Concrete Mattresses for Lining and Sealing of Canals

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Agenda

- What are concrete mattresses?
- Design of concrete mattresses
- Benefits of concrete mattresses
- Installation follow up of concrete mattresses
- Case studies
- One more thing...

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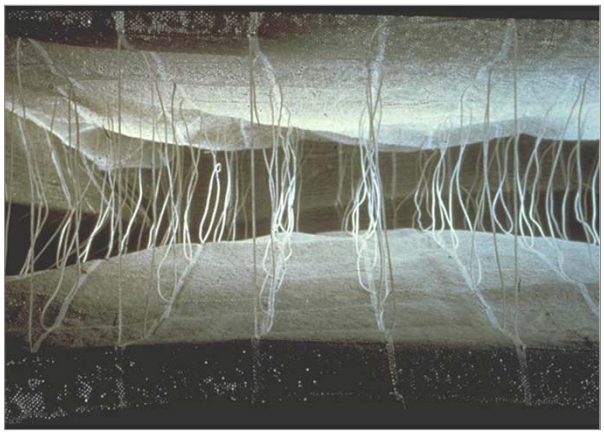
What are concrete mattresses?

Concrete mattresses consists out of two basic components



Geotextile formwork

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Highly fluid concrete

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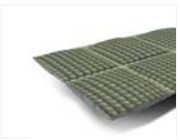
What are concrete mattresses?

General types of mattresses

State-of-the-art cover lining and erosion control with concrete mattresses.



Permeable cushion mattress with built-in hinge zones, designed for high hydraulic loads and settlement-prone bases.

The permeable concrete mat for use on stable subsoil and lower hydraulic loads.

The plantable concrete mat for erosion protection, ideally suited for shore protection above the permanent water level or for standing water bodies.

Impermeable | **Permeable**

- Thickness controlled by
  - Binder length
  - Size and distance of filterpoints
- Shrinkage depends on the type chosen
  - Vertical binders
    - Up to 4 % areal shrinkage
  - Cross binders or filterpoints
    - Up to 30 % areal shrinkage

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Design of concrete mattresses

- Type according to application
  - Sealing
  - Erosion protection
- Thickness according to flow- or wave load
  - Different approaches available like
    - Pilarczyk
    - Hawkswood
    - Own lab tests and experience
    - ...

Benefits of concrete mattresses

- Flexible system, which adapts to the underground
- Proven sealing system
  - Canals
  - Ditches
  - Ponds
  - ...
- High hydraulic resistance
- Mannings n of uniform section mattress: 0,015
- High mechanical resistance
  - Anchor fall resistance (thickness >= 20 cm)
- Installation on steep slopes possible
- Underwater installation common practice
- Robust and long lasting
- Installation speed: up to 2000 m²/d

Inlet with a maximum inclination of 1:1,5 and an approx. length of 160 m for a max. discharge of 5 m³/s

Benefits of concrete mattresses

Non- Coherent

Coherent

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Installation follow up of concrete mattresses

* How it should be done:

1. Preparation/leveling of the subsoil

2. Lay out of the pre-fabricated panels

3. Filling of the mattress with highly fluid concrete/mortar

* Also possible...:

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Case studies

Canal Imperial de Aragones, Spain (1973) - Sealing of an irrigation canal

Condition in 2000

Condition in 2011

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Case studies

Banter See, Wilhelmshaven, Germany (1977) - Erosion protection of a lake bank

Condition in 2008

Condition in 2008

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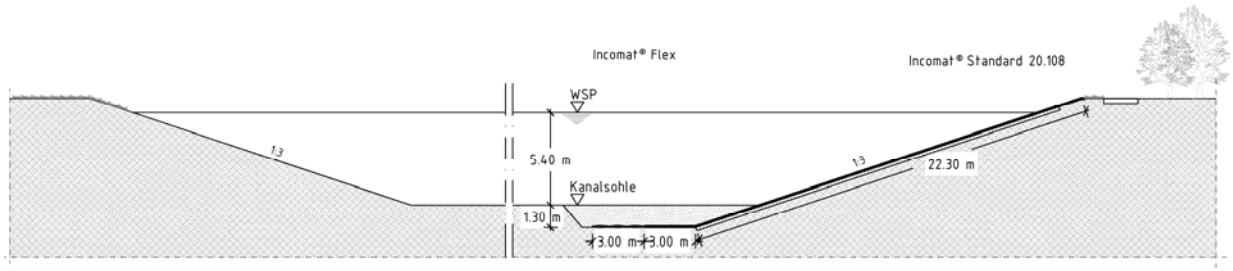
Case studies

Canal de Jonage, France (1994)



Design:
v = 0.5 to 2.0 m/s
h = 5.4 to 7.0 m
Slope 1:3

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Case studies

Canal de Jonage, France (1994)

During installation

After completion

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Case studies

Canal de Jonage, France (1994)

Condition in 1998

Condition in 2016

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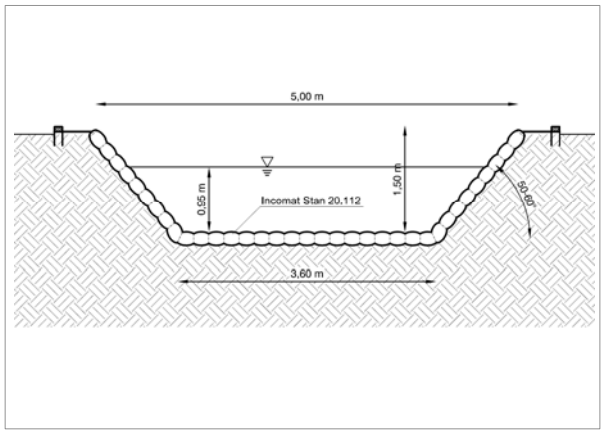
Case studies

Morrovalle, hydroelectric power plant canal, Italy (2011) - Sealing



Design

Excavated canal

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Case studies

Morrovalle, hydroelectric power plant canal, Italy (2011) - Sealing

Lay-out and anchorage of the mat

Concreting works in progress

Case studies

Morrovalle, hydroelectric power plant canal, Italy (2011) - Sealing

After completion

Situation in July 2021 (source: google street view)

Case studies

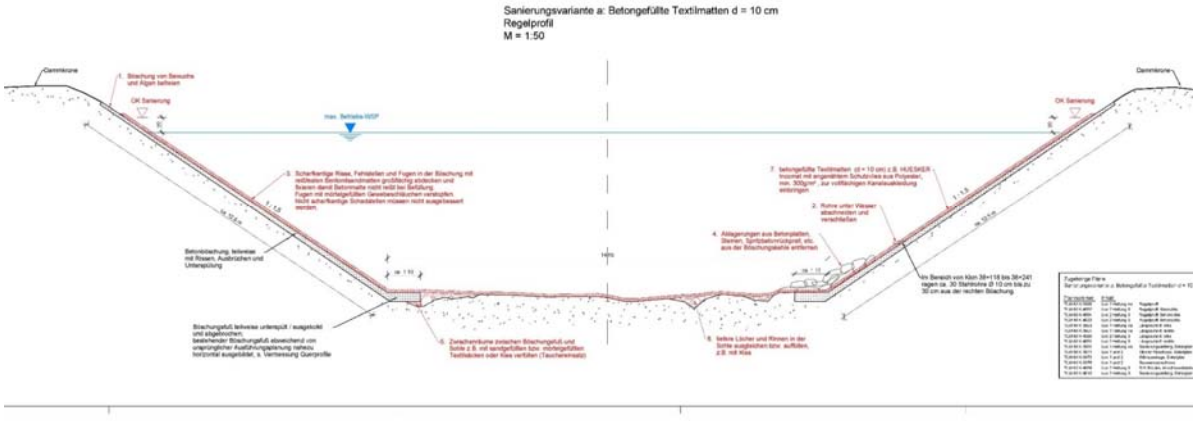
Munich, rehabilitation of the Mittlere Isarkanal, Germany (2013) - Sealing

Location of the Mittlere-Isarkanal (Source: wikipedia)

Areal view of the emptied channel of a previous rehabilitated section (Source: wikipedia)

Case studies

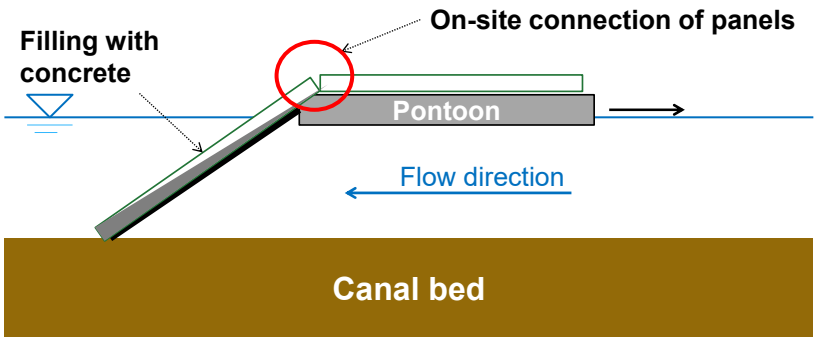
Munich, rehabilitation of the Mittlere Isarkanal, Germany (2013) - Sealing



Cross section; h= 5 m to 7 m

Case studies

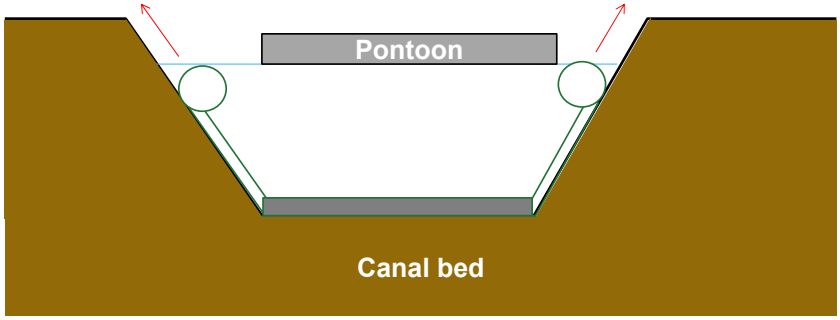
Munich, rehabilitation of the Mittlere Isarkanal, Germany (2013) - Sealing



Schematic installation process (longitudinal section)

Case studies

Munich, rehabilitation of the Mittlere Isarkanal, Germany (2013) - Sealing



Schematic installation process (cross sectional cut)

Case studies

Munich, rehabilitation of the Mittlere Isarkanal, Germany (2013) - Sealing

Installation pontoon with “Bierzelt”

Filling of the bed section on the ramp

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Case studies

Munich, rehabilitation of the Mittlere Isarkanal, Germany (2013) - Sealing

Filling of the slope elements

Rehabilitated section

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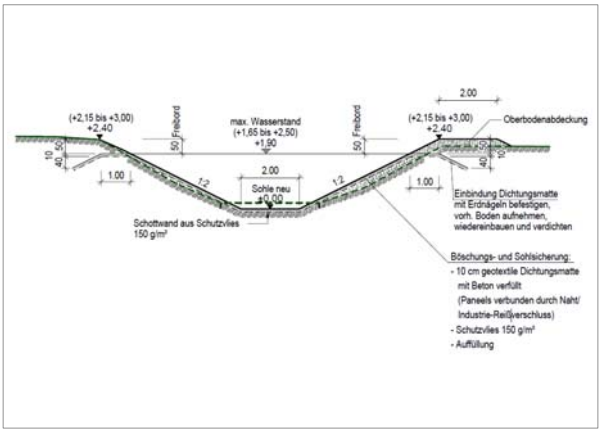
Case studies

Berlin, Drainage ditch for WWTP, Germany (2018) - Sealing

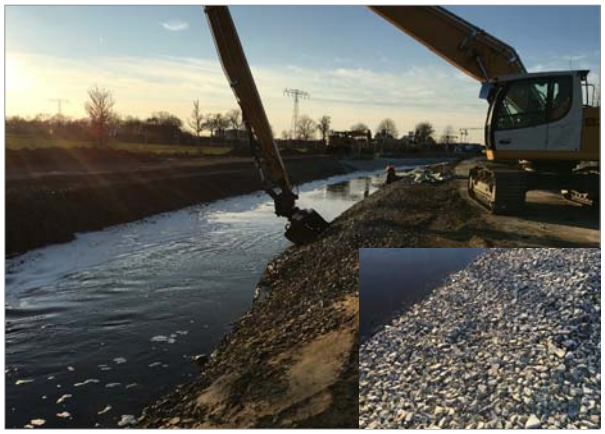


Cross section

Subsoil preparation

Case studies

Berlin, Drainage ditch for WWTP, Germany (2018) - Sealing



Final bedding layer

Empty fabric formwork installed

Case studies

Berlin, Drainage ditch for WWTP, Germany (2018) - Sealing

Covering transition zone

After completion

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One more thing…

Concrete mattresses as pipe cover

Installation of pipe cover

Installation of ballasted syphon

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Thank you for your attention

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