

# Cemented Soil Dams An example of flood protection CS dike in France

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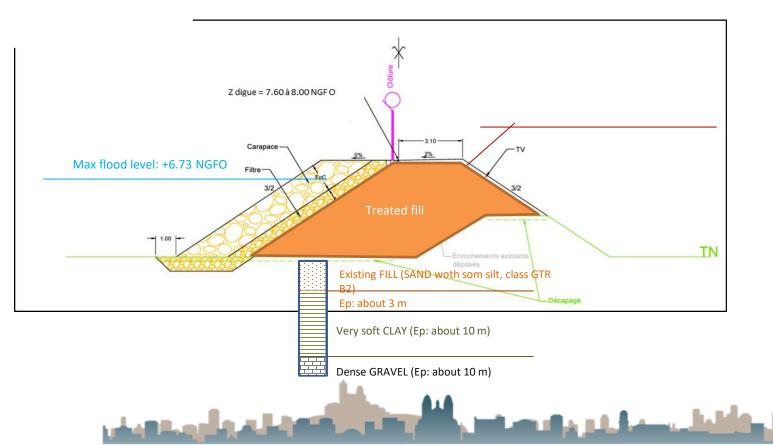
# CSD flood protection dike of an industrial area in France



Small and long flood dike. High level of safety required for extreme flood and wave events.

CSD solution selected because of :

- Limited footprint
- High safety regarding erosion risk ()



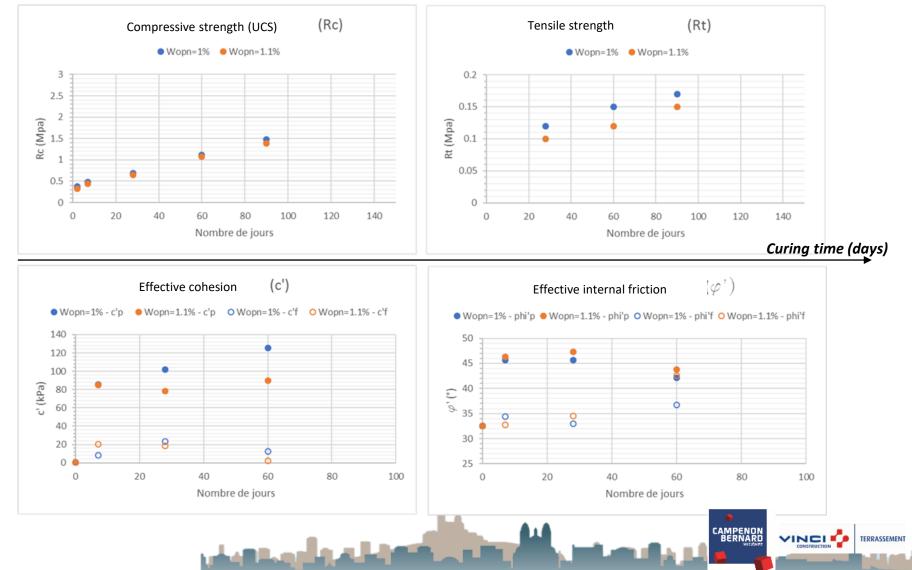




## Mechanical strength of lime-treated earthfill

Soil type B6 :

- Silty sand with plastic fine
- D<sub>max</sub> < 50 mm
- Fine content: 12 % to 35 %
- PI > 12
- Treatment : 1% quicklime



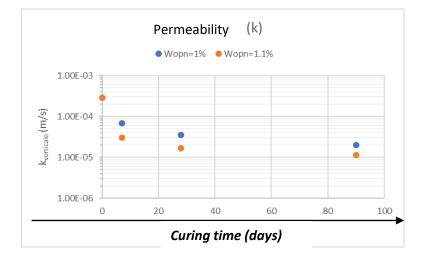




# Permeability of lime-treated earthfill

Soil type B6 treated with 1% lime

Permeability suitable with non-permanent seepage requirement



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#### Resistance to internal erosion of lime-treated earthfill

Soil type B6 treated with 1% lime : Dramatical improvement of critical shear strength



Critical shear stress for natural soil ( $\tau c$ ) < 5 Pa Critical shear stress for treated soil

- (τc) > 400 Pa @ 7 days (HET)
- (τc) > 450 Pa @ 28 days (HET)





### Geotechnical design key points

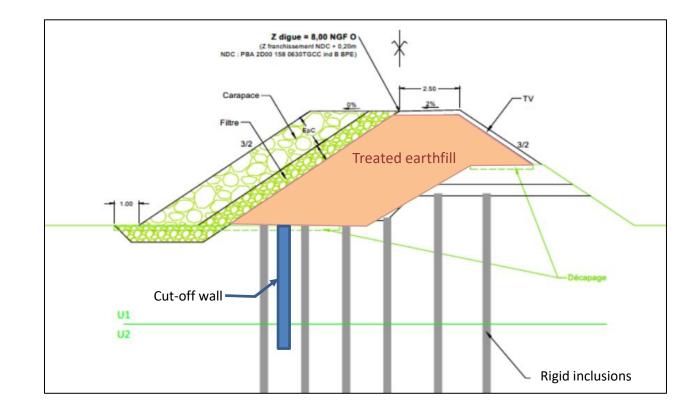
#### Low strength, compressible foundation :

- high settlement to be controlled
- risk of bearing capacity failure

=> foundation reinforcement / rigid inclusion to control settlement and ensure global stability

#### Steep downstream slope :

=> treated soil zone for high internal shear strength







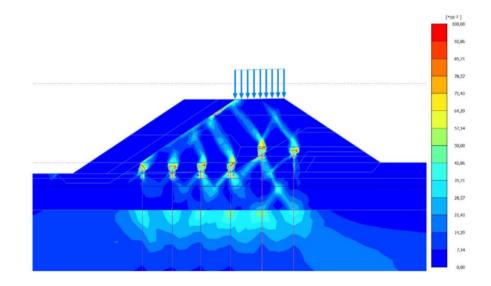
## Design issues related to the use of treated soils in embankments

#### Development of stress concentration due to rigid inclusions :

• Local shear strength to be check

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• flow seepage at dike/foundation to be controlled











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