

2-57 a, b, c



VAKGROEP
WATERBOUWKUNDE
Afd. Civiele Techniek
TH Delft

2-57

Ontwerp van doorlaatcaissons
en een geprefabriceerde uitwateringssluis
t.b.v. het Asan Paal project
in Zuid Korea

G.J. Bosselaar

Hoofdontwerp Constructieve Waterbouwkunde
bij prof.ir. J.F. Agema

onder begeleiding van
ir. C.P. Bourguignon

FIGURENBOEK

Ontwerp van doorlaatcaissons
en een geprefabriceerde uitwateringssluis
t.b.v. het Asan Paai project
in Zuid Korea

G.J.Bosselaar

Hoofdontwerp Constructieve Waterbouwkunde
bij prof.ir. J.F. Agema

onder begeleiding van
ir. G.P. Bourguignon

FIGURENBOEK

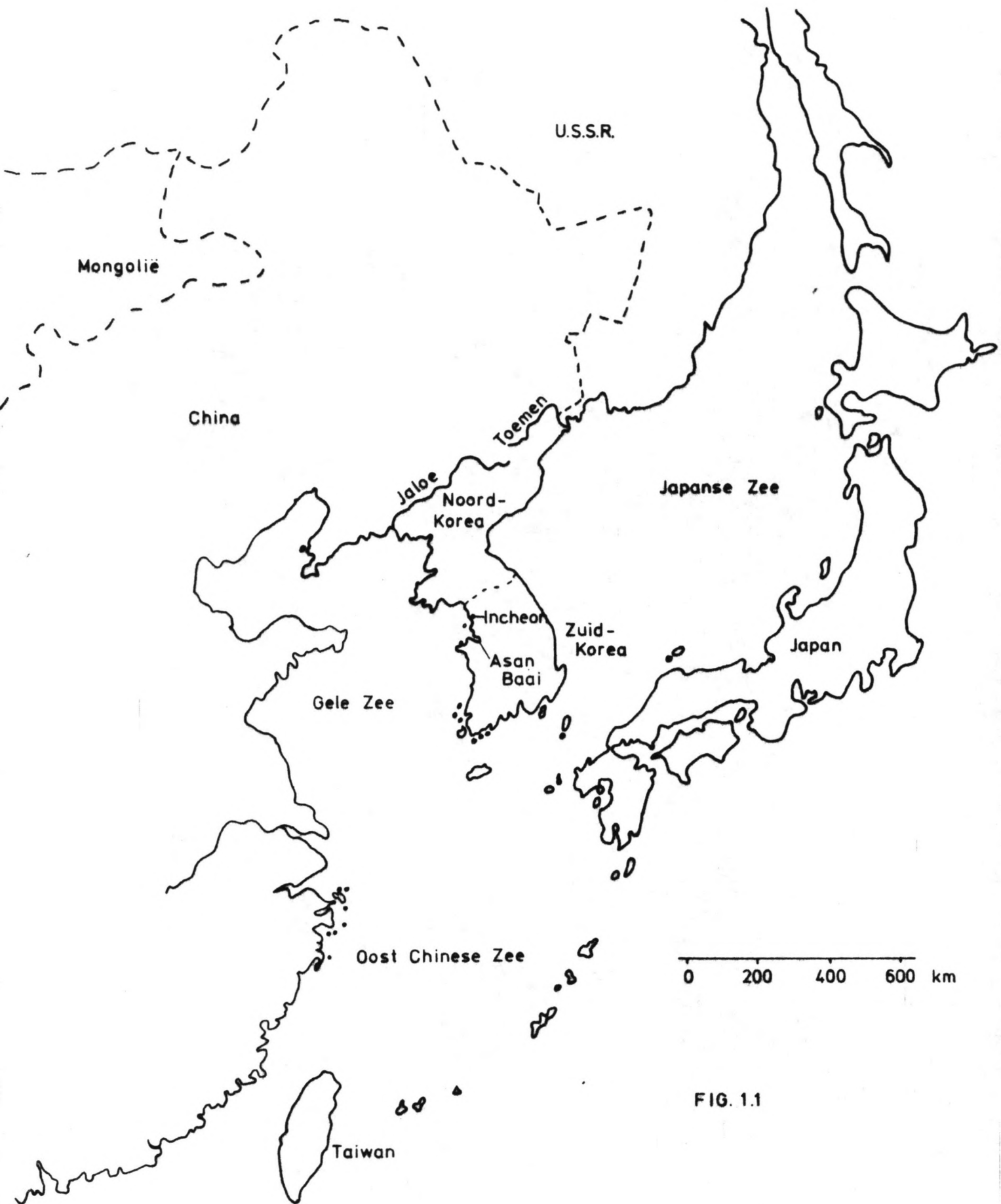


FIG. 1.1

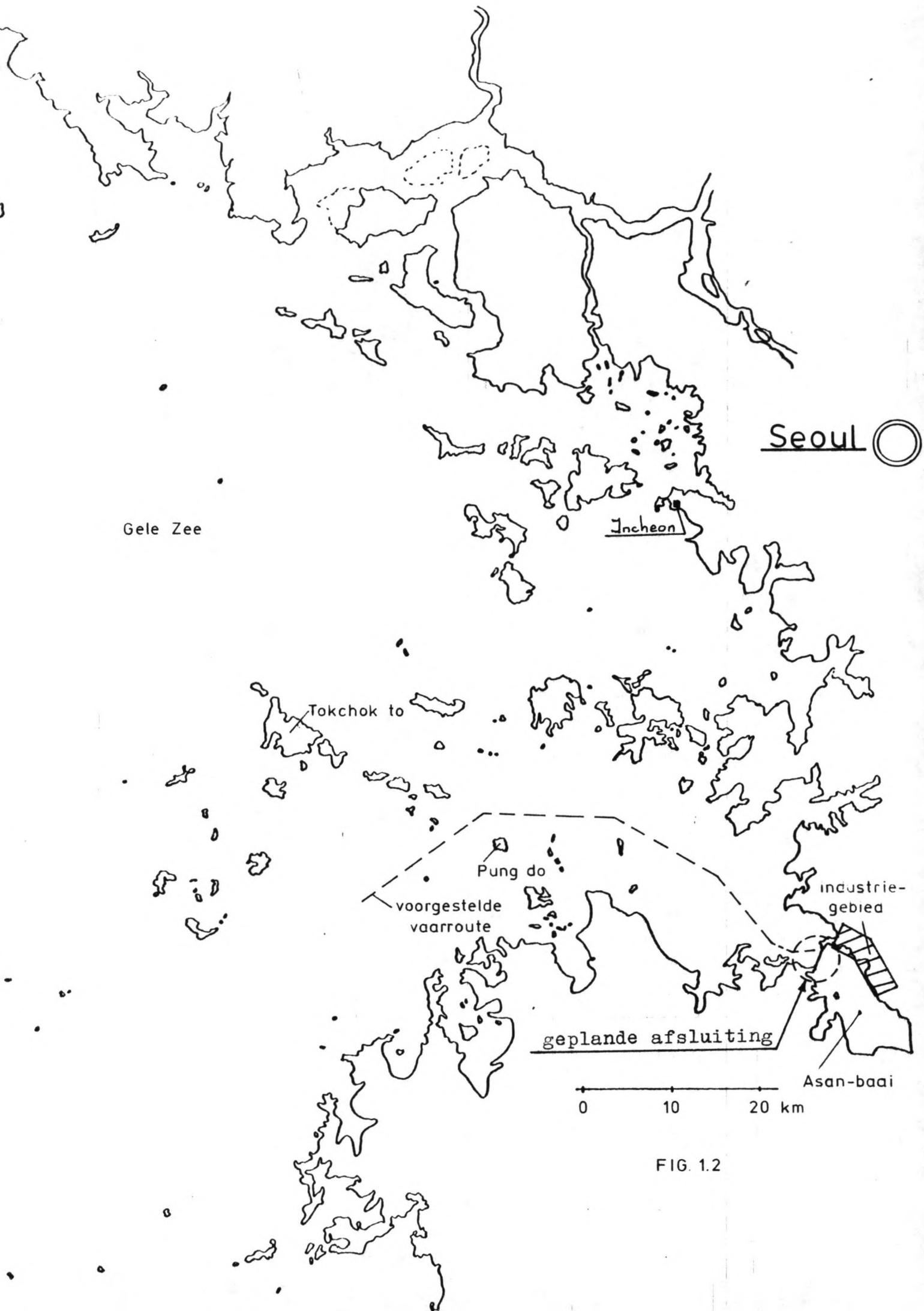


FIG. 1.2

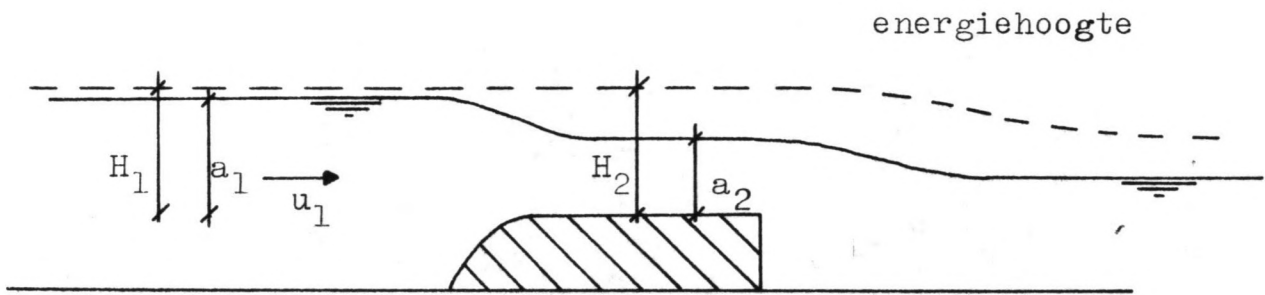


fig. 2.3.1 Volkomen overlaat

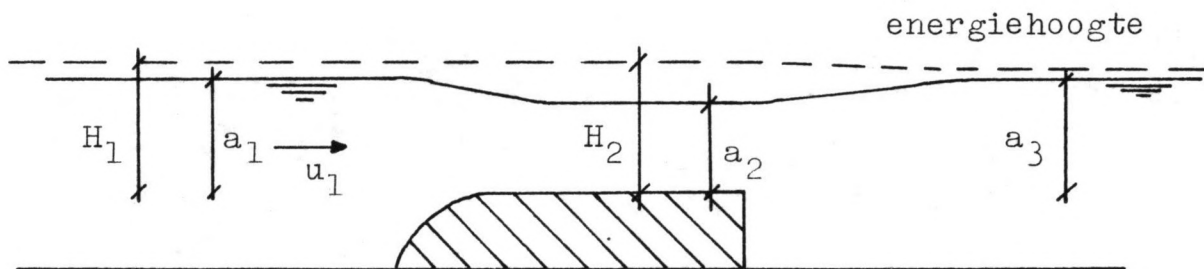
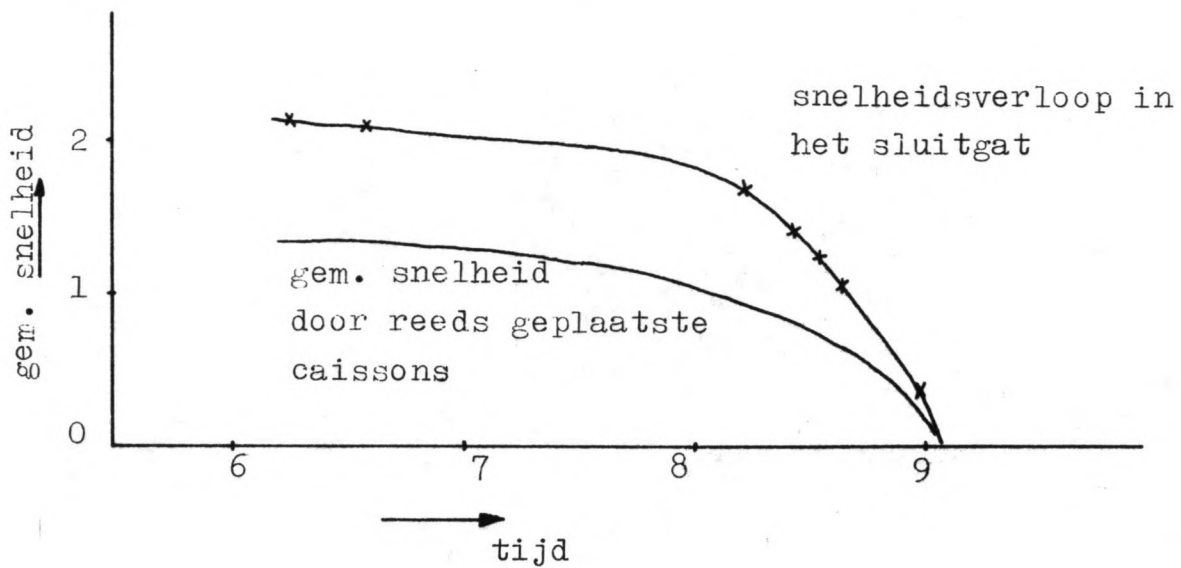


fig. 2.3.2 Onvolkomen overlaat

| literatuur- verwijzing | omschrijving | afvoer- coëfficiënt |
|---------------------------|--|------------------------|
| lit. 6 nr. 59 | Volkerak uitwaterings- sluis (2 onderzochte typen) | = 0,95 = 1,5 |
| lit. 6 nr. 52 | Haringvliet uitwate- ringsluis bij eb: bij vloed: | = 1,15 = 1,0 |
| lit. 6 nr. 71 | spui- inlaatsluis Brouwersdam | = 1,5 |
| lit. 8 blz. 78 | ontwerp stormstuw- caissondam in de Oosterschelde | = 0,85-0,95 |
| lit. 6 nr. 58 | Lauwerszee doorlaat- caisson (drempelniveau: NAP -6) | = 0,6-0,7 |
| lit. 6 nr. 58 | Volkerak doorlaat- caisson (drempelniveau: NAP -7) | = 0,75-0,8 |
| lit. 6 nr. 58 | Brouwershavense gat doorlaatcaisson (drempelniveau: NAP -10) | = 0,8-0,85 |
| lit. 7 1972 nr. 12 | ontwerp doorlaatcaisson Oosterschelde (drempelniveau: NAP -16) | = 1,0 |

fig. 2.3.3 Overzicht afvoercoëfficiënten



| | tijd | stroomsnelheid op de drempel |
|--|------|------------------------------|
| Vertrek uit het bouwdok | 6.15 | 2,17 m/sec |
| Caisson geparkeerd op stroom | 6,35 | 2,12 m/sec |
| Begin opvaren, afstand tot de drempel 350 m. | 8.13 | 1,70 m/sec |
| Voorzijde caisson ter hoogte van de drempel | 8.26 | 1,37 m/sec |
| Scharnierpunt gereed, caisson 60° ingedraaid | 8.32 | 1,20 m/sec |
| Caisson 90° ingedraaid | 8.37 | 1,07 m/sec |
| Sein afsluiters open draaien | 8.59 | 0,30 m/sec |
| Caisson aan de grond | 9.04 | kentering |

fig. 2.4.1 Tijdschema van de plaatsing van het 8^e Volkerak doorlaatcaisson

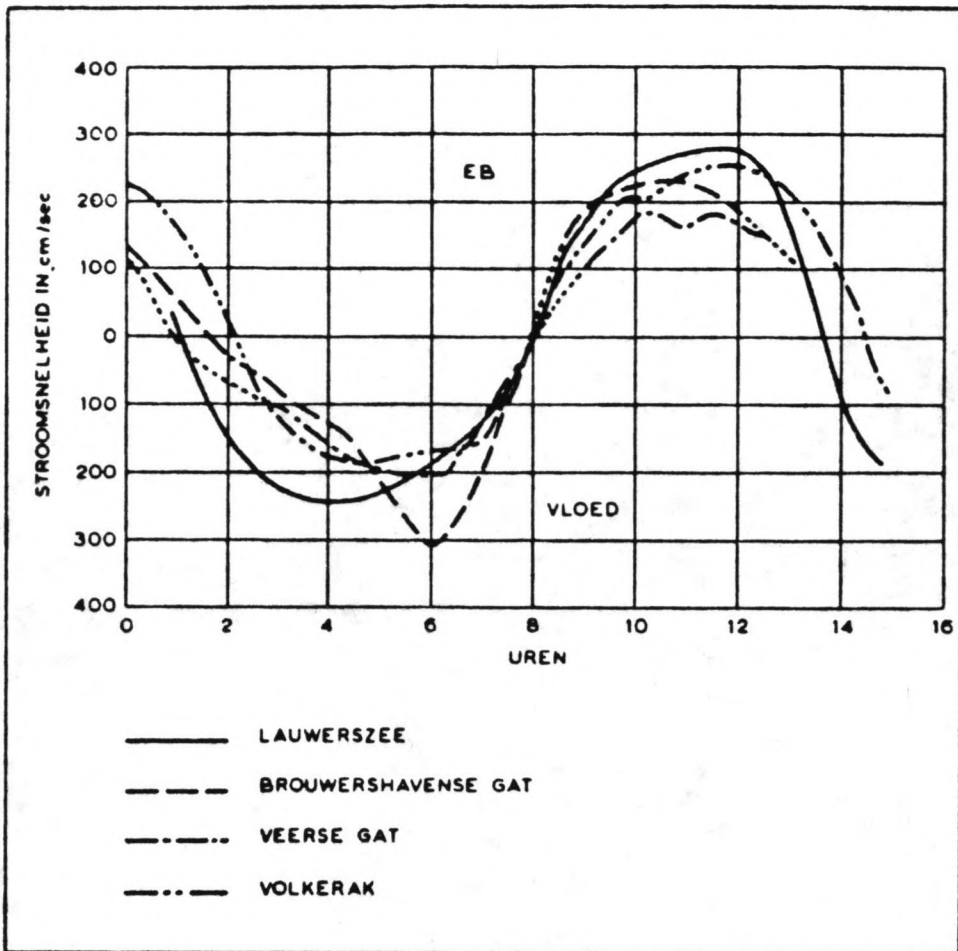


fig. 2.4.2 Snelheidsverlopen tijdens laatste caissonplaatsingen

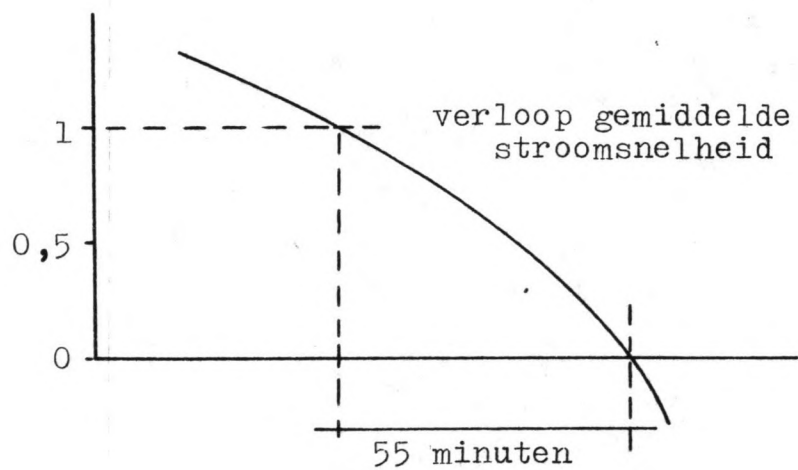


fig. 2.4.3 Plaatsingscriterium

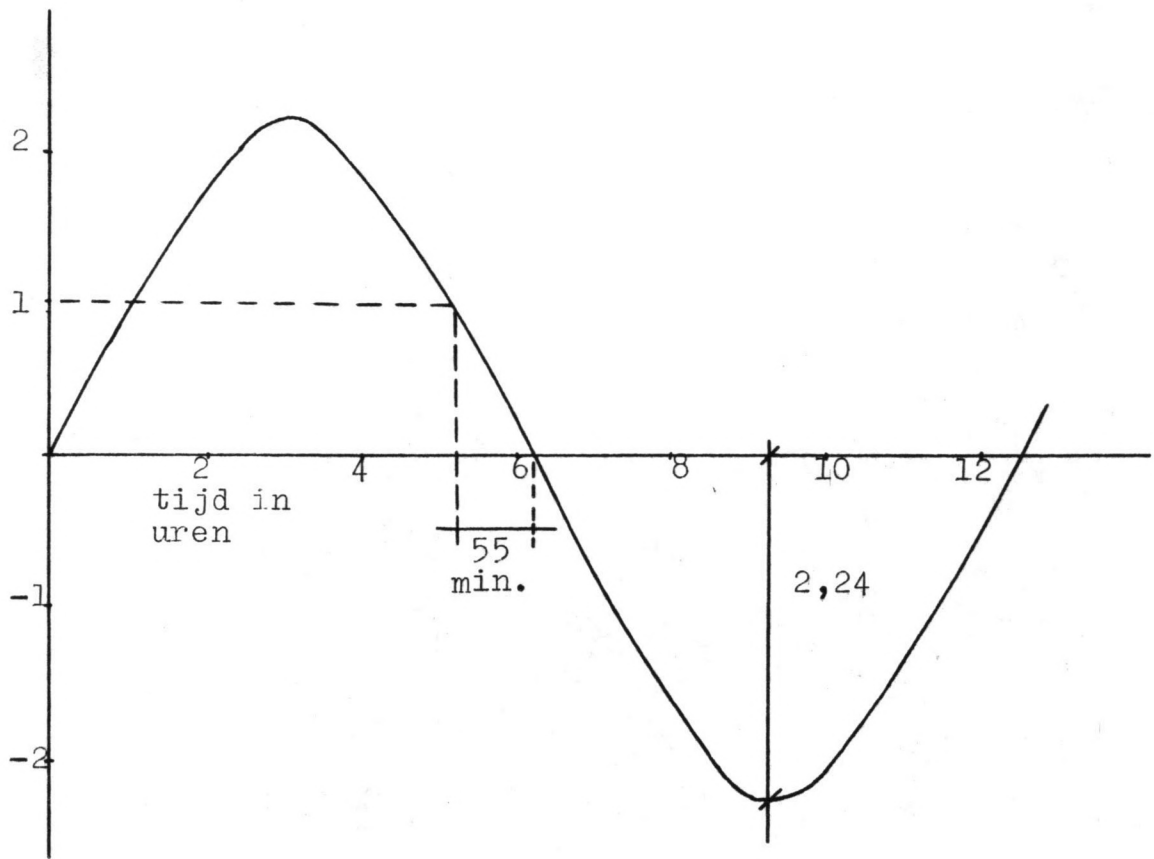


fig. 2.5.1 Verloop gemiddelde stroomsnelheid

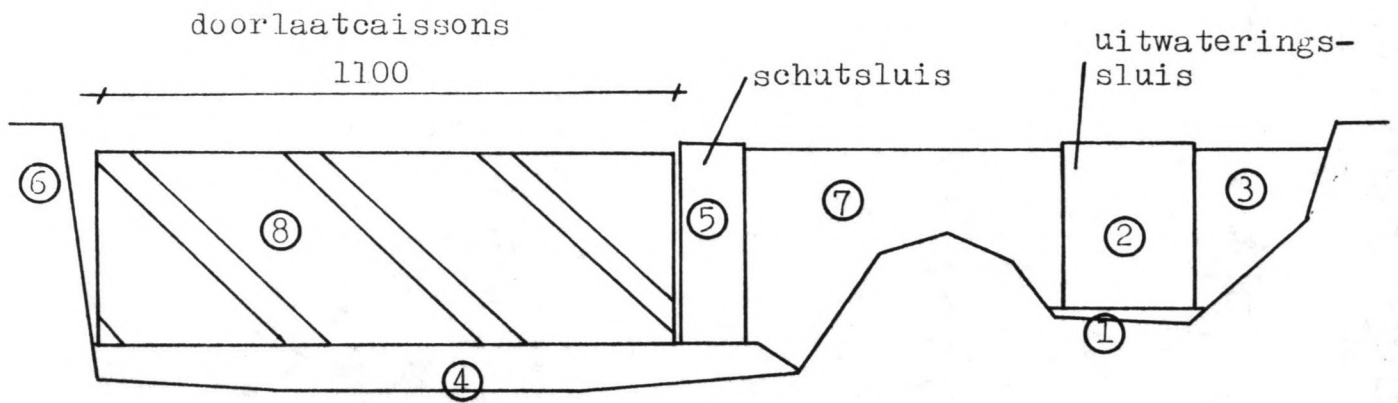


fig. 2.6.1 Traditionele caissonsluiting
(bouwvolgorde)

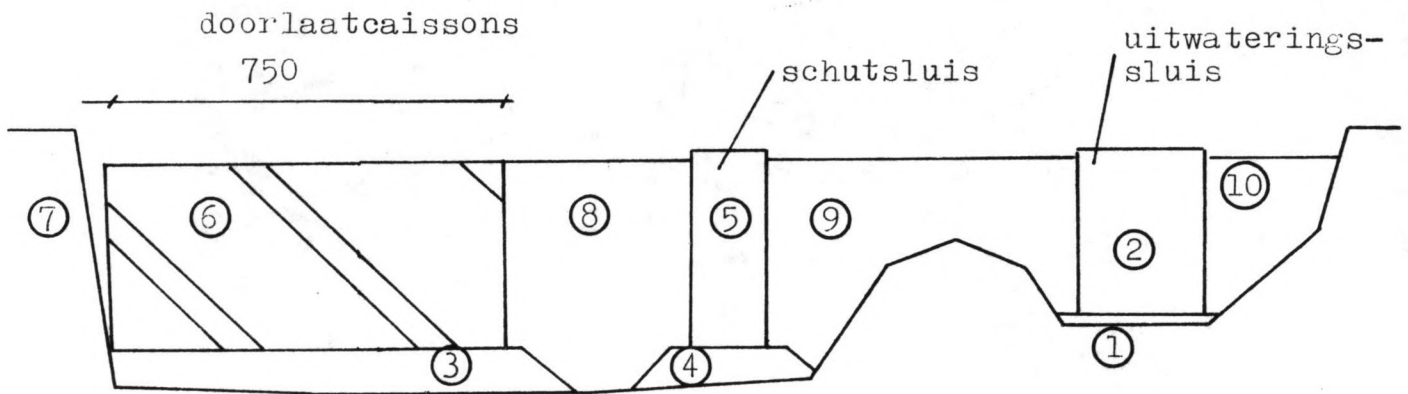


fig. 2.6.2 Alternatieve caissonsluiting
(bouwvolgorde)

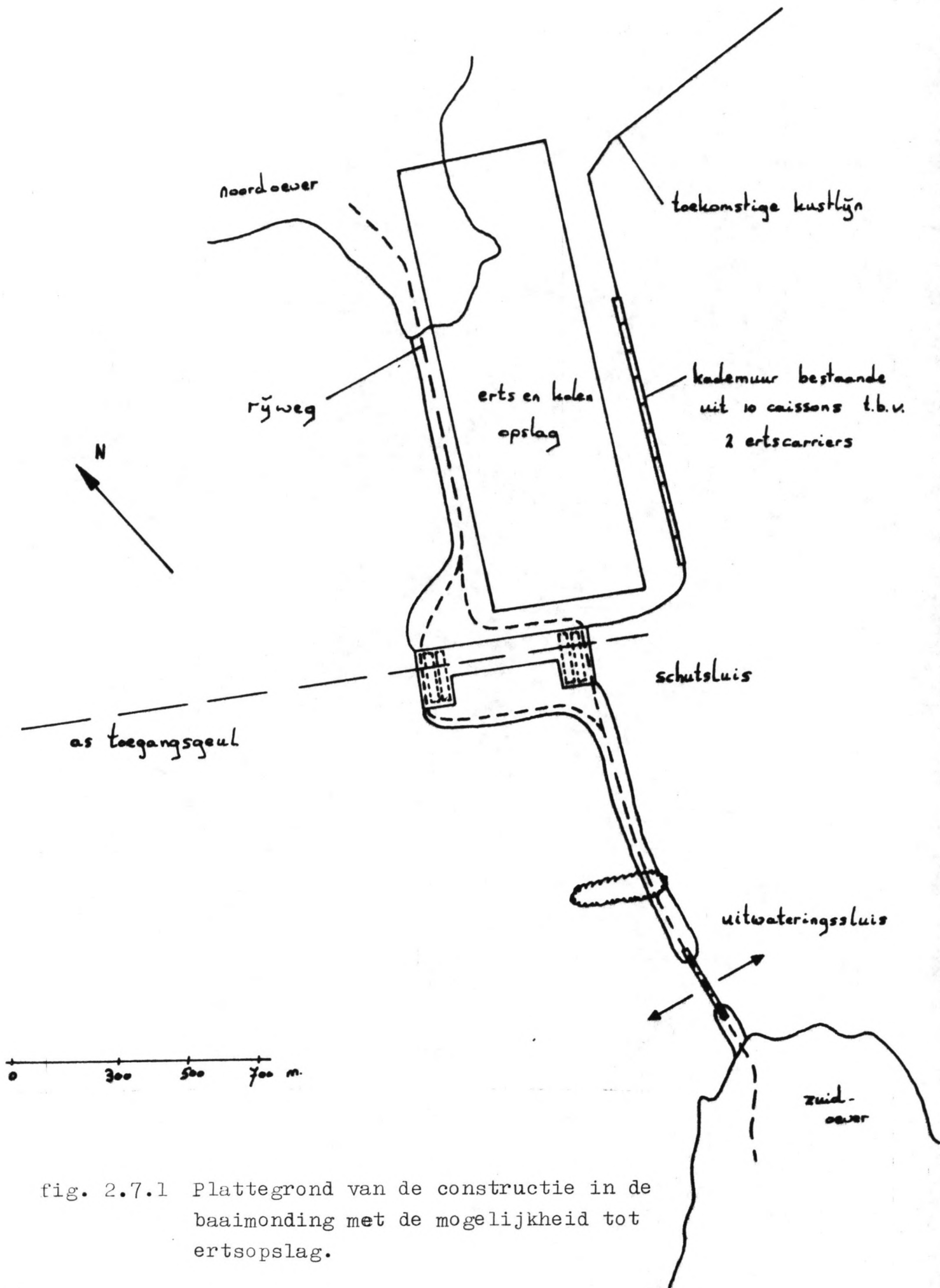


fig. 2.7.1 Plattegrond van de constructie in de baaimonding met de mogelijkheid tot ertsopslag.

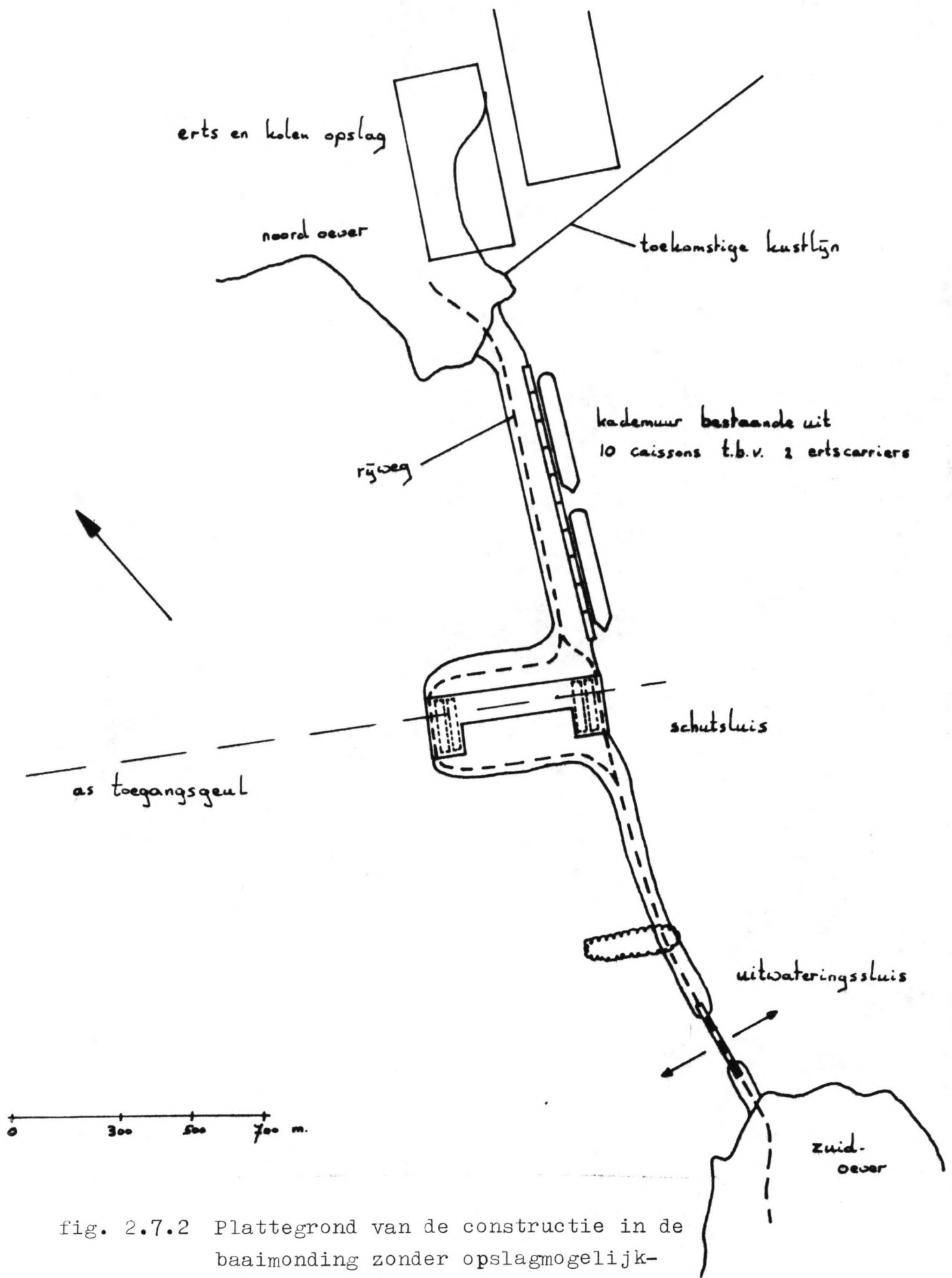
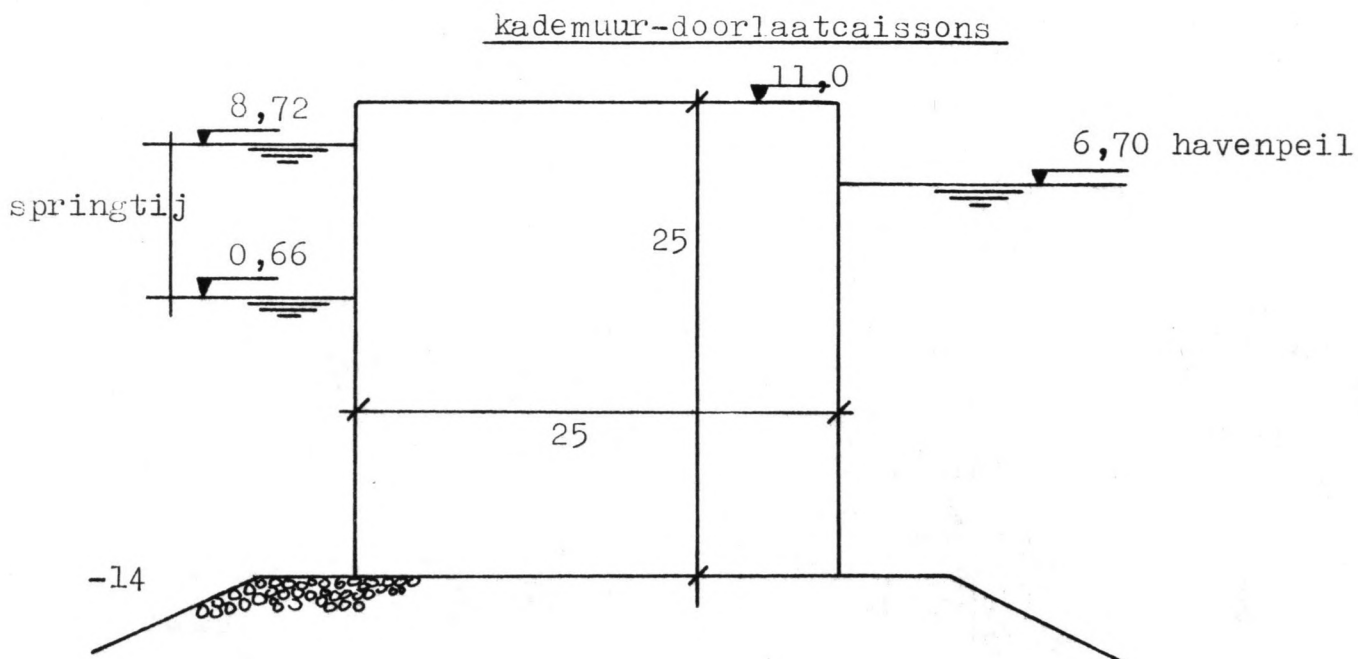


fig. 2.7.2 Plattegrond van de constructie in de baaimonding zonder opslagmogelijkheid.

hoofdafmetingen doorsnede



waterverplaatsing: ca. 32000 m³

hoofdafmetingen doorsnede

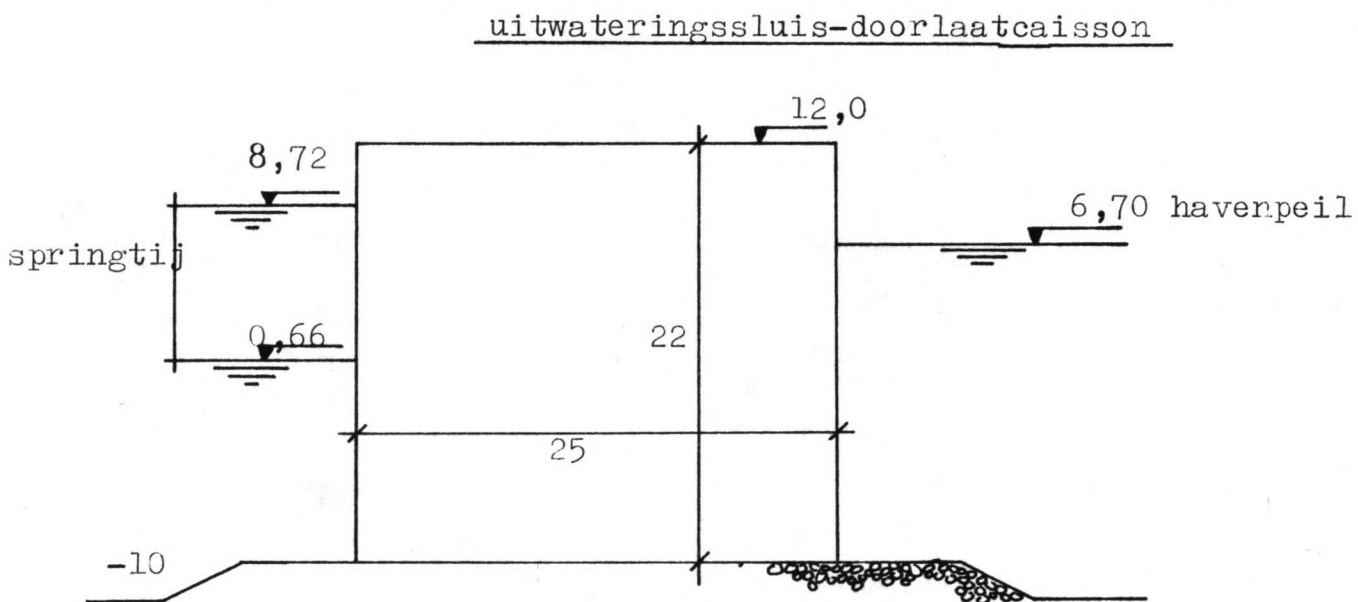
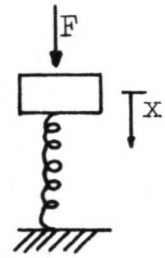
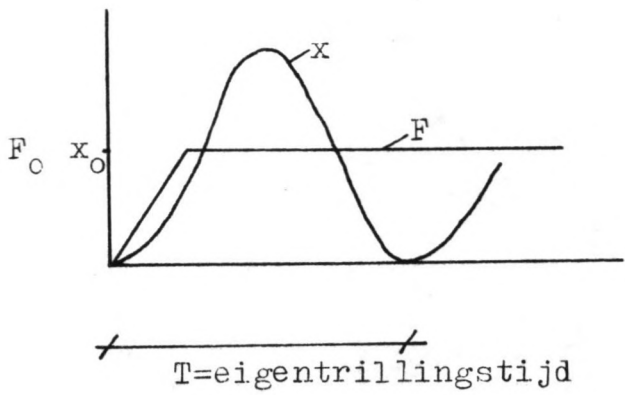


fig. 2.7.3 Hoofdafmetingen caissons



$$\text{dynamische vergrotingsfactor} = \frac{\text{ware maximale uitwijking}}{\text{max. statische uitwijking } (x_0)}$$

fig. 3.1.1 Respons éénmassaveersysteem op een snel aangroeiende belasting

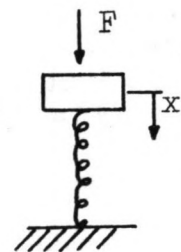
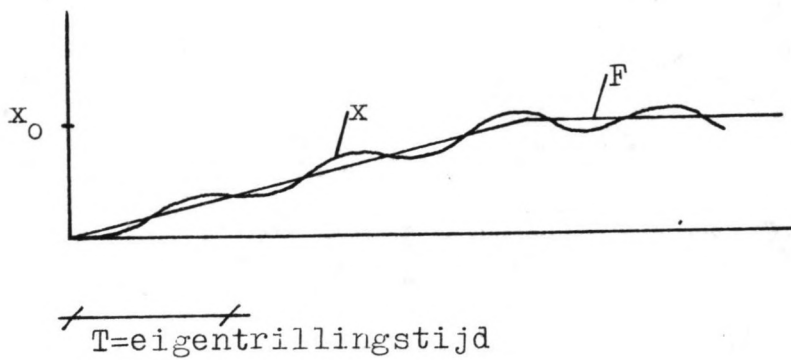


fig. 3.1.2 Respons éénmassaveersysteem op langzame veranderingen in de belasting.

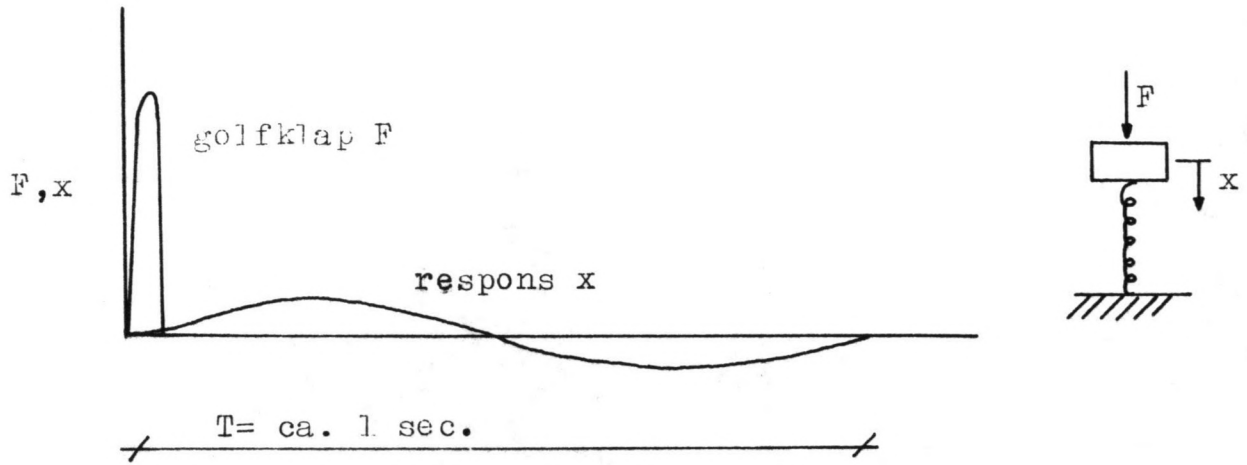


fig. 3.1.3 Respons éénmassaveersysteem op een stootvormige belasting

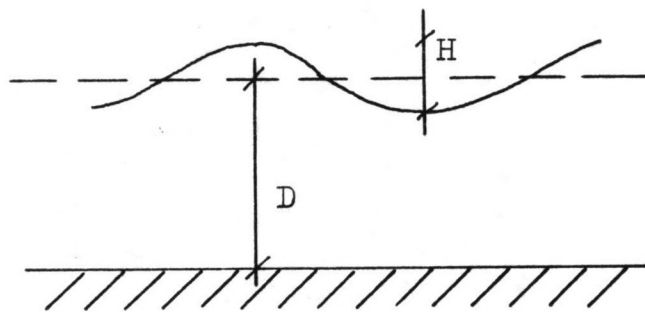
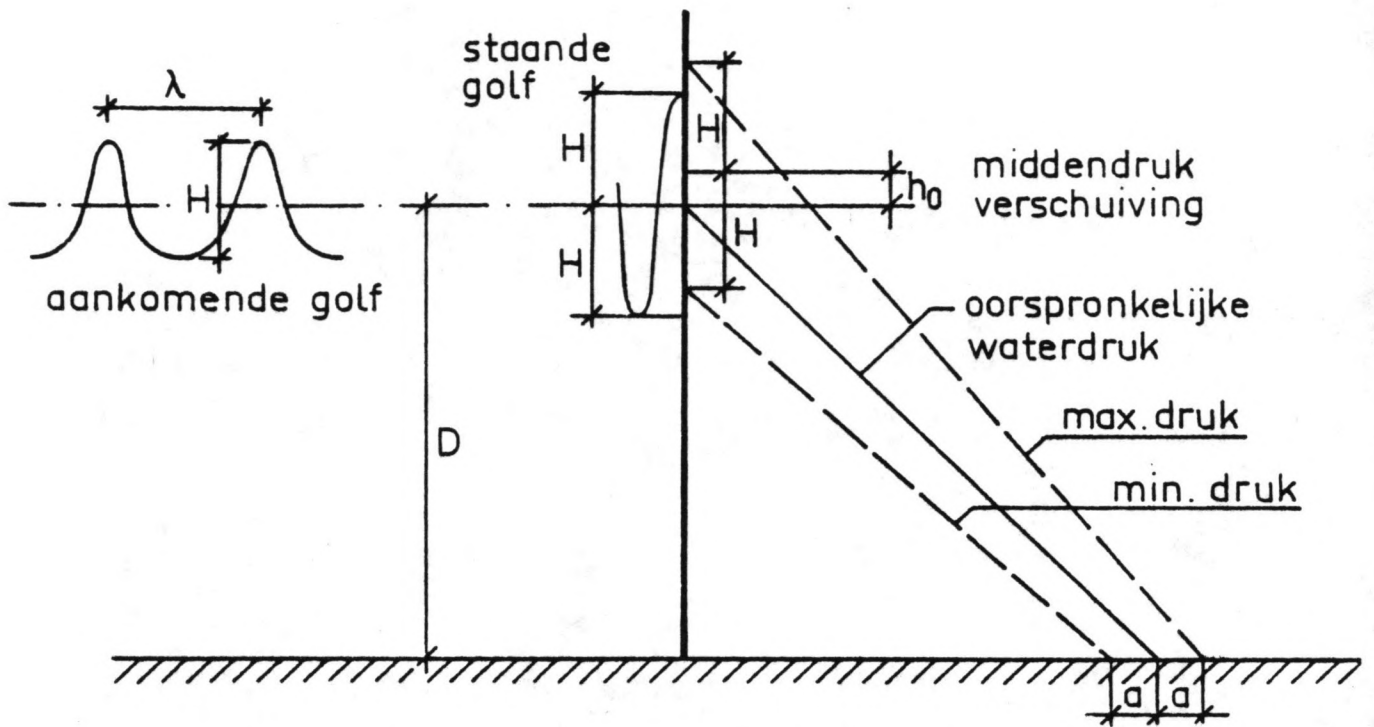


fig. 3.1.4 Breekcriterium



$$h_0 = (\pi H^2 / \lambda) \coth h(2\pi D / \lambda)$$

$$a = H / \cosh(2\pi D / \lambda)$$

fig. 3.1.5 Golfdruk volgens Sainflou

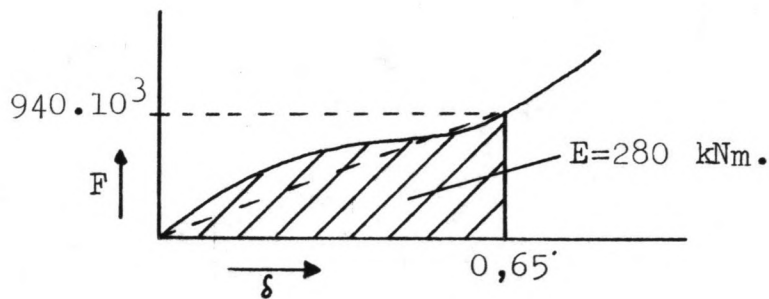


fig. 3.2.1 Energieopslag in een Giant-fender

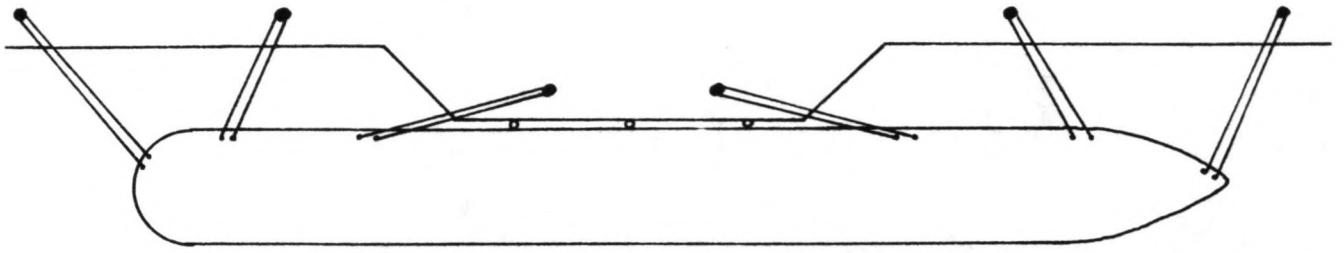


fig. 3.2.2 Voorbeeld meerplan

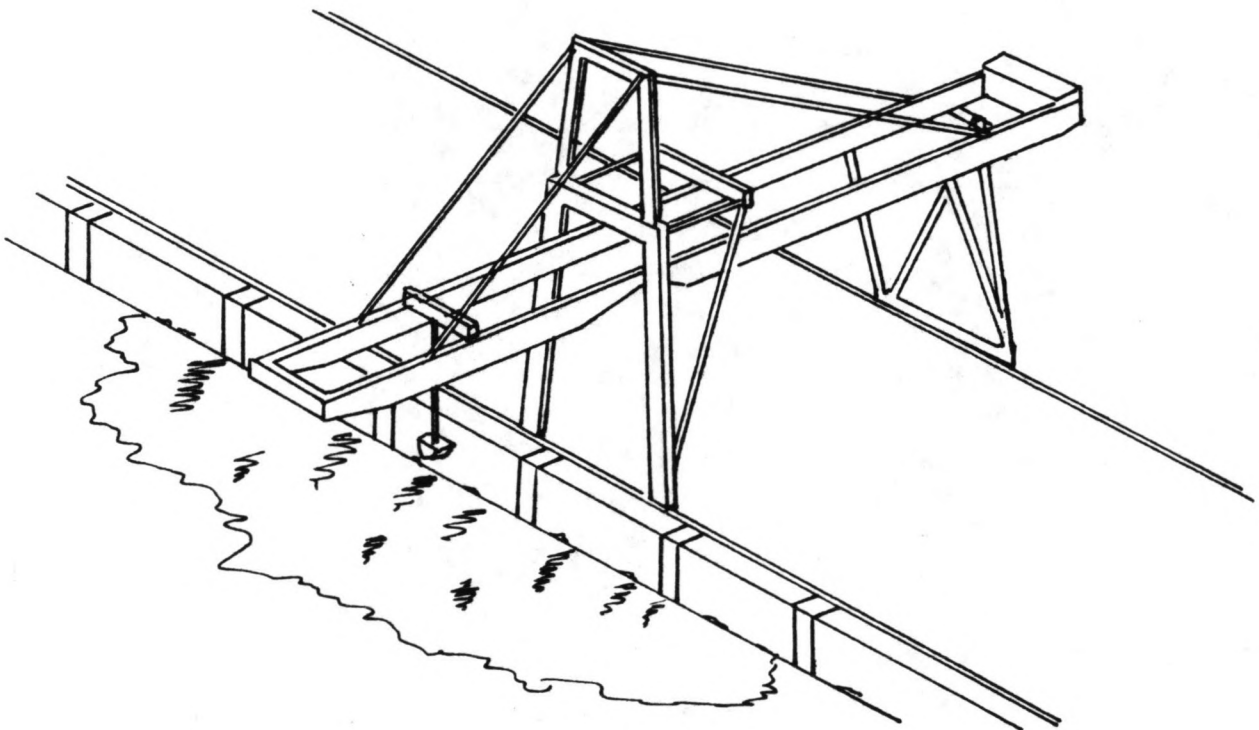


fig. 3.2.3 Voorbeeld losinstallatie

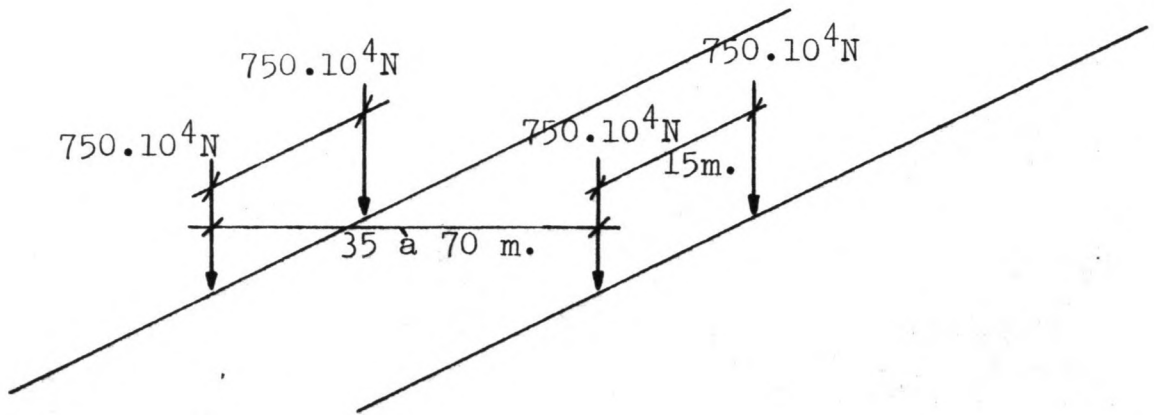


fig. 3.2.4 Geschematiseerd lastenstelsel

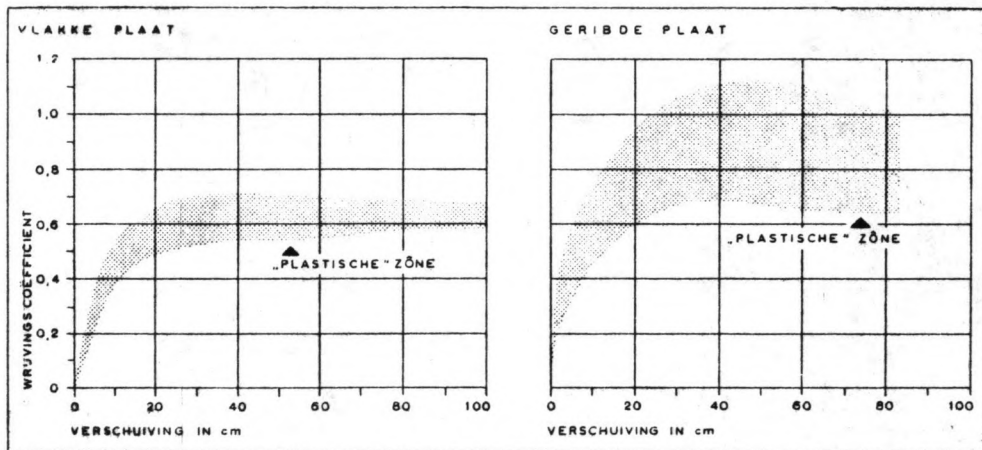


fig. 3.3.1 Wrijvingscoëfficiënt gladde en geribde plaat

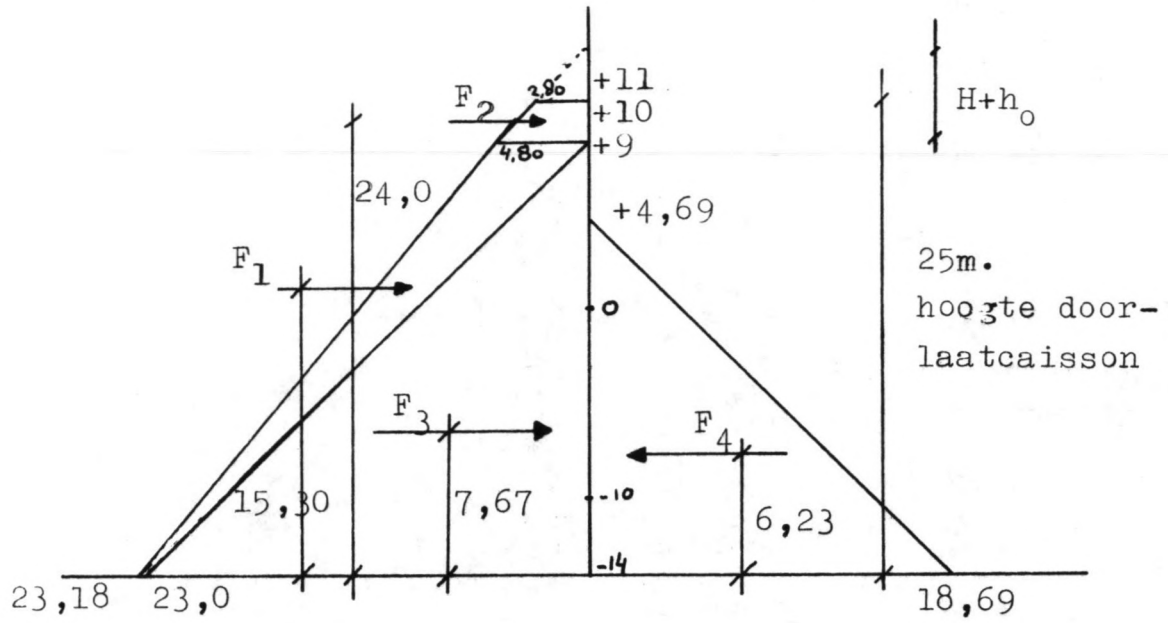


fig. 4.1.1.1 Horizontale krachten op doorlaatcaisson

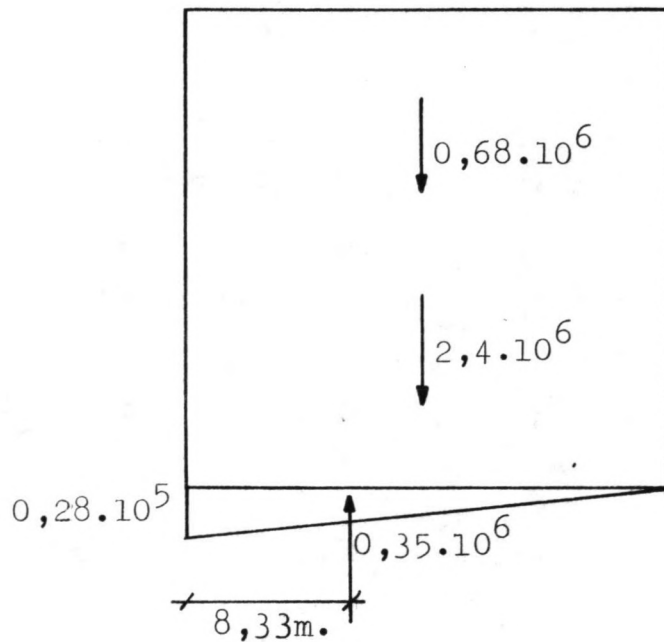


fig. 4.1.1.2 Verticale belasting doorlaatcaisson

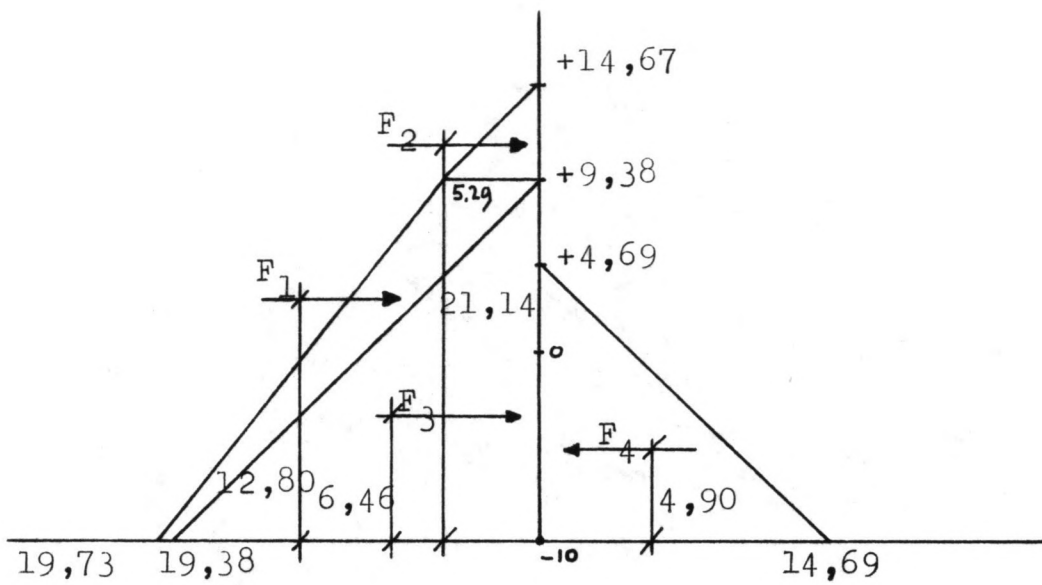


fig. 4.1.2.1 Horizontale krachten op de uitwateringssluis

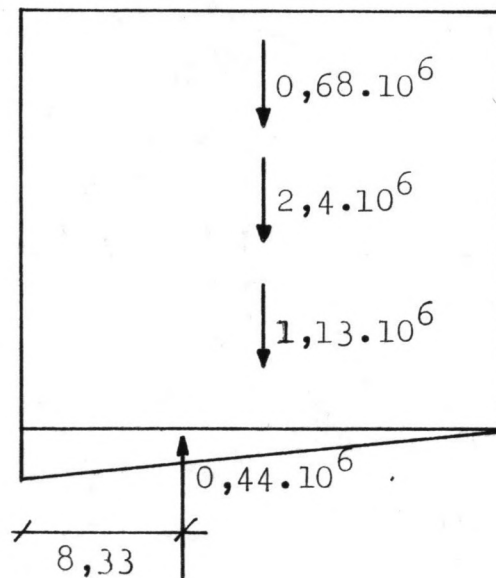


fig. 4.1.2.2 Verticale belasting uitwateringssluis

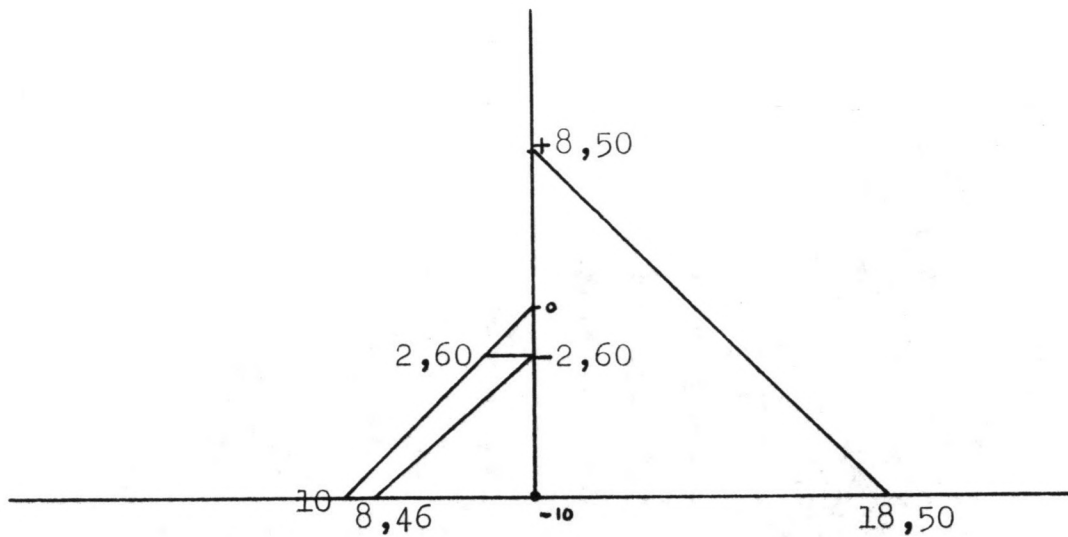


fig. 4.1.2.3 Horizontale krachten op de uitwateringssluis bij een lage buitenwaterstand

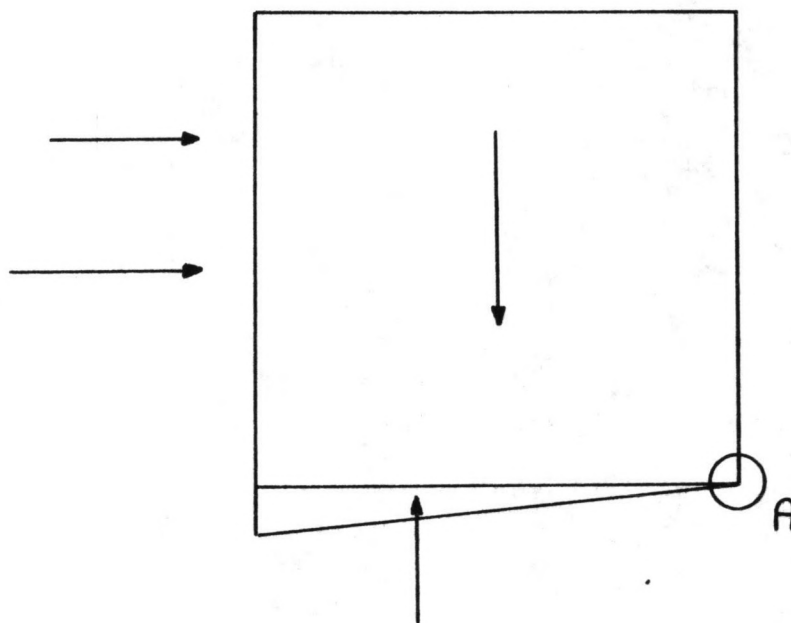


fig. 4.2.1.1 Momentenevenwicht om punt A

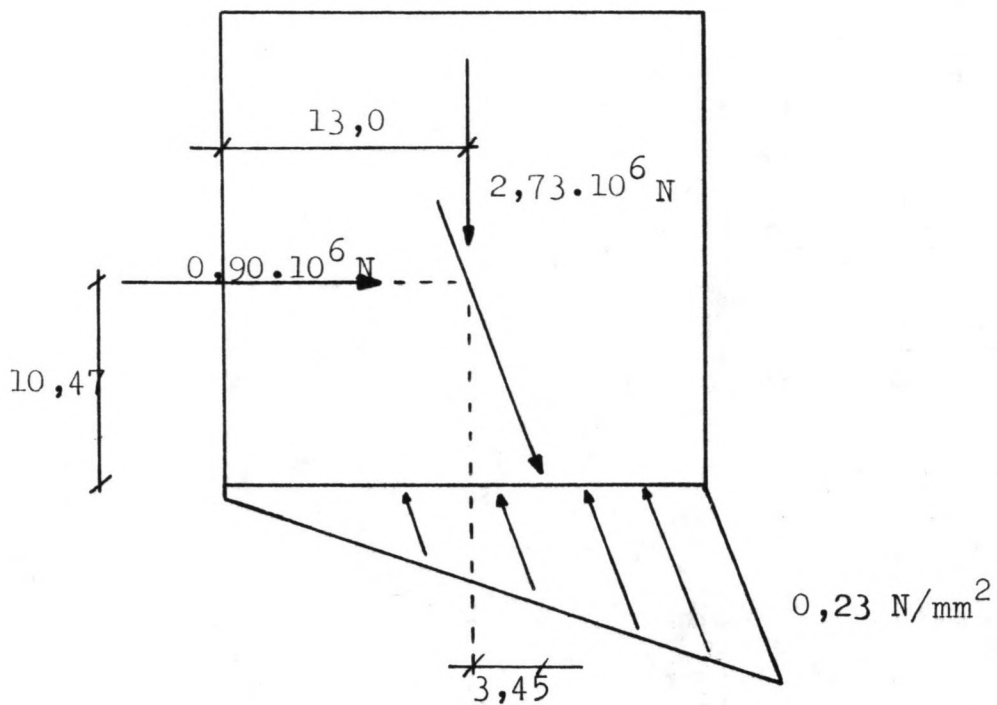


fig. 4.2.1.2 Resultante van de statische belastingen en reacties op de doorlaat caisson

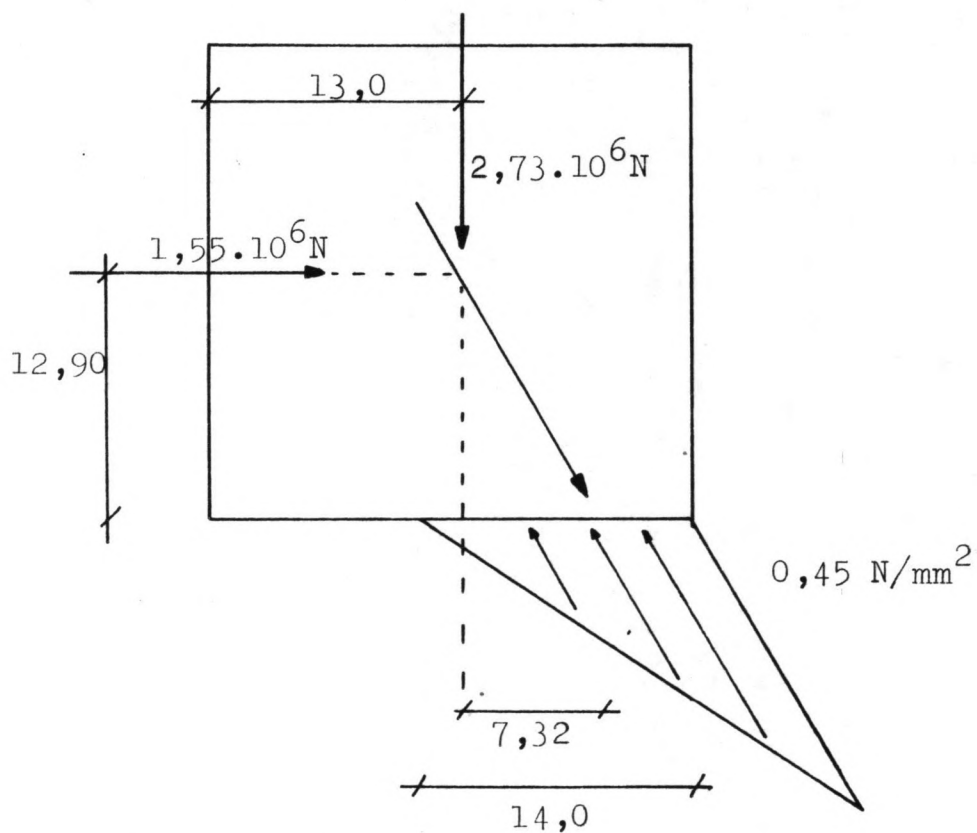


fig. 4.2.1.3 Resulterende maximale belastingen en reacties op de doorlaatcaisson (kortstondig)

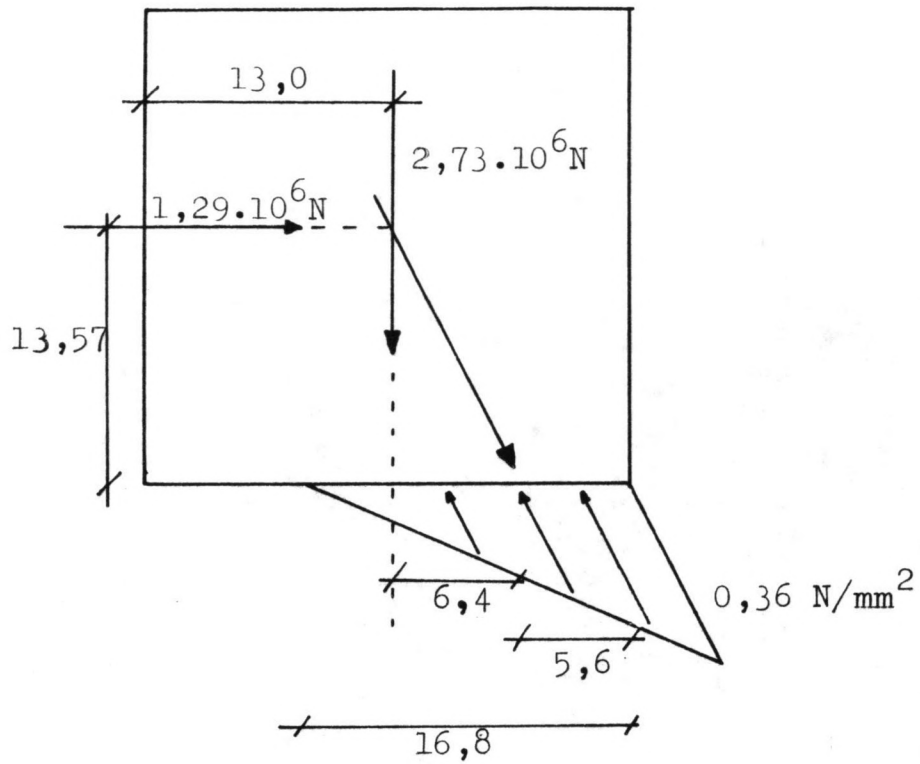


fig. 4.2.1.4 Resultante van de maximale belastingen en reacties op de doorlaatcaisson bij een havenpeil van +6,00m.

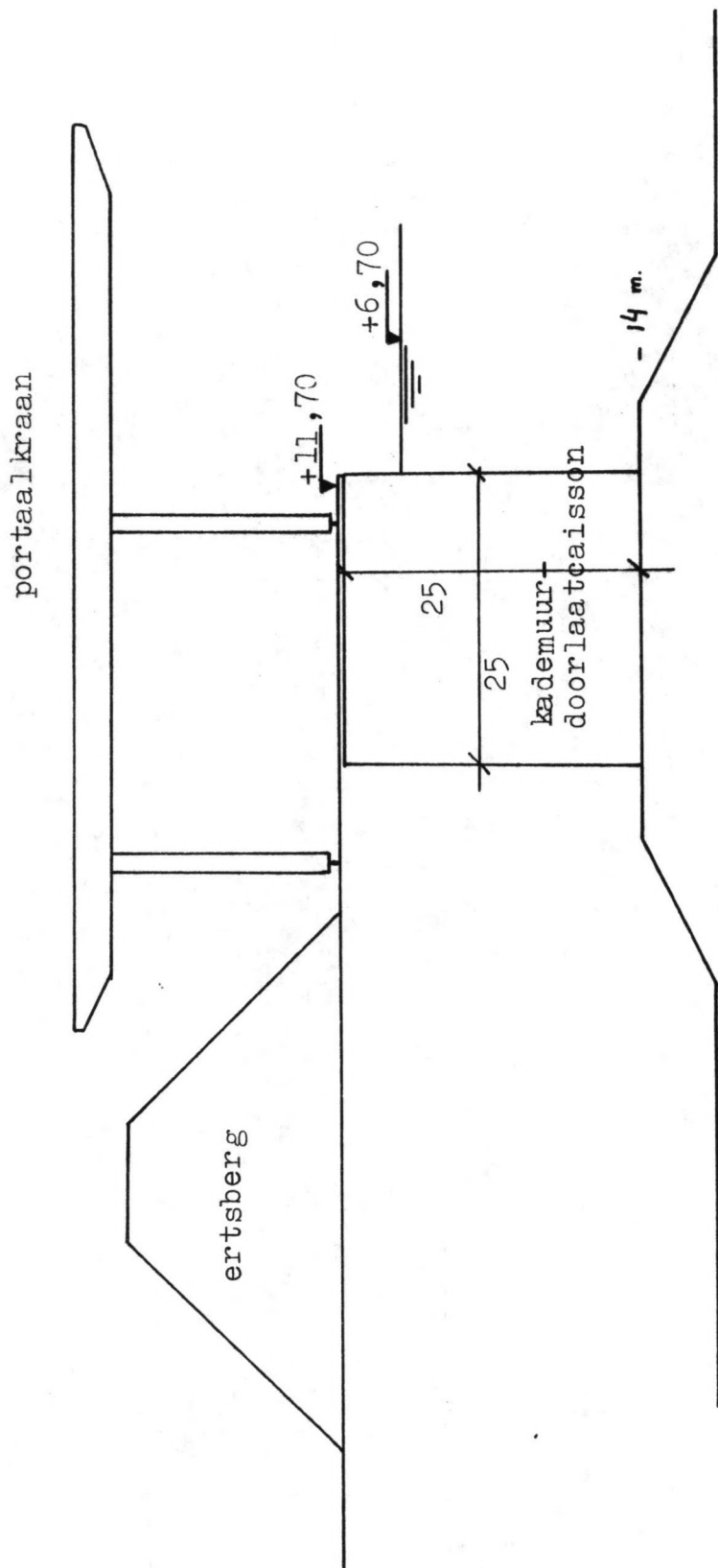
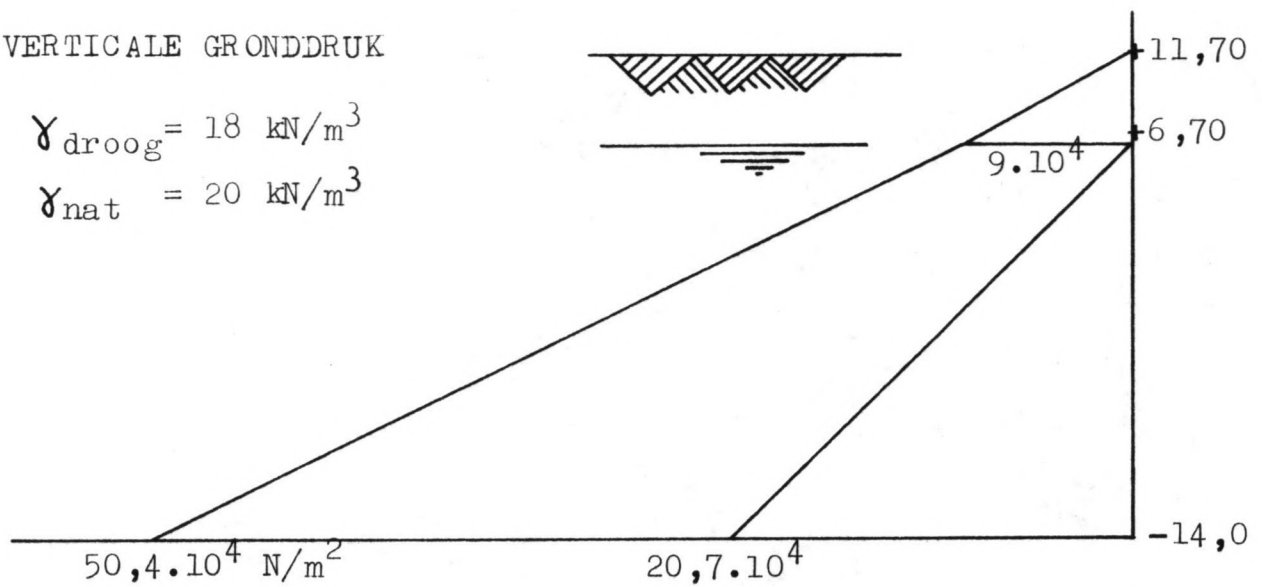


fig. 4.3.1 Mogelijke doorsnede kadeconstructie

VERTICALE GRONDDRUK

$$\gamma_{\text{droog}} = 18 \text{ kN/m}^3$$

$$\gamma_{\text{nat}} = 20 \text{ kN/m}^3$$



HORIZONTALE GRONDDRUK

$$\lambda_n = 0,5$$

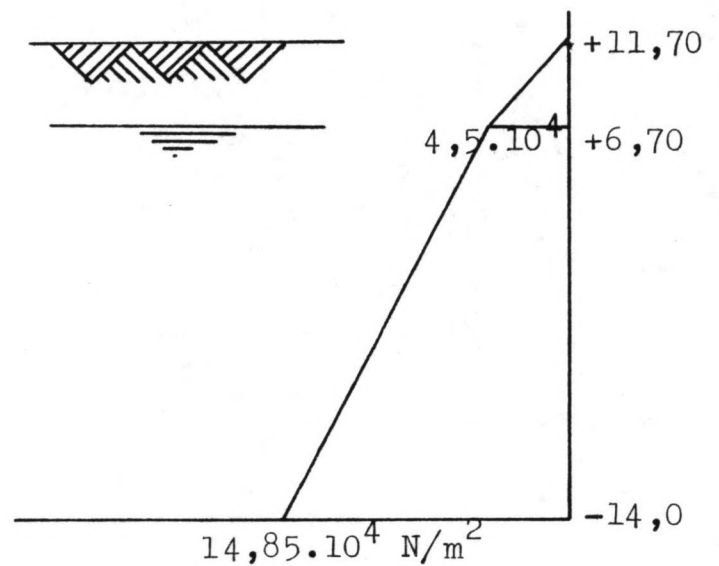


fig. 4.3.2 Gronddruk achter de kademuur

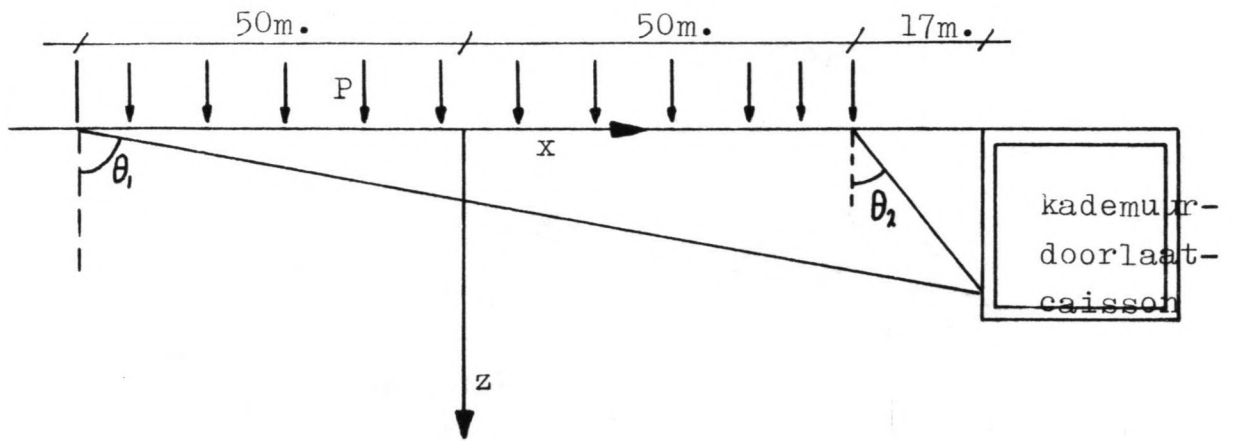


fig. 4.3.3 Schematisatie ertsberg

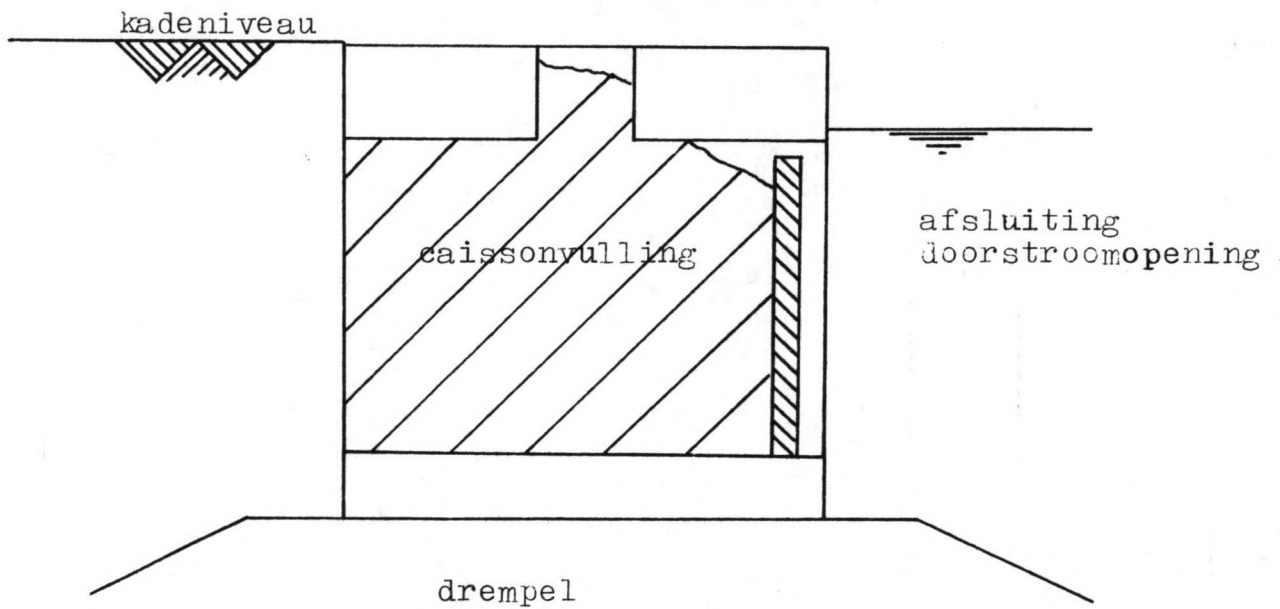


fig. 4.3.4 Verzwaard kademuurcaisson

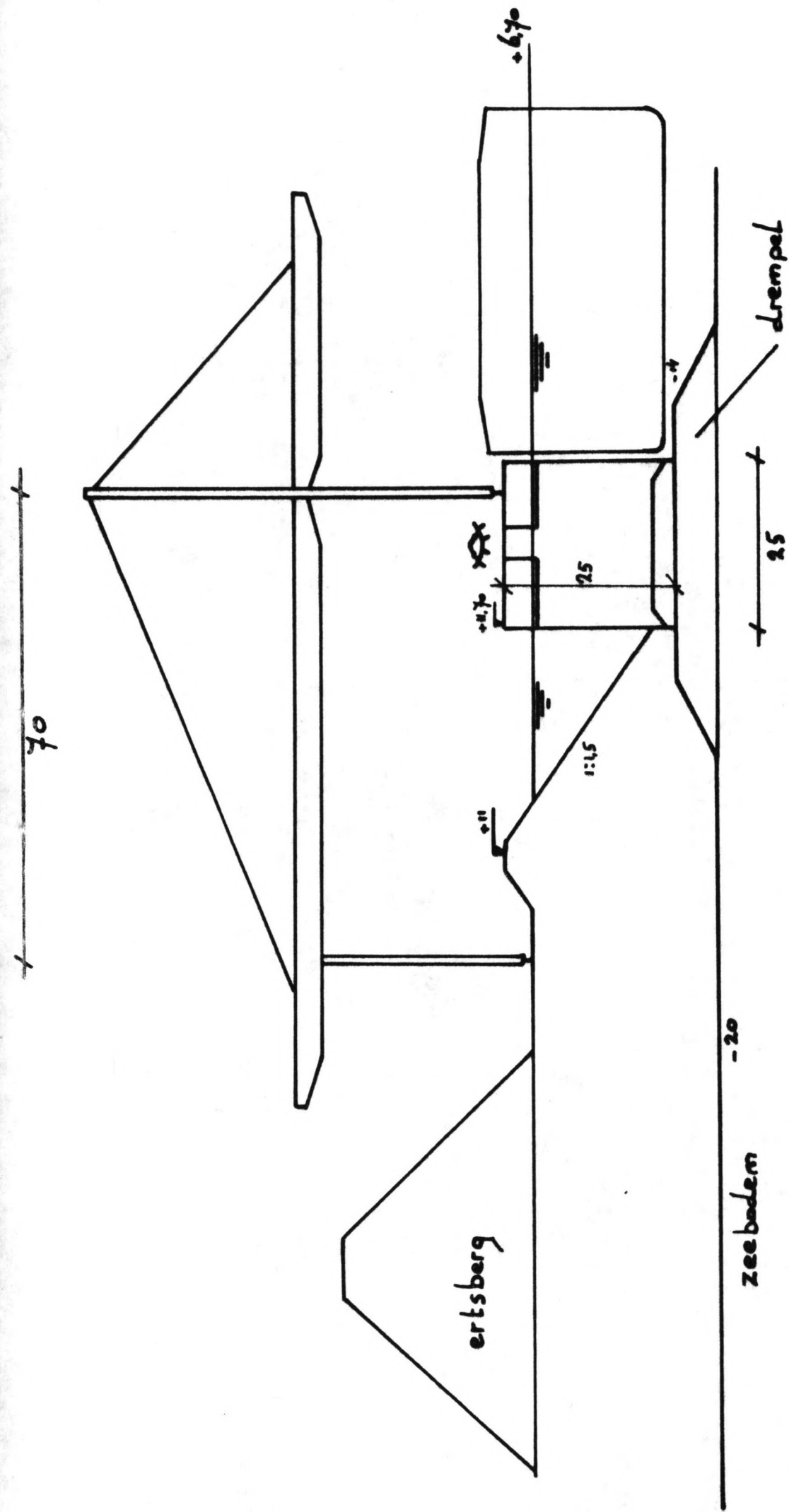


fig. 4.3.5 Doorsnede kadeconstructie behorende
 bij fig. 2.7.1 met aangrenzende
 mogelijkheid tot ertsopslag

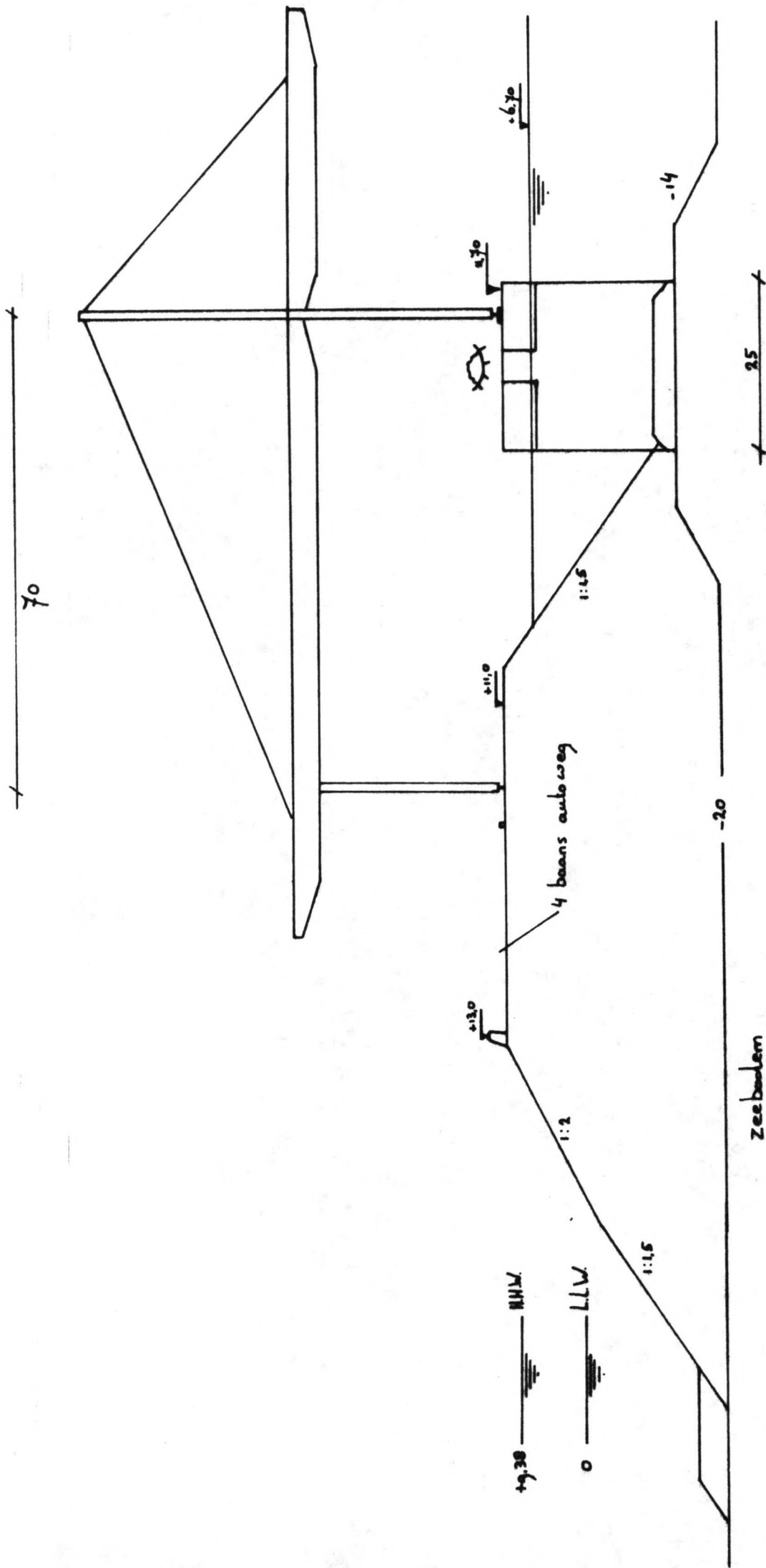


fig. 4.3.6 Doorsnede kadeconstructie behorende bij fig. 2.7.2 zonder direkt aangrenzende mogelijkheid tot ertsopslag

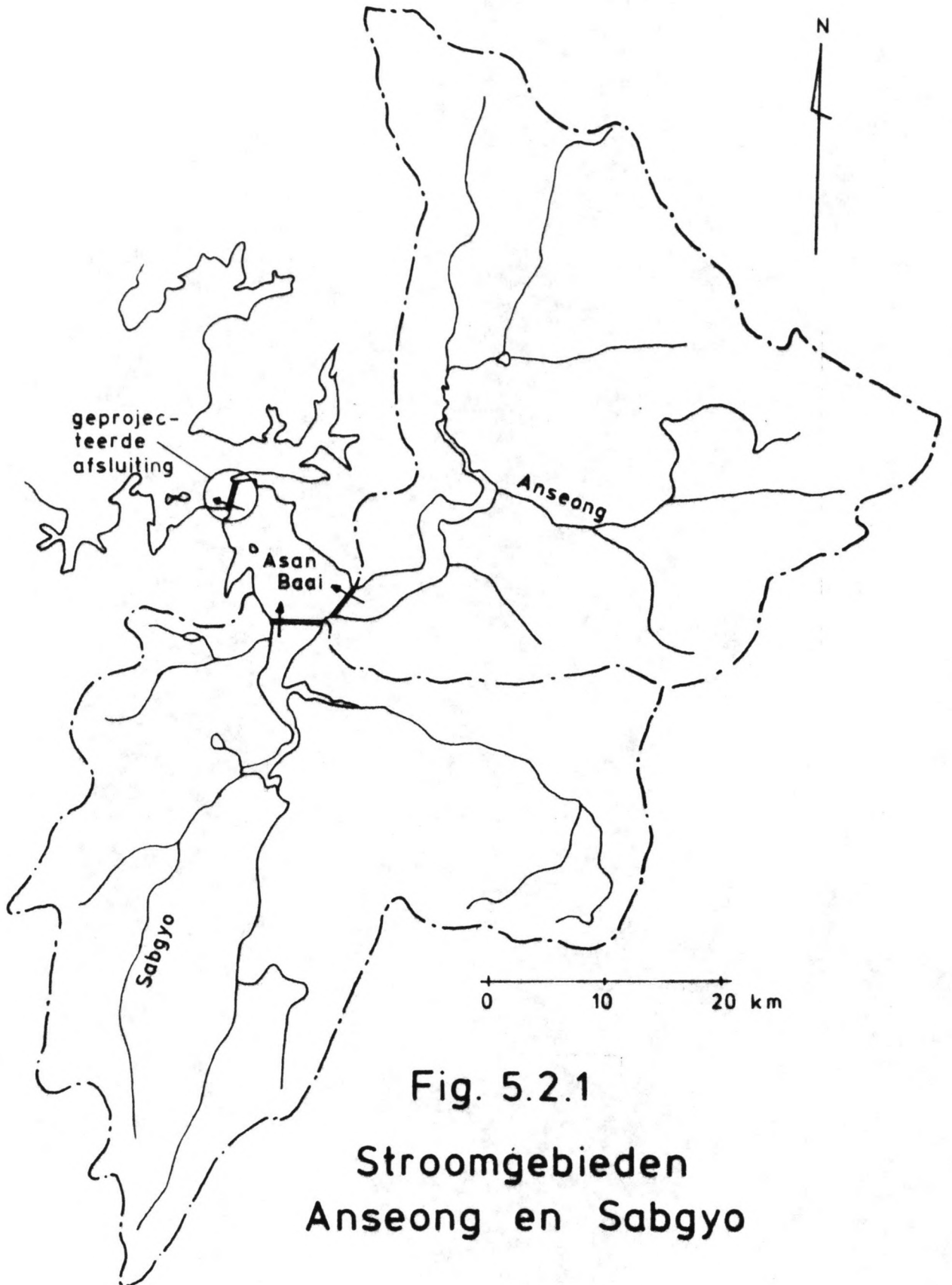
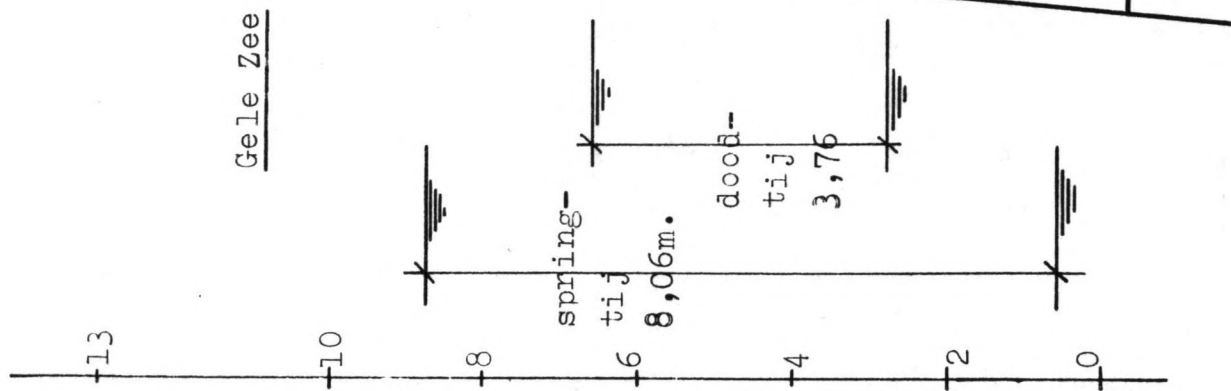


Fig. 5.2.1
Stroomgebieden
Anseong en Sabgyo

geplande afsluiting
van de Asan baai



Gele Zee

13

10

8

6

4

2

0

spring-
tijd
8,06m.

dood-
tijd
3,76

Anseong
reservoir

Asan dike

+9,19

+8,19

hoogste niveau

normaal niveau



instroming
via

Anseongrivier

uitwaterings-
sluis

uitwaterings-
sluis

havenbekken

+6,70

fig. 5.2.2 Langsdoorsnede van het havenbekken en
het Anseongreservoir

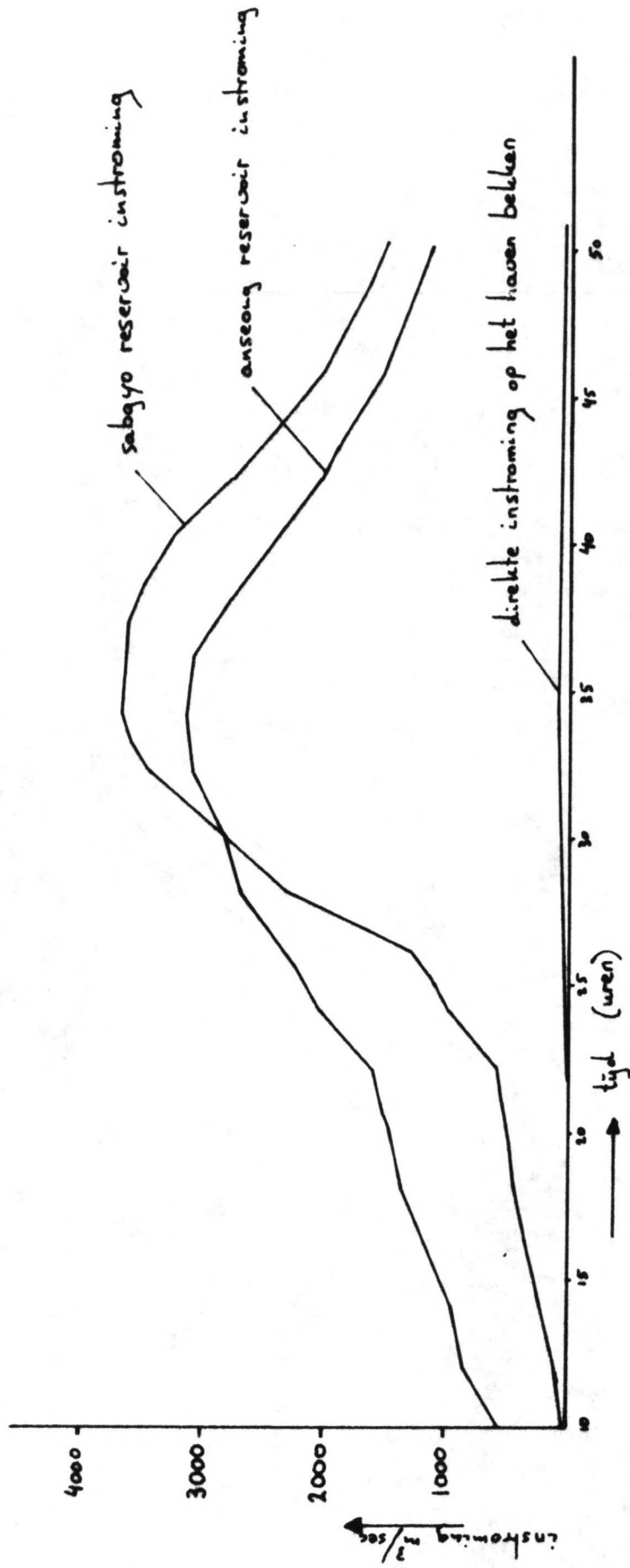
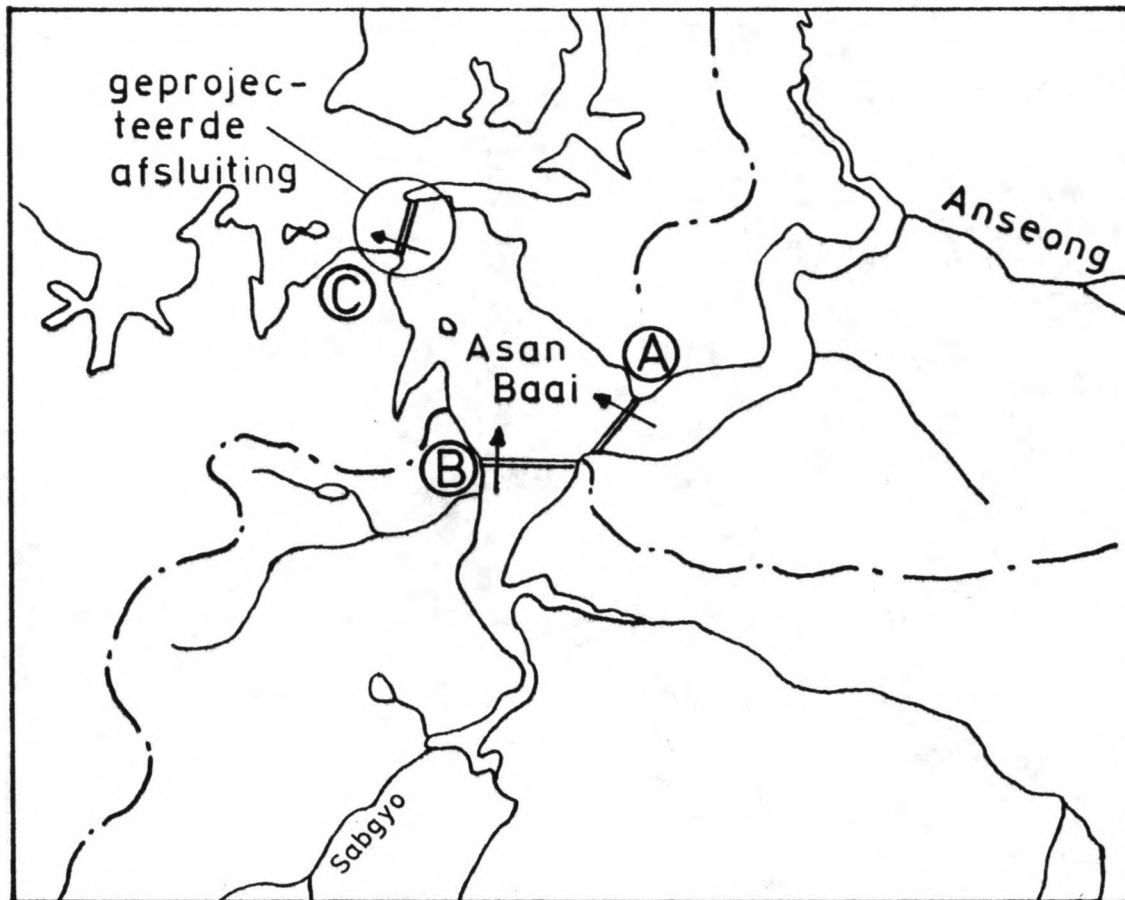


fig. 5.2.3 Debietsverloop Anseong en Sabgyo gedurende de maatgevende afvoergolf



Asan Baai

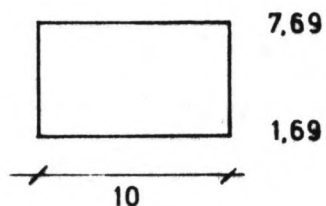
NORMAAL NIVEAU: 6,69 M

Anseong reservoir

NORMAAL NIVEAU : 8,19 M

MAXIMAAL NIVEAU : 9,19 M

12 POORTEN

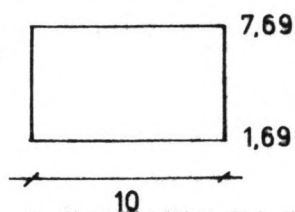


Sabgyo reservoir

NORMAAL NIVEAU : 7,69 M

MAXIMAAL NIVEAU : 8,69 M

12 POORTEN



4 POORTEN

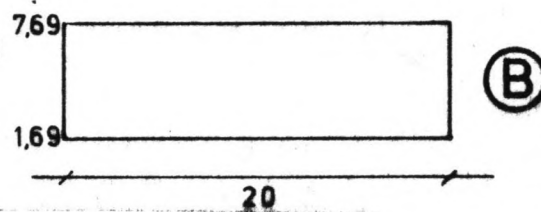
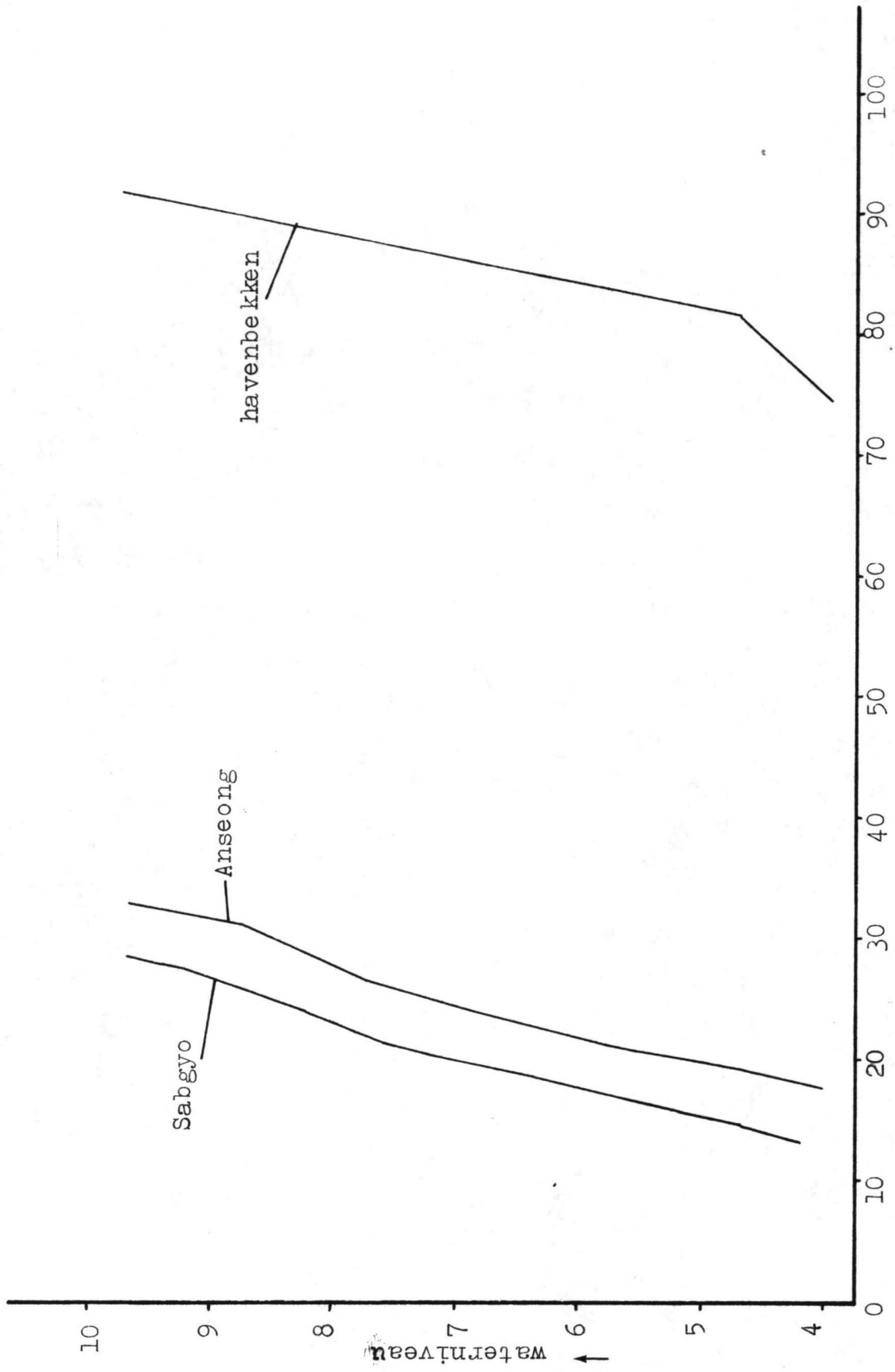


fig. 5.2.4 Gegevens bestaande uitwateringsluizen



→ wateroppervlak x 10⁶ m² fig. 5.2.5

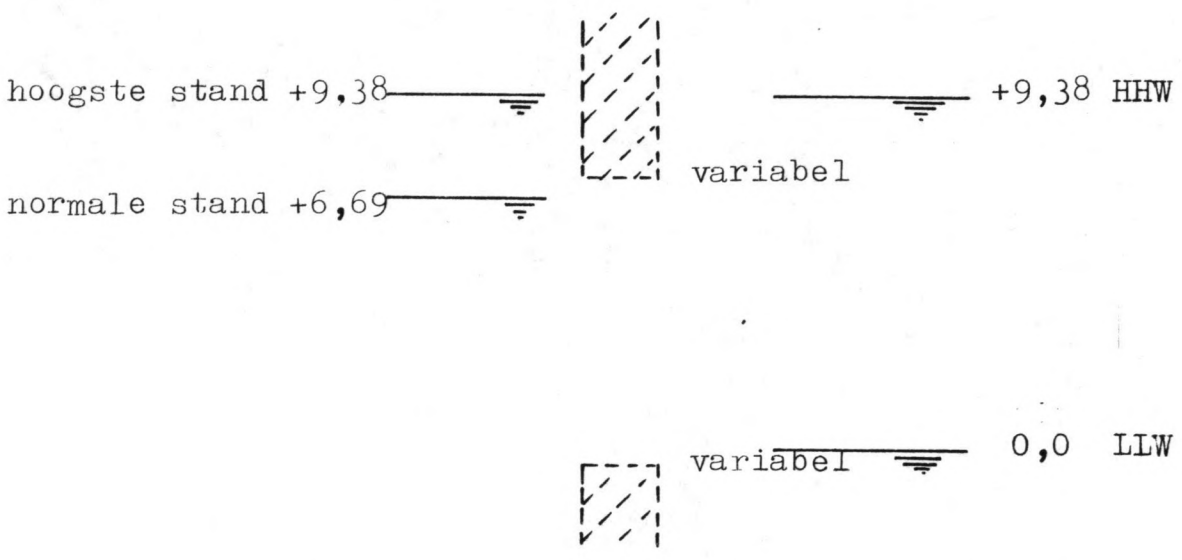
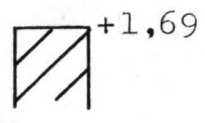
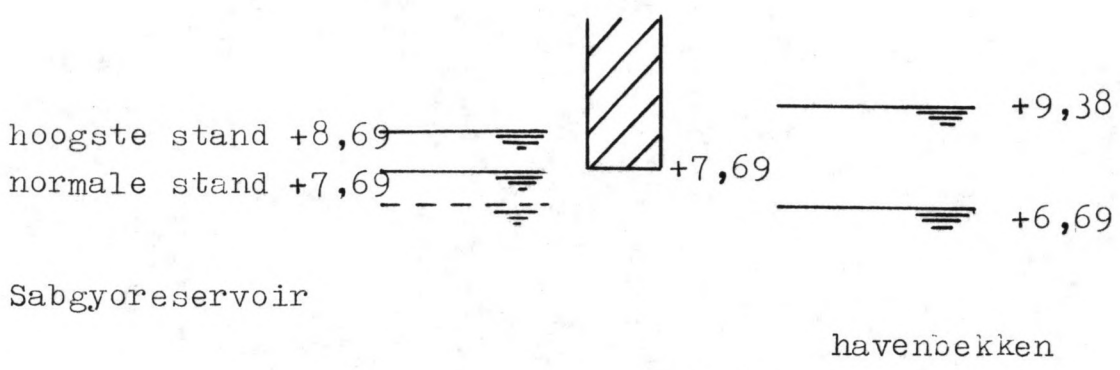
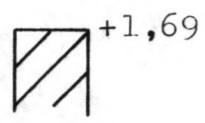
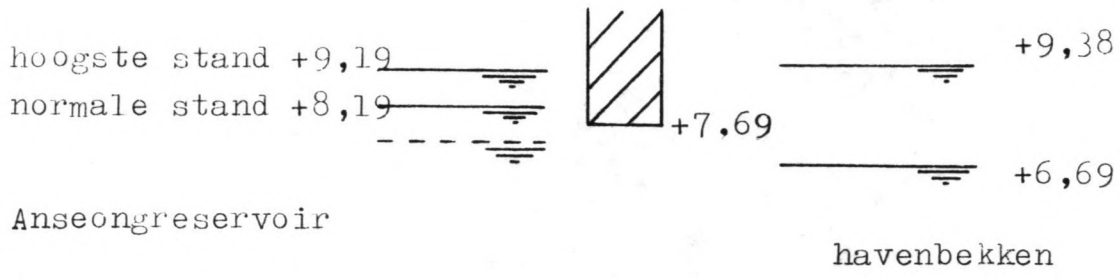
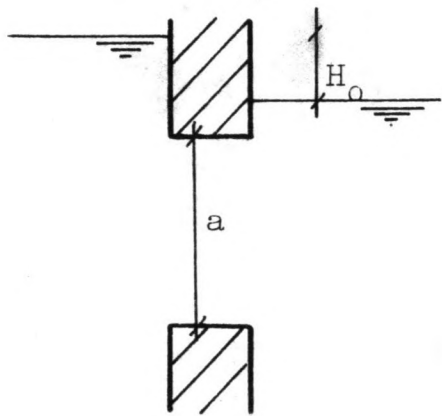


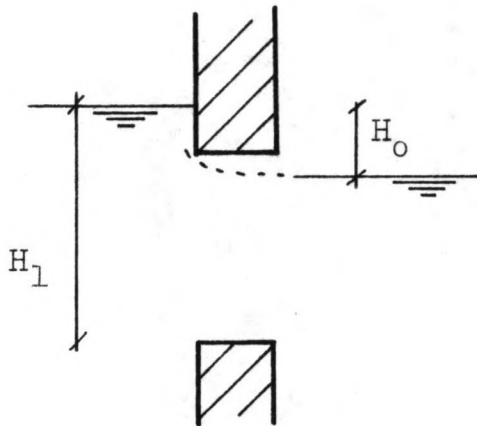
fig. 5.2.6 Overzicht optredende waterstanden



b = breedte van de opening
 c = afvoercoëfficiënt

$$Q = c \cdot a \cdot b \cdot \sqrt{2 \cdot g \cdot H_0}$$

g = versnelling van de zwaartekracht

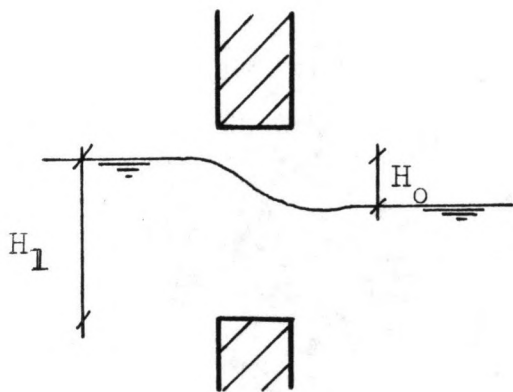


$$H_0 \leq 1/3 \cdot H_1$$

$$Q = c \cdot b \cdot (H_1 - H_0) \cdot \sqrt{2 \cdot g \cdot H_0}$$

$$H_0 > 1/3 \cdot H_1$$

$$Q = c \cdot b \cdot 2/3 \cdot H_1 \cdot \sqrt{2/3 \cdot g \cdot H_1}$$

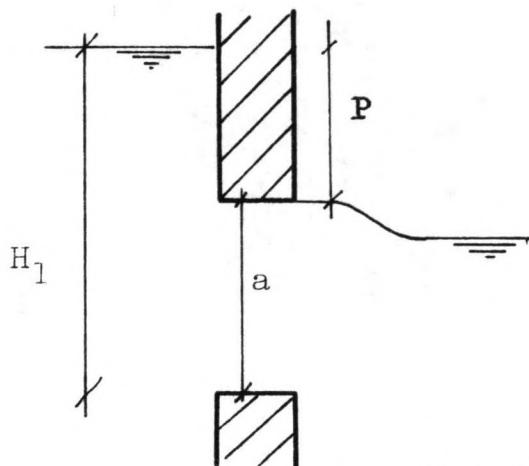


$$H_0 \leq 1/3 \cdot H_1$$

$$Q = c \cdot b \cdot (H_1 - H_0) \cdot \sqrt{2 \cdot g \cdot H_0}$$

$$H_0 > 1/3 \cdot H_1$$

$$Q = c \cdot b \cdot 2/3 \cdot H_1 \cdot \sqrt{2/3 \cdot g \cdot H_1}$$



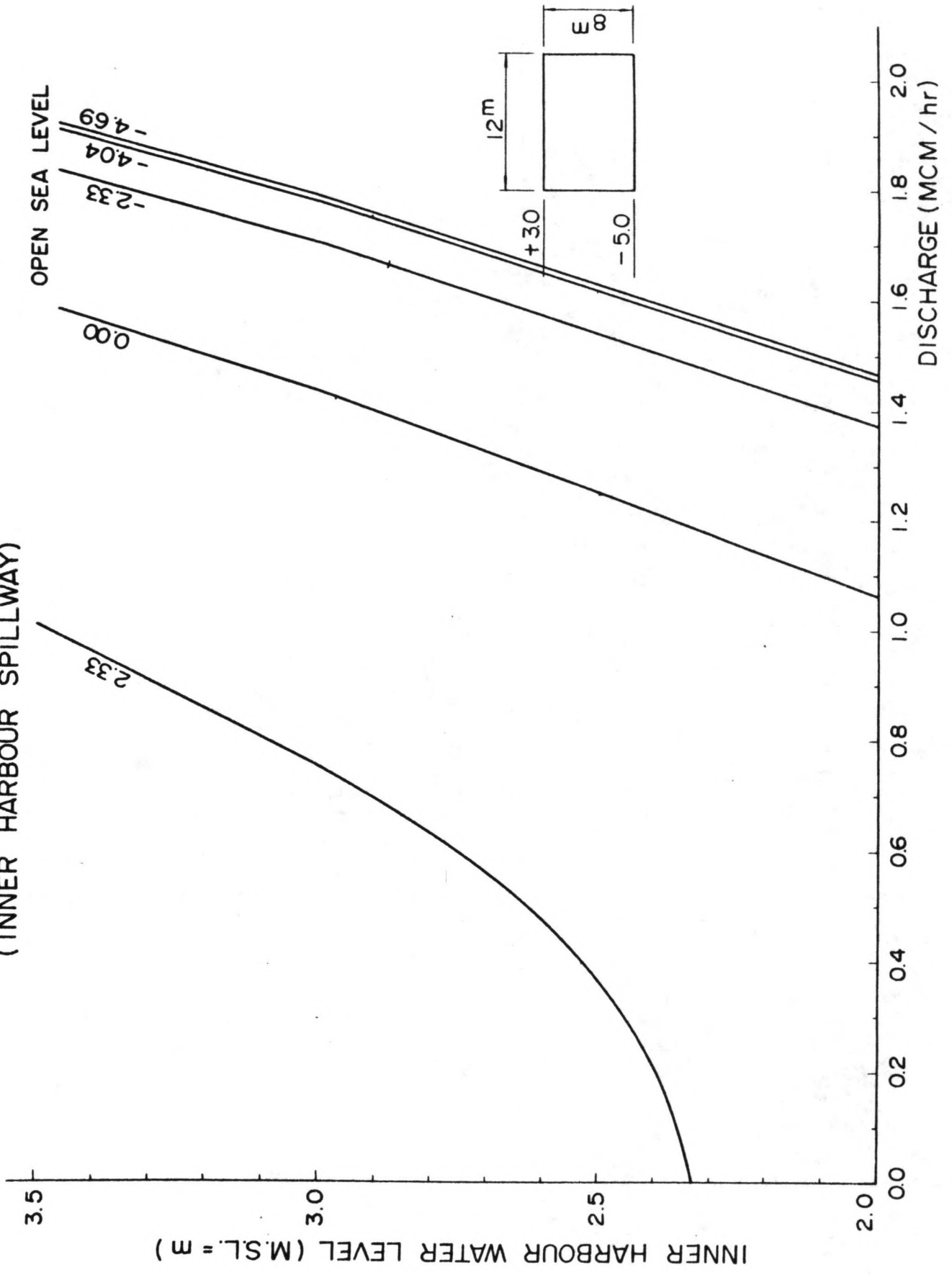
$$H_1 > 3/2 \cdot a$$

$$Q = c \cdot b \cdot a \cdot \sqrt{2 \cdot g \cdot P}$$

fig. 5.2.7 Gebruikte afvoerformules
 (lange overlaat)

FIG 2 3 1 DISCHARGE CURVE PER ONE GATE

Fig 5.3.1 DISCHARGE CURVE PER ONE GATE
(INNER HARBOUR SPILLWAY)



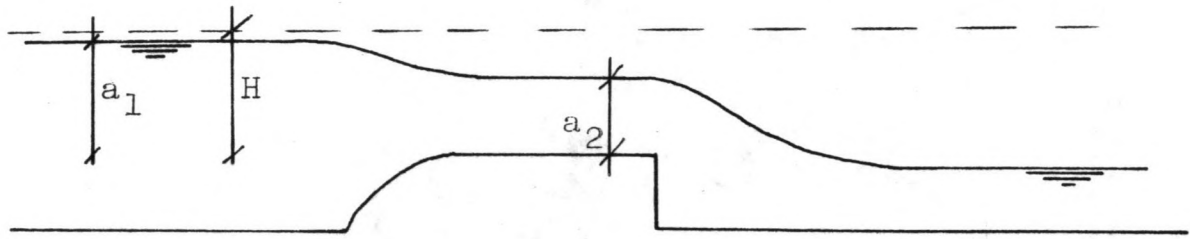


fig. 5.4.1 Volkomen lange overlaat

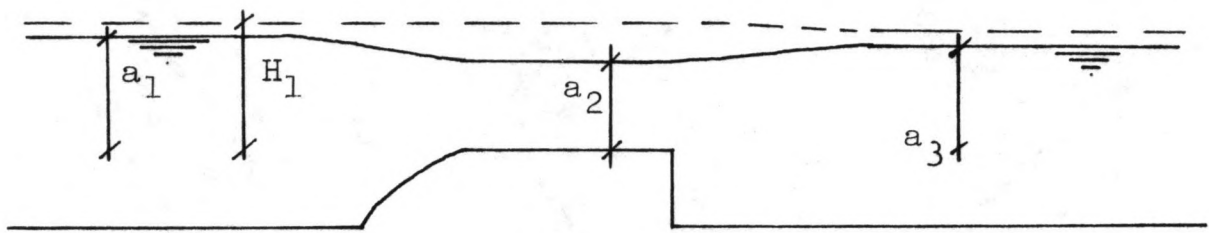


fig. 5.4.2 Onvolkomen lange overlaat

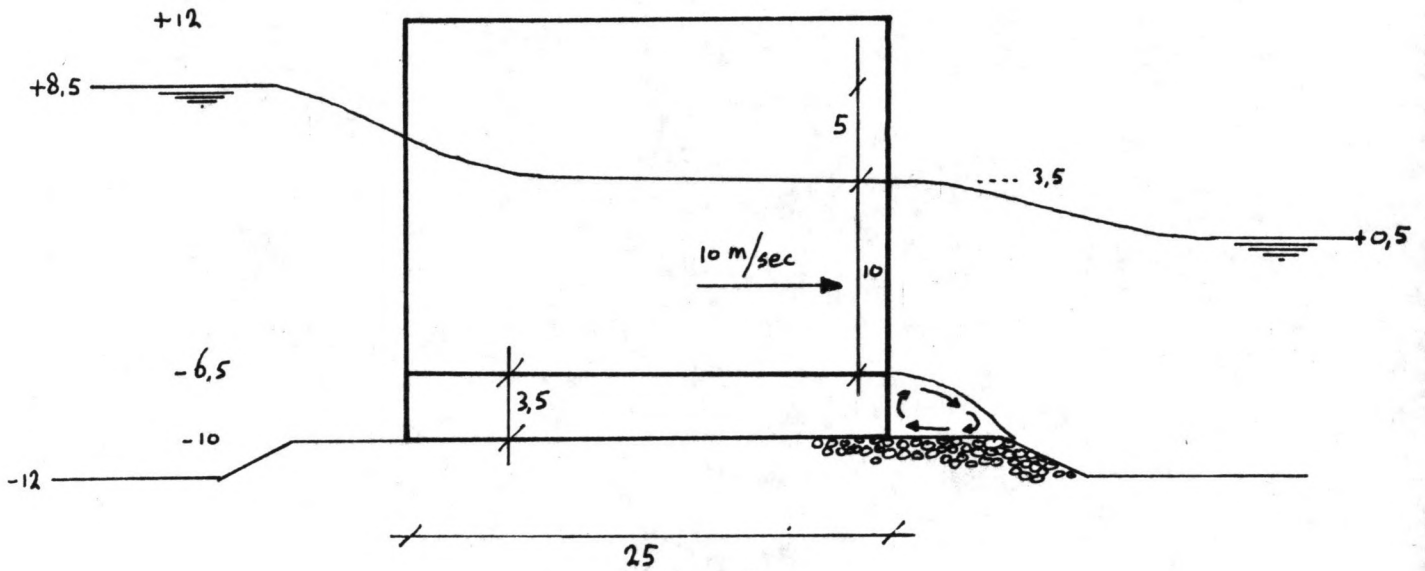


fig. 5.5.1 Uitwateringssluiss met een laag bodemniveau

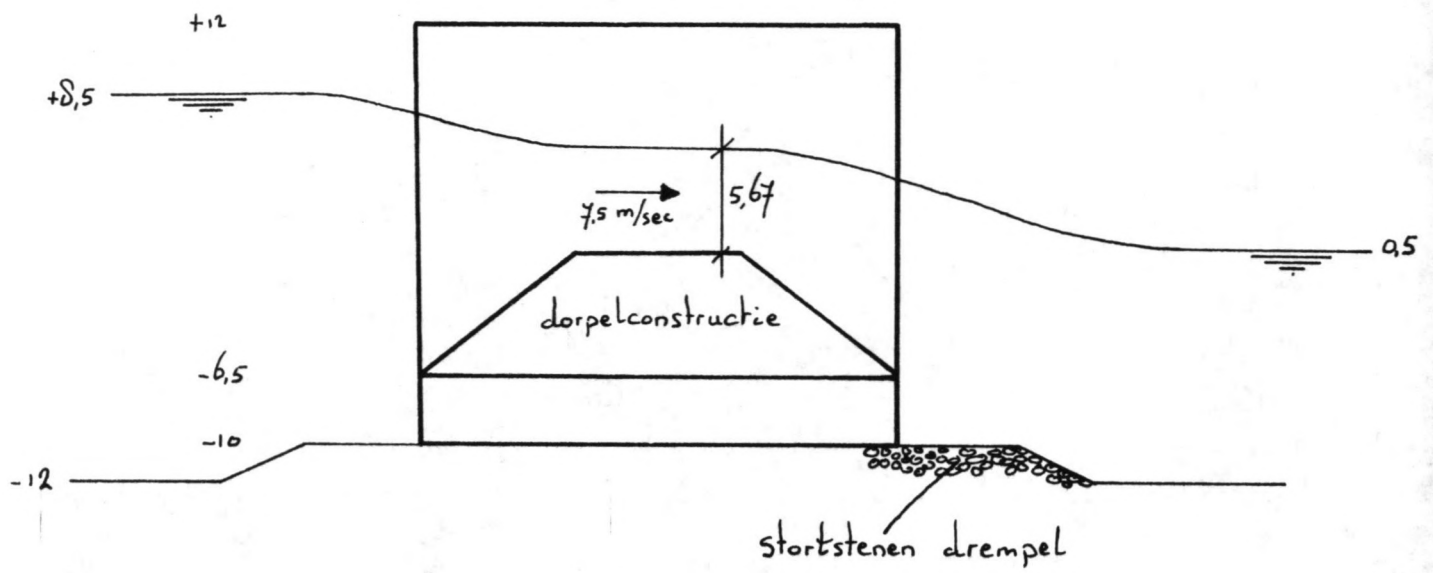


fig. 5.5.2 Uitwateringsluis met drempel

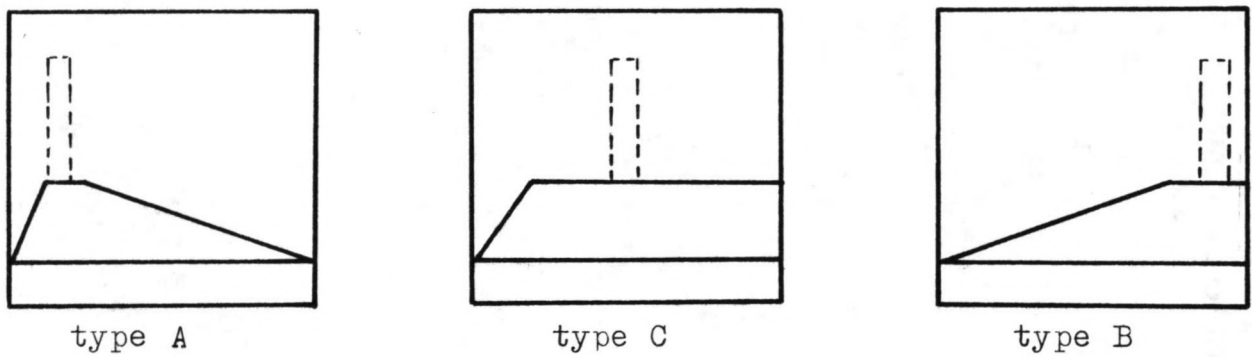


fig. 5.5.3 Mogelijke dorpelvormen

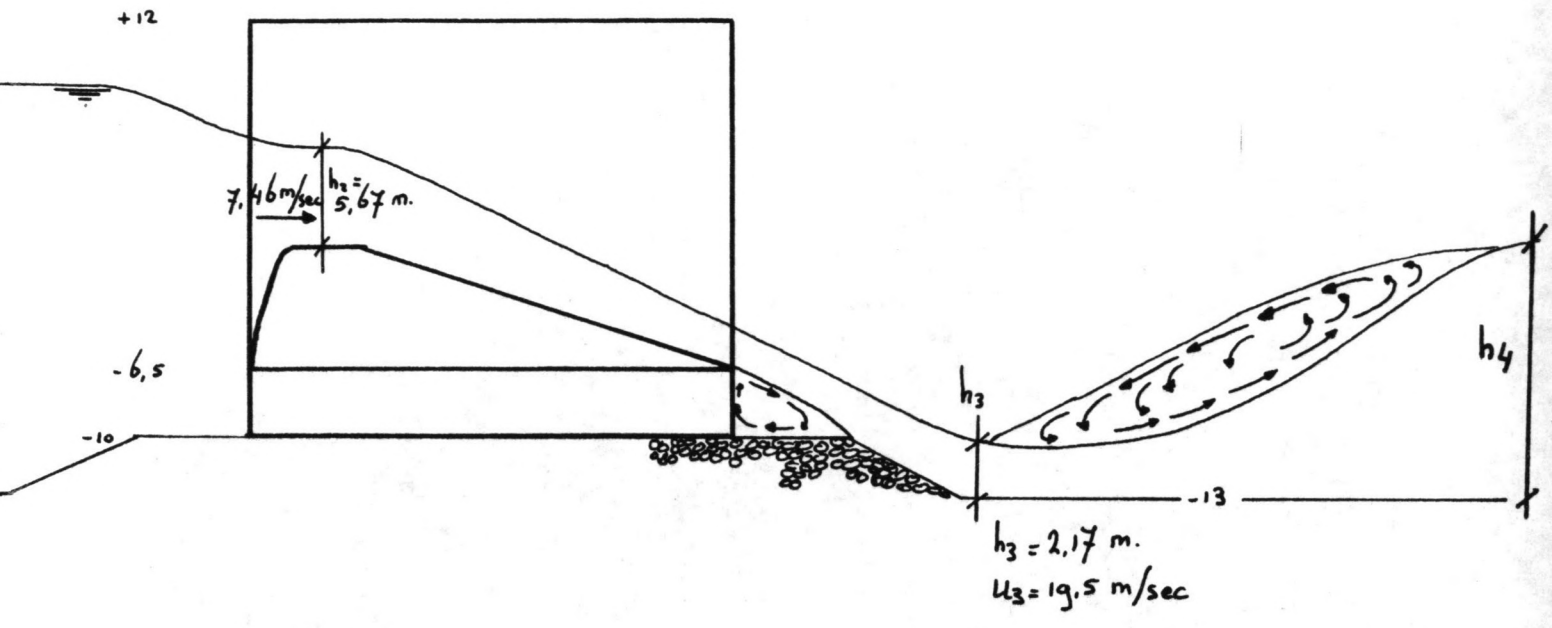
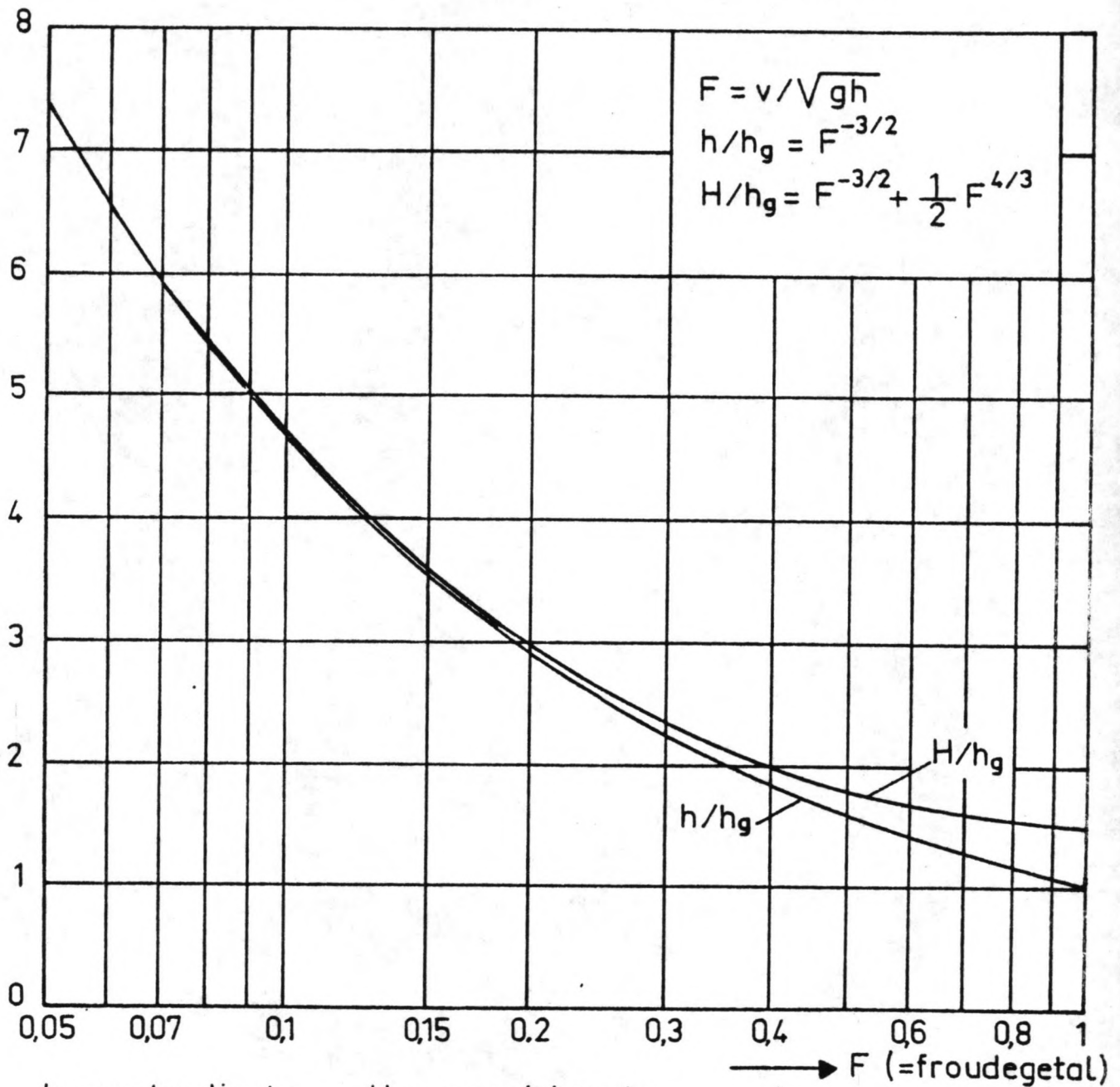


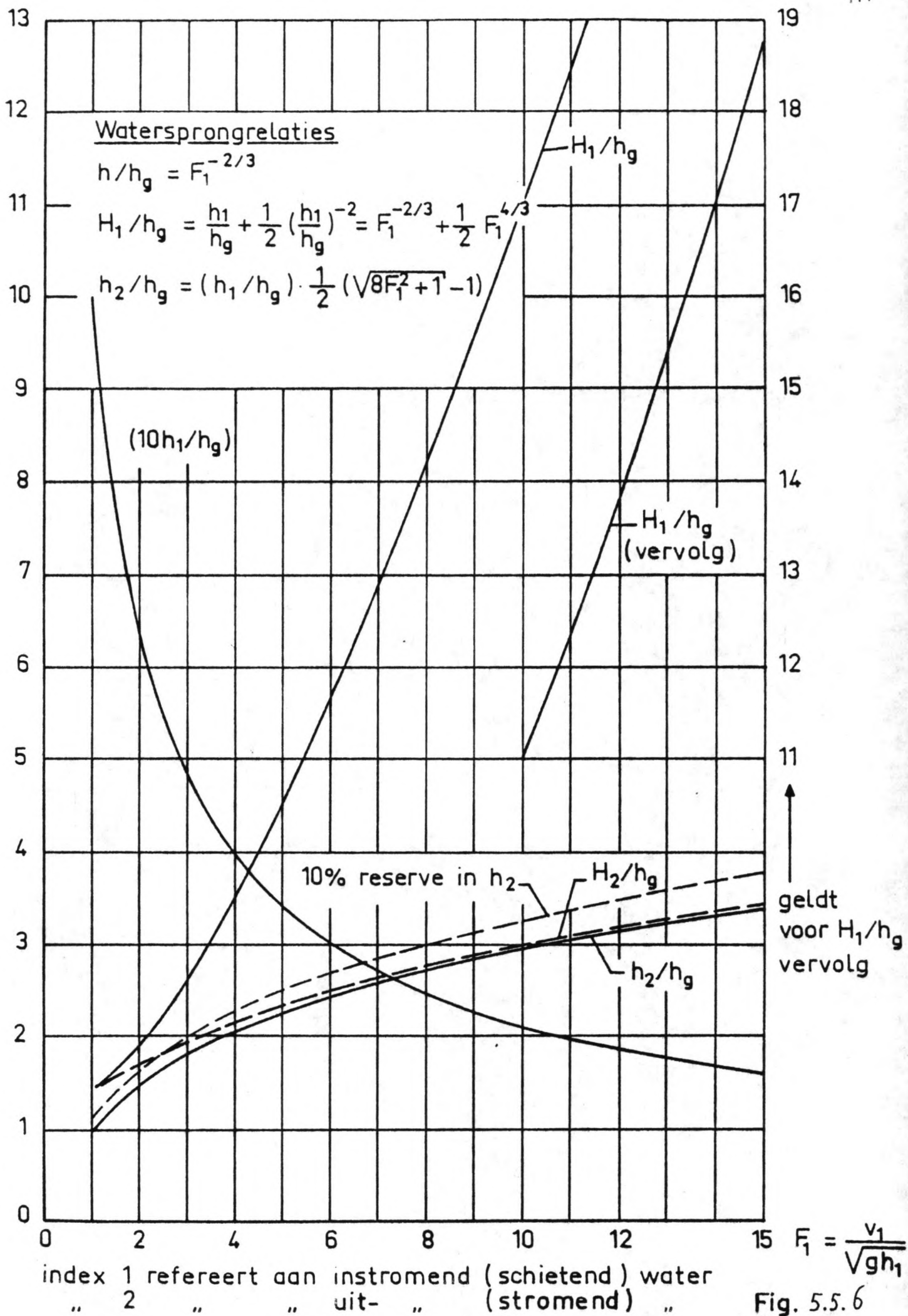
fig. 5.5.4 Uitwateringsluis type A

fig. 5.5.5 Stromend water
Energiehoogte versus waterdiepte



h = waterdiepte H = energiehoogte
 h_g = grensdiepte = $\sqrt[3]{q^2/g} = \sqrt[3]{v^2 h^2/g}$

→ F (=froudegetal)



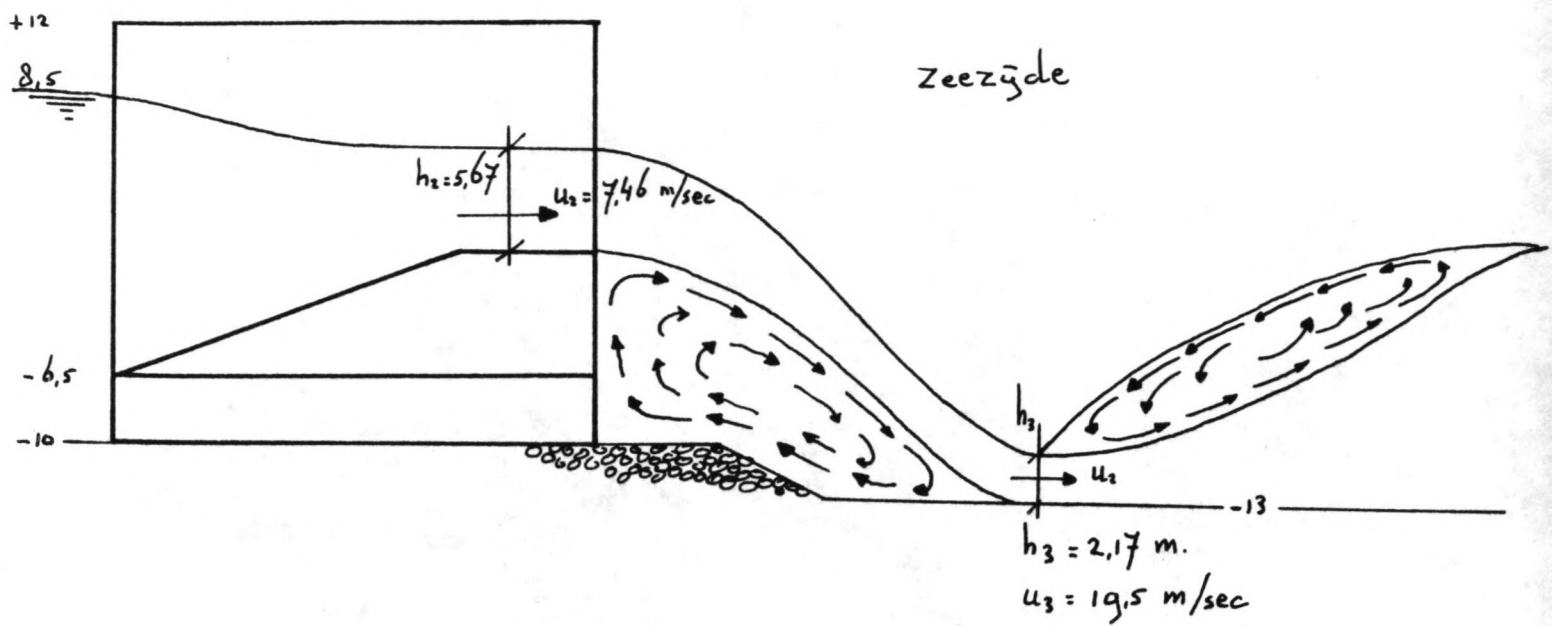


fig. 5.5.7 Uitwateringsluis type B

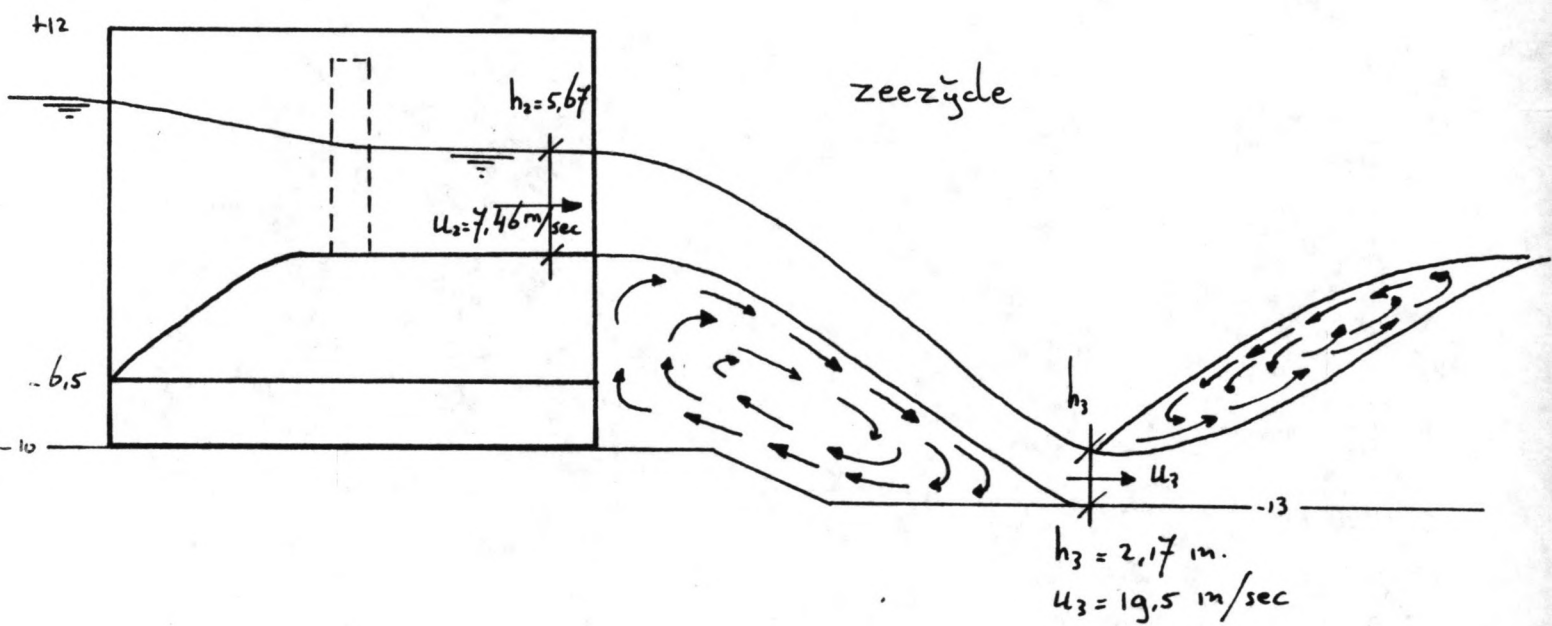


fig. 5.5.8 Uitwateringsluis type C

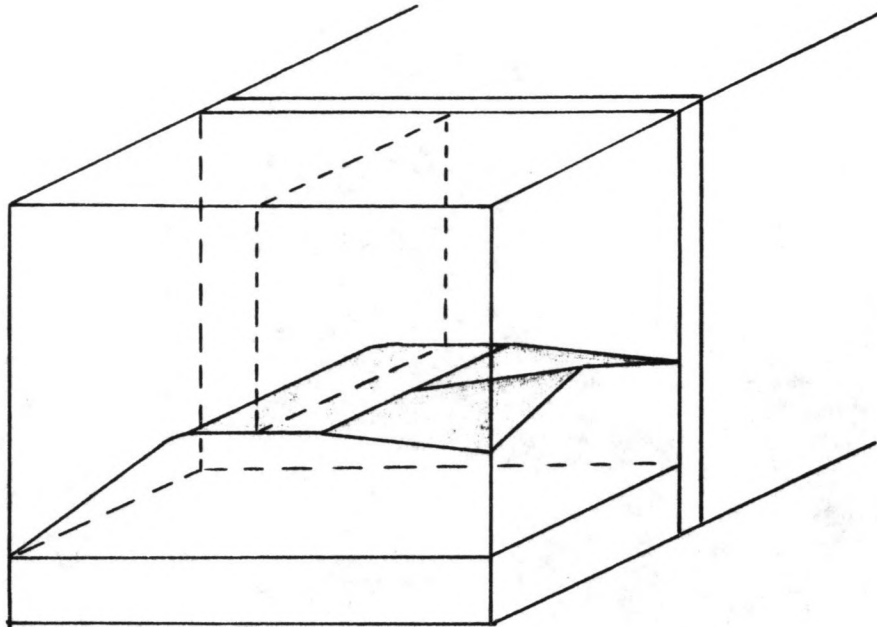


fig. 5.5.9 Dorpelvormgeving

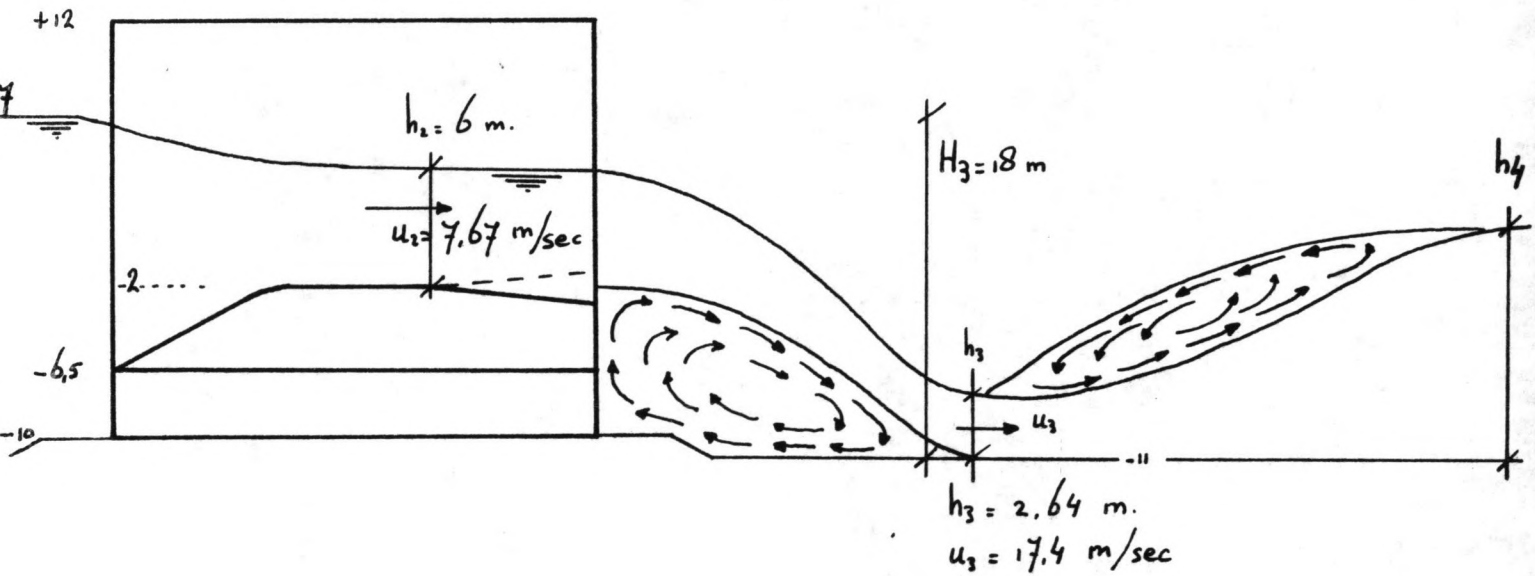


fig. 5.5.10 Normale situatie Uitwateringsluis

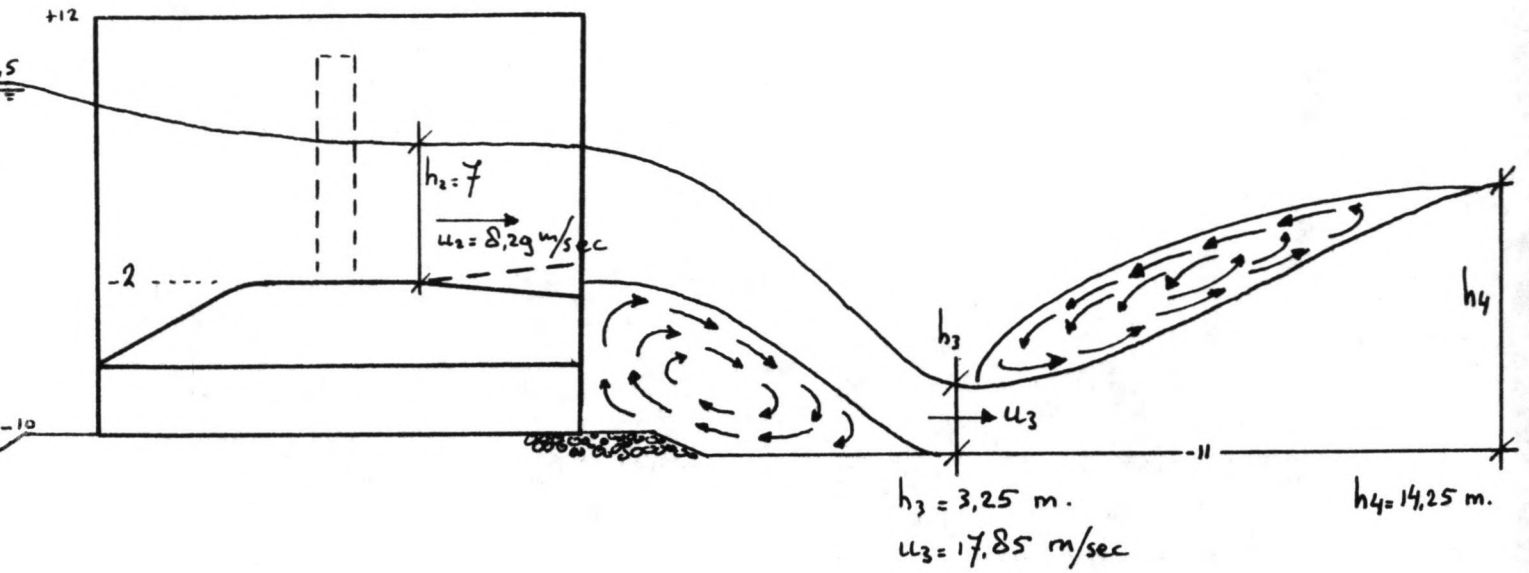


fig. 5.5.11 Extreme situatie uitwateringsluis

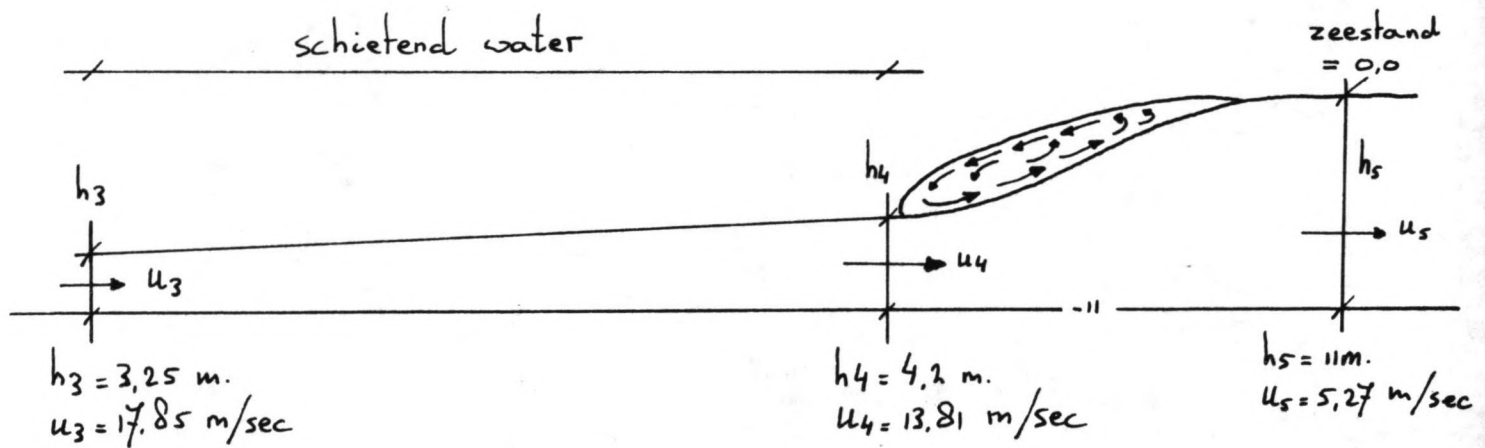


fig. 5.5.12 Energiedissipatie in schieterend water

fig. 5.6.1

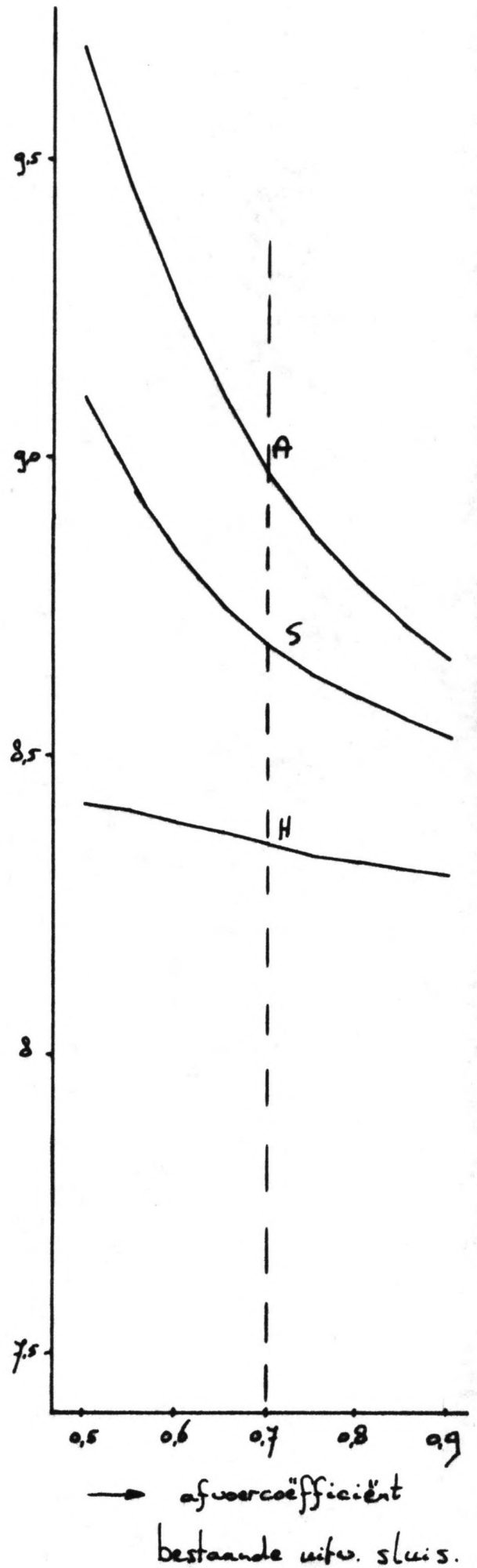
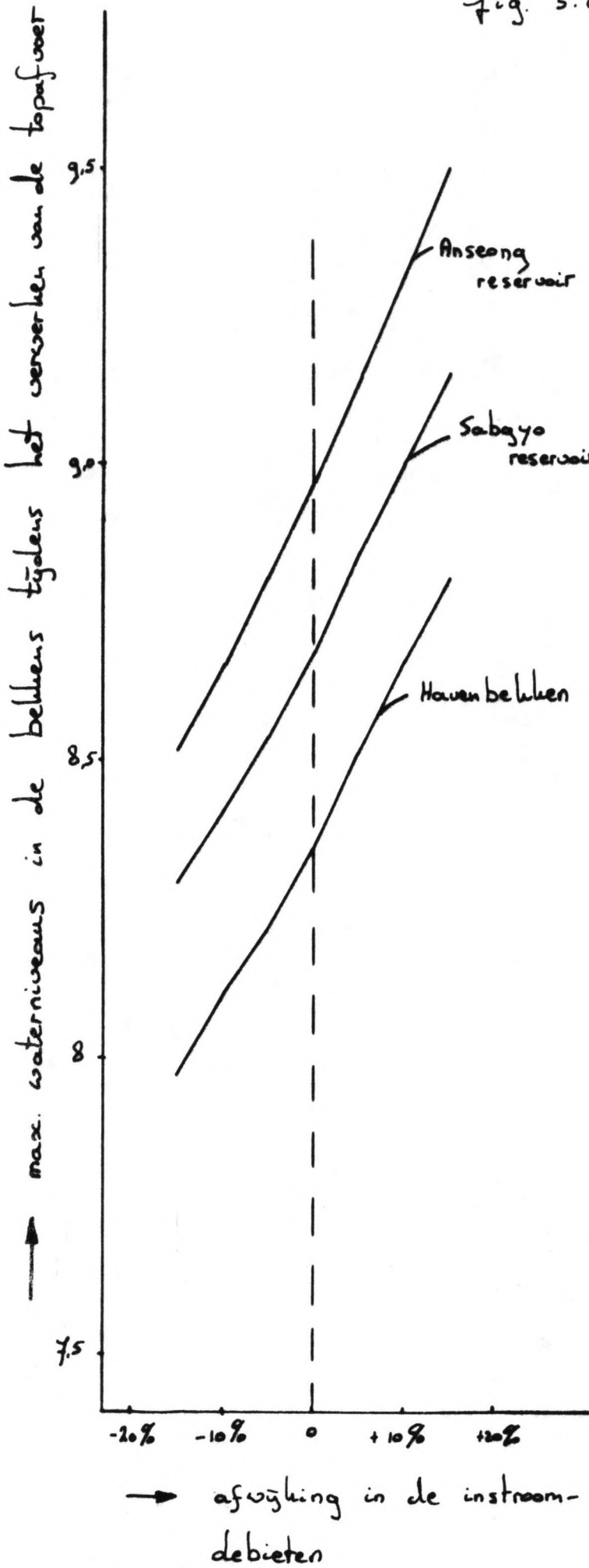


fig. 5.6.2

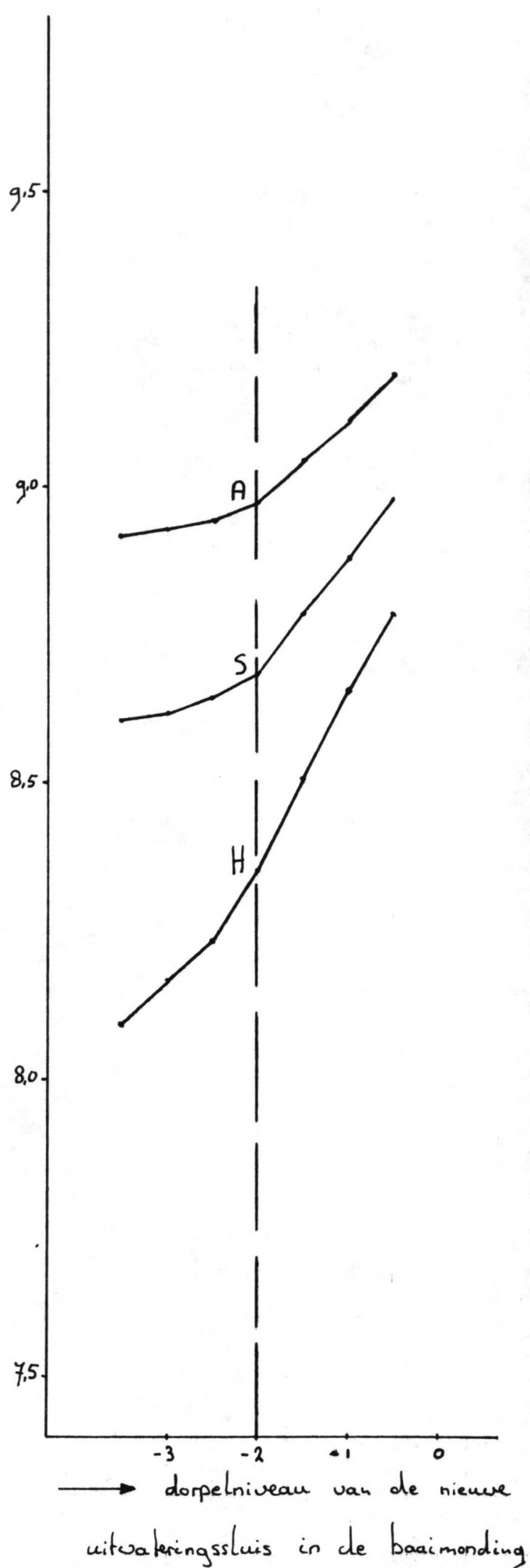
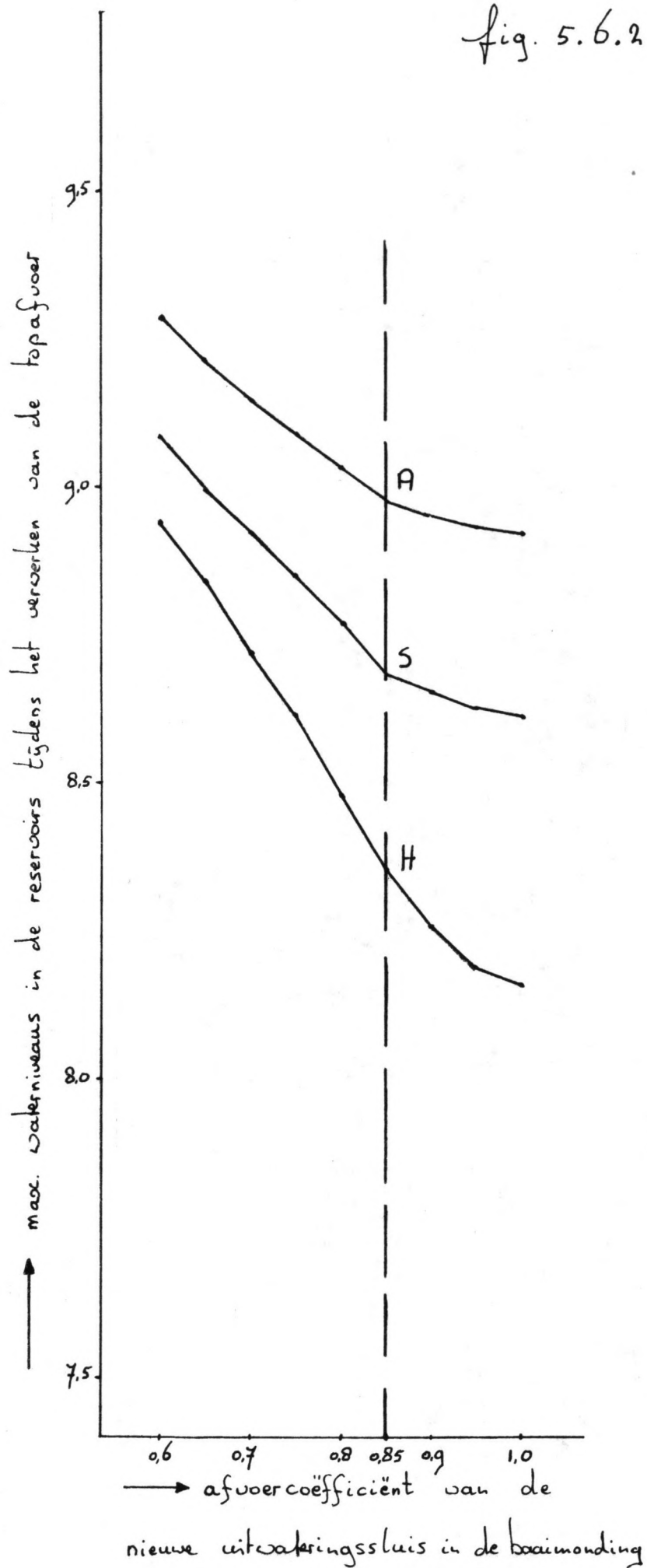


fig. 5.6.3

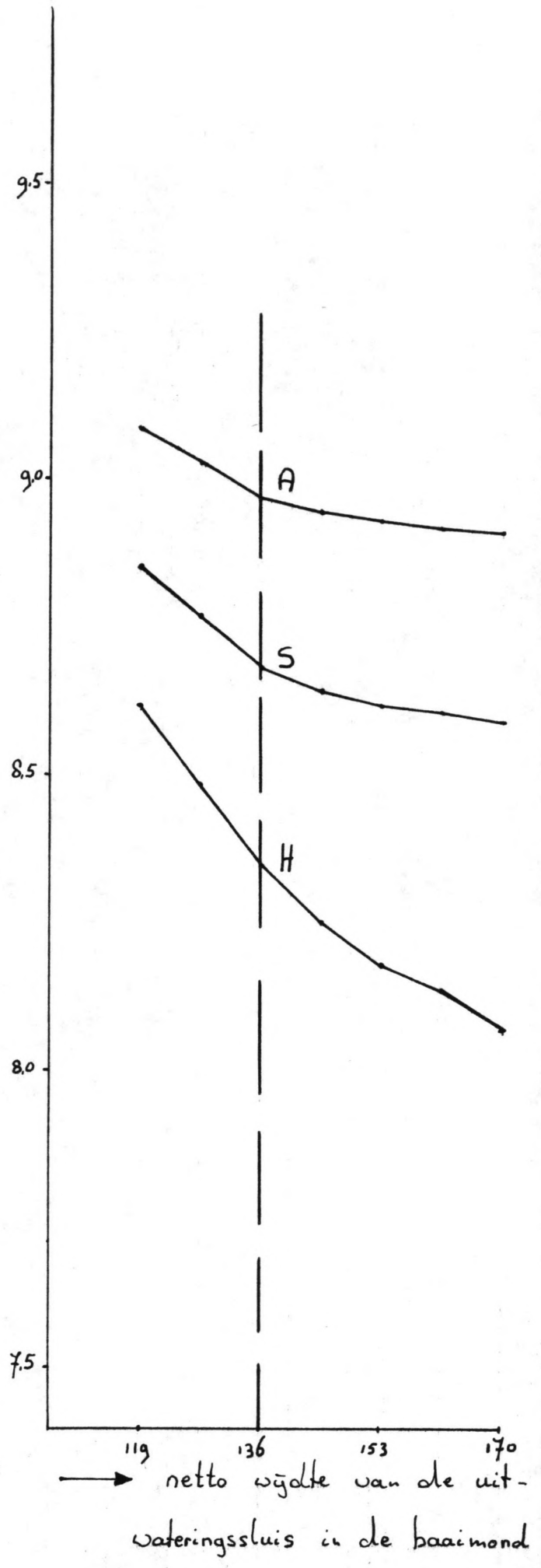
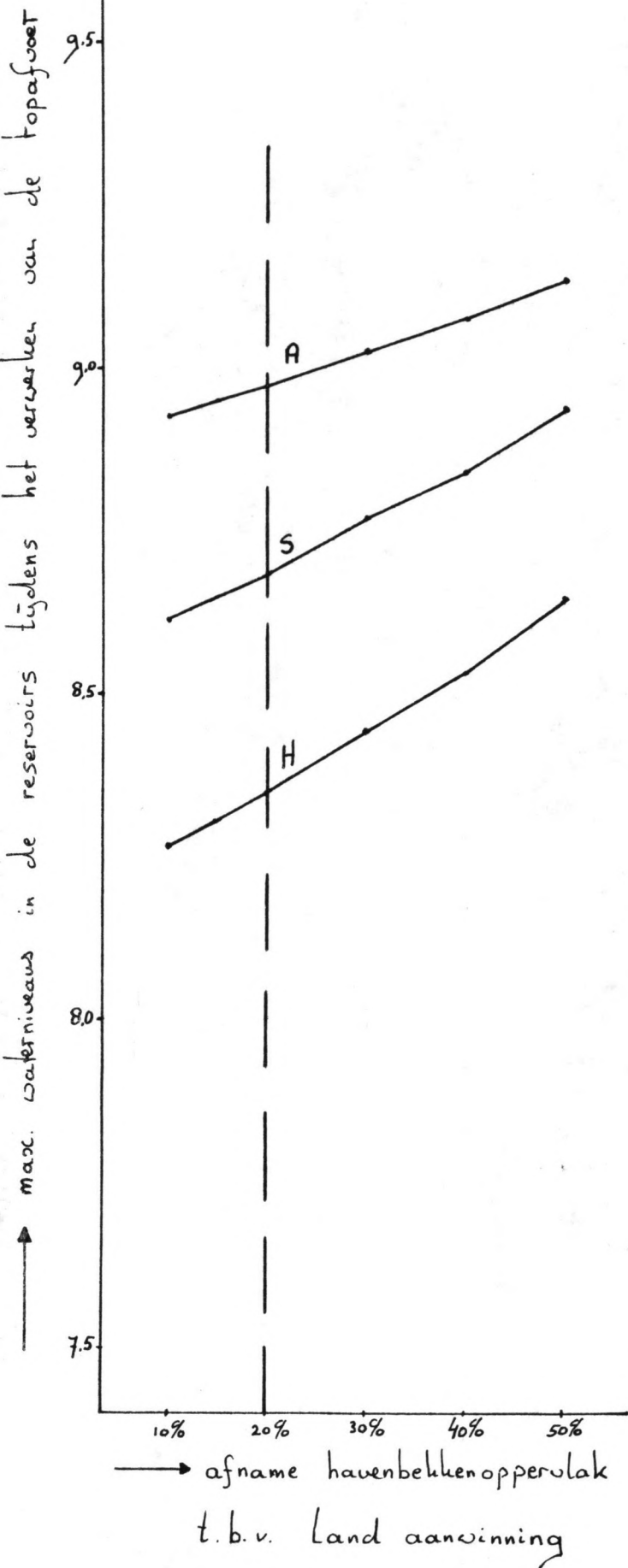
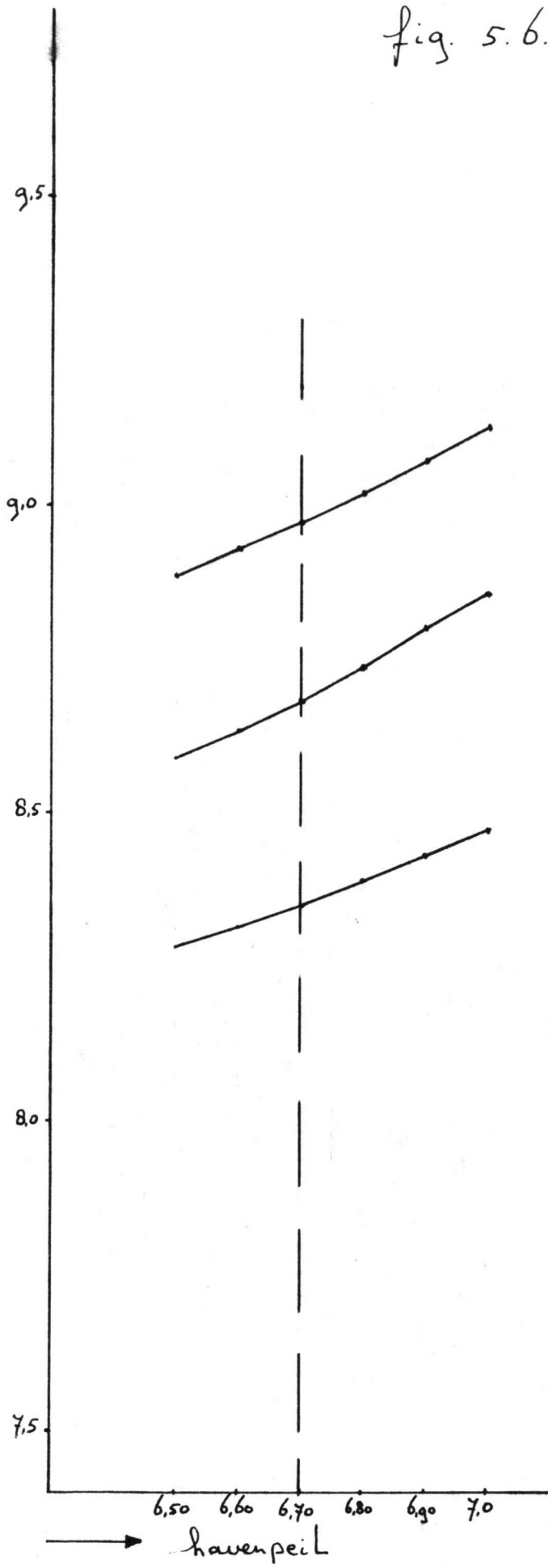


fig. 5.6.4



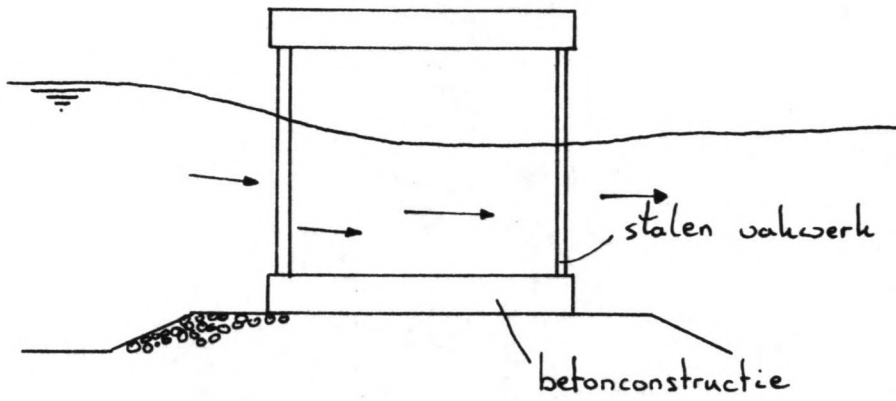
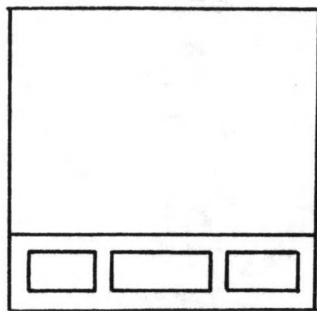
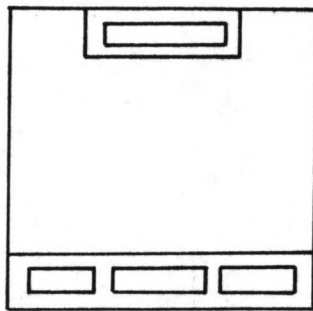


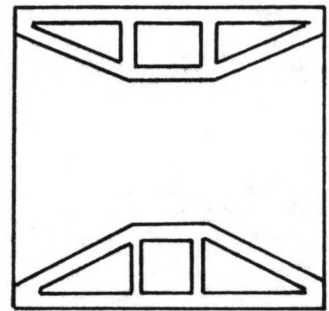
fig. 6.2.1 Conventioneel doorlaatcaisson



"open bak"



"halve bak"



"venturi"

fig. 6.2.2 Voorbeelden van caissons zonder uitwendige staalconstructies

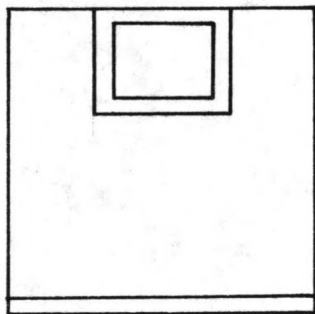


fig. 6.2.3 "DOSbouw" caisson

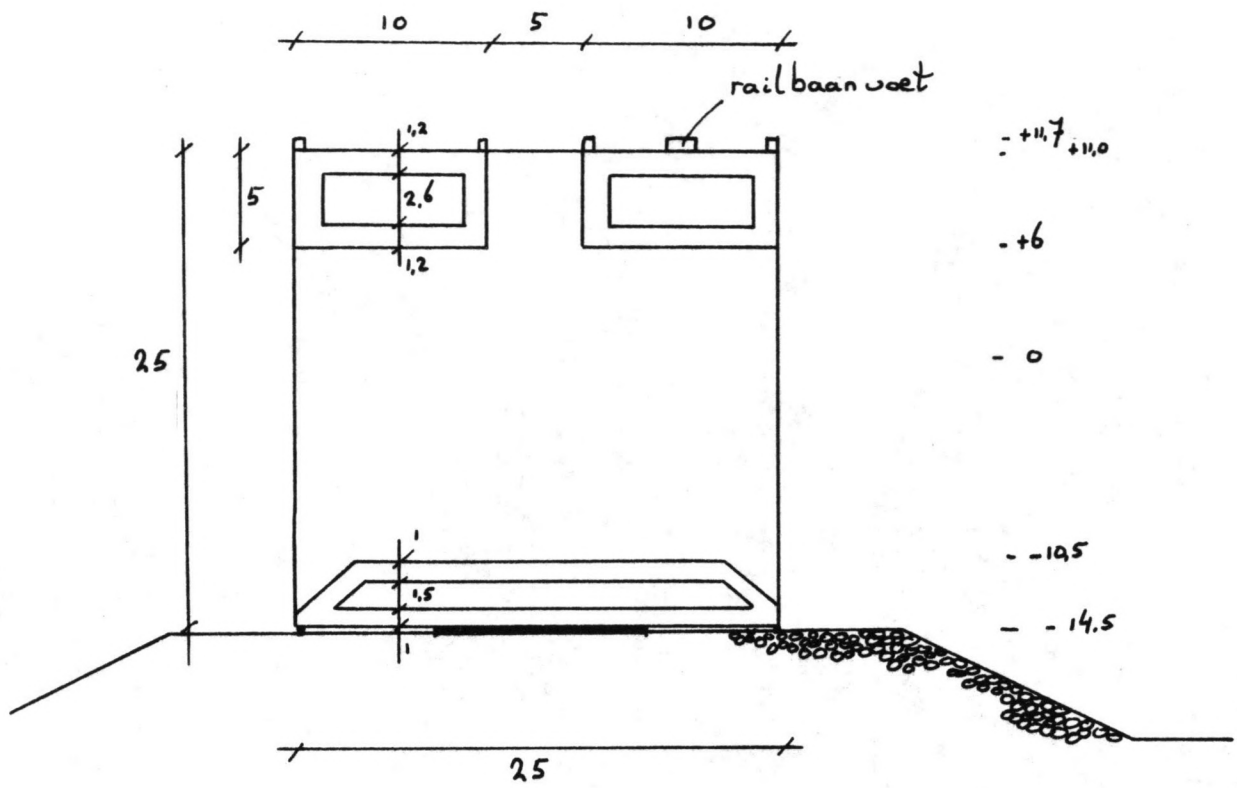


fig. 6.2.4 Doorsnede
kademuur-doorlaatcaisson

4.17 -

- 0 -

- 10.5 -

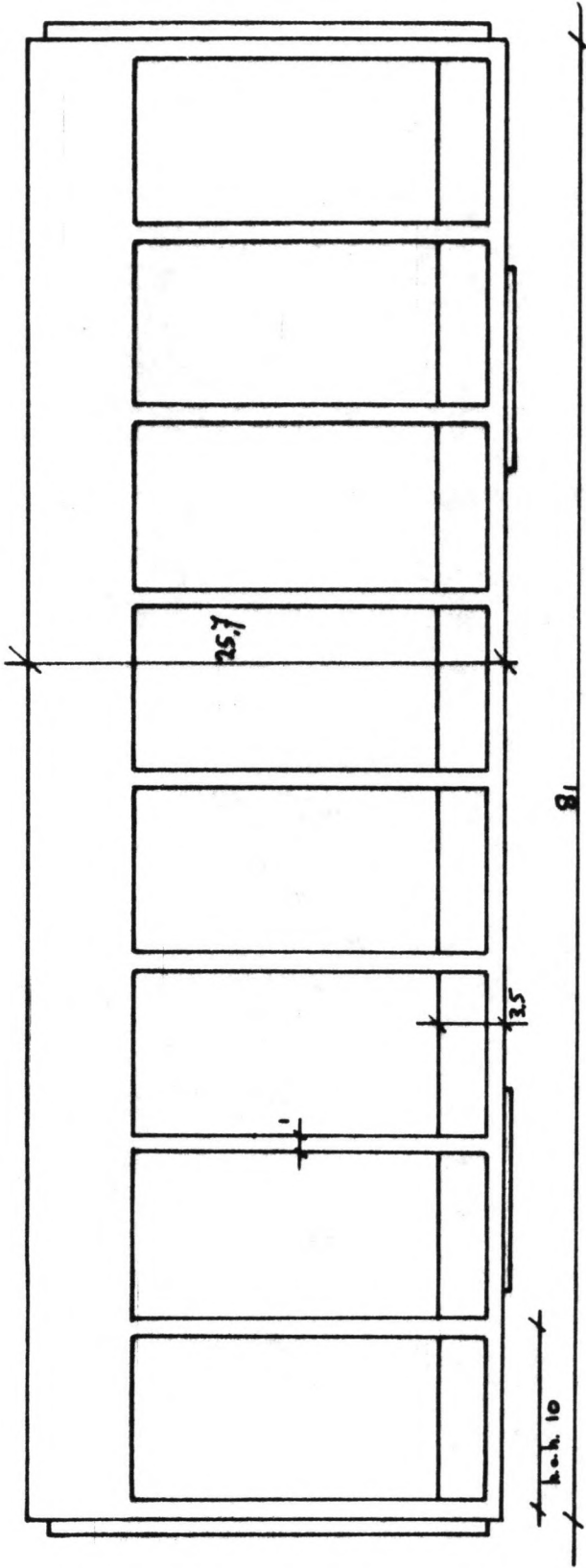
- 25.7 -

- 41.0 -

Zij aanzicht

Kademuur -

doorlaatcaisson



boven aanzicht

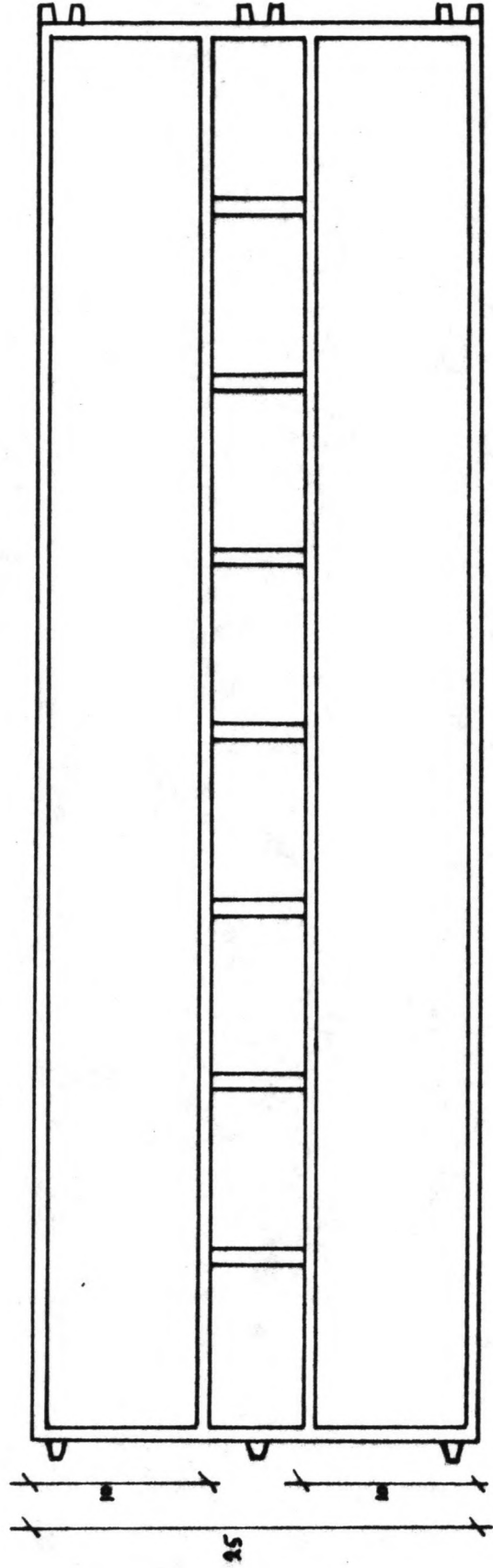


fig 6.2.5

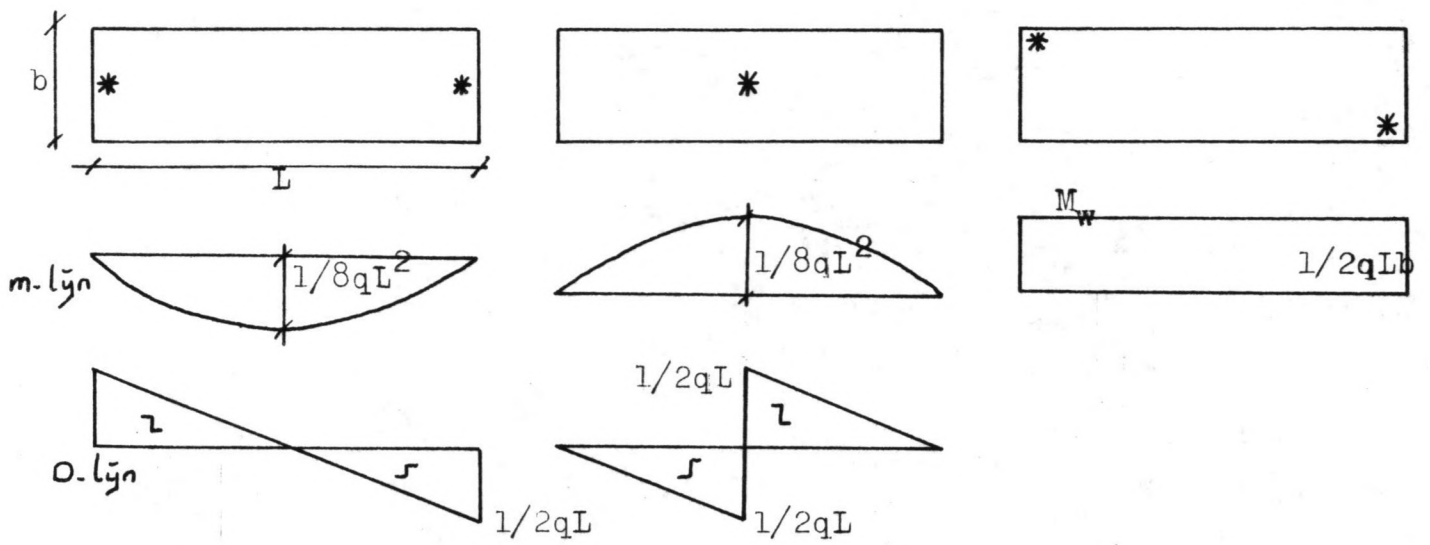


fig. 6.2.6 Mogelijke extreme momenten

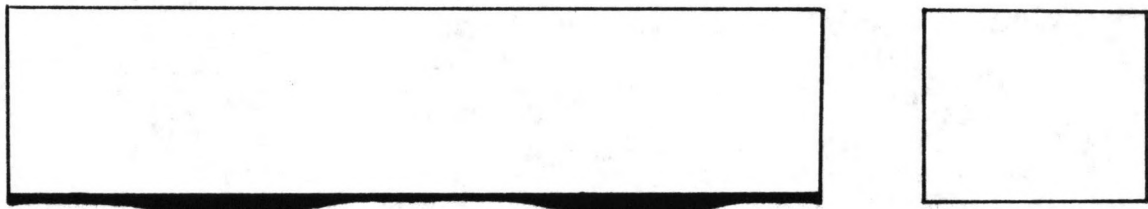


fig. 6.2.7 Voorbeeld gewelfde bodemvorm

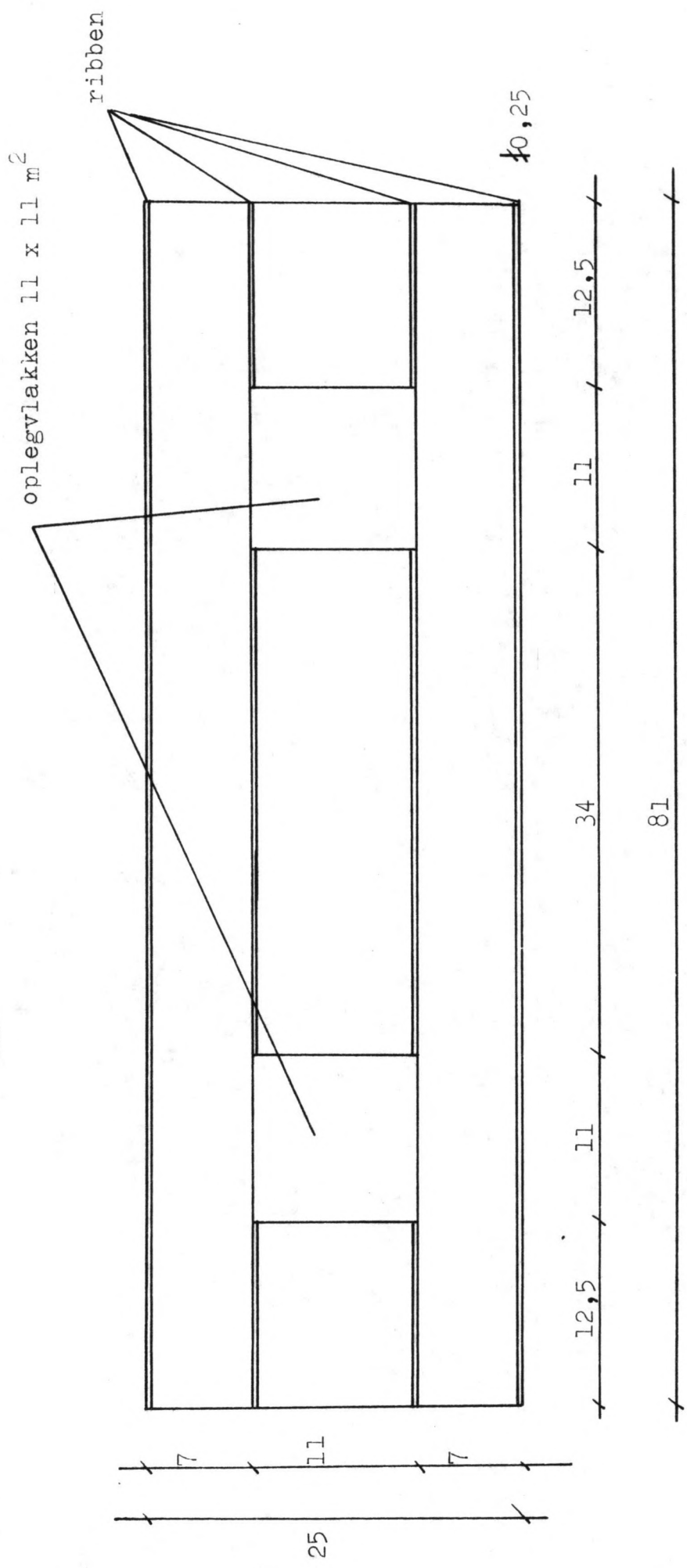


fig. 6.2.8 Asan Baai caisson onderaanzicht

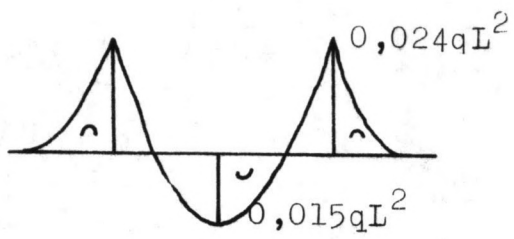
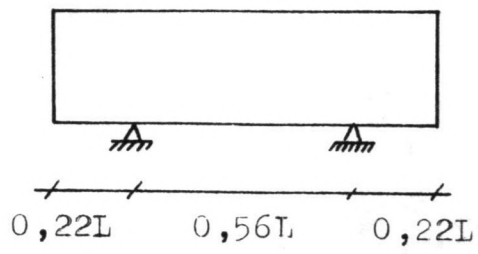


fig. 6.3.1 Verdeling buigende momenten

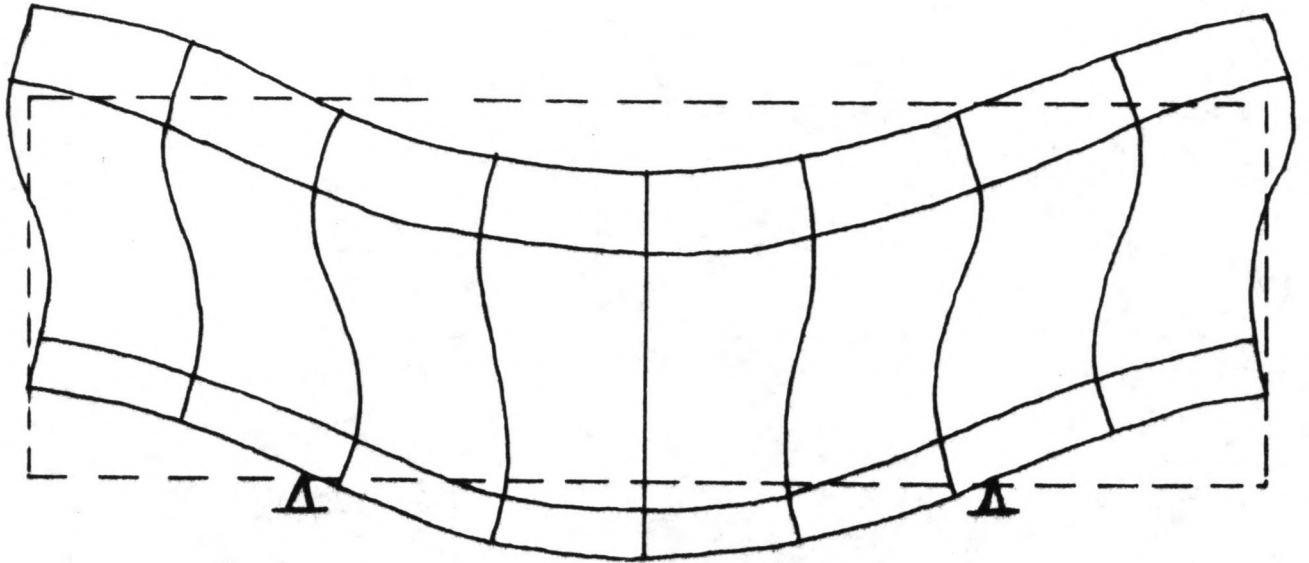


fig. 6.3.2 Vervorming met buigstijve kokers

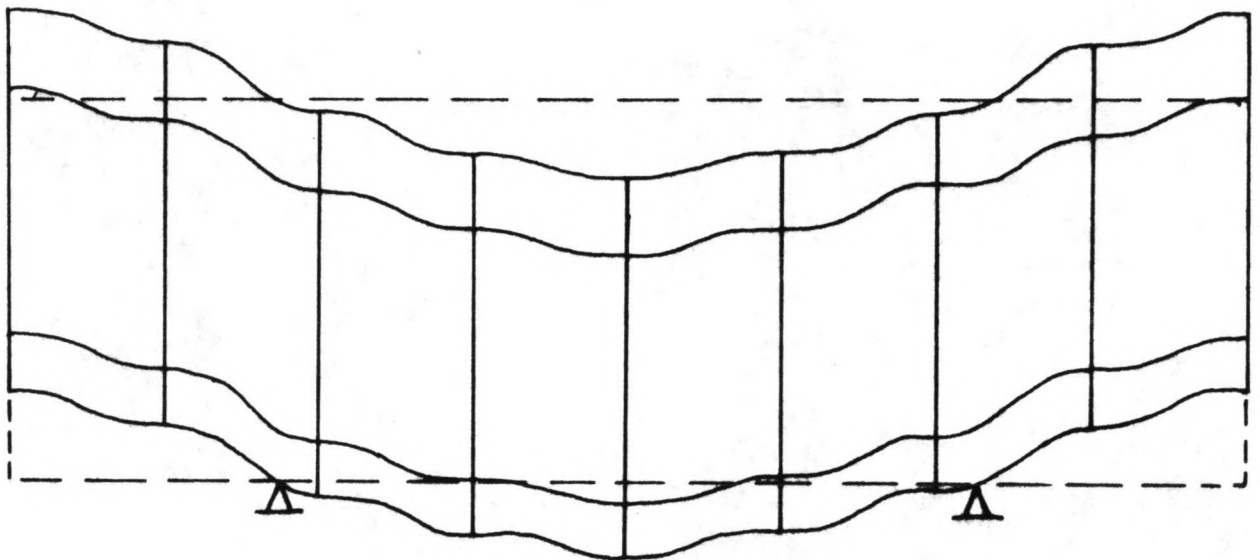


fig. 6.3.3 Vervorming met buigstijve wanden

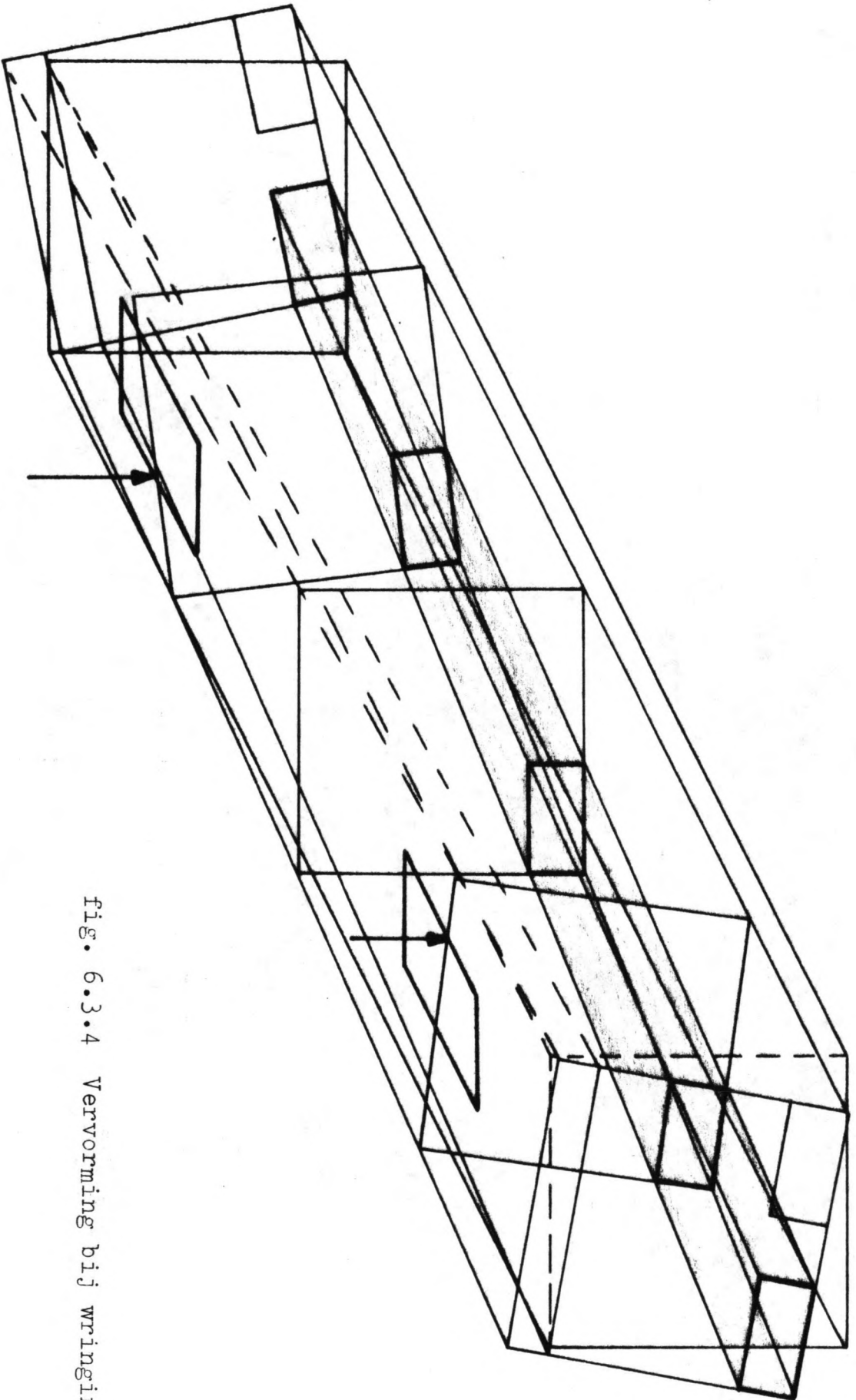


fig. 6.3.4 Vervorming bij wringing

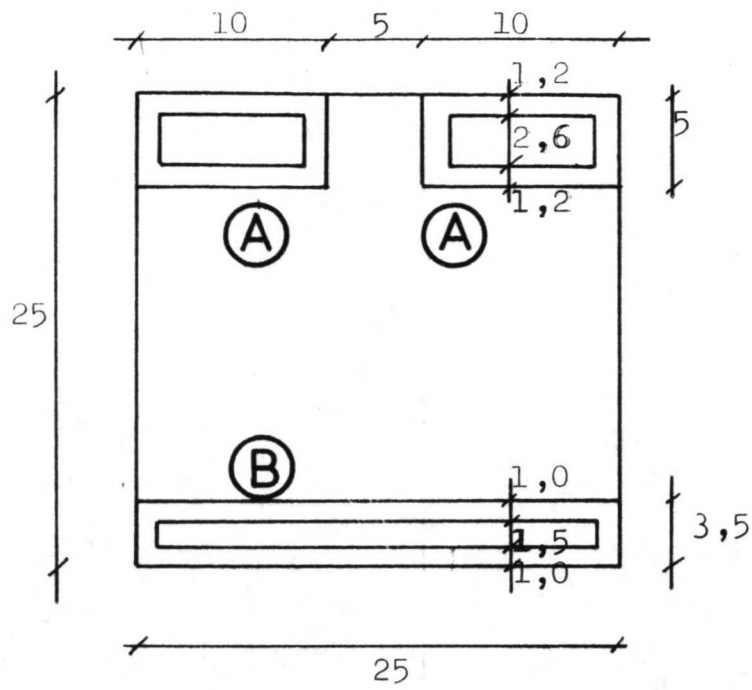


fig. 6.3.5 Overzicht wringstijve kokers

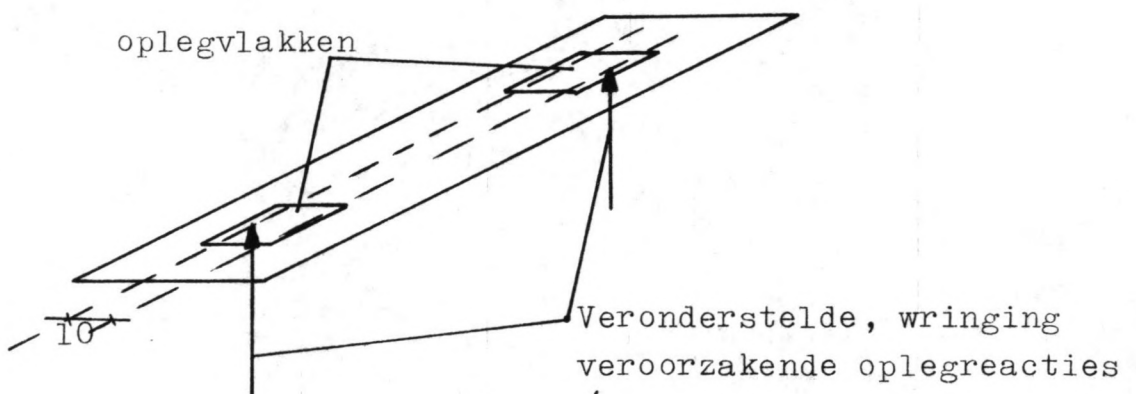


fig. 6.3.6 Wringing veroorzakende oplegreacties

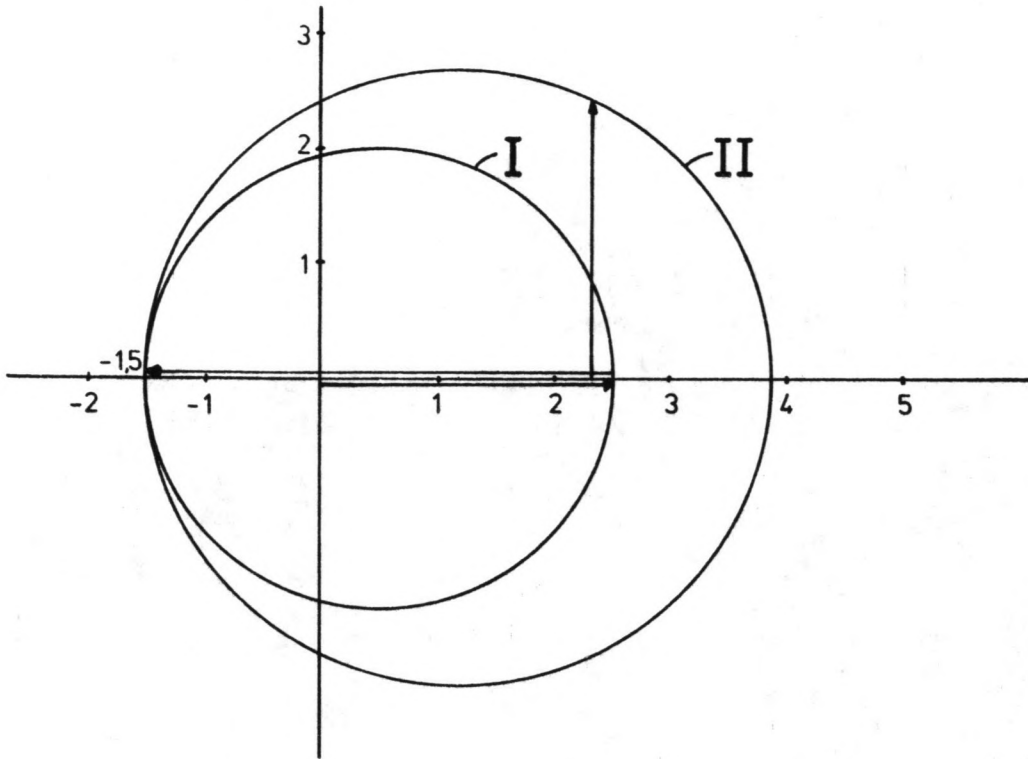


fig. 6.3.7 Cirkel van Mohr

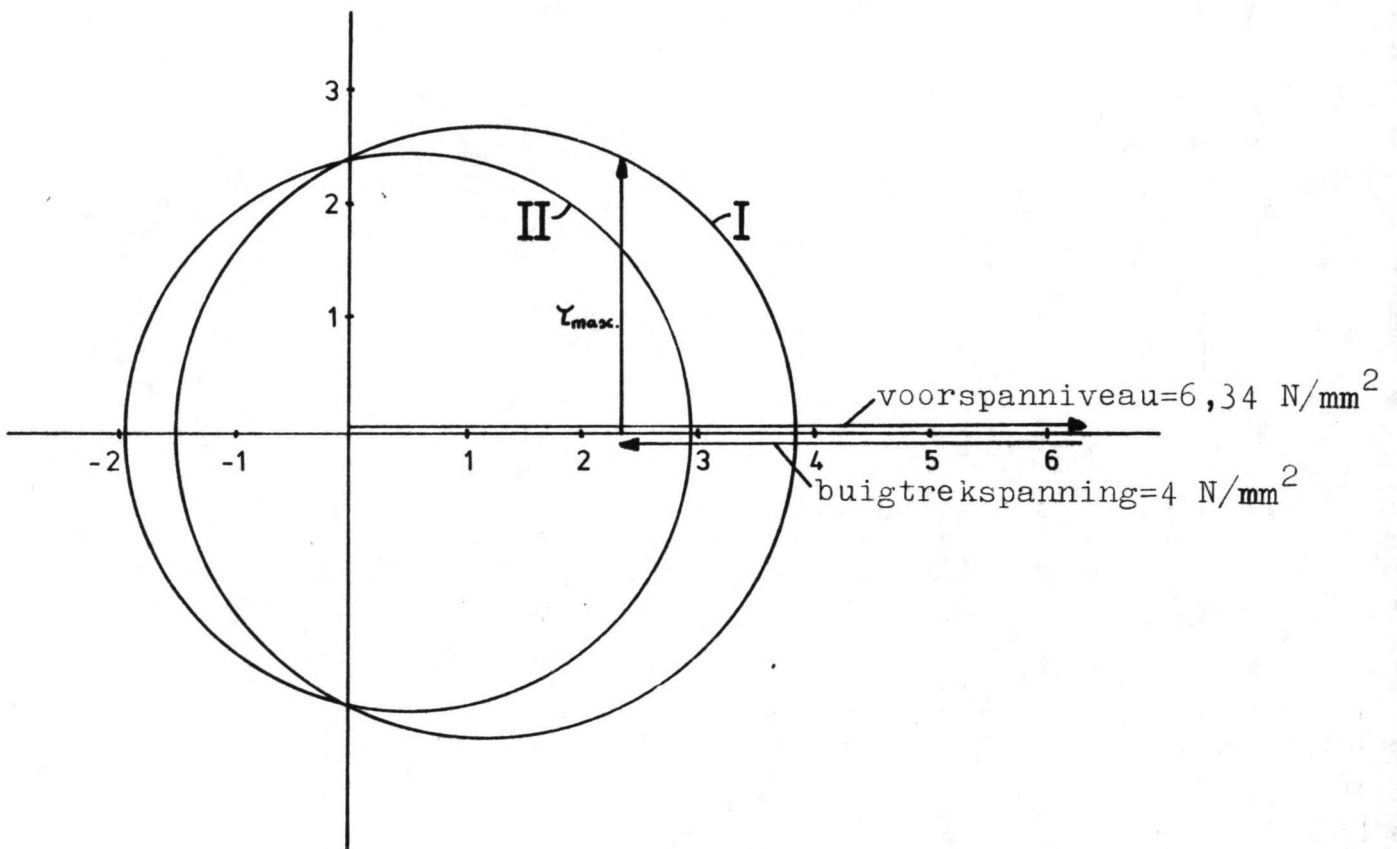


fig. 6.3.8 Cirkel van Mohr

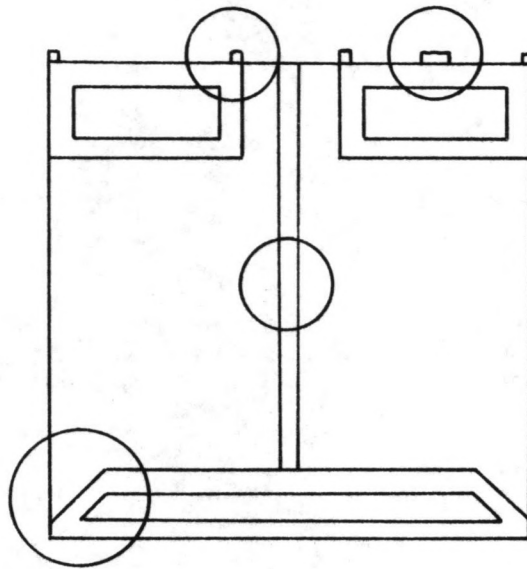


fig. 6.4.1 Behandelde details

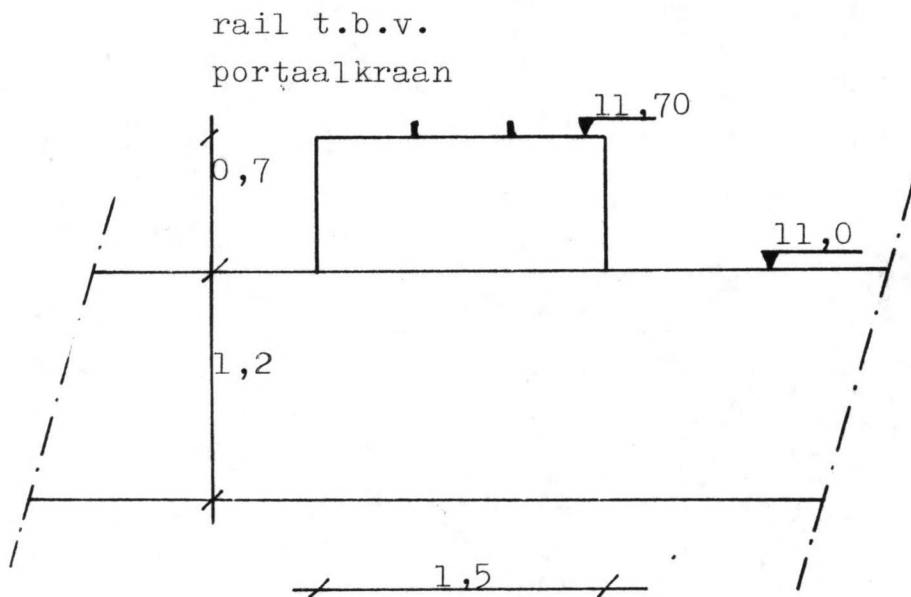


fig. 6.4.2 Railbaandetail doorlaatcaisson

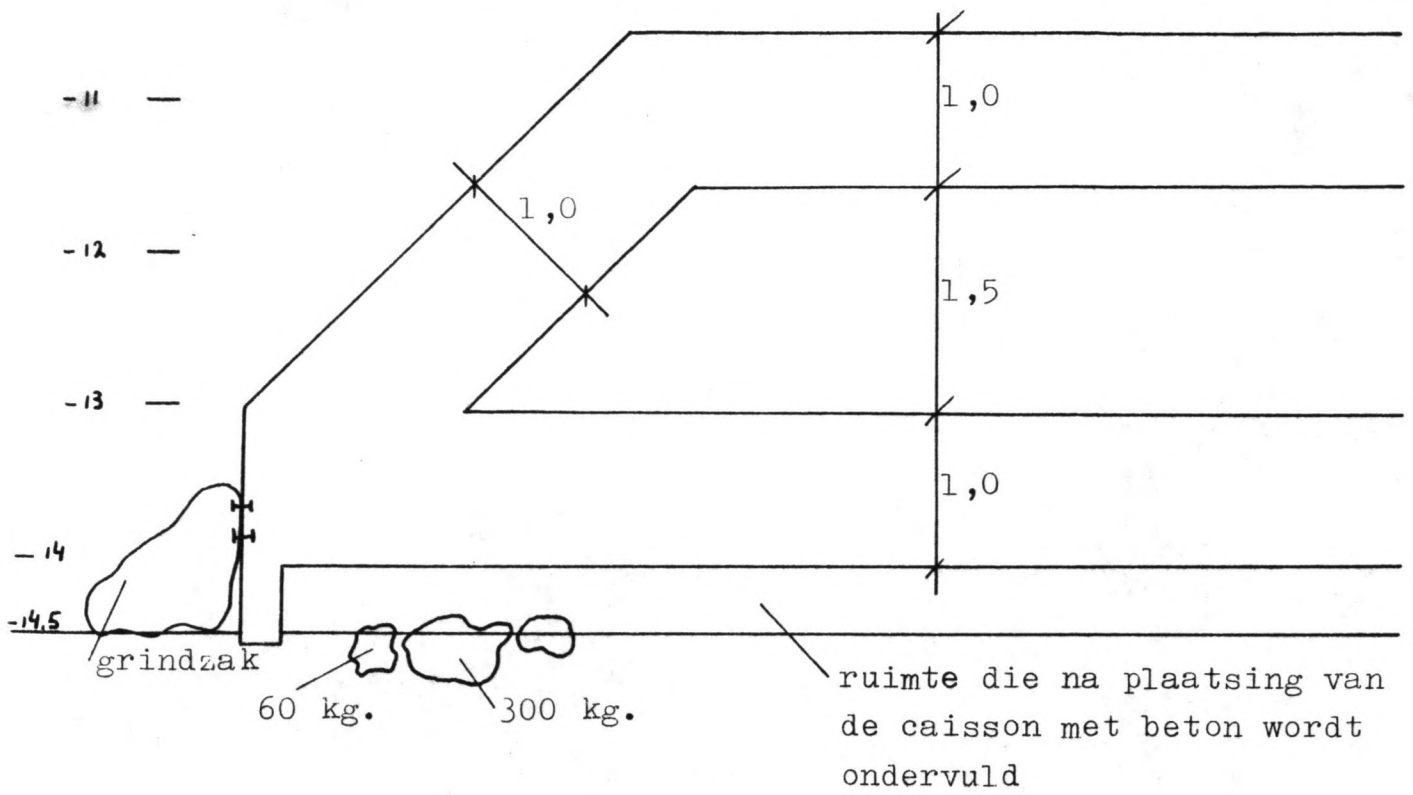


fig. 6.4.3 Detail onderkoker

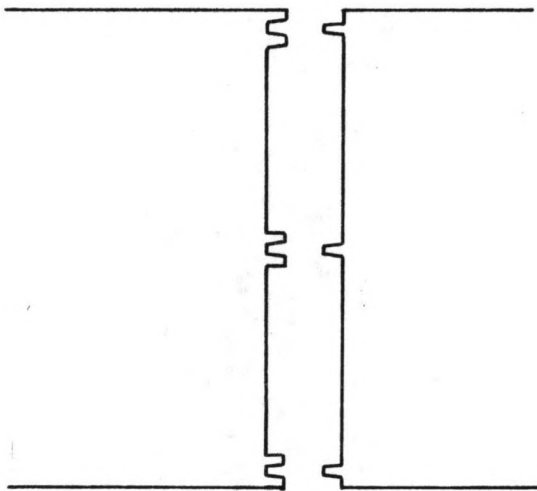
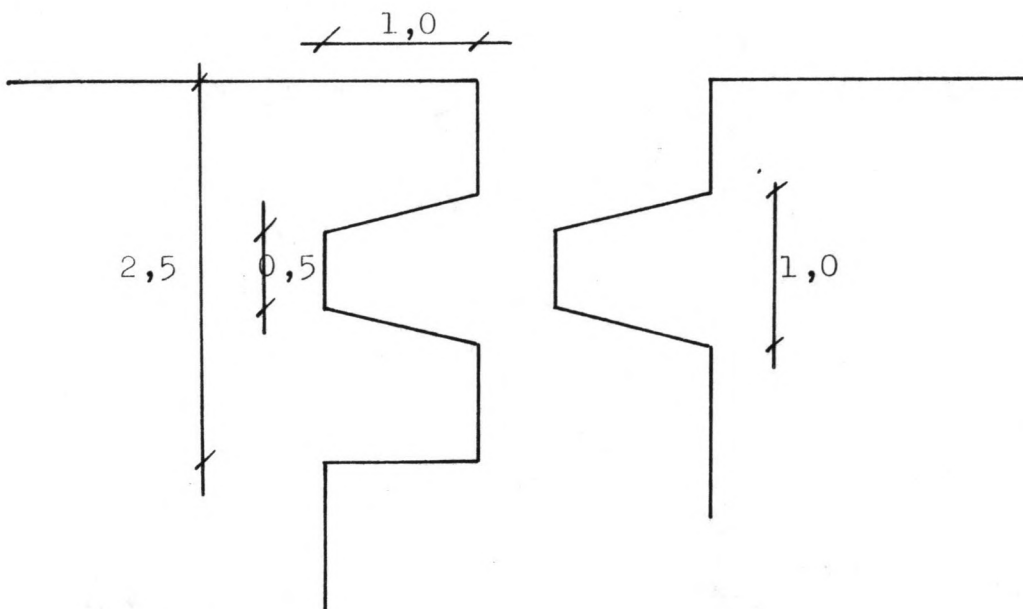


fig. 6.4.4 Aansluiting tussen twee caissons



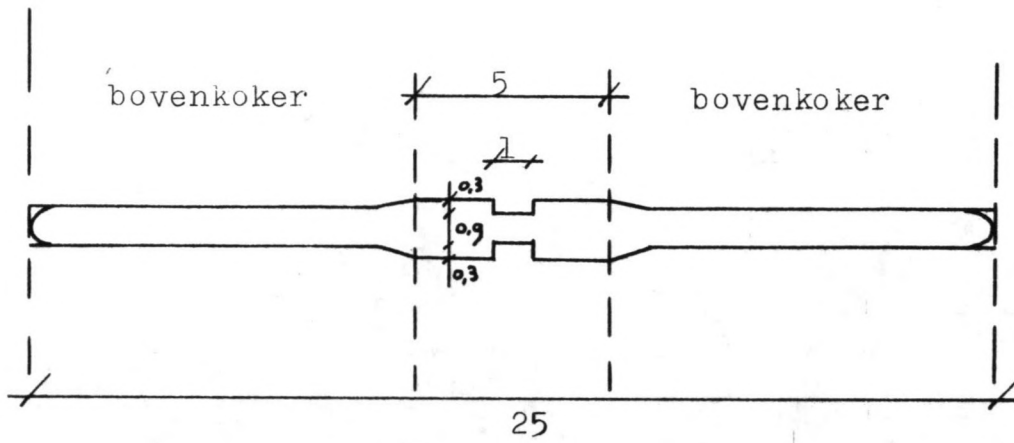


fig. 6.4.5 Doorsnede tussenwand

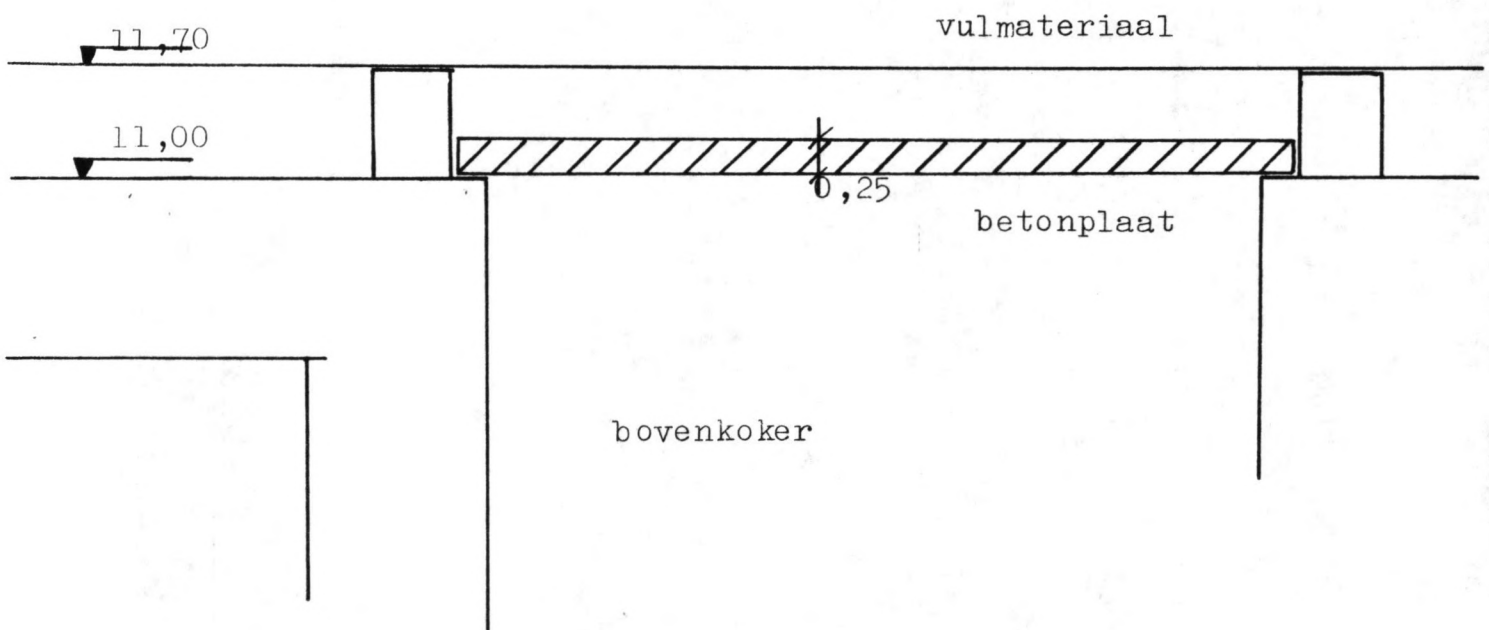


fig. 6.4.6 Afdichting bovenkant doorlaatcaisson

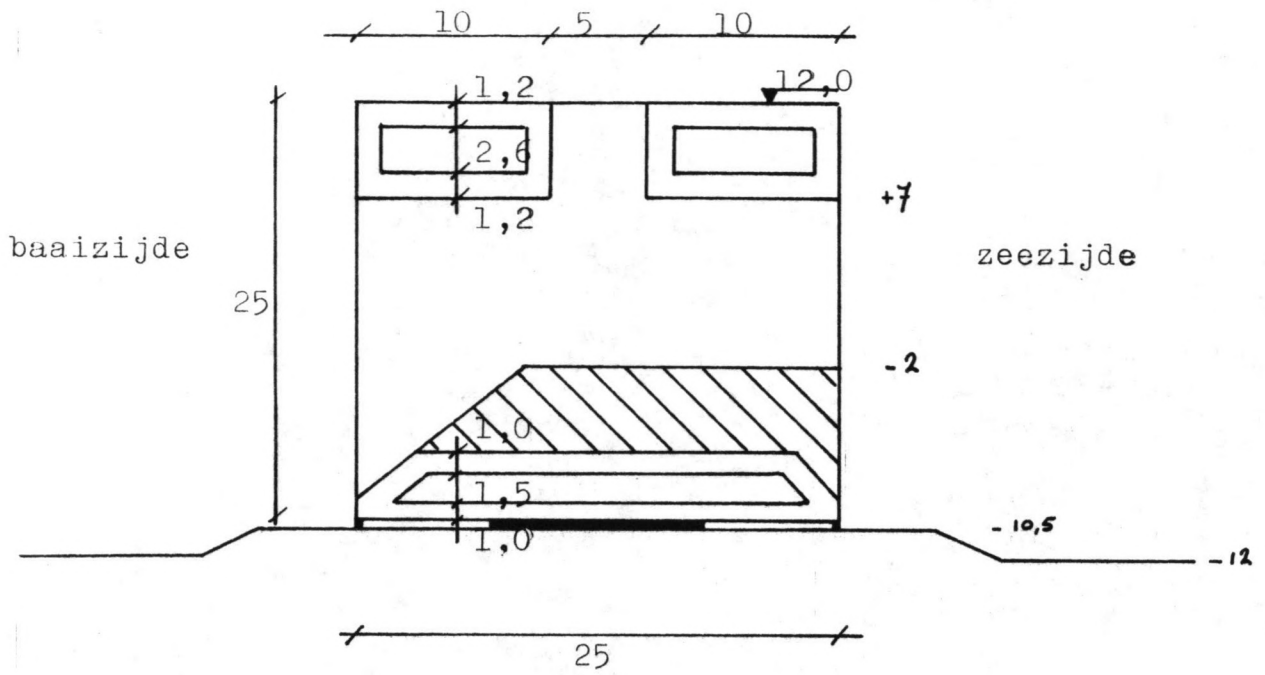


fig. 7.1.1 Doorsnede uitwateringssluis

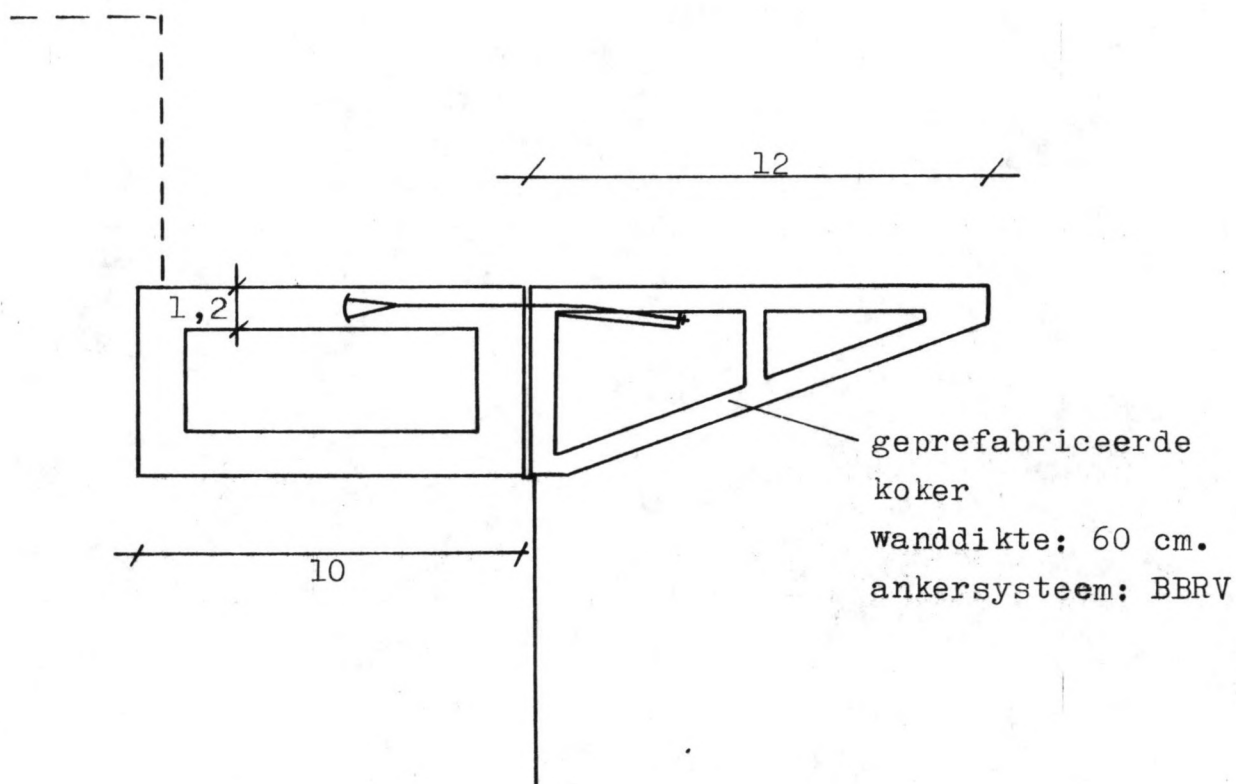
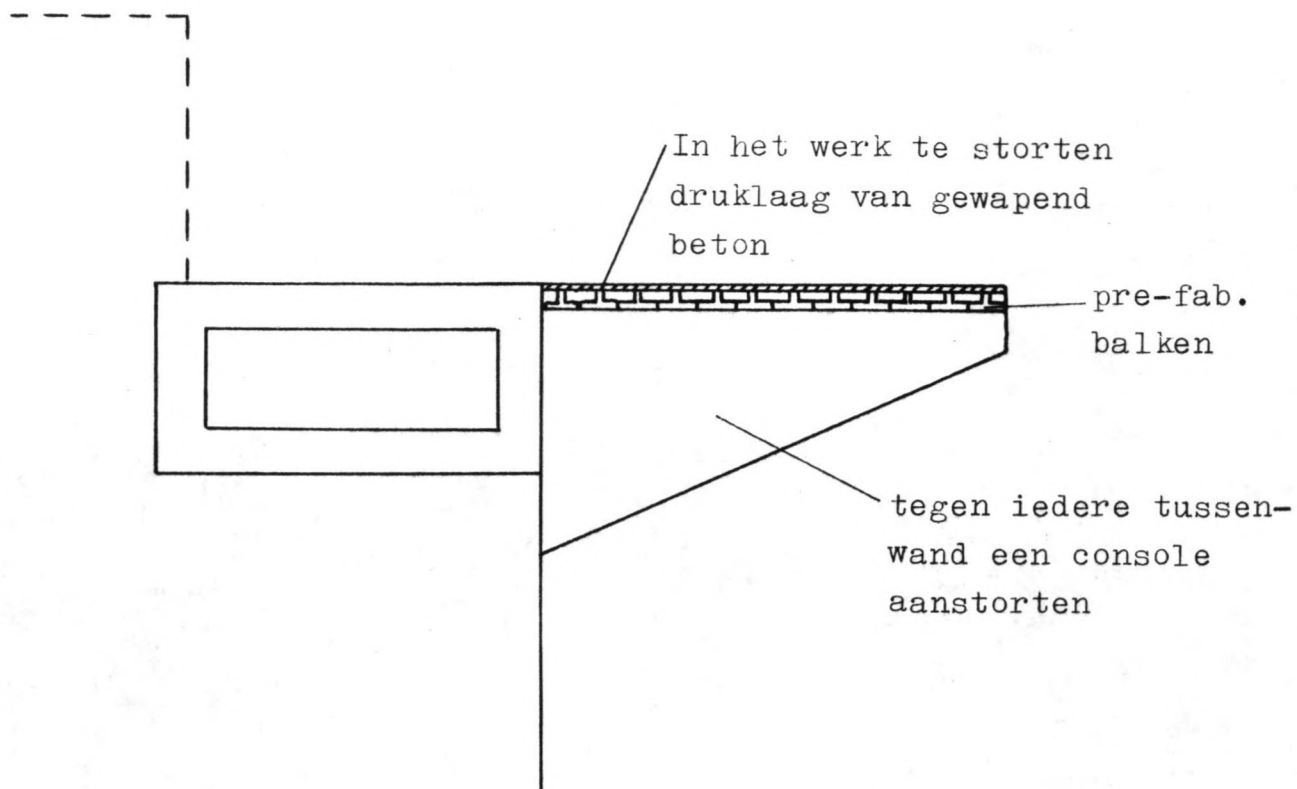


fig. 7.2.1 Aanbouw t.b.v. rijweg

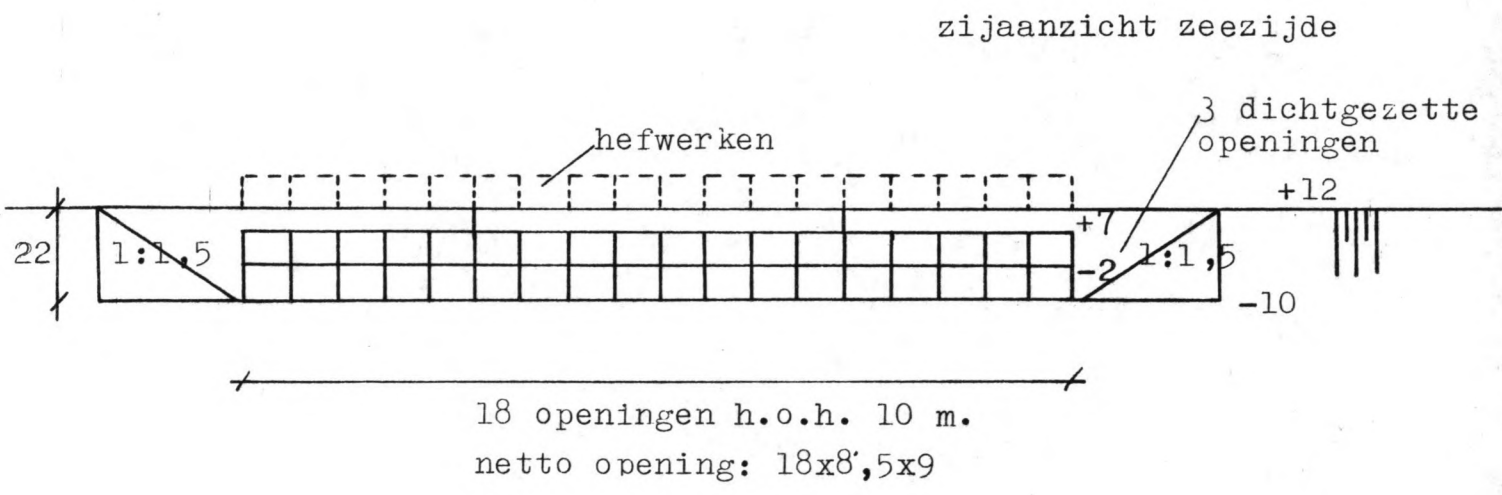
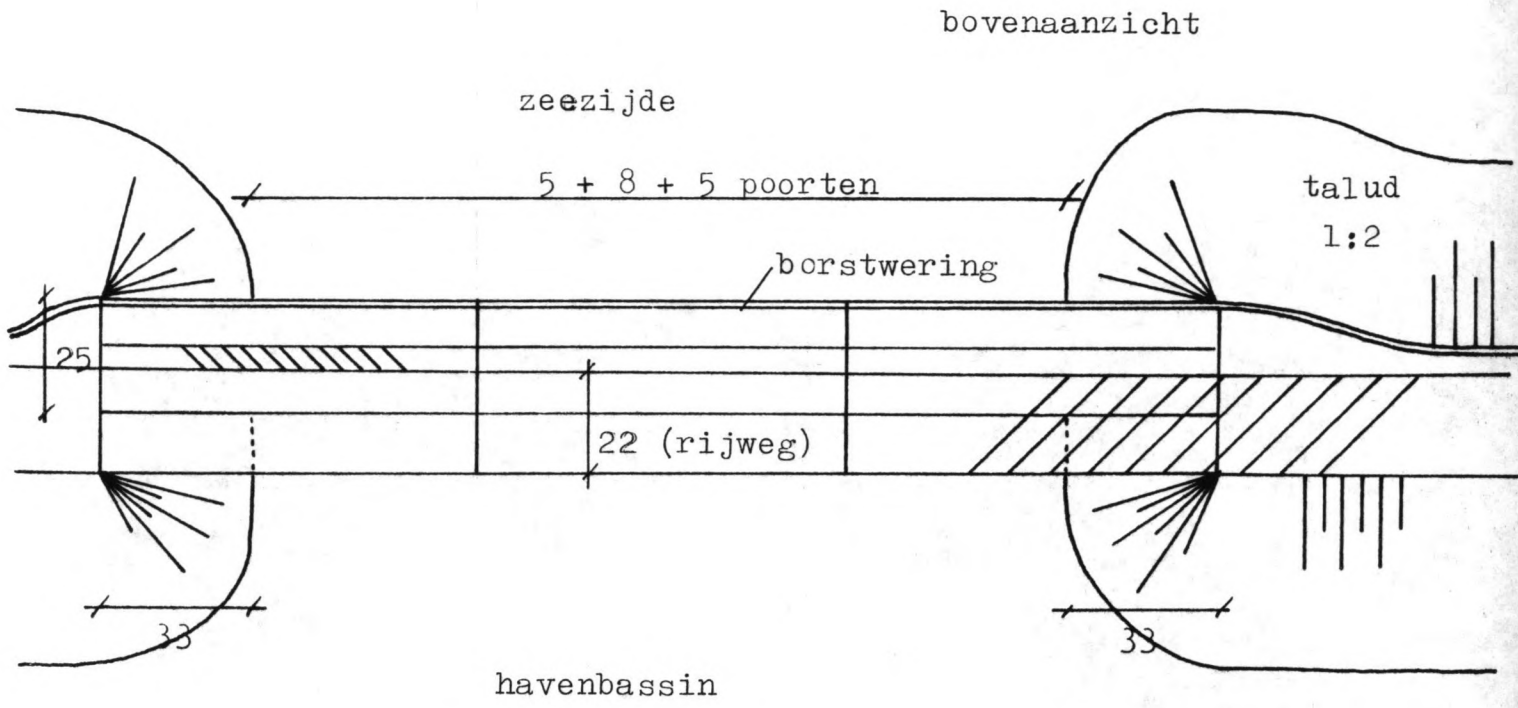


fig. 7.2.2 Uitwateringssluiss

Uitwateringssluis

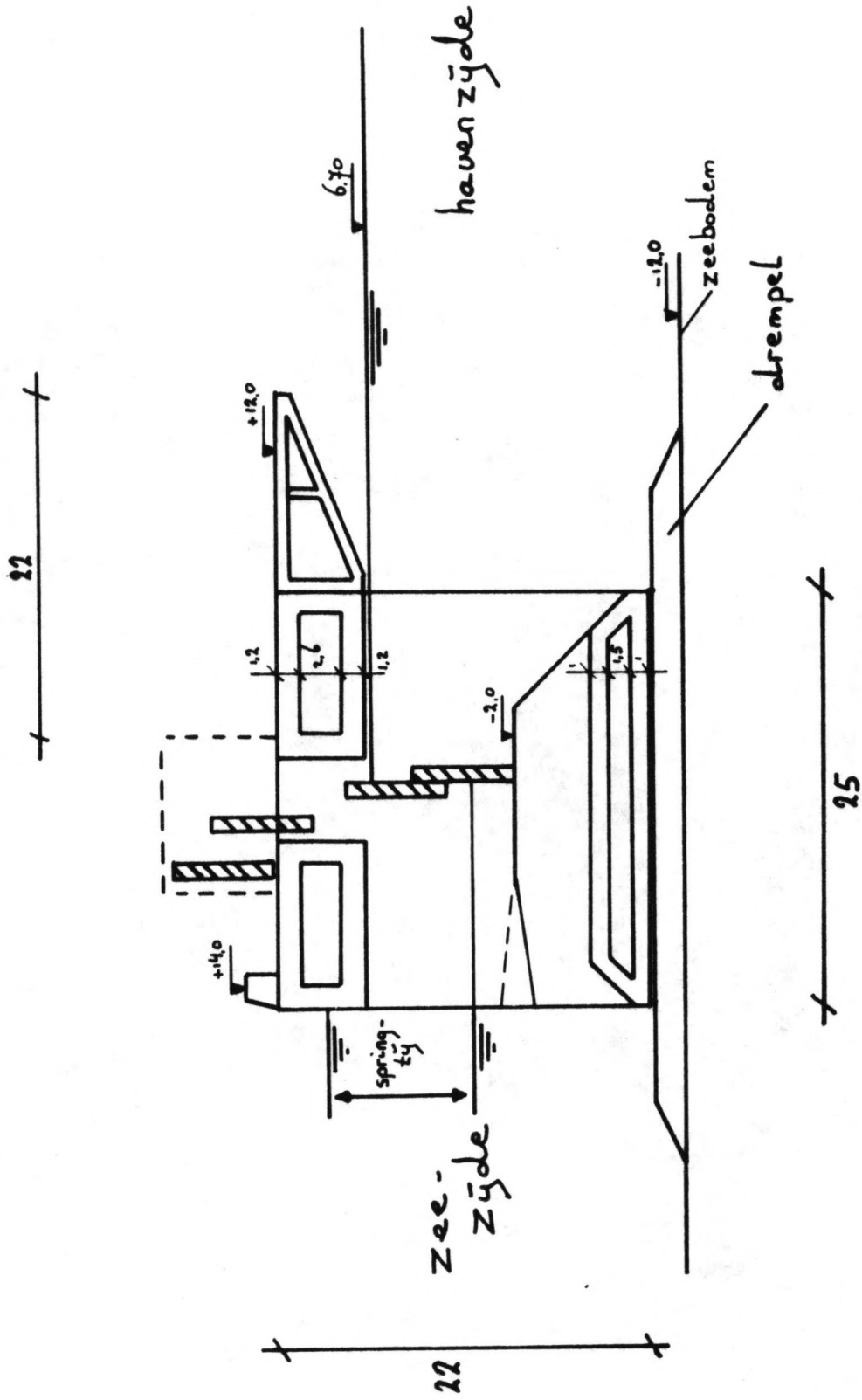


fig. 7.2.3 Doorsnede uitwateringssluis

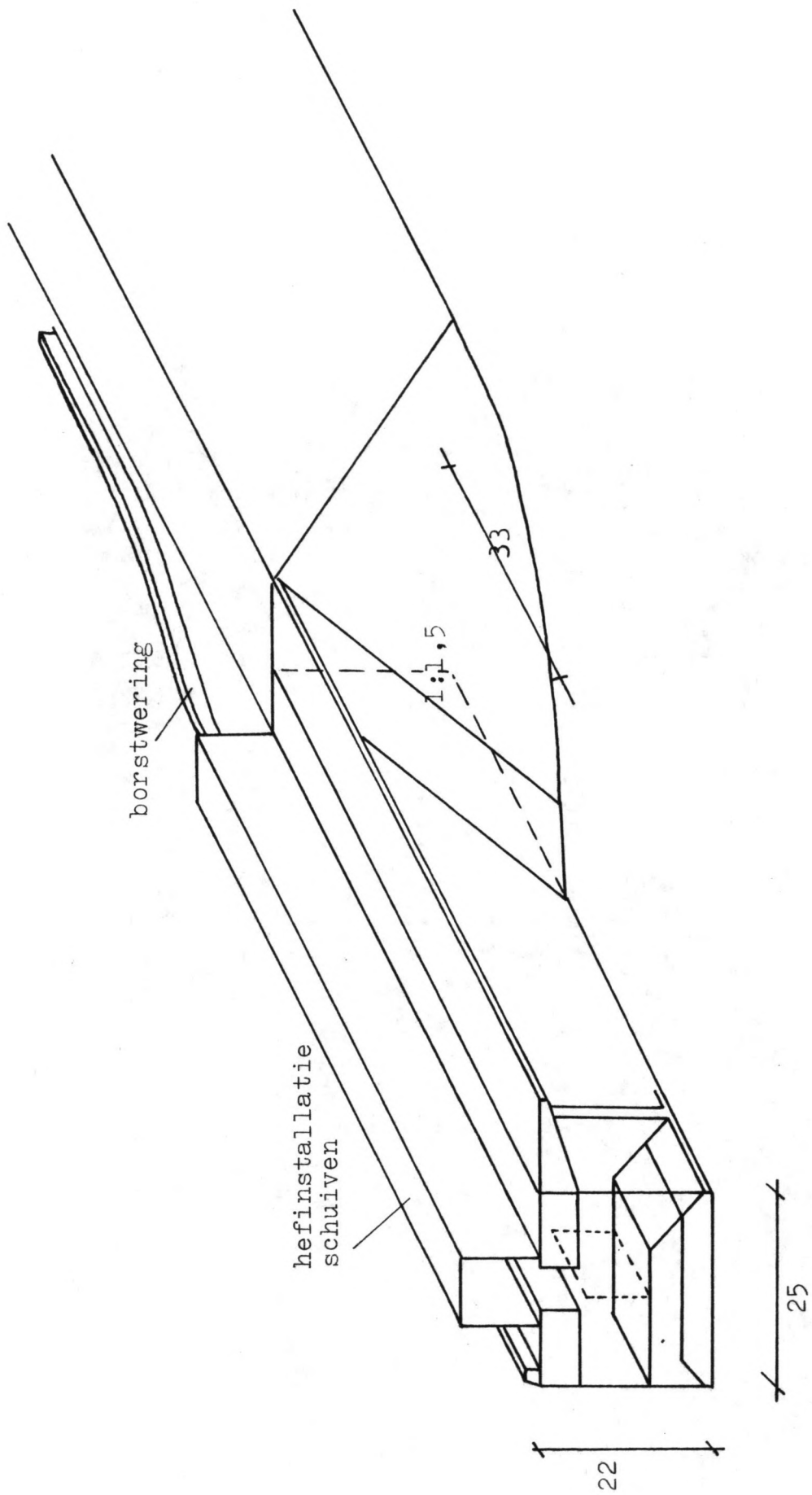


fig. 7.2.4 Detail landhoofdaansluiting

borstwering

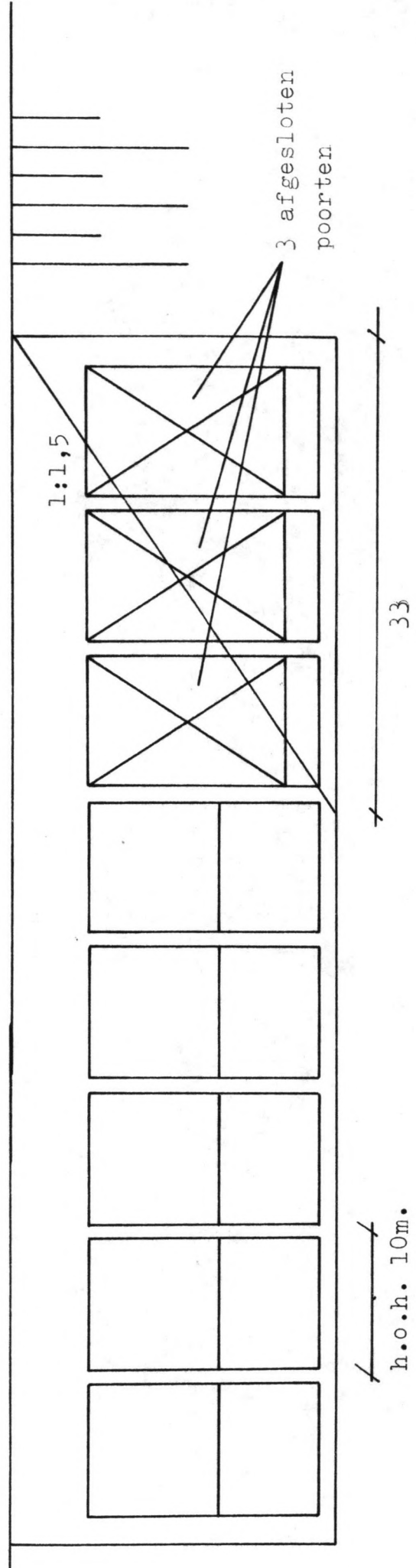


fig. 7.2.5 Aanzicht landhoofdoplossing zeezijde

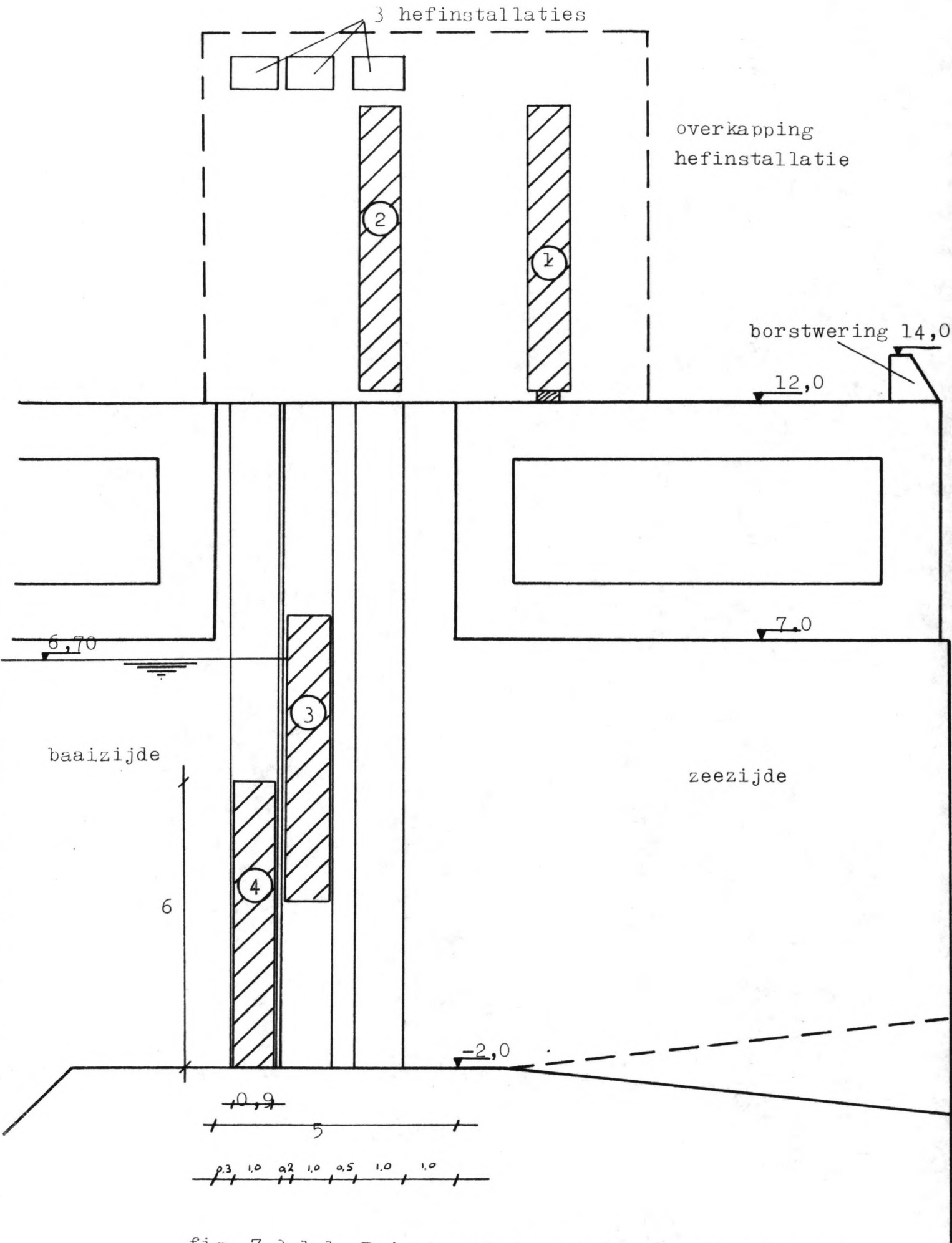


fig. 7.3.1.1 Principeschets van de afsluitmiddelen

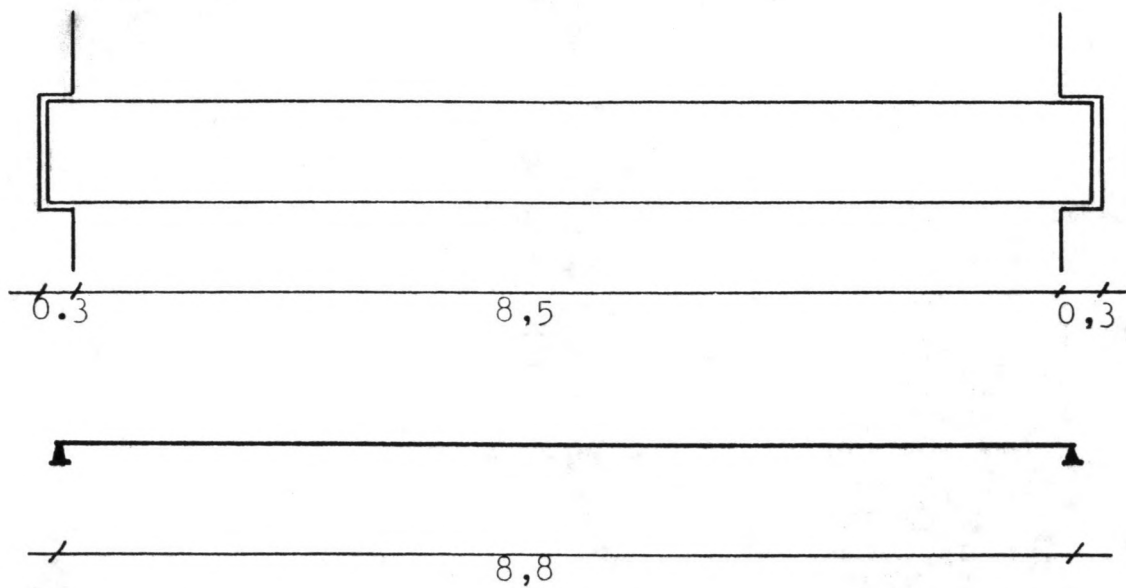


fig. 7.3.2.1 Opleglengte van de schuif

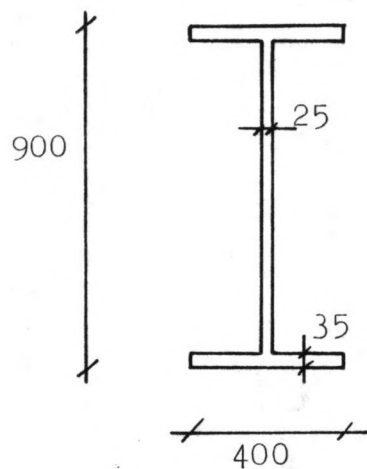


fig. 7.3.2.2 Afmetingen hoofdligger

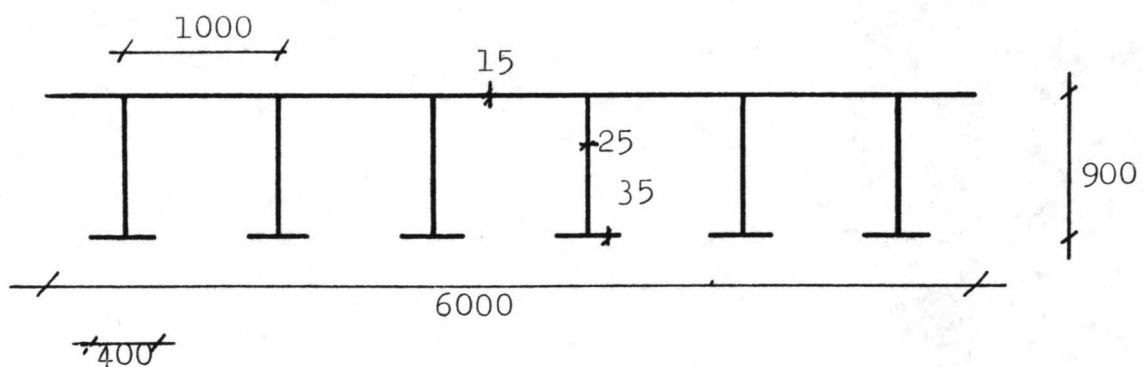


fig. 7.3.2.3 Mogelijke hoofdafmetingen van de schuifdoorsnede

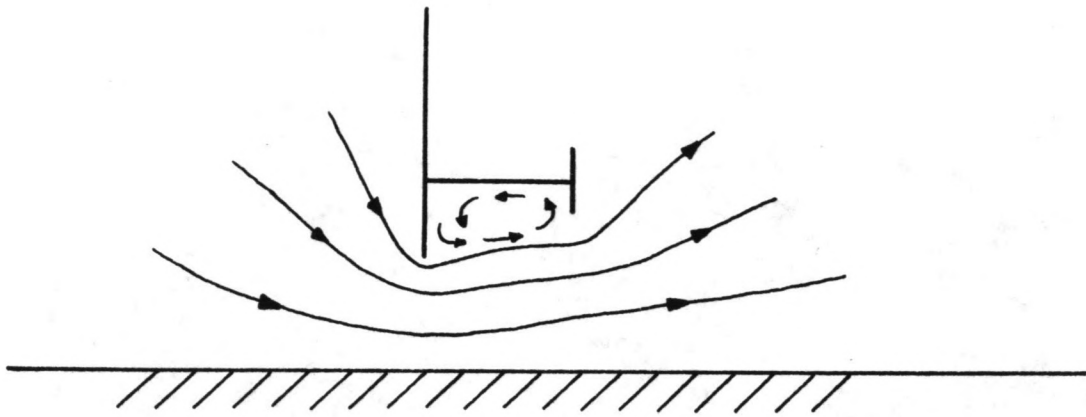


fig. 7.3.2.4 Trillingveroorzakende vormgeving

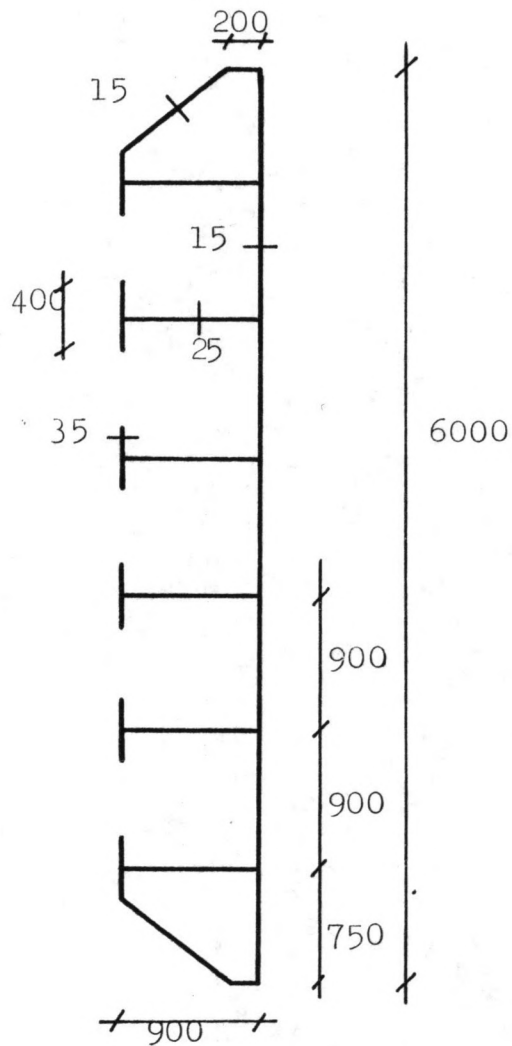


fig. 7.3.2.5 Gekozen hoofdafmetingen afsluittmiddel

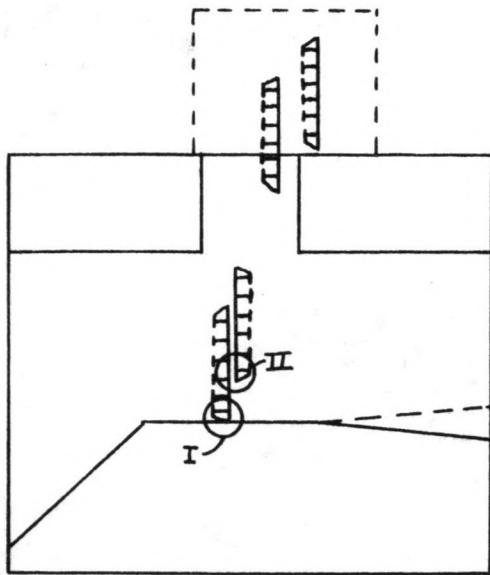


fig. 7.3.2.6

Opstelling van de vier regelschuiven

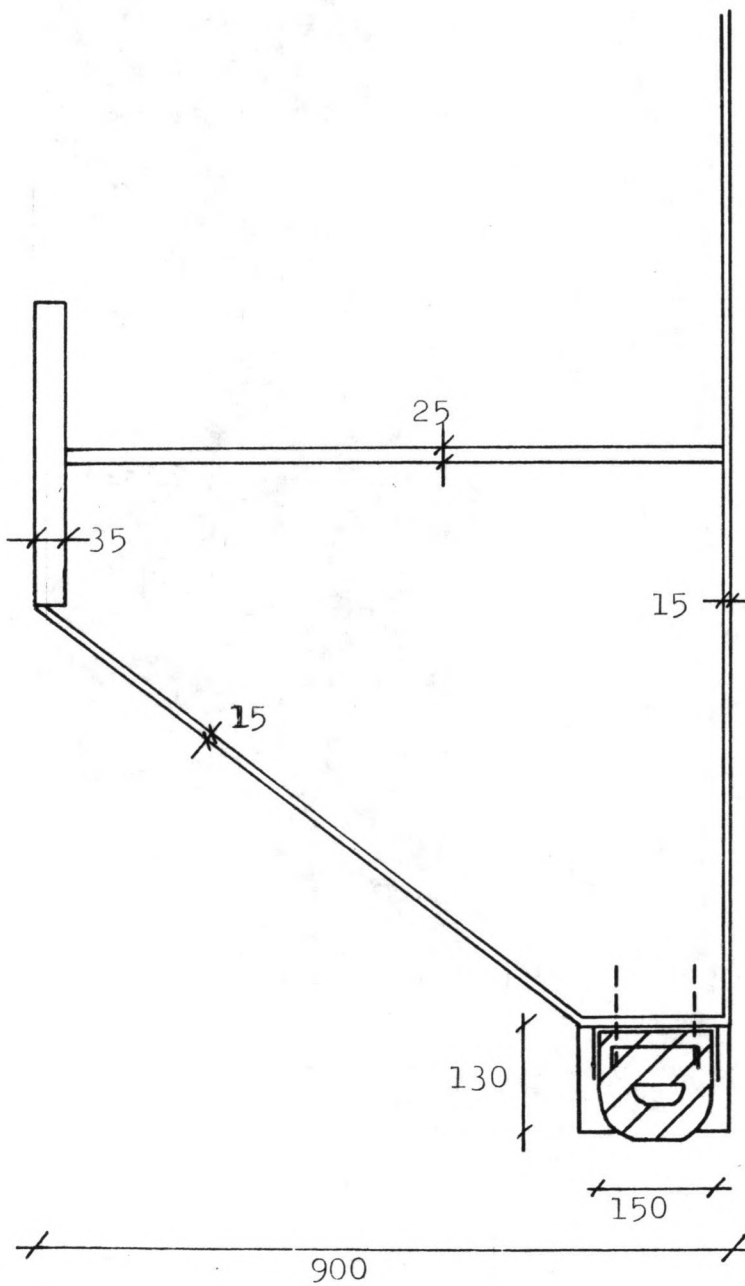


fig. 7.3.2.7

Detail I uit fig. 7.3.2.6
afdichting

afdichtingsprofiel

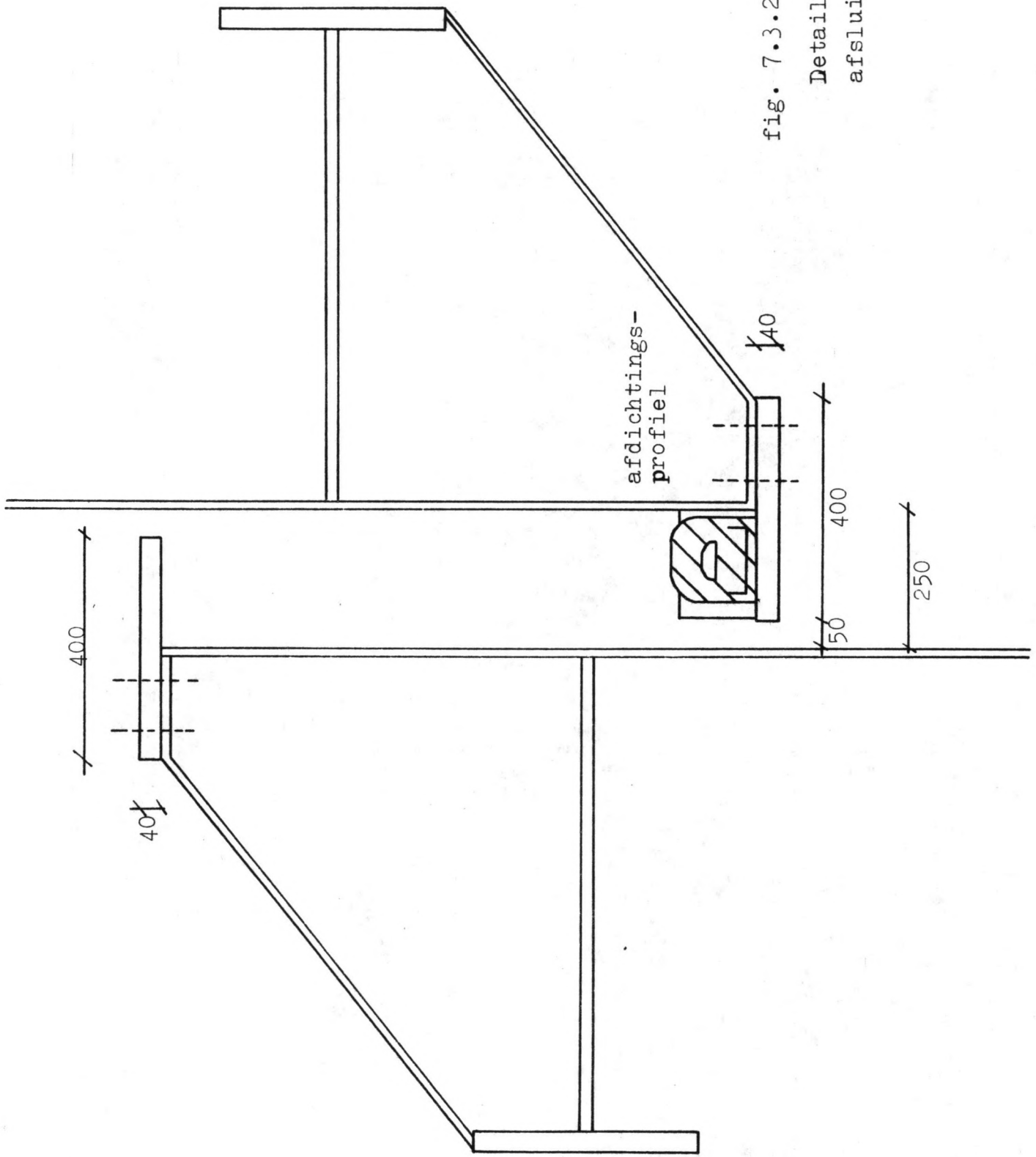


fig. 7.3.2.8

Detail II uit fig. 7.3.2.6
afsluitingsconstructie

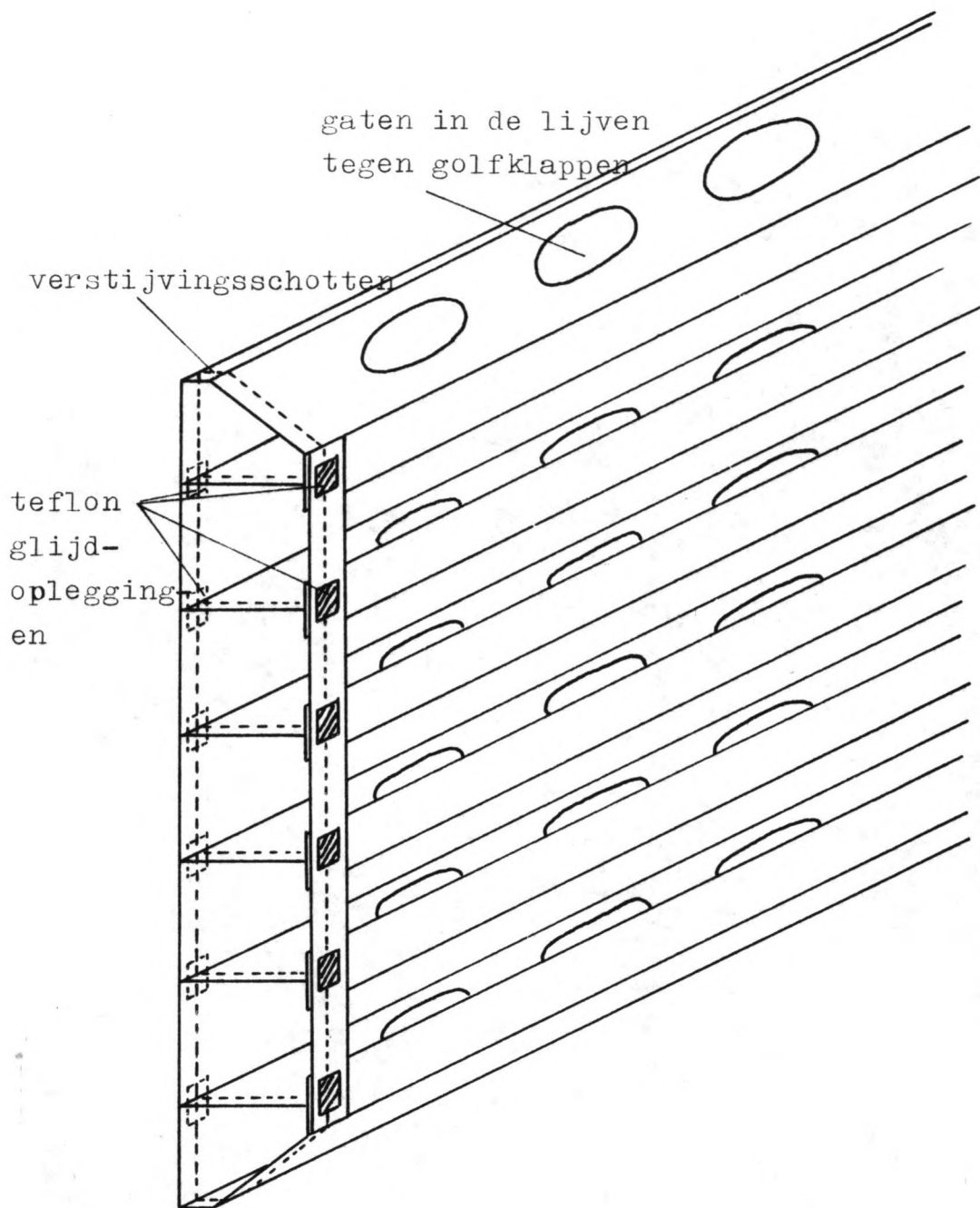


fig. 7.3.2.9 Detail oplegging van de schuif met teflon opleggingen en tussenschotten.

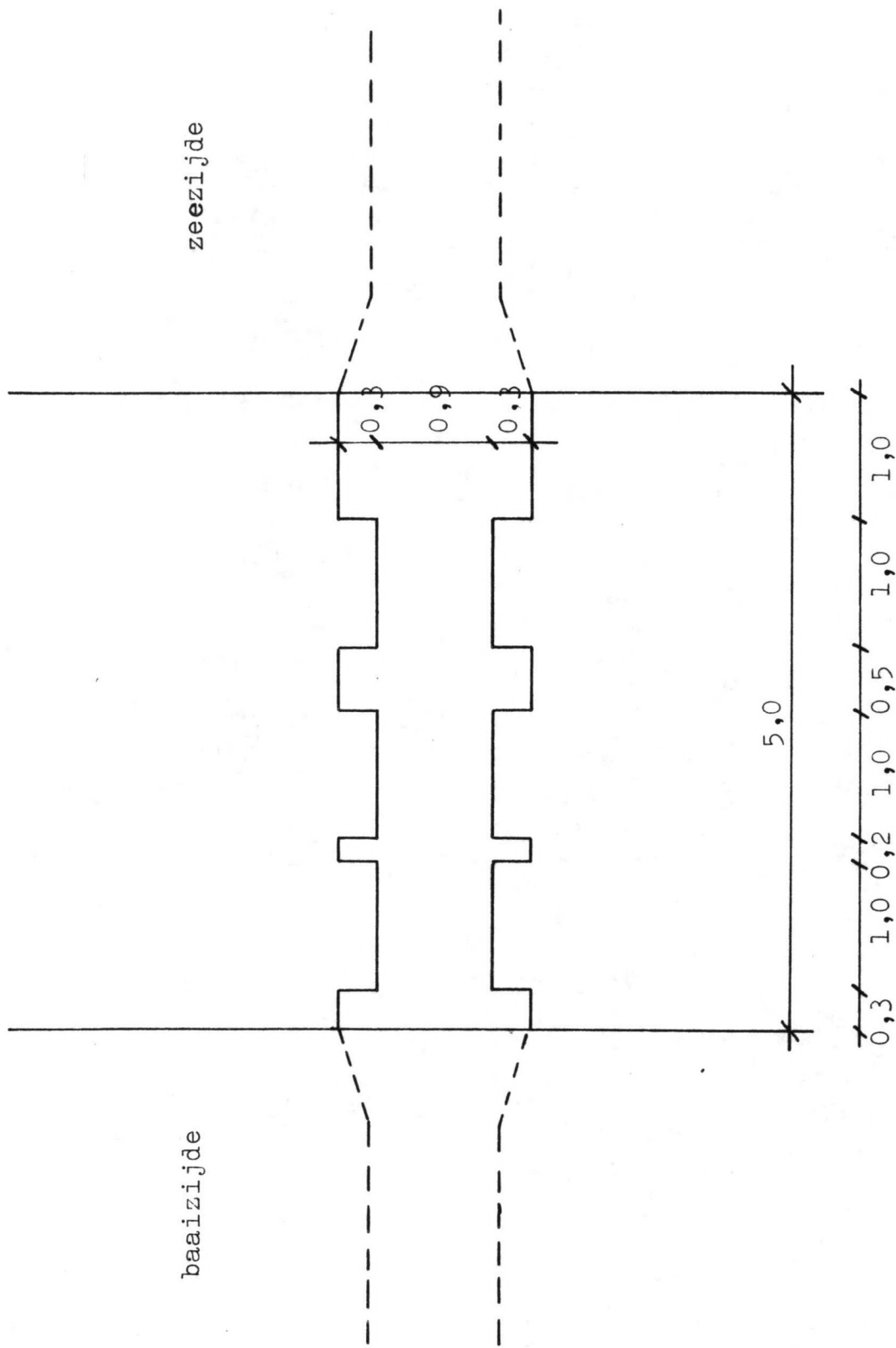


fig. 7.3.2.10 Bovenanzicht van een tussenwand t.p.v. de sponningen voor de schuiven

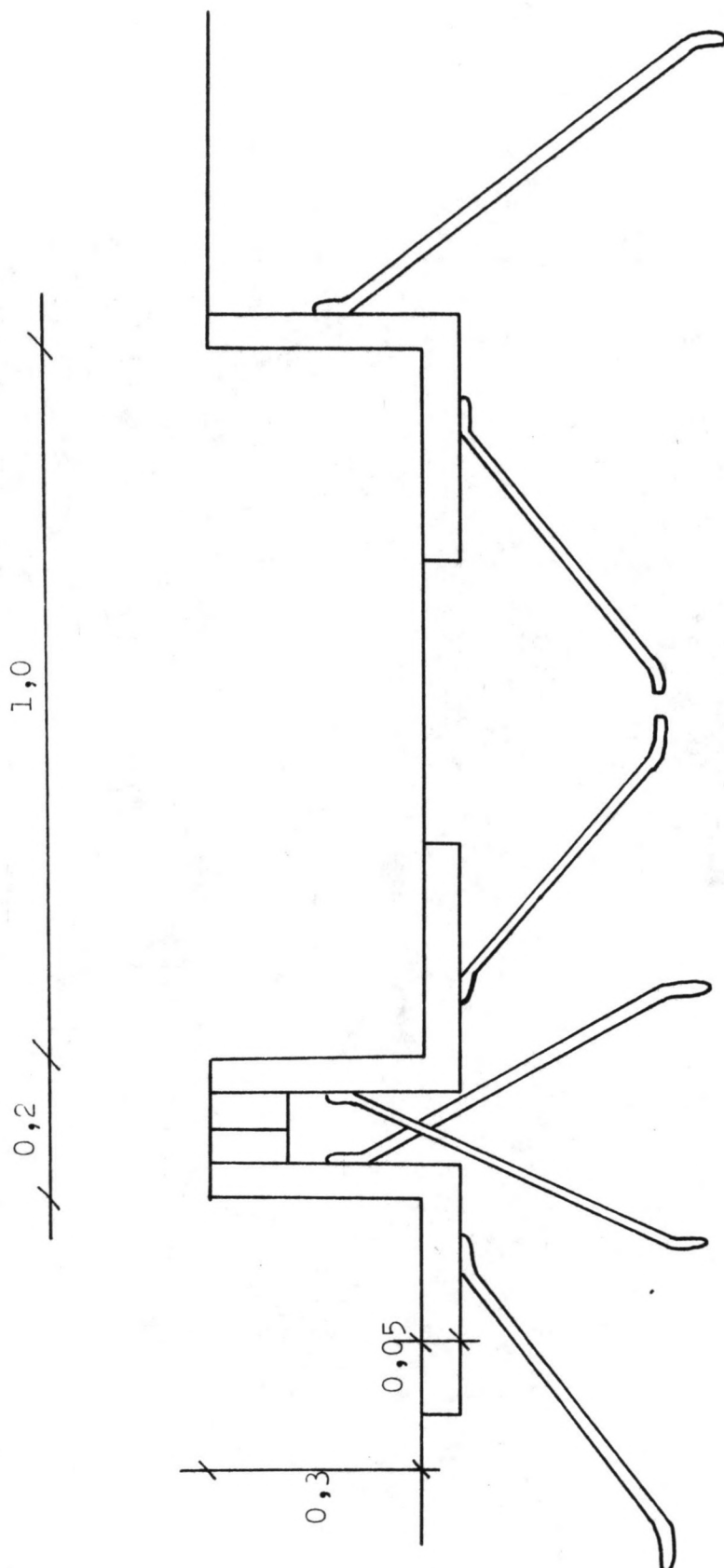


fig. 7.3.2.11 Detail schuifspanningen

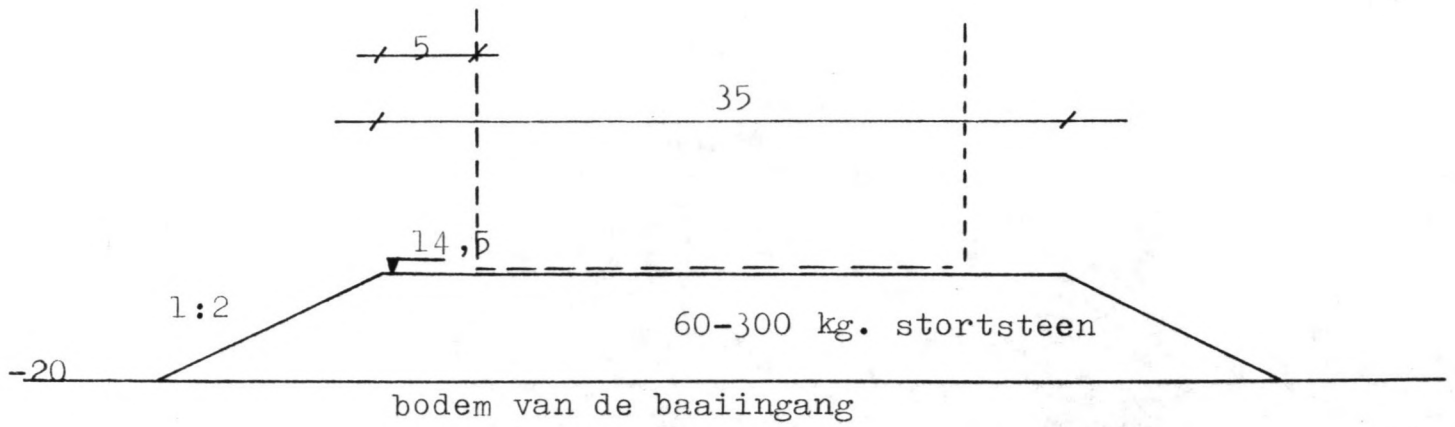


fig. 8.1.1 Drempel kademuur-doorlaatcaisson

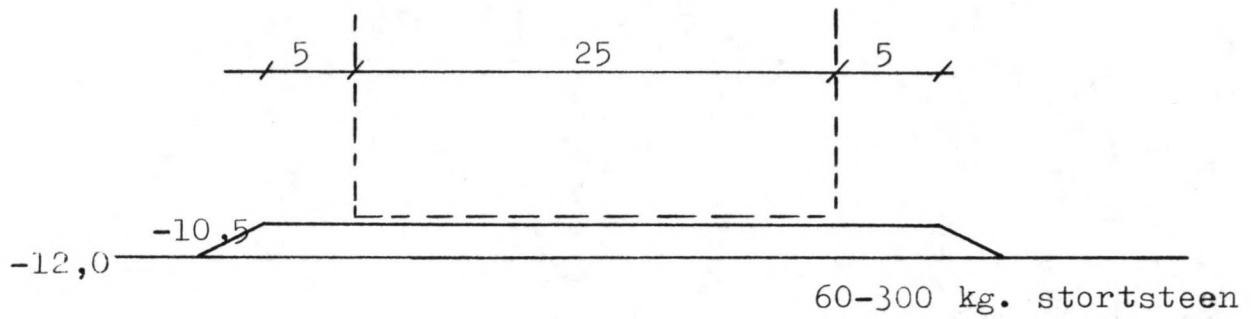


fig. 8.1.2 Drempel uitwateringssluiss

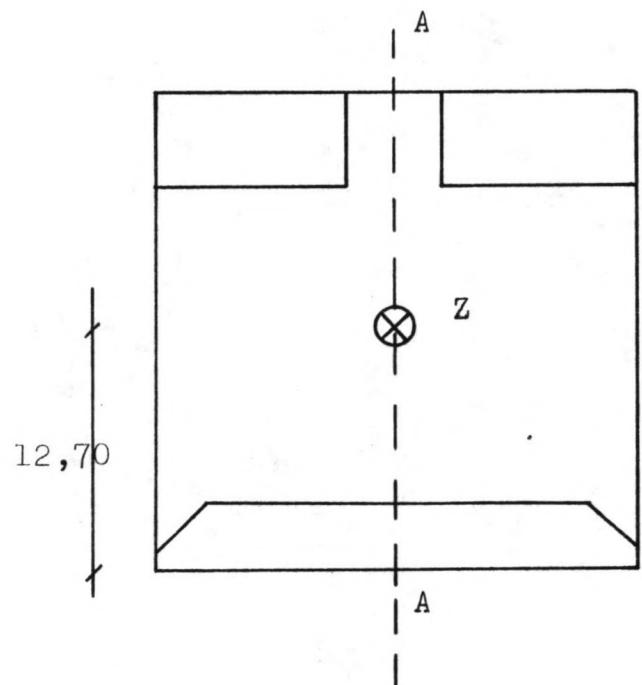


fig. 8.2.1 Zwaartepunt doorlaatcaisson

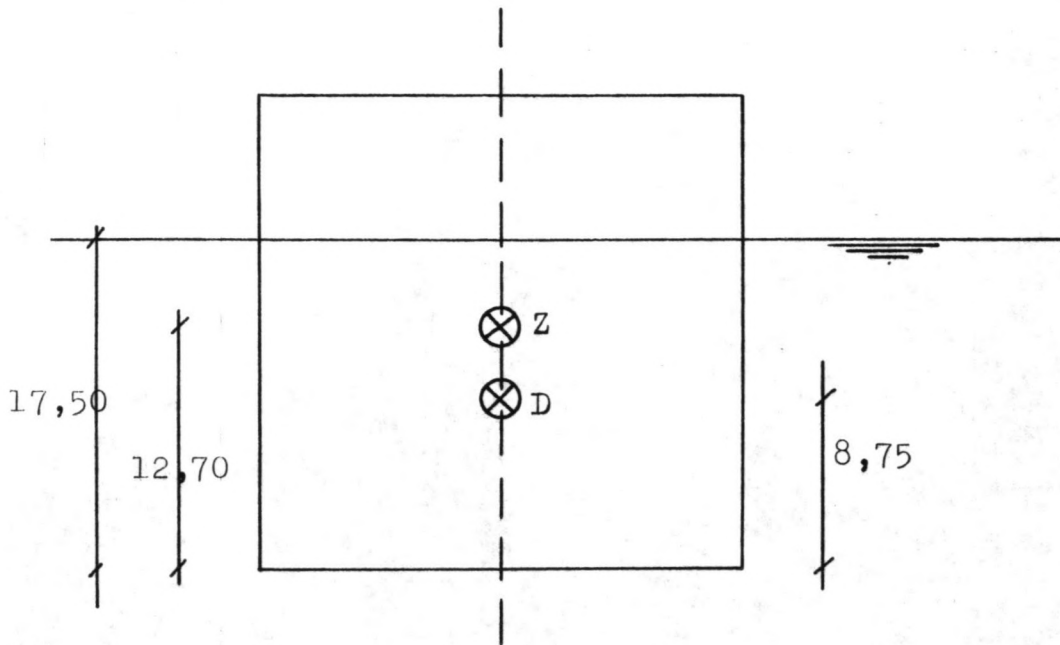


fig. 8.2.2 Ligging drukingspunt en zwaartepunt

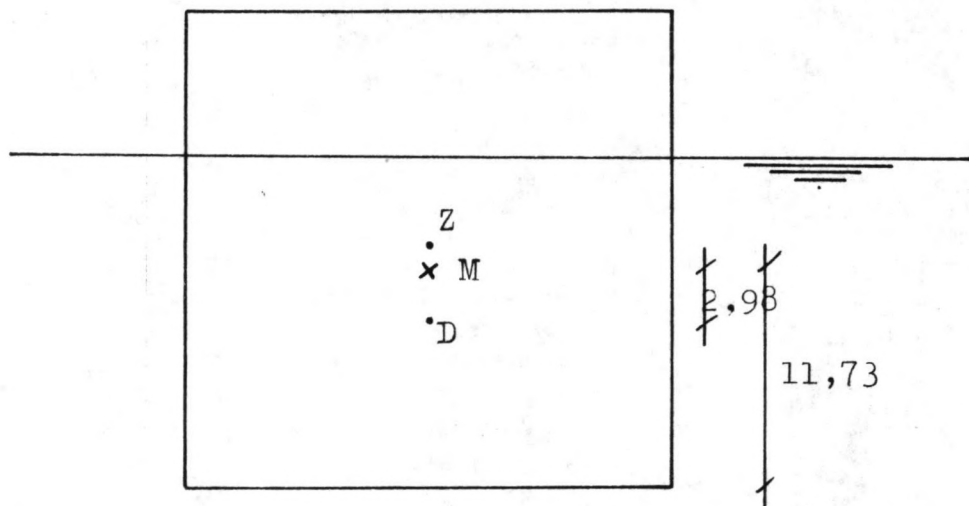
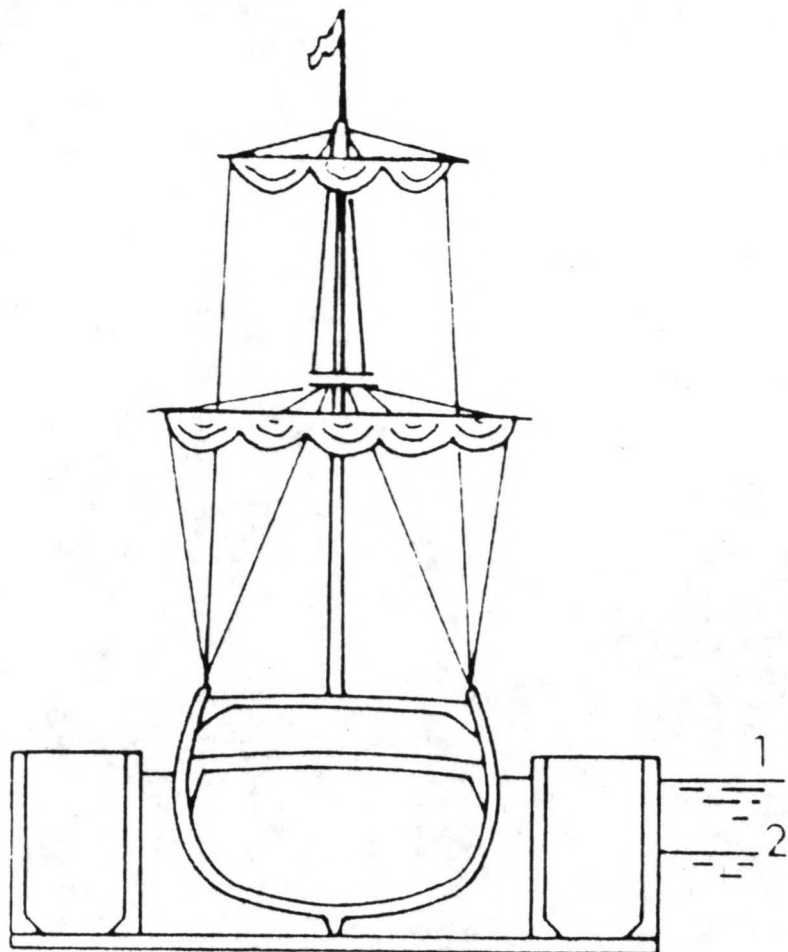


fig. 8.2.3 Ligging metacentrum



1 normal waterline
2 waterline when lifted

fig. 8.2.4 Scheepskameel

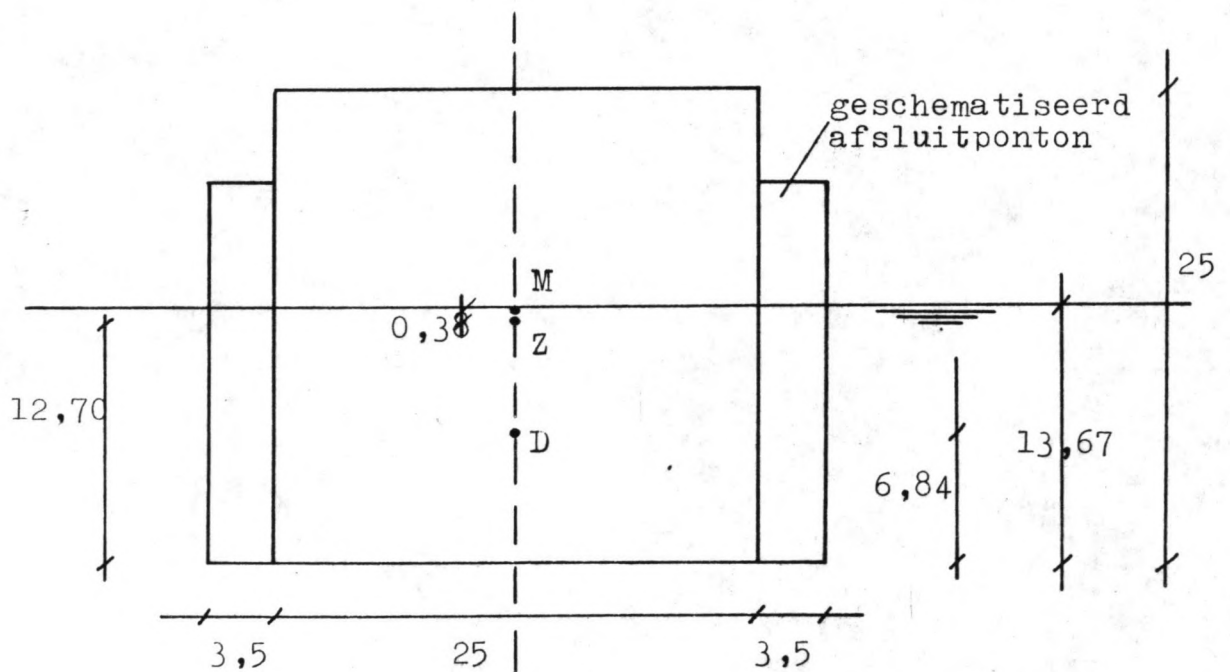


fig. 8.2.5 Doorlaatcaisson met twee afsluitpontons als drijflichaam

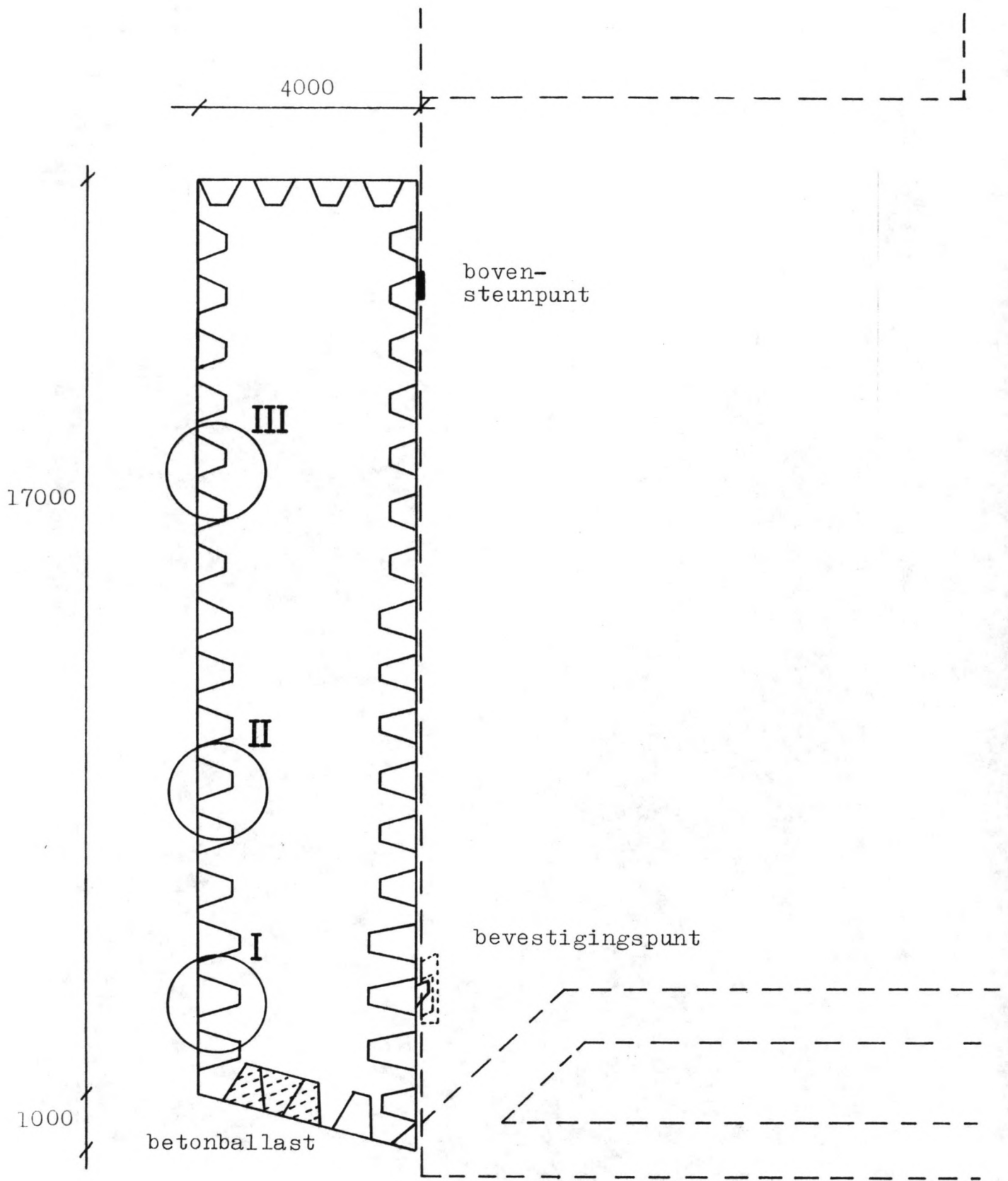


fig. 8.2.6 Ontwerp doorsnede drijflichaam

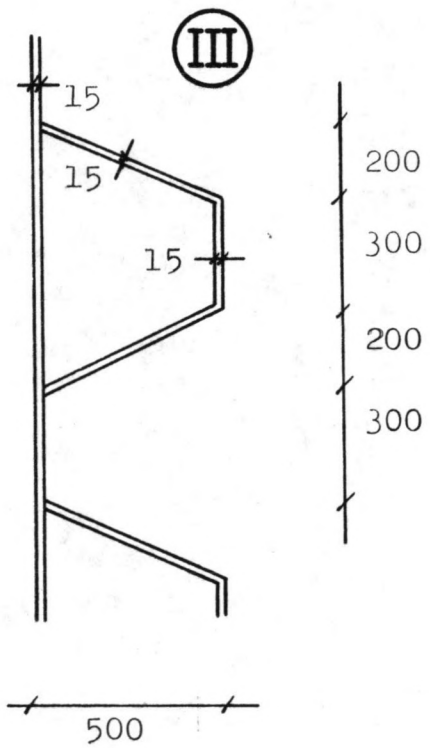
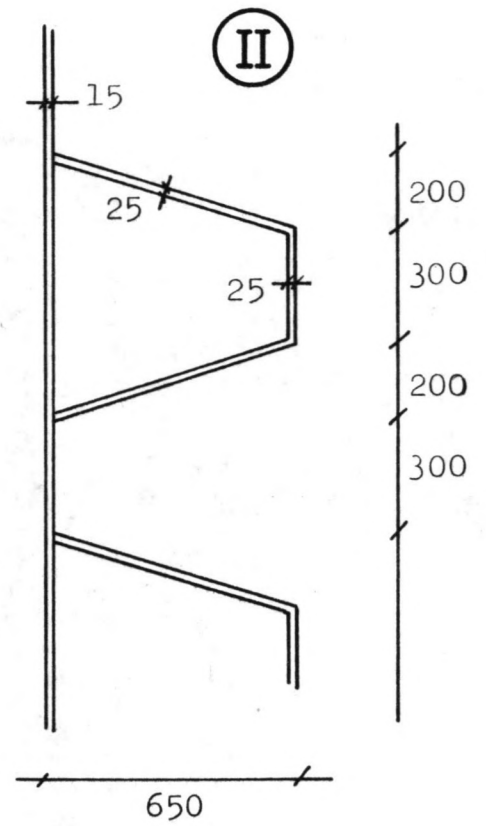
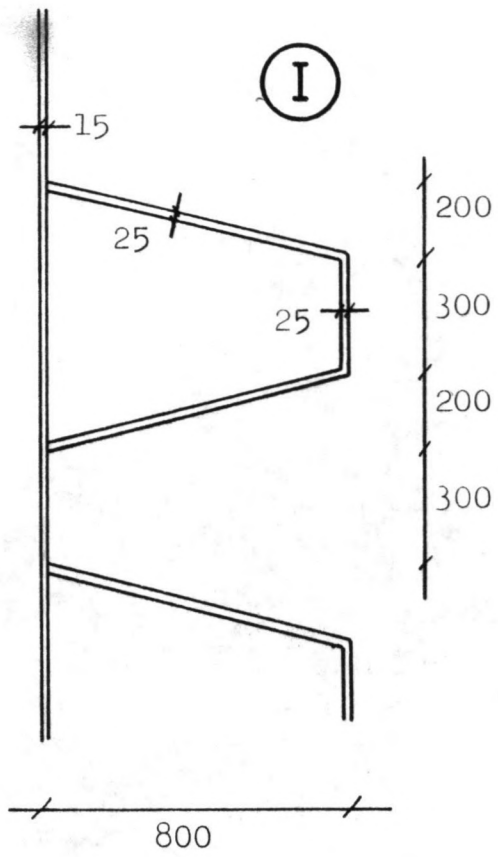


fig. 8.2.7

Details
drijflichaam

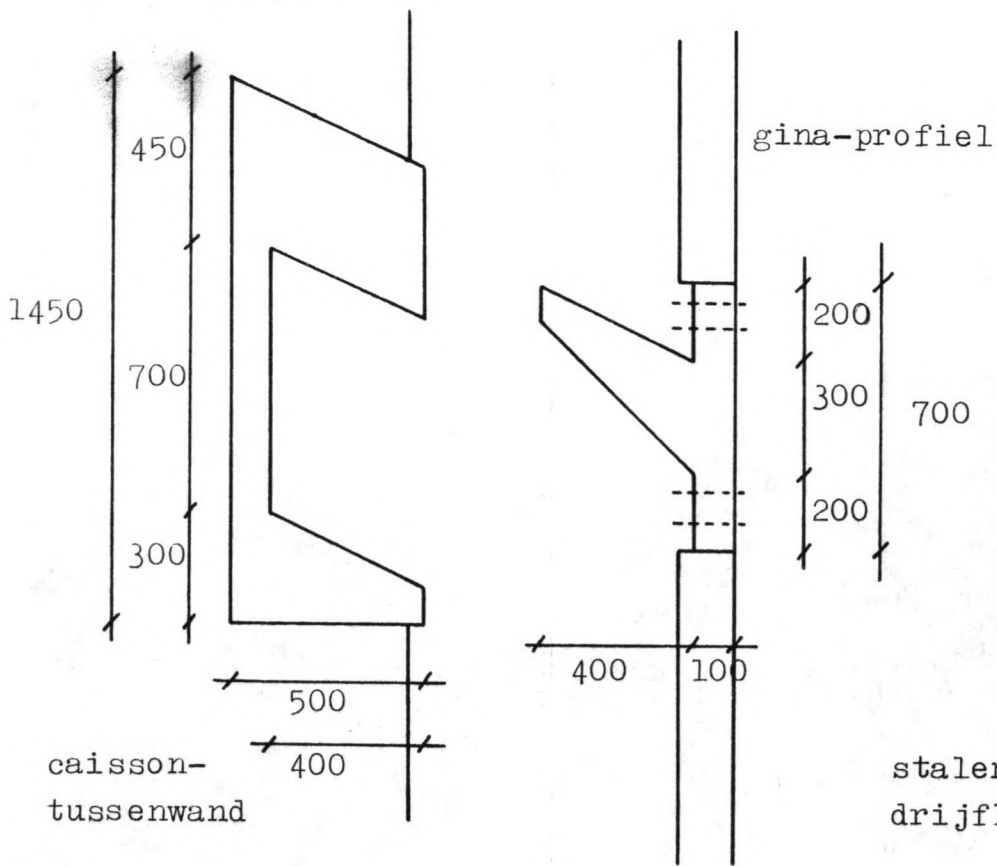


fig. 8.2.8
Zijaanzicht be-
 vestigingscon-
 structie van het
 drijflichaam

stalen
 drijflichaam

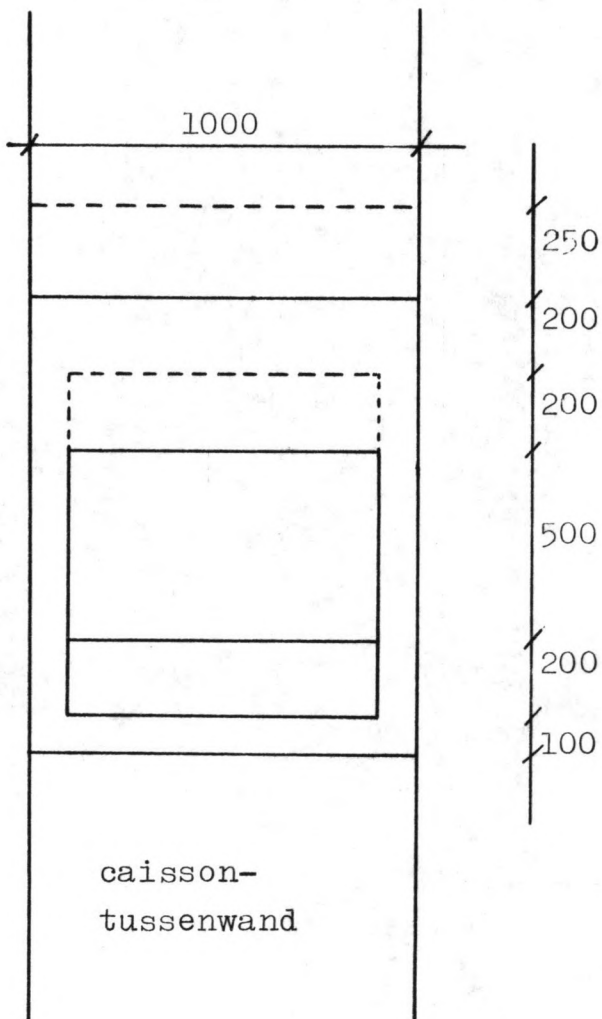


fig.8.2.9
 Vooraanzicht
 bevestigings-
 punt

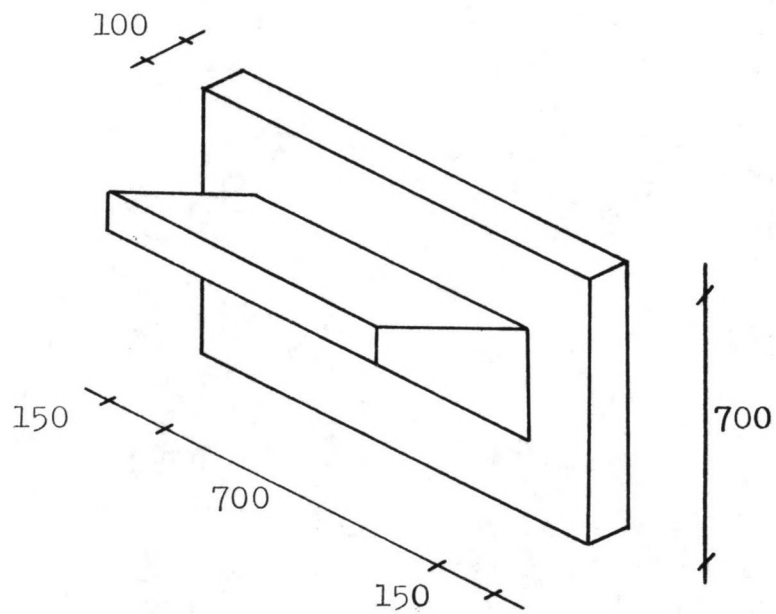
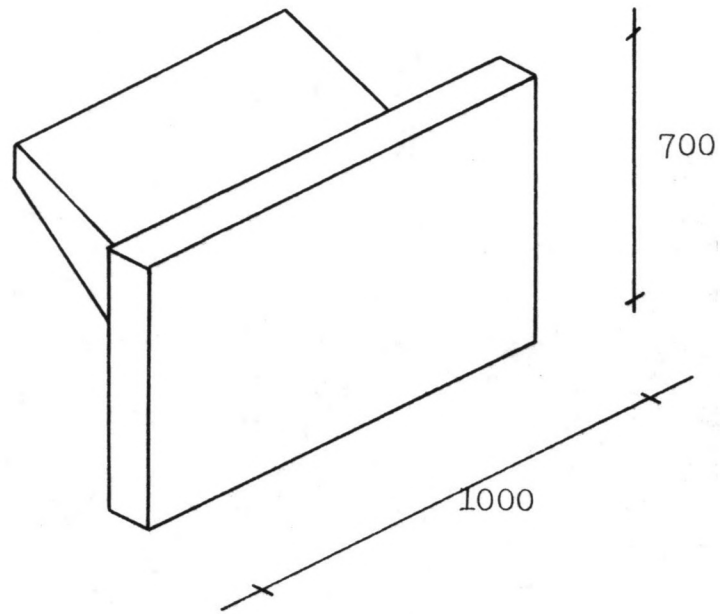


fig. 8.2.10 Bevestigingsnok in perspectief

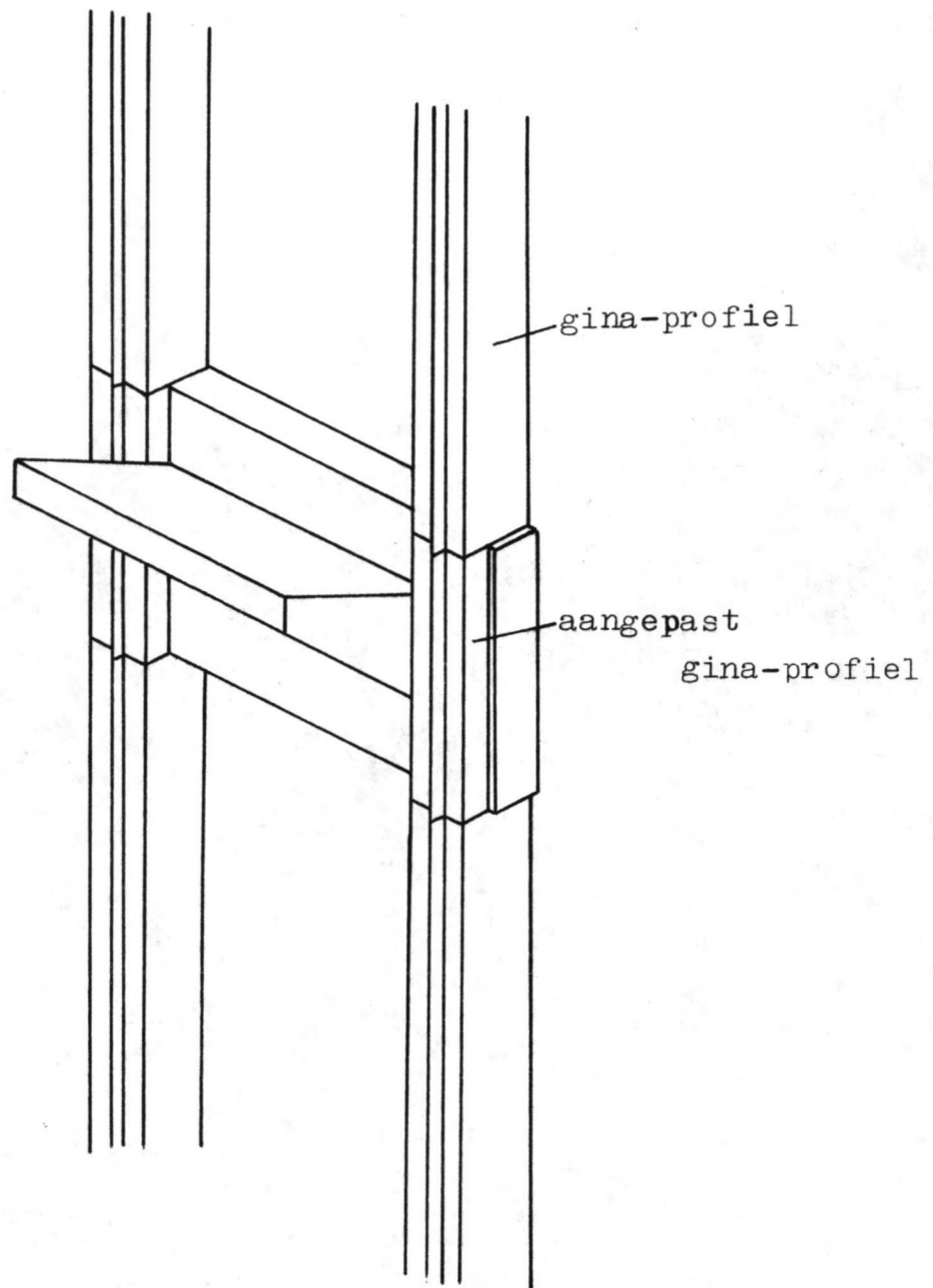


fig. 8.2.11 Detail afdichtingsconstructie
t.p.v. de bevestigingsnok

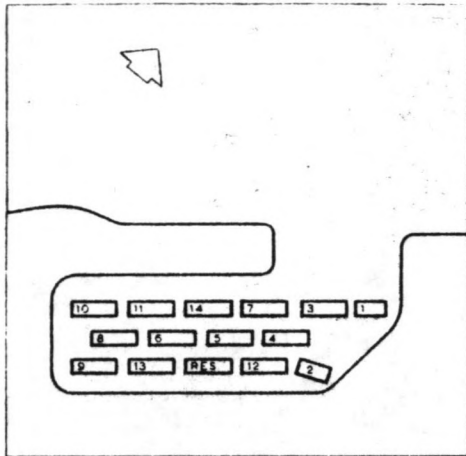


fig. 8.3.1 Voorbeeld plattegrond bouwdok

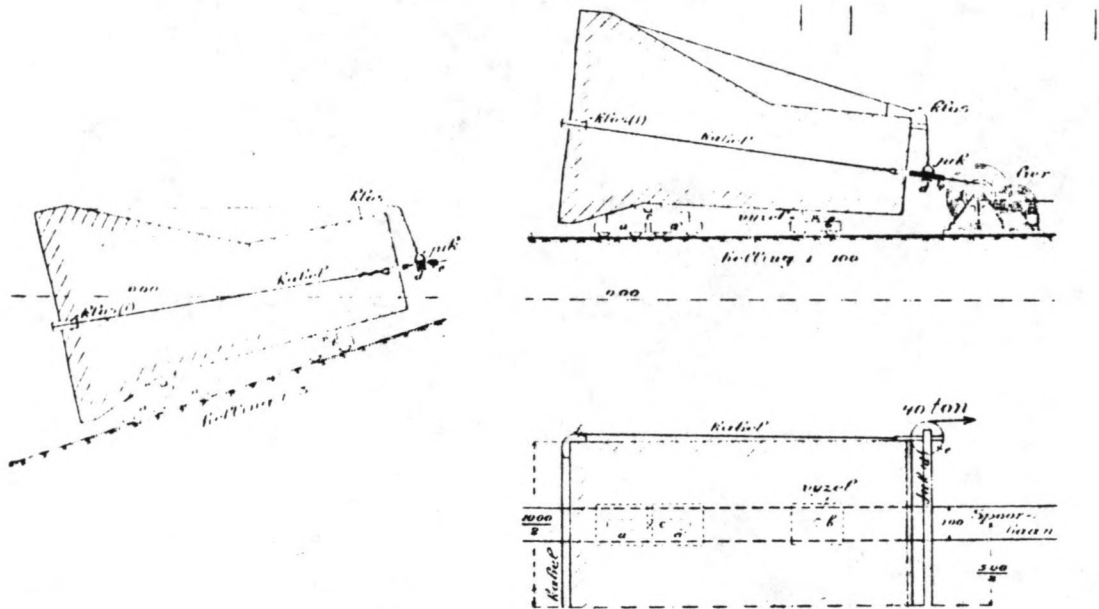
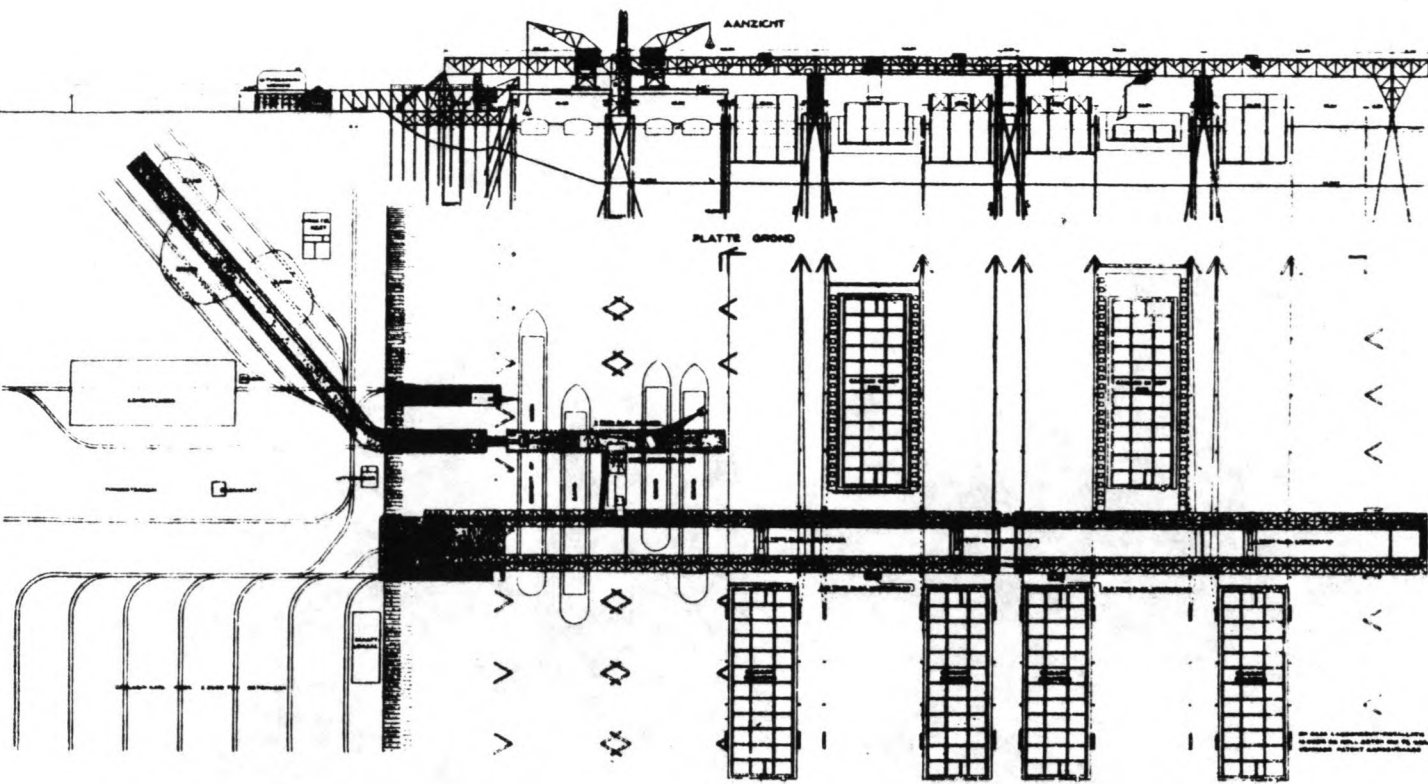
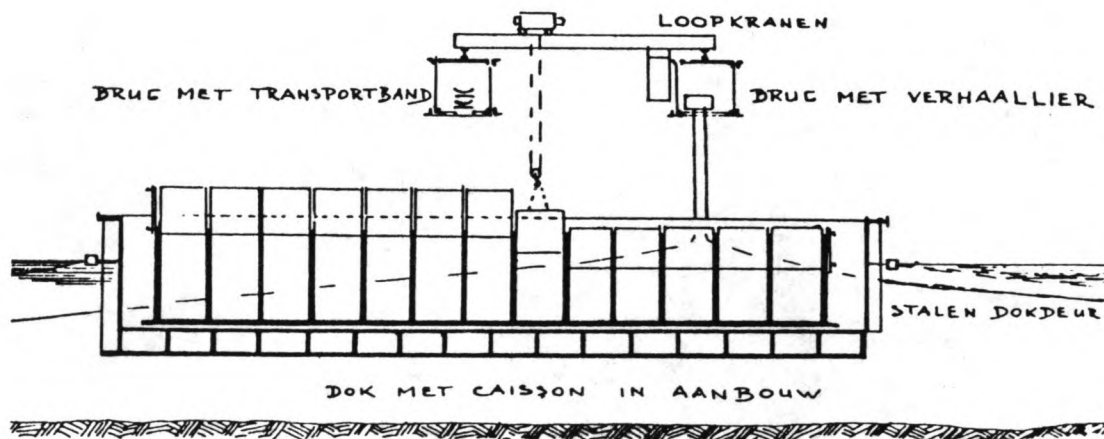


fig. 8.3.2 Tewaterlating van caissons
m.b.v. helling



bovenaanzicht

fig. 8.3.3 Caissonbouwinstallatie uit 1930



doorsnede bouwdok

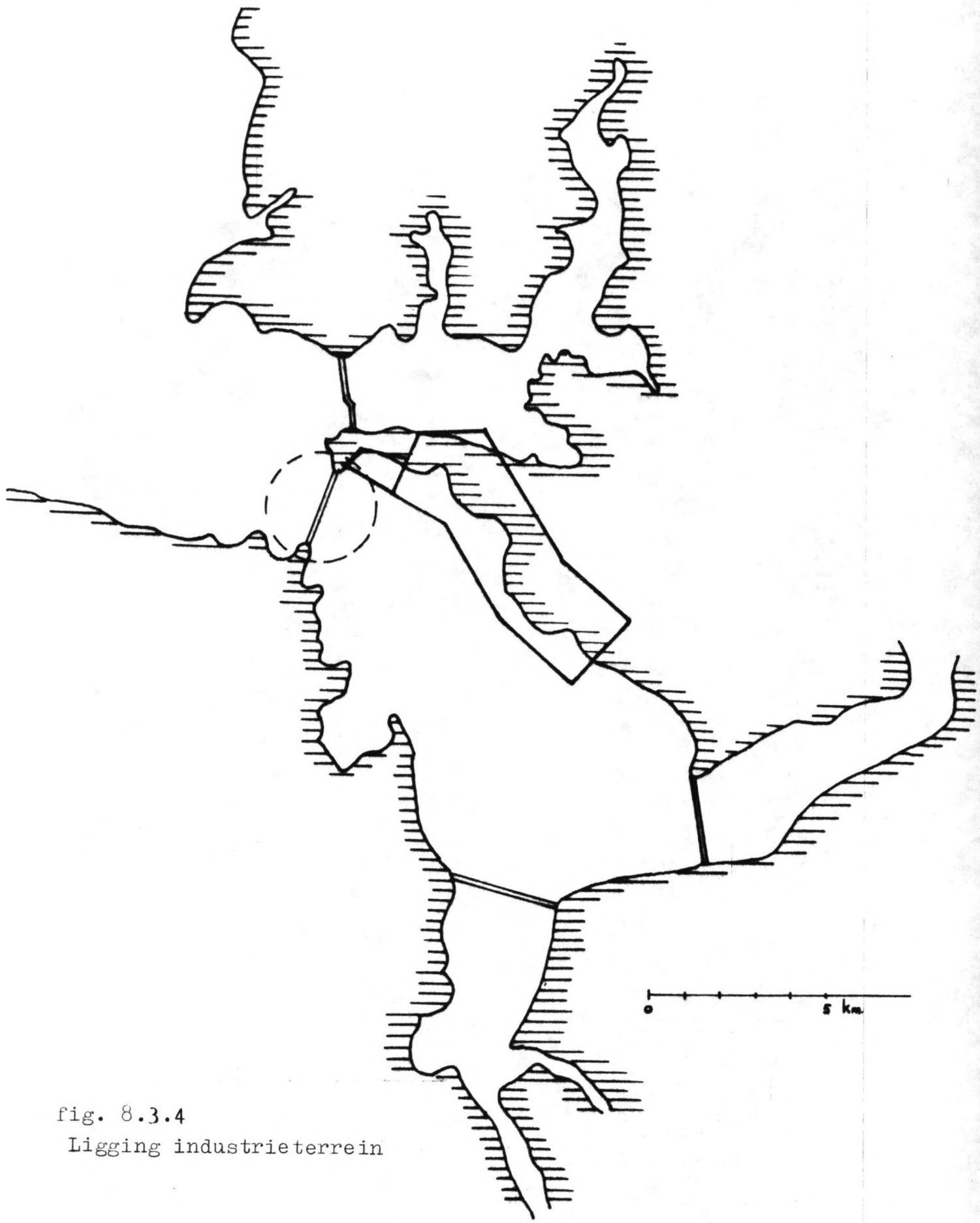


fig. 8.3.4
Ligging industrieterrein

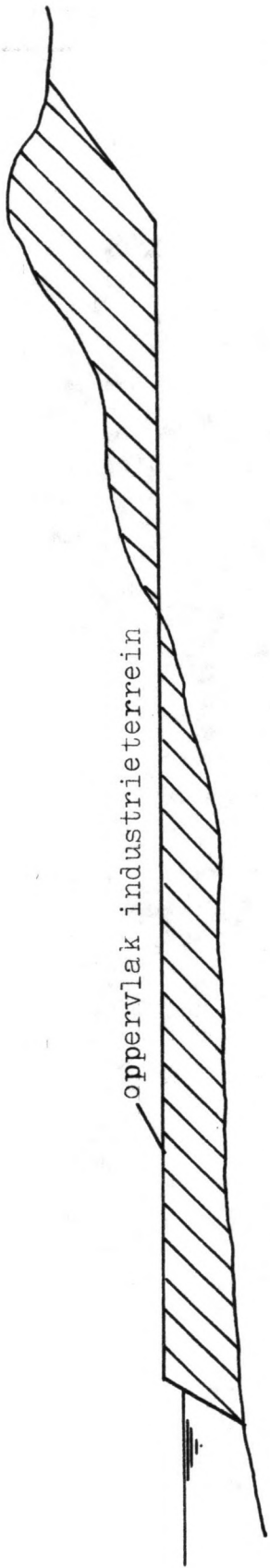


fig. 8.3.5 Doorsnede industrieterrein

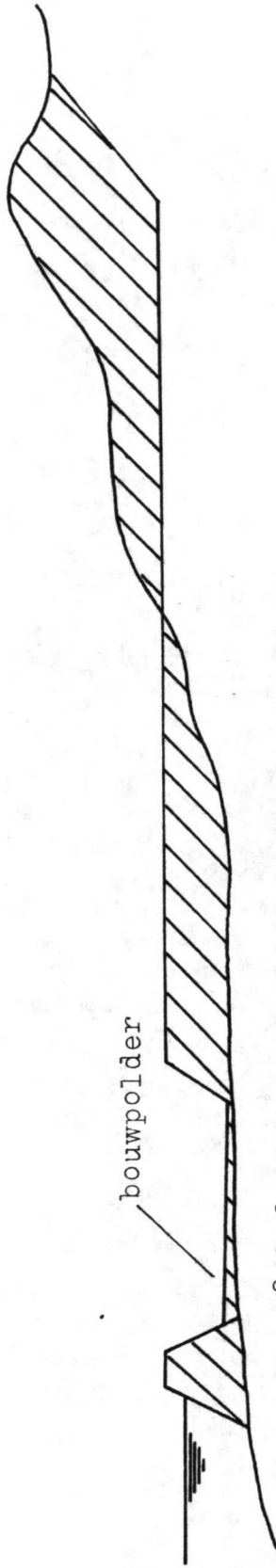


fig. 8.3.6 Doorsnede tijdelijke bouwpolder

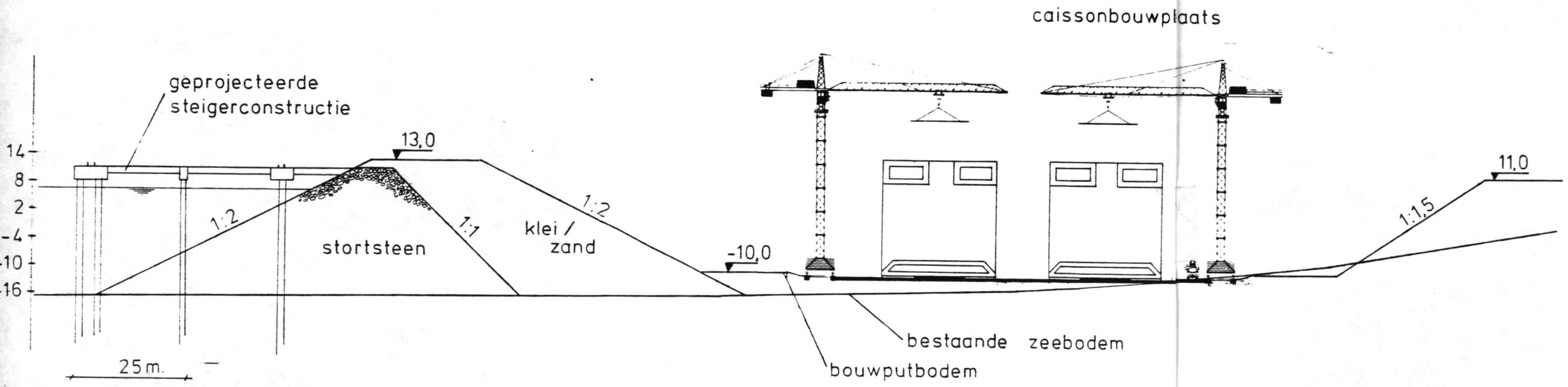


fig. 8.3.7 Doorsnede van de bouwpuolder

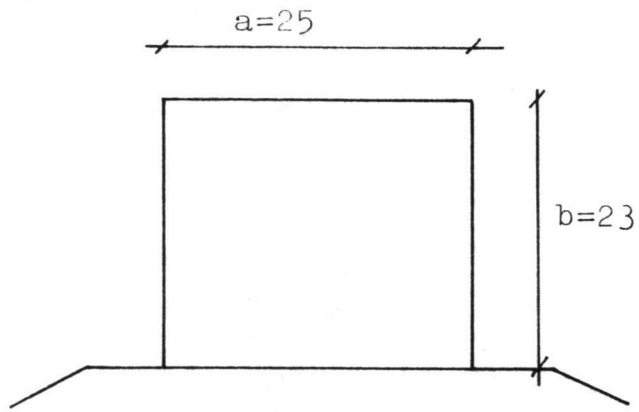


fig. A.1 Caissonschematisatie

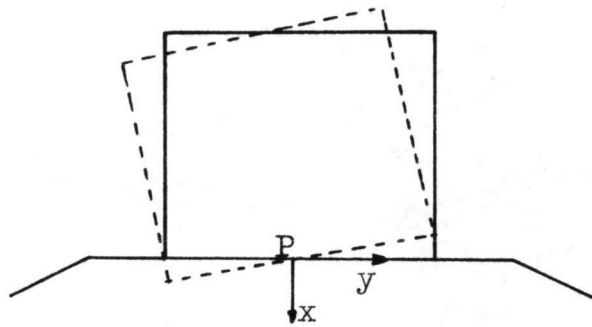


fig. A.2 Rotatie

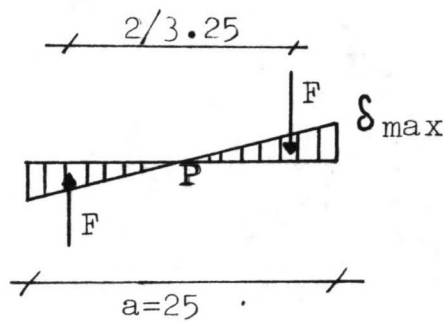


fig. A.3 Tegendrukdiagram

Fig. B.1 RESULT OF FLOOD CONTROL CALCULATION

