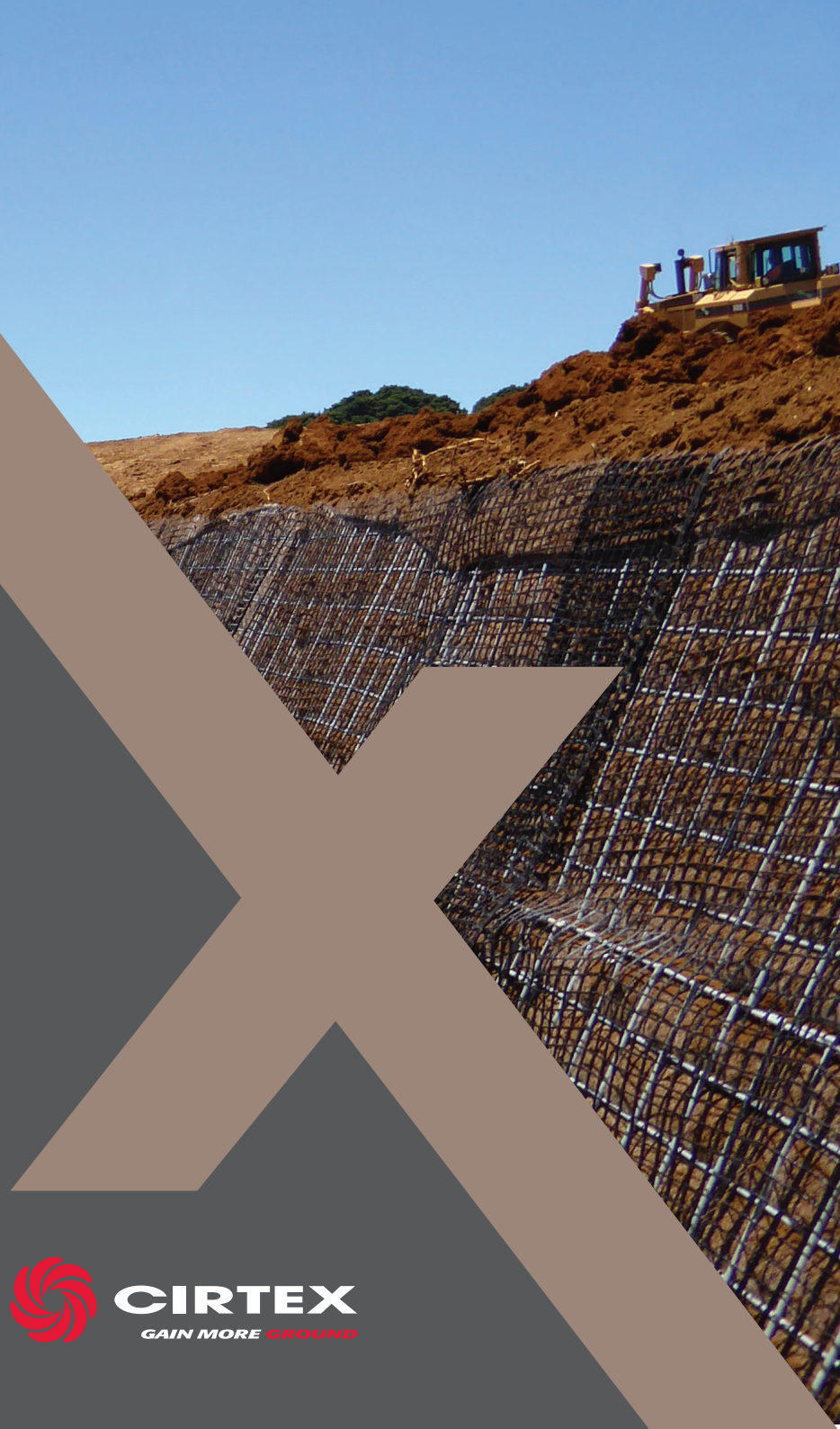
DESIGN TOOLBOX

CIRTEX ADVANCED DESIGN SOLUTIONS

REINFORCED SOIL WALL & SLOPE DESIGN

Designing **Reinforced Soil Walls** and **Slopes** with Geogrid.



CIRTEX

GAIN MORE GROUND

DESIGN TOOLBOX

CIRTEX ADVANCED DESIGN SOLUTIONS

Practical Design Assistance for Geogrid Reinforced Walls and Slopes.

TOOLBOX CONTENTS

- Checklist to identify project parameters
- Product Information
- Using the Cirtex® Concept Design Service
- Project Design output
- Specification sheet
- CAD details and drawings
- Installation Guides & Methodology
- Project Design options

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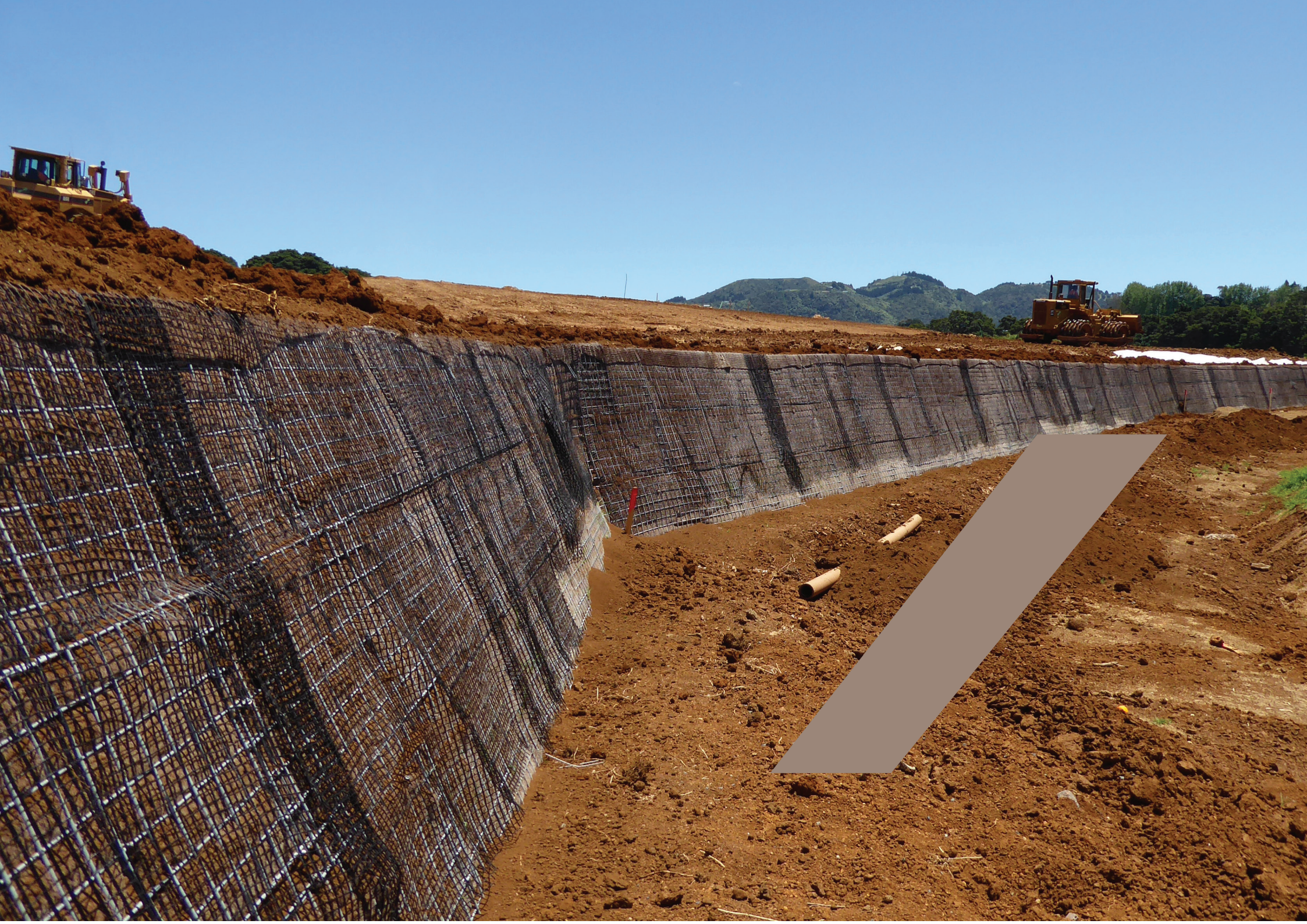


PROJECT DETAILS FOR DESIGN OF A CIRTEX REINFORCED SOIL STRUCTURE

PROJECT DETAILS

Project Name:

Project No.:

Location:

Client:

CONTACT DETAILS

Company:

Engineer:

Contractor:

Phone:

Email:

Date:

APPLICATION

Wall (≥ 70˚) ☐ Slope (< 70˚) ☐

GEOMETRY

H_1(m) = β_1 =

H_2(m) = β_2 =

H_3(m) = β_3 =

a(m) = b(m) =

q (kPa) =

FACING

☐ Vegetated ☐ DuraGreen

☐ Segmental Blocks ☐ DuraMesh

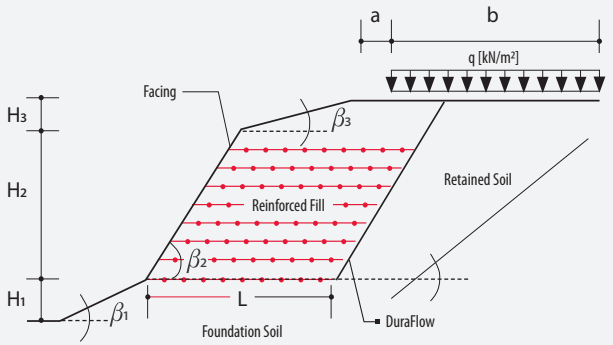
☐ Gabions ☐ DuraSlope

☐ Other:

PGA

Horizontal = Vertical =

COMMENTS:



Ground water level

Soil parameters (design values)

γ = c = φ Retained Soil

γ = c = φ Reinforced Fill

γ = c = φ Foundation Soil

Other:

Design cross-section with dimensions

Enclosures: [page(s)]

☐ Please contact me

Design needed by:

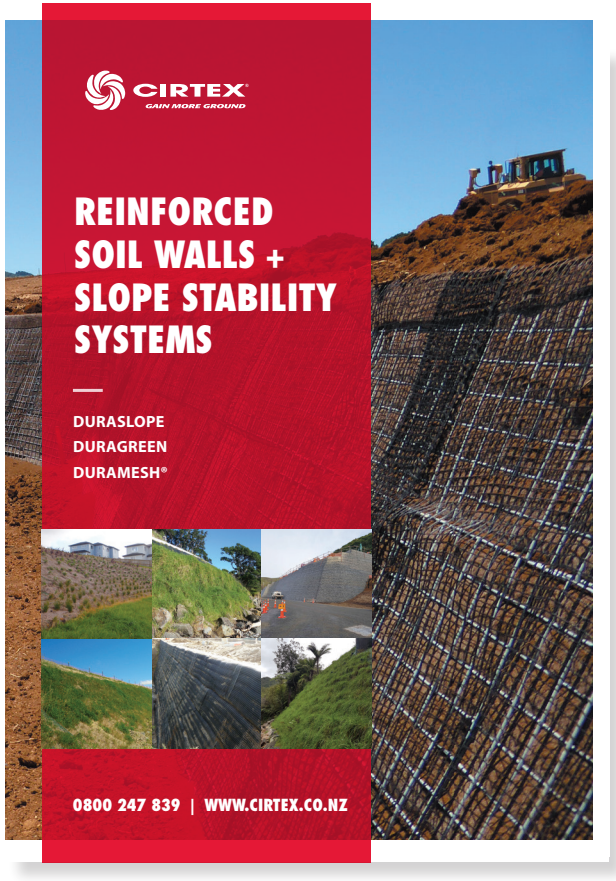
PRODUCT INFORMATION

Within this pack you will find a copy of the Cirtex Reinforced Soil Walls Brochure. If missing contact Cirtex call 0800 CIRTEX (247 839), email INFO@CIRTEX.CO.NZ or visit WWW.CIRTEX.CO.NZ.

DuraSlope™ - For slopes 45˚ and less with vegetated facing.

DuraGreen™ - For slopes 45˚- 70˚ with vegetated facing.

DuraMesh® - For slopes and walls 70˚- 90˚ with vegetated or stone facing.



DESIGN ASSISTANCE FOR WALLS & SLOPES

Within this pack you will find a copy of the Cirtex Reinforced Soil Walls Brochure. If missing contact Cirtex call 0800 CIRTEX (247 839), email INFO@CIRTEX.CO.NZ or visit WWW.CIRTEX.CO.NZ.

Cirtex offers design support for reinforced soil walls and slopes as set out in section 9 of this tool box. Cirtex has recognised design software packages which can be used free of charge to assist the engineer to design soil reinforced structures.

However, Cirtex would like to highlight the benefits of submitting your design parameters to our qualified design team for site specific design and therefore taking advantage of a much wider package of design tools.

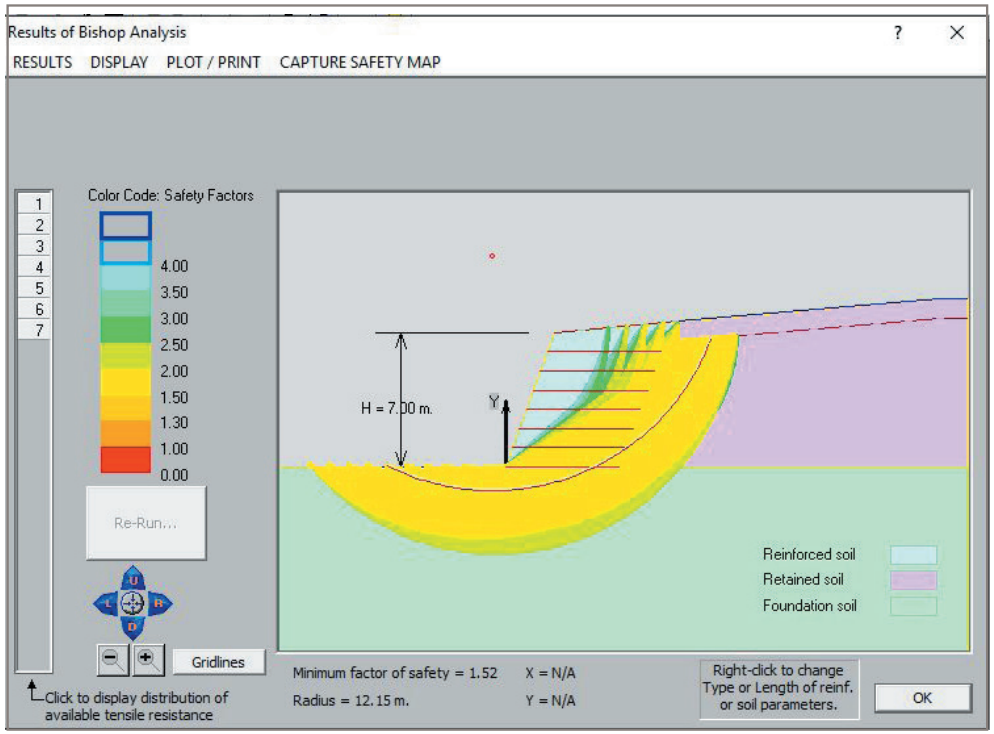
Fill in the data input sheet attached to this designer's tool box and forward to the team, or call for one of our specialist sales team to visit and discuss your project.

BENEFITS OF UTILISING THE CIRTEX DESIGN TEAM ANALYSIS...

- We have qualified engineers and technicians with 10+ years experience who are familiar with geosynthetic application in civil engineering
- We have a wide range of design tools and software packages for providing a more reliable solution
- We are not limited to one brand of geogrid which may not be the most cost effective in every case
- We have the ability to adjust all the inputs on a case by case basis as the latest testing and standards become available
- We can integrate multiple reinforcement mechanisms in one wall to optimise performance

PROJECT DESIGN OUTPUT

Cirtex will present your Project Concept in a concise and attractive package which not only provides all the relevant data and analysis to demonstrate that the design is technically sound, but also assists you to present this to your client and demonstrates the benefits of the system.



Professional Analysis

On-site assessment by experienced Cirtex Staff

Concise Project Concept

Interpretation and CAD Drawings

CIRTEX REINFORCED SOIL WALLS & SLOPES SPECIFICATIONS

Here you will find the product specifications required for a range of solutions. These outline the key performance criteria required from the product to ensure your project is a success, and are also available in PDF format as required. Full product data sheets are available from www.cirtex.co.nz

SPECIFICATIONS FOR PRODUCT REQUIRED FOR REINFORCES SOIL APPLICATIONS

GEOGRID SPECIFICATION

Primary reinforcement shall be Cirtex Geogrid of the grade listed in the construction drawings. Primary reinforcement shall have the following minimum values and characteristics: -

- Long Term Design Strength as per Cirtex Data sheet
- Creep Reduction Factor no more than 1.45 to limit long term creep of the structure
- Manufactured from High Tenacity Polyester Yarn with protective coating
- Molecular weight, Mn > 30,000 g/mol
- Carboxyl End Group, CEG of <25 mmol/kg
- Manufactured to ISO 9001 QA Program
- Must be NZTA Approved

DRAINAGE COMPOSITE SPECIFICATION

Drainage composite to be placed between the retained soil and the reinforced zone is to be Cirtex DuraFlow and must have the following minimum values and characteristics: -

- High flow HDPE drainage net with non-woven needle punched geotextile both sides
- Thickness at 200 kPa > 5mm
- Geotextile Mass ≥ 120 gsm
- Tensile strength ≥ 17 kN/m
- Water Flow in plane 1.1 l/m/s @ 50 kPa and i = 1.0

PIPE FILTRATION SPECIFICATION

Drainage Pipe at the base of the DuraFlow must be 110mm punched drainpipe (or 160mm if directed by the site engineer) and must conform to NZTA F/5, and be wrapped with Cirtex Filter Sleeve. Pipes must be bedded in a no fines filter aggregate and the base of the DuraFlow should be placed over the pipe to ensure continuous water flow. Please note the knit structure and pore size of Filter Sleeve is critical to the performance. Filter Sleeve used must have a current RMS 3553 specification compliance.

FOR DURAMESH WALLS ADD... STEEL FACING PANELS

Steel Facing Panels to be Cirtex DuraMesh welded panels and have the following minimum performance characteristics

- Dimensions 600mm x 600mm x 2.4m
- Minimum 6mm diameter wire welded mesh
- Maximum opening size 75mm
- Heavy Zinc Galvanized coating
- 4 x 70° locking braces per panel

BIODEGRADABLE FACING MAT

Facing Mat placed behind the DuraMesh panel is to be Cirtex BioCoir BC450 or BC450JR and comply with the following specifications

- Minimum Mass 450 gsm
- Minimum tensile strength 1.9 kN/m
- Minimum thickness 5mm

FOR DURAGREEN ADD... FACING SOCK

DuraGreen facing sock is to be Cirtex knitted Erosion Control sock made from PET yarn for UV stability, and must have a minimum diameter when placed of 200mm. Jute Bags may be used at the discretion of the engineer for sites where very short term bag life is acceptable.

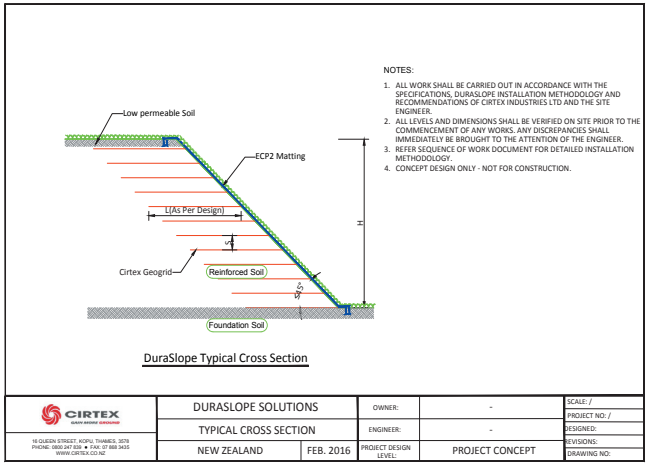
FOR DURASLOPE ADD... SURFACE EROSION AND SCOUR CONTROL MATTING

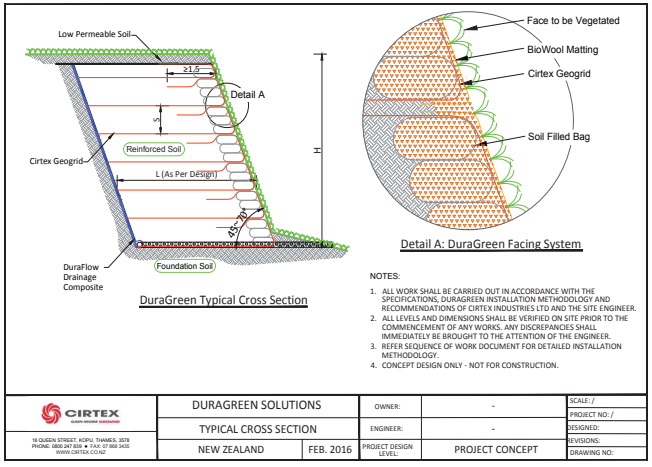
Surface Matting is to be Cirtex ECP2 matting and must conform with the following specifications

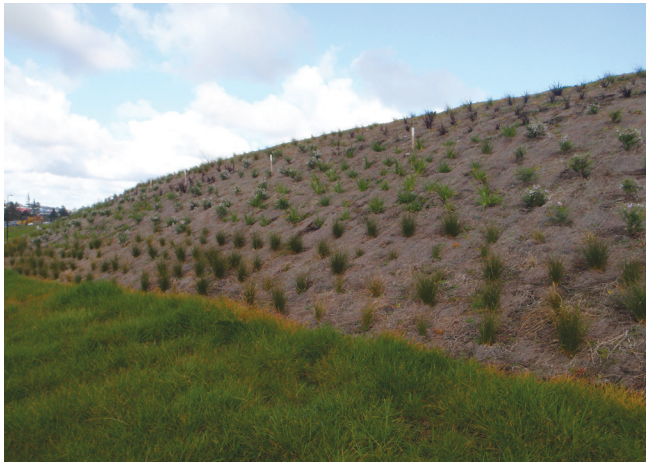
- Uniformly distributed 100% green polypropylene fibre and two medium-weight polypropylene nets
- Securely sewn together with UV stabilized thread
- Meet Type 5.A, 5.B and 5.C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) FP-03 Section 713.18.
- Mass ≥ 400 gsm
- Tensile Strength 5.8 kN/m
- Light Penetration 14%
- UV resistance 82% 1000 Hr accelerated test
- Vegetated Flow velocity 6.1 m/s
- Vegetated Shear stress 574 kPa

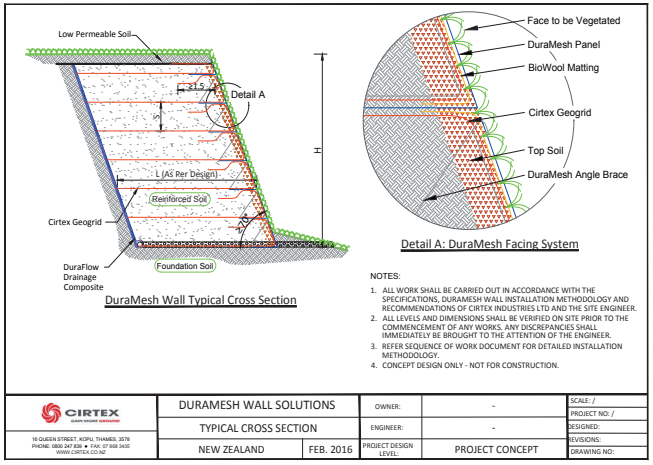
CAD DETAILS

Cirtex has a large number of CAD details for all Wall systems, which can be customised to your project. See below for some common examples.









INSTALLATION METHODOLOGIES

See the information section of this folder for comprehensive installation guidelines for DuraSlope™, DuraGreen™, DuraMesh™ and Gabion Faced MSE Wall and Slope Systems.

Phone Cirtex on 0800 247 839 or email info@cirtex.co.nz for a new copy, either printed copy or a .pdf version.

DURASLOPE
WALL SYSTEM

INSTALLATION GUIDELINES
IG G 001 026
Issue No. 04 JANUARY 2020

THESE INSTRUCTIONS ARE GENERAL AND THE INSTRUCTIONS OF THE PROJECT ENGINEER MAY OVERRIDE THESE INSTRUCTIONS.

Before beginning the contractor must have an understanding of the following key concepts relating to Reinforced Soil Construction:

- Drainage detail is of utmost importance. All drainage must be installed as per contract drawings. Surface water must be diverted away from the reinforced zone, and a collector system must be installed for ground water seepage from the retained zone.
- Geogrid placement, spacing and orientation are critical. Geogrids must be of the grade specified in the contract documents, and must be laid with the main strength direction running from the face of the wall to the back.
- Compaction of the subgrade and each reinforced layer is a critical design factor. The Project Engineer will require regular testing as set out in the Project Specification.

1. Prepare the foundation per the construction plans and specifications. Place and compact any soil required by the specifications and/or construction plans to achieve starting level. For cut structures: during the initial excavation be sure to excavate to the required geogrid embedment length. The geogrid embedment length is typically measured back from the front face of the reinforced soil structure. The prepared subgrade must now be rolled to achieve a firm surface. If a granular foundation pad is used this must be well compacted at this point to 98% MDD or as per project specification.
2. Lay out the StrataGrid® primary reinforcement on the subgrade. The geogrid shall be placed perpendicular to the wall face and should extend from the back of the wall horizontally to the face (toe point) then continue further out past the toe to allow for the wrap back if a wrap back is detailed in the design. Before unrolling the StrataGrid, verify required length and placement location. Measure and cut StrataGrid to the specified length. StrataGrid may be cut using a razor, scissors, sharp knife or other cutting tool. Care should be taken to avoid injury while cutting the StrataGrid.

CIRTEX GAIN MORE GROUND

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DURAGREEN
SLOPE SYSTEM

INSTALLATION GUIDELINES
IG G 001 025
Issue No. 02 JULY 2019

THESE INSTRUCTIONS ARE GENERAL AND THE INSTRUCTIONS OF THE PROJECT ENGINEER MAY OVERRIDE THESE INSTRUCTIONS.

Before beginning the contractor must have an understanding of the following key concepts relating to Reinforced Soil Construction:

- Drainage detail is of utmost importance. All drainage must be installed as per contract drawings. Surface water must be diverted away from the reinforced zone, and a collector system must be installed for ground water seepage from the retained zone.
- Geogrid placement, spacing and orientation are critical. Geogrids must be of the grade specified in the contract documents, and must be laid with the main strength direction running from the face of the wall to the back.
- Compaction of the subgrade and each reinforced layer is a critical design factor. The Project Engineer will require regular testing as set out in the Project Specification.

1. Prepare the foundation as per the construction plans and specifications. Place and compact any soil required by the specifications and/or construction plans to achieve starting level. For cut structures: during the initial excavation be sure to excavate to the required geogrid embedment length. The geogrid embedment length is typically measured back from the front face of the reinforced soil structure. The prepared subgrade must now be rolled to achieve a firm surface. If a granular foundation pad is used this must be well compacted at this point to 98% MDD or as per project specification.
2. Lay out the StrataGrid® primary reinforcement on the subgrade. The geogrid shall be placed perpendicular to the wall face and should extend from the back of the wall horizontally to the face (toe point) then a further 2.1m out past the toe to allow for the wrap back. Before unrolling the StrataGrid, verify required length and placement location. Measure and cut StrataGrid to the specified length. StrataGrid may be cut using scissors, sharp knife or other cutting tool. Care should be taken to avoid injury while cutting the StrataGrid.

CLICK HERE to view a Typical 3D Cross Section of a DuraGreen wall

CIRTEX GAIN MORE GROUND

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DURAMESH®
WALL SYSTEM

INSTALLATION GUIDELINES 70°
IG G 001 001
Issue No. 10 MAY 2020

THESE INSTRUCTIONS ARE GENERAL AND THE INSTRUCTIONS OF THE PROJECT ENGINEER MAY OVERRIDE THESE INSTRUCTIONS.

The contractor must have an understanding of the following key concepts relating to reinforced soil construction prior to the commencement of any construction:

- Drainage is of utmost importance. All drainage works shall be carried out as per contract drawings. Surface water shall be diverted away from the reinforced zone, and a collector system shall be installed for ground water seepage from the retained zone.
- Geogrid placement, spacing and orientation are critical. Geogrid shall be of the grade specified in the contract documents, and shall be laid with the main strength direction running from the face of the wall to the back.
- Compaction of the subgrade and each reinforced layer shall meet the compaction requirements (e.g. MDD). The project engineer will require regular testing as set out in the project specification.

1. Prepare the foundation as per the construction plans and specifications. Install the levelling pad (when required), place and compact granular soil as required by the specifications and/or construction plans to achieve starting level. Drainage system shall be constructed as per design. If cutting is involved, be sure to excavate to the required geogrid embedment length which is typically measured from the face of the reinforced soil structure to the cut face.
2. Place DuraMesh® panels at the proper elevation and stationing. Adjacent panels shall be butted together and hog ringed or laced with wire to maintain proper alignment during construction. Lay the BioWool™ matting up the inside of the DuraMesh® panel and clip top and bottom. If a fabric wrap is also specified, lay the fabric inside the BioWool™ matting wrap with the bottom length extending back 500mm from the panel face. Allow the fabric to also lie over the top face of the DuraMesh® panel.

CIRTEX GAIN MORE GROUND

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GABION FACED
MSE WALL SYSTEM

INSTALLATION GUIDELINES
IG G 001 001
Issue No. 08 SEPTEMBER 2020

THESE INSTRUCTIONS ARE GENERAL AND THE INSTRUCTIONS OF THE PROJECT ENGINEER MAY OVERRIDE THESE INSTRUCTIONS.

The contractor must have an understanding of the following key concepts relating to reinforced soil construction prior to the commencement of any construction:

- Drainage is of utmost importance. All drainage works shall be carried out as per contract drawings. Surface water shall be diverted away from the reinforced zone, and a collector system shall be installed for ground water seepage from the retained zone.
- Geogrid placement, spacing and orientation are critical. Geogrid shall be of the grade specified in the contract documents, and shall be laid with the main strength direction running from the face of the wall to the back.
- Compaction of the subgrade and each reinforced layer shall meet the compaction requirements (e.g. MDD). The project engineer will require regular testing as set out in the project specification.

1. Prepare the foundation as per the construction plans and specifications. Install the levelling pad (when required), and place and compact backfill soils as required by the specifications and/or construction plans to achieve starting level. For cut structures: during the initial excavation be sure to excavate to the required Geogrid embedment length. The Geogrid embedment length is typically measured back from the front face of the reinforced soil structure, not the back of the gabion.
2. Place the first layer of ACEGrid primary reinforcement on the foundation at the elevation shown on the plans. The Geogrid shall be placed perpendicular to the wall face and should extend from the face of the gabion to the back of the wall. Before unrolling AceGrid®, verify required length and placement location. Do not run the roll direction parallel to the face. Measure and cut AceGrid® to the specified length. AceGrid® may be cut using a razor knife, scissors, sharp knife or other cutting tool. Care should be taken to avoid injury while cutting the AceGrid®. Where required, adjacent sections of AceGrid® may butt each other at the face of the structure or overlap up to 300mm. AceGrid® cannot be spliced in the roll direction to achieve required embedment length. One continuous section of AceGrid® must be used to achieve the specified length face of the DuraMesh panel.

CIRTEX GAIN MORE GROUND

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PROJECT DESIGN OPTIONS

This text has been taken from Cirtex Project Design Options F 001 001 document. For the latest copy refer to our website **WWW.CIRTEX.CO.NZ** or phone **0800 CIRTEX (247 839)**

TECHNICAL SUPPORT

Technical support is our standard, no-cost customer support which is available by telephone, email or during sales representative's routine visits during normal business hours to provide support on our range of products and their suitability for a given project. This support can include data sheets, case studies and other relevant technical backup and a quotation if required.

This support is based on our understanding of your requirements and assumed or client supplied site information. Any specifications, sketches, plans or drawings provided by us do not necessarily relate specifically to a particular project or site, and should not be relied on as such.

Should you require further design assistance we can either offer our in house concept design service or alternatively, full 3rd Party Design which is provided by a 3rd party registered engineer.

PROJECT CONCEPTS

This level of support is normally carried out by our in house technical team and is very useful for establishing concepts used for proposals and costing purposes. Project Concepts can often form part of the full 3rd Party Design should you make a decision to obtain a 3rd Party Design at a later date. Outputs for this service will vary depending on the application and situation, however, will normally include reinforcement layout, type and strength required for reinforced slope and wall applications, anchor selection guidelines for Earth Anchoring applications, and CAD drawings and installation guidelines. Details of what will be provided can be discussed with one of our technical team. For earth anchoring applications a site pullout test is often included in the concept design phase.

This level of design carries no contractual warranty and a producer statement is not provided. This service is based on assumed or client supplied information. You should ensure that any outputs from a Project Concept service are checked by a suitable qualified and certified engineer instructed by you. Our technical team will provide the relevant calculations and drawings to your engineer and will cooperate with the engineer.

Any costs associated with this service will be discussed at the time of acceptance.

3RD PARTY DESIGN

If 3rd Party Design is required, it is carried out by a suitably qualified and registered 3rd party engineer. Prior to providing a quotation for this type of design, in depth discussion will be carried out to establish the exact requirements of the client and scope of the design. Each design is costed accordingly and based on the work involved to fulfil the requirements of the client. These costs will be defined in the engagement documentation. The Project Concept Design can often be utilised to reduce the overall cost to the client in this stage.

DESIGN TOOLBOX

CIRTEX ADVANCED DESIGN SOLUTIONS

CIRTEX INDUSTRIES LTD

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