

Fabric ARCHITECTURE

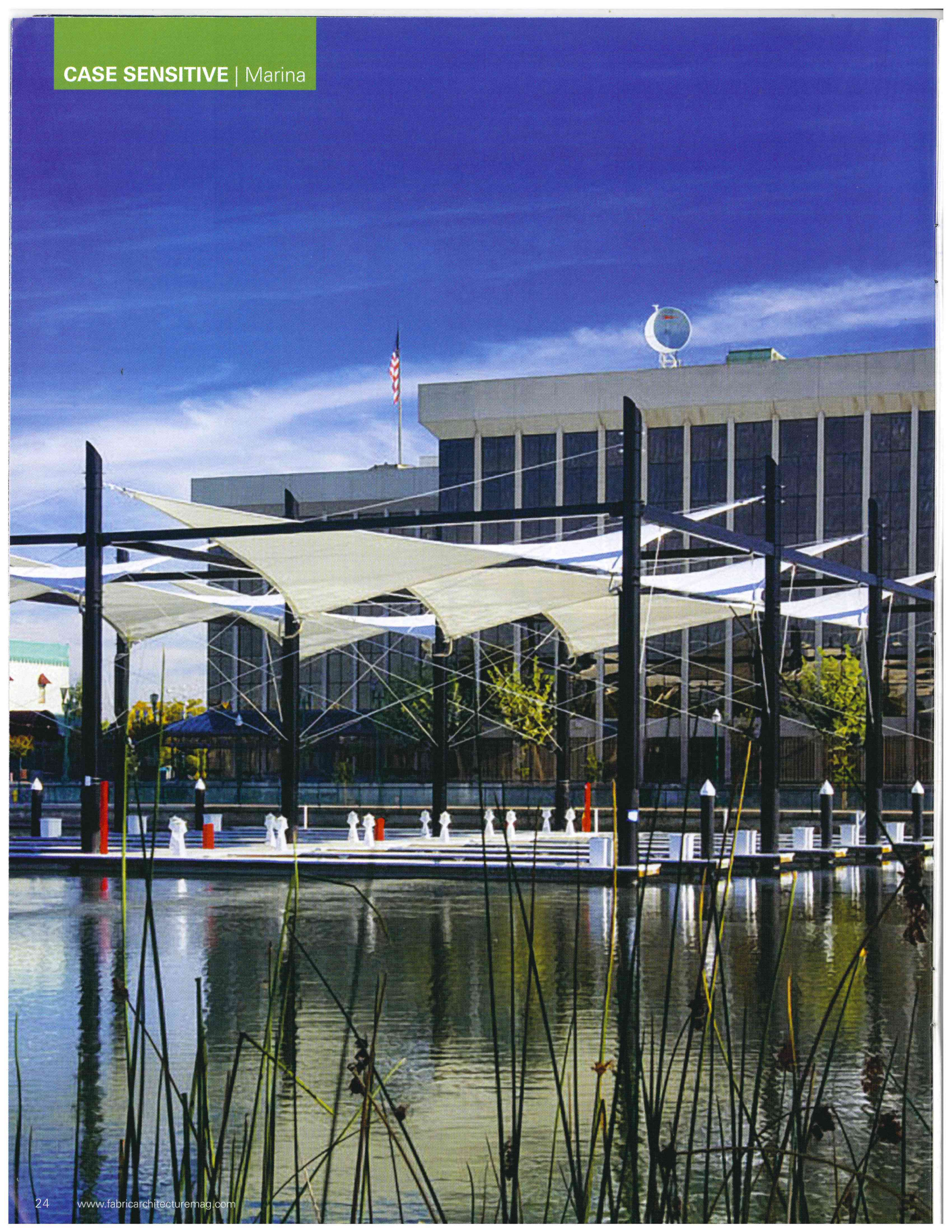
DESIGN FOR SUSTAINABILITY

LESSONS LEARNED

Air domes: last of a dying breed?

Herzog & de Meuron's
Allianz Arena 10+ yrs

Millennium Dome—
What's up with that?



Cool water

Multiple shade 'sails' on a California marina keep boaters in the breeze

Stockton, located in the hot and dry Central Valley of California about 60 miles east of San Francisco Bay, began during the Gold Rush of 1848. After an initial flirtation with prospecting, the city, with its strategic location at the center of the San Joaquin Delta network of waterways, soon found it paid more handsomely to serve as an outfitting and shipping center of goods. In the early 20th century Stockton quickly became the nexus of transportation for California's burgeoning agriculture production and manufacturing. In 1933, Stockton became the first inland seaport in the state. The city steadily grew until the 2000s, then suffered a decline after the housing bubble of the early 21st century burst, leaving Stockton as one of the hardest hit regions of California.


Key to the city's recent efforts to revitalize its downtown is an ambitious multiphase redevelopment of the waterfront. The new Downtown Marina and Joan Darrah Promenade are prime efforts. The 66-berth marina—designed to accommodate a variety of watercraft—consists of six 24m slips, 12 18m slips and 48 15m slips. A unique tensioned fabric canopy composed of 24 saddle-shaped fabric shades (or "sails") grouped in four sets of six sails hovers above the 15m slips.

Designed by LDH Partnership LLP architects and Huntington Design Associates Inc. structural engineers, the marina is "a dynamic visual signature that is reminiscent of the great sailing vessels that ventured upriver from San Francisco to Stockton's inland port," reads a project description on the architects' website. Aside from the unusual aesthetics of the repeated white sails, the project may be "a unique application of fabric tension structures as covers for a floating boat dock," says structural engineer Craig Huntington.

In a traditional covered dock system, the roof structure is attached to the dock so it moves up and down with the dock as the tides change. The Stockton marina roof system is attached to the piles, not the dock, so it remains at a set height despite tidal ebb and flow. This approach gives the marina's structure a more permanent and monumental presence, but required special considerations, including a guaranteed clearance for the tallest boats to fit under the roof at the highest predicted water levels. Tubular steel beams link the pile tops to restrain them against the large lateral loads exerted by the catenary cables that define the fabric sail edges. The beams are field bolted to short shop-welded stubs on the pile faces, with the bolt connections helping to resist lateral wind and seismic forces. Vertical bracing was required to provide additional lateral resistance using steel cables for visual lightness.



Vertical cross bracing with steel cables maintains a visually light appearance.

The Stockton Downtown Marina is an important piece in the city's economic revitalization. Completed last summer, the fabric canopy's beautiful design is a beacon to tourists and has contributed to the waterfront's renewed popularity. Perhaps a true test of its success: the marina has taken the position of icon on Stockton's travel and business websites, and it garnered the city's Project of the Year award for 2009. 

PROJECT DATA

Client: City of Stockton, Calif.

Architect: LDA Partners LLP

Structural (fabric canopies): Huntington Design Associates Inc.

Fabrication (fabric canopies): FabriTec Structures

Marine contractors: Power Engineering Contractors Inc.

Fabric: SHEERFILL®V from Saint-Gobain Performance Plastics

The overall mission of this association is to promote the use and growth of fabric structures and to represent the interests and concerns of the fabric structures industry in the Americas. FSA strives to continue to educate the design community on the use of fabric structures.

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