CHARTING THE PATH
TOWARD THE FUTURE
Geotechnical Engineering Education

INTERNATIONAL CONFERENCE

What role should software play in geotechnical education?

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SOLETANCHE BACHY

SIMSG ISSMGE

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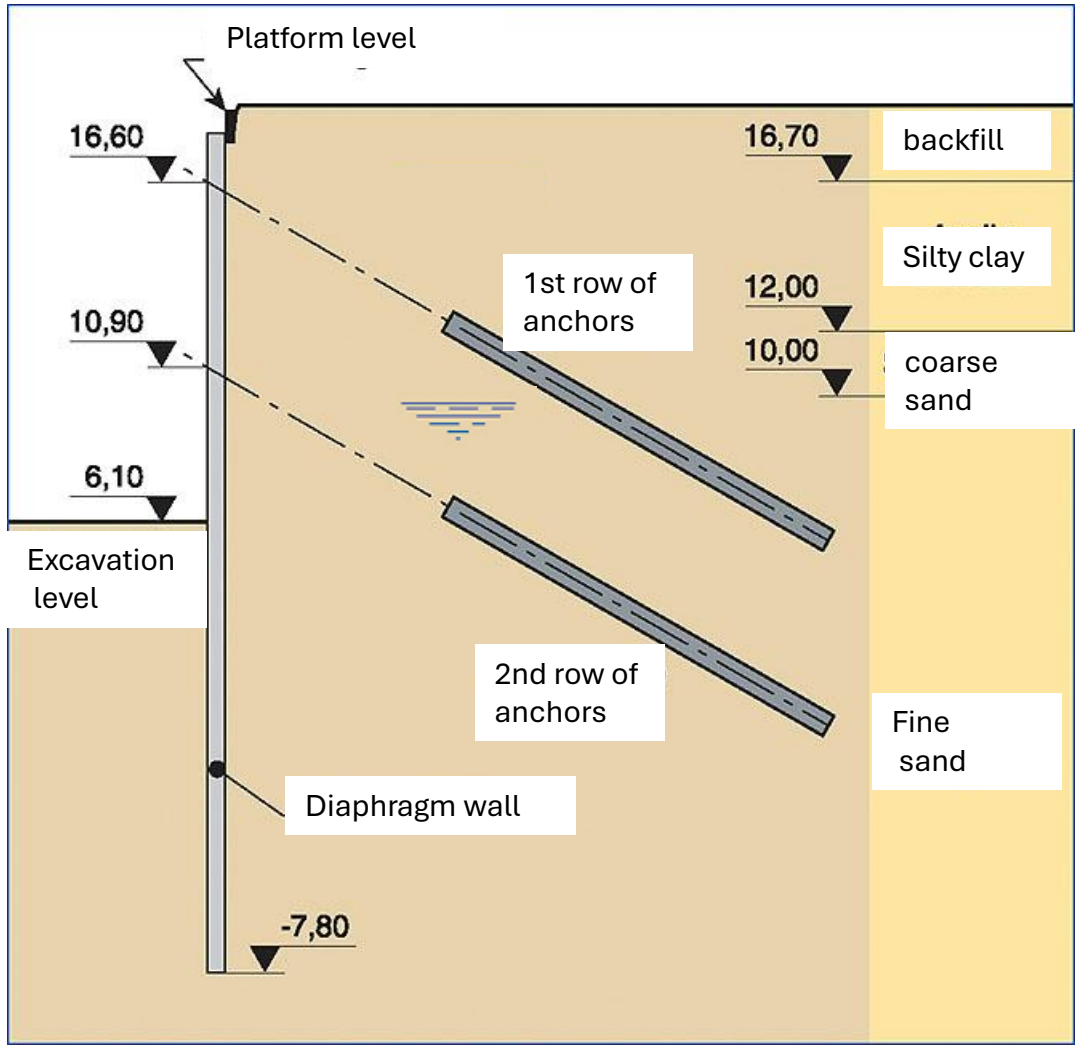
ÉCOLE NATIONALE SUPÉRIEURE GÉOLOGIE NANCY

cfms
COMITÉ FRANÇAIS DE MÉCANIQUE DES SOLS ET DE GÉOTECHNIQUE

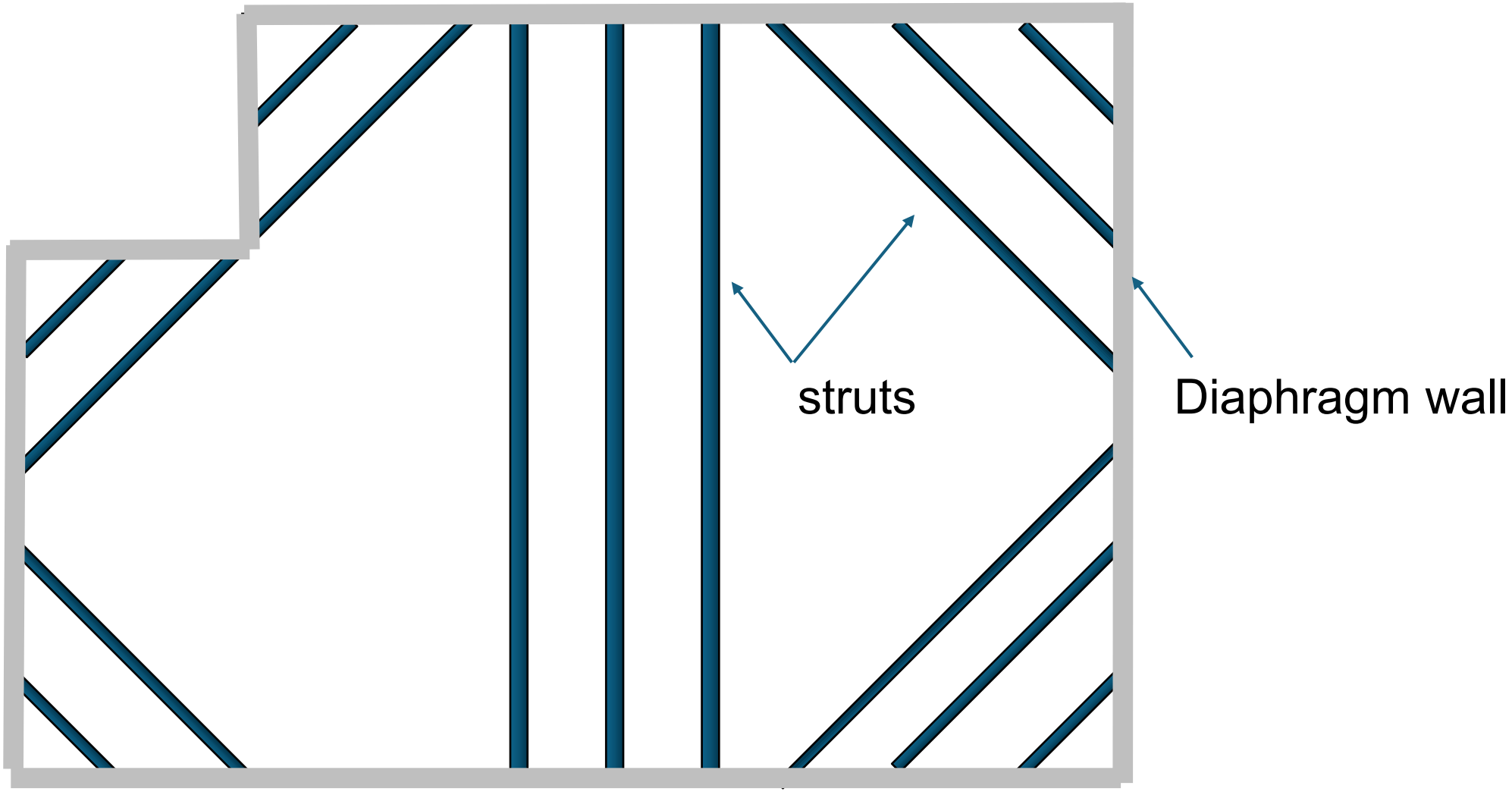
1st example – boundary conditions



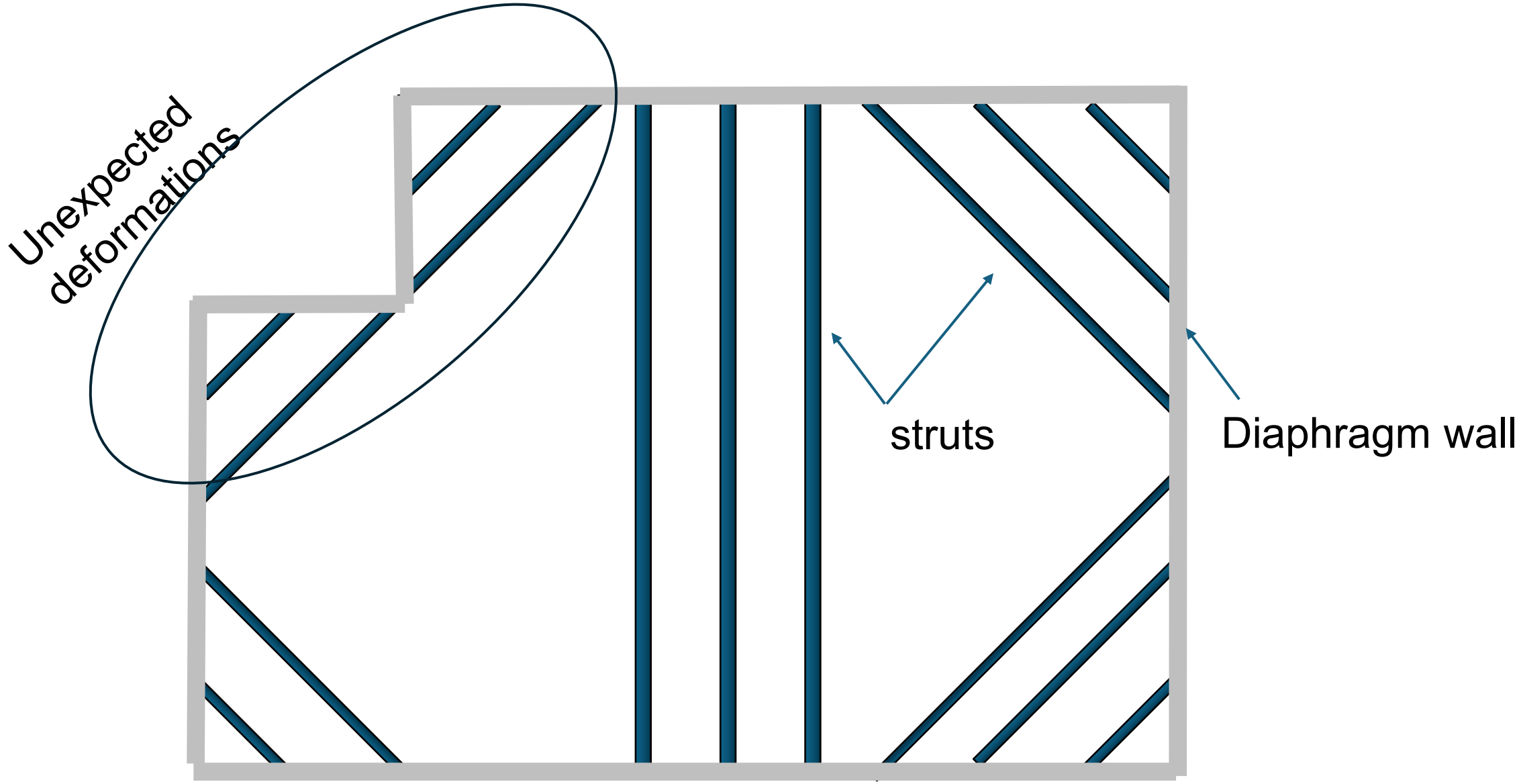
1st example – boundary conditions

The NILE

2nd example – 2nd law of Newton



2nd example – 2nd law of Newton



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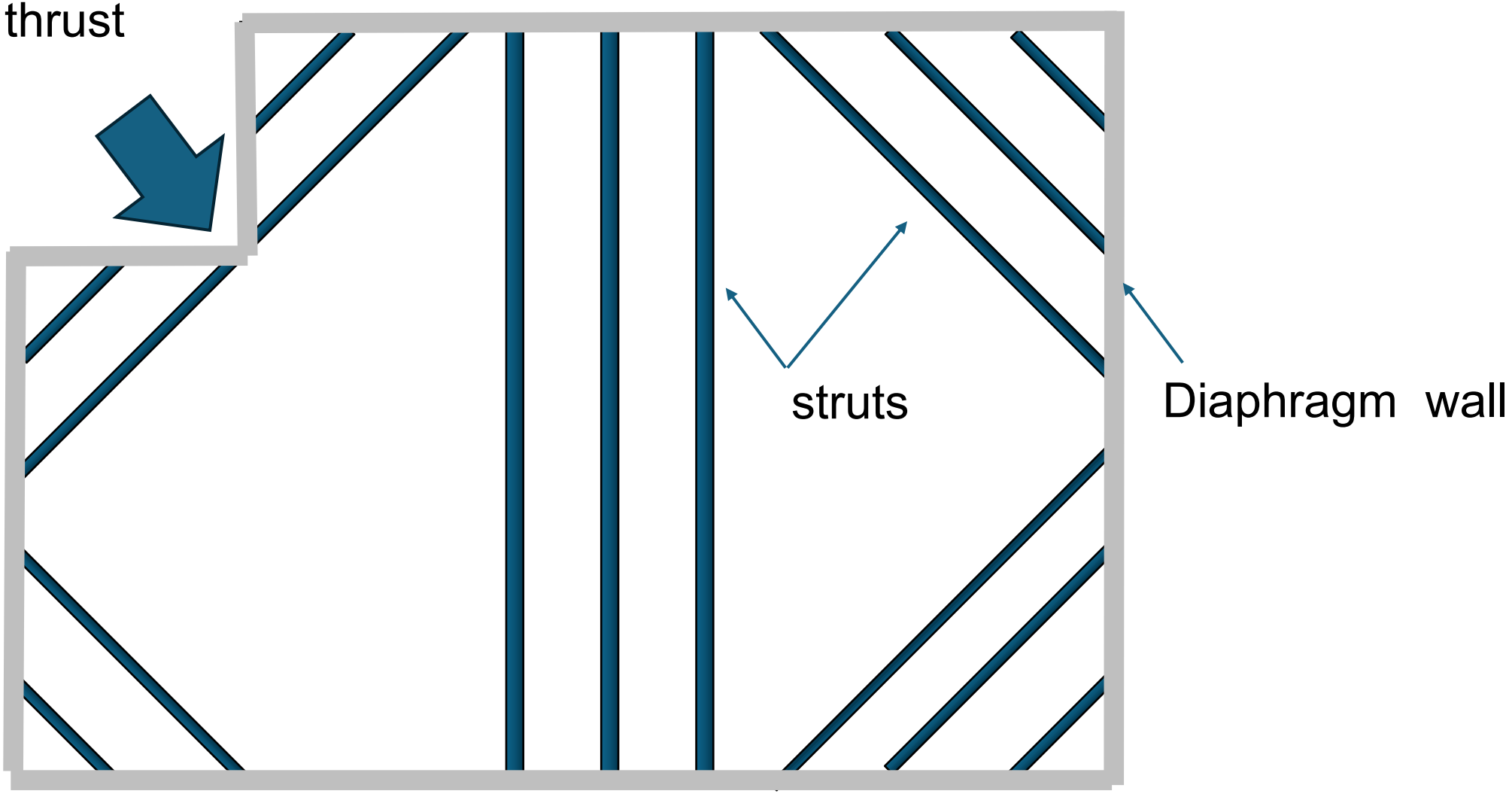

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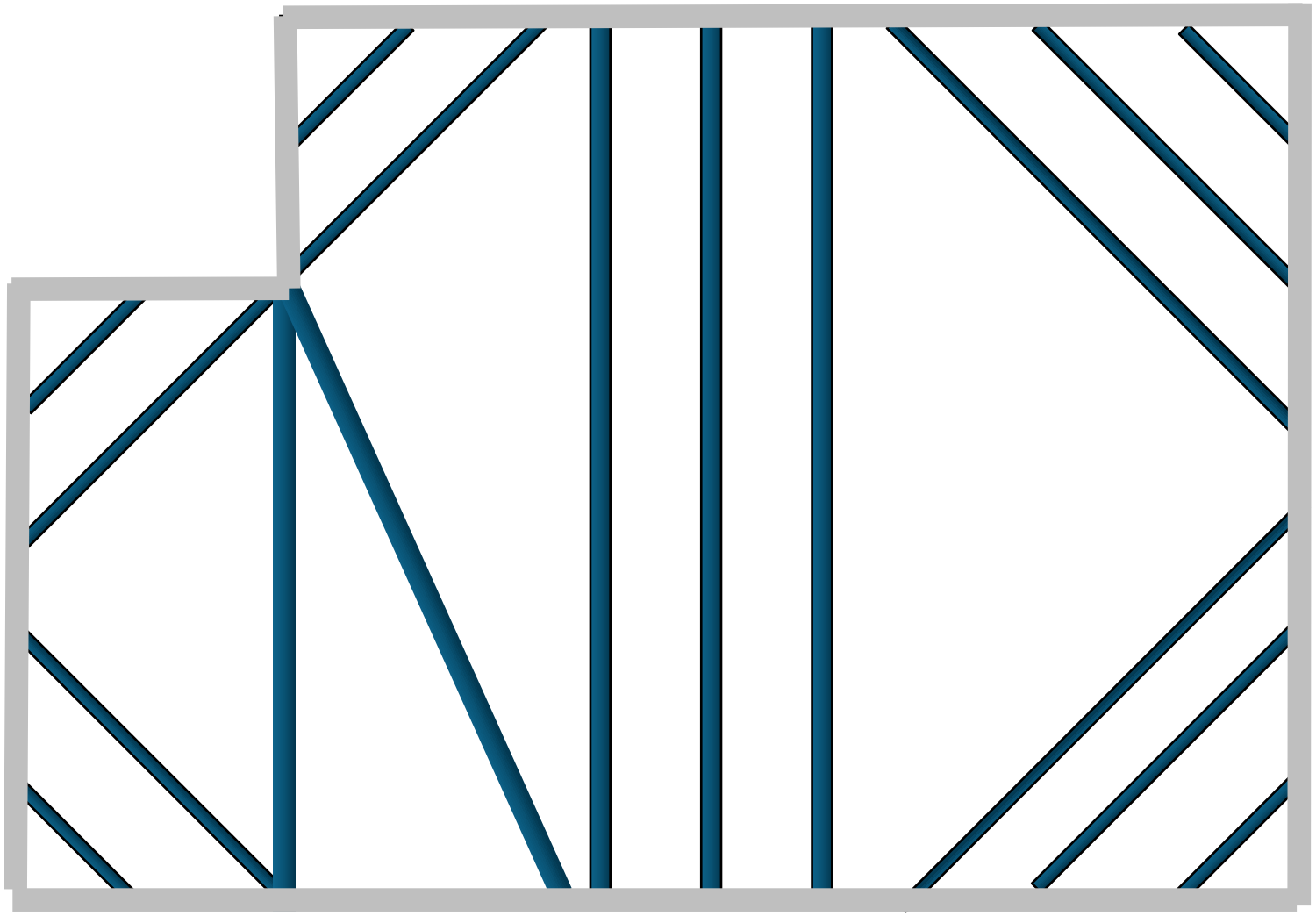
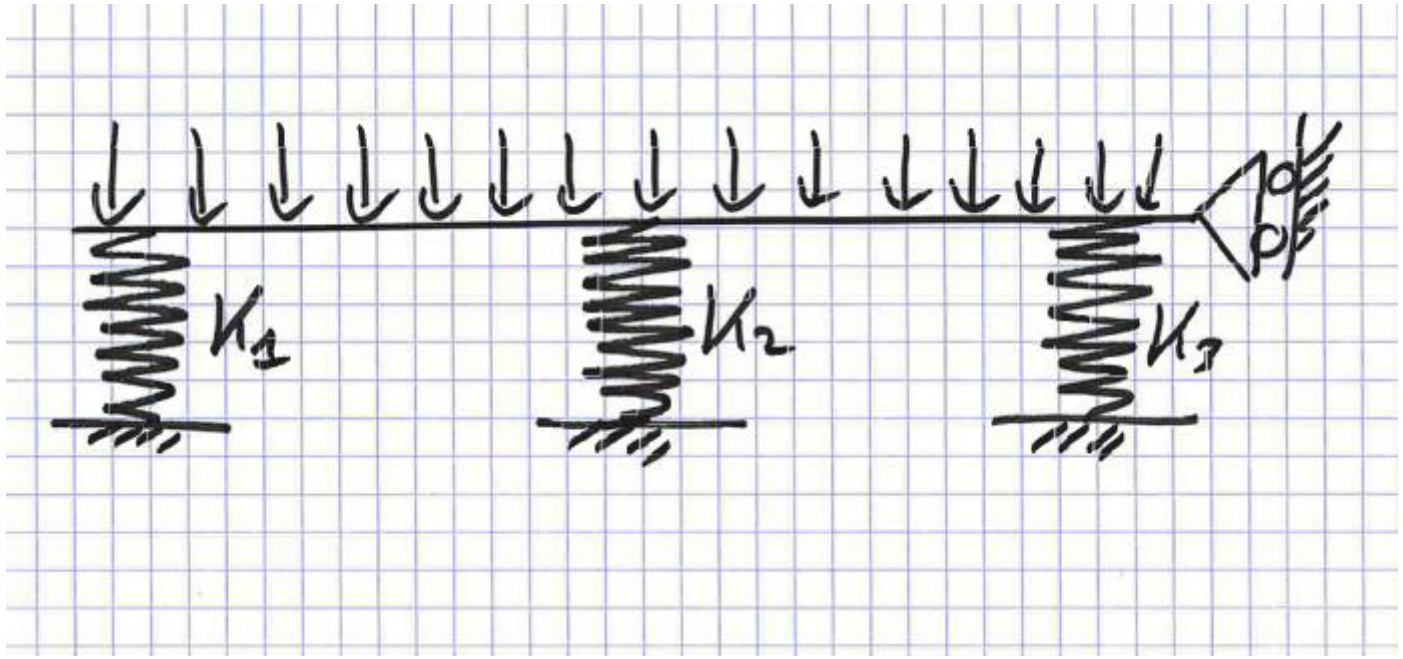
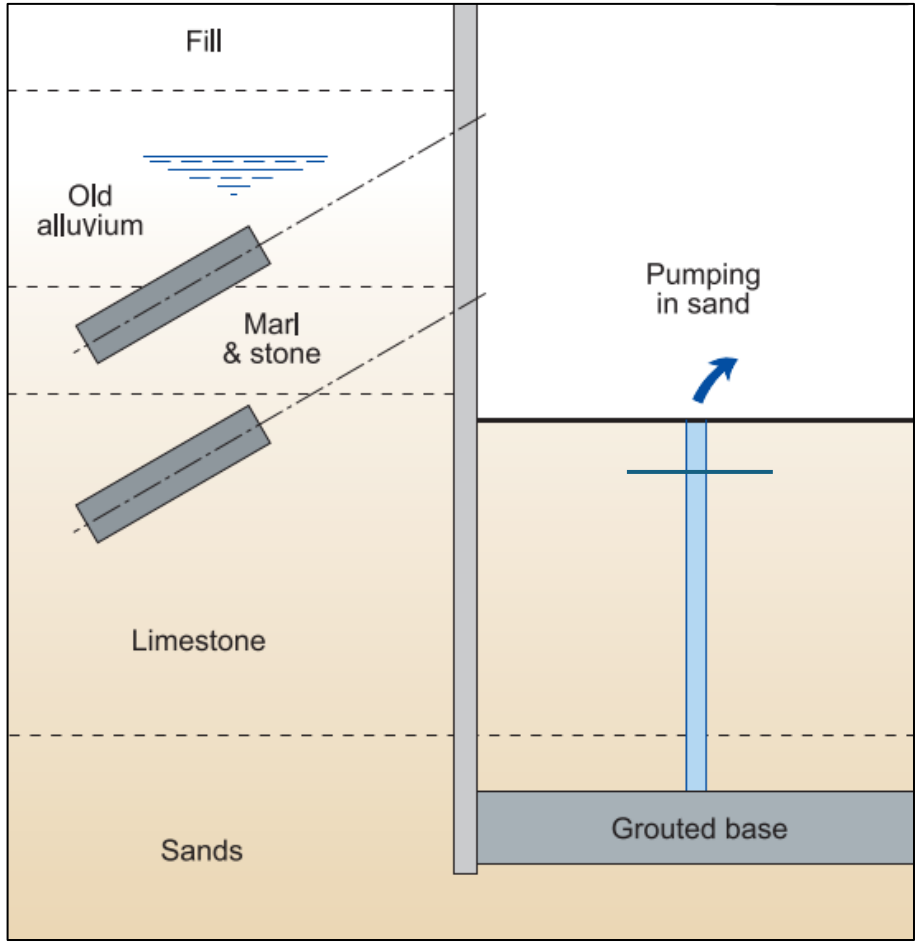


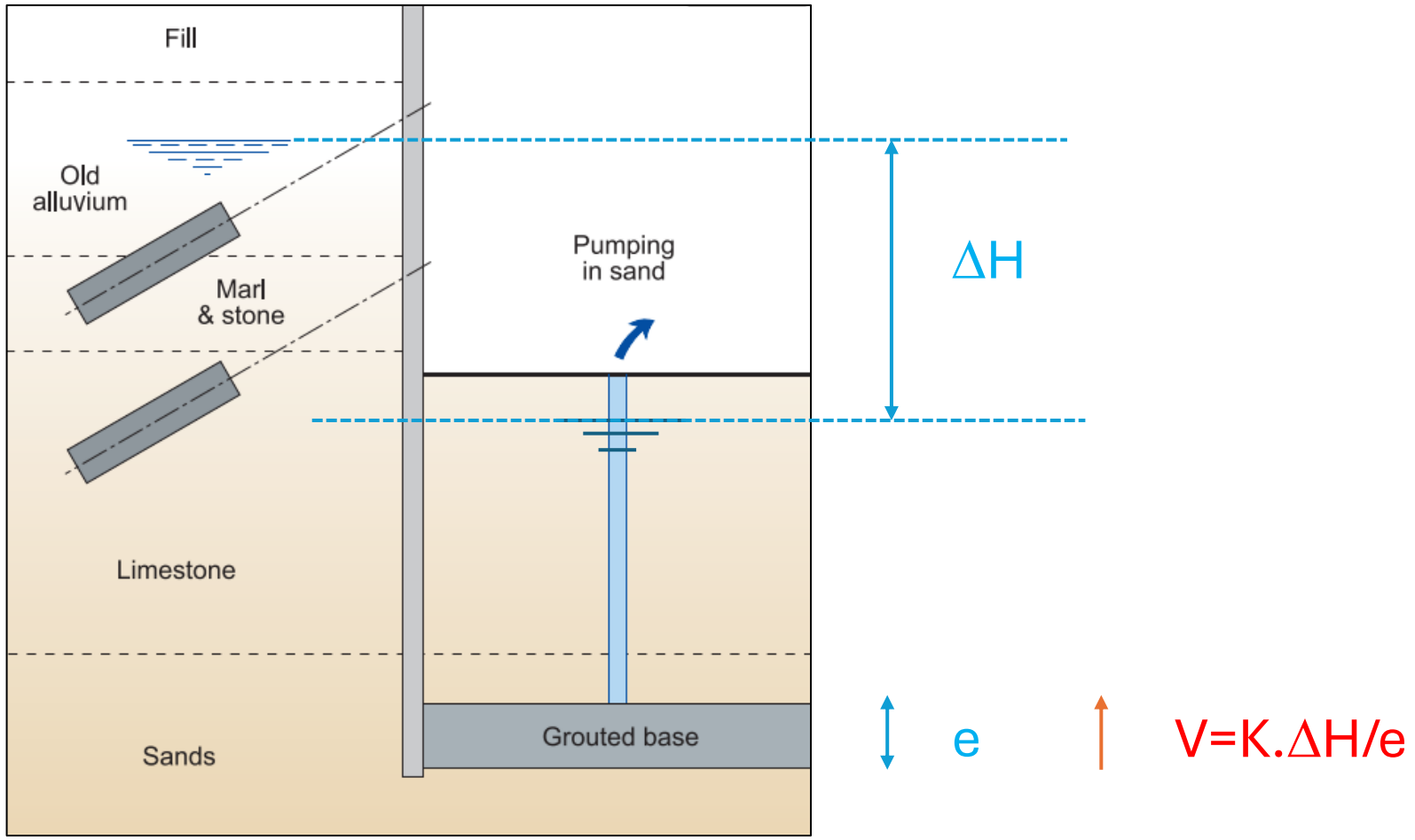
3rd example – The “supreme judge”?



4th example - Useless modelling



4th example - Useless modelling



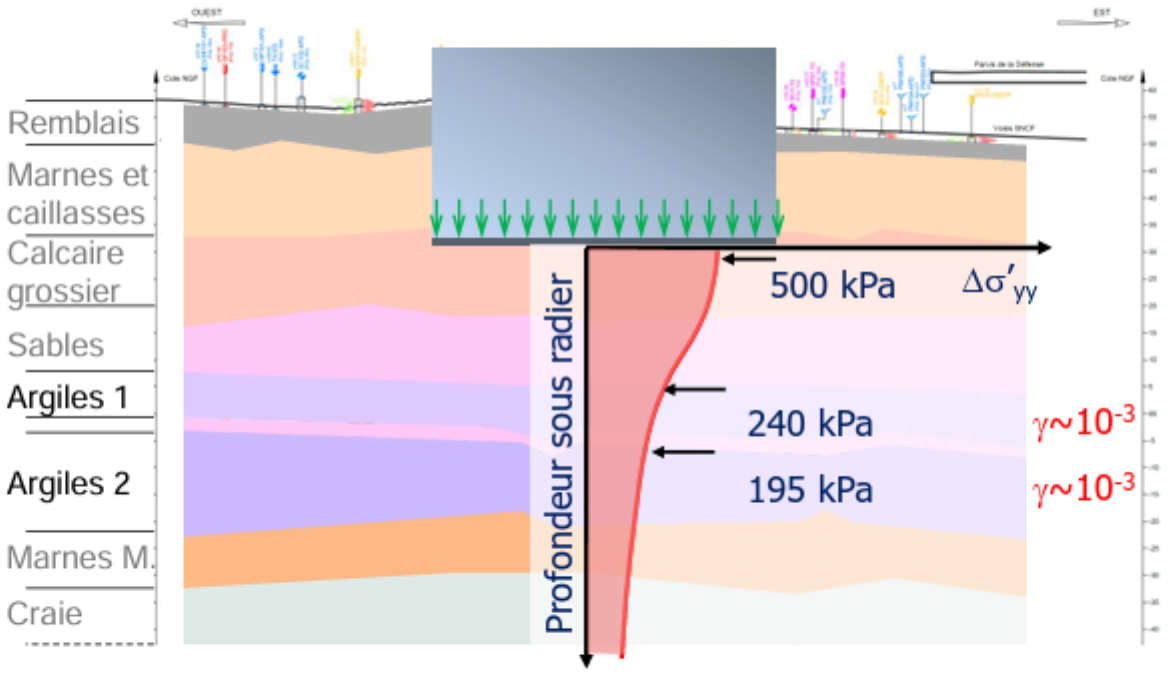
5th example - Is BOUSSINESQ old fashioned?

Joseph valentin BOUSSINESQ
1842-1929

5th example - Is BOUSSINESQ old fashioned?

Exemples d'application

- Fondations des tours à la Défense



Taux de travail des argiles en profondeur (de l'ordre de 1/10e de p_l^* = 2 à 3 MPa)

terrasol
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Optimisation des ouvrages géotechniques – Déformabilité du terrain

5th example - Is BOUSSINESQ old fashioned?

Exemples d'application

- Fondations des tours à la Défense
  - Tours de différentes hauteurs, en grande partie sur radier général
  - Tassements en profondeur : Argiles de l'Yprésien

Rapport E/E_M dans Argiles	Modèle numérique (éléments finis 3D)	Modèle analytique (Boussinesq)	Rapport des résultats
6,0	5,2 cm	5,5 cm	1,06
4,5	6,0 cm	6,5 cm	1,08
3,0	7,5 cm	8,5 cm	1,13
1,5	12,0 cm	14,2 cm	1,18

En affinant le choix du « modèle » : marge de 5 à 20%
En affinant le choix du « module » : rapport de 1 à 3 sur le résultat !

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The engineer’s approach

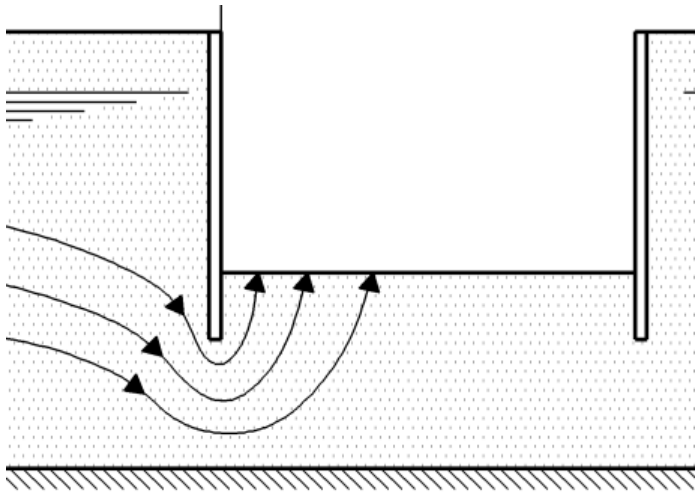
Making assumptions

Solid and comprehensive theoretical and technical base

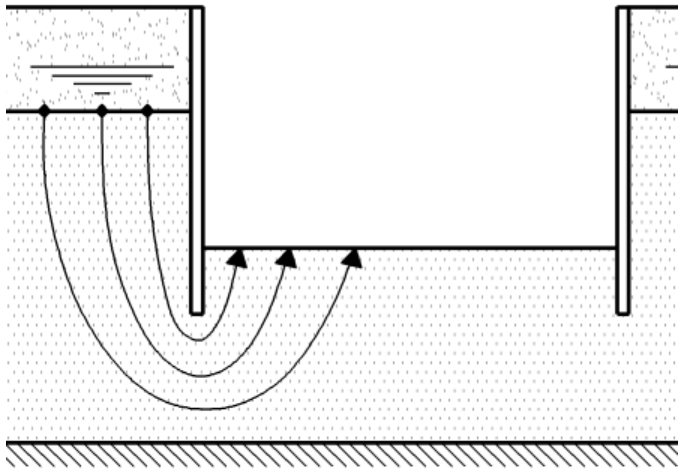
Reducing the problem to elementary case

Do not complicate what is simple, and simplify what is complicate

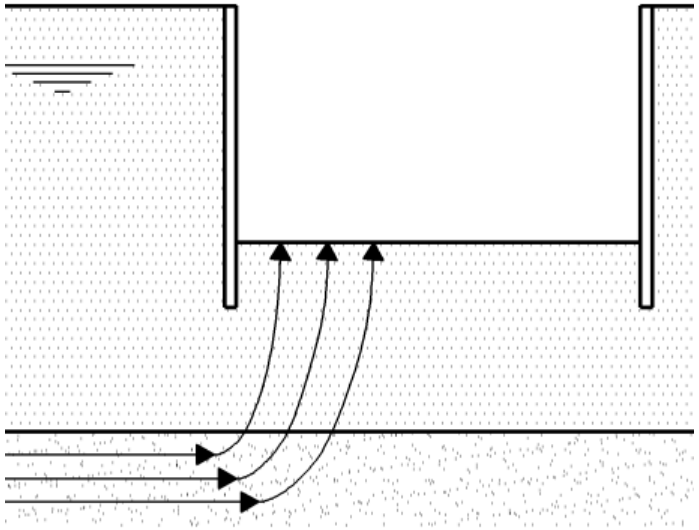
The engineer’s approach



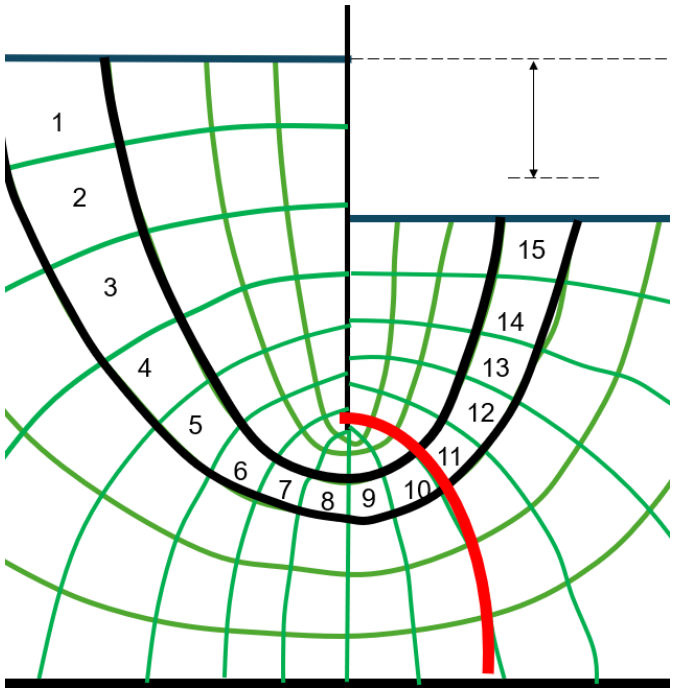
a) Radial flow



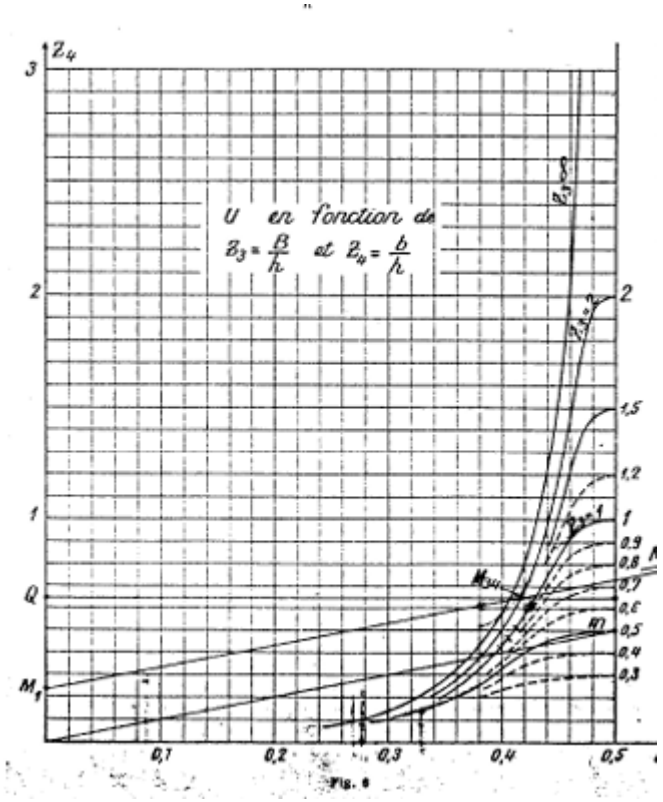
b) Downward vertical flow



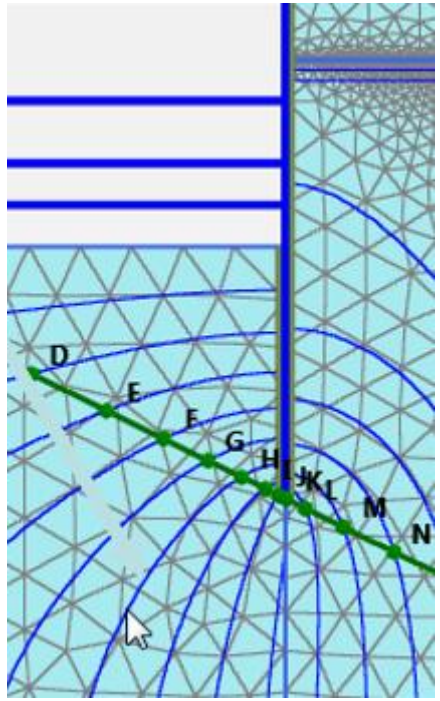
c) Upward vertical flow



a) Manual flow net



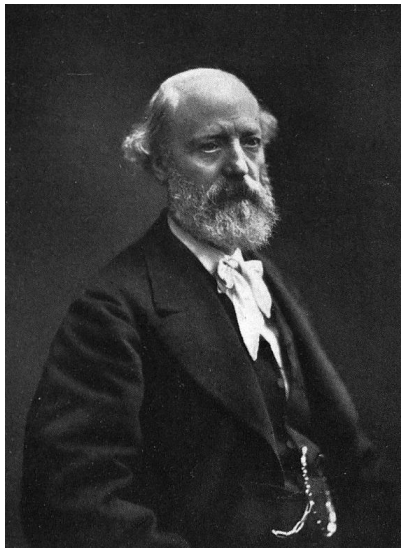
b) Abacus (by Mandel)



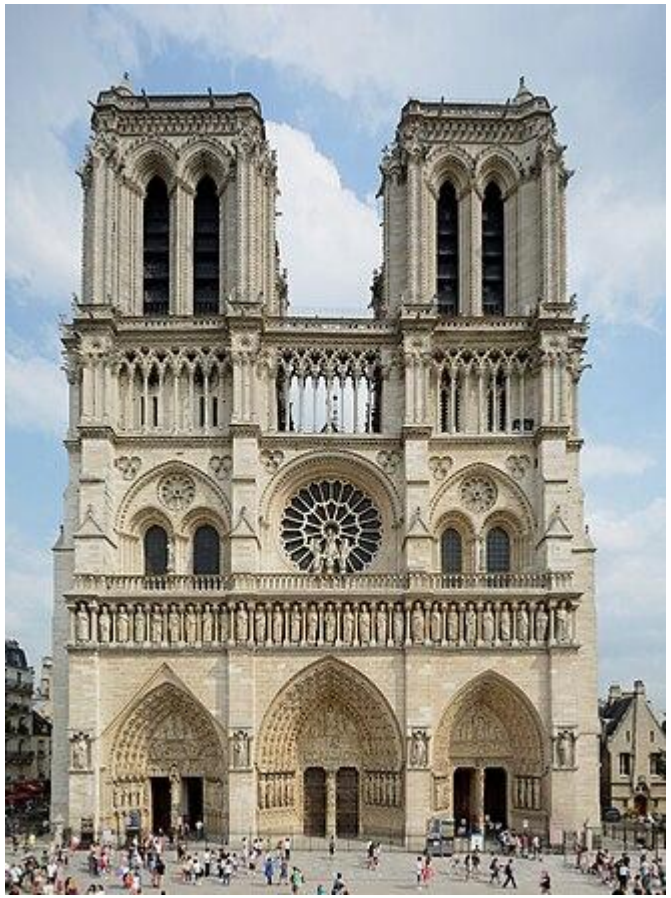
c) FEM

“To see is to know, and to draw is to see well”

“Voir, c’est savoir, et dessiner, c’est bien voir”



Eugène VIOLLET-LE-DUC
1814-1879



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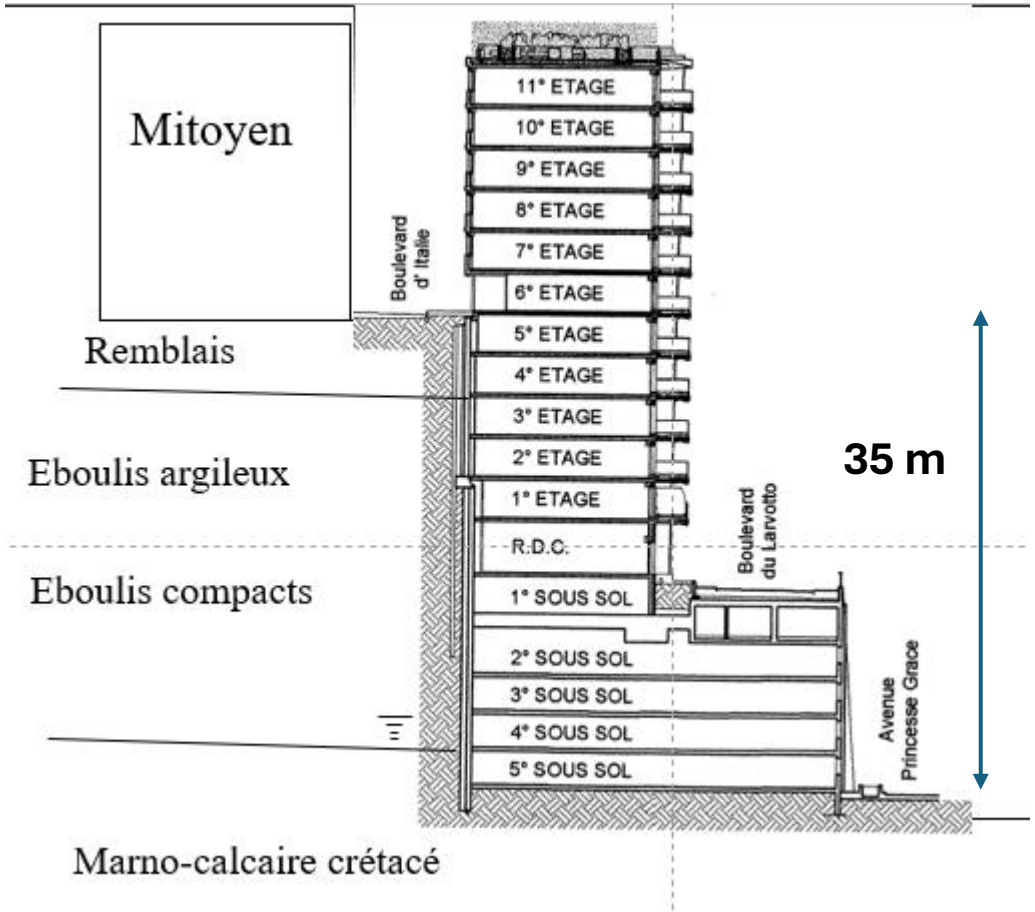

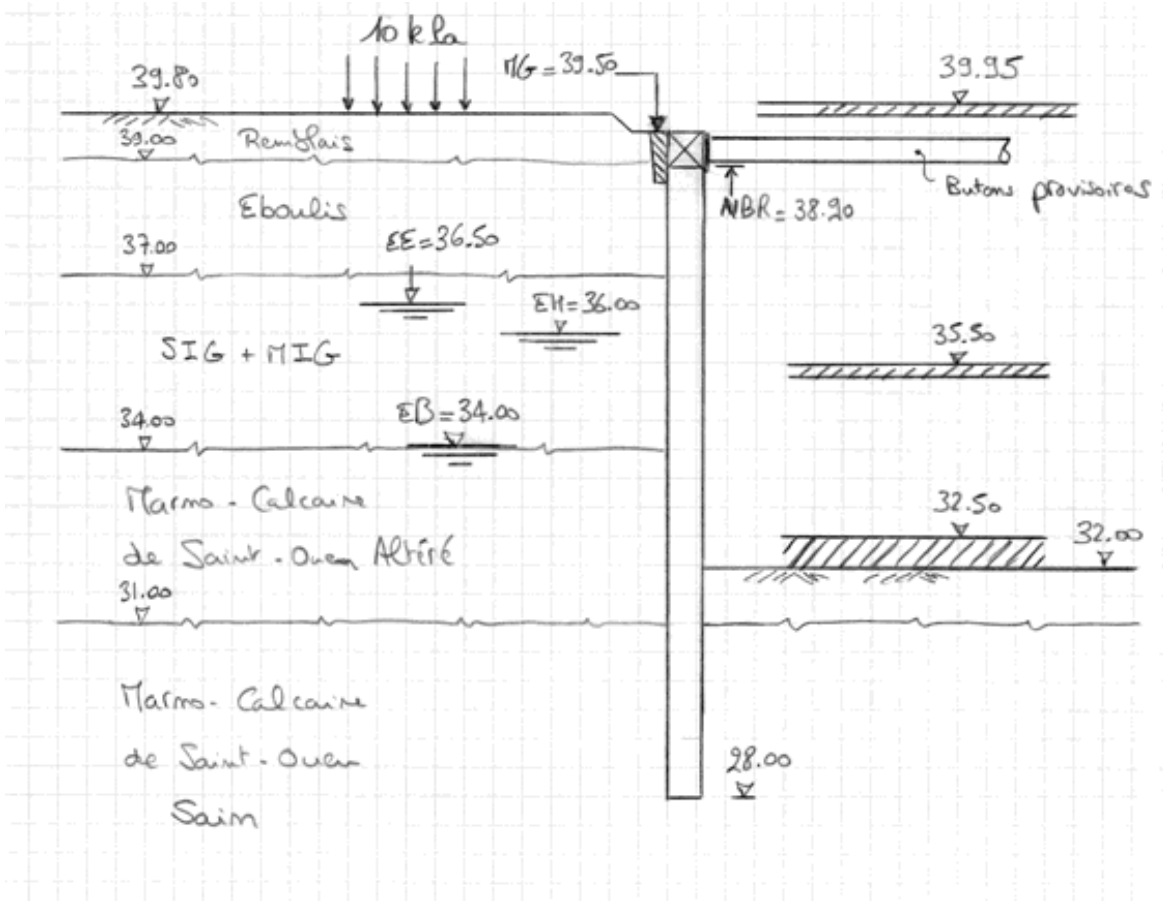

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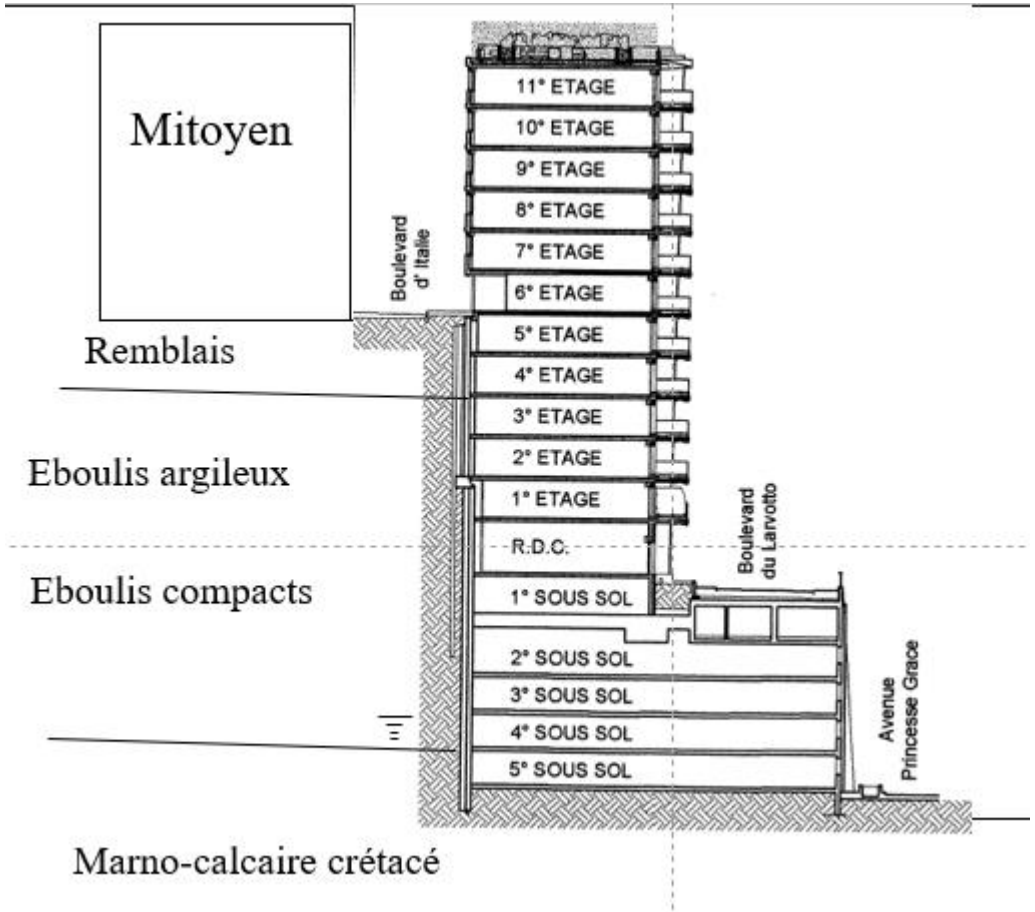
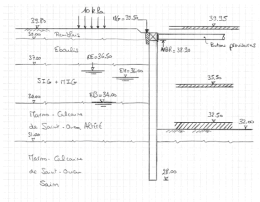
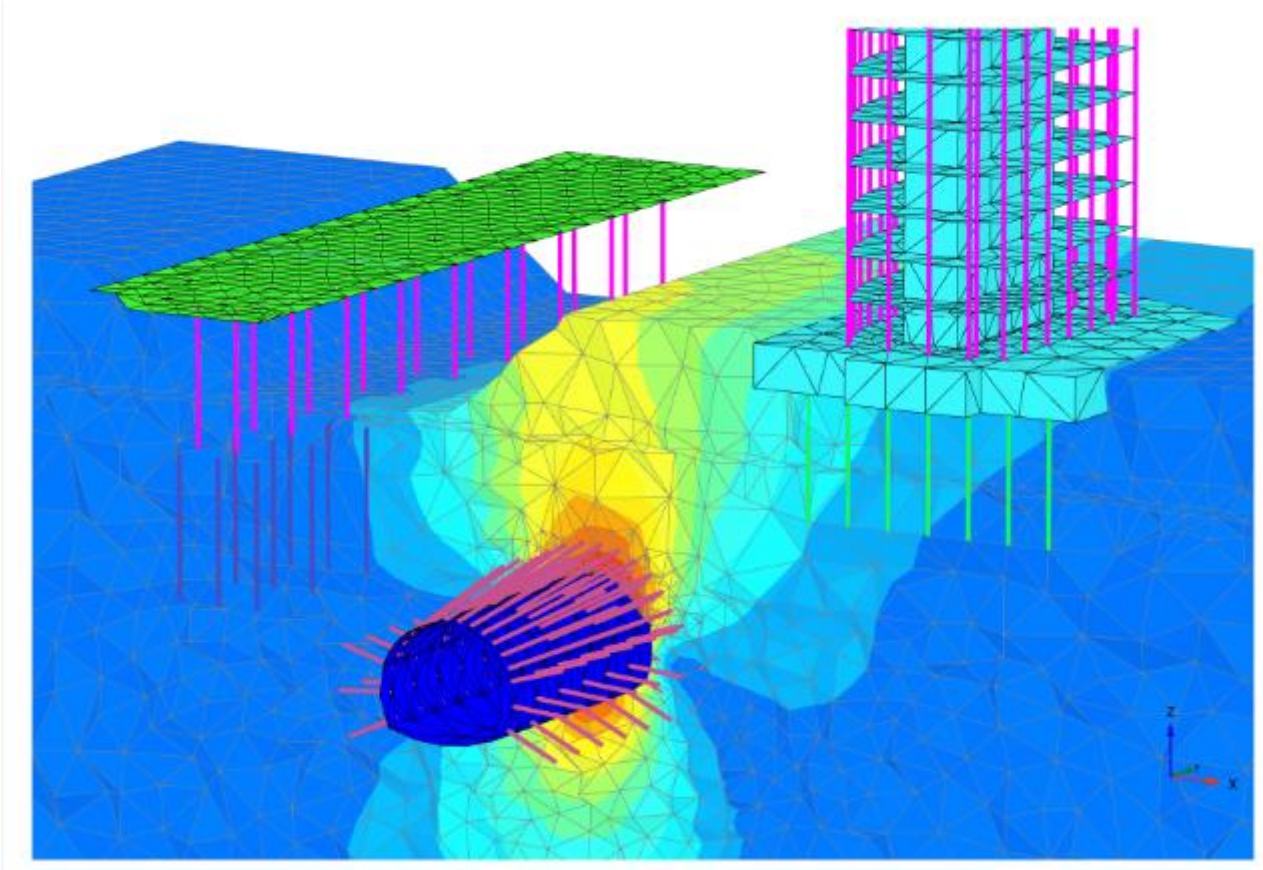
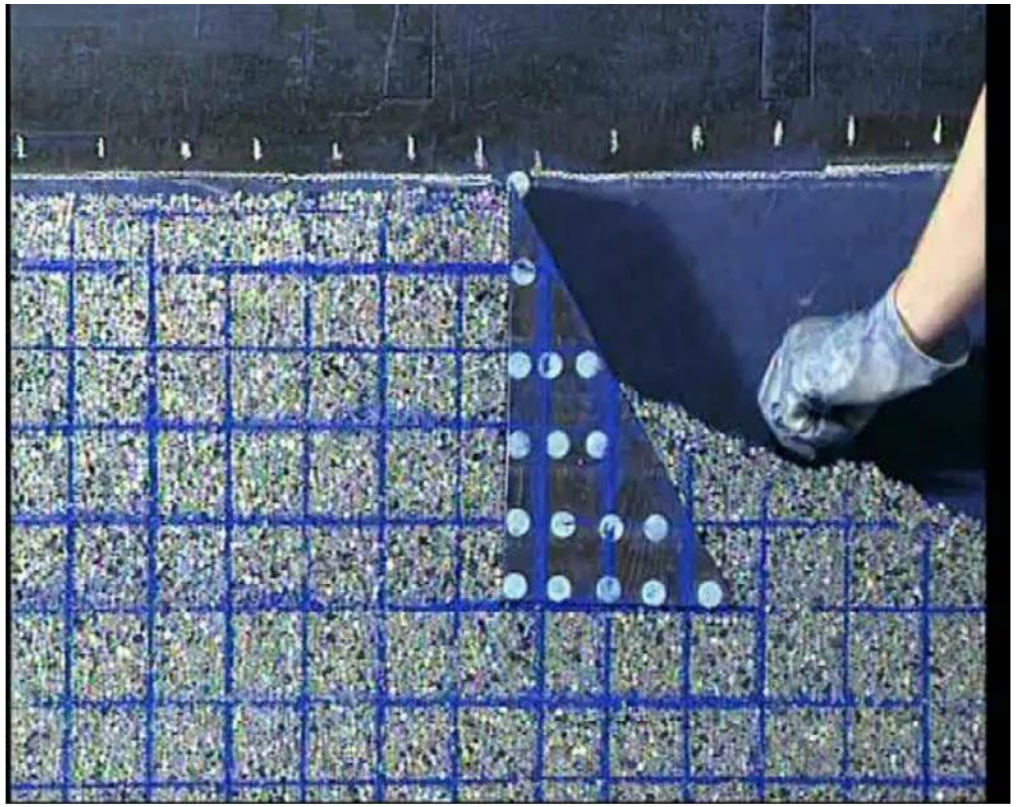


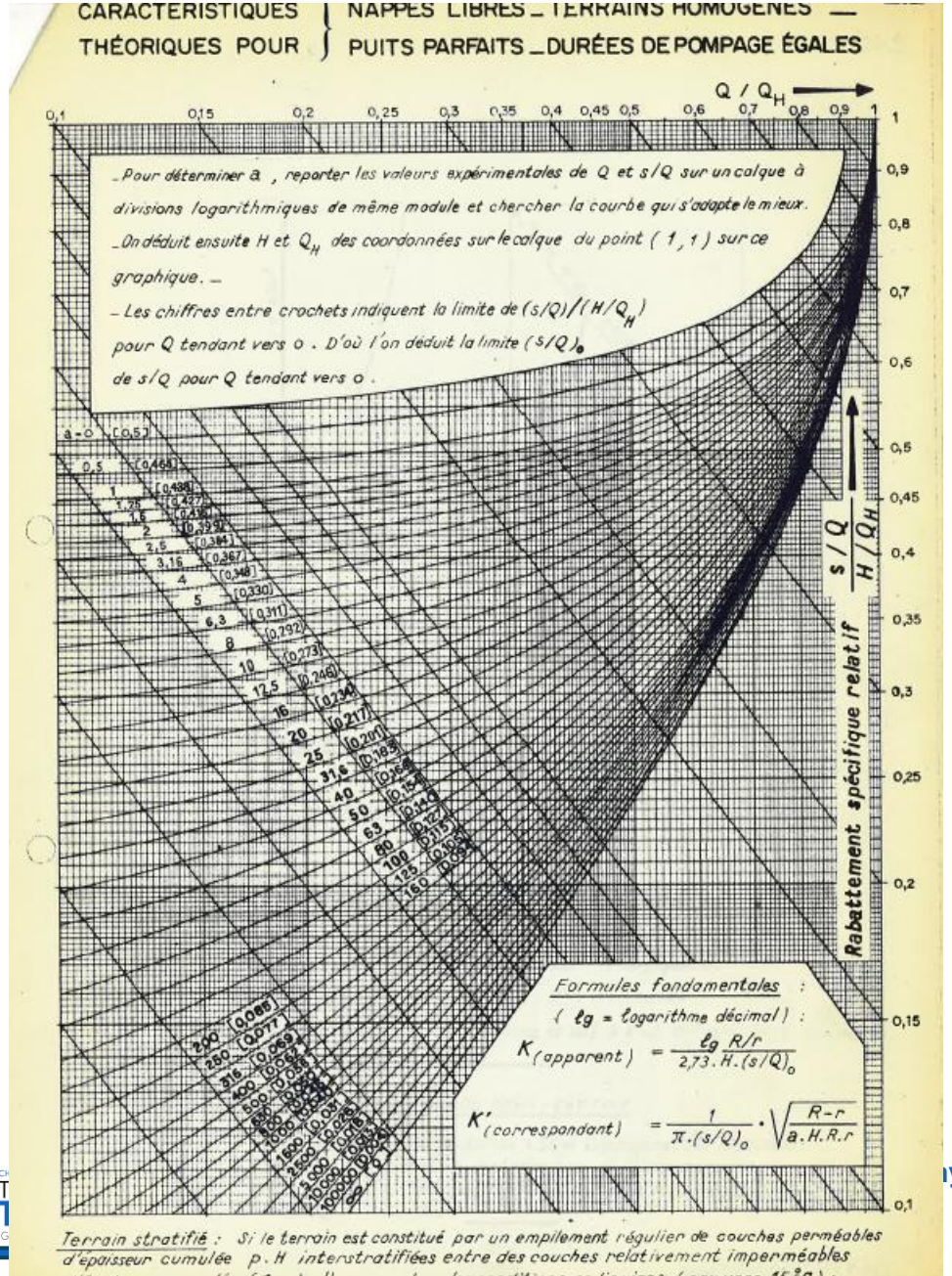


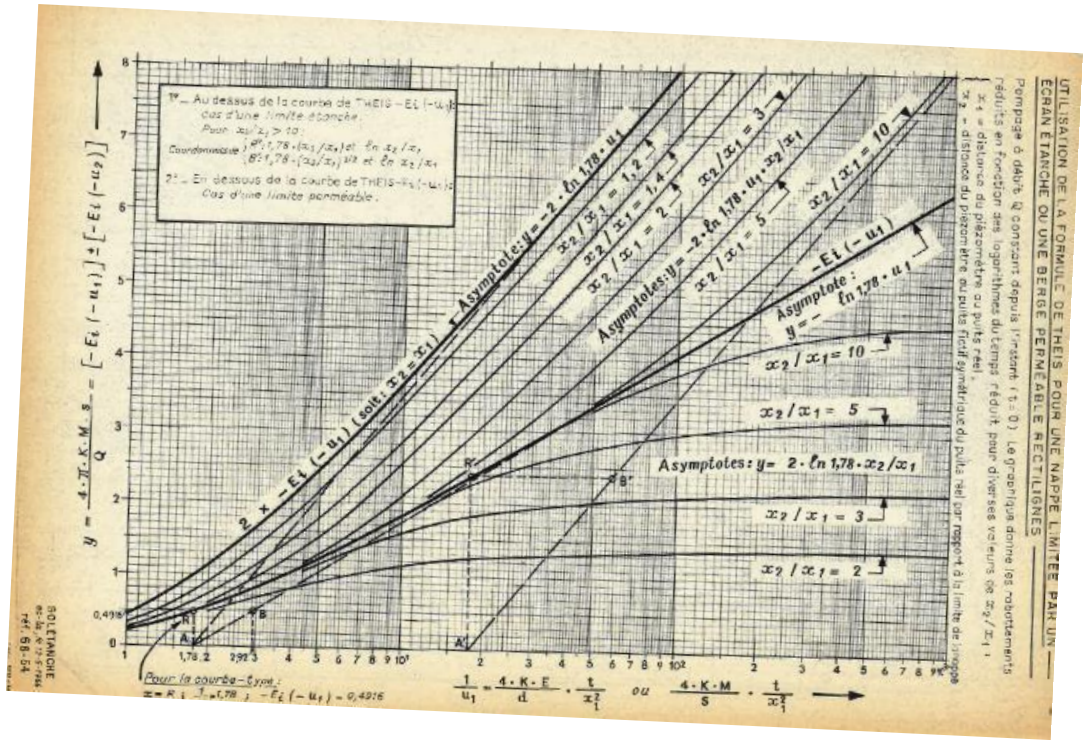
“great job!!!!”





Back to the future?





The art of engineering

Prof. Henri CAMBEFORT
technical director of Soletanche from 1946 to 1975

“To solve an underground hydraulic problem, an engineer has many formulae at his disposal.
How can he choose? “

“If the engineer is good, the formula is good. Otherwise…”

As a conclusion

Relevance of the hypothesis and results.

Always compare the results with reality.

"Natura enim non nisi parendo vincitur"
Nature to be commanded must be obeyed.

Soil never went to school. It doesn't read the models.

Francis BACON
1561-1626

As a conclusion

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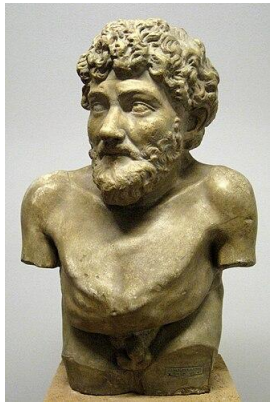
Engineers are allowed to think !

Prof. C HOVART

Prof. J.-L.PROUST (†)

"Software is the best and the worst of things.“

(inspired by Aesop)



Aesop ?
~620 B.C ~ 564 B.C.