Information Bulletin – Research Summary
Performance of Tensar InterAx Geogrid NX850™, NX750™ and TriAx® TX160 (Small-Scale Trafficker)

Research Organisation
- Tensar Technology Centre
- Blackburn, UK

Testing Conducted
- Moving Wheel Load
- Surface and Subgrade Rutting Profiles

Sections Tested
- 150mm Aggregate (Control)
- 150mm Aggregate over TriAx TX160 (Control)
- 150mm Aggregate over InterAx NX750
- 150mm Aggregate over InterAx NX850

TX160 **NX850**

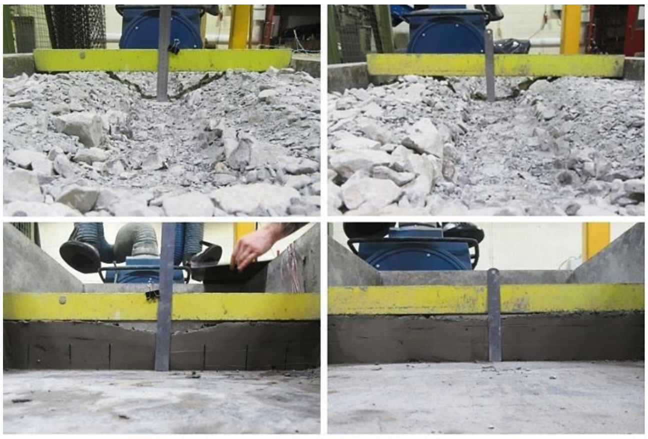

Figure 1. *Aggregate surface (top photos) and subgrade (bottom photos) rutting profiles after trafficking.*

Key Findings
- Tensar InterAx NX850 and NX750 performed better than TriAx TX160 and the non stabilised control.
- Tensar InterAx reduced surface deformation by 29% - 34% and subgrade deformation by 40% - 47% compared to TriAx.
- NX850 and NX750 supported 11.6 times and 6.8 times as many passes of the wheel load as TX160, respectively, to achieve equivalent surface deformation.

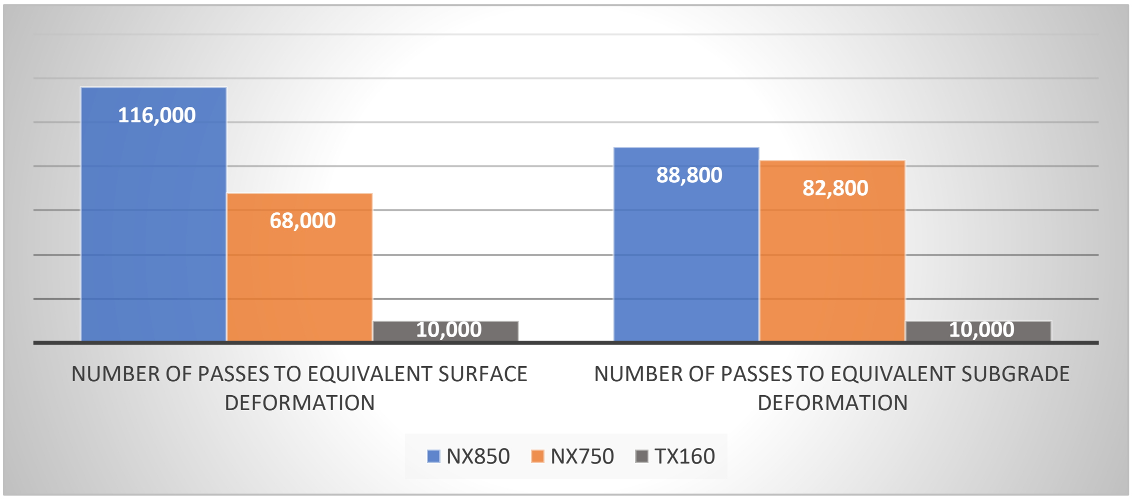

Figure 2. *Number of passes for NX850 and NX750 to achieve equal surface and subgrade deformation to TX160, based on power model.*

Background

The Tensar Technology Centre was built to investigate trafficking performance between different types of geogrids and the way in which geogrids function in stabilisation. The Tensar trafficker allows for the development of performance data for various prototype geogrids before using larger and more costly accelerated trafficking facilities.

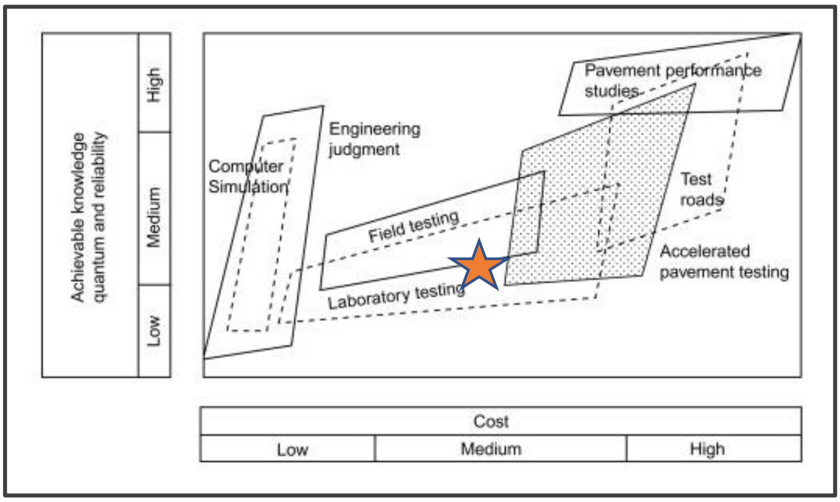

Figure 3. *Relationship between pavement engineering test types (reliability and knowledge gained) and cost (from Hugo et al. 1991.). The relative location of this research report is indicated by a star on the chart.*

The test device and procedures are particularly well-suited for quantifying levels of performance within geogrid families, to understand how small variations in product properties (i.e., rib geometry, rib aspect ratio, aperture shape, material science, and structure of the rib elements) influence performance, and to optimise a product for performance. Test results can be used to determine relative levels of performance for geogrids. Results can also be combined with other full-scale tests of related products (i.e., from the same family) to reliably predict performance for products that have not yet been tested in full-scale.

Figure 4. *The trafficking device, associated controls, and test box.*

Test Procedure

The pavement test section construction consists of a 75mm layer of clay (a highly consistent manufactured smooth grey clay), followed by the geogrid to be tested with two 75mm layers of compacted aggregate on top. Plasticizers and other chemicals are not used or added to the clay subgrade. Due to the high degree of consistency of the clay, the target CBR of subgrade is consistent in all tests. The geogrid is placed directly on top of the clay and oriented with the product's roll direction aligned to the proposed direction of trafficking as is consistent with normal construction practice. The aggregate material is a standard UK base material - Ministry of Transport (MOT) Type 1 Road Stone, with a top size of 40 mm. The gradation is shown in Table 1.

Table 1. *Sieve analysis for MOT Type 1 Road Stone*

Particle Size (mm)	% Passing	Min. Spec.	Max. Spec.
63	100	100	100
31.5	97	75	99
16	75	43	81
8	52	23	66
4	33	12	53
2	20	6	42
1	13	3	32
0.063	1	0	9

The test section is trafficked to 10,000 passes utilising loading parameters that have been calibrated to full-scale testing from the former Transport Research Laboratory. The deformation is measured continuously using an ultrasonic sensor at three sensor points and recorded by computer every 20 passes (approx. 1 minute) against the number of passes. A minimum of three tests are always performed for each test configuration to ensure statistically relevant results are obtained. Temperature, materials and construction / testing procedures are standardised and controlled where possible.

Figure 5. *The trafficking device in service. The pressure applied is approximately 600 kPa, which is equivalent to a conventional, fully loaded truck tire.*

As the sections are constructed and testing is performed in a controlled laboratory environment, highly repeatable results with minimal variability is achieved.

Results

After trafficking is complete, the aggregate base is removed and the geogrid is exhumed. Final documentation is recorded, then the section is completely removed in preparation for the next test. The trafficking facility continues to be used to develop a complete database of trafficking performance for a variety of section compositions and geosynthetics.

Post trafficking photos of each of the four section compositions are shown in Figure 7 below. Figures 7, 8 and 9 show detailed deformation results for the surface and subgrade, respectively. All geogrids significantly outperformed the non stabilised (no geogrid) control section. Both InterAx NX750 and NX850 performed measurably better than the TriAx section, with NX850 being the best performer.

Figure 6. *The NX750 exhumed after trafficking is complete.*

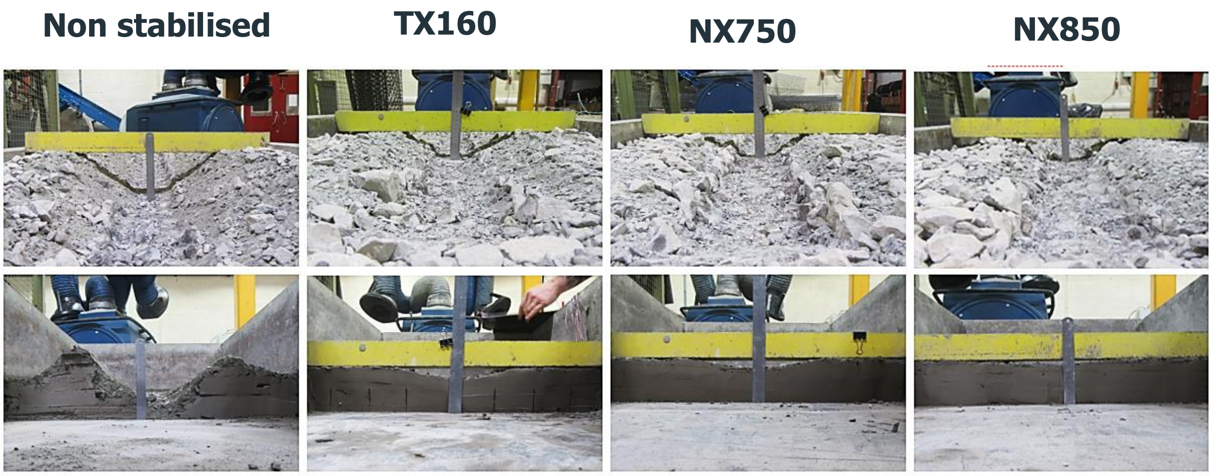

Figure 7. *Aggregate surface (top photos) and subgrade (bottom photos) rutting profiles after trafficking. The yellow straight edge is used to improve visual comparison of the sections. InterAx NX850 experienced the least surface and subgrade rutting.*

Figure 8. *Enlarged photo of the subgrade rutting in the NX850 section. The minimal amount of rutting experienced is noted by the red dashed lines.*

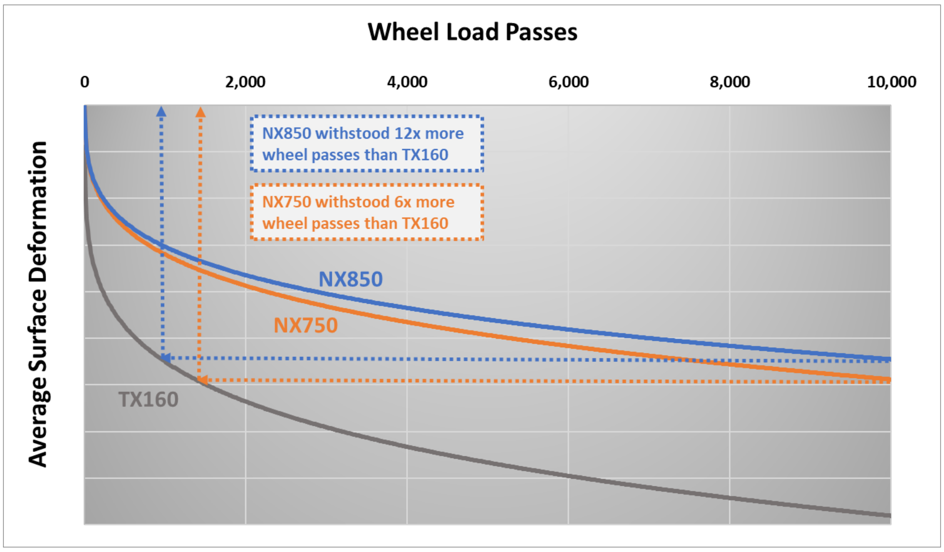

Figure 9. *Aggregate surface deformation results for NX850, NX750 and TX160 sections.*

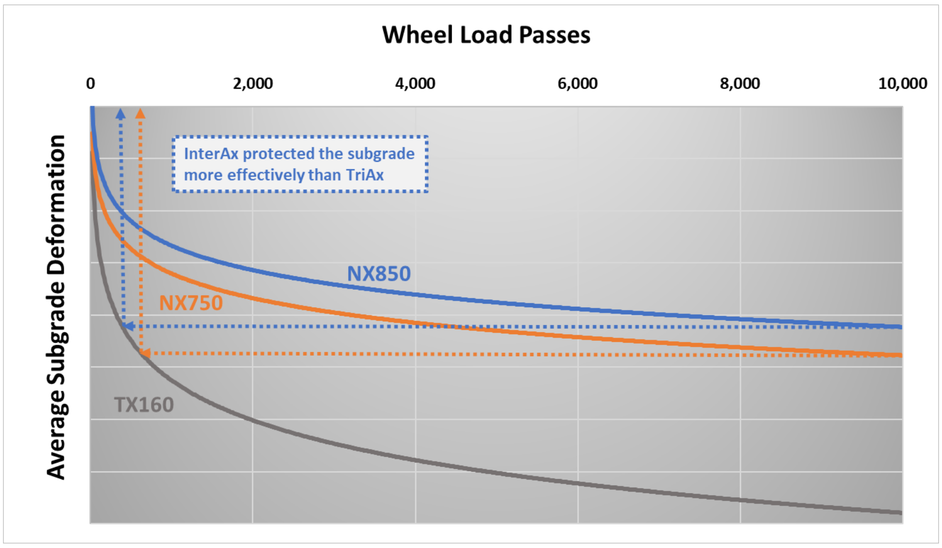

Figure 10. *Subgrade deformation results for NX850, NX750 and TX160 sections.*

At 10,000 passes, InterAx NX850 reduced surface deformation by 34% and subgrade deformation by 47% compared to TX160. InterAx NX750 reduced surface deformation by 29% and subgrade deformation by 40% compared to TX160.

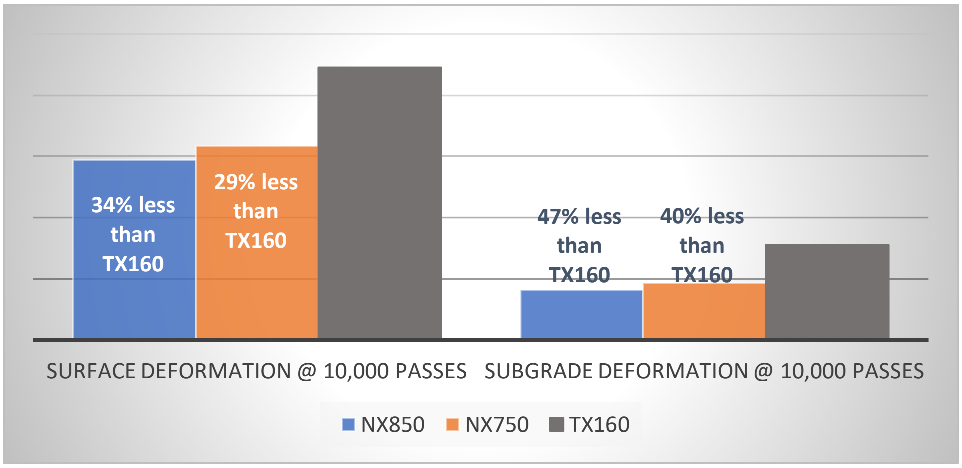

Figure 11. *Surface deformation and subgrade deformation of NX850 and NX750 compared to TX160, after 10,000 passes of the wheel load.*

A power model can be used to estimate the deformation at a different number of load cycles beyond 10,000. Use of the power model predicts that the NX850 section will sustain the same surface rutting at 116,000 cycles as TX160 at 10,000 cycles. The same deformation is predicted for the NX750 section at 68,000 cycles. These results are summarised in Table 2 below.

Table 2. Estimated performance of NX750 and NX850 compared to TX160 using power model.

	Estimated Wheel Load Passes to Achieve Equivalent Surface Deformation to TX160 @ 10,000 Passes	Improvement over TX160	Estimated Wheel Load Passes to Achieve Equivalent Subgrade Deformation to TX160 @ 10,000 Passes	Improvement over TX160
NX750	**68,000**	**6.8 times as many passes**	**82,800**	**8.3 times as many passes**
NX850	**116,000**	**11.6 times as many passes**	**88,800**	**8.9 times as many passes**

References

1. Curson, Andrew, 2020, "Small scale trafficking comparison of two NextGen variants versus one TriAx control", Tensar International Limited Technical Report. UK-TCTR-0420.
2. Gallagher, Daniel, 2017, "Procedures for Construction and Testing of a Small Scale Trafficking Sample", Tensar International Limited Technical Report.
3. Hugo, F., B.F. McCullough, and B. Van der Walt, "Full Scale Accelerated Pavement Testing for the Texas State Department of Highways and Public Transportation," Transportation Research Record 1293, Transportation Research Board, National Research Council, Washington, D.C., 1991, pp. 52–60.

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