AB Fence Tech Sheet

Tech Sheet #2011

In-House Full-Scale System Testing On AB Fence Panel

Round 1 with Single Point Load Transfer Configuration

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This tech sheet summarizes the results for the full-scale panel tests preformed on the Allan Block fence panel using 2 two-course traditional bond beams for lateral support. All tests were preformed in the Allan Block lab using Allan Block equipment and personnel. These tests were conducted as an extension of the fence testing preformed at the University of Calgary in 2003. However, this testing includes four different height configurations ranging from 4ft to 8ft (1.2 – 2.4m) or 6 to 12 courses. The wind loads were simulated using a hydraulic ram with a worst-case configuration of full load development at the mid-span of the panel. A single vertical spreader bar transferred the applied force to the two bond beams and the bottom bond beam free spanned from post to post. This setup was chosen because it forces the load transfer to the bond beams in a more direct fashion, which mimics the current design methodology.

Test Objective & Procedure

The principal objectives of these tests were to determine the interaction between the rigid bond beams and the dry stacked units and how this interaction affects the forces applied to the supporting posts. The outcome will be a series of reduction values to more accurately design for the applied moment in the structural post. The current design methodology uses wind stagnation pressures provided by the 1997 UBC code. The design methodology only allows the designer to use 100% of the applied wind load divided by the number of transverse load caring members (bond beams) and then transfers 100% to the supporting vertical posts. It has been observed in the Calgary testing that a dissipation of forces occurs during testing. The Allan Block tests had the force applied to the mid-span by use of a hydraulic ram and the received load at the posts were recorded using load cells at three points on each post. By simply comparing the applied force to the received, a percentage of loss can be determined. Also a sensitive deflection devise was used to accurately measure the repeated deflections and rebounds the panel and bond beam endured during the complete test series.

Test Results

During the first set of tests at 6-courses tall, the bond beams were very stiff and resisted the applied force with very little deflection. Once the final force representing the 150 mph (241 kph) force was applied, stress cracks appeared in the center of the panel blocks and adjacent to the mid-span. At the end of this test when the load was relaxed the deflection returned to basically zero from a maximum deflection of .51 in (13mm). In all subsequent tests the deflection was recorded to progress evenly as the load increased, with a maximum recorded deflection of 1.575 in (40 mm) in Test Set-Up #4.

Over the course of this test the panels were stressed to a sustained wind force of 150+ mph (241+ kph) over 12 times, and in each case the panel returned to its original at-rest condition. Even after having been cracked the bond beam continued to deliver the required strength to resist repeated 150 mph (241 kph) winds.

To gain a better understanding of the significance of a 150 mph (241 kph) sustained wind, it should be noted that a Category 4 hurricane has winds ranging from 131 – 155 mph (211 – 250 kph) and a Category 5 hurricane has wind speeds of greater than 155 mph (264 kph). The maximum adjusted wind speed achieved in this series of tests was for the 6-course panel, which registered at 164 mph (250 kph). The table below represents a comparison of the wind stagnation pressures given by the UBC and the applied force in psf and mph.

TABLE UBC vs. Tested results

	Wind Stagnation pressure from the 1997 UBC					
Basic Wind Speed (mph)	70	80	90	100	110	120
Pressure qs (psf)	9.45	12.3	15.6	19.2	23.25	27.675

	Tested Values					
Converted Average Wind Speed (mph)	91	105	111	129	140	154
Average Applied Pressure (psf)	12.32	16.09	19.26	24.72	29.69	35.55

These values were obtained by summing the loads applied to the load cells and comparing them to the force applied by the ram. At lower forces the percentage transferred to the post is relatively small due to the ability of the panel to shift and readjust to the load, which is essentially dissipating the applied wind forces. As the panels receive additional load the dry stacked units ball and socket configuration begin to “tighten” and contributes to the resistance of the applied force, thus the panel becomes more rigid and the percentage increases.

The following tables represent the recommended force reductions based on these test results. These reductions should only be applied to the design force applied to the post for the design of the cantilever moments.

	MPH Design Wind from 1997 UBC					
Mph	70	80	90	100	110	120

	Percentage of Design Force For Post Design (All Heights)					
%	70	80	80	90	100	100

The following is a list of conclusions formulated from physical data and visual observations during testing:

- The Allan Block Fence panel has the ability to reseat itself, which has the effect of releasing pressure that otherwise would build up inside of other rigid panel systems.
- The AB Fence panel’s ball and socket seat provides both the flexibility to the system at lower forces and the rigid strengthening effect at higher forces.
- The AB Panel Bond Beam, when constructed with sand mix grout as recommended by Allan Block, provides an incredible capacity to resist force while remaining plastic enough to rebound 100% from +150 mph (241 kph) wind or 1.575 in (40mm) deflections.
- The AB Panel Bond Beam, while free spanning over the duration of all tests and subjected to repeated horizontal deflections and rebounds, showed no vertical sage of any measurable amount.
- The AB Panel Bond Beam is a composite beam that functions as a monolithic concrete beam. That is, the stressed beam cracked where expected, at the mid-span and not along the joints of the panel block. At the conclusion of testing all panel block with bond beams were fully connected to the course above with no visible signs of distress other than the rebounded hairline cracks at mid-span.