



Green Terramesh Reinforced Earth Slopes

Location Address:	BCA School, Merthyr
Geoman Design Reference Number:	23-6011-F1
Maccaferri CRM Project Number:	42090

Issued to	Issue purpose	Revision	Designed	Checked	Date
Willmott Dixon	For Approval	0	ST		13.09.24
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1.0 Introduction

1.1 Brief

Maccaferri requested that Geoman Ltd. carry out a design for various Green Terramesh (GTM) reinforced earth slopes as an element of the permanent works at the proposed redevelopment of BCA School in Merthyr.

The GTM slopes are to retain various sections of the site. Refer to Geoman drawing number BCA-GEO-VX-XX-D-C-0001 to -03 for the location of each of the slopes.

1.2 Scope

The limits of this element design are the reinforced soil zone, which extends from the front face of the base course of units back to the rear of the Green Terramesh reinforcement tails, and up to the underside of the surface vertically above the rear of the uppermost reinforcement tails.

The following most onerous sections have been considered:

Wall	Section	Retained height	Crest slope details	Toe slope details	Drawing Ref:
03	7-7	2.540m	Max 1V:2.7H	Max 1V:40H	BCA-GEO-VX-XX-D-C-0001
05	8A-8A	0.74m	None	Max 1V:4H	BCA-GEO-VX-XX-D-C-0001
05	8-8	4.058m	None	None	BCA-GEO-VX-XX-D-C-0001
13	11-11	2.097m	Max 1V:8H	None	BCA-GEO-VX-XX-D-C-0001
06, 07 & 08	1-1	Maximum 1.30m on each tier	None	None	BCA-GEO-VX-XX-D-C-0002
09,10 & 11	4-4	Maximum 1.20m on each tier	None	None	BCA-GEO-VX-XX-D-C-0003

The scope is as follows:

- Temporary excavations have the potential to collapse rapidly and without warning. This solution is for the permanent works only and is issued on the basis that a safe system of works is provided for construction. The Principal Contractor/ Green Terramesh installer must produce a method statement and risk assessment for the works to be approved by the Client's Consulting Engineer. Stability of the excavated face in the short term is outside our scope and is to be designed by the Temporary Works Contractor.
- All slope geometry, setting out and required offsets are to be confirmed by the Principal Contractor prior to construction. The Principal Contractor must also confirm the locations of all services prior to construction and ensure that none will be affected by the Green Terramesh and its installation.



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- Some settlement will occur after construction, depending on the compaction and condition of the backfill placed. Settlement should be monitored, and the placement of any surface finishes delayed until it has ceased.
- Design and details of all required pedestrian and vehicular protection is entirely outside the scope of this design and should be confirmed by the Principal Designer/ Client's Consulting Engineer.

The Principal Contractor must contact the Client's Consulting Engineer to ensure that the excavation required for the proposed reinforced slope does not affect the stability of any surrounding existing or proposed roads, services or structures. Unless the Client's Consulting Engineer accepts this, it is recommended that construction does not proceed.

Any solution outside this scope is not covered by this design and Geoman Ltd. should be informed so that a new design can be advised as necessary. Site drainage is outside the scope of this design.

1.3 Responsible Parties

- Wilmott Dixon is Maccaferri's Client and the Principal Contractor.
- Cambria Consulting is the Client's Consulting Engineer.
- Merthyr Tydfil Council is the Project Client.
- Maccaferri Ltd. is our client and the GTM material supplier.
- Solution Installer is to be confirmed.

The above parties should all read and check this design document before proceeding. **Please advise us before proceeding with construction if there are any errors in the scope.**

1.4 Information

This design package is based on the information provided to Geoman Ltd. as follows:

- Cambria Consulting Drawing BCA-CAM-VX-XX-DR-C-1000-C03 1001-C01 1002-C03 - Northern Site Retaining Wall Sections
- Integral Geotechnique Site Investigation Report 14075 (January 2024)
- Maccaferri Design Brief (19.08.24)
- General email correspondence (copies retained by Geoman Ltd.)

Geoman Ltd keep a record of all email correspondence.

2.0 Design

2.1 Ground Conditions/Design Parameters

2.1.1 Relevant Geotechnical Information

The Client's Consulting Engineer and Principal Contractor must ensure that all parameters used comply with those found on site. Any variance in these must be reported to Geoman Ltd. immediately so that the implications can be assessed.

We have been provided with Integral Geotechnique Site Investigation Report 14075 (January 2024) which includes the logs of exploratory holes sunk at the site.



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2.1.2 Ground Conditions Local to GTM Slope

The most relevant boreholes to each wall are as follows:

- Wall 03 – TP205, WS179
- Wall 05 – WS179
- Wall 13 – TP209
- Walls 06, 07, 08 – TP206, WS178, TP151
- Walls 09, 10, 11 – TP155, TP157, TP158, WS182

The logs generally encountered Made Ground and/or Soft Clay (up to a depth of 3.0m) overlying firm to stiff silty slightly gravelly CLAY. It has been assumed that the GTM slopes will be founded on firm to stiff silty slightly gravelly CLAY with the exception of the upper tiers of walls 07 and 08 which we have assumed will be on engineered Class 1 or 2Cup fill, placed and compacted in layers in accordance with the MCHW Specification for Highway Works, Series 600, Table 6/4).. It has been assumed that the retained material will consist of soft to firm silty sandy gravelly CLAY or Class 1/2C Upfill. A minimum angle of internal friction of 28 degrees has been assumed for the foundation and retained material based on a minimum SPT N value of 6 (Bowles 2004) and a maximum PI value of 19.3% (NAVFAC 1971) on the site within firm to stiff CLAY.

2.1.3 Selected Design Parameters

The soil parameters assumed in the design, based on the above, are therefore as follows:

Material	Description	Unit Weight (kN/m ³)	Assumed Effective Angle of Internal Friction	Cohesion (kN/m ²)
Foundation	Firm to stiff silty slightly gravelly CLAY or Class 1/2C Engineered Upfill	19.0	28°	0
Retained	Soft to firm CLAY and Class 1/2C Engineered Upfill	19.0	28°	0

The Site investigation indicates the presence of soft CLAY/ MADE GROUND (up to 3.0mbgl). Such material is not a suitable foundation strata for the wall and ground improvement (such as excavate out and replace it with Class 6F2 compacted granular soil) will be required. Any soft, loose or unsuitable material (such as soft made ground, alluvium or organics) at or below formation level that does not comply with the assumed soil parameters must be excavated out down to competent stratum and replaced with compacted Class 6F2 granular material. The Principal Contractor must confirm the suitability of the founding material prior to construction commencing.

The Principal Contractor and/ or a Geotechnical Engineer must confirm the suitability of the founding material, and that it has a safe bearing resistance of >90kPa prior to construction commencing. A series of hand shear vane/plate load tests should be carried out by the Principal Contractor to confirm this.

We suggest in-situ testing to confirm the required safe bearing resistance of 90kN/m² is achieved. Hand shear vane tests would be suitable for cohesive material or plate load tests carried out to comply with BS1377-9. Incremental load tests to Cl4.1.6.4.2. The 600mm plate should be loaded in 50kPa increments to at least 250kPa.



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2.1.4 Reinforced Backfill

The reinforced backfill for the slopes shall comprise a selected compacted granular fill material which complies with Class 6I of the Manual of Contract Documents for Highway Works, SFHW, Series 600. This material is assumed to have the following characteristics: $\Phi' = 35$ degrees, $\gamma = 19$ kN/m³ and $c' = 0$ kPa, compacted in accordance with SFHW Series 600. The Principal Contractor is responsible for the selection of this material to ensure compliance with the geotechnical characteristics as shown on the relevant drawings and in the design documents/calculations.

Class of Fill (MCHW vol. 1, Series 600)	Use	Unit Weight (kN/m ³)	Effective Angle of Internal Friction	Cohesion (kN/m ²)
Class 6I	GTM reinforced zone	19	35°	0

Site-won selected material may be suitable for re-use providing it complies with required grading and physical properties of Class 6I fill. **If site won material is proposed for re-use in the reinforced zone, representative samples must be tested prior to placement to ensure that it complies with all of the requirements of Class 6I.**

Classification testing of any proposed site won material to be used within the reinforced earth zone material is to be carried out in accordance with Appendix 1/5 Testing to be carried out by the Contractor and Appendix 6/1 Requirements for Acceptability and Testing etc. of Earthworks. Quality control testing should follow the principles set out in HA 44/91 and under responsibility of the Principal Contractor.

Any material outside the requirements of Class 6I must not be used in the reinforced soil zone. The use of material outside the specification of Class 6I may lead to unacceptable settlement and movement of the structure.

The Principal Contractor is responsible for the selection of this material to ensure compliance with the geotechnical characteristics specified in 'Series 600' of the MCHW Specification for Highway Works, as shown on the relevant drawings and in the design documents/calculations.

2.2 Surcharge Loads

A maximum variable live load of 20kN/m² was assumed to act on the ground on the retained side of the slopes. Please advise if a more onerous surcharge should be considered.

2.3 Crest/ Toe Slopes

Refer to Geoman Ltd. drawing number BCA-GEO-VX-XX-D-C-0001 to -03 for details.

Topography of the toe and crest slope must be checked by the Principal Contractor prior to construction to ensure they are no steeper/ more onerous than assumed in this design.

2.4 Ground Water

All relevant logs remained dry. It is assumed that the wall, foundation and retained materials will be maintained in a fully drained condition. Site drainage is outside the scope of this design.

No Porewater Pressure Coefficient (r_u) or piezometric surface has been assumed for the any material for analysis purposes.



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2.5 Drainage

A minimum 150mm diameter perforated PVC drainage pipe is to be placed at the rear of the reinforced slope, with a fall to a suitable outlet (as per Geoman Ltd. drawings BCA-GEO-VX-XX-D-C-0001 to -03). The drain is to be wrapped in the drainage geocomposite and be connected to an approved outlet, and must be fully jettable and regularly maintained.

Any excavated slopes should be checked for any flows or seepage that requires drainage measures. Any flows, seepage or standing water should be directed to a suitable outfall as soon as they are encountered.

Intermediate outlet/ rodding points will be required to ensure the full-length drainage can be rodded and drained. We advise rodding/ drainage points are installed at maximum 40m spacings along the wall.

Maintenance of the rear of slope drains should be included in the maintenance regime for the site. **Temporary drainage measures should be installed to direct surface water away from the line of walls and also to prevent “ponding” at the toe/foundation which could cause this to deteriorate and soften over time.** Site drainage is outside the scope of this design.



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3.0 Analysis

3.1 Design

- Methods of Analysis: BSEN1997-1:2004 – Eurocode 7 and BS8006-1:2010
- Factors of Safety: According to BSEN1997-1:2004 – Eurocode 7 and BS8006-1:2010

Analysis of the most onerous design sections has been carried out to confirm the required GTM slope construction.

MacStars W (Rel. 4.0) analysis files MS23-6011-F1-01 to -08 are included in the attached Appendix. As shown by all of the Factors of Safety for the worst Load Combinations being in excess of 1.00, the requirements of BSEN1997-1:2004 and BS8006-1:2010 were satisfied for all analyses. The following table is a summary of the analysis results:

Section	Analysis	In accordance with:	Minimum Factors of Safety		
7-7	MS23-6011-F1-01	Eurocode 7 EN 1997-1	Global Stability Check	DA1/1 1.306	DA1/2 1.056
7-7	MS23-6011-F1-02	BS 8006-1:2010	Sliding Check	A 1.735	B 1.262
			Overturning Check	3.792	2.472
			Required safe bearing resistance	90kPa	
				A 1.681	B 1.470
			Internal Stability	1.681	1.470
8-8	MS23-6011-F1-03	Eurocode 7 EN 1997-1	Global Stability Check	DA1/1 1.816	DA1/2 1.475
8-8	MS23-6011-F1-04	BS 8006-1:2010	Sliding Check	A 4.089	B 2.935
			Overturning Check	12.086	8.374
			Required safe bearing resistance	90kPa	
				A 1.107	B 1.107
			Internal Stability	1.107	1.107
8A-8A	MS23-6011-F1-05	Eurocode 7 EN 1997-1	Global Stability Check	DA1/1 1.430	DA1/2 1.151
8A-8A	MS23-6011-F1-06	BS 8006-1:2010	Sliding Check	A 2.914	B 2.009
			Overturning Check	6.896	4.630
			Required safe bearing resistance	90kPa	
				A 1.890	B 1.720
			Internal Stability	1.890	1.720
1-1	MS23-6011-F1-07	Eurocode 7 EN 1997-1	Global Stability Check	DA1/1 1.542	DA1/2 1.248
1-1	MS23-6011-F1-08	BS 8006-1:2010	Sliding Check	A 3.362	B 3.248
			Overturning Check	6.969	6.722
			Required safe bearing resistance	90kPa	
				A 1.177	B 1.418
			Internal Stability	1.177	1.418



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4.0 Summary

This design proposal and associated drawing have been produced using the methodology detailed above. However, it should be noted that the design proposal has been generated from information provided to Geoman Ltd, which has not been independently verified and may contain assumptions and inaccuracies regarding geotechnical, hydraulic and other parameters.

If any discrepancy is noted between the site conditions and the design assumptions (regarding water levels, soil conditions, proposed loadings etc.), the Principal Contractor must contact Geoman Ltd. immediately to facilitate a review of the design.

Geoman Ltd did not undertake to supervise the construction of the structure, and therefore cannot comment on the standard of workmanship. The main issues to consider are adequate compaction of the foundation soils and imported fill, and adequate drainage.

Geoman Ltd accordingly does not accept responsibility for the accuracy or completeness of information or assumptions from which the design proposal has been produced.

The design proposal remains the copyright and property of Geoman Ltd and is not to be copied or disclosed to any person other than the person to whom it is originally intended.

The material supplier can provide typical health & safety hazards to consider when approaching this work. Designer's hazards include falling from height and the stability of excavated cuttings.



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5.0 Construction Supervision Requirements

The following construction supervision requirements should be adhered to by the project team (Principal Contractor and Client's Consulting Engineer). If any issues arise on site which differ from what has been assumed in this design, Geoman Ltd. should be contacted immediately so the possible consequences can be assessed.

1. The Principal Contractor and/ or a geotechnical engineer must confirm the localised suitability of the material at formation level over the full extent of the wall. It must be ensured that original, competent firm to stiff silty slightly gravelly CLAY is present over the full width of the GTM slopes (See Section 2.1.4).
2. The reinforced backfill for the slopes shall comprise a selected compacted granular fill material which complies with Class 6I of the Manual of Contract Documents for Highway Works, SFHW, Series 600. (Refer to Section 2.1.5)
3. The slope construction should be carried out in accordance with the manufacturer's installation guidelines by an installer experienced with reinforced earth systems.
4. It should be ensured that the face does not rotate during compaction of each course. SHW advice (Cl. 622.7) concerning restriction of compaction plant within 2.0m of the front face shall be followed. If face movement should occur, the next course shall be set back as necessary to ensure that overall face batter remains at or below 70 degrees.

Within 2 m of the face, the maximum compaction plant shall be:

- Vibratory roller: 1,300kg/m and a total mass of 1,000kg
 - Vibrating plate compactor not greater than 1,000kg
 - Vibro-tamper not exceeding 75kg.
5. Seeded topsoil should be placed in the face to promote rapid vegetation growth. It should be ensured that the front face does not dry out in the first few months by watering as necessary. The front face should be kept moist.
 6. Particular attention must be taken over the quality and condition of the topsoil placed behind the unit facing, and the pre-seeding/planting of this. The use of good quality topsoil is essential to promote rapid vegetation. Irrigation of the surface maybe required if dry weather conditions occur.
 7. The Principal Contractor must accept it will be their responsibility to ensure successful vegetation achieved by careful construction, inclusion of suitable topsoil on face, appropriate planting and irrigation if this becomes necessary. Should, three months after completing construction, no significant vegetation be visible we recommend that the face of the Green Terramesh slope is hydro seeded.



6.0 Maintenance Requirements

Maintenance requirements for the Green Terramesh slope are as follows:

- The slope should be routinely inspected once a month for the 6 months following construction. After six months, the GTM slope should be checked annually for signs of any faults, vandalism or movement. The batter of the slope should be checked to ensure it remains within the allowed tolerances in accordance with BS EN 14475:2006.
- The ground above and below the GTM should also be inspected for signs of any movement.
- It should be ensured that the front face does not dry out by watering as necessary. The front face should be kept moist.
- The rear of wall drainage must be maintained annually and following heavy storms, this should be included as part of the maintenance regime for the site.

These requirements should be included in the maintenance regime for the site/development.



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7.0 CDM Regulations

Geoman is not the Principal Designer, but has considered the risks associated with this element of the works that affect or are affected by the design. “**Designers**” are responsible for fulfilling their obligations as defined in the Construction (Design & Management) Regulations 2015.

Geoman Ltd., as designers, understand that under the Regulations its duties are generally to;

- Ensure that the client for the project is aware of the duties and responsibilities that they have.
- So far as is reasonably practicable, taking due account of other relevant design considerations, avoid foreseeable risks to the health and safety of any persons carrying out, liable to be affected by such or maintaining the permanent fixtures and fittings of construction work.

In discharging this duty, the designer shall:

- Eliminate hazards that may give rise to risks
- Reduce risks from any remaining hazards and in doing so give collective measures priority over individual measures.

The designer shall also:

- Take all reasonable steps to provide with the design sufficient information about aspects of the design of the structure or its construction or maintenance as will adequately assist clients, other designers and contractors to comply with their duties under the Regulations.

In respect of this particular project, Geoman hereby draws to the attention of the Principal Designer and Principal Contractor that they have specific duties under CDM 2015.

The ‘Principal Contractor’ must be responsible for and fulfil all the contractor’s obligations.

However, since the **Principal Designer** has designated the chosen location and dimensions of the structures on this site, the **Principal Designer** has, in this respect, acted as a ‘designer’ under CDM 2015. The **Principal Designer** is therefore responsible for fulfilling all the obligations that this entails.

The scope of Geoman, as element ‘designer’, to minimise design risks is therefore limited by those elements of the design pre-determined by the **Principal Designer**. The significant design risks shown in Section 7.1 remain and must therefore be addressed by the **Principal Designer** and **Principal Contractor**.

7.1 SIGNIFICANT DESIGN RISKS REMAINING:

RISK		SUGGESTED REMEDIATION	ACTION BY
01	Wall stability compromised and/ or excessive settlement due to in situ soils not complying with design assumptions.	The Principal Contractor and/ or a geotechnical engineer must confirm the localised suitability of the material at formation level over the full extent of the wall. Refer to Section 2.1.4. for details of the requirements of the foundation soils.	Principal Contractor/ Project Engineer



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02	Use of unsuitable fill material in the reinforced earth zone causing excessive movement/failure of the Green Terramesh.	Backfill for GTM slope to be confirmed to meet minimum requirements outlined in Section 2.1.5 Quality control testing to follow principles set out in HA 44/91 and under the responsibility of the Principal Contractor.	Principal Contractor
03	Wind/impact loads on fences affecting the slope stability.	Design and details of all required pedestrian and vehicular protection is entirely outside the scope of this design and should be confirmed by the Principal Designer/ Client's Consulting Engineer.	Principal Contractor/ Project Consulting Engineer
04	Instability of the temporary cut slope.	Temporary excavations have the potential to collapse rapidly and without warning. This solution is for the permanent works only and is issued on the basis that a safe system of works is provided for construction. The Principal Contractor/ Green Terramesh installer must produce a method statement and risk assessment for the works to be approved by the Client's Consulting Engineer. Stability of the excavated face in the short term is outside our scope and is to be designed by the Temporary Works Contractor. The Principal Contractor should employ a temporary works contractor to advise on the most appropriate measures.	Principal Contractor/ Principal Designer
05	Serviceability failure of the Green Terramesh slope during/immediately following construction	The slope construction should be carried out in accordance with the manufacturer's installation guidelines. It should be ensured that the face does not rotate during compaction of each course. (Refer to Section 5.0)	Principal Contractor
06	Erosion of the GTM face due to failure to establish vegetation on the slope	Seeded topsoil should be placed in the face to promote rapid vegetation growth. It should be ensured that the front face does not dry out in the first few months by watering as necessary. Particular attention must be taken over the quality and condition of the topsoil placed behind the unit facing, and the pre-seeding/planting of this. The use of good quality topsoil is essential to promote rapid vegetation. (See Section 5.0)	Principal Contractor
07	Incorrect construction geometry	All slope geometry, setting out and required offsets are to be confirmed by the Principal Contractor and Principal Designer prior to construction. The Principal Contractor and Principal Designer must also confirm the locations of all services prior to construction and ensure that none will be affected by the reinforced earth slope and its installation. The contractor must ensure that the correct geogrid tail length is installed based on the maximum retained height as indicated on the design drawings.	Principal Contractor
08	Inadequate drainage installed behind the GTM Slopes	Installation of permanent and maintained drainage is critical to the stability of the GTM slope. Prior to construction of the GTM slope this groundwater must be permanently drained/ diverted away from the excavation via suitable drainage measures. Any excavated slopes should be checked for any flows or seepage that requires drainage measures. Any flows, seepage or standing water should be directed to a suitable outfall as soon as they are encountered. Regular maintenance of the wall and site drainage is required to ensure it remains fully functioning at all times. This maintenance should be included in the maintenance regime for the site. Temporary drainage measures should be installed to direct surface water away from the line of walls and also to prevent "ponding" at the toe/foundation which could cause this to deteriorate and soften over time.	Principal Contractor



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		Refer to Section 2.5 for design assumptions	
09	Stability of existing trees / tree root protection area	GTM slope location to be confirmed prior construction by Client's Consulting Engineer. The Client's Consulting Engineer has to ensure excavation works do not undermine any existing trees or disturb any tree root protection areas.	Project Consulting Engineer



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8.0 Designer Risk Assessment

CONSTRUCTION OF GREEN TERRAMESH

NOTICE OF HAZARD IDENTIFICATION (GENERIC DESIGNER RISK ASSESSMENT)

CATEGORY C/D/M	ACTIVITY/ELEMENT	POSSIBLE HAZARD	RISK ASSESSMENT Low/Medium/High	ACTION PROPOSED	ACTION BY
C	Working at heights >2m	Falling	H	Wear Harness OR provide access scaffold	Contractor
C/M	Working at heights	Falling	M	Wear Harness OR provide access scaffold	Contractor
C	Cutting mesh, lacing, etc.	Personal Injury	M	Use of suitable PPE (safety goggles, gloves, etc.)	Contractor
C	Placing backfill	Personal Injury	M	Use mini excavator to place stone fill where practicable	Contractor
C	Excavation of embankment prior to installation of wall	Embankment Slip - Personal Injury	H	Excavation of embankment to a safe angle of repose for the short term.	Contractor
M	Steep retaining structures > 2m in height	Falling/Personal Injury	H	Provision of permanent fence/ barrier at crest of retaining structure	Client

Category: C = Construction, M = Maintenance/Use, D = Demolition

NOTICE OF HAZARD IDENTIFICATION (SPECIFIC DESIGNER RISK ASSESSMENT)

CATEGORY C/D/M	ACTIVITY/ELEMENT	POSSIBLE HAZARD	RISK ASSESSMENT Low/Medium/High	ACTION PROPOSED	ACTION BY
C	Excavation into existing material to foundation level	Bank slip / Personal injury	H	Excavation of ground to a safe angle of repose for the short term and/ or foundation excavation & construction of lower courses carried out in short lengths. Use of granular backfill.	Principal Contractor / Wall Installer
C	Excavation into existing material to foundation level	Striking existing services/ Personal injury	M	Principal Designer to provide details of all existing services in the vicinity of the wall to Contractor. Use of Cable Avoidance Tools (CAT scanners).	Principal Designer / Principal Contractor / Wall Installer
C	Excavation into existing material to foundation level	Striking live cables/ electrocution	M	Principal Designer to provide details of all existing electrical services in the vicinity of the wall to Contractor. Electrical services to be relocated where risk is unacceptable. Use of Cable Avoidance Tools (CAT scanners).	Principal Designer / Principal Contractor / Wall Installer
C	General Installation of Green Terramesh	Personal Injury	M	Adhere to Supplier Installation Guidelines.	Contractor

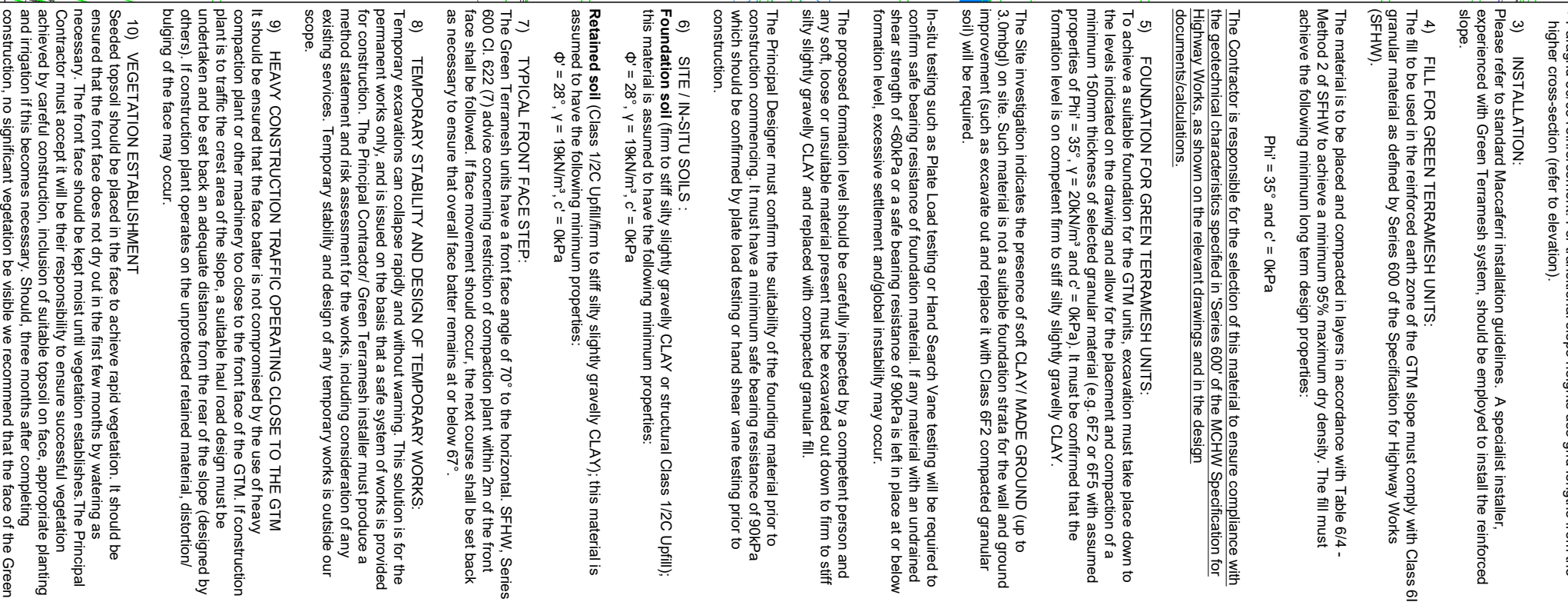
Category: C = Construction, M = Maintenance/Use, D = Demolition



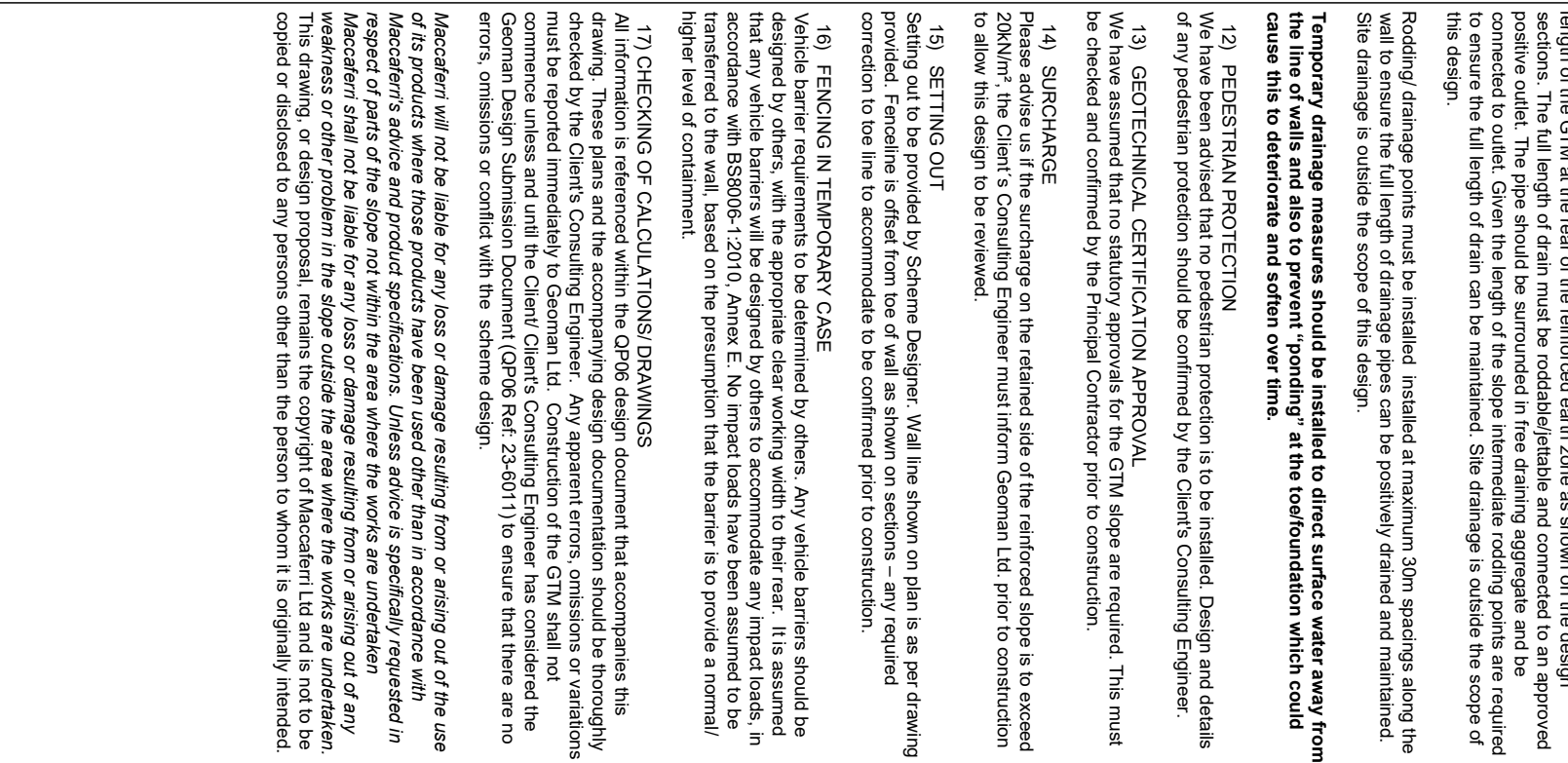
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9.0 Appendices

- Geoman Ltd. drawing numbers BCA-GEO-VX-XX-D-C-0001 to -03
- MacStars analysis files MS23-6011-F1-01 to -08



11) DRAINAGE
The accelerated erosion should be checked for any flume or streambed that exhibits drainage.



MacStARS W – Rel. 4.0

Maccaferri Stability Analysis of Reinforced Slopes and Walls
Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 7-7

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-01 Section 1-1 Wall 03 Global

Date.....: 08/30/2024

Checks according to: Eurocode 7 EN 1997-1
 Eurocode 7 EN 1997-1

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.39	265.92	26.41	268.47	26.56	268.47	29.46	269.53

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	265.84	20.82	265.82	25.18	265.93	25.39	265.92
26.00	265.43	27.88	265.43	28.71	267.56	30.51	267.70
50.00	267.70						

Stratum: RETAINED

Description:

Soil : RETAINED

X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
28.71	267.56	29.46	269.53	30.19	269.79	50.00	269.79

REINFORCED BLOCKS
Block : GTM

Block dimensions.....[m] : Base width..... = 2.50 Height..... = 3.04
 Block Origin.....[m] : Abscissa..... = 25.00 Ordinate..... = 265.43
 Face inclination.....[°] : 23.00

Structural embankment type..... : Gravel
 Structural embankment..... : CLASS 6I
 Backfill soil..... : RETAINED
 Covering soil..... : CLASS 6I
 Foundation soil..... : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.50
 Natural soil slope.....[°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m] = 2.50
 Vertical spacing.....[m] = 0.76
 Wrapped length.....[m] = 0.67

Linear Composites - ParaGrid - 50

Length.....[m] = 2.50
 Vertical spacing.....[m] = 0.76
 Offset.....[m] = 0.00

SURCHARGE LOADS
Distributed Loads : 20KPA

Description :

Class : Variable unfavourable

Magnitude.....[kN/m²] = 20.00 Inclination angle.....[°] = 0.00
 Abscissa.....[m] : from = 28.00 To = 50.00

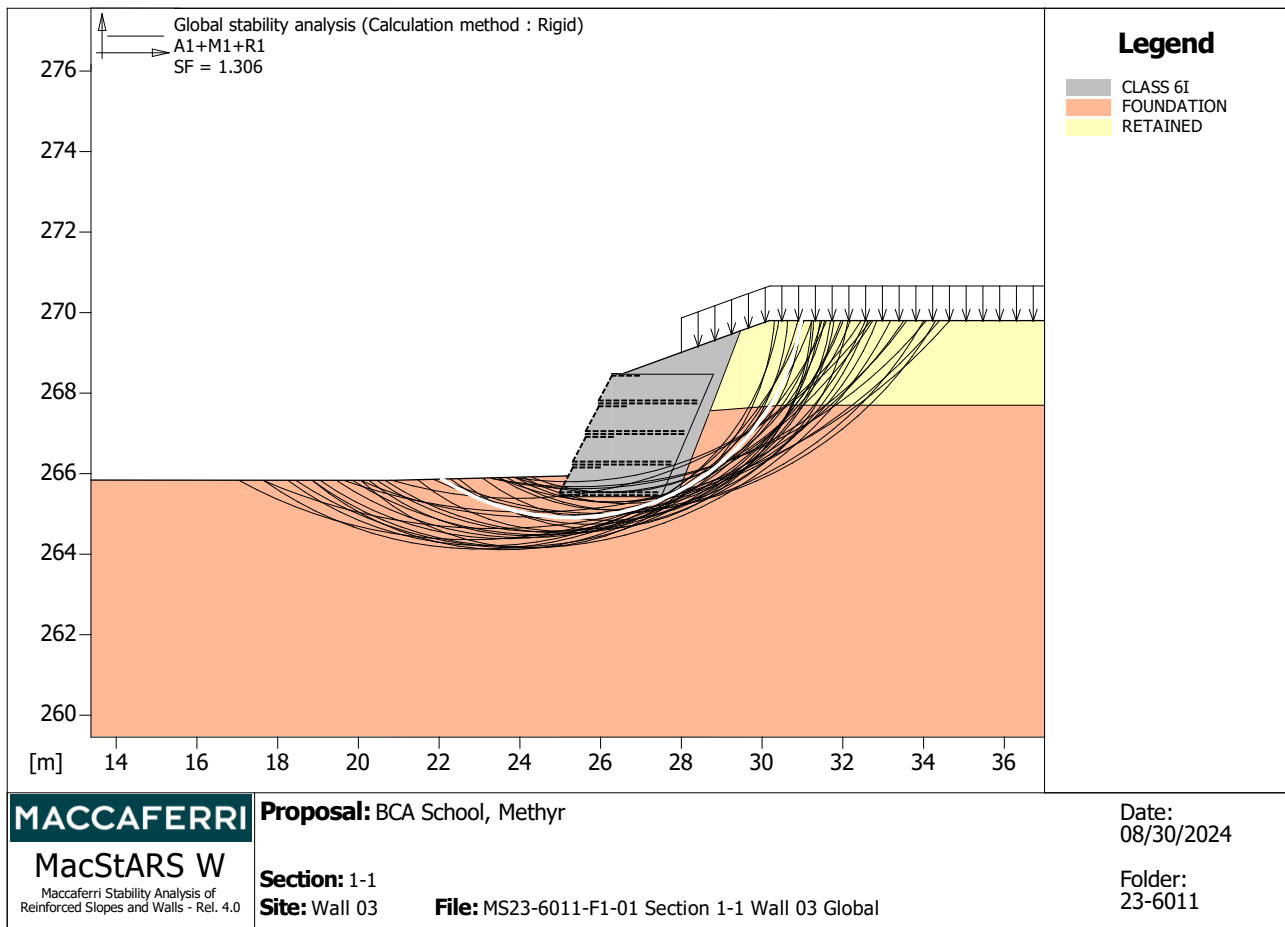
PROPERTIES OF THE USED REINFORCEMENTS

Linear Composites - ParaGrid - 50

Tensile strength UTS.....[kN/m] : 50.00
 Plastic extension ratio..... : 0.00
 Elastic extension coefficient.....[m³/kN] : 1.10e-04
 Reinforcement Stiffness.....[kN/m] : 556.00
 Minimum anchorage length.....[m] : 0.15
 Breakage Safety Factor (gravel)..... : 1.54
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sand)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (silty sand)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sandy clay)..... : 1.52

Pull-out Safety Factor.....	:	1.00
Interaction factor reinforcement/reinforcement.....	:	0.16
Pullout coefficient reinforcement-gravel.....	:	0.90
Pullout coefficient reinforcement-sand.....	:	0.90
Pullout coefficient reinforcement-silt.....	:	0.70
Pullout coefficient reinforcement-clay.....	:	0.40
Maccaferri - Green Terramesh - 8/2.2 P		
Tensile strength UTS.....[kN/m].....	:	35.00
Plastic extension ratio.....	:	2.00
Elastic extension coefficient.....[m ³ /kN].....	:	1.10e-04
Reinforcement Stiffness.....[kN/m].....	:	350.00
Minimum anchorage length.....[m].....	:	0.15
Breakage Safety Factor (gravel).....	:	1.26
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sand).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (silty sand).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sandy clay).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Interaction factor reinforcement/reinforcement.....	:	0.30
Pullout coefficient reinforcement-gravel.....	:	0.90
Pullout coefficient reinforcement-sand.....	:	0.65
Pullout coefficient reinforcement-silt.....	:	0.50
Pullout coefficient reinforcement-clay.....	:	0.30

CHECKS RESULTS



Global Stability Check :

Multiplier combination : A1+M1+R1

Reinforcements active Forces according to Rigid Method

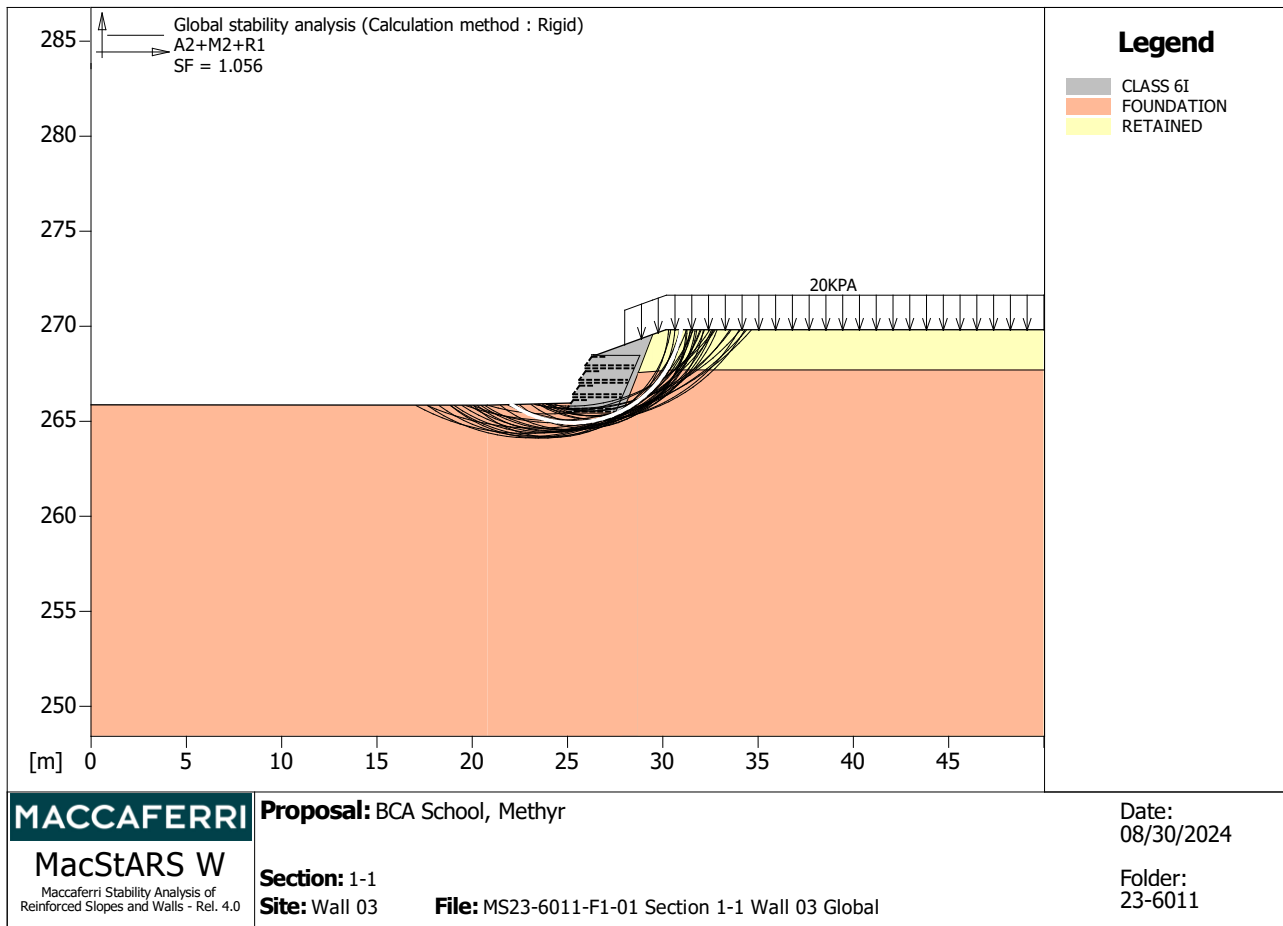
Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.306

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	29.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.50	Variable unfavourable
1.00	Angle of shearing resistance (Tan phi)
1.00	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability



Global Stability Check :

Multiplier combination : A2+M2+R1

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.056

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	29.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.30	Variable unfavourable
1.25	Angle of shearing resistance (Tan phi)
1.25	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability

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Maccaferri Stability Analysis of Reinforced Slopes and Walls
Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011-F1

File.....: MS23-6011-F1-02 Section 1-1 Wall 03 Wall Checks

Date.....: 08/30/2024

Checks according to: BS 8006-1:2010
 Wall - Cat. 2 (medium)

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Mass of the reinforced soil body
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Foundation soil
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description:
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Earth pressure (mass of the backfill) behind the structure
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.39	265.92	26.41	268.47	26.56	268.47	29.46	269.53

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	265.84	20.82	265.82	25.18	265.93	25.39	265.92
26.00	265.43	27.88	265.43	28.71	267.56	30.51	267.70
50.00	267.70						

Stratum: RETAINED

Description:

Soil : RETAINED

X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
28.71	267.56	29.46	269.53	30.19	269.79	50.00	269.79

REINFORCED BLOCKS
Block : GTM

Block dimensions.....[m].....: Base width.....= 2.50 Height.....= 3.04
 Block Origin.....[m].....: Abscissa.....= 25.00 Ordinate.....= 265.43
 Face inclination.....[°].....: 23.00

Structural embankment type.....: Gravel
 Structural embankment.....: CLASS 6I
 Backfill soil.....: RETAINED
 Covering soil.....: CLASS 6I
 Foundation soil.....: FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.50
 Natural soil slope.....[°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m].....= 2.50
 Vertical spacing.....[m].....= 0.76
 Wrapped length.....[m].....= 0.67

Linear Composites - ParaGrid - 50

Length.....[m].....= 2.50
 Vertical spacing.....[m].....= 0.76
 Offset.....[m].....= 0.00

SURCHARGE LOADS
Distributed Loads : 20 KPA

Description :

Class : Traffic load behind reinforced soil block

Magnitude.....[kN/m²].....= 20.00 Inclination angle.....[°].....= 0.00

Abscissa.....[m].....: from = 30.50 To = 45.00

Distributed Loads : 20KPA

Description :

Class : Traffic load on reinforced soil block

Magnitude.....[kN/m²].....= 20.00 Inclination angle.....[°].....= 0.00

Abscissa.....[m].....: from = 27.00 To = 30.40

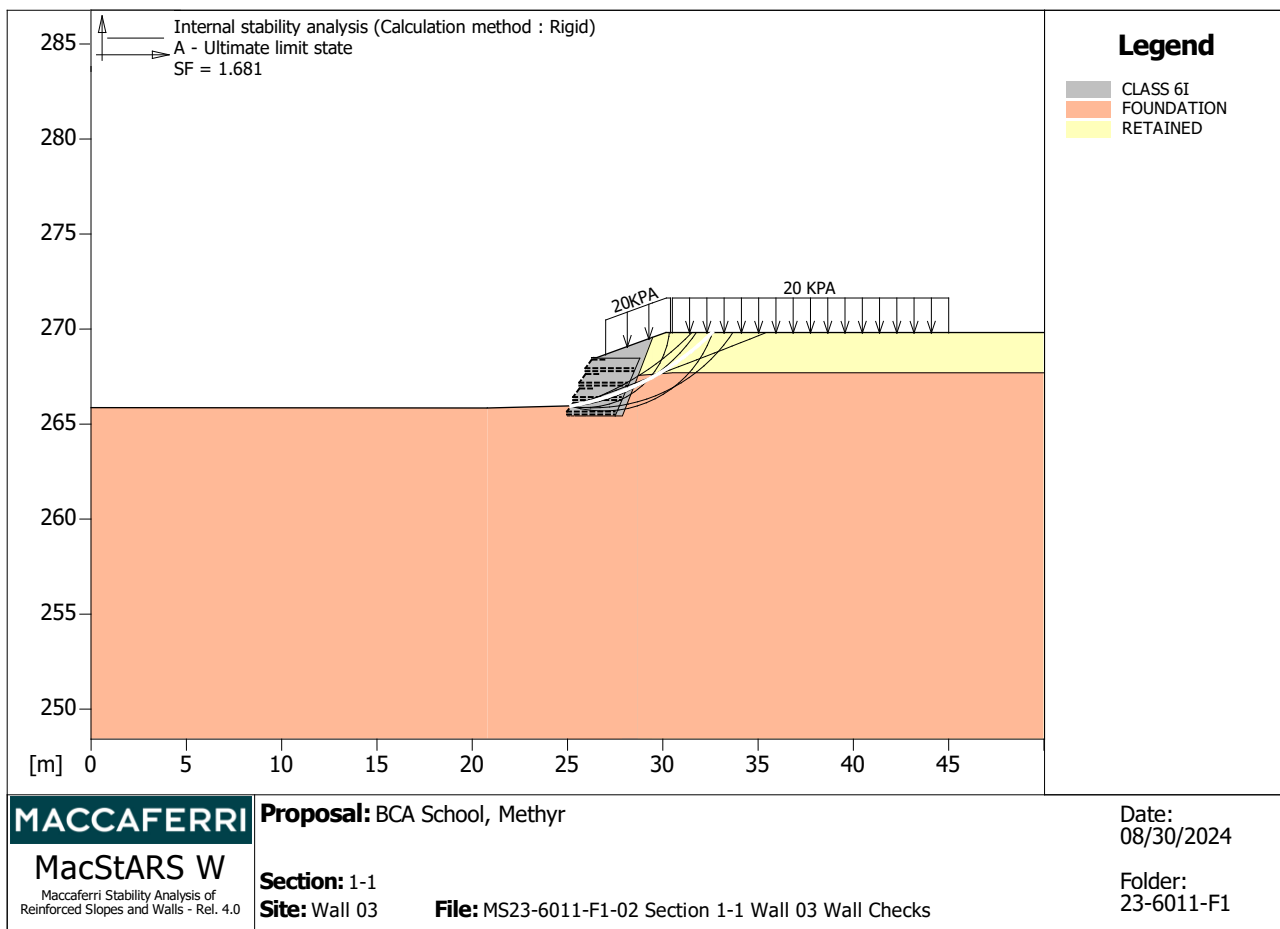
PROPERTIES OF THE USED REINFORCEMENTS

Linear Composites - ParaGrid - 50

Tensile strength UTS.....[kN/m].....: 50.00
 Plastic extension ratio.....: 0.00
 Elastic extension coefficient.....[m³/kN].....: 1.10e-04
 Reinforcement Stiffness.....[kN/m].....: 556.00
 Minimum anchorage length.....[m].....: 0.15
 Breakage Safety Factor (gravel).....: 1.54
 Pull-out Safety Factor.....: 1.00
 Breakage Safety Factor (sand).....: 1.52

Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (silty sand).....	:	1.52
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sandy clay).....	:	1.52
Pull-out Safety Factor.....	:	1.00
Interaction factor reinforcement/reinforcement.....	:	0.16
Pullout coefficient reinforcement-gravel.....	:	0.90
Pullout coefficient reinforcement-sand.....	:	0.90
Pullout coefficient reinforcement-silt.....	:	0.70
Pullout coefficient reinforcement-clay.....	:	0.40
Maccaferri - Green Terramesh - 8/2.2 P		
Tensile strength UTS.....[kN/m].....	:	35.00
Plastic extension ratio.....	:	2.00
Elastic extension coefficient.....[m ³ /kN].....	:	1.10e-04
Reinforcement Stiffness.....[kN/m].....	:	350.00
Minimum anchorage length.....[m].....	:	0.15
Breakage Safety Factor (gravel).....	:	1.26
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sand).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (silty sand).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sandy clay).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Interaction factor reinforcement/reinforcement.....	:	0.30
Pullout coefficient reinforcement-gravel.....	:	0.90
Pullout coefficient reinforcement-sand.....	:	0.65
Pullout coefficient reinforcement-silt.....	:	0.50
Pullout coefficient reinforcement-clay.....	:	0.30

CHECKS RESULTS



Internal Stability :

Multiplier combination : A - Ultimate limit state

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.681

Surfaces searching range
Arrival range, abscises [m]
Block GTM First point 28.00 Second point 45.00
Number of starting point on the starting segment.....: 1
Total number of trial surfaces.....: 100
Minimum base length of slices.....[m].....: 0.50
Superior limit search angle.....[°].....: 0.00
Inferior limit search angle.....[°].....: 0.00

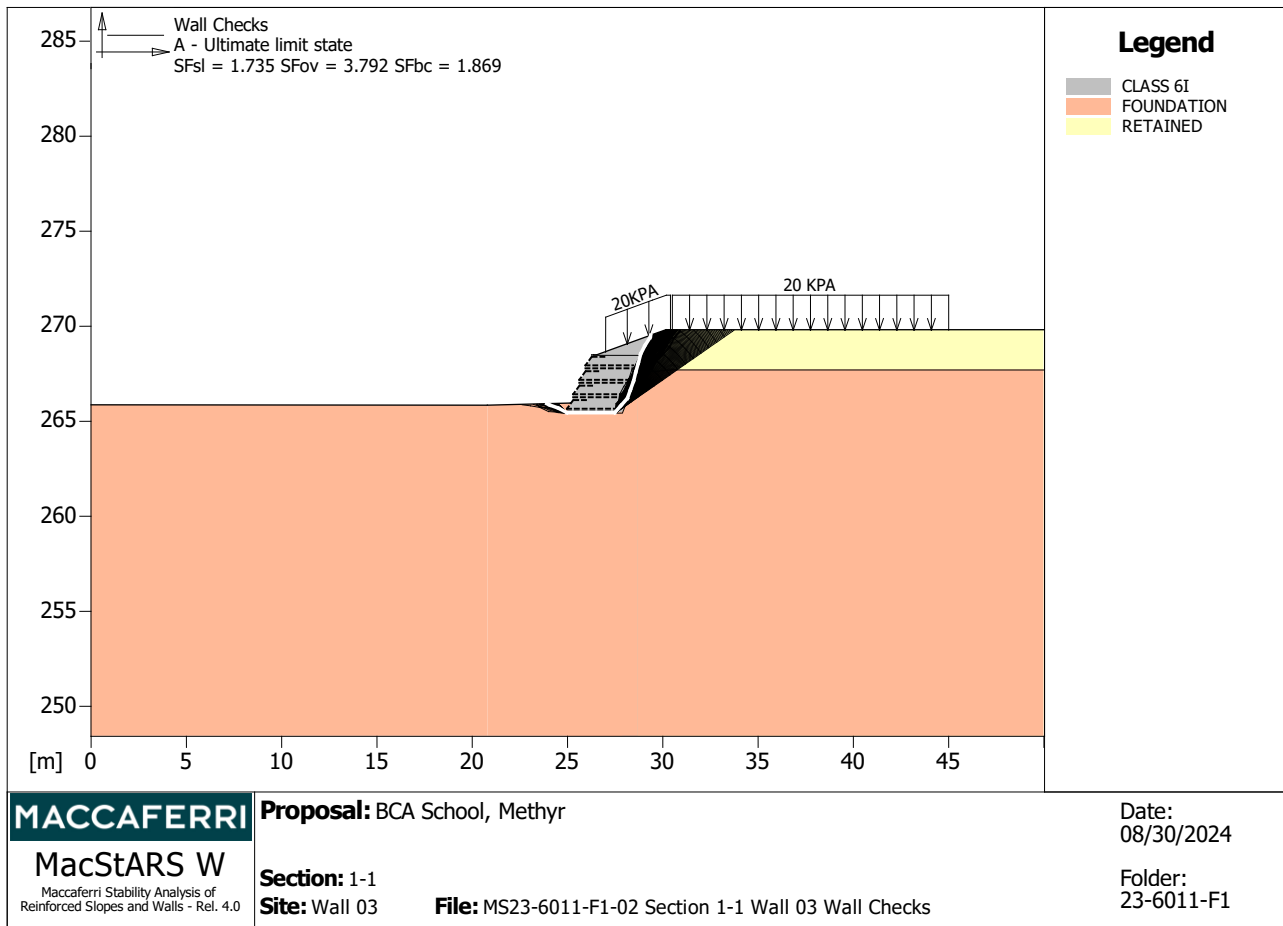
Block : GTM
Maccaferri - Green Terramesh - 8/2.2 P

Y	Tb breakage	Tp pullout	Td design	Tb/Td 1/Fmax	TP/Td
[m]	[kN/m]	[kN/m]	[kN/m]		
0.760	35.0	47.0	27.8	1.26	1.69

Block : GTM
Linear Composites - ParaGrid - 50

Y	Tb	Tp	Td	Tb/Td	TP/Td
---	----	----	----	-------	-------

		breakage	pullout	design	1/Fmax	
	[m]	[kN/m]	[kN/m]	[kN/m]		
	0.760	50.0	21.4	16.5	3.03	1.30
Multiplier		Class				
1.50		Traffic load behind reinforced soil block				
1.50		Traffic load on reinforced soil block				
1.00		Soil material factor tan(phi)				
1.60		Soil material factor c'				
1.00		Soil material factor cu				
1.50		Earth pressure (mass of the backfill) behind the structure				
1.00		Foundation soil				
1.50		Mass of the reinforced soil body				
1.00		Category of structure				
1.30		Pull-out factor (= fp x fn)				
1.00		Danger level of the work				



Wall Checks :

Multiplier combination : A - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 158.10

Active force.....[kN/m].....: 70.09

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 1.735

Restoring moment.....[kN*m/m].....: 653.89

Overturning moment.....[kN*m/m].....: 172.43

Overturning class.....: Overturning

Overturning safety factor.....: 3.792

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 300.00

Active pressure.....[kN/m²].....: 118.92

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 1.869

Equivalent bearing area.....[m].....: 2.50

Eccentricity of normal force.....[m].....: -0.37

Lever arm of overturning force.....[m].....: 2.46

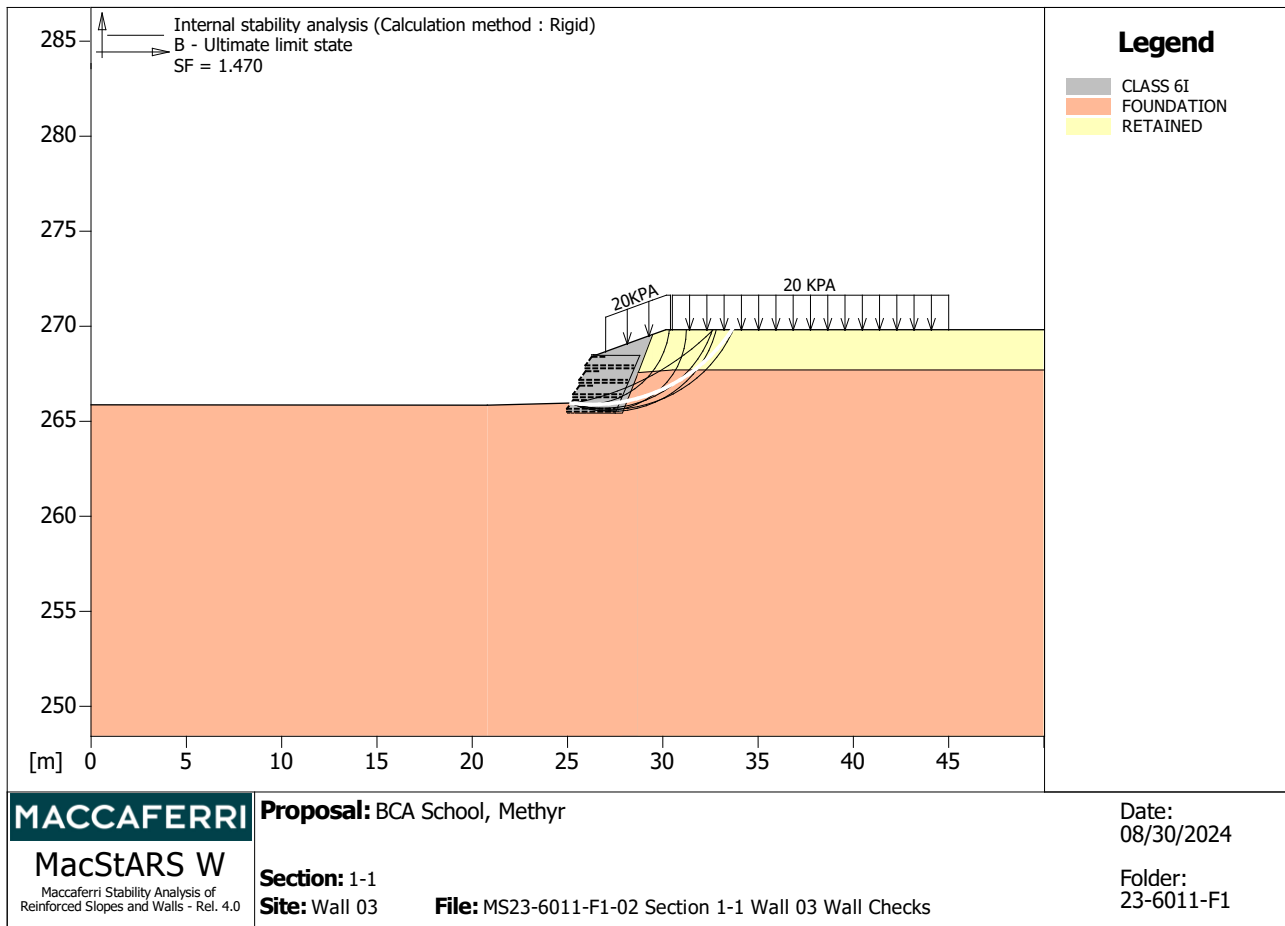
Normal force on the base.....[kN].....: 297.34

Outer edge stress.....[kN/m²].....: -43.26

Inner edge stress.....[kN/m²].....: 380.69

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.50	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'

1.00	Soil material factor c_u
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.50	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor ($= f_p \times f_n$)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning



Internal Stability :

Multiplier combination : B - Ultimate limit state

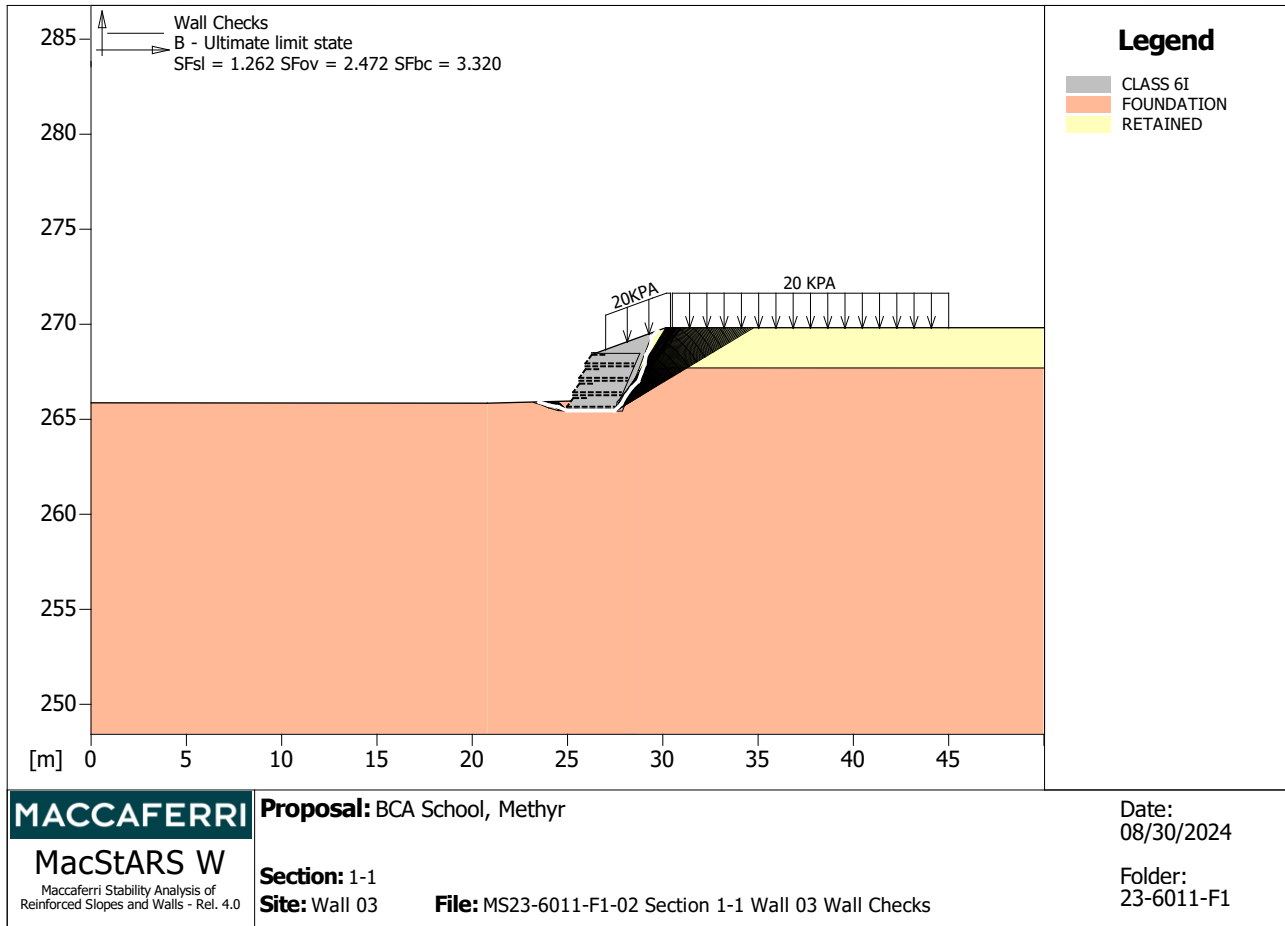
Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.470

Block GTM	Surfaces searching range	
	First point 28.00	Second point 45.00
Number of starting point on the starting segment.....:	1	
Total number of trial surfaces.....:	100	
Minimum base length of slices.....[m].....:	0.50	
Superior limit search angle.....[°].....:	0.00	
Inferior limit search angle.....[°].....:	0.00	

Multiplier	Class
1.00	Traffic load behind reinforced soil block
0.00	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= fp x fn)
1.00	Danger level of the work



Wall Checks :

Multiplier combination : B - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 86.53

Active force.....[kN/m].....: 52.72

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 1.262

Restoring moment.....[kN*m/m].....: 332.21

Overturning moment.....[kN*m/m].....: 134.40

Overturning class.....: Overturning

Overturning safety factor.....: 2.472

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 300.00

Active pressure.....[kN/m²].....: 66.94

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 3.320

Equivalent bearing area.....[m].....: 2.43

Eccentricity of normal force.....[m].....: 0.03

Lever arm of overturning force.....[m].....: 2.55

Normal force on the base.....[kN].....: 162.73

Outer edge stress.....[kN/m²].....: 70.49

Inner edge stress.....[kN/m²].....: 59.67

Multiplier	Class
1.50	Traffic load behind reinforced soil block
0.00	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'

1.00	Soil material factor cu
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= fp x fn)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning

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Maccaferri Stability Analysis of Reinforced Slopes and Walls
Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-03 Section 8-8 Wall 05 Global

Date.....: 08/30/2024

Checks according to: Eurocode 7 EN 1997-1
 Eurocode 7 EN 1997-1

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.36	265.01	25.60	265.75	27.97	265.77		

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	262.96	17.60	262.96	18.49	263.10	25.09	264.96
25.33	265.01	25.36	265.01	25.79	264.25	27.39	264.22
27.97	265.77	50.00	265.96				

REINFORCED BLOCKS

Block : GTM

Block dimensions.....[m] : Base width..... = 2.00 Height..... = 1.52
 Block Origin.....[m] : Abscissa..... = 25.00 Ordinate..... = 264.20
 Face inclination.....[°] : 23.00

Structural embankment type..... : Gravel
 Structural embankment..... : CLASS 6I
 Backfill soil..... : RETAINED
 Covering soil..... : CLASS 6I
 Foundation soil..... : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.50
 Natural soil slope.....[°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m] = 2.00
 Vertical spacing.....[m] = 0.76
 Wrapped length.....[m] = 0.67

SURCHARGE LOADS

Distributed Loads : 20KPA

Description :

Class : Variable unfavourable

Magnitude.....[kN/m²] = 20.00 Inclination angle.....[°] = 0.00

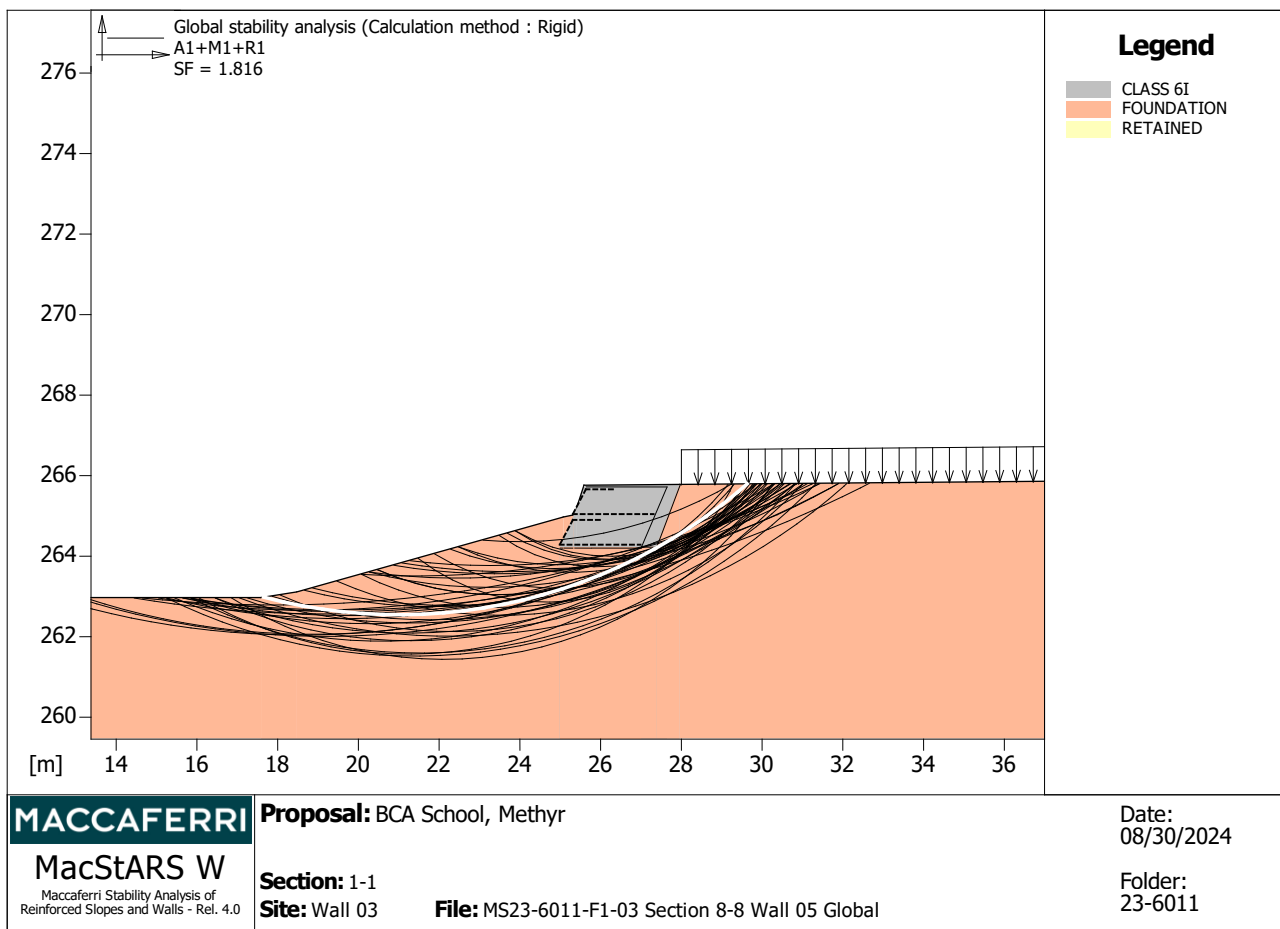
Abscissa.....[m] : from = 28.00 To = 50.00

PROPERTIES OF THE USED REINFORCEMENTS

Maccaferri - Green Terramesh - 8/2.2 P

Tensile strength UTS.....[kN/m] : 35.00
 Plastic extension ratio..... : 2.00
 Elastic extension coefficient.....[m³/kN] : 1.10e-04
 Reinforcement Stiffness.....[kN/m] : 350.00
 Minimum anchorage length.....[m] : 0.15
 Breakage Safety Factor (gravel)..... : 1.26
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sand)..... : 1.09
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (silty sand)..... : 1.09
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sandy clay)..... : 1.09
 Pull-out Safety Factor..... : 1.00
 Interaction factor reinforcement/reinforcement..... : 0.30
 Pullout coefficient reinforcement-gravel..... : 0.90
 Pullout coefficient reinforcement-sand..... : 0.65
 Pullout coefficient reinforcement-silt..... : 0.50
 Pullout coefficient reinforcement-clay..... : 0.30

CHECKS RESULTS



Global Stability Check :

Multiplier combination : A1+M1+R1

Reinforcements active Forces according to Rigid Method

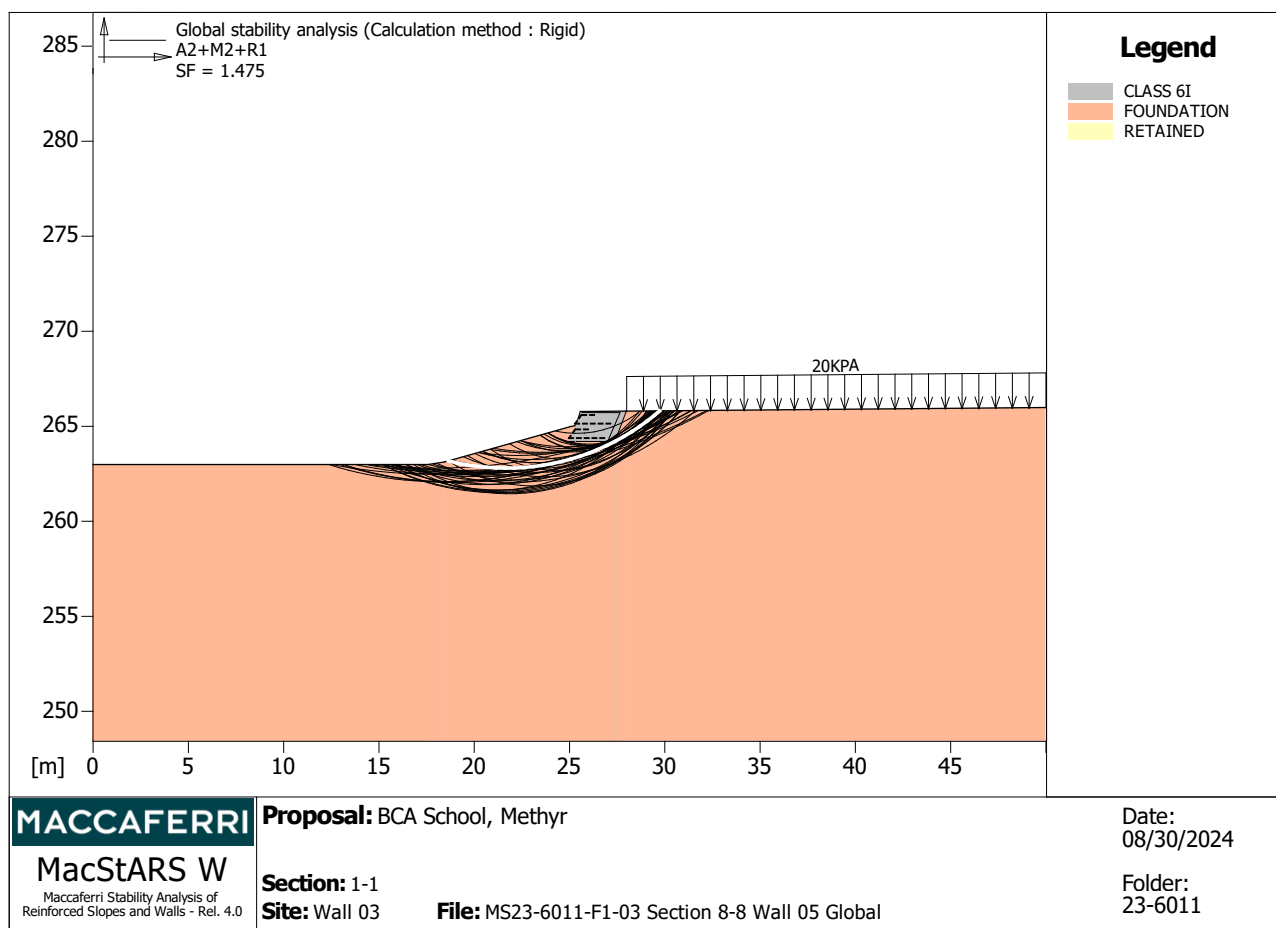
Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.816

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	29.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.50	Variable unfavourable
1.00	Angle of shearing resistance (Tan phi)
1.00	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability



Global Stability Check :

Multiplier combination : A2+M2+R1

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.475

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	28.50	45.00

Number of starting point on the starting segment.....: 100
 Total number of trial surfaces.....: 1000
 Minimum base length of slices.....[m].....: 0.50
 Superior limit search angle.....[°].....: 0.00
 Inferior limit search angle.....[°].....: 0.00

Multiplier	Class
1.30	Variable unfavourable
1.25	Angle of shearing resistance (Tan phi)
1.25	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability

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MacStARS W – Rel. 4.0

Maccaferri Stability Analysis of Reinforced Slopes and Walls
Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-04 Section 8-8 Wall 05 Wall Checks

Date.....: 08/30/2024

Checks according to: BS 8006-1:2010
 Wall - Cat. 2 (medium)

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Mass of the reinforced soil body
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Foundation soil
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Earth pressure (mass of the backfill) behind the structure
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.36	265.01	25.60	265.75	27.97	265.77		

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	262.96	17.60	262.96	18.49	263.10	25.09	264.96
25.33	265.01	25.36	265.01	25.79	264.25	27.39	264.22
27.97	265.77	50.00	265.96				

REINFORCED BLOCKS

Block : GTM

Block dimensions.....[m] : Base width..... = 2.00 Height..... = 1.52
 Block Origin.....[m] : Abscissa..... = 25.00 Ordinate..... = 264.20
 Face inclination.....[°] : 23.00

Structural embankment type..... : Gravel
 Structural embankment..... : CLASS 6I
 Backfill soil..... : RETAINED
 Covering soil..... : CLASS 6I
 Foundation soil..... : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.50
 Natural soil slope.....[°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m] = 2.00
 Vertical spacing.....[m] = 0.76
 Wrapped length.....[m] = 0.67

SURCHARGE LOADS

Distributed Loads : 20KPA

Description :

Class : Traffic load behind reinforced soil block

Magnitude.....[kN/m²] = 20.00 Inclination angle.....[°] = 0.00

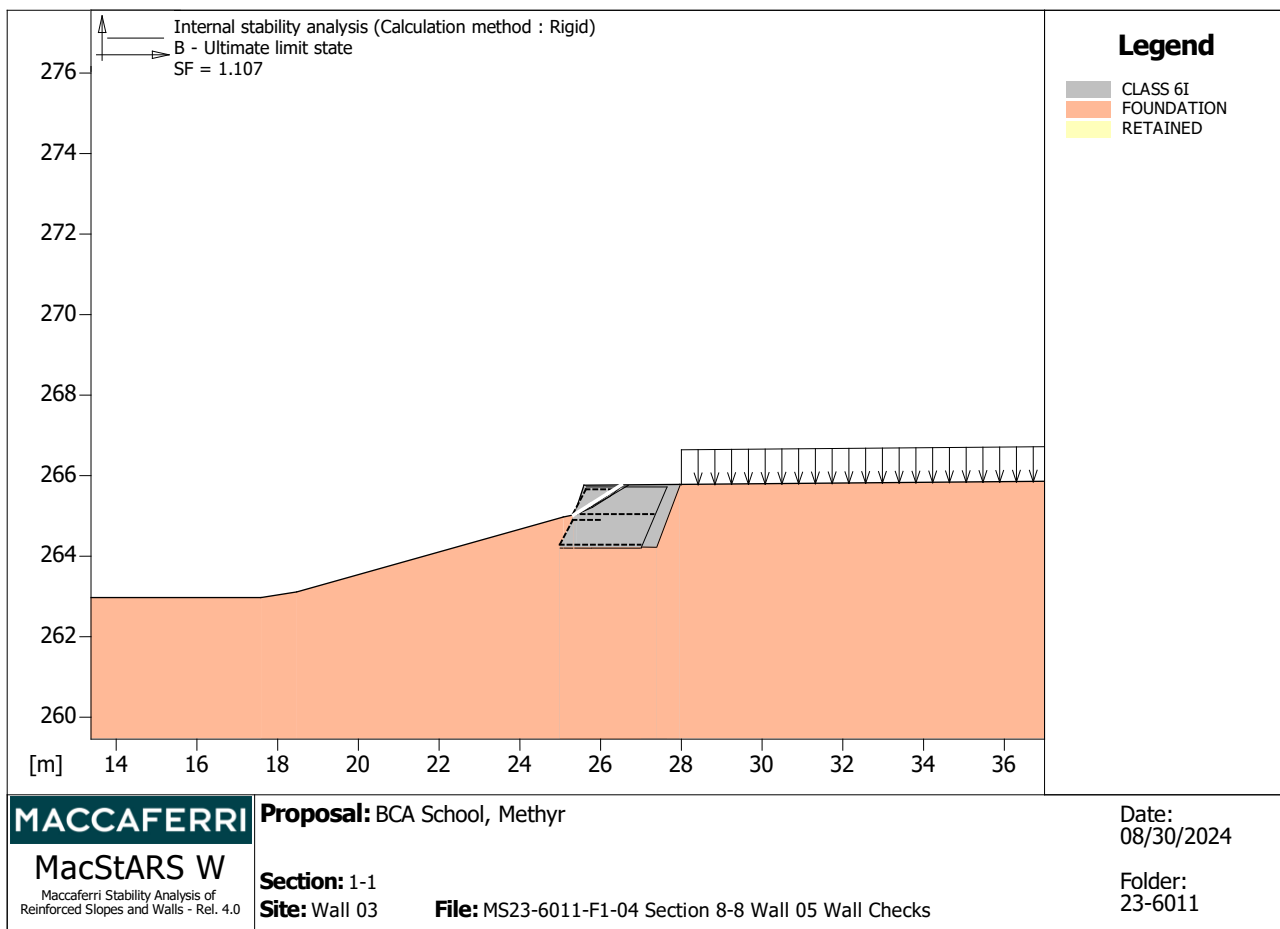
Abcissa.....[m] : from = 28.00 To = 50.00

PROPERTIES OF THE USED REINFORCEMENTS

Maccaferri - Green Terramesh - 8/2.2 P

Tensile strength UTS.....[kN/m] : 35.00
 Plastic extension ratio..... : 2.00
 Elastic extension coefficient.....[m³/kN] : 1.10e-04
 Reinforcement Stiffness.....[kN/m] : 350.00
 Minimum anchorage length.....[m] : 0.15
 Breakage Safety Factor (gravel)..... : 1.26
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sand)..... : 1.09
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (silty sand)..... : 1.09
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sandy clay)..... : 1.09
 Pull-out Safety Factor..... : 1.00
 Interaction factor reinforcement/reinforcement..... : 0.30
 Pullout coefficient reinforcement-gravel..... : 0.90
 Pullout coefficient reinforcement-sand..... : 0.65
 Pullout coefficient reinforcement-silt..... : 0.50
 Pullout coefficient reinforcement-clay..... : 0.30

CHECKS RESULTS



Internal Stability :

Multiplier combination : B - Ultimate limit state

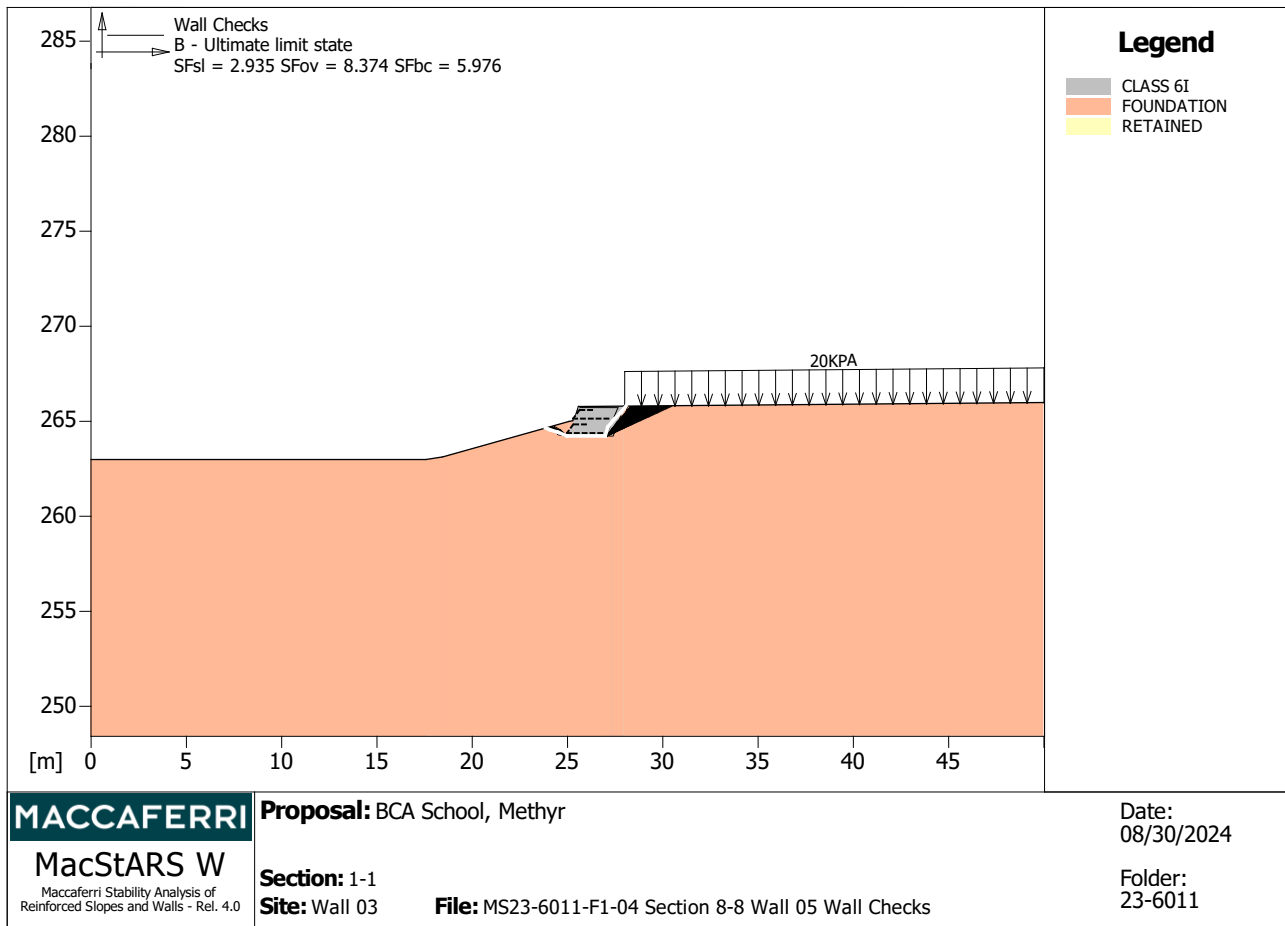
Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor : 1.107

Block	Surfaces searching range	
GTM	Arrival range, abscises [m]	
	First point	Second point
	26.50	45.00
Number of starting point on the starting segment.....	:	1
Total number of trial surfaces.....	:	100
Minimum base length of slices.....[m].....	:	0.50
Superior limit search angle.....[°].....	:	0.00
Inferior limit search angle.....[°].....	:	0.00

Multiplier	Class
1.00	Traffic load behind reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= fp x fn)
1.00	Danger level of the work



Wall Checks :

Multiplier combination : B - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 32.95

Active force.....[kN/m].....: 8.63

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 2.935

Restoring moment.....[kN*m/m].....: 80.31

Overturning moment.....[kN*m/m].....: 9.59

Overturning class.....: Overturning

Overturning safety factor.....: 8.374

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 250.00

Active pressure.....[kN/m²].....: 30.99

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 5.976

Equivalent bearing area.....[m].....: 2.00

Eccentricity of normal force.....[m].....: -0.14

Lever arm of overturning force.....[m].....: 1.11

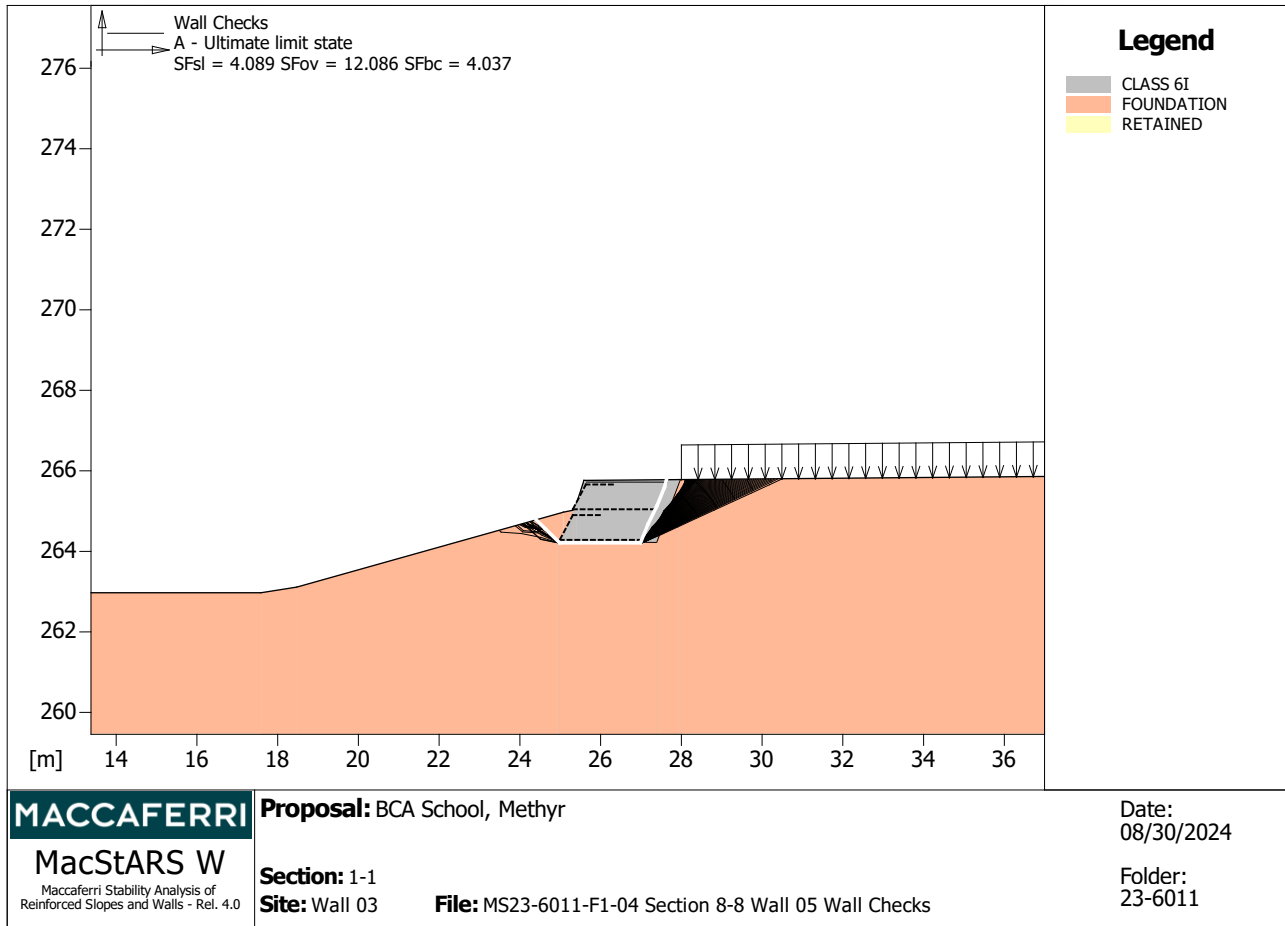
Normal force on the base.....[kN].....: 61.97

Outer edge stress.....[kN/m²].....: 18.28

Inner edge stress.....[kN/m²].....: 53.88

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu

1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= $f_p \times f_n$)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning



Wall Checks :

Multiplier combination : A - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 48.78

Active force.....[kN/m].....: 9.18

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 4.089

Restoring moment.....[kN*m/m].....: 120.31

Overturning moment.....[kN*m/m].....: 9.95

Overturning class.....: Overturning

Overturning safety factor.....: 12.086

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 250.00

Active pressure.....[kN/m²].....: 45.87

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 4.037

Equivalent bearing area.....[m].....: 2.00

Eccentricity of normal force.....[m].....: -0.20

Lever arm of overturning force.....[m].....: 1.08

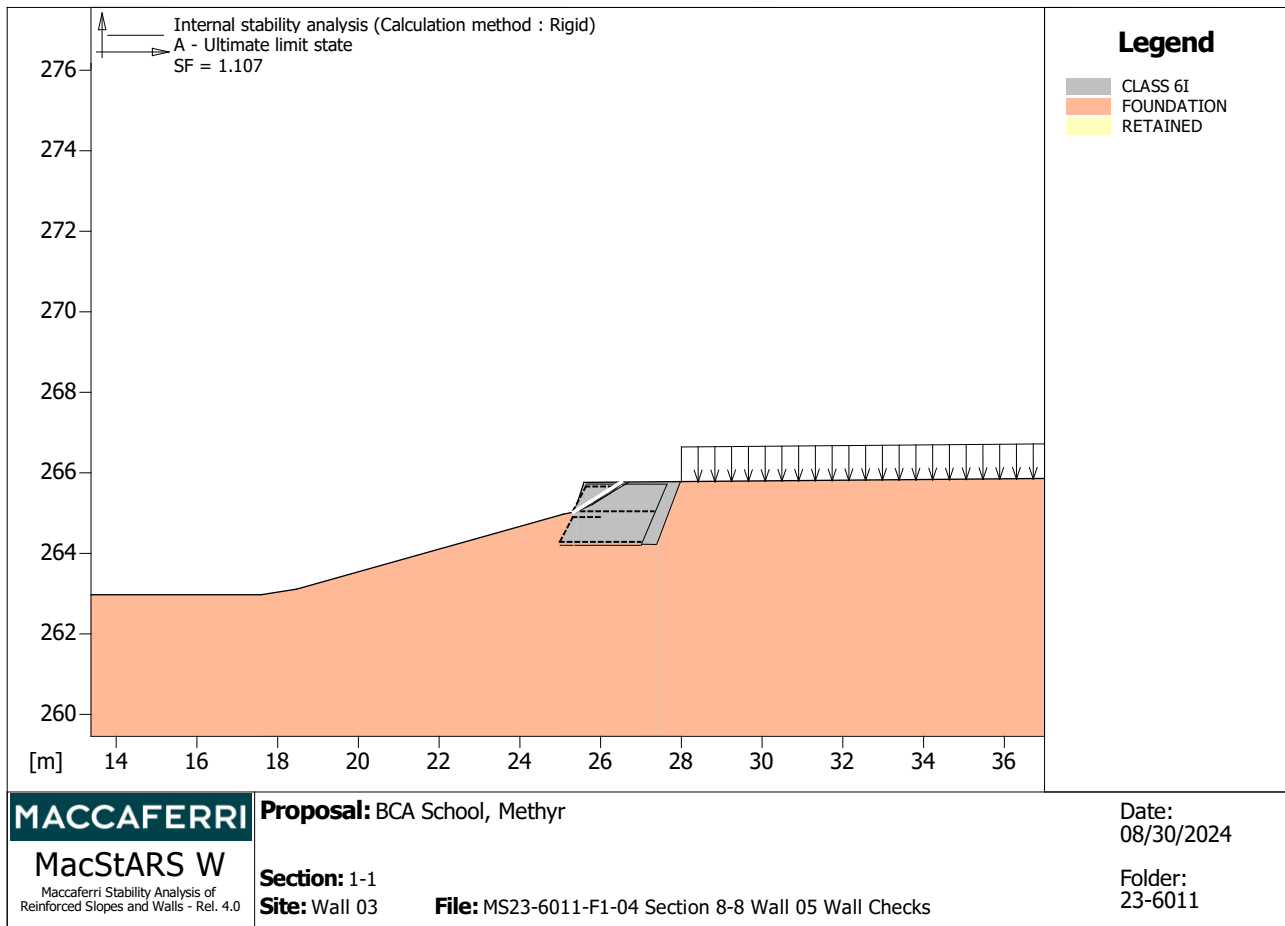
Normal force on the base.....[kN].....: 91.75

Outer edge stress.....[kN/m²].....: 13.63

Inner edge stress.....[kN/m²].....: 101.46

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu

1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.50	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= $f_p \times f_n$)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning



Internal Stability :

Multiplier combination : A - Ultimate limit state

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.107

Block GTM	Surfaces searching range	
	First point	Second point
	26.50	45.00
Number of starting point on the starting segment.....:	1	
Total number of trial surfaces.....:	100	
Minimum base length of slices.....[m].....:	0.50	
Superior limit search angle.....[°].....:	0.00	
Inferior limit search angle.....[°].....:	0.00	

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.00	Soil material factor $\tan(\phi)$
1.60	Soil material factor c'
1.00	Soil material factor c_u
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.50	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= $f_p \times f_n$)
1.00	Danger level of the work

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Maccaferri Stability Analysis of Reinforced Slopes and Walls
Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-05 Section 8A-8A Wall 05 Global

Date.....: 08/30/2024

Checks according to: Eurocode 7 EN 1997-1
 Eurocode 7 EN 1997-1

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.18	261.80	26.91	265.86	30.12	265.86		

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	261.84	21.47	261.84	22.59	261.83	25.18	261.80
25.53	261.30	28.39	261.30	30.12	265.86	50.00	265.86

REINFORCED BLOCKS

Block : GTM

Block dimensions [m] : Base width = 3.00 Height = 4.56
 Block Origin [m] : Abscissa = 25.00 Ordinate = 261.30
 Face inclination [°] : 23.00

Structural embankment type : Gravel
 Structural embankment : CLASS 6I
 Backfill soil : RETAINED
 Covering soil : CLASS 6I
 Foundation soil : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth [m] : 0.50
 Natural soil slope [°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length [m] = 2.50
 Vertical spacing [m] = 0.76
 Wrapped length [m] = 0.67

Linear Composites - ParaGrid - 50

Length [m] = 3.00
 Vertical spacing [m] = 0.76
 Offset [m] = 0.00

SURCHARGE LOADS

Distributed Loads : 20KPA

Description :

Class : Variable unfavourable

Magnitude [kN/m²] = 20.00 Inclination angle [°] = 0.00

Abcissa [m] : from = 28.00 To = 50.00

PROPERTIES OF THE USED REINFORCEMENTS

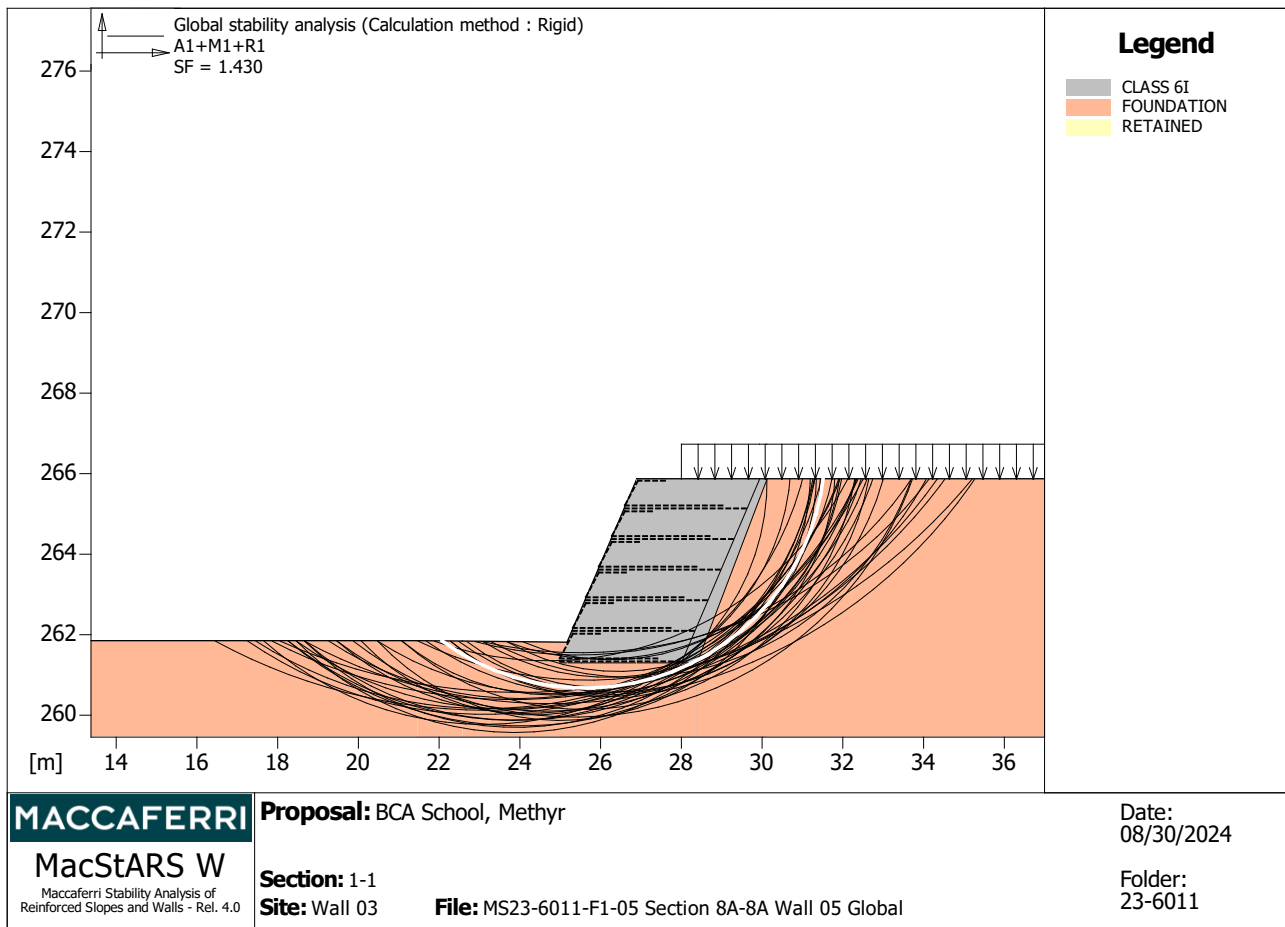
Linear Composites - ParaGrid - 50

Tensile strength UTS	[kN/m]	50.00
Plastic extension ratio		0.00
Elastic extension coefficient	[m ³ /kN]	1.10e-04
Reinforcement Stiffness	[kN/m]	556.00
Minimum anchorage length	[m]	0.15
Breakage Safety Factor (gravel)		1.54
Pull-out Safety Factor		1.00
Breakage Safety Factor (sand)		1.52
Pull-out Safety Factor		1.00
Breakage Safety Factor (silty sand)		1.52
Pull-out Safety Factor		1.00
Breakage Safety Factor (sandy clay)		1.52
Pull-out Safety Factor		1.00
Interaction factor reinforcement/reinforcement		0.16
Pullout coefficient reinforcement-gravel		0.90
Pullout coefficient reinforcement-sand		0.90
Pullout coefficient reinforcement-silt		0.70
Pullout coefficient reinforcement-clay		0.40

Maccaferri - Green Terramesh - 8/2.2 P

Tensile strength UTS	[kN/m] :	35.00
Plastic extension ratio	:	2.00
Elastic extension coefficient	[m³/kN] :	1.10e-04
Reinforcement Stiffness	[kN/m] :	350.00
Minimum anchorage length	[m] :	0.15
Breakage Safety Factor (gravel)	:	1.26
Pull-out Safety Factor	:	1.00
Breakage Safety Factor (sand)	:	1.09
Pull-out Safety Factor	:	1.00
Breakage Safety Factor (silty sand)	:	1.09
Pull-out Safety Factor	:	1.00
Breakage Safety Factor (sandy clay)	:	1.09
Pull-out Safety Factor	:	1.00
Interaction factor reinforcement/reinforcement	:	0.30
Pullout coefficient reinforcement-gravel	:	0.90
Pullout coefficient reinforcement-sand	:	0.65
Pullout coefficient reinforcement-silt	:	0.50
Pullout coefficient reinforcement-clay	:	0.30

CHECKS RESULTS



Global Stability Check :

Multiplier combination : A1+M1+R1

Reinforcements active Forces according to Rigid Method

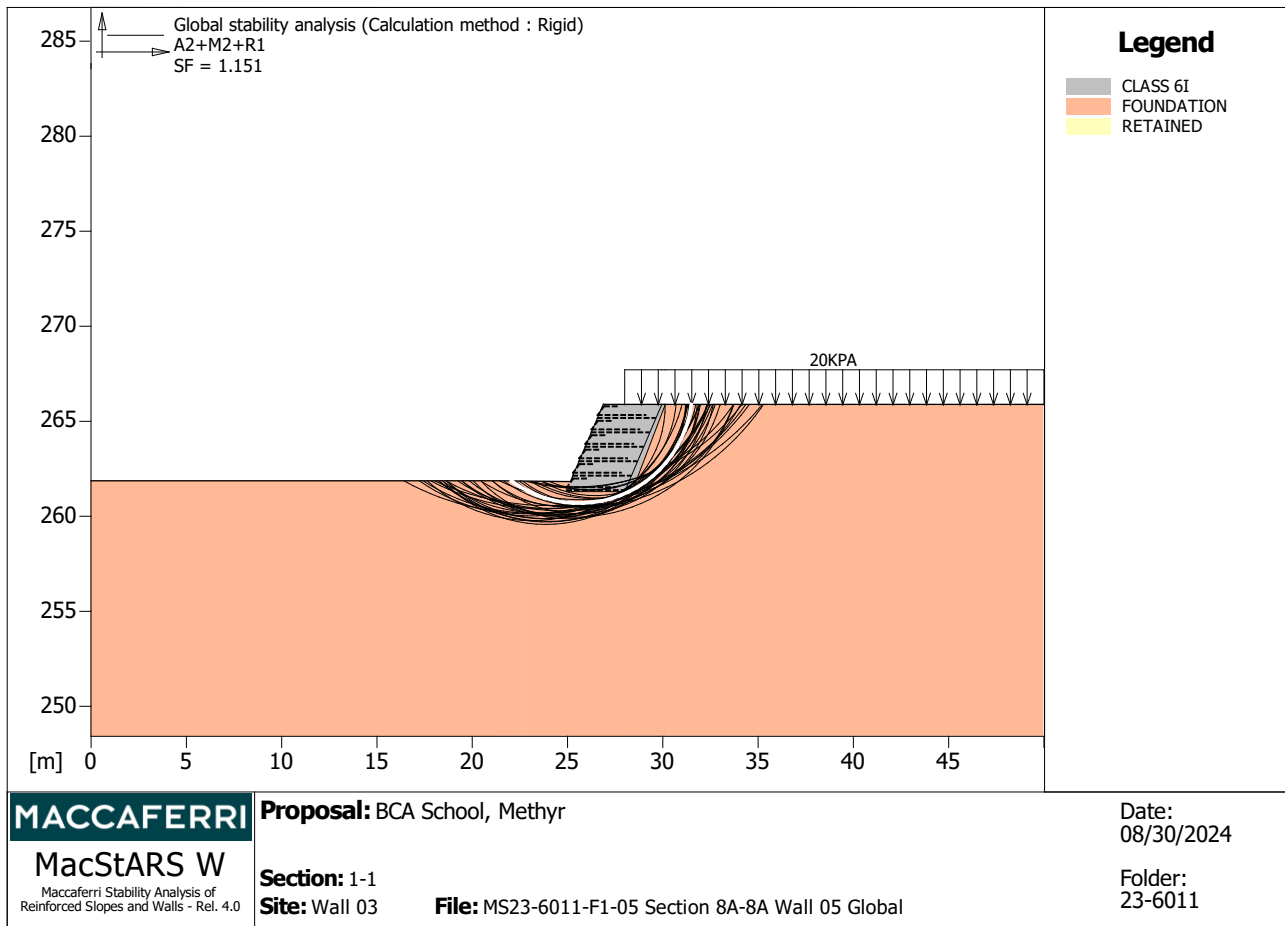
Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.430

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	29.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.50	Variable unfavourable
1.00	Angle of shearing resistance (Tan phi)
1.00	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability



Global Stability Check :

Multiplier combination : A2+M2+R1

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.151

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	29.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.30	Variable unfavourable
1.25	Angle of shearing resistance (Tan phi)
1.25	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability

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MacStARS W – Rel. 4.0

Maccaferri Stability Analysis of Reinforced Slopes and Walls
Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-06 Section 8A-8A Wall 05 - Wall Checks

Date.....: 08/30/2024

Checks according to: BS 8006-1:2010
 Wall - Cat. 2 (medium)

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Mass of the reinforced soil body
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Foundation soil
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Earth pressure (mass of the backfill) behind the structure
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.18	261.80	26.91	265.86	30.12	265.86		

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	261.84	21.47	261.84	22.59	261.83	25.18	261.80
25.53	261.30	28.39	261.30	30.12	265.86	50.00	265.86

REINFORCED BLOCKS

Block : GTM

Block dimensions [m] : Base width = 3.00 Height = 4.56
 Block Origin [m] : Abscissa = 25.00 Ordinate = 261.30
 Face inclination [°] : 23.00

Structural embankment type : Gravel
 Structural embankment : CLASS 6I
 Backfill soil : RETAINED
 Covering soil : CLASS 6I
 Foundation soil : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth [m] : 0.50
 Natural soil slope [°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length [m] = 2.50
 Vertical spacing [m] = 0.76
 Wrapped length [m] = 0.67

Linear Composites - ParaGrid - 50

Length [m] = 3.00
 Vertical spacing [m] = 0.76
 Offset [m] = 0.00

SURCHARGE LOADS

Distributed Loads : 20 KPA

Description :

Class : Traffic load on reinforced soil block

Magnitude [kN/m²] = 0.00 Inclination angle [°] = 0.00

Abcissa [m] : from = 28.00 To = 30.14

Distributed Loads : 20KPA

Description :

Class : Traffic load behind reinforced soil block

Magnitude [kN/m²] = 20.00 Inclination angle [°] = 0.00

Abcissa [m] : from = 30.15 To = 50.00

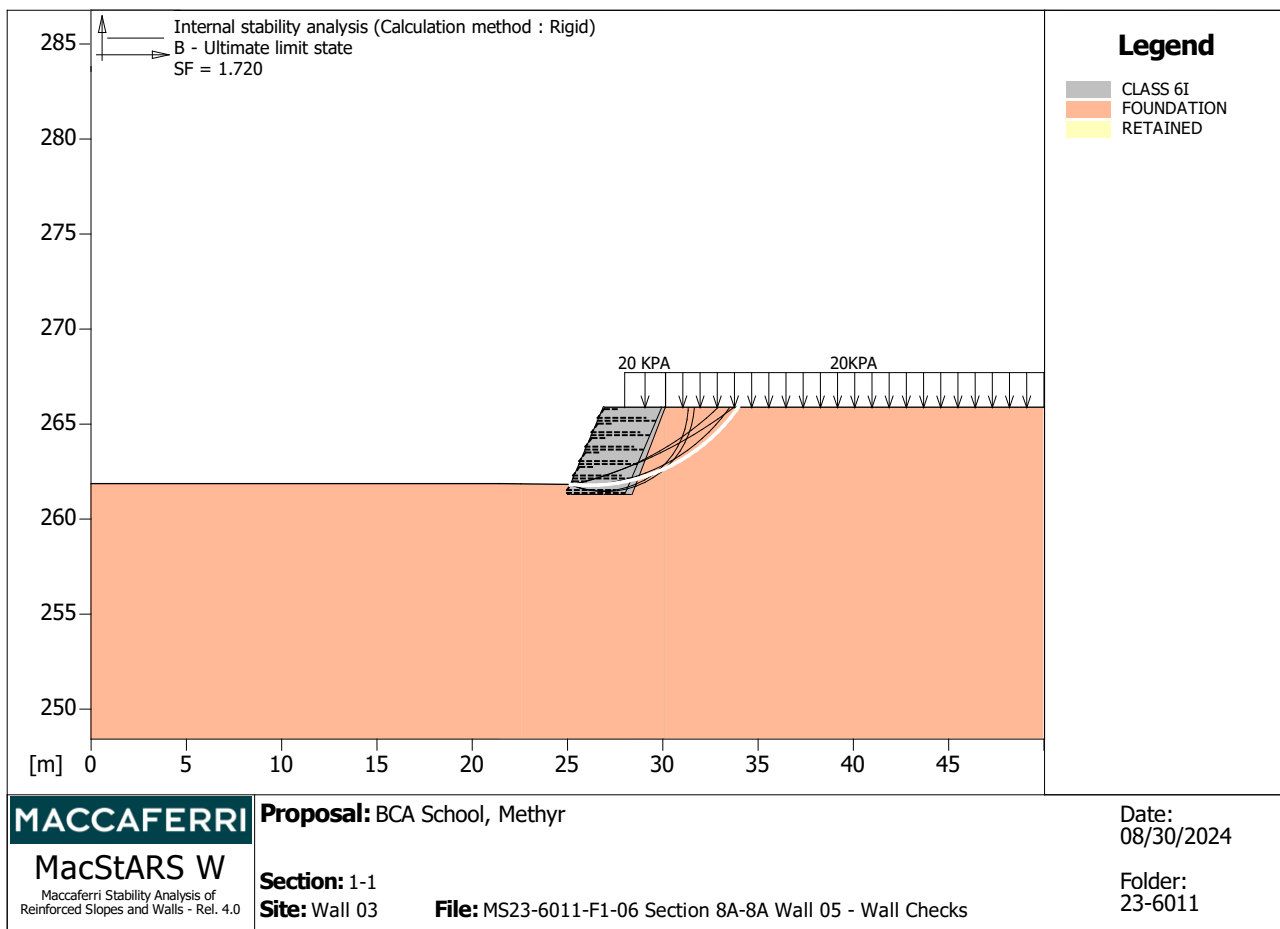
PROPERTIES OF THE USED REINFORCEMENTS

Linear Composites - ParaGrid - 50

Tensile strength UTS [kN/m] : 50.00
 Plastic extension ratio : 0.00
 Elastic extension coefficient [m³/kN] : 1.10e-04
 Reinforcement Stiffness [kN/m] : 556.00
 Minimum anchorage length [m] : 0.15
 Breakage Safety Factor (gravel) : 1.54
 Pull-out Safety Factor : 1.00
 Breakage Safety Factor (sand) : 1.52
 Pull-out Safety Factor : 1.00
 Breakage Safety Factor (silty sand) : 1.52
 Pull-out Safety Factor : 1.00
 Breakage Safety Factor (sandy clay) : 1.52
 Pull-out Safety Factor : 1.00
 Interaction factor reinforcement/reinforcement : 0.16
 Pullout coefficient reinforcement-gravel : 0.90

Pullout coefficient reinforcement-sand.....	:	0.90
Pullout coefficient reinforcement-silt.....	:	0.70
Pullout coefficient reinforcement-clay.....	:	0.40
Maccaferri - Green Terramesh - 8/2.2 P		
Tensile strength UTS.....[kN/m].....	:	35.00
Plastic extension ratio.....	:	2.00
Elastic extension coefficient.....[m ³ /kN].....	:	1.10e-04
Reinforcement Stiffness.....[kN/m].....	:	350.00
Minimum anchorage length.....[m].....	:	0.15
Breakage Safety Factor (gravel).....	:	1.26
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sand).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (silty sand).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Breakage Safety Factor (sandy clay).....	:	1.09
Pull-out Safety Factor.....	:	1.00
Interaction factor reinforcement/reinforcement.....	:	0.30
Pullout coefficient reinforcement-gravel.....	:	0.90
Pullout coefficient reinforcement-sand.....	:	0.65
Pullout coefficient reinforcement-silt.....	:	0.50
Pullout coefficient reinforcement-clay.....	:	0.30

CHECKS RESULTS



Internal Stability :

Multiplier combination : B - Ultimate limit state

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.720

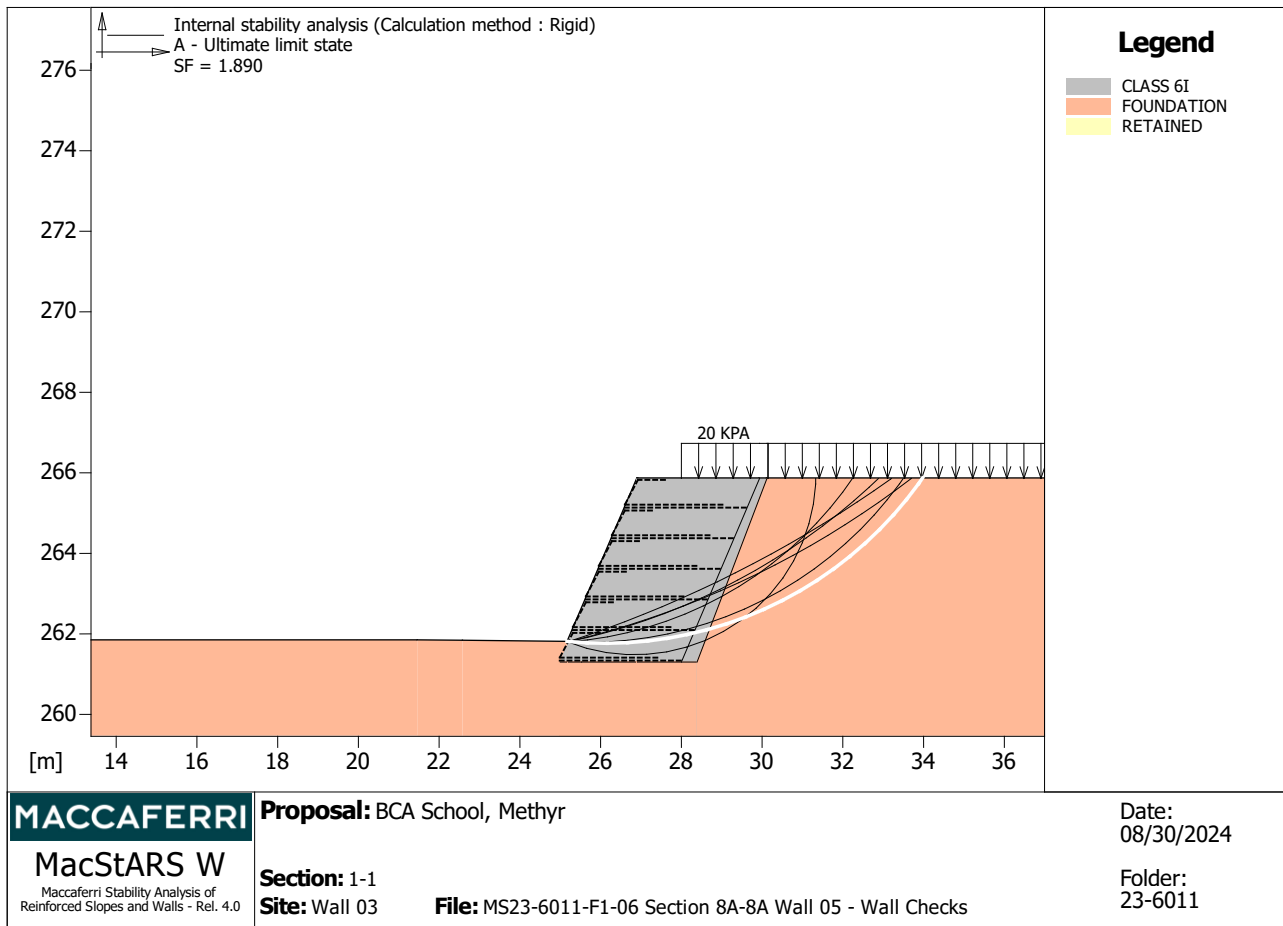
Surfaces searching range
Arrival range, abscises [m]
Block GTM First point Second point
26.00 45.00

Number of starting point on the starting segment.....: 1
Total number of trial surfaces.....: 100
Minimum base length of slices.....[m].....: 0.50
Superior limit search angle.....[°].....: 0.00
Inferior limit search angle.....[°].....: 0.00

Multiplier	Class
1.00	Traffic load behind reinforced soil block
0.00	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= fp x fn)

1.00

Danger level of the work



Internal Stability :

Multiplier combination : A - Ultimate limit state

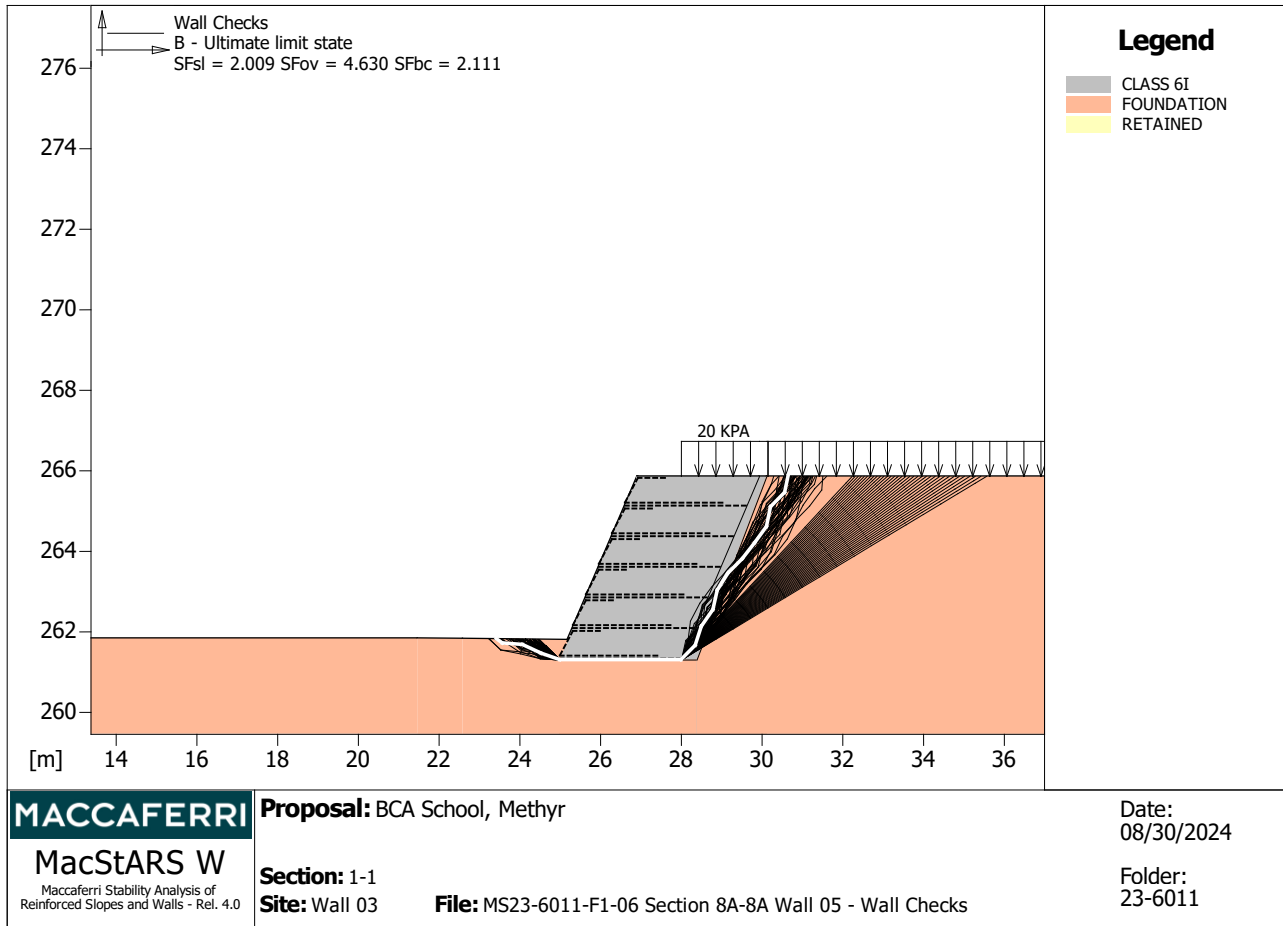
Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.890

Block GTM	Surfaces searching range	
	First point	Second point
	26.00	45.00
Number of starting point on the starting segment.....:	1	
Total number of trial surfaces.....:	100	
Minimum base length of slices.....[m].....:	0.50	
Superior limit search angle.....[°].....:	0.00	
Inferior limit search angle.....[°].....:	0.00	

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.50	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.50	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= fp x fn)
1.00	Danger level of the work



Wall Checks :

Multiplier combination : B - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 139.93

Active force.....[kN/m].....: 53.58

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 2.009

Restoring moment.....[kN*m/m].....: 660.94

Overturning moment.....[kN*m/m].....: 142.74

Overturning class.....: Overturning

Overturning safety factor.....: 4.630

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 250.00

Active pressure.....[kN/m²].....: 87.72

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 2.111

Equivalent bearing area.....[m].....: 3.00

Eccentricity of normal force.....[m].....: -0.47

Lever arm of overturning force.....[m].....: 2.66

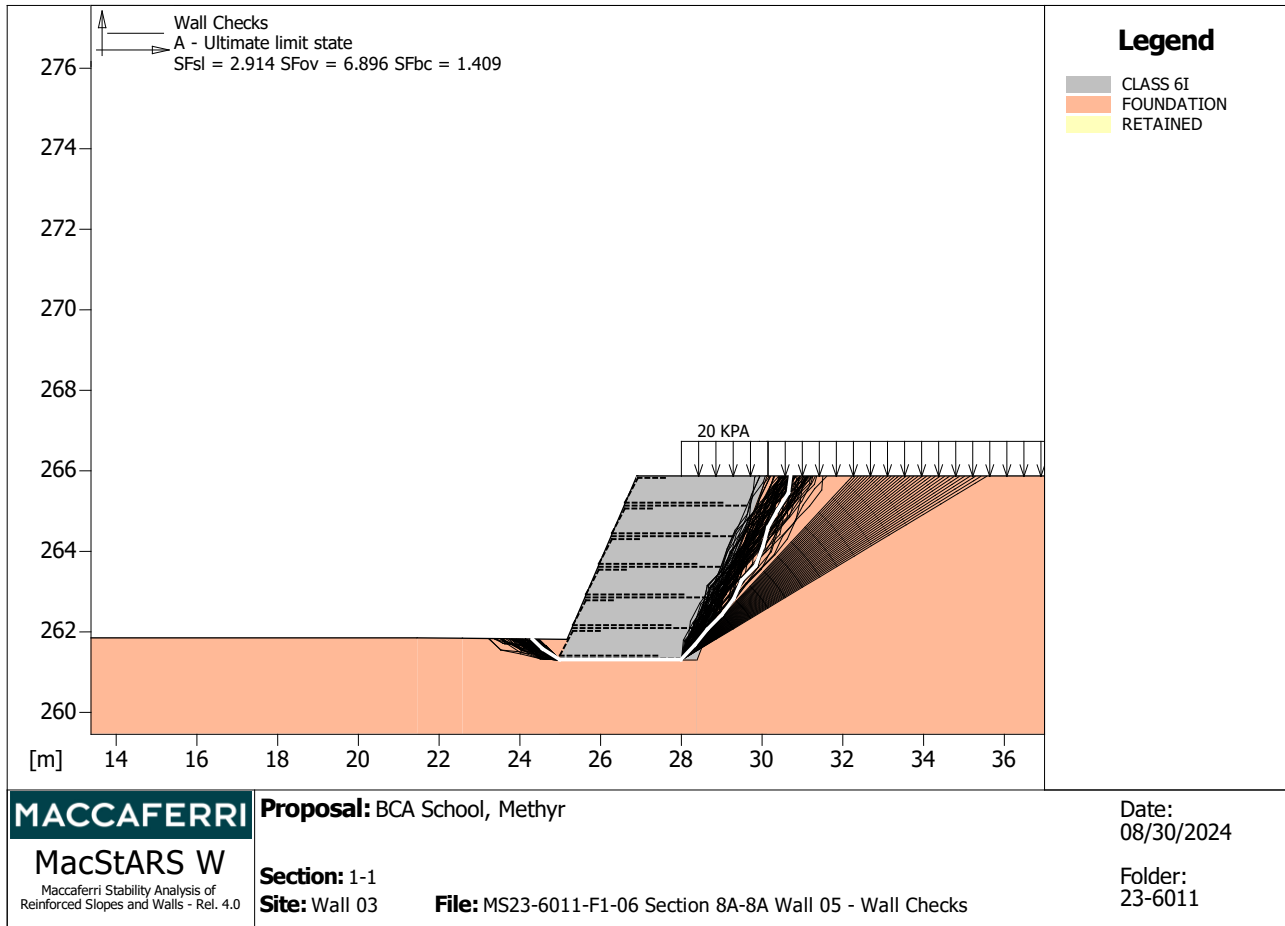
Normal force on the base.....[kN].....: 263.16

Outer edge stress.....[kN/m²].....: -46.63

Inner edge stress.....[kN/m²].....: 301.92

Multiplier	Class
1.50	Traffic load behind reinforced soil block
0.00	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'

1.00	Soil material factor c_u
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor ($= f_p \times f_n$)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning



Wall Checks :

Multiplier combination : A - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 209.62

Active force.....[kN/m].....: 55.33

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 2.914

Restoring moment.....[kN*m/m].....: 991.37

Overturning moment.....[kN*m/m].....: 143.75

Overturning class.....: Overturning

Overturning safety factor.....: 6.896

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 250.00

Active pressure.....[kN/m²].....: 131.41

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 1.409

Equivalent bearing area.....[m].....: 3.00

Eccentricity of normal force.....[m].....: -0.65

Lever arm of overturning force.....[m].....: 2.60

Normal force on the base.....[kN].....: 394.24

Outer edge stress.....[kN/m²].....: -300.10

Inner edge stress.....[kN/m²].....: 763.90

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.50	Traffic load on reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'

1.00	Soil material factor cu
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.50	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= fp x fn)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning

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MacStARS W – Rel. 4.0

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Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-07 Tiered Section Global

Date.....: 08/30/2024

Checks according to: Eurocode 7 EN 1997-1
 Eurocode 7 EN 1997-1

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Effective cohesion
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Angle of shearing resistance (Tan phi)
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Weight density
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.46	265.85	25.95	267.15	28.00	267.15	28.43	268.45
30.65	268.45	31.08	269.62	33.42	269.63		

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	263.63	25.03	264.94	25.92	265.01	26.00	264.87
27.88	264.87	28.00	265.17	50.00	266.83		

Stratum: RETAINED

Description:

Soil : RETAINED

X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
28.00	265.17	28.60	266.73	30.06	266.73	30.51	267.90
32.76	267.90	33.42	269.63	50.00	269.63		

Stratum: TOE

Description:

Soil : RETAINED

X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	265.85	25.46	265.85	25.92	265.01		

REINFORCED BLOCKS
Block : GTM

Block dimensions.....[m].....: Base width.....= 2.50 Height.....= 2.28
 Block Origin.....[m].....: Abscissa.....= 25.00 Ordinate..= 264.87
 Face inclination.....[°].....: 23.00

Structural embankment type.....: Gravel
 Structural embankment.....: CLASS 6I
 Backfill soil.....: RETAINED
 Covering soil.....: CLASS 6I
 Foundation soil.....: FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.50
 Natural soil slope.....[°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m].....= 2.50
 Vertical spacing.....[m].....= 0.76
 Wrapped length.....[m].....= 0.67

Linear Composites - ParaGrid - 50

Length.....[m].....= 2.50
 Vertical spacing.....[m].....= 0.76
 Offset.....[m].....= 0.00

Block : GTM2

Block dimensions.....[m].....: Base width.....= 2.00 Height.....= 1.52
 Block Origin.....[m].....: Abscissa.....= 27.45 Ordinate..= 266.93
 Face inclination.....[°].....: 23.00

Structural embankment type.....: Gravel
 Structural embankment.....: CLASS 6I
 Backfill soil.....: RETAINED
 Covering soil.....: CLASS 6I
 Foundation soil.....: FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.00
 Natural soil slope.....[°] : 0.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m].....= 2.00

Vertical spacing.....[m]..... = 0.76
 Wrapped length.....[m]..... = 0.67

Block : GTM3

Block dimensions.....[m]..... : Base width..... = 2.00 Height..... = 1.52
 Block Origin.....[m]..... : Abscissa..... = 30.45 Ordinate..... = 268.10
 Face inclination.....[°]..... : 23.00

Structural embankment type..... : Gravel
 Structural embankment..... : CLASS 6I
 Backfill soil..... : RETAINED
 Covering soil..... : CLASS 6I
 Foundation soil..... : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.00
 Natural soil slope.....[°] : 0.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m]..... = 2.00
 Vertical spacing.....[m]..... = 0.76
 Wrapped length.....[m]..... = 0.67

SURCHARGE LOADS
Distributed Loads : 20KPA

Description :

Class : Variable unfavourable

Magnitude.....[kN/m²]..... = 20.00 Inclination angle.....[°]..... = 0.00
 Abscissa.....[m]..... : from = 28.00 To = 50.00

PROPERTIES OF THE USED REINFORCEMENTS

Linear Composites - ParaGrid - 50

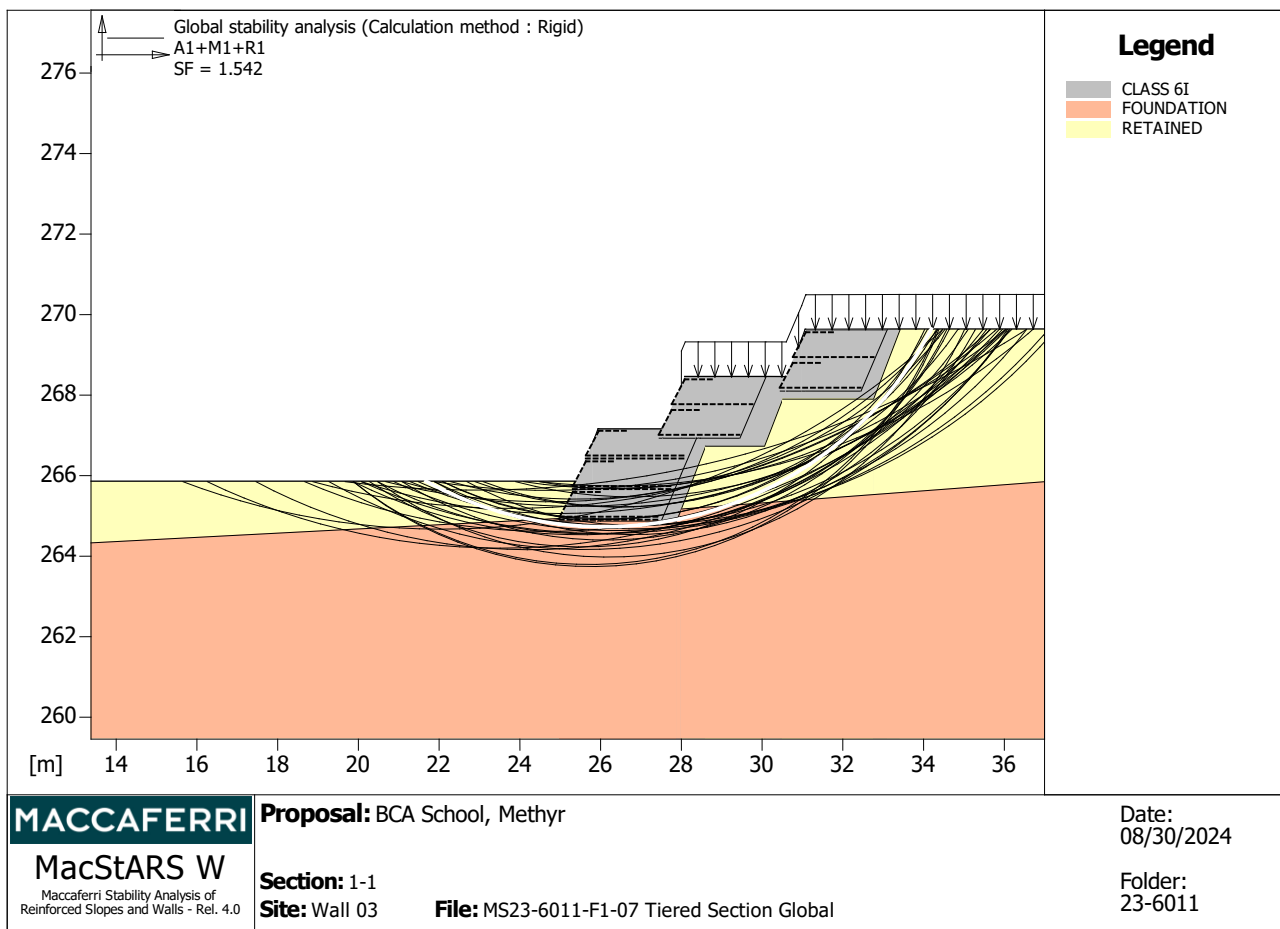
Tensile strength UTS.....[kN/m]..... : 50.00
 Plastic extension ratio..... : 0.00
 Elastic extension coefficient.....[m³/kN]..... : 1.10e-04
 Reinforcement Stiffness.....[kN/m]..... : 556.00
 Minimum anchorage length.....[m]..... : 0.15
 Breakage Safety Factor (gravel)..... : 1.54
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sand)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (silty sand)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sandy clay)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Interaction factor reinforcement/reinforcement..... : 0.16
 Pullout coefficient reinforcement-gravel..... : 0.90
 Pullout coefficient reinforcement-sand..... : 0.90
 Pullout coefficient reinforcement-silt..... : 0.70
 Pullout coefficient reinforcement-clay..... : 0.40

Maccaferri - Green Terramesh - 8/2.2 P

Tensile strength UTS.....[kN/m]..... : 35.00
 Plastic extension ratio..... : 2.00
 Elastic extension coefficient.....[m³/kN]..... : 1.10e-04
 Reinforcement Stiffness.....[kN/m]..... : 350.00

Minimum anchorage length.....[m].....:	0.15
Breakage Safety Factor (gravel).....:	1.26
Pull-out Safety Factor.....:	1.00
Breakage Safety Factor (sand).....:	1.09
Pull-out Safety Factor.....:	1.00
Breakage Safety Factor (silty sand).....:	1.09
Pull-out Safety Factor.....:	1.00
Breakage Safety Factor (sandy clay).....:	1.09
Pull-out Safety Factor.....:	1.00
Interaction factor reinforcement/reinforcement.....:	0.30
Pullout coefficient reinforcement-gravel.....:	0.90
Pullout coefficient reinforcement-sand.....:	0.65
Pullout coefficient reinforcement-silt.....:	0.50
Pullout coefficient reinforcement-clay.....:	0.30

CHECKS RESULTS



Global Stability Check :

Multiplier combination : A1+M1+R1

Reinforcements active Forces according to Rigid Method

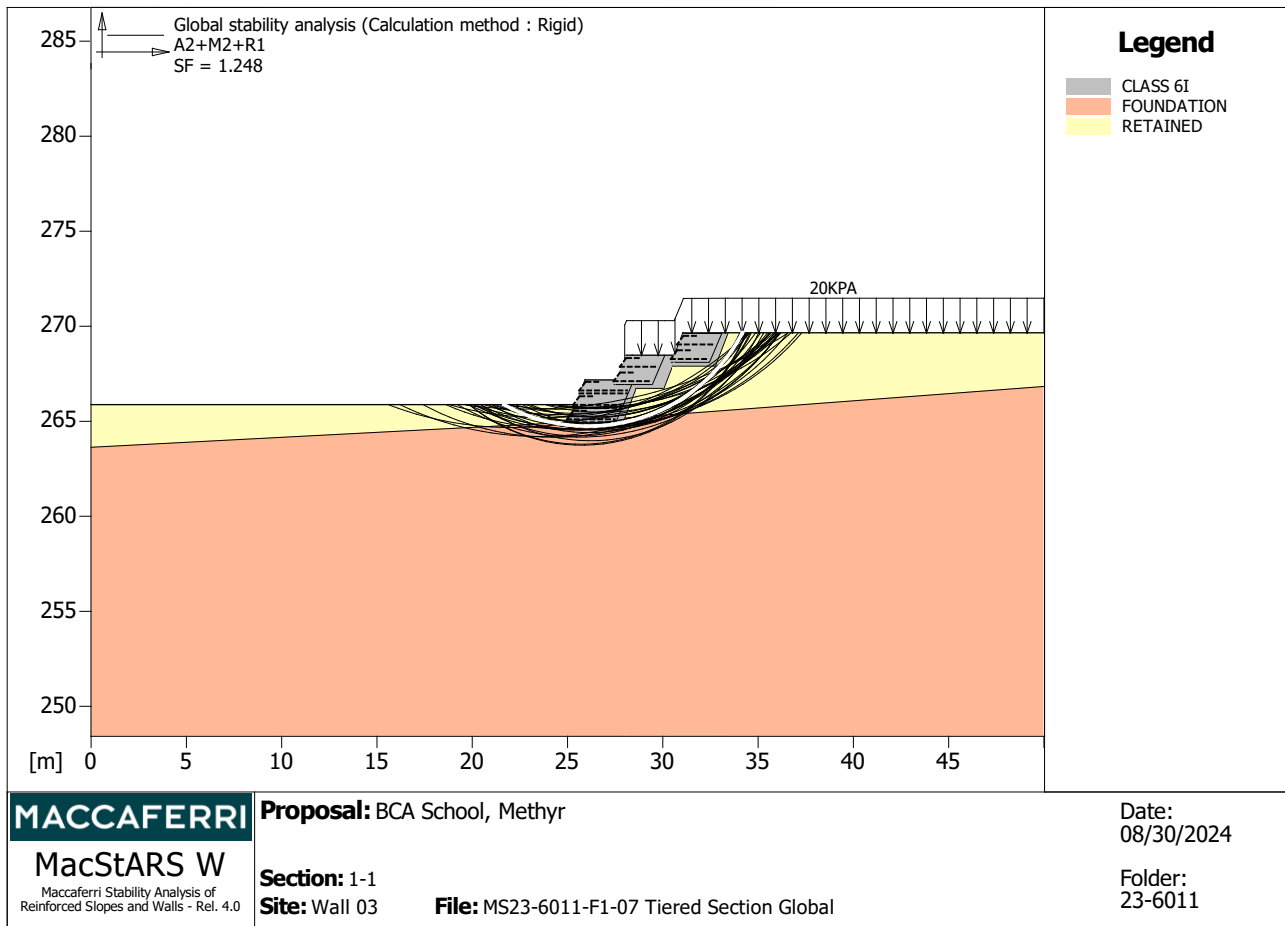
Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.542

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	34.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.50	Variable unfavourable
1.00	Angle of shearing resistance (Tan phi)
1.00	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability



Global Stability Check :

Multiplier combination : A2+M2+R1

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.248

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
5.00	24.90	34.00	45.00
Number of starting point on the starting segment.....:		100	
Total number of trial surfaces.....:		1000	
Minimum base length of slices.....[m].....:		0.50	
Superior limit search angle.....[°].....:		0.00	
Inferior limit search angle.....[°].....:		0.00	

Multiplier	Class
1.30	Variable unfavourable
1.25	Angle of shearing resistance (Tan phi)
1.25	Effective cohesion
1.00	Weight density
1.00	Tensile strength of reinforcement
1.00	Pullout resistance of reinforcement
1.00	Ground resistance for overall stability

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MacStARS W – Rel. 4.0

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Officine Maccaferri S.p.A. - Via Kennedy 10 - 40069 Zola Predosa (Bologna)
Tel. 051.6436000 - Fax 051.236507

Geoman Ltd.

Project Title.....: BCA School, Methyr

Cross Section.....: 1-1

Site.....: Wall 03

Folder.....: 23-6011

File.....: MS23-6011-F1-08 Tiered Section Wall Checks

Date.....: 08/30/2024

Checks according to: BS 8006-1:2010
 Wall - Cat. 2 (medium)

TABLE OF CONTENTS

SOIL PROPERTIES

Soil: CLASS 6I	Description: Class 6I
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 35.00
Ru value.....	: 0.00
Weight Class.....	: Mass of the reinforced soil body
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: FOUNDATION	Description: firm to stiff CLAY
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Foundation soil
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

Soil: RETAINED	Description: Class 1/2C Upfill
Cohesion Class.....	: Soil material factor c'
Cohesion.....	[kN/m ²].....: 0.00
Friction Angle Class.....	: Soil material factor $\tan(\phi)$
Friction Angle.....	[°].....: 28.00
Ru value.....	: 0.00
Weight Class.....	: Earth pressure (mass of the backfill) behind the structure
Bulk unit weight - above GWT.....	[kN/m ³].....: 19.00
Bulk unit weight - below GWT.....	[kN/m ³].....: 19.00
Elastic Modulus.....	[kN/m ²].....: 0.00
Poisson's ratio.....	: 0.30

STRATA PROFILES

Stratum: CLASS 6I		Description:					
Soil : CLASS 6I							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
25.03	264.94	25.46	265.85	25.98	267.15	28.00	267.15
28.49	268.45	30.65	268.45	31.08	269.62	33.42	269.63

Stratum: FOUNDATION		Description:					
Soil : FOUNDATION							
X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	263.63	25.03	264.94	25.30	264.87	27.89	264.87
28.00	265.17	50.00	266.83				

Stratum: RETAINED

Description:

Soil : RETAINED

X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
28.00	265.17	28.60	266.73	30.06	266.73	30.51	267.90
32.76	267.90	33.42	269.63	50.00	269.63		

Stratum: TOE

Description:

Soil : RETAINED

X	Y	X	Y	X	Y	X	Y
[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
0.00	265.85	25.46	265.85				

REINFORCED BLOCKS
Block : GTM

Block dimensions.....[m].....: Base width.....= 2.50 Height.....= 2.28
 Block Origin.....[m].....: Abscissa.....= 25.00 Ordinate..= 264.90
 Face inclination.....[°].....: 23.00

Structural embankment type.....: Gravel
 Structural embankment.....: CLASS 6I
 Backfill soil.....: RETAINED
 Covering soil.....: CLASS 6I
 Foundation soil.....: FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.50
 Natural soil slope.....[°] : 3.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m].....= 2.50
 Vertical spacing.....[m].....= 0.76
 Wrapped length.....[m].....= 0.67

Linear Composites - ParaGrid - 50

Length.....[m].....= 2.50
 Vertical spacing.....[m].....= 0.76
 Offset.....[m].....= 0.00

Block : GTM2

Block dimensions.....[m].....: Base width.....= 2.00 Height.....= 1.52
 Block Origin.....[m].....: Abscissa.....= 27.45 Ordinate..= 266.93
 Face inclination.....[°].....: 23.00

Structural embankment type.....: Gravel
 Structural embankment.....: CLASS 6I
 Backfill soil.....: RETAINED
 Covering soil.....: CLASS 6I
 Foundation soil.....: FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.00
 Natural soil slope.....[°] : 0.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m].....= 2.00

Vertical spacing.....[m]..... = 0.76
 Wrapped length.....[m]..... = 0.67

Block : GTM3

Block dimensions.....[m]..... : Base width..... = 2.00 Height..... = 1.52
 Block Origin.....[m]..... : Abscissa..... = 30.45 Ordinate..... = 268.20
 Face inclination.....[°]..... : 23.00

Structural embankment type..... : Gravel
 Structural embankment..... : CLASS 6I
 Backfill soil..... : RETAINED
 Covering soil..... : CLASS 6I
 Foundation soil..... : FOUNDATION

Brinch Hansen, Vesic or Meyerhof bearing capacity parameters

Embedment depth.....[m] : 0.00
 Natural soil slope.....[°] : 0.00

Reinforcements pattern :

Maccaferri - Green Terramesh - 8/2.2 P

Length.....[m]..... = 2.00
 Vertical spacing.....[m]..... = 0.76
 Wrapped length.....[m]..... = 0.67

SURCHARGE LOADS
Distributed Loads : 20KPA

Description :

Class : Traffic load behind reinforced soil block

Magnitude.....[kN/m²]..... = 20.00 Inclination angle.....[°]..... = 0.00
 Abscissa.....[m]..... : from = 35.00 To = 50.00

PROPERTIES OF THE USED REINFORCEMENTS

Linear Composites - ParaGrid - 50

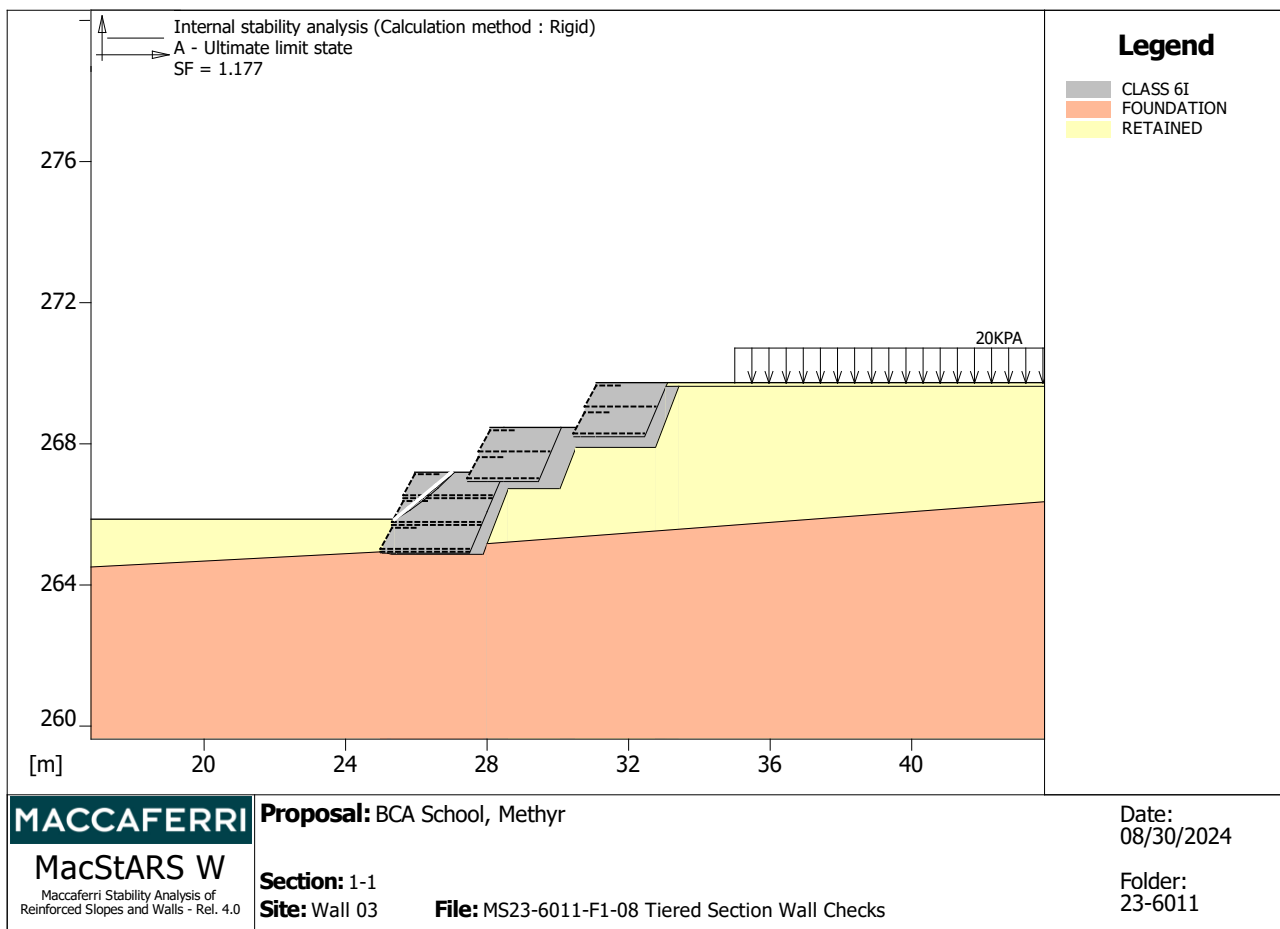
Tensile strength UTS.....[kN/m]..... : 50.00
 Plastic extension ratio..... : 0.00
 Elastic extension coefficient.....[m³/kN]..... : 1.10e-04
 Reinforcement Stiffness.....[kN/m]..... : 556.00
 Minimum anchorage length.....[m]..... : 0.15
 Breakage Safety Factor (gravel)..... : 1.54
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sand)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (silty sand)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Breakage Safety Factor (sandy clay)..... : 1.52
 Pull-out Safety Factor..... : 1.00
 Interaction factor reinforcement/reinforcement..... : 0.16
 Pullout coefficient reinforcement-gravel..... : 0.90
 Pullout coefficient reinforcement-sand..... : 0.90
 Pullout coefficient reinforcement-silt..... : 0.70
 Pullout coefficient reinforcement-clay..... : 0.40

Maccaferri - Green Terramesh - 8/2.2 P

Tensile strength UTS.....[kN/m]..... : 35.00
 Plastic extension ratio..... : 2.00
 Elastic extension coefficient.....[m³/kN]..... : 1.10e-04
 Reinforcement Stiffness.....[kN/m]..... : 350.00

Minimum anchorage length.....[m].....:	0.15
Breakage Safety Factor (gravel).....:	1.26
Pull-out Safety Factor.....:	1.00
Breakage Safety Factor (sand).....:	1.09
Pull-out Safety Factor.....:	1.00
Breakage Safety Factor (silty sand).....:	1.09
Pull-out Safety Factor.....:	1.00
Breakage Safety Factor (sandy clay).....:	1.09
Pull-out Safety Factor.....:	1.00
Interaction factor reinforcement/reinforcement.....:	0.30
Pullout coefficient reinforcement-gravel.....:	0.90
Pullout coefficient reinforcement-sand.....:	0.65
Pullout coefficient reinforcement-silt.....:	0.50
Pullout coefficient reinforcement-clay.....:	0.30

CHECKS RESULTS



Internal Stability :

Multiplier combination : A - Ultimate limit state

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.177

Surfaces searching range
Arrival range, abscises [m]
Block GTM First point 27.00 Second point 45.00
Number of starting point on the starting segment.....: 1
Total number of trial surfaces.....: 100
Minimum base length of slices.....[m].....: 0.50
Superior limit search angle.....[°].....: 0.00
Inferior limit search angle.....[°].....: 0.00

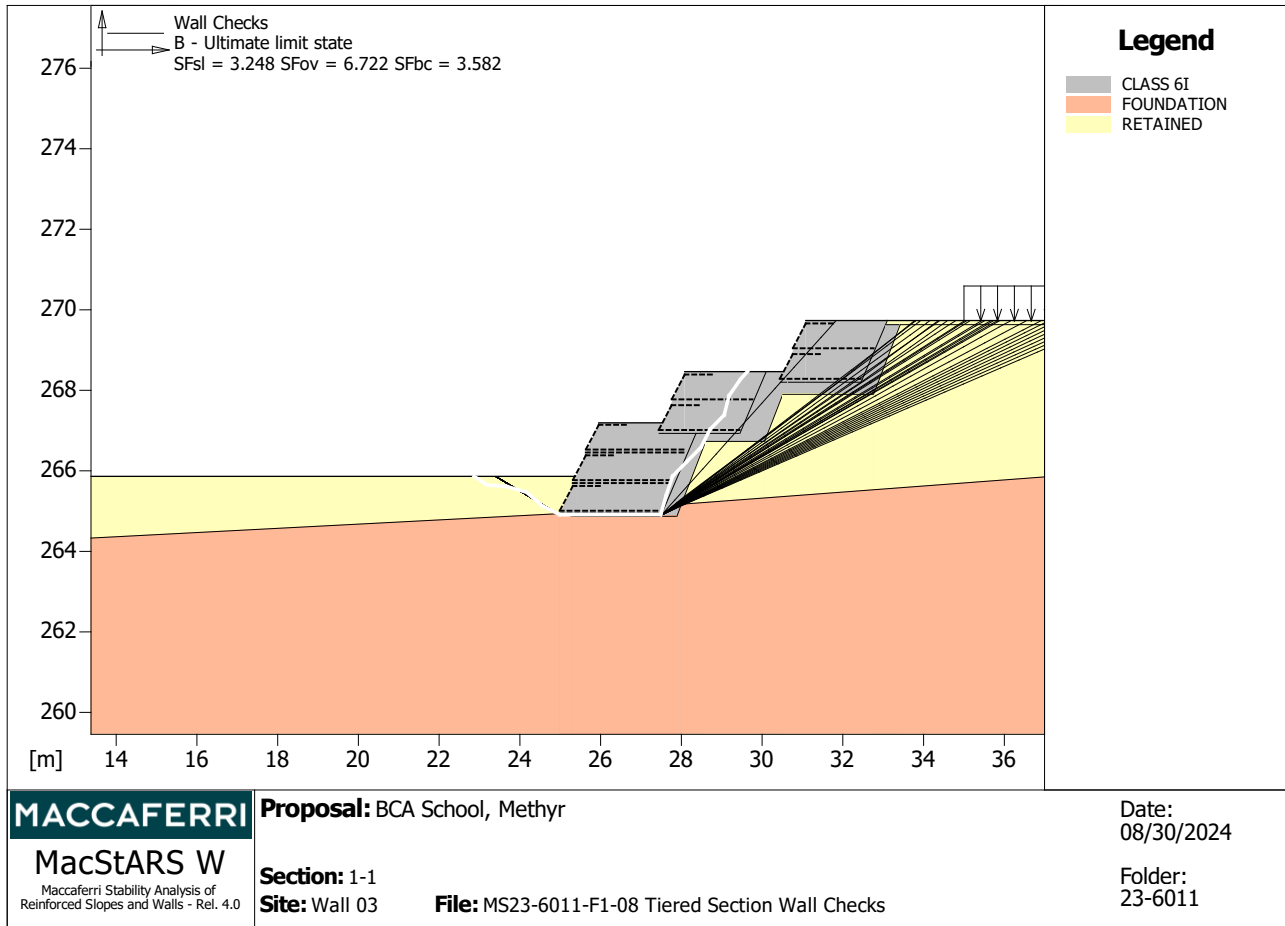
Block : GTM
Maccaferri - Green Terramesh - 8/2.2 P

Y	Tb breakage	Tp pullout	Td design	Tb/Td 1/Fmax	Tp/Td
[m]	[kN/m]	[kN/m]	[kN/m]		
1.520	35.0	2.0	1.6	21.88	1.25

Block : GTM
Linear Composites - ParaGrid - 50

Y	Tb	Tp	Td	Tb/Td	Tp/Td
---	----	----	----	-------	-------

	breakage	pullout	design	1/Fmax	
[m]	[kN/m]	[kN/m]	[kN/m]		
1.520	50.0	2.0	1.5	33.33	1.33
Multiplier	Class				
1.50	Traffic load behind reinforced soil block				
1.00	Soil material factor $\tan(\phi)$				
1.60	Soil material factor c'				
1.00	Soil material factor c_u				
1.50	Earth pressure (mass of the backfill) behind the structure				
1.00	Foundation soil				
1.50	Mass of the reinforced soil body				
1.00	Category of structure				
1.30	Pull-out factor (= $f_p \times f_n$)				
1.00	Danger level of the work				



Wall Checks :

Multiplier combination : B - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 88.75

Active force.....[kN/m].....: 21.02

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 3.248

Restoring moment.....[kN*m/m].....: 236.63

Overturning moment.....[kN*m/m].....: 35.20

Overturning class.....: Overturning

Overturning safety factor.....: 6.722

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 250.00

Active pressure.....[kN/m²].....: 51.70

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 3.582

Equivalent bearing area.....[m].....: 2.50

Eccentricity of normal force.....[m].....: -0.31

Lever arm of overturning force.....[m].....: 1.67

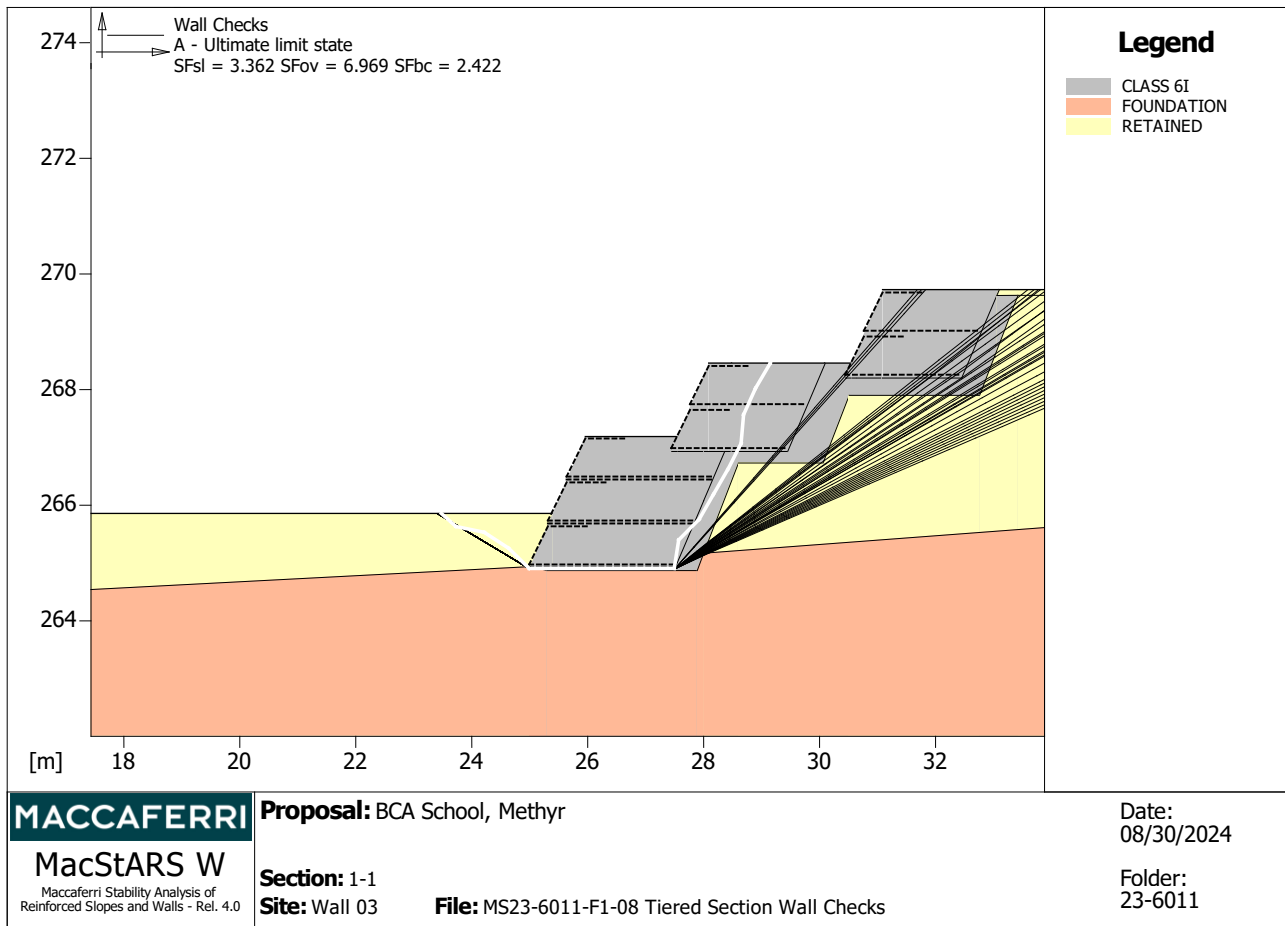
Normal force on the base.....[kN].....: 129.26

Outer edge stress.....[kN/m²].....: 1.21

Inner edge stress.....[kN/m²].....: 136.06

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu

1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= $f_p \times f_n$)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning



Wall Checks :

Multiplier combination : A - Ultimate limit state

Considered block : GTM

Resisting force.....[kN/m].....: 131.25

Active force.....[kN/m].....: 30.03

Sliding class.....: Sliding along base of structure

Sliding safety factor.....: 3.362

Restoring moment.....[kN*m/m].....: 354.54

Overturning moment.....[kN*m/m].....: 50.88

Overturning class.....: Overturning

Overturning safety factor.....: 6.969

Imposed ultimate bearing pressure

Ultimate bearing pressure.....[kN/m²].....: 250.00

Active pressure.....[kN/m²].....: 76.46

Pressure class.....: Bearing capacity

Bearing capacity safety factor.....: 2.422

Equivalent bearing area.....[m].....: 2.50

Eccentricity of normal force.....[m].....: -0.34

Lever arm of overturning force.....[m].....: 1.69

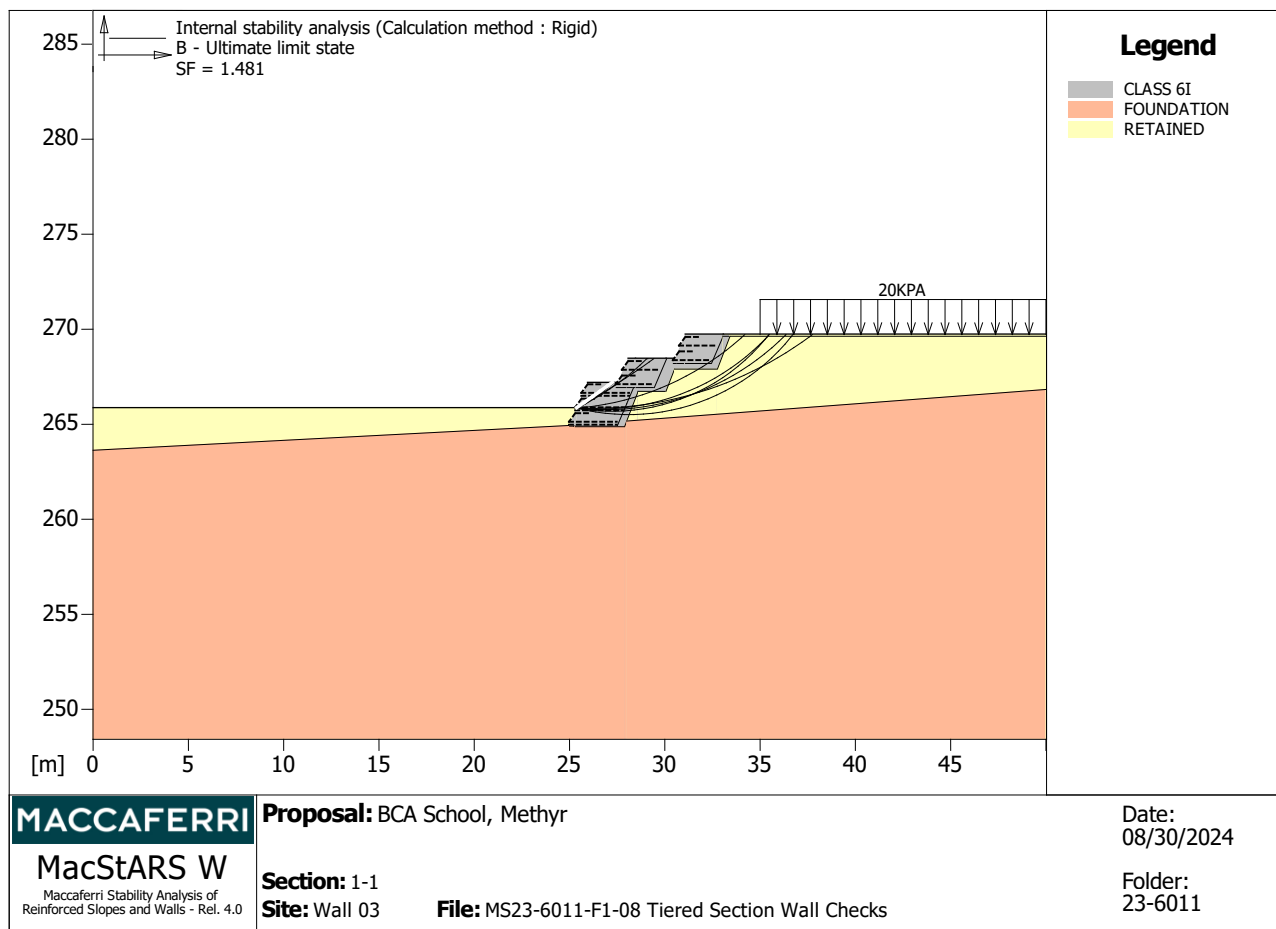
Normal force on the base.....[kN].....: 191.16

Outer edge stress.....[kN/m²].....: -11.98

Inner edge stress.....[kN/m²].....: 221.71

Multiplier	Class
1.50	Traffic load behind reinforced soil block
1.00	Soil material factor tan(phi)
1.60	Soil material factor c'
1.00	Soil material factor cu

1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.50	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor (= $f_p \times f_n$)
1.30	Sliding along base of structure
1.35	Bearing capacity
1.00	Overturning



Internal Stability :

Multiplier combination : B - Ultimate limit state

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor.....: 1.481

Surfaces searching range
Arrival range, abscises [m]
Block GTM First point 27.20 Second point 45.00
Number of starting point on the starting segment.....: 1
Total number of trial surfaces.....: 100
Minimum base length of slices.....[m].....: 0.50
Superior limit search angle.....[°].....: 0.00
Inferior limit search angle.....[°].....: 0.00

Block : GTM
Maccaferri - Green Terramesh - 8/2.2 P

Y	Tb breakage	Tp pullout	Td design	Tb/Td 1/Fmax	Tp/Td
[m]	[kN/m]	[kN/m]	[kN/m]		
1.520	35.0	1.9	1.5	23.33	1.27

Block : GTM
Linear Composites - ParaGrid - 50

Y	Tb breakage	Tp pullout	Td design	Tb/Td 1/Fmax	Tp/Td
[m]	[kN/m]	[kN/m]	[kN/m]		

1.520	50.0	1.9	1.5	33.33	1.27
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Multiplier	Class
1.00	Traffic load behind reinforced soil block
1.00	Soil material factor $\tan(\phi)$
1.60	Soil material factor c'
1.00	Soil material factor c_u
1.50	Earth pressure (mass of the backfill) behind the structure
1.00	Foundation soil
1.00	Mass of the reinforced soil body
1.00	Category of structure
1.30	Pull-out factor ($= f_p \times f_n$)
1.00	Danger level of the work

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