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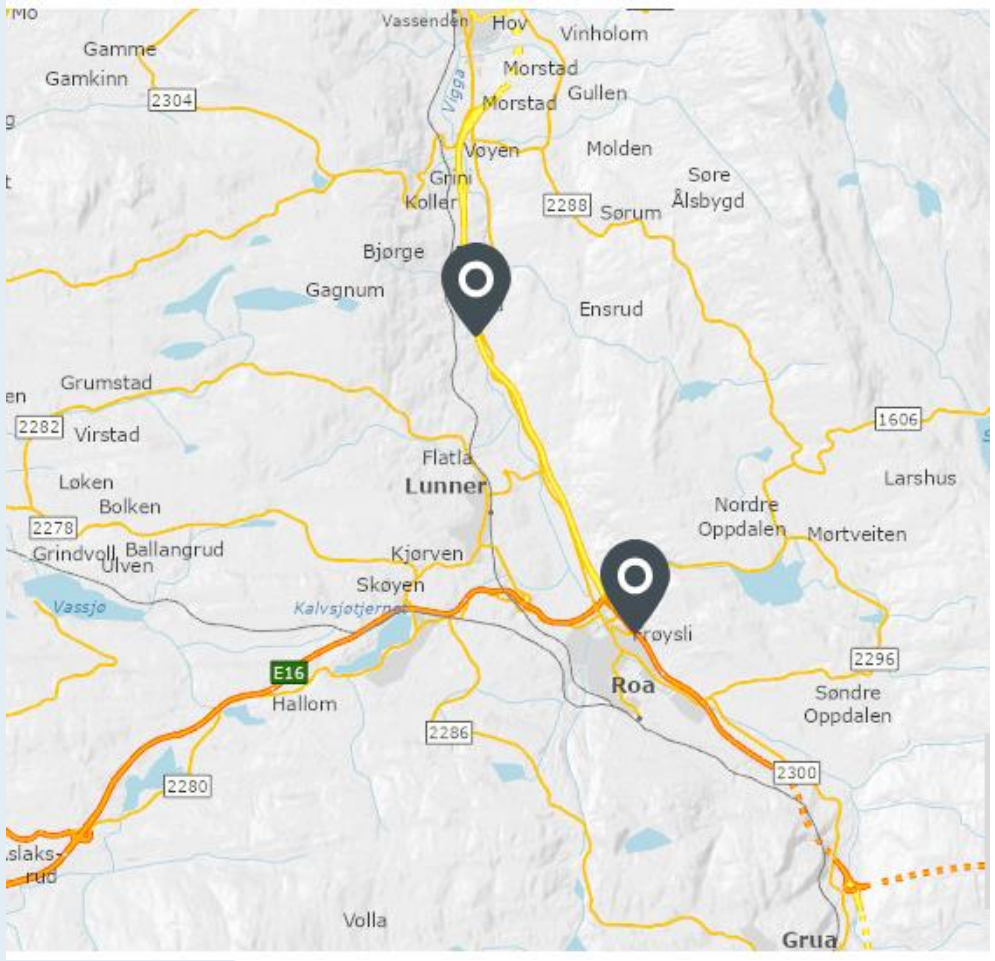
A Division of CMC

Optimization Load Transfer Platforms by application of TriAx geogrids for RV4 Roa – Gran project in Norway

Theo Huijbregts (Tensar)
Martin Sandbakken (Tentex)

RV4 Roa – Gran project



Turnkey contract with design and construction of:

- 4500 m four-lane highway in road class HX
- A large level sign junction at Roa.
- 6 structures, including K06 Holmen bridge of 280 m spanning the river Vigga.
- In places very poor soil conditions with soft marsh masses, far to mountains and elements of quick clay. Among other things, cement stabilization collums will be used in peatland, which has not been common in Norway before.
- Full road lighting

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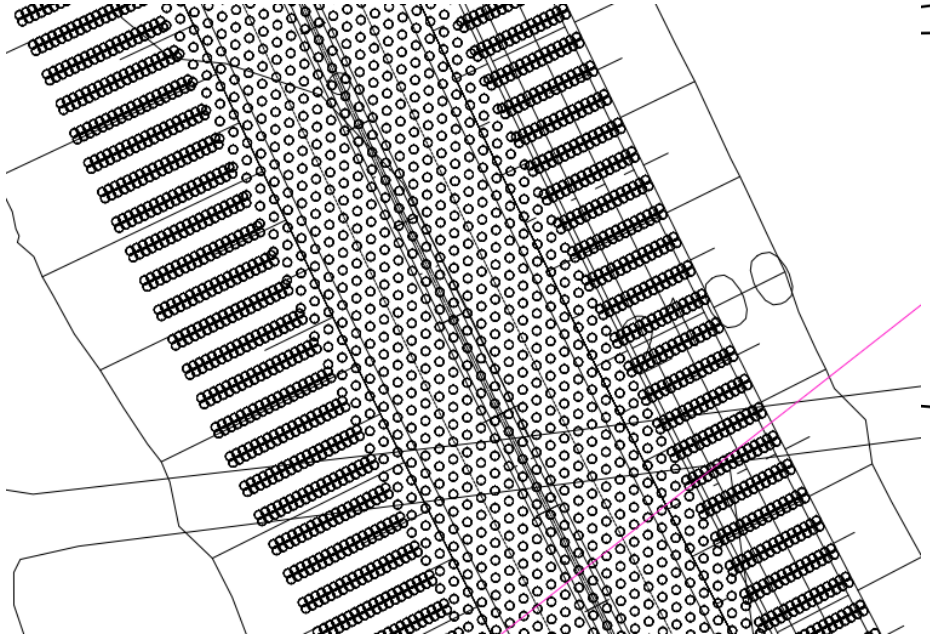
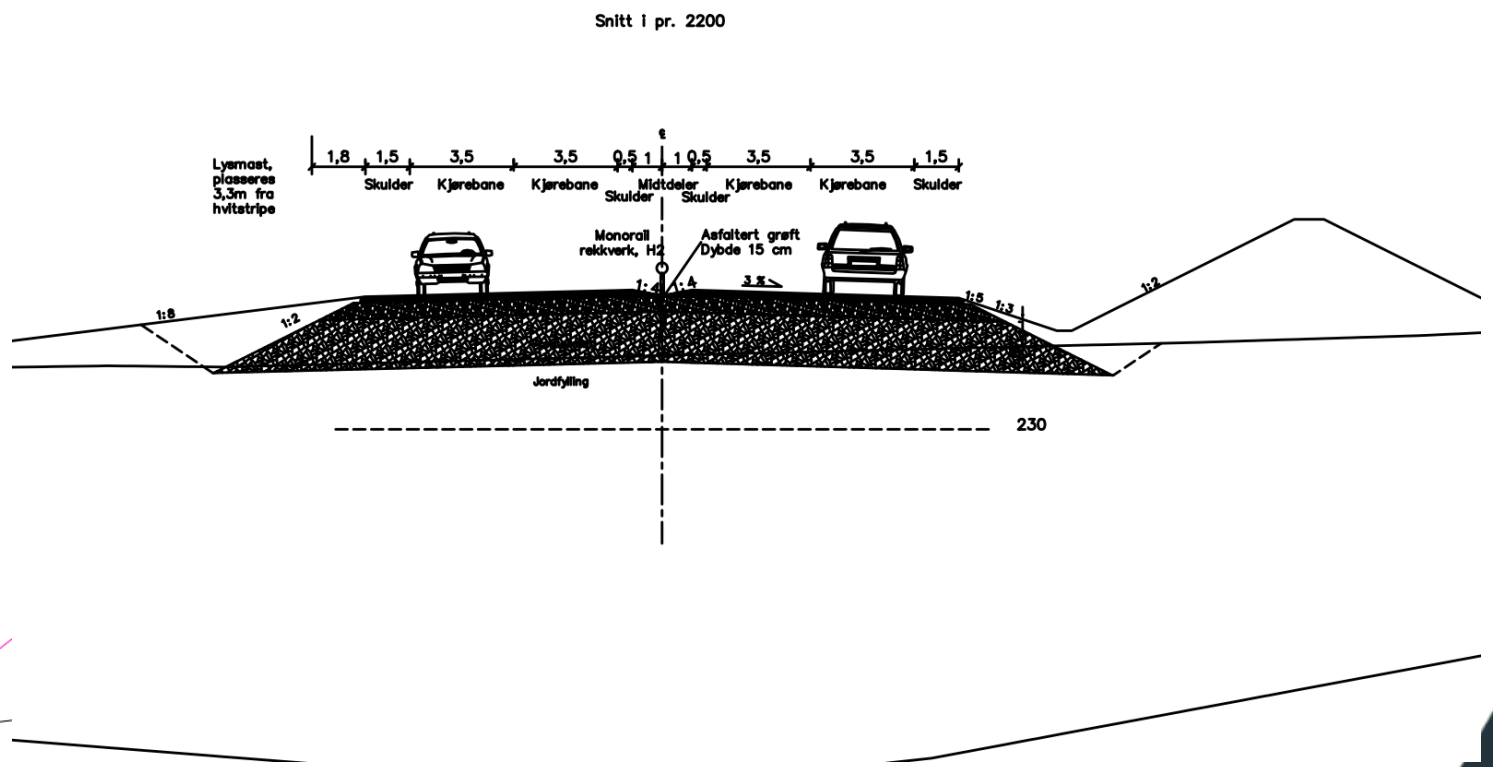
Between KM1925 and 2450 a piled embankment





Pile pattern 1,55 m (triangular)
Pile diameter 0,80 m

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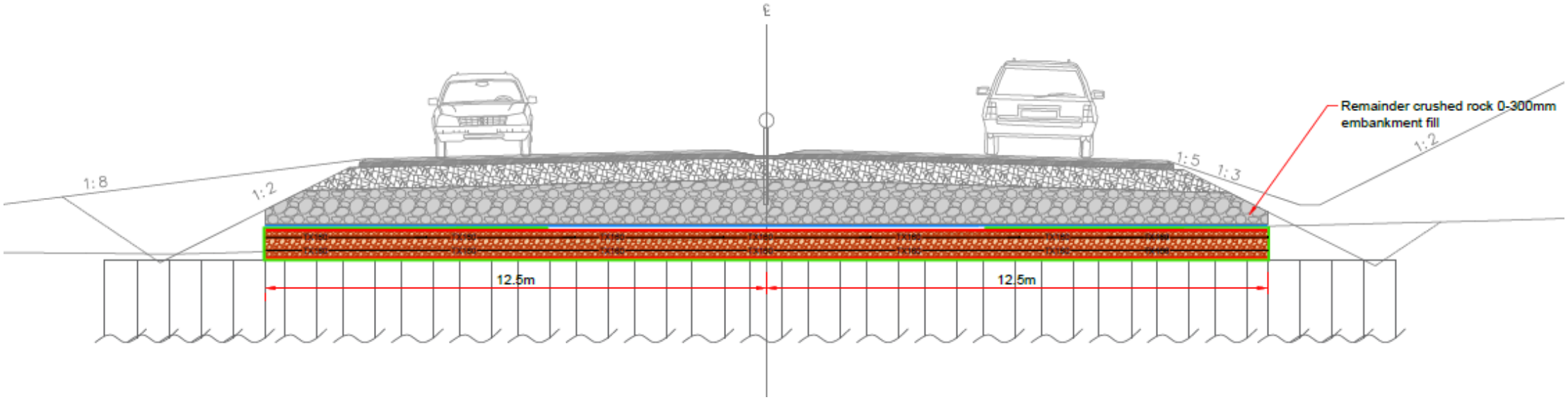
Between KM1925 and 2450 a piled embankment



Length approx 525 m and width 25 m

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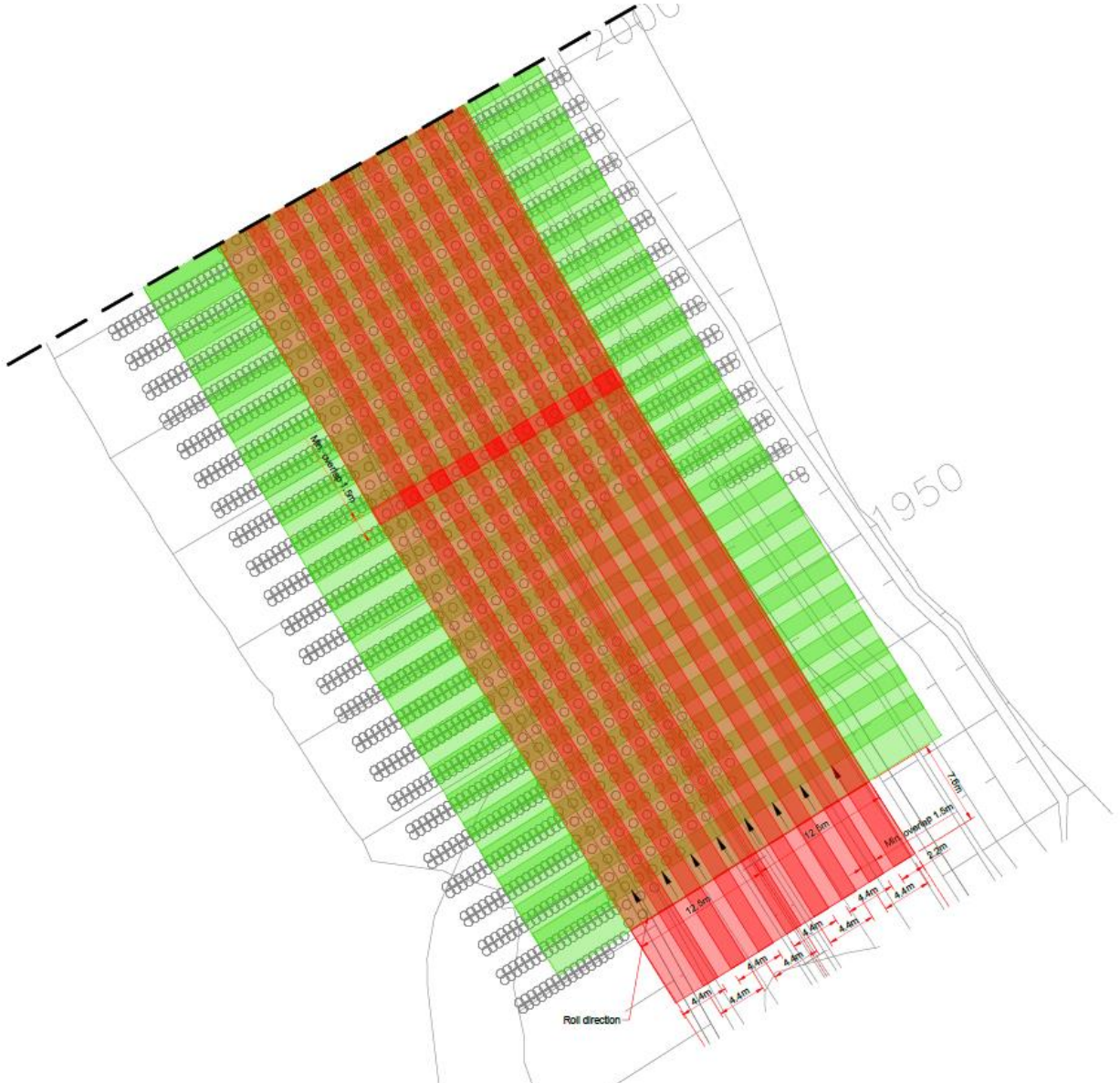
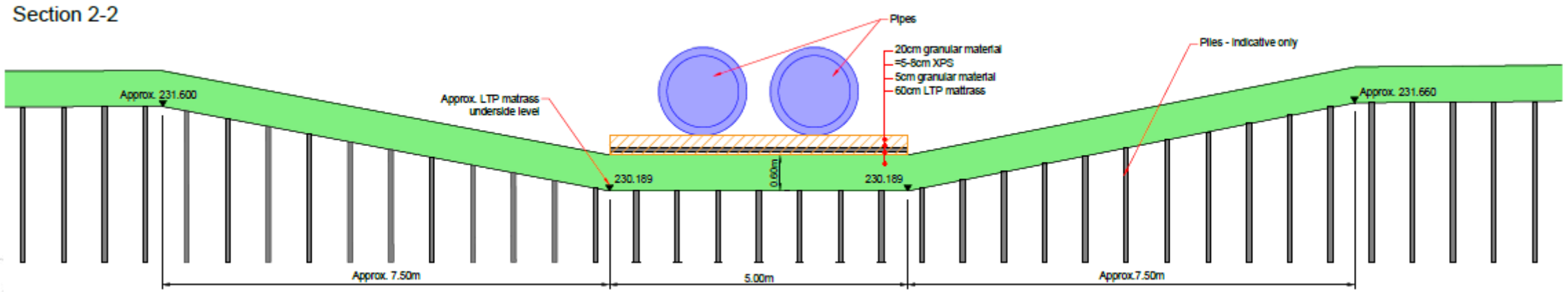
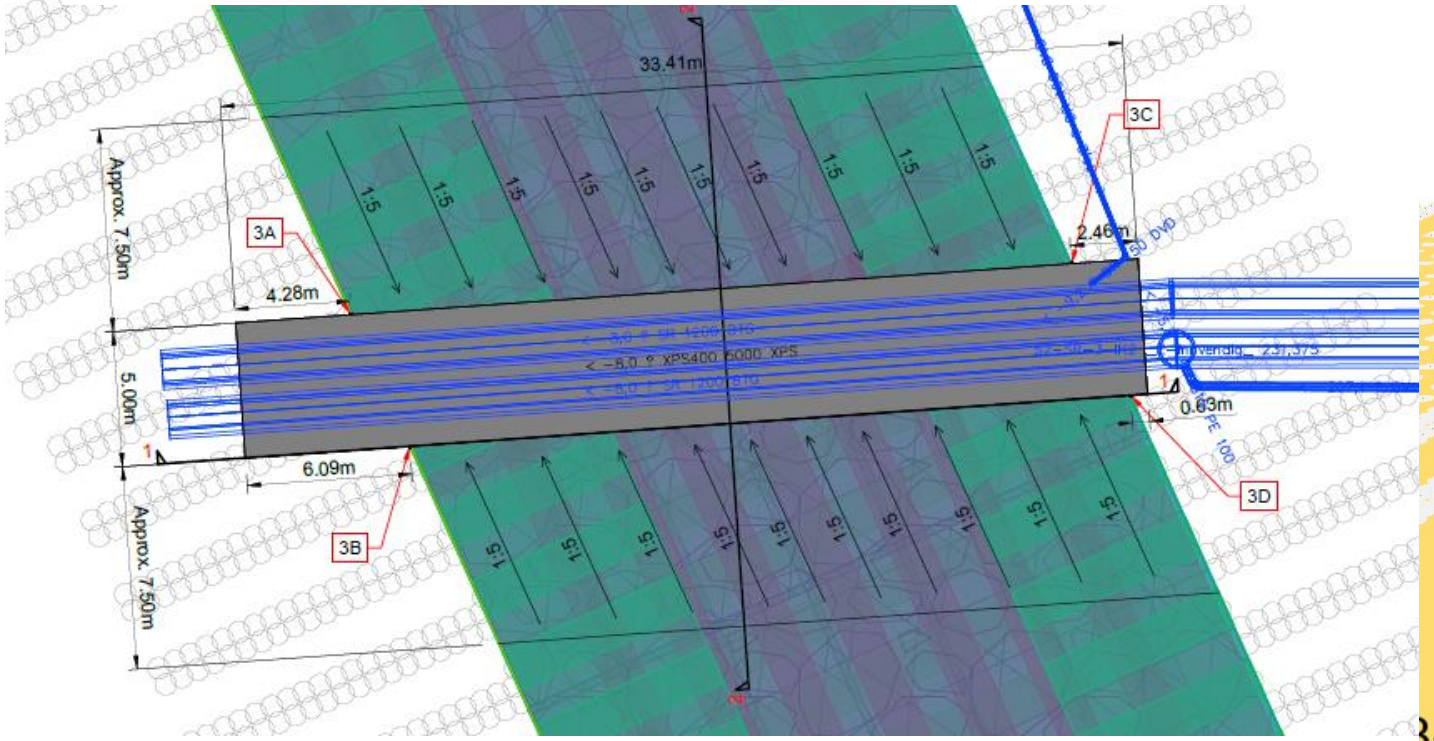
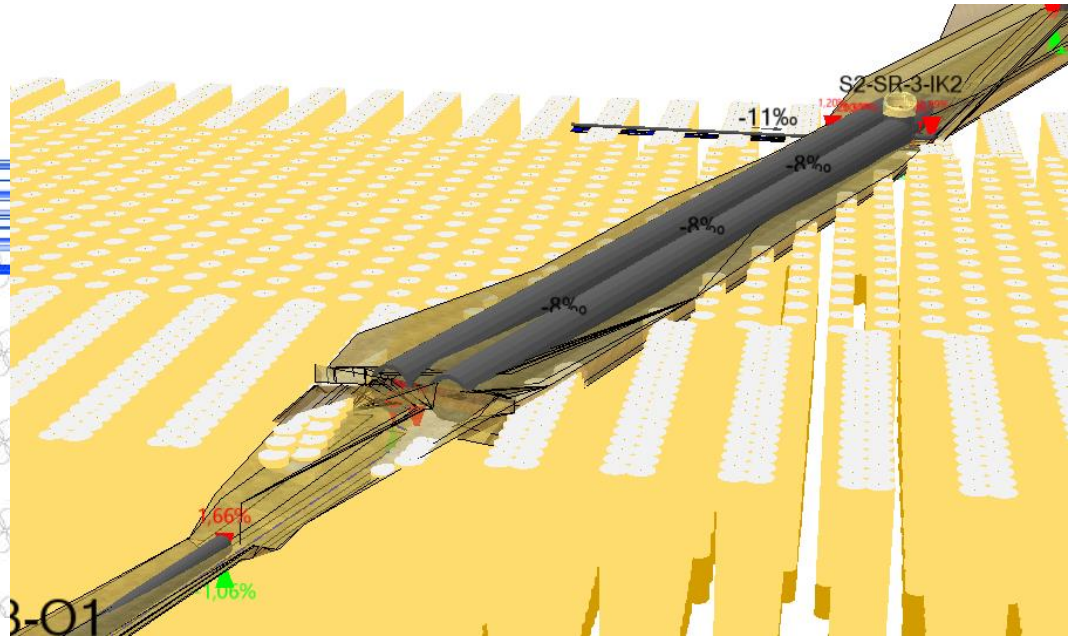
Between KM1925 and 2450 a piled embankment



3 pipe crossings in piled embankment







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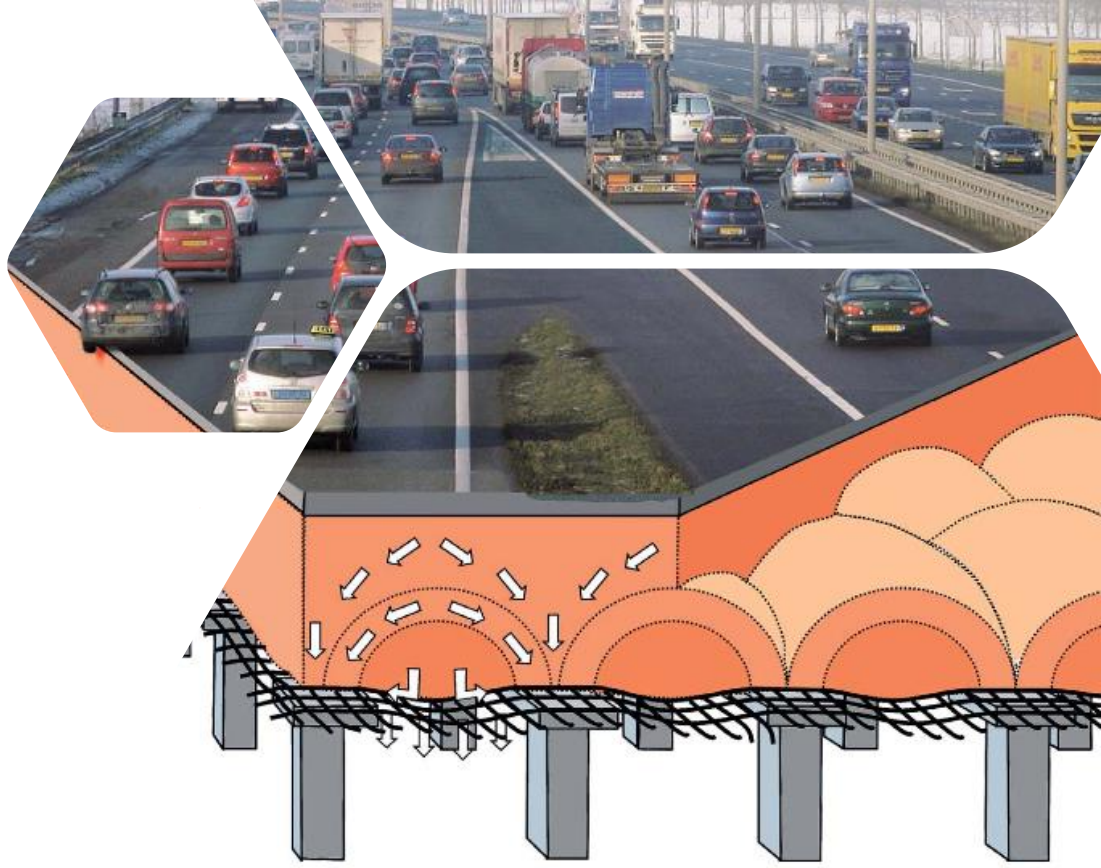
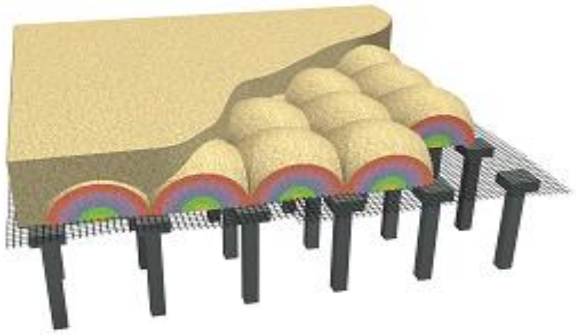
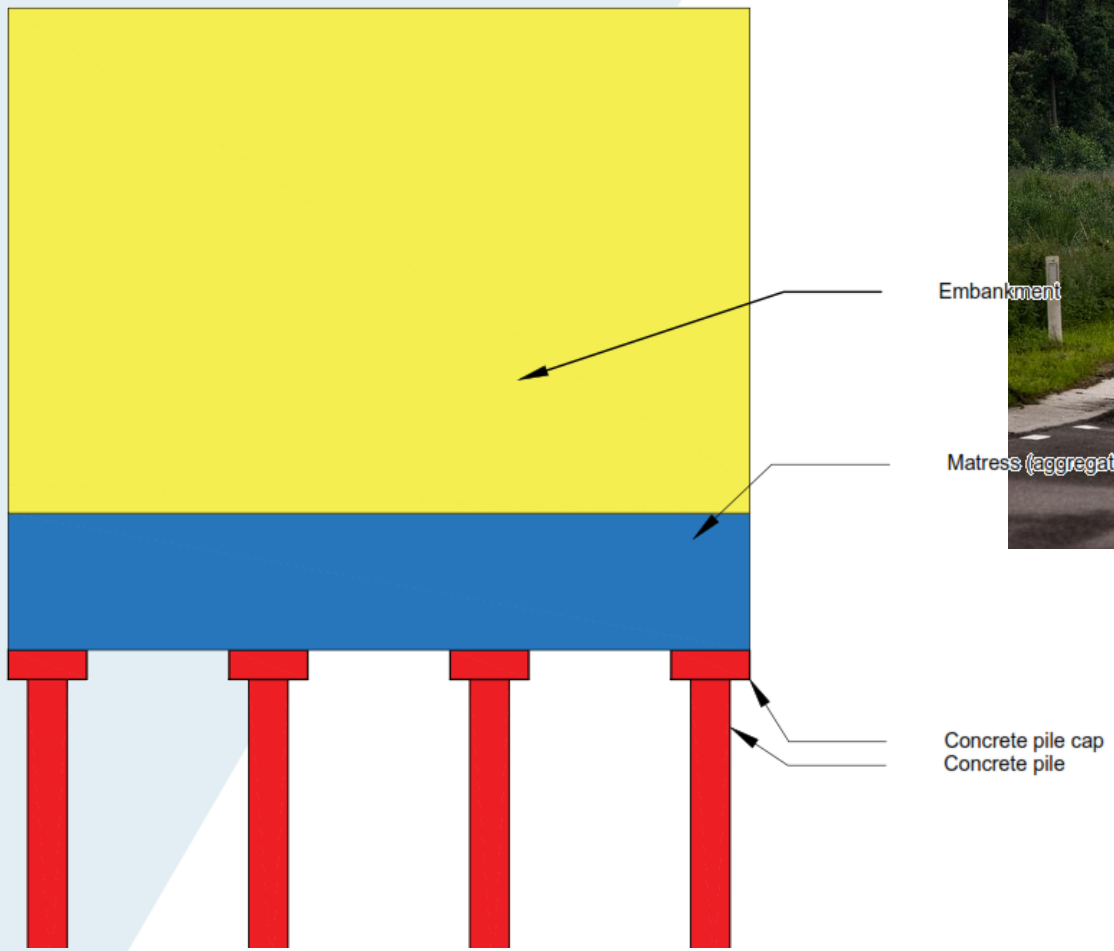




What is an LTP?

- Roads with very soft subgrades
- Load Transfer Platform



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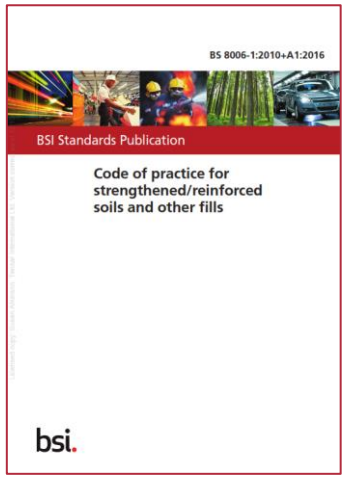
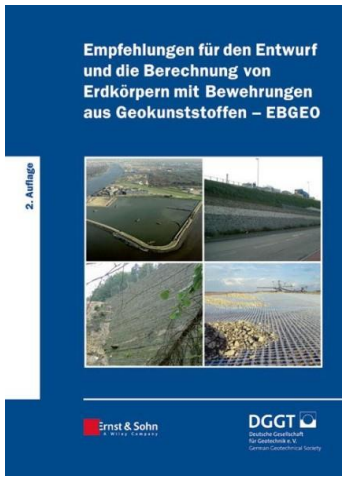
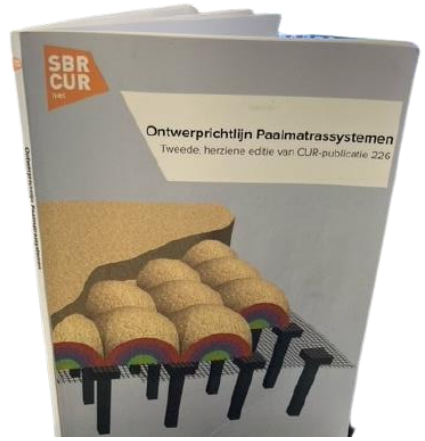
Design Guidelines

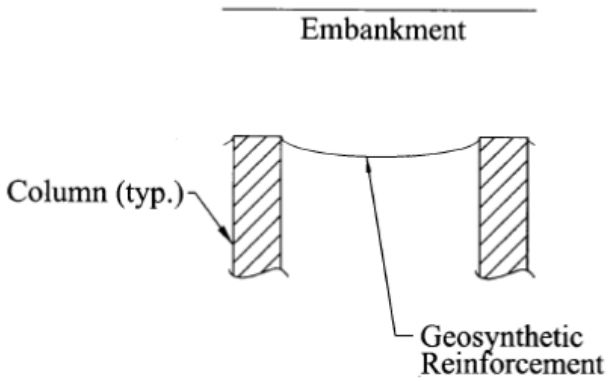
- BS8006 | EBGEO
- CUR226



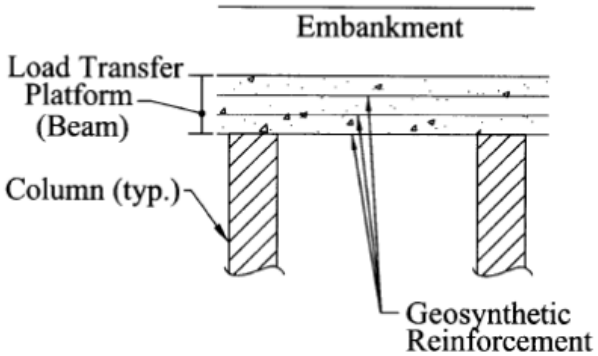




- Hammock theory
- Beam theory



a) Catenary Theory



b) Beam Theory

Bush Jenner | "Enhanced arch method" | Collin method | Guido method

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What is an LTP?

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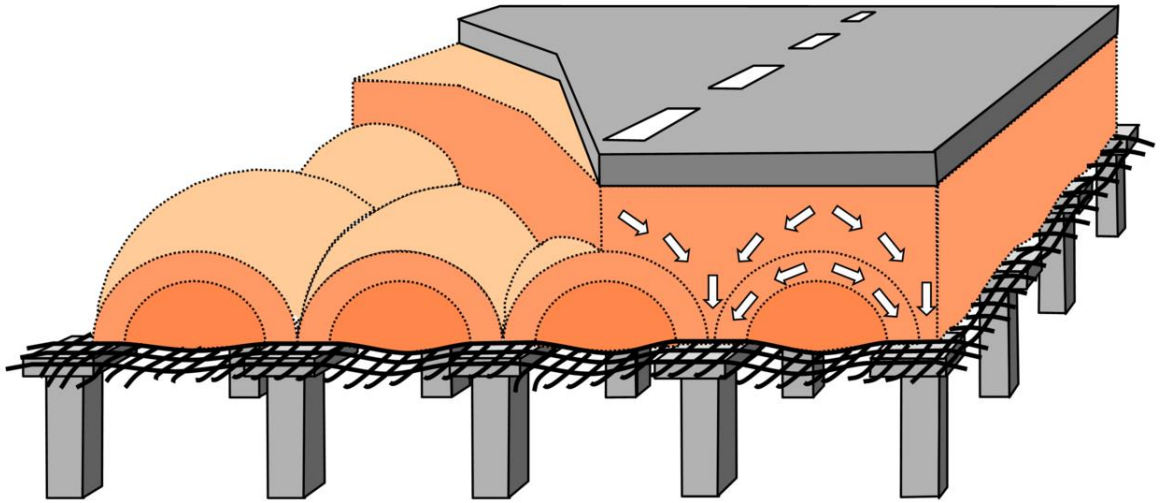
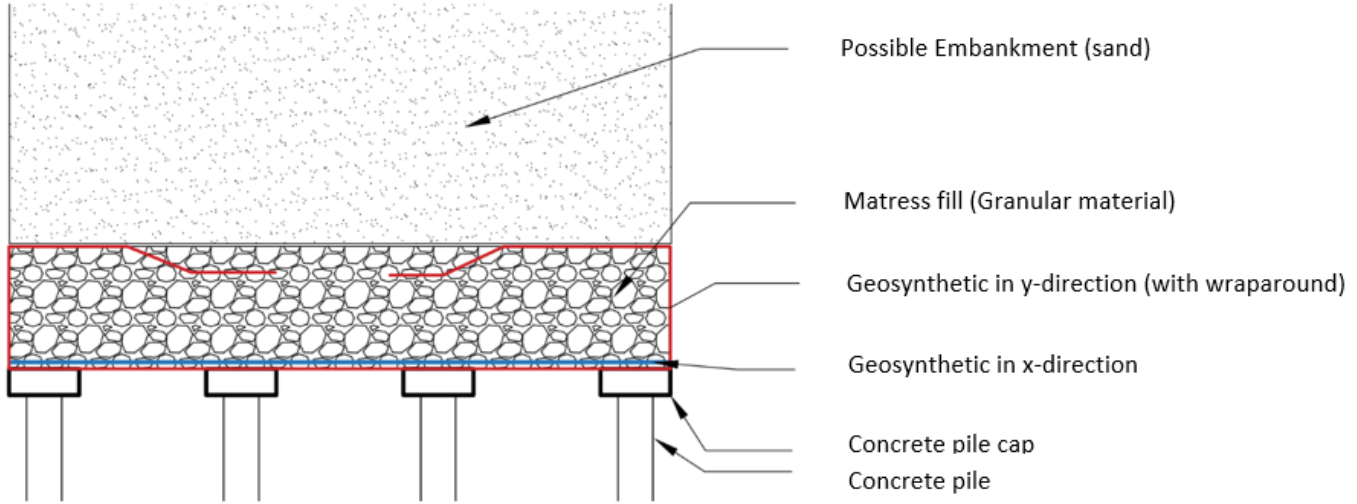
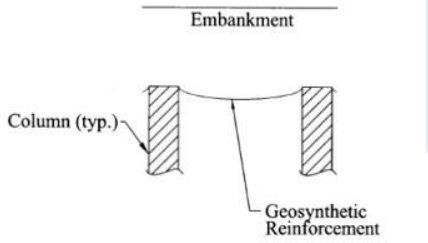
Design Guidelines

BS8006 / EBGEO / CUR226

- Arching
- Hight-strength geotextiles
- Wraparound







a) Catenary Theory

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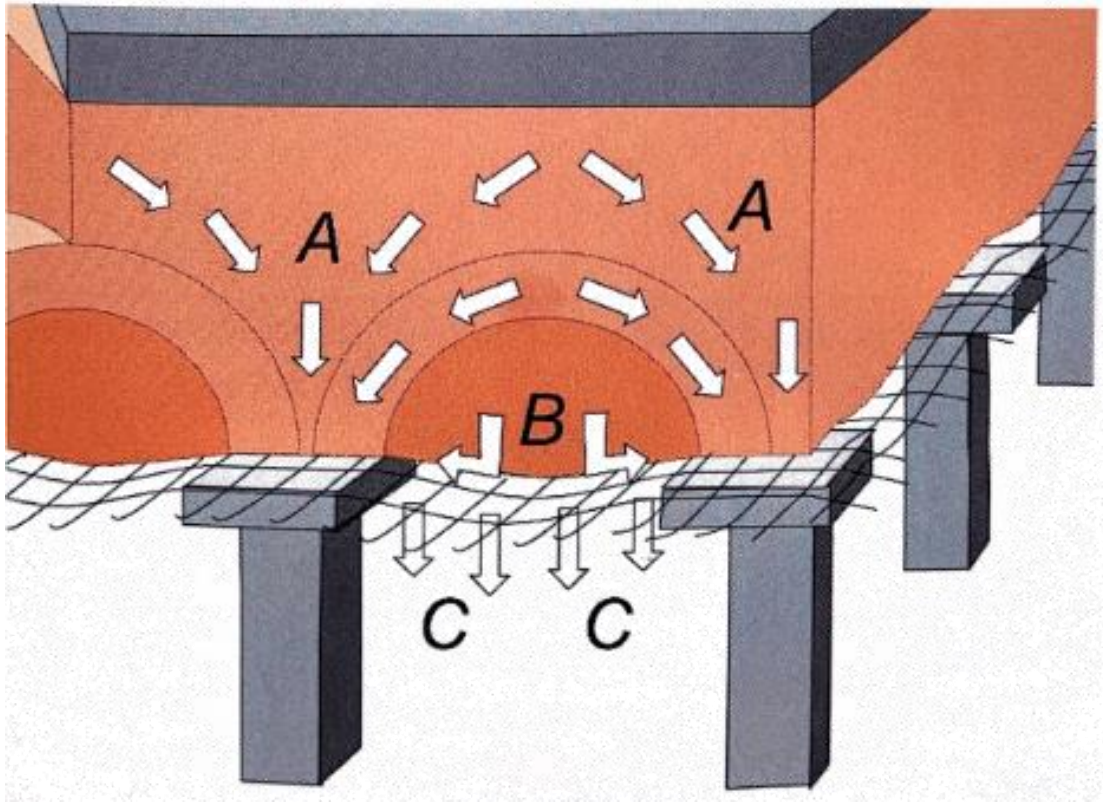
General Principle CUR226

- Vertical load
- Concentric Arch
- Loadpart A (kN/paal)
- Loadpart B (kN/paal)
- Loadpart C (kN/paal)



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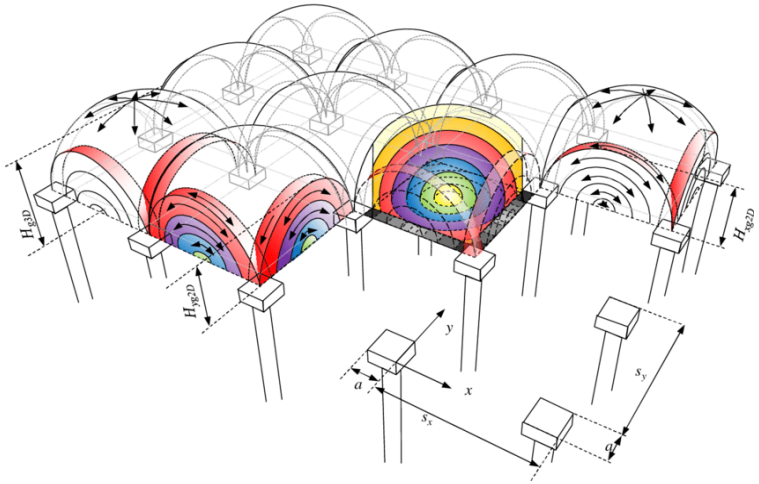
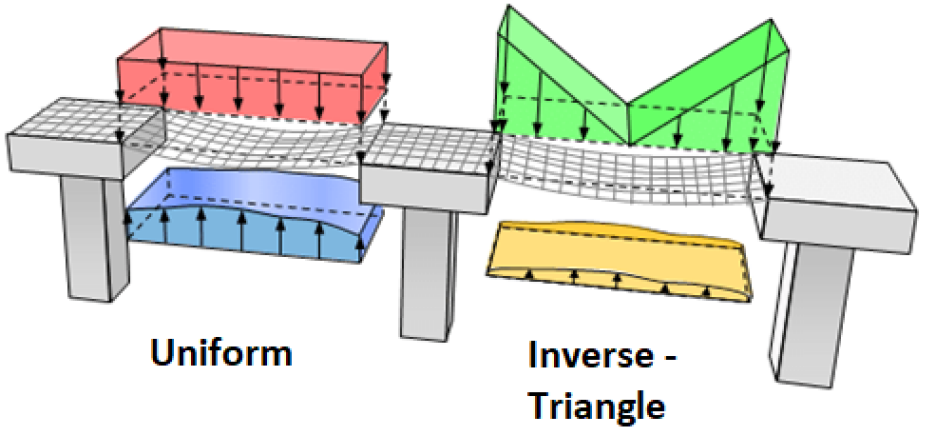
CUR226



- Calculating step 1 – Concentric Arch Method
  - A kN/pile, vertical load in pilecaps.
  - B+C in kN/pile, vertical load at geosynthetic and subsoil

- Calculating step 2 - Strain and Tensile strength



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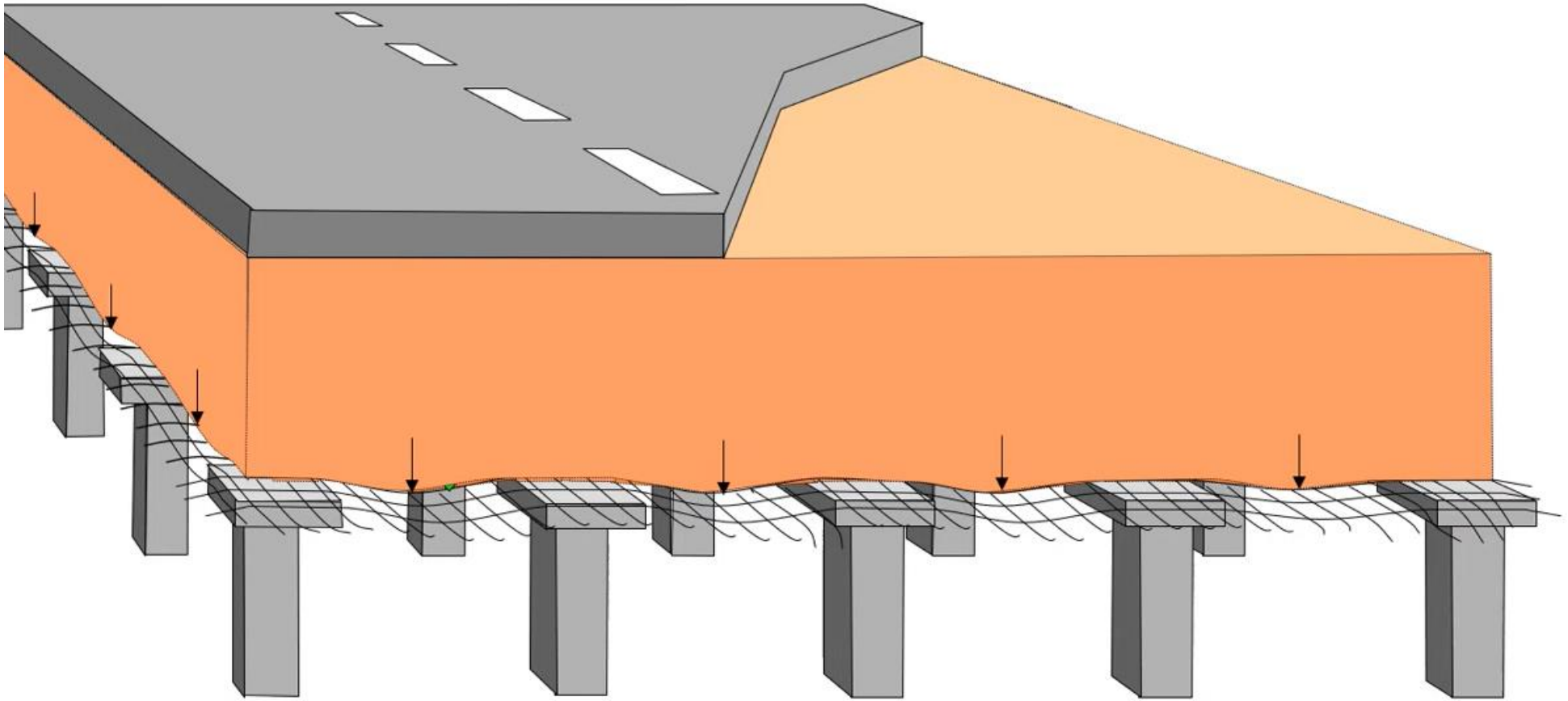
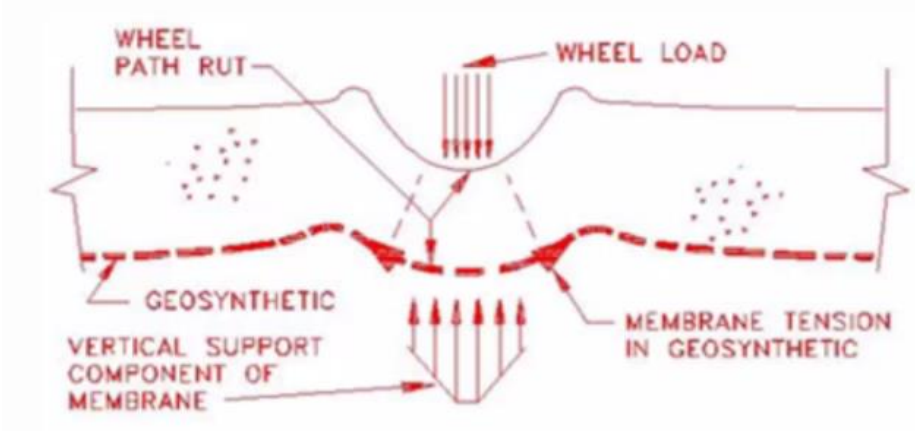
Displacements

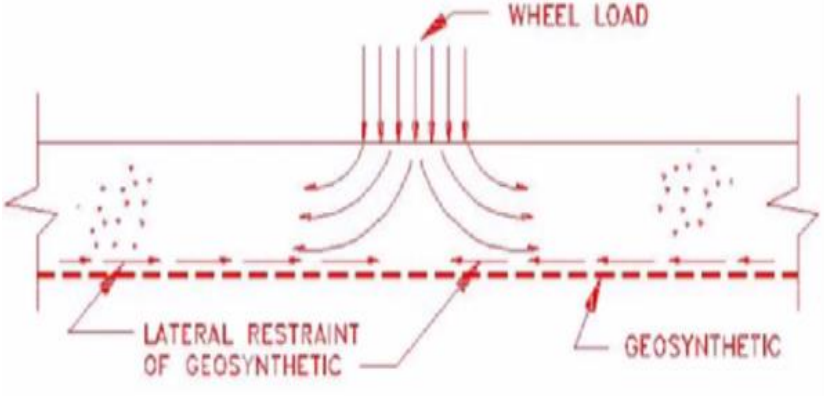


Material properties geotextiles

Two Mechanisms:

Membrane effect





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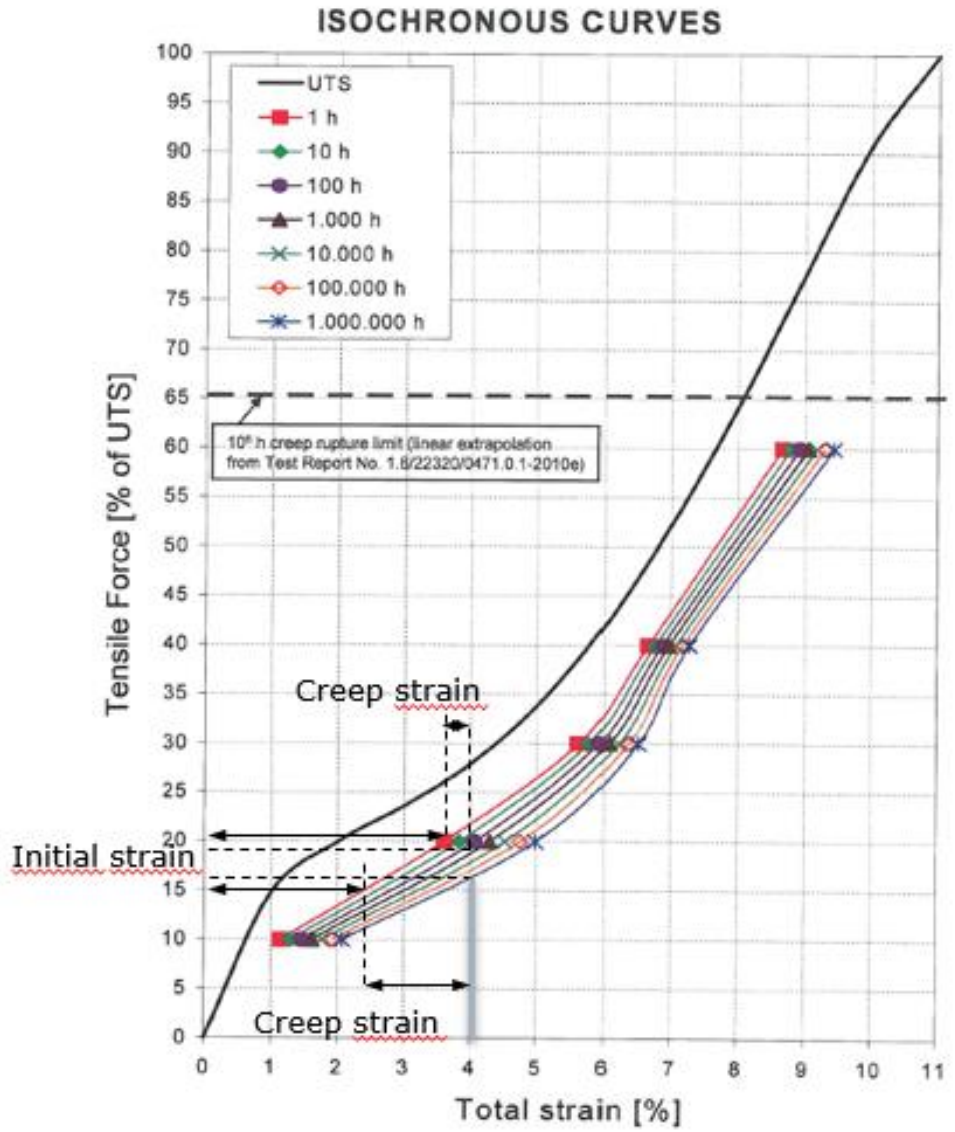
Material properties geotextiles

- Strain = 3 á 4 %
- Creep = 2 á 3 %



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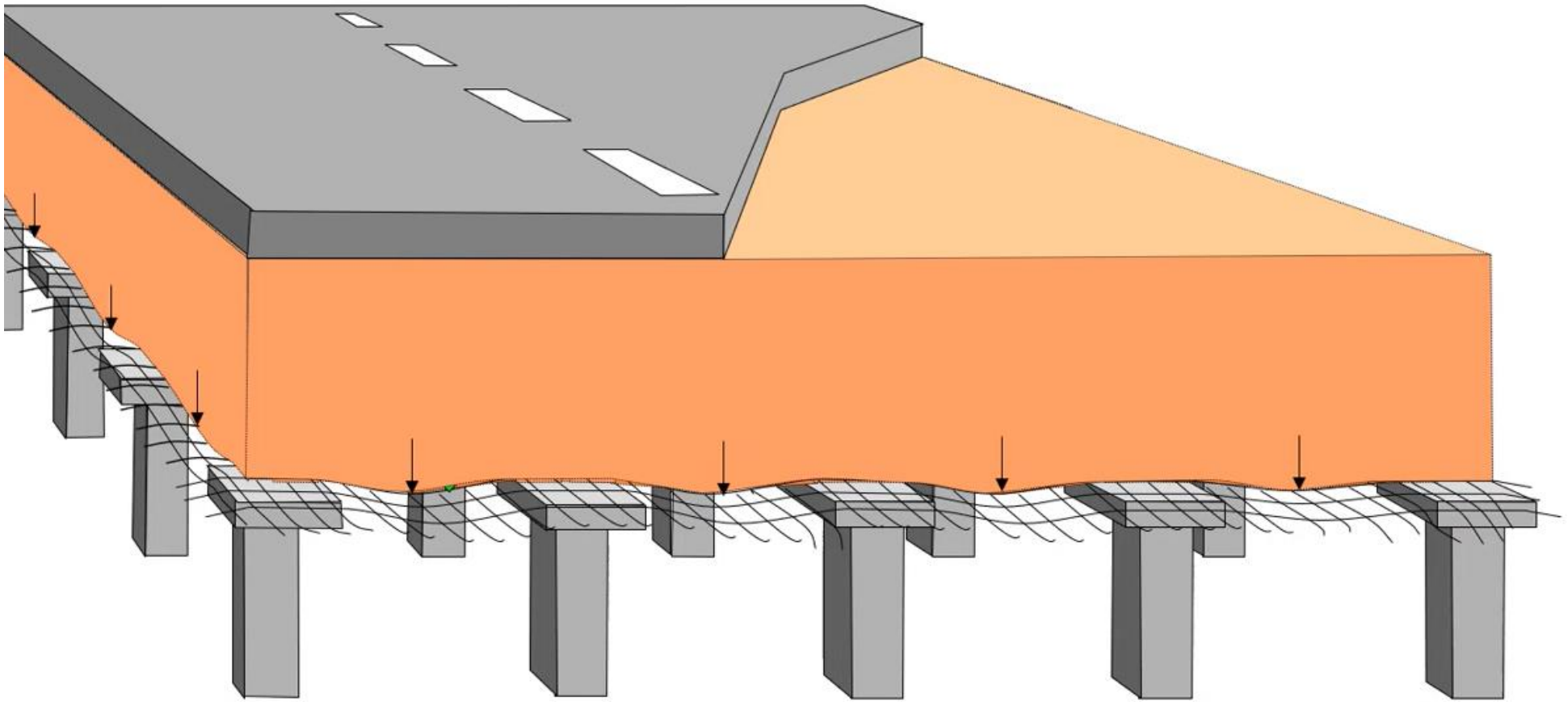
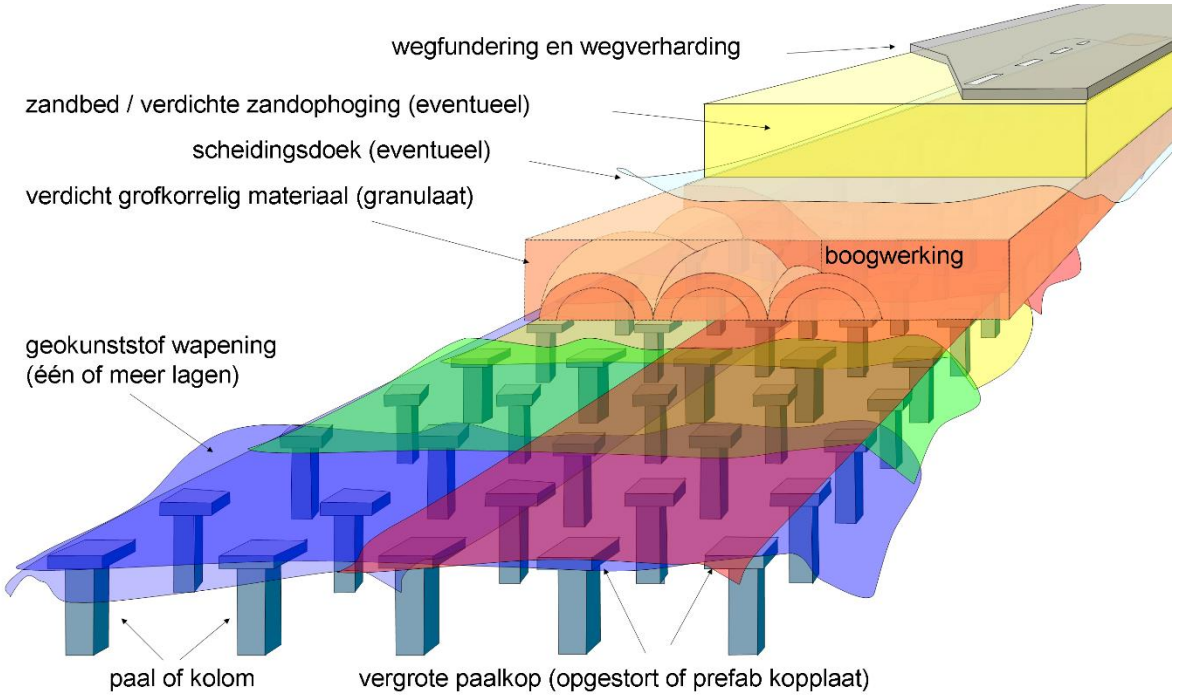
Materialproperties geotextiles



Main question

"To what extent does the application of an alternative geogrid performs compared to the traditional grids in a load transfer platform?"



Tensar TriAx® (TX) Geogrids

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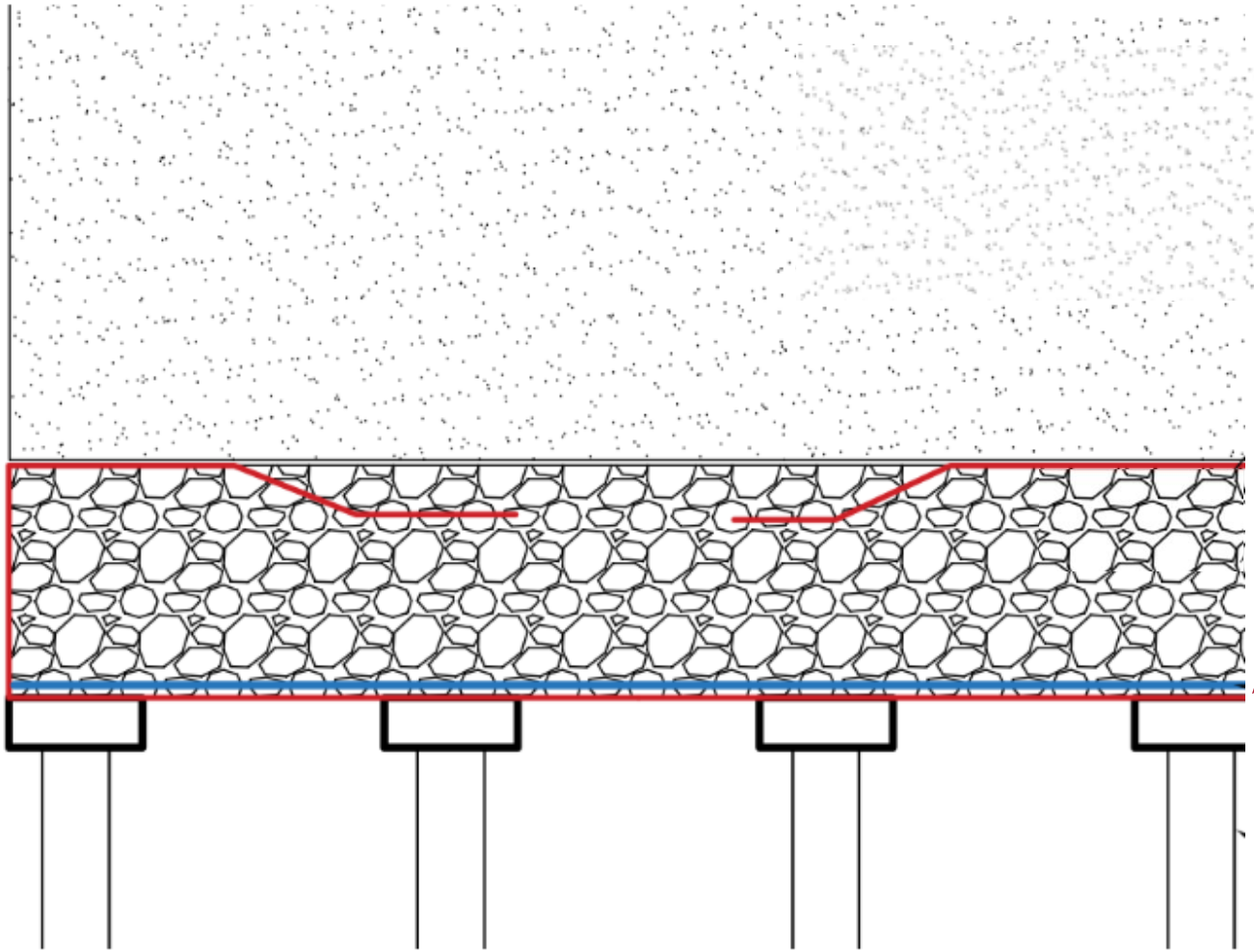
Replace main reinforcement?



Polypropylene

High creep factor

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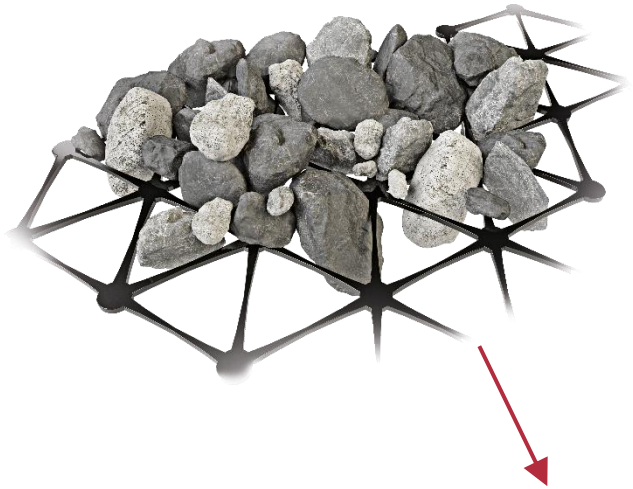
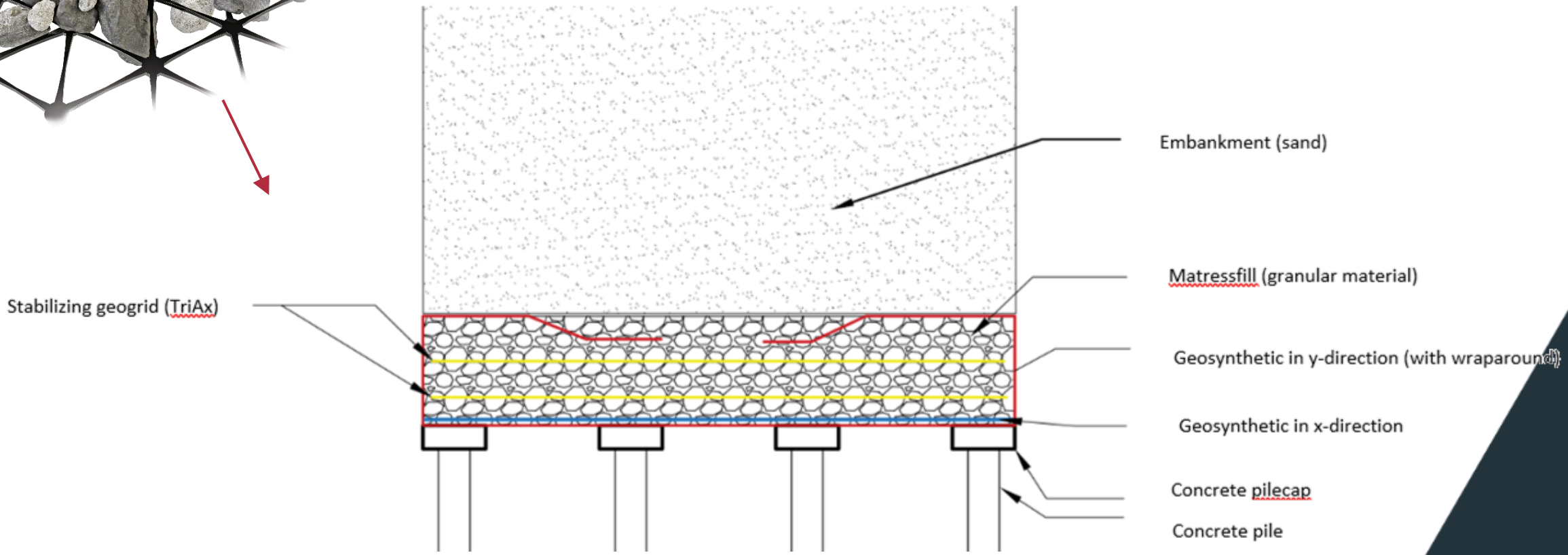
Innovation ‘Auxiliary grid’





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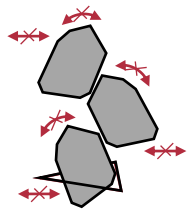
Innovation ‘Auxiliary grid’

Mechanical confinement → Cohesion → Equivalent internal friction angle → Better arching



- More vertical load directly to piles
- Less vertical load to geosynthetic
- Less tensile strength needed in main reinforcement

$$\varphi_{virtual;c=0} = \tan^{-1}\left(\frac{\sigma_v \tan\varphi + c}{\sigma_v}\right)$$

(Van Eekelen, S. J. M. (2015). *Basal Reinforced Piled Embankments* (Thesis ed., Vol. 2015). TU Delft.)

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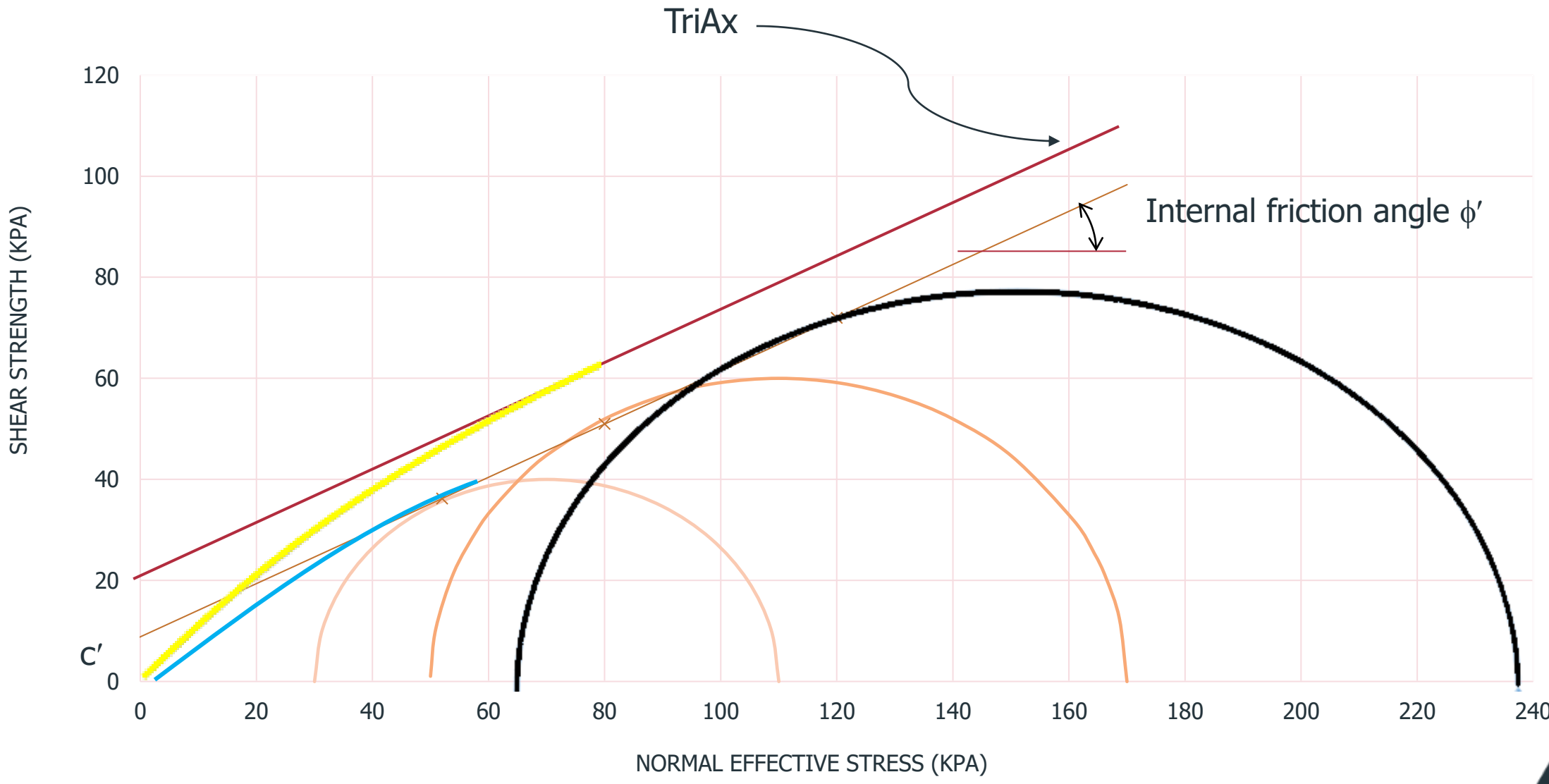
Application Innovation



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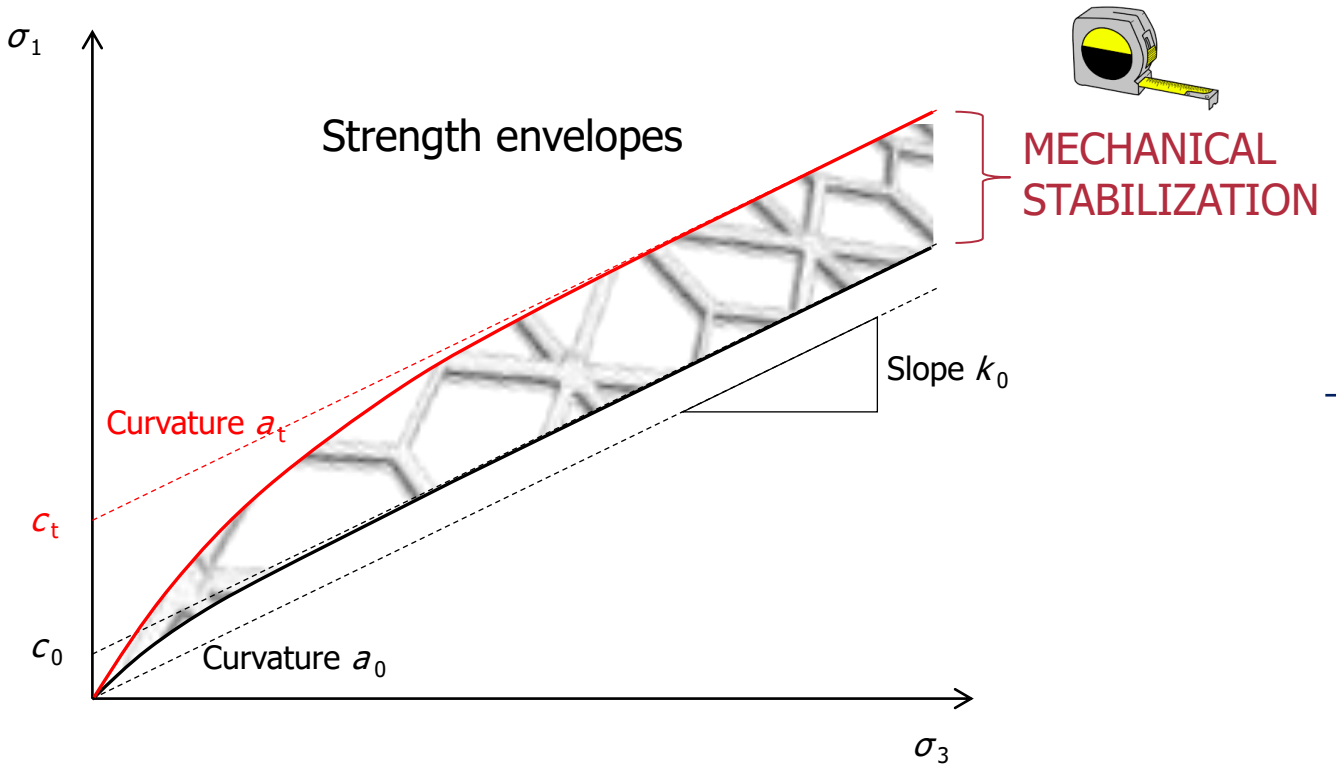
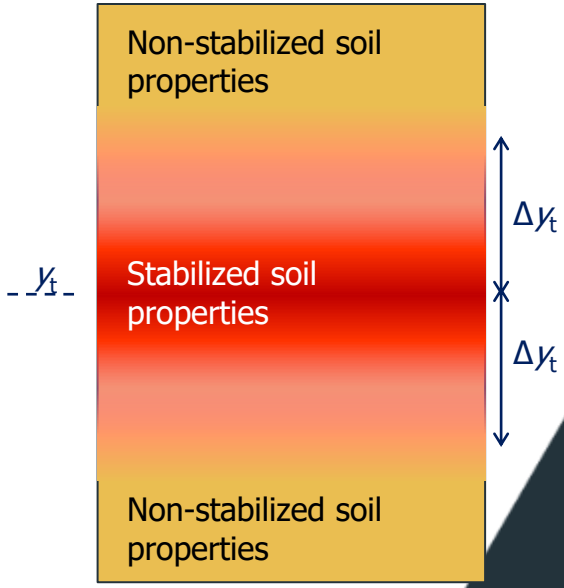
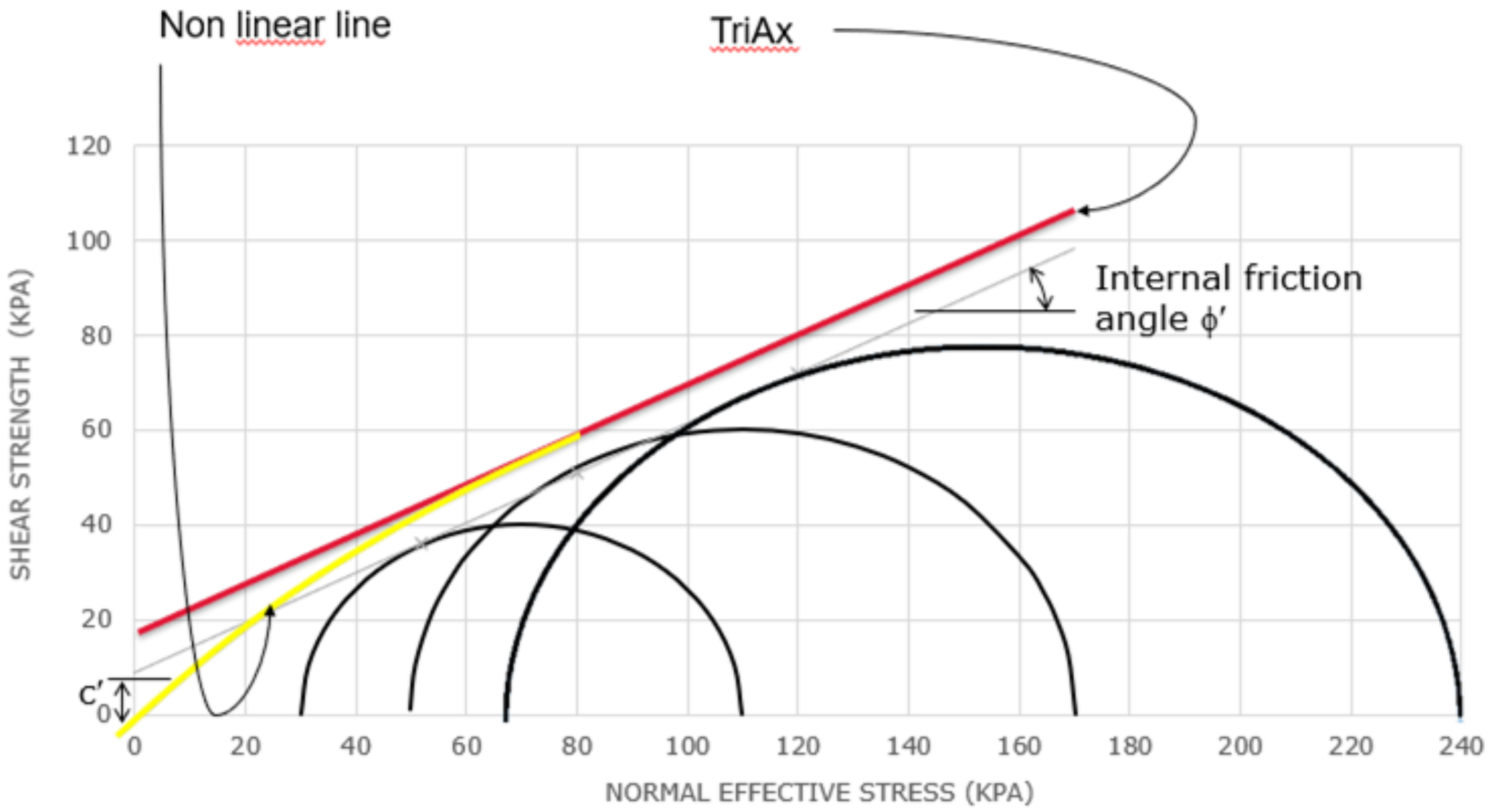
Application Innovation

Tensar Stabilized Soil Model





Application Innovation



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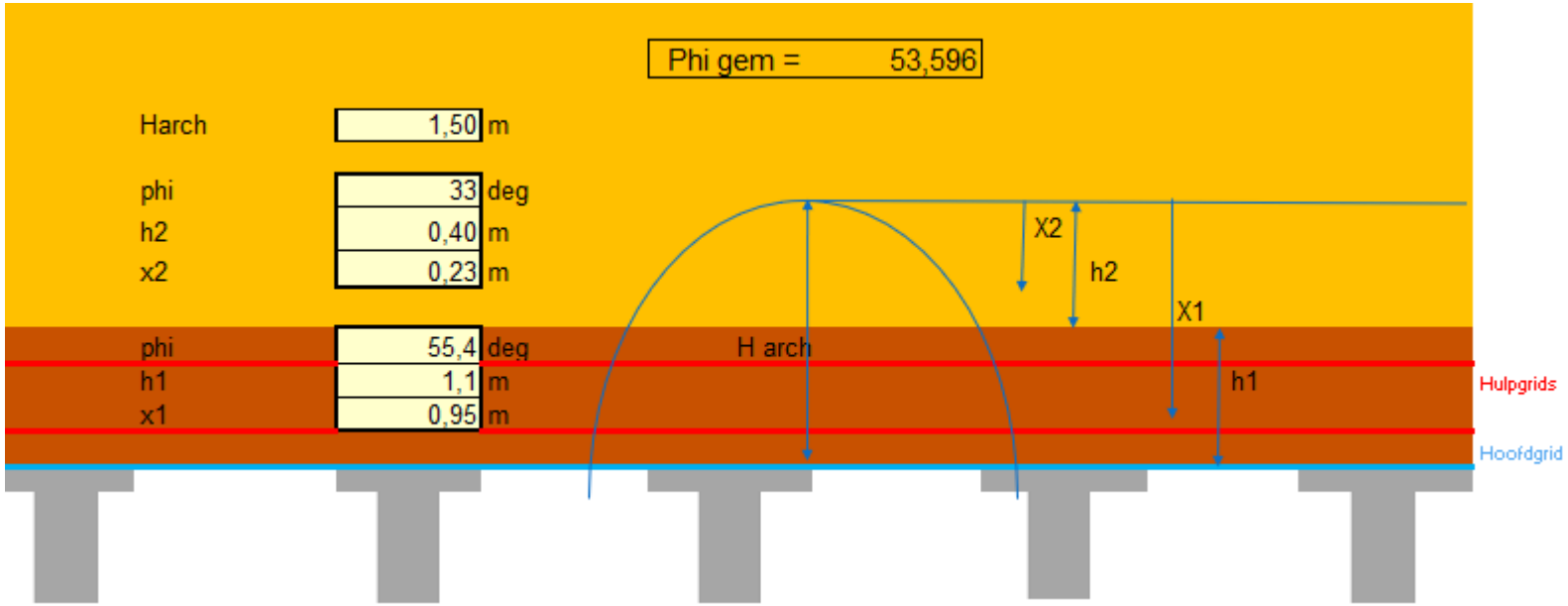
Application Innovation



e.g.

Phi embankment = 33°

Phi matress (stabilized) = 55,4°

Phi average = ***53,6°***

$$tan\varphi'_{average;d} = \frac{\sum_{j=1}^{j=n} h_j \cdot tan\varphi'_{j;d} \cdot X_j}{\sum_{j=1}^{j=n} h_j \cdot X_j}$$

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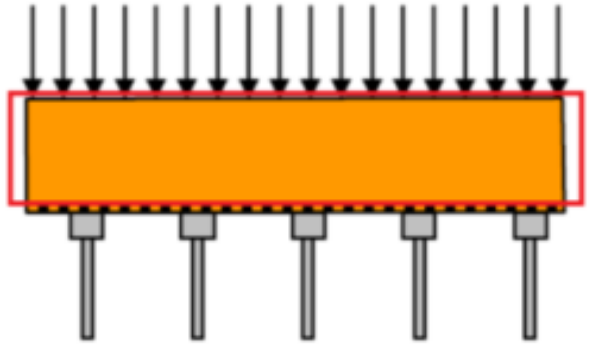
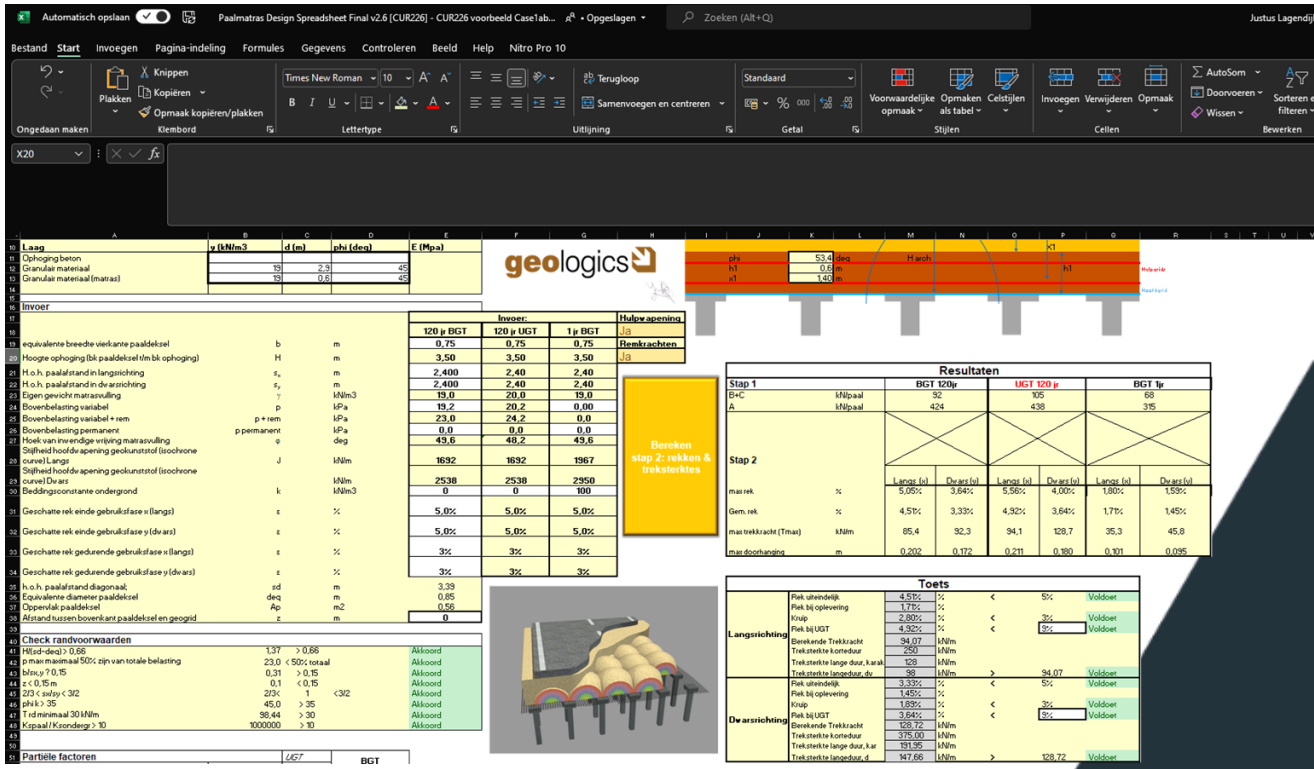
Design spreadsheet



- Only mattress design
- Validated
- 4 cases
  - Arcadis
  - Geotec Solutions
  - Crux
  - Voorbeeld CUR226



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Execution RV4 Roa – Gran project

Execution RV4 Roa – Gran project

Execution RV4 Roa – Gran project

Execution RV4 Roa – Gran project

Execution RV4 Roa – Gran project (time-laps)

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Execution RV4 Roa – Gran project (final result)

Thank you for attention.
Questions?