Swedish Invasion

By Gary Reynolds, P.E.

Swedish manufacturer SSAB HardTech Incorporated, a subsidiary of Swedish Steel AB, had a lot riding on their decision to enter the U.S. automotive marketplace in 1998 - not the least of which was a $70 million investment in a new manufacturing plant. The venture's success would be determined by the ability to have a new facility designed, constructed and operational within 24 months in order to produce scheduled customer orders.

SSAB HardTech is a tier-one automotive supplier, producing steel bumper rails, side-impact beams and safety cage beams. Their press-hardened product-line boasts exceptional strength at low weight allowing their automotive clients to achieve emission guidelines without compromising safety. It was against this backdrop that Michigan-based HarleyEllis commenced design on a 65-acre site in Mason, MI.

Initially issues including size, industrial process, energy usage

requirements, and protected wetlands created the design's framework. The resulting 275,000-sq. ft. facility includes 175,000-sq. ft. designated for high-bay manufacturing containing overhead bridge cranes, equipment mezzanines, a below-grade process support and equipment level. It also contains a one-story, 23,000-sq. ft. administrative office and employee support area including a cafeteria, computer facility, exercise gym and locker rooms.

As with every project, building materials are selected for low maintenance, long life and material savings. Following this premise, the facility's specifications outlined hot-dipped galvanizing on the following: exterior exposed steel, stainless steel process and cooling piping; mechanically galvanized tension-control bolts; flexible crane girder tie-backs; adjustable weldable crane rail clamps; long-span roof decking and sandwich panel siding.

The building's footprint dictated a column grid layout with industrial processes, material storage, shipping and receiving requirements based on 67'×30' bays with a clear height of 32' 10" to underside of truss. The administrative offices are based on 32'×48' bays.

The facility's specifications outlined the use of hot-dipped galvanizing on all exposed steel.

The installation of production area flooring. Photo courtesy of Clark Construction.

Adapting Swedish Technology

Outside of incorporating state-of-the-art design, the project marks the first North American use of Swedish Steel AB's uniquely shaped (dual ribbed) fabricated long-span roof decking system. Produced by subsidiary Plannja International, the decking system (TRP 200) provides a clear span between the structural steel trusses, requiring no intermediate support or purlins. HarleyEllis's structural engineers elected to utilize the technology for its load-carrying capacity, reduced material cost and shortened structural steel fabrication and erection time.

Strong enough to carry roof loads across 39' spans, the TRP 200 deck is a function of depth, profile and material thickness. Each section measures 8" deep by 29½" wide. In cross section, the profile combines longitudinal ridging in conjunction with transverse embossing. Material thickness ranges from 22 to 16 gauges. Special shaped support cleats attach to the truss top chords ensuring the deck sheets are laid at the correct cover width preventing the deck from spreading, in addition to providing the horizontal shear transfer required for diaphragm action.

Due to the nature of the SSAB HardTech facility, the roof system for the plant area differed from the administrative space. The industrial space utilized a TRP 200 deck topped by 6" of mineral fiber insulation including a vapor barrier and a 3" deep finish metal roof panel. A 4½" deck was applied to the administrative office area since it spanned 16' and did not require special support cleats. It was topped with 5/8" gypsum board, followed by 2" of rigid insulation and a single-ply roofing membrane.

Incorporating the long-span deck system created additional challenges as opposed to a conventional truss purlin and braced project. Temporary struts and braces primarily stabilized the freestanding

Interior view showcasing the high bay manufacturing area.

columns and trusses until the roof decking and siding were installed. Additionally, the structural framework, consisting of 1950 tons of structural steel of both ASTM A572 Grade 50 and ASTM A36, was temporarily stabilized with vertical structural steel bracing and struts between the truss top chords. Lateral stability, horizontally and vertically, was accomplished by utilizing exterior wall diaphragms, as well as bracing and moment frames in the crane bay areas.

Prepared in Sweden by Plannja's structural engineers, the building's exterior is clad in another example of Swedish innovation. The facility's sidewalls incorporate a horizontal ribbed sandwich metal panel wall system spanning 30', eliminating the need for traditional sidewall girts and intermediate wind columns. Requiring more field assembly than standard insulated panels, the installation included the erection of light gage steel structural sections, followed by the liner panels, insulation, gypsum sheathing and the exterior horizontal ribbed panel on vertical sub girts.

Creating Storage

With a tight deadline and international product requirements, the project team was fully prepared for the Owner's requirement for a stacked manufacturing die storage area adjacent to the press area and immediately over the below-grade equipment level. Utilizing a direct rail support system, a system was designed comprised of W36 girders spanning over the equipment level's reinforced concrete columns and side walls, with W24 carrying beams and two parallel W8 rails. The W8 rails bear on top of the W24's carrying the weight of the stacked dies. The surrounding supported floor slab was designed for a 2,100-psf live load, reducing the structural slab depth required.

Sixty-three foot span bridge cranes ranging in capacity from 5 to 30 metric tons provide for overhead material handling. The crane girders and rails were specified with flexible tiebacks and adjustable weldable rail clamps. Finally, manufactured parts are conveyed to sequenced operations by an overhead conveyor system hung from the truss bottom chord, while scrap handling utilizes a below-grade belt conveyor system.

Just in Time

The collaboration between the owner, roof and siding supplier, general contractor, structural steel fabricator and erector and engineer facilitated the completion of the project within 24 months allowing SSAB Hartdtech a successful and timely start to their North American pursuits, while Mason, MI was granted a glimpse into Nordic design.

A member of HarleyEllis' structural engineering team in Southfield, MI, Gary Reynolds, P.E.'s experience extends over 26 years, including an emphasis on building support systems.

Owner:
SSAB HardTech

General contractor:
Clark Construction

Structural Engineer:
HarleyEllis, Southfield, MI

Software:
RAM Structural System and Eagle Point Structural Expert Series