

PROJECT NUMBER: PAV013-11-07-71766 rev 090106 **DATE:** November 29, 2005
PAGE: 1 of 8

ON-SITE LOAD AND DEFLECTION TESTING OF PAVE EDGING

Prepared for:

**PAVE TECH
Attn: Bob Cramer
15354 Flag Avenue South
Prior Lake, MN 55372**

Client Purchase Order Number: Verbal

Prepared By:



**Joel Lessard
Mechanical Engineer
Materials Testing & Analysis Group
Phone: 651-659-7205**

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.
No conclusions were drawn from the testing provided.

PROJECT NUMBER: PAV013-11-07-71766 rev 090106

DATE: November 29, 2005
PAGE: 2 of 8

INTRODUCTION:

On November 15 and 25, 2005, load and deflection testing was performed on-site at Pave Tech located in Prior Lake, MN. The scope of testing was limited to:

- Measuring the force transferred outward against the selected pave edging, and
- Measuring the outward deflection of each pave edging.

The testing was performed and completed on November 25, 2005.

PRODUCTS TESTED:

On November 15, four (4) types of edging were tested.

- Pave Edge[™] by Pave Tech
- Snap-Edge[™]
- Edge Pro[™] by Dimex
- The Beast[™] by Brickstop

Spike placement had followed the manufacturer's suggested spacing.

On November 25, 2005, four (4) more edging types were tested.

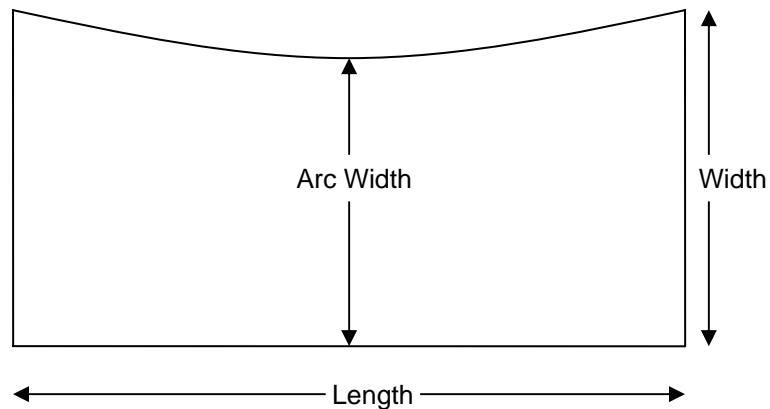
- Brickhold[™]
- Snap-Edge[™]
- The Beast[™] by Brickstop
- Edge Pro[™] by Dimex

Spike placement was more concentrated than previous tests.

The edging will be referenced by the product name within this report.

TEST SITE:

Four (4) test areas were prepared several days before the test date. The test sites were laid out in the following fashion:



PROJECT NUMBER: PAV013-11-07-71766 rev 090106 **DATE:** November 29, 2005
PAGE: 3 of 8

<u>Test Date</u>	<u>Edging Type</u>	<u>Length (in.)</u>	<u>Width (in.)</u>	<u>Arc width (in.)</u>
15-Nov-05	Pave Edge	94 7/8	48 1/2	39
15-Nov-05	Snap Edge	94 3/4	49 1/2	38 1/4
15-Nov-05	The Beast	87 1/8	47 1/2	36 3/8
15-Nov-05	Edge Pro**	75 1/4	43 7/8	36 3/8
25-Nov-05	The Beast	83 5/16	46 1/2	36 5/8
25-Nov-05	Brickhold	82 7/8	45 1/8	35
25-Nov-05	Snap Edge	83	45	35 1/8
25-Nov-05	Edge Pro	83	44 3/4	34 1/8

The dimensions were measured on the test date indicated. Material limitations contributed to fluctuations in test area dimensions.

All test sites were prepared by Pave Tech. Each shared the same gravel base, and spacing between test areas was approximately two (2) to three (3) feet. Bedding sand was spread in each test area to a thickness of 1 inch. The bed was screeded and the pavers were laid over the sand bed. The pavers used for each test area were Holland Stone pavers measuring 101mm by 202mm by 60mm thick. A soldier pattern of pavers was laid out along the border of the edging, with a herringbone pattern filling in the center sections (see Figure 1). Edging was installed according to the manufacturer's instructions, with spike placement as specified in the charts on the following pages.

**The Edge Pro test area was prepared a second time on November 15, 2005. Data from the first area was considered invalid due to errors in the test procedure. The measurements listed above represent the second test area.

TEST METHOD:

Two (2) test pavers were fabricated out of cold rolled 1045 square steel tubing. They were milled flat on the top and bottom, and steel plate was welded to each end to close the box. Final test paver dimensions were 101mm by 202mm by 45mm thick. A strain gage was attached to each at the center of the top surface. The orientation of the strain gage was parallel to the long direction of the test paver. Two (2) 1-inch slots were milled into the top surface in the long direction. The slots served to isolate the strain gage from transverse forces and to provide better resolution at low loads. A 15mm cover plate was also fabricated to give a final test paver height of 60mm and to protect the strain gage from the compaction process. A photo of the test paver can be seen in Figure 2. Compressive loads were applied to each test paver using a calibrated material test system. Each test paver was calibrated between 10 and 500 pounds. Each paver was soaked at 30 degrees F immediately prior to calibration.

One test area was tested at a time. One paver was removed from a straight soldier border section, and one from a curved soldier border section. Pavers were selected from locations midway between the spikes holding the edging in place. Each was replaced by a test paver connected to a signal conditioner and strain indicator. Two (2) 2-inch dial indicators were used to measure the edging displacement before and after compaction. An aluminum post was driven at least 6 inches into the base gravel approximately two (2) feet from the edging to be measured. A 24 inch aluminum post was used to bridge the distance from the edging to the dial indicator. Deflection locations were selected near the test pavers midway between edging spikes.

PROJECT NUMBER: PAV013-11-07-71766 rev 090106 **DATE:** November 29, 2005
PAGE: 4 of 8

Pre-compaction loads and displacements were measured and recorded. Instrumentation setup can be seen in Figure 3.

Compaction was accomplished through the use of a plate compactor. Five (5) initial passes were made with the compactor, before turning it off and taking load and deflection readings. These readings were recorded and five (5) more compaction passes were made. Final load and deflection readings were taken.

TEST RESULTS:

Test Date 11-15-05

Edging Type	<u>Pave Edge</u>	<u>Snap Edge</u>	<u>The Beast</u>	<u>Edge Pro</u>
<u>Straight Section</u>				
Spike Spacing (in.)	24	23 1/2	20	24
Pre-Compaction Load (lbf)	0	0	0	0
Initial Compaction Load (lbf)	50	80	32	64
Final Compaction Load (lbf)	280	90	62	66
Pre-Compaction Deflection* (in.)	0.000	0.000	0.000	0.000
Initial Compaction Deflection* (in.)	0.004	0.004	0.012	0.052
Final Compaction Deflection* (in.)	0.004	0.026	0.063	0.059
<u>Curved Section</u>				
Spike Spacing (in.)	10 1/2	23 1/2	20	18
Pre-Compaction Load (lbf)	0	0	0	0
Initial Compaction Load (lbf)	205	35	40	57
Final Compaction Load (lbf)	255	85	55	66
Pre-Compaction Deflection* (in.)	0.000	0.000	0.000	0.000
Initial Compaction Deflection* (in.)	0.005	0.115	0.125	0.257
Final Compaction Deflection* (in.)	0.014	0.225	0.267	0.301

*Deflection within the context of this report refers to the movement of the needle on the dial indicator. The value indicates the deformation of the pave edging at the point of measurement.

lbf = pounds force

PROJECT NUMBER: PAV013-11-07-71766 rev 090106 **DATE:** November 29, 2005
PAGE: 5 of 8

Test Date 11-25-05

Edging Type	<u>The Beast</u>	<u>Brickhold</u>	<u>Snap Edge</u>	<u>Edge Pro</u>
<u>Straight Section</u>				
Spike Spacing (in.)	20	20	20	20
Pre-Compaction Load (lbf)	0	0	0	0
Initial Compaction Load (lbf)	40	100	65	45
Final Compaction Load (lbf)	72	120	85	65
Pre-Compaction Deflection* (in.)	0.000	0.000	0.000	0.000
Initial Compaction Deflection* (in.)	0.017	0.023	0.016	0.057
Final Compaction Deflection* (in.)	0.044	0.042	0.024	0.068
<u>Curved Section</u>				
Spike Spacing (in.)	12	12	12	12
Pre-Compaction Load (lbf)	0	0	0	0
Initial Compaction Load (lbf)	20	60	20	45
Final Compaction Load (lbf)	65	75	50	72
Pre-Compaction Deflection* (in.)	0.000	0.000	0.000	0.000
Initial Compaction Deflection* (in.)	0.186	0.075	0.015	0.025
Final Compaction Deflection* (in.)	0.190	0.085	0.095	0.030

*Deflection within the context of this report refers to the movement of the needle on the dial indicator. The value indicates the deformation of the pave edging at the point of measurement.

lbf = pounds force

PROJECT NUMBER: PAV013-11-07-71766 rev 090106 **DATE:** November 29, 2005
PAGE: 6 of 8

DISCUSSION:

Testing was conducted outside for both sets of tests. The ambient temperature during testing on November 15 was 33 degrees F and the conditions were overcast with slight rain. The ambient temperature on November 25 was 25 degrees F with light snow. There was also light snow cover. A heating blanket had been used to preserve the integrity of the test area. The quantitative effect of the different test conditions is unknown, and determining this effect is beyond the scope of this project.

TEST EQUIPMENT:

Phase II 0-2" Dial Indicator ID H073, calibrated 2-8-05.
Phase II 0-2" Dial Indicator ID H154, calibrated 2-8-05.

Instruments Group Signal Conditioner, ID MM100-008, calibrated before use.
Instruments Group Strain Indicator, ID L-147, calibrated before use.

Calibration Equipment

MTS Model 810 Material Test System, System Number US1.12366, calibrated 12-15-04.

PROJECT NUMBER: PAV013-11-07-71766 rev 090106

DATE: November 29, 2005
PAGE: 7 of 8

PHOTOS:



Figure 1--The test areas.



Figure 2--One of the test pavers used to measure the outward force on the edging.

PROJECT NUMBER: PAV013-11-07-71766 rev 090106

DATE: November 29, 2005
PAGE: 8 of 8



Figure 3--Test and instrumentation setup.



Figure 4—A photo of the Snap Edge curved section after final compaction. Note the large outward deflection. Deflection of this magnitude was common for measurements exceeding 0.200.”