In-Situ Performance Comparison Testing of TX130S and BX1200 Stabilized Aggregate Layers

Summary

The intent of this research was to measure and compare the in-situ performance of two different geosynthetic products, Tensar TX130S and Tensar BX1200 (BX Class 2), within an aggregate base. Two research projects were conducted to provide a comparison of performance. On both projects, Automated Plate Load Tests (APLTs) were conducted to measure the true composite, stabilized or unstabilized base and subgrade resilient modulus values. Permanent and resilient deformations were also measured and compared.

Figure 1. *APLT equipment and testing setup*

A range of subgrade conditions were evaluated, ranging from California Bearing Ratio (CBR) values less than 3% to a low value of 0.7%. Dense graded aggregate thickness was selected based on applied load and subgrade support. **Testing demonstrated that aggregate sections with TX130S geogrid had higher resilient modulus values compared to the sections with BX1200 geogrid of equal thickness across all subgrade conditions.** A summary of the testing can be found in Figure 2. An overview of the two research projects is outlined on the following pages.

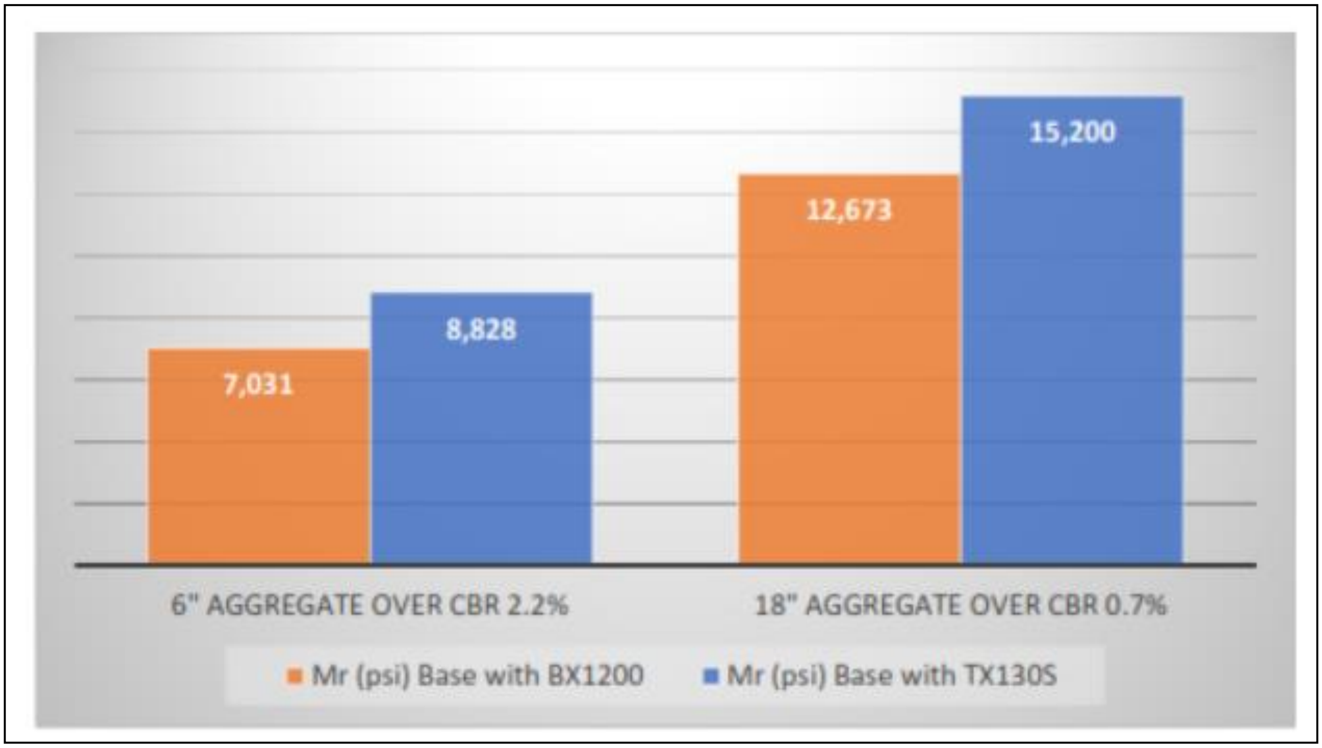

Figure 2. *In-situ resilient modulus (M_r) values for aggregate base over varying subgrade CBR*

Research Project 1 - Boone County, Iowa Test Sections

APLTs were conducted on sections consisting of 6" of base over Tensar BX1200 and TX130S. The aggregate base course was classified as a poorly-graded gravel with sand and silt (GP-GM) with about 8% fines content and 100% passing the ¾" sieve. The subgrade layer was fairly uniform and classified as sandy lean clay (CL), with CBRs ranging from 0.7% to 2.3%, with an average value of 2.2% at the subgrade-base interface. Laboratory testing was conducted on the aggregate base and subgrade materials to determine index properties. DCP tests were conducted to determine penetration resistance and CBR profiles. Sand cones were conducted to determine dry unit weights and moisture contents.

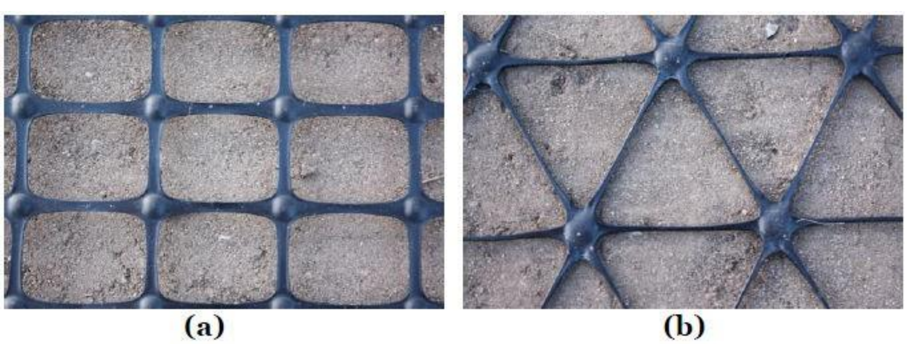

Figure 3. *BX1200 (a) and TX130S (b) geogrids installed on prepared subgrade*

Cyclic APLTs were conducted with cyclic stresses ranging from 3 and 100 psi in seven loading sequences, with 100 cycles in each loading sequence, using a 12-inch diameter plate. The cyclic test results were used to determine composite, stabilized base, and subgrade layer resilient modulus values, and assess permanent and resilient deformation characteristics.

Results from the study showed benefits for using TX130S and BX1200 (TBR values ranging from 1.5 to 5.4) at all cyclic stress levels. **TX130S exhibited the greatest benefit and had the least amount of permanent deformation.** The TBR values in the sections were consistent with the measurements observed in previous trafficking tests on this site. Permanent deformation results for each section are summarized in Figure 4.

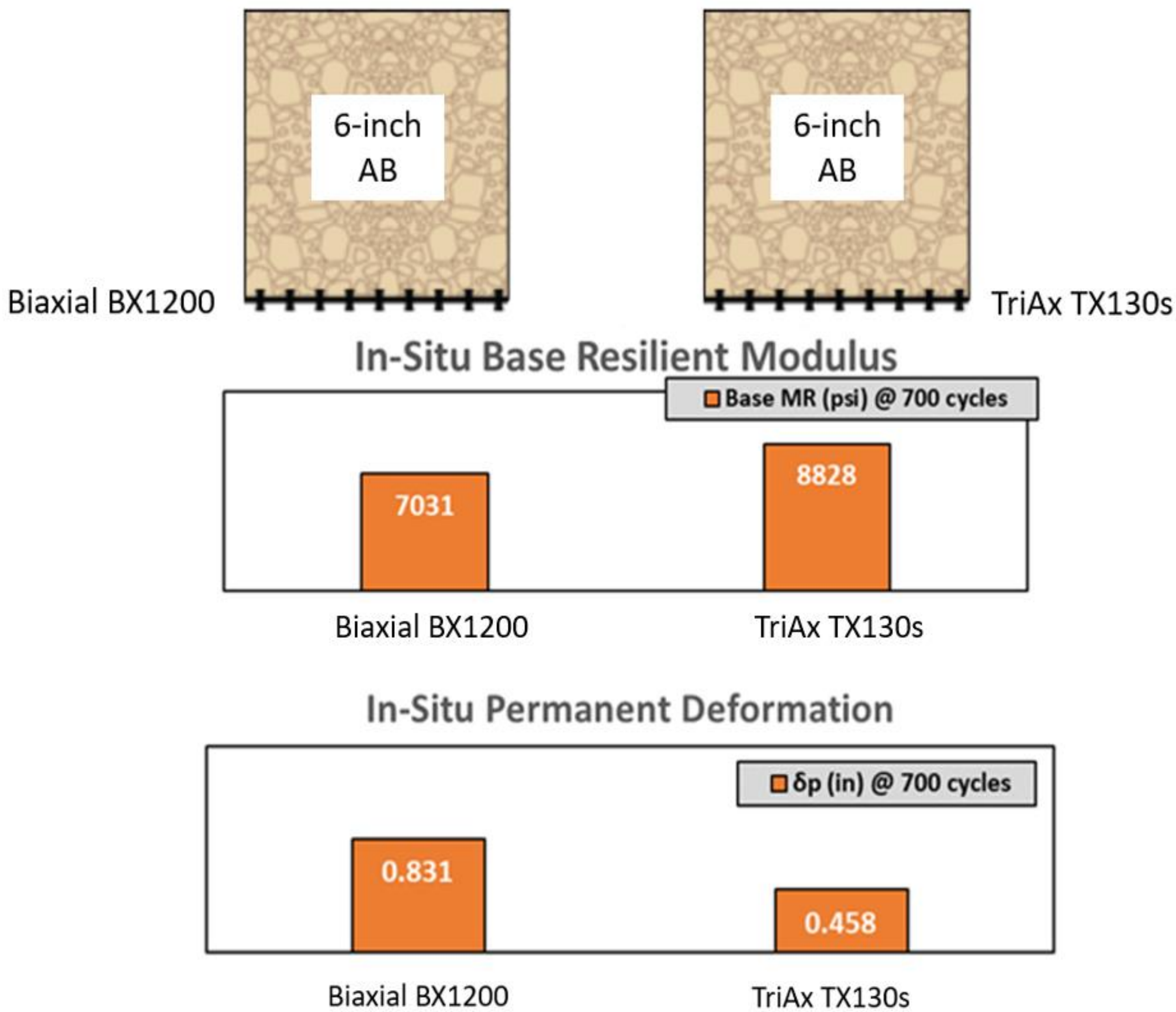

Figure 4. *In-situ permanent surface deformation for BX1200 and TX130S*

Research Project 2 - Northfield, Minnesota Heavy Loading

This testing consisted of cyclic plate load testing on 18” of dense graded aggregate over TX130S and BX1200 geogrids. The aggregate base met the gradation for Minnesota DOT Class 5 aggregate base. The compacted subgrade was a CL material identified as Northfield Clay, with an average CBR of 0.7% at the base-subgrade interface.

The intent of this testing was to better understand how the two geogrid test items affected permanent deformation in a soft subgrade. A high 20,000 cycle APLT was conducted with one stress sequence (max stress of 80 psi) using a 12-inch diameter plate on each section.

Figure 5. *Construction and identification of test sections*

As summarized in Table 1, **TX130S reduced the accumulated permanent deformation in the subgrade by 38% at the conclusion of the test compared to BX1200.** Also, the number of cycles to reach 1” permanent deformation was more than two times greater for TX130S compared to BX1200.

Table 1. *Permanent deformation measurement of test sections*

	Permanent Deformation (in) after 20,000 Cycles (subgrade)	Predicted Number of Cycles to Achieve 1" Permanent Deformation (aggregate surface)
BX1200	0.69	269,367
TX130S	0.50	578,353

Conclusions

Geogrid performance must be based on in-ground performance testing, where the interaction and stabilization effect of aggregate and the geogrid can be measured under repeated loading. Testing from these two projects demonstrated that aggregate sections stabilized with TX130S geogrid performed better than sections stabilized with BX1200 geogrid of equal thickness. These tests were performed over a range of subgrade strengths.

For additional discussion on this research, relative geosynthetic performance, and performance validation and testing methods, please contact your local Tensar representative.