Newport Beach Civic Center and Park

Newport Beach, Calif.

Each wave roof atop the city hall and community room perches over a Vierendeel truss crafted from W10s.

David Wakely

Project Team

Owner
City of Newport Beach, Newport Beach, Calif.

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Bohlin Cywinski Jackson, San Francisco

Structural Engineer
Arup, San Francisco

General Contractor
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Steel Fabricators
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Photos and content submitted by Bohlin Cywinski Jackson and Arup

Southern California's Civic Center Catches Some Waves with Its Unique Use of Standard Steel Shapes

Wide-flange shapes and hollow structural sections adapted to provide a wave-shaped roof for the center's city hall, clearing the decks for the sustainable structure to save hundreds of thousands of dollars in operating costs.

This view of the city hall exterior bay at night highlights the undulating roof.

Nic LeHoux

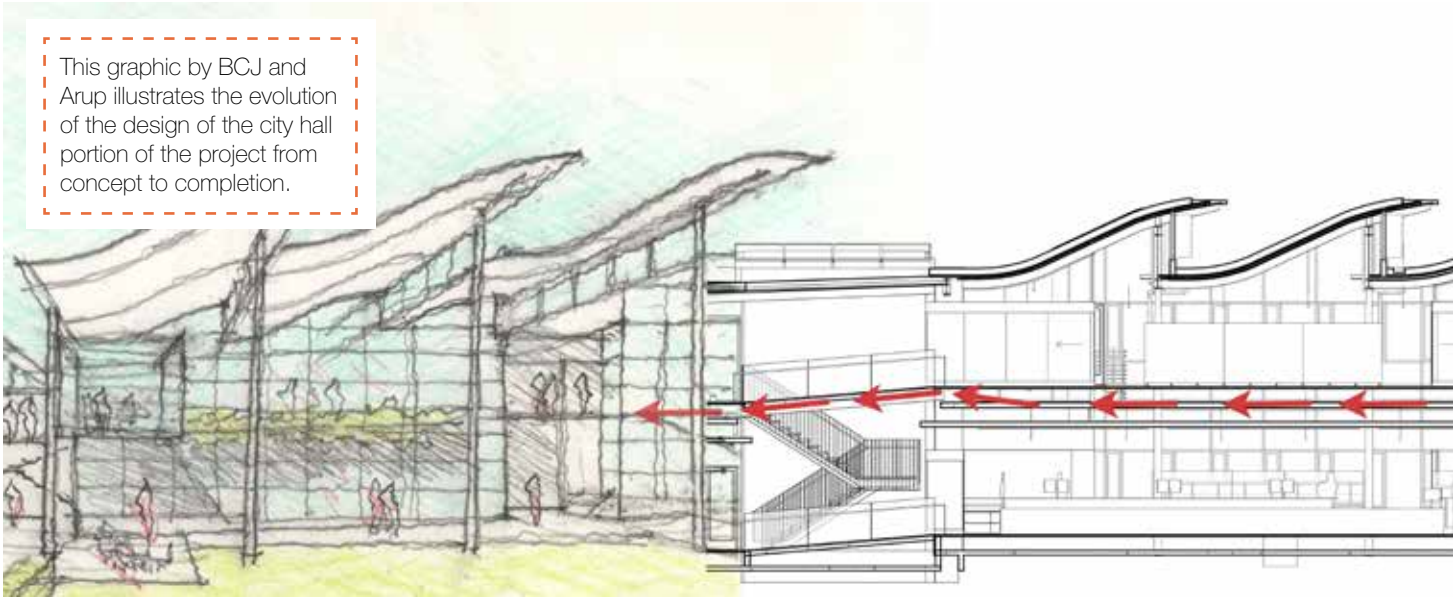
The eye-catching wave-shaped roof of the Newport Beach Civic Center may use standard wide-flange shapes and hollow structural sections (HSS) to complement the architect's vision and provide sustainable building features through coordinated multi-disciplinary services provided by the structural engineer, but it does so in a unique and unforgettable fashion.

The iconic undulating roof form that covers the city hall portion of the center and provides ample outdoor shelter was created by bending W10 sections in double curvature with multiple radii. Each wave roof perches over a Vierendeel truss crafted from W10s, which allows for operable, north-facing clerestory windows and a place to nestle dimmable lighting. Penetrations in the webs of wide flanges are used for conduit and fire sprinklers.

The carefully coordinated structural steel design ensures flexibility and control over the lighting and mechanical systems, saving the LEED Gold certified city hall building an anticipated $85,000 a year on operating costs.

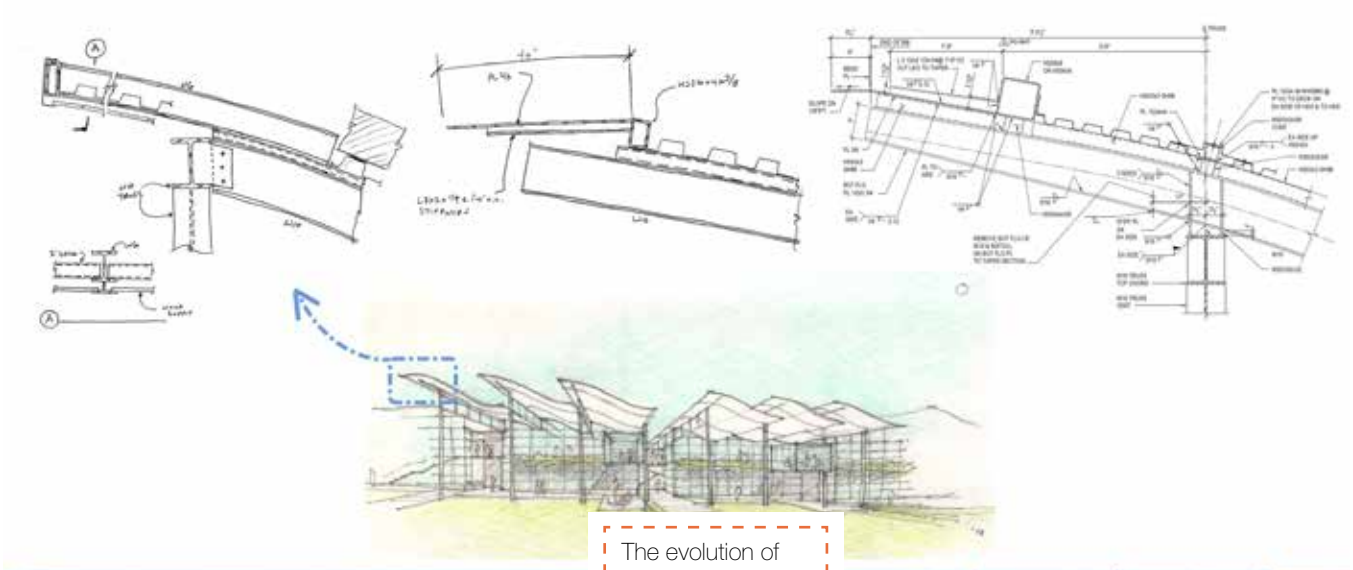
The City of Newport Beach offices are on display alongside perimeter public corridors stretching the entire length of the building and along vertical circulation cores. In keeping with this open expression, the majority of the steel structure is proudly on display to exhibit its purpose and function. The aesthetic desire for slender vertical supports around the perimeter of the building is achieved with tapered-end round HSS and simple pin base connections built up from steel plates.

The buckling restrained brace (BRB) frames were made to fit the structurally required core area within the architecturally desired round HSS casing size. Exposed BRB's with pin connections are prominently displayed at the entrance to the community room, in all of the repeated cores, and in private offices. The steel skeleton forms a sculpture that demonstrates to occupants how both gravity and lateral earthquake forces flow from the roof down to the foundations.



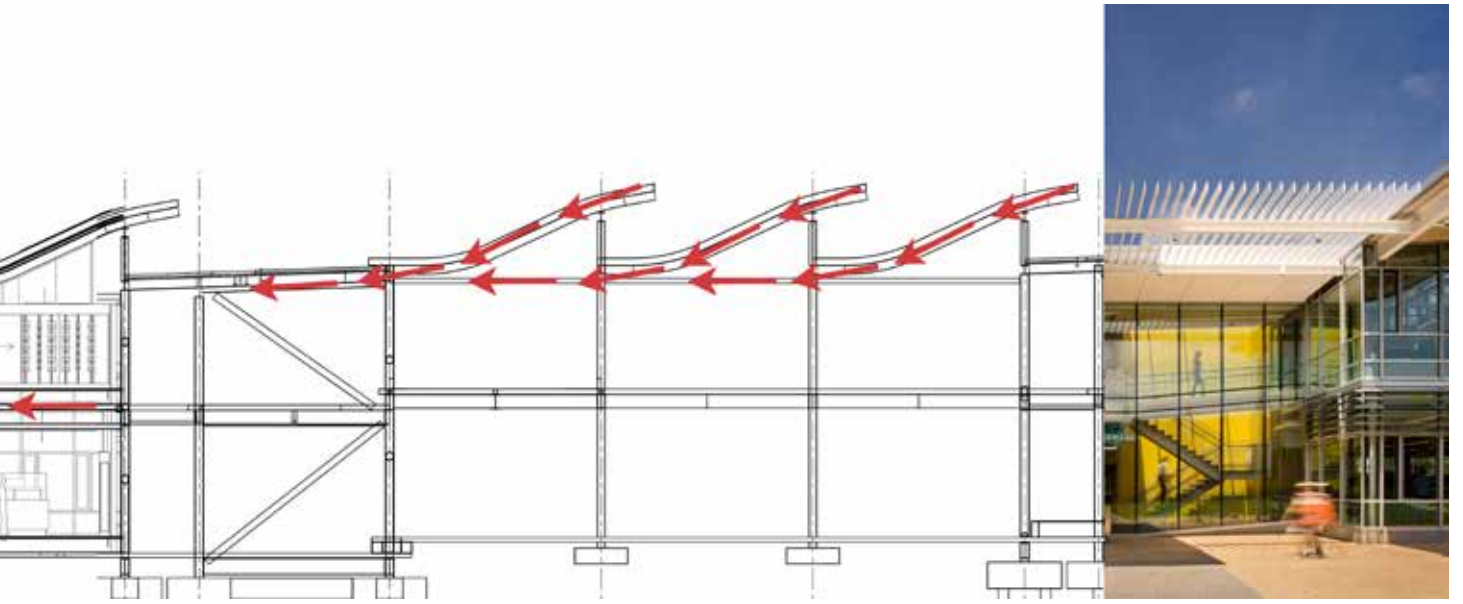
This graphic by BCJ and Arup illustrates the evolution of the design of the city hall portion of the project from concept to completion.

To prevent obstruction of sight lines to the Pacific Ocean, the already-sloping site was carved away so that the two-story structure steps down 18 inches at every bay. This led to a stepped diaphragm at the second floor, which, coupled with the discontinuous wave roof diaphragms, created the challenge of delivering diaphragm forces to the BRBs located in the cores. Diaphragm forces from each wave roof segment are collected through pin-ended round HSS collectors that double as chords. The architect highlighted the gusset plates of these pinned collectors by elongating the plate further into the core areas. At the steps in the second floor where



The evolution of the wave-form roof's nosing detail.

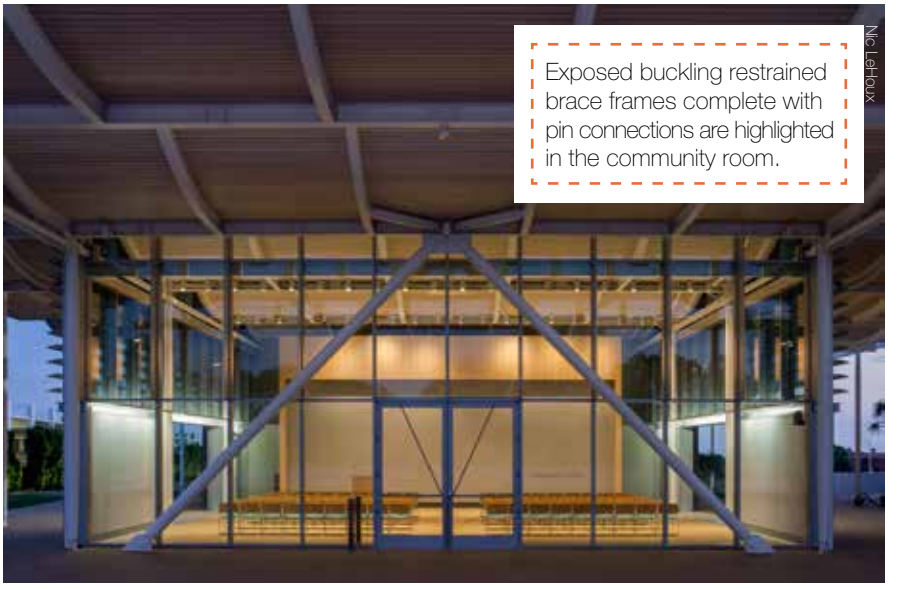
BCJ, Arup



the public edge of the core has very few horizontal connection points, the pedestrian bridge ramps, designed with wide-flange girders, are used as sloped funnels for diaphragm forces. The scissor stair in each core was carefully detailed with a ground floor sliding base plate to allow for two inches of interstory drift.

Spanning 60 ft each, a pair of tensioned cable trusses allows for a column-free, 150-seat space for public gathering in the council chambers during city council meetings. The unobtrusive trusses are constructed with a thin-tensioned-rod bottom chord, cruciform struts made from steel plate, and a built-up plate and back-to-back MC section top chord. The wall behind the dais bench is the formwork for the center's iconic sail. The curved-in-plan sail support wall is assembled out of vertically canted rectangular HSS sections and square HSS special concentric braced frames.

The existing public library was expanded to create an area for children and private reading spaces in the 17,000-sq-ft, two-story, wide-flange steel moment frame addition. A café and credit union will serve the community in the new main entrance, which opens up to the new Civic Green. The roof's tapered steel plate girders cantilever in excess of 50 ft in two directions over a single exposed steel built-up column prominently displayed at the entry doors, forming a dramatic entry canopy that thins down to a 6-in. architectural fascia.



Nic LeHoux

Exposed buckling restrained brace frames complete with pin connections are highlighted in the community room.

Nic LeHoux

A sweeping 50-ft roof made of tapered steel plate girders cantilevers in two directions over the entrance to the library addition.

Scattered across the 14 acres of restored wetland park are three simple-profile steel pedestrian bridges and a steel girder bridge which connects two parcels of parkland separated by a main thoroughfare. The sight-line friendly, low-profile San Miguel Bridge was designed with two major wide-flange girders that span 150 ft from the abutment anchored on the north end to the elevator tower on the south parcel. The main girders fly over the top of a pair of wide-flange cantilever beams embedded in the concrete shear wall elevator tower and cantilever out to form a 52-ft observation platform with striking views out to Catalina Island.

Building Facts

Completion Date: 2013
Construction Cost: $110 million
Square Feet: 100,000 – City Hall
17,000 – Library addition
Acreage: 20 total, 14-acre park
Sustainability: LEED Gold Certified

The library under construction.

Janice Mochizuki

A site plan highlights building structures and bridges on the site.

BCJ

A view from the bustling park over the sloping civic center site toward the Pacific Ocean.

Janice Mochizuki

Observation platform and bridges.

Janice Mochizuki

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