Passengers ferrying to the islands of Maine's Casco Bay start their journey in a terminal that has expanded in both size and prominence.

Beacon on the BAY

BY NATHAN MERRILL, P.E.

Robert Benson Photography

AS TOM PETTY SAYS, the waiting is the hardest part.

That used to apply to the Casco Bay Ferry Terminal on the Maine State Pier in Portland.

The gateway to the islands of Casco Bay, the original terminal was built in 1988, having moved from its previous location to property owned by the City of Portland along the western edge of the Maine State Pier. At that time, the Casco Bay Island Transit District (CBITD) was serving a smaller population and using smaller boats; the waterfront was largely a working waterfront and the island population was mostly comprised of fishermen and local residents, and the boats using the terminal were typically between 70 ft and 80 ft in length.

Much has changed since the late 1980s. Nearly one million people now use the ferry service every year, more than double the number the terminal was designed for in 1988. The amount of freight being handled by the ferries has increased dramatically as well, and vehicular traffic on the east side of the terminal is congested all summer long. To handle the increased traffic, Casco Bay Island Transit District (CBITD) has built several new boats, ranging from 100 ft to 120 ft in length and causing increased pressure on the already crowded wharf.

Because the waiting room and ticketing area were so undersized, there were frequently long lines of passengers waiting to buy tickets. And because of the increased freight, especially in the summer, it became more and more difficult for passengers to get to the boats safely. Expansion became necessary.

Scott Simons Architects (SSA) was selected to prepare a master plan for increasing the size of the terminal and address the facility's evolving needs. The project involved a new 4,500-sq.-ft single-story addition at the south end of the existing terminal to house a ticket office, waiting area and support spaces. A portion of the existing terminal superstructure was demolished and removed to allow for the new addition; no structural work within the existing portion was required (though a cursory seismic review was performed to ensure that the building still complied with code-required forces).

The new addition is a reinterpretation of the spartan industrial buildings that are native to the working waterfront. The building features 19-ft-tall exposed steel columns, a cantilevered roof structure and a large amount of glazed curtain wall, including two large bi-fold doors that open the waiting room to the sights and sounds of the working waterfront. Besides expansion, the goal was to create a destination, not just a transit stop.

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Cantilever lengths (from 6 ft to 17.5 ft) are unique on each face of the building and were determined based on limiting column reactions at the existing foundation.

All vertical components of the structure (i.e., columns and braces) were left exposed.

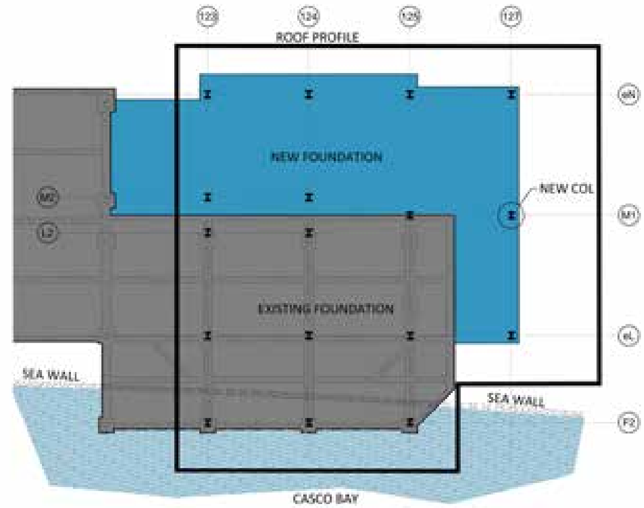
Final roof cantilever lengths and column locations complimented the rigorous architectural design and ensured that the existing foundation elements were not overstressed due to the newly located column reactions.

Maintaining Access

In order to maximize the return on the publicly funded $2.1 million project budget, the new addition was founded partially on new shallow spread footing foundations and partially on existing pile foundations. Geotechnical firm Haley and Aldrich provided recommendations on subgrade preparation and shallow spread footing design parameters such that anticipated differential settlements were minimized to below a ½ in.

Using the original 1988 construction documents, the role of the existing ground-level structural slab, primary and secondary grade beams and pile caps were maintained, and a refined demolition scope was generated, which kept as much of the original foundation structure as undisturbed as possible. This was critical to operations as access to the busiest gates—which were directly adjacent to the construction—had to be maintained.

All of the vertical components of the new steel framing (65 tons in all) were to be left exposed. This was accomplished by taking cues from the surrounding maritime riggings and sensitively detailing a tension-only steel rod braced frame. Conventional, cost-conscious connection details were modified, which maximized economy and minimized the impact to the architectural design. This was realized by specifying clevises at rod terminations and gusset plates detailed



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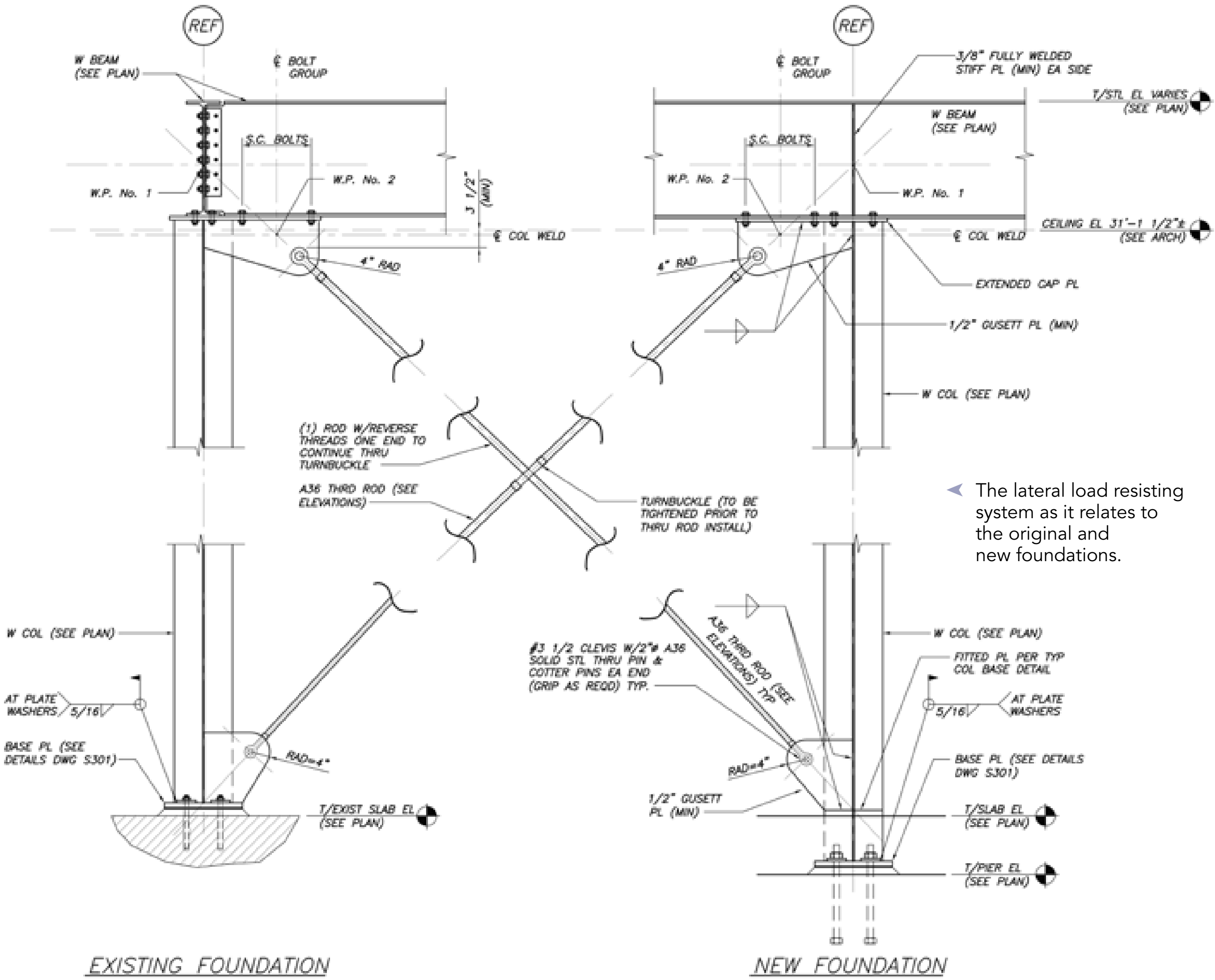
Nathan Merrill (**nathan@beckerstructural.com**) is a senior project engineer with Becker Structural Engineers.



The lateral load resisting system as it relates to the original and new foundations.

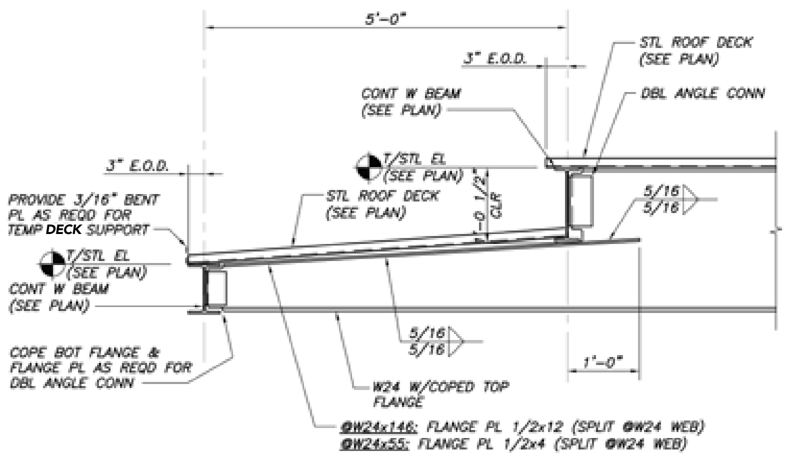
with a radius profile in lieu of the industry standard square-cut. Where rods would have crossed, a customary turnbuckle was provided on one rod and located such that the opposing rod was threaded through the eye opening allowing the centerline of each rod to be maintained.

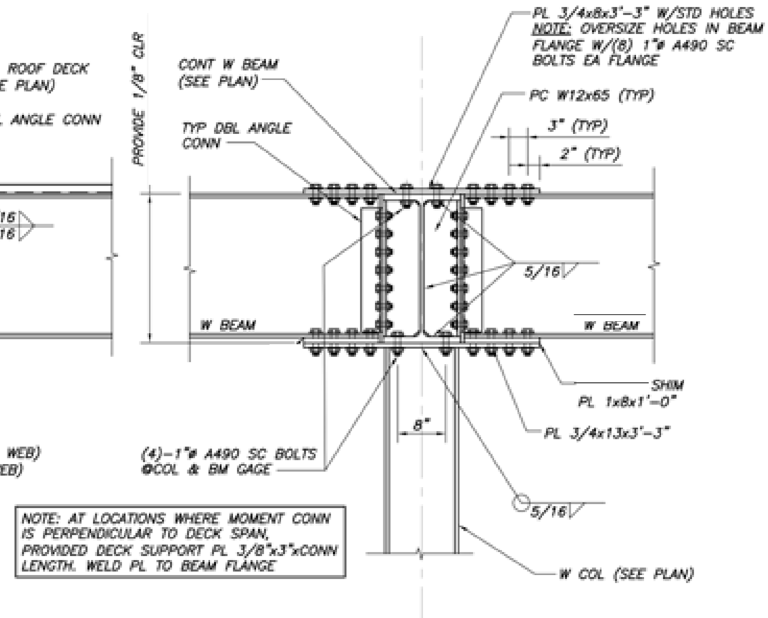
Through an iterative process, final roof cantilever lengths and column locations for the new steel framing system were determined that ensured that the existing foundation elements were not overstressed due to the newly located column reactions. To provide a consistent column base detail, regardless of whether the column was founded on existing foundation or new foundation, false closure plates were specified at the finish floor elevation to emulate the appearance of exposed base plates. Acorn nuts were installed at the exposed anchor rod and base plates to complete the architectural detailing.

Undoubtedly, the most striking architectural gesture and structural design feat is the outstretched roof. Again, the cantilever lengths—which are unique on each face of the building, varying from 6 ft to 17.5 ft—were determined based on limiting column reactions at the existing foundation. This allowed overhang lengths to be maximized at the faces of the building that are supported on new foundation elements. The longer cantilevers necessitated W24×146 structural steel beams to limit perceived deflections.

Connection detailing at corner columns was a complex item of critical importance. Since framing members were coplanar, primary cantilever members with deeper overhangs (17.5 ft) were given priority, meaning that the secondary, shallower overhangs (9.5 ft) were spliced with flange-plated, fully restrained, bolted moment connections. In order to minimize the visual impact of a 24-in.-deep roof structure, a roof edge detail was established that produces a thin, graceful roof profile. (SDS/2 was used to help identify bolting conflicts and potential erection issues at the moment connections, many of which involve joining four to five W24 members.) Due to the length of the beam copes created to achieve this thin edge profile, fabricator James A. McBrady, Inc., plasma cut the beam copes to reduce the potential for distortions. As a result, passengers can now wait outside under the shelter of the deep roof overhang.

Given the budget constraints of this public project, the building defines the best characteristics of structural steel design and construction. There is a humble restraint in the details; nothing is unnecessary and every component is exploited to its fullest potential. The project is not only a reinvestment in Maine's transportation infrastructure, it also fortifies a lifeline to the Casco Bay island community and serves as a beacon for travelers. The open design allows travelers' island experience to begin not when they get to the islands but rather as soon as they enter the terminal.





▲ In order to minimize the visual impact of a 24-in.-deep roof structure, a roof edge detail was established that is indiscernible from the passerby's perspective yet produces a thin, graceful roof profile.

Owner
Casco Bay Island Transit District

General Contractor
Landry French Construction

Architect
Scott Simons Architects

Structural Engineer
Becker Structural Engineers

Steel Team

Fabricator
James A. McBrady, Inc.

Erector
American Aerial Services, Inc.