Job No: DFS221011 Design Engineer: AR Date: 15 April 2023

Job Name: BROXWOOD VIEW, 29 ST. EDMUND'S TERRACE LONDON NW8 7QH

Calc Title: Detailed Designs – ∅450 Secant Pile Retaining Wall, ∅600 Contiguous Pile Retaining Wall & ∅300 Bearing Piles Rev. 06

CADS PWS 6.09 Computer Output Files for Pile Retaining Wall – SLS Analysis

Pile geometry

Pile top Level	0	m
Pile Length	14	m
Pile toe level	-14	m

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level -4.85

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
.00	Made Ground	18.00	18.00	15000	0	1		28	.67	.30	1.43
						1		28	.50	4.15	4.99
-2.50	S to F to Stiff	19.00	19.00	24000	9600	30	12.0		.67	1.00	2.58
						30	12.0		.50	1.00	2.45

Construction sequence

Stage Ref		Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1	A	Line load	0.00	270.0	.3	.0	
2	A	Active surcharge	0.00	150.0	.3		
3		Insert prop	-0.50				
4	A	Passive side excavation	-3.00				
5		Insert prop	-2.50				
6	A	Passive side excavation	-4.85				
7		Insert prop	-3.83				
8	A	Remove prop	-2.50				
9		Insert prop	-0.30				
10	A	Remove prop	-0.50				
11	A	Active water level	0.00				

Code of practice

Code of practice or reference document	
Application of pressures for stability	Not applicable for FOS=1 on moments
FOS on moments (stability check)	1.00
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.00

Wall analysis detail options

Nominal Phi for load distribution	30.0	Degrees
Depth of water filled tension cracks	.0	m
Density of water	9.8	kN/m3
Minimum equivalent fluid density	5.0	kN/m3
Depth of passive softened soil	.0	m
Continuity model for wall analysis	Pins at second and lower props	

Deflection parameters

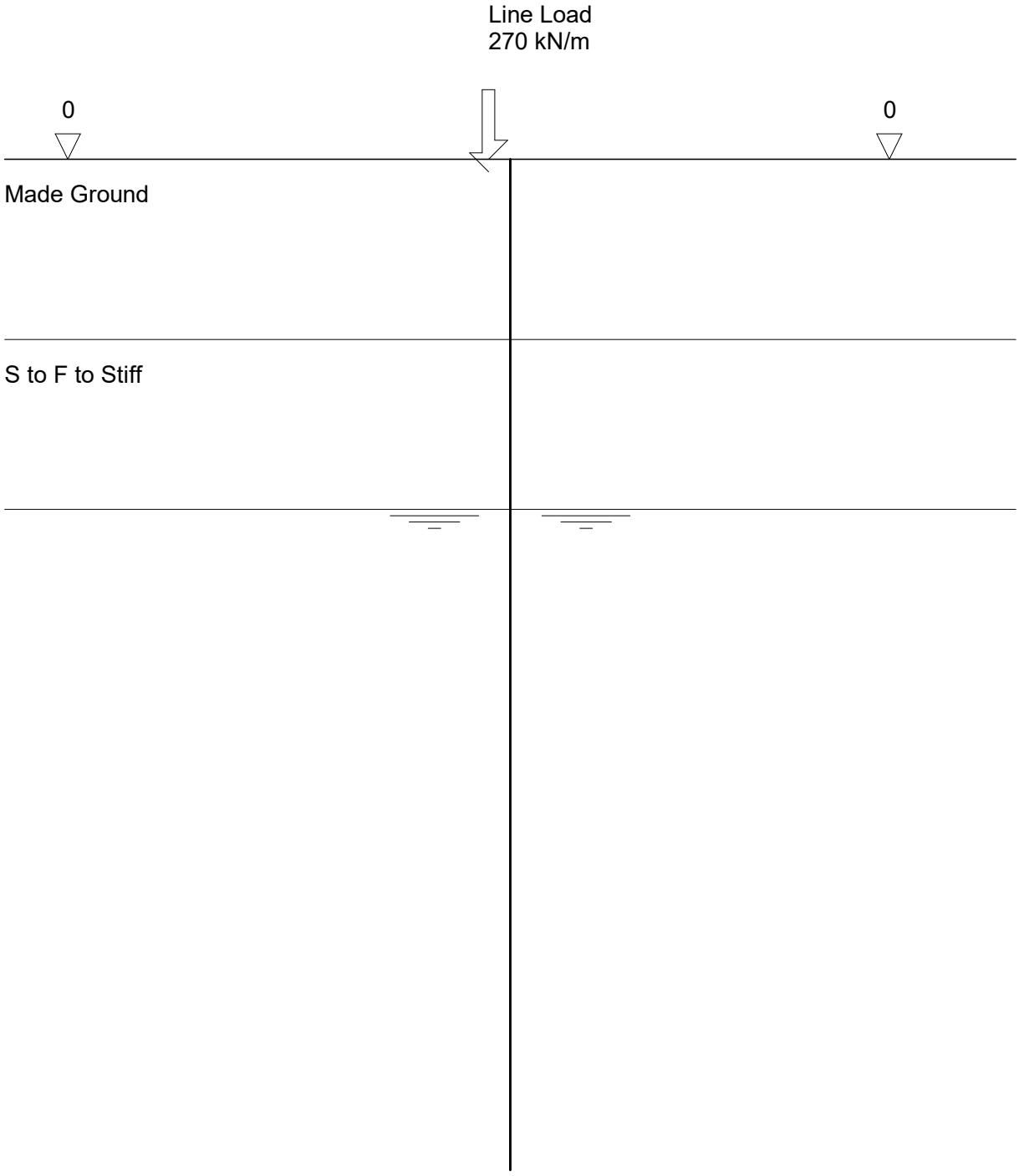
Wall moment of inertia	1908818	cm4/m
Wall Youngs modulus	28000000	kN/m2
Properties for prop at -0.5		
Prop/Tie cross sectional area	3	cm2 each
Prop/Tie Youngs modulus	200000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm
Properties for prop at -2.5		
Prop/Tie cross sectional area	3	cm2 each
Prop/Tie Youngs modulus	200000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Deflection parameters - continued

Properties for prop at -3.83		
Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Properties for prop at -0.3		
Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

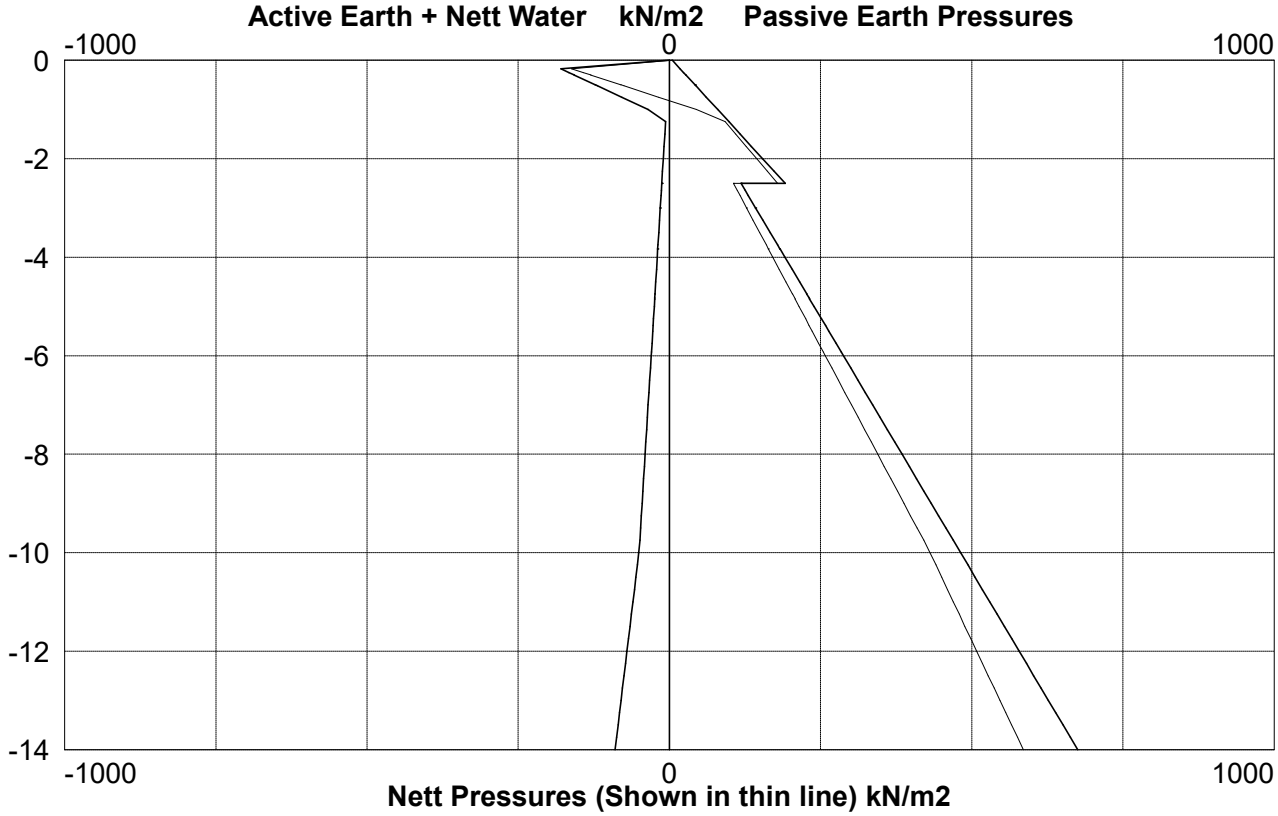
Stage ref. **1**
Stage type **Line load**

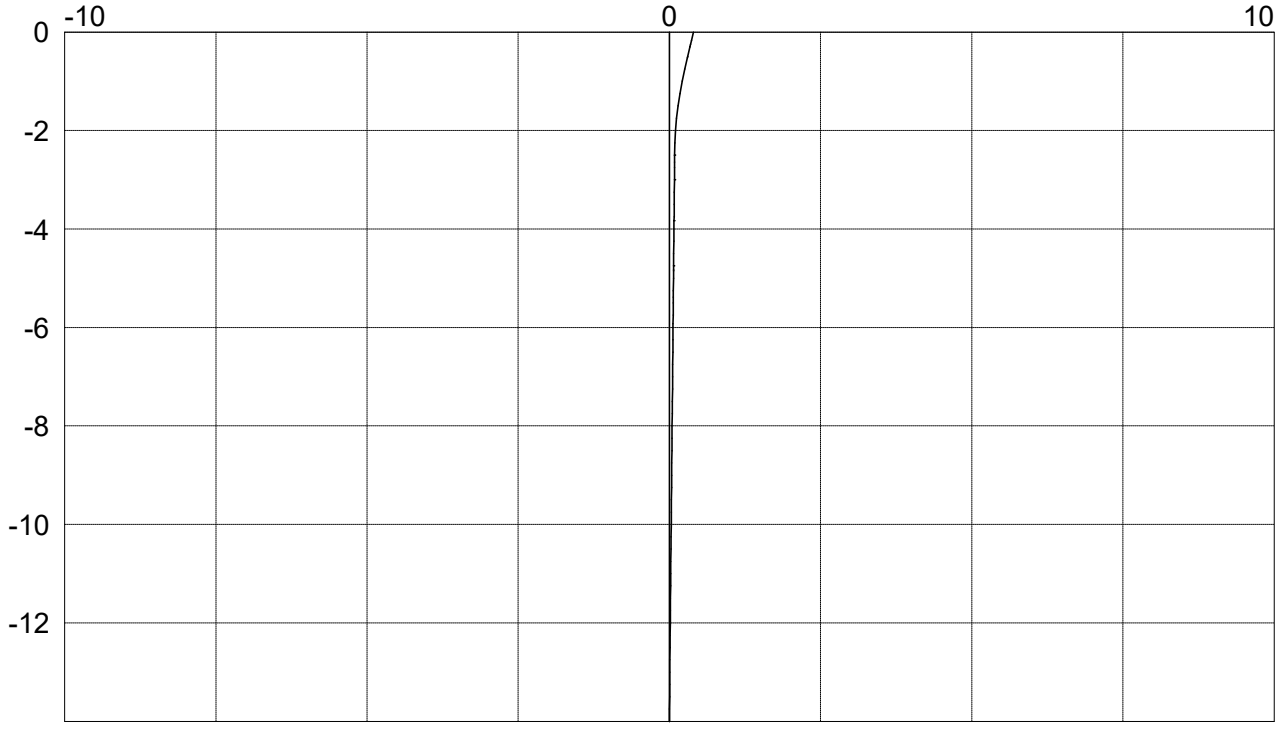


Tabular results from analysis of stage ref 1

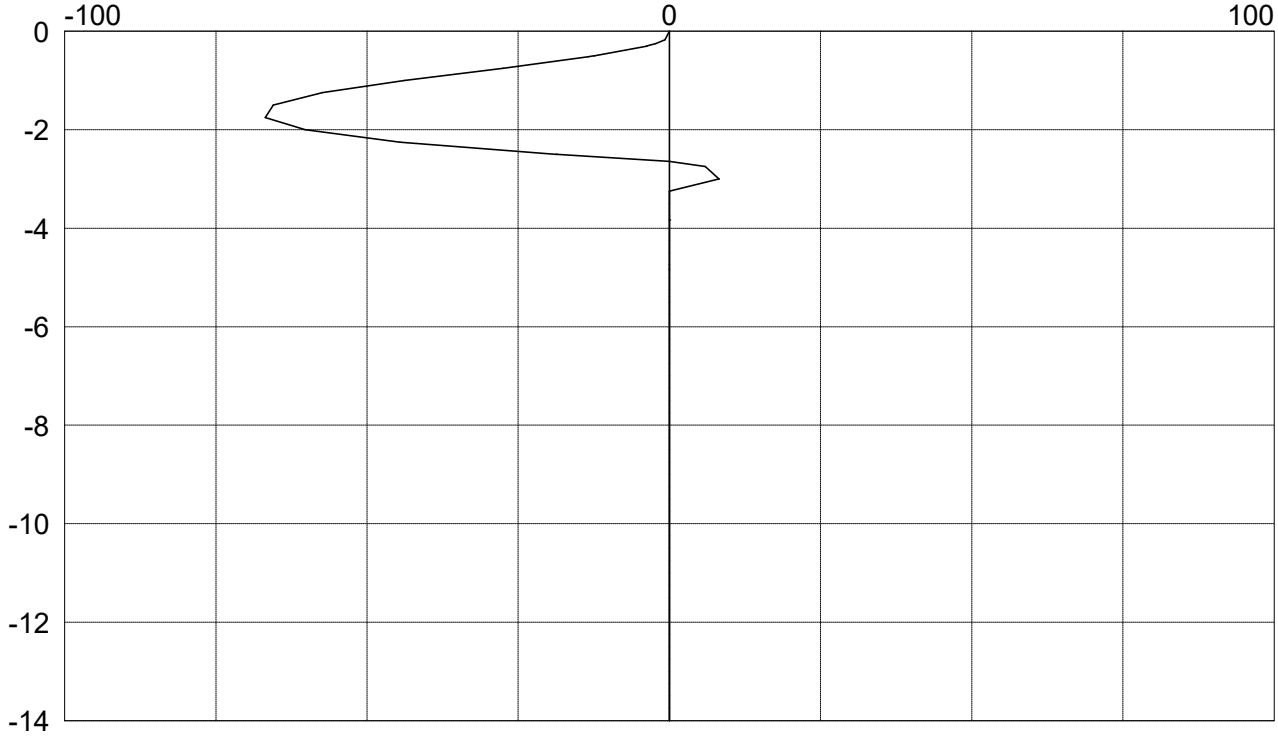
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	5.0	.0	-5.0	0	0	.4		.00
-.17	3.1	179.5	.0	3.1	17.9	.0	161.6	.8	-13.6	.4		.16
-.30	5.4	157.4	.0	5.4	27.4	.0	130.0	3.7	-32.0	.3	.0	.13
-.30	5.4	157.0	.0	5.4	27.6	.0	129.5	3.8	-32.3	.3		.13
-.50	9.0	122.5	.0	9.0	42.3	.0	80.1	12.4	-53.1	.3	.0	.15
-.50	9.0	122.1	.0	9.0	42.5	.0	79.6	12.5	-53.2	.3		.15
-.52	9.4	119.1	.0	9.4	43.8	.0	75.3	13.4	-54.6	.3		.15
-1.00	18.0	35.2	.0	18.0	79.7	.0	-44.5	43.7	-62.0	.2		.25
m -2.00	36.0	10.0	.0	36.0	154.4	.0	-144.4	60.2	43.8	.1		.65
m -2.50	45.0	12.5	.0	45.0	191.8	.0	-179.3	18.8	124.7	.1	.0	.92
m -2.50	45.0	12.5	.0	45.0	118.5	.0	-106.0	18.7	124.7	.1		.92
m -2.50	45.0	12.5	.0	45.0	118.6	.0	-106.1	18.5	124.9	.1		.92
m -2.64	47.7	13.2	.0	47.7	125.5	.0	-112.2	0	140.4	.1		1.00
m -3.00	54.5	15.0	.0	54.5	142.6	.0	-127.6	-8.2	46.4	.1		1.20
m -3.00	54.5	15.0	.0	54.5	142.7	.0	-127.7	-8.2	45.9	.1		1.20
m -3.83	70.3	19.2	.0	70.3	182.8	.0	-163.7	0	0	.1	.0	1.64
m -3.83	70.3	19.2	.0	70.3	182.9	.0	-163.8	0	0	.1		1.64
m -4.00	73.5	20.0	.0	73.5	191.1	.0	-171.1	0	0	.1		1.73
m -4.75	87.7	23.7	.0	87.7	227.2	.0	-203.4	0	0	.1		2.13
m -4.82	89.2	24.1	.0	89.2	231.0	.0	-206.8	0	0	.1		2.17
m -4.85	89.6	24.2	.0	89.6	232.1	.0	-207.9	0	0	.1		2.18
m -4.85	89.6	24.3	.0	89.6	232.2	.0	-208.0	0	0	.1		2.18
m -5.00	92.5	25.0	.0	92.5	239.5	.0	-214.5	0	0	.1		2.26
m -5.38	99.8	26.9	.0	99.8	258.1	.0	-231.1	0	0	.1		2.47
m -5.92	110.1	29.6	.0	110.1	284.2	.0	-254.6	0	0	.1		2.76
m -6.00	111.5	30.0	.0	111.5	287.9	.0	-257.9	0	0	.1		2.80
m -7.00	130.5	35.0	.0	130.5	336.3	.0	-301.3	0	0	.1		3.33
m -8.00	149.5	40.0	.0	149.5	384.7	.0	-344.7	0	0	0		3.84
m -9.00	168.5	45.0	.0	168.5	433.0	.0	-388.0	0	0	0		4.32
w -10.00	187.5	.0	50.5	187.5	481.4	.0	-431.0	0	0	0		4.77
w -11.00	206.5	.0	60.3	206.5	529.8	.0	-469.6	0	0	0		5.19
w -12.00	225.5	.0	70.1	225.5	578.2	.0	-508.2	0	0	0		5.55
w -13.00	244.5	.0	79.9	244.5	626.6	.0	-546.8	0	0	0		5.87
w -14.00	263.5	.0	89.7	263.5	675.0	.0	-585.3	0	0	0		6.13

Graphical results from analysis of stage ref 1

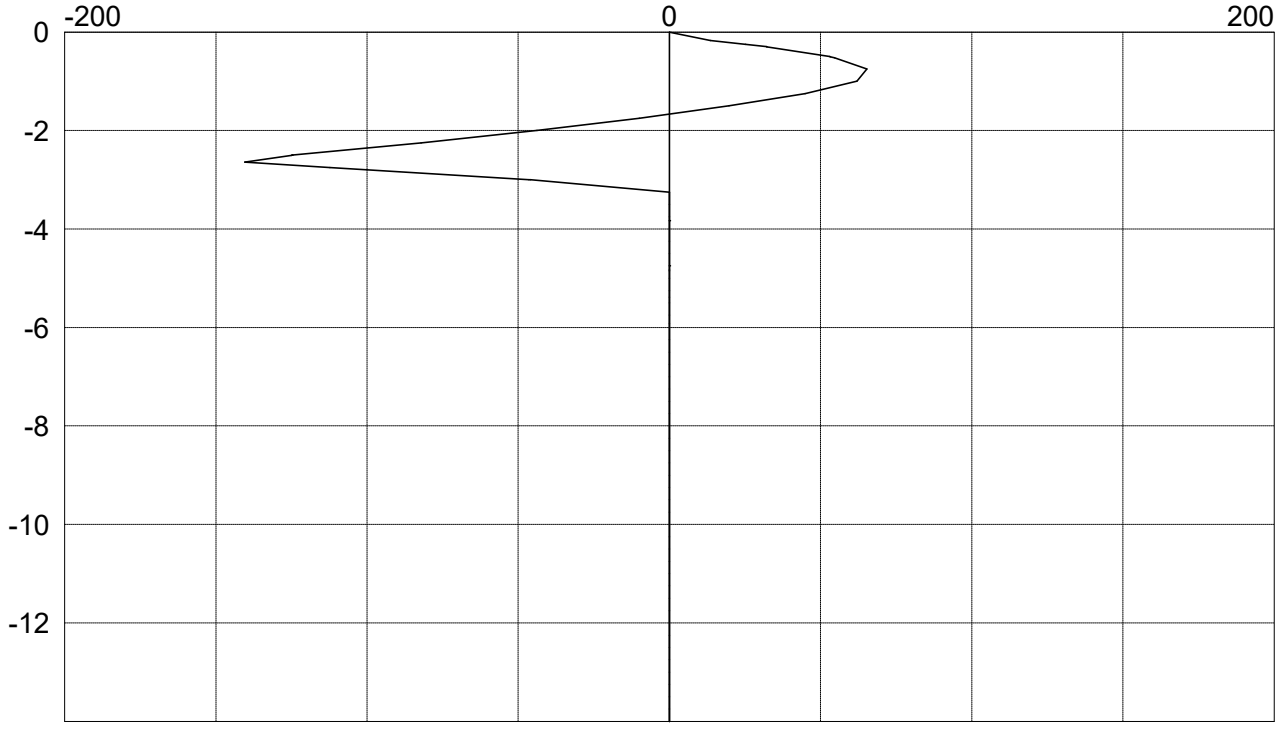




Graphical results from analysis of stage ref 1 continued

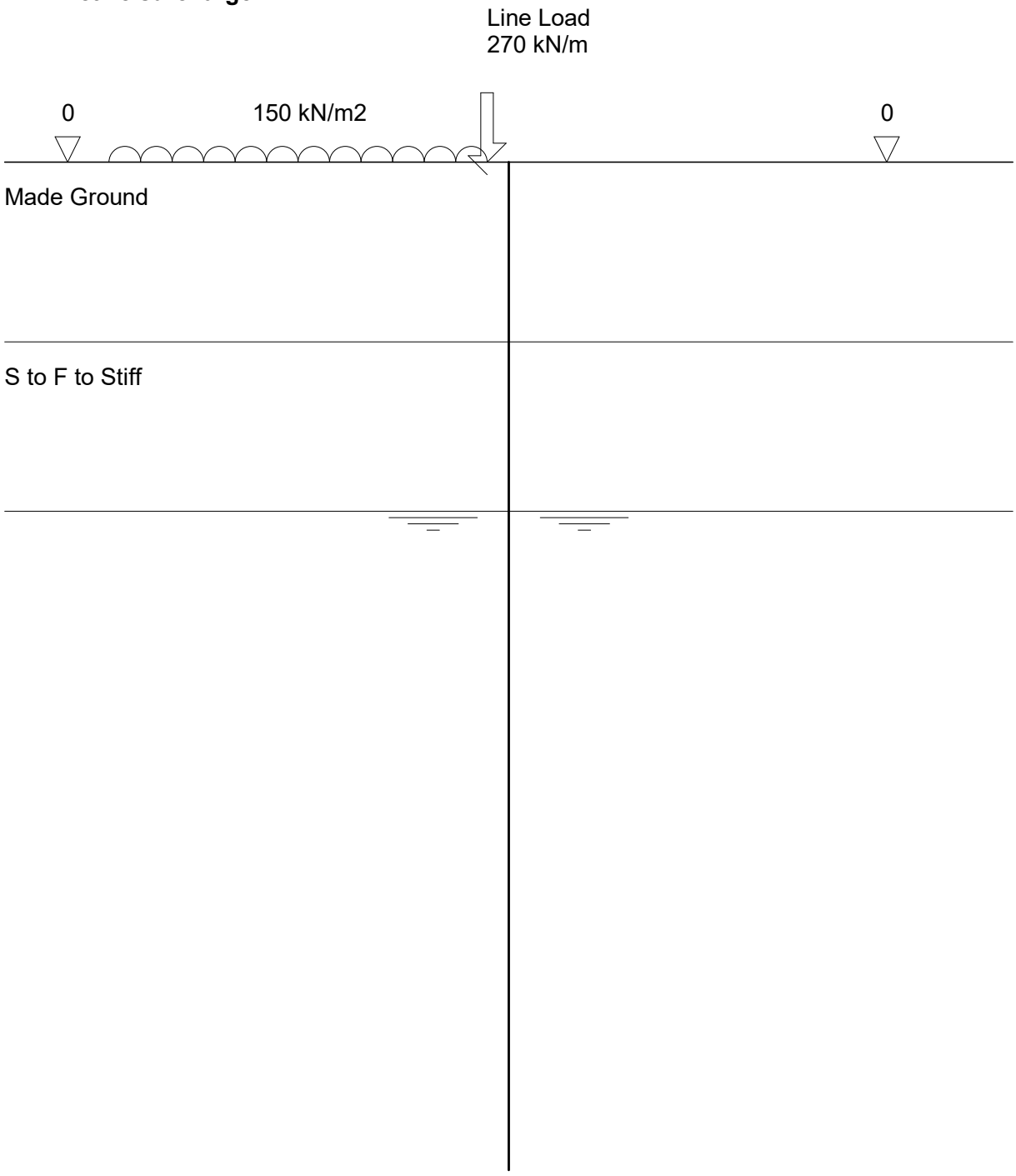


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

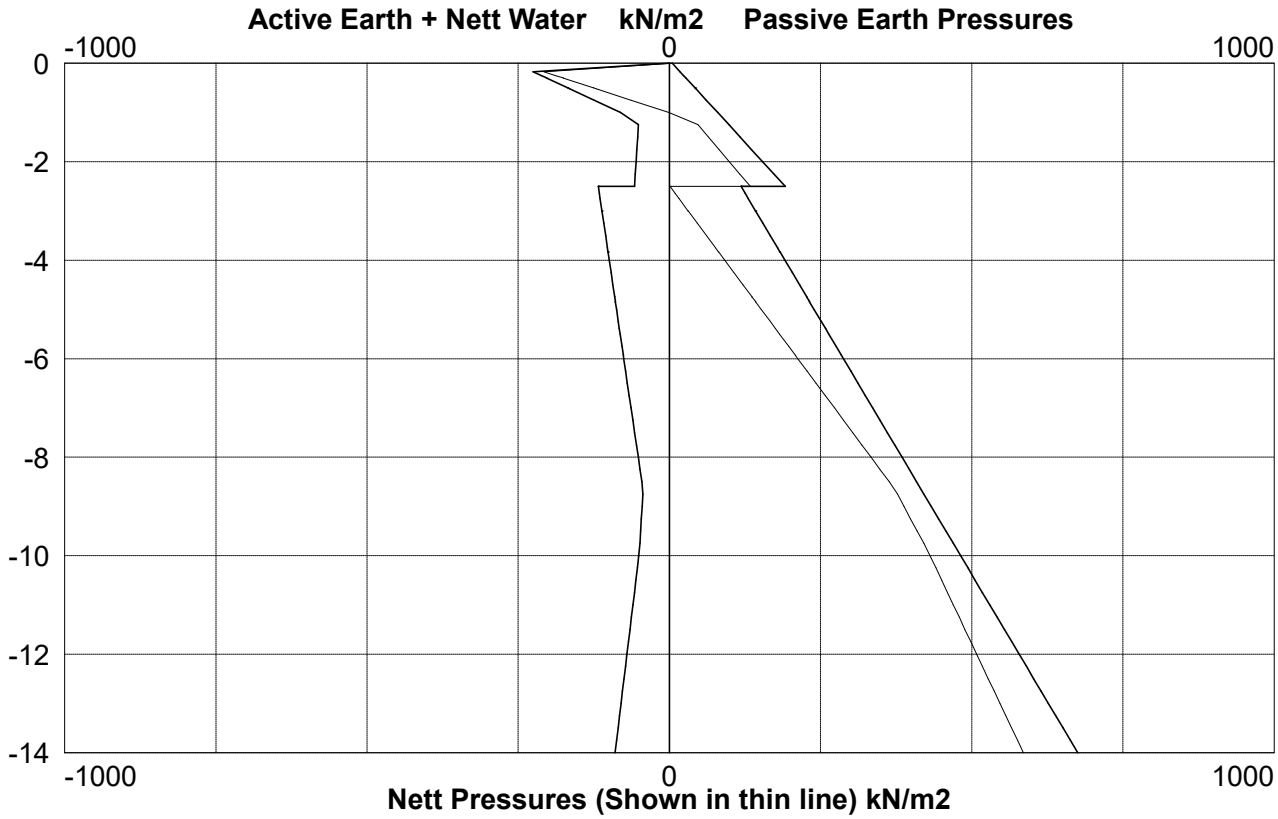
Stage ref. **2**
Stage type **Active surcharge**

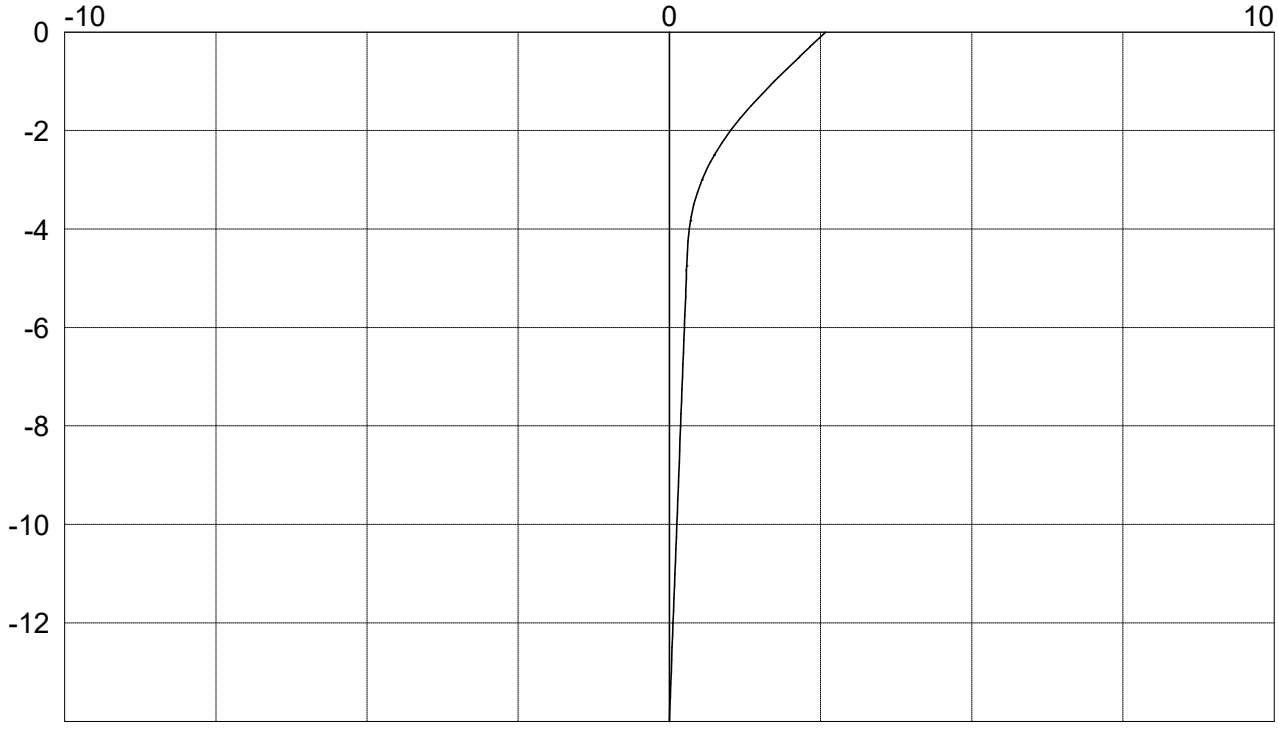


Tabular results from analysis of stage ref 2

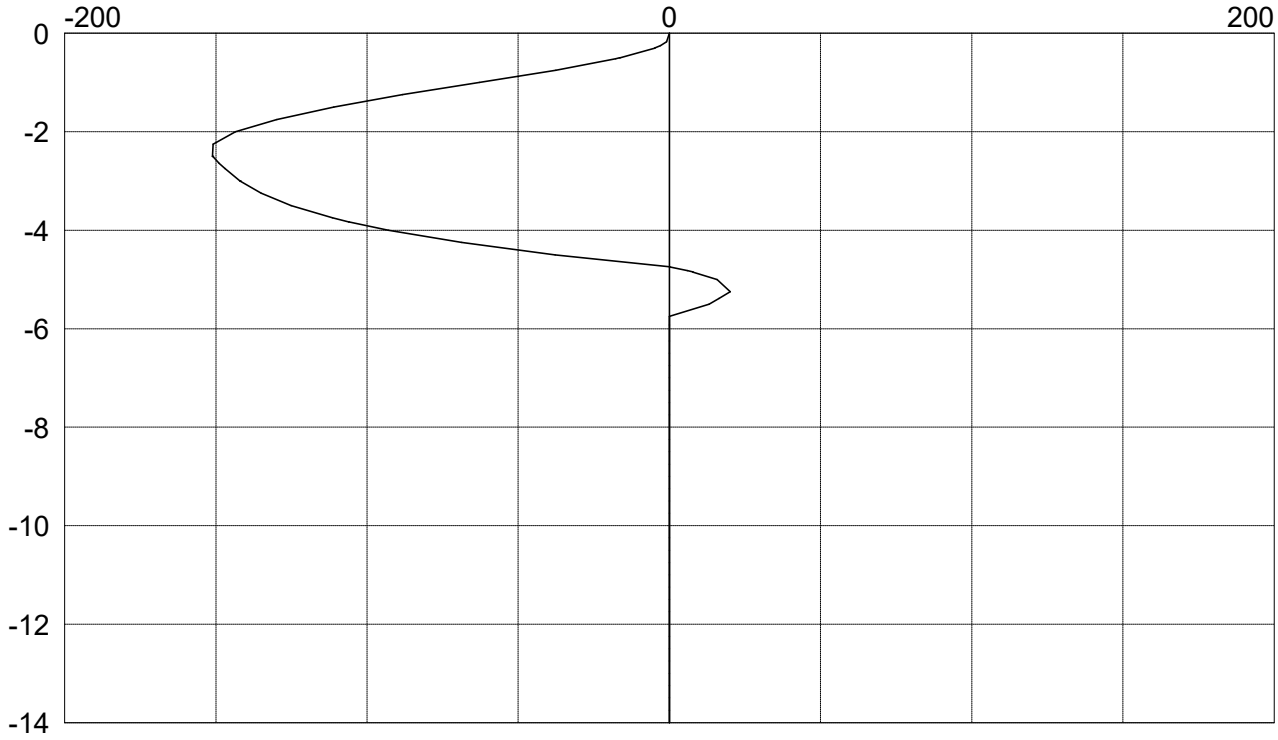
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	5.0	.0	-5.0	0	0	2.6		.00
-.17	153.1	225.1	.0	3.1	17.9	.0	207.2	1.0	-17.5	2.4		.12
-.30	155.4	203.0	.0	5.4	27.4	.0	175.6	4.8	-41.8	2.3	.0	.10
-.30	155.4	202.7	.0	5.4	27.6	.0	175.1	4.9	-42.1	2.3		.10
-.50	159.0	168.1	.0	9.0	42.3	.0	125.8	16.3	-71.9	2.2	.0	.12
-.50	159.0	167.8	.0	9.0	42.5	.0	125.3	16.5	-72.2	2.2		.12
-.52	159.4	164.7	.0	9.4	43.8	.0	120.9	17.8	-74.3	2.1		.12
-1.00	168.0	80.8	.0	18.0	79.7	.0	1.2	62.8	-103.7	1.7		.19
-2.00	186.0	55.1	.0	36.0	154.4	.0	-99.3	143.5	-42.9	1.0		.43
-2.50	195.0	57.9	.0	45.0	191.8	.0	-133.9	151.1	15.4	.7	.0	.58
-2.50	195.0	117.5	.0	45.0	118.5	.0	-1.0	151.1	15.4	.7		.58
-2.50	195.0	117.4	.0	45.0	118.6	.0	-1.1	151.1	15.4	.7		.58
-2.64	197.7	115.7	.0	47.7	125.5	.0	-9.7	148.8	16.2	.7		.62
-3.00	204.5	111.5	.0	54.5	142.6	.0	-31.1	142.1	23.4	.5		.71
-3.00	204.5	111.5	.0	54.5	142.7	.0	-31.2	142.0	23.4	.5		.71
-3.83	220.3	101.5	.0	70.3	182.8	.0	-81.4	106.0	70.2	.4	.0	.86
-3.83	220.3	101.5	.0	70.3	182.9	.0	-81.5	105.9	70.3	.3		.86
-4.00	223.5	99.4	.0	73.5	191.1	.0	-91.6	92.9	84.9	.3		.89
-4.75	237.7	90.5	.0	87.7	227.2	.0	-136.7	0	170.0	.3		1.00
-4.82	239.2	89.5	.0	89.2	231.0	.0	-141.4	-5.9	156.1	.3		1.01
-4.85	239.6	89.3	.0	89.6	232.1	.0	-142.9	-7.7	151.8	.3		1.02
-4.85	239.7	89.2	.0	89.6	232.2	.0	-143.0	-7.9	151.4	.3		1.02
-5.00	242.5	87.4	.0	92.5	239.5	.0	-152.0	-15.8	124.5	.3		1.04
-5.38	249.8	82.8	.0	99.8	258.1	.0	-175.2	-16.4	55.7	.3		1.09
-5.92	260.1	76.3	.0	110.1	284.2	.0	-207.9	0	0	.3		1.18
-6.00	261.5	75.4	.0	111.5	287.9	.0	-212.5	0	0	.2		1.19
-7.00	280.5	63.4	.0	130.5	336.3	.0	-272.9	0	0	.2		1.35
-8.00	299.5	51.4	.0	149.5	384.7	.0	-333.3	0	0	.2		1.53
m -9.00	318.5	45.0	.0	168.5	433.0	.0	-388.0	0	0	.2		1.72
w -10.00	337.5	.0	50.5	187.5	481.4	.0	-431.0	0	0	.1		1.93
w -11.00	356.5	.0	60.3	206.5	529.8	.0	-469.6	0	0	.1		2.15
w -12.00	375.5	.0	70.1	225.5	578.2	.0	-508.2	0	0	.1		2.37
w -13.00	394.5	.0	79.9	244.5	626.6	.0	-546.8	0	0	0		2.59
w -14.00	413.5	.0	89.7	263.5	675.0	.0	-585.3	0	0	0		2.82

Graphical results from analysis of stage ref 2

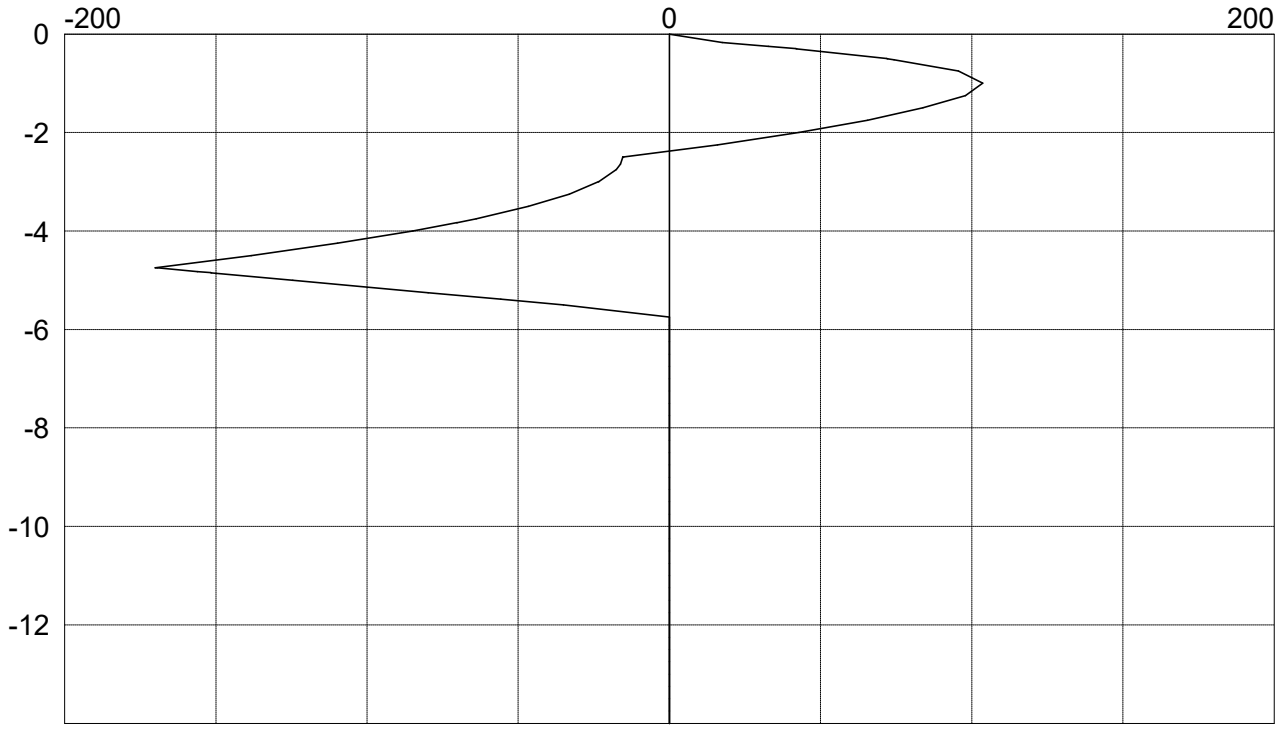




Graphical results from analysis of stage ref 2 continued

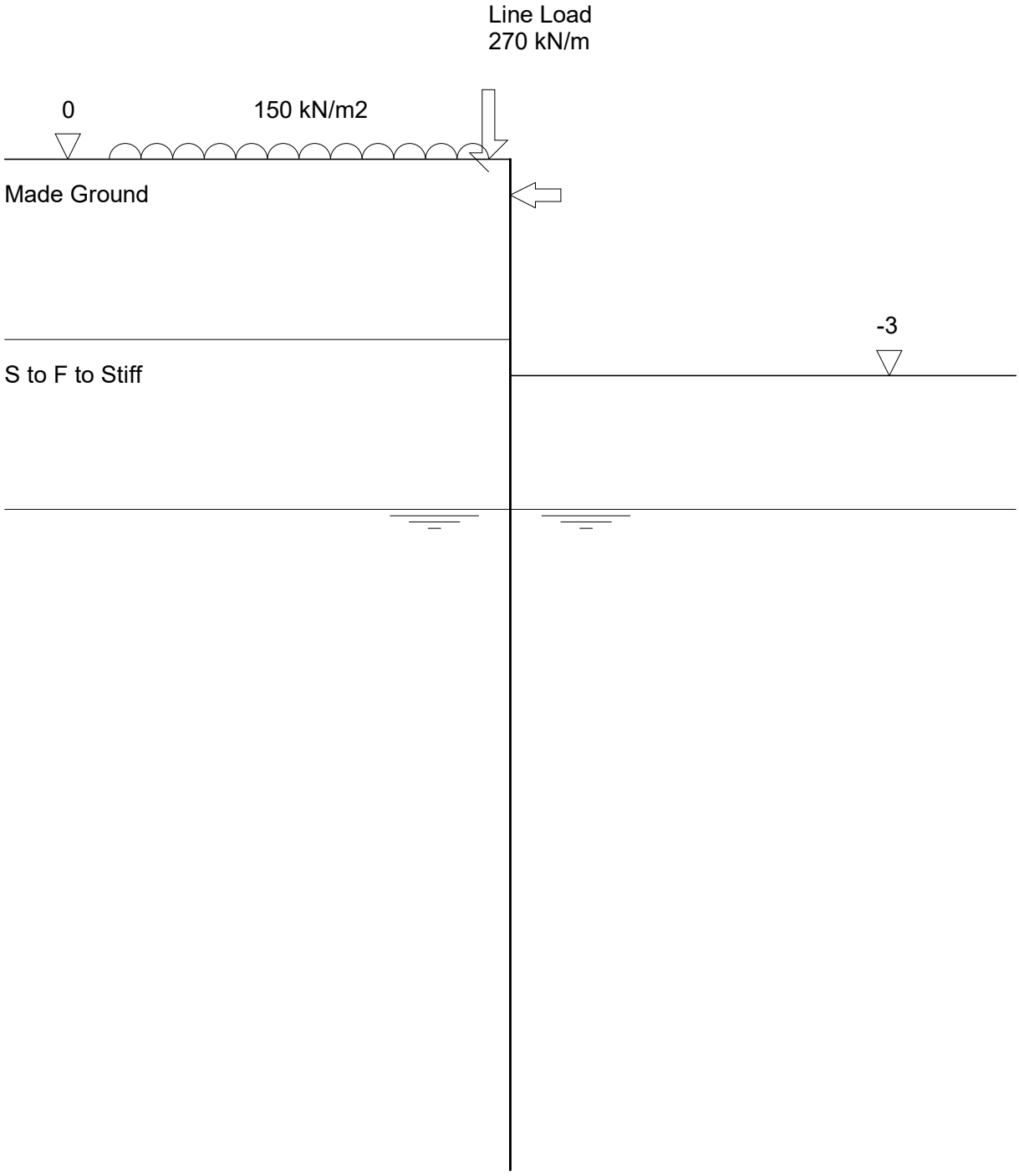


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

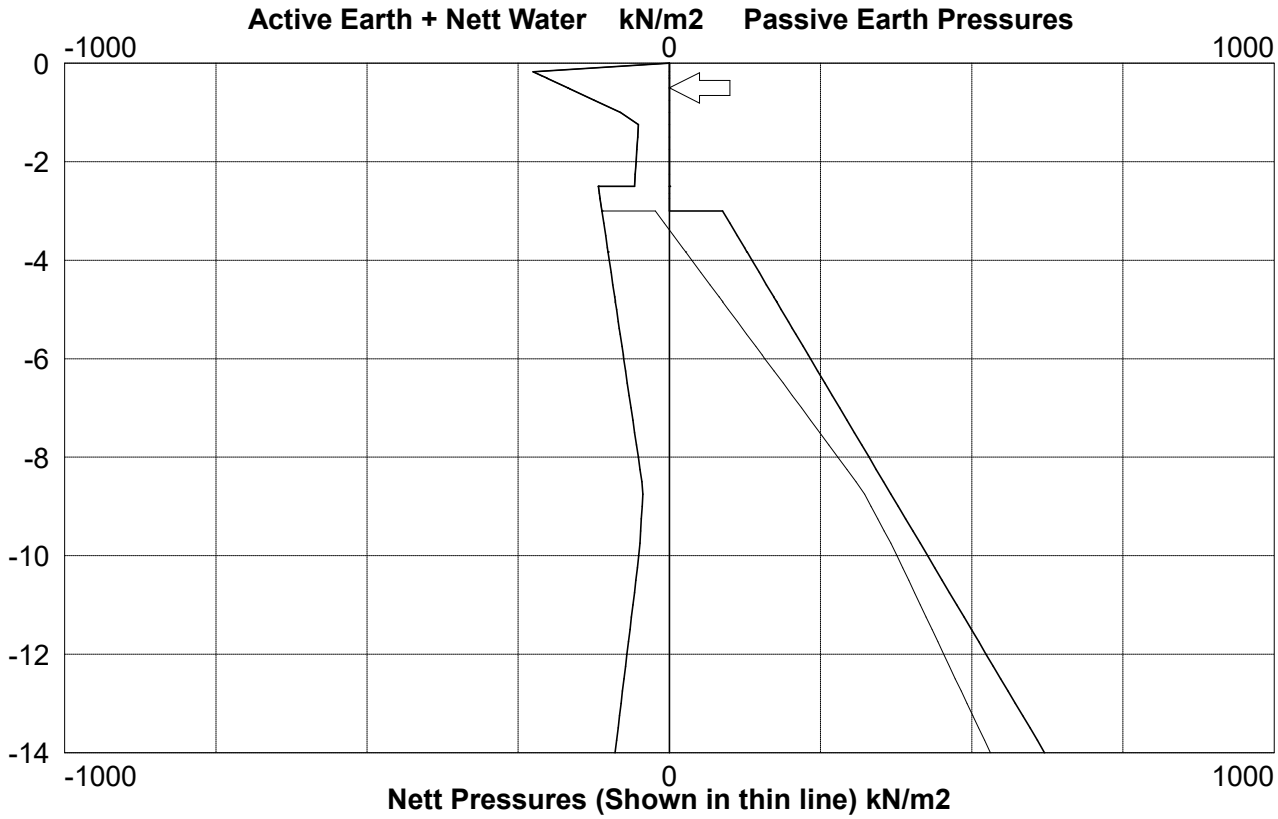
Stage ref. **4**
Stage type **Passive side excavation**

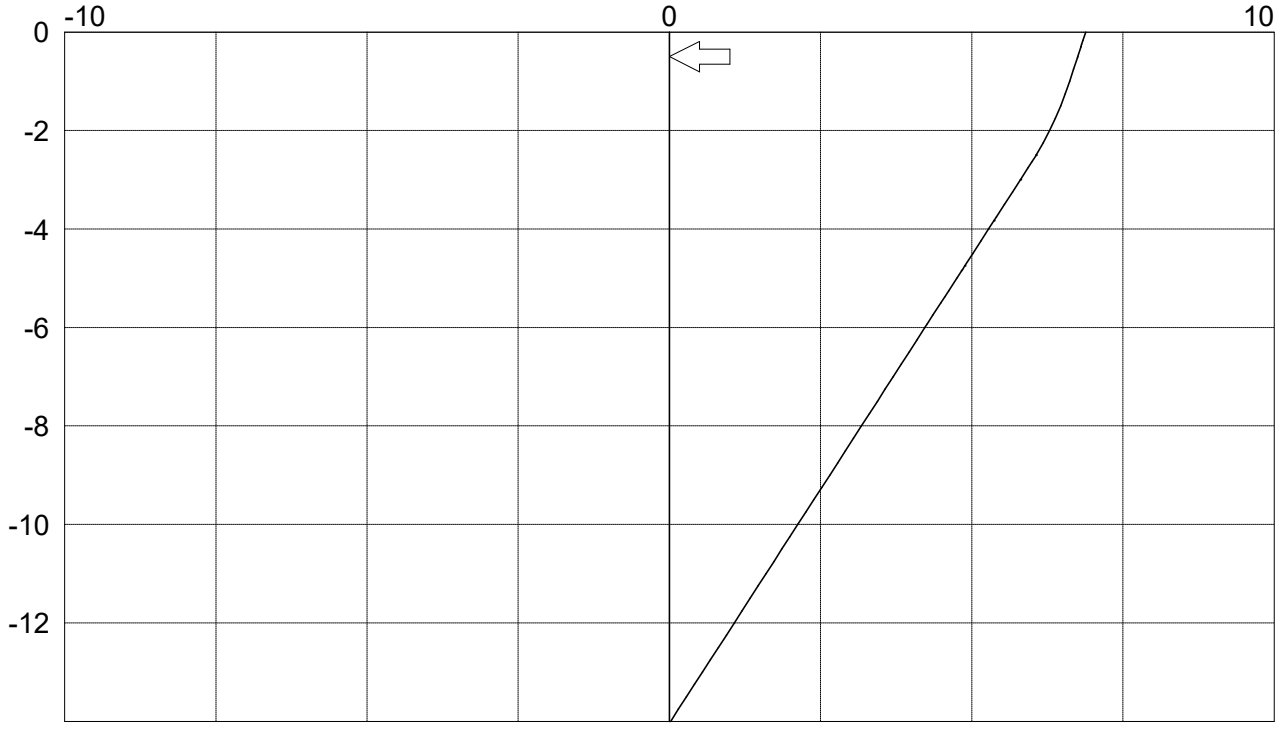


Tabular results from analysis of stage ref 4

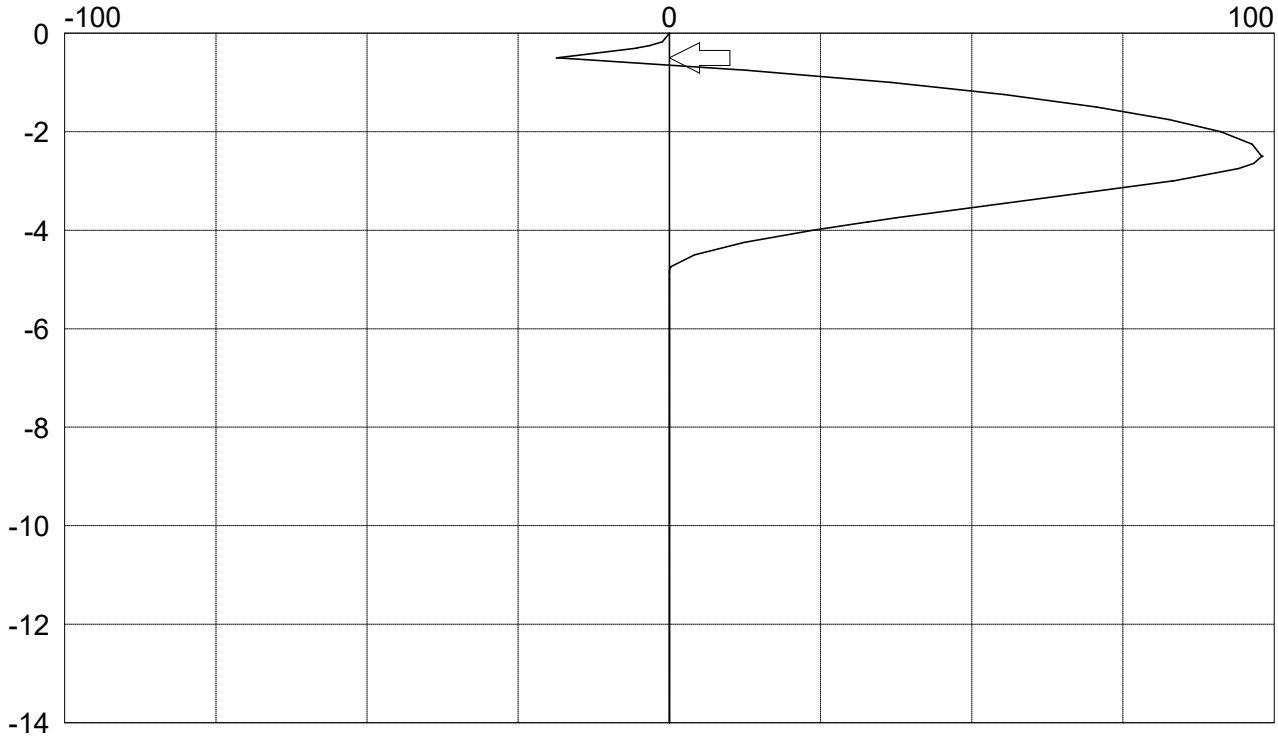
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	6.9		.00
-.17	153.1	225.1	.0	.0	.0	.0	225.1	1.1	-19.5	6.8		.00
-.30	155.4	203.0	.0	.0	.0	.0	203.0	5.3	-46.6	6.8	.0	.00
-.30	155.4	202.7	.0	.0	.0	.0	202.7	5.4	-47.0	6.8		.00
-.50	159.0	168.1	.0	.0	.0	.0	168.1	18.5	-83.8	6.8	229.8	.00
-.50	159.0	167.8	.0	.0	.0	.0	167.8	18.7	145.7	6.8		.00
-.52	159.4	164.7	.0	.0	.0	.0	164.7	16.1	142.8	6.7		.00
-1.00	168.0	80.8	.0	.0	.0	.0	80.8	-36.7	83.8	6.6		.00
-2.00	186.0	55.1	.0	.0	.0	.0	55.1	-91.2	27.5	6.3		.00
-2.50	195.0	57.9	.0	.0	.0	.0	57.9	-98.0	-.7	6.1	.0	.00
-2.50	195.0	117.5	.0	.0	.0	.0	117.5	-98.0	-.7	6.1		.00
-2.50	195.0	117.4	.0	.0	.0	.0	117.4	-98.0	-1.0	6.1		.00
-2.64	197.7	115.7	.0	.0	.0	.0	115.7	-96.7	-17.5	6.0		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-83.3	-57.7	5.8		.00
-3.00	204.5	111.5	.0	.0	88.2	.0	23.3	-83.2	-57.9	5.8		.00
-3.83	220.3	101.5	.0	15.8	128.3	.0	-26.9	-32.9	-56.4	5.4	.0	.54
-3.83	220.3	101.5	.0	15.8	128.4	.0	-27.0	-32.8	-56.3	5.4		.55
-4.00	223.5	99.4	.0	19.0	136.6	.0	-37.1	-23.7	-50.9	5.3		.63
-4.75	237.7	90.5	.0	33.2	172.7	.0	-82.2	-.2	-6.4	4.9		.97
-4.82	239.2	89.5	.0	34.7	176.5	.0	-86.9	0	0	4.8		1.00
-4.85	239.6	89.3	.0	35.1	177.6	.0	-88.4	0	0	4.8		1.01
-4.85	239.7	89.2	.0	35.2	177.7	.0	-88.5	0	0	4.8		1.01
-5.00	242.5	87.4	.0	38.0	185.0	.0	-97.5	0	0	4.8		1.08
-5.38	249.8	82.8	.0	45.3	203.6	.0	-120.7	0	0	4.6		1.25
-5.92	260.1	76.3	.0	55.6	229.7	.0	-153.4	0	0	4.3		1.50
-6.00	261.5	75.4	.0	57.0	233.4	.0	-158.0	0	0	4.2		1.54
-7.00	280.5	63.4	.0	76.0	281.8	.0	-218.4	0	0	3.7		2.06
-8.00	299.5	51.4	.0	95.0	330.2	.0	-278.8	0	0	3.2		2.68
m -9.00	318.5	45.0	.0	114.0	378.5	.0	-333.5	0	0	2.6		3.42
w -10.00	337.5	.0	50.5	133.0	426.9	.0	-376.5	0	0	2.1		4.15
w -11.00	356.5	.0	60.3	152.0	475.3	.0	-415.1	0	0	1.6		4.79
w -12.00	375.5	.0	70.1	171.0	523.7	.0	-453.7	0	0	1.1		5.28
w -13.00	394.5	.0	79.9	190.0	572.1	.0	-492.3	0	0	.5		5.63
w -14.00	413.5	.0	89.7	209.0	620.5	.0	-530.8	0	0	0		5.88

Graphical results from analysis of stage ref 4

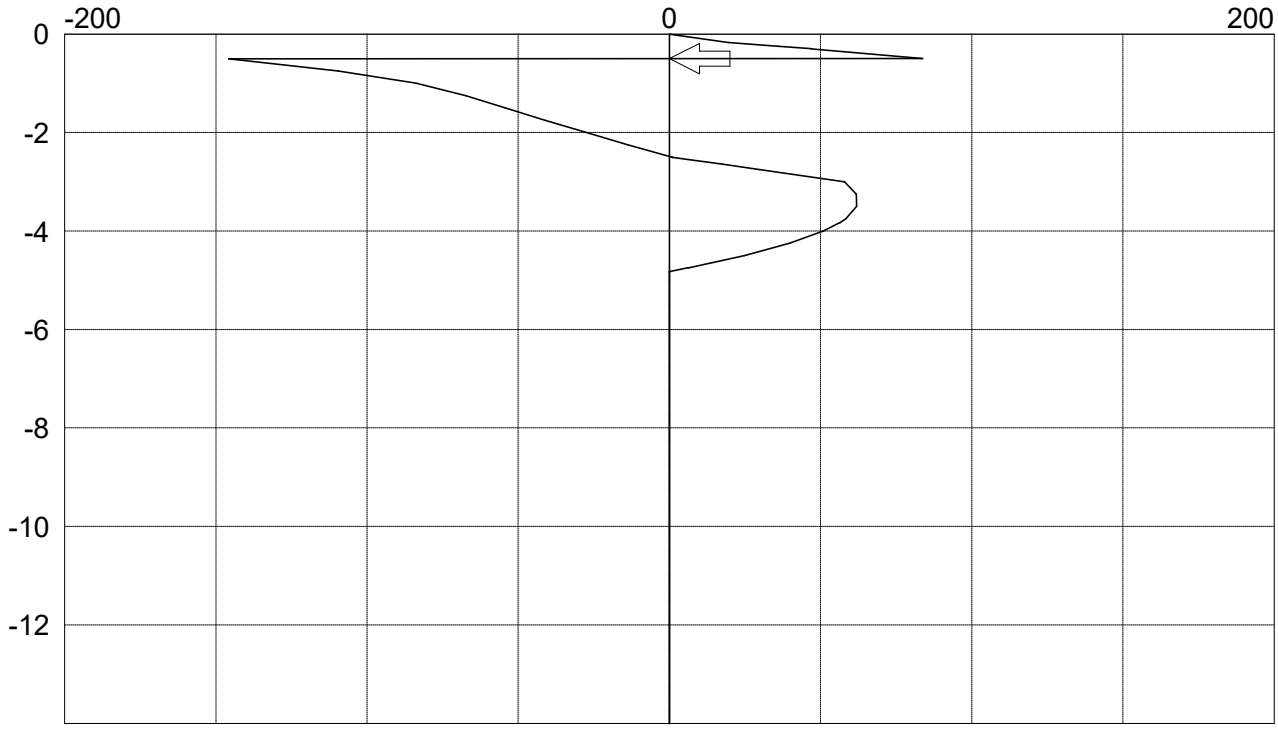




Graphical results from analysis of stage ref 4 continued

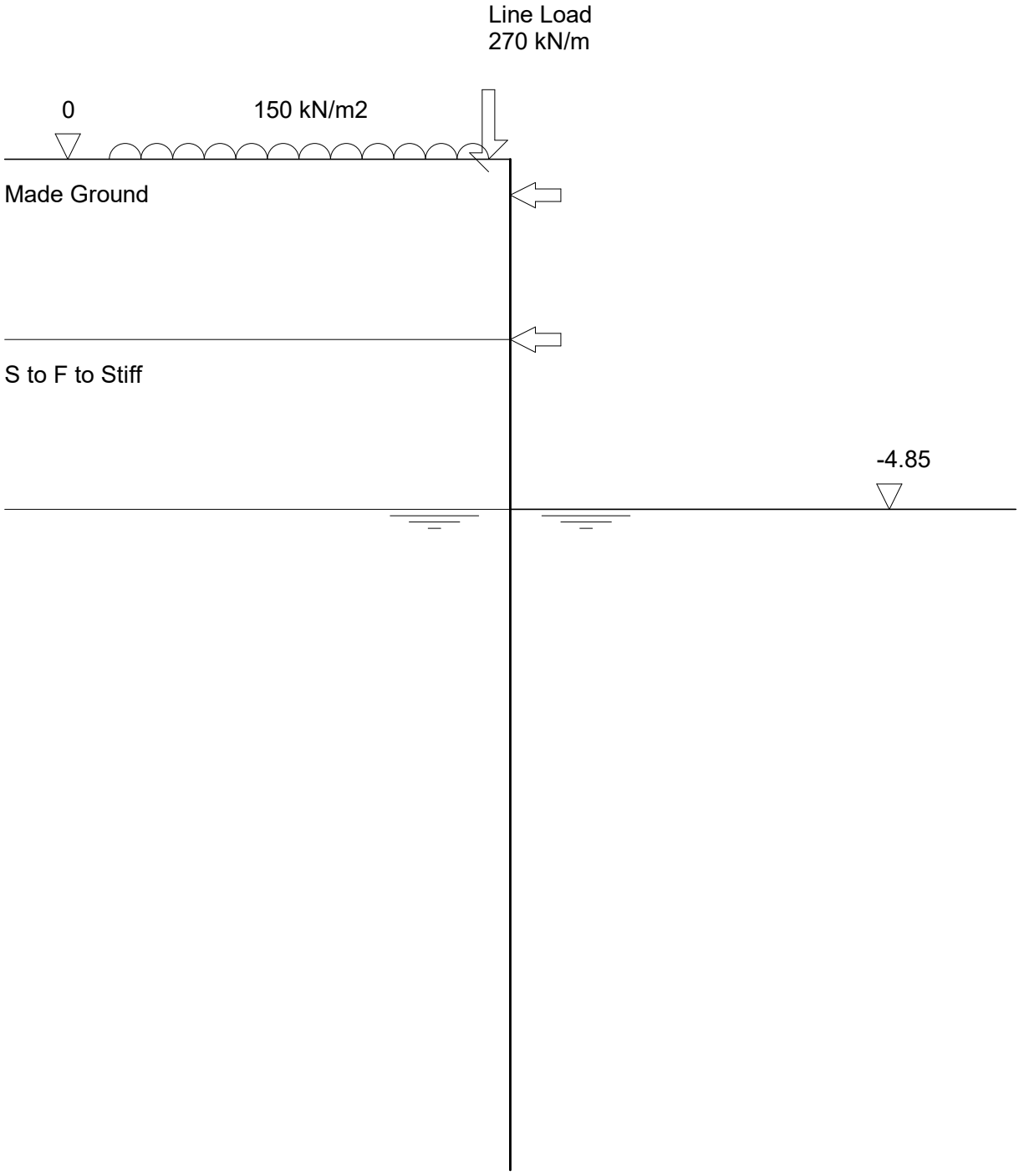


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

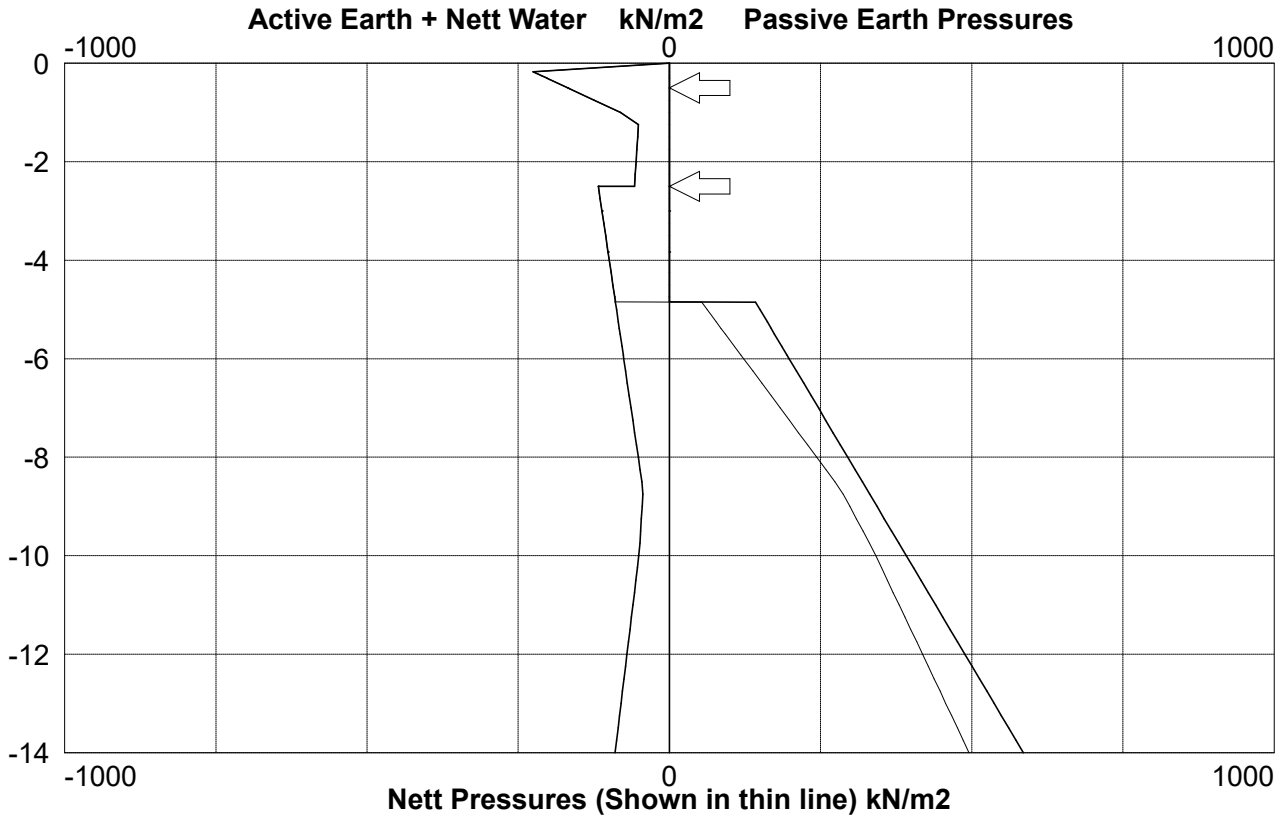
Stage ref. **6**
Stage type **Passive side excavation**

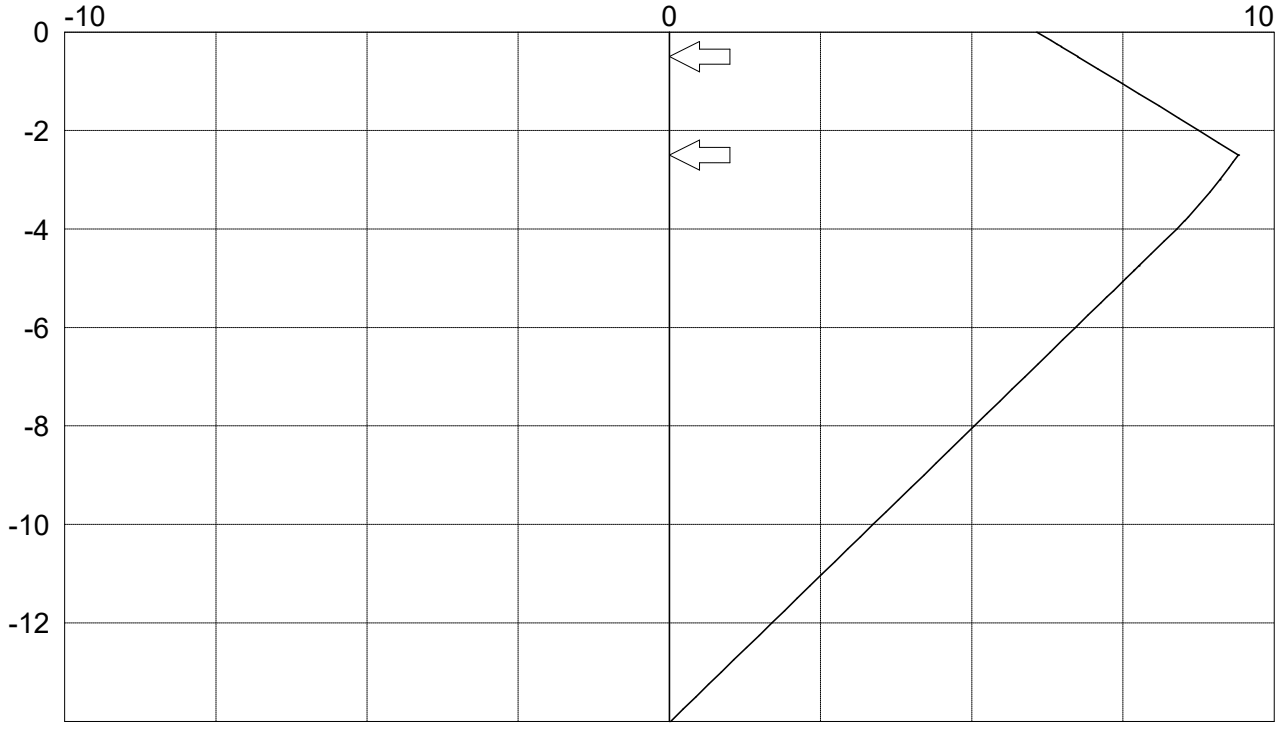


Tabular results from analysis of stage ref 6

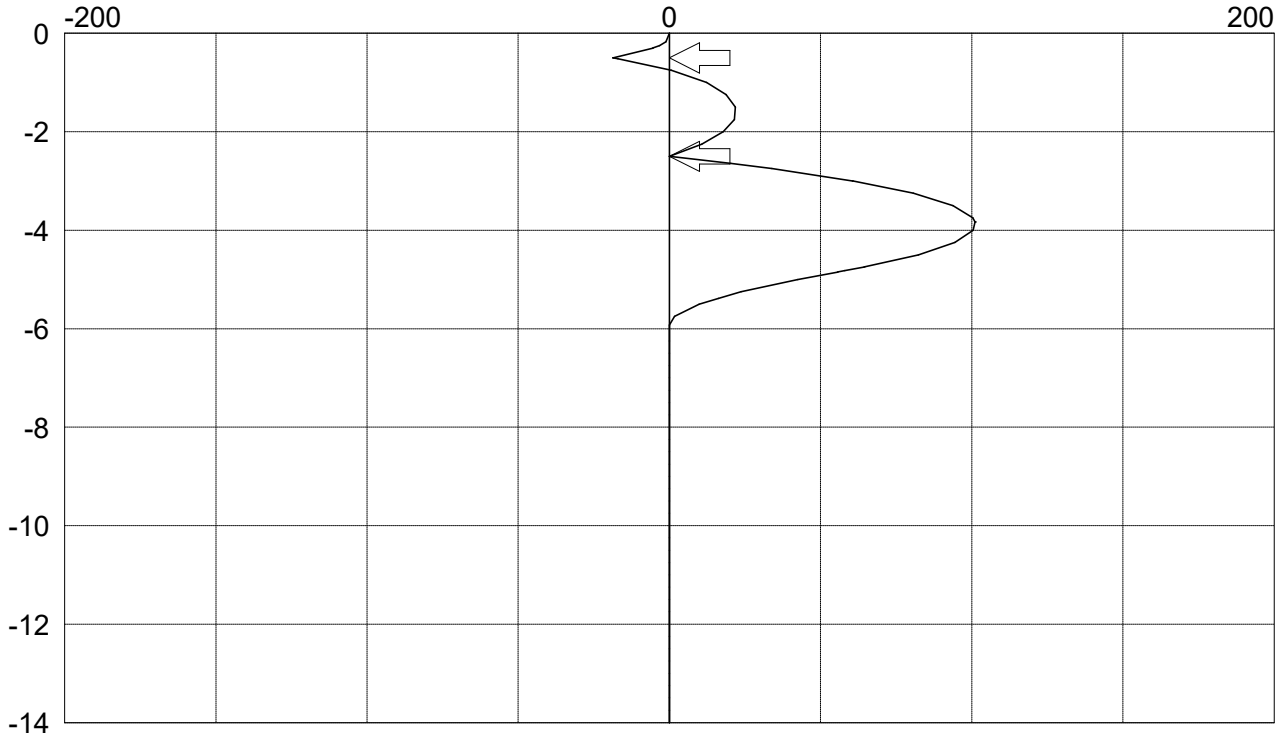
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	6.1		.00
-.17	153.1	225.1	.0	.0	.0	.0	225.1	1.1	-19.5	6.3		.00
-.30	155.4	203.0	.0	.0	.0	.0	203.0	5.3	-46.6	6.5	.0	.00
-.30	155.4	202.7	.0	.0	.0	.0	202.7	5.4	-47.0	6.5		.00
-.50	159.0	168.1	.0	.0	.0	.0	168.1	18.5	-83.8	6.8	180.8	.00
-.50	159.0	167.8	.0	.0	.0	.0	167.8	18.7	96.7	6.8		.00
-.52	159.4	164.7	.0	.0	.0	.0	164.7	17.0	93.8	6.8		.00
-1.00	168.0	80.8	.0	.0	.0	.0	80.8	-12.3	34.8	7.4		.00
-2.00	186.0	55.1	.0	.0	.0	.0	55.1	-17.8	-21.5	8.8		.00
-2.50	195.0	57.9	.0	.0	.0	.0	57.9	0	-49.7	9.4	200.4	.00
-2.50	195.0	117.5	.0	.0	.0	.0	117.5	0	150.7	9.4		.00
-2.50	195.0	117.4	.0	.0	.0	.0	117.4	-.2	150.5	9.4		.00
-2.64	197.7	115.7	.0	.0	.0	.0	115.7	-20.3	133.9	9.3		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-60.6	93.7	9.1		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-60.8	93.5	9.1		.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	-101.1	5.1	8.5	.0	.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	-101.1	4.9	8.5		.00
-4.00	223.5	99.4	.0	.0	.0	.0	99.4	-100.5	-12.0	8.4		.00
-4.75	237.7	90.5	.0	.0	.0	.0	90.5	-64.7	-82.8	7.8		.00
-4.82	239.2	89.5	.0	.0	.0	.0	89.5	-58.0	-89.8	7.7		.00
-4.85	239.6	89.3	.0	.0	.0	.0	89.3	-55.8	-92.0	7.7		.00
-4.85	239.7	89.2	.0	.0	142.6	.0	-53.3	-55.6	-92.0	7.7		.00
-5.00	242.5	87.4	.0	2.9	149.8	.0	-62.4	-42.4	-83.4	7.6		.18
-5.38	249.8	82.8	.0	10.1	168.4	.0	-85.6	-16.3	-54.5	7.2		.55
-5.92	260.1	76.3	.0	20.4	194.5	.0	-118.2	0	0	6.8		1.00
-6.00	261.5	75.4	.0	21.9	198.2	.0	-122.8	0	0	6.7		1.06
-7.00	280.5	63.4	.0	40.9	246.6	.0	-183.2	0	0	5.9		1.79
-8.00	299.5	51.4	.0	59.9	295.0	.0	-243.6	0	0	5.0		2.55
m -9.00	318.5	45.0	.0	78.9	343.4	.0	-298.4	0	0	4.2		3.42
w -10.00	337.5	.0	50.5	97.9	391.8	.0	-341.3	0	0	3.4		4.26
w -11.00	356.5	.0	60.3	116.9	440.2	.0	-379.9	0	0	2.5		4.92
w -12.00	375.5	.0	70.1	135.9	488.6	.0	-418.5	0	0	1.7		5.39
w -13.00	394.5	.0	79.9	154.9	537.0	.0	-457.1	0	0	.9		5.70
w -14.00	413.5	.0	89.7	173.9	585.4	.0	-495.7	0	0	0		5.89

Graphical results from analysis of stage ref 6

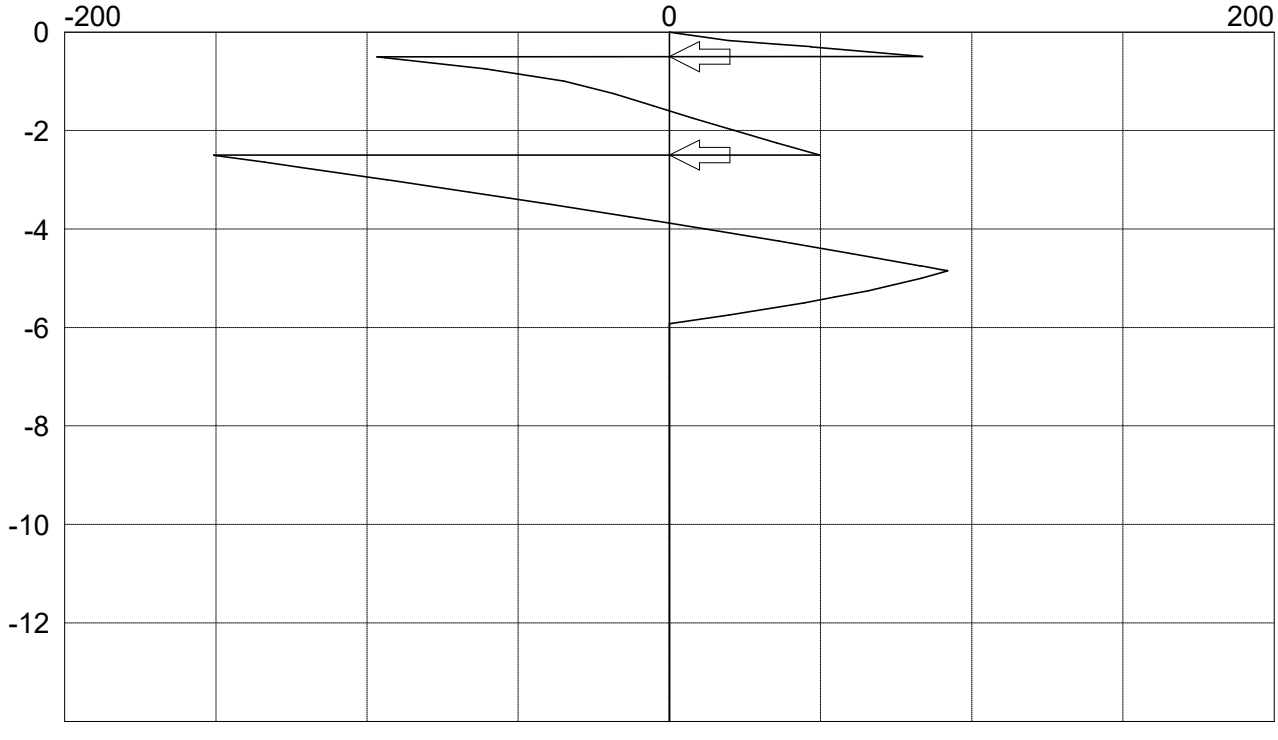




Graphical results from analysis of stage ref 6 continued

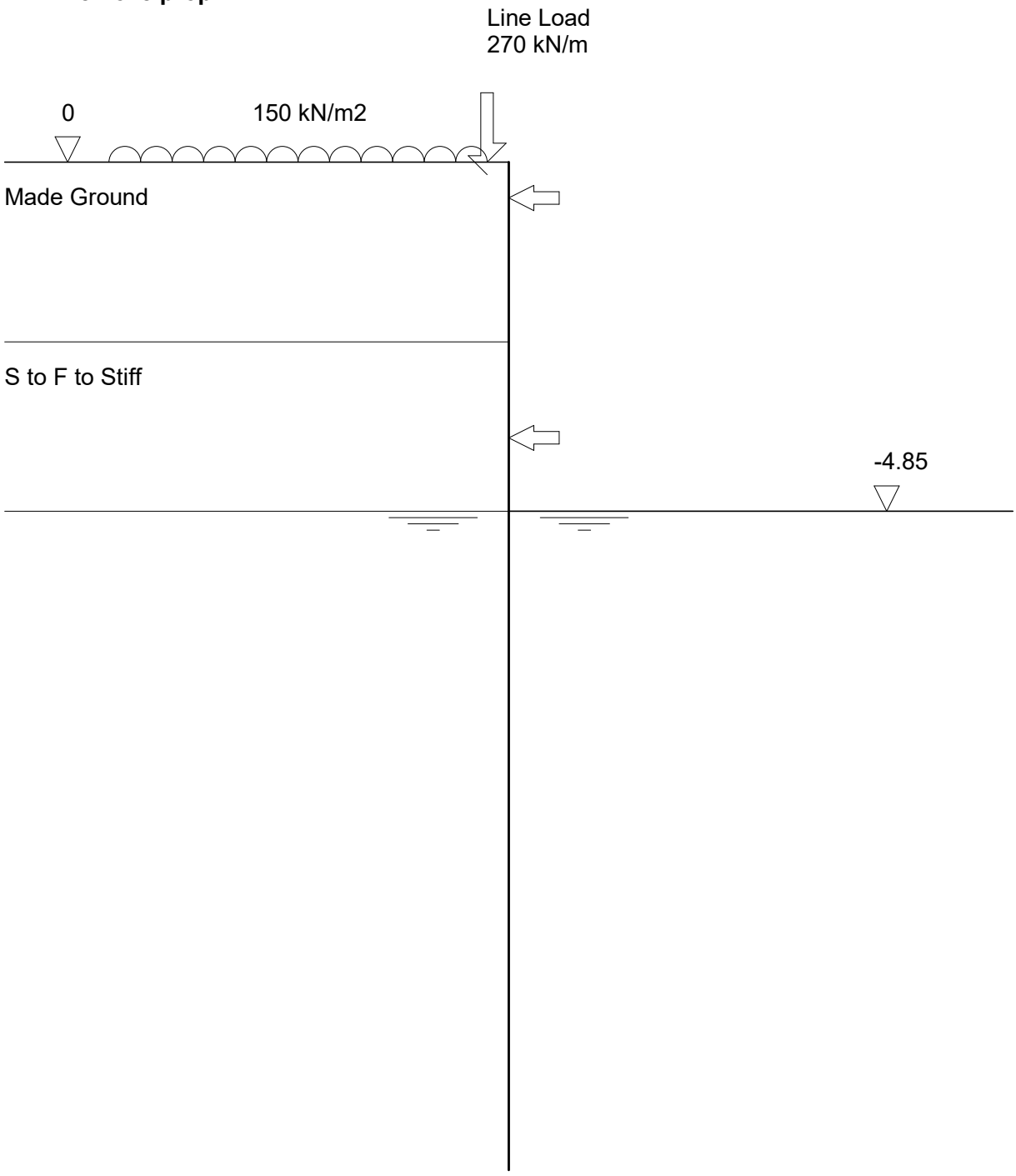


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

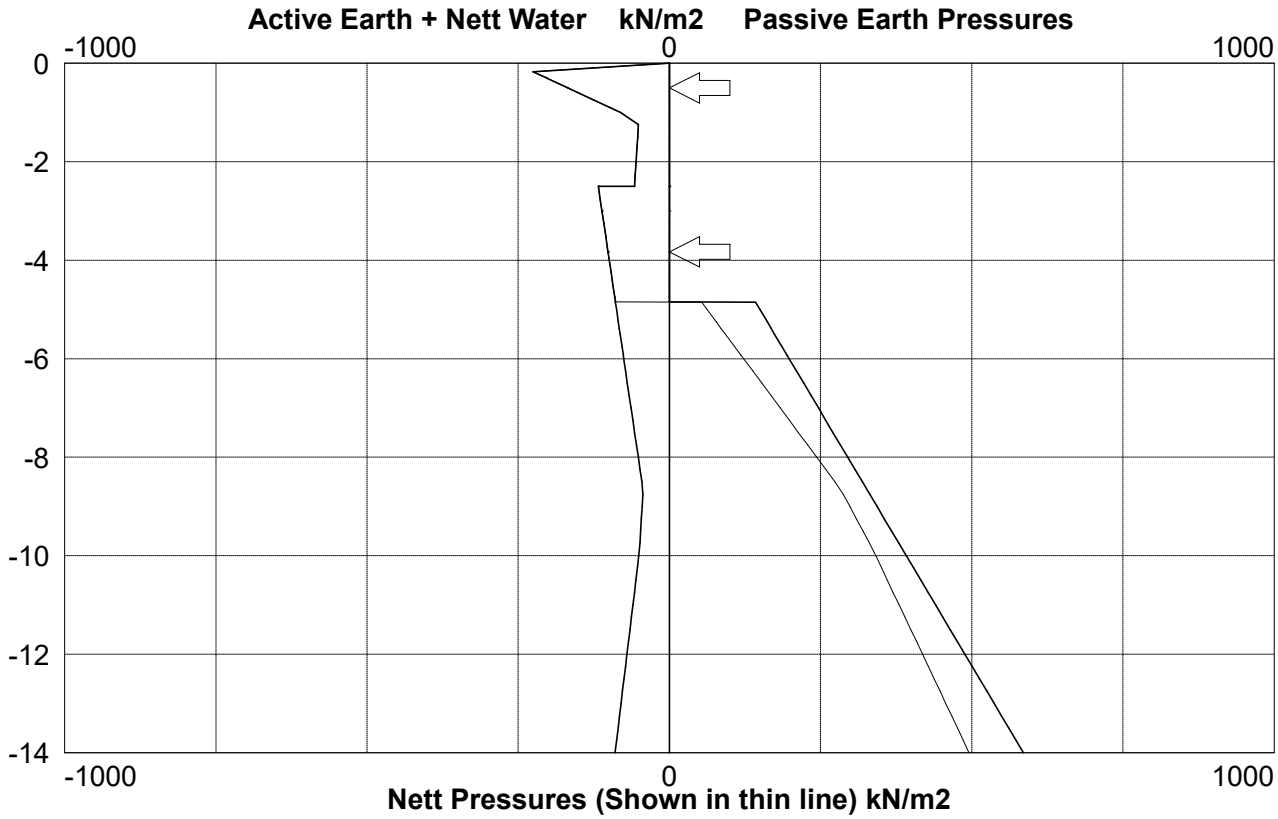
Stage ref. **8**
Stage type **Remove prop**

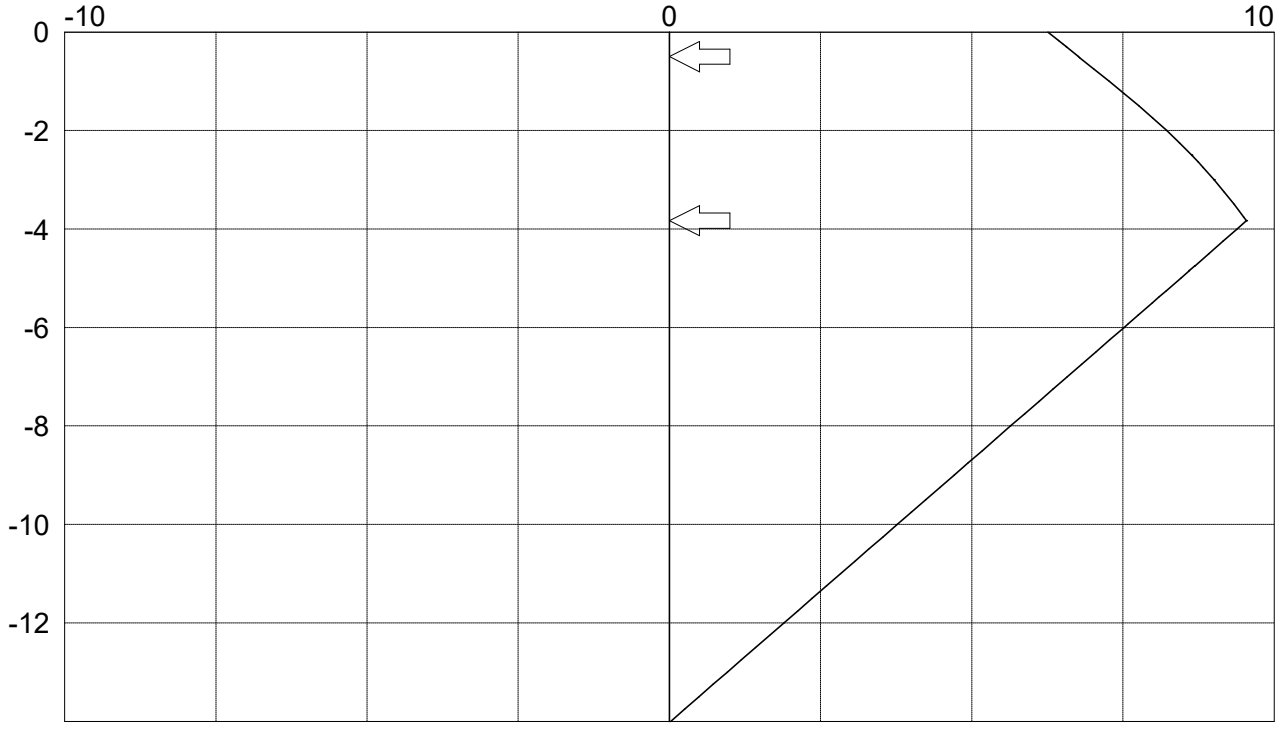


Tabular results from analysis of stage ref 8

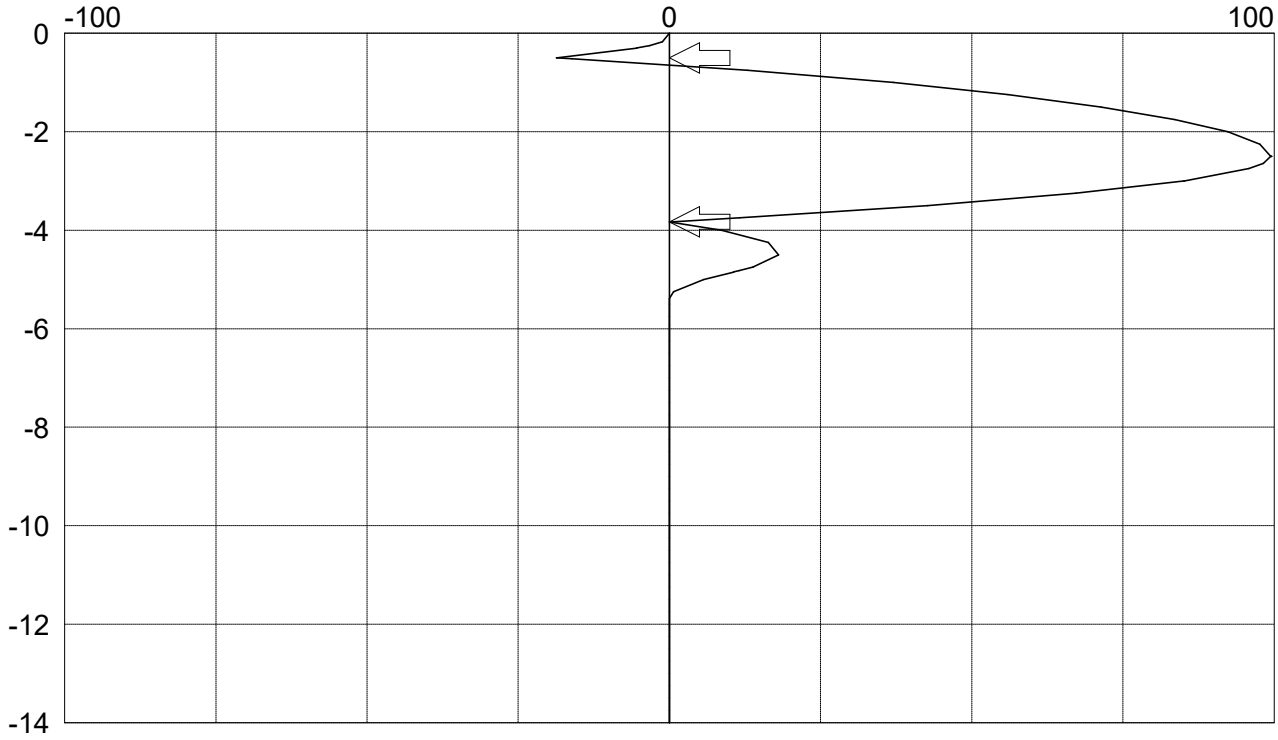
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	6.3		.00
-.17	153.1	225.1	.0	.0	.0	.0	225.1	1.1	-19.5	6.4		.00
-.30	155.4	203.0	.0	.0	.0	.0	203.0	5.3	-46.6	6.6	.0	.00
-.30	155.4	202.7	.0	.0	.0	.0	202.7	5.4	-47.0	6.6		.00
-.50	159.0	168.1	.0	.0	.0	.0	168.1	18.5	-83.8	6.8	230.6	.00
-.50	159.0	167.8	.0	.0	.0	.0	167.8	18.7	146.5	6.8		.00
-.52	159.4	164.7	.0	.0	.0	.0	164.7	16.1	143.6	6.8		.00
-1.00	168.0	80.8	.0	.0	.0	.0	80.8	-37.1	84.6	7.3		.00
-2.00	186.0	55.1	.0	.0	.0	.0	55.1	-92.3	28.3	8.2		.00
-2.50	195.0	57.9	.0	.0	.0	.0	57.9	-99.5	0	8.6	.0	.00
-2.50	195.0	117.5	.0	.0	.0	.0	117.5	-99.5	0	8.6		.00
-2.50	195.0	117.4	.0	.0	.0	.0	117.4	-99.5	-.2	8.6		.00
-2.64	197.7	115.7	.0	.0	.0	.0	115.7	-98.2	-16.8	8.7		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-85.1	-57.0	9.0		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-85.0	-57.2	9.0		.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	-.3	-145.6	9.5	205.8	.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	0	60.0	9.5		.00
-4.00	223.5	99.4	.0	.0	.0	.0	99.4	-8.7	43.1	9.4		.00
-4.75	237.7	90.5	.0	.0	.0	.0	90.5	-14.0	-27.7	8.7		.00
-4.82	239.2	89.5	.0	.0	.0	.0	89.5	-11.5	-34.8	8.6		.00
-4.85	239.6	89.3	.0	.0	.0	.0	89.3	-10.7	-36.9	8.6		.00
-4.85	239.7	89.2	.0	.0	142.6	.0	-53.3	-10.6	-36.9	8.6		.00
-5.00	242.5	87.4	.0	2.9	149.8	.0	-62.4	-5.7	-28.3	8.5		.38
-5.38	249.8	82.8	.0	10.1	168.4	.0	-85.6	0	0	8.1		.99
-5.92	260.1	76.3	.0	20.4	194.5	.0	-118.2	0	0	7.6		1.55
-6.00	261.5	75.4	.0	21.9	198.2	.0	-122.8	0	0	7.5		1.61
-7.00	280.5	63.4	.0	40.9	246.6	.0	-183.2	0	0	6.6		2.40
-8.00	299.5	51.4	.0	59.9	295.0	.0	-243.6	0	0	5.6		3.23
m -9.00	318.5	45.0	.0	78.9	343.4	.0	-298.4	0	0	4.7		4.22
w -10.00	337.5	.0	50.5	97.9	391.8	.0	-341.3	0	0	3.8		5.10
w -11.00	356.5	.0	60.3	116.9	440.2	.0	-379.9	0	0	2.8		5.71
w -12.00	375.5	.0	70.1	135.9	488.6	.0	-418.5	0	0	1.9		6.08
w -13.00	394.5	.0	79.9	154.9	537.0	.0	-457.1	0	0	1.0		6.27
w -14.00	413.5	.0	89.7	173.9	585.4	.0	-495.7	0	0	0		6.35

Graphical results from analysis of stage ref 8

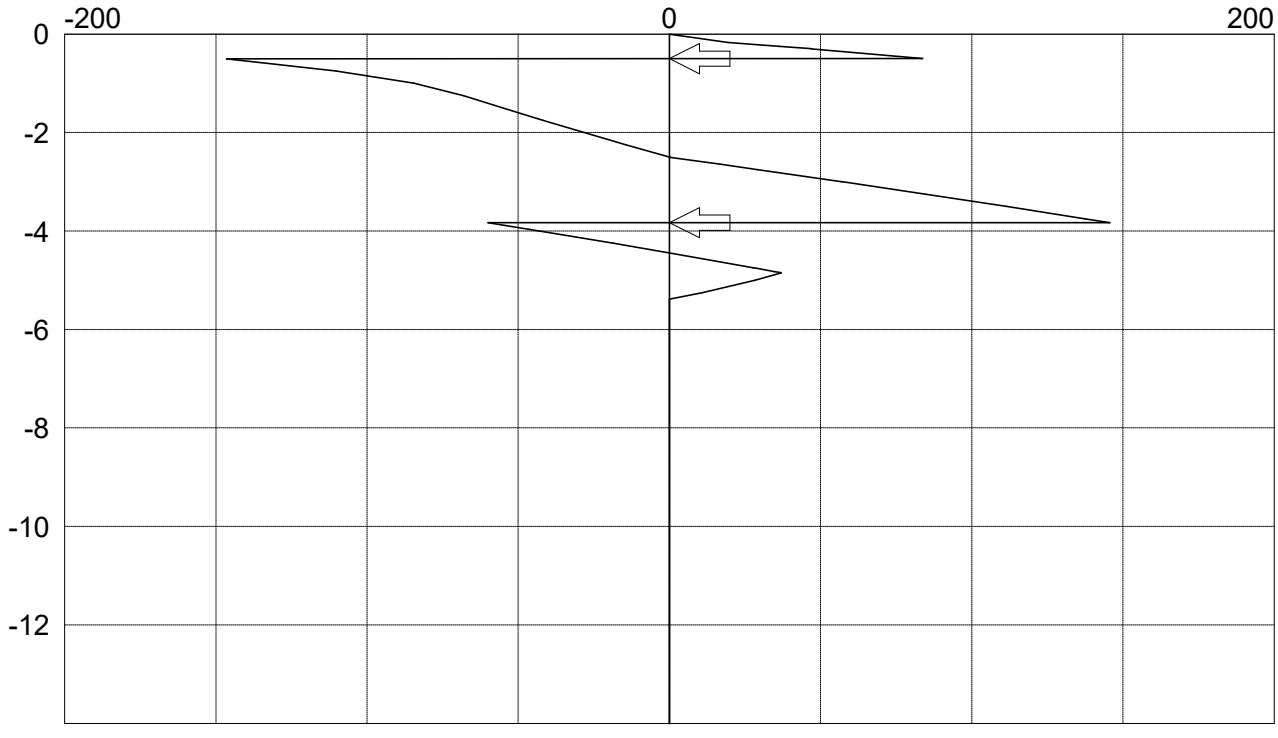




Graphical results from analysis of stage ref 8 continued

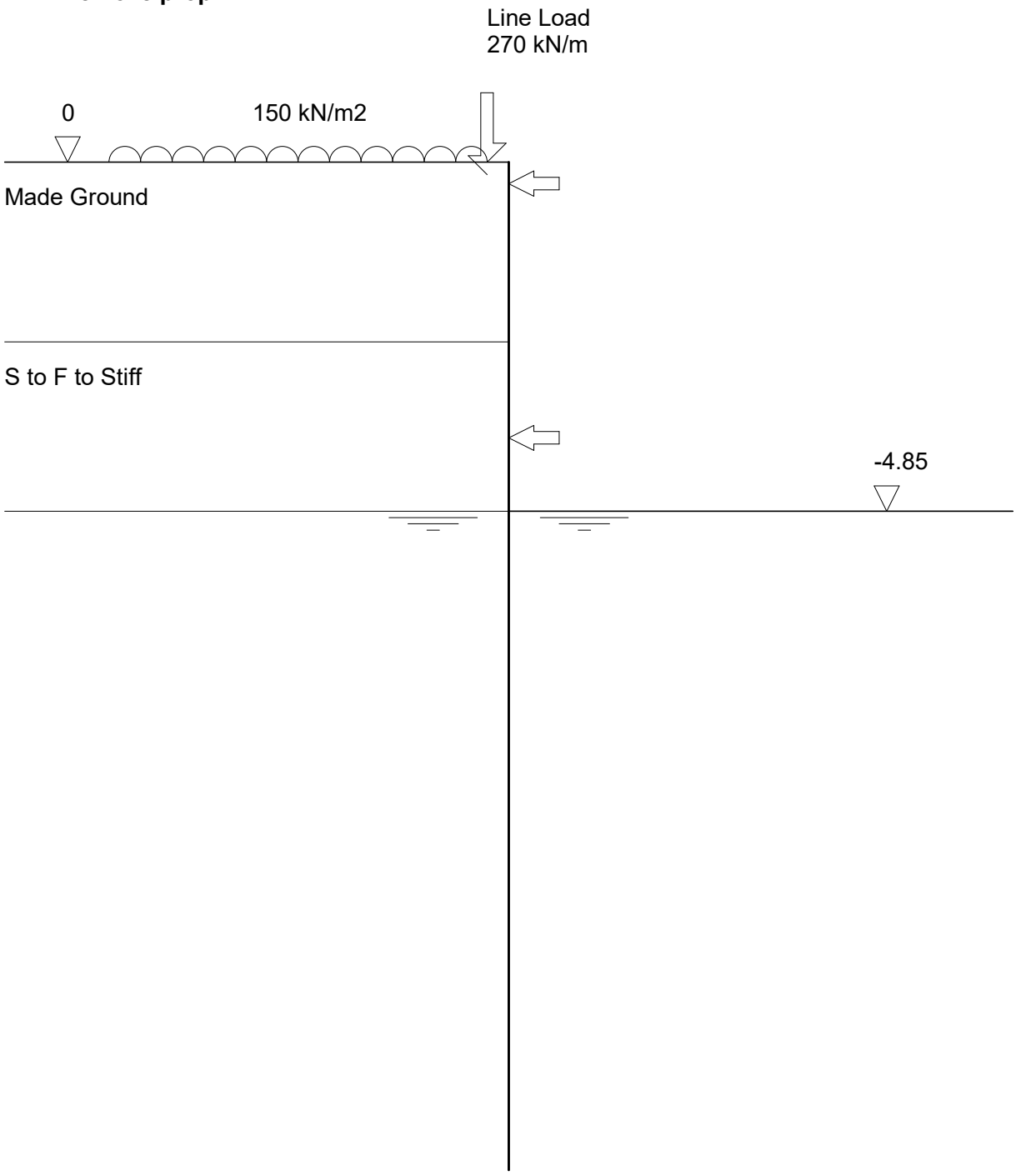


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

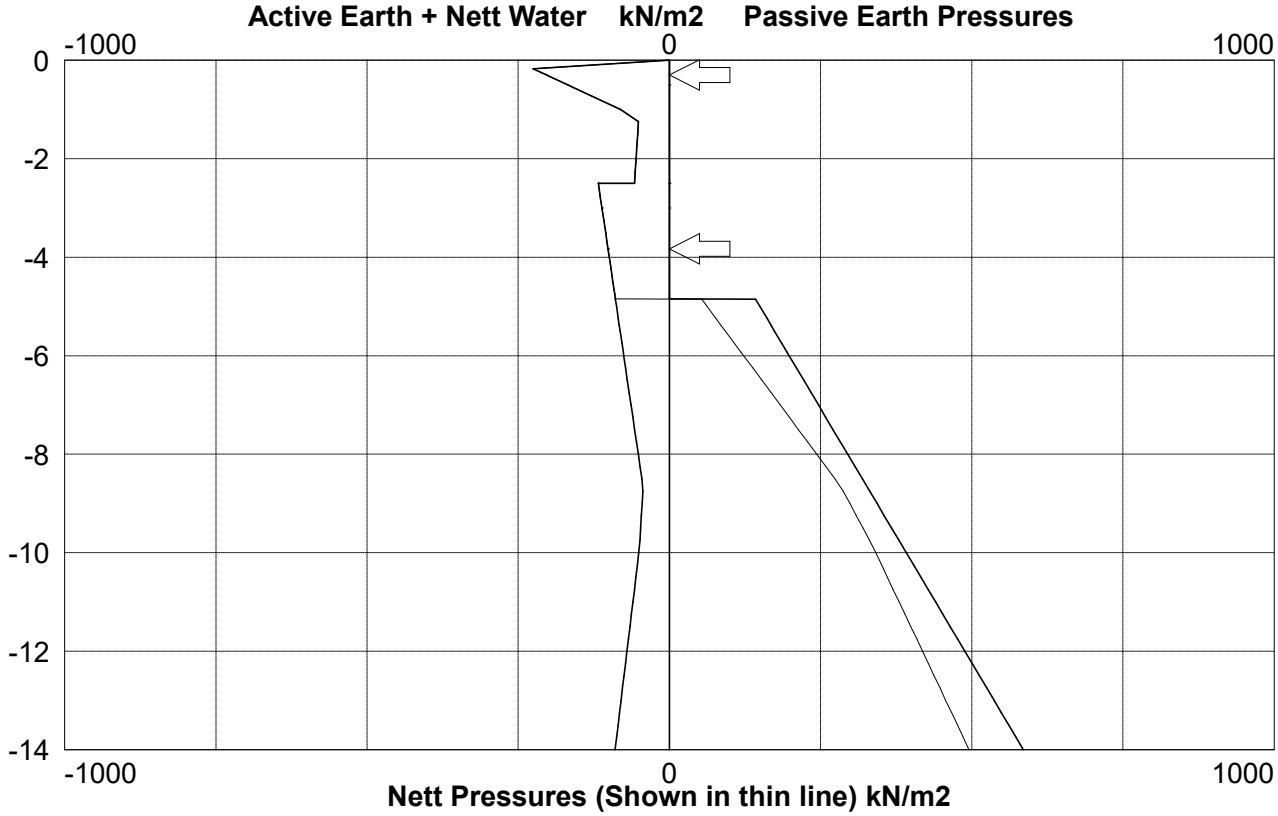
Stage ref. **10**
Stage type **Remove prop**

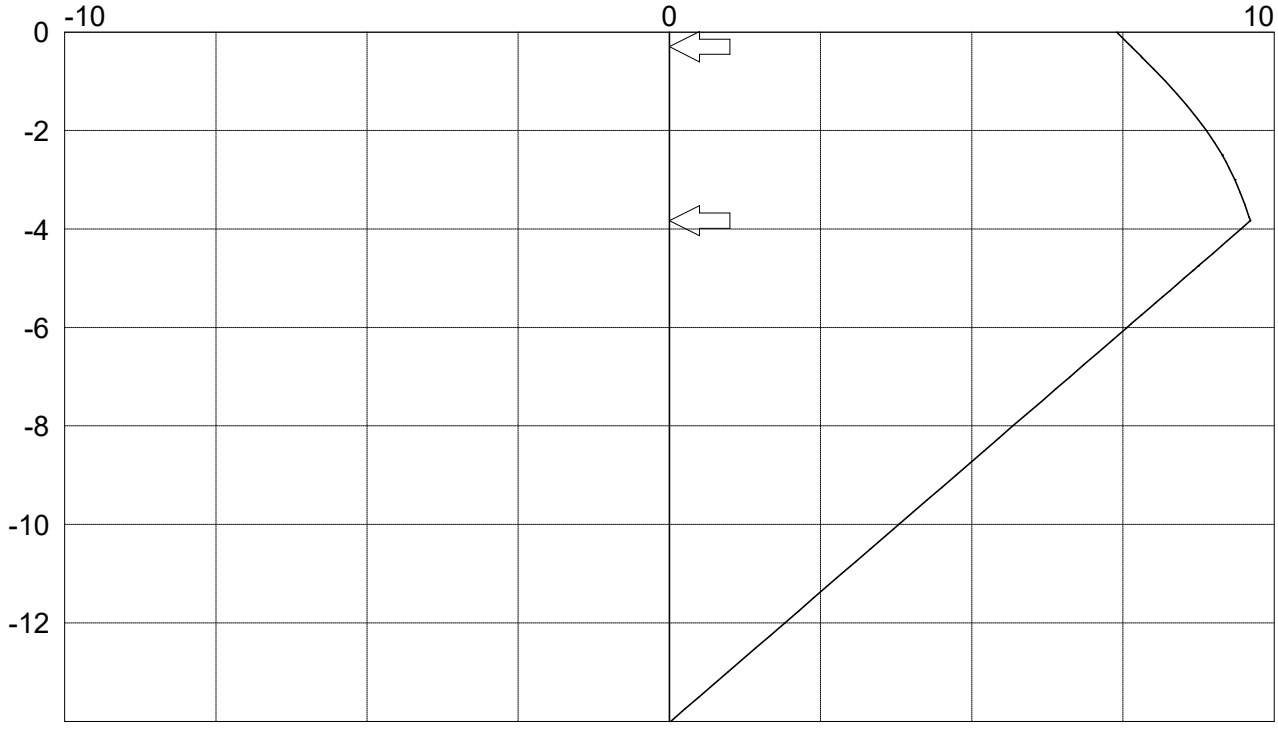


Tabular results from analysis of stage ref 10

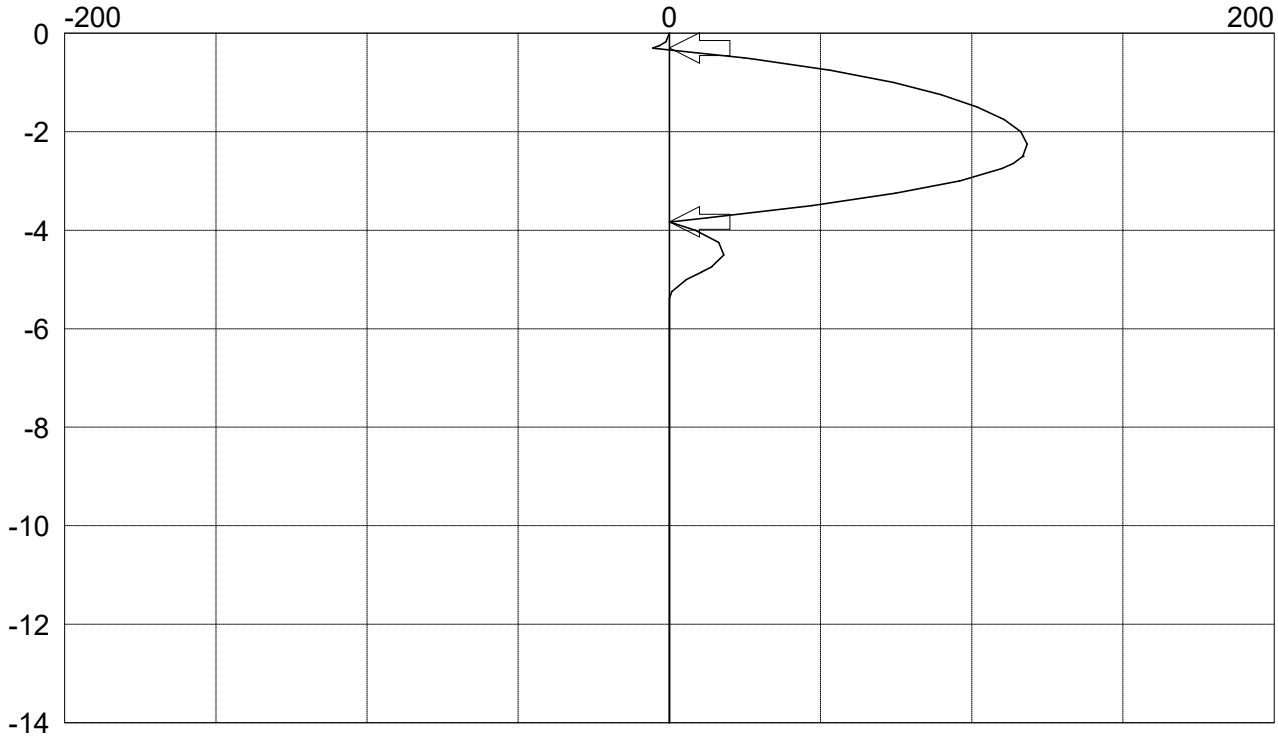
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.4		.00
-.17	153.1	225.1	.0	.0	.0	.0	225.1	1.1	-19.5	7.5		.00
-.30	155.4	203.0	.0	.0	.0	.0	203.0	5.3	-46.6	7.6	217.5	.00
-.30	155.4	202.7	.0	.0	.0	.0	202.7	5.4	170.5	7.6		.00
-.50	159.0	168.1	.0	.0	.0	.0	168.1	-24.6	133.8	7.8	.0	.00
-.50	159.0	167.8	.0	.0	.0	.0	167.8	-24.8	133.4	7.8		.00
-.52	159.4	164.7	.0	.0	.0	.0	164.7	-27.2	130.5	7.8		.00
-1.00	168.0	80.8	.0	.0	.0	.0	80.8	-74.1	71.5	8.2		.00
-2.00	186.0	55.1	.0	.0	.0	.0	55.1	-116.3	15.2	8.9		.00
-2.50	195.0	57.9	.0	.0	.0	.0	57.9	-116.9	-13.1	9.1	.0	.00
-2.50	195.0	117.5	.0	.0	.0	.0	117.5	-116.8	-13.1	9.1		.00
-2.50	195.0	117.4	.0	.0	.0	.0	117.4	-116.8	-13.3	9.1		.00
-2.64	197.7	115.7	.0	.0	.0	.0	115.7	-113.8	-29.8	9.2		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-96.0	-70.1	9.4		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-95.9	-70.3	9.4		.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	-.3	-158.7	9.6	218.8	.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	0	60.0	9.6		.00
-4.00	223.5	99.4	.0	.0	.0	.0	99.4	-8.7	43.1	9.5		.00
-4.75	237.7	90.5	.0	.0	.0	.0	90.5	-14.0	-27.7	8.8		.00
-4.82	239.2	89.5	.0	.0	.0	.0	89.5	-11.5	-34.8	8.7		.00
-4.85	239.6	89.3	.0	.0	.0	.0	89.3	-10.7	-36.9	8.7		.00
-4.85	239.7	89.2	.0	.0	142.6	.0	-53.3	-10.6	-36.9	8.7		.00
-5.00	242.5	87.4	.0	2.9	149.8	.0	-62.4	-5.7	-28.3	8.5		.38
-5.38	249.8	82.8	.0	10.1	168.4	.0	-85.6	0	0	8.1		1.00
-5.92	260.1	76.3	.0	20.4	194.5	.0	-118.2	0	0	7.6		1.55
-6.00	261.5	75.4	.0	21.9	198.2	.0	-122.8	0	0	7.6		1.61
-7.00	280.5	63.4	.0	40.9	246.6	.0	-183.2	0	0	6.6		2.40
-8.00	299.5	51.4	.0	59.9	295.0	.0	-243.6	0	0	5.7		3.23
m -9.00	318.5	45.0	.0	78.9	343.4	.0	-298.4	0	0	4.7		4.22
w -10.00	337.5	.0	50.5	97.9	391.8	.0	-341.3	0	0	3.8		5.10
w -11.00	356.5	.0	60.3	116.9	440.2	.0	-379.9	0	0	2.9		5.71
w -12.00	375.5	.0	70.1	135.9	488.6	.0	-418.5	0	0	1.9		6.08
w -13.00	394.5	.0	79.9	154.9	537.0	.0	-457.1	0	0	1.0		6.27
w -14.00	413.5	.0	89.7	173.9	585.4	.0	-495.7	0	0	0		6.35

Graphical results from analysis of stage ref 10

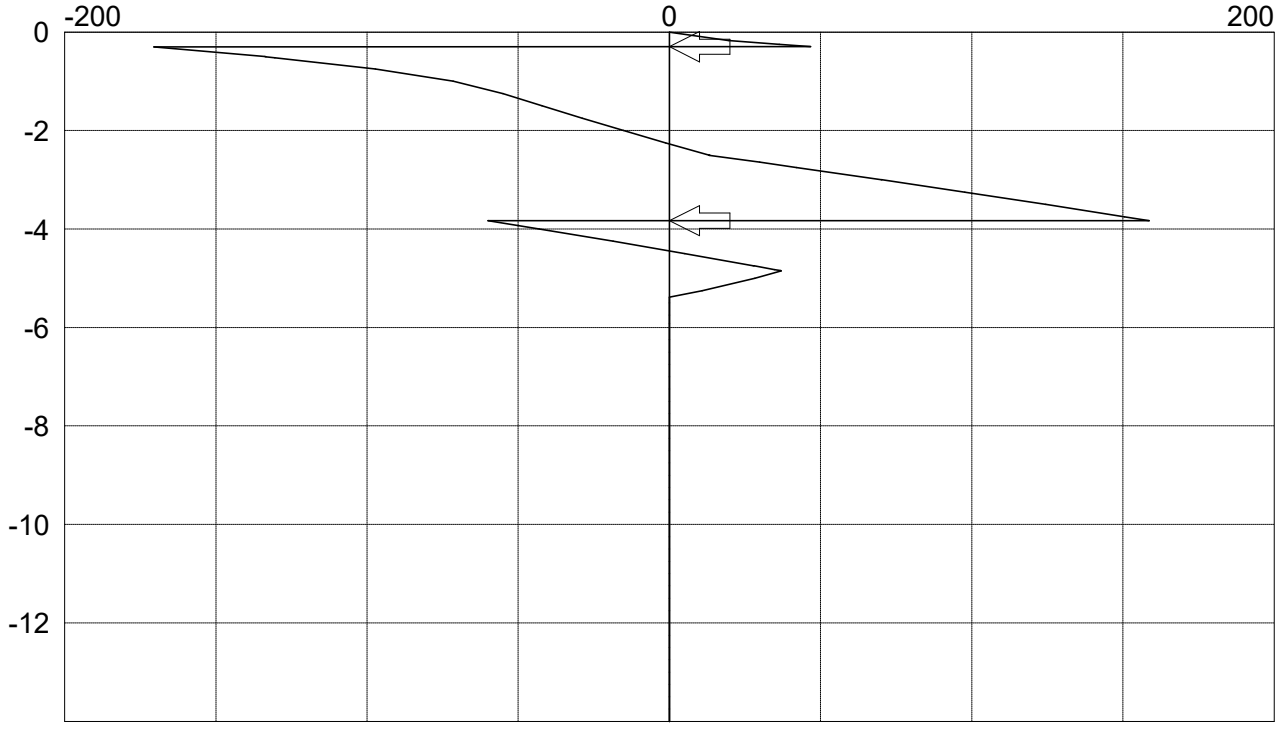




Graphical results from analysis of stage ref 10 continued

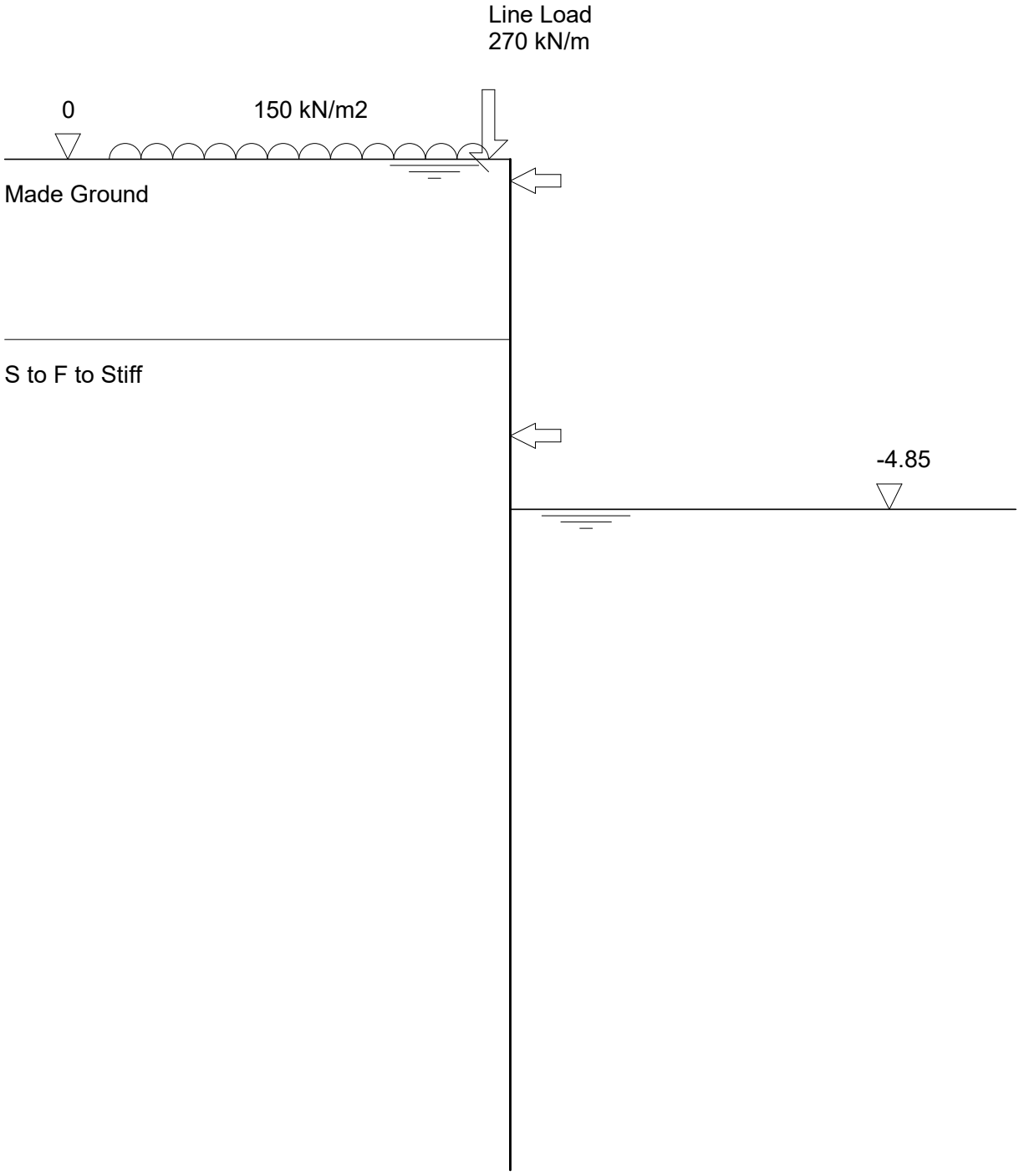


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

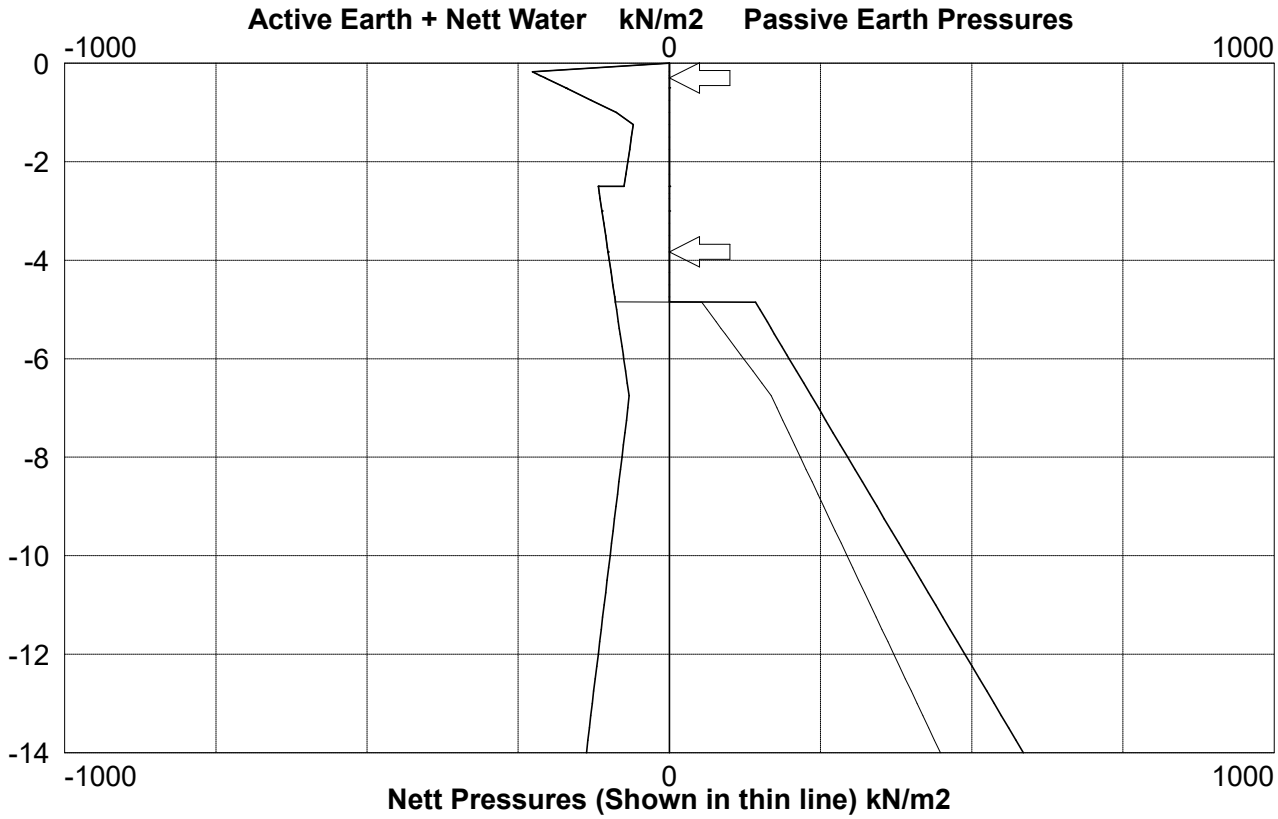
Stage ref. **11**
Stage type **Active water level**

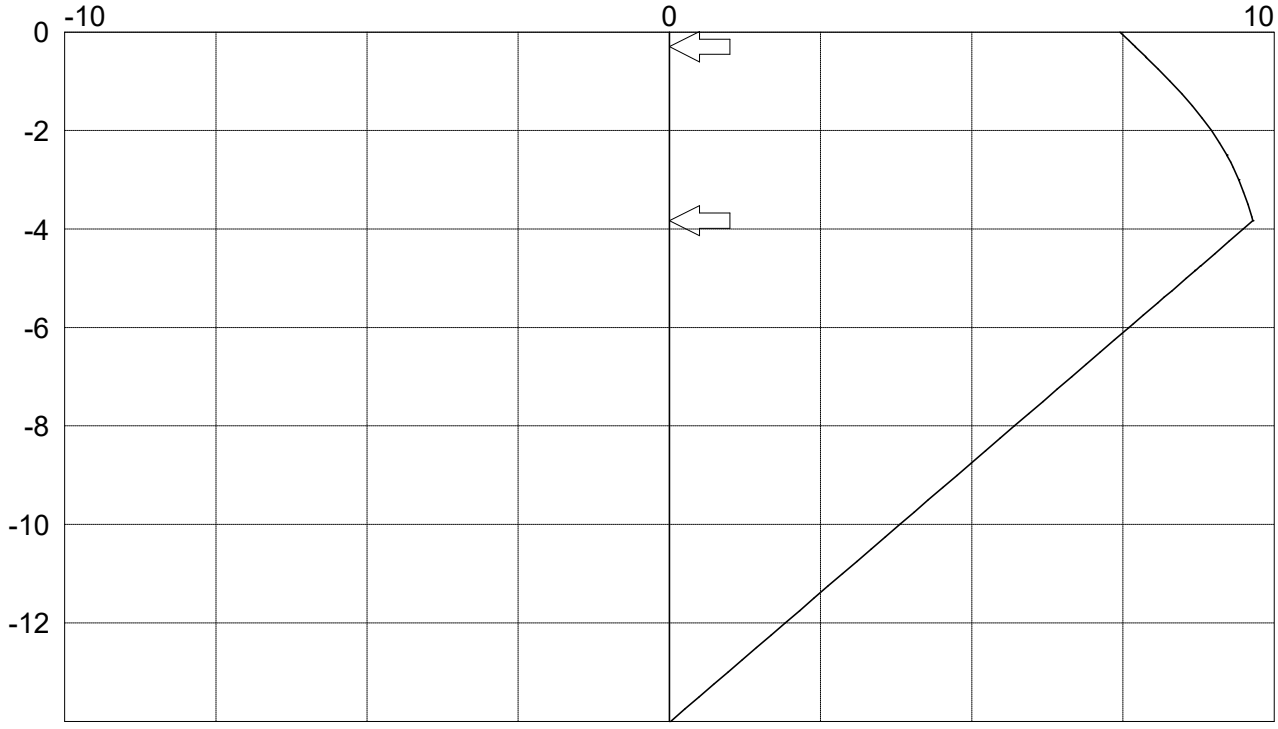


Tabular results from analysis of stage ref 11

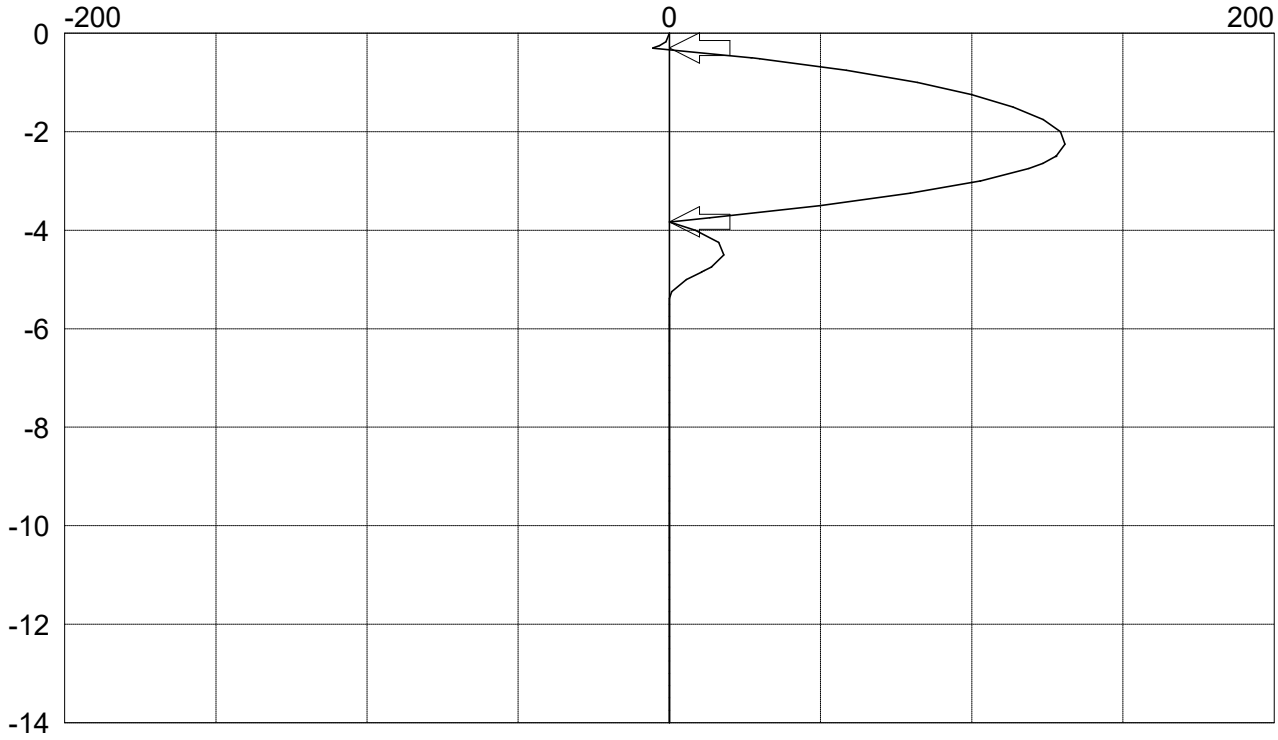
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.5		.00
-.17	151.4	224.6	1.7	.0	.0	.0	226.3	1.1	-19.6	7.6		.00
-.30	152.5	202.1	2.9	.0	.0	.0	205.1	5.4	-46.9	7.7	230.6	.00
-.30	152.5	201.8	3.0	.0	.0	.0	204.7	5.5	183.2	7.7		.00
-.50	154.1	166.6	4.9	.0	.0	.0	171.5	-27.0	146.0	7.9	.0	.00
-.50	154.1	166.3	4.9	.0	.0	.0	171.2	-27.3	145.6	7.9		.00
-.52	154.3	163.1	5.1	.0	.0	.0	168.2	-29.8	142.6	7.9		.00
-1.00	158.2	77.9	9.8	.0	.0	.0	87.7	-82.1	81.2	8.3		.00
-2.00	166.4	49.2	19.6	.0	.0	.0	68.8	-129.4	14.6	9.0		.00
-2.50	170.5	50.4	24.5	.0	.0	.0	74.9	-127.8	-21.3	9.2	.0	.00
-2.50	195.0	117.5	.0	.0	.0	.0	117.5	-127.8	-21.3	9.2		.00
-2.50	195.0	117.4	.0	.0	.0	.0	117.4	-127.8	-21.5	9.2		.00
-2.64	197.7	115.7	.0	.0	.0	.0	115.7	-123.6	-38.1	9.3		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-102.9	-78.3	9.4		.00
-3.00	204.5	111.5	.0	.0	.0	.0	111.5	-102.8	-78.5	9.4		.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	-.3	-166.9	9.7	227.1	.00
-3.83	220.3	101.5	.0	.0	.0	.0	101.5	0	60.0	9.6		.00
-4.00	223.5	99.4	.0	.0	.0	.0	99.4	-8.7	43.1	9.5		.00
-4.75	237.7	90.5	.0	.0	.0	.0	90.5	-14.0	-27.7	8.8		.00
-4.82	239.2	89.5	.0	.0	.0	.0	89.5	-11.5	-34.8	8.7		.00
-4.85	239.6	89.3	.0	.0	.0	.0	89.3	-10.7	-36.9	8.7		.00
-4.85	239.7	89.2	.0	.0	142.6	.0	-53.3	-10.6	-36.9	8.7		.00
-5.00	242.5	87.4	.0	2.9	149.8	.0	-62.4	-5.7	-28.3	8.5		.38
-5.38	249.8	82.8	.0	10.1	168.4	.0	-85.6	0	0	8.2		1.00
-5.92	260.1	76.3	.0	20.4	194.5	.0	-118.2	0	0	7.7		1.55
-6.00	261.5	75.4	.0	21.9	198.2	.0	-122.8	0	0	7.6		1.61
w -7.00	280.5	.0	68.6	40.9	246.6	.0	-178.0	0	0	6.7		2.39
w -8.00	299.5	.0	78.4	59.9	295.0	.0	-216.6	0	0	5.7		2.92
w -9.00	318.5	.0	88.2	78.9	343.4	.0	-255.2	0	0	4.8		3.26
w -10.00	337.5	.0	98.0	97.9	391.8	.0	-293.8	0	0	3.8		3.49
w -11.00	356.5	.0	107.8	116.9	440.2	.0	-332.4	0	0	2.9		3.66
w -12.00	375.5	.0	117.6	135.9	488.6	.0	-371.0	0	0	1.9		3.79
w -13.00	394.5	.0	127.4	154.9	537.0	.0	-409.6	0	0	1.0		3.89
w -14.00	413.5	.0	137.2	173.9	585.4	.0	-448.2	0	0	0		3.97

Graphical results from analysis of stage ref 11

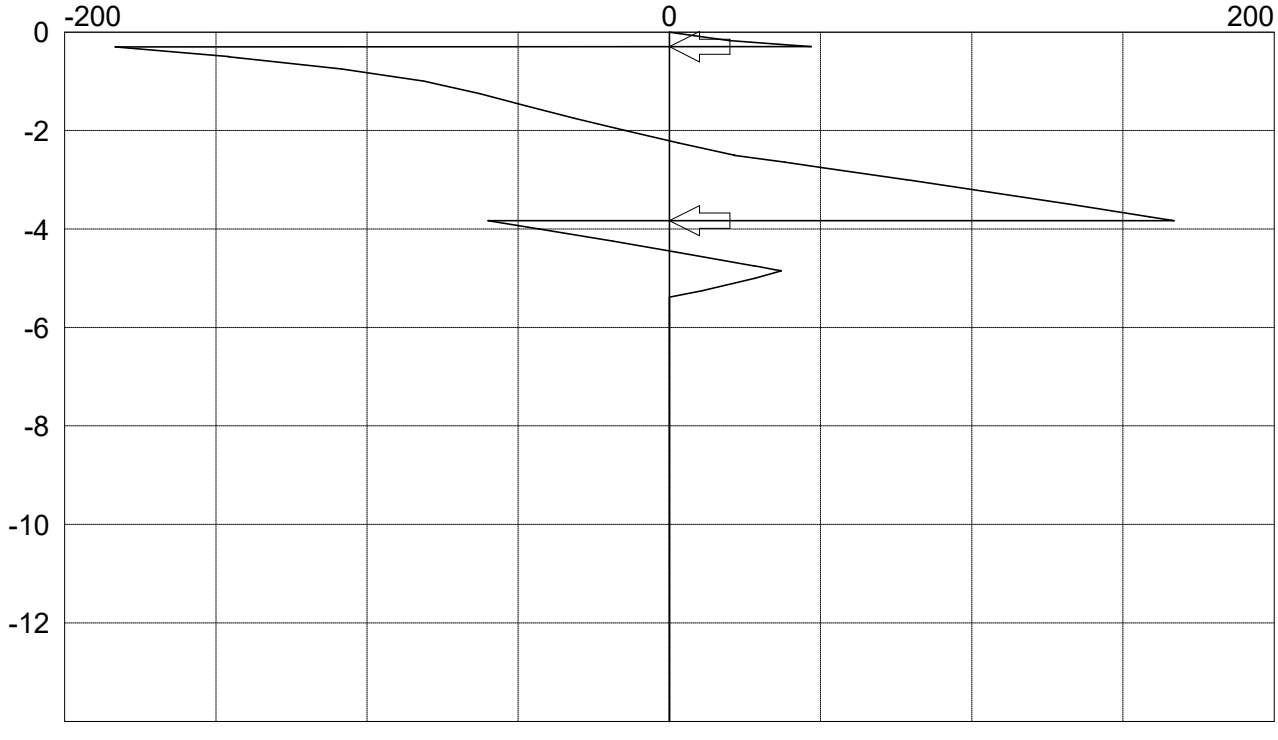




Graphical results from analysis of stage ref 11 continued

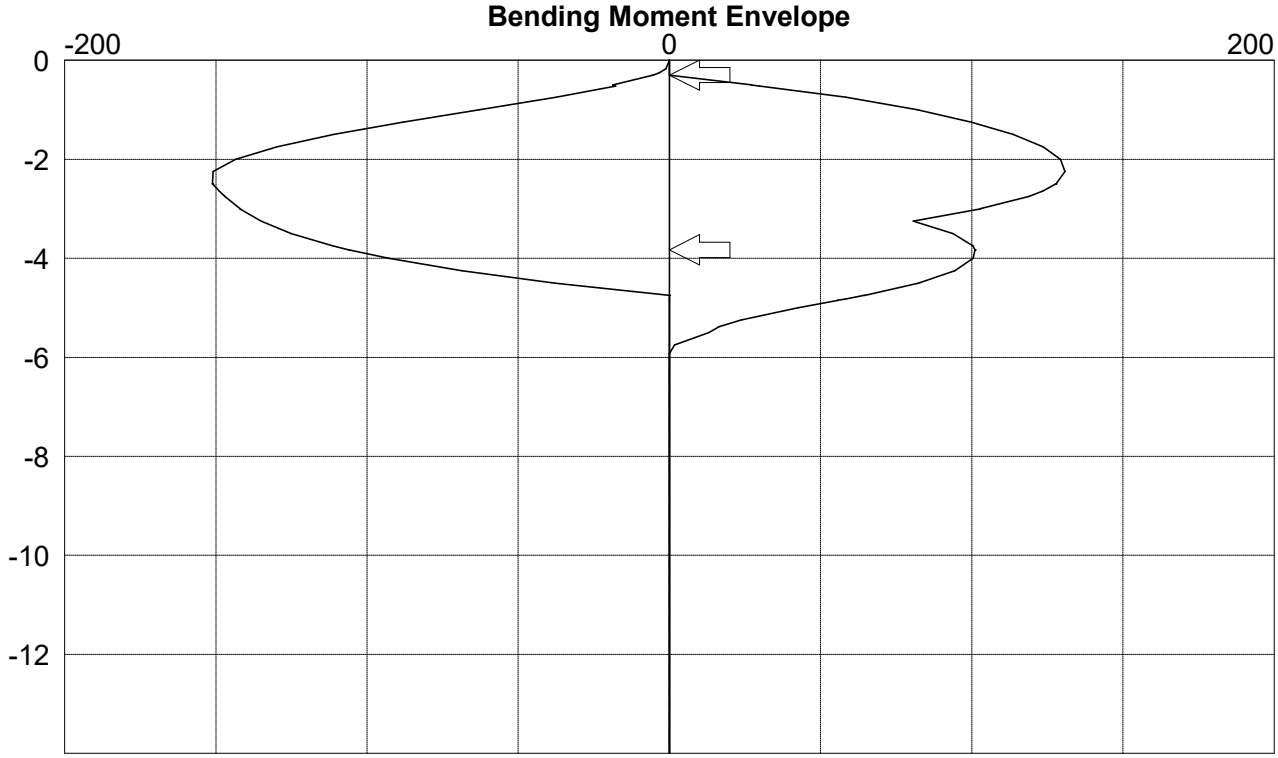


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Graphical plot of envelope from selected construction stages



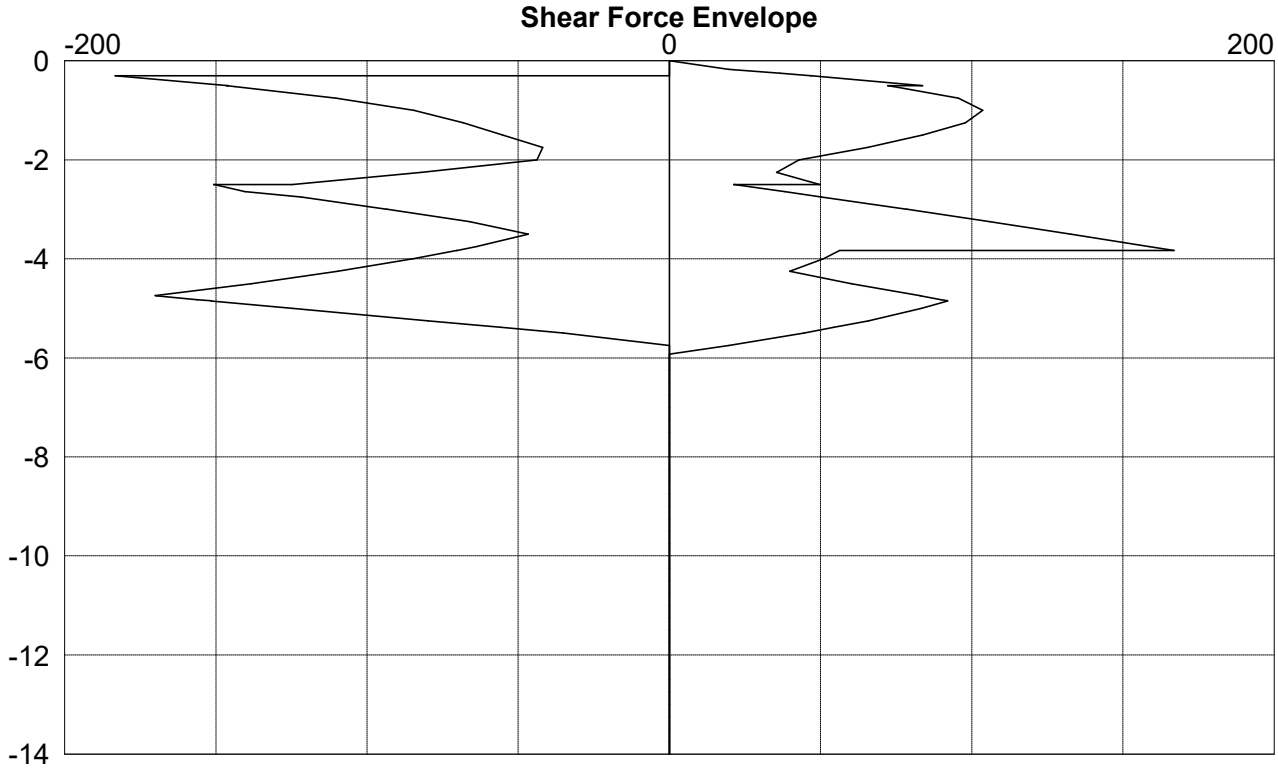


Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
.00	.0	.0	.0	.0	
-.17	.0	1.1	-19.6	.0	
-.30	.0	5.4	-46.9	.0	230.6
-.30	.0	5.5	-47.0	183.2	
-.50	-27.0	18.5	-83.8	146.0	230.6
-.50	-27.3	18.7	-72.2	146.5	
-.52	-29.8	17.8	-74.3	143.6	
-1.00	-82.1	62.8	-103.7	84.6	
-2.00	-129.4	143.5	-42.9	43.8	
-2.50	-127.8	151.1	-49.7	124.7	200.4
-2.50	-127.8	151.1	-21.3	150.7	
-2.50	-127.8	151.1	-21.5	150.5	
-2.64	-123.6	148.8	-38.1	140.4	
-3.00	-102.9	142.1	-78.3	93.7	
-3.00	-102.8	142.0	-78.5	93.5	
-3.83	-101.1	106.0	-166.9	70.2	227.1
-3.83	-101.1	105.9	-56.3	70.3	
-4.00	-100.5	92.9	-50.9	84.9	
-4.75	-64.7	.0	-82.8	170.0	
-4.82	-58.0	.0	-89.8	156.1	
-4.85	-55.8	.0	-92.0	151.8	
-4.85	-55.6	.0	-92.0	151.4	
-5.00	-42.4	.0	-83.4	124.5	
-5.38	-16.4	.0	-54.5	55.7	
-5.92	.0	.0	.0	.0	
-6.00	.0	.0	.0	.0	
-7.00	.0	.0	.0	.0	
-8.00	.0	.0	.0	.0	
-9.00	.0	.0	.0	.0	
-10.00	.0	.0	.0	.0	
-11.00	.0	.0	.0	.0	
-12.00	.0	.0	.0	.0	
-13.00	.0	.0	.0	.0	
-14.00	.0	.0	.0	.0	

Structural design of wall

Wall section properties

Primary pile diameter	600	mm
Primary pile spacing	700	mm
Infill pile diameter		mm
Main rebar bar diameter	25	mm
Main rebar number of bars	12	
Links/Helix bar diameter	16	mm
Links/Helix spacing/pitch	225	mm

Wall material properties

Concrete cube strength	35	N/mm2
Concrete cover	75	mm
Main rebar steel grade	500	N/mm2
Link rebar steel grade	500	N/mm2
Ultimate load factor	1.50	

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	159	434	kNm
Max longitudinal steel. BS8110 max 6% by area	16965	5890	mm2
Min longitudinal steel. BS8110 min 0.4% by area	1131	5890	mm2
Shear resistance. BS8110	192	430	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	16	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	270	225	mm
Min shear link area. BS8110 Clause 3.4.5	361	1787	mm2/m

Pile geometry

Pile top Level	0	m
Pile Length	14	m
Pile toe level	-14	m

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level -4.85

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
.00	Made Ground	18.00	18.00	15000	0	1		28	.67	.30	1.43
						1		28	.50	4.15	4.99
-2.50	S to F to Stiff	19.00	19.00	19200	7680	10		25	.67	.35	1.52
						10		25	.50	3.38	4.51

Construction sequence

Stage Ref	Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1 A	Line load	0.00	270.0	.3	.0	
2 A	Active surcharge	0.00	150.0	.3		
3 A	Insert prop	-3.83				
4	Insert prop	-0.30				
5 A	Passive side excavation	-4.85				
6 A	Active water level	0.00				

Code of practice

Code of practice or reference document	
Application of pressures for stability	Not applicable for FOS=1 on moments
FOS on moments (stability check)	1.00
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.00

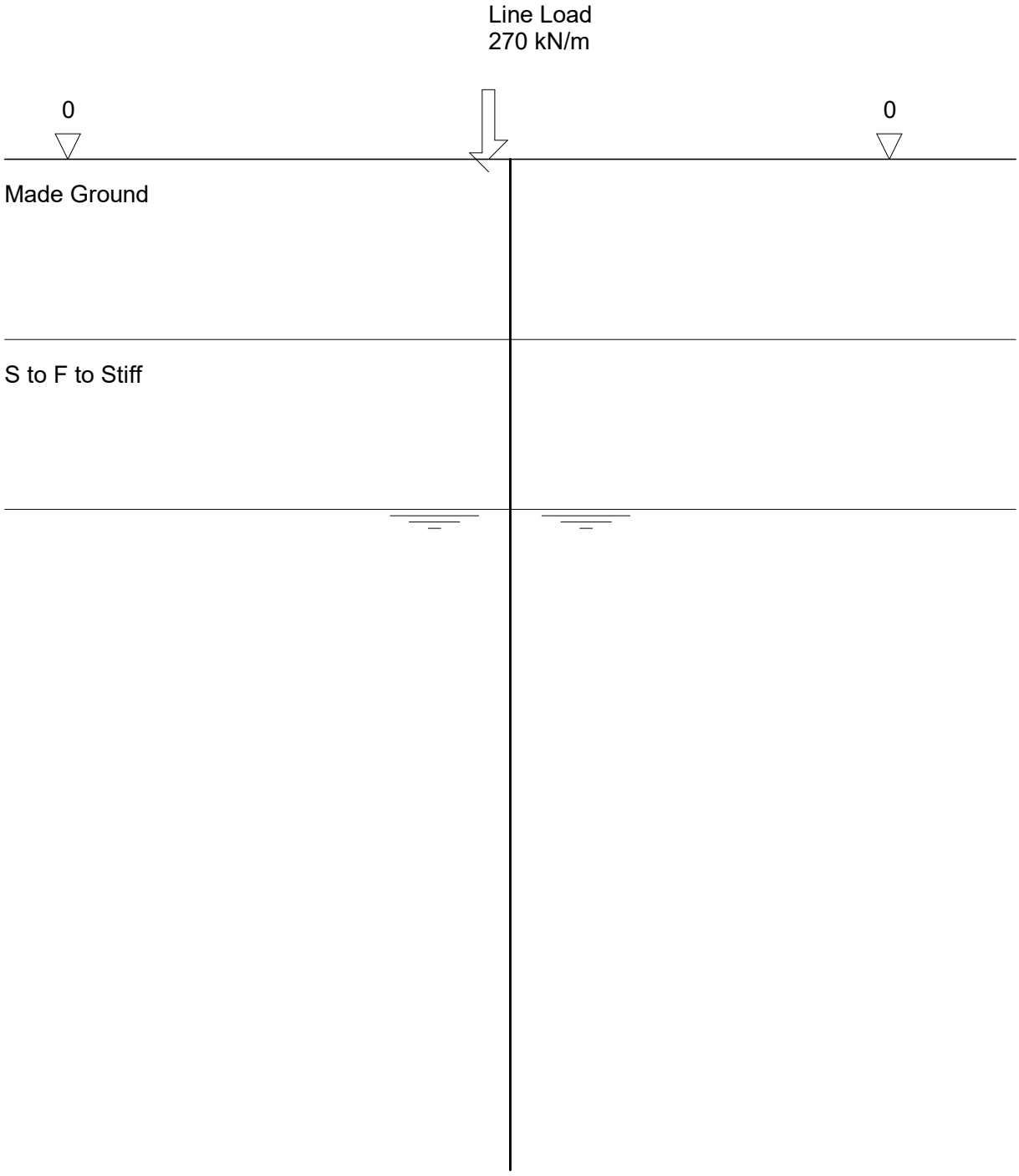
Wall analysis detail options

Nominal Phi for load distribution	30.0	Degrees
Depth of water filled tension cracks	.0	m
Density of water	9.8	kN/m3
Minimum equivalent fluid density	5.0	kN/m3
Depth of passive softened soil	.0	m
Continuity model for wall analysis	Pins at second and lower props	

Deflection parameters

Wall moment of inertia	1908818	cm4/m
Wall Youngs modulus	28000000	kN/m2
Properties for prop at -3.83		
Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm
Properties for prop at -0.3		
Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

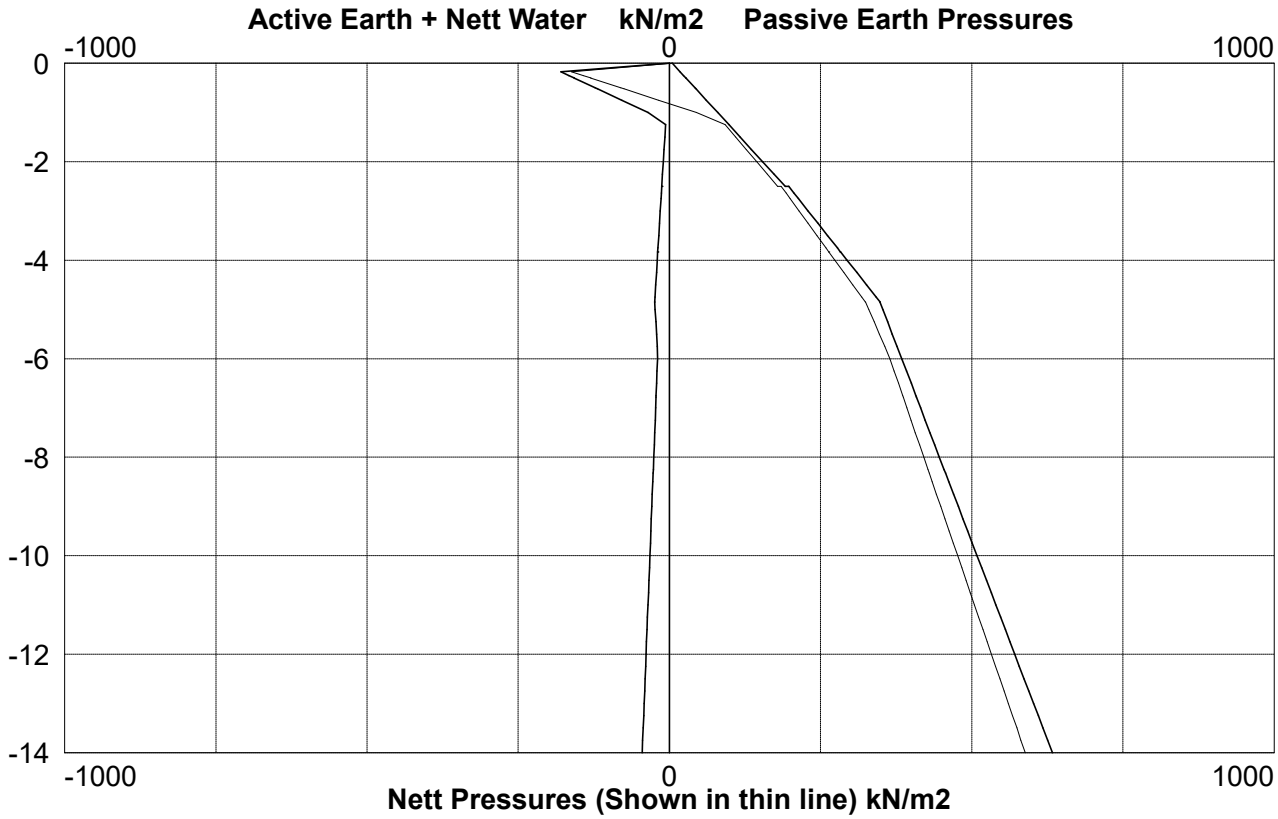
Stage ref. **1**
Stage type **Line load**

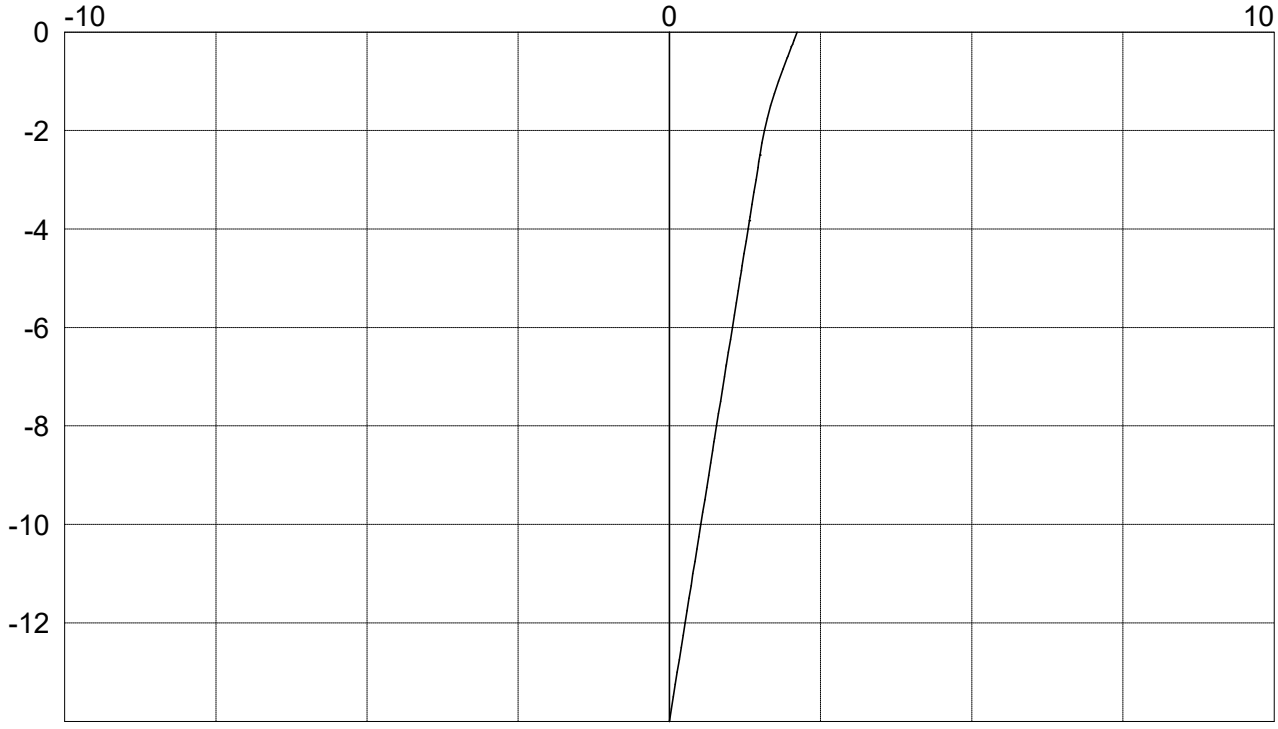


Tabular results from analysis of stage ref 1

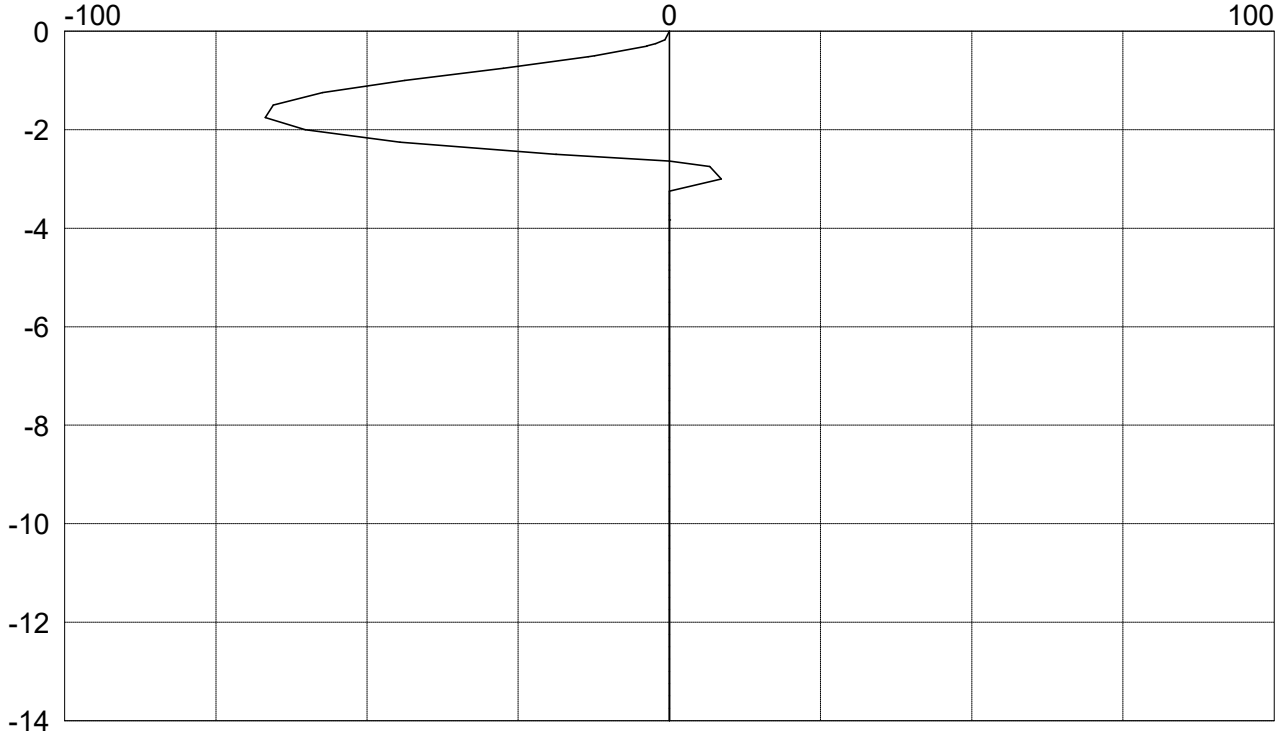
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	5.0	.0	-5.0	0	0	2.1		.00
-.17	3.1	179.5	.0	3.1	17.9	.0	161.6	.8	-13.6	2.1		.16
-.30	5.4	157.4	.0	5.4	27.4	.0	130.0	3.7	-32.0	2.0	.0	.13
-.30	5.4	157.0	.0	5.4	27.6	.0	129.5	3.8	-32.3	2.0		.13
-.52	9.4	119.1	.0	9.4	43.8	.0	75.3	13.4	-54.6	2.0		.15
-1.00	18.0	35.2	.0	18.0	79.7	.0	-44.5	43.7	-62.0	1.8		.25
m -2.00	36.0	10.0	.0	36.0	154.4	.0	-144.4	60.2	43.8	1.6		.65
m -2.50	45.0	12.5	.0	45.0	191.8	.0	-179.3	18.8	124.7	1.5		.92
m -2.50	45.0	12.5	.0	45.0	197.3	.0	-184.8	18.7	124.7	1.5		.92
m -2.64	47.6	13.2	.0	47.6	206.2	.0	-193.0	0	150.8	1.5		1.00
m -3.00	54.5	15.0	.0	54.5	229.5	.0	-214.5	-8.6	47.3	1.4		1.23
m -3.83	70.3	19.2	.0	70.3	282.9	.0	-263.7	0	0	1.3	.0	1.83
m -3.83	70.3	19.2	.0	70.3	283.0	.0	-263.8	0	0	1.3		1.83
m -4.00	73.5	20.0	.0	73.5	293.8	.0	-273.8	0	0	1.3		1.96
m -4.85	89.6	24.2	.0	89.6	348.3	.0	-324.1	0	0	1.2		2.63
m -4.85	89.6	24.3	.0	89.6	348.5	.0	-324.2	0	0	1.2		2.63
m -5.00	91.0	25.0	.0	91.0	353.1	1.5	-329.6	0	0	1.2		2.75
-6.00	100.2	19.4	11.3	100.2	384.3	11.3	-364.8	0	0	1.0		3.58
-6.78	107.4	21.9	18.9	107.4	408.6	18.9	-386.7	0	0	.9		4.22
-7.00	109.4	22.6	21.1	109.4	415.4	21.1	-392.8	0	0	.9		4.40
-8.00	118.6	25.8	30.9	118.6	446.5	30.9	-420.7	0	0	.8		5.20
-8.32	121.6	26.8	34.0	121.6	456.6	34.0	-429.8	0	0	.7		5.45
-9.00	127.8	29.0	40.7	127.8	477.7	40.7	-448.7	0	0	.7		5.95
-10.00	137.0	32.1	50.5	137.0	508.8	50.5	-476.7	0	0	.5		6.65
-11.00	146.2	35.3	60.3	146.2	539.9	60.3	-504.6	0	0	.4		7.30
-12.00	155.4	38.5	70.1	155.4	571.1	70.1	-532.6	0	0	.3		7.88
-13.00	164.6	41.7	79.9	164.6	602.2	79.9	-560.5	0	0	.1		8.41
-14.00	173.8	44.9	89.7	173.8	633.3	89.7	-588.5	0	0	0		8.88

Graphical results from analysis of stage ref 1

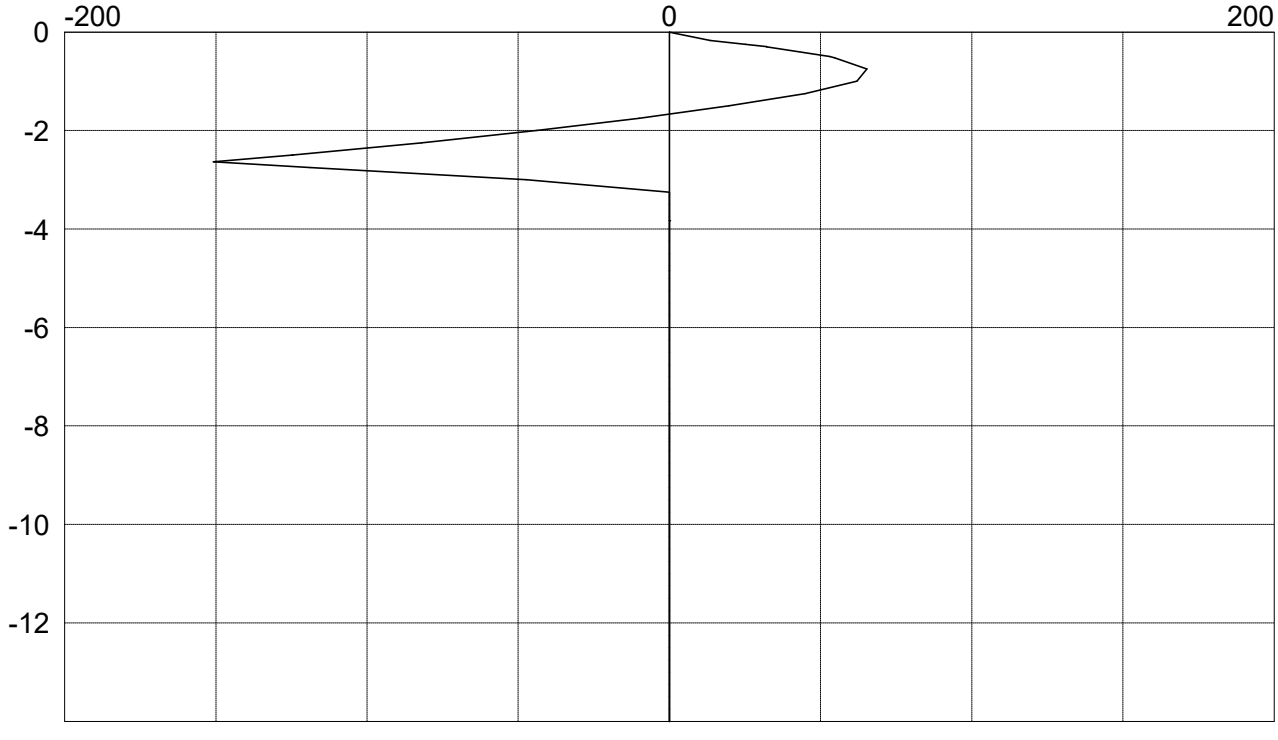




Graphical results from analysis of stage ref 1 continued

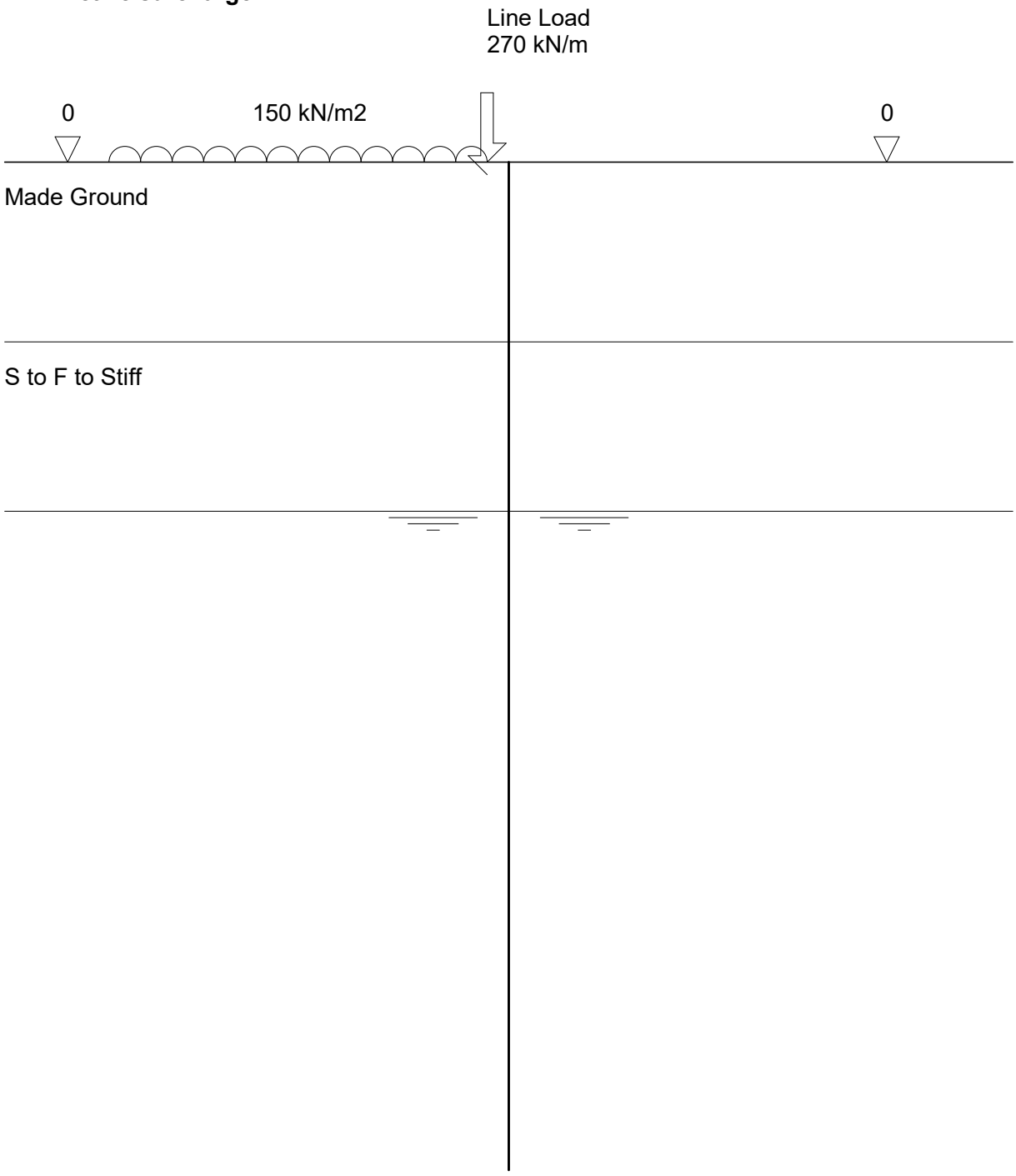


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

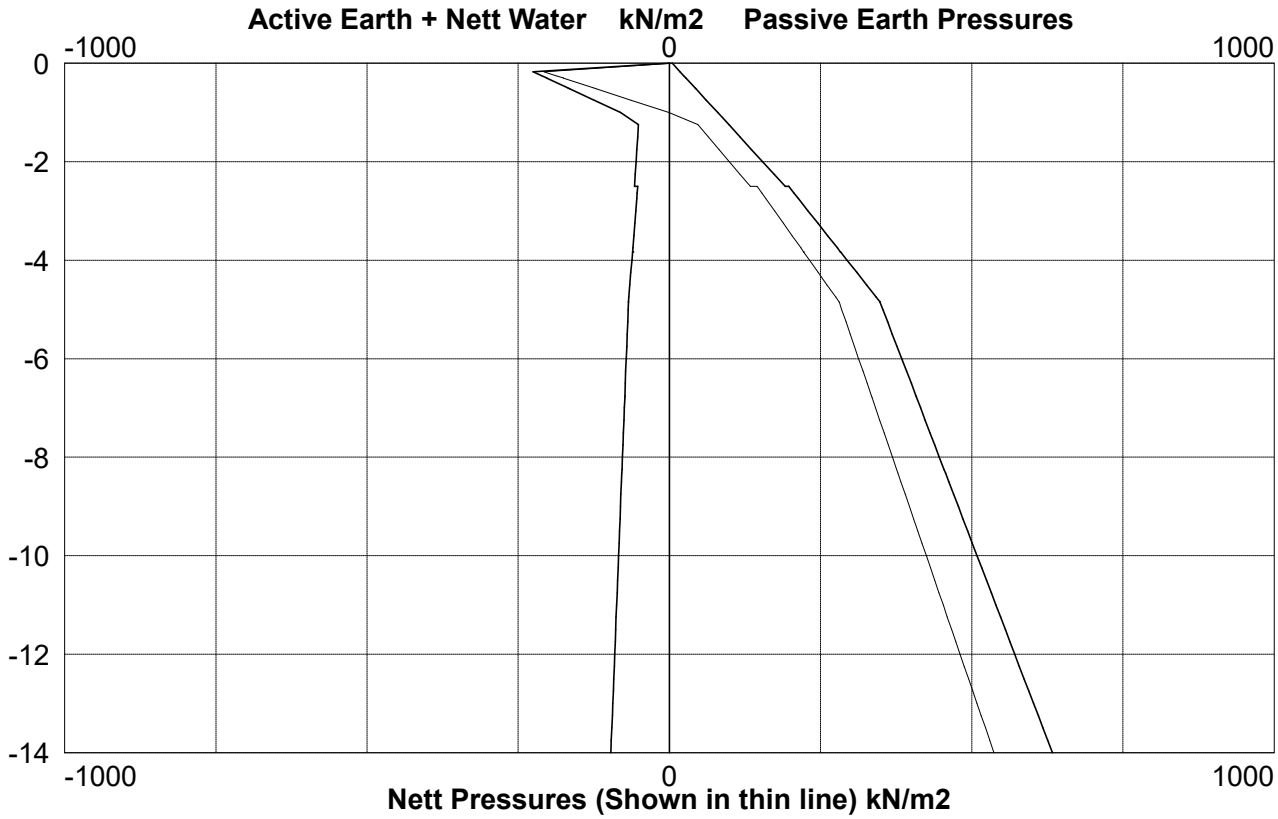
Stage ref. **2**
Stage type **Active surcharge**

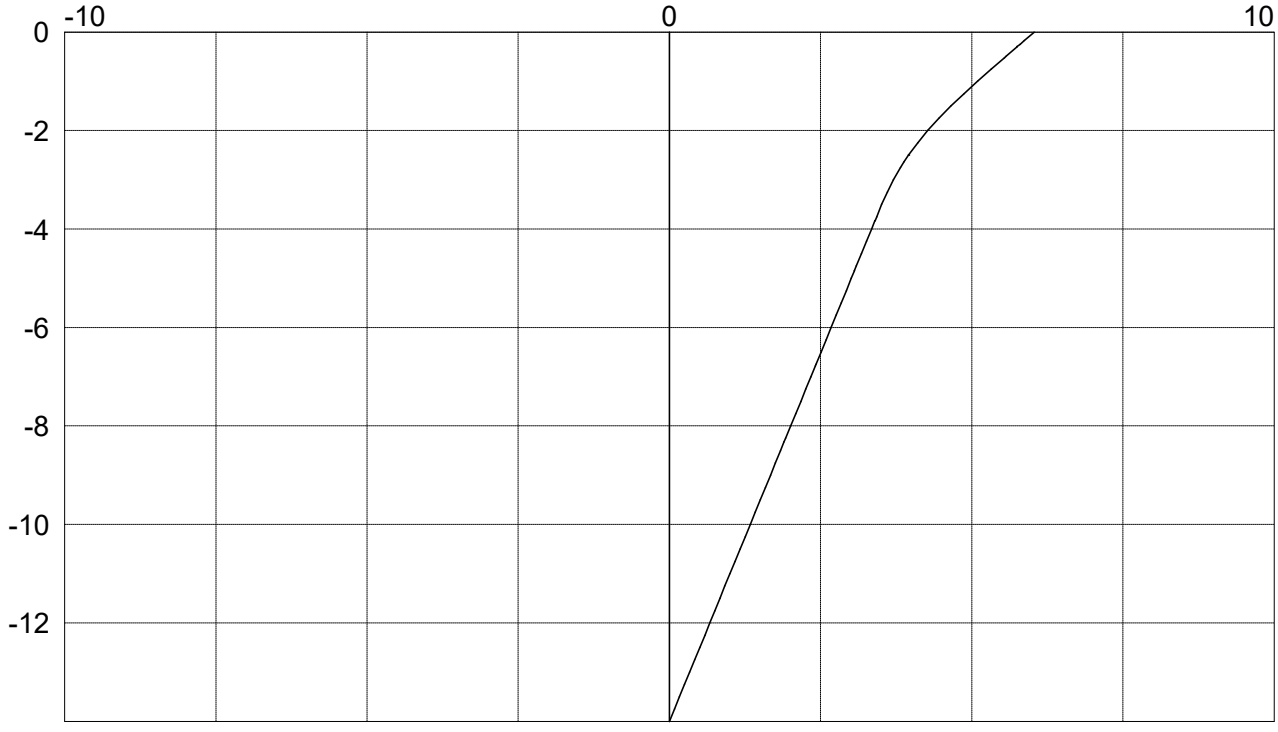


Tabular results from analysis of stage ref 2

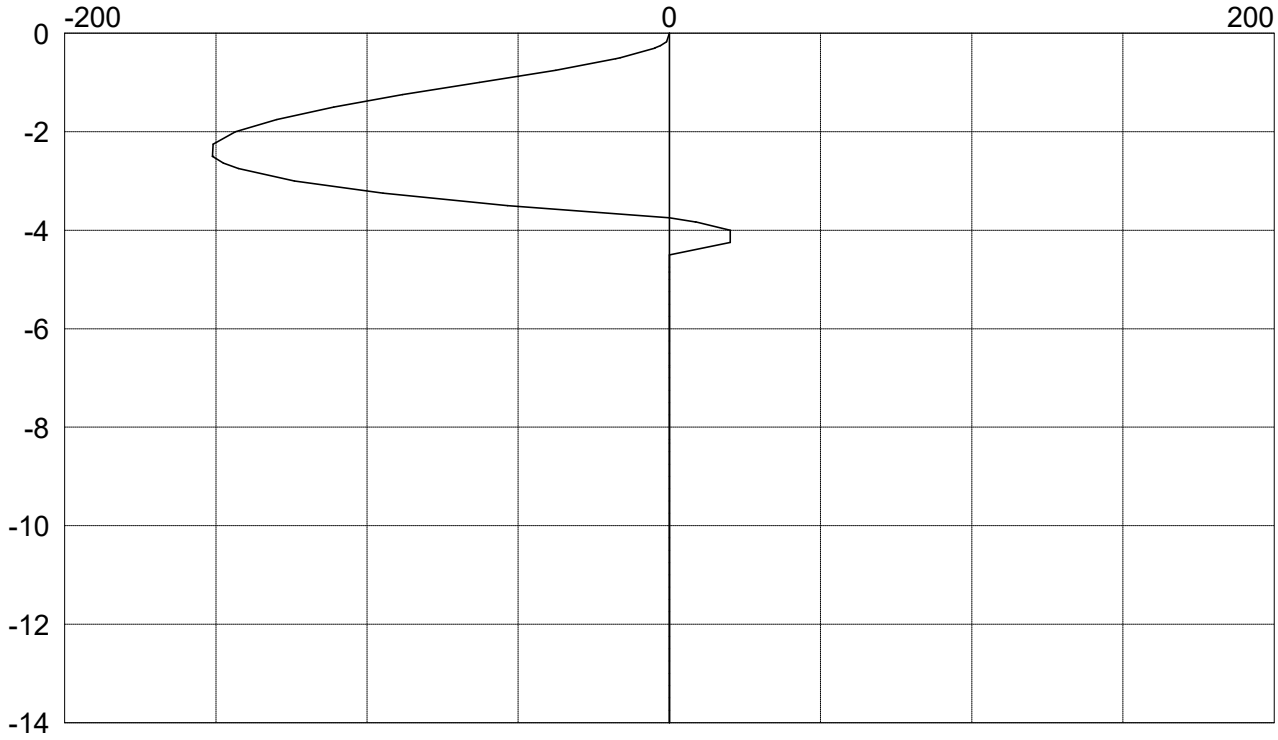
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	5.0	.0	-5.0	0	0	6.0		.00
-.17	153.1	225.1	.0	3.1	17.9	.0	207.2	1.0	-17.5	5.9		.12
-.30	155.4	203.0	.0	5.4	27.4	.0	175.6	4.8	-41.8	5.8	.0	.10
-.30	155.4	202.7	.0	5.4	27.6	.0	175.1	4.9	-42.1	5.7		.10
-.52	159.4	164.7	.0	9.4	43.8	.0	120.9	17.8	-74.3	5.5		.12
-1.00	168.0	80.8	.0	18.0	79.7	.0	1.2	62.8	-103.7	5.1		.19
-2.00	186.0	55.1	.0	36.0	154.4	.0	-99.3	143.5	-42.9	4.3		.43
-2.50	195.0	57.9	.0	45.0	191.8	.0	-133.9	151.1	15.4	4.0		.58
-2.50	195.0	52.2	.0	45.0	197.3	.0	-145.2	151.1	15.4	4.0		.58
-2.64	197.6	53.1	.0	47.6	206.2	.0	-153.2	147.6	36.0	3.9		.63
-3.00	204.5	55.4	.0	54.5	229.5	.0	-174.1	124.1	95.2	3.7		.74
-3.83	220.3	60.9	.0	70.3	282.9	.0	-222.0	-8.6	216.2	3.4	.0	1.03
-3.83	220.3	60.9	.0	70.3	283.0	.0	-222.1	-8.8	215.5	3.4		1.03
-4.00	223.5	62.0	.0	73.5	293.8	.0	-231.8	-20.2	161.3	3.3		1.09
-4.85	239.6	67.6	.0	89.6	348.3	.0	-280.7	0	0	3.1		1.39
-4.85	239.7	67.6	.0	89.6	348.5	.0	-280.9	0	0	3.1		1.39
-5.00	241.0	68.1	1.5	91.0	353.1	1.5	-285.1	0	0	3.0		1.44
-6.00	250.2	71.2	11.3	100.2	384.3	11.3	-313.0	0	0	2.7		1.78
-6.78	257.4	73.7	18.9	107.4	408.6	18.9	-334.9	0	0	2.4		2.03
-7.00	259.4	74.4	21.1	109.4	415.4	21.1	-341.0	0	0	2.3		2.10
-8.00	268.6	77.6	30.9	118.6	446.5	30.9	-368.9	0	0	2.0		2.38
-8.32	271.6	78.6	34.0	121.6	456.6	34.0	-378.0	0	0	1.9		2.47
-9.00	277.8	80.8	40.7	127.8	477.7	40.7	-396.9	0	0	1.7		2.65
-10.00	287.0	84.0	50.5	137.0	508.8	50.5	-424.8	0	0	1.3		2.88
-11.00	296.2	87.1	60.3	146.2	539.9	60.3	-452.8	0	0	1.0		3.10
-12.00	305.4	90.3	70.1	155.4	571.1	70.1	-480.8	0	0	.7		3.30
-13.00	314.6	93.5	79.9	164.6	602.2	79.9	-508.7	0	0	.3		3.49
-14.00	323.8	96.7	89.7	173.8	633.3	89.7	-536.7	0	0	0		3.66

Graphical results from analysis of stage ref 2

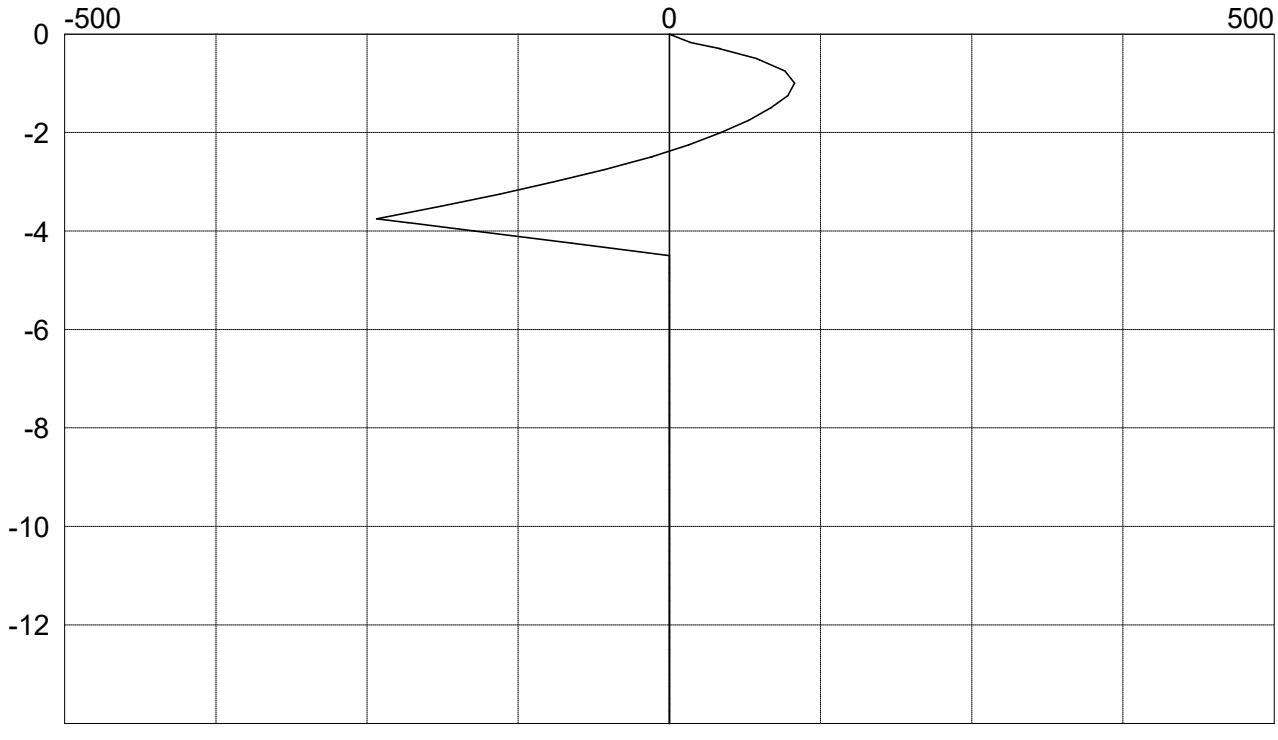




Graphical results from analysis of stage ref 2 continued

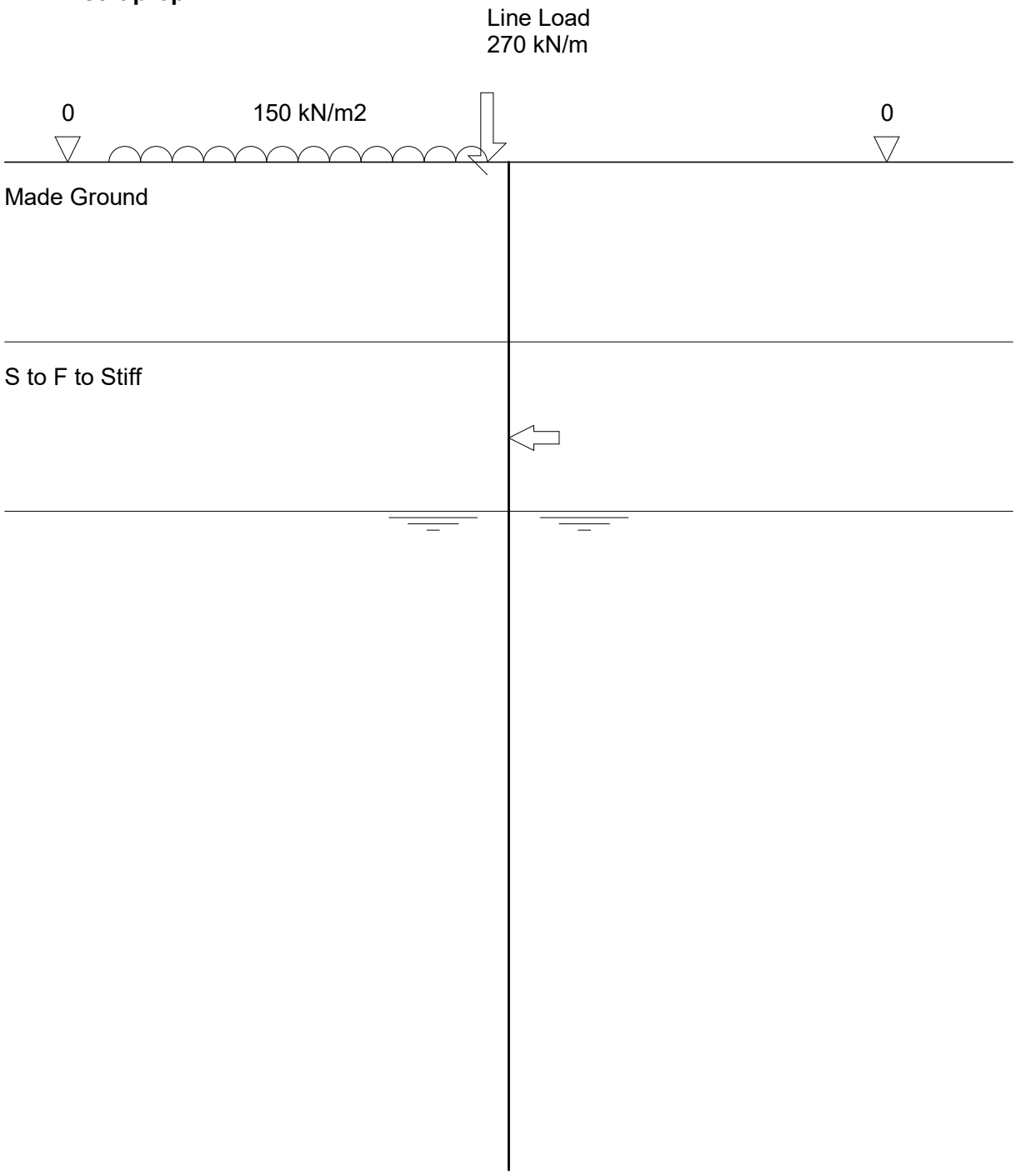


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

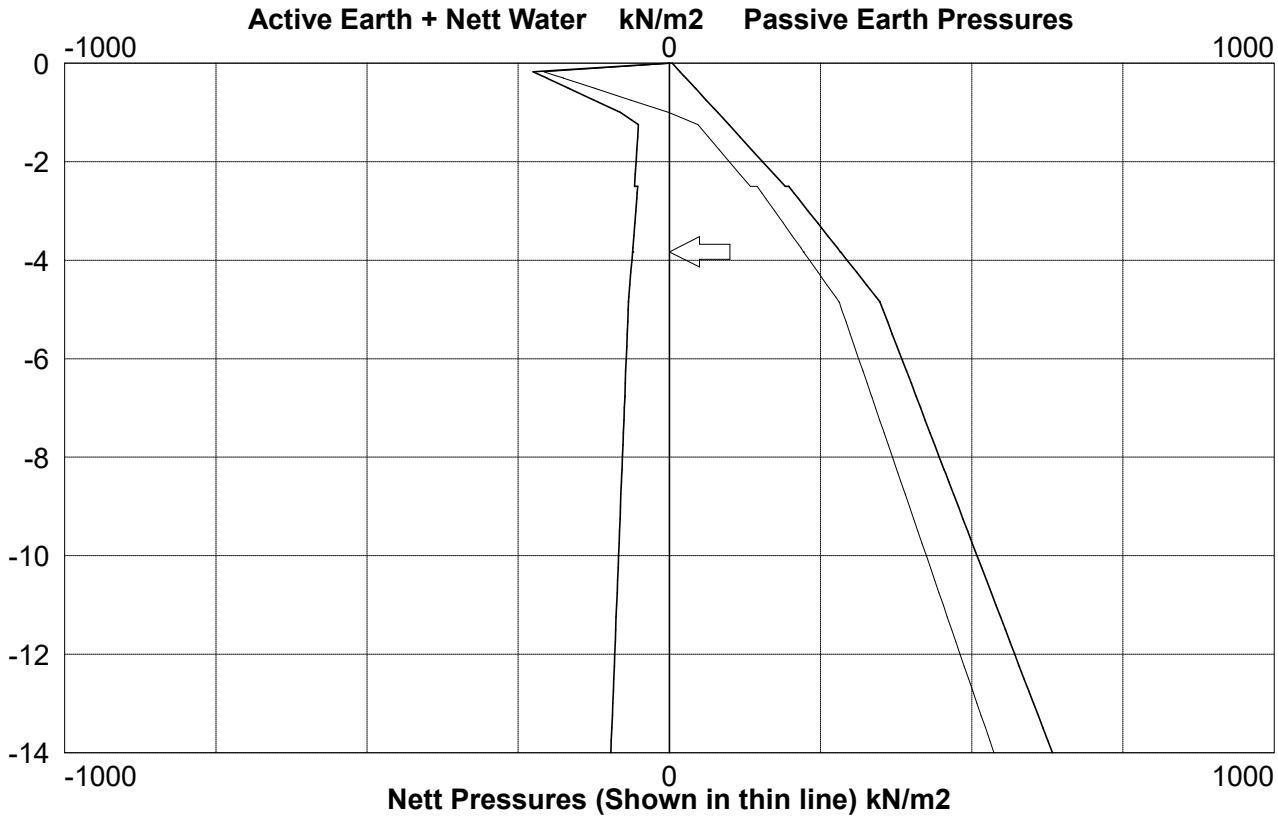
Stage ref. **3**
Stage type **Insert prop**

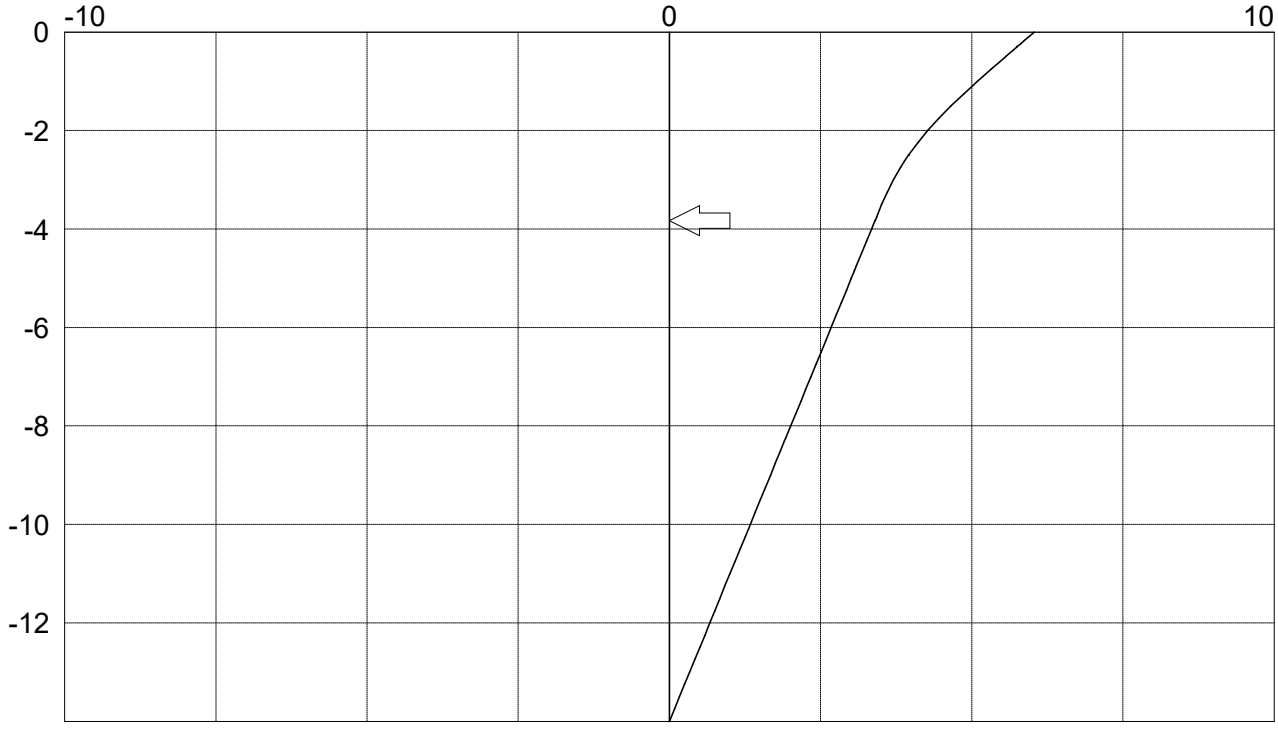


Tabular results from analysis of stage ref 3

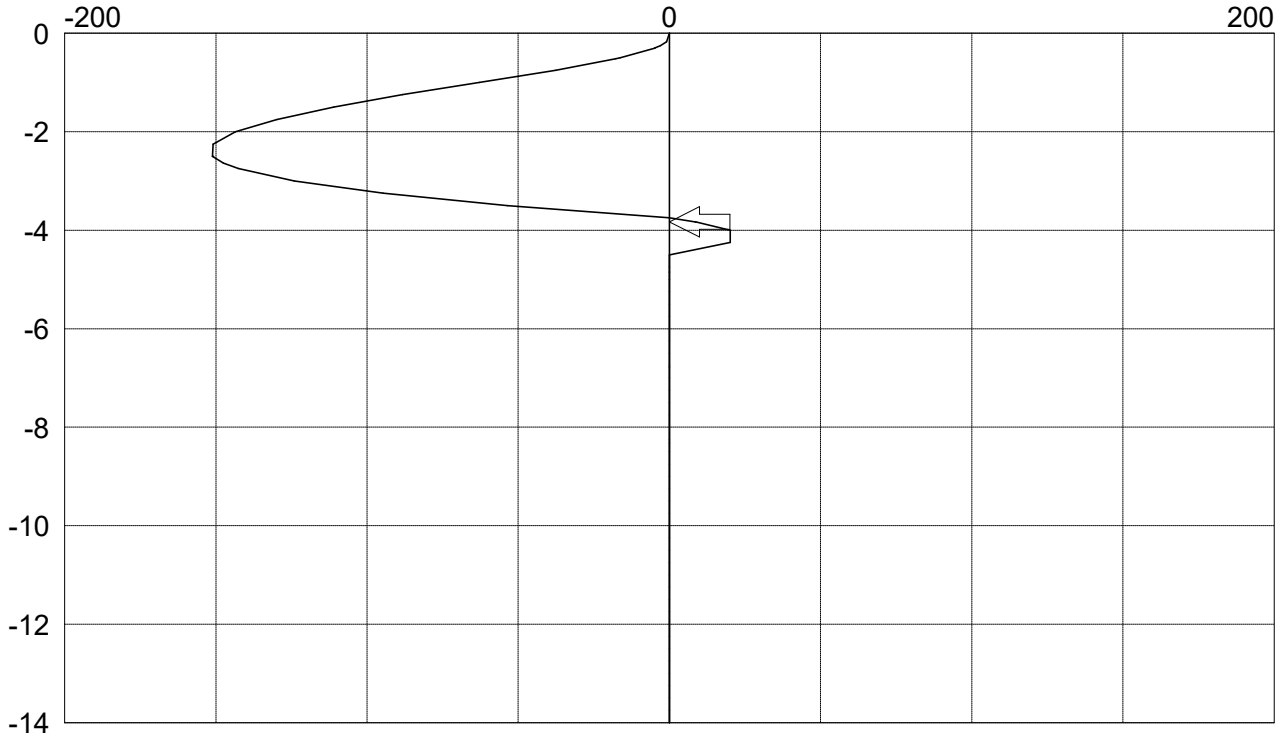
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	5.0	.0	-5.0	0	0	6.0		.00
-.17	153.1	225.1	.0	3.1	17.9	.0	207.2	1.0	-17.5	5.9		.12
-.30	155.4	203.0	.0	5.4	27.4	.0	175.6	4.8	-41.8	5.8	.0	.10
-.30	155.4	202.7	.0	5.4	27.6	.0	175.1	4.9	-42.1	5.7		.10
-.52	159.4	164.7	.0	9.4	43.8	.0	120.9	17.8	-74.3	5.5		.12
-1.00	168.0	80.8	.0	18.0	79.7	.0	1.2	62.8	-103.7	5.1		.19
-2.00	186.0	55.1	.0	36.0	154.4	.0	-99.3	143.5	-42.9	4.3		.43
-2.50	195.0	57.9	.0	45.0	191.8	.0	-133.9	151.1	15.4	4.0		.58
-2.50	195.0	52.2	.0	45.0	197.3	.0	-145.2	151.1	15.4	4.0		.58
-2.64	197.6	53.1	.0	47.6	206.2	.0	-153.2	147.6	36.0	3.9		.63
-3.00	204.5	55.4	.0	54.5	229.5	.0	-174.1	124.1	95.2	3.7		.74
-3.83	220.3	60.9	.0	70.3	282.9	.0	-222.0	-8.6	216.2	3.4	.0	1.03
-3.83	220.3	60.9	.0	70.3	283.0	.0	-222.1	-8.8	215.5	3.4		1.03
-4.00	223.5	62.0	.0	73.5	293.8	.0	-231.8	-20.2	161.3	3.3		1.09
-4.85	239.6	67.6	.0	89.6	348.3	.0	-280.7	0	0	3.1		1.39
-4.85	239.7	67.6	.0	89.6	348.5	.0	-280.9	0	0	3.1		1.39
-5.00	241.0	68.1	1.5	91.0	353.1	1.5	-285.1	0	0	3.0		1.44
-6.00	250.2	71.2	11.3	100.2	384.3	11.3	-313.0	0	0	2.7		1.78
-6.78	257.4	73.7	18.9	107.4	408.6	18.9	-334.9	0	0	2.4		2.03
-7.00	259.4	74.4	21.1	109.4	415.4	21.1	-341.0	0	0	2.3		2.10
-8.00	268.6	77.6	30.9	118.6	446.5	30.9	-368.9	0	0	2.0		2.38
-8.32	271.6	78.6	34.0	121.6	456.6	34.0	-378.0	0	0	1.9		2.47
-9.00	277.8	80.8	40.7	127.8	477.7	40.7	-396.9	0	0	1.7		2.65
-10.00	287.0	84.0	50.5	137.0	508.8	50.5	-424.8	0	0	1.3		2.88
-11.00	296.2	87.1	60.3	146.2	539.9	60.3	-452.8	0	0	1.0		3.10
-12.00	305.4	90.3	70.1	155.4	571.1	70.1	-480.8	0	0	.7		3.30
-13.00	314.6	93.5	79.9	164.6	602.2	79.9	-508.7	0	0	.3		3.49
-14.00	323.8	96.7	89.7	173.8	633.3	89.7	-536.7	0	0	0		3.66

Graphical results from analysis of stage ref 3

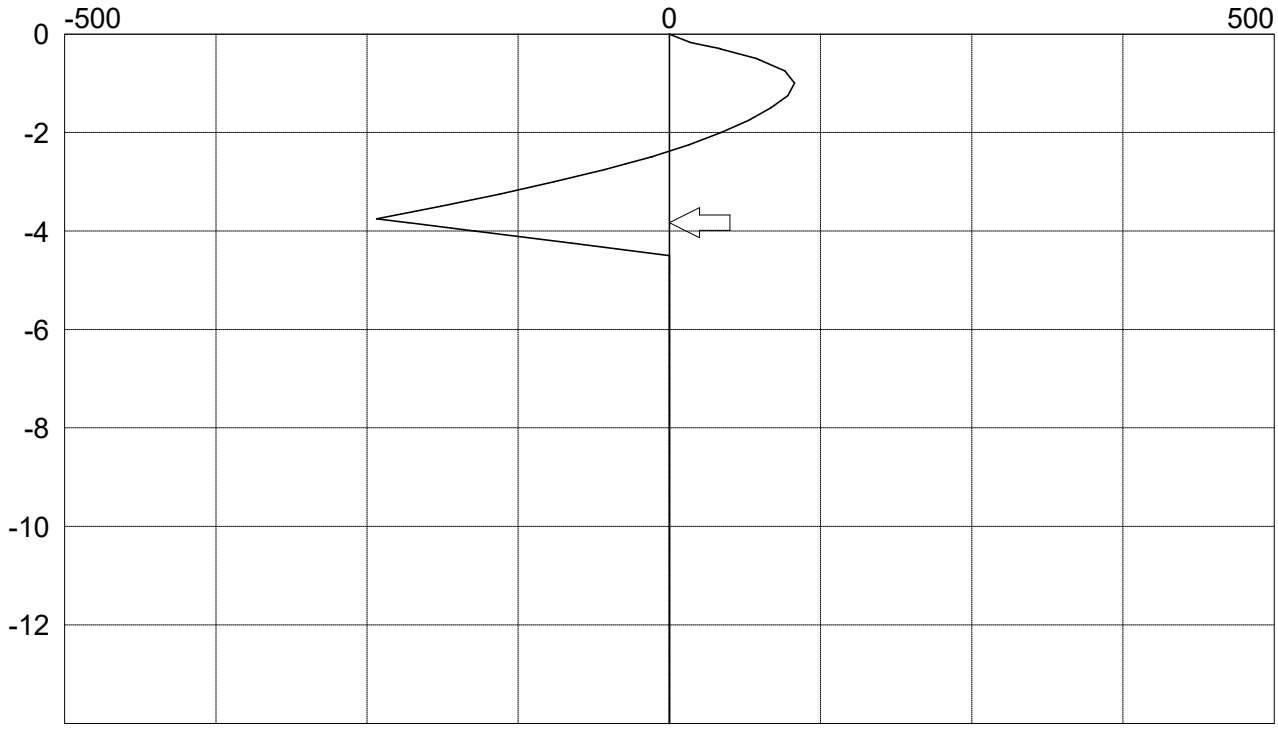




Graphical results from analysis of stage ref 3 continued

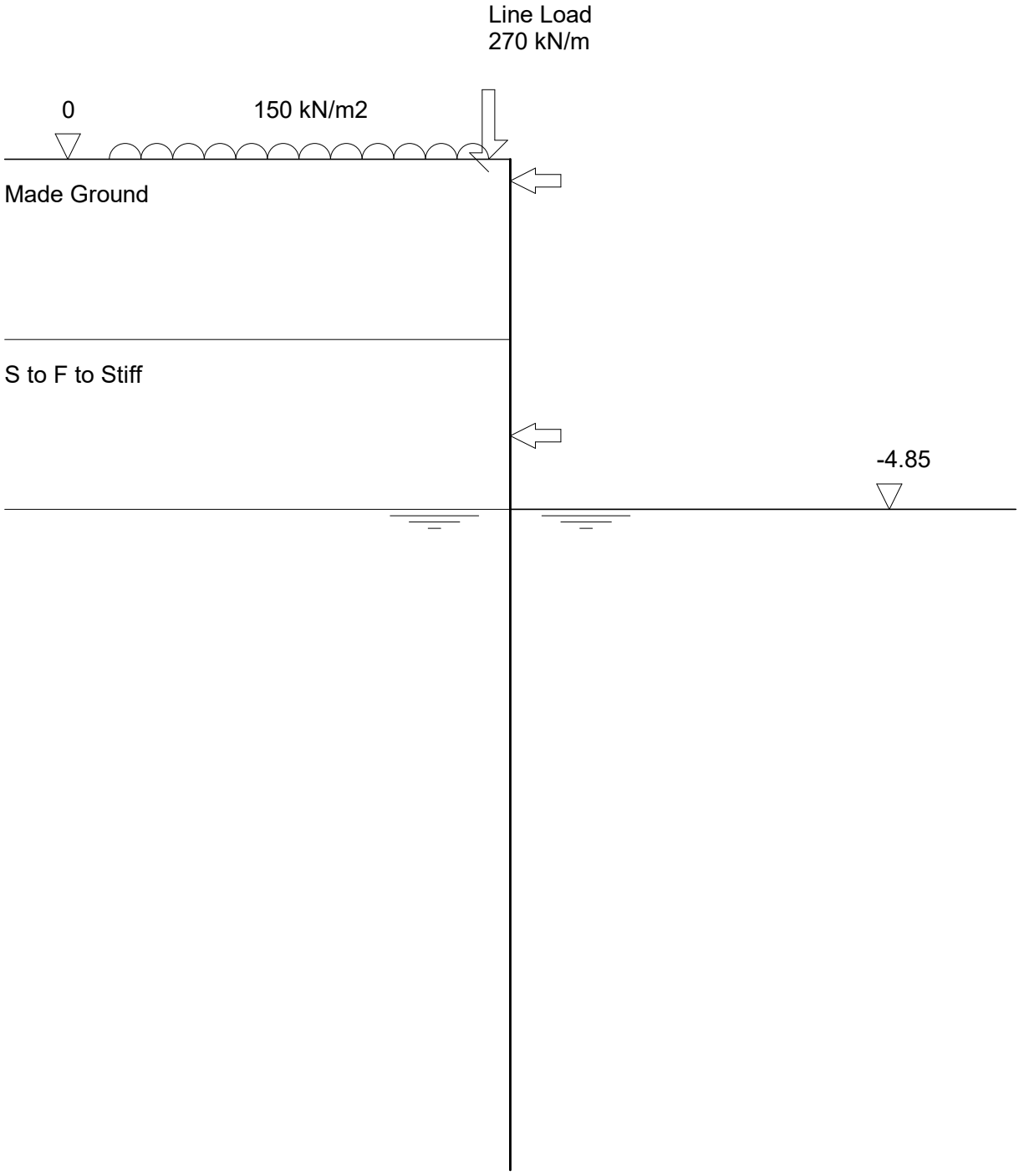


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

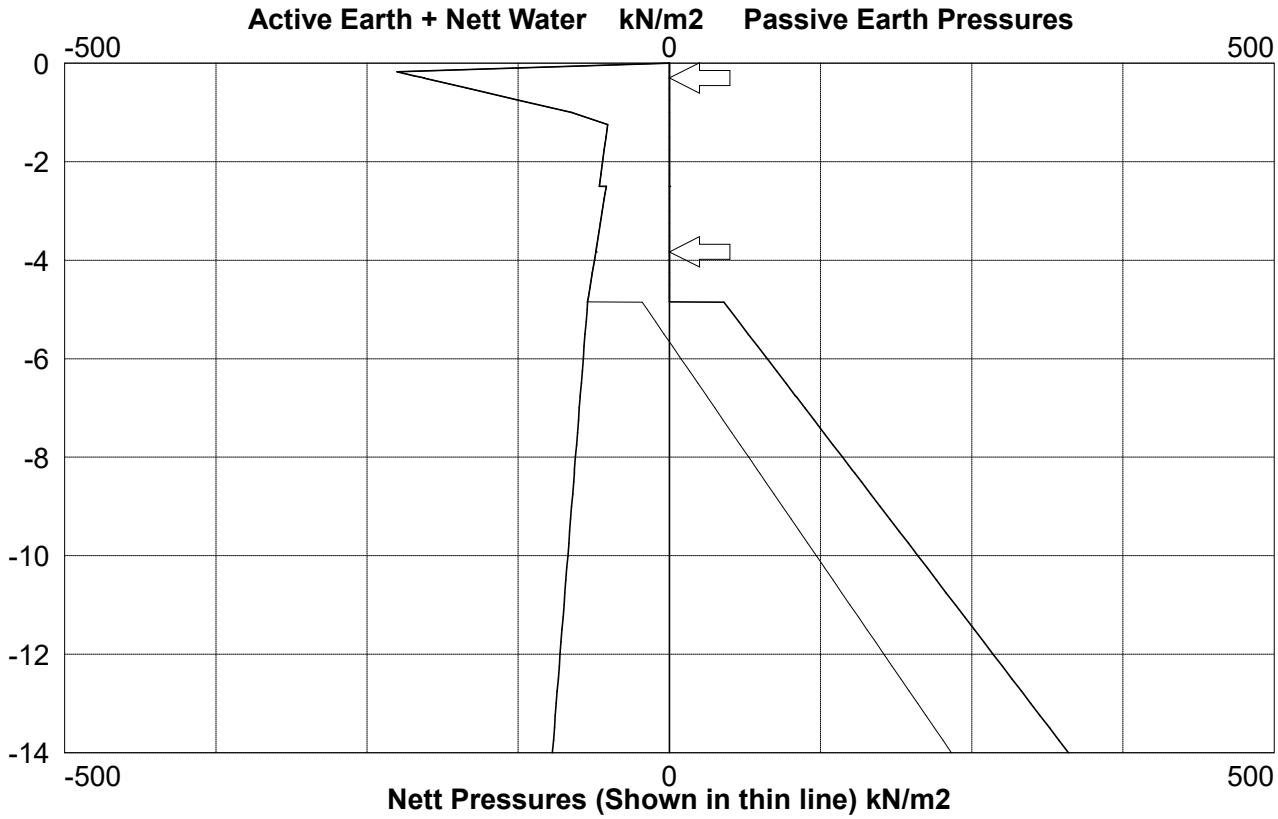
Stage ref. **5**
Stage type **Passive side excavation**

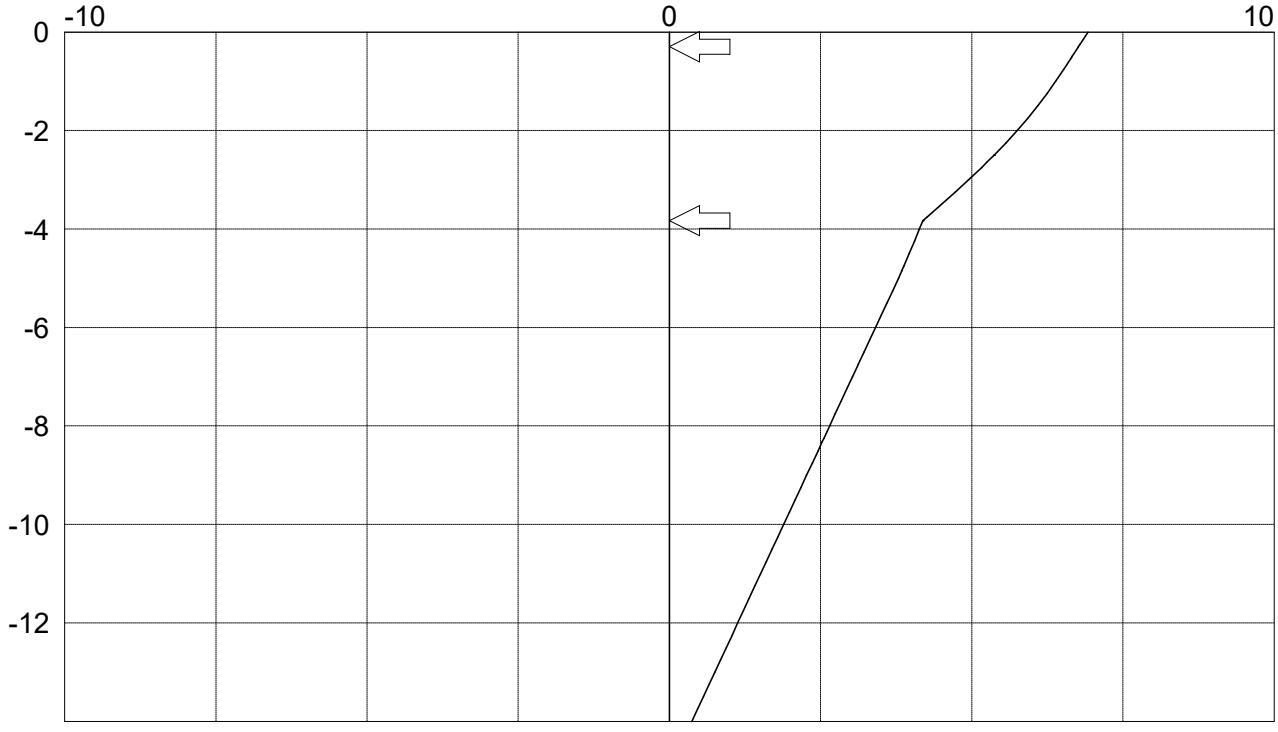


Tabular results from analysis of stage ref 5

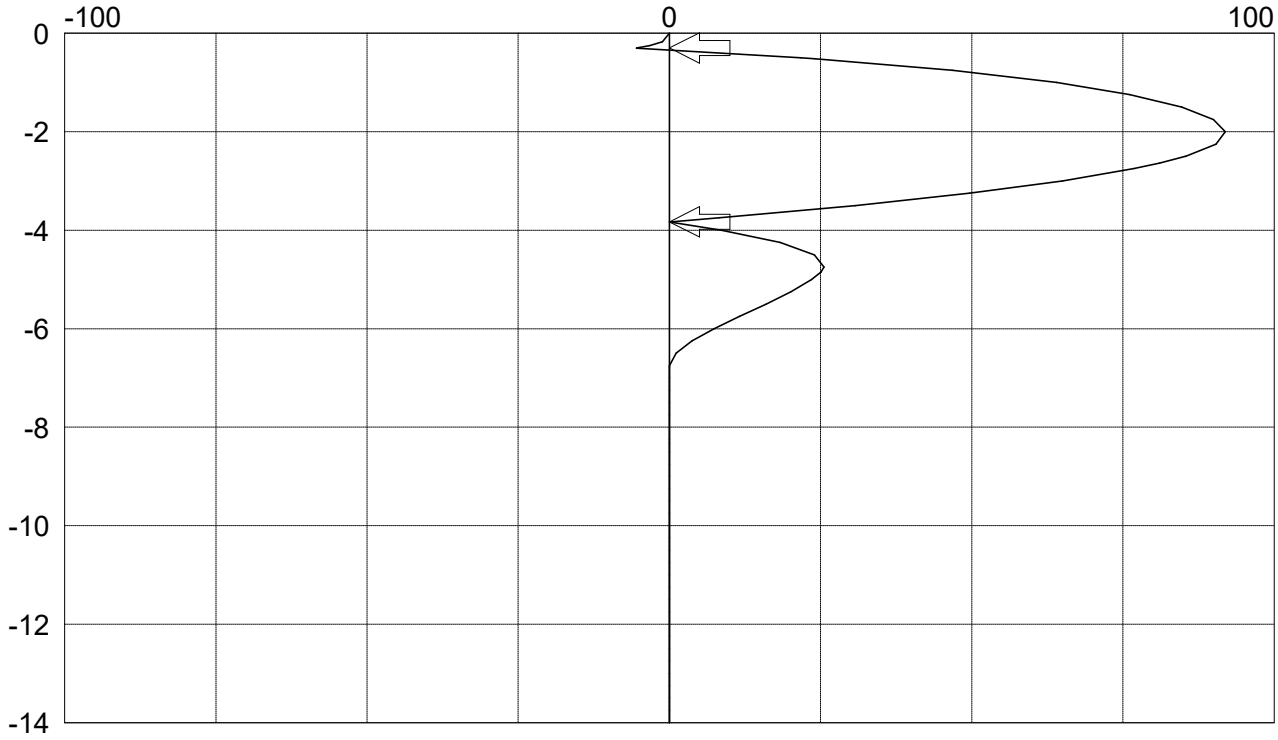
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	6.9		.00
-.17	153.1	225.1	.0	.0	.0	.0	225.1	1.1	-19.5	6.8		.00
-.30	155.4	203.0	.0	.0	.0	.0	203.0	5.3	-46.6	6.8	203.2	.00
-.30	155.4	202.7	.0	.0	.0	.0	202.7	5.4	156.1	6.8		.00
-.52	159.4	164.7	.0	.0	.0	.0	164.7	-24.0	116.2	6.7		.00
-1.00	168.0	80.8	.0	.0	.0	.0	80.8	-64.1	57.2	6.4		.00
-2.00	186.0	55.1	.0	.0	.0	.0	55.1	-91.9	.9	5.8		.00
-2.50	195.0	57.9	.0	.0	.0	.0	57.9	-85.3	-27.4	5.4		.00
-2.50	195.0	52.2	.0	.0	.0	.0	52.2	-85.3	-27.4	5.4		.00
-2.64	197.6	53.1	.0	.0	.0	.0	53.1	-81.1	-34.7	5.3		.00
-3.00	204.5	55.4	.0	.0	.0	.0	55.4	-65.0	-54.3	4.9		.00
-3.83	220.3	60.9	.0	.0	.0	.0	60.9	-.2	-102.6	4.2	159.4	.00
-3.83	220.3	60.9	.0	.0	.0	.0	60.9	0	56.8	4.2		.00
-4.00	223.5	62.0	.0	.0	.0	.0	62.0	-8.7	46.4	4.1		.00
-4.85	239.6	67.6	.0	.0	.0	.0	67.6	-25.1	-8.5	3.8		.00
-4.85	239.7	67.6	.0	.0	45.1	.0	22.5	-25.1	-8.6	3.8		.00
-5.00	241.0	68.1	1.5	1.4	49.7	1.5	18.3	-23.5	-11.7	3.8		.17
-6.00	250.2	71.2	11.3	10.6	80.9	11.3	-9.6	-7.4	-16.0	3.4		.74
-6.78	257.4	73.7	18.9	17.8	105.2	18.9	-31.5	0	0	3.1		1.00
-7.00	259.4	74.4	21.1	19.8	112.0	21.1	-37.6	0	0	3.0		1.06
-8.00	268.6	77.6	30.9	29.0	143.1	30.9	-65.5	0	0	2.6		1.34
-8.32	271.6	78.6	34.0	32.0	153.2	34.0	-74.6	0	0	2.5		1.42
-9.00	277.8	80.8	40.7	38.2	174.3	40.7	-93.5	0	0	2.3		1.59
-10.00	287.0	84.0	50.5	47.4	205.4	50.5	-121.5	0	0	1.9		1.81
-11.00	296.2	87.1	60.3	56.6	236.5	60.3	-149.4	0	0	1.5		2.03
-12.00	305.4	90.3	70.1	65.8	267.7	70.1	-177.4	0	0	1.1		2.23
-13.00	314.6	93.5	79.9	75.0	298.8	79.9	-205.3	0	0	.8		2.43
-14.00	323.8	96.7	89.7	84.2	329.9	89.7	-233.3	0	0	.4		2.61

Graphical results from analysis of stage ref 5

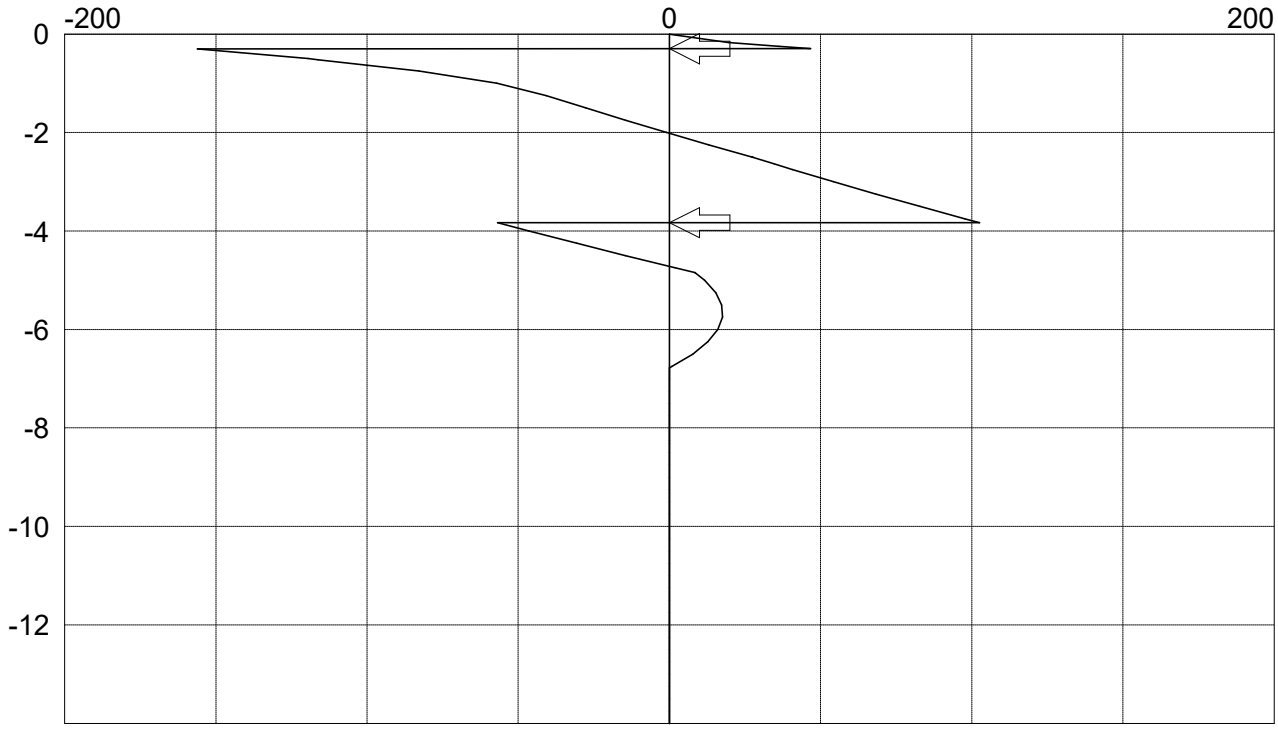




Graphical results from analysis of stage ref 5 continued

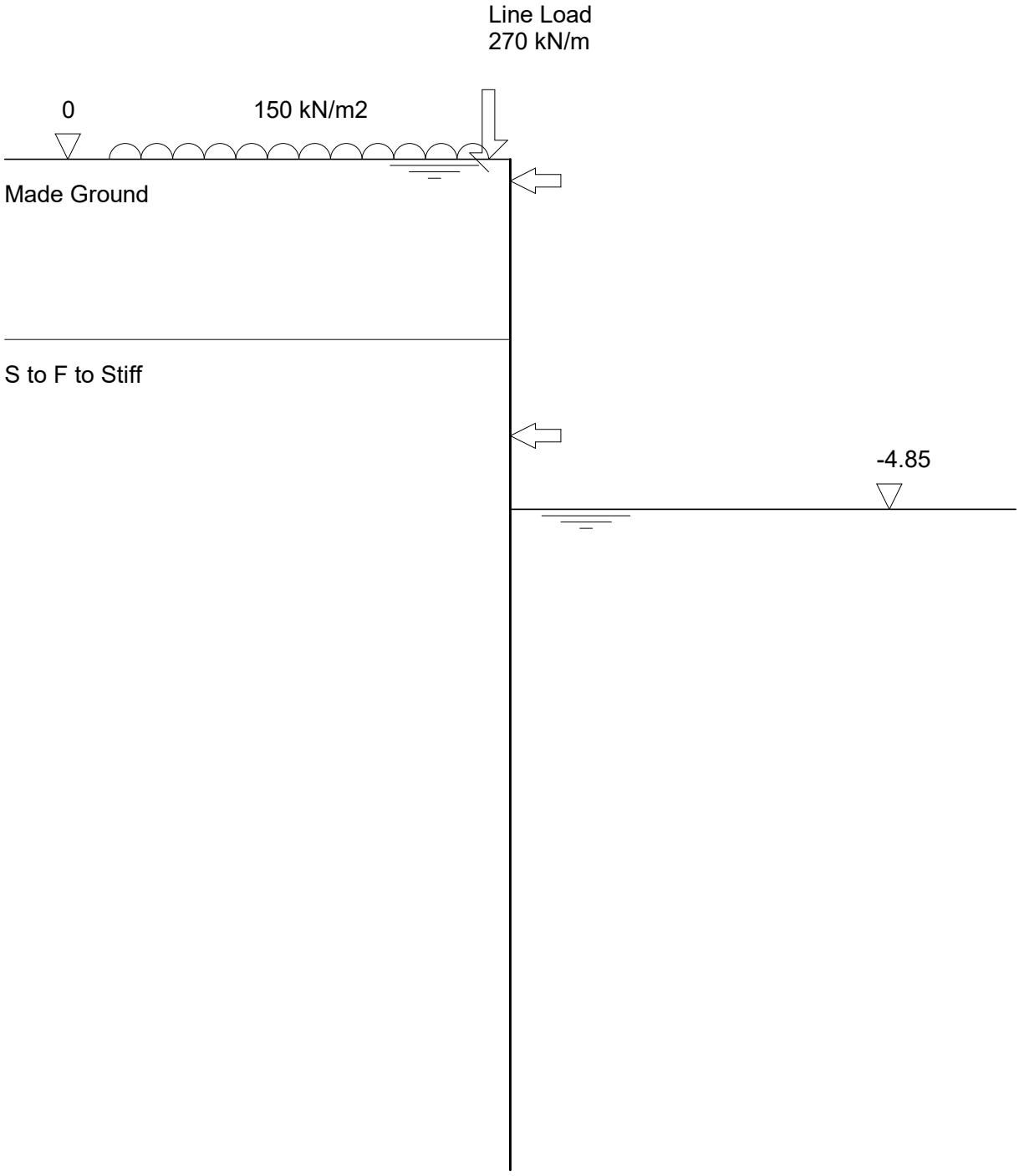


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

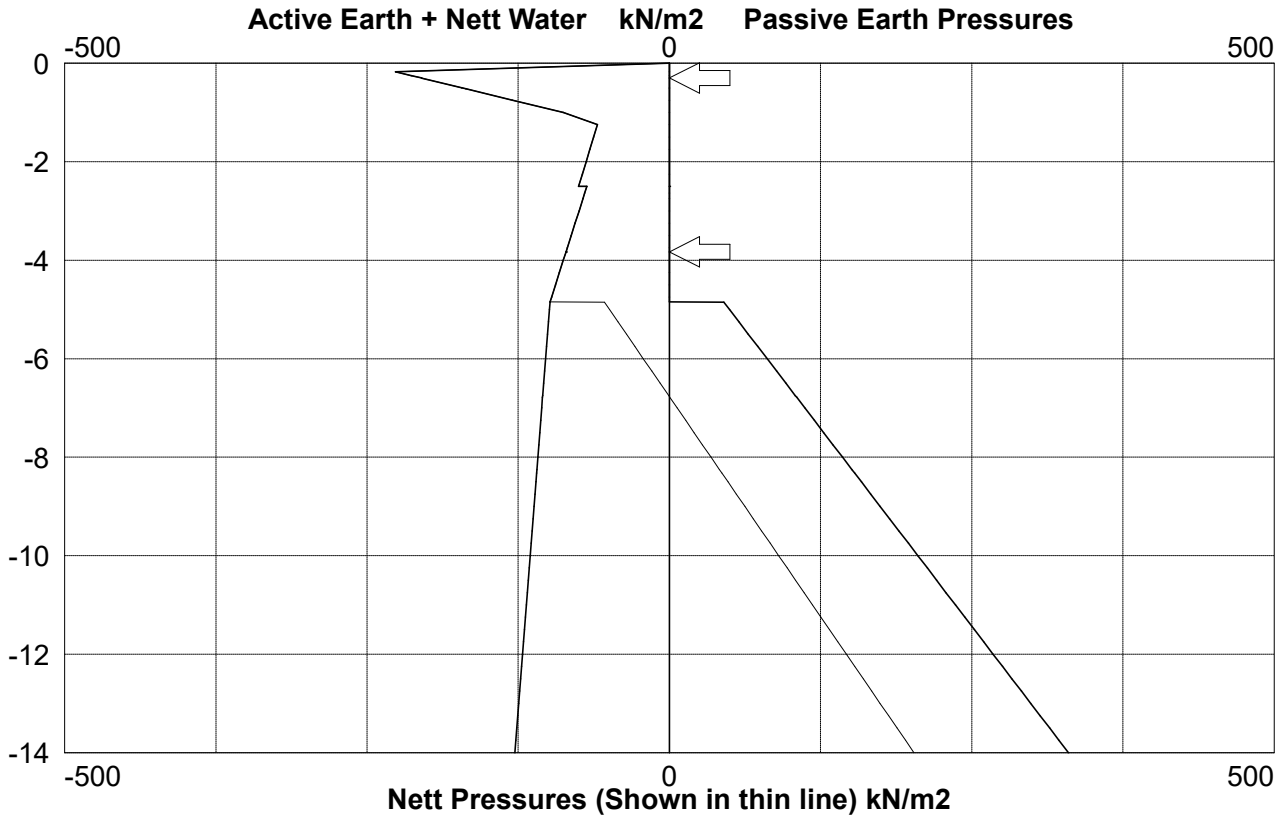
Stage ref. **6**
Stage type **Active water level**

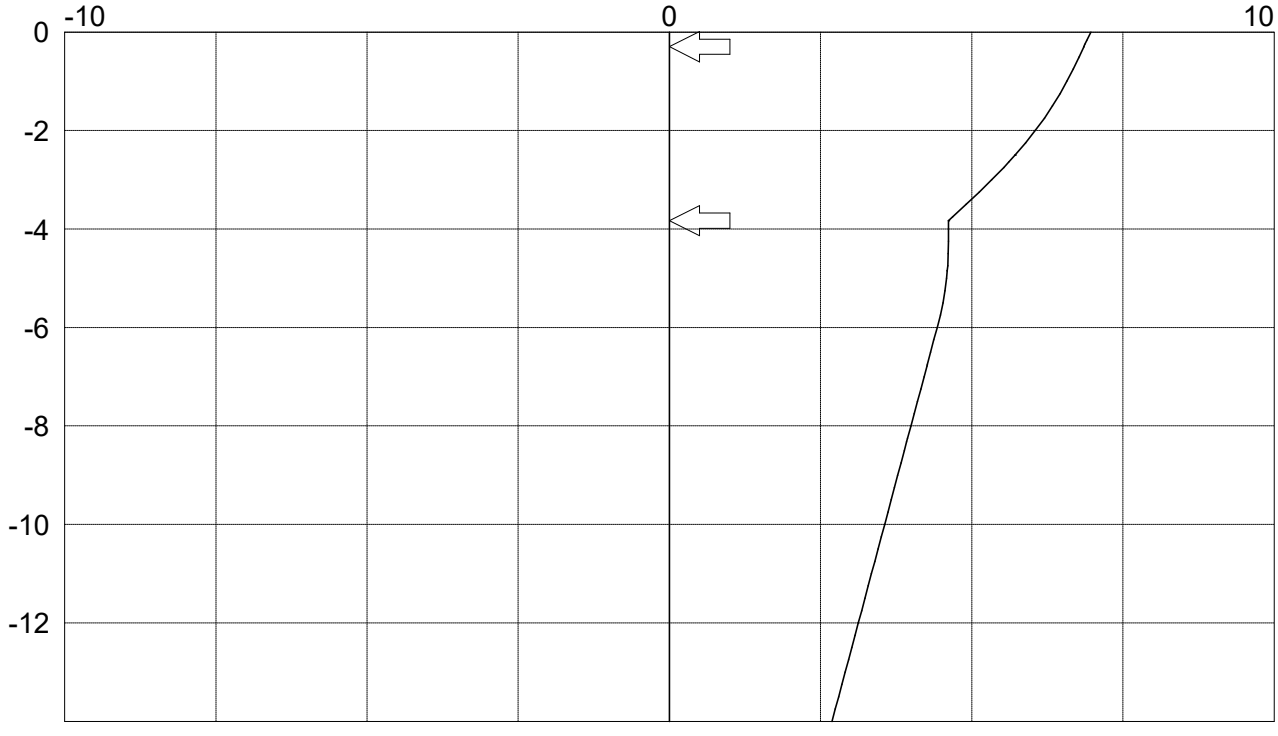


Tabular results from analysis of stage ref 6

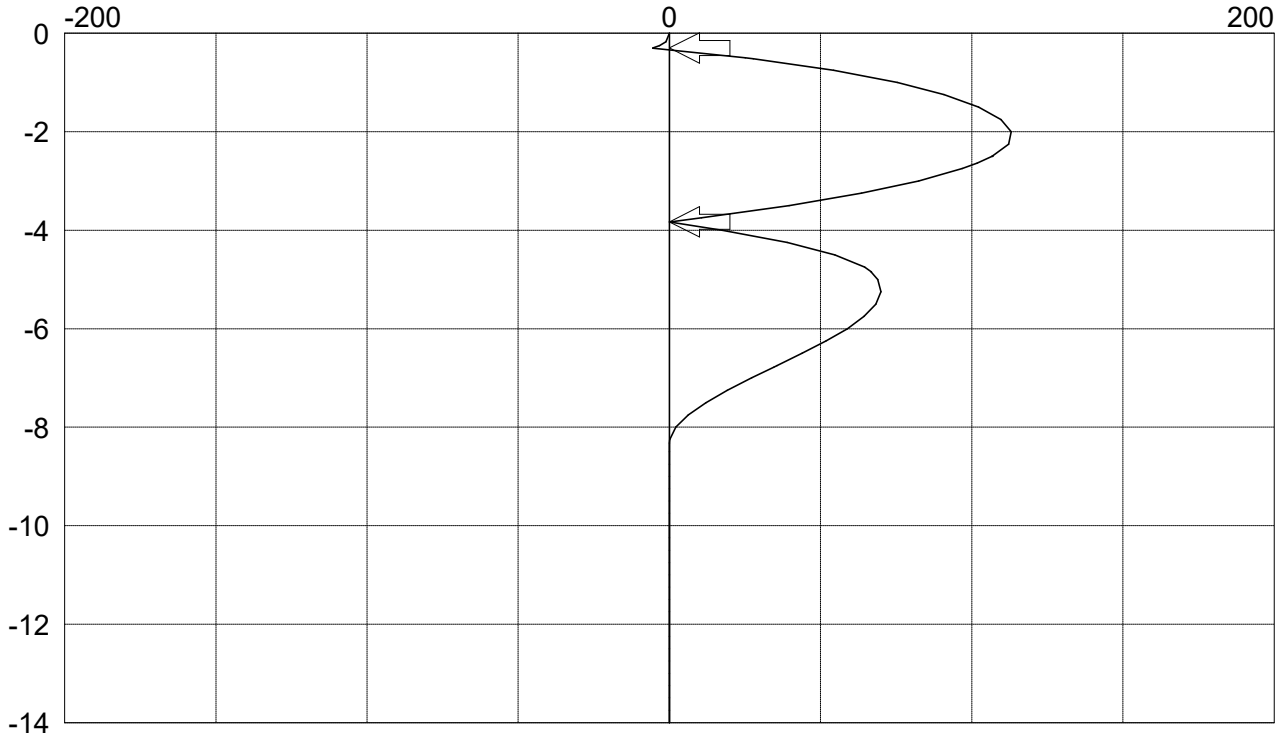
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.0		.00
-.17	151.4	224.6	1.7	.0	.0	.0	226.3	1.1	-19.6	6.9		.00
-.30	152.5	202.1	2.9	.0	.0	.0	205.1	5.4	-46.9	6.9	221.0	.00
-.30	152.5	201.8	3.0	.0	.0	.0	204.7	5.5	173.6	6.9		.00
-.52	154.3	163.1	5.1	.0	.0	.0	168.2	-27.8	133.0	6.8		.00
-1.00	158.2	77.9	9.8	.0	.0	.0	87.7	-75.4	71.6	6.6		.00
-2.00	166.4	49.2	19.6	.0	.0	.0	68.8	-113.1	5.0	6.1		.00
-2.50	170.5	50.4	24.5	.0	.0	.0	74.9	-106.7	-30.9	5.7		.00
-2.50	170.5	43.7	24.5	.0	.0	.0	68.2	-106.7	-30.9	5.7		.00
-2.64	171.8	44.1	25.9	.0	.0	.0	70.0	-101.8	-40.4	5.6		.00
-3.00	175.1	45.3	29.4	.0	.0	.0	74.7	-82.5	-66.6	5.3		.00
-3.83	182.7	47.9	37.5	.0	.0	.0	85.5	-.3	-133.1	4.6	244.6	.00
-3.83	182.8	47.9	37.6	.0	.0	.0	85.5	0	111.4	4.6		.00
-4.00	184.3	48.5	39.2	.0	.0	.0	87.7	-17.5	96.9	4.6		.00
-4.85	192.1	51.2	47.5	.0	.0	.0	98.7	-66.8	17.9	4.6		.00
-4.85	192.1	51.2	47.5	.0	45.1	.0	53.6	-66.8	17.7	4.6		.00
-5.00	193.5	51.6	49.0	1.4	49.7	1.5	49.4	-68.9	10.0	4.6		.12
-6.00	202.7	54.8	58.8	10.6	80.9	11.3	21.5	-58.8	-25.5	4.4		.51
-6.78	209.9	57.3	66.5	17.8	105.2	18.9	-.4	-34.5	-33.8	4.3		.70
-7.00	211.9	58.0	68.6	19.8	112.0	21.1	-6.5	-27.2	-33.0	4.2		.74
-8.00	221.1	61.2	78.4	29.0	143.1	30.9	-34.4	-2.1	-12.6	4.0		.94
-8.32	224.1	62.2	81.6	32.0	153.2	34.0	-43.5	0	0	3.9		1.00
-9.00	230.3	64.4	88.2	38.2	174.3	40.7	-62.4	0	0	3.8		1.12
-10.00	239.5	67.5	98.0	47.4	205.4	50.5	-90.3	0	0	3.6		1.30
-11.00	248.7	70.7	107.8	56.6	236.5	60.3	-118.3	0	0	3.3		1.46
-12.00	257.9	73.9	117.6	65.8	267.7	70.1	-146.3	0	0	3.1		1.62
-13.00	267.1	77.1	127.4	75.0	298.8	79.9	-174.2	0	0	2.9		1.77
-14.00	276.3	80.2	137.2	84.2	329.9	89.7	-202.2	0	0	2.7		1.92

Graphical results from analysis of stage ref 6

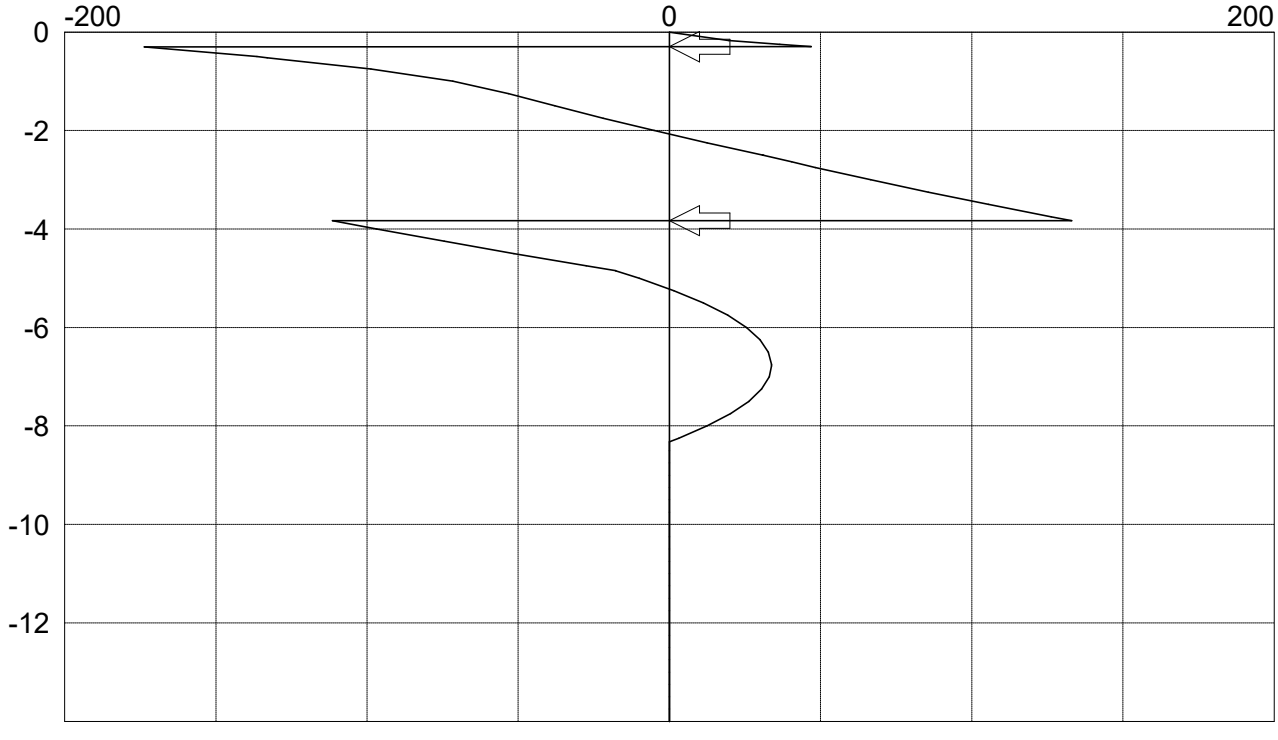




Graphical results from analysis of stage ref 6 continued

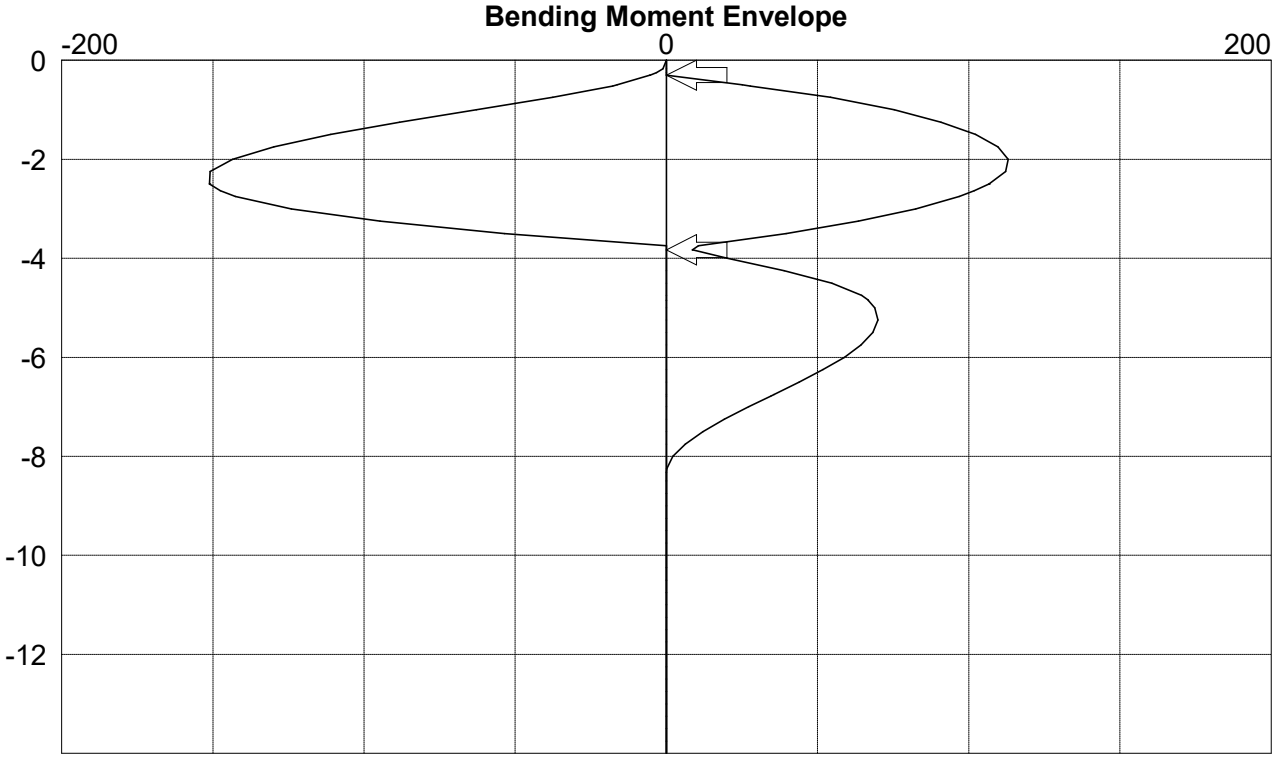


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Graphical plot of envelope from selected construction stages



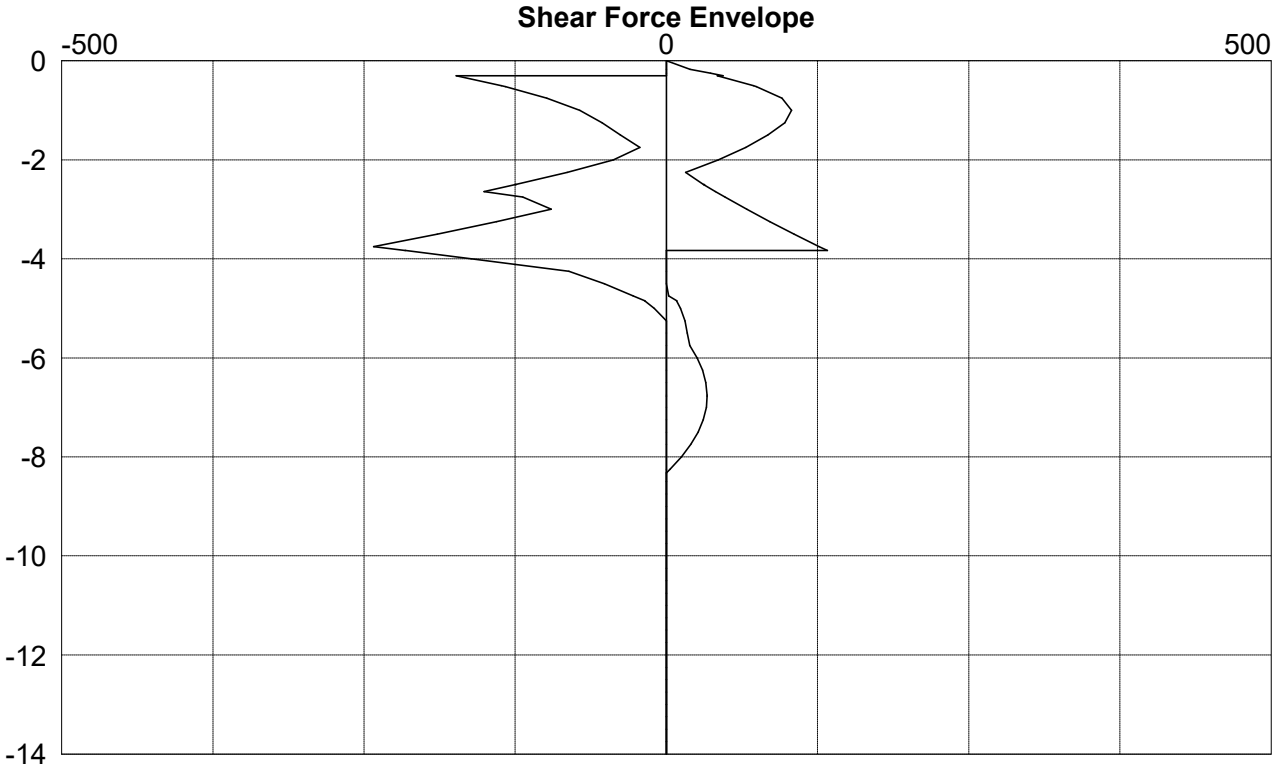


Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
.00	.0	.0	.0	.0	
-.17	.0	1.1	-19.6	.0	
-.30	.0	5.4	-46.9	.0	221.0
-.30	.0	5.5	-42.1	173.6	
-.52	-27.8	17.8	-74.3	133.0	
-1.00	-75.4	62.8	-103.7	71.6	
-2.00	-113.1	143.5	-42.9	43.8	
-2.50	-106.7	151.1	-30.9	124.7	
-2.50	-106.7	151.1	-30.9	124.7	
-2.64	-101.8	147.6	-40.4	150.8	
-3.00	-82.5	124.1	-66.6	95.2	
-3.83	-8.6	.0	-133.1	216.2	244.6
-3.83	-8.8	.0	.0	215.5	
-4.00	-20.2	.0	.0	161.3	
-4.85	-66.8	.0	-8.5	17.9	
-4.85	-66.8	.0	-8.6	17.7	
-5.00	-68.9	.0	-11.7	10.0	
-6.00	-58.8	.0	-25.5	.0	
-6.78	-34.5	.0	-33.8	.0	
-7.00	-27.2	.0	-33.0	.0	
-8.00	-2.1	.0	-12.6	.0	
-8.32	.0	.0	.0	.0	
-9.00	.0	.0	.0	.0	
-10.00	.0	.0	.0	.0	
-11.00	.0	.0	.0	.0	
-12.00	.0	.0	.0	.0	
-13.00	.0	.0	.0	.0	
-14.00	.0	.0	.0	.0	

Structural design of wall

Wall section properties

Primary pile diameter	600	mm
Primary pile spacing	700	mm
Infill pile diameter		mm
Main rebar bar diameter	25	mm
Main rebar number of bars	12	
Links/Helix bar diameter	16	mm
Links/Helix spacing/pitch	225	mm

Wall material properties

Concrete cube strength	35	N/mm2
Concrete cover	75	mm
Main rebar steel grade	500	N/mm2
Link rebar steel grade	500	N/mm2
Ultimate load factor	1.50	

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	159	434	kNm
Max longitudinal steel. BS8110 max 6% by area	16965	5890	mm2
Min longitudinal steel. BS8110 min 0.4% by area	1131	5890	mm2
Shear resistance. BS8110	254	430	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	16	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	270	225	mm
Min shear link area. BS8110 Clause 3.4.5	664	1787	mm2/m

Pile Wall Section B-B Temporary Condition	Page No 1 Analysis Temp Condition
CADS Piled Wall Suite Version 6.10 Design of embedded retaining walls and cofferdams	Project SLS Analysis File Name B-B -Temp Condn.pws"
Broxwood View, 29 St. Edmund's Terrace London NW8 450mm Dia. Secant Pile Retaining Wall	Engineer AA Date 14/02/2023

Pile geometry

Pile top Level	0	m
Pile Length	8	m
Pile toe level	-8	m

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level -4.85

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
.00	Made Ground	18.00	18.00	15000	0			28	.67	.30	
								28	.50	4.15	
-2.50	S to F to Stiff	19.00	19.00	24000	9600	30	12.0		.67	1.00	2.58
						30	12.0		.50	1.00	2.45

Construction sequence

Stage Ref		Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1	A	Active surcharge	0.00	10.0	.3		
2	A	Passive side excavation	-1.00				
3		Insert prop	-0.50				
4	A	Passive side excavation	-4.85				
5		Insert prop	-3.83				
6	A	Remove prop	-0.50				
7		Insert prop	-0.30				
8	A	Active water level	0.00				
9	A	Active surcharge	0.00	50.0	.3		
10	A	Horizontal load					

Code of practice

Code of practice or reference document	
Application of pressures for stability	Not applicable for FOS=1 on moments
FOS on moments (stability check)	1.00
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.00

Wall analysis detail options

Nominal Phi for load distribution	30.0	Degrees
Depth of water filled tension cracks	.0	m
Density of water	9.8	kN/m3
Minimum equivalent fluid density	5.0	kN/m3
Depth of passive softened soil	.0	m
Continuity model for wall analysis	Pins at second and lower props	

Deflection parameters

Wall moment of inertia	335482	cm4/m
Wall Youngs modulus	27000000	kN/m2

Properties for prop at -0.5

Prop/Tie cross sectional area	3	cm2 each
Prop/Tie Youngs modulus	200000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

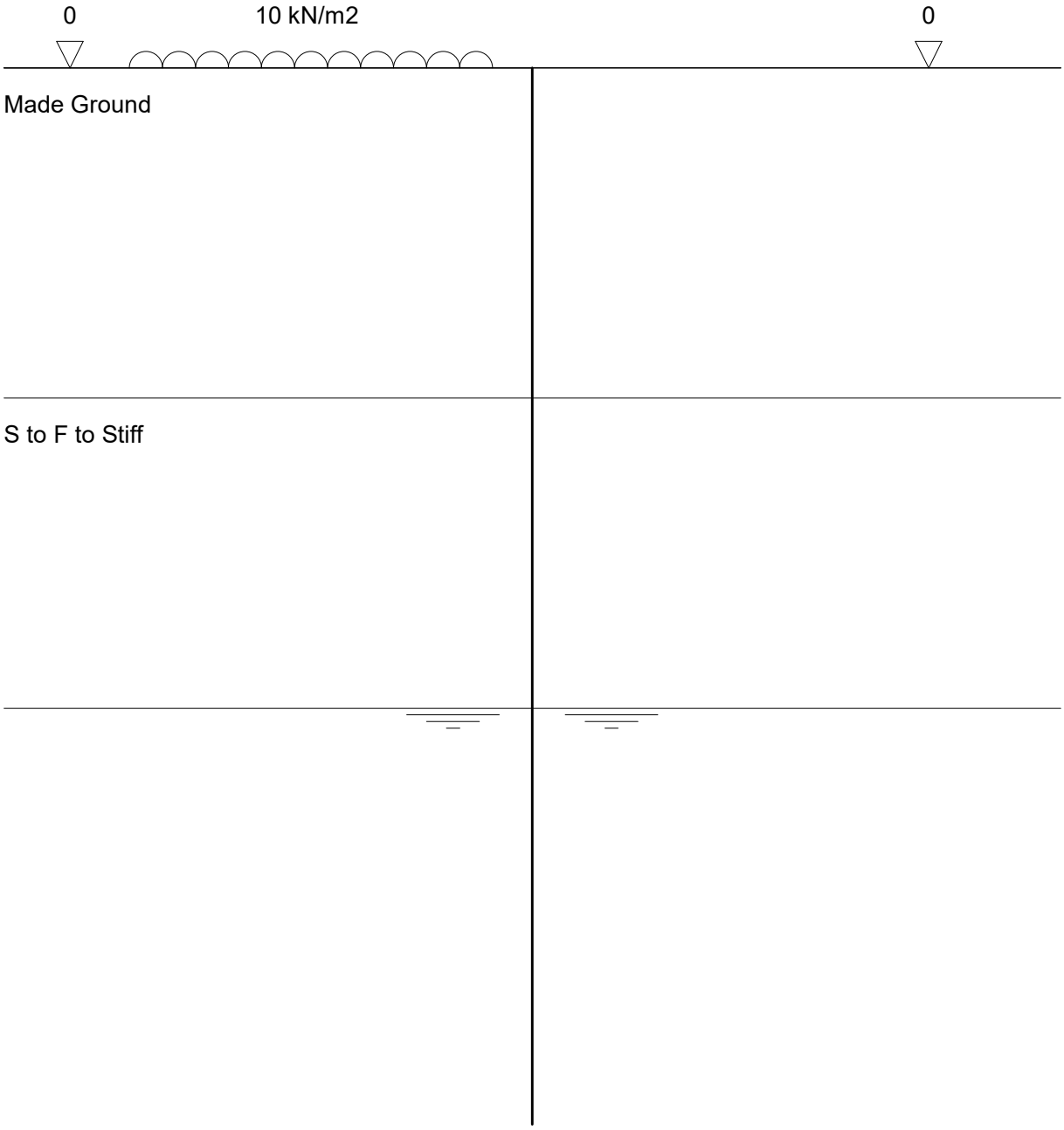
Properties for prop at -3.83

Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Properties for prop at -0.3

Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

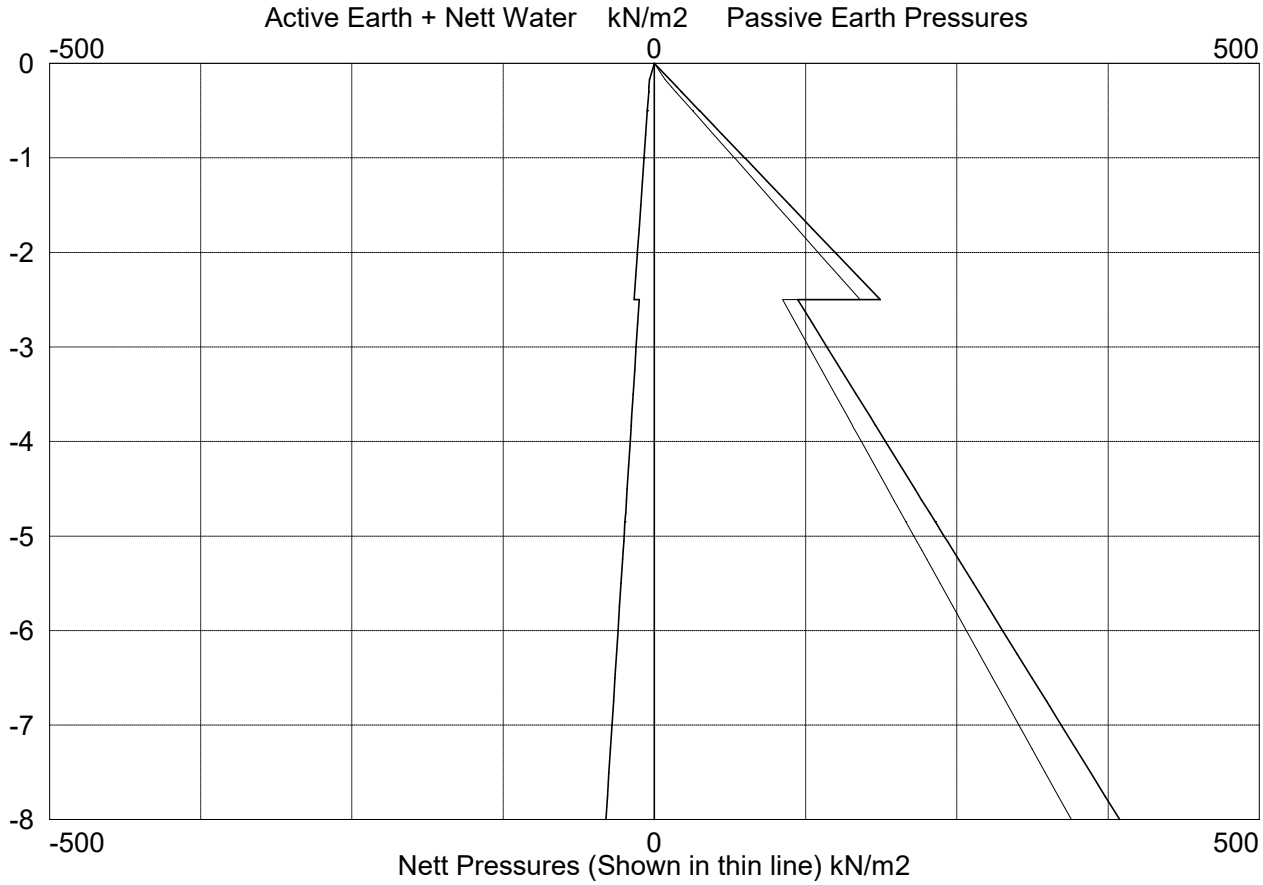
Stage ref. 1
Stage type Active surcharge

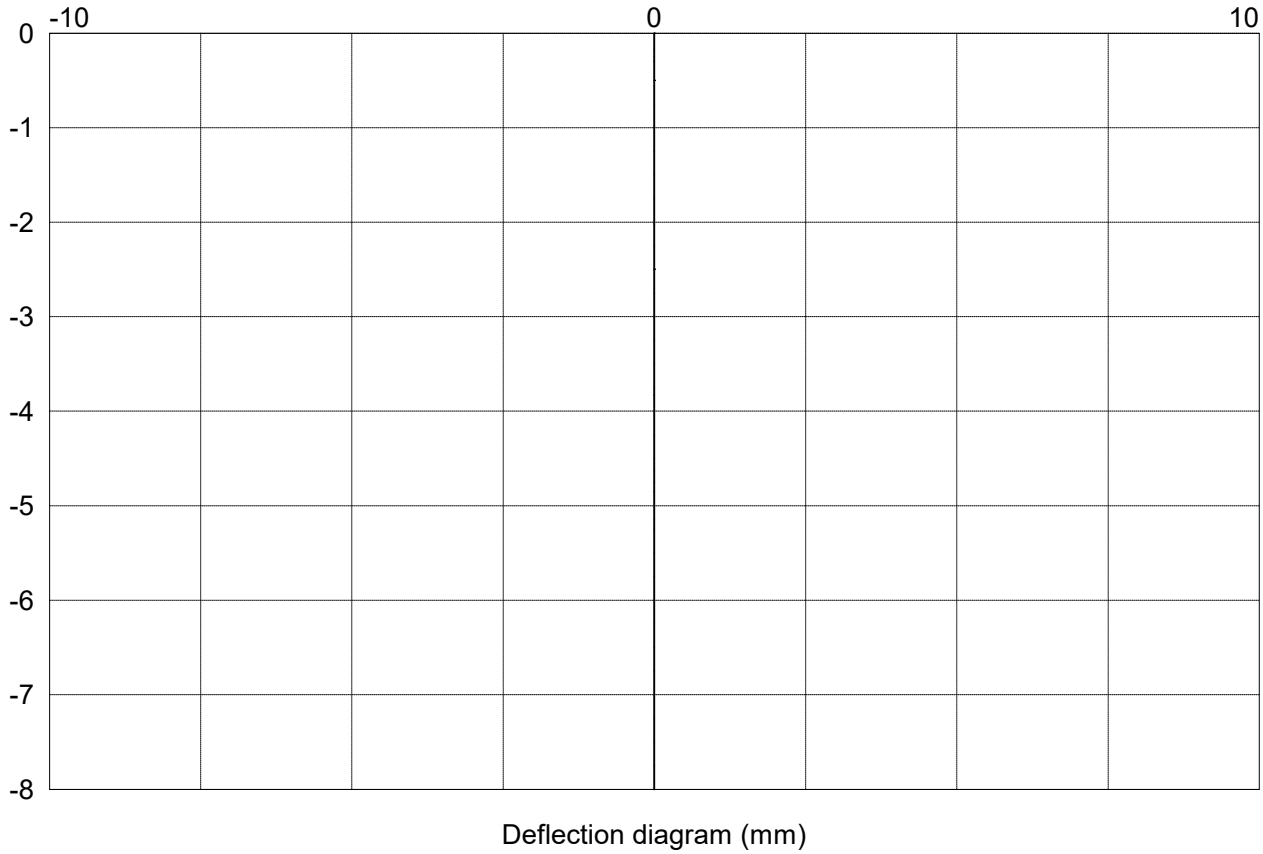


Tabular results from analysis of stage ref 1

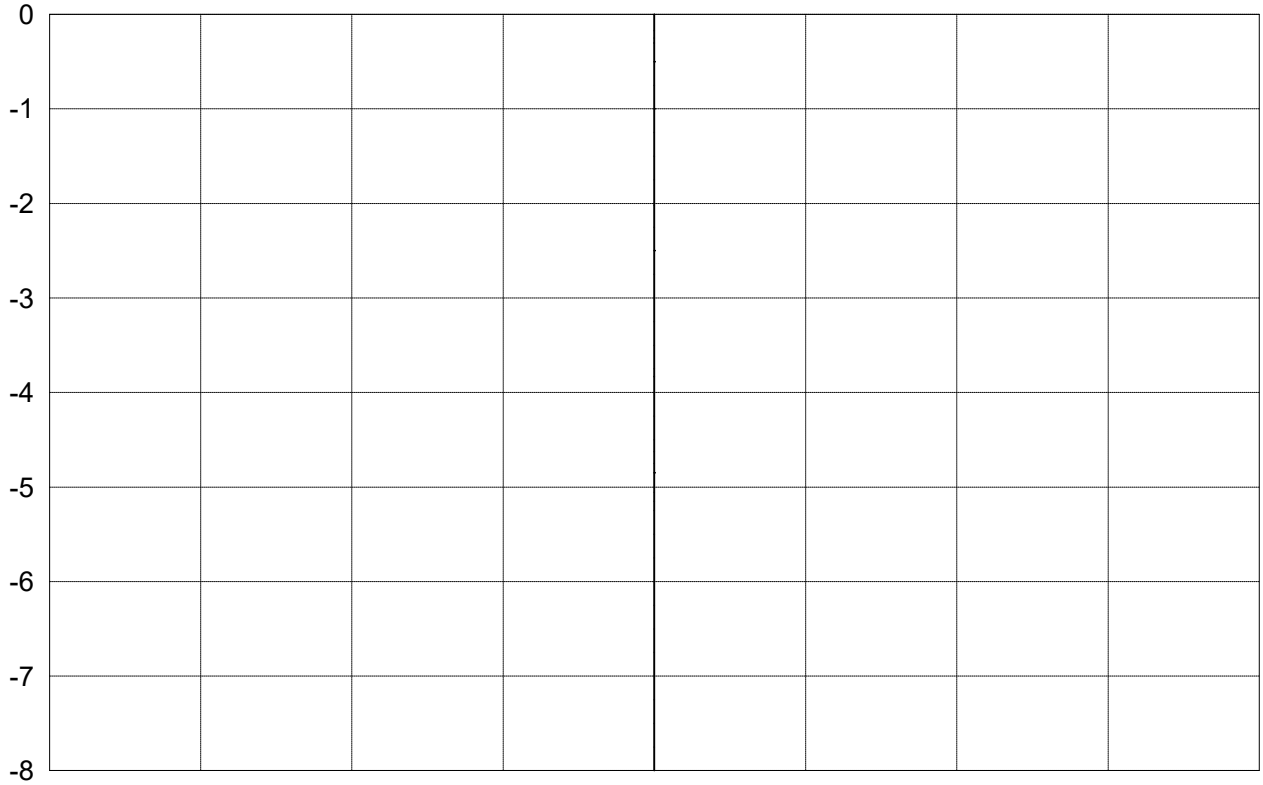
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	0		.00
.00	.0	.0	.0	.0	.1	.0	-.1	0	0	0		>100.00
-.17	13.1	4.0	.0	3.1	12.9	.0	-9.0	0	0	0		>100.00
-.30	15.4	4.7	.0	5.4	22.4	.0	-17.7	0	0	0	.0	>100.00
-.30	15.4	4.7	.0	5.4	22.6	.0	-17.9	0	0	0		>100.00
-.50	19.0	5.8	.0	9.0	37.4	.0	-31.6	0	0	0	.0	>100.00
-.50	19.0	5.8	.0	9.0	37.5	.0	-31.7	0	0	0		>100.00
-1.00	28.0	8.5	.0	18.0	74.6	.0	-66.1	0	0	0		>100.00
-1.00	28.0	8.5	.0	18.0	74.7	.0	-66.2	0	0	0		>100.00
-2.00	46.0	14.0	.0	36.0	149.4	.0	-135.4	0	0	0		>100.00
-2.02	46.4	14.1	.0	36.4	150.9	.0	-136.8	0	0	0		>100.00
-2.50	55.0	16.7	.0	45.0	186.8	.0	-170.0	0	0	0		>100.00
m -2.50	55.0	12.5	.0	45.0	118.5	.0	-106.0	0	0	0		>100.00
m -3.00	64.5	15.0	.0	54.5	142.7	.0	-127.7	0	0	0		>100.00
m -3.83	80.3	19.2	.0	70.3	182.8	.0	-163.7	0	0	0	.0	>100.00
m -3.83	80.3	19.2	.0	70.3	182.9	.0	-163.8	0	0	0		>100.00
m -4.00	83.5	20.0	.0	73.5	191.1	.0	-171.1	0	0	0		>100.00
m -4.62	95.4	23.1	.0	85.4	221.3	.0	-198.2	0	0	0		>100.00
m -4.85	99.6	24.2	.0	89.6	232.1	.0	-207.9	0	0	0		>100.00
m -4.85	99.6	24.3	.0	89.6	232.2	.0	-208.0	0	0	0		>100.00
m -5.00	102.5	25.0	.0	92.5	239.5	.0	-214.5	0	0	0		>100.00
m -5.06	103.6	25.3	.0	93.6	242.2	.0	-216.9	0	0	0		>100.00
m -5.15	105.4	25.8	.0	95.3	246.7	.0	-221.0	0	0	0		>100.00
m -6.00	121.5	30.0	.0	111.5	287.9	.0	-257.9	0	0	0		>100.00
m -7.00	140.5	35.0	.0	130.5	336.3	.0	-301.3	0	0	0		>100.00
m -8.00	159.5	40.0	.0	149.5	384.7	.0	-344.7	0	0	0		>100.00

Graphical results from analysis of stage ref 1

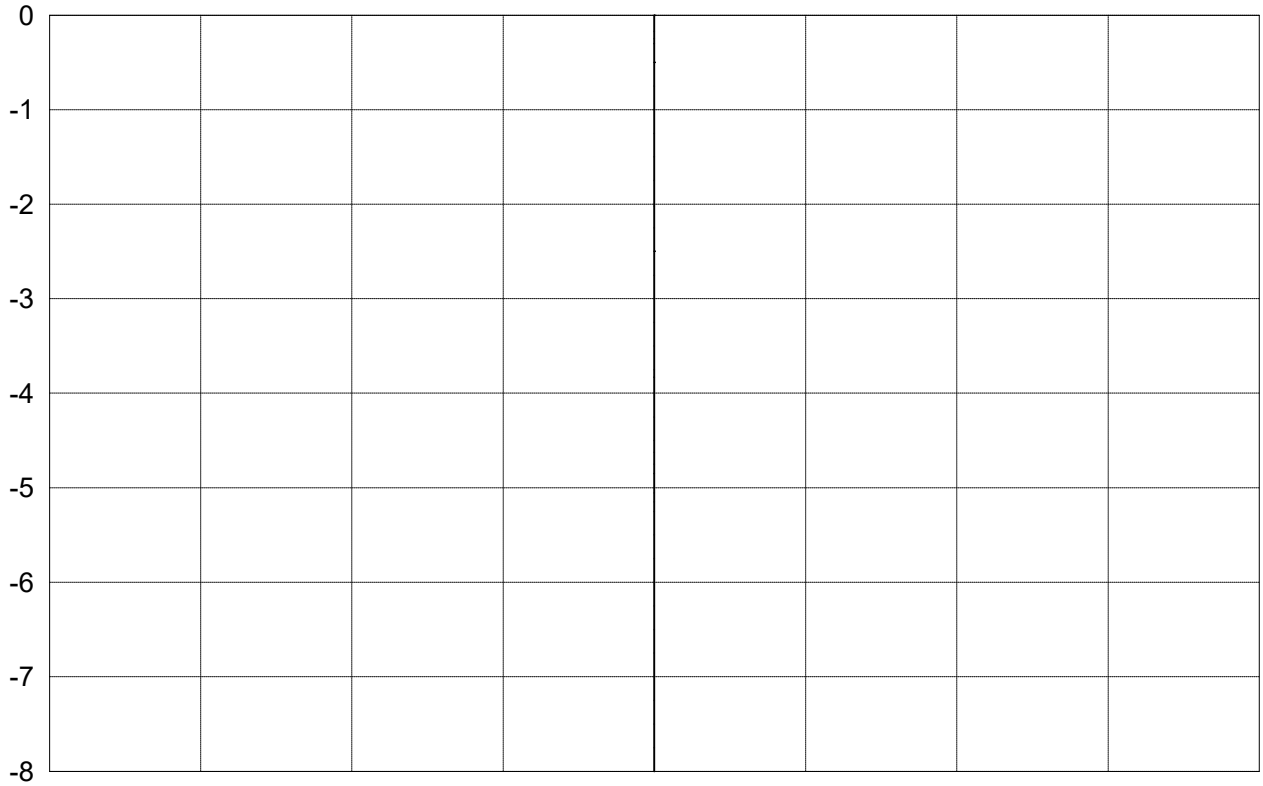




Graphical results from analysis of stage ref 1 continued

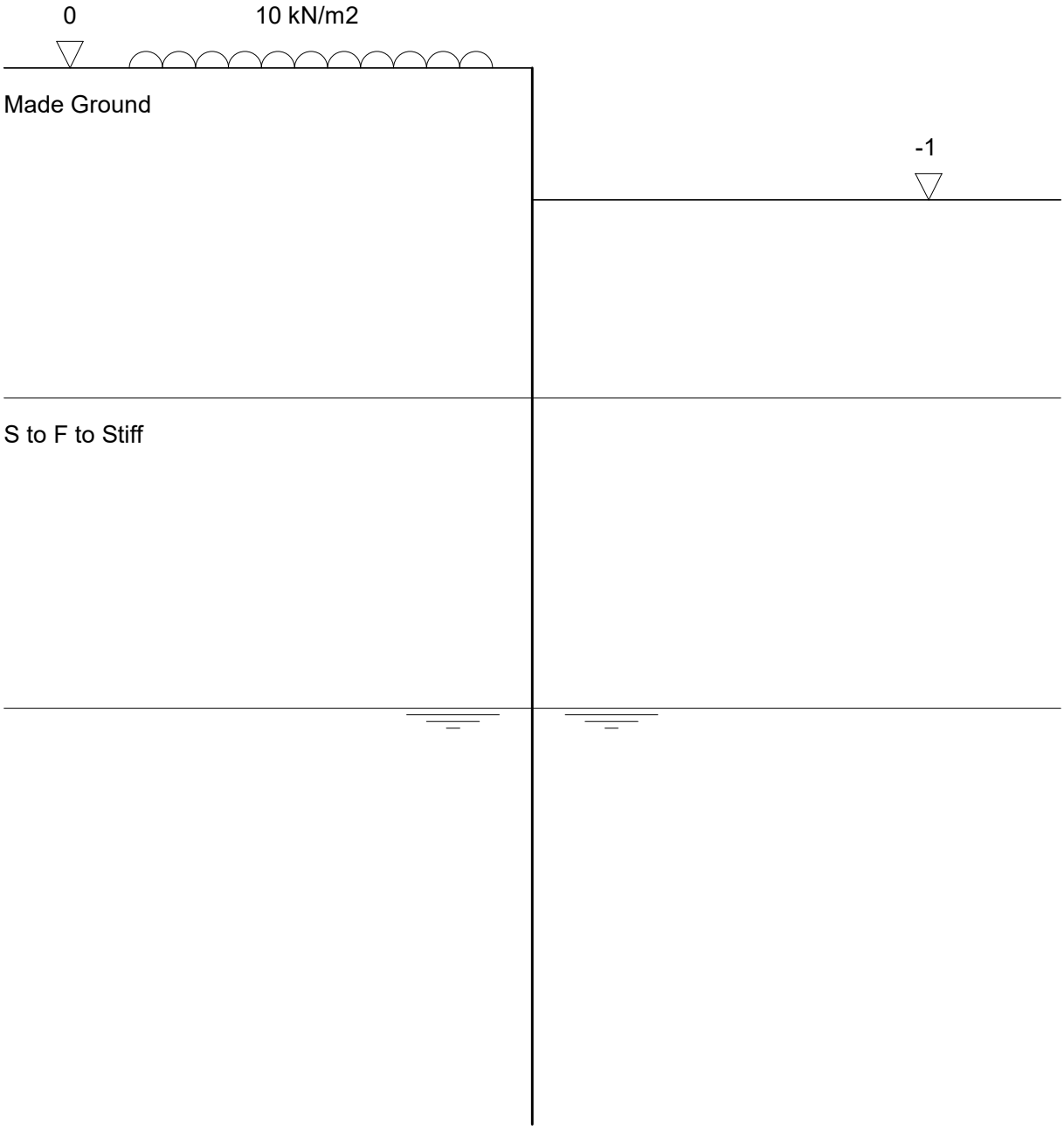


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

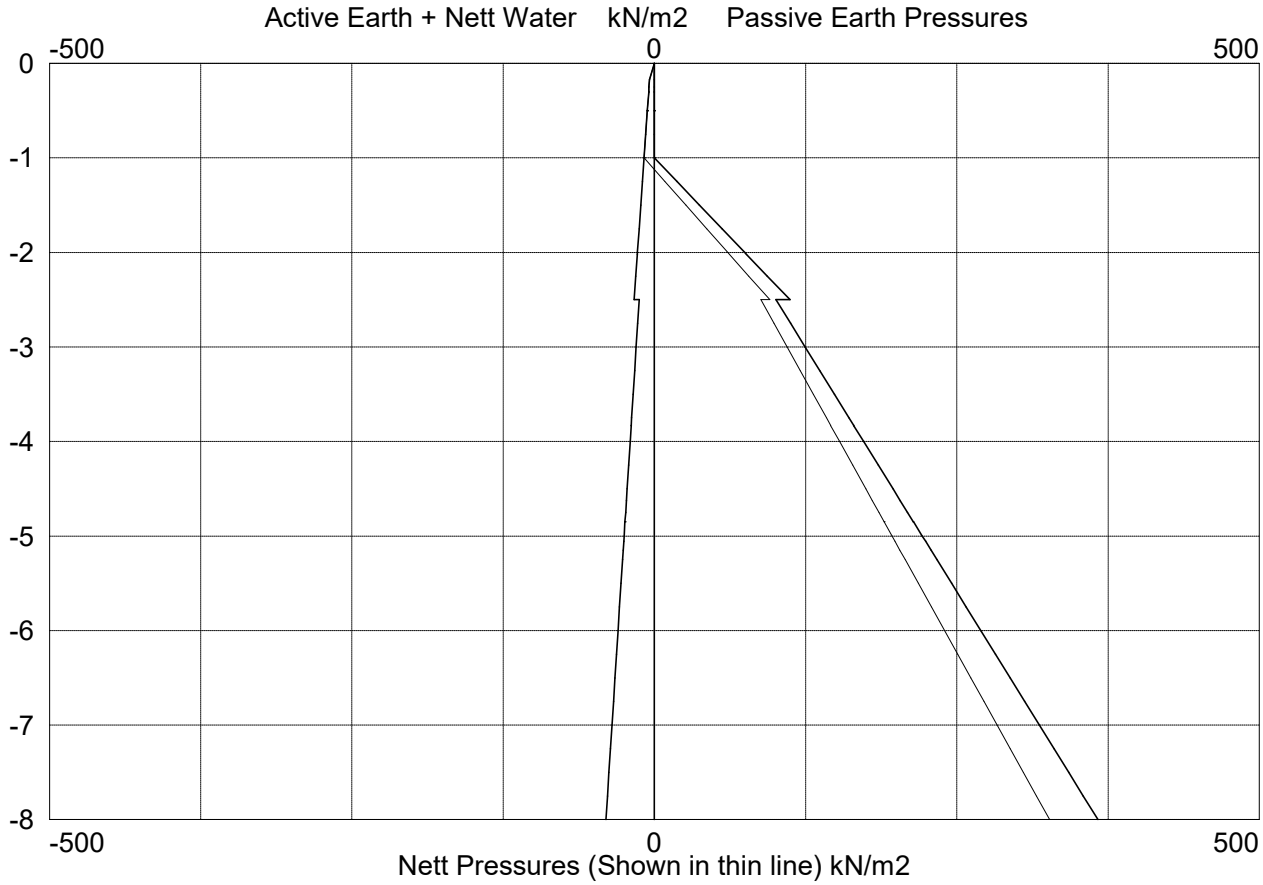
Stage ref. 2
Stage type Passive side excavation



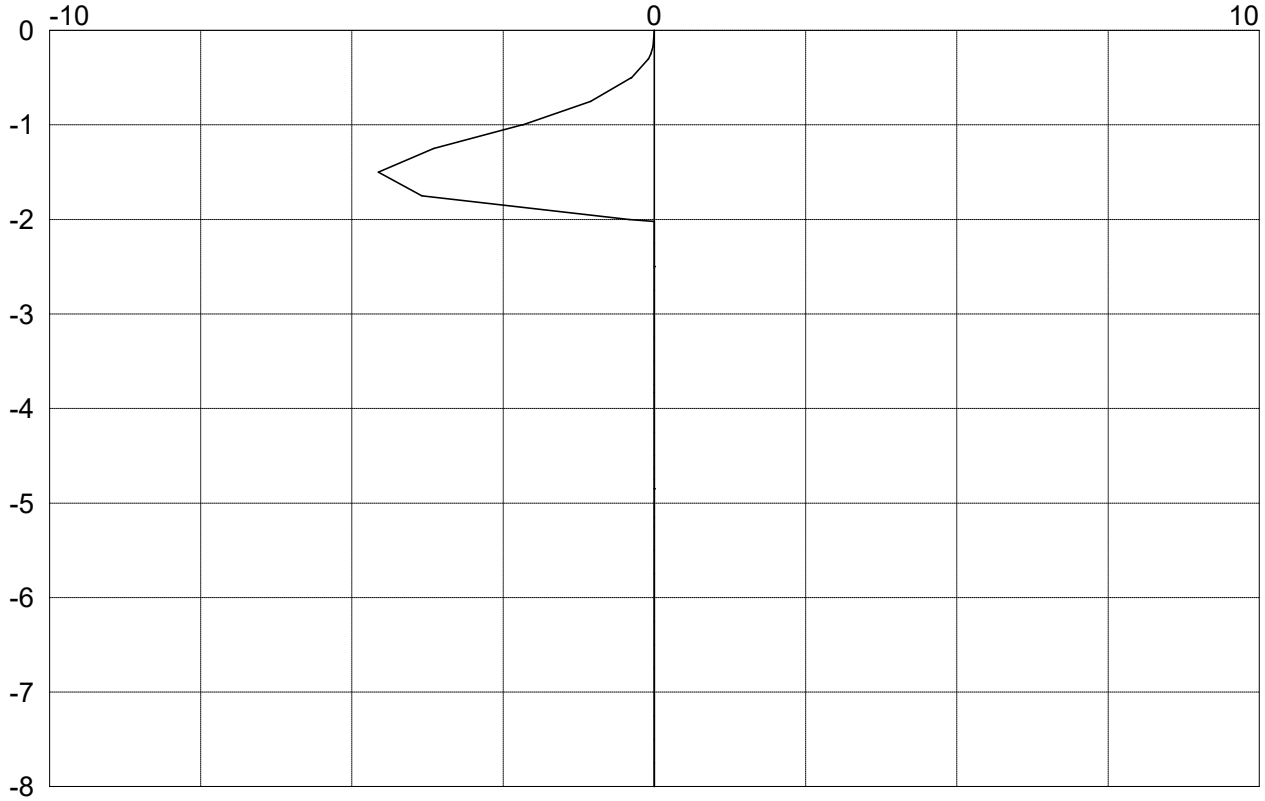
Tabular results from analysis of stage ref 2

Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	.5		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	.5		.00
-.17	13.1	4.0	.0	.0	.0	.0	4.0	0	-.3	.4		.00
-.30	15.4	4.7	.0	.0	.0	.0	4.7	.1	-.9	.4	.0	.00
-.30	15.4	4.7	.0	.0	.0	.0	4.7	.1	-.9	.4		.00
-.50	19.0	5.8	.0	.0	.0	.0	5.8	.4	-1.9	.4	.0	.00
-.50	19.0	5.8	.0	.0	.0	.0	5.8	.4	-2.0	.4		.00
-1.00	28.0	8.5	.0	.0	.0	.0	8.5	2.2	-5.5	.4		.00
-1.00	28.0	8.5	.0	.0	.0	.0	8.5	2.2	-5.5	.4		.00
-2.00	46.0	14.0	.0	18.0	74.7	.0	-60.7	.4	20.6	.3		.97
-2.02	46.4	14.1	.0	18.4	76.2	.0	-62.1	0	21.8	.3		1.00
-2.50	55.0	16.7	.0	27.0	112.1	.0	-95.3	0	0	.3		1.82
m -2.50	55.0	12.5	.0	27.0	100.5	.0	-88.0	0	0	.3		1.82
m -3.00	64.5	15.0	.0	36.5	124.7	.0	-109.7	0	0	.3		2.64
m -3.83	80.3	19.2	.0	52.3	164.8	.0	-145.7	0	0	.2	.0	3.81
m -3.83	80.3	19.2	.0	52.3	164.9	.0	-145.8	0	0	.2		3.81
m -4.00	83.5	20.0	.0	55.5	173.1	.0	-153.1	0	0	.2		4.02
m -4.62	95.4	23.1	.0	67.4	203.3	.0	-180.2	0	0	.2		4.71
m -4.85	99.6	24.2	.0	71.6	214.1	.0	-189.9	0	0	.2		4.94
m -4.85	99.6	24.3	.0	71.6	214.2	.0	-190.0	0	0	.2		4.94
m -5.00	102.5	25.0	.0	74.5	221.5	.0	-196.5	0	0	.2		5.08
m -5.06	103.6	25.3	.0	75.6	224.2	.0	-198.9	0	0	.1		5.13
m -5.15	105.4	25.8	.0	77.3	228.7	.0	-203.0	0	0	.1		5.21
m -6.00	121.5	30.0	.0	93.5	269.9	.0	-239.9	0	0	.1		5.87
m -7.00	140.5	35.0	.0	112.5	318.3	.0	-283.3	0	0	.1		6.47
m -8.00	159.5	40.0	.0	131.5	366.7	.0	-326.7	0	0	0		6.94

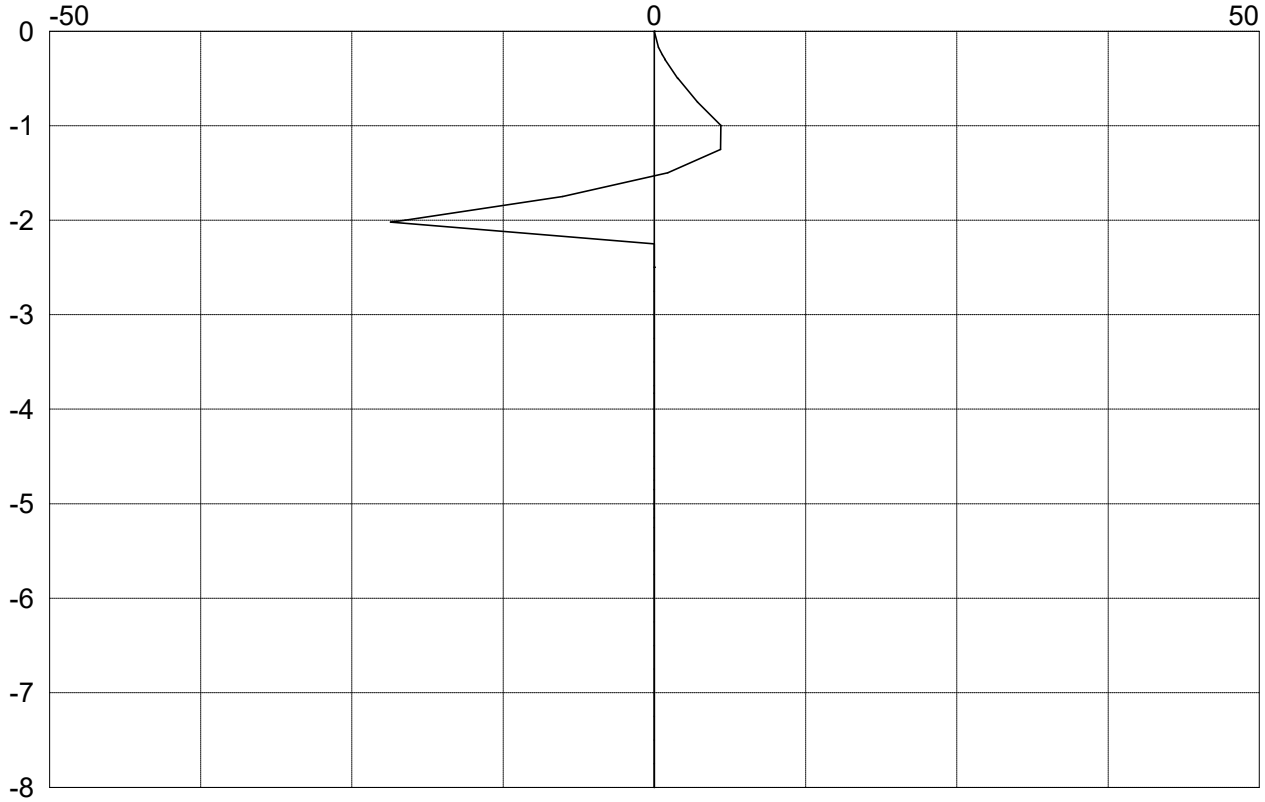
Graphical results from analysis of stage ref 2



Graphical results from analysis of stage ref 2 continued

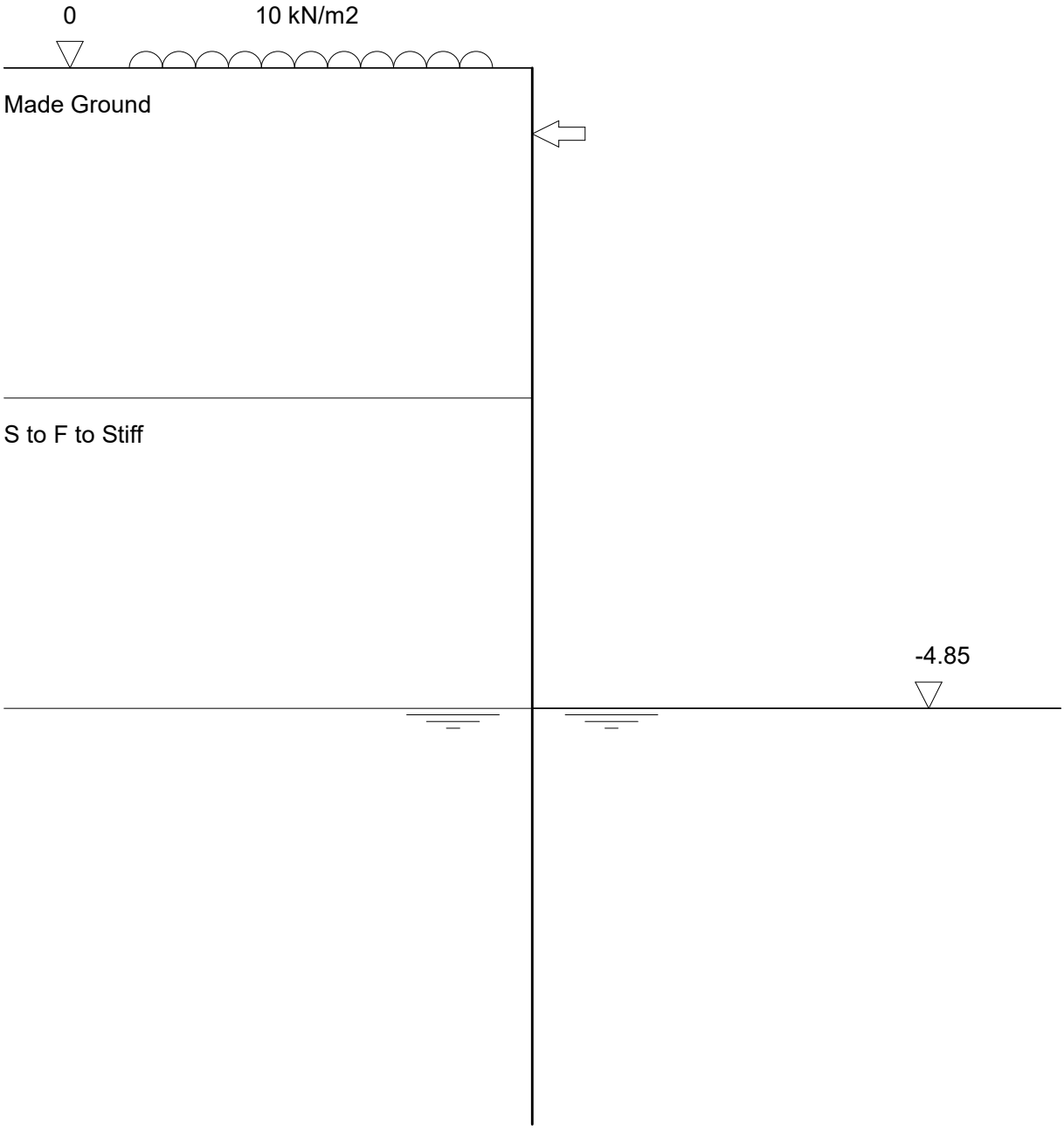


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

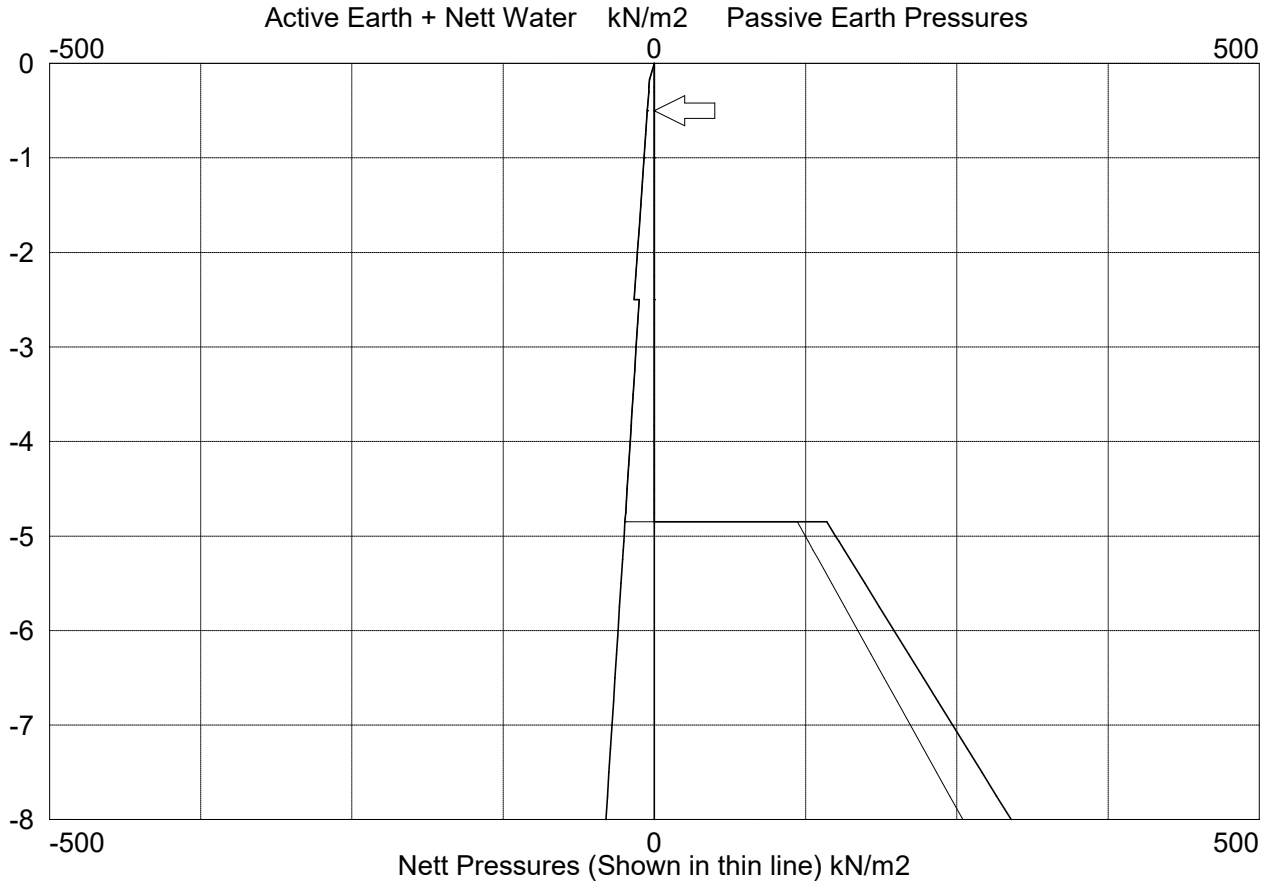
Stage ref. 4
Stage type Passive side excavation

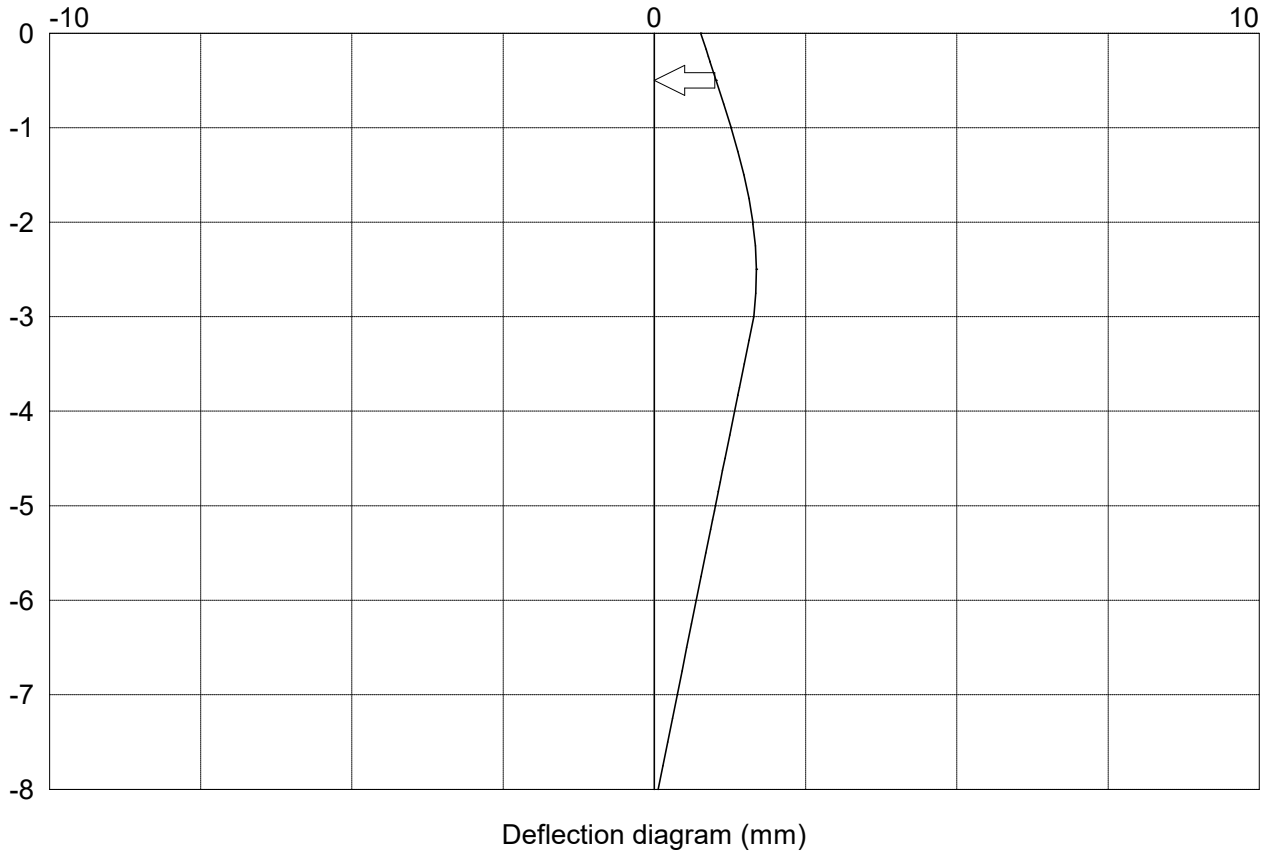


Tabular results from analysis of stage ref 4

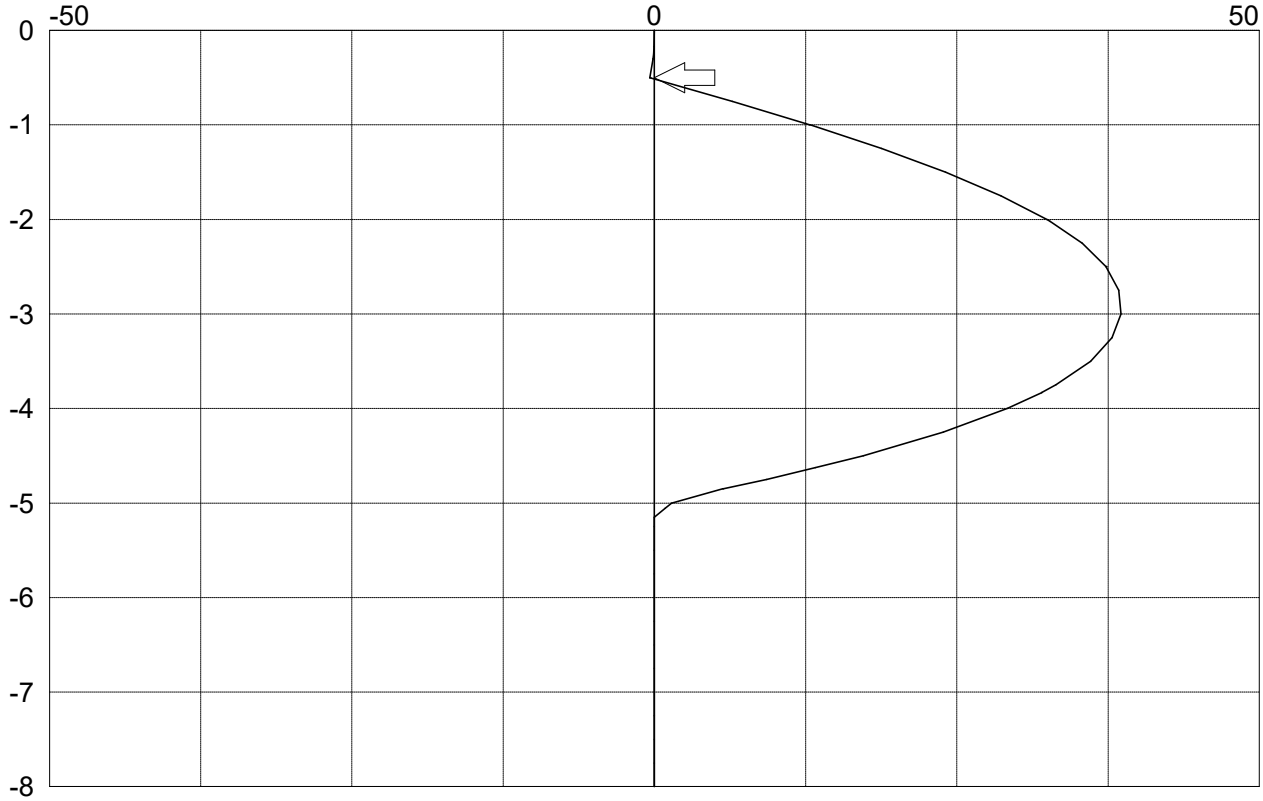
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	.8		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	.8		.00
-.17	13.1	4.0	.0	.0	.0	.0	4.0	0	-.3	.9		.00
-.30	15.4	4.7	.0	.0	.0	.0	4.7	.1	-.9	.9	.0	.00
-.30	15.4	4.7	.0	.0	.0	.0	4.7	.1	-.9	.9		.00
-.50	19.0	5.8	.0	.0	.0	.0	5.8	.4	-1.9	1.0	30.3	.00
-.50	19.0	5.8	.0	.0	.0	.0	5.8	.4	28.3	1.0		.00
-1.00	28.0	8.5	.0	.0	.0	.0	8.5	-12.8	24.8	1.3		.00
-1.00	28.0	8.5	.0	.0	.0	.0	8.5	-12.9	24.7	1.3		.00
-2.00	46.0	14.0	.0	.0	.0	.0	14.0	-32.5	13.5	1.6		.00
-2.02	46.4	14.1	.0	.0	.0	.0	14.1	-32.7	13.2	1.6		.00
-2.50	55.0	16.7	.0	.0	.0	.0	16.7	-37.3	5.8	1.7		.00
m -2.50	55.0	12.5	.0	.0	.0	.0	12.5	-37.3	5.8	1.7		.00
m -3.00	64.5	15.0	.0	.0	.0	.0	15.0	-38.6	-1.1	1.6		.00
m -3.83	80.3	19.2	.0	.0	.0	.0	19.2	-32.0	-15.2	1.4	.0	.00
m -3.83	80.3	19.2	.0	.0	.0	.0	19.2	-32.0	-15.3	1.4		.00
m -4.00	83.5	20.0	.0	.0	.0	.0	20.0	-29.2	-18.6	1.3		.00
m -4.62	95.4	23.1	.0	.0	.0	.0	23.1	-13.3	-32.1	1.1		.00
m -4.85	99.6	24.2	.0	.0	.0	.0	24.2	-5.7	-37.3	1.1		.00
m -4.85	99.6	24.3	.0	.0	142.6	.0	-118.3	-5.7	-37.2	1.1		.00
m -5.00	102.5	25.0	.0	2.9	149.8	.0	-124.8	-1.4	-19.0	1.0		.53
m -5.06	103.6	25.3	.0	3.9	152.5	.0	-127.2	-.9	-11.9	1.0		.70
m -5.15	105.4	25.8	.0	5.7	157.1	.0	-131.3	0	0	1.0		.99
m -6.00	121.5	30.0	.0	21.9	198.2	.0	-168.2	0	0	.7		3.01
m -7.00	140.5	35.0	.0	40.9	246.6	.0	-211.6	0	0	.4		4.46
m -8.00	159.5	40.0	.0	59.9	295.0	.0	-255.0	0	0	.1		5.39

Graphical results from analysis of stage ref 4

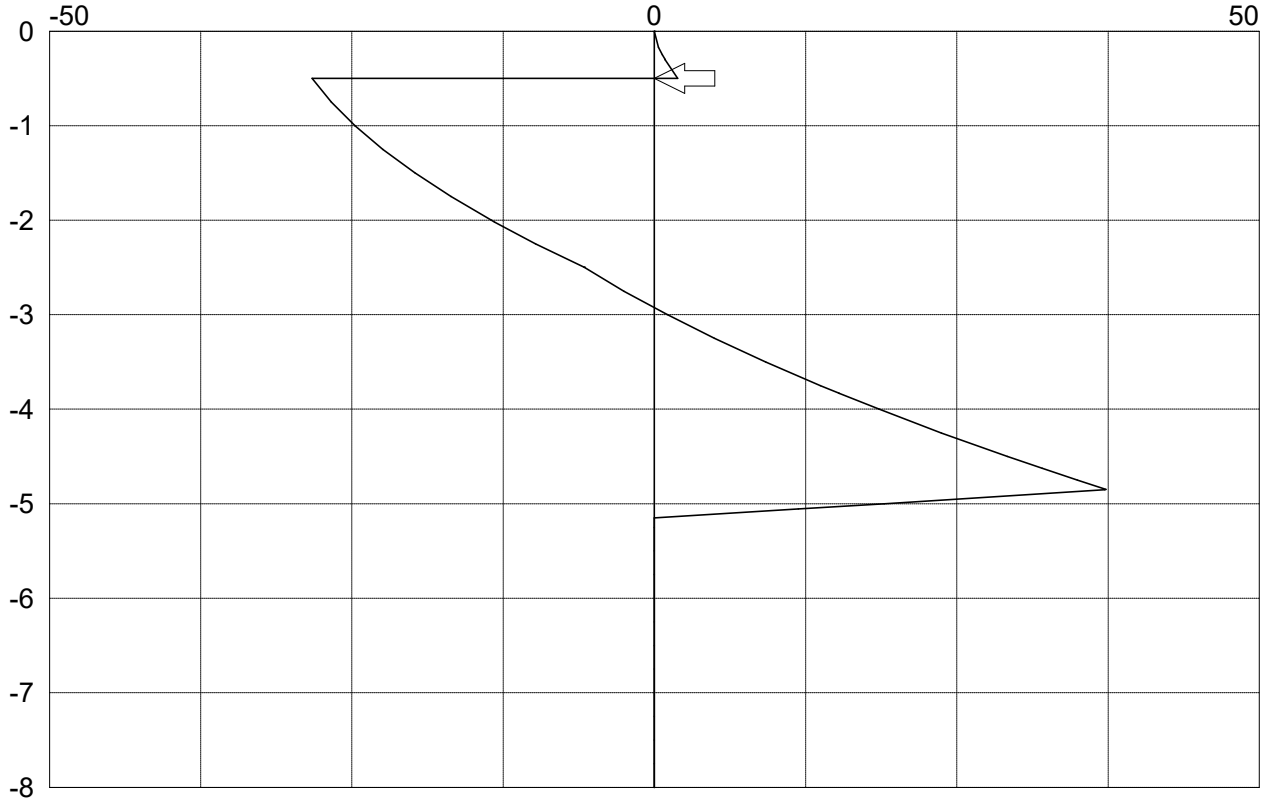




Graphical results from analysis of stage ref 4 continued

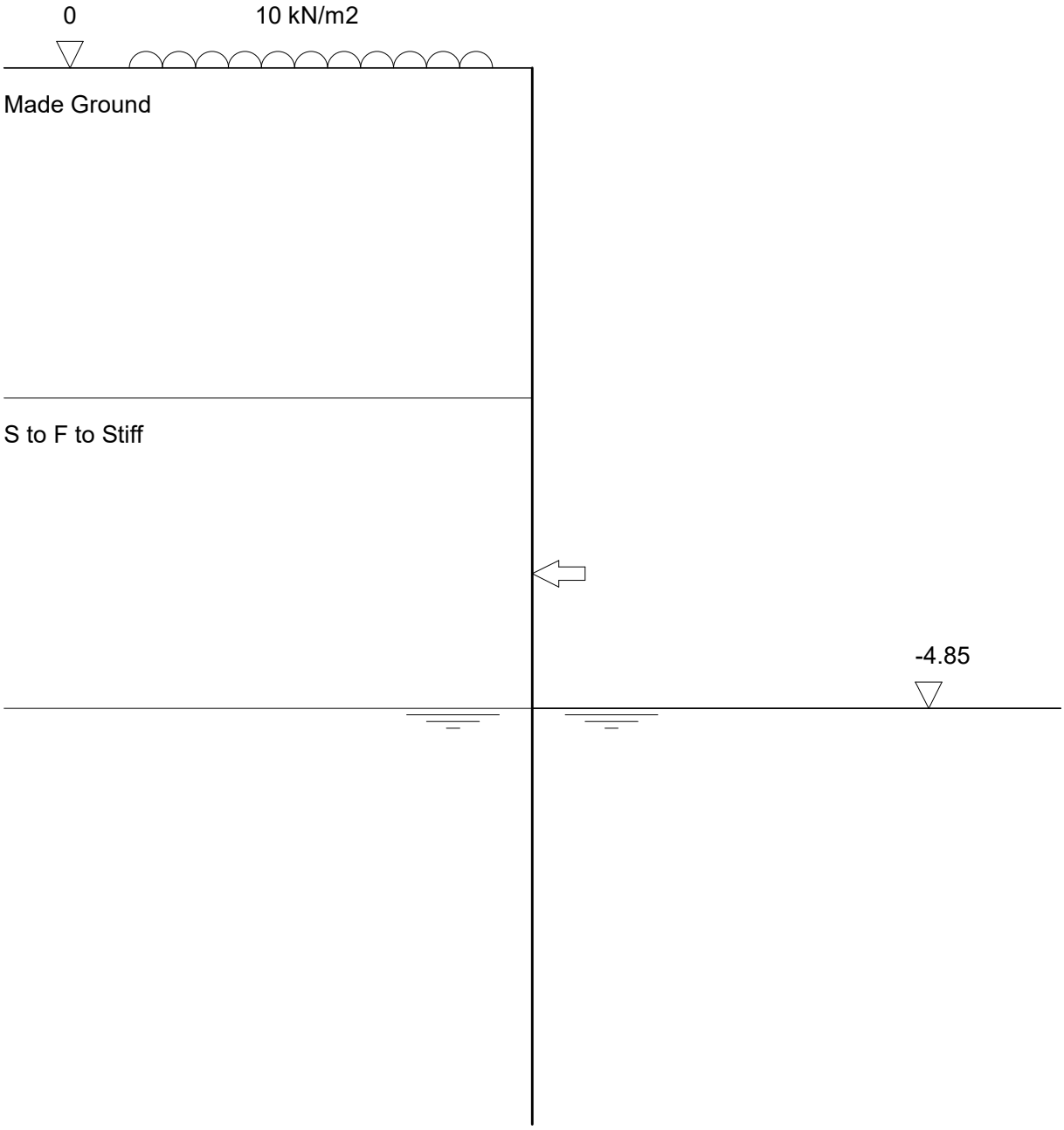


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

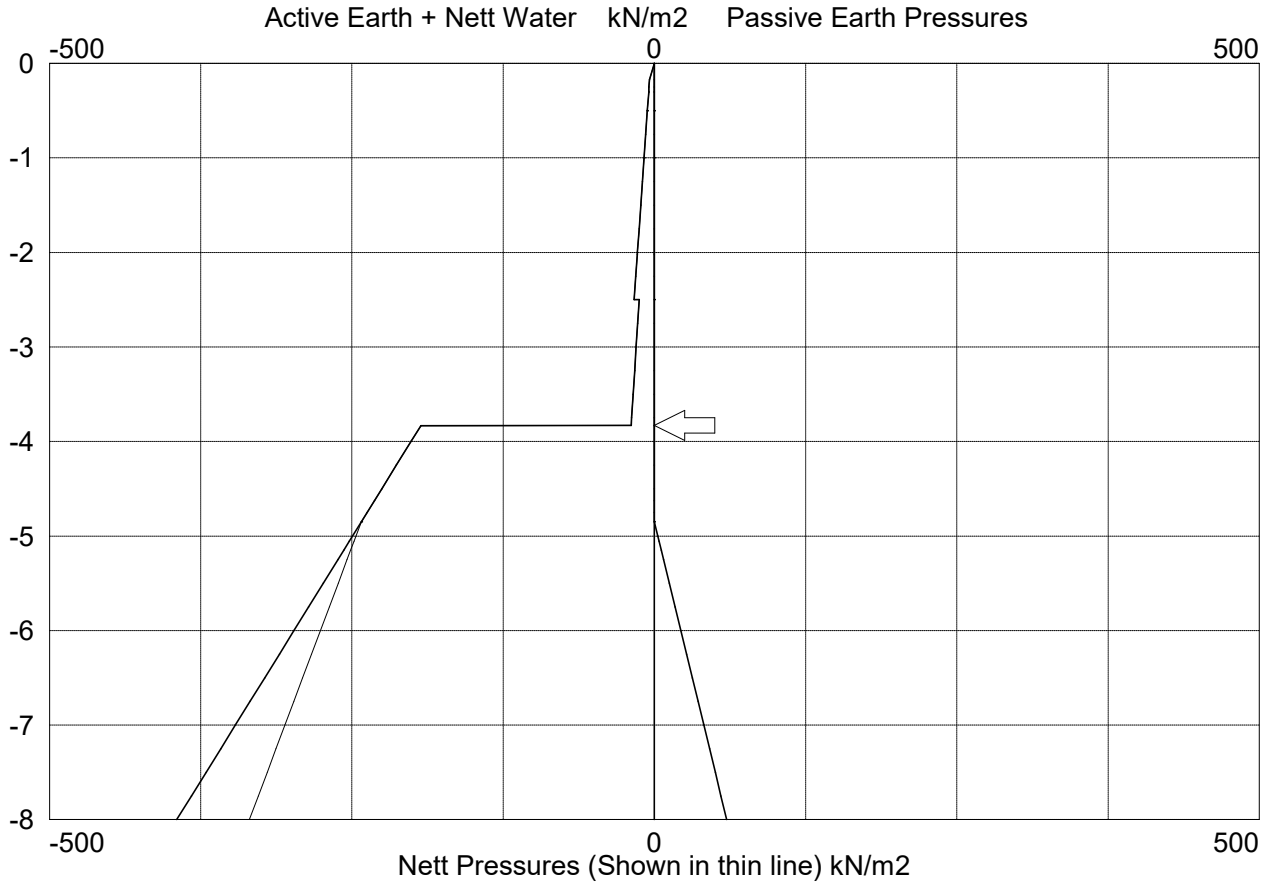
Stage ref. 6
Stage type Remove prop

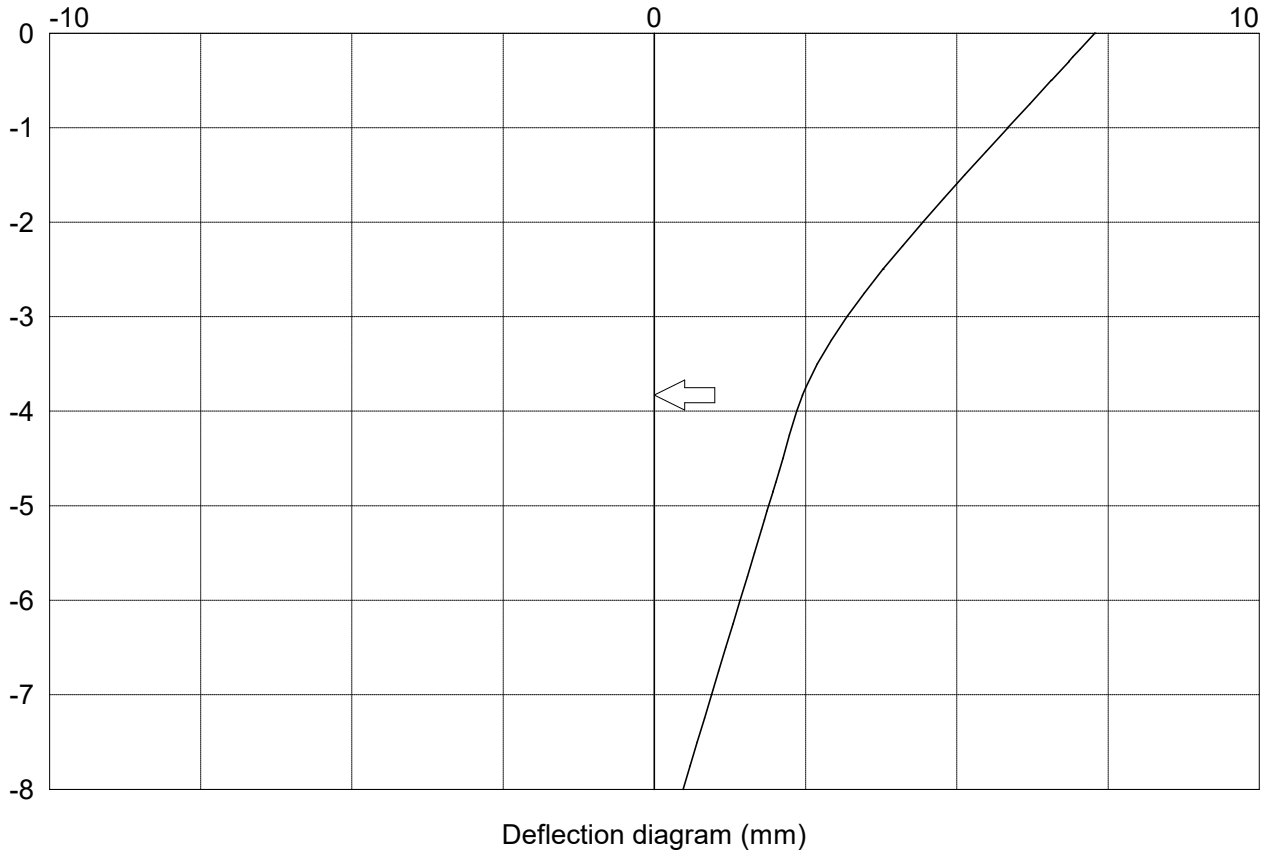


Tabular results from analysis of stage ref 6

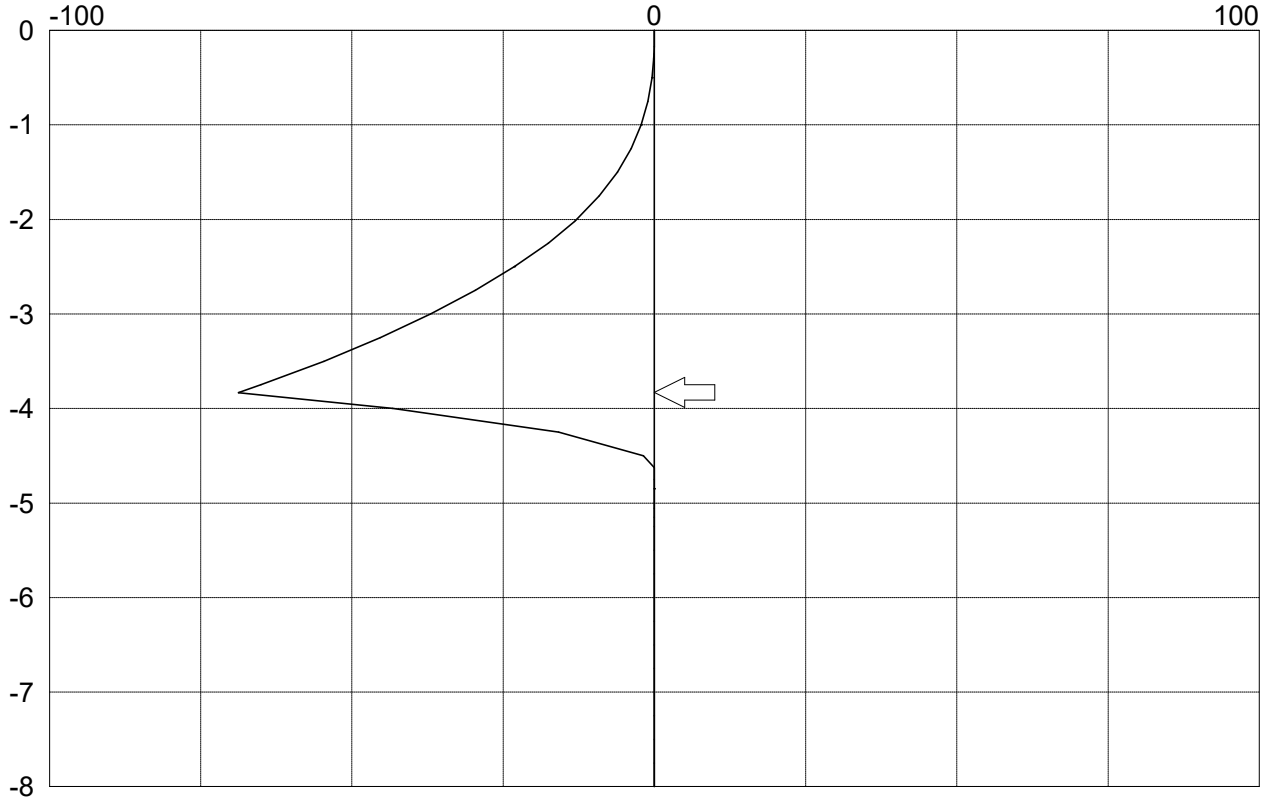
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.3		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.3		.00
-.17	13.1	4.0	.0	.0	.0	.0	4.0	0	-.3	7.0		.00
-.30	15.4	4.7	.0	.0	.0	.0	4.7	.1	-.9	6.9	.0	.00
-.30	15.4	4.7	.0	.0	.0	.0	4.7	.1	-.9	6.8		.00
-.50	19.0	5.8	.0	.0	.0	.0	5.8	.4	-1.9	6.6	.0	.00
-.50	19.0	5.8	.0	.0	.0	.0	5.8	.4	-2.0	6.6		.00
-1.00	28.0	8.5	.0	.0	.0	.0	8.5	2.2	-5.5	5.8		.00
-1.00	28.0	8.5	.0	.0	.0	.0	8.5	2.2	-5.5	5.8		.00
-2.00	46.0	14.0	.0	.0	.0	.0	14.0	12.9	-16.8	4.4		.00
-2.02	46.4	14.1	.0	.0	.0	.0	14.1	13.2	-17.0	4.4		.00
-2.50	55.0	16.7	.0	.0	.0	.0	16.7	23.1	-24.4	3.8		.00
m -2.50	55.0	12.5	.0	.0	.0	.0	12.5	23.1	-24.4	3.8		.00
m -3.00	64.5	15.0	.0	.0	.0	.0	15.0	37.0	-31.3	3.2		.00
m -3.83	80.3	19.2	.0	.0	.0	.0	19.2	68.6	-45.5	2.4	214.0	.00
m -3.83	80.3	192.9	.0	.0	.0	.0	192.9	68.7	168.2	2.4		.00
m -4.00	83.5	201.1	.0	.0	.0	.0	201.1	43.2	135.1	2.4		.04
m -4.62	95.4	231.3	.0	.0	.0	.0	231.3	0	0	2.1		1.03
m -4.85	99.6	242.1	.0	.0	.0	.0	242.1	0	0	2.0		1.70
m -4.85	99.6	242.2	.0	.0	.0	.0	242.2	0	0	2.0		1.71
m -5.00	102.5	249.5	.0	2.9	2.9	.0	246.6	0	0	1.9		2.29
m -5.06	103.6	252.2	.0	3.9	3.9	.0	248.3	0	0	1.9		2.53
m -5.15	105.4	256.7	.0	5.7	5.7	.0	251.0	0	0	1.8		2.94
m -6.00	121.5	297.9	.0	21.9	21.9	.0	276.0	0	0	1.4		6.79
m -7.00	140.5	346.3	.0	40.9	40.9	.0	305.4	0	0	.9		8.41
m -8.00	159.5	394.7	.0	59.9	59.9	.0	334.8	0	0	.5		7.85

Graphical results from analysis of stage ref 6

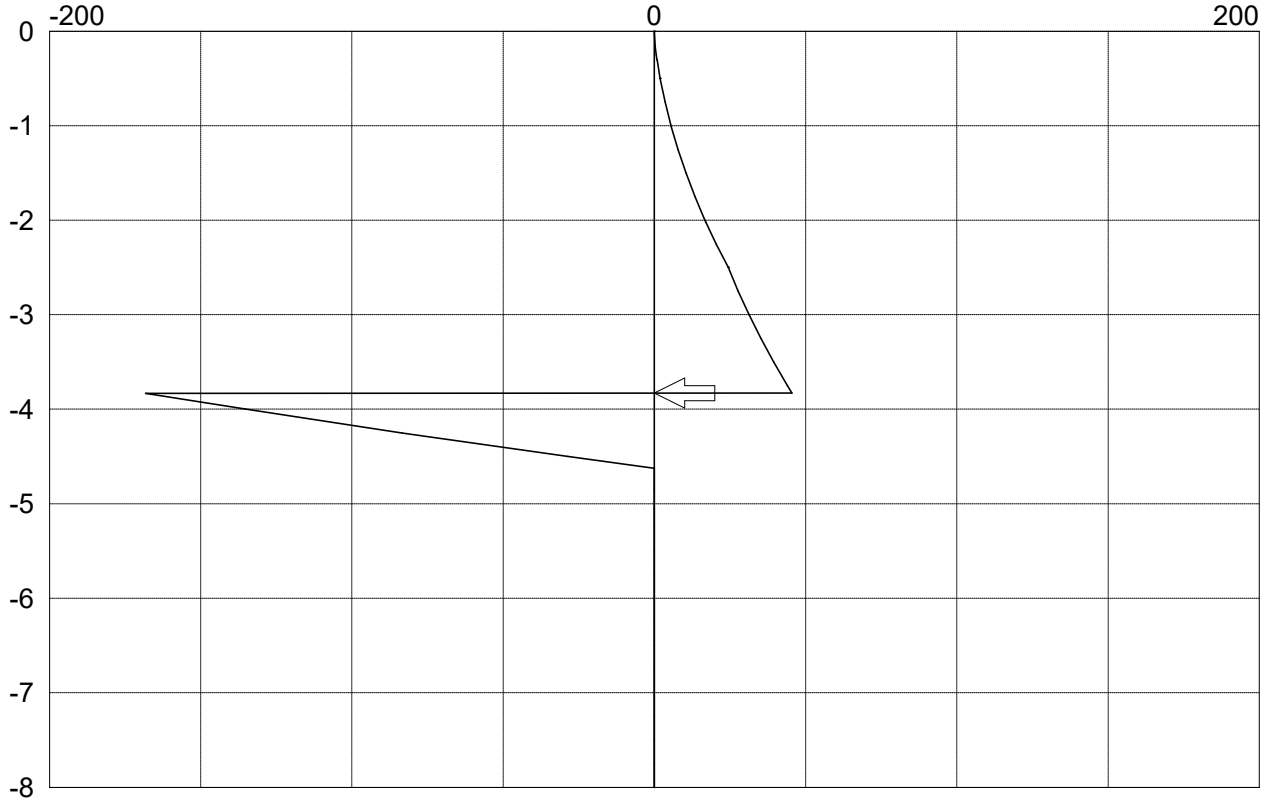




Graphical results from analysis of stage ref 6 continued

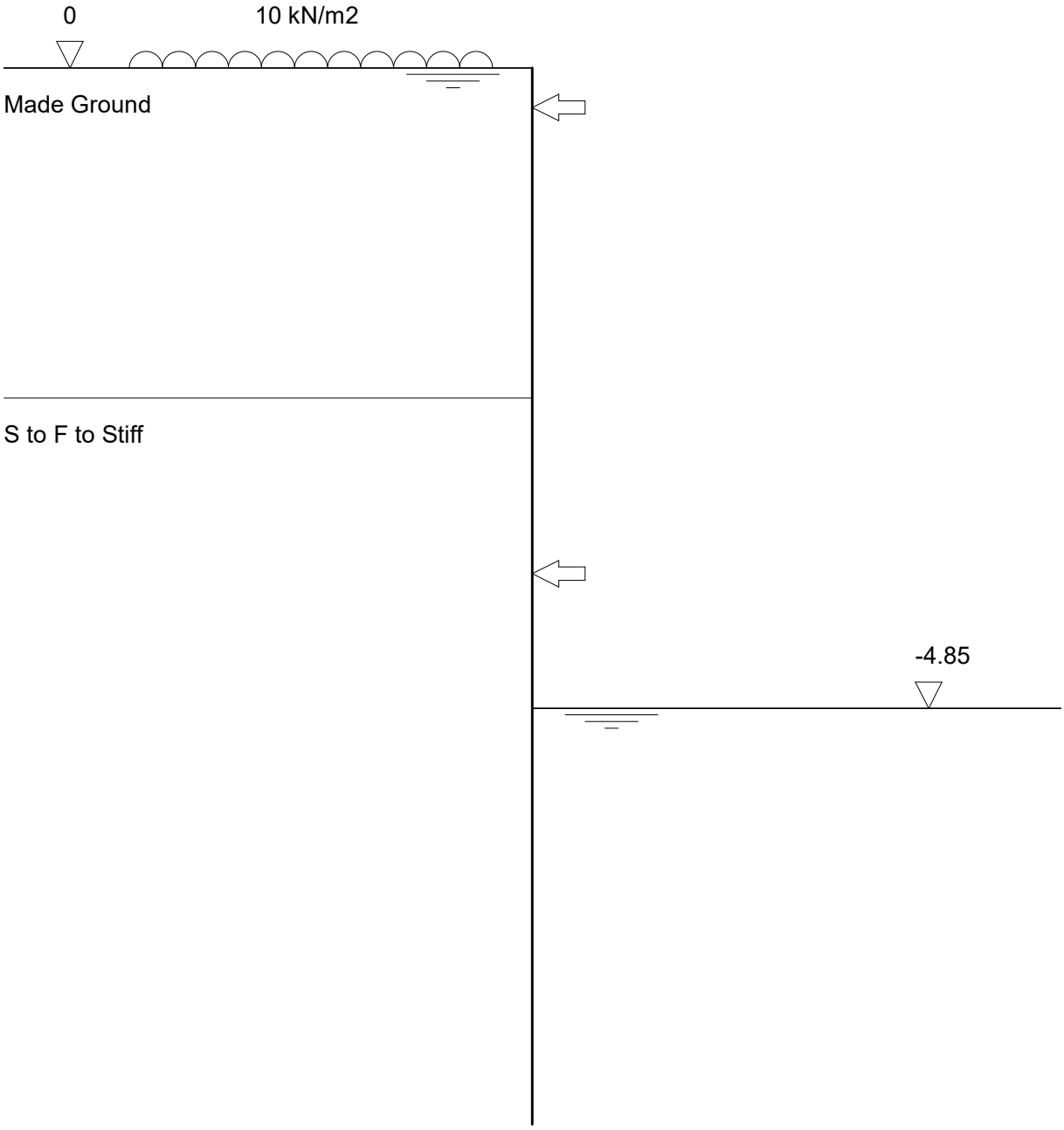


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

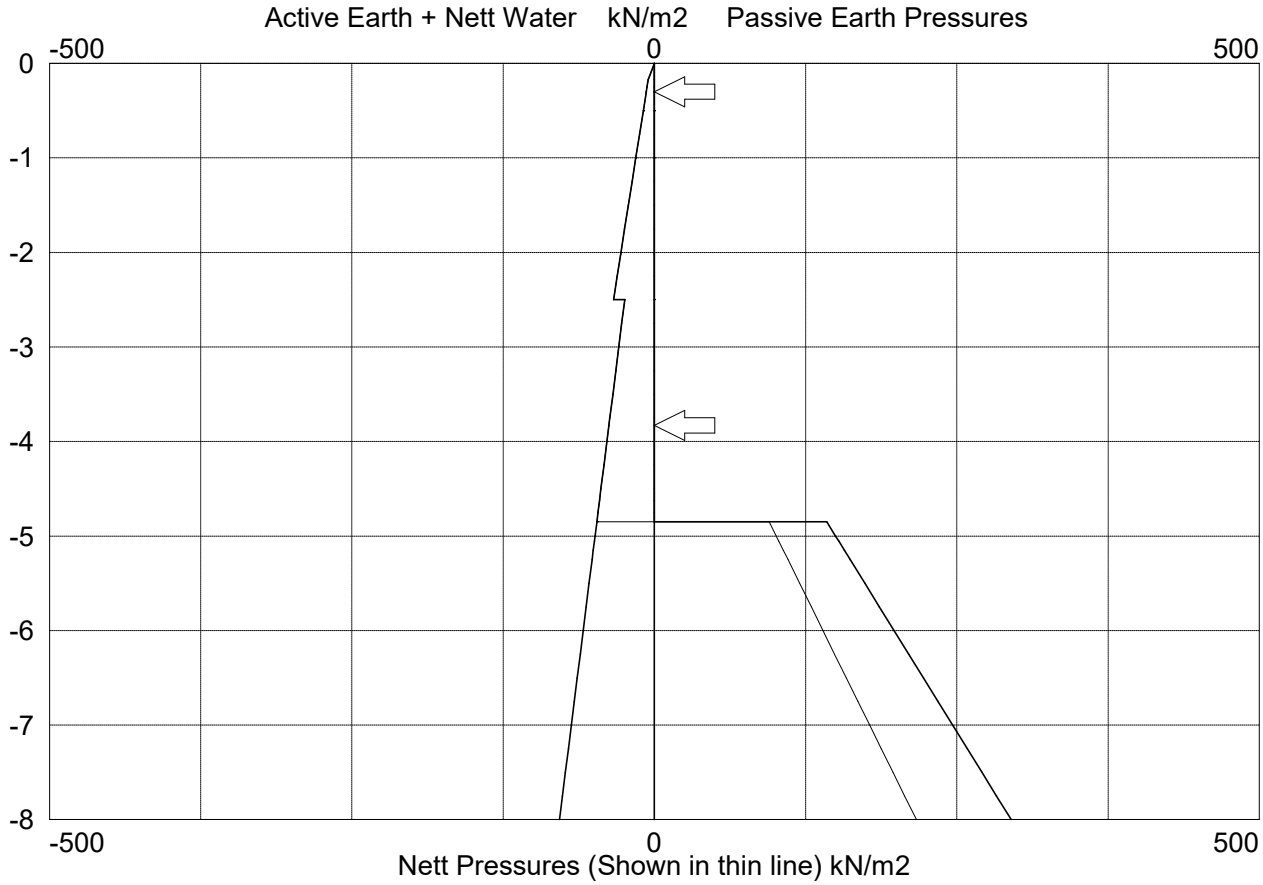
Stage ref. 8
Stage type Active water level

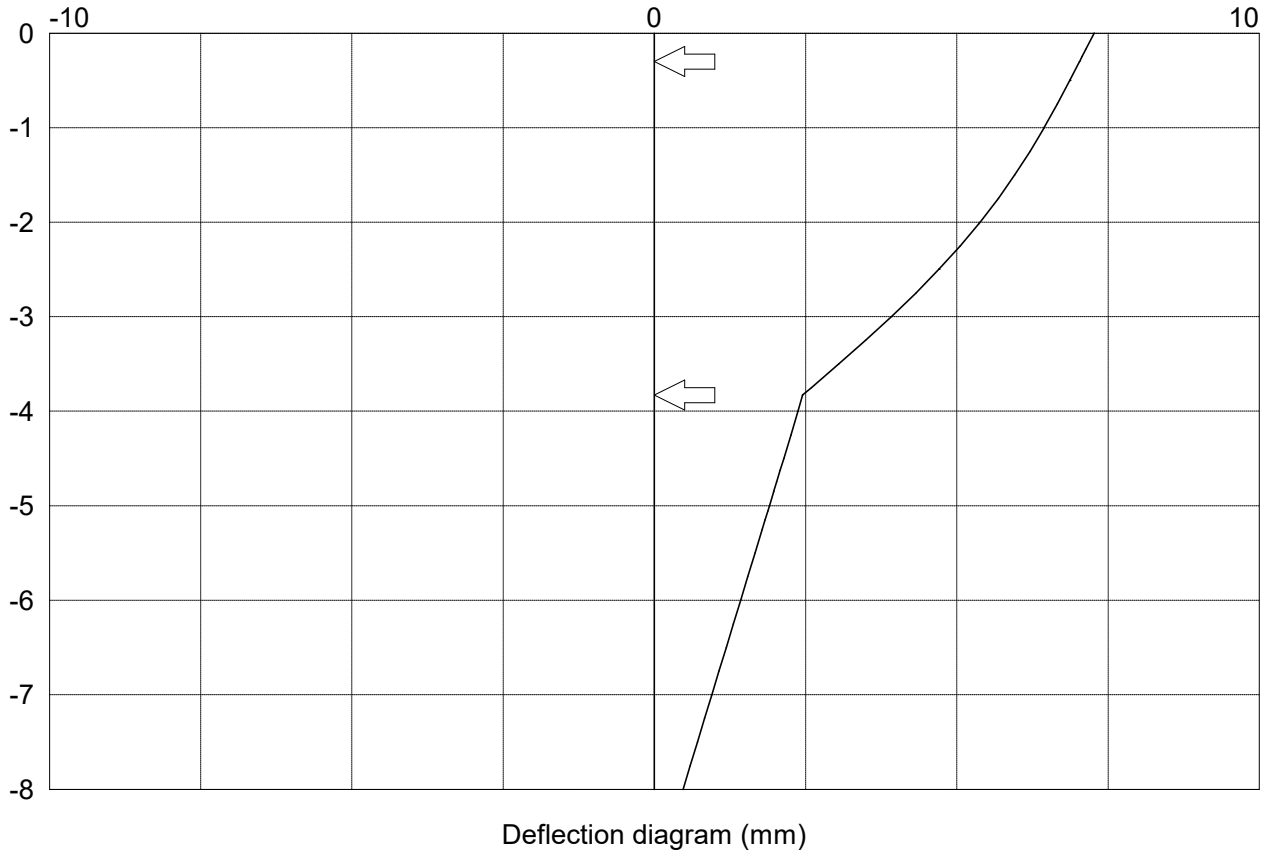


Tabular results from analysis of stage ref 8

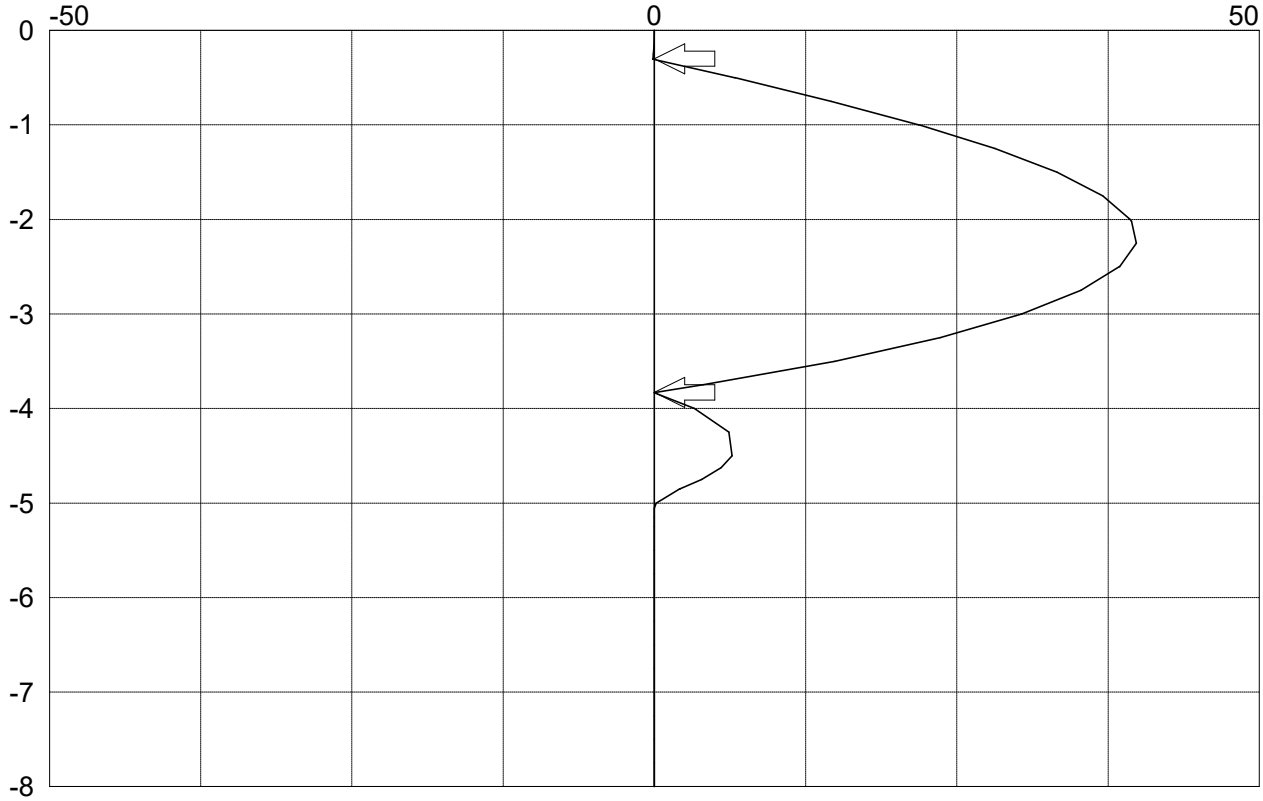
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.3		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.3		.00
-.17	11.4	3.5	1.7	.0	.0	.0	5.2	0	-.4	7.1		.00
-.30	12.5	3.8	2.9	.0	.0	.0	6.7	.1	-1.2	7.0	36.1	.00
-.30	12.5	3.8	3.0	.0	.0	.0	6.8	.1	34.9	7.0		.00
-.50	14.1	4.3	4.9	.0	.0	.0	9.2	-6.6	33.3	6.9	.0	.00
-.50	14.1	4.3	4.9	.0	.0	.0	9.2	-6.7	33.3	6.9		.00
-1.00	18.2	5.5	9.8	.0	.0	.0	15.3	-21.8	27.2	6.4		.00
-1.00	18.2	5.5	9.8	.0	.0	.0	15.3	-21.9	27.2	6.4		.00
-2.00	26.4	8.0	19.6	.0	.0	.0	27.6	-39.3	5.7	5.4		.00
-2.02	26.6	8.1	19.8	.0	.0	.0	27.9	-39.4	5.1	5.4		.00
-2.50	30.5	9.3	24.5	.0	.0	.0	33.8	-38.5	-9.7	4.7		.00
w -2.50	55.0	.0	24.5	.0	.0	.0	24.5	-38.5	-9.7	4.7		.00
w -3.00	64.5	.0	29.4	.0	.0	.0	29.4	-30.4	-23.1	3.9		.00
w -3.83	80.3	.0	37.5	.0	.0	.0	37.5	-.1	-50.9	2.4	73.9	.00
w -3.83	80.3	.0	37.6	.0	.0	.0	37.6	0	22.9	2.4		.00
w -4.00	83.5	.0	39.2	.0	.0	.0	39.2	-3.3	16.4	2.4		.00
w -4.62	95.4	.0	45.3	.0	.0	.0	45.3	-5.5	-9.9	2.1		.00
w -4.85	99.6	.0	47.5	.0	.0	.0	47.5	-2.1	-20.3	2.0		.00
w -4.85	99.6	.0	47.5	.0	142.6	.0	-95.0	-2.1	-20.3	2.0		.01
w -5.00	102.5	.0	49.0	2.9	149.8	.0	-100.8	-.2	-5.6	1.9		.78
w -5.06	103.6	.0	49.5	3.9	152.5	.0	-103.0	0	0	1.9		.98
w -5.15	105.4	.0	50.5	5.7	157.1	.0	-106.6	0	0	1.8		1.31
w -6.00	121.5	.0	58.8	21.9	198.2	.0	-139.4	0	0	1.4		2.62
w -7.00	140.5	.0	68.6	40.9	246.6	.0	-178.0	0	0	1.0		3.13
w -8.00	159.5	.0	78.4	59.9	295.0	.0	-216.6	0	0	.5		3.40

Graphical results from analysis of stage ref 8

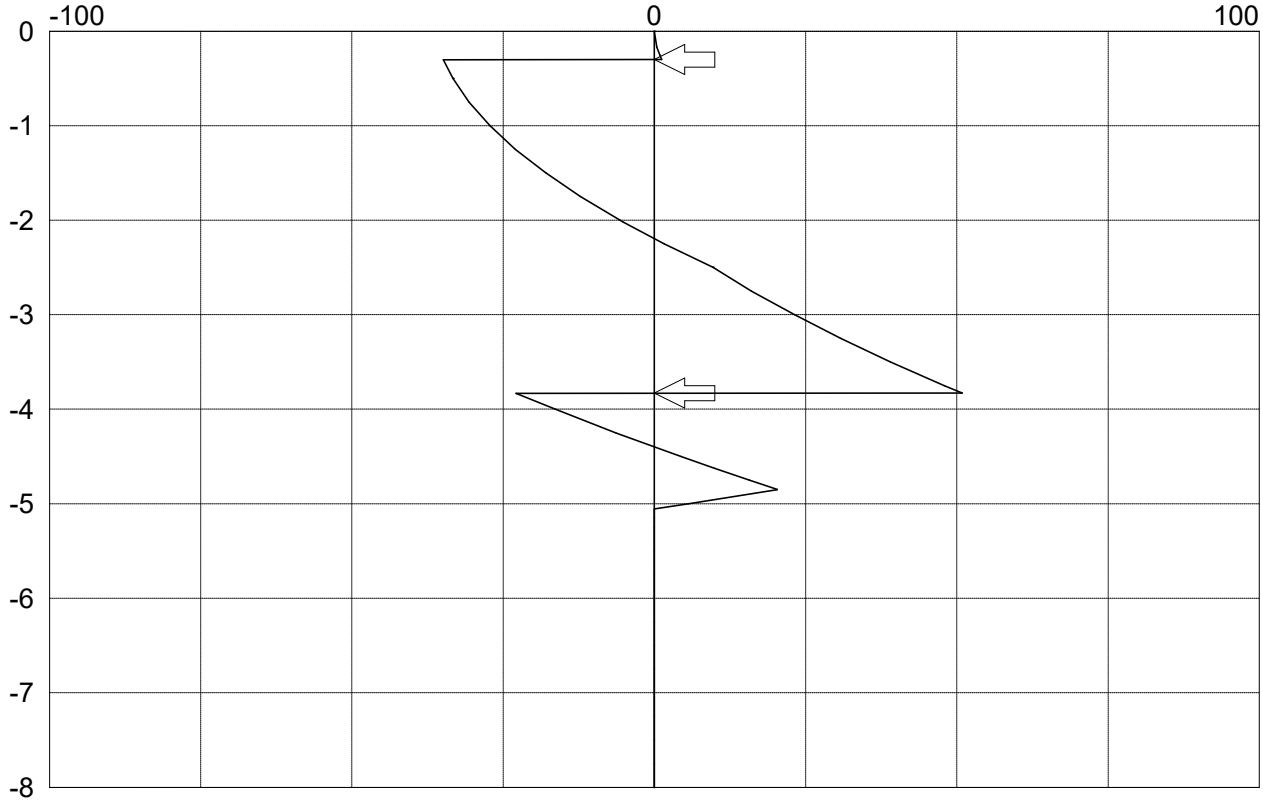




Graphical results from analysis of stage ref 8 continued

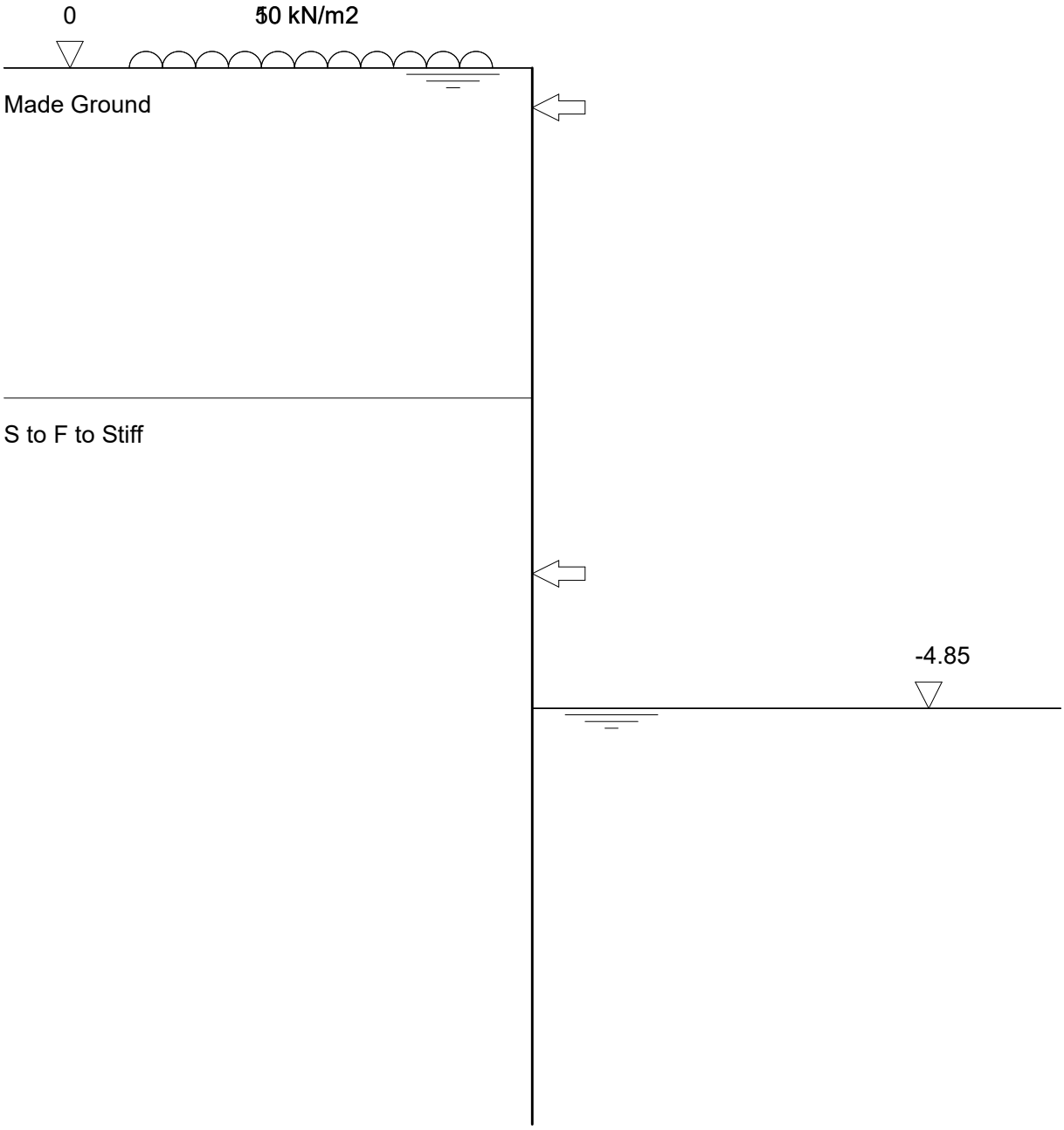


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

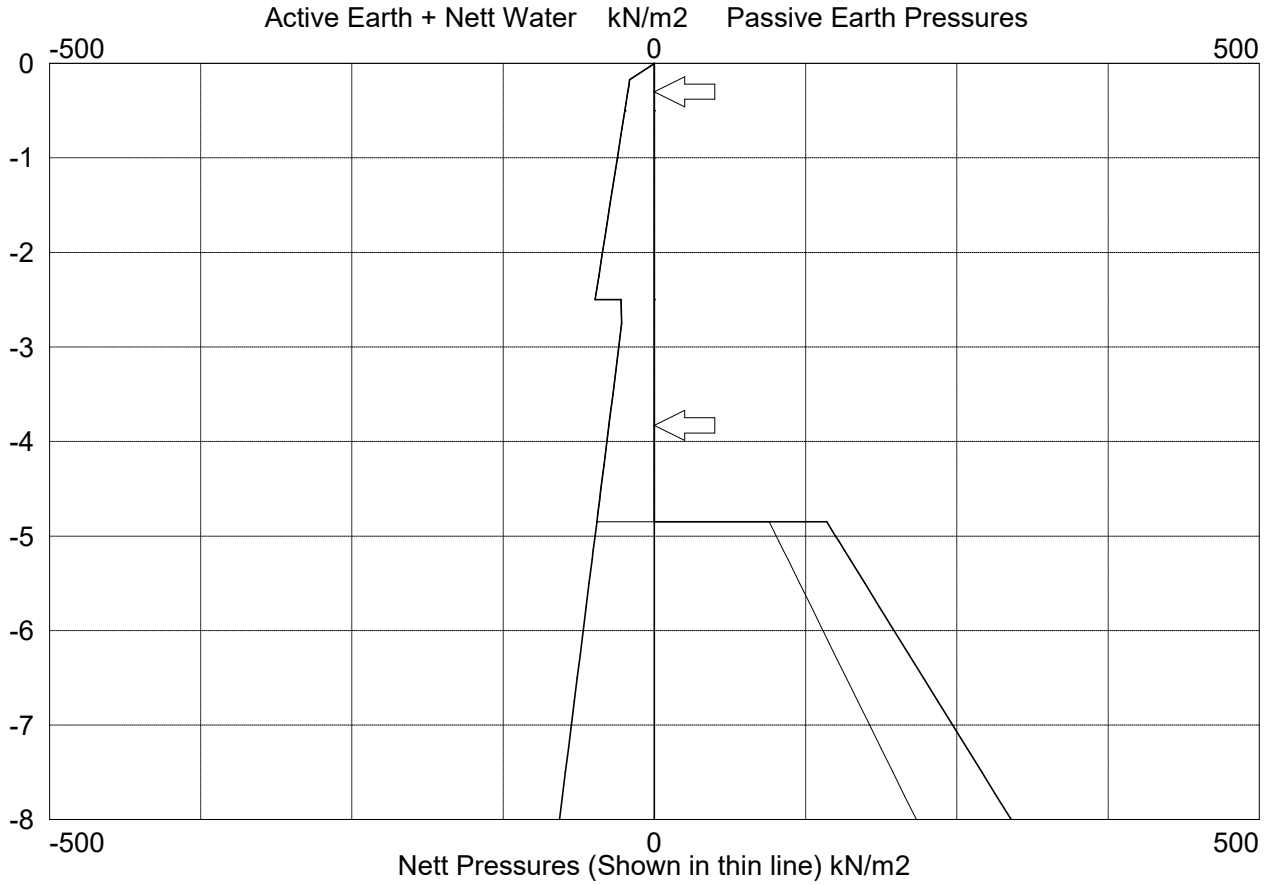
Stage ref. 9
Stage type Active surcharge

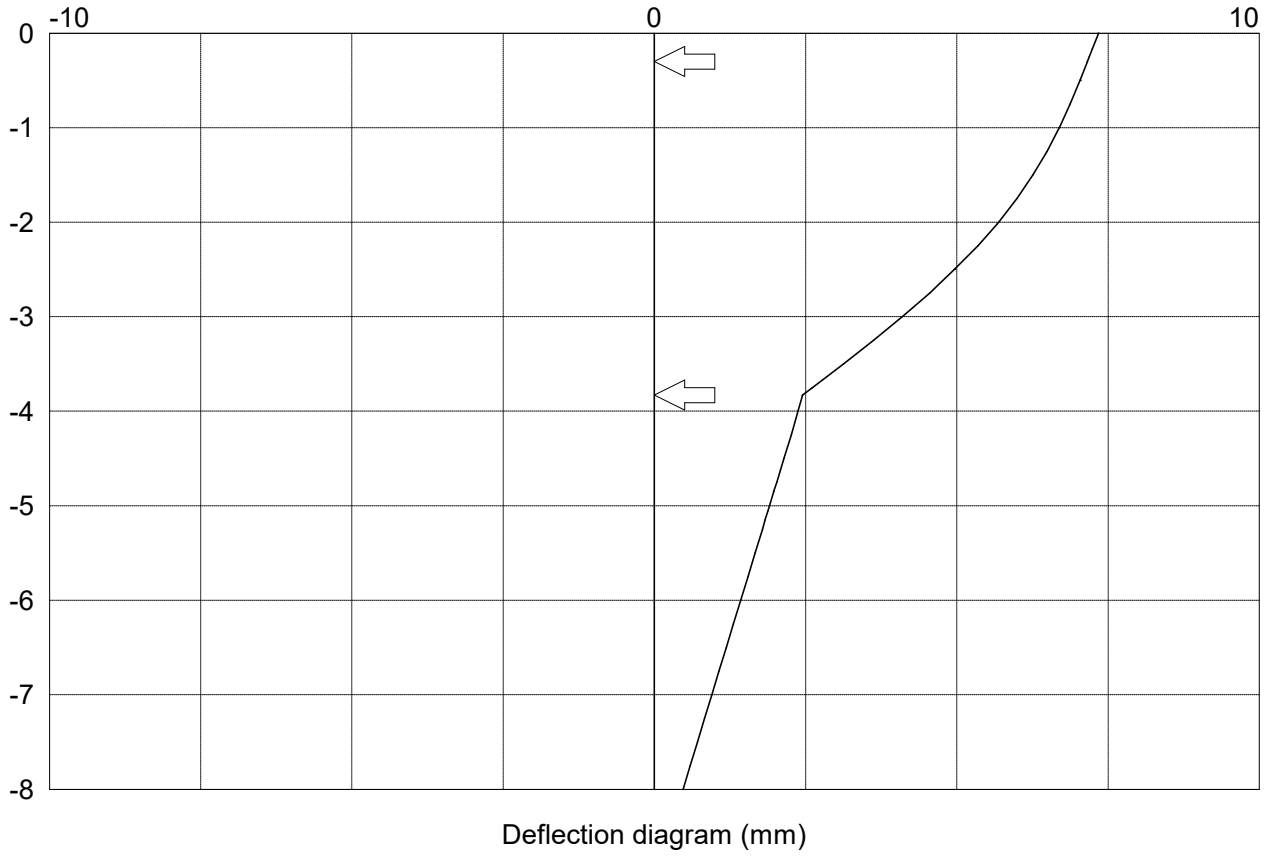


Tabular results from analysis of stage ref 9

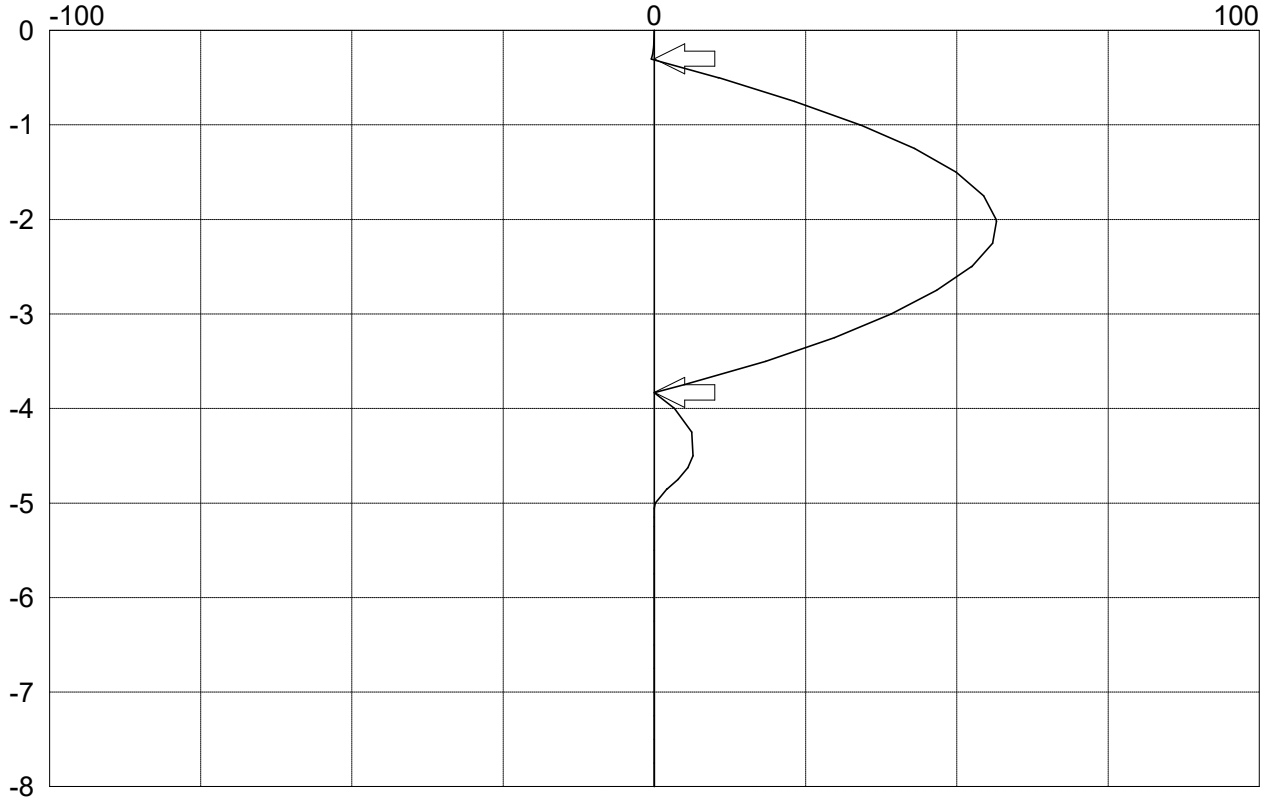
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.3		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.3		.00
-.17	61.4	18.7	1.7	.0	.0	.0	20.4	.1	-1.7	7.2		.00
-.30	62.5	19.0	2.9	.0	.0	.0	21.9	.5	-4.4	7.2	62.6	.00
-.30	62.5	19.0	3.0	.0	.0	.0	22.0	.5	58.1	7.2		.00
-.50	64.1	19.5	4.9	.0	.0	.0	24.4	-10.6	53.5	7.0	.0	.00
-.50	64.1	19.5	4.9	.0	.0	.0	24.4	-10.7	53.5	7.0		.00
-1.00	68.2	20.7	9.8	.0	.0	.0	30.5	-34.0	39.9	6.7		.00
-1.00	68.2	20.7	9.8	.0	.0	.0	30.5	-34.0	39.8	6.7		.00
-2.00	76.4	23.2	19.6	.0	.0	.0	42.8	-56.5	3.1	5.7		.00
-2.02	76.6	23.3	19.8	.0	.0	.0	43.1	-56.6	2.3	5.7		.00
-2.50	80.5	24.5	24.5	.0	.0	.0	49.0	-52.5	-19.8	5.0		.00
-2.50	105.0	27.5	.0	.0	.0	.0	27.5	-52.5	-19.8	5.0		.00
w -3.00	114.5	.0	29.4	.0	.0	.0	29.4	-39.1	-33.7	4.1		.00
w -3.83	130.3	.0	37.5	.0	.0	.0	37.5	-.1	-61.5	2.5	84.4	.00
w -3.83	130.3	.0	37.6	.0	.0	.0	37.6	0	22.9	2.4		.00
w -4.00	133.5	.0	39.2	.0	.0	.0	39.2	-3.3	16.4	2.4		.00
w -4.62	145.4	.0	45.3	.0	.0	.0	45.3	-5.5	-9.9	2.1		.00
w -4.85	149.6	.0	47.5	.0	.0	.0	47.5	-2.1	-20.3	2.0		.00
w -4.85	149.7	.0	47.5	.0	142.6	.0	-95.0	-2.1	-20.3	2.0		.01
w -5.00	152.5	.0	49.0	2.9	149.8	.0	-100.8	-.2	-5.6	1.9		.78
w -5.06	153.6	.0	49.5	3.9	152.5	.0	-103.0	0	0	1.9		1.00
w -5.15	155.4	.0	50.5	5.7	157.1	.0	-106.6	0	0	1.8		1.31
w -6.00	171.5	.0	58.8	21.9	198.2	.0	-139.4	0	0	1.4		2.62
w -7.00	190.5	.0	68.6	40.9	246.6	.0	-178.0	0	0	1.0		3.13
w -8.00	209.5	.0	78.4	59.9	295.0	.0	-216.6	0	0	.5		3.40

Graphical results from analysis of stage ref 9

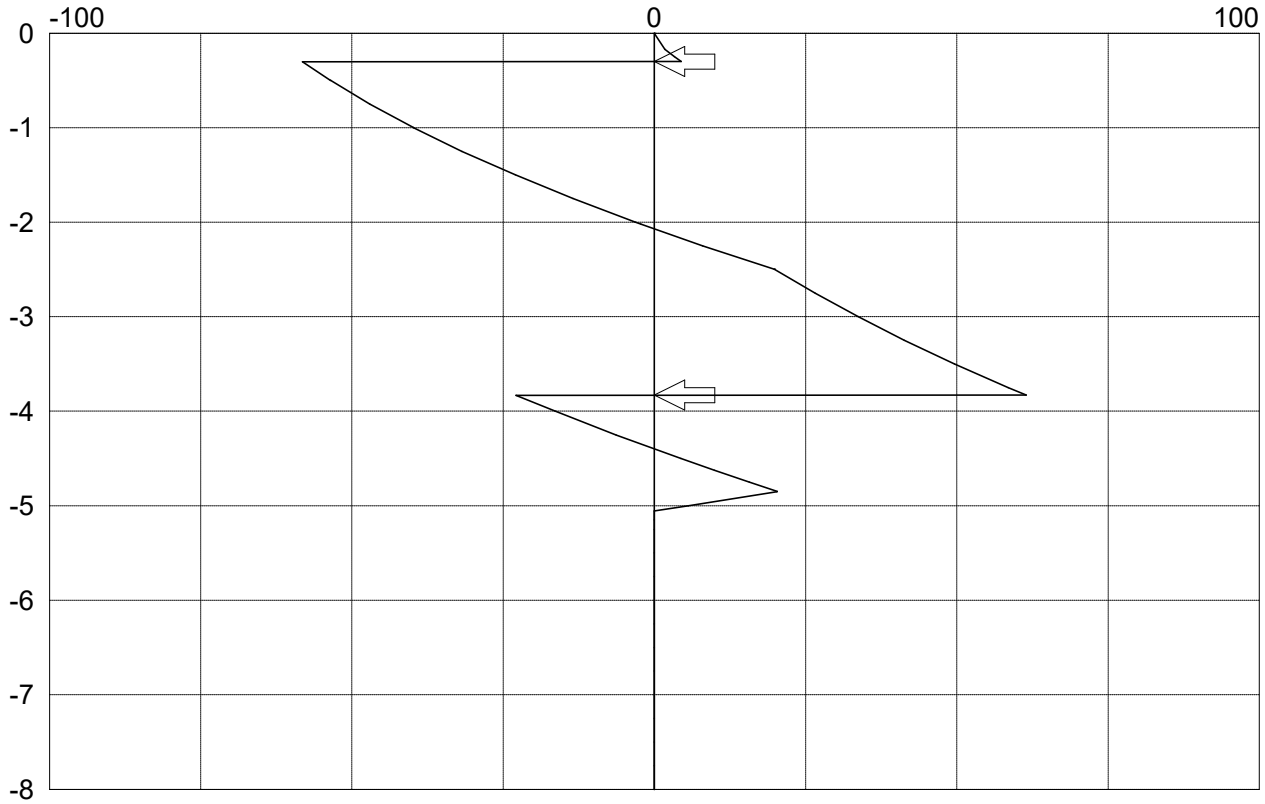




Graphical results from analysis of stage ref 9 continued

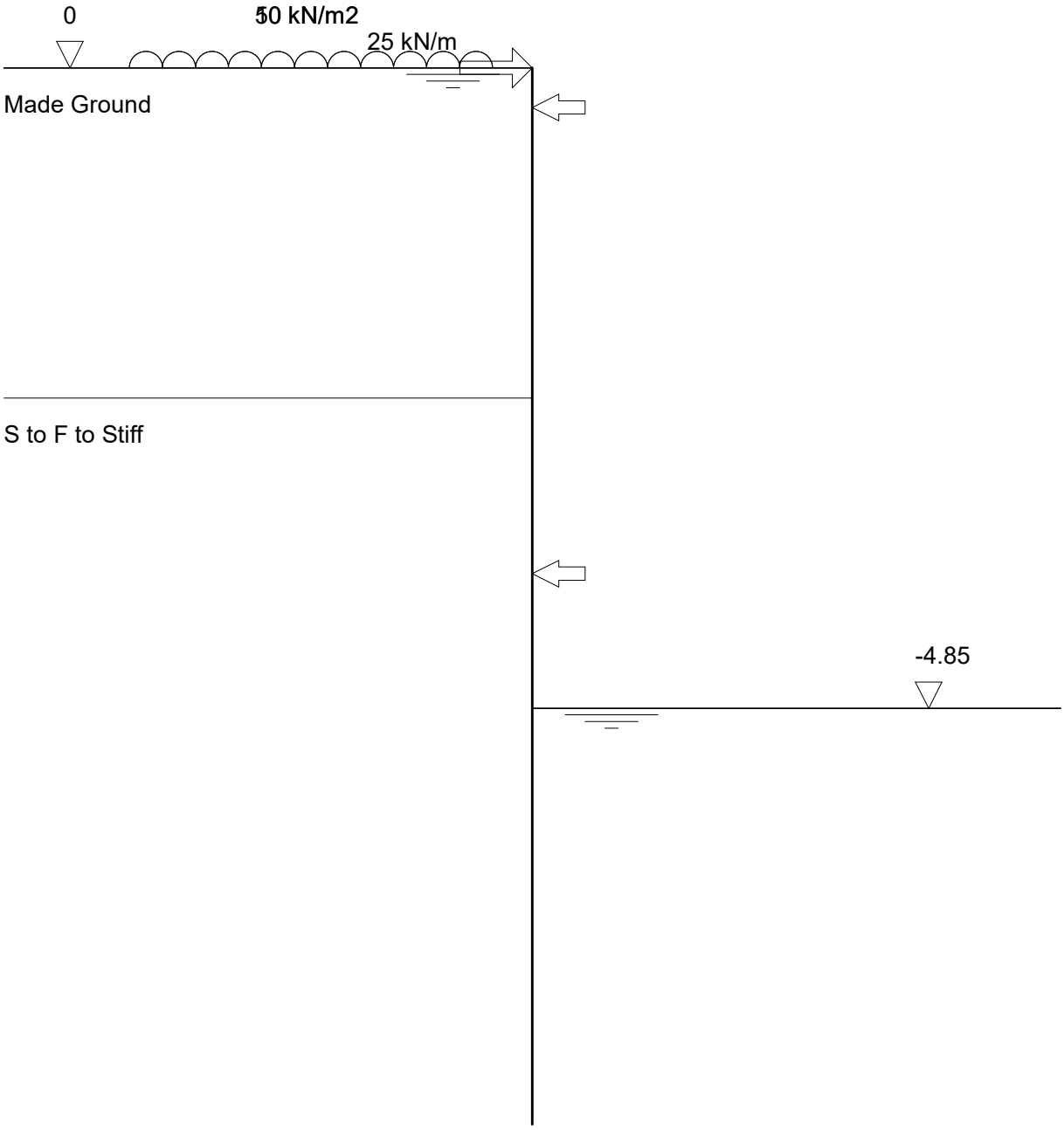


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

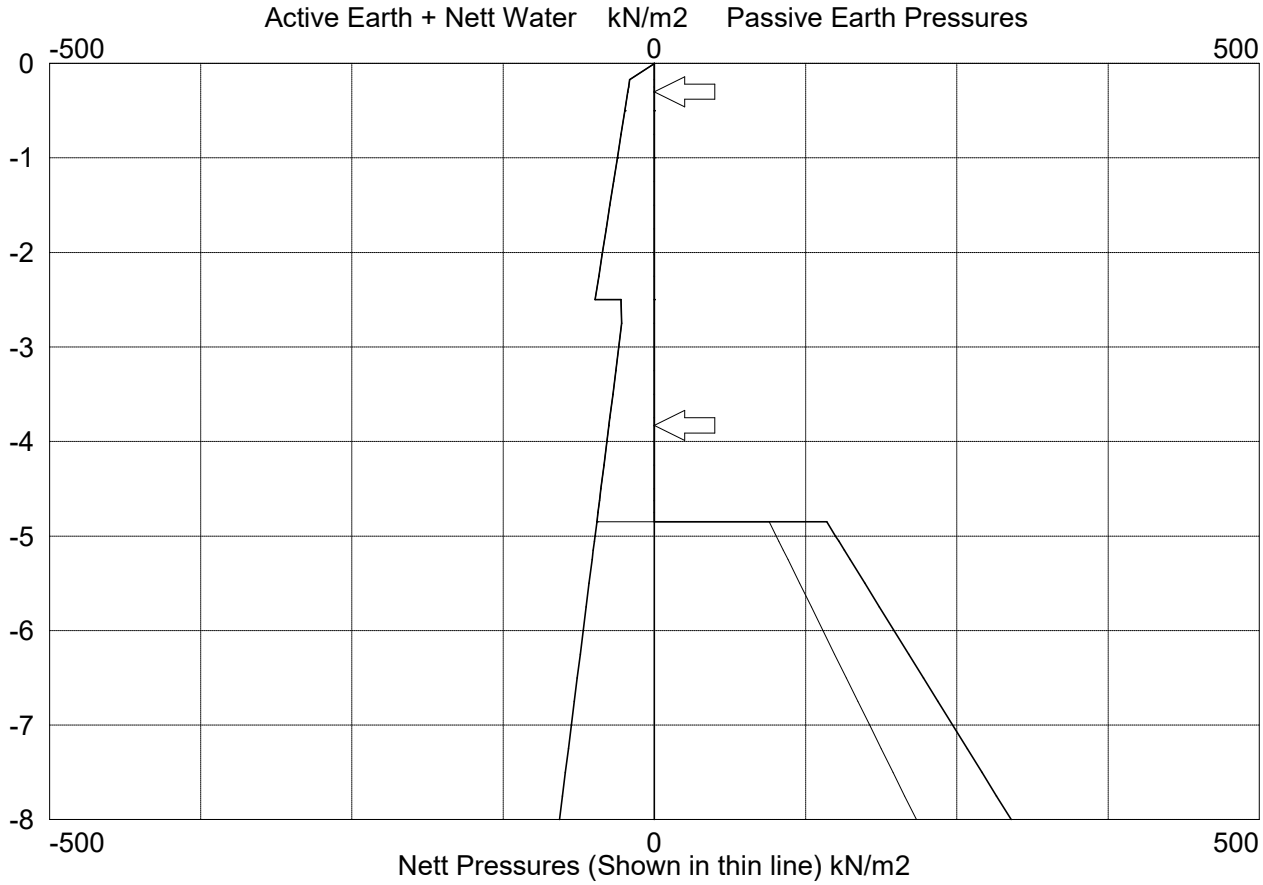
Stage ref. 10
Stage type Horizontal load

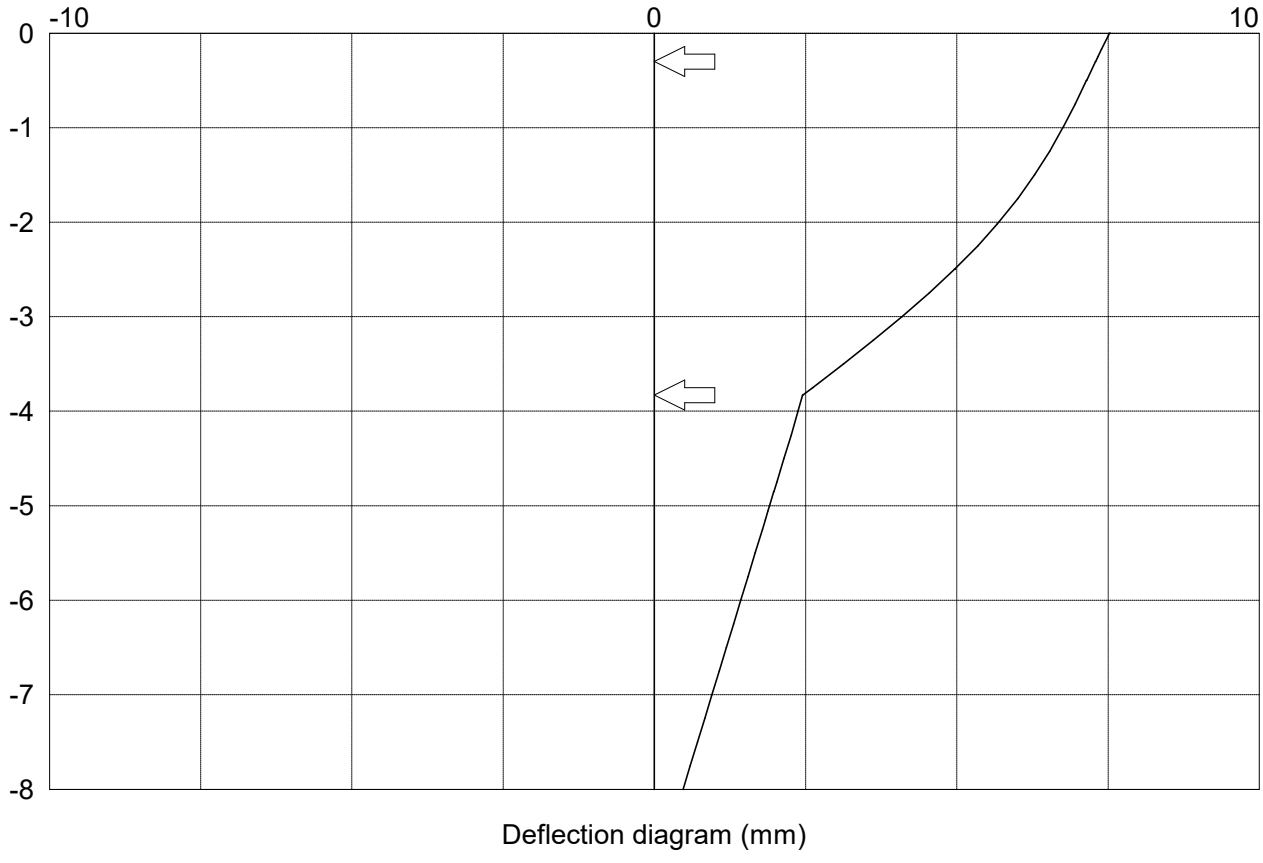


Tabular results from analysis of stage ref 10

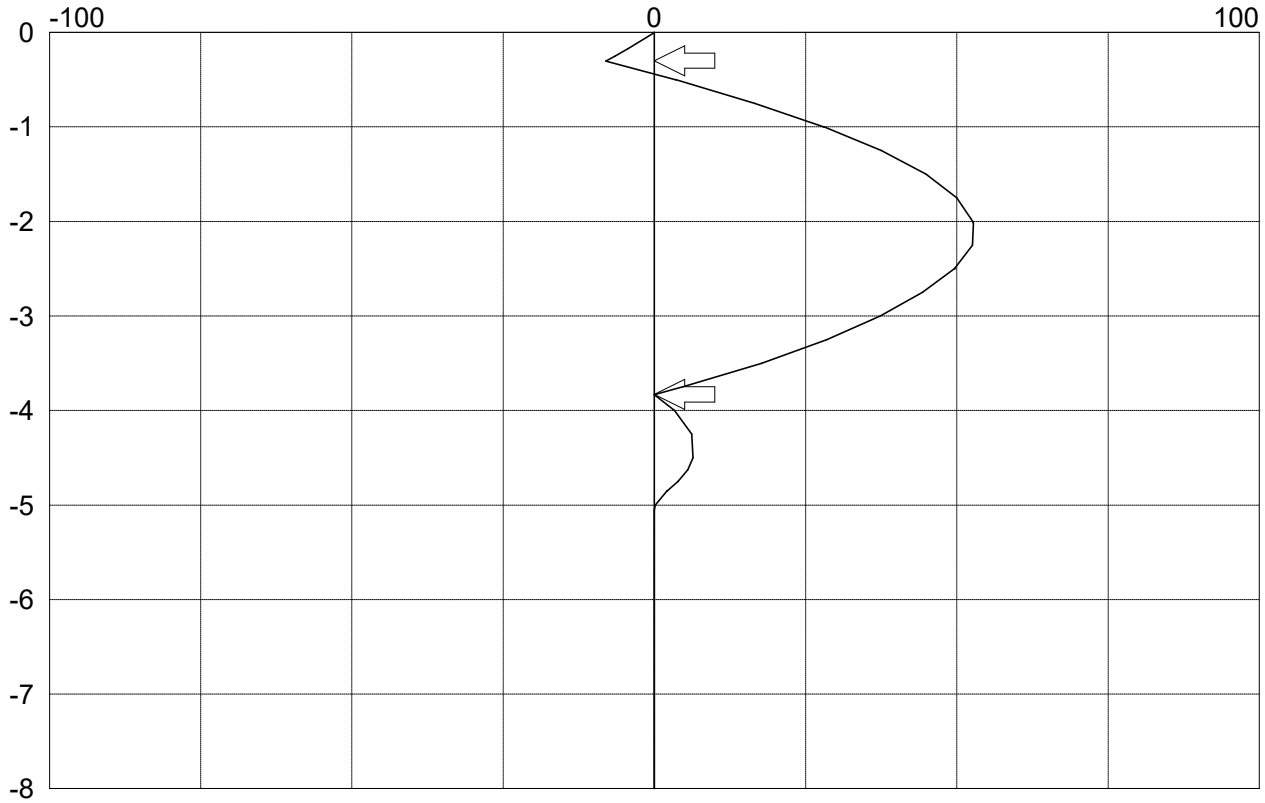
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	7.5		.00
.00	.0	.0	.0	.0	.0	.0	0	0	-25.0	7.5		.00
-.17	61.4	18.7	1.7	.0	.0	.0	20.4	4.4	-26.7	7.4		.00
-.30	62.5	19.0	2.9	.0	.0	.0	21.9	7.9	-29.4	7.3	89.7	.00
-.30	62.5	19.0	3.0	.0	.0	.0	22.0	8.0	60.3	7.3		.00
-.50	64.1	19.5	4.9	.0	.0	.0	24.4	-3.5	55.7	7.1	.0	.00
-.50	64.1	19.5	4.9	.0	.0	.0	24.4	-3.6	55.6	7.1		.00
-1.00	68.2	20.7	9.8	.0	.0	.0	30.5	-27.9	42.0	6.8		.00
-1.00	68.2	20.7	9.8	.0	.0	.0	30.5	-28.0	41.9	6.8		.00
-2.00	76.4	23.2	19.6	.0	.0	.0	42.8	-52.6	5.2	5.7		.00
-2.02	76.6	23.3	19.8	.0	.0	.0	43.1	-52.7	4.4	5.7		.00
-2.50	80.5	24.5	24.5	.0	.0	.0	49.0	-49.6	-17.7	5.0		.00
-2.50	105.0	27.5	.0	.0	.0	.0	27.5	-49.6	-17.7	5.0		.00
w -3.00	114.5	.0	29.4	.0	.0	.0	29.4	-37.4	-31.6	4.1		.00
w -3.83	130.3	.0	37.5	.0	.0	.0	37.5	-.1	-59.3	2.5	82.3	.00
w -3.83	130.3	.0	37.6	.0	.0	.0	37.6	0	22.9	2.5		.00
w -4.00	133.5	.0	39.2	.0	.0	.0	39.2	-3.3	16.4	2.4		.00
w -4.62	145.4	.0	45.3	.0	.0	.0	45.3	-5.5	-9.9	2.1		.00
w -4.85	149.6	.0	47.5	.0	.0	.0	47.5	-2.1	-20.3	2.0		.00
w -4.85	149.7	.0	47.5	.0	142.6	.0	-95.0	-2.1	-20.3	2.0		.01
w -5.00	152.5	.0	49.0	2.9	149.8	.0	-100.8	-.2	-5.6	1.9		.78
w -5.06	153.6	.0	49.5	3.9	152.5	.0	-103.0	0	0	1.9		1.00
w -5.15	155.4	.0	50.5	5.7	157.1	.0	-106.6	0	0	1.8		1.31
w -6.00	171.5	.0	58.8	21.9	198.2	.0	-139.4	0	0	1.4		2.62
w -7.00	190.5	.0	68.6	40.9	246.6	.0	-178.0	0	0	1.0		3.13
w -8.00	209.5	.0	78.4	59.9	295.0	.0	-216.6	0	0	.5		3.40

Graphical results from analysis of stage ref 10

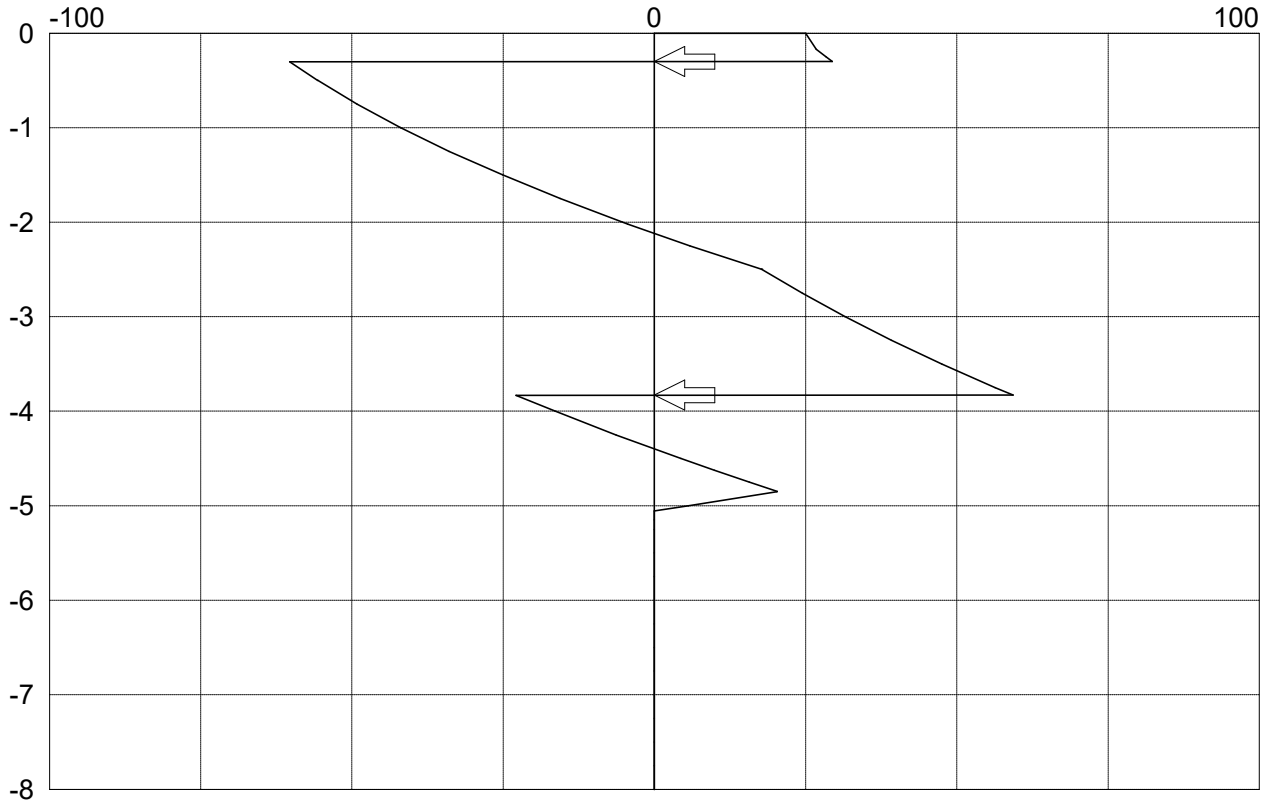




Graphical results from analysis of stage ref 10 continued

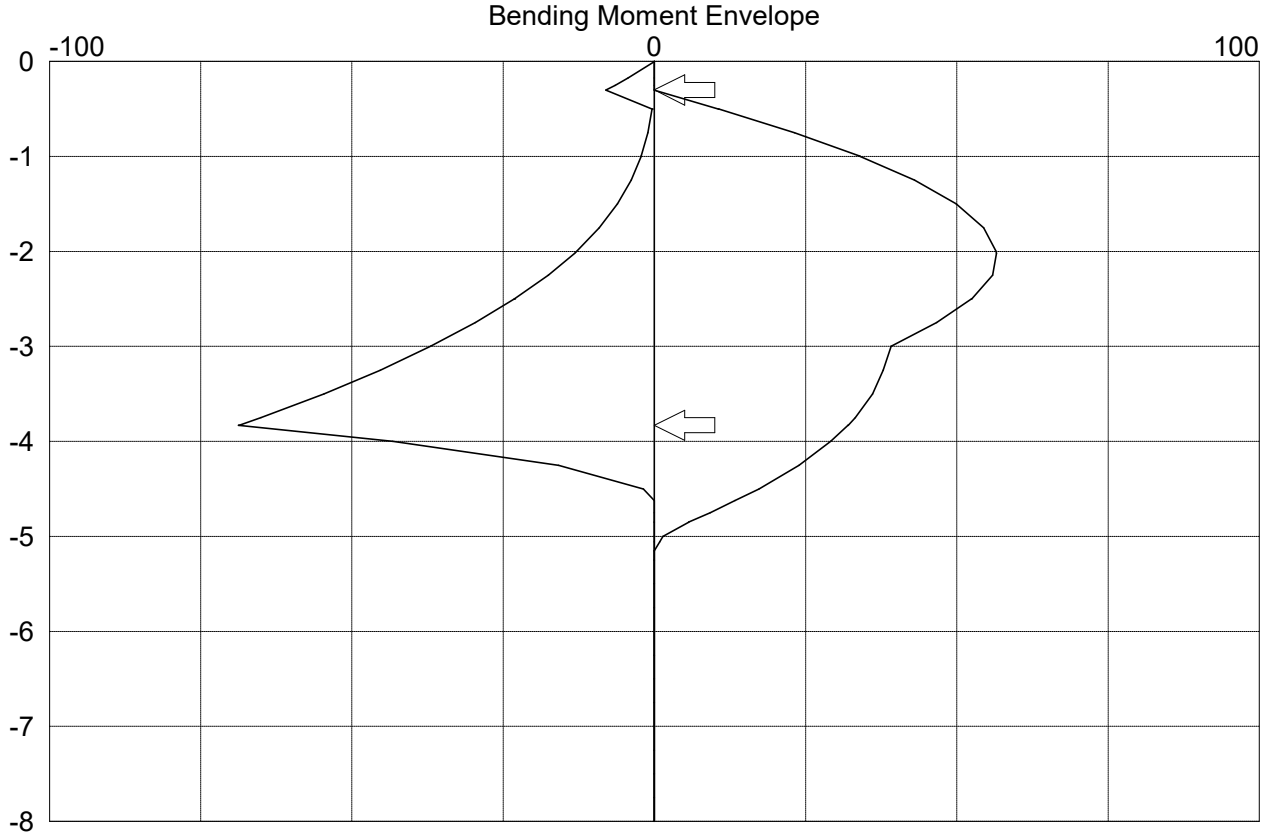


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Graphical plot of envelope from selected construction stages



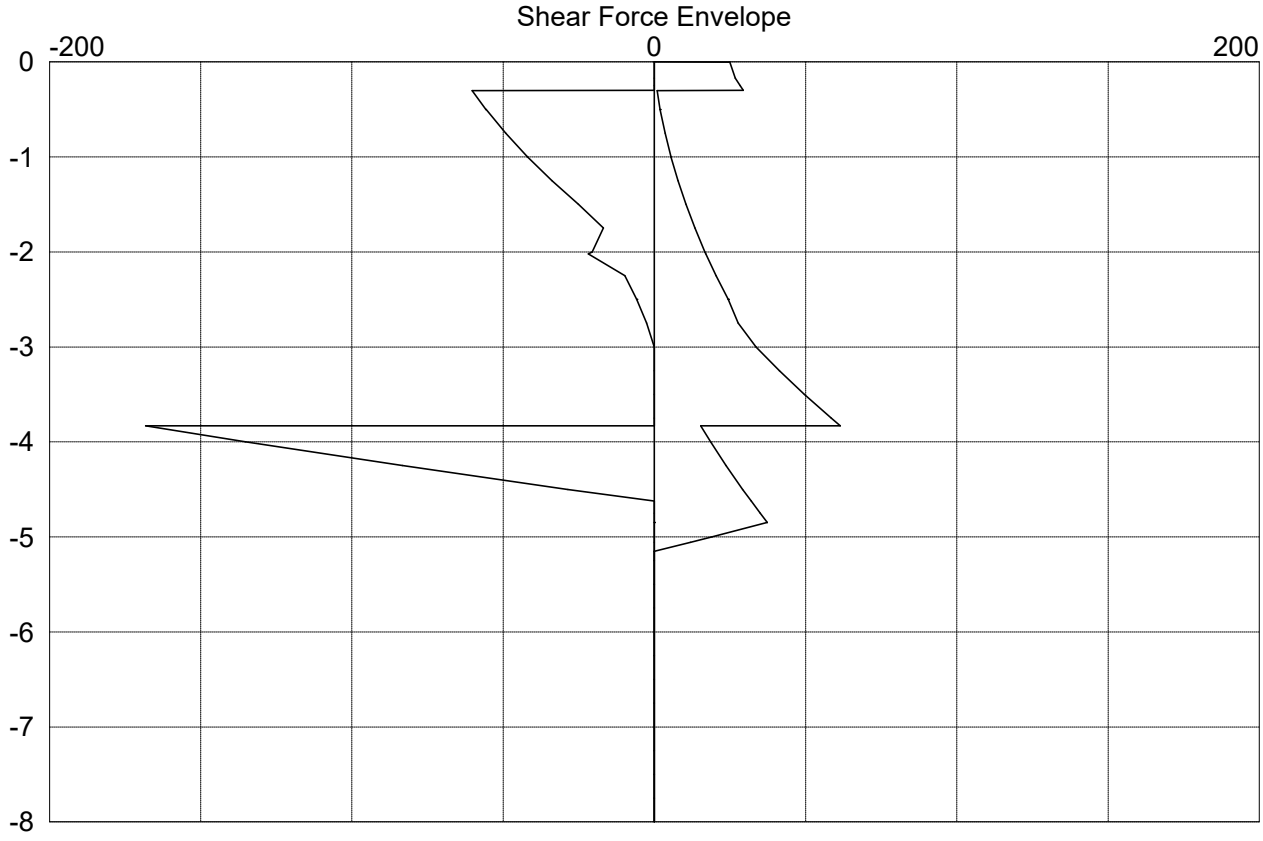


Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
.00	.0	.0	.0	.0	
.00	.0	.0	-25.0	.0	
-.17	.0	4.4	-26.7	.0	
-.30	.0	7.9	-29.4	.0	89.7
-.30	.0	8.0	-.9	60.3	
-.50	-10.6	.4	-1.9	55.7	30.3
-.50	-10.7	.4	-2.0	55.6	
-1.00	-34.0	2.2	-5.5	42.0	
-1.00	-34.0	2.2	-5.5	41.9	
-2.00	-56.5	12.9	-16.8	20.6	
-2.02	-56.6	13.2	-17.0	21.8	
-2.50	-52.5	23.1	-24.4	5.8	
-2.50	-52.5	23.1	-24.4	5.8	
-3.00	-39.1	37.0	-33.7	.0	
-3.83	-32.0	68.6	-61.5	.0	214.0
-3.83	-32.0	68.7	-15.3	168.2	
-4.00	-29.2	43.2	-18.6	135.1	
-4.62	-13.3	.0	-32.1	.0	
-4.85	-5.7	.0	-37.3	.0	
-4.85	-5.7	.0	-37.2	.0	
-5.00	-1.4	.0	-19.0	.0	
-5.06	-.9	.0	-11.9	.0	
-5.15	.0	.0	.0	.0	
-6.00	.0	.0	.0	.0	
-7.00	.0	.0	.0	.0	
-8.00	.0	.0	.0	.0	

Structural design of wall

Wall section properties

Primary pile diameter	450	mm
Primary pile spacing	600	mm
Infill pile diameter		mm
Main rebar bar diameter	20	mm
Main rebar number of bars	5	
Links/Helix bar diameter	8	mm
Links/Helix spacing/pitch	175	mm

Wall material properties

Concrete cube strength	35	N/mm2
Concrete cover	50	mm
Main rebar steel grade	500	N/mm2
Link rebar steel grade	500	N/mm2
Ultimate load factor	1.35	

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	56	103	kNm
Max longitudinal steel. BS8110 max 6% by area	9543	1571	mm2
Min longitudinal steel. BS8110 min 0.4% by area	636	1571	mm2
Shear resistance. BS8110	136	141	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	8	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	232	175	mm
Min shear link area. BS8110 Clause 3.4.5	540	574	mm2/m

Pile Wall Section B-B Permanent Condition	Page No 1 Analysis Perm Condition
CADS Piled Wall Suite Version 6.10 Design of embedded retaining walls and cofferdams	Project SLS Analysis File Name B-B - perm condn.pws"
Broxwood View, 29 St. Edmund's Terrace London NW8 450mm Dia. Secant Pile Retaining Wall	Engineer AA Date 14/02/2023

Pile geometry

Pile top Level	0	m
Pile Length	8.05	m
Pile toe level	-8.05	m

Soils and ground water initial data (Soils data given for active and passive sides)

Initial Ground Water level -4.85

Top Level m	Description	Bulk Dens kN/m3	Sat' Dens kN/m3	Young Mod kN/m2	Young Inc. kN/m3	Cu C' kN/m2	C Inc. kN/m3	Phi Deg	Wall Shear Ratio	Ka Kp	Kac Kpc
.00	Made Ground	18.00	18.00	15000	0			28	.67	.30	
								28	.50	4.15	
-2.50	S to F to Stiff	19.00	19.00	19200	7680	10		25	.67	.35	1.52
						10		25	.50	3.38	4.51

Construction sequence

Stage Ref		Stage Type	Level or Angle m/deg.	Load kN(/m)	Offset m	Width m	Length m
1	A	Active surcharge	0.00	50.0	.3		
2	A	Insert prop	-3.83				
3		Insert prop	-0.30				
4	A	Passive side excavation	-4.85				
5	A	Active water level	0.00				
6	A	Horizontal load					

Code of practice

Code of practice or reference document	
Application of pressures for stability	Not applicable for FOS=1 on moments
FOS on moments (stability check)	1.00
ULS factor on Tan(Phi) values	1.00
ULS fFactor on drained cohesion values	1.00
ULS factor on undrained cohesion values	1.00
ULS factor on active soil pressures	1.00
ULS factor on passive soil pressures	1.00
ULS factor on active water pressures	1.00
ULS factor on passive water pressures	1.00
ULS factor on loads applied to the soil	1.00
ULS factor on loads applied to the wall	1.00
FOS on embedment (stability check)	1.00
Correction factor on cantilever embedment	1.00

Wall analysis detail options

Nominal Phi for load distribution	30.0	Degrees
Depth of water filled tension cracks	.0	m
Density of water	9.8	kN/m3
Minimum equivalent fluid density	5.0	kN/m3
Depth of passive softened soil	.0	m
Continuity model for wall analysis	Pins at second and lower props	

Deflection parameters

Wall moment of inertia	335482	cm4/m
Wall Youngs modulus	27000000	kN/m2

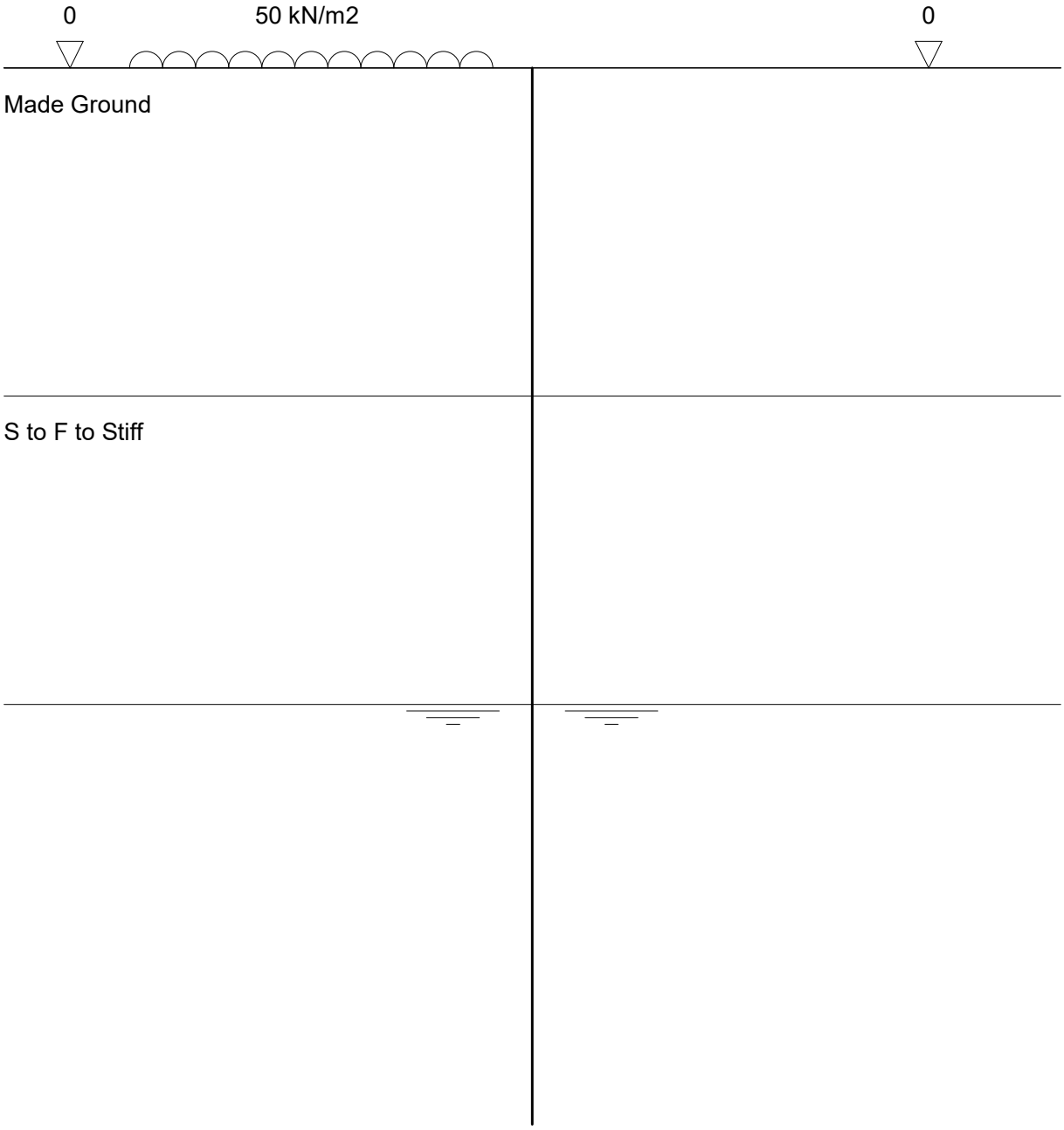
Properties for prop at -3.83

Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

Properties for prop at -0.3

Prop/Tie cross sectional area	72	cm2 each
Prop/Tie Youngs modulus	28000000	kN/m2
Prop/Tie length	1.0	m
Prop/Tie spacing	1.0	m
Waling moment of inertia	Waling deflection not included	
Waling Youngs modulus	Waling deflection not included	
Prop/Tie preload	0	kN
Initial lack of fit	0.0	mm

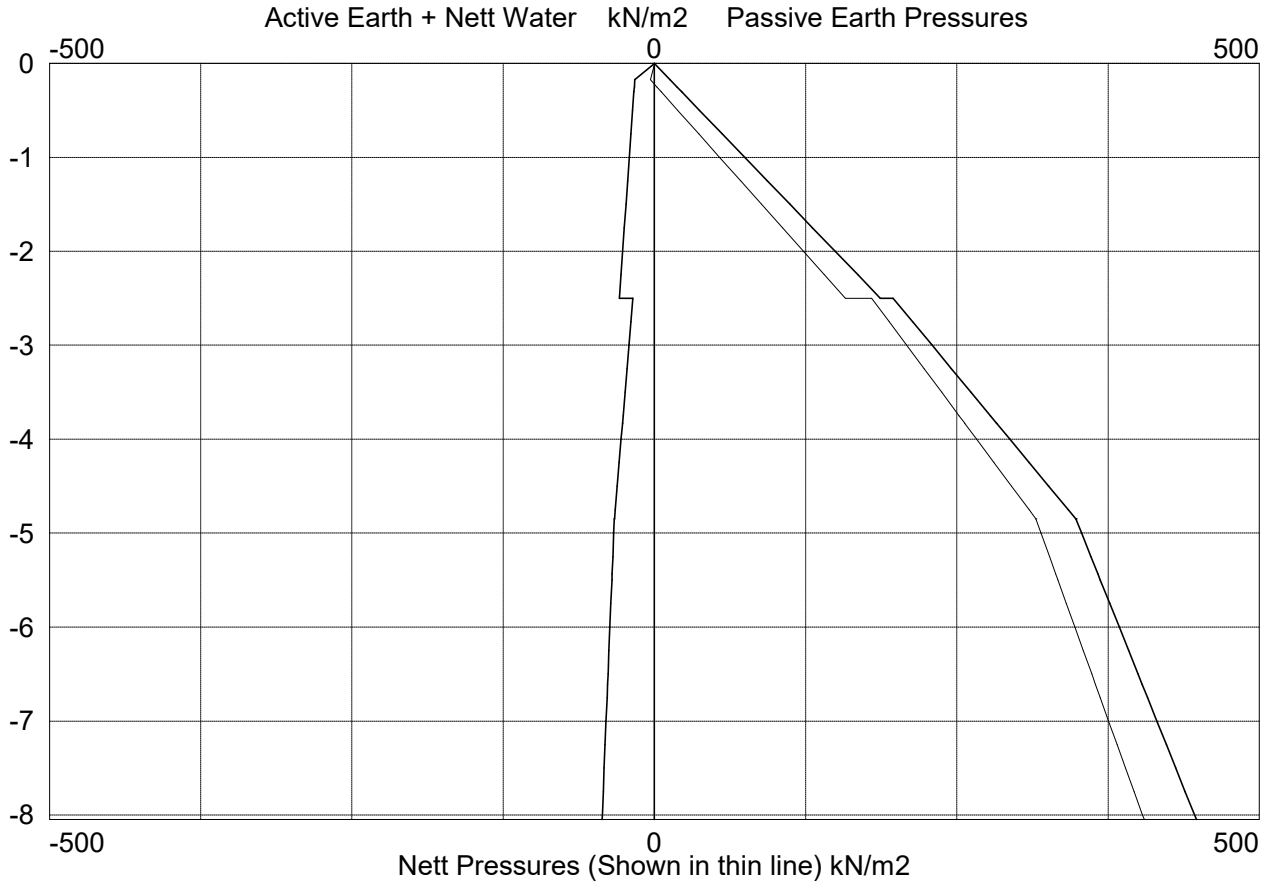
Stage ref. 1
Stage type Active surcharge

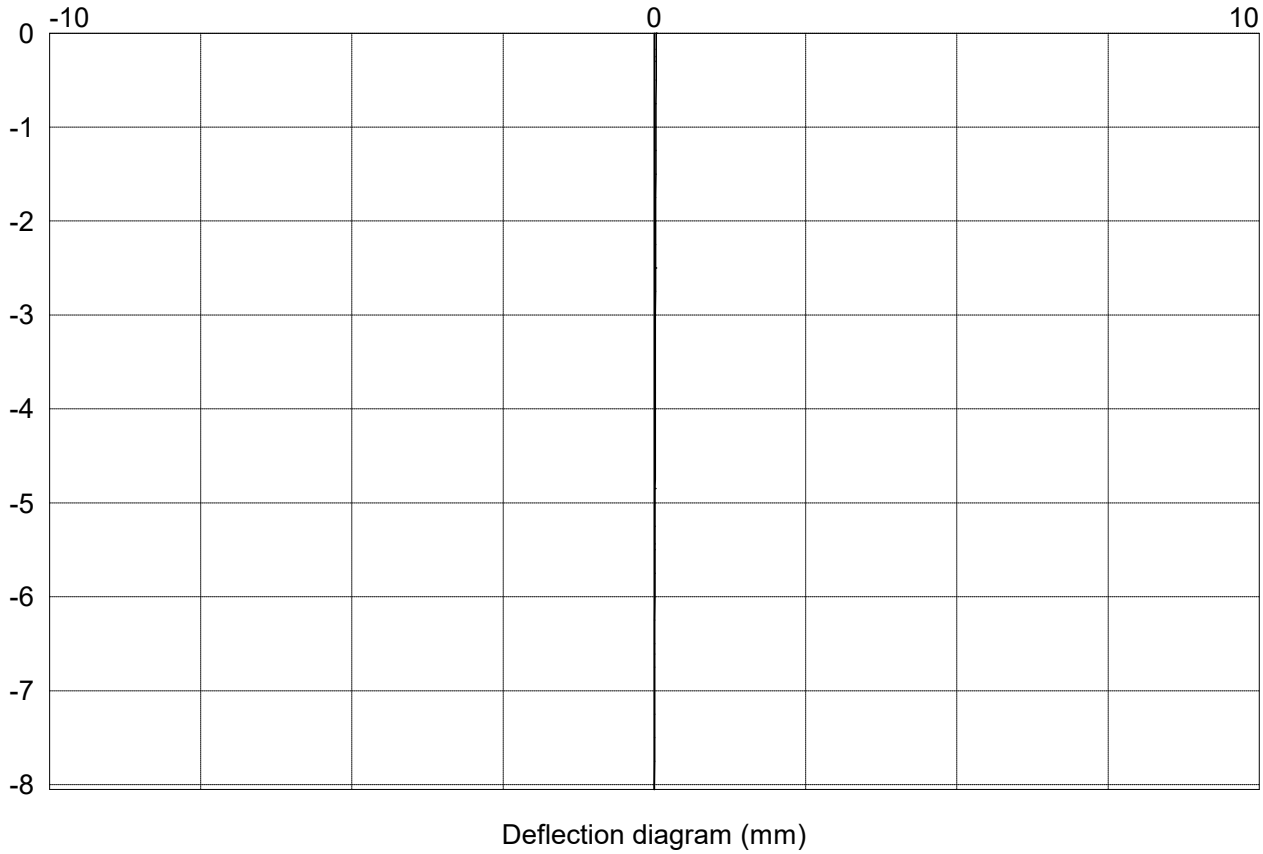


Tabular results from analysis of stage ref 1

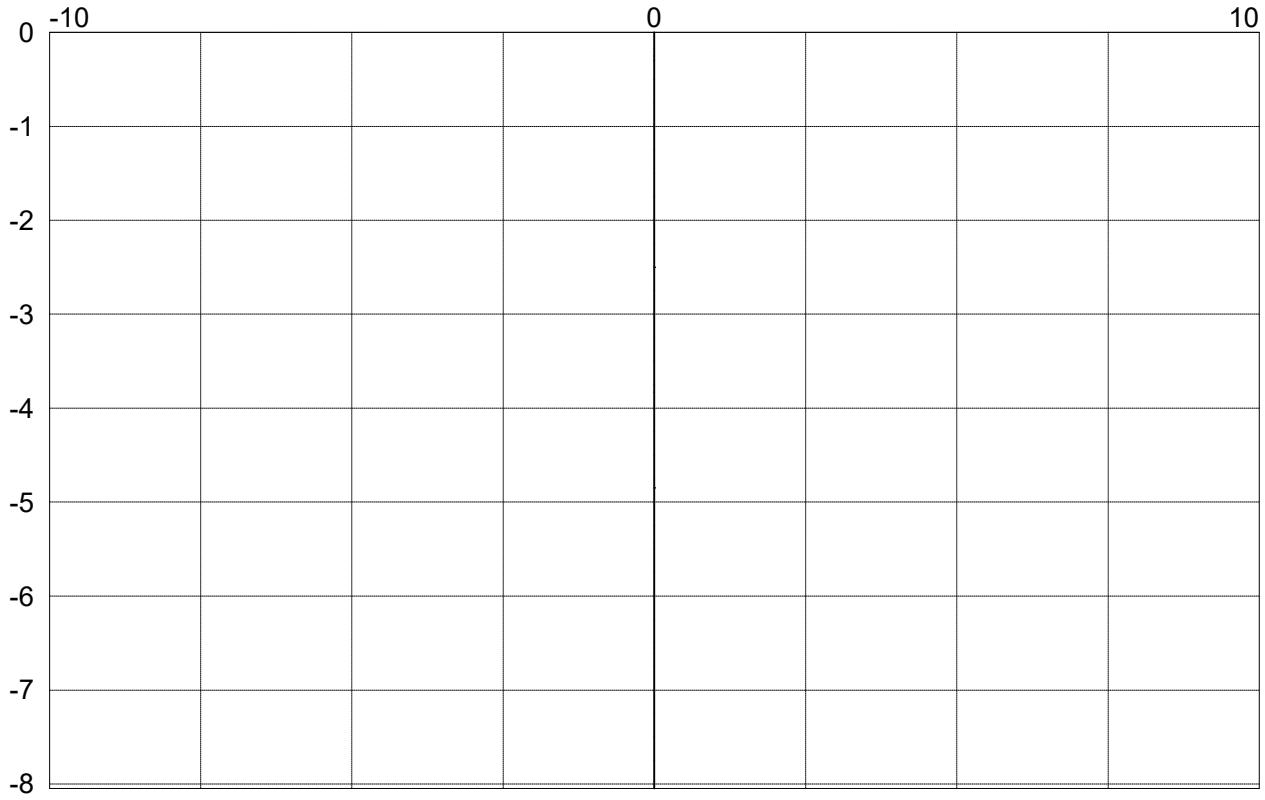
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	0		.00
.00	.0	.0	.0	.0	.1	.0	-.1	0	0	0		13.65
-.17	53.1	16.2	.0	3.1	12.9	.0	3.2	0	0	0		.82
-.30	55.4	16.9	.0	5.4	22.4	.0	-5.6	0	0	0	.0	.87
-.30	55.4	16.9	.0	5.4	22.6	.0	-5.7	0	0	0		.87
-1.00	68.0	20.7	.0	18.0	74.7	.0	-54.0	0	0	0		1.71
-2.00	86.0	26.2	.0	36.0	149.4	.0	-123.3	0	0	0		2.84
-2.50	95.0	28.9	.0	45.0	186.8	.0	-157.9	0	0	0		3.32
-2.50	95.0	17.6	.0	45.0	197.3	.0	-179.7	0	0	0		3.32
-3.00	104.5	20.9	.0	54.5	229.5	.0	-208.6	0	0	0		3.84
-3.83	120.3	26.4	.0	70.3	282.9	.0	-256.5	0	0	0	.0	4.75
-3.83	120.3	26.4	.0	70.3	283.0	.0	-256.6	0	0	0		4.76
-4.00	123.5	27.5	.0	73.5	293.8	.0	-266.3	0	0	0		4.93
-4.85	139.6	33.0	.0	89.6	348.3	.0	-315.3	0	0	0		5.76
-4.85	139.7	33.0	.0	89.6	348.5	.0	-315.4	0	0	0		5.76
-5.00	141.0	33.5	1.5	91.0	353.1	1.5	-319.6	0	0	0		5.89
-5.44	145.0	34.9	5.7	95.0	366.7	5.7	-331.8	0	0	0		6.25
-6.00	150.2	36.7	11.3	100.2	384.3	11.3	-347.6	0	0	0		6.67
-6.61	155.8	38.6	17.2	105.8	403.2	17.2	-364.6	0	0	0		7.05
-7.00	159.4	39.9	21.1	109.4	415.4	21.1	-375.5	0	0	0		7.27
-8.00	168.6	43.1	30.9	118.6	446.5	30.9	-403.5	0	0	0		7.73
-8.05	169.1	43.2	31.4	119.1	448.1	31.4	-404.9	0	0	0		7.75

Graphical results from analysis of stage ref 1

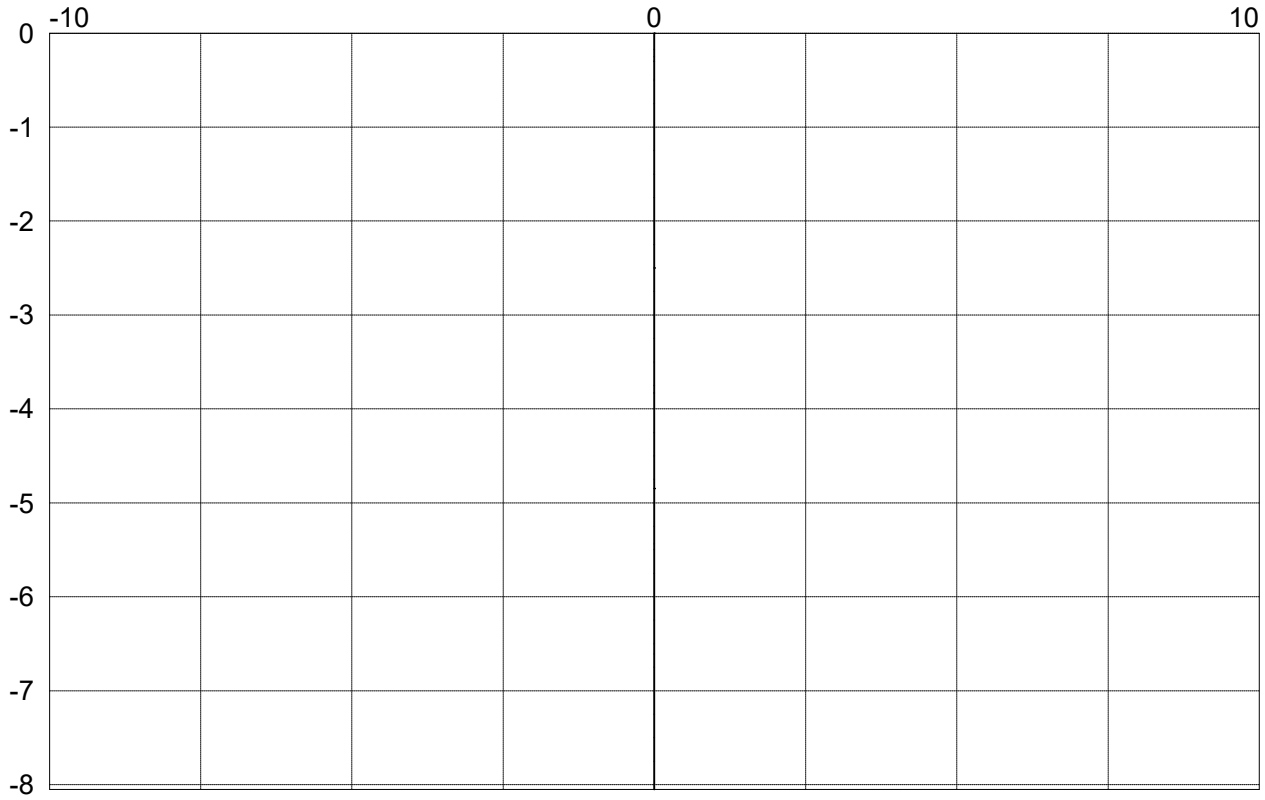




Graphical results from analysis of stage ref 1 continued

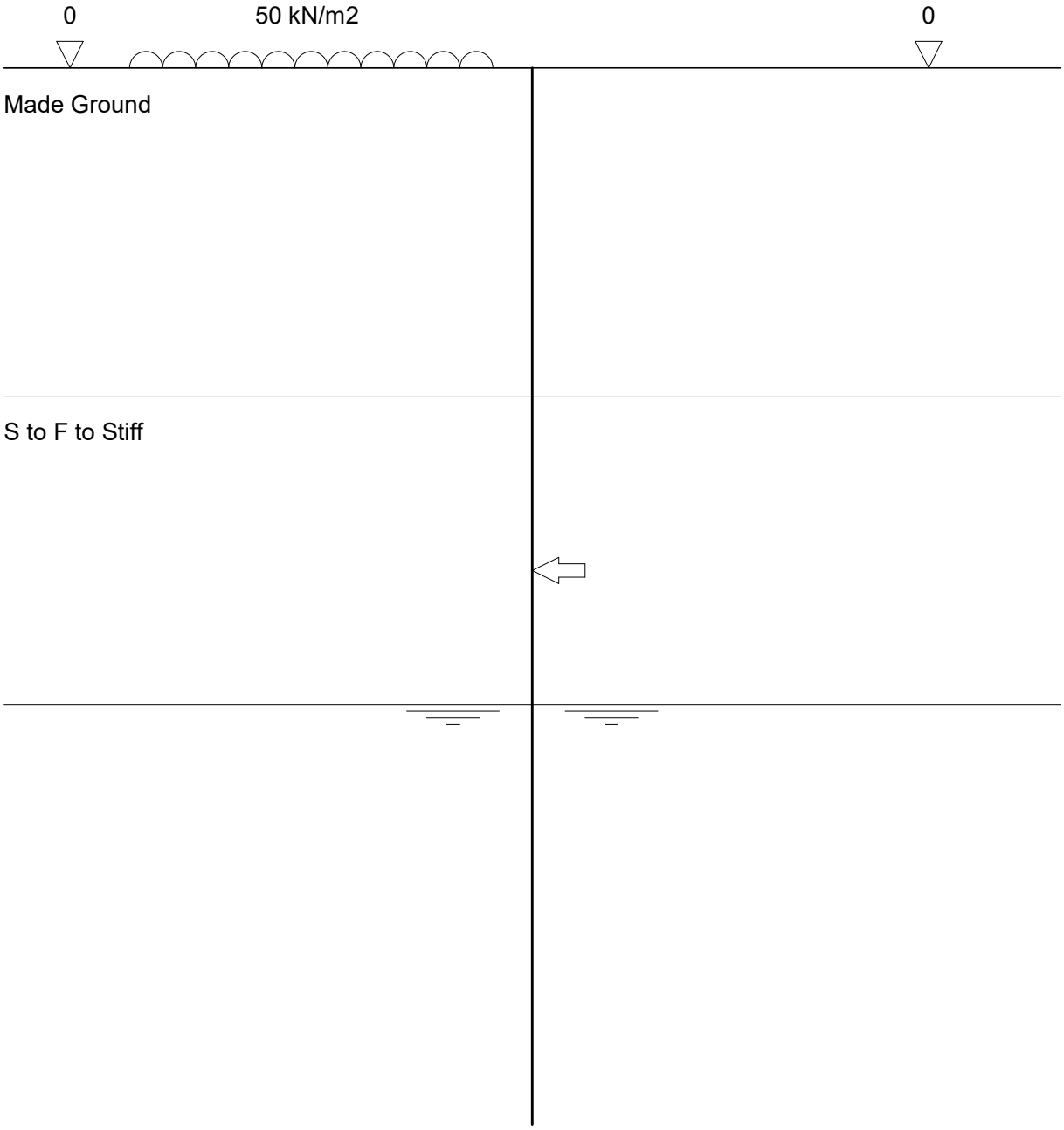


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

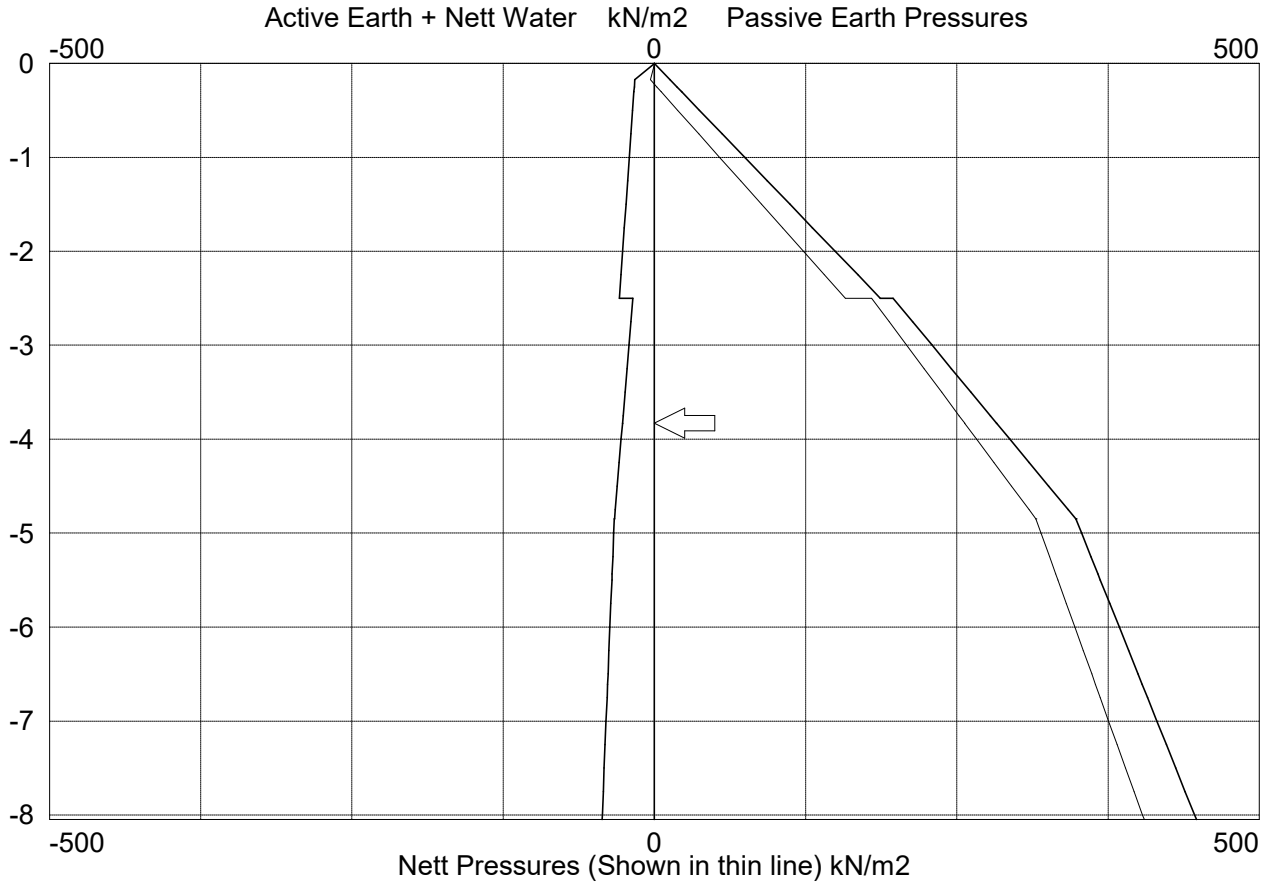
Stage ref. 2
Stage type Insert prop

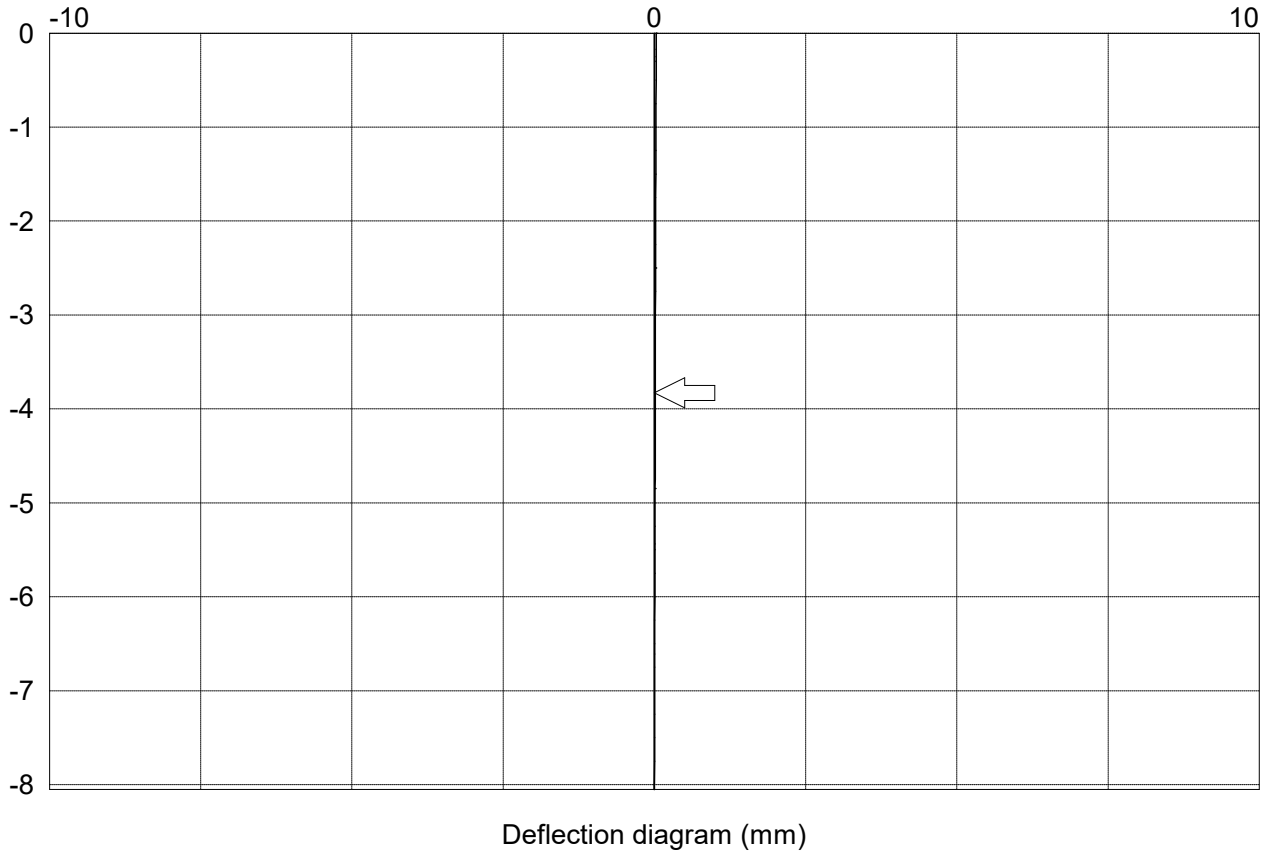


Tabular results from analysis of stage ref 2

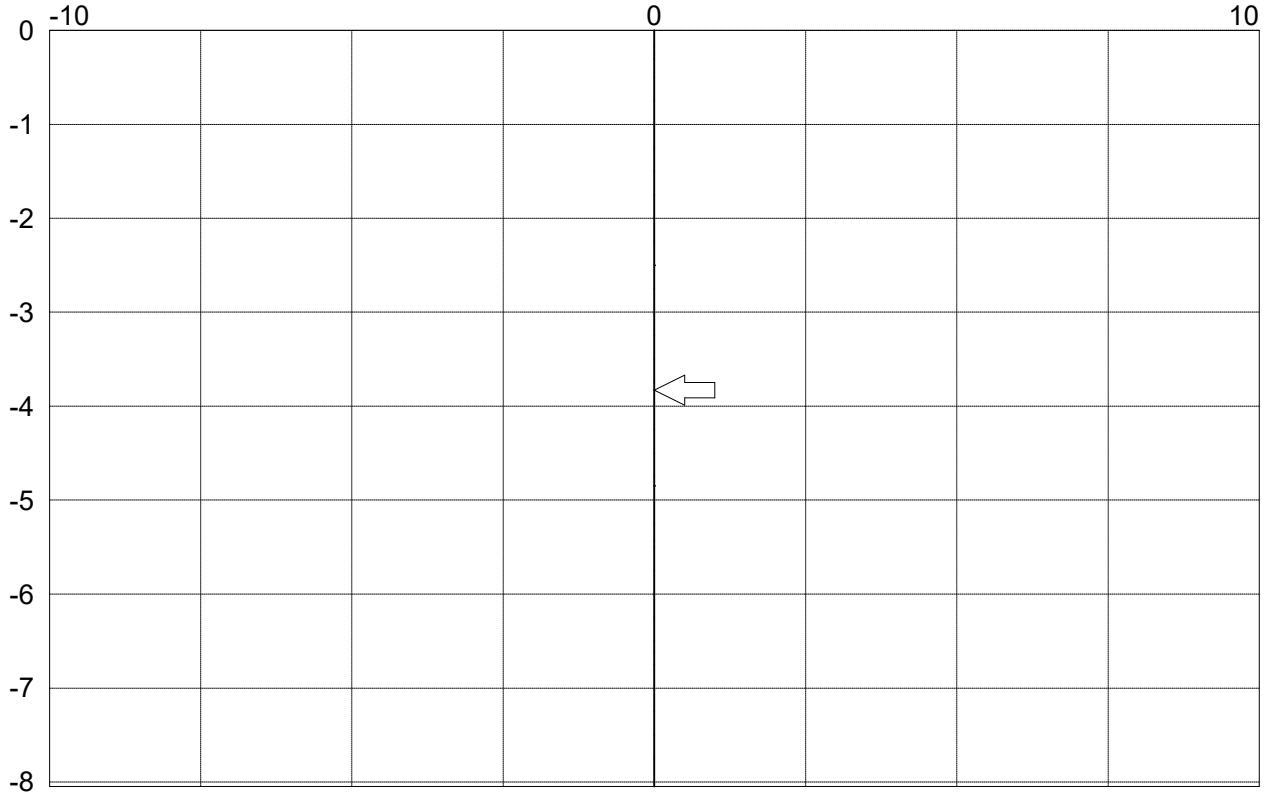
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	0		.00
.00	.0	.0	.0	.0	.1	.0	-.1	0	0	0		13.65
-.17	53.1	16.2	.0	3.1	12.9	.0	3.2	0	0	0		.82
-.30	55.4	16.9	.0	5.4	22.4	.0	-5.6	0	0	0	.0	.87
-.30	55.4	16.9	.0	5.4	22.6	.0	-5.7	0	0	0		.87
-1.00	68.0	20.7	.0	18.0	74.7	.0	-54.0	0	0	0		1.71
-2.00	86.0	26.2	.0	36.0	149.4	.0	-123.3	0	0	0		2.84
-2.50	95.0	28.9	.0	45.0	186.8	.0	-157.9	0	0	0		3.32
-2.50	95.0	17.6	.0	45.0	197.3	.0	-179.7	0	0	0		3.32
-3.00	104.5	20.9	.0	54.5	229.5	.0	-208.6	0	0	0		3.84
-3.83	120.3	26.4	.0	70.3	282.9	.0	-256.5	0	0	0	.0	4.75
-3.83	120.3	26.4	.0	70.3	283.0	.0	-256.6	0	0	0		4.76
-4.00	123.5	27.5	.0	73.5	293.8	.0	-266.3	0	0	0		4.93
-4.85	139.6	33.0	.0	89.6	348.3	.0	-315.3	0	0	0		5.76
-4.85	139.7	33.0	.0	89.6	348.5	.0	-315.4	0	0	0		5.76
-5.00	141.0	33.5	1.5	91.0	353.1	1.5	-319.6	0	0	0		5.89
-5.44	145.0	34.9	5.7	95.0	366.7	5.7	-331.8	0	0	0		6.25
-6.00	150.2	36.7	11.3	100.2	384.3	11.3	-347.6	0	0	0		6.67
-6.61	155.8	38.6	17.2	105.8	403.2	17.2	-364.6	0	0	0		7.05
-7.00	159.4	39.9	21.1	109.4	415.4	21.1	-375.5	0	0	0		7.27
-8.00	168.6	43.1	30.9	118.6	446.5	30.9	-403.5	0	0	0		7.73
-8.05	169.1	43.2	31.4	119.1	448.1	31.4	-404.9	0	0	0		7.75

Graphical results from analysis of stage ref 2

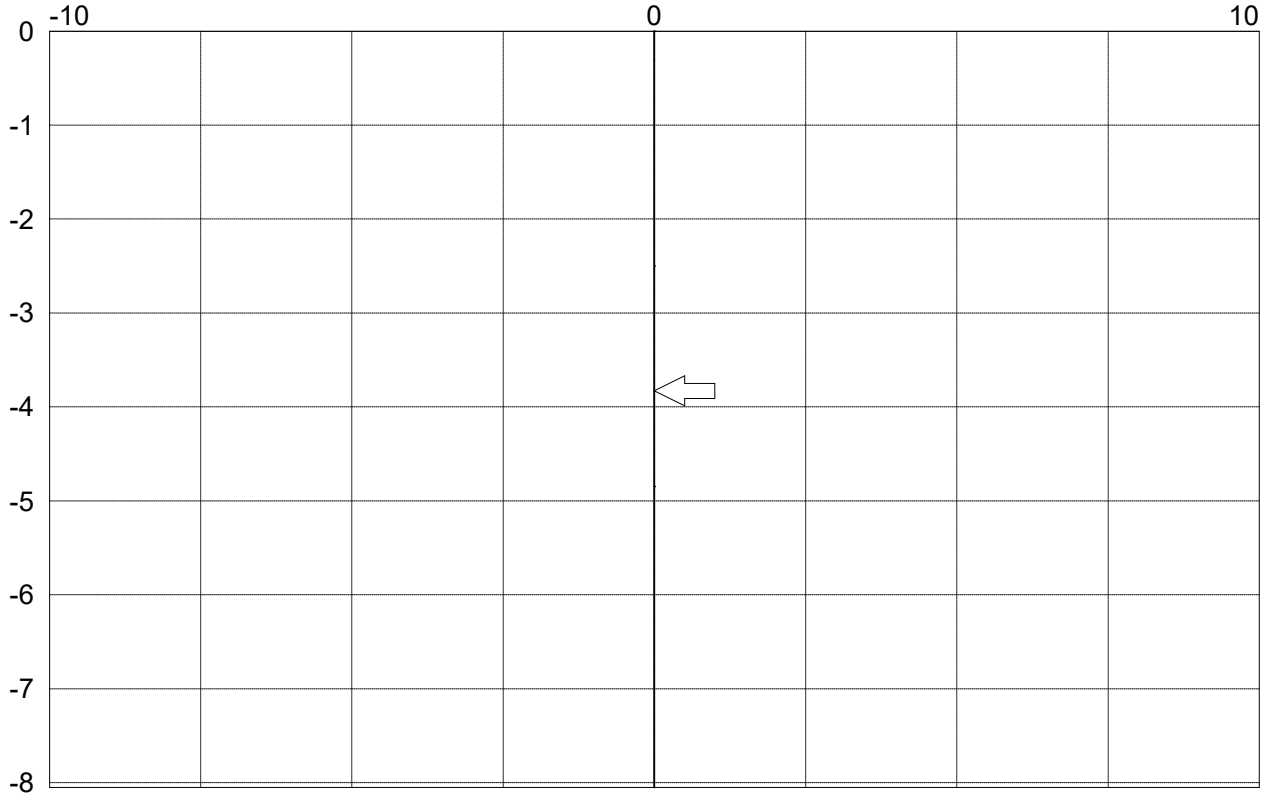




Graphical results from analysis of stage ref 2 continued

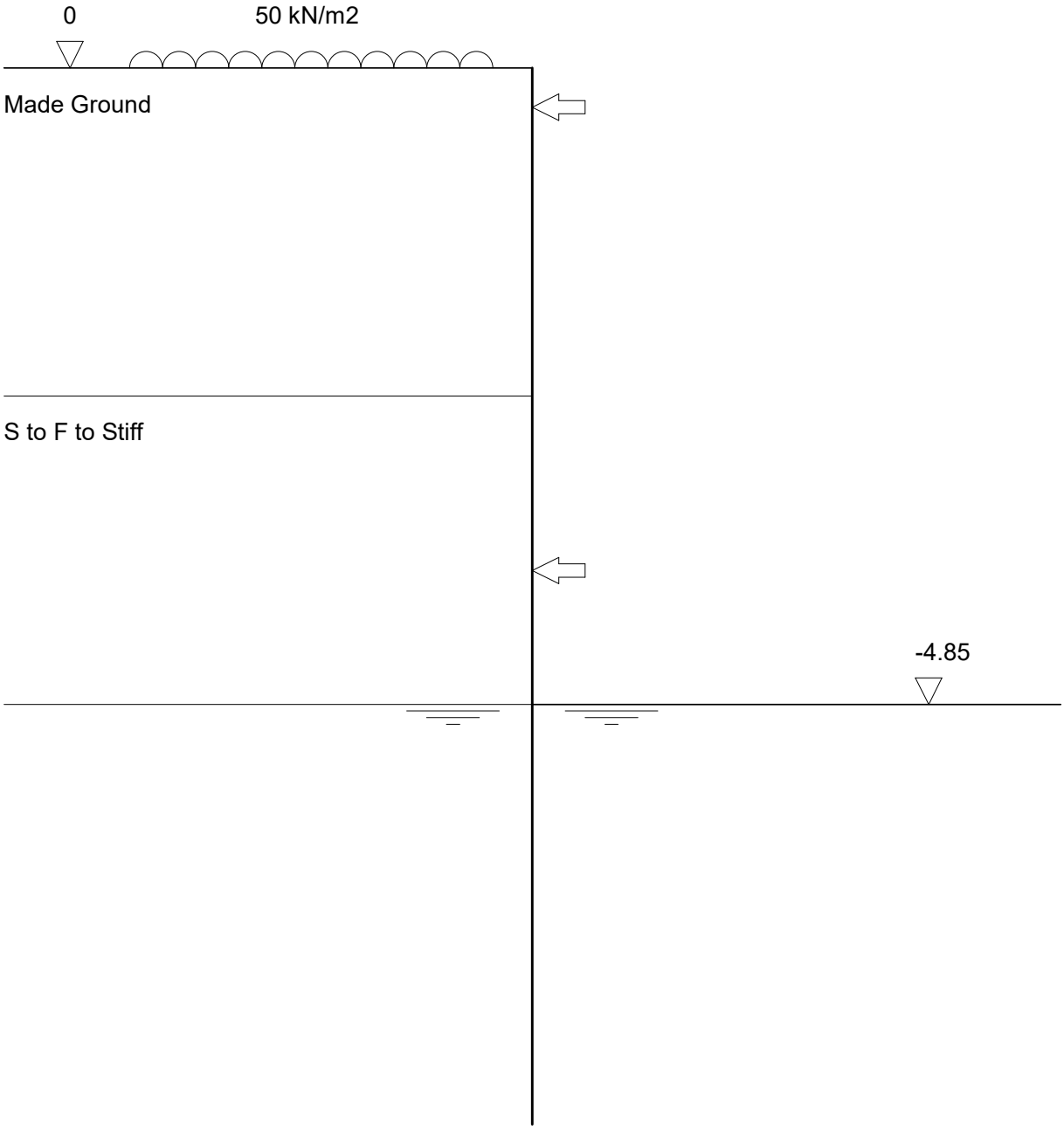


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

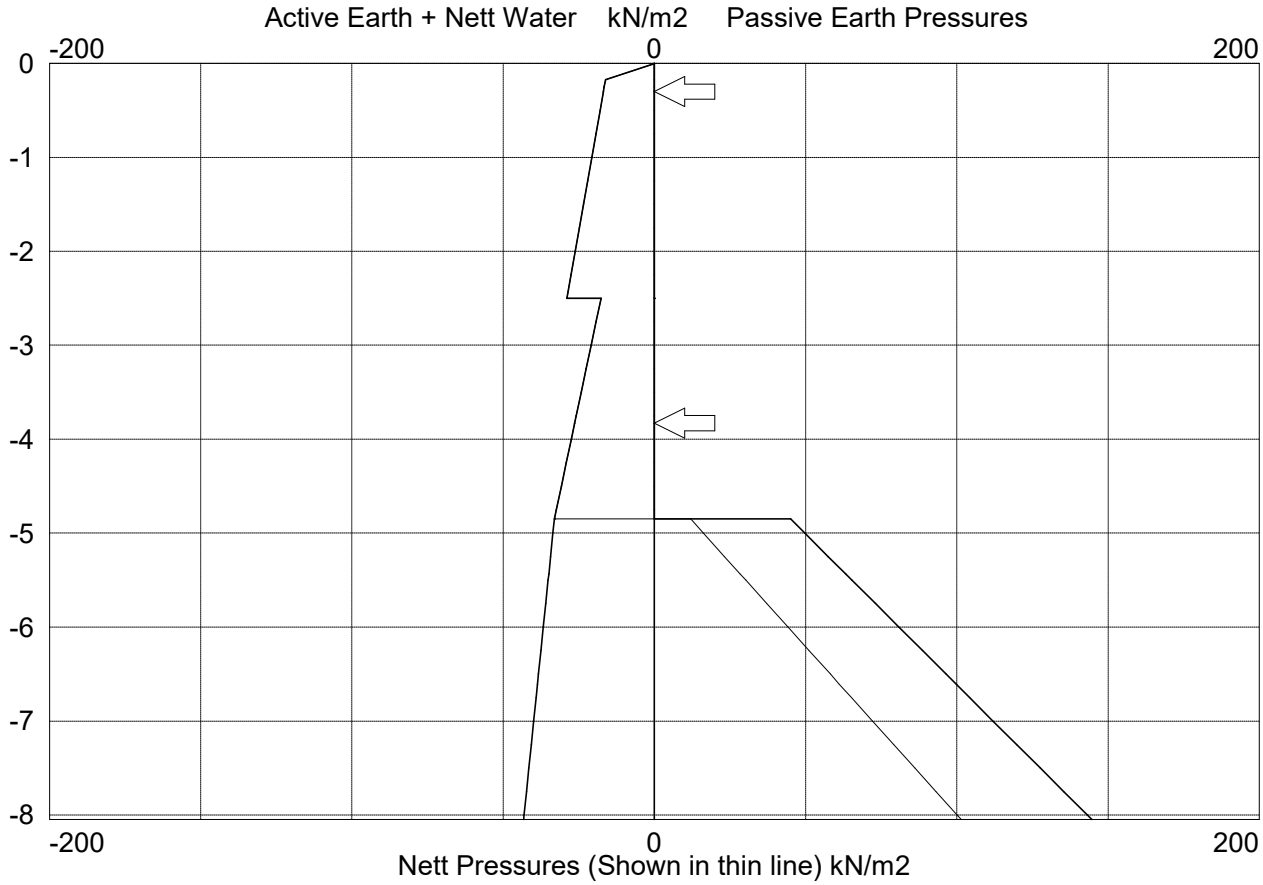
Stage ref. 4
Stage type Passive side excavation

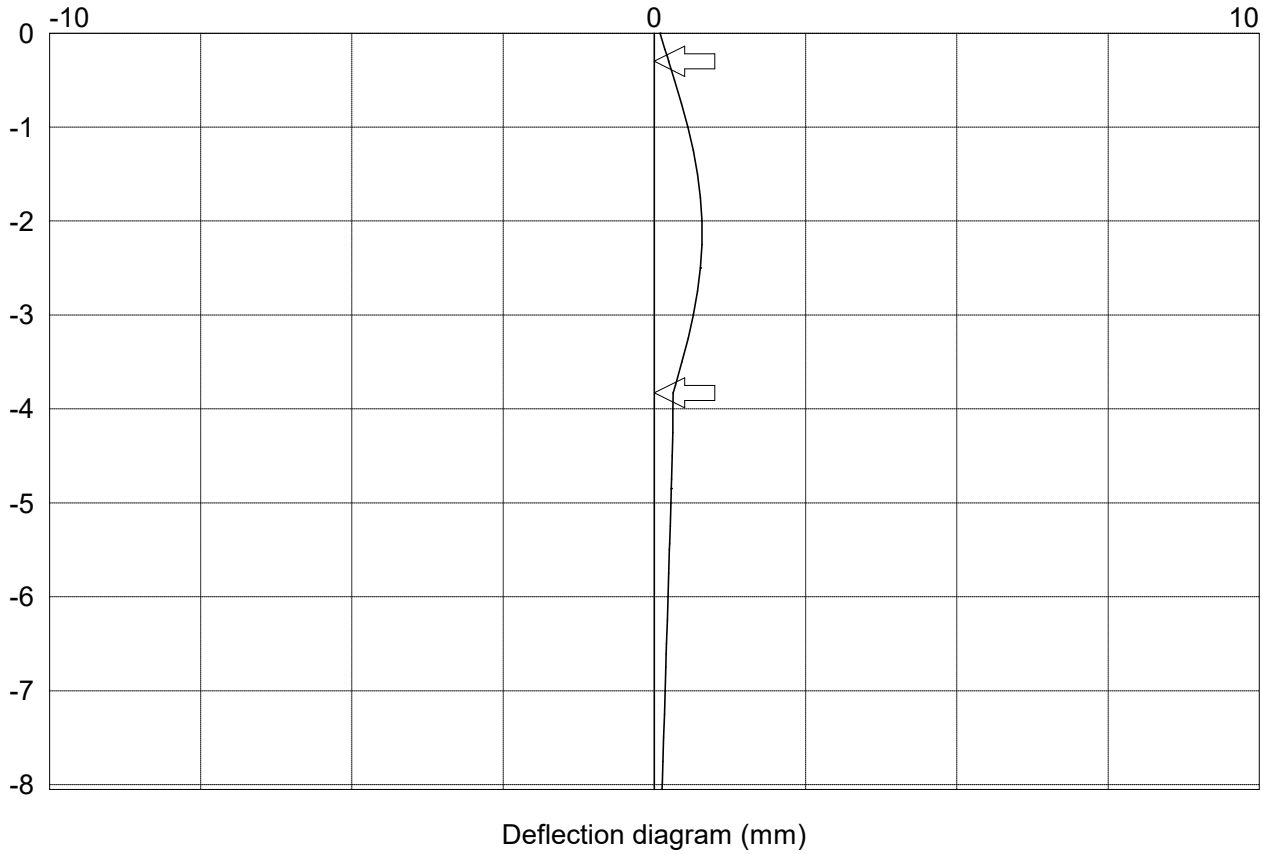


Tabular results from analysis of stage ref 4

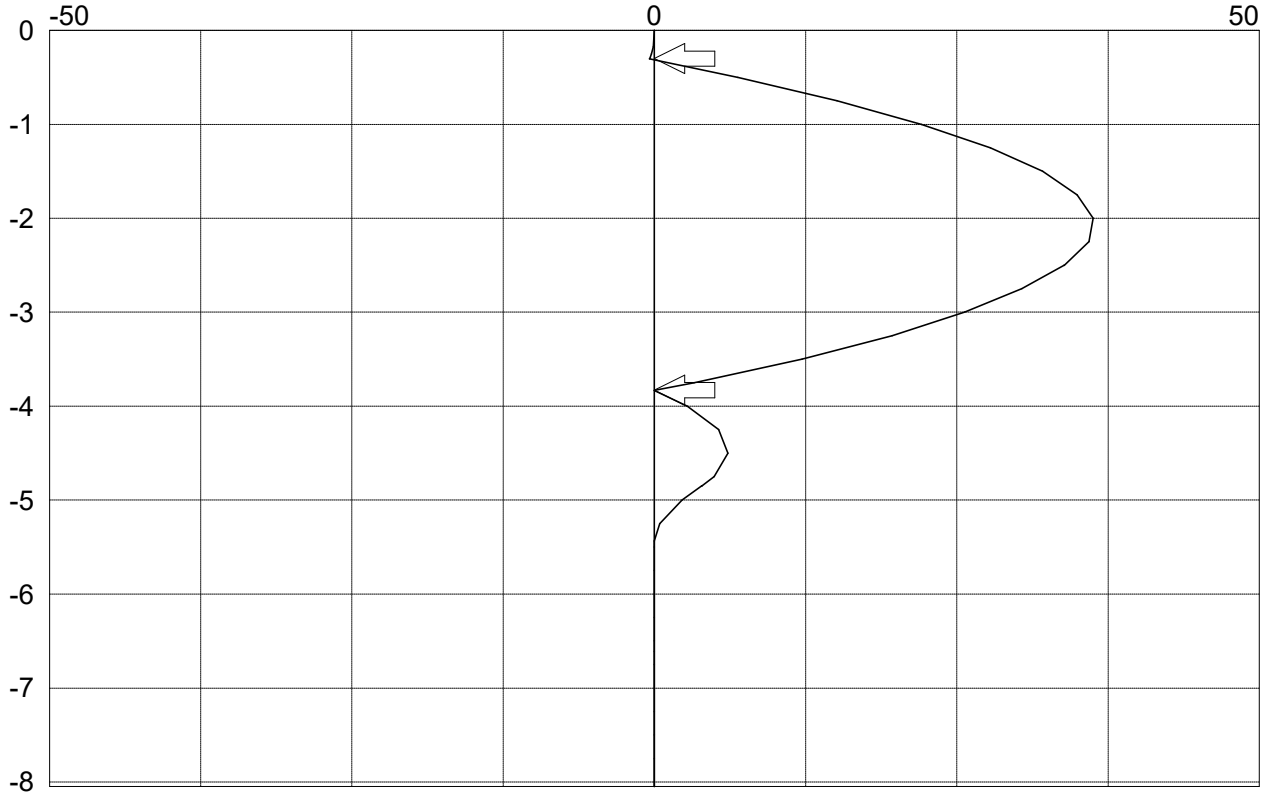
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	.1		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	.1		.00
-.17	53.1	16.2	.0	.0	.0	.0	16.2	.1	-1.4	.2		.00
-.30	55.4	16.9	.0	.0	.0	.0	16.9	.4	-3.5	.2	42.0	.00
-.30	55.4	16.9	.0	.0	.0	.0	16.9	.4	38.5	.2		.00
-1.00	68.0	20.7	.0	.0	.0	.0	20.7	-22.1	25.4	.6		.00
-2.00	86.0	26.2	.0	.0	.0	.0	26.2	-36.3	2.0	.8		.00
-2.50	95.0	28.9	.0	.0	.0	.0	28.9	-33.9	-11.8	.8		.00
-2.50	95.0	17.6	.0	.0	.0	.0	17.6	-33.9	-11.8	.8		.00
-3.00	104.5	20.9	.0	.0	.0	.0	20.9	-25.7	-21.4	.6		.00
-3.83	120.3	26.4	.0	.0	.0	.0	26.4	-.1	-41.0	.3	59.4	.00
-3.83	120.3	26.4	.0	.0	.0	.0	26.4	0	18.4	.3		.00
-4.00	123.5	27.5	.0	.0	.0	.0	27.5	-2.7	13.9	.3		.00
-4.85	139.6	33.0	.0	.0	.0	.0	33.0	-3.9	-11.8	.3		.00
-4.85	139.7	33.0	.0	.0	45.1	.0	-12.0	-3.9	-11.8	.3		.00
-5.00	141.0	33.5	1.5	1.4	49.7	1.5	-16.2	-2.3	-9.7	.3		.36
-5.44	145.0	34.9	5.7	5.4	63.3	5.7	-28.4	0	0	.3		.99
-6.00	150.2	36.7	11.3	10.6	80.9	11.3	-44.2	0	0	.2		1.49
-6.61	155.8	38.6	17.2	16.2	99.9	17.2	-61.2	0	0	.2		1.87
-7.00	159.4	39.9	21.1	19.8	112.0	21.1	-72.1	0	0	.2		2.08
-8.00	168.6	43.1	30.9	29.0	143.1	30.9	-100.1	0	0	.1		2.54
-8.05	169.1	43.2	31.4	29.4	144.7	31.4	-101.5	0	0	.1		2.56

Graphical results from analysis of stage ref 4

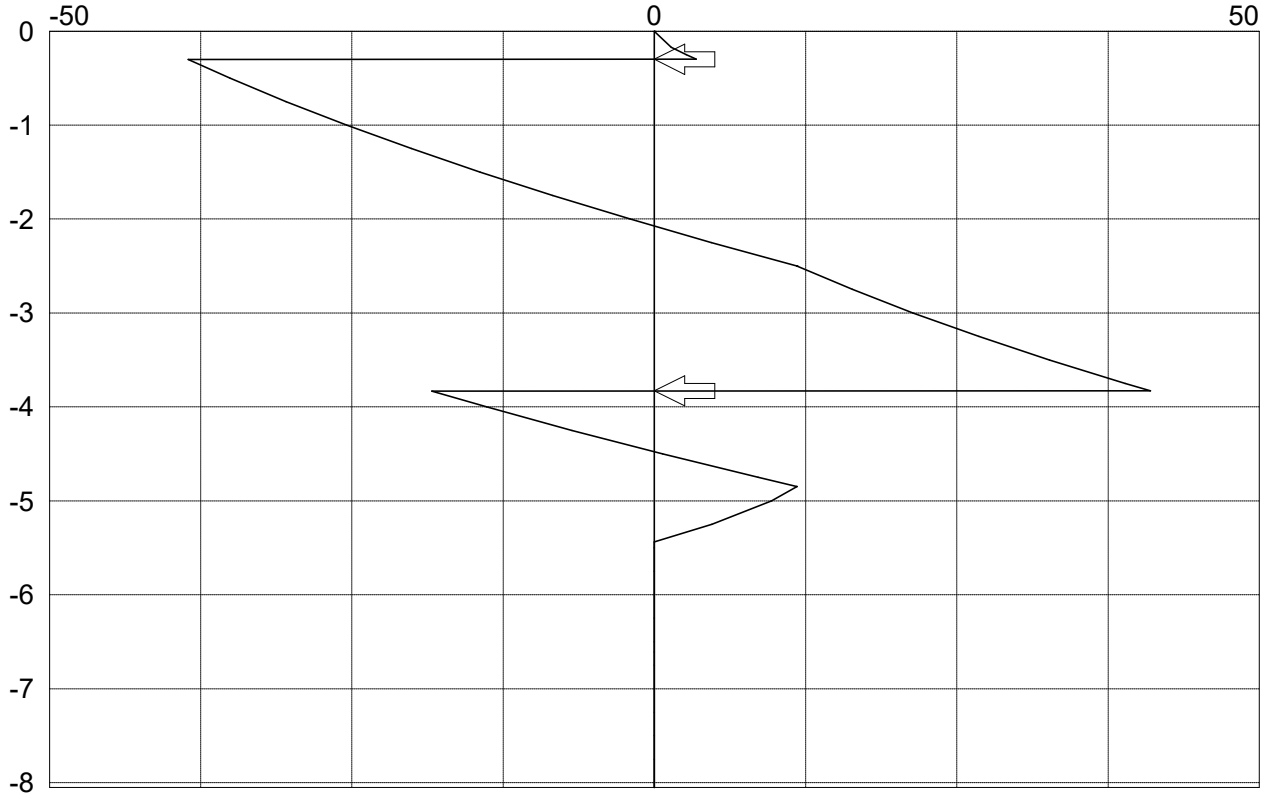




Graphical results from analysis of stage ref 4 continued

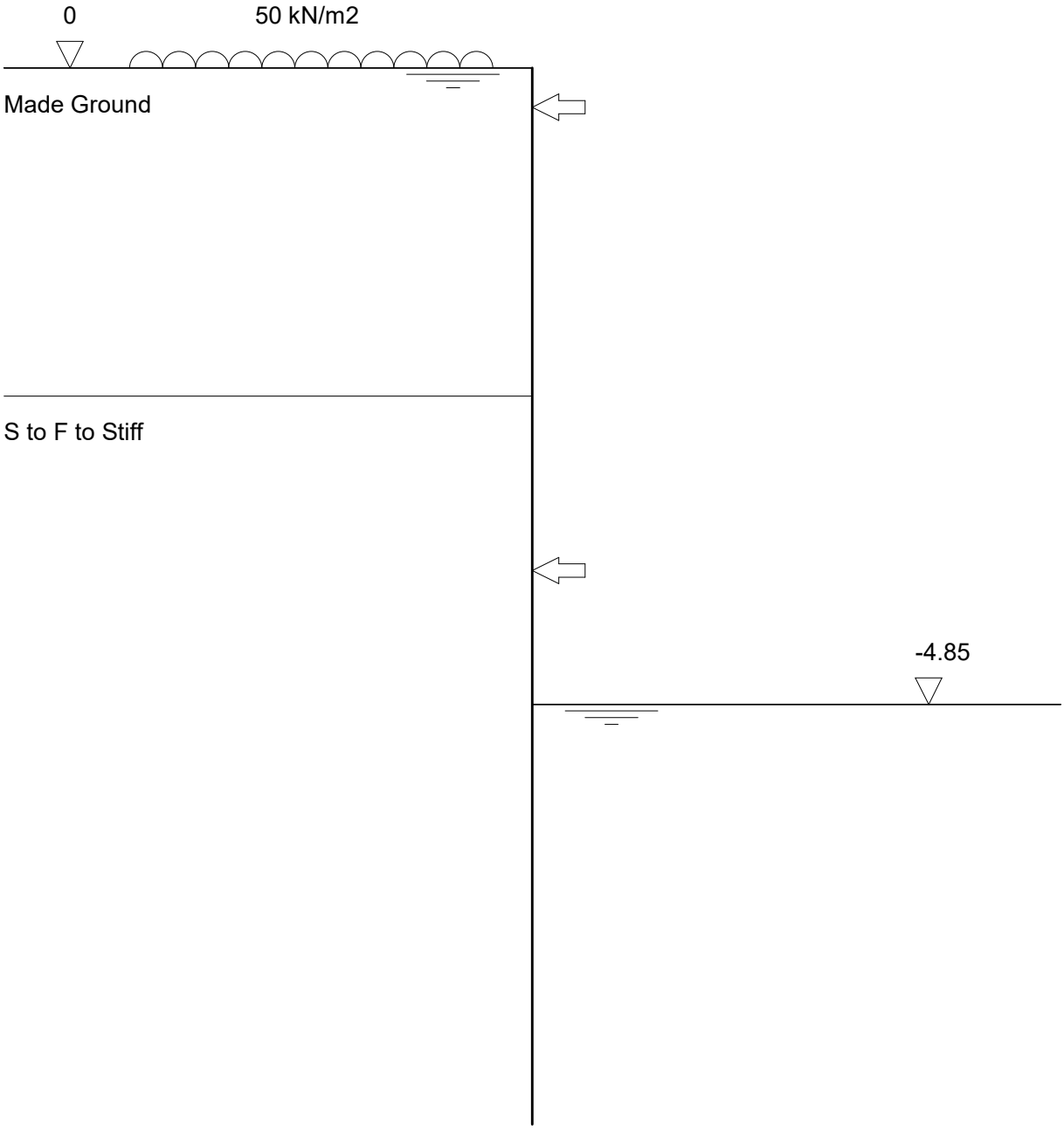


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

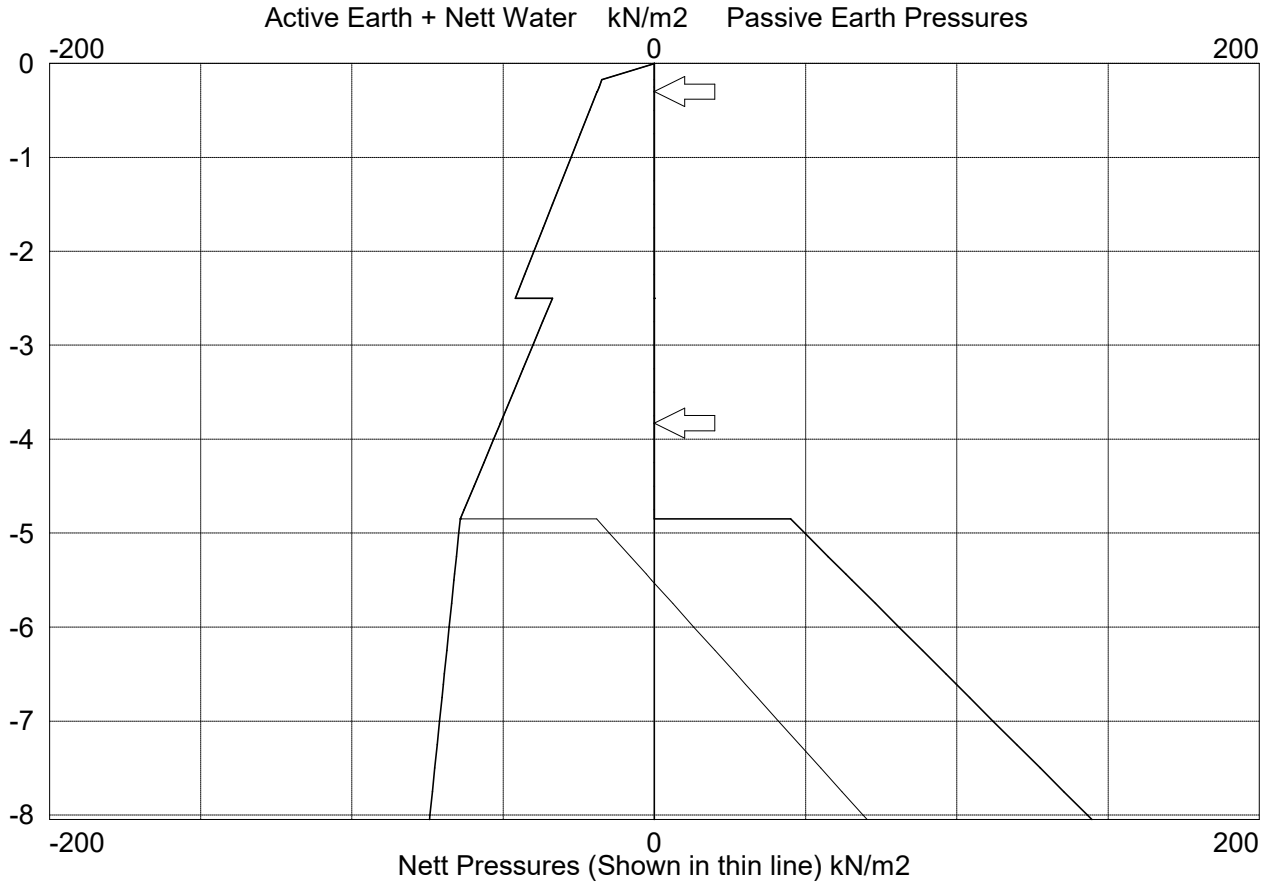
Stage ref. 5
Stage type Active water level

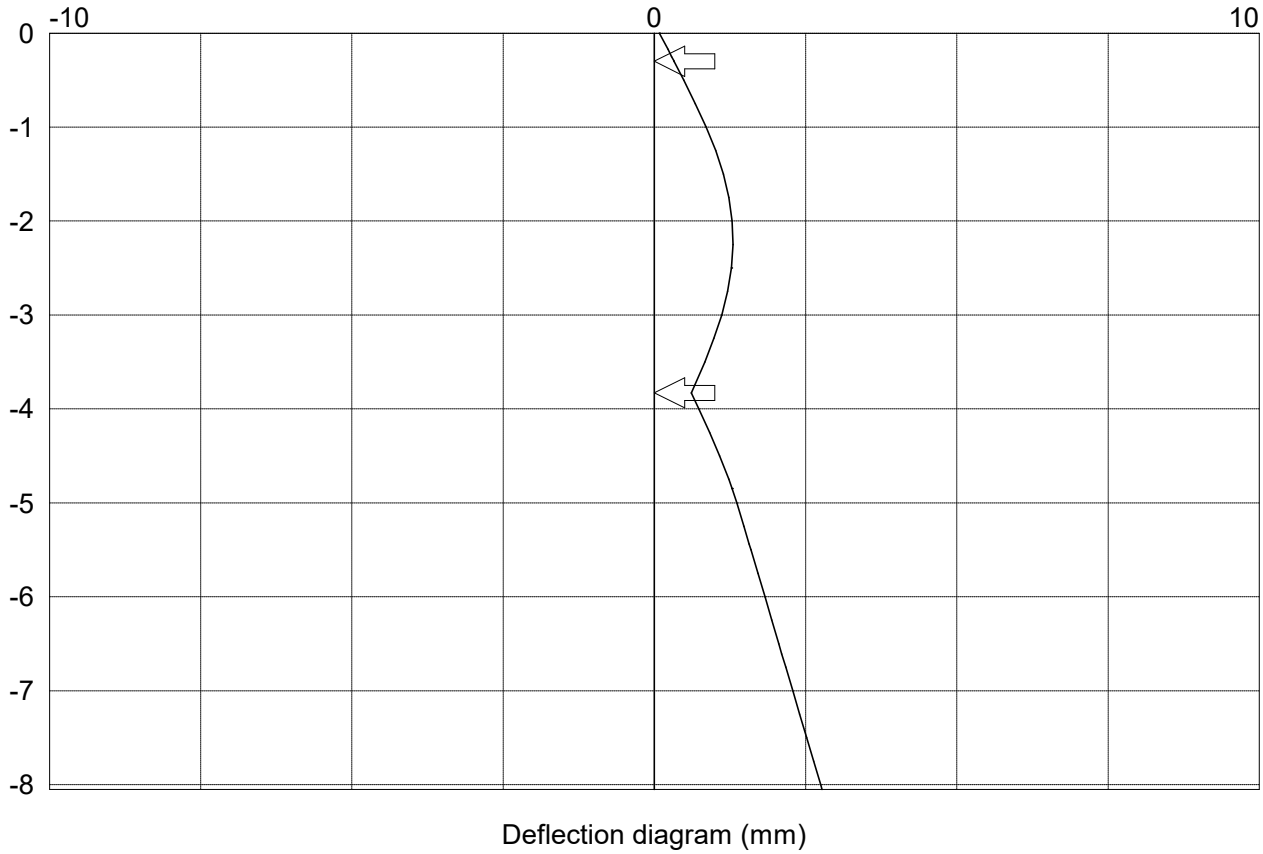


Tabular results from analysis of stage ref 5

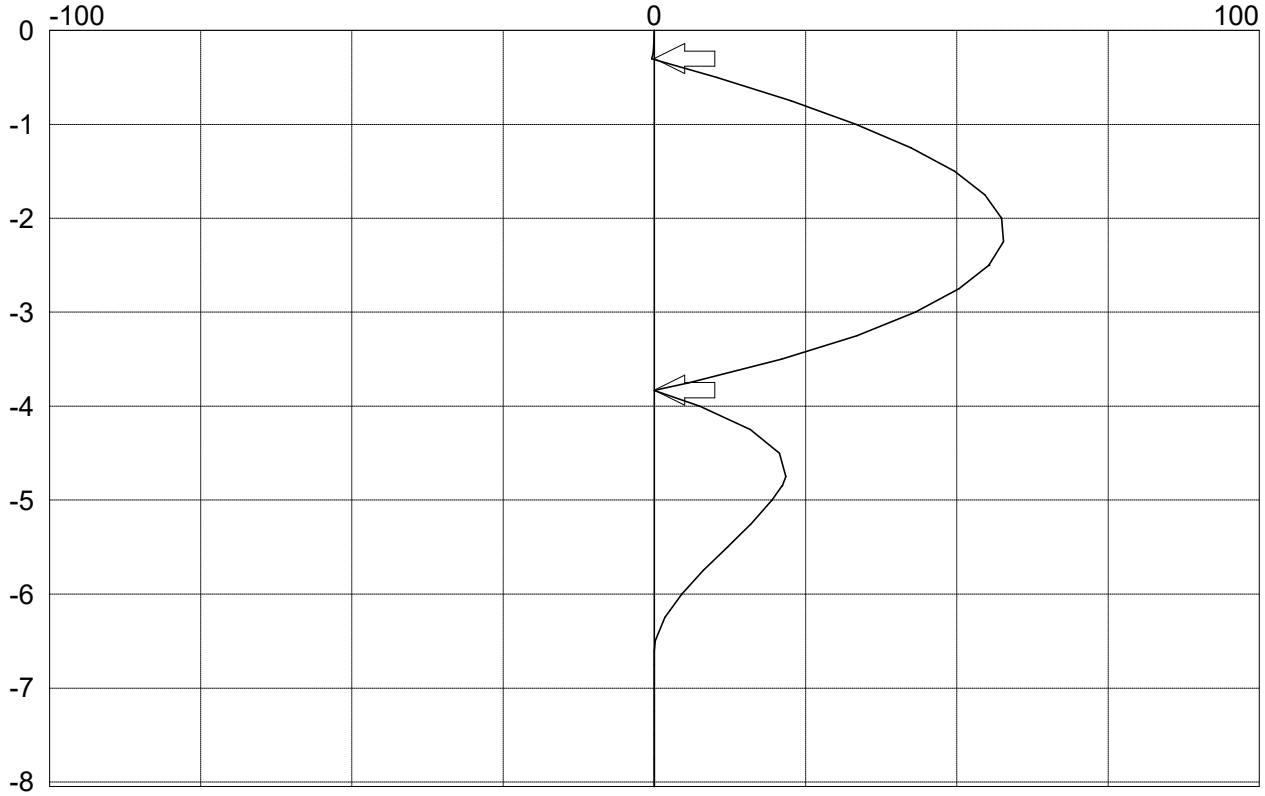
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	.1		.00
.00	.0	.0	.0	.0	.0	.0	0	0	0	.1		.00
-.17	51.4	15.6	1.7	.0	.0	.0	17.3	.1	-1.5	.2		.00
-.30	52.5	16.0	2.9	.0	.0	.0	18.9	.4	-3.8	.3	59.9	.00
-.30	52.5	16.0	3.0	.0	.0	.0	18.9	.4	56.0	.3		.00
-1.00	58.2	17.7	9.8	.0	.0	.0	27.5	-33.4	39.8	.9		.00
-2.00	66.4	20.2	19.6	.0	.0	.0	39.8	-57.4	6.2	1.3		.00
-2.50	70.5	21.4	24.5	.0	.0	.0	45.9	-55.3	-15.2	1.3		.00
-2.50	70.5	9.2	24.5	.0	.0	.0	33.7	-55.3	-15.2	1.3		.00
-3.00	75.1	10.7	29.4	.0	.0	.0	40.1	-43.2	-33.7	1.1		.00
-3.83	82.7	13.4	37.5	.0	.0	.0	50.9	-.1	-71.5	.6	120.5	.00
-3.83	82.8	13.4	37.6	.0	.0	.0	50.9	0	48.9	.6		.00
-4.00	84.3	13.9	39.2	.0	.0	.0	53.1	-7.5	40.2	.7		.00
-4.85	92.1	16.6	47.5	.0	.0	.0	64.1	-21.1	-9.5	1.3		.00
-4.85	92.1	16.6	47.5	.0	45.1	.0	19.1	-21.1	-9.6	1.3		.00
-5.00	93.5	17.1	49.0	1.4	49.7	1.5	14.9	-19.5	-12.2	1.4		.19
-5.44	97.5	18.5	53.3	5.4	63.3	5.7	2.7	-13.1	-16.0	1.6		.52
-6.00	102.7	20.3	58.8	10.6	80.9	11.3	-13.1	-4.5	-13.1	1.8		.78
-6.61	108.3	22.2	64.8	16.2	99.9	17.2	-30.1	0	0	2.1		1.00
-7.00	111.9	23.5	68.6	19.8	112.0	21.1	-41.0	0	0	2.3		1.12
-8.00	121.1	26.6	78.4	29.0	143.1	30.9	-69.0	0	0	2.7		1.41
-8.05	121.6	26.8	78.9	29.4	144.7	31.4	-70.4	0	0	2.8		1.42

Graphical results from analysis of stage ref 5

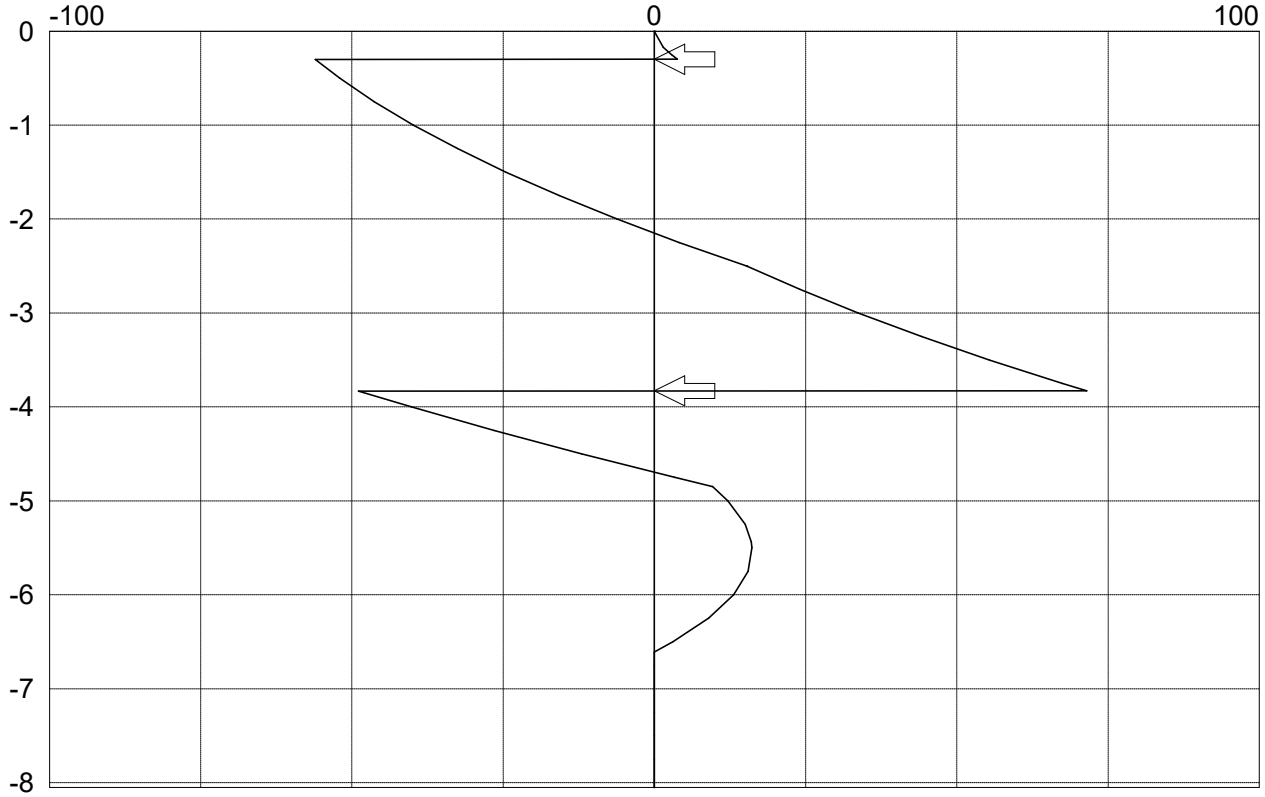




Graphical results from analysis of stage ref 5 continued

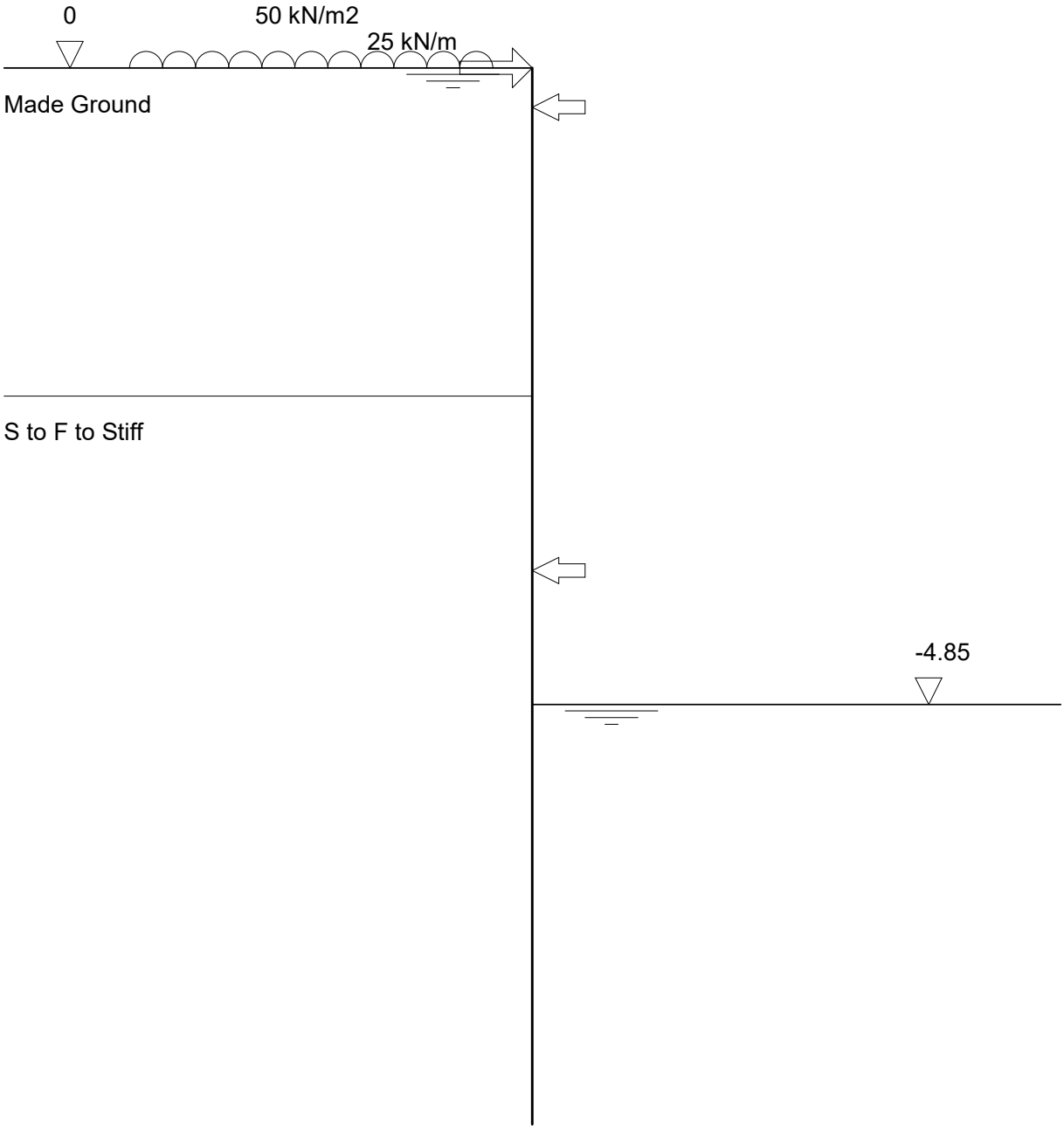


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

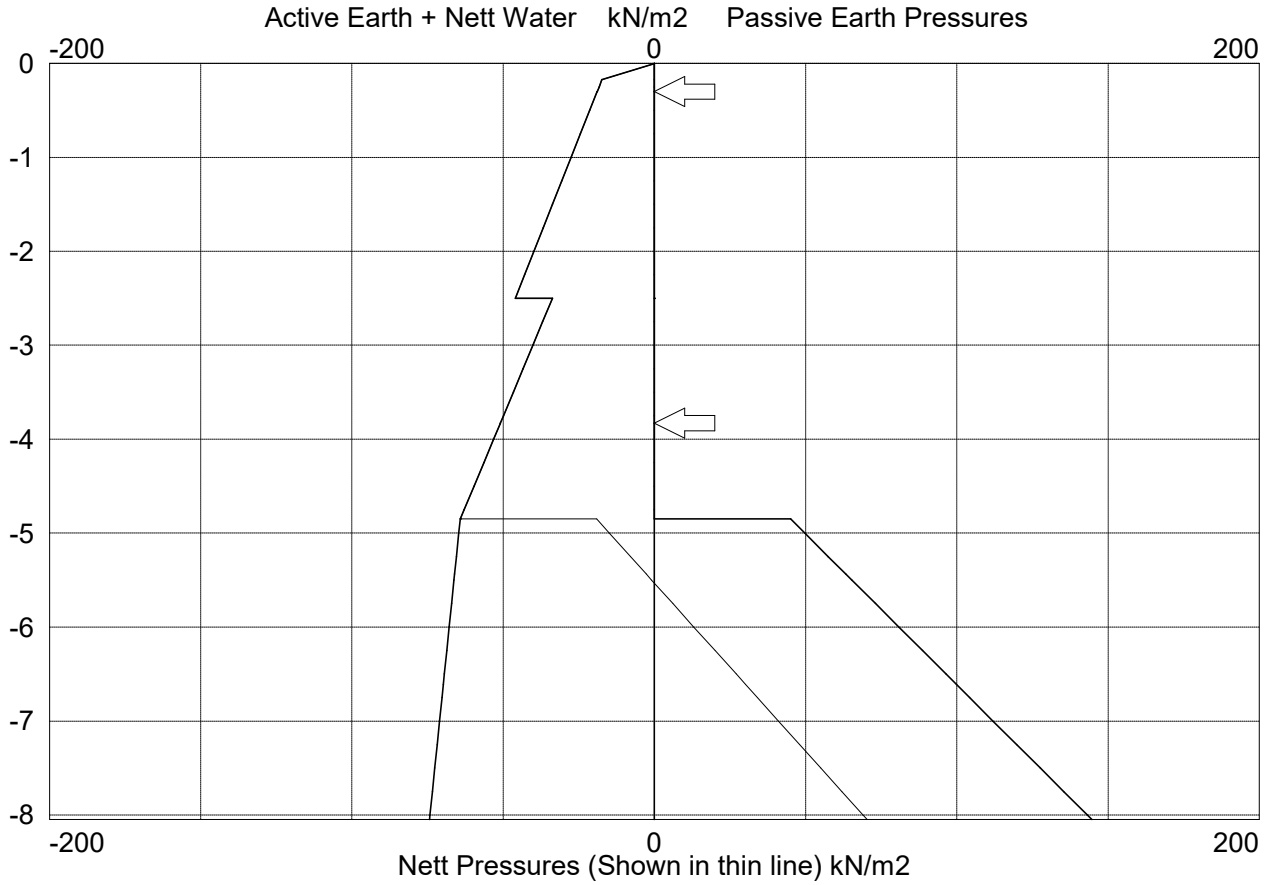
Stage ref. 6
Stage type Horizontal load

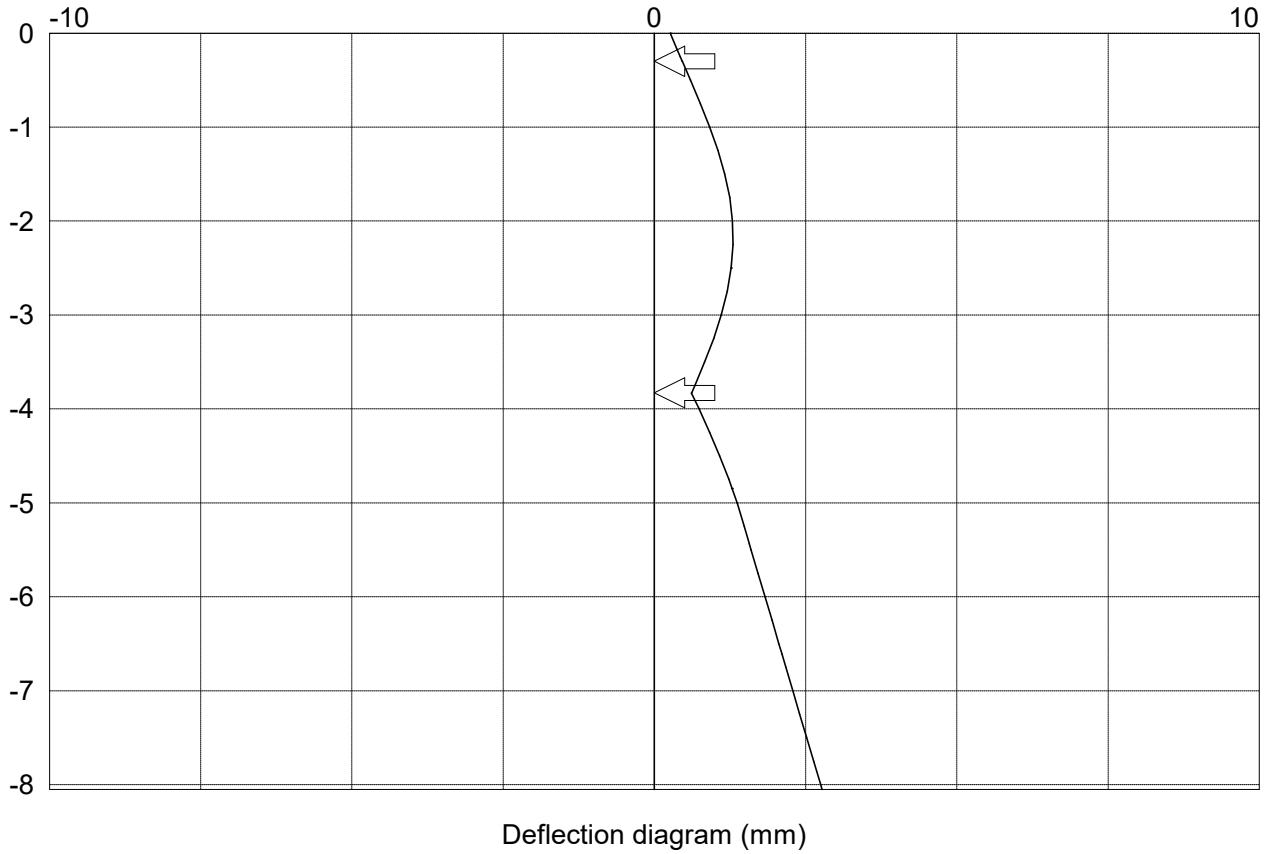


Tabular results from analysis of stage ref 6

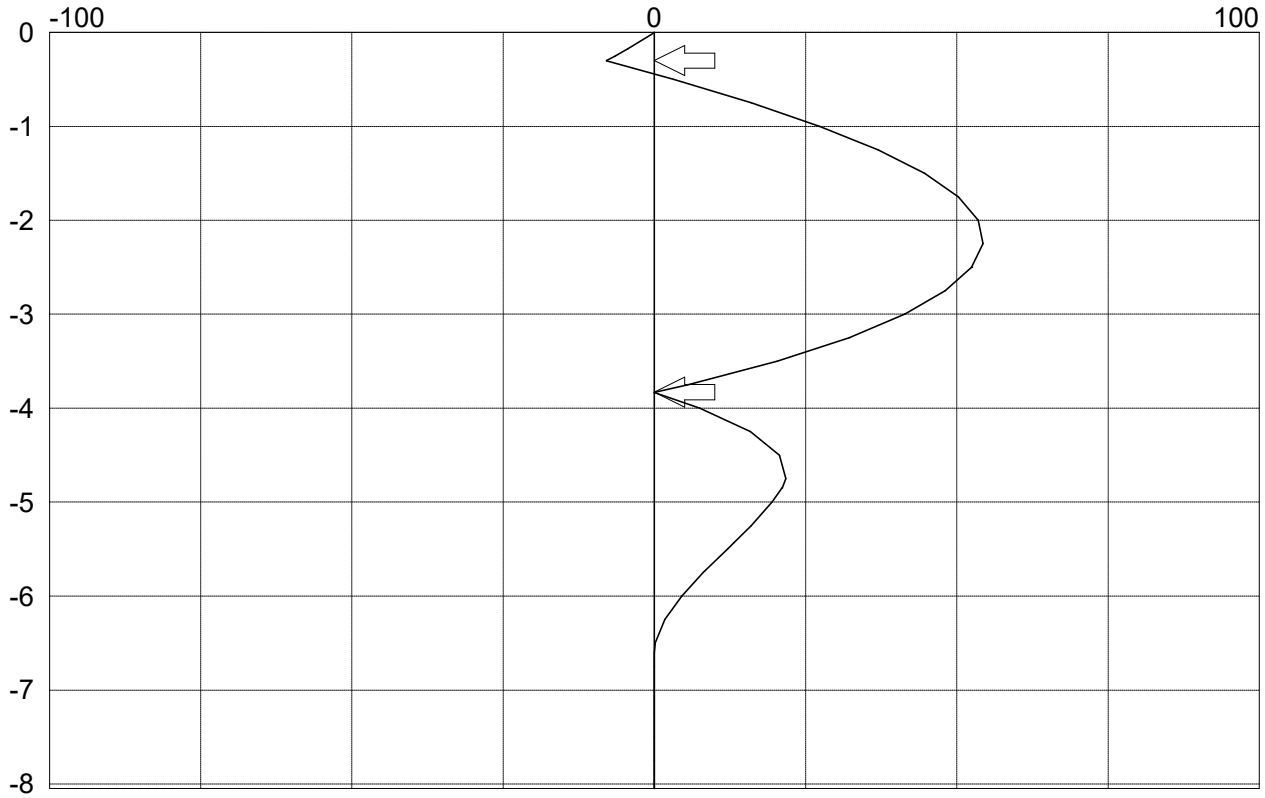
Calc Level m	Active Vert kN/m2	Active Earth kN/m2	Active Water kN/m2	Pas' Vert kN/m2	Pas' Earth kN/m2	Pas' Water kN/m2	Total Nett kN/m2	Bend. Moment kNm/m	Shear Force kN/m	Defl't mm	Prop Force kN/m	FOS
.00	.0	.0	.0	.0	.0	.0	0	0	0	.3		.00
.00	.0	.0	.0	.0	.0	.0	0	0	-25.0	.3		.00
-.17	51.4	15.6	1.7	.0	.0	.0	17.3	4.4	-26.5	.4		.00
-.30	52.5	16.0	2.9	.0	.0	.0	18.9	7.9	-28.8	.5	87.0	.00
-.30	52.5	16.0	3.0	.0	.0	.0	18.9	7.9	58.2	.5		.00
-1.00	58.2	17.7	9.8	.0	.0	.0	27.5	-27.4	42.0	.9		.00
-2.00	66.4	20.2	19.6	.0	.0	.0	39.8	-53.5	8.3	1.3		.00
-2.50	70.5	21.4	24.5	.0	.0	.0	45.9	-52.4	-13.1	1.3		.00
-2.50	70.5	9.2	24.5	.0	.0	.0	33.7	-52.4	-13.1	1.3		.00
-3.00	75.1	10.7	29.4	.0	.0	.0	40.1	-41.4	-31.6	1.1		.00
-3.83	82.7	13.4	37.5	.0	.0	.0	50.9	-.1	-69.4	.6	118.4	.00
-3.83	82.8	13.4	37.6	.0	.0	.0	50.9	0	48.9	.6		.00
-4.00	84.3	13.9	39.2	.0	.0	.0	53.1	-7.5	40.2	.7		.00
-4.85	92.1	16.6	47.5	.0	.0	.0	64.1	-21.1	-9.5	1.3		.00
-4.85	92.1	16.6	47.5	.0	45.1	.0	19.1	-21.1	-9.6	1.3		.00
-5.00	93.5	17.1	49.0	1.4	49.7	1.5	14.9	-19.5	-12.2	1.4		.19
-5.44	97.5	18.5	53.3	5.4	63.3	5.7	2.7	-13.1	-16.0	1.6		.52
-6.00	102.7	20.3	58.8	10.6	80.9	11.3	-13.1	-4.5	-13.1	1.8		.78
-6.61	108.3	22.2	64.8	16.2	99.9	17.2	-30.1	0	0	2.1		1.00
-7.00	111.9	23.5	68.6	19.8	112.0	21.1	-41.0	0	0	2.3		1.12
-8.00	121.1	26.6	78.4	29.0	143.1	30.9	-69.0	0	0	2.7		1.41
-8.05	121.6	26.8	78.9	29.4	144.7	31.4	-70.4	0	0	2.8		1.42

Graphical results from analysis of stage ref 6

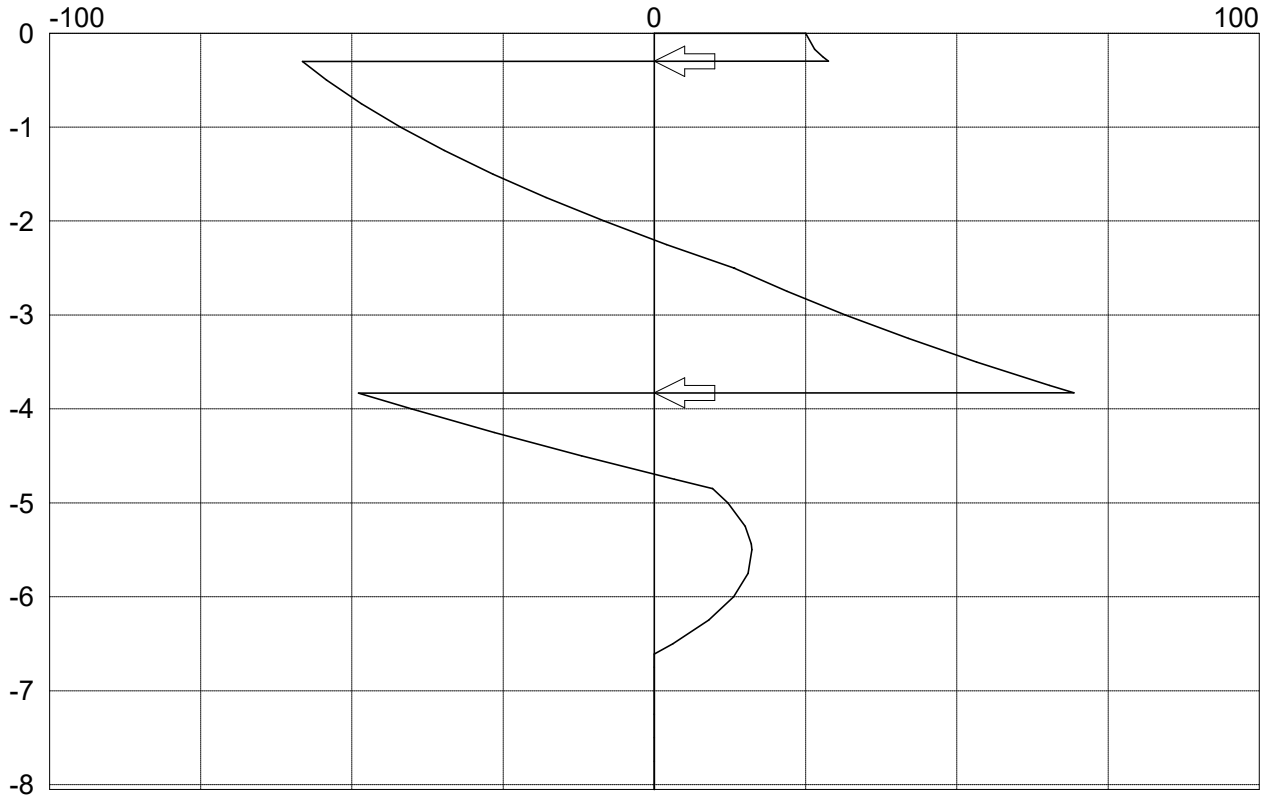




Graphical results from analysis of stage ref 6 continued

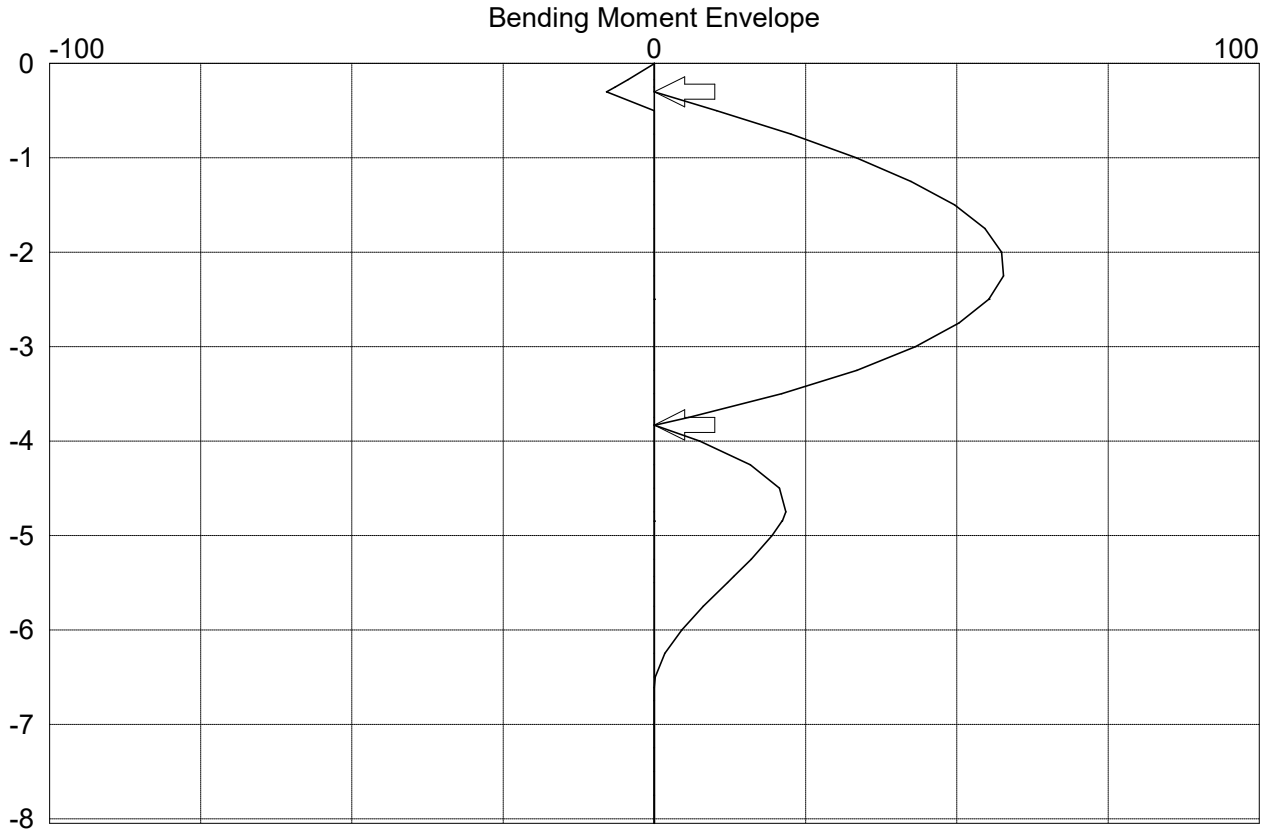


Bending Moment Diagram (kNm/m)



Shear Force Diagram (kN/m)

Graphical plot of envelope from selected construction stages



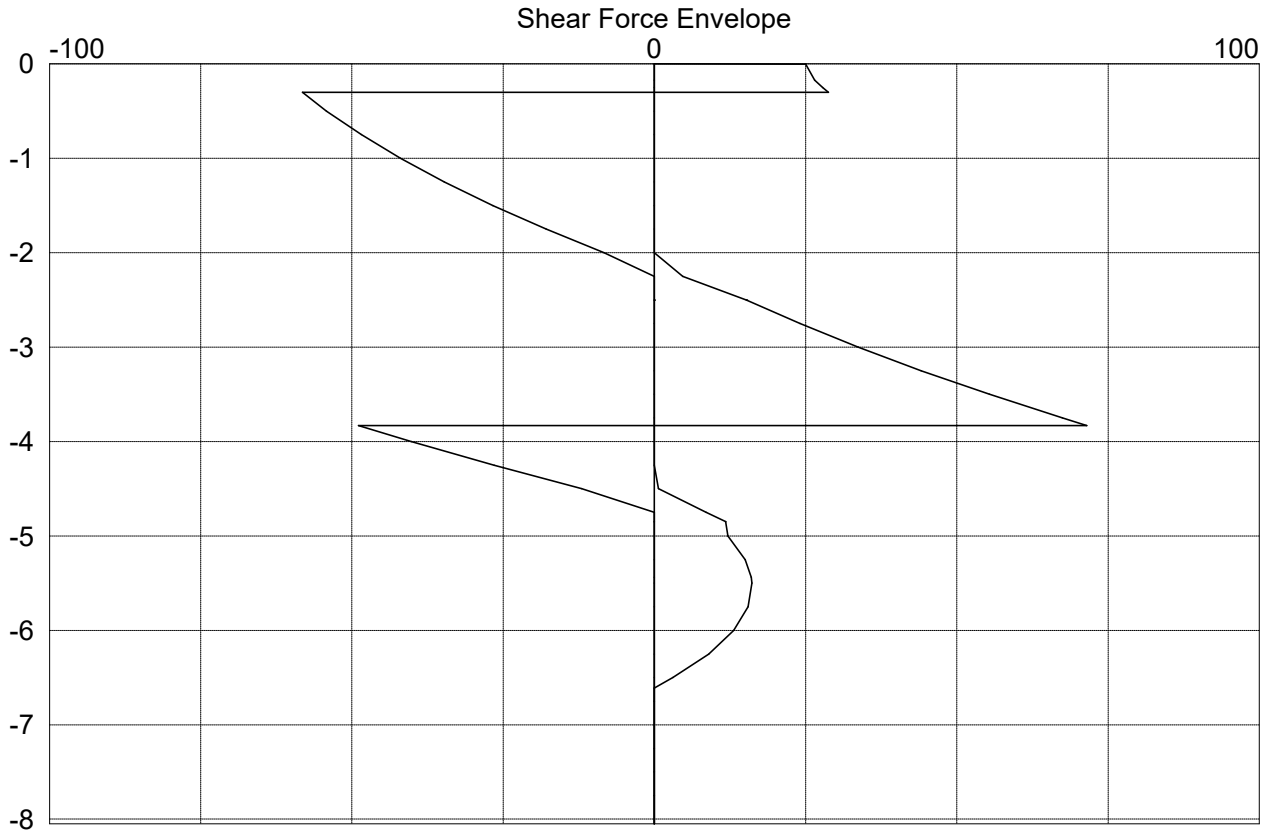


Table of envelope for wall forces

Calc Level m	Bending Minimum kNm/m	Bending Maximum kNm/m	Shear Minimum kN/m	Shear Maximum kN/m	Prop Force kN/m
.00	.0	.0	.0	.0	
.00	.0	.0	-25.0	.0	
-.17	.0	4.4	-26.5	.0	
-.30	.0	7.9	-28.8	.0	87.0
-.30	.0	7.9	.0	58.2	
-1.00	-33.4	.0	.0	42.0	
-2.00	-57.4	.0	.0	8.3	
-2.50	-55.3	.0	-15.2	.0	
-2.50	-55.3	.0	-15.2	.0	
-3.00	-43.2	.0	-33.7	.0	
-3.83	-.1	.0	-71.5	.0	120.5
-3.83	.0	.0	.0	48.9	
-4.00	-7.5	.0	.0	40.2	
-4.85	-21.1	.0	-11.8	.0	
-4.85	-21.1	.0	-11.8	.0	
-5.00	-19.5	.0	-12.2	.0	
-5.44	-13.1	.0	-16.0	.0	
-6.00	-4.5	.0	-13.1	.0	
-6.61	.0	.0	.0	.0	
-7.00	.0	.0	.0	.0	
-8.00	.0	.0	.0	.0	
-8.05	.0	.0	.0	.0	

Structural design of wall

Wall section properties

Primary pile diameter	450	mm
Primary pile spacing	600	mm
Infill pile diameter		mm
Main rebar bar diameter	20	mm
Main rebar number of bars	5	
Links/Helix bar diameter	8	mm
Links/Helix spacing/pitch	200	mm

Wall material properties

Concrete cube strength	35	N/mm2
Concrete cover	50	mm
Main rebar steel grade	500	N/mm2
Link rebar steel grade	500	N/mm2
Ultimate load factor	1.35	

Wall structural design checks

Check description	Required or Limit	Provided or Actual	Units
Bending resistance. BS8110 plane strain analysis	47	103	kNm
Max longitudinal steel. BS8110 max 6% by area	9543	1571	mm2
Min longitudinal steel. BS8110 min 0.4% by area	636	1571	mm2
Shear resistance. BS8110	58	131	kN
Min link dia. BS8110 6mm or 0.25x bar dia	6	8	mm
Max link spacing. BS8110 12x main bar dia or 0.75d	232	200	mm
Min shear link area. BS8110 Clause 3.4.5	236	503	mm2/m