T-Value

A new direction for
working platforms

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Introduction

Tensar's design approach, using the T-Value method of calculation, is based on the relationship between bearing capacity and the load transfer efficiency of a granular layer, expressed as a T-value.

Working Platforms & Piling Mats >

The Importance of Safety >

Designing Temporary Working Platforms & Piling Mats >

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Working Platforms and Piling Mats

Temporary working platforms are important aspects of many construction projects, providing stable and safe working areas. Piling mats are working platforms designed specifically to carry the heavy static and dynamic loads from piling rigs, their support cranes and associated equipment.

Often placed over weaker subgrades, temporary working platforms are typically built using well-graded, compacted granular fill, such as natural gravels and crushed rock, as well as recycled demolition material. Geogrids can be incorporated in the granular material to stabilise it and increase bearing capacity, and platforms are designed to be free-draining, to prevent a build-up of water on the surface.

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The Importance of Safety

The UK's Federation of Piling Specialists (FPS), estimates that a third of all dangerous occurrences reported by its members are related to piling mats – a soft spot just 1m² can cause a rig to topple, with the potential for devastating consequences. Safety in design, construction and maintenance is obviously of paramount importance.

The FPS recommends that piling mats should be inspected daily to ensure they are in proper working condition. If any excavations, trenches or holes have formed in the surface, they must be properly backfilled to ensure they are as stable as the rest of the mat.

Every site with an operational piling rig has to have a Working Platform Certificate, which confirms that the piling mat has been properly designed, and constructed in accordance with the design, and that it will be regularly inspected and maintained. This is signed by the principal contractor and provided to the piling contractor before work starts.

Source: www.heavyliftnews.com/accidents/tragic-crane-accident-vungtau-vietnam

FEDERATION OF PILING SPECIALISTS

Find out more >

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Designing Temporary Working Platforms and Piling Mats

Temporary working platform design should be carried out by a competent person, and preferably a geotechnical engineer. Design depends on ground conditions and the groundwater regime, and so requires sufficient ground investigation data.

Platform thickness depends on subgrade strength, the platform materials and, of course, the expected construction loads. Piling machinery, in particular, is some of the heaviest on site. It is important to have a platform that can provide sufficient bearing capacity for safe working, while being economic and straightforward to construct.

If the platform is being built over particularly loose and weak soils, additional ground treatment may be needed before it is built.

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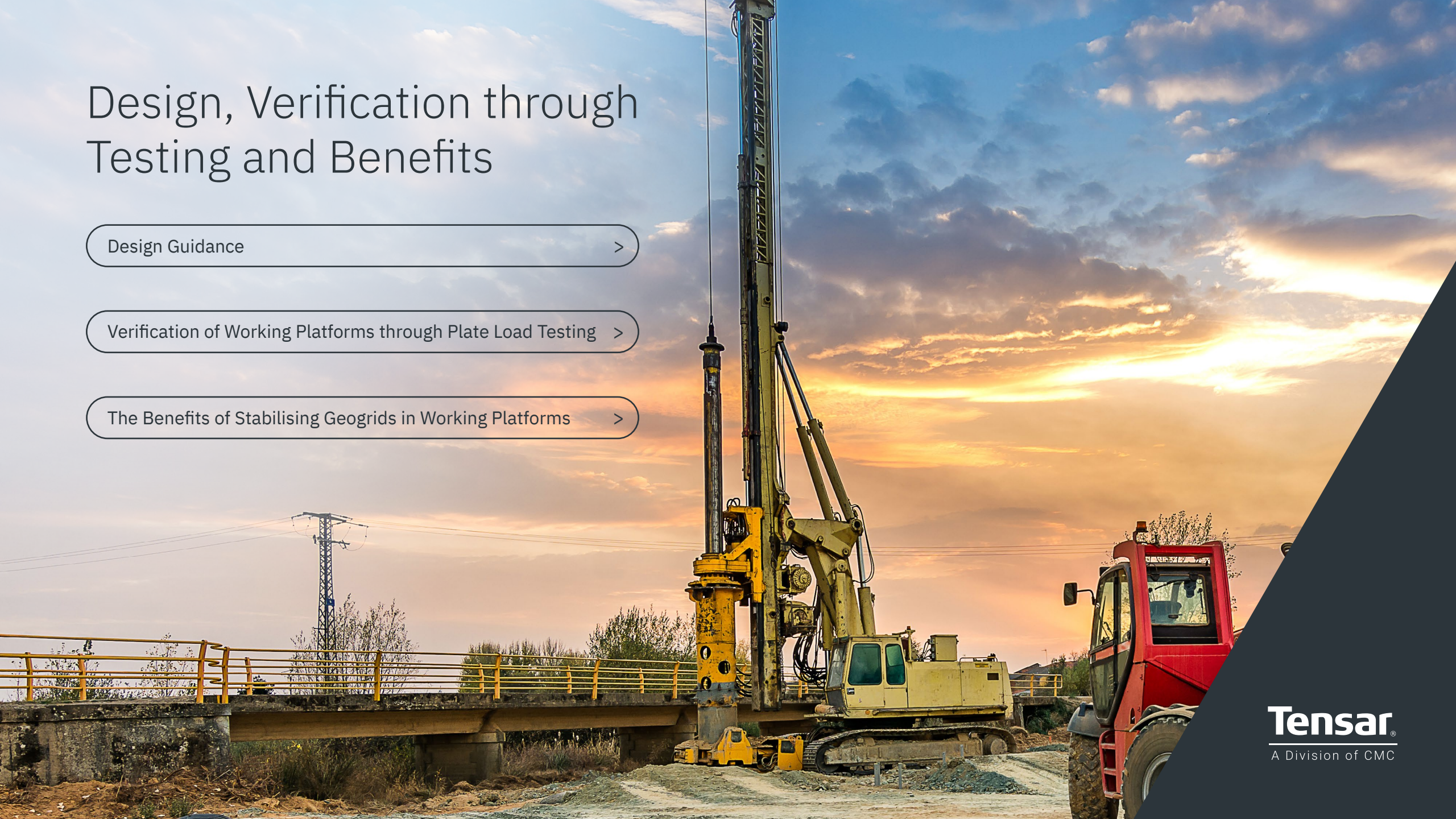
Design, Verification through Testing and Benefits

Design Guidance >

Verification of Working Platforms through Plate Load Testing >

The Benefits of Stabilising Geogrids in Working Platforms >



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Design Guidance

The key document for UK designers is BR470 “Working platforms for tracked plant”, which includes guidance on the design, construction, operation and maintenance of working platforms. It was written by by the Building Research Establishment under the direction of the FPS.

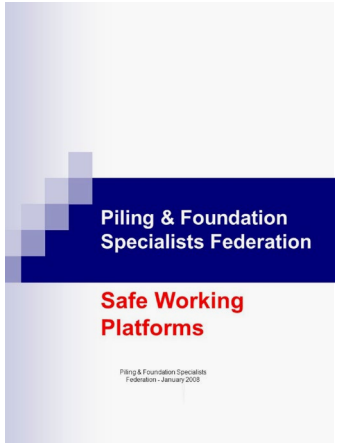
In 2011, BRE published a supplementary document, “Use of structural geosynthetic reinforcement – A BRE review seven years on”. This recognises that alternative design methods can be used, including platforms built using granular material mechanically stabilised with geogrid, as long as designs are based on ‘credible and representative’ research and project case studies.

BR470 Working platforms for tracked plant

Includes guidance on the design, construction, operation and maintenance of working platforms.

Buy now >

Other guidance includes:



Federation of Piling Specialists Guide to Working platforms

View now >

The European Federation of Foundation Contractors and Deep Foundations Institute

View now >

The Institution of Civil Engineers Temporary Works Forum’s Working platforms – Design of granular working platforms for construction plant.

View now >

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Verification of Working Platforms Through Plate Load Testing

BR470 recommends that the design and verification of working platforms should be carried out using plate load tests. A plate load test involves increasing the loading applied to a circular steel plate placed on the ground surface and measuring the resulting settlement, to determine bearing capacity.

Plate load tests typically use 0.3m or 0.6m diameter plates, with the size of the pressure bulb created (and therefore the depth of ground being tested) being related directly to the size of the plate – typically twice its diameter (so about 0.6m depth for a 0.3m diameter plate).

Plate load tests typically use

0.3m | 0.6m

diameter plates, with the size of the pressure bulb created being related directly to the size of the plate.

To learn more about **the best approach for plate load testing** watch our Ground Coffee video here...

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The Benefits of Stabilising Geogrids in Working Platforms

Incorporating stabilising geogrids in the granular material used to form a working platform can enhance bearing capacity, resulting in a thickness of around a half of the equivalent non-stabilised platform.

This is because of the interlocking mechanism and particle confinement that develops between the aggregate and the geogrid. This prevents lateral movement of the granular material, creating a mechanically stabilised layer that increases bearing capacity and controls differential settlement.

Additionally, lower quality and recycled granular fill can be used and together, this can save time and money through reduced excavation and imported materials, as well as reducing the platform's carbon footprint.

To learn more about **Mechanical Interlock** watch our Ground Coffee video here...

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Design, Verification through Testing and Field Trials

- Tensar’s T-Value Method >
- How T-Value Differs from Other Methods >
- Verification of the T-Value Method Through Laboratory >
- Verification of the T-Value Method Through Field Trials testing >

Tensar's T-Value Method

Tensar's T-value method of calculation enables a more accurate assessment of the positive effect of stabilising geogrids on the bearing capacity of a granular working platform.

Applicable to a range of working platform materials, in different ground conditions, the method allows designs with, or without, geogrid to be compared, including for very low subgrade shear strengths. It can also be applied to surface and shallow embedded foundations, with dry or saturated granular layers.

For the first time, the full benefits of stabilising geogrids can be incorporated consistently in designs for working platforms. It delivers verifiable designs that can reduce platform thickness and improve bearing capacity, cutting construction costs by up to 50% and reducing a platform's carbon footprint by up to 50%.

Cutting construction costs by up to

50%

Reducing a platform's carbon footprint by up to

50%

To learn more about our **T-Value methodology for working platforms**, watch our Ground Coffee video here...

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How T-Value Differs from other Methods

What makes the T-Value approach different compared to other methods is that, for the first time, the performance of a composite of granular material and stabilising geogrid can be analysed. This gives a truer prediction of performance and also allows designers to compare this performance with that of non-stabilised materials.

The relationship between the T-Value and subgrade strength has been derived for Tensar geogrids alone across a growing number of granular fill types. If other aggregates and geogrids are to be used, the relationship must be derived through FEA and laboratory testing and validated using full-scale testing appropriate to the platform or foundation being built.

While BR470 considers geosynthetics, their effects are based upon manufacturers' guidance, which can lead to inconsistency and uncertainty during design checks. Existing methods are either overly-simplified (eg a common load spread angle for all cases) or use obscure, hard-to-understand empirical input parameters.

Furthermore, a granular material's bearing capacity and a geosynthetic's tensile strength are considered separately. This is inappropriate to stabilising geogrids because, as discussed, rather than acting in tension to reinforce granular material, the aggregate and geogrid perform as a composite, due to interlocking and particle confinement in the geogrid's apertures.

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Verification of the **T-Value Method** through Laboratory Testing

The T-Value method was developed using finite element analysis (FEA) of granular layers stabilised with geogrid.

However, FEA models used in geotechnical design characterise geogrid in terms of its in-air tensile stiffness or strength properties, together with the mechanical characteristics of the soil without geogrid, often measured using triaxial tests.

This can lead to significant under-prediction of stabilisation geogrid performance, because this depends critically on the mechanical interlock between the aggregate particles and the geogrid apertures. Triaxial testing of the aggregate and geogrid together overcomes this, as it enables the performance of a composite material to be measured.

500

More than
500 Large scale
triaxial tests carried out

To learn more about
Triaxal Testing, watch our
Ground Coffee video here...

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Verification of the **T-Value Method** through Field Trials

The T-Value method has also been tested in the real world, with Tensar teaming up with the University of Saskatchewan in Canada to carry out full-scale plate load tests of a trial section of granular working platform on a clay subgrade.

Testing, using two 20t trucks as a reaction force, was carried out on 0.25m and 0.5m thick granular platforms, on sections with, and without, stabilising geogrid.

A 1m square plate was used to create a pressure bulb similar in size, and depth, to the one created by the track of a piling rig or crane. This, gave a more accurate assessment of ultimate (and safe) bearing capacity of the platform, compared with conventional tests using 0.3m or 0.6m diameter plates.

20t Testing using **two 20 tonne** trucks

To learn more about **how we conducted our full scale trials on the Canada prairies**, watch our Ground Coffee video here...

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Applying in Practice, Acceptance and Tensar+ design software

- Applying the T-Value Method in Practice at MSD Carlow >
- Applying the T-Value Method in Practice at HS2 Stoneleigh Park >
- Acceptance of the T-Value Method Testing >
- Using Tensar+ online software to design your working platform >

T-Value

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Download the full case study now >

Applying the T-Value Method in Practice at HS2 Stoneleigh Park

As an alternative to traditional design methods, a leaner working platform was required for the Stoneleigh Park Overbridge piling operations, which needed to address the issues of high rig track pressures over a variable subgrade.

Following comprehensive geotechnical investigation, the subgrade conditions were identified as variable; between cohesive and granular over the 5,000m2 area. The project team aimed to also substantially reduce the volumes of imported fill to be used in the platform's construction and maintenance.

Using the updated T-value method in conjunction with Tensar's best ever performing geogrid, Tensar InterAx, a mechanically-stabilised solution was proposed, resulting in significant quantifiable savings in whole life construction time, cost and embodied carbon emissions.

£250K	75%	75%	1.0M
est. reduction in construction cost	est. reduction in construction time	est. saving in carbon emissions	est. of 6F2/5 saving in stone depth

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Applying the T-Value Method in Practice at MSD Carlow, Ireland

Download the full case study now >

Expansion of the Carlow pharmaceuticals facility required a new production building. Soft ground determined the need for piled foundations. This called for a 9,000m2 piling platform constructed with imported granular fill. The contractor saved €58,000 on the platform with Tensar's solution.

The contractor, Robert Quinn Ltd, contacted Tensar to ask for a value engineered alternative to the suggested working platform design. Tensar was able to provide a full design solution for a working platform that saved 45% of imported granular fill compared to the original design. The solution featured a Tensar Mechanically Stabilised Layer incorporating Tensar stabilisation geogrid to achieve the required bearing capacity with a thinner aggregate layer.

€58,000
cost savings to the contractor

5,000
tonnes less imported aggregate used

35
tonnes CO_2e reduction in est. construction emissions

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Acceptance of the T-Value Method

The T-Value method has been welcomed by industry, having been used on projects around the world since its introduction in 2019.

Additionally, a number of academic papers have been published in industry journals, outlining the theory behind the method:

Ground Engineering Magazine
October | 2019
Bearing Capacity of geogrid-stabilised granular layer on clay.

Read now >

Canada Geotechnical Journal
April | 2019
Strength envelope of granular stabilised by multi-axial geogrid in large triaixal tests.

Buy now >

A. Lees / J. Kawalec
September | 2022
The design of mechanically stabilized working platforms.

Read now >

Institution of Civil Engineers
February | 2020
The bearing capacity of a granular layer on clay, Volume 173 Issue 1.

Buy now >

13th Australian New Zealand Conference
April | 2019
Working platforms for tracked plant — BR470 guideline and revised approach to stabilisation design with multi-axial hexagonal geogrid.

Read now >

A. Lees / A.Ali
April | 2023
The surface bearing capacity of a strong granular layer on weaker sand.

Buy now >

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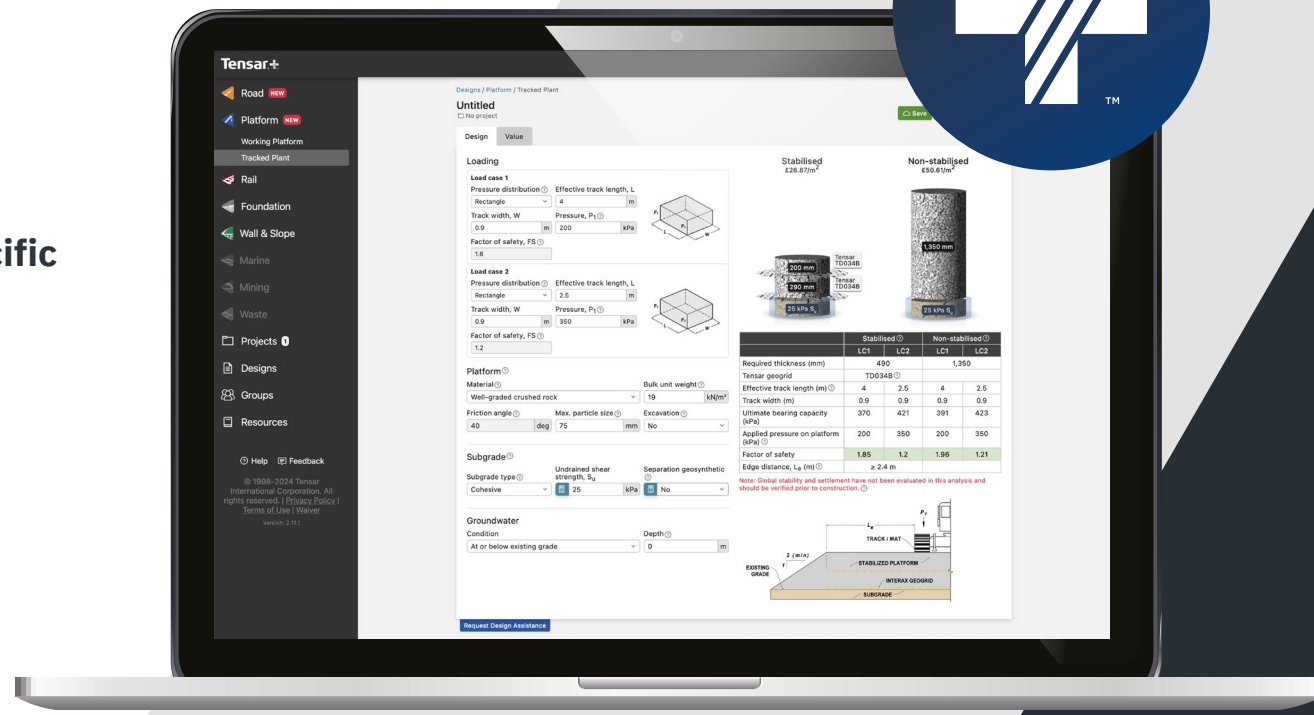
Use Tensar+ online software to design your working platform

The Tensar+ Platform module allows you to model project specific conditions to calculate what a Tensar mechanically stabilised working platform will look like using the T-Value method.

Tracked plant as well as outriggers from mobile cranes can be modelled with several pressure distribution options available.

Subgrade strength parameters, groundwater conditions, associated load cases as well as a growing number of different granular fill types can be included. As well as a design proposal, an assessment of available cost, time and carbon savings can be generated for inclusion in project specific proposals.



PROVEN Technology

PROVEN Savings

PROVEN Success

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Sign up >

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Get in touch

Contact Tensar for further information on T-Value or if you have any other working platform enquires.

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