

TENSAR[®] TECHNOLOGY

FOR USE IN THE SURFACE MINING INDUSTRY



Tensar[®]

Tensor® Technology – Proven, Practical Products and Systems and the Know-How to Get Them Built

Based on the characteristic properties of Tensor geogrids, Tensor Technology is widely used in ground stabilisation, soil reinforcement and asphalt reinforcement applications often delivering major environmental benefits and real savings in cost and time. We can help you apply Tensor Technology to improve the profitability of your project.

Tensor is a worldwide leader in the manufacture and provision of soil reinforcement and ground stabilisation products and systems. Our expertise and experience has been accumulated over several decades of successful collaboration in major international projects. Our service team, comprising many qualified civil engineers, provides practical and best value advice and design to support the use of Tensor products and systems in your application.



Saving Money From a Well Designed Haul Road

Good haul road construction and subsequent maintenance practices are vital when operating a fleet of mining haulage trucks cost effectively. With truck haulage accounting for up to 50% of total surface mining costs, the savings to be gained from a well designed haul road using the appropriate materials are considerable.

A mechanically stabilised haul road can limit development of damaging ruts and potholes. A smoother running surface will allow vehicle operating speeds to be maintained and reduce 'wear and tear' on the trucks, reducing down time and maintenance costs.



Bearing capacity is greatly improved through bespoke solutions for working platforms.



Bearing the cost of haulage, Tensar® Technology can benefit your project with huge savings in both construction time and maintenance on major haulage and access roads.

High Performance Stabilisation Solutions of Roads and Working Areas

There are now unprecedented demands to design economic roads and working areas that reduce maintenance costs and improve haul truck efficiency. Tensar® geogrids give a high performance solution which also meets these demands. The structural contribution made by Tensar TriAx® geogrids is to stabilise the unbound layers of roads and trafficked areas to create a mechanically stabilised layer. Aggregate particles interlock with the geogrid and are confined within the apertures, creating an enhanced composite material with improved load distribution and resistance to rutting.

A mechanically stabilised layer incorporating TriAx geogrids combines cost savings with considerable performance benefits in granular capping, sub-base and other aggregate layers.

When compared with an unstabilised aggregate layer, a mechanically stabilised layer incorporating TriAx geogrids can:

- ▶ Reduce potholes and rutting, leading to less spillage
- ▶ Control differential settlement
- ▶ Reduce vehicle maintenance due to fewer potholes and ruts
- ▶ Reduce road maintenance costs
- ▶ Increase design life
- ▶ Increase bearing capacity
- ▶ Reduce fill thickness requirements



Aggregate particles interlock with the TriAx geogrid and are confined within the apertures forming a mechanically stabilised layer with increased load bearing capacity.



TENSAR TRIAX GEOGRIDS WORK BY CONFINING AGGREGATE PARTICLES

Tensar TriAx geogrids can solve stabilisation problems because they interlock very efficiently with granular materials. When granular particles are compacted over these geogrids, they partially penetrate and project through the apertures and are mechanically confined by the geogrid to create a stiff composite layer.



Tensor® geogrid used to stabilise track ballast since the early 1980s.

Effective Railway Trackbed Stabilisation

Poor track geometry and a loss of vertical and horizontal alignment of the rails is a major reason for line speed restrictions and track maintenance work. These can significantly affect schedules as well as being expensive and disruptive to the train operators. Track maintenance, involving ballast tamping or full ballast replacement, is required not only on weak subgrades but also on firmer supporting soils. Mechanical stabilisation of ballast using Tensor® geogrids gives the railway engineer a rapid, inexpensive and proven solution. Tensor geogrids have been used to stabilise track ballast since the early 1980s.

When constructing track over soft subgrade having a low bearing capacity, it is necessary to improve the foundation to

support the ballast effectively. This can involve a time consuming chemical stabilisation of the subgrade or deep excavation followed by importation and placement of a thick and expensive granular sub-ballast layer. Introducing Tensor geogrid stabilisation allows for a significant reduction of sub-ballast layer thickness for the required bearing capacity. This allows the reduction in subgrade excavation and spoil disposal and much less imported sub-ballast fill, while still achieving the target stiffness value required for the support of the ballast. Tensor has extensive experience in mechanically stabilising sub-ballast layers, especially in the upgrading of European railway corridors, that has resulted in many successful cost effective installations.

Safe Placement and Compaction of Fill in Tailings Lagoons



Remediation treatments of tailings lagoons can be costly and environmentally challenging for a mine owner and operator. Tensor has developed techniques for the capping of tailings lagoons. Tensor TriAx® geogrids enable safe placement and compaction of the fill when the sludge lagoon or industrial waste deposit is being capped. This has now become a popular method of capping tailings lagoons.

- ▶ Enables safe access to the tailings lagoon to enable capping to take place
- ▶ Avoids expensive treatment
- ▶ Reduces environmental impact
- ▶ Helps to control differential settlement

Improved access and a more stable working platform means lagoon capping can be completed quickly and safely.

Leach Pad Projects and Geogrid Applications

Heap leaching is used at many mining sites to extract precious metals and copper compounds from ore. The mountains of mineral ore are loaded onto a leach pad which is lined with impermeable clay or geomembrane liner. The ore is then sprayed with a leach solution so the valuable metals are dissolved. This solution then percolates all the way through the heap and into collector pipes. Significant amounts of ore are required to produce the precious metals that are the end result of the process which means that the pipes experience very high loads. Tensar geogrids can be used to confine the particles above and between the pipes. This supports the heavy equipment used in the process as well as providing a greater bearing capacity for the heap of mineral ore.



Leach pad construction with Tensar® geogrids.

Dump and Head Walls - High Load Resistant and Durable

Dump and head walls are vital to the operational efficiency of mines worldwide. It is vital that the walls are designed to be durable with the ability to carry the loads and repeated traffic they endure. TensarTech® Earth Retaining Systems enable structures to be built using locally won or recycled material, including colliery spoil. Benefits of TensarTech Earth Retaining Systems can include:

- ▶ Rapid and economical construction
- ▶ Durable with little or no maintenance
- ▶ Resistance to impact loading
- ▶ No specialist construction skill necessary
- ▶ High resistance to earthquake loading
- ▶ Reduced need for expensive foundation treatments due to low bearing pressure



Head walls are easily assembled but provide robustness and durability in a tough working environment.

Reliable Performance Through Cold Region Testing

In certain areas such as Russia and Canada, extremely low temperatures can be experienced during the winter period which is when much of the construction work takes place. Tensar mechanically stabilised layers have been proven to work on mining projects in cold regions and have performed well in laboratory testing and in full scale tests in extreme cold conditions.

The Siberian Roads Academy in Omsk performed tests on Tensar geogrid to check its performance at low temperatures. Conclusions from the series of tests showed that when used in ice roads, the load carrying capacity of the ice was increased by up to 60%. When frozen into ice beams, Tensar geogrid increased the force required for destruction by a factor of 2 or 3. Further research in Russia has been carried out with LIŽD St Peterburg, VITU, MIIT and Soyuzdornii.



Tensar® mechanically stabilised layers can provide the required performance for working platforms necessary in the surface mining industry.



TensarTech TR2 steel mesh panel system at Lee Moor Crushing Plant offered considerable savings over a concrete faced alternative.

Case Study: Lee Moor Crushing Plant, Plymouth, UK

In order to install a very large crushing and washing plant, Imerys Minerals PLC needed to construct a 17.7 metre high stepped structure. The fully loaded, 150 tonne delivery vehicles deliver their payload into the crushing plant that sits on the terrace. Surcharges from the vehicles and the “Big Grizzly” are extremely high (75kPa).

The original design for the structure envisaged the use of a concrete panel to face the reinforced soil structure. The TensarTech® TR2 steel mesh panel system with its geotextile liner is durable enough for the situation, at half the cost of a concrete faced alternative. Waste material, from the china clay process, was used throughout the structure as the reinforced fill.

Environmental Benefits and Reductions in CO₂ Emissions

By using a Tensar mechanically stabilised layer in a road or a working area, construction savings can be made in the amount of aggregate required by up to 50%. This means that the project can run more quickly, as less excavated material needs to be taken away from site, less compaction is required and less aggregate needs to be imported on to the site.

By reducing vehicle movements and the volume of material to be removed from the site, considerable savings of up to 50% can be made in construction CO₂ emissions when compared with an unstabilised design. Tensar published the TriAx® Carbon Calculator in 2009, this was developed and verified by Coffey Geotechnics. Armed with an application suggestion from Tensar, the user can enter the details and print out a statement which shows the percentage saving in CO₂ emissions when compared with the unstabilised design.

The TriAx Carbon Calculator is available at www.tensarsustain.co.uk



Achieving Safer Working Platforms over Weak Subgrades

Cranes, piling rigs and other heavy equipment require a working platform to operate safely and with controlled accuracy. Frequently, these operations have to take place over weak subgrades. Tensar mechanically stabilised layers help to increase the bearing capacity by spreading the load.

Cost Savings in Waste Dewatering

Dewatering and containment of mining waste requires a special solution of its own. Tensar Triton® Geotextile Tubes provide an economical, environmentally friendly alternative to traditional technologies. Strong and durable, Triton Geotextile Tubes can contain even fine grained materials. With their unique construction, they typically outperform conventional tube systems.



Tensar® Triton geotextile tubes are often cheaper and can outperform other methods in waste dewatering.

Tensar - Practical Experience for the Sub Surface Mining Industry

Tensar offers a number of solutions to support the unique requirements of sub surface mining and tunnelling construction.

These applications include:

- ▶ Rib Control
- ▶ Straps
- ▶ Roof Control
- ▶ Longwall Screening
- ▶ Highwall Screens
- ▶ Road Stabilisation

Full information on Tensar Sub Surface Mining Applications can be found in the brochure entitled "Mining underground and surface systems", which is available on request at info@tensar-international.com.

Tensar Support Services

We offer the services of a team of professionals who can assist in developing concepts to support your design or undertake full construction design. We also provide advice and initial training on site to assist you to install our products and systems in your project. Our range of innovative products is combined with our global experience of thousands of projects in a wide variety of climatic conditions and soil types. This means that we provide you with a unique specialist civil engineering viewpoint on how to use Tensar products and systems and proven, best value solutions in your application. We are committed to providing the highest levels of technical assistance in the field to support the use of our products and systems. Our own dedicated and trained teams of civil engineers or those of Tensar local distributors work in partnership with you to ensure the success of your project.

TENSAR OFFERS A RANGE OF DESIGN SERVICE OPTIONS IN 3 CORE STREAMS

- 1 **SUPPLY ONLY**
- 2 **APPLICATION SUGGESTION & SUPPLY**
Conceptual drawing and advice
- 3 **DESIGN & SUPPLY**
Certified detailed design and construction drawings covered by Tensar's Professional Indemnity (PI) insurance

Your local distributor is:

Tensar[®]

Tensar International Limited
Units 2-4 Cunningham Court
Shadsworth Business Park
Blackburn BB1 2QX
United Kingdom

Tel: +44 (0)1254 262431
Fax: +44 (0)1254 266867
e-mail: info@tensar.co.uk
tensar-international.com



Q 05288
ISO 9001:2008



EMS 86463
ISO 14001:2004

Copyright ©Tensar International Limited 2012
Printed April 2012, Issue 2, SDA: 644560

The copyright in this brochure (including without limitation all text, photographs and diagrams) and all other intellectual property rights and proprietary rights herein belongs to Tensar International Limited and/or its associated group companies and all rights are reserved. This brochure, whether in whole or in part, may not be copied or redistributed or reproduced or incorporated in any other work or publication in any form whatsoever without the permission of Tensar International Limited. The information in this brochure supersedes any and all prior information for the products referred to in previous versions of this brochure, is of an illustrative nature and supplied by Tensar International Limited free of charge for general information purposes only. This brochure is not intended to constitute, or be a substitute for obtaining, project specific engineering, design, construction and/or other professional advice given by someone with full knowledge of a particular project. It is your sole responsibility and you must assume all risk and liability for the final determination as to the suitability of any Tensar International Limited product and/or design for the use and in the manner contemplated by you in connection with a particular project. The contents of this brochure do not form part of any contract or intended contract with you. Any contract for the provision of a Tensar International Limited product and/or design service will be on Tensar International Limited's Standard Conditions in force at the time of entering into the contract. Whilst every effort is made to ensure the accuracy of the information contained in this brochure at the time of printing, Tensar International Limited makes no representations about the suitability, reliability, comprehensiveness and accuracy of the information, services and other content of this brochure. Save in respect of Tensar International Limited's liability for death or personal injury arising out of negligence or for fraudulent misrepresentation (if any), Tensar International Limited shall not be liable to you directly or indirectly in contract, tort (including negligence), equity or otherwise for any loss or damage whatsoever or howsoever arising in connection with the use of and/or any reliance placed upon the contents of this brochure including any direct, indirect, special, incidental or consequential loss or damage (including but not limited to loss of profits, interest, business revenue, anticipated savings, business or goodwill). Tensar and TriAx are registered trademarks, TensarTech is a registered trademark in Europe. In case of legal disputes between the parties, the original English language version of this disclaimer shall prevail.

Contact Tensar 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**
Stabilising 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
- ▶ **TensarTech[™] Earth Retaining Systems**
Bridge abutments, retaining walls and steep slopes
- ▶ **Railways**
Mechanical stabilisation of track ballast and sub-ballast
- ▶ **Foundations Over Piles**
Constructing over weak ground without settlement
- ▶ **Basal Reinforcement**
Using Basetex high-strength geotextiles
- ▶ **TensarTech Foundation Mattress System**
- ▶ **Erosion**
Controlling erosion on soil and rock slopes