DESIGN-BUILD FOR MASONRY RESTORATION:

CHALLENGES AND SUCCESSES AT THE KANSAS CITY MUNICIPAL AUDITORIUM

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Fig. 1: Kansas City Municipal Auditorium, circa 2012
(Image courtesy of the Kansas City Convention & Visitors Association)

THE SEPTUAGENARIAN CELEBRATION

Designed in 1933, the Kansas City Municipal Auditorium (Fig. 1) has been nationally recognized for its value as an architectural landmark. Designed by Gentry, Voskamp & Neville along with Hoit, Price & Barnes, the facility was constructed as part of a larger Art Deco-inspired overhaul of the downtown core, along with the City Hall, police headquarters, and county courthouse buildings. The Municipal Auditorium was designed in a transitional Art Deco/Moderne style and clad in a variegated Indiana limestone veneer. Decorating the massive building are relief sculptures personifying the fine arts, local industry, and athletics. Since the 1936 opening, the Municipal Auditorium has been in continuous use as a sports arena, theatrical space, and events venue.

To ready the building for its upcoming 75th anniversary, the owner, the City of Kansas City, funded an exterior restoration package that was to include masonry work, architectural lighting, marquee signage upgrades, decorative metal restoration, and a number of other facility operation-related scope items.

Because of successful past experiences using design-build as a delivery method for roadways and some limited design services, the City issued the project as a "best-value" Request for Proposals with a guaranteed maximum price of approximately $3 million. While the industry is comfortable with design-build for new construction, it is still somewhat unorthodox for use on the restoration side. Managing risks while assembling a competitive proposal can be complicated. The success of design-

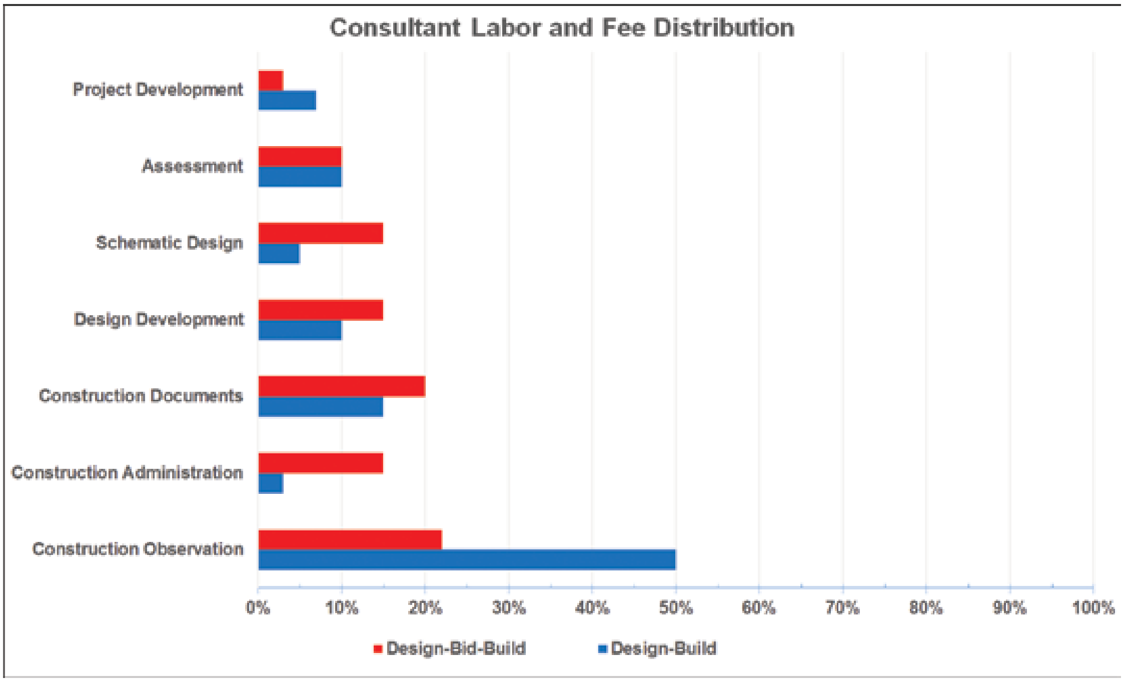

Fig. 2: Comparative breakdown of labor and fee allocation between design-bid-build and design-build

build at the Municipal Auditorium will serve as a case study illustrating the various benefits and challenges of this approach for preservation-focused projects.

THE PROJECT TEAM

By 2010, the building was in great need of maintenance. The limestone façades were deeply soiled; mortar was in need of replacement; and cracking of stone units, movement of parapets, and spalling were widely occurring. To assemble the best-value proposal, a multidisciplinary team was assembled to include a general contractor as the design-build team leader, a façade restoration engineering firm, a preservation architect, a masonry restoration subcontractor, and numerous other subcontractors to address the varied scope items. After successful selection, the winning team was told by the owner that selection was made not only because of their collective experience with masonry restoration but also because of collaborative efforts on past projects. The owner chose design-build because of the "one-contract, one-team" structure and thought the winning team best represented that ideology.

ACCLIMATING TO DESIGN-BUILD

The proposal schedule allowed about 4 weeks for teams to prepare a detailed proposal, complete with an intensive project approach, technical information, cost opinions, and a fast-track schedule with a mandatory completion date of 12 months.

Because design-build requires more up-front, at-risk work from the competing teams with no compensation for an unsuccessful bid, teams must manage pre-proposal efforts against win expectations. A visual assessment of the masonry was needed to prepare the initial technical scopes and cost opinions, and the assessment was performed with the intention that future work would build directly on this information. One of the strongest advantages of design-build is the ability of the consultants and executing contractors to collaborate on intervention strategies from the start, eliminating the knowledge discontinuity and repetition of effort inherent in the more traditional design-bid-build structure.

Aside from developing the technical scope, which benefited immensely from this collaboration, the difference in allocation of fee and effort between design-build and design-bid-build is perhaps the strongest argument in favor of design-build for restoration work (Fig. 2). From the consultant's perspective, the highest value of their contribution to a project is provided in the design and construction observation. Because of the collaborative nature of design-build and no need to produce conservative bidding documents, developing the technical aspects of the project is far more efficient. Additionally, the design-build leader takes on responsibility for the majority of the project management and construction administration, reducing duplication of effort in these activities which would normally be provided concurrently but separately by the consultant and the general contractor. As a result, the consultant can rebalance fee and labor into higher-value efforts—specifically, construction observation. Quality of craftsmanship is critical for masonry restoration work, and when the consultant can dedicate more effort to this aspect, the overall project benefits exponentially, particularly for design-build, which eliminates much of the sometimes contentious relationship between the consultant and the contractor.

THE BLENDING OF "DESIGN" AND "BUILD"

The lack of formal construction documents at the start of the work is another facet of design-build that can be stressful for a weakly integrated team. Due to the pre-proposal work and early collaboration of the façade consultant and the masonry subcontractor, the project at the Municipal Auditorium began with a library of repair details with preselected materials and agreed-upon processes. Early during the proposal phase, the team had been able to explore a variety of "if/then" repair scenarios which enabled the development of unit price work items to address all but the most atypical conditions. This reduced mobilization time, allowing the team to take full advantage of a fast-track schedule with a rigid phasing plan.

The Municipal Auditorium is a massive structure, occupying an entire city block with nearly 200,000 ft^2 (18,580 m^2) of masonry wall. Keeping track of the extraordinary amount of cleaning and

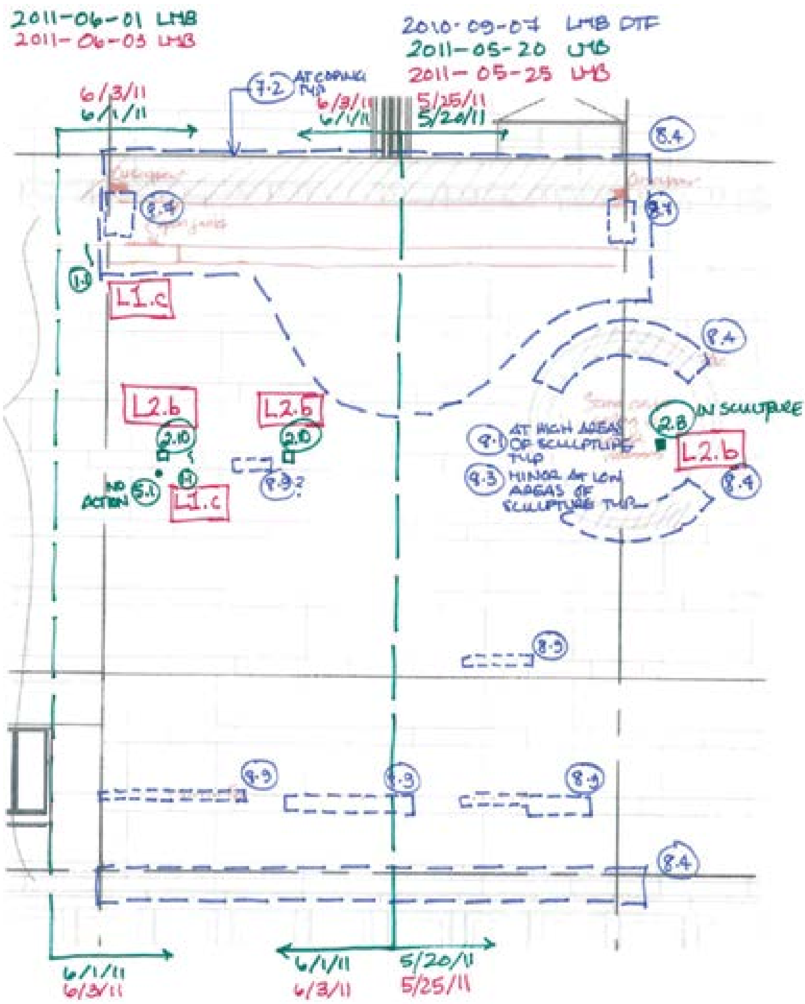

Fig. 3: Field sheet at West Elevation location showing overlap of documentation: pre-proposal assessment (blue); pre-construction assessment (green); and punchlist review (red)

repair work to be performed required organization and diligent documentation. To address this, a detailed quality management plan was developed as part of the proposal, outlining quality assurance responsibilities and procedures and including a number of documentation logs to track progress and quantities. The numerical codes in the logs were keyed to both the unit price work items and the field sheets, allowing easy reference across the various project documents. These logs also served as a detailed punchlist report as work progressed around the building.

THE PROCESS OF QUALITY ASSURANCE

During construction, the façade consultant primarily performed quality assurance activities, including construction observation and field testing. Due to the fast-track schedule, submitting daily progress reports and tracking weekly milestones were critical to meeting the substantial completion deadline. The façade consultant and masonry subcontractor developed a detailed quality assurance process: documenting quantities of repair for cost tracking, early identification of atypical conditions, and field observation for workmanship. This was achieved through a three-part process.

PRE-CONSTRUCTION SURVEY

Prior to the start of work at each suspended scaffold location, the façade consultant and masonry subcontractor would perform a survey together to quantify typical repairs, identify atypical conditions, and to agree on a restoration program specific to the conditions at each drop. Observations made during the pre-construction survey were overlaid onto the preliminary assessment documentation on the field sheets (Fig. 3).

PROGRESS REVIEW

During construction, the team would again ride the stage to observe work progress, monitor workmanship, and troubleshoot unforeseen complications to repairs.

PUNCHLIST DOCUMENTATION

Upon completion of work at each drop, the façade consultant and the masonry subcontractor would document completed work and prepare a "punchlist" of outstanding work items to either be completed prior to demobilization or to be addressed in the future. Repairs were coded against the pre-proposal list of unit prices and estimated quantities. Completed work was again overlaid onto the same field sheets (Fig. 3).

This three-part process proved exceedingly efficient for tracking work and ensuring that punchlist items were completed. Because quantities of some work items, particularly crack and spall

Fig. 4: Corrosion of a structural steel column that resulted in damage to the stone veneer. Note that steel is directly behind with veneer with no protection from moisture

Fig. 5: Successful cleaning mockup, showing level of heavy soiling removed

repairs, substantially increased when close-up access to the façade became available, the real-time documentation allowed the team to closely monitor executed work versus the estimated quantities. In several instances, rebalancing work item budgets occurred with no reduction in the technical scope or quality of work because notice was provided sufficiently in advance to accommodate the unit price overruns.

TECHNICAL CONSIDERATIONS

Transitional façades of this era—called "transitional" because they integrate characteristics of both bearing wall construction and modern hung veneer systems—have a unique set of deterioration challenges because of the inefficiency with which they manage water inside the exterior wall system. Built with neither a waterproofing layer nor integral drainage, deterioration of the steel structural frame is common (Fig. 4), and it can be difficult to determine whether visible distress is related to masonry deterioration or underlying structural issues.

Cleaning and weatherproofing the façades were the primary targets of the client. Decades of atmospheric soiling, likely composed of tenaciously adhered hydrocarbon pollutants, proved difficult to remove without resorting to overly aggressive cleaners, while the biological soiling was more easily treated. Through a long mockup process, a level of acceptable clean was established using a two-step biocide and detergent cleaner that did not damage the limestone surface (Fig. 5). During the cleaning process, the pH of the rinse water was regularly monitored to ensure that runoff was neutralized in compliance with city regulation.

Much of the required masonry repairs were related to deterioration of internal steel cramps and stone anchors. Spalling and crack repair were the most common repairs, and shot-sawn limestone surface repairs required an artistic eye from the masons. In addition to cracks and spalls, a number of overhead hazards were identified at the parapets, where coping and fascia stones had moved out of plane. Due to the movement, the stone anchors failed at the back of the panels, and the units needed to be re-anchored to the backup.

Damage and displacement of stone units was also observed at several of the sculptural panels. "Drama," at the center of the North Elevation, directly over the main entry marquee, exhibited the worst distress with localized shattering of two perimeter units (Fig. 6). Because repair strategies had been developed during the proposal phase, products and methods already on hand were able to be employed for these somewhat on-the-fly repairs. The units were stabilized with a combination of pinning in place, installing repair materials, and grout injection.

SHARING THE LESSONS LEARNED

While the technical execution of the work was well-performed, the Municipal Auditorium project was successful because of the trust relationship built between the team members, including the owner.

Fig. 6: Severe damage to perimeter unit on right side of "Drama"

The design-build structure allowed effort to be directed to the most critical aspects of the project, maximizing efficiency of schedule and fee. For those considering the design-build delivery method for a future restoration project, a few lessons learned from our team:

- The design-build team members will ideally have experience working together on restoration projects. Communication, accountability, and individual ownership of the project are critical to developing a "one-team" mentality.
- The owner's representative will ideally have been involved with the project from conception, will understand the stakeholders' ultimate goals, and will be empowered with the authority to make decisions on scope and cost issues.
- The bid submittal needs to be developed as a collaborative effort. This process will help reduce risk and will establish procedures for addressing out-of-scope or unforeseen conditions.
- Quality assurance processes should be established at the very beginning and written into a quality control plan. The quality control plan should be a living document that is updated regularly and accessible to the entire team.

CONCLUDING THE ARGUMENT FOR DESIGN-BUILD

Design-build holds many advantages for historic restoration work. For clients with a very general scope and a set budget, it can be a cost- and schedule-efficient delivery method. Also, where access is sufficiently difficult to make a detailed assessment prohibitively expensive, a modified design-build approach could be a consideration to reduce mobilization and rigging costs.

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