t</td>
</tr>
</tbody>
</table>

- **Container**
  - Anteil Transit: 26,2%
  - \(L = 170-185\)m
  - \(B = \text{ca.} \, 28\)m
  - \(T_{\text{konstr}} = 10,5-11\)m
  - TEU = 32-37,000t

- **Bulker**
  - Anteil Transit: 2,6%
  - \(L = 160-170\)m
  - \(B = \text{ca.} \, 26\)m
  - \(T_{\text{konstr}} = 10,5-10,8\)m
  - tdw = 28-31,000t

- **Stückgut**
  - Anteil Transit: 52,8%
  - \(L = 170-190\)m
  - \(B = \text{ca.} \, 26\)m
  - \(T_{\text{konstr}} = 10,0-10,6\)m
  - tdw = 24-29,000t
Most benefitting Vessels / MBV

Exemples already in operation

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

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

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

- **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
Thorough studies lead to the Deepening Principle inside the existing cross section.

Thus costs can be limited to about 140 Mio. € ($\Delta t + 1,0 \text{ m}$)

~7.0 m³ of soil have to be removed and disposed.

Additional Measures (Curve- and Sidingoptimization) will cost another ~140 Mio. €.
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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
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.
Long Term Planning:
Planning of restoration and -if necessary- capacity increase of lock group Kiel ordered in 2008 by the Federal Ministry of Transport, Building and Urban Affairs
Thank you for your attention!

Wir machen Schifffahrt möglich.