

Report for D-Sheet Piling 18.1

Design of Diaphragm and Sheet Pile Walls
Developed by Deltares

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Verification according to National Annex of Eurocode 7 in the Netherlands (NEN 9997-1:2016)

1 Summary

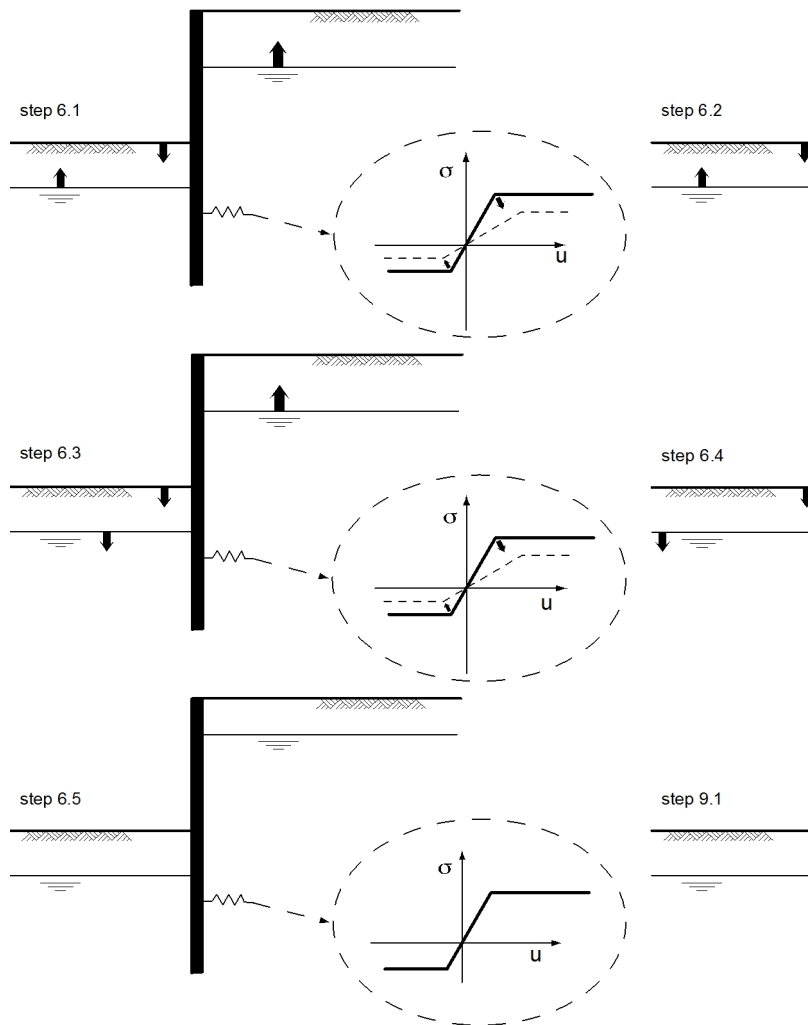
1.1 Overview per Stage and Test

Stage nr.	Verification	Displacement [mm]	Moment [kNm]	Shear force [kN]	Mob. perc. moment [%]	Mob. perc. resistance [%]	Vertical balance
7	Not verified						
7	Not verified						
7	Not verified						
7	Not verified						
7	Not verified						
7	Not verified						
7	EC7(NL)-Step 6.3		82,19	-70,95	0,0	40,8	Upwards
7	EC7(NL)-Step 6.4		82,15	-70,48	0,0	40,6	Upwards
7	EC7(NL)-Step 6.5	-8,0	42,65	-25,37	0,0	18,8	Upwards
7	EC7(NL)-Step 6.5 * 1,20		51,18	-30,45			
9	Not verified						
9	EC7(NL)-Step 6.3		56,42	-35,74	0,0	21,3	Upwards
9	EC7(NL)-Step 6.4		56,36	-35,70	0,0	21,3	Upwards
9	EC7(NL)-Step 6.5	-11,7	56,42	-35,74	0,0	21,3	Upwards
9	EC7(NL)-Step 6.5 * 1,20		67,70	-42,89			
Max			82,19	-70,95	0,0	40,8	Sufficient

1.2 Overall Stability per Stage

Stage name	Stability factor [-]
Hoog - normaal ...	2,15
MHW - laag + b...	2,52

1.3 CUR Verification Steps



2 Input Data for all Stages

2.1 General Input Data

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Model	Sheet piling
Check vertical balance	Yes
Number of construction stages	9
Unit weight of water	10,00 kN/m ³
Number of curves for spring characteristics	3
Unloading curve on spring characteristic	No
Elastic calculation	Yes

2.2 Sheet Piling Properties

Length	6,40 m
Level top side	21,40 m
Number of sections	1
q _b ;max	13,00 MPa
Xi factor	1,39

2.2.1 General properties

Section name	From [m]	To [m]	Material type	Acting width [m]
AZ 18	15,00	21,40	Steel	1,00

2.2.2 Stiffness EI (elastic behaviour)

Section name	Elastic stiffness EI [kNm ² /m']	Red. factor on EI [-]	Corrected elas. stiffness EI [kNm ²]	Note to reduction factor
AZ 18	7,1820E+04	1,00	7,1820E+04	

2.2.3 Maximum allowable moments

Section name	Mr;char;el [kNm/m']	Modification factor [-]	Material factor [-]	Red. factor allow. moment [-]	Mr;d;el [kNm]
AZ 18	432,00	1,00	1,00	1,00	432,00

2.2.4 Properties for vertical balance

Section name	From [m]	To [m]	Height [mm]	Coating area [m ² /m ² wall]	Section area [cm ² /m']
AZ 18	15,00	21,40	380,00	1,35	150,00

2.3 Calculation Options

First stage represents initial situation
 Calculation refinement
 Reduce delta(s) according to CUR
 Verification

No
 Coarse
 Yes
 EC7 NA NL - method B: Partial factors (design values) in verification
 Eurocode 7 using the factors as described in the National Annex of the Netherlands. It is basically design approach III.

Verification of stage

7: Hoog - normaal + belasting

Used partial factor set

RC 1

Factors on loads	
- Permanent load, unfavourable	1,00
- Permanent load, favourable	1,00
- Variable load, unfavourable	1,00
- Variable load, favourable	0,00
Material factors	
- Cohesion	1,15
- Tangent phi	1,15
- Delta (wall friction angle)	1,15
- Modulus of low representative subgrade reaction	1,30
Geometry modification	
- Increase retaining height	10,00 %
- Maximum increase retaining height	0,50 m
- Reduction in phreatic line on passive side	0,20 m
- Raise in phreatic line on passive side	0,20 m
- Raise in phreatic line on active side	0,05 m
Overall stability factors	
- Cohesion	1,30
- Tangent phi	1,20
- Factor on unit weight soil	1,00
Vertical balance factors	
- Partial factor base resistance (gamma_b)	1,20
Verification of stage	9: MHW - laag + belasting
Used partial factor set	RC 0 RC0 is added for simple constructions. To be compared with CUR class I
Factors on loads	
- Permanent load, unfavourable	1,00
- Permanent load, favourable	1,00
- Variable load, unfavourable	1,00
- Variable load, favourable	0,00
Material factors	
- Cohesion	1,00
- Tangent phi	1,00User defined
- Delta (wall friction angle)	1,00User defined
- Modulus of low representative subgrade reaction	1,00User defined
Geometry modification	
- Increase retaining height	0,00 %User defined
- Maximum increase retaining height	0,00 mUser defined
- Reduction in phreatic line on passive side	0,00 mUser defined
- Raise in phreatic line on active side	0,00 mUser defined
Overall stability factors	
- Cohesion	1,00User defined
- Tangent phi	1,00User defined
- Factor on unit weight soil	1,00
Vertical balance factors	
- Partial factor base resistance (gamma_b)	1,00User defined

End of Report