



Edifici 1: 24



Edifici 2: 40



Edifici 3: 42



Edifici 4: 44



Edifici 5: 46



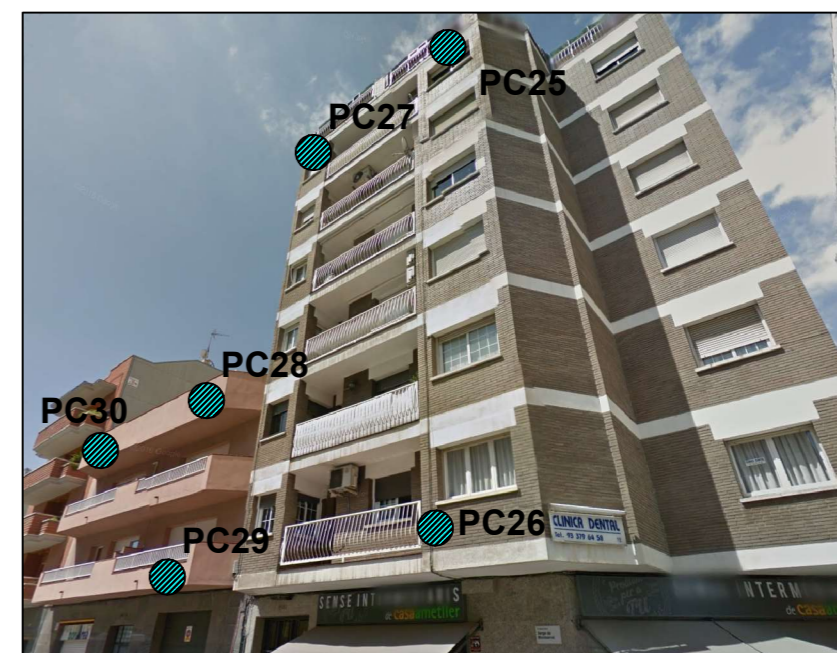
Edifici 6: 48



Edificio 7: 50



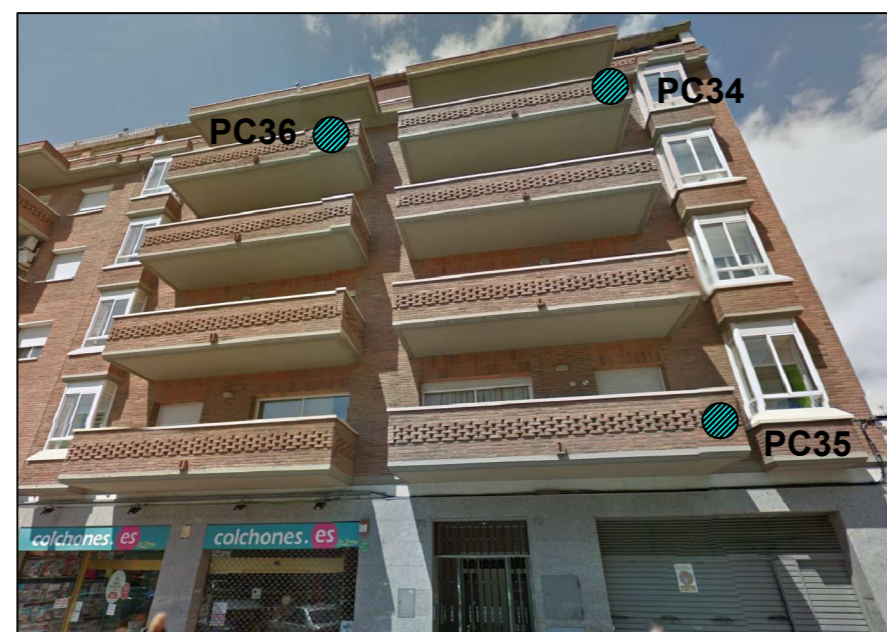
Edificio 8: 52



Edificios 9 i 10: 54-56, 58-60



Edificio 11: 62



Edificio 12: 64



Edificio 13: 74-76



Edifici 14: 78-82



Edifici 15: 84-90



Edifici 16: 37



Edifici 17: 39



Edifici 18: 41



Edifici 19: 43



Edifici 20: 45



Edifici 21: 47



Edifici 22: 51-53



Edifici 23: 55



Edificis 24 i 25: 57-61



Edificis 26 i 27: 63-67



Edificis 28 i 29: 69-73



Edificis 30 i 31: 77-81



Edificis 32 i 33: 85-87



Edifici 34: 91-93-95

ANNEX 2

LLISTAT CÀLCULS

REPORT

octubre 27, 2016

User: PCG
Title: 0954-AV-BARCELONA-EST

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1. GENERAL INFORMATION

Table [1] Units

Type	Unit
Length	m
Force	kN
Time	day

Table [2] Model dimensions

	min.	max.
X	-65,000	65,000
Y	-50,000	4,500

Table [3] Model

Model	Plane strain
Element	15-Noded

2. GEOMETRY

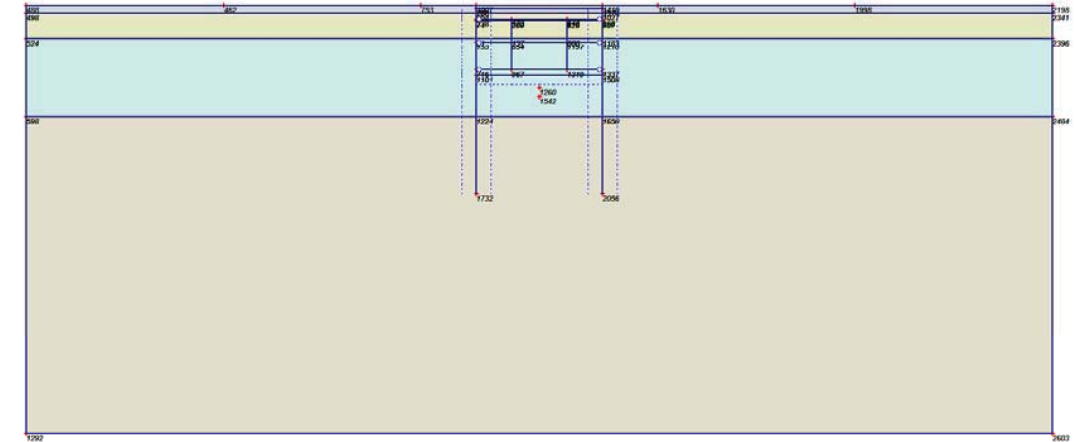


Fig. 1 Plot of geometry model with significant nodes

Table [4] Table of significant nodes

Node no.	x-coord.	y-coord.	Node no.	x-coord.	y-coord.
1292	-65,000	-50,000	716	-8,000	-3,750
2603	65,000	-50,000	1337	8,000	-3,750
238	-8,000	2,750	1319	3,500	-3,750
956	8,000	2,750	967	-3,500	-3,750
488	-65,000	4,500	1101	-8,000	-4,500
2198	65,000	4,500	1508	8,000	-4,500
498	-65,000	3,500	74	-8,000	2,500
2341	65,000	3,500	957	8,000	2,500
462	-40,000	4,500	209	-3,500	2,500
753	-15,000	4,500	626	3,500	2,500
1630	15,000	4,500	524	-65,000	0,250
1998	40,000	4,500	2396	65,000	0,250
373	-3,500	2,750	51	-8,000	0,250
916	3,500	2,750	1183	8,000	0,250
766	-8,000	4,000	137	-3,500	0,250
254	-8,000	3,500	680	3,500	0,250
1374	8,000	4,000	598	-65,000	-9,750
1027	8,000	3,500	2484	65,000	-9,750
1007	-8,000	4,500	1224	-8,000	-9,750
1410	8,000	4,500	1650	8,000	-9,750
153	-8,000	-0,250	1542	0,000	-7,250
1210	8,000	-0,250	1260	0,000	-6,072
654	-3,500	-0,250	1732	-8,000	-19,500

Node no.	x-coord.	y-coord.	Node no.	x-coord.	y-coord.
1197	3,500	-0,250	2056	8,000	-19,500

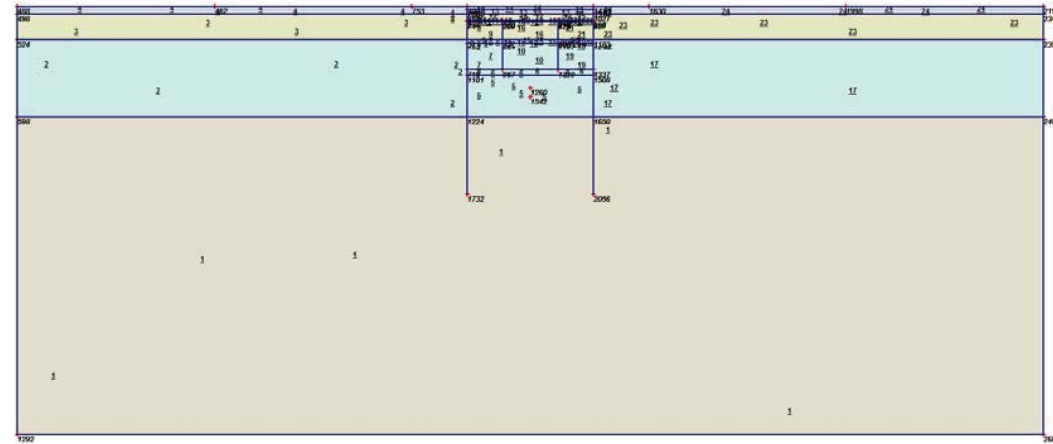


Fig. 2 Plot of geometry model with cluster numbers

Table [5] Table of clusters

Cluster no.	Nodes
1	1292, 2603, 598, 2484, 1224, 1650, 1732, 2056.
2	153, 716, 1101, 524, 51, 598, 1224.
3	238, 498, 254, 74, 524, 51.
4	488, 498, 462, 753, 766, 254, 1007.
5	1101, 1508, 1224, 1650, 1542, 1260.
6	716, 1337, 1319, 967, 1101, 1508.
7	153, 654, 716, 967.
8	153, 654, 51, 137.
9	74, 209, 51, 137.
10	654, 1197, 1319, 967.
11	238, 373, 74, 209.
12	238, 956, 373, 916, 254, 1027.
13	766, 254, 1374, 1027.
14	766, 1374, 1007, 1410.
15	654, 1197, 137, 680.
16	209, 626, 137, 680.
17	1210, 1337, 1508, 2396, 1183, 2484, 1650.
18	373, 916, 209, 626.
19	1210, 1197, 1337, 1319.
20	1210, 1197, 1183, 680.
21	957, 626, 1183, 680.
22	956, 916, 957, 626.
23	956, 2341, 1027, 957, 2396, 1183.
24	2198, 2341, 1630, 1998, 1374, 1027, 1410.

3. STRUCTURES

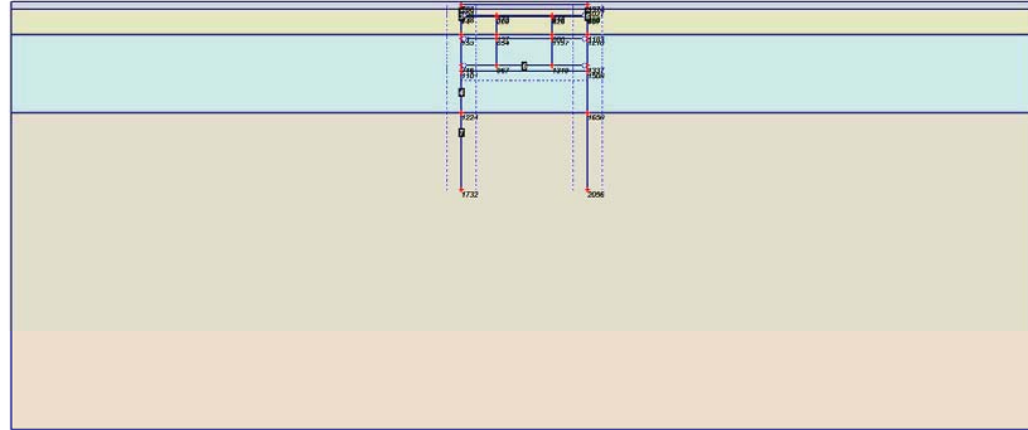


Fig. 3 Plot of geometry model with structures

Table [6] Beams

Plate no.	Data set	Length [m]	Nodes
1	Espatller	1,250	766, 254, 238.
2	Espatller	1,250	1374, 1027, 956.
3	Pilars	3,500	1197, 1319.
4	Pilars	3,500	654, 967.
5	Pantalles Contenció	22,250	238, 74, 51, 153, 716, 1101, 1224, 1732.
6	Pantalles Contenció	22,250	956, 957, 1183, 1210, 1337, 1508, 1650, 2056.
7	Pilars	3,000	654, 137, 209, 373.
8	Pilars	3,000	1197, 680, 626, 916.
9	Forjat Interior	16,000	153, 654, 1197, 1210.
10	Llosa fonamentació	16,000	716, 967, 1319, 1337.
11	Coberta	16,000	238, 373, 916, 956.

Table [7] Interfaces

Interface no.	Data set	Nodes
1	Argiles llimoses plana deltaïca Rebliment Argiles llimoses plana deltaïca Rebliment	238, 254. 254, 766. 254, 238. 766, 254.

Interface no.	Data set	Nodes
2	Argiles llimoses plana deltaïca Rebliment Argiles llimoses plana deltaïca Rebliment	956, 1027. 1027, 1374. 1027, 956. 1374, 1027.
3	Llims falca intermitja Unitat sorrenca Unitat sorrenca Unitat sorrenca Unitat sorrenca Argiles llimoses plana deltaïca Argiles llimoses plana deltaïca	1224, 1732. 1101, 1224. 716, 1101. 153, 716. 51, 153. 74, 51. 238, 74.
4	Unitat sorrenca Argiles llimoses plana deltaïca	716, 153, 1101, 716, 1224, 1101, 153, 51. 74, 238, 51, 74.
5	Llims falca intermitja Unitat sorrenca Unitat sorrenca Unitat sorrenca Unitat sorrenca Unitat sorrenca Argiles llimoses plana deltaïca Argiles llimoses plana deltaïca Argiles llimoses plana deltaïca	1650, 2056, 2056, 1650. 1650, 1508. 1508, 1337. 1210, 1337, 1337, 1508, 1508, 1650, 1183, 1210. 1337, 1210. 1210, 1183. 1183, 957. 957, 956. 956, 957, 957, 1183.
6	Unitat sorrenca	967, 716, 1319, 967, 1337, 1319.
7	Llims falca intermitja	1732, 1224.

4. LOADS & BOUNDARY CONDITIONS

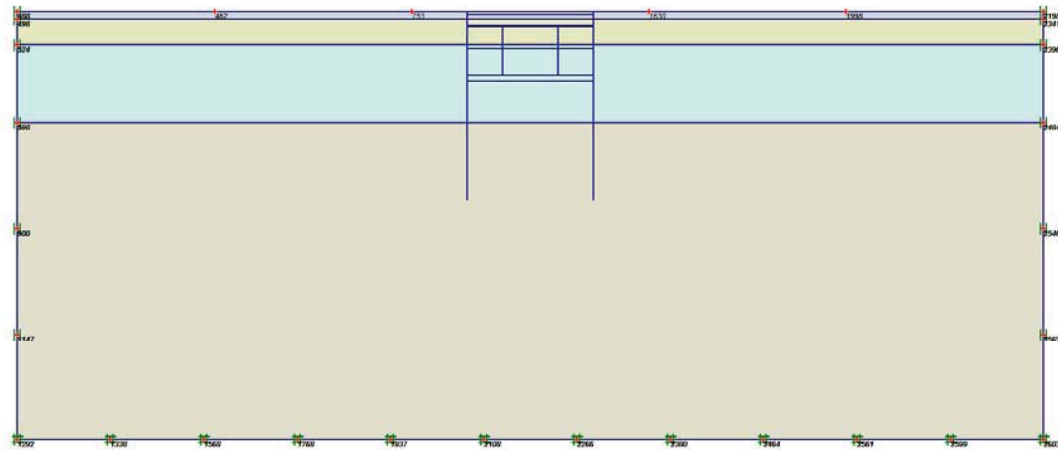


Fig. 4 Plot of geometry with loads & boundary conditions

Table [8] Node fixities

Node no.	Sign	Horizontal	Vertical	Node no.	Sign	Horizontal	Vertical
1292	#	Fixed	Fixed	488		Fixed	Free
2603	#	Fixed	Fixed	2198		Fixed	Free
2599	#	Fixed	Fixed	498		Fixed	Free
2561	#	Fixed	Fixed	2341		Fixed	Free
2464	#	Fixed	Fixed	524		Fixed	Free
2380	#	Fixed	Fixed	2396		Fixed	Free
2266	#	Fixed	Fixed	598		Fixed	Free
2108	#	Fixed	Fixed	2484		Fixed	Free
1937	#	Fixed	Fixed	900		Fixed	Free
1768	#	Fixed	Fixed	1147		Fixed	Free
1568	#	Fixed	Fixed	2546		Fixed	Free
1338	#	Fixed	Fixed	2562		Fixed	Free

Table [9] Distributed loads A

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	0,000	462	0,000	0,000
2	462	0,000	0,000	753	0,000	0,000
3	1630	0,000	0,000	1998	0,000	0,000

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
4	1998	0,000	0,000	2198	0,000	0,000

5. MESH DATA

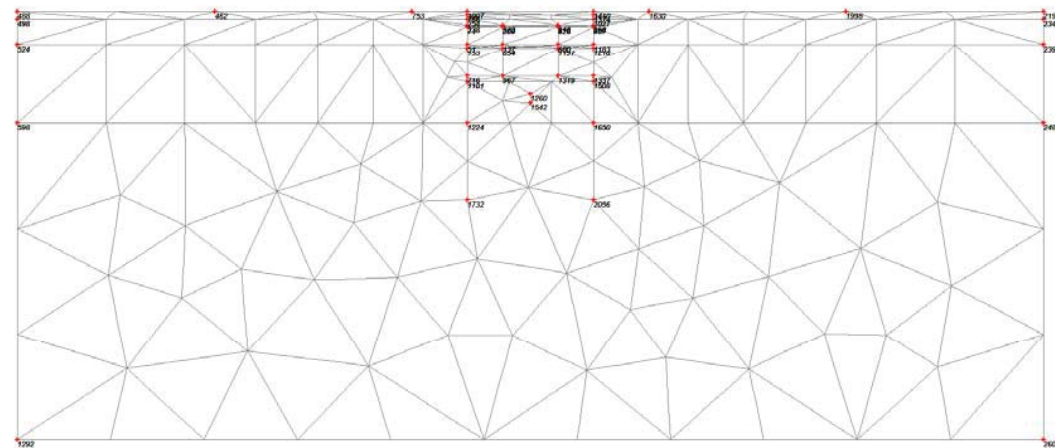


Fig. 5 Plot of the mesh with significant nodes

Table [10] Numbers, type of elements, integrations

Type	Type of element	Type of integration	Total no.
Soil	15-noded	12-point Gauss	296
Plate	5-node line	4-point Gauss	39
Interface	5-node line	4-point Newton-Cotes	47

6. MATERIAL DATA

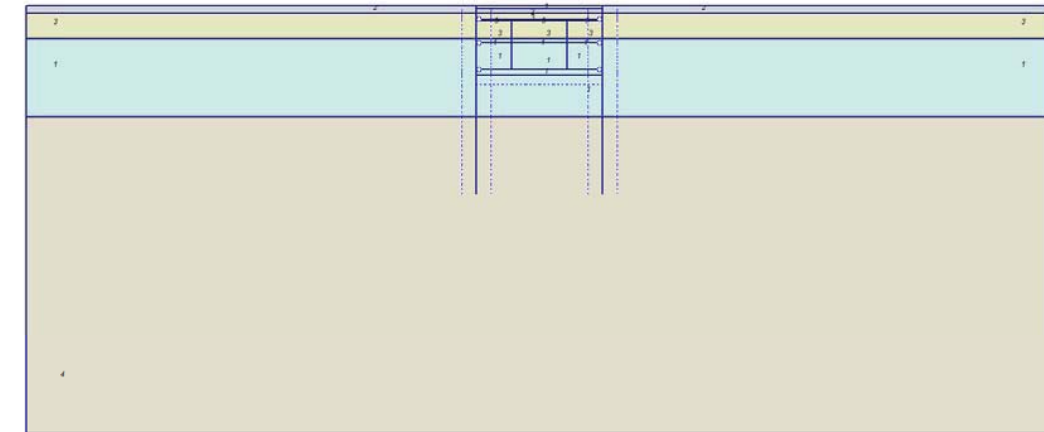


Fig. 6 Plot of geometry with material data sets

Table [11] Soil data sets parameters

<i>Hardening Soil</i>		1 Unitat sorrenca	2 Rebliment	3 Argiles llimoses plana deltaica	4 Llims falca intermitja
Type		Drained	Drained	Drained	Drained
γ_{unsat}	[kN/m ³]	19,00	18,00	19,00	19,00
γ_{sat}	[kN/m ³]	20,00	18,00	20,00	19,50
k_x	[m/day]	55,000	85,000	0,300	0,003
k_y	[m/day]	22,000	85,000	0,200	0,001
e_{init}	[-]	0,50	0,50	0,50	0,50
e_{min}	[-]	0,00	0,00	0,00	0,00
e_{max}	[-]	999,00	999,00	999,00	999,00
c_k	[-]	1E15	1E15	1E15	1E15
E_{50}^{ref}	[kN/m ²]	40000,00	6000,00	10000,00	8000,00
E_{oed}^{ref}	[kN/m ²]	40000,00	6000,00	10000,00	8000,00
power (m)	[-]	0,50	0,50	0,50	0,50
c_{ref}	[kN/m ²]	0,20	0,20	10,00	10,00
ϕ	[°]	35,00	25,00	27,00	25,00
ψ	[°]	0,00	0,00	0,00	0,00
E_{ur}^{ref}	[kN/m ²]	120000,00	18000,00	30000,00	24000,00
$\nu_{ur}^{(nu)}$	[-]	0,150	0,150	0,150	0,150
p^{ref}	[kN/m ²]	100,00	100,00	100,00	100,00
$c_{increment}$	[kN/m ²]	0,00	0,00	0,00	0,00
y_{ref}	[m]	0,00	0,00	0,00	0,00

Hardening Soil		1	2	3	4
		Unitat sorrenca	Rebliment	Argiles llimoses plana deltaica	Llims falca intermitja
R _r	[-]	0,90	0,90	0,90	0,90
T _{strength}	[kN/m ²]	0,00	0,00	0,00	0,00
R _{inter}	[-]	0,33	0,33	0,33	0,33
δ _{inter}	[m]	0,00	0,00	0,00	0,00
Interface permeability		Neutral	Neutral	Neutral	Neutral

Table [12] Beam data sets parameters

No.	Identification	EA [kN/m]	EI [kNm ² /m]	w [kN/m/m]	v [-]	Mp [kNm/m]	Np [kN/m]
1	Pantalles Contenció	2,4E7	1,28E6	4,00	0,20	1E15	1E15
2	Coberta	1,8E7	5,4E5	15,00	0,20	1E15	1E15
3	Forjat Interior	9E6	67500,00	7,50	0,20	1E15	1E15
4	Llosa fonamentació	3E7	2,5E6	5,00	0,20	1E15	1E15
5	Pilars	4,8771E5	26011,00	1,07	0,20	1E15	1E15
6	Espatller	1,1431E7	1,5241E5	2,00	0,20	1E15	1E15

7. CALCULATION PHASES

Table [13] List of phases

Phase	Ph-No.	Start phase	Calculation type	Load input	First step	Last step
Initial phase	0	0		-	0	0
<Phase 1>	1	0	Plastic	Staged construction	1	4
<Phase 2>	2	1	Plastic	Staged construction	5	7
<Phase 3>	3	2	Plastic	Staged construction	8	9
<Phase 4>	4	3	Plastic	Staged construction	10	12
<Phase 5>	5	4	Plastic	Staged construction	13	15
<Phase 6>	6	5	Plastic	Staged construction	16	17
<Phase 7>	7	6	Plastic	Staged construction	18	23
<Phase 8>	8	7	Plastic	Staged construction	24	29
<Phase 9>	9	8	Plastic	Staged construction	30	31
<Phase 10>	10	9	Plastic	Staged construction	32	33
<Phase 11>	11	10	Plastic	Staged construction	34	36
<Phase 12>	12	11	Plastic	Staged construction	37	43

Table [14] Staged construction info

Ph-No.	Active clusters	Inactive clusters	Active beams	Active geotextiles	Active anchors
0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.				
1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.				
2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.		1, 2, 5, 6.		
3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24.	14.	1, 2, 5, 6.		
4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 19, 20, 21, 23, 24.	11, 12, 13, 14, 18, 22.	1, 2, 5, 6.		
5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 19, 20, 21, 23, 24.	11, 12, 13, 14, 18, 22.	1, 2, 5, 6, 11.		
6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 19, 20, 21, 23, 24.	11, 12, 13, 14, 18, 22.	1, 2, 5, 6, 11.		

Ph-No.	Active clusters	Inactive clusters	Active beams	Active geotextiles	Active anchors
7	1, 2, 3, 4, 5, 17, 23, 24.	6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22.	1, 2, 5, 6, 11.		
8	1, 2, 3, 4, 5, 6, 17, 23, 24.	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22.	1, 2, 5, 6, 10, 11.		
9	1, 2, 3, 4, 5, 6, 17, 23, 24.	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22.	1, 2, 3, 4, 5, 6, 9, 10, 11.		
10	1, 2, 3, 4, 5, 6, 17, 23, 24.	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.		
11	1, 2, 3, 4, 5, 6, 12, 13, 14, 17, 23, 24.	7, 8, 9, 10, 11, 15, 16, 18, 19, 20, 21, 22.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.		
12	1, 2, 3, 4, 5, 6, 12, 13, 14, 17, 23, 24.	7, 8, 9, 10, 11, 15, 16, 18, 19, 20, 21, 22.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.		

Table [15] Control parameters 1

Ph-No.	Additional steps	Reset displacements to zero	Ignore undrained behaviour	Delete intermediate steps
1	250	No	No	Yes
2	250	Yes	No	Yes
3	250	No	No	Yes
4	250	No	No	Yes
5	250	No	No	Yes
6	250	No	No	Yes
7	250	No	No	Yes
8	250	No	No	Yes
9	250	No	No	Yes
10	250	No	No	Yes
11	250	No	No	Yes
12	250	No	No	Yes

Table [16] Control parameters 2

Ph-No.	Iterative procedure	Tolerated error	Over relaxation	Max. iterations	Desired min.	Desired max.	Arc-Length control
1	Standard	0,010	1,200	60	6	15	Yes
2	Standard	0,010	1,200	60	6	15	Yes
3	Standard	0,010	1,200	60	6	15	Yes
4	Standard	0,010	1,200	60	6	15	Yes
5	Standard	0,010	1,200	60	6	15	Yes
6	Standard	0,010	1,200	60	6	15	Yes
7	Standard	0,010	1,200	60	6	15	Yes
8	Standard	0,010	1,200	60	6	15	Yes
9	Standard	0,010	1,200	60	6	15	Yes
10	Standard	0,010	1,200	60	6	15	Yes
11	Standard	0,010	1,200	60	6	15	Yes
12	Standard	0,010	1,200	60	6	15	Yes

Table [17] Incremental multipliers (input values)

Ph-No.	Displ.	Load A	Load B	Weight	Accel	Time	s-f
0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
1	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
2	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
3	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
4	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
5	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
6	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
7	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
8	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
9	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
10	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
11	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
12	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Table [18] Total multipliers - input values

Ph-No.	Displ.	Load A	Load B	Weight	Accel	Time	s-f
0	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
1	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
2	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
3	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
4	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
5	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
6	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
7	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
8	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
9	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
10	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
11	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
12	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000

Table [19] Total multipliers - reached values

Ph-No.	Displ.	Load A	Load B	Weight	Accel	Time	s-f
0	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
1	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
2	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
3	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
4	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
5	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
6	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
7	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
8	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
9	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
10	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
11	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000
12	1,0000	1,0000	1,0000	1,0000	0,0000	0,0000	1,0000

8. RESULTS FOR PHASE 1

Table [20] Step info phase no: 1

Step no:	4
Calculation type	PLASTIC
Extrapolation factor	1,888
Relative stiffness	0,396

Table [21] Reached multipliers phase no: 1

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [22] Staged construction info phase no: 1

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	1,000
Active proportion of stage	0,498	1,000

Table [23] Realised tunnel contraction info phase no: 1

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [24] Iteration info phase no: 1

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,009	3542	557	4	0	0	7	4
2	0,008	3542	569	38	0	0	7	7

Table [25] Active distributed loads A phase no: 1

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

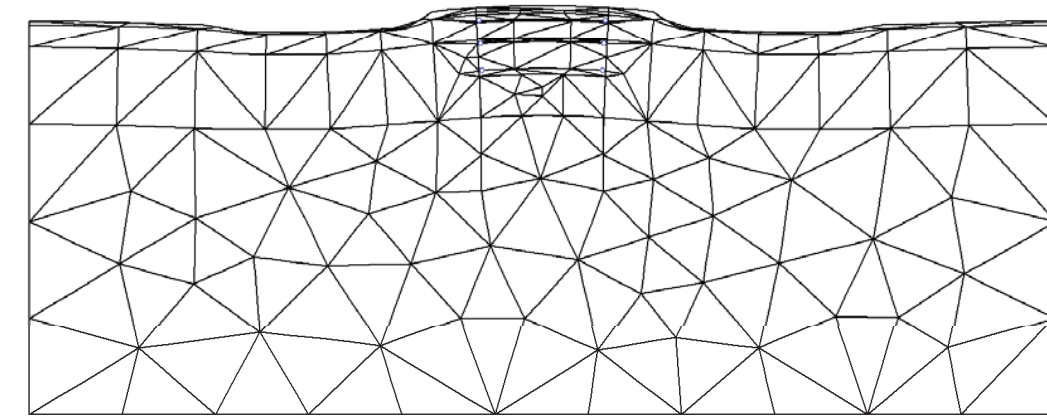


Fig. 7 Plot of deformed mesh - step no: 4 - (phase: 1)

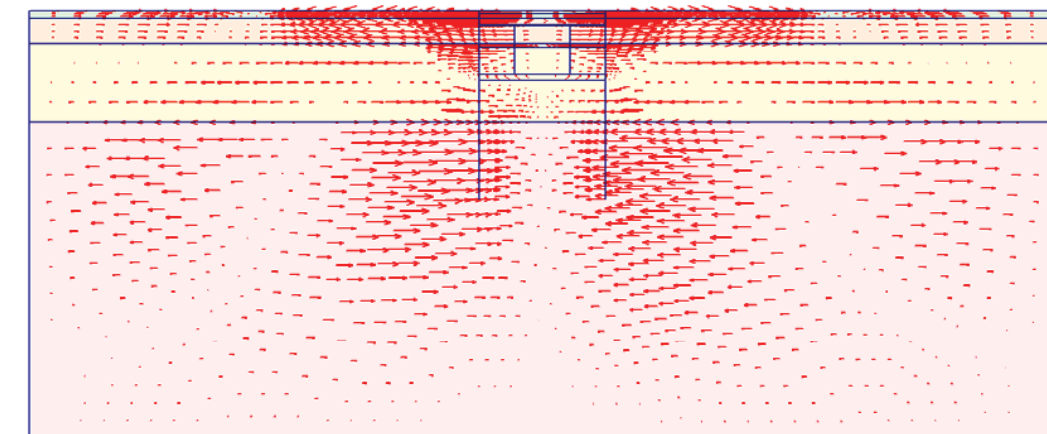
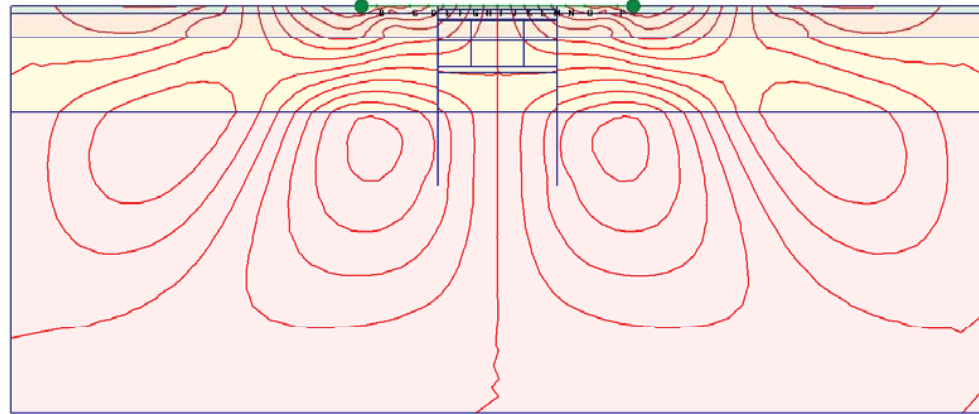
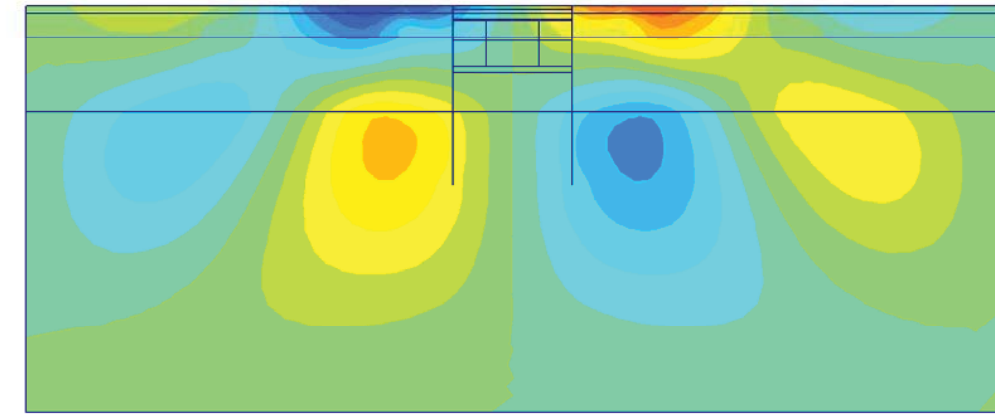


Fig. 8 Plot of horizontal displacements (arrows)
- step no: 4 - (phase: 1)



[10^{-3}]
A: -16.000
B: -14.000
C: -12.000
D: -10.000
E: -8.000
F: -6.000
G: -4.000
H: -2.000
I: 0.000
J: 2.000
K: 4.000
L: 6.000
M: 8.000
N: 10.000
O: 12.000
P: 14.000
Q: 16.000

Fig. 9 Plot of horizontal displacements (contour lines)
- step no: 4 - (phase: 1)



[10^{-3}]
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
-10.000
-12.000
-14.000
-16.000

Fig. 10 Plot of horizontal displacements (shadings)
- step no: 4 - (phase: 1)

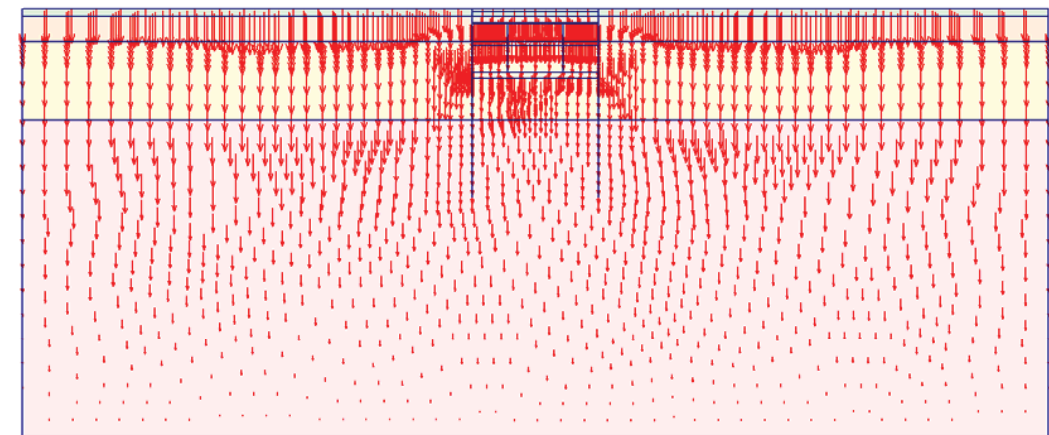
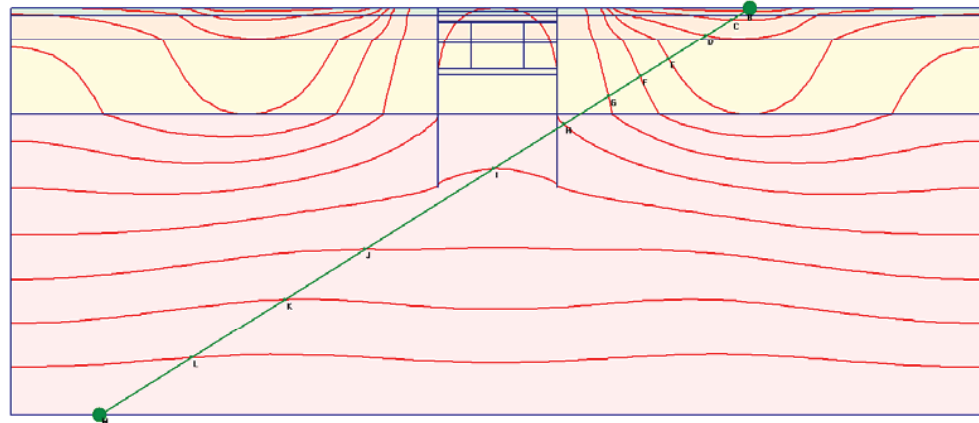
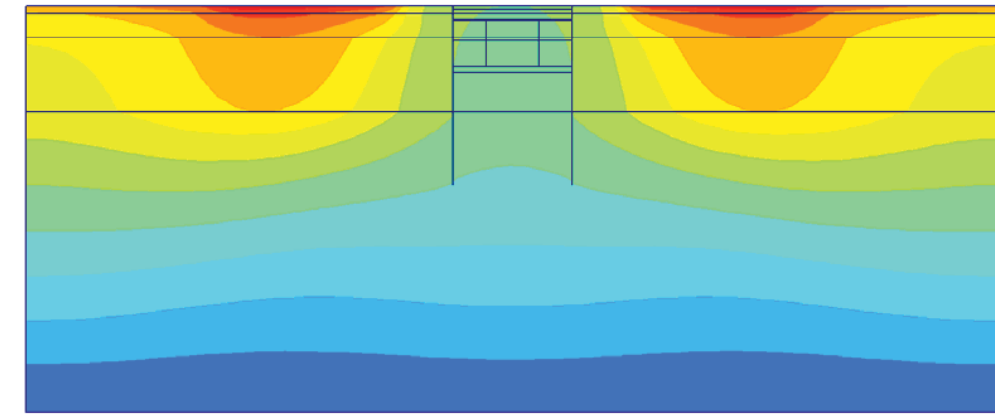


Fig. 11 Plot of vertical displacements (arrows)
- step no: 4 - (phase: 1)



[*10⁻³]
A: -120.000
B: -110.000
C: -100.000
D: -90.000
E: -80.000
F: -70.000
G: -60.000
H: -50.000
I: -40.000
J: -30.000
K: -20.000
L: -10.000
M: -0.000
N: 10.000

Fig. 12 Plot of vertical displacements (contour lines)
- step no: 4 - (phase: 1)



[*10⁻³]
10.000
0.000
-10.000
-20.000
-30.000
-40.000
-50.000
-60.000
-70.000
-80.000
-90.000
-100.000
-110.000
-120.000

Fig. 13 Plot of vertical displacements (shadings)
- step no: 4 - (phase: 1)

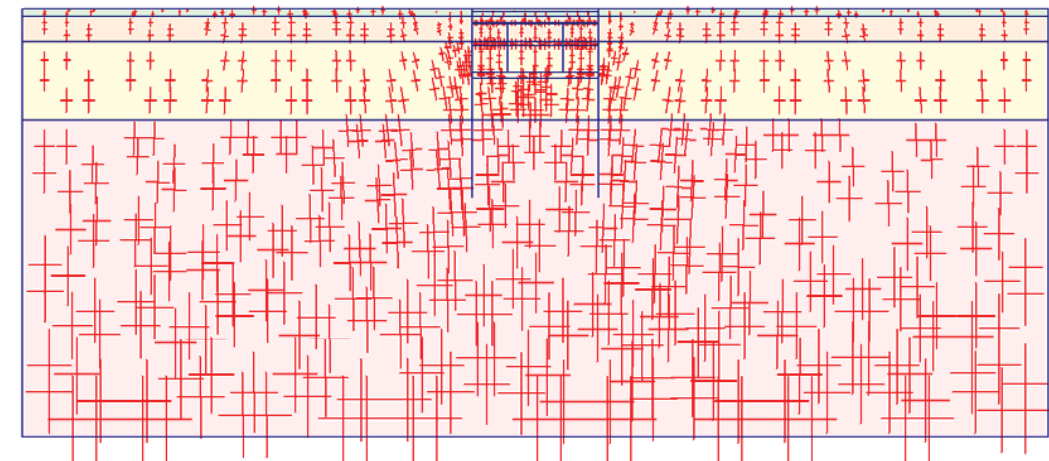
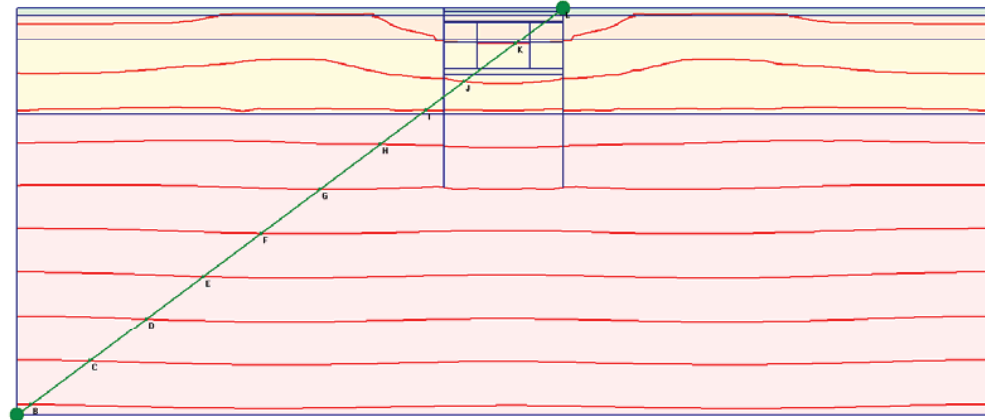


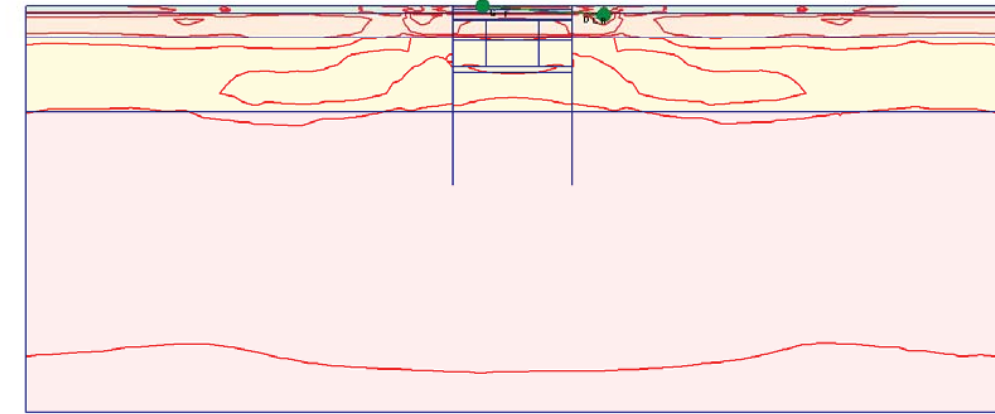
Fig. 14 Plot of effective stresses (principal directions)
- step no: 4 - (phase: 1)



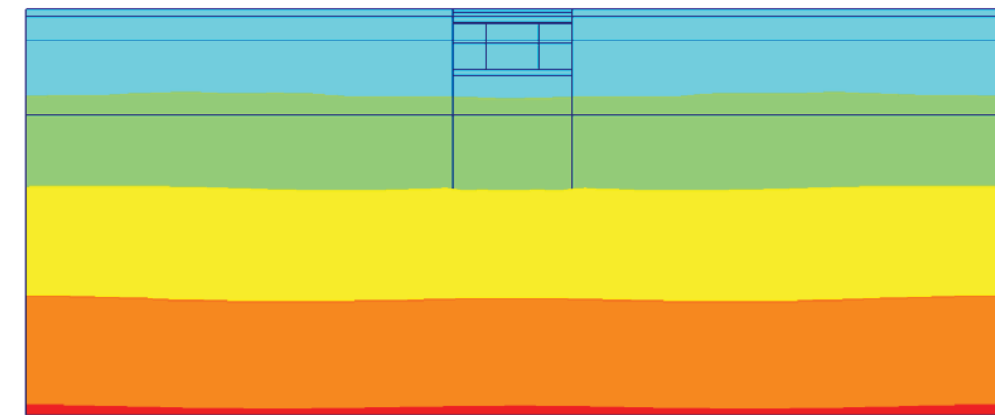
A: -440.000
B: -400.000
C: -360.000
D: -320.000
E: -280.000
F: -240.000
G: -200.000
H: -160.000
I: -120.000
J: -80.000
K: -40.000
L: 0.000
M: 40.000

Fig. 15 Plot of effective stresses (mean contours)
- step no: 4 - (phase: 1)

Fig. 16 Plot of effective stresses (relative shear contours)
- step no: 4 - (phase: 1)



A: 0.300
B: 0.400
C: 0.500
D: 0.600
E: 0.700
F: 0.800
G: 0.900
H: 1.000



100.000
0.000
-100.000
-200.000
-300.000
-400.000
-500.000

Fig. 17 Plot of effective stresses (mean shadings)
- step no: 4 - (phase: 1)

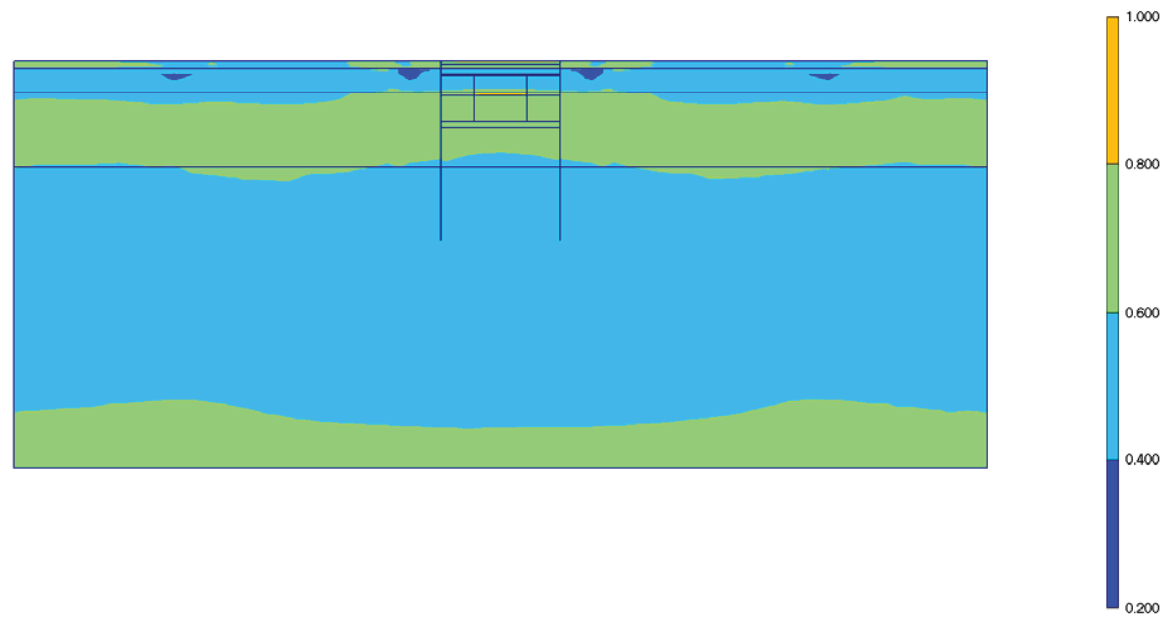


Fig. 18 Plot of effective stresses (relative shear shadings)
- step no: 4 - (phase: 1)

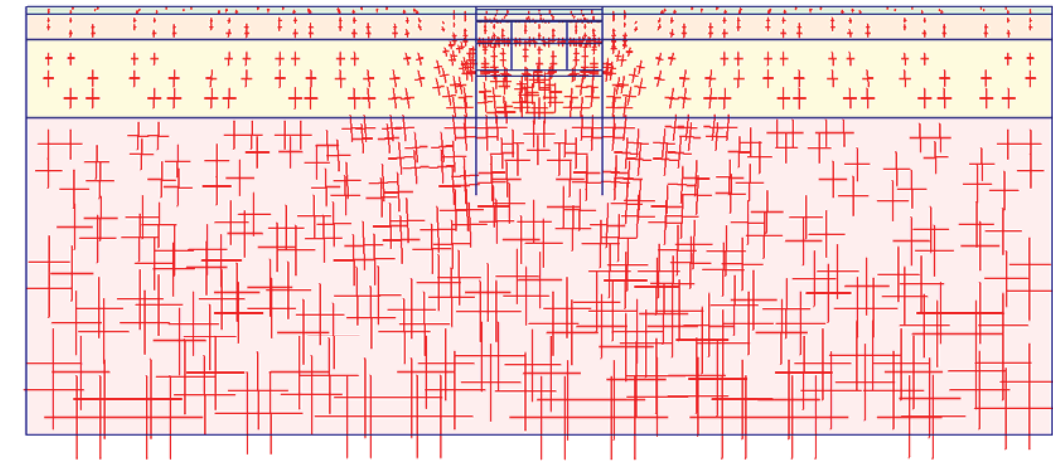
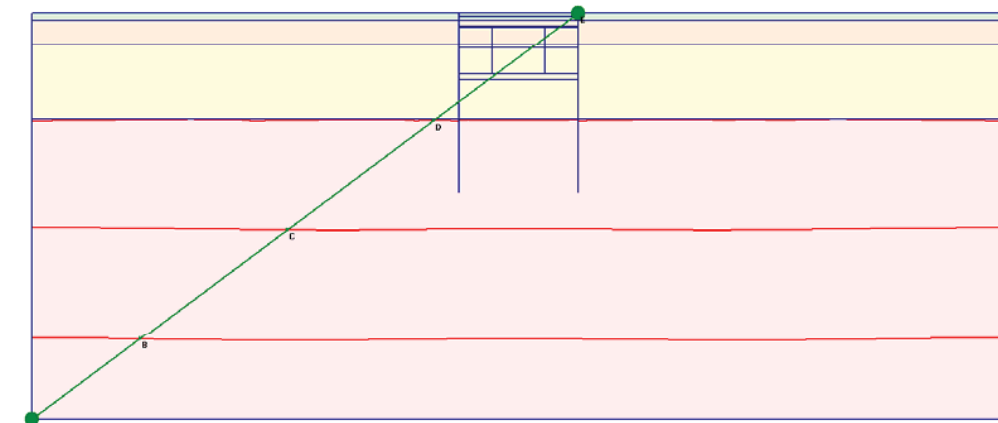
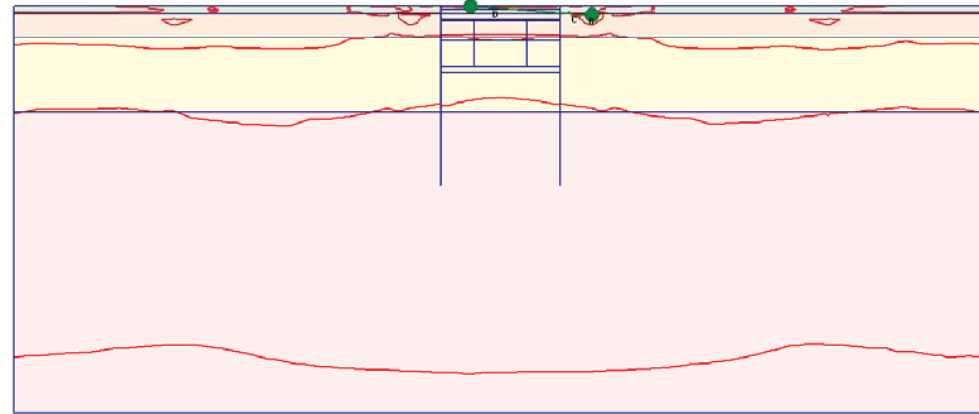


Fig. 19 Plot of total stresses (principal directions)
- step no: 4 - (phase: 1)



A: -1000.00
B: -750.000
C: -500.000
D: -250.000
E: 0.000
F: 250.000

Fig. 20 Plot of total stresses (mean contours)
- step no: 4 - (phase: 1)



- A: 0.200
- B: 0.400
- C: 0.600
- D: 0.800
- E: 1.000

Fig. 21 Plot of total stresses (relative shear contours)
- step no: 4 - (phase: 1)

Fig. 22 Plot of total stresses (mean shadings)
- step no: 4 - (phase: 1)

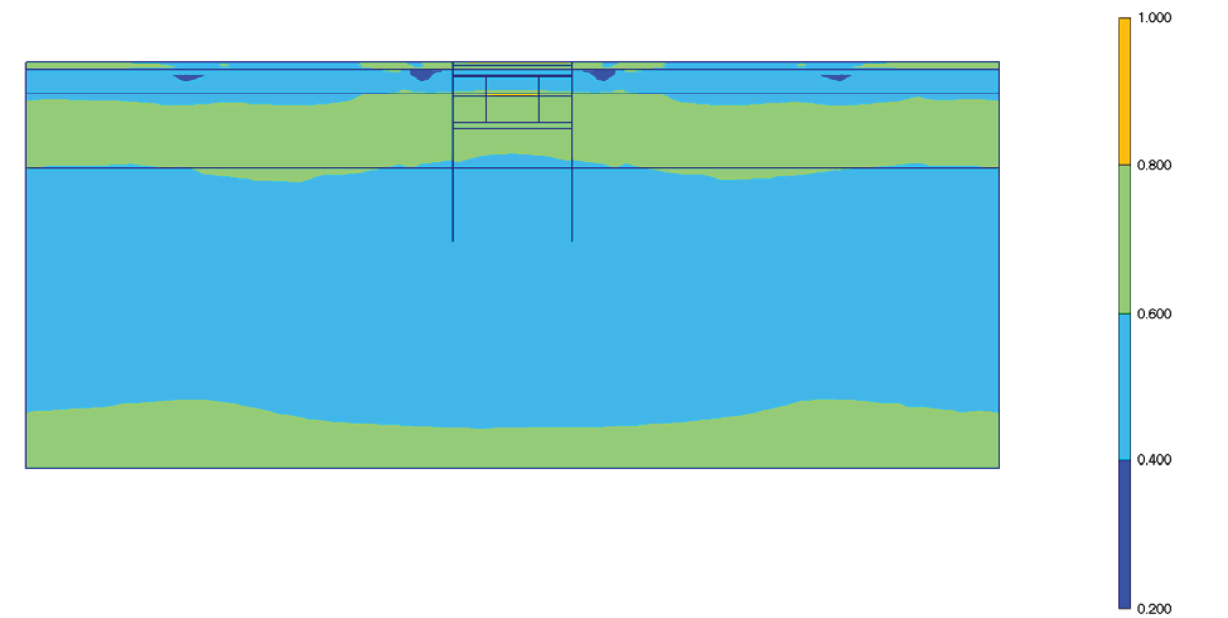
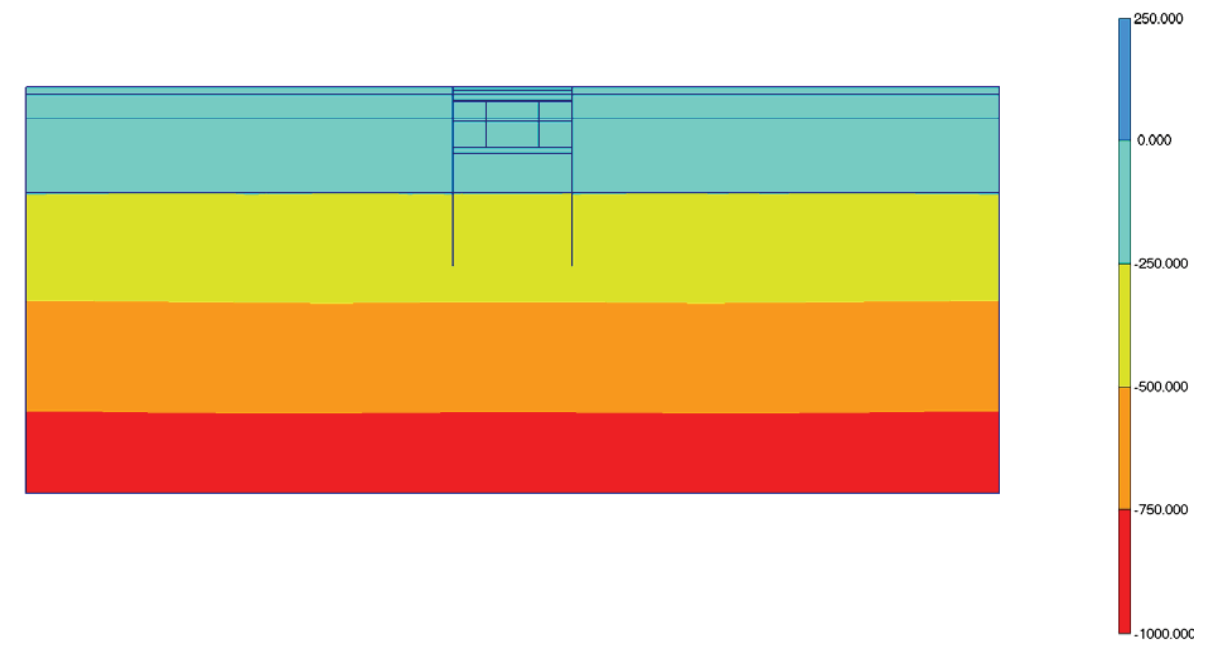
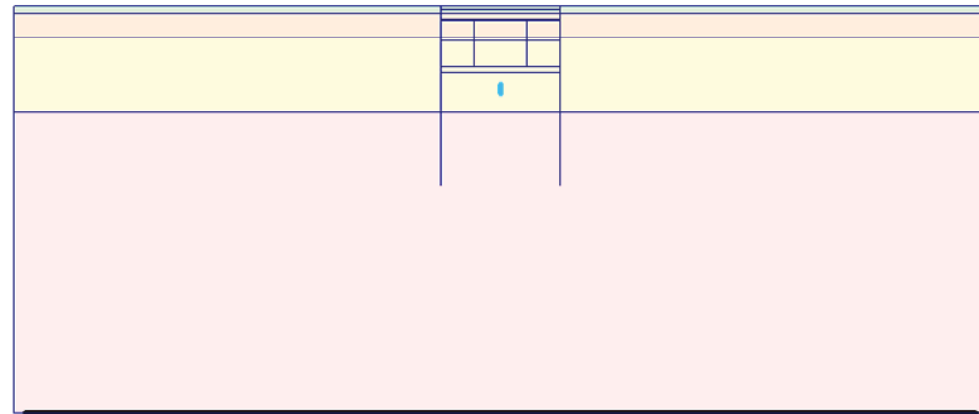


Fig. 23 Plot of total stresses (relative shear shadings)
- step no: 4 - (phase: 1)



A: 2.220
B: 2.240
C: 2.260
D: 2.280

Fig. 24 Plot of groundwater head (contour lines)
- step no: 4 - (phase: 1)

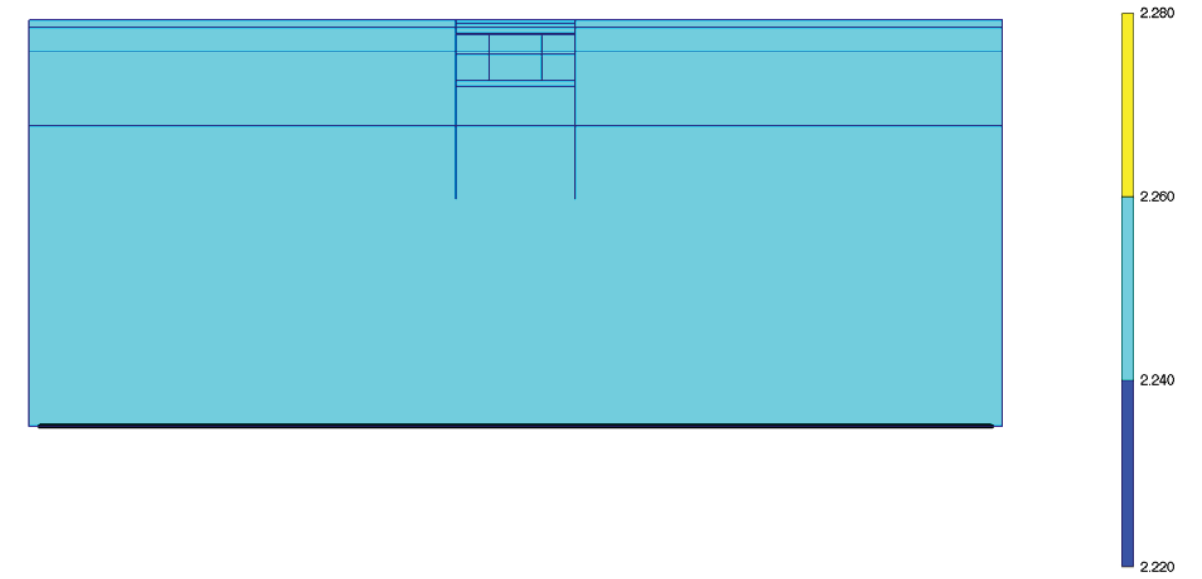


Fig. 25 Plot of groundwater head (shadings)
- step no: 4 - (phase: 1)

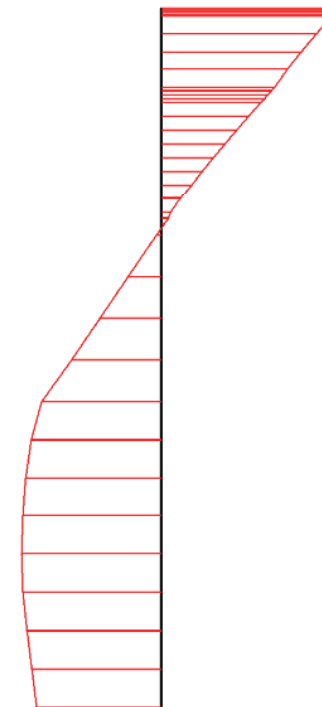


Fig. 26 Horizontal displacements in beam (plate no: 6)
Extreme value $6,82 \cdot 10^{-3}$ m (phase: 1)

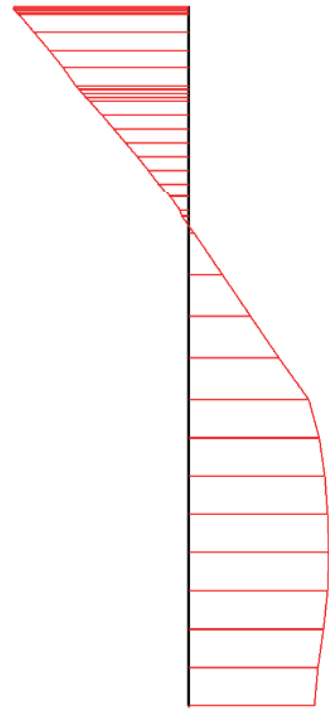


Fig. 27 Horizontal displacements in beam (plate no: 5)
Extreme value $-6,81 \cdot 10^{-3}$ m (phase: 1)

Fig. 28 Vertical displacements in beam (plate no: 6)
Extreme value $-52,55 \cdot 10^{-3}$ m (phase: 1)





Fig. 29 Vertical displacements in beam (plate no: 5)
 Extreme value $-52,53 \cdot 10^{-3}$ m (phase: 1)

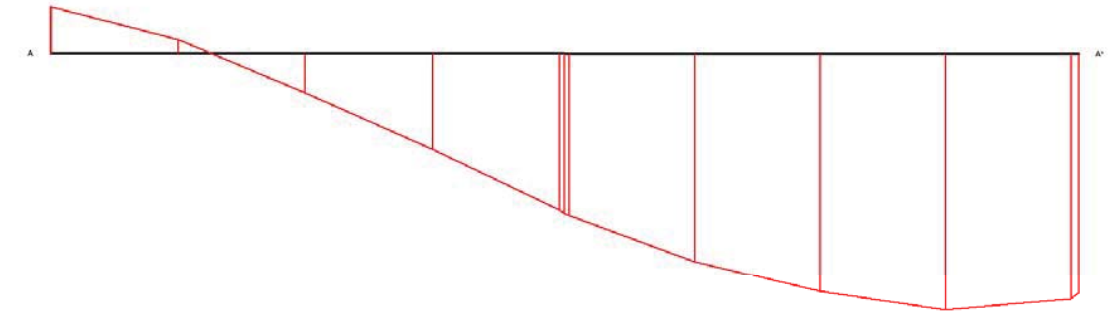


Fig. 30 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $-14,25 \cdot 10^{-3}$ m (phase: 1)

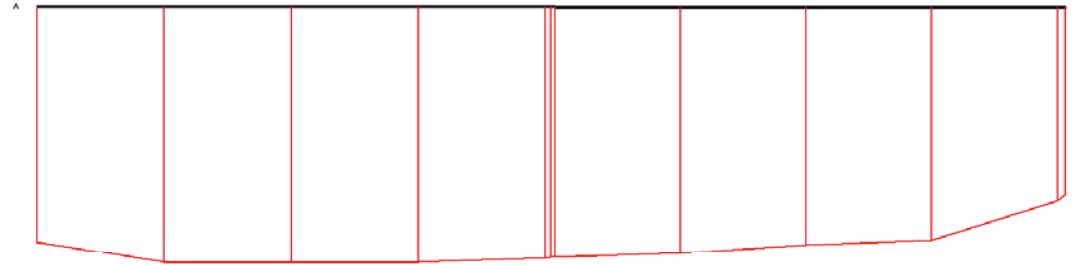


Fig. 31 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-116,94 \cdot 10^{-3}$ m (phase: 1)

9. RESULTS FOR PHASE 2

Table [26] Step info phase no: 2

Step no:	7
Calculation type	PLASTIC
Extrapolation factor	1,489
Relative stiffness	0,483

Table [27] Reached multipliers phase no: 2

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [28] Staged construction info phase no: 2

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	1,000
Active proportion of stage	0,406	1,000

Table [29] Realised tunnel contraction info phase no: 2

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [30] Iteration info phase no: 2

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,002	2672	2375	11	0	0	2	2
2	0,001	2654	2372	4	0	0	2	2

Table [31] Active distributed loads A phase no: 2

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

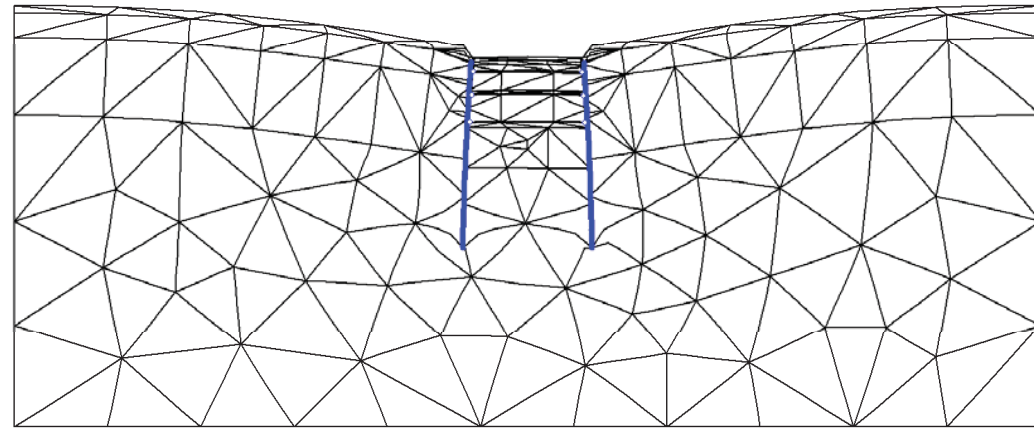


Fig. 32 Plot of deformed mesh
- step no: 7 - (phase: 2)

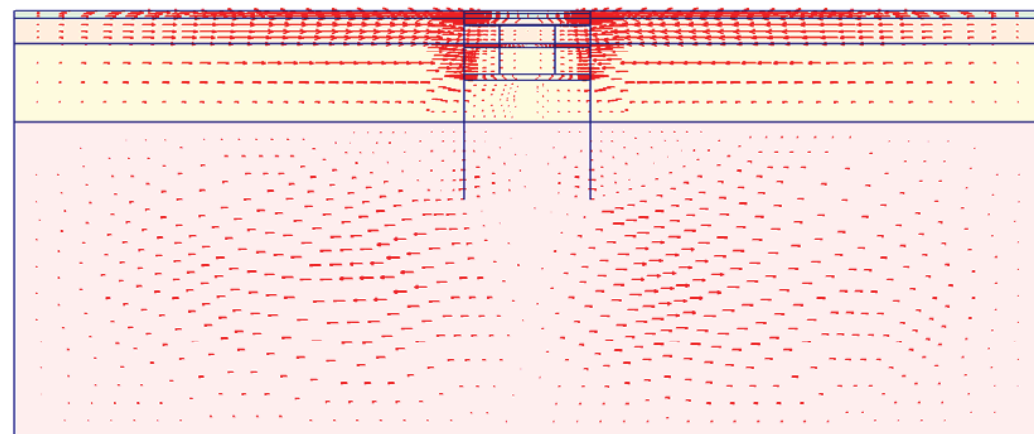
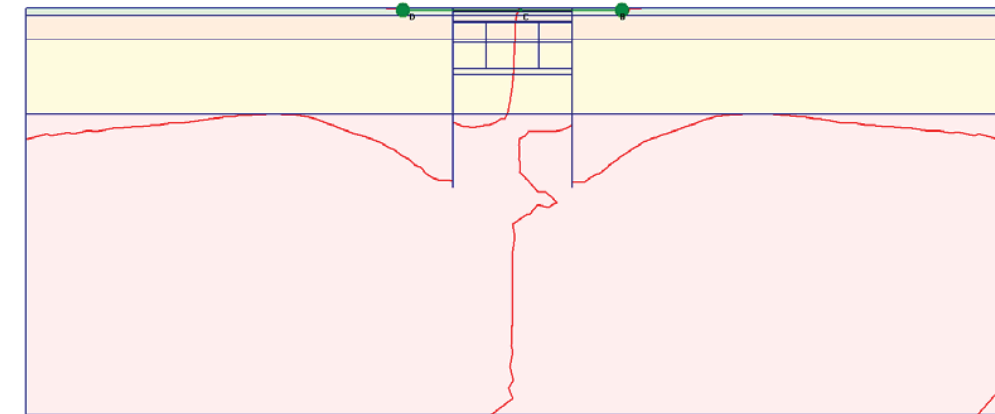


Fig. 33 Plot of horizontal displacements (arrows)
- step no: 7 - (phase: 2)



[*10⁻³]
A: -4.000
B: -2.000
C: 0.000
D: 2.000
E: 4.000

Fig. 34 Plot of horizontal displacements (contour lines)
- step no: 7 - (phase: 2)

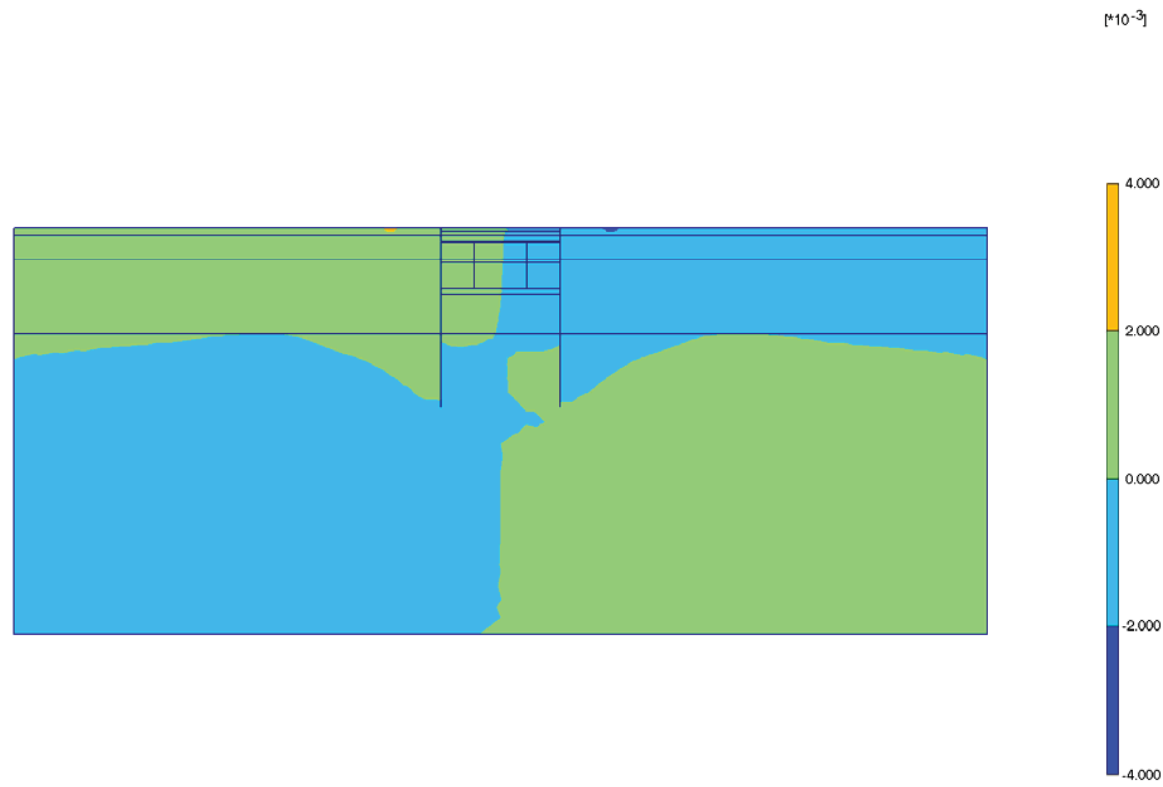


Fig. 35 Plot of horizontal displacements (shadings)
- step no: 7 - (phase: 2)

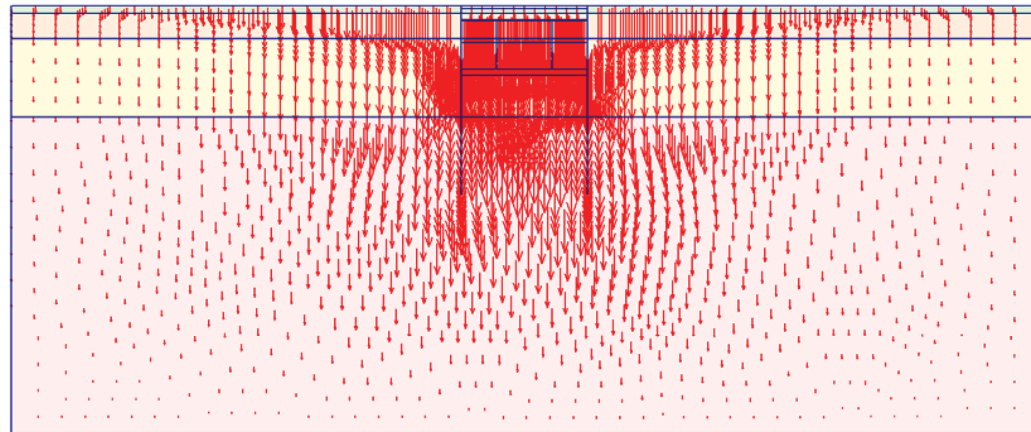


Fig. 36 Plot of vertical displacements (arrows)
- step no: 7 - (phase: 2)

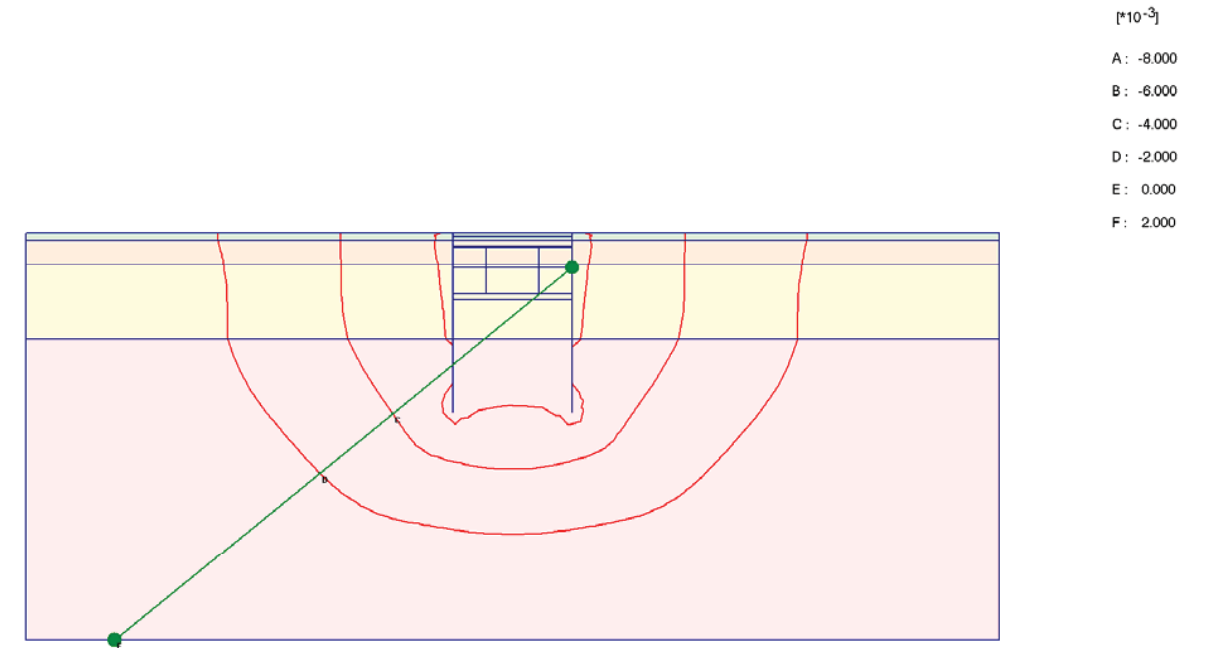
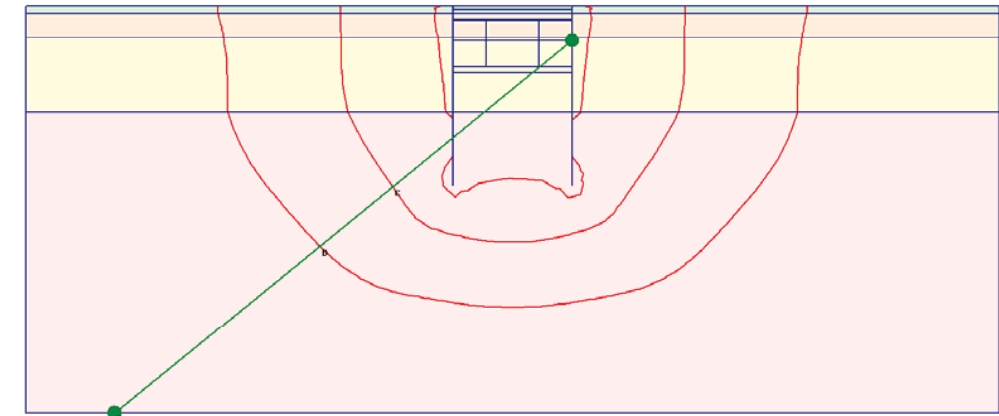


Fig. 37 Plot of vertical displacements (contour lines)
- step no: 7 - (phase: 2)



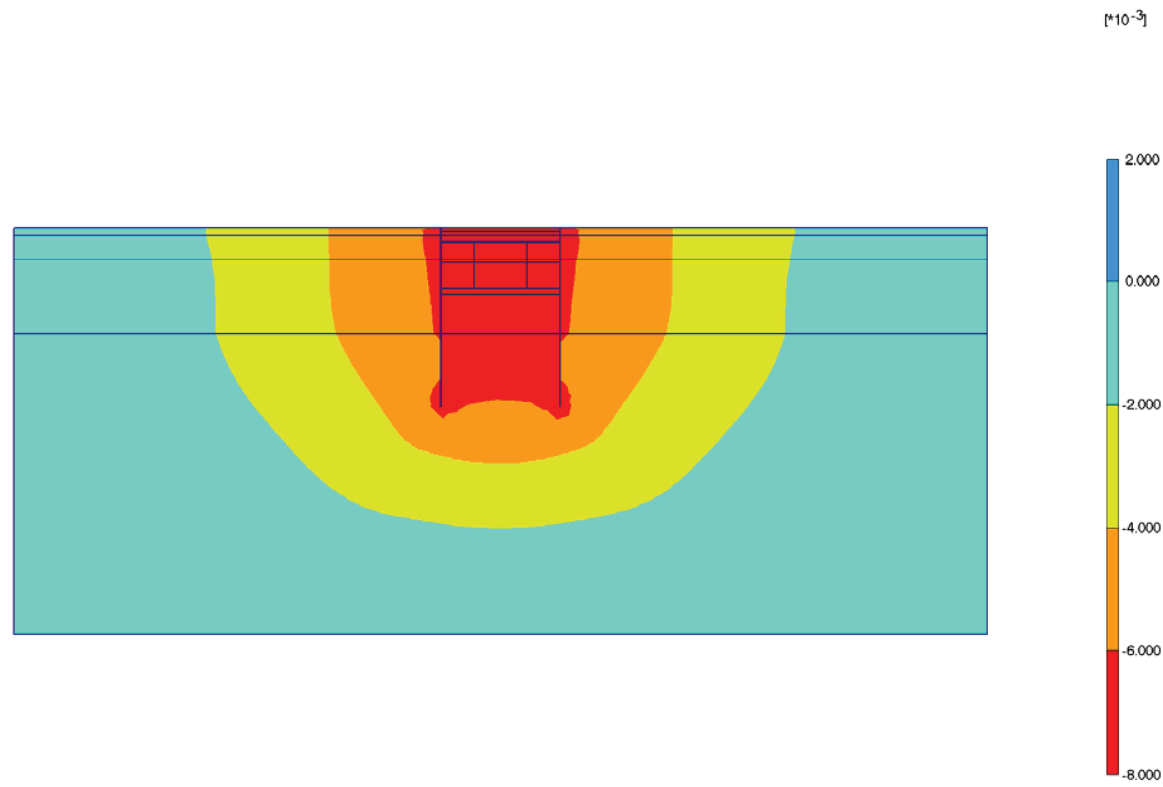


Fig. 38 Plot of vertical displacements (shadings)
- step no: 7 - (phase: 2)

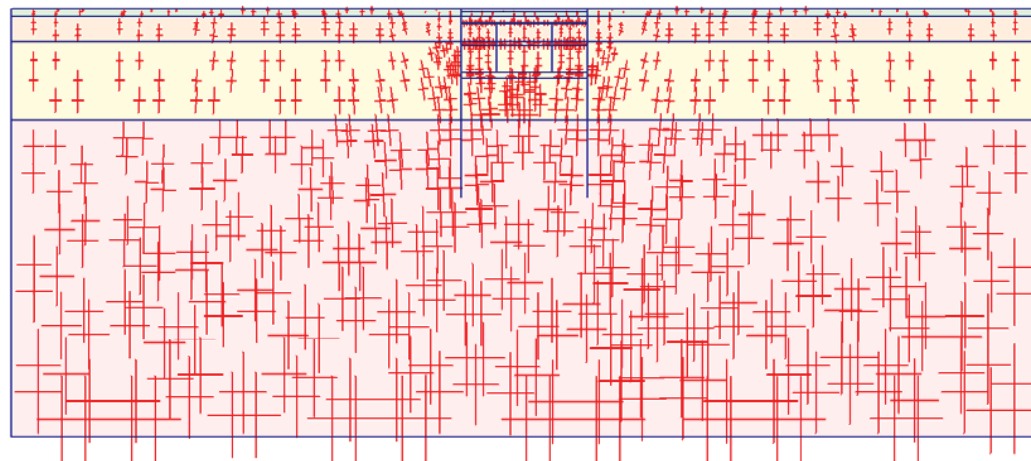


Fig. 39 Plot of effective stresses (principal directions)
- step no: 7 - (phase: 2)

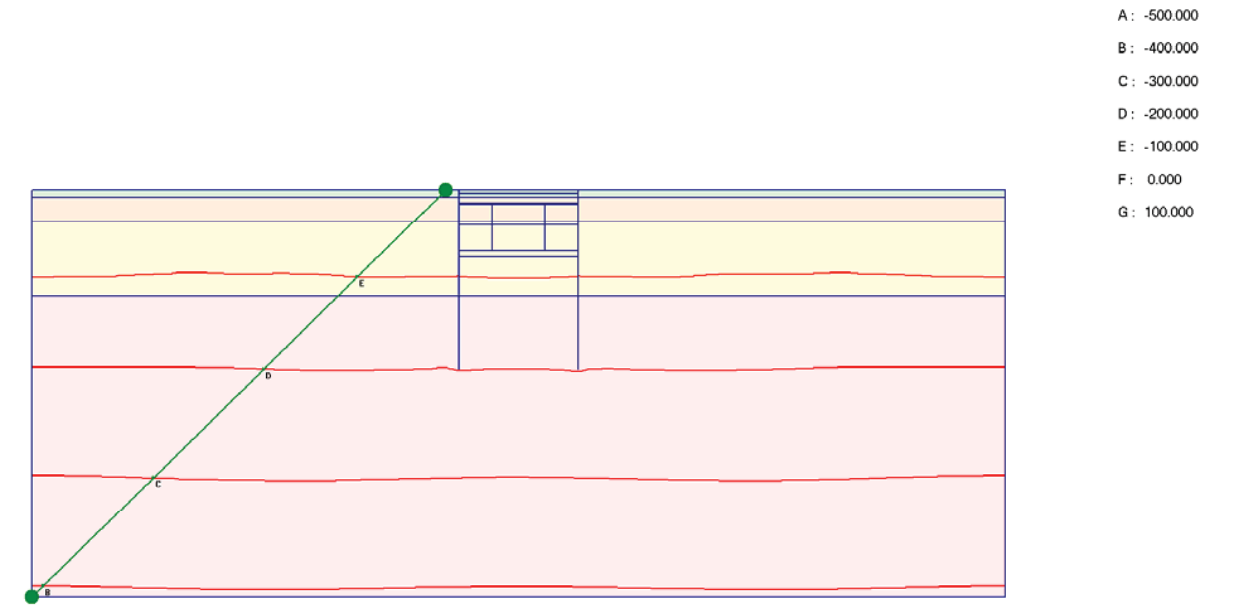
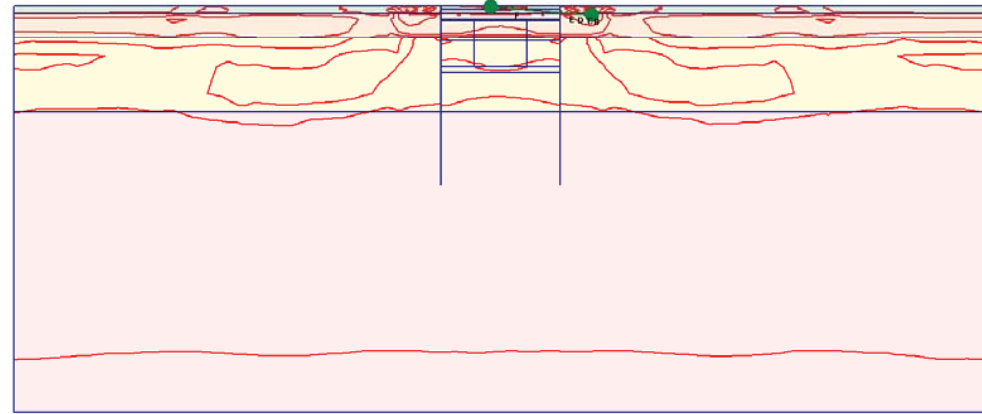
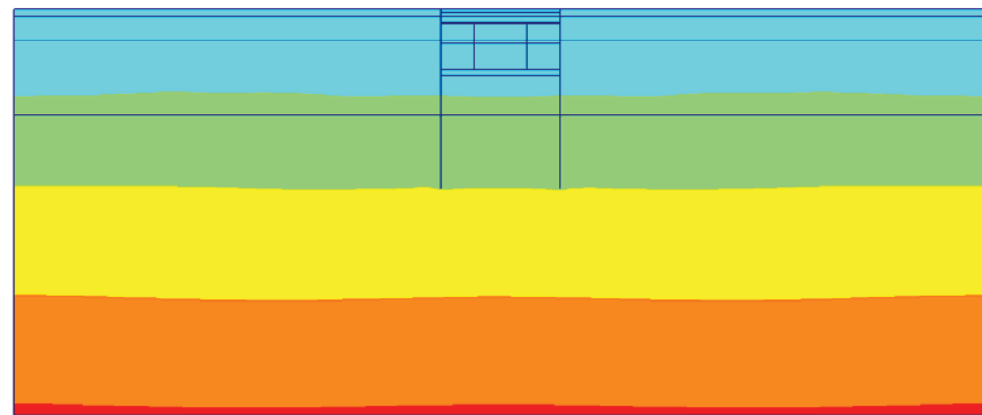


Fig. 40 Plot of effective stresses (mean contours)
- step no: 7 - (phase: 2)



- A: 0.200
- B: 0.300
- C: 0.400
- D: 0.500
- E: 0.600
- F: 0.700
- G: 0.800

Fig. 41 Plot of effective stresses (relative shear contours)
- step no: 7 - (phase: 2)



- 100.000
- 0.000
- 100.000
- 200.000
- 300.000
- 400.000
- 500.000

Fig. 42 Plot of effective stresses (mean shadings)
- step no: 7 - (phase: 2)

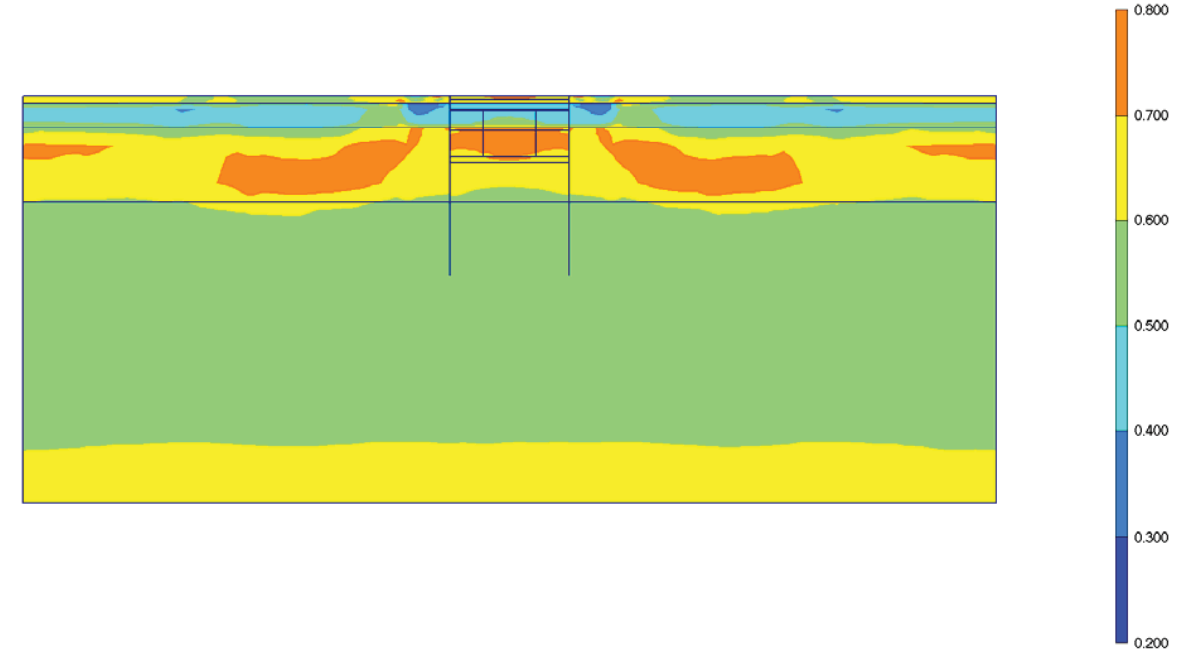


Fig. 43 Plot of effective stresses (relative shear shadings)
- step no: 7 - (phase: 2)

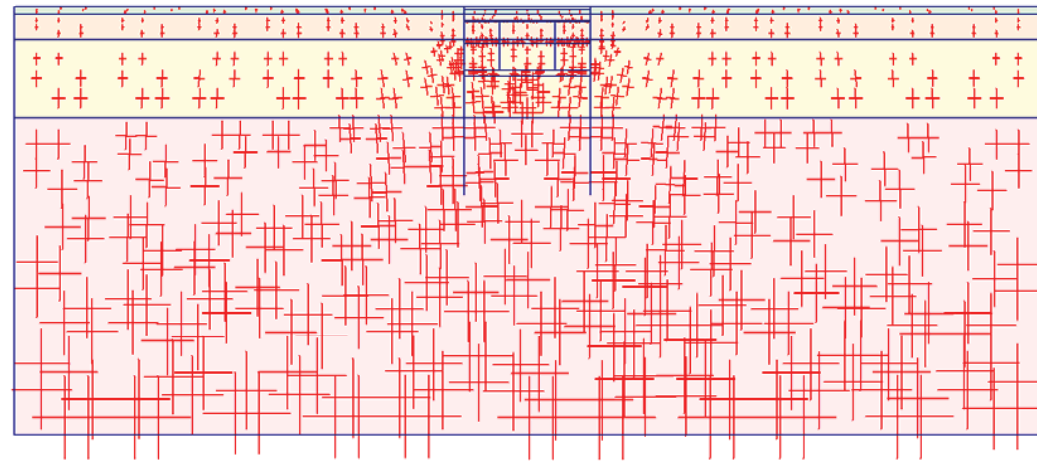


Fig. 44 Plot of total stresses (principal directions)
- step no: 7 - (phase: 2)

- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

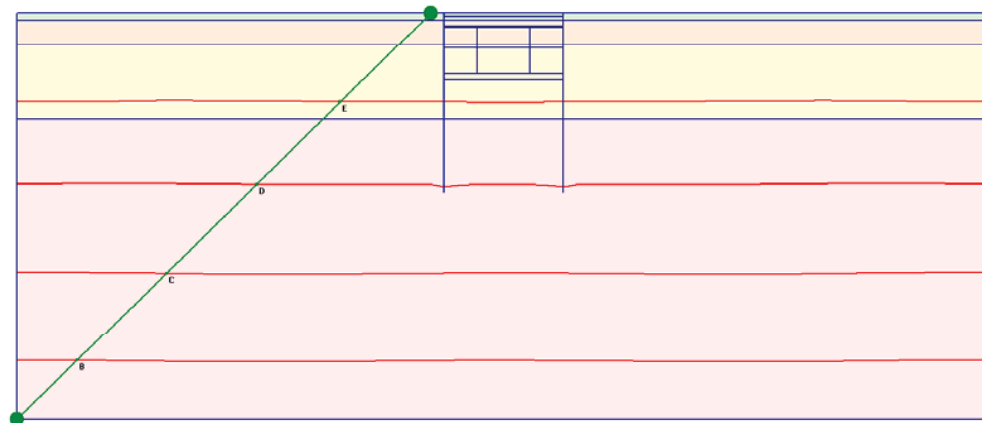
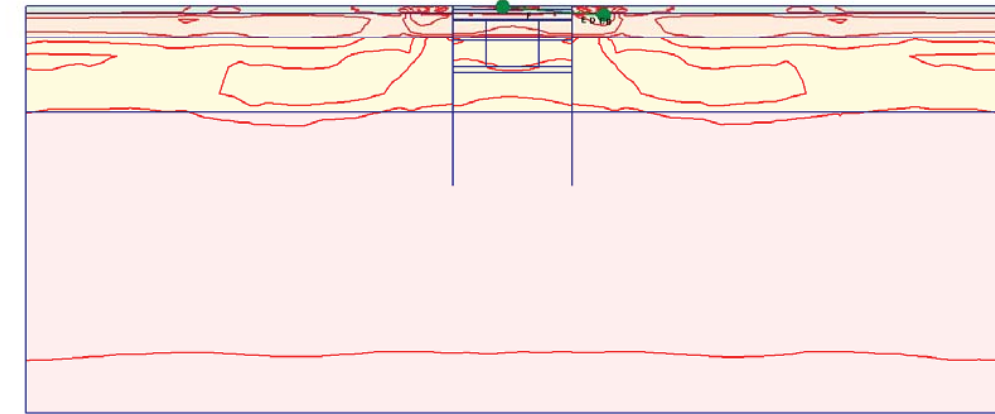


Fig. 44 Plot of total stresses (principal directions)
- step no: 7 - (phase: 2)

Fig. 45 Plot of total stresses (mean contours)
- step no: 7 - (phase: 2)



- A: 0.200
- B: 0.300
- C: 0.400
- D: 0.500
- E: 0.600
- F: 0.700
- G: 0.800

Fig. 46 Plot of total stresses (relative shear contours)
- step no: 7 - (phase: 2)

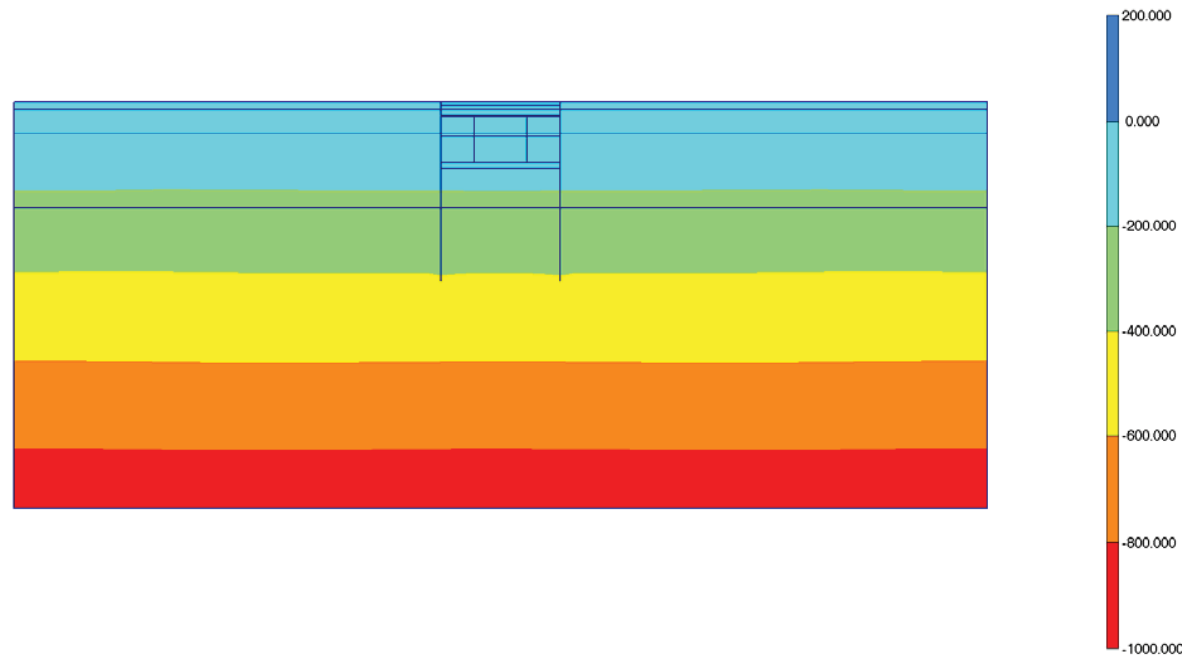


Fig. 47 Plot of total stresses (mean shadings)
- step no: 7 - (phase: 2)

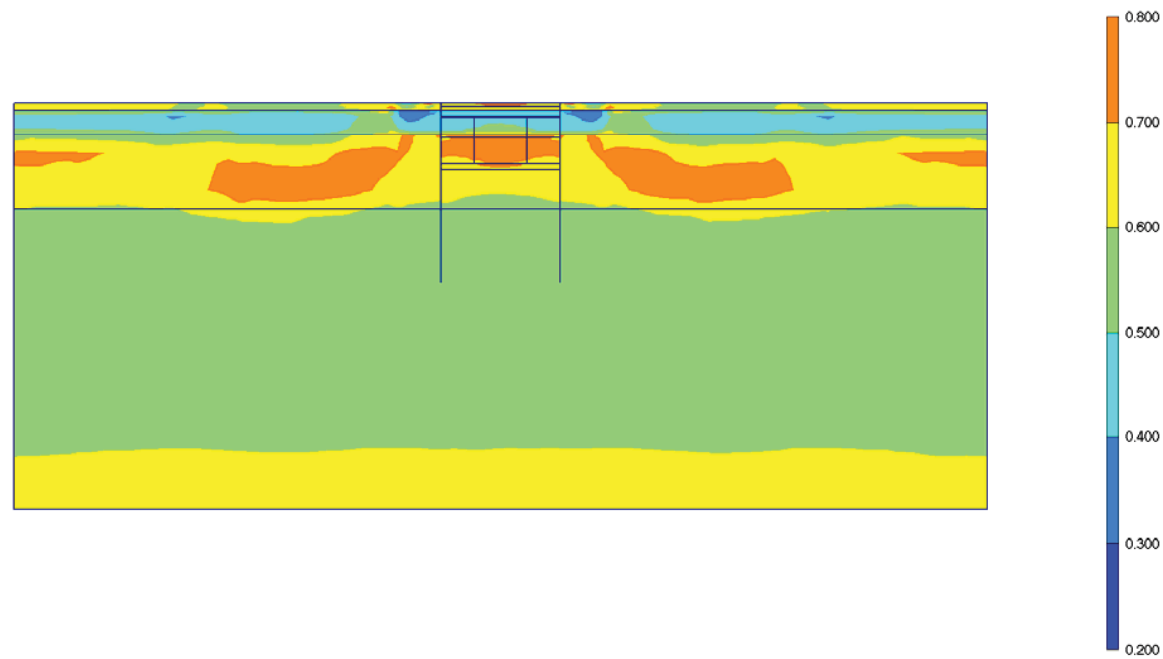


Fig. 48 Plot of total stresses (relative shear shadings)
- step no: 7 - (phase: 2)

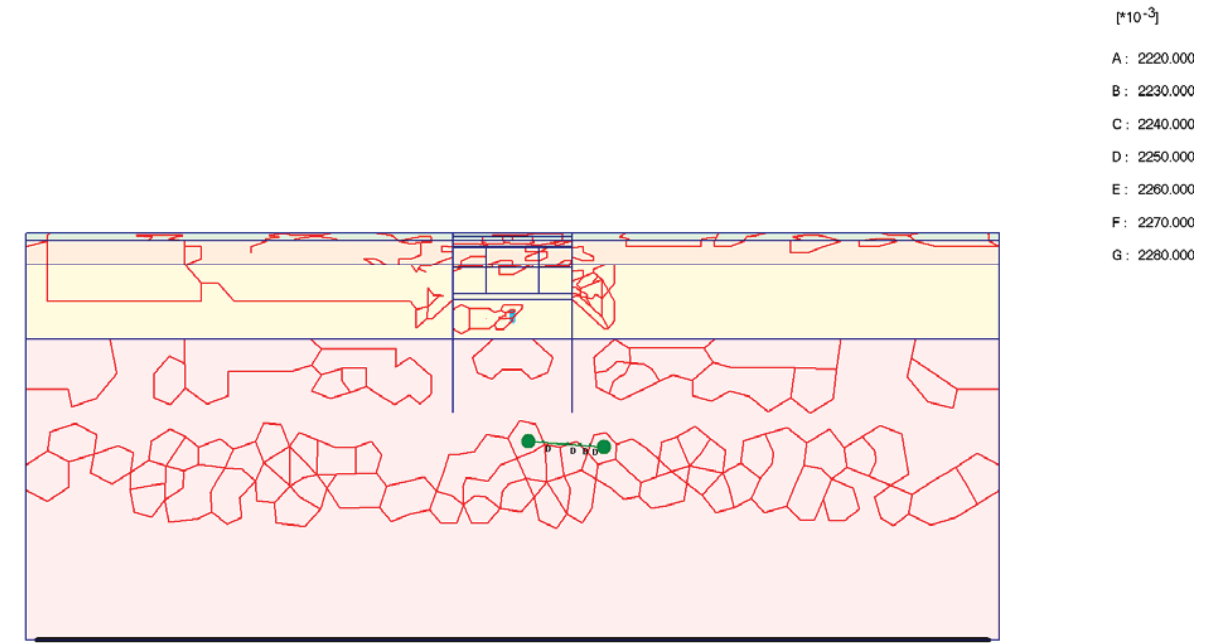


Fig. 49 Plot of groundwater head (contour lines)
- step no: 7 - (phase: 2)

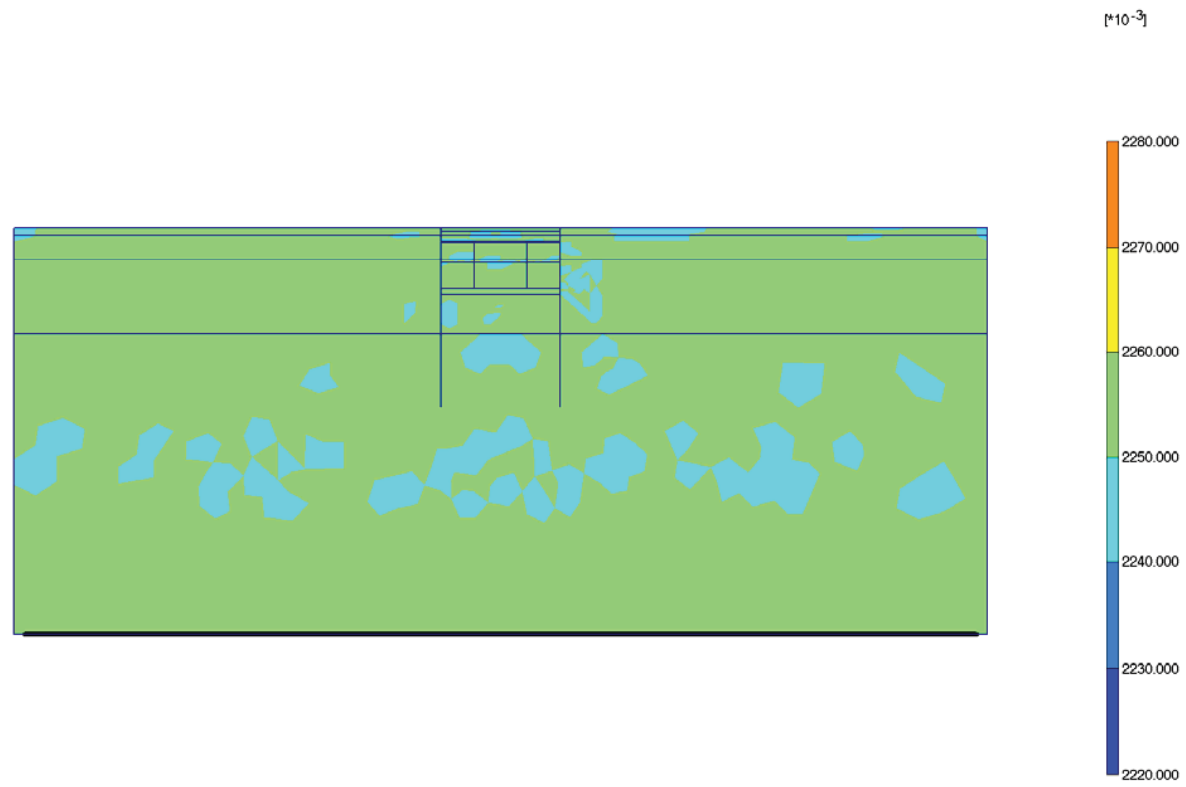


Fig. 50 Plot of groundwater head (shadings)
- step no: 7 - (phase: 2)

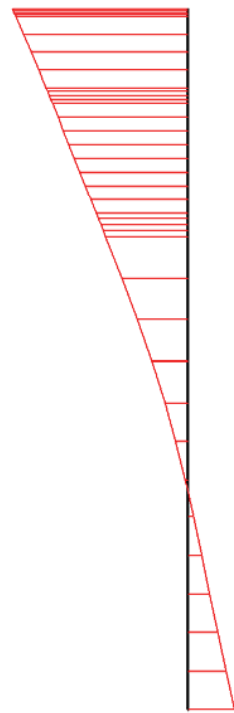


Fig. 51 Horizontal displacements in beam (plate no: 6)
Extreme value $-750,25 * 10^{-6}$ m (phase: 2)

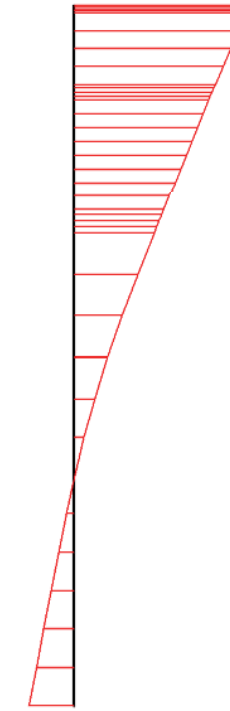


Fig. 52 Horizontal displacements in beam (plate no: 5)
Extreme value $777,65 * 10^{-6}$ m (phase: 2)



Fig. 53 Vertical displacements in beam (plate no: 6)
Extreme value $-7,68 \cdot 10^{-3}$ m (phase: 2)



Fig. 54 Vertical displacements in beam (plate no: 5)
Extreme value $-7,62 \cdot 10^{-3}$ m (phase: 2)

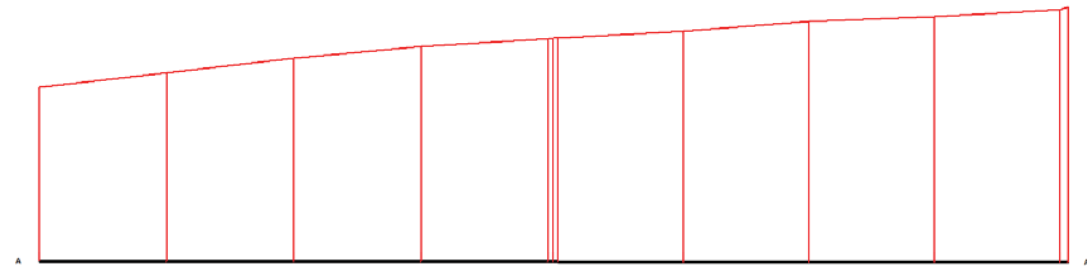


Fig. 55 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $2,04 \cdot 10^{-3}$ m (phase: 2)

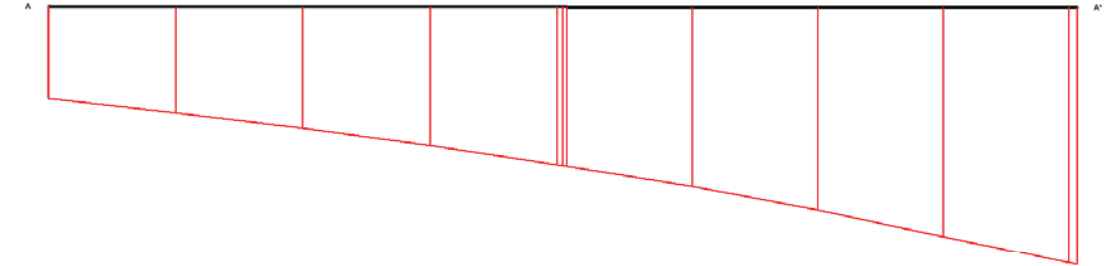


Fig. 56 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-5,42 \cdot 10^{-3}$ m (phase: 2)

10. RESULTS FOR PHASE 3

Table [32] Step info phase no: 3

Step no:	9
Calculation type	PLASTIC
Extrapolation factor	1,065
Relative stiffness	0,811

Table [33] Reached multipliers phase no: 3

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [34] Staged construction info phase no: 3

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,999
Active proportion of stage	0,500	1,000

Table [35] Realised tunnel contraction info phase no: 3

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [36] Iteration info phase no: 3

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,000	281	240	86	0	0	10	10
2	0,000	274	238	33	0	0	10	10
3	0,000	272	237	31	0	0	6	6
4	0,000	270	239	26	0	0	6	6

Table [37] Active distributed loads A phase no: 3

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

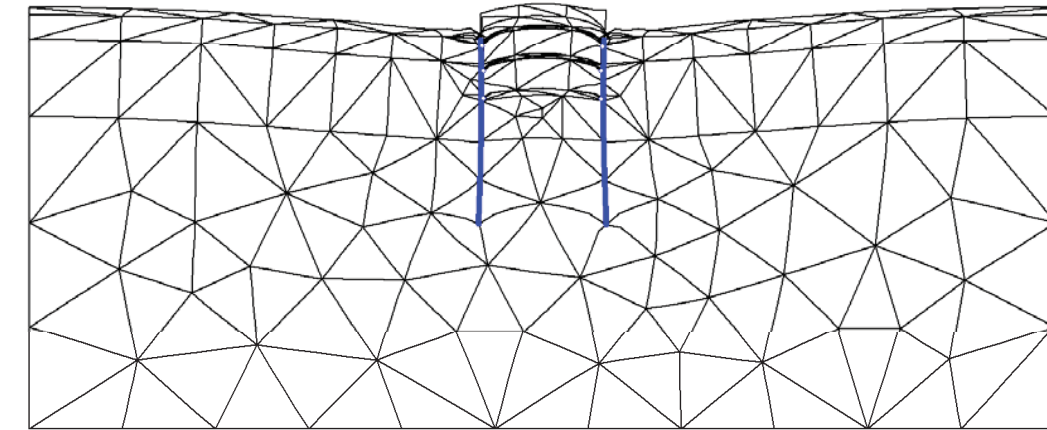


Fig. 57 Plot of deformed mesh - step no: 9 - (phase: 3)

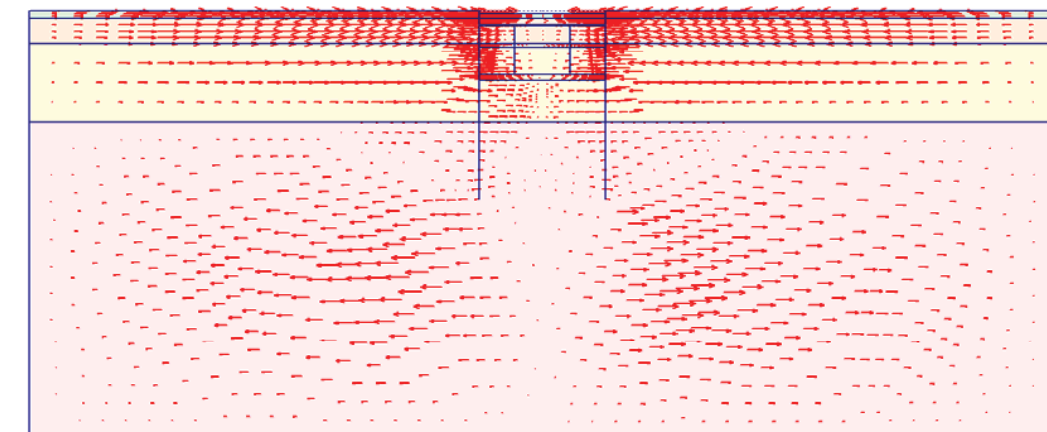
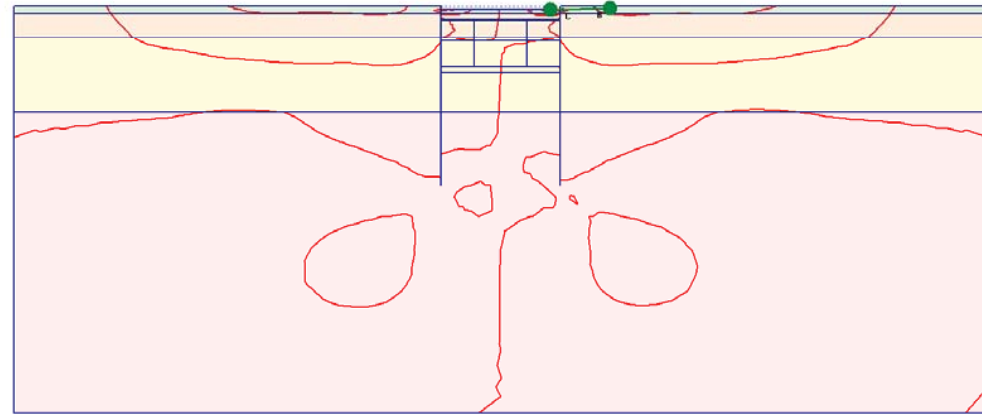
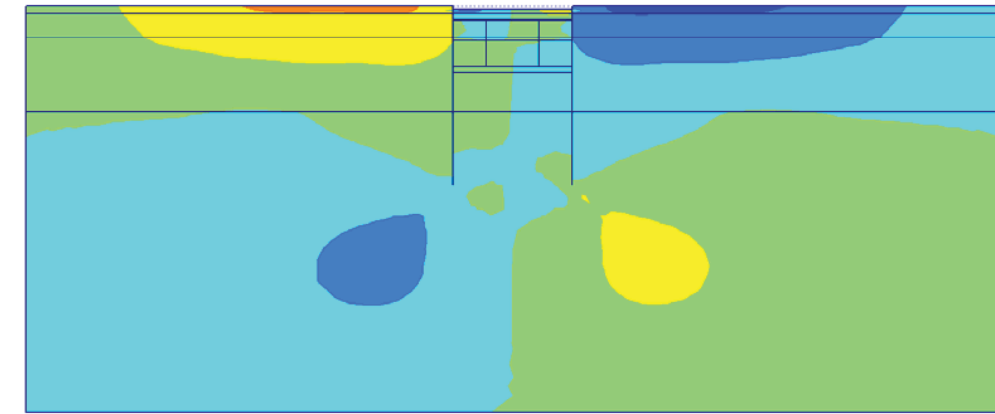


Fig. 58 Plot of horizontal displacements (arrows)
- step no: 9 - (phase: 3)



[*10⁻³]
A: -1.500
B: -1.000
C: -0.500
D: 0.000
E: 0.500
F: 1.000
G: 1.500

Fig. 59 Plot of horizontal displacements (contour lines)
- step no: 9 - (phase: 3)



[*10⁻³]
1.500
1.000
0.500
0.000
-0.500
-1.000
-1.500

Fig. 60 Plot of horizontal displacements (shadings)
- step no: 9 - (phase: 3)

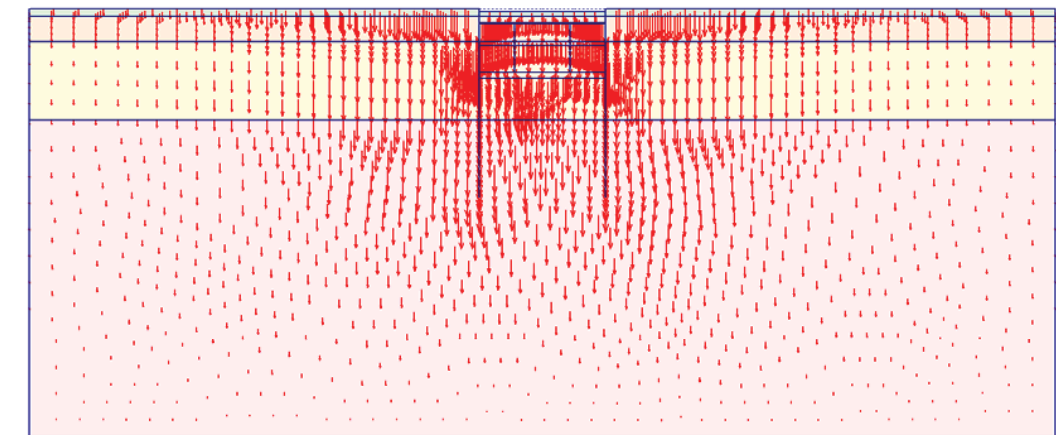
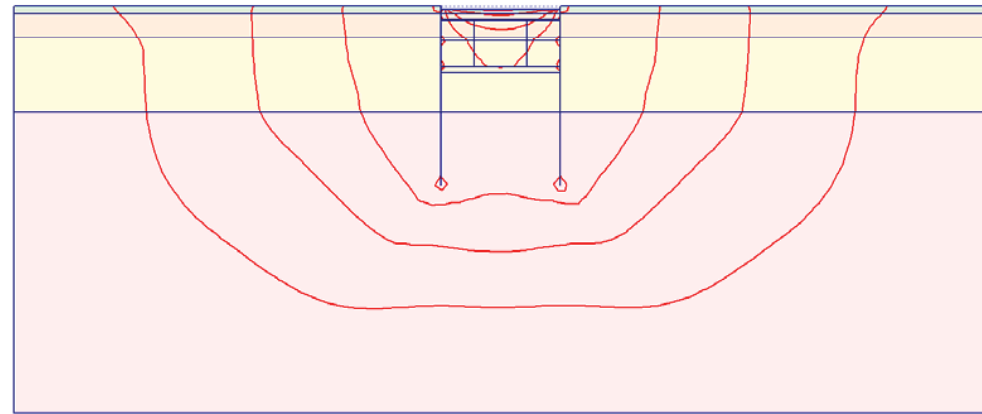


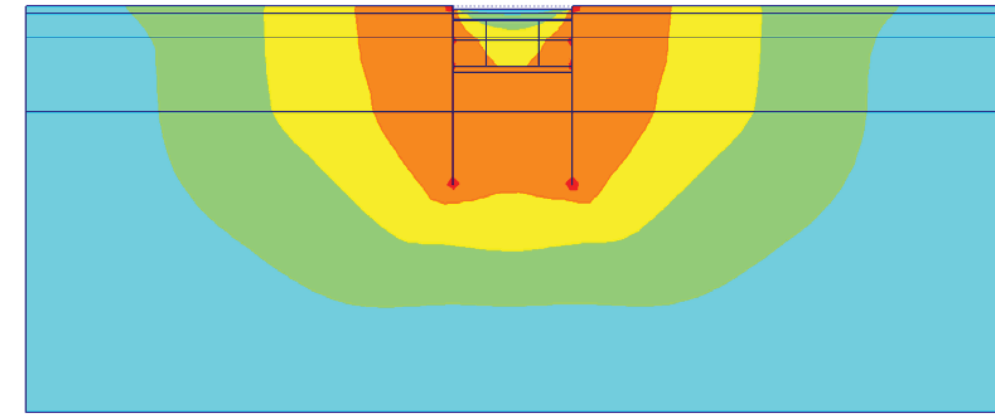
Fig. 61 Plot of vertical displacements (arrows)
- step no: 9 - (phase: 3)



[*10⁻³]
A: -5.000
B: -4.000
C: -3.000
D: -2.000
E: -1.000
F: 0.000
G: 1.000

Fig. 62 Plot of vertical displacements (contour lines)
- step no: 9 - (phase: 3)

Fig. 63 Plot of vertical displacements (shadings)
- step no: 9 - (phase: 3)



[*10⁻³]

1.000
0.000
-1.000
-2.000
-3.000
-4.000
-5.000

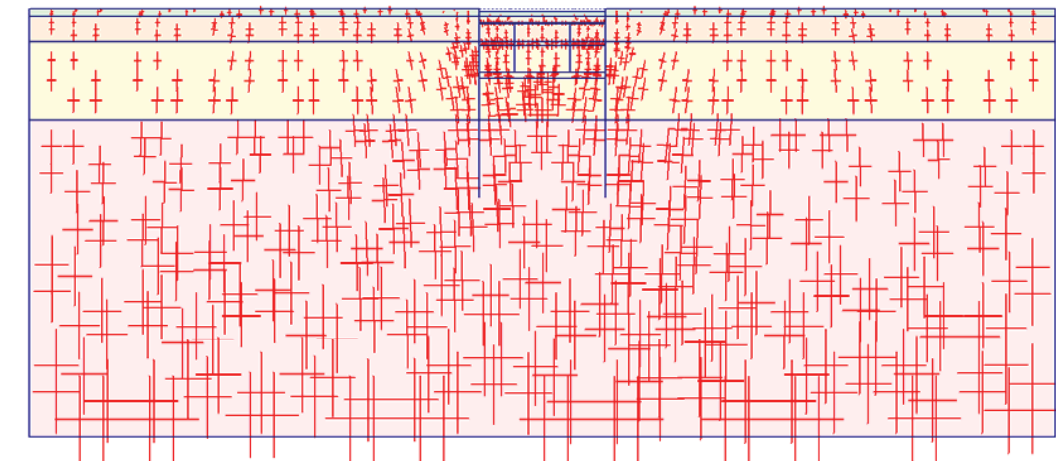
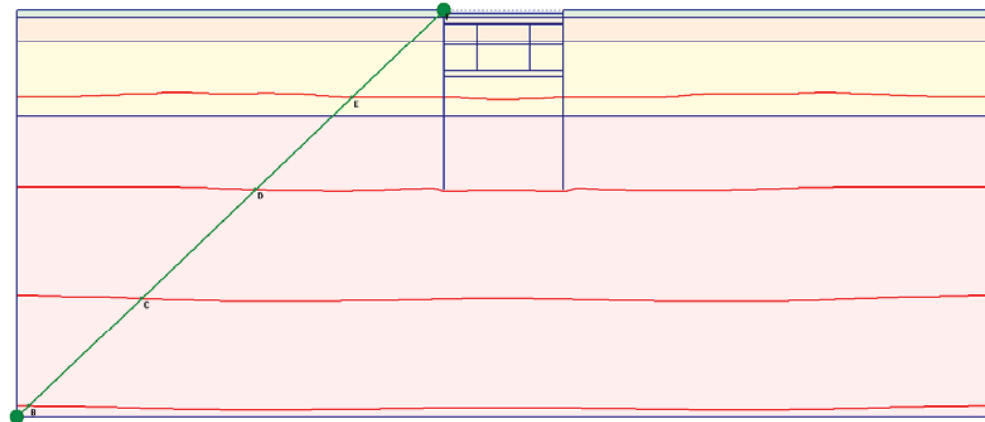


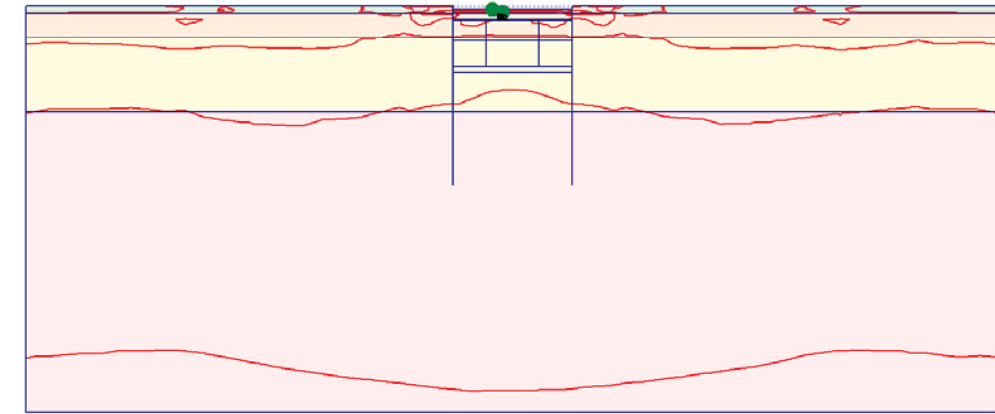
Fig. 64 Plot of effective stresses (principal directions)
- step no: 9 - (phase: 3)



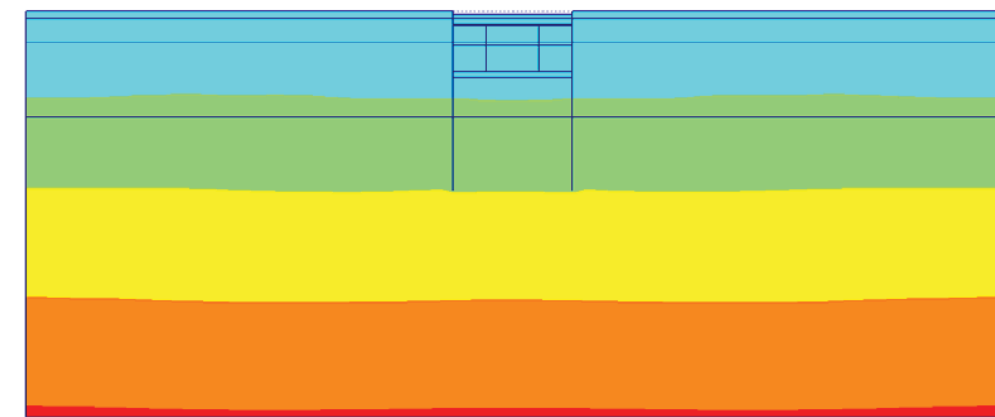
A: -500.000
B: -400.000
C: -300.000
D: -200.000
E: -100.000
F: 0.000
G: 100.000

Fig. 65 Plot of effective stresses (mean contours)
- step no: 9 - (phase: 3)

Fig. 66 Plot of effective stresses (relative shear contours)
- step no: 9 - (phase: 3)



A: 0.000
B: 0.200
C: 0.400
D: 0.600
E: 0.800
F: 1.000
G: 1.200



100.000
0.000
-100.000
-200.000
-300.000
-400.000
-500.000

Fig. 67 Plot of effective stresses (mean shadings)
- step no: 9 - (phase: 3)

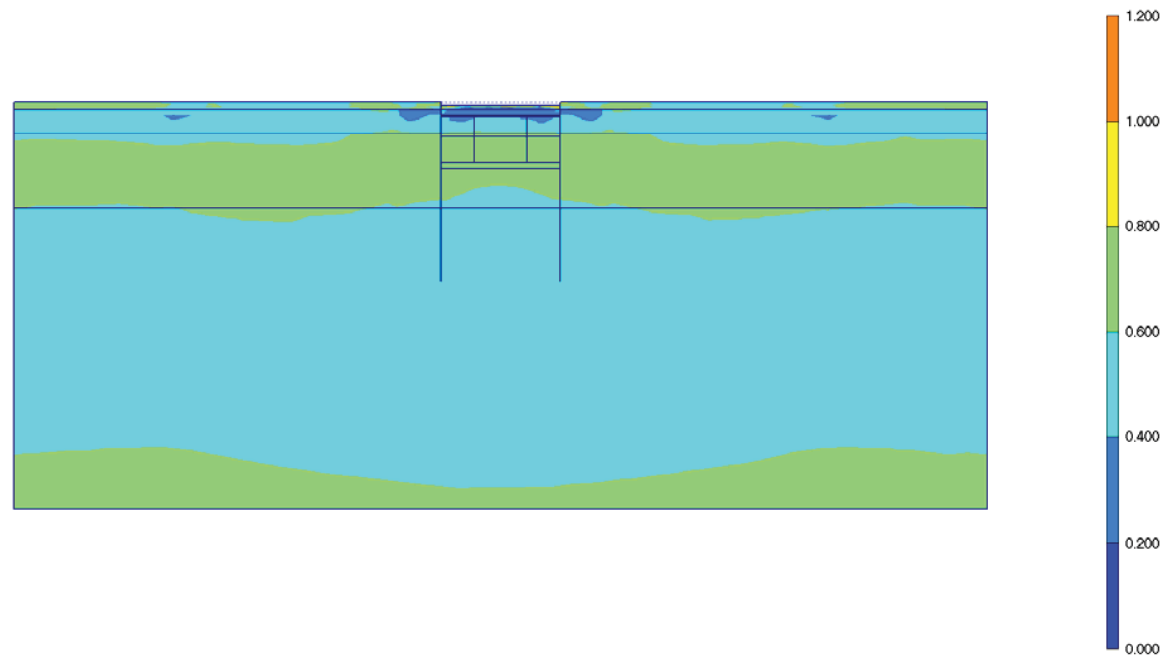


Fig. 68 Plot of effective stresses (relative shear shadings)
- step no: 9 - (phase: 3)

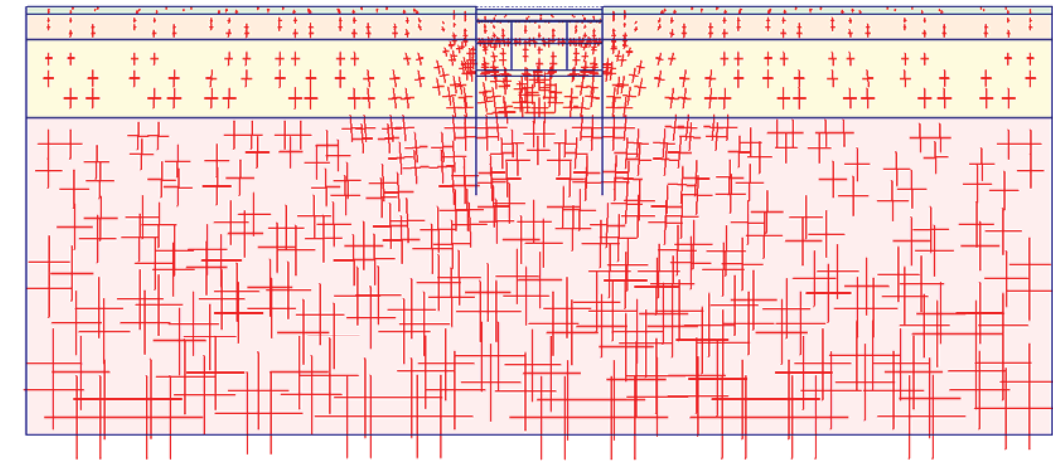


Fig. 69 Plot of total stresses (principal directions)
- step no: 9 - (phase: 3)

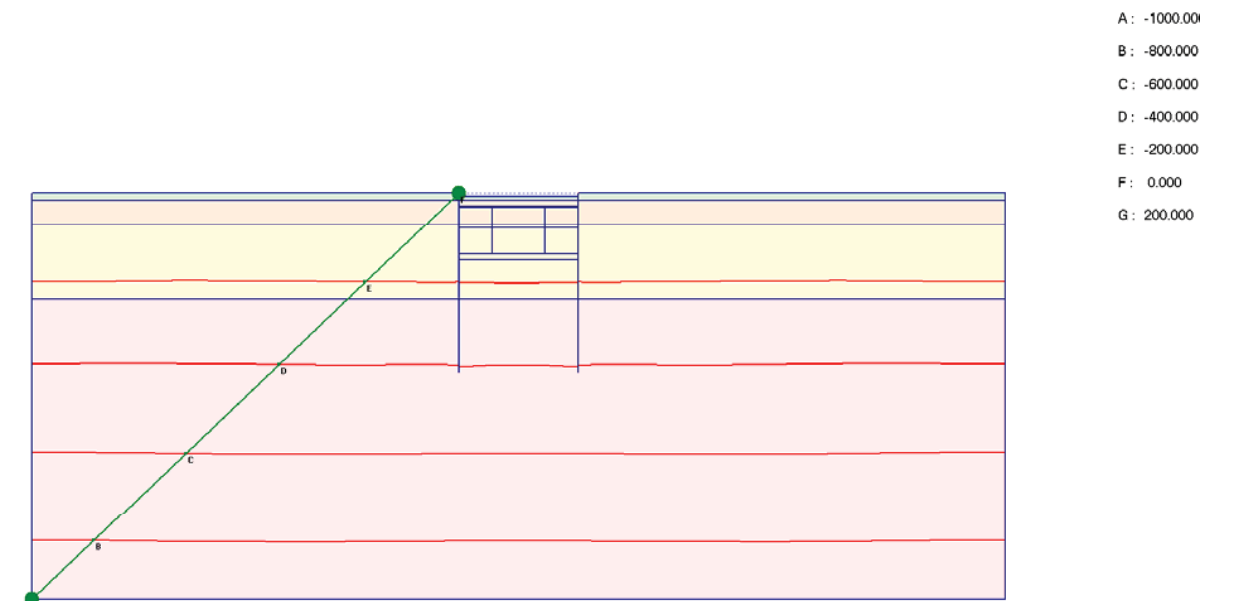
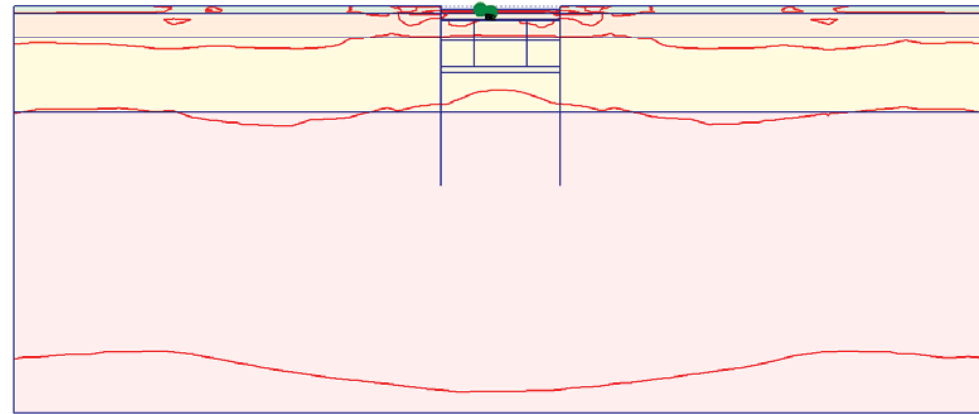


Fig. 70 Plot of total stresses (mean contours)
- step no: 9 - (phase: 3)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 71 Plot of total stresses (relative shear contours)
- step no: 9 - (phase: 3)

Fig. 72 Plot of total stresses (mean shadings)
- step no: 9 - (phase: 3)

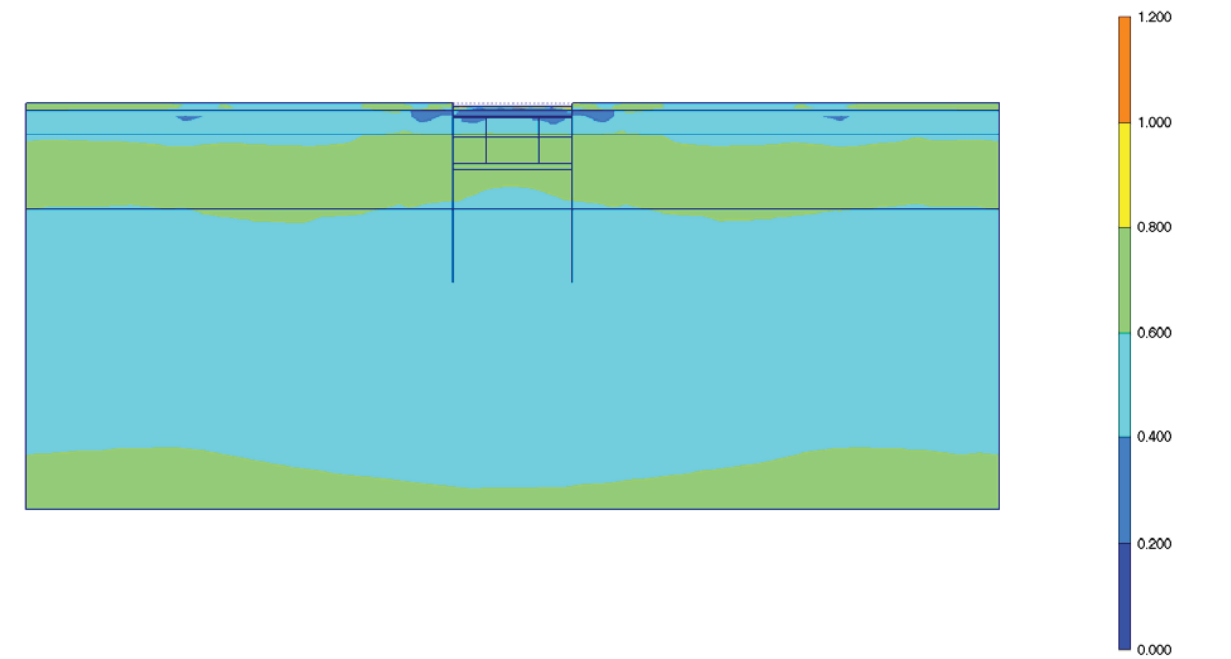
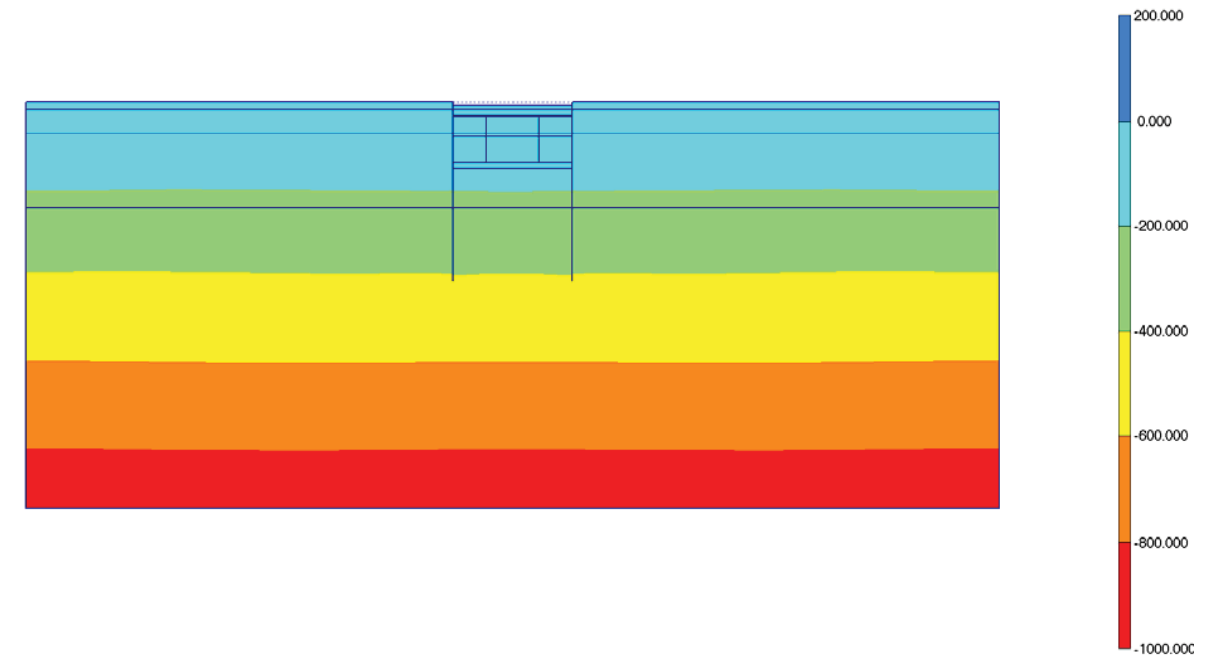
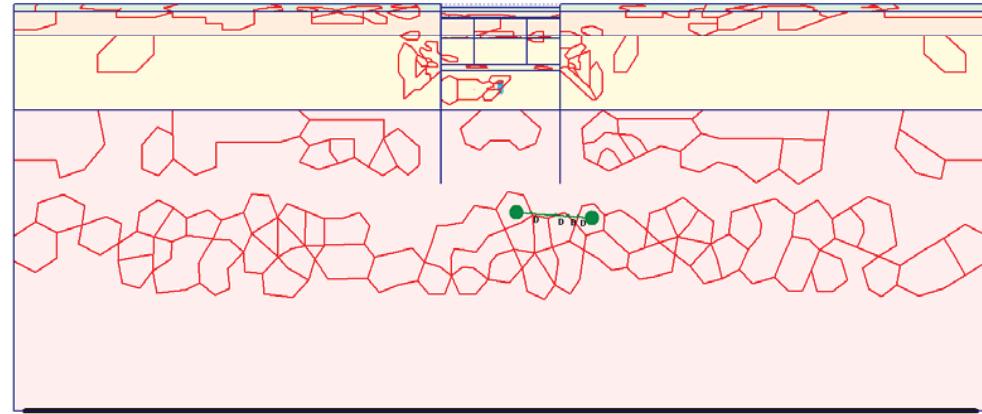


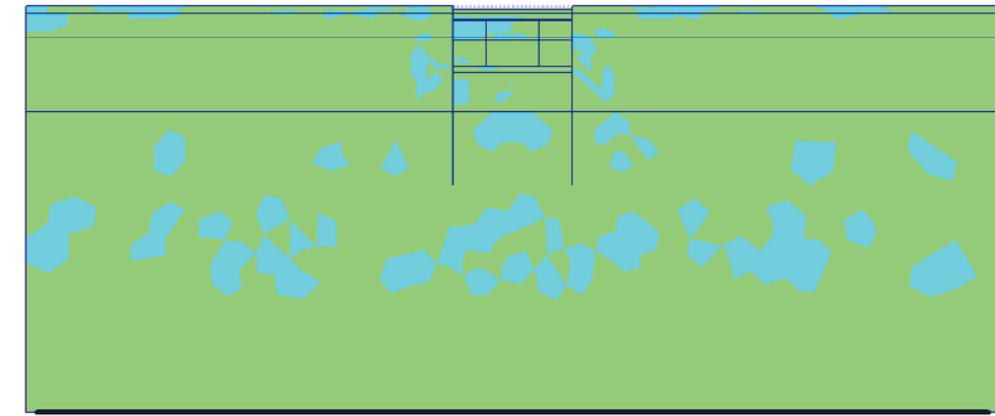
Fig. 73 Plot of total stresses (relative shear shadings)
- step no: 9 - (phase: 3)



[*10⁻³]
A: 2220.000
B: 2230.000
C: 2240.000
D: 2250.000
E: 2260.000
F: 2270.000
G: 2280.000

Fig. 74 Plot of groundwater head (contour lines)
- step no: 9 - (phase: 3)

Fig. 75 Plot of groundwater head (shadings)
- step no: 9 - (phase: 3)



[*10⁻³]
2280.000
2270.000
2260.000
2250.000
2240.000
2230.000
2220.000

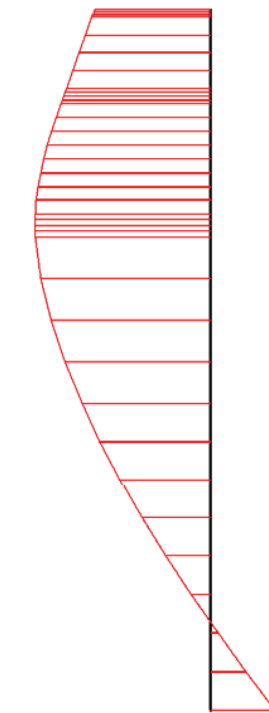


Fig. 76 Horizontal displacements in beam (plate no: 6)
Extreme value $-297,49 \cdot 10^{-6}$ m (phase: 3)

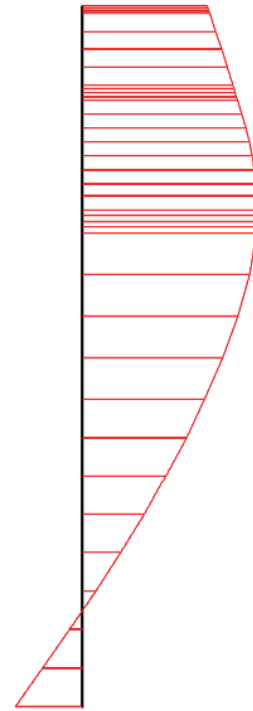


Fig. 77 Horizontal displacements in beam (plate no: 5)
Extreme value $302,16 \cdot 10^{-6}$ m (phase: 3)



Fig. 78 Vertical displacements in beam (plate no: 6)
Extreme value $-4,48 \cdot 10^{-3}$ m (phase: 3)



Fig. 79 Vertical displacements in beam (plate no: 5)
Extreme value $-4,41 \cdot 10^{-3}$ m (phase: 3)

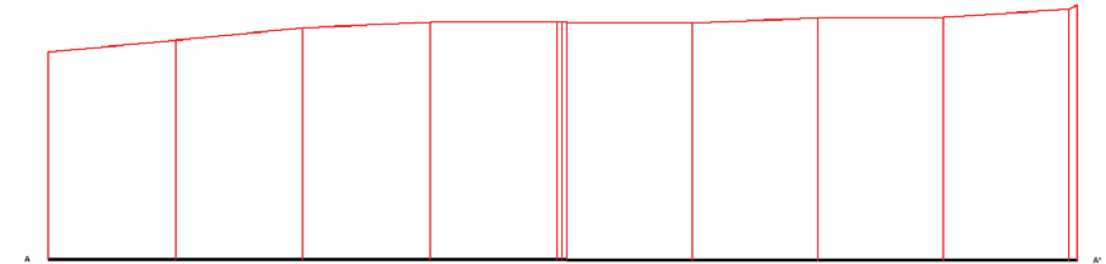


Fig. 80 Horizontal displacements in cross section (cross section A - A*)
Extreme value $1,15 \cdot 10^{-3}$ m (phase: 3)

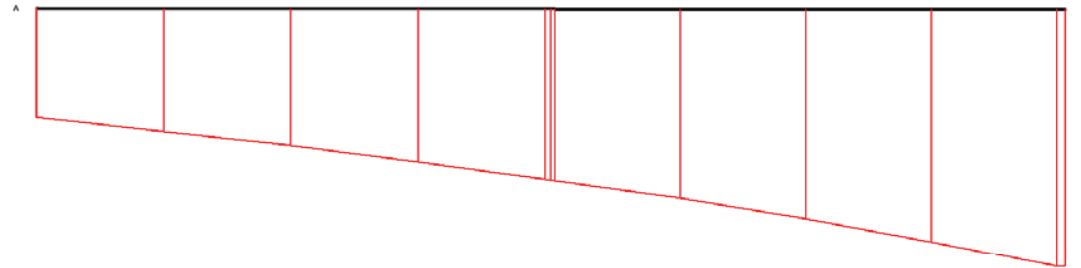


Fig. 81 Vertical displacements in cross section (cross section A - A*)
Extreme value $-3,65 \cdot 10^{-3}$ m (phase: 3)

11. RESULTS FOR PHASE 4

Table [38] Step info phase no: 4

Step no:	12
Calculation type	PLASTIC
Extrapolation factor	0,275
Relative stiffness	0,431

Table [39] Reached multipliers phase no: 4

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [40] Staged construction info phase no: 4

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,995
Active proportion of stage	0,111	1,000

Table [41] Realised tunnel contraction info phase no: 4

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [42] Iteration info phase no: 4

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,003	1087	1102	166	44	44	2	2
2	0,002	1077	1076	78	44	8	2	2
3	0,002	1059	1065	75	44	5	2	2

Table [43] Active distributed loads A phase no: 4

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

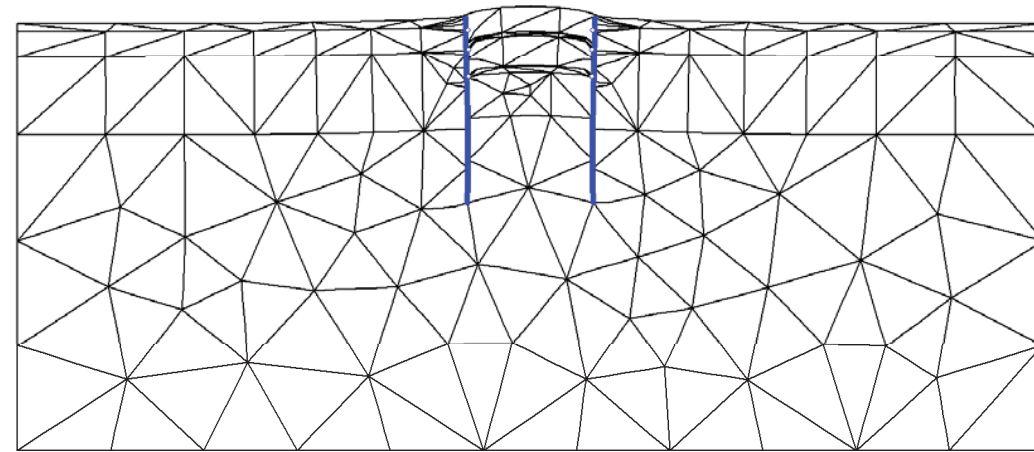


Fig. 82 Plot of deformed mesh
- step no: 12 - (phase: 4)

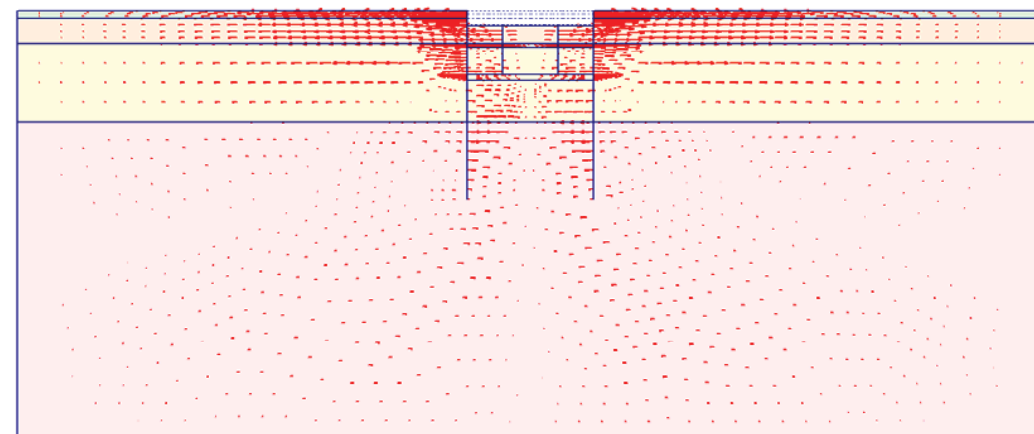


Fig. 83 Plot of horizontal displacements (arrows)
- step no: 12 - (phase: 4)

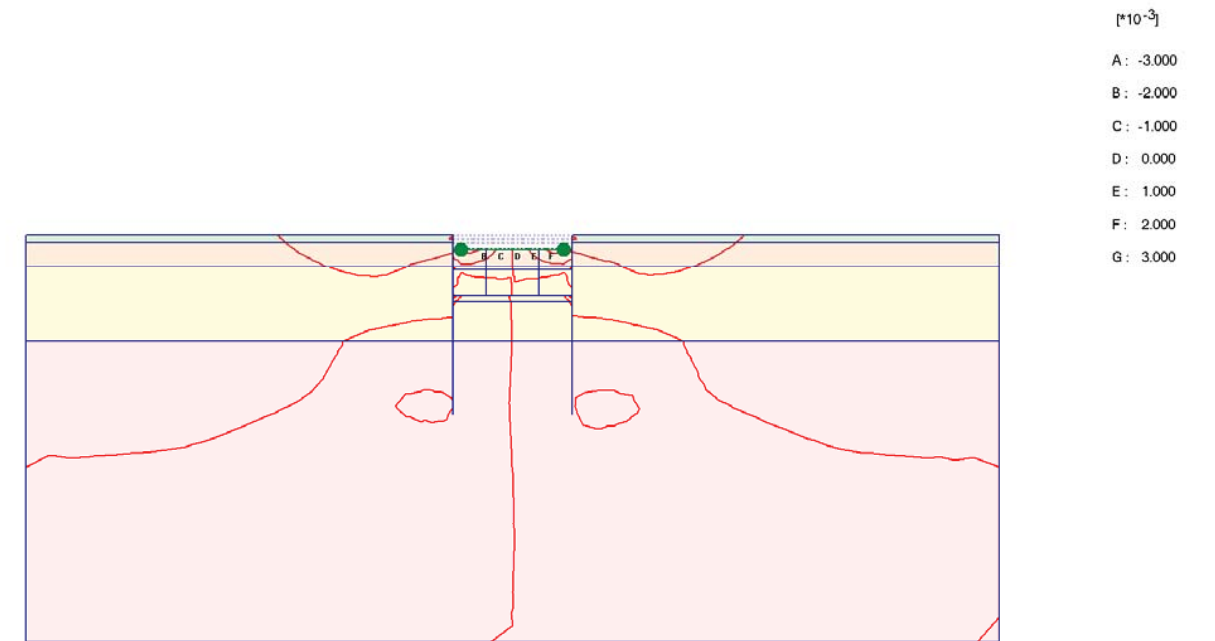


Fig. 84 Plot of horizontal displacements (contour lines)
- step no: 12 - (phase: 4)

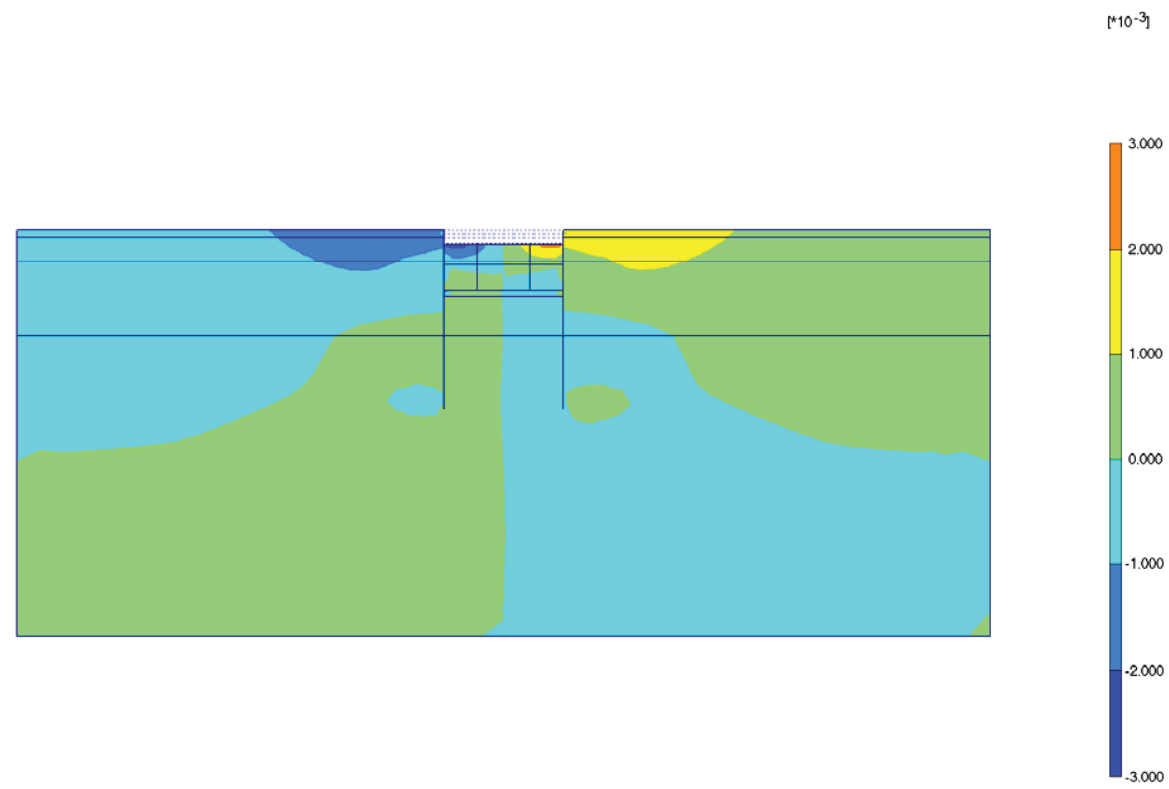


Fig. 85 Plot of horizontal displacements (shadings)
- step no: 12 - (phase: 4)

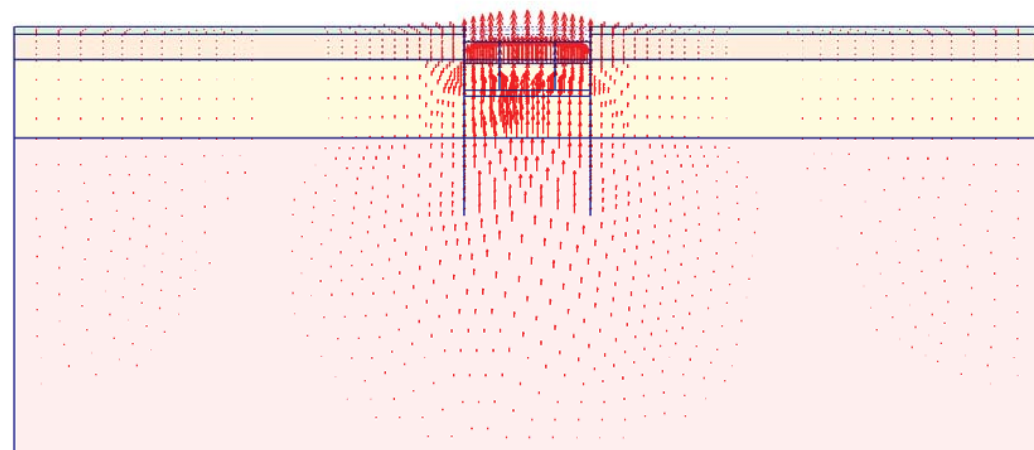


Fig. 86 Plot of vertical displacements (arrows)
- step no: 12 - (phase: 4)

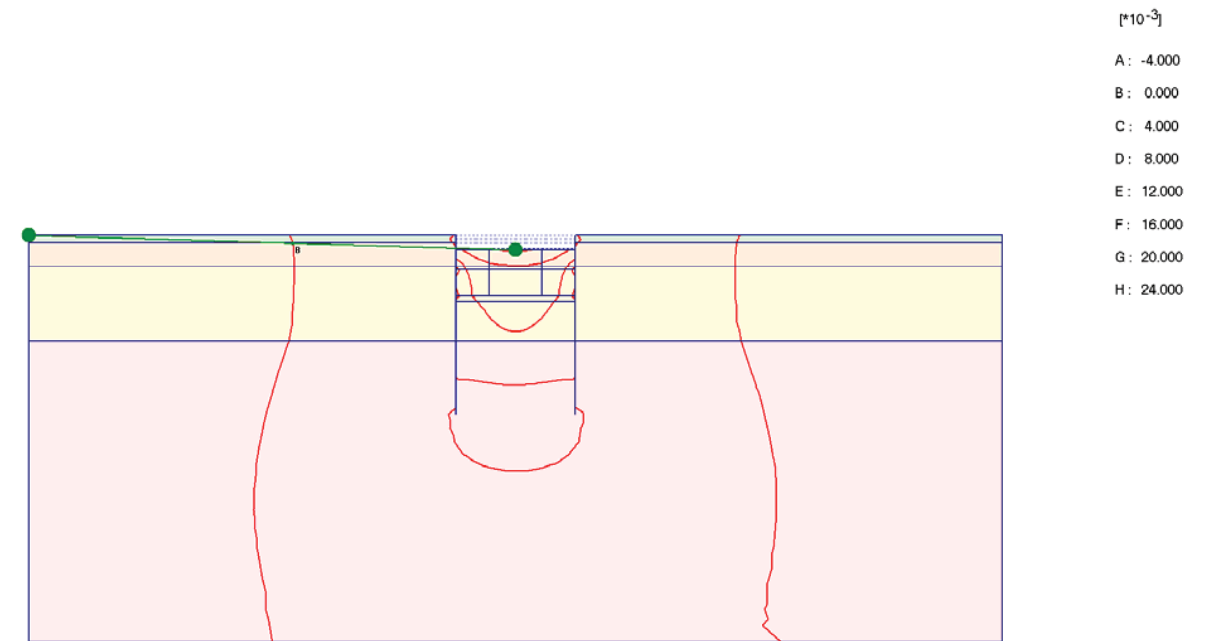


Fig. 87 Plot of vertical displacements (contour lines)
- step no: 12 - (phase: 4)



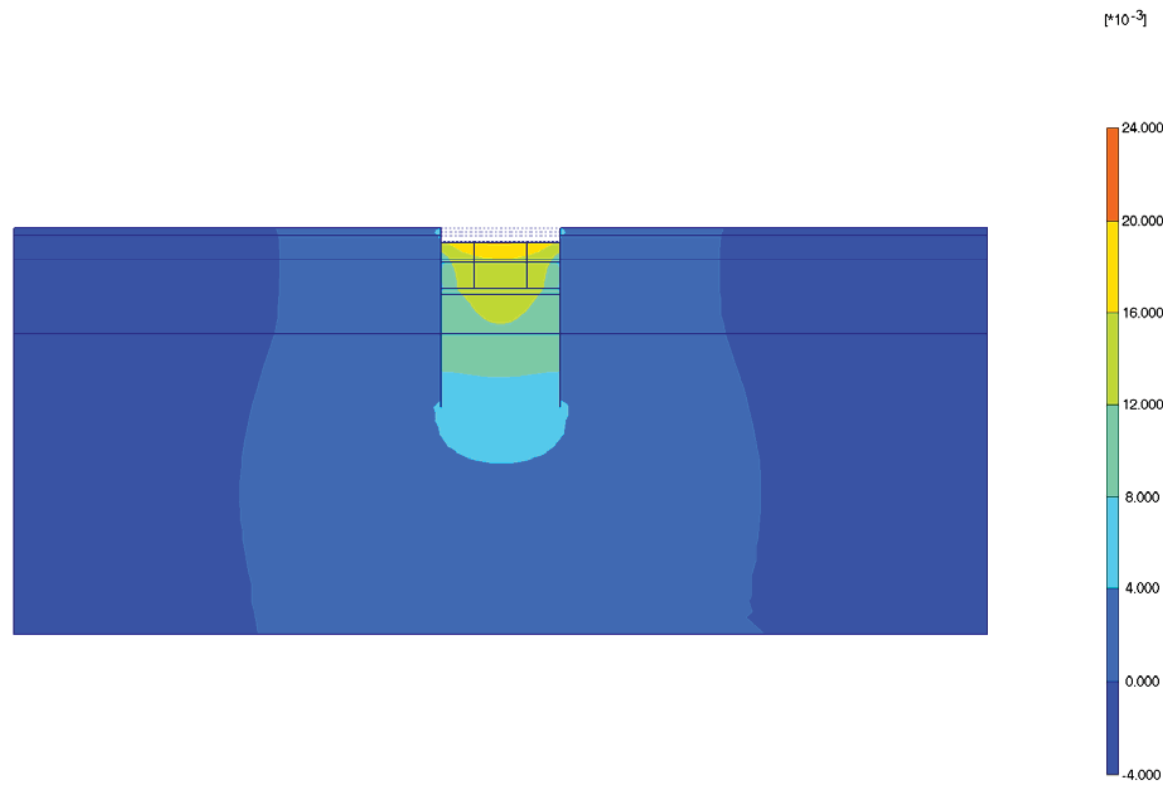


Fig. 88 Plot of vertical displacements (shadings)
- step no: 12 - (phase: 4)

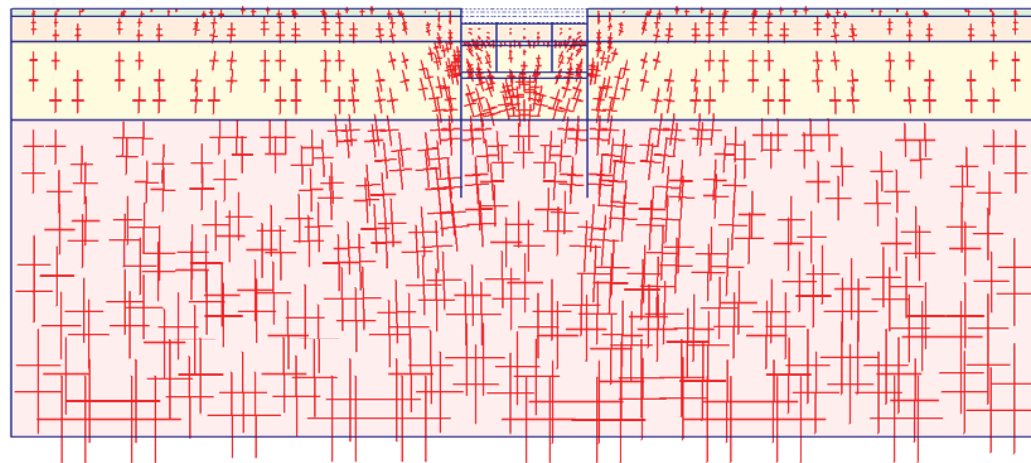


Fig. 89 Plot of effective stresses (principal directions)
- step no: 12 - (phase: 4)

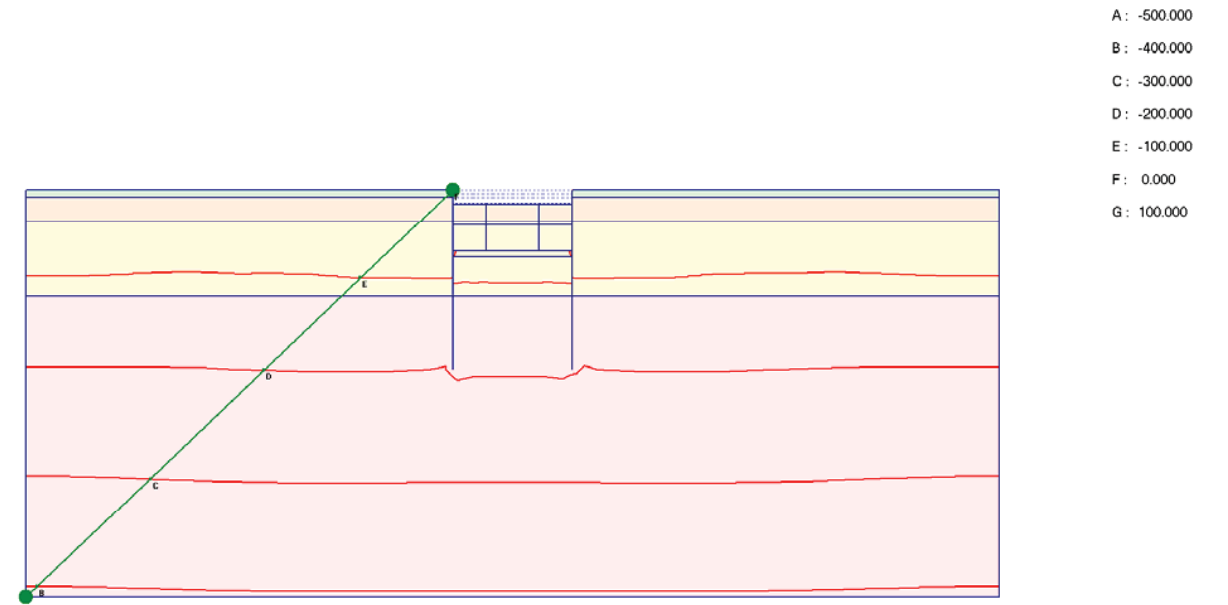
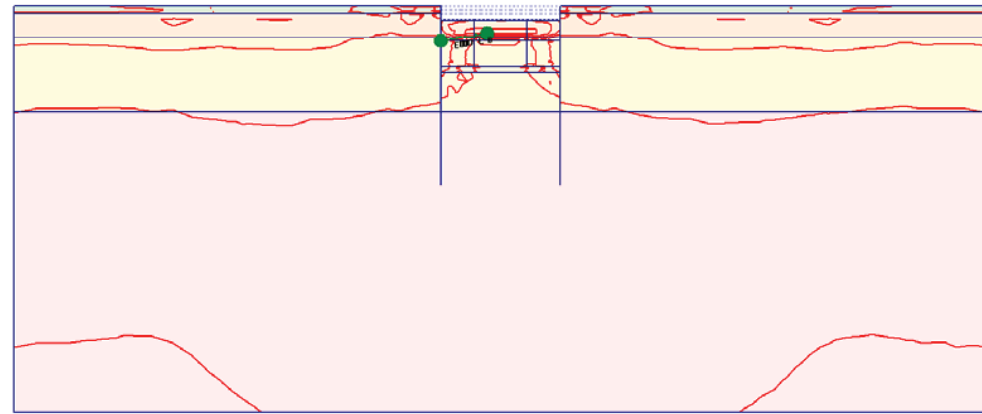
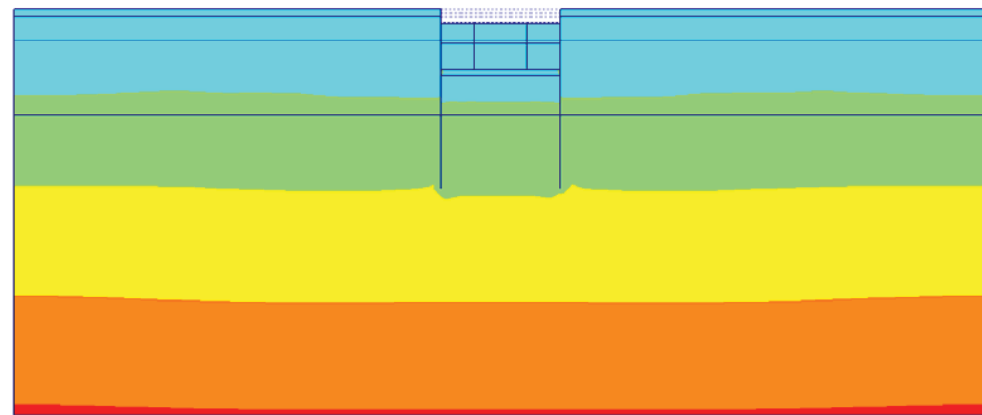


Fig. 90 Plot of effective stresses (mean contours)
- step no: 12 - (phase: 4)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 91 Plot of effective stresses (relative shear contours)
- step no: 12 - (phase: 4)



- 100.000
- 0.000
- 100.000
- 200.000
- 300.000
- 400.000
- 500.000

Fig. 92 Plot of effective stresses (mean shadings)
- step no: 12 - (phase: 4)

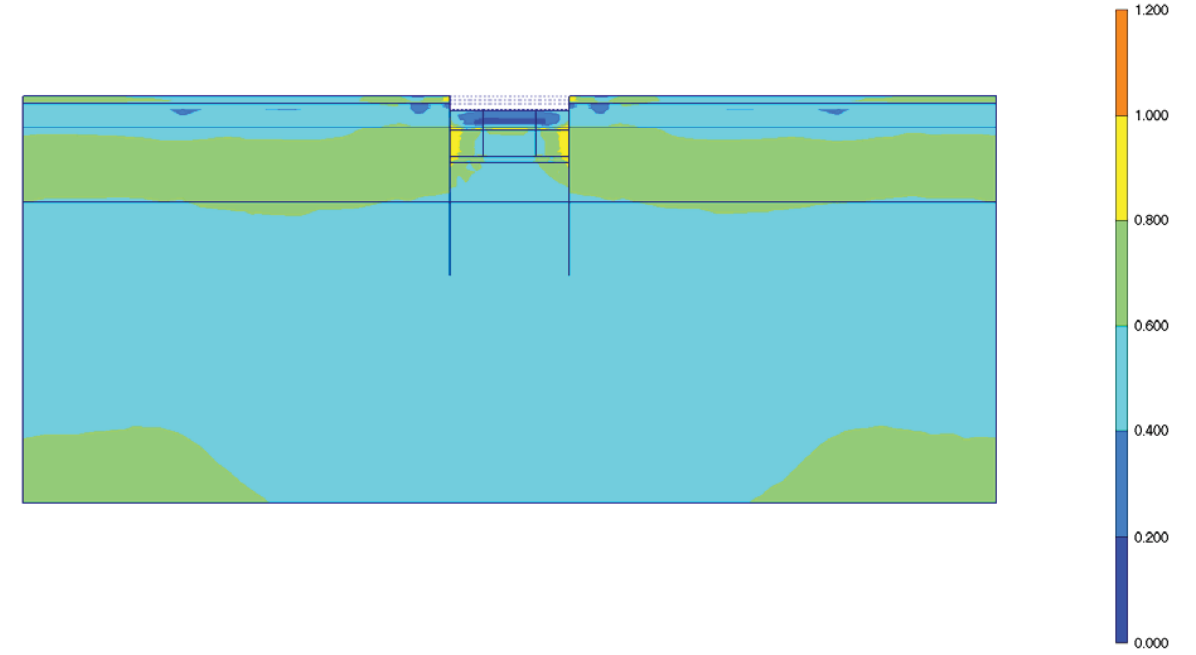


Fig. 93 Plot of effective stresses (relative shear shadings)
- step no: 12 - (phase: 4)

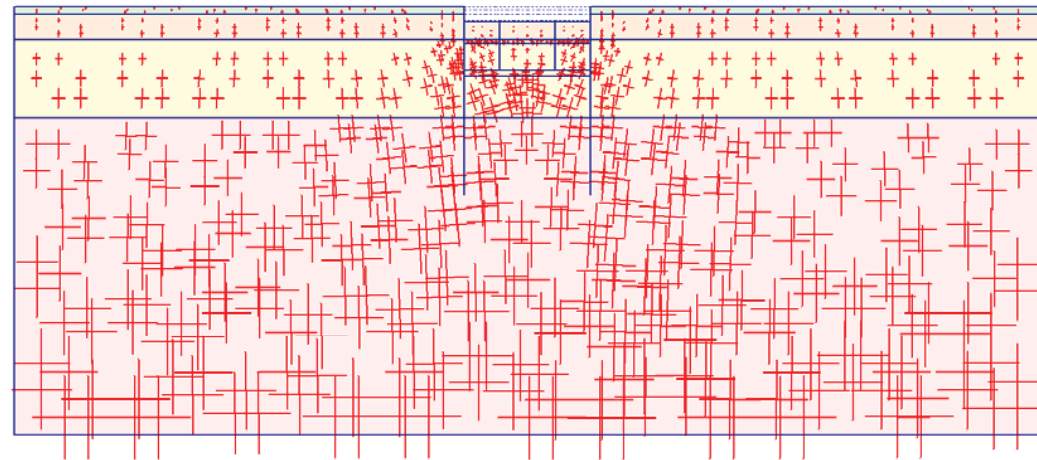


Fig. 94 Plot of total stresses (principal directions) - step no: 12 - (phase: 4)

- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

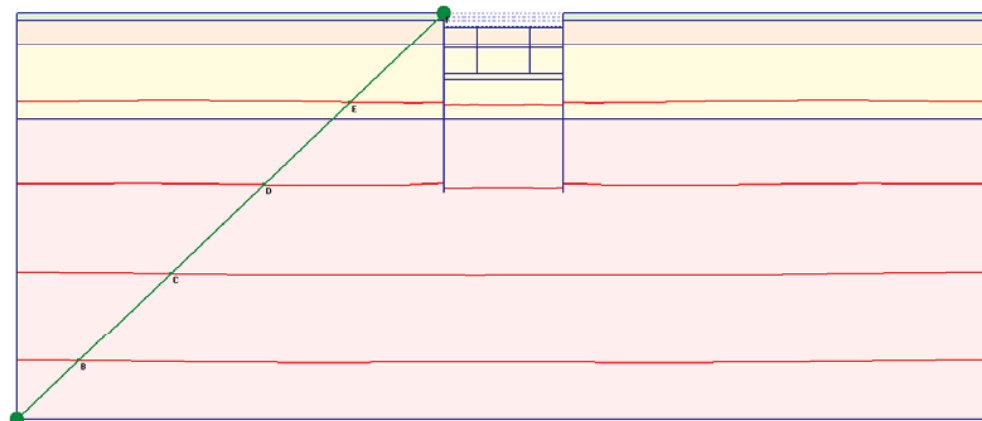


Fig. 95 Plot of total stresses (mean contours) - step no: 12 - (phase: 4)

- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

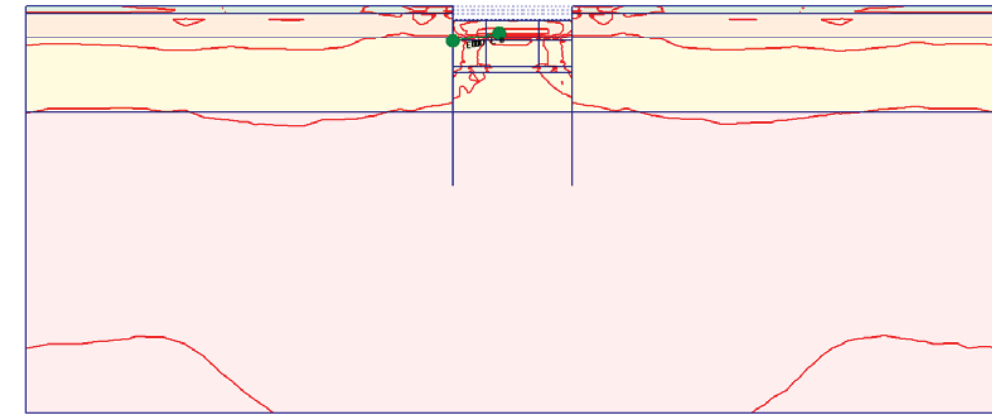


Fig. 96 Plot of total stresses (relative shear contours) - step no: 12 - (phase: 4)

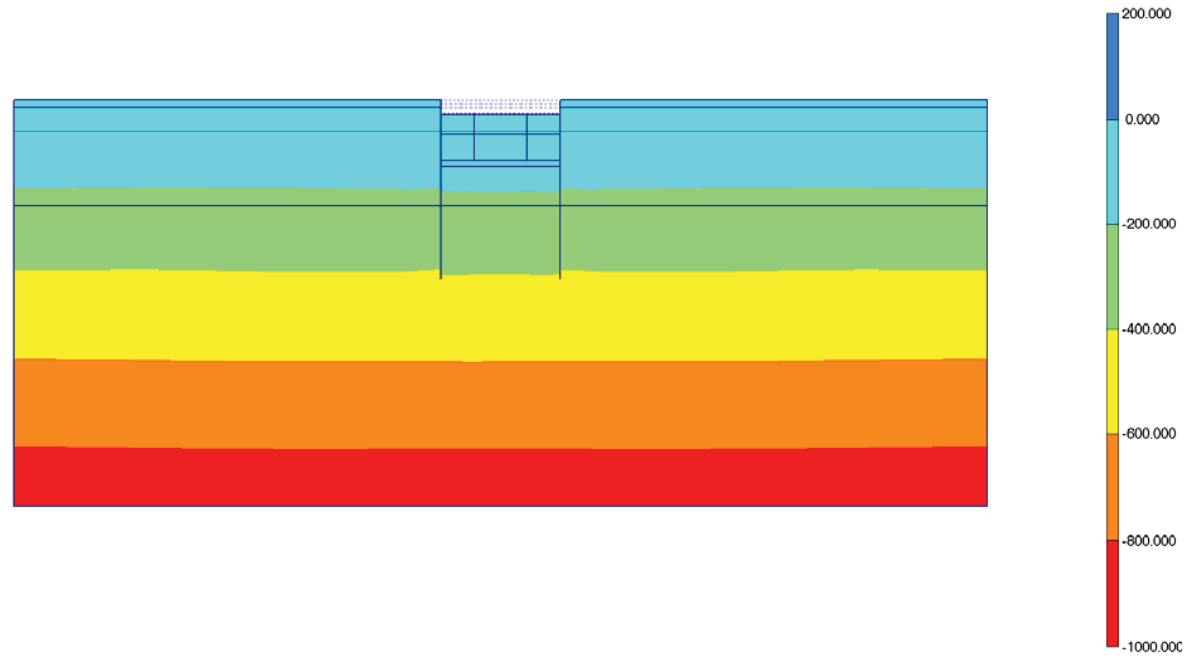


Fig. 97 Plot of total stresses (mean shadings)
- step no: 12 - (phase: 4)

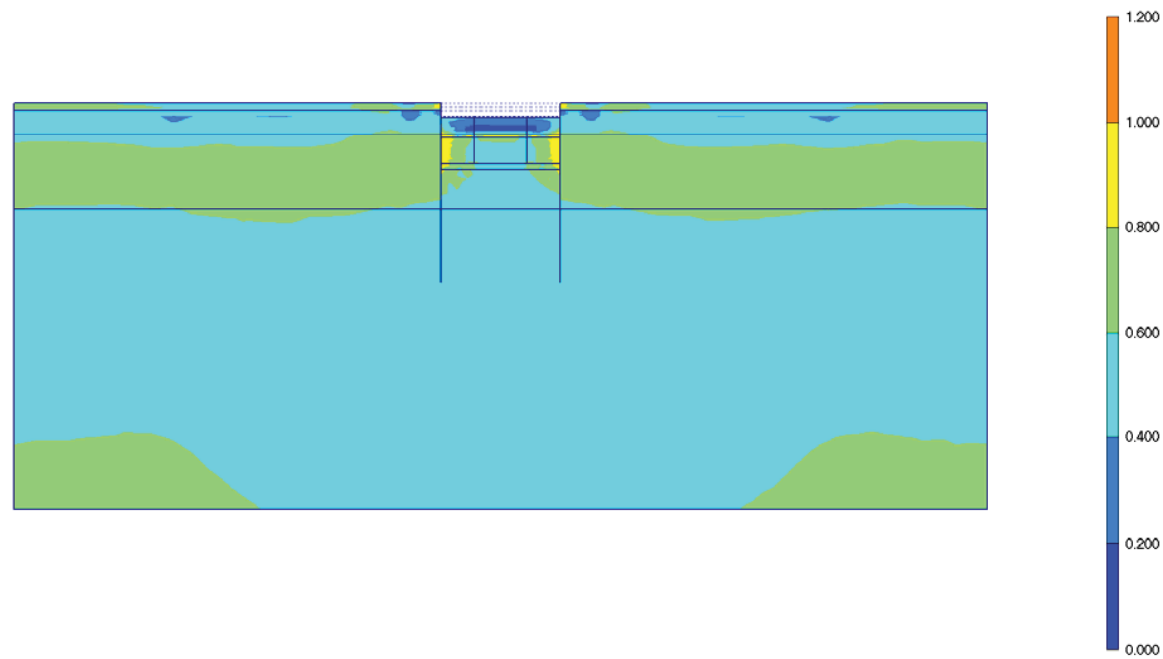


Fig. 98 Plot of total stresses (relative shear shadings)
- step no: 12 - (phase: 4)

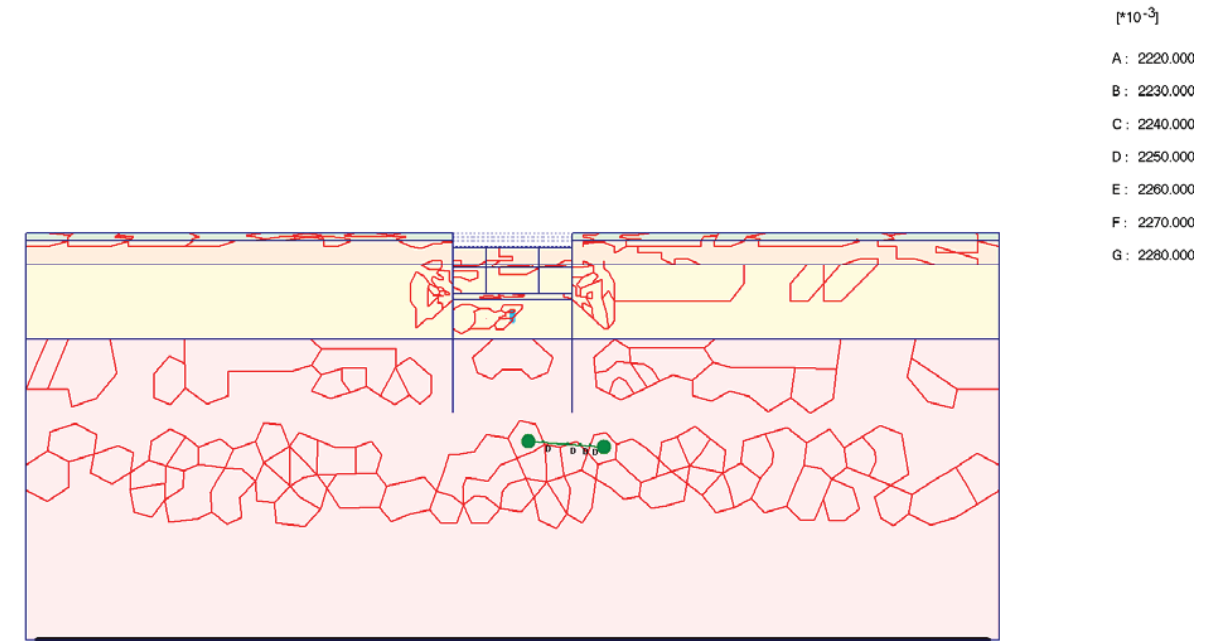


Fig. 99 Plot of groundwater head (contour lines)
- step no: 12 - (phase: 4)

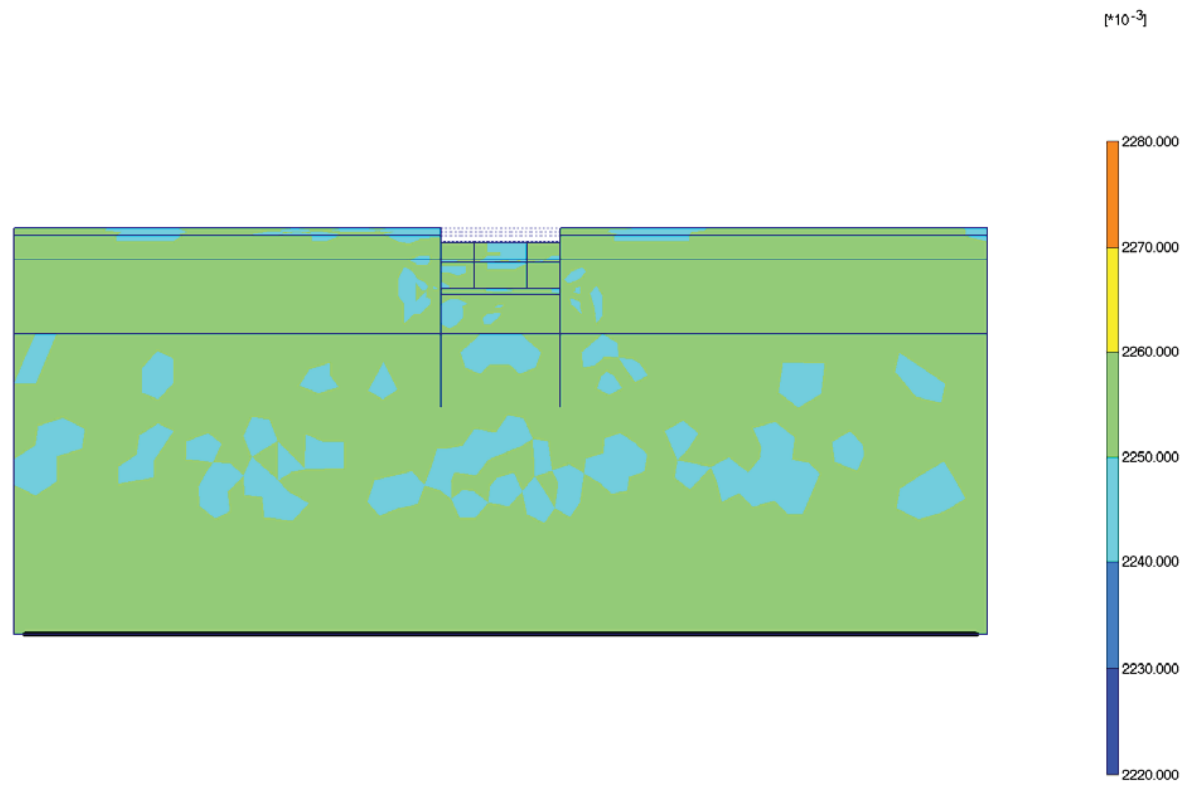


Fig. 100 Plot of groundwater head (shadings)
- step no: 12 - (phase: 4)

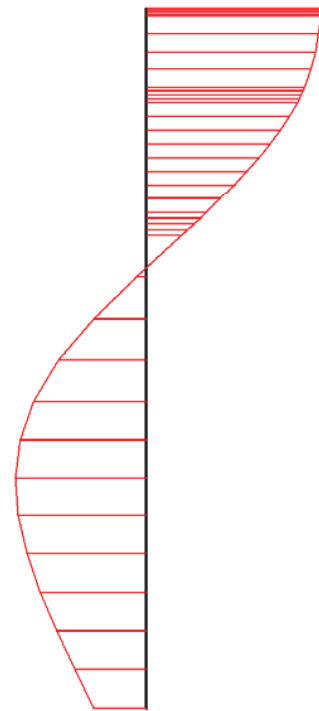


Fig. 101 Horizontal displacements in beam (plate no: 6)
Extreme value $689,15*10^{-6}$ m (phase: 4)

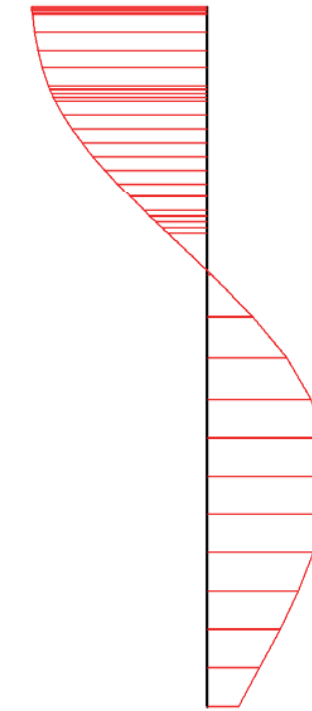


Fig. 102 Horizontal displacements in beam (plate no: 5)
Extreme value $-707,92*10^{-6}$ m (phase: 4)

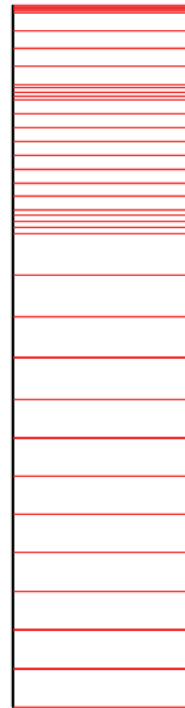


Fig. 103 Vertical displacements in beam (plate no: 6)
Extreme value $5,27 \cdot 10^{-3}$ m (phase: 4)

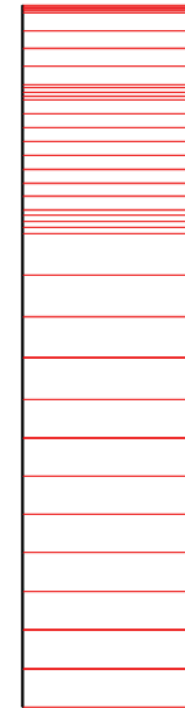


Fig. 104 Vertical displacements in beam (plate no: 5)
Extreme value $5,31 \cdot 10^{-3}$ m (phase: 4)

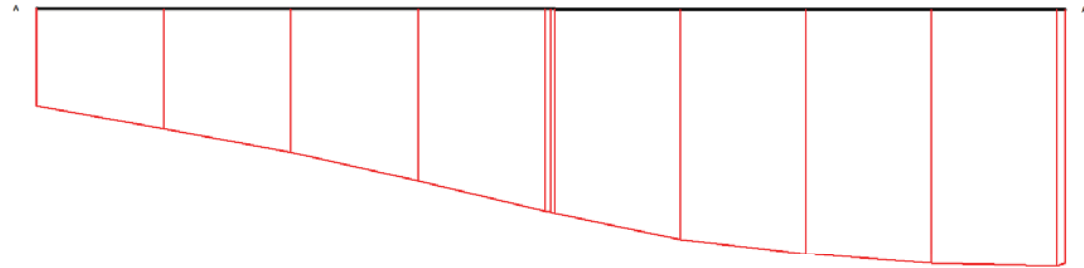


Fig. 105 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $-1,55 \cdot 10^{-3}$ m (phase: 4)

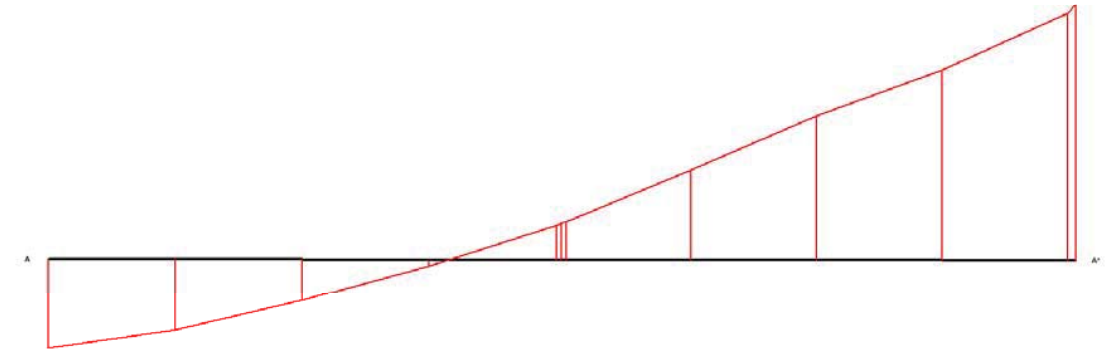


Fig. 106 Vertical displacements in cross section (cross section A - A*)
 Extreme value $1,35 \cdot 10^{-3}$ m (phase: 4)

12. RESULTS FOR PHASE 5

Table [44] Step info phase no: 5

Step no:	15
Calculation type	PLASTIC
Extrapolation factor	2,000
Relative stiffness	0,704

Table [45] Reached multipliers phase no: 5

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [46] Staged construction info phase no: 5

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,995
Active proportion of stage	0,500	1,000

Table [47] Realised tunnel contraction info phase no: 5

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [48] Iteration info phase no: 5

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,001	468	585	227	34	34	2	2
2	0,001	481	590	53	34	0	2	2
3	0,001	485	591	53	34	0	2	2
4	0,001	486	589	46	34	0	2	2
5	0,002	725	791	245	34	34	2	2
6	0,001	751	796	64	34	0	2	2

Table [49] Active distributed loads A phase no: 5

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

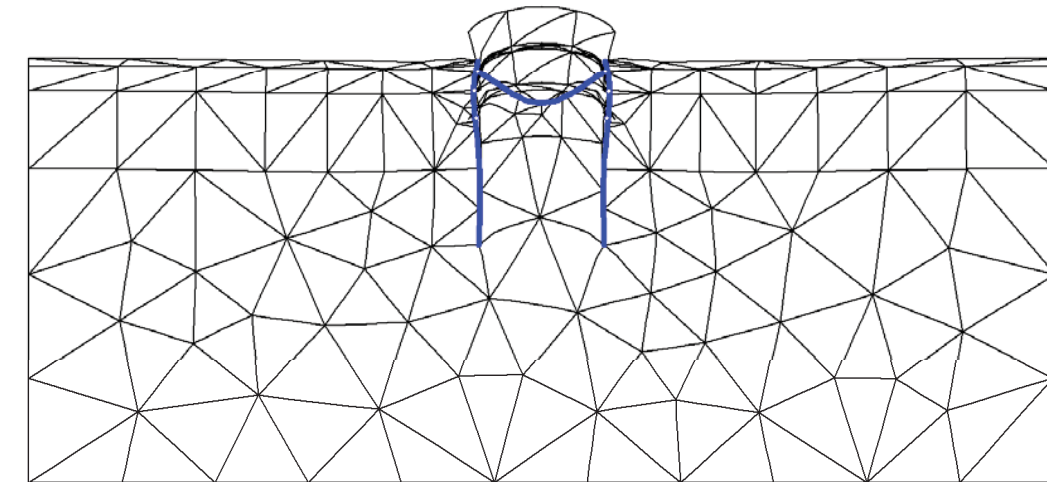


Fig. 107 Plot of deformed mesh - step no: 15 - (phase: 5)

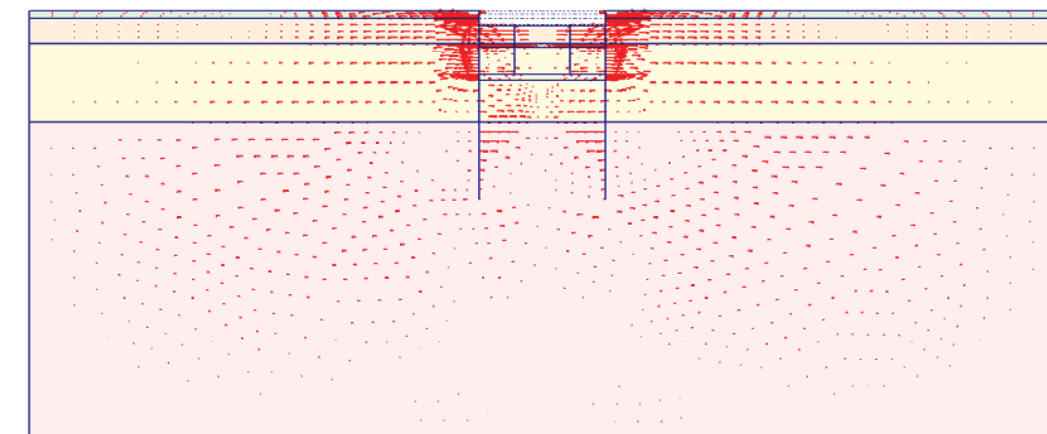
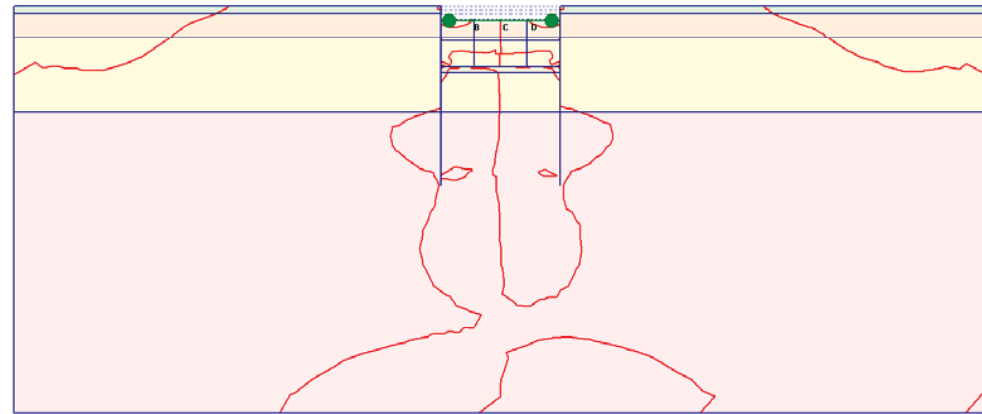


Fig. 108 Plot of horizontal displacements (arrows)
- step no: 15 - (phase: 5)



[*10⁻³]
A: -4.000
B: -2.000
C: 0.000
D: 2.000
E: 4.000

Fig. 109 Plot of horizontal displacements (contour lines)
- step no: 15 - (phase: 5)

[*10⁻³]

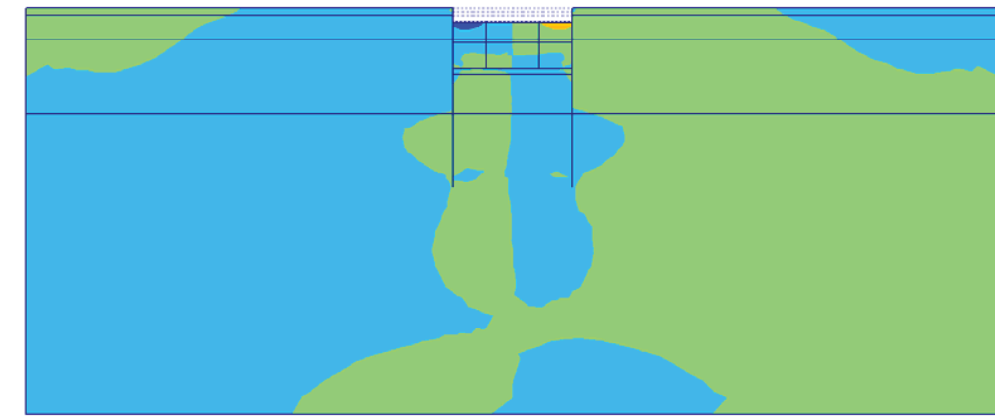


Fig. 110 Plot of horizontal displacements (shadings)
- step no: 15 - (phase: 5)

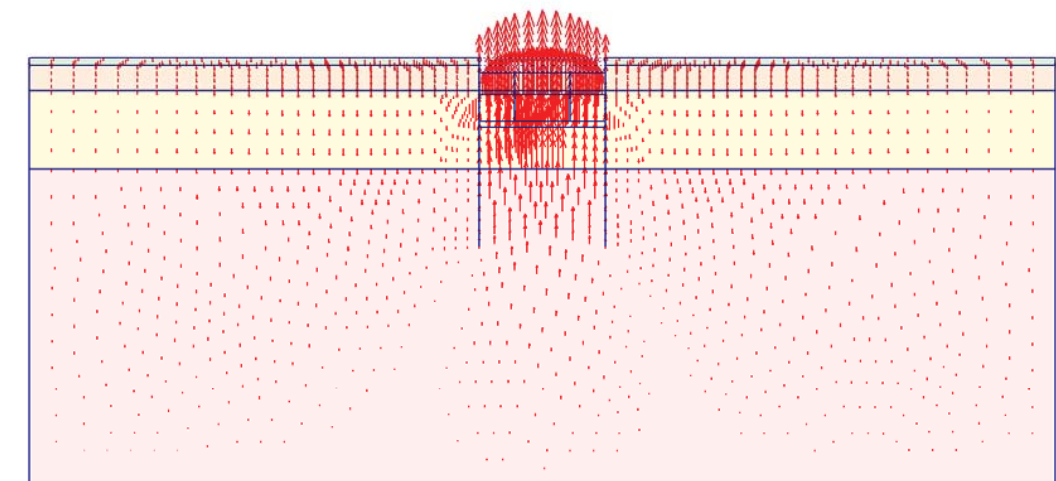
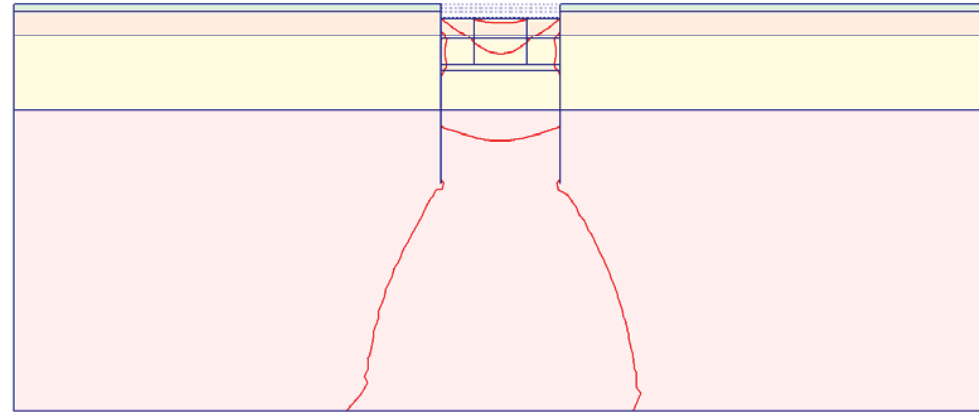


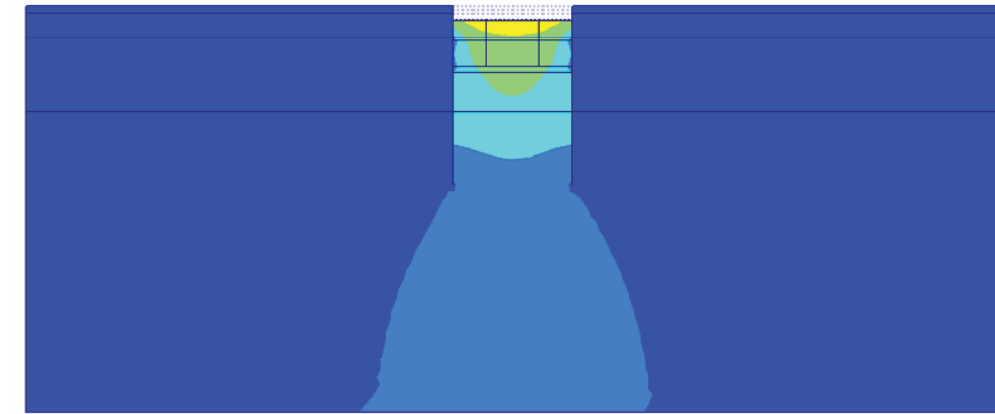
Fig. 111 Plot of vertical displacements (arrows)
- step no: 15 - (phase: 5)



[*10⁻³]
A: -5.000
B: 0.000
C: 5.000
D: 10.000
E: 15.000
F: 20.000

Fig. 112 Plot of vertical displacements (contour lines)
- step no: 15 - (phase: 5)

Fig. 113 Plot of vertical displacements (shadings)
- step no: 15 - (phase: 5)



[*10⁻³]

20.000
16.000
12.000
8.000
4.000
0.000
-4.000

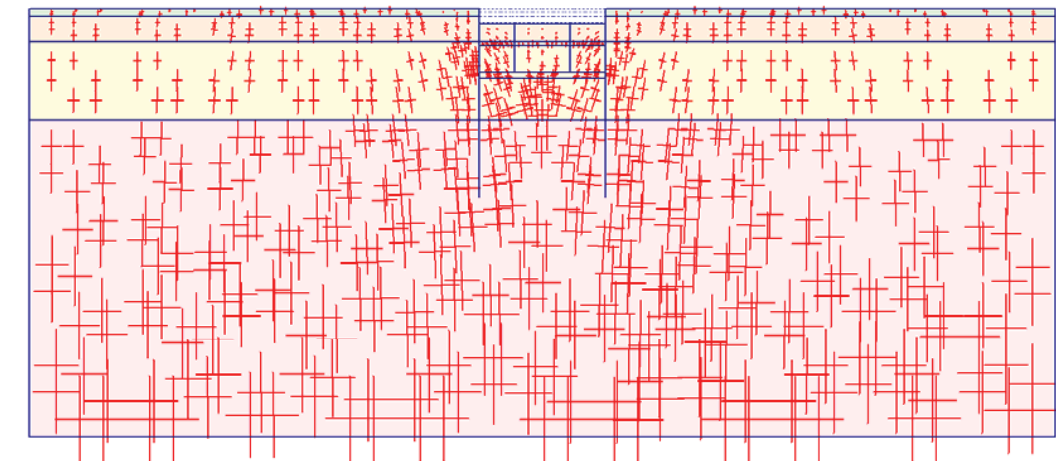
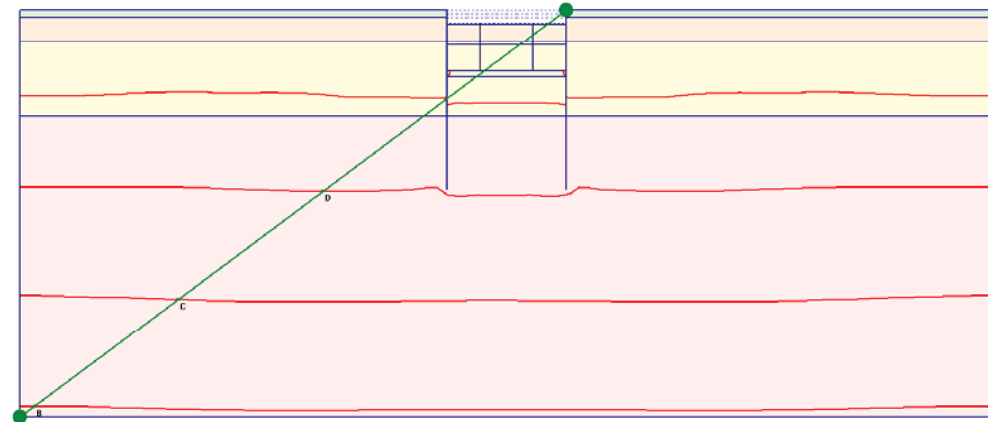


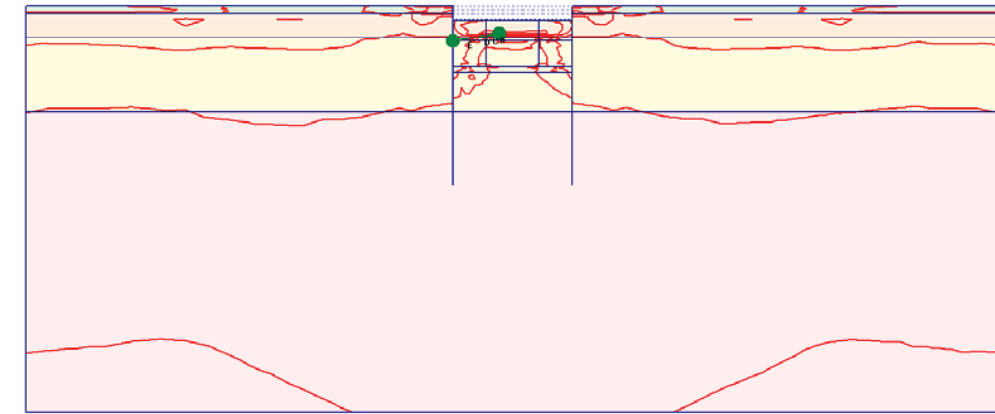
Fig. 114 Plot of effective stresses (principal directions)
- step no: 15 - (phase: 5)



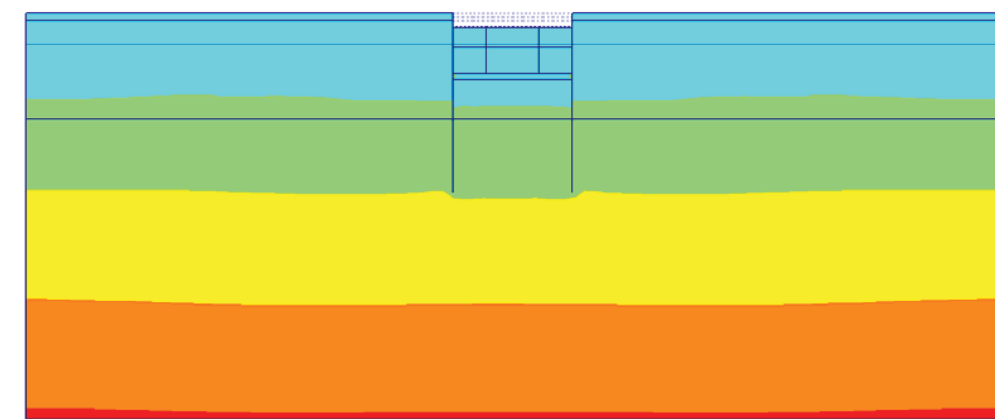
A: -500.000
B: -400.000
C: -300.000
D: -200.000
E: -100.000
F: 0.000
G: 100.000

Fig. 115 Plot of effective stresses (mean contours)
- step no: 15 - (phase: 5)

Fig. 116 Plot of effective stresses (relative shear contours)
- step no: 15 - (phase: 5)



A: 0.000
B: 0.200
C: 0.400
D: 0.600
E: 0.800
F: 1.000
G: 1.200



100.000
0.000
-100.000
-200.000
-300.000
-400.000
-500.000

Fig. 117 Plot of effective stresses (mean shadings)
- step no: 15 - (phase: 5)

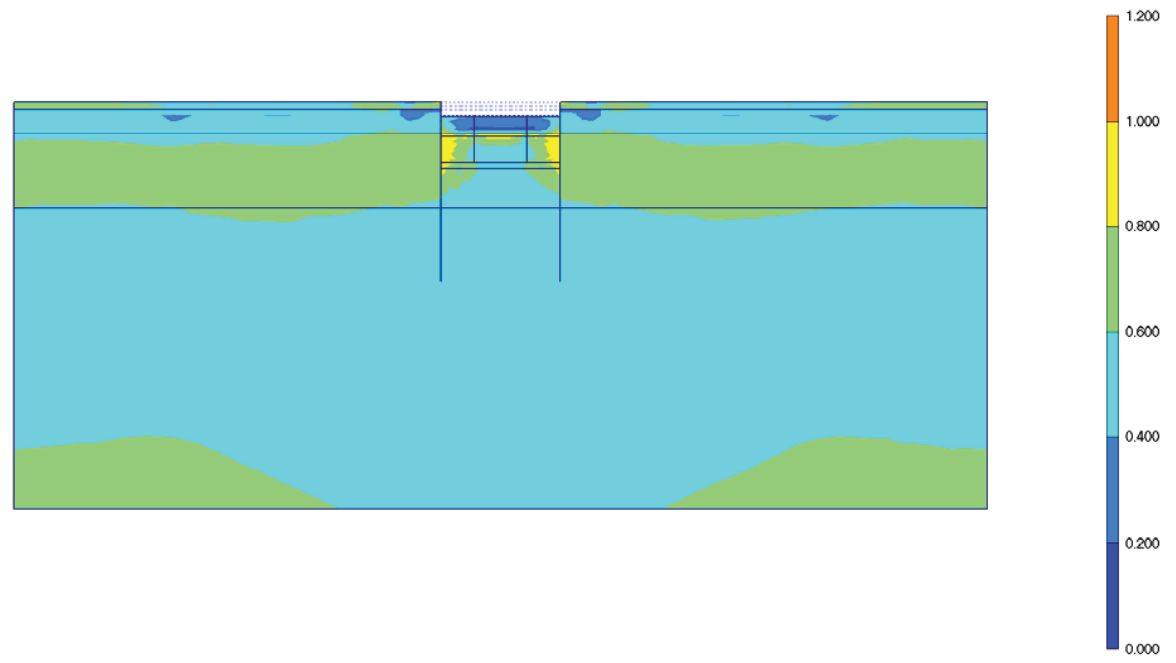


Fig. 118 Plot of effective stresses (relative shear shadings)
- step no: 15 - (phase: 5)

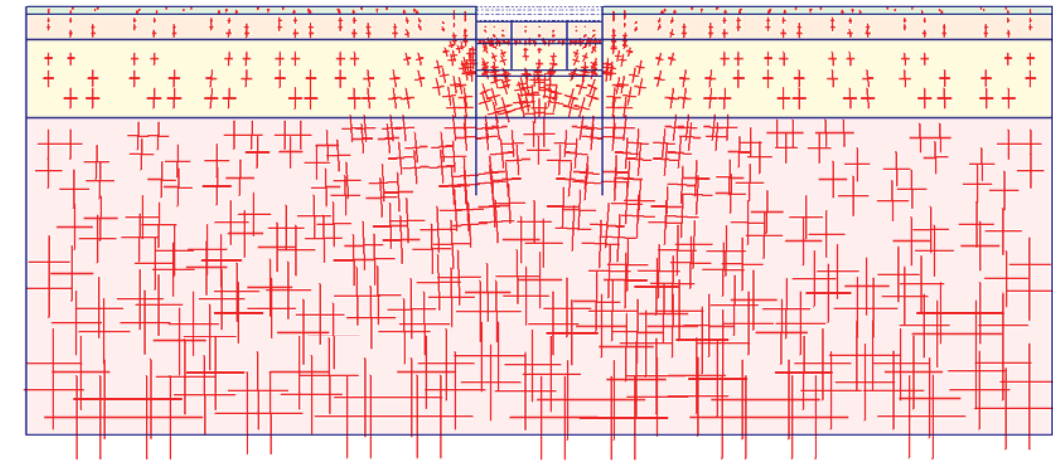
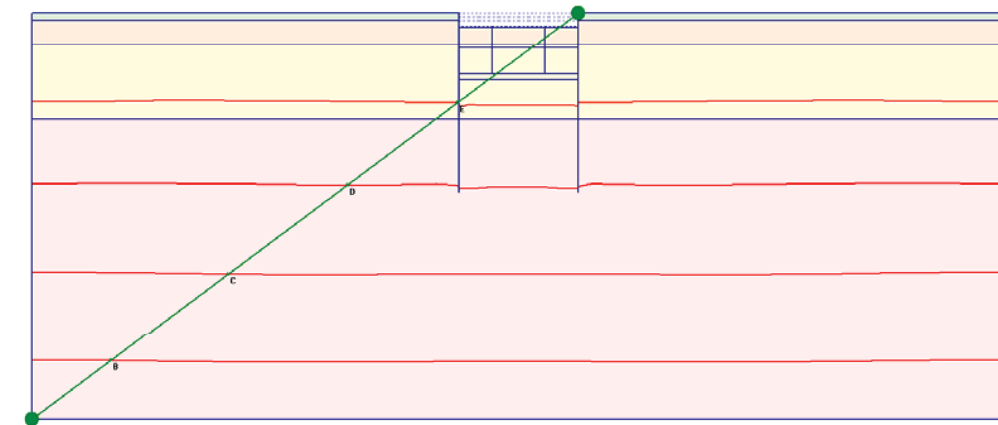
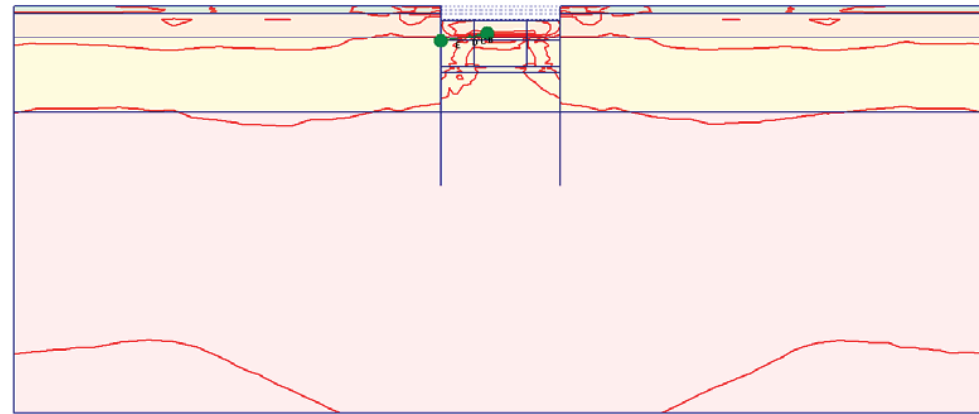


Fig. 119 Plot of total stresses (principal directions)
- step no: 15 - (phase: 5)



- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

Fig. 120 Plot of total stresses (mean contours)
- step no: 15 - (phase: 5)



A: 0.000
B: 0.200
C: 0.400
D: 0.600
E: 0.800
F: 1.000
G: 1.200

Fig. 121 Plot of total stresses (relative shear contours)
- step no: 15 - (phase: 5)

Fig. 122 Plot of total stresses (mean shadings)
- step no: 15 - (phase: 5)

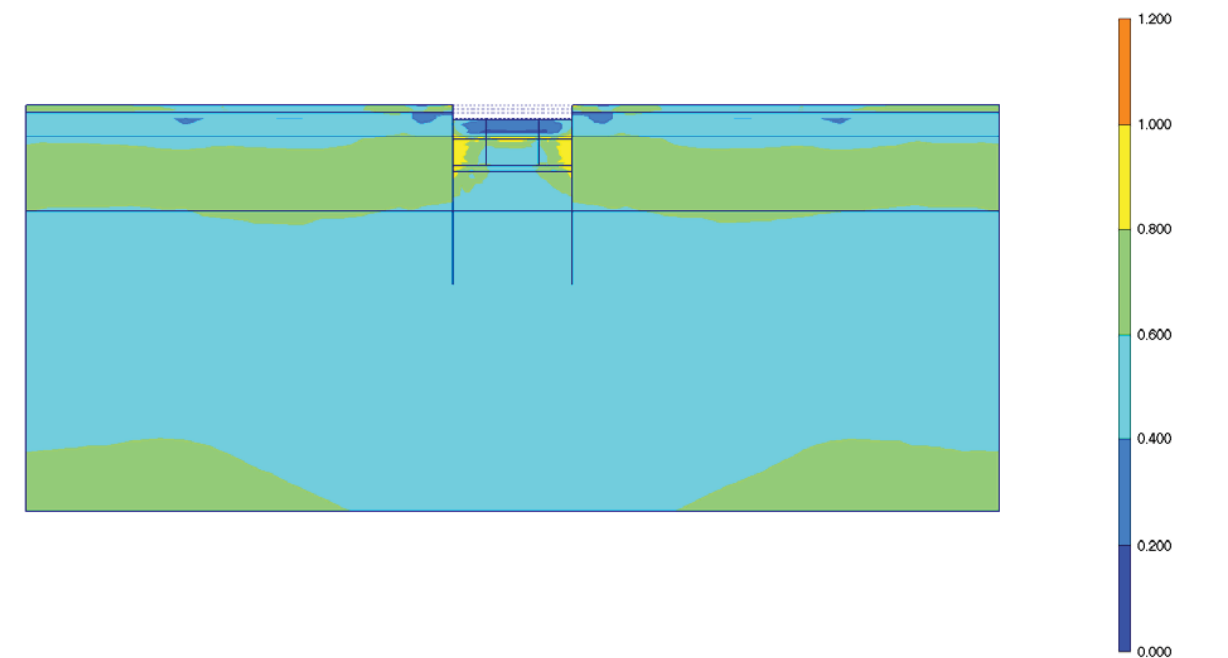
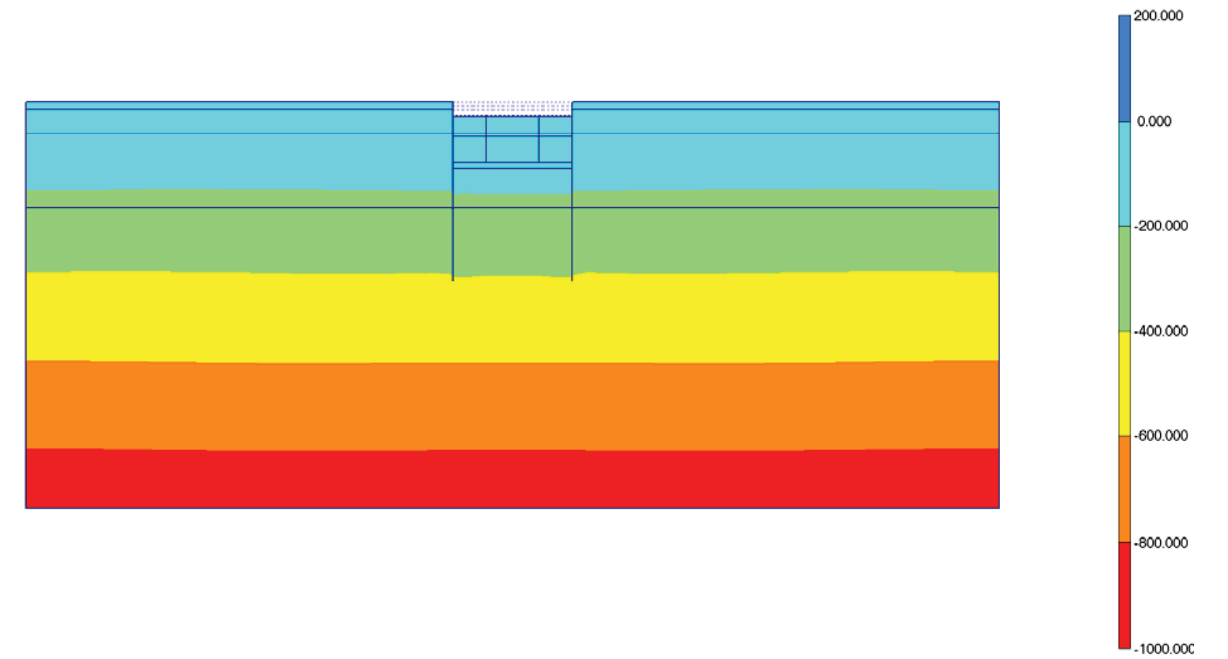
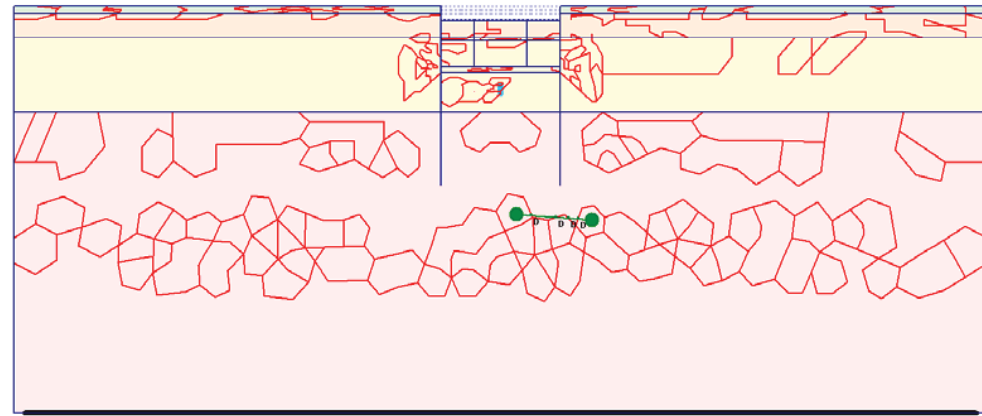


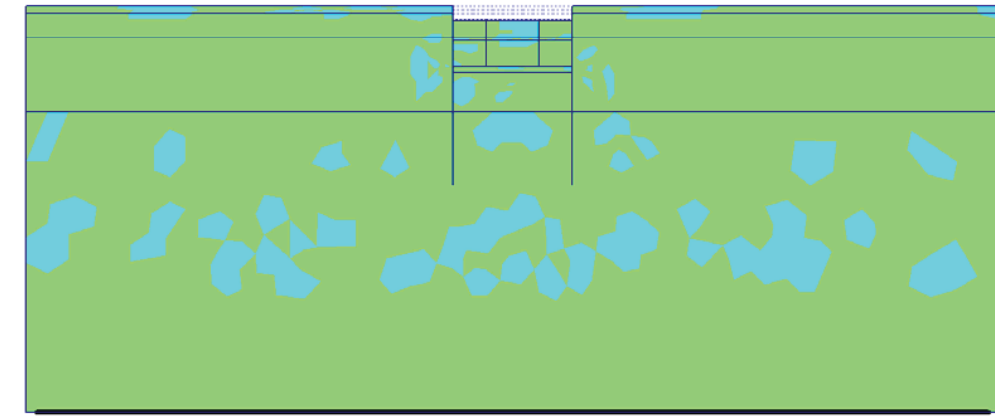
Fig. 123 Plot of total stresses (relative shear shadings)
- step no: 15 - (phase: 5)



[*10⁻³]
A: 2220.000
B: 2230.000
C: 2240.000
D: 2250.000
E: 2260.000
F: 2270.000
G: 2280.000

Fig. 124 Plot of groundwater head (contour lines)
- step no: 15 - (phase: 5)

Fig. 125 Plot of groundwater head (shadings)
- step no: 15 - (phase: 5)



[*10⁻³]
2280.000
2270.000
2260.000
2250.000
2240.000
2230.000
2220.000

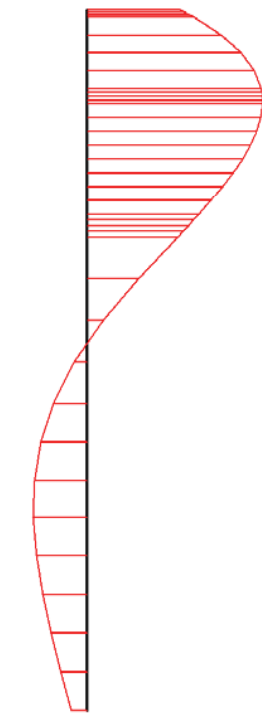


Fig. 126 Horizontal displacements in beam (plate no: 6)
 Extreme value $1,26 \cdot 10^{-3}$ m (phase: 5)

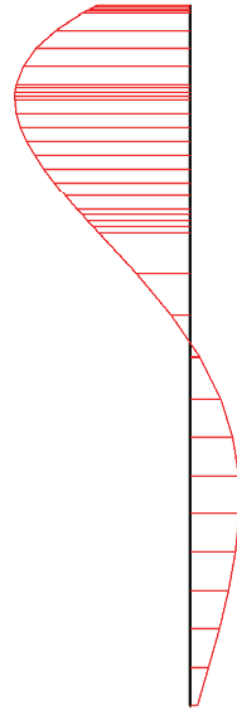


Fig. 127 Horizontal displacements in beam (plate no: 5)
 Extreme value $-1,28 \cdot 10^{-3}$ m (phase: 5)

Fig. 128 Vertical displacements in beam (plate no: 6)
 Extreme value $-631,24 \cdot 10^{-6}$ m (phase: 5)





Fig. 129 Vertical displacements in beam (plate no: 5)
 Extreme value $-575,83 \cdot 10^{-6}$ m (phase: 5)

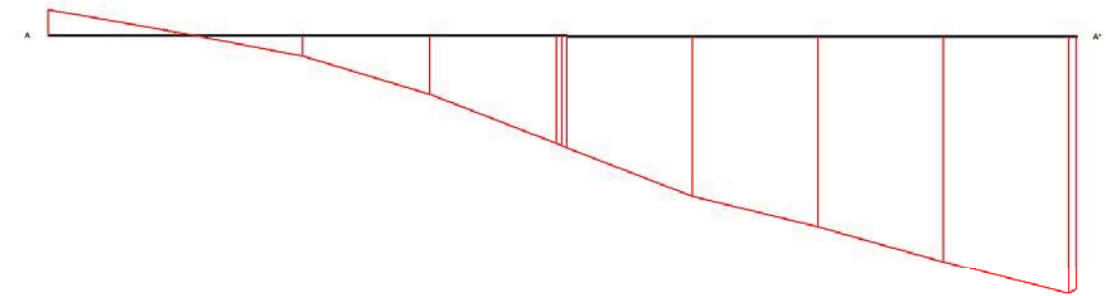


Fig. 130 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $-595,54 \cdot 10^{-6}$ m (phase: 5)

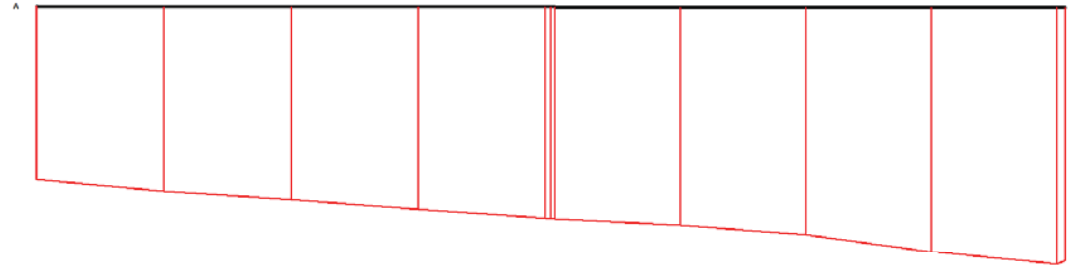


Fig. 131 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-1,89 \cdot 10^{-3}$ m (phase: 5)

13. RESULTS FOR PHASE 6

Table [50] Step info phase no: 6

Step no:	17
Calculation type	PLASTIC
Extrapolation factor	0,499
Relative stiffness	0,520

Table [51] Reached multipliers phase no: 6

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [52] Staged construction info phase no: 6

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,995
Active proportion of stage	0,295	1,000

Table [53] Realised tunnel contraction info phase no: 6

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [54] Iteration info phase no: 6

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,006	2450	1200	393	0	0	0	0
2	0,004	2436	1189	22	0	0	0	0

Table [55] Active distributed loads A phase no: 6

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

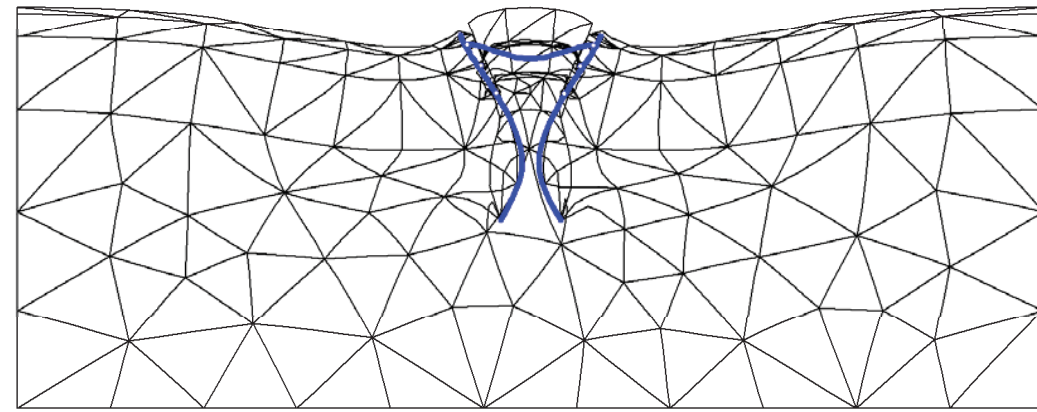


Fig. 132 Plot of deformed mesh
- step no: 17 - (phase: 6)

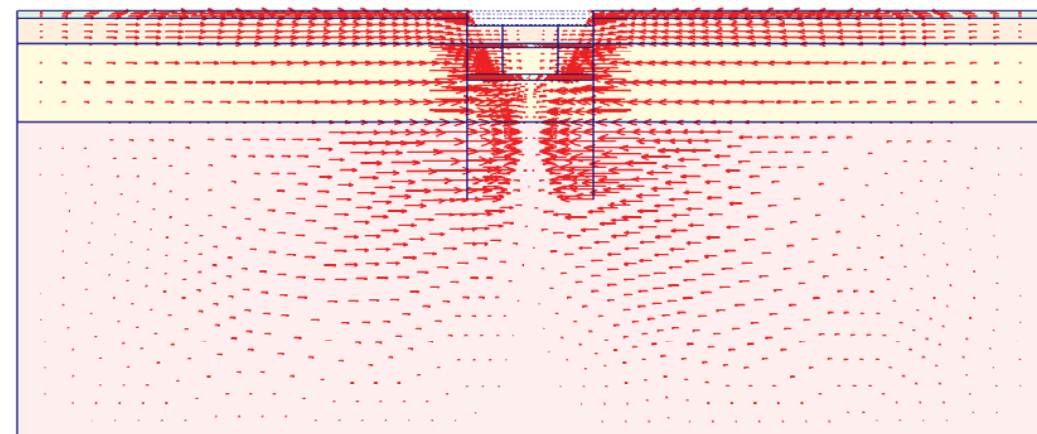
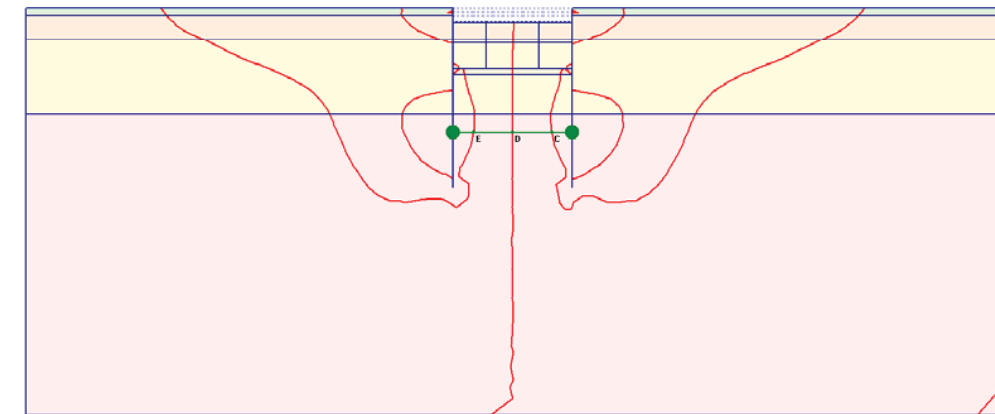


Fig. 133 Plot of horizontal displacements (arrows)
- step no: 17 - (phase: 6)



[*10⁻³]
A: -15.000
B: -10.000
C: -5.000
D: 0.000
E: 5.000
F: 10.000
G: 15.000

Fig. 134 Plot of horizontal displacements (contour lines)
- step no: 17 - (phase: 6)

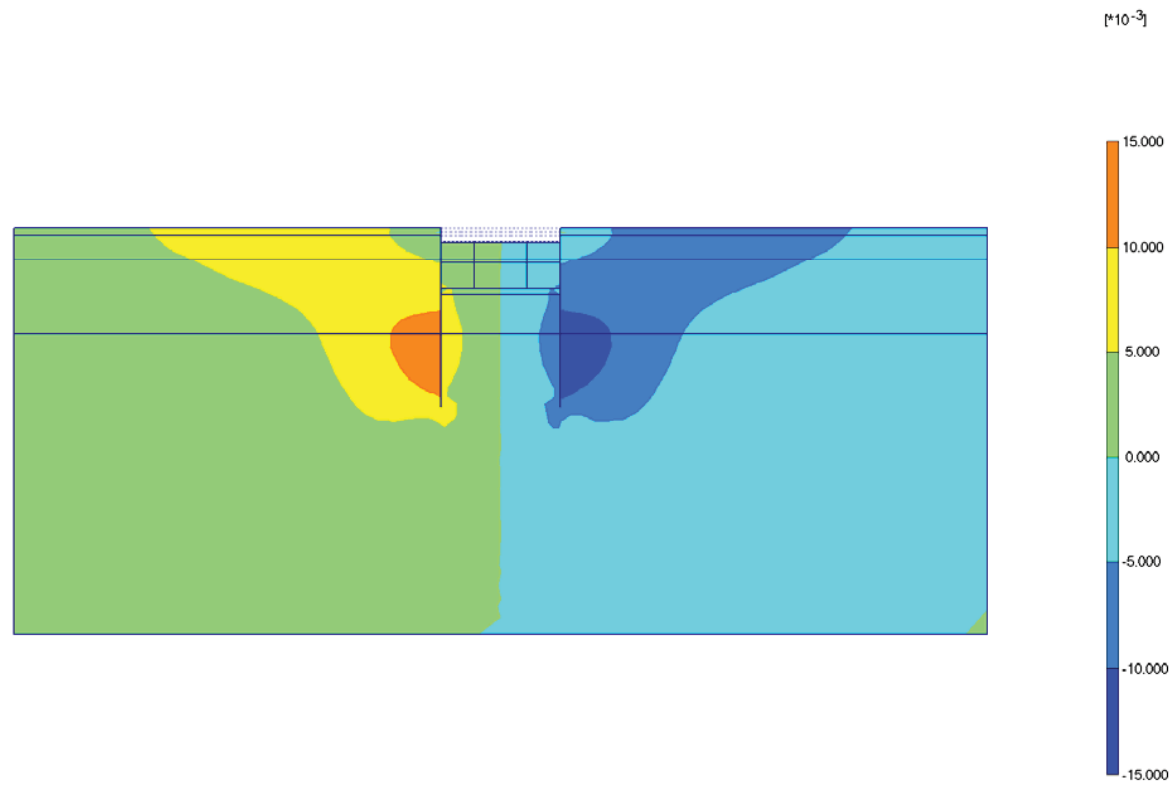


Fig. 135 Plot of horizontal displacements (shadings)
- step no: 17 - (phase: 6)

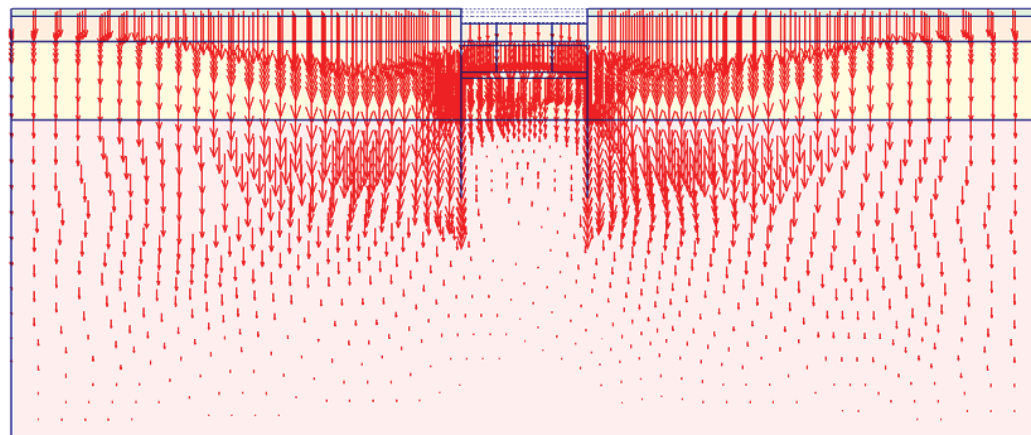


Fig. 136 Plot of vertical displacements (arrows)
- step no: 17 - (phase: 6)

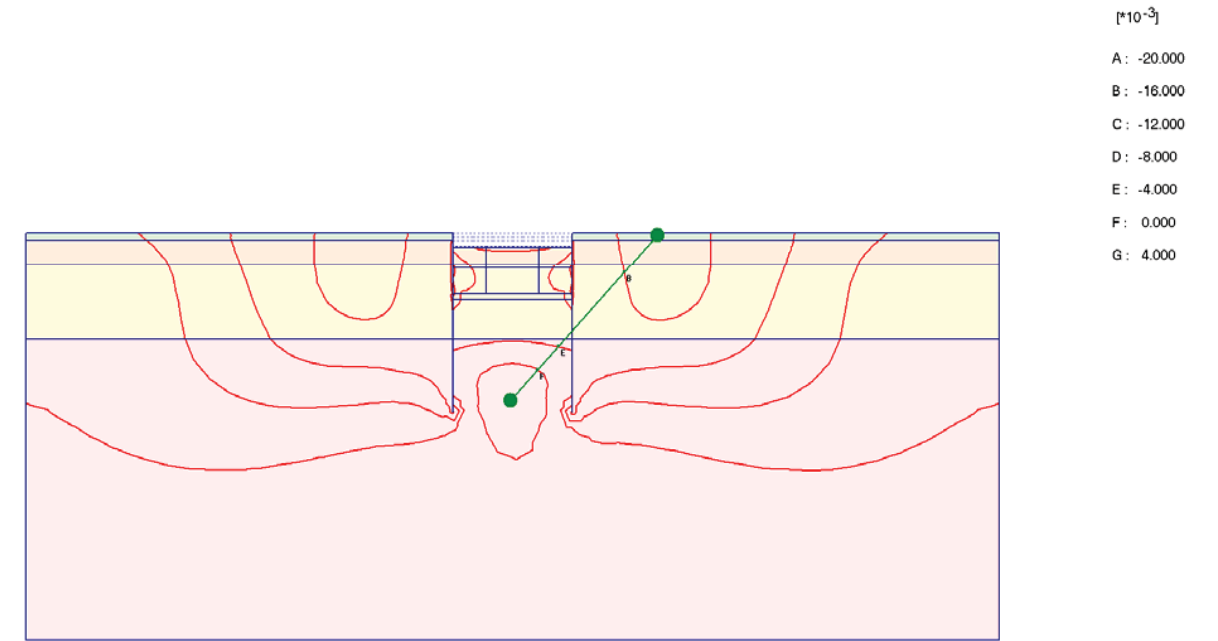
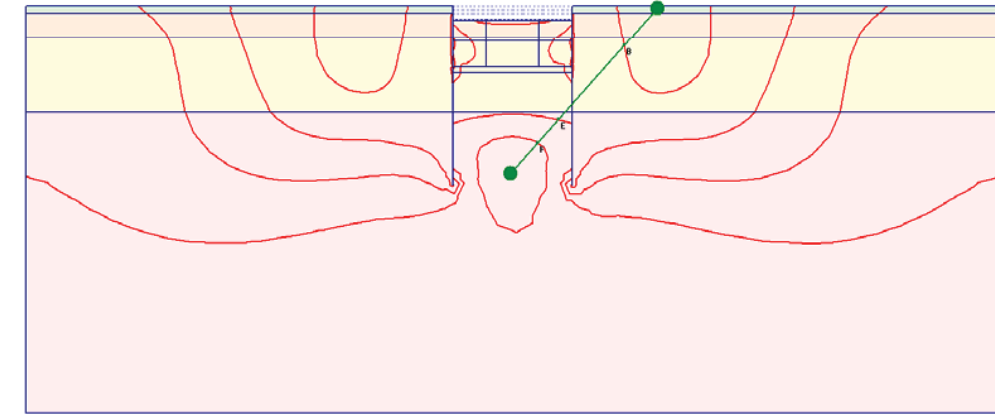


Fig. 137 Plot of vertical displacements (contour lines)
- step no: 17 - (phase: 6)



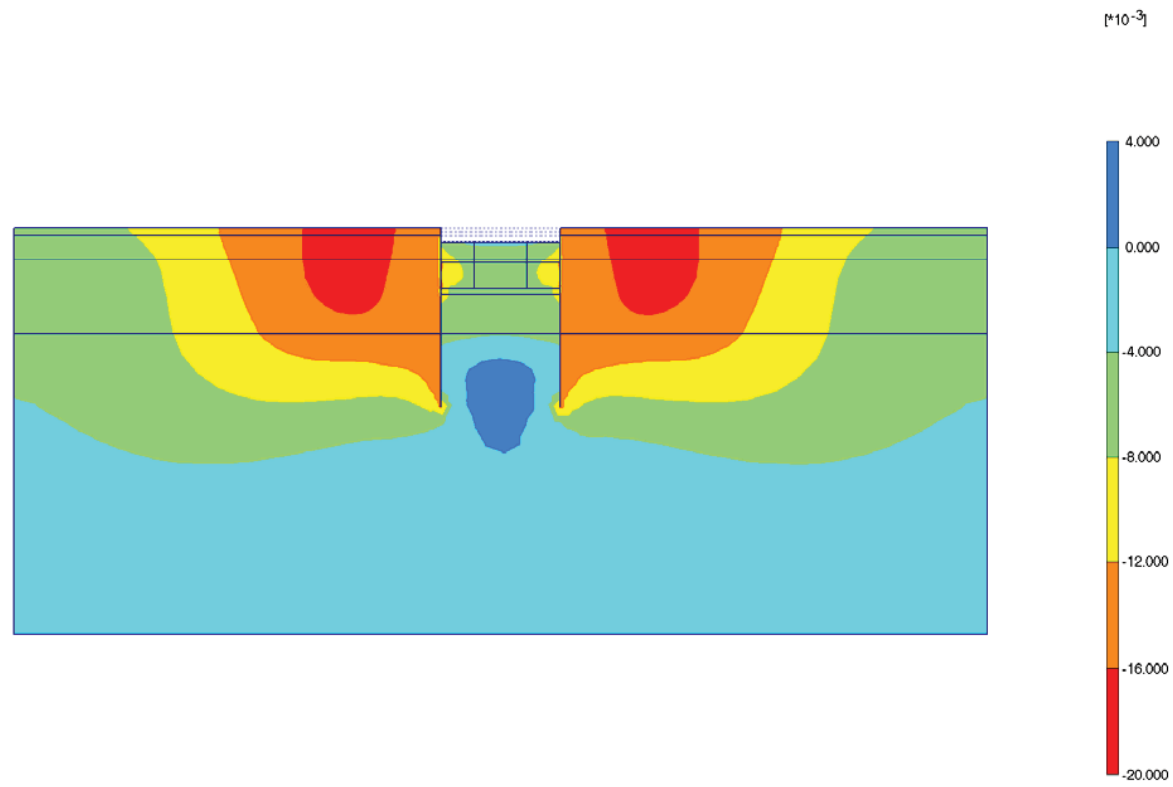


Fig. 138 Plot of vertical displacements (shadings)
- step no: 17 - (phase: 6)

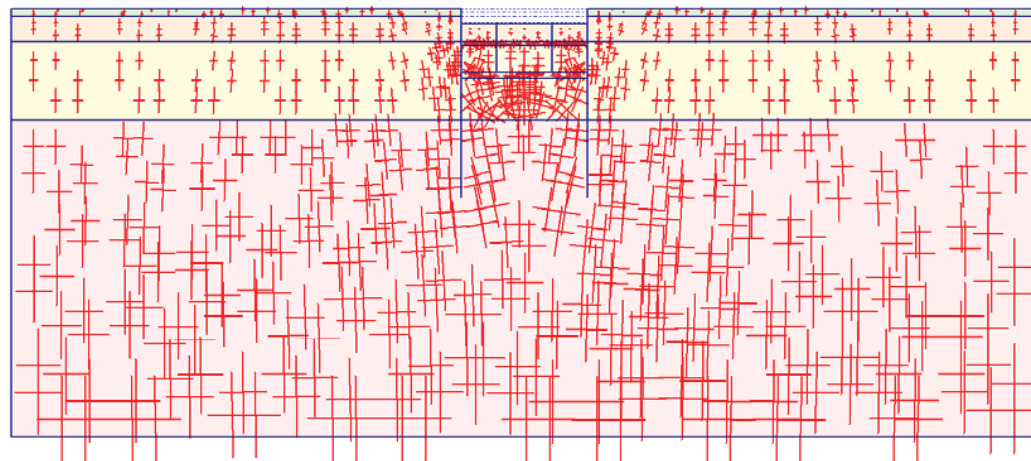


Fig. 139 Plot of effective stresses (principal directions)
- step no: 17 - (phase: 6)

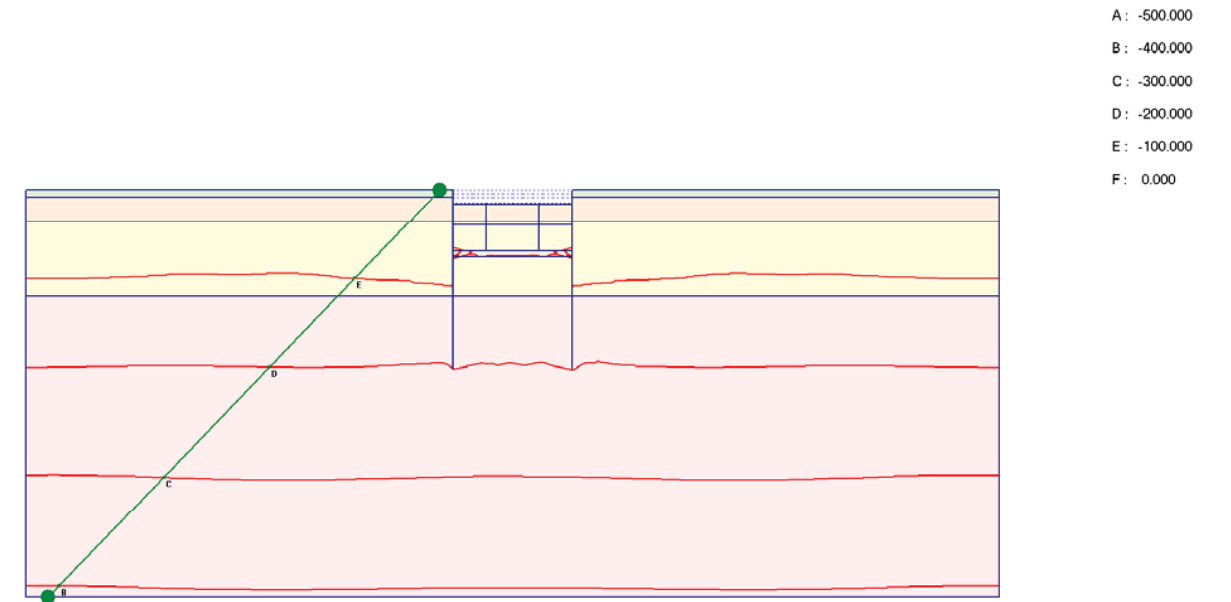
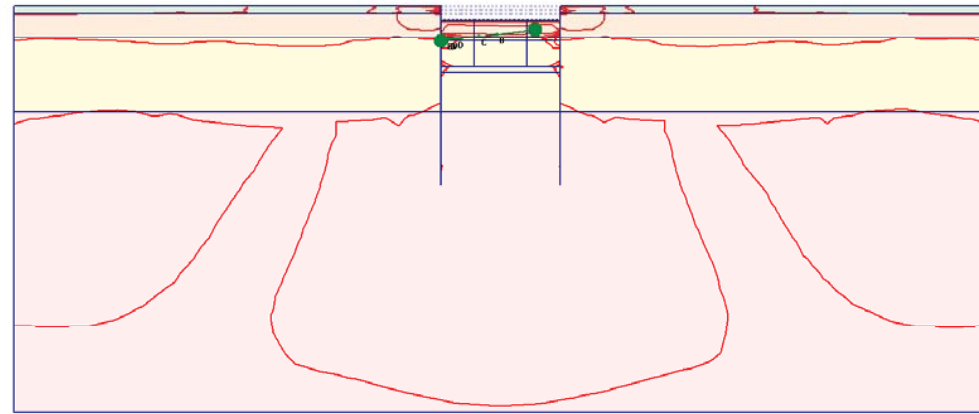
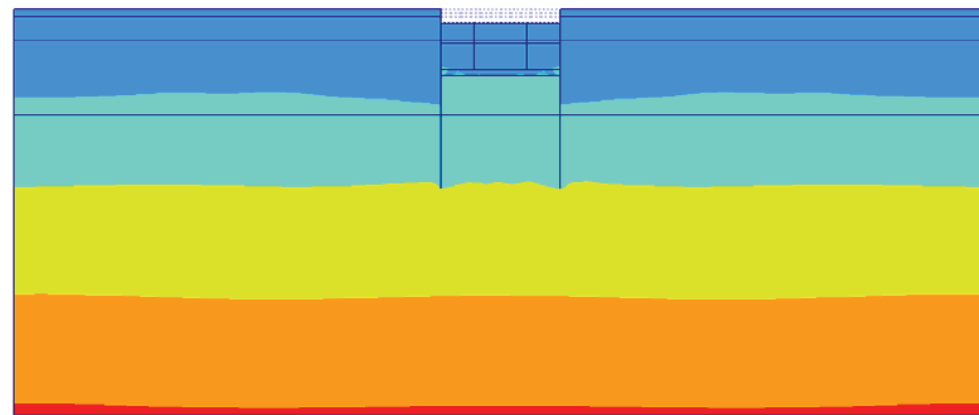


Fig. 140 Plot of effective stresses (mean contours)
- step no: 17 - (phase: 6)



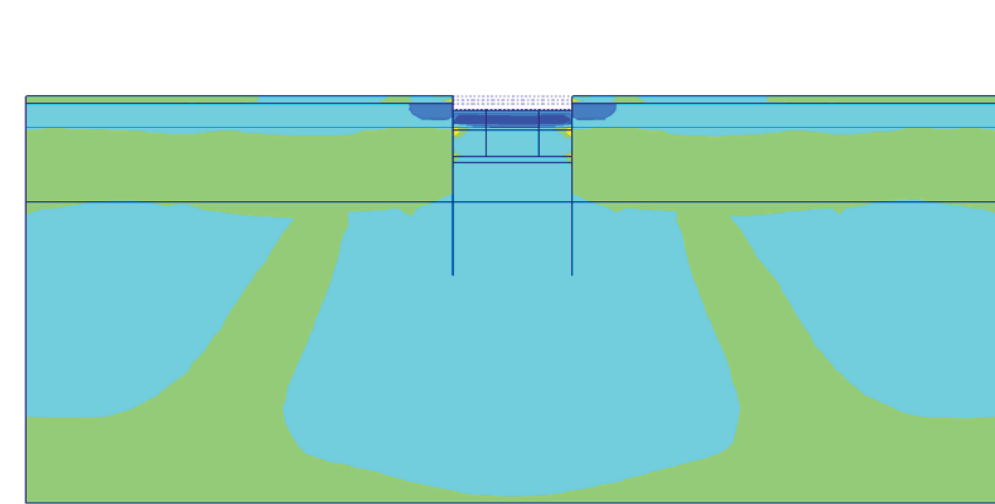
- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 141 Plot of effective stresses (relative shear contours)
- step no: 17 - (phase: 6)



- 0.000
- 100.000
- 200.000
- 300.000
- 400.000
- 500.000

Fig. 142 Plot of effective stresses (mean shadings)
- step no: 17 - (phase: 6)



- 1.200
- 1.000
- 0.800
- 0.600
- 0.400
- 0.200
- 0.000

Fig. 143 Plot of effective stresses (relative shear shadings)
- step no: 17 - (phase: 6)

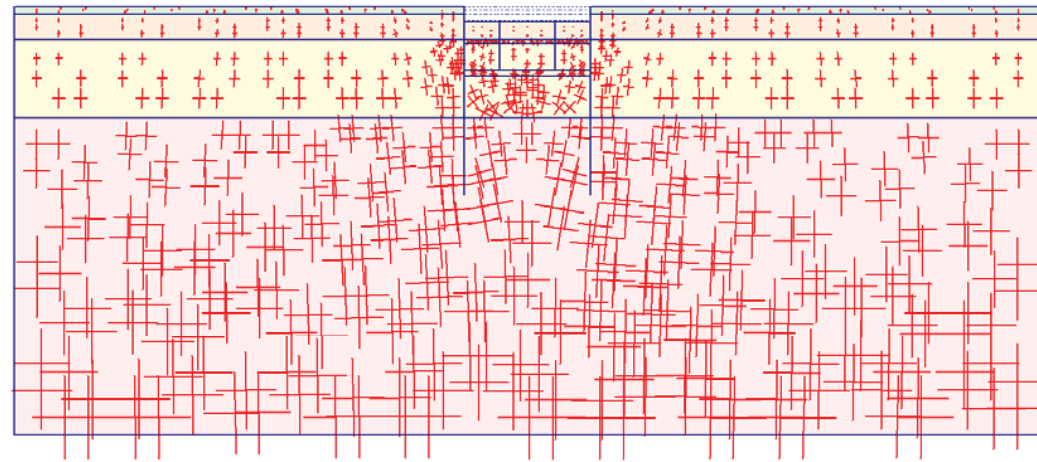


Fig. 144 Plot of total stresses (principal directions)
- step no: 17 - (phase: 6)

- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

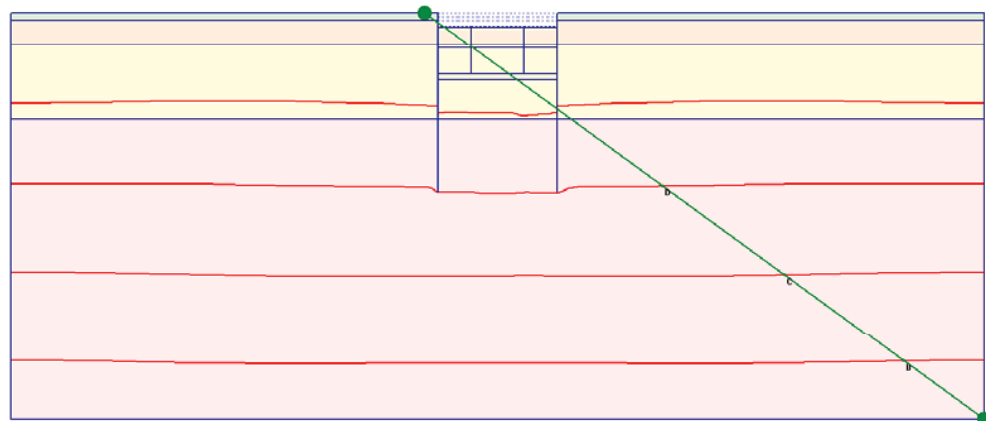
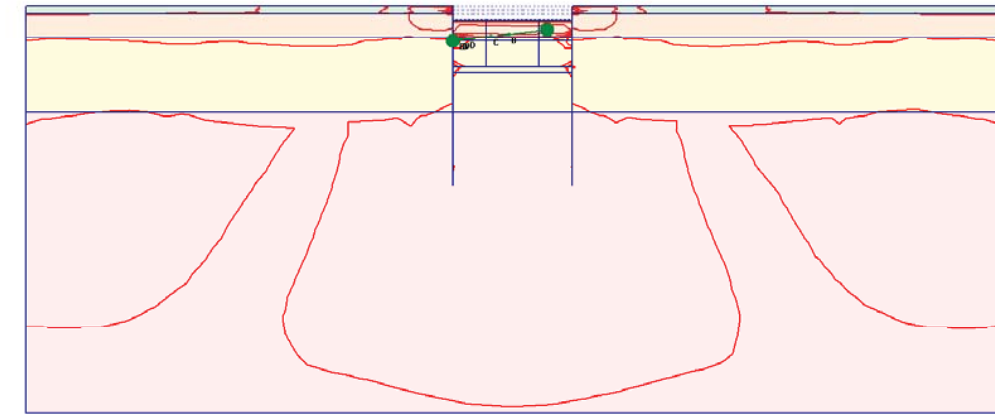


Fig. 145 Plot of total stresses (mean contours)
- step no: 17 - (phase: 6)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 146 Plot of total stresses (relative shear contours)
- step no: 17 - (phase: 6)

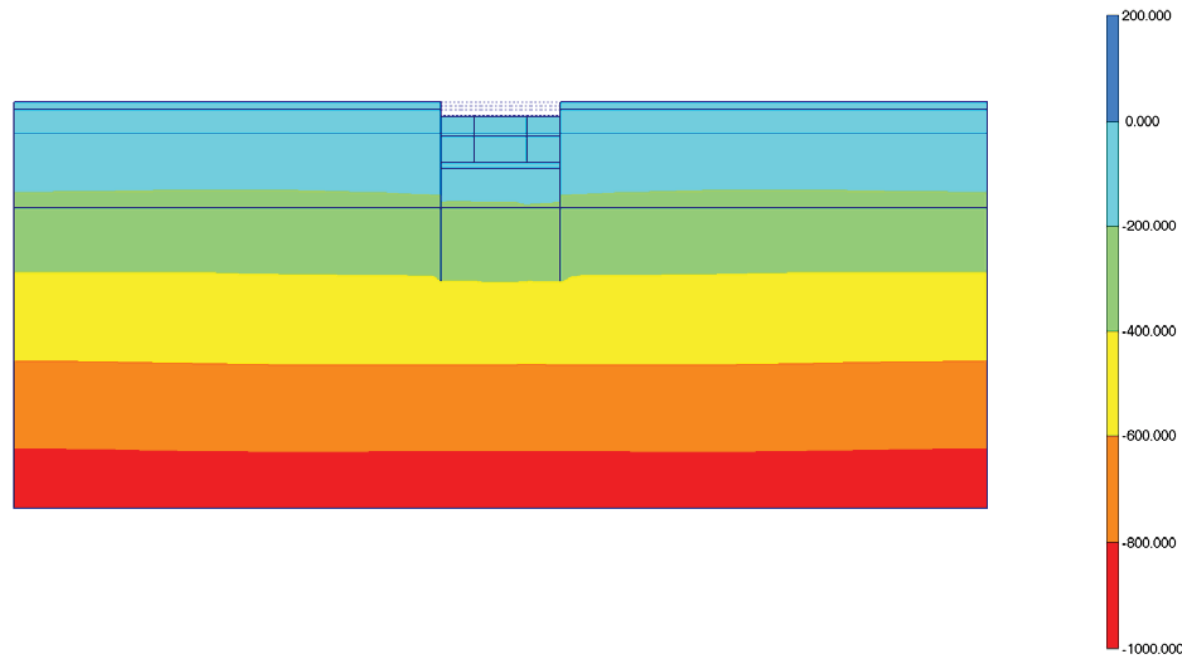


Fig. 147 Plot of total stresses (mean shadings)
- step no: 17 - (phase: 6)

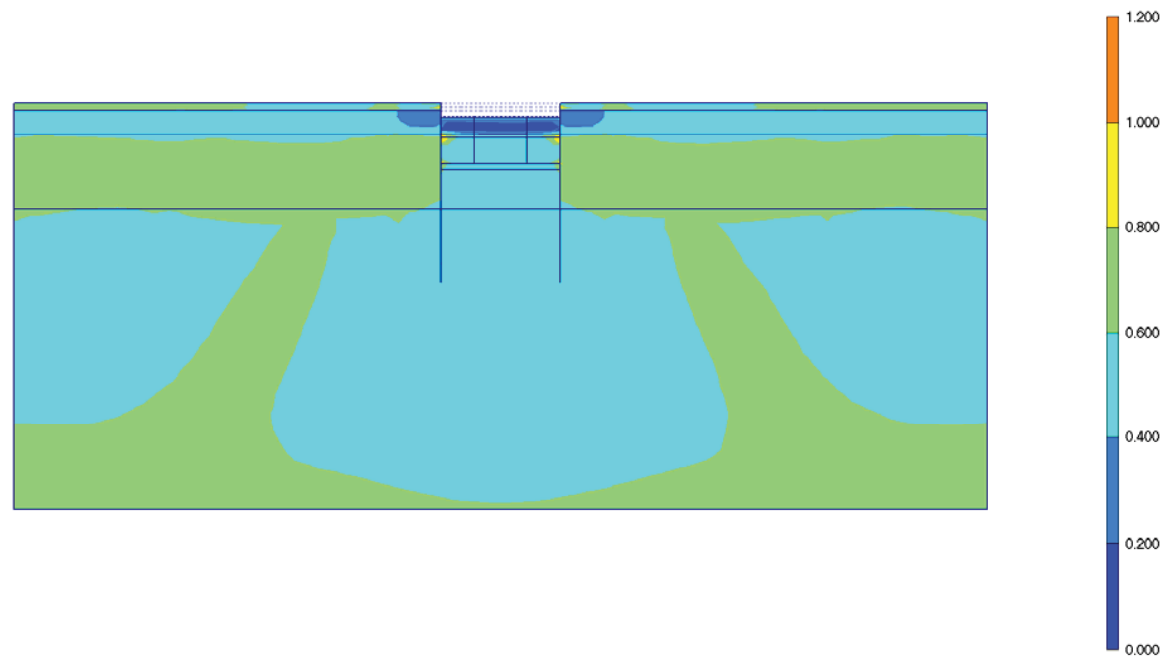


Fig. 148 Plot of total stresses (relative shear shadings)
- step no: 17 - (phase: 6)

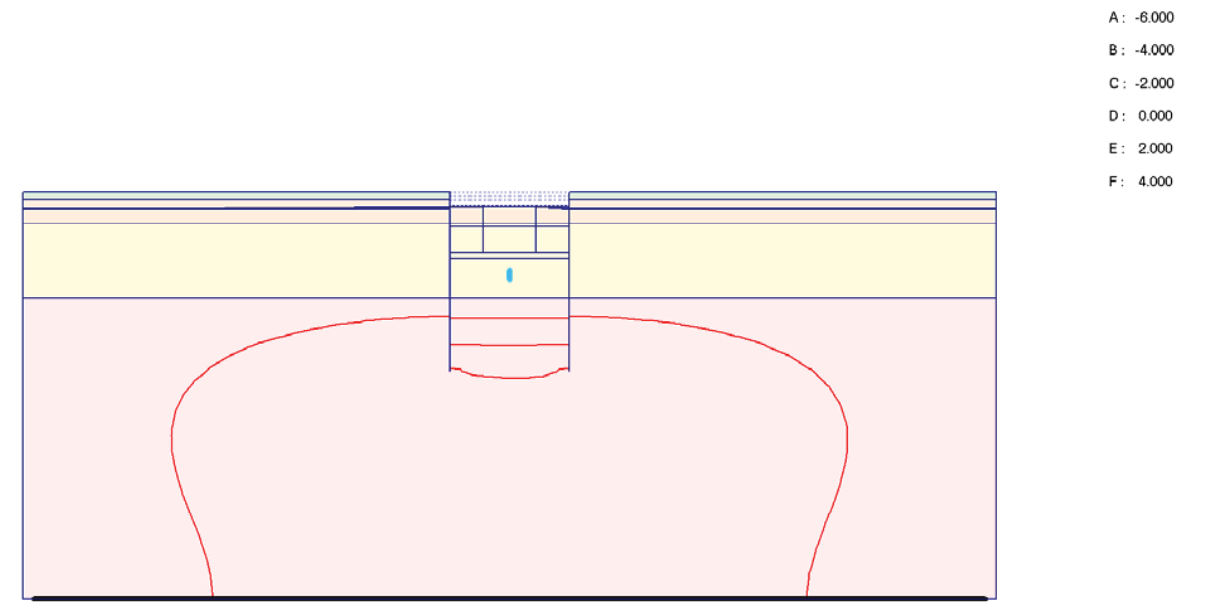


Fig. 149 Plot of groundwater head (contour lines)
- step no: 17 - (phase: 6)

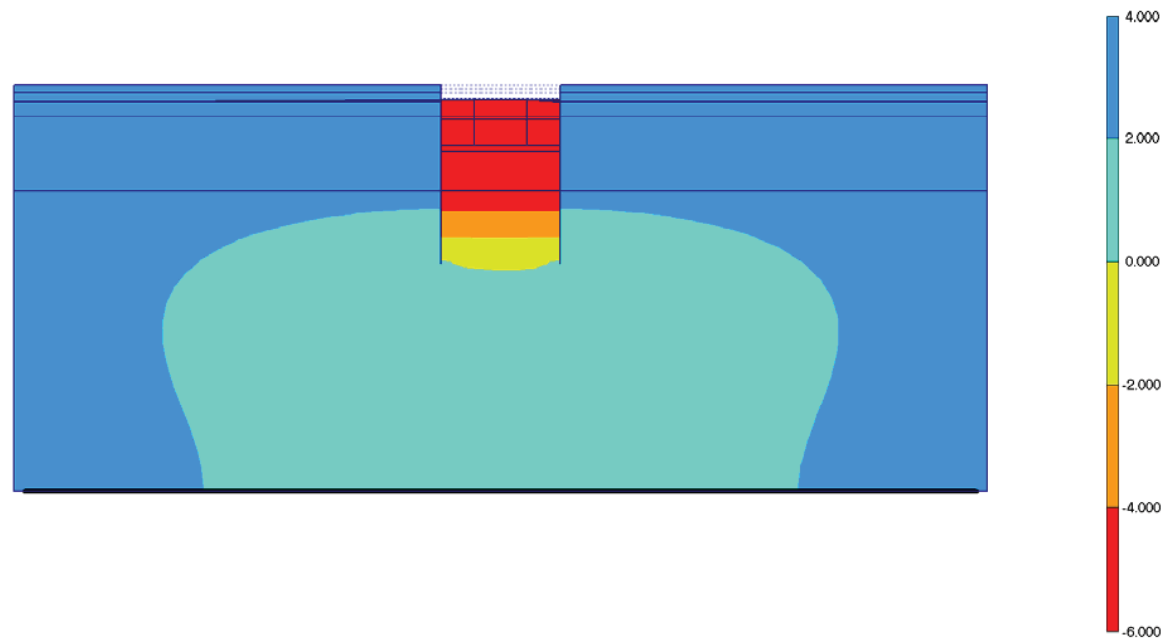


Fig. 150 Plot of groundwater head (shadings)
- step no: 17 - (phase: 6)

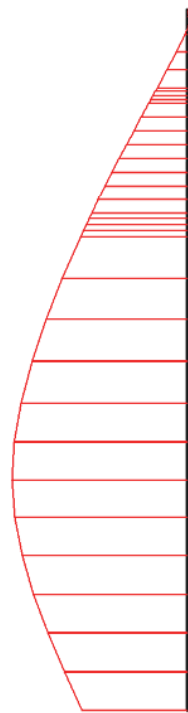


Fig. 151 Horizontal displacements in beam (plate no: 6)
Extreme value $-13,91 \cdot 10^{-3}$ m (phase: 6)

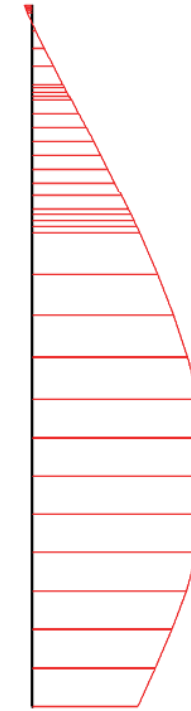


Fig. 152 Horizontal displacements in beam (plate no: 5)
Extreme value $13,93 \cdot 10^{-3}$ m (phase: 6)



Fig. 153 Vertical displacements in beam (plate no: 6)
Extreme value $-13,24 \cdot 10^{-3}$ m (phase: 6)



Fig. 154 Vertical displacements in beam (plate no: 5)
Extreme value $-13,11 \cdot 10^{-3}$ m (phase: 6)

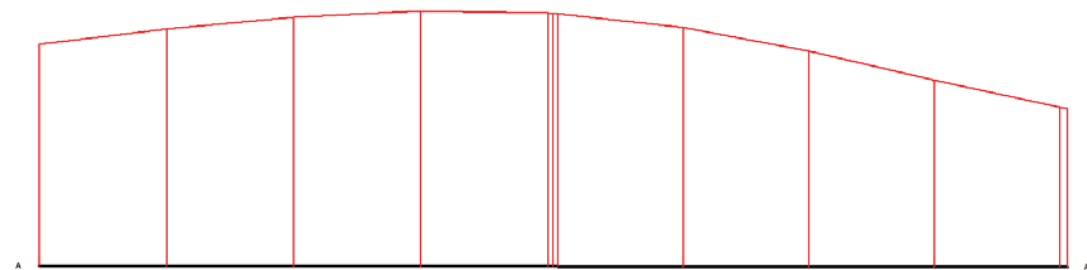


Fig. 155 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $8,12 \cdot 10^{-3}$ m (phase: 6)

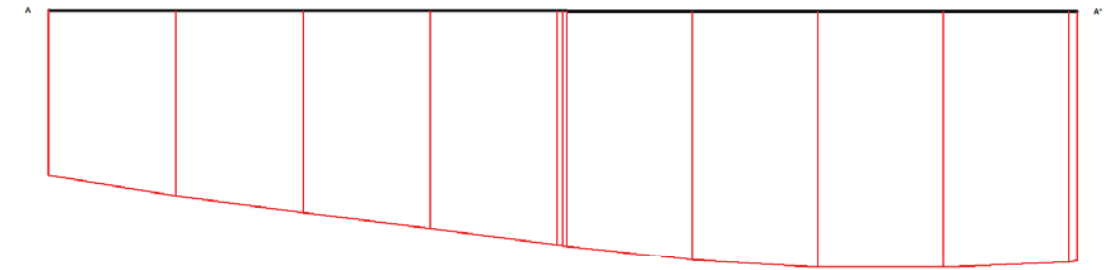


Fig. 156 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-17,11 \cdot 10^{-3}$ m (phase: 6)

14. RESULTS FOR PHASE 7

Table [56] Step info phase no: 7

Step no:	23
Calculation type	PLASTIC
Extrapolation factor	0,419
Relative stiffness	0,035

Table [57] Reached multipliers phase no: 7

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [58] Staged construction info phase no: 7

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,980
Active proportion of stage	0,013	1,000

Table [59] Realised tunnel contraction info phase no: 7

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [60] Iteration info phase no: 7

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,007	1149	737	237	72	29	6	6
2	0,006	1148	737	85	72	2	6	6

Table [61] Active distributed loads A phase no: 7

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

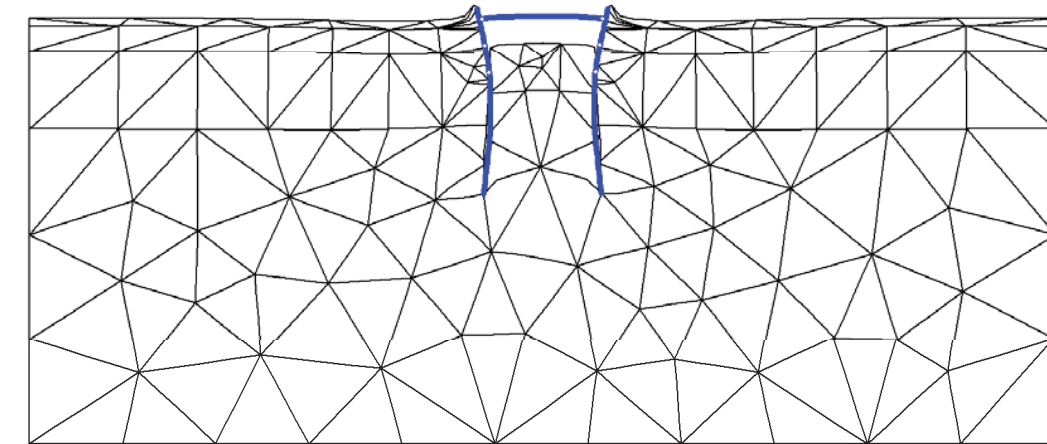


Fig. 157 Plot of deformed mesh - step no: 23 - (phase: 7)

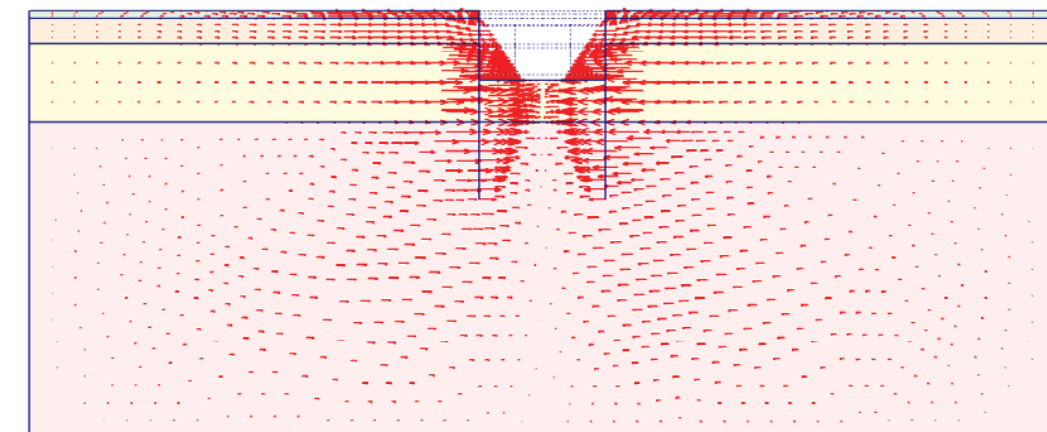
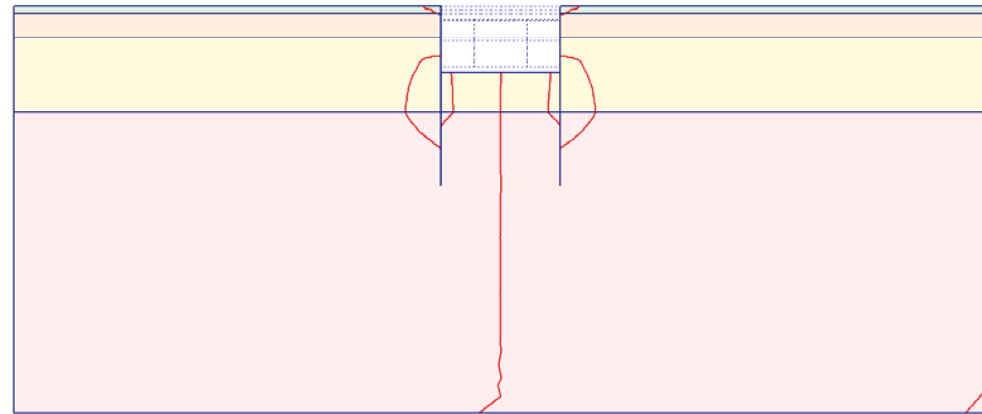


Fig. 158 Plot of horizontal displacements (arrows)
- step no: 23 - (phase: 7)



A: -0.040
B: -0.020
C: -0.000
D: 0.020
E: 0.040

Fig. 159 Plot of horizontal displacements (contour lines)
- step no: 23 - (phase: 7)

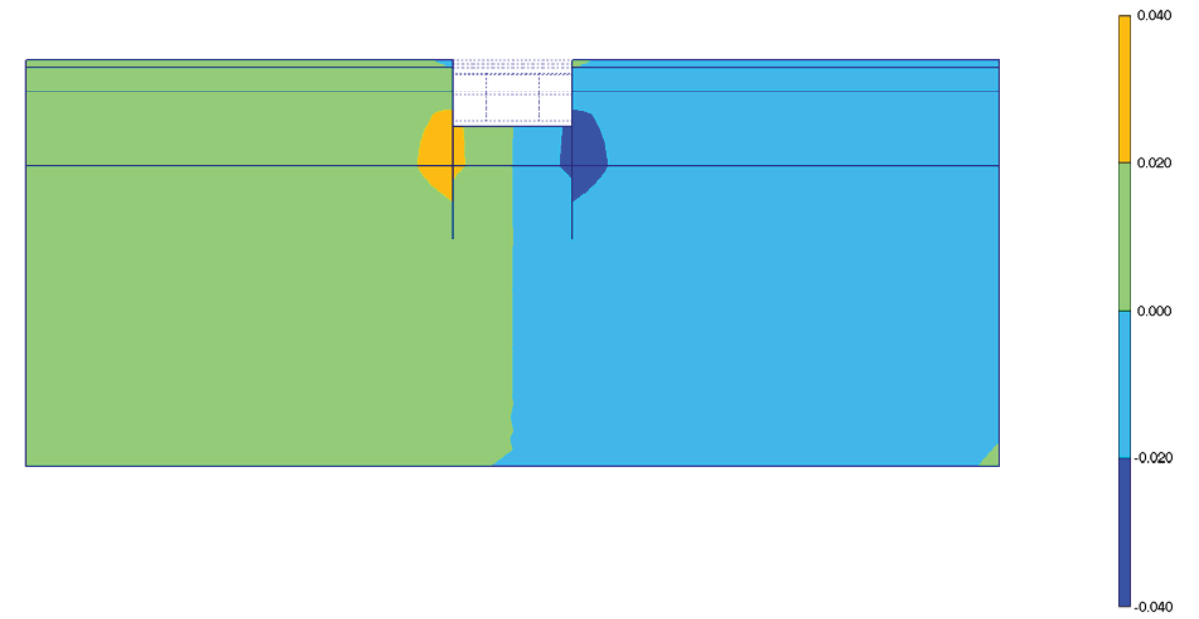


Fig. 160 Plot of horizontal displacements (shadings)
- step no: 23 - (phase: 7)

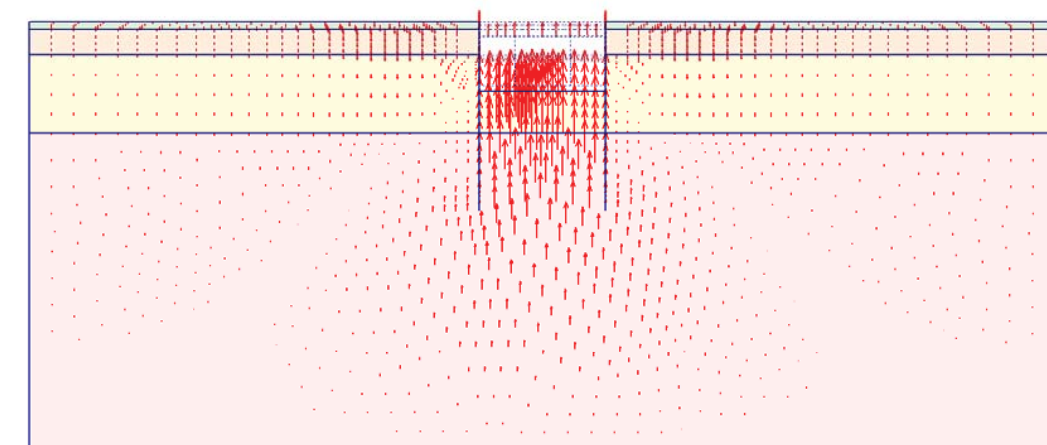
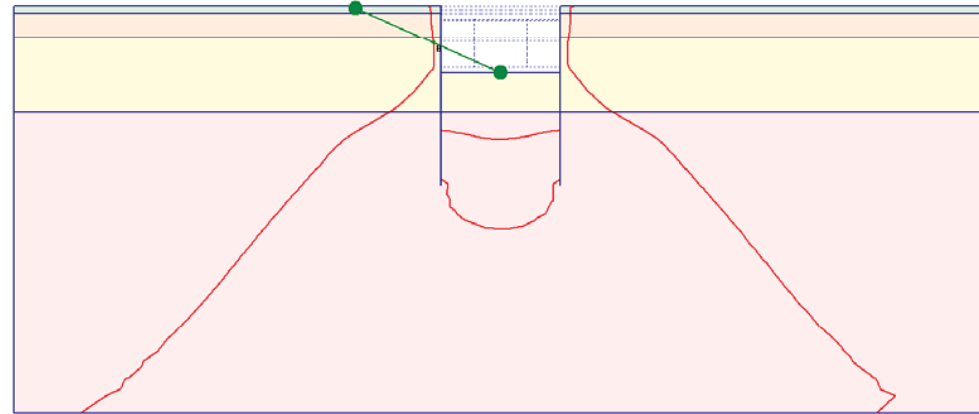


Fig. 161 Plot of vertical displacements (arrows)
- step no: 23 - (phase: 7)



A: -0.040
B: 0.000
C: 0.040
D: 0.080
E: 0.120

Fig. 162 Plot of vertical displacements (contour lines)
- step no: 23 - (phase: 7)

Fig. 163 Plot of vertical displacements (shadings)
- step no: 23 - (phase: 7)

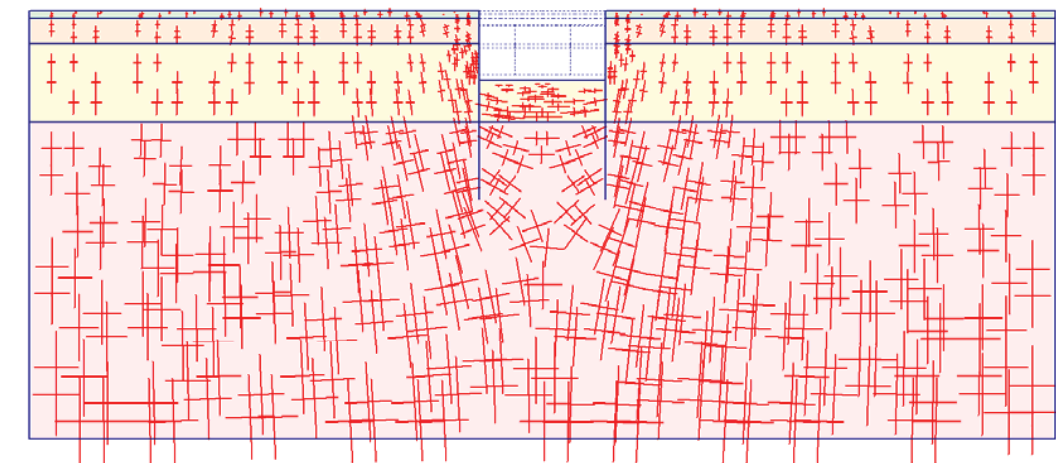
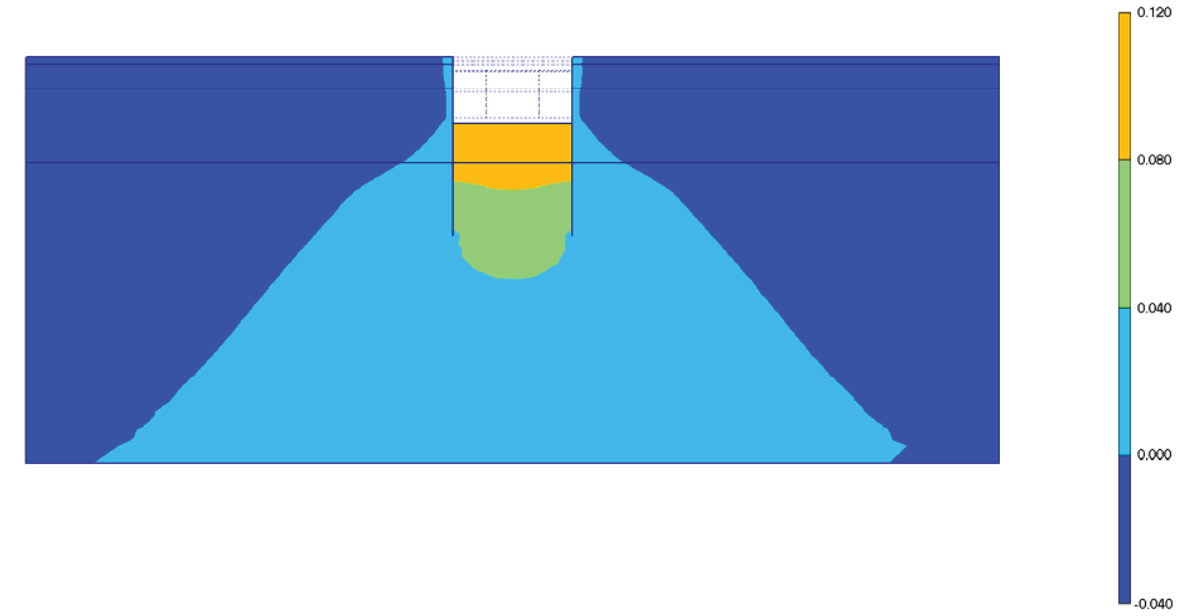
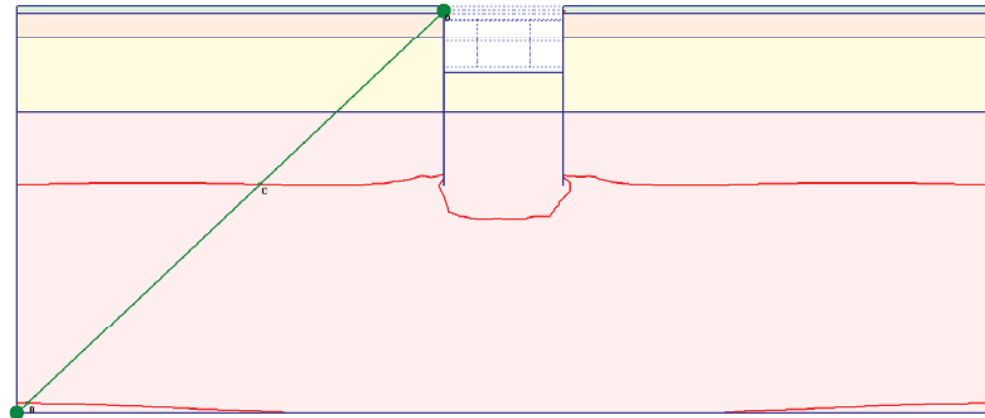


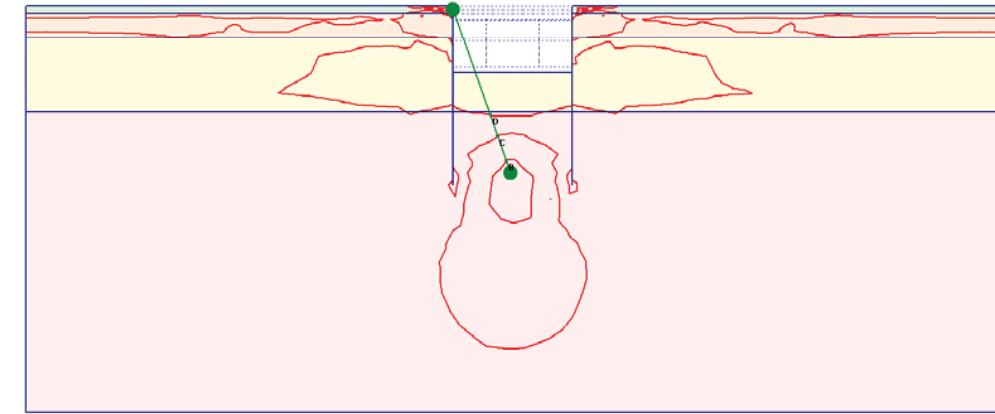
Fig. 164 Plot of effective stresses (principal directions)
- step no: 23 - (phase: 7)



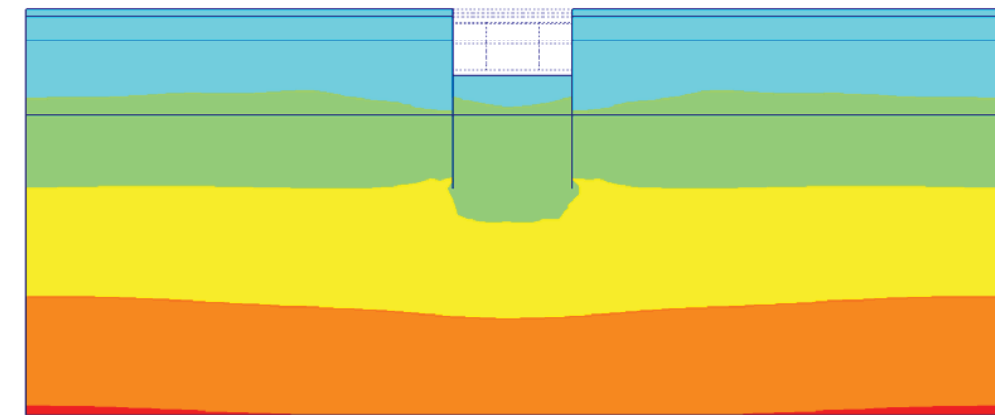
A: -600.000
B: -400.000
C: -200.000
D: 0.000
E: 200.000

Fig. 165 Plot of effective stresses (mean contours)
- step no: 23 - (phase: 7)

Fig. 166 Plot of effective stresses (relative shear contours)
- step no: 23 - (phase: 7)



A: 0.000
B: 0.250
C: 0.500
D: 0.750
E: 1.000
F: 1.250



100.000
0.000
-100.000
-200.000
-300.000
-400.000
-500.000

Fig. 167 Plot of effective stresses (mean shadings)
- step no: 23 - (phase: 7)

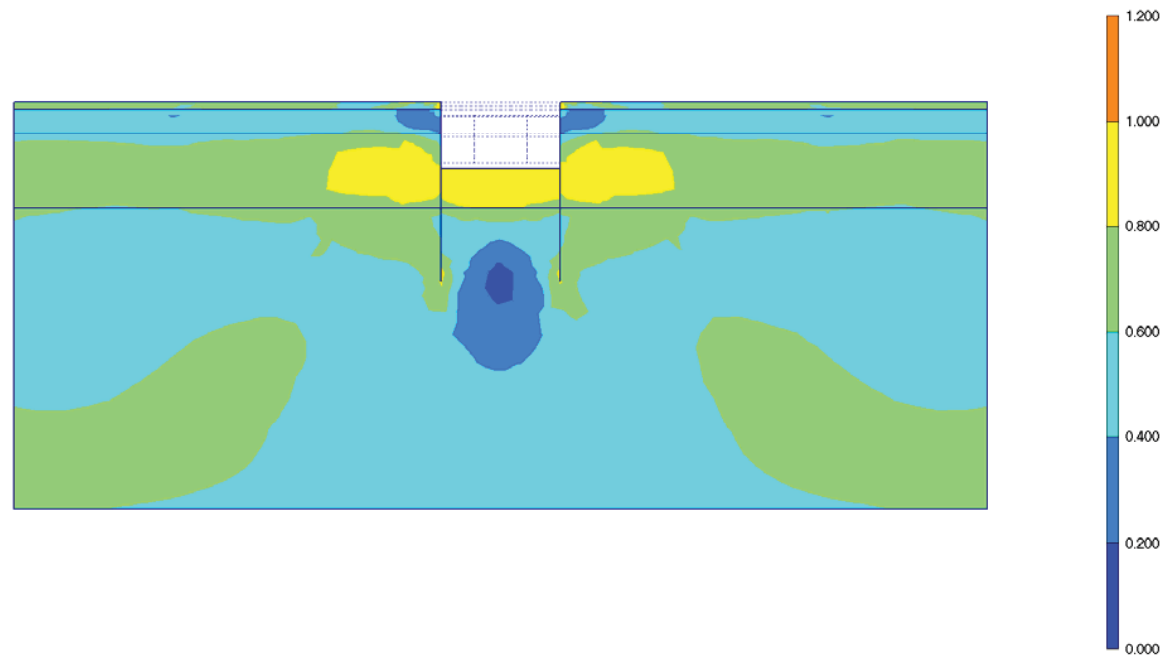
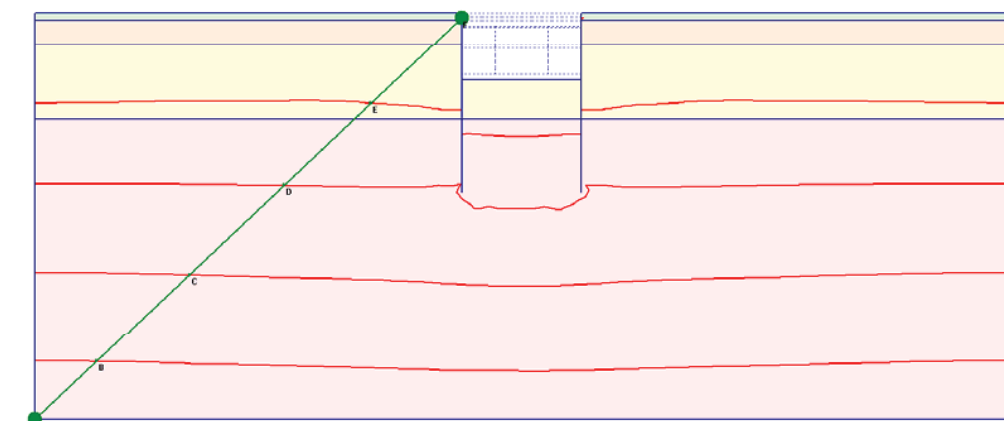
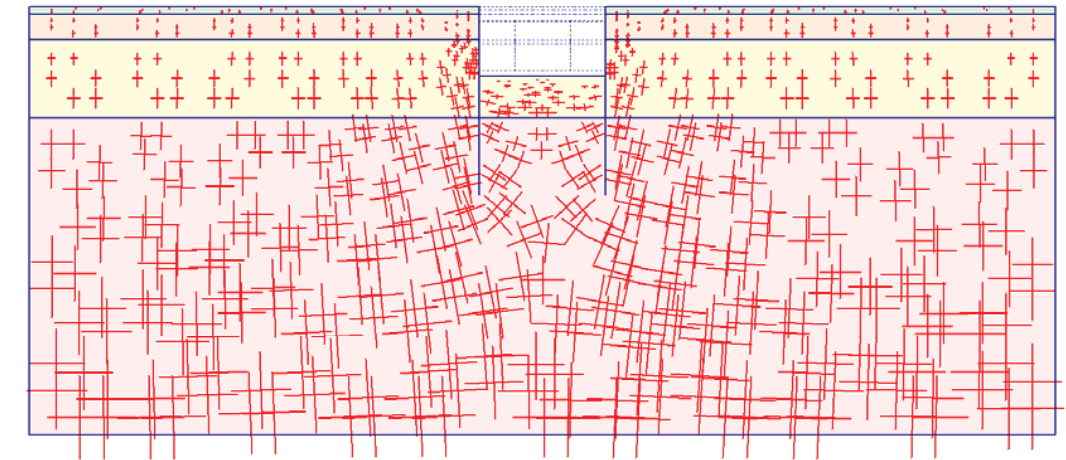


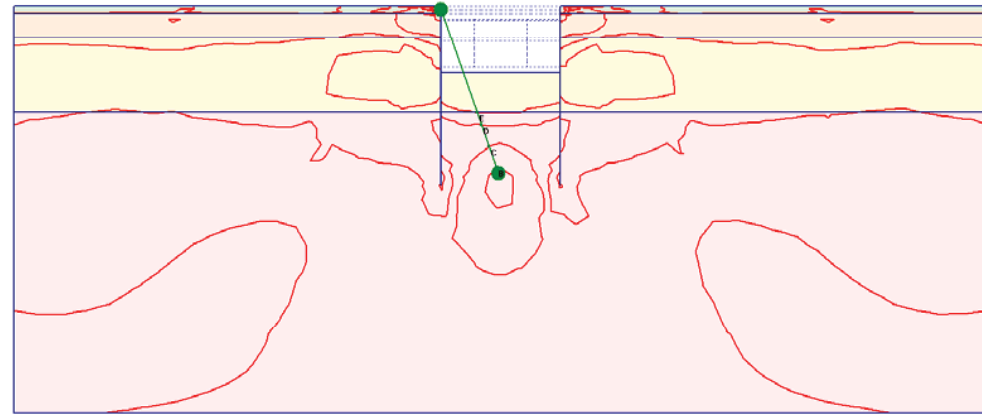
Fig. 168 Plot of effective stresses (relative shear shadings)
- step no: 23 - (phase: 7)

Fig. 169 Plot of total stresses (principal directions)
- step no: 23 - (phase: 7)



- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

Fig. 170 Plot of total stresses (mean contours)
- step no: 23 - (phase: 7)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 171 Plot of total stresses (relative shear contours)
- step no: 23 - (phase: 7)

Fig. 172 Plot of total stresses (mean shadings)
- step no: 23 - (phase: 7)

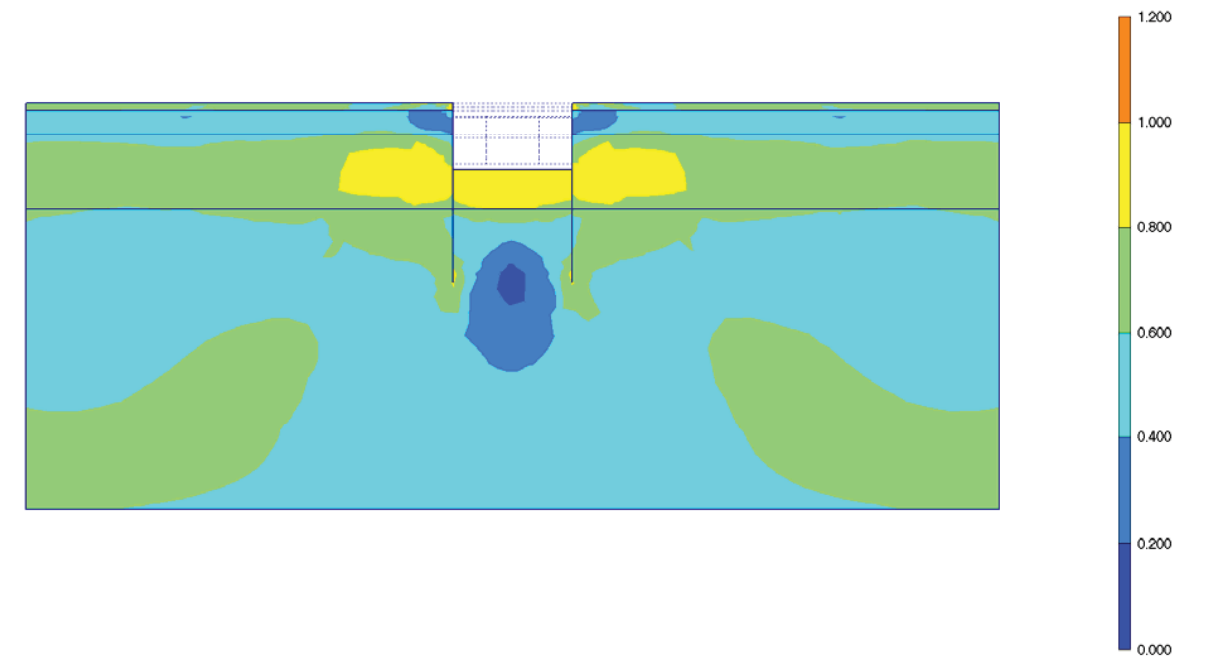
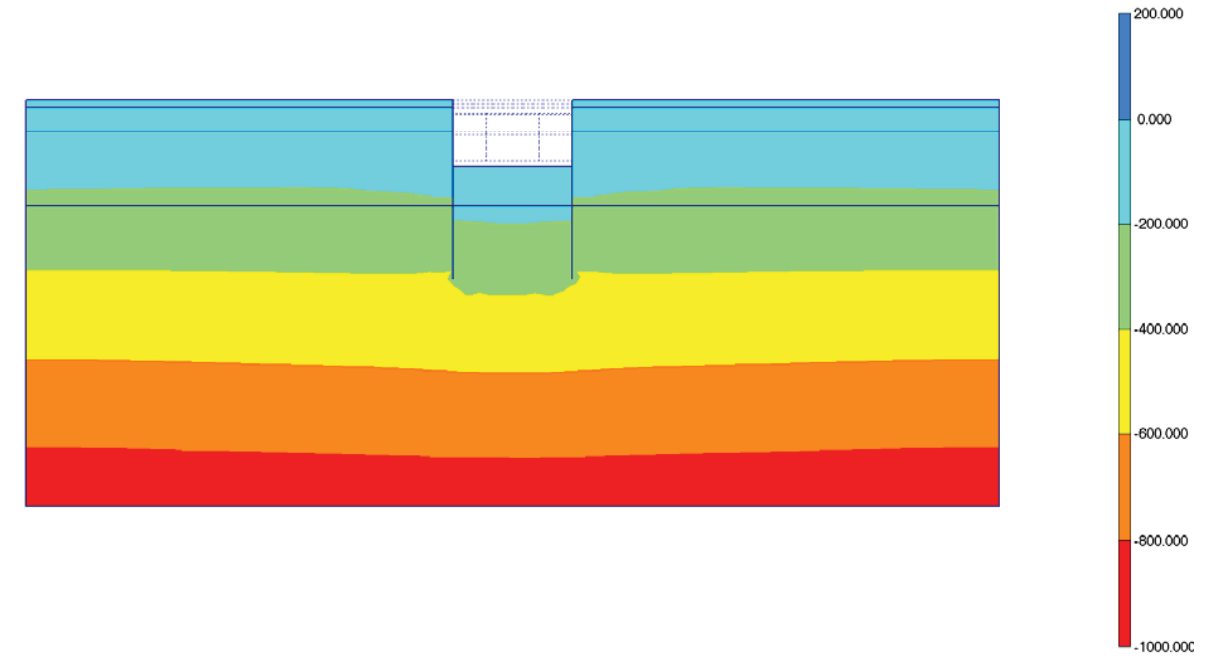
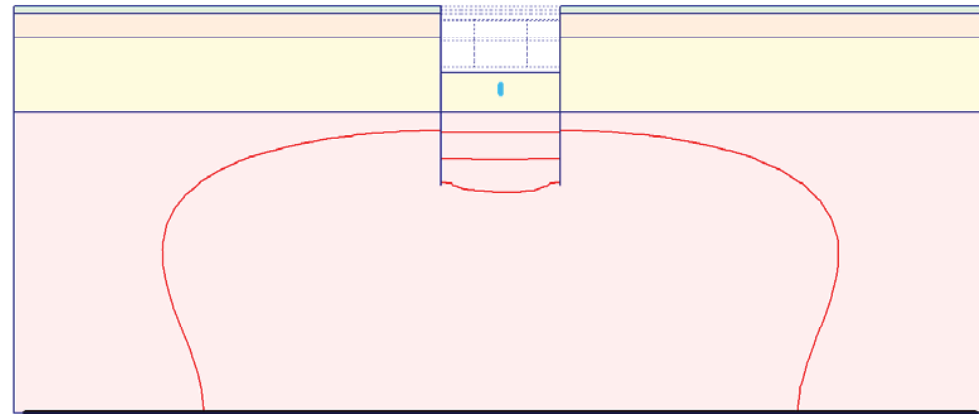


Fig. 173 Plot of total stresses (relative shear shadings)
- step no: 23 - (phase: 7)



A: -6.000
B: -4.000
C: -2.000
D: 0.000
E: 2.000
F: 4.000

Fig. 174 Plot of groundwater head (contour lines)
- step no: 23 - (phase: 7)

Fig. 175 Plot of groundwater head (shadings)
- step no: 23 - (phase: 7)

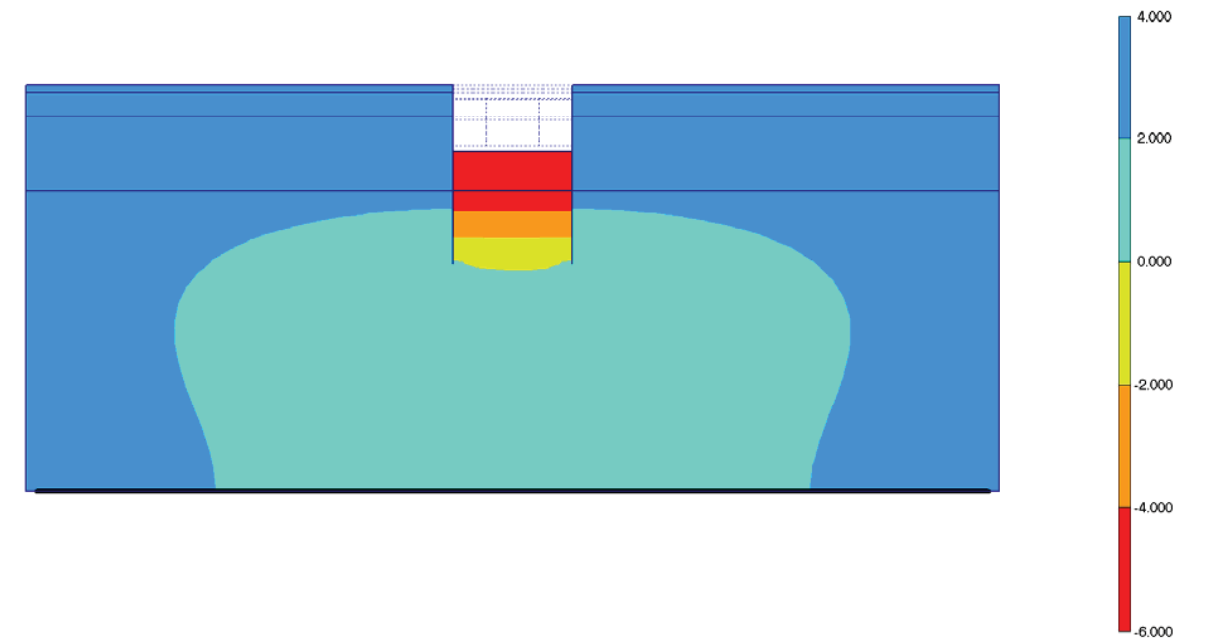


Fig. 176 Horizontal displacements in beam (plate no: 6)
Extreme value $-28,94 \cdot 10^{-3}$ m (phase: 7)

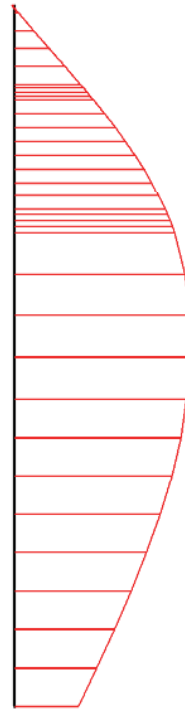


Fig. 177 Horizontal displacements in beam (plate no: 5)
Extreme value $29,10 \cdot 10^{-3}$ m (phase: 7)

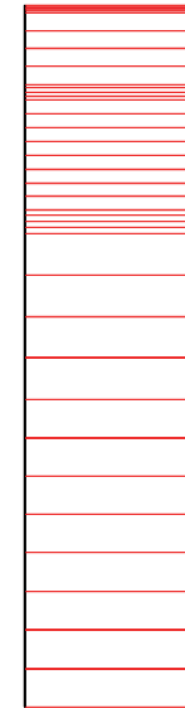


Fig. 178 Vertical displacements in beam (plate no: 6)
Extreme value $27,50 \cdot 10^{-3}$ m (phase: 7)

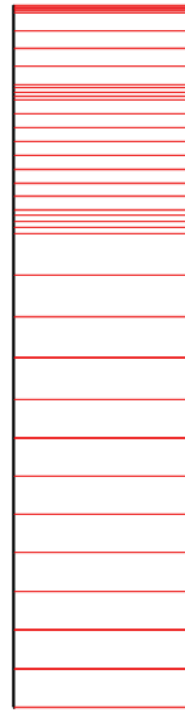


Fig. 179 Vertical displacements in beam (plate no: 5)
 Extreme value $26,74 \cdot 10^{-3}$ m (phase: 7)

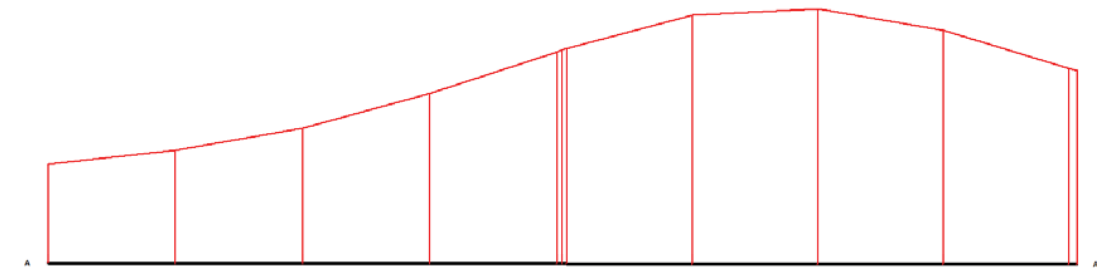


Fig. 180 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $10,68 \cdot 10^{-3}$ m (phase: 7)

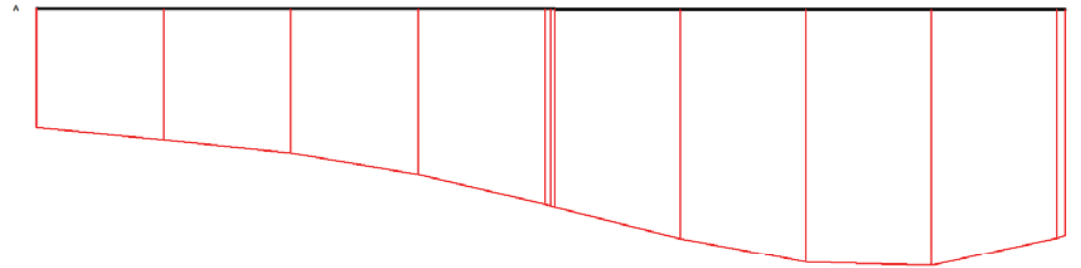


Fig. 181 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-14,82 \cdot 10^{-3}$ m (phase: 7)

15. RESULTS FOR PHASE 8

Table [62] Step info phase no: 8

Step no:	29
Calculation type	PLASTIC
Extrapolation factor	0,025
Relative stiffness	0,161

Table [63] Reached multipliers phase no: 8

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [64] Staged construction info phase no: 8

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,981
Active proportion of stage	0,005	1,000

Table [65] Realised tunnel contraction info phase no: 8

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [66] Iteration info phase no: 8

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,000	121	493	59	13	13	10	10
2	0,000	122	488	6	13	0	10	4

Table [67] Active distributed loads A phase no: 8

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

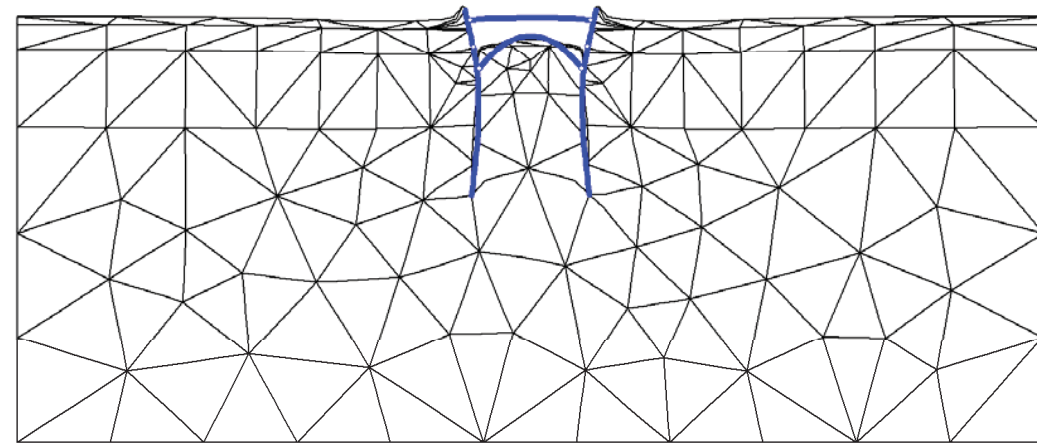


Fig. 182 Plot of deformed mesh
- step no: 29 - (phase: 8)

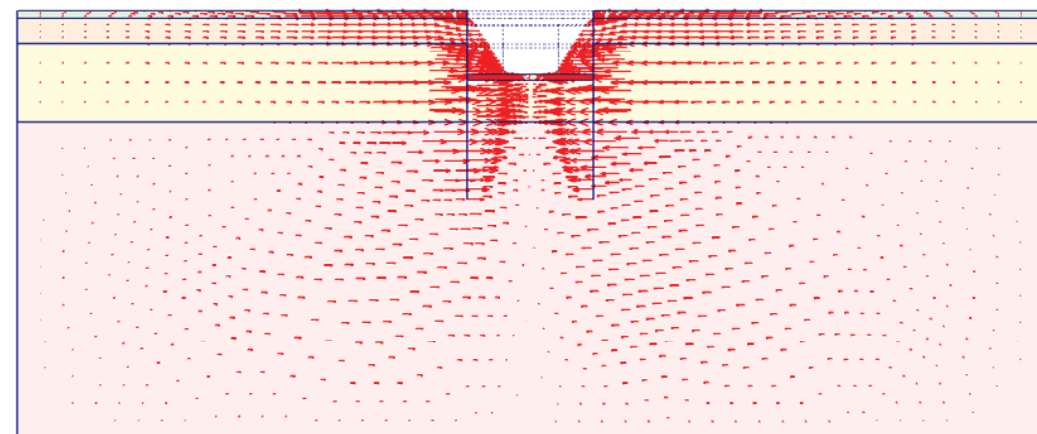
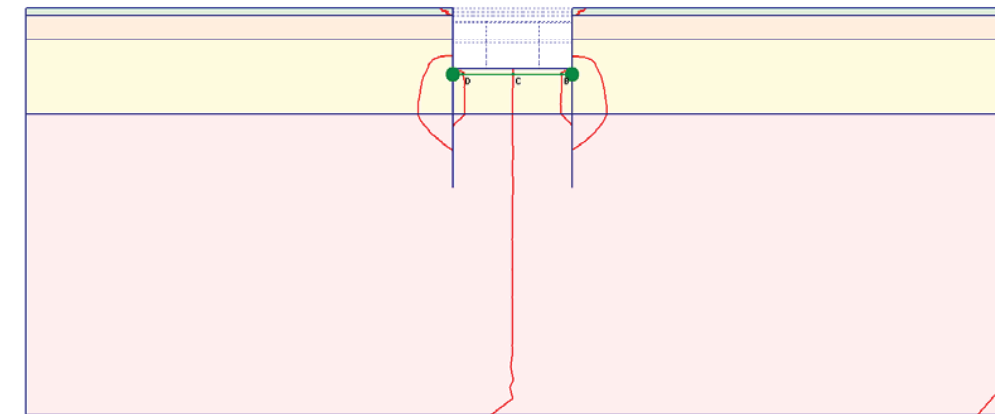


Fig. 183 Plot of horizontal displacements (arrows)
- step no: 29 - (phase: 8)



A: -0.040
B: -0.020
C: -0.000
D: 0.020
E: 0.040

Fig. 184 Plot of horizontal displacements (contour lines)
- step no: 29 - (phase: 8)

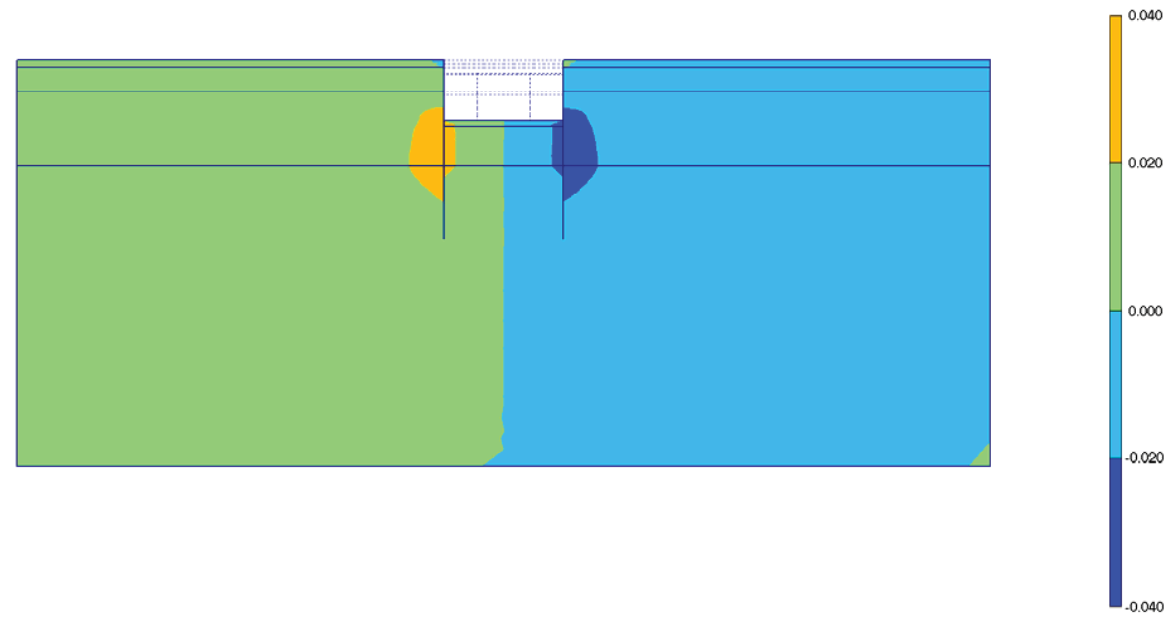


Fig. 185 Plot of horizontal displacements (shadings)
- step no: 29 - (phase: 8)

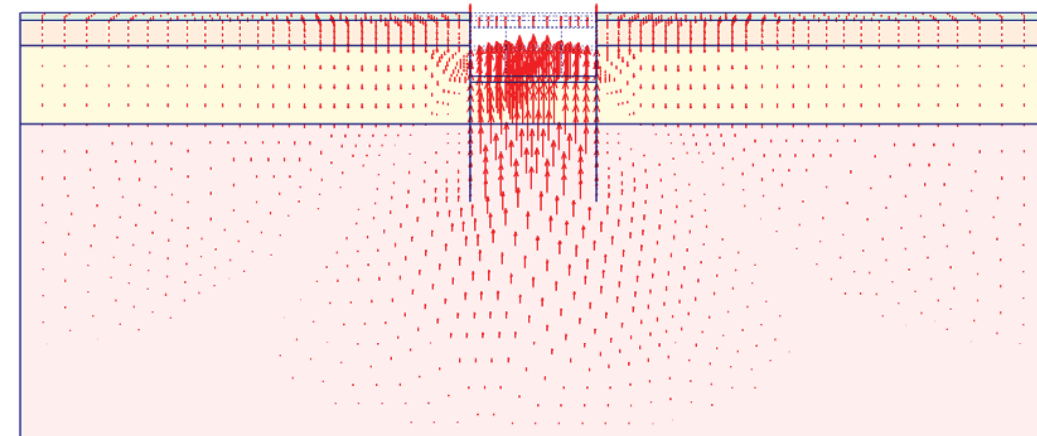


Fig. 186 Plot of vertical displacements (arrows)
- step no: 29 - (phase: 8)

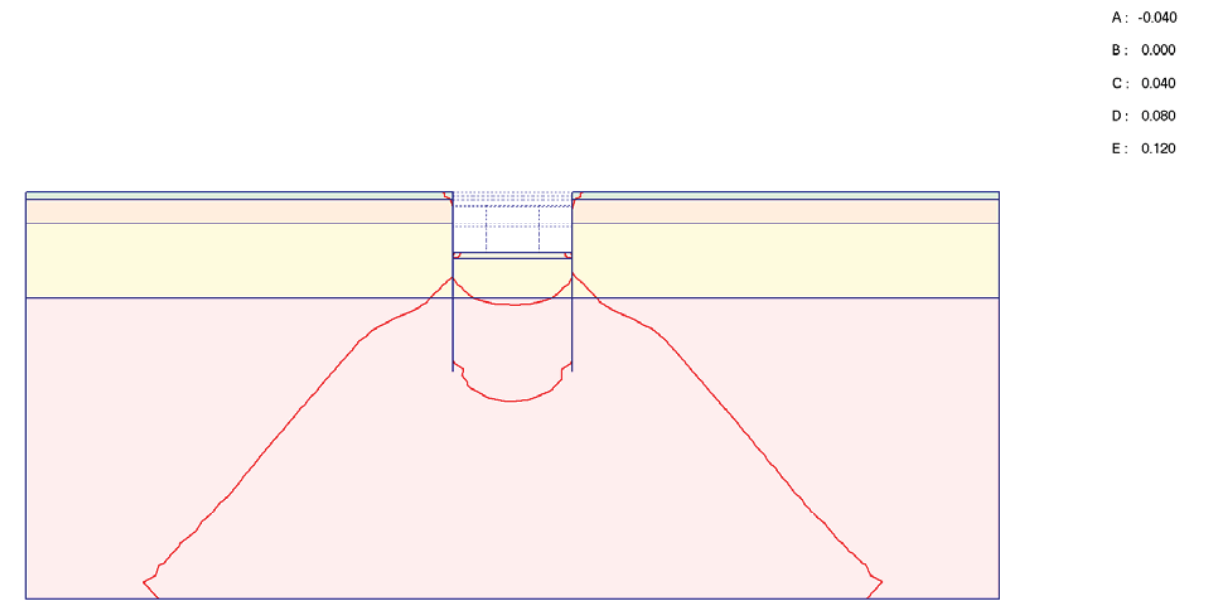
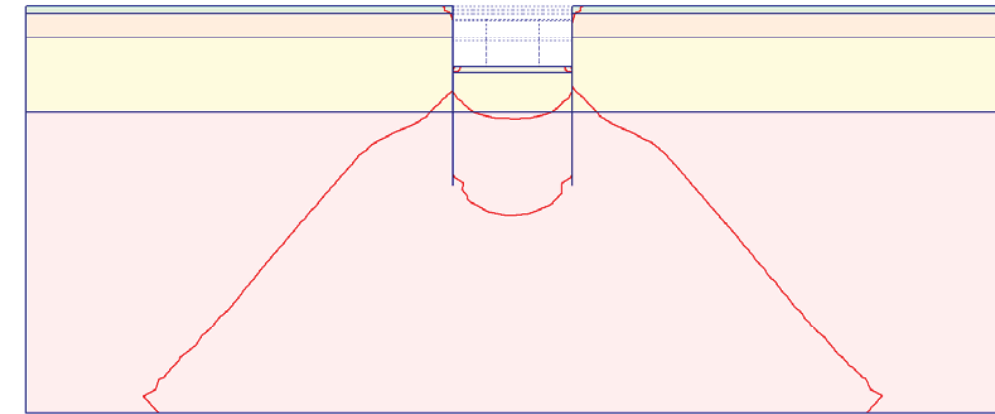


Fig. 187 Plot of vertical displacements (contour lines)
- step no: 29 - (phase: 8)



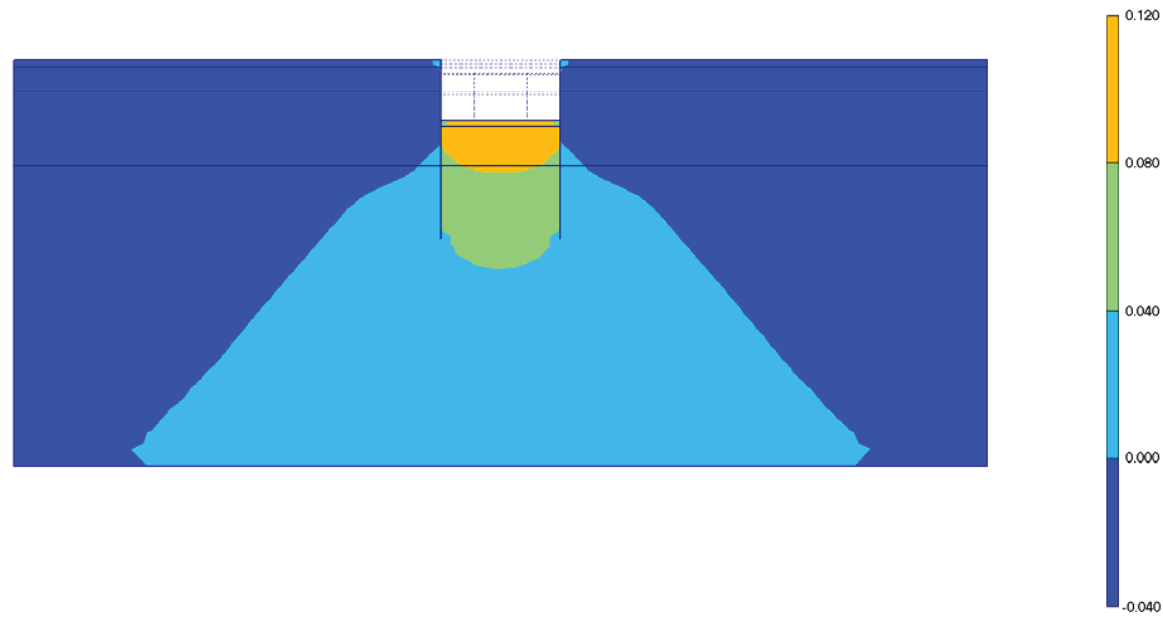


Fig. 188 Plot of vertical displacements (shadings)
- step no: 29 - (phase: 8)

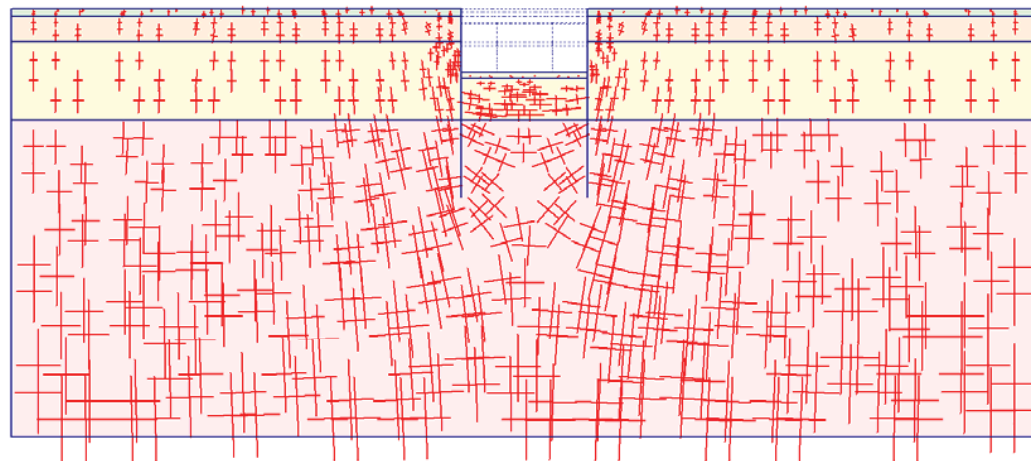


Fig. 189 Plot of effective stresses (principal directions)
- step no: 29 - (phase: 8)

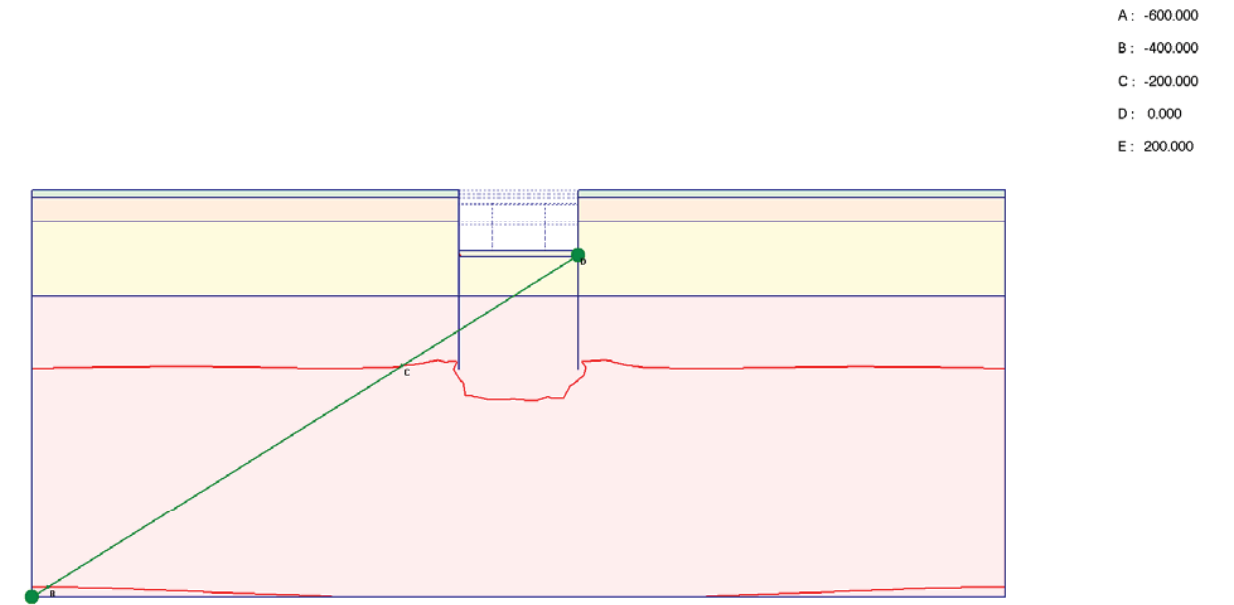


Fig. 190 Plot of effective stresses (mean contours)
- step no: 29 - (phase: 8)

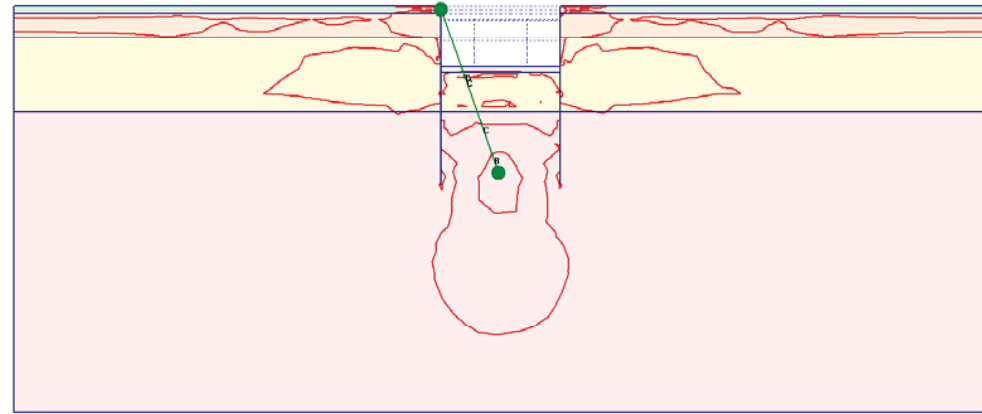


Fig. 191 Plot of effective stresses (relative shear contours) - step no: 29 - (phase: 8)

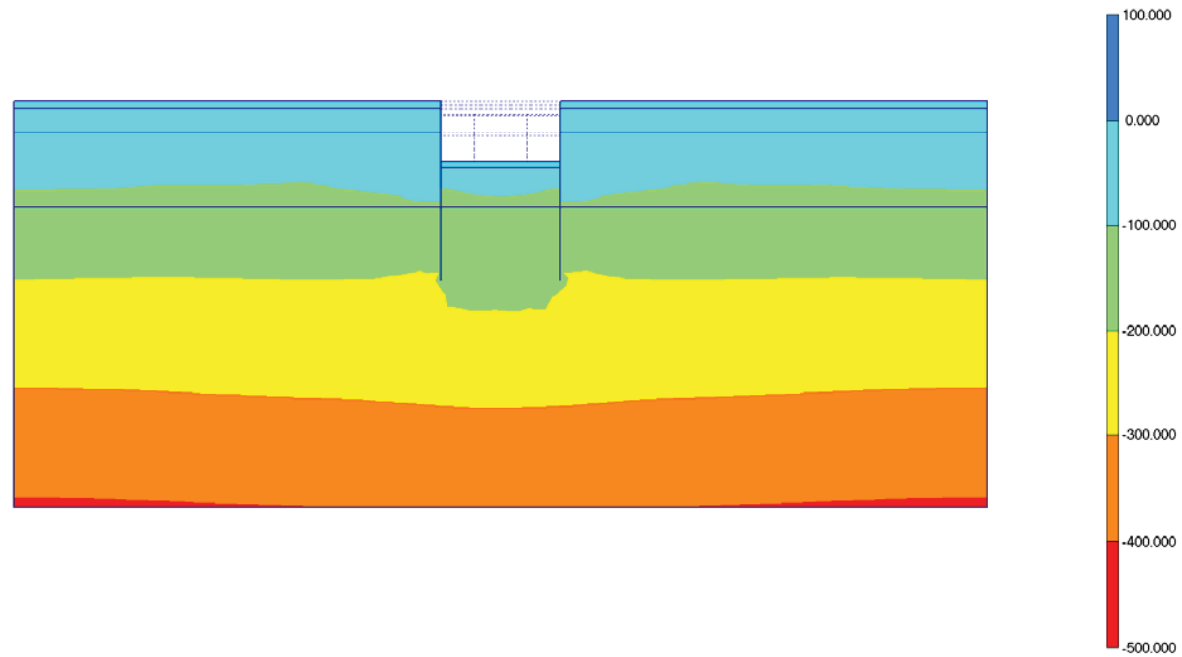


Fig. 192 Plot of effective stresses (mean shadings) - step no: 29 - (phase: 8)

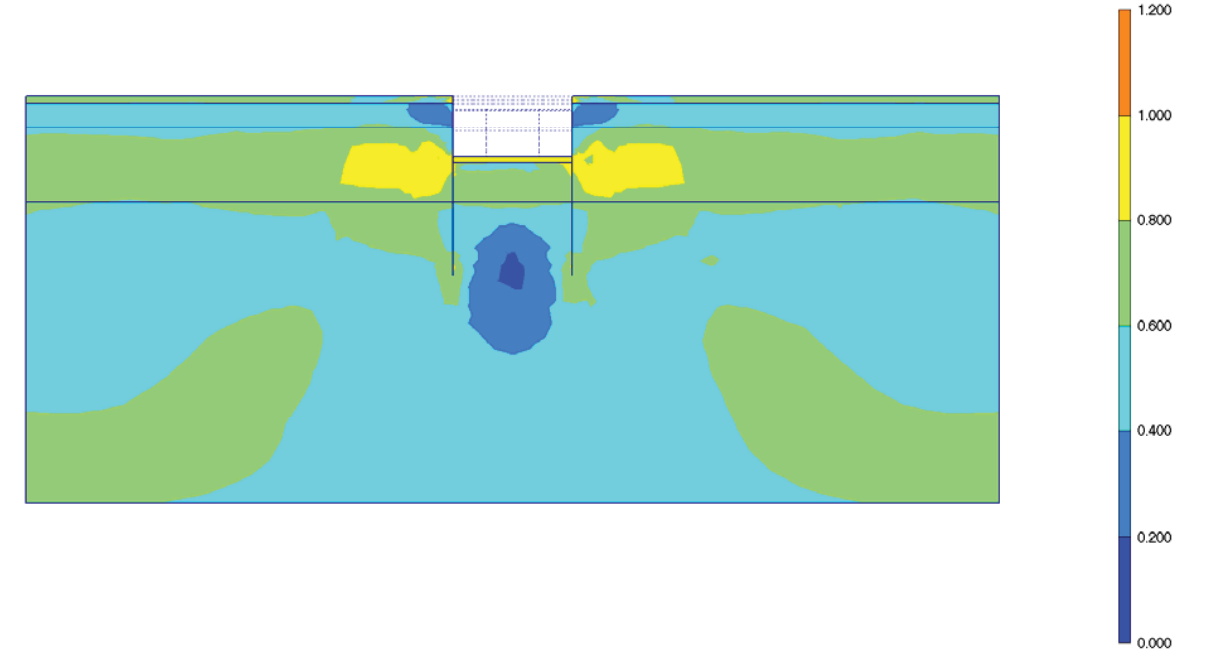


Fig. 193 Plot of effective stresses (relative shear shadings) - step no: 29 - (phase: 8)

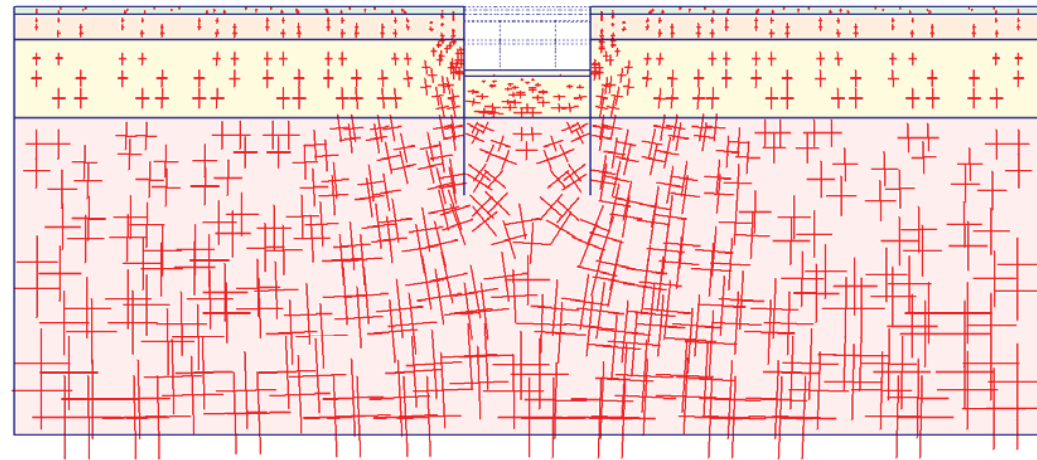


Fig. 194 Plot of total stresses (principal directions)
- step no: 29 - (phase: 8)

- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

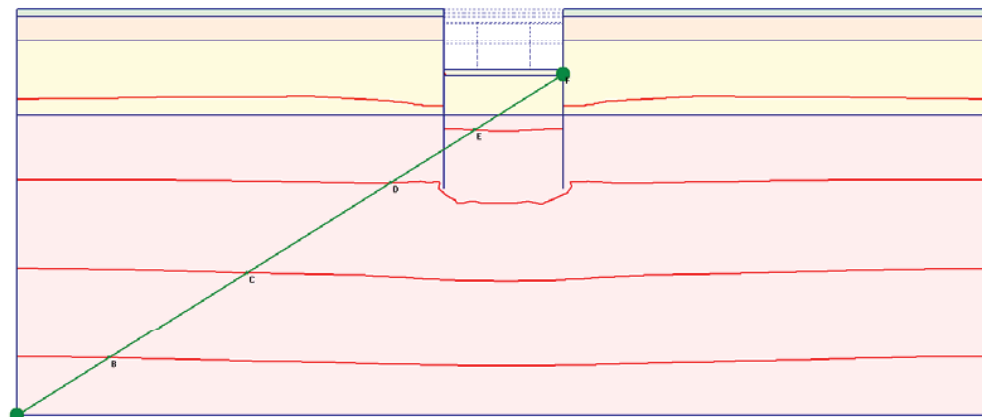
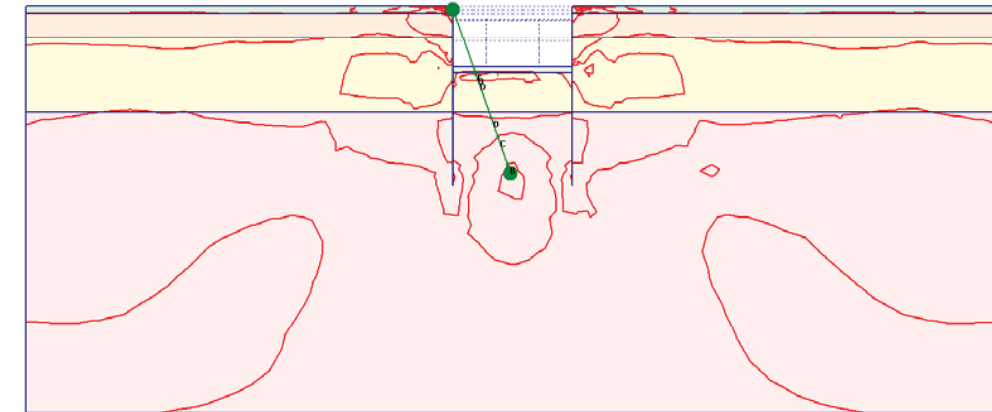


Fig. 195 Plot of total stresses (mean contours)
- step no: 29 - (phase: 8)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 196 Plot of total stresses (relative shear contours)
- step no: 29 - (phase: 8)

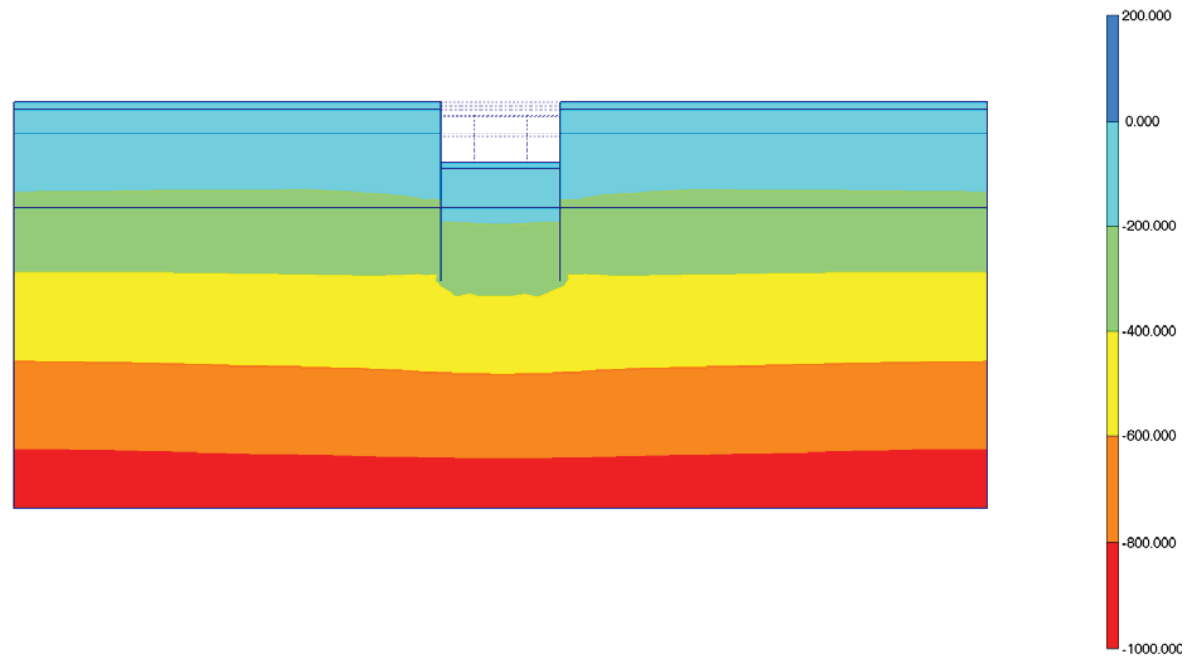


Fig. 197 Plot of total stresses (mean shadings)
- step no: 29 - (phase: 8)

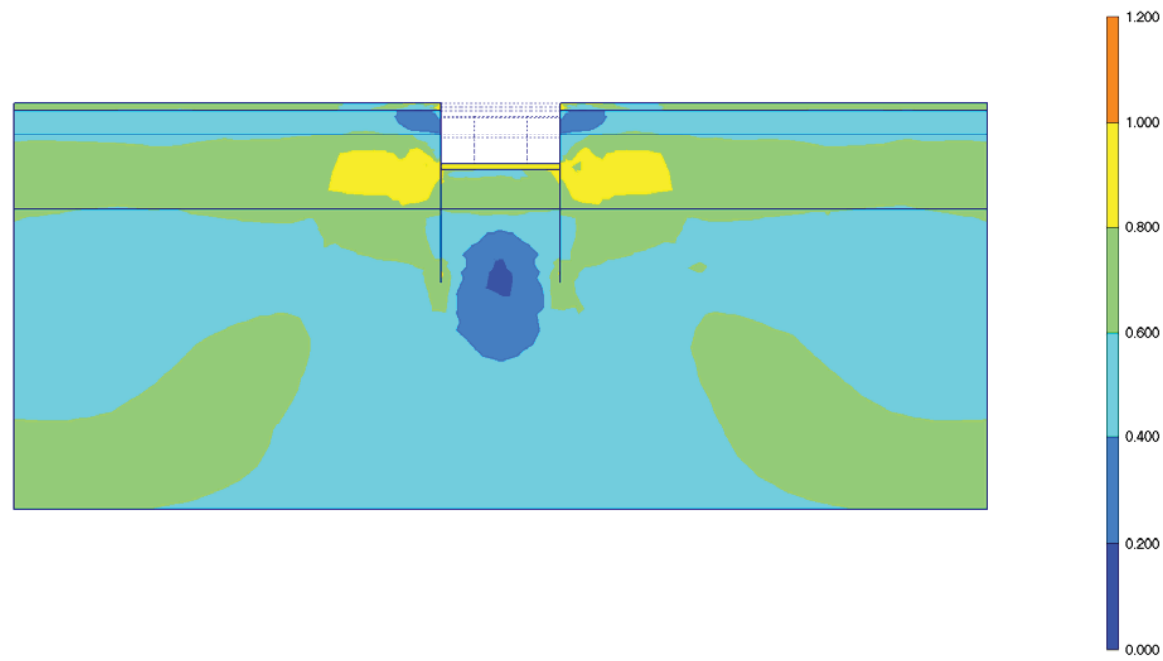


Fig. 198 Plot of total stresses (relative shear shadings)
- step no: 29 - (phase: 8)

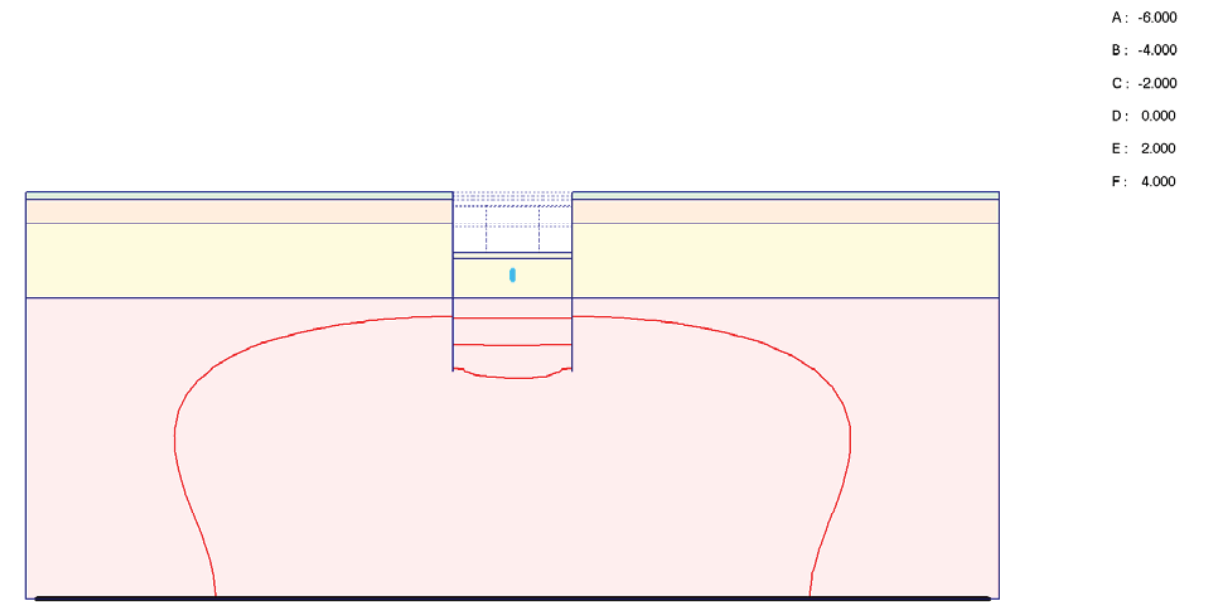


Fig. 199 Plot of groundwater head (contour lines)
- step no: 29 - (phase: 8)

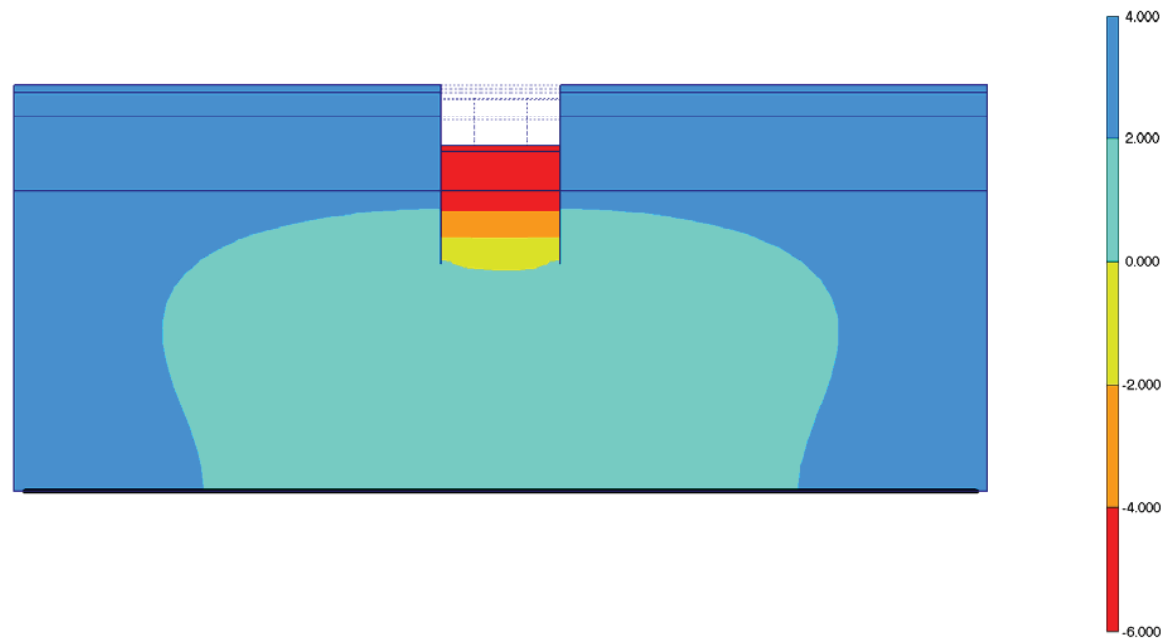


Fig. 200 Plot of groundwater head (shadings)
- step no: 29 - (phase: 8)

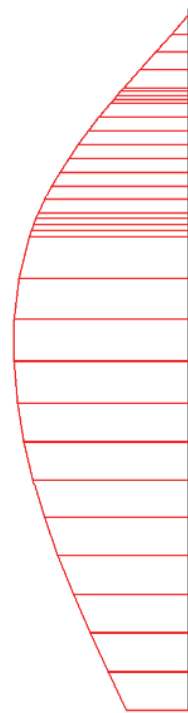


Fig. 201 Horizontal displacements in beam (plate no: 6)
Extreme value $-28,82 \cdot 10^{-3}$ m (phase: 8)

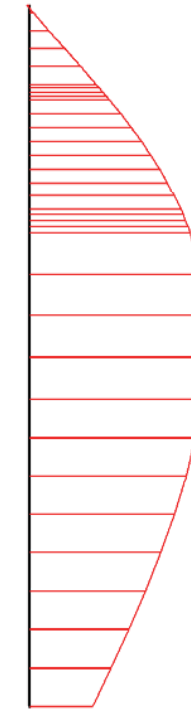


Fig. 202 Horizontal displacements in beam (plate no: 5)
Extreme value $29,00 \cdot 10^{-3}$ m (phase: 8)

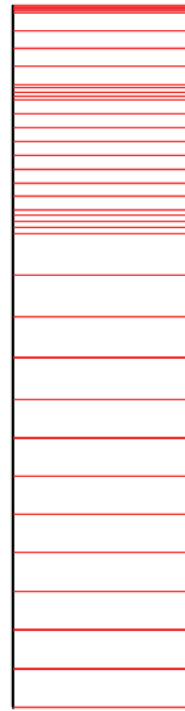


Fig. 203 Vertical displacements in beam (plate no: 6)
Extreme value $20,80 \cdot 10^{-3}$ m (phase: 8)

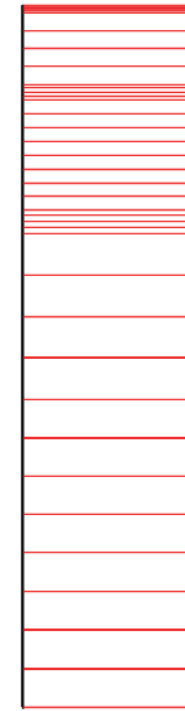


Fig. 204 Vertical displacements in beam (plate no: 5)
Extreme value $20,00 \cdot 10^{-3}$ m (phase: 8)

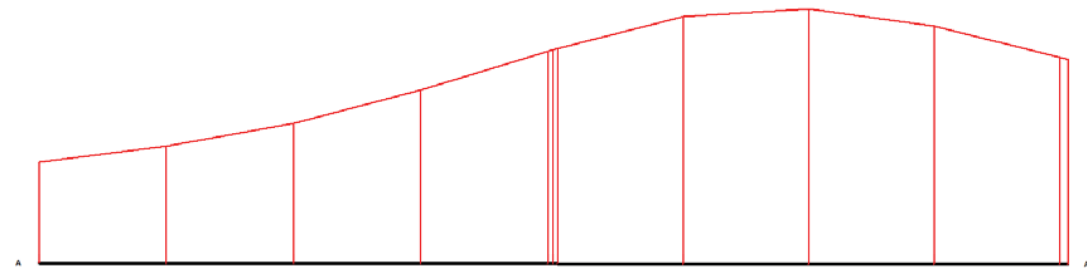


Fig. 205 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $12,48 \cdot 10^{-3}$ m (phase: 8)

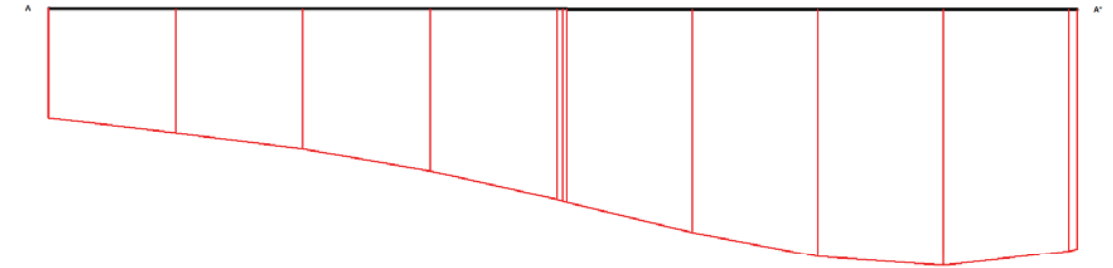


Fig. 206 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-18,22 \cdot 10^{-3}$ m (phase: 8)

16. RESULTS FOR PHASE 9

Table [68] Step info phase no: 9

Step no:	31
Calculation type	PLASTIC
Extrapolation factor	1,000
Relative stiffness	0,951

Table [69] Reached multipliers phase no: 9

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [70] Staged construction info phase no: 9

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,981
Active proportion of stage	0,500	1,000

Table [71] Realised tunnel contraction info phase no: 9

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [72] Iteration info phase no: 9

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,001	706	491	105	2	2	10	10
2	0,000	707	482	15	2	2	10	10

Table [73] Active distributed loads A phase no: 9

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

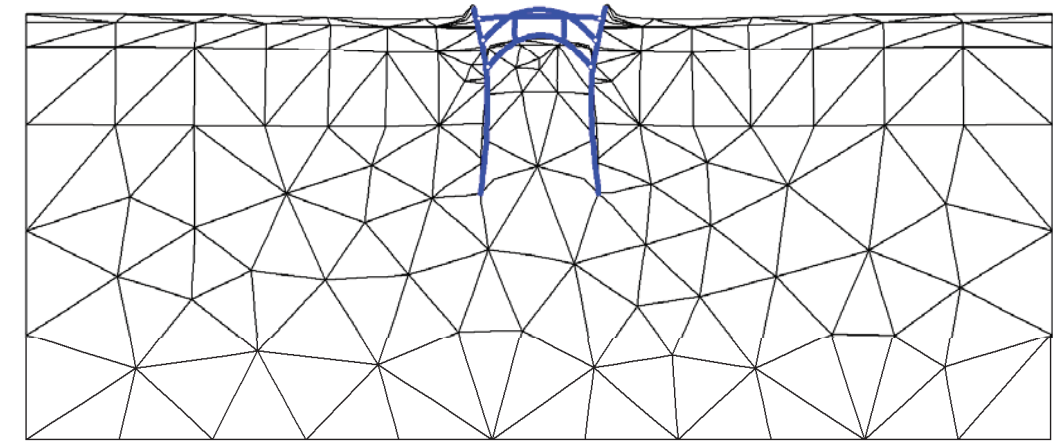


Fig. 207 Plot of deformed mesh - step no: 31 - (phase: 9)

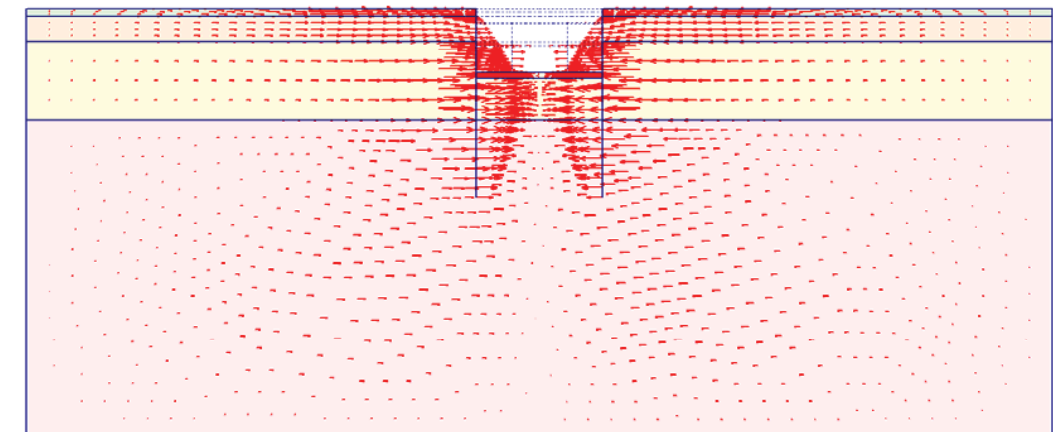
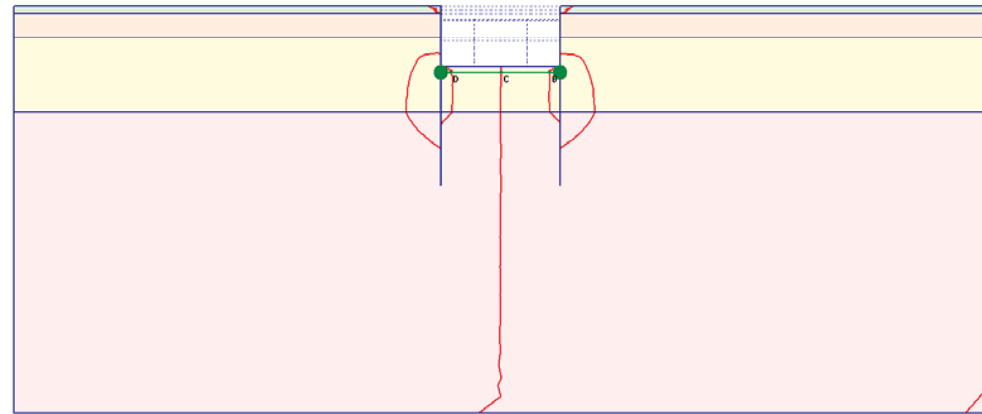


Fig. 208 Plot of horizontal displacements (arrows)
- step no: 31 - (phase: 9)



A: -0.040
B: -0.020
C: -0.000
D: 0.020
E: 0.040

Fig. 209 Plot of horizontal displacements (contour lines)
- step no: 31 - (phase: 9)

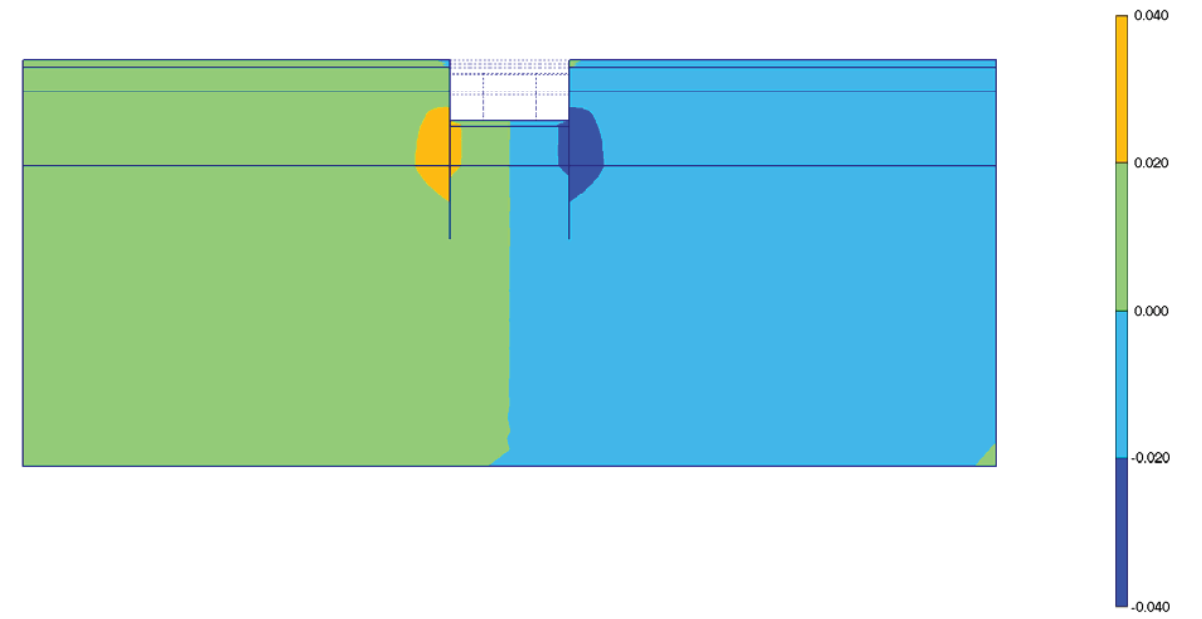


Fig. 210 Plot of horizontal displacements (shadings)
- step no: 31 - (phase: 9)

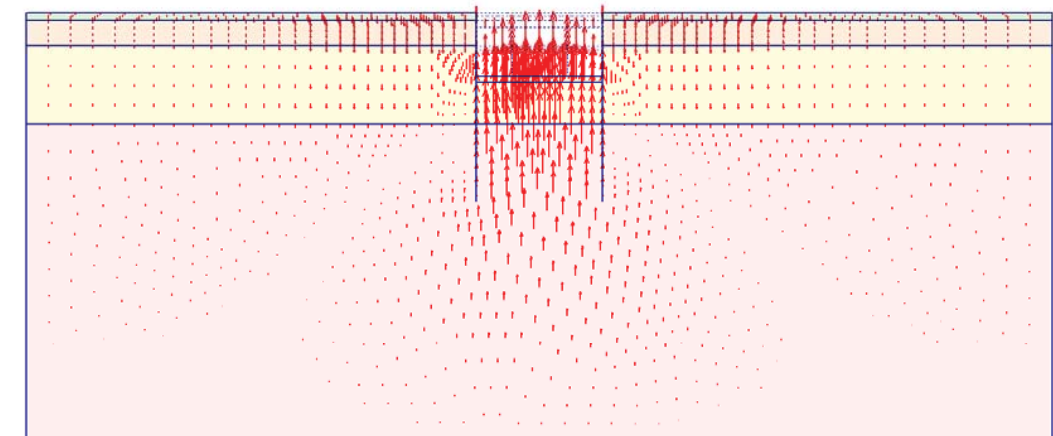
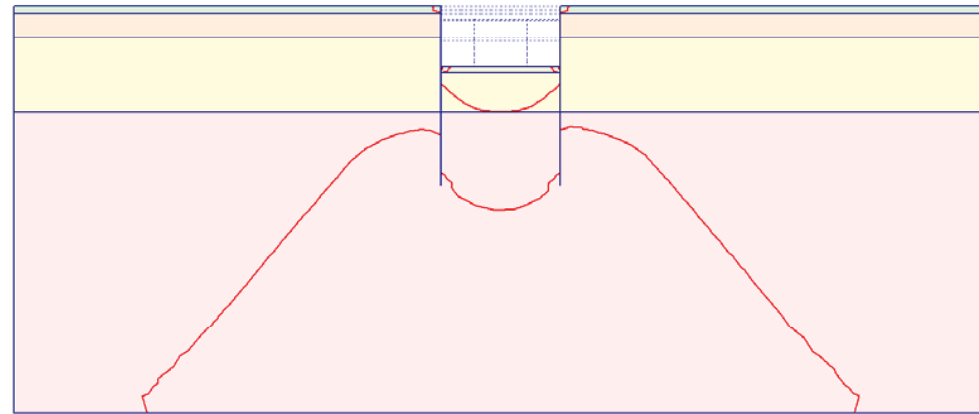


Fig. 211 Plot of vertical displacements (arrows)
- step no: 31 - (phase: 9)



A: -0.040
B: 0.000
C: 0.040
D: 0.080
E: 0.120

Fig. 212 Plot of vertical displacements (contour lines)
- step no: 31 - (phase: 9)

Fig. 213 Plot of vertical displacements (shadings)
- step no: 31 - (phase: 9)

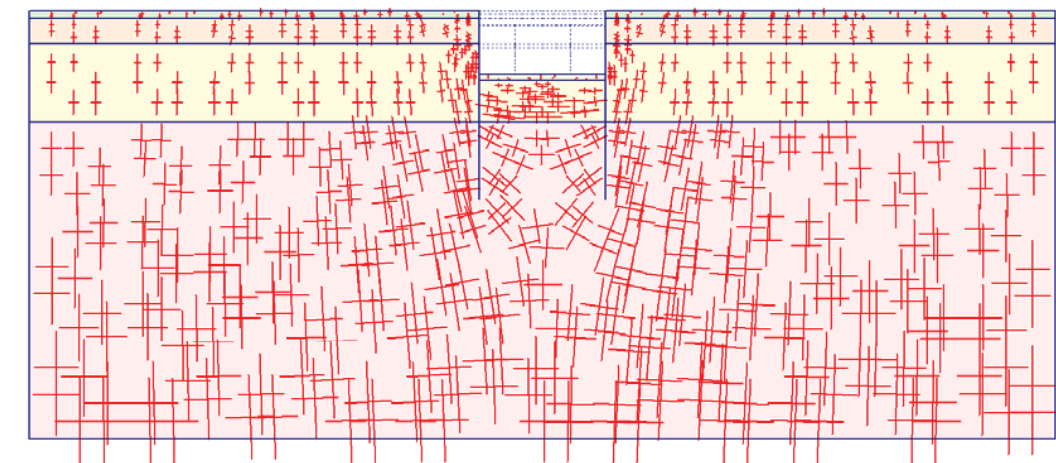
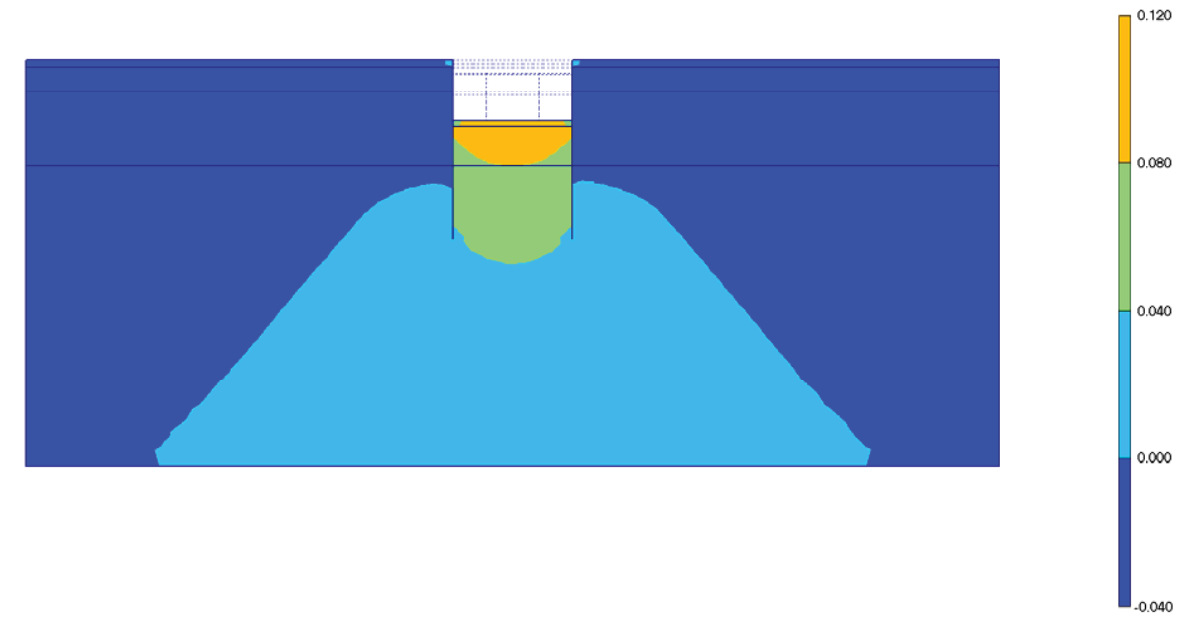


Fig. 214 Plot of effective stresses (principal directions)
- step no: 31 - (phase: 9)

A: -600.000
B: -400.000
C: -200.000
D: 0.000
E: 200.000

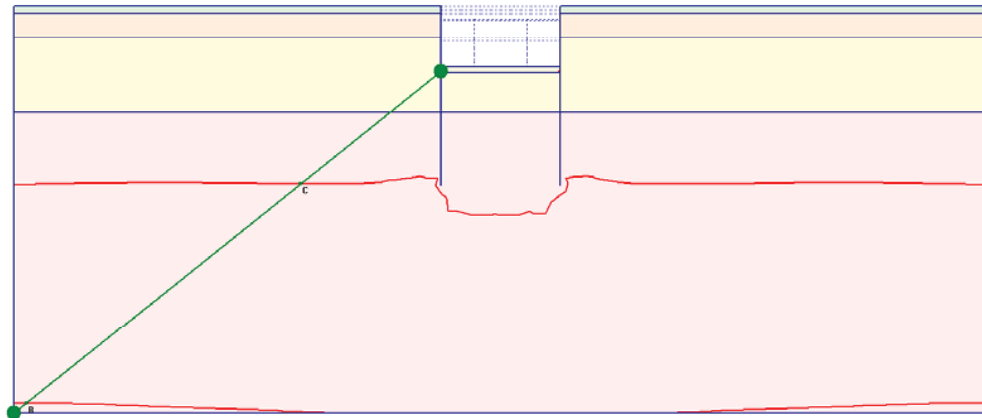


Fig. 215 Plot of effective stresses (mean contours)
- step no: 31 - (phase: 9)

A: 0.000
B: 0.250
C: 0.500
D: 0.750
E: 1.000
F: 1.250

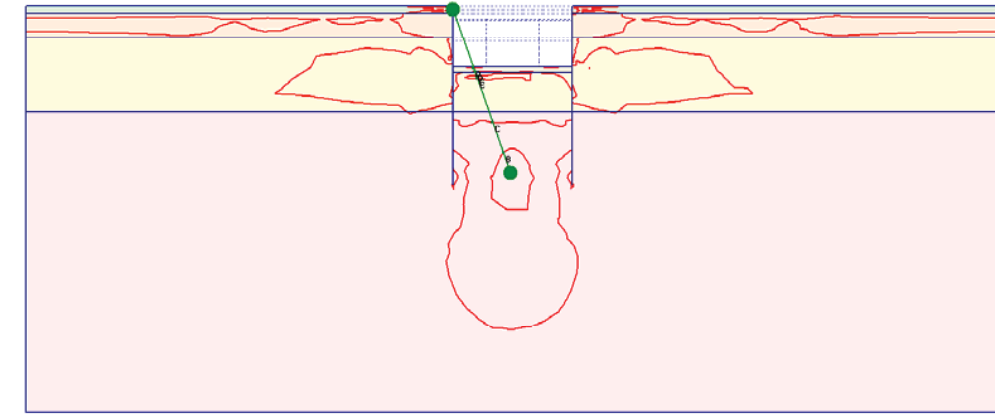


Fig. 216 Plot of effective stresses (relative shear contours)
- step no: 31 - (phase: 9)

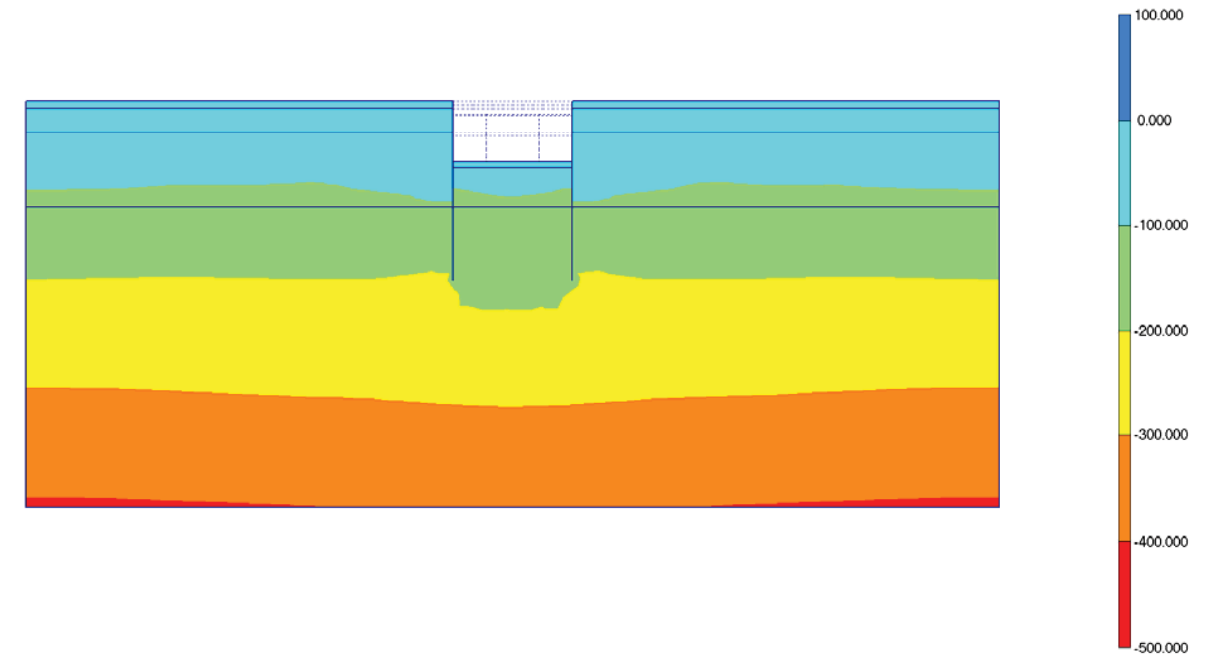


Fig. 217 Plot of effective stresses (mean shadings)
- step no: 31 - (phase: 9)

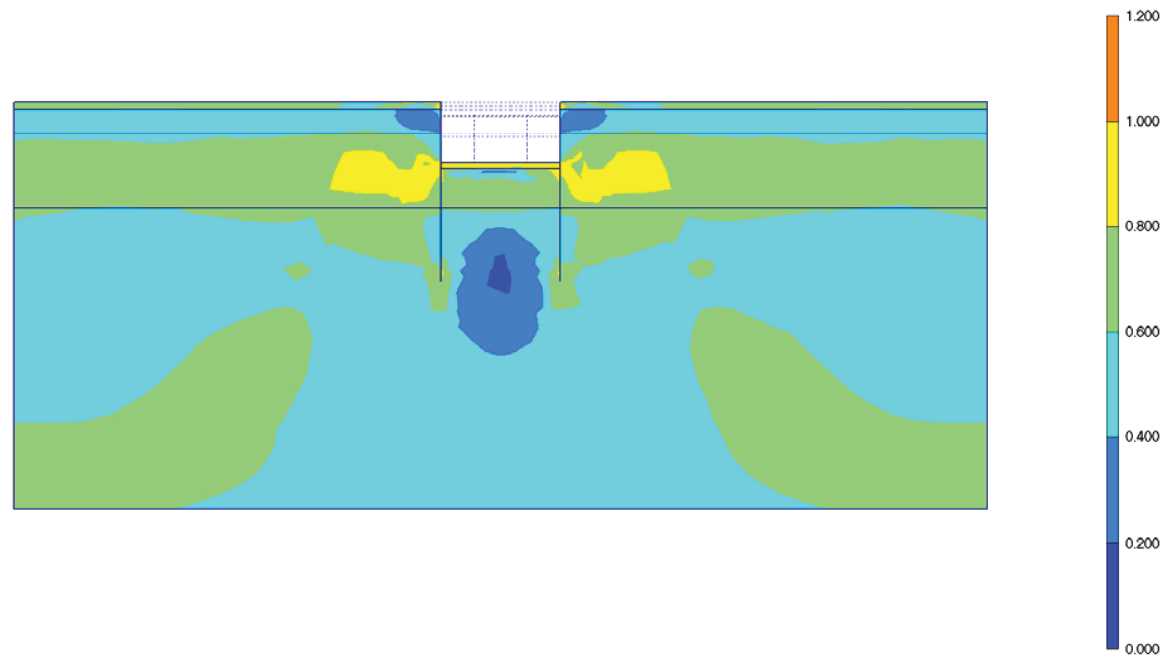


Fig. 218 Plot of effective stresses (relative shear shadings)
- step no: 31 - (phase: 9)

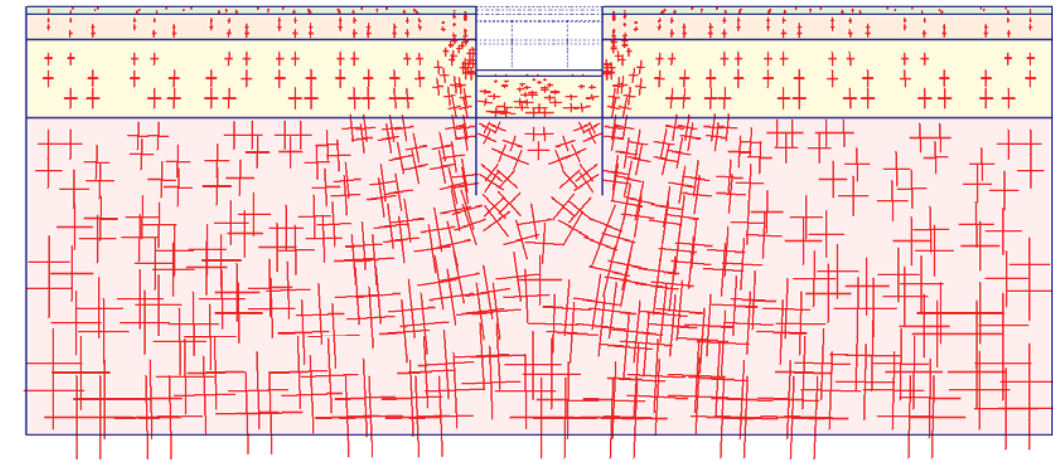


Fig. 219 Plot of total stresses (principal directions)
- step no: 31 - (phase: 9)

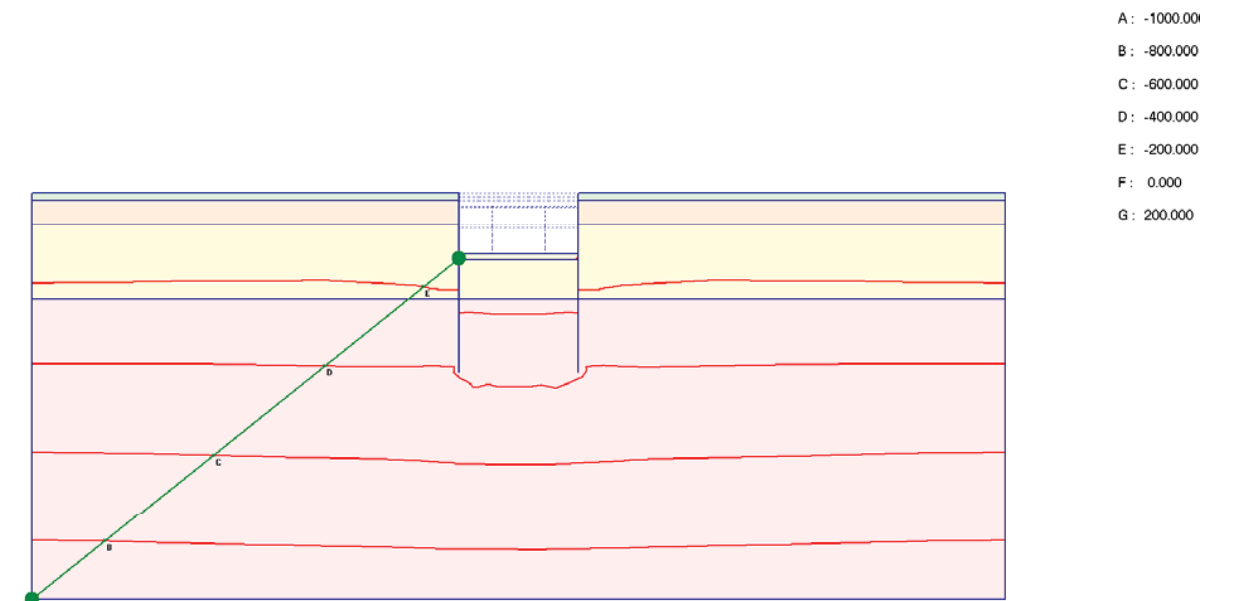
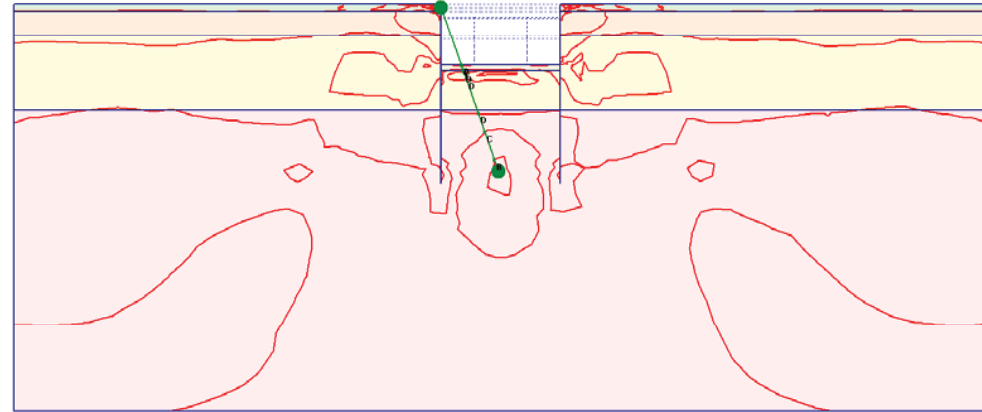


Fig. 220 Plot of total stresses (mean contours)
- step no: 31 - (phase: 9)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 221 Plot of total stresses (relative shear contours)
- step no: 31 - (phase: 9)

Fig. 222 Plot of total stresses (mean shadings)
- step no: 31 - (phase: 9)

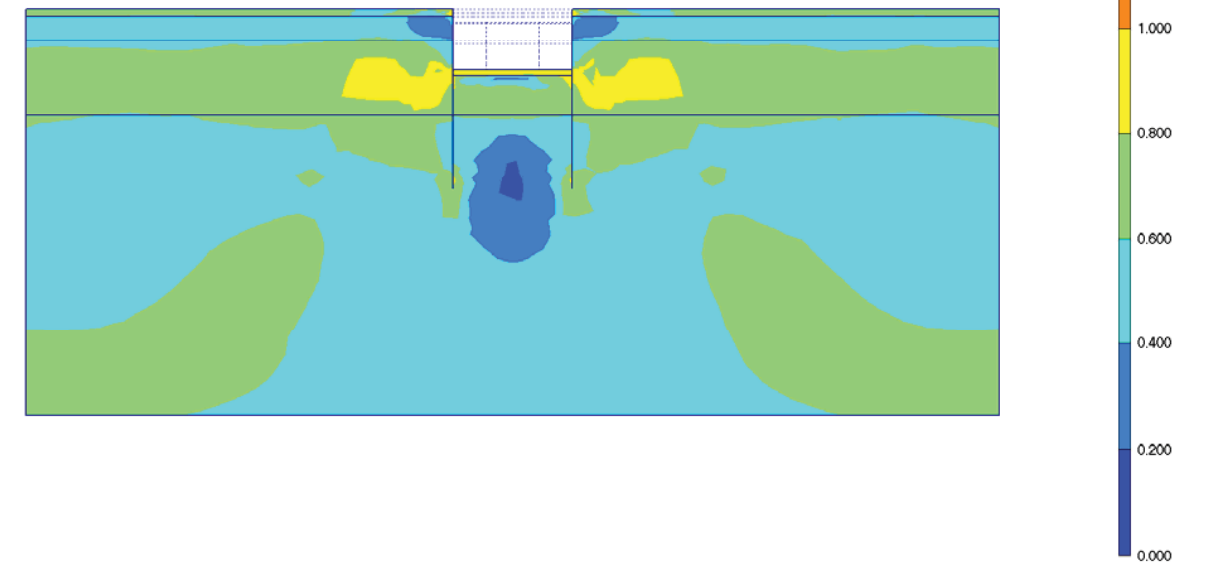
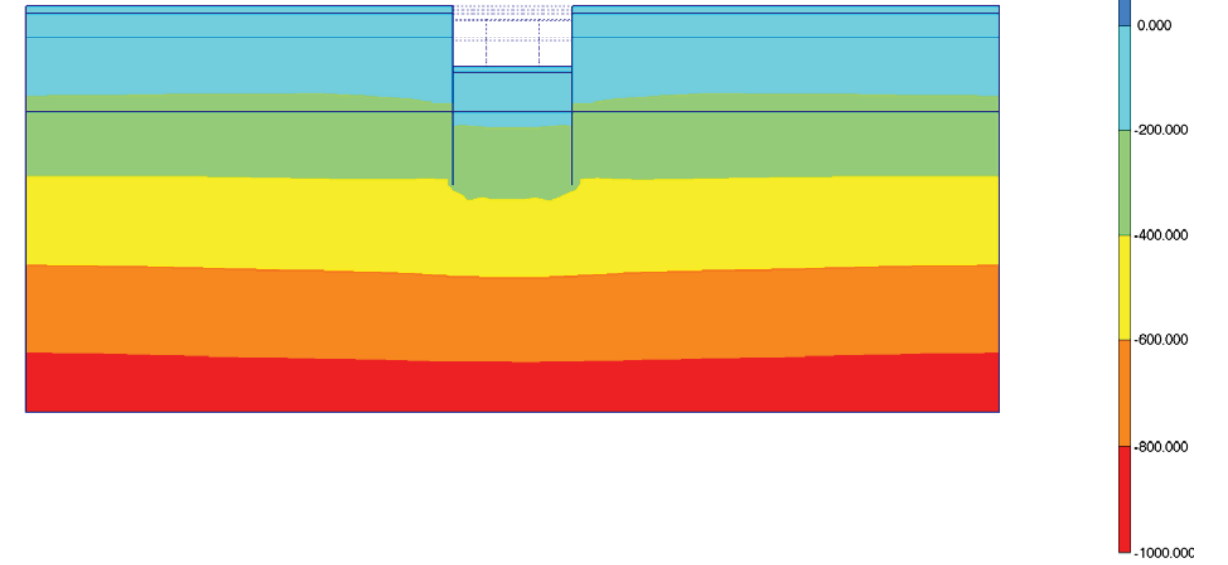
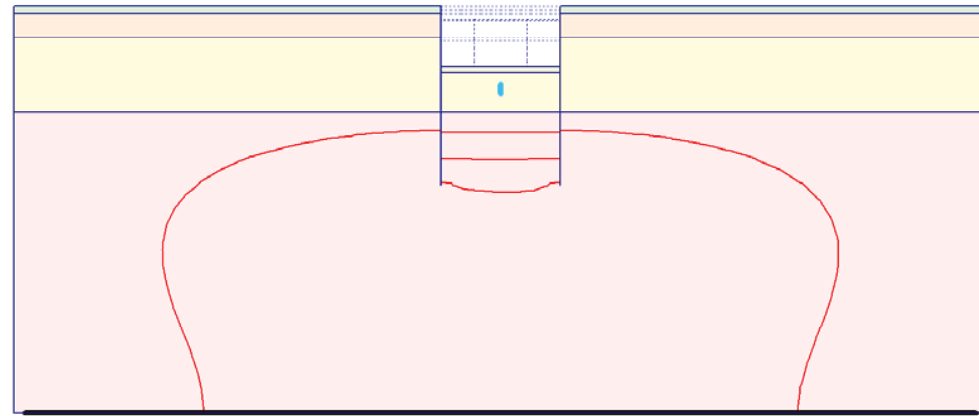


Fig. 223 Plot of total stresses (relative shear shadings)
- step no: 31 - (phase: 9)



A: -6.000
B: -4.000
C: -2.000
D: 0.000
E: 2.000
F: 4.000

Fig. 224 Plot of groundwater head (contour lines)
- step no: 31 - (phase: 9)

Fig. 225 Plot of groundwater head (shadings)
- step no: 31 - (phase: 9)

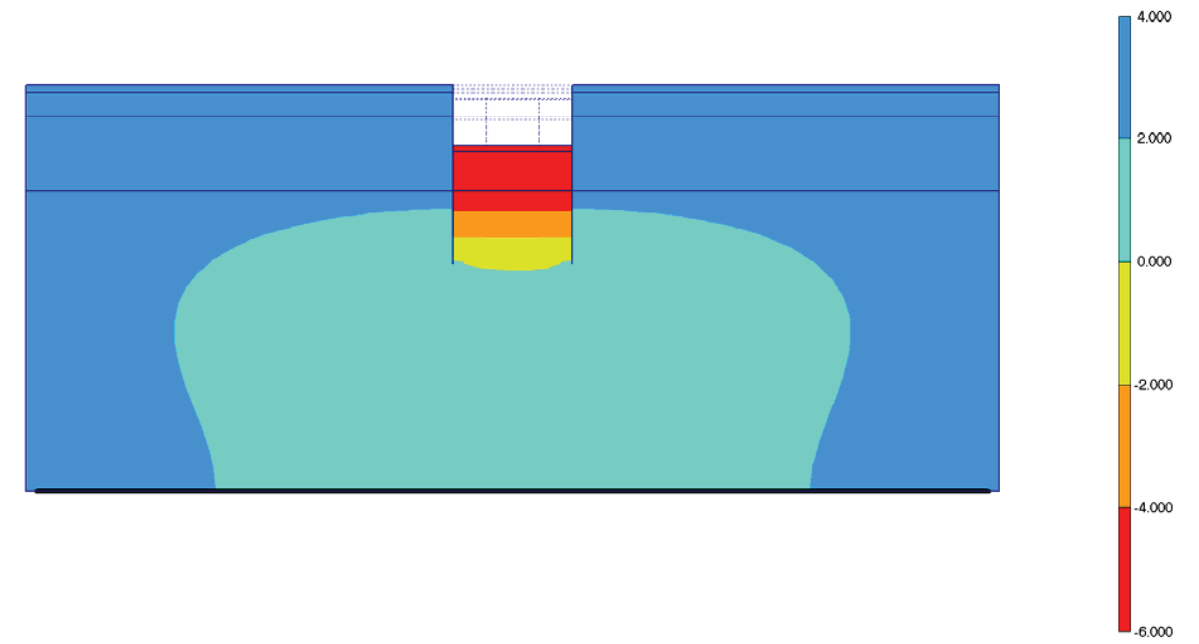
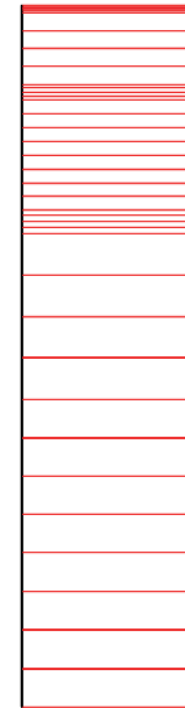


Fig. 226 Horizontal displacements in beam (plate no: 6)
Extreme value $-28,78 \cdot 10^{-3}$ m (phase: 9)



Fig. 227 Horizontal displacements in beam (plate no: 5)
Extreme value $28,99 \cdot 10^{-3}$ m (phase: 9)

Fig. 228 Vertical displacements in beam (plate no: 6)
Extreme value $17,76 \cdot 10^{-3}$ m (phase: 9)



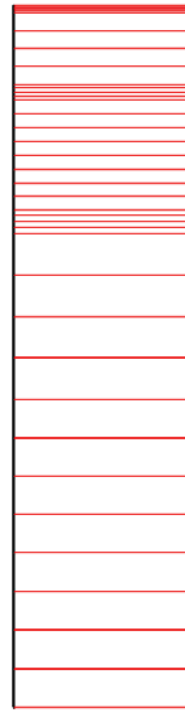


Fig. 229 Vertical displacements in beam (plate no: 5)
Extreme value $16,92 \cdot 10^{-3}$ m (phase: 9)

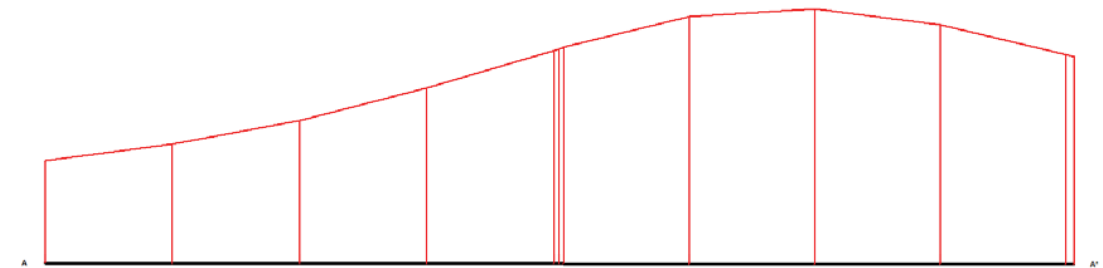


Fig. 230 Horizontal displacements in cross section (cross section A - A*)
Extreme value $13,21 \cdot 10^{-3}$ m (phase: 9)

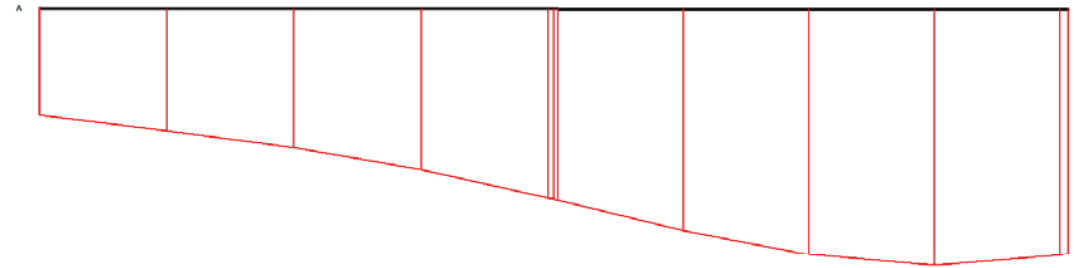


Fig. 231 Vertical displacements in cross section (cross section A - A*)
Extreme value $-19,72 \cdot 10^{-3}$ m (phase: 9)

17. RESULTS FOR PHASE 10

Table [74] Step info phase no: 10

Step no:	33
Calculation type	PLASTIC
Extrapolation factor	1,000
Relative stiffness	0,634

Table [75] Reached multipliers phase no: 10

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [76] Staged construction info phase no: 10

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,981
Active proportion of stage	0,500	1,000

Table [77] Realised tunnel contraction info phase no: 10

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [78] Iteration info phase no: 10

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,000	394	347	17	0	0	9	9
2	0,000	403	330	8	0	0	9	3

Table [79] Active distributed loads A phase no: 10

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

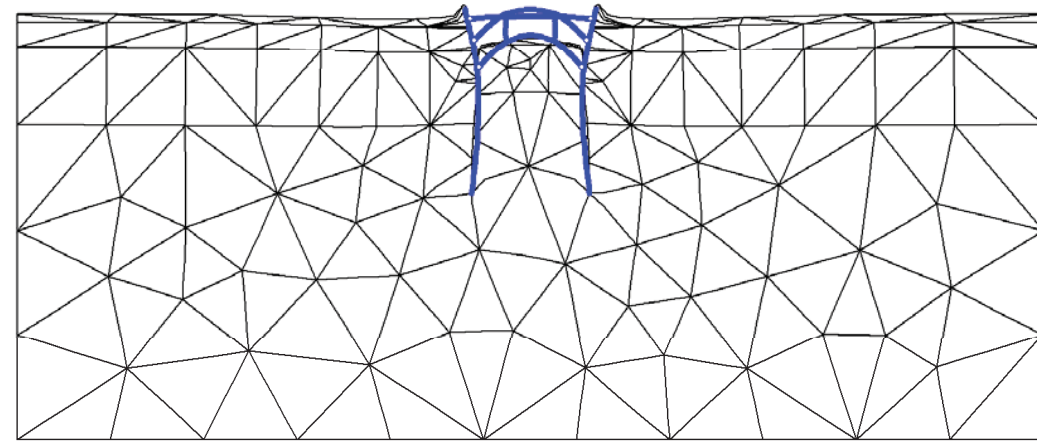


Fig. 232 Plot of deformed mesh
- step no: 33 - (phase: 10)

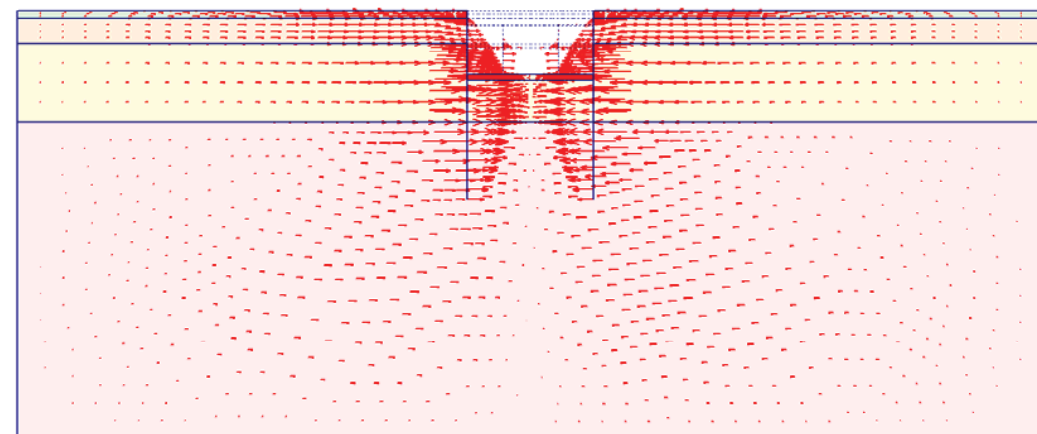
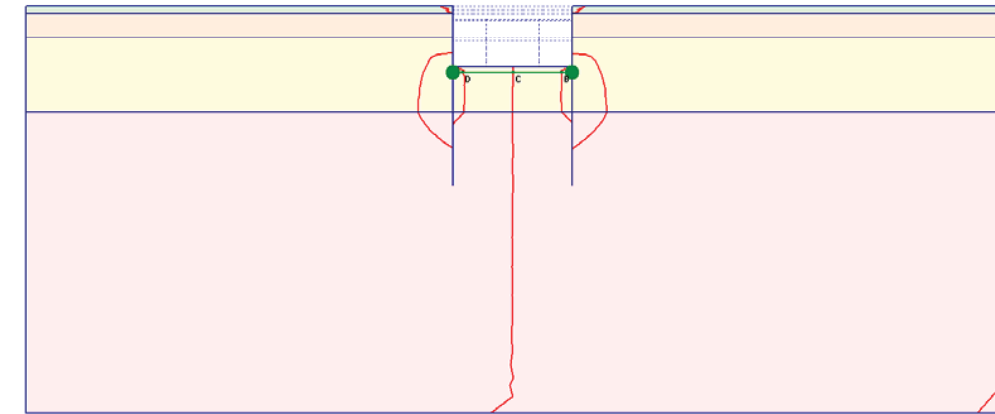


Fig. 233 Plot of horizontal displacements (arrows)
- step no: 33 - (phase: 10)



A: -0.040
B: -0.020
C: -0.000
D: 0.020
E: 0.040

Fig. 234 Plot of horizontal displacements (contour lines)
- step no: 33 - (phase: 10)

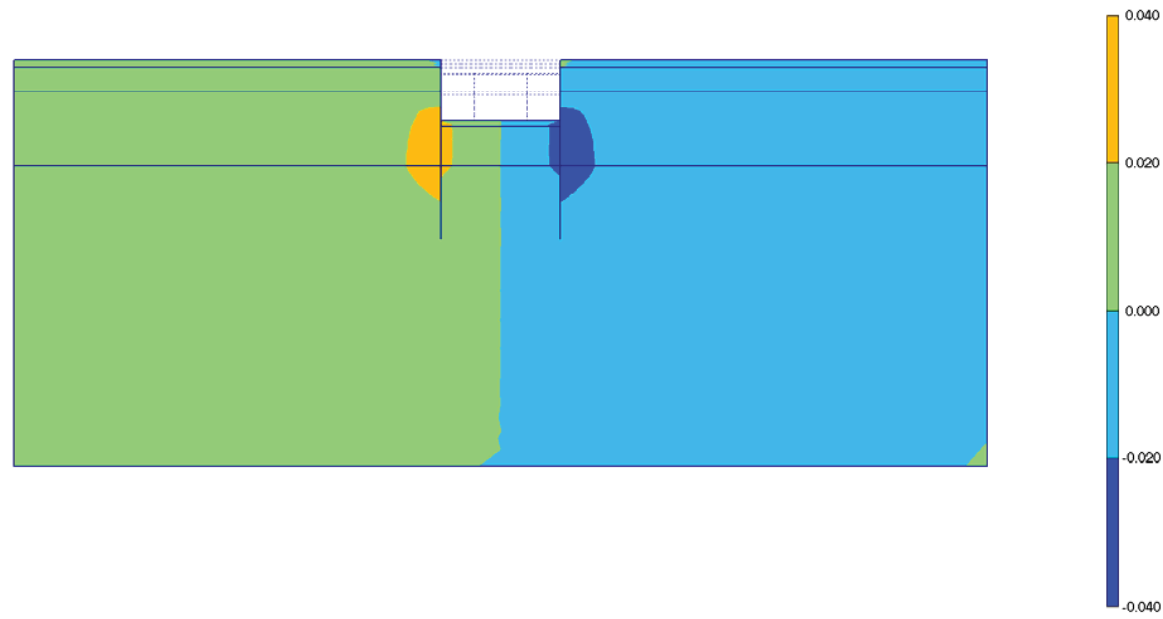


Fig. 235 Plot of horizontal displacements (shadings)
- step no: 33 - (phase: 10)

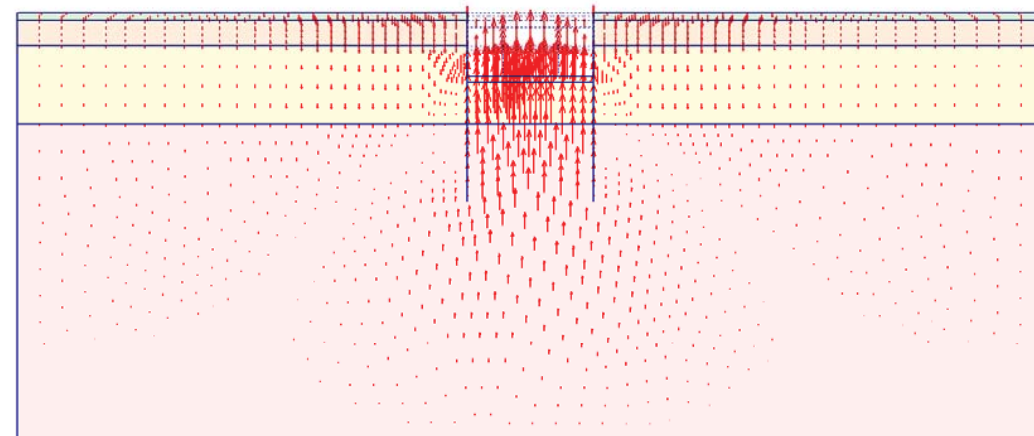


Fig. 236 Plot of vertical displacements (arrows)
- step no: 33 - (phase: 10)

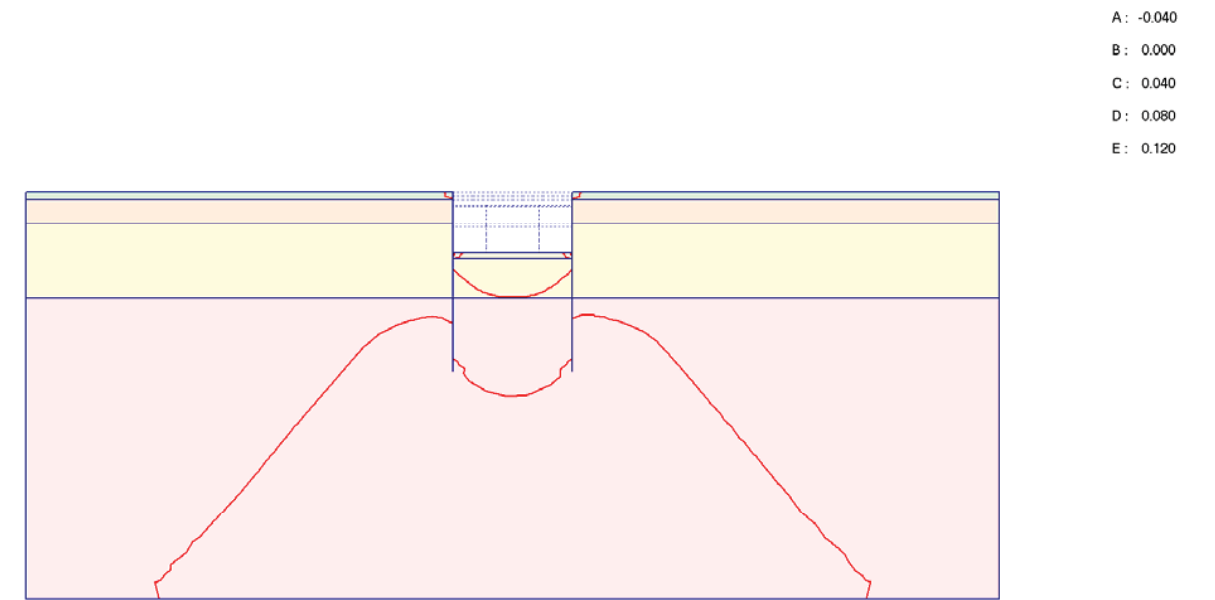
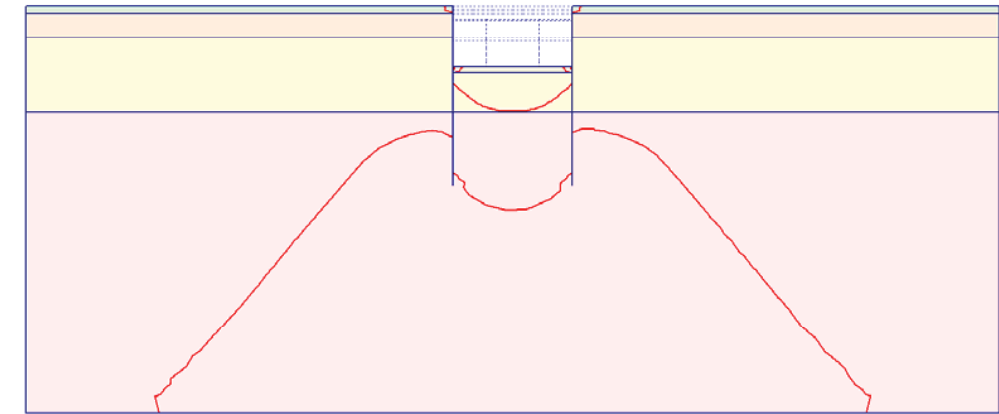


Fig. 237 Plot of vertical displacements (contour lines)
- step no: 33 - (phase: 10)



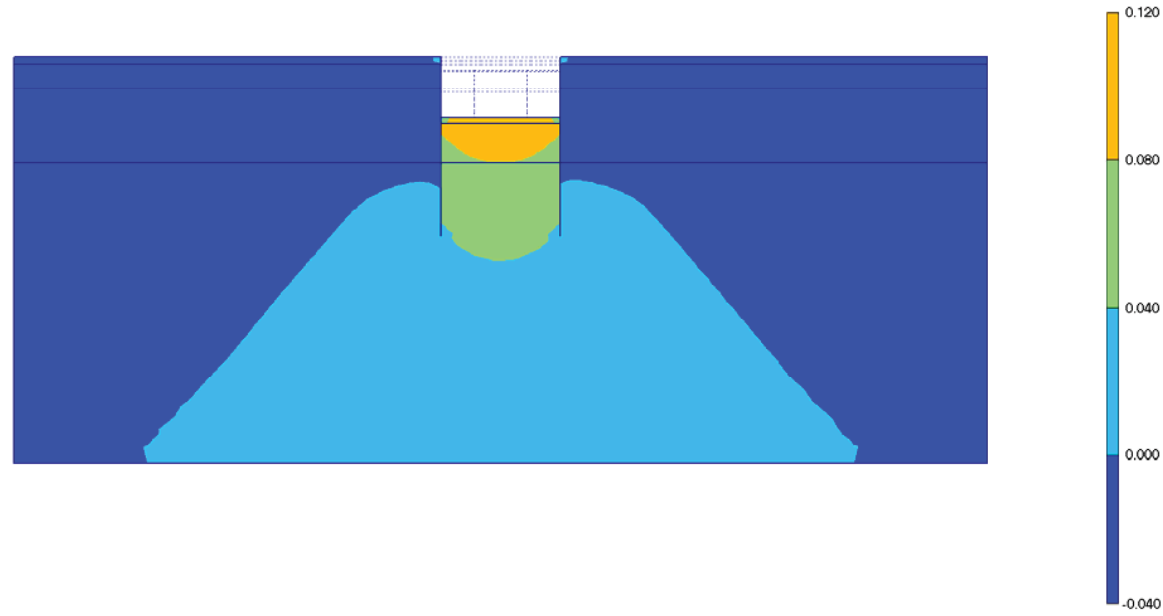


Fig. 238 Plot of vertical displacements (shadings)
- step no: 33 - (phase: 10)

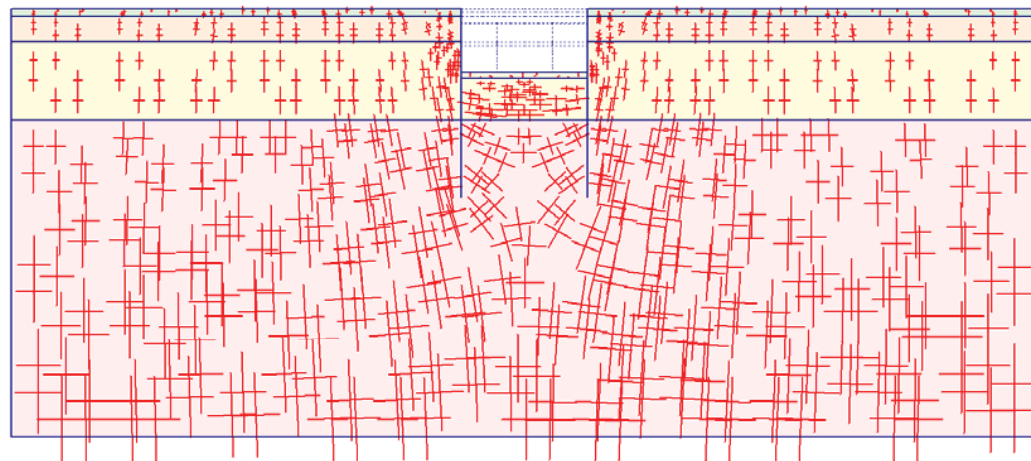


Fig. 239 Plot of effective stresses (principal directions)
- step no: 33 - (phase: 10)

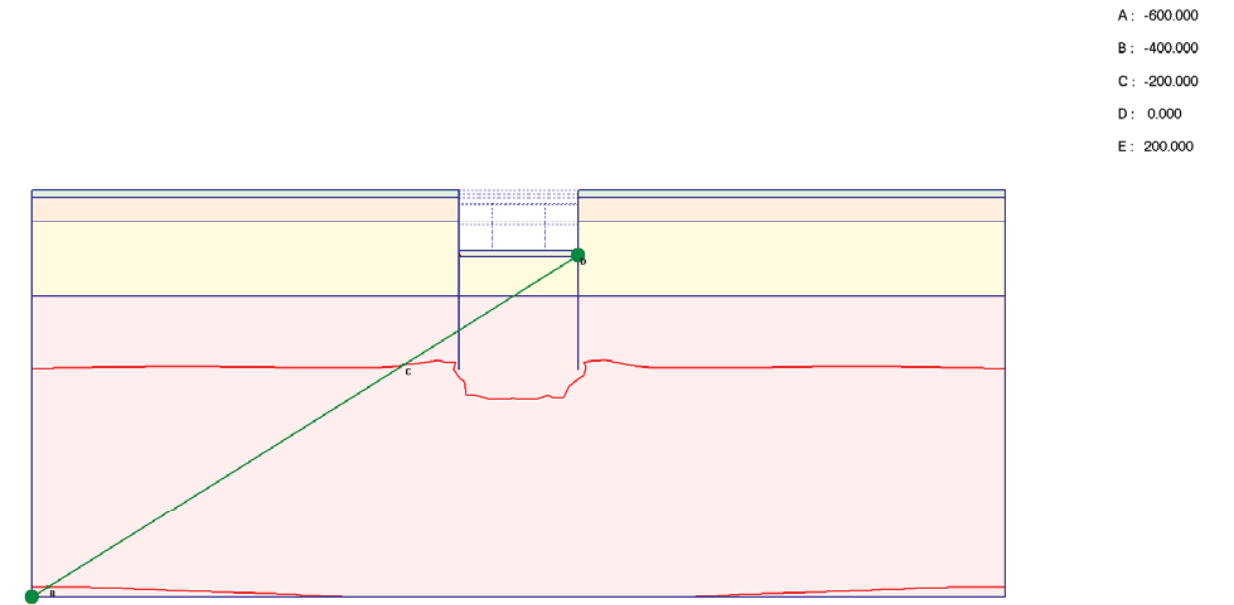
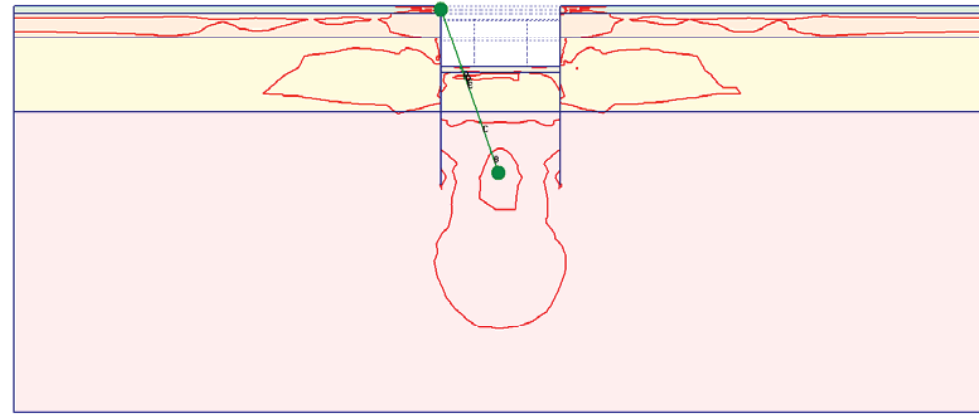
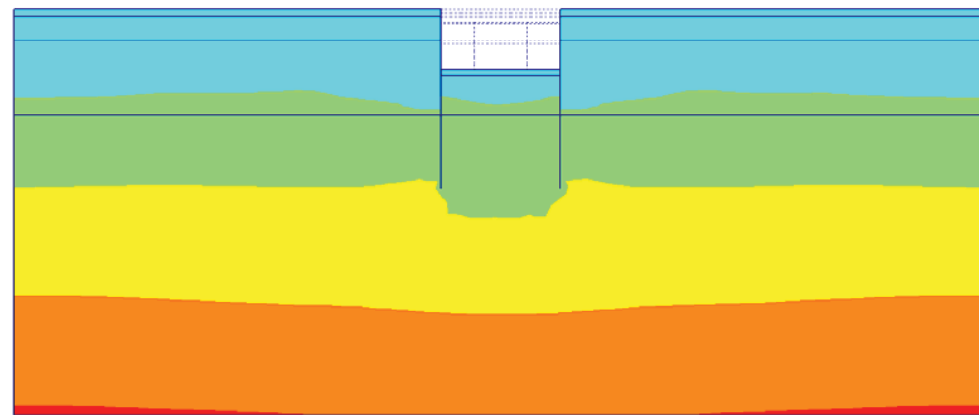


Fig. 240 Plot of effective stresses (mean contours)
- step no: 33 - (phase: 10)



- A: 0.000
- B: 0.250
- C: 0.500
- D: 0.750
- E: 1.000
- F: 1.250

Fig. 241 Plot of effective stresses (relative shear contours)
- step no: 33 - (phase: 10)



- 100.000
- 0.000
- 100.000
- 200.000
- 300.000
- 400.000
- 500.000

Fig. 242 Plot of effective stresses (mean shadings)
- step no: 33 - (phase: 10)

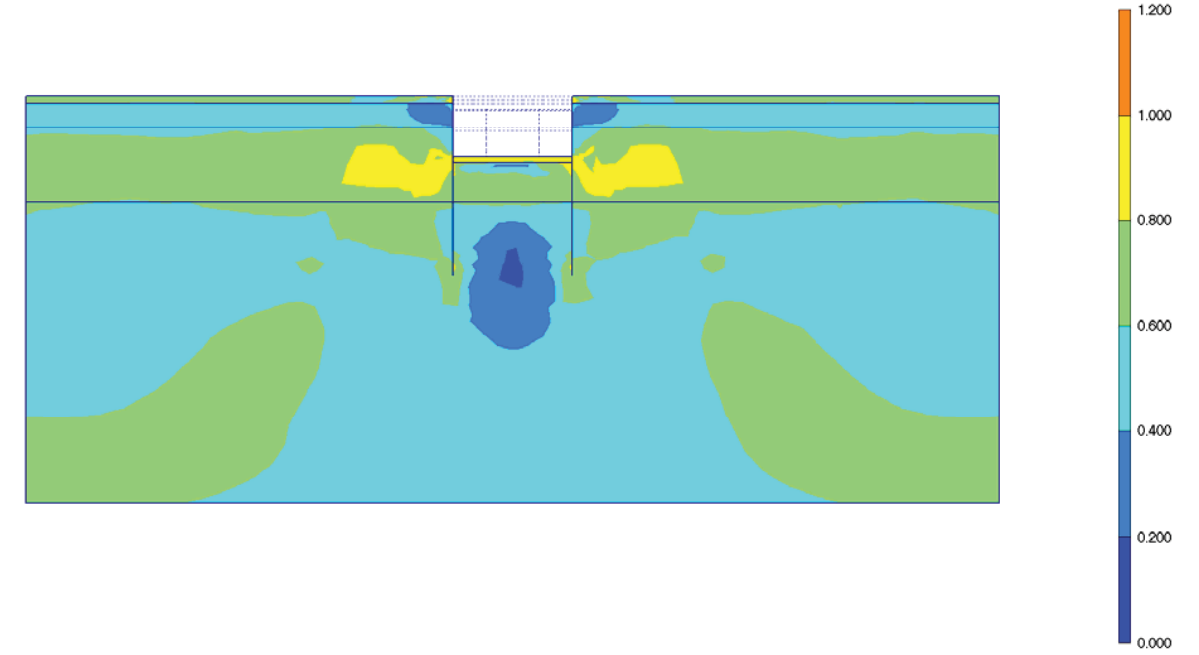


Fig. 243 Plot of effective stresses (relative shear shadings)
- step no: 33 - (phase: 10)

- 1.200
- 1.000
- 0.800
- 0.600
- 0.400
- 0.200
- 0.000

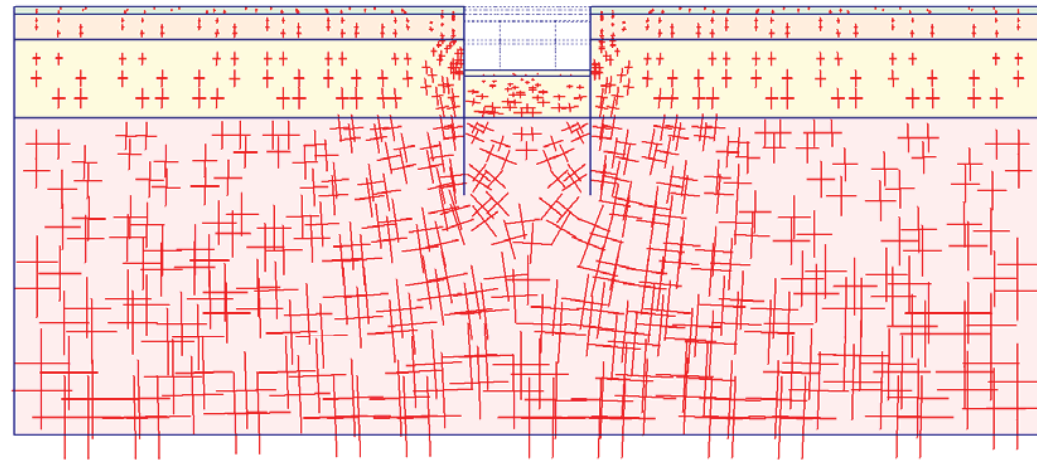


Fig. 244 Plot of total stresses (principal directions)
- step no: 33 - (phase: 10)

- A: -1000.00
- B: -800.000
- C: -600.000
- D: -400.000
- E: -200.000
- F: 0.000
- G: 200.000

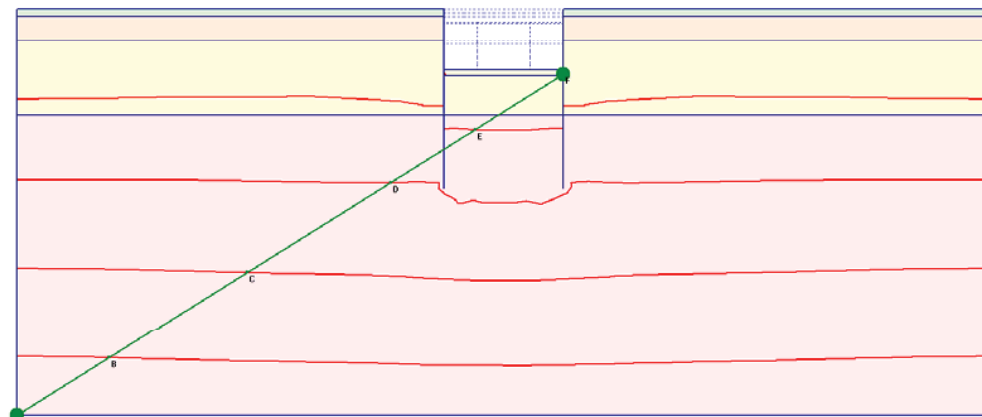
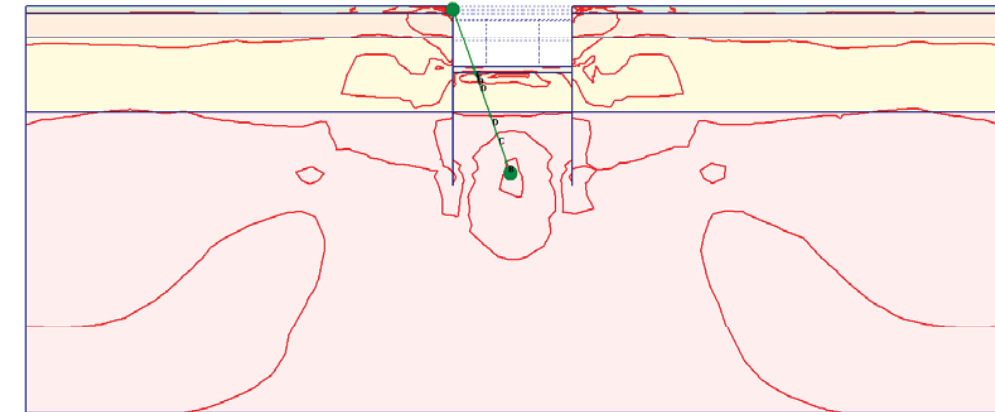


Fig. 245 Plot of total stresses (mean contours)
- step no: 33 - (phase: 10)



- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 246 Plot of total stresses (relative shear contours)
- step no: 33 - (phase: 10)

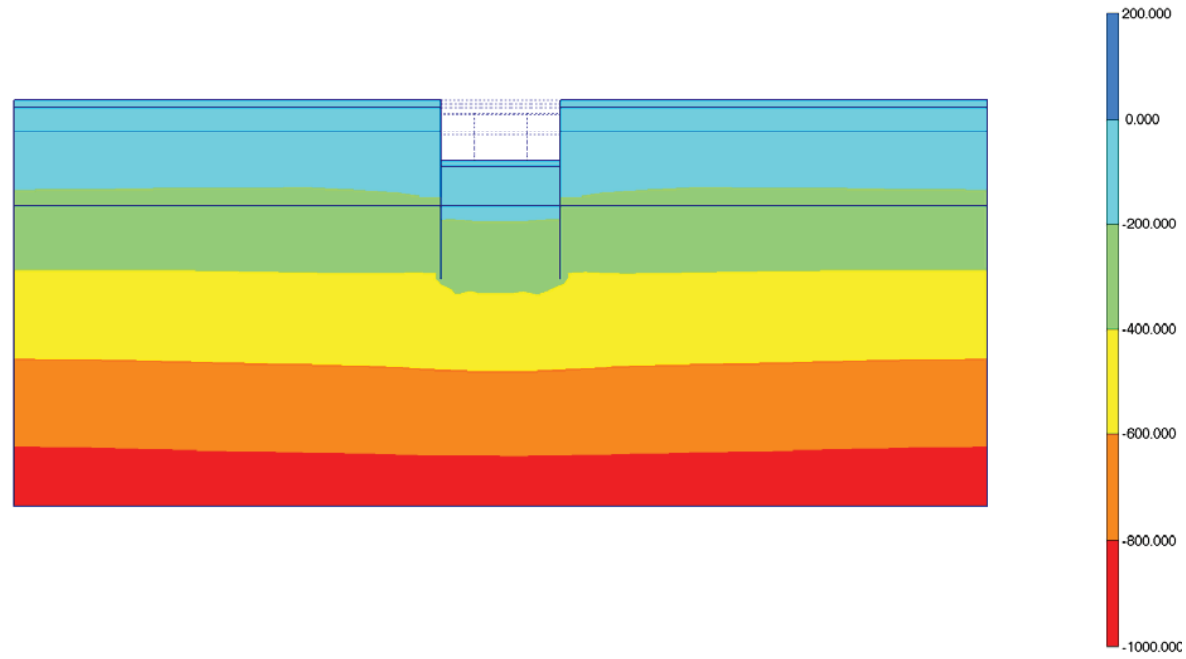


Fig. 247 Plot of total stresses (mean shadings)
- step no: 33 - (phase: 10)

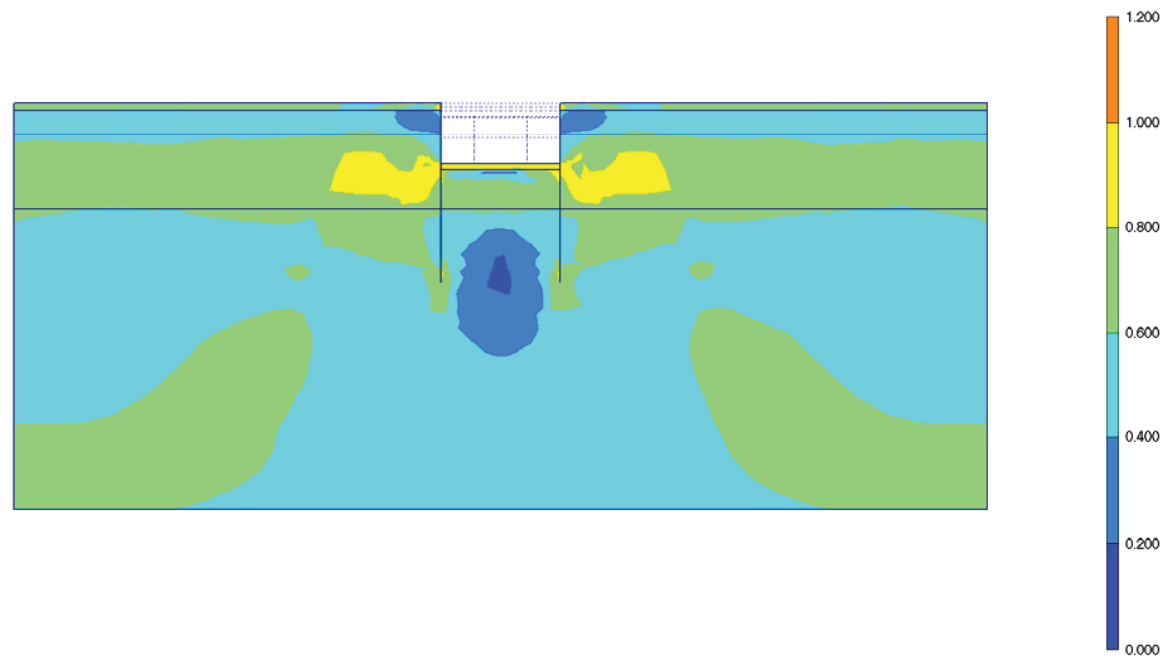


Fig. 248 Plot of total stresses (relative shear shadings)
- step no: 33 - (phase: 10)

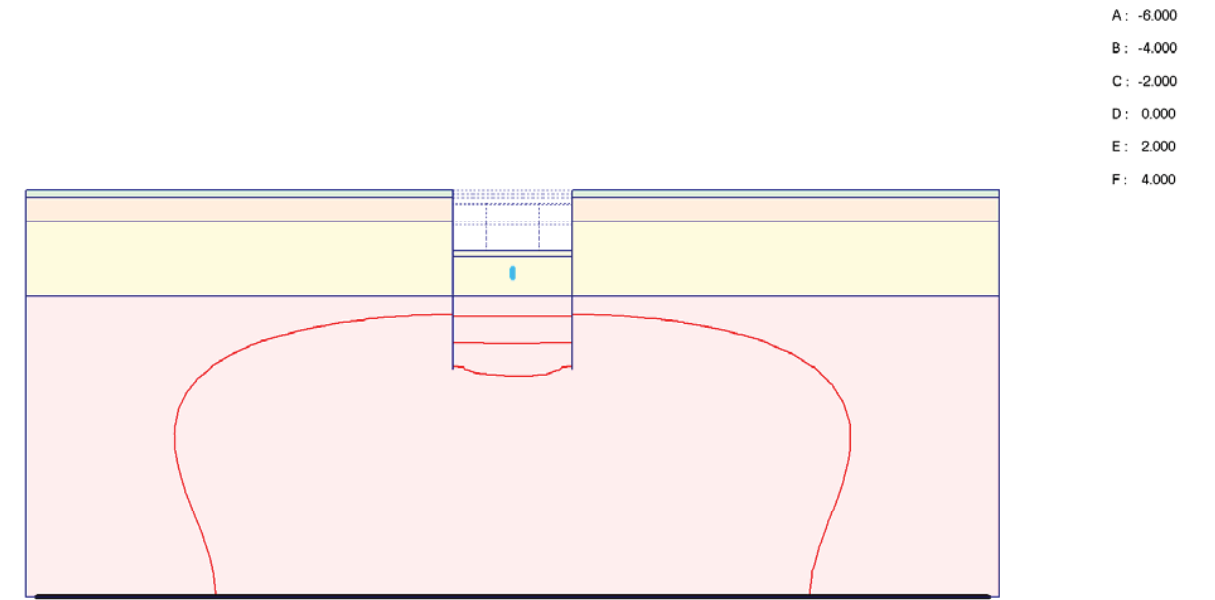


Fig. 249 Plot of groundwater head (contour lines)
- step no: 33 - (phase: 10)

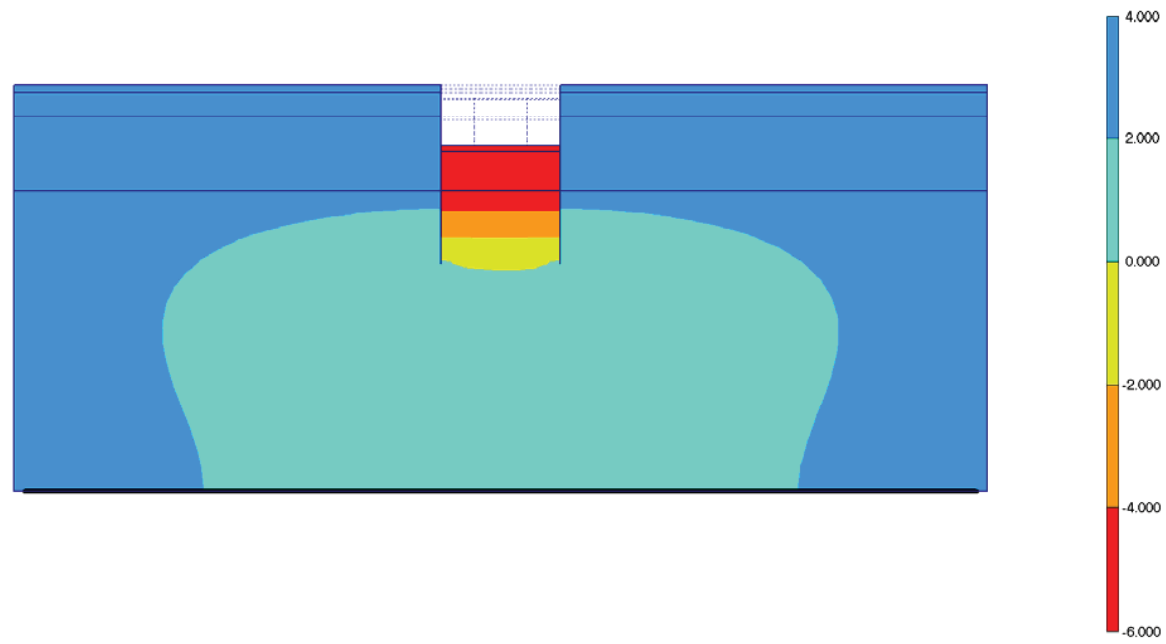


Fig. 250 Plot of groundwater head (shadings)
- step no: 33 - (phase: 10)

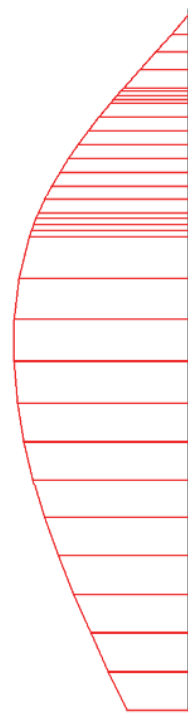


Fig. 251 Horizontal displacements in beam (plate no: 6)
Extreme value $-28,78 \cdot 10^{-3}$ m (phase: 10)

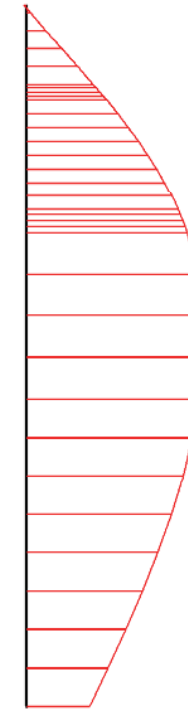


Fig. 252 Horizontal displacements in beam (plate no: 5)
Extreme value $28,99 \cdot 10^{-3}$ m (phase: 10)

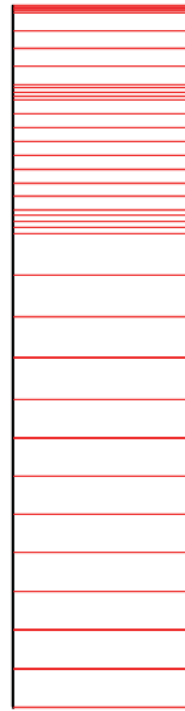


Fig. 253 Vertical displacements in beam (plate no: 6)
Extreme value $17,58 \cdot 10^{-3}$ m (phase: 10)

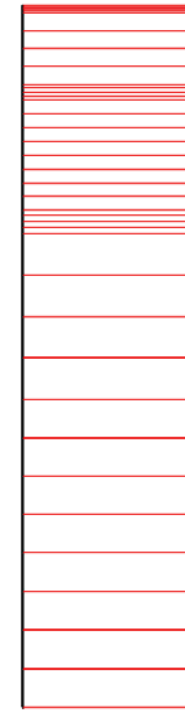


Fig. 254 Vertical displacements in beam (plate no: 5)
Extreme value $16,75 \cdot 10^{-3}$ m (phase: 10)

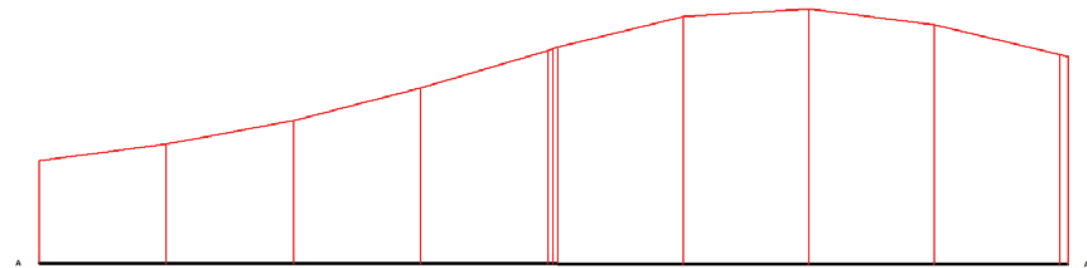


Fig. 255 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $13,26 \cdot 10^{-3}$ m (phase: 10)

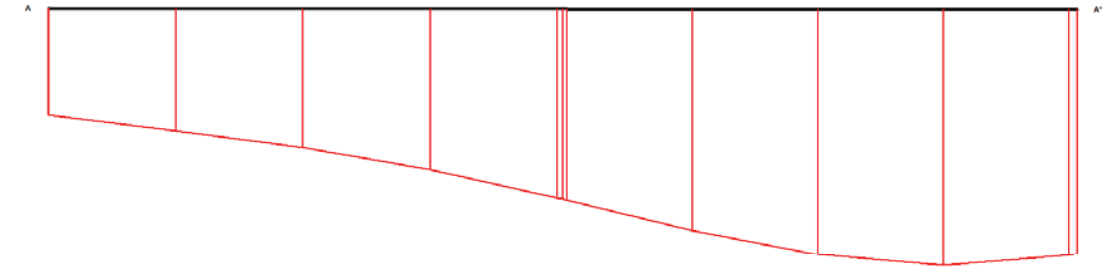


Fig. 256 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-19,81 \cdot 10^{-3}$ m (phase: 10)

18. RESULTS FOR PHASE 11

Table [80] Step info phase no: 11

Step no:	36
Calculation type	PLASTIC
Extrapolation factor	0,271
Relative stiffness	0,753

Table [81] Reached multipliers phase no: 11

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [82] Staged construction info phase no: 11

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,985
Active proportion of stage	0,117	1,000

Table [83] Realised tunnel contraction info phase no: 11

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [84] Iteration info phase no: 11

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,001	1121	764	308	0	0	6	6
2	0,001	1102	742	59	0	0	6	4

Table [85] Active distributed loads A phase no: 11

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000

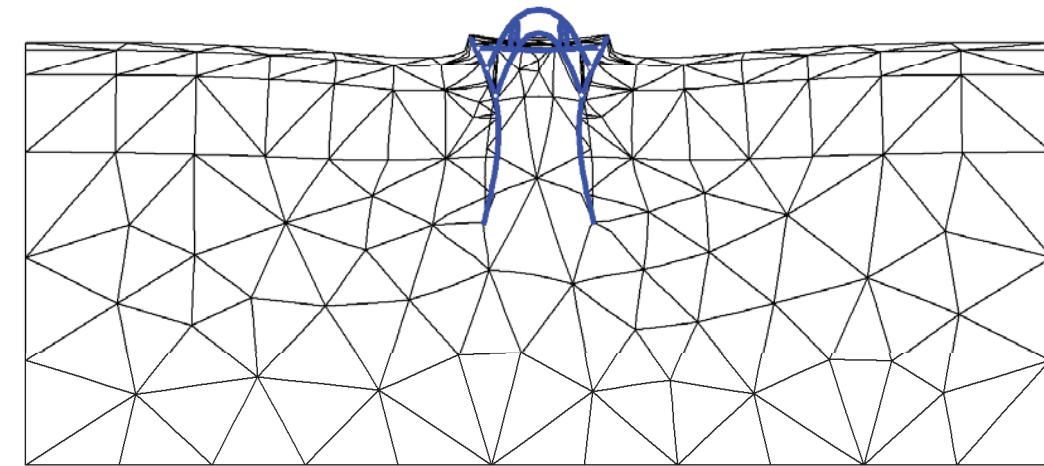


Fig. 257 Plot of deformed mesh - step no: 36 - (phase: 11)

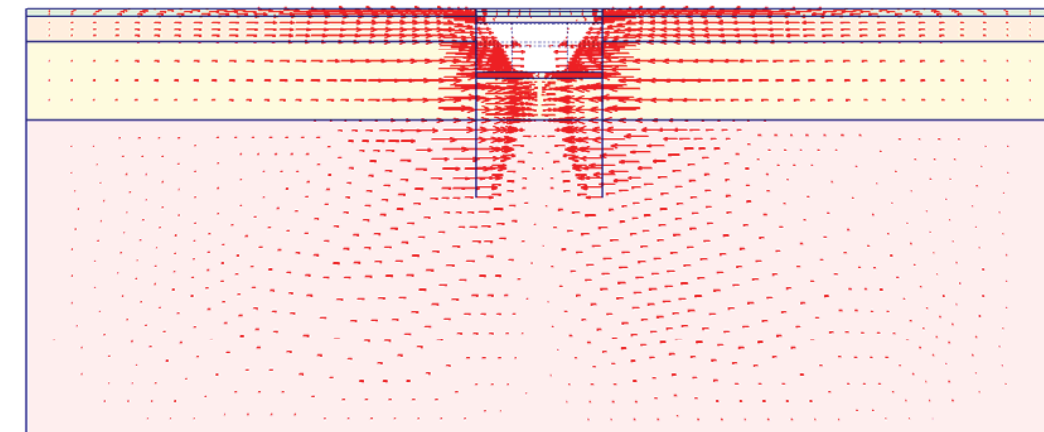
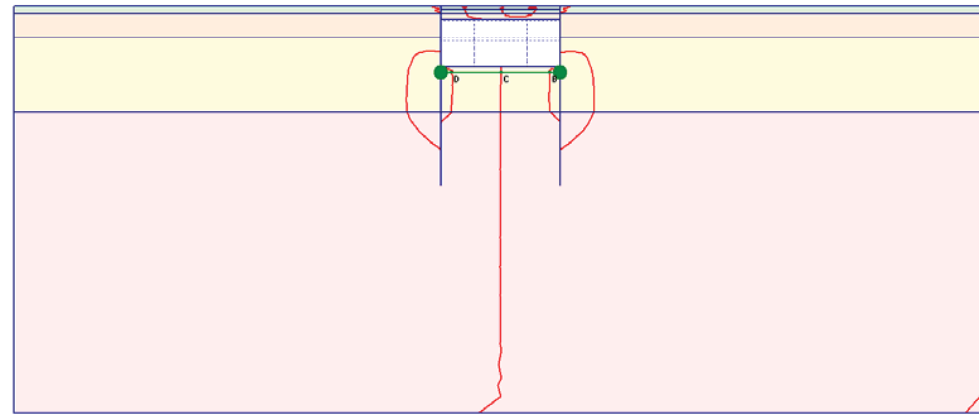


Fig. 258 Plot of horizontal displacements (arrows)
- step no: 36 - (phase: 11)



A: -0.040
B: -0.020
C: -0.000
D: 0.020
E: 0.040

Fig. 259 Plot of horizontal displacements (contour lines)
- step no: 36 - (phase: 11)

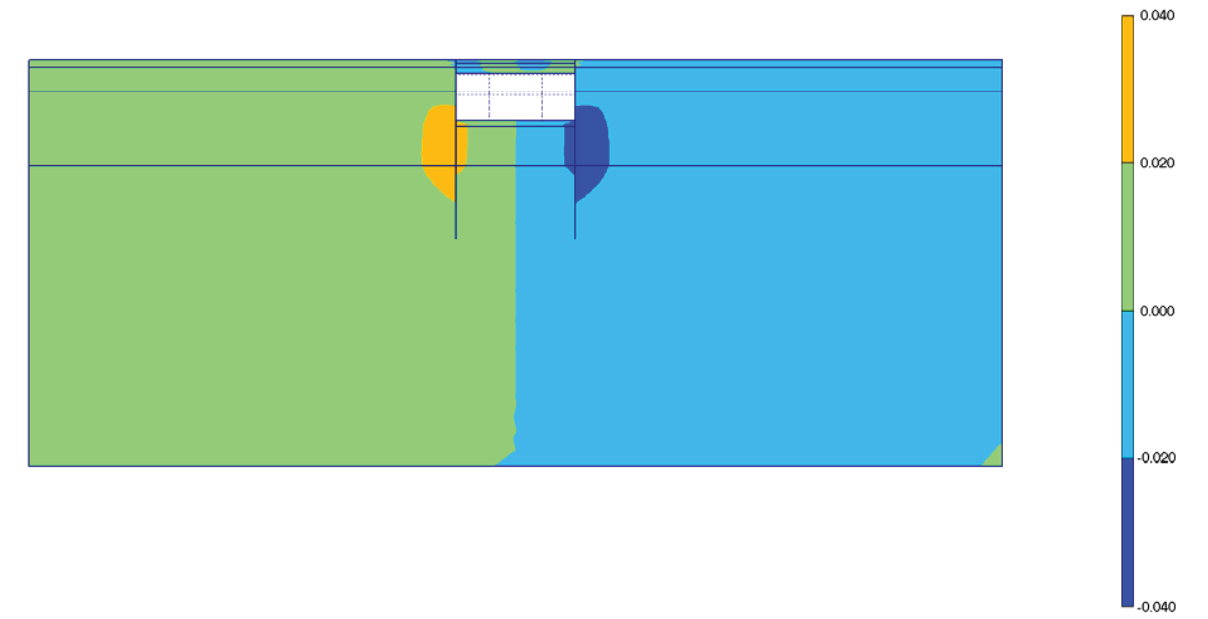


Fig. 260 Plot of horizontal displacements (shadings)
- step no: 36 - (phase: 11)

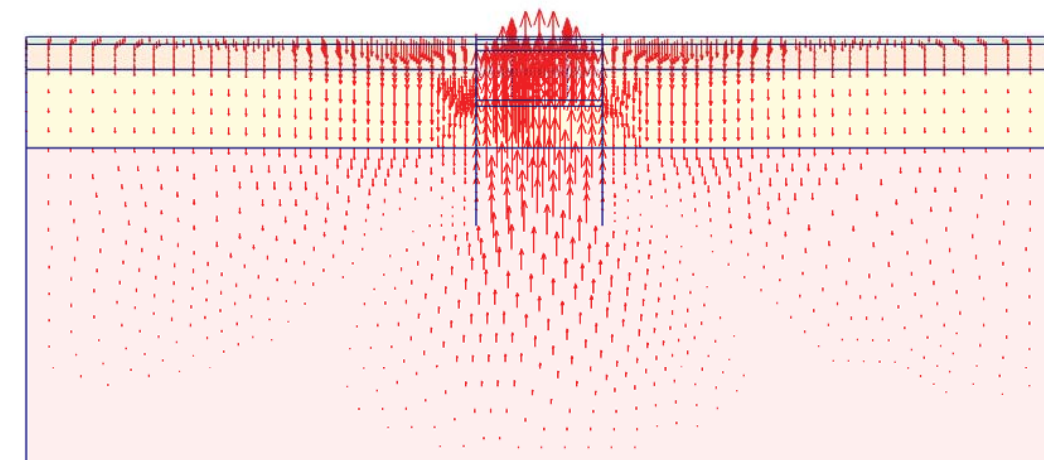
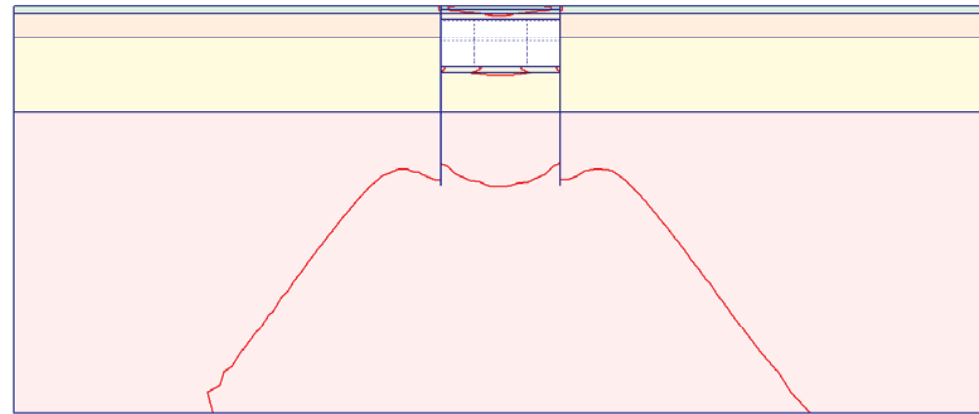


Fig. 261 Plot of vertical displacements (arrows)
- step no: 36 - (phase: 11)



A: -0.040
B: 0.000
C: 0.040
D: 0.080
E: 0.120

Fig. 262 Plot of vertical displacements (contour lines)
- step no: 36 - (phase: 11)

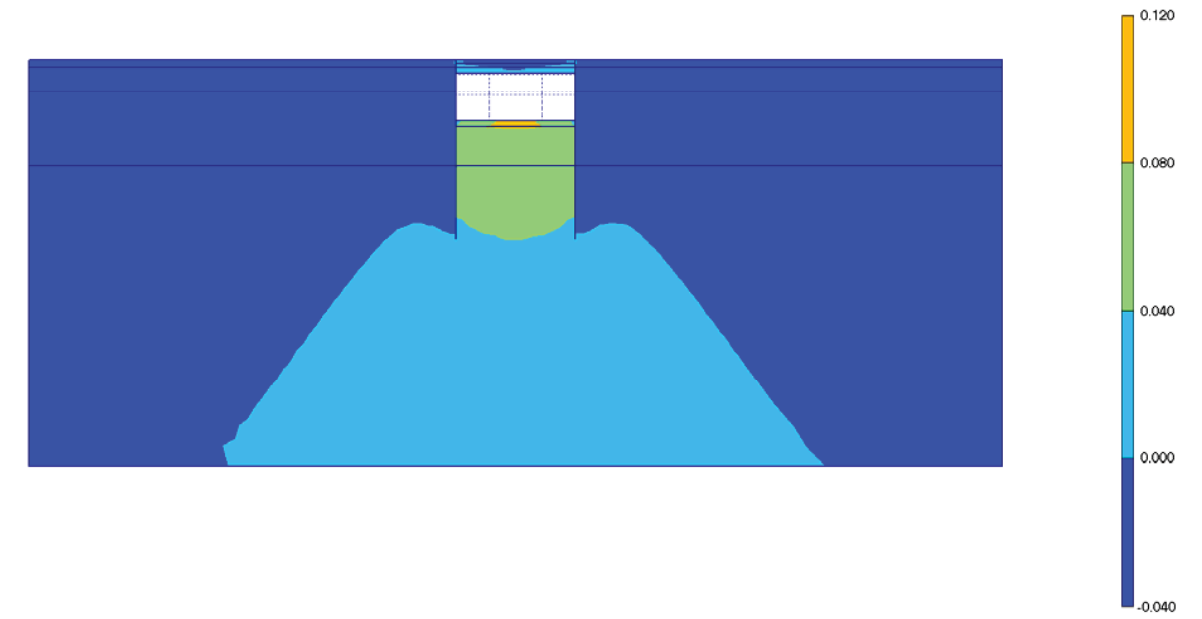


Fig. 263 Plot of vertical displacements (shadings)
- step no: 36 - (phase: 11)

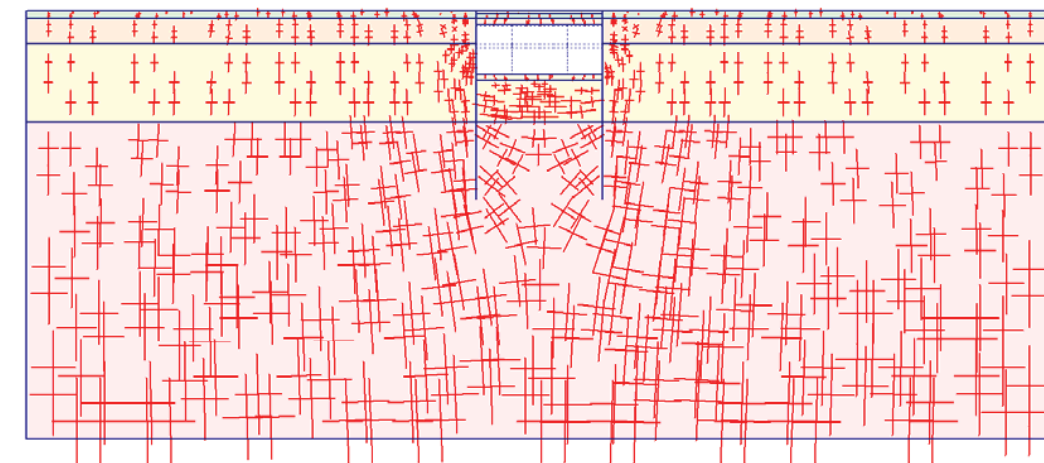


Fig. 264 Plot of effective stresses (principal directions)
- step no: 36 - (phase: 11)

A: -600.000
B: -400.000
C: -200.000
D: 0.000
E: 200.000

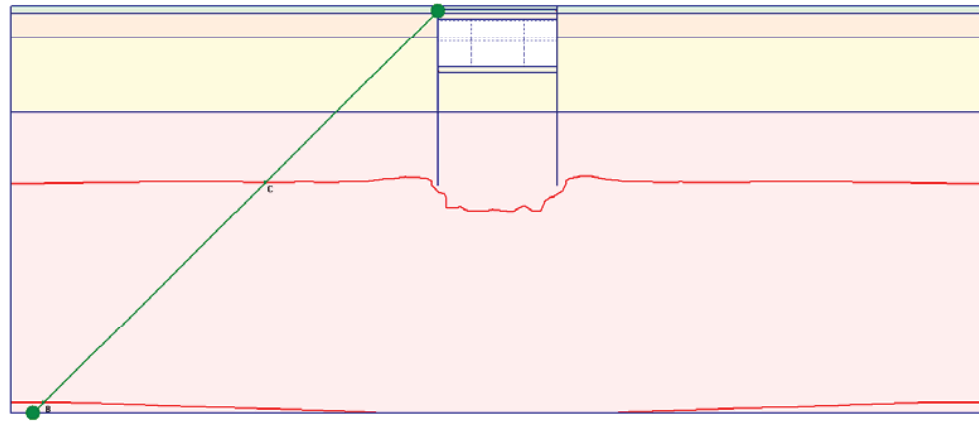


Fig. 265 Plot of effective stresses (mean contours)
- step no: 36 - (phase: 11)

A: 0.000
B: 0.250
C: 0.500
D: 0.750
E: 1.000
F: 1.250

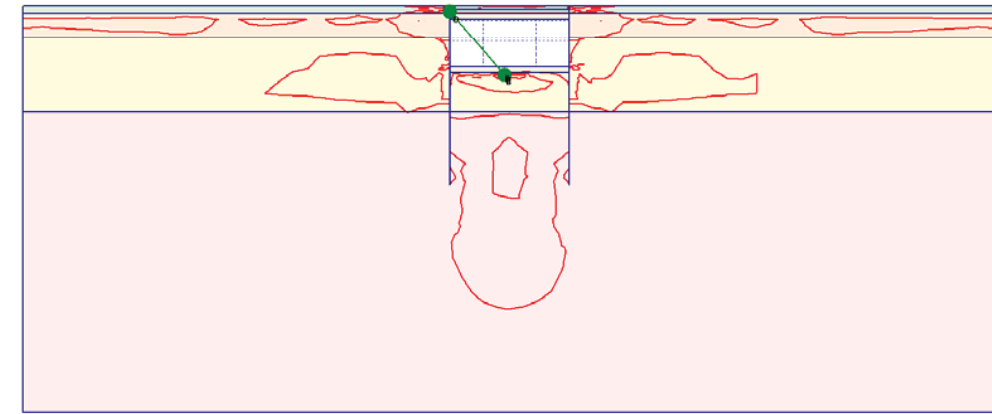


Fig. 266 Plot of effective stresses (relative shear contours)
- step no: 36 - (phase: 11)

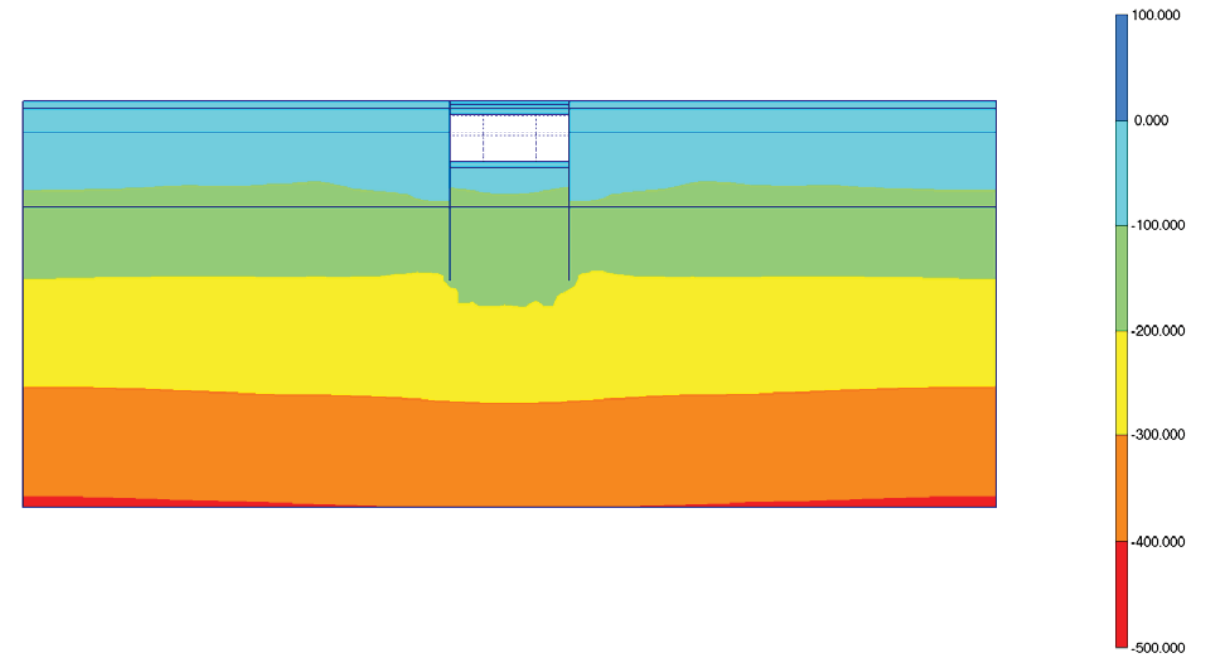


Fig. 267 Plot of effective stresses (mean shadings)
- step no: 36 - (phase: 11)

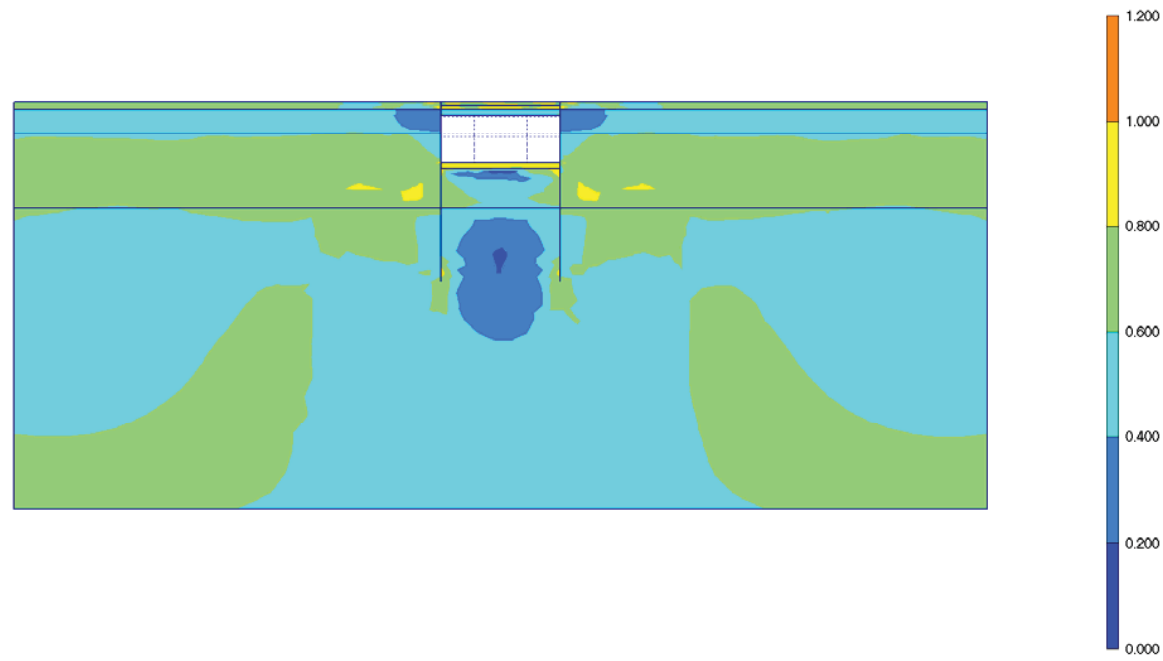


Fig. 268 Plot of effective stresses (relative shear shadings)
- step no: 36 - (phase: 11)

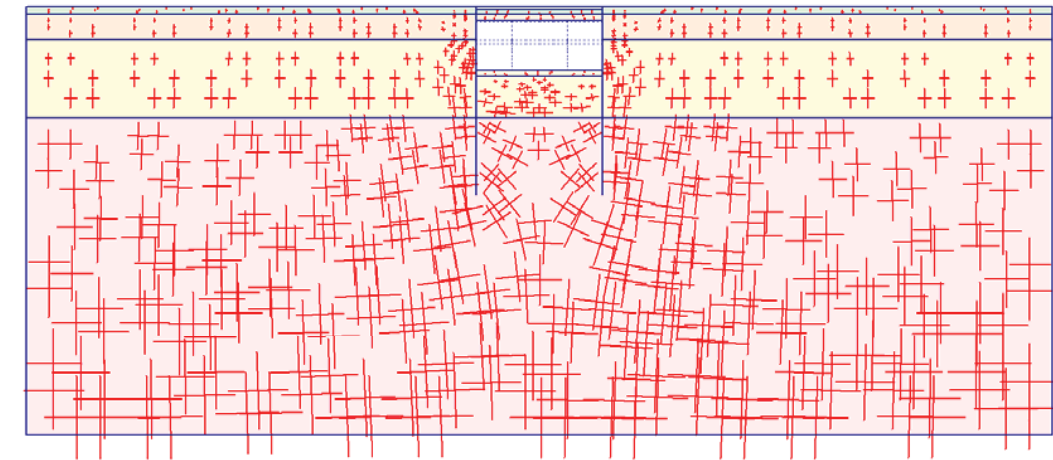


Fig. 269 Plot of total stresses (principal directions)
- step no: 36 - (phase: 11)

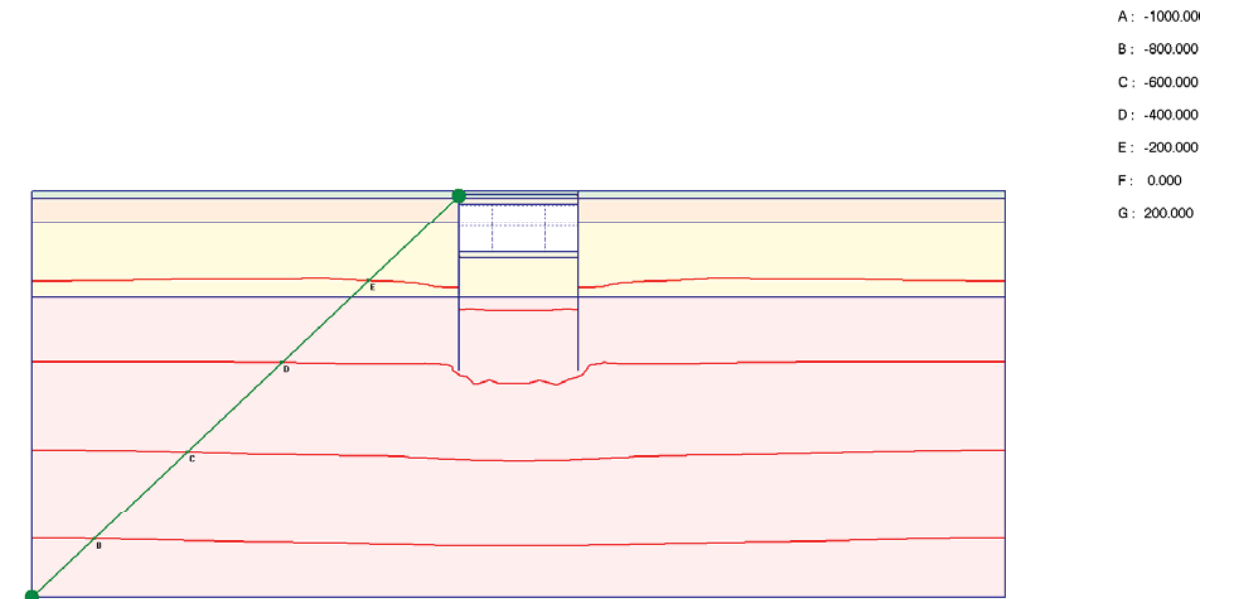
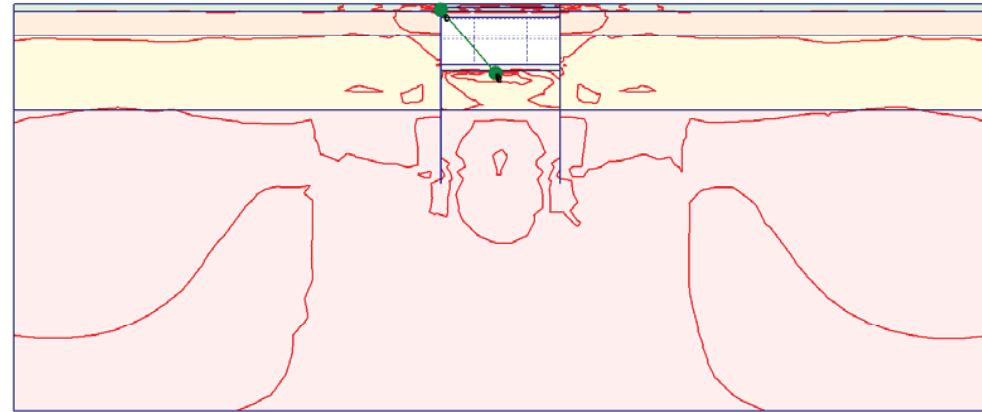


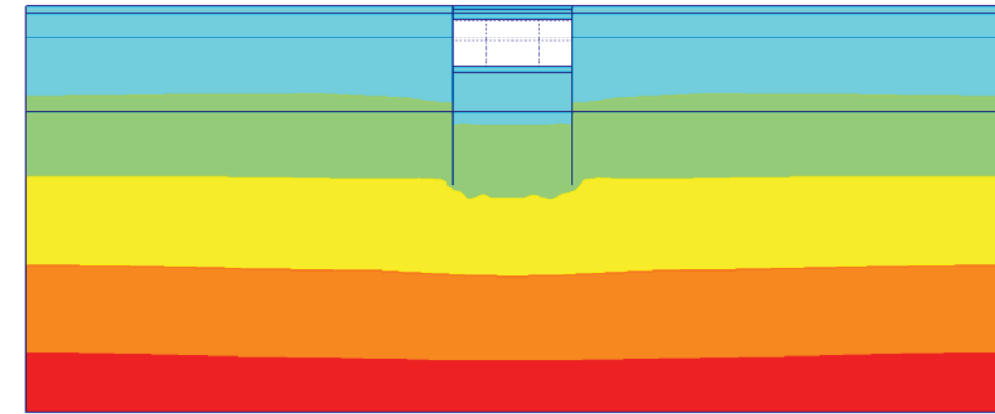
Fig. 270 Plot of total stresses (mean contours)
- step no: 36 - (phase: 11)



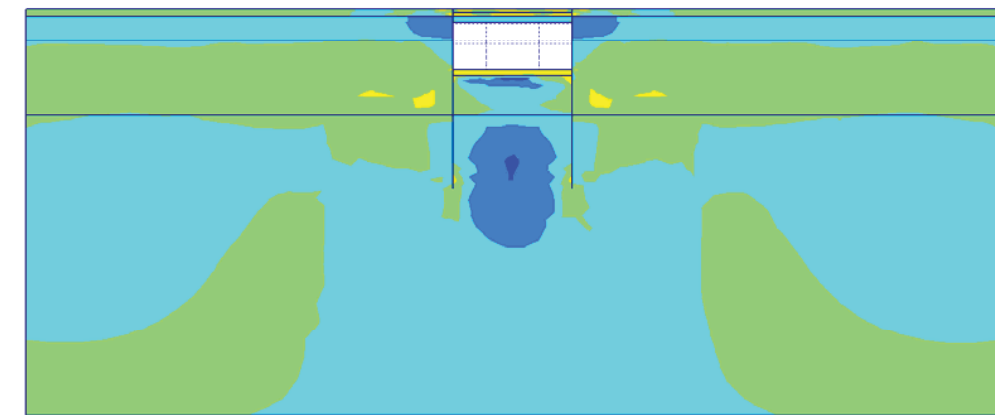
- A: 0.000
- B: 0.200
- C: 0.400
- D: 0.600
- E: 0.800
- F: 1.000
- G: 1.200

Fig. 271 Plot of total stresses (relative shear contours)
- step no: 36 - (phase: 11)

Fig. 272 Plot of total stresses (mean shadings)
- step no: 36 - (phase: 11)

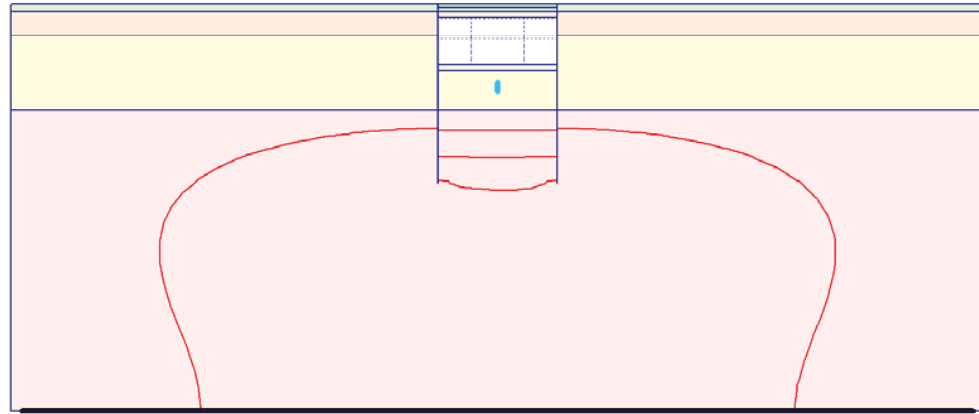


- 200.000
- 0.000
- 200.000
- 400.000
- 600.000
- 800.000
- 1000.000



- 1.200
- 1.000
- 0.800
- 0.600
- 0.400
- 0.200
- 0.000

Fig. 273 Plot of total stresses (relative shear shadings)
- step no: 36 - (phase: 11)



A: -6.000
B: -4.000
C: -2.000
D: 0.000
E: 2.000
F: 4.000

Fig. 274 Plot of groundwater head (contour lines)
- step no: 36 - (phase: 11)

Fig. 275 Plot of groundwater head (shadings)
- step no: 36 - (phase: 11)

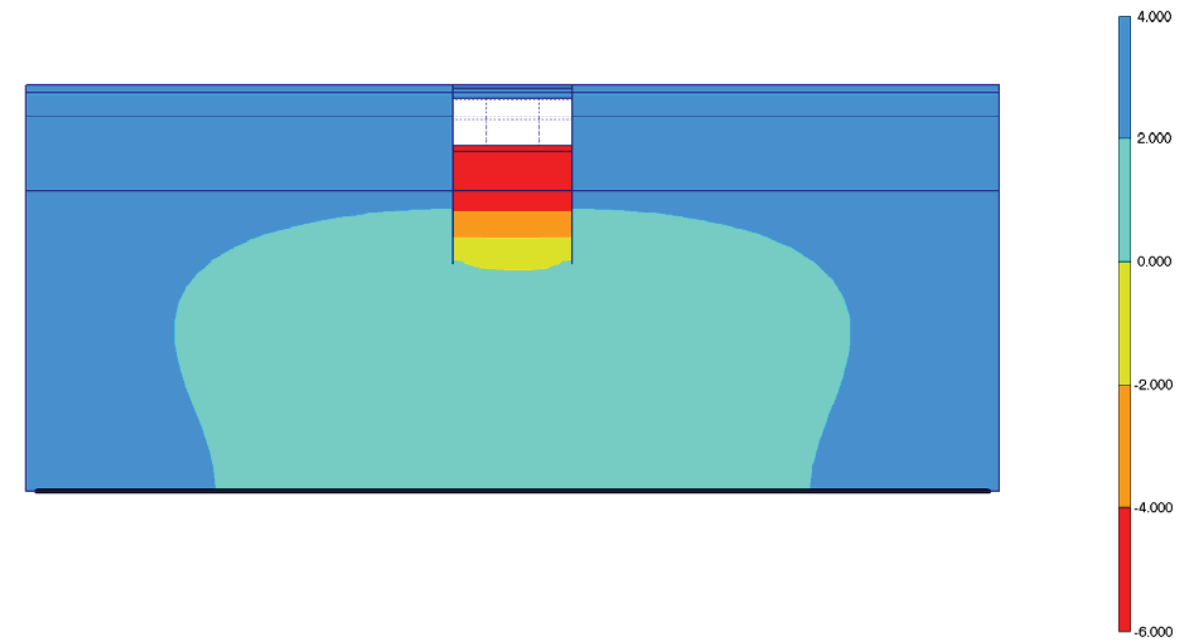
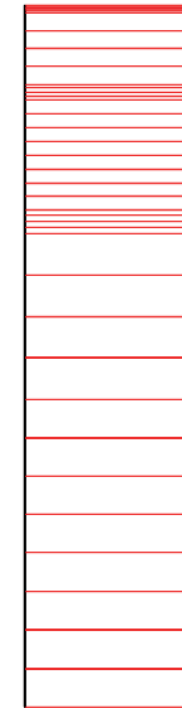


Fig. 276 Horizontal displacements in beam (plate no: 6)
Extreme value $-28,74 \cdot 10^{-3}$ m (phase: 11)



Fig. 277 Horizontal displacements in beam (plate no: 5)
Extreme value $28,90 \cdot 10^{-3}$ m (phase: 11)

Fig. 278 Vertical displacements in beam (plate no: 6)
Extreme value $4,23 \cdot 10^{-3}$ m (phase: 11)



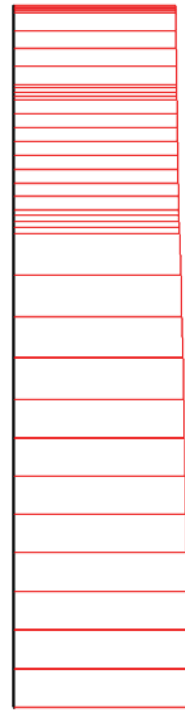


Fig. 279 Vertical displacements in beam (plate no: 5)
 Extreme value $3,61 \cdot 10^{-3}$ m (phase: 11)

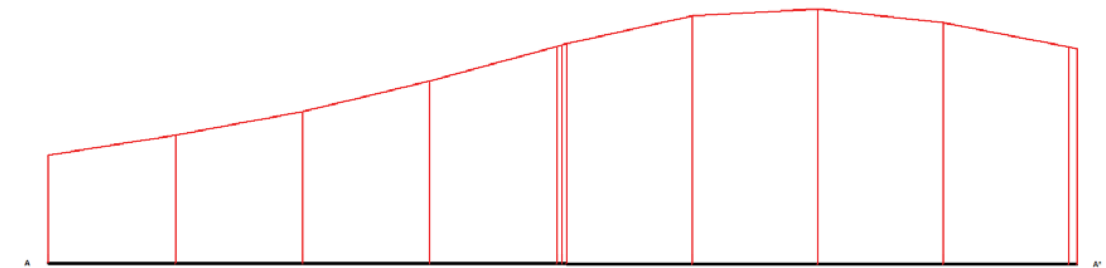


Fig. 280 Horizontal displacements in cross section (cross section A - A*)
 Extreme value $16,44 \cdot 10^{-3}$ m (phase: 11)

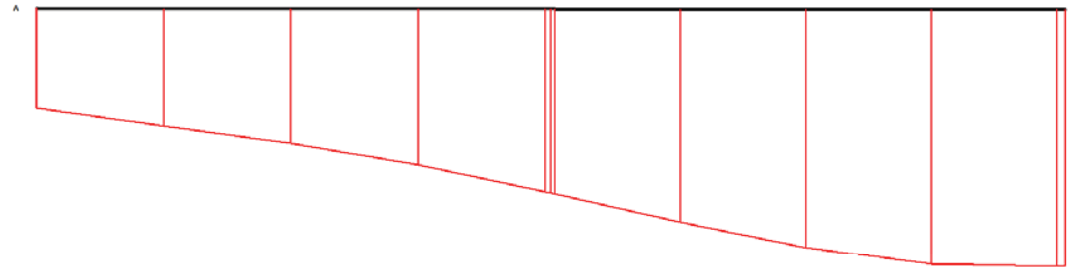


Fig. 281 Vertical displacements in cross section (cross section A - A*)
 Extreme value $-26,69 \cdot 10^{-3}$ m (phase: 11)

19. RESULTS FOR PHASE 12

Table [86] Step info phase no: 12

Step no:	43
Calculation type	PLASTIC
Extrapolation factor	0,869
Relative stiffness	0,448

Table [87] Reached multipliers phase no: 12

Multipliers	Incremental value	Total value
Prescribed displacements	0,0000	1,0000
Load system A	0,0000	1,0000
Load system B	0,0000	1,0000
Soil weight	0,0000	1,0000
Acceleration	0,0000	0,0000
Strength reduction factor	0,0000	1,0000
Time	0,0000	0,0000

Table [88] Staged construction info phase no: 12

Staged construction	Incremental value	Total value
Active proportion of total area	0,000	0,985
Active proportion of stage	0,141	1,000

Table [89] Realised tunnel contraction info phase no: 12

Tunnel*	Increment [%]	Total [%]
* Tunnels are referred to by lining chain number		

Table [90] Iteration info phase no: 12

Iter. no.	Global error	Plastic points	Plastic Cap + Hard. points	Inacc. Pl. pts.	Plastic Intf. pts.	Inacc. Intf. pts.	Apex & Tension	Inacc. Apx. pts.
1	0,000	529	412	23	13	13	9	8
2	0,000	527	412	14	13	0	9	8

Table [91] Active distributed loads A phase no: 12

Loads no.	First node	qx [kN/m/m]	qy [kN/m/m]	Last node	qx [kN/m/m]	qy [kN/m/m]
1	488	0,000	-20,000	462	0,000	-20,000
2	462	0,000	-40,000	753	0,000	-40,000
3	1630	0,000	-40,000	1998	0,000	-40,000
4	1998	0,000	-20,000	2198	0,000	-20,000