FS93-18

IBC: 202 (New), 1402.2, 1404.5 (New), 1404.5.1 (New), 1404.5.2 (New), Chapter 35

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2018 International Building Code

Add new definition as follows:

WIND-DRIVEN RAIN INDEX. A representation of the combined climate effects of wind and rain which affect the magnitude and frequency of rain deposition on building exterior surfaces.

Revise as follows:

1402.2 Weather protection. *Exterior walls* shall provide the building with a weather-resistant *exterior wall envelope*. The *exterior wall envelope* shall include flashing, as described in Section 1404.4. The *exterior wall envelope* shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a *water-resistive barrier* behind the exterior veneer, as described in Section 1403.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the *exterior wall* assembly shall be provided in accordance with Section 1404.3. Where required by Section 1404.5, additional provisions for weather protection shall be provided.

Exceptions:

1. A weather-resistant *exterior wall envelope* shall not be required over concrete or masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1403.2 and 1404.4, shall not be required for an *exterior wall envelope* that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:
   - 2.1. *Exterior wall envelope* test assemblies shall include not fewer than one opening, one control joint, one wall/eave interface and one wall sill. Tested openings and penetrations shall be representative of the intended end-use configuration.
   - 2.2. *Exterior wall envelope* test assemblies shall be not less than 4 feet by 8 feet (1219 mm by 2438 mm) in size.
   - 2.3. *Exterior wall envelope* assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m^2).
   - 2.4. *Exterior wall envelope* assemblies shall be subjected to a minimum test exposure duration of 2 hours.

   The *exterior wall envelope* design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the *exterior wall envelope*, joints at the perimeter of openings or intersections of terminations with dissimilar materials.
3. *Exterior insulation and finish systems* (EIFS) complying with Section 1407.4.1.

Add new text as follows:

1404.5 Additional provisions for weather protection. The provisions of Section 1404.5.1 and 1404.5.2 shall apply in the required wind-driven rain index and climate zones and, where not required, shall be permitted.

1404.5.1 Enhanced drainage. Where the wind-driven rain index of Figure 1404.5.1 is 4 or greater, the means of drainage required by Section 1402.2 shall be satisfied by one of the following:

1. A drained air space not less than nominal 3/16-inch deep behind the cladding,
2. An open drainage material, not less than nominal 1/4-inch thick and with a cross-section area that is not less than 80 percent open, installed between the cladding and backing,
3. Hollow-backed metal or vinyl siding installed in accordance with the manufacturer's instructions, or
4. An approved drainage design with drainage performance at least equivalent to Items 1, 2, or 3, or

not less than 90 percent drainage efficiency as measured in accordance with ASTM E 2273 or Annex A2 of ASTM E 2925.

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1404.5.1
WIND-DRIVEN RAIN INDEX

1404.5.2 Protection against inward vapor drive. Where claddings addressed in Sections 1404.10 and 1404.15 are used in Climate Zones 1A, 2A, or 3A in accordance with Chapter 3 of the International Energy Conservation Code and installed over wood-based or gypsum-based sheathing, a ventilated air space shall be provided in accordance with Exception 2 in Section 2510.6 and drainage shall be provided in accordance with Items 1, 2, or 4 of Section 1404.5.1.

Exceptions:

1. An approved drainage and ventilation design, including vent inlets and outlets, with ventilation performance at least equivalent to Items 1 or 2 of Section 1404.5.1 as measured in accordance with Annex A1 of ASTM E 2925.
2. An air space for ventilation shall not be required where foam plastic insulating sheathing complying with ASTM C 578 or ASTM C 1289 is located between the cladding and the wood-based or gypsum-based sheathing.

Add new standard(s) follows:

CHAPTER 35 REFERENCED STANDARDS

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

E2925-17:

Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function

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Reason:
Proposed new Section 1404.5 is needed to provide adequate moisture performance for exterior wall coverings and vulnerable wall materials in hazardous climate conditions that are prone to cause moisture problems. In these cases, the generic minimum weather protection practices in the code are unreliable and increase the risk of moisture durability problems including material degradation, rot, and mold. This proposal will serve to address this problem and provide risk-consistent solutions in coordination with climate hazards (e.g., wind-driven rain) as they vary across the U.S. In regions of low-to-moderate hazard, this proposal requires no change in practice but permits the enhanced provisions to be used.

First, the existing exceptions in Section 1402.2 are unchanged. Therefore, where these existing exceptions apply, the enhanced requirements of proposed Section 1404.5 would not apply because the charging language for use of Section 1404.5 is located in Section 1402.2.

Second, the provisions of proposed Section 1404.5 are required only in the more extreme climates of the U.S. with regard to moisture effects on exterior walls of buildings. However, the practices employed are beneficial in all climates; therefore, they are permitted to be used in other climate conditions.

Within Section 1404.5, proposed Section 1404.5.1 addresses drainage for exterior wall coverings in climates with significant wind-driven rain hazard. In these climates, the need for enhanced drainage is well understood from experience and research. For example, these provisions are modeled very closely after provisions found in the National Building Code of Canada (Section 9.27) as applied to climates with significant wind-driven rain. The NBC provsions were necessitated by wide-spread water intrusion problems and are based on research, field studies, and expert judgment. In the U.S. similar problems are occurring, particularly with conventional stucco installations on wood frame construction. These provisions will also help mitigate risk of water intrusion damage related to normal imperfections in exterior wall covering installation.

Also within Section 1404.5, proposed Section 1404.5.2 addresses inward vapor drives which present a well-known cause of moisture problems for walls clad with "reservoir claddings" such as adhered veneer (1404.10) and stucco (1404.15). These cladding types absorb water rainwater and then while drying (particularly with impinging energy from the sun) create significant inward vapor drives, forcing water vapor through underlying layer(s), such as the water resistive barrier, and into moisture sensitive materials within the wall assembly (such as wood-based and gypsum-based sheathings). Moisture sensitive materials such as wood-based and gypsum-based sheathings backing stucco and adhered veneers are particularly vulnerable if not adequately protected. Other reservoir claddings, like anchored masonry veneer (i.e., not adhered), already comply with Section 1404.5.2 due to the presence of a nominal 1-inch or greater vented air space behind the veneer.

The proposed provisions of Section 1404.5.2 coordinate with changes made last code cycle for Section 2510.6, exception 2. However, these requirements are broadly applicable and, thus, are best located in Chapter 14 and not hidden in an incomplete exception statement back in Chapter 25. More importantly, Section 1404.5.2 ensures the ventilated air space required in Exception 2 of Section 2510.6 also complies with the drainage requirements of Section 1404.5.1 and this serves to define a minimum size or effectiveness of the ventilated air space. Additionally, the charging language for Section 1404.5 permits these enhanced practices or options to be used in any climate zone, not just those limited conditions addressed in Exception 2 of Section 2510.6.

The exceptions in Section 1404.5.2 provide useful alternative means of addressing inward vapor drives from reservoir claddings. The first exception provides a means to justify use of alternative drainage and ventilation designs. The second exception provides a means to avoid use of a ventilated air space. It works by way of blocking the inward movement of water vapor from the reservoir cladding by use of lower permeneance foam plastic insulating sheathing behind the cladding. This practice has been used successfully to prevent inward vapor drives from reservoir claddings and protect underlying moisture sensitive wall materials. It is also commonly used with 1-coat stucco systems. The drainage requirements of Section 1404.5.1 would still apply where applicable.

The provisions of Section 1404.5 are supported by various sources as documented in the research report ("Moisture Control Guide") referenced in the bibliography. The wind-driven rain map provided as new Figure 1404.5.1 is based on an ASTM paper as noted as the source for the figure. It is also very consistent with a more recent wind-driven rain climatology study by the University of Georgia.

From a resiliency perspective, it is no less appropriate to consider actions to address variation of building durability climate hazards across the U.S. as it is to consider variation in structural hazards such as wind, snow, and earthquake loads as they also vary across the U.S. In fact, durability problems related to climate-driven moisture effects and associated vulnerabilities of construction materials and methods often contribute to damages from structural hazards. Thus, this proposal will help ensure intended structural performance for the service life of a building.

Bibliography:
Model Moisture Control Guidelines for Light-Frame Walls: A Building Code Supplement for Builders, Designers, and Code Officials, ABTG Research Report No. 1701-01, 2017, Applied Building Technology Group LLC, https://www.appliedbuildingtech.com/rr/1701-01

Cost Impact
The code change proposal will increase the cost of construction .

cdpACCESS does not provide a option to declare "The code change proposal will increase and decrease cost of construction" (which is perhaps a more appropriate description of the cost impact of this proposal for reasons that follow).

For most of the U.S. these provisions do not apply and there is no cost impact. However, proposed Section 1404.5.1 will increase costs for cladding installation on some types of construction in the more hazardous wind-driven rain climates by requiring provision of adequate drainage behind claddings. However, there is no change or cost impact for claddings that already meet the requirements (e.g., anchored brick veneer) or which are already inherently drained (e.g., vinyl siding). There also is no change or cost impact for walls of concrete or masonry construction per Section 1402.2, Exception 1, or for claddings meeting the existing performance requirement of Section 1402.2, Exception 2 (e.g., barrier EIFS).

Proposed Section 1404.5.2 would appear to increase cost for stucco and adhered veneer installations that are in hot-humid climates and which do not already address inward driven moisture, but the drainage and ventilation requirements are already vaguely required (complete in concept but not in detail) in Exception 2 of Section 2510.6 of the code. Also, Exception 1 of Section 1402.2 prevents any cost impact to installations on concrete or masonry construction. Finally, proposed Section 1404.5.2 includes additional options for compliance (e.g., exceptions) that may actually reduce cost of compliance for some stucco and adhered veneer installations.

Without robust data on the variation in construction types and cladding types by regional climate conditions, it is difficult to determine the magnitude of cost impact and whether or not it is a net increase or decrease in cost for a population of buildings representative of those built using the IBC. But, it is clear in some specific cases there could be a cost increase. In these specific cases, one conventional solution that would satisfy both Sections 1404.5.1 and 1404.5.2 would be to provide furring behind the cladding (and this is not necessarily the low-cost solution). The total cost of furring including overhead and profit per the 2017 RS Means Open Shop Building Construction Costs manual ranges from about $0.60/SF ($1.17/LF 1x3 wood furring pneumatically nailed to wood framing at 24"oc) to $2.22/SF (metal furring at 16"oc). Considering the many cases where there is no cost impact, this proposal will range in cost impact of $0/SF to as much as $2.22/SF depending on a number of factors. It is likely that the net impact is closer to $0/SF than $2.22/SF.

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