Gateway to Savannah

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

Curving, contemporary canopies welcome visitors to the gem of Georgia.

Elkins Constructors

▲ An aerial view of the project site during construction.

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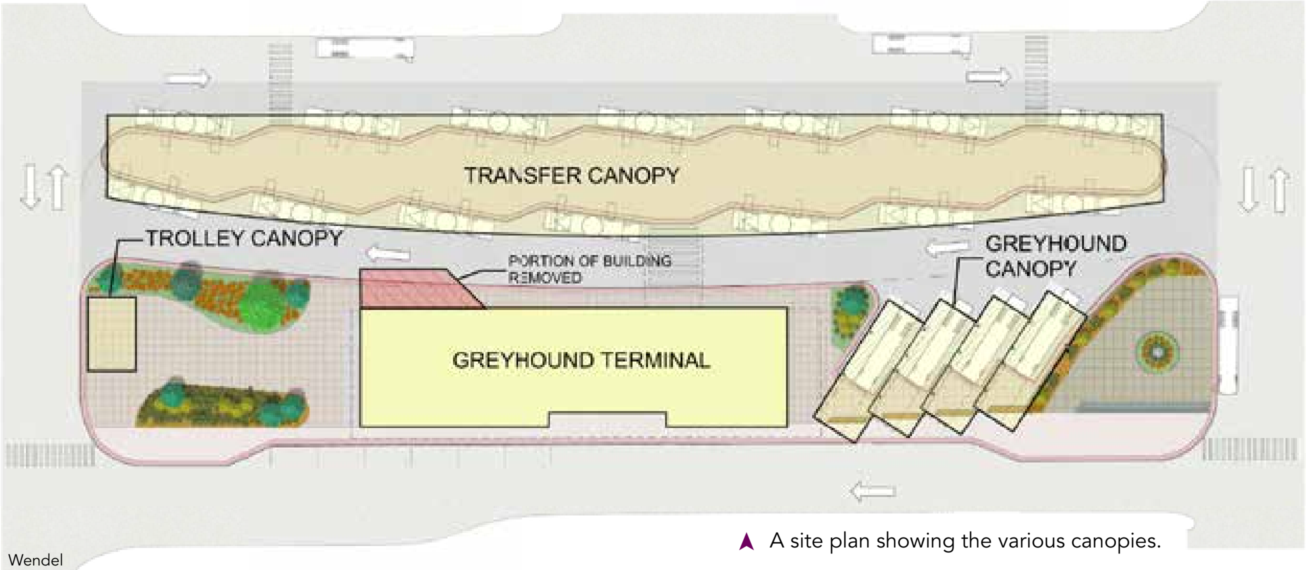
SAVANNAH, WITH ITS SPANISH MOSS, colonial architecture and Southern charm, prides itself on its history. But to provide better access to all of this, as well as serve its growing population and increased tourism, it needed a modern, centralized transit center.

First conceived in 1995, the Chatham Area Transit (CAT) Downtown Intermodal Transit Center was originally slated to provide a central transfer point for bus riders, office and retail space and a 180-car parking garage. After considering 34 sites, a county-owned property near the western border of Savannah's Historic District was established as the site for the proposed hub. However, the project was put on hold three times and withstood public opposition from numerous groups. Finally, an alternative site was selected with unified public support—the nearby Greyhound station (also just west of the Historic District)—and the project restarted in 2008.



Wendel

A site plan showing the various canopies.

The original concept included the demolition of the existing Greyhound station. However, with input from the Historic Savannah Foundation and Metropolitan Planning Commission, the direction changed to retain the terminal. The design was instead developed around the existing structure, which was transformed from a deteriorating and unappealing facility into an iconic entry to Savannah.

A New Pattern

While the existing Greyhound terminal, built in 1964, was in excellent structural condition, its footprint conflicted with the desired traffic circulation pattern of the new transfer platform. To resolve this conflict, the entire northernmost bay (rear) of the building was removed. The removed bay consisted of enclosed building space and an integral passenger canopy constructed of precast concrete single tees that matched the roof construction of the rest of the building. The tees were repurposed in the construction and several were attached to the steel framing of a new canopy, which services Savannah's popular trolley system, via new connection plates. The remaining tees were used to create an eave along the rear of the building where the bay was removed.

Along with the rear bay, the west shear wall of the terminal was also removed and multiple penetrations were added in the east elevation for passenger entries, which meant the existing north-south lateral system, comprised of CMU walls, was no longer intact. Per the *International Existing Building Code*, the terminal was considered a Level 3 alteration, as less than 30% of the floor and roof space was involved in the structural alteration. This meant the facility only needed to sustain original design loading, which would not have included seismic loading. The north-south lateral system was to be replaced with new concrete shear walls within the plane of the original CMU walls. Therefore, the facility was voluntarily upgraded to meet current wind and seismic code-prescribed loads for north-south loading. The east-west lateral system was left intact as it proved adequate for current wind loading, even with Savannah's 130-mph design wind speed.

Steel was used throughout the renovation of the terminal to facilitate the required modifications. As the existing roof tees did not have adequate capacity to support new rooftop mechanical equipment, a steel mechanical frame (using galvanized HSS, angles and

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Shop-fabricated utility penetrations in the steel framing.

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The transfer canopy during erection.

wide-flange members) was constructed independently and isolated from the existing structure to assure that no new loads were transmitted to the existing lateral systems. HSS4×4×3/8 members were used to shore the existing walls where numerous penetrations were cut to make way for new entryways.

Winning Wing

The steel "wing" of the transfer canopy is the signature element of the new transit facility. The form and geometry of the canopy posed several issues for the design team. For starters, the site has a roughly 10-ft grade change within the footprint of the canopy. Another complexity was the desire for a radial column grid along the southern half of the canopy to facilitate better sight lines to enhance the safety and efficiency of traffic flow. With economy and constructability in mind, the project team deemed it necessary that every column be rolled to the same radius and length (centerline radius of 22 ft, column length of nearly 35 ft, all rolled to a nearly full 90°). As such, the radial grid was revised to an orthogonal grid. Column bearing elevations varied to follow the grade of the site, and column centerlines varied to create the effect of a radial column grid.

The structural system for the canopy, which uses W21×111 for the rolled columns and W21×101 and W14×61 for the longitudinal girders, is especially efficient as it makes use of the intermediate W24×94 "broke back" tie beam to create a rigid frame. This effectively reduced the required cantilever to 15 ft versus the 34 ft that was required if the team had not taken advantage of the tie beam. The reduction of cantilever length was also beneficial given Savannah's location in a coastal region with the potential for hurricanes. As with most canopies that have minimal mechanical and architectural dead load, wind loading governs the design of the structural members. However, as the project schedule did not allow time for scale model wind tunnel testing, the project team used the code-prescribed wind loading instead.

The structure's overall shape is very similar to that of the "Troughed Free Roofs" illustrated in ASCE 7 *Minimum Design Loads for Buildings and Other Structures*, with the exception of a variable roof angle. Angles throughout the actual roof were considered, and the worst-case scenario was applied in every case. The roof was also checked for ultimate load capacity against the requirements of ASCE 7's "Monoslope Free Roofs" since there was concern that the gap incorporated for natural ventilation would relieve enough pressure for the roofs to behave as monoslope roofs. As would be expected, the net effect of the code-prescribed wind loads created significant uplift, which was countered by a series of helical piers incorporated into the column footings.

The canopy's framing system not only allowed for the desired architectural aesthetics, but also provided exceptional functionality. The canopy makes extensive use of daylighting, as well as natural ventilation to increase occupant comfort throughout the various seasons. The center portion of the roof uses polycarbonate panels that allow diffused daylight to illuminate the transfer platform while decreasing the need for lights and energy consumption (the facility is designed to achieve LEED Gold certification). The outer portion of the canopy makes use of a long-span, 13-ft steel roof deck, clad with standing seam zinc roofing, to shade the buses and surrounding areas. An opening between the two roofing materials was provided to allow for natural ventilation to evacuate vehicle exhaust and provide a natural cooling effect.

While not immediately noticeable, the framing system also allowed for many small details that resulted in a big difference in the overall final appearance and operation of the facility. One such detail was the provision of oversized shop-fabricated penetrations through the web of each curved column to conceal routing of utilities throughout the canopy. A great deal of effort was put into coordination of the various trades to assure the openings were large enough and in the right locations. Another detail was the steel benches that cantilever from the canopy columns, providing occupant comfort in a manner that does not create additional obstructions for debris to collect; HSS6×2×5/16 with L3×3×¼ were used for the racking bracing. The project team was concerned about the amount of abuse any such bench would receive, but it took very little steel to create a bench that was extremely strong (once installed, the construction manager commented that he could park a dump truck on one of the benches).

As with all transit facilities, user safety is paramount. The layout of the site created separation between the transit center and transfer platform in a manner such that pedestrian traffic must cross the path of bus circulation, and an elevated sidewalk with safety lighting activated by pedestrian traffic was used to act as a speed-calming device.



Photos this page: Atlantic Archives, Inc.

▲ The Chatham Area Transit Downtown Intermodal Transit Center uses 309 tons of new structural steel throughout all of the canopies.

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▲ The walkway canopy works in conjunction with an elevated walkway platform to provide visual cues for motorists in order to enhance pedestrian safety.

▼ The underside of the completed CAT transfer canopy.

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▲ The trolley canopy employs reused building tees and steel framing.

▼ The completed Greyhound canopy.

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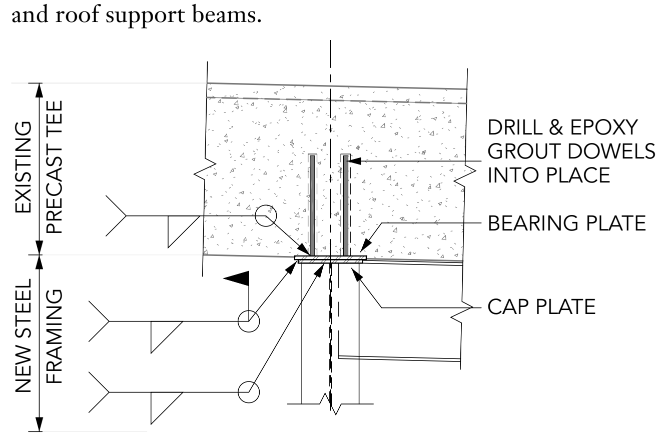
To further enhance safety and rider comfort, a variable-radius rolled steel canopy (using W21×111) was placed over the elevated sidewalk, creating a dramatic visual cue for drivers to look for pedestrians.

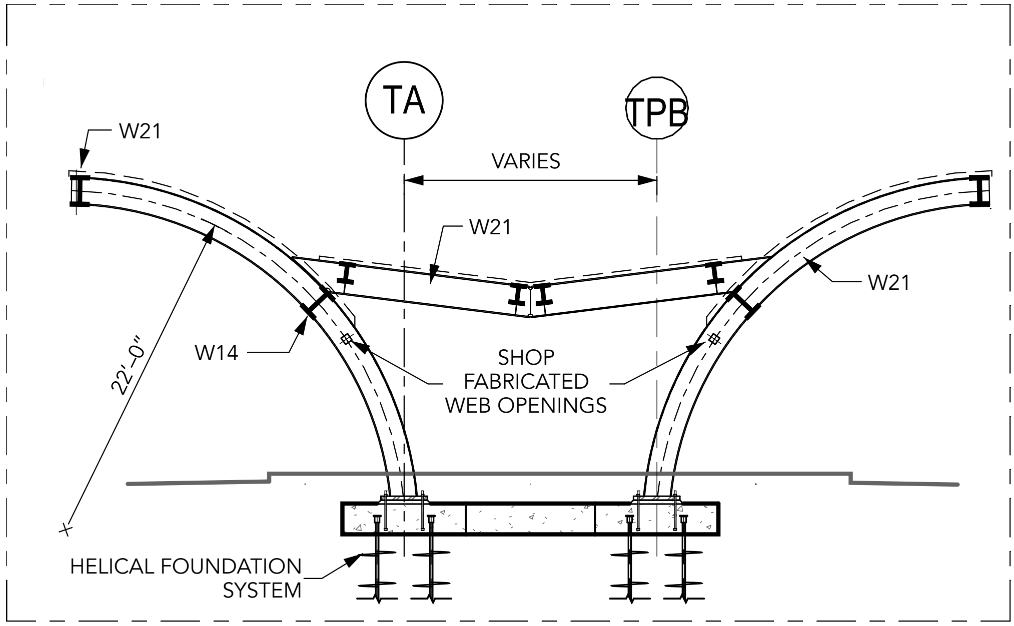
Supporting Canopies

Another canopy provides shelter for four Greyhound bus slips and a pathway for passengers into the terminal. While not intended to be the signature element that the transfer canopy is, this steel-framed structure contributes significantly to this facility's architecture, using HSS12×12×5/8 columns and wide-flange roof framing to create 21-ft cantilevers with W24×76 members and moment frames in both directions. As with the transfer canopy, the philosophies of economy and constructability, through member repetition, were continued throughout the design of this canopy. All upper and lower canopy framing is typical for each of the four slips, and the elevations of the column footings vary to follow the grade, which creates the staggered roof profile.

A third canopy services Savannah's bustling tourism trolleys, a mode of transportation not often considered at transit facilities. This canopy makes use of some of the repurposed roof tees from the portion of the demolished terminal. The column grid was set to match the original support points of the tees, but new connections to the steel were created due to concerns over the ability to reuse original embed plates after demolition. While the structure is clad in decorative masonry and architectural precast concrete, the presence of the steel support structure is obvious with the exposed chevron braces and roof support beams.



▲ A detail of the repurposed roof tees.



➤ Frame elevation of the transfer canopy.

Completed in September and using 309 tons of steel in all, the $10.5 million project welcomes visitors and commuters to the Historic District with style and charm worthy of Savannah. MSC

Owner
Chatham Area Transit (CAT), Savannah, Ga.

General Contractor
Elkins Constructors, Inc., Savannah

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Cogdell and Mendrala Architects PC, Savannah (Station)

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Steel Team

Steel Fabricator
Trinity Fabricators, Inc., Green Cove Springs, Fla., (AISC Member/AISC Certified Fabricator)

Steel Detailer
International Design Services, St. Louis (AISC Member)