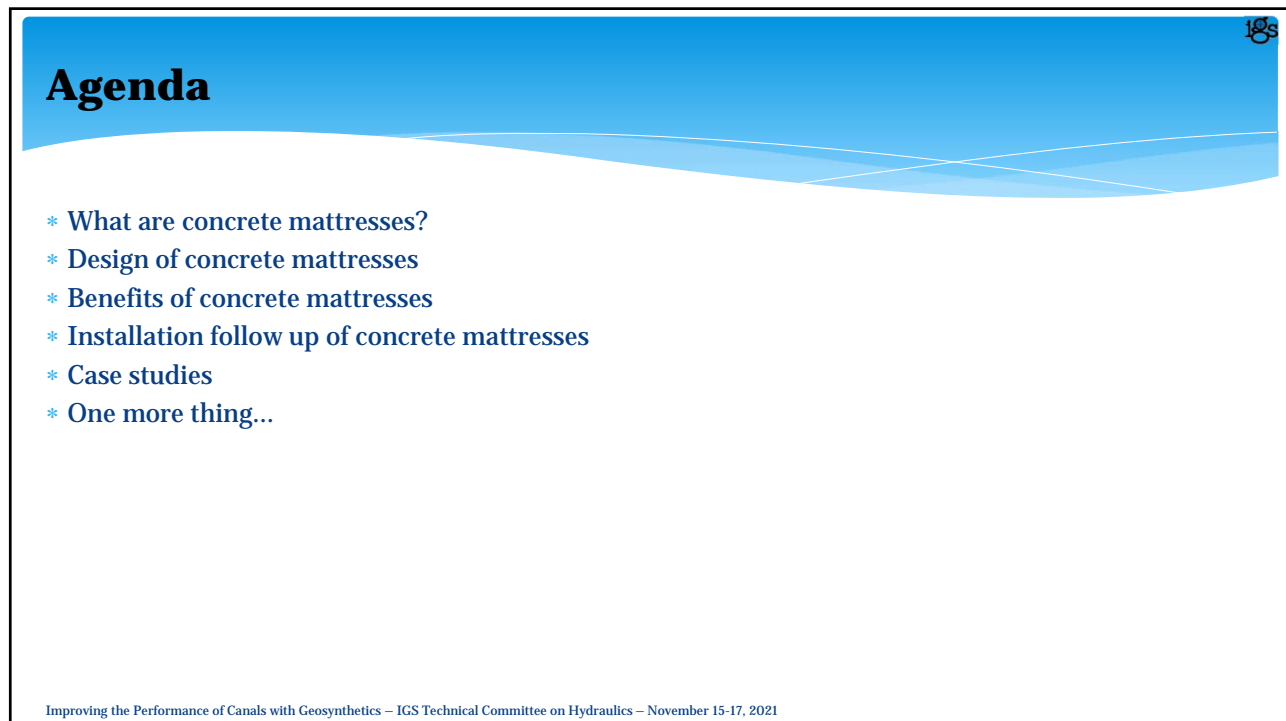


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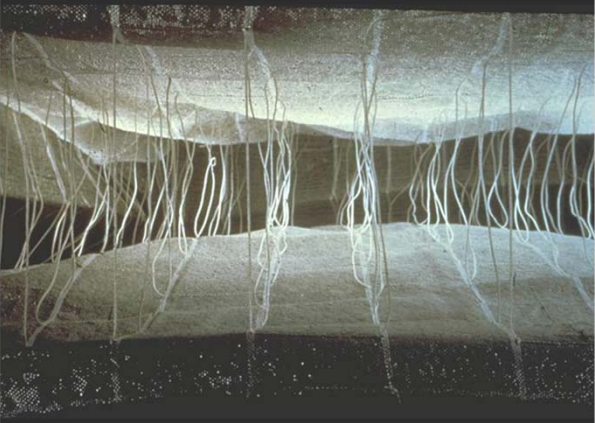


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What are concrete mattresses?

Concrete mattresses consists out of two basic components



Geotextile formwork

+



Highly fluid concrete


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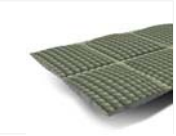
18

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
 - * ...



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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

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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

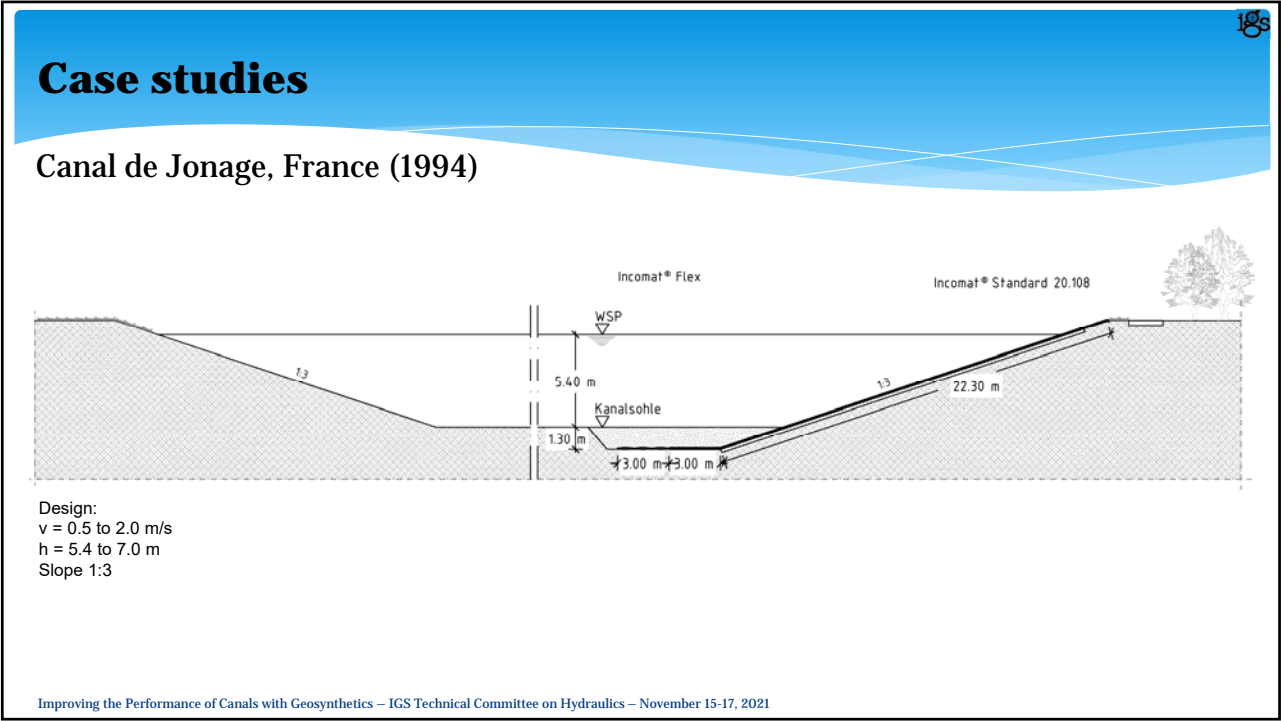


Condition in 2008

Condition in 2008

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Case studies

Canal de Jonage, France (1994)



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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Ebbert - Concrete Mattresses for Lining and
Sealing of Canals

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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

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Case studies

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



After completion

Situation in July 2021 (source: google street view)

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Case studies

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



Location of the Mittlere-Isarkanal (Source: wikipedia)



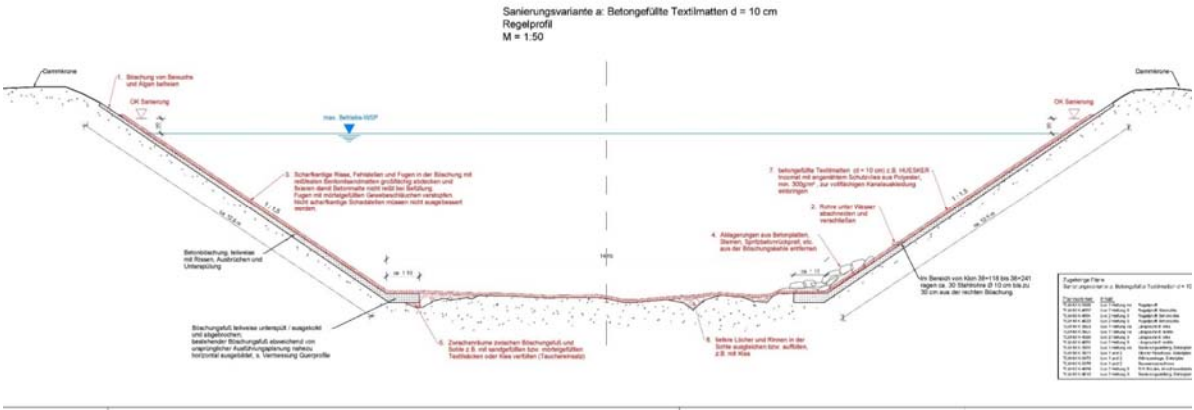
Areal view of the emptied channel of a previous rehabilitated section (Source: wikipedia)

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Case studies

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



Cross section; h= 5 m to 7 m

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Case studies

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

The diagram shows a longitudinal section of a canal bed (brown) with a sloped left bank. A grey pontoon is being moved from right to left, as indicated by a blue arrow labeled 'Flow direction'. A red circle highlights the 'On-site connection of panels' where the pontoon meets the bank. A dashed line and arrow point to the area where the geosynthetic panel is being 'Filled with concrete'. The water level is shown as a blue line with a triangle symbol.

Schematic installation process (longitudinal section)

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Case studies

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

The diagram shows a cross-sectional cut of a canal bed (brown) with sloped sides. A grey pontoon is positioned across the top of the canal. Two green circles on the sloped banks represent the geosynthetic panels being installed. Red arrows point upwards from the panels towards the water level, indicating the direction of installation or sealing.

Schematic installation process (cross sectional cut)

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



Filling of the slope elements



Rehabilitated section

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Ebbert - Concrete Mattresses for Lining and
Sealing of Canals

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Case studies

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



Diagram illustrating the cross-section of the drainage ditch. Key dimensions and components include:

- Top width: 2.00 m
- Bottom width: 1.00 m
- Side slopes: 1:1
- Maximum water level: max. Wasserstand (+1.65 bis +2.50) +1.65
- Freeboard: 50 cm
- Soil layer: Schottrand aus Schutzvlies 150 g/m²
- Geotextile layer: 10 cm geotextile Dichtungsmatte mit Beton verfüllt (Paneele verbunden durch Naht/ Industrie-Raillverschluss)
- Protection layer: Schutzvlies 150 g/m²
- Fill: Auffüllung



Photograph showing the subsoil preparation work, where the ground is being excavated and prepared for the geosynthetic lining.

Cross section

Subsoil preparation

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Case studies

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



Photograph showing the final bedding layer, which is a layer of gravel or coarse sand, being laid out for the geosynthetic lining.



Photograph showing the empty fabric formwork installed along the ditch, ready for the geosynthetic lining.

Final bedding layer

Empty fabric formwork installed

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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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