Foundations over Piles

Constructing Load Transfer Platforms over weak ground with piled foundations

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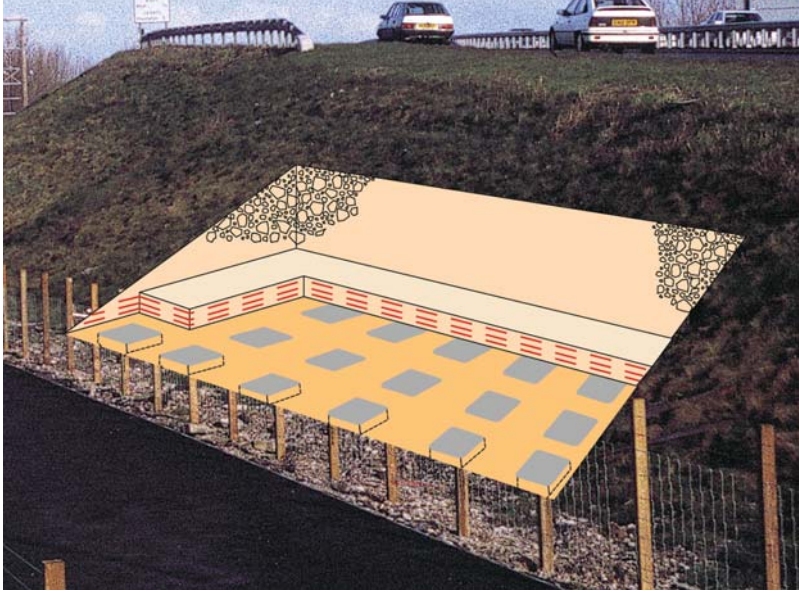
Tensar Technology - proven practical solutions and the know-how to get them built

Based on the characteristic properties of Tensar geogrids and geotextiles, Tensar Technology is widely adopted for ground stabilisation and soil reinforcement problems, delivering real savings in cost and time. We can help you apply Tensar Technology to improve the bottom line on your project.



Cut-away view of embankment supported over a Load Transfer Platform.

Constructing Load Transfer Platforms over weak ground with piled foundations

Engineers often need to construct embankments in areas where minimal settlement can be tolerated. This is especially true when the serviceability of adjacent structures would be compromised by anything other than minimal settlement. The engineer, therefore, needs to design a foundation that will provide a firm support without the consequential settlements and consolidation of underlying soils.

Using a Load Transfer Platform (LTP) avoids the delay required for consolidation settlement as a result of placing embankment fill over soft, compressible soils. The Tensar Load Transfer Platform distributes embankment loads efficiently onto a series of piles or vibro concrete columns (VCCs) which bear on firmer strata below. This avoids the cost of using a concrete raft. In situations where the foundation soils can be assured to provide some permanent support to the area between the piles, then a LTP of good quality granular fill reinforced with multiple layers of Tensar grids can be used. In all other installations an alternative design, using Tensar Basetex, can be employed and accommodate poorer quality fill if necessary.

Tensar LTPs have also been successfully used below concrete ground floor slabs in order to avoid designing the slabs to span between piles. However, LTPs are not suitable for use with some ground treatment techniques such as vibro stone columns.

When settlement restrictions dictate that a deep foundation solution is required to support an embankment or ground-bearing slab, a Tensar LTP:

- Avoids the delay required for consolidation settlement
- Avoids the need for concrete rafts, or ground beams
- Can be used under ground-bearing slabs to avoid or minimise bending
- Is rapid and economical to install
- Is a proven, reliable solution

Installing pile caps (Holland).

Geogrid installation.

Placing a fill layer.

Tensar International Support Services

Tensar International's experienced engineers are available to provide clients, consultants and contractors with design and construction advice. Designs are carried out in-house.

The services offered range from a free of charge application suggestion to a full design and supply service. No liability in negligence or responsibility of any kind is accepted by Tensar International for any project where Tensar products are not used.

Installation of the Enhanced Arch Load Transfer Platform is simple and rapid.

Load Transfer Mechanisms

Enhanced Arch Load Transfer Platform

The inclusion of Tensar geogrids within granular layers has been shown to increase the angle of load distribution considerably in comparison with the unreinforced condition. The geogrids interlock with the fill to mobilise the maximum shear strength of the granular layer and enhance the load spreading mechanism.

An Enhanced Arch LTP is designed such that the majority of the overlying embankment load is transferred directly to the pile heads via a reinforced granular layer. This layer acts as a series of inverted pedestals above the pile heads which join together to provide a continuously supported area. The geogrid within the granular layer combines with the permanent support from the subgrade to support the fill beneath the pedestals and confines the granular material, thereby resisting dilation and effectively increasing its shear strength - see figure 1.

The fill material below the theoretical arch must be permanently supported by the grids and the subgrade while the arch itself must be loaded by either additional fill or a concrete slab to ensure that the arch is permanently locked in compression.

As the embankment height increases the lateral forces within the embankment increase and these must be resisted by reinforcement anchored at the embankment edge, to prevent the forces being imposed on the vertical piles. Raking piles can be used as an alternative although for some types of pile, e.g. vibro concrete columns, this may be impractical.

Tensioned Membrane Load Transfer Platform (LTP)

A Tensioned Membrane LTP is designed such that the embankment fill is supported directly by the geotextile spanning between the piles. This load is transferred into the piles by tension in the geotextile. Arching within the fill results in some reduction in vertical stress applied to the geotextile compared with the full embankment height. There is no special requirement for fill properties - see figure 2.

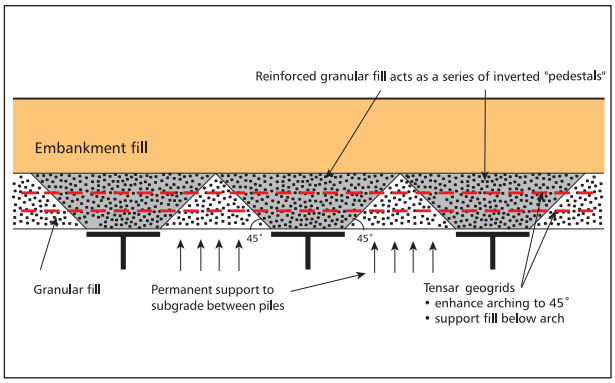


Figure 1: Enhanced Arch mechanism.

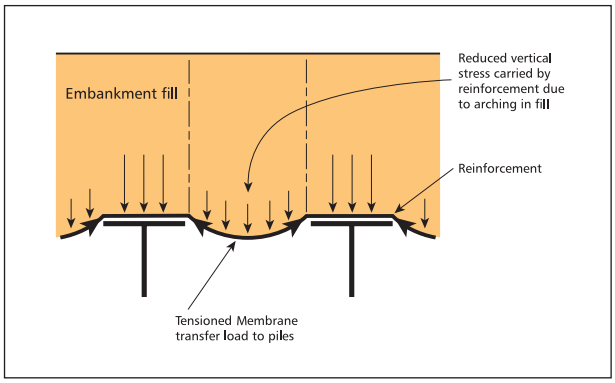


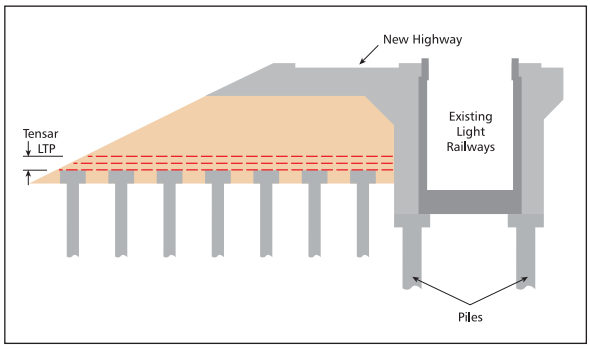
Figure 2: Tensioned Membrane mechanism.

Tensar Basetex Tension Membrane below High Speed 1 railway embankment, UK.

Anchorage for lateral Basetex layers can be achieved by wrapping around an edge thrust block.

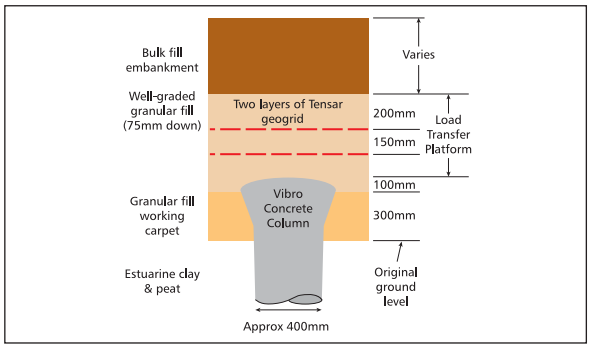
Examples of Load Transfer Mechanisms and their applications

Enhanced Arch Load Transfer Platform



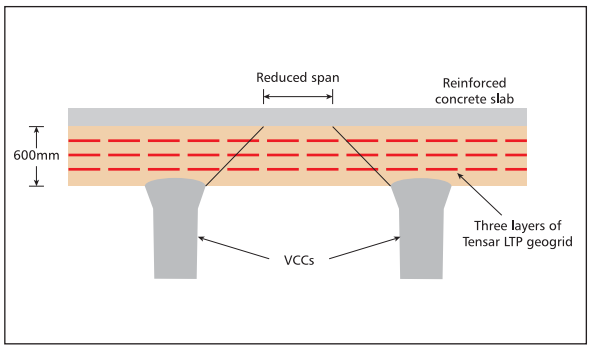
Embankment support over soft ground where only minimal settlements can be tolerated.

Highway construction adjacent to a rigid railway structure (UK).



Embankment support over soft ground where time for consolidation is either not available or can not be reliably determined.

Motorway toll booth plaza constructed on a Tensar LTP - the alternative to surcharge avoiding uncertainty of predicting consolidation period (UK).



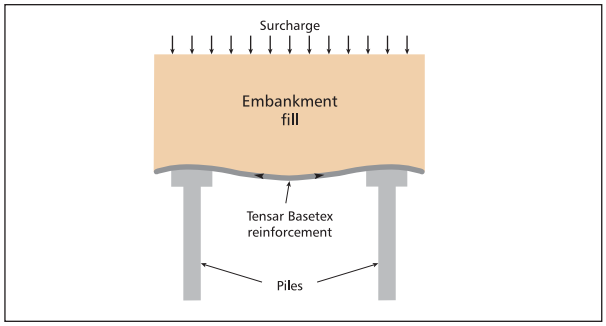
Support of concrete ground floor slabs over soft ground.

Building of supermarket (UK).

Tensioned Membrane Load Transfer Platform

Basetex high-strength knitted geotextiles provide the necessary load/strain properties when the basal reinforcement is designed to act as a Tensioned Membrane spanning between the piles. This approach is used, for example, when there is insufficient granular fill available to form the LTP layer.

Reinforced soil embankment constructed over piles using Tensar Basetex.



Tensar Basetex Tensioned Membrane - an alternative approach to the LTP.

Small pile caps being cast prior to constructing the Enhanced Arch Load Transfer Platform.

Construction of an Enhanced Arch Load Transfer Platform

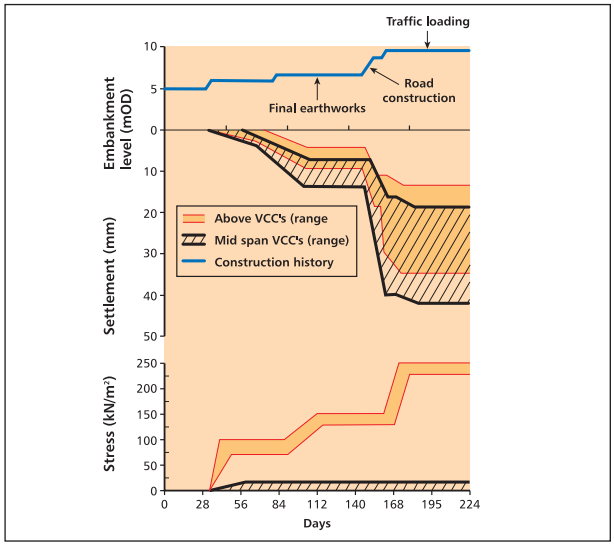
Once the supporting piles/VCCs have been installed the simple construction process involves the inclusion of 2 or 3 layers of Tensar geogrids in the granular layers above the supports. Dead weight compaction of the cushion layer of fill under the bottom grid, and the layer of fill between the bottom two grids, is the only deviation from standard embankment placement and compaction operations. Overlapping, or tying, of adjacent grids provides the continuity required.

A grid layer is placed.

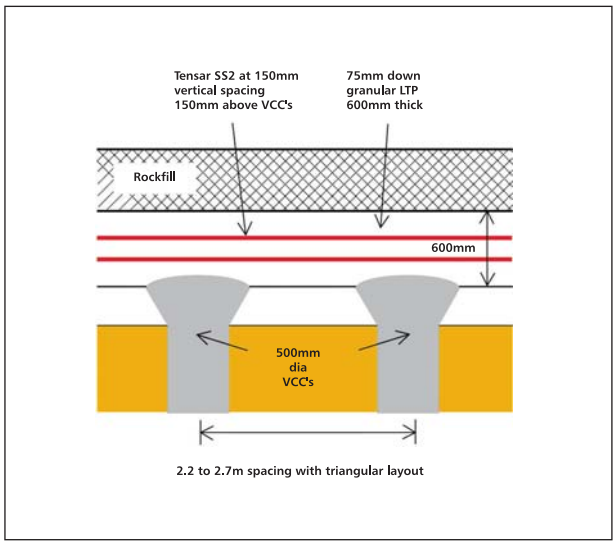
The design thickness of granular fill is placed, spread and compacted.

Second Severn Crossing, UK

The Toll Plaza area for the Second Severn Crossing in the UK was built over compressible soils supported on VCCs. Load from the embankment and pavement above was transmitted to the VCCs using a Tensar geogrid reinforced Enhanced Arch Load Transfer Platform (LTP). The graphs summarise the performance from monitoring this LTP. Settlement above the VCCs and mid-way between them is almost the same, whereas stress measured at subgrade level between the VCCs is almost zero. These results show how well the design assumptions have been realised in practice. The Enhanced Arch LTP has performed as a stiff raft, transmitting loads from the pavement and embankment directly to the VCCs using the excellent load spreading capability of a granular layer reinforced with Tensar biaxial geogrids.



Second Severn Crossing Enhanced Arch Load Transfer Platform performance.



Details of Enhanced Arch LTP at Second Severn Crossing.

Contact Tensar International or your local distributor to receive further literature covering Tensar products and applications.

Also available on request are product specifications, installation guides and specification notes.

The complete range of Tensar literature consists of:

- **Tensar Geosynthetics in Civil Engineering** A guide to products, systems and services
- **Ground Stabilisation** Reinforcing unbound layers in roads and trafficked areas
- **TriAx™ A Revolution in Geogrid Technology** The properties and performance advantages of Tensar TriAx™ geogrids
- **Asphalt Pavements** Reinforcing asphalt layers in roads and trafficked areas
- **Tensar*tech* Earth Retaining Systems** Bridge abutments, retaining walls and steep slopes
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- **Foundations over Piles** Constructing over weak ground without settlement
- **Basal Reinforcement** Using Basetex high strength geotextiles
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Q 05288
ISO 9001:2008

EMS 86463
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Printed August 2010 Issue 11, SDA: 583090

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