

GEOQUEST

# Rockfall Protection

TECHNICAL EXPERTISE IN MOUNTAINOUS AREAS

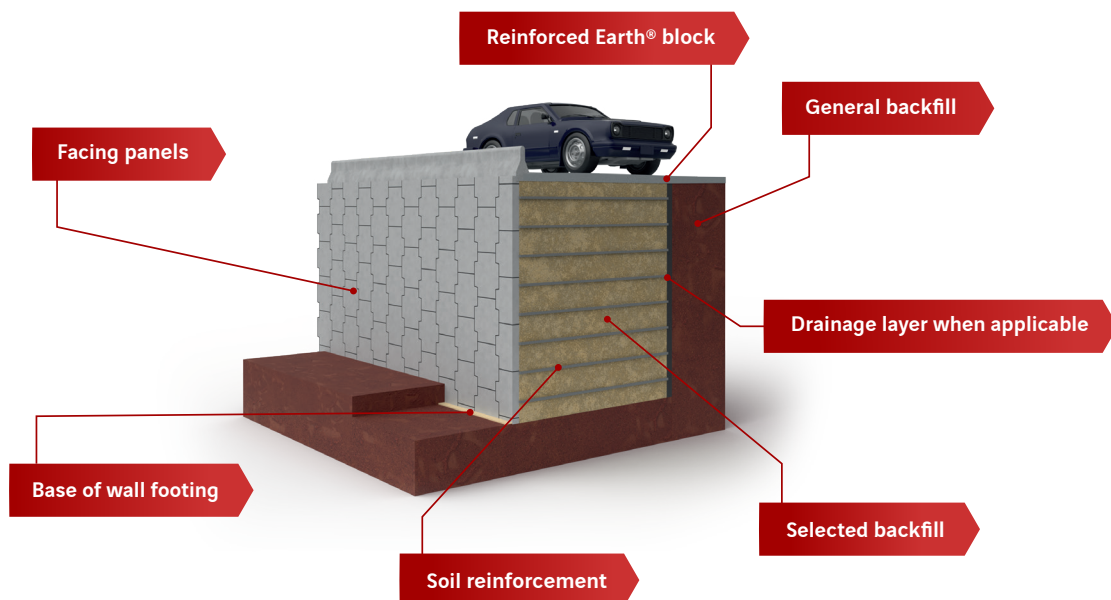
# Reinforced Earth<sup>®</sup>, the value of experience

Reinforced Earth<sup>®</sup> structures are designed for and installed to mountainous areas around the world. Thanks to their highly technical performance, Reinforced Earth<sup>®</sup> walls are widely used to protect areas at high natural risks such as rockfall and landslides.

Reinforced Earth<sup>®</sup> forms a durable mass gravity retaining structure consisting of:

- steel or geosynthetic tensite reinforcement (generally laid horizontally)
- selected and controlled granular material (backfill) forming the body of the structure
- and a modular facing system, generally made of precast concrete panels, welded wire mesh with stone or vegetated facing panels.

The interplating of soil and reinforcements develops friction at the points of contact between the two.



## A simple construction methodology

During the **basic design** phase, our design teams work with the **client** and the **consultants** responsible for engineering the protective structure.

Then, in collaboration with the General Contractor, Geoquest provides a **detailed design of the Reinforced Earth<sup>®</sup> structure and supplies the material required to build it.**

The Reinforced Earth® solution offers public and private sector clients as well as design offices the following advantages:

- Engineered solutions suitable for complex structures
- Unrivalled experience in Reinforced Earth® solutions
- A global network of innovative subsidiaries well rooted in their markets
- An unparalleled range of reliable and durable materials
- A complete manufacturer independence



Cairnmuir - New Zealand

## Reinforced Earth® protective embankments

When rock impact exceeds 5000 kJ, fences and rockfall barriers rapidly become insufficient. Embankment-type structures are recommended to intercept falling blocks.

Reinforced Earth® can be used to build narrow protective embankments with a limited footprint and a very high energy absorption capacity.



Avalanche barrier - Iceland

- The embankment slope can be steepened up to 90°;
- The slope can be faced with rock or vegetation to blend with the landscape;
- Construction is possible even for structures with a narrowness ratio of up to 0.5 x h;
- No height limitation.

With a high absorption capacity and a rapid construction time, our TerraTrel® and GeoTrel® solutions are particularly suitable in these conditions.

### Emergency repair kit

Geoquest has designed a technical solution to rapidly and durably repair the protective embankment following rockfall impact and restore the initial technical characteristics.

## A turnkey avalanche protection embankment solution

Resilient and flexible, Reinforced Earth® structures are widely used to protect against avalanches. TerraTrel® and GeoTrel® solutions offer greater flexibility while facilitating logistics and construction in remote areas and sites that are difficult to access.



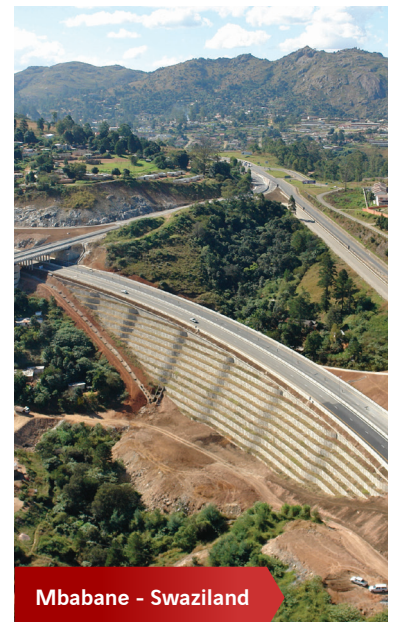
A89 - France



Nueno Congosto - Spain



SKM - South Korea



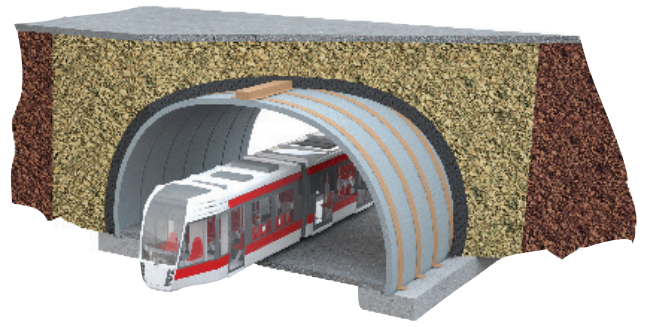
Mbabane - Swaziland

## Passive rockfall protection: TechSpan® and TechBox® solutions

**TechSpan®**, a precast arch system, is used to mitigate the risk of rockfall and slope failure at tunnel entrances and exits. It can also be used to protect an endangered road section. TechSpan® arches are designed to fit the shape of the tunnel and can be installed without traffic disruption.

The TechSpan® system is straightforward: precast concrete half arch units are supported by footings and then keyed to form a funicular curve. These structures, made of precast concrete and delivered on site as precast segments, are ready for installation to meet the works schedule. The length of the structure can be limited by building Reinforced Earth® wing and head walls during the backfill is placed.

**TechBox®** consists of precast "box" structures. Geoquest has developed its expertise in optimizing soil-structure interaction to minimise section sizes and allow rapid on-site installation with precast units for buried "box" structures. TechBox® is made of special precast concrete components, including one-piece walls and over bridging units. The features and advantages of the solution are similar to those of TechSpan® arches.



### Advantages of TechSpan® arches

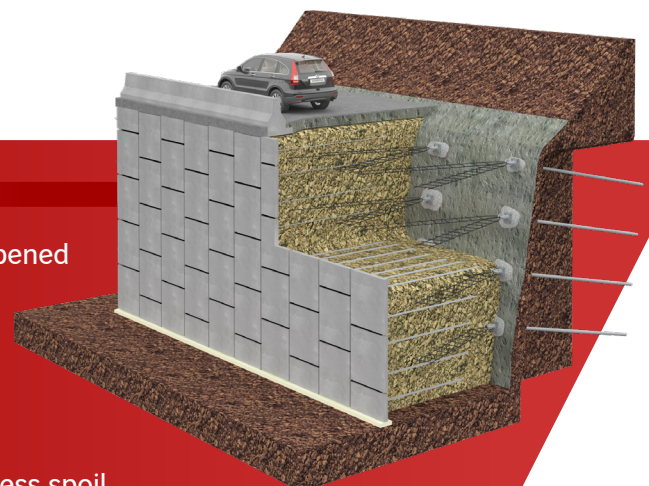
- Rapid and simple construction
- Low manpower requirement
- Bespoke design
- Quality via precasting
- Possible reproduction of the shape of an existing structure in need of use extension.



Langeni - South Africa

## TerraLink®: The Reinforced Earth® solution for limited spaces

The TerraLink® solution completes the construction of a Reinforced Earth® wall when the width to height ratio does not allow for a standard mechanically stabilised earth wall to be used. In this case, it is built on an existing structure and connected to it using metallic or geosynthetic reinforcements. The solution is particularly suitable for confined environments with a limited right of way available, such as mountainous areas.



### Advantages of TerraLink®

- Adaptable solution to a wide range of environments: steepened slopes, mountainous, coastal and urban areas
- Ensures reliability and safety of the existing structure
- Minimises the costs and construction times
- Broad range of facings: stone, architectural concrete, etc.
- Durable materials used
- Substantial gains in worksite operations: less excavation, less spoil, reuse of excavated materials, limited use of worksite machinery, small worksite team required
- Reduced carbon footprint

# About Us



**1968**

established since



**293 M€**

2023 revenue



**80**

countries



**70 million m<sup>2</sup>**

of Reinforced Earth<sup>®</sup>  
walls



**+100.000**

structures around  
the world



**102,8 m**

tallest structure

As global specialist we operate as **designer** and **supplier** of civil engineering solutions that **Retain, Cross, Protect and Strengthen**. As the **inventor of the Reinforced Earth<sup>®</sup> solution**, our strength is the result of an **unrivalled combination of expertise with over 60 years of experience** in the fields of **soil-structure interaction** and **engineered backfills**.

Geoquest delivers **its leading technologies** to serve clients' projects, from the simplest to the most extraordinary. Guided by our focus on **innovation** and our **culture of excellence in client care**, we offer **durable solutions**. We build on our **global expertise**, which is applied by our **local companies** to develop new applications to address challenges and ensure sustainability of our solutions.

**Watch our Retain, Cross, Protect, Strengthen video.**

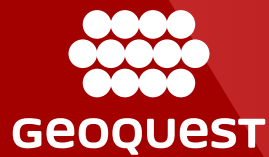


 [www.geoquest-group.com](http://www.geoquest-group.com)

 Geoquest Group

 Geoquest Group

**Engineering expertise, innovation and  
excellence in client care  
to deliver sustainable solutions.**



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