An Eye-Catching Showroom

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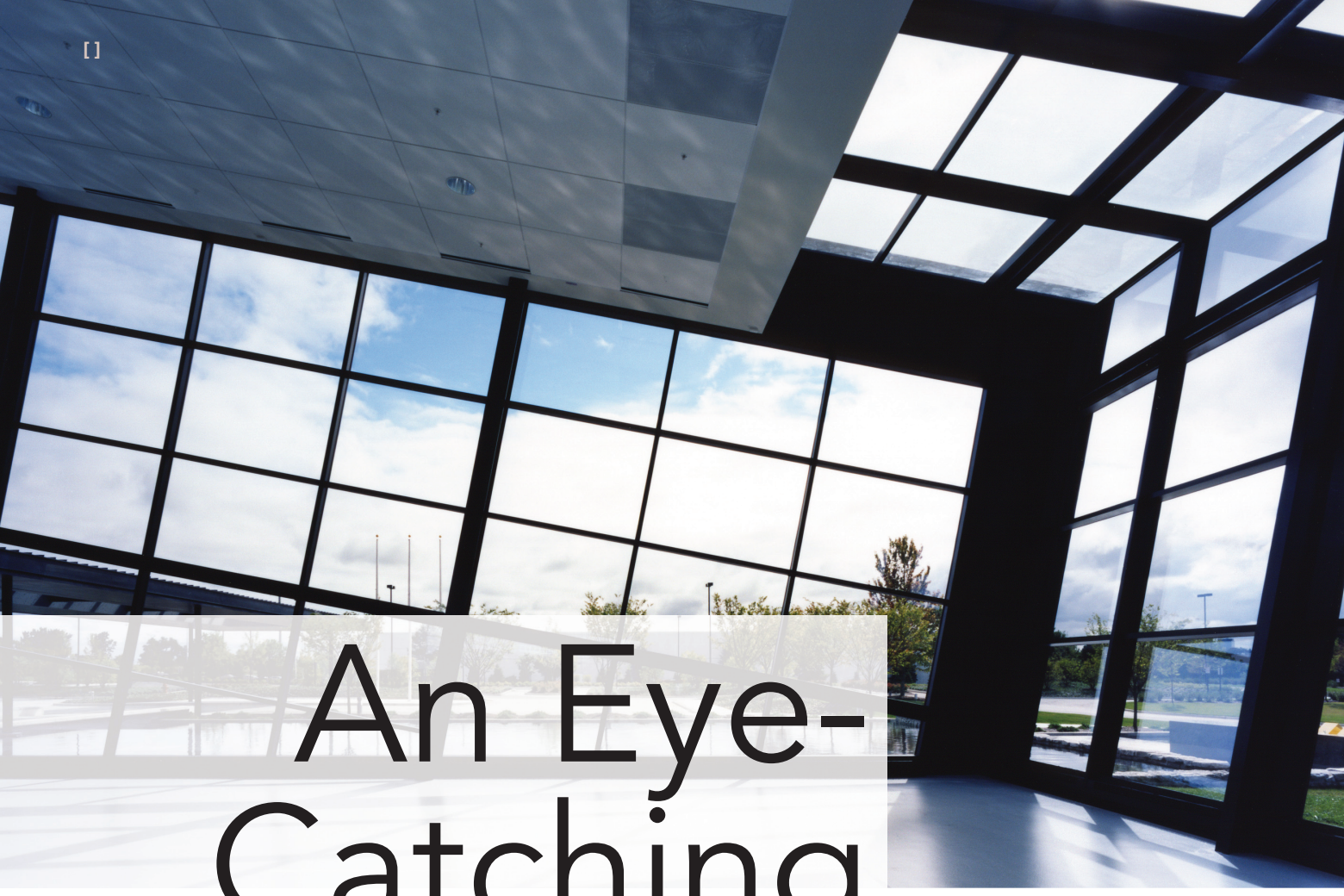

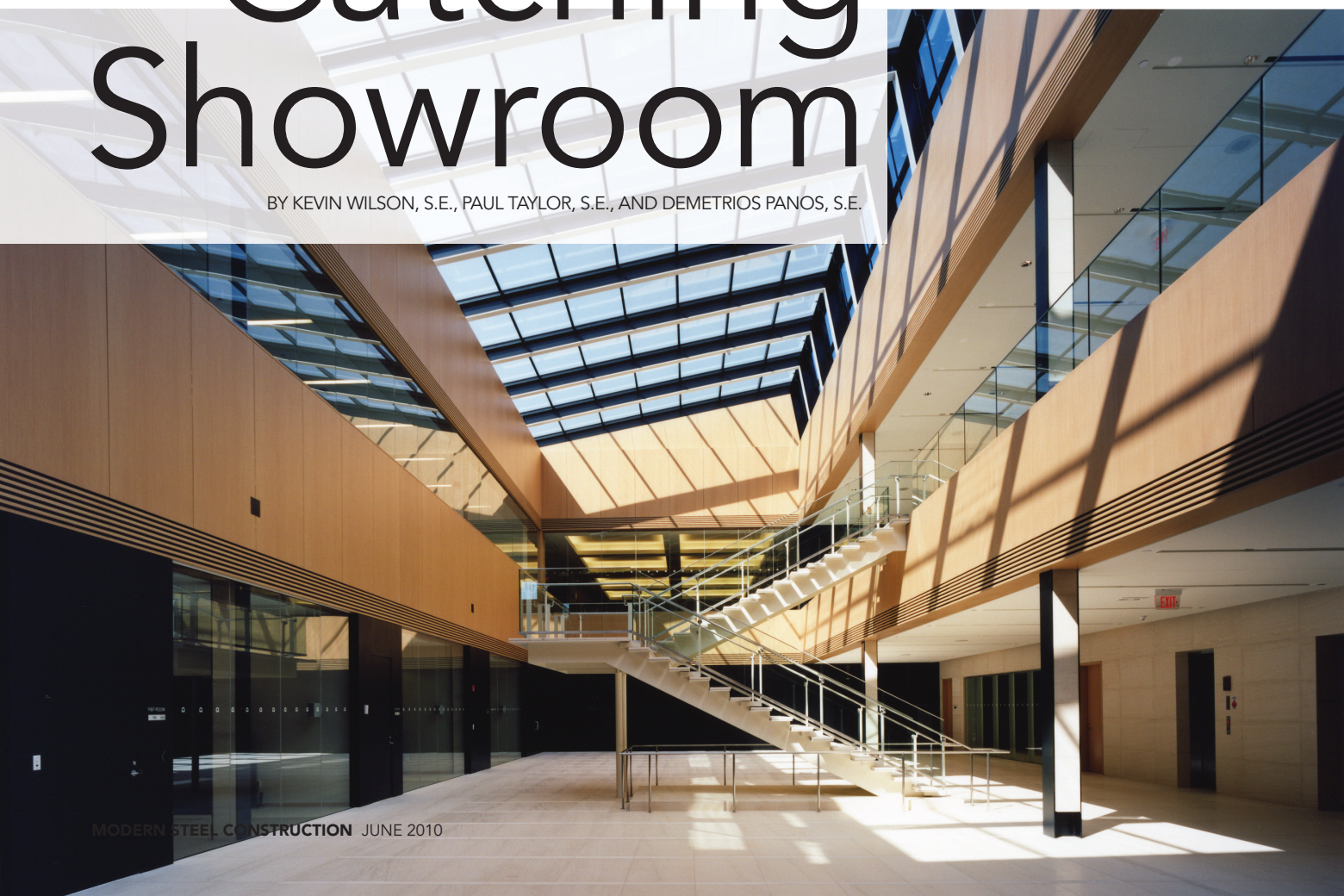

A tilted steel frame gives character to open space and accentuates the glass façade.

SITUATED 30 MILES NORTHWEST of Chicago in Schaumburg, Ill., the Amada Solution Center is a multi-purpose facility that provides a venue for equipment demonstrations and technical sessions pertaining to the precision sheet metal fabrication industry. The owner charged the project team with creating an architecturally significant structure that would seamlessly meld the technical center, consisting of classrooms and meeting rooms, with the showroom where an array of machines and software showcases Amada's precision sheet metal fabrication equipment. The resulting 135,000-sq.-ft structure incorporates exposed steel frames with glass and brick masonry veneers and serves as Amada's newest North American Solution Center.

Architectural Design

The centerpiece of the facility is a 45,000-sq.-ft column-free showroom with an all-glass façade on three sides. The glass façade at the long side of the showroom continues up and over the showroom's roof to form a continuous skylight running along its entire length, allowing an abundance of natural light into the space.

The showroom's column-free space is achieved through the use of exposed steel bents. The steel bents span 117 ft and are pitched 11° to the horizontal at the roof and 11° to the vertical at the exterior wall. The steel bents are incorporated into the architectural design by exposing the bents within the showroom space and by extending them through the roof and wall construction to the outside. To present a "clean" look, the bents were fabricated and erected with only welded connections.

The two-story, 90,000-sq.-ft technical center is an integral component of the facility with classrooms, meeting rooms and administrative offices. The second level meeting spaces cantilever over and look down onto the Showroom area, offering views of the entire display space. In keeping with the theme of the showroom design, an open atrium in the technical center has an exposed steel fabricated skylight support structure that mimics the form of the showroom's steel bents.

Opposite page, above: The exposed steel bents, glass façade support framing and roof edge skylight are all visible in this interior view of the showroom. Photos by Shin-Shasin-Koubou Inc. except as noted.

Opposite page, below: The wide-flange skylight support framing in the atrium of the technical center mimics the steel bents of the showroom.

Structural System

The structural steel framing system easily met the architectural design requirements of long spans and exposed structure while also providing an "industrial" feel in the showroom. For the technical center, steel easily accommodated multiple floor live load loading requirements, elevation changes and the need for future flexibility.

The architecturally significant steel bents for the showroom were designed with readily available W36 wide-flange main members and supplemental WT18 T-shaped members. W14 purlins span between bents. The W14 purlins support the 1½-in.-wide ribbed roof deck.

The top of the W14 purlins and the W36 main bent members align to accommodate steel roof deck erection. The WT18 members extend upward through the roof membrane and outward beyond the glass façade wall construction. The W14 purlin depth was carefully coordinated to provide the needed ceiling space for mechanical duct runs and to achieve the required height for the ceiling finish material.

The technical center's elevated floors typically are supported by compositely designed steel framing consisting of W18 beams and W24 girders. The floor bays are typically 30 ft by 30 ft with the W18 beams spaced at 10 ft on center. The floor beams and girders support 2-in. composite steel deck with 3¼-in. lightweight concrete topping slab. The floors were designed per AISC's *Design Guide 11 – Floor Vibrations Due to Human Activity* to meet the owner's desired service requirements for the different use areas across the second floor.

The roof is typically supported by W16 beams spaced 10 ft on center, W24 girders and a 3-in. steel roof deck. Wide-flange members were used at the roof in lieu of open web steel joists because of the large number of rooftop mechanical units and the length of screen wall structure that had to be supported. Steel wide-flange members also can easily accommodate future mechanical equipment changes and additions. The wide-flange framing also aided in the support of the steel skylight structure at the technical center's atrium that mimics the showroom. Typically, W12 columns transfer the roof and floor gravity loads to concrete spread footings.

The technical center contains a two-story open space used to transition new Amada fabrication equipment into and out of the showroom space. The two-story space is needed to accommodate the large forklift required to lift the manufacturing equipment. The two-story space required a steel girt system to support the

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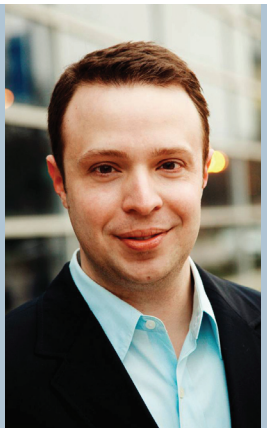

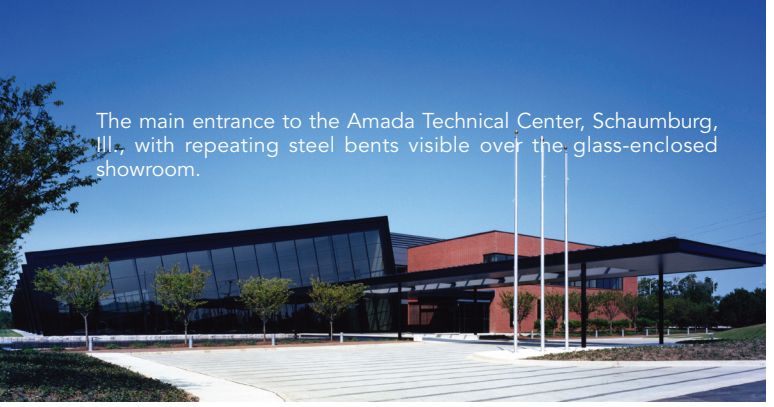

The main entrance to the Amada Technical Center, Schaumburg, Ill., with repeating steel bents visible over the glass-enclosed showroom.

The vertical alignment of the overhead door openings and two-story brick façade walls on the service entrance side are in stark contrast to the cant of the showroom end wall's exposed steel support grid.

two-story brick façade that matches the remainder of the technical center.

The extensive amount of exterior glass façade around the showroom's three sides required a supplemental support system. The exposed structural steel members employed became an integral component of the architectural design. Steel supports were especially critical on the end walls where the glass spans reach nearly 40 ft. The steel support framing consists of W14 wind columns and W14 girts reinforced with HSS7x3 members. The W14 columns mimic the 11° slope of the steel bent "legs" and the W14 girts mimic the 11° slope of the roof.

The lateral load resisting system for the facility consists of the steel bents for the showroom and ordinary concentric braced frames with HSS brace members for the two-story technical center. In the direction perpendicular to the bent spans, the bent columns are part of ordinary moment frames incorporating the glass façade support steel framing along the long exterior face of the showroom into the design.

The showroom bents required a thorough thermal analysis, given the bents are both interior and exterior of the building envelope and the large range of temperatures in the Chicago area. The thermal loads could result in movement and added forces in the showroom bents as well as transfer load to the technical center. The potential thermal movement needed to be evaluated for coordination with the window wall and ceiling systems. In order to address this, multiple thermal load cases were evaluated for various stages of construction to the completed condition along with seasonal effects thereafter. Steel bent deflections, stresses and connection forces were evaluated for the multiple load cases and combinations. In addition, the mechanical engineer had to carefully consider the bents in the energy analysis and mechanical system design as the exposed bents provided no thermal break.

Project Team Collaboration

Early collaboration between the steel fabricator and steel erector, facilitated by the design-build contractor, was extremely beneficial on this project.

The fabricator facilitated selection of readily available structural framing member sizes and the coordination of cost-effective and efficient connection designs. Both items were critical, given that the project schedule required the structural steel packages to be issued early for steel ordering, detailing and fabrication.

The erector's early involvement allowed sensitive erection issues to be considered during the overall building design. Steel erection sequencing, temporary shoring and shop versus field welding alternates were all issues discussed by the design and construction teams in the construction document phase. Steel framing members were designed and detailed to incorporate suggestions and recommendations made by the steel erector. This included the coordination of shop and field welds for the showroom bent connections, review of the effects of erection aids on the finished construction and the selection of shop bolted-field bolt double angle connections at the technical center. The erector also preferred to use the technical center framing to support the inclined column of the showroom bent adjacent the showroom until the bents were fully erected and detailed. That dictated the technical center steel framing be designed, detailed and erected prior to the showroom.

Right, above: The lifting lugs visible on the top bent in this photo facilitated rapid erection. Girts can be seen already in place in the first few bays. Photo: TGRWA.

Right, below: Adjacent to a busy interstate in the northwest suburbs of Chicago, the Amada showroom is intimately connected to the office (technical center). Note the tops of the showroom bents extending above the roof deck.

The Amada Solution Center is proving to be both extremely functional and beautiful as a structure that will meet the owner's needs for years to come. MSC

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Amada Global, Japan

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Architect of Record
Griskelis Young Harrell, Chicago

Structural Engineer
TGRWA, Chicago

Steel Fabricator
Munster Steel Company, Inc., Munster, Ind. (AISC Member)

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Area Erectors, Rockford, Ill. (IMPACT and TAUC Member)

Structural Software
SAP2000
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