ROOF DECKS A to Z

Part XIII: Vintage, Obscure, or Obsolete Systems

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ABSTRACT

This is the 13th in a series of articles examining various deck types. Among the numerous considerations when selecting a roof system, the type of decking is one of the most important. With the variety of decks to be encountered (both new and old), it is incumbent upon roofing experts to be the authority on these matters. This article will explore four vintage, obscure, or obsolete systems. Due to space constraints, discussion of these four products is admittedly brief. The author is wary of condensed literature, and it is hoped the article stands without surrendering meaningful content.

Some decks featured in this article—and others of the category— are "autoclaved" products. An autoclave is a steam pressure chamber used to cure any number of things, including coatings, rubber products, and cementitious building material such as old Johns Manville Transite and other fiber cement products. Autoclaved building materials are recognized as having very good resistance to high-humidity conditions as might be encountered in foundries, textile mills, pulp/paper facilities, and the like. These products are very hard, possibly making drilling and fastening difficult.

Owens-Corning Fiberglas Corporation	
Ceiling Tiles	
Insulating Cement	(1940-1951)
Finishing Cement	(1940-1951)
Kaylo 10 Block Insulation	
Kaylo 20 Block Insulation	
Kaylo Block Insulation	(1953-1975)
Kaylo Pipe Covering	(1953-1975)
Type II Mastic	(1964-1978)
Ready Mix	(1940-1952)
Owens-Illinois, Inc.	
Kaylo Block Insulation	(1944-1958)
Kaylo Pipe Covering	(1944-1958)

Table 1

Some of these old deck systems may contain asbestos or crystalline silica (or both), whereby cutting, grinding, drilling, abrading, or otherwise working the materials would introduce harmful particulates into the air. Regarding the health risk to workers, the Occupational Safety and Health Administration (OSHA) has put forth a standard to address the risk. The ruling was controversial, and National Roofing Contractors Association (NRCA) Executive VP William Good petitioned OSHA for variance consideration, citing the safety of workers when the stipulated rooftop measures are deployed.[1]

The United States Department of Labor website[2] states, "To protect workers exposed to respirable crystalline silica, OSHA has issued two respirable crystalline silica standards: one for construction and the other for general industry and maritime." Further review of that standard is beyond the scope of this article; however, the practicing consultant should be aware of these issues in advance of carrying out a reroofing project, especially on those involving new deck openings or repairs to the same.

KAYLO

Kaylo was a proprietary-name product manufactured by Owens-Corning from the 1950s until 1972 (first marketed by Owens-Illinois). While characterized in old literature as hydrous calcium silicate, it was an asbestos-containing material. In fairness, asbestos was a remarkable building material and found wide use in several industries. Kaylo was used extensively as block insulation and pipe covering, but the products carried over to roof tile and deck units as well. From one trade catalog of the era:

> Kaylo Structural Insulating Block is not a finished building material in itself and is not made for exposure to the weather. Its principal uses are as a structural roof tile, or roof deck unit, in which a steel reinforcing mat is inserted at the time of forming, and as a core material.

Meanwhile, because of heath risks and the related litigation that followed, old literature has been collected and archived by various parties assisting in recovery of damages.[3] Some of that literature reveals the product descriptions listed in *Table 1*.

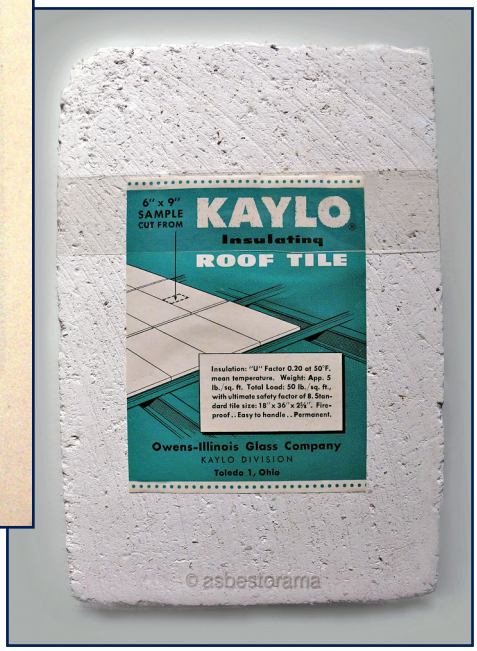
This and other old literature is particularly helpful when dealing with decks of this type (*Figure 1*). Some of it is still available

Figure 1 – Vintage product literature from Owens-Illinois, well before zip codes came into use (note contact info).

from resources such as Products Research, Solon, OH.[4]

Kaylo was similar to structural cement fiber in that tiles were arranged into a system of sub-purlins with panel edges, then grouted for proper nesting (mastics and cements for that work would likely also contain asbestos). To its credit, Owens-Corning discontinued the Kaylo brand and stopped producing insulation materials containing asbestos. While not produced since the early 1970s, Kaylo may still be found in older buildings and even some homes. Anyone encountering this type of roof deck (or insulation) should contact a certified professional for any removal, disposal, or modifications (*Figure 2*).

Figure 2 – Kaylo product sample (image from https://hiveminer.com/Tags/asbestos,tile). Anyone encountering this type of roof deck (or insulation) should contact a certified professional for removal, disposal, or modifications.



F & A SYSTEMS

F & A System are another hollow-core configuration, somewhat of the variety reviewed in Part X of this series. As shown in *Figure 3*, it is a hybrid system, blending aspects of precast (the inverted T-joists) and cast-in-place concrete (the topping pour). This also makes it a "composite" system, whereby load-carrying capacity is gained through the reinforcing steel, the inverted T's, the hollow-core units, and the topping course. *Figure 4* depicts one such project where the bottom face of hollow-core units is flush with the bottom of the inverted T-joists; this was an alternative feature available to the specifier/designer.[5]

Ordinary steel reinforcing bars were used in the inverted T's, linked together by hairpin-type stirrups, and welded wire mesh would likely reside in the topping pour. Older systems are likely to have a serrated or "toothed" surface on top of the inverted T-joists. This served to link the poured topping course to the inverted T-joists, somewhat analogous to Nelson

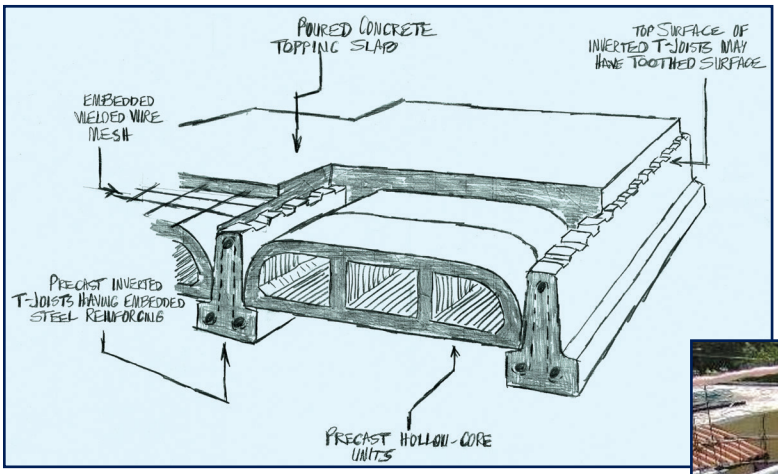


Figure 3 – F & A roof decking is a hybrid system, blending aspects of precast and cast-in-place concrete. Steel reinforcing bars were situated in the inverted T's, linked together by "hairpin-type" stirrups; welded wire mesh would likely be present in the topping pour of concrete.

Figure 4 – Note here that the bottom face of hollow-core units is flush with the bottom of inverted T-joists. This was an alternative available to the specifier/designer.

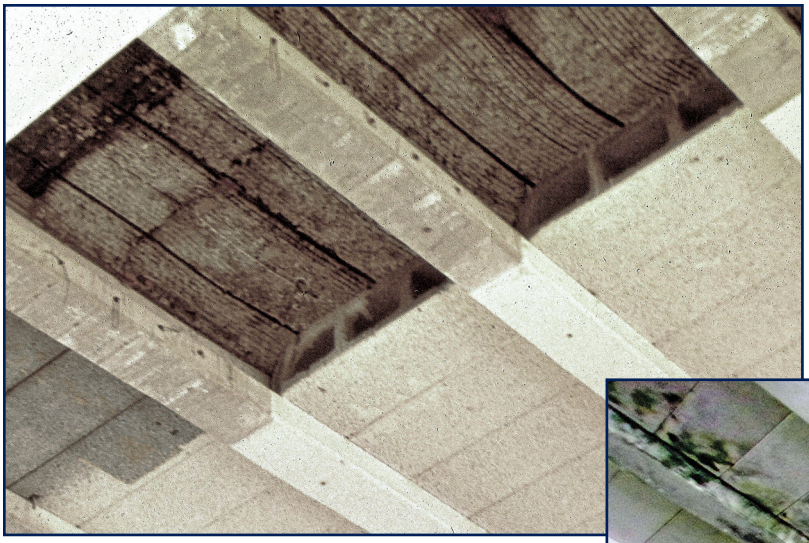


Figure 5 – New openings or repairs can be a challenge for F & A roof decks.

Figure 6 – This F&A System was used in a residential setting. It was a dead-flat plaza area that ponded water and leaked at cracks in the concrete topping course. Meanwhile, after decades of exposure (i.e., no topside membrane), inverted T-joists were in very good condition with no evidence of creep deflection or other distress.

studs on a metal form deck where a concrete mezzanine floor will later be poured. As depicted in *Figure 5*, new openings or repairs can be a challenge for F & A roof decks.

Figure 6 depicts an F & A system in a residential setting. This one was an exposed, dead-flat plaza area that ponded water and leaked at cracks in the concrete topping course. After decades of service, inverted T-joists were in very good condition with no outward evidence of creep deflection or other distress. Properly designed concrete will have long-term service creep factored into the load/span relationships; nonetheless, this one was remarkable because of its exposure (i.e., no topside membrane protection).

A modern iteration of this arrangement is the Quad-Deck system marketed by Quad-Lock. It is one of the various types of insulated concrete forms (ICFs). Aside from roof decks, this arrangement can also be deployed as a floor system.

DOX PLANK

Precast modular concrete blocks make up this rather unique system. The blocks were arranged in a row at the time of manufacture to form a "plank" of whatever length was dictated by the project and then clamped together tightly, introducing compression into the group. Steel reinforcing bars were inserted into the formed void and then grouted (*Figure 7*). After the grout cured, the clamping load was removed, relaxing the compressed length and imparting some measure of pre-stressing into the finished plank—now called a "beam." Note that tongue-and-groove edges were cast into the blocks for proper nesting in the long direction of the finished beams.

Instead of seven-strand cable, ordinary rebar was used, so this manufacturing procedure was not as effective as modern

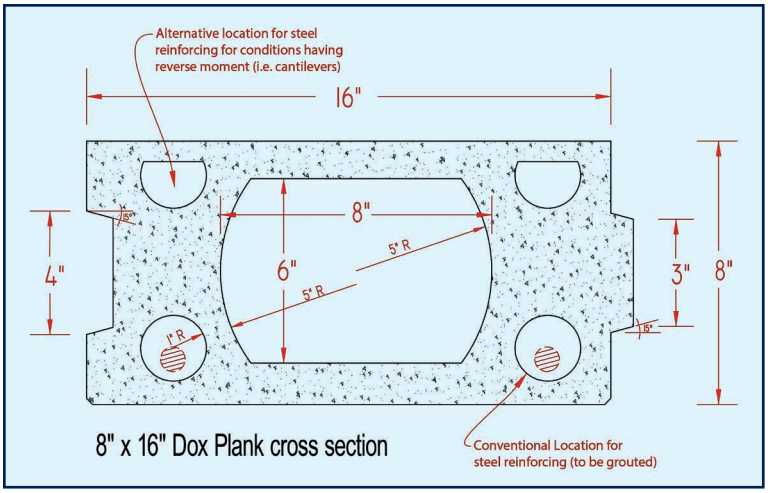


Figure 7 – Precast modular concrete blocks make up the rather unique Dox Plank system. Precast blocks were arranged in a row at the time of manufacture to form a "plank" of whatever length was dictated by the project and then clamped together tightly, introducing compression into the group. Steel reinforcing bars were inserted into the formed void and then grouted.

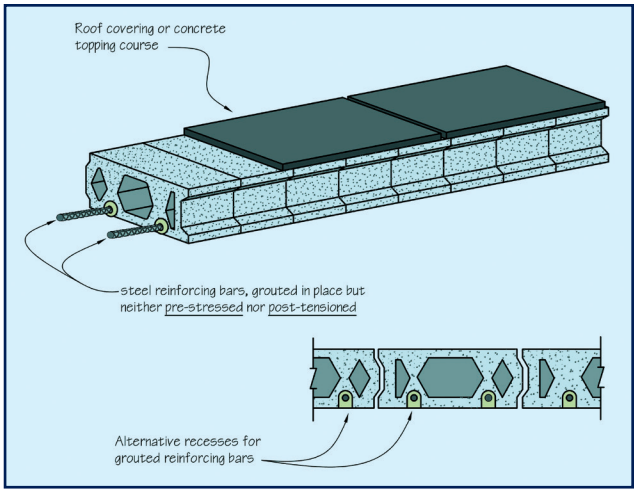


Figure 8 – Instead of seven-strand cable, ordinary rebar was used, so this manufacturing procedure was not as effective as modern pre-stressing or post-tensioning techniques; consequently, design tables for modern pre-stressed concrete product should not be used to analyze this type of roof deck.

pre-stressing or post-tensioning techniques (*Figure 8*); consequently, design tables for modern pre-stressed concrete product should not be used to analyze this type of roof deck.[6]

Beams were then delivered, hoisted into place, anchored, and grouted. Concrete used in the blocks was considered lightweight because of the aggregate used; this should not be confused with lightweight insulating concrete (LWIC). Load/span tables from the 1950s indicate that a topping layer of concrete would be applied over the finished array ("as required"), but stipulated a 2-in. minimum thickness. Additionally, the number and size of bars could vary. As with several other deck types, this arrangement could double as a structural floor system, at which time a slight variation in the shape of precast blocks was deployed.

From the foregoing, it is easy to see that exploratory top-side coring would reveal cast-in-place concrete, while examination of the underside would reveal individual block units. What is not so evident would be the hollow cells and internal reinforcement. If you enjoy a lively debate among colleagues, offer up this type of deck as a subject.

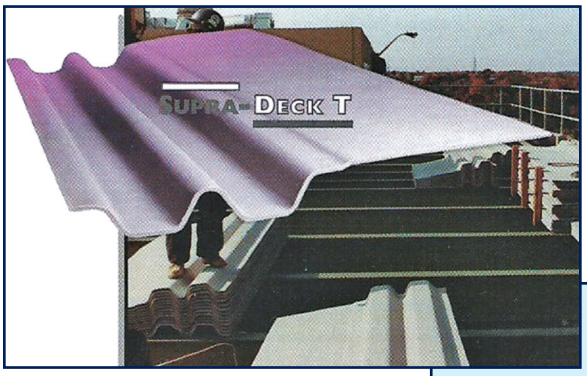


Figure 9 – SupraDur was a precast autoclaved material formerly marketed by Cemfort (marketed first by Atlas Turner, Inc. at the same plant location in Montreal).

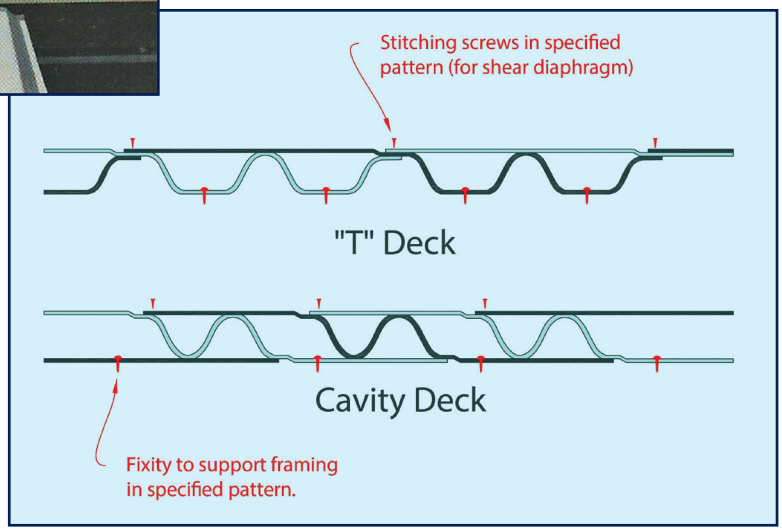


Figure 10 – There were two principal shapes, known as "C-deck" and "T-deck." Where the finished underside was flat, a cavity was formed between the top and bottom surfaces, and thus it was referred to as cavity deck.

SUPRADUR

SupraDur was a precast autoclaved material formerly marketed by Cemfort in Montreal, Canada (marketed first by Atlas Turner, Inc. at the same location). The system was also known as Supra-Deck, cavity deck, and possibly other monikers (*Figure 9*). There were two principal shapes, known as "C-deck" and "T-deck." Where the finished underside was flat, a cavity was formed between the top and bottom surfaces, and thus it was referred to as cavity deck (*Figure 10*).

Once fastened in place with the long edges stitch-screwed (such as with conventional steel decking), this profile made an excellent horizontal shear diaphragm and was quite sturdy underfoot. It had a high modulus of rupture (MOR),[7] deflecting little for a given service load and could even be deployed as a floor system through appropriate coordination with an in-house technical department. Built-up roofs were often married to this deck system (*Figure 11*).

In the mid-1990s, cellulose fibers were traded for asbestos, and the product was reinvented, so to speak. The author witnessed testing car-

ried out on the new version of the product; however, Cemfort closed its doors circa 2001, and this specific type of product is no longer available. Later, FINEX purchased the installations and technology of Cemfort, reportedly offering continuation of an equivalent product.[8]

Because of outstanding flame spread rating and resistance to high temperatures, this deck type may still be found in old manufacturing plants such as foundries. They were also corrosion resistant and found popular use in settings such as chemical production, pulp and paper, and storage of phosphate, potash, and fertilizer. Older decks will contain asbestos and silica, so the cautions outlined above should be observed. A smooth under-deck surface (possibly painted) having joint lines 12-15 in. on center should be suspected as being this type of deck.

SUMMARY REMARKS

These are certainly not the only deck types that would be classified as vintage, obscure, or obsolete. Older buildings seldom come with original drawings that can be scrutinized, so it is paramount that these decks be properly identified well in advance of a pending reroofing project. This would possibly include coring, sampling, load testing, and lab analysis. Characterizing these as merely concrete, precast, cementitious, or plank deck is a disservice to the project and the client. This caution will be appreciated later into a project where attachment or sourcing problems manifest.

Meanwhile, encountering one of these decks will likely bring about some challenging questions for the consulting expert. For instance, how would you specify a scheme for localized deck repairs? How would you configure a modern replacement roof covering onto these decks? What would the system of choice be? How would you provide for new drain openings through this type of substrate (along with proper underdeck bracing)? For purposes of reporting to the client, how would you characterize a Dox PLank system—monolithic, assembled plank, pre-stressed, cast-in-place, hollow-core, precast, composite, built-up beam, tongue-and-groove, segmented, or other descriptor?

With any vintage roof deck system, give consideration to the smart way of configuring a new roof covering. This includes matters of priming, whether or not to use a base sheet, whether to attach or adhere, slope improvements, testing, how to close openings left by removal of obsolete equipment, and treatment of deteriorated or broken areas.

Finally, as stated earlier, caution should be exercised regarding any kind of demolition, building repurposing, and reroofing over substrates of this category. Give consideration to zones subject to a drifting snow load where additional support bracing may be necessary (e.g., loading docks joining higher building walls). Give new consideration to edge features, as wind-resistant details have drastically improved since these decks were first marketed.

REFERENCES

1) "NRCA Testifies on OSHA's Proposed Crystalline Silica Rule." NRCA press release, April 2, 2014.
2) www.osha.gov/dsg/topics/silicacrystalline/
3) http://www.asbestos-attorney.com/asbestos_product_brands.htm
4) Products Research, LLC (asbestos catalogues through eBay).

Figure 11 – A nearly finished Supra-Deck, ready for stitching screws. Bituminous roofs were commonly applied to this substrate.

5) D. Matthew Stuart, PE, SE. "Antiquated Structural Systems Series, Part 5," *Structure*. September 2008, p. 25.
6) Anthony M. Dolhon. "Condition Survey of Assembled Concrete Blocks (Dox PLank)." *3rd Residential Building Design & Construction Conference*. March 2-3, 2016 at Penn State, University Park, PA. pp. 153-155.
7) Modulus of rupture, also known as "flexural strength," is a material property, defined as the stress in a material just before it yields in a flexure-testing mode. For roof decks (and anything else that spans across supports), it can be simplified as the slope of the graph plotting stress against strain.
8) Personal communiqué with Helios Muñoz, sales and technology representative, FINEX (October 11, 2016).

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Lyle Hogan is owner and principal engineer of Fincastle Engineering, Inc., Greensboro, NC. He is a registered engineer, a Registered Roof Consultant, a Fellow of IIBEC, and an ICC structural masonry inspector. He has designed and administered roofing projects in half of the United States using a variety of systems. Hogan has received IIBEC's Lifetime Achievement Award and its Michael DeFrancesco, Williamun C. Correll, and Richard M. Horowitz Awards.

Seminole Hard Rock Café Hotel & Casino Shaped Like a Guitar

The Seminole Hard Rock Hotel & Casino is under construction in Hollywood, Florida, and promises to be an iconic building. The guitar-shaped tower will cost $1.5 billion and include a new Hard Rock Live theater, 638 hotel rooms in the guitar tower, 168 rooms in the pool tower, a 10-acre lagoon-style pool, 30 new restaurants, 120,000 sq. ft. of meeting space, and 21,000 sq. ft. of retail space. And we can't forget 3,000 new slot machines, 193 table games, and a 46-table poker room.

The 450-ft.-tall, 596,044-sq.-ft. tower is expected to be completed in 2020.

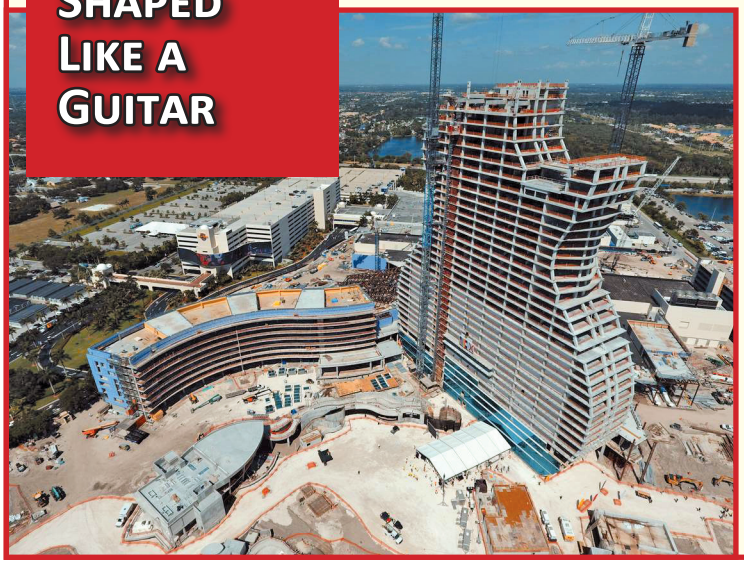
The tower is clad in a custom pre-glazed curtainwall system incorporating LED lighting in the mullions of the design. The façade is designed to appear to have 355-ft.-long lighted "strings" up and down the guitar, which will be lit by light cannons.

The construction team of Suffolk Construction and Yates Construction modeled the complete project using building information modelling (BIM).

In 2006, the Seminole Tribe acquired Hard Rock International, with restaurants in 75 countries. It is making its Hollywood location its signature property.

For a video about the kickoff of the construction in October 2017, visit https://www.youtube.com/watch?v=1takEiLFoak.

— *ENR* and seminolehardrockhollywood.com and *Miami Herald*



Casino under construction. Courtesy Seminole Hard Rock Hotel & Casino Hollywood.