



# THE CHURCH LEADER'S GUIDE TO ROOFING

WHAT YOU NEED TO KNOW WHEN MAKING A ROOFING DECISION

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Making a Roofing Decision*

When it comes to re-roofing their facilities, church leaders have a huge responsibility. All kinds of things come into play. Architectural integrity. Aesthetics. Energy efficiency. Life expectancy. Maintenance costs. Proper installation. Weight. Fire resistance. The list goes on from there. And, what's more, church leaders report to their entire congregations, made up of individuals who also individually have the right to be heard.

The best result is a roof choice that is as beautiful as it is functional. A roof choice that saves energy, protects the structure, and requires no maintenance. A roof choice that makes all of the stake holders happy by fulfilling as many of their wishes as possible. Done properly, a good roof choice will save future congregations from roof replacement and maintenance costs, allowing church contributions to be used for ministry.

The Church Leader's Guide To Roofing has been written to provide comprehensive information and education that will assist religious facilities in making roofing choices that are right for them. Because so many churches across North America are now turning to metal roofs, this guide has a special focus on what is available today in terms of metal roofing and the way that metal can meet a church's unique needs.

Roofing decisions are big choices. Bad choices can have splintering effects on church congregations. Your contractor who provided this guide will be happy to answer your questions and provide further information.

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## TEMPORARY ROOFING MATERIALS

*Many of the most popular roofing materials today are chosen because of their price, not their longevity. These roofing alternatives, while initially attractive, quickly lose their appeal as they begin to deteriorate. Temporary roofs are initially less expensive than permanent roofing systems. But, when you consider the cost of periodic re-roofing, loss of energy efficiency, and potential damage due to weather, the cost of temporary roofing becomes astronomical over the long haul. That is why many church leaders are avoiding temporary roofing materials. Let's look at the options though.*

### COMPOSITION SHINGLES

Composition shingles are comprised of felt or fiberglass material with tiny stones glued to the surface. From the moment these shingles are installed, the wind, weather, and heat from the sun begin to break down the asphalt-based adhesives that hold everything together. This sets off a process where the shingles begin to curl, crack, and streak due to algae and loss of granules.

Composition shingles also act as a sponge, soaking up the sun's radiant heat and trapping it inside the structure's attic space. Unlike metal, asphalt and fiberglass shingles hold onto their heat, forcing the church's air-conditioning unit to work harder to keep the house cool.

According to the asphalt roofing industry, the average shingle roof lasts 17 – 19 years. The actual lifetime is dramatically lower than this in hot climates and extreme weather situations. Unfortunately, the warranties on these products do not cover natural wear and tear from weather. Damage resulting from high winds, hail, rain, and extreme temperatures are also not covered.

Lastly, in order for new shingle warranties to be effective, the old shingles must first be removed. These petroleum-soaked shingles are placed in landfills across the country where the oils and chemicals seep into the ground. There is unfortunately nothing "green" about a shingle roof. If a building owner decides not to tear off the old shingles, the new shingle warranties are often voided.

### WOOD SHAKES

For hundreds of years, wood shakes and shingles adorned the roofs of structures in America. Because the wood was plentiful and the alternatives were few, wood shakes and shingles became an accepted part of the American landscape.

Unfortunately, wood shakes, while beautiful in appearance, require regular and intense maintenance. Because the wood is an organic material, in hot and humid as well as shaded areas, it is susceptible to mold, algae, and other forms of unsightly growth.

Since these growths are water-retaining life forms, the shingles begin to rot, causing leaks to the underside of the roof. Eventually, the battens and decking begin to rot away and the whole roof needs to be torn off and replaced.

Tearing off the old roof will have detrimental effects. Pieces of wood, nails, and other debris litter the yard and neighborhood and, just like with standard shingles, the refuse must be deposited in a landfill.

### CLAY AND CONCRETE TILE AND SLATE

The beauty of clay tiles and slate are associated with certain areas of the country and are thought to be long lasting and highly efficient. However, the high weight of these products can cause undue strain on the structure. Many clay and concrete tiles are highly porous. As water seeps into the tiles, the tiles crack and break. This situation is made worse by freeze-thaw weather cycles. In high winds, clay tiles can be quite dangerous and the damage leaves holes that could affect the interior of a building. These heavy products are also very prone to cause structural collapse in the event of seismic activity or an interior fire.

Natural slate is more indestructible than man-made tiles but, unfortunately, the nails that hold them in place are not. In many instances, the nails rust away leaving the heavy slates held in place by gravity's pull alone. Falling slate can be very dangerous and damaging to property. Many older churches with original slate roofs are now facing significant annual maintenance costs.

### OTHER TEMPORARY ROOFING MATERIALS

There are many other roofing materials such as rubber, plastic, and other composite materials. These materials are higher cost materials and are liable to fade and chalk in the intense heat of the sun. Many of these products also do not yet have proven track records.

## **THE BOTTOM LINE**

Temporary roofing materials like composition, wood, and other materials may be less expensive at first glance, but will, over time, cost exponentially more due to re-roofing over and over again as well as losses in energy efficiency.

## BENEFITS OF METAL ROOFING

*First, let's take a look at the benefits of metal roofing. Choosing the right metal roof is critical but, even before that, you must know why you're choosing metal in the first place. As we discussed, it is often a higher investment than more common roofing materials. Why are so many church leaders choosing metal each year?*

### WEATHER RESISTANCE AND OTHER BENEFITS

The roofing industry is driven by extreme weather. Whether strong winds and storms, hail, snow, ice, or brutal sun, the weather is what makes roofing materials break down. Firsthand experience may be why you are investigating metal roofing as an option. Let's look at how metal stands up to weather extremes.

### HEAT AND SUN

While particularly damaging in southern exposures and at high altitudes, heat and sun play huge roles in the degradation of most roofing systems. Ultimately, most roofing systems fail because they dry out, become brittle, and crack with age. Metal roofing systems are completely impervious to this type of damage. They will not curl, crack, or become brittle when exposed to sun and heat. Additionally, today's coating technology offers a variety of finishes that maintain their integrity and color very well when exposed to heat and sun.

### WIND RESISTANCE

Devastating hurricanes in our country have brought a lot of press to this subject in recent years. We have all seen the video footage of roof damage. In these extreme weather events, the roof is a terrible place to be for all product genres. Does metal really perform better than other products? Let's take a look at the factors involved.

It's important to understand that, in a hurricane or other windstorm, there are many things that happen which affect the roof. Of course, you have actual physical wind-speed blowing into the roof from some angle. This wind puts strain on the metal panels as it hits them but, sometimes even to a greater degree; it puts uplift pressure on the backside of the roof. Next, you can often have structural movement occurring which will impact roof performance – some buildings are built better than others to withstand this. Structural movement can cause roof panels to disengage, particularly if they were not designed to allow for it. Additionally, improper attic venting can even cause attics to literally explode in extreme wind events. No roof covering will be able to handle that. And, of course, windblown debris striking the roof can compromise its performance as well.

In order to verify their wind resistance, metal roofing products are subjected to uplift tests which simulate actual wind occurrences. This is done through what is called the "bag test". With some variations, a section of roofing is installed in a laboratory with plastic bagging between the metal and the roof decking. This plastic bagging is then filled with air pressure to determine at what point the metal roof panels disengage. The point of disengagement can be used to approximate a failure point in terms of wind speed.

Some metal products have actual mechanical interlocks between the panels. These products, if properly designed and installed, will often perform better in uplift tests than will panels that overlap or have a "slip lock" rather than a true interlock. Some products with overlapping panels, though, will have fasteners driven right through the overlap and that can also make them perform very well.

Aging is an important factor to remember when considering the wind performance of any roofing material. Many roofing materials soften or become brittle with age. As that happens, their ability to withstand extreme winds lessens. Metal products, on the other hand, retain their strength and wind resistance very well as they age. A 30-year-old metal roof will likely withstand wind the same as a brand new metal roof; most other roofing material doesn't come close to this ability. For all of these reasons, property owners in wind-prone areas are increasingly turning to metal as their roof system of choice.

### SNOW AND ICE

Many people may not think about it but snow and ice are among the worst elements that Mother Nature can throw at a roof. They cause degradation of materials and failure of sealants. Ice damming may also occur, causing significant structure damage.

Metal roofing is known for its ability to quickly shed snow loads. Typically this happens when the sun comes out and radiant heat passes through the snow load, warming the metal a bit. In some cases, it may be advisable to have snow guards on the roof. These are small protrusions designed to hold the snow a bit, and break it up into smaller chunks when it does slide. This can be a good idea particularly over doorways and delicate shrubbery.

Although metal roofing tends to shed snow quickly, it still doesn't make up for the lack of attic insulation and ventilation which can result in ice damming on the roof. Generally speaking, snow and ice on a metal roof will not cause damage, but if ice damming occurs over the eaves and water starts to pool and freeze higher up on the roof, it can be a challenge for any roof system. When replacing your church roof, it is a good idea to ask your contractor whether you need any additional or improved attic ventilation or insulation to guard against winter damages. The cathedral ceilings present in many churches can increase the risk of heat escaping to the roof and causing problems.

### LIGHTNING

It is common to wonder whether a metal roof might attract lightning. Metal conducts electricity but it does not "draw" it. There is no evidence that metal roofing puts a structure at greater risk of a lightning strike. Typically, lightning will hit the highest object around. If desired, metal roofs can be grounded by a lightning protection specialist.

## HAIL

Metal roofing is widely respected for its hail resistance. While there can certainly be storms from which no roofing material will escape unscathed, metal roofing offers good protection from leaks even if aesthetic damages do occur. The most widely-accepted test of hail-resistance is Underwriters Lab (U.L.) 2218, a steel-ball drop test that simulates the effect of hail impact on roofing products. Metal roofs pass U.L. 2218 at Class IV, the highest rating. As a result, property owners in many hail-prone states may obtain discounts on their insurance premiums. Additionally, unlike other roofing materials, metal roofing resists hail damage even as it ages. This is another big advantage for metal.

## FIRE SAFETY

Most metal roofs are approved for Class A, B, and C fire ratings. In some cases, a special underlayment may be required to meet certain code and fire classification requirements. However, metal roofing is widely recognized for its resistance to airborne sparks and burning debris. Particularly if you have a wood shingle or shake roof currently, you may enjoy a lower insurance premium with a metal roof. Additionally, in the event of a fire inside a church, the low weight of metal roofing minimizes the possibility of roof cave-in as the structure weakens. This can help save the structure and its contents, providing firefighters with greater opportunity to put out the fire.

## EARTHQUAKE RESISTANCE

With weights from 45 pounds for aluminum roofing, up to a maximum of about 125 pounds (per 100 square feet) for steel and copper, metal can be as little as 1/20th the weight of other roofing materials. It is generally the lowest weight roofing available. This can help protect the structure in the event of seismic activity when often buildings are destroyed under the weight of heavy roofs. Additionally, metal's low weight can be a positive factor for older structures as well.

## **THE BOTTOM LINE**

The industry is seeing a rapid increase in the use of metal roofing in areas prone to severe weather. This is because the “proof is in the pudding.” People are seeing metal systems out-perform other roofing systems on a regular basis during weather occurrence of all types. Products that perform well in severe weather will also, naturally, do very well in more moderate weather, too.



## DIFFERENT TYPES OF METAL

*Many people automatically assume, when they hear “metal roofing” that the “metal” is steel. Yes, a majority of metal roofing products are manufactured from various types of steel, but there are several other quality metals used more frequently today (and some used less commonly today than in eras past). Additionally, there are different types and grades of steel that the educated consumer needs to be aware of! What follows is a summary of these various metals and their relative applicability in relation to one another.*

### GALVALUME STEEL

Base carbon/iron steel coated with an alloy of aluminum and zinc is known as galvalume steel. When aluminum is added with zinc, both of the positive and negative attributes of aluminum are magnified. Because aluminum itself is a very corrosion-resistant metal, galvalume steel is also very corrosion resistant, i.e. the aluminum/zinc alloy provides barrier protection, as opposed to galvanic. The negative aspect of aluminum in the alloy, though, is that galvalume doesn't self-protect scratches or cut edges as well as galvanized steel does.

Galvalume steel is also more susceptible to a process known as “tension bend staining.” When steel is formed into the various metal roofing profiles, the galvalume zinc/aluminum and the galvanized zinc coatings are spread very thin over areas in the metal where there are deep folds or tight bends—so thin that the coating has a tendency to form microscopic cracks. Because of galvanic action of zinc, galvanized steel is able to protect these scratches with little harm. With galvalume steel, however, the aluminum in the alloy somewhat neutralizes zinc's galvanic properties and therefore the galvalume steel isn't able to self-protect the cracks, or other scratches in general.

Tension bend staining occurs when moisture or other corrosive elements permeate these cracks and facilitate rusting. The result is “stains” of rust in areas with folds and bends in the metal. Over time, this corrosion will spider its way under the metallic coating, causing further deterioration.

For this reason, galvalume steel is used most commonly in rather simple profiles, such as standing seam, because there isn't quite as much bending in the metal. Because galvalume steel is more corrosion-resistant than galvanized, it is sometimes installed unpainted or with a low cost acrylic clear coat. While this is most often done in commercial applications, property owners who like the bright, shiny metallic look have selected unpainted galvalume as well. Most galvalume, though, like galvanized, is painted for added durability and beauty.

### **GALVALUME STEEL SUMMARY**

- Advantages: Very corrosion resistant, strong, relatively inexpensive (but often slightly more expensive than galvanized).
- Disadvantages: Susceptible to tension bend staining, limited profile availability (mostly standing seam or simple shingle styles), must be cut with a shearing action rather than saw-cut.
- Thicknesses: 24 gauge (.024”) is most common for standing seam systems.
- Weight: Between 100 and 150 lbs. per square (100 sq. ft.).
- Recycled Content: Usually around 35%.

## GALVANIZED STEEL

Because the traditional carbon/iron steel alloy is rust prone when exposed to the elements, steels used for the metal roofing industry are coated with a specific thickness of another metal or alloy on both sides of the base carbon/iron steel strip. The process used to accomplish this is called the hot-dip process, and involves running the steel through a molten bath of the metal to be applied. The hot-dipped process is basically a cheaper, more efficient alternative to a similar process called electroplating.

Steels are classified and named according to the metal that is applied. Galvanized steel is base carbon/iron steel with a metallic coating of zinc. The coating metal offers two kinds of protection: galvanic or barrier. Galvanic protection is a self-sacrificial process by which the metal coating gives itself up rather than allow the base metal to corrode. Barrier protection is simply that the coating metal keeps the elements from reaching the base metal.

In the metal roofing industry, galvanized steel is available in most metal roofing profiles. It is higher cost than galvalume, strong, and has a great affinity to hold paint. Because zinc provides galvanic protection, scratches on galvanized steel are somewhat self-protected or “band-aided,” preserving the steel from rust. Therefore, the life-span of galvanized steel depends largely on the thickness of its metallic coating since the more zinc that is present, the longer the steel is able to remain protected and rust-free. G-90, the most common zinc thickness used in the metal roofing industry, means that 0.90 ounces of zinc are coated per square foot of steel surface. Lesser grade-galvanized steels are G-30 and G-60 and should usually be avoided for residential applications. Always check the manufacturer’s specifications to determine the thickness of the steel’s metallic coating.

It is important to note that G-90 only refers to the thickness of the zinc coating, not the thickness of the steel itself. That thickness is measured in gauge number (26 Gauge, 24 Gauge, etc.) and depends on the profile of the steel metal roofing product to be used. In regards to the overall metal thickness, the higher the gauge number, the thinner the metal is.

With a few exceptions, such as mill-finished shingles or other metal roof styles, all galvanized steel systems are coated with a base paint coat of some sort. In addition, many of the higher quality galvanized steel metal roofing products, especially shake, shingle, and tile systems that are used largely on residential applications, come with an added “post-forming” coat to help protect against corrosion in areas where the metal was refashioned during the manufacturing process. This is discussed in further detail in the Coatings section.

Galvanized steel is not a good option for buildings in coastal areas or areas with an above average amount of corrosive elements in the air. Salt spray and other elements can speed up corrosion and shorten the life of galvanized steel. Overall, though, with consideration just for the metal itself, galvanized steel is very applicable for residential products.

## **GALVANIZED STEEL SUMMARY**

- Advantages: Strong, lower cost, comes in almost any look.
- Disadvantages: Shorter life span than other metals, can rust prematurely if not used or installed properly, can be more difficult to work with, must be cut with a shearing action rather than saw-cut.
- Thicknesses: 26-28 gauge (.018” - .014”) is the most common for shake, shingle, tile, and slate profiles. 24 gauge (.024”) is most common for standing seam systems, with a good amount of 26 gauge as well.
- Weight: Between 100 and 150 lbs. per square (100 sq. ft.).
- Recycled Content: Usually around 35%.

## ALUMINUM

Lightweight, durable, and corrosion resistant, aluminum is a great option for almost any metal roofing system, including standing seam, shake, shingle, tile, and slate profiles. Aluminum will never rust, so it is an ideal metal for coastal applications and other areas where steel might be in danger. Aluminum's propensity to resist rust gives it an extremely long life span. One of the first architectural aluminum applications was the cap on the Washington Monument in 1885. It was around this time that processes to separate aluminum from bauxite and then manufacture building grade aluminum alloys became efficient enough to make aluminum a viable option for the building industry. Prior to that, aluminum had been considered a precious metal.

These days, virtually all aluminum roofing is pre-painted, and aluminum can be found in just about any profile in which metal roofing is manufactured. In fact, more heavily formed products lend themselves very well to aluminum due to its high malleability and the fact that heavy forming adds additional structural strength. Aluminum roofing is usually manufactured from a large percentage of recycled material, the majority of which is post-consumer material such as used beverage cans.

The recycled content of aluminum roofing will usually be 90 – 95%. One square of aluminum roofing (.019" thick) can use as many as 1,152 aluminum beverage cans—closing the recycling loop for the consumer. Many church leaders easily make the decision that aluminum is the best choice they can make in terms of overall value for their roof.

## **ALUMINUM SUMMARY**

- Advantages: Lightweight, rust free, attractive, energy efficient.
- Disadvantages: More expensive than steel. Not as hail resistant, particularly in less-formed profiles.
- Thicknesses: .019" for shake, shingle, and tile. Minimum .032" for standing seam and for some heavier tile profiles.
- Weight: As low as 45 lbs. per square.
- Recycled Content: Usually around 95% (mostly post-consumer).

## COPPER

Copper is generally recognized as one of the most attractive metal roofing options. Unfortunately, it carries a pretty hefty price tag. Copper is the most expensive of the three most popular roofing metals (steel, aluminum, copper – in increasing order of expense). Rarely used over an entire roof, copper is mainly used for accents over bay windows, dormers, or other areas where a touch of elegance is desired. Copper is used often on historic buildings, church steeples, cupolas, and decorative accent roofs. Copper is installed in short standing seam panels or sheeting, but there are some copper shingles available as well.

Sometimes copper is used as a flashing material in conjunction with other roofing materials. However, copper flashing is not recommended for use with aluminum or steel roofing. This is not only because most metal roof systems come with their own preformed flashings, but also because if copper is left in direct contact with a dissimilar metal it will speed up the deterioration of the other metal through galvanic action. As the copper patinates, the water runoff has a tendency to stain other metals, brick, concrete, and almost anything else with which it comes in contact. Therefore, it's important to understand where the water runoff over a copper portion of a roof is being directed and how it is channeled off of the roof. As an alternative, and to solve this problem, lead-coated copper is sometimes used as a replacement for pure copper. This is being done less often, though, due to the public outcry against anything lead-related in building products.

Copper is best known for its attractive blue-green, or verdigris patina that forms when left exposed for 8-15 years. The actual length of time to completed patination depends on what is in the air; salt spray in a coastal environment, for example, dramatically speeds the process. The patina is like a barrier against corrosive elements and is part of the reason for copper's extremely long life. While copper can be treated to speed up or slow down the patination process, or even be purchased pre-patinated, most building owners elect to allow copper to weather naturally, so as to ensure the rich, luxurious verdigris look.

Because copper is relatively soft and malleable, it is fairly easy to work with and usually solders well. Copper is extremely durable and has a very long life—sometimes more than 100 years. Copper has been used extensively for hundreds of years in the United States. One of the first applications was the Massachusetts State House. The copper for this project was one of the first orders for Paul Revere's newly founded copper rolling mill in 1801.

Recent coatings technology has brought churches the option of choosing steel or aluminum roofing that has been coated to resemble copper. Finishes are available from bright "new" copper to fully weathered copper, as well as coatings designed to look like copper in varying stages of the patination process. This gives property owners an option of the permanence of copper at a lower cost.

## **COPPER SUMMARY**

- Advantages: Beautiful, extremely durable, easy to work with, easily solderable.
- Disadvantages: Expensive, runoff will streak or stain other materials, natural patination takes time.
- Thicknesses: .12 oz. (.016") and 16 oz. (.022") are common for pre-formed shingles. 16 oz. (.022") and 20 oz. (.027") are common for vertical seam.
- Weight: Between 100 and 150 lbs per square.
- Recycled Content: Varies but is often around 35%.

### OTHER EXOTIC METALS

There are other metals available for roofing as well including rolled zinc, stainless steel, terne-coated steel, terne-coated stainless, and titanium. Generally, roofs made from these more exotic metals will be architect-specified and will be custom-formed by a fabricator for a particular application. If you have interest in one of these more specialized metals, contact metal roofing manufacturers to check on availability and suitability for your end use.

### **THE BOTTOM LINE**

One of the most unique things about metal roofing is the wide variety of product types. This affords consumers the opportunity to do their research and find the product that works best for them. As they go through this process, church leaders often choose to look at the expected life-cycle cost of each metal. From this examination emerges the realization that those choosing metal roofing have a choice between ferrous (rusting) metals and non-ferrous (non-rusting) metals. Many of the non-ferrous products come at considerable extra expense. However, aluminum roofing is often seen to offer the best value – an ideal combination of reasonable price and worry-free durability.

## PRODUCT CLASSIFICATIONS

*Much consumer and even contractor confusion stems from the various classifications of metal roofing that are available. Unfortunately, there is a lack of understanding of the differences between various product classifications and proper application of each. Installing a product that is improper for a particular application will sometimes have devastating results. That is why it is important to understand the material explained in this section.*

### STRUCTURAL VS. ARCHITECTURAL

Most metal roofing products fall under the blanket definition of Architectural. Architectural metal roofing products are designed to shed water in an efficient manner, and also to accentuate other architectural elements of the structure. What sets architectural metal roofing products apart from structural products is that they are applied over solid decking and therefore are often manufactured from thinner metals than structural metal roofing products. In essence, architectural products are designed to pass rooftop weight loads through to the roof decking beneath them, rather than support weight loads and pass them through to the building's structural members. Architectural metal roof systems allow for standard attic ventilation methods.

Structural metal roofing products are installed without a solid decking beneath them. They are generally used in applications where the metal roofing is installed over purlins, also known as lathe boards. The spacing of such purlins is a function of the structural strength of the metal roofing and can be determined through load tables supplied by the roofing manufacturer. Structural metal roofs, because they are designed as part of the "structure" of the building, are generally manufactured from thicker metals. Structural metal roofing is usually intended for applications such as industrial facilities, strip malls, barns, warehouses, storage units, and metal buildings.

Because of the potential for direct contact between the backside of the roofing panels and warm, moist air inside the structure, special ventilation issues can exist with structural metal roof systems especially on smaller buildings. If a structural metal roof is ever installed on a church without decking, it is critical that ventilation and condensation control be taken into consideration. When metal roofing is installed this way, there must be, at the minimum, a vapor barrier behind the ceilings, adequate insulation, and strong attic ventilation. If these things do not exist and work in conjunction with one another, disappointing results will follow.

### STEEP VS. LOW SLOPE

Roof pitch factors are stated in terms of rise over run. For example, 3:12 refers to a roof that is framed such that, for every 12' the roof goes back horizontally ("run"), it will "rise" 3' vertically.

The industry defines "steep sloped roofing" as anything with a pitch of 3:12 or greater. Virtually all metal roofing products are appropriate on steep sloped applications; however, 3:12 is usually the minimum pitch for which shake, shingle, slate, and tile profiles are applicable. In heavy snow load areas, some shake and shingle products are appropriate only on pitches of 4:12 and higher.

Most standing seam profiles are applicable on certain low slope roofs, usually down to 2:12 pitch. Any roof with less than a 2:12 pitch requires a mechanically seamed profile to help ensure water tightness. Typically used on commercial buildings, availability of these products may be limited.

It is not at all uncommon for churches with a combination of steep and low-sloped roof sections to use a combination of metal roofing products to appropriately accent the different roof configurations. For example, a metal shingle profile may be used for the majority of the roof, and a standing seam profile may be used for a portion of the roof, such as an overhang over a porch that is low-sloped.

Under absolutely no circumstances should a metal roofing product ever be used on a roof of lower pitch than that recommended by the roofing manufacturer.

#### THROUGH-FASTENED VS. CLIP-FASTENED SYSTEMS

Through-fastened panels refer to metal roof systems in which the screw or nail that secures the metal roofing to the deck, purlin, lathe, etc., actually penetrates through the panel itself. Conversely, clip-fastened panels utilize a specialized clip system that attaches to the panel or shingle. The fasteners are then driven through the clips and therefore have no direct contact with the metal panels themselves.

In most cases, clip-fastened panels are designed so that the clip and fastener are concealed (concealed fastener system). The fastener can also be concealed on certain types of through fastened panels as well. Some products with concealed fasteners may use a combination of through fasteners and clips. Both through-fastened and clip-fastened systems may be architectural or structural.

Through-fastened panels that utilize exposed fasteners are most common. In many cases, the exposed fastener is simply driven through an overlap between panels as well as through other strategic locations as specified by the roofing manufacturer. Exposed fastener systems are usually lesser-quality systems and therefore subject to lesser warranties than concealed fastener systems. The reason for this is that exposed fasteners are susceptible to the elements and tend to break down and fail much sooner than concealed-fastener panels. Exposed fasteners are normally self-drilling screws with a hex-head drive. These screws will typically have an oversized “cap” head protecting a neoprene washer for water tightness. The screws will normally be painted to match the roof system. Although the screws are self-drilling, most installers will pre-drill holes in the roofing from the backside to ensure proper placement. Over time, as the metal panels expand and contract, a great deal of pressure is put on through-fasteners, often wallowing out the holes in the panels or fatiguing the fasteners and causing them to back out or even break.

Concealed-clip fastener systems are usually regarded as higher quality and more functionally sound for another reason; because metal expands and contracts when it is subjected to temperature changes, sometimes panels have a tendency to “wrinkle” or “oilcan” as it is called in the industry. The most common cause of oilcanning is fasteners that are driven too tight and are therefore not allowed to move when they expand and contract. If the panels are secured with fasteners that are driven through a clip and not the panels themselves, the result is a system that “floats” over the deck and is much less susceptible to oilcanning. This also creates far less concern for fastener fatigue. With concealed fasteners, the fasteners are often screws for longer roofing panels and nails for smaller “modular” sized shingles. Other causes for oilcanning can include an uneven surface of the original roof deck, improper forming of the roofing and, quite often, unavoidable stresses and chemical composition differences inherent to the metal itself.

## THE BOTTOM LINE

It is important to choose the proper product classification for the project at hand. This choice is quite clear when it comes to choosing a product that is appropriate for the pitch of the roof. Additionally, products installed without decking can have condensation problems when used on homes and churches. Most, but not all, concealed fastener systems in some way have allowance for the natural expansion and contraction of the panels. This can ensure a more attractive and longer lasting roof system. On products with exposed through-fasteners, the weak point tends to be the resulting hole which, over time, can be susceptible to leaking and, with ferrous metals, rusting as well. Property owners who want to make sure that their metal roof investment brings the most value possible to them will opt for systems with concealed fasteners.



## PROFILES

*There are literally dozens of different “looks” and “feels” that can be achieved with metal roofing—from the traditional standing seam look, to the old-world tile look or the beauty of shakes, to the more agricultural corrugated look. The variety of attractive metal roofing profiles is one of the great advantages of the industry. No matter what the style or look of your church, there is almost certainly a metal roof system out there that will complement it perfectly! Unfortunately, the variety of profiles is sometimes one of the industry’s detriments as well because it can lead to improper products being used for less than ideal applications. The following section should help you make an informed choice about the product that will work best, both aesthetically and functionally, for your building.*

### SHEET ROOFING

Sheet metal roofing is available in many different profiles, all going by different names. “5V” Crimp, “R” Panel, corrugated roofing, face-fastened panels, through-fastened panels, or screw down panels are some of the synonyms for the style of metal roofing that is encompassed under the umbrella term “sheet.” Metal sheet roofing is manufactured primarily from galvalume or galvanized steel in thicknesses that often vary between 26 and 30 gauge. The defining characteristic of all sheet roofing is large panels (or sheets) of varying widths and lengths that overlap and have exposed fasteners. The fasteners are driven through the overlapping portions of the panels, as well as in other strategic locations and into the roof decking, purlin, or spaced sheathing below. A neoprene washer is located beneath the head of the fastener to ensure water tightness.

One common type of sheet roofing is the 5V Crimp pattern. It has five small V crimps per panel. Other corrugated patterns of sheet roofing give a more “wavy” look. The look of any of these products is sometimes construed as an agricultural or rural look. Sheet roofing can also give a historical look, particularly if used unpainted.

Sheet roofing can be installed painted or unpainted. Because sheet roofing is often chosen as a more economical type of metal roofing, the paints used on sheet metal roofing are often lesser quality. This saves even more money on the overall system. Generally, sheet roofing systems should be examined closely before being selected for churches looking for a lifetime roof. While most sheet roofing is still higher quality than many traditional roofing materials, it contrasts sharply with some of the more technologically-advanced metal roofing options available to church leaders who want to make lasting investments in their facilities.

Sheet roofing is the most economical form of metal roofing. It is also one of the easier-to-install types of metal roofing. The disadvantages of sheet roofing are that it’s not as long lasting, both functionally and aesthetically, as some other types of metal roof systems. Additionally, especially when installed over heated structures, the screws in these panels loosen over time, causing leaks and other deterioration.

### STANDING SEAM

Standing seam is probably the most recognizable profile of metal roofing for both commercial and residential projects. The popularity of standing seam has grown so much in recent decades that many people automatically assume that standing seam is implied by the term “metal roofing.” Standing seam provides a contemporary look. One key to choosing the right standing seam depends on the actual dimensions of the roof. More often than not, church roofs are smaller, more compact, and more complex than commercial roofs. For this reason, it’s advisable to select a standing seam roof with a relatively small panel width – usually around 12 inches. Wider panels will present a more commercial look to the roof, obviously a condition to be avoided when selecting a metal roof for a church.

As mentioned in the section on through-fastened vs. clip-fastened systems, standing seams can be either through- or clip-fastened. Through-fastened standing seam systems are less common and utilize a fastening “flange” that runs the length of the panels. The fasteners are driven through this flange and then concealed by the subsequent panel. So, although the fastener is concealed to the elements, fastening still occurs directly through the panels. These systems are more cost effective options, but since most quality standing seams used residentially are continuous panels—meaning the panels are custom formed to the length of the rafter—using these through-fastened panels is not recommended on longer rafter lengths. The reason is that the longer the panel, the more it will expand and contract, and the more likely to fatigue fasteners, “wallow out” fastener holes and also to oilcan. These through-fastened panels are a good option, however, for shorter runs such as porch accents or bay windows.

For longer runs, the better option is a standing seam system that utilizes a clip system. The clip should be manufactured from a similar metal as the standing seam itself, or from a metal like stainless steel that is not conducive to galvanic action between dissimilar metals. The clip is fastened to the roof deck so that the panels are allowed to “float.”

This helps to ensure that the system will maintain its water tightness much longer, and also its aesthetics, as oil canning will be less of a concern. For longer runs, or even for shorter runs downhill from longer roof runs, it is also recommended that a system with a higher rib is used. The rib is the portion of the standing seam that gives it its dimension, and is also the joint of the two adjacent panels. Higher ribs will give the panels more capability to carry water down the entire rafter length, and thus prevent water from spilling over the panels and possibly backing up under an overwhelmed rib or other flashing.

Standing seam roofs are most commonly manufactured from galvanized or galvalume steel and range in gauge from 18 for the heavier structural products to a lighter 26 or even 28 gauge for simpler projects. Gauge 24 and 26 are the most common for steel standing seams. Some high quality standing seams are manufactured in heavy gauge .032” thick aluminum.

Many standing seam systems come with an entire array of preformed flashings. These flashings help reduce installer error and help ensure a watertight roof for many decades to come. Flashings for true standing seam systems usually need to be custom-made for each job in order to exactly meet the pitch and other geometry of each individual roof.

### SHAKE, SHINGLE, TILE, AND SLATE PROFILES

The growth in demand for standing seam in the church roofing market over the past few years may be exceeded only by the growth in popularity of the “new metal roofs” – the shake, shingle, tile, and slate profiles. These products provide the benefits of metal roofing along with the looks of something very traditional and timeless. The different types of “modular” panels can vary greatly in terms of look and use.

Metal shakes are designed to mimic the look of hand split cedar shakes. While many property owners select these shake systems because of their resemblance to wood shakes and also because of the long-term performance metal provides, many other property owners enjoy these specialty metal shake systems for their own unique and distinctive look.

These modular panels come in various sizes with common dimensions of 2' x 1' and 4' x 1' and are usually fastened to the roof deck with a concealed clip system or a nailing flange formed into the top of the shingle. Shake and shingle facsimile profiles are installed on the roof in a staggered pattern to avoid vertical line repetition. The shake systems are usually more “high-profile” than shingle systems, meaning that they are designed with a little more dimension and texture. Many times, this added dimension to the shingle allows it to be installed directly over previous roof layers, even some thin wood shingles. Metal shakes are usually manufactured from 26 or 28 gauge steel, or .019” or .024” thick aluminum. Steel metal shakes are commonly coated with a post-forming stone coat or Kynar powder coat. This helps seal the edges in areas where the zinc or zinc/aluminum alloy coating has been spread thin over areas of tight bends. Some manufacturers also offer aluminum shakes with the special post-forming coats, but in the case of aluminum, these coats are selected more for aesthetic reasons than to ensure the functional soundness of the system.

Most metal shake systems come with a complete line of pre-formed flashings which usually includes hip caps, ridge caps, gable trim, sidewall flashing, eave starter, and valley. These are typically universal flashings designed to work with any roof pitch. Higher-quality metal shake systems utilize an open valley system to help ensure that leaves, ice, pine straw, etc. do not obstruct the valley and cause water to back up under the panels or the valley itself. It is usually a good idea to inquire with your contractor about the type of valley flashing used with the metal roof system you are considering. Metal shingles are similar to metal shakes except with a lower-profile design.

Also since metal shingles look more like dimensional standard shingles, they are chosen to blend in with a more modest neighborhood look. Like the shake profiles, the shingle metal roof systems are modularized panels fastened to the roof deck most commonly with a clip system, or sometimes with a nailing flange formed into the top of the shingle.

Metal tile profiles come in a wide variety of looks and feels, from the exotic Mediterranean barrel tile look to the stately S-Serpentine look. Most tile profiles are through-fastened usually with exposed fasteners, and some utilize a batten grid attached to the roof deck to which the panels are attached. Most metal tile systems are made in large sheets that typically stretch from eave to ridge. Fewer seams and quicker installation are a plus, but waste can be dramatically increased with such systems.

Metal slate profiles are manufactured in steel, aluminum, and copper to replicate the look of natural slate. The advantage of metal facsimile slate profiles is that they are about thirty to fifty percent the cost of real slate, and are also much, much lighter than traditional slate – which can help prolong the life of older buildings.

Some other more exotic profiles, such as diamond shapes, scalloped, and flat tiles are available in metal roofing.

## THE BOTTOM LINE

Those considering a metal roof have a wide variety of looks to choose from. This allows them to choose a roof system which matches the design of their church. Each different roof design has its own characteristics and attributes so it is also important for consumers to read this guide and understand those aspects of their purchase as well.

## OTHER THINGS YOU SHOULD KNOW

*Selecting and purchasing a new roof is a significant event. Property owners who do their research and have complete information available to them are the ones who end up making wise investment choices when it comes to roofing. Following are several concerns which frequently arise during the roof decision process.*

### PROPER INSTALLATION

As is the case with any building material, metal roofing must be properly installed in order to be successful. Church leaders are encouraged to fully investigate both the metal roofing materials they are considering and the contractors they are considering for installing those materials. This investigation should include looking at past jobs and talking with past customers. If the manufacturer and/or the contractor are unwilling or unable to share information with you concerning proper installation procedures, it might be wise to find different suppliers. Check also for proper insurances and licenses, and make sure the crew that will be installing your roof is the same crew that was on the reference jobs you visited.

### INSTALLING OVER EXISTING ROOFING MATERIALS

Due to their very low weight, many metal roofs can be installed over existing roofing materials. This is particularly the case when going over old composition shingles. Additionally, the formation of many of the heavily profiled shake and tile profiles of metal roofing can even permit installation over wood shingles or wood shakes.

Before deciding to install over an existing roof, the manufacturer or an experienced contractor must be consulted, as weight is not the only issue. In many cases, building codes prohibit more than two layers of roofing, although building inspectors have been known to waive that restriction for metal roof layover installations. If there is an existing weight problem with the structure or if there is question as to the integrity of the structure or roof decking, those issues must be addressed before installing over the existing shingles.

In some cases, particularly with wood shingles and shakes, the old roofing must be removed from the edge perimeter of the roof and even the lumber can be removed and replaced with fresh lumber before proceeding with the roof installation.

Metal can also sometimes be installed over existing slate and asbestos slate roofs though, again, the manufacturer or an experienced contractor should be consulted. Existing tile roofs and, in most cases, existing metal roofs, need to be removed prior to installation of the new roof.

### COATINGS

In most cases, the coatings on metal roofing are applied before the manufacturer or contractor even see the metal. The finishes are applied at roll-coating facilities where the metal is cleaned, chemically etched, coated, and baked. In some cases, a “print coat” is involved as well, allowing for these finishes to have an attractive multi-hued appearance. After coating, the coiled metal is shipped off to the manufacturer who fashions it into the various profiles.

The finishes used in the metal roofing industry consist of three main components: 1) the pigment (also referred to as “solids”), which gives the coating its color, 2) the solvent, which is the liquid medium that is baked off after the coating has been applied, and 3) the resin, which binds the pigment to the surface after the solvent is gone. The finishes used in the metal roofing industry are classified by the quality of their resins.

There are three main types of coil-applied baked-on metal finishes used in the North American metal roofing industry today. Water-based acrylic emulsions are one of the most common and most environmentally-friendly coatings. They are typically two-coat systems consisting of a primer coat followed by a topcoat. They do not carry a warranty for fade or chalk.

Another coating type is polyester, which includes a number of formulations such as siliconized modified polyester (SMP). Like acrylics, polyesters are lower cost finishes and also subject to fade and chalk over time. SMP finishes are higher quality than more generic polyester paints, but still won't achieve the performance of the standard for today's metal roofing industry: polyvinylidene fluoride (PVDF).

PVDF coatings are usually sold and applied to metal as the trade names Kynar® and Hylar®. These are two-coat systems with a primer coat followed by a topcoat. If the formulation is made up of the standard 70% Kynar® or Hylar® resin, it can use the full Kynar 500® or Hylar 5000® trade names. These trade names are used so that consumers, contractors, and architects can tell for sure that the finish on the metal roof system they are selecting is of the highest quality possible.

There is no substantive difference between Kynar® PVDF resin and Hylar® PVDF resin, except that they are manufactured by two different companies, and thus marketed under two separate trade names. Kynar 500® / Hylar 5000® finishes usually carry a 30 year fade warranty up to five Delta E units. A Delta E unit is the smallest recognizable color shade shift seen by the naked eye. PVDF represents the highest quality coatings available for use on metal roof systems. Most metal roofing manufacturers and contractors would never recommend selecting a residential product that uses something other than a PVDF – Kynar 500® / Hylar 5000® finish.

In addition to these base coating options, some steel shake, shingle, and tile profiles include an extra layer of coating to add both beauty and functionality to the products. This type of coating is applied “post-forming,” which means after the profile is fashioned by the manufacturer. The advantage of these post-forming coats, in addition to creating a gorgeous look, is that they can help seal off any cracks or fissures in the zinc or zinc/aluminum coating over the steel that may have occurred during the fashioning of the profile. The two main options here are stone-coatings and Kynar® powder coatings.

Stone coated steel products (also called “aggregate” or “granular” coated) are used very extensively for residential applications, primarily on the West Coast and in the Southwest. These coatings present a multi-hued, textured appearance and are primarily used on shake and tile profiles. The coatings consist of ceramic-coated sand or stones, which are bonded to the base steel and then covered with a clear acrylic coating. These coatings can streak and stain with mold and mildew.

The other post-forming coating option, the Kynar® powder coat, is an electro-statically applied Kynar® powder coat that is then baked into the base Kynar® coat. The result is a beautiful, long-lasting, scratch-resistant, multi-hued coat that represents the pinnacle of modern coating technology. This coat is called the ThermoBond Textured Finish.

The newest development under the “coatings” headline is probably the most exciting due to its potential impact on the entire roofing industry: reflective pigment technology. These specially formulated pigments, which were first developed by the military in order to help camouflage tanks against infrared detection, are able to reflect a much larger percentage of the sun’s rays even in darker colors. This means that less heat is absorbed into the attic space, and therefore less energy is required to keep the structure at a comfortable temperature during the hot summer months. The end result is a reduction in the building’s energy bills!

Please note that all galvanized steel, galvalume, and aluminum roofs should have some sort of protective coating on the backside of the metal as well. It is acceptable for this to be a low cost coating. In many cases, it might be colorless.

#### SOUND TRANSMISSION

Most residential metal roofs are installed over solid decking and there is usually an attic space beneath that. These factors help to reduce noise transmission and avoid objectionable noise from rain hitting the roof. Additionally, the more heavily profiled metal roof styles are very good at breaking up any “sound board effect.” Whereas rain may create a slightly louder sound hitting metal roofing than other products, it will not create a “tinny” sound. If you hear rain noise now, you will hear it with a metal roof though the tone will be different.

#### VENTILATION

In most cases, metal roofing does not increase the need for attic ventilation. However, it also doesn’t decrease it. The fact is, buildings are being built more airtight today than ever before. This is resulting in moisture getting trapped inside the house.

This moisture generally migrates to the attic and needs to be exhausted out year-round, as does the excessive attic heat which can build during the summer months. The most proven method of venting is a combination of soffit vents and a roof ridge vent. Most metal roof systems will offer some sort of ridge vent option. If moisture is not vented from an attic, unhealthy and damaging conditions including mold and rot can occur. Proper attic ventilation is also the key way to avoid winter ice dams.

In the rare instances when structural metal roofing (i.e., metal roofing that is installed over purlin or lathe rather than solid decking) is used on a church, good ventilation is critical to prevent the collection of condensation on the exposed bottom side of the roofing panels.

#### WALKABILITY

Most metal roofs can be safely walked without damage. Inquire with the roofing manufacturer as to the correct methods for foot traffic on the roof. Some of the shingle and shake style metal roofing products have optional foam backers for even greater rigidity and walkability.

#### ENERGY EFFICIENCY AND ENVIRONMENTAL IMPACT

Metal roofing is increasingly being recognized for its many “green” benefits. The durability of metal roofing makes it a very sustainable product. Additionally, should it ever need to be removed in the future, it is 100% recyclable.

Most metals used in roofing have very high initial recycled content. This is as high as 95% with aluminum, and lower with other metals. The production of metal from recycled stock also has very low embodied energy in comparison to producing metal from original ores.

With the onset of various “cool roofing” initiatives in the country, metal is being recognized for its ability to keep buildings cooler in hot weather. This is done through a combination of reflectivity and emissivity, often enhanced by coatings on metal roofing. Additionally, shake, shingle, and tile profile metal roofing products have minimal contact with the building’s structure, blocking heat transfer by conduction as well.

Finally, the ability to install metal roofing over old roofing materials means that landfills are not being burdened with the old roofing.



## WARRANTIES

Metal roofing has a long history. Many metal roofs can be found in the United States today which are 100+ years old. Those roofs did not have the benefit of today's coating and manufacturing technology. Metal roofing manufacturers provide warranties covering such things as manufacturer's defects, product integrity, and coating integrity. The coating warranties may include such things as fade and chalk. Church leaders are reminded though that, as is the case with all building materials, the actual installation workmanship is warranted by the installing contractor, not by the product manufacturer. Compare warranties both from the product manufacturers and the installing contractors before making a final choice.

## UNDERLAYMENT

Most contractors, out of force of habit, use asphaltic-based 15-lb or 30-lb felt underlayment on any type of project, no matter the roofing type. While this is usually enough to satisfy a building inspector, many metal roofing manufacturers now support an alternative to the traditional felt underlayments. New polymer underlayments are beneficial in that they are much lighter and easier to install for the contractor. Also, in the event of a construction delay, they can be left exposed for up to three months with no ill effects.

These polymer underlayments also last much, much longer than asphalt-based 30-lb felt. In the unfortunate event of a breach in the roofing material or a flashing, it's good to know that the roof's second line of defense, the underlayment, is going to handle the problem. This might not be the case if using the traditional 30-lb felt, especially with standing seam. In hot weather, the asphaltic-based 30-lb felt may stick to the backside of the standing seam panels, and when the panels expand and contract, the underlayment can tear. Most responsible contractors, who use 30-lb felt with metal roofing applications, will use a "slip-sheet" (most commonly red rosin paper) between the 30-lb. felt and the backside of the panels to keep them from sticking together. With the use of the polymer underlayments, this slip-sheet is not necessary.

Additionally, many contractors will use specialized self-adhering ice and water barrier underlayments near the eaves and down the length of all valleys. In colder climates with heavier snow loads, these products may be used over the entire roof. Building codes in certain areas will mandate the use of at least some of this type of underlayment material.

In all cases, the underlayment used beneath metal roofing should have a smooth, non-granulated surface. Granulated surfaces can cause damage to the back of the metal roofing panels over time.

## FURTHER INFORMATION

*Where do I go from here?*

Choosing the right metal roof can be one of the best things you will ever do for your church and for future congregations. Churches have a long history of structures that are durable and lasting. This makes far more sense than a structure which continually requires expensive investments in repair and maintenance costs. Making wise decisions now that ensure the ability for your church to fund Kingdom-building ministries in the future is a legacy that your entire church will celebrate.

The contractor who provided you with The Church Leader's Guide To Roofing is available to provide further information and assist you in understanding today's roofing options. Evaluating those options on a cost per year basis is often a major part of the church leader's decision process. The end result is a decision that has eternal payback.