DESIGN BUILD AND DESIGN ASSIST

TWO GROWTH AREAS AT HAVENS STEEL

Don Proffer

Aerial view of partially completed internally resolved dome structure taken from 300′ boom erection crane.

In an industry that has always been driven by schedules, budgets and quality, Havens Steel is using design-build and design-assist techniques to more closely achieve all three of these goals for owners. Ken McCullough, President of Havens Steel says that the percentage of Havens' structural steel tonnage that is part of design-build or design-assist contracts is growing rapidly.

"There are a number of advantages for the owners in contracting a job as design-build. The owner has a single point of contact who has total responsibility for the job. And if it is done right, design-build has the potential for significant savings in time and money on a major project." McCullough continues, "We've had successful experiences as the lead design-build contractor and as the structural steel design-assist component of the design-build team. We really believe it's a better way."

Mike Gravino, Regional Sales Manager for Havens, says that it's a matter of timing for Havens. "We've long had a value engineering component in our jobs, but often it happens after the design documents are completed, so it was more difficult to incorporate our ideas into the process. In design-build, our fabricating and erection experts are at the table with the architects, engineers, general contractor—the whole team, sharing our specific knowledge to optimize fabrication, delivery and the erection schedule."

At Havens Steel, design-build has two major permutations. One is a true design-build, in which Havens has overall responsibility for a structure including foundations, structural steel, exterior cladding, even mechanical and electrical—the entire "box." In this scenario, Havens has contractual responsibility for the structural steel and engineer(s) of record, as well as all other aspects of the project.

The second category is design-assist, where Havens assists the engineers of record in the development of the design documents. Havens's design-assist can be part of a design-build team or a conventional "design, bid, build" methodology. In either case, it is early and consistent involvement in the process that produces the benefits for the project.

Architect's rendering of Omaha Convention Center/Arena.

Steve Hofmeister, Design Manager at Havens-SPI, the engineering and detailing subsidiary of Havens Steel, believes that benefits also derive from the holistic team approach required in a design-build contract. "This is really a team approach to a project. Members of the team need to change the way they think. All decisions must take into consideration the overall effect on the project, not just how it affects an individual trade. This requires on-going communications among all the contractors and designers."

Havens offers recent examples of design-build and design-assist that showcase the benefits of this construction methodology on the structural steel aspects of a project. One is a replacement roof for the Dakota Dome at the University of South Dakota in Vermillion; the other is a new convention center/arena in Omaha, NE.

Dakota Dome

When the University of South Dakota's 25-year-old Dakota Dome needed a new roof, it was decided to replace the old air-supported, fabric roof structure with a conventional, steel-supported roof. The state decided to let this project as a design-build competition. The selected design-build team consisted of Harris Construction of Lawrence, KS, as the design-build general contractor, Devine, deFlon, Yeager, Inc., architects, Martin Harper & Associates, structural engineers, Havens Steel and Havens Erectors, all of Kansas City, MO and additional contractors and engineers for other trades.

According to Bo Harris of Harris Construction, "This project not only had a budget to adhere to but also a very hard deadline for completion. We weren't getting the building until April 2001, and it had to be reopened in September. That deadline was absolutely critical. So we had to 'keep this project in the box.' The on-going communication within the d-b team was critical to control the process for cost, schedule and quality, and the communication had to continue for the life of the project."

Southwest view of the Omaha Convention Center/Arena rendering.

Steve Hofmeister, who was Principal-in-Charge with Martin Harper at the time, maintains that the "ability to sit down with Havens to work out the specifics of fabrication, shipping and erection actually made this job possible."

"Our original design concept would have included trusses that were at least 15′ deep. After consultation with Havens, it was obvious that there was no room in the schedule for field assembly of trusses."

"So with David McKenzie of Havens SPI and the rest of the Havens team, we determined the best overall solution was to make the trusses 11′-6″ deep at the centerlines. This was the maximum depth that could be economically shipped to the site. This increased the tonnage but enabled the trusses to arrive at the site and go straight from the truck into place. Without this one change, it would not have been possible to replace the 160,000-sq. ft. roof in $4^1/2$ months."

Continues Hofmeister, "A design engineer working alone probably would not have been able to fully evaluate the cost implications of tonnage vs. time. Having the expertise right there was critical to the success of this project."

The Dakota Dome roof consists of a 40′-diameter, center compression hub connecting pairs of long span trusses acting as the dome ribs. The compression hub consists of a steel frame with 10'-square, 2"-thick plates on the top and bottom. The assembled hub was too heavy to lift into place, so it had to be built in the air.

View from the existing concrete ring beam showing the balanced erection of the partially erected dome. (The existing roof fabric is pierced by the shoring tower).

The trusses range in length from 200' to 230', resulting in a clear span dome of up to 460'. Two 300-ton cranes were used to simultaneously place opposing pairs of trusses to maintain balance on the compression hub. Two thousand tons of structural steel and metal deck went into this project.

Concludes Gravino, "Design-build allowed us to recognize a potentially devastating scheduling problem while there was still time to avoid it."

New Convention Center/Arena

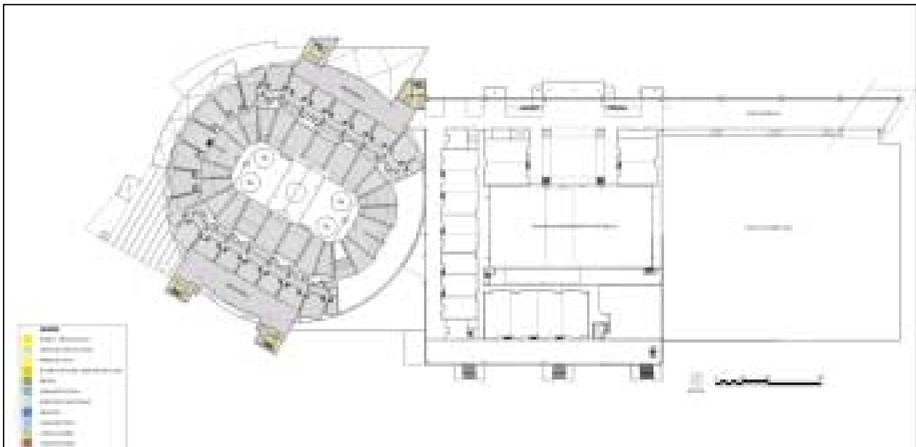
The Metropolitan Entertainment & Convention Authority (MECA) in Omaha, NE, is the operator and manager of that city's new convention center/arena. With a completion date of August 2003, MECA contracted with DLR Group of Omaha, architect of record, Thornton Tomasetti Engineers of New York, structural engineering consultants and Kiewit Construction Company of Omaha, construction manager at risk, to deliver the new convention center/arena. LMN Architects and NBBJ Sports and Entertainment were concept design consultants for the convention center and arena respectively.

According to Cal Logan, Kiewit Project Manager, "We had to develop a guaranteed maximum price and completion schedule from nine pages of 'concept' drawings. Then preliminary design drawings were developed, and we set out to find the best subcontractors for the job. After reviewing their preliminary cost estimate and, more importantly, their design-assist capabilities, we contracted with Havens for the structural steel detailing, fabrication and erection."

The convention center/arena has approximately 10,900 tons of steel in beams, 150' trusses, columns, vertical bracing and bar joists. Since the project had a guaranteed maximum price (GMP), the owner made it clear to all of the contractors that each one had a financial stake in the project coming in on time and on budget. With that in mind, Havens worked with Thornton Tomasetti very early in the process to provide fabrication and erection expertise as well as local knowledge on the project.

Gravino explains, "Thornton Tomasetti is truly one of America's premier engineering firms, and at Havens, we have significant expertise in convention center and arena fabrication and erection. This natural synergy made it possible for us to come up with the most economical ways to achieve our common goals."

States Hofmeister, "In weekly meetings we offer suggestions on member configurations, connections, paint, bearings and other ways to reduce costs and improve the fabrication and erection schedules. For instance, on this project, unlike the Dakota Dome, we suggested that the truss depths be increased from 12' center-to-center to 13'-6". This reduced the truss weight by approximately 10% and actually improved the structural performance of



Plan view of the Omaha Convention Center/Arena.

the trusses. Havens could make these suggestions because we knew where the trusses were to be fabricated and how they were to be shipped. An engineer working alone wouldn't have had immediate access to that information, so they would have to take the most conservative approach."

Cal Logan of Kiewit confirms, "Havens design-assist efforts have value engineered well over $1 million worth of savings and about 1,000 tons of steel so far on the convention center. And since their collaboration with Thornton Tomasetti was early in the design process, these efficiencies are in original drawings, not expensive change orders. So far this has been a win-win situation for all of the contractors on the project."

"Team players in critical areas are essential to successful design-build and design-assist projects. We think it can cut 10% to 20% off a schedule if we have the right people," concludes Logan.

Havens' Ken McCullough summarizes, "The Dakota Dome and Omaha Convention Center are two different projects, one a design-build and one a specialized design-assist format. Both benefited from Havens' steel design-assist efforts: one on a critical completion schedule and the other in substantial cost savings that can be applied to the GMP. Either way the owners and construction team members are the beneficiaries."

Don Proffer is President of Proffer Productions, a marketing communications firm, located in Overland Park, KS.

DAKOTA DOME

STRUCTURAL ENGINEER:
Martin Harper & Associates, Kansas City, MO

ARCHITECT:
Devine, deFlon, Yeager, Inc., Kansas City, MO

STEEL FABRICATOR:
Havens Steel, Kansas City, MO (AISC member)

STEEL ERECTOR:
Havens Erectors, Kansas City, MO (AISC member)

STEEL DETAILER:
Havens SPI, Kansas City, MO (NISD member)

SOFTWARE:
SDS/2

CONVENTION CENTER/ARENA

STRUCTURAL ENGINEER:
Thornton Tomasetti Engineers, New York City, Kiewit Construction Company, Omaha

ARCHITECT:
DLR Group, Omaha

STEEL FABRICATOR:
Havens Steel, Kansas City, MO (AISC member)

STEEL ERECTOR:
Havens Erectors, Kansas City, MO (AISC member)

STEEL DETAILER:
Havens SPI, Kansas City, MO (NISD member)

SOFTWARE:
SDS/2