PROPRIETARY

OYSTER PROJECT

Structural Design Calculation for CNS utility building

Doc. No. : OYSTER-EA-CBU-CA-001 Rev. No : 0

Safety Class	□HOR SC1	□HOR SC2	□HOR SC3	■NNC	□N/A
Quality Class	□QC1	□QC2	□QC3	■Non-QC	□N/A

Verification Method	□Design Review □Qualification Test	□Alternate Calculation
Verification Status	□Complete	□Incomplete

Prepared by : (Signature) _____ 14 July 2015
(Name)
(Position) Responsible Engineer
Date

Reviewed by : (Signature) _____ _____
(Name)
Independent Reviewer
Date

Reviewed by : (Signature) _____ 14 July 2015
(Name) I
(Position) Lead Engineer
Date

Approved by: (Signature) _____ 14 July 2015
(Name) I
(Position) Project Manager
Date

RID will release this document with purpose AFC (Approved for Construction) after the detailed engineering in Phase 2 is finalised and approved.

KAERI Korea Atomic Energy Research Institute
HYUNDAI ENGINEERING & CONSTRUCTION
HYUNDAI ENGINEERING CO., LTD.

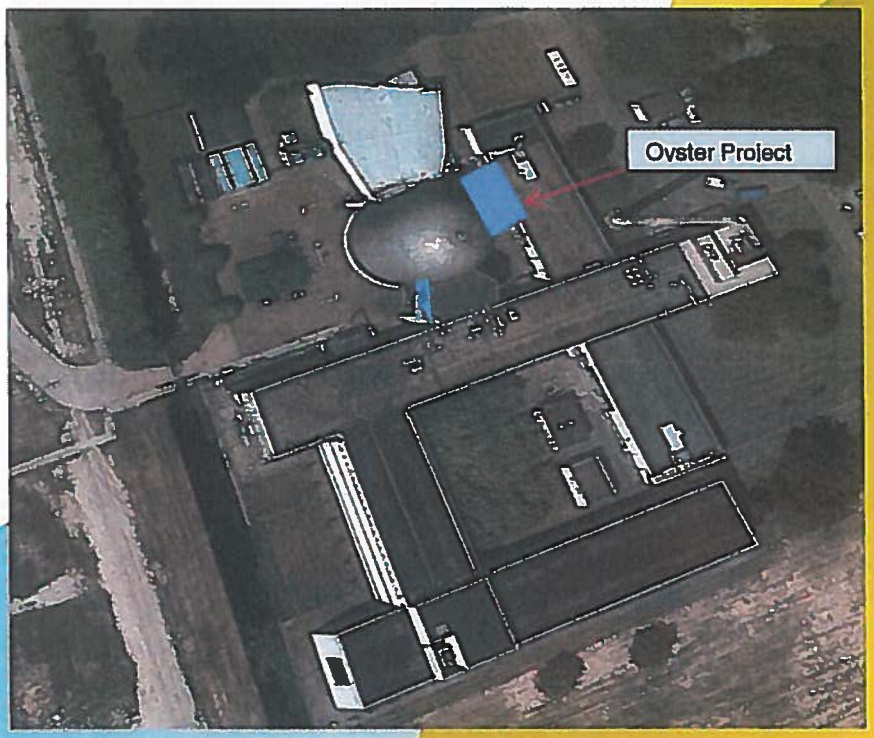
Revision History

Document Title: Structural Design Calculations for CNS utility building

Document No.: OYSTER-EA-CBU-CA-001

Rev. No.	Date	Description of Revision (Including the chapters and provisions of the revision)	Prepared by	Approved by
P0	10 Apr. 2015	Issued for review		
P1	26 May 2015	Issued for approval		
0	14 July 2015	Final basic design		
Notes				

Royal HaskoningDHV
Enhancing Society Together



BD4376-101-100 | UO-R901

Structural design

Oyster project IRI Delft

Inhoud

Document titel	: Structural design
Documentnummer	: UO-R901
Status	: provisionally
Datum	: 25-03-2015
Project naam	: Oyster project IRI Delft
Project nummer	: BD4376-101-100
Client	: TU Delft
Client contact	:
Opgesteld door	: en
Datum/paraaf	: 2-04-2015
Gecontroleerd door	:
Datum/paraaf	: 22.05.2015
Goedgekeurd door	:
Datum/paraaf	: 22.05.2015

Revisiegeschiedenis

wijz.	datum	omschrijving	gewijzigde blz.	toegev. blz.	gecontr.	gezien
A	22.5.'15	CALC.+ENG.	34.40	81-97.		

Dit rapport bestaat uit 80 pagina's (incl. bijlagen)

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Template revision 002

Inleiding :

On the site of Reactor Institute Delft (RID), Hyundai Engineering & Construction will develope a building for supporting nuclear installations. Royal haskoningDHV, as a local consulting company, is asked for helping to realise this building. This report containes the structural design of the building.

Table of contents:

Short summery BOD :

All European standards shall be used in conjunction with the relevant National Annex.

Design working life 50 years
Consequences class CC3

Grade of concrete C35/45
Grade of reinforcement B500B

Fire resistants 60minutes

Horizontal ground acceleration a_g=1,0m/s^2 (S_d=0,1)

Loads:

floors: Concrete 220 mm.

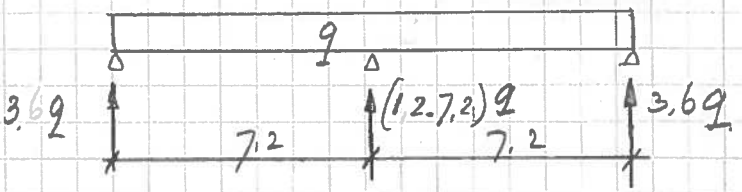
Own weight	$0,22 \cdot 25,0 = 5,5$ kN/m²	$\}$ * 1,3 =	9,75 kN/m²
Finish	$0,10 \cdot 20,0 = 2,0$ "		
Var. load	$= \underline{7,0}$ "	* 1,65 =	11,55 "
	$P_k = 14,5$ kN/m²	P_d =	21,3 kN/m²

facade: $P_k = 2,5$ kN/m² $\quad P_d = 1,3 \cdot 2,5 = 3,25$ kN/m²

BRIDGE: $P_k = \dfrac{(2 \cdot 4,0 + 2 \cdot 2,5) \cdot 2,5}{2,5} = 13,0$ kN/m² (OUTLINE)

$P_d = 1,3 \cdot 13,0 = 16,9$ kN/m²

Weight Calculation:



q_{1d} facade $= 3,3 \cdot 3,25 = 10,7$ kN/m'

q_{2d} floor $= 3,6 \cdot 21,3 = 76,7$ kN/m'

q_{3d} floor $= 8,6 \cdot 21,3 = 183,2$ kN/m'

q_{4d} facade $= 5,2 \cdot 3,25 = 16,9$ kN/m'

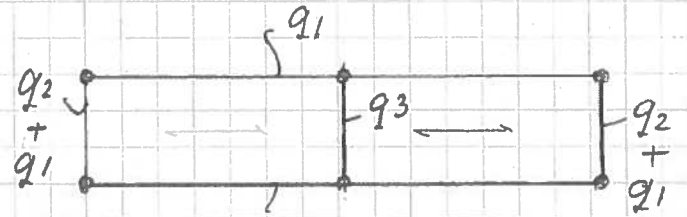
q_{5d} facade $= 3,0 \cdot 3,25 = 9,8$ kN/m'

F_{1d} BRIDGE $= \frac{2,5}{2} \cdot \frac{2,5}{2} \cdot 16,9$

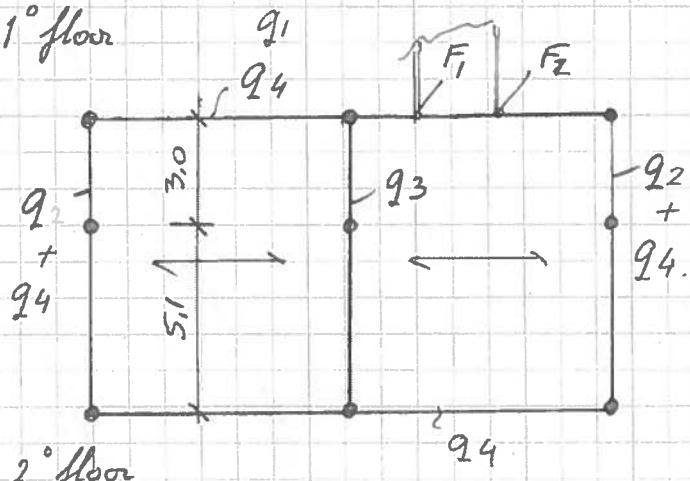
$= 26,4$ kN

F_{2d} BRIDGE $= \frac{3,5}{2} \cdot \frac{2,5}{2} \cdot 16,9$

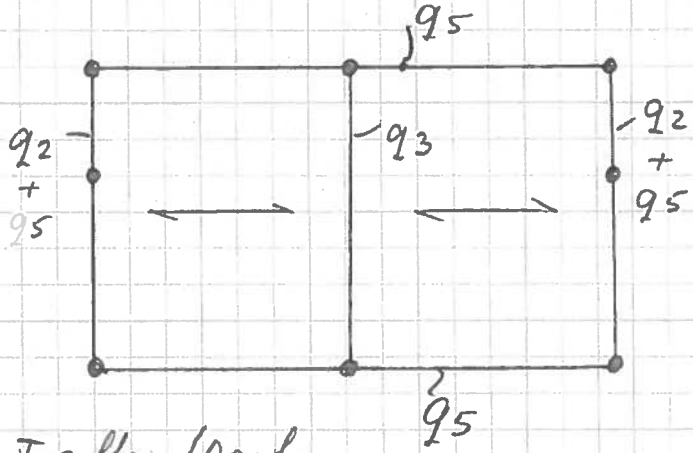
$= 36,9$ kN



1° floor



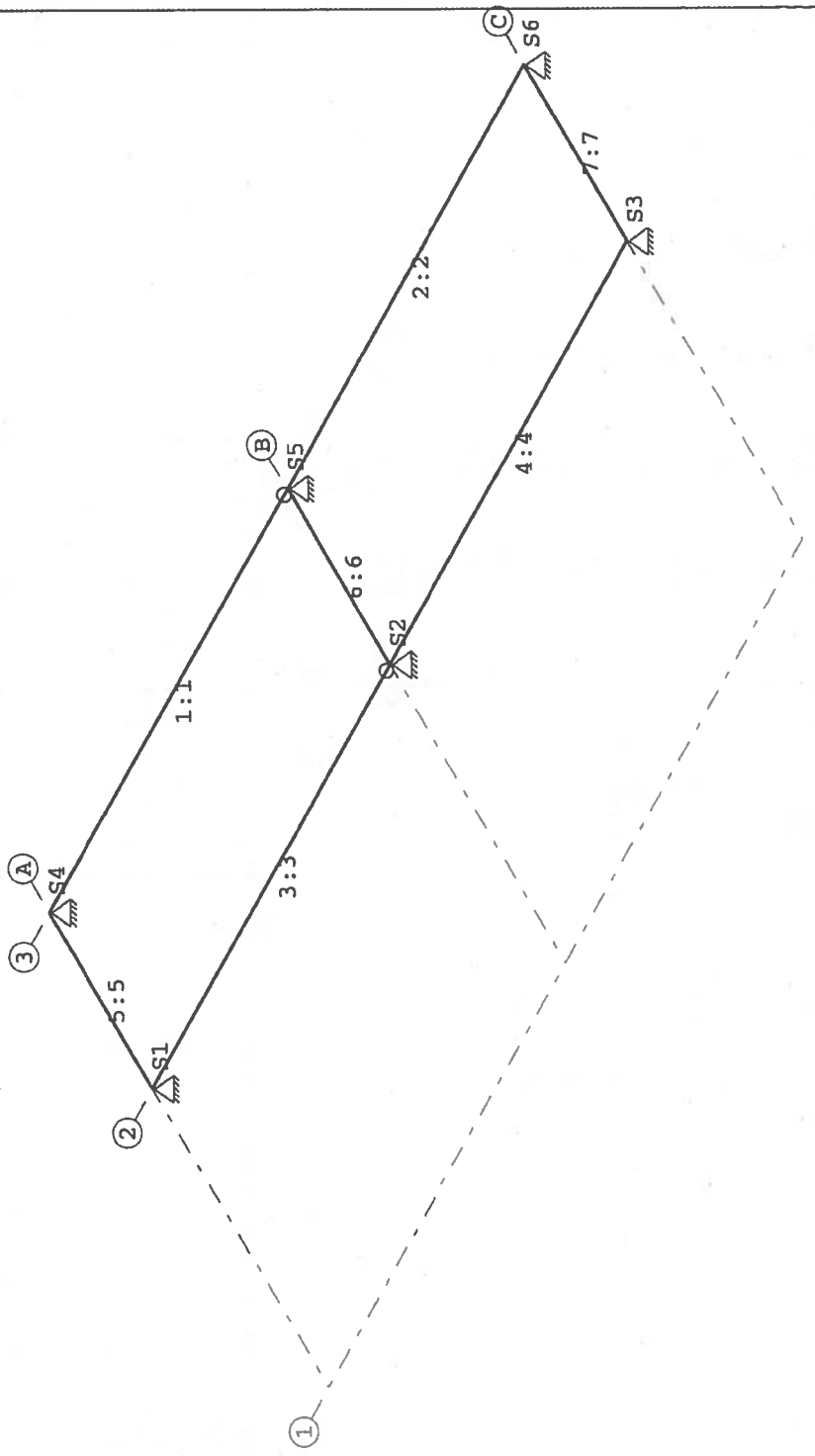
2° floor



Top floor / roof.

Project..: - Oyster project
Onderdeel: first floor
Dimensies: kN/m/rad
Datum....: 18/03/2015
Bestand..: c:\users\150033\documents\hyundai delft\1ste verdieping nieuw.grw
Torsiefac: 10 %

GEOMETRIE



Project..: - Oyster project
Onderdeel: first floor

MATERIALEN

Mt	Omschrijving	E-mechanica[N/mm2]	Kruipcoef.	S.M.	Pois.
1	S235	210000		78.5	0.30

PROFIELEN [mm]

Prof.	Omschrijving	Materiaal	Oppervlak	Torsietr.	Traagheid
1	HEB240	1:S235	1.060e+004	1.039e+006	1.126e+008
2	HEB280	1:S235	1.314e+004	1.461e+006	1.927e+008

PROFIELEN vervolg [mm]

Nr.	Vormf.	Breedte	Hoogte	Zs	Rek.As	Type	b1	h1	b2	h2
1	0.00	240	240	120	0.00					
2	0.00	280	280	140	-0.00					

STRAMIENLIJNEN

Nr.	Naam	X-begin	Y-begin	X-eind	Y-Eind
1	A	0.000	8.100	0.000	0.000
2	B	7.200	8.100	7.200	0.000
3	C	14.400	8.100	14.400	0.000
4	1	0.000	0.000	14.400	0.000
5	2	0.000	5.100	14.400	5.100
6	3	0.000	8.100	14.400	8.100

BALKEN

Nr.	Naam	Begin	Eind	Profiel
1	1	A;3	B;3	1:HEB240
2	2	B;3	C;3	1:HEB240
3	3	A;2	B;2	1:HEB240
4	4	B;2	C;2	1:HEB240
5	5	A;2	A;3	2:HEB280
6	6	B;2	B;3	2:HEB280
7	7	C;2	C;3	2:HEB280

BALKEN vervolg

Nr.	Naam	Aansl.begin	Aansl.eind	Excentr.	Pasm.begin	Pasm.eind	Opm.
1	1	WDM	WD-	0.000	0.000	0.000	
2	2	WDM	WDM	0.000	0.000	0.000	
3	3	WDM	WD-	0.000	0.000	0.000	
4	4	WDM	WDM	0.000	0.000	0.000	
5	5	WDM	WDM	0.000	0.000	0.000	
6	6	WDM	WDM	0.000	0.000	0.000	
7	7	WDM	WDM	0.000	0.000	0.000	

Opmerkingen:
De torsie traagheid van alle balken is tot 10% gereduceerd

Project..: - Oyster project
Onderdeel: first floor

STEUNPUNTTYPEN

Nr. : 1 Rx:Vrij Z:Vast Ry:Vrij
Afmeting : vast (0)
Min.afst.: 0.500

STEUNPUNTEN

Nr.	Steunpunttype	Balk	Positie	Excentr.	Opm:
1	1:vast	3:3	0.000	0.000	
2	1:vast	3:3	7.200	0.000	
3	1:vast	4:4	7.200	0.000	
4	1:vast	1:1	0.000	0.000	
5	1:vast	1:1	7.200	0.000	
6	1:vast	2:2	7.200	0.000	

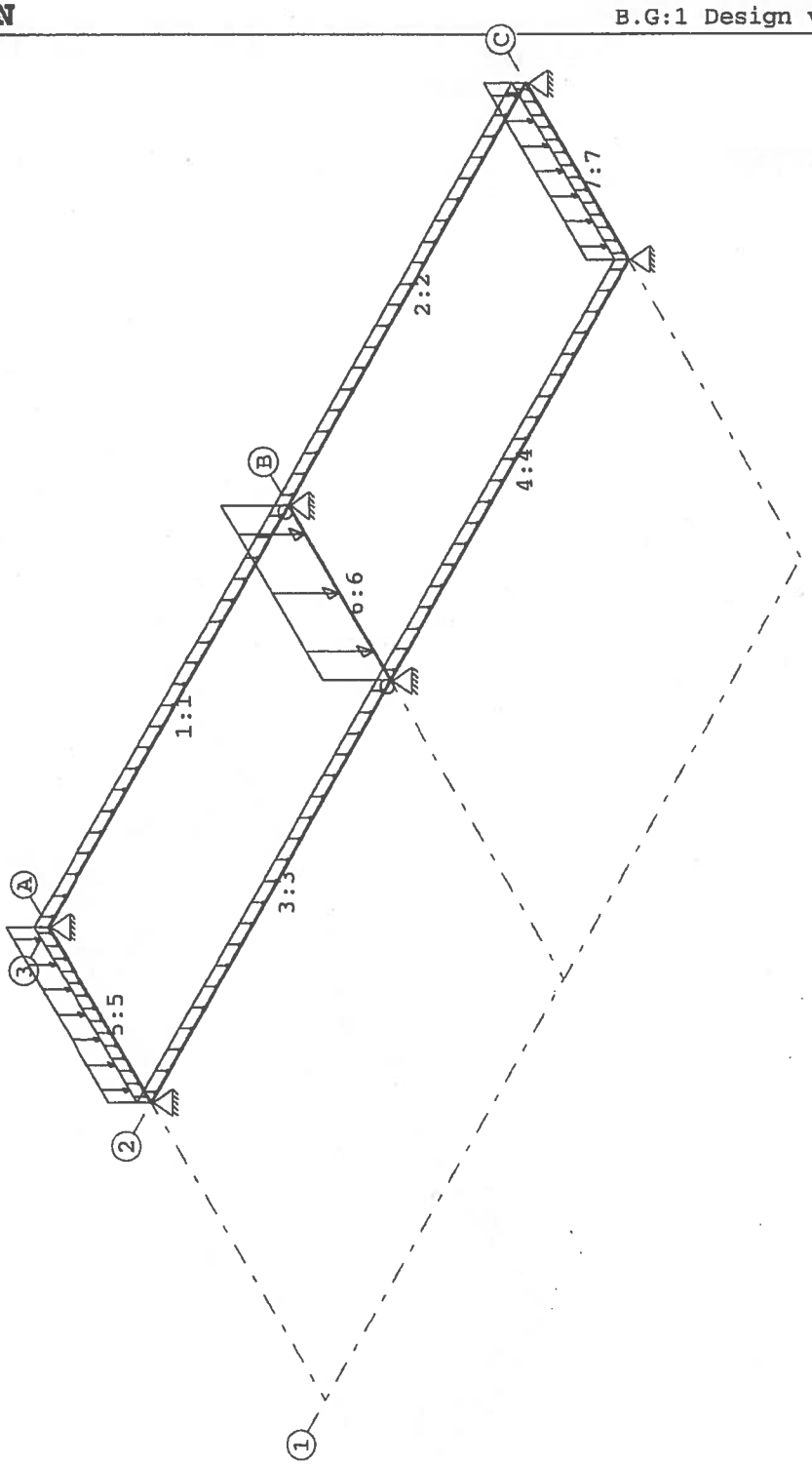
BELASTINGGEVALLEN

B.G.	Omschrijving	Belast/onbelast	Ψ_0	Ψ_1	Ψ_2	e.g.
1	Design values	2:Permanent EN1991				0.00

Project..: - Oyster project
Onderdeel: first floor

VELDBELASTINGEN

B.G:1 Design values



Project..: - Oyster project
Onderdeel: first floor

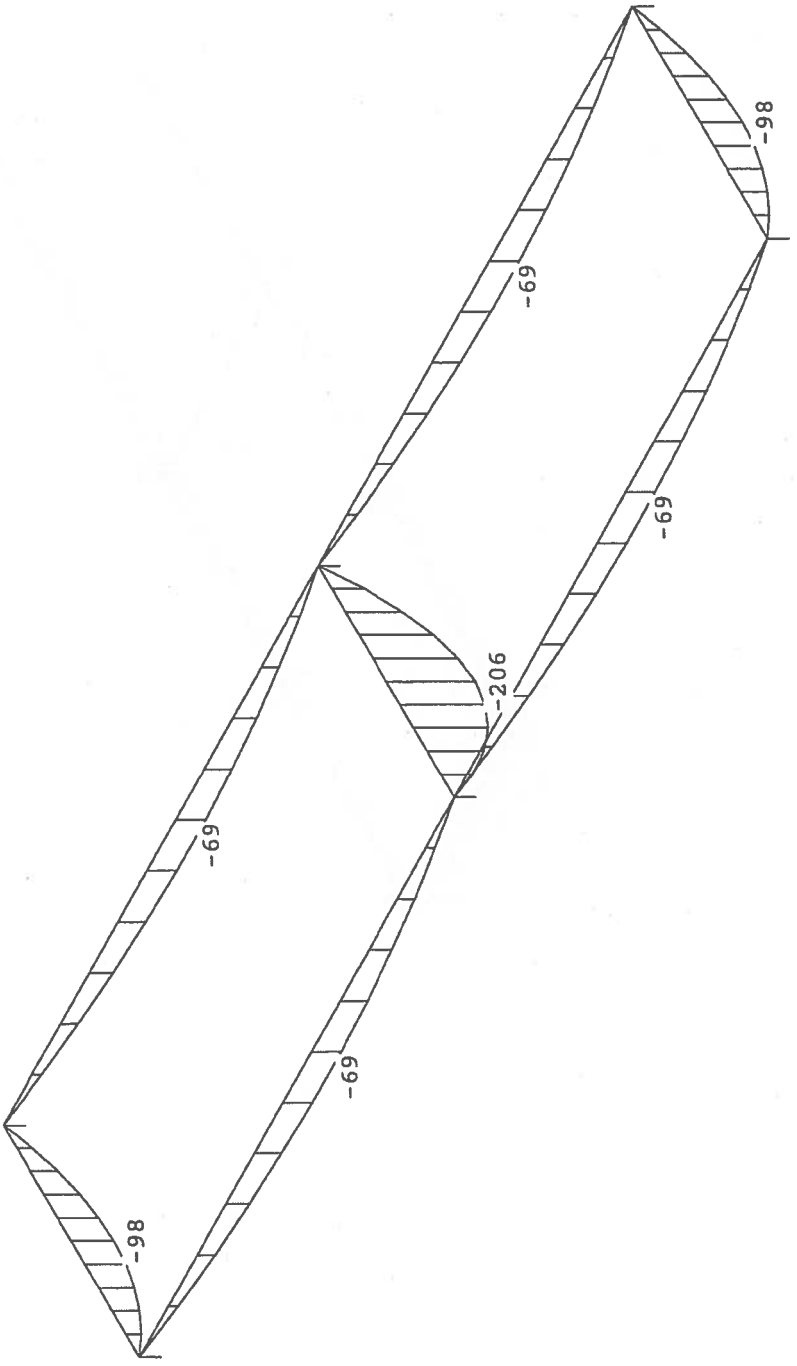
VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
1:1	1	1:q-last	-10.700	-10.700	0.000	7.200	0.000

MOMENTEN

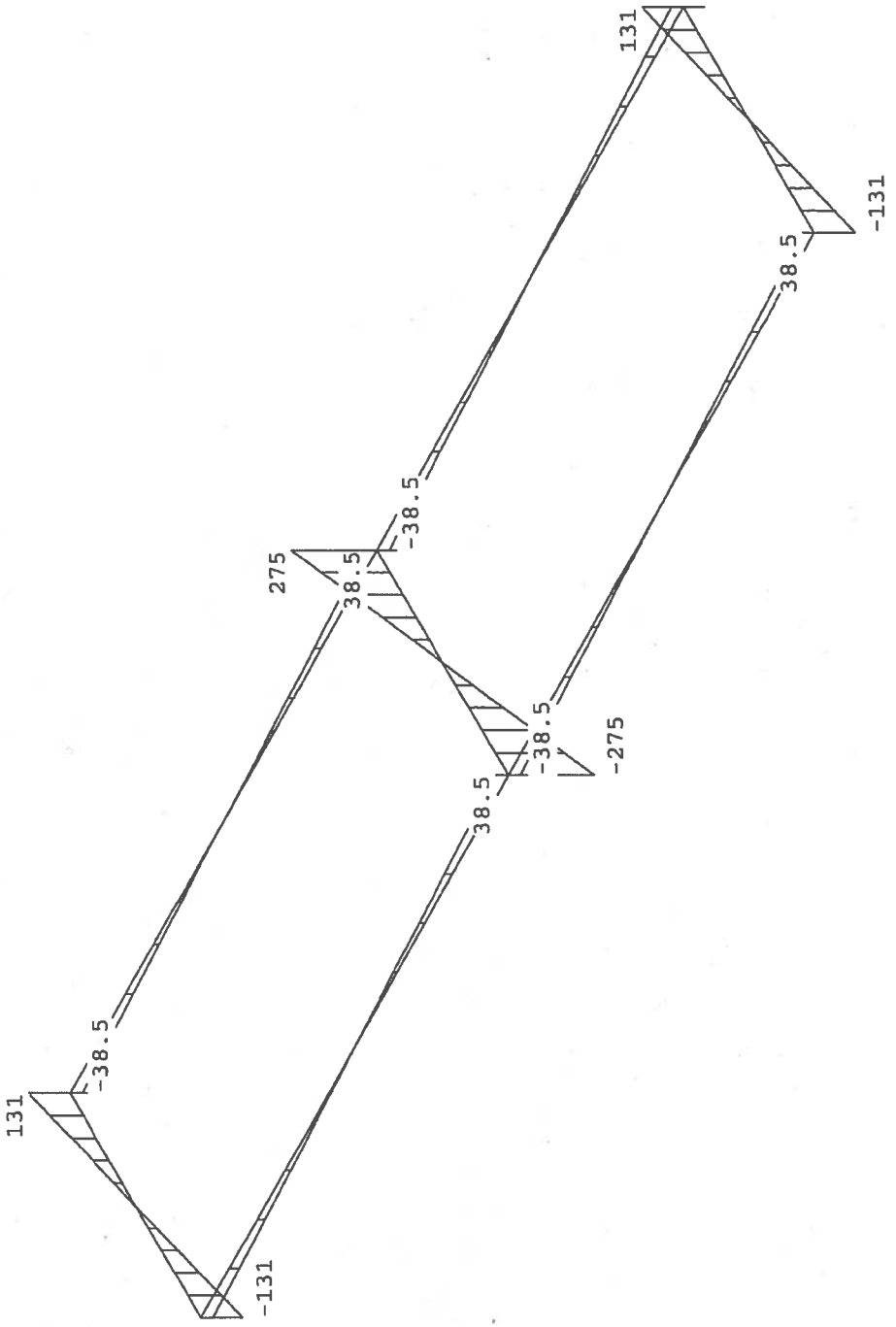
B.G:1 Design values



Project..: - Oyster project
Onderdeel: first floor

DWARSKRACHTEN

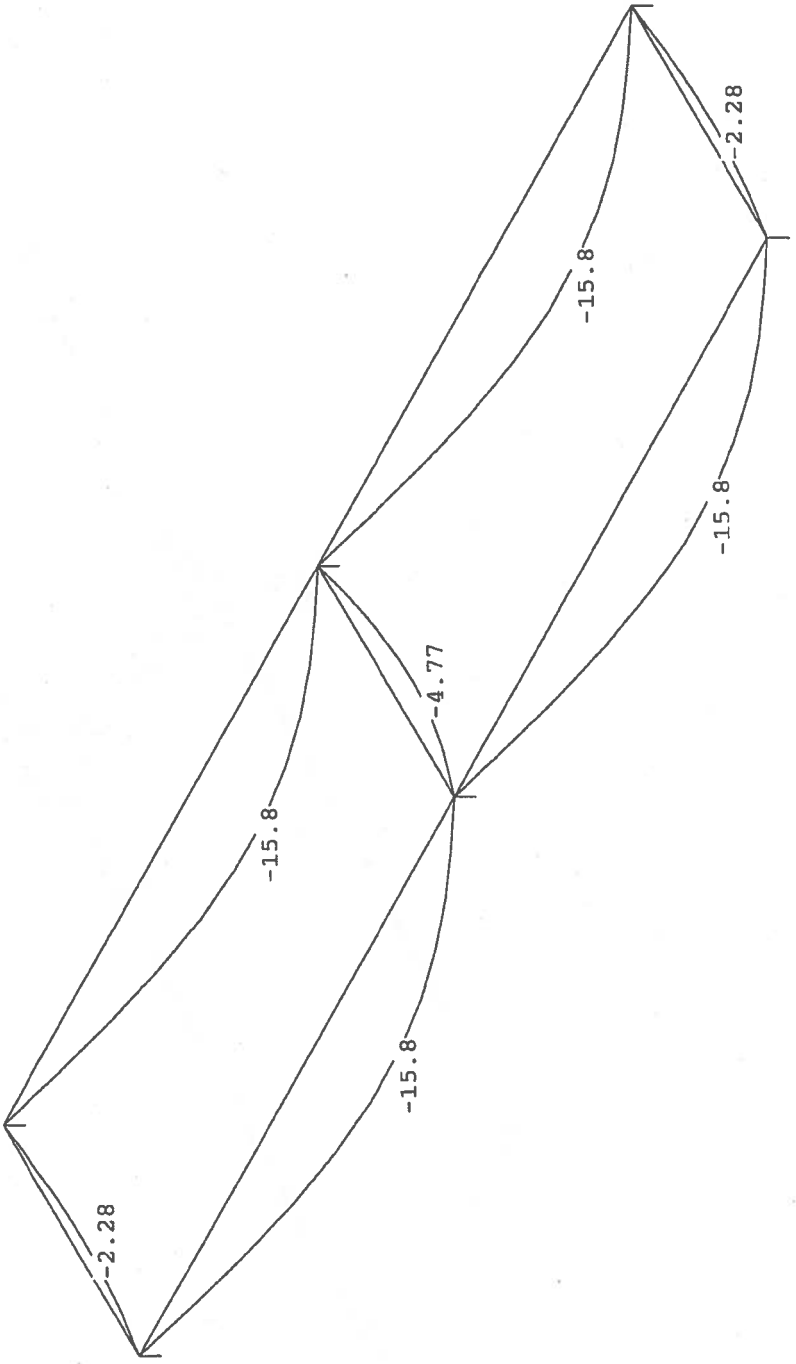
B.G:1 Design values



Project..: - Oyster project
Onderdeel: first floor

VERPLAATSINGEN [mm]

B.G:1 Design values



VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
2:2	1	1:q-last	-10.700	-10.700	0.000	7.200	0.000
3:3	1	1:q-last	-10.700	-10.700	0.000	7.200	0.000
4:4	1	1:q-last	-10.700	-10.700	0.000	7.200	0.000
5:5	1	1:q-last	-10.700	-10.700	0.000	3.000	0.000

Project..: - Oyster project
Onderdeel: first floor

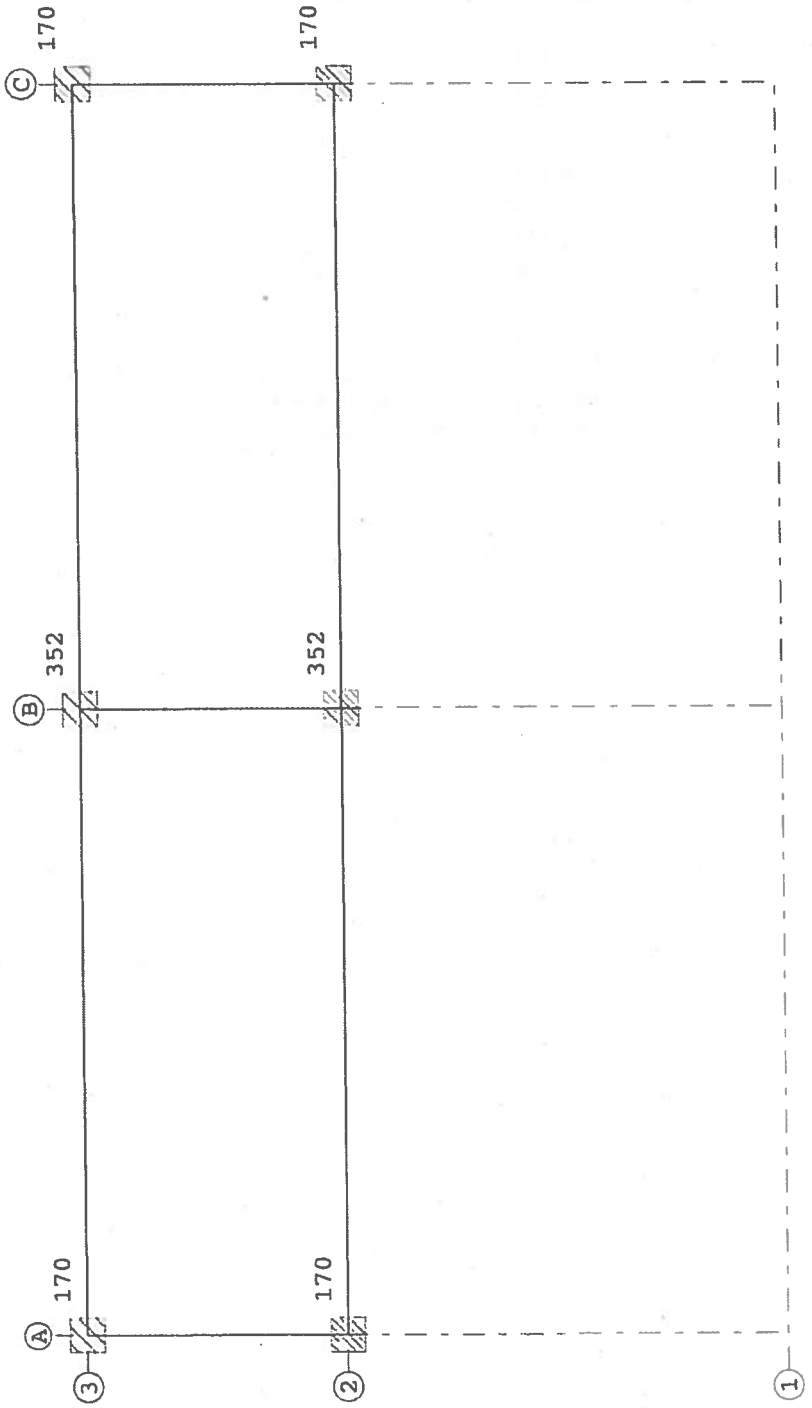
VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
5:5	2	1:q-last	-76.700	-76.700	0.000	3.000	0.000
6:6	1	1:q-last	-183.200	-183.200	0.000	3.000	0.000
7:7	1	1:q-last	-10.700	-10.700	0.000	3.000	0.000
7:7	2	1:q-last	-76.700	-76.700	0.000	3.000	0.000

REACTIES

B.G:1 Design values



Project..: - Oyster project
Onderdeel: first floor

REACTIES

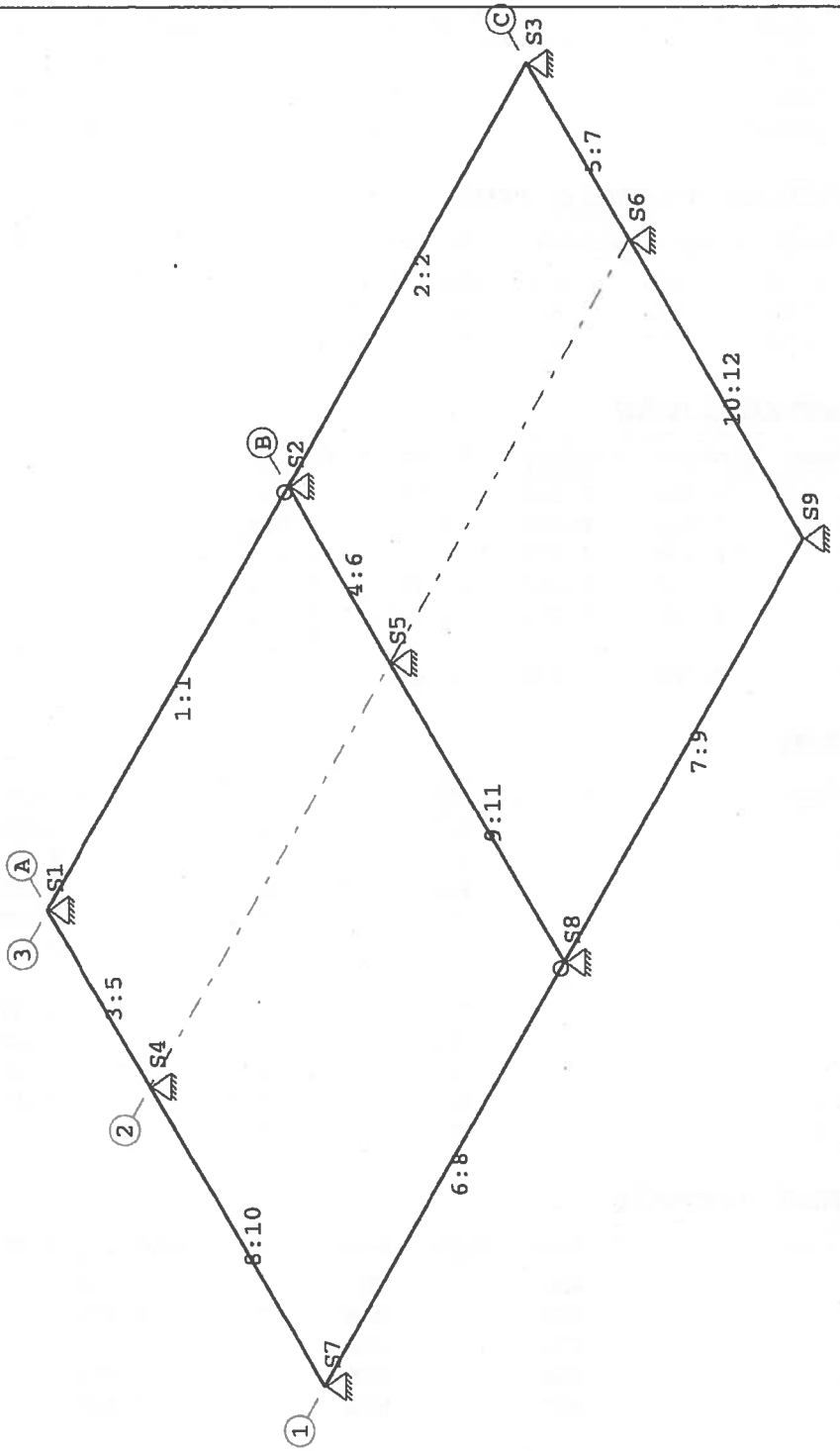
B.G:1 Design values

Balk	Stp	MX	Z	MY
1	4	0.00	169.62	0.00
1	5	0.00	351.84	0.00
2	5	0.00	351.84	0.00
2	6	0.00	169.62	0.00
3	1	0.00	169.62	0.00
3	2	0.00	351.84	0.00
4	2	0.00	351.84	0.00
4	3	0.00	169.62	0.00
5	1	0.00	169.62	0.00
5	4	0.00	169.62	0.00
6	2	0.00	351.84	0.00
6	5	0.00	351.84	0.00
7	3	0.00	169.62	0.00
7	6	0.00	169.62	0.00

1382.16 : Som reacties
-1382.16 : Som belastingen

Project..: - Oyster project
Onderdeel: second floor
Dimensies: kN/m/rad
Datum....: 18/03/2015
Bestand..: c:\users\150033\documents\hyundai delft\2de verdieping nieuw.grw
Torsiefac: 10 %

GEOMETRIE



Project..: - Oyster project
Onderdeel: second floor

MATERIALEN

Mt	Omschrijving	E-mechanica[N/mm2]	Kruipcoef.	S.M.	Pois.
1	S235	210000		78.5	0.30

PROFIELEN [mm]

Prof.	Omschrijving	Materiaal	Oppervlak	Torsietr.	Traagheid
1	HEB240	1:S235	1.060e+004	1.039e+006	1.126e+008
2	HEB280	1:S235	1.314e+004	1.461e+006	1.927e+008
3	HEB340	1:S235	1.709e+004	2.628e+006	3.666e+008

PROFIELEN vervolg [mm]

Nr.	Vormf.	Breedte	Hoogte	Zs	Rek.As	Type	b1	h1	b2	h2
1	0.00	240	240	120	0.00					
2	0.00	280	280	140	-0.00					
3	0.00	300	340	170	0.00					

STRAMIENLIJNEN

Nr.	Naam	X-begin	Y-begin	X-eind	Y-Eind
1	A	0.000	8.100	0.000	0.000
2	B	7.200	8.100	7.200	0.000
3	C	14.400	8.100	14.400	0.000
4	1	0.000	0.000	14.400	0.000
5	2	0.000	5.100	14.400	5.100
6	3	0.000	8.100	14.400	8.100

BALKEN

Nr.	Naam	Begin	Eind	Profiel
1	1	A;3	B;3	1:HEB240
2	2	B;3	C;3	2:HEB280
3	5	A;2	A;3	2:HEB280
4	6	B;2	B;3	3:HEB340
5	7	C;2	C;3	2:HEB280
6	8	A;1	B;1	1:HEB240
7	9	B;1	C;1	1:HEB240
8	10	A;1	A;2	2:HEB280
9	11	B;1	B;2	3:HEB340
10	12	C;1	C;2	2:HEB280

BALKEN vervolg

Nr.	Naam	Aansl.begin	Aansl.eind	Excentr.	Pasm.begin	Pasm.eind	Opm.
1	1	WDM	WD-	0.000	0.000	0.000	
2	2	WDM	WDM	0.000	0.000	0.000	
3	5	WDM	WDM	0.000	0.000	0.000	
4	6	WDM	WDM	0.000	0.000	0.000	
5	7	WDM	WDM	0.000	0.000	0.000	
6	8	WDM	WD-	0.000	0.000	0.000	
7	9	WDM	WDM	0.000	0.000	0.000	
8	10	WDM	WDM	0.000	0.000	0.000	
9	11	WDM	WDM	0.000	0.000	0.000	

Project..: - Oyster project
Onderdeel: second floor

BALKEN vervolg

Nr.	Naam	Aansl.begin	Aansl.eind	Excentr.	Pasm.begin	Pasm.eind	Opm.
10	12	WDM	WDM	0.000	0.000	0.000	

Opmerkingen:
De torsie traagheid van alle balken is tot 10% gereduceerd

STEUNPUNTTYPEN

Nr. : 1 Rx:Vrij Z:Vast Ry:Vrij
Afmeting : vast (0)
Min.afst.: 0.500

STEUNPUNTEN

Nr.	Steunpunttype	Balk	Positie	Excentr.	Opm:
1	1:vast	1:1	0.000	0.000	
2	1:vast	1:1	7.200	0.000	
3	1:vast	2:2	7.200	0.000	
4	1:vast	3:5	0.000	0.000	
5	1:vast	4:6	0.000	0.000	
6	1:vast	5:7	0.000	0.000	
7	1:vast	6:8	0.000	0.000	
8	1:vast	6:8	7.200	0.000	
9	1:vast	7:9	7.200	0.000	

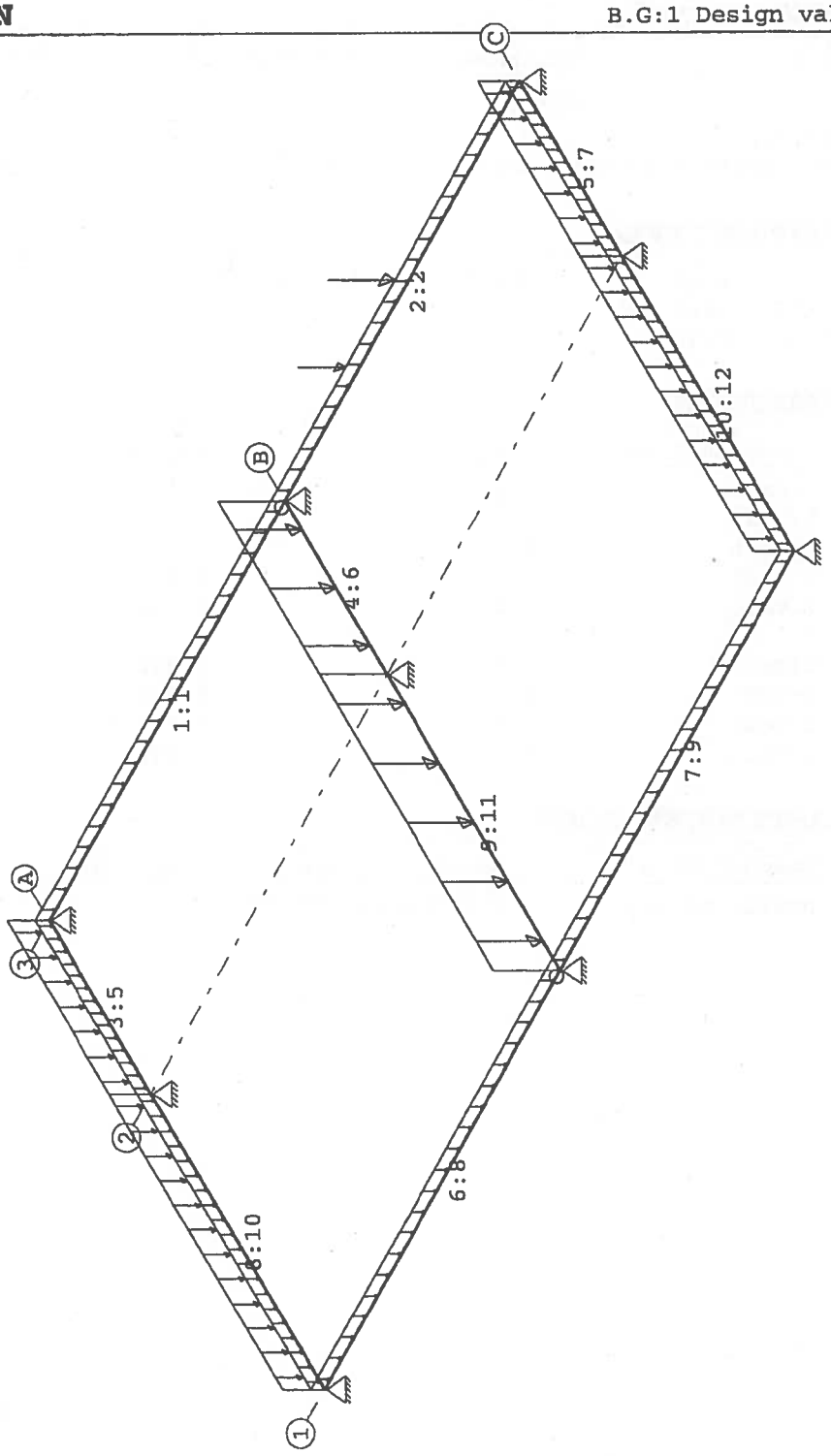
BELASTINGGEVALLEN

B.G.	Omschrijving	Belast/onbelast	ψ_0	ψ_1	ψ_2	e.g.
1	Design values	2:Permanent EN1991				0.00

Project..: - Oyster project
Onderdeel: second floor

VELDBELASTINGEN

B.G:1 Design values



Project..: - Oyster project
Onderdeel: second floor

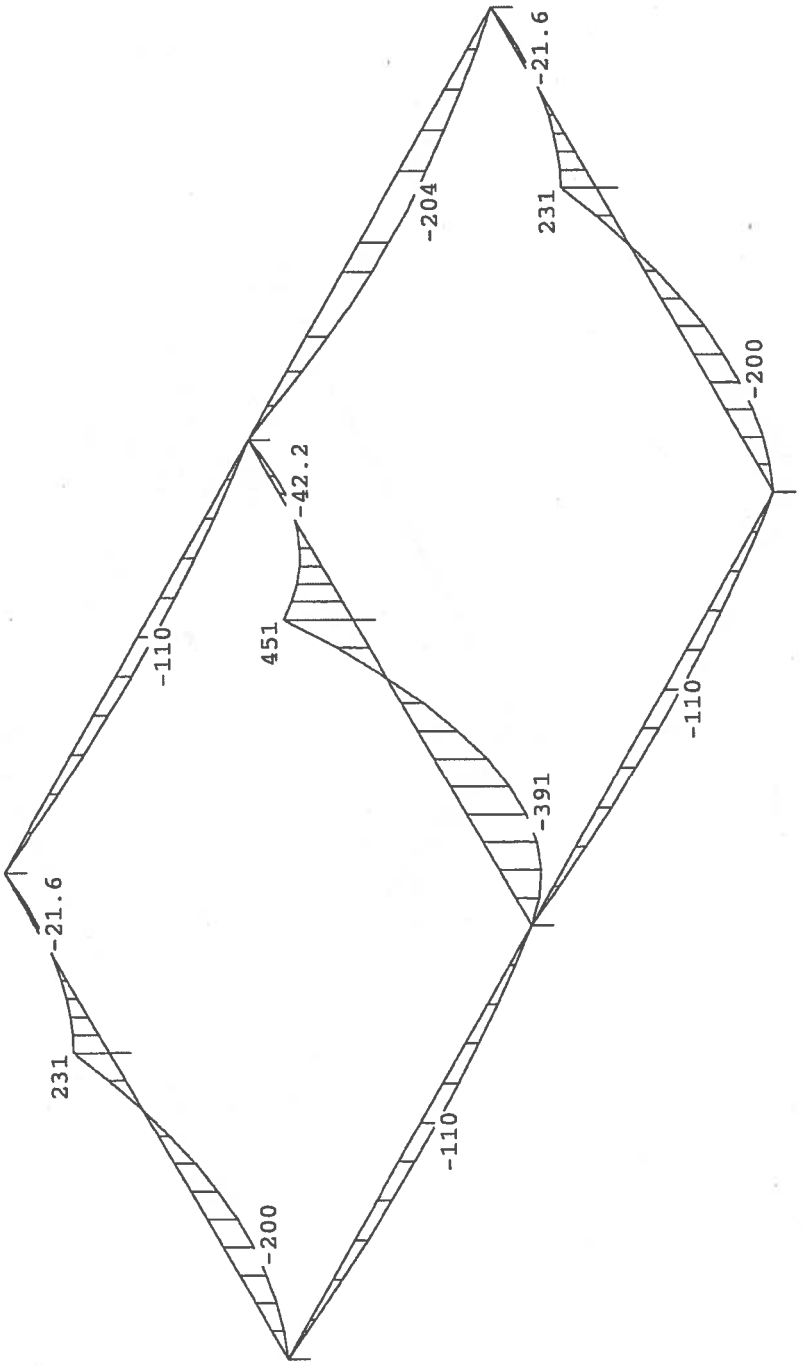
VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
1:1	1	1:q-last	-16.900	-16.900	0.000	7.200	0.000

MOMENTEN

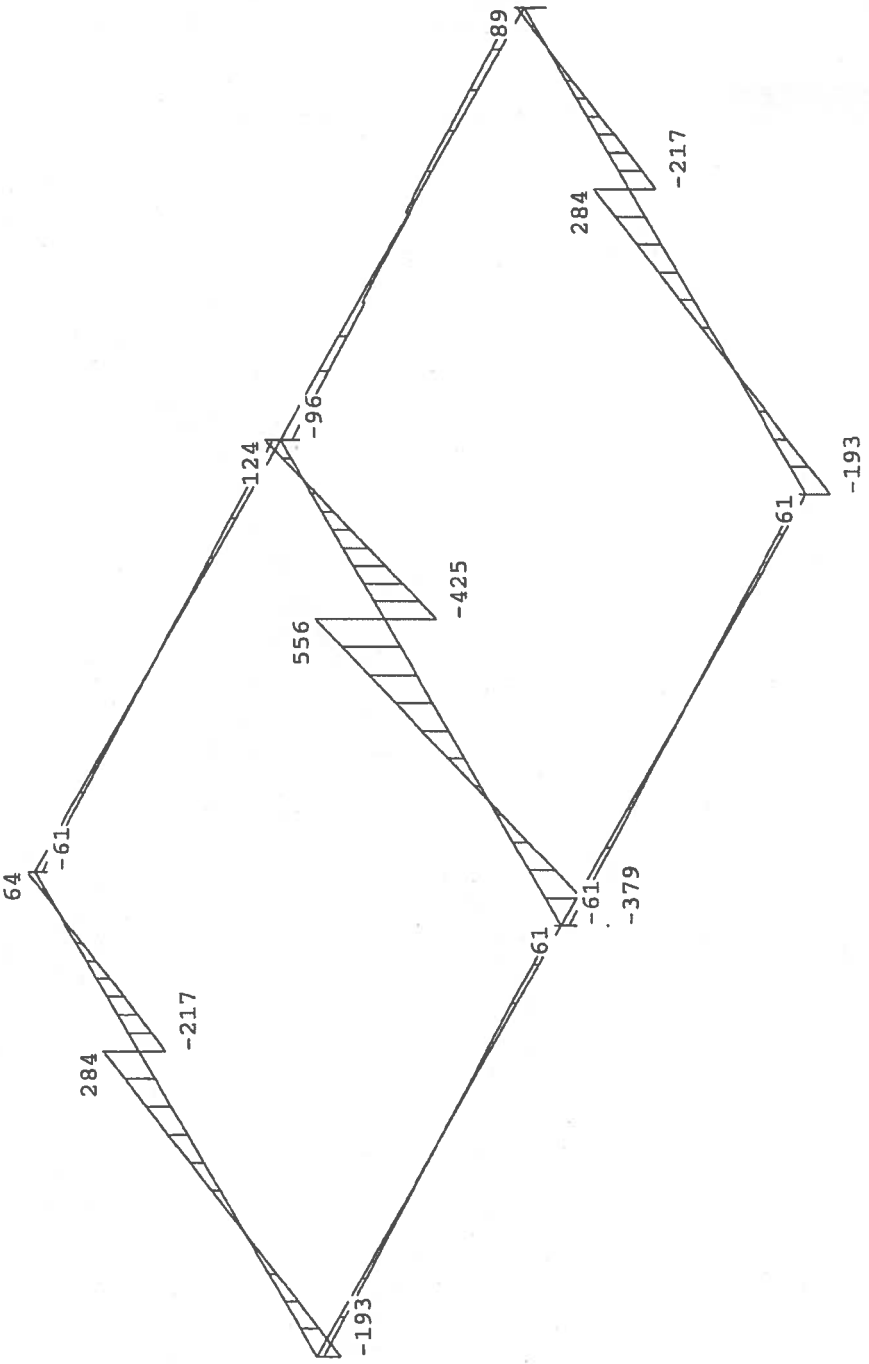
B.G:1 Design values



Project..: - Oyster project
Onderdeel: second floor

DWARSKRACHTEN

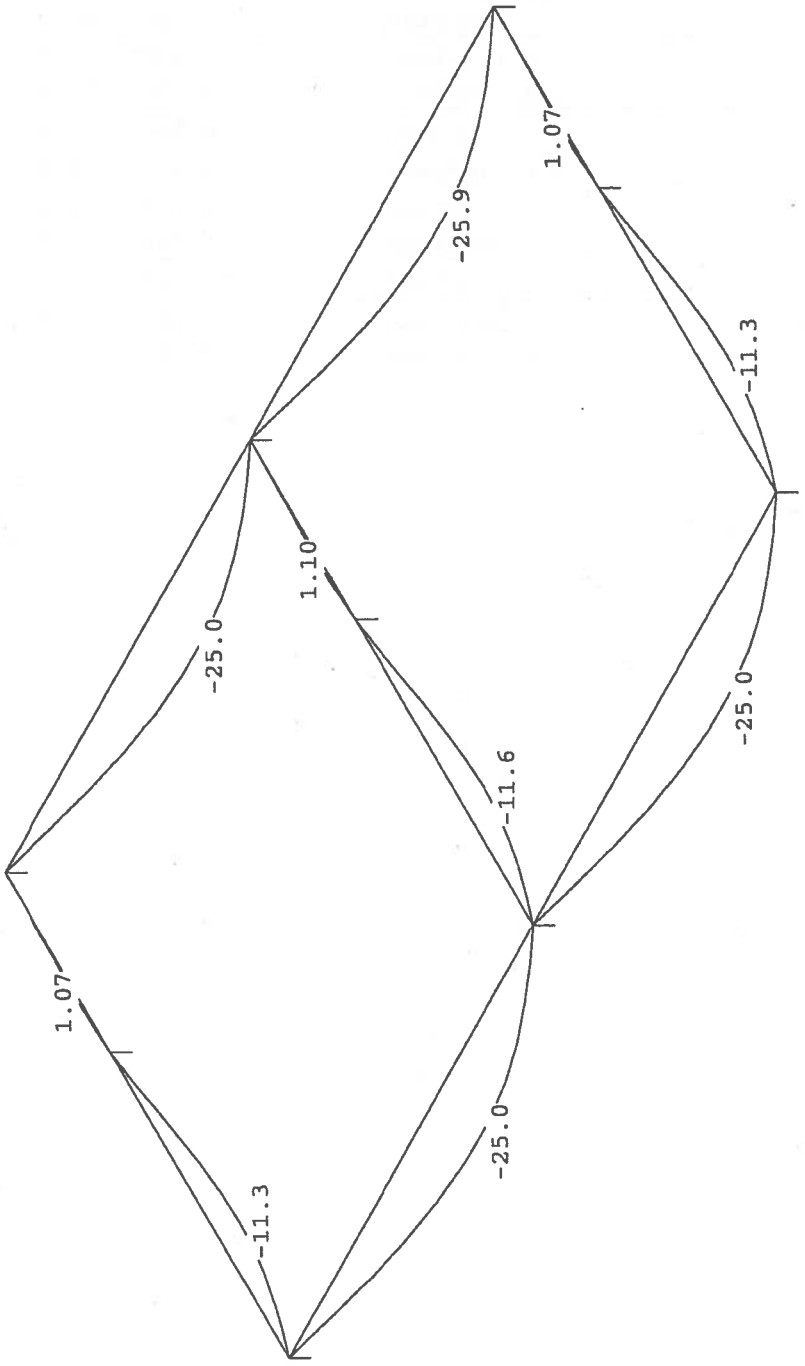
B.G:1 Design values



Project..: - Oyster project
Onderdeel: second floor

VERPLAATSINGEN [mm]

B.G:1 Design values



VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
2:2	1	1:q-last	-16.900	-16.900	0.000	7.200	0.000
2:2	2	8:Puntlast	-26.400		2.300		0.000
2:2	3	8:Puntlast	-36.900		3.800		0.000
3:5	1	1:q-last	-16.900	-16.900	0.000	3.000	0.000
3:5	2	1:q-last	-76.700	-76.700	0.000	3.000	0.000

Project..: - Oyster project
Onderdeel: second floor

VELDBELASTINGEN

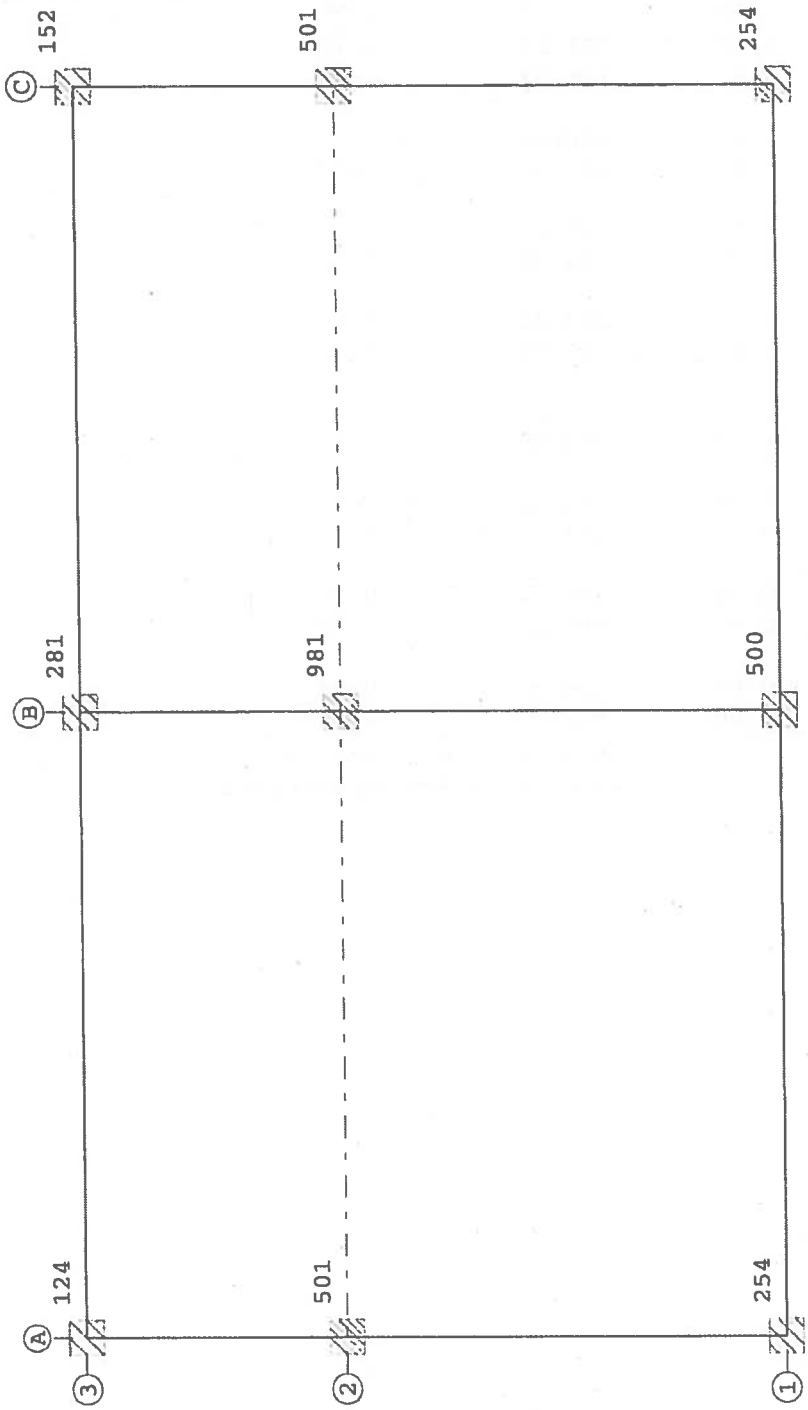
B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
4:6	1	1:q-last	-183.200	-183.200	0.000	3.000	0.000
5:7	1	1:q-last	-16.900	-16.900	0.000	3.000	0.000
5:7	2	1:q-last	-76.700	-76.700	0.000	3.000	0.000
6:8	1	1:q-last	-16.900	-16.900	0.000	7.200	0.000
7:9	1	1:q-last	-16.900	-16.900	0.000	7.200	0.000
8:10	1	1:q-last	-16.900	-16.900	0.000	5.100	0.000
8:10	2	1:q-last	-76.700	-76.700	0.000	5.100	0.000
9:11	1	1:q-last	-183.200	-183.200	0.000	5.100	0.000
10:12	1	1:q-last	-16.900	-16.900	0.000	5.100	0.000
10:12	2	1:q-last	-76.700	-76.700	0.000	5.100	0.000

Project..: - Oyster project
Onderdeel: second floor

REACTIES

B.G:1 Design values



REACTIES

B.G:1 Design values

Balk	Stp	MX	Z	MY
1	1	0.00	124.37	0.00
1	2	0.00	281.42	0.00
2	2	0.00	281.42	0.00
2	3	0.00	152.28	0.00

Project..: - Oyster project
Onderdeel: second floor

REACTIES

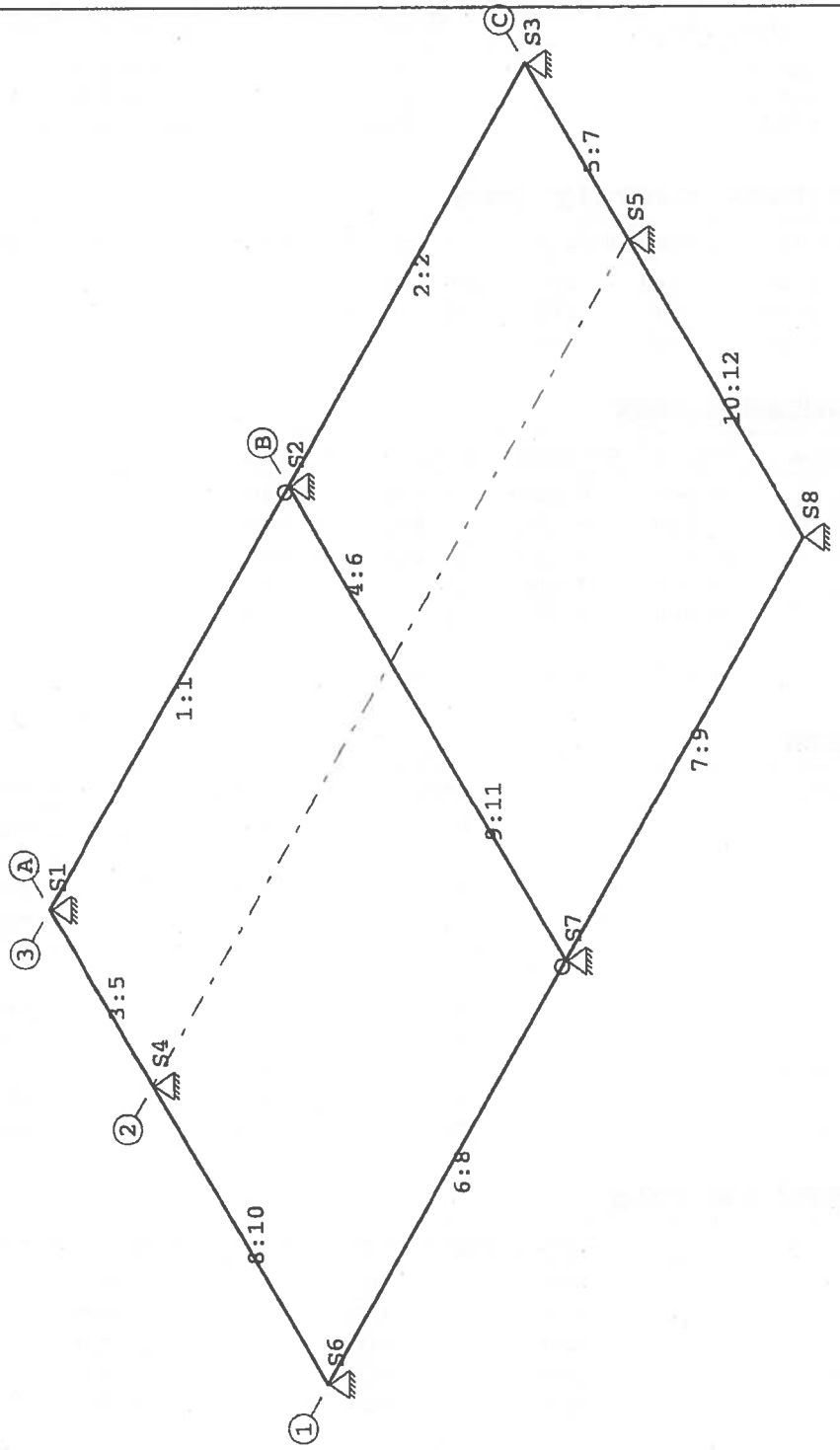
B.G:1 Design values

Balk	Stp	MX	Z	MY
3	4	0.00	501.17	0.00
3	1	0.00	124.37	0.00
4	5	0.00	980.91	0.00
4	2	0.00	281.42	0.00
5	6	0.00	501.17	0.00
5	3	0.00	152.28	0.00
6	7	0.00	254.30	0.00
6	8	0.00	500.34	0.00
7	8	0.00	500.34	0.00
7	9	0.00	254.30	0.00
8	7	0.00	254.30	0.00
8	4	0.00	501.17	0.00
9	8	0.00	500.34	0.00
9	5	0.00	980.91	0.00
10	9	0.00	254.30	0.00
10	6	0.00	501.17	0.00

3550.26 : Som reacties
-3550.26 : Som belastingen

Project..: - Oyster project
Onderdeel: third floor
Dimensies: kN/m/rad
Datum....: 18/03/2015
Bestand..: c:\users\150033\documents\hyundai delft\3de verdieping nieuw.grw
Torsiefac: 10 %

GEOMETRIE



Project..: - Oyster project
Onderdeel: third floor

MATERIALEN

Mt	Omschrijving	E-mechanica[N/mm2]	Kruipcoef.	S.M.	Pois.
1	S235	210000		78.5	0.30

PROFIELEN [mm]

Prof.	Omschrijving	Materiaal	Oppervlak	Torsietr.	Traagheid
1	HEB240	1:S235	1.060e+004	1.039e+006	1.126e+008
2	HEB280	1:S235	1.314e+004	1.461e+006	1.927e+008
3	HEB650	1:S235	2.863e+004	7.490e+006	2.106e+009

PROFIELEN vervolg [mm]

Nr.	Vormf.	Breedte	Hoogte	Zs	Rek.As	Type	b1	h1	b2	h2
1	0.00	240	240	120	0.00					
2	0.00	280	280	140	-0.00					
3	0.00	300	650	325	0.00					

STRAMIENLIJNEN

Nr.	Naam	X-begin	Y-begin	X-eind	Y-Eind
1	A	0.000	8.100	0.000	0.000
2	B	7.200	8.100	7.200	0.000
3	C	14.400	8.100	14.400	0.000
4	1	0.000	0.000	14.400	0.000
5	2	0.000	5.100	14.400	5.100
6	3	0.000	8.100	14.400	8.100

BALKEN

Nr.	Naam	Begin	Eind	Profiel
1	1	A;3	B;3	1:HEB240
2	2	B;3	C;3	1:HEB240
3	5	A;2	A;3	2:HEB280
4	6	B;2	B;3	3:HEB650
5	7	C;2	C;3	2:HEB280
6	8	A;1	B;1	1:HEB240
7	9	B;1	C;1	1:HEB240
8	10	A;1	A;2	2:HEB280
9	11	B;1	B;2	3:HEB650
10	12	C;1	C;2	2:HEB280

BALKEN vervolg

Nr.	Naam	Aansl.begin	Aansl.eind	Excentr.	Pasm.begin	Pasm.eind	Opm.
1	1	WDM	WD-	0.000	0.000	0.000	
2	2	WDM	WDM	0.000	0.000	0.000	
3	5	WDM	WDM	0.000	0.000	0.000	
4	6	WDM	WDM	0.000	0.000	0.000	
5	7	WDM	WDM	0.000	0.000	0.000	
6	8	WDM	WD-	0.000	0.000	0.000	
7	9	WDM	WDM	0.000	0.000	0.000	
8	10	WDM	WDM	0.000	0.000	0.000	
9	11	WDM	WDM	0.000	0.000	0.000	

Project..: - Oyster project
Onderdeel: third floor

BALKEN vervolg

Nr.	Naam	Aansl.begin	Aansl.eind	Excentr.	Pasm.begin	Pasm.eind	Opm.
10	12	WDM	WDM	0.000	0.000	0.000	

Opmerkingen:
De torsie traagheid van alle balken is tot 10% gereduceerd

STEUNPUNTTYPEN

Nr. : 1 Rx:Vrij Z:Vast Ry:Vrij
Afmeting : vast (0)
Min.afst.: 0.500

STEUNPUNTEN

Nr.	Steunpunttype	Balk	Positie	Excentr.	Opm:
1	1:vast	1:1	0.000	0.000	
2	1:vast	1:1	7.200	0.000	
3	1:vast	2:2	7.200	0.000	
4	1:vast	3:5	0.000	0.000	
5	1:vast	5:7	0.000	0.000	
6	1:vast	6:8	0.000	0.000	
7	1:vast	6:8	7.200	0.000	
8	1:vast	7:9	7.200	0.000	

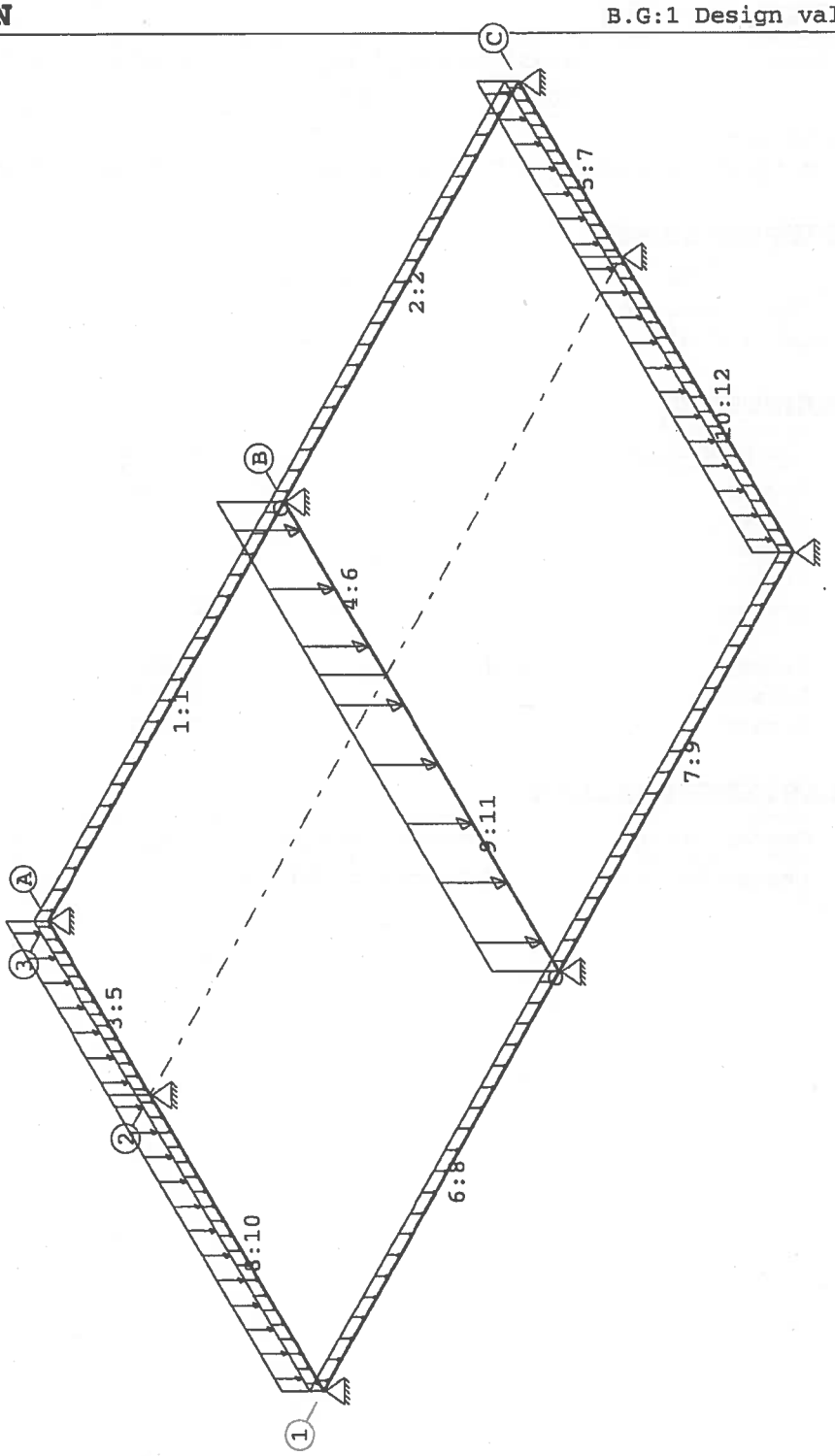
BELASTINGGEVALLEN

B.G.	Omschrijving	Belast/onbelast	Ψ_0	Ψ_1	Ψ_2	e.g.
1	Design values	2:Permanent EN1991				0.00

Project..: - Oyster project
Onderdeel: third floor

VELDBELASTINGEN

B.G:1 Design values



Project..: - Oyster project
Onderdeel: third floor

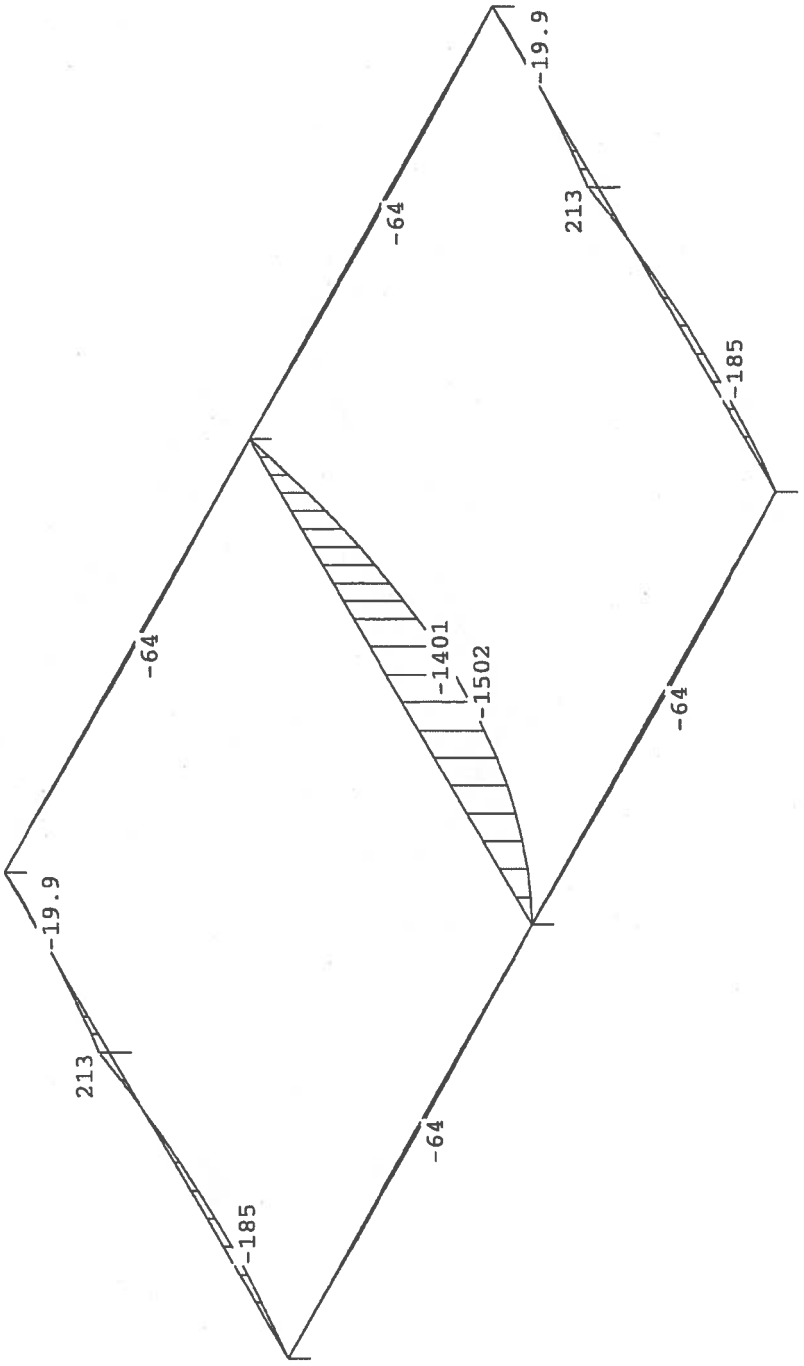
VELDBELASTINGEN

B.G:1 Design values

Balk	Last Type	q1/p/m	q2	Afstand	Lengte	Exc.
1:1	1 1:q-last	-9.800	-9.800	0.000	7.200	0.000

MOMENTEN

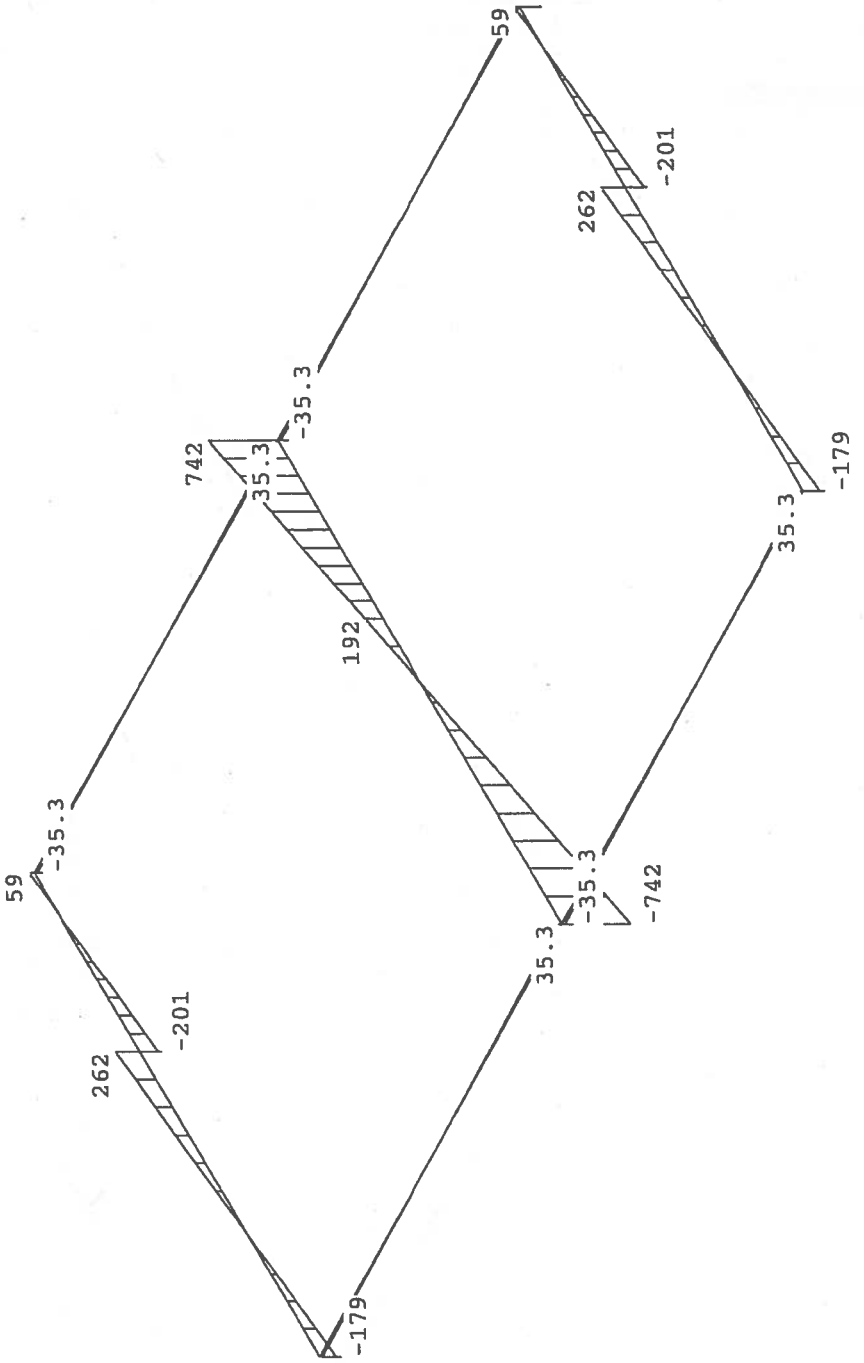
B.G:1 Design values



Project..: - Oyster project
Onderdeel: third floor

DWARSKRACHTEN

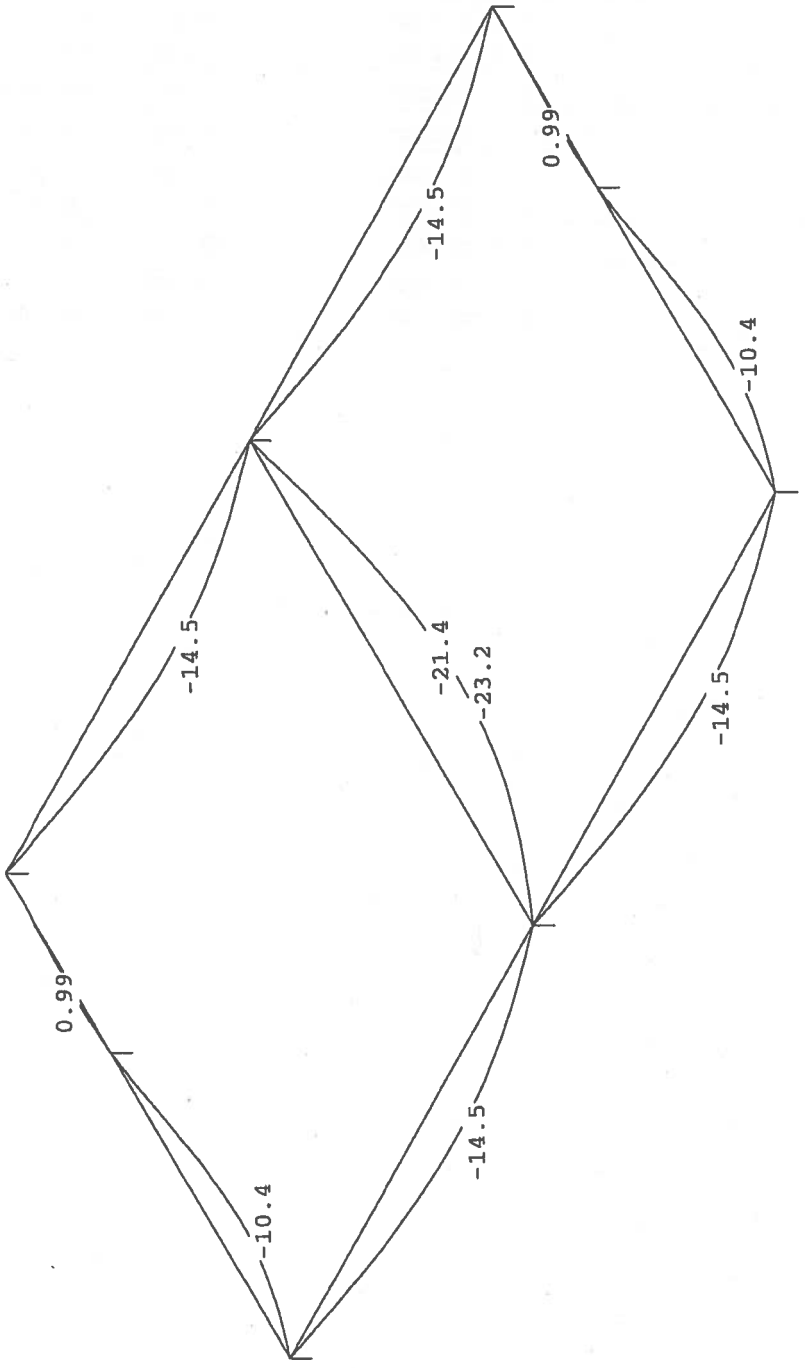
B.G:1 Design values



Project..: - Oyster project
Onderdeel: third floor

VERPLAATSINGEN [mm]

B.G:1 Design values



VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
2:2	1	1:q-last	-9.800	-9.800	0.000	7.200	0.000
3:5	1	1:q-last	-9.800	-9.800	0.000	3.000	0.000
3:5	2	1:q-last	-76.700	-76.700	0.000	3.000	0.000
4:6	1	1:q-last	-183.200	-183.200	0.000	3.000	0.000

Project..: - Oyster project
Onderdeel: third floor

VELDBELASTINGEN

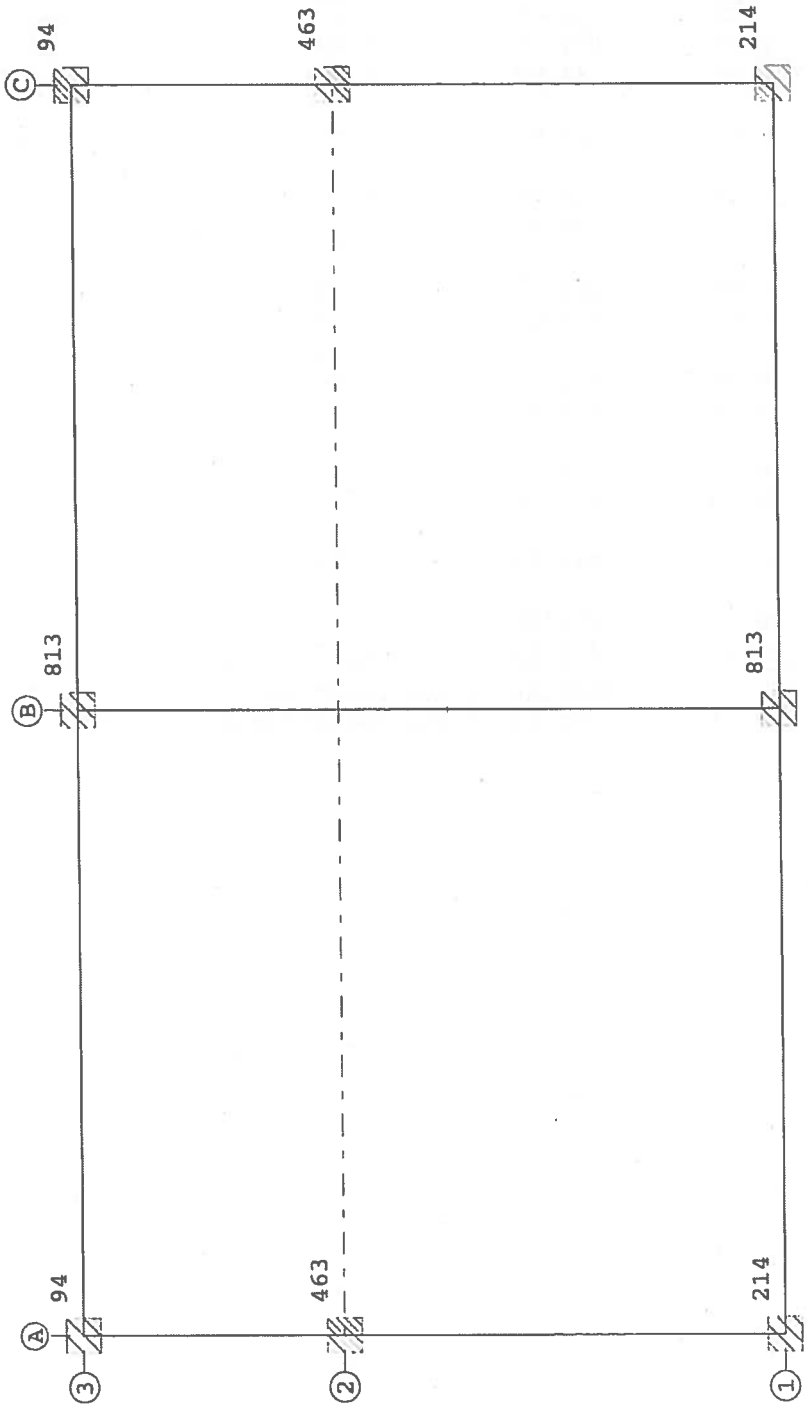
B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
5:7	1	1:q-last	-9.800	-9.800	0.000	3.000	0.000
5:7	2	1:q-last	-76.700	-76.700	0.000	3.000	0.000
6:8	1	1:q-last	-9.800	-9.800	0.000	7.200	0.000
7:9	1	1:q-last	-9.800	-9.800	0.000	7.200	0.000
8:10	1	1:q-last	-9.800	-9.800	0.000	5.100	0.000
8:10	2	1:q-last	-76.700	-76.700	0.000	5.100	0.000
9:11	1	1:q-last	-183.200	-183.200	0.000	5.100	0.000
10:12	1	1:q-last	-9.800	-9.800	0.000	5.100	0.000
10:12	2	1:q-last	-76.700	-76.700	0.000	5.100	0.000

Project..: - Oyster project
Onderdeel: third floor

REACTIES

B.G:1 Design values



REACTIES

B.G:1 Design values

Balk	Stp	MX	Z	MY
1	1	0.00	93.99	0.00
1	2	0.00	812.52	0.00
2	2	0.00	812.52	0.00
2	3	0.00	93.99	0.00

Project..: - Oyster project
Onderdeel: third floor

REACTIES

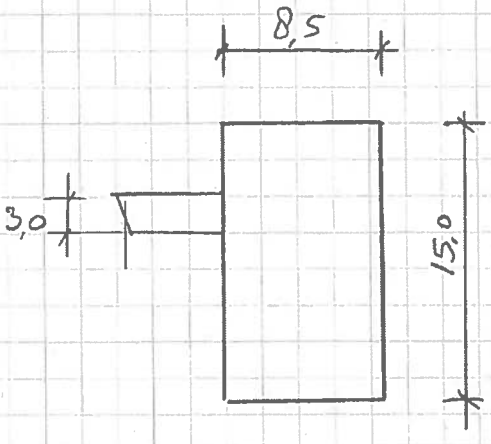
B.G:1 Design values

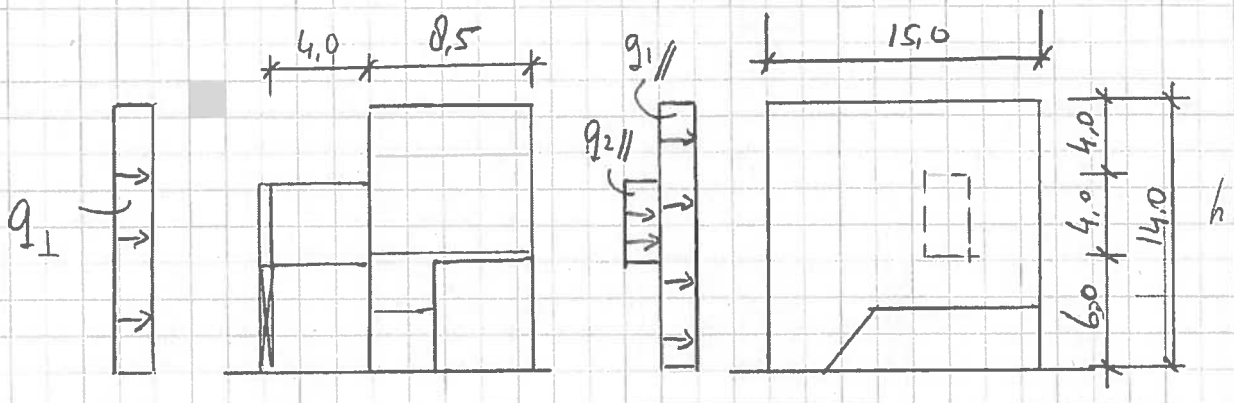
Balk	Stp	MX	Z	MY
3	4	0.00	463.16	0.00
3	1	0.00	93.99	0.00
4	2	0.00	812.52	0.00
5	5	0.00	463.16	0.00
5	3	0.00	93.99	0.00
6	6	0.00	214.07	0.00
6	7	0.00	812.52	0.00
7	7	0.00	812.52	0.00
7	8	0.00	214.07	0.00
8	6	0.00	214.07	0.00
8	4	0.00	463.16	0.00
9	7	0.00	812.52	0.00
10	8	0.00	214.07	0.00
10	5	0.00	463.16	0.00

3167.46 : Som reacties
-3167.46 : Som belastingen

Wind: According to the Dutch Annex: TABEL NB 5

$q_p = 0,8 \text{ kN/m}^2$





$h/d \approx 1$ $\quad C_{pe10} = 0,85(0,8+0,5) = 1,1$ (TABEL NB6.).

$C_{fr} = 0,02$

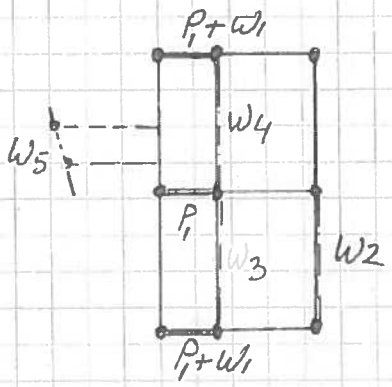
$q_{1\perp} = 15,0 \cdot 1,1 \cdot 0,8 + 2 \cdot 8,5 \cdot 0,02 \cdot 0,8 = 13,5 \text{ kN/m}'$

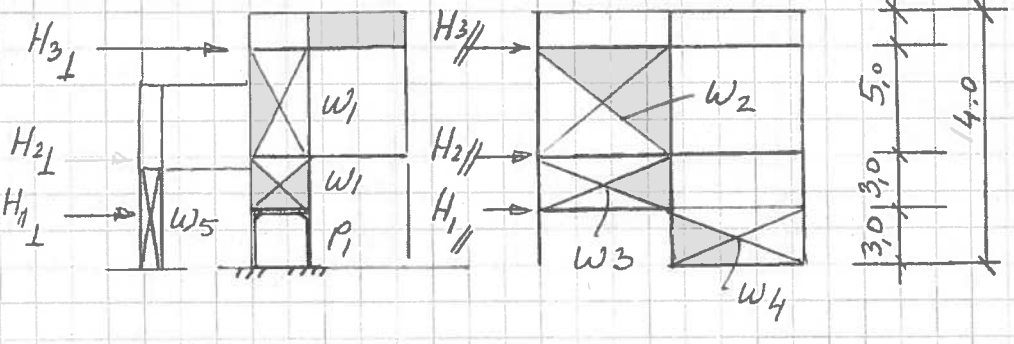
$q_{1//} = 8,0 \cdot 1,1 \cdot 0,8 + 2 \cdot 15,0 \cdot 0,02 \cdot 0,8 = 7,5 \text{ kN/m}'$

$q_{2//} = \frac{4,0}{2} \cdot 1,1 \cdot 0,8 = 1,8 \text{ kN/m}'$

SNOW: NOT NORMATIVE

Windloads on foundation:





$H1_{\perp d} = 1,65 \cdot 3,0 \cdot 13,5 = 66,8\ kN$

$H2_{\perp d} = 1,65 \cdot 4,0 \cdot 13,5 = 89,1\ kN$

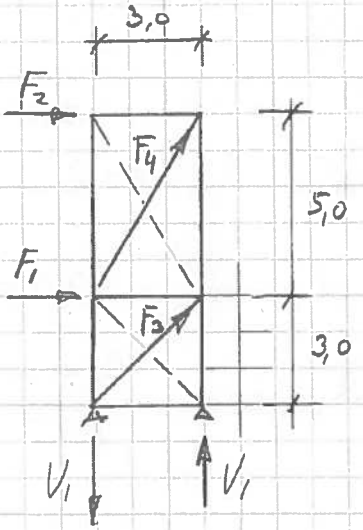
$H3_{\perp d} = 1,65 \cdot 5,5 \cdot 13,5 = 122,5\ kN$

$H1_{//d} = 1,65 \cdot 3,0 \cdot 7,5 = 37,1\ kN$

$H2_{//d} = 1,65 \cdot (4,0 \cdot 7,5 + 2,0 \cdot 1,8) = 55,4\ kN$

$H3_{//d} = 1,65 \cdot (5,0 \cdot 7,5 + 2,0 \cdot 1,8) = 67,8\ kN$

W1 : (2x).



$F_{1d} = \frac{89,1}{2} = 44,6\ kN$

$F_{2d} = \frac{122,5}{2} = 61,3\ kN$

$F_{3d} = (44,6 + 61,3) \cdot \sqrt{2} = 149,7\ kN$

$A_{s\,req} = \frac{149,7 \cdot 10^3}{235} = 637\ mm^2$

$\neq 12 * 100\ mm.$

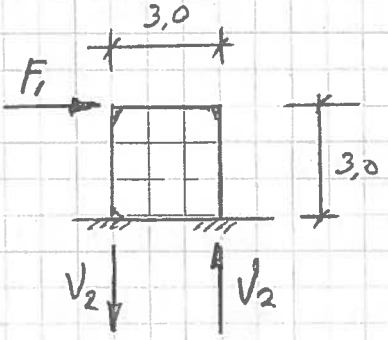
$F_{4d} = \frac{5,8}{3,0} \cdot 61,3 = 118,5\ kN$

$A_{s\,req} = \frac{118,3 \cdot 10^3}{235} = 503\ mm^2.$

$\neq 12 * 100$

$V_{1d} = +/- \frac{3,0 \cdot 44,6 + 8,0 \cdot 61,3}{3,0} = +/- 208,1\ kN.$

Portal P1 (3x)

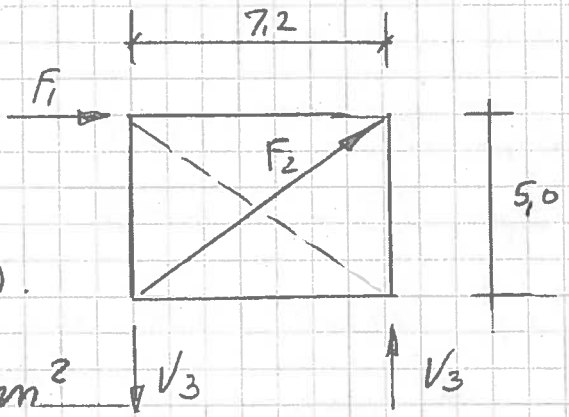


$F_{1d} = \frac{66,8 + 89,1 + 122,5}{3} = 92,8\ kN.$

$V_{2d} = +/- 92,8\ kN.$

PORTAL SEE PAGE 54

W2



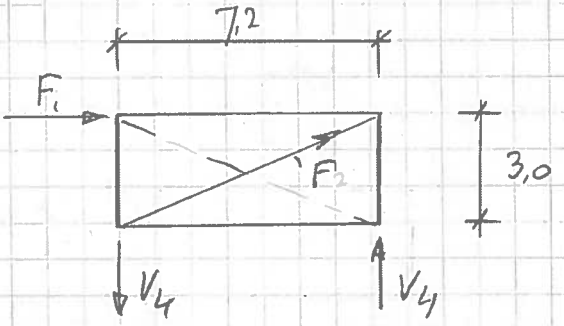
$F_{1d} = 67,8\ kN$

$F_{2d} = \frac{8,8}{7,2} \cdot 67,8 = 82,9\ kN.$

$A_{s\,net} = \frac{82,9 \cdot 10^3}{235} = 353\ mm^2 \neq 12 * 100\ mm$ (see also

$V_{3d} = \frac{5,0}{7,2} \cdot 67,8 = 47,1\ kN.$

W3.



$F_{1d} = 55,4 + 67,8 = 123,2\ kN$

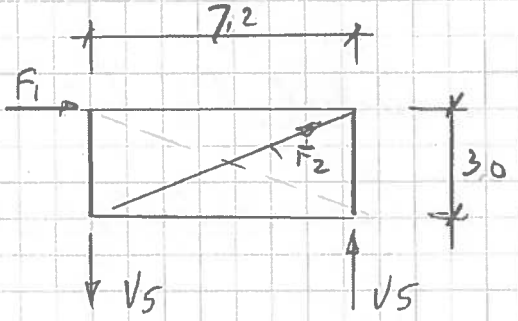
$F_{2d} = \frac{7,8}{7,2} \cdot 123,2 = 133,5\ kN.$

$A_{s\,net} = \frac{133,5 \cdot 10^3}{235} = 568\ mm^2.$

$2* \neq 12 * 100\ mm$ (SEISMIC LOADS NORMATIVE)

$V_{4d} = +/- \frac{123,2 \cdot 3,0}{7,2} = +/- 51,3\ kN$

W4:



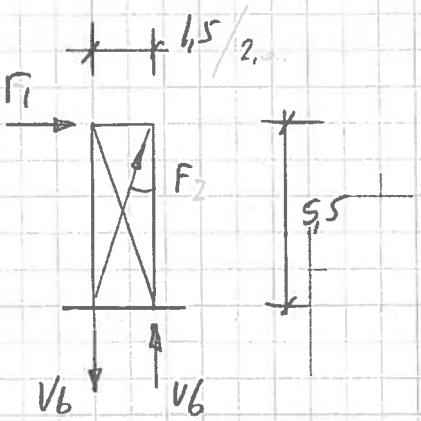
$F_{1d} = 37,1 + 55,4 + 67,8 - 160,3\ kN$

$F_{2d} = \frac{7,8}{7,2} \cdot 160,3 = 173,6\ kN$

$A_{s\,net} = \frac{173,6 \cdot 10^3}{235} = 738\ mm^2$ $2 \neq 12 * 100\ mm$ (SEISMIC LOADS NORM.)

$V_{5d} = +/- \frac{160,3 \cdot 3,0}{7,2} = +/- 66,8\ kN.$

W5 :



$F_{1d} = 4,0 \cdot 1,8 = 7,2\ kN$

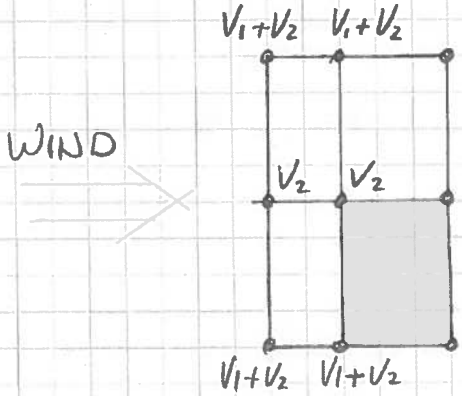
$F_{2d} = \frac{5,7}{1,5} \cdot 7,2 = 27,4\ kN$

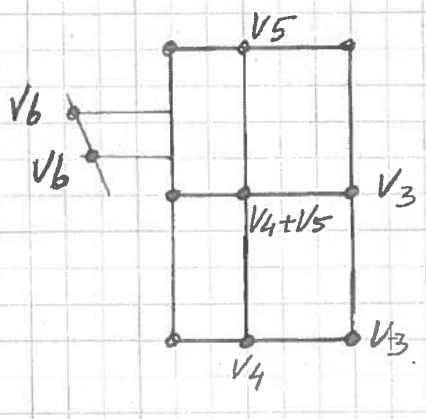
$A_{s\,req} = \frac{27,4 \cdot 10^3}{235} = 116\ mm^2$

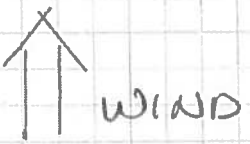
BAR $\phi 25 / M24$

$V_b = +/- \frac{7,2 \cdot 5,5}{1,5} = +/- 26,4\ kN.$

Resumé Wind loads on foundation:







$V_{1d} = 208,1\ kN$

$V_{1d} + V_{2d} = 208,1 + 92,8 = 300,9\ kN$

$V_{2d} = 92,8\ kN.$

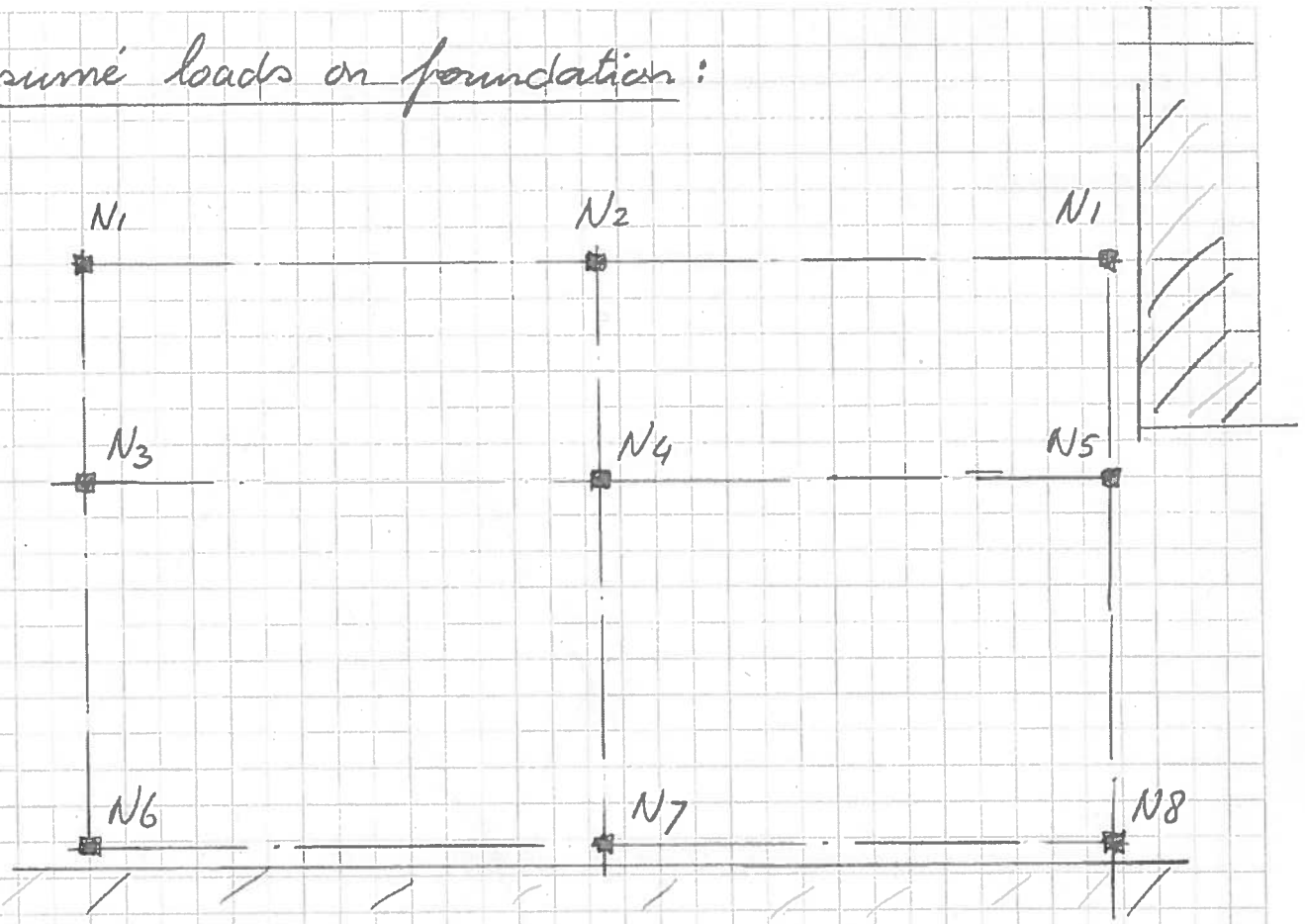
$V_{3d} = 47,1\ kN.$

$V_{4d} = 51,3\ kN$

$V_{5d} = 66,8\ kN.$

$V_{6d} = 26,4\ kN$

Resumé loads on foundation:



N_{1d} = 170,0 + 124,0 + 94,0 + 208,1 + 92,8 = 688,9 kN

N_{2d} = 352,0 + 281,0 + 813,0 + 92,8 = 1538,8 kN

N_{3d} = 170,0 + 501,0 + 463,0 + 208,1 + 92,8 = 1434,9 kN *

N_{4d} = 352,0 + 981,0 + 0 − 51,3 + 66,8 = 1348,5 kN

N_{5d} = 170,0 + 501,0 + 463,0 + 208,1 + 92,8 = 1434,9 kN *

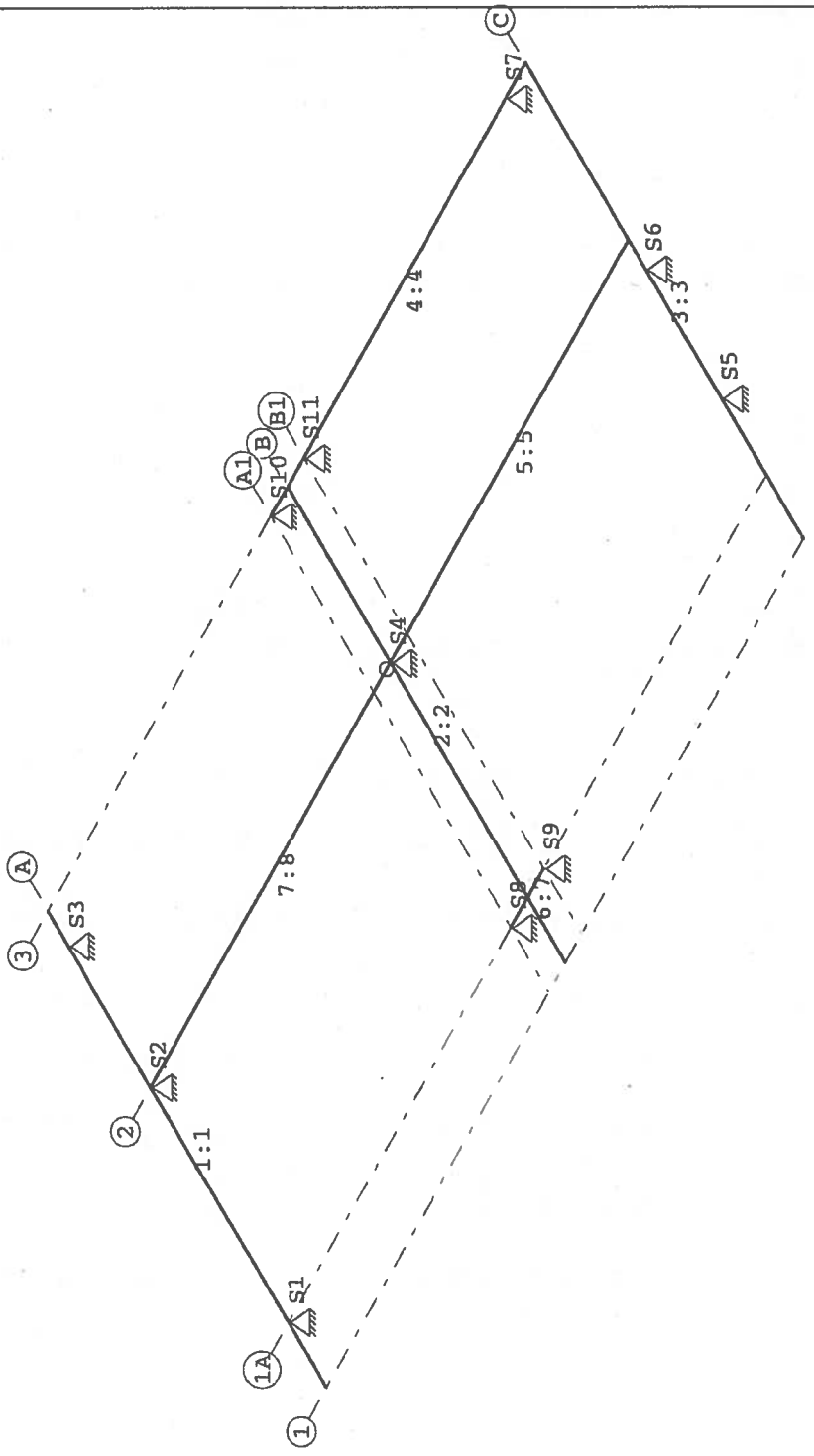
N_{6d} = 254,0 + 214,0 + 47,1 = 515,1 kN

N_{7d} = 500,0 + 813,0 + 47,1 = 1360,1 kN

N_{8d} = 254,0 + 214,0 + 0 = 468,0 kN

Project..: - Oyster project
Onderdeel: foundation
Dimensies: kN/m/rad
Datum....: 18/03/2015
Bestand..: c:\users\150033\documents\hyundai delft\fundatie nieuw.grw
Torsiefac: 10 %

GEOMETRIE



Project..: - Oyster project
Onderdeel: foundation

MATERIALEN

Mt	Omschrijving	E-mechanica[N/mm2]	Kruipcoef.	S.M.	Pois.
1	S235	210000		78.5	0.30
2	C25/30	8352	2.77	24.0	0.20

PROFIELEN [mm]

Prof.	Omschrijving	Materiaal	Oppervlak	Torsietr.	Traagheid
1	B*H 600*800	2:C25/30	4.800e+005	3.166e+010	2.560e+010
2	B*H 300*300	2:C25/30	9.000e+004	1.141e+009	6.750e+008

PROFIELEN vervolg [mm]

Nr.	Vormf.	Breedte	Hoogte	Zs	Rek.As	Type	b1	h1	b2	h2
1	0.00	600	800	400	0.00	0:RH				
2	0.00	300	300	150	0.00	0:RH				

STRAMIENLIJNEN

Nr.	Naam	X-begin	Y-begin	X-eind	Y-Eind
1	A	0.000	8.100	0.000	0.000
2	B	7.200	8.100	7.200	0.000
3	C	14.400	8.100	14.400	0.000
4	1	0.000	0.000	14.400	0.000
5	2	0.000	5.100	14.400	5.100
6	3	0.000	8.100	14.400	8.100
7	1A	0.000	1.100	14.400	1.100
8	A1	6.700	8.100	6.700	0.000
9	B1	7.700	8.100	7.700	0.000

BALKEN

Nr.	Naam	Begin	Eind	Profiel
1	1	A;1	A;3	1:B*H 600*800
2	2	B;1	B;3	1:B*H 600*800
3	3	C;1	C;3	1:B*H 600*800
4	4	A1;3	C;3	1:B*H 600*800
5	5	B;2	C;2	1:B*H 600*800
6	7	1A;A1	1A;B1	1:B*H 600*800
7	8	A;2	B;2	2:B*H 300*300

BALKEN vervolg

Nr.	Naam	Aansl.begin	Aansl.eind	Excentr.	Pasm.begin	Pasm.eind	Opm.
1	1	WDM	WDM	0.000	0.000	0.000	
2	2	WDM	WDM	0.000	0.000	0.000	
3	3	WDM	WDM	0.000	0.000	0.000	
4	4	WDM	WDM	0.000	0.000	0.000	
5	5	WDM	WDM	0.000	0.000	0.000	
6	7	WDM	WDM	0.000	0.000	0.000	
7	8	WDM	WD-	0.000	0.000	0.000	

Opmerkingen:
De torsie traagheid van alle balken is tot 10% gereduceerd

Project..: - Oyster project
Onderdeel: foundation

STEUNPUNTTYPEN

Nr. : 1 Rotatie X:Vrij
Afmeting : round 400 (400) Verplaatsing Z:Veerwaarde: 100000
FRd : 1000.000000 Rotatie Y:Vrij
Min.afst.: 0.500

STEUNPUNTEN

Nr.	Steunpunttype	Balk	Positie	Excentr. Opm:
1	1:round 400	1:1	1.100	0.000
2	1:round 400	1:1	5.100	0.000
3	1:round 400	1:1	7.500	0.000
4	1:round 400	2:2	5.100	0.000
5	1:round 400	3:3	2.400	0.000
6	1:round 400	3:3	4.600	0.000
7	1:round 400	4:4	7.100	0.000
8	1:round 400	6:7	0.000	0.000
9	1:round 400	6:7	1.000	0.000
10	1:round 400	4:4	0.000	0.000
11	1:round 400	4:4	1.000	0.000

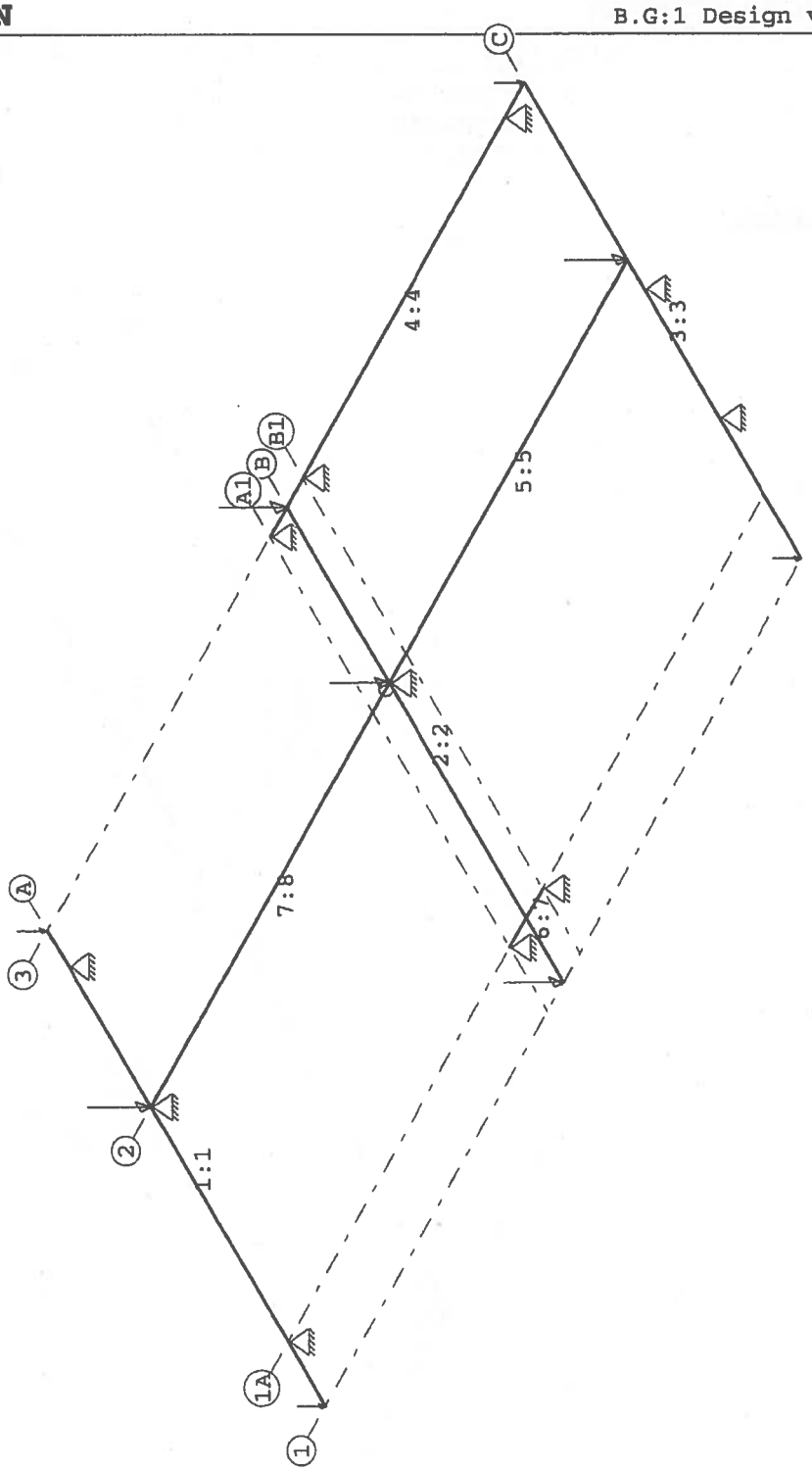
BELASTINGGEVALLEN

B.G.	Omschrijving	Belast/onbelast	Ψ_0	Ψ_1	Ψ_2	e.g.
1	Design values	2:Permanent EN1991				-1.30

Project..: - Oyster project
Onderdeel: foundation

VELDBELASTINGEN

B.G:1 Design values



Project..: - Oyster project
Onderdeel: foundation

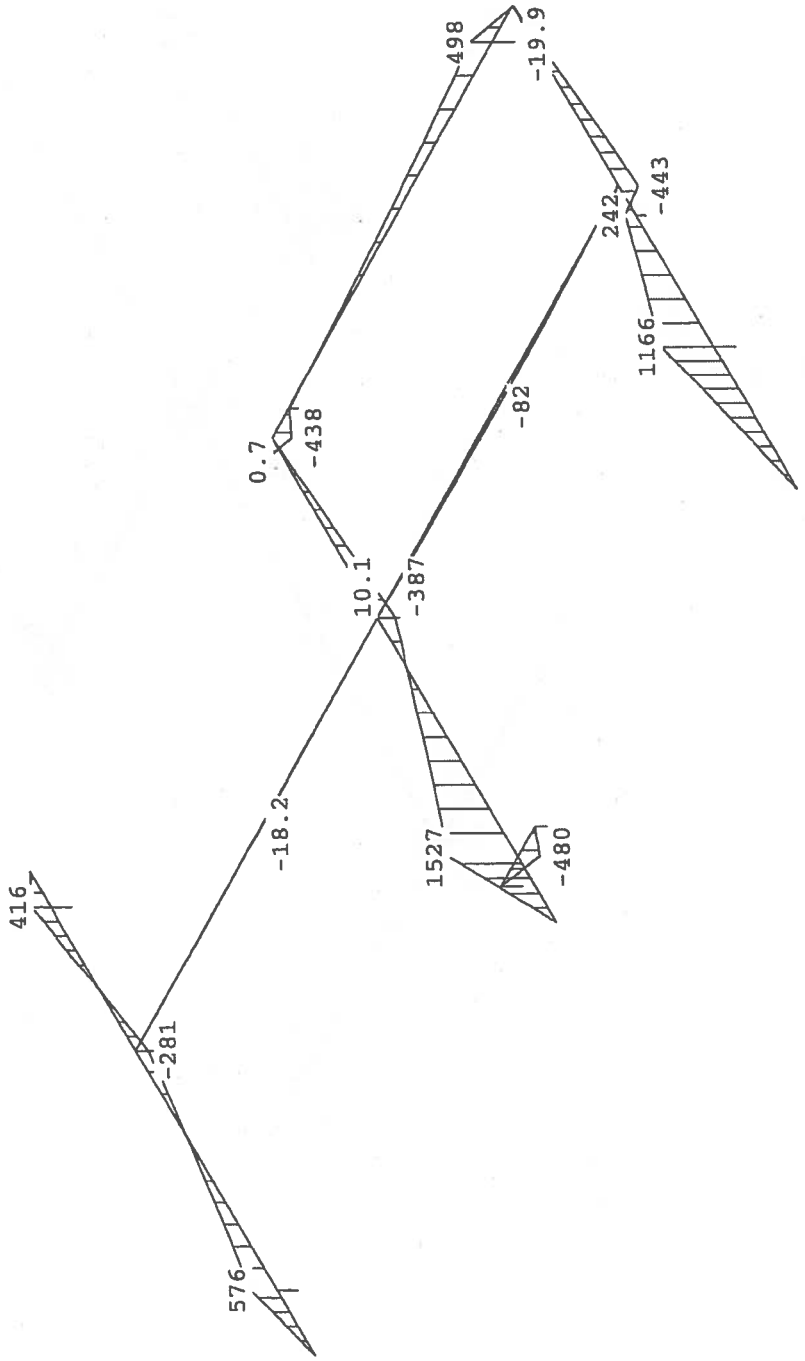
VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
1:1	1	8:Puntlast	-515.100		0.000		0.000
1:1	2	8:Puntlast	-1434.900		5.100		0.000
1:1	3	8:Puntlast	-688.900		8.100		0.000

MOMENTEN

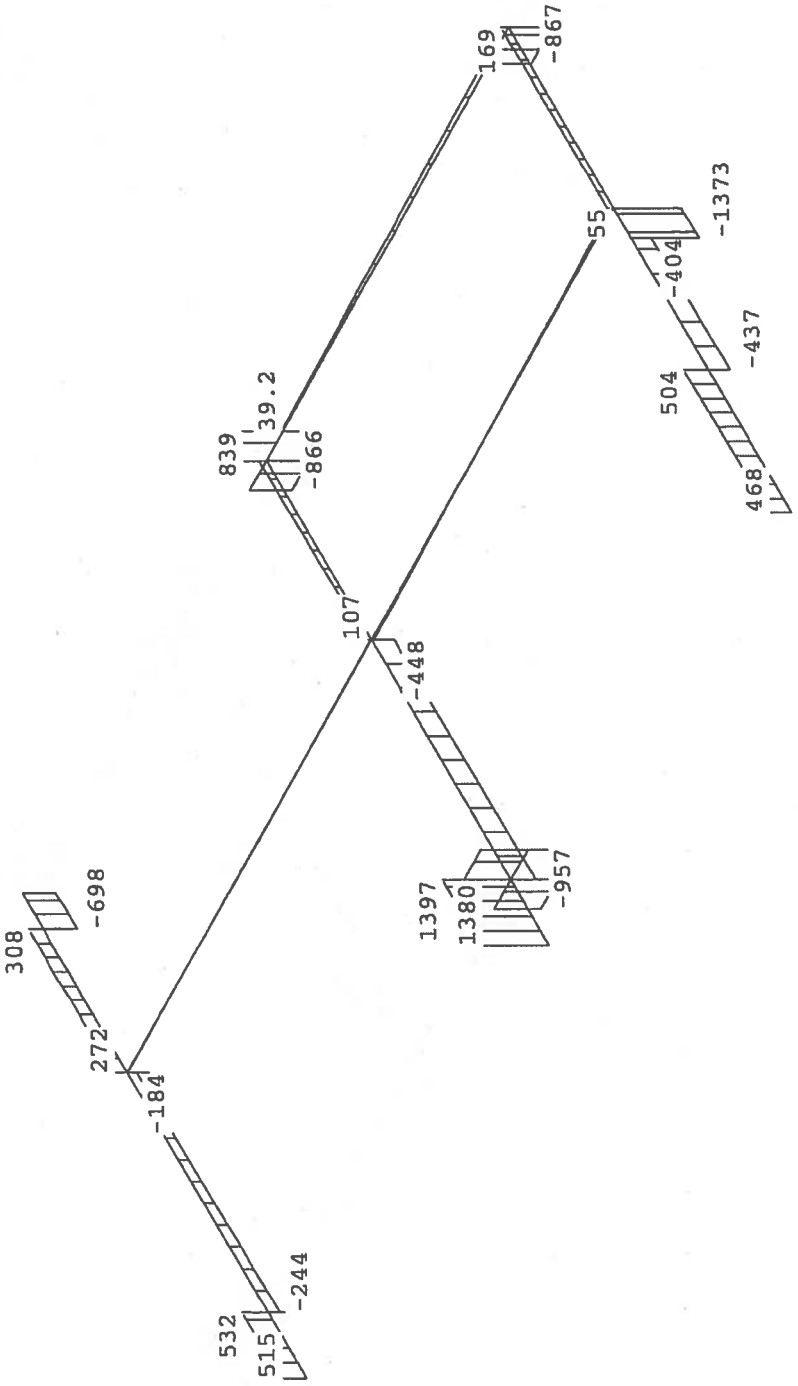
B.G:1 Design values



Project..: - Oyster project
Onderdeel: foundation

DWARSKRACHTEN

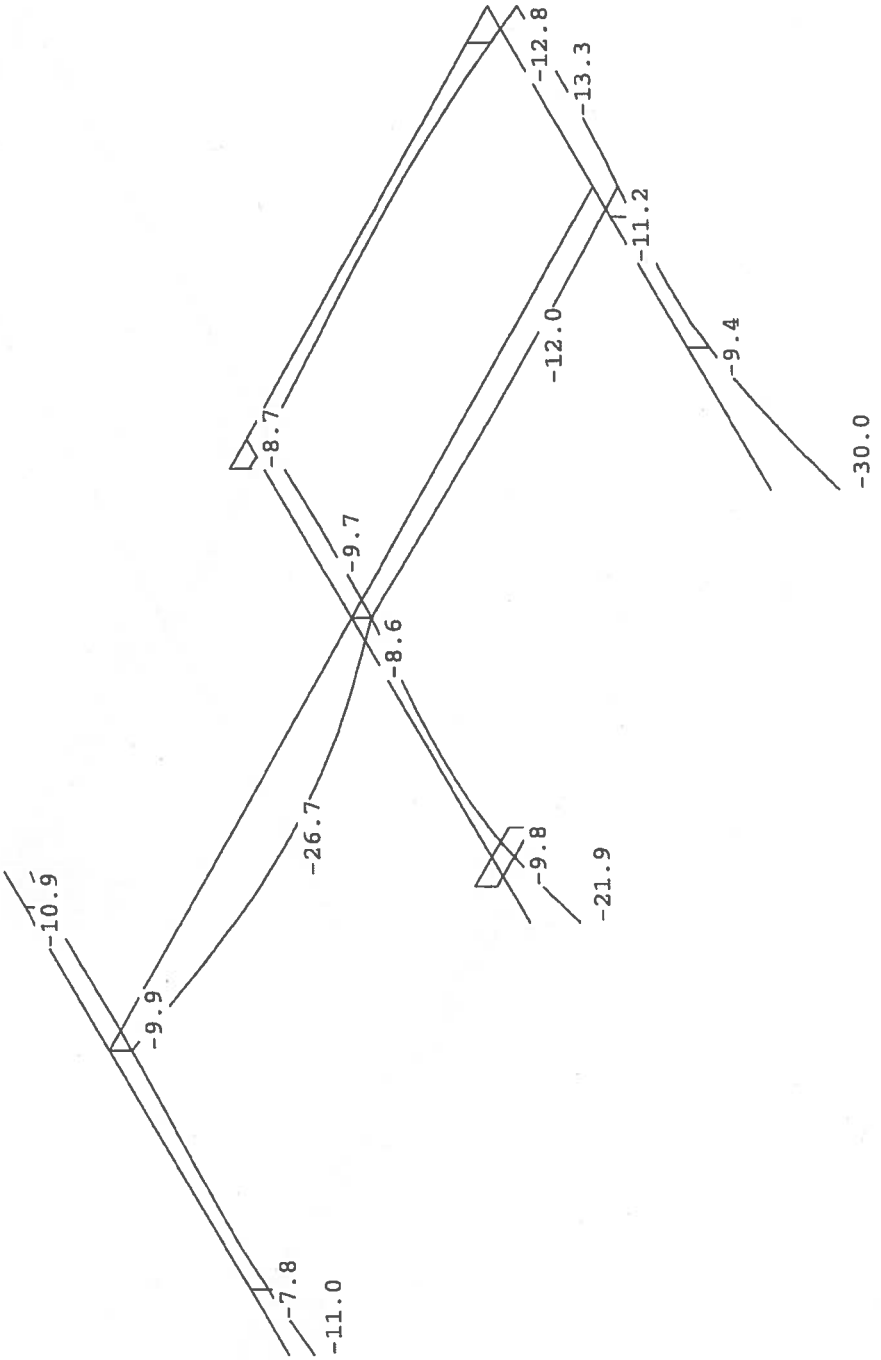
B.G:1 Design values



Project..: - Oyster project
Onderdeel: foundation

VERPLAATSINGEN [mm]

B.G:1 Design values



VELDBELASTINGEN

B.G:1 Design values

Balk	Last	Type	q1/p/m	q2	Afstand	Lengte	Exc.
2:2	1	8:Puntlast	-1380.100		0.000		0.000
2:2	2	8:Puntlast	-1348.500		5.100		0.000
2:2	3	8:Puntlast	-1538.800		8.100		0.000
3:3	1	8:Puntlast	-468.000		0.000		0.000
3:3	2	8:Puntlast	-1434.900		5.100		0.000

Project..: - Oyster project
Onderdeel: foundation

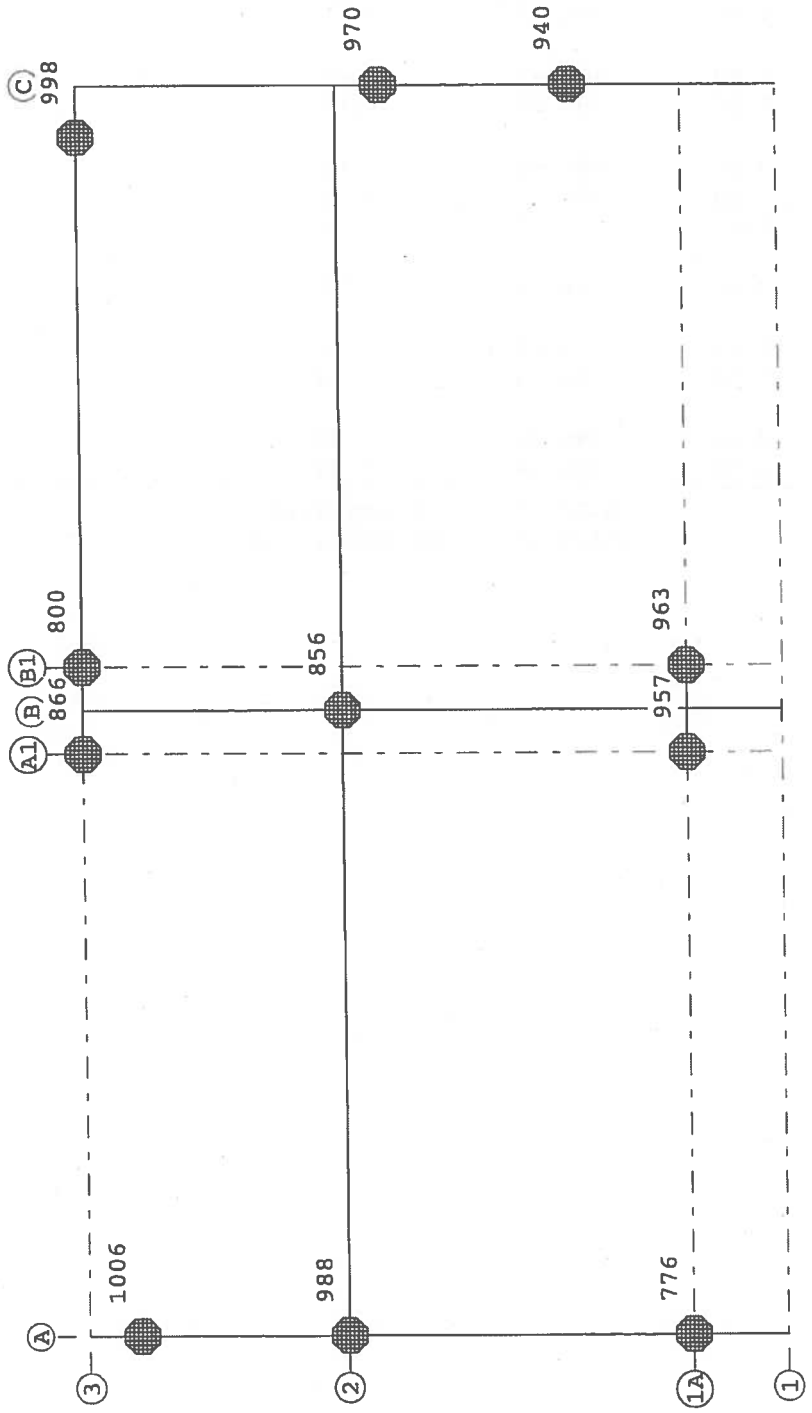
VELDBELASTINGEN

B.G:1 Design values

Balk	Last Type	q1/p/m	q2	Afstand	Lengte	Exc.
3:3	3 8:Puntlast	-688.900		8.100		0.000

REACTIES

B.G:1 Design values



Project..: - Oyster project
Onderdeel: foundation

REACTIES

B.G:1 Design values

Balk	Stp	MX	Z	MY
1	1	0.00	775.67	0.00
1	2	0.00	988.36	0.00
1	3	0.00	1006.29	0.00
2	4	0.00	856.29	0.00
3	5	0.00	940.47	0.00
3	6	0.00	969.67	0.00
4	10	0.00	865.98	0.00
4	11	0.00	800.15	0.00
4	7	0.00	997.80	0.00
5	4	0.00	856.29	0.00
6	8	0.00	956.63	0.00
6	9	0.00	963.03	0.00
7	2	0.00	988.36	0.00
7	4	0.00	856.29	0.00

10120.35 : Som reacties
-10120.35 : Som belastingen

Project : Oyster project
Onderdeel : Concrete beam
Datum : kN/m/rad
Eenheden : 18/03/2015

Toegepaste normen volgens Eurocode met Nederlandse NB

Belastingen	NEN-EN 1990:2002	C2:2010	NB:2011(nl)
	NEN-EN 1991-1-1:2002	C1:2009	NB:2011(nl)
Beton	NEN-EN 1992-1-1:2005	C2:2010	NB:2011(nl)

Bepaling hoofdwapening. (B)

GEOMETRIE

Elementtype : Balk
Betonkwaliteit : C35/45
Soort spanningsrekdiagram : Parabolisch - rechthoekig diagram
Doorsnedevorm : Rechthoek
Afmetingen : b=600 h=800
Scheurvorming volgens art : 7.3.3
Referentieperiode : 50 jaar

WAPENING

Staalkwaliteit : B500B
Soort spanningsrekdiagram : Bi-lineair diagram met horizontale tak
Beugeldiameter : 10
Toevallige inklemming : nee

	Boven	Onder
Gekozen diameter :	25	25
Breedte stortsleuf :	30	

Betondekking	Boven	Onder
Milieu :	XC1	XC2
Gestort tegen bestaand beton :	Nee	Nee
Element met plaatgeometrie :	Nee	Nee
Specifieke kwaliteitsbeheersing :	Nee	Nee
Oneffen beton oppervlak :	Nee	Nee
Ondergrond :	Glad / N.v.t.	Glad / N.v.t.
Constructieklasse :	S3	S4
Grootste korrel :	31.5	

Project : Oyster project
Onderdeel : Concrete beam
Datum : kN/m/rad
Eenheden : 18/03/2015

Betondekking		Boven			Onder		
Hoofdwapening	:		2de laag			2de laag	
Nominale dekking	:		30			30	
Toegepaste dekking	:		50			50	
Gelijkwaardige diameter	:		25			25	
$C_{min,b}$ $C_{min,dur}$ ΔC_{dur}	:	25	10	0	25	25	0
C_{min} ΔC_{dev} C_{nom}	:	25	5	30	25	5	30
Beugel / Verdeelwapening	:		1ste laag			1ste laag	
Nominale dekking	:		15			30	
Toegepaste dekking	:		40			40	
Gelijkwaardige diameter	:		10			10	
$C_{min,b}$ $C_{min,dur}$ ΔC_{dur}	:	10	10	0	10	25	0
C_{min} ΔC_{dev} C_{nom}	:	10	5	15	25	5	30

BELASTING **RESULTATEN**

Nr	NEd [kN]	MEd [kNm]	Nrep [kN]	Mrep [kNm]	Sterkte Ab-boven [mm2]	Sterkte Ab-onder [mm2]	Scheurvorming Ab-boven [mm2]	Scheurvorming Ab-onder [mm2]	Opm.
1	0.0	1527.0	0.0	0.0	5391	0	5391	0	

Project : Oyster project
Onderdeel : Concrete beam
Datum : kN/m/rad
Eenheden : 18/03/2015

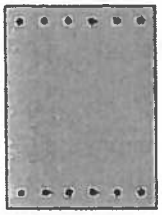
Toegepaste normen volgens Eurocode met Nederlandse NB

Belastingen	NEN-EN 1990:2002	C2:2010	NB:2011(nl)
	NEN-EN 1991-1-1:2002	C1:2009	NB:2011(nl)
Beton	NEN-EN 1992-1-1:2005	C2:2010	NB:2011(nl)

Ontwerp dwarskrachtwapening. (B)

GEOMETRIE

Elementtype : Balk
Betonkwaliteit : C35/45
Soort spanningsrekdiagram : Parabolisch - rechthoekig diagram
Doorsnedevorm : Rechthoek
Afmetingen : b=600 h=800
Referentieperiode : 50 jaar



WAPENING

Staalkwaliteit : B500B
Soort spanningsrekdiagram : Bi-lineair diagram met horizontale tak
Toevallige inklemming : nee

	Boven	Onder
Toegepaste wapening :	6x20	6x20
Breedte stortsleuf :	30	

Betondekking	Boven	Onder
Milieu :	XC1	XC2
Gestort tegen bestaand beton :	Nee	Nee
Element met plaatgeometrie :	Nee	Nee
Specifieke kwaliteitsbeheersing :	Nee	Nee
Oneffen beton oppervlak :	Nee	Nee
Ondergrond :	Glad / N.v.t.	Glad / N.v.t.
Constructieklasse :	S3	S4
Grootste korrel :	31.5	
Hoofdwapening :	2de laag	2de laag
Nominale dekking :	25	30
Toegepaste dekking :	50	50
Gelijkwaardige diameter :	20	20
$C_{min,b}$ $C_{min,dur}$ ΔC_{dur} :	20 10 0	20 25 0
C_{min} ΔC_{dev} C_{nom} :	20 5 25	25 5 30

Project : Oyster project
Onderdeel : Concrete beam
Datum : kN/m/rad
Eenheden : 18/03/2015

Betondekking		Boven			Onder		
Beugel / Verdeelwapening	:		1ste laag			1ste laag	
Nominale dekking	:		15			30	
Toegepaste dekking	:		40			40	
Gelijkwaardige diameter	:		10			10	
$C_{min,b}$ $C_{min,dur}$ ΔC_{dur}	:	10	10	0	10	25	0
C_{min} ΔC_{dev} C_{nom}	:	10	5	15	25	5	30

Minimale beugelafstand : 50 Theta [graden] : 45.0
Uitg.p. inw.hefboomsarm z : MRd

BELASTING

Trek aan de : onderzijde
Nd [kN] : 0.0

Dwarskrachten [kN] bij verschillende beugels en hoh-afstanden

Diameter [mm]	Bgls. /drsn	z [mm]	H.o.h.-afstanden beugels [mm] 300	150	100	75	50
10.0	2	709.6	199.08	323.07	484.61	646.14	969.22
12.0	2	707.5	231.93	463.86	695.80	927.73	1391.59

Opmerkingen

[132] De h.o.h.-afstand 300.0 mm van de beugels is groter dan 240.5 mm (art. 9.2.2(5))

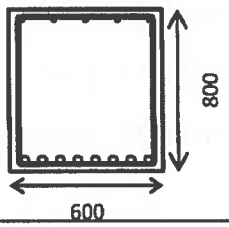
Controle van een betondoorsnede belast op zuivere buiging volgens Eurocode 2

Project:	Oyster	Datum:	26-3-2015
Projectnummer:	BD4376-101-100	Naam:	GJR
Omschrijving:	balk	Versie:	1.0

Royal HaskoningDHV
Enhancing Society Together

Geometrie

Vorm:
- ○ Plaat
- ◉ Balk (rechthoekig)
- ○ Balk (T-vorm)



Breedte:	b =	600	mm
Hoogte:	h =	800	mm

Materiaaleigenschappen

Betonsterkteklasse:		C35/45
Staalkwaliteit:		B500B
Druksterkte beton:	f_{ck} =	35 N/mm²
Treksterkte staal:	f_{yk} =	500 N/mm²
Ontwerplevensduur:		50 jaar
Ontwerpsituatie:		Blijvend
Belastingsduur:		Lange duur
Aanvullende richtlijn:		Geen

Beugelwapening

Beugeldiameter:	$\varnothing_v$ =	12 mm		Dekking op beugel:	c_{appl} = 30 mm
H.o.h afstand:	s =	100 mm	n = 4	Dekking op zijkant beugel:	c_{appl} = 30 mm

Trekwapening

Laag	aantal	diameter	tussenafstand		
1	8	32 mm	37 mm	Dekking op trekwap.:	$c_{1;appl}$ = 42 mm
2	0	0 mm	mm	h.o.h. 1e en 2e laag:	55 mm ≥ 53 mm
				Nuttige hoogte:	d = 742 mm

Drukwapening

Laag	aantal	diameter	tussenafstand		
1	5	16 mm	109 mm	Dekking op drukwap.:	$c_{2,appl}$ = 42 mm
				Nuttige hoogte drukwap.:	d_2 = 50 mm

UGT Bepaling bezwijkmoment

Percentage herverdeling:		0 %	≤ 30 %	x_u =	225 mm	≤ x_{umax} =	397 mm
Moment UGT:	M_{Ed} =	-1527 kNm					
Hefboomsarm:	z =	655 mm		M_{Rd} =	1847,5 kNm	UC =	-0,83

Dwarskracht

Beugelwapening:	Ø 12 - 100 mm	4-snedig		Oppervlak trekwapening:	A_{sl} = 6434 mm²
Dwarskracht UGT:	V_{Ed} =	1380 kN		$\rho_1 = A_{sl}/b_w d \le 2\%$	ρ_l = 1,45 %
Hoek met as ligger:	α =	90 °		$\nu = 0{,}6*(1-f_{ck}/250)$	ν = 0,52
Hoek drukdiagonaal:	θ =	40 °		$k = 1+(200/d)^{0,5} \le 2{,}0$	k = 1,52
Beugelafstand:	s = 100 mm	≤ $s_{l,max}$ =	300 mm		
Capaciteit zonder dwarskrachtwapening:		: $V_{Rd,c}$ =	300 kN	Verschuiving momentenlijn	a_l = 390 mm
Capaciteit bij bereiken vloeigrens:		$V_{Rd,s}$ =	1534 kN		
Capaciteit bij bezwijken drukdiagonaal:		$V_{Rd,max}$ =	2328 kN	V_{Rd} = 1534 kN	UC = 0,90

BGT Scheurbeheersing

					hoofdwap.	beugelwap.
Profilering staal:	Geprofileerd					
Milieuklasse:	XC2			c_{nom} =	37 mm	25 mm
w_{max} = 0,30 mm * 1,14	=	0,34 mm		$c_{toegepast}$ =	42 mm	30 mm
Moment BGT:	$M_{E,fq}$ =	64 kNm		k_x =	1,14	1,20
Spanning tgv opg. vervorm.:	$\Delta\sigma_s$ =	0 N/mm²				
Staalspanning:	σ_s =	15 N/mm²		(σ_s =	340 N/mm² bij $M_{R,fq}$)	
Betondrukzonehoogte:	x_{fq} =	296 mm				
Staafafstand:	s =	69 mm	≤	5*(c+Ø/2) =	290 mm	
Maximale scheurafstand:	$s_{r,max}$ =	216 mm		(formule 7.11)		
Verschil rek:	$\varepsilon_{sm} - \varepsilon_{cm}$ =	0,05 ‰				
Scheurwijdte (Lange duur) :	w_k =	0,01 mm	≤	w_{max} =	0,34 mm	voldoet
	Maximale moment bij $w_k = w_{max}$:			$M_{R,fq}$ =	1415 kNm	UC = 0,05

Controle wapeningspercentages

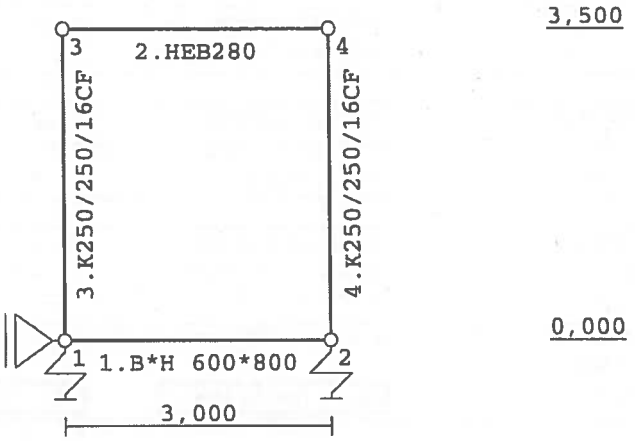
Trekwap. (art. 7.3.2):	590 mm² (0,13%)	≤	6434 mm² (1,45%)			
Trekwap. (art. 9.2.1.1):	646 mm² (0,15%)	≤	6434 mm² (1,45%)	≤	19200 mm²	(4,0%)
Drukwap (art. 9.2.1.1):			1005 mm² (0,21%)	≤	19200 mm²	(4,0%)
Beugelwap. (art. 9.2.2):	568 mm²/m (0,09%)	≤	4524 mm²/m (7,54%)			

Project...: Hyundai
Part.....: Portaal begane grond
Dimensions: kN;m;rad (unless otherwise stated)
Date.....: 09/02/2015
File.....: C:\Users\150033\Documents\Hyundai Delft\Portaal nieuw.rww

Theory for structural analysis: Geometrical linear.

Selfweight favorable/unfavorable according to NEN6702 5.2.1.

GEOMETRY



GRID LINES

No.	X	Z-min	Z-max
1	0.000	0.000	3.500
2	3.000	0.000	3.500

LEVELS

No.	Z	X-min	X-max
1	0.000	0.000	3.000
2	3.500	0.000	3.000

MATERIALS

Mt	Description	E-modulus[N/mm2]	S.M.	Pois.	Exp. coeff.
1	C25/30	8352	24.0	0.20	1.0000e-005
2	S235	210000	78.5	0.30	1.2000e-005

MATERIALS contd.

Mt	Description	Creep coeff.	Aggregate	Rho[kg/m3]
1	C25/30	2.77	Normal	2400

SECTIONS [mm]

Sect.	Description	Material	Area	Inertia	Formf.
1	B*H 600*800	1:C25/30	4.8000e+005	2.5600e+010	0.00
2	HEB280	2:S235	1.3140e+004	1.9270e+008	0.00
3	K250/250/16CF	2:S235	1.3877e+004	1.2047e+008	0.00

Project...: Hyundai
Part.....: Portaal begane grond

SECTIONS contd. [mm]

Sect.	Bar type	Width	Height	e	Type	w1	h1	w2	h2
1	0:Normal	600	800	400.0	0:RH				
2	0:Normal	280	280	140.0					
3	0:Normal	250	250	125.0					

NODES

Node	X	Z
1	0.000	0.000
2	3.000	0.000
3	0.000	3.500
4	3.000	3.500

BARS

Bar	Ni	Nj	Section	Joint.i	Joint.j	Length	Rem.
1	1	2	1:B*H 600*800	ASM	ASM	3.000	
2	3	4	2:HEB280	ASM	ASM	3.000	
3	1	3	3:K250/250/16CF	ASM	ASM	3.500	
4	2	4	3:K250/250/16CF	ASM	ASM	3.500	

FIXED SUPPORTS

No.	node	Code XZR 1=fixed 0=free	Angle
1	1	100	0.00

SPRINGS

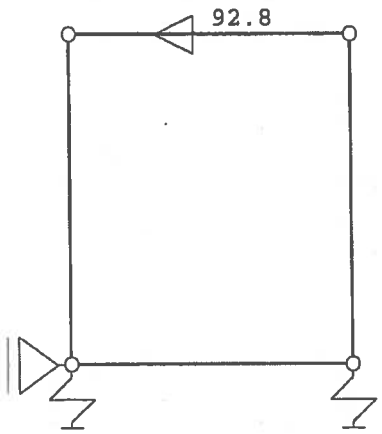
Spring	Node	Direction	Angle	Spring const.	Type	Top limit	Bot. limit
1	1	2:Z-transl.	0.00	1.000e+005	Normal	0.000	0.000
2	2	2:Z-transl.	0.00	1.000e+005	Normal	0.000	0.000

LOAD CASES

LCa	Description	Type
1	SWZ=0.00	1 Permanent load

Project...: Hyundai
Part.....: Portaal begane grond

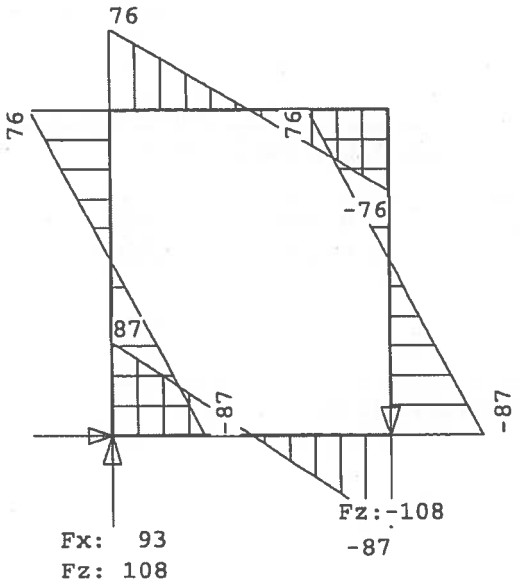
LOADINGS LCa:1



NODE LOADS LCa:1

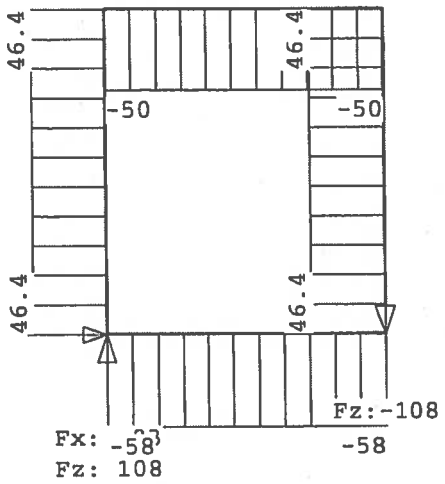
Load	Node	Direction	value
1	4	X	-92.800

MOMENTS LCa:1

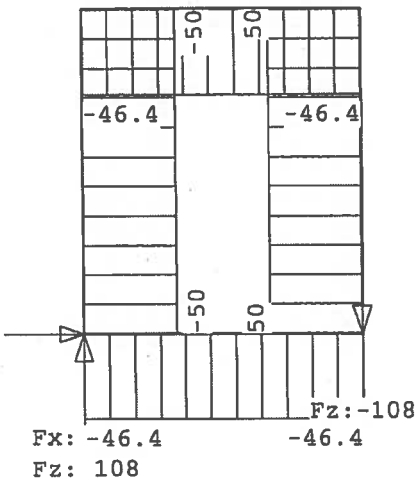


Project...: Hyundai
Part.....: Portaal begane grond

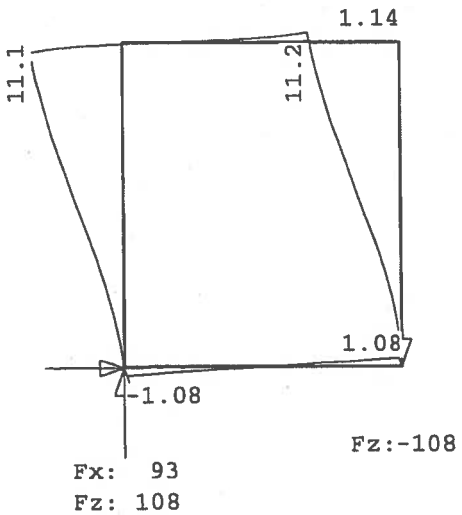
SHEAR FORCES LCa:1



AXIAL FORCES LCa:1



TRANSLATIONS [mm] LCa:1



Project...: Hyundai
Part.....: Portaal begane grond

BAR FORCES

LCa:1

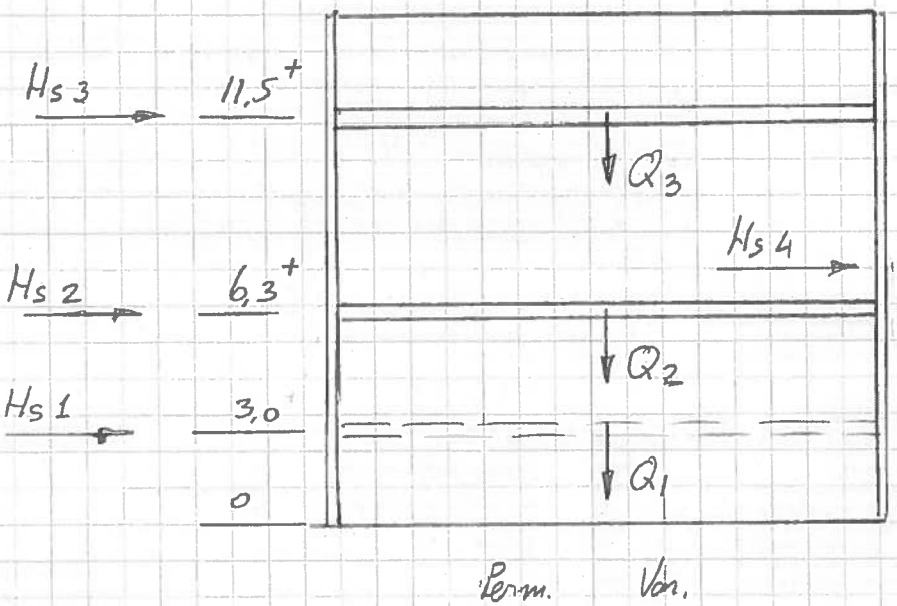
Bar	Nd.	Pos.	AXi/AXj	SZi/SZj	MYi/MYj
1	1		-46.43	-57.85	86.72
1		1.499			0.00
1	2		-46.43	-57.85	-86.84
2	3		-46.37	-50.41	75.58
2		1.499			0.00
2	4		-46.37	-50.41	-75.67
3	1		-50.41	46.37	-86.72
3		1.870			0.00
3	3		-50.41	46.37	75.58
4	2		50.41	46.43	-86.84
4		1.870			0.00
4	4		50.41	46.43	75.67

REACTIONS

LCa:1

Nd.	X	Z	M
1	92.80	108.27	
2		-108.27	
	92.80	0.00	: Sum of the reactions
	-92.80	0.00	: Sum of the loads

Seismic horizontal load:



$Q_1 = 14,5 \cdot 3,4 \cdot (7,5 + 0,5 \cdot 7,0) = 370,0 + 173,0 = 542,3\ kN$

$Q_2 = 14,5 \cdot 8,5 \cdot (7,5 + 0,5 \cdot 7,0) = 924,0 + 431,0 = 1355,0\ kN.$

$Q_3 = 14,5 \cdot 8,5 \cdot (7,5 + 0,5 \cdot 7,0) = 924,0 + 431,0 = 1355,0\ kN$

$Hs_1 = 542,3 \cdot 0,1137 = 61,6\ kN.$

$Hs_2 = 1355,0 \cdot 0,1137 = 154,0\ kN$

$Hs_3 = 1355,0 \cdot 0,1137 = 154,0\ kN$

Project:	Oyster project
Workorder:	BD4376-101-100
Part:	Seismic load for 100KN
Date:	19-3-2015

Design of concrete structures according EN 1998-1:2004
Seismic Action

Made by ir. B.G. van de Vrugt, Updated 13 07 2009
Revised & completed for bid by M.C. Wiersma, 07 02 2013

Ground type C

Table 1: Ground types

Ground type	Parameters			Description of stratigraphic profile
	$v_{s,30}$ (m/s) *1)	N_{SPT} (blows/30cm)	c_u (kPa)	
A	>800	-	-	Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface
B	360 - 800	> 50	>250	Deposits of very dense sand, gravel, or very stiff clay, at least several tens of metres in thickness, characterised by a gradual increase of mechanical properties with depth
C	180 - 360	15 - 50	70 - 250	Deposits of dense or medium-dense sand, gravel or stiff clay with thickness from several tens to many hundreds of metres
D	<180	<15	< 70	Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers) or of predominantly soft-to-firm cohesive soil
E				A soil profile consisting of a surface alluvium layer with v_s values of type C or D and thickness varying between about 5m and 20m, underlain by stiffer material with v_s > 800 m/s
S1	<100 (indicative)	-	10 - 20	Deposits consisting, or containing a layer at least 10 m thick, of soft clays/silts with a high plasticity index (PI>40) and high water content.
S2				Deposits of liquefiable soils, of sensitive clays, or any other soil profile not included in types A - E or S1

*1) The site should be classified according to the value of the average shear wave velocity $v_{s,30}$, if this is available. Otherwise the value of N_{SPT} should be used.
*2) The average wave velocity $v_{s,30}$ should be computed in accordance with the following expression $v_{s,30} = \frac{30}{\sum_{i=1,N} h_i / v_i}$
- where h_i and v_i denote the tickness (in metres) and shear-wave velocity (at shear strain level of 10^{-6} or less) of the i-th formation or layer, in total of N, existing in the top 30m
*3) For sites with ground conditions matching either one of the two special ground types S1 or S2, special studies for the definition of the seismic action are required. For these types particulary for S2, the possibility of soil failure under the seismic action shall be taken into account.

Spectra Type 2

Type 1 : *Surface wave magnitude most posible earthquakes (Ms) > 5,5*
Type 2 : *Surface wave magnitude most posible earthquakes (Ms) ≤ 5,5*

Table 2: Values of the parameters of the selected elastic response spectra (Ground Type = C, Spectra type = 2)

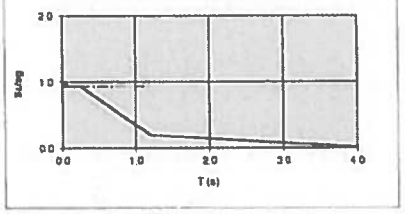
S	1,5	soil factor
T_B (s)	0,1	lower limit of the period of the constant spectral acceleration branch
T_C (s)	0,25	upper limit of the period of the constant spectral acceleration branch
T_D (s)	1,2	value defining the beginning of the constant displacement response range of the spectrum
η	1,70	Damping correction factor with a reference value of η=1 for 5% viscous damping (ξ = 5%, $\eta \geq 0.55$) — ξ = 1

Reference peak ground acceleration (see EN1998 1 2004 art 3.2.1)
Ground acceleration (a_{gR}) 1 m/s² (see EN1998 1 2004 and/or National Annex)
Design ground acceleration (a_g) 1,4 m/s² ($a_g = \gamma_I * a_{gR}$)

Type of structure
Buiding importance category 1,7 Vital importance e.g. hospitals, fire stations, power plants (EN 1998-1:2004 art 5.2.2.2)
Structural Type b2 ST:Eccentric bracings
Base material Steel ~~Factor prevailing failure mode, kw~~ 1,00 (EN1998 1 2004 art. 2.1 and National Annex)
Building importance factor (γ_I) 1,4 (EN1998 1 2004 art. 2.1 and National Annex)
Number of stories in building 3,0 Height of the structure considered (m) 11,5 (EN1998-1:2004 art. 4.3.3.2.2)
Structural factor Ct 0,075 (EN1998-1:2004 art. 4.3.3.2.2)
Basic value behaviour factor DCM q_{DCM} 4,00 Ratio α_u/α_1 1,1 (EN 1998-1:2004, art 5.2.2.2)
Upper limit behaviour factor DCH q_{DCH} 5,50 DCH 5 * α_u/α_1 5,5
Behaviour factor in calculations q_{cal} 4,00

Calculated variables
Fundamental period of vibration T_1 0,25 sec
Correction factor λ 0,85
Ordinate Elastic Response Factor, Sd/a_g (T_1=Tc) 0,938
Seismic design factor ($Fb=Sd(T_1)*a_g*\lambda$) 1,116 m/s2
Seismic design factor ($Fb=Sd(T_1)*a_g*\lambda/g$) 0,114 Fb/g to mulitply loads in kN

Figure 1: Horizontal Elastic Response Spectrum



Loads
Dead load (DL) 100 kN
Variable load (Q) 0 kN
ψ_{2i} *(combination coefficient Q)* 1 - *(Takes into account the likelihood of the loads Q not being present over the entire structure during the earthquake, see EN1990:2002 and EN1998)*

ΣM_{EG} = $DL + \psi_{2i} * Q$ = 100 kN *(Total mass presence which will be taken into account for seismic action)*

Seismic horizontal load 11,37 kN To be applied to the structure

Seismic vertical design force (Fv,EQ)

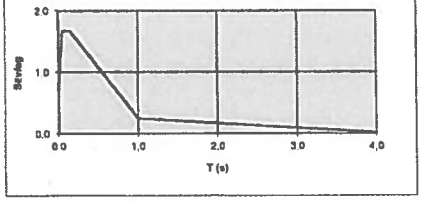
Table 3: Values of the parameters of the selected vertical elastic response spectra (Level Type = 2)

a_{vg}/a_g	0,45	Ratio of the vertical ground acceleration to the horizontal ground acceleration
T_B (s)	0,05	lower limit of the period of the constant spectral acceleration branch
T_C (s)	0,15	upper limit of the period of the constant spectral acceleration branch
T_D (s)	1,00	value defining the beginning of the constant displacement response range of the spectrum
η	1,70	Damping correction factor with a reference value of η=1 for 5% viscous damping (ξ = 5%, $\eta \geq 0.55$)

Seismic vertical design force (Fv,EQ)
Fundamental period of vibration T_1 0,25 sec
Behaviour factor in calculations q_{cal} 1,5
Ordinate Elastic Response Factor, Sd/a_g (T_1=Tc) 1,000
Seismic design factor ($Fb=Sd(T_1)*a_g*\lambda$) 0,536 m/s2
Seismic design factor ($Fb=Sd(T_1)*\lambda$) 0,055 Fb/g to multiply loads in kN

Seismic vertical load 5,46 kN To be applied to the structure

Figure 2: Vertical Elastic Response Spectrum



W1. (2x) see page 36 38

$F_{1d} = \frac{154,0}{2} = 77,0$ kN.

$F_{2d} = \frac{154,0}{2} = 77,0$ kN.

$F_{3d} = (77,0 + 77,0) \cdot \sqrt{2} = 217,8$ kN

$A_{s\,net} = \frac{217,8 \cdot 10^3}{235} = 926$ mm^2 - # 12 x 100 mm acc.

$F_{4d} = \frac{5,8}{3,0} \cdot 77,0 = 148,8$ kN.

$A_{s\,net} = 633$ mm^2 # 12 x 100 mm acc.

PORTAL P1 : (3x)

$F_{1d} = \frac{61,6 + 2 \cdot 54,6}{3} = 123,2$ kN - see page 64 etc

Ligger : HE 280 B.

$M_{d\,max} = 1/8 \cdot 183,2 \cdot 3,0^2 + \frac{100,0}{2} = 256,1$ kNm

$\sigma_{sd} = \frac{256,1 \cdot 10^6}{1380 \cdot 10^3} = 185,5$ N/mm^2 < 235 acc.

Column : K. 250.250.16

$N_{d\,max} = 1538,8$ kN
$M_d = 100,0$ kNm.

} see page 62.

Project : Column in portal P1
Onderdeel : Column
Datum : kN/m/rad
Eenheden : 23/03/2015

Toegepaste normen volgens Eurocode met Nederlandse NB

Belastingen	NEN-EN 1990:2002	C2:2010	NB:2011(nl)
	NEN-EN 1991-1-1:2002	C1:2009	NB:2011(nl)
Staal	NEN-EN 1993-1-1:2006	C2:2009	NB:2011(nl)

Knikstabiliteit. (S)

Profielnaam : K250/250/16CF
Doorsnedeklasse : 1
Gewalst/gelast (1/2) : 1
Vloeispanning [N/mm2] : 235
Omega-kip : 0.530

-- Geschoord in het vlak --		-- Geschoord uit het vlak --	
L-systeem [m] :	3.00		
Kniklengte gesch. [m] :	3.00	Kniklengte gesch. [m] :	3.00
Moment begin [kNm] :	-100.00	Moment midden [kNm] :	-0.00
Moment eind [kNm] :	100.00	Normaalkracht [kN] :	-1538.00
Aanpend.belasting [kN] :	-1538.00	Belastingfactor :	1.00

Resultaten

Toegepast artikel :	6.3.3	Omega-buc/e* :	0.927
Unity-check y-as :	0.663	Unity-check z-as :	0.509

W_2 (see page 37)

$F_{1d} = 154,0$ kN.

$F_{2d} = \frac{8,8}{7,2} \cdot 154,0 = 188,2$ kN.

$A_{s\,net} = 800$ mm^2. — $\neq 12 * 100$ mm.

W_3

$F_{1d} = 2.154,0 = 308,0$ kN

$F_{2d} = \frac{7,8}{7,2} \cdot 308,0 = 333,7$ kN

$A_{s\,net} = \frac{333,7 \cdot 10^3}{235} = 1420$ mm^2 $2* \neq 12 * 100$ mm

W_4

$F_{1d} = 61,6 + 2.154,0 = 369,6$ kN

$F_{2d} = \frac{7,8}{7,2} \cdot 369,6 = 400,4$ kN.

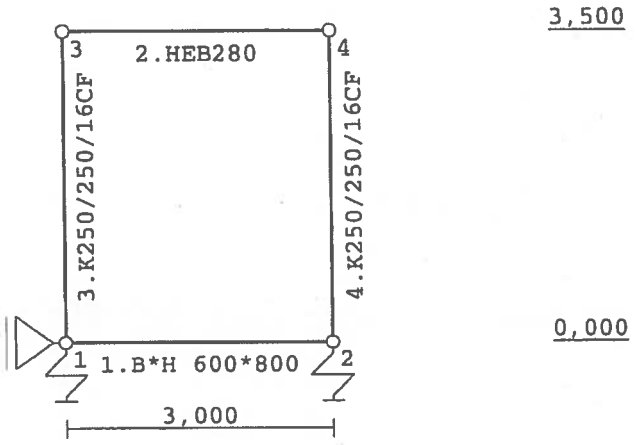
$A_{s\,nett} = 1704$ mm^2 $2* \neq 12 * 100$ mm.

Project...: Hyundai
Part.....: Portaal begane grond
Dimensions: kN;m;rad (unless otherwise stated)
Date.....: 09/02/2015
File.....: C:\Users\150033\Documents\Hyundai Delft\Portaal nieuw aardbeving.rww

Theory for structural analysis: Geometrical linear.

Selfweight favorable/unfavorable according to NEN6702 5.2.1.

GEOMETRY



GRID LINES

No.	X	Z-min	Z-max
1	0.000	0.000	3.500
2	3.000	0.000	3.500

LEVELS

No.	Z	X-min	X-max
1	0.000	0.000	3.000
2	3.500	0.000	3.000

MATERIALS

Mt	Description	E-modulus[N/mm2]	S.M.	Pois.	Exp. coeff.
1	C25/30	8352	24.0	0.20	1.0000e-005
2	S235	210000	78.5	0.30	1.2000e-005

MATERIALS contd.

Mt	Description	Creep coeff.	Aggregate	Rho[kg/m3]
1	C25/30	2.77	Normal	2400

SECTIONS [mm]

Sect.	Description	Material	Area	Inertia	Formf.
1	B*H 600*800	1:C25/30	4.8000e+005	2.5600e+010	0.00
2	HEB280	2:S235	1.3140e+004	1.9270e+008	0.00
3	K250/250/16CF	2:S235	1.3877e+004	1.2047e+008	0.00

Project...: Hyundai
Part.....: Portaal begane grond

SECTIONS contd. [mm]

Sect.	Bar type	Width	Height	e	Type	w1	h1	w2	h2
1	0:Normal	600	800	400.0	0:RH				
2	0:Normal	280	280	140.0					
3	0:Normal	250	250	125.0					

NODES

Node	X	Z
1	0.000	0.000
2	3.000	0.000
3	0.000	3.500
4	3.000	3.500

BARS

Bar	Ni	Nj	Section	Joint.i	Joint.j	Length	Rem.
1	1	2	1:B*H 600*800	ASM	ASM	3.000	
2	3	4	2:HEB280	ASM	ASM	3.000	
3	1	3	3:K250/250/16CF	ASM	ASM	3.500	
4	2	4	3:K250/250/16CF	ASM	ASM	3.500	

FIXED SUPPORTS

No.	node	Code XZR 1=fixed 0=free	Angle
1	1	100	0.00

SPRINGS

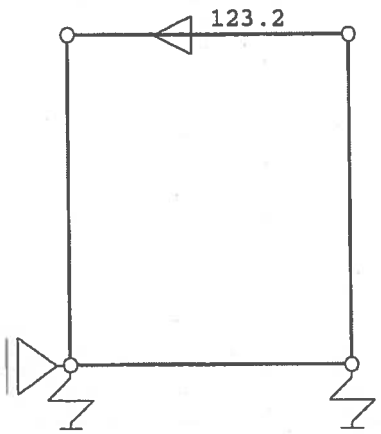
Spring	Node	Direction	Angle	Spring const.	Type	Top limit	Bot. limit
1	1	2:Z-transl.	0.00	1.000e+005	Normal	0.000	0.000
2	2	2:Z-transl.	0.00	1.000e+005	Normal	0.000	0.000

LOAD CASES

LCa	Description	Type
1	SWZ=0.00	1 Permanent load

Project...: Hyundai
Part.....: Portaal begane grond

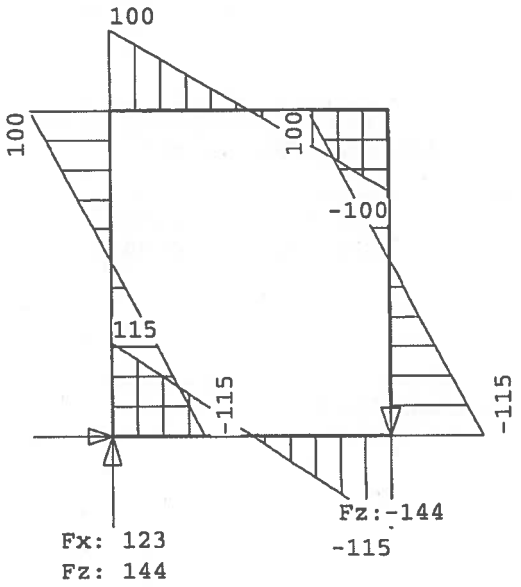
LOADINGS LCa:1



NODE LOADS LCa:1

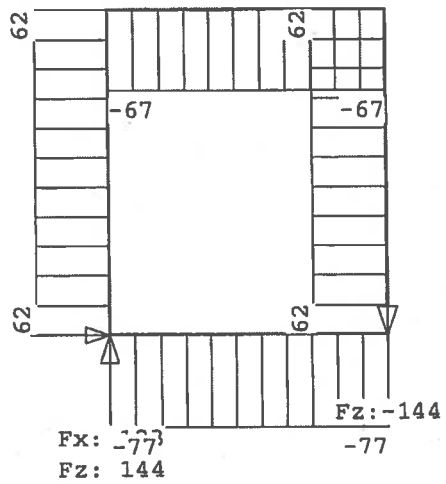
Load	Node	Direction	value
1	4	X	-123.200

MOMENTS LCa:1

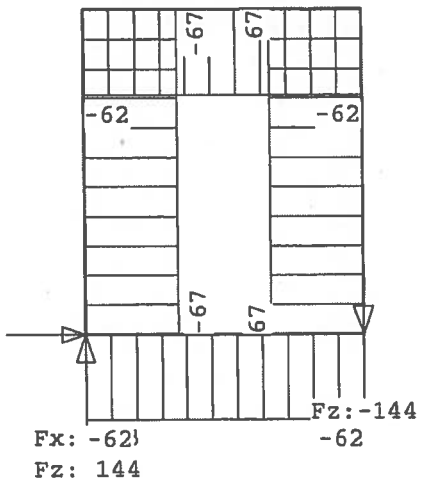


Project...: Hyundai
Part.....: Portaal begane grond

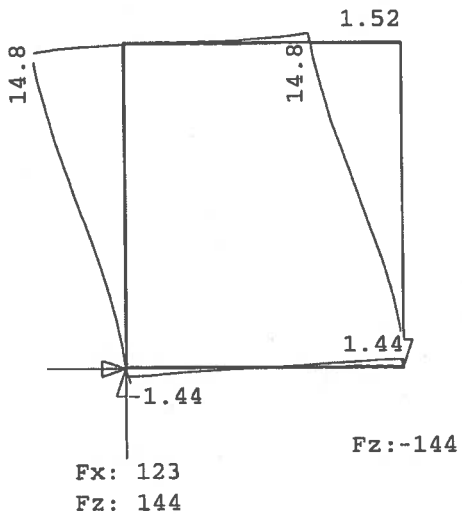
SHEAR FORCES LCa:1



AXIAL FORCES LCa:1



TRANSLATIONS [mm] LCa:1



Project...: Hyundai
Part.....: Portaal begane grond

BAR FORCES

LCa:1

Bar	Nd.	Pos.	AXi/AXj	SZi/SZj	MYi/MYj
1	1		-61.64	-76.80	115.13
1		1.499			0.00
1	2		-61.64	-76.80	-115.29
2	3		-61.56	-66.93	100.34
2		1.499			0.00
2	4		-61.56	-66.93	-100.45
3	1		-66.93	61.56	-115.13
3		1.870			0.00
3	3		-66.93	61.56	100.34
4	2		66.93	61.64	-115.29
4		1.870			0.00
4	4		66.93	61.64	100.45

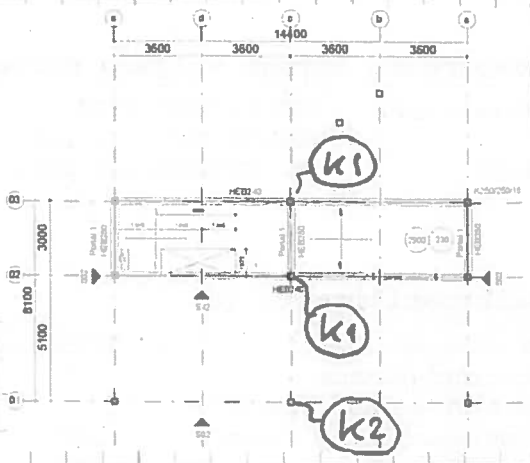
REACTIONS

LCa:1

Nd.	X	Z	M
1	123.20	143.73	
2		-143.73	
	123.20	0.00	: Sum of the reactions
	-123.20	0.00	: Sum of the loads

Columns:

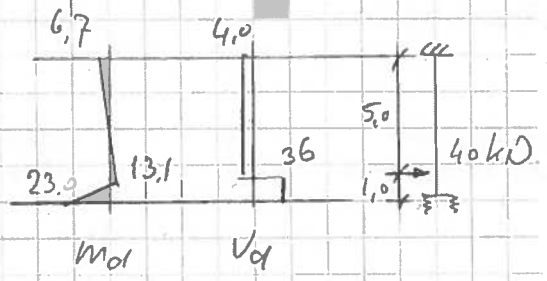
(K1) Ground floor part of a Portal - see page 62

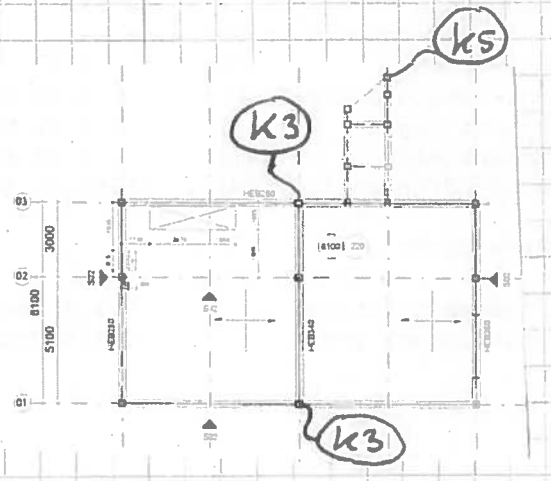


(K2) $l_1 = 6,0$ m.

$N_{d\,max} = 1360,1$ kN see p. 40

Collision load 40 kN

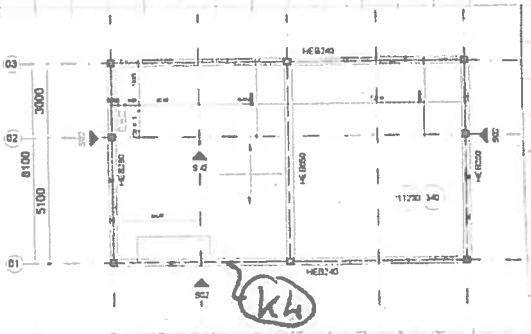




K 250.250.10 - see p. 70

fire: C 35/45

$$N_\Theta = \left(\frac{5,1}{2} + \frac{8,1}{2}\right) \cdot 7,2 \cdot (5,5 + 2,0 + 0,5 \cdot 7,0) + \underbrace{7,2 \cdot 8,5 \cdot 1,2}_{\text{gevel}} = 596,1 \text{ kN}$$



$l_{buc} = 0,5 \cdot 6,0 = 3,0$ m

$$\lambda_z = \frac{3000 \cdot \sqrt{12}}{230} = 45 \Rightarrow k = 0,878 \quad \eta = 0,509$$

$$N_{u\Theta} = 0,509 \cdot 0,83 \cdot 0,878 \cdot \frac{45^2}{1,3} \cdot 230 \cdot 10^{-3} = 679,0 \text{ kN} > 596 \text{ kN}$$ acc.

Project : Oyster project
Onderdeel : K2
Datum : kN/m/rad
Eenheden : 25/03/2015

Toegepaste normen volgens Eurocode met Nederlandse NB

Belastingen	NEN-EN 1990:2002	C2:2010	NB:2011(nl)
	NEN-EN 1991-1-1:2002	C1:2009	NB:2011(nl)
Staal	NEN-EN 1993-1-1:2006	C2:2009	NB:2011(nl)

Knikstabiliteit. (S)

Profielnaam : K250/250/10CF
Doorsnedeklasse : 1
Gewalst/gelast (1/2) : 1
Vloeispanning [N/mm2] : 235
Omega-kip : 0.530

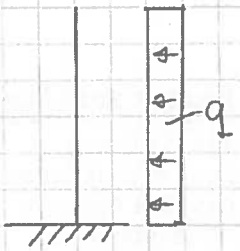
	-- Geschoord in het vlak --		-- Geschoord uit het vlak --
L-systeem [m] :	6.00		
Kniklengte gesch. [m] :	6.00	Kniklengte gesch. [m] :	6.00
Moment begin [kNm] :	0.00	Moment midden [kNm] :	-13.10
Moment eind [kNm] :	0.00	Normaalkracht [kN] :	-1360.00
Aanpend.belasting [kN] :	-1360.00	Belastingfactor :	1.00

Resultaten

Toegepast artikel :	6.3.3	Omega-buc/e* :	0.750
Unity-check y-as :	0.918	Unity-check z-as :	0.834

K3 – $l_k = 5{,}0$ m.
$N_{d\,max} = 813{,}0$ kN. } K 250.250.10 – see p. 72

K4 $h = 3{,}0$ m c.t.c. 2,4 m $\ell/h < 3$



$c_t = 2{,}1$

$q_p = 0{,}8$ kN/m²

$q_d = \underbrace{1{,}3}_{\gamma} \cdot \underbrace{0{,}8}_{q_p} \cdot \underbrace{2{,}1}_{c_t} \cdot \underbrace{2{,}4}_{ctc} = 5{,}24$ kN/m'

$M_d = 1/2 \cdot 5{,}24 \cdot 3{,}0^2 = 23{,}6$ kNm

$W_{ben} = 100 \cdot 10^3$ mm³ – HE 160 A. ($W = 220 \cdot w^3$)

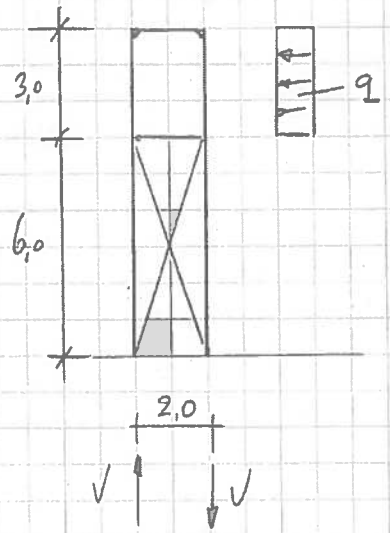
$$u_{top} = \frac{q_{rep} \cdot h \cdot h^3}{8EI} = \frac{4{,}0 \cdot 3{,}0^4}{8 \cdot 2{,}1 \cdot 10^8 \cdot 1673 \cdot 10^{-8}} \cdot 10^3$$

$= 11{,}5$ mm $\approx 1/300\,h$

K5

$q_p = 0{,}8$ kN/m'

$q_d = \underbrace{1{,}3}_{\gamma} \cdot \underbrace{0{,}8}_{q_p} \cdot \underbrace{1{,}1}_{c} \cdot \frac{5{,}4}{2} = 3{,}1$ kN/m'



$M_{d\,max} = 5{,}2$ kNm.

$W_{ben} = \frac{5{,}2 \cdot 10^6}{235} = 22 \cdot 10^3$ mm³

– K. 200 200. 5

OR – HE 160 A

Project : Oyster project
Onderdeel : K3
Datum : kN/m/rad
Eenheden : 25/03/2015

Toegepaste normen volgens Eurocode met Nederlandse NB

Belastingen	NEN-EN 1990:2002	C2:2010	NB:2011(nl)
	NEN-EN 1991-1-1:2002	C1:2009	NB:2011(nl)
Staal	NEN-EN 1993-1-1:2006	C2:2009	NB:2011(nl)

Knikstabiliteit. (S)

Profielnaam : K250/250/10CF
Doorsnedeklasse : 1
Gewalst/gelast (1/2) : 1
Vloeispanning [N/mm2] : 235
Omega-kip : 0.530

	-- Geschoord in het vlak --		-- Geschoord uit het vlak --	
L-systeem [m] :	5.00			
Kniklengte gesch. [m] :	5.00	Kniklengte gesch. [m] :		5.00
Moment begin [kNm] :	0.00	Moment midden [kNm] :		-0.00
Moment eind [kNm] :	0.00	Normaalkracht [kN] :		-813.00
Aanpend.belasting [kN] :	-813.00	Belastingfactor :		1.00

Resultaten

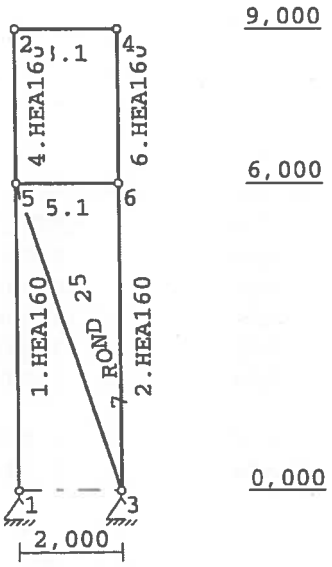
Toegepast artikel :	6.3.1.1	Omega-buc/e* :	0.815
Unity-check y-as :	0.458	Unity-check z-as :	0.458

Project...: Oyster project
Part.....:
Dimensions: kN;m;rad (unless otherwise stated)
Date.....: 25/03/2015
File.....: C:\Users\150033\Documents\Hyundai Delft\portaal nabij reactor.rww

Theory for structural analysis: Geometrical linear.

Selfweight favorable/unfavorable according to NEN6702 5.2.1.

GEOMETRY



GRID LINES

No.	X	Z-min	Z-max
1	0.000	0.000	9.000
2	2.000	0.000	9.000

LEVELS

No.	Z	X-min	X-max
1	0.000	0.000	2.000
2	6.000	0.000	2.000
3	9.000	0.000	2.000

MATERIALS

Mt	Description	E-modulus[N/mm2]	S.M.	Pois.	Exp. coeff.
1	S235	210000	78.5	0.30	1.2000e-005

SECTIONS [mm]

Sect.	Description	Material	Area	Inertia	Formf.
1	HEA160	1:S235	3.8800e+003	1.6730e+007	0.00
2	ROND 25	1:S235	4.9087e+002	1.9175e+004	0.00

Project...: Oyster project
Part.....:

SECTIONS contd. [mm]

Sect.	Bar type	Width	Height	e	Type	w1	h1	w2	h2
1	0:Normal	160	152	76.0					
2	0:Normal	25	25	12.5					

NODES

Node	X	Z	Node	X	Z
1	0.000	0.000	6	2.000	6.000
2	0.000	9.000			
3	2.000	0.000			
4	2.000	9.000			
5	0.000	6.000			

BARS

Bar	Ni	Nj	Section	Joint.i	Joint.j	Length Rem.
1	1	5	1:HEA160	ASM	ASM	6.000
2	3	6	1:HEA160	ASM	ASM	6.000
3	2	4	1:HEA160	ASM	ASM	2.000
4	5	2	1:HEA160	ASM	ASM	3.000
5	5	6	1:HEA160	ASM	ASM	2.000
6	6	4	1:HEA160	ASM	ASM	3.000
7	3	5	2:ROND 25	ASM	ASM	6.325

FIXED SUPPORTS

No.	node	Code XZR 1=fixed 0=free	Angle
1	1	110	0.00
2	3	110	0.00

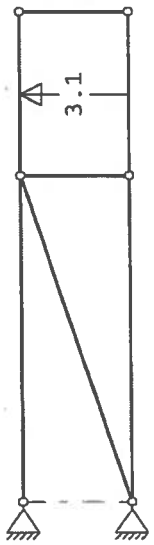
LOAD CASES

LCa	Description		Type
1	design loads	SWZ=0.00	1 Permanent load

Project...: Oyster project
Part.....:

LOADINGS

LCa:1 design loads



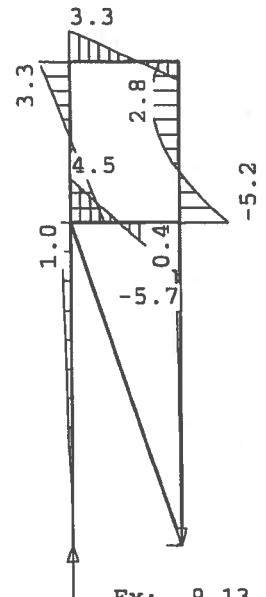
BAR LOADS

LCa:1 design loads

Load	Bar	Type	q1/p/m	q2	A	B	psi	psi-t	Rem.
1	6	1:QZLocal	3.100	3.100	0.000	0.000			

MOMENTS

LCa:1 design loads

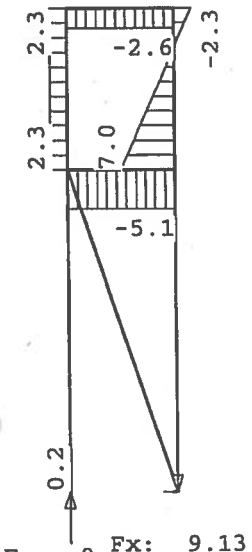


Fx: 0. Fx: 9.13
Fz: 34.[illegible] Fz:-34.88

Project...: Oyster project
Part.....:

SHEAR FORCES

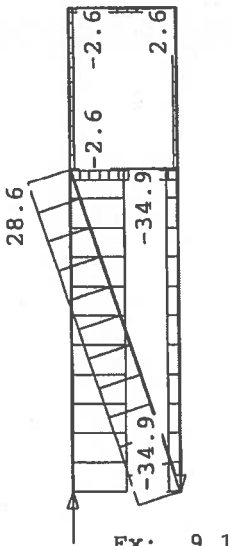
LCa:1 design loads



Fx: 0. Fx: 9.13
Fz: 34. Fz:-34.88

AXIAL FORCES

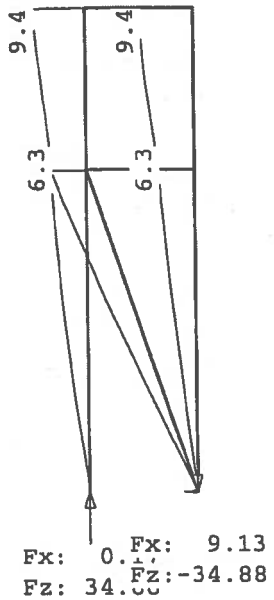
LCa:1 design loads



Fx: 0. Fx: 9.13
Fz: 34. Fz:-34.88

Project...: Oyster project
Part.....:

TRANSLATIONS [mm] LCa:1 design loads



BAR FORCES LCa:1 design loads

Bar	Nd.	Pos.	AXi/AXj	SZi/SZj	MYi/MYj
1	1		-34.87	0.17	0.00
1	5		-34.87	0.17	1.01
2	3		7.70	0.07	0.00
2	6		7.70	0.07	0.45
3	2		-2.27	-2.59	3.26
3		1.256			0.00
3	4		-2.27	-2.59	-1.93
4	5		-2.59	2.27	-3.54
4		1.562			0.00
4	2		-2.59	2.27	3.26
5	5		-6.96	-5.11	4.55
5		0.890			0.00
5	6		-6.96	-5.11	-5.67
6	6		2.59	7.03	-5.22
6		0.935			0.00
6		2.269		0.00	2.76
6	4		2.59	-2.27	1.93
7	3		28.64	0.00	-0.00
7	5		28.64	0.00	0.00

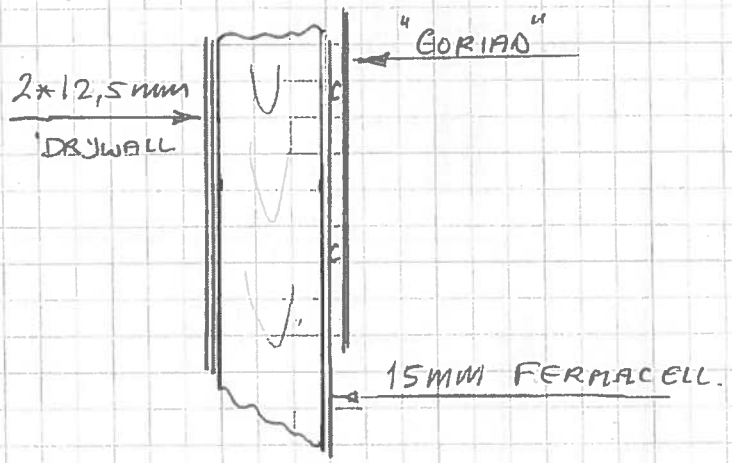
Project...: Oyster project
Part.....:

REACTIONS

LCa:1 design loads

Nd.	X	Z	M	
1	0.17	34.87		
3	9.13	-34.87		
	9.30	0.00		: Sum of the reactions
	-9.30	0.00		: Sum of the loads

Facade:



DRYWALL = 0,2 kN/m²
Struct. = 0, "
FERMAC. = 0,15 "
GORIAN 0,21 "
P_k = 0,66 kN/m²

Wind: q_p = 0,8 kN/m²
C_t = 1,4
γ = 1,3

P_k = 1,1 kN/m²
P_d = 1,5 kN/m²

H = 5,0 m: Columns c.t.c 0,4 m

$M_d = 1/8.(0,4.1,5).5,0^2 = 1,9$ kNm

$W_{ben} = \frac{1,9.10^6}{9,0} = 211.10^3$ mm³ - 71 * 140 mm

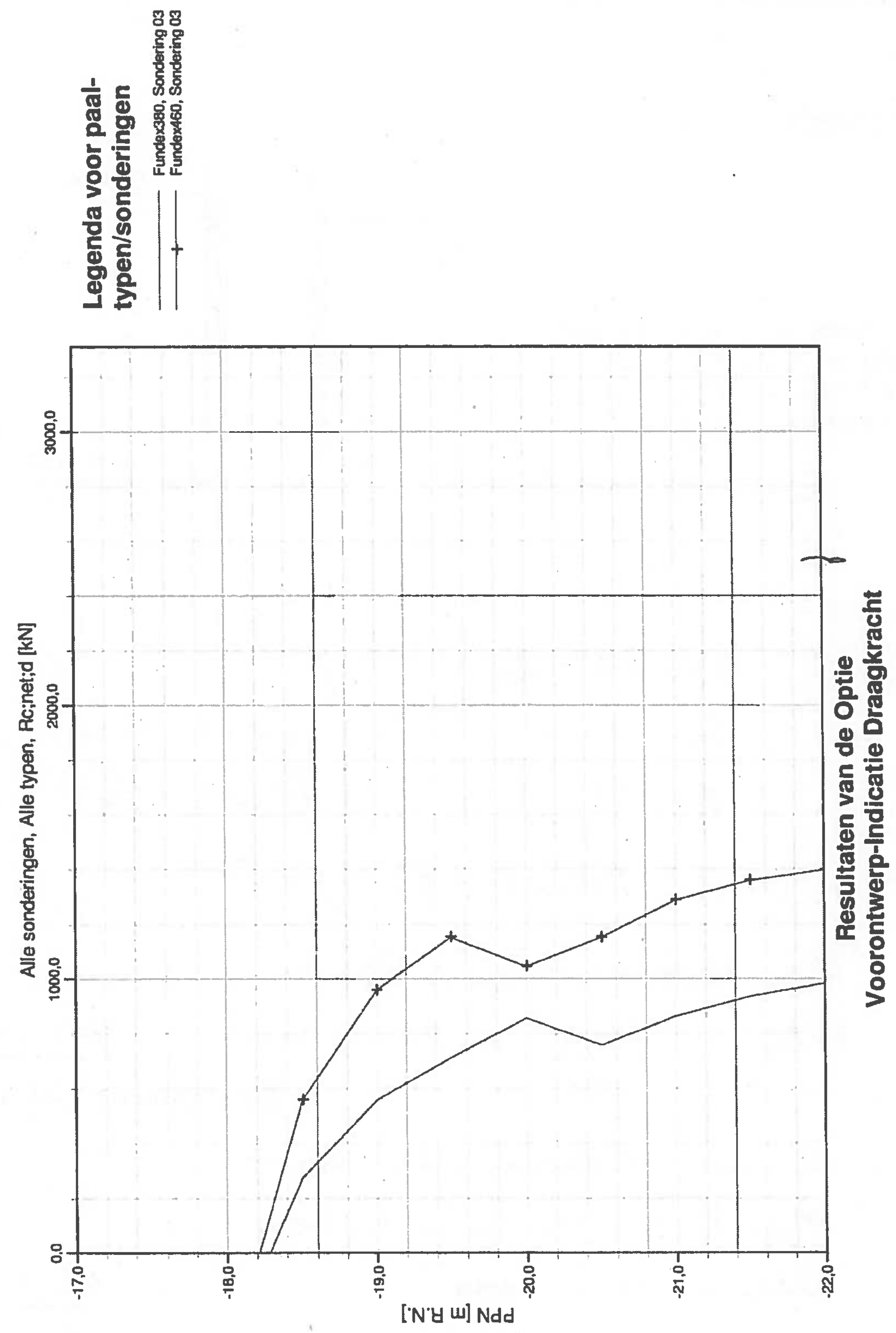
tpv WINDOVERB 96 * 140 mm

H = 3,0 m. Columns c.t.c 0,4 m

$M_d = 1/8.(0,4.1,5).3,0^2 = 0,7$ kNm

$W_{ben} = 75.10^3$ mm³ - 46 * 140 mm
($W = 150.10^3$)

86



Royal HaskoningDHV	Laan 1914 nr 35 3818 EX Amersfoort	Tel +31 (0)6 46 37 14 07 Fax	datum 3/27/2015	get.
				ctr.
D-Foundations version.dll : berekening draagkracht fundexpaal.fol			Bijl.	form. A4

TS/Liggers Rel: 6.00 22 may 2015
Project.....: Oyster -
Component....: Floorslab
Struct. eng..: 150033
Principal....:
Dimensions...: kN/m/rad
Date.....: 22/05/2015

Partial fixity left	: 15%	Partial fixity right	: 15%
Redistribution of moments	: No	Max. section length	: 0.000
Age of concrete at loading	: 28	Relative humidity	: 50%

Bendings are calculated by corrected stiffness.

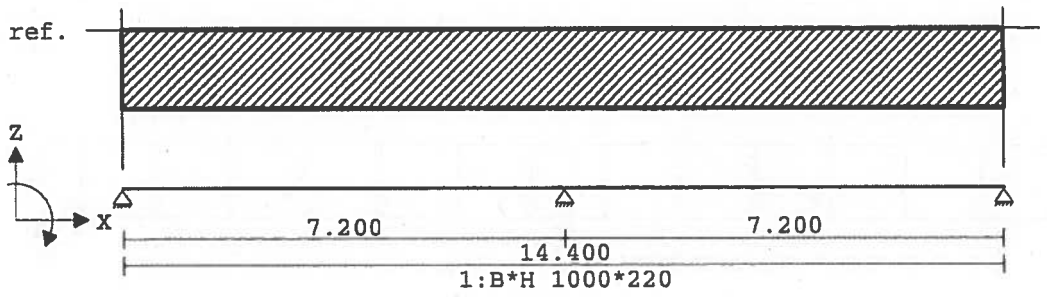
Physical linear: Calculations are based on E-modulus from MATERIALS table.
Phy.NLE.short : Calculations are based on corrected E-modulus. (short term)
These E-mod. are calculated from the forces of the Physical linear calculation.

Applied standards according to Eurocode with Dutch NA

Loads	NEN-EN 1990:2002	C2:2010	NB:2011(nl)
	NEN-EN 1991-1-1:2002	C1:2009	NB:2011(nl)
Concrete	NEN-EN 1992-1-1:2011(nl)	C2:2011(nl)	NB:2011(nl)

GEOMETRY

Beam:1



FIELD LENGTHS

Beam:1

Field	From	To	Length
1	0.000	7.200	7.200
2	7.200	14.400	7.200

MATERIALS

Mt	Description	E-modulus[N/mm2]	Cement	Creep coef.	U.M.	U.M.incr.	Pois.
1	C35/45	10728	N	2.18	25.0		0.20

SECTIONS [mm]

Sect.	Description	Material	Area	Inertia
1	B*H 1000*220	1:C35/45	2.2000e+005	8.8733e+008

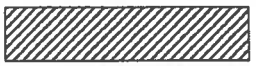
SECTIONS contd. [mm]

Sect	Formf.	Width	Height	ey	Type	w1	h1	w2	h2
1	0.00	1000	220	110.0	0:RH				

Project.....: Oyster -
Component....: Floorslab

SECTIONFORMS [mm]

1 B*H 1000*220



LOAD CASES

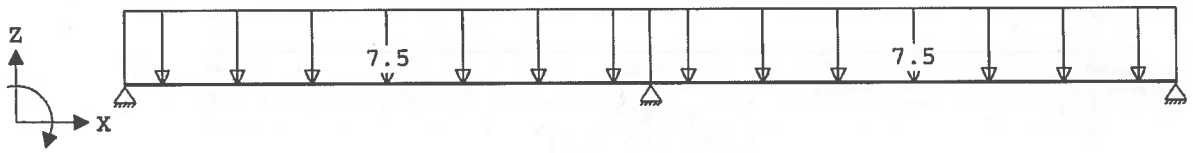
L.C.	Description	Loaded/unloaded	ψ_0	ψ_1	ψ_2	s.w.
1	permanent load	2:Permanent EN1991				0.00
2	Var. load	1:Checkerboard EN1991	1.00	0.90	0.80	0.00

LOAD CASES

LCa	Description	Type
1	permanent load	1
2	Var. load	2 Var. load pers. etc. (p_rep)

FIELD LOADS

Beam:1 LCa:1 permanent load



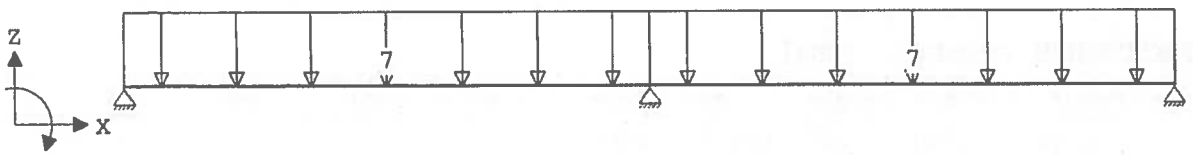
FIELD LOADS

Beam:1 LCa:1 permanent load

Load Ref.	Type	Description	q1/p/m	q2	psi	Dist.	Length
1	1:q-load		-7.500	-7.500	0.000	7.200	
2	1:q-load		-7.500	-7.500	7.200	7.200	

FIELD LOADS

Beam:1 LCa:2 Var. load



Project.....: Oyster -
Component....: Floorslab

FIELD LOADS

Beam:1 LCa:2 Var. load

Load Ref.	Type	Description	q1/p/m	q2	psi	Dist.	Length
1	1:q-load		-7.000	-7.000	0.000	7.200	
2	1:q-load		-7.000	-7.000	7.200	7.200	

LOAD COMBINATIONS

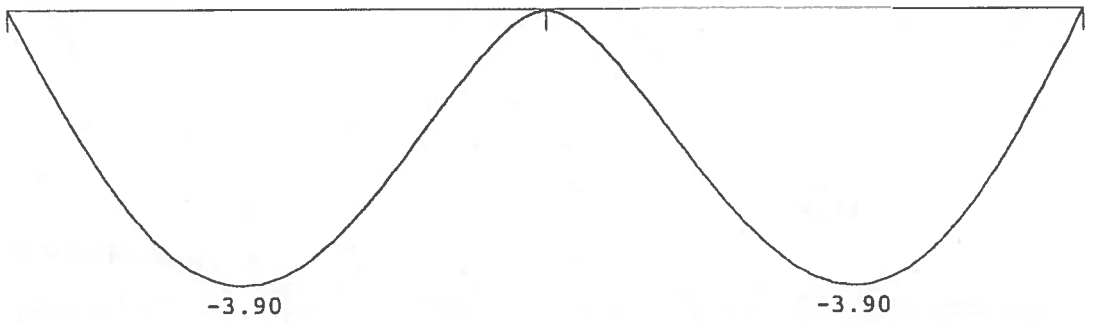
LCo	Type	LCa	Gen. Factor	LCa	Gen. Factor	LCa	Gen. Factor	LCa	Gen. Factor
1	Fund.	1	Perm 1.35						
2	Fund.	1	Perm 0.90						
3	Fund.	1	Perm 1.35	2	psi0 1.50				
4	Fund.	1	Perm 1.20	2	Extr 1.50				
5	Fund.	1	Perm 0.90	2	Extr 1.50				
6	Fund.	1	Perm 0.90	2	psi0 1.50				
7	Char.	1	Perm 1.00	2	Extr 1.00				
8	Quas.	1	Perm 1.00						
9	Quas.	1	Perm 1.00	2	psi2 1.00				
10	Freq.	1	Perm 1.00						
11	Freq.	1	Perm 1.00	2	psi1 1.00				
12	Perm.	1	Perm 1.00						

FAVOURABLE PARTS OF PERMANENT ACTION

LCo	Fields with favourable parts of permanent action
1	No beams
2	All fields the factor:0.90
3	No beams
4	No beams
5	All fields the factor:0.90
6	All fields the factor:0.90

DEFLECTION w1 [mm]

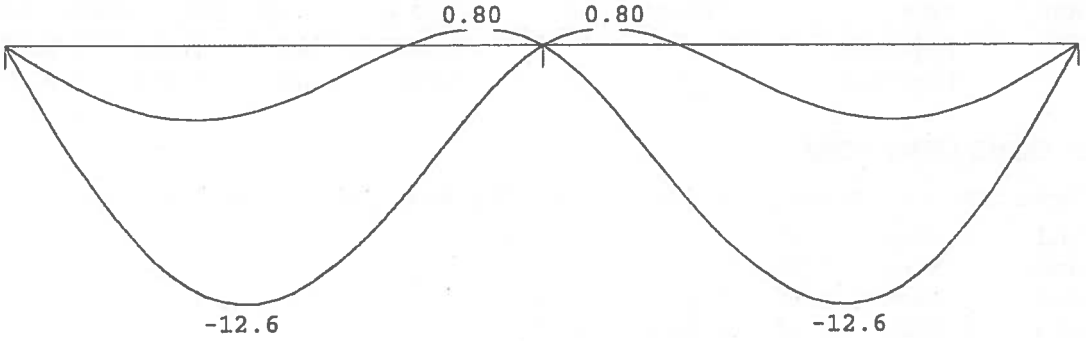
Beam:1 Permanent combination



Project.....: Oyster -
Component....: Floorslab

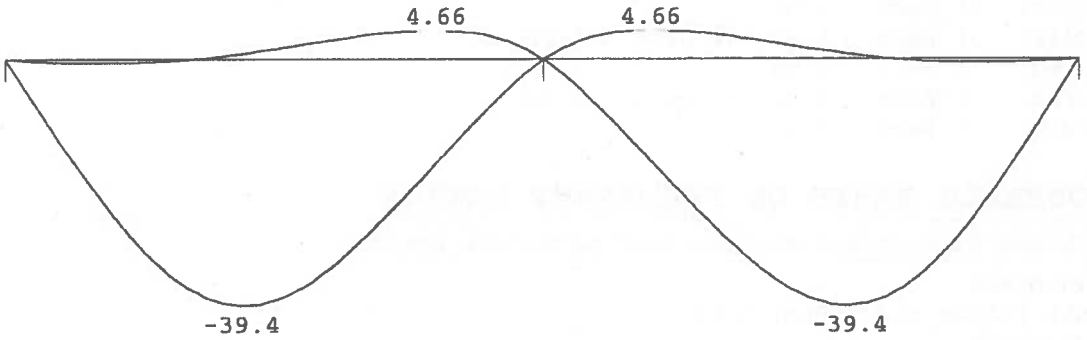
DEFLECTION w2 [mm]

Beam:1 Quasi-permanent combination



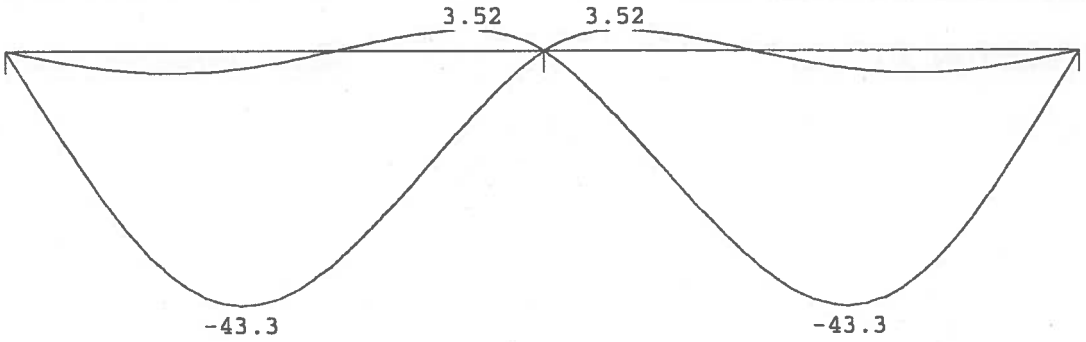
DEFLECTION Wbij [mm]

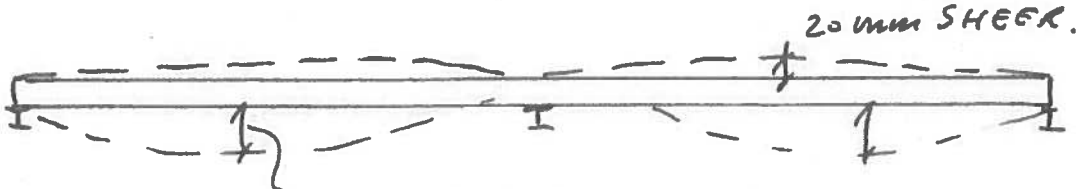
Beam:1 Characteristic combination



DEFLECTION Wmax [mm]

Beam:1 Characteristic combination





$23{,}3 < 0{,}004 \cdot 7200 = \underline{28{,}8}$ mm

Project.....: Oyster -
Component....: Floorslab

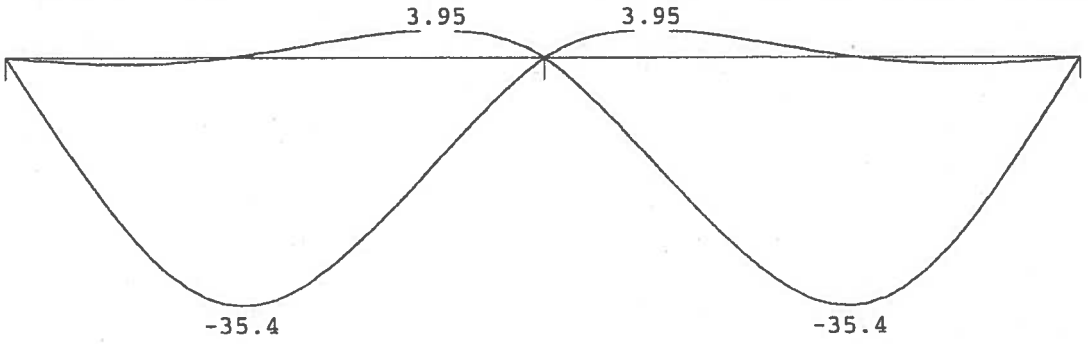
DEFLECTION

Characteristic combination

Field	side	position [m]	l_{rep} [mm]	w_1 [mm]	w_2 [mm]	w_{add} [mm]	w_{add} [lrep/]	w_{tot} [mm]	w_c [mm]	w_{max} [mm]	w_{max} [lrep/]
1	Neg.	3.120	7200	-3.9	-12.6	-39.4	183	-43.3		-43.3	166
1	Pos.	5.760	7200	-1.4	0.5	4.7	1544	3.2		3.2	2224
2	Neg.	4.080	7200	-3.9	-12.6	-39.4	183	-43.3		-43.3	166
2	Pos.	1.440	7200	-1.4	0.5	4.7	1544	3.2		3.2	2224

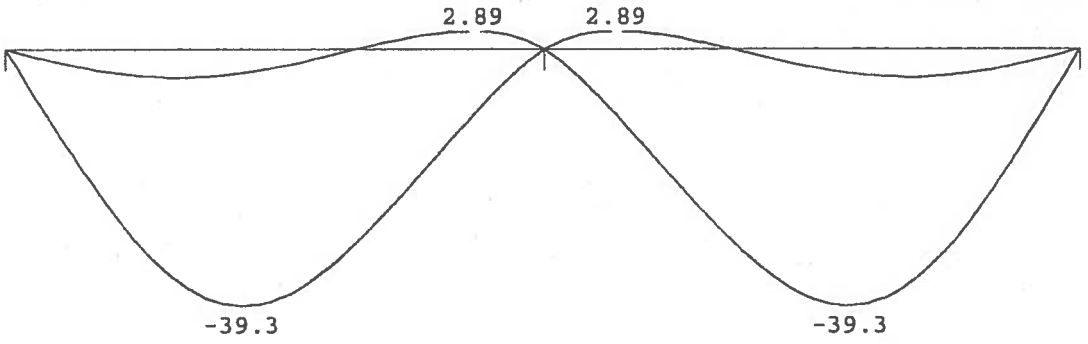
DEFLECTION Wbij [mm]

Beam:1 Frequent combination



DEFLECTION Wmax [mm]

Beam:1 Frequent combination



Project.....: Oyster -
Component....: Floorslab

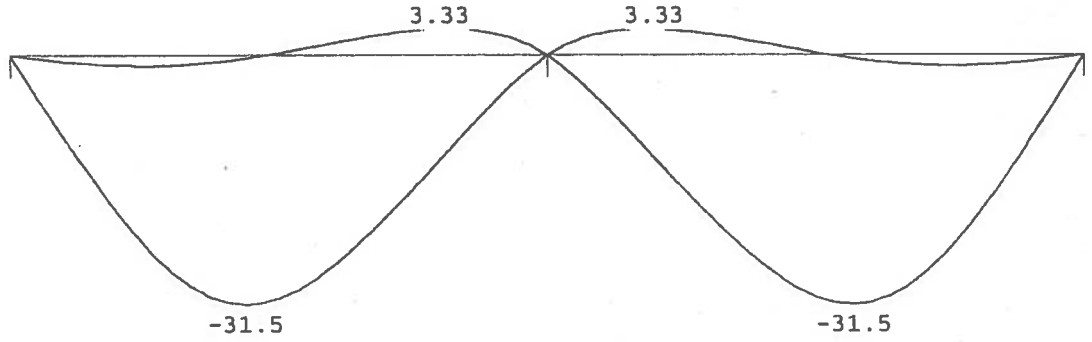
DEFLECTION

Frequent combination

Field	side	position [m]	l_{rep} [mm]	w_1 [mm]	w_2 [mm]	w_{add} [mm]	w_{add} [lrep/]	w_{tot} [mm]	w_c [mm]	w_{max} [mm]	w_{max} [lrep/]
1	Neg.	3.120	7200	-3.9	-12.6	-35.4	203	-39.3		-39.3	183
1	Pos.	5.760	7200	-1.4	0.5	4.0	1822	2.5		2.5	2850
2	Neg.	4.080	7200	-3.9	-12.6	-35.4	203	-39.3		-39.3	183
2	Pos.	1.440	7200	-1.4	0.5	4.0	1822	2.5		2.5	2850

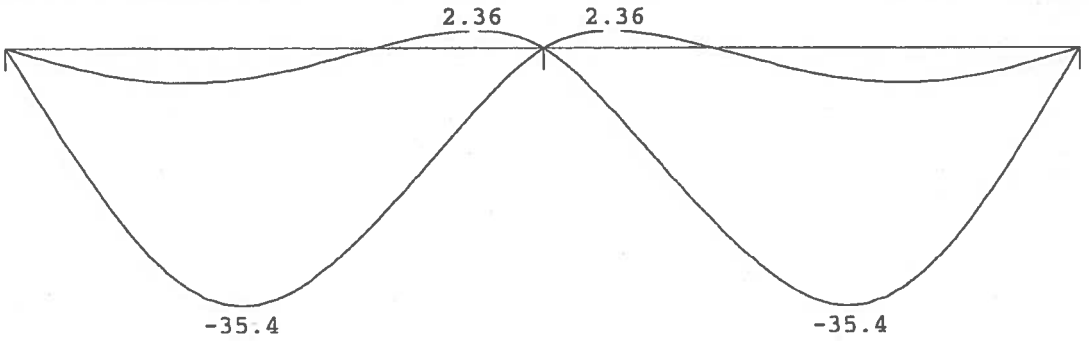
DEFLECTION Wbij [mm]

Beam:1 Quasi-permanent combination



DEFLECTION Wmax [mm]

Beam:1 Quasi-permanent combination

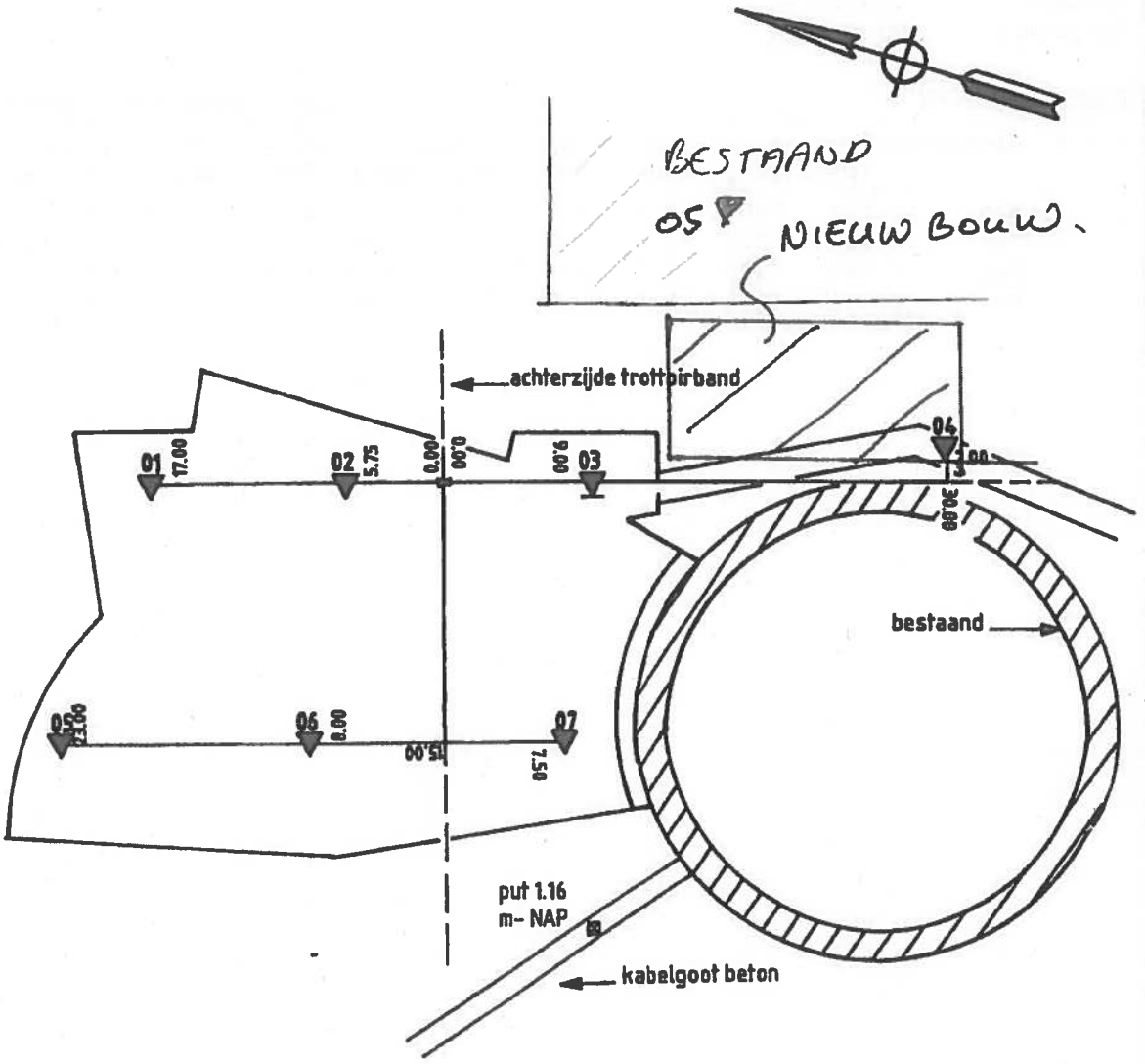


Project.....: Oyster -
Component....: Floorslab

DEFLECTION

Quasi-permanent combination

Field	side	position [m]	l_{rep} [mm]	w_1 [mm]	w_2 [mm]	w_{add} [mm]	w_{add} [lrep/]	w_{tot} [mm]	w_c [mm]	w_{max} [mm]	w_{max} [lrep/]
1	Neg.	3.120	7200	-3.9	-12.6	-31.5	229	-35.4		-35.4	203
1	Pos.	5.760	7200	-1.4	0.5	3.3	2164	1.9		1.9	3787
2	Neg.	4.080	7200	-3.9	-12.6	-31.5	229	-35.4		-35.4	203
2	Pos.	1.440	7200	-1.4	0.5	3.3	2164	1.9		1.9	3787



referentiepunt = put
kruising Mekelweg /
Van der Broekweg = 0.95 m- NAP

0 4 8 12 16 20

VERKLARING DER TEKENS	
▼	DIEPSONDERING
▼	DIEPSONDERING MET PL. WRIJVING
▽	NIET UITGEVOERD
●	BORING

SCHAAL 1: 400 | DD. 17-11-1995

OYSTER PROJECT.
BD 4376-101-100

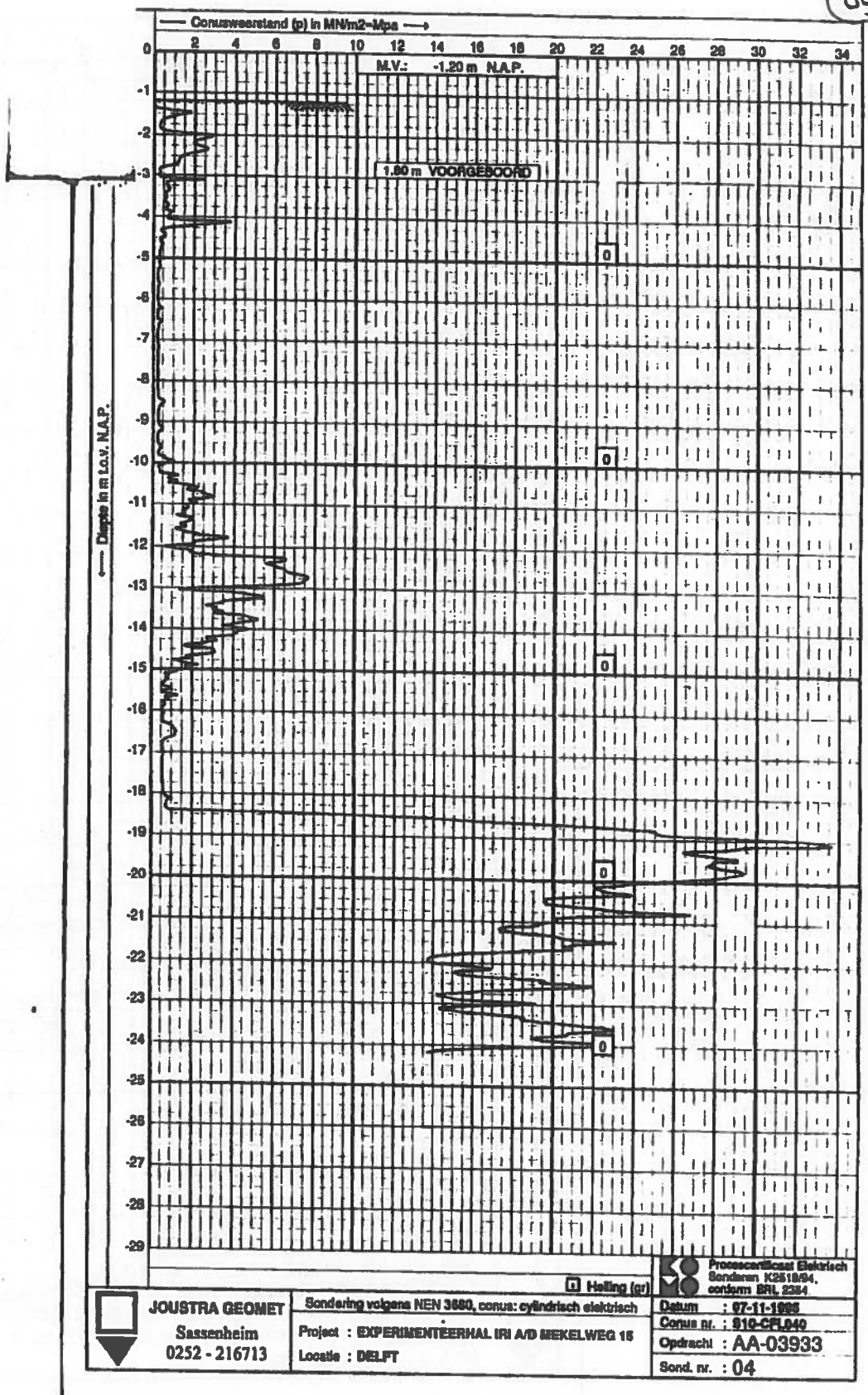
CAR 10.3.'15

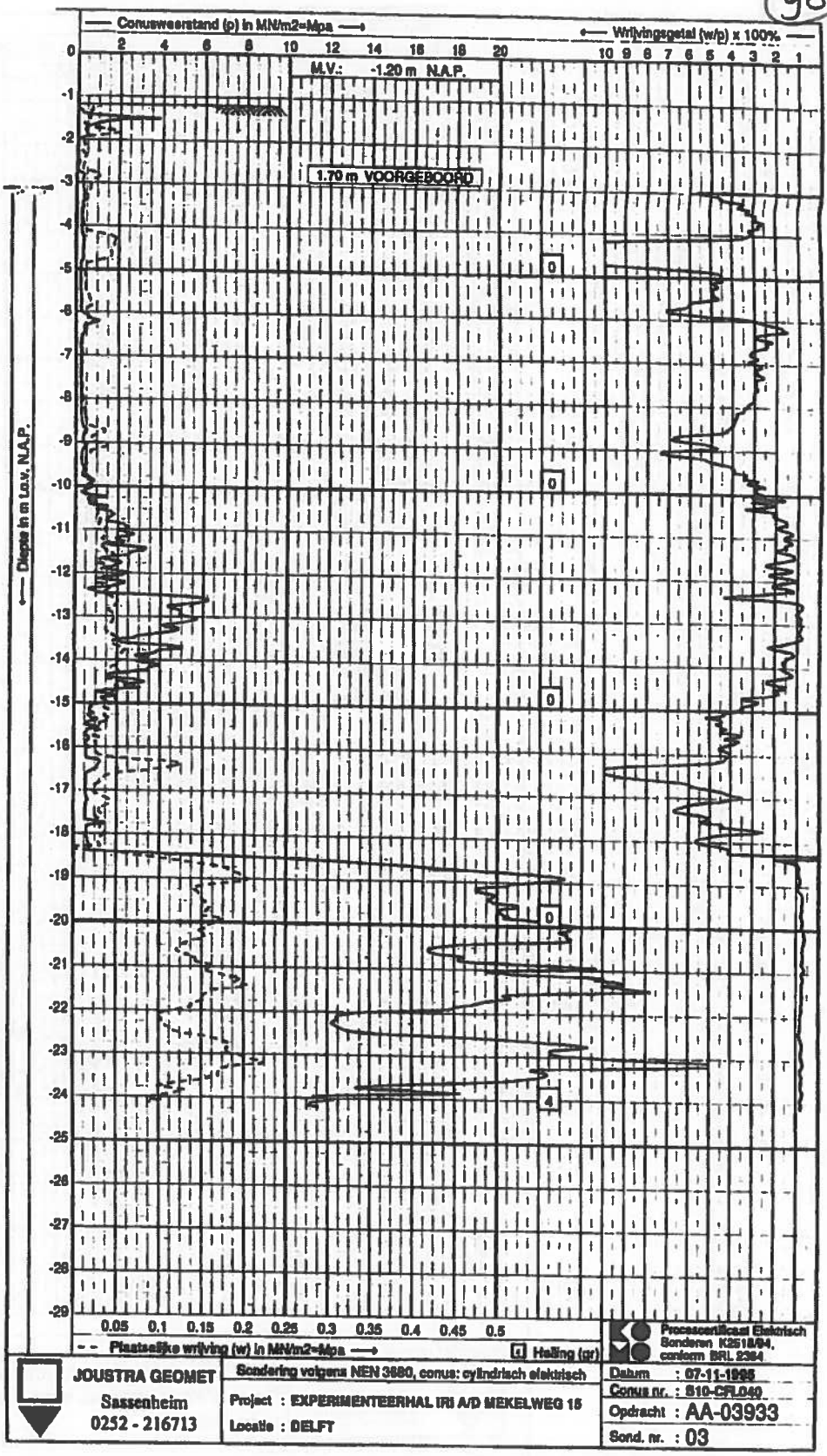
JOUSTRA GEOMET
Sassenheim

EXPERIMENTEERHAL IRI TU DELFT
MEKELWEG 15 DELFT

SITUATIE

Opdr. nr.
AA-03933

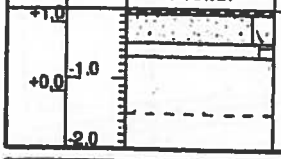

Conusweerstand (p) in MN/m2=Mpa
M.V.: -1.20 m N.A.P.
1.80 m VOORGEBOORD
Diepte in m t.o.v. N.A.P.
Helling (gr)
JOUSTRA GEOMET
Sassenheim
0252 - 216713
Sondering volgens NEN 3680, conus: cylindrisch elektrisch
Project : EXPERIMENTEERHAL IRI A/D MEKELWEG 15
Locatie : DELFT
Procescertificaat Elektrisch Sonderen K251/94, conform BRL 2384
Datum : 07-11-1995
Conus nr. : 910-CFL040
Opdracht : AA-03933
Sond. nr. : 04


Conusweerstand (p) in MN/m2=Mpa
Wrijvingsgetal (w/p) x 100%
M.V.: -1.20 m N.A.P.
1.70 m VOORGEBOORD
Diepte in m t.o.v. N.A.P.
Plastische wrijving (w) in MN/m2=Mpa
Helling (gr)
JOUSTRA GEOMET
Sassenheim
0252 - 216713
Sondering volgens NEN 3680, conus: cylindrisch elektrisch
Project : EXPERIMENTEERHAL IRI A/D MEKELWEG 15
Locatie : DELFT
Procescertificaat Elektrisch Sonderen K251B/94, conform BRL 2364
Datum : 07-11-1995
Conus nr. : S10-CFL040
Opdracht : AA-03933
Sond. nr. : 03

S03 07-11-95
Handboring

Maaiveldhoogte: **1.20** t.o.v. **NAP**
Grondwaterniveau: -.-- t.o.v.

Coordinaten:

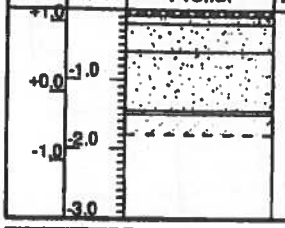


M	G	P	Omschrijving bodemprofiel	Opmerkingen
			0.00m Verharding, (straatstenen). 0.08m Zand, matig fijn, bruin, matig schelpenhoudend. 0.50m Klei, matig slap, donkergrijs, zwak veenhoudend. 0.70m Klei, matig slap, blauwgrijs. 1.50m Einde boring	

S04 07-11-95
Handboring

Maaiveldhoogte: **1.18** t.o.v. **NAP**
Grondwaterniveau: -.-- t.o.v.

Coordinaten:

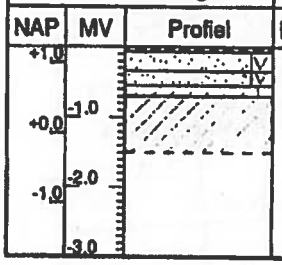


M	G	P	Omschrijving bodemprofiel	Opmerkingen
			0.00m Verharding, (straatstenen). 0.08m Zand, matig fijn, grijs, zwak schelpenhoudend. 0.20m Zand, matig fijn, lichtbruin. 0.60m Zand, matig fijn, grijs. 1.45m Grind. 1.50m Klei, slap, donkergrijs. 1.60m Einde boring.	

S07 07-11-95
Handboring

Maaiveldhoogte: **1.23** t.o.v. **NAP**
Grondwaterniveau: -.-- t.o.v.

Coordinaten:

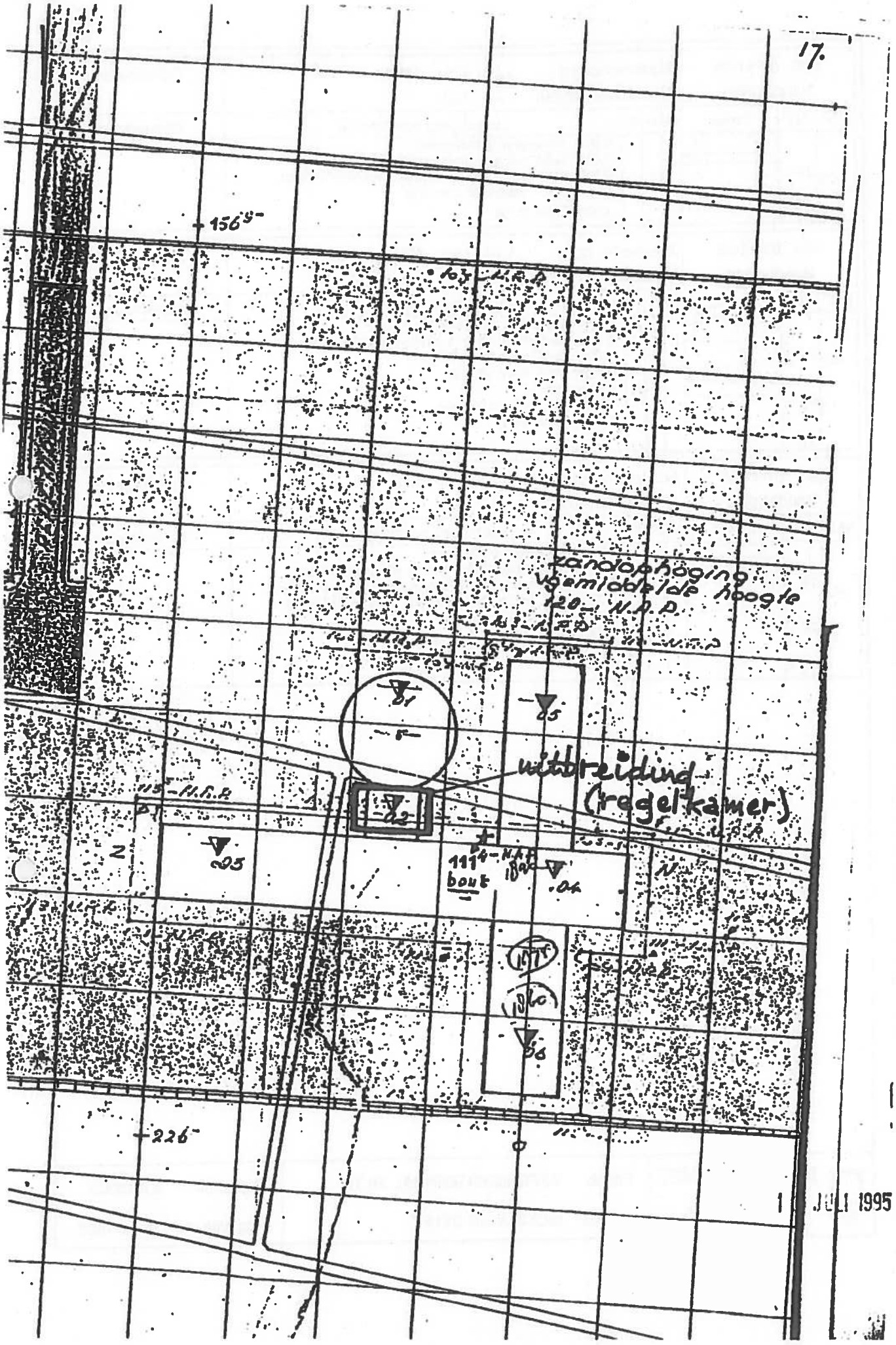


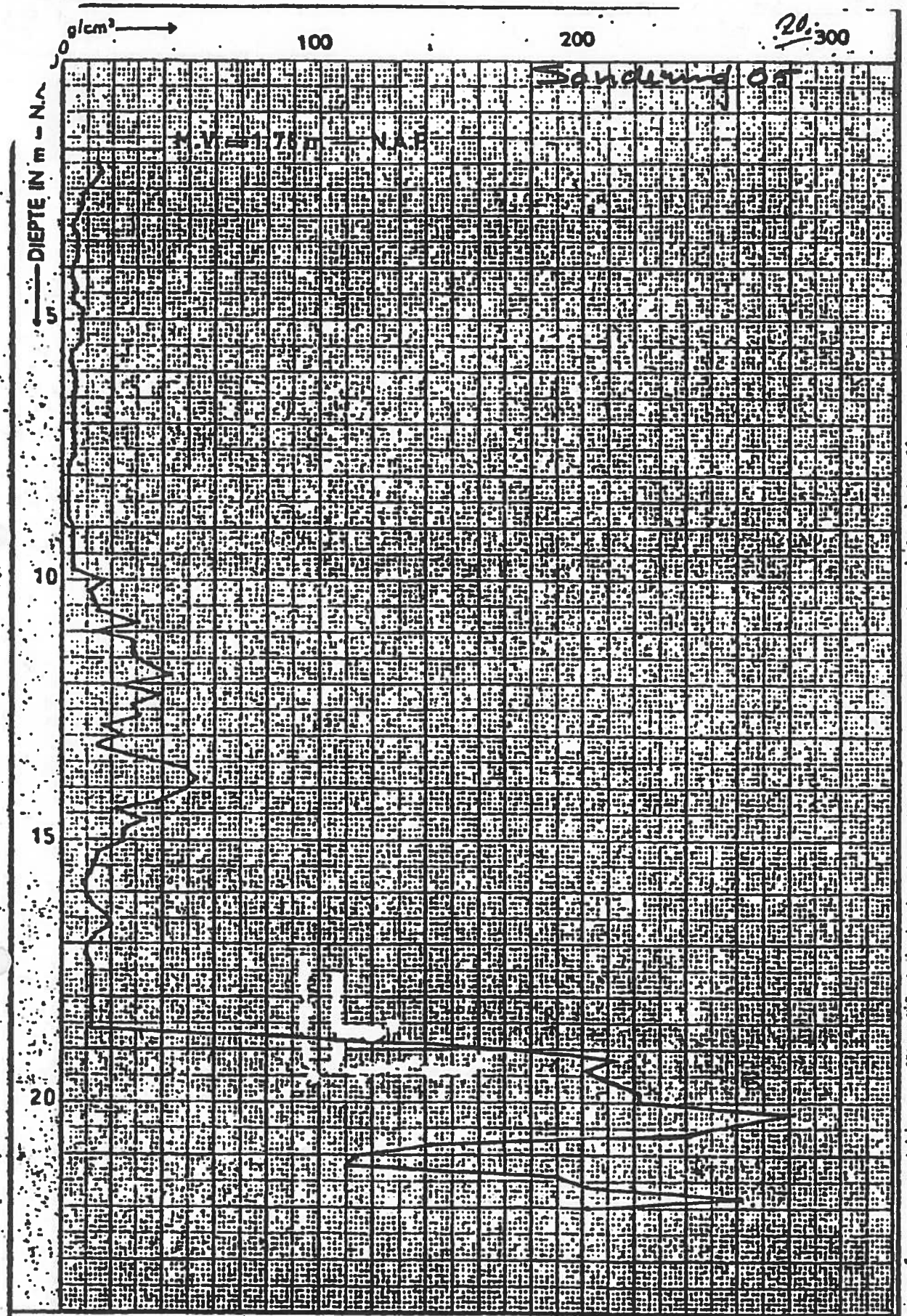
M	G	P	Omschrijving bodemprofiel	Opmerkingen
			0.00m Verharding, (straatstenen). 0.08m Zand, matig fijn, bruin, matig schelpenhoudend. 0.35m Zand, matig fijn, donkergrijs, matig schelpenhoudend. 0.55m Klei, matig slap, donkergrijs, zwak veenhoudend. 0.70m Klei, slap, blauw. 1.50m Einde boring.	

JOUSTRA GEOMET
Sassenheim
0252 - 216713

Project: **EXPERIMENTEERHAL IRI TU**
Locatie: **MEKELWEG DELFT**

Rapportnr: **AA-03933**
Proj. datum: **13-12-1995**


156
kandophoging
gemiddelde hoogte
uitbreiding
(regelkamer)
115 N.A.P.
111.4 N.A.P.
bout
226



LABORATORIUM VOOR GRONDMECHANICA TE DELFT

KERNREACTOR T.H. DELFT

DIEPSONDERING 05

CONUSWEERSTAND

dd 26-6-1958

S.W.	TAK	BIJLAGE 6
A4		CO-10236-6 C

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HOME

PRODUCTS/SERVICES

- Pile Types
- Driven Pile
- Alternative Pile Processes
- Shoring Systems

RESEARCH

SHOWCASE PROJECTS

CONTACT

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81 Big break Road
Oakley, CA 94561
Phone: 925-754-6633
Email info@foundationpiledriving.com

FOUNDATION
PILEDRIVING CONTRACTORS

FUNDEX PILES

VIBRATION-FREE SOIL DISPLACEMENT CAST-IN-PLACE CONCRETE PILE

The Fundex pile is a true full section cast in place reinforced concrete pile, installed by torque and down pressure, completely free of vibration and with no piledriving noise. It is a true soil displacement pile over its full pile length. Fundex piles are usually designed for a 40 to 125 ton service capacity. The method of installation permits no possibility of discontinuities of the pile shaft because a sealant prevents intrusion of soil or water into the incomplete pile. There are no limitations on the depth of the reinforcing cage or rebar size within the pile. There is no central tendon required, and concrete is not soil mixed, but rather pure structural concrete.
Fundex piles are true soil displacement cast-in-place piles. While the operation appears similar to a drilling job, the patented Fundex tip displaces the soil laterally, bringing no spoils to the ground surface. This soil-displacement quality greatly enhances the pile's capacity over comparably sized conventional drilled shafts.

A cast iron boring tip is fitted to a drilling mandrel by means of a chuck assembly. The mandrel is installed by using torque and down-pressure, producing veryJow noise levels and no vibration. Upon reaching the bearing layer - or upon sufficiently penetrating soil strata in the case of friction pile design - a reinforcing cage is suspended within the mandrel, and concrete is placed. The drill mandrel is then extracted by oscillation thereby leaving the tip, concrete and cage behind in place. In this way, true full section cast-in-place concrete piles are constructed.

The mandrel is 14" in diameter, and the boring tip is 18" in diameter. The effective diameter of the completed pile

produced is nominally 16 inches. While the Fundex pile is designed for capacities comparable to conventional 14" Precast driven piles, the cast insitu construction of the piles produces a roughened amplitude surface at the pile-to-sc interface, thereby increasing the frictional capacity of the Fundex piles over other soil displacement piles.

The tip, concrete, and reinforcing are the primary structural elements of the pile. Because the tip is fitted to the mandrel with a drilling chuck and waterproof caulking, there is no concern of soil or groundwater entering the pile mandrel prior to the completion of the pile. Greatly variable depths across a site are achievable as the mandrel may be stopped at any point "refusal" is encountered.

FUNDEX PILES ARE SUITABLE FOR PROJECTS ON WHICH:

- Drilled shafts may be appropriate, but drill spoils are to be avoided
- Space restricts the use of larger diameter drilled shafts, and higher unit friction values are required to develop capacity
- The project space is too confined for conventional precast piledriving
- Noise or vibration is not permissible
- There is a high variability in required pile depths
- Are too remote from precast pile fabricators to economically ship precast piles to the site.
- Auger cast pile construction presents quality control issues

ADVANTAGES OVER PRECAST PILES

- Suitable for projects inaccessible to precast piles due to space restrictions
- Lengths are easily adjusted as required in the field for each pile
- Roughened amplitude of concrete surface affords higher unit friction than smooth pipe or concrete pile
- Installation produces no piledriving noise or vibration

ADVANTAGES OVER DRILLED PIERS

- Running sands, caving or very poor soils, or the presence of a high water table do not affect the installation of Fundex pile.
- Because Fundex piles are displacement piles, the Fundex pile affords a higher unit friction capacity than a comparable drilled shaft
- No materials are conveyed to the surface or are allowed to migrate to deeper strata- a consideration if contaminants are known to exist at a site. Drill spoil offhaul is virtually eliminated.
- Fundex method allows reinforcing cages of any length, and constructs the structural shaft without necking or soil intrusion

ADVANTAGES OVER ACP / ACIP PILES

- Fundex piles are full section soil displacement
- The mandrel prevents intrusion of soil and ground water into the structural elements
- Reinforcing is not limited, nor 'pushed' in grout columns. The cage is set prior to concrete placement
- The pile may be fully inspected at any point during installation prior to or during concrete placement. Inspection B does not rely on 'black box' interpretation to evaluate the pile shaft. The inspector can literally look down the || shaft to the tip.

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FUNDEX PILES PILING WITHOUT VIBRATION

Method of Installation:

Phase 1.
A crawler mounted hydraulic piling rig fitted with an hydraulic drill table with 1,5 m stroke Hydraulic pull down.
The drill point complete with a bayonet joint, is attached to a drill tube which in turn is clamped in the drill table.
To commence drilling the drill table is raised to its maximum height and the drill tube is clamped. The drill tube is drilled into the ground with a pull down force on the axis (F = 200 kN) and a torque (var. 120-500 kNm). The ground is displaced, as drilling takes place.

Phase 2.
After ensuring that the drill tube is dry, the reinforcing is placed in position and sufficient concrete for the complete pile is poured into the drill tube.

Phase 3.
The drill tube is extracted with upward and downward oscillating movements. The drill-point forms an enlarged pile base and stays in the soil.

Phase 4.
The pile is completed when the reinforcing cage is placed in position.

TEST PROGRAM FUNDEXPILES

Powerstation Yselcontrole Harculo/Executed by "Delft Soil Mechanics laboratory."

By using a manometer installed in the hydraulic circuit it is possible to assess the ground resistance by direct comparison with the pressure and it is therefore possible to measure the load bearing capacity of the foundation layer There is a fairly accurate correlation between the pressure shown on the manometer and the cone resistance which has been measured previously.

Because of horizontal displacement and compaction, the cone-resistance of the soil will increase, which has a positive effect on the pilebearing capacity.

Should this system be applied in very weak soils, it is possible to place a prefabricated core or a thin steel casing in the drill-tube after reaching the foundation level. The inner casing is then filled with concrete and the drill-tube extracted. The space formed by the drill point and the inner-casing or prefabrication core is then filled with grout. When very dense or hard layers have to be penetrated the tube will be drilled by using fluidation. Water is injected through the drill-point around drillpoint and drill-tube. By means of increasing the pore pressure the effective stress of the soil is temporary decreased in order that the drilling'procedure will continue easier.

ADVANTAGES OF THE FUNDEX PILES

- **No vibration.** No danger to adjacent buildings during drilling. Soil displacement so no decrease of cone resistance and no harm to existing piles.
- **Silent operation:** The only noise comes from the power pack.

- **Speed:** The piling rig can be moved on site and quickly erected and made ready for work, thereby providing a high production capacity.
- **Bearing capacity:** A strong bond between the ground and the pile is created due to the shape of the pile surface, and the soil displacement and compaction.
- **Control:** The changes in the ground resistance can be monitored by the pressure readings shown on the manometer.
- **Economy:** There is no superfluous pile length and reinforcement can be light.
- **Removal of the ground:** The ground is not removed but displaced to the side, so that it compacts and improves.
- **Anchor piles:** The Fundex pile can be installed to a maximum rake of 1 in 3.
- **Bearing capacity:** Depending the soil resistance from 1000 to 1250 kN.
- **Fundex tension piles:** A variation on the system is the Fundex tension pile.
- **Method of installation:** The drill-tube is provided with a specially designed drill point in which a short reinforcement cage is installed.

When the foundation level is reached, the reinforcement is placed over the anchorcage in the pilepoint, which guarantees sufficient anchor length. The drill-tube can be extracted after placing of concrete. Due to the shape of the pilepoint, the Fundexpiles is very suitable for tension piles.

For piles with high tension, Fundexpiles with prestressed steel bars can be applied, also Tubexpiles (like Fundex but with permanent casing).

Standard sizes of Fundexpiles:

Shaft diameter	Drill point diameter:
380 mm	450 mm
450 mm	550 mm

In special cases, but depending pile length and soil resistance:

Shaft diameter:	**Drill point diameter:**
520 mm	670 mm

Fundex piles can be constructed at 800 mm from an adjacent building, but in a corner this distances is more.

Driven Pile | Shoring Systems | Alternative Pile | Tubex Piles | Edttex Piles
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