



ROOFING TRENDS

BY VINCE HILL

Since the turn of the century, there have been many changes in the low-slope roofing industry. What has occurred? What is causing it? How has the roofing industry responded? What are the driving factors? And what is causing the roofing industry to transform so dramatically? There is no smoking gun that can account for the shift in roofing other than a confluence of economic, legislative (code), and environmental issues that are rearranging the roofing landscape.

GROWTH OF SINGLE-PLIES

In 2000, built-up roofing (BUR) was the leader of the low-slope roofing market, with a 45.7% market share.¹ Now BUR accounts for only 6% of the new low-slope construction roofing market and 9% of the reroofing market of contractors who are members of the National Roofing Contractors Association (NRCA).² Conversely, thermoplastic polyolefin (TPO) had an 11.6%³ share in 2001 and currently commands 40% of the new low-slope construction market and 30% of the reroofing market among NRCA members (Figure 1.) The big winner is TPO, but how and why?

The growth of TPO over the past 15 years was heavily influenced by the dramatic economic swings of the first decade of this millennium. We witnessed two momentous

economic downturns sandwiching a dramatic growth in commercial construction. Starting in 2003, the real estate market in the U.S. expanded dramatically. Between

2001 and 2008, there was a huge inflow of capital into real estate (Figure 2). All types of construction were occurring, from homes, to schools (government), to shopping centers,

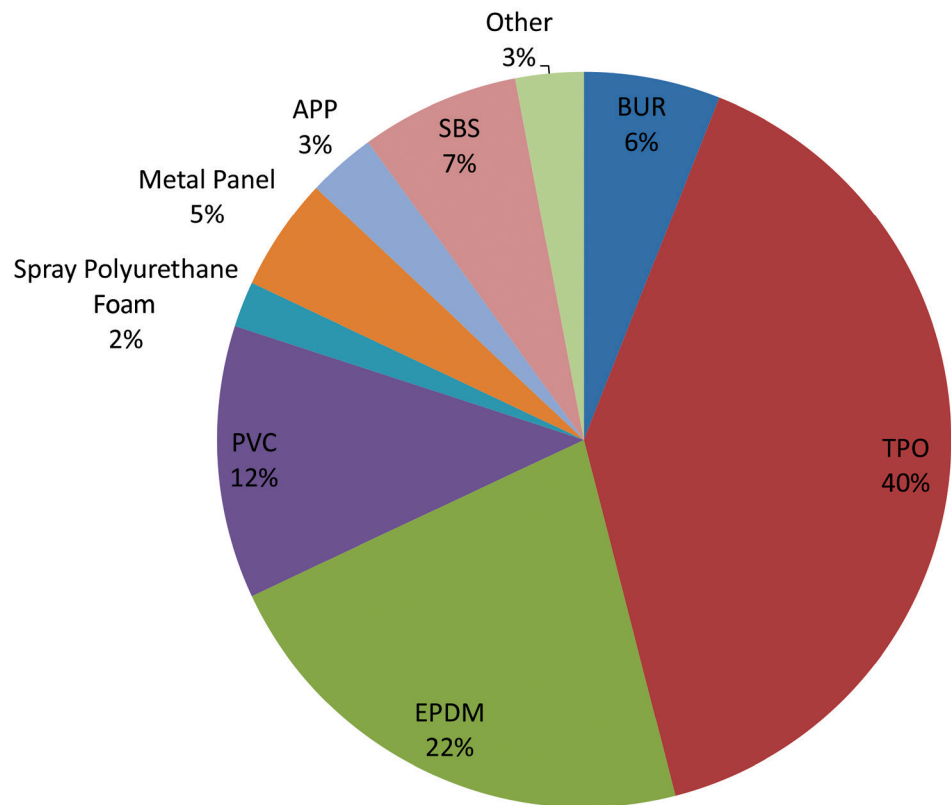


Figure 1 – Product mix of new low-slope construction sales by roof system of contractor members of the NRCA, 2016.

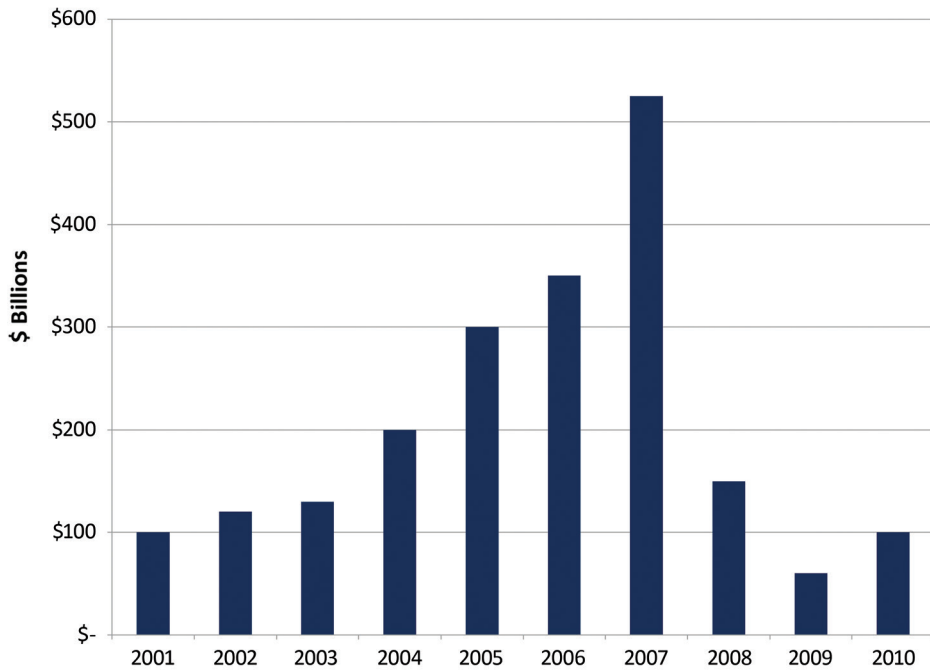


Figure 2 – Commercial real estate transaction volume. Source: Real Capital Analytics.

to mega warehouses. The government sector predominately continued utilizing asphalt-based systems, whereas the commercial real estate sector, which was focused on return on investment (ROI), looked towards other roofing systems to lower their cost of construction.

During this construction boom, there was a huge demand for skilled laborers throughout the construction industry. Because of the growth in construction, demand for qualified, trained tradesmen outstripped the roofing industry’s ability to supply. The shortage of skilled roofers, therefore, became a major problem.

Asphalt-based systems require the contractor to install multiple layers (plies) of roofing to build the roof. Single-plys, as

their name suggests, require only one ply of roofing material. Therefore, much less labor per square foot is required to install a single-ply system than an asphalt system.⁴ The redundancy that is inherent in a BUR or modified system was not as valued to the commercial real estate industry as was the ROI. Because of the economic boom, the low unemployment rate, and the need for higher ROIs, single-ply roofing systems—and, particularly, TPO—became the roofing systems in highest demand.

LONGER WARRANTIES

In 2008, just as the economic crisis started to dramatically impact the construction industry, a shift was occurring with the length of roof warranties and the gauge of the membranes. Prior to 2008, the majority of TPOs installed were 45-mil; but in 2008, that balance shifted to 60-mil membranes.⁵ The average length of TPO roof warranties prior to 2008 was around 12 years. Now TPO warranties are averaging over 17 years.⁶ Many TPO manufacturers only provided warranties in excess of 15 years with 60-mil or thicker membranes. Commercial real estate building owners were demanding longer-term roof warranties. Buildings without roof warranties were being discounted by the buyer. Often lending institutions would not even provide financing unless the building had a roof warranty.

Longer roof warranties allow the building owner a greater window in which to divest the building without being penalized at the sale. Owners that are long-term holders of the buildings understood the benefits of thicker membranes and longer warranties. There is a clear demand by the customer and a willingness by the manufacturers to increase the length of roof warranties. These thicker membrane products last longer and are less susceptible to incidental damage, which is good for the manufacturer and the building owner.

HD COVERBOARDS

High-density (HD) polyisocyanurate boards have become popular within the past ten years. Their light weight, ease of handling,

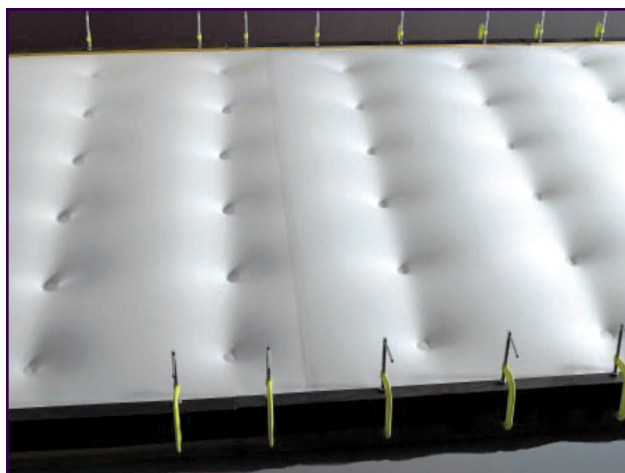


Figure 3 – Induction welding.

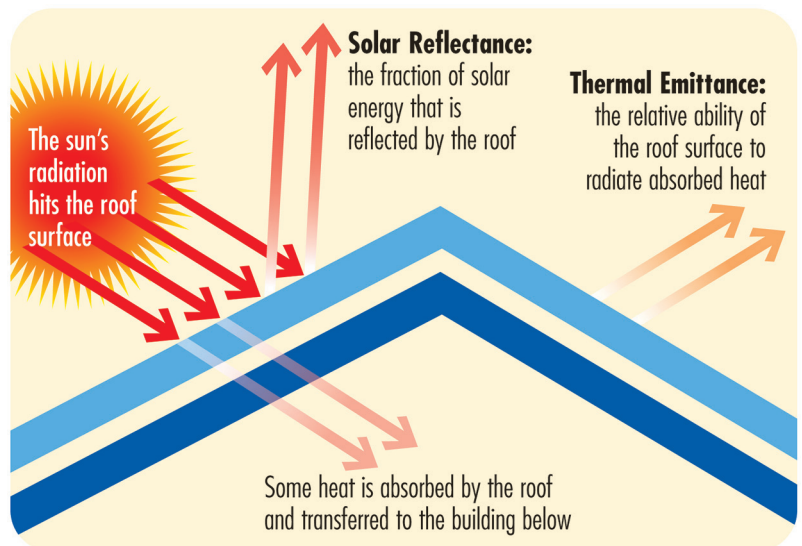


Figure 4 – Solar reflectance and thermal emittance. Source: Cool Roof Rating Council.

and speed of installation compared to some other cover boards are attractive qualities. These characteristics give them an economic advantage over traditional cover boards in regard to installation costs. Gypsum-based cover boards are heavy, difficult to cut, and susceptible to degradation when wet.

Manufacturers design the new HD boards to meet many of the characteristics of previous cover boards but without their negative attributes. These boards come with closed-cell insulation and glass-coated fabric facers, therefore avoiding potential mold issues. On the downside, they do not have the same compressive strength of the gypsum-based materials, but can be more durable than other coverboards. HD boards have compressive strength between 80 and 125 psi, whereas gypsum-based cover boards can achieve compressive strengths of 800 psi.

INDUCTION WELDING OF THERMOPLASTICS

Another innovation that is gaining in popularity is induction welding of thermoplastics. Induction welding is the use of an electromechanical field to heat a bonding plate located under the thermoplastic membrane and to weld it to the membrane (Figure 3). This is considered a nonpenetrating attachment method. From an economic and labor standpoint, contractors would like to use the widest single-ply sheet possible when installing mechanically attached systems. This reduces the amount of seams, fasteners, and labor required to complete the roof. However, in order to meet certain uplift requirements, the spacing of the fastener may preclude the contractor from using the widest sheets available. With induction welding, the attachment of the membrane is accomplished across the entire sheet, not just at the membrane's edge. This distributes the uplift forces over more structural members, allowing it to withstand greater uplift pressures. Consequently, a contractor can use wider sheets, fewer fasteners, and less labor and still meet the design pressures for the roof. These productivity gains and cost reductions are of particular interest to building owners and roofing contractors.

As a case in point, a building owner recently shared bids regarding a new 750,000-sq.-ft. warehouse. The contractor quoted installing a 60-mil induction welded system for the same cost as a 45-mil mechanically attached system. The reduced labor associated in installing an induction-welded system allowed the owner to

opt for a thicker membrane roof, which the building owner found as a great value.

REFLECTIVITY

Another factor driving thermoplastic growth is the "green" movement. Global warming or climate change has become a focus point for many individuals and governments. Electrical blackouts caused by the increased use of air conditioning (AC) had people looking at ways to reduce the electrical demand and carbon footprint of a building. A relatively easy and passive way

to reduce the AC demand was to design roofs that reflected the solar heat away from the building; thus, reflective and emissive requirements and codes were created. Solar reflectance is the fraction of solar energy that is reflected by the roof. Thermal emittance is the relative ability of the roof surface to radiate absorbed heat (Figure 4).

In 2005, California adopted building energy efficiency standards that required "cool roofs" on low-slope, nonresidential roofs as part of the already-existing Title 24. Around the same time, Chicago, Illinois,

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Reflectivity & Emittance Programs

Code or Program	Description of Code	Solar Reflectance New	Solar Reflectance Minimum	Thermal Emittance	SRI Minimum
California Title 24 Building Energy Efficiency Standards (2013)	Mandatory for new construction and major reroofing		0.63	0.75	75
Energy Star			0.65 New 0.50 (3 years)	N/A	N/A
USGBC LEED v4	Voluntary certification program				82 New 64 (3 years)
City of Chicago Energy Conservation Code	Mandatory city wide energy code		0.72 New 0.50 (3 year)		

Figure 5 – Reflectivity requirements.

ASHRAE 90.1 R- Ratings per Climate Zone

CLIMATE ZONE	ASHRAE 90.1-2004	ASHRAE 90.1-2007	ASHRAE 90.1-2013
1	10	15	20
2	15	20	25
3	15	20	25
4	15	20	30
5	15	20	30
6	15	20	30
7	15	20	35
8	15	20	35

Figure 6 – ASHRAE R-factors.

mandated cool roofs. Additionally, the U.S. Green Building Council (USGBC) created the Leadership in Energy and Environmental Design (LEED) certification program for buildings that are designed, constructed, and operated towards sustainability. This program assigns points for certain types of designs and provides a construction point for white roofs. Many designers and building owners determined that one of the easiest and least expensive ways to achieve credit toward LEED ratings or comply with the standards was through installation of a TPO or PVC roof. Though PVC and TPO come in many colors, by far the most prevalent color is white. The chart in Figure 5 shows the various codes and requirements.

Different modified bitumen (modbit) manufacturers created white cap sheets to meet code requirements and market demand. There are many applications where a modbit system is a better roofing system choice. Manufacturers have created modbits using white granules, synthetic chips, trilaminate films, and acrylic coatings. These modbit cap sheets are required to pass Energy Star, Title 24, and LEED

requirements if they are expected to be used where the code requires reflectivity. Modbit systems have an important place in the roofing industry but are commanding a shrinking portion of the roofing market because of their higher installed cost compared to single plies.

INSULATION

While the green movement influenced the color of the roof, it also influenced the codes relating to building insulation. Codes for continuous roofing insulation above the deck have dramatically increased the amount of insulation required. The table in Figure 6 demonstrates the increase in insulation required by the ASHRAE 90.1 codes. Between ASHRAE 90.1-2004 and ASHRAE 90.1-2013, the required insulation has doubled in some zones in less than a decade. This increase impacts the installed cost, but it should decrease the overall operational energy cost of a facility.

ADHESIVES

New adhesives have been created over the past decade to adhere these new single-ply products. With many hot kettles collecting rust in the warehouse yard, other nonpenetrating attachment methods were needed. There are several markets throughout the U.S. that prohibit high volatile organic compound (VOC) adhesives (Figure 7). To address this, manufacturers have developed low-VOC and water-based adhesives, as well as self-adhered membranes. These products are designed to be used anywhere there are low-VOC requirements. These products may be used where regulatory requirements limit or exclude the use of solvent-based adhesives, but most are constrained or impacted by low temperatures and high humidity. These products usually take longer to install, if they can be installed at all at low temperatures. Some manufacturers have created adhesives and self-adhering membranes that have great

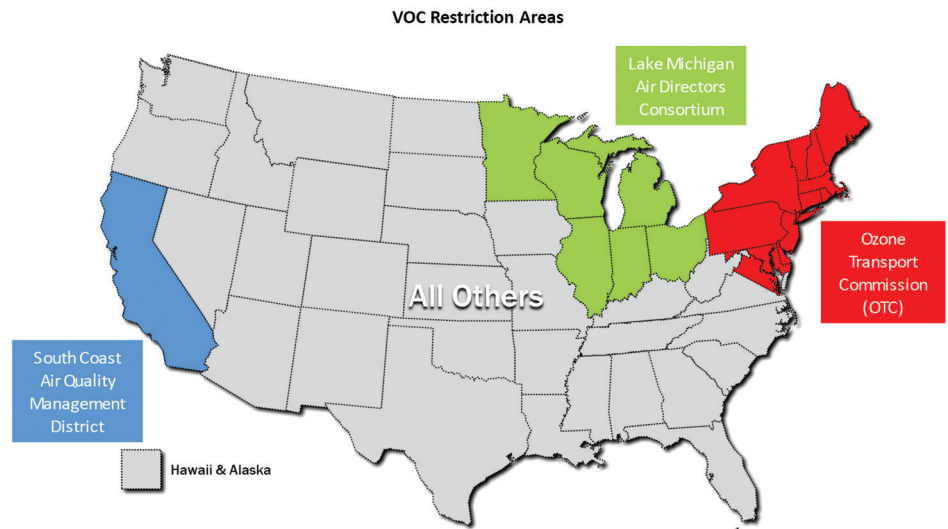


Figure 7 – VOC restriction areas in the U.S.

Cumulative Solar PV Capacity through Q2 2016

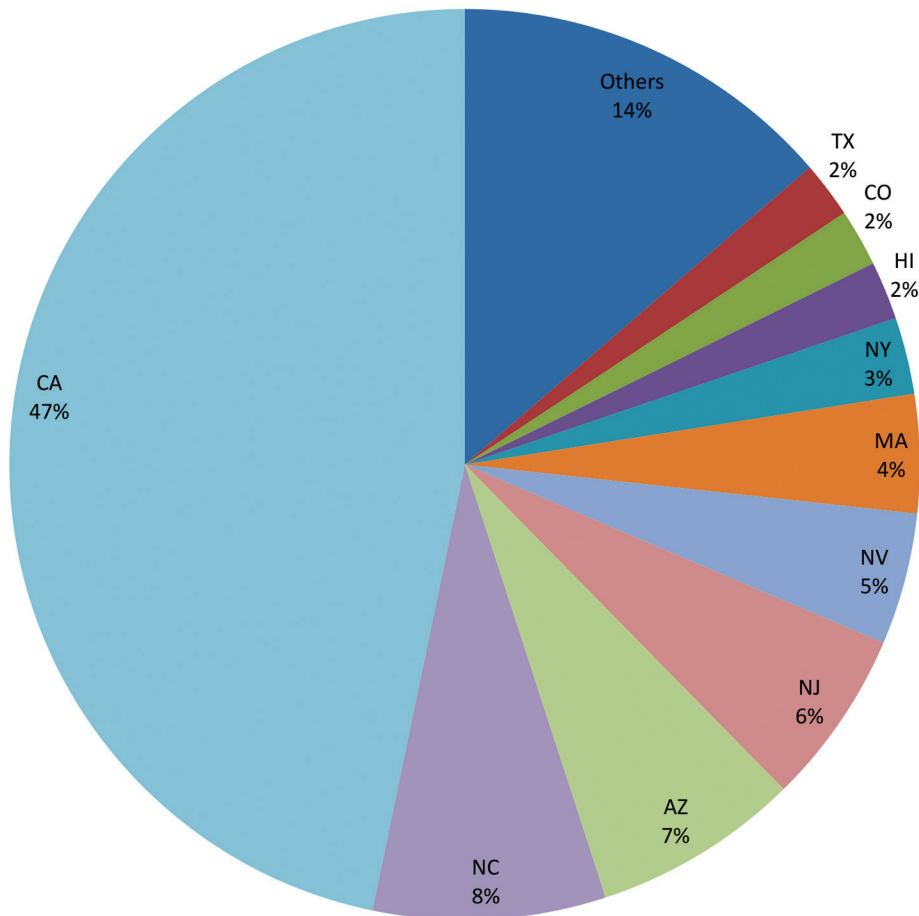


Figure 8 – Cumulative solar photovoltaic (PV) capacity through Q2 2016. Source: SEIA.

temperature installation parameters and can increase the productivity of the roofer.⁷

SOLAR

Solar projects in the United States have grown at a compounded annual rate of over 60% for the last ten years. This growth has occurred as the installed price of solar has decreased 70% over the same time period. Solar adoption has not been uniform across the U.S. This is evident with California having close to 50% of the U.S. solar generation (Figure 8). Whatever the reason for solar being adopted, many of these systems are being installed on commercial roofs.

There are two types of systems being installed: “thin film” and “crystalline.” They are being installed through penetrating mounting systems (crystalline), ballasted nonpenetrating systems (crystalline), and self-adhered or bonded systems (thin film). Solar energy generates “clean electricity” for the building owner or utility provider. It is not a product that protects the occupants of the facility from the weather. Most roofing manufacturers have policies regarding the

installation and maintenance of solar over their membranes. Some roofing manufacturers have dedicated teams to assist building owners with their solar projects.

There have been numerous articles published in *RCI Interface* addressing solar collectors. A search on “solar” in the RCI Technical Articles Library (<http://rci-online.org/publications/tech-library/>) returns 179 results, which shows that solar is a very hot subject. With the declining prices of solar installations and companies focused on their “carbon footprint,” solar projects will continue to cover many more roofs.

VEGETATIVE

Another trend tied to the green movement is the increased use of vegetative roofs. Vegetative roofs (Figure 9) have been installed in the U.S. since the 1970s, but have seen limited use until recently. But now vegetative roofs are being installed in locations where the municipalities are mandating a reduction in stormwater runoff. The soil and plant materials on vegetative

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Figure 9 – Vegetative roof system.

roofs absorb rainwater during storms and release it into the environment at a slower or indirect way, thereby reducing the quantity of water being discharged into the storm system.⁸ This is important because in older cities, the stormwater and sewage systems are often combined. During heavy downpours, these systems are taxed beyond their ability to safely move sewage to the

treatment plants, and untreated sewage gets dumped into our waterways.

Another advantage to vegetative roofs is their ability to create micro-environments.⁹ They can reduce the temperature within the building, create environments where wildlife can grow, and develop places where the local occupants can enjoy the outdoors. Vegetative roofing systems are clas-

sified into three systems: extensive, semi-intensive, and intensive. Extensive systems are the most common. These systems can be designed to meet the specific stormwater control, weight, and cost parameters for the project. They are usually the least expensive and lightest of the three, which makes their adoption easier. Intensive systems use the most growing media and are often built in place. These are intended to be used as amenity spaces for the occupants of the building. The semi-intensive falls between these two systems. Whatever system is used, the building owner will need to understand the engineering and waterproofing requirements to make the system perform and last.

DAYLIGHTING

Daylighting has been around since the beginning of civilization. Prior to the advent of electricity, people were always trying to get sunlight into interior spaces. Once Thomas Edison created the lightbulb, the need for natural light inside a building became less necessary. Buildings could be built that were hundreds or even thousands of feet deep without any natural lighting.

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Figure 10 – Skylights/daylights.

ASHRAE 90.1¹⁰ mandated the use of natural light in commercial buildings through skylights or windows. This mandate was created to reduce the use of electricity and a building’s carbon footprint. In some instances, the amount of electricity consumed by a building can be reduced by 35-60%¹¹ with the addition of a daylighting system.

In many buildings, getting the required light to an interior space can only be achieved through skylights. Often these skylights are used along with an active daylighting system (Figure 10). These systems monitor the amount of daylight that is coming into a building and automatically turn the interior lights on and off. With more facilities being built with skylights and daylighting systems, more waterproofing and flashing concerns will be associated with them.

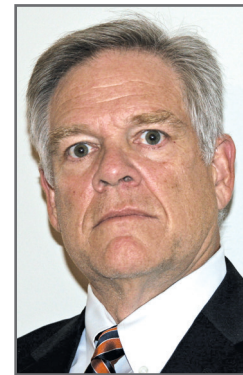
CONCLUSION

What are the new roofing trends and products going to be? I do not have a crystal ball, but some of the items that influenced the past ten years in roofing will be the same influencers for the next ten years. Finding qualified employees, environmental concerns, government mandates, codes, laws, and how to address these items to deliver the best value for the end customer will be issues facing the roofing community into the future. 

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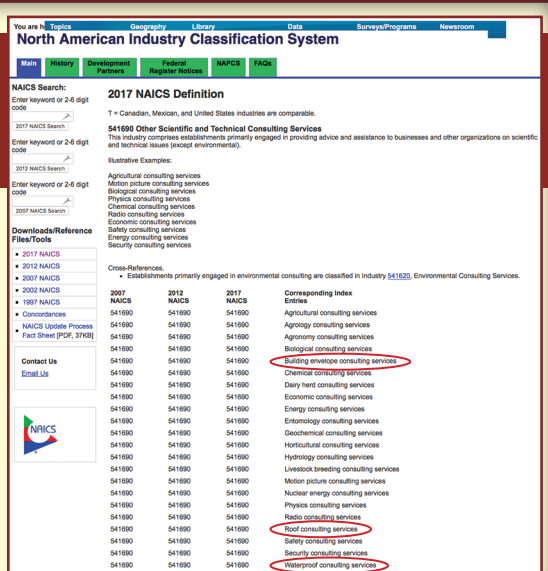
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Vincent Hill is the consultant services manager for Firestone Building Products. In his current position, he manages Firestone’s relationships with the roof consultant community. Prior to Firestone, his 30-year career involved managing and overseeing the roofing assets for several large industrial REITs.

Building Envelope Consulting Achieves NAICS Recognition

RCI recently received exciting news for building envelope consultants. In early January, the United States Census Bureau released 2017 NAICS, the latest update of the North American Industry Classification System (NAICS). This 2017 version now cites building envelope consulting services, roof consulting services, and waterproof [sic] consulting services within Classification 541690, titled “Other Scientific and Technical Consulting Services.” RCI members and others engaged in building envelope consulting, when asked to provide a “NAICS number,” can now pencil in “541690.”

For an extensive article on the process RCI went through to obtain the NAICS index item classification for building envelope consulting and its uses in business, visit the newsfeed at rci-online.org.



2017 NAICS Definition

541690 Other Scientific and Technical Consulting Services

This industry comprises establishments primarily engaged in providing science and technical services (except environmental).

Illustrative Examples:

- Agricultural consulting services
- Automotive consulting services
- Biological consulting services
- Physics consulting services
- Chemical consulting services
- Radio consulting services
- Economic consulting services
- Energy consulting services
- Security consulting services

Corresponding Index Entries:

- Agricultural consulting services
- Agrology consulting services
- Agromony consulting services
- Biological consulting services
- Building envelope consulting services
- Chemical consulting services
- Dairy herd consulting services
- Economic consulting services
- Energy consulting services
- Entomology consulting services
- Geochemical consulting services
- Horticultural consulting services
- Hydrology consulting services
- Livestock breeding consulting services
- Motion picture consulting services
- Nuclear energy consulting services
- Physics consulting services
- Radio consulting services
- Roof consulting services
- Safety consulting services
- Security consulting services
- Waterproof consulting services