



Analysis of beam on elastic foundation

Input data

Project

Date : 28.5.2010

Settings

Standard - EN 1997 - DA1

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)

Loads and combinations : according to EN 1990

Global settings

Parameters of the analysis : calculation of C1 and C2

FE subdivision : 20

Calculate assuming tension cutoff of soils

Compute geostatic stress : from ground

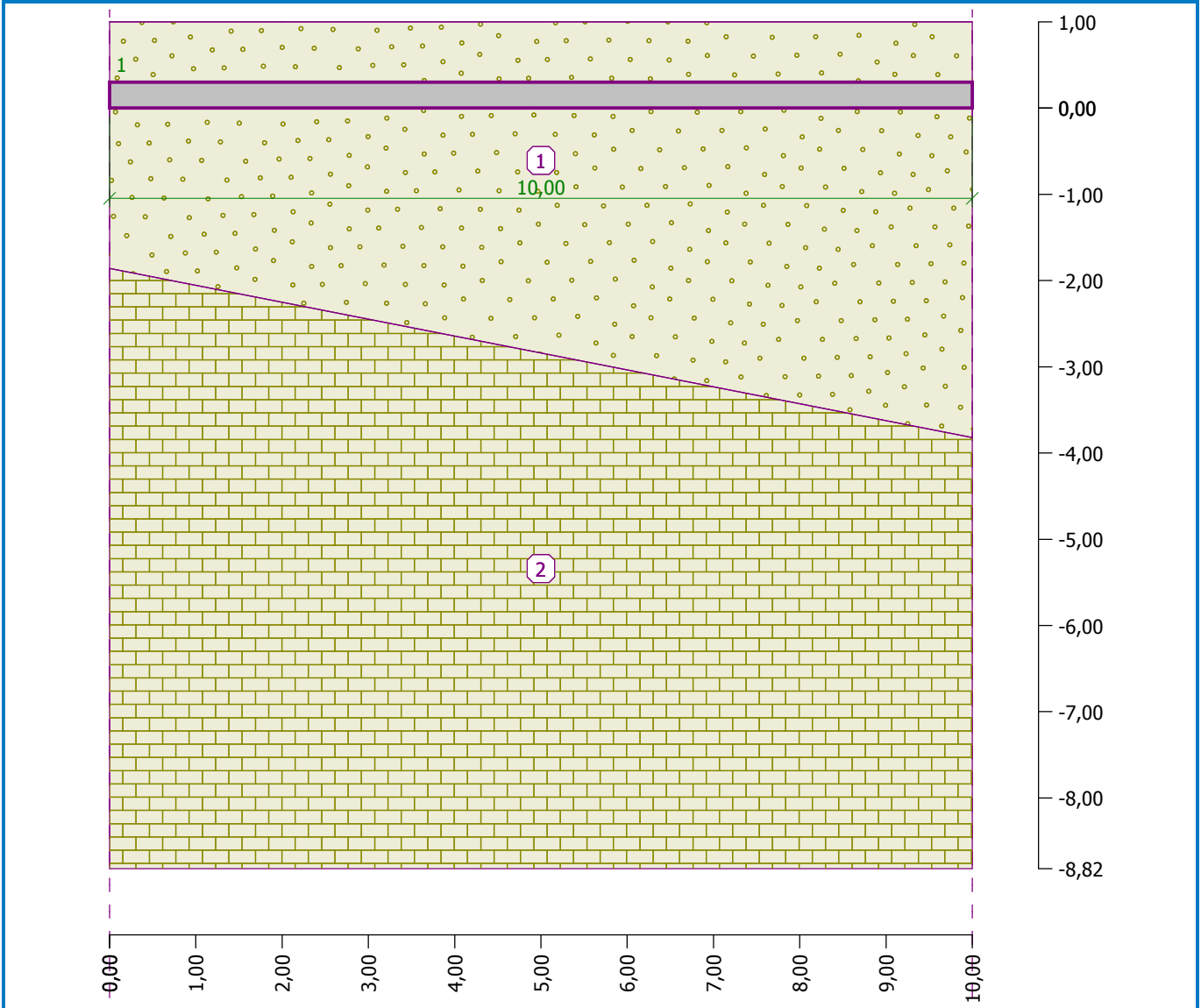
Number of iterations of C1 and C2 : 3

Segments

No.	Length [m]	Width [m]	Depth [m]	Area of cross-section [m ²]	Moment of inertia [m ⁴]	Material
1	10,00	1,00	0,30			C 20/25



Name : Geometry



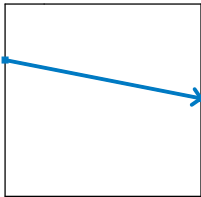
Segments materials

No.	Material	Elasticity modulus E_{cm} [MPa]	Shear modulus G [MPa]	Specific weight γ [kN/m ³]
1	C 20/25	29000,00	11340,00	25,00

Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0,00	1,00	2,00	1,00	10,00	1,00



No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
2		0,00	-1,86	10,00	-3,82		

Location

x : 0,00 m
z : 0,00 m

Soil parameters

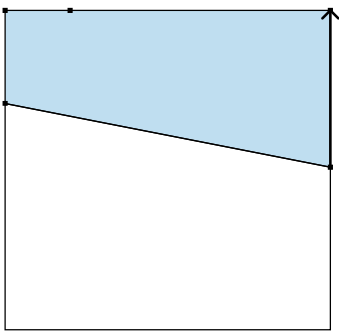

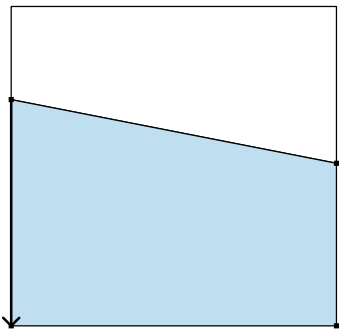

Sand

Unit weight : $\gamma = 20,00 \text{ kN/m}^3$
 Deformation modulus : $E_{\text{def}} = 75,00 \text{ MPa}$
 Poisson's ratio : $\nu = 0,28$
 Coeff. of structural strength : $m = 0,20$
 Saturated unit weight : $\gamma_{\text{sat}} = 20,00 \text{ kN/m}^3$

Rock

Unit weight : $\gamma = 20,00 \text{ kN/m}^3$
 Deformation modulus : $E_{\text{def}} = 1200,00 \text{ MPa}$
 Poisson's ratio : $\nu = 0,28$
 Coeff. of structural strength : $m = 0,20$
 Saturated unit weight : $\gamma_{\text{sat}} = 20,00 \text{ kN/m}^3$

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		10,00	-3,82	10,00	1,00	Sand 
		2,00	1,00	0,00	1,00	
		0,00	-1,86			
2		0,00	-1,86	0,00	-8,82	Rock 
		10,00	-8,82	10,00	-3,82	

Water

Water type : No water



Load case 1

Name	Load case Code	Type	Coefficient		Active load case
			$\gamma_{f,sup}$	$\gamma_{f,inf}$	
G1 self-weight-permanent	Self-weight	Permanent	1,35	0,90	

Load

No.	Type of load	Origin x [m]	Length l [m]	Magnitude		unit
				f, m, q, q ₁	q ₂	
1	distr. uniform on beam segment	0,00	10,00	7,50		[kN/m]

Load case 2

Name	Load case Code	Type	Coefficient		Active load case
			$\gamma_{f,sup}$	$\gamma_{f,inf}$	
G2	Force	Permanent	1,35	0,90	

Load

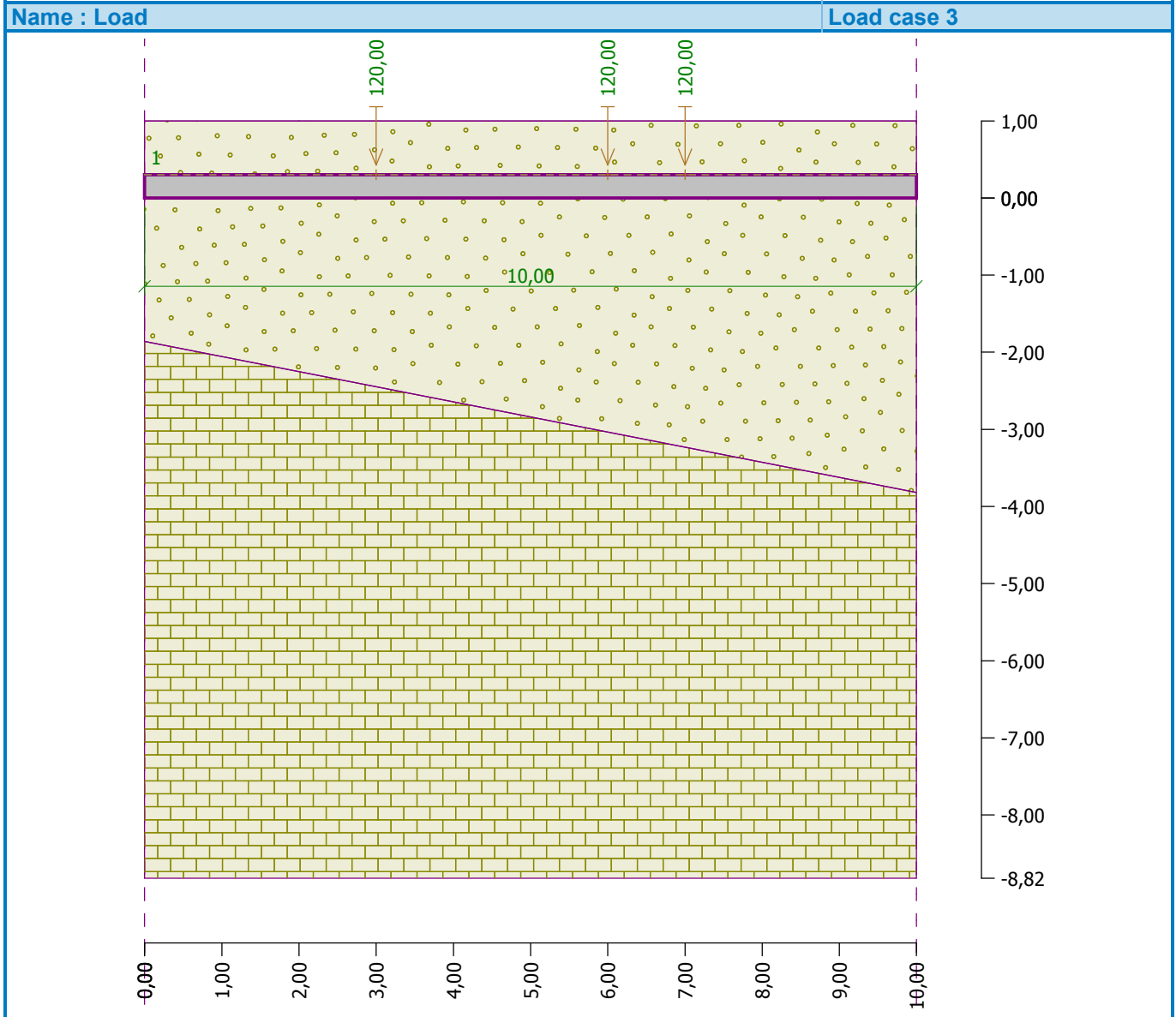
No.	Type of load	Origin x [m]	Length l [m]	Magnitude		unit
				f, m, q, q ₁	q ₂	
1	distr. uniform on beam segment	0,00	10,00	10,00		[kN/m]

Load case 3

Name	Load case Code	Type	Coefficient		Active load case
			$\gamma_{f,sup}$	$\gamma_{f,inf}$	
Q3	Force	Variable	1,50		Yes

Load

No.	Type of load	Origin x [m]	Length l [m]	Magnitude		unit
				f, m, q, q ₁	q ₂	
1	concentrated force	3,00		120,00		[kN]
2	concentrated force	6,00		120,00		[kN]
3	concentrated force	7,00		120,00		[kN]



Load case 4

Name	Load case		Coefficient		Active load case
	Code	Type	$\gamma_{f,sup}$	$\gamma_{f,inf}$	
Q4	Force	Variable	1,50		

Load

No.	Type of load	Origin x [m]	Length l [m]	Magnitude		unit
				f, m, q, q ₁	q ₂	
1	distr. uniform on beam segment	0,00	10,00	12,00		[kN/m]

Combination ULS

No.	Name and type of combination	Assembly
1	Q4:G1+G2	$\gamma_{f,sup,1} * [G1 \text{ self-weight-permanent}] + \gamma_{f,sup,2} * [G2] + \gamma_{f,sup,4} * [Q4]$
2	Q3:G1+G2+Q4	$\gamma_{f,sup,1} * [G1 \text{ self-weight-permanent}] + \gamma_{f,sup,2} * [G2] + \gamma_{f,sup,3} * [Q3] + \gamma_{f,sup,4} * \psi_{0,4} * [Q4]$
3	Q4:G1+G2+Q3	$\gamma_{f,sup,1} * [G1 \text{ self-weight-permanent}] + \gamma_{f,sup,2} * [G2] + \gamma_{f,sup,3} * \psi_{0,3} * [Q3] + \gamma_{f,sup,4} * [Q4]$
4	Q3:G1+G2	$\gamma_{f,sup,1} * [G1 \text{ self-weight-permanent}] + \gamma_{f,sup,2} * [G2] + \gamma_{f,sup,3} * [Q3]$



Combination SLS

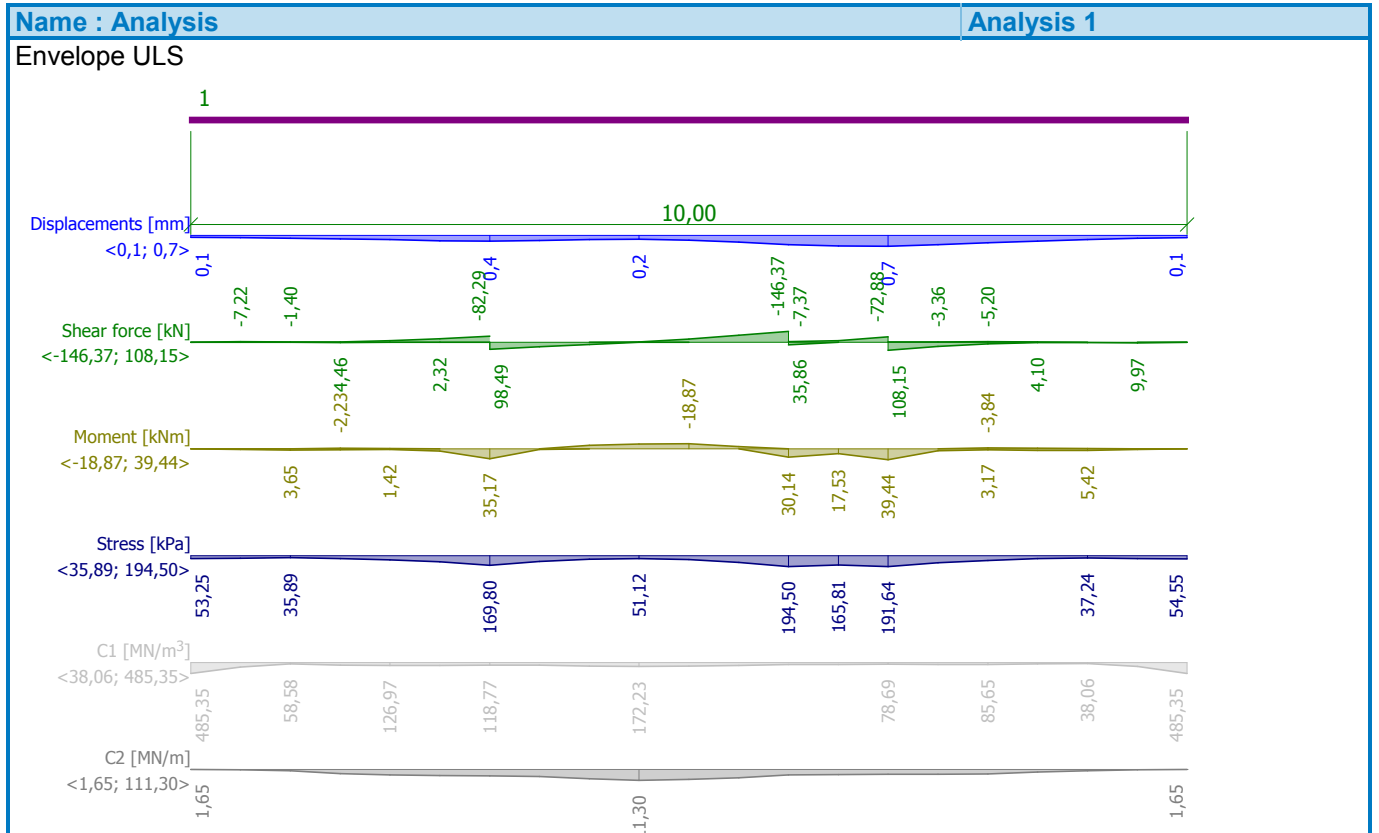
No.	Name and type of combination	Assembly
1	Q4:G1+G2+Q3	[G1 self-weight-permanent] + [G2] + $\psi_{0,3}$ * [Q3] + [Q4]
2	Q3:G1+G2+Q4	[G1 self-weight-permanent] + [G2] + [Q3] + $\psi_{0,4}$ * [Q4]

Results

Calculation is carried out.

Typical combination for subsoil analysis : SLS: Q3:G1+G2+Q4

Analysis 1



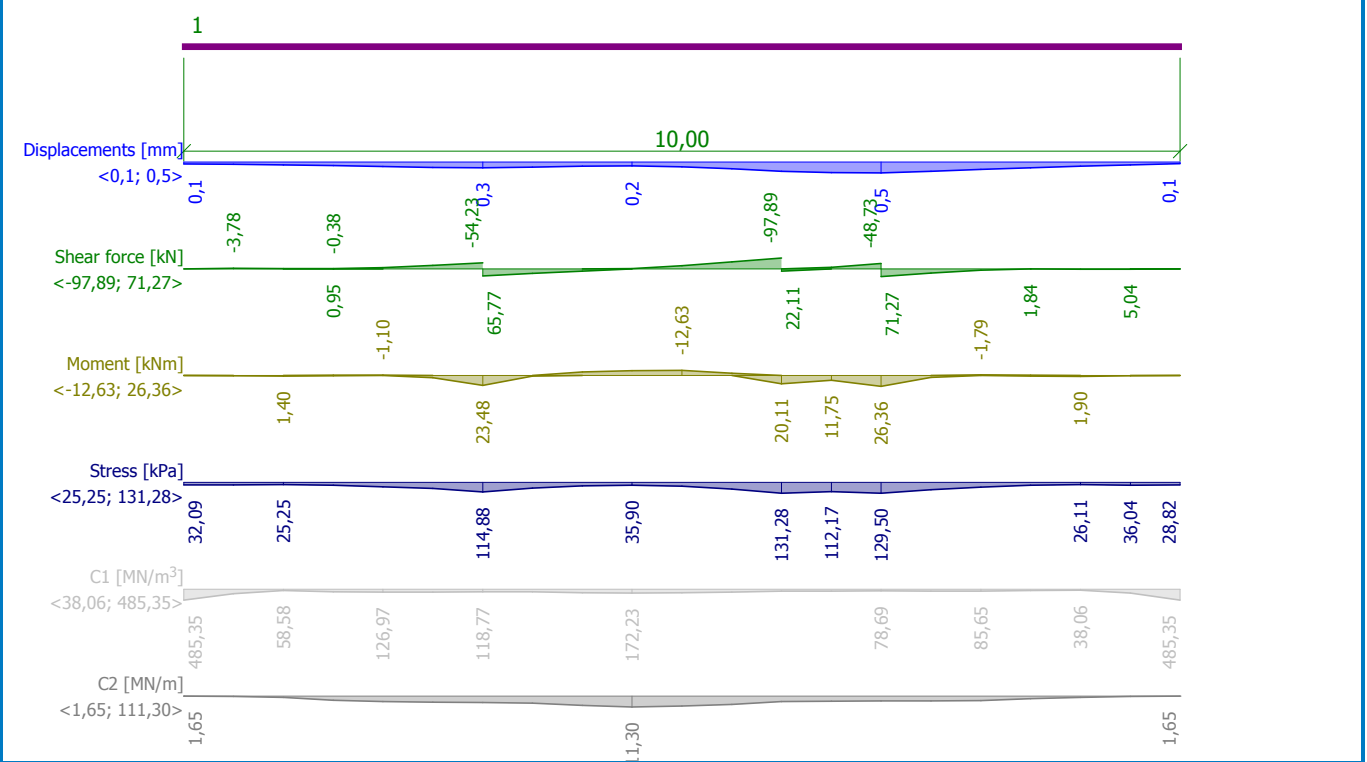
Analysis 2



Name : Analysis

Analysis 2

Envelope SLS



Distributions - C1 and C2

x [m]	C1 [MN/m³]	C2 [MN/m]
0.00	485.35	1.65
0.50	207.03	3.52
1.00	58.58	12.62
1.50	119.70	44.53
2.00	126.97	58.25
2.50	123.28	64.19
3.00	118.77	67.35
3.50	119.83	72.18
4.00	154.31	96.96
4.50	172.23	111.30
5.00	157.69	103.53
5.50	129.73	85.57
6.00	85.86	56.28
6.50	83.70	53.87
7.00	78.69	49.03
7.50	82.45	48.89
8.00	85.65	47.06
8.50	56.54	27.49
9.00	38.06	14.50
9.50	172.13	4.10
10.00	485.35	1.65



Distributions - Envelope ULS

Envelope ULS - maximum values

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.13	0.00	0.00	53.25
0.50	0.15	0.00	1.65	44.27
1.00	0.18	0.16	3.65	35.89
1.50	0.22	4.46	2.83	50.02
2.00	0.28	3.48	1.42	75.47
2.50	0.34	2.32	7.22	109.46
3.00	0.37	2.58	35.17	169.80
3.00	-	98.49	-	-
3.50	0.32	63.93	1.33	102.20
4.00	0.26	31.82	0.00	62.65
4.50	0.24	0.03	0.00	51.12
5.00	0.30	0.00	0.00	65.47
5.50	0.43	0.00	0.00	117.04
6.00	0.59	0.00	30.14	194.50
6.00	-	35.86	-	-
6.50	0.67	0.00	17.53	165.81
7.00	0.68	0.00	39.44	191.64
7.00	-	108.15	-	-
7.50	0.59	59.89	6.36	128.07
8.00	0.47	22.54	3.17	85.16
8.50	0.36	4.10	5.27	49.37
9.00	0.26	5.27	5.42	37.24
9.50	0.18	9.97	2.09	50.96
10.00	0.14	0.00	0.00	54.55

Envelope ULS - minimum values

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.00	-0.00	-0.00	0.00
0.50	0.00	-7.22	-0.14	0.00
1.00	0.00	-1.40	-0.46	0.00
1.50	0.00	-2.20	-2.23	0.00
2.00	0.00	-18.74	-2.17	0.00
2.50	0.00	-46.41	0.00	0.00
3.00	0.00	-82.29	0.00	0.00
3.00	-	0.00	-	-
3.50	0.00	0.00	0.00	0.00
4.00	0.00	0.00	-12.91	0.00
4.50	0.00	-2.13	-17.96	0.00
5.00	0.00	-41.73	-18.87	0.00
5.50	0.00	-92.03	-8.66	0.00
6.00	0.00	-146.37	0.00	0.00
6.00	-	-7.37	-	-
6.50	0.00	-18.78	0.00	0.00
7.00	0.00	-72.88	0.00	0.00
7.00	-	-3.40	-	-



x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
7.50	0.00	-3.36	0.00	0.00
8.00	0.00	-5.20	-3.84	0.00
8.50	0.00	-3.66	-3.04	0.00
9.00	0.00	0.00	-1.08	0.00
9.50	0.00	0.00	-0.62	0.00
10.00	0.00	-0.00	-0.00	0.00

Distributions - Envelope SLS

Envelope SLS - maximum values

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.08	0.00	0.00	32.09
0.50	0.10	0.00	0.67	31.36
1.00	0.13	0.00	1.40	25.25
1.50	0.15	0.95	0.22	34.99
2.00	0.19	0.00	0.00	52.19
2.50	0.23	0.00	4.85	74.76
3.00	0.25	0.00	23.48	114.88
3.00	-	65.77	-	-
3.50	0.22	42.79	0.90	69.79
4.00	0.18	21.37	0.00	43.52
4.50	0.17	0.00	0.00	35.90
5.00	0.21	0.00	0.00	45.45
5.50	0.29	0.00	0.00	79.75
6.00	0.40	0.00	20.11	131.28
6.00	-	22.11	-	-
6.50	0.46	0.00	11.75	112.17
7.00	0.46	0.00	26.36	129.50
7.00	-	71.27	-	-
7.50	0.40	39.11	4.32	87.27
8.00	0.32	13.76	0.00	58.66
8.50	0.25	1.84	0.92	34.38
9.00	0.18	3.44	1.90	26.11
9.50	0.13	5.04	0.64	36.04
10.00	0.07	0.00	0.00	28.82

Envelope SLS - minimum values

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.00	-0.00	-0.00	0.00
0.50	0.00	-3.78	0.00	0.00
1.00	0.00	-0.55	0.00	0.00
1.50	0.00	-0.38	-0.80	0.00
2.00	0.00	-11.64	-1.10	0.00
2.50	0.00	-30.37	0.00	0.00
3.00	0.00	-54.23	0.00	0.00
3.00	-	0.00	-	-
3.50	0.00	0.00	0.00	0.00
4.00	0.00	0.00	-8.63	0.00



x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
4.50	0.00	-1.41	-12.02	0.00
5.00	0.00	-28.01	-12.63	0.00
5.50	0.00	-61.68	-5.80	0.00
6.00	0.00	-97.89	0.00	0.00
6.00	-	0.00	-	-
6.50	0.00	-12.72	0.00	0.00
7.00	0.00	-48.73	0.00	0.00
7.00	-	0.00	-	-
7.50	0.00	0.00	0.00	0.00
8.00	0.00	0.00	-1.79	0.00
8.50	0.00	0.00	-0.74	0.00
9.00	0.00	0.00	0.00	0.00
9.50	0.00	0.00	0.00	0.00
10.00	0.00	-0.00	-0.00	0.00

Distributions - Combination ULS

Combination ULS: Q3:G1+G2

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.04	-0.00	-0.00	18.12
0.50	0.08	-1.24	-0.14	25.40
1.00	0.13	0.16	-0.46	24.12
1.50	0.17	-2.20	-2.23	37.81
2.00	0.23	-18.74	-2.17	61.97
2.50	0.30	-46.41	6.93	96.55
3.00	0.33	-82.29	34.92	157.72
3.00	-	97.71	-	-
3.50	0.28	62.70	1.24	90.26
4.00	0.22	30.69	-12.75	50.02
4.50	0.21	-2.13	-17.61	35.79
5.00	0.27	-40.36	-18.49	52.46
5.50	0.39	-89.68	-8.46	104.61
6.00	0.54	-144.14	29.98	182.86
6.00	-	35.86	-	-
6.50	0.62	-17.32	17.09	154.09
7.00	0.62	-71.85	38.93	179.10
7.00	-	108.15	-	-
7.50	0.53	59.89	5.76	114.47
8.00	0.40	22.54	-3.84	71.60
8.50	0.29	4.10	-3.04	38.81
9.00	0.20	2.37	-1.08	26.99
9.50	0.11	1.31	-0.62	30.46
10.00	0.03	-0.00	0.00	9.88

Combination ULS: Q4:G1+G2+Q3

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.11	-0.00	-0.00	44.78
0.50	0.15	-5.22	0.90	44.27



x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
1.00	0.18	-0.73	1.88	35.89
1.50	0.22	1.15	0.15	50.02
2.00	0.25	-11.02	-0.67	70.27
2.50	0.29	-31.09	5.42	93.28
3.00	0.31	-56.05	24.94	134.45
3.00	-	69.95	-	-
3.50	0.27	46.33	1.06	86.95
4.00	0.23	23.72	-9.24	60.17
4.50	0.22	-1.47	-13.02	51.12
5.00	0.26	-30.98	-13.70	62.62
5.50	0.36	-67.45	-6.32	97.97
6.00	0.47	-105.34	21.30	151.18
6.00	-	20.66	-	-
6.50	0.54	-15.02	12.83	131.20
7.00	0.55	-52.34	28.27	150.35
7.00	-	73.66	-	-
7.50	0.50	39.90	5.23	107.21
8.00	0.42	12.64	-0.78	77.13
8.50	0.34	0.66	1.05	48.19
9.00	0.26	4.83	2.51	37.24
9.50	0.18	6.93	0.82	50.96
10.00	0.10	-0.00	-0.00	39.80

Combination ULS: Q3:G1+G2+Q4

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.08	-0.00	-0.00	34.24
0.50	0.13	-3.42	0.36	38.70
1.00	0.17	-0.26	0.64	33.67
1.50	0.22	-0.85	-1.37	49.64
2.00	0.28	-17.68	-1.74	75.47
2.50	0.34	-45.70	7.22	109.46
3.00	0.37	-81.51	35.17	169.80
3.00	-	98.49	-	-
3.50	0.32	63.93	1.33	102.20
4.00	0.26	31.82	-12.91	62.65
4.50	0.24	-2.12	-17.96	48.88
5.00	0.30	-41.73	-18.87	65.47
5.50	0.43	-92.03	-8.66	117.04
6.00	0.59	-146.37	30.14	194.50
6.00	-	33.63	-	-
6.50	0.67	-18.78	17.53	165.81
7.00	0.68	-72.88	39.44	191.64
7.00	-	107.12	-	-
7.50	0.59	58.87	6.36	128.07
8.00	0.47	20.96	-2.88	85.16
8.50	0.36	2.99	-1.44	49.37
9.00	0.26	3.96	0.56	36.20



x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
9.50	0.16	4.33	0.01	45.35
10.00	0.07	0.00	-0.00	26.39

Combination ULS: Q4:G1+G2

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.13	0.00	-0.00	53.25
0.50	0.15	-7.22	1.65	43.95
1.00	0.16	-1.40	3.65	31.54
1.50	0.16	4.46	2.83	39.08
2.00	0.15	3.48	1.42	44.62
2.50	0.14	2.32	0.94	42.63
3.00	0.13	2.58	0.82	39.89
3.50	0.12	4.05	0.33	39.44
4.00	0.12	3.72	-0.53	41.73
4.50	0.12	0.03	-1.16	43.26
5.00	0.12	-4.52	-1.25	42.96
5.50	0.14	-7.76	-0.67	41.06
6.00	0.15	-7.37	0.52	38.45
6.50	0.17	-4.80	1.43	38.71
7.00	0.19	-3.40	1.69	41.45
7.50	0.21	-3.36	1.98	44.93
8.00	0.22	-5.20	3.17	44.81
8.50	0.22	-3.66	5.27	34.88
9.00	0.21	5.27	5.42	30.45
9.50	0.18	9.97	2.09	49.18
10.00	0.14	-0.00	0.00	54.55

Distributions - Combination SLS

Combination SLS: Q3:G1+G2+Q4

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.06	0.00	-0.00	25.06
0.50	0.09	-2.59	0.31	27.65
1.00	0.12	-0.24	0.58	23.77
1.50	0.15	-0.38	-0.80	34.73
2.00	0.19	-11.64	-1.10	52.19
2.50	0.23	-30.37	4.85	74.76
3.00	0.25	-54.23	23.48	114.88
3.00	-	65.77	-	-
3.50	0.22	42.79	0.90	69.79
4.00	0.18	21.37	-8.63	43.52
4.50	0.17	-1.41	-12.02	34.41
5.00	0.21	-28.01	-12.63	45.45
5.50	0.29	-61.68	-5.80	79.75
6.00	0.40	-97.89	20.11	131.28
6.00	-	22.11	-	-
6.50	0.46	-12.72	11.75	112.17
7.00	0.46	-48.73	26.36	129.50



x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
7.00	-	71.27	-	-
7.50	0.40	39.11	4.32	87.27
8.00	0.32	13.76	-1.79	58.66
8.50	0.25	1.84	-0.74	34.38
9.00	0.18	2.86	0.60	25.42
9.50	0.12	3.31	0.09	32.30
10.00	0.05	-0.00	0.00	19.89

Combination SLS: Q4:G1+G2+Q3

x [m]	Displacements [mm]	Shear force [kN]	Moment [kNm]	Stress [kPa]
0.00	0.08	-0.00	-0.00	32.09
0.50	0.10	-3.78	0.67	31.36
1.00	0.13	-0.55	1.40	25.25
1.50	0.15	0.95	0.22	34.99
2.00	0.17	-7.20	-0.38	48.72
2.50	0.20	-20.63	3.65	63.98
3.00	0.21	-37.26	16.66	91.31
3.00	-	46.74	-	-
3.50	0.19	31.06	0.72	59.63
4.00	0.16	15.97	-6.19	41.86
4.50	0.15	-0.98	-8.73	35.90
5.00	0.18	-20.84	-9.19	43.55
5.50	0.24	-45.29	-4.24	67.04
6.00	0.32	-70.54	14.22	102.40
6.00	-	13.46	-	-
6.50	0.37	-10.22	8.61	89.09
7.00	0.38	-35.04	18.92	101.98
7.00	-	48.96	-	-
7.50	0.34	26.46	3.57	73.36
8.00	0.29	8.21	-0.39	53.30
8.50	0.24	0.29	0.92	33.59
9.00	0.18	3.44	1.90	26.11
9.50	0.13	5.04	0.64	36.04
10.00	0.07	0.00	-0.00	28.82

Overall results - Envelope ULS

Maximum structure moment : 39,44 kNm
 Minimum structure moment : -18,87 kNm
 Maximum structure shear force : 108,15 kN
 Maximum structure deflection : 0,68 mm
 Maximum interfacial stress : 194,50 kPa

Overall results - Envelope SLS

Maximum structure moment : 26,36 kNm
 Minimum structure moment : -12,63 kNm
 Maximum structure shear force : 71,27 kN
 Maximum structure deflection : 0,46 mm
 Maximum interfacial stress : 131,28 kPa