

**PROJECT:                    SAN JOSE CIVIC CENTER  
                                  SAN JOSE, CA**

**DATE:                        FEBRUARY 17-18, 2004**

**Air infiltration test per ASTM E283-99**

**Static water penetration test per ASTM E331-00**

**Dynamic water penetration test per AAMA 501.1-64**

**Uniform structural load test at design load per ASTM E330-97**

**Seismic racking - phase I (Elastic) per AAMA 501.4-00**

**Uniform structural proof load test per ASTM E330-97**

**Seismic racking - phase II (Inelastic) per AAMA 501.4-00**

# PERFORMANCE TEST REPORT

**SAN JOSE CIVIC CENTER  
SKYLIGHT MOCK-UP  
SAN JOSE, CA**

**CCLW JOB #04-4453 A**

**MARCH 22, 2004**

DATE OF FORMAL TESTING

**FEBRUARY 17, 18, 2004**

TESTED FOR & INSTALLED BY

**ENCLOS CORP.  
7901 STONERIDGE DRIVE, STE. 499  
PLEASANTON, CA 94588**

TEST LOCATION

**CONSTRUCTION CONSULTING LABORATORY WEST  
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## **MOCKUP DESCRIPTION**

The specimen tested was a nominal two-story mock-up, containing an outside corner, consisting of glass and metal panels on a skylight and curtain wall mockup, measuring approx. 30' long by 10' deep by 22' high. The curtainwall was furnished and installed by Enclos Corp. and the skylight was furnished and installed by Metcoe Skylight Specialties Co.

For a complete description including sealant, anchorage, weeps, and framing details, see drawings at the conclusion of this report (sheets 1 through 30).

This report is not complete unless these drawings, marked in red and stamped by this laboratory, are included.

**TEST LOADS**            Design loads (100%): **30.0 psf** positive and **30.0 psf** negative

All references to positive pressures are considered inward acting and negative is outward.

The mock up was tested in accordance with each applicable AAMA or ASTM standard.

## **TEST EQUIPMENT**

The specimen was installed into a test chamber constructed of structural angles, beams, and columns covered with plywood and steel bulkheads, accessible through a bulkhead door.

Air infiltration was measured with a Meriam laminar flow element and a Dwyer electronic manometer.

Water was applied from a vertical spray rack mounted 24" from the specimen. The rack was equipped with swirl-type nozzles spaced two (2) feet on center, vertically and horizontally, which delivered five (5) gallons of water per hour per square foot of wall frontal area.

Pressure differentials were measured with a Dwyer electronic manometer.

The pressure differential between the exterior and interior of the chamber was created by a positive and negative blower system.

Structural deflections were measured with numerous dial indicator gages with follow-up hands.

Dynamic winds were generated by a Curtis Wright 3350 radial aircraft engine with a three (3) bladed propeller, 14'-5" diameter, which formulates typical and atypical wind conditions.

## **WITNESSED BY (all or partial)**

Mark Sparrowhawk

Jon Weir

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Metcoe Skylight Specialties Co.

Metcoe Skylight Specialties Co.

Construction Consulting Laboratory West

Construction Consulting Laboratory West

**PRE-TESTING**

**FEBRUARY 5, 2004**

The mock-up specimen was pre-tested for air infiltration and static water penetration to the same criteria as the formal testing.

**FORMAL TESTING AS FOLLOWS**

**FEBRUARY 17, 2004**

**PRELOAD**

To set the specimen for testing, a positive pressure differential of **15.0 psf** was applied to the specimen while exhausting air in the air infiltration test. It was held for ten (10) seconds and then reduced to **6.24 psf** to complete the air test. There was no indication of any failure.

**AIR INFILTRATION TEST per ASTM E283-99**

During the pre-test the exterior of the wall area was sealed with a visqueen material and tape. The exterior face of the specimen was then subjected to a positive static pressure differential of **6.24 psf**. Air infiltration was measured. This infiltration reading represents the amount of air infiltration through the chamber (tare). The visqueen was removed and a second reading recorded at **6.24 psf** pressure differential (gross) representing the amount of air infiltration through the wall area of the specimen and the chamber. Subtracting the former reading from the latter reading yields the amount of air infiltration through that portion of the tested specimen.

The gross air reading was read during the formal test. The chamber reading (tare) was utilized from the pretest, as there were no changes to the chamber enclosure.

**ALLOWABLE**

Air infiltration shall not exceed **0.06 cfm** per square foot of fixed wall area as determined by actual measurement.

Net allowable based on measurements was **47.0 cfm** total.

484 sq. ft. wall

300 sq. ft. roof

784 sq. ft. total fixed x 0.06 cfm = **47 cfm**

**RESULTS**

**Specimen passed.**

Air leakage measured a total of **34 cfm.** (177 -143)

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**STATIC WATER PENETRATION TEST per ASTM E331-00**

Water was applied to the exterior face of the specimen, at a minimum rate of five (5) gallons per hour per square foot of wall frontal area, in such a way as to completely cover the exterior face of the specimen. At the same time, a positive differential static pressure of **12.0 psf** was applied to the face of the specimen. The application of pressure and water was maintained for a period of fifteen (15) minutes, with observers viewing the interior of the specimen.

### **ALLOWABLE**

The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied:

- a) All water is contained and drained to the exterior,
- b) There is no wetting of a surface that would be visible to building occupants,
- c) There would be no staining or other damage to any part of the completed building or its furnishings.
- d) Sources of water leakage shall be identified.

### **RESULTS**

**Specimen passed.** There was no water leakage noted.

### **DYNAMIC WATER PENETRATION TEST per AAMA 501.1-94**

The specimen was subjected to a dynamic wind load pressure equivalent of **12.0 psf (68.5 mph wind speed)** with a water application of five (5) gallons per hour per square foot of wall frontal area for a duration of fifteen (15) minutes.

### **ALLOWABLE**

There shall be no unacceptable water leakage during or at the conclusion of this test. The same criteria as the static water test above.

### **RESULTS**

**Specimen passed.** There was no water leakage noted.

### **UNIFORM STRUCTURAL LOAD TEST AT DESIGN LOAD per ASTM E330-97**

The test specimen was subjected to a positive load of **15.0 psf**, 50% design load, to set for testing. The pressure was held for ten (10) seconds and released. Indicators were set to zero.

The test specimen was subjected to a positive load of **30.0 psf**, 100% design load, held for ten (10) seconds and released. Indicators were read and all data was recorded.

The test specimen was subjected to a negative load of **15.0 psf**, 50% design load, for ten (10) seconds to set for negative testing, then released. The indicators were set to zero.

The test specimen was subjected to a negative load of **30.0 psf**, 100% design load, for ten (10) seconds and released. Indicators were read and all data was recorded.

### **ALLOWABLE**

Perpendicular to the plane of the curtain wall, net deflection of framing members shall not exceed **1/175** times span, not to exceed **3/4"**. Perpendicular to the plane of the skylight, net deflection of framing members shall not exceed **L/240** times span, not to exceed **3/4"**. In the plane of the skylight, deflection of framing members shall not exceed **1/8"** this includes horizontal rail sag due to dead load.

The net deflection parallel and perpendicular to enclosure surface for framing members at perimeter sealant joints shall not exceed smallest of: value specified above; 50% of joint width or movement capacity of sealant.

At connection points of framing members to anchors, combined movement of anchor relative to the building structure, and framing member relative to anchor, shall not exceed 1/8" in any direction. Upon reversal of load direction at any magnitude, slippage at fastened and/or clamped connections shall not exceed 1/8".

Deflection of aluminum panels, panel support or trim members shall be limited to 1/120 times span or 1/2" whichever is less.

The deflection at the midpoint of each light of glass shall be no greater than 1".

### **RESULTS**

**Specimen passed as noted.** See drawings for dial indicator locations. See Charts #1 and #2 on page 9 for deflection and permanent set results (reference bold number - ~~xx~~/xx for **deflection**). There was no glass breakage.

### **REPEAT STATIC WATER PENETRATION TEST per ASTM E331-00**

The same procedure and allowable criteria as previous static water test was used.

### **RESULTS**

**Specimen passed.** There was no water leakage noted.

### **VERTICAL FLOOR DISPLACEMENT**

The center floor level of the specimen was displaced upward 3/8", held for ten (10) seconds, returned to zero, then displaced downward 3/8", held for ten (10) seconds, then returned to zero. This was repeated two additional times for a total of three (3) two-stroke cycles. Upon completion of the third cycle the test specimen was left in the maximum open position during the remainder of all testing.

### **ALLOWABLE**

Observations of behavior, flex at anchors and racking of framing will be recorded. There shall be no failure or gross permanent distortion of anchors, frames, glass or panels; structural silicone shall experience no adhesive or cohesive failure along any glass or panel edge. Glazing gaskets may not disengage and weather seals must not fail.

### **RESULTS**

**Specimen passed.**

There was no glass breakage or sealant tearing noted. There was no yielding or racking of framing or undue stress at anchors noted during the test. The portion of wall moved was left in the up position.

**REPEAT STATIC WATER PENETRATION TEST per ASTM E331-00**

The same procedure and allowable criteria as previous static water test was used.

**RESULTS**

**Specimen passed.** There was no water leakage noted.

**SEISMIC RACKING - PHASE I (ELASTIC) per AAMA 501.4-00**

The intermediate floor framing was made to move in a lateral direction. The framing was moved laterally one direction **0.60" (5/8")**, returned to zero, then racked in the opposite direction **0.60" (5/8")**, then returned to zero. That was repeated for a total of three (3) two-stroke cycles. At the same time the top floor framing was moved in the same direction and manner as the intermediate floor to **1.125" (1 1/8")**.

The intermediate floor framing was then made to move in a perpendicular direction (in and out) **0.60" (5/8")**, and cycled again for a total of three (3) two-stroke cycles. At the same time the top floor framing was moved in the same direction and manner as the intermediate floor to **1.125" (1 1/8")**. (based on  $150" \times 0.004 = 0.60"$ )

**ALLOWABLE**

Observations of behavior, flex at anchors and racking of frame members will be recorded. There shall be no damage or disengagement of trim or snap on members, glazing gaskets, nor breakage of glass or metal panels.

**RESULTS**

**Specimen passed as noted.**

Glazing gaskets and silicone seals at glass remained in place. No glass breakage occurred. There was no evidence of metal yielding or gross permanent distortion at framing members or anchors. After the movement the mockup returned to its original position.

**REPEAT STATIC WATER PENETRATION TEST per ASTM E331-96**

The same procedure and allowable criteria as previous static water test was used.

**RESULTS**

**Specimen passed.** There was no water leakage noted.

There was water that was contained within the eave condensation gutter that entered through an incomplete perimeter seal at the flashing/trim.

### REPEAT DYNAMIC WATER PENETRATION TEST per AAMA 501.1-94

The same procedure and allowable criteria as previous dynamic water test was used.

#### RESULTS

**Specimen passed.** There was no water leakage noted.

### UNIFORM STRUCTURAL PROOF LOAD TEST per ASTM E330-97

The test specimen was subjected to a positive load of **22.5 psf** (75% design load). The pressure was held for ten (10) seconds and released, with indicators then set to zero.

The test specimen was subjected to a positive load of **45.0 psf** (150% design load), held for ten (10) seconds and released. Indicators were read and all data recorded.

The test specimen was subjected to a negative load of **22.5 psf** (75% design load). The pressure was held for ten (10) seconds and released, with indicators set to zero.

The test specimen was subjected to a negative load of **45.0 psf** (150% design load), held for ten (10) seconds and released. Indicators were read and all data recorded.

#### ALLOWABLE

Net permanent deflection of framing members shall not exceed L/1000 times the span. At connection points of framing member to anchors, combined movement of anchor relative to building structure and framing member relative to anchor, shall not experience a permanent set that exceeds 1/8" in any direction.

#### RESULTS

**Specimen passed.**

All measured spans complied with specified criteria. See drawings for dial indicator locations. See Charts #3 and #4 on page 10 for deflection and permanent set results (reference bold number - xx/xx for **permanent set**). There was no glass breakage.

### SEISMIC RACKING - PHASE II (INELASTIC) per AAMA 501.4-00

The intermediate floor framing of the window wall and the skylight mockup was made to move in a lateral direction. The framing was moved laterally 3 1/4", held for a minimum of ten (10) seconds, returned to zero, then racked in the opposite direction 3 1/4" held for a minimum of ten (10) seconds, then returned to zero. That was repeated for a total of three (3) two-stroke cycles. At the same time the top floor framing was moved in the same direction 5 5/8", returned to zero, then racked in the opposite direction 5 5/8", then returned to zero.

**ALLOWABLE**

Observations of behavior, flex at anchors and racking of frame members will be recorded. Deformation or damage of framing members and/or breakage of glass and metal panels may occur defined only as cracking or spalling. System anchorage may deform, but catastrophic failure cannot occur, nor shall any damaged or broken materials fall from the wall

**RESULTS**

**Specimen passed.**

Glazing gaskets and silicone seals at glass perimeters remained in place. No glass breakage occurred. There was no evidence of metal yielding or gross permanent distortion at window or skylight framing members or anchors. After the movement the mockup returned to its nominal original position with no yielding.

**END OF TESTING**

**COMMENTS**

As built mock-up drawings, reviewed and stamped by the laboratory, should accompany and are a part of this report.

*Jack W. Jackson*

CONSTRUCTION CONSULTING LABORATORY WEST  
JACK W. JACKSON  
PRESIDENT/MANAGER OF TESTING

*Francis Pickell, Sr.*

FRANCIS PICKELL, SR.  
PROFESSIONAL ENGINEER



**STRUCTURAL READINGS**  
**100% DESIGN LOAD**

**SAN JOSE CIVIC CENTER**  
**SKYLIGHT MOCKUP**  
**REPORT NO: 04-4453 A**

**CHART 1 OF 4**  
**TEST PRESSURE = 30.0 PSF      POSITIVE**

DIAL IND.	MEMBER / D'TL	REF.	POSITION	GROSS READ	NET READ	ALLOW BELOW	SPAN
1	VERT. MULL. DTL 1/MU150		BOTTOM	00/00	00/00	12	ANCH
2	VERT. MULL. DTL 1/MU150	(1&3)	MID SPAN	60/02	59/02	75	196"
3	VERT. MULL. DTL 1/MU150		W.L ANCHOR	01/00	01/00	12	ANCH
4	HORZ. MULL. DTL 3/MU100	(3&5)	MID SPAN	13/02	11/02	65	113"
5	HORZ. MULL. DTL 3/MU100		RIGHT	04/01	04/01	12	ANCH
6	GLASS - 1" INSULATED		CENTER	61/00	61/00	100	56"
7	RAFTER MULL. DTL 2/5		BOTTOM	11/01	-	-	-
8	RAFTER MULL. DTL 2/5	(7&9)	MID SPAN	22/01	16/00	* 47	112"
9	RAFTER MULL. DTL 2/5		TOP	02/00	02/00	12	ANCH
10							

**CHART 2 OF 4**  
**TEST PRESSURE = 30.0 PSF      NEGATIVE**

DIAL IND.	MEMBER / D'TL	REF.	POSITION	GROSS READ	NET READ	ALLOW BELOW	SPAN
1	VERT. MULL. DTL 1/MU150		BOTTOM	02/00	02/00	12	ANCH
2	VERT. MULL. DTL 1/MU150	(1&3)	MID SPAN	62/06	60/05	75	196"
3	VERT. MULL. DTL 1/MU150		W.L ANCHOR	03/01	03/01	12	ANCH
4	HORZ. MULL. DTL 3/MU100	(3&5)	MID SPAN	11/03	07/02	65	113"
5	HORZ. MULL. DTL 3/MU100		RIGHT	05/02	05/02	12	ANCH
6	GLASS - 1" INSULATED		CENTER	62/00	62/00	100	56"
7	RAFTER MULL. DTL 2/5		BOTTOM	12/01	-	-	-
8	RAFTER MULL. DTL 2/5	(7&9)	MID SPAN	32/02	23/01	* 47	112"
9	RAFTER MULL. DTL 2/5		TOP	06/01	06/01	12	ANCH
10							

READINGS ARE IN HUNDRETHS OF INCH  
 READINGS ARE DEFLECTION/PERMANENT SET

WALL DEFL. LIMIT = L/175, MAX 3/4"  
 \* SKYLIGHT DEFL. LIMIT = L/240, MAX 3/4"  
 FRAMING TO ANCHOR 1/8" MAX  
 GLASS = 1" MAX.

**STRUCTURAL READINGS**  
**150% DESIGN LOAD**

**SAN JOSE CIVIC CENTER**  
**SKYLIGHT MOCKUP**  
**REPORT NO: 04-4453 A**

**CHART 3 OF 4**  
**TEST PRESSURE = 45.0 PSF      POSITIVE**

DIAL IND.	MEMBER / D'TL	REF.	POSITION	GROSS READ	NET READ	ALLOW 1000	SPAN
1	VERT. MULL. DTL 1/MU150		BOTTOM	02/01	02/01	12	ANCH
2	VERT. MULL. DTL 1/MU150	(1&3)	MID SPAN	76/03	76/03	20	196"
3	VERT. MULL. DTL 1/MU150		W.L ANCHOR	03/01	03/01	12	ANCH
4	HORZ. MULL. DTL 3/MU100	(3&5)	MID SPAN	17/00	11/-01	11	113"
5	HORZ. MULL. DTL 3/MU100		RIGHT	09/01	09/01	12	ANCH
6	GLASS - 1" INSULATED		CENTER	78/00	78/00	-	56"
7	RAFTER MULL. DTL 2/5		BOTTOM	18/02	-	-	-
8	RAFTER MULL. DTL 2/5	(7&9)	MID SPAN	32/02	21/01	11	112"
9	RAFTER MULL. DTL 2/5		TOP	05/00	05/00	12	ANCH
10							

**CHART 4 OF 4**  
**TEST PRESSURE = 45.0 PSF      NEGATIVE**

DIAL IND.	MEMBER / D'TL	REF.	POSITION	GROSS READ	NET READ	ALLOW 1000	SPAN
1	VERT. MULL. DTL 1/MU150		BOTTOM	06/02	06/02	12	ANCH
2	VERT. MULL. DTL 1/MU150	(1&3)	MID SPAN	116/08	109/06	20	196"
3	VERT. MULL. DTL 1/MU150		W.L ANCHOR	09/01	09/01	12	ANCH
4	HORZ. MULL. DTL 3/MU100	(3&5)	MID SPAN	13/02	04/00	11	113"
5	HORZ. MULL. DTL 3/MU100		RIGHT	09/03	09/-03	12	ANCH
6	GLASS - 1" INSULATED		CENTER	80/01	80/01	-	56"
7	RAFTER MULL. DTL 2/5		BOTTOM	50/03	-	-	-
8	RAFTER MULL. DTL 2/5	(7&9)	MID SPAN	47/02	04/-01	11	112"
9	RAFTER MULL. DTL 2/5		TOP	36/04	36/04	12	ANCH
10							

READINGS ARE IN HUNDRETHS OF INCH  
 READINGS ARE DEFLECTION/**PERMANENT SET**

PERM. SET LIMIT = L/1000