Kimbell Art Museum Expansion

By Keith Simmons, RRO

The Kimbell Art Museum has been the landmark of culture for the Fort Worth community since its opening in 1972. Designed by the distinguished American architect Louis Kahn, the building brought natural light to art and sculpture and overdue respect to "Cowtown," a city previously known for oil and cattle.

As expansion plans were long studied, the Kimbell Art Foundation and the architectural community at large shared their concerns about any potential new structure adjacent to the Kimbell that might detract from this hailed architectural gem. After many years of consideration, the Kimbell's board commissioned famed Italian architect Renzo Piano, who had been inspired by the Kimbell when he designed the Menil Collection in Houston—and more recently, the Nasher Sculpture Center in nearby Dallas, Texas.

Renzo Piano was very much aware of the challenges that existed when considering a building sited next to Kahn's iconic structure, and he developed a design concept that was greatly influenced by Kahn's building while clearly embodying his own design aesthetics. In addition, the majority of this new building would be situated underground.

At 80 feet below grade, the new structure would cross paths with the Trinity River Basin. This reality presented waterproofing challenges that would need to be incorporated into the design in order to protect priceless pieces of art from moisture. Garden roofs atop portions of the expansion project served to provide a landscaped space that would separate the old and new structures, with a portion of the project including a below-grade parking garage for visitors.

A specially designed glass roof, complete with photovoltaic solar panels mounted on exposed Douglas-fir-laminated glue-lam beams, was carefully designed to bring appropriate amounts of diffuse natural light into the gallery spaces while reducing the overall heat island effect.

While the new building in no way mimics the original Kahn structure, it clearly succeeds in satisfying the goals of the Kimbell Art Foundation, the architectural community, and art patrons.

The Beck Group, out of Dallas, Texas, was chosen as construction manager for this project. DryTec Moisture Protection Technology Consultants, Inc. (DryTec) was chosen by Beck and the Paratus Group (the management firm engaged by the Kimbell Foundation to provide peer design review and quality-assurance observation services related to the building envelope, excluding the specially designed glass roof system).

After a careful review of the well-crafted plans prepared by Kendall/Heaton Associates, Inc. of Houston, Texas, a conference was held at the site. All parties involved with the waterproofing aspects and certain critical details were involved as part of the team's overall goal of delivering a leak-free facility to the Foundation.

After this overall review, separate pre-installation conferences were held with each of the building envelope-related subcontractors' and manufacturers' representatives. These included critical details, down to the type of curing compound that could be used on poured-in-place concrete decks scheduled to receive garden roof assemblies.

The correct design and installation of the below-grade waterproofing was of paramount importance for the success of the project, as the Trinity River Basin would provide potentially significant hydrostatic pressure, depending upon the annual rainfall amounts. Starting at the bottom of

Photo 1 – HDPE waterproofing.

Photo 2 – Steel reinforcing in piers.

the excavation, high-density polyethylene (HDPE) waterproofing was installed (*Photo 1*). The manufacturer's required seam tape was adhered to the end laps, seams, and flashings to provide a continuous mechanical bond with the concrete cast upon it. Careful inspection of this product was provided by Drytec to supplement the oversight by Beck and the waterproofing subcontractor.

Coordination and cooperation among trades was essential. Concrete tradesmen needed to carefully fold the waterproofing membrane away from a concrete pour, taking care not to destroy the membrane, which would need to be extended up and above at a later date to tie in with vertical below-grade waterproofing. Careful inspection by all parties also ensured that waterproofing membranes were not punctured during installation of steel reinforcing (*Photo 2*).

Custom details were prepared for flashings at grade beams, reinforced concrete piers, and expansion joints, with all such installations being reviewed on the basis of approved submittals and manufacturers' written instructions. Below-grade waterproofing demands a perfect installation to prevent future costly remedial repairs. This, coupled with a well-designed subsurface drainage system, has the new museum "in the dry."

On the vertical, meticulous preparation of the concrete finish was executed to allow for proper adhesion of the chosen waterproofing membrane. All repairs to the sub-grade concrete walls were executed in conformance with ASTM D5295, *Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems*; and *ACI 515, A Guide to the Use of Waterproofing, Dampproofing, Protective and Decorative Barrier Systems for Concrete*; with a number of irregularities caused by rod holes, honeycombing, and rock pockets requiring additional attention.

After the below-grade concrete had been properly prepared, the chosen primer was applied to the walls and allowed to dry. After this, a self-adhering waterproofing membrane (*Photo 3*) was fully adhered

Photo 3 – Self-adhering waterproofing membrane.

Photo 4 – Modified asphalt with polyester reinforcement.

Photo 5 – Protection sheet.

to the walls, with careful oversight being provided as noted previously. Prior to the backfill being installed, a drainage mat and associated protection board were installed.

A liquid-applied, vapor-permeable air/moisture barrier was installed after careful review and consideration of all critical flashing details. At joints in the precast architectural concrete panels, T-shaped pieces of the 24-ga. stainless steel sheet metal were installed to bridge the joints in the concealed spaces within the specially designed architectural concrete walls, with small rollers being used to apply the flashing membrane for this system.

A year and a half passed before it was time to install the green roofing systems. With the works of Picasso, Matisse, and other artists displayed directly beneath these roof decks, absolute perfection was essential.

At the roof level (which is actually ground level), the architect of record chose to install a hot, modified-asphalt system. The concrete decks were primed with an approved material, followed by a hot mopping of modified asphalt with spun-bounded polyester reinforcement embedded in the hot bitumen (*Photo 4*). The temperature of the bitumen was monitored to meet equiviscous temperature (EVT) criteria during applications. The manufacturer's protection sheet (*Photo 5*) was hot-mopped as a part of the installation after all surface defects in the concrete were properly addressed.

To aid in the identification of any future leaks in the green roofing membrane, a vector-mapping electronic leak detection system was specified and performed. Prior to the installation of overburden and landscaping, flood testing was performed in areas of concern and at minor deflections in the deck. With the aid of this system, leaks were identified and corrected as the work progressed. Some leaks were a result of something as small as a piece of pea gravel penetrating the membrane, while others were due to more obvious damage from other trades.

Common gutters insulated with polyvinyl chloride (PVC) cladding (*Photo 6*) were lifted onto the 100-foot-long Douglas-fir "glue-lam" beams (*Photo 7*). A series of photovoltaic solar panels are installed in a low-profile sawtooth-monitor fashion. Fritted glass and fabric scrims illuminate

Photo 6 – Common gutters.

Photo 7 – Douglas-fir "glue-lam" beams.

the silvery sheen of the exposed concrete walls, which contain 2% titanium additive in the concrete mix. A German-based contractor fabricated the specially designed glass roof.

Only one-third of the interior of the Piano Pavilion is above ground, reducing heating and cooling demands. Because of its below-grade construction—coupled with solar panels and 460-ft.-deep geothermal walls—the Piano Pavilion will use half the energy required for the operation of the Kahn Building.

Original critics of this addition have hailed the expansion as a success. "No Harm to the Kimbell," wrote architecture critic Martin Fuller. Further comments were, "does no harm to the adjacent landmark," and, "a warm embracing fusion of art and architecture."

Visitors to this structure will experience art displayed amidst beautiful natural wood floors, expertly executed architectural concrete walls, and diffuse natural light. Members of the design and construction team will most likely be thinking about the critical waterproofing issues that were solved as a part of this project.

Keith Simmons, RRO

Keith Simmons has been a Registered Roof Observer with DryTec Moisture Protection Technologies for the past nine years. Prior to that, he was a roofing contractor in the North Texas area for 23 years. He has been a member of RCI since 2005 and a participating member of its North Texas Chapter since its inception.

CONSTRUCTION BACKLOG HITS RECORD HIGH

The Associated Builders and Contractor's (ABC's) measure of its members' backlogs for new work reached an all-time high during the second quarter of this year. The Construction Backlog Indicator (CBI) hit 8.5, up 5.6% from the first quarter and 3.6% above the second quarter of 2013. "Gains [were] registered in every industry segment in nearly all geographies and for firms of virtually all sizes," reported Anirban Basu, ABC chief economist. The increases are likely due to job growth and rising consumer confidence, Basu reports.

— ENR