PIANC - AGA 2011 - Berlin
Development of Locks of the Waterway Construction Official Magdeburg
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German Unity Transport Project 17:
Expansion of Waterway Link Hannover – Magdeburg – Berlin

The responsibility of the Waterway Construction Official Magdeburg covers:
Waterway Link Hannover - Magdeburg - Berlin

Expansion targets / rated ships

- 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

Key data for dimension of locks:

- Depth of water: 4.0 m
- Loaded draught: 2.80 m
Waterway Cross Magdeburg
Situation before development measures
Waterway Cross Magdeburg
Initial considerations ...
Waterway Cross Magdeburg
Implemented solution
Content of presentation

Introduction

Lock Rothensee
1997-2001

Lock Hohenwarthe
1998-2003

2nd Lock Wusterwitz
2008-2012

2nd Lock Zerben
Beginning 2012

Low Water Lock Magdeburg
2008-2012
We make shipping possible.

Lock Rothensee
Generell Overview with Ship-Lift
Lock Rothensee
Technical data

- 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 = 17.5 m³/s
- Start of construction: 1997
- Opening: 2001
Lock Rothensee
Hydraulic System

Plan view of base flow system in the bottom with longitudinal channels

Cross section of chamber and water saving basins
Lock Rothensee
Hydraulic System

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

- Water saving channels closure
  - 6 roller gates
  - Size 2 x 3,2 m
  - 12 t each
Lock Rothensee
Gates

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
Lock Rothensee
Concrete blocks of the walls in construction (August 1999)
Content of presentation

Introduction

Lock Rothensee
1997-2001

Lock Hohenwarthe
1998-2003

2nd Lock Wusterwitz
2008-2012

2nd Lock Zerben
Beginning 2012

Low Water Lock Magdeburg
2008-2012
We make shipping possible.

Lock Hohenwarthe

Generell Overview

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Lock Hohenwarthe

Technical Data

- 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 m³/s
- Start of construction: 1998
- Opening: 2003
Lock Hohenwarthe
Hydraulic system – identical to Rothensee but 2 chambers
Lock Hohenwarthe
Gates

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
  -> resulting settlement differences
- Decision for Monolithic base: Dimensions 246 x 64 x 5.50 m, Volume = 68,000 m³
Lock Hohenwarthe
Concrete blocks and expansion joints

- Longitudinal section of the chamber
- Monolithic base
- Walls with 15 m block-wide, back-step procedure
- Different arrangement of expansion joints, not going through base
Lock Hohenwarthe
Concrete work May 2001
Lock Hohenwarthe
Expansion joints of the chamber walls
Excursion: Expansion Joints

Common weaknesses of the construction

Concrete damage in the joint area

Failure of the joint material

Uneven settlement or twist of blocks

Solution:
Minimise or if possible avoid expansion joints
Introduction

Lock Rothensee
1997-2001

Lock Hohenwarthe
1998-2003

2nd Lock Wusterwitz
2008-2012

2nd Lock Zerben
Beginning 2012

Low Water Lock Magdeburg
2008-2012
We make shipping possible.

2nd Lock Wusterwitz
Technical data

- Lifting height 4,75 m
- 1 chamber: 190 m long, 12,5 m wide
- Start of construction: 2008
- Opening: 2012
Lock Rothensee
- Base 45 m sections
- Walls 15 m sections

Lock Hohenwarthe
- Monolithic Base
- Walls 15 m sections

2nd Lock Wusterwitz
- Monolithic design

1997

1998

2008
2nd Lock Wusterwitz
Monolithic construction / no expansion joints

- Reinforced concrete: approx. 40,000 m³
- Monolithic building length: 261 m
- Concrete construction up to 34.30 m wide
- Max. height of concrete structure: 14.45 m
- 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
2nd Lock Wusterwitz
Impressions of the Hydraulic System

Lower head: discharge structure with flow piers

View into longitudinal channel

Filling nozzles before concreting

Upper head: Hydraulic intake structure
2nd Lock Wusterwitz
Hydraulic engineering

- Upper and lower gate: mitre gates
  - Upper: height 5.16 m, weight 34 to
  - Lower: height 9.56 m, weight 58 to
- 4 longitudinal channel closures
  - constructed as sliding gates
  - 6 to each, dimensions of 2.0 x 3.25 m
Content of presentation

Introduction

Lock Rothensee
1997-2001

Lock Hohenwarthe
1998-2003

2nd Lock Wusterwitz
2008-2012

2nd Lock Zerben
Beginning 2012

Low Water Lock Magdeburg
2008-2012
2nd Lock Zerben

Generell Overview

- 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
We make shipping possible.

2nd Lock Zerben

General Overview / position first and second lock
Introduction

Lock Rothensee
1997-2001

Lock Hohenwarthe
1998-2003

2nd Lock Wusterwitz
2008-2012

2nd Lock Zerben
Beginning 2012

Low Water Lock Magdeburg
2008-2012
Low Water Lock Magdeburg
Generell Overview (Simulation) with location of lock
Low Water Lock Magdeburg

Special features of the lock

- Location: River Lock in Channel
- Traffic objective: gain year-round water depth in Rothensee – Connection Channel and Port of Magdeburg of min. 4.0 m
- Operating while water level of river Elbe <39.60 m above sea level
- Free passage through chamber if water level >39.60 m above sea level
- Operating about 50% of days in a year
Low Water Lock Magdeburg

Technical data

- Maximum lifting height 1.86 m
- Dimensions: 190 x 25 m
- Sheet pile lock
- Massive heads
- Pump plant with 3 x 3.5 m³/s next to lower head

Picture: May 2008
Low Water Lock Magdeburg
Hydraulic system / Gates

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

Picture: Installation September 2010
We make shipping possible.

Low Water Lock Magdeburg
Outlook 2012…
Summary / Developments

- Reduction of expansion joints till monolithic design

- Selection of the Hydraulic system depends mainly to the lifting height

- If longitudinal channels are required: change from roller gates to sliding gates
Thank you for your attention

http://www.wna-magdeburg.wsv.de
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