



GEOQUEST

# Ports & coastal works

REINFORCED EARTH® APPLICATIONS FOR HYDRAULIC WORKS

Oceans and seas cover nearly 71% of our planet surface and almost 60% of the world's population live on or close to seashores. The continuous development of coastlines on all continents is driven either by economic factors such as international trade or by various social and demographic trends. Seas and oceans are potential sources of natural hazards which go from erosion to storms, tidal waves or raising water levels that can make them highly destructive.

**Drawing on their global expertise and track record, Geoquest brings tailor-made solutions and provide support at all stages of the projects, fulfilling the demanding requirements of marine applications.**

Swansea - United Kingdom

Reinforced Earth® marine structures have generally been constructed under dry condition or during periods of low tides. Experience has proven that structures in sheltered sites or harbors can be submerged during the initial stages of construction without any damage to wall construction.

The use of large size Z-shaped panels allows for **rapid construction**, providing **additional protection against adverse weather conditions and extreme tidal fluctuations**.

## Reinforced Earth® and the sea

The Reinforced Earth® technique has been used for around 60 years to build marine structures either on coastlines or in harbors. The design and construction materials used in marine environments must allow for the risks associated with this special environment. Performance characteristics that have made Reinforced Earth® solution universally accepted in traditional civil engineering applications can be easily adapted to the requirements of marine projects.

Marine structures are **intermittently or continuously exposed to seawater**. The GeoMega® system, based on the use of GeoStrap® or EcoStrap™ soil reinforcements in combination with polymeric connections set in concrete facing panels is **perfectly adapted to the seawater environment**.

Reinforced Earth® marine structures are designed and built **to resist the combined forces of water and waterborne debris** which can be highly destructive during storms, as well as other environmental stresses such as **waves or driven pack ice**. Structures often include **panels designed for functional requirements such as wave deflectors**.

Reinforced Earth® panels combined with **appropriate backfill materials ensure adequate drainage**, especially if the structure is subject to tides with high amplitudes or storm surges.



Severn River estuary - United Kingdom

### Sea walls

Roads, motorways and railways, are often constructed along the seacoast just above the maximum high tide level. When the seacoast is so narrow that new construction or widening of existing communication link encroach on the sea, retaining structures are required and the Reinforced Earth® technique is perfectly adapted to such applications.

### Breakwaters and jetties

**The inherent characteristic of resilience to dynamic loads** makes Reinforced Earth® solutions particularly well suited for breakwater and jetty structures. As in traditional marine construction, and depending on the site conditions, the exposed side of these structures can be protected by rip rap, tetrapods or any other appropriate mean.

### Quays

Reinforced Earth® structures can be designed to **withstand the heavy loads** imposed by railroad locomotives and freight cars, as well as by a traveling crane and the **stresses generated by bollards or other docking means**. Thus the technique is particularly suitable for the construction of quays in commercial harbors.

### Channels and slipways

The advantageous properties of Reinforced Earth® system have also been used to build ancillary harbor structures such as slipways or channels, either temporary or permanent.

### Marinas

The Reinforced Earth® method is well known to combine strong technical and operational benefits with aesthetic properties while providing speed of construction and substantial cost savings. Therefore it is an excellent solution for the construction of marinas, providing **the perfect answer to owners, local communities and users**.

### Watertight marine structures

The GeoMega® system can be combined with a waterproofing membrane on the back face of the panels (patent pending). This allows the use of Reinforced Earth® solution for structures which need to be watertight such as dry docks or protection levees against cyclonic storms or sea water surges.

# Reinforced Earth® applications for harbors and coastal works

- Suitability of soil reinforcing and facing materials to environmental and site conditions
- Rapid construction
- Structural flexibility on moderately compact or heterogeneous foundation soils
- Reduced land use and site impact during construction
- Exceptional response to seismic events
- Lower CO<sub>2</sub> impact than conventional techniques
- Use of natural or recycled materials
- Durability
- Ease of inspection, maintenance and upgrading
- Compatibility with internal waterproofing geomembranes

Dun Laoghaire - Ireland

## Reinforced Earth®, the value of experience

Choosing a Reinforced Earth® solution allows owners and engineers to benefit from:

The longest experience in the field of mechanically stabilised earth structures

Tailored engineered solutions adapted to complex situations

The widest range of reliable and sustainable materials

Seaton Carew - United Kingdom

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® 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.

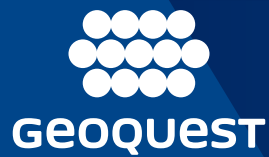


 [www.geoquest-group.co.uk](http://www.geoquest-group.co.uk)

 Geoquest UK

 Geoquest Group

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



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