Basement Impact Assessment

(Supplemental information)

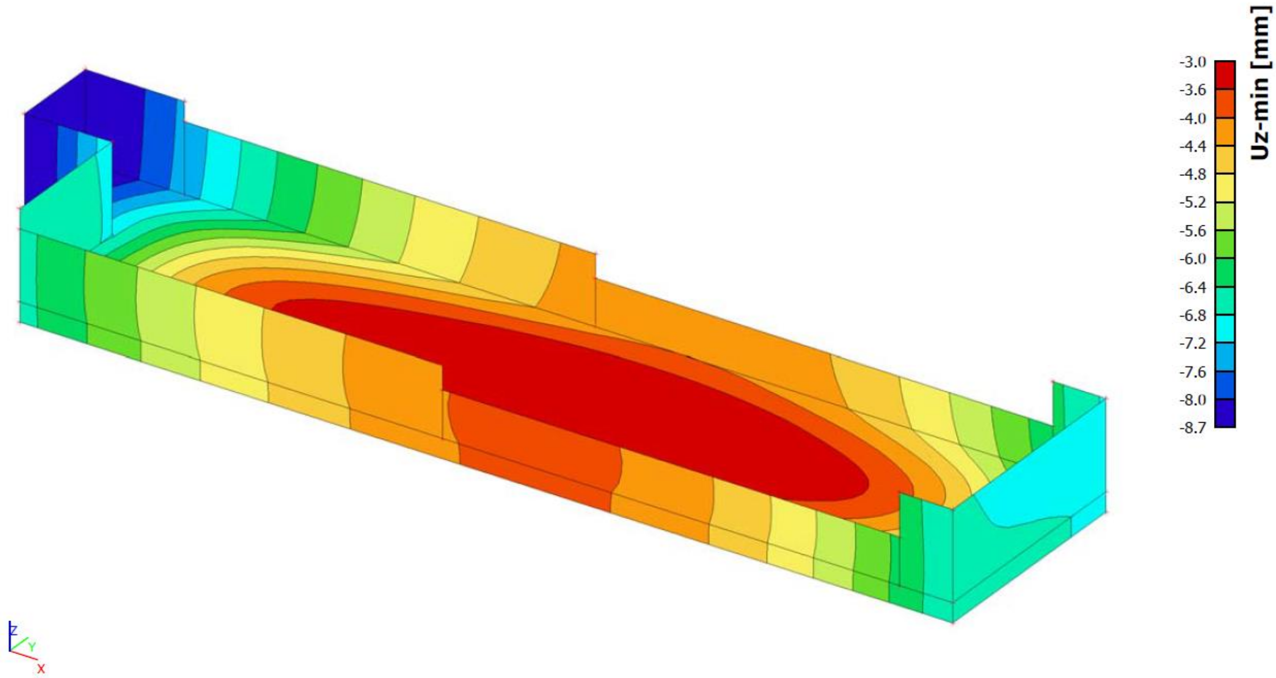
19 Rona Road, London NW3 2HY

Structural & Civil Engineering Only.

Contents

1.0 Ground Movement Assessment

Note: For design information see Appendix 1

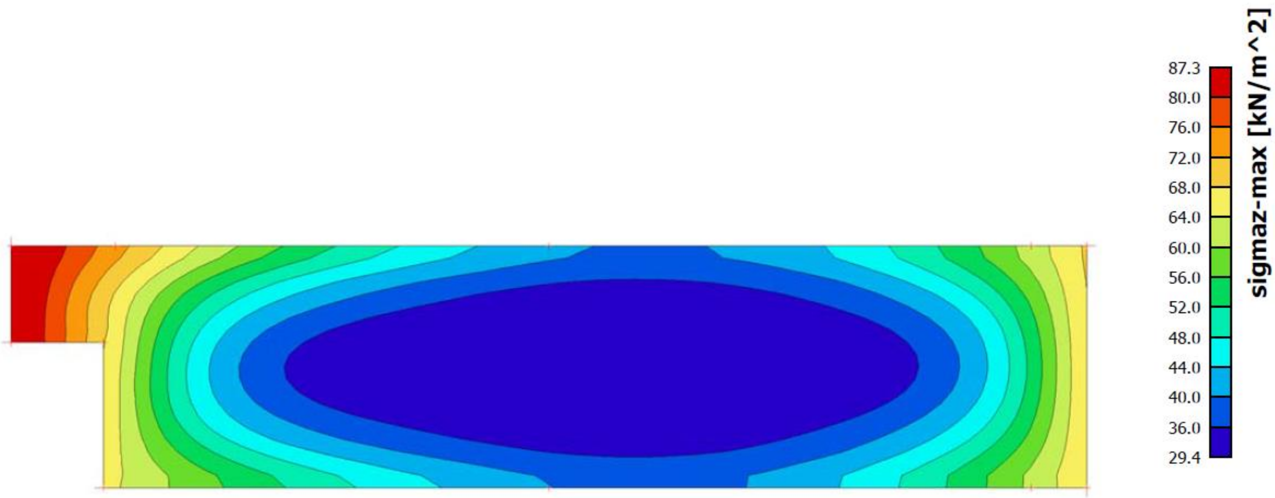


Graphical extract from calculations showing displacements (+ve Z direction is vertical upwards)

Maximum settlement figures beneath the new basement slab are between 8.7 and 3.0 mm

As can be seen the maximum displacement is experienced within the rear lightwell of the building with the main displacement along the party walls varying from 4.0mm to 6.4mm under the worst case loading condition for the basement.

The Forces applied to the ground are within the allowed ground bearing pressure for the sub-strata with a maximum applied stress of 87.3 kN/m² with a more general applied load of around 30-50 kN/m² over the slab.



Graphical extract from calculations showing contract stresses with the ground

2.0 Damage Impact Assessment

Based on the following information an assessment of the damage impact was made:

- Design commentary outlining the design philosophy for the basement (appendix 1)
- Annotated output sheets from Scia explaining their various aspects (appendix 1)
- A Scia Engineer Fact Sheet which provides additional explanation on how the soil parameters are used by the program. (appendix 2)

With regard to the predicted movement, lateral movement of the walls will be negligible (maximum anticipated is 0.5mm) and will not have any noticeable effect on either this building or the neighbouring buildings. Vertical displacement due to stressing of the soil is predicted to be at worst 8.7mm localised around the lightwell and generally 6.4mm along the party walls as shown in section 7.4 of the results (see appendix 1). However this is a transitional displacement not a differential one with 'sloping' more likely to occur as opposed to fracturing.

Subsequently, such theoretical displacement will result in minimal damage to the superstructure and is predicted to be CIRIA 580 Category 1 (very slight).

Most movement in houses undergoing underpinning arises from workmanship issues and not ground movement and, although we have specified dry packing and curing times etc., damage to Category 2 (slight) would not be unusual in such works. Movement due to 'workmanship' cannot be designed/predicted but, from experience, invariably is the prime cause for movement in domestic schemes such as this.

3.0 Basement Retaining Wall Under Temporary Condition

The retaining wall was considered under temporary loading conditions to ensure stability of the wall is maintained throughout the construction.

This will be achieved by carrying out the works in opposite pairs and providing a series of props between them to resist horizontal movement until the infill basement floor has been cast.

Sequencing and details of this can be seen on drawing L15/088/04/506.

Calculations for the temporary condition are appended to this report in Appendix 3.

4.0 Temporary Propping Works

Temporary propping works to be provided to retain and maintain the stability of the front façade of the building.

Additional propping to be provided between the two neighbouring properties in a series of horizontal shores between spreader plates located at the rear and middle sections of the property to ensure stability is maintained when works to reconstruct the rear wall and floor replacement are carried out.

The set of props at the back of the property will maintain the lateral stability of the neighbouring buildings when the rear wall is reconstructed and buttressing at the rear is temporarily discontunued.

The central set of props will provide additional lateral stability when floors are rennovated by ensuring continuity between the terraced buildings.

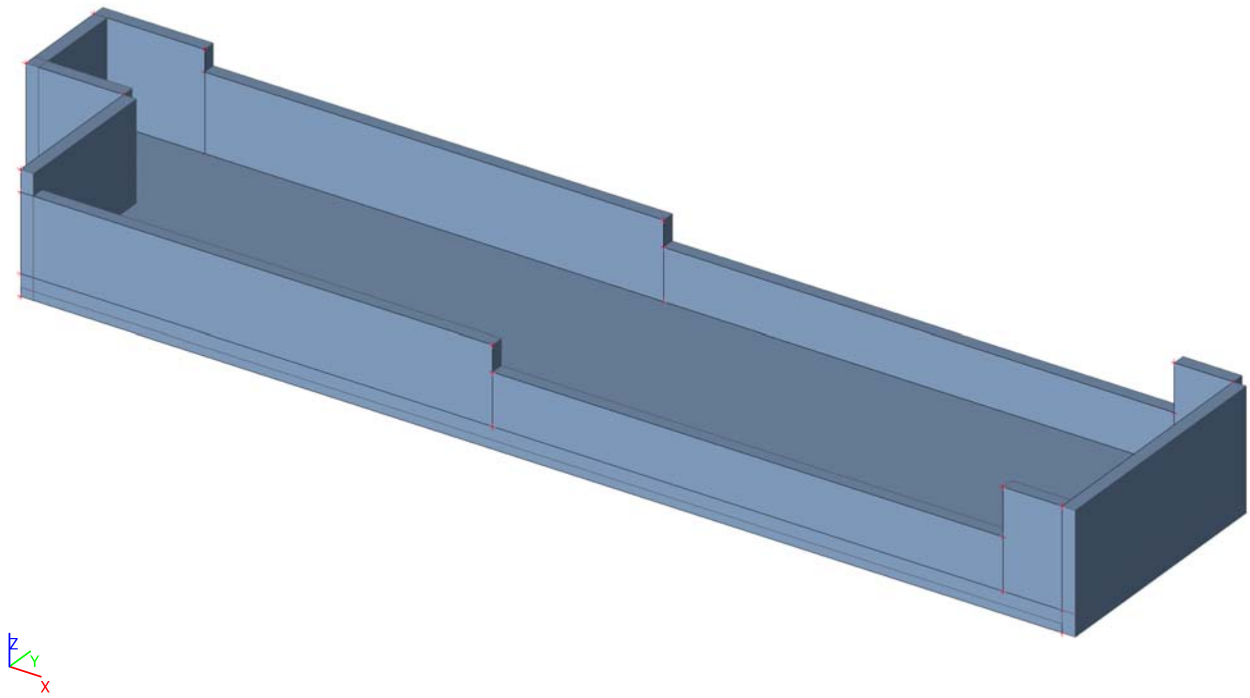
Temporary propping is shown on drawing L15/088/04/505

Appendix 1
SCIA Design Model and Philopshy

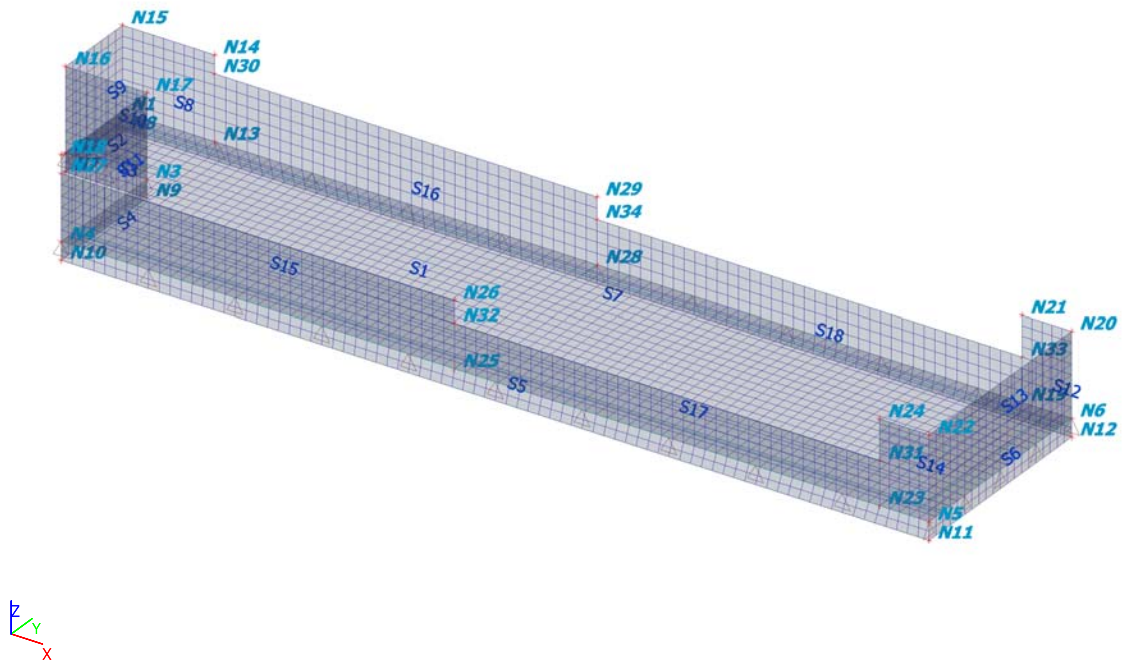
1. Table of contents

2. Model snapshots

2.1. 3D Model



2.2. Analysis model



3. Libraries

3.1. Setup manager

Combination setup

Annex - Category H loading not to be combined with snow or wind	
Category H loading not to be combined with snow or wind	✓

Psi factors

Load	Psi0	Psi1	Psi2
CategoryA	0.7	0.5	0.3
CategoryB	0.7	0.5	0.3
CategoryC	0.7	0.7	0.6
CategoryD	0.7	0.7	0.6
CategoryE	1	0.9	0.8
CategoryF	0.7	0.7	0.6
CategoryG	0.7	0.5	0.3
CategoryH	0	0	0
Snow	0.5	0.2	0
Wind	0.6	0.2	0
Temperature	0.6	0.5	0

Load combination factors

Permanent action - unfavorable	1.35
Permanent action - favorable	1.00
Leading variable action	1.50
Accompanying variable action	1.50
Reduction factor ksi	0.85
Permanent action - unfavorable	1.00
Permanent action - favorable	1.00
Leading variable action	1.30
Accompanying variable action	1.30

3.2. Materials

Concrete EC2

Name	Type	Unit mass [kg/m^3]	E mod [kN/m^2]	Poisson - nu	Thermal exp [m/mK]	Characteristic compressive cylinder strength fck(28) [MPa]
C30/37	Concrete	2500.0	32800000.0	0.2	0.00	30.00

Reinforcement EC2

Name	Type	Unit mass [kg/m^3]	E mod [kN/m^2]	G mod [kN/m^2]	Thermal exp [m/mK]	Characteristic yield strength fyk [MPa]
B 500B	Reinforcement steel	7850.0	200000000.0	83333333.3	0.00	500.0

3.3. Subsoils

Name	C1x [kN/m^3]	C1z	C1y [kN/m^3]	Stiffness [kN/m^3]	C2x [kN/m]	C2y [kN/m]	Sigma oc [kN/m^2]
Sub1	1000.0	Flexible	1000.0	10000.0	1000.0	1000.0	100.0

4. Structure

4.1. Nodes

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N1	-2.260	5.939	0.000
N2	-2.260	3.572	0.000
N3	0.000	3.572	0.000
N4	0.000	0.000	0.000
N5	24.097	0.000	0.000
N6	24.097	5.939	0.000
N7	-2.260	3.572	-0.500
N8	-2.260	5.939	-0.500
N9	0.000	3.572	-0.500
N10	0.000	0.000	-0.500
N11	24.097	0.000	-0.500
N12	24.097	5.939	-0.500

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N13	0.300	5.939	0.000
N14	0.300	5.939	2.300
N15	-2.260	5.939	2.300
N16	-2.260	3.572	2.300
N17	0.000	3.572	2.300
N18	0.000	0.000	2.300
N19	22.729	5.939	0.000
N20	24.097	5.939	2.300
N21	22.729	5.939	2.300
N22	24.097	0.000	2.300
N23	22.729	0.000	0.000
N24	22.729	0.000	2.300

Name	Coord X [m]	Coord Y [m]	Coord Z [m]
N25	10.918	0.000	0.000
N26	10.918	0.000	1.800
N27	0.000	0.000	1.800
N28	10.918	5.939	0.000
N29	10.918	5.939	1.800
N30	0.300	5.939	1.800
N31	22.729	0.000	1.200
N32	10.918	0.000	1.200
N33	22.729	5.939	1.200
N34	10.918	5.939	1.200

4.2. 2D members

Name	Layer	Type	Analysis model	Material	Thickness type	Th. [mm]	
S1	Layer2-Concrete Slabs	plate (90)	Standard	C30/37	constant	300	
S2	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S3	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S4	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S5	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S6	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S7	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S8	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S9	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S10	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S11	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S12	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S13	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S14	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S15	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S16	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S17	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	
S18	Layer3-Concrete Wall	wall (80)	Standard	C30/37	constant	300	

4.3. 2D member supports

Name	Type	Subsoil	2D member
SS1	Individual	Sub1 - 100 KN/m2	S1

5. Sets

5.1. Load cases

Name	Description	Action type	LoadGroup	Direction	Duration	Master load case
	Spec	Load type				
LC1	Self-Weight	Permanent Self weight	LG1-D	-Z		
LC2	Soil Pressure	Permanent Standard	LG1-D			
LC3	Water Pressure Standard	Variable Static	LG3-L1		Short	None
LC4	Surcharge (D)	Permanent Standard	LG1-D			
LC5	Surcharge (L) Standard	Variable Static	LG2-L		Short	None
LC6	Heave Pressure Standard	Variable Static	LG3-L1		Short	None

5.2. Load groups

Name	Load	Relation	Type
LG1-D	Permanent		
LG2-L	Variable	Standard	Cat A : Domestic
LG3-L1	Variable	Exclusive	Cat A : Domestic

5.3. Combinations

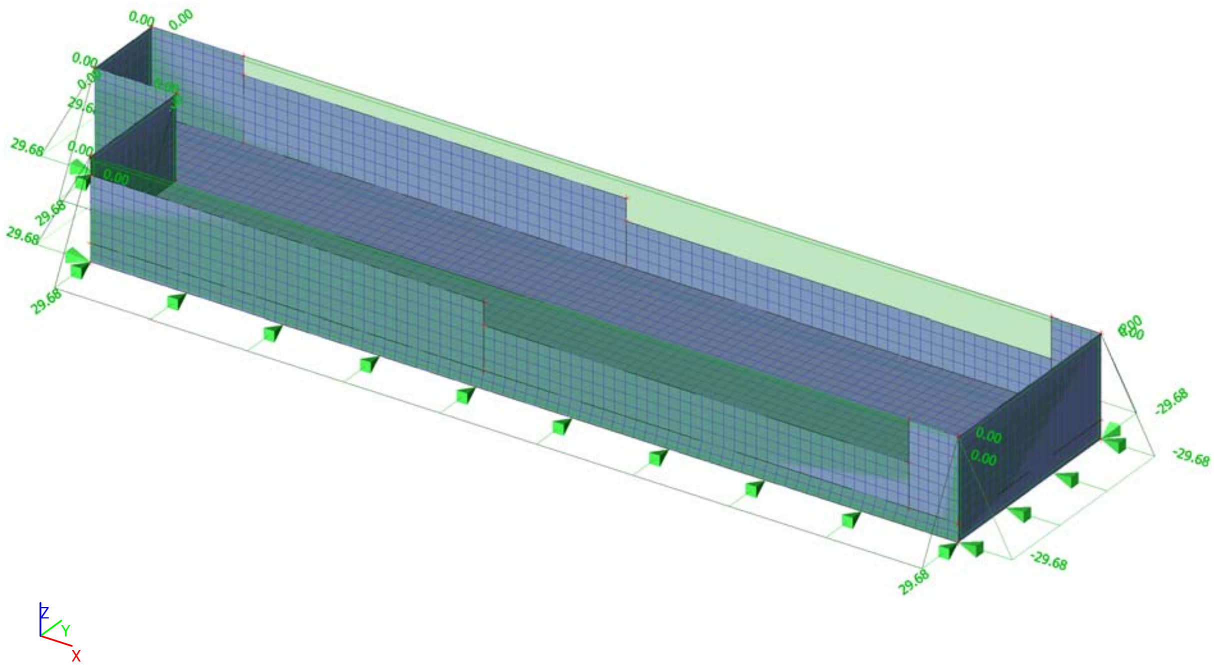
Name	Description	Type	Load cases	Coeff. [-]
ULS		EN-ULS (STR/GEO) Set B	LC1 - Self-Weight	1.00
			LC2 - Soil Pressure	1.00
			LC3 - Water Pressure	1.00
			LC4 - Surcharge (D)	1.00
			LC5 - Surcharge (L)	1.00
			LC6 - Heave Pressure	1.00
SLS-Ch		EN-SLS Characteristic	LC1 - Self-Weight	1.00
			LC2 - Soil Pressure	1.00
			LC3 - Water Pressure	1.00
			LC4 - Surcharge (D)	1.00
			LC5 - Surcharge (L)	1.00
			LC6 - Heave Pressure	1.00
SLS-Fr		EN-SLS Frequent	LC1 - Self-Weight	1.00
			LC2 - Soil Pressure	1.00
			LC3 - Water Pressure	1.00
			LC4 - Surcharge (D)	1.00
			LC5 - Surcharge (L)	1.00
			LC6 - Heave Pressure	1.00
SLS-Qp		EN-SLS Quasi-permanent	LC1 - Self-Weight	1.00
			LC2 - Soil Pressure	1.00
			LC3 - Water Pressure	1.00
			LC4 - Surcharge (D)	1.00
			LC5 - Surcharge (L)	1.00
			LC6 - Heave Pressure	1.00

5.4. Result classes

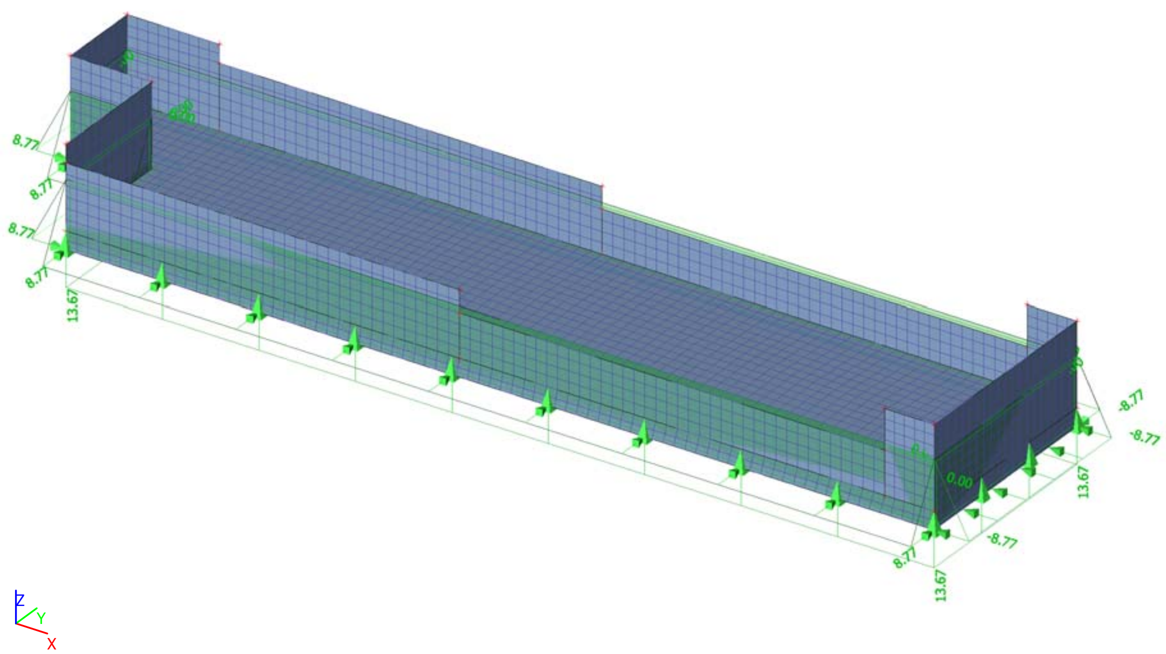
Name	List
SLS	SLS-Ch - EN-SLS Characteristic
	SLS-Fr - EN-SLS Frequent
	SLS-Qp - EN-SLS Quasi-permanent
GEO	ULS - EN-ULS (STR/GEO) Set B

6. Loads

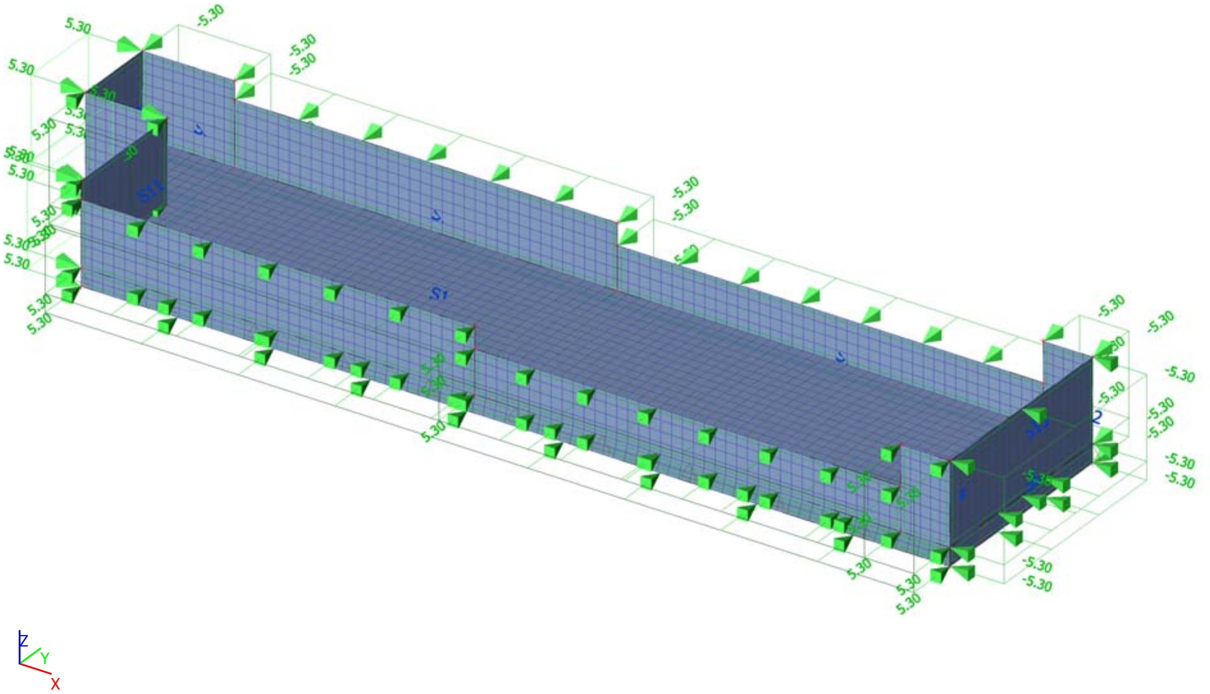
6.1. LC2 - Soil pressure = ko*γs*Ht



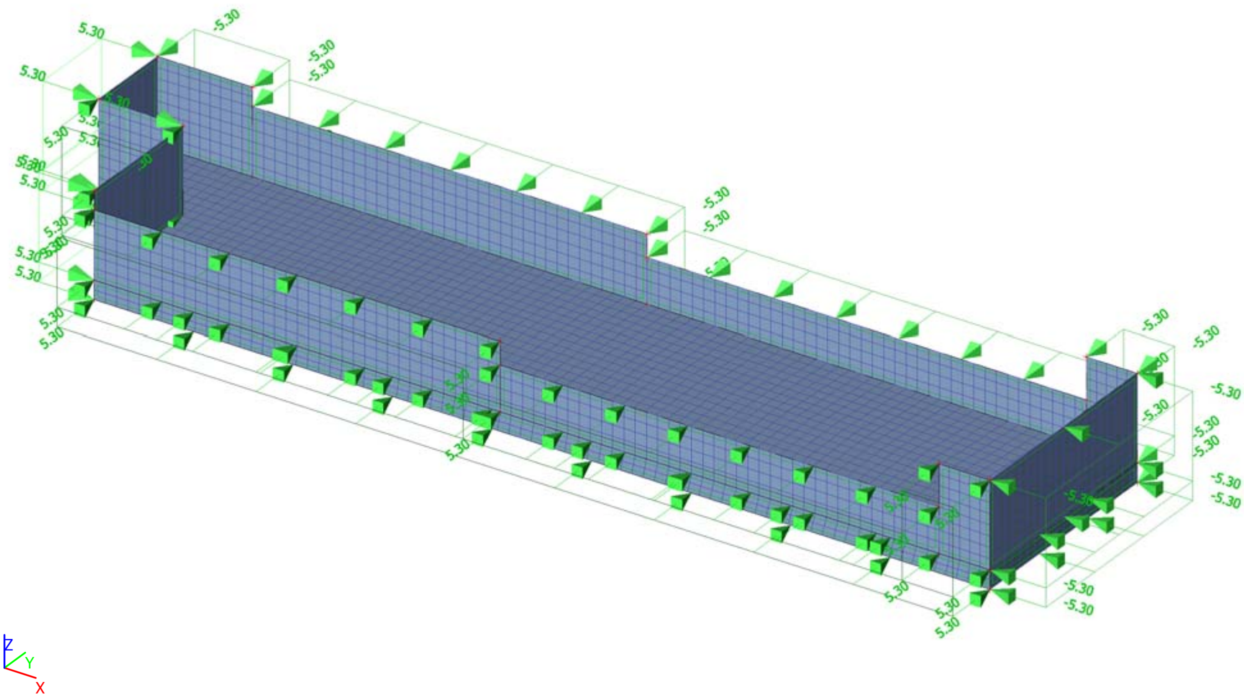
6.2. LC3 - Water Pressure = (1-ko)*γw*(2/3Ht)



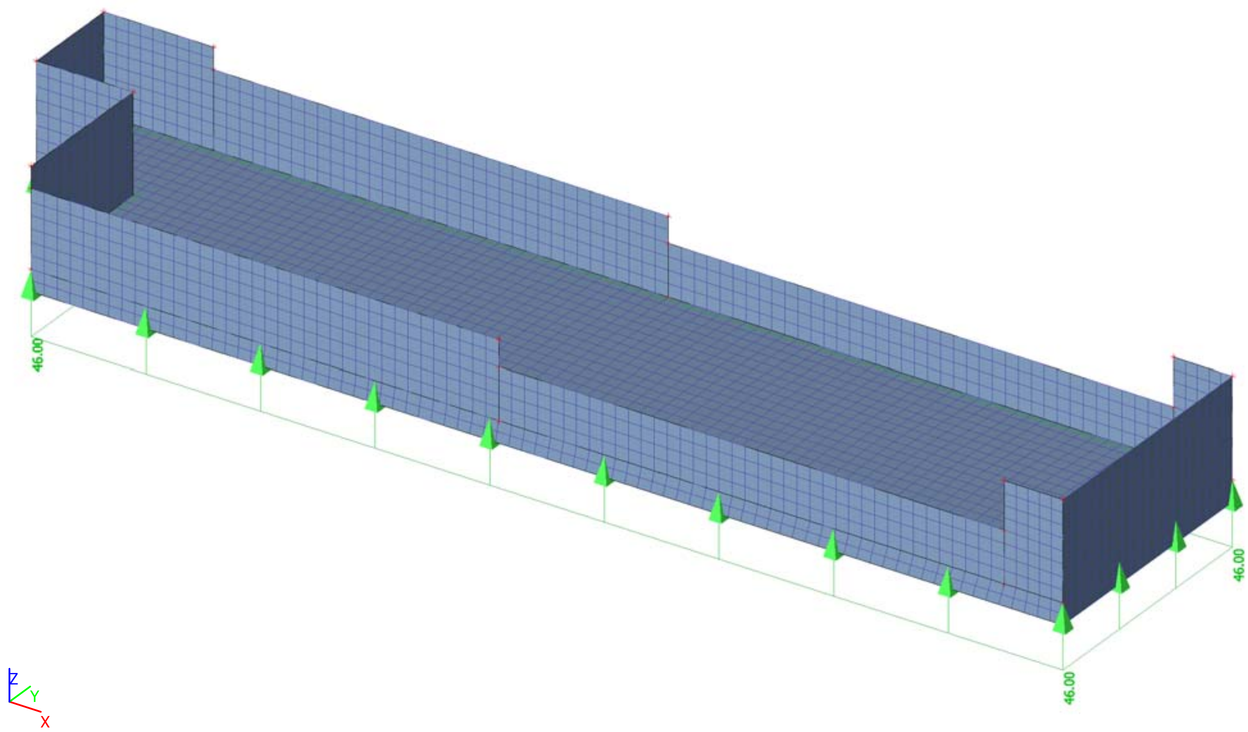
6.3. LC4 - Surcharge Dead = ko*D



6.4. LC5 - Surcharge Live = ko*L



6.5. LC6 - Heave Pressure = γs*Ht



6.6. Surface load

Name	Dir	Type	Value [kN/m^2]	2D member	Load case	System	Loc
SF3	Z	Force	13.67	S1	LC3 - Water Pressure	GCS	Length
SF4	X	Force	-5.30	S13	LC4 - Surcharge (D)	GCS	Length
SF5	X	Force	5.30	S11	LC4 - Surcharge (D)	GCS	Length
SF6	X	Force	5.30	S2	LC4 - Surcharge (D)	GCS	Length
SF7	X	Force	5.30	S9	LC4 - Surcharge (D)	GCS	Length
SF8	X	Force	5.30	S4	LC4 - Surcharge (D)	GCS	Length
SF9	X	Force	-5.30	S6	LC4 - Surcharge (D)	GCS	Length
SF10	Y	Force	-5.30	S18	LC4 - Surcharge (D)	GCS	Length
SF11	Y	Force	5.30	S17	LC4 - Surcharge (D)	GCS	Length
SF12	Y	Force	5.30	S15	LC4 - Surcharge (D)	GCS	Length
SF13	Y	Force	5.30	S14	LC4 - Surcharge (D)	GCS	Length
SF14	Y	Force	5.30	S5	LC4 - Surcharge (D)	GCS	Length
SF15	Y	Force	5.30	S3	LC4 - Surcharge (D)	GCS	Length
SF16	Y	Force	5.30	S10	LC4 - Surcharge (D)	GCS	Length
SF17	Y	Force	-5.30	S16	LC4 - Surcharge (D)	GCS	Length
SF18	Y	Force	-5.30	S12	LC4 - Surcharge (D)	GCS	Length
SF19	Y	Force	-5.30	S7	LC4 - Surcharge (D)	GCS	Length
SF20	Y	Force	-5.30	S8	LC4 - Surcharge (D)	GCS	Length
SF21	Y	Force	5.30	S15	LC5 - Surcharge (L)	GCS	Length
SF22	Y	Force	-5.30	S16	LC5 - Surcharge (L)	GCS	Length
SF23	Y	Force	5.30	S10	LC5 - Surcharge (L)	GCS	Length
SF24	Y	Force	5.30	S3	LC5 - Surcharge (L)	GCS	Length
SF25	Y	Force	5.30	S5	LC5 - Surcharge (L)	GCS	Length
SF26	Y	Force	5.30	S17	LC5 - Surcharge (L)	GCS	Length
SF27	Y	Force	-5.30	S18	LC5 - Surcharge (L)	GCS	Length
SF28	Y	Force	-5.30	S12	LC5 - Surcharge (L)	GCS	Length
SF29	Y	Force	5.30	S14	LC5 - Surcharge (L)	GCS	Length
SF30	Y	Force	-5.30	S8	LC5 - Surcharge (L)	GCS	Length
SF31	Y	Force	-5.30	S7	LC5 - Surcharge (L)	GCS	Length
SF32	X	Force	-5.30	S13	LC5 - Surcharge (L)	GCS	Length
SF33	X	Force	5.30	S11	LC5 - Surcharge (L)	GCS	Length

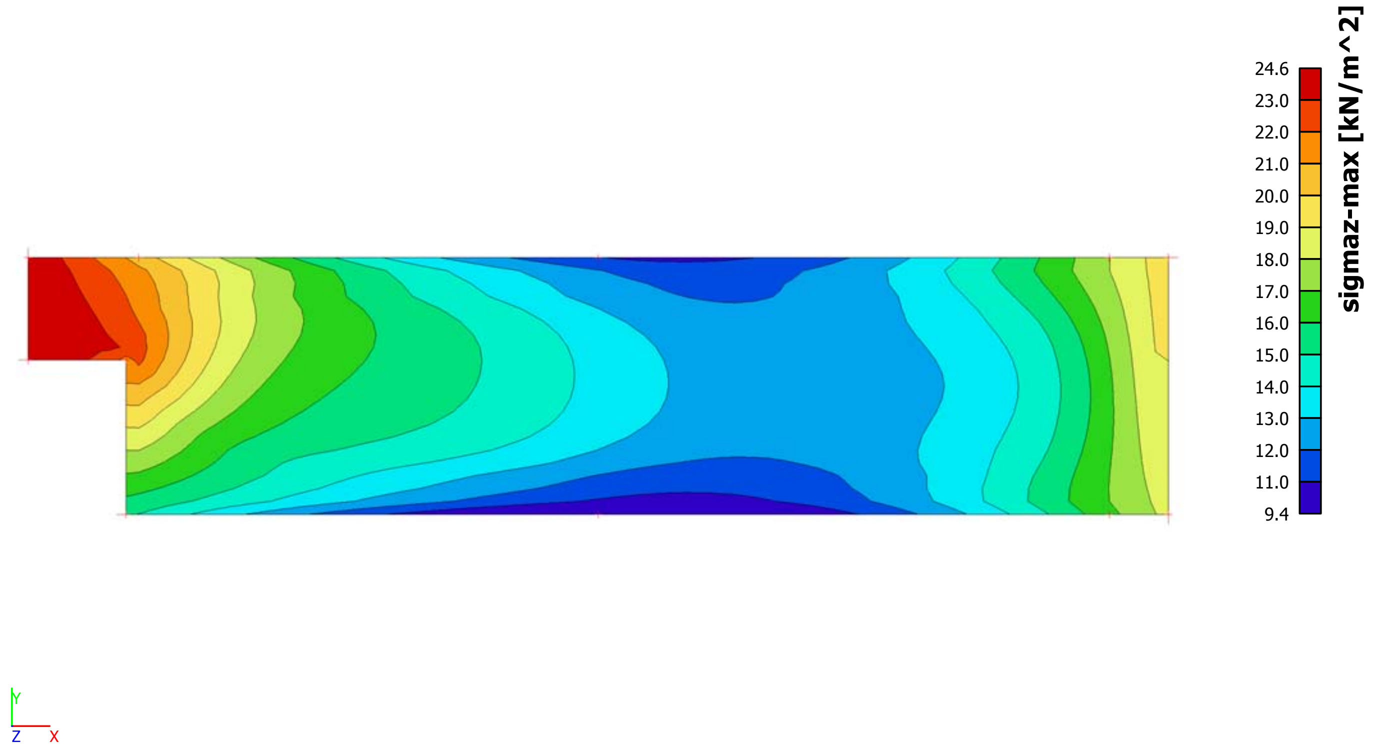
Name	Dir	Type	Value [kN/m^2]	2D member	Load case	System	Loc
SF34	X	Force	5.30	S4	LC5 - Surcharge (L)	GCS	Length
SF35	X	Force	5.30	S2	LC5 - Surcharge (L)	GCS	Length
SF36	X	Force	5.30	S9	LC5 - Surcharge (L)	GCS	Length
SF37	X	Force	-5.30	S6	LC5 - Surcharge (L)	GCS	Length
SF38	Z	Force	46.00	S1	LC6 - Heave Pressure	GCS	Length

6.7. Free surface load

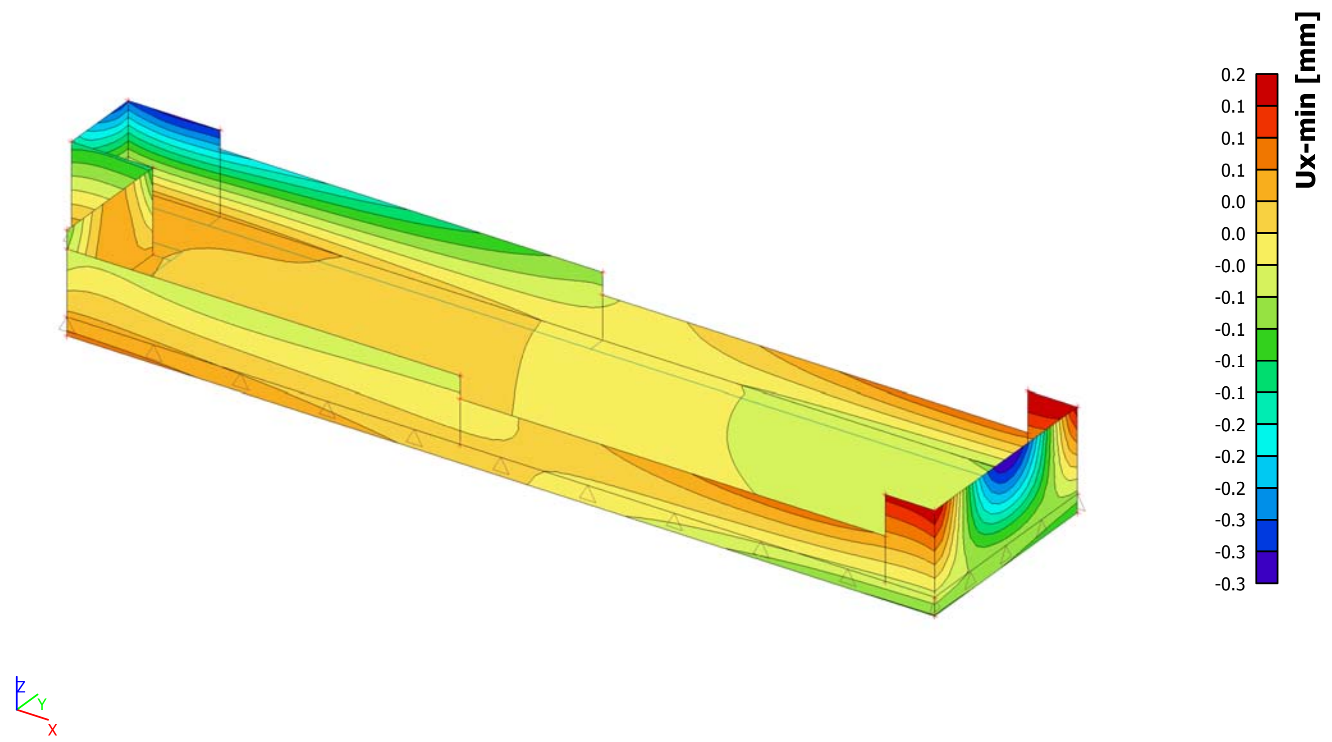
Name	Load case	Dir	Type	Distribution	q1 [kN/m^2]	q2 [kN/m^2]	Validity	Select	System	Location
FF7	LC2 - Soil Pressure	Y	Force	Dir Y	0.00	29.68	Z=0	Auto	GCS	Length
FF8	LC2 - Soil Pressure	Y	Force	Dir Y	-29.68	0.00	Z=0	Auto	GCS	Length
FF9	LC2 - Soil Pressure	X	Force	Dir Y	-29.68	0.00	Z=0	Auto	GCS	Length
FF10	LC2 - Soil Pressure	X	Force	Dir Y	29.68	0.00	Z=0	Auto	GCS	Length
FF11	LC2 - Soil Pressure	X	Force	Dir Y	29.68	0.00	Z=0	Auto	GCS	Length
FF12	LC2 - Soil Pressure	Y	Force	Dir Y	29.68	0.00	Z=0	Auto	GCS	Length
FF13	LC3 - Water Pressure	Y	Force	Dir Y	0.00	8.77	Z=0	Auto	GCS	Length
FF14	LC3 - Water Pressure	Y	Force	Dir Y	-8.77	0.00	Z=0	Auto	GCS	Length
FF15	LC3 - Water Pressure	X	Force	Dir Y	-8.77	0.00	Z=0	Auto	GCS	Length
FF16	LC3 - Water Pressure	X	Force	Dir Y	8.77	0.00	Z=0	Auto	GCS	Length
FF17	LC3 - Water Pressure	X	Force	Dir Y	8.77	0.00	Z=0	Auto	GCS	Length
FF18	LC3 - Water Pressure	Y	Force	Dir Y	8.77	0.00	Z=0	Auto	GCS	Length

7. Results

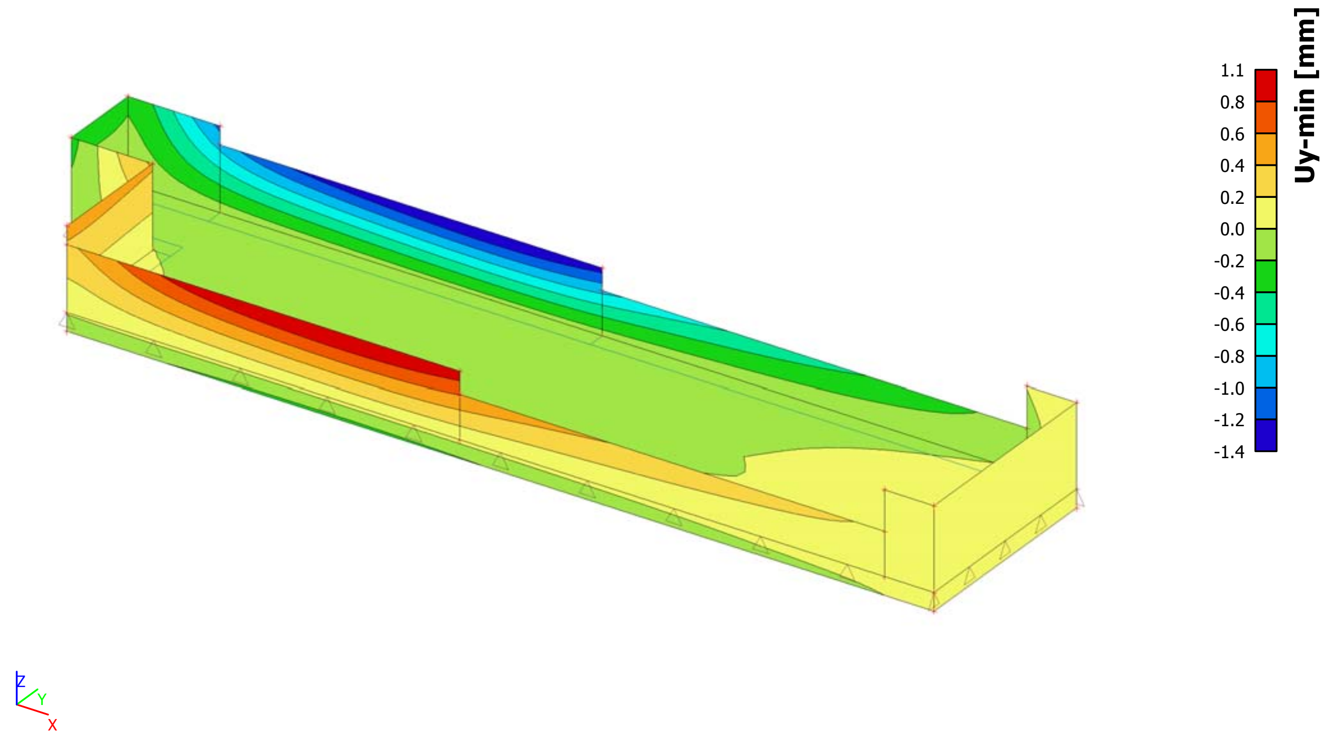
7.1. Contact stresses; sigmaz (SLS)



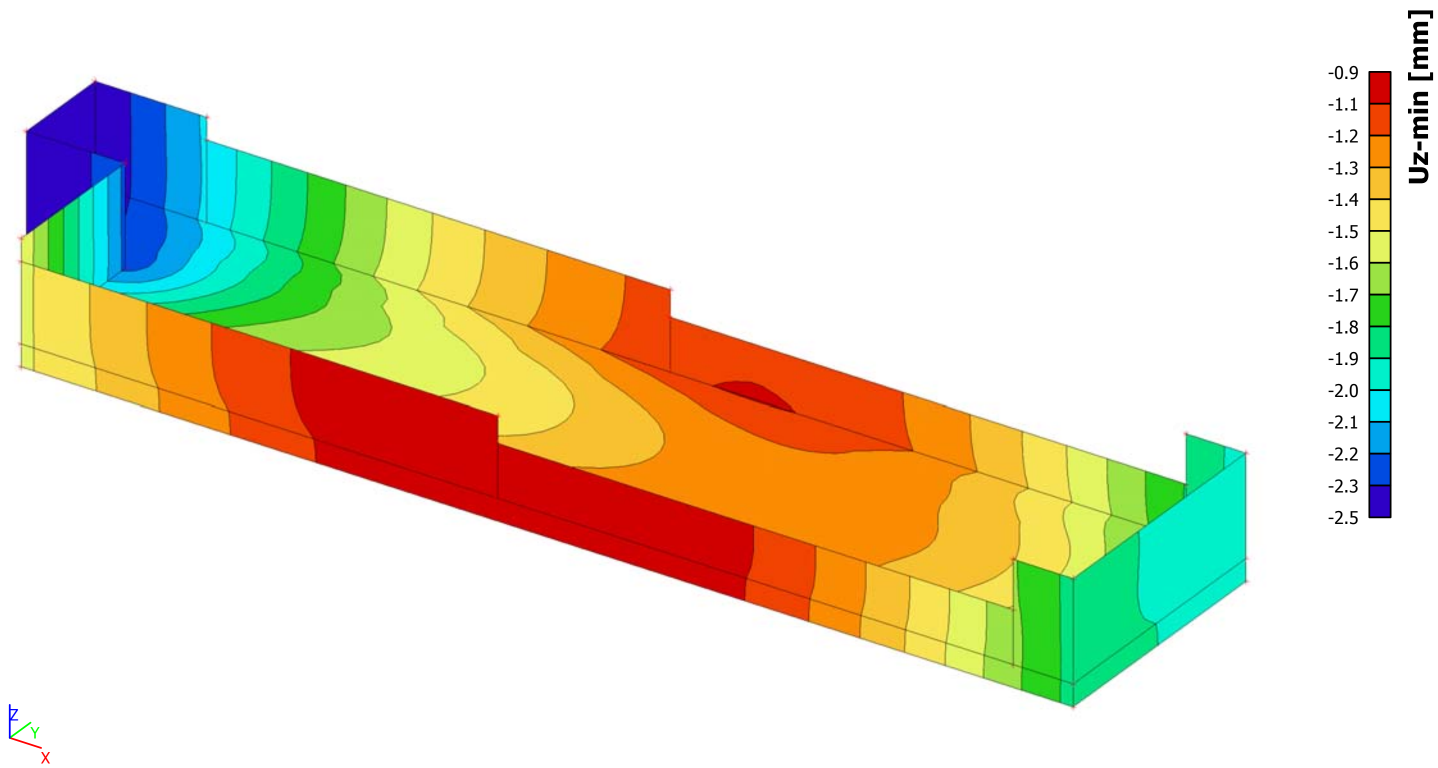
7.2. Displacement of nodes; Ux (SLS)



7.3. Displacement of nodes; Uy (SLS)

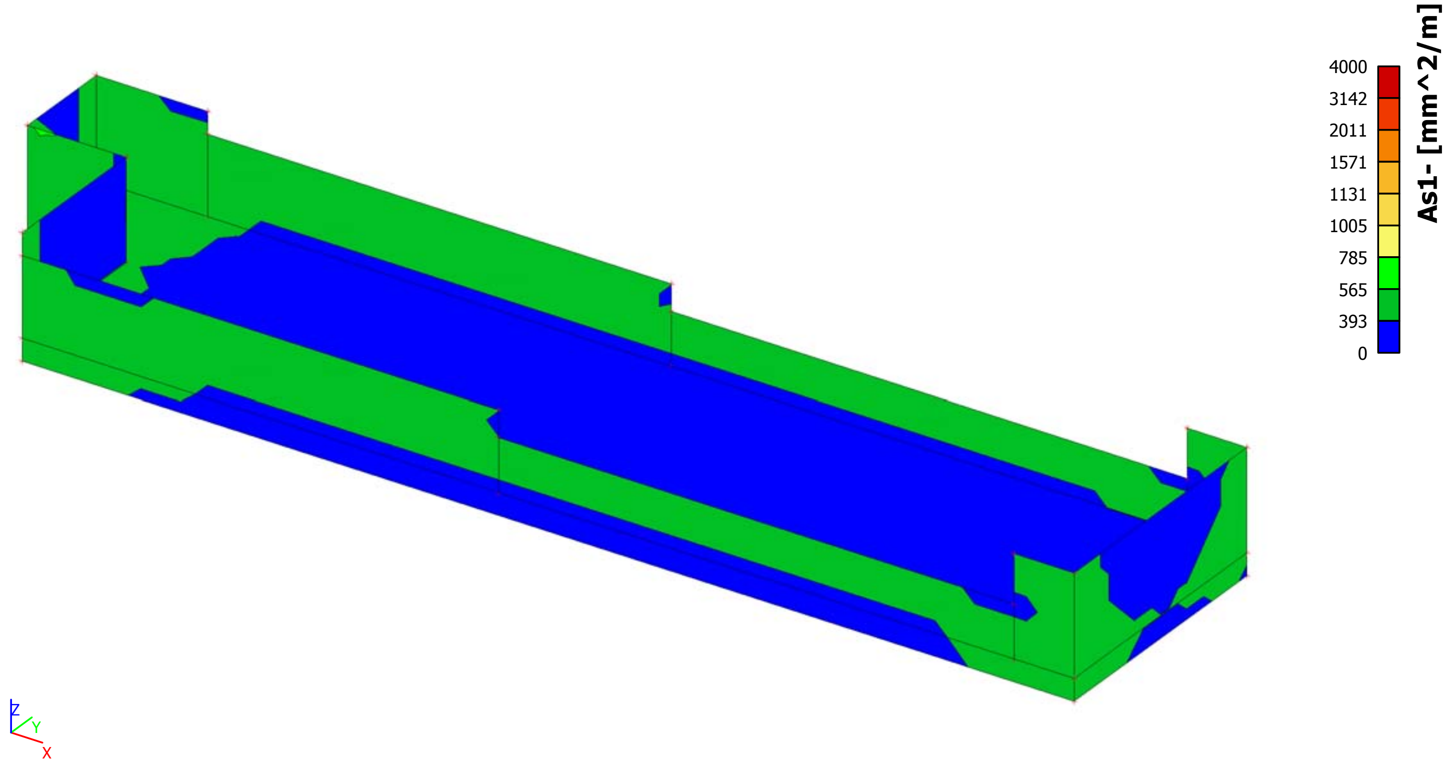


7.4. Displacement of nodes; Uz (SLS)

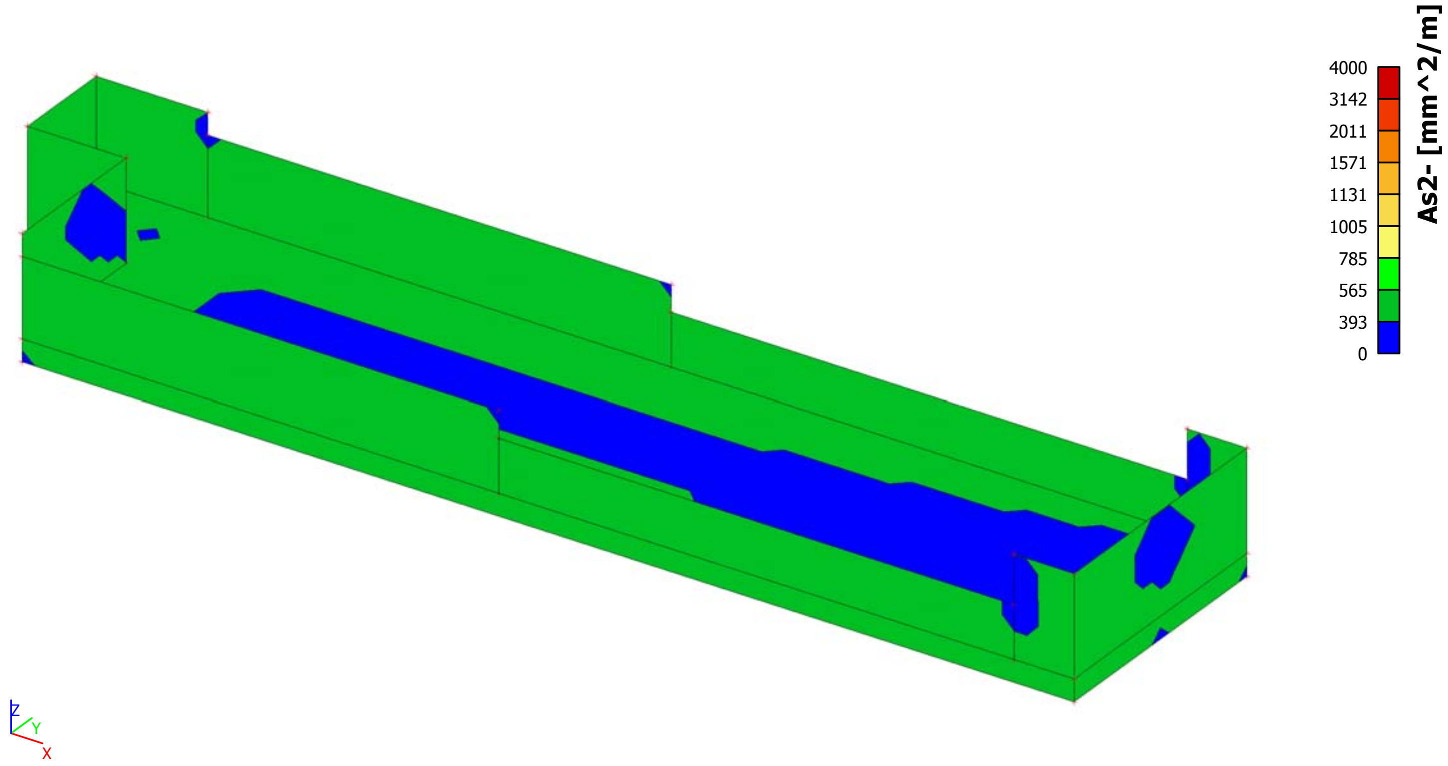


8. Design

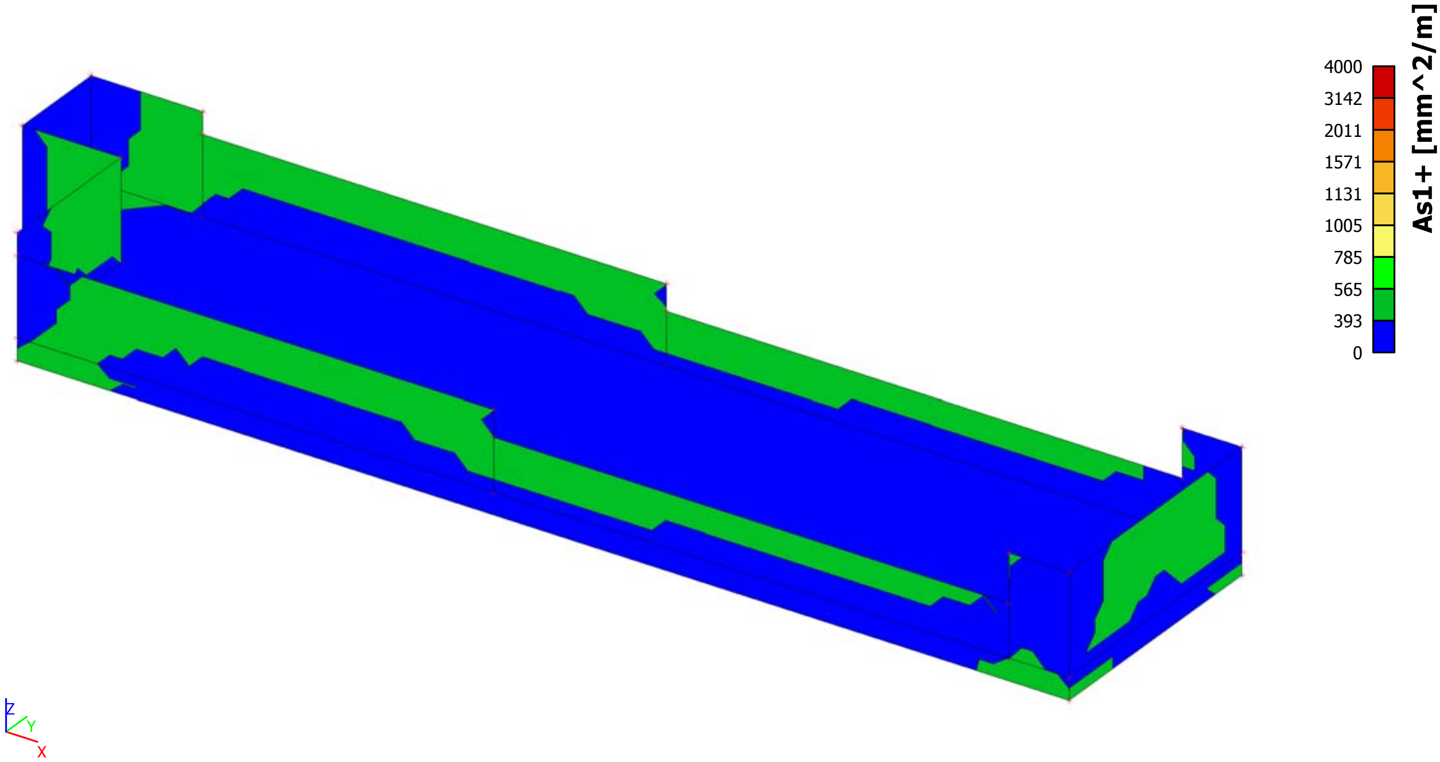
8.1. Member 2D - design - required areas; As1- (ULS) Slab bottom - x, Walls Outer Face - x



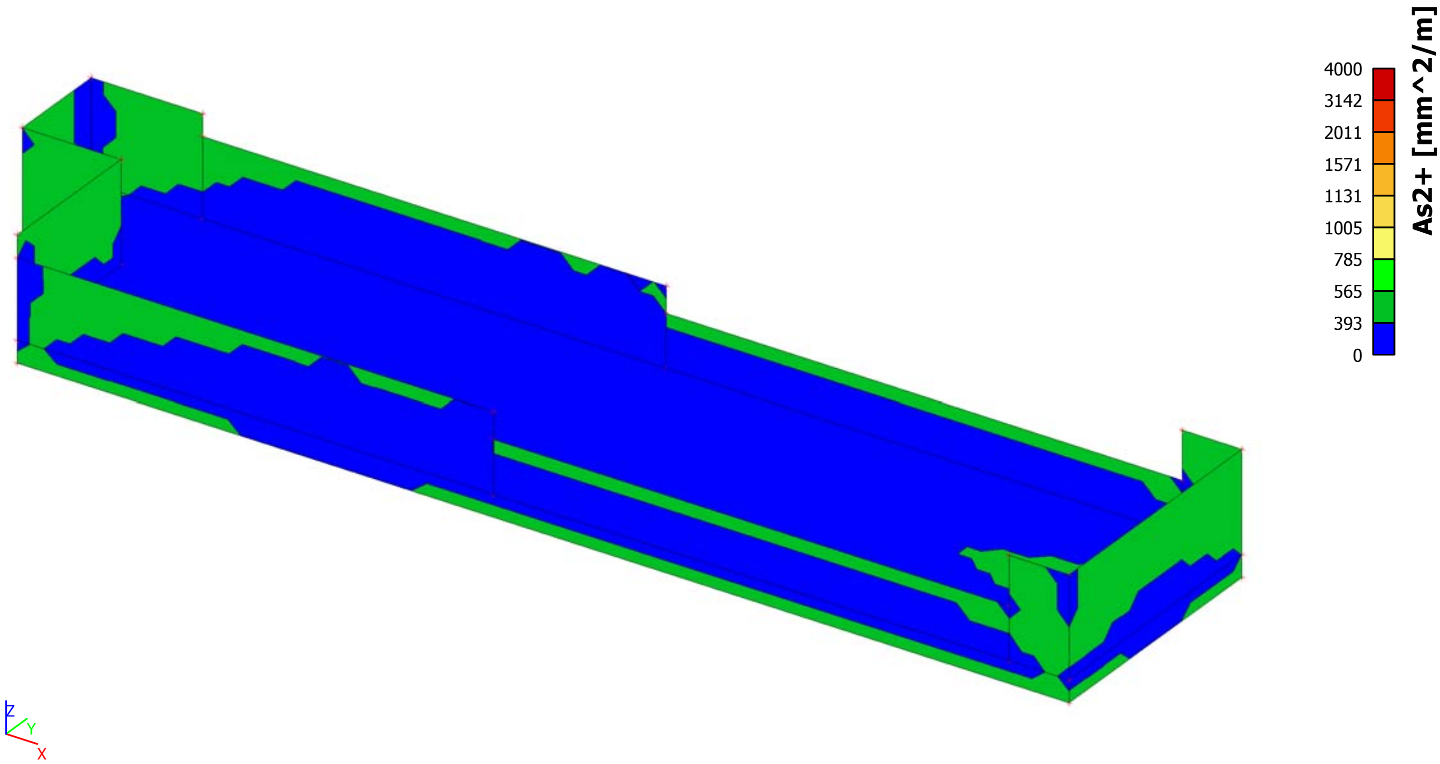
8.2. Member 2D - design - required areas; As2- (ULS) Slab bottom - y, Walls Outer Face - y



8.3. Member 2D - design - required areas; As1+ (ULS) Slab Top - x, Walls Inner Face - x



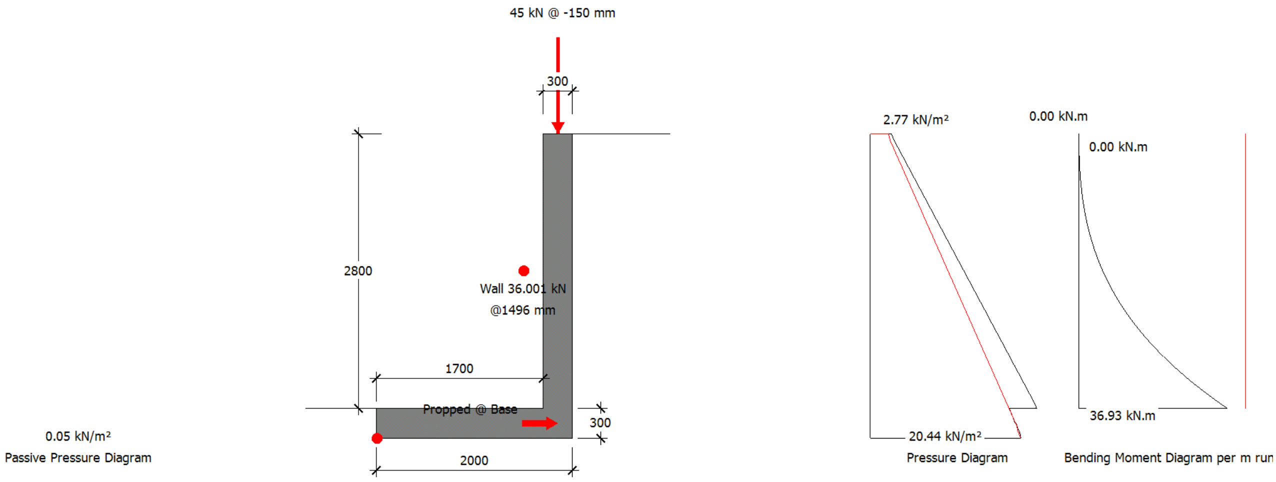
8.4. Member 2D - design - required areas; As2+ (ULS) Slab Top - y, Walls Inner Face - y



Appendix 2
SCIA Design Fact Sheets

Appendix 3
Calculations – Retaining wall in temporary condition

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 AND BS 8110 : 1997
RC Retaining Wall
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Soil 18.00, Concrete 25.00
Concrete grade	fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 40 mm, Wall outer cover 40 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 7.00 kN/m², Fully drained

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Additional Loads

Wall Propped at Base Level	Therefore no sliding check is required
Vertical Line Load	45 kN/m @ X -150 mm and Y 0 mm - Load type Live
† Dimensions	Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Soil bearing pressure	Allowable pressure @ front 100.00 kN/m², @ back 100.00 kN/m²
Back Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel, P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge

Case 1: Geotechnical Design	$1.00\ G_{Wall}+1.00\ Fv_{Heel}+1.00\ P_a+1.00\ P_{surcharge}$
Case 2: Structural Ultimate Design	$1.40\ G_{Wall}+1.60\ Fv_{Heel}+1.00\ P_a+1.00\ P_{surcharge}$

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	40.425/137.100	0.295	OK

Wall Sliding - Virtual Back Pressure

$Fx/(Rx_{Friction}+ Rx_{Passive})$	0.000/(29.228+0.000)	0.000	OK
Prop Reaction Case 2 (Service)	35.5 kN @ Base		

Soil Pressure

Virtual Back (No uplift)	Max(16.994/100, 64.002/100) kN/m²	0.640	OK
Wall Back (No uplift)	Max(29.054/100, 51.942/100) kN/m²	0.519	OK

Structural Design

Prop Reaction

Maximum Prop Reaction (Ultimate)	41.4 kN @ Base

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
	Steel Provided (Cover) Main H10@200 (40 mm) Dist. H10@200 (50 mm)		393 mm²
OK			
Compression Steel Provided (Cover)	Main H10@200 (40 mm) Dist. H10@200 (50 mm)	393 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	255 mm, 1000 mm, 393 mm², 500 N/mm², 30.0 N/mm²	242 mm	
Mr=fn(above,As',d',x,x/d)	393 mm², 45 mm, 14 mm, 0.06	41.4 kN.m	
Moment Capacity Check (M/Mr)	M 36.9 kN.m, Mr 41.4 kN.m	0.892	OK
Wall Axail Design (N/Ncap)	N 101.4 kN, Ncap 3600.0 kN	0.028	OK
Wall Slenderness λ	Leff/tk =1.96x2800.0/300.0	18.3	OK
Kmin = (Nuz-N)/(Nuz-Nbal)	Min(1.0, 4000.0 - 101.4)/(4000.0 - 1716.4)	1.0	
M_{add}= N.Kmin.h.λ^2/2000	101.4x1.0x300.0x18.3²/2000	5.1kN.m	
(M+Madd)/Mr_{Axial}	M+Madd 42.0 kN, Mr_{Axail}58.3 kN.m	0.720	OK
Shear Capacity Check	F 35.6 kN, vc 0.403 N/mm², Fvr 102.7 kN	0.35	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 393 mm², 500 N/mm², 30 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	393 mm², 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 0.0 kN.m, Mr 39.8 kN.m	0.001	OK
Shear Capacity Check	F 0.3 kN, vc 0.412 N/mm², Fvr 101.0 kN	0.00	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 393 mm², 500 N/mm², 30 N/mm²	233 mm	
Mr=fn(above,As',d',x,x/d)	393 mm², 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 37.8 kN.m, Mr 39.8 kN.m	0.952	OK
Shear Capacity Check	F 71.8 kN, vc 0.412 N/mm², Fvr 101.0 kN	0.71	OK

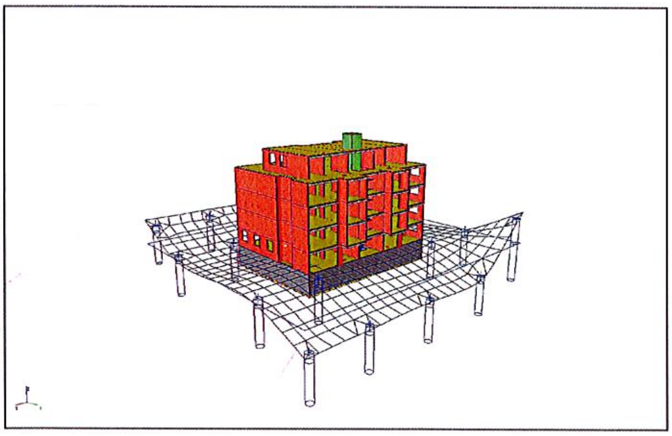
Scia Engineer Fact Sheet

Soil interaction (Soil-in)

E **esas.06**

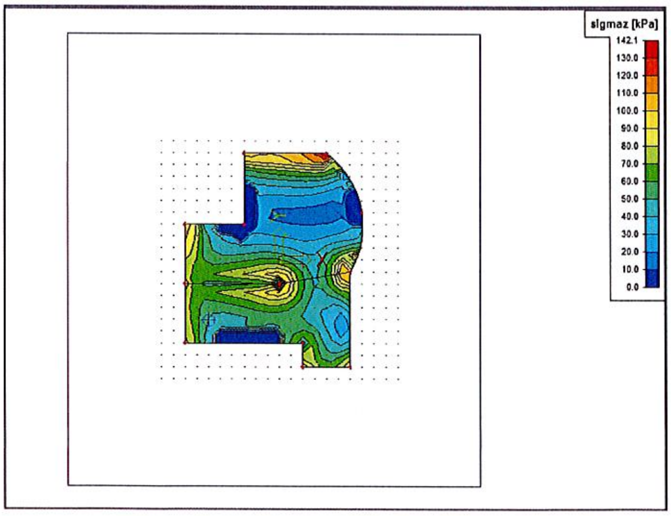
Determination of the 'real' C parameters and calculation of the interaction between the structure and the soil due to settings of the soil. The distribution of the tension in the soil under the foundation plates, the distribution and the level of the load, the contact tension between the structure and the subsoil, the geometry of the contact layer and the geological characteristics of the subsoil at a specific position. As the C parameters have an influence on the contact tension (and vice versa), the subsidence of the contact layer and a consequence also the C parameters are influenced by the contact tension; the calculation of the properties is iterative. The calculation determines the occurring settings and the influence of these settings on the structure. The calculation is based on the Pasternak model.

Highlights
Multi-parametric interaction between ground slab and foundation soil
Taken into account: distribution and intensity of load, contact stress between structure and soil, footing surface geometry, local geological conditions
Input of subsoil using data from borehole surveying
Display of SigmaZ and soil structure strength
Generation of Vertexes (soil points)



- The module calculates C parameters for the interaction between ground slab and foundation soil, taking into account loading distribution and intensity, structure/soil border contact stress, footing surface geometry and local geological conditions.

- The model used in "Soil- in" is called the Energy or More- constants Model and has been used in practice since 1975, comparing well with many in-situ measurement systems. The "More-constants model" name refers to the energy model capacity:
  a. the shear stiffness of the subsoil C_2 using the Pasternak model;
  b. the orthotropy or anisotropy of the subsoil by means of the C_{2x}, C_{2y} and C_{2xy} constants;
  c. the surface friction in the structure/soil interface by means of the C_{1x}, C_{1y} constants.
- The "Soil- in" module uses a layered half- space model with these features:
  a. Users can apply the Boussinesq influence function to calculate the development of the vertical stress component SigmaZ in the subsoil in any surface overload situation despite any layering, uneven soil constitution or other anomaly. The various geomechanical standards approve this method.
  b. Users can determine any overloading at the excavation surfaces using the Boussinesq formulae for a half-space loaded at a general depth.
  c. The model uses the approximate solution of an elastic layer of finite thickness to indicate the existence of an incompressible layer.
  d. The model calculates the soil compression strain components and settlements taking into account the nature of the subsoil layers.
- The program follows the Eurocode 7 and ČSN 73 0001 codes.



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Input

The user selects foundation plates where the "Soil- in" module should determine stiffness, meaning that he or she can select only those foundation slabs that should be analysed by "Soil-in".

The model can define several boreholes with different layers and properties in each borehole:

- t = thickness of the layer;
- E = deformation modulus of soil mass in compression (cylindrical standard test);
- n = Poisson's ratio;
- g = specific weight dry and wet;
- m = soil structure strength factor (defined in different codes).

Engineers will have to consider excavating if the foundation plate and subsoil do not interact on the original terrain surface. The program calculates the parameters automatically.

Calculation

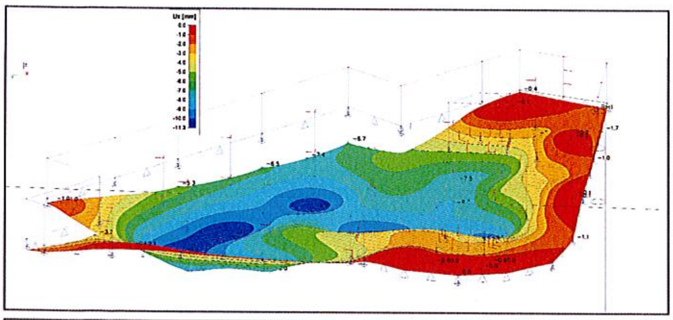
The program needs the structure- soil interaction parameters for subsequent iteration. Firstly the FEM analysis of the upper structure with initial C interaction parameters (which the user can modify) gives a first approximation of contact stress.

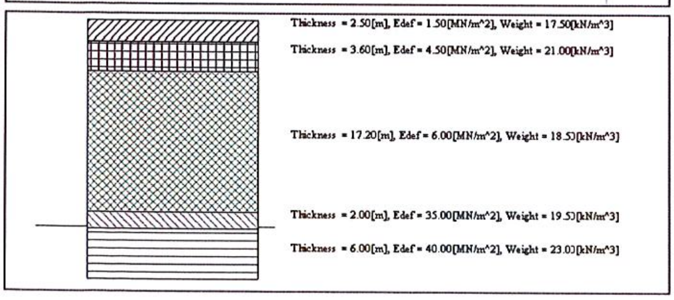
These subsoil contact stress values serve as input for "Soil- in". This program solves settlements and corrects C parameter values. The program repeats the whole FEM calculation + "Soil- in" cycle until iteration test completion, thus obtaining the correct deformation and internal force values.

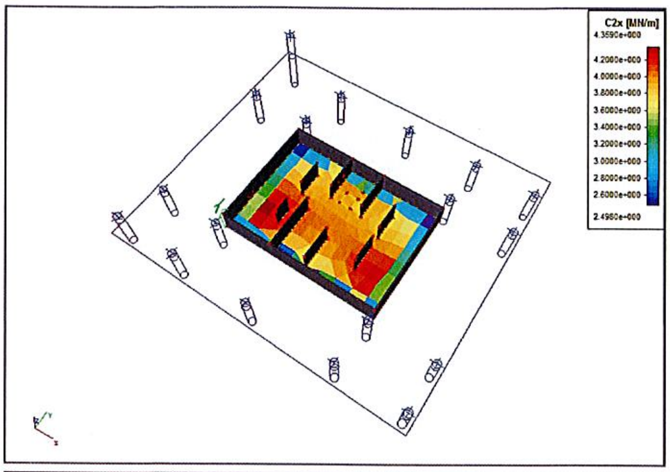
Results

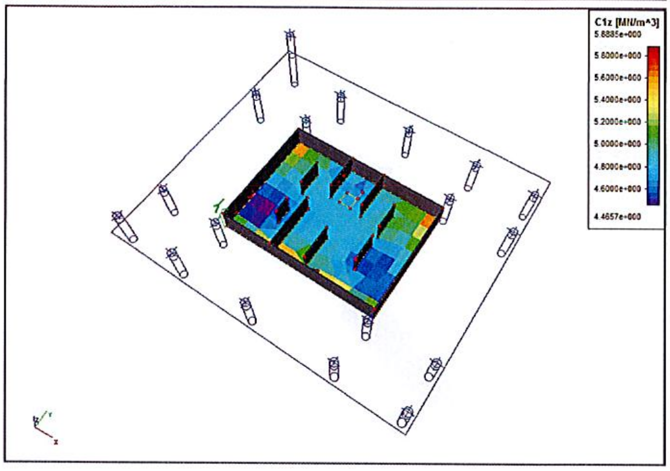
Both graphical and numerical results, along with all standard SCIA Engineer output facilities - iso-bands, isolines, DXF export, search for extremes, and documentation - are available.

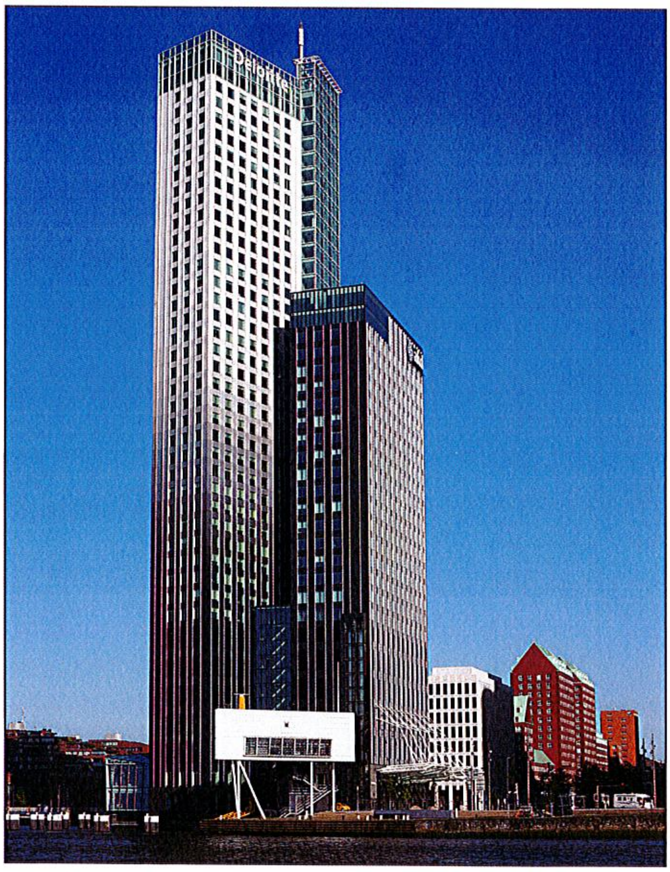
The program determines and displays the C_{1z}, C_{2x} and C_{2y} coefficients. Foundation plate/subsoil contact stress values at every iteration are also available.











Required modules

esa.01 and esas.00