



City of Seattle
 Department of Planning and Development (DPD)
 www.seattle.gov/dpd
 700 Fifth Ave, Suite 2000, P.O. Box 34019, Seattle, WA 98124-4019

Phone: 206-684-3350

RECEIVED
 DEPT OF PLANNING
 AND DEVELOPMENT
 DEC 22 2011

Code Modification or Alternate Request

Date Requested: December 20, 2011

Contact Information:

Name: Arny Hartwell
 Mailing Address: 1301 First Avenue
Suite 301
Seattle, WA 98101
 Phone Number: 206.902.5524
 Fax Number: 206.467.0627
 E-mail Address: ahartwell@gglo.com

Relationship to Project:

- Owner
 Design Professional
 Contractor

Project Information:

A/P Number: 6256329
 Address: 2401 NE BLAKELEY ST Seattle, WA
 Code Edition: 2006 Seattle Building Code

Structure Information:

Project Description:
Exterior cladding & window replacement.
 Occupancy Group(s)/ Character:
R-1 / A-3 (based on original UBC permit)
 Type of Construction: Type V, 1-hour
 Number of Stories: 4
 Basements/ Mezzanines: 0
 Sprinkler Location: None

Code Modification Request:

Ref. SBC 104.9. A code modification is a waiver of a code requirement, and is intended to provide flexibility to the building official where there are practical difficulties meeting specific code requirements so long as the intent of the code is accomplished.

The requestor is expected to demonstrate:

1. *There are practical difficulties involved in strictly conforming to the provisions of the code; and*
2. *The modification conforms with the intent and purpose of the code; and*
3. *Together with other safety features of the building or other relevant circumstances, the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety, accessibility and sanitation.*

When engaged for the project, the registered design professional in responsible charge shall submit the request for a code modification under their seal and signature, including a statement that in their professional opinion, the proposal is in conformance with the intent and purpose of the code and the modification will provide a reasonable level of strength, effectiveness, fire resistance, durability, safety, accessibility and sanitation.

Please attach plans showing your proposal.

Code Alternate Request:

Ref. SBC 104.10. A code alternate is intended to provide for introduction of alternate materials, systems and methods for which the code did not anticipate, provisional upon the alternate complying with the code and providing an equivalent solution. Essentially, a code alternate is intended to meet a performance standard rather than a prescriptive standard.

The requestor is expected to demonstrate that the alternate does not conflict with the code and together with other safety features of the building or other relevant circumstances, will provide an equivalent level of strength, effectiveness, fire resistance, durability, safety, accessibility and sanitation.



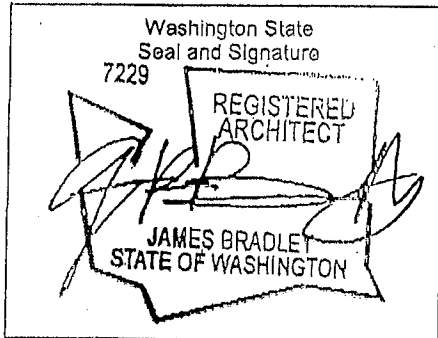
Construction Review & Inspection Quality

Jonathan Siu, Principal Engineer

When engaged for the project, the registered design professional in responsible charge shall submit the request for a code alternate under their seal and signature, including a statement that in their professional opinion the alternate is equivalent to the code provisions.

Please attach plans showing your proposal.

CITY OF SEATTLE
DEPT. OF PLANNING
AND
DEVELOPMENT



DPD Use Only **DEC 29 2011**

Approved
 Approved with Amendment
 Denied

Reasons:
PER PROFESSIONAL OF RECORD JUSTIFICATIONS &
SEC. 721.6 OF SRC 2006
APPROVAL IS ONLY FOR FIRE RESISTIVE EQUIVALENCY
NOT FOR PERFORMANCE OF THE MATERIAL FOR
OTHER PURPOSES.

APPROVED Subject to Errors
And Omissions
BY Kaveh Aminian
Kaveh Aminian

Description of Alternate/ Modification (include reason for request):

In order to achieve a 1-hour fire rating from both interior and exterior sides, a new exterior wall assembly is proposed for this renovation project. Please refer to the attached Letter of Explanation for a description of materials proposed.

Description of Code Requirement (include section):

Please refer to the attached Letter of Explanation.

Justification (attach copies of any reference, test reports, expert opinions, etc.):

Please refer to attached product cutsheets for Roxul ComfortBoard showing fire-resistive properties.



Construction Review & Inspection Quality

Jonathan Siu, Principal Engineer

December 20, 2011

Mr. Kaveh Aminian
City of Seattle Department of Planning & Development
700 Fifth Avenue, Suite 2000
Seattle, WA 98124-4019

Re: Code Modification Request, 1-Hour Wall Assembly
Blakeley Manor Rehabilitation, DPD Project No. 6256329
2401 NE Blakeley Street, Seattle, WA 98105

Dear Mr. Aminian,

Please find the following information pertaining to this Code Modification Request:

Pertaining to the Description of Alternate/Modification

Blakeley Manor is an existing four-story stucco-sided apartment building operated by the Seattle Housing Authority which will soon undergo renovation. The scope of work includes removal of the existing stucco and lath finish and replacement with 15/32" exterior plywood for shear, a liquid applied weather and air resistive barrier system, an exterior layer of mineral wool for added thermal insulation, and a rainscreen siding system using cementitious lap or panel siding over 2x4 PT furring strips. The existing wood stud framing, batt insulation, and interior GWB remain in place unless damaged.

The replacement wall assembly was reviewed by the DPD as part of our permit set and is the same assembly used on several other permitted SHA renovation projects: 6255337, 6256140, and 6251153. These projects' permits were issued under the 2006 SBC. During a courtesy field inspection at Nelson Manor (6255337), Warren Parker labeled the assembly as "failed" because it was not rated from both interior and exterior sides as required per 704.9, 2006 SBC - ie, it did not have an exterior layer of GWB.

Initially we were hoping to prove this assembly's fire resistivity from the exterior face by calculating its fire resistance per Section 720 and sub sections of the 2006 SBC for a "Prescriptive Fire Resistance" approach. According to Section 721.6 Wood Assemblies and Tables 721.6.2(1), 721.6.2(2) and 721.6.2(5) our proposed assembly would be allowed the following cumulative fire resistance ratings for the individual components:

1) As calculated from inside out:

Existing 5/8" interior Type X GWB	40 minutes	Table 721.6.2(1)
Existing 2x6 wood stud framing @ 16" o.c.	20 minutes	Table 721.6.2(2)
Glass fiber batt insulation	15 minutes	See Section 721.6.2.5 & Table 721.6.2(5) – Not needed for FR rating
15/32" exterior plywood	10 minutes	Table 721.6.2(1)
TOTAL	85 minutes	Meets reqs of 1-hr wall from interior

2) As calculated from outside in:

Fiber Cement Siding	0 minutes	According to James Hardie representative
1 ¼" Thick Mineral Wool (density = 4.4 pcf)	15 minutes	Table 721.6.2(5)
15/32" exterior plywood	10 minutes	Table 721.6.2(1)
Glass fiber batt insulation	15 minutes	See Section 721.6.2.5 & Table 721.6.2(5). May be needed for FR rating.
Existing 2x6 wood stud framing @ 16" o.c.	20 minutes	Table 721.6.2(2)
TOTAL	60 minutes	Meets reqs. of 1-hr wall from exterior

However, you had expressed concerns about this assembly since the proposed layer of mineral wool was discontinuous between the furring strips. Therefore, we have revised the wall assembly detail to show a continuous 1 ¼" thick higher density mineral wool layer, Roxul's ComfortBoard IS, installed over the sheathing. The new proposed mineral wool will increase density and weight from 4.4 PCF to 8.0 PCF. The furring strips will be installed through the mineral wool to the existing studs. The continuous mineral wool will provide enhanced fire resistance and the increased density will improve thermal performance while eliminating thermal bridging. We believe this assembly meets the intent of Section 721, Calculated Fire Resistance, by providing a 1-hour rated wall as tested from the exterior face.

Code Modification Request
Blakeley Manor Rehabilitation, 6256329
December 20, 2011
Page **3** of **3**

Enclosed with this document is a cut-sheet of Roxul's ComfortBoard IS product, the mineral wool we prefer to use. Also please find a detail of the revised, proposed wall assembly.

It is my professional opinion that the proposed wall assembly code modification for Blakeley Manor meets the intent of the 2006 Seattle Building Code. This opinion is true and sound to my best information, knowledge, and belief.

Sincerely,

GGLO, LLC

James Bradley, AIA
Principal

Att: Exhibit A – Revised Wall Assembly
Exhibit B – Roxul ComfortBoard IS Technical Data
Exhibit C – Roxul Deflection Test Report

EXHIBIT A: REVISED WALL ASSEMBLY

	<p>FIBER REINFORCED CEMENTITIOUS LAP SIDING, 4" EXPOSURE 1x3 PT RAINSCREEN STRAPPING ATTACHED TO FRAMING PER SIDING MANUFACTURER'S RECOMMENDATIONS R-5 MINERAL WOOL INSULATION LIQUID-APPLIED WEATHER RESISTIVE BARRIER EXTERIOR PLYWOOD SHEATHING: (1) LAYER 15/32" CDX 32/16 PLYWOOD NAILED 6" O.C. AT ALL EDGES, 12" IN THE FIELD, WITH 10 PENNY SHORT NAILS (2-1/4" LONG, 0.148 IN. DIAMETER), ALL EDGES BLOCKED. MINIMUM SIZE OF PLYWOOD SHEATHING SHALL BE 24" HIGH x 16" WIDE EXIST 2x6 FRAMING MEMBERS TO REMAIN. IF REPLACEMENT REQUIRED DUE TO DAMAGE, MEMBERS SHALL BE REPLACED w/ NOM 2x6 INCH SPACED 16 IN. OC w/ TWO 2x6 INCH TOP AND ONE 2x6 INCH BOTTOM PLATES. ALL NEW FRAMING SHALL BE DF-L #2 TO MATCH EXISTING. R-21 BATT INSULATION TO REPLACE EXISTING, AS REQUIRED EXIST INTERIOR TYPE 'X' GWB TO REMAIN, REPLACE DAMAGED AS REQ'D NOTE: ALL FLOORS 2X RIM TO TOP PLATE - ADD (1) LTP4 AT 16" OC. FASTEN EACH LTP4 WITH (12) 8D X 1 1/2 NAILS DIRECT TO THE FRAMING (BELOW SHEATHING) OR WITH (12) 8X 2 3/8 NAILS OVER SHEATHING. CONTRACTOR TO COORDINATE CLIP LOCATIONS AND INSTALLATION WITH OTHER TRADES AND EXISTING CONDITIONS INCLUDING PLUMBING AND ELECTRICAL.</p> <p>* REFER TO ELEVATIONS FOR EXTERIOR COLOR KEYNOTE LEGEND</p>	<p>1 HR</p> <p>TEST SOURCE: 2006 SBC TABLES 721.6.2(1), 721.6.2(2), & 721.6.2(5)</p>
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General Product Information:

ROXUL® products are mineral wool fibre insulations made from basalt rock and slag. This combination results in a non-combustible product with a melting point of approximately 2150°F (1177°C), which gives it excellent fire resistance properties. ROXUL mineral wool is a water repellent yet vapour permeable material.

Description & Common Applications:

The ComfortBoard™ IS product is a rigid mineral wool insulation sheathing board that is non-combustible, water repellent, fire resistant and sound absorbent. This product is exterior non-structural insulation sheathing for high performance residential wall systems.

Compliance and Performance:

ASTM C 612	Mineral Fiber Block and Board Thermal Insulation	Type IVB, Complies
CAN/ULC –S702	Mineral Fibre Thermal Insulation for Buildings	Type 1, Complies

Fire Performance:

ASTM E 136	Behaviour of Materials at 750°C (1382°F)	Non-Combustible
CAN/ULC S114	Test for Non-Combustibility	Non-Combustible
ASTM E 84(UL 723)	Surface Burning Characteristics	Flame Spread = 5
		Smoke Developed = 10
		Flame Spread = 5
		Smoke Developed = 10
CAN/ULC S102	Surface Burning Characteristics	

Moisture Resistance:

ASTM C 1104	Moisture Sorption	0.05%
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Water Vapour Permeance:

ASTM E 96	Water Vapour Transmission, Desiccant Method	1768 ng/Pa.s.m ² (30.9 perm)
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Fungi Resistance

ASTM C1338	Determination of Fungi Resistance	Passed
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Thermal Resistance:

ASTM C 518 (C 177)	R-value/inch @ 75°F	4.0 hr.ft ² .F/Btu***
	RSI value/25.4 mm @ 24°C	0.72 m ² K/W

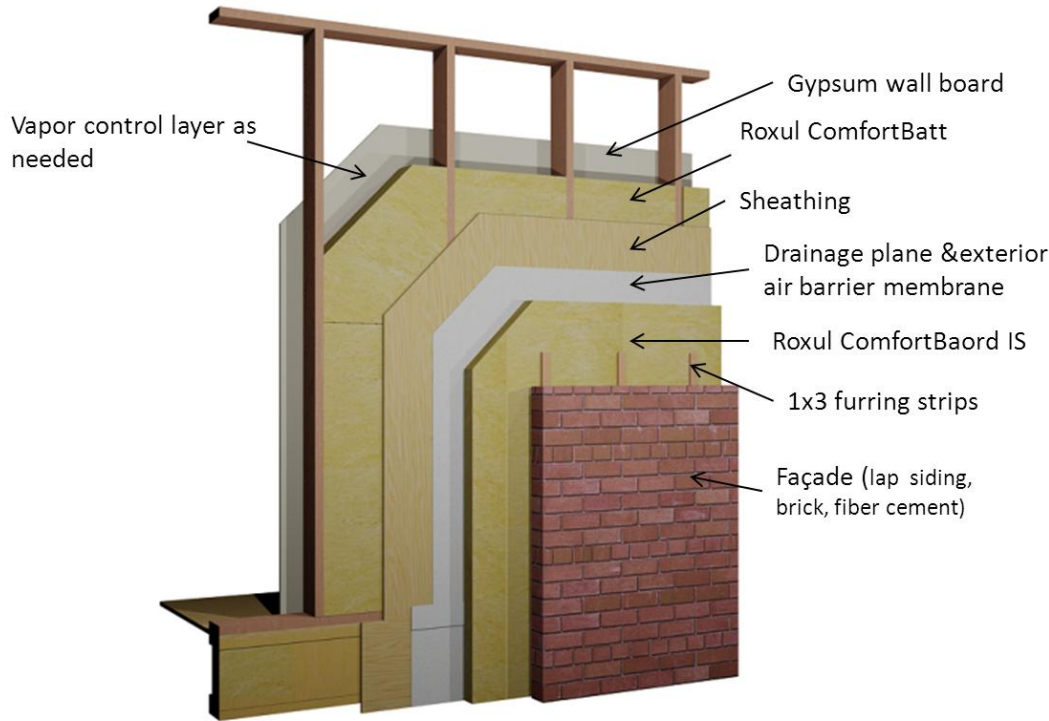
Corrosive Resistance:

ASTM C 665	Corrosiveness to Steel	Pass
ASTM C 795 ****	Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692: U.S. Nuclear Regulatory Commission, Reg. Guide #1.36: U.S. Military Specifications MIL-I-24244 (all versions including B and C)	Conforms

Acoustical Performance

ASTM C423 CO-EFFICIENTS AT FREQUENCIES							
Thickness	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
1.5"	0.21	0.64	0.92	1.00	0.95	1.01	0.90
2.0"	0.43	0.78	0.90	0.97	0.97	1.00	0.90
3.0"	0.75	0.82	0.89	0.94	1.00	1.00	0.90

*MASTER FORMAT 1995 EDITION **MASTER FORMAT 2004 EDITION
*** at the time of manufacturing



Compressive Strength:

ASTM C 165	at 10%	743 psf (35.6 kPa)
	at 25%	1269 psf (60.8 kPa)

Density:

ASTM C 612-00 – Actual	8.0 lbs/ft ³	128 kg/m ³
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Dimensions:

24" (width) x 48" (length)
 610 mm x 1219 mm

36" (width) x 48" (length)
 610 mm x 1219 mm

48" (width) x 96" (length)
 1219 mm x 2438 mm

Thickness:

Product is available in 1.25" 1.5" 2" 3"
 For additional sizes, please contact our customer service representatives.

Key Application Qualifiers:

- Good compressive strength
- Low moisture sorption
- Durability
- Fire resistance
- Excellent thermal resistance
- Non-corrosive
- Chemically inert
- CFC and HCFC free product and process
- Made from natural & recycled materials

Other ROXUL Products:

Please consult ROXUL for all your insulation needs. We have an extensive range of products for all applications from pipe insulation to commercial products to residential batts. ROXUL invites all inquiries and will act promptly to service all of your requirements.

Note:

As ROXUL Inc. has no control over installation design and workmanship, accessory materials or application conditions, ROXUL Inc. does not warrant the performance or results of any installation containing ROXUL Inc's products. ROXUL Inc's overall liability and the remedies available are limited by the general terms and conditions of sale. This warranty is in lieu of all other warranties and conditions expressed or implied, including the warranties of merchantability and fitness for a particular purpose.



March 3, 2011

Mark Bromiley
Roxul Inc.
420 Bronte St. S. Suite 105
Milton, Ontario, L9T 0H9

Via email: mark.bromiley@roxul.com

Re: Roxul – Exterior Insulation Deflection Testing

Background

As society demands more energy efficient buildings, codes and builders are responding by increasing the R-value of the building enclosure, in particular the above-grade wall. Given that the cavity of the standard 2x6 wood frame wall used in low-rise housing is already filled with insulation, the clear path forward to higher R-values is to add layers of exterior insulation. Although other solutions are possible, exterior insulation layers have the benefits that:

1. At thicknesses of up to 1.5”, exterior insulation has long been used by the industry, and hence there is experience with its installation and detailing,
2. Thermal bridging through framing members, floor joists, lintels, etc. is very significantly reduced, increasing the wall R-value significantly,
3. The risk of cold-weather condensation within the moisture-vulnerable wood framing is significantly reduced, and potentially eliminated,
4. A range of target R-values can be easily reached as similar details can be used for the design of walls that have 2, 3, 4 or even 6” of insulation,
5. The marginal cost of increasing framing thickness and/or building double-walls usually outweighs the marginal cost of adding insulating sheathing layers.

Highly-permeable insulation like Roxul has the added benefit that it allows very fast outward drying during cold weather: this dries the wood-frame cavity very quickly, even if the framing is wet from construction or becomes wet because of incidental water leaks.

A major impediment to the wide-spread adoption of exterior sheathing behind direct applied claddings such as vinyl, wood, fibre cement, stucco and adhered veneer, is the lack of information about the structural performance of claddings installed over insulating sheathing. Foam plastic insulations, which have much higher compressive strengths (often 15 to 25 psi @10% deformation) than most Roxul products (often 1 to 5 psi) are seen as better products for this application. The concern is that the insulation is not stiff enough to suspend claddings and deformations may occur causing cracking, and other issues.

Very little testing has been conducted to show the strength and stiffness of insulation supporting cladding and no testing results of Roxul insulation is available.

The most common method of attaching cladding over thick insulation is to use wood furring (strapping) attached with screws through the insulation to the framing as shown in Figure 1.

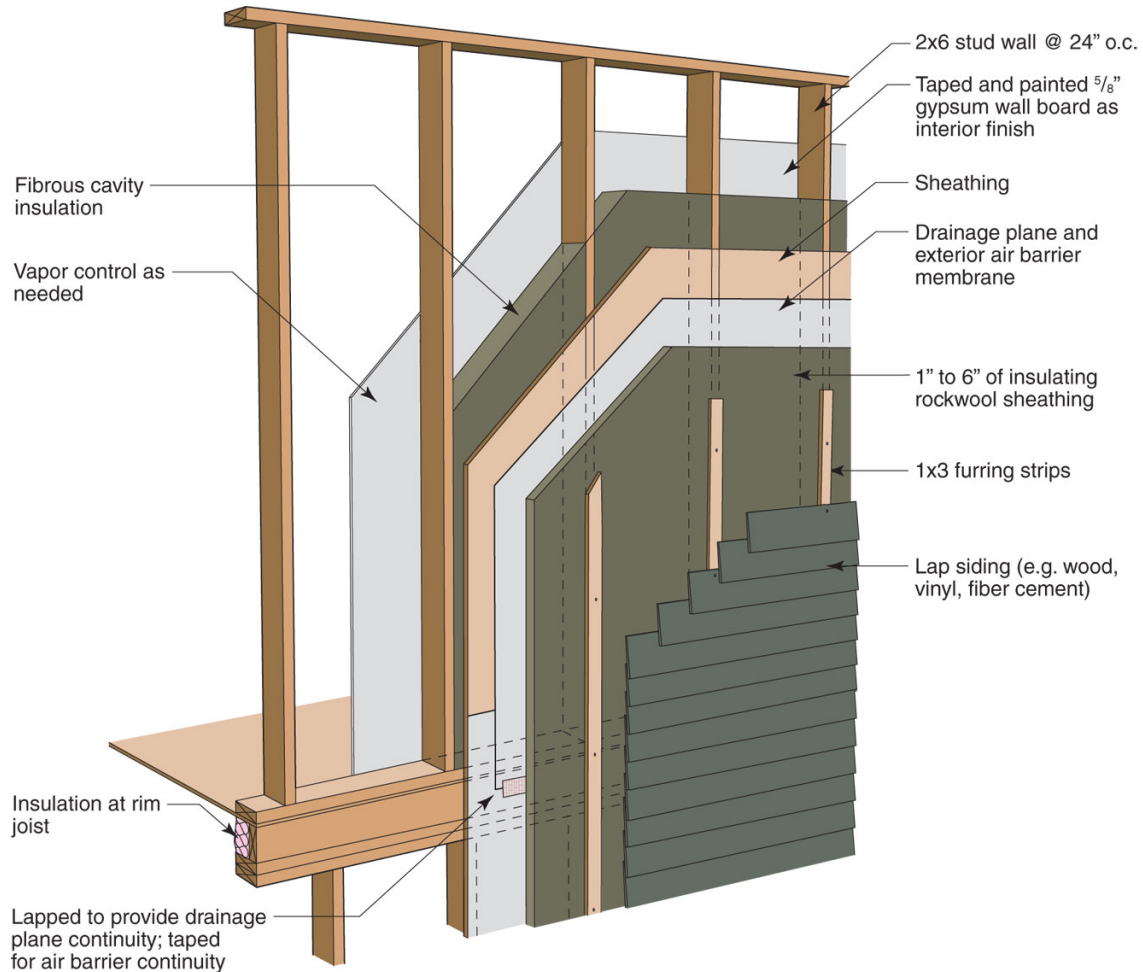


Figure 1: Typical application of semi-rigid Roxul insulation over wood framing

Objective

The objective of this study is to quantify the relationship between cladding gravity loads and deflection under cladding weights of up to 30 pound per square foot. These results are intended to be used to provide guidance to designers, builders, and code officials involved in projects using Roxul brand semi-rigid rockwool sheathing.

Scope

This report summarizes the results of load deflection testing deflection of strapping over six types of Roxul exterior insulation as shown in Table 1. These walls were tested on 24" oc framing, with strapping attachment screws at vertical spacings of 16" oc. Other variables such as 16" oc framing, different screw sizes and spacings were outside the

scope of the testing program. This study was designed to simulate walls providing the least support practically likely (thin screws wide spacing of studs and fasteners) and hence the highest likely deflections. If improved construction standards are used, such as stronger screws and/or more frequent screw spacing, the amount of deflection would decrease. This is meant to be a type of worst case, yet realistic, scenario.

Table 1: Roxul insulation types to be tested

Insulation Product	Approximate Density (lb/ft³)
1.25" Cavity Rock MonoDensity	4.1
3" Cavity Rock DualDensity	3.4 / 6.2
1.25" RB60	6.0
1.25" RB80	8.0
3" RB80	8.0
1.25" Drainboard	8.0
1" Type IV extruded polystyrene	2.0

Testing Apparatus

To conduct the testing, a 2x wall frame with 24" stud spacing was securely fastened to a concrete block wall in the laboratory. OSB sheathing and a house wrap were installed over the sheathing. The different types of Roxul insulation were installed over the house wrap, and held in place by screws driven through nominal 1x3 strapping (actual dimension ¾"x 2.5") connected directly to the wood framing (Figure 2). The strapping was attached with screws spaced vertically at 16" oc. Given the 24" spacing of the framing, this is 2.67 square feet per fastener (or about 4 connectors per square meter).

Figure 3 presents photographs of the screws used for strapping attachment for both 1.25" thick insulation and 3" thick insulation. To attach strapping over 1.25" thick insulation, 3" deck screws were used. For the first tests the strapping over 3" thick insulation was attached using #9 x 5" trim head bronze wood screws were used (middle screw in Figure 3). After inspection of the screws following the first test, this screw showed considerable permanent deflection, and the smaller diameter heads pulled deep into the wood of the furring strip. Hence, subsequent test of 3" thick insulation used #10 x 5" wood screws with standard head sizes. These screws showed a marked improvement in performance.



Figure 2 : Roxul insulation attached to wall frame ready for test

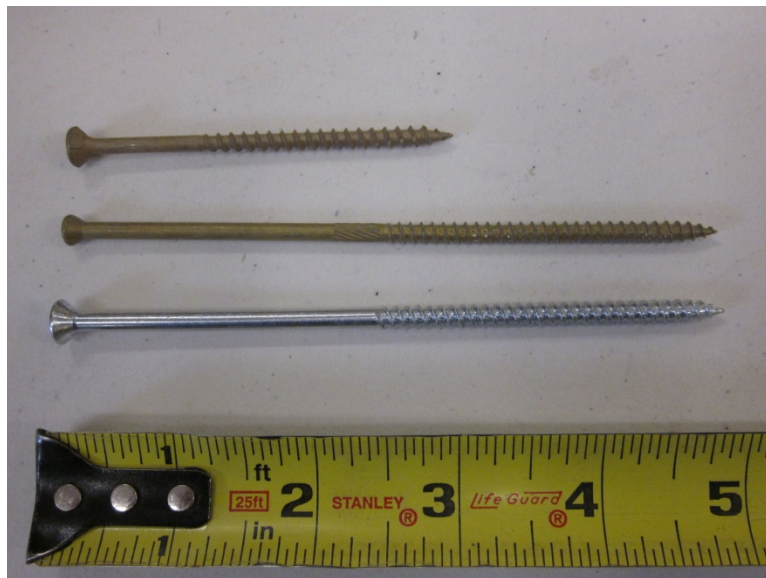


Figure 3 : Strapping attachment screws

A 2 tonne-capacity hydraulic ram was used to apply force to a metal angle in contact with the bottom edge of both strapping pieces (Figure 4). To measure the applied force a 1000 lbf (4500 N) strain gauge load cell (with ± 0.4 lbf rated accuracy) was placed between the angle and the ram.

Deflection gauges (with a resolution of $1/1000''$ or 0.025 mm) were used to measure the movement of the wall sheathing and the strapping on both the left and right side. Metal

clips were attached to the strapping to allow deflection gauges to measure the strapping movement.

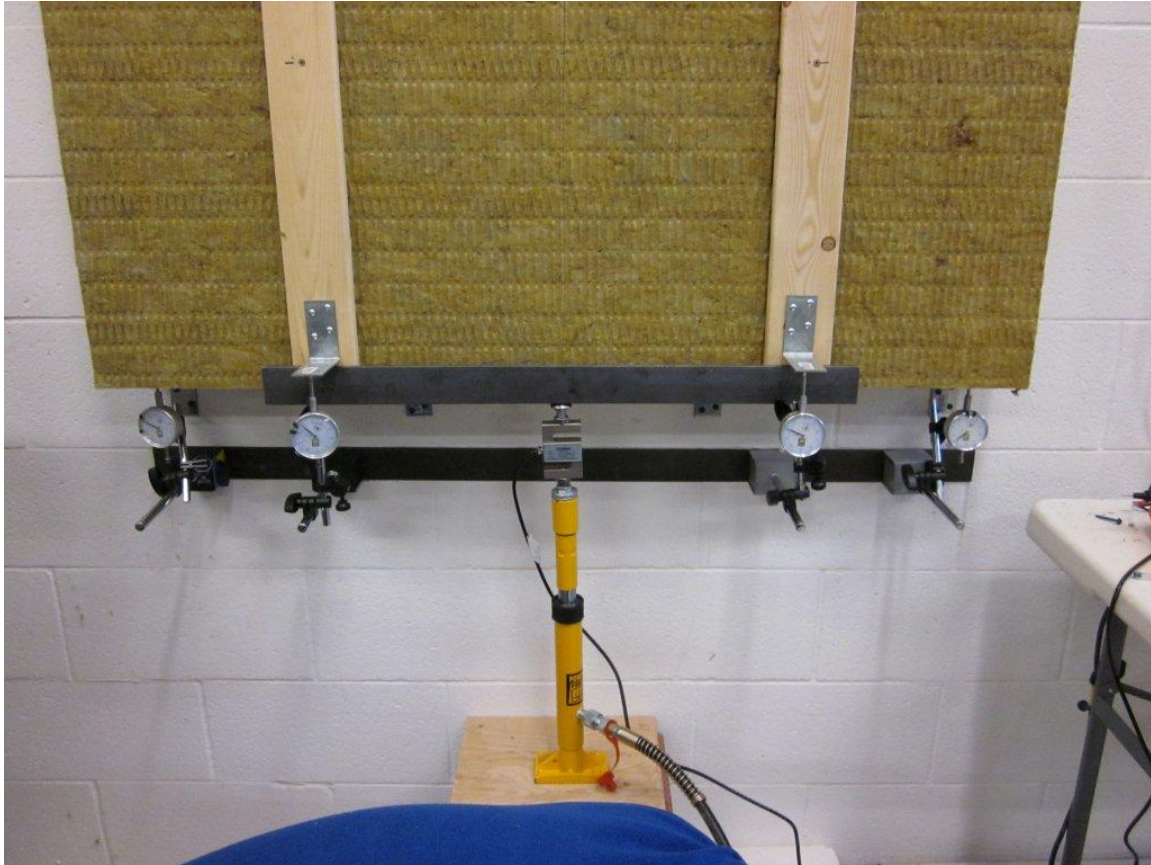


Figure 4: Hydraulic Ram with load cell and deflection gauges measuring strapping movement (sheathing deflection gauges not shown)

Loads were applied in increments of 100 lbs between 100 lbs and 1,000 lbs. The four deflection readings were recorded at each increment. Each load increment was applied over about 30 to 60 seconds and the readings taken with 30 seconds. All of the tests were conducted three times on the same test specimen. The wall was loaded to 1000 lbs, unloaded, and reloaded two more times.

Results and Analysis

The average deflection was calculated by determining the average of the deflection of the right and left strapping pieces and subtracting any movement measured in the wall frame. In general, the framing moved very little (about 10% of the total deflection).

For all of the specimens, the first time the wall was loaded the deflection was significantly larger and than the last two tests. The second pair of tests showed good repeatability. It is assumed that this behavior is due to the wall assembly “seating” itself or “settling in”. The amount of seating could be increased by attaching the initial torque during installation of the screws: controlling the amount of screw torque was a challenge as it was not always easy to achieve perfectly plumb strapping.

EXHIBIT C

Roxul – Exterior Insulation Deflection Testing – February 2011

The results of load and deflection can be compared to spatial mass density of typical claddings shown in Table 2. These weights are meant to be representative of all similar claddings although some cladding types might be outside of the range listed. The testing was conducted to approximately twice the weight of the heaviest cladding in the table, adhered stone veneer (i.e., 15 psf x 4 x 8 x 2 = 960 lbs). These ranges of cladding weights are shown in the analysis graph as shaded areas in Figure 5.

Table 2 : Approximate cladding weights

Cladding Type	Typical mass density range (psf)	Equivalent weight for 4’x8’ test panel (lbs)
Vinyl siding	0.6-1.0	20-32
Wood siding	1.0-1.5	32-48
Fiber cement siding	3-5	96-160
Cement stucco	10-12	320-384
Adhered stone veneer	12-15	384-480

Figure 5 plots the load-deflection curves for 3” CavityRock. As this graph is representative of all of the insulations tested, the remaining load-deflection graphs are attached in the appendix, and the results are summarized in Table 3. As can be seen, the load-deflection curve has a degree of curvature to it, but it largely linear for the first 100-200 pounds (eg. the load imposed by lap siding).

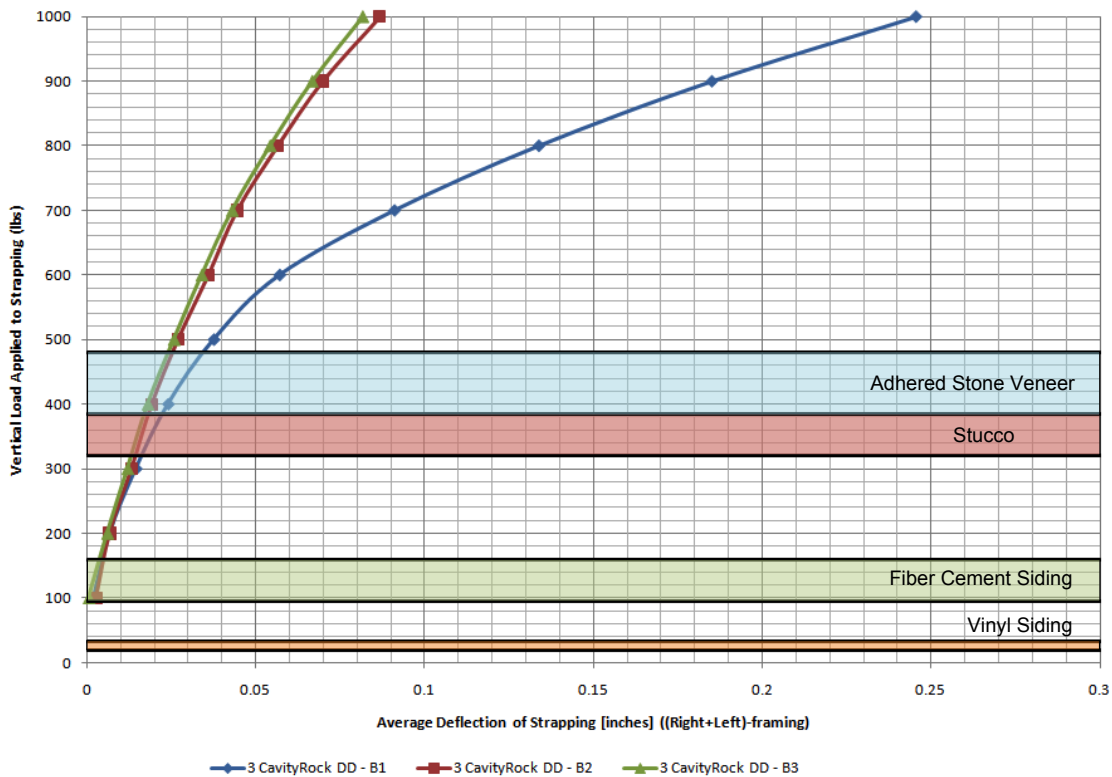


Figure 5: Deflection Testing of 3" CavityRock

EXHIBIT C

Roxul – Exterior Insulation Deflection Testing – February 2011

Table 3 shows the deflection results for all three 1000lb loadings on each test system in the order of least average deflection to greatest average deflection. The average deflection was calculated from all three loadings and used to determine the performance order. If the average was taken of the second and third repeatable deflection on each wall, the relative ranking of performance would not change.

Table 3 : Summary of Deflection Results at 1000 lbs

Insulation	Density [lb/ft ³]	Compressive Strength (@25%) [kPa]	1 st Loading [inches]	2 nd Loading [inches]	3 rd Loading [inches]	Average [inches]
1" XPS	-	-	0.068	0.0355	0.0345	0.0460
1 ¼" RB80	8	60.8	0.089	0.034	0.030	0.0506
3" RB80	8	60.8	0.094	0.038	0.027	0.0529
3" RB60	6	28.1	0.117	0.044	0.041	0.0672
1 ¼" CavityRock MD	4.1	-	0.134	0.076	0.069	0.0927
3" CavityRock MD	6.2 / 3.4	-	0.246	0.087	0.082	0.1379
1 ¼" CavityRock with no OSB sheathing	4.1	-	0.166	0.136	0.1335	0.1452
1 ¼" DrainBoard	8	35	0.265	0.090	0.092	0.1486

Table 4 summarizes the measured data into what is a more useful format. For each of the product types the initial deflection measured is used to predict the deflection in service for three typical cladding types. Given that measurements of less than 0.010" are difficult to measure repeatedly or reliably, and that such a deflection is negligible in service, any deflections of less than 0.01" (0.25 mm) have been simply entered as "<0.01" in the table.

Table 4: Estimated Deflection (inches) in Service for Typical Cladding Loads

Insulation & Thickness	Vinyl Siding (1 psf)	Fiber Cement Siding (4 psf)	Stucco 3/4” (12 psf)
1.25” Cavity Rock MonoDensity	<0.01	0.012	0.050
3” Cavity Rock DualDensity	<0.01	<0.01	0.020
3” RB60	<0.01	<0.01	0.014
1.25” RB80	<0.01	<0.01	0.010
3” RB80	<0.01	<0.01	<0.01
1.25” Drainboard	<0.01	<0.01	0.045
1” Type IV extruded polystyrene, no OSB	<0.01	<0.01	0.120
1.25” Cavity Rock MonoDensity, no OSB	<0.01	0.015	0.060

Note: Assumes studs at 24” o.c. or closer, and minimum #10 fasteners at maximum 16” vertical spacing through nominal 1x3 furring strips. Deflection is based on the initial loading, and assumes that no creep occurs over long-term. Wind suction pressure may control the design of the fastening in high wind areas, not vertical deflection.

Summary and Conclusions

- All of the insulations tested showed very little deflection (less than 0.01” or 0.25 mm) at the loads imposed by lap siding (of wood, vinyl, or fiber cement)
- The least amount of deflection was experienced by RB80, with a density of 8lb/ft³ and the highest rated compressive strength of the Roxul insulations tested.
- The 1” Type 4 extruded polystyrene was no stiffer than the RB80
- If the strapping and insulation are not attached tightly to the wall sheathing, the initial deflection can be expected to be larger than if the insulation is firmly clamped, and the cladding attached with nail guns or other techniques that caused settling.
- All six materials tested resulted in very similar patterns of deflection. The first loading produced the largest amount of deflection for each wall, and the second and third tests were very similar and repeatable with much less deflection, approximately half as much as the initial loading.

Note that these tests were conducted to simulate some of the worst-case realistic scenarios for deflection (i.e., 24” o.c. strapping, and 16” vertical spacing between screws). This is equivalent to only 4 fasteners per square meter. Also, the screws used were the lowest quality, length and thickness that would be reasonable for this

application. Using more screws, more often would likely decrease deflection, but more testing is required to determine the amount that the deflection could be decreased.

Recommendations

It is recommended that field trials be conducted to gain feedback from installers in the field. It was noted that some care was required when installing the screws to attach the fastening so as to ensure a plumb strapping: excess or insufficient screw torque could cause the strap to be bent.

In practice, recommending screw attachments at 12” o.c for 24” o.c framing and 16” for 16” o.c framing would provide some additional safety factors.

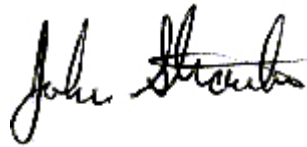
Despite the very favourable results achieved, it is recommended that field testing, in a test facility or on a jobsite, should be conducted to assess the potential for stucco or adhered veneer cracking over a 1-2 year test period before proceeding with wider deployment.

If you have any questions or comments about any part of this report, please do not hesitate to call or email.

Sincerely



Jonathan Smegal, M.A.Sc.
Associate EIT



John Straube, Ph.D. P.Eng.
Principal

EXHIBIT C

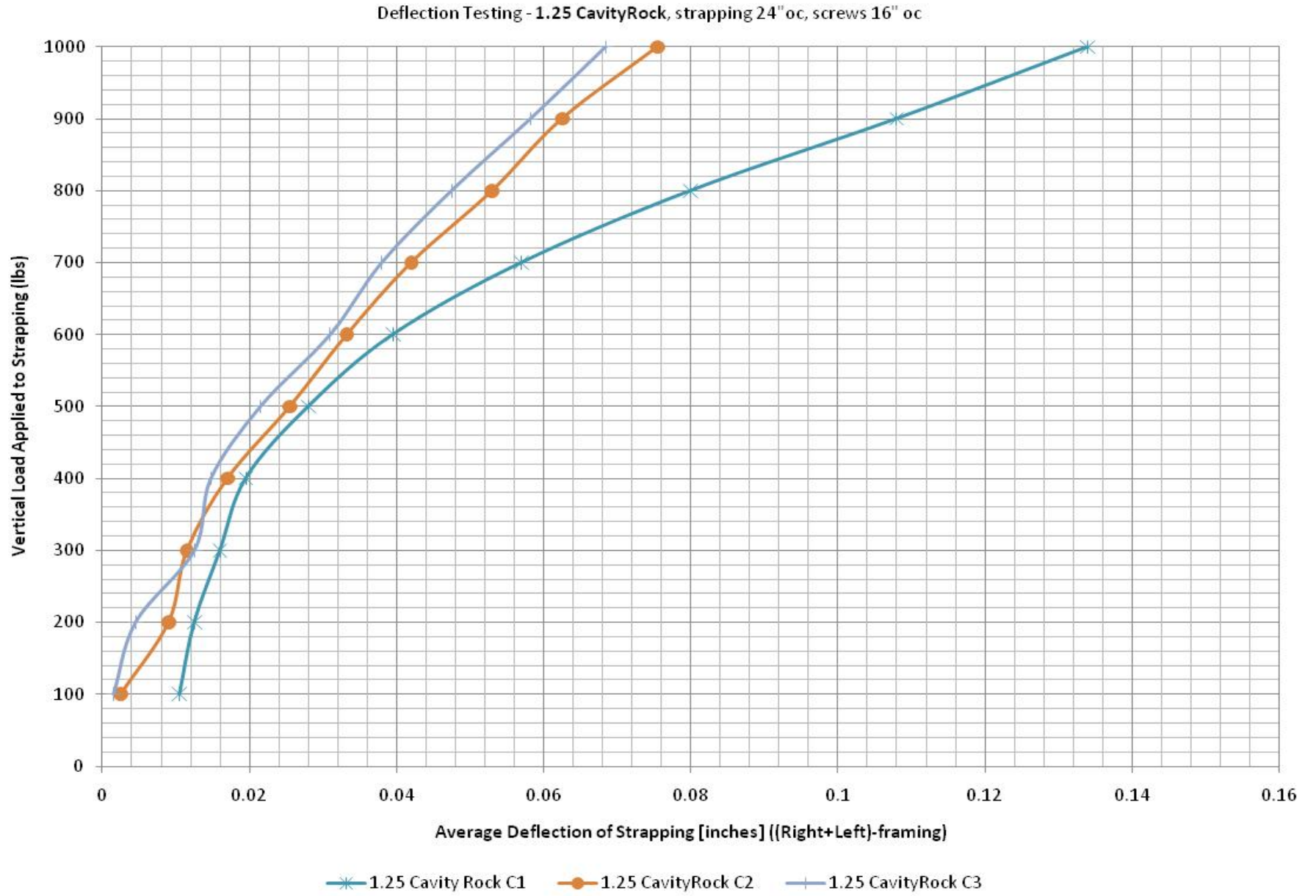


EXHIBIT C

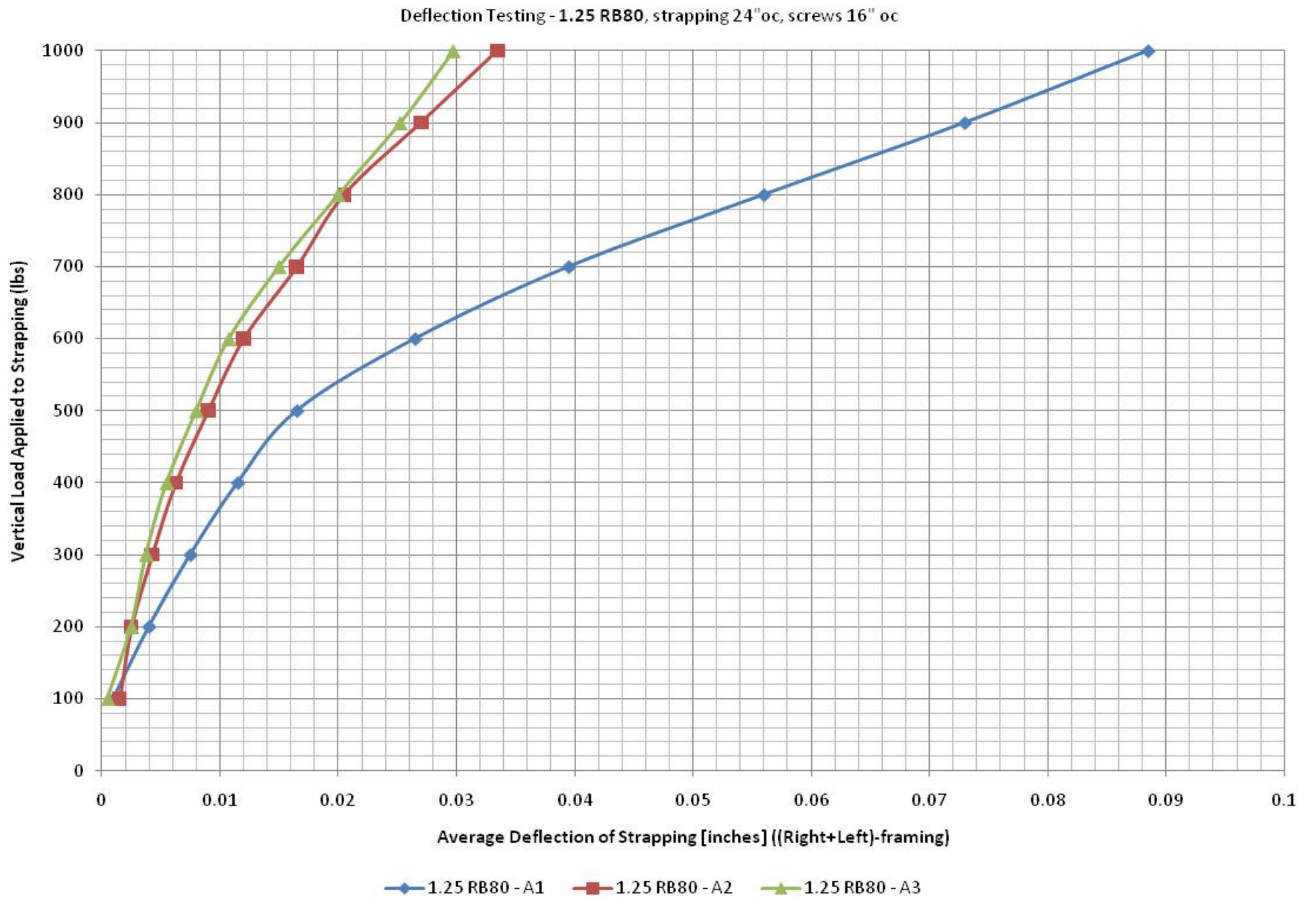


EXHIBIT C

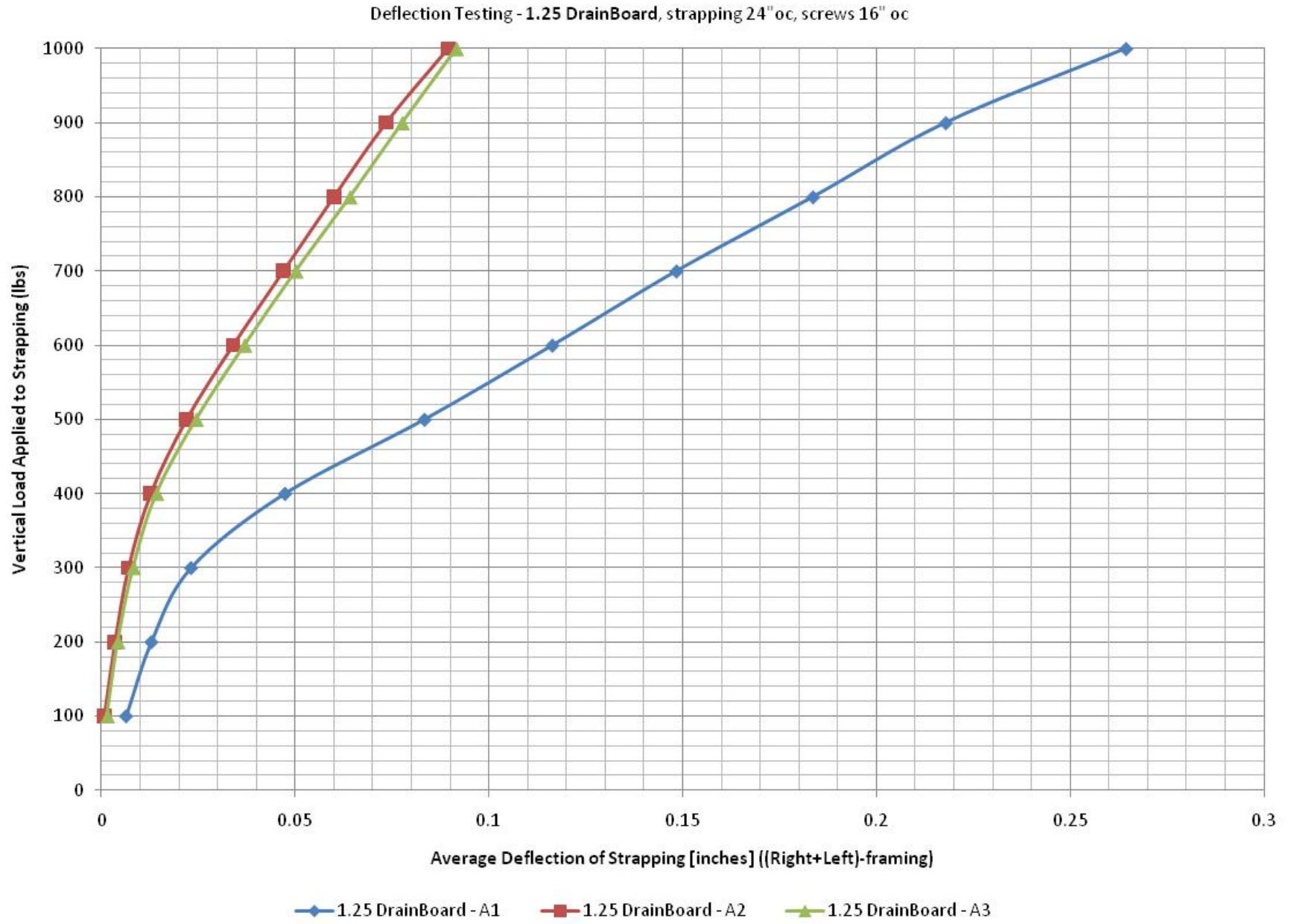


EXHIBIT C

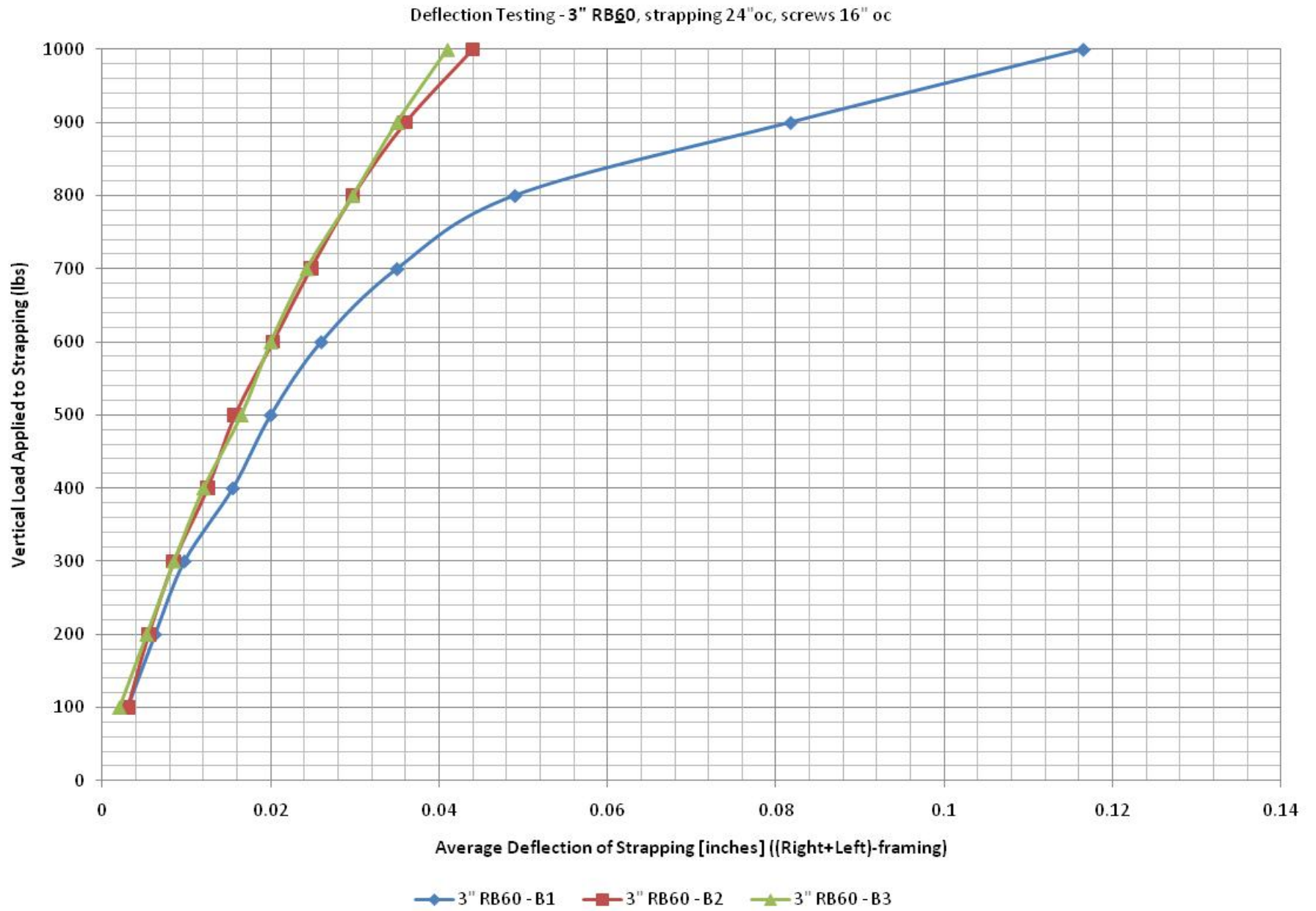


EXHIBIT C

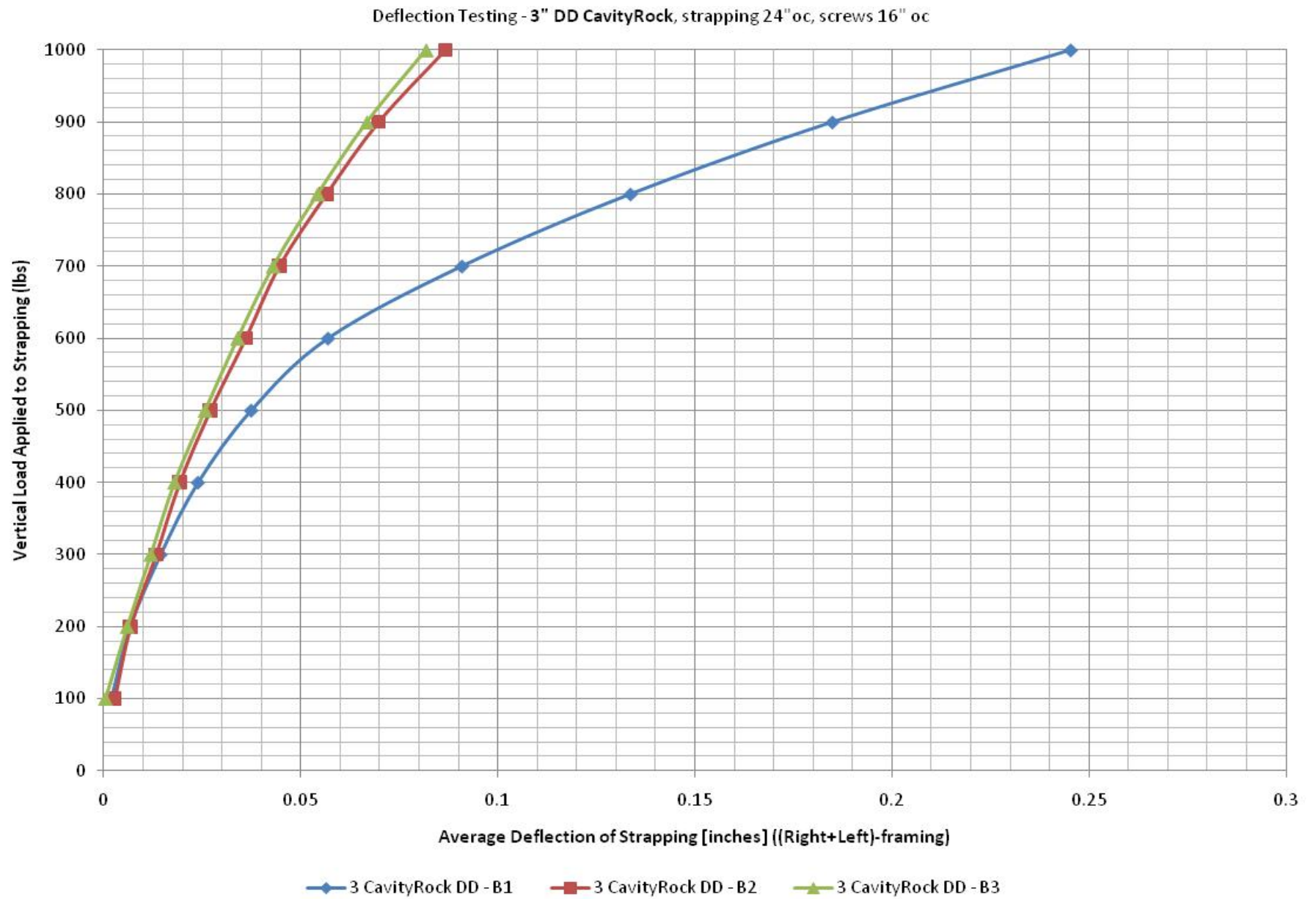


EXHIBIT C

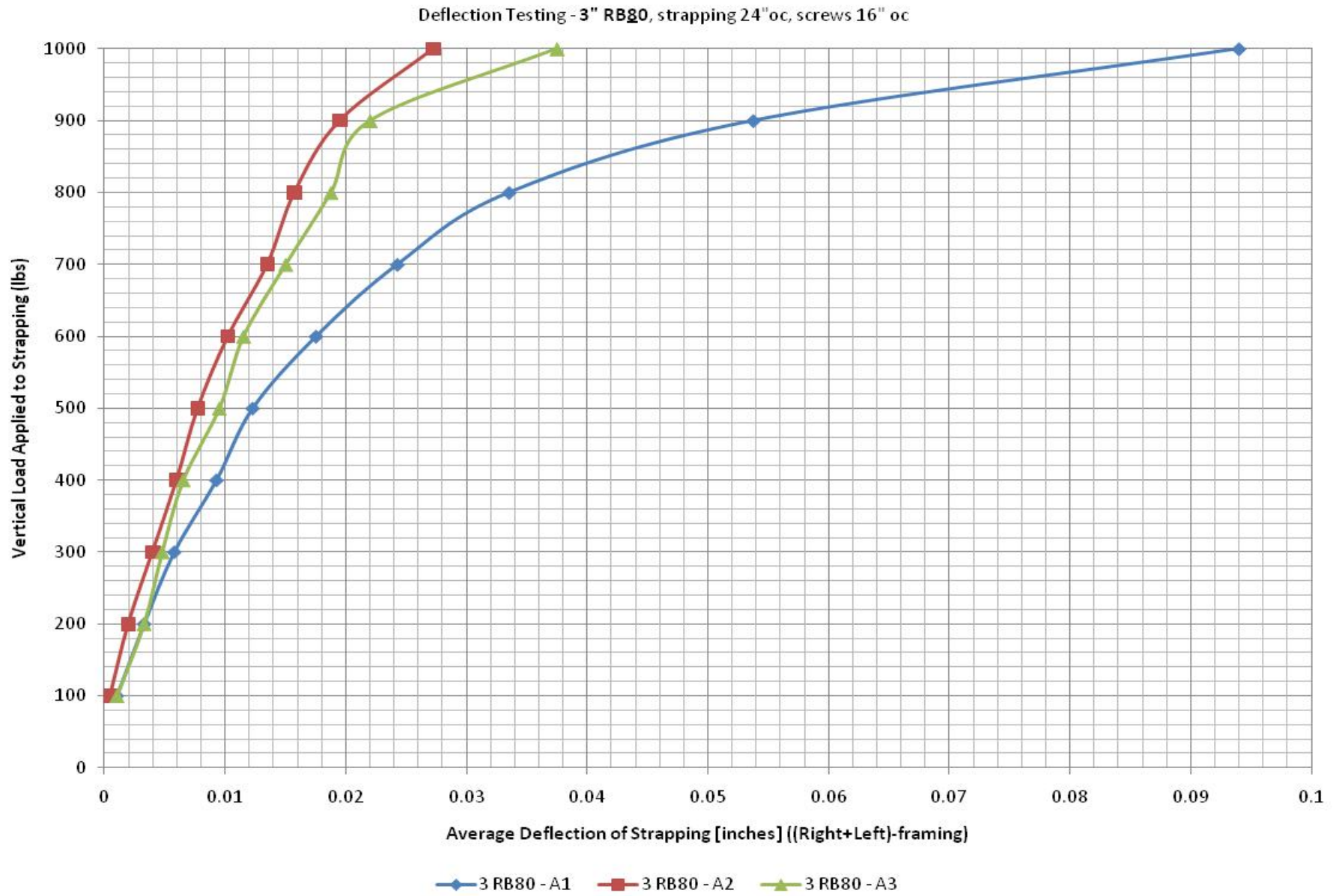


EXHIBIT C

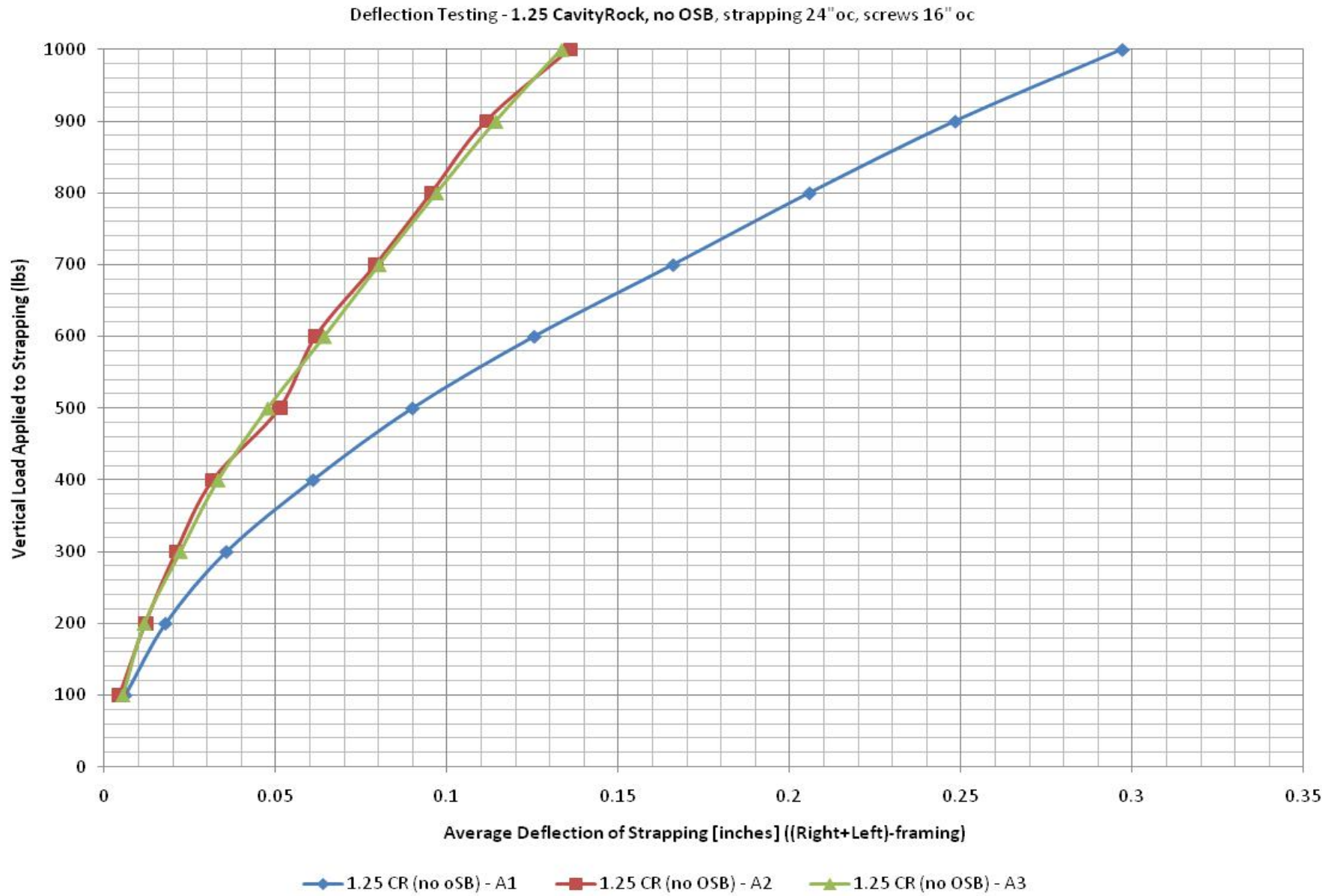


EXHIBIT C

