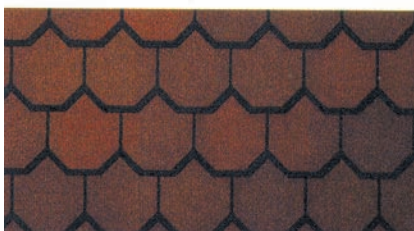
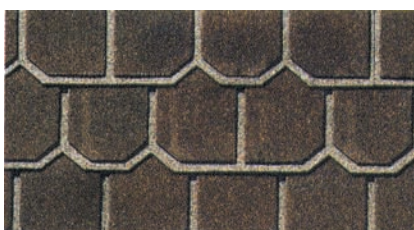


“Apparent” COLOR VARIATION of Asphalt Shingles

BY RAY CORBIN



History

Over the years, the asphalt shingle has been the most cost-effective covering for steep-sloped roofs. In addition to economy, asphalt shingles provide style, beauty, weathering, and fire retardant properties. While asphalt shingles perform well, there have been a few concerns, one of which is “apparent” color variation. “Apparent” color variation, as it is generally referred to, can have different forms of variation, caused by the way that light reflects from the surface layer of protective granules, rather than from any actual variation in color.

The degree that a shingled roof appears to exhibit some form of “apparent” color variation is highly subjective and can vary, not only between observers, but also by the time of day and lighting conditions. Since asphalt shingles are often compared to natural products, such as wood and slate, it should be pointed out that these products are also prone to natural color variation. In almost all cases, except for extreme granule loss, the color variation is generally an appearance issue and hardly ever one that results in reduction of life expectancy of the asphalt shingle.

General Background

Asphalt shingles are manufactured with filled coating asphalt on either an organic felt or fiberglass mat and are covered with a blend of colored ceramic granules. These granules not only provide weather protection for the shingles, but give the product distinctive beauty, as well as adding to their fire protection value. During the production run, granules are dropped in a color blend onto the moving web of organic felt or fiberglass mat that is coated with a hot-filled coating asphalt. While the sheet is hot, the granules are applied and embedded into the filled coating asphalt, allowed to cool, and then the web is cut into the shingle’s final shape and packaged. Laminated shingles, containing multiple pieces, normally take a few more processing steps to complete.

Causes of “Apparent” Color Variation

“Apparent” color variation can be caused by several factors, and unless the cause is severe, the shingle is almost always able to perform properly over its life expectancy. Causes of “apparent” color variation can be from manufacturing variables or from improper application and storage techniques.

MANUFACTURE

During the production run, proper granule application is important because, if done incorrectly, it can lead to “apparent” color variation. During the manufacturing process, granules are deposited on the sheet as it travels through the shingle machine. The speed of the machine has a tendency to orient the granules in a slightly tilted direction. Depending upon the width of the machine, shingles are usually cut into opposing pairs. These pairs are turned during packaging. If the “tilt” is pronounced, it is possible that light may reflect differently between these pairs, and under certain circumstances, “apparent” color variation may result. The process in which shingles are packaged as opposing pairs is called “lefts and rights.” If other conditions of manufacture and/or application are not met, it may be possible to observe differences in how the shingle reflects light, which can cause “apparent” color variation.

Figure 1: The Asphalt Roofing Manufacturers Association claims “asphalt color choices are taking roofing to new heights.” Photo, courtesy ARMA.

Machine Speed – Granule Tilt

Variations in the speed of the shingle machine can affect the tilt of granules as they are being deposited onto the moving sheet (asphalt coated felt or mat). Granules deposited at higher rates of speed tend to tilt more than those deposited at lower speeds. These variations in tilt reflect light differently, and if those shingles are applied side-by-side, can produce “apparent” color variation.

Machine Speed – Granule Blend

Variations in the speed of the shingle machine can also change the concentration of the color blend. The higher the speed, the more muted the blend tends to be. Combining shingle bundles produced at varying speeds can result in an appearance of color variation. Also, combining bundles from different production dates can have the same effect.

Color Blend

If the color blend is not consistent throughout the run, the possibility exists that bundles from different parts of the run can be applied side-by-side. If the blend has varied significantly, a side-by-side application can magnify the problem and appear as an “apparent” color variation. Variation can also come from having an improper gradation of “fine vs. coarse” sizing of the granules. Coarse, or slightly larger granules, tend to sit higher on the sheet and reflect light differently than the smoother appearing fine granules.

Press, Over or Under

After the granules are deposited, the sheet then travels around a turnover drum, which presses the granules into the hot filled coating asphalt. Care is taken to press or set the granules properly. Too little and they can become loose and fall off the shingle. Too much and the asphalt coating can bleed up, resulting in over-press. Extremes in either case can cause enough difference that if the shingles were mixed, it could produce an “apparent” color variation effect.

During the production process, each manufacturer runs a test procedure called the “granule rub test” to determine if the granules have been properly applied. This test is performed periodically during the shingle production run. The test is ASTM D-4977, the “Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion.” This test method applies to “as-manufactured” material and is used as a quality control procedure during the manufacturing process. While not intended for other purposes, sometimes a manufacturer will use the test on recently manufactured product. While not applicable to weathered product,

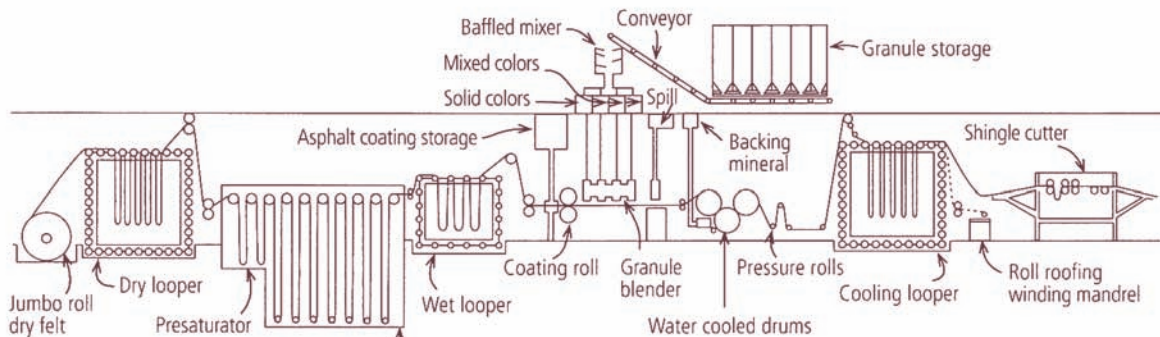


Figure 2: Shingle machine.

the test is also used occasionally to verify the granule adhesion of field samples.

Some granule loss can be expected, as new shingles tend to have excess granules known as “hitch-hikers.” These are extra granules that mechanically lock themselves to the face of the shingle during the manufacturing process. Most of these granules are dislodged in the bundle during shipping or as the shingles are installed. Sometimes it takes a few heavy rainstorms for them to wash off the roof. Evidence of this can be granule accumulation in either the gutters or where the rainspout discharges. This is normal and is not cause for concern unless the shingles appear to have granule voids or missing areas or the loss continues significantly after the first year of weathering. Missing granules can cause an appearance problem that might be objectionable. It can also lead to long-term shingle failure as the ultraviolet rays of the sun can cause degradation of exposed asphalt coating. However, this type of failure may take ten years or more to occur.

APPLICATION AND STORAGE

Installation techniques can either emphasize or moderate any tendency that a shingle may have to show “apparent” color variation. Even slight variation can appear monumental to a homeowner when a block of a different-appearing shingle bundle is improperly installed straight up the roof (racked) in its most visible area. The same bundle, properly spread out across the same roof area, would be hard to detect by any but the most highly trained eye.

Mixing Code Dates

Mixing of different production runs may be the easiest of the installation problems to overcome. Even though the color blend may be marked the same, mixing bundles from another date will generally appear much different when installed side-by-side. To prevent this, manufacturers print a production date on each bundle. The installer only has to verify that the bundles are all from the same run. If not, the wrong date should be returned, or if fairly similar, can be used on a different side or location of the roof, preferably in the least obvious area.

Racking

Racking is when shingles are applied straight up the roof, using a full width shingle in every other course. If there is any tendency



Figure 3 and 4: The photo at left shows racked shingles. The one below shows the correct way to lay shingles.



towards “apparent” color variation, the eye will pick up variation between adjacent blocks or rows of shingles that are (incorrectly) applied vertically. The industry recommendation is to apply the shingles across and up, never straight up the roof. Racking also leads to improper fastening, as one out of four nails is typically left out of every other row. This is sometimes referred to as “three-nailing.”

Scuffing

Scuffing or surface damage can occur when shingles are installed in hot weather or when walking on installed shingles that have been heated by the sun’s radiant energy. Care should always be taken when working or walking on recently installed shingles. Excessive scuffing will displace granules and permanently damage the shingle.

Storage at the Job Site

Improper or prolonged job site storage can create an “apparent” color variation problem. Stacking too high or cross-bundle stacking can create pressure points that cause bleed-through of the asphalt coating. This would make the area appear smoother, thus reflecting light differently. Also, these pressure points can distort the shingle as well as cause staining, both of which produce a noticeable difference.

Mixing Algae-resistant with Non Algae-resistant Shingles

Never mix algae-resistant with non algae-resistant shingles. Even if the color blends seem to be similar, it is very likely that the blends will appear as different colors when installed side-by-side on the roof. Long-term, the difference will be even more pronounced as the non algae-resistant shingles most likely will attract algae that will darken their appearance significantly.

Mixing Shadow-line with Non Shadow-line Shingles

Never mix shadow-line with non shadow-line shingles, because their difference will be obvious. The use of a shadow line is to

emphasize the shingle’s tab, making it seem thicker and distinctive. Applying shingles with and without shadow line on the same roof will create an undesirable contrast.

SOLUTIONS

The best way to avoid “apparent” color variation is to properly manufacture, store, and install the asphalt shingle roof. Even the slightest tendency toward “apparent” color variation can be a concern if the installation deviates from standard industry recommendations. Occasionally, products manufactured at relatively high speed can be expected to have some degree of variation. Following recommended industry installation procedures can significantly reduce or eliminate most of these concerns.

Weathering

When sample examination indicates that an “apparent” color variation problem was not caused by excessive granule loss, one year of weathering is usually recommended. Normally, a year or more of weathering will allow any extra “hitchhiker” granules to wash off the roof. Also, a year of weathering will “bleach” or moderate stained shingles. And finally, a year of weathering will deposit enough dirt and dust to moderate the variation among contrasting shingles. Because of jobsite conditions on new construction projects, the effect of weathering is even more pronounced. Further, continued weathering will reduce all but the most severe causes of “apparent” color variation.

Laminates

Laminates are usually the best solution to overcoming “apparent” color variation. Laminates have a more pronounced color blend as well as additional pieces added. The added pieces are usually of a slightly different color blend, coming from another portion of the run. The added pieces and the different color blend are designed to break up the visual pattern and distract the observer from seeing any trend toward “apparent” color variation.

Apply in Rows Across the Roof

Most manufacturers, as well as the Asphalt Roofing Manufacturers Association (ARMA), recommend that shingles be applied in rows across the roof. This way, any contrast will be muted as the eye catches vertical blocks of “apparent” color variation much easier than if it has been spread out horizontally across the roof. The problem with this solution is that it is more time consuming to apply full shingle widths (36") horizontally than it is to go 5" up and 6" over as in a typical step or pyramid pattern.

Use Only Pronounced Blends

The type or degree of color blend can make a difference. The more pronounced the color blend, the more likely it will be able to distract the eye from any causes of “apparent” color variation. Usually, the worse cases appear with either solid white or black colors that have little or no color blend.

Separate “Lefts and Rights”

The easiest way to separate “lefts and rights” is to examine the bundles to see on which side the tabs lie. If it appears that half of the tabs are to the bundle’s front and half to the rear, then this is an example of how “lefts and rights” are packaged. In this case, use the tabs packaged to the front on one part of the roof and those packaged to the rear on the remaining portion of the roof, preferably on the other side.

SUMMARY

The keys to successful shingle installation are consistency during manufacture and correct application. Variations in the manufacturing process, such as machine speed and weight control, can affect the shingle appearance. Failure on the part of the installer to follow accepted industry procedures when applying the shingles also can increase the problem. Failure to observe either will lead to an improperly installed roof that may be unattractive.

To be fair to everyone involved (the homeowner, manufacturer, and installer), “apparent” color variation should be evaluated when the sun is directly overhead. This can be 10 a.m. to 2 p.m. in the winter and possibly 9 a.m. to 3 p.m. in the summer. Observations, either in early morning or late afternoon, can make the problem seem more pronounced than it actually is.

In most cases, except for that of missing granules, any roof that exhibits “apparent” color variation should be allowed to weather for a minimum of one year. Weathering allows all but the most extreme cases to blend and moderate. The exception may be where one bundle or block of shingles has been improperly installed vertically (racked) in a most obvious spot. In this case, the “block” is proba-

bly too visible to the eye to “weather-in” and may have to be replaced. When replacing such an area, it is best to use similar shingles from a less conspicuous part of the same roof. Even non-weathered shingles set aside from the same run would appear different until they too had enough time to “weather” and blend in.

This material is also covered in more detail in the *RCI Rooftop Quality Assurance Manual*. Key points on steep roofing application are addressed, including safety, ventilation, and flashing.



Figure 5 shows lot-to-lot variation caused by shingles from different production runs weathering at different rates.

REFERENCES

1. *Rooftop Quality Assurance Manual*, RCI.
2. R.L. Corbin, “Today’s Asphalt Roofing Shingle,” *Interface*, January 1995.
3. R.L. Corbin, “Performance of the Glass Fiber Reinforced Asphalt Shingle,” *Interface*, May 1998.
4. R.L. Corbin, “Attic Ventilation: Why It’s Necessary,” *Interface*, August 2000.
5. Kirk-Othmer, Chapter on “Roofing Materials,” *Encyclopedia of Chemical Technology*, Fourth Edition, Vol. 21.
6. *Steep Roofing Manual*, NRCA.
7. *ARMA Residential Manual*.

ABOUT THE AUTHOR

Raymond L. Corbin is the president of Corbin Roofing Systems. He was formerly the director of Johns Manville’s BURS I (the Better Understanding of Roofing Systems Institute) for 20 years. Ray holds four U.S. roofing shingle design and application patents. He is a former chairman of ARMA’s Code Committee. Ray has been an industry member of RCI since 1985 and was honored with the Richard Horowitz Award for excellence in technical writing for *Interface* in March 2003. In 2004, he was awarded honorary membership in RCI.



RAYMOND L. CORBIN