

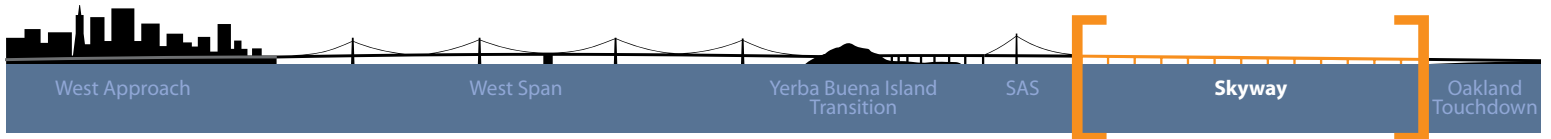


THE SAN FRANCISCO-OAKLAND BAY BRIDGE SEISMIC SAFETY PROJECTS

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FACT SHEET

The Skyway

Spanning over 1.2 miles, the Skyway is the longest portion of the new East Span—gracefully rising from the Oakland shoreline to connect with the elegant single tower Self Anchored Suspension (SAS) span near Yerba Buena Island.



PROJECT OVERVIEW

Bridge builders have broken new ground for the design and construction of the East Span, which will look and perform very differently from the original 1936 steel truss-cantilever span.

The new bridge will feature parallel roadways, providing motorists with sweeping views of San Francisco Bay. Each deck will accommodate five lanes of traffic and include 10-foot-wide shoulders to help keep traffic moving.



The Skyway will have massive pilings reaching deep into the bay soils, and seismic safety devices that will enable the road decks to move, rather than buckle, in the event of an earthquake. Some elements of the span have been specifically designed to deform during an earthquake in order to protect the most important parts of the bridge's structure.

Several critical bridge elements were tested in the design phase to assess their viability in the event of a major earthquake, and mock-ups were built to determine their construction feasibility.

The Skyway's decks are comprised of 452 pre-cast, post-tensioned concrete segments, fabricated in Stockton and transported by barge to the project site. These are the largest segments of their kind ever cast. They are lifted into place by winches, which were custom-made for this project.

SKYWAY NEARING COMPLETION

The Skyway's parallel bridge decks extend over the bay towards Oakland. The existing span, which is visible to the right of the Skyway, will eventually be demolished.

Key Facts

- *Project Cost: \$1.293 billion*
- *Project Start Date: 2002*
- *Expected Completion Date: 2007*
- *Unique Structural Features: Skyway decks are composed of the world's largest pre-cast concrete segments—some standing three-stories high*
- *Skyway Design: T.Y. Lin International/Moffat & Nichols, a Joint Venture*
- *Skyway Construction: Kiewit-FCI-Manson (KFM), a Joint Venture*

The Skyway is one of a series of Bay Bridge Seismic Safety Projects to strengthen the bridge. A seismic retrofit of the bridge's West Span was completed in 2004.

The East Span, between Yerba Buena Island and Oakland, is being entirely rebuilt to bring it up to seismic safety standards.



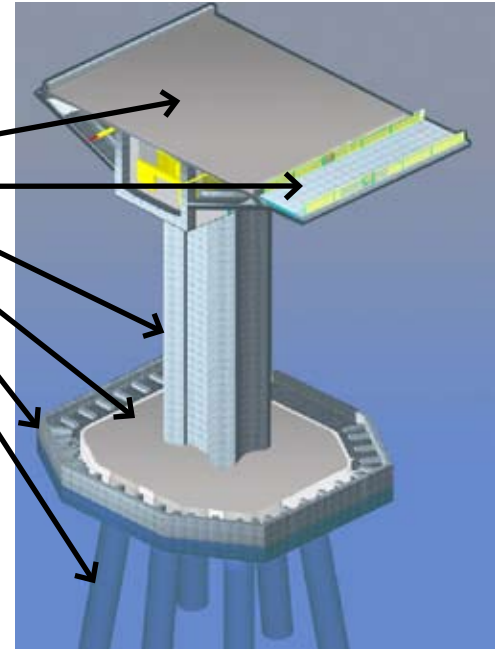
For more information on the Skyway, visit www.baybridgeinfo.org



A SOLID FOUNDATION

Diagram showing major components of a Skyway support, or “pier”

Pier Table
Pedestrian/Bicycle Path
Pier Column
Pile Cap
Fender
Piles



PIER TABLE CONSTRUCTION

Once the pier column is complete, a pier table is cast in place. Strand jacks will later be installed to lift the pre-cast segments into place.

The concrete segments are supported by pier tables on top of massive piers, resembling giant “Ts” protruding from the water. The piers range in height from 45 feet to 115 feet, with the shorter piers placed in the shallower waters near Oakland.

The pier tables, which are cast in place at the project site, are erected on top of enormous pier columns. Piles measuring eight and a half feet in diameter are driven deep into the bay’s soil and sediment—up to three hundred feet

below the water’s surface. These piles are welded into the footing boxes—or pile caps, which are underneath the columns. Unlike the original bridge’s wooden pilings, which range from 85 to 200 feet, the Skyway’s steel piles extend as much as 300 feet below the water’s surface to anchor in stable soils.

For additional stability and resistance during an earthquake, the piles are driven into the soil at an angle, through a process called “battering.” This method has been used to

create secure foundations for oil rigs for more than two decades, but has not been used for bridge construction of this scale. The piles weigh approximately 365 tons each and are driven by one of the world’s largest hydraulic hammers, which generates 1.2 million pounds of force—the equivalent of a car hitting a brick wall at 265 mph.

To mitigate the impact of pile driving on fish and other wildlife, dense columns of air bubbles or “bubble curtains,” are created around the piles underwater. These bubbles help to dissipate the shock waves that are produced by the force of the hammering.



HINGE PIPE BEAMS TAKE THE HEAT (and the Cold)

Twenty hinge pipe beams were fabricated to precise tolerances by the Transbay Steel Corporation. They are designed to move within their sleeves during expansion or contraction of the decks due to changes in temperature. They are also specifically designed to absorb the energy of an earthquake by deforming in their middle or “fuse” section. This will minimize the damage to the bridge’s main structure. The damaged section can then be

PILE DRIVING

One of the world’s largest hydraulic hammers is used to drive massive steel piles deep into the bay mud. These piles are then cleaned out and filled with steel and concrete.



INSTALLING A HINGE PIPE BEAM

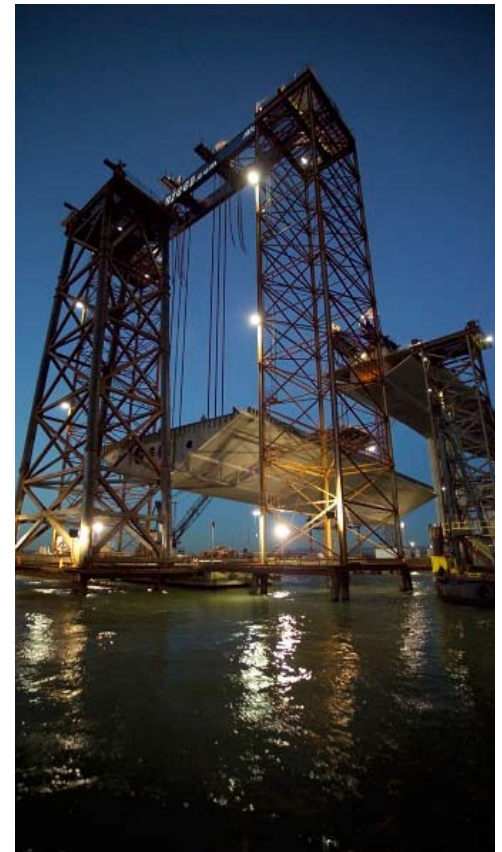
Designed to function like a fuse, these beams will deform during an earthquake and can quickly be replaced.

quickly replaced with a new one. The hinge pipe beams are placed between every four pier columns.

Two huge steel transition segments, fabricated by Universal Structures, Inc., were hoisted into place in two of the heaviest lifts in California history. These segments, weighing nearly 2,000 tons each, will eventually connect the Skyway section with the new SAS span.

Once all of the sections are in place, the surface of the deck will be paved with high-

strength polyester concrete, which is both durable and weather resistant. A 15½-foot-wide bicycle and pedestrian path will be attached on the southern side of the eastbound structure. The path will extend from Oakland to Yerba Buena Island and will link to the 400-mile multi-use Bay Trail that will ultimately encircle the entire Bay. The path will include six viewing areas, providing dramatic vistas from the new bridge.



THE BIG LIFT

One of two massive steel transition segments is lifted into place.

THE SKYWAY TAKES FORM

A pre-cast concrete segment is lifted into place by a pair of strand jacks while another segment awaits its turn on a barge.





Aerial view of the Skyway prefabrication site in Stockton, CA.



Segments being match cast to ensure a perfect fit.

STOCKTON YARD

Located on a deepwater shipping channel in Stockton California, the Stockton Yard serves as an ideal location for producing the 452 pre-cast concrete segments that comprise the Skyway. While the segments are being cast, cured and stored in Stockton, work to build their foundations in San Francisco Bay continues. In this way, a tight production timeline is kept on course and possible environmental impacts to the bay are minimized.

To ensure that the segments will fit together precisely when they are lifted into place, they are match cast in a giant mold in the order in which they will be installed on the bridge. Each concrete section is poured, one after the other, with ridges or “shear keys” on the adjoining surfaces. These shear keys ensure proper alignment and help hold the segments together during final assembly.

After the concrete has set, the segments are transported to a curing area by a massive, computerized straddle carrier, designed expressly for this project. The concrete then cures for two to 18 months. Finally, the straddle carrier loads the segments onto a barge for the 10-12 hour journey to the construction site in San Francisco Bay.



Straddle carrier loads a segment on a barge.



Two segments make their way to the construction site.

This publication is one in a series of fact sheets available about the Seismic Safety Projects on the San Francisco-Oakland Bay Bridge, published by the Bay Bridge Public Information Office.

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