Roof slope guidelines

Minimum and maximum slopes vary by roof system and project type

by Mark S. Graham

Proper roof slope can be an important consideration when designing high-performance roof systems. Minimum and maximum roof slope limits vary based on specific roof system and project types. Following is a review of code requirements and NRCA's roof slope guidelines, as well as some additional factors designers should consider.

Code requirements

Building codes generally provide prescriptive minimum roof slope requirements for various roof system types. For example, the *International Building Code,® 2018 Edition* (IBC® 2018) prescribes a 1⁄4:12 minimum roof slope for asphalt built-up, polymer-modified bitumen, thermoset and thermoplastic single-ply, and liquid-applied membranes in new construction. This 1⁄4:12 minimum roof slope requirement also applies to spray polyurethane foam (SPF) roof systems in new construction.

For metal panel roof systems with nonsoldered seams with applied lap sealant, IBC 2018 prescribes a 1⁄2:12 minimum roof slope. For

standing-seam metal roof panel systems, a 1⁄4:12 minimum roof slope is prescribed.

For steep-slope roof systems, IBC 2018 provides for a 1:12 minimum roof slope for mineral-surfaced roof roll roofing; 2:12 minimum roof slope for asphalt shingles, photovoltaic (PV) shingles and building-integrated PV; 21⁄2:12 minimum roof slope for clay and concrete tile; 3:12 minimum roof slope for metal roof panels with nonsoldered seams without applied lap sealant, metal shingles and wood shingles; and 4:12 minimum roof slope for slate and wood shakes.

The *International Residential Code,® 2018 Edition* (IRC® 2018) prescribes minimum roof slopes similar to those of IBC 2018 except IRC 2018 indicates a 3:12 minimum roof slope for wood shakes.

In cases of roof system replacement and re-cover of existing low-slope roof systems, IBC 2018 and IRC 2018 waive the codes' 1⁄4:12 minimum slope requirement and apply a performance-based, positive roof drainage minimum requirement. Both codes define the term positive roof drainage as: "The drainage condition in which consideration has been made for all loading deflections on the roof deck and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation."

Although building codes do not directly prescribe maximum allowable roof slopes, fire classifications—which are required by code—often do include maximum roof slope limitations. For example, some EPDM membrane assemblies have maximum roof slope limitations as low as 1⁄2:12. Some TPO membrane assemblies also have relatively low maximum roof slope limitations. PVC membrane assemblies generally have higher maximum roof slope limitations; some are unlimited. Steep-slope assemblies generally do not have maximum roof slope limitations.

Designers should refer to manufacturers' specific roof assembly fire classifications for maximum roof slope limitations. Individual manufacturers can be consulted for their fire classifications, which are roof assembly-configuration specific. This information also is accessible via UL's online classifications directory at www.ul.com or FM Approvals' RoofNav application at www.roofnav.com.

NRCA's guidelines

NRCA's guidelines for minimum roof slope are provided in the roof system-specific sections of The NRCA Roofing Manual.

NRCA recommends membrane, liquid-applied and SPF roof systems be sloped to provide positive roof drainage. Additionally, for new construction, a roof system should meet building code requirements for minimum roof slope.

For metal panel roof systems, NRCA recommends slopes of 1⁄2:12 or more for structural panel systems and 3:12 or more for architectural panel systems.

For asphalt shingle, clay and concrete tile, metal shingle, slate and wood shake and shingle roof systems, NRCA recommends slopes of 4:12 or more.

NRCA's recommended minimum roof slope guidelines for steep-slope roof systems generally are greater (at steeper inclines) than those in the building code. Although the code's values represent minimum requirements in the context of minimum legal requirements for construction, NRCA's recommendations are best practice guidelines.

Additional considerations

Designers also should consider the following project-specific conditions.

For steep-slope roofs where two roof areas of equal slope intersect to form a valley, the resulting valley slope is less than that of the two adjacent roof surfaces. For example, where roofs with a 4:12 slope intersect at a valley, the valley's actual slope is only about 3:12. To accommodate this, designers should consider greater than the minimum recommended roof slope for steep-slope roof designs with valleys or other complex geometries.

Also, steep-slope roof areas with long rafter lengths experience greater amounts of water runoff than roof areas with short rafter lengths. To better accommodate this water runoff, designers should consider roof slopes greater than the minimum recommended slope.

For low-slope roofs where a tapered insulation cricket or saddle creates a valley, the valley's slope will be less than that of the cricket or saddle. Some ponding water along cricket and saddle valleys typically will occur and should be anticipated.

Additional information regarding roof slope and project-specific design considerations is provided in The NRCA Roofing Manual.

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Study finds construction industry can benefit from AI adoption

A McKinsey & Co. study about artificial intelligence (AI) applications in the construction industry reports a combined use of machines and digital technology can enhance quality control, project scheduling, data analysis and project cost savings, according to www.constructiondive.com.

The construction industry currently is the second-least digitized economic sector in the world, and the industry needs to lay the groundwork before AI can be widely adopted. The study identifies investment in data collection and processing tools such as cloud infrastructure and advanced analytics as the first step.

There has been increased interest in sensors, cloud-based data sharing and mobile connectivity within the construction industry. Some employers already are using wearable sensory devices to monitor workers' location and equipment at work sites. Data collected from the devices is transmitted to a cloud-based platform accessible from any compatible mobile device. AI algorithms advance the process one step further by deploying real-time solutions based on data analysis, helping employers ensure their workers stay safe on the job.

Industry employers may look to other industries that have successfully used AI to optimize processes, including the pharmaceutical and healthcare industries. The study notes an AI algorithm is used by the pharmaceutical industry to predict medical trial outcomes; a similar algorithm may be used by the construction industry to forecast project risks and constructability. And image recognition algorithms used by the healthcare industry to support diagnoses may enable drones to assess construction site images for signs of defects or structural failures.

Drones approved for project inspections in Spokane, Wash.

The Spokane Public Works Department, Spokane, Wash., approved a plan to use drones to assist in various projects related to water main breaks, construction and landscape analysis, according to www.constructiondive.com.

Officials say the plan will save contractors money by decreasing overtime hours and make job sites safer by delegating risky inspections to drones.

"Routine inspections might be able to happen more quickly because we don't have to set up all the protections that we would need to normally," says Public Works Director of Strategic Development Marlene Feist. "Anytime we can have the ability to assess a situation in an unmanned, safer way, that's a good thing for us."

The real-time data and images gathered from drones can help contractors track project progress and identify issues early on, helping to finish a project on time and budget.

One drone, which will cost the city $15,000, is expected to be in use by the end of summer.

Davis

International Accreditation Service appoints chairman

The International Accreditation Service (IAS), a member of the International Code Council Family of Companies, has appointed Rocco Davis chairman of its board of directors. The board of directors helps set the strategic direction for IAS as it provides independent verification that businesses, organizations and government entities comply with industry and international standards in more than 40 countries.

Davis has served on the IAS board of directors since 2012, most recently as vice chairman. He is vice president and regional manager of the Pacific Southwest Region of the Laborers' International Union of North America (LIUNA). Davis previously served as a field representative for the Center for Contract Compliance, a regional coordinator for the National Heavy-Highway Committee and a LIUNA chief of staff.

"With such an extensive history of building and organizing coalitions between community, labor and business, Davis brings a unique background to the IAS board of directors," says Raj Nathan, president of IAS. "He is recognized for his dedication, hard work and devotion to the causes of workers everywhere and has been a valuable member of the board during the past six years. I look forward to working with him closely as we build our customer base, expand our offerings and move into new markets."