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Value Engineer Is Invaluable to Clients

Innovative, cost-efficient solutions have become the calling card of engineer Crawford, Murphy & Tilly Inc. **BY JOHN GREGERSON**

REVISED COURSE
Reconfiguring the I-70 Interchange in St. Louis saved client Missouri Dept. of Transportation 28% of programmed costs.

Springfield, Ill.-based engineer Crawford, Murphy & Tilly Inc. (CMT) has a transformative effect on the design issues it encounters.

To contend with sanitary sewer overflows in an area served by a 9.4-mile-long section of trunk sewer, Metropolitan St. Louis Sewer District (MSD) initially considered constructing a \$120-million to \$160-million deep tunnel relief sewer until, during a predesign study, client and CMT began to brainstorm.

“Our rule is, there’s no crazy idea. Put everything on the table,” says CMT project manager Raed Armouti.

In all, discussions generated 14 feasible alternatives, though one in particular resonated. What if MSD instead constructed as many as four flow-equalization

tanks to store sewage during a rain event, then release it into the system once conditions stabilized? In theory, the alternative could yield considerable savings, assuming it was executed in combination with upgrades to existing pipe that reduced infiltration and inflow.

In subsequent sessions, CMT performed hydraulic modeling to vet the concept, evaluating design flows, sewer sizes, storage volumes and placement of the tanks within the sewer system, all while calculating costs of candidate configurations.

The upshot: Only two storage tanks were needed rather than four, bringing total cost savings to more than \$80 million.

As designed by CMT, the first of the two tanks, a

6-million-gallon concrete structure, is supported by a diversion structure and six submersible pumps to accommodate a range of flows, with a firm capacity of 30,000 gpm. During rainfalls, a real-time SCADA system monitors water levels in the trunk sewer while controlling diversion of flow into and out of the tank, a solution that minimized storage requirements.

The project, completed last year, was the first of its kind for MSD.

For CMT, a firm of 260 employees, firsts are second nature. “We’re not a firm that holds box lunch meetings to discuss how to innovate,” says Roger Austin, CMT vice president and marketing director. “It’s in our DNA. We’re a medium-size firm that brings a small firm’s perspective to client needs. We don’t bring cookie-cutter concepts to the table.”

Nor are designers constrained by layers of management. Across 10 regional offices and four operating groups, including aviation, highways and bridges, water resources and civil site services, “the project manager is king,” says the firm’s president, Dan Meckes, who is based in the firm’s St. Louis office. “Organizationally, we’re flat. We believe in empowering our designers and letting them lead in our collaborations with clients.”

“As project managers, we select our own teams and engage in early negotiations with clients to determine scope of work and negotiate fees, understanding that any incentives carry the responsibility of meeting budget and schedule,” says Armouti. “We, in turn, empower our team members, seeking input to best serve the project and client.”

To enhance design concepts, the firm customarily organizes workshops to unite key stakeholders at a project’s inception. “That’s the point when you minimize risk and maximize value, rather than at the end stages of design, when value engineering more typically occurs,” says Austin.

To bring fresh perspective to concepts, CMT frequently solicits participation from contractors with expertise with a particular project type but no stake in the project. “Designers and builders tend to think on different planes, so early input of that nature is useful for unusual projects,” says Greg Law, group manager, highways and bridges, with CMT’s St. Louis office.

Contractors typically hail from outside the region to ensure opinions aren’t informed by previous experience with the client.

For Missouri’s new Interstate 70 interchange, a structure linking three highways—I-70, I-44, I-55—to the Mississippi River’s recently completed Stan Musial Veterans Memorial Bridge, CMT recruited the retired owner of a mid-size construction firm specializing in bridges to join members of Missouri Dept. of Transportation (MoDOT) and Federal Highway Administration in reviewing conceptual plans.

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Interchange Exchange

Here, a primary issue was budget, with MoDOT and Illinois Dept. of Transportation having revised concepts in order to reduce project costs for bridge and interchange by nearly one-third, to \$690 million. Among other concessions, MoDOT agreed to eliminate east and west flyovers from the interchange, providing the footprint to accommodate the two in the future. Even then, says Law, “budgets were extremely tight.”

During the workshop, client, design team and contractor developed strategies to further reduce interchange costs. By reversing the positions of current and future flyovers—locating the former closer to grade and the latter higher aloft—they reasoned they could reduce roadway fill and bridge heights while trimming the heights of retaining walls by 20 to 30 ft.

“The solution also resulted in a smaller footprint,” says Law.

As built, the reconfigured structure achieved \$13.6 million in savings—or 28% of programmed costs—with MoDOT receiving 100% of savings, compared with 50% under a traditional value engineering contractor proposal, which entitles the contractor to the other half. MoDOT allocated the savings to the bridge.

Rewards also are flowing CMT’s way. Last year, firm revenue leapt 22%—to \$53 million—on the strength of several key projects, including a 280-ft land bridge that will span I-70 to connect downtown St. Louis to Gateway Arch grounds—Phase 1 of the \$380-million St. Louis Gateway Arch Grounds Renovation project.

From his office window, Meckes can see crews drilling shafts in preparation for pilings. He says work is proceeding briskly in order to complete the span—dubbed Park Over the Highway—by December, with future phases of the project due for a 2015 completion to mark the Arch’s 50th anniversary.

Time and Money

“If the I-70 interchange was about saving money, Park Over the Highway is about saving time,” adds Law. Design work, he says, was accelerated by three months as soon as contract negotiations commenced. A one-day construction staging workshop yielded no fewer than 14 design initiatives to shave the project’s schedule by four months.

Logistics are convoluted, and call for demolition of a pair of bridges to make way for Park Over the Highway as well as relocation of attendant systems, including a steam line feeding the Arch. Elsewhere, deck and base of a third bridge slated for demolition are serving

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GATEWAY TO THE GATEWAY Park Over the Highway, a current project of CMT's, will link downtown St. Louis to the city's Gateway Arch grounds.

TUNNEL TANKED
Rather than build a deep tunnel relief sewer, CMT worked with client Metropolitan St. Louis Sewer District to develop plans for an above-grade tank to contend with sanitary sewer overflows.

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as staging areas for construction of end bents for the landscaped bridge.

Although CMT envisioned a box-like structure for the bridge, it later incorporated catenary curves at two ends in order to mimic the lines of the Arch—a configuration that introduced trapezoidal geometries to the structure. The finished design calls for straight girders for central portions of the bridge and splayed members closer to the catenary walls. Complex loading studies accounted for myriad variables, including paving, sidewalks and trees.

CMT employees believe firmly in quality but also equality. For Park Over the Highway, as with other of its projects, participation rates among disadvantaged business enterprises (DBE) exceed project requirements. MoDOT set a goal of 20%. CMT hit 32%. Of 10 subconsultants for the I-70 interchange, seven of the participants were DBE firms.

“A more diverse project team is a more innovative project team,” says Meckes. “Everyone brings something to the table that’s unique to their experience. For I-70, CMT engaged subconsultants in informal mentoring to acclimate them to a project of its magnitude.

DBE requirements for client Lambert-St. Louis International Airport vary, depending on how projects are funded. “In one instance, we’d assembled a team to meet the 30% goal at Lambert, then kept the same percentage—and team—intact when we bid on a federally funded project requiring only 10% DBE participation,”

says Meckes. “Ultimately, it’s about relationships that develop over time.”

Mentoring programs continue. “We have our CFO engage with firms and our marketing team engage with them,” says Meckes. “We’ve also given them our project management manuals and told them to run with it.”

CMT, meantime, is charting its own path for growth. Although acquisitions have bolstered its presence in Indianapolis; Springfield, Mo.; and Edwardsville, Ill., growth in other offices, including those in Chicago and Aurora, Ill., has largely been organic.

Employees typically are recruited following college graduation, then groomed to assume roles of greater responsibility. A decade ago, CMT founded a Young Professional Planning Group, the intent being to engage employees with three to 10 years of experience with the firm while ensuring lines of communication extend in both directions. Employees serve the six-member group for three years, then rotate out.

As a departure, CMT intends to look outside the firm for key hires when the occasion warrants, particularly when the practice promotes greater growth and diversity in regional offices.

“We really do grow our own,” says Meckes, “but we also want to be sure we’re presenting home-grown employees with new opportunities. It’s been a point of discussion with our Young Professional Group. And they get it. They’re excited about growing. We all are.” ■

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Office Locations: Springfield, IL | Aurora, IL | Chicago, IL | St. Louis, MO | Indianapolis, IN | Columbus, OH | Peoria, IL | Rockford, IL | Edwardsville, IL | Springfield, MO

A message from the Midwest Design Firm of the Year

Thank You

On behalf of our 270 employees, Crawford, Murphy & Tilly, Inc. would like to extend a sincere and humble thank you to all of our clients and partners for the key role that you have played in our being named **ENR Midwest Design Firm of the Year**. It's through our collaborative efforts that we can provide the highest value possible for the infrastructure we collectively deliver. Together we can do extraordinary things. We thank you for your continued trust, dedication and insight.

- ✈ *Aviation*
- 🛣 *Highways and Bridges*
- 💧 *Water Resources*
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