Pavement Technical Solutions

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July 25, 2019

Geoff Whitcher
AZPECTS USA
14902 Preston Road
Dallas, TX 75254

Re: EasyBASE Testing
Structural Evaluation Summary

Dear Mr. Whitcher:

Pavement Technical Solutions, Inc. (PTS) is pleased to submit the following summary of findings for the structural evaluation of paver test sections constructed in New Holland, Pennsylvania. The evaluation included Non-Destructive Testing (NDT) of the pavement and a subsequent structural analysis. It should be noted that PTS was not present during the construction of the test sections and was only present on site to conduct the NDT.

The purpose of the testing was to compare the structural performance of pavers constructed on the EasyBASE grid on subgrade and pavers constructed on No. 57 aggregate base on subgrade. A woven geotextile was placed on subgrade in each section to provide separation. The tested pavement sections are summarized in Table 1 below.

Table 1: Pavement Section Summary

Section 1 (0+00 – 0+20)	Section 2 (0+20 – 0+40)	Section 3 (0+40 – 0+70)	Section 4 (0+70 – 0+80)
6 cm TechBloc Bleu Paver	6 cm TechBloc Bleu Paver	6 cm TechBloc Bleu Paver	6 cm TechBloc Bleu Paver
1-in. #9 stone	1-in. #9 stone	EasyBASE	EasyBASE with #9 stone swept in
12-in. 57 stone	6-in. 57 stone	1-in. #9 stone	1-in. #9 stone
Woven Geotextile	Woven Geotextile	Woven Geotextile	Woven Geotextile

Non-Destructive Testing (NDT)

Non-Destructive Testing (NDT) was conducted on each of the pavement sections detailed in Table 1 utilizing PTS's in-house Dynatest Model 8000 Falling Weight Deflectometer (FWD). Testing was conducted on the test sections described above on July 10, 2019. The FWD simulates a moving vehicle load with deflections measured in response to the FWD load.

For each NDT test, three load applications were applied to the pavement's surface. The corresponding pavement deflections were measured and recorded in the FWD's on-board computer. In addition, each FWD test location was recorded by station.

PTS utilized the deflection data to perform a structural evaluation of the in-place pavements.

The original intent of the testing was to record center plate deflections, as well as deflections recorded at fixed offsets from the plate to compute layer moduli. However, the deflection response of the finite rigid pavers to the applied loads as well as the joint spacing of the pavers caused variable and irregular deflections to be recorded over the length of the sensor beam beyond the load plate. Therefore, the analysis was only based on computing the Impulse Stiffness Modulus (ISM) as described below.

Impulse Stiffness Modulus (ISM)

The ISM is a measure of the total support of pavement layers and underlying subgrade soils. Since the test sections were constructed on a short, 80-foot section, the subgrade strength along the test sections were assumed to be uniform. Therefore, when comparing the ISMs between the four (4) pavement sections, any differences or similarities in ISM can be attributed to the paver pavement sections. In other words, if the ISMs between the two systems are the same, then it can be inferred that the structural performance of the systems would be the same.

The maximum deflections (deflection occurring directly under the FWD load plate) were used to compute the ISM values as shown below. The results are plotted and typically used for identifying pavement section limits, locating isolated weak sections, and assessing the overall support conditions of the in-place pavements. ISM is computed as follows:

$$ISM = \left(\frac{L}{d_0} \right)$$

Where:

ISM	=	Impulse Stiffness Modulus, lbs./in.
L	=	Applied FWD load, lbs.
d_o	=	Maximum deflection, inches.

Results and Conclusions

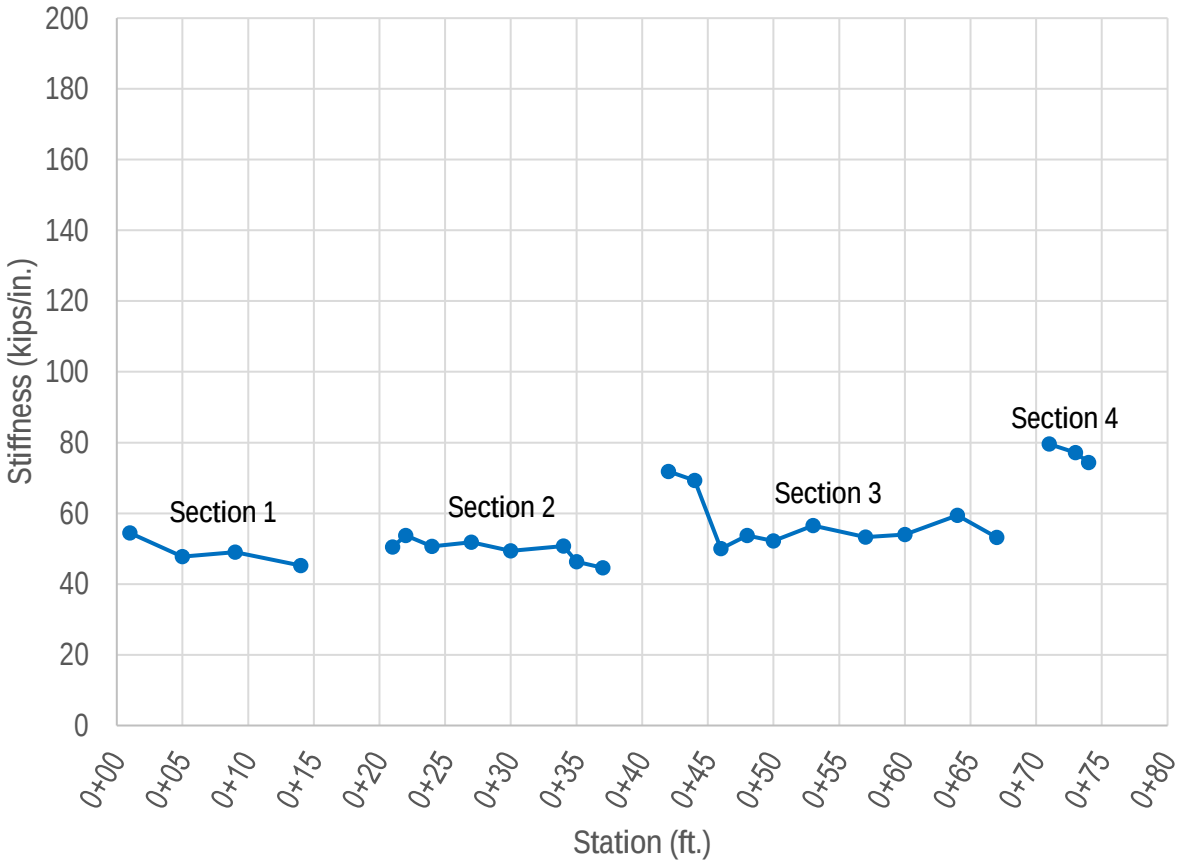
The ISM computations were completed for all pavement sections tested and the ISM results are depicted in Table 2, "*ISM Results*" and Figure 1, "*ISM Profile Plot*".

Based on the results presented in Table 2 and Figure 1, the two paver sections constructed utilizing EasyBASE are slightly stronger than the two paver sections constructed on No, 57 stone, although the differences are not statistically significant. Therefore, it can be implied that each of the sections constructed on equal strength subgrade will provide similar structural performance. In other words, for the test sections that were tested, pavers on EasyBASE will provide structural performance similar to pavers constructed on 12-inches of No. 57 stone for equal strength subgrade.

Table 2: ISM Results

Station	Load (lbs.)	Deflection @ Load Plate (mils)	ISM (kips/in.)
Section 1 (Average ISM = 49 kips/in.)			
0+01	5,549	101.93	54
0+05	5,322	111.42	48
0+09	5,171	105.54	49
0+14	5,263	116.34	45
Section 2 (Average ISM = 50 kips/in.)			
0+21	5,081	100.62	50
0+22	5,036	93.69	54
0+24	5,108	100.89	51
0+27	5,020	96.85	52
0+30	4,981	100.80	49
0+34	5,012	98.81	51
0+35	5,065	109.29	46
0+37	5,168	115.88	45
Section 3 (Average ISM = 57 kips/in.)			
0+42	4,366	60.76	72
0+44	4,472	64.55	69
0+46	4,453	89.12	50
0+48	4,485	83.44	54
0+50	4,898	93.81	52
0+53	4,750	83.98	57
0+57	4,679	87.82	53
0+60	4,742	87.90	54
0+64	4,787	80.57	59
0+67	5,020	94.33	53
Section 4 (Average ISM = 77 kips/in.)			
0+71	4,893	61.50	80
0+73	4,893	63.41	77
0+74	4,480	60.27	74

Figure 1: ISM Profile Plot



Sincerely,

Brian J. Orandello
President/CEO

cc: \ Mr. Brian J. Santiestevan, PTS