

Traitement de sol par inclusions rigides en zone sismique : l'exemple du Pont de Rion-Antirion

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THESSALONIKI

Grèce Continentale

PATRA

ATHENS

Péloponnèse



RION

Golfe de Corinthe

ANTIRION

EAUX PROFONDES :


RION

ANTIRION

65 m

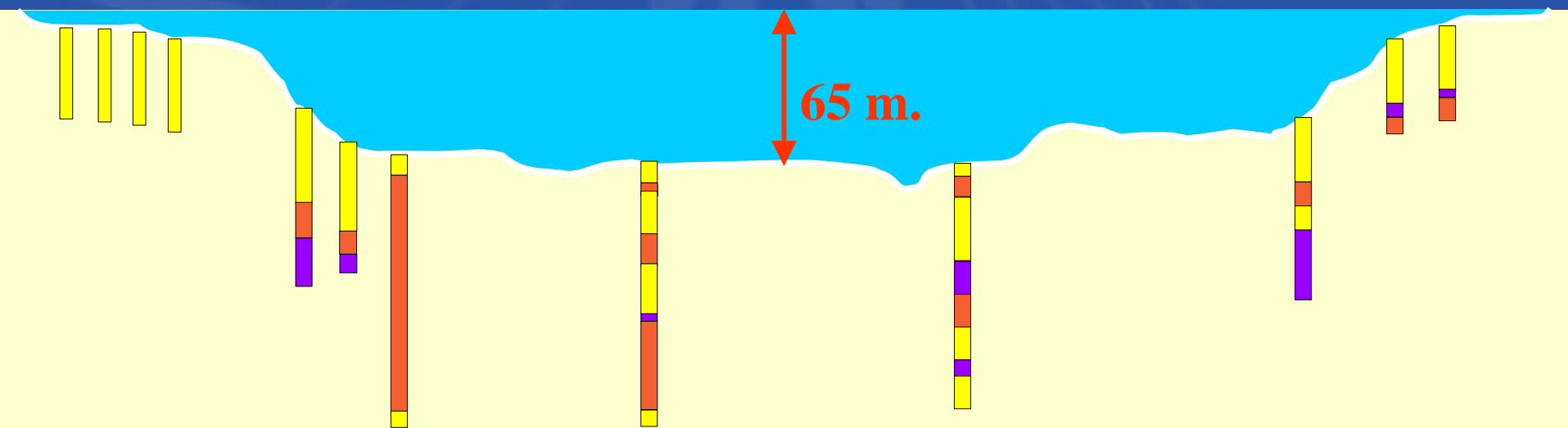
A cross-sectional diagram of a water body. The top part is a dark blue gradient representing the sky or atmosphere. Below it is a light blue horizontal band representing the water surface. The water body is depicted as a light blue area with a black outline, situated above a yellowish ground surface. A red double-headed vertical arrow indicates the depth from the surface to the bottom, labeled '65 m'. The left side of the water body is labeled 'RION' and the right side is labeled 'ANTIRION'.

ALLUVIONS MEDIOCRES:

-  SABLE ET GRAVIERS
-  ARGILE
-  SILT

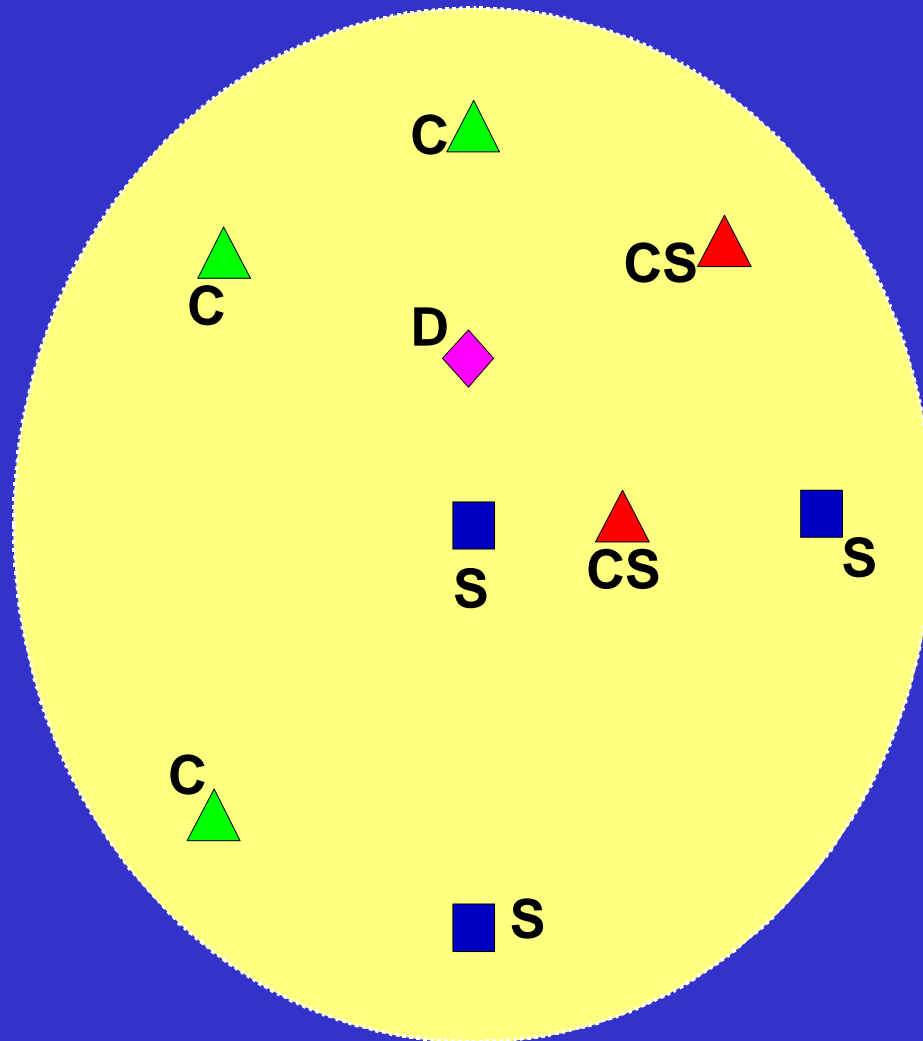
RION

ANTIRION



RECONNAISSANCE GEOTECHNIQUE

Fondations ouvrage principal



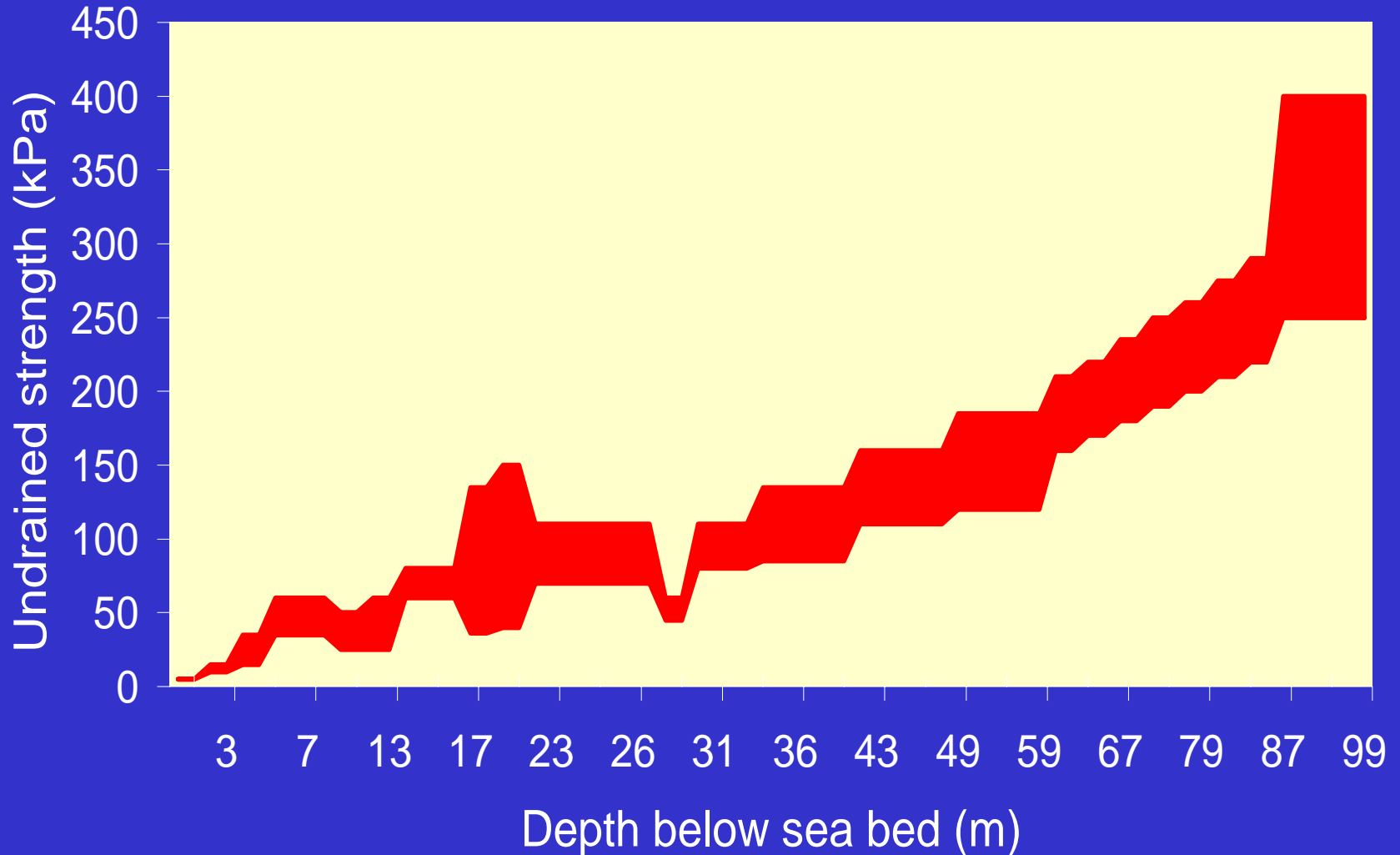
S : 100 m

C : 60 m

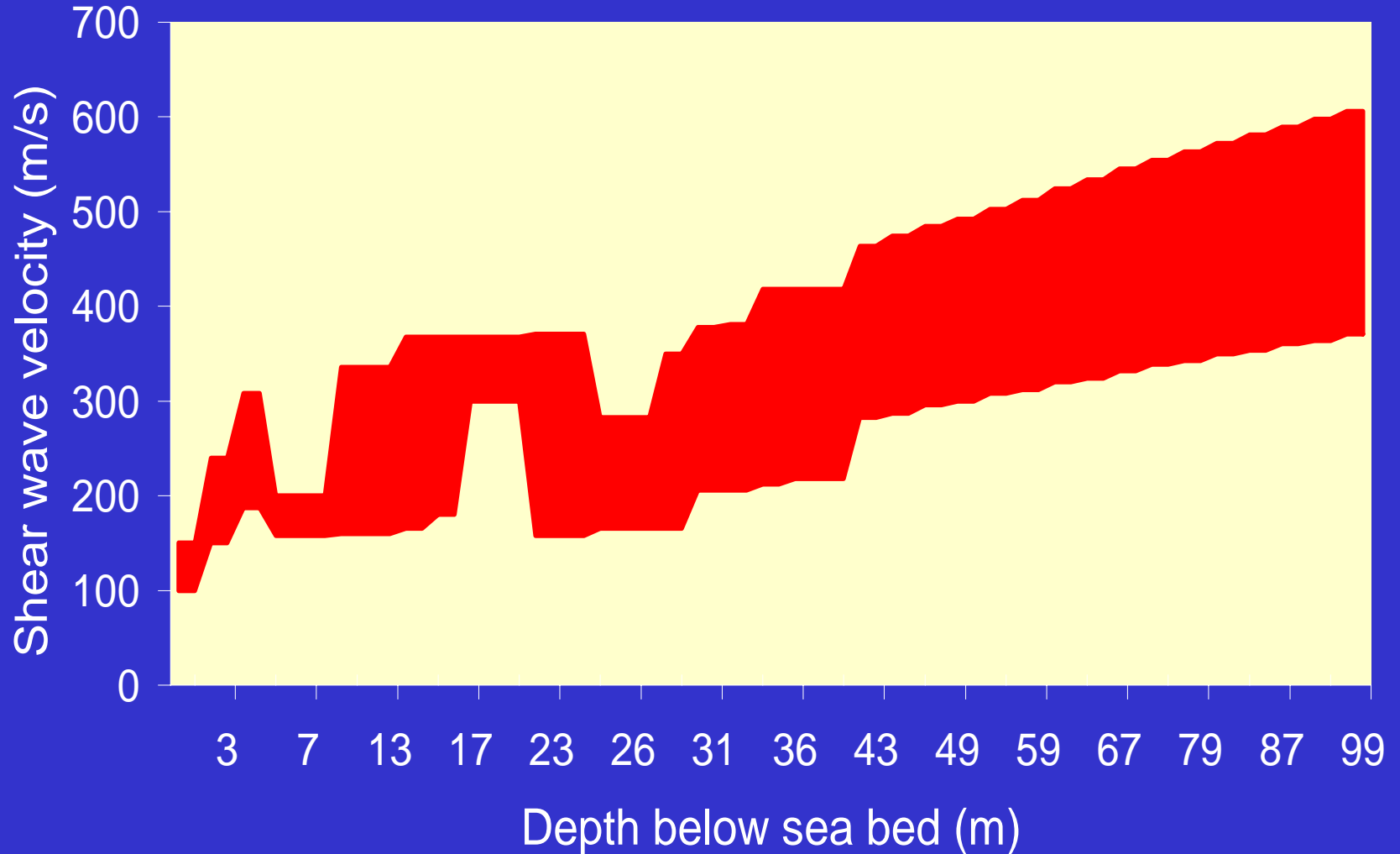
CS: 60 m

D : 60 m

RESISTANCE DU SOL PYLONE M1

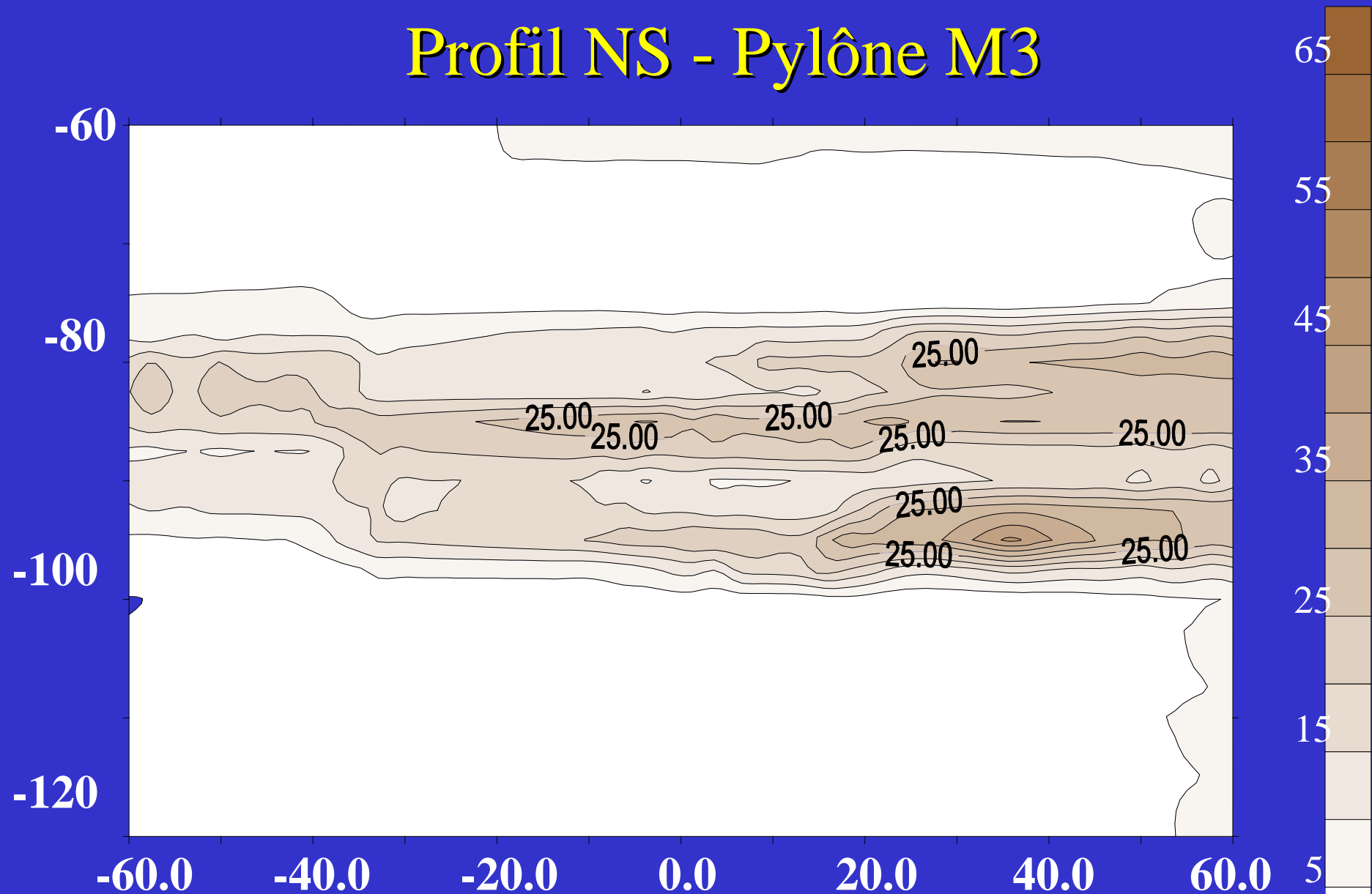


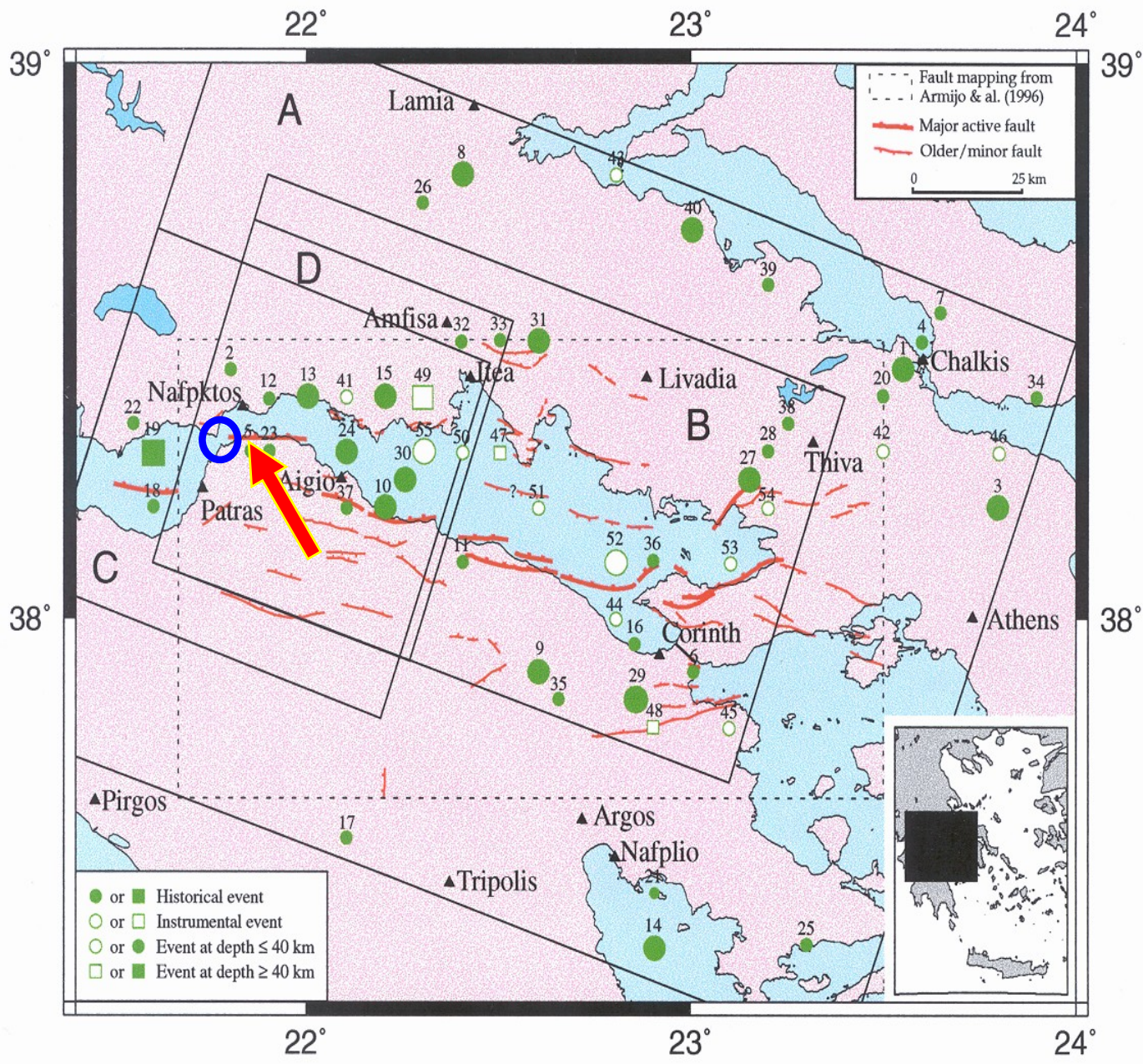
CELERITE DES ONDES DE CISAILLEMENT PYLONE M1



RESISTANCE de POINTE

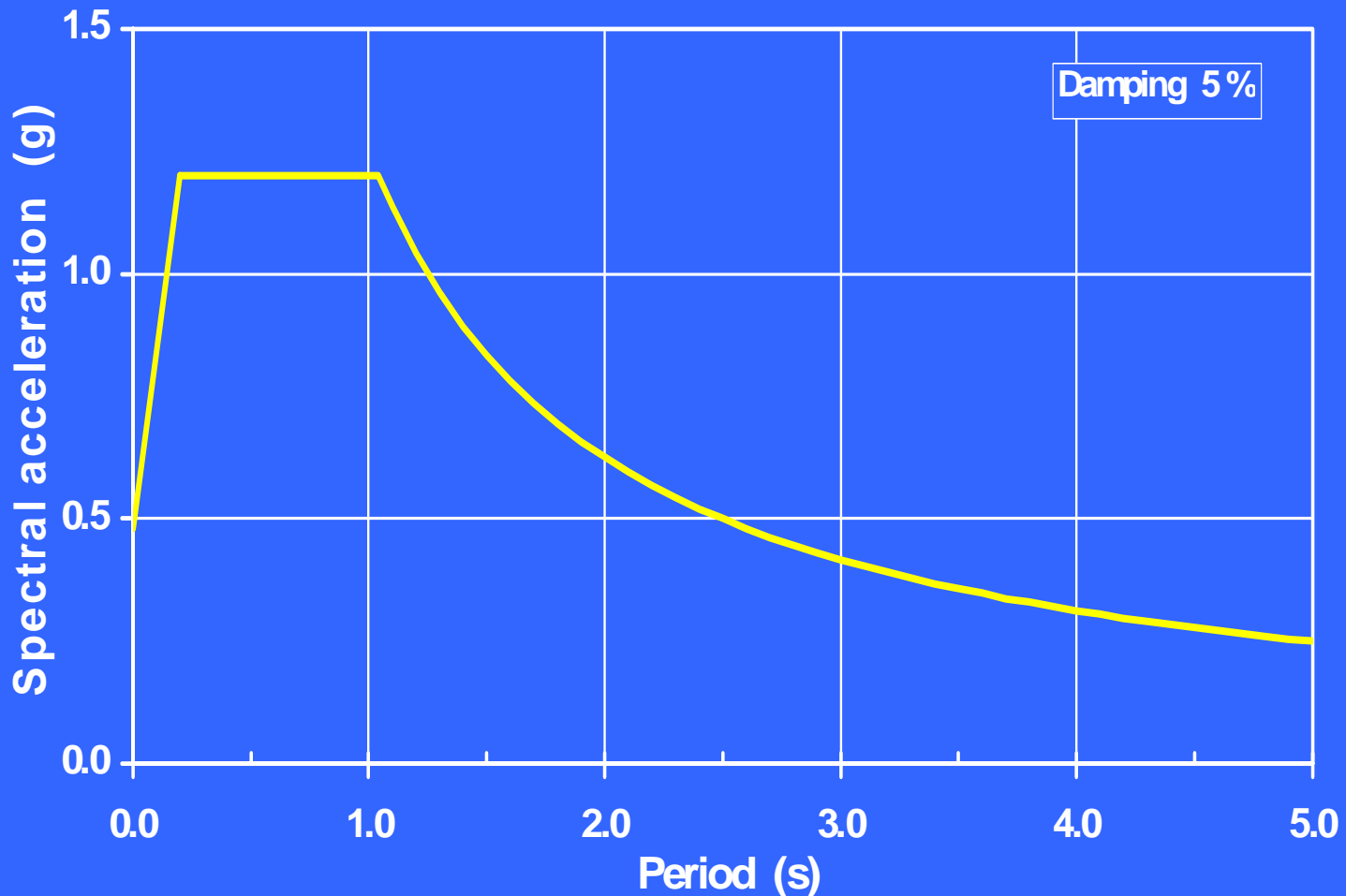
Profil NS - Pylône M3





SPECTRE DE CALCUL

Fond de mer

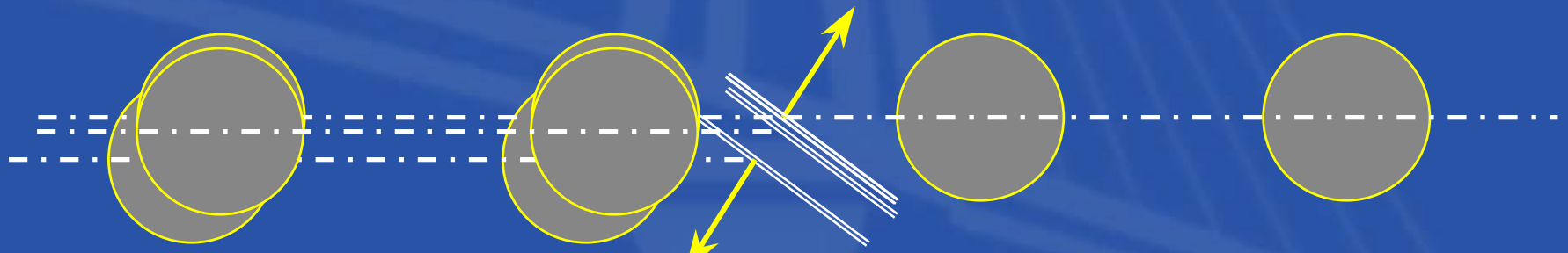


MOUVEMENTS TECTONIQUES



ELEVATION :

**DEPLACEMENT VERTICAL
: 2m**



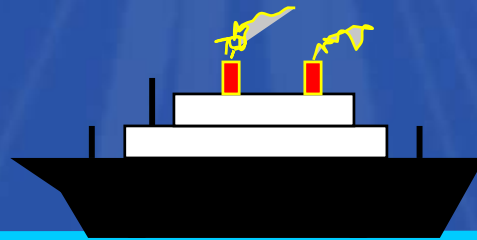
PLAN :

**DEPLACEMENT HORIZONTAL :
2 m**

CHOC DE NAVIRE :

16 nœuds

RION



ANTIRION



180 000 t

ENVIRONNEMENT

- Forte épaisseur d'alluvions récentes ($H > 500$ m)

⇒ Sables, silts, argiles silteuses de caractéristiques médiocres

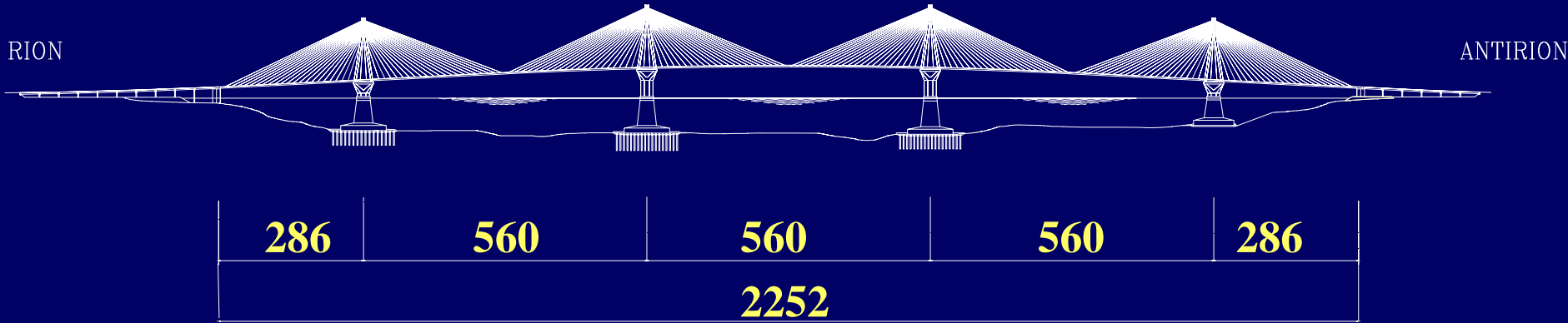
- Forte profondeur d'eau (65 m)

- Activité sismique élevée

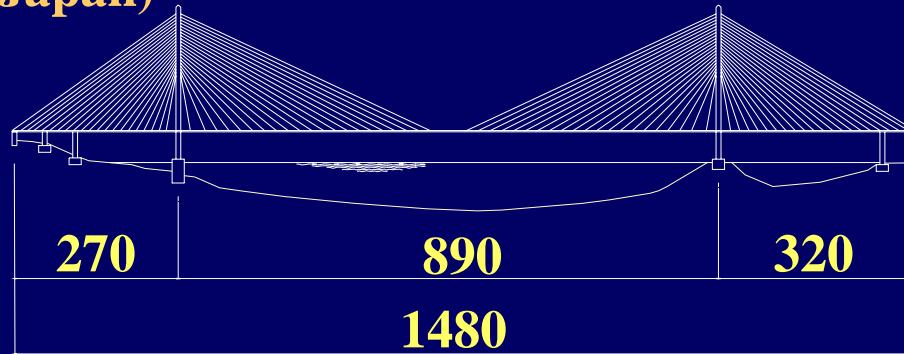
e à 0.48 g au fond de mer

de mouvement tectonique
tre deux piles adjacentes

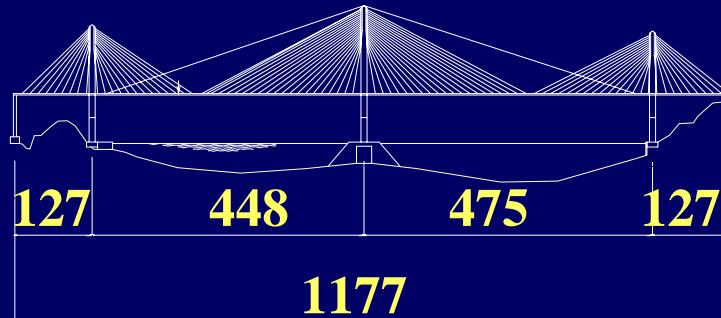
RION-ANTIRION Bridge (Greece)

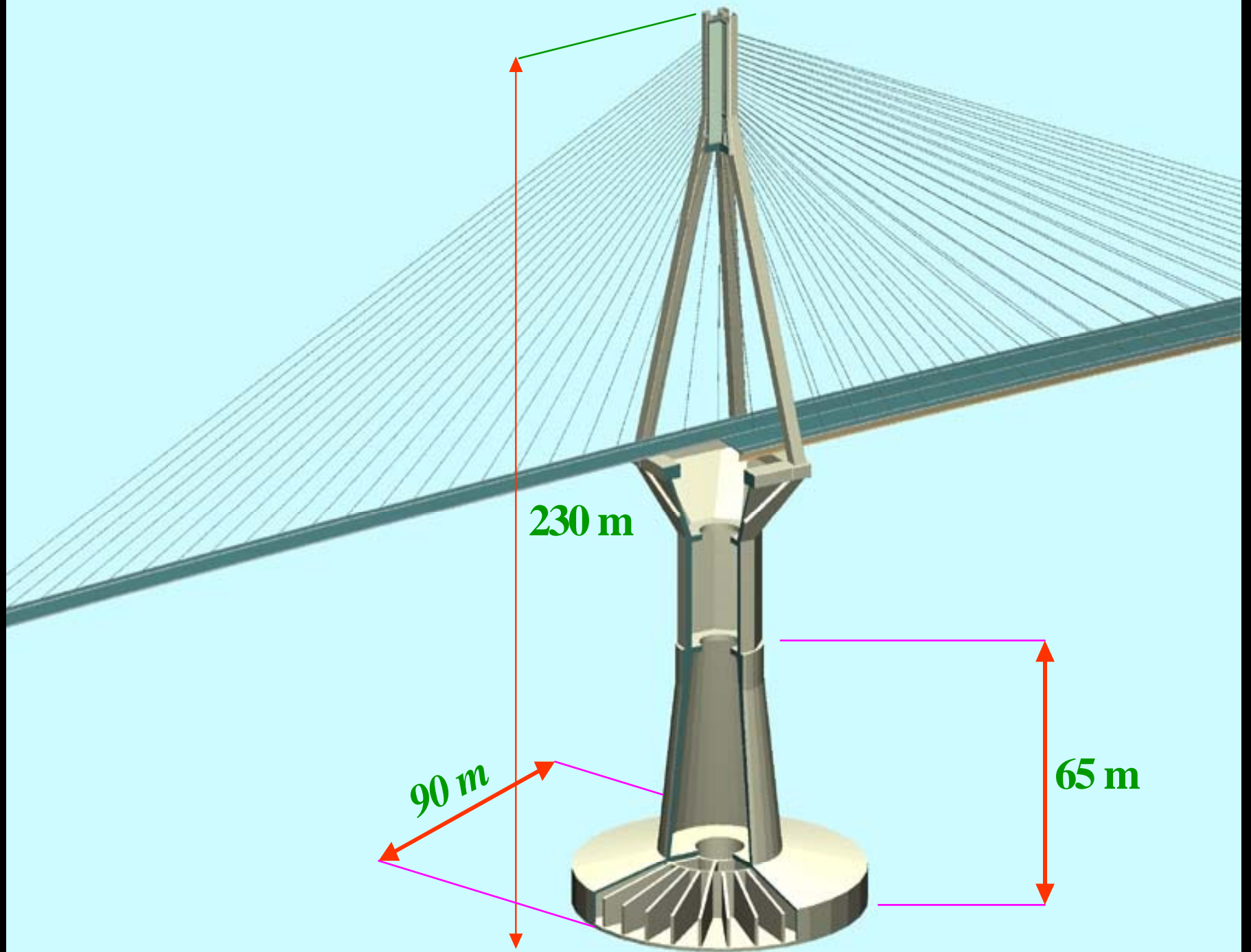


TATARA Bridge (Japan)



TING KAU Bridge (Hong Kong)





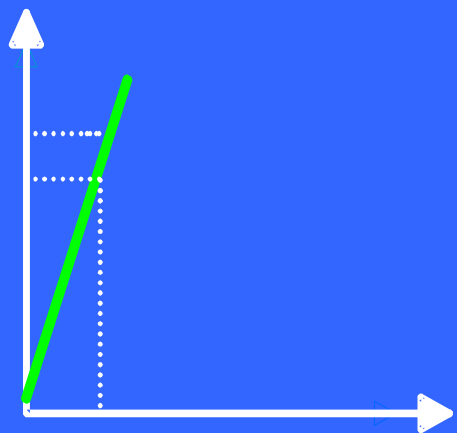
" Souvent les ingénieurs et les hommes publics sont tenus de résoudre certaines questions alors même que sur ces questions la science n'est pas faite. Messieurs, vous devez arriver à des solutions pratiques, même en présence d'une science inachevée. "

Louis PASTEUR

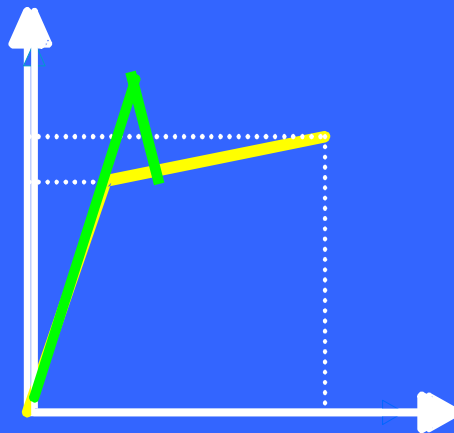
PRINCIPES DU DIMENSIONNEMENT EN CAPACITE

“The strategy invites the designer to tell the structure where plastic hinges are desirable or convenient and practicable at ULS and to proscribe plastification in other regions”

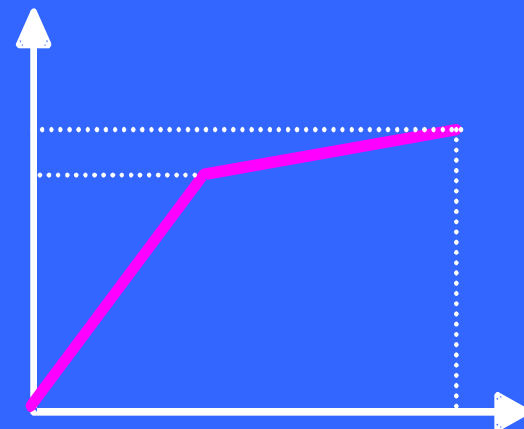
T. Paulay



Δ_1



$\Delta_1 \mu \Delta_1$

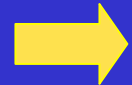


$n \Delta_1 + \mu \Delta_1$

$$\mu^* = \frac{n + \mu}{n + 1}$$

N Maillons fragiles + Maillon ductile = Chaîne ductile

FONDATIONS ?



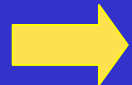
PIEUX



CAISSONS ENTERRES



SUBSTITUTION SOL



FONDATIONSUPERFICIELLE
SUR SOL RENFORCE

RETOUR D'EXPERIENCE

- Ville de Mexico (Michoacan 1985)
 - ⇒ Semelles isolées
 - ⇒ Radiers superficiels
 - Tassements > 1 m
 - Rotations : quelques %



RESTAURANTE
CAMPIRANO

FOTOLINICA
FOTO MEDICA
TRANSPARENCIAS P... NEERENCIAS
ARTICULOS FOTOGRAFICOS...
FOTOSTATICOS...
1000
1000



HORARIO
LUNES A VIERNES
1000 A 1800

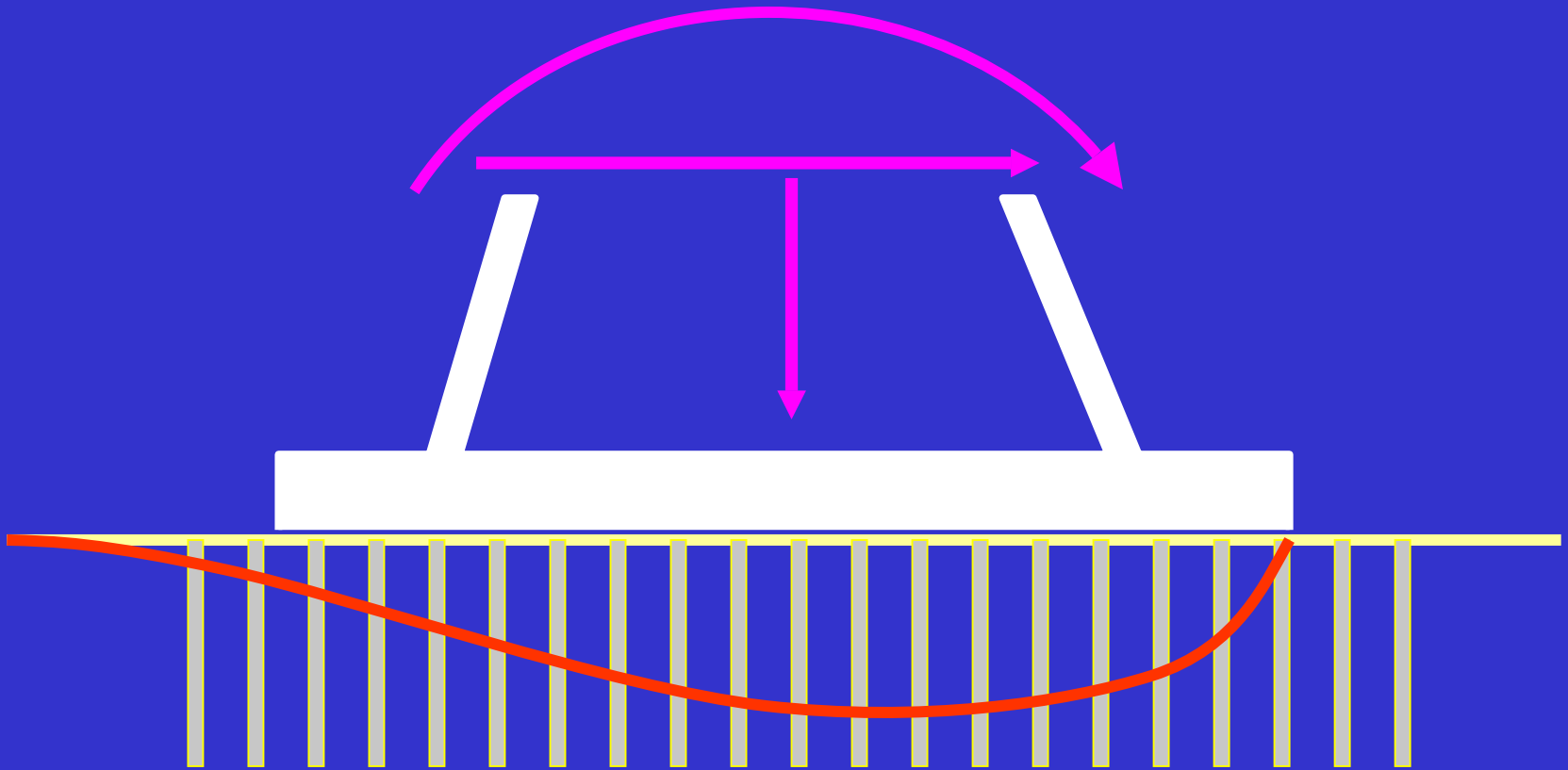
MINOLTA XD-5

59

TO REY



Inclusions



PHILOSOPHIE DIMENSIONNEMENT EN CAPACITE

Rotule plastique = Couche graviers \Rightarrow Fusible

Surcapacité = Renforcement de sol

EFFET COMBINE

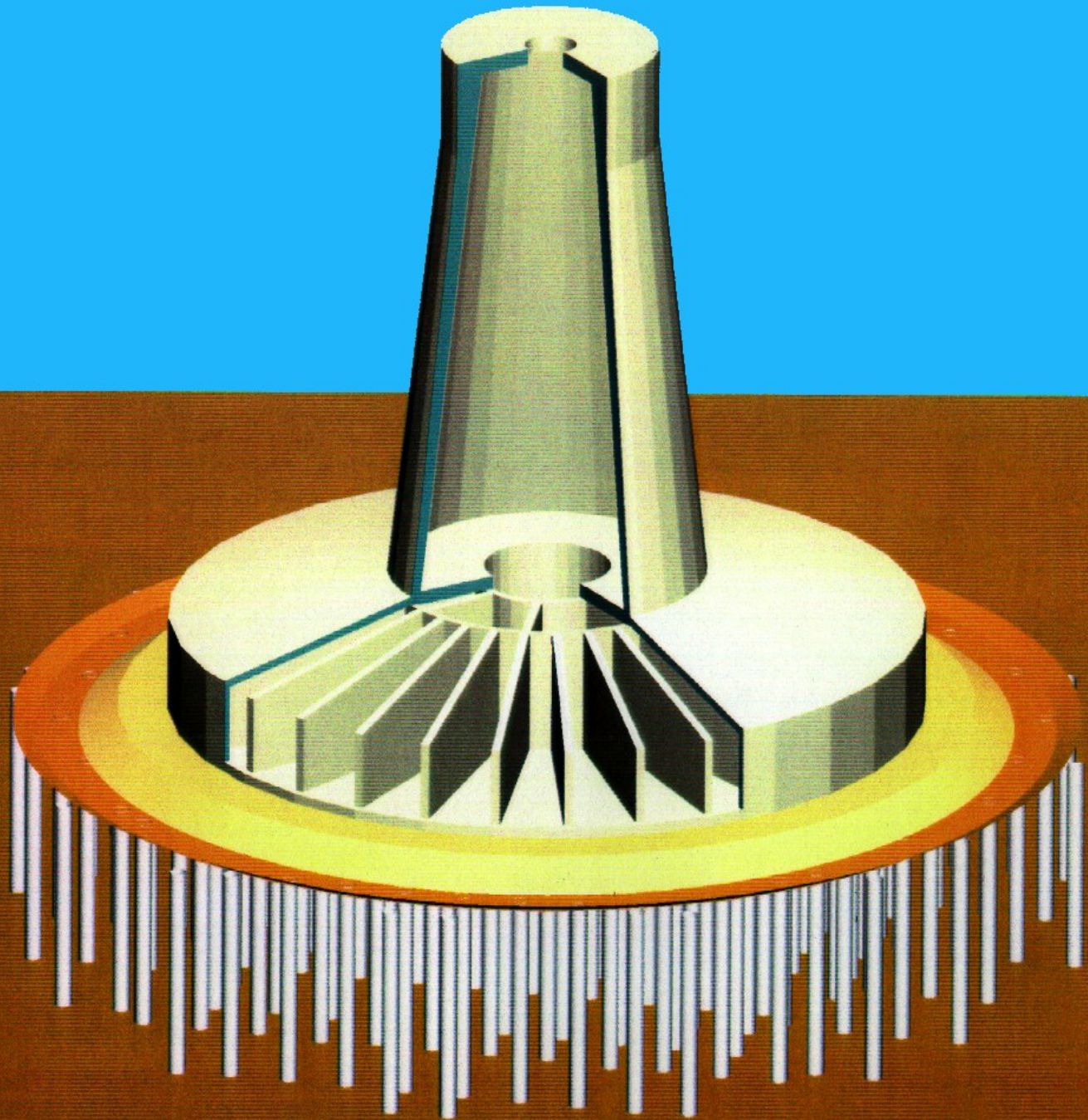
- **Limitation des forces dans la superstructure**
- **Contrôle du mode de rupture**

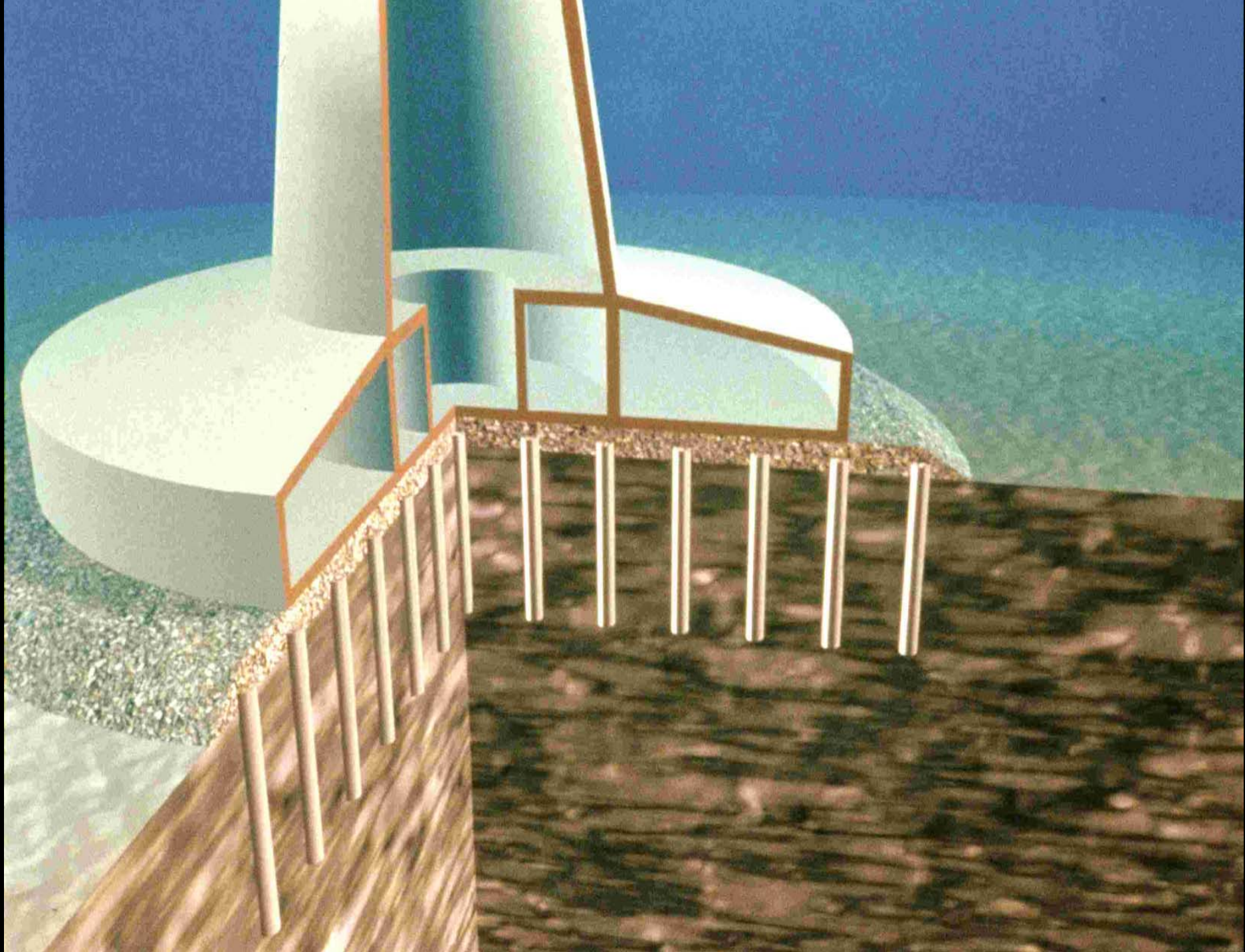
RENFORCEMENT SOL

- Tubes métalliques battus
 - ⇒ Diamètre 2 m, Epaisseur 20 mm
 - ⇒ Longueur 25 m to 30 m
 - ⇒ Espacement 7 m x 7 m

200 INCLUSIONS SOUS CHAQUE FONDATION

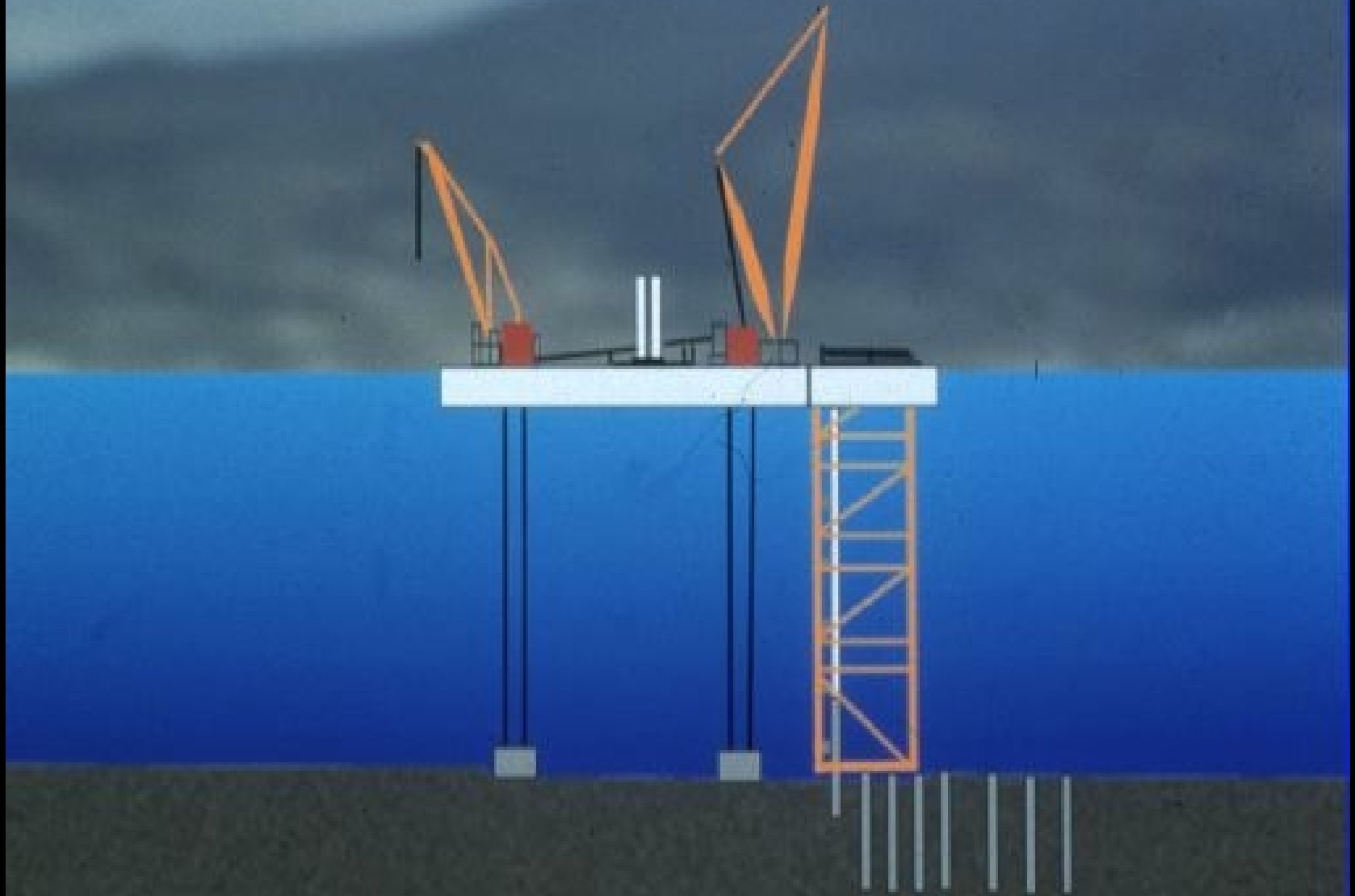
- Couche de graviers







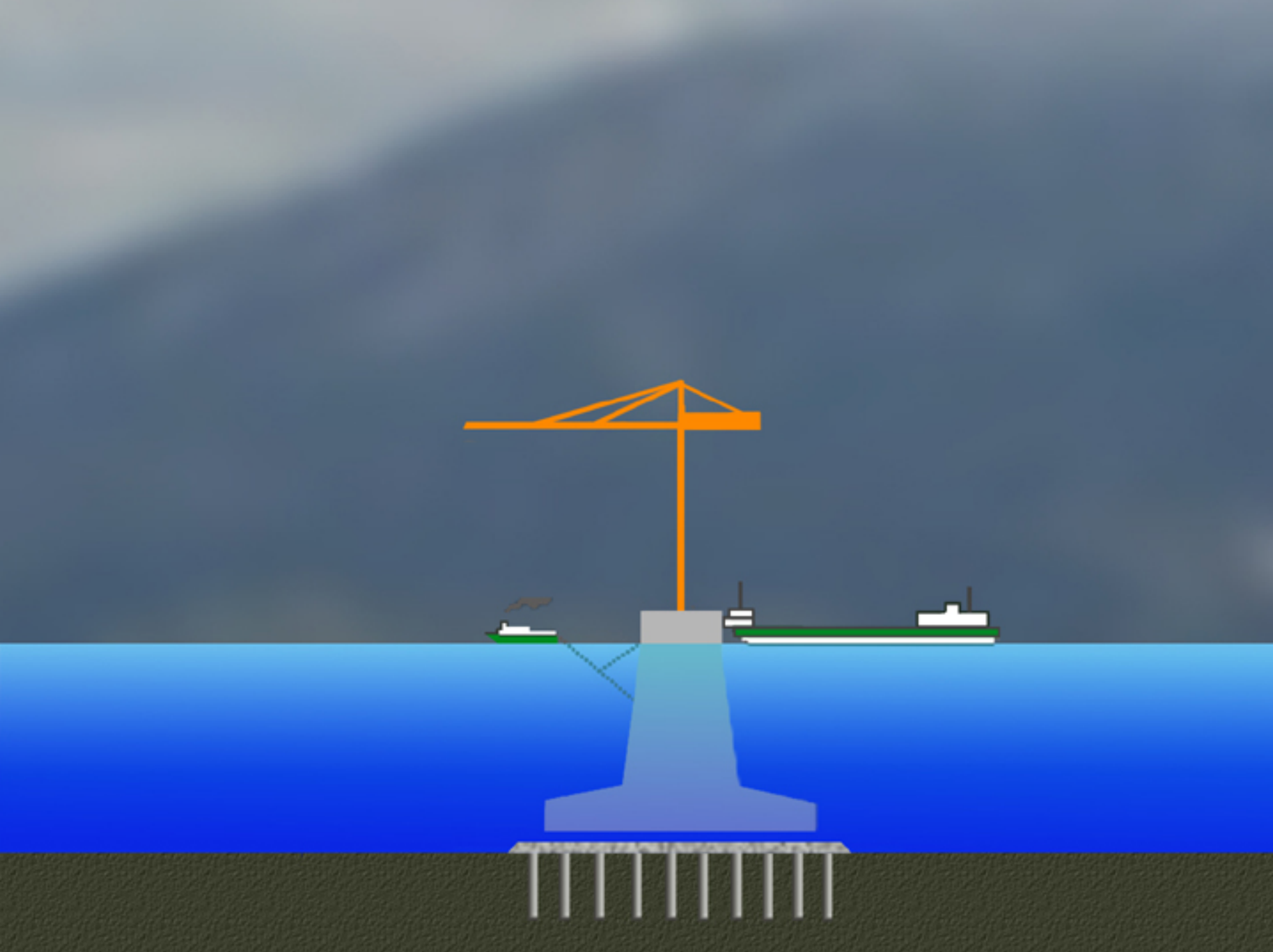
Inclusions



Battage des inclusions & Installation du Gravier

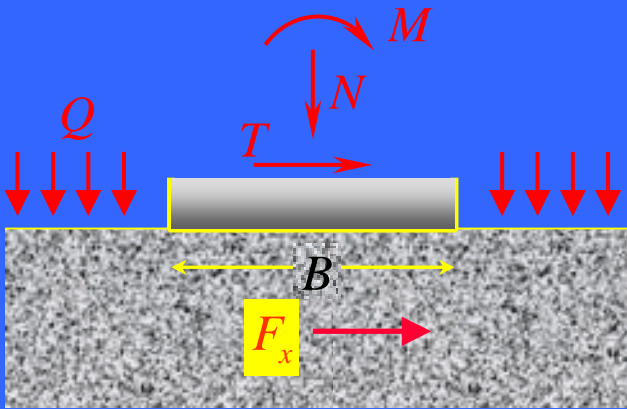




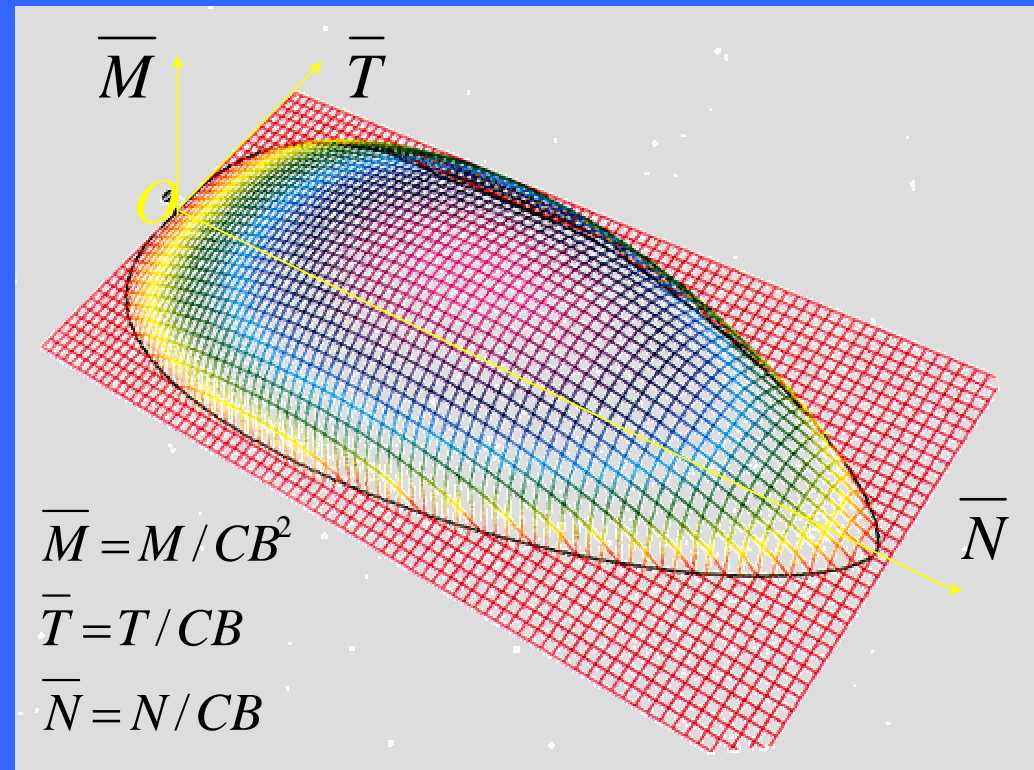




CAPACITE PORTANTE SOUS CHARGEMENT COMBINE

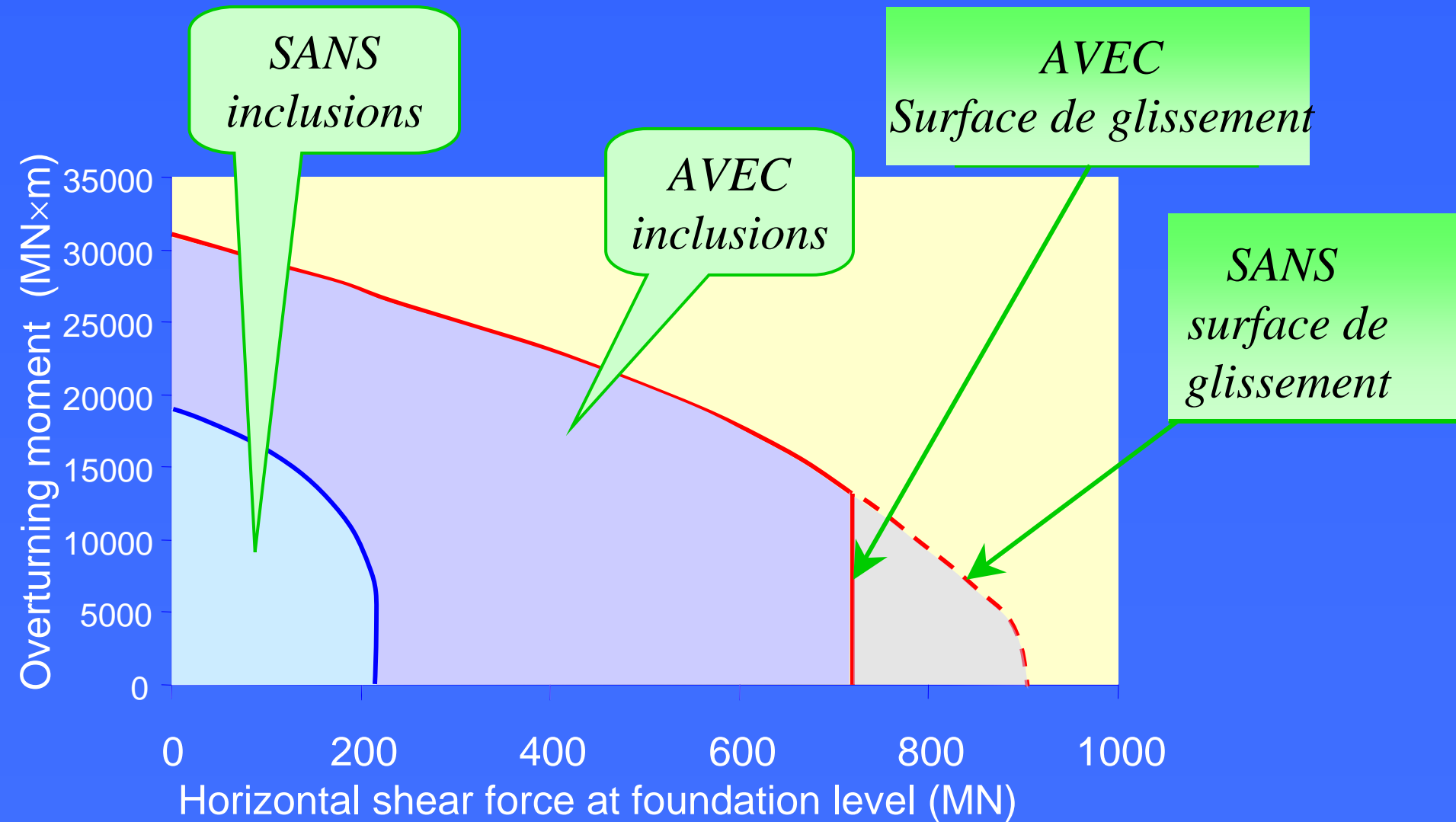


Calcul à la rupture

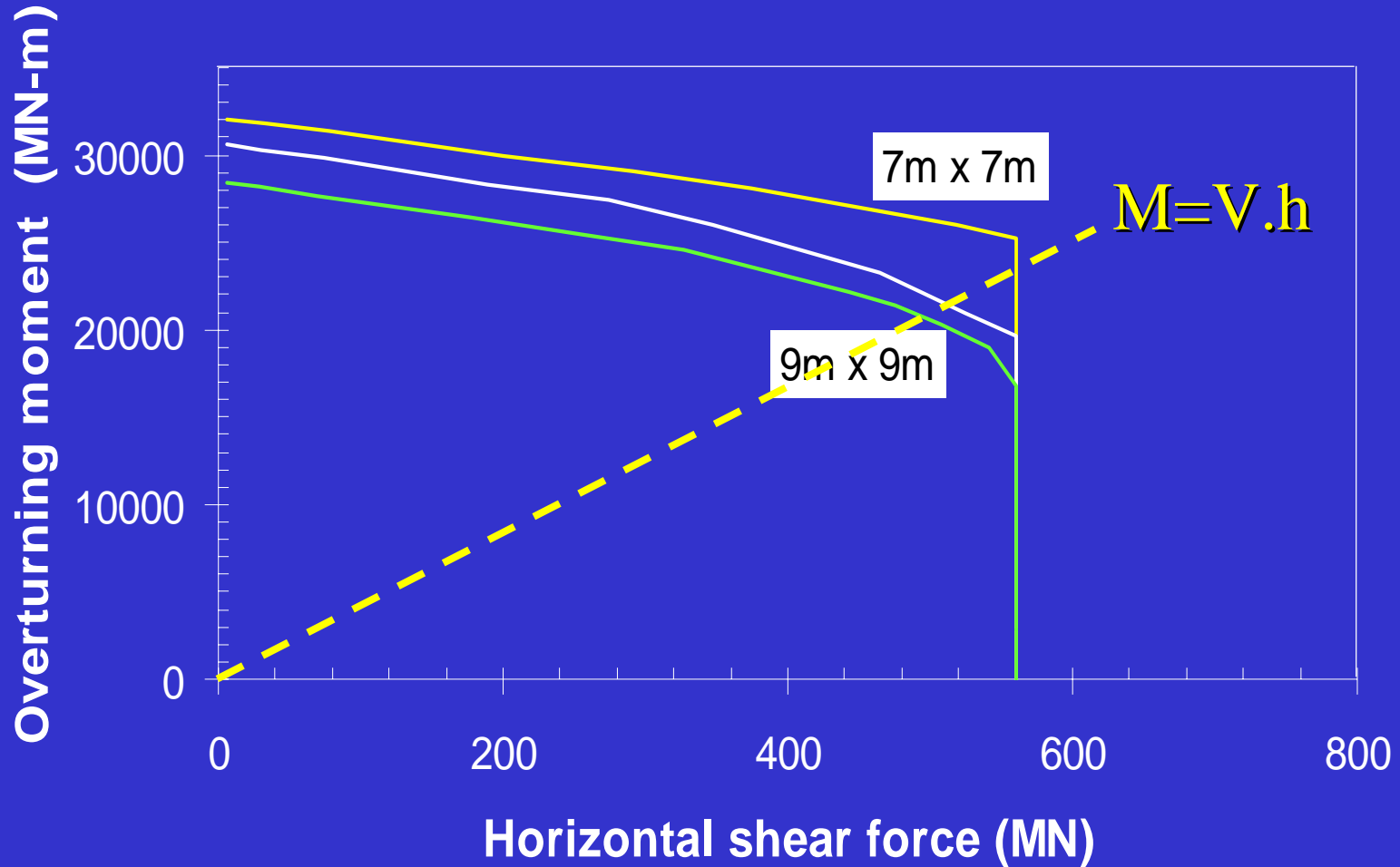


SURFACE LIMITE

$N = 860 \text{ MN} - L = 25 \text{ m} - S = 7 \text{ m}$

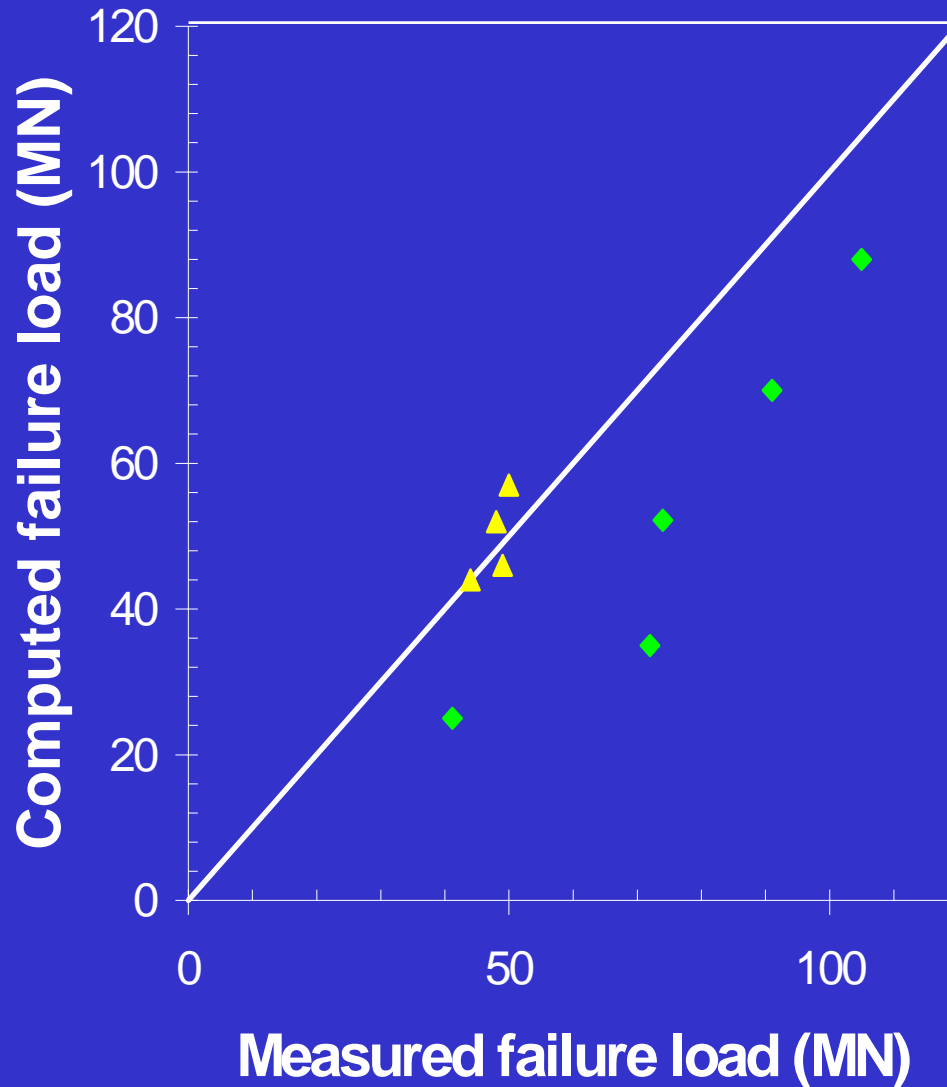


ESPACEMENT DES INCLUSIONS

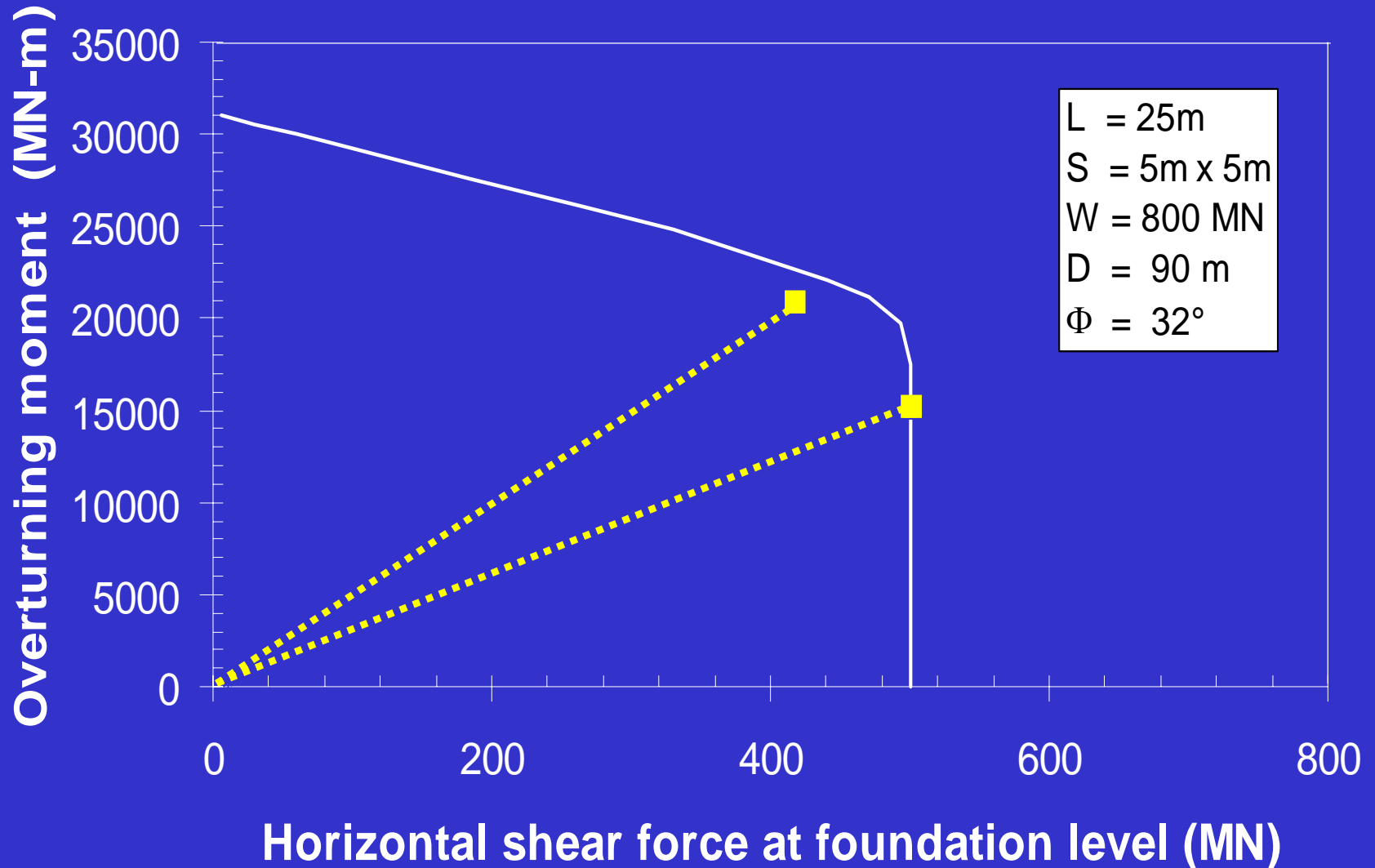


CHARGE ULTIME

Essais monotones



ANALYSE ELEMENTS FINIS



SUIVI DES TASSEMENTS

