

Tensar Grid Reinforced Soil Application Suggestion

Client: DGN Sp. z o.o.

Project:

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Objective:

Calculations in accordance with:
Institut für Bautechnik method

Calculations carried out using Winwall Version 8.21

Details of the theory used in this program are available on request from:

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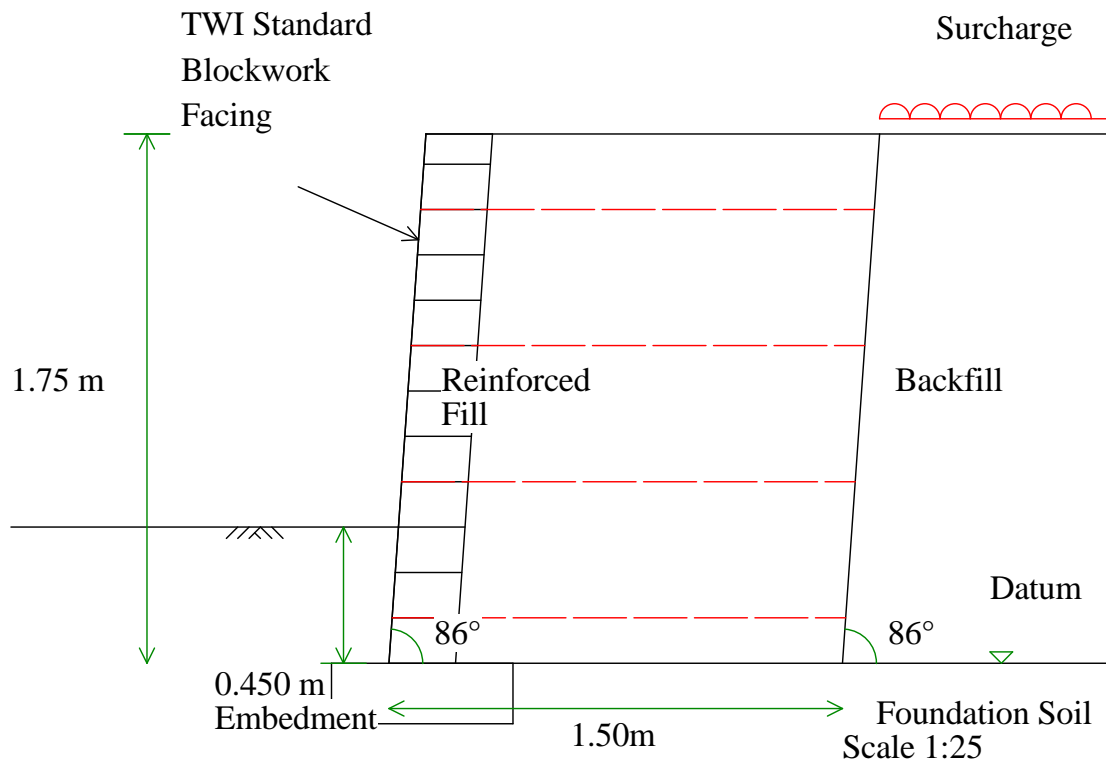
This Application Suggestion is specific to the unique characteristics of the **Tensar** geogrids which are referenced within the calculations.

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Input data

Geometry and facing details



Soil properties

Soil type	c' (kN/m ²)	ϕ'_{cv} (degrees)	Unit weight (kN/m ³)
Reinforced fill	0.00	32.00	19.00
Backfill	0.00	32.00	19.00
Foundation	0.00	35.00	18.00

Surcharges

Load acts from: x (m)	To: x (m)	Load (kN/m ²)	Temporary/ Permanent
1.500	100.000	5.000	Temporary

x coordinates are measured from the top of the wall.

Temporary surcharges are only used when they reduce the factor of safety.

Reinforcement data - Design Temperature = 20°C

Grid strengths are for a design life of up to 120 years

Tensar Geogrid type	Creep limited strength F_B/A_1 (kN/m)	Installation and compaction factor A_2	Calculated safety factor γ	Permissible working load at 20°C (kN/m)
RE510	18.79	1.10	1.75	9.76

Coefficients of interaction:

Pullout	1.000
Sliding	0.800

Reinforcement layout

Tensar geogrid	Number of geogrids	Starting level above datum (m)	Vertical spacing (m)	Finishing level above datum (m)
RE510	3	0.600	0.450	1.500
RE510	1	0.150	-	-

Horizontal coverage of grids is 100.000%.

There are a total of 4 layers of Tensar main reinforcement

Grid coordinates

Tensar Geogrid	Level above datum (m)	Left end (m)	Right end (m)	Length (m)
RE510	0.150	0.010	1.510	1.500
RE510	0.600	0.042	1.542	1.500
RE510	1.050	0.073	1.573	1.500
RE510	1.500	0.105	1.605	1.500

RESULTS

External stability

All calculations are for 1m running length of structure with the width of the reinforced soil block = 1.500m at its base.

Calculation of forces and moments

The active forces on the back of the reinforced soil block calculated by iterative Coulomb wedge check (DIN 4085) are:

Vertical load : 2.8kN/m; Horizontal load : 8.9kN/m.

These give an overturning moment about the centre of the base of 3.6kNm/m.

The total weight of the reinforced soil wall is 49.9kN; its overturning moment about the centre of its base is -3.1kNm.

Temporary surcharge load on the reinforced soil wall is 0.0kN/m; this gives a moment about the centre of the base of 0.0kNm/m. This is used only in checking the bearing pressure.

Sliding resistance check

The sliding resistance is 32.9kN; this gives a factor of safety against sliding of 3.679; this is >1.5 and acceptable (DIN 1054).

The critical case for sliding is for active pressure on a block which is wider at the base than the reinforced soil block.

The width of the base of the block is 1.622 m, and the angle of the back of the block is 90.0°.

The sliding resistance is 34.8kN; this gives a factor of safety against sliding of 3.590; this is >1.5 and acceptable (DIN 1054).

Bearing capacity check

With permanent loads only:

The resultant acts at an eccentricity of -0.014 m; this lies within the middle third and is acceptable (DIN 4017).

The bearing capacity coefficients (DIN 4017) are as follows:

$$N_c = 46.12 \quad N_d = 33.30 \quad N_b = 22.61$$

Bearing pressure check with no live loads between the centreline of the base and the back of the wall, to give maximum overturning moment:

This resultant acts at an eccentricity of 0.010m. Check bearing pressure with this eccentricity: x_b is 0.572; this gives an ultimate bearing pressure of 344.5kN/sq.m. over an effective length of 1.479m, giving an ultimate load of 509.5kN. With a total vertical force of 52.7kN, this gives a factor of safety on bearing capacity of 9.675. This is >2.0 and acceptable (DIN 4017).

Bearing capacity check with full surcharge load:

The resultant acts at an eccentricity of 0.010m. x_b is 0.572; this gives an ultimate bearing pressure of 344.5kN/sq.m. over an effective length of 1.479m, giving an ultimate load of 509.5kN. With a total vertical force of 52.7kN, this gives a factor of safety on bearing capacity of 9.675. This is >2.0 and acceptable (DIN 4017).

Internal stability check

Check of wedges at face starting at elevation = 0.000m

Wedge Angle (degrees)	Force Required for equilibrium Z (kN/m)	Force Provided by Grids R (kN/m)	Coordinates of Back of Wedge x(m) y(m)		Wedge Stability
0	-25.6	0.0	1.500	0.000	OK
3	-21.6	0.0	1.506	0.079	OK
6	-18.0	1.6	1.511	0.159	OK
9	-14.8	9.8	1.517	0.240	OK
12	-11.8	9.8	1.523	0.324	OK
15	-9.1	9.8	1.529	0.410	OK
18	-6.7	9.8	1.535	0.499	OK
21	-4.4	9.8	1.541	0.592	OK
24	-2.4	12.4	1.548	0.689	OK
27	-0.6	14.7	1.555	0.793	OK
30	1.1	16.6	1.563	0.902	OK
33	2.5	18.2	1.571	1.020	OK
36	3.8	20.6	1.580	1.148	OK
39	4.9	21.8	1.590	1.288	OK
42	5.8	22.9	1.601	1.441	OK
45	6.4	24.2	1.613	1.613	OK
48	6.9	25.5	1.576	1.750	OK
51	7.4	26.7	1.417	1.750	OK
54	7.7	27.8	1.271	1.750	OK
57	7.9	28.8	1.136	1.750	OK
60	7.8	29.7	1.010	1.750	OK
63	7.7	30.6	0.892	1.750	OK
66	7.4	31.5	0.779	1.750	OK
69	6.9	32.3	0.672	1.750	OK
72	6.2	32.6	0.569	1.750	OK
75	5.4	32.8	0.469	1.750	OK
78	4.3	33.1	0.372	1.750	OK
81	3.0	33.3	0.277	1.750	OK
84	1.3	33.6	0.184	1.750	OK

Angle of steepest wedge which does not intersect any grids is 5.671°

Factor of Safety against sliding on this wedge is 2.607

Internal stability check

Check of wedges at face starting at elevation = 0.150m

Wedge Angle (degrees)	Force Required for equilibrium Z (kN/m)	Force Provided by Grids R (kN/m)	Coordinates of Back of Wedge x(m) y(m)		Wedge Stability
0	-23.8	0.0	1.510	0.150	OK
3	-20.1	0.0	1.516	0.229	OK
6	-16.8	0.0	1.522	0.309	OK
9	-13.8	0.0	1.527	0.390	OK
12	-11.1	0.0	1.533	0.474	OK
15	-8.6	0.0	1.539	0.560	OK
18	-6.4	2.0	1.545	0.649	OK
21	-4.3	4.9	1.552	0.742	OK
24	-2.5	7.1	1.559	0.839	OK
27	-0.9	8.9	1.566	0.943	OK
30	0.6	9.8	1.574	1.052	OK
33	1.9	11.2	1.582	1.170	OK
36	3.0	12.5	1.591	1.298	OK
39	3.9	13.5	1.601	1.438	OK
42	4.7	14.7	1.611	1.591	OK
45	5.2	16.0	1.610	1.750	OK
48	5.8	17.1	1.451	1.750	OK
51	6.2	18.2	1.306	1.750	OK
54	6.5	19.1	1.173	1.750	OK
57	6.6	20.0	1.050	1.750	OK
60	6.6	20.8	0.934	1.750	OK
63	6.4	21.6	0.826	1.750	OK
66	6.2	22.4	0.723	1.750	OK
69	5.8	22.7	0.625	1.750	OK
72	5.2	22.9	0.530	1.750	OK
75	4.5	23.2	0.439	1.750	OK
78	3.6	23.4	0.351	1.750	OK
81	2.5	23.6	0.264	1.750	OK
84	1.1	23.8	0.179	1.750	OK

Angle of steepest wedge which does not intersect any grids is 16.375°

Factor of Safety against sliding on this wedge is 1.554

Factor of Safety against sliding on the grid at this elevation is 3.140