

FILTERS MET GEOKUNSTOFFEN

INTRODUCTIE

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INTRODUCTION

- Geotextiles are used in various applications in hydraulics and coastal engineering.
- Most cases the filter function, permeability and strength are important.
- In applications in this lecture:
 - filter function
 - weight (for revetments)
 - permeability
 - strength

FIRST APPLICATIONS: FACINE MATTRESSES

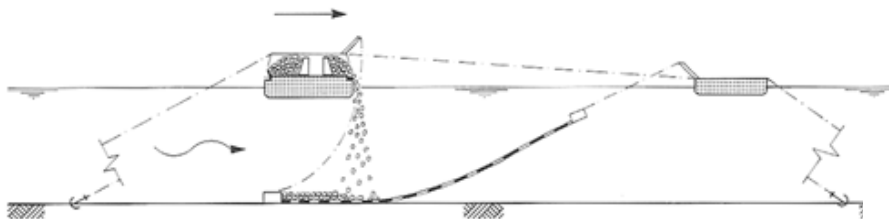


filterdoek



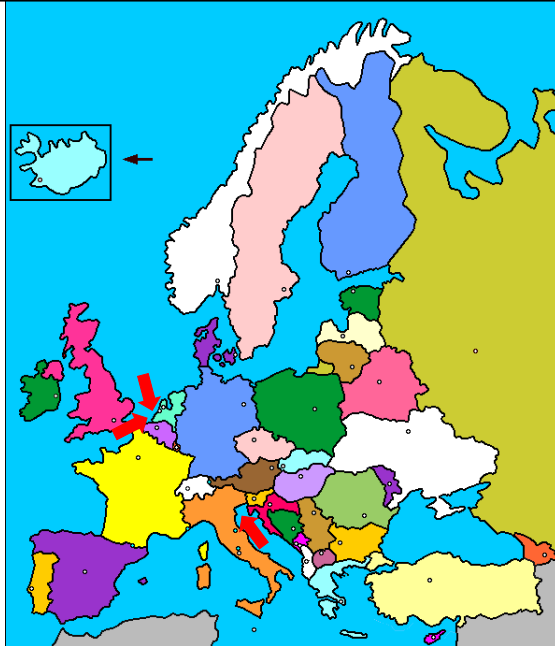
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PLACEMENT



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DEVELOPMENTS IN FILTER APPLICATIONS



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DEVELOPMENTS IN FILTER APPLICATIONS

Haringvlietsluizen, 60-ties
No geotextiles



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DEVELOPMENTS IN FILTER APPLICATIONS

Haringvlietsluizen, 60-ties
No geotextiles



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Haringvlietsluizen, 60-ties: No geotextiles



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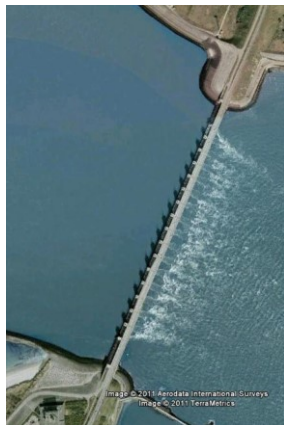
DEVELOPMENTS IN FILTER APPLICATIONS

Eastern Scheldt storm surge barrier, 70-ties
Geotextiles for packing



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DEVELOPMENTS IN FILTER APPLICATIONS

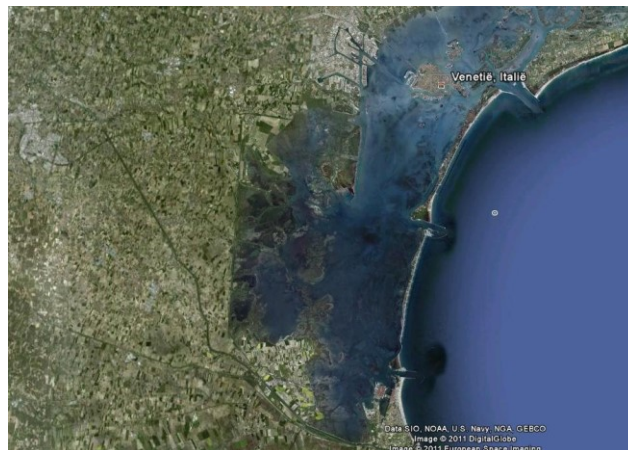
Eastern Scheldt storm surge barrier, 70-ties
Geotextiles with metal reinforcement



36-32cm dik

DEVELOPMENTS IN FILTER APPLICATIONS

Venice flood barrier, present
Geotextiles as filter



DEVELOPMENTS IN FILTER APPLICATIONS

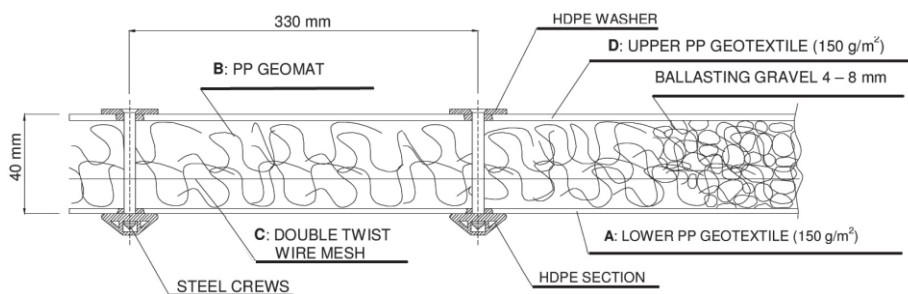
Venice flood barrier, present
Geotextiles as filter



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DEVELOPMENTS IN FILTER APPLICATIONS

Venice flood barrier, present
Geotextiles as filter



- Textile has a function during lifetime barrier
- No expensive steel reinforced geotextile
- One layer of granular material.

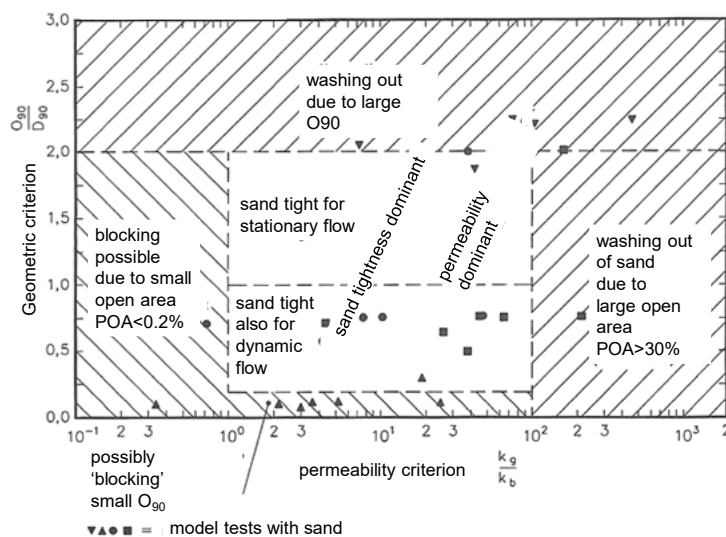
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DEVELOPMENTS IN FILTER APPLICATIONS

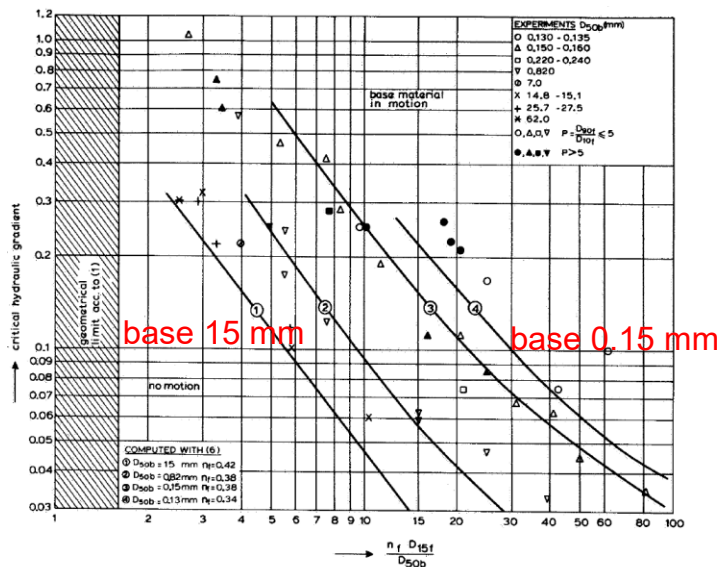
What have we learned in 50 years:

- To use geotextiles in major hydraulic structures
- How to make stronger geotextiles without steel reinforcement
- Durability

FILTER CRITERIA



FILTER CRITERIA: OPEN FILTERS, GRADIENTS



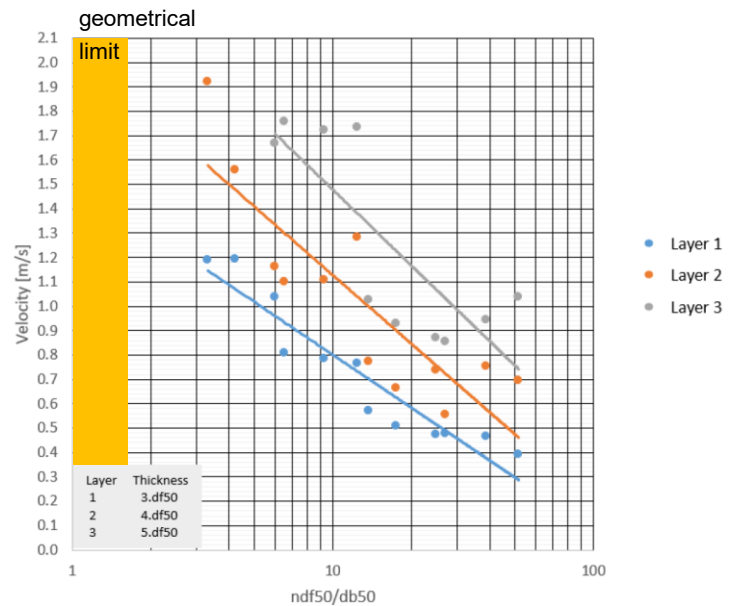
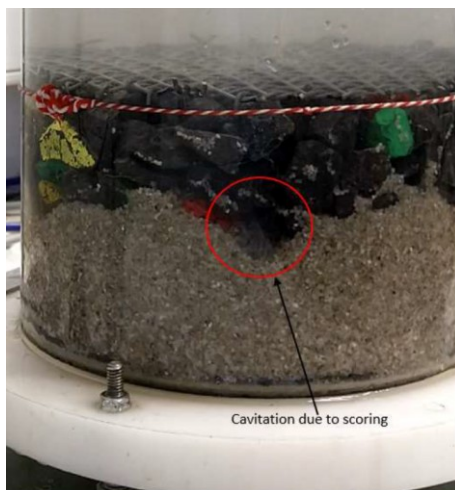
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FILTER CRITERIA: OPEN FILTERS, VELOCITIES



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FILTER CRITERIA: OPEN FILTERS, VELOCITIES



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FILTER CRITERIA: OPEN FILTERS

- Developed for the Eastern Scheldt storm surge barrier
- Now renewed interest for use in:
 - * revetments
 - * scour protection for wind turbines
- Often used to prevent the use of geotextiles
- A combination may be interesting

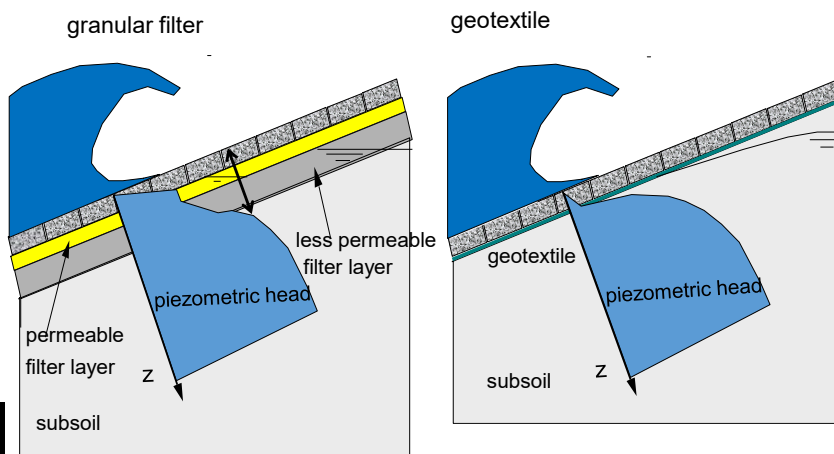
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REVTMENTS AND GEOTEXTILES



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REVTMENTS GEOTEXTILE ≠ GRANULAR FILTER



The weight of the granular filter is not replaced by the geotextile

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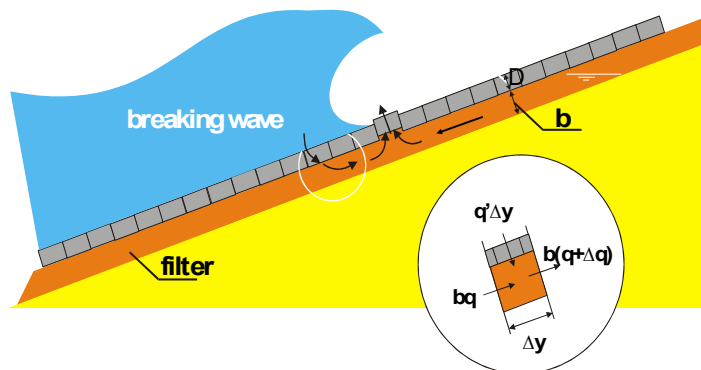
REVENEMENTS GEOTEXTILE ≠ GRANULAR FILTER



The weight of the granular filter is not replaced by the geotextile

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FLOW IN REVETMENTS

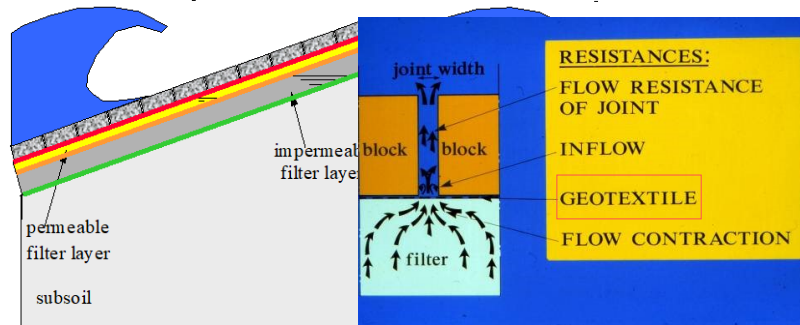


$$\Lambda = \sqrt{\frac{bkD}{k'}}$$

Leakage length is important
-filter (k) not too permeable
-cover layer permeable

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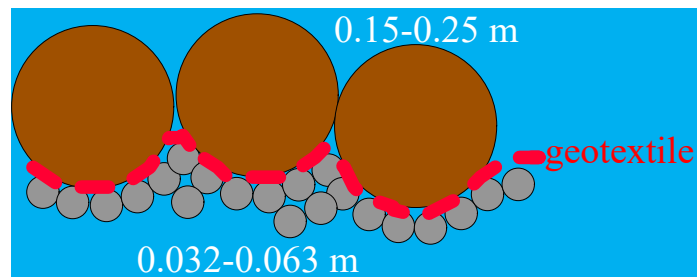
REVETMENTS



Permeability of geotextile in soil is limited, therefore no placement between permeable layers

PERMEABILITY/PERMITTIVITY

- EN ISO 11058 without load and without soil.
- Soil has an influence
 - blocking reduction to 20% of value without soil.



PERMEABILITY / PERMITTIVITY

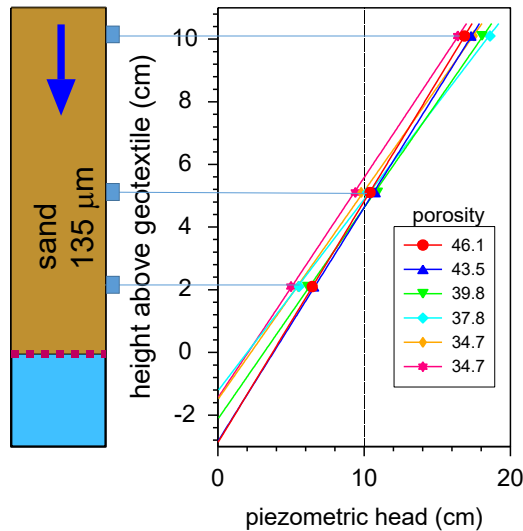
Sand influences
Permittivity of geotextile

Flow resistance of
geotextile of 1 mm
comparable to
1 to 2.5 cm sand

Geotextile on RVS plate
Opening is 35%

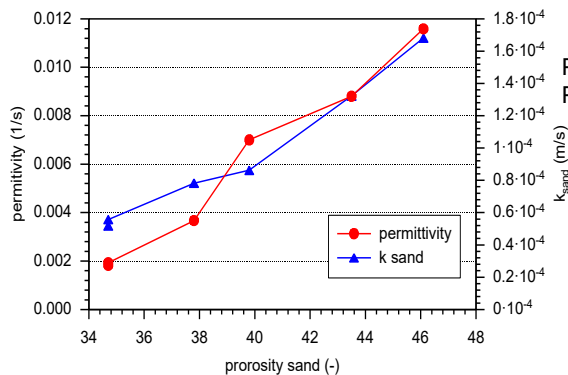


water flow

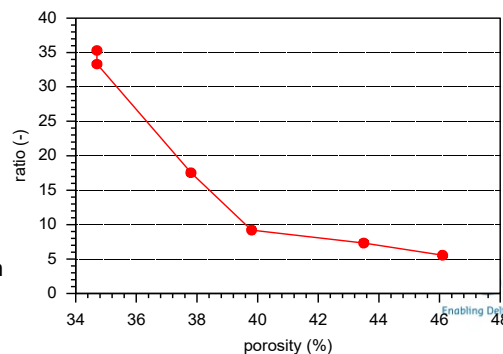


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PERMEABILITY / PERMITTIVITY



Permittivity geotextile follows
Permeability sand



Flow capacity is reduced with
a factor 5 to 35 by the sand



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PERMEABILITY PERMITTIVITY

$$v = k \cdot i \quad v = \psi \cdot \Delta\phi$$

- Permeability indicates influence of thickness
- Flow capacity in geotextile in soil is more determined by the interface geotextile-soil, thus thickness not important.
- Pressure drop over geotextile is important

DAMAGE DURING INSTALLATION



DAMAGE DURING INSTALLATION



CONCLUSIONS:

- Flood barriers show that progress in geotextile technology led to significant savings.
- Geometrically open filters can be of interest for low flow velocities
- In a revetment the weight of a granular filter is not replaced by the geotextile.
- The flow capacity of a geotextile may decrease dramatically when placed in sandy soil.
- Geotextiles have a permittivity more than a permeability.
- Damage during installation has to be prevented

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