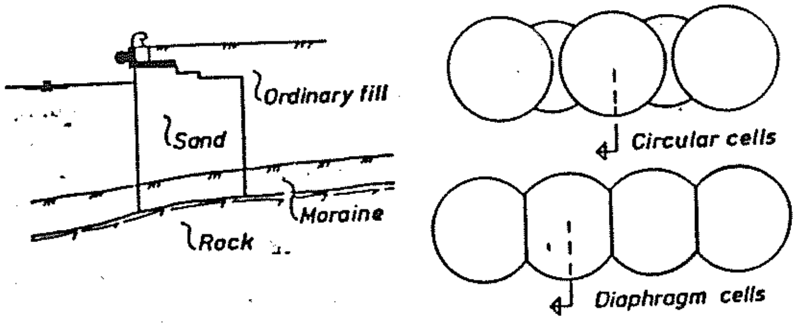


Cross-section

Plan

Fig. 3.5.2.3.A Sheet pile cell quay

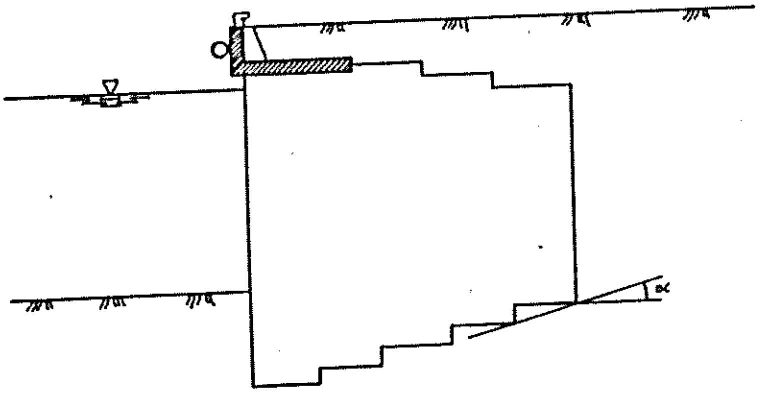


Fig. 3.5.2.3.C Stair-step method for sheet piling

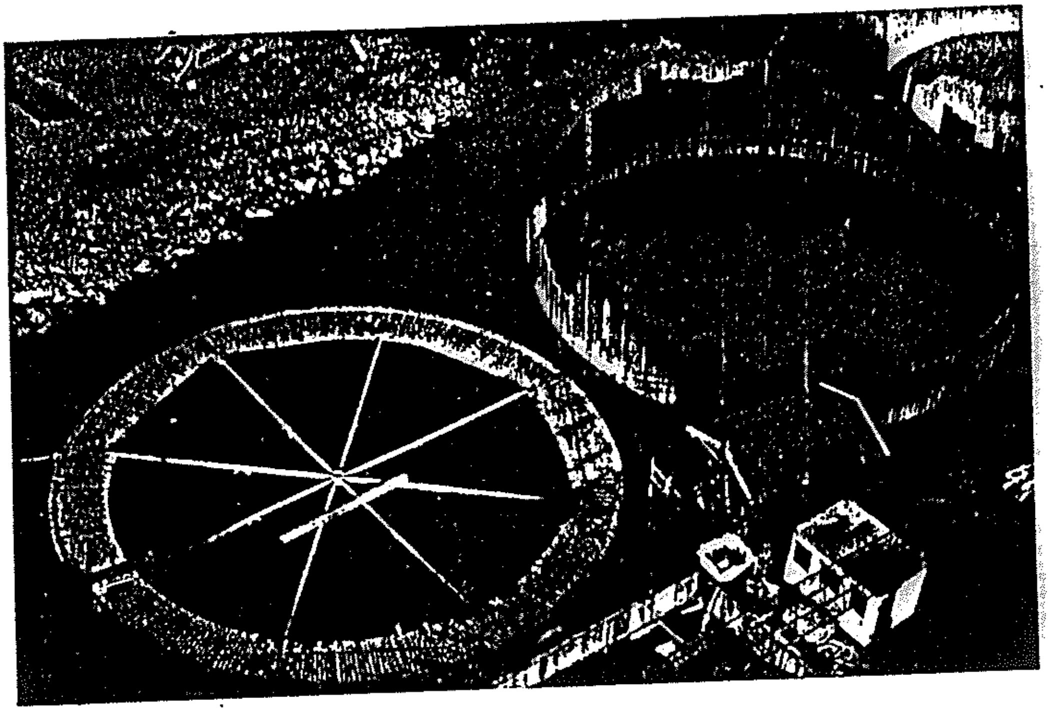
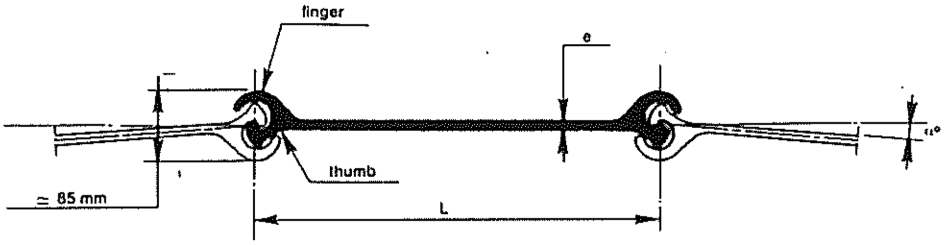


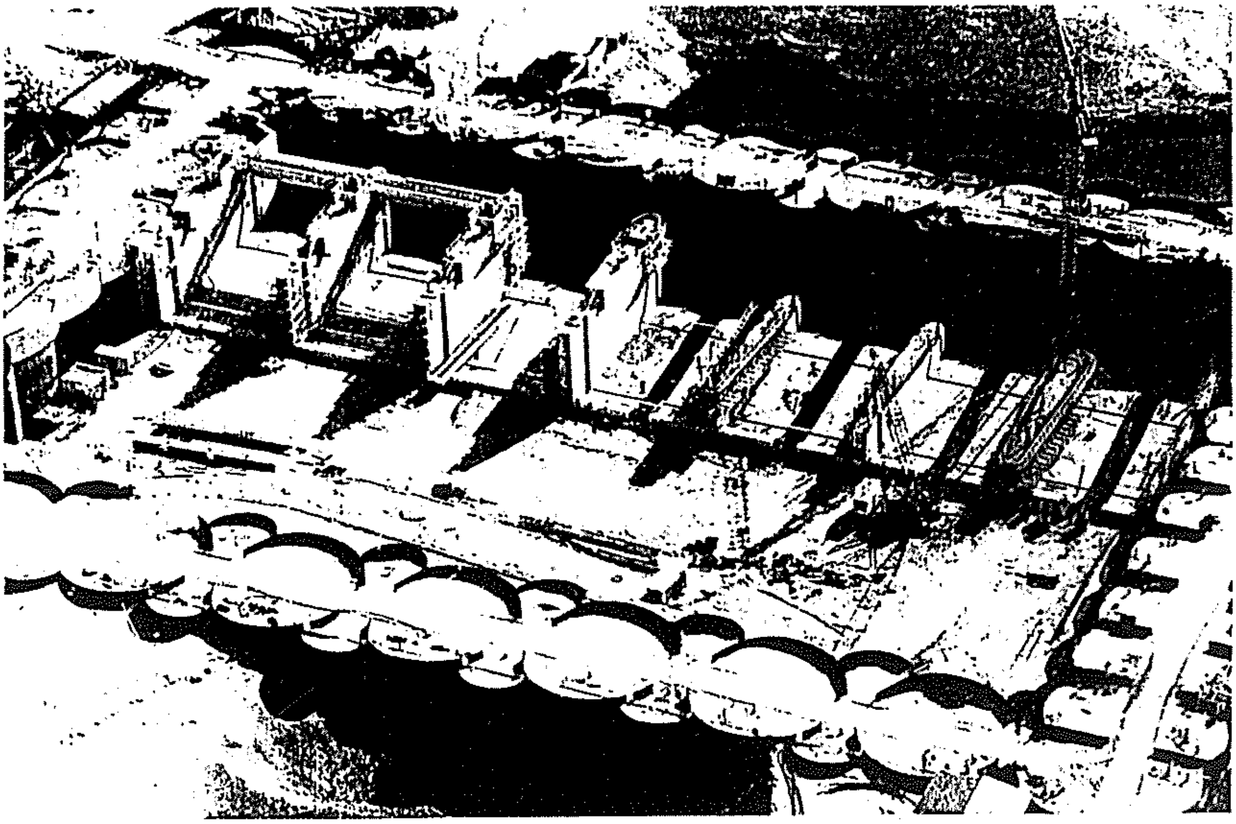
Photo 3.5.2.3 Construction of a cell quay

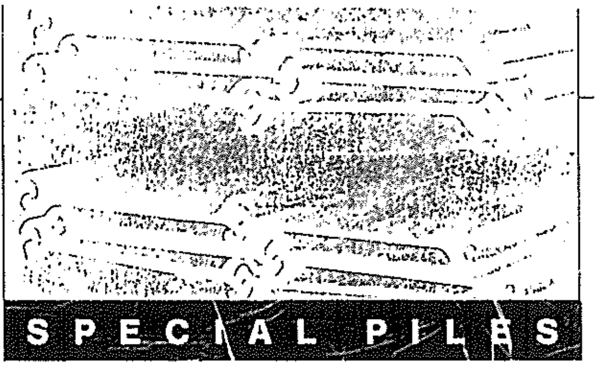
STRAIGHT WEB SECTIONS



Section	Nominal width L mm	Web thickness e mm	Deviation angle α°	Perimeter of a single pile cm	Steel section of a single pile cm^2	Mass per m of a single pile kg/m	**Mass per m^2 of wall** **kg/m^2**	Section modulus of a single pile cm^3	Moment of inertia of a single pile cm^4
500J-9,5	500	9,5	12	139	80,9	63,5	127	45	167
500J-12	500	12,0	6	139	93,0	73,0	146	47	180
500J-12,5	500	12,5	4	139	94,9	74,5	149	47	180

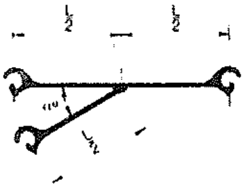
Note : All the sections interlock together.



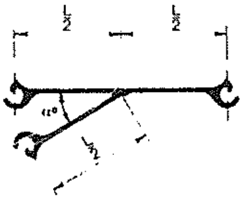


Junction Piles

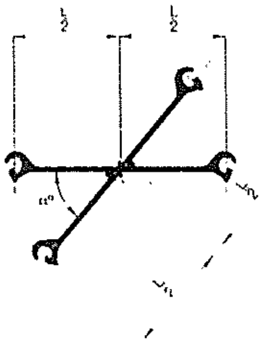
In general the assembling of the junction piles is done be welding, nevertheless other types of assembling are possible (bolting, riveting...).



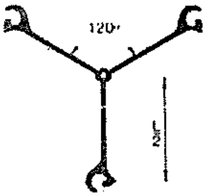
BI



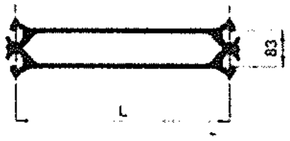
BP



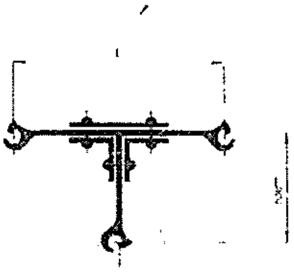
X



Y



E



TP

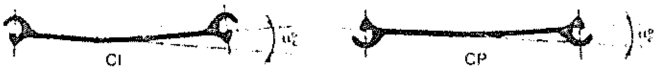
The connecting angle α should be in the range from 30° to 45° (or 120 to 135°) for a pile length of more than 15 m.

Section	Mass kg/m* TI-TP	BI-BP	X-E	Y
500J-9,5	146	95	127	95
500J-12	160	110	146	110
500J-12,5	-	112	149	112

* The mass shown in the table does not take into account the mass of the welds.

Bent Pile

If deviation angles exceeding the values given in the table page 27 have to be realised, piles pre-bent in the mill may be used.



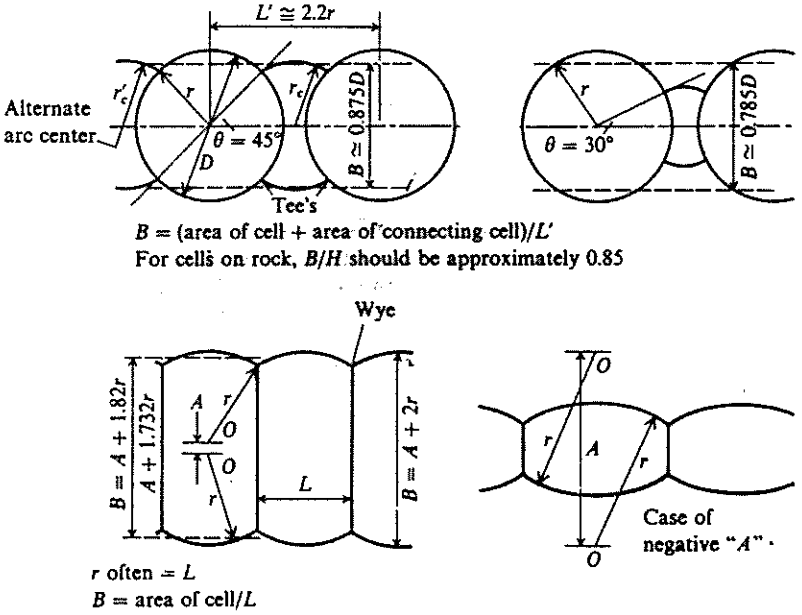
Normal angle of bending : $\alpha_c = 8°$

remove the water which percolates through and beneath the cell wall from the differential water head, a reasonably dry work area is made.

Cellular cofferdams may also be used for structures such as breakwaters and retaining walls, or the cells may be built out into the water to function as a pier-type structure. In these cases the cell fill may function as the base for a road, railroad, or warehouse.

The circular cells (Fig. 15-1*a*) consist of circles of different radii (occasionally of the same radius) intersecting as shown. The cell intersection angle is usually between 30 and 45° (Fig. 15-3). The joint is often a tee, i.e., the intersection angle is 90°, but other angles can be used. A 30° angle on the connector has been used, and may be a better solution for large-diameter cells where high tee stresses will exist.

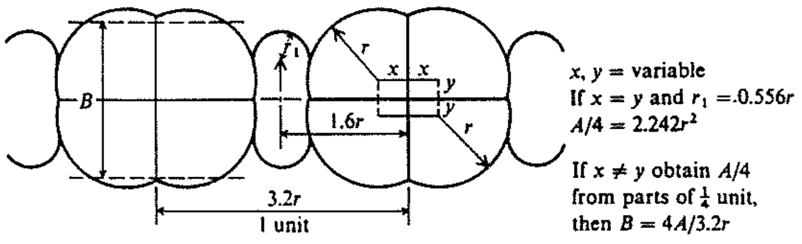
FIGURE 15-3 Cellular cofferdam dimensions and definitions of terms used in design equations.



B = (area of cell + area of connecting cell)/L'
For cells on rock, B/H should be approximately 0.85

r often = L
B = area of cell/L

(*a*) Dimensions of cellular cofferdams.

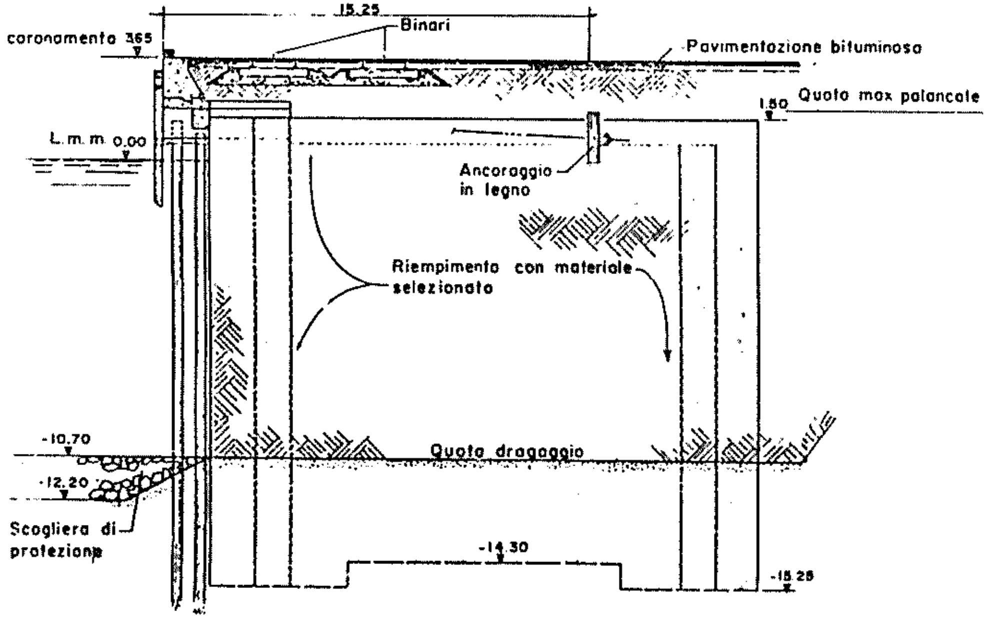


x, y = variable
If $x = y$ and $r_1 = 0.556r$
$A/4 = 2.242r^2$

If $x \neq y$ obtain $A/4$ from parts of $\frac{1}{4}$ unit, then $B = 4A/3.2r$

(*b*) Cloverleaf cell.

Fig.19 COFFERDAMS A PIANTA CIRCOLARE



PORTO ELIZABETH (NEW JERSEY)

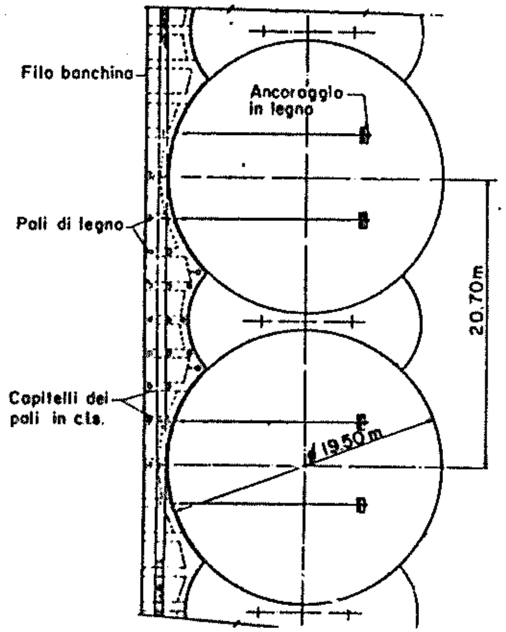
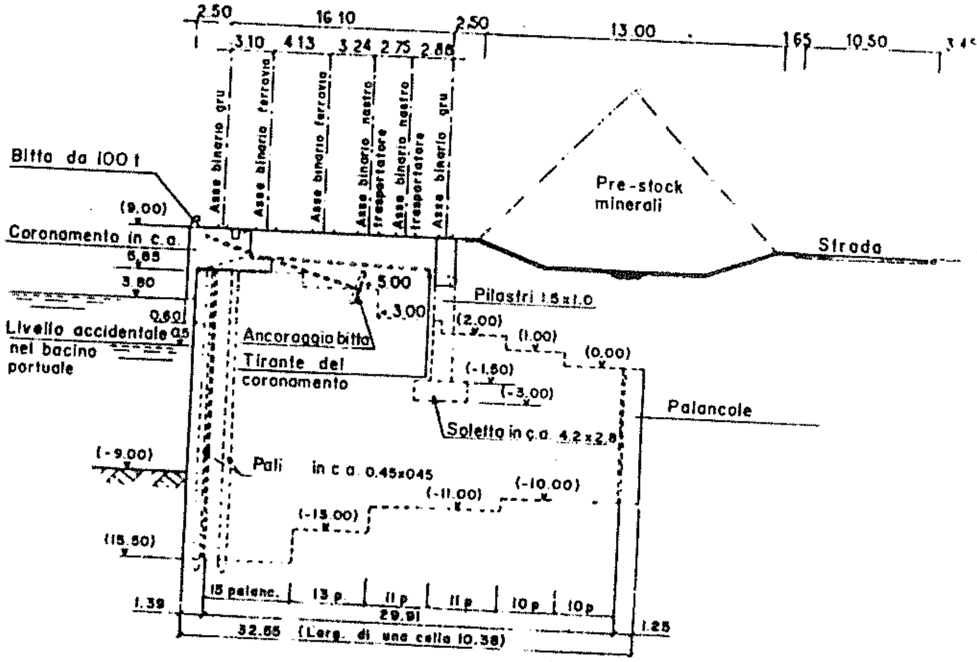
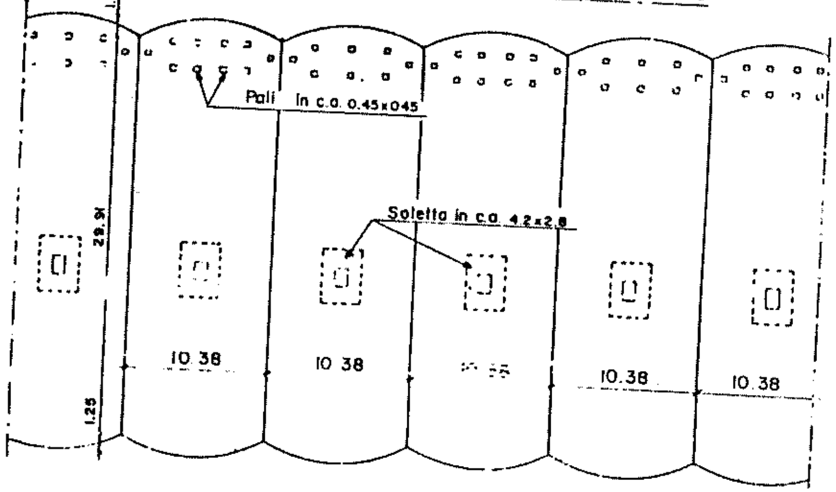


Fig.20 COFFERDAMS CON PARETI-TIRANTE

(Porto di Dunkerque)



SEZIONE ORIZZONTALE A QUOTA -1.00

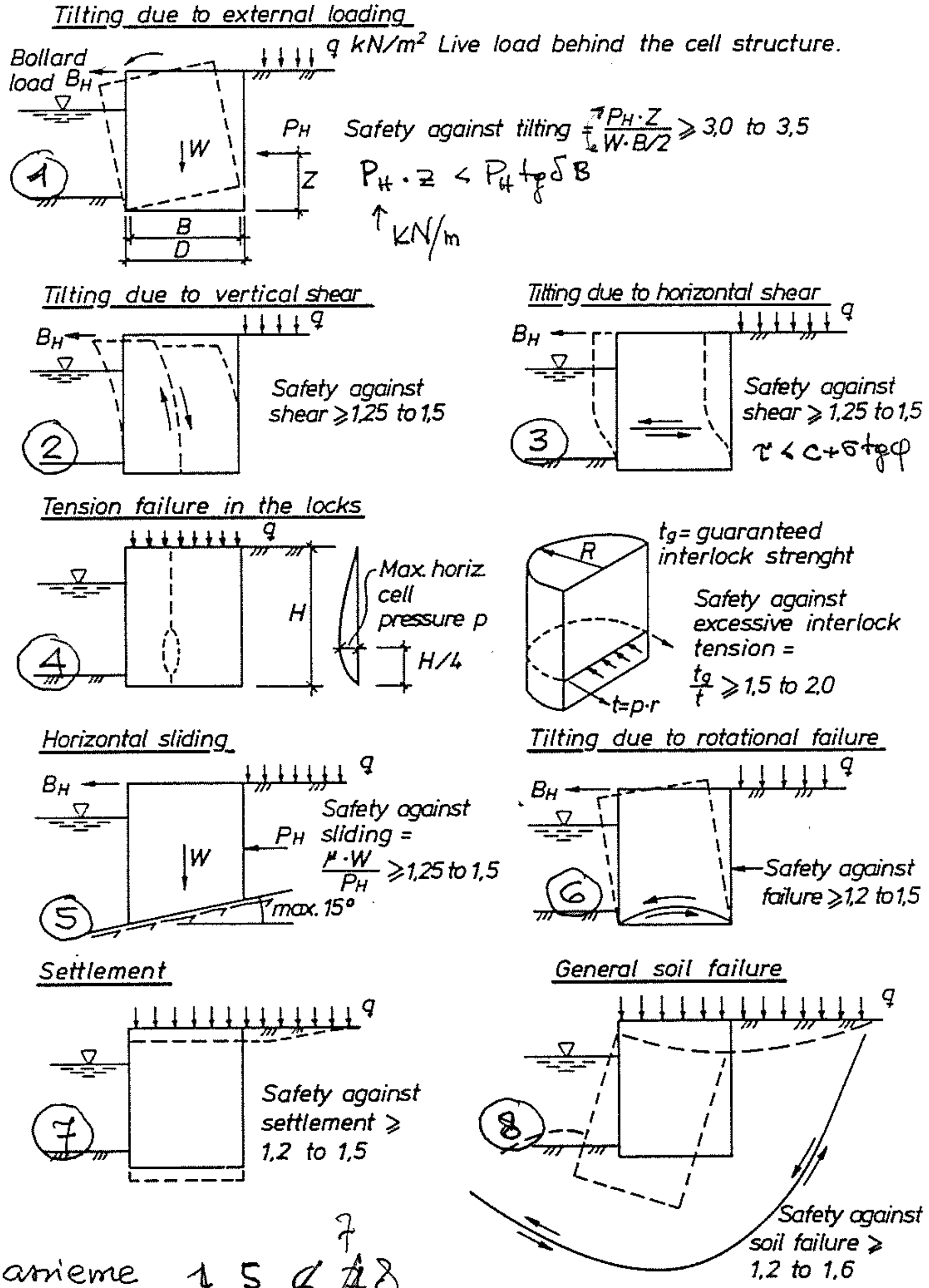


l connec-
normally
flat steel
eight per

etain the
ength of
eel sheet
g on the
angular
distances
are pub-
ar cells is

ads. The
virtually
s is there-

according
.3.C. This
h quality

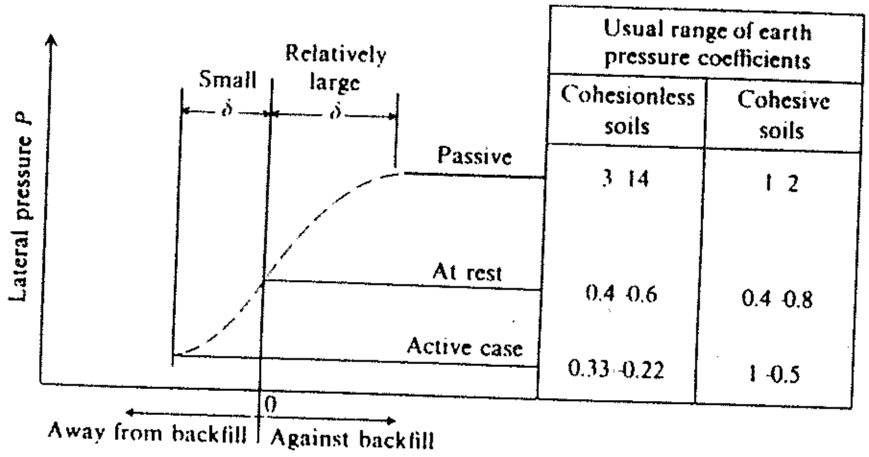


7
Stabilità d'assieme 1 5 ~~6~~ ~~7~~ 8

Fig. 3.5.2.3.D Modes of cell failure

Stabilità del monolite

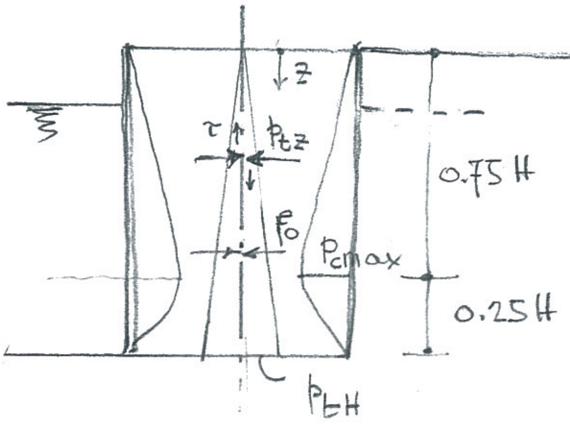
terreno 3 6 ~~7~~ (terreno del gabbione!)
cortina metallica (giunti) 4
cortina + terreno 2



Usual range of earth pressure coefficients	
Cohesionless soils	Cohesive soils
3-14	1-2
0.4-0.6	0.4-0.8
0.33-0.22	1-0.5

FIGURE 11-3 Illustration of active and passive pressures with usual range of values for cohesionless and cohesive soil.

GABBIONI - CELLULAR COFFERDAMS - CELL QUAYS



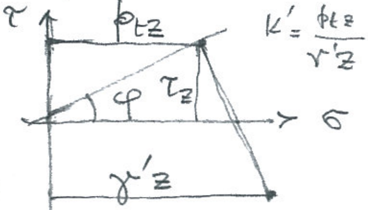
Pressioni:

- Sul cilindro : $p_{cmax} = \gamma'(0.75\,H)\,K_a$

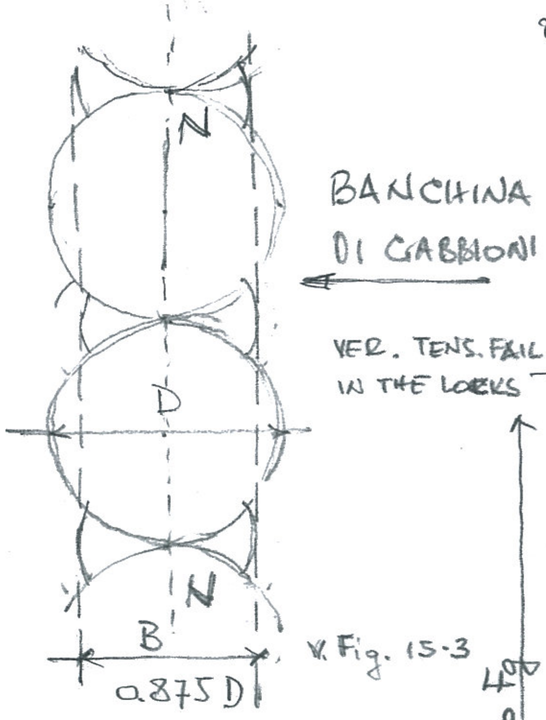
L'andamento è dovuto alla def. del cil.

- Sulla faccia del terreno NN alla q. z

$$p_{tz} = \gamma' z K' \qquad K' = \frac{\cos^2\varphi}{2-\cos^2\varphi} \approx 0.5 \quad (\varphi = 35°)$$



NB. Il triangolo delle p_z è portato per semplicità fino alla superficie



BANCHINA DI GABBIONI

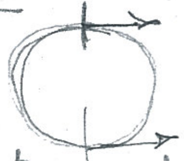
VER. TENS. FAIL. IN THE LOCKS

V. Fig. 15-3

- Sulla faccia NN alla base : $p_{tH} = \gamma' H K'$

Trazione massima sul giunto

$$t_{gmax} = p_{cmax} \cdot \frac{D}{2} \quad kN/m$$



Risultante delle trazioni nell'intero giunto =

$$T_g = t_{gmax} \cdot H/2$$

Calcolo F_g

Forza di attrito per scorrimento giunto

$$S_g = T_g\,\mu \quad kN \; ; \; \mu = \text{coeff att. scorr. giunto} = 0.3$$

Forza di attr. per scorr. giunto per m di banchina (riportato a

$$\boxed{F_g} = S_g/(D/2) \quad kN/m$$

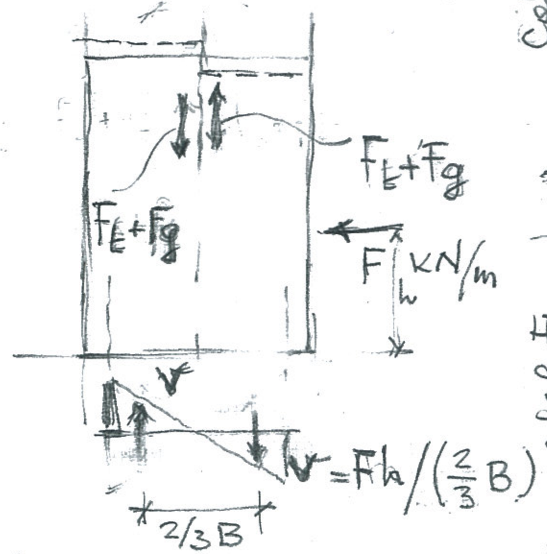
Calcolo F_t

Forza per m di banchina sulla faccia NN

$$S_t = \frac{1}{2}\,p_{tH}\,H \quad kN/m$$

Forza per m di banchina che si oppone allo scorrimento reciproco sulla NN

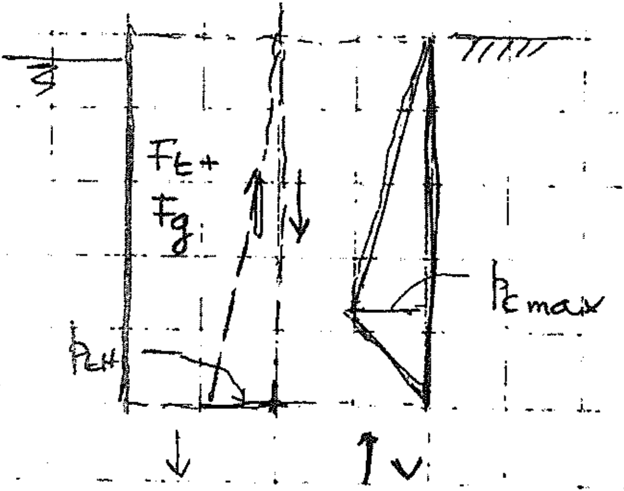
$$\boxed{F_t = S_t\,tg\,\varphi} \quad kN/m$$



$$V = F_h / \left(\tfrac{2}{3}B\right)$$

VERIFICA AL TILTING DUE TO VERTICAL SHEAR

$$F_g + F_t > V \quad (\text{coeff. sic. min. } 1.25)$$



$H = 15$ m $D = 12$ m $B = 10.5$ m

$\gamma' = 11$ kN/m³ $\varphi = 30°$ $\delta \neq 0$

$K_a = 0.33$ $K' = 0.6$ $\tan\varphi = 0.577$

$\delta \simeq \varphi$

$p_{c\,max} = 11 \times 0.75 \times 15 \times 0.33 = 41$ kN/m²

$t_{g\,max} = 41 \times 12/2 = 246$ kN/m   verifica del giunto

$T_g = 246 \times 15/2 = 1{,}845$ kN

$S_g = 1845 \times 0.3 = 554$ kN

$F_g = 554/(12/2) = 92$ kN/m di banchina

$p_{tH} = 11 \cdot 15 \cdot 0.6 = 99$ kN/m²

$S_t = 1/2 \cdot 99 \cdot 15 = 743$ kN/m

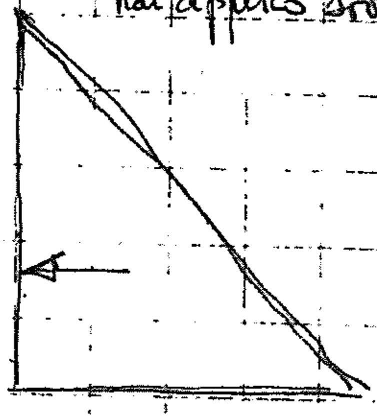
$F_t = 743 \cdot 0{,}577 = 429$ kN/m di banchina

$F_g + F_t = 521$ kN/m di banchina

$V = 291$ kN/m di banchina

$SF = 521/291 = 1.8$ OK

non applico δ0.



$S_{\text{spinta}} = \frac{1}{2}\, 11 \cdot 0.33 \cdot 15^2 = 408$ kN/m

$M_{om} = 408 \cdot 15/3 = 2040$ kN·m/m

$V = 2040 / \left(\frac{2}{3}\, 10.5\right) = 291$ kN/m