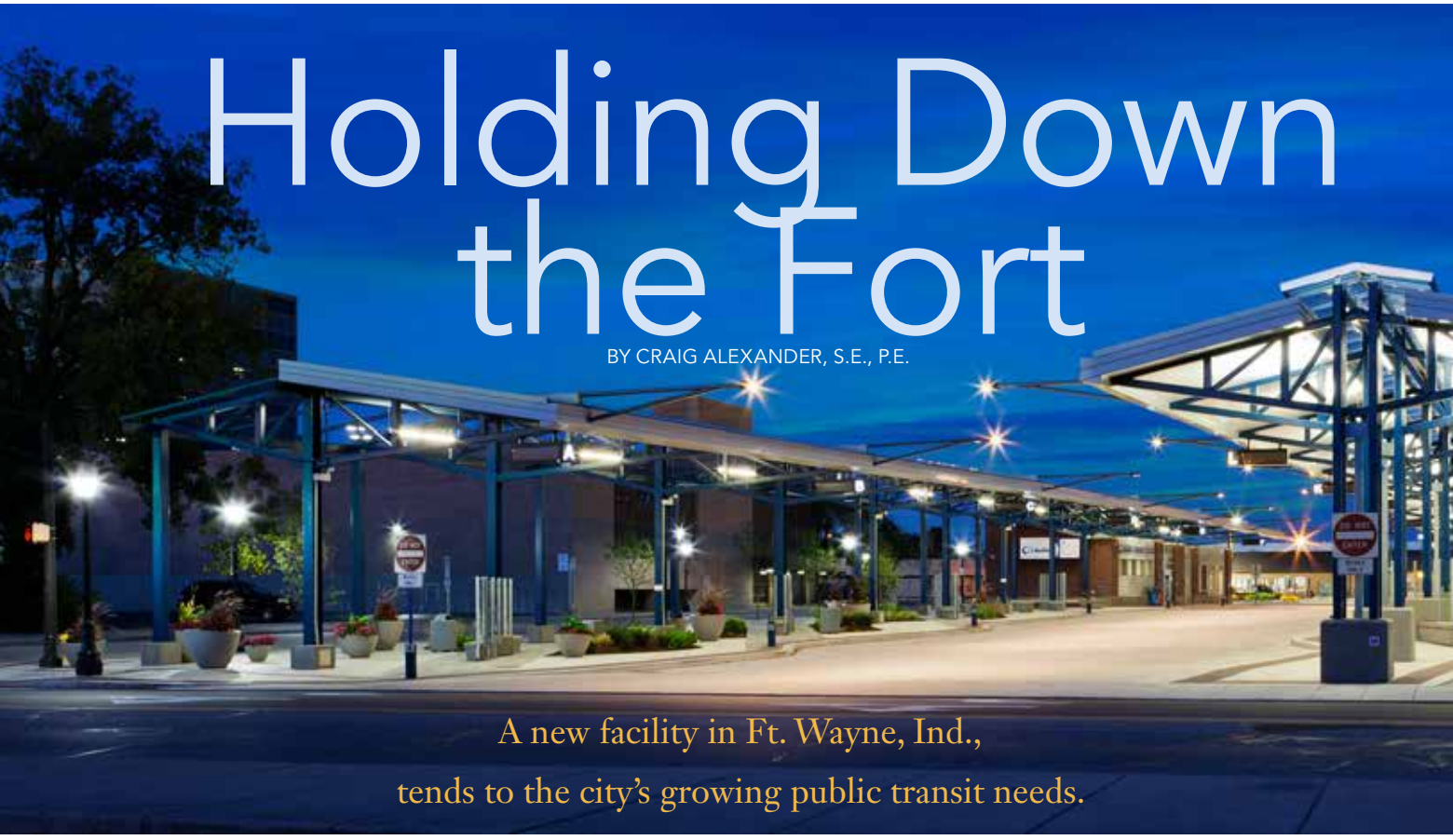
Holding Down the Fort

BY CRAIG ALEXANDER, S.E., P.E.



A new facility in Ft. Wayne, Ind., tends to the city's growing public transit needs.

FT. WAYNE HAS SEEN STEADY GROWTH over the last couple of decades. In fact, between 2000 and 2010, the city of roughly 255,000 added nearly 50,000 residents.

Responding to the increasing population as well as other factors, Fort Wayne Public Transportation Corporation (Citilink) recently opened a new, modern centralized mass transit facility to serve both its city and inter-city bus routes. The new transportation center sits in the heart of Fort Wayne and is charged with reestablishing and enhancing the city's urban fabric.

Architect and structural engineer Wendel Duchscherer selected the site in 2001 with mindful concern of its proximity to the adjacent elevated railroad and historic Baker Street Station for future rail connectivity. One challenge in designing the new $4.5 million transportation center was the need to insert 18 bus slips within the relatively tight site of approximately 1.25 acres. Integrating the canopy truss system and form of the building became a main design feature, and the flexibility of structural steel made this feasible.

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The resulting canopy design is truly a marriage of structural engineering and architecture. The canopies are framed with a combination of wide-flange and hollow structural sections (HSS). This particular combination of framing provided flexibility to conceal the myriad of utilities required to support the function of the canopies while still providing a sleek, modern look that pays homage to historic transit-based structures of yesteryear.

Early in the project the need for a high level of security achieved by unobstructed sightlines was identified as a design goal. To compensate for this, four-post steel columns (HSS6×6×⅜) were used to provide the needed structural capacity while providing maximum visibility through the structure. Connecting these columns to the roof trusses posed a challenge in that the connection had to safely transfer all imposed loading and allow for the truss to be fully fabricated off-site and installed easily in the field with means for adjustments. The final connection detail was comprised of bolted stiffened shear plates, and careful consideration was given to the orientation of the stiffening plates to allow for ease of erection and appropriately transfer all applied loads.

Another canopy design element was the large, integrated cantilevered arms used to illuminate the center drive aisles for evening transfer platform safety. While minimal in load, there was a concern that the arms would be stiff enough to eliminate wind induced vibrations as well as provide ease of routing utilities to the fixtures, and HSS6×3×⅜ sections were selected to address these issues and also provide long unbraced spans.

The building itself, while small in footprint, posed several design issues. The front wall incorporates a sawtooth pattern to match the layout of the bus slips. The building uses ordinary reinforced masonry shear walls for the north-south lateral system, while the east-west lateral system is comprised of ordinary steel moment frames composed of W10×39 columns and W16×26 beams.

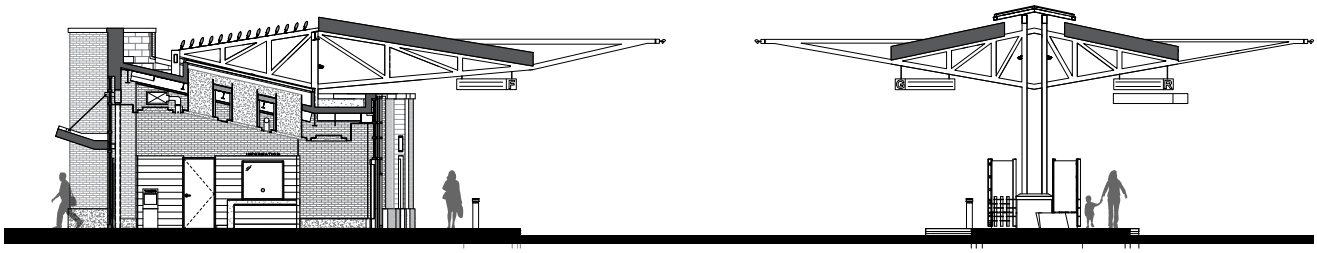
All images courtesy Wendel Duchscherer

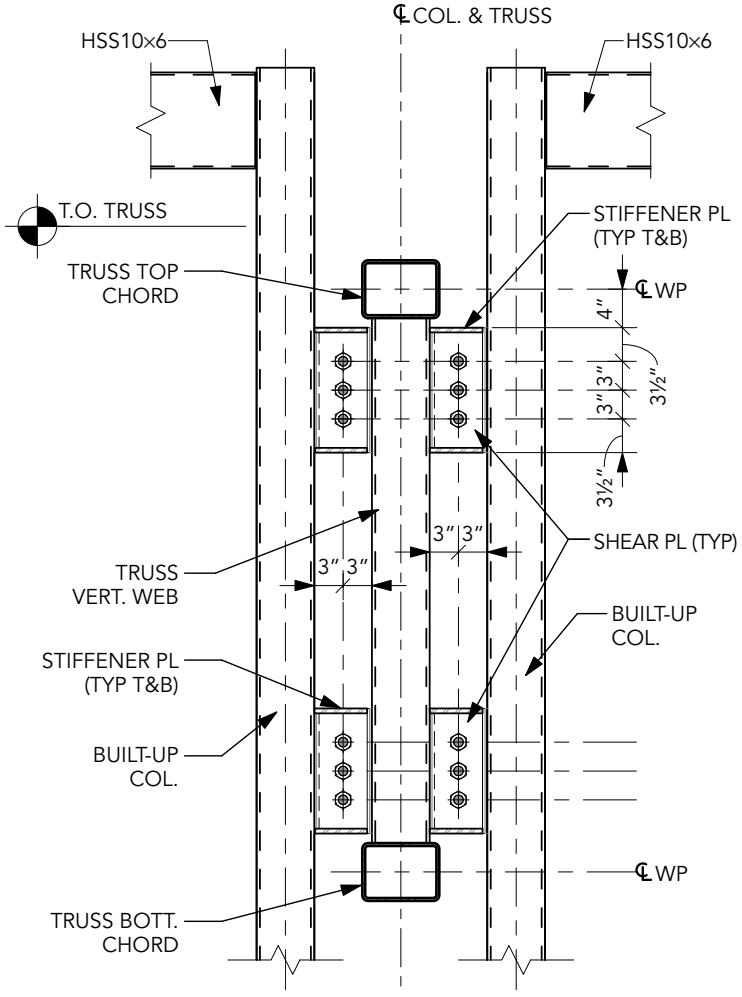
- The project sits at the center of Ft. Wayne, Ind.
- It includes 18 bus slips.
- The canopy's HSS provides long unbraced spans as well as easy routing of utilities.

Keeping Cool

The building, as an assembly space, will be mostly under cooling loads, so shading it from southern solar gain was a sustainable goal from the beginning of the project. The northern side of the canopy has a large, louvered trellis that allows abundant daylighting for the planting below. Daylighting into the building is provided through a series of skylights that have been framed into a composite steel deck; using composite deck provided the required diaphragm

- The steel-supported canopy balances daylight with shelter.
- Skylights in the canopy.





▲ A cross section of the facility.

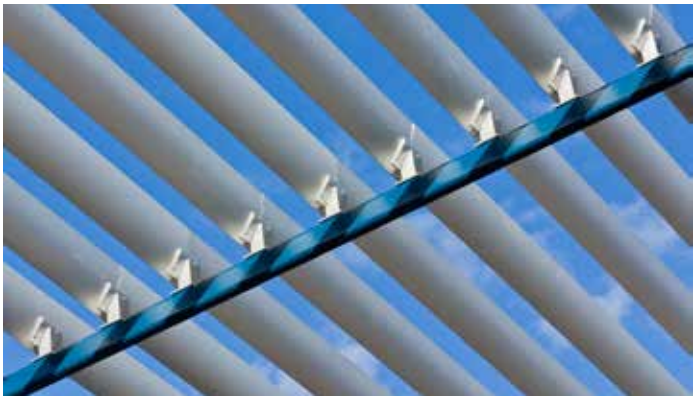
◀ A typical four-post column in the canopy.

strength and facilitated a large percentage of open roof. Daylighting components within both the building and canopies ensure the facility will function with minimal power use during daylight hours. The main canopies use a center monitor roof for functional ventilation and additional daylighting on the platforms to minimize lighting loads.

Another challenge was the integration of the bus canopy into the building structure in the form of thermal bridging due to the large thermal mass of the canopy penetrating the building envelope through the roof. A break was created using neoprene-bearing material and bolted column plate connections in the plane of the roof insulation to eliminate the thermal bridge. Careful consideration was given to assure that the thermal break occurred within the plane of the roof insulation. Similar techniques were used at building exterior entry canopies and the plane of the exterior glazing.

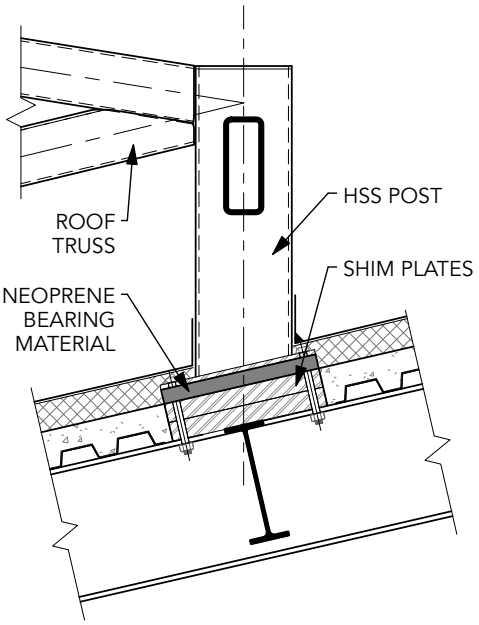
The building was modeled in RAMSteel and the canopies were modeled in STAAD, and the project team used Revit as the modeling and construction documentation platform. The use of 3D modeling allowed for full coordination, as well as clash detection. Several areas of the building required intricate detailing, which was provided in the traditional fashion—2D drawings—and 3D isometric views were created for the more complex areas. The multiple views helped to facilitate accurate construction of these areas the first time, with no rework needed.

The facility, which uses 175 tons of steel, opened last fall and serves as a central point that will likely be seeing increased connections in the coming years. MSC



▲ The northern side of the canopy has a large, louvered trellis that allows abundant daylighting for the planting below.

▲ The facility uses 175 tons of steel in all.



Thermal breaks at the roof.

Owner
Fort Wayne Public Transportation Corporation (Citilink)

Architect and Structural Engineer
Wendel Duchscherer, Buffalo

General Contractor
Hamilton Hunter Builders Inc., Fort Wayne, Ind.

Steel Team

Fabricator
Service Steel Framing, Inc., Butler, Ind. (AISC Member/AISC Certified Fabricator)

Detailer
International Design Services, Inc., Maryland Heights, Mo. (AISC Member)

The canopies were modeled in STAAD.