PERFORMANCE TEST REPORT

Rendered to:

ROYAL CROWN LIMITED

TYPE: 6 ft High by 8 ft and 6 ft Wide
PVC Harmony Privacy Fence System

Report No: 72392.01-119-16
Report Date: 04/17/07
Revision 1: 05/03/07
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1.0 General Information

1.1 Product

8 ft and 6 ft PVC Privacy Fence Systems

1.2 Project Description

Architectural Testing, Inc. (ATI) was contracted by Royal Crown Limited Corporation to perform dynamic wind load tests on their 6 ft high by 8 ft wide and 6 ft wide composite privacy fence systems and lateral, static load post testing. This report includes comprehensive written and photographic documentation of the testing performed.

2.0 Dynamic Wind Load Testing

2.1 Test Specimen

Two (2) fence sections measuring approximately 6 ft high by 8 ft wide and 6 ft wide were tested. Royal Crown Limited provided all test materials and the fence sections were assembled at ATI by the technical staff. See drawings in Appendix A for detailed descriptions of assembly and components.

2.2 Equipment

The wind generator consists of an engine driven vane axial fan. The fan blades were fixed at a 5-1/2° pitch as marked on the fan. The plenum has an outlet of 8' wide by 4' high with eight 2' by 2' baffled outlets. Deflections were measured with linear displacement transducers accurate to 0.01 inch. Wind speeds were calibrated according to Section 7 of Miami-Dade's Protocol TAS 100-95 (reference ATI Report No. 72064.02-119-18).
2.3 Test Setup

A steel test fixture was designed and fabricated to simulate a rigid post embedment. The separation between the bottom rail and top of the test fixture was 2.0 inches. The wind generator outlet was located 4 ft. from the face of the specimen (see photographs in Appendix B). Linear displacement transducers were fixed on the top rail, middle of the in-fill area, and bottom rail for horizontal deflection measurements.

2.4 Test Procedure

Wind load testing was performed directly perpendicular to the specimens and started at 70 mph and incremented in 10 mph intervals until 110 mph or fence failure. The duration of the applied wind load at each wind speed is an inverse relationship and was determined by using the following equation:

\[
t = \frac{3600}{V_{fm}}
\]

(Equation 1)

where:

- \( t \) = duration, seconds, and
- \( V_{fm} \) = "fastest mile" wind speed, mph.

Wind speeds used in testing correlate with "fastest mile" wind speeds \( V_{fm} \) for reference to codes and design standards. Maximum deflections were recorded at each load level. Two (2) specimens were tested using this sequence of loading.

2.5 Limitations of Test

Test setup and procedure provides information for evaluation of the fence assembly to resist sustained wind speeds indicated in the test results. This evaluation includes the transfer of wind loads to the fence panels, rails, and support posts. The posts only support a single section of fence in this simulation and are therefore not fully evaluated for actual field conditions. Additional evaluation of the support posts is included in Section 3.0 Static Load Post Testing.
2.6 Wind Load Test Results

See drawings in Appendix A for assembly details and photographs in Appendix B for specimen orientation respective to wind direction.

**Specimen #1**: 6' high x 8' wide PVC Privacy Fence  **Series/Model**: Harmony Privacy Fence  
**Test Date**: 04/03/07  
**Grade to Bottom Rail Height**: 2.0"  
**Rails**: Two 5.5" by 1-1/2" rectangular PVC rails with aluminum insert  
**Panels**: Fifteen 6-1/4" by 5/8" by 60-3/4" PVC panels  
**Post**: Two 5" by 5" by 0.29" wall PVC posts  
**Rail Attachment**: Top and bottom rails were inserted into routed PVC posts. Top rail was secured in PVC post by #8 by 1-1/4" screw through a 3-3/4" by 0.71" galvanized plate. Bottom rail rested in routed posts and was not secured with screws or galvanized plate. PVC "C"-channel was attached to PVC post with 1-1/4" screws spaced 16". Vertical panels were placed in the channels of top and bottom rail and held together by tongue and groove system.

<table>
<thead>
<tr>
<th>Wind Speed</th>
<th>Duration</th>
<th>Top</th>
<th>Mid</th>
<th>Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 mph</td>
<td>50 seconds</td>
<td>6.44</td>
<td>7.06</td>
<td>3.92</td>
</tr>
<tr>
<td>80 mph</td>
<td>45 seconds</td>
<td>8.28</td>
<td>9.12</td>
<td>5.00</td>
</tr>
<tr>
<td>0 mph</td>
<td>Permanent Set</td>
<td>0.35</td>
<td>0.54</td>
<td>0.48</td>
</tr>
<tr>
<td>90 mph</td>
<td>40 seconds</td>
<td>11.00</td>
<td>11.86</td>
<td>6.28</td>
</tr>
<tr>
<td>100 mph</td>
<td>≈ 2 seconds</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:

1. **Observation**: Panels disengaged from top and bottom rails.

Maximum wind speed achieved and held for duration of loading was 90 mph.
2.6 Wind Load Test Results: (Continued)

Specimen #2: 6' high x 6' wide PVC Privacy Fence  Series/Model: Harmony Privacy Fence
Test Date: 04/03/07
Grade to Bottom Rail Height: 2.0"

Rails: Two 5.5" by 1-1/2" rectangular PVC rails with aluminum insert
Panels: Eleven 6-1/4" by 5/8" by 60-3/4" PVC panels
Post: Two 5" by 5" by 0.29" wall PVC posts
Rail Attachment: Top and bottom rails were inserted into routed PVC posts. Top rail
was secured in PVC post by #8 by 1-1/4" screw through a 3-3/4" by 0.71" galvanized
plate. Bottom rail rested in routed posts and was not secured with screws or galvanized
plate. PVC "C"-channel was attached to PVC post with 1-1/4" screws spaced 16".
Vertical panels were placed in the channels of top and bottom rail and held together by
tongue and groove system.

<table>
<thead>
<tr>
<th>Wind Speed</th>
<th>Duration</th>
<th>Maximum Deflection (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Top</td>
</tr>
<tr>
<td>70 mph</td>
<td>50 seconds</td>
<td>2.51</td>
</tr>
<tr>
<td>80 mph</td>
<td>45 seconds</td>
<td>3.57</td>
</tr>
<tr>
<td>0 mph</td>
<td>Permanent Set</td>
<td>0.72</td>
</tr>
<tr>
<td>90 mph</td>
<td>40 seconds</td>
<td>4.82</td>
</tr>
<tr>
<td>100 mph</td>
<td>35 seconds</td>
<td>6.23</td>
</tr>
</tbody>
</table>

Observation: Panels disengaged on the way to 110 mph.

Maximum wind speed achieved and held for duration of loading was 100 mph.
3.0 Static Load Post Testing

3.1 Test Specimens

Three composite posts 5" x 5" x 96" long with a 0.29" thick wall were tested.

3.2 Test Equipment

The support post was tested in a self-contained structural frame designed to accommodate anchorage of the specimen and application of the required test loads. The specimen was loaded using an electric winch mounted to a rigid steel test frame. High strength steel cables, nylon lifting straps, and load distribution beams were used to impose test loads on the specimen. Applied load was measured using an electronic load cell located within the loading system. Deflections were measured to the nearest 0.01" using electronic linear displacement transducers.

3.3 Test Setup and Procedure

One end of the post was securely anchored and braced in a rigid test frame (simulated post embedment) in a horizontal orientation. Transducers mounted to an independent reference frame were located to record movement of reference points on the support post (top and bottom rail location). See photos in Appendix B for typical test setup. The post was then loaded at a steady uniform rate until failure. Deflection was electronically recorded continuously until failure.

3.4 Static Load Post Test Results

<table>
<thead>
<tr>
<th>Composite Post Type</th>
<th>Sample Number</th>
<th>Ultimate Test Load (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot; x 5&quot; x 0.29&quot; wall thickness</td>
<td>1</td>
<td>628</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>438</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>561</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>542</td>
</tr>
</tbody>
</table>
4.0 Summary and Conclusions

The maximum wind speed achieved for the 6' x 8' Harmony Fence was 90 mph. The average load held by the post during static loading was 542 lb. A 6' x 8' fence at wind speeds of 90 mph requires the post to hold a minimum static load of 749 lb. See Appendix C for design wind load calculations.

The maximum wind speed achieved for the 6' x 6' Harmony Fence was 100 mph. The average load held by the post during static loading was 542 lb. A 6' x 6' fence at wind speeds of 100 mph requires the post to hold a minimum static load of 694 lb. See Appendix C for design wind load calculations.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report, and all other supporting evidence will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period, said materials shall be discarded without notice, and the service life of this report by Architectural Testing, Inc. shall expire. Results obtained are tested values and were secured using the designated test methods. This report neither constitutes certification of this product nor expresses an opinion or endorsement by this laboratory; it is the exclusive property of the client so named herein and relates only to the tested specimens. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

Matthew D. Freeborn  
Technician - Code Compliance

David H. Forney, P.E.  
Senior Project Engineer

MDF:mdf/nlb

Attachments (pages)  
This report is complete only when all attachments listed are included.
- Appendix A - Drawings (9)
- Appendix B - Photographs (3)
- Appendix C - Design Wind Load Calculations (2)
### Revision Log

<table>
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<th>Date</th>
<th>Page(s)</th>
<th>Revision(s)</th>
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<td>N/A</td>
<td>Original report issue</td>
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<tr>
<td>1</td>
<td>05/03/07</td>
<td>6</td>
<td>Summary and Conclusions paragraph was changed to show loads that need to be achieved for 6' x 6' static load for 100 mph wind speeds and 6' x 8' static load for 90 mph wind speeds.</td>
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</table>
APPENDIX A

Drawings
Architectural Tasting

Test sample complies with these details. Deviations are noted.

Report # 72392.7.76-11A-16
Date 4/12/09 Tech. MDF

Note: 34" post embedment with concrete

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
<th>Length</th>
<th>Qty</th>
<th>Drawn By</th>
<th>Date</th>
<th>File Name</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>HS1302-6 Pocket Rail, 1 1/2 x 5 1/2</td>
<td>70.75</td>
<td>2</td>
<td>PAF</td>
<td>2/7/2007</td>
<td>6ft Harmony 72in.dwg</td>
</tr>
<tr>
<td>2</td>
<td>HS1300-9 5&quot; Square Post (End Shown)</td>
<td>108.0</td>
<td>2</td>
<td>Hole Chart</td>
<td>Length</td>
<td>Width</td>
</tr>
<tr>
<td>3</td>
<td>HS1301-1 7/8 x 6 T&amp;G Picket</td>
<td>60.75</td>
<td>11</td>
<td>&quot;A&quot;</td>
<td>5.562</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>HS1522 5&quot; Square Cap</td>
<td>NA</td>
<td>2</td>
<td>&quot;B&quot;</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>F-43333-6 Reinforcement Channel</td>
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<td>&quot;C&quot;</td>
<td>X</td>
<td></td>
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<tr>
<td>6</td>
<td>HS1304-2 Channel, C</td>
<td>58.9</td>
<td>2</td>
<td>&quot;D&quot;</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

6' Harmony Select 72" Royal Crown Limited Fabrication Drawing

6' Harmony 72" Drawings are Property of Royal Crown Limited ®
Architectural Testing

Test sample complies with these details. Deviations are noted.

Report: 72392.01-119-16
Date: 4/12/67  Tech: MLP

Note: 34" post embedment with concrete

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
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<th>Qty.</th>
<th>Hole Chart</th>
<th>Length</th>
<th>Width</th>
<th>Radius</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>HS1302-8 Pocket Rail, 1 1/2 x 5 1/2</td>
<td>94.75</td>
<td>2</td>
<td>PAF</td>
<td>5.562</td>
<td>X</td>
<td>1.530</td>
</tr>
<tr>
<td>2</td>
<td>HS1300-9 5&quot; Square Post (End Shown)</td>
<td>108.0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>HS1301-2 7/8 x 6 T&amp;G Picket</td>
<td>60.75</td>
<td>15</td>
<td>&quot;A&quot;</td>
<td>5.562</td>
<td>X</td>
<td>1.530</td>
</tr>
<tr>
<td>4</td>
<td>HS1522 5&quot; Square Cap</td>
<td>NA</td>
<td>2</td>
<td>&quot;B&quot;</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>F-43333-8 Reinforcement Channel</td>
<td>91.0</td>
<td>2</td>
<td>&quot;C&quot;</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>HS1304-1 Channel, C</td>
<td>58.9</td>
<td>2</td>
<td>&quot;D&quot;</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>&quot;E&quot;</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8' Harmony Select 72"

Royal Crown Limited Fabrication Drawing

8' Harmony 72"

Drawings are Property of Royal Crown Limited ®
Architectural Testing

Test sample complies with these details. Deviations are noted.

Report: 72392.01-119-16
Date: 4/12/67   Tech: MDF

SCALE 2:1

SCALE 1:1

EXPOSED -------

SEQ: 9/29/06   DESCRIPTION: DRAWING RELEASED (REPLACES 7648 PER NW)   BY: BLS

CUSTOMER: Crown   SUBSTRATE: PVC   TOT. AREA:---
CUST. DWG: FINISH PRIM:---
LIASION: BENDABLE? NO
PROCESS: RIGID/CAP
EMBOSSED? NO
RIG. AREA:---

R.045 (FULL)
R.031
.88

SYM

.090

.010 TYP CAPSTOCK

.857

R.045

1.600

LENGTH TOLERANCE - OFFLINE CUT
LENGTH +/- 0.10

Title: Harmony Fencing C-Channel
DESCRIPTION: Profile Drawing

DRAWN: BLS   DATE: 8/06   CONTROL NUMBER: 090506-2
SCALE: NOTED  A   DRAWING NUMBER: 822

Royal Mouldings, Ltd.
P.O. Box 610
Marion, VA 24354
(276) 783-8161

The design, concept and other information contained within this drawing is proprietary to Royal Mouldings, Ltd. and may not be reproduced, used or disclosed without written permission.
ARCHITECTURAL TESTING

Test sample complies with these details. Deviations are noted.

Report: 72392.01 - 1/9/16
Date: 4/12/07 Tech MFE

---

FULL SIZE | EXPOSED/FINISHED SURFACE
---|---

SEQ: | DATE: | DESCRIPTION: | BY: |
1 | 9/27/04 | GAP WAS 0.025 THICK - PER DC RES |

CUSTOMER: ROYAL PLASTICS
SUBSTRATE: PVC/WF
CUST. DWG: PED5000105
FINISH PERIM: UNF
LIAISON: N. KING
PROCESS: CELUKA
EMBOSS? YES

CELL AREA: 4.649
FLEX AREA: 
CAP AREA: 0.880

SYMMETRICAL ABOUT CENTERLINES

R.200 [R5.08]

4.510 [114.55]

4.975

5.000 [127.00]

.292

.250 [6.35]

.045 [1.14]

4/5/04

4/12/07

POST 5x5

PROFILE DRAWING

DESCRIPTION:

DRAWN: RES
DATE: 9/24/04
SCALE: 1:1
PROJECT: 7551

CONTROL NUMBER:

DRAWING NUMBER: A
PART NO. | LENGTH
---|---
F-43333-6 | 66.87±.13
F-43333-8 | 90.87±.13
F-43333-10 | 120.0±.13

Architectural Testing

| TIE-技 | 4/12/06
| 22/219-10 | 19-16

Test sample complies with these details.

Revised: 22/219-10-19 19-16

Test Sample complies with these details.

Architectural Testing
Harmony Fence Installation Instructions

Predetermine layout and elevation/slope changes. Panels will rack approximately 1" in 6 or 8 feet. Posts may need to be customized for stepping down sloped areas. When setting post depth, remember the fence is designed for a 2" space between bottom rail and ground. 36" embedment – DO NOT DRIVE POSTS.

Step 1) Dig postholes 72" on center for 5' sections and 96" for 8' sections. Holes should be 9-12" in diameter, 36" in ground.

Step 2) Center C-Channel onto post and attach with SS Screws. (Fig. 2 & 3) (1) Screw top, bottom, and every 16".

Step 3) Place post in hole so that there is 2" of clearance from ground. (Do not set posts permanently in place at this time) (Fig. 1)

Step 4) Insert the reinforcement rail into the center cavity of the top and bottom rails. Install bottom rail into posts.

Step 5) With bottom rail installed, level bottom rail. Make sure to maintain 2" ground clearance. Install tongue and groove boards into the bottom rail. Install top rail starting at one end.

Step 6) Slightly lean the post away to install the section into the post. As each section is installed and T&G boards are snug between posts, posts may now be set permanently with concrete.

Step 7) Secure top rails with top plates and screws (Fig. 2).

Step 8) Install post caps (flat shown) by pressing into place. A dab of PVC glue can be used to secure caps permanently in place. (Fig. 2)

Architectural Testing

Test sample complies with these details. Deviations are noted.

Report 72392.01-19.16

Date 4/19/107

Royal Crown Limited

Care and Cleaning — Ordinary dirt and mud usually washes off with a hose. At times it may be necessary to use a non-abrasive household cleaner to remove residue and then rinse with a hose.

Royal Crown Limited

PO Box 360

Milford, IN 46542-0360

Phone 800-365-3625

Fax 574-658-3147
APPENDIX B

Photographs
Photo No. 1
Wind Generator, Data Acquisition and Tested Fence Specimen

Photo No. 2
Typical Specimen during Testing
Photo No. 3
6' x 6' Specimen before Disengaging

Photo No. 4
6' x 6' Specimen after Disengagement
Photo No. 5
Static Load Post Setup

Photo No. 6
Post Load Failure
APPENDIX C

Design Wind Load Calculations
WIND DESIGN PRESSURE ANALYSIS
Ref. ASCE 7-98

Project: Royal Crown
Job No.: 72392.01-119-16
Component: 6-ft. Privacy Fence
Date: 04/20/07

Basic Wind Speed, $V_{3s}$ = 90 mph (eq. 75 mph $V_{fm}$)
Structure Classification, Category: I Low Hazard
Exposure Category (A, B, C, D): C
Exposure Coefficient, $K_z$ = 0.85
Topographic Factor, $K_{zt}$ = 1.0
Directionality Factor, $K_d$ = 1.0
Importance Factor, $I$ = 0.87 (Hurricane Prone Region)

Velocity Pressure, $q_z = 0.00256 K_z K_{zt} K_d V^2 I = 15.3$ psf

Note: Values do not account for wind speed-up over hills and escarpments

Gust Effect Factor, $G$ = 0.85
Net Force Coefficient, $C_f$ = 1.2

Design Wind Force, $F = q_z G C_f A_f$ ($A_f =$ Projected Area, $ft^2$)

<table>
<thead>
<tr>
<th>Design Load:</th>
<th>Test Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hgt.</td>
<td>Length</td>
</tr>
<tr>
<td>6.0</td>
<td>8.0</td>
</tr>
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</table>
WIND DESIGN PRESSURE ANALYSIS

Project: Royal Crown
Job No.: 72392.01-119-16
Component: 6-ft. Privacy Fence
Date: 04/20/07

Basic Wind Speed, $V_{3s} = 100$ mph (eq. 75 mph $V_{fm}$)
Structure Classification, Category: I Low Hazard
Exposure Category (A, B, C, D): C
Exposure Coefficient, $K_z = 0.85$
Topographic Factor, $K_{zt} = 1.0$
Directionality Factor, $K_d = 1.0$
Importance Factor, $I = 0.87$ (Hurricane Prone Region)

Velocity Pressure, $q_z = 0.00256 K_z K_{zt} K_d V^2 I = 18.9$ psf

*Note: Values do not account for wind speed-up over hills and escarpments*

Gust Effect Factor, $G = 0.85$
Net Force Coefficient, $C_f = 1.2$

Design Wind Force, $F = q_z G C_f A_f$ ($A_f =$ Projected Area, ft$^2$)

<table>
<thead>
<tr>
<th>Design Load:</th>
<th>Test Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hgt.</td>
<td>Length</td>
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<tr>
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