ARCHITECTURE

EHLINGER & ASSOCIATES **FIRST QUARTER 1993**

GAINESWOOD PLANTATION
DEMOPOLIS, ALABAMA

Gaineswood evolved from a two room "dog trot" log house into a major Greek Revival plantation house from 1842 until the Civil War. General Nathan Bryan Whitfield purchased the 1,000 acre cotton plantation from the original owner, Gaines, and acted as Architect of the transformation, even though his education was more engineering in background. General Whitfield was also an inventor and several of his inventions are resident in the house today along with most of the original furnishings.

The labor that built the house was slave labor but the slaves were native American Indians, not African. They were extremely accomplished carpenters and plasterers.

This issue's limited edition signed print by Ladd P. Ehlinger is from the Northwest looking toward the Porte Cochere' Entrance, Reception Rooms and Ballroom, with Bedrooms above.

The house is asymmetrically composed of symmetrical elements, all very artfully assembled on a grand scale. The exterior utilizes Doric style columns and the interior has Ionic style columns throughout except for the Drawing Room that has Corinthian style columns.

The logs of the original house were removed toward the completion of the house, although the "foot print" of the original "dog trot" house remains as part of the floor plan. The plan is non-axial in its overall composition, although the sub-elements are axially composed, rendering a very picturesque quality.

This house is Alabama's finest Greek Revival mansion and is well worth seeing. It is listed on the National Register of Historic Places, and is also a National Historic Landmark. It is now owned and maintained by the State of Alabama.

NEW ON THE SCREENS

E&A recently was selected by the Louisiana Architects Selection Board to design The New Student Services and Classroom Building for Delgado Community College West Bank Campus, New Orleans, LA. This 34,000 square foot building will provide 15 sorely needed classrooms, 3 of which will be tiered with interactive TV and other audiovisual equipment. It also will provide a new Library and all of the Administrative Services such as Dean's Office, Bursar, Registrar, Admissions and a Bookstore for the campus. The budget is $2.8 million.

PRODUCTS FREQUENTLY IN LITIGATION

The Huntsville, AL Chapter of CSI (Construction Specifications Institute) requested the writer to conduct a seminar talk on 24 March 1993 about those products that are most frequently encountered in litigation due to failure of the products, based upon experience in Forensic investigations and expert testimony.

Those products most frequently associated with failures are Single Ply Roof Membranes, Vermiculite Concrete Decks, Brick Veneer, EIFS (Exterior Insulation & Finish Systems), Curtain Walls, and Light Wood Trusses.

SINGLE PLY ROOF MEMBRANES

Two types of single ply roof membranes are frequently in litigation due to different causes of failure: PVC (Polyvinyl Chloride) and EPDM (Ethylene Propylene Diene Monomer), a synthetic cured rubber.

PVC membranes were originally developed in northern Europe, and were used with success before they were imported to the U.S. In the U.S., the PVC membranes are subjected to harsher climatic conditions than they are in northern Europe. The winter temperatures are frequently lower, and the summer temperatures are higher. The lower latitudes subject these membranes to more intense ultraviolet light. The combination of high heat with the ultraviolet light causes the plasticizers to evaporate from the membrane, thereby causing the PVC to become brittle and inflexible. The membrane looks and sounds like potato chips when in this state and walked on. Resultant cracking allows water penetration into the building. Some formulations of PVC have been observed to shrink when subjected to the heat and ultraviolet light, and to fail the edge anchorage of the system, and thus leak by exposing roof deck area at the perimeter. The former type of failures caused Plymouth Rubber Company to withdraw its PVC membrane "Plyroof" from the market and to renege upon all warranties until adjudicated to fulfill them. The latter types of failure were associated with Trocal brand membranes. These warranties were fulfilled in most cases.

The EPDM membrane failures are primarily in the seams of the sheets that comprise the membrane. Since these membranes are vulcanized, that is cured rubber, the sheets have to be glued together where they adjoin. This is unlike PVC or uncured rubber membranes that can be "welded" together by a solvent being applied to the seam. Most EPDM

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manufacturers call for a sealant to be applied to the top raw edge of the glued seams to protect them from deterioration by rainwater. The underside of the seam is vulnerable, however. When the membrane is punctured and there is water intrusion to a substrate that is highly absorbent, the water is converted to vapor by the heat and attacks the seam adhesive from below.

In the early 1980's, some manufacturers changed their adhesive requirements. They allowed an ethylene adhesive to be used for seam adhesive as well as for adherence of the membrane to dissimilar materials. Before, only a butyl based adhesive had been allowed for seams. Numerous failures resulted as the ethylene adhesives were much more sensitive to heat and moisture than the butyl adhesives were. Seams delaminated from below, and allowed more water intrusion, so that the failures were progressive. The worst failures occurred with substrates composed of wood fiber board, absorbent insulation board, or vermiculite insulating concrete. Today, all EPDM manufacturers require butyl based adhesives on the seams, and are discouraging the use of any absorbent substrate. One manufacturer, Carlisle, has even developed a system whereby a factory applied bead of sealant seals the sewn from underneath.

VERMICULITE CONCRETE DECKS

Lightweight insulating concrete roof decks with vermiculite as the aggregate that also provides the insulating qualities of the deck have a long history of failure. Despite this, there has always been tremendous pressure to use these decks because of their fire resistive properties and the resultant lowering of fire insurance premiums.

Vermiculite is a naturally occurring mineral that has insulating properties. It also has the property of being hygrometric, that is it absorbs water from the atmosphere and retains it. When wetted, it retains the water for a long time. The typical garden store sells vermiculite as a moisturizer for garden soil!

The primary manufacturer of vermiculite concrete roof deck systems is W.R. Grace Co., and the product is called Zonolite.

When used in an insulating concrete, the vermiculite has to be dried before a roof membrane is applied, as the water contained will fail most roof membranes. To make the concrete, one has to mix water with the cement, sand and vermiculite. It is exposed to the weather, where it absorbs more water.

Since the Zonolite has no structural capabilities, it has to be applied to a structural deck, usually a formed metal deck or a structural concrete deck.

On metal decks, the metal is provided with ventilation holes for the vermiculite to dry out from below. Years ago, vent clips were used between adjoining sheets of the metal deck to provide the venting. When vent clips were found not to provide enough area for the vermiculite to dry, the manufacturers began to perforate the metal deck, at first with 3/4% venting area, then 11/2% venting area, and finally with 3% venting area.

On concrete decks, a different mix of Zonolite was developed, using less vermiculite. This has been found to not be effective at all.

Attempts have been made to vent the Zonolite decks from above with disastrous results. Vents were placed in the roof membrane down to the Zonolite deck. These vents actually increased the moisture in the vermiculite, due to condensation occurring at night.

Research has shown that Zonolite decks have remained wet from the original mix water of the insulating concrete for as long as ten years, failing the roof membrane with a cycle of vaporizing and condensing the water below the membrane and failing it, whether it was a built-up roof, EPDM or modified bitumen membrane.

BRICK VENEER

Brick veneer systems fail when they are designed and constructed with an air space that is too small. When the air space is less than 2 inches, it becomes clogged with mortar droppings during its construction. A 2 inch wide air space allows the mason to pull up a cord suspended board in the cavity as he lays up the wall. This board catches the inadvertent mortar droppings. Otherwise, these mortar droppings bridge across the air space and clog the weep holes at the bottom, causing water that penetrates the brick to bridge across the air space to the backup wall and enter the building, either in positions up the wall or at the bottom.

Years ago, brick veneer walls were considered to be different from masonry cavity walls, and the air space, which is the equivalent of the cavity, was allowed to be one inch wide as opposed to the 2 inch wide cavity. Weep holes were required to be at 48" on center. In the intervening years, because of the failures of brick veneer walls on multiple story commercial buildings with metal stud backup walls, these standards have changed. In February of 1987, the Brick Institute of America changed the recommended air space to 2 inches, and recommended that the backup walls have very stiff properties: a deflection in wind loading of L/600 or greater. The frequency of weep holes has been increased to 24" on center, preferably 16" on center.

CURTAIN WALLS

Aluminum and glass curtain walls, sometimes with metal fill-in panels, with glazing gaskets are a frequent source of litigation due to water intrusion. The gaskets on the outside portion of these systems are held in place by a pressure plate. The pressure exerted upon the glass is designed to prevent water intrusion except during very strong winds. Curtain walls are rated for various pressures. When the rated pressure is exceeded these systems have a backup method for removing the water that intrudes into the glazing cavity. The glazing cavity is designed in such a way as to collect the water, channel it to a weephole and let it weep out similar to the Brick Veneer wall. To do this the glazing cavity of the wall has to be totally and thoroughly seated from the interior of the building to prevent differential pressure from "sucking" this water into the building. The usual failure is for the glazing cavity seal to be breached or never installed properly.

EIFS

EIFS is a system of thin synthetic stucco applied over a foam insulation board that is usually glued to the backup wall. The stucco is composed of portland cement, sand and acrylic polymers applied with a nylon or fiberglass mesh to the foam board.

EIFS failures are of three distinct types. The first consists of undesigned penetrations, such as water pipes, conduits, fasteners for downspouts, etc. that allow water to intrude to the glue attachment to the backup wall and fail the glue. The second type of failure is that of crushing of the EIFS when horizontal expansion joints are not installed at the floor line when the backup walls are of wood frame and cross grain shrinkage is experienced. The third type is that of cracking due to excessive shrinkage or thermal stress because extra mesh has not been applied at the inside and outside comers, or the mesh is too thin for the configuration of the wall, such as when a window is in the middle of a wall panel.

Light wood trusses fail when the bracing required is not installed and when the design is “fudged” for economic considerations. Also, contractor abuse during storage and handling, is a major cause of failure.

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