

**WATER PENETRATION COMPARATIVE STUDY**  
**VICTORY BEAR/FUKUVI-USA**  
**VICTORY BEAR WATER MANAGEMENT SYSTEM**

**Victory Bear/FUKUVI-USA**  
**7631 Progress Court**  
**Huber Heights, Ohio 45424**

**July 18, 2005**

# NELSON TESTING LABORATORIES

## *Construction Materials*

1220 REMINGTON ROAD  
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Victory Bear/FUKUVI-USA  
7631 Progress Court  
Huber Heights, Ohio 45424

Attn: Mr. Kyozauro Takagi  
Vice President

### REPORT OF TESTS

SUBJECT: **Water Penetration Study to Determine the Effectiveness of the Victory Bear Water Management System Used in Various Clay Brick Masonry Wall Units**

PROJECT: Victory Bear/FUKUVI-USA Research Program

TEST METHODS: ASTM E 514, "Test Method for Water Penetration and Leakage Through Masonry"  
  
ASTM C 67, "Test Methods of Sampling and Testing Brick and Structural Clay Tile"  
  
ASTM C 270, "Specification for Mortar for Unit Masonry"

### TEST OVERVIEW

Within this study, five brick masonry single-wythe walls were constructed and subjected to the test procedures outlined in ASTM E 514, "Test Method for Water Penetration and Leakage Through Masonry". A type "N" (ASTM C 270) mortar was proportioned and used together with modular brick to construct five walls, two with "peel and stick" flashing and three with the Victory Bear Water Management System. Each wall was assembled using 2" x 4" lumber studs, 16 inches on center. A vertical seam was located in the center of each wall substrate sheeting. A one-inch air cavity was located between the clay brick and substrate. Each open end of the walls used a water end dam.

This study was designed to compare the performance of the Victory Bear Water Management flashing systems with the commonly used peel and stick masonry flashing system. The results highlight the differences in directing water out of a masonry cavity wall system through the weep holes. The differences are reflected in the amount of water collected through the weep holes and the amount of water collected in the cavity of each wall system.

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Comparative Study of the Effectiveness  
Of Wall Drainage Systems Used in  
Masonry Cavity Wall Construction  
July 18, 2005  
Page 2

### TEST WALL DESCRIPTIONS

#### Wall #1 – Victory Bear #1

- ¾ inch OSB lumber sheathing;
- Victory Bear Water Management System with one joint in the base piece and one flashing unit without joint attached to the 2" x 4" stud framing through the yellow nailing strip using a staple gun;
- Tyvek house wrap.

#### Wall #2 – Victory Bear #2

- Dow Super Tuff R Polyisocyanurate Insulation sheathing;
- Victory Bear Water Management System with one joint in the base piece and one flashing unit with one joint offset of the base piece joint attached to each 2" x 4" stud framing through the yellow strip using a 1.5-inch drywall screw;
- 2-inch thick waterproof tape sealing horizontally across the top of the flashing and vertically down the joints on the flashing.

#### Wall #3 – Victory Bear #3

- Dow Super Tuff R Polyisocyanurate Insulation sheathing;
- Victory Bear Water Management System with one joint in the base piece and one flashing unit with one joint offset of the base piece joint attached to each 2" x 4" stud framing through the yellow strip using a 1.5-inch drywall screw;
- Waterproof silicone caulk sealing vertically down, behind and in front of the joint of the flashing.

#### Wall #4 – Control #1

- ¾ inch OSB lumber sheathing;
- IPCO peel and stick flashing with overlapping seam;
- Tyvek house wrap;
- Weep holes located every third brick.

#### Wall #5 – Control #2

- Dow Super Tuff R Polyisocyanurate Insulation sheathing;
- IPCO peel and stick flashing with overlapping seam;
- Weep holes located every third brick.

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Of Wall Drainage Systems Used in  
Masonry Cavity Wall Construction  
July 18, 2005  
Page 3

### TEST WALL FABRICATION

Five (5) walls for water penetration testing were constructed according to ASTM E 514 requirements. The five walls were single-wythe wall panels, 48" wide x 56" high. Each wall was assembled using 2" x 4" lumber studs, 16 inches on center. A vertical seam was located in the center of each wall substrate sheeting. A one-inch air cavity was located between the clay brick and substrate. Each open end of the walls used a water end dam.

The brick portions of the walls were built during a one-day period by an experienced lead mason. Workmanship was judged as to be average. Ambient temperature was maintained between 60 degrees F. and 75 degrees F. during the fabrication and subsequent curing period. Each clay brick wall was constructed by one mason and required approximately 1.5 hours to complete with the masonry work being done over a period of about 60 minutes. The walls were constructed on an inverted steel channel, and the bottom course was laid on a bed of mortar. Full bedded mortar joints were used, and the walls were constructed one course at a time by applying mortar the full length of the bed joint, then buttering the ends of a brick one at a time before setting on the bed joint. The joints were initially struck and tooled with a concave jointer after the top course was laid, and a final tooling was done approximately 30 to 60 minutes later. The bed and head joints were full.

The walls were constructed in a random order to avoid potential systematic errors which might have occurred if the walls had been built in a particular order. The walls were cured according to ASTM E 514 which requires curing for 7 days enclosed in plastic sheeting and for a minimum of 7 subsequent days curing in laboratory air. The total curing time for the walls ranged from 14 to 21 days. Flashing was built into the wall to collect water that had passed completely through the wall. There was a bottom trough which was built under the wall to collect water that penetrated into the interior cavities on the blocks, collected at the bottom of the cavities and leaked through the weep holes and mortar joints.

### TEST PROCEDURES

ASTM E 514 test procedures were followed throughout the test. ASTM E 514 test chambers were constructed of welded aluminum angle stock, and the observation face of the chambers was outfitted with Lexan sheet to allow full view into the chamber. All fixtures and appurtenances were in conformity with ASTM E 514, section 4. Each frame was outfitted with a monometer to measure interior pressure and a flow meter to monitor the amount of flow. During the testing, the frame was pressurized to 10 psf, and the water flow was adjusted to 40.8 gal/hour which is equal to 3.4 gal/sq.ft./hr. The units were held in place with clamps, and closed cell foam gasket materials.

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July 18, 2005  
Page 4

### MATERIAL TEST DATA

#### Brick Analysis (ASTM C 67)

Brick size: 7.62 inches long x 3.62 inches wide x 2.25 inches high

Specimen No.	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Absorption (%)					
24 hour	8.2	8.0	8.4	8.1	8.4
5 hour boil	9.3	9.4	9.9	9.5	9.5
Saturation Coefficient	0.88	0.85	0.84	0.85	0.88
IRA (g/min/30 sq.in.)	17.1	17.4	18.9	17.3	18.1
Compressive Strength (psi)	8963	9145	8025	8563	8594

#### Mortar Analysis (ASTM C 780)

Type	"N"
Flow	132
Air Content	6.3
Cone Penetrometer	64 mm
Compressive Strength	
7 days	875
28 days	1426

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July 18, 2005  
Page 5

### TEST RESULTS

#### A. OBSERVATIONS

##### Wall #1 – Victory Bear #1

Measurable water began flowing through both of the two weep holes 1.0 hour after the start of the test. During the course of the 4 hour test a total of 14.3 liters of water exited through those two weep holes. At the completion of the test, no water was found to have collected within the wall cavity.

##### Wall #2 – Victory Bear #2

Measurable water began flowing through both of the two weep holes 15 minutes after the start of the test. During the course of the 4 hour test a total of 35.4 liters of water exited through those two weep holes. At the completion of the test, no water was found to have collected within the wall cavity.

##### Wall #3 – Victory Bear #3

Measurable water began trickling through the right of two weep holes 1.25 hours after the start of the test. During the course of the 4 hour test a total of 1.0 liter of water exited through the right weep hole. No water exited through the left weep hole. At the completion of the test, water collected within the cavity to a height of 2.25 inches.

##### Wall #4 – Control #1

Measurable water began trickling through the center of three weep holes 1.5 hours after the start of the test. During the course of the 4 hour test a total of 0.1 liter of water exited the center of three weep holes. No water exited the left or right weep holes. At the completion of the test, water collected within the cavity to a height of 6.75 inches.

##### Wall #5 – Control #2

Measurable water began trickling through the center of three weep holes 2.5 hours after the start of the test. During the course of the 4 hour test a total of 1.5 liters of water exited the center of three weep holes. No water exited the left or right weep holes. At the completion of the test, water collected within the cavity to a height of 2.25 inches.

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July 18, 2005  
Page 6

### B. DATA

	<u>Water Collected Through Weep Holes</u>	<u>First Sign of Water Exiting Weep Holes</u>	<u>Depth of Water Remaining in Cavity Wall</u>
<u>Wall #1</u> – Victory Bear #1	14.3 liters	1.00 hour	no water
<u>Wall #2</u> – Victory Bear #2	35.4 liters	0.25 hour	no water
<u>Wall #3</u> – Victory Bear #3	1.0 liter	1.25 hours	2.25 inches
<u>Wall #4</u> – Control #1	0.1 liter	1.50 hours	6.75 inches
<u>Wall #5</u> – Control #2	1.5 liters	2.50 hours	2.25 inches
<u>Average</u>			
Victory Bear Systems	16.9 liters	0.83 hour	0.75 inch
Control	0.8 liter	2.00 hours	4.50 inches

### C. SUMMARY

The Victory Bear Water Management System strongly outperformed the standard peel and stick flashing system during the course of this test procedure. While the wall cavities and the corresponding weep holes in the peel and stick walls became completely or almost completely blocked with mortar droppings, the Victory Bear Water Management System provided a system for preventing mortar blockage, allowing water to escape through their weep holes.

Respectfully submitted,

NELSON TESTING LABORATORIES



Robert L. Nelson  
Principal