# PLANNING TRANSPORTATION MEGAPROJECTS: LESSONS FROM REPLACING THE EAST SPANS OF THE SAN FRANCISCO-OAKLAND BAY BRIDGE

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As California searches for solutions to its transportation challenges, it is natural to look elsewhere–to other countries, even other states–for useful models and examples of cost-effective and transformational transportation alternatives. I suggest it is useful to look as well to earlier periods in California history, specifically the New Deal, for projects that were both cost-effective and transformational.

The specific example I have in mind is the San Francisco-Oakland Bay Bridge in 1936.

My 2017 study, *A Tale of Two Bridges: The San Francisco Oakland Bay Bridges of 1936 and 2013* sought to explain through narrative history how the 1936 bridge succeeded and the 2013 East Span replacement failed. As I sought to write a concluding chapter for this book, I found myself amazed at the contrasting experiences of building these two bridges, which were on the same alignment but could hardly be more different.

I was struck especially by the differences between the 1936 bridge and the 2013 bridge when both were evaluated by common metrics for very large projects: were they built on time and within budget; did they experience technical failures; were they popular with the general public; and so forth. In contrasting the two versions of the Bay Bridge, I derived five lessons to explain why one project worked and the other did not.

## LESSON NO. 1. A MEGAPROJECT SHOULD ENJOY BROAD PUBLIC SUPPORT.

The first lesson is that consensus should exist before a public agency undertakes a very expensive megaproject. The 1936 bridge may have been the most popular public works project in California history. San Francisco leaders lobbied for the project for more than a decade before it was built. Financing, not a lack of public support, kept the project in limbo. This consensus, approaching unanimity, gave the project political immunity. When things went wrong, as they always will in a project of this magnitude, this popularity shielded Bay Bridge planners from criticism.

The 2013 East Span replacement project by contrast was never popular among the general public. The decision to replace rather than repair the old bridge after the 1989 Loma Prieta earthquake originated from Caltrans. The public, including the state Legislature, were brought along after DOT planners had already fully committed the state to the project.

This lesson does not mean we should only undertake very popular projects. It does indicate, however, that popular projects will be more likely to earn public patience and forgiveness by the public when inevitable problems arise. For example, San Francisco's Hetch Hetchy dam project was unpopular in some circles but wildly popular with San Franciscans, who initially authorized the project in 1908 with a vote of 86 percent (and very much wanted the water it would send their way). The initial cost estimates were grossly underestimated, however, and M.M.

O'Shaughnessy needed to return for additional bond authorizations in 1924 and 1928 to complete the project.

Conversely, projects having marginal or negative approval ratings will likely not earn such patience among voters. Would Californians have approved bonds for the East Span replacement, had they known in was going to be 650 percent more expensive than they thought?

LESSON NO. 2. INITIAL COST ESTIMATES WILL FORM THE BASIS FOR SUCCESS OR FAILURE OF A MEGAPROJECT.

If there is one conclusion that unites all the literature on transportation megaprojects, it is that initial cost estimates are almost uniformly misleading. Observers disagree as to whether bad cost estimates come from uncertainly or from dishonesty. Under either explanation, the public has come to mistrust these estimates because they are so uniformly misleading.

The 1936 Bay Bridge was on budget, actually slightly under budget, because the original estimate was made professionally and honestly, Additionally, the Reconstruction Finance Corporation would only loan the state a set amount, defined by the state's ability to repay the debt through anticipated toll revenues.

The 2013 bridge was estimated to cost $1 billion and cost $6.5 billion, a 650 percent error. There can be no doubt that the citizens of the Bay Area will be paying for this error for decades with higher tolls, which were at $1 when the work was started and have risen to $6. Peak hour tolls will soon be $7, 700 percent of what they were when the project began.

As a rule, transportation megaprojects that have giant overruns–Boston's Big Dig, Denver International Airport, the Bay Bridge, the California High-Speed Rail–will go down in history as failures, even if they succeed in their original functional intent, as is the case with the Denver Airport and the Big Dig.

LESSON NO. 3. PRESERVE AN ESCAPE ROUTE IF THE ORIGINAL ESTIMATE IS BADLY WRONG.

The Bay Bridge illustrates the yin and the yang of cost estimation. The 1936 bridge needed no safety valve because it was built slightly under budget. The 2013 bridge badly needed a safety valve because it was 650 percent over budget. This was not a problem, however, because state and local planners had the obvious way out: raise tolls.

Other very expensive projects were not so lucky. Massachusetts transportation officials at all levels suffer from having to pay for overages on the Big Dig, scornfully called the Big Dig Debt. High-Speed Rail in California is in serious jeopardy because state planners simply ran out of creative ways to finance its $40 billion overage.

LESSON NO. 4. LET TECHNICAL PEOPLE HANDLE TECHNICAL MATTERS AND LET POLITICAL PEOPLE HANDLE POLITICAL MATTERS

This was the opposite of what happened with the Bay Bridge East Span. During the design of the 2013 span, state engineers made the policy decision to replace the span (a political matter) but turned to local political leaders to decide on the bridge type (a highly technical matter). Local leaders, including Jerry Brown and Willie Brown (then mayors of Oakland and San Francisco) selected a single tower self-anchoring suspension span, a risky, untried design that led to most of the cost overruns and recurring safety concerns.

This lesson seems to have little applicability to other famous but troubled megaprojects, such as the Big Dig, DIA, and High-Speed Rail. One can hope this design-by-public-officials mistake will not be repeated.

LESSON NO. 5. DO NOT LET TECHNOLOGY GET AHEAD OF PRACTICALITY.

The final lesson from the Bay Bridge study was that it is wise to avoid using untested technologies unless it cannot be avoided. The 1936 bridge necessarily used untested technologies because it was such a dramatic structure. They had no choice. Nonetheless, they consistently chose the least risky of choices.

The western suspension span, 9280 feet long, for example, posed a choice between two risky alternatives: a conventional suspension span, with unprecedented main and side spans, or two bridges with a concrete center anchorage, which had never been built before. The designers selected the latter as the less risky considering major wind and seismic challenges at the bridge site.

The 2013 bridge uses a single-tower self-anchoring suspension span, something never built before. For the shipping channel main span, engineers could easily have used tried technologies, such as a cable-stayed or even a concrete viaduct. However, the non-technical advisory panel—a group of political people—deliberately and unnecessarily used an untried technology, resulting in massive cost overrun and lingering safety concerns.

Other historical examples exist in which transportation planners elected to use risky and untried technologies with bad consequences. Washington State in 1940 proposed a conventional suspension bridge at the Tacoma Narrows until Leon Moissieff (one of main designers of the 1936 Bay Bridge) convinced them that it would cost less to build a suspension bridge without the usual double-deck truss stiffener. That untried technology created a handsome bridge but one that lasted less than a year before it blew apart from aeroelastic flutter, earning it the unpleasant sobriquet of Galloping Gertie. Washington State officials learned what Californians learned decades later, that pursuing an untested technology when conventional methods are available is unwise.

The overall lesson from the Bay Bridge is that we need to be honest and careful when planning large transportation projects. We should not be afraid to think big; our transportation tangles are so great they call for courageous planning. But we should never mislead ourselves or the general

public about the true costs of a big project, and we should include contingencies to pay for the unavoidable overruns. The bigger the project, the greater the need for honesty and transparency.