Exposed Steel Offers High-Tech Look

A new home for a savvy a/e firm serves double-duty as a showcase for the company's design philosophy

By Fred C. Teitgen, P.E.

IT'S OFTEN SAID THAT A LAWYER WHO REPRESENTS HIMSELF HAS A FOOL FOR A CLIENT. Too often, the same sentiments can be applied to architectural firms who undertake the design of their own offices. There are too many "experts"—and perhaps even worse, the firm knows that it will ultimately be judged by potential clients on the success of the project.

To overcome potential problems, Flad & Associates, a 175-person architectural engineering firm headquartered in Madison, WI, selected a specific design team from within the firm to work on the project. At the same time, Ralph Jackson, who is now the president of the firm, acted as the "owner's representative," with all direction channeled through him.

The design process began with a facilitated planning workshop, the goal of which was to develop a vision and identify specific goals for the facility. The workshop drew on the firm's skills in planning, designing and managing facility environments and selected four primary goals for the new facility:

- ✓ to create a welcoming atmosphere;
- ✓ to facilitate multi-discipline project teams;
- ✓ to stimulate creativity and communication; and
- ✓ to visually represent the firm's beliefs and design philosophy.

In what can be considered a model exercise, the design team involved all of Flad's employees through the use of questionnaires and a "display wall." The display wall was particularly important and allowed all firm members an opportunity to comment and provide input to design options and criteria as they evolved. Because it is at the

heart of how the building functions, full-scale mock-ups of the proposed work stations were constructed and occupied by representative employees to fine tune the building planning module and bay size early in the process.

The Site

In searching for a site for the new office, the design team surveyed staff to determine what location would be most convenient. In addition, the designers wanted a site that would enhance the firm's image in the key industries in which they work: high-technology, R&D, corporate, industrial and health care. As a result of these two criteria, a site was chosen in the University of Wisconsin Research Park on Madison's west side, not far from the existing office. Gregg Hyer, facilities coordinator for the Park, worked closely with Flad to obtain the most appropriate site.

The site selected has a full-story grade change off the frontage road, with a sweeping view to the north of a prairie restoration area that doubles as a natural stormwater retention basin. This site topography led to a building design that drops a full story from the entrance facade, accessed from the parking lot on the south side of the site, to the open design team space areas located adjacent to the full-height glass curtain-wall overlooking the prairie to the north. Staggered foundation walls at the grade change resist one-way soil loadings.

Building Organization

The building has three floor plates totalling 56,000 sq. ft. It is organized with a full length east-west circulation spine. Fixed offices and spaces not requiring daylight are located on the southern portion of the building, where above grade spaces have modest window sizes. The open office team spaces are located on the north on each level in a 40-ft.-wide band along the fully glazed north wall. There are no exterior offices along this wall; instead, division leader offices and small conference rooms occur as islands in the midst of the teams they direct. Open team space areas, with plenty of stack surfaces for ongoing project evolution, are scattered throughout the building. Closed conference areas for the less frequent, but more noisy and disruptive types of meetings or those requiring more privacy, are distributed throughout the building. Storage, auditorium and mechanical spaces are located along the "buried" south side of the lower level.

The team space studies and station mock-up indicated a 9-ft.-by-9-ft. workstation as the optimal universal planning module. Groupings of eight workstations, plus 4-ft.-8-in. aisles, led to a structural bay size of 22-ft.-8-in. by 40-ft. for the open office spaces and 22-ft.-8-in. by 24-ft. for the enclosed fixed spaces.

Exposed joists and tubular columns helped create an open feeling for Flad & Associates' new headquarters n Madison, WI.

To complement the scale of the team space areas, ceilings were omitted. Instead the structural members, as well as the lighting systems and mechanical ductwork, were carefully integrated into the architectural design. The use of an exposed structural system also served to reflect the type of design clients with whom the firm often works: high-technology, R&D, corporate, industrial and health care providers.

Open web joists and joist girders were selected for their cost effectiveness, the ease for which lighting and ductwork can be run through the joist openings and for the airy, open feeling created by the steel members. Various joist orientations and spacings were explored before 40-ft. joist spans with 7-ft.-6.67-in. spacings. Joist supplier was AISC-member Canam Steel

An "interaction" stairway near the main entrance helps communication by giving the staff a place where they are likely to casually bump into colleagues.

Corporation. Lead engineer for Flad on the joist design was Tom Gatzke.

To further increase the open feel of the space, a slightly higher-than-usual floor-to-floor height of 13-ft.-1-in. was selected. Epicore linear plank dove-tail ribbed composite steel decking with 50% acoustical panels and 2½-in. of normal concrete fill, resulting in a 4½-in. total slab thickness, was utilized for the floor system. In addition to superb sound control, the composite decking and acoustical panels also meshed well with the overall architectural design of the space. Sound control is further enhanced by carpeting, and the large open expanses produce a masking background noise effect, which even further improves acoustics.

The building has 47 steel tube columns extending full hieght. They are 8-in.-by-8-in.-½-in. ASTM A500 with yield strength of 46 ksi. Support brackets connected to the columns were carefully designed to be aesthetically pleasing as well as functional and economical.

Connections to the tube columns fall into two general categories:

- ✓ Wide flange beams were bolted to columns by means of either through-plates or W-Tees
- ✓ Joists and joist girders bear on haunches fabricated from plates. Plates were welded together and to the tube column to form a T-shaped assembly. Members were secured to supports by a combination of erection bolts and field fillet welds.

Stabilizer plates were provided at joist bottom chords. Typical joist girder chords were left unwelded.

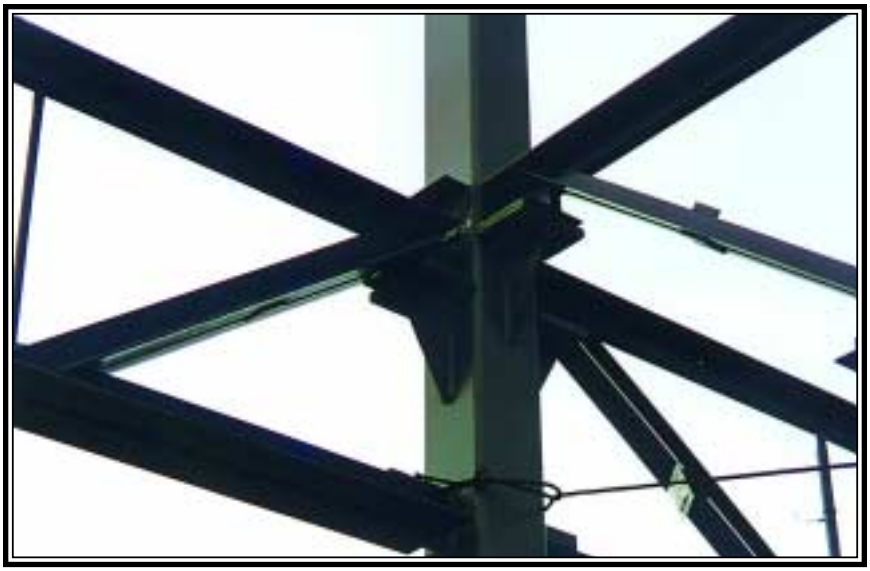
Where wind load bents occurred, continuity plates were provided through the tubes at top chord connections and stabilizer plates were replaced by through-plates at bottom chord connections. Welding provided the continuity connections. Chord sizes were increased to reflect higher axial loads from wind load moments.

By staying within the maximum floor areas permitted by the State building code, fire resistivity requirements were satisfied by combining the incombustible nature of the steel framing with automatic fire sprinkler system without the need for spray-on fireproofing. Code exit stairways required fire rated enclosure walls. Because stair support members extended through the rated walls and connected to the tube columns adjacent to the stairway, it was necessary to fire rate them as well. Options considered were to wrap the tubes in several layers of gypsum wall board or to coat them with intumescent paint. The latter option was chosen to preserve the clean architecture. Albi Clad TF coating was used for this purpose.

Design Loads

The structure's floors were designed for a self-weight of 55 psf, including metal deck, concrete fill and an allowance for joists. A superimposed dead load of 10 psf provides for ducts, lights, sprinklers and miscellaneous items. Floors were designed for 80 psf live load typically, with 100 psf at the lobbies, main corridors and stairs. The roof structure was designed for 30 psf total dead load, which included decking, insulation, ballasted roof and suspended lighting, ducts and sprinklers. The roof design live load was 30 psf plus drifting snow load. Design wind load was 20 psf.

The lateral wind load resistance system was designed to be both simple and economical. Joist girders are rigidly attached to the tube columns to provide moment resistance to lateral



loads in the longitudinal direction of the building. Three braced bay bents resist wind loads in the transverse direction. The computer software program STAAD-III by Research Engineers, Inc., was used to analyze and design the lateral load system.

The building utilizes a total of 115 tons of structural steel framing and 47 tons of miscellaneous steel including steel framing, steel railings, bent plates and perimeter angles. In addition there are 102 tons of joists and joist girders. Final construction cost was $65 per sq. ft., including site development, plus an additional $10 per sq. ft. for workstations and other fit-up.

Through the use of preliminary/scope design documents for pricing, the general contractor, Vogel Brothers Building Co. of Madison, WI, was brought on board early as a vital team member. Vogel Brothers made many suggestions and offered a number of options that were evaluated by the design team to maximize the value received per dollar spent. As an example, Kynar finished steel panels were substituted for aluminum for the rooftop equipment screen wall.

Interior Architecture

Flad's design efforts resulted in the decision to custom design their own work station system, both to create a more attractive system and to save money over pre-manufactured systems. The team space workstation blocks are separated by 64-in.-high spine walls that occur along column lines. They are constructed of structural steel studs and white painted drywall. Power, data and communication lines are concealed within the walls, which also support workstation surfaces and overhead storage units. Embedded conduits in the floor slab feed the spine walls, with extra conduits provided to support future technologies such as fiber optics.

Panels separating workstations are 4-ft. tall to facilitate communications, yet still provide a sense of individual privacy. Each wall has a narrow top "transaction" shelf—a small horizontal surface between spaces on which designers can sketch or take notes during a quick discussion. Interior architect Randy Schmitgen selected white maple for the panels, note boards and shelf units to provide a warm, contemporary contrast to the white exposed structure. In keeping with the exposed structural theme, though, the panels are interconnected using exposed steel fasteners.

Interior indirect lighting is used very effectively in combination with the white acoustical deck surface. Continuous communication and circulation corridors occur on both sides of the team studio space, along the north window wall, and along the interior side adjacent to the partitioned support areas where coffee, copy, fax and supply rooms occur. A custom designed entry desk and conference room furniture features stainless steel and the white maple wood used elsewhere, providing design and material continuity.

Exterior Design

A very simple design expression was chosen intentionally for the outside of the building. This crisp design, in keeping with Flad's technology focus, also helped to keep costs affordable. In part to help satisfy the Research Park's requirement for a "white" surfacing material for all of the buildings in the complex, Frank Maersch, project architect, selected white 3½-in.-thick ground face concrete masonry units scored to a 8-in.-by-8-in. pattern as the facing material for the south, west and east elevations. Window openings on these elevations are minimized to reduce solar gain and to focus more of the window budget on the north face of the building.

The back-up structure is 6-in.-by-16-gage structural steel studs. Except for on the main entrance, the gravity weight of masonry facing is kept within the masonry system, with the steel stud back-up resisting only perpendicular wind loads. This system substantially reduced the cost of the building's superstructure framing.

Visually, the north wall is completely different from the building's other faces. Instead of concrete masonry unit panels with minimal window openings, it is completely glazed. However, as with the other walls, the system is self-supporting for gravity weight. The system was further enhanced by the buildings open framing system. The open web joist girder perimeter structural members allow natural light to

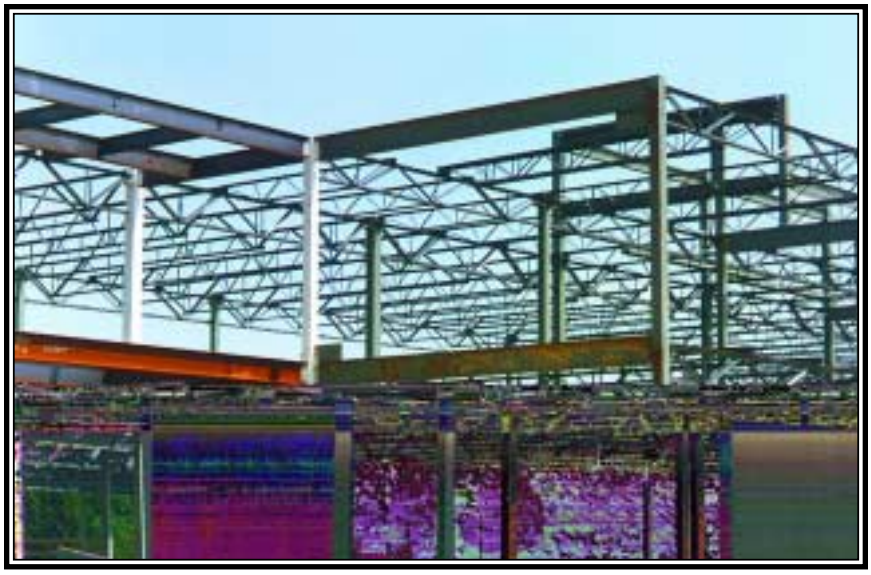
illuminate the light colored acoustical deck "ceiling" during the day, and allows them to become a backlit feature when viewed from outside in the evening.

Communication Stairs

Even though code requirements are met with three standard stairs in the building, a fourth "interaction" stairway was introduced adjacent to the main entrance reception area and north wall. A generous cut-out in the floor plate overlooks the central resource library below, and exposed stairway acts both for transportation and aesthetics. In a continuation of the theme of structural and architectural integration prevalent throughout the structure, the multi-run stairway is framed with exposed steel tube stringers and steel handrails. The "bridge" extension of the exterior corridor adjacent to the cut-out has an exposed hangar rod and connection hardware. In addition to its aesthetic advantages, the design should encourage more vertical traffic and provide another opportunity for team members to meet and communicate.

The exposed integrated systems have proven not only to be very popular with both employees and visitors, but have also served an educational role in illustrating the design systems and features Flad works to incorporate into their clients' buildings. The winning combination of form, function and an economical budget has resulted in requests by several clients for similarly integrated facilities. In addition, the interior architecture won an "Award of Excellence" from *Madison Magazine* in February of this year.

Fred C. Teitgen, P.E., is a principal with Flad Structural Engineers, a 22-person entity within Flad & Associates that provides structural services to both Flad and other clients throughout the country.



The use of joists and joist girders, combined with tubular columns, proved to be both economical and attractive. Fire protection was provided primarly through the use of automatic sprinklers.