3 Schools +2 Years = 1 Team

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Design-build was the solution to the equation for streamlining a fast-track, multi-building school project in Queens, NY.

School is open in Glen Oaks, NY—on time, within budget, and as the result of a successful project. The three-school campus is the New York School Construction Authority's (NYSCA) largest public-school construction project using the design-build delivery method.

The Glen Oaks campus is located in Queens, NY, adjacent to the Cross Island Parkway. Two grammar/middle schools and one high school share the site. The grammar/middle schools are both four-story, 1000-ton steel frames, each approximately 125,000 sq. ft. The High School for Teaching Professionals is a six-story, 1,500-ton steel frame, approximately 225,000 sq. ft.

General Contractor Leon D. DeMatteis Construction Corporation, of Elmont, NY, led the design-build team to meet the challenge of designing and constructing the three schools simultaneously in approximately 18 months. The design-build approach for the Glen Oaks Schools project was driven by the need for speed and economy. "With design build, there is potential to save money and particularly time," said Dean Johanson, project officer for the NYSCA. "We have deadlines from our client that aren't movable. We like to put kids in school in September, and it's difficult to open schools in the middle of year. We are very fond of fast track, and building at the same time as designing."

The bid process began in early April 2001 using preliminary architectural design documents distributed by the NYSCA to several pre-qualified contractors. The DeMatteis firm assembled the architectural and subcontractor teams to perform their preliminary design and pricing based on the NYSCA documents in 2001. After a competitive bid process, the DeMatteis firm was awarded the project based on a proposed early completion date.

"The NYSCA sent out an RFP for a design-build project," said Steve Tartaro, general superintendent for DeMatteis. "With that they give you a 20% set of documents with schematic drawings. It gives you a basic concept of what they want the project to look like,

The flexibility of steel framing made it easy to accomodate design changes during construction.

and also provide a set of design standards. We put together a proposal based on that, with a 30% set of drawings back. We added some information and submitted that with our price and schedule, and we were awarded the contract."

Steel fabricator South Carolina Steel joined DeMatteis' design-build team to create the proposal. "We had our design team together for this," Tartaro said. "For this job, it was so big that we didn't want to go into it not knowing who we were going to use. Because of the complexity and the short schedule, we needed to go in with confidence and a fabricator we knew. There were a lot of milestone dates that South Carolina's team members had to buy into, which they did, and it allowed them to start running much earlier. When we were awarded the contract, they started work right away. The schedule was so tight that if they had started any later, it wouldn't have been done on time."

Johanson says it was particularly important to have all trades at the table from the beginning. "When we do design-build, we want the major trades at the table, at the kickoff meeting. We can't walk into a major construction project without a concept of where we're going. We know that the contractor already has an electrician or a mechanical contractor on board, and might still be shopping around for others, but we expect them to have the major trades sitting at the table with us from day one, ready to design, build and fabricate, otherwise we don't have a chance of making the fast-track deadline. The fabricator is the key guy, and one of the linchpins for the whole operation. We can shop around for a cabinet guy or a floor guy, but without the steel guy, we're dead in the water."

Architect John Ciardullo agrees that the fabricator's presence at the start of the project is crucial. "What happens is, each fabricator works a certain way—some like bolted connections, others like welded. In any design-build, you find out their preferences and get input from the very beginning, so conceptually you work the project out. You can talk to them about the framing system and how you want to handle it—how to phase, sequence and build the project, so you can start the shop drawings."

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Another important aspect of assembling the design-build team was that the companies were familiar with each other. In this case, the NYSCA had worked closely with DeMatteis on previous school projects, and DeMatteis had worked with South Carolina steel. "We had done about six or seven design-builds in schools for New York City, so we knew how to approach this project and how to integrate the structural system," Ciardullo said. "South Carolina Steel had done work with DeMatteis before, and felt comfortable with them. We had the team assembled and we had worked together before. We knew what was necessary going into the project."

The trust between the design-build team members from the beginning was crucial. "In a design-build, you don't have drawings to bid from," Ciardullo said. "So you have to have an understanding with other subs that when they put together a proposal, they can live with that price, without the drawings being complete. They put together numbers that they feel comfortable with, and as the drawings develop, you try to keep it efficient."

DESIGN AND BUILD

The architect successfully united the three structures into a campus arrangement. Structural steel was the clear choice based on cost and erection speed. It the only material flexible enough to create the complex geometric shapes required for functional architectural features such as barrel (bow-string) HSS trusses to support the gymnasium roof and partial-cone roofs over the grammar and middle school assembly areas.

"One of the reasons for the choice of steel was that while the foundations were going in, we could design and fabricate the steel so we wouldn't lose any time," Ciardullo said. "It's a great solution. If we had to make changes, it was also flexible. Unlike concrete, which requires big moves to accommodate changes, with steel you can just move a few beams."

Foundation work began while engineers worked on the structural design. An old hospital building located on the construction site was torn down and the soil was compacted through a dynamic compaction process. A retaining wall was installed to eliminate slope. Spread footings were installed with the first floor. Small basement areas were created for mechanical equipment.

The structures were composite steel-framed buildings with concentrically braced frames and HSS tension/compression struts. The typical bays consisted of W14 filler beams, W24 girders, and W12 columns. Shear connections were constructed with bolted double-clip angles. Bracing connections were accomplished with double-knife plates shop-welded to the HSS braces and field-bolted to the gusset plates at the column/beam interface. The steel columns and beams were fire-protected with a cementitious spray. The 2" by 20-gage composite-steel floor deck was unprotected to achieve a two-hour floor-to-floor fire rating. A small amount of the structure, particularly in exposed areas of the gymnasiums, was painted with intumescent paint.

Cary Engineering Consultants of Greenville, SC submitted preliminary structural-steel designs for approval in mid-July 2001. "In order to meet the construction schedule, we issued drawings for structural steel detailing using primarily schematic drawings from the architect and typical NYSCA standards," said John Arrowood, P.E., vice president of Cary Engineering. "The majority of the structural steel was fabricated prior to the architects' first issuance for construction! Complicating our drawing development were our issuances to the NYSCA for 35%, 65%, and 100% review and approval. Their comments were incorporated before, during, and after the detailing and fabrication process."

Arrowood says another challenge was to revise some of the NYSCA's standards in order to provide more economical and efficient construction details. One example was the development of a new construction detail pertaining to the brick veneer relief system. "NYSCA standards specified a hanging-lintel system with the brick-relief angle at the window head. Cary Engineering developed a system to support the brick at the floor level utilizing a bent-plate-slab pour stop and adjustable galvanized steel angle. This allowed the relief system to be fabricated and erected in one piece instead of the previous standard which required the exterior beam, hangers at 4' on center, and lintel angle to be installed separately. This was a challenge due to the required approval process of the NYSCA, which included three separate design submittals to both the SCA and their review engineer. This review/approval process took place while the steel was being mill-ordered and detailed."

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QUICK EXCHANGE

Engineers used RAM Structural System software for structural design. "RAMSteel provided us the flexibility to accommodate the constant changes to mechanical openings, beam locations and braced-frame locations," said Ryan Summey, P.E., project engineer for Cary Engineering. "The software also provided an excellent organizational tool for design calculation submittals to the NYSCA and its review engineering firm."

Structural information was communicated to SC Steel's detailing teams with the CIS-2 file format for electronic data interchange. SC Steel could download the structural information and perform detailing work using SDS/2 detailing software. This allowed mill orders to be placed mid-August to accommodate the late November delivery.

Connection design and the approval-drawing process was streamlined by submitting shop drawings electronically from three separate SC Steel detailing teams directly to the internal design team of Cary Engineering. This facilitated approval-drawing return within one week, which improved the delivery schedule a minimum of two to three weeks. Copies of the approved drawings were then sent to the DeMatteis and the NYSCA for coordination and record while detail information was fed to the shop for fabrication.

"Data interchange from RAM to SDS/2 significantly reduced detailing time and errors," said Engineer of Record William E. Cary, P.E. "This ability to transfer the data directly from our design software to the detailing software also gave our engineers more confidence that their design was carried through—a comfort when the schedule dictated a limited amount of shop-drawing review. Our relationship also allowed us to follow shop drawing development as individual fabrication details were developed, eliminating the need for time-consuming revising and resubmitting of shop drawings. In fact, several portions of the project's shop drawings were reviewed over a company intranet server using TIF file software."

3,500 tons of structural steel and 500,000 sq. ft of metal deck were erected simultaneously through the winter months, and substantially completed in April 2002, at the rate of approximately 700 tons and 100,000 sq. ft of deck per month. Two 140-ton cable-rig cranes with 200' booms were used to erect the steel.

"All three schools were built simultaneously, with multiple crews," Johanson said. "The subcontracts were shared between all three buildings, from soup to nuts. The coordination of materials and manpower was tremendous. Our client is thrilled about the result."

Because of the logistics of the simultaneous construction and the small site, erection proceeded in a careful sequence. "Instead of the normal process, that begins with the erection of the whole first floor, then the whole second floor, this time, we had to work on part of the building and go up, while another part of the building was at a different stage," Tartaro said. "Each building was constructed in two or three parts, so that while we were doing foundations on one half, we were erecting on the other half."

THE ONLY WAY

Design-build is becoming the preferred project delivery system. Its success is driven by owners who have built projects under the design-bid-build process with poor results. Poor designs invariably lead to cost overruns, poor quality, and buildings that don't meet the owner's functional requirements

Project owners are beginning to realize that when they transfer design responsibility to the contractor and subcontractors, they eliminate a huge liability. This way, owners can assure themselves an economical solution to their requirements that also functions to the specified standards.

"For this project, the complexity of the buildings allowed us to finalize steel shop drawings as concrete was being poured," Johanson said. "You can save months and months off of design. The end result is that we feel we're going to get a building of equal quality when we need it with some cost savings."

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Like most complex steel projects on a fast-track path, problems can occur with design-build delivery. But problem resolution is almost instantaneous, because of the close working relationship between a design-build fabricator and engineer of record. Also, when you have only one entity responsible for changes, there is no need to create a continuous stream of RFI's. Other types of project teams often find themselves mired in a river of formal RFI documentation to avoid future liability issues, and as a result, the project schedule suffers. The design-build process avoids this time consuming process. The success of the team is the number one priority, so team members each take responsibility for performing their work in a timely manner.

"There's always inherent problems on every job, but when it is a design-build, it all became our responsibility, and the team works it out," Tartaro said. "If this were not design-build, we'd be stopped every week with a problem. Invariably, fast decisions would never be made, we'd have to put a price on everything and negotiate it, and we would be halted constantly."

The designers at Cary Engineering also felt that design-build was key to the effective communication of the project team and the speed of construction. "Without the design-build process, the delivery of the buildings on time would not have been possible," Cary said. "The project's design-build structure also allowed us to get immediate and ongoing feedback from the general contractor's superintendents so that we could revise our design as requested to help them meet the schedule and budget constraints."

Most importantly, the NYSCA is satisfied with the results. "The teamwork on the project was phenomenal," Johanson said. "There were some changes made during the design and construction, and like any project, you run into obstacles. But the team reacted extremely well as they arose. We met at least once every week to discuss what was coming up in a partnership fashion. All cards were on the table. The fabricator's coordination of the steel design and fabrication process brought us to where we are now—unpacking books, sweeping floors, and waiting for the kids to start school!"

The team approach is the most successful way to attack the design-build project. The general contractor brings together trusted and proven subcontractors that have the knowledge and ability to design and perform their portion of the work. With each subcontractor's expertise, the projects owner benefits by getting the most bang for the buck. ★

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RAM Structural System

DETAILING SOFTWARE
SDS/2

STEEL SHAPE BENDER
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