FULL EXPOSURE

Exposed Steel Adds Architectural Character to WCCCD's New Health and Wellness Center

By **Mary Kremposky McArdle** Associate Editor

As dawn breaks over the southwest edge of downtown Detroit, trailers loaded with 45-foot-long sections of steel trusses rumble down Fort Street and come to a halt on Wayne County Community College District's (WCCCD) downtown Detroit campus. Thanks to the expertise of Bristol Steel & Conveyor Corporation and the aid of the Davison firm's own 80-ton crane, the sections are now part of the 135-foot-long steel trusses spanning the new gymnasium and home court of WCCCD's Wildcat basketball teams.

The gymnasium is only part of WCCCD's new $25 million Health and Wellness Center being built by Tooles Contracting Group, LLC, Detroit. Beginning in June 2018, Tooles and Bristol coordinated a series of just-in-time steel deliveries to this tight site located directly next door to the main campus building. By summer's end, the two-story structural frame was assembled, the steel outlining the spaces soon to house the gymnasium, three classrooms, administrative offices, and separate student and public locker rooms on the first floor. A weight room, aerobic studios, cardio fitness equipment, and an elevated running track above the gymnasium will be located on the second floor.

As a project goal, WCCCD wanted the bustle and athletic activity within the building to be visible from the street and the surrounding streetscape to visually enter the building interior, according to Project Manager/Project Architect Jim Cummings, Hannah-Neumann/Smith (HNS). To achieve this goal, HNS designed a building with generous expanses of glass curtain wall visually linking the college and the community. The glass showcases the building's steel structure as well, making it imperative to design the steel with an eye for both function and aesthetics.

Function: A Robust Steel Structure

The structural steel design is the equivalent of a well-cushioned, ergonomic athletic shoe with custom arch supports. Structural engineers, Ruby + Associates, Inc., Bingham Farms, worked closely with HNS to design a robust structural steel frame to handle the vibrations produced by hundreds of aerobic dancers, joggers, and weight lifters subtly jostling the building's structure with their collective workout.

The new facility's structure is stiffer and the steel beams are larger than an office building or similar commercial structure. "The steel beams had to be stiffer because of the vibration resulting from various aerobic activities," said Ruby Project Manager Thad Greiner, PE, SE. "Many of the beams in the Health and Wellness Center are W 18 x 40 (18 being the nominal depth of the beam and 40 being the weight in pounds per foot), but they would probably have been W 16 or even W 14 in a typical office building."

The building's usage as a gymnasium and fitness center steered the design team towards stiffer roof steel as well. "Mechanical and air-handling units must move more air around in the large open spaces of a gymnasium and fitness facility than in a standard office building," said Cummings. "Essentially, the greater size and amount of mechanical and air-handling units needed for these fitness spaces calls for extra steel to be installed on the roof."

A stiff steel structure requires equally stiff connections. Portions of the steel frame are pieced together with moment, or rigid, connections that are more

The building's structural steel frame has vertical bracings fabricated out of tube steel and 75 post or pipe columns also in combination with masonry shear walls.

PHOTO CREDIT: CHRISTOPHER LARK / RUBY + ASSOCIATES, INC.

labor-intensive to fit-up in the fabrication shop and to bolt and weld in the field. In addition, the sheer size of the beams added to the complexity of the connections. "An 18-inch beam, compared to a 12-inch beam, requires more bolts and more welds, and consequently more labor," said Bristol Project Director Brent L. Irrer.

Aesthetics: Steel on Display

HNS and Ruby also worked closely together to create an architecturally pleasing exposed steel frame. Aesthetically, having exposed steel throughout the building inspired a different selection of steel members. The design team opted for 14-inch diameter rounded pipe columns in lieu of wide-flange steel. "Using pipe columns allows us to really showcase the structure, because in using pipe columns, we didn't have to place column wraps around the steel," said Cummings.

Approximately 75 pipe columns were used throughout the structure, both in the open fitness spaces of the second floor and in the small number of enclosed classrooms and offices on the first floor. According to Greiner, this continuity of steel members is more practical because it eliminates the difficulty of transitioning from round to wide-flange columns.

The pipe columns slightly boosted the efficiency of the structural frame as well. "There is not a great deal of difference in an analysis model of the two different steel members," said Greiner, "but structurally, rounded pipe, or post, columns have the same strength in both directions, whereas standard wide-flange columns are stronger in one direction and weaker in the other. Overall, there is some efficiency in using rounded columns, depending on how they are used."

Bristol didn't waste any time in turning the structural design into actual steel. Immediately after the first submittal, Bristol began fabricating the pipe columns and other steel members in April 2018, working six days a week, eight to nine hours a day. This intense fabrication schedule is Bristol's standard work week, added Irrer.

As a fully automated fabricator, Bristol's 95,000-square-foot facility in Davison is equipped with a computer-controlled drill machine to ensure quality fit-up, according to Bristol's website. The caveat with rounded pipe columns is "you can't run a rounded pipe through a drill line to make the connections or bolt holes," said Irrer. "In the shop, it takes probably double the fit-up time for a rounded pipe column as compared to a wide-flange or I beam."

Field installation of the labor-intensive moment connections "required sliding and bolting two rounded plates on a single rounded pipe column," said Irrer. "Some of the pipe columns had connections on four sides." Now completed, the intricacy and complexity of the steel structure's bolted moment connections fully display Bristol's workmanship in the field and will surely add to the architectural character of the completed building.

A Perfect Finish

The pipe columns in place throughout the building are only part of the Health and Wellness Center's structural design. "The foundations are standard spread footings, and in addition to the post columns, the structural steel frame has vertical bracings in combination with masonry shear walls," said Greiner.

Bristol Steel fabricated the building's vertical x-shaped bracings out of tube steel. The exposed bracings and connections were also part of the building's architectural "gallery" of well-crafted steel. For each individual x-shaped bracing, four diagonal tube steel members converge on a steel gusset plate and a central pipe column, all steel members being held to the plate with bolted connections and continuous welds. "The iron workers had to take their time when they were welding because those welds were also going to be exposed," said Irrer. "We had to make sure the welds were continuous and flowed around the steel plates."

Because one of the driving forces of the entire project is to design, fabricate, and erect exposed steel with a higher finished quality, all of the exposed steel in the building was subject to a SP6 blast finish in Bristol's fabrication shop. The term SP6 refers to the degree of cleaning and the quality of the finish. For WCCCD's Health and Wellness Center, Bristol's two in-house blasting machines "removed manufacturing labels and mill scale off of the steel and gave the steel the desired quality finish," said Irrer.

After the finishing process, the pipe columns, tube steel bracing, and other exposed steel members were handled with the steel industry's version of kid gloves. "We used straps instead of chains and chokers to handle the exposed steel in our shop," said Irrer. "We wanted to maintain that perfect finish and avoid having any marks on the steel. When you pick up a 10,000-lbs. beam, the chains and choker 'bite' into the beam, but the strap is gentle and handles the steel with more care."

22,000 lbs. Trusses

HNS wanted to preserve the architectural effect of having exposed steel throughout the building, including the 135-foot-long trusses spanning the gymnasium and located above the elevated track. The challenge was exposing the steel while meeting code. The National Fire Protection Association (NFPA) code requires the application of either spray-applied fireproofing or intumescent paint on steel members installed 20 feet or lower over a walking surface. This code stipulation would require fireproofing the steel trusses installed directly above the second-level elevated track.

HNS and Ruby + Associates worked together in the early stages of the design review process to strategically alter the truss design. As a result, both ends of each truss step-up, forming a type of half-trapezoid over the elevated track. This truss configuration creates higher trusses at both ends, and because the trusses are now more than 20 feet above the walking surface of the elevated track, the steel members meet code.

"Essentially, we shifted the bottom chord of the truss up a couple of feet over the elevated track to place it outside of the fire protection range," said Greiner. "The main part of each truss is 10-feet-tall, but both ends of each truss transition to about half that height, making the ends and the connections a bit more complicated to design." The NFPA code never applied to the main expanse of each truss, because these steel members are already 30 feet above the first-floor gymnasium.

"Otherwise, they are fairly typical trusses," continued Greiner. "It is a double-angle truss, top and bottom chord. Essentially, the trusses resemble very heavy-duty bar joists."

For Bristol Steel, a series of just-in-time steel deliveries in 13 carefully plotted sequences and the splicing of the 135-foot-long trusses in two locations for delivery in three pieces were strategies employed to effectively work on this tightly constrained site.

PHOTO CREDIT: CHRISTOPHER LARK / RUBY + ASSOCIATES, INC.

For transport and site access, Bristol Steel spliced each truss in two locations and shipped the trusses to the site in three pieces. "Typically, we ship trusses as long as 100 feet with a single splice, but in this case, we didn't think we could get the trusses on the tight site very easily," said Irrer.

Once on site, "the steel sections were assembled flat on the ground, and then the crane tipped up the entire truss and lifted it into position," explained Greiner. The five steel trusses, each weighing 22,000 lbs. fully assembled, were the heaviest pick, or hoist, of the project. "We used a crane from our own extensive fleet of lift equipment to hoist each truss into place," added Irrer.

A Tight Site

Bristol Steel worked closely with Tooles Contracting Group on a tight site sandwiched between two buildings and in a dense grid of urban streets. Tooles formulated an effective logistics plan to manage site constraints, essentially arranging for construction of a temporary road directly through the middle of the emerging building.

"Early on in the process, we realized we had a very small site with very limited access," said Tooles Construction Manager Steve Schoenknecht. "Because it was tightly constrained on two sides, we knew we were not going to be able to place the crane anywhere but inside the building pad. We incorporated a temporary roadway down the middle of the building in our scope of work. We also worked with MDOT to obtain a right-of-way permit, which allowed us to be able to bring trucks down alongside of the sidewalk for unloading."

Bristol delivered and installed the steel in 13 small but carefully plotted sequences –one for each of the building's 13 bays. "We had only one to two trucks of steel per sequence," said Irrer. "Normally, we do two sequences or bays of steel erection at a time, but the site logistics were so challenging we installed one sequence at a time, using just-in-time delivery and taking one to two days to erect each sequence."

Bristol drove the crane right down the middle

PHOTO CREDIT: CHRISTOPHER LARK / RUBY + ASSOCIATES, INC.

of the building on the "Tooles' Highway" to begin steel installation. "We backed out of the building as we worked, and they closed the street down for us to set our crane for a short period of time when we reached that point," added Irrer.

"Brent and his team have been very accommodating," said Schoenknecht. "Bristol's foreman and superintendent on the project are exceptionally good. They are the best I've worked with. It's been a real pleasure."

All of the challenges were not above and at grade. For Tooles, the infrastructure was the second main construction challenge. Excavation of any site in a 317-year-old city can be similar to an archeological dig. Tooles' team uncovered two 8- to 10-foot lengths of log water lines dating to the early days of Detroit's history and brick sewer lines from the late 1800s, according to Schoenknecht.

According to Schoenknecht and Cummings, Tooles and HNS worked together to identify and tap into a usable sewer line located 40 feet below grade on a site that most recently served as a parking lot and that once housed a railroad station in the 1880s.

Connecting the Dots with Steel

For HNS, one of the main design issues was programming a host of diverse uses into a 70,000-square-foot building. The Health and Wellness Center's menu of spaces includes instructional, office, and fitness and wellness areas designed to serve students, faculty and the community.

The first challenge in gathering these diverse uses into a single building was the design of a fire wall. "We had to create a fire-resistant envelope that separated the classrooms from the other spaces," said Cummings.

The second issue was structurally linking the different column grids on the two levels of the building. The steel columns of the two floors do not align, because the first floor has an unconventional column grid for the enclosed classrooms and offices versus the conventional column grid of the open spaces of the second-floor fitness studios. As a solution, the structural steel design called for six heavy transfer girders. "The second-floor columns are located from 5 to 15 feet away from the first-floor columns," said Greiner. "We ended up using large W 36 transfer girders."

The steel design offered HNS flexibility in its programming. On the first floor, "the three classrooms, devoted to health and wellness-related instructional programs, are tucked behind the lobby area underneath the second floor," said Cummings. "The two separate locker rooms, one for the public and the other for students, are located on either side of the administrative space."

In the main lobby, a monumental stair, clad in marble steps and featuring glass handrails, links the two levels of the building. Heavy tube steel versus

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conventional steel channels form the stringers defined as the side members of the staircase connecting to the stair treads. "You don't see heavy tube steel used in this application very often," said Irrer.

The reason for its use is to support the heavier weight of the marble steps, along with the sheer eight-foot width of the two-story staircase. Once again, "we had to have a much stiffer support structure," said Greiner.

For Bristol Steel as fabricator and erector, the tube steel is easier to work with than channel steel in a marble-clad staircase. To ease field installation, "we fabricated the stair in one piece, so it can be installed in one piece on the site," said Irrer.

Steel makes its mark in other spaces of the building, including the steel eyebrow overhanging the glass curtain wall as a shading device. A series of steel-supported terraces grace the building; one terrace may host yoga classes in good weather and another will be located next to a café and healthy eatery.

Steel, both aesthetic and functional, has connected together WCCCD's Health and Wellness Center. The facility itself is helping to connect and expand the footprint of WCCCD's downtown Detroit campus. According to Cummings, the building's exterior cladding of mainly ultra high performance concrete panels is in sync with the pre-cast concrete exterior of an existing, circa 1970s, campus building located directly next door. The staggered placement of the new building's ultra high performance concrete panels, combined with brick and aluminum composite panels, add to the contemporary feel of this new "freshman" building on campus.

Slated for completion in late spring 2019, the new building is also helping to piece together another part of Detroit. The new Health and Wellness Center is part of the urban fabric housing the best of Detroit's past and present, namely the historic Fort Street Presbyterian Church and the revitalized Cobo Center. Thanks to WCCCD and the project team, next year will witness the grand opening of a new building created to not only expand WCCCD's downtown campus and build a more dynamic Detroit, but to create a healthier community and student body.

TOP LEFT: Steel forms both an eyebrow as a glass shading device and a series of terraces for WCCCD's new Health and Wellness Center. The building is expanding the footprint of the college's downtown campus and adding to the vibrancy of the Comeback City.

TOP RIGHT: Expanses of glass showcase the building's steel structure, making it imperative to design the steel with an eye for both function and aesthetics.