REINFORCED GRANULAR FOUNDATIONS FOR MSE WALLS
Product: MacGrid® WG woven geogrids

Project Background:
Conceived to strengthen transportation and trade links between Canada and the United States, the Windsor Essex Parkway will reduce road congestion within the City of Windsor and foster economic growth. The Parkway will run generally east to west and connect Highway 401 to a new custom inspection plaza and new international crossing over the Detroit river. It will be a sunken six lane highway, 11.2km long with 15 bridges and 11 tunnels and service roads to provide access to neighbourhoods, schools and natural areas.

In order to separate the new highway from traffic within the City of Windsor, the 11 tunnel structures will allow for connections across the highway for surface roads, trails and natural crossings. These structures will be pre-cast concrete girders supported on piled foundations with mechanically stabilized earth abutments.

Problem:
The route selected for the new Parkway is located within an area that was created by the deposition of materials during the retreat of the glaciers in the last Ice Age. These glacial till like deposits are typically 20 to 35m thick and consists primarily of silty clay and clayey silt materials. The majority of these glacial deposits were created within a lacustrine environment. A thin surficial crust layer (typically 2m) of hard to stiff clay exists that is underlain by generally soft to firm soils.

The new highway is sunk approximately 9-10m below the surrounding grades. Where a connection is required from one side to other, a crossing of variable width is built. The crossings are designed as 2 span structures incorporating semi-integral abutment and centre pier founded on deep end bearing steel piles.

For a typical structure, the foundation loads were anticipated to be between 100 and 200kPa, depending upon the dimensions of the structure, the purpose of the crossing and traffic loading. Extensive geotechnical investigations carried out at each crossing location indicated that the soils at the foundation elevation would typically be the soft silty clays. For design purposes, these soils have an allowable bearing capacity of 50 to 60 kPa.

Client:
- Parkway Infrastructure Constructors (PIC)

General Contractor:
- Parkway Infrastructure Constructors

Designer:
- Maccaferri Canada Ltd.

Products used:
- MacGrid® WG woven polyester geogrids

Date of construction:
- April 2012
Solution:

In order to reduce the loads applied to the soft foundation soils, the project geotechnical engineers recommended that a 1.5m thick layer of compacted crushed sand and gravel, reinforced with multiple layers of geogrid reinforcement (Reinforced Granular Mat—RGM) be designed and constructed under each of the abutment structures for the crossings. The loads associated with the bridge structures would be carried by piles that would be driven through the RGM after it was constructed. A typical RGM consists of an 8.5m wide pad, typically 250m long at each abutment location.

Using Maccaferri MacRead Software, a multi-layer model was used to design the RGM foundations. Using woven polyester geogrids, Maccaferri used 3 layers of reinforcement at 0.5m vertical spacing. The strain within the layers of geogrid was limited to between 2-3%. With a very small width to length ratio, the loading was primarily transverse to the longitudinal axis of the granular foundations under the MSE walls, so mono-directional reinforcement oriented transversely across the granular pad was used. The tensile strength of the geogrid was determined based upon the load applied to the surface of the RGM, the depth of the reinforcement below the MSE structure and foundation soils at each site. MacGrid® WG3, WG6, and WG8 have been used to build numerous RGM structures.

MacGrid® WG geogrids are used for soil reinforcement. They are made from high molecular weight, high tenacity polyester multifilament yarns. The yarns are woven under tension in the machine direction and finished with a polymeric coating. MacGrid® is engineered to be mechanically and chemically durable, and resistant to biological degradation. MacGrid® WG series geogrids are used predominately in Mechanically Stabilized Earth (MSE) and Reinforced Soil Slopes (RSS) structures.