



August 1, 2008

TO: PARTIES INTERESTED IN EVALUATION REPORTS ON METAL ROOF COVERINGS

SUBJECT: Proposed Revisions to the Acceptance Criteria for Metal Roof Coverings, Subject AC166-0808-R1 (WM/MO)

Dear Madam or Sir:

The revisions proposed to the subject acceptance criteria are being posted on the ICC-ES web site to allow for public comment.

The Metal Construction Association is requesting changes to AC166 for the purpose of providing a method of establishing equivalency of a metal roof covering applied over spaced sheathing or spaced supports to a solid or closely fitted deck installed in accordance with the prescriptive requirements of the code with respect to diaphragm action.

The proposed revisions to AC166 are noted in Attachment A. The intent is to establish load/deflection parameters as a pass/fail criteria in the AC. Applicants choosing to evaluate their product for this option would be required to test in accordance with the requirements specified in the AC. The results would be compared to the established load/deflection parameters to determine if the system can be used as an alternative to solid or closely fitted deck installed in accordance with the prescriptive requirements of the code with respect to diaphragm action. Justification for the proposed testing protocol is noted in Attachments B and C.

You are cordially invited to submit written comments, within 30 days of the date of this letter. Please use the comment form on the web site attaching any letters to the form. An explanation of the alternate criteria process can be found on our web site at http://www.icc-es.org/Criteria_Development/alternative_criteria_process.shtml.

All comments received in the 30-day comment period will be considered in preparing revisions to the criteria that may be considered at a future Evaluation Committee meeting. Comments received will be posted on the web site shortly after the close of the comment period.

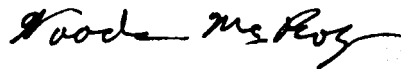
Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations

of the committee should refrain from communicating, whether in writing or verbally, with committee members. The committee reserves the right to refuse communications that do not comply with this request.

Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory's accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to pmccullen@iasonline.org.

Please submit all comments using the form on the web site. Attach any letters to the comment form. If you have any questions (not comments), please contact the undersigned at (800) 423-6587, extension 5686, or Michael O'Reardon, at extension 5685. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Woods McRoy, P.E.
Senior Staff Engineer

WFM/raf

Enclosures

cc: Evaluation Committee

ATTACHMENT "A"

Metal Construction Association Proposed Revisions to AC166 Roof Diaphragm Option

1.4.5.9 ASTM F 1667-03, Specification for Driven Fasteners: Nails, Spikes and Staples.

3.1.12 Roof Diaphragm (Optional): For recognition as an alternative to a roof covering system with a solid or closely fitted wood deck meeting the prescriptive requirements of the applicable code (for roof diaphragm purposes), reports of testing in accordance with Section 4.11 shall be submitted. The average deflection of the system using metal roof shingles or panels shall demonstrate deflections no greater than that specified in Table 1 for each of the corresponding loads. This is a pass/fail test. No design loads shall be reported in the evaluation report.

4.11 Roof Diaphragm: Three test specimens shall be constructed in accordance with the manufacturer's published installation instructions. Testing shall be in accordance with ASTM E 72, Section 14. A hold-down device and lateral guides as shown in Figure 7 are to be used to overcome the tendency of one end of the diaphragm to rise as the racking loads are applied. Spacing of the framing shown in Figure 6 of ASTM E 72 shall be 24 inches (610 mm). Framing materials used shall be consistent with materials intended for use with the roof covering assembly. The assembly shall be loaded to failure. The minimum number of test load increments and the test load are listed in Table 1. Additional test loads and deflections may be used. The data shall be reported in tabular form as well as a graph of load-versus-deflection.

4.11.1 Test Specimens: The construction of the test roof frames for testing the metal roof covering shall comply with the following:

4.11.1.1 Specimen Size: 8 ft x 8 ft (2.4 m x 2.4 m)

4.11.1.2 Framing Material: The test roof frame shall be constructed of No. 2 Douglas Fir-Larch or Spruce-Pine Fir. The rafters and ridge board shall be a nominal 2x6. The top plate shall be a nominal 2x4. The rafters shall be placed at 24 inches (610 mm) on center. The average moisture content of the framing members during the test shall be between 10% and 12%.

4.11.1.3 Framing Fasteners: Framing fasteners shall be 16d box nails (3-1/2" x 0.135") complying with ASTM F 1667. The ridge board shall be toe-nailed to the rafters using 4-16d box nails. The rafters are to be toe-nailed to the top plate using 2-16d box nails. If additional information on nailing of the roof test frame see International Residential Code Table R602.3(1).

4.11.1.4 Metal Roof Covering: The spaced sheathing and the metal roof covering are to be installed in accordance with the metal roof covering manufacturer’s installation instructions.

TABLE 1—MAXIMUM PERMITTED DEFLECTION

LOADS APPLIED PERPENDICULAR TO THE RAFTER FRAMING													
<u>Load</u> <u>(lb)</u>	<u>L₁</u>	<u>L₂</u>	<u>L₃</u>	<u>L₄</u>	<u>L₅</u>	<u>L₆</u>	<u>L₇</u>	<u>L₈</u>	<u>L₉</u>	<u>L₁₀</u>	<u>L₁₁</u>	<u>L₁₂</u>	<u>Failure</u>
<u>Deflection</u> <u>(in)</u>	<u>Δ₁</u>	<u>Δ₂</u>	<u>Δ₃</u>	<u>Δ₄</u>	<u>Δ₅</u>	<u>Δ₆</u>	<u>Δ₇</u>	<u>Δ₈</u>	<u>Δ₉</u>	<u>Δ₁₀</u>	<u>Δ₁₁</u>	<u>Δ₁₂</u>	---
LOADS APPLIED PARALLEL TO THE RAFTER FRAMING													
<u>Load</u> <u>(lb)</u>	<u>L₁</u>	<u>L₂</u>	<u>L₃</u>	<u>L₄</u>	<u>L₅</u>	<u>L₆</u>	<u>L₇</u>	<u>L₈</u>	<u>L₉</u>	<u>L₁₀</u>	<u>L₁₁</u>	<u>L₁₂</u>	<u>Failure</u>
<u>Deflection</u> <u>(in)</u>	<u>Δ₁</u>	<u>Δ₂</u>	<u>Δ₃</u>	<u>Δ₄</u>	<u>Δ₅</u>	<u>Δ₆</u>	<u>Δ₇</u>	<u>Δ₈</u>	<u>Δ₉</u>	<u>Δ₁₀</u>	<u>Δ₁₁</u>	<u>Δ₁₂</u>	---

For SI: 1 inch = 25.4 mm, 1 pound = 4.4482 N

Metal Construction Association is to submit the specific test details for determining the loads and deflections for Table 1. If the testing protocol and test specimens are accepted by the Evaluation Committee, MCA will conduct testing and submit the results and propose load/deflection limits to the committee for approval at another meeting.

ATTACHMENT "B"

Walker Engineering, Inc.

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Correlation Test Program for Metal Roof Covering Diaphragm

Test Program Roof Diaphragm:

Six 24 ft x 24 ft (7.32 m x 7.32 m) wood structural panel specimens are to be tested to failure with three specimens tested with the load applied perpendicular to the rafter framing and three specimens tested with the load parallel to the rafter framing using ASTM E 455 (simple beam procedure). Six 8 ft x 8 ft (2.43 m x 2.43 m) wood structural panel specimens are to be tested to failure with three specimens tested with the load applied perpendicular to the rafter framing and three specimens tested with the load parallel to the rafter framing using ASTM E 72. The test results are to be evaluated to determine the relationship between the test procedures. The metal roof covering manufacturers are to test six specimens of 8 ft x 8 ft (2.43 m x 2.43 m) under ASTM E 72. These test results will be evaluated to the test results for the six 8 ft x 8 ft (2.43 m x 2.43 m) wood structural panel specimens.

ASTM E 455 Test Program:

Test three 24 ft x 24 ft (7.32 m x 7.32 m) wood structural panel specimens using ASTM E 455-04, Standard Method for Static Load Testing of Framed Floor or Roof Diaphragm Construction for Buildings, to determine load and deflection to failure under perpendicular loading and parallel loading using the simple beam procedure. The test data will be presented as graphs and in a table format. The following table is provided as an example.

ASTM E 455 Data								
Load (lbf)	Deflection (inches)							
	Load Perpendicular to Rafter				Load Parallel to Rafter			
	Specimen			Avg	Specimen			Avg
	1	2	3		1	2	3	
2,400	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1
3,600	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2
4,800	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3
6,000	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4
7,200	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5
8,400	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6
9,600	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7
10,800	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8

Correlation Test Program for Metal Roof Covering Diaphragm

ASTM E 455 Data (continued)								
Load (lbf)	Deflection (inches)							
	Load Perpendicular to Rafter				Load Parallel to Rafter			
	Specimen			Avg	Specimen			Avg
	1	2	3		1	2	3	
12,000	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9
13,200	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}
14,400	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}
15,600	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}
16,800	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}
18,000	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}
19,200	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}
20,400	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}
21,600	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}
Failure	--	--	--	--	--	--	--	--

ASTM E 72 Test Program:

Test three 8 ft x 8 ft (2.43 m x 2.43 m) wood structural panel specimens using ASTM E 72-04, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction, to determine load and deflection to failure under perpendicular loading and parallel loading. A hold-down device and lateral guides as shown in Figure 7 are to be used to overcome the tendency of one end of the diaphragm to rise as the racking loads are applied. The test data will be presented as graphs and in a table format. The following table is provided as an example.

ASTM E 72 Data								
Load (lbf)	Deflection (inches)							
	Load Perpendicular to Rafter				Load Parallel to Rafter			
	Specimen			Avg	Specimen			Avg
	1	2	3		1	2	3	
500	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1	Δ_1
800	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2	Δ_2
1,000	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3	Δ_3
1,200	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4	Δ_4
1,400	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5	Δ_5
1,600	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6
1,800	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7

Correlation Test Program for Metal Roof Covering Diaphragm

ASTM E 72 Data (continued)								
Load (lbf)	Deflection (inches)							
	Load Perpendicular to Rafter				Load Parallel to Rafter			
	Specimen			Avg	Specimen			Avg
	1	2	3		1	2	3	
1,600	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6	Δ_6
1,800	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7	Δ_7
2,000	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8	Δ_8
2,200	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9	Δ_9
2,400	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}	Δ_{10}
2,600	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}	Δ_{11}
2,800	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}	Δ_{12}
3,000	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}	Δ_{13}
3,200	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}	Δ_{14}
3,400	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}	Δ_{15}
3,600	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}	Δ_{16}
3,800	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}	Δ_{17}
Failure	--	--	--	--	--	--	--	--

Wood Structural Panel Test Specimen for ASTM E 455 Test Program:

(These specimens are to be performed by the Metal Construction Association for the development of the optional racking procedure and evaluation rationale in AC166.)

Size: 24 ft x 24 ft (7.32 m x 7.32 m)

(AC43 – Section 4.2.3)

Material:

Frame: No. 2 Douglas Fir-Larch or Spruce-Pine Fir

Rafter: 2x6

Ridge Board: 2x6

Top plate: 2x4

Sheathing: $1\frac{5}{32}$ " Structural Wood Panel (SR 32/16)

(DOC PS-1 or PS-2)

Sheathing Fasteners: 8d common nail (2- $\frac{1}{2}$ " x 0.131")

(ASTM F 1667-03)

Framing Fasteners: 16d box nail (3- $\frac{1}{2}$ " x 0.135")

(ASTM F 1667-03)

Average Moisture Content:

Framing: 10% to 12%

Sheathing: 10% to 12%

Correlation Test Program for Metal Roof Covering Diaphragm

Framing installation:

Rafter to ridge board: 4-16d (toe nail) (IRC Table R602.3(1))
Rafter to top plate: 2-16d (toe nail) (IRC Table R602.3(1))
Rafter at 24" (610 mm) on center

Sheathing Installation:

Fasteners Spacing: 6" (152 mm) on center along the panel edges and 12" (305 mm) on center on intermediate supports.

Sheathing: Install 4x8 wood structural panels perpendicular to rafters. No blocking will be used at the interior panel joints. The panels are to be attached only to the rafters (No attachment to the ridge board). Wood structural panels are to be placed on the rafter in accordance with Case 1 of IBC Table 2306.3.1.

Wood Structural Panel Test Specimen for ASTM E 72 Test Program:

(These specimens are to be performed by the Metal Construction Association for the development of the optional racking procedure and evaluation rationale in AC166.)

Size: 8 ft x 8 ft (2.43 m x 2.43 m) (ASTM E 72 – Section 14)

Material:

Frame: No. 2 Douglas Fir-Larch or Spruce-Pine Fir
Rafter: 2x6
Ridge Board: 2x6
Top plate: 2x4
Sheathing: $1\frac{5}{32}$ " Structural Wood Panel (SR 32/16) (DOC PS-1 or PS-2)
Sheathing Fasteners: 8d common nail (2- $\frac{1}{2}$ " x 0.131") (ASTM F 1667-03)
Framing Fasteners: 16d box nail (3- $\frac{1}{2}$ " x 0.135") (ASTM F 1667-03)

Average Moisture Content:

Framing: 10% to 12%
Sheathing: 10% to 12%

Framing installation:

Rafter to ridge board: 4-16d (toe nail) (IRC Table R602.3(1))
Rafter to top plate: 2-16d (toe nail) (IRC Table R602.3(1))
Rafter at 24" (610 mm) on center

Sheathing Installation:

Fasteners Spacing: 6" (152 mm) on center along the panel edges and 12" (305 mm) on center on intermediate supports.

Correlation Test Program for Metal Roof Covering Diaphragm

Sheathing: Install 4x8 wood structural panels perpendicular to rafters. No blocking will be used at the interior panel joints. The panels are to be attached only to the rafters (No attachment to the ridge board). Wood structural panels are to be placed on the rafter in accordance with Case 1 of IBC Table 2306.3.1.

Metal Roof Covering Test Specimen:

(These specimens are to be tested by the individual metal roof manufacturer for their metal roof covering being evaluated under the optional racking procedure in AC166.)

Size: 8 ft x 8 ft (2.43 m x 2.43 m) (ASTM E 72 – Section 14)

Material:

Frame: No. 2 Douglas Fir-Larch or Spruce-Pine Fir

Rafter: 2x6

Ridge Board: 2x6

Top plate: 2x4

Framing Fasteners: 16d box (3-1/2" x 0.135") nail

Average Moisture Content:

Framing: 10% to 12%

Framing installation:

Rafter to ridge board: 4-16d (toe nail)

(IRC Table R602.3(1))

Rafter to top plate: 2-16d (toe nail)

(IRC Table R602.3(1))

Rafter at 24" (610 mm) on center

Metal Roof Covering Installation:

Per manufacturer's installation instructions.

ATTACHMENT "C"

Walker Engineering, Inc.

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205-854-0160
205-854-0160 (fax)

Correlation Criteria:

Since the test specimens for ASTM E 455 and ASTM E 72 are not the same size, the test results will need to be compared and evaluated after adjusting the applied loads and corresponding deflections to address the affect of the different specimen sizes.

Load Adjustment: The applied loads will be converted to a load per unit length of test specimen in the direction of the applied load. The each applied load will be divided by the test specimen's length in the direction of the applied load to obtain a unit load per unit length (i.e. pound per foot).

Deflection Adjustment: The deflections will be converted to strains based on each deflection divided by the test specimen's length in the direction of the applied load.

Presentation of Test Results: The adjusted loads and their corresponding strains for ASTM E 455 and ASTM E 72 will be presented in both table and graph formats. The graph format for each test procedure will use the same units for the adjusted loads and for the strains so that the graphs may be overlaid.

Evaluation of Test Results: The ASTM E 72 adjusted loads and corresponding strains will be considered equal to ASTM E 455 under the following conditions. The evaluation will be based on adjusted loads of 25 pounds per foot or greater to the last sustained load before ultimate failure:

1. Each adjusted load and its corresponding strain is equal to the same adjusted load and its corresponding strain from ASTM E 455.
2. The ASTM E 72 adjusted load is equal to the ASTM E 455 adjusted load and the ASTM E 72 corresponding strain for that adjusted load is less than the corresponding strain for the same ASTM E 455 adjusted load.
3. The adjusted loads and their corresponding strains meet a combination of criterion 1 and 2.

Conclusion: If the evaluation of the test results for ASTM E 72 indicates that the adjusted loads and their corresponding strains are equal to the adjusted loads and corresponding strains from ASTM E 455, then testing under ASTM E 72 will be considered as equivalent to testing under ASTM E 455. This will allow the comparison testing of wood structural panel diaphragms to metal roof covering diaphragms to be based on ASTM E 72 procedure.

July 22, 2008