

# Reinforced Earth<sup>®</sup>, the Value of Experience

When it was invented almost 50 years ago, nobody could foresee the great success of the Reinforced Earth<sup>®</sup> technique. It is now recognized as a major innovation in the field of civil engineering. The Reinforced Earth<sup>®</sup> method has widened its scope of applications to beyond just roads in the last 30 years, demonstrating its advantages in other markets. Reinforced Earth<sup>®</sup> structures have been designed and supplied by companies of the global network of Terre Armée Internationale for rivers and waterways applications.

Choosing a Reinforced Earth<sup>®</sup> solution allows owners and engineers to benefit from:

- the longest experience in the field of mechanically stabilized earth structures
- a global network of innovative companies deeply rooted in their markets
- tailored engineered solutions adapted to complex situations
- the widest range of reliable and sustainable materials
- a complete independence from manufacturers of reinforcing materials

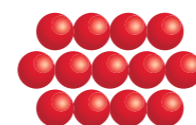


Our goal is to create, design and supply innovative techniques to the civil engineering industry with a strong commitment to excellence in design, service and public welfare.

## Sustainable Technology

# Rivers & waterways

Reinforced Earth<sup>®</sup> applications for hydraulic works



**REINFORCED EARTH**

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**REINFORCED EARTH**  
SUSTAINABLE TECHNOLOGY

Rivers and waterways around the world are essential assets to be maintained and preserved. The valleys opened by rivers frequently provide way for roads and railways which have to be built to allow a safe traffic of people and freight whatever the condition of the rivers might be. Waterways constitute vital links between communities and they allow sustainable transportation means to be used. Rivers, waterways and also lakes, can play a key role in land development.

**Drawing on their global expertise and track record, Reinforced Earth entities worldwide bring tailor-made solutions and provide support at all stages of the projects, fulfilling the demanding requirements of rivers and waterways hydraulic applications.**



A43 Motorway (France)



Ampang Waterfront, Kuala Lumpur (Malaysia)



Les Eyzies de Tayac (France)



Tawi river, Jammu (India)



Prescott, Ontario (Canada)



Olio Bridge (USA)



Banbury Lane (United Kingdom)

## River walls

Roads, motorways and railways are often constructed along river valleys just above the high water or normal flood stage elevation. When the riverbank is so narrow that new construction or widening of existing communication links encroach on the river, retaining structures are required which will be permanently or temporarily in contact with water.

The Reinforced Earth® technique has been extensively used for 40 years to build such structures supporting highways and railways along rivers, lakes and waterways. It is easily adapted to these complex situations and has performance characteristics that have made it universally accepted in more traditional civil engineering applications.

The wide choice of the soil reinforcement materials associated with Reinforced Earth® system allows this technique to be used for all types of water conditions, fresh, brackish or saline.

Although vertical concrete facings are generally used, vegetalized steel mesh provides a good solution to restore natural river banks.

Reinforced Earth® river structures are designed and built to resist the combined forces of water and water borne debris which can be highly destructive during and after storms or floods. Reinforced Earth® structures also resist other environmental stresses such as strong currents.

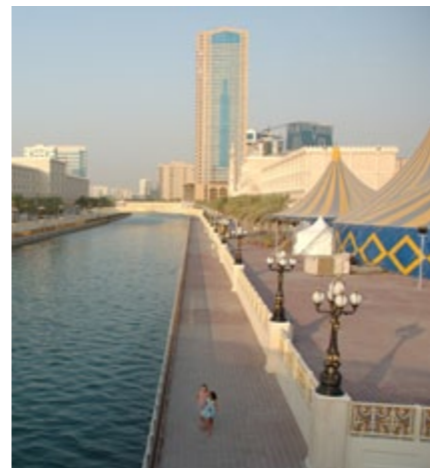
Reinforced Earth® panels combined with proper backfill materials ensure adequate drainage, especially if the structure may be subjected to sudden rapid draw down and other variations in water level.

## Bridges

Crossing rivers and waterways, bridges are essential civil engineering structures. Since the construction of the first Reinforced Earth® bridge abutments on rivers in the beginning of the 70s, the technique has been extensively used for this type of structures. The combination of TechSpan® arches and Reinforced Earth® technique allows the design and construction of arch bridges that blend into the environment.



Chautagne lock (France)



Majaz canal, Sharjah (UAE)



Leitrim (Ireland)



Omaha OCCA marina, Nebraska (USA)



Owensboro, Kentucky (USA)

## Canals

The Reinforced Earth® technique provides an interesting solution for canals due to its ease and speed of construction. When watertightness is necessary, the GeoMega® system which associates concrete facing panels and GeoStrap® or EcoStrap™ soil reinforcements can be combined with a waterproofing membrane on the back face of the panels (patent pending). This allows the use of the Reinforced Earth® technique for complex structures such as locks and water saving basins.

## Quays, jetties and marinas

Its intrinsic characteristics also make the Reinforced Earth® technique well adapted to hydraulic structures associated with water transportation such as quays, jetties or marinas constructed alongside rivers, waterways or lakes.

For commercial freight transportation, Reinforced Earth® structures can be designed to withstand the heavy loads imposed by railroad locomotives and freight cars as well as by traveling cranes, and the stresses generated by bollards or other docking systems.

While concrete panels are the most common facing used for these structures, steel mesh facing is also an option in the case of freshwater or for structures with a short design life. The GeoTrel® system which associates this type of facing with synthetic soil reinforcements provides a good solution when access to site is a constraint and satisfies the labour intensive policies of certain countries.



Lake Victoria fishing jetty (Uganda)

## Land development

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. Thus it is a logical solution when land development or urban planning schemes require the rearrangement of existing rivers or lakes, or the creation of new ones. Reinforced Earth companies can provide the right answer to the requirements of planners and local communities.

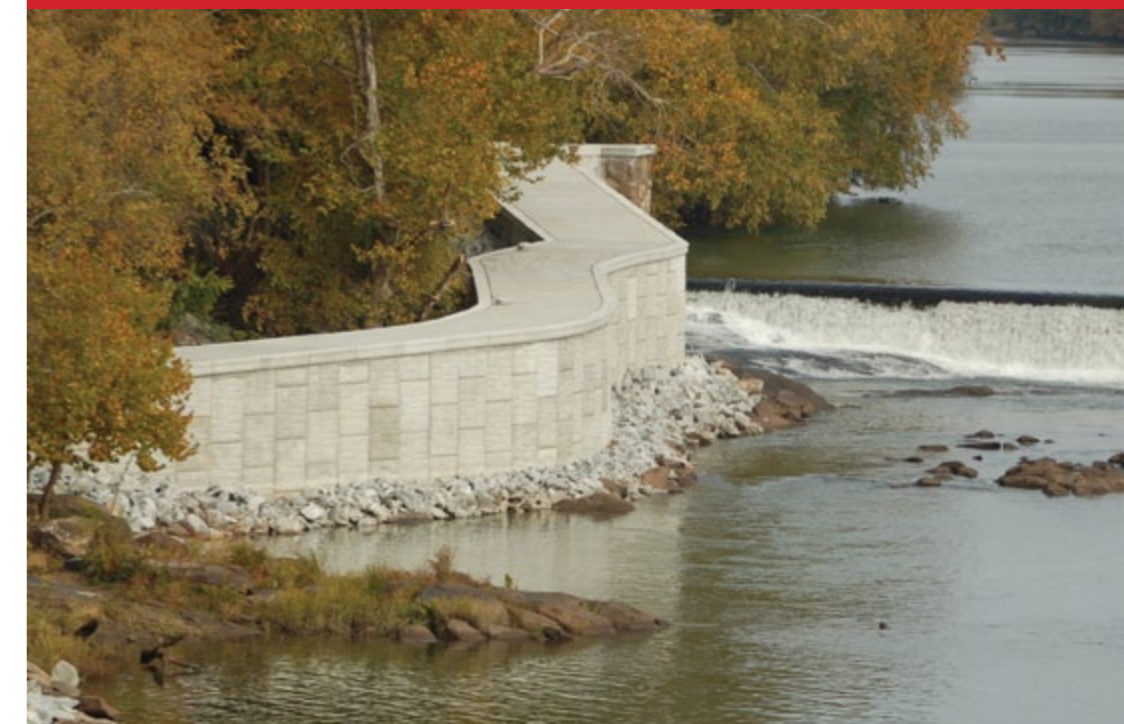


Den Bosch (The Netherlands)



Green Village, Dubai (UAE)

# Reinforced Earth® applications for rivers and waterways



- Lower land use and site impact during construction
- Suitability of soil reinforcing and facing materials to environmental and site conditions
- Rapid construction
- Structural flexibility on moderately compact or heterogeneous foundation soils
- Compatibility with internal waterproofing geomembranes
- 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