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.

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

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

Based on the characteristics of Tensar geogrids and geotextiles, Tensar Technology is widely adopted for ground stabilization and consolidation applications, delivering real savings in cost and time. We can help you apply Tensar Technology to improve the bottom line on your projects.

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 unsaturated 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 piles combined with ground bearing slabs. This avoids the cost of using a concrete raft. In situations where the foundation soils can be assured to provide some permanent support, 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 or necessary.

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 unloading embankment load is transferred directly to the pile heads via a reinforced granular layer. This layer acts as a series of inverted pedestals upon which the pile heads rest as they join together to provide a continuously supported area. The geo grid within the granular layer combines with the permanent support from the subgrade to support the fill below the embankment and confirm 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 as the arch itself must be loaded by either additional fill or a concrete slab to ensure that the arch is permanently locked in compensation. As the embankment height increases, the lateral forces within the embankment increase and must be resisted by reinforcement and anchoring the embankment load. This can be achieved by raking 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

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 piles by tension in the geotextile. Acting within the fill, the LTP results in some reduction in vertical stress. The ultimate support from the subgrade is provided by the grid-reinforced granular layer.

Examples of Load Transfer Mechanisms and their applications

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Examples of Load Transfer Mechanisms and their applications

Enhanced Arch Load Transfer Platform

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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 interact 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 in a series of inverted pedstals above the pile heads, while joining 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 embankment and confirm 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 must be resisted by reinforcement (enhanced) and the embankment supported by a series of piles or vibro concrete columns (VCCs) which bear on firmer ground with piled foundations.

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 where the unconsolidated 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 underlay soils below. This avoids the cost of using a concrete slab. In situations where the foundation soils can be assumed 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 been successfully used to substitute 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 economic to install
- Is a proven, reliable solution

Examples of Load Transfer Mechanisms and their applications

Enhanced Arch Load Transfer Platform

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 via tension in the geotextile. Arching within the fill results in some reduction in vertical stress applied to the piles by tension in the geotextile. Arching within the fill increases the lateral forces within the embankment fill which must be resisted by reinforcement (enhanced) and the embankment supported by a series of piles or vibro concrete columns (VCCs) which bear on firmer ground with piled foundations.

Tensioned Membrane

A Tensioned Membrane LTP may be impractical for some types of pile, e.g. vibro concrete columns; this may be impractical.

Reinforced soil embankment constructed using Tensar Basetex, Tensar Basetex Tensioned Membrane - an alternative approach to the LTP framework supported embankment on soft ground. Building of supermarket (UK).

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 support 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 or the advice not followed.
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 unimproved condition. The geogrids work 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 in a series of inverted pedestals above the pile heads while, at the same time, it joins together to provide a continuously supported area. The layer above the granular layer is reinforced with a permanent support from the subgrade to support the fill thereby the embankment and confine the granular matrix. The fill material below the theoretical arch must be permanently supported by the geogrids and the subgrade as the arch itself must be loaded by either additional fill or a concrete slab to ensure that the arch is permanently locked in compression.

Examples of Load Transfer Mechanisms and their applications

Enhanced Arch Load Transfer Platform

Support of concrete ground floor slab over soft ground. Building of supermarket (UK).

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

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 piles by tension in the geotextile. Therefore, the fill height may be increased without limit while the load is transferred from the embankment into the piles. As the embankment height increases the lateral forces within the embankment increase and these must be resisted by reinforcement anchored into the embankment fill as shown in figure 2. Raking piles may be used as an alternative although for some applications e.g. vibro concrete columns, this may be impractical.

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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 where the unconsolidated 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 underlining 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 all other installations an embankment is supported over soft, compressible soils. The Tensar Load Transfer Platform 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 in a series of inverted pedestals above the pile heads while, at the same time, it joins together to provide a continuously supported area. The layer above the granular layer is reinforced with a permanent support from the subgrade to support the fill thereby the embankment and confine the granular matrix. The fill material below the theoretical arch must be permanently supported by the geogrids and the subgrade below. 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 piles by tension in the geotextile. Therefore, the fill height may be increased without limit while the load is transferred from the embankment into the piles. As the embankment height increases the lateral forces within the embankment increase and these must be resisted by reinforcement anchored into the embankment fill. Raking piles may be used as an alternative although for some applications e.g. vibro concrete columns, this may be impractical.

Load Transfer Mechanisms

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Examples of Load Transfer Mechanisms and their applications

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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.

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.

Contact Tensar International or your local distributor to receive further literature covering Tensar products and applications. Also available are 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.
- Railways: Stabilisation of track ballast and sub-ballast.
- Foundations over Piles: Constructing over weak ground without settlement.
- Geotextiles: Reinforcement Using Biaxial High-strength Geotextiles.
- Tensar® Enhanced Mat Systems: 
- Anchors: Controlling motion on soil and rock slopes.

Second Severn Crossing Enhanced Arch Load Transfer Platform performance.

Foundations over Piles
Constructing Load Transfer Platforms over weak ground with piled foundations.
A grid layer is placed. The design thickness of granular fill is placed, spread and compacted.

**Construction of an Enhanced Arch Load Transfer Platform**

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