WHITE PAPER

Retrofitting Existing Roofing with Metal

Overview

One of the most common questions asked by a small commercial building owner or homeowner faced with having to replace an existing roof is if a new roof can simply be installed over the old roof to save tear-off costs. It is a fair question considering removal labor costs and that obsolete roofing materials contribute 9 to 10 million tons of waste to landfills every year[1.]

A quick internet search will expose many articles that say this may not be a good idea from a roofing standpoint, at least not when putting new shingles over old roofing materials, especially shingles. The list of reasons include:

- The added weight of the double layer of roofing may exceed the structural design of the deck and/or roof framing.
- Typical asphaltic shingles are designed to be installed over a flat deck, not a rough, uneven surface such as old shingles.
- Not exposing the underlying roof deck prohibits it from being inspected from outside to identify potential leaks.
- The new roof warranty is reduced or voided.

These are all sound reasons, and an additional restriction may be that old roofing may be required to be removed prior to applying new roofing by local building regulations.

Installation of a new metal retrofit roof system over an old roof is an entirely different scenario. Such systems were specifically created for this purpose and take many of these factors into account in their design. This paper will educate a small building owners or homeowners on the advantages of retrofit metal roofing systems when applied over existing built-up roofs.

Discussion

Advantages of Metal Retrofit Systems

The versatility of retrofit metal roofing translates into many advantages. Among these are cost savings created by lighter weight systems and enhanced aesthetics and durability.

Weight and Labor Savings

In jurisdictions where installation of an additional roof covering on top of an existing roof is allowed, existing roofs with a single layer of roofing material are often covered with metal roof systems. This avoids the tear-off and disposal of tons of old roof covering material. In addition to reducing the burden on landfills with torn-off roofing materials, there are several additional factors that support this practice:

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- Metal roofs are low weight, ranging from 40 to 140 pounds per "square" (100 square feet). This stands in stark contrast to virtually all other roofing materials which can be as heavy as 250 pounds per square or more. That difference could allow for the weight of a metal roof in the design when a second layer of conventional roofing is not an option. This is especially important for aging structures or in areas with high earthquake loads.
- The cost of construction labor, coupled with shortages of same, encourages property owners to invest in premium roofing systems rather than labor to remove old roofing materials.
- Leaving the old roofing material in place provides a small R-value boost to the building envelope to enhance energy efficiency if metal sub-purlins or battens are used.

Enhanced appearance and durability

In return for an upgrade to a quality metal roof, property owners receive benefits such as:

- Long-life durability - Many metal roofing products carry warranties of 20-50 years and MCA studies have shown a 60-year service life for a properly constructed metal roofing system[2].
- Resiliency and high performance for high wind applications, fire resistance, and impact protection not available from other materials.
- Attractive curb appeal with styles including raised vertical seam and ribbed profiles as well as "modular" panels with the aesthetics of shingles, wood shakes, slate, or tile. Coatings include a wide range of high-performance and heat-reflective paint systems as well as granulated finishes.
- Up through the end of 2020, and retroactive to 2018, tax incentives were available for projects incorporating materials meeting the ENERGY STAR requirements[3]. Legislation beyond 2020 is under consideration, however no programs have been announced as of this writing. Check with material suppliers for currently available programs.

Metal roofing can carry Underwriters Laboratory (UL) ratings as high as:

- Class 90 rating or greater for wind uplift (UL 580)
- Class A rating for external fire exposure (UL 790)
- Class IV rating for impact damage (UL 2218)

For more information, search the UL website (https://iq.ulprospector.com) for file numbers starting with "TGFU" and "TGKX". Achieving these performance ratings may reduce insurance rates and provide extra protection and value to the structure.

A common goal of a metal roof installation is enhanced energy efficiency. By minimizing solar heat gain, products and assemblies that have a thermal break (e.g., a layer of low-conductive material or air cavity) between the metal and the structure can be very beneficial to this goal. These metal roofing systems can also adapt well to the use of an additional radiant barrier, as shown in Figure 1, for even greater efficiency.

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Figure 1: Metal Roof over Radiant Barrier, courtesy of Roof Hugger.

Installation Methods

There are two common installation methods for installing metal roofing over existing roofing materials: Direct-to-Deck and Over-Purlin.

Direct-to-Deck Installation

In a "Direct-to-Deck" installation, if the existing roof is not leaking, the metal panels are installed directly over the existing roofing materials, as shown in Figure 2 and Figure 3.

Figure 2: Direct to Deck Insulation, courtesy of the Metal Roofing Alliance

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Figure 3: Direct-to-Deck Installation, courtesy of McElroy Metal

If the existing roofing show signs of leaking, a full tear-off of the roof or an additional code compliant underlayment may be required. See the original roof manufacturer's documentation for proper procedures and note the underlayment requirements which may require additional materials to be installed over the existing roofing materials. The addition of an underlayment may also serve as a slip sheet to protect the back side of the metal panels from the abrasive surface of the roofing material. See panel metal roof system's manufacturer specifications for acceptable underlayments and procedures.

CAUTION: *While "Direct-to-Deck" is a simpler and more cost-effective approach, installing some metal roofing materials over higher profile shingles may cause visual telegraphing of the shingle profile (a.k.a "rippling" or "oil-canning") in the metal panel surfaces, particularly for flat-pan standing seam roofs. Check with the panel manufacturer for installation guidance.*

Over-Purlin Installation

In an Over-Purlin (sometimes called "Wood Purlin" installation), horizontal wood or metal zee or hat-shaped purlins are installed directly over the existing roofing materials, as shown in Figure 4.

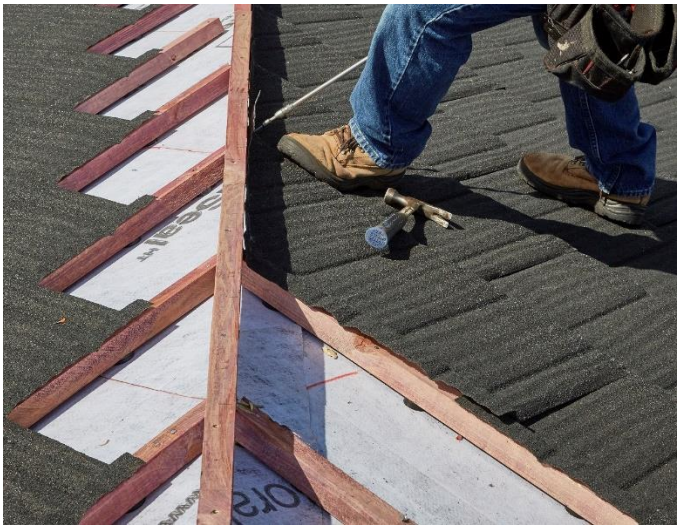

Figure 4: Over-Purlin Installation, courtesy of Boral Roofing

Over-purlin installations are typically done over solid non-metal decks. This process elevates the metal above the roofing material and provides a new framing for the attachment of the metal roofing system. This can be especially helpful when the existing roof is very uneven. Check the metal roofing manufacturer's specifications to verify the suitability of this application with a specific product paying particular attention to fastener and purlin size and spacing. Additional underlayment may be required for this type of application. Purlins must be mechanically fastened (e.g., screws or nails) to the roof structure (i.e., existing rafters) and not just the roof sheathing.

CAUTION: *Lumber treated with copper or other metal-based solutions MUST NOT be used in direct contact with aluminum or carbon steel panel systems.*

CAUTION: *It is generally advised to install metal roofs over purlins with a layer of solid sheathing and underlayment between the purlins and the roof structure to reduce condensation concerns.*

Above-Sheathing Ventilation

A common energy-saving strategy used when installing metal retrofit systems is called Above-Sheathing Ventilation, or ASV. This installation method allows for fresh air to enter the cavity between the old roof and the new metal roof at the eave and vent out at the ridge. To accomplish this cavity, wood or metal purlins are fastened vertically (i.e., perpendicular to the roof slope) over every rafter location – these purlins are sometimes referred to as "sleepers". Then horizontal purlins or new roof sheathing and underlayment are installed across the sleepers. (See Figure 5)

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Figure 5: ASV using wood purlins, courtesy of MBCI

Horizontal purlin spacing required for the chosen metal panels must be as specified by the panel manufacturer. There are also proprietary systems available which provide the same venting cavity that utilize stand-off clips to accomplish the same effect. (See Figure 6)

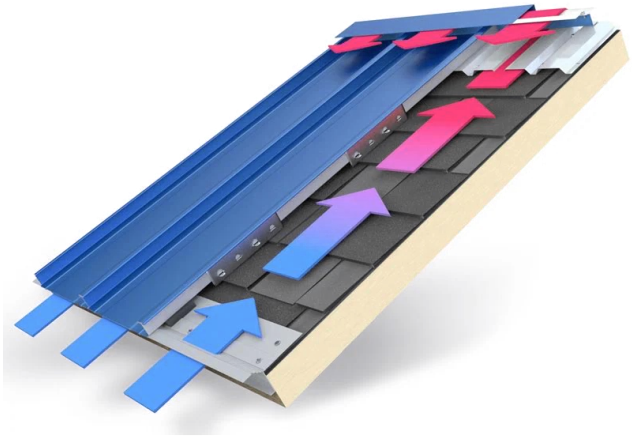

Figure 6 – ASV utilizing a clip system, courtesy of McElroy Metal

At the eave, vent material is installed between the existing fascia board and the new metal starter strip to allow air to enter but still protecting the venting cavity from debris and/or pests. Fresh air will flow up to the ridge where it allowed to escape through a manufacturer-approved vent ridge assembly. This constant flow of fresh air under the metal roof reduces heat gain in the summer[4] and the possibility of ice dams in the winter.

NOTE: *Above Sheathing Ventilation may raise the roof level significantly, which can impact various roof protrusions including skylights, chimneys, dormers, and dormer windows. Additionally, ASV installations will generally lead to re-positioning of any gutters on the structure.*

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Inspecting Existing Roof and Deck

The first step in completing an inspection is to understand the existing roof and what is needed for a successful retrofit.

- **Determine the number of roofing layers are on the existing structure.** Check the local building code to determine the allowable number of layers. If more than one layer exists, the roofing will likely have to be removed before installing an additional roof layer.
- **Determine the existing roof condition.** In a "Direct-to-Deck" installation, any curled or raised roofing material should be nailed down or removed to allow for a consistent roof surface. NOTE: If curled roofing is simply removed, the water shedding properties of the existing roof may be diminished. In this case, an added layer of underlayment should be included to restore the protection.
- **Identify any weak spots in the deck.** Any areas that feel spongy or deflect when walked on may require removal of the roofing and subsequent deck inspection and replacement. Additional inspection of the underside of the roof deck is suggested whenever possible. Look for evidence of mold or discoloration indicating past or active leaks. Concerns regarding the current roof deck can be tested with a fastener pull-out test, similar to ASTM D1761, seeking resistance of at least 80 pounds.
- **Identify areas of sagging roof sheathing between rafters.** Check the sheathing thickness and verify it meets the metal roof supplier requirements. Sagging areas should be corrected. Deflections may be visible on the new metal roof and could impact uplift resistance. Corrections may include:
    - Replacing or repairing the sagging area
    - Using shims to align the purlins if a purlin system is being installed.
    - Plan to replace all existing trim, pipe jacks or flashings, skylights (if over 10 years old) and any other ancillary items on the roof.

NOTE: *For most types of construction, attic ventilation that meets building code requirements helps to ensure a healthy and energy-efficient structure and helps to avoid winter ice dams.*

Installing the New Roof

Follow the metal roofing system manufacturer's instructions for installation. Most manufacturers will have matching prefabricated components for various roof conditions such as eaves, ridges, gables, hips, valleys, roof-to-wall intersections, and roof penetrations. By using these components, total system integrity will be preserved, and installation effort will be minimized.

Ideally, use a contractor with experience installing the chosen system. Most manufacturers have a preferred installer program which provides additional training and support to the member contractors. Another good resource is the Metal Roofing Alliance website, located at www.metalroofing.com, which has links to project photos, testimonials as well as an installer locator.

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Summary

Metal roofing retrofit systems carry unique advantages such as long service life, resilience, extended warranties and even energy savings. They can be deployed over most roofs, often without having to remove the existing materials, and provide an attractive, long-lasting solution to the building owner. They may be applied directly to the roof or over purlins. Purlin systems may also incorporate ASV for additional energy savings. When choosing from these systems, it is very important to follow all manufacturer recommendations utilizing a preferred installer whenever possible.

References

1. US Army Corps of Engineers, Public Works Technical Bulletin 200-1-44; "Recycling Exterior Building Finish Materials", February 2007
2. Metal Construction Association, "Service Life Assessment of Low-Slope Unpainted 55% Al-Zn Alloy-Coated Standing Seam Metal Roof Systems", 2014 https://www.metalconstruction.org/index.php/online-education/service-life-assessment-of-low-slope-unpainted-55-al-zn-alloy-coated-steel-standing-seam-metal-roof-systems---published-102018.
3. Internal Revenue Service, "Energy Incentives for Individuals: Residential Property Updated Questions and Answers"; found at: https://www.irs.gov/newsroom/energy-incentives-for-individuals-residential-property-updated-questions-and-answers, August 2020
4. Miller, William & Karagiozis, Achilles & Wilson, J.; "The Impact of Above-Sheathing Ventilation on the Thermal and Moisture Performance of Steep-Slope Residential Roofs and Attics", January 2006

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