GEOQUEST

Bridge Abutments

Bridge Abutmens

Reinforced Earth® is a proven and effective system capable of a variety of applications. Historically, as Reinforced Earth® was used to construct very tall and heavily loaded retaining walls, this technology was easily adapted to the construction of abutments for the direct support of bridge superstructures. Although the general principles involved are the same, the great loads created by bridge superstructures significantly affect the distribution of stress and strain within the reinforcements. As with research on Reinforced Earth® retaining walls, studies on the effect of such loadings and the development of increasingly precise design methods included measurements of actual projects, reducedscale models, and finite element studies.

Reinforced Earth® retaining structures are an ideal way to meet ordinary and extraordinary earth retention and load supporting needs. Reinforced Earth® offers a variety of bridge abutment and bridge crossing solutions. Bridge abutments are considered critical structures and the unique strength and load distribution capabilities of Reinforced Earth® address that criticality in an economical and structurally efficient way. Each Reinforced Earth® structure is custom-engineered by Geoquest to project-specific requirements including applied loading, foundation conditions, and aesthetics.

Summary

- In the design of load-bearing abutments, a detailed analysis of the abutment geometry and applied loading is required.
- Reinforced Earth®'s inherent flexibility makes it possible to construct bridge abutments on comprehensible foundation soils. Special foundations are not required, although in some cases simple soil improvement techniques are recommended.
- The design and construction scheduling of each project must take into consideration the characteristics of the superstructure, phasing and waiting-period requirements, geotechnical data, and the inherent properties of Reinforced Earth® construction.
- In special cases, it may be necessary to separate the retaining and bearing functions of a structure by constructing a type of bridge abutment supported on piles. In such cases, if the foundation soils are good, the use of an integral or semi-integral abutment may be viable.
- The worldwide experience gained in developing various designs and configurations of hundreds of abutments enables Geoquest engineers to determine the optimum solution for each application.

Advantages

- Reduced construction cost and time
- Construction in all weather conditions
- Fully engineered making field changes unnecessary
- Inextensible steel reinforcements
- No time dependent internal movements
- Precast concrete facing panels
- More durable than concrete masonry units

Types of Bridge Abutments using Reinforced Earth®

There are two types of Reinforced Earth® abutments. “True” bridge abutments support the horizontal and vertical loads applied at the bridge seat, which sits directly on the Reinforced Earth® volume. With “False” bridge abutments the bridge seat is supported on piles.

True Bridge Abutments

Abutments, where the bearing seats (spread footings) rest directly on the Reinforced Earth® structure are known as “true” abutments.

A Reinforced Earth® bridge abutment consists of a Reinforced Earth® retaining wall designed to support the earth pressures behind it as well as the heavy concentrated vertical and horizontal surcharge loads imposed by the bridge superstructure and traffic loading.

Superstructure and traffic loading are transferred from the bridge seat to the Reinforced Earth® volume, where the forces are subsequently distributed resulting in lower bearing pressures on the foundation soils.

Reinforced Earth®’s inherent flexibility makes it possible to construct bridge abutments on soft soils and special foundations are not required.

Benefits

True Reinforced Earth® abutments are a superior and often more economical solution in cases where poor foundation soils might otherwise dictate use of deep piles or other remedial foundation treatments. Because of its flexibility, a Reinforced Earth® abutment can withstand considerable settlements arising from consolidation of the foundation soils. Even when foundation soil improvement techniques must be employed in combination with construction of the abutments, Reinforced Earth® can still allow the realization of significant cost savings. An additional benefit typical of all true Reinforced Earth® abutments is that the approach embankment leading up to a Reinforced Earth® abutment is continuous with the compacted granular fill on which the bridge seat rests. Therefore, if the embankment settles due to movement within the foundation soils, the bridge seat moves with it rather than being rigidly fixed in position by piles. The “bump at the end of the bridge” is eliminated, with resulting reduced maintenance cost.

False Bridge Abutments

Abutments, where the vertical loads are supported on a piles or pier structures located either in front of or within the mass are known as “false” abutments. The horizontal loads are supported by the Reinforced Earth® structure.

Steel strip soil reinforcements with bolted connections are able to skew around piles. These design details are applicable to both traditional non-integral and integral pile supported Reinforced Earth® abutments.

In some cases a portion of the lateral load on the pile-supported seat is transmitted to the Reinforced Earth® fill. This load can be resisted by Reinforced Earth® reinforcements in the wall or by reinforcements extending from the backwall of the bridge seat.

TerraTrel Abutments

TerraTrel® wire-faced Reinforced Earth® walls provide a cost-effective solution for applications where aesthetics are not a critical requirement. TerraTrel® may be used for permanent and temporary applications such as service roads, low volume state roads, and phased construction of bridges in lieu of other methods of shoring such as sheeting or pile and lagging walls; this allows traffic to flow on the lanes of an existing bridge while the new Reinforced Earth® abutments and bridge are constructed. If significant settlement or preload conditions are anticipated for a structure, a two-staged Reinforced Earth® wall can be utilized combining TerraTrel® and a precast or cast-in-place facing.

Bridge Abutments Geometry

Open abutment with oblique wing walls

Closed abutment

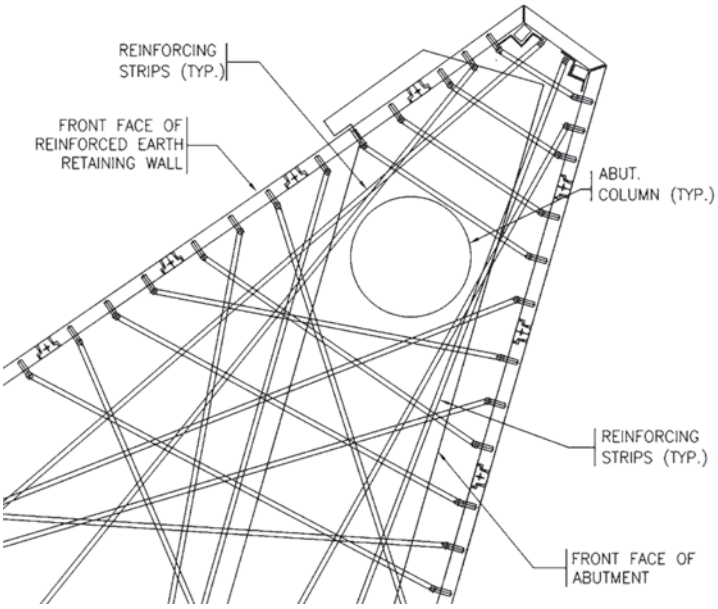
Open abutment with straight wing walls

Open abutment with inwardly curved wing wall

Skewed abutment

Acute Corners

The design of the Reinforced Earth® system for acute corners less than 70 degrees is unique. The nose portion of the structure is designed as an internally tied bin structure with atrest earth pressures from top to bottom. The reinforcing strips are designed as tension members only and are generally at low stress due to the bin effect (soil arching) and the conservative number of strips used. The connections to the panels are all double shear structural connections. The tied bin section is separated from the adjacent reinforced portion of the structure by slip joints. In addition, reinforcing strips are extended back from the nose portion of the structure to tie this relatively light section back into the major portion of the mass. The performance of this system has proven remarkable due to its high strength and flexibility. The individual soil reinforcing strips and numerous connection locations on the backs of the panels make the system very versatile and constructible in the presence of obstructions such as piles.



Proven Solutions

Reinforced Earth® technology has made new and economical designs possible for bridge abutments adapatable to the widest variety of superstructures and foundation soils. Complementing the performance of engineering techniques that have undergone more than 40 years of research and development are all the advantages of quick and scaffold-free construction.

A Worldwide Organization

The Geoquest Group of companies operates in 96 countries on six continents.
Although part of the same Group, each company is independently managed by nationals of that country who are professional engineers that understand local conditions, codes of practice, and construction capabilities and techniques.
The dynamics of this organization allow each Geoquest company to offer government agencies, owners, consultants and contractors the understanding and flexibility of a local business, combined with the vast resources and technological advantages of a global concern.

To contact us and learn more about Geoquest products and services please visit **geoquest.ca/contact**

Geoquest | 5090 Explorer Drive, Suite 400, Mississauga, ON L4W 4T9 | Tel: +1 (905) 564-0896