Understanding the new

GREEN BUILDING CODE

The recently released IgCC will affect roof system designs

by Mark S. Graham

In March, the new *International Green Construction Code,*

2012 Edition (IgCC) was published after two years in development. This new model code is intended to serve as a basis for local jurisdictions wishing to adopt code requirements defining the sustainability of buildings and building sites.

Because a building's envelope, including its roof assembly, plays a large role in the building's overall sustainability, IgCC includes a number of specific requirements applicable to roof assemblies. And some requirements are more stringent than what most roofing professionals are accustomed to seeing in other codes.

An overview of IgCC and some of its roofing-related requirements follows.

IgCC

IgCC is a model code developed by the International Code Council® (ICC) that provides minimum requirements to safeguard the environment, public health and general welfare by establishing requirements intended to reduce the negative effects and increase the positive effects of the built environment. It addresses natural resources, materials, water and energy conservation, as well as indoor environmental quality and comfort, building commissioning, operations and maintenance for new and existing buildings, building sites and building materials, component equipment and systems.

When adopted by specific code jurisdictions, IgCC is intended to apply to all building occupancies other than temporary structures defined in Section 3103—Temporary Structures and certain residential occupancies. Specifically, IgCC does not apply to one- and two-family dwellings and townhouses within the scope of the International Residential Code®'s (IRC's) Group R-3 occupancies and Group R-2 and Group R-4 residential occupancies four stories or less in height.

IgCC is intended to be used as an "overlay code," meaning it is not intended to replace existing codes but should be used with ICC's other model codes, commonly referred to as I-codes. I-codes include the International Building Code® (IBC), IRC, International Energy Conservation Code® (IECC), International Fire Code® and International Plumbing Code.®

IgCC was developed in collaboration with the following organizations, which are known as cooperating sponsors: The American Institute of Architects, ASTM International, ASHRAE, Illuminating Engineering Society and U.S. Green Building Council.

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Arrangement and format

IgCC is arranged into 12 chapters and four appendices. Unlike IBC and IRC, both of which contain specific chapters applicable to roof assemblies and rooftop structures, IgCC does not have a specific chapter providing the code's requirements applicable to roof assemblies. Instead, IgCC's roofing-related requirements are spread among multiple chapters, including Chapter 4—Site Development and Land Use; Chapter 5—Material Resource and Conservation and Efficiency; Energy Conservation, Efficiency and CO_2e Emission Reduction; Chapter 8—Indoor Environmental Quality and Comfort; Chapter 9—Commissioning, Operation and Maintenance; and Chapter 10—Existing Buildings.

Jurisdictions may adopt IgCC appendices if they so choose.

Also, IgCC contains a reprint of ASHRAE 189.1-2011, "Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings." IgCC allows compliance with ASHRAE 189.1 as an alternative compliance path to IgCC's technical requirements.

Jurisdictional requirements

IgCC contains mandatory provisions that apply when IgCC is adopted. It also includes additional requirements, referred to as jurisdictional requirements, that can be selected by a jurisdiction at the time of adoption if the jurisdiction is interested in achieving higher levels of sustainability requirements and/or additional sustainability requirements.

IgCC's Chapter 3—Jurisdictional Requirements and Life Cycle Assessment's Table 302.1—Requirements Determined by the Jurisdiction list 19 items a jurisdiction can select to achieve higher sustainability levels. Examples of such jurisdictional requirements include extending IgCC's applicability to one- and two-family dwellings and townhouses, additional enhanced energy performance levels and whether IgCC requires evaluation of existing buildings.

Table 302.1 provides guidance regarding jurisdictions' waste material diversion. Jurisdictions need to select a minimum intended percentage of waste material to be diverted to landfills. The code provides a 50 percent of waste diversion baseline value; however, jurisdictions can

select 65 percent or 75 percent options as a jurisdictional requirement.

Chapter 3 also contains provisions for whole building life cycle assessment. When a whole building life cycle assessment is performed according to specific parameters defined in IgCC, the material selection requirements of Section 505—Material Selection can be waived.

Reflectivity and vegetative roof systems

IgCC's Chapter 4—Site Development and Land Use provides specific requirements for roof system reflectivity and emittance, and vegetative roof systems are addressed in Section 408—Heat Island Mitigation.

Section 408.3—Roof Surfaces requires buildings in IECC's climate zones 1 through 3 to have no less than 75 percent of their roof surfaces and any covered parking adhere to prescribed minimum reflectance and emittance values, be covered with a vegetative roof system or have a combination of both. IECC's climate zones 1 through 3 include Alabama, Florida, Hawaii, Louisiana, Mississippi and South Carolina and portions of Arizona, Arkansas, California, Georgia, Nevada, New Mexico, North Carolina, Oklahoma, Tennessee, Texas and Utah.

For roof assemblies with slopes of 2:12 (9 degrees) or less, a minimum aged solar reflectance of 0.55 and minimum aged thermal emittance of 0.75 or a minimum aged solar reflectance index (SRI) of 60 is required. For roof assemblies with slopes greater than 2:12 (9 degrees), a minimum aged solar reflectance of 0.30 and minimum aged thermal emittance of 0.75 or a minimum aged SRI of 25 is required.

For vegetative roof systems, IgCC's Section 408.3.2—Vegetative Roofs requires plantings be selected based on their hardiness zone classifications described in USDA MP1475, "USDA Plant Hardiness Zone Map." In addition, planting density must provide a minimum of 80 percent coverage within two years of the installation date. Also, a performance-based requirement is included: "Plantings shall be capable of being managed to maintain the function of a vegetative roof. …"

Waste management and material selection

IgCC's Chapter 5—Material Resource Conservation and Efficiency provides specific requirements for construction material storage and waste management, material selection and building envelope moisture control.

Section 502—Construction Material Management requires materials to be stored and handled on job sites according to manufacturers' printed instructions. Any materials damaged by moisture or visibly colonized by fungi must be cleaned and dried. If damage to materials cannot be corrected, the materials must be removed and replaced.

Section 503—Construction Waste Management requires no less than 50 percent of nonhazardous construction waste be diverted from disposal. A construction material and waste management plan must be implemented documenting recycled or salvaged construction materials and waste. Documentation includes receipts or other evidence of the waste diversion. The percentage of materials diverted can be calculated either by weight or volume.

As a jurisdictional requirement, the minimum 50 percent waste diversion value can be increased to 65 or 75 percent if a jurisdiction selects a higher value from Table 302.1 as a jurisdictional requirement.

Section 505—Material Selection provides requirements for material selection and use. No less than 55 percent of total building materials used in a project, based on mass, volume or cost, must be previously used, recycled, recyclable, bio-based or indigenous. Additional subsections provide specific requirements for each criterion.

For example, indigenous materials are required to be composed of resources that are recovered, harvested, extracted and manufactured within a 500-mile radius of a building site. When only a portion of a material or product complies with the 500-mile criteria, only that portion of that material or product will be considered indigenous. If resources are transported by water or rail, a 0.25 factor can be applied to the product's transportation, indicating a radius of up to 2,000 miles is possible in particular instances.

Section 507—Building Envelope Moisture Control requires roof coverings, roof drainage and flashings undergo a pre-building occupancy inspection by an agency approved by the code official documenting compliance with IgCC and IBC's Chapter 15—Roof Assemblies and Rooftop Structures.

Energy conservation and efficiency

IgCC's Chapter 6—Energy Conservation, Efficiency and CO_2e Emission Reduction provides specific requirements for buildings' energy efficiencies, including

building envelopes' thermal performances, which include roof assemblies. To allow flexibility to permit the use of innovative approaches and techniques to achieve effective use of energy, IgCC permits performance- and prescriptive-based methods.

Using IgCC's performance-based approach, the whole building and building site are modeled for energy usage and production and the project needs to demonstrate a zero energy performance index (zEPI) of no more than 51. Jurisdictions may adopt a maximum zEPI less than 51 (greater energy efficiency) as a jurisdictional requirement for specific building occupancies.

zEPI is a scalar ratio of energy performance of a specific building and site design compared with the average energy performance of buildings relative to a benchmark year. Buildings complying with IECC's 2000 edition are deemed to have a zEPI of 100, and buildings complying with IECC's 2006 edition are deemed to have a zEPI of 73. Comparably, IgCC's performance-based approach with a maximum zEPI of 51 represents significant energy usage savings over IECC 2000 and IECC 2006.

Using IgCC's prescriptive-based compliance approach, buildings' thermal envelopes must exceed IECC 2012's requirements by no less than 10 percent. IgCC intentionally does not provide specific R-value targets; instead, it relies on an increased performance level above what is required in IECC 2012.

Also, using the prescriptive-based approach, a continuous air barrier is required for buildings in all U.S. climate zones. Air barriers shall comply with IECC's 2012 requirements except the deemed-to-comply options do not apply to IgCC. IECC 2012's deemed-to-comply options allow certain roof assemblies such as built-up, polymer-modified bitumen and adhered single-ply membranes to be considered air barriers without testing.

For both IgCC's performance- and prescriptive-based approaches, Section 610—Building Renewable Energy Systems requires buildings to be equipped with one or more renewable energy systems, including photovoltaic (PV) systems, wind energy systems or solar water heating equipment. IgCC requires PV systems or wind energy systems provide no less than 2 percent of the total estimated annual electric energy consumption. Solar water heating equipment shall provide no less than 10 percent of the building's annual estimated hot water energy usage.

VOC limits

IgCC's Chapter 8—Indoor Environmental Quality and Comfort provides specific requirements, including maximum volatile organic compound (VOC) limits for many construction materials, that are intended to provide interior environments conducive to the health of a building's occupants.

IgCC's Table 806.2(1)—Site-applied Adhesive and Sealant VOC Limits provides for a VOC limit of 250 for single-ply roof membrane adhesives used on the interior side of building envelopes.

IgCC's Table 806.3(1)—VOC Content Limits for Architectural Coatings provides for VOC limits of 400 for aluminum roof coatings, 50 for bituminous roof coatings, 350 for bituminous roof primers, 50 for roof coatings and 250 for waterproofing membranes used as interior architectural coatings.

Operations and maintenance

IgCC's Chapter 9—Commissioning, Operation and Maintenance provides specific requirements for pre- and post-building occupancy commissioning and building operation and maintenance.

Section 904.3—Building Operations and Maintenance Documents requires operations and maintenance documents be provided for roof assemblies indicating the manufacturer's recommended care and maintenance instructions.

Reroofing

IgCC's Chapter 10—Existing Buildings provides requirements for the alteration, repair, addition, maintenance and change of occupancy of existing buildings and structures. This specifically includes reroofing.

Section 1003.2.7—Roof Replacement Insulation requires roof system replacement on existing buildings where the insulation is entirely above the roof deck and the roof system is sloped less than 2:12 (9 degrees) to comply with the R-value requirements in IECC 2012. As a result, in these cases, an R-value of 20 is required in climates zones 1 through 3; 25 in climate zones 4 and 5; 30 in climate zone 6; and 35 in climate zones 7 and 8. These values are less than would be required by IgCC's Chapter 6 for new construction situations.

IgCC contains language allowing the use of less R-value in roof system replacement when proper roof flashing heights are not possible.

IgCC does not require upgrading roof assembly R-values for roof system replacement configurations other than insulation entirely above deck or for roof system repair or re-cover operations.

Challenges and concerns

IgCC's sustainability-based performance levels are somewhat more stringent than what most roofing professionals are accustomed to seeing in other codes. Because of this, building owners, designers, builders and roofing professionals likely will face challenges complying with IgCC.

The methods of showing compliance with IgCC appear to be far more stringent than other codes and, to a large extent, are unknown at this time.

For example, IgCC's requirement for a construction waste management plan will be difficult to develop and implement, and its documentation will be cumbersome. Similarly, documentation of IgCC's material selection requirements, which in some instances requires documentation of products' raw material sources, will be burdensome to achieve and may be impossible to provide.

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Some of IgCC's requirements will limit product and specific roof system choices in certain instances. For example, IgCC requirements for minimum reflectance and emittance values in climate zones 1 through 3 will limit roof systems to those having highly reflective and emissive surfaces. Similarly, IgCC's VOC limits will largely require the use of low VOC or water-based adhesives for single-ply membrane roof systems instead of conventional solvent-based adhesives, which have proven performance histories.

IgCC requirements in Chapter 6 for air barriers in building envelopes are currently impractical without IECC's deemed-to-comply options because air leakage data does not exist for the multitude of building facades, roofing materials and roof assemblies that currently exist in the U.S.

Other requirements in IgCC pose possible liability risks to designers, builders and roofing professionals. For example, IgCC's requirements for vegetative roof systems requiring plantings to be "… capable of being managed to maintain the function …" and 80 percent vegetative coverage two years after installation create post-occupancy, in-service performance expectations beyond designers' and contractors' controls. In-service performance of vegetative roof systems depends on a number of variables, including post-occupancy care and maintenance and weather conditions.

The costs of complying with IgCC remain to be seen. Until more information is available regarding complying with IgCC's requirements, NRCA recommends building owners, designers, builders and roofing contractors consult with building material and product manufacturers regarding compliance information in jurisdictions and for projects where compliance with IgCC is required.

IgCC adoption

Now that IgCC has been published in its final form, it is available for adoption by state and local code jurisdictions.

Draft versions of IgCC have been adopted by some jurisdictions. ICC reports a draft or the final version of IgCC has been adopted in Florida, Maryland, North Carolina, Oregon and Rhode Island and in local jurisdictions in Arizona, Florida and New Hampshire. In most instances, IgCC adoptions to date are limited in scope and applicability, such as being a design standard for specific government-funded projects or sustainability programs.

I encourage you to inquire with your local code jurisdictions to determine the statuses of local adoptions and applicability and possible implementation dates.

IgCC is available from ICC in print and electronic formats. To purchase this code, call ICC customer service at (800) 786-4452 or access www.iccsafe.org/store.

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