RE2D-38-23 Modification

IECC RE: Table R408.2, R408.2.1.3, Table R408.2.1.3, R408.2.1.3.1

Modification replaces the original proposal. Legislative edits are shown against Public Comment Draft #2.

Revise as follows:

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

		Climate Zone 0 & 1	Climate Zone 2
R408.2.1.3(1)	Roof solar reflectance index (roof is part of the *building thermal envelope* and directly above cooled, conditioned space)	1	~~1~~0
R408.2.1.3(2)	Roof solar reflectance index (roof is above an unconditioned space that contains a duct system)	1	1

R408.2.1.3 Roof solar reflectance index. ~~Roofs in Climate Zones 0-4 and 4C shall comply with one or more of the options in Table R408.2.1.3. The following roofs and portions of roofs are excluded from the roof reflectance credit:~~
Low slope roofs in *Climate Zones* 0-2 shall earn credit for Table R408.2 measure numbers R408.2.1.3(1) and R408.2.1.3(2) where the three-year aged solar reflectance index (SRI) is greater than or equal to 75. To earn credit, not less than 95 percent of the roof area shall comply. The combined area of the following portions of roof shall not be greater than 5 percent of the roof area:

1. Portions ~~of the roof~~ that include or are covered by the following:
    1.1 Photovoltaic systems or components.
    1.2 Solar air or water-heating systems or components.
    1.3 Vegetative roofs or landscaped roofs.
    1.4 Above-roof decks or walkways.
    1.5 Skylights.
    1.6 HVAC systems and components, and other opaque objects mounted above the roof.
2. Portions ~~of the roof~~ shaded during the peak sun angle on the summer solstice by permanent features of the *building*, ~~or by~~ permanent features of adjacent buildings, or natural objects.
3. Portions ~~of roofs~~ that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.
4. ~~Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.~~

The three-year aged SRI shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h x ft^2 x °F (12 W/m^2 x K). Calculation of aged SRI shall be based on three-year aged solar reflectance values tested in accordance with ASTM C1549, ASTM E903, ASTM E1918, or CRRC S100 and three-year aged thermal emittance values tested in accordance with ASTM C1371, ASTM E408, or CRRC S100.

ROOF SLOPE	THREE-YEAR AGED SOLAR REFLECTANCE INDEX[b]
Low slope	75
Steep slope	16

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for solar reflectance shall be assigned a 3-year aged solar reflectance in accordance with Section R408.2.1.3.1.

b. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h x ft^2 x °F (12 W/m^2 x K). Calculation of aged SRI shall be based on aged tested values of solar reflectance tested in accordance with ASTM C1549, ASTM E903, ASTM E1918, or CRRC S100 and thermal emittance tested in accordance with ASTM C1371, ASTM E408, or CRRC S100.

R408.2.1.3.1 Aged solar reflectance. Where an a tested 3-year aged solar reflectance value is not available, it an assigned value shall be determined in accordance with Equation 4-4.

$$R_{aged} = [0.2 + 0.7(R_{initial} - 0.2)] \hspace{2cm} \text{(Equation 4-4)}$$

where:
R_{aged} = The aged solar reflectance.
$R_{initial}$ = The initial solar reflectance determined in accordance with ASTM C1549, ASTM E903, ASTM E1918, or with CRRC-S100 CRRC S100.

Reason Statement

This Modification addresses the following shortcomings in Section R408.2.1.3:

1. **Section R408.2.1.3 does not explicitly state what percentage of roof area must comply with the SRI requirements to earn credit.**

   When this section was added in PCD #1, it was silent as to the percentage of roof area required for credit. Presumably, 100% was the default.

   In PCD #2, exception language was imported from Section C402.4 in the Commercial code. A percentage is buried in Exception 4. Per the proponent, the intention was not to provide a roof area compliance percentage, but rather to prevent false claiming of credit.

   Moreover, although the two sections have similarities, Section C402.4 is a *requirement*, while this section is an option.

   MODIFICATION:
   Explicitly states a required percentage and does so outside the exceptions.

2. **The required percentage of roof area must correlate with the credits in Table R408.2.**

   Although Exception 4 was not intended to provide a compliance percentage, as PCD #2 reads, Exception 4 does exactly that.

   What is that percentage? Exception 4 requires some work to decipher:

   > In C402.4, where ≥75% of the roof area falls into one or more of the exceptions, the entire roof is exempt from the requirement. In other words, the requirement must be met if >25% of the roof area does not fall into one or more of the exceptions.
   >
   > But R408.2.1.3 is not a requirement; it's an optional measure. So, here, the exception language means: The roof can qualify for credit if >25% of the roof area does not fall into one or more of the exceptions.
   >
   > In other words, a roof qualifies for credit if 26% of the roof area meets the SRI and 74% does not.

   In the context of this section, Exception 4 translates to: credit can be earned if just over 25% of roof area complies with the required SRI.

   In PNNL's analysis, it was assumed **100%** of roof area met the required SRI. Modeled at 100% compliance, measure number R408.2.1.3(2) achieved one point by the slimmest of margins – 0.04% in Climate Zone 1 and 0.02% in Climate Zone 2. If PNNL had modeled, for example, 30% of roof area (or even a considerably higher percentage), the measure would not have met the 0.50 threshold to be rounded up to one point.

   MODIFICATION:
   To earn credit, 95% of roof area must meet the required SRI.
   (Although 100% of roof area was modeled, a 5% allowance is provided for items such as HVAC equipment on the roof.)

3. **The required SRIs must correlate with the credits in Table R408.2. The steep slope SRI does not.**

   In PCD #2, the required steep slope SRI is ≥16 and the required low slope SRI is ≥75.

   PNNL modeled only SRI 75. The credit values in Table R408.2 are based solely on SRI 75.

   Modeled at SRI 75, the measures barely achieved one point. Measure number R408.2.1.3(1) qualified for one point in one Climate Zone (rounded up from 0.67%) and measure number R408.2.1.3(2) qualified for one point in two Climate Zones (rounded up from 0.54% and 0.52%).

   Modeled at SRI 16, neither measure would have qualified for a point in any Climate Zone.

   MODIFICATION:
   Deletes steep slope SRI 16. Credit can be earned only for low slope roofs with SRI ≥75.

4. **This Modification also:**

   a. Adds (1) and (2) to the measure numbers in Table R408.2.

   b. References the two measure numbers.

      In PCD #2, Section R408.2.1.3 does not reference the two measures in Table R408.2, only the two options in Table R408.2.1.3.

   c. Replaces "reflectance" with "solar reflectance index" in the section title and measure descriptions.

      This change more accurately describes the measure and alleviates confusion between the terms "solar reflectance" (which is not included in the measure) and "solar reflectance index."

   d. Removes Table R408.2.1.3. It is unnecessary; the measure reads clearer without it.

   e. Adds "natural objects" to the list of items that can shade a roof, e.g., mountains, hills, bluffs.

      Reference: IECC-C Section C402.4.2 and IgCC Section 801.4.1.1

   f. Removes credit for measure number R408.2.1.3(1) in Climate Zone 2 per PNNL's most recent analysis.

   g. Replaces "Climate Zones 0-4 and 4C" with "Climate Zones 0-2" per PNNL analysis.

      The subcommittee has already approved this revision in RE2D-39.

This Modification brings Section R408.2.1.3 into alignment with the results of PNNL's analysis. Approval of this Modification would not require new analysis.

Cost Impact

The code change proposal will neither increase nor decrease the cost of construction. This is an optional measure that presumably will not be chosen unless it is cost effective.