



Structural Testing of Silca Grate

Prepared for
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Alliance, Ohio

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Background

Sare Plastics has developed a product named Silca Grate and it is designed to support cement pavers on elevated decks. The product consists of injection molded plastic panel with a honeycomb structure produced in 16" x 18" panels intended to be installed via screws or nails on conventional 2x joists spaced 16" on center. Sare Plastics is interested in preliminary testing to demonstrate basic structural performance of the product.

Samples

A Research Center representative visited the Alliance, Ohio production facility to select product for the testing. 15 panels were randomly selected from the ready to ship inventory and marked. The samples were packaged and shipped to the Research Center.

The product measures 16" wide by 18" long by 1.525" thick. The typical honeycomb web measured 0.215" thick at the bottom and tapers to 0.165" at the top surface. Figure 1 is a photo of the Silca Grate product.

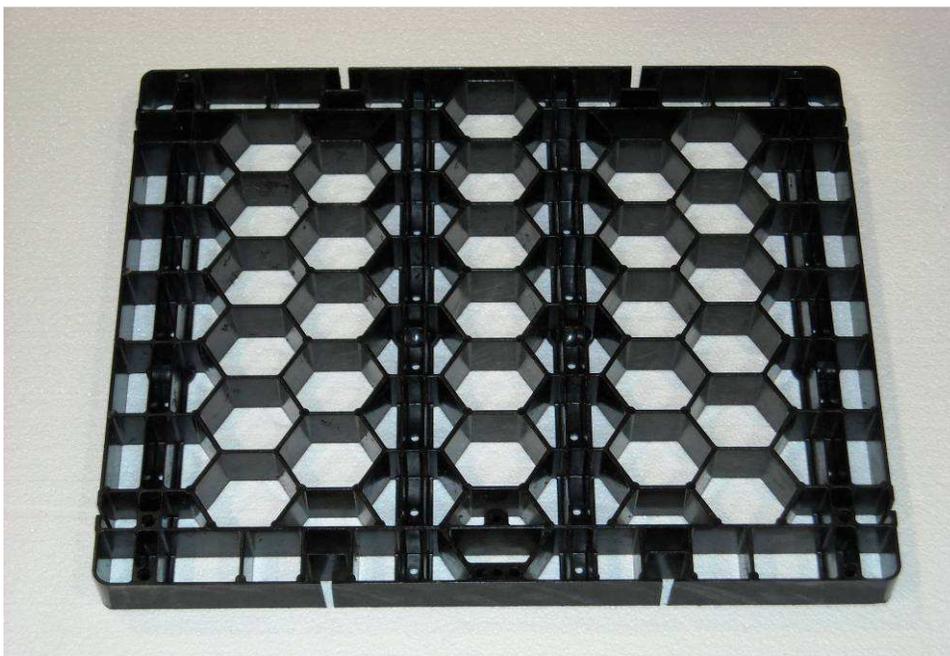


Figure 1: Silca Grate

Test Method

Because of the unique nature of the product there is not a standard test method available. The approach chosen was guided by reviewing the flexural testing portions of

ASTM D7032, “Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems”, and ASTM D6109-05, “Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products”. Both ASTM D7032 and ASTM D6109 are intended for composite deck lumber typically of 4-8 inches wide and length ranging up to many feet. Some deviations were required to accommodate the Silca Grate panel dimension and usage. One deviation was that Silca Grate was attached to a constructed wooden frame at 16” on center rather than supported on roller reaction bearings. The Silca Grate was attached to the frame with four 16d common nails (1 nail per corner). The Silca Grate has additional fastener locations in the center and would normally be installed with 6 fasteners. However, only 4 were used per the manufacturer’s request as a worse case. The ASTM test methods call for 3rd point loading with rollers. Because of the thin honeycomb webs, there was concern that the limited point contact would cause deformation unrepresentative of actual use with cement pavers. The loading was applied via a 1.5” wide steel bar. This spread the load more than a roller but considerably less than a 4” wide brick paver. A loading rate of .25 in/minute was used for the testing. Figure 2 shows the typical test set up in the laboratory’s 100 kip universal test machine. A deflectometer (not shown) was used to measure the deflection of the center of the panel under load.

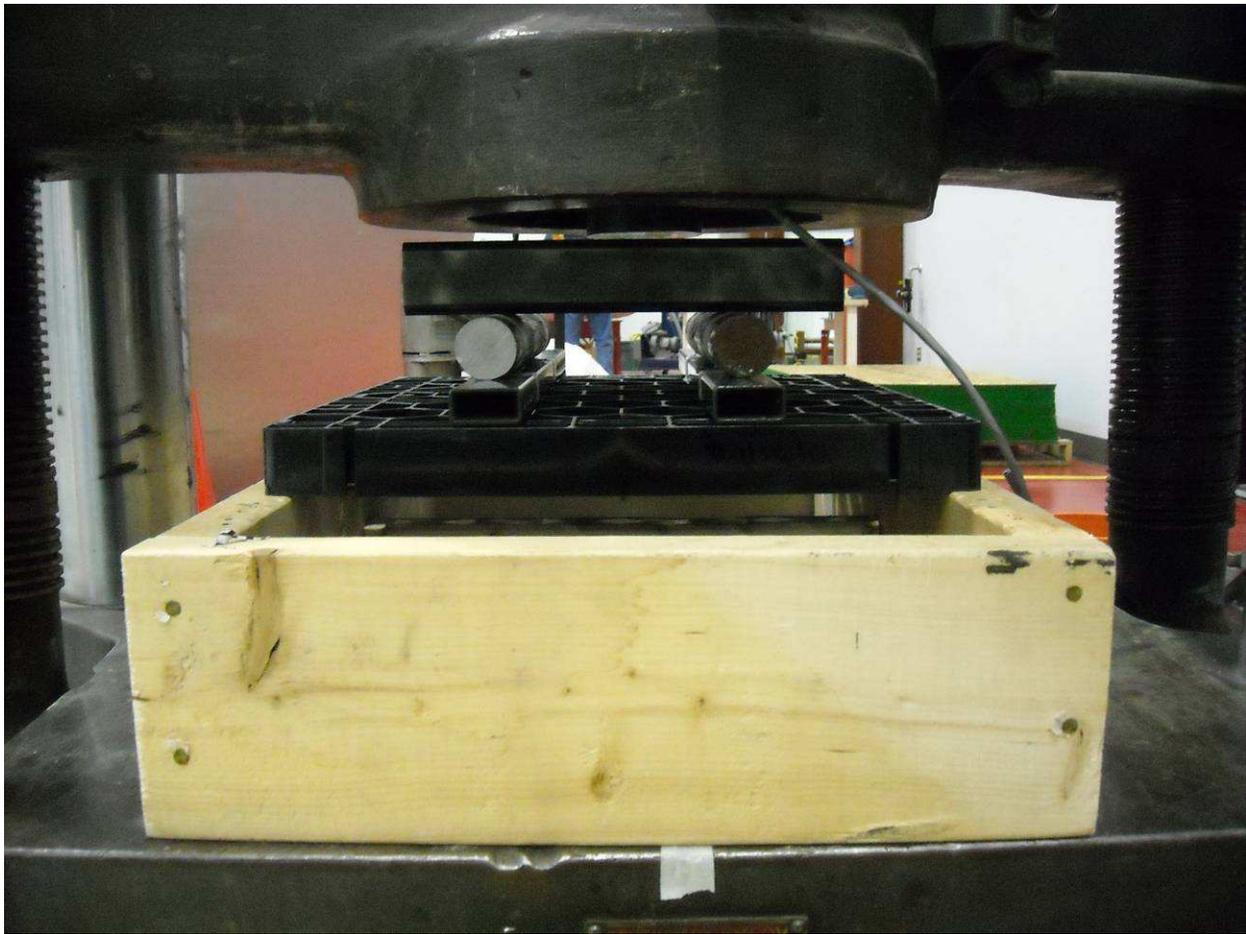


Figure 2: Test Set-up

Because the specimens had significant deflection, they were not tested to failure as the deflection caused the loading points to slip out of position. The specimens were tested till the panels had deflected 1.5” or until slippage of the load points or deflectometer created an issue. Five specimens were tested.

Sare Plastics also requested some preliminary basic pure compression testing. This testing was accomplished by placing the Silca Grate on the steel bed of the universal test machine, placing a 16” x 16” x 1.75” paver on top of the grate and loading the assembly in compression. This test was also repeated with loading via a 4” x 8” cement paver brick. Only one replicate of each was tested.

Results

The test results are summarized in Table 1.

Table 1: Flexural Test Results

Deflection	Load (lbs) vs Deflection (inches)					Average
	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	
0.125	407	441	389	384	375	399
0.250	731	826	746	774	741	764
0.500	1256	1317	1240	1281	1266	1272
0.750	1560	1646	1552	1609	1624	1598
1.000	1822	2249	1784	1874	1908	1927
1.250	2038	2390	1974	2029	2016	2089
1.500	2197	N/A	2086	2113	2191	2147
Max load per square foot (lbs/ft²)¹						
	1098	1195	1043	1056	1095	1097

Figure 3 shows a typical panel under load near the maximum deflection.



Figure 3: Silca Grate under load at 1.5” deflection

¹ This load is calculated by dividing the maximum load by the square footage of the panel. Since the load was applied at 1/3 of the span this value is not representative of a uniform load. This value is conservative.

None of the samples failed structurally or cracked. They only showed some minor localized permanent deformation in a few web members along the center line (See Figure 4). The nails did not pull out and the panels did not come off the wooden frame even with 1.5" of deflection.

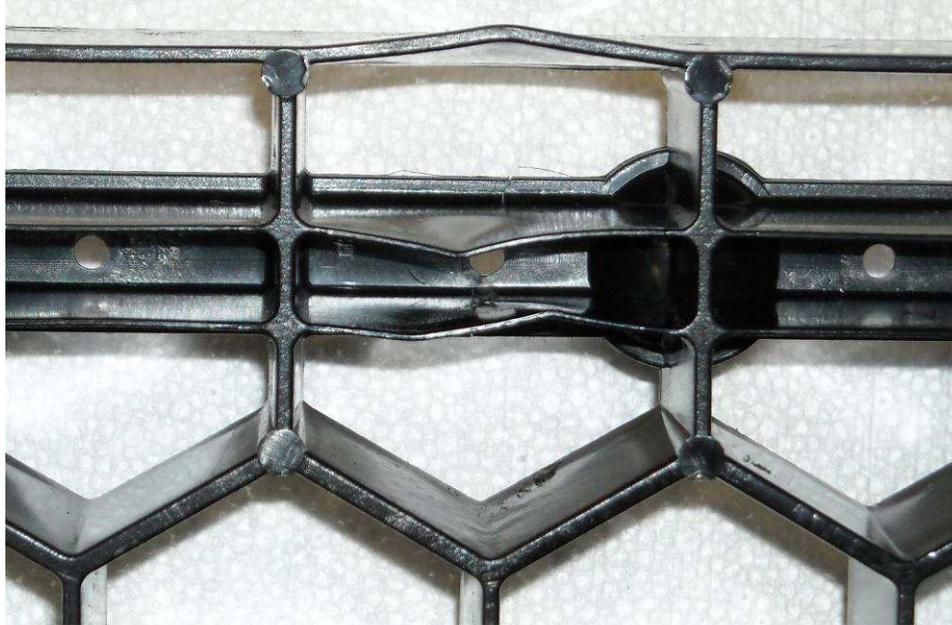


Figure 4: Residual deformation after flexural loading

The compression tests results were as follows.

Table 2: Compression Test Results

Paver size	Max Load	Test Result
16" x 16"	150,000 lbs	No visible failure, no significant compression deflection
4" x 8"	29,089 lbs	Cement paver cracked where honeycomb indented the paver

Discussion

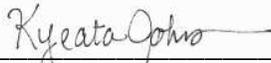
The flexural test results indicate that Silca Grate product at room temperature supports typical deck loads with a significant margin of safety. The effects of high or low temperature or weathering effects were not included in the scope of this testing.

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