Vintage Structure With Hybrid Decking and Low-Rise Foam

By Donald Kilpatrick

Vintage structures are witness to a wide variety of old-school construction practices that will likely never again have a place in today's built environment. Their mere presence can (and, in this instance, did) provide challenges during the construction phase. An appreciation for that was encountered on a recently completed steep-slope clay tile roof replacement project that was cause for old-world engineering in the form of what would be considered a hybrid roof deck by today's standards, partnering with new-world adhesive technology.

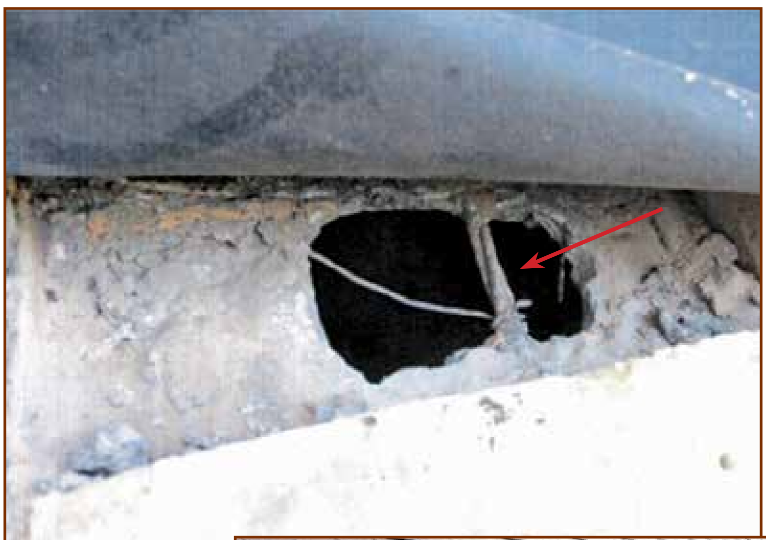

Photo 1 – Spiral-wound steel reinforcement of concrete deck.

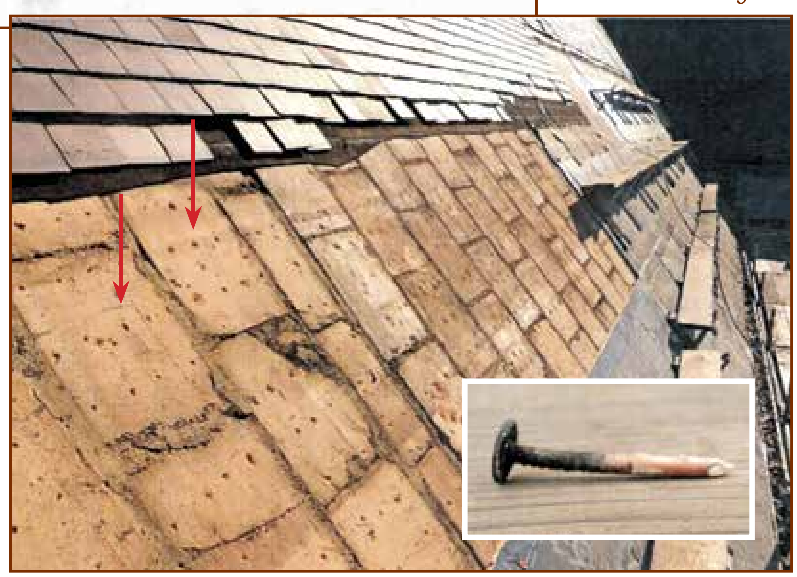

Photo 2 – Overall condition of structural clay tile roof deck with uniformly spaced rows of pockmarks from the original nailed installation of flat-slab clay tile.

Due-diligence inspections confirmed the presence of "structural clay tile" as the receiving substrate for the originally installed organic-ply underlay and flat-slab clay tiles. It was not unusual in steep-sloped configurations of circa 1920s construction to use structural clay tile as a nailable substrate for hanging clay roof tiles.

On the attic interior, a visual examination of the underside of the "deck" was observed as concrete. On previous projects of similar construction, the concrete was of sufficient depth or thickness to comfortably accommodate the loads imposed by the structural and flat-slab clay tile. In encounters of decks with what was assumed to be similar construction, the concrete was of sufficient thickness to accommodate pilot holes and mechanical fastening of the new plywood sheathing from the top side without the risk of encountering the reinforcement.

On the first day of tear-off, the contractor made sever-

Photo 3 – Initial test panel set in adhesive to structural clay tile substrate under controlled conditions.

al attempts to fasten the plywood to the underlying cast-in-place concrete. The 4-ft. x 8-ft. x ¾-in. sheets of plywood were predrilled with the prescribed pattern of holes to accept the fasteners and stress plates. The sheets were laid on the deck and used as a template for the pilot holes to mechanically attach the plywood to the underlying concrete deck. Early in the process, it became evident that the reinforcement of the cast-in-place primary deck was regularly encountered by the bits of the rotary hammer drills at depths in the range of ¾ inch into the concrete substrate. An inspection opening was made from the top side, and it was determined that the concrete deck carrying the structural clay tile was nominally 1.5 in. thick. The individual structural clay tile units were originally set on top of the concrete deck in a bed of mortar with joints infilled and struck flush. The reinforcement that was encountered at 3-in. centers was composed of three 3/16-in. wires wound in a spiral. Mechanically fastening to the concrete deck was no longer considered a viable option (*Photo 1*).

The overall condition of the structural clay tile deck was considered good for its age. Removal of the tile and organic underlay yielded a substrate that, aside from the pockmarks from the original installation of clay tile, was fairly pristine (*Photo 2*). The initial response was to explore all options related to mechanically fastening to the book tile. A series of varied fasteners were tested for pullout resistance in the book tile substrate. While some fasteners demonstrated promise at one location, another of like kind at an adjacent location would

Photo 4 – Test apparatus set up for the pull test of the 2-ft. square panel fixed to the deck with low-rise foam adhesive under controlled conditions.

Photo 5 – Pull test values in excess of 140 lbs. per square foot derived under controlled conditions.

Photo 6 – Contractor preparing test panel for pull test under field conditions.

Photo 7 – Test result under field conditions yields pull test values in excess of 180 lbs. per square foot.

fail. In the interim, the masonry contractor was working off the shared work platforms (scaffolding from grade to gutter line), with everyone making progress on their assigned work tasks. But the roofing issues (more notably, the unforeseen conditions related to the decking and reinforcement) were having an impact on the key parameters of the overall project schedule.

In an effort to get the roofing component of the project moving forward, low-rise foam was given consideration as a means to secure the new ¾-in. sheathing to the book tile deck. The manufacturer's representative was engaged to witness the test panel uplift resistance in accordance with ANSI/SPRI IA-1, *Standard Field Test for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Varied Substrates.* The initial 2- x 2-ft. panel was set in the field of the roof area and allowed to cure for a period of 20 minutes (*Photo 3*). Pull test results for this panel were in excess of 110 lbs. per sq. ft. (*Photos 4* and *5*). A second 2-foot-square test panel was cut from the center of a full sheet of ¾-in. plywood after a cure period of 15-20 minutes. Uplift values in excess of 180 lbs. per sq. ft. were derived at that test location (*Photos 6* and *7*).

The material manufacturer did not necessarily endorse its product for the described end use and configuration. The only recommendation the field representative offered was that the materials be dispensed on the back side of the plywood sheathing, orientated horizontally prior to setting in place. The manufacturer's technical department suggested that OSB be used in lieu of plywood, which was not considered. The plywood sheets were toenailed into the structural clay tile at the corners and midspan immediately after being set in position, or hung in a means similar to that of the flat-slab clay tile that was part of the original installation.

The project is entering its third year of service and to date, there are no indications that the low-rise foam materials are not performing as intended.

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Reformation of Depreciation Schedule for Commercial Roofs on Legislative Agenda

On May 22, Representatives Tom Reed (R-NY) and Bill Pascrell (D-NJ) of the House of Representatives and Senators Ben Cardin (D-MD) and Mike Crapo (R-ID) introduced legislation (H.R. 4740 and S. 2388) that would reform the depreciation schedule currently allowed by the Internal Revenue Service (IRS) for commercial roofs. The current schedule allows a 39-year depreciation, while the new legislation would create a 20-year schedule.

The depreciation schedule for nonresidential property was increased from 15 to 39 years between 1981 and 1993. The average lifespan of most commercial roofs, however, is only 17 years, according to a study by Ducker Worldwide. This has caused building owners to delay the full replacement of older, failing roofs in favor of limited piecemeal repairs. Moreover, building owners who install new roofs before the current 39-year schedule has elapsed are required to depreciate roofs at different schedules, causing paperwork burdens for businesses.

The depreciation reform is supported by numerous business, labor, and energy-efficiency groups, including the National Roofing Contractors Association; United Union of Roofers, Waterproofers, and Allied Workers; and the Polyisocyanurate Insulation Manufacturers Association.