

**DEPARTMENT OF HOUSING AND  
URBAN DEVELOPMENT**

**24 CFR Part 3280**

[Docket No. FR-4271-N-01]

RIN 2502-AH05

**Manufactured Home Construction and  
Safety Standards: Metal Roofing;  
Interpretative Bulletin I-2-98**

**AGENCY:** Office of the Assistant  
Secretary for Housing—Federal Housing  
Commissioner, HUD.

**ACTION:** Interpretative Bulletin.

**SUMMARY:** In January 1994 HUD amended the Manufactured Home Construction and Safety Standards to improve the resistance of manufactured homes to wind forces in areas prone to hurricanes. In part, the amendments provided that manufactured homes designed to be sited in high wind areas must be designed to resist either the design wind loads in a specified industry performance standard or alternative wind pressures set out in a prescriptive Table included in the regulations. Some questions have arisen concerning: Whether manufacturers that design their products using the wind pressures in the Table must provide roof sheathing under metal roofing; and the appropriateness of the testing of metal roofing that has been done. Therefore, the Department finds it necessary to reiterate, through this Interpretative Bulletin (IB), its current policy with regard to the regulations. A related advance notice of proposed rulemaking is published elsewhere in today's **Federal Register**.

**DATES:** Effective Date: May 12, 1998.

**FOR FURTHER INFORMATION CONTACT:** David R. Williamson, Director, Office of Consumer and Regulatory Affairs, Department of Housing and Urban Development, 451 Seventh Street, SW, Room 9156, Washington, DC 20410, telephone: (202) 708-6401 (this is not a toll-free number). For hearing- and speech-impaired persons, this number may be accessed via TTY (text telephone) by calling the Federal Information Relay Service at 1-800-877-8339.

**SUPPLEMENTARY INFORMATION:** In this Interpretative Bulletin ("IB") HUD clarifies the meaning of the standard in 24 CFR 3280.305(c)(1)(ii)(B) as applied to metal roofing. Under this provision, elements of manufactured homes that are designed for high wind areas currently must be designed to resist wind pressures prescribed in a Table of Design Wind Pressures ("Table").

(Alternatively, under § 3280.305(c)(1)(ii)(A), the design may be qualified using general performance standards that utilize the design wind loads in ANSI/ASCE 7-88; this IB does not affect the option to use those performance standards.) This IB is issued pursuant to 24 CFR 3280.9 and 3282.113.

HUD has received requests from manufacturers and Design Approval Primary Inspection Agencies (DAPIAs) for clarification of design and testing requirements for metal roofing in wind zones II and III under the provisions in § 3280.305(c)(1)(ii)(B). Because these requirements are not being applied uniformly by DAPIAs and manufacturers, and HUD agrees with industry representatives that the regulation needs clarification, the Secretary has determined that the public's interest in the manufacture of housing that is safe for the conditions under which the housing is sited would best be served by the issuance of this IB. Issuance of the IB also is in the interest of competitive fairness to members of the industry. This IB does not denote any change in policy or interpretation formulated by HUD, but clarifies requirements that were adopted as part of an extensive notice-and-comment rulemaking process.

Therefore, because of the need for resolution of any question regarding the requirements applicable under the Manufactured Home Construction and Safety Standards ("standards") to metal roofing in wind zones II and III, and the fact that this is not a change in the position or policy of the Department, in accordance with 24 CFR 3282.113, the Secretary has deemed it not to be in the public interest to issue the interpretation for public comment under 24 CFR part 3282, subpart C.

The Department understands, however, that there may be concerns about the requirements or implementation of roofing standards for manufactured homes sited in high-wind areas. In that regard, persons interested in recommending any changes to the policy clarified in this IB are directed to the advance notice of proposed rulemaking published elsewhere in today's **Federal Register**.

**Background**

The manufactured housing construction standards in 24 CFR 3280.305(c)(1)(ii) for wind zones II and III were established by HUD in a rule published on January 14, 1994 (59 FR 2469) ("January 1994 rule"). It is clear from the history of this rule, which amended the Federal Manufactured Home Construction and Safety

Standards in 24 CFR part 3280 to improve the resistance of manufactured homes to wind forces in areas prone to hurricanes, that HUD was intending to create prescriptive standards that manufacturers could elect to comply with as an alternative to the general performance standards that utilize the design wind loads in ANSI/ASCE 7-88. In particular, the January 1994 rule provided that each manufactured home designed for wind zones II or III must be designed to resist either the design wind loads in ANSI/ASCE 7-88 or the wind pressures specified in the Table.

A question has been raised concerning whether manufacturers that design their homes using the wind pressures in the Table must provide roof sheathing under metal roofing to meet the requirement for resisting the wind pressures specified for roof coverings in the Table. Although the preamble of the January 1994 rule does not address the issue of metal roofing and roof sheathing directly, there is ample evidence of HUD's objectives in establishing the higher wind standards. The January 1994 rule clearly reflects HUD's intent to provide, through the prescriptive Table, an option that would provide comparable rigidity ("a rigid box"),<sup>1</sup> as an alternative to designing manufactured homes using the design wind loads of ANSI/ASCE 7-88. This intent also is consistent with the statement in § 3280.301 that subpart D of 24 CFR part 3280, which includes § 3280.305, is intended "to assure that the manufactured home will provide: (a) Structural strength and rigidity \* \* \*."

**The January 1994 Rule**

Although it is more prescriptive than the ANSI/ASCE 7-88 performance standard, the Table allows manufacturers to use alternative materials for the roof structure as long as those materials, and the entire manufactured home, meet the requirements in the Table.<sup>2</sup> In explaining the need for the January 1994 rule, HUD noted that storm damage to manufactured housing is primarily in the form of roof failure, loss of roof diaphragm material, connection failures, and tiedown/foundation failures. HUD also noted that in Hurricane Andrew, manufactured homes "became dangerous flying missiles, inflicting more property damage on neighboring

<sup>1</sup> Note, i.e., the option of using the Table would provide structural performance within permissible deflection limits.

<sup>2</sup> One kind of roof design, which is specified in footnote 7 of the Table, has been deemed to meet the performance requirements of the Table without the need for additional engineering analysis or load tests.

structures." (See 59 FR at 2457, "Problem to be Addressed.") In the "Summary" in the preamble of the January 1994 rule, HUD stated: "The revised standard also requires exterior roof and wall coverings to be fastened adequately to sheathing and framing members, to resist higher design wind pressures. The purpose of this rule is to increase the safety of manufactured homes, thereby reducing deaths and injuries and extensive property damage losses in areas where wind-induced damage is a particular hazard and risk." (59 FR at 2456.)

Also in the preamble, HUD related that "[a]mong the major deficiencies contributing to manufactured housing damage in Hurricane Andrew were inadequate connections between exterior roof or wall coverings and supporting sheathing or framing and between walls, roofs, and floors" (59 FR at 2458, "Field Investigations"). This portion of the preamble continues:

In particular, losses of roof coverings were widespread, and were considered by some to be the first mode of failure for manufactured homes damaged in Hurricane Andrew. Other roof-related damage was due to loss of sheathing, failure of connections, or a combination of these problems \* \* \*

\* \* \* Metal or plastic siding used in manufactured housing was readily damaged or penetrated by flying debris during the high winds in Hurricane Andrew. Loss of roof or wall cladding allows the building to be penetrated by the weather and has far-reaching consequences beyond the area of envelope integrity.

\* \* \* In addition, failure of coverings or attachments to the manufactured home structure also caused missile-type damage to other homes.

\* \* \* Edges and corners of roofs and endwalls of manufactured homes appeared to have been particularly vulnerable to the high wind forces, according to the damage typically reported in these areas \* \* \* (59 FR at 2458)

Later in the preamble, these same themes were sounded. For example: "Commonly observed failures included loss of roof membranes and blow-off of roof sheathing \* \* \*." (59 FR at 2458.)

HUD also cited a Federal Emergency Management Agency (FEMA) report on the damage in Hurricane Andrew:

It was observed that the breakup of corrugated metal siding and roofed buildings such as manufactured homes and pre-engineered metal frame buildings contributed significantly to the generation of airborne debris. This was evident from debris damage to nearby downwind structures.

(59 FR at 2462, "Cost Considerations").

HUD did state its expectation that the manufactured housing industry would

be innovative in developing designs, components, and construction techniques that meet the standards but maintain the affordability of manufactured homes. It was clear, however, that the final product would be expected to perform at an acceptable level. In fact, HUD's stated intent was to strengthen the requirements for structural assemblies, components, connectors, fasteners, and a number of other areas so that the manufactured home would be able to resist the same wind forces as required for site-built and modular housing. (59 FR at 2467.)

HUD also notes that the economic analysis prepared by an industry trade association factored into the predicted costs of compliance with HUD's higher wind standard proposals the cost of roof sheathing.<sup>3</sup> Therefore, the indications are that the industry itself, at the time the rule was being developed, understood that the requirement was for a rigid box.

Finally, in summarizing the changes made by the January 1994 rule to § 3280.305(c), the preamble states that:

Exterior roof and wall coverings (excluding glazing), sheathing, and fastenings need not be evaluated for the design pressures specified by the Table, when fastened to a 3/8" structural rated sheathing and the sheathing is oriented and secured to framing members in accordance with the fastening schedule specified in the Table. (59 FR at 2467.)

An IB that was published by HUD in the **Federal Register** on July 1, 1994 (59 FR 34294), further bolsters the intent of the January 1994 rule. In that IB, HUD recognized that metal siding (such as vertical steel siding) could, under strict circumstances, be approved as both a structural wall sheathing and an exterior covering material. The strict circumstances specified in the IB ensured that the metal siding/exterior covering would, in effect, maintain a rigid box, including covering and fastening requirements, and would resist the full design pressures specified in the Table. The same reasoning applies to metal roofs in Wind Zones II and III in this IB.

#### Subsequent Testing of Metal Roofs

In reviewing tests performed under the higher wind standards on metal roof systems without sheathing, the Department has found that none of the tests satisfied all of the requirements of the standards. The test methods used introduced additional resistance for the test assemblies that would not be

<sup>3</sup> See attachments to the comments submitted by the Manufactured Housing Institute (commenter #112 in Docket #FR-3380) on the proposed rule that was finalized in the January 1994 rule.

available under actual conditions of application or construction, contrary to the requirements of § 3280.303(c). The test methods also did not consider the combined effect on fasteners and components of horizontal wind forces, nor the compression load added as a result of the sole use of metal roofing without sheathing. The tests also did not measure deflection, as required under § 3280.401 and as would be necessary to ensure compliance with §§ 3280.305 (a) and (h).

Other specific questions about the tests include:

- Concerns about whether the laboratory tests simulated factory conditions for replicating the workmanship associated with the small edge distance and installation of the large number of fasteners required;

- The ability of the quality control system to prevent production problems that would be caused because of the large number of fasteners required and the small edge distance for the outermost row of fasteners at the metal-to-rim rail connection of the roof, which is likely to cause damage to wood rim members or tearing of the metal during production or when design wind loads are applied;

- Failure of the tests to include all of the fasteners required in actual production, which would have further damaged the rim rail and weakened the tested assemblies; and

- Lack of information about deformation criteria for the connectors (fastener slip) or other conditions that would constitute failure of the test assembly, such as rim rail rotation.

Accordingly, under the authority of 42 U.S.C. 3535(d), Interpretative Bulletin I-2-98 is issued by the Department as follows:

**Note:** HUD Interpretative Bulletin I-2-98 will not appear in the Code of Federal Regulations.

#### Interpretative Bulletin I-2-98— Manufactured Home Construction and Safety Standards: Metal Roofing (24 CFR Part 3280)

Under section 604 of the National Manufactured Housing Construction and Safety Standards Act of 1974, 42 U.S.C. 5403, the Secretary is authorized to establish, amend, and revoke by order appropriate Federal manufactured home construction and safety standards ("standards"). On January 14, 1994 (59 FR 2456), HUD published certain changes to the standards for high wind areas, as codified in 24 CFR part 3280. Subsequently, HUD has published interpretations of the January 1994 rule at 59 FR 19072 (April 21, 1994) and 59 FR 34294 (July 1, 1994). In the April 21,

1994, Interpretative Bulletin, HUD indicated that it may issue additional Interpretative Bulletins to provide further assistance in the implementation of the new standards. This Interpretative Bulletin I-2-98<sup>1</sup> is issued to clarify requirements applicable to the use of metal roofing in wind zones II and III. All section references are to sections of 24 CFR part 3280.

HUD interprets § 3280.305(c)(1)(ii)(B) to require every design for manufactured housing for high wind areas to include roof sheathing or alternative roof material that performs like sheathing in resisting the wind pressures specified in the Table of Design Wind Pressures ("Table"), whenever the Table is used as the basis for qualifying the design. The phrase "performs like sheathing" means that the roofing system will transfer the higher wind loads to which the Table is formulated to structural support members and components without compromising the integrity of those members and components to such an extent that they cannot resist the applicable design pressures specified in the Table.<sup>2</sup> In developing the Table, HUD contemplated a design that utilizes structural rated roof sheathing that is at least 3/8 of an inch thick and is installed in accordance with footnote 7. If roof sheathing is not used in the design for the roof system, in accordance with § 3280.303(c) load tests or engineering analyses used to determine that the manufactured home complies with the Table must account for the additional high-wind loads transferred to other parts of the structure because of the absence of separate load-resistant sheathing. Thus, metal roofs without sheathing may be used if they are strong enough to perform like sheathing and can meet all of the requirements discussed in this paragraph.

When separate sheathing is utilized in a design, the sheathing must be shown to be capable of resisting the wind pressures specified for sheathing in the Table, unless the sheathing is structural rated roof sheathing that is at least 3/8 of an inch in thickness and is installed and secured as provided in footnote 7 of the Table. A manufacturer that includes in its design sheathing that complies with the specifications set out in

footnote 7 can avoid having to substantiate the sheathing as being in compliance with the loading requirements for sheathing in the Table. In both of these cases, however, all other loading requirements in the Table and requirements of the standards would still have to be met.

Of course, manufacturers continue to have the additional option, set forth in § 3280.305(c)(1)(ii)(A), to design any manufactured home, including the roof (metal or nonmetal), using the design wind loads for Exposure C as specified in ANSI/ASCE 7-88 and the applicable design wind speed.

#### Testing Protocols

To be acceptable under the standards, all roofs, including metal roofs, must be designed using either engineering analysis or suitable load testing protocols, in accordance with § 3280.303(c). Until the higher standards were adopted for wind zones II and III, metal roofs for manufactured homes generally had been qualified using engineering analysis. Manufacturers have chosen to test metal roofs intended for wind zones II and III using the design wind pressures in the Table, apparently because the metal roofs may not have been able to qualify under the higher standards through engineering analysis.

The regulations set forth a series of requirements regarding testing. Under § 3280.303(c), if the strength and rigidity of a unit or component is to be determined by testing, the load tests must replicate the actual loads and conditions of application, not just approximate those loads and conditions. A manufacturer relying on § 3280.401 to establish the acceptability of a compliance alternative also must meet all of the requirements established in that section. Section 3280.401(b), for example, requires that deflection measurements be taken.<sup>3</sup> Further, if a manufacturer cannot perform an engineering analysis to demonstrate compliance with the § 3280.305(h) design requirements for roofs and the § 3280.305(c) design requirements for systems, components, and framing, the

manufacturer must comply fully with established testing protocols or obtain HUD approval of special testing under § 3280.303(g).

Section 3280.303(g) allows for the development of special testing procedures that demonstrate structural properties and significant characteristics when there is no recognized or suitable testing procedure. In the absence of an established suitable testing protocol, a manufacturer that wants to establish compliance with a standard through testing must submit the testing protocol to HUD for approval. HUD would anticipate that such a protocol would address test set-up, loading apparatus, and size and dimensions of the test assembly, and would establish failure criteria. Section 3280.303(g) places the burden on manufacturers for developing such testing procedures to demonstrate structural properties and significant characteristics of a material, assembly, component, or member.

#### Summary of Requirements, Using Table

Because there has been confusion about the requirements of the regulations in question, HUD will allow a grace period of 30 days after the date of publication of this IB for compliance with the requirements as clarified in this IB. Thus, in qualifying any roof through testing, HUD will not recognize as being in compliance with the requirements of the Table a metal roof system that is installed on any unit for which the manufacturing process is completed beyond the grace period, unless that metal roof system is able to resist the appropriate wind pressures specified in the Table and complies with at least one of the following conditions:

(1) The metal roofing is a covering, which is designed to resist the applicable wind pressures specified for roof coverings in Table and is installed in conjunction with structural rated roof sheathing that is at least 3/8 of an inch in thickness and is fastened as provided in footnote 7 of the Table;

(2) The metal roofing is a covering, which is designed to resist the applicable wind pressures specified for roof coverings in Table and is installed in conjunction with roof sheathing that does not qualify as acceptable automatically under footnote 7 in the Table, but that has been qualified through engineering analysis or appropriate testing procedures as capable of resisting the wind pressures established for roof sheathing in the Table; or

(3) The metal roof itself has been tested, using procedures that either meet all of the requirements of §§ 3280.303(c)

<sup>1</sup> This designation indicates that this is the second interpretive bulletin issued in 1998. The interpretive bulletin issued on February 18, 1998 (63 FR 8330) was not officially designated as I-1-98 because it was an amendment to an earlier interpretive bulletin designated as J-1-76.

<sup>2</sup> In order for the metal roof to resist the uplift loads applicable in Wind Zones II and III and transfer the design loads, the Department expects that the metal roof would be fastened to the support members (trusses, edge members, etc.).

<sup>3</sup> This concern with deflection measurements, and the concept of a sound structural frame, are also seen in § 3280.305(h), which specifically requires that roofs be of sufficient strength to withstand the load requirements in § 3280.305(c) without exceeding established deflections, and in § 3280.305(a), which states:

Each manufactured home shall be designed and constructed as a completely integrated structure capable of sustaining the design load requirements of this standard, and shall be capable of transmitting these loads to stabilizing devices without exceeding the allowable stresses or deflections\* \* \* .

and 3280.401 (or another suitable load test) or have been developed and approved in accordance with § 3280.303(g), and the metal roof has been determined to perform like sheathing by transferring the higher wind loads to structural support members and components without compromising the integrity of those members and components to such an

extent that they cannot resist the applicable design pressures specified in the Table.<sup>4</sup>

As noted, in the absence of recognized testing procedures, a manufacturer may develop and submit to HUD for approval, in accordance with § 3280.303(g), a testing procedure that would demonstrate the requisite

<sup>4</sup> See footnote 2, above.

structural properties and significant characteristics of the alternate design or material.

**Authority:** 42 U.S.C. 3535(d) and 5424.

Dated: April 29, 1998.

**Art Agnos,**

*Acting General Deputy Assistant Secretary for Housing.*

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