LEVINE & COMPANY, INC.
ROOF CONSULTING & ARCHITECTURAL CONSERVATION
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RIDGEWALKER NEWS

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Insights into Today's Roofing Issues

Professional Services

- Roof consulting
- Construction documentation and administration
- Condition assessment reports
- Leak investigations
- Cost estimating
- Hands-on surveys and test probes
- Historic building restoration and rehabilitation
- Maintenance planning and surveys
- Materials analysis and selection
- Construction litigation support/Expert witness services

Steep-Slope Roofing

- Slate
- Wood shingles
- Clay tile
- Standing seam and batten seam copper
- Asphalt shingles
- Flashings
- Rainwater conduction systems

Low-Slope Roofing

- Flat seam copper
- Built-up roofing
- Modified bitumen systems
- EPDM
- Fluid-applied systems
- Flashings

Building Envelope

- Exterior masonry
- Dormer windows
- Stained and leaded glass
- Architectural woodwork
- Chimneys
- Steeples, parapets, and cornices

Competence

- Expertise in roofing technology and building pathology
- Holistic approach to identifying and treating deterioration
- Hands-on, up-close surveys from ladders and high reach equipment
- Principal involvement in all projects
- Attention to detail
- Close client collaboration
- Frequent site visits during construction to monitor the work
- Continuously refining our understanding of building technologies

DO IT RIGHT, DO IT ONCE

Red Lead Oxide Staining – An Environmental Phenomenon

Terne Coated Stainless Steel (TCS) was manufactured by Follansbee Steel, from about 1968 to 1997.[1] It consists of Type 304 stainless steel sheet with an 80% lead/20% tin alloy coating on both sides. The thickness of the coating was approximately 25 microns. TCS had many advantages over traditional terne metal (lead/tin alloy on steel sheet) for roofing and cladding. It was very durable (with an expected service life of 100 years or more), maintenance free, and generally weathered to a pleasing dark, dull-grey color, or patina.

For most of the twentieth century, there were enough pollutants in the atmosphere (mainly sulphur dioxides stemming from the burning of fossil fuels) for high-lead alloy metals (e.g., TCS and lead coated copper) to react with the pollutants to form a dark gray, lead sulphate patina (chemically, likely $PbSO_4$). In the absence of these pollutants, a rusty, reddish-brown colored staining can form on the surface of TCS (photo at top of next column). Lead in the lead-tin coating of the TCS oxidizes to form red lead oxide, chemically PbO or, likely more frequently, Pb_3O_4. PbO is reddish-yellow in color. Pb_3O_4 is orange-red in color.[2]

In the past, red oxide staining on TCS, and lead coated copper for that matter, was primarily limited to rural and marine environments, so called "pristine environments," with little

pollution. With stricter environmental regulations in the later part of the twentieth century, there are fewer sulphates in the atmosphere and the problem of red oxide staining of lead-bearing metals is becoming more widespread. The formation of Pb_3O_4, red lead, is favored in cleaner, less-polluted air.

Red oxide staining on TCS roofing and cladding can be widespread or more localized due to the presence of "micro-climates." Oxidation is a complex, natural process that occurs at the micro level. Thus, the micro-climate can be an elevation or roof slope, or even particular pans on a given elevation. Very small differences in moisture level, slope, exposure to the sun, drying time, concentrations of pollutants, dwell times (how long pollutants and other contaminants stay on the surface of the metal), heat, Ph levels, and working of the metal during installation can impact the surface chemistry of the TCS enough to support, or not support, the formation of red lead oxide. One, key, micro-climate factor acting on buildings can be concentrated water flows over the surface of the TCS (photo on reverse). All other things being equal, lower-sloped surfaces and surfaces frequently washed by water will have lower concentrations of atmospheric pollutants on their surfaces and will, therefore, be more susceptible to red oxide staining.

[1] TCS was replaced by TCS II (a zinc-tin alloy coated stainless steel) in c.1997. (TCS II was called "Viromet" from 1997 to 1998.) Follansbee Steel went out of business in c.2012.

[2] There are many different lead oxides. Their characteristics, and color, vary depending on the number of oxygen atoms the lead is attached to, the valence state of the lead, and their crystal structure.

Red Lead Oxide Staining – An Environmental Phenomenon Cont'd.

Fortunately, the consensus seems to be that red oxide staining is a surface phenomenon; a natural patina, with no significant accelerated or detrimental corrosion of the stainless steel substrate taking place. In other words, the staining is primarily an aesthetic issue, not a performance issue in most cases. The exception would be "micro-climates" where water washing is the primary feature. Water washing over a surface is, by its nature an erosive process, however slight and however slow. Coating loss will occur. It is, however, unlikely to impact the integrity/watertightness of the TCS panels as the stainless steel base metal is, itself, very resistant to atmospheric corrosion and erosion.

Removal of red oxide staining is difficult and expensive. Moreover, if the underlying factors contributing to the staining are not addressed (also difficult), the staining will recur. In most instances, therefore, allowing the staining to remain and permitting the TCS panels to patina naturally is recommended.

Levine & Company News - Recent and Upcoming Speaking Engagements

Jeff and Julie had the honor of presenting an update on the slate roofing industry at the NYAPPA & SUNY/PPAA Summer Conference at Ithaca College in August 2016, and then again at the RCI Delaware Valley Chapter's fall event in Ephrata, PA. Their paper, "Slate Roofing, Nothing's New; Everything's New," focused on recent changes in the slate industry, including materials testing, ASTM Standards, and building code updates, new sources of roofing slate and those no longer available, issues with underlayments, and synthetic polymer shingles (aka fake slate).

Back in April, 2016, Jeff gave a primer on slate roofing to students in the Heritage Preservation Studio, Graduate Program in Historic Preservation, at the University of Pennsylvania, Philadelphia, PA. The presentation complimented the student's semester-long project to document, in detail, the slate quarries, past and present, of Lehigh and Northampton Counties, PA, which were, at one time, the largest slate producing region in the country.

Lastly, Jeff is teaming up with Bob Fulmer of North Conway, NH and Doug Fishburn of Hornby, ON, Canada to give a paper at RCI, Inc.'s 32nd International Convention & Trade Show in Anaheim, CA in March of next year. The paper, entitled "Slate Roofing for Consultants: What You Wanted to Know," is in response to a joint RCI/National Slate Association survey of its membership and will focus on the interests of the survey respondents; namely, domestic and international sources of slate shingles, slate roof assessments, fasteners, underlayments, and slate roof detailing.

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