

## TenCate Solutions for Basal Reinforcement



Protective Fabrics  
Space Composites  
Aerospace Composites  
Advanced Armour

Geosynthetics  
Industrial Fabrics  
Grass



## Embankments on Soft Soil

### Case Study

project	Seawall Construction for Port Extension
location	Brisbane, Australia

The project requires the construction of a 4.60km long perimeter seawall from the end of the existing port to contain the reclamation fill. The soil conditions where the seawall will be constructed consist of very soft marine clays extending over 30m below the seabed in some areas. A number of design options were evaluated but the use of TenCate high strength polyester geotextiles as basal reinforcement of the seawall was assessed to be the most cost effective. Geotextile tensile strengths of 400kN/m and 850kN/m were used to reinforce the embankment seawall up to a maximum height of 7.50m. The geotextiles were sewn offsite to form a large sheet and loaded on a barge for underwater installation. Ballasts were placed immediately over the geotextile to hold it in place on the seabed.

#### Reinforcement over soft soil

Geosynthetics reinforce the shear stresses of the fill material leading to an increase of the foundation bearing capacity.

High strength geosynthetics provide a cost effective solution to achieve a greater and quicker stability of embankments constructed on soft foundations. Geosynthetics allow:

- Optimum embankment height over a minimum area
- Steeper side slopes
- Increase in construction speed with no loss of stability
- Resistance to outward movement of the embankment

#### TenCate Geosynthetics over soft soils

TenCate Mirafi® (woven), TenCate Miragrid® (geogrids) and TenCate Polyfelt® (composites), made from high tenacity polymers meet the highest demands of the site:

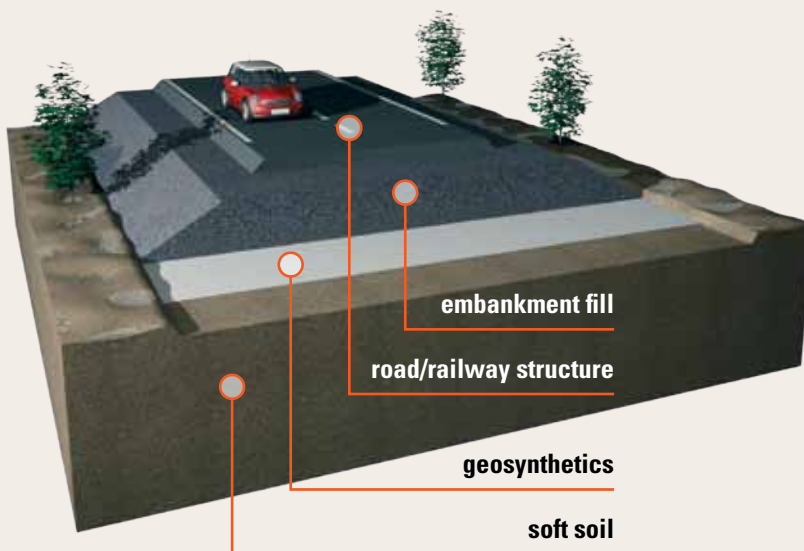
- Strength up to 1600kN/m to ensure embankment stability
- Long term properties to guarantee performance over the lifetime of the structure
- Adaptable rolls to suit site requirements:
  1. Long and wide rolls
  2. Custom made roll sizes to facilitate ease of installation



## TenCate solutions

The technical skills of our engineers ensures the most effective and economic solution:

- TenCate offers a reliable and comprehensive solution to the customer
- Design suggestions are proposed to the consultant using the most relevant and up-to-date design codes
- Installation support and advice helps the contractor place the geosynthetic correctly and efficiently



TenCate Mirafi® PET



TenCate Miragrid® GX



TenCate Polyfelt® PEC





# Reinforced Embankments on Piles

## Case Study

project	Electrified Double Railway Track Upgrade
location	Malaysia

The railway project involves laying two new parallel tracks, replacing the existing single-track. The alignment traversed through grounds varying from residual to mine tailing deposits from previous mining activities. A lightweight pile system was used for ground improvement in several areas amounting to 4km of railway line. The piles were founded in stable sand or gravel layer with depths varying between 6m and 18m. The 150mm diameter piles were pushed into the soil in a close square grid pattern. Two layers of TenCate Miragrid® GX geogrids with tensile strength 250kN/m were placed on top of the enlarged individual pile caps. The geogrids were laid with the main strength direction perpendicular to one another to provide vertical load shedding to the piles and resistance against lateral sliding of the 2m high embankment.

### Reinforcement of load transfer platforms

TenCate Geosynthetics provide cost effective solutions, optimising load transfer platforms to achieve greater stability and surface settlement control:

- Improved load transfer from the embankment through the piles into firmer soils
- The high strength of the geosynthetics allows the piles to be spaced further apart, resulting in major cost savings
- The size of the pile caps can be reduced: in a conventional embankment pile caps would cover 60-70% of the total area. This is reduced to 10-20% when using a geosynthetic allowing increased speed of earthworks and additional large cost benefits
- The horizontal thrust from the embankment is resisted by the geosynthetic which avoids the need for inclined or reinforced piles

### Reinforcement of working platform

The resistance of the working platform under traffic is an essential requirement. An inadequate bearing capacity may lead to severe problems of use and safety. Geosynthetics reinforce the structure, ensuring stability and safety. They eliminate the need for expensive granular fill material, saving on costs and limiting the environmental impact of using valuable mineral resources.

### TenCate Geosynthetics for reinforcement purposes

When coarse-grained fill materials are used, optimum friction is achieved with TenCate Miragrid® GX geogrids. Conversely with fine-grained fill materials, optimum friction values are obtained with TenCate Mirafi® PET and TenCate Polyfelt® PEC high strength geotextiles.



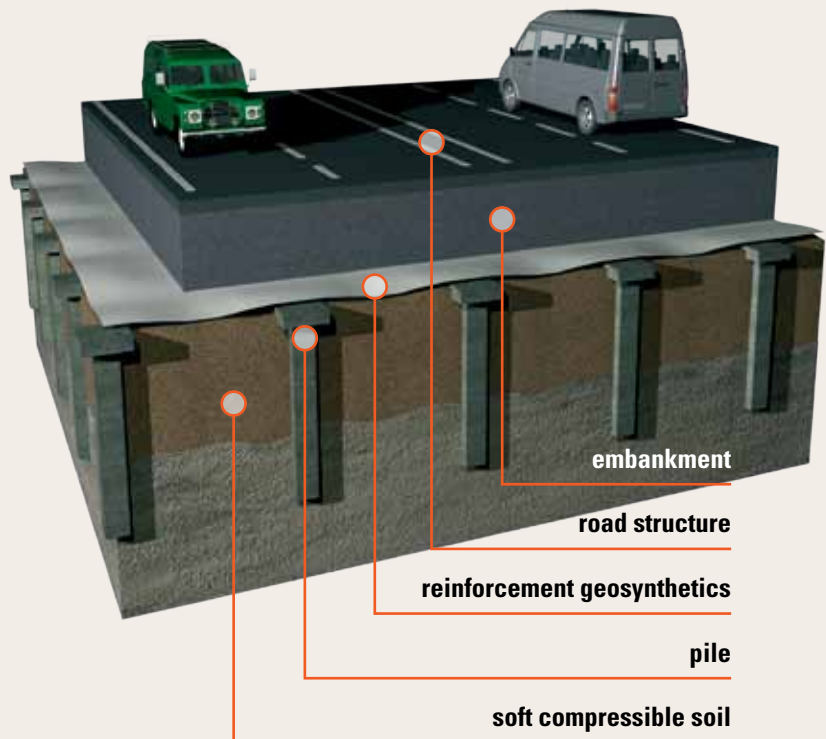
Made from the best performing polymers TenCate Mirafi® (wovens), TenCate Miragrid® (geogrids) and TenCate Polyfelt® (composites) provide the characteristics needed to reinforce load transfer platforms and working platforms:

- Strengths up to 1600kN/m to ensure embankment stability
- High stiffness to control the deformation and surface settlement
- Long term properties to guarantee performance over the lifetime of the structure
- Adaptable rolls to suit site requirements

### TenCate solutions

Thanks to active participations in numerous research and construction projects and the technical skills of our engineers, TenCate is able to propose innovative, effective and economic solutions including:

- Comprehensive designs for the owner
- Design suggestions using the latest and appropriate design methods to the consultant
- Advice and installation support to the contractor





## Reinforcement over Cavities

### Case Study

project	LGV Est High Speed Railway Track Project
location	Lorraine, France

During construction of this high speed railway line, cavities were discovered in the foundation along the proposed track alignment. The cavities existed in a karst limestone layer with joint fracture ranging between 0.15m and 0.20m wide. It was anticipated that the cavity could develop to a maximum of 0.50m diameter. To maintain the high speed performance of the train and to minimise surface deformation, it was decided to design a structural fill thickness supported by geosynthetic reinforcement that will span across any potential foundation voids. A structural fill thickness of 1.05m was used along with a composite geosynthetic reinforcement, the TenCate Polyfelt® PEC of 75kN/m tensile strength in both longitudinal and cross directions. Above these layers, rail ballasts of 0.25m and railway tracks were placed.

#### Securing areas at risk of subsidence

In areas prone to cavities, such as in carstic zones or old mines, sudden collapse can be prevented where high strength geosynthetics are used to reinforce road embankments or base courses. Geosynthetics reinforce and prevent the collapse of the structure, ensuring safety for the users. Depending on the size of the cavity and the thickness of the structure the reinforcement limits or avoids settlement at the surface for the design lifetime of the structure.

With geosynthetics the needed quantity of granular fill material decreases, providing significant cost reductions and limitation of environmental footprints.

#### Reinforcement and monitoring

When using reinforcing geosynthetics to avoid surface settlement when voids collapse, it is difficult to know when this collapse has occurred. If the void were to grow over a long period, it would be in the interests of the engineer to be aware of the collapse and to be able to decide whether remedial action was required. To assist with monitoring these critical structures the installation of the TenCate GeoDetect® system is recommended. TenCate GeoDetect® is integral with the reinforcement and measures the direct strain in that reinforcement transmitting a warning signal once the geosynthetic reaches a preset elongation limit.

For further information on TenCate GeoDetect®, visit the site: [www.tencategeodetect.com](http://www.tencategeodetect.com)



## TenCate Geosynthetics for reinforcement purposes

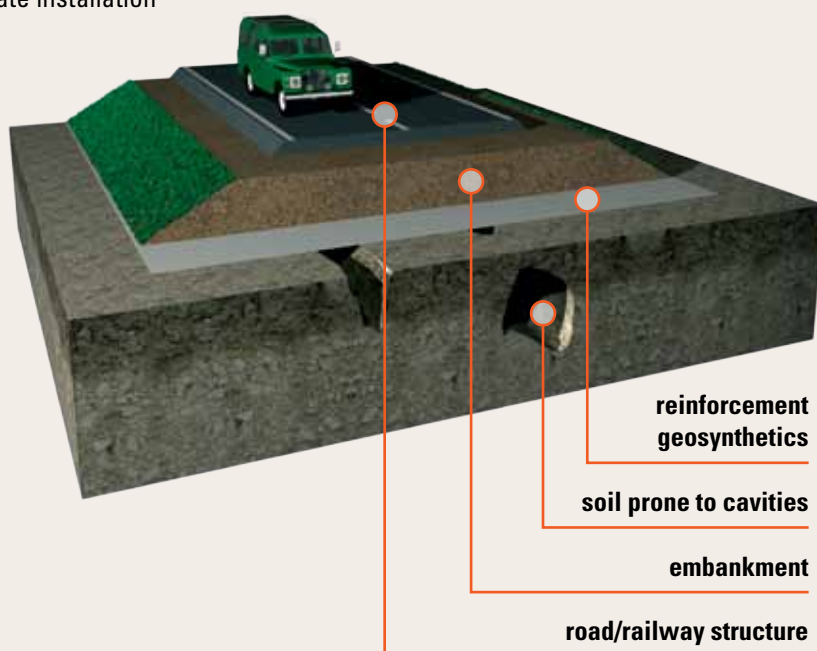
TenCate Mirafi® (wovens), TenCate Miragrid® (geogrids) and TenCate Polyfelt® (composites), made from the best performing polymer, are perfectly adapted to reinforcement over cavities:

- Strength up to 1600 kN/m to ensure the embankment stability
- High stiffness modulus to control the deformation and surface settlement
- Long term properties to insure the performance over the lifetime of the structure
- Form of supply adapted to the application:
  1. Long and wide rolls
  2. Custom made rolls to facilitate installation

## TenCate solutions

Thanks to the participation at the research project RAFAEL (1997-1998) and the use of the resulting method design in several guidelines over Europe, TenCate acquired a great deal of knowledge in the use of geosynthetic spanning of voids. This experience was completed by numerous construction projects over cavities where TenCate geosynthetics were installed.

With the addition of TenCate GeoDetect®, we offer a complete geosynthetic and monitoring system with all the related service for design and installation assistance.



TenCate develops and produces quality products that increase performance, reduce cost, and deliver measurable results by working with our customers to provide advanced solutions.

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