Raising the Roof Edge

Increased Thermal Values Affect an Existing Roof's Edge

Recent code and standard development has resulted in increased thermal insulation. This increase has required greater and greater insulation thicknesses, which are even thicker when tapered insulation is added. This roof system thickness, especially in reroofing design, has thrown a curveball to many designers: How should they address existing rooftop conditions?

I have successfully dealt with this for more than three decades and mostly with ease. However, based on the fight being put up by the Chicago Roofing Contractors Association (CRCA), you would think it is putting contractors out of business rather than having the potential to increase their bottom lines.

Consequently, this will be the first of several articles discussing how designers can deal with existing conditions on the roof when increased thermal values are required. This article will explain the roof edge—the first defense against wind uplift and often an aesthetic concern. Future topics will include drains, roof curbs, access doors, windows, RTUs and plumbing vents.

WHY THE NEED

Twenty-five or 30 years ago, insulation was what you placed on the roof deck to act as a separator between the roof cover and roof deck, especially with the increased use of fluted steel decks instead of monolithic-type decks, like concrete, gypsum, wood and cementitious wood fiber. Prior to that, roof covers were often placed directly on these monolithic roof decks sans insulation.

It has only been within the last 25 to 30 years that insulation has become an integral component of the roof system, often changing how the roof cover behaved. As energy and the conservation of energy became vogue, codes and standards became more stringent in regard to thermal insulation values. With the increase in R-value came an increase in the thickness of insulation. This in turn requires roof edges be higher to accommodate the increases in insulation, ultimately changing how the roof edge on buildings without parapets are designed.

The use of tapered insulation with thicknesses often above 12 inches changed how the roof edge is treated, especially in reroofing situations, which has resulted in design challenges. Add to this, modern building design that forewent parapets for gravel stops; the challenge of raising the roof edge to accommodate new insulation heights has dramatically increased.

The Washington, D.C.-based American Institute of Architects has issued a challenge to the design community to make all new construction Zero Energy Buildings (buildings that produce as much energy as they use) by 2030. Intuitively, more insulation (and perhaps fewer windows) will result in a building that uses less energy and, thus, more easily achieves a balance point.

This altruistic, far-reaching goal is being fought. CRCA, for example, is fighting the new code increases in roof insulation. Although the organization states a variety of reasons, it appears that the fear of owners delaying work that costs more because of increased insulation thickness is the greatest concern. This is interesting because design—by state mandate—is the purvey of licensed design professionals. Is the CRCA advocating design by non-licensed designers? I believe the CRCA's position is foolish. Why would a predominately union-based contractor organization fight a code mandate that allows their members to increase profits? Perhaps the challenge by
“right to work contractors” is greater than believed.

CONCERNS: LEGITIMATE OR NOT

There are a number of concerns, or design challenges, as I like to say, to raising the roof edge. For us architects, respecting the architect’s vision and design intent is often in conflict with what may need to be accomplished. I have worked with clients in buildings of note, designed by well-known architects, and have been able to respect every detail of the roof-edge vision. It is very difficult and challenging.

Another concern can be cost.

Historically, a dimensional 2x was set at the roof edge and nailed; now we often raise the roof edge with prefabricated insulated curbs. Costs are always a concern but when budgeted correctly and the client is informed during the process, the project has always been realized within a year or two.

Another concern I often hear voiced is, “It’s difficult” or “I cannot figure it out”. When one considers that the roof edge must be (let’s say should be) tied to the building structure to resist wind loads, these are true concerns. These types of conditions often call on years of experience. Therefore, I say the challenge is on!

EXISTING-CONDITION KNOWLEDGE

When the need to raise the roof edge arises, you should start out by investigating the existing-building roof edge construction. Existing construction
FIGURE 2: On this detail from an older project, the roof edge is being raised with multiple layers of 2 by 12s—a bit old school but easily performed. It is recommended to not specify preservative-treated wood, coated screws and offset joints.

PHOTO 2: Stacking wood to raise the roof edge is old school. Here you can see the new wood blocking is the second stacking over previously installed wood on a previous reroof.

PHOTO 3: To strengthen the multiple stacks of 2x6s, 3/4-inch plywood is being added on the exterior.

PHOTO 4: When stacking, wood joints should be offset and scarf at 45 degrees.
drawings should be reviewed if possible. If they are not available, you should disassemble the roof edge to determine the existing conditions. This should also be considered even when the drawings are located because construction often differs from that which is drawn.

The type of structural system should be determined. You also must determine the location of perimeter structural members, roof-deck type, wall-cladding construction and how the wall to roof deck juncture, as well as how the existing roof system terminates at the wall.

This knowledge will lead to design decisions in the roof edge design. Understanding how the wall to roof edge on an existing building is constructed is critical. On a recent project in which the roof sustained a wind event, investigation for the design of the new roof edge and system found multiple concerns: open metal stud cavities to the parapet, open metal panel joints, wood and substrate boards attacked with drywall wall screws and moisture drive concerns. This information led to the design of one of our most complicated roof edges (see Photo 1 and Figure 1).

**DISCLAIMER**

When the need to raise the roof edge arises, you should start out by investigating the existing-building roof edge construction.

**DESIGN CONSIDERATION**

A paramount consideration in design and construction of raising the roof edge is tying the new roof edge construction back to the structure of the building. This is required to prevent loss of the roof edge, roofing and components from the roof edge during a wind event. The method of anchorage to the structure needs to be considered, as well. Type of anchor, material type, size, spacing and installation method all must be considered.

The height of the new roof edge is often determined by the maximum height of the insulation, either by saddles or tapered insulation. The designer must not only calculate the total insulation height, but also consider any insulation adhesive. Spray or bead foam adhesive can add 3/16 inch per layer of height to the total insulation height. I have seen the top surface of insulation rise several inches above the roof edge as a result of this oversight.

You also must consider the roof edge width. Like a masonry wall’s slender ratio (height versus unbraced length), the taller the raised roof edge the wider the new roof edge should be. The days of stacked 2 by 4s are past. Six- and 8-inch widths allow for a better base width and resistance to bending. An additional concern to take into consideration, depending on new roof height, is an increased potential snow load along the roof edge, which can be a real concern when the roof edge is an overhang.

**DESIGN**

How does one raise the roof edge? Historically the roof edge perimeter was raised with stacked 2x lumber, nailed together. As the insulation height rose, the 2x number increased until they grew to ridiculous heights (see Figure 2 and photos 2, 3 and 4). The stacking of 2x lumber often resulted in a vertical edge that was not plumb but bent inward or outward—a condition that did the sheet-metal crews no favors.

Twenty-five years ago, I started using 12-inch-wide 1/4-inch bend plates with leg dimensions to the roof edge conditions to which vertical 2x members were bolted and capped with a 2 by 4 screwed to the verticals. There were challenges with this solution. For example, a 1/4-inch piece of plywood had to be inserted at the bend plates to make up the needed width of a 2 by 4; shimming the base of the bent plate often allowed rotation at the rolled corner making holding a vertically plumb exterior condition at the wall, to which sheet metal would be attached, difficult.

This detail was improved following in-field installation observation (another good reason to be out on the roof to observe installation) by changing the bend plate to a 1/2-inch steel angle so that the insertion of a 1/4-inch shim...
was not required, the square corner of the angle did not rotate as much and the angle was made continuous to eliminate concerns with the proper location of adjacent angles. This allowed for shimming ease and resulted in vertically plumb wood blocking (see Figure 3 and photos 5, 5b, 6, 7 and 8). The steel angle could be through-bolted to steel, lag-bolted to wood and anchor-bolted to masonry. When the roof edge is thin, with a 2 by 4, a steel tee can be used (as in Photo 8).

Over time, the steel angle and vertical 2x solution appeared old school. Thinking in a new way: How can the roof edge be raised, installation time decreased, thermal breaks removed and quality improved? After some thought, the idea of a prefabricated roof edge curb rail was developed (see Figure 4). This concept improves on all the benefits of the previous concepts.

**I have found that being onsite for the first few days of installation to ensure appropriate installation and continuity is vital.**
Curbs have since been installed in a variety of anchorage configurations and seem to be the perfect solution.

CONVEYING THE DESIGN SOLUTION TO CONTRACTORS

The art of detailing is the expression of design solutions in graphic form in a manner in which the field crew can understand and implement. All too many designers try to provide drawn details that are not fully developed to communicate design intent to contractors—often with dire results.

Most roofing crews I know are only fair mind readers. The final design should be graphically clear and communicative. All components should be noted, as well as how they are to be installed. Be specific. Remember, you are the designer. As the famous architect Mies Van de Rohe once said, "God is in the details." Some of these details can become very complex and, thus, I suggest step-by-step details be utilized. It is not uncommon to have three or more progression details. A
designer with a background in construction will be very helpful.

The proper specification should, of course, provide the material particulars, many of which can be noted on the detail. A quality detail, well drawn and properly noted, in my opinion, will result in better results than just a specification.

GETTING IT DONE
Once the design is conceived, the challenge then moves to achieving it. A well-designed solution, properly graphically delineated, really doesn't need an installation shop drawing, though a fabrication shop drawing for the curb might be needed.

The concept and installation should be reviewed in the preconstruction meeting, attended most importantly by the foreman who will be onsite. I have found that explaining the design concept and importance of various components, asking for the contractor’s input, brings them into the team and often gets their buy-in.

Another key to achieving positive results is procuring a correct mockup. The first order of business is to be sure that the mock-up is installed by the same personnel who will be installing it onsite. This is an important matter that should be required in the

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specifications. I have found that being onsite for the first few days of installation to ensure appropriate installation and continuity is vital.

Once the roof edge curb has been installed, the roof system can be installed. This is followed by roof edge sheet-metal cladding.

**FOREFRONT OF CHANGE**

Energy conservation is something all school children are now learning. The reduction of greenhouse gases can be greatly affected by a reduction in the use of fossil fuels to produce energy.

The roofing industry is on the forefront of being able to substantially contribute to energy-use reduction. Will it be easy? Not very often. Achieving something of substantial benefit requires intelligence, empathy, sacrifice, talent, dedication, perseverance and belief.

While we may not all agree on the whys and needs, we should all band together to achieve our country’s goal of energy conservation.

So go ahead. I challenge you: Raise the roof edge.

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