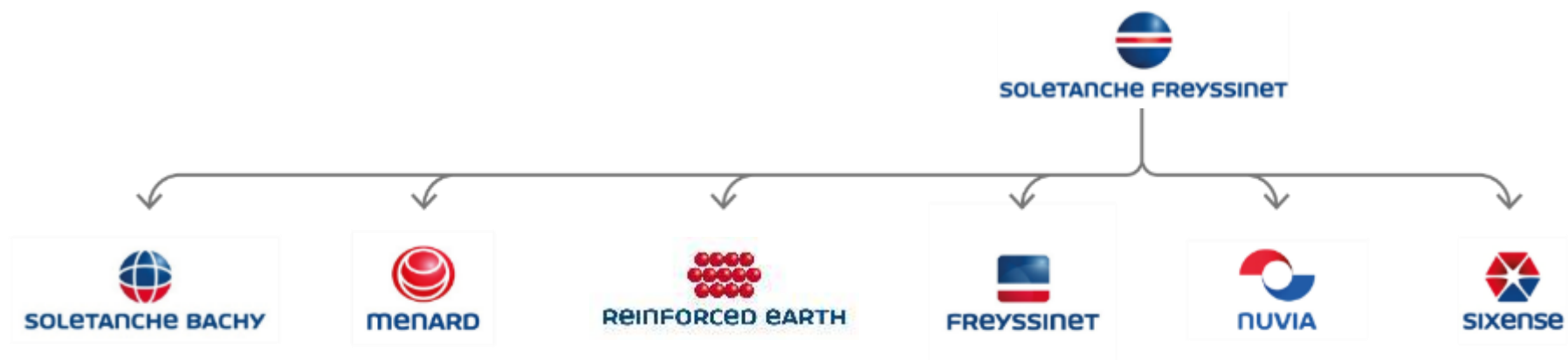




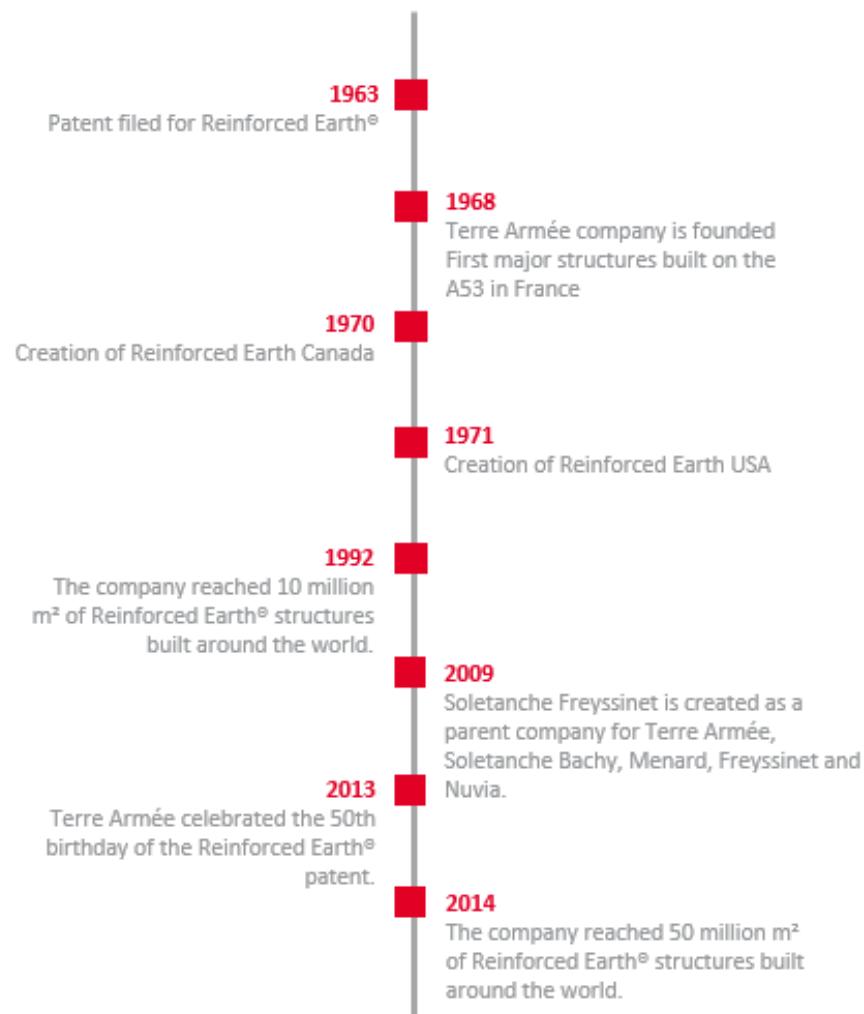
Soletanche Freyssinet, worldwide leader in specialized civil engineering



A global network



History and Key Figures



1200 employees



Present in **80** countries



300 Mn € of turnover in 2020



Over **66 Mn m²** built worldwide



Over **100,000** structures built around the world



The world's tallest Reinforced Earth® structure rises at **102,8m**



Henri Vidal, inventor of Reinforced Earth® in 1963

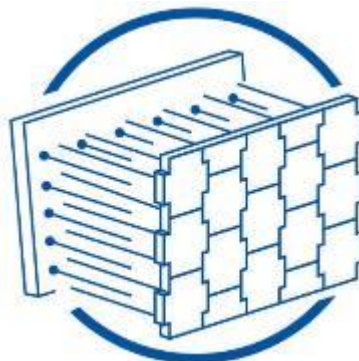
Terre Armée concentrates an unequalled combination of expertise and accumulated experience in **the fields of soil-structure interaction and engineered backfills.**

Terre Armée's portfolio of techniques applies to a **wide range of structures for an extended array of sectors:** roads and motorways, environment, railways, hydraulic works, mining, industry, energy, commercial, housing or military.

Our main solutions



Reinforced Earth®



TerraLink™



TechWall®



T-Wall®



TechSpan®



TechBox®

Our Services

MAJOR STAGES OF A PROJECT

Our teams are involved throughout the project, from the preliminary design, to engineering and construction.

1 DESIGN

The Reinforced Earth design office carries out an initial technical analysis and draws up a preliminary estimate based on the geotechnical conditions and the features of the engineering structure.



2 BID

The sales team coordinates with the design office to propose a detailed drawing of the structure, an associated construction timeline and a precise cost estimate.



3 CONSTRUCTION SURVEY

Following signature of the contract, the design office produces the drawings, engineering calculations and execution methods.



4 MATERIALS SUPPLY

The Operations department takes over for the design office and manages the supply of components directly.



5 CONSTRUCTION SERVICES

The components are delivered to the jobsite. The Operations team trains the contractor's personnel in building the structures according to design office specifications. Our team remains available to provide technical expertise.



Rail Expertise

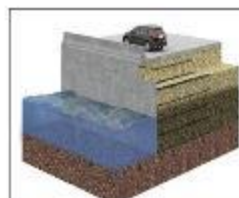
Some of
our many
innovative
solutions



info@reniforcedearth.co.uk

+44(0)1952 204357

Reinforced Earth® Applications in precast or wire mesh



Hydraulic
Ports | Sea walls | Rivers
Dams | Reservoirs | Bunds



Highways
Ramps Walls | Cuttings
Abutments | Wing Walls



Mining
Dump walls | Silos
Crusher walls | Rockfall bunds



Airports
Runway aprons | Extensions
Access roads



Residential | Commercial
Retaining walls



Rail & HS Rail
Ramp walls | Cuttings
Bridge Abutments

Alternative Reinforced Earth® Solutions

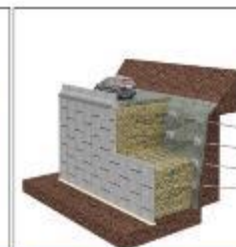
Over 60million m² installed



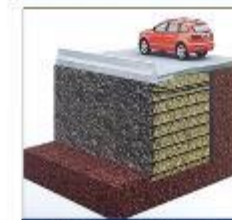
Mixed Abutments



Pure Integral Abutments



Shored Walls



Wire Faced | Mineral or Green



Green precast

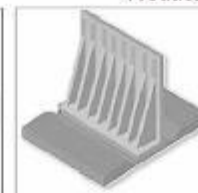


Steep Slopes

Products & Solutions



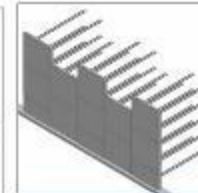
T-Wall
Stackable | Modular
1.5m to 20m+



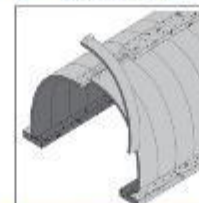
Tech-Wall
Counterfort Walls
6m+ to 15m



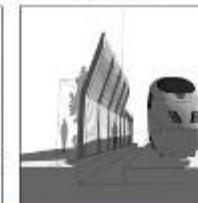
Copings
N1-N2 | H4A
Top Hats



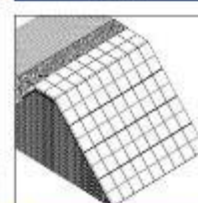
Reinforced Earth®
Precast Panels
Low Carbon



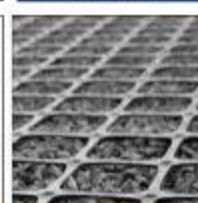
TechSpan
Precast Arches
Cut & Cover Tunnels



Noise Barriers
DLr | DLs
High Speed Rail | Roads



Precast Revetment
Individual Armor Blocks
Articulated Mats



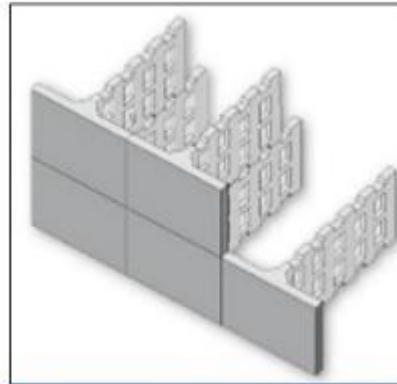
Geosynthetics
GeoGrids | GeoCells
GeoTextiles | Clay liners



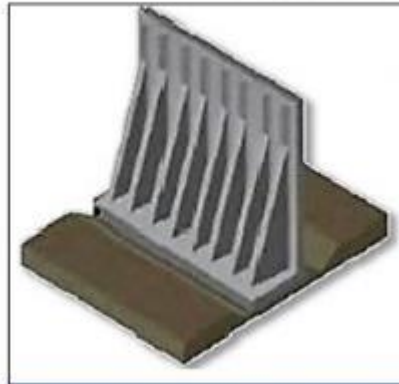
Aesthetic panel finishes

Low Carbon Precast solutions

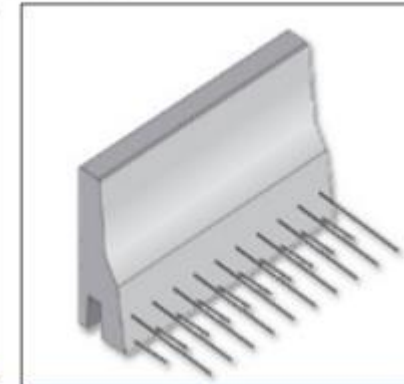
Precast solutions



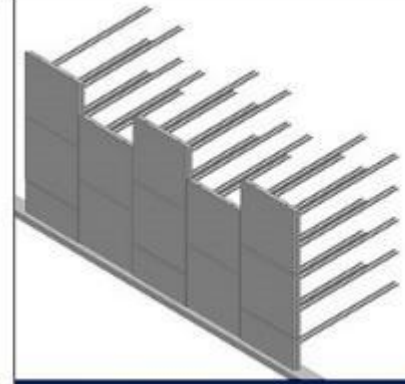
T-Wall
Stackable | Modular
1.5m to 20m+



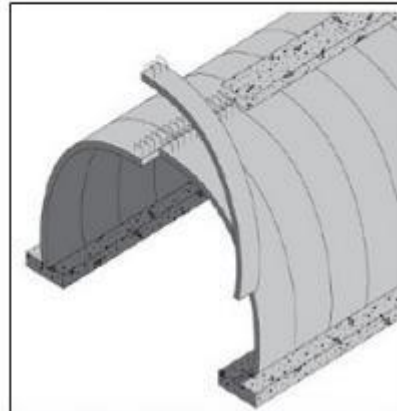
Tech-Wall
Counterfort Walls
6m+ to 15m



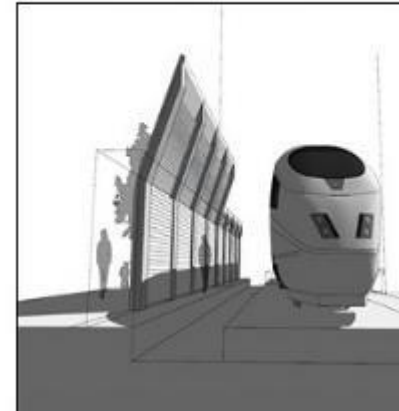
Copings
N1-N2 | H4A
Top Hats



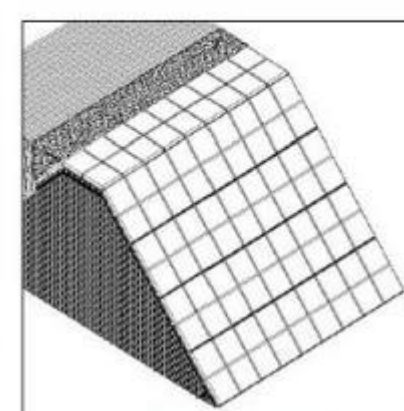
Reinforced Earth[®]
Precast Panels
1.5 x 1.5 x 0.14m



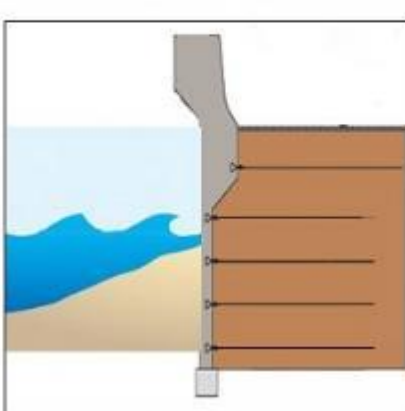
TechSpan
Precast Arches
Cut & Cover Tunnels



Noise Barriers
A5 | B4
High Speed Rail | Roads



Precast Revetment
Individual Armor Blocks
Articulated Mats



Piano Wall
Full height panel
Integral wave wall



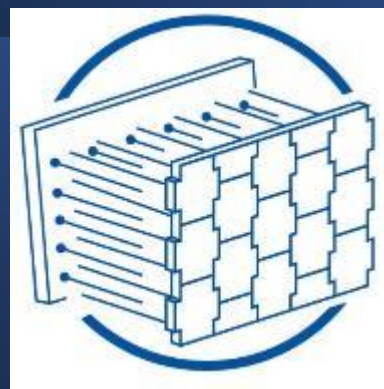
Aesthetic panel finishes



Reinforced Earth®



T-Wall®



TerraLink™



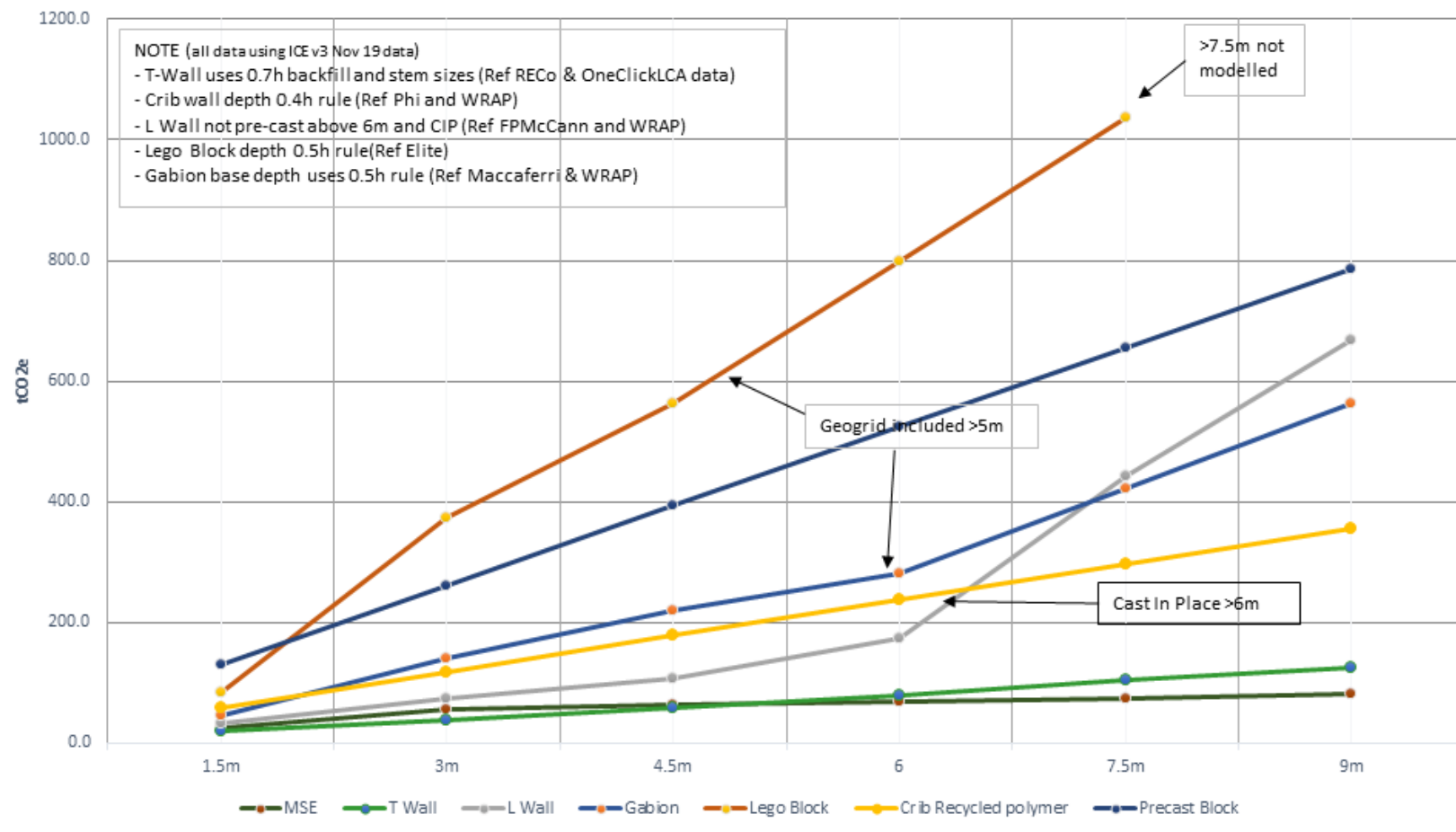
TechWall®



EcoDuct®

Low Carbon Solutions

tCO2e comparison for 100m length retaining wall at various heights Manufacture, Supply & Install (all materials) (Max surcharge on granular fill 10kN/m², all aggregates imported)



Uses

Alternative Reinforced Earth® Solutions Over 60million m² installed



Mixed Abutments
Spans over 40m



Pure Abutments
Spans over 40m



Shored Walls
Heights over 50m



Wire Faced | Mineral or Green
Heights over 50m



Green precast
Noise and GHG Absorber



Steep Slopes
>60° to 40m heights

World Class Solutions

- **Structural solutions**
 - Precast Retaining Walls
 - Bridge Abutments
 - Counterfort Wall & Pre-Cast
 - Wire mesh faced/green walls
 - Geosynthetics
 - Noise Barriers



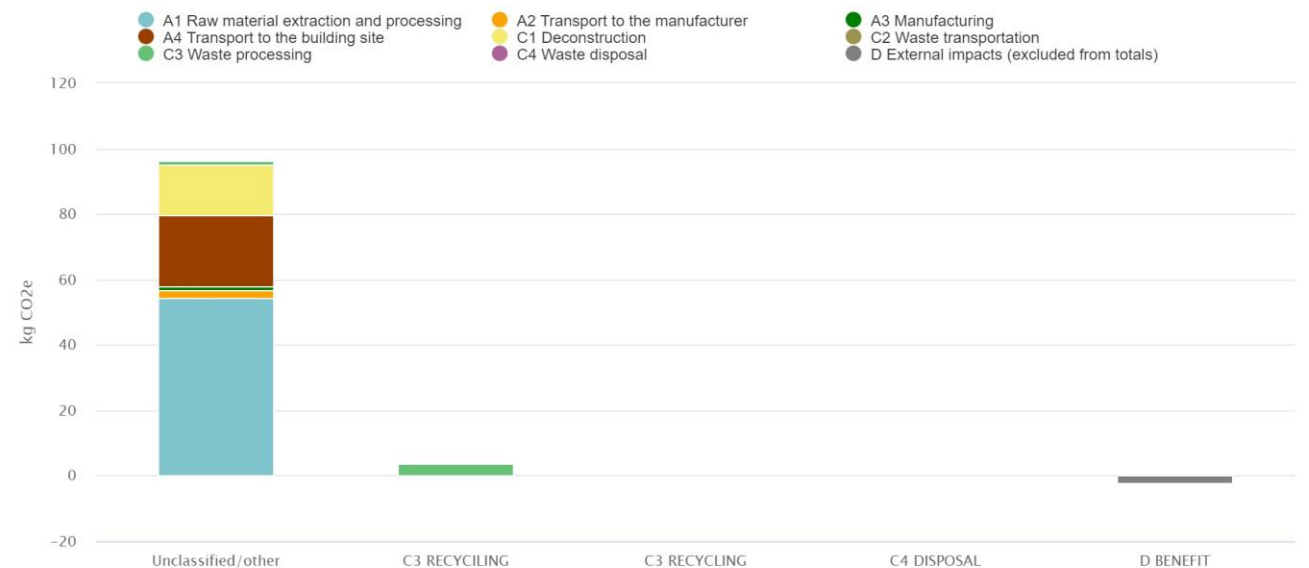
Reinforced Earth®
140mm panels +
geosynthetics.
Any surface
aesthetic.
BBA/HAPAS
Certified



Reinforced Earth®



Global warming (GWP) grouped by Classification breakdown





Kyung-Bu - South Korea



Shinkansen Shin-Onomochi - Japan



Gautrain - South Africa



Hannover Leinhausen - Germany



Bordeaux tramway - France



LRT Charlotte - USA

Global Expertise - Retaining walls supporting track beds



Vierzon - France



Route 417 – USA



Zonzeel - The Netherlands



Koprulu - Turkey



Shenton Park - Australia



Cambridge – United Kingdom

Global Expertise - Bridge abutments spanning railway lines



Nye Bane Kobenhavn-Ringsted HS Rail 2015

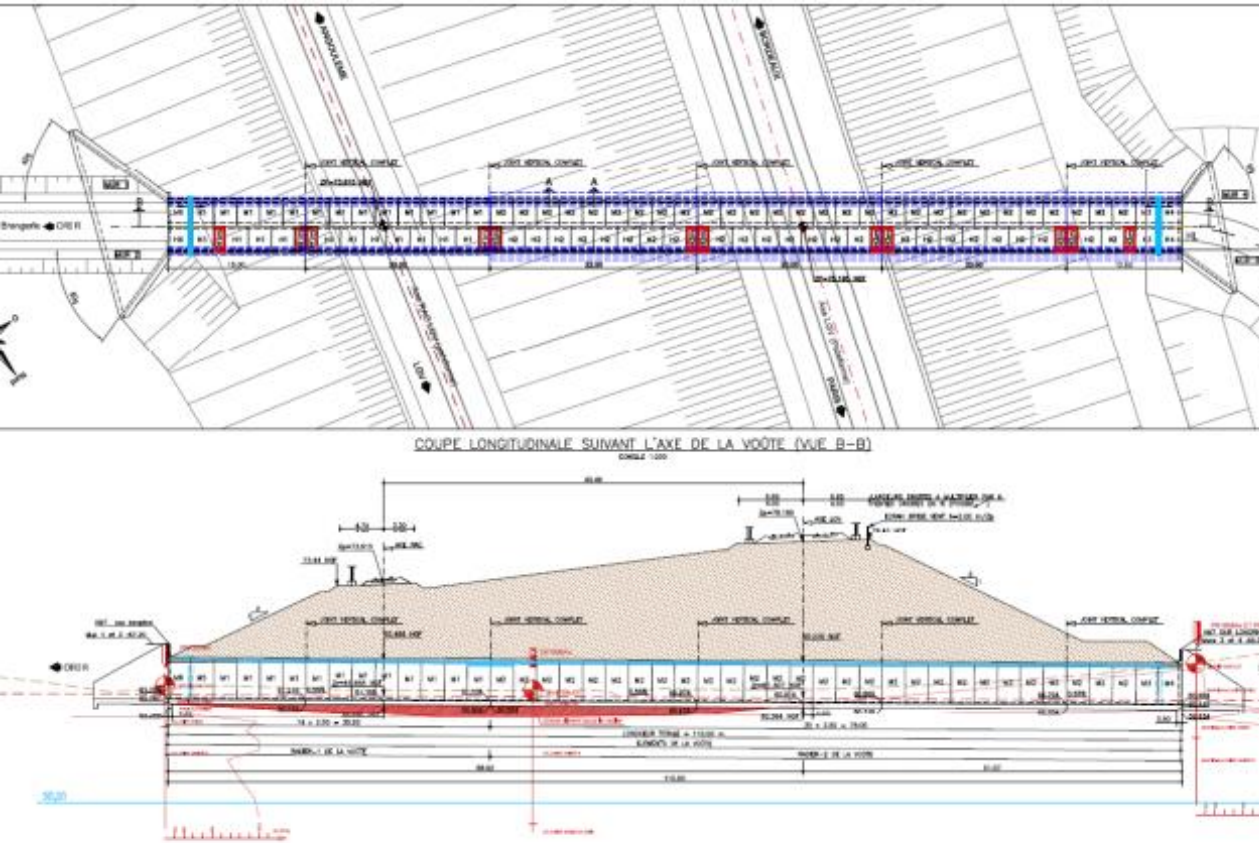
CROSS BUSINESS LINE

TechSpan® Precast Arches

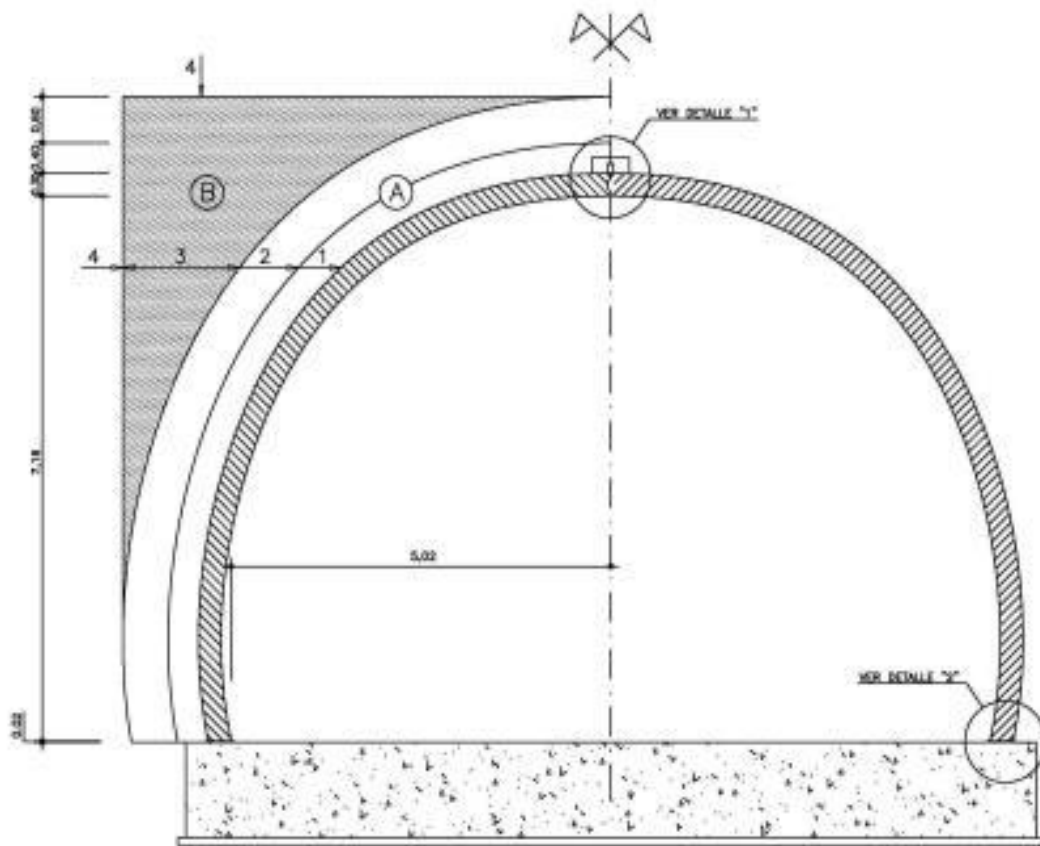
F U N I C U L A R S H A P E S E R I E S

Global precast arch/Greenbridge expertise

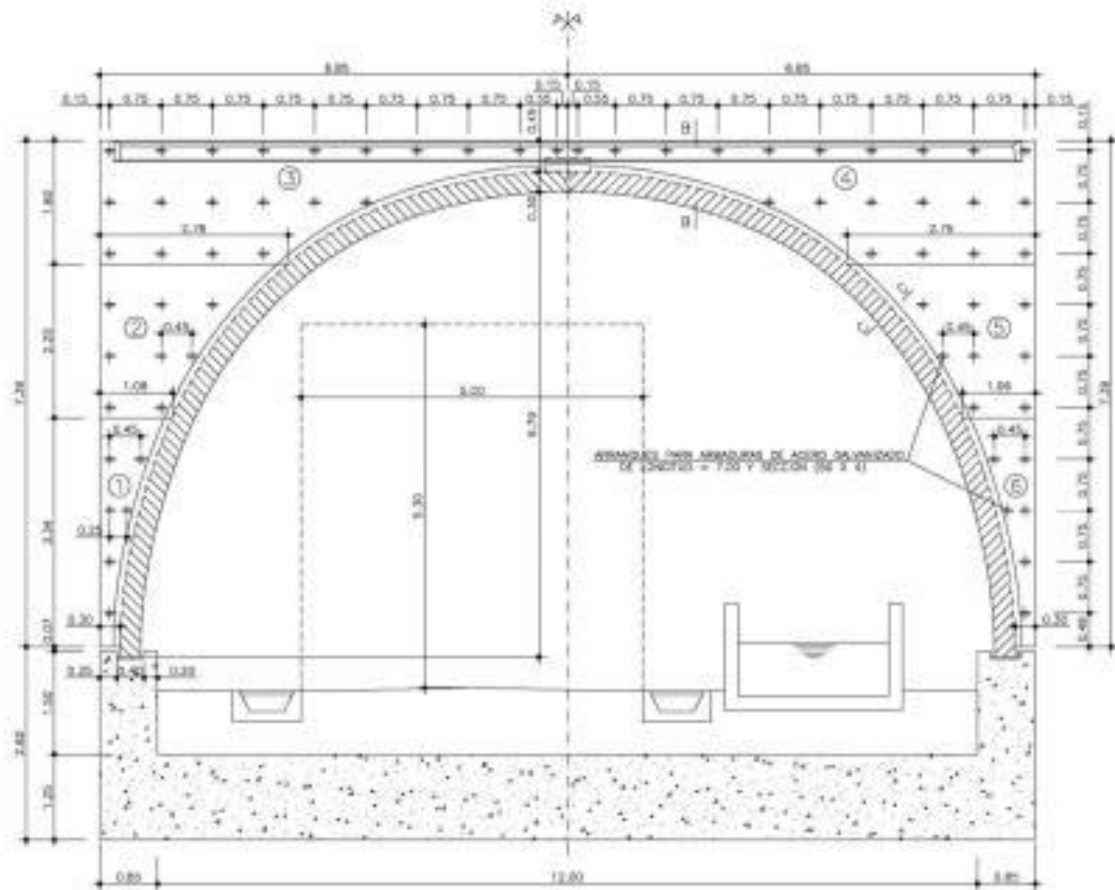
OCTOBER 2018



Hydraulic culvert under HS TGV France



HS underpass Spain |



HS underpass Spain



Greenbridges



EcoDucts



Multiple & large spans



Rockfall protection



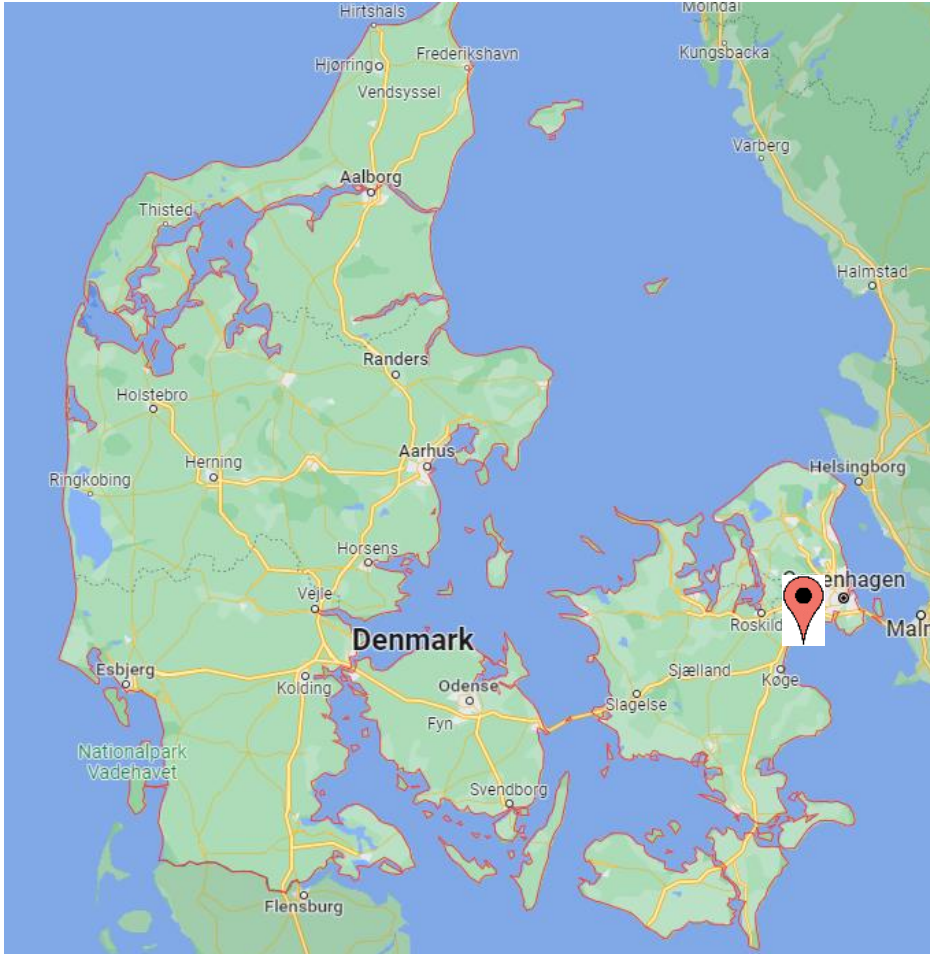
Iceland/Norway Avalanche
Barriers



Scandinavian Rail Examples

Denmark

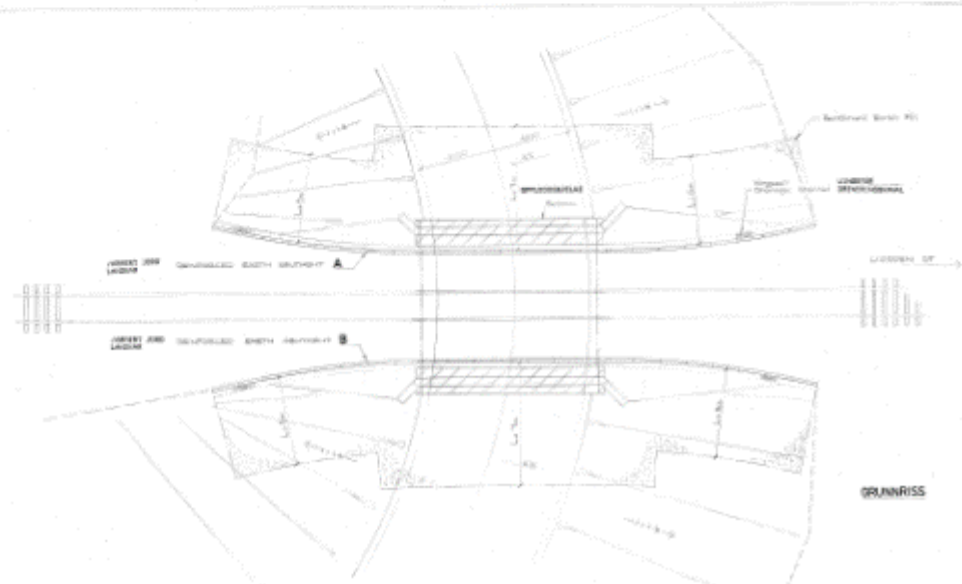
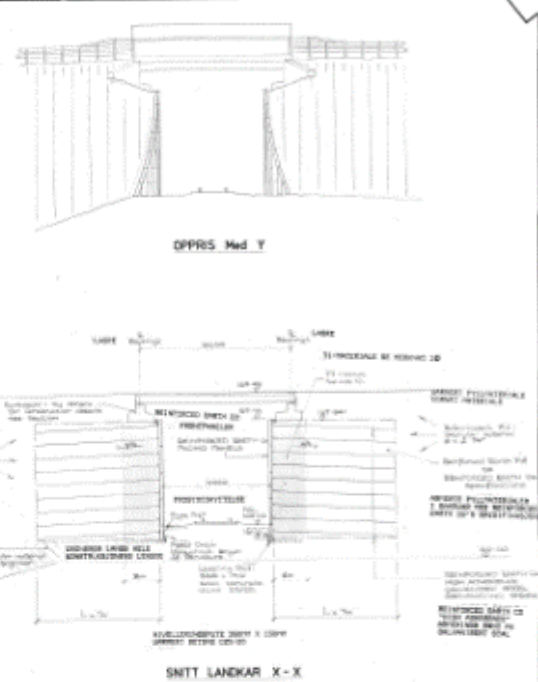
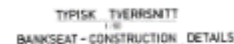
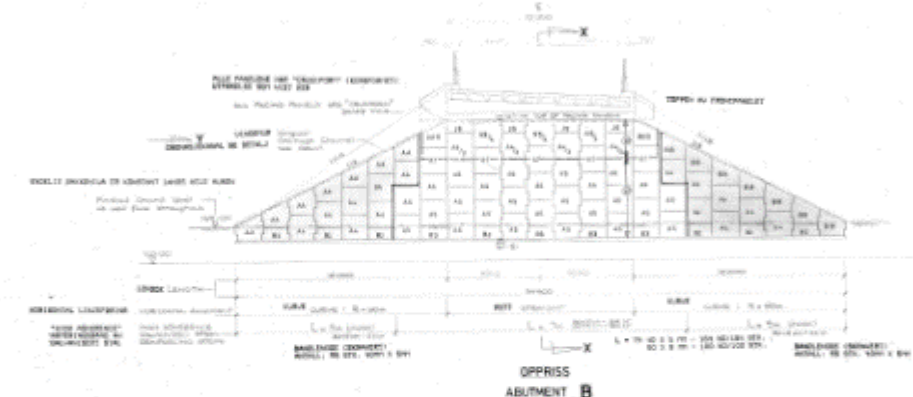
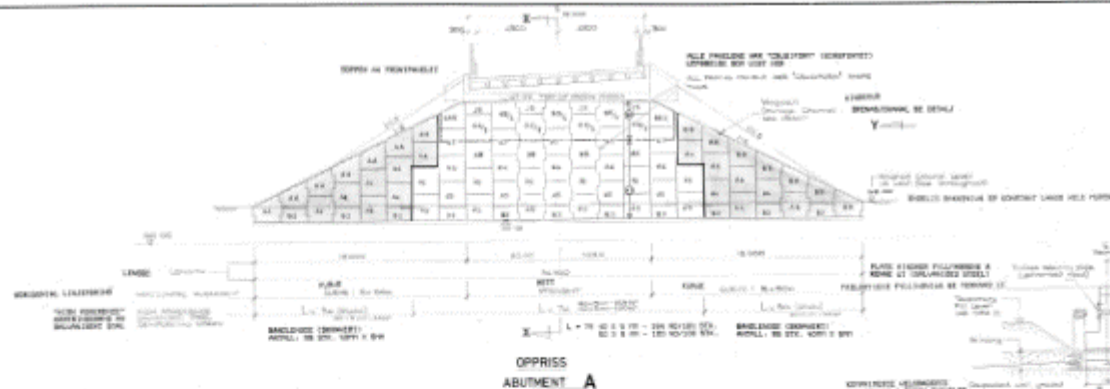
Copenhagen-Ringsted rail line – 6 structures (4 wingwalls under the track and 2 abutments over the track)



Norway

Project Number	Project name	Structure Reference	Type of structure	Year construction	Client/contact
329	Folefoss	Undergang E 68	Abutment (2 walls)	1982	-
357	Roverud Bru	Amert Jord	Abutment (2 walls)	1983	-
372	Akershus Vegvesen	Amert Jord		1983	
420	Hunselva	Hunselva		1984	
430	Kongsberg	Kongsberg		1984	
628	Vegkontoret/Nord Trondelag	RA 1902 Gartland Bru	Abument & wingwalls (railway)	1988	Vegkontoret Nord Trondelag
664	Statens Vegvesen	Jernbanekryssing ved liodden	Abutments, wingwalls (railway)	1988	Statens Vegvesen Buskerud
730	Statens Vegvesen Oppland	Gjorvik RV4 Hunselva		1990	
780	RV 181 Ny Sundbru I Eidsvoll	Landkar og mur av armert jord	Abutment (railway) & retaining wall (road)	1990	-
867	Statens Vegvesen Buskerud	Follum Bru	3 walls (2 railways, 1 road)	1989	Statens Vegvesen Buskerud

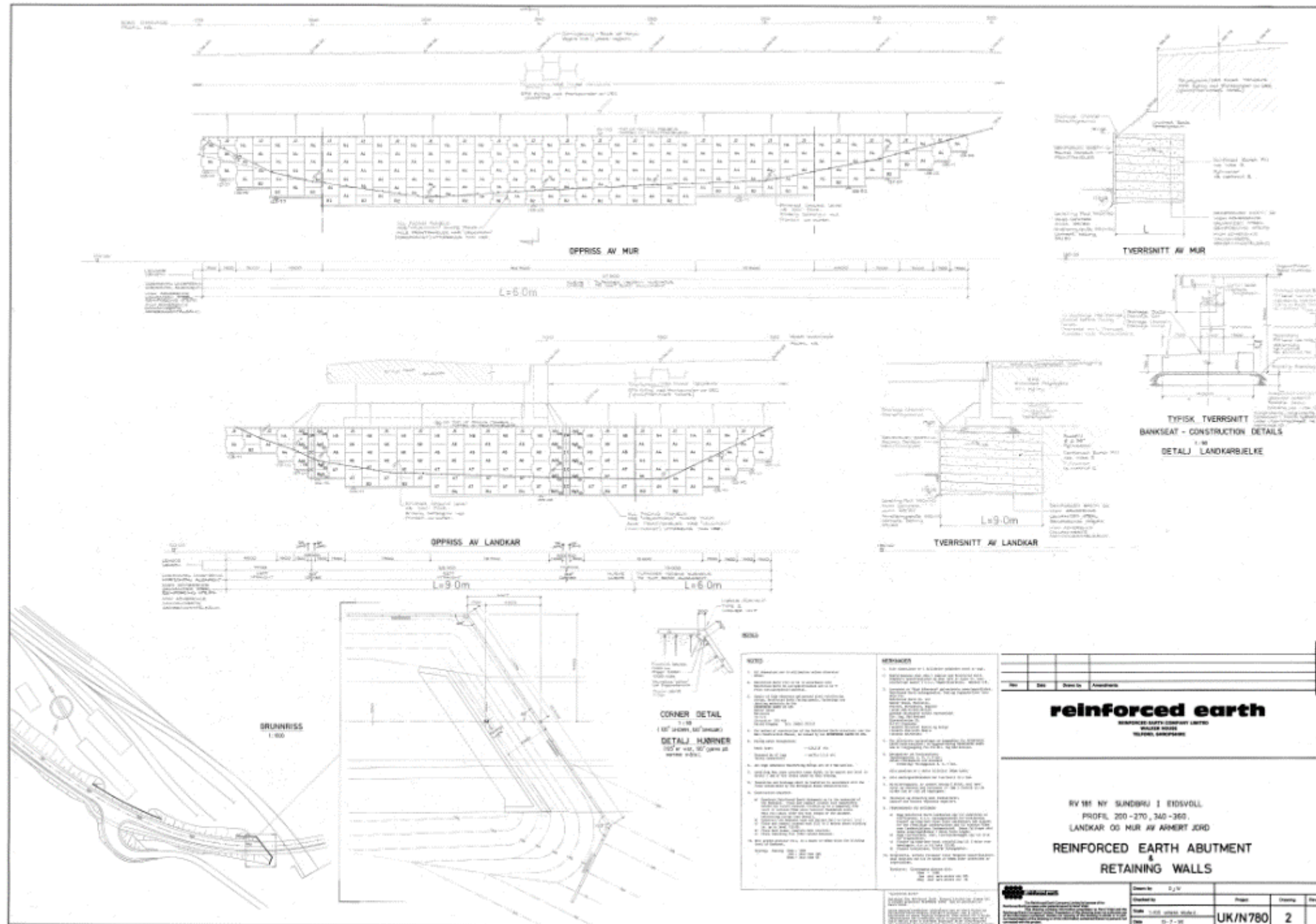


[illegible]**reinforced earth**

REINFORCED GLASS COMPANY LIMITED
WALKER HOUSE
TELFORD, SHROPSHIRE
THE WALKER BUILDING / 0192 555

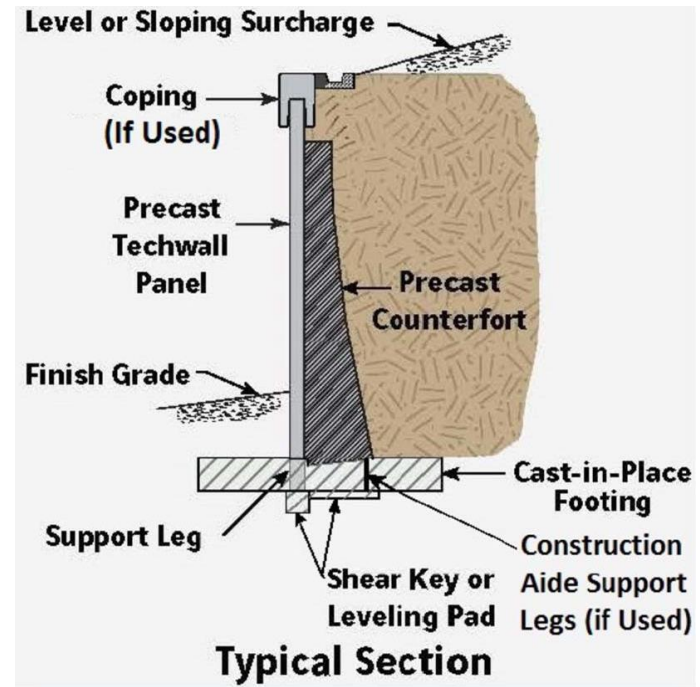
STATENS VEGVESEN
JERNBANEKRYSSING VED LIDØEN
LANDKAR OG VINGEMURER
AV REINFORCED EARTH
**REINFORCED EARTH ABUTMENTS
&
WINGWALLS**

 national grid UK National Grid is a registered trademark of National Grid plc. All rights reserved. © National Grid plc 2008. All other trademarks are the property of their respective owners.	Order for: Eight	Project:		Drawing:	No:
	Checked by:	Project:		Drawing:	No:
	Size: 1:500 (unless stated)	Project:		Drawing:	No:
	Date: 22/11/08	Project:		Drawing:	No:

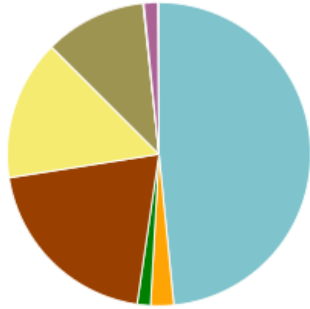




TechWall Counterfort panels
Up to 18m tall x 2.5m wide



Global warming kg CO₂e - Life-cycle stages



- A1 Raw material extraction and processing - 10.8%
- A2 Transport to the manufacturer - 2.0%
- A3 Manufacturing - 1.4%
- A4 Transport to the building site - 20.0%
- A5 Installation into the building - 15.0%
- C1 Deconstruction - 10.8%
- C2 Waste transportation - 0.1%
- C3 Waste processing - 1.5%
- C4 Waste disposal - 0.1%



TechWall®

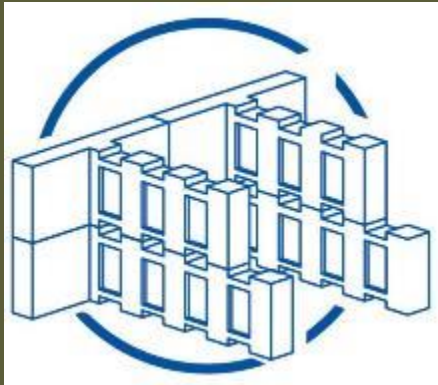
TechWall Counterfort panels
Up to 18m tall x 2.5m wide, 140mm thick



T-Wall Modular Stackable Panels for retaining, abutments, platforms



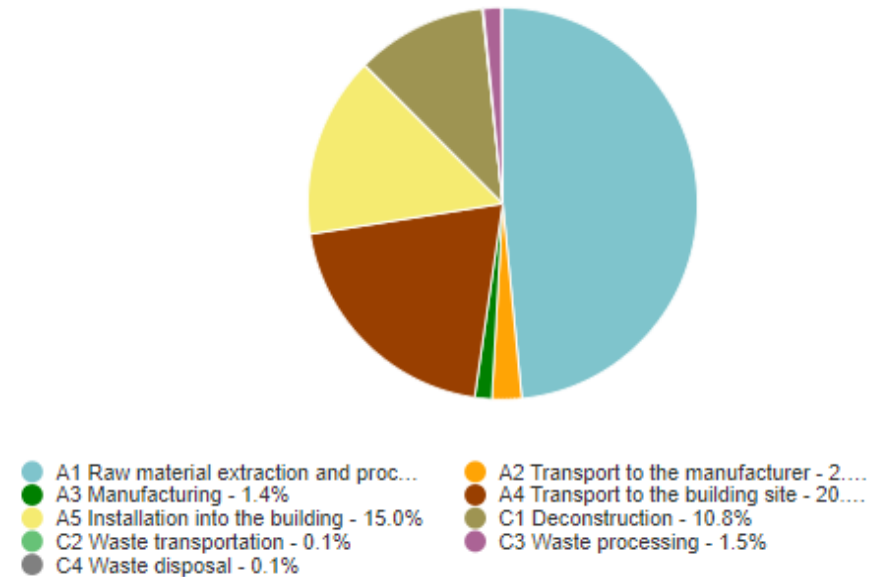
T-Wall Modular
Stackable Panels
for retaining
walls, abutments.
140mm thick
Any surface
aesthetic

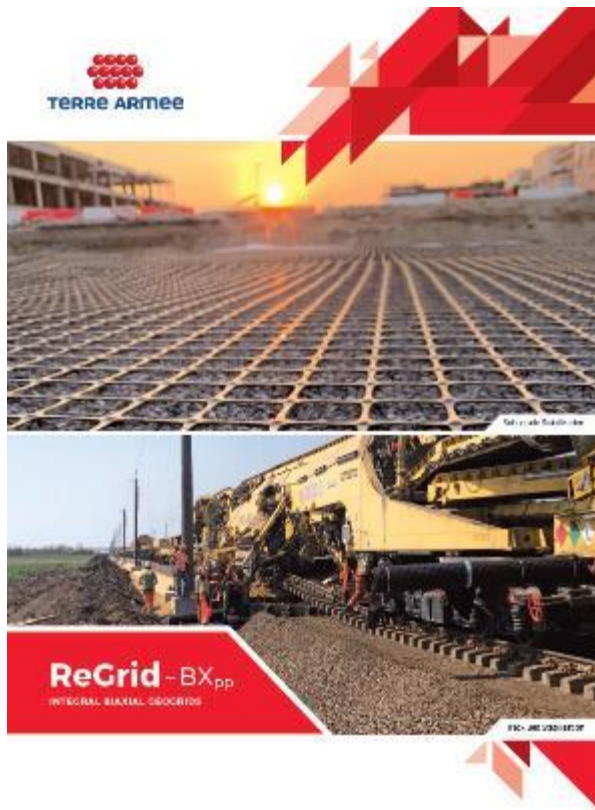


T-Wall®



Global warming kg CO₂e - Life-cycle stages





Geosynthetics

Hybrid Mineral green faced



ReGrid – UX_{PET}

ReGrid – UX_{PET} is a knitted polyester Geogrid manufactured into a dimensionally stable network of apertures providing tensile reinforcement capacity in one direction. ReGrid – UX_{PET} is best suited for demanding soil reinforcement applications.

Applications

- **Steep Slopes:** Used as soil reinforcement for reinforced soil steep slopes and embankments.
- **Basal Reinforcement:** ReGrid – UX_{PET} improves the stability of soft sub-soils by interacting with engineered fill and providing a strong mattress foundation for embankments and platforms.
- **Foundation Improvement:** ReGrid – UX_{PET} is used to support shallow structural foundations, by improving stability, enhancing load distribution and reducing differential settlement.

Technical Parameters

Properties	Test Method	Units	RG-UX _{PET} 40	RG-UX _{PET} 60	RG-UX _{PET} 80	RG-UX _{PET} 100	RG-UX _{PET} 120	RG-UX _{PET} 150	RG-UX _{PET} 180	RG-UX _{PET} 200	RG-UX _{PET} 250	RG-UX _{PET} 300
Minimum Average Roll Value (MARV)												
Physical Properties												
Material			Polyester									
Mass Per Unit Area	ASTM D 5263	g/m ²	209	244	306	356	427	463	526	555	648	751
Mechanical Properties												
Ultimate Tensile Strength in Machine Direction	ASTM D 6637 B	kN/m	40	60	80	100	120	150	180	200	250	300
Ultimate Tensile Strength in Cross Machine Direction		kN/m	20	20	30	30	30	30	30	30	30	30
Elongation at Designated Strength (%T ₀)		%	10	10	10	10	10	10	10	11	11	11
Tensile Strength at 5% Strain (%T ₀)			20	30	40	50	60	75	81	90	100	120
Crimp Reduction Factor (3.14 Years Design Life)	ASTM D 6637 A	at 20°C	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39
		at 30°C	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Partial Factor - Installation Damage	ASTM D 5818	Particle size < 5mm (Dry Sand)	1.10	1.10	1.02	1.02	1.02	1.02	1.02	1.06	1.06	1.06
		Particle size < 30mm (Gravelly Sand)	1.12	1.12	1.06	1.06	1.04	1.04	1.04	1.04	1.04	1.04
		Particle size < 125mm (Sandy Gravel)	1.19	1.19	1.16	1.16	1.11	1.11	1.11	1.11	1.11	1.11
Partial Factor - Environmental Effects	GR-GGT, GR-GGB, Environment	4 × pH < 8	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Molecular Properties												
Molecular Weight (GR-GGT)		g/mol	minimum 25,000									
Carbonyl End Group (GR-GGT)		mmol/kg	maximum 30									
Standard Packaging												
Roll Dimensions (Width x Length)		m	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100	3.8 x 100
Roll Area ^a		m ²	380	380	380	380	380	380	380	380	380	380
Weight Per Roll ^b		kg	90.5	112.9	138.4	157.8	182.1	199.2	232.6	246.7	287	315

All the values mentioned are of minimum average roll values (MARV)
^a ±1% variation possible
^b Other roll sizes available

NOTES
 A. All prescribed values are minimum unless otherwise mentioned and tested in GR-GGT accredited laboratories.
 B. These properties may change at the time of manufacturing, handling, storage and shipping.
 C. Roll weights are average values including shipping costs. Actual weight may vary.
 D. Customized rolls with varying lengths of master rolls can be manufactured.
 E. The above values are subject to change as per discretion of the company.

www.terre-atheos.com

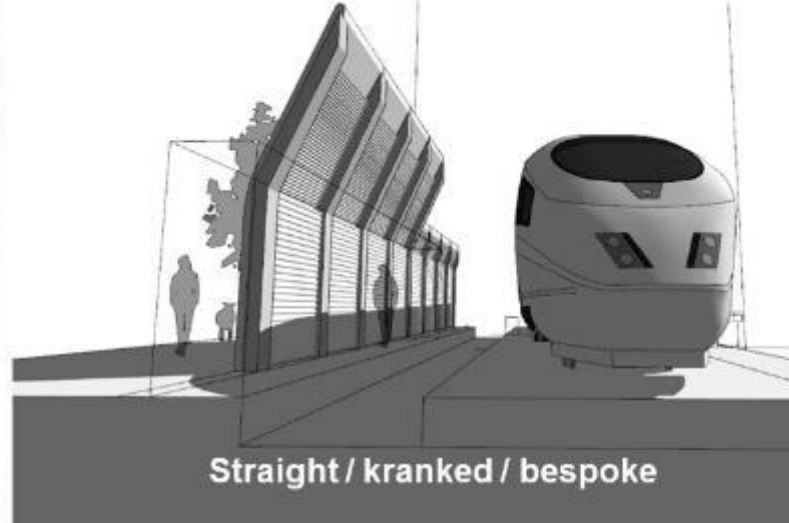
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actual product may differ wholly or partially. The images are only for static representation of the actual product. Terre Atmos Management cannot be held liable for any inaccuracies of description or illustration and reserve the right to change specifications without notification.

August 2020



Geosynthetics - Drainage



Noise
Barriers –
600,000m²
installed





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