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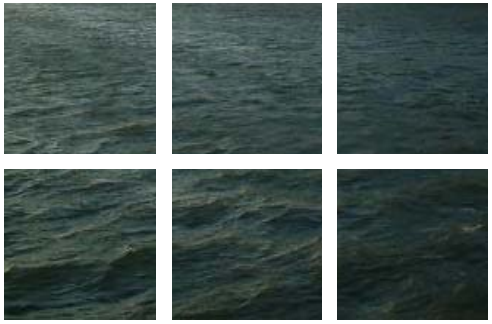
PIANC - AGA 2011 - Berlin
Development of Locks of the Waterway Construction Official Magdeburg

Dipl.- Ing. Christian Jöckel



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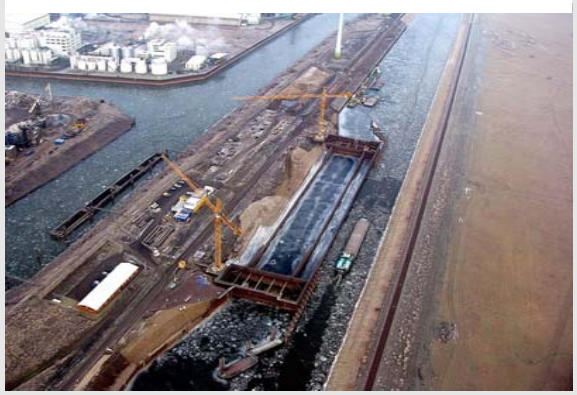

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German Unity Transport Project 17:

Expansion of Waterway Link Hannover – Magdeburg - Berlin

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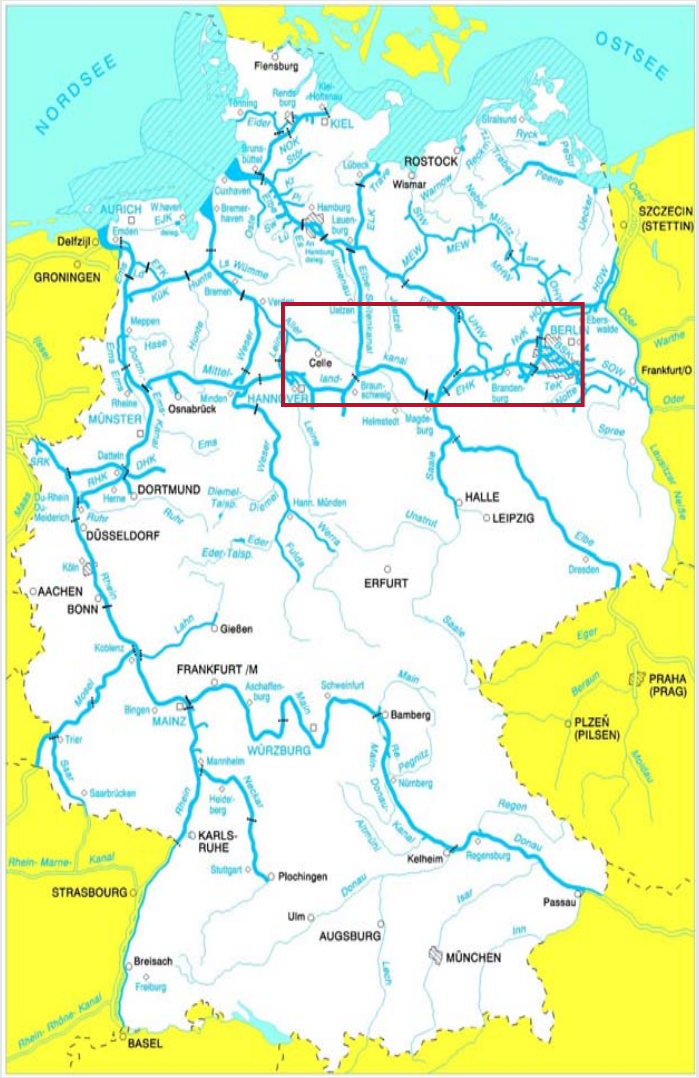

The responsibility of the Waterway Construction Official Magdeburg covers:

Waterway Link Hannover - Magdeburg - Berlin

Expansion targets / rated ships

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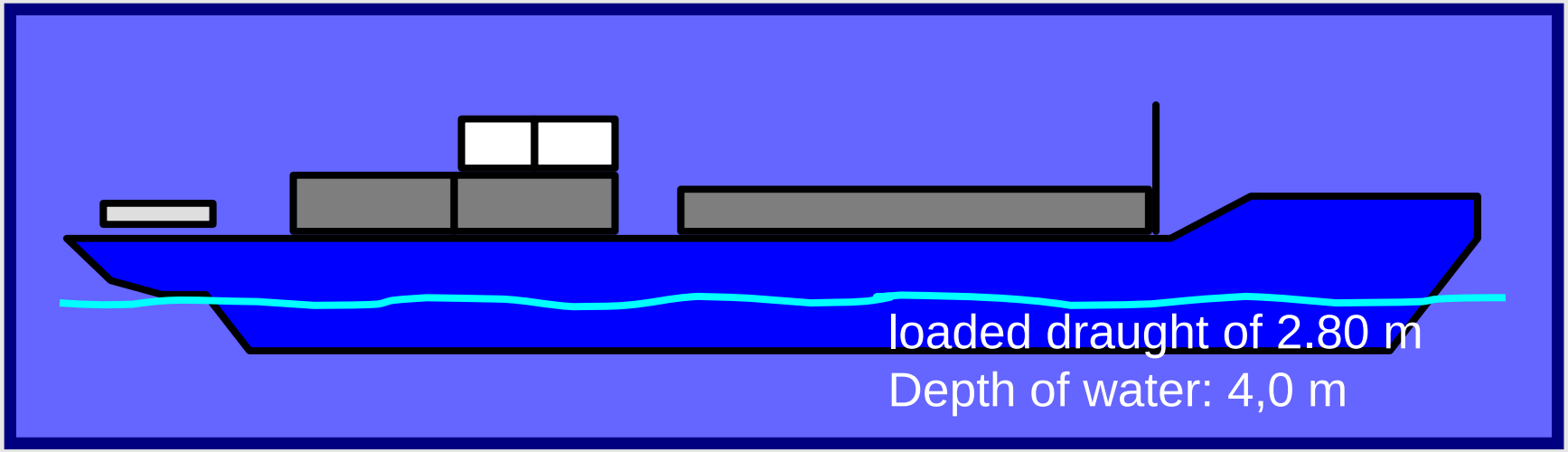

- large motor cargo vessels with a length of 110 m, width of 11.40 m, capability of 2.000 t

- pushed barge with a length of 185 m, width of 11.40 m, capability of 3.500 t

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Waterway Cross Magdeburg

Situation before development measures

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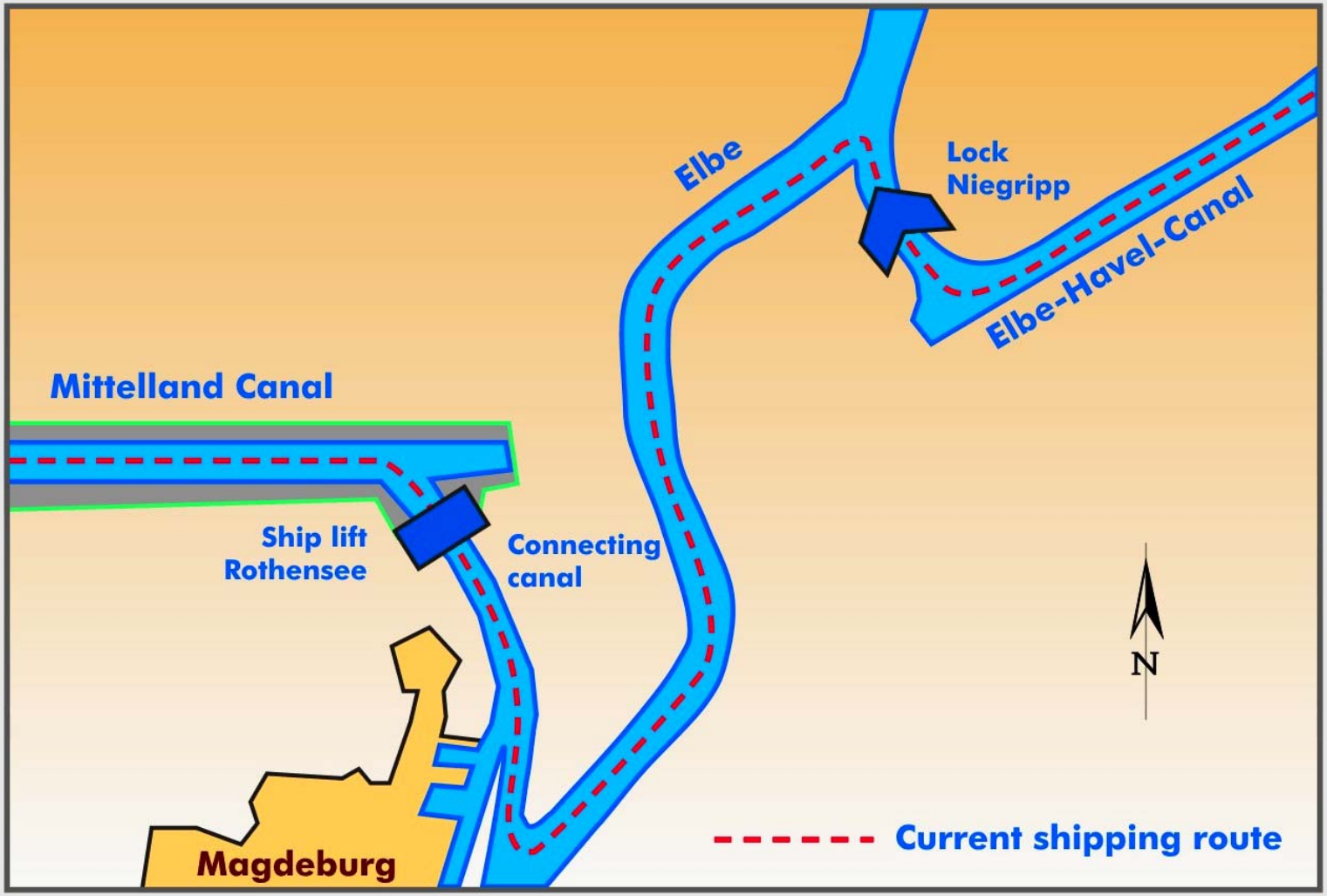

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Waterway Cross Magdeburg

Initial considerations ...

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Waterway Cross Magdeburg

Implemented solution

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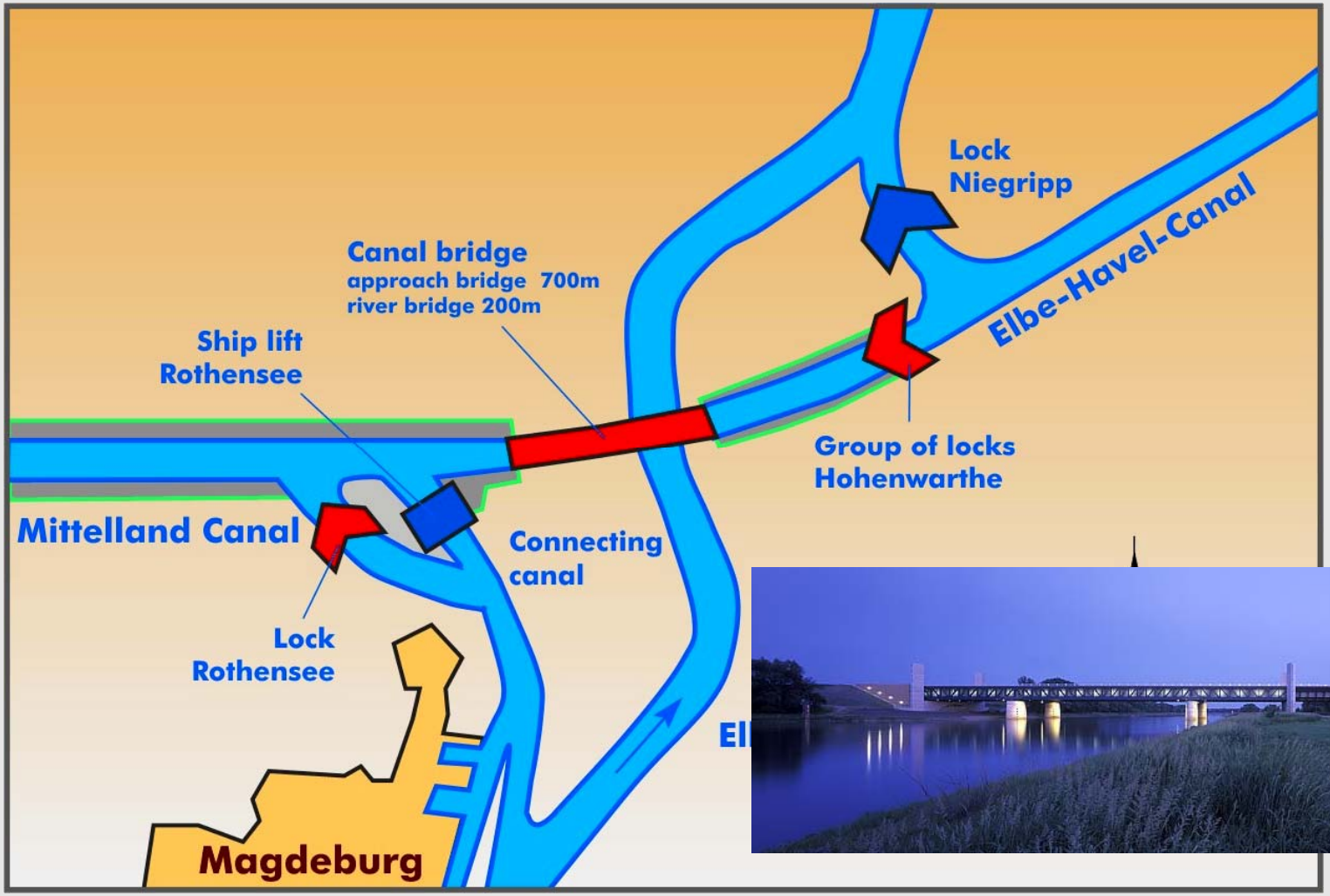

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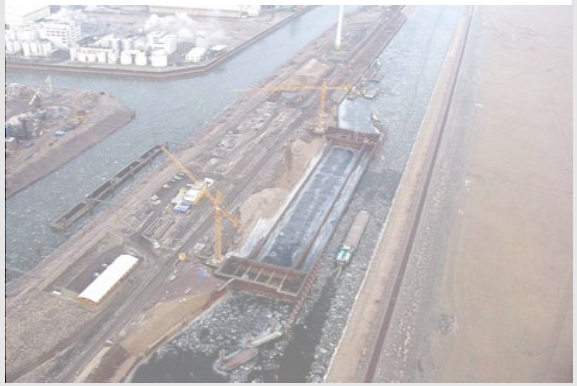

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Lock Rothensee

Generell Overview with Ship-Lift

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Lock Rothensee

Technical data

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- Length: 190.00 m
- Width: 12.50 m
- Lifting height 10.45 m – 18.46 m, depending on the water level of the Elbe
- 3 water saving bassins
- Pumping station 5 x 3,5 m³/s
- Start of construction: 1997
- Opening: 2001

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Lock Rothensee

Hydraulic System

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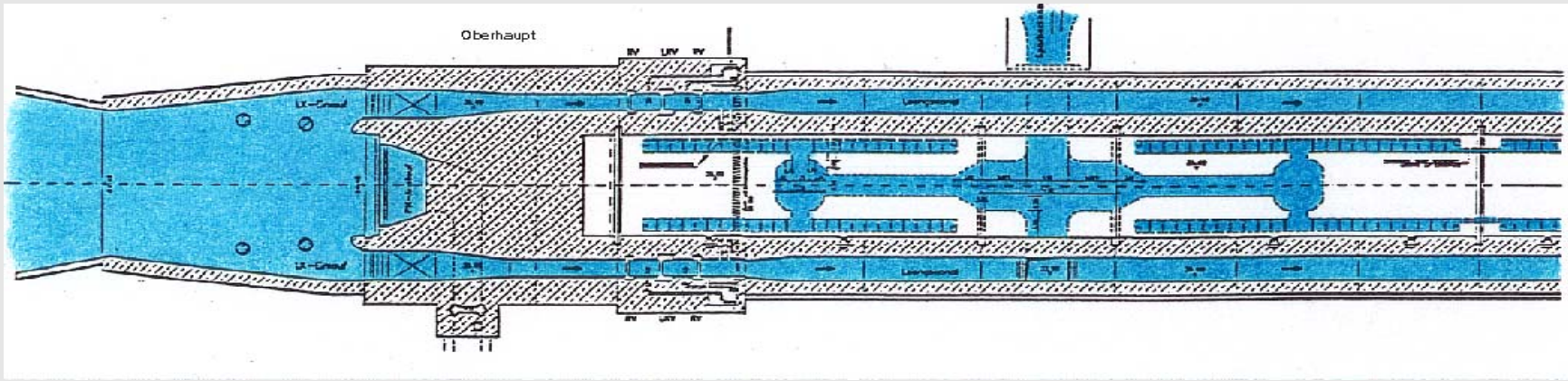
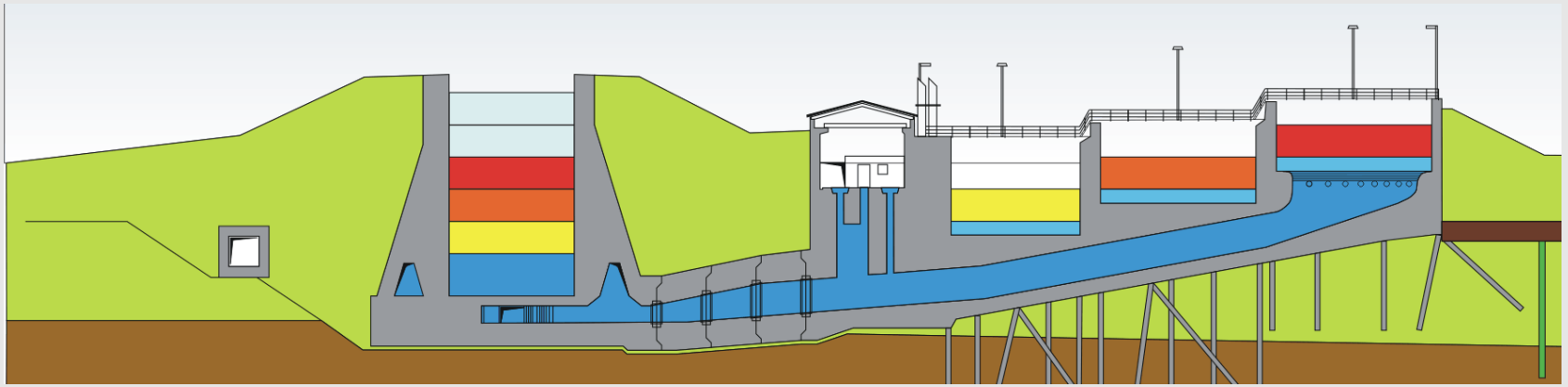
Plan view of base flow system with longitudinal channals



cross section of chamber and water saving bassins



Lock Rothensee

Hydraulic System

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- Longitudinal channals closure
  - 4 roller gates
  - Size 2 x 3,2 m
  - 12 t each

- Water saving channals closure
  - 6 roller gates
  - Size 2 x 3,2 m
  - 12 t each

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Lock Rothensee

Gates

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Upper Gate: Rotary segment gate

height: 5.10 m, weight 40 t

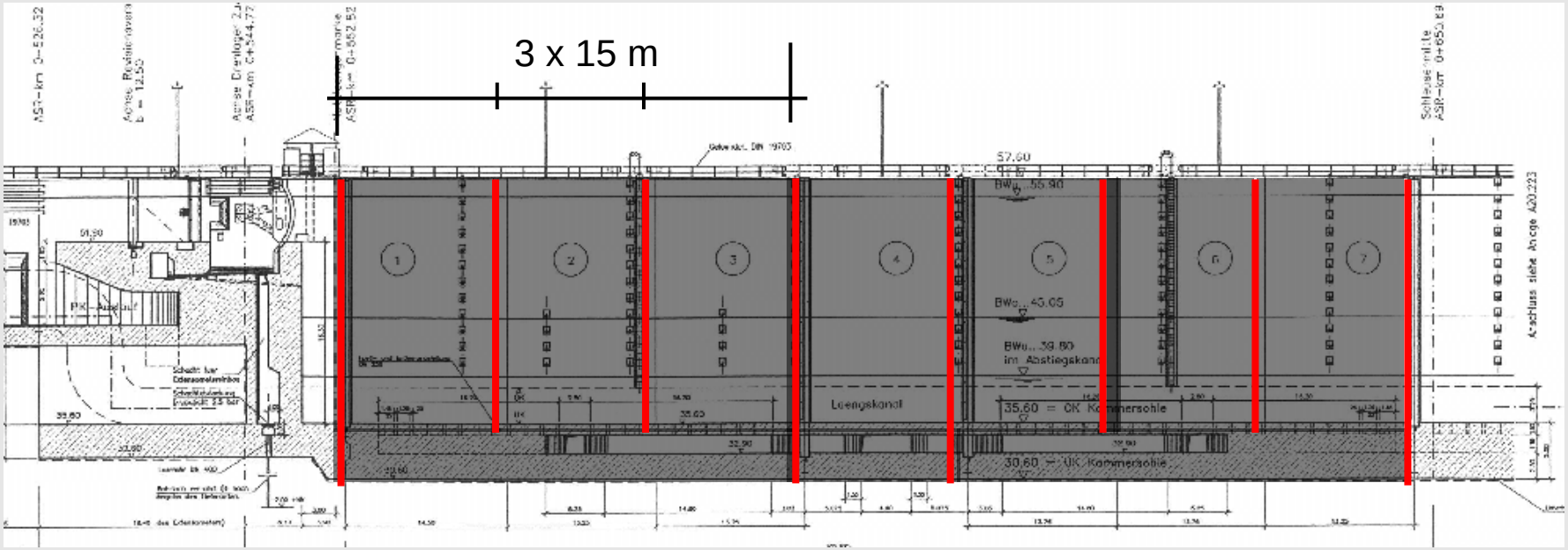
Lower gate: mitre gate

height: 21.40 m, total weight 200 t

Lock Rothensee

Concrete blocks and expansion joints

- Half-frame in concrete design
- Longitudinal section of the chamber with concreting sections of base and walls
- Walls: Back–step-procedure



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Concrete blocks in construction

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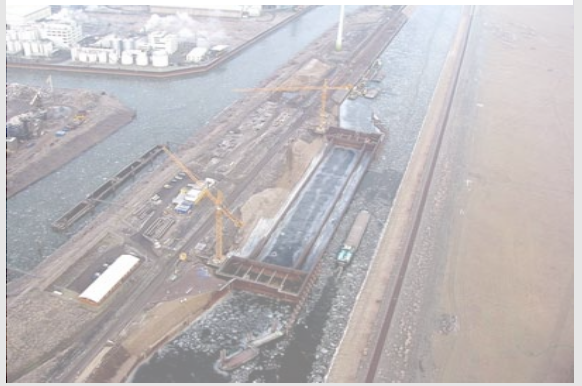
Low Water Lock Magdeburg

2008-2012



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Lock Hohenwarthe

Generell Overview

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Lock Hohenwarthe

Technical Data

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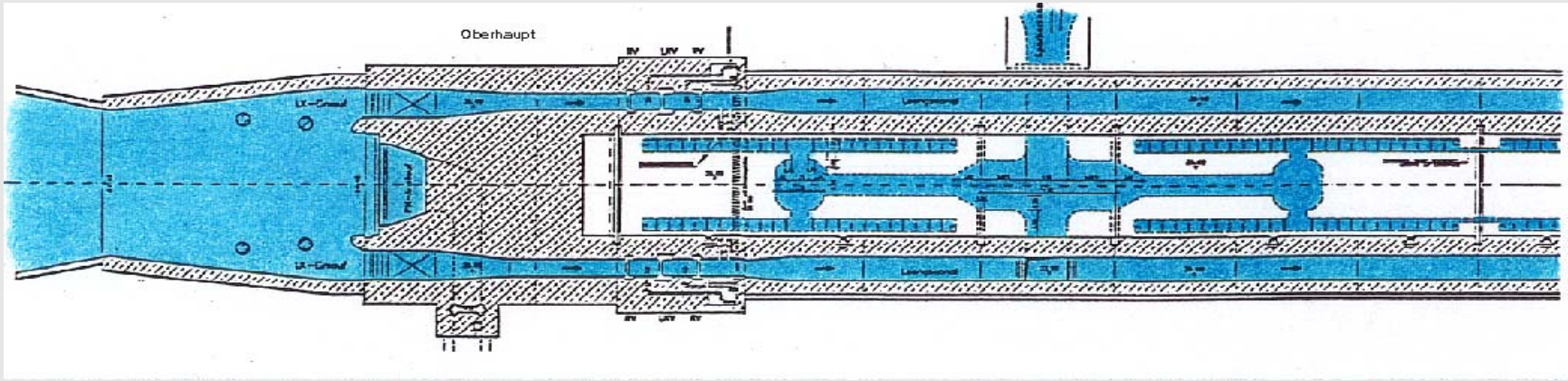
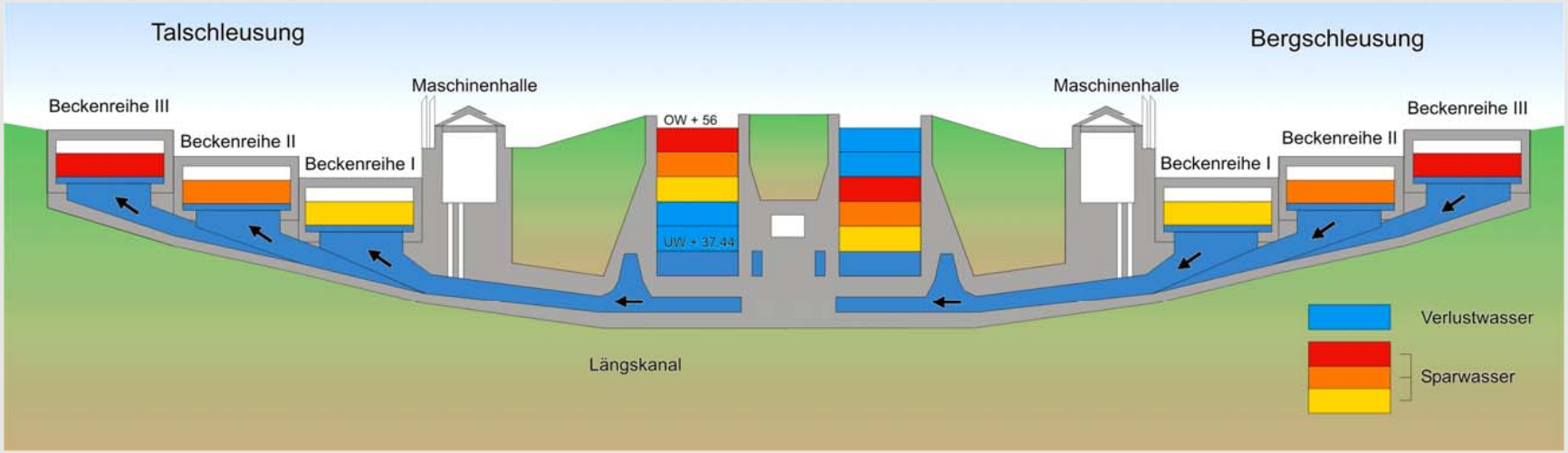
- Twin water-saving lock
- Lifting height of 18,5 m
- 2 independent chambers:

  each 190 m long, 12,5 m wide,
- Each chamber with
  3 water saving bassins
- Pumping station 3 x 3,5 m^3/s
- Start of construction: 1998
- Opening: 2003

Lock Hohenwarthe

Hydraulic system – identical to Rothensee/ 2 chambers





Lock Hohenwarthe

Gates

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Upper Gate: rotary segment gate

Height 5.30 m, weight 40 t

Lower gate: vertical lift gate

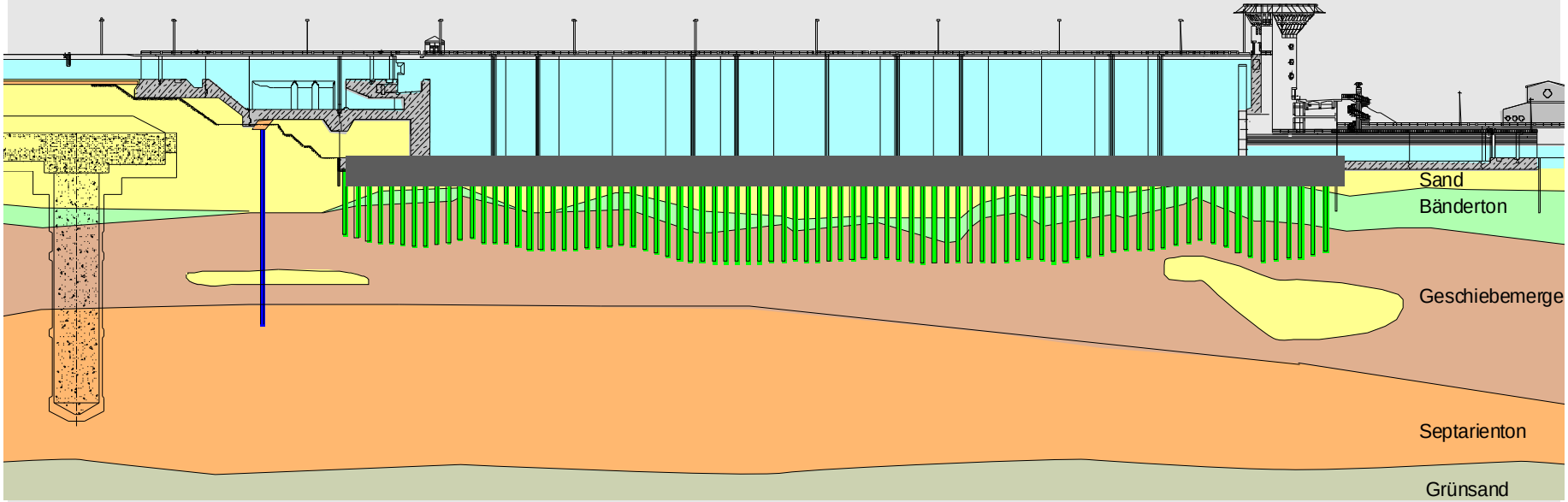
Height 10.30 m, weight 135 t

Lock Hohenwarthe

Soil and foundation

- due to the complexity and inhomogeneous building ground resultant settlement differences

- Monolithic base: Dimensions 246 x 64 x 5,50 m, Volume = 68.000 m³



Lock Hohenwarthe

Concrete blocks and expansion joints

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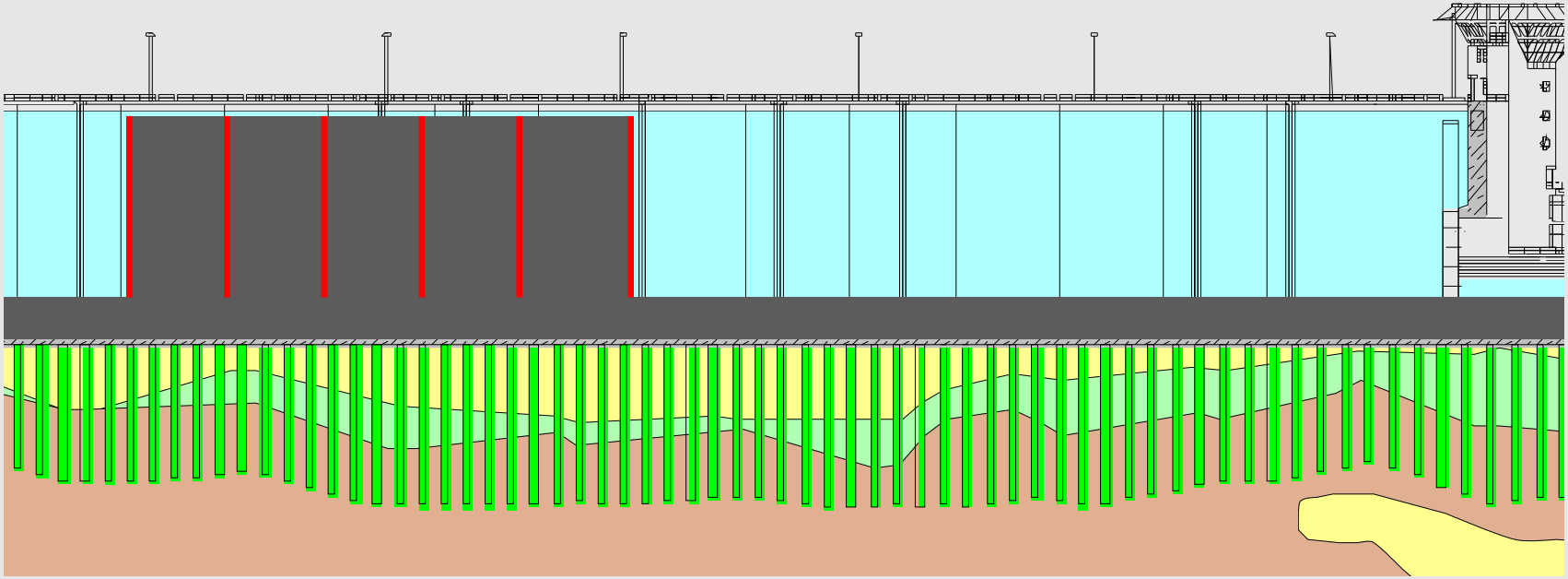
- Longitudinal section of the chamber
- monolithic base
- walls with 15 m block-wide, back-step procedure
- different arrangement of expansion joints



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Lock Hohenwarthe

Concrete work May 2001

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Lock Hohenwarthe

Expansion joints of the chamber walls

Expansion joints

Weaknesses of the construction

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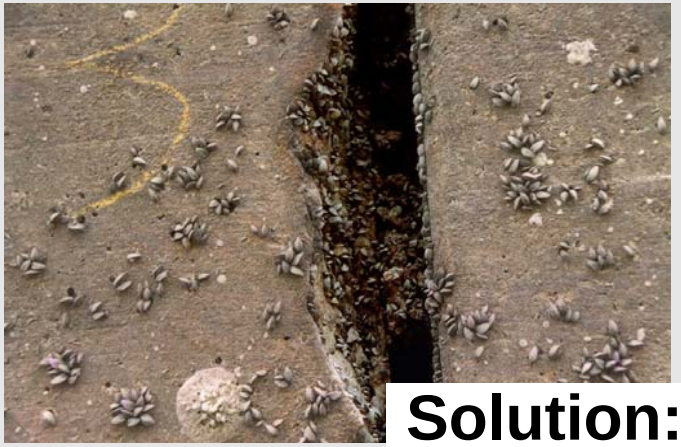


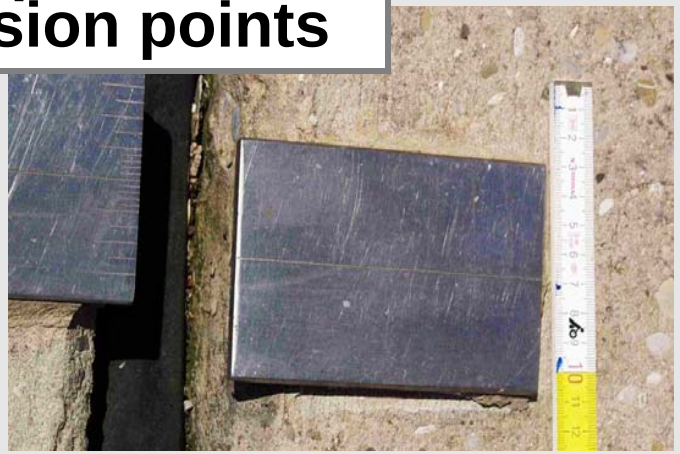
Concrete damage i

g through vessels

Solution:

Minimizing or if possible avoiding expansion points

Failure of the joint material



uneven settlement or twist of blocks

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Low Water Lock Magdeburg

2008-2012

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2nd Lock Wusterwitz

Technical data

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- Lifting height 4,75 m
- 1 chamber: 190 m long, 12,5 m wide
- Start of construction: 2008
- Opening: 2012

2nd Lock Wusterwitz

Monolithic construction

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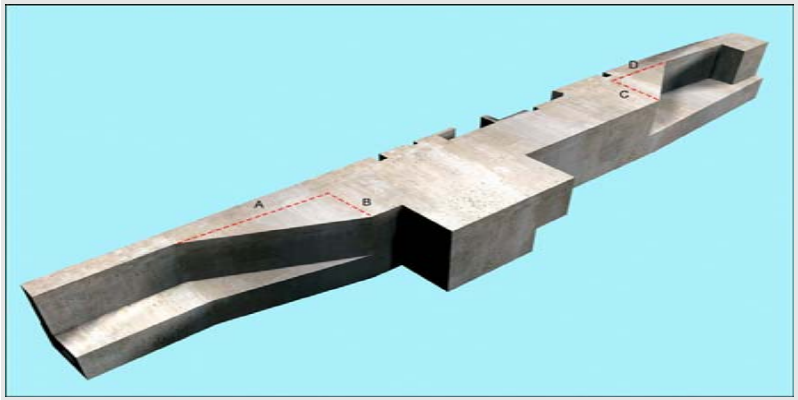
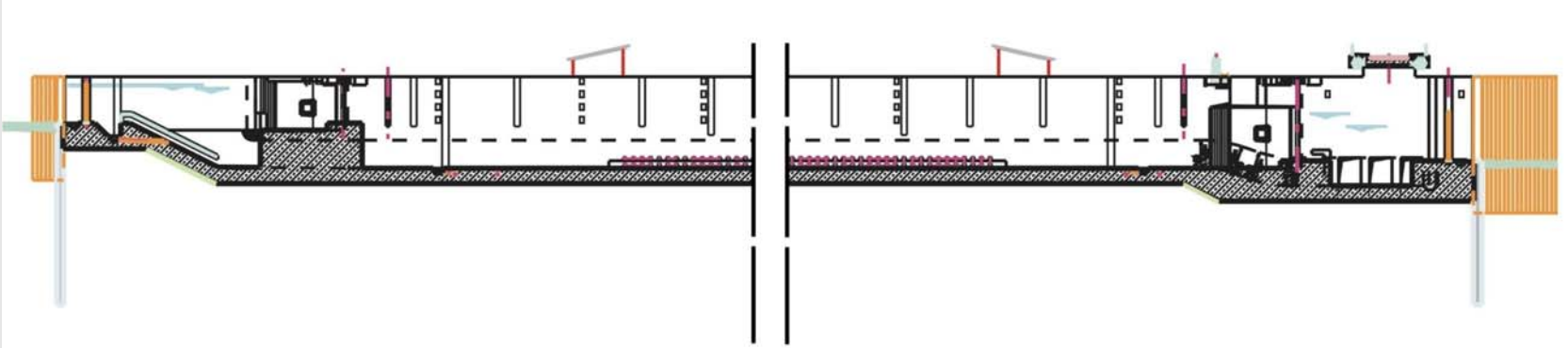
- Reinforced concrete: approx. 40,000 m³
- Monolithic building length: 261m
- Wide concrete construction up to 34.30 m
- Max. height of concrete structure: 14.45m
- Elastically bedded beam with variable cross-sections
- Design principle: avoidance of stiffness jumps/ sliding transitions



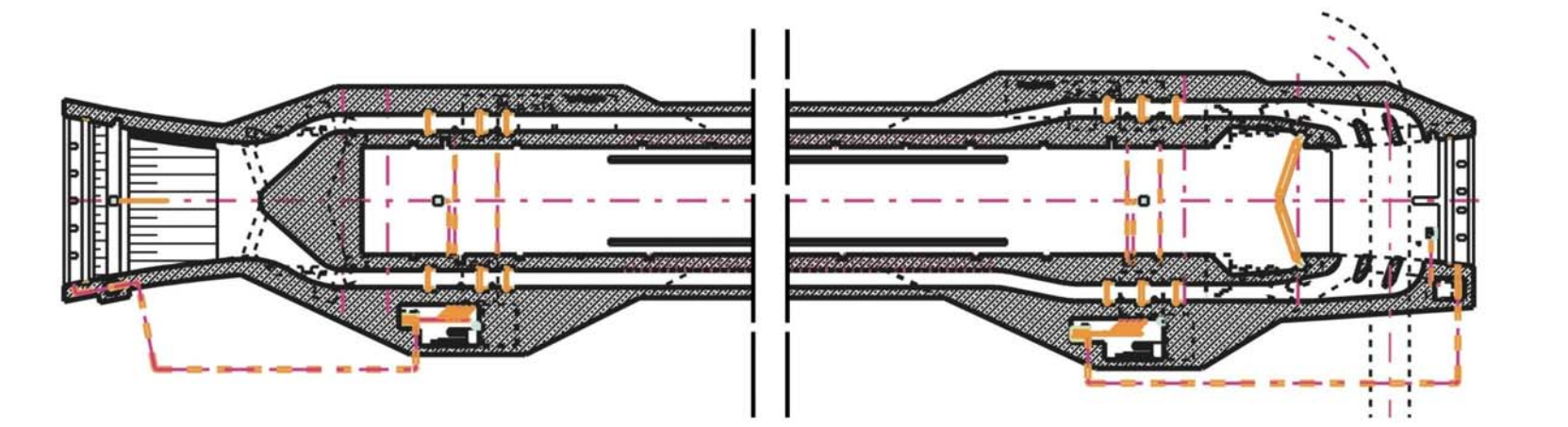
2nd Lock Wusterwitz

Hydraulic System – Multiport with side longitudinal channel

Longitudinal section



Plan view



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2nd Lock Wusterwitz

Hydraulic System – Multiport with side longitudinal channel

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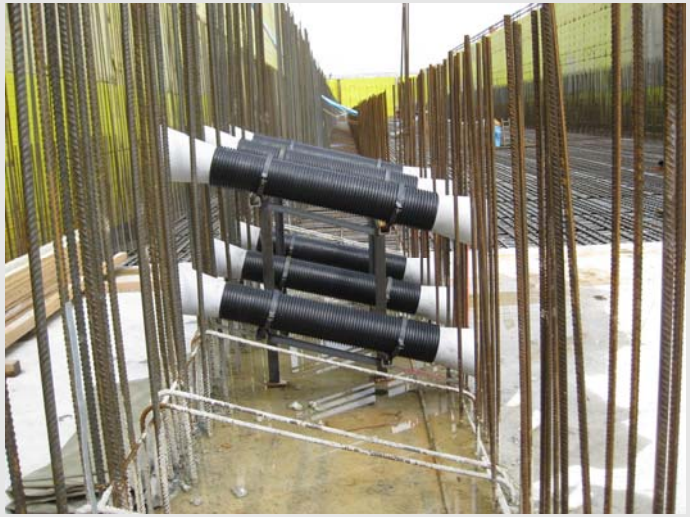

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2nd Lock Wusterwitz

Hydraulic engineering

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Upper and lower gate: mitre gates

Upper: each leaf 6,65 x 5,16 m, total 34 to

Lower: each leaf 6,65 x 9,56 m, total 58 to

4 longitudinal channel closures constructed as slide gates, 6 to each, 2,0 x 3,25 m driven by electromechanical cylinder

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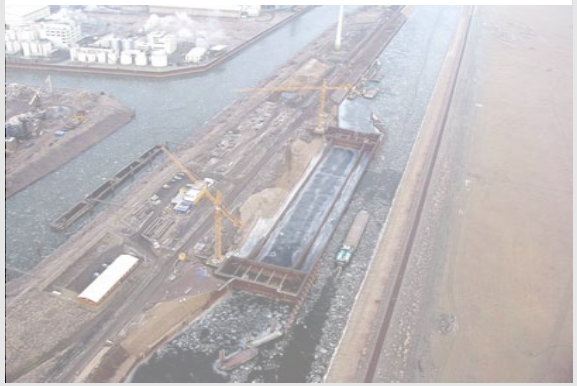

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2nd Lock Zerben

Generell Overview

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- Lifting height 5.50 m
- 1 chamber: 190 m long, 12.5 m wide
- Construction basically identical to 2nd Lock Wusterwitz
- Start of Construction work in 2012

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2nd Lock Zerben

Generell Overview / position first and second lock

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2008-2012

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Low Water Lock Magdeburg

Generell Overview (Simulation)

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Low Water Lock Magdeburg

Special features of the lock

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- Location: River Lock in Channel
- Traffic destination: year-round water depth in Rothensee – Connection Channel and Port of Magdeburg of min. 4.0 m
- Operation depending on water level of river Elbe if <39.60 m above sea level
- free passage if Elbe > 39.60 m above sea level
- about 50% of days in a year operating

Low Water Lock Magdeburg

Technical data

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- Maximum lifting height 1.86 m
- Dimensions: 190 x 25 m
- Sheet pile lock
- Massive heads
- Pump plant with 3 x 3.5 m^3 / s
- Operating by remote control

Picture: May 2008

Low Water Lock Magdeburg

Hydraulic system / Gates

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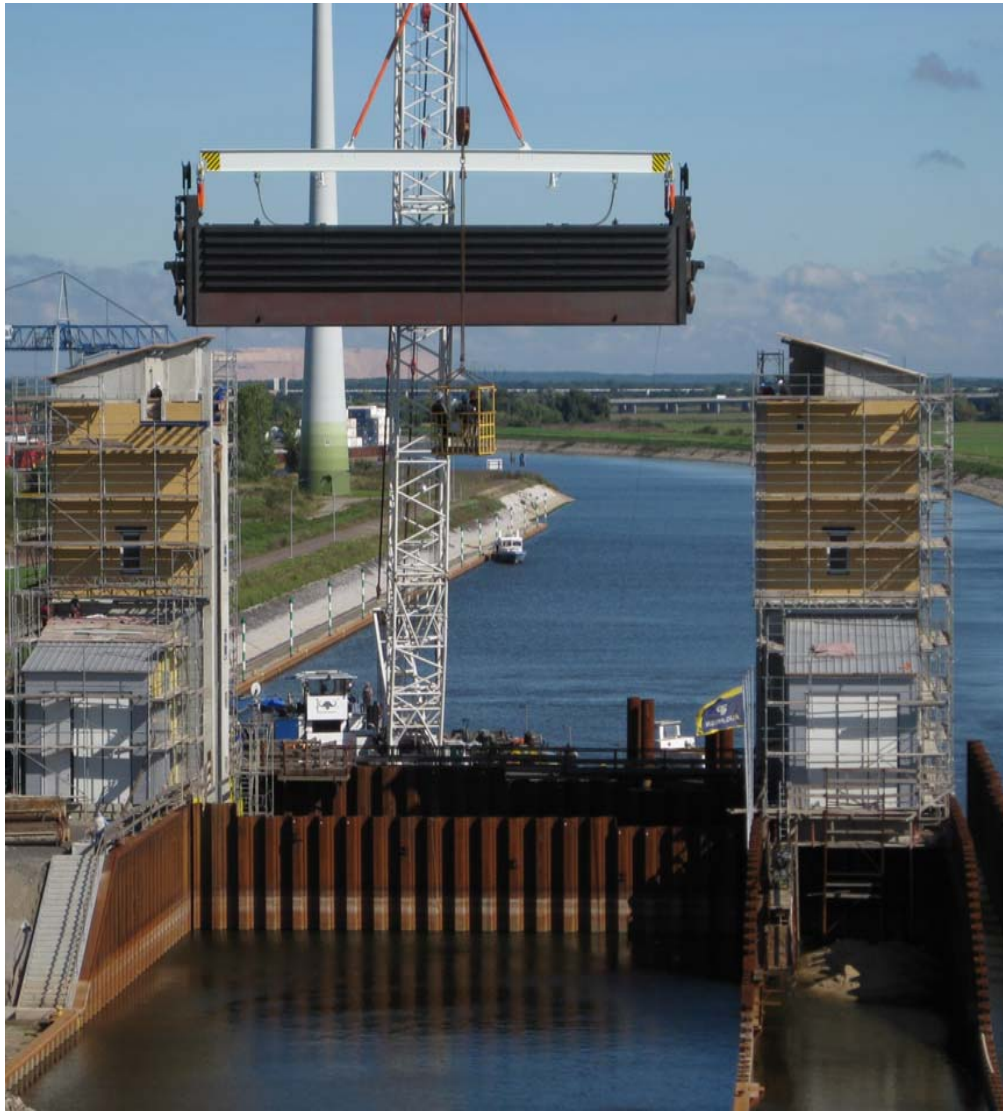
- Upper and Lower Gate: Lifting Gate
- Width 25 m, height 6 m
- Weight each 90 t
- Filling / emptying chamber by lifting gates



Picture: September 2010

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Low Water Lock Magdeburg

Outlook 2012…

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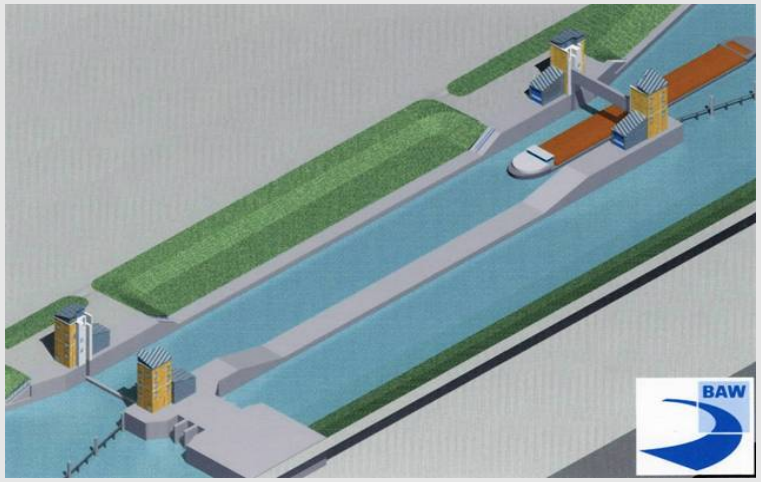

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Thank you for your attention

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Wasserstraßen-Neubauamt Magdeburg

Bundesministerium für Verkehr, Bau und Stadtentwicklung