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### Construction Stages

Name	Term	Objects present in this stage
Stage 1 (Generated)	Long	Wall 1 (Generated) On retained side: Ground 1 (Generated), Borehole 1 (Generated), On excavated side: Excavation 1 (Generated), Borehole 1 (Generated),

### Ground Profiles

Name	Type	Other Properties
Ground 1 (Generated)	Horizontal	

### Excavations

Name	Type	Depth (m)	Plan length (m)	Plan breadth (m)	Other Properties
Excavation 1 (Generated)	Horizontal	5.00	-	-	

### Soils

Name	Type	Class	State	Other Properties
Soil 1 (Generated)	Clay	Low-plasticity	Firm	Soil is not fissured

### Soil properties

Name	Wet weight kN/m <sup>3</sup>	Dry weight kN/m <sup>3</sup>	Failure state	Friction °	Cohesion kPa	Poisson's ratio
Soil 1 (Generated)	20.1	20.1	Peak	20.0	5.0	0.30

### Soil properties (undrained)

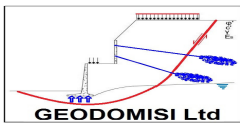
Name	Strength kPa	Strength increase kN/m <sup>3</sup>	From depth m
Soil 1 (Generated)	65.0	5.0	0.00

### Layers

Name	Type	Thickness (m)	Soil	Dip (°)	OCR	Tension crack	
Layer 1 (Generated)	Undrained	22.50	Soil 1 (Generated)	0.0	1.0	Flooded	Not rigid

### Boreholes

Name	Depth (m)	Contains layers:
Borehole 1 (Generated)	22.5	Layer 1 (Generated);



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### Retaining Walls

Name	Type	Depth of toe m	Upstand m	Material	Density kg/m <sup>3</sup>	E GPa
Wall 1 (Generated)	Sheet Pile	15.00	0.00	Steel	7800	210.0

### Retaining Wall sections

Name	Section	Sectional area cm <sup>2</sup> /m	Moment of inertia cm <sup>4</sup> /m	Section modulus cm <sup>3</sup> /m
Wall 1 (Generated)	Sheet pile section = FX36	245	82915	3605

### Sheet pile sections

Section	b mm	h mm	d mm	t mm	f mm	A cm <sup>2</sup> /m	m/L kg/m	m/A kg/m <sup>2</sup>	I cm <sup>4</sup> /m	Z cm <sup>3</sup> /m
FX36	675	460	18.0	14.0	149	245	129.7	192.2	82915	3605

### Anchors

Name	Type	Depth (m)	Horizontal spacing (m)	Inclination (°)	Pre-stress (kN/anchor)	L/EA (m/kN)	Other Properties
Anchor 1	Anchor	1.50	1.00	15.0	250.00	0.10	Permanent

### Surcharges

Name	Type	Depth (m)	Magnitude			Other Properties
Surcharge 1	Uniform	0.00	10.0 kPa	V	U	Load type = Custom Loading

### Design Standard

Type = Eurocode 7 (Case B)  
 Earth pressure coefficients  
 Type = Caquot & Kerisel  
 Tension crack limited to the retained height  
 Cantilever toe-in = 20%

Equilibrium calculated at the minimum safe embedment (with designated safety factors)

#### Unfavourable

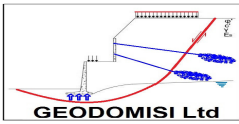
Permanent (G) = 1.35  
 Variable (Q) = 1.50  
 Accidental (A) = 1.00

#### Favourable

Permanent (G) = 1.00  
 Variable (Q) = 0.00  
 Accidental (A) = 0.00

Minimum surcharge = 0 kPa

On shearing resistance = 1.00  
 On effective cohesion = 1.00  
 On undrained strength = 1.00



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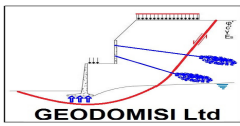
Date

**Design Standard [Continued]**

On effective earth pressures = 1.00  
 On total earth pressures = 1.00  
 Safety factor on resistance applied via: Gross passive pressures  
 Minimum active pressure = 0.00 kN/m<sup>3</sup>

Unplanned excavation = 10% of clear height, but maximum of 0.5m  
 Softened formation = 0 m

On bending moments = 1.00  
 On shear forces = 1.00  
 On prop forces  
 Short-term = 1.00/1.00  
 Long-term = 1/1



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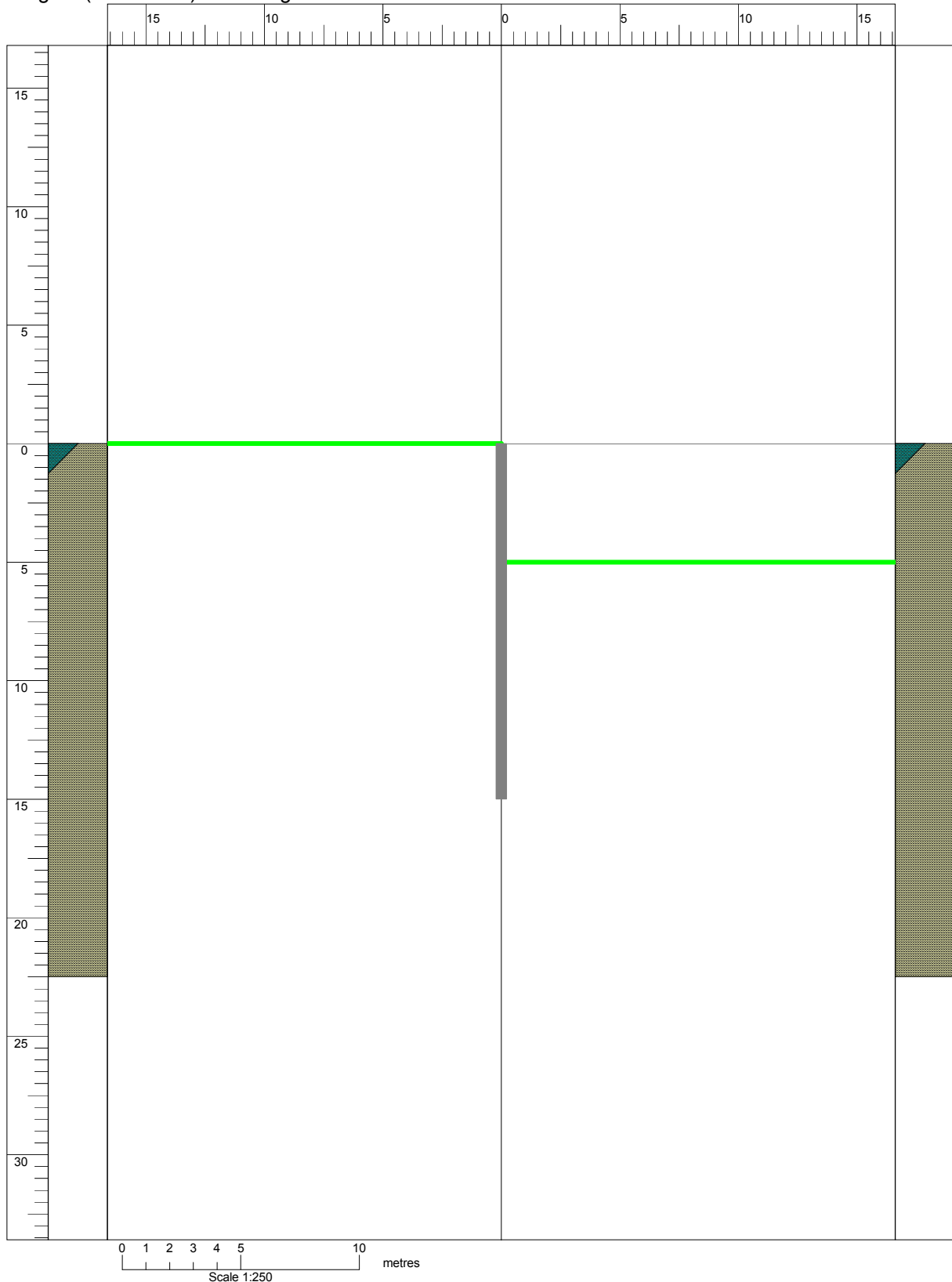
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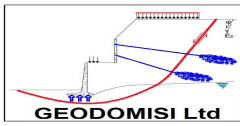
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Stage 1 (Generated) - Drawing Board





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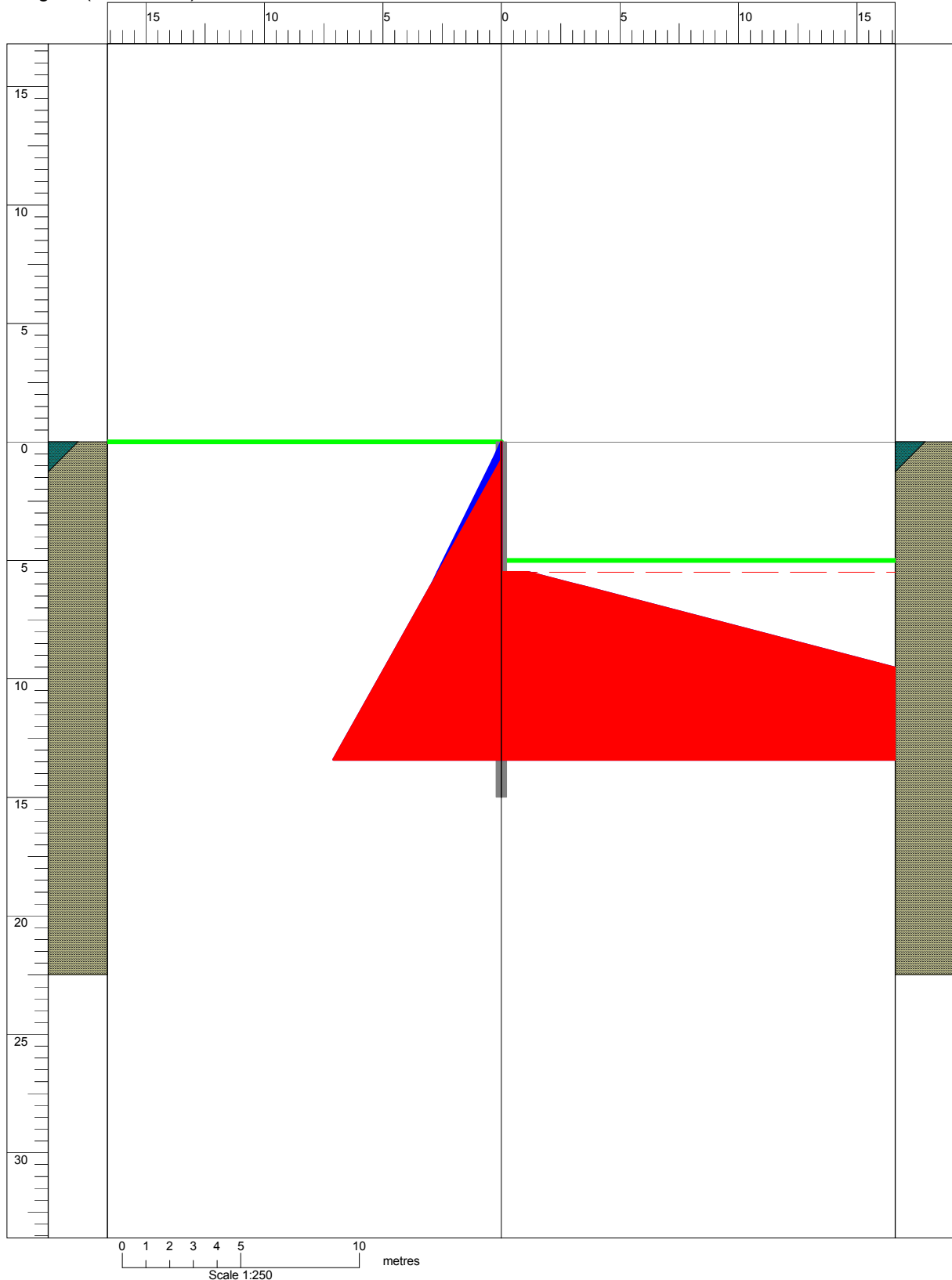
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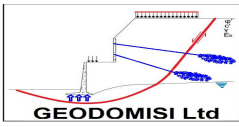
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Stage 1 (Generated) - Earth Pressures As Built





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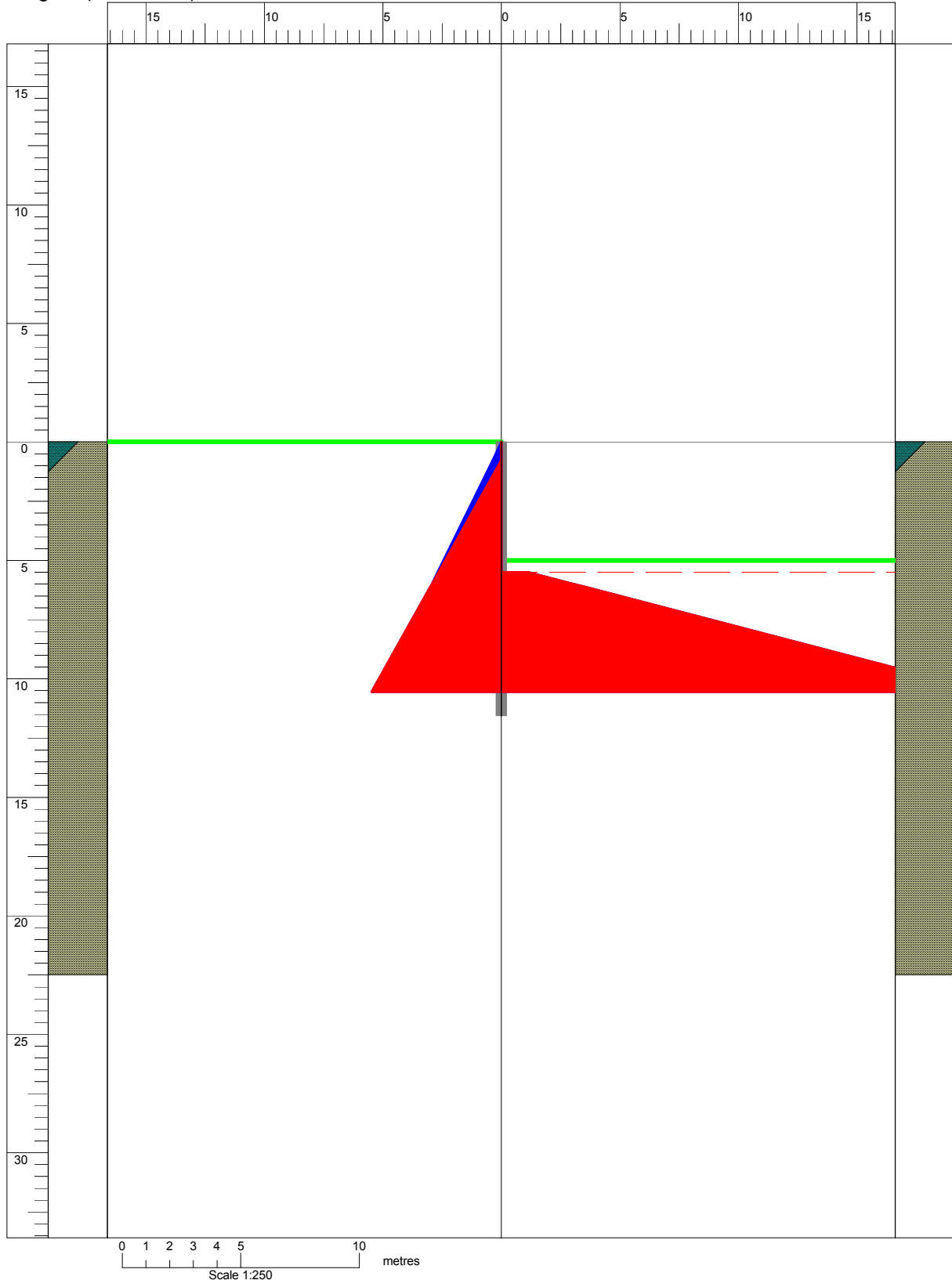
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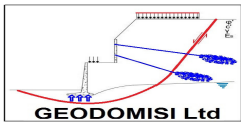
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Stage 1 (Generated) - Earth Pressures At Minimum Safe Embedment





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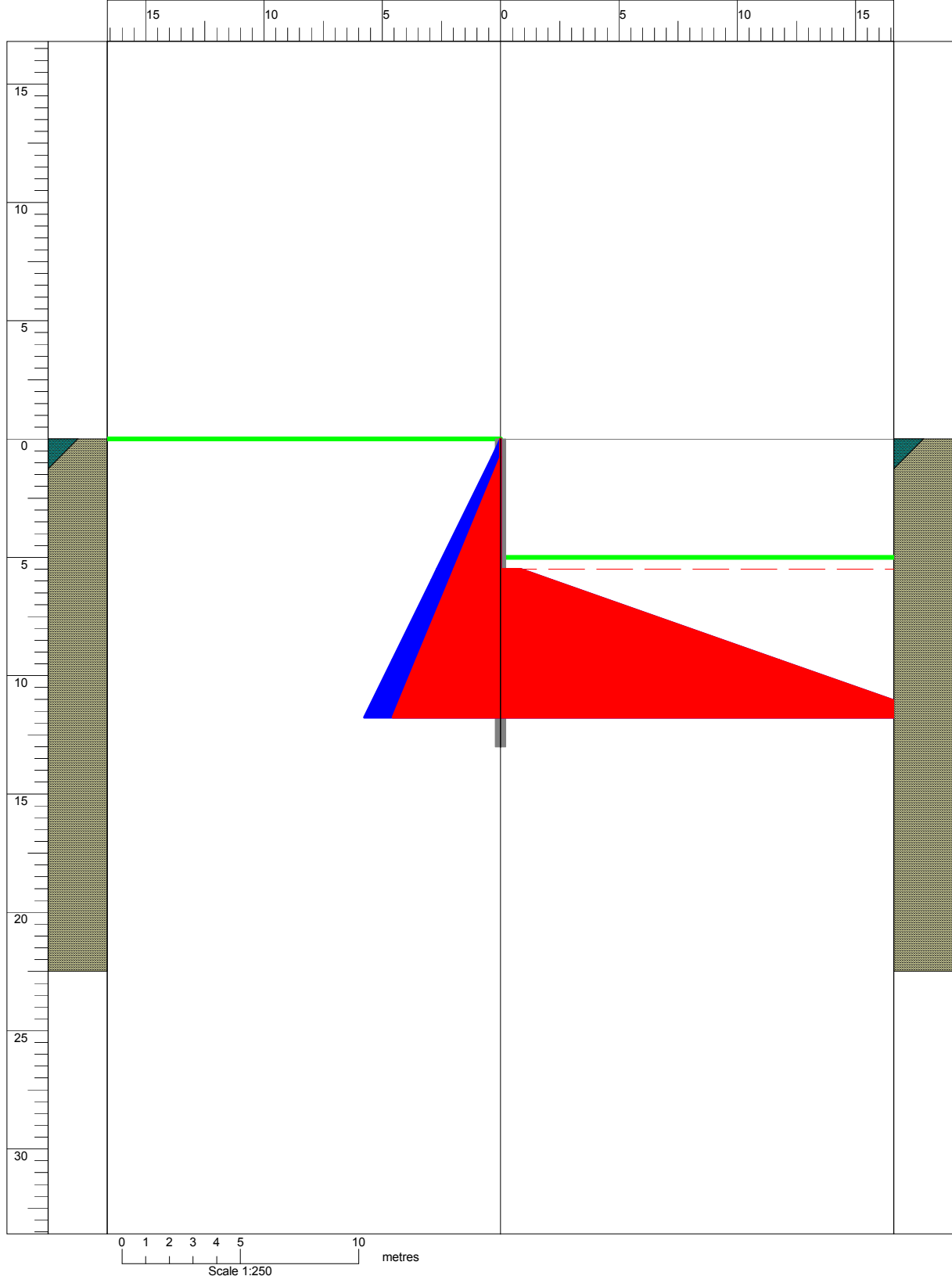
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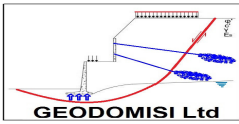
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Stage 1 (Generated) - Earth Pressures At Failure





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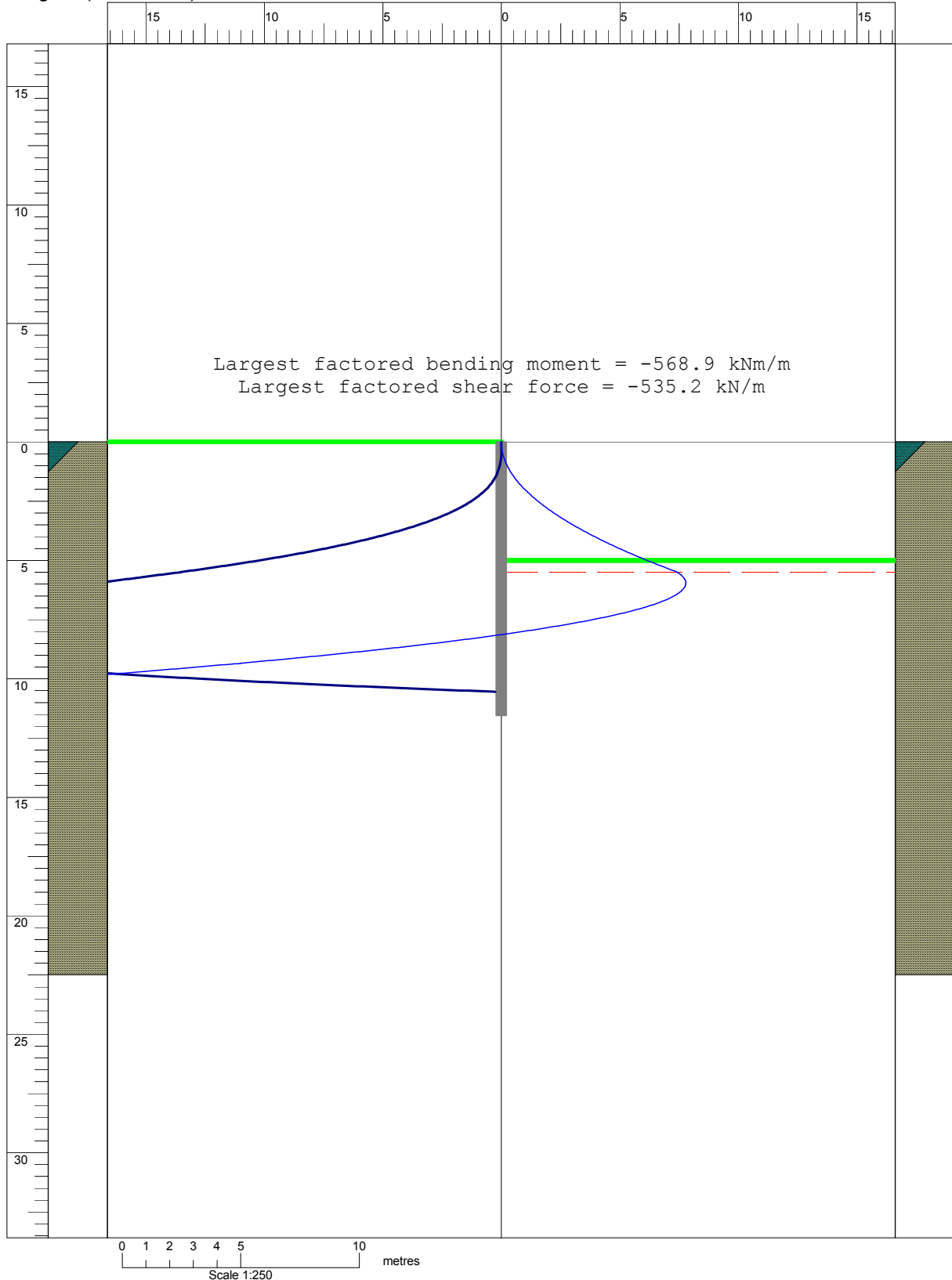
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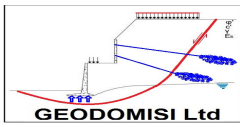
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**Stage 1 (Generated) - Structural Forces**







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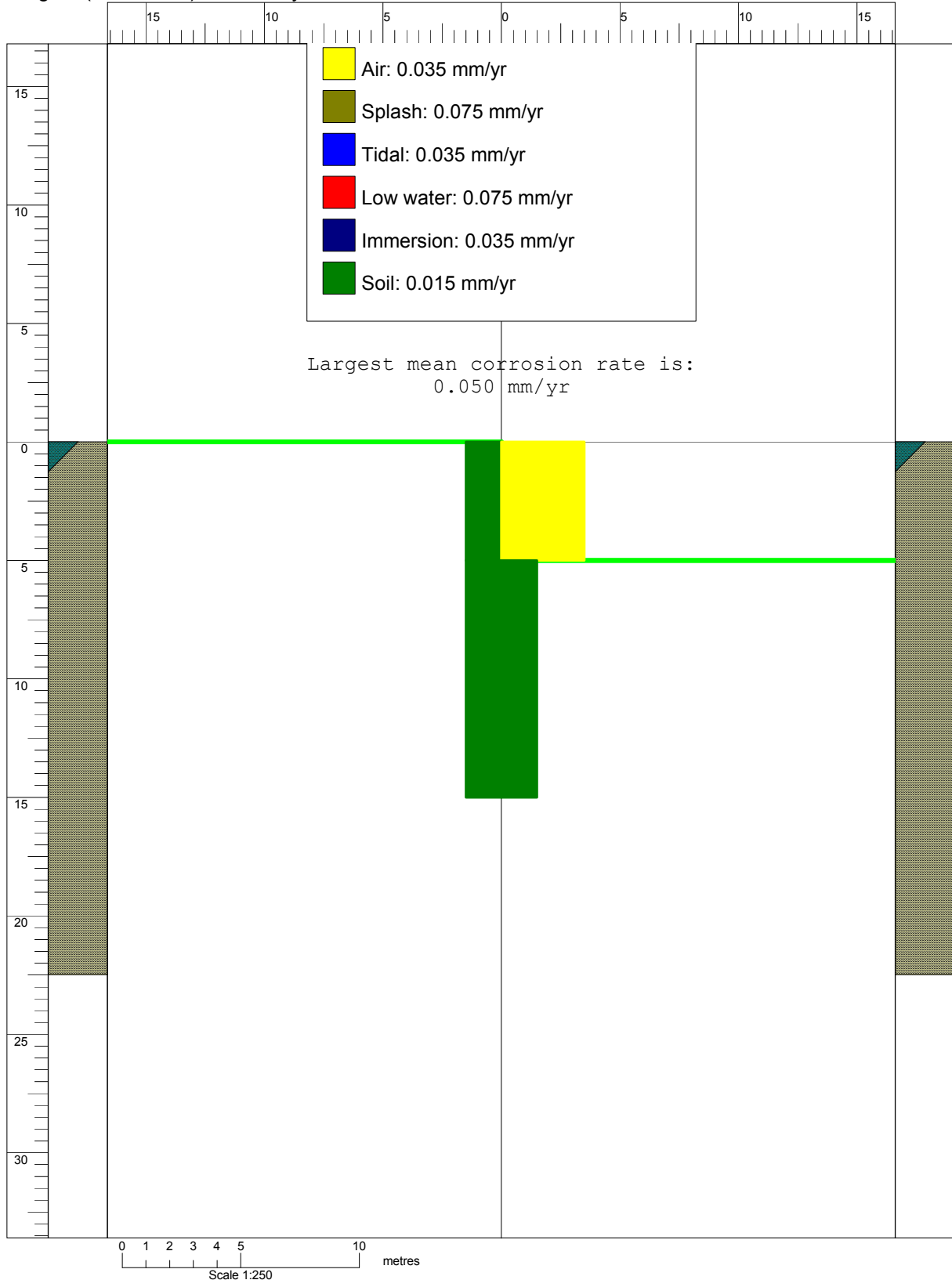
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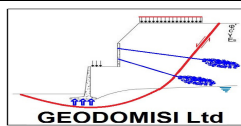
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**Stage 1 (Generated) - Durability**





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**Stage 1 (Generated) - Earth Pressures As Built**

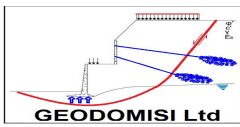
Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	7.59	7.59	0.00	0.00	0.00
0.77	0.00	7.59	7.59	0.00	0.00	0.00
5.50	53.03	0.90	53.94	0.00	0.00	0.00
5.50	53.03	0.90	53.94	22.70	0.00	22.70
5.96	58.22	0.25	58.47	58.22	0.00	58.22
5.96	58.22	0.25	58.47	58.22	0.00	58.22
6.14	60.21	0.00	60.21	71.80	0.00	71.80
6.14	60.21	0.00	60.21	71.80	0.00	71.80
9.35	96.23	0.00	96.23	318.25	0.00	318.25
9.35	96.23	0.00	96.23	318.25	0.00	318.25
13.42	141.86	0.00	141.86	630.42	0.00	630.42

**Stage 1 (Generated) - Earth Pressures At Minimum Safe Embedment**

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	7.59	7.59	0.00	0.00	0.00
0.77	0.00	7.59	7.59	0.00	0.00	0.00
5.50	53.03	0.90	53.94	0.00	0.00	0.00
5.50	53.03	0.90	53.94	22.70	0.00	22.70
5.96	58.22	0.25	58.47	58.22	0.00	58.22
5.96	58.22	0.25	58.47	58.22	0.00	58.22
6.14	60.21	0.00	60.21	71.80	0.00	71.80
6.14	60.21	0.00	60.21	71.80	0.00	71.80
9.35	96.23	0.00	96.23	318.25	0.00	318.25
9.35	96.23	0.00	96.23	318.25	0.00	318.25
10.55	109.74	0.00	109.74	410.68	0.00	410.68

**Stage 1 (Generated) - Earth Pressures At Failure**

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.77	0.00	7.59	7.59	0.00	0.00	0.00
0.77	0.00	7.59	7.59	0.00	0.00	0.00
5.50	39.28	14.65	53.94	0.00	0.00	0.00
5.50	39.28	14.65	53.94	16.82	0.00	16.82
5.96	43.13	15.35	58.47	43.13	0.00	43.13
5.96	43.13	15.35	58.47	43.13	0.00	43.13
9.35	71.28	20.41	91.69	235.74	0.00	235.74
9.35	71.28	20.41	91.69	235.74	0.00	235.74
11.77	91.37	24.02	115.39	373.18	0.00	373.18



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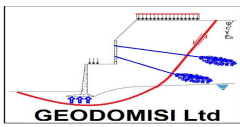
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**Stage 1 (Generated) - Required Embedment As Built  
 Results of earth pressure calculation**

**Retaining Wall**  
 Name = Prototype: Wall 1 (Generated)  
 Retained height = 5.50 m  
 Depth of toe = 15.00 m  
**Partial factors**  
 Factors on actions  
 Unfavourable  
 Permanent (G) = 1.35  
 Variable (Q) = 1.50  
 Accidental (A) = 1.00  
 Favourable  
 Permanent (G) = 1.00  
 Variable (Q) = 0.00  
 Accidental (A) = 0.00  
 Minimum surcharge = 0 kPa  
 Factors on material properties  
 On shearing resistance = 1.00  
 On effective cohesion = 1.00  
 On undrained strength = 1.00  
 Factors on resistance  
 On effective earth pressures = 1.00  
 On total earth pressures = 1.00  
 Safety factor on resistance applied via: Gross passive pressures  
 Minimum active pressure = 0.00 kN/m<sup>3</sup>  
 Safety margins on geometry  
 Unplanned excavation = 10% of clear height, but maximum of 0.5m  
 Softened formation = 0 m  
 Factors on structural forces  
 On bending moments = 1.00  
 On shear forces = 1.00  
 On prop forces  
 Short-term = 1.00/1.00  
 Long-term = 1/1  
**Moments**  
 Overturning = 4038 kNm/m  
 Restoring = 7059 kNm/m  
 Out-of-balance = -3021 kNm/m  
 Restoring/Overturning = 175 %  
 Reaction at wall toe = -1665.2 kN/m



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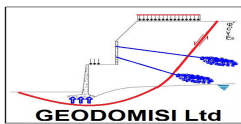
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**Stage 1 (Generated) - Required Embedment At Minimum Safe Embedment  
 Results of earth pressure calculation**

<p><b>Retaining Wall</b>          Name = Prototype: Wall 1 (Generated)          Retained height = 5.50 m          Depth of toe = 11.56 m  <b>Partial factors</b>          Factors on actions            Unfavourable              Permanent (G) = 1.35              Variable (Q) = 1.50              Accidental (A) = 1.00            Favourable              Permanent (G) = 1.00              Variable (Q) = 0.00              Accidental (A) = 0.00          Minimum surcharge = 0 kPa          Factors on material properties            On shearing resistance = 1.00            On effective cohesion = 1.00            On undrained strength = 1.00          Factors on resistance            On effective earth pressures = 1.00            On total earth pressures = 1.00          Safety factor on resistance applied via: Gross passive pressures          Minimum active pressure = 0.00 kN/m<sup>3</sup>          Safety margins on geometry            Unplanned excavation = 10% of clear height, but maximum of 0.5m            Softened formation = 0 m          Factors on structural forces            On bending moments = 1.00            On shear forces = 1.00            On prop forces              Short-term = 1.00/1.00              Long-term = 1/1  <b>Moments</b>          Overturning = 1942 kNm/m          Restoring = 1942 kNm/m          Out-of-balance = 0 kNm/m          Restoring/Overturning = 100 %          The wall is in equilibrium          Reaction at wall toe = -535.2 kN/m</p>
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**Project: Cantilever Steel SheetPile Retaining Wall  
 Analysis & Design, Free Earth Support In  
 accordance Eurocode 7.**

Job Ref.  
[www.geodomisi.com](http://www.geodomisi.com)

Section  
**Civil & Geotechnical Engineering Calculations for**

Sheet no./rev. 1

Calc.Made by  
 Dr. C. Sachpazis

Date  
 27/02/2016

Chk'd by

Date

App'd by

Date

**Stage 1 (Generated) - Required Embedment At Failure  
 Results of earth pressure calculation**

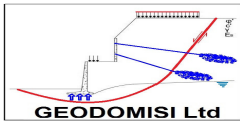
Retaining Wall  
 Name = Prototype: Wall 1 (Generated)  
 Retained height = 5.50 m  
 Depth of toe = 13.02 m  
 Partial factors  
 Factors on actions  
 Unfavourable  
 Permanent (G) = 1.00  
 Variable (Q) = 1.00  
 Accidental (A) = 1.00  
 Favourable  
 Permanent (G) = 1.00  
 Variable (Q) = 1.00  
 Accidental (A) = 1.00  
 Minimum surcharge = 0 kPa  
 Factors on material properties  
 On shearing resistance = 1.00  
 On effective cohesion = 1.00  
 On undrained strength = 1.00  
 Factors on resistance  
 On effective earth pressures = 1.00  
 On total earth pressures = 1.00  
 Safety factor on resistance applied via: Gross passive pressures  
 Minimum active pressure = 0.00 kN/m<sup>3</sup>  
 Safety margins on geometry  
 Unplanned excavation = None  
 Softened formation = 0 m  
 Factors on structural forces  
 On bending moments = 1.00  
 On shear forces = 1.00  
 On prop forces  
 Short-term = 1.00/1.00  
 Long-term = 1/1  
 Moments  
 Overturning = 2663 kNm/m  
 Restoring = 2663 kNm/m  
 Out-of-balance = 0 kNm/m  
 Restoring/Overturning = 100 %  
 The wall is in equilibrium  
 Reaction at wall toe = -543.1 kN/m

**Stage 1 (Generated): Structural Forces**

Depth (m)	Bending Moment (kNm/m)	Shear Force (kN/m)	Prop Force (kN/m)	Notes
8.15	-568.9	-1.2		See above Maximum bending moment
10.55	-5.4	-535.2		See above Maximum shear force

**Stage 1 (Generated): Messages**

Ground 1 (Generated) added to stage  
 Wall 1 (Generated) added to stage  
 Excavation 1 (Generated) added to stage



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Calc. Made by	Date	Chk'd by	Date	App'd by	Date
Dr. C. Sachpazis	27/02/2016				

Stage 1 (Generated): Messages [Continued]

Borehole 1 (Generated) added to stage

Borehole 1 (Generated) added to stage

Validating the construction stage

Calculating earth pressures as built (for the specified wall length and safety factors)

Calculating earth pressures at the minimum safe embedment (with the specified safety factors)

Calculating earth pressures with maximized safety factors (for the specified wall length)

Calculating earth pressures at failure (with safety factors set to 1)

1 error/warning message(s) generated during the calculations: please inspect the Messages View for more information

Calculating structural forces

Calculating durability

Validating the construction stage

Calculating earth pressures as built (for the specified wall length and safety factors)

Calculating earth pressures at the minimum safe embedment (with the specified safety factors)

Calculating structural forces

Calculating durability

Calculating earth pressures with maximized safety factors (for the specified wall length)

Calculating earth pressures at failure (with safety factors set to 1)

1 error/warning message(s) generated during the calculations: please inspect the Messages View for more information

Validating the construction stage

Calculating earth pressures as built (for the specified wall length and safety factors)

Calculating earth pressures at the minimum safe embedment (with the specified safety factors)

Calculating structural forces

Calculating durability

Calculating earth pressures with maximized safety factors (for the specified wall length)

Calculating earth pressures at failure (with safety factors set to 1)

1 error/warning message(s) generated during the calculations: please inspect the Messages View for more information