



San Francisco – Oakland Bay Bridge Second Crossing

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The Bay Bridge is one of the greatest engineering achievements in American history, as described in the article on page 26. However, the recent renovation has not added a single lane to relieve traffic congestion, which has a negative impact on the Bay Area and California economies. There is one obvious solution for the problem – to build a second crossing between San Francisco and Oakland on an alignment approximately parallel to the original bridge.

After initially proposing this idea, the authors completed a feasibility study. We believe that the new bridge should be a double-decker, saving 15% of the cost versus two side-by-side decks and saving 50% of the shade cast on the Bay. The west span should be a new suspension bridge in harmony with the existing, with complementary spans up to 2500 feet (760 m); the east span can be a new bridge with spans similar to the existing east portion, but it would be more efficient to retrofit and relocate the existing structures onto new foundations on piles near the current alignment (see *Figure*).

The old existing structure is currently planned for demolition. Saving and reusing it is only one option for building this portion of the second crossing, but it seems to be the best. The existing east span foundations are the most deficient part of the old bridge, while its superstructure has performed well during the past 80 years of service. Our study makes use of effective methods of strengthening the existing trusses, such as transforming the system to several continuous structures, reinforcing or replacing some elements found deficient, replacing the existing concrete deck with orthotropic or other lightweight steel decks, etc. Such reuse is a rare opportunity to create the much-needed second trans-bay crossing faster and for less cost.

The feasibility study proves that a new Second SFO Bay Bridge Crossing is perfectly achievable. The new west span – as a suspension or cable-stayed bridge of up to 2500 feet (760 m) – is not a problem for today's construction techniques. Currently there are more than 40 such bridges with spans longer than 2500 feet. Based on our study, the new east span could be easily built with modern steel trusses and orthotropic or other lightweight decks, or by relocating the

existing structures to new foundations using high-capacity jacks on barges with temporary piers. Preserving and reusing 60,600 tons (55,000 metric tons) of steel is also a significant economic and environmental saving.

The main achievements of the new crossing would be increasing the trans-bay traffic capacity and providing a bicycle lane between San Francisco and Oakland. It would add four new lanes to the existing five in each direction, thus increasing the overall capacity by 80%. By 2035, the Bay Area population is estimated to increase by 50% from 1990, when the traffic congestion was already very heavy. The California Department of Transportation (Caltrans) needed five years of planning and design plus nearly 12 years of construction to build just one half of a full crossing, so it is obvious that we are running out of time to solve the problem.

The estimated steel quantities for the second crossing are 152,670 tons (138,500 metric tons), including over 99,200 tons (90,000 metric tons) for new structures and 53,460 tons (48,500 metric tons) for retrofitted members from the old east span; 78,800 tons (71,500 metric tons) for the new west crossing (including the San Francisco approach and Yerba Buena Island transition structures), and 73,850 tons (67,000 metric tons) for the east crossing, only 20,400 tons (18,500 metric tons) of which would be new steel. This project can be completed in less than five years, including design competitions and construction. Based on recent construction of similar bridges, the estimated cost is \$2.55B. The efficiency of the second bridge crossing is demonstrated by comparing the 152,670 tons for this entirely steel structure with the 266,750 tons (242,000 metric tons) of steel used for the new east crossing replacement, which is about half as long as the overall new proposed crossing and mainly a concrete bridge.

Accomplishing a second Bay Bridge crossing is a challenging task, but not at all comparable to the problems that our predecessors had to overcome some 80 years ago, designing and



Existing Bay Bridge and proposed second crossing.

building simultaneously the Bay Bridge and the Golden Gate Bridge during the Great Depression. This project is completely within the capability of American engineers and builders; the only challenge is to persuade federal and California state transportation authorities to begin working immediately on planning and designing the new crossing.

The advantages of the second Bay Bridge crossing are:

- Solving the traffic congestion on the current bridge;
- Using the most innovative techniques available to build a new crossing within reasonable time and cost;
- Providing an additional transportation link at considerable materials and cost savings;
- Completing the pedestrian/bicycle lane for the full length between Oakland and San Francisco;
- Setting an example for efficient use of funding for infrastructure renovation; and,
- A great opportunity for our engineers and builders to revive the art of American bridge engineering. ■

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