

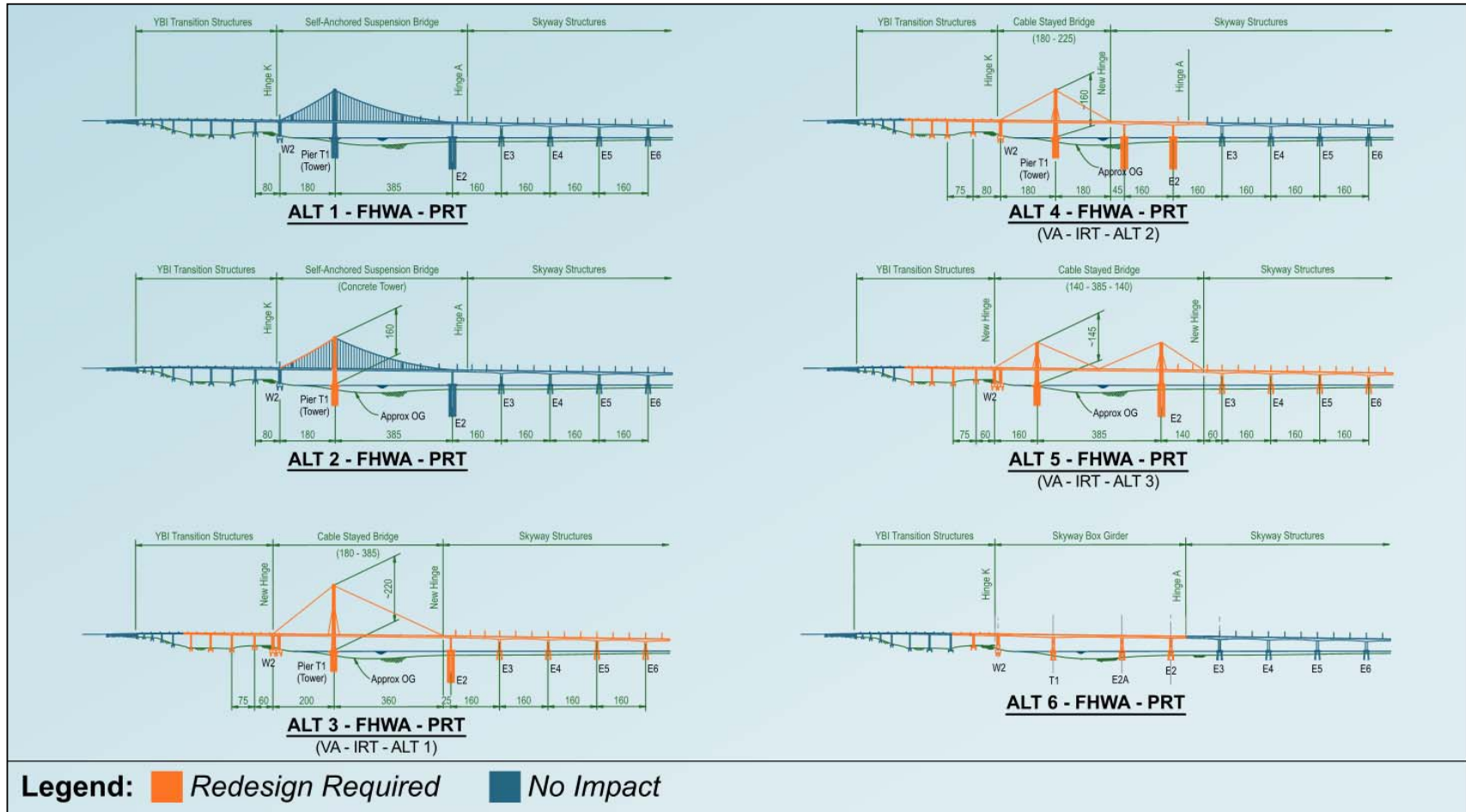


**California Department of Transportation
Toll Bridge Seismic Retrofit Program Report**

**Findings and Recommendation
For Completion of the Main Span
of the San Francisco–Oakland Bay Bridge
East Span Seismic Safety Project**

December 8, 2004

Alternatives Being Evaluated





Alternative 1 - Self-Anchored Suspension



Alternative 4 - Two-span Symmetrical Cable-stayed with Concrete Tower and Deck



Alternative 2 - Modified SAS Concrete Tower



Alternative 5 - Two-tower Three-span Cable-stayed



Alternative 3 - Two-span Asymmetrical Cable-stayed with Concrete Tower and Deck



Alternative 6 - Extend the Skyway Bridge to Yerba Buena Island

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Executive Summary

On October 17, 1989, the Loma Prieta Earthquake (magnitude 7.1) struck the San Francisco Bay Area, resulting in major infrastructure damage and loss of life. The epicenter of the earthquake was approximately 60 miles south of the San Francisco-Oakland Bay Bridge (SFOBB). SFOBB, which carries 275,000 vehicles per day, sustained major damage and was closed for one month. This major earthquake highlighted the seismic vulnerabilities of all the State-owned toll bridges, especially the SFOBB with its unique site geology and close proximity to two major faults, both of which are substantially closer to the SFOBB than the Loma Prieta epicenter. Given the high cost of retrofitting the eastern span of that structure, the Department and regional officials elected to replace the existing bridge with a “signature” span.

The decision to replace the 2.2 mile-long east span of the SFOBB and the subsequent selection of the replacement bridge design was the result of many years of regional consensus building. Virtually all of the major elements of the replacement bridge have already been designed, and several sections have been constructed or are currently under construction. The 0.4-mile long self-anchored suspension (SAS) portion of the replacement, referred to as the “main span”, is the section that is now in question. T.Y. Lin International – Moffat & Nichols, a joint venture, was the consultant team that designed the entire east span of the SFOBB, including the SAS main span.

On May 26, 2004, after 16 months of contract advertisement, a single bid of \$1.4 billion was received for the self-anchored suspension bridge (SAS) contract, which was nearly double the budget adopted by the Legislature in AB1171. Major factors contributing to the high bid include availability and cost of domestic steel, industry-wide steel price increases, and bonding and insurance market changes after 9/11. After the bid expired on September 30, 2004, due to the lack of a funding solution to provide the additional budget, the California Business, Transportation and Housing Agency (BTH) and the California Department of Transportation (Department) initiated an evaluation of six alternatives for proceeding with the construction of the SFOBB main span:

1. Repackage and re-advertise the SAS as a de-federalized contract.
2. Modify the SAS design to change the towers and deck from steel to concrete.
3. Redesign as a two-span asymmetrical cable-stayed bridge with concrete tower and deck.
4. Redesign as a two-span symmetrical cable-stayed bridge with concrete tower and deck.
5. Redesign as a two-tower, three-span cable-stayed bridge.
6. Extend the Skyway Bridge to Yerba Buena Island.

To facilitate a comprehensive analysis in anticipation of a funding solution during the 2005-2006 Legislative session, the evaluation included technical peer reviews, industry consultations, and environmental resource agency and stakeholder input. The following is a list of major activities included in this effort to assess scope, cost, and schedule for each alternative:

- Federal Highway Administration (FHWA) Peer Review Team (PRT).
- Independent Review Team (IRT).
- Executive Industry Consultation Program (contractors and fabricators, surety firms, and bridge design firms).

Executive Summary

- Stakeholder Outreach Program (State and Federal resource and regulatory agencies, and public interest groups).

The PRT provided an extensive risk assessment of all alternatives. The IRT provided preliminary design information focused on the cable-stayed alternatives. Industry provided feedback on the ability to design, bid, and construct the various bridge types based on their experience in bonding, financing, and building large public works projects. Resource agencies and public interest groups provided suggestions on the environmental impacts and permit issues essential to minimizing the time for the redesign alternatives. The Bechtel Infrastructure Corporation (Bechtel) August 2004 Cost Review Report, which was originally performed to assist in the evaluation of the single SAS bid, also provided valuable project cost, schedule, and risk information.

Major areas of evaluation included seismic performance, foundation design, environmental issues, interface with structures adjacent to the main span, materials availability, construction risks, cost savings, project delivery alternatives, and completion schedules. A summary of the pros and cons of each alternative follows:

Alternative 1

Repackage and Re-advertise the SAS as a de-federalized contract. (Elimination of the original contract's federal status which in turn removes the requirements of "Buy America".)

The self-anchored suspension (SAS) alternative is unique and only a small number of bridges of this type have been constructed worldwide. The expertise in both construction and design of SAS bridges is limited. Relatively new technology and innovation comes with substantial construction risk and a potential for cost escalation and delay. The SAS has a significant advantage in having regional consensus, being completely designed, and having the necessary environmental approvals and permits to allow construction to begin. De-federalization will result in significant costs savings by allowing the use of foreign steel, as demonstrated by the \$400 million cost differential in the previous bid. This will also encourage more bidders by creating a more competitive bidding environment.

Alternative 2

Modify the SAS design to change the towers and deck from steel to concrete.

The SAS with a concrete tower possesses some of the same risks as Alternative 1 with respect to design and constructability, plus it has its own unique risks. The concrete tower provides advantages in material cost, but also adds weight to the tower foundation, which may require foundation modification. This alternative does not have a completed design and will likely require minor modifications to existing environmental permits. The potential for cost savings with this alternative is limited.

Alternatives 3 through 5

Redesign as a two-span asymmetrical cable-stayed bridge with concrete tower and deck / Redesign as a two-span symmetrical cable-stayed bridge with concrete tower and deck / Redesign as a two tower three-span cable-stayed bridge.

Executive Summary

Three cable-stayed alternatives, with different span lengths, tower heights, and foundation locations were considered. While the industry is familiar with cable-stayed design and construction, complex site conditions exist. The interface of a cable-stayed structure, which differs from the original SAS design, and adjacent structures will likely present challenges in developing constructible details that satisfy the stringent seismic criteria. The foundation construction work will be complex and the design will likely have significant geotechnical requirements to address. The cable-stayed alternatives have only conceptual designs (five percent) and will require revising existing environmental permits, which could require significant effort to resolve. While potential for cost savings exists when comparing a cable-stayed bridge to the SAS alternative, this savings could easily be lost due to delays in obtaining regional consensus and the necessary environmental permits. In addition, the costs to modify existing contracts and completed work may likely absorb any remaining savings achieved with the cable-stayed alternatives.

Alternative 6

Extend the Skyway Bridge to Yerba Buena Island.

This alternative essentially continues with a structure similar in type and appearance to the skyway structure, currently under construction. The continuation of the skyway will not provide a signature span (a cable supported structure), which differs from the other alternatives. This alternative diverges from public expectations for a signature bridge and narrows the U.S. Coast Guard navigational channel. Community acceptance, along with revisiting environmental approval and review of the permits required, will add risk, and may require significant time and effort to resolve. Little design effort has been expended on this alternative, however, the design and construction of this type of bridge is more common than any of the other alternatives. The potential for reduction in cost and construction risks add to the attractiveness of this alternative. Like Alternatives 3-5, potential savings could be lost due to delays in obtaining regional consensus, environmental review, and regulatory permits.

RECOMMENDATION

Based upon the input from the teams involved, along with external and internal experts, the Department recommends two options.

1. Proceed with Alternative 1, which re-advertises the SAS contract, in conjunction with modifications and enhancements described below. The Department believes this alternative has a high likelihood of meeting the key objective of achieving seismic safety, but the potential for cost increases is also high. The substantial uncertainty associated with the other alternatives (lack of available design details and the potential to re-open political debate) makes it considerably less likely that the objective would be met.

Modifications and enhancements, some of which may require legislation and policy changes, could make the contract more biddable and buildable, hence likely to result in more

Executive Summary

competition and less cost than those received in May 2004. These include: (1) waiver of domestic steel requirements on major items if de-federalization of the entire contract is not possible, (2) authorize the Department to develop an alternative insurance and bonding strategy more appropriate for this project, (3) extension of the seismic retrofit law which authorizes 15-day action on state permits, (4) increase stipend amount paid to contractors to develop a bid to encourage competition, (5) authorize Department to negotiate with sole bidder if there is only one bid, and (6) solicit and hire steel bridge construction management expertise to complement and assist the Department's construction management activities. The Department would also aggressively pursue post bid project enhancements through the Cost Reduction Incentive Proposal (CRIP) provision in the contract specifications in order to identify and implement potential cost savings measures.

2. As cost is a critical factor, Alternative 6 needs to be considered. While there are risks associated with this alternative, the potential for savings is higher than Alternative 1. The primary risk associated with Alternative 6 is the time it may take to reach public consensus and to obtain final environmental approvals and permits for this alternative. If this process takes too long, it is possible that not only any potential cost savings could be lost, but also an increase of the risk of a major seismic event damaging the existing east span bridge.

It is important to note that no alternative under consideration stands out as an obvious choice in this decision process. The Department received substantial input to assist in making a decision, but the recommendations from involved sources varied significantly. The Department therefore recommends that the two options cited above be considered for implementation.

Introduction

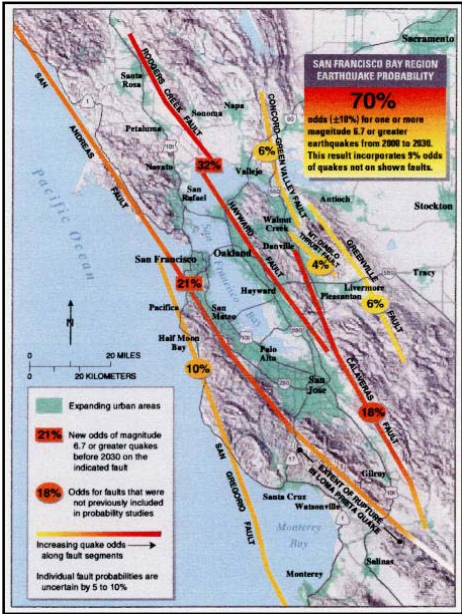
REPORT PURPOSE

This report provides analysis and background for the Department’s recommended course of action to proceed with the completion of the east span of the SFOBB.

On May 26, 2004, the California Department of Transportation (Department) opened a single bid for the contract to construct the main span of the San Francisco–Oakland Bay Bridge (SFOBB) east span on Interstate 80. This bid of \$1.4 billion for the SFOBB east span self-anchored suspension bridge¹ (SAS), a “signature span”, was nearly double the engineer’s estimate. The State and the region could not secure legislative approval of a revised funding plan for the additional cost and the once-extended bid was allowed to expire on September 30, 2004.

DECISION VALUES

On October 17, 1989, the 7.1-magnitude Loma Prieta Earthquake collapsed one section of the upper deck of the east span of the SFOBB. This 15-second event killed one motorist and closed the SFOBB for repairs until November 18, 1989. This closure had significant mobility and financial impacts on the region and state. Damage surveys following the quake indicated that had the earthquake’s strong motion continued for a few seconds longer, several sections of the East Span could have collapsed entirely and fallen into the Bay.



Scientists from the U.S. Geological Survey (USGS), have concluded that there is a 70 percent probability of a strong earthquake striking the greater San Francisco Bay Region sometime during the 30-year period of 2000-2030². Such an earthquake will most likely occur on one of seven main fault systems identified in their study. The SFOBB is located between the two fault lines with the greatest odds of a major quake: the Hayward Fault and the San Andreas Fault. The epicenter of the Loma Prieta Quake was in the Santa Cruz Mountains, about 60 miles away. The Hayward Fault and San Andreas Fault are each within ten miles of the SFOBB and are both capable of large magnitude earthquakes.

¹ Foreign steel and iron alternate under Buy America provisions. The bid also included a domestic steel and iron alternate for \$1.8 billion.
² The USGS updates its earthquake probabilities on a regular basis. As of 2002, the risk of a major earthquake in the Bay Area. (M_≥6.7) was estimated at a 62 percent probability.

Introduction

In its December 2003 report to the Director of Transportation, the Caltrans Seismic Advisory Board outlines the dilemma facing the State:

“Because of the current and potential cost overruns on this project and the present budgetary crisis in California, the Seismic Advisory Board is extremely concerned that this very important seismic safety project may experience significant delays and/or work stoppages. The Board wishes to remind the Director that the existing East Span, vital to the economic well being of the Bay Area, is living on borrowed time with respect to seismic hazard. The timely completion of the bridge truly embodies *The Race to Seismic Safety*.”³

There are three critical decision values that guide the development of the East Span of the SFOBB. These are:

- Seismic Safety
- Cost
- Aesthetics

The value of Seismic Safety includes both the engineering aspects of a seismically safe structure and the timeliness of the replacement of the existing East Span. The Department is committed to completing the East Span of the SFOBB in the shortest time possible.

The ranking of the values of “Cost” and “Aesthetics” have jockeyed for priority position over the course of this project. The initial bridge types proposed by the Department favored cost over aesthetics. With the passage of Senate Bill (SB) 60 (Kopp, Statutes of 1997), the design aspects of the bridge were transferred from the Department to the region. The Metropolitan Transportation Commission (MTC) headed this regional effort. SB 60 provided for the inclusion of amenities that would increase the cost of the East Span over a baseline alternative (Skyway) proposed by the Department if the regional agency agreed to finance those cost increases. During the planning and design stage for the East Span, the Engineering and Design Advisory Panel (EDAP) and the Bay Bridge Design Task Force approved a design and additional items that enhanced aesthetics and provided greater or different functionality. Specifically, the region chose the SAS structure knowing that at the time, it was \$340 million more than a simpler Skyway structure and \$260 million more than a cable-stayed structure (based on estimates derived from 30 percent design of each design option). Now, with the receipt of a bid for SAS construction nearly double the original estimate, the relative values of “Cost” and “Aesthetics” must be reconsidered.

³ “*The Race to Seismic Safety - Protecting California’s Transportation System*” Seismic Advisory Board Report to the Director, California Department of Transportation. December 2003.

Main Span Alternatives

BACKGROUND

The replacement of the SFOBB East Span is a complicated project. Its engineering is difficult, and its politics are complex. These complexities led the State from an initial recommendation by the 1990 Board of Inquiry for an accelerated seismic retrofit program, to a region selected “signature span”, to delays imposed by competing political interests.

Regional consensus in the Bay Area is tenuous and fragile. Delay generated by a lack of consensus increases the risk of a major earthquake prior to the completion of the East Span project and increases the cost of the project due to price escalations and changes in market conditions. Truly, time is of the essence.

***"Earthquakes
measure our
actions, not our
words."***

*Seismic Advisory
Board, December
2003*

STATUS OF MAIN SPAN CONTRACT

In some sense, the main span is already under construction. The western foundation (W2) is complete, and the tower and eastern foundations (T1 and E2) are under construction. Figure 1 gives an overall representation of the SFOBB.

Several factors contributed to the bid amount for the self-anchored suspension bridge. They include:

- Bonding and insurance market changes due to the events of 9/11.
- Steel price increases and steel industry consolidation.
- Unusual construction material escalation.
- Construction industry consolidation and capacity reduction that limited competition.
- Complexity of the project in a marine environment.
- Sheer size of the project, both from a physical perspective as well as a financial one.

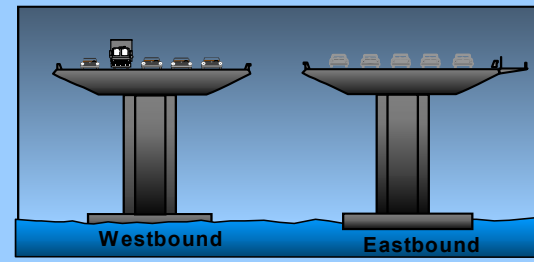
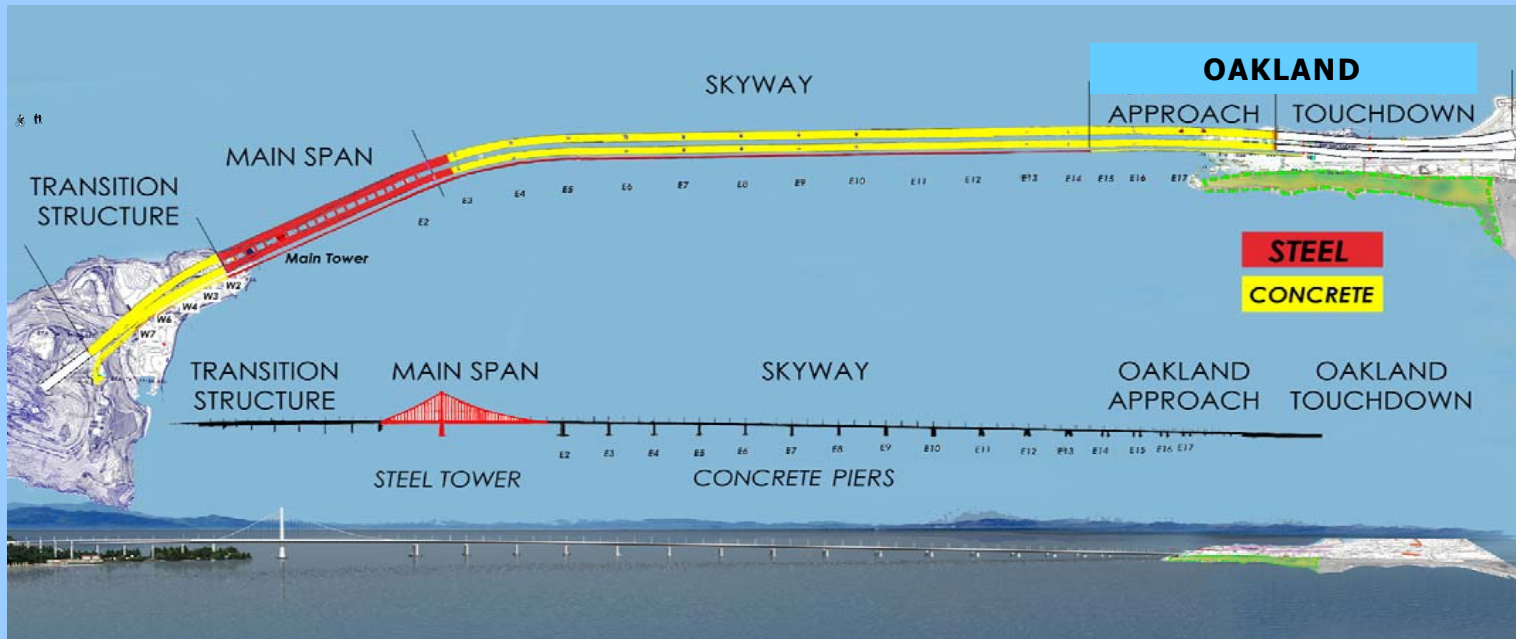
Prior to opening this bid, the Department sought input from the contracting and fabrication industry, and utilized several Value Analysis and Quality Assurance processes to mitigate potential cost impacts. Specific mitigation steps included:

- The original self-anchored suspension span project was split into smaller contracts to improve competition and increase the number of bidders, reduce the individual contract bonding requirements, and enhance opportunities for small business enterprises.
- Contract enhancements were incorporated for addressing the scale of work on the self-anchored suspension bridge to facilitate a biddable contract. These included bidder stipends (to recognize the unique level of effort necessary to prepare a bid for a project of this complexity and magnitude), marine access mobilization (to compensate for the increased mobilization costs associated with projects in a marine environment), earlier mobilization payments to improve contractor cash flow, and an owner-contractor campus operation to reduce plan approval timelines.

Main Span Alternatives

Figure 1

SFOBB East Span Plan and Elevation



Draft- Confidential

1

Main Span Alternatives

Organizational business practices were revised to provide an improved timeline for shop drawing approvals, to increase quality communication, and to reduce contractor overhead during the fabrication and erection phases.

- Approval to use an “ Alternative C” bidding technique on the SAS project was obtained. This provision of the Buy America requirements allowed for the use of a foreign and domestic steel bid. In order to utilize the foreign bid, overall costs of the domestic bid must be 25% or more greater than the foreign bid. This process had never been used prior to this project. Application of this process resulted in a \$400M cost savings.
- Payment method changes to address materials on hand, payment for preparing shop Drawings, and marine construction.
- Multiple contractor outreach sessions to answer bidder inquiries.
- Performance of pre-award shop audits of fabrication sites.
- Modification of fabrication tolerances to be more flexible and encourage competition.
- Extensive review of welding specifications to make them more contractor-friendly.
- Reduction of amount of performance and payment bonds required in order to stimulate bidder competition, pursuant to Streets and Highways Code, Section 30154.
- Acquisition of land to provide space for the prospective contractor and the Department to work closely together to resolve issues, expedite reviews, and facilitate the construction activities.

In spite of these efforts, for the reasons cited above, only one bid was received for the project and that bid was almost double the engineer’s estimates.

ALTERNATIVES ANALYSIS

During the period from May through September 2004, the Department worked with MTC, Bechtel, and the Independent Review Committee (IRC) to assess the overall status of the Toll Bridge Seismic Retrofit Program funding, review the advisability of proceeding with the single SAS bid, notify the Administration and Legislature of the program funding status, and develop a draft funding plan. A summary of the current financial status of the TBSRP is included as Appendix A.

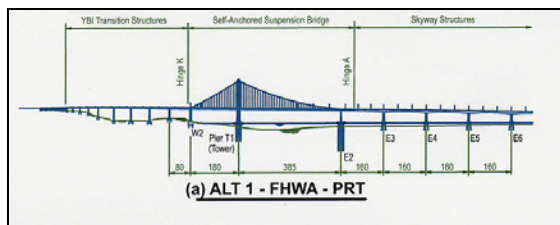
The Legislature was not successful in approving a funding plan before they adjourned in September. At that point, the Department allowed the single bid to expire, and focused efforts on the evaluation of a range of alternatives that might still meet the values of seismic safety, cost, and aesthetics.

The Department engaged some members of the IRC and additional experts in environmental process to form an Independent Review Team (IRT) for this effort, and also sponsored the FHWA led Peer Review team to also assist in the analysis. Both of these efforts are described in further detail later in this report. Working with these two groups, six main span alternatives were identified and are described as follows:

Main Span Alternatives

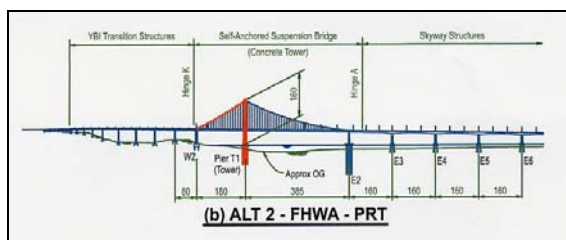
Alternative 1: Repackage and Re-advertise the SAS as a De-Federalized Contract

This alternative would re-bid the self-anchored suspension structure with modifications and enhancements, as soon as funding is secured. It allows the ongoing SAS marine foundation construction and Skyway construction to advance as they were originally designed.



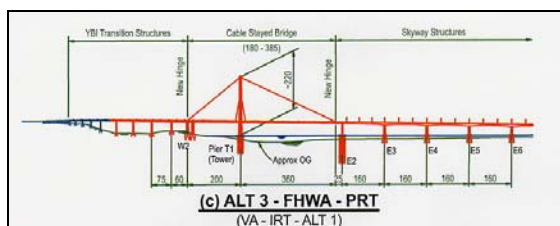
Alternative 2: Modify the SAS Design to Change the Towers and Deck from Steel to Concrete

This alternative redesigns the predominately steel self-anchored suspension structure with a concrete tower and a composite concrete and steel bridge deck. The alternative substitutes as much concrete as possible for the more expensive structural steel. It would still be considered a signature span. This design involves a heavier structure with increased cable costs and complexity. It has potential foundation complexities. Overall, its savings potential is limited. It's unlikely that this redesign will result in reduced cost and its implementation will likely delay completion.



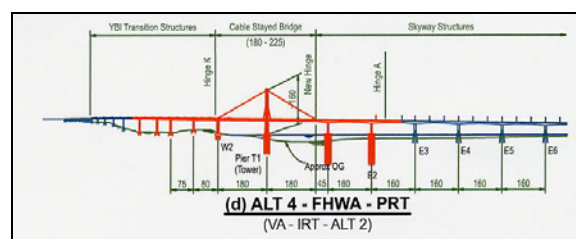
Alternative 3: Redesign as a Two-Span Asymmetrical Cable-Stayed Bridge with Concrete Tower and Deck

Alternative 3 provides an alternative bridge type that would still meet the "signature span" criteria. Span lengths are 180 meters and 385 meters, similar to the SAS. In addition to changing the bridge type, it also substitutes as much concrete as possible for the more expensive structural steel. Issues with this structure include its tower height, heavier concrete back span, and impacts to the W2 (existing SAS foundation on Yerba Buena Island), T1 (SAS Tower foundation currently under construction), and E2 (SAS foundation at the SAS-Skyway interface, currently under construction), and the interface with the Skyway structure.



Alternative 4: Redesign as a Two-Span Symmetrical Cable-Stayed Bridge with Concrete Tower and Deck

Alternative 4 is a smaller nearly symmetric two-span cable-stayed structure. It would also be considered a "signature span". Its spans are 180 meters and 225 meters in length. It includes a concrete tower and a composite concrete and

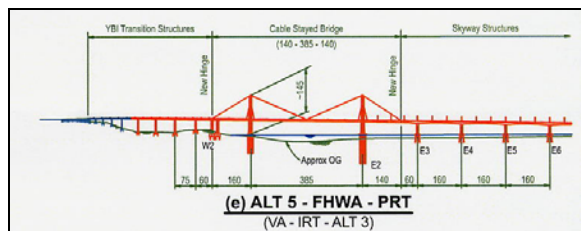


Main Span Alternatives

steel deck. Due to its shorter spans, it will require an additional pier in the bay and the Skyway structure will need to be extended. This results in a reduced width for the eastern navigational channel.

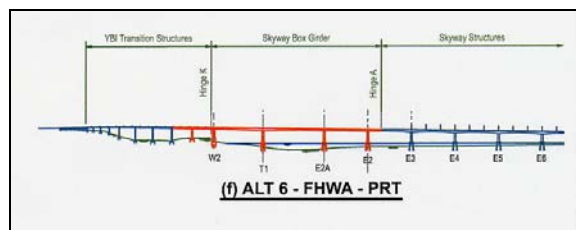
Alternative 5: Redesign as a Two Tower Three-Span Cable-Stayed Bridge

This structure uses a concrete tower and a composite concrete and steel deck. This cable-stayed structure is longer than the current SAS structure. Its spans are 140 meters, 385 meters and 140 meters in length. As with Alternatives 3 and 4, this structure would be considered a “signature span” but of a different form. In order to account for the difference in length, the Skyway structure would need to be shortened and there would be slightly different pier locations for the E2 and T1 foundations.



Alternative 6: Extend the Skyway Bridge to Yerba Buena Island

This alternative uses box girder structures similar to the Skyway currently under construction. This alternative would not be considered a “signature span”. It would require an additional set of piers, it would narrow the navigational channel, and it would impact the Yerba Buena Island structure.



There is general agreement by contractors, consultant engineers, and Department staff that would a Skyway extension would be a simpler and less costly structure to construct, provided the project could be bid in a competitive environment.

THREE FUNDAMENTAL ALTERNATIVES

The re-evaluation of the main span structure is being driven by the desire to reduce costs while maintaining (or accelerating) the anticipated bridge completion date (2012). The six proposed alternatives look at reducing cost by:

- Further easing the contract requirements associated with the initially designed SAS structure.
- Substituting reinforced and pre-stressed concrete for structural steel.
- Substituting a cable-stayed structure for the self-anchored suspension structure in order to alleviate the need for large temporary supports and reduce construction complexity.
- Extending the Skyway structures, similar to those currently under construction, the remaining distance across the Bay to Yerba Buena Island.

This field of six alternatives can and should be reduced to only consider alternatives that can conceivably accomplish the following:

- Completion on or before the current schedule of 2012.

Main Span Alternatives

- Reduction in the costs of the project.
- Maximization of the limited flexibility that still exists at this late date due to the progress of the adjacent projects.
- Maintenance of the required level of seismic safety and functionality.

Alternatives that do not reflect this focus are not likely to achieve savings and will likely increase costs and delay completion schedules. In evaluating cost savings, the following are critical issues:

- Minimizing changes to contracts underway.
 - Minimizing major modifications to the on-going billion-dollar Skyway contract.
 - Where negotiations are necessary, proactively work to develop a position of negotiation strength for the State.
- Emphasizing structural efficiency and cost effective structural systems.
- Emphasizing simplicity.
- Encouraging multiple bidders.
- Minimizing risks, particularly those risks the State has limited ability to control or manage.

Alternative 1 can begin the construction phase before any of the other alternatives.

Alternative 2 represents a major redesign to change the material types from steel to concrete. If the time is taken to complete a major redesign, it seems unlikely that a self-anchored suspension structure would be selected as the “best value” choice. Alternative 2 discards Alternative 1’s advantage of being able to go to construction quickly and as a result can be dropped from consideration. Additionally, the construction industry has expressed little interest in bidding on this option.

Alternatives 3 through 5 offer a range of cable-stayed bridge concepts that encourage multiple bidders and emphasize cost-effective structural systems. Given that cost savings is one objective the Department is pursuing, these alternatives should be distilled into a single cable-stayed alternative that allows for the most efficient and effective tower, foundation, and superstructure designs, while not forcing major modifications to the Skyway.

Alternative 6 provides a simple and cost effective structural system that continues the same basic type of structure as the Skyway currently under construction.

This concentrates the field of six structural alternatives down to three:

- Alternative 1: Repackage and Re-advertise the SAS as a de-federalized contract.
- Alternatives 3-5: Design an efficient cable-stayed bridge(s) that is compatible with the Skyway structure.
- Alternative 6: Extend the Skyway Bridge to Yerba Buena Island.

These three Alternatives will be used as the basis of this discussion.

Outreach

As a part of the alternative analysis, the Department engaged in a number of outreach programs. The results of these outreaches are summarized in this section and in Appendix B.

ENVIRONMENTAL AND PUBLIC EXPECTATION ISSUES

The Department has coordinated extensively with State and Federal resource and regulatory agencies, public interest groups, and interested State and Federal legislators over the course of planning, funding and constructing the east span. The Department has recently met with environmental interest groups to discuss the impacts of the six alternatives, and to obtain comments from the groups on each of the alternatives.

Thirteen agencies have review and approval roles related to the main span of the east span SFOBB. There are also ten permits / approvals associated with the SFOBB project. The Department is implementing a mitigation program to meet resource agency project permit and approval conditions. Cost of the mitigation program is \$40 million. Mitigation is primarily for biological impacts, hazardous waste remediation, and cultural resources effects. Approximately \$31 million is designated for biological mitigation, \$5.2 million for hazardous waste remediation and \$3 million for cultural resources mitigation. To date, approximately \$12 million, or 30%, of the mitigation funds have been expended, \$9.4 million for biological mitigation, \$1.2 million for hazardous waste mitigation, and \$1.3 million for cultural mitigation.

The degree of difficulty of revisiting the environmental and permitting process for each of the six alternatives was evaluated by the agencies on a scale of “High – Medium – Low”. Following is a simplified display of this evaluation.

Table 1: Degree of Difficulty (High/Medium/Low) In Obtaining Required Agency Consultations and Permits From the Perspective of Regulatory Agency Representatives

AGENCY	ALTERNATIVE 1:	ALTERNATIVES 3-5:			ALTERNATIVE 6:
	SAS	CABLE-STAYED			
		Alternative 3	Alternative 4	Alternative 5	SKYWAY
BCDC	Low	High	High	High	High
RWQCB	Low	Low	Low	Low	Low
Fish and Game	Low	Low	Medium	Low	Medium
NOAA-Fisheries	Low	Low	Low	Low	Low
NOAA-Marine Mammals	Low	Medium	Medium	Medium	Medium
USFWS	Low	Medium	High	Medium	High
ACOE	Low	Medium	Medium	Medium	Medium
USEPA	Low	Low	Low	Low	Low
DMMO	Low	Medium	Medium	Medium	Medium
USCG	Low	Low	High	Low	High
SHPO	Low	Low	Low	Low	Low

Outreach

Environmental and Permitting Risks. There are three primary areas of environmental risk associated with Alternatives 3-6. They include obtaining a revised U.S.Coast Guard permit, obtaining a revised BCDC permit, and reopening the public process.

Any alternative that substantially narrows the navigation channel (Alternatives 4 and 6) would be of concern to the U.S. Coast Guard. According to the U.S. Coast Guard representative, these options "...may not receive favorable review by the Coast Guard. This would prevent those two options from being constructed." The current structure provides approximately 1300 feet of clear channel. Alternatives 1, 2, 3, and 5 would provide at least 1200 feet of clear channel. Alternative 6 could provide as little as 500 feet and as much as 850 feet of clear channel. The cost of the skyway alternative is very dependant on the channel width.

BCDC Executive Director wrote:

"...any proposal to significantly depart from the approved design would reignite the debate over engineering considerations, seismic performance of various bridge types, geological conditions, aesthetics, and other issues that were considered in the selection of the Main Span. Thus, there will be considerable political controversy over any alternative other than Alternatives 1 or 2. If this controversy is not adequately addressed in another manner, a BCDC public hearing might have to serve as the only forum for public expression of concerns, including those beyond the environmental, public access, and seismic safety issues within BCDC's mandated purview."

Possibly the largest risk to expeditiously completing the environmental and permitting processes is not actually an environmental issue. As described by the BCDC Executive Director, the predominant risk is in re-opening the public debate over the project, and the difficulty of managing that debate once re-opened. Issues such as bridge design, aesthetics, bicycle access, accommodation of rail, and habitat mitigation amount and location, were all subject to protracted discussions. All these issues, and potentially others not previously aired, would be open to new debate. The results of the debate, and how long it would take to complete, are potentially significant delay factors.

Environmental Review of Alternatives. The Department believes that the federal environmental re-evaluation process should be used to determine if the approved EIS remains valid [this project is Statutorily Exempt under CEQA]. A re-evaluation could be used to document the changes for revised design Alternatives 2 through 6. No re-evaluation would be needed for Alternative 1. The re-evaluation approach is appropriate because no "new" impacts are anticipated – all impacts are within the range of those disclosed in the approved EIS. Expected environmental impacts are in-water construction, Bay fill, and bridge aesthetics. See Table 2 for the impact assessment of each alternative. Resource agency representatives concurred that the design options would have differing levels of intensity of Bay impacts, but no new impacts are expected. SAS, Cable-Stayed and Skyway design variations were evaluated in the Final EIS.

Outreach

Table 2 -- Environmental Implications of SFOBB Main Span Alternatives

	Alternative					
	Alternative 1 - SAS	Alternative 2 – SAS Modified	Alternative 3 – 2-span Asymmetrical Cable-Stayed	Alternative 4 – 2-span Symmetrical Cable-Stayed	Alternative 5 – 2-tower, 3-span Cable-Stayed	Alternative 6 - Skyway
Main Span Piers in Bay	2	2	2	3	2	3
Total Piers in Bay	44	44	44	45	44	45
Main Span Net Fill in Bay (cubic yards)	13,000 (Baseline)	19,500 to 32,500	19,500 to 32,500	19,500 to 32,500	19,500 to 39,000	19,500 to 32,500
Net Fill in Bay (approximate percent Main Span represents of currently permitted new fill in the Bay [Corps permit])	20% (Baseline - 66,000 cubic yards)	30% to 50%	30% to 50%	30% to 50%	30% to 60%	30% to 50%
Temporary Foundations in Bay	Yes	Yes	No	No	No	No
Deck Height at Highest Point	Baseline	Same	Same	Same	Same	Same
Navigational Channel Width (Existing channel is 1,329 feet)	1,164 feet	1,164 feet	1,164 feet	640 feet	1,164 feet	640 feet
Biological Impact (Intensity of pile-driving and open water fill impacts)	Baseline	Minor change from larger tower footing.	Minor change from new tower location.	Minor change from new tower location.	Minor change due to additional tower.	Minor change due to addition footings.
Historic/Cultural Resources (on YBI)	Baseline	No change	Resources avoided	Resources avoided	Resources avoided	Resources avoided
Archaeological Impacts (Native American burial sites on YBI)	Baseline	No change	Known sites avoided. New impacts possible.	Known sites avoided. New impacts possible.	Known sites avoided. New impacts possible.	Limited footing changes on YBI. Low potential for disturbance.
Maximum Tower Height	525 feet	525 feet	720 feet	525 feet	480 feet	No tower
Cable System Appearance	Baseline	No change	Minor change in cable appearance	Minor change in cable appearance	Moderate change – cables drop to deck mid-span.	Major change – no cables.
Main Span Appearance (Signature Span)	Baseline	Minimal change from concrete tower. Signature span retained.	Moderate change – modified signature span.	Moderate change – modified signature span.	Moderate change – modified dual-tower signature span.	Major change – no signature span.

Outreach

A re-evaluation would be expected to take 9 to 18 months to complete, depending on when design information becomes available. Public review of the re-evaluation is not required by law, but it is strongly recommended that public review of findings be incorporated into the re-evaluation process. Inclusion of public review of the re-evaluation document would likely push the re-evaluation schedule to the 18-month timeframe. Public review could consist of public posting and distribution of the re-evaluation document, public meetings to take comments from citizens and agency representatives, followed by FHWA approval of the document. Intense Department and Administration effort to build consensus with resource agencies and the public for the selected Alternative is essential to successfully completing the re-evaluation process. If the effort to build consensus fails, the 18-month timeframe is not achievable.

Preparation of a Supplemental Environmental Impact Statement (SEIS) was verbally recommended by the PRT as being the lowest risk and most legally protective course of action. A SEIS would be required if the design options had significant new environmental impacts not evaluated in the EIS, or new information or circumstances which warrant reconsideration of the conclusions in the Record of Decision (ROD). As described above, that is not the case. Therefore, the Department’s Division of Environmental Analysis believes a re-evaluation does not present a significant risk for any of the alternatives. Should a SEIS be pursued, it is expected to take 24 months to complete provided there is no significant controversy or opposition.

While a SEIS would be the most legally protective in the event of a lawsuit, a lawsuit over environmental issues is considered a minor risk for this decision. The major risk comes from re-opening the public process and the difficulty of managing that process, once opened. From that perspective, Alternative 1 represents the lowest risk. Alternative 6, which diverges most from the public’s expectation for a signature bridge and narrows the US Coast Guard navigation channel, represents the highest risk to completing the process expeditiously.

INDUSTRY OUTREACH

After the single SAS bid expired, the Department reached out to a variety of Industry Stakeholders as part of an Industry Consultation Program. Meetings were held with:

- American Bridge.
- Kiewit-Pacific Company and Koch Skanska, Inc.
- Cleveland Bridge.
- Associated General Contractors (AGC).
- California Alliance for Jobs.
- Nippon Steel Corporation.

A solicitation for written comments regarding potential improvements to the Department’s bidding package and process, conditions and requirements, constructability concerns, and ideas to improve the

**Table 3:
Participants at Surety and Design Meetings**

Participants from:	
Surety Industry	Design Firms
• The Surety Association of America	• HDR
• Federal Insurance Company (Chubb)	• Parsons
• Liberty Mutual Insurance Company	• EarthTech
• Safeco Insurance Company of America	• Buckland & Taylor
• Zurich American Insurance Company	• DMJM-Harris

Outreach

six alternatives were requested of contractors, fabricators, and other industry stakeholders. This was followed by an Industry Executive Roundtable attended by 18 firms. Phone meetings were also held with Executives from the Surety Industry and Principals from firms with design experience in cable-stayed and segmental bridgework.

A summary of the input received is included in Appendix B

PEER REVIEW

The Department requested peer reviews from three separate groups:

- The Independent Review Team (IRT)⁴ (See Appendix C for Executive Summary).
- The Federal Highway Administration (FHWA) Peer Review Team (PRT) (See Appendix D for Executive Summary).
- The Seismic Safety Peer Review Panel (SSPRP) (See Appendix E).

Independent Review Team (IRT)

The Independent Review Team (IRT) was commissioned in September 2004 to provide an independent assessment of the pros and cons of awarding, re-bidding, or redesigning the SAS span. When the single bid on the SAS was allowed to expire, the IRT was tasked with assessing whether design alternatives⁵ previously proposed by the IRT could meet the seismic design criteria and still achieve the significant cost savings previously suggested.

The IRT focused their preliminary technical analysis on two of the cable-stayed Alternatives:

- Alternative 3: A two-span asymmetrical structure with span lengths of 180m and 385m.
- Alternative 5: A three-span structure with lengths of 140m, 385m and 140m.

In addition, the IRT provided limited comments on Alternative 2 and Alternate 6.

The IRT concluded the following in their final report:

- The cable-stayed alternatives can meet or exceed the seismic design criteria for the SFOBB East Span Project.
- The foundation size and number of piles planned for the SAS design can remain the same. All necessary environmental work can be accomplished through a reevaluation process with minor modifications to existing permits. The visual impacts of the cable-stayed design would be similar to that of the SAS structure.
- The estimated net savings for Alternatives 3 and 5 would exceed \$600 million (based on the \$1.58 billion combined bids on the SAS and E2/T1 foundations) plus \$250 million in anticipated construction phase cost avoidance deemed to be associated with the SAS.
- All of the cable-stayed alternatives can be permitted, designed and constructed by or before the current SAS planned construction timeline.

⁴ The IRT first assembled as the Independent Review Committee (IRC) to advise the Department when bids for the E2 and T1 foundations for the SAS design exceeded the engineer's estimate by 62 percent.

⁵ The IRC suggested a number of design alternatives and potential savings in a report prepared in April 2004.

Outreach

Review of the IRT's conclusions by the Department and the Seismic Safety Peer Review Panel (SSPRP). Working with Department staff and T.Y. Lin International, the IRT was able to develop conceptual designs for Alternatives 3 and 5. Despite the short time allotted to them, significant progress was made towards establishing the viability of these alternatives. However, based on the high seismicity and varied geology of this location, the Department and the SSPRP do not believe that these alternatives could be developed to a point sufficient to confirm the identified cost savings in the time available. The Department would consider applying a 40-50% contingency factor for projects of this complexity at this stage of conceptual design. Therefore, the Department does not believe that the cost savings purported by the IRT will ultimately be achieved by the time the project reaches 100% design.

Federal Highway Administration (FHWA) Peer Review Team (PRT)

The FHWA Peer Review Team completed a risk assessment of the six alternatives under consideration. The team included public agency and academic experts in large transportation project management, earthquake engineering, bridge engineering, environmental planning and law, construction engineering and management, and cost estimating and risk assessment. The team used an industry standard technique to assess risk. Fundamental to the risk assessment was the identification of the key project objectives and the project specific risk drivers. These are explained in detail in the PRT's final report.

Tables 4 and 5 summarize the Peer Review Team's risk assessment of the six main span alternatives. The higher the number, the greater the scored risk of that alternative.

Table 4: Summary of Risk Assessment Results

Issue	Alternative 1: SAS		Alternatives 3-5: Cable-Stayed			Alternative 6: Skyway
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Technical, Cost, and Schedule	3.2	4.1	5.2	5.2	5.4	2.8
Environmental	0.1	0.8	1.7	2.5	2.4	2.7
Management	2.9	3.0	2.1	2.1	2.2	1.3
Acceptance and Expectation	1.1	3.0	9.6	12.8	16.2	15.7
Risk Total	7.3	10.8	18.6	22.9	26.2	22.5

In order to test the reliability of their results (important for decision analysis), the PRT repeated its analysis, this time with the “*Acceptance and Expectation*” driver removed from their analysis.

Outreach

Table 5: Reduced Scores for Probability and Impact for Acceptance Expectations

Issue	Alternative 1: SAS		Alternatives 3-5: Cable-Stayed			Alternative 6: Skyway
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Technical, Cost, and Schedule	6.2	8.0	10.0	10.5	10.3	5.3
Environmental	0.2	1.5	3.2	4.8	4.7	5.2
Management	5.6	5.7	4.1	4.1	4.2	2.5
Acceptance and Expectation	0.0	0.0	0.0	0.0	0.0	0.0
Risk Total	11.9	15.2	17.3	19.4	19.2	13.0

The Department agrees with the methodology employed by the PRT to assess the risk of the various alternatives. While certainly a critical factor to the successful implementation of any of the alternatives, it appears the emphasis placed on “*Acceptance and Exception*” may be out of proportion to the other factors. However, the PRT recognized this and validated their initial assessment by removing this factor entirely in their second risk assessment.

Appendix B includes a summary of the results of the overall outreach efforts.

Cost and Schedule

COST INFORMATION

It is difficult to compare Alternative 1 (SAS), which has a 100 percent design, with Alternatives 3-5 (cable-stayed options) and 6 (Skyway), which have five percent conceptual level designs. Unknown impacts to adjacent structures already under construction, complex site conditions, and unpredictable environmental/political actions increase the risk associated with Alternatives 3-5 and 6 as demonstrated by the PRT data.

It is the Department's practice to apply a 20% to 30% contingency on conceptual designs. This industry standard practice enjoys FHWA's approval. Under the current circumstance (5% conceptual design of a very complex project), significantly more uncertainty and engineering risk is present, which would indicate the application of a higher (40-50%) contingency could be warranted.

Producing cost estimates for large public works projects is complicated and should utilize standardized estimating practices coupled with sound engineering judgment to produce a quality estimate. It is desirable to engage construction industry expertise as well as the past experience from other public works agencies to help validate an estimate.

The Department and the T.Y. Lin International - Moffat & Nichol, joint venture, have utilized experienced estimating teams for the Bay Bridge Project. The estimates were prepared and reviewed with input from construction industry experts with many years of experience. Value Analysis studies were performed by several large private engineering firms with considerable experience on large public works projects (Bechtel, Parsons Brinkerhoff). Independent peer review teams with considerable expertise were also utilized to validate the estimates.

In reviewing this data, it was noted that the IRT's estimated cost was generally significantly less than other estimates. Careful review of their estimate indicates that mobilization and the impacts to adjacent contracts are not fully addressed. In addition, the IRT's estimate does not contain adequate contingency given the uncertainty at the conceptual design level.

Table 6 presents a comparison of cost information available to the Department. Each design team assessed the capital cost for the mainspan, and foundations (which are already under construction for the SAS). Each team estimated the cost based on the level of design completion, their experience, potential for delays, and anticipated construction market conditions for each design. Impacts to the foundations and adjacent contracts for the redesign alternatives were considered by most teams. As a result, differences exist between each design team's estimated range. Given these variations, cost estimates in this table should only be used to compare the relative cost difference between various alternatives. The Bechtel and Department estimates present the most realistic range for the actual cost since they fully consider the potential impacts, escalation and contingencies for the level of design completed.

Cost and Schedule

Table 6: Summary of Main Span Capital Cost Estimates

Data Source	Alternative 1 SAS	Alternatives 3-5			Alternative 6 Skyway
		Cable-Stayed 180m-385m	Cable-Stayed 180m-225m	Cable-Stayed 140m-385m- 140m	
Capital Cost (\$billion)					
TYLin/MN ⁶	1.2-1.4	1.0-1.3	1.2-1.5	1.2-1.5	0.8-1.0
Bechtel ⁷	1.9-2.1	1.7-1.8			1.3-1.7 ⁸
IRT ⁹	1.6-1.7	0.9	0.9	0.75	Up to 1.1
Department	1.8-2.1	1.5-1.6 ¹⁰			1.3-1.6 ¹¹

The T.Y. Lin/MN estimates includes:

- Capital cost of the main span and main span foundations.
- Cost of impacts to adjacent contracts including termination, redesign, or modification to on going contracts.
- Design costs (\$30 to \$50 million).
- Escalation – no indication that the estimate was escalated to the mid-point of construction.
- Contingency – a specific contingency was not provided other than in the estimated cost range shown.

The Bechtel estimate includes:

- Capital cost of the main span and main span foundations E2/T1 and W2.
- Cost of impacts to adjacent contracts including termination, redesign or modification.
- Design costs.
- Redesign options include permit delay risk (\$0-\$200million).
- Escalation – 5% per annum was used for specific portions of the work.
- Contingency was developed based on a probabilistic risk analysis.

The IRT estimates includes:

- Capital cost of the main span and main span foundations E2/T1 and W2 (modifications).
- No cost for impacts to adjacent contracts.
- Escalation to mid-point of construction.
- Design costs (\$25 million).
- Contingencies of \$100M on the redesign.

The Department estimate includes:

- Capital cost of the main span and main span foundations.
- Cost of impacts to adjacent contracts including termination, redesign, or modification.
- Design costs (\$30-50 million).
- Escalation – estimates are escalated to the mid-point of construction.
- Contingency – 10% to 15% on re-advertise, 20% to 30% on redesign.
- Lack of bid competition was not accounted for in the Skyway estimate.

⁶ T.Y. Lin/Moffat & Nichols presentation to the FHWA-PRT.

⁷ Bechtel Infrastructure Corporation study dated August 2004.

⁸ Cost presented by MTC-Bechtel, August 2004

⁹ Independent Review Team's Final Report dated November 19, 2004.

¹¹ These costs could increase by \$200M if there is a substantial delay in obtaining permits

Cost and Schedule

SCHEDULE INFORMATION

Also presented in the PRT report are estimates from T.Y. Lin International, Bechtel, and the IRT regarding the estimated completion dates for each of the main span Alternatives. The Department's estimated completion dates also have been included in this table.

Table 7: Summary of Schedule Completion Estimates Available to the Department

Data Source	Alternative 1 SAS	Alternatives 3-5			Alternative 6 Skyway
		Cable-Stayed 180m-385m	Cable-Stayed 180m-225m	Cable-Stayed 140m-385m-140m	
T.Y. Lin	2011	2013	2013	2013	2012
Bechtel	2012	2013	—	—	—
IRT	2011	2010	2010	2010	—
Department	2012-2013	2012-2014			2011-2013

Based on the Department's estimated completion dates for each of the three Alternatives, the re-bid of the SAS is estimated to be complete in 2012-2013. The baseline schedule for Alternatives 3-5 and 6 are both estimated to be complete in early 2012 without consideration of potential delay risk during the environmental and redesign phase. The following timelines include the major elements required to deliver and construct each alternative. Detailed schedules are included in Appendix F. These schedules are conservative, based on normal procurement practices. The Department will make every effort to accelerate this process.

Risks

FINDINGS

The following discussion outlines the pros and cons of the three alternatives under consideration for the main span of the east span of the SFOBB. It should be clear that short of 30 to 50 percent design packages for rigorous comparison, much of the comparison defaults to subjective analysis.

Table 8: Pros of Main Span Alternatives

Pros by Value	Alternative 1: SAS	Alternatives 3-5: Cable-Stayed	Alternative 6: Skyway
Seismic Safety	<ul style="list-style-type: none"> Permits and consultation complete, environmental document complete. Design meets seismic safety criteria and design life. Design has gone through seismic peer review. Can be advertised/awarded as soon as funding is made available. 	<ul style="list-style-type: none"> Design can be made to meet seismic safety and design life criteria. Shorter construction duration. 	<ul style="list-style-type: none"> Design can be made to meet seismic safety and design life criteria.
Cost	<ul style="list-style-type: none"> Design is complete and known. Constructability reviews are complete. Plans and specifications are available to make reasoned cost estimates. No changes to E2T1, W2, or Skyway. 	<ul style="list-style-type: none"> Six bidders have expressed interest in contract. Concrete is cheaper than structural steel. Better known construction methods, less risk of construction cost increases than SAS. Very little temporary work. 	<ul style="list-style-type: none"> Design is conventional. Conventional and known (existing Skyway contract) construction methods are more predictable, should allow for faster construction, and limit construction phase cost escalation. Savings expected from this design.
Aesthetics	<ul style="list-style-type: none"> Bridge Type Selected by Community - NEPA Process. Signature Span. 	<ul style="list-style-type: none"> Signature Span. 	

Risks

Table 9: Cons of Main Span Alternatives

Cons by Value	Alternative 1: SAS	Alternatives 3-5: Cable-Stayed	Alternative 6: Skyway
Seismic Safety	<ul style="list-style-type: none"> Legislative funding package required. 	<ul style="list-style-type: none"> Legislative funding package and bridge type change authority required. Permit and consultation processes reopened. Lack of community consensus could lead to schedule delays and cost escalation. Legislation required to change bridge type. Needs environmental re-evaluation or Supplemental EIS. 	<ul style="list-style-type: none"> Legislative funding package and bridge type change authority required. Permit and consultation processes reopened. Lack of consensus could lead to schedule delays and cost escalation. Legislation required to change bridge type. Need environmental re-evaluation or Supplemental EIS.
Cost	<ul style="list-style-type: none"> Possible that there will be only two bidders. Design is complex to construct. Complex construction methods and fabrication requirements could negatively impact schedule and cost. Highest risk for construction phase cost increases. Temporary work required, cost and environmental impacts. Alternative is expensive (steel). Difficult to shorten construction duration. 	<ul style="list-style-type: none"> Changes likely to W2, T1, E2 foundations and Skyway. Design is incomplete. Design is complicated. Constructability reviews have not been done. Design is complex to construct. Plans and specifications are not available to make reasoned cost estimates. Complex construction methods could negatively impact schedule and cost. Potential for construction phase cost increases high, but not as high as SAS. No significant savings foreseen with this design. 	<ul style="list-style-type: none"> Changes likely to Skyway E2 T1, and W2. Design is incomplete. Due to overwhelming cost advantage to current Skyway contractor, bidder competition is limited or non-existent. Constructability reviews have not been done. Plans and specifications are not available to make reasoned cost estimates.
Aesthetics		<ul style="list-style-type: none"> Change to MTC Bridge Type Selection Required. Bridge Type previously rejected by community -- NEPA Process. 	<ul style="list-style-type: none"> Change to MTC Bridge Type Selection Required. Bridge Type previously rejected by community -- NEPA Process. Most difficult of options to reach community consensus.

Risks

In evaluating the alternatives, the values described on page one must be considered.

- Does the alternative achieve seismic safety at the soonest time possible?
- Which alternative gives the best value (cost)?
- Does the alternative provide an aesthetically acceptable structure?

The following section addresses the risks and issues associated with each value.

SEISMIC SAFETY

Both SAS and Skyway Will Be Seismically Safe

The SAS design has been through extensive peer review and laboratory testing. All background concerns regarding the seismic performance of the SAS have been mitigated. A Skyway extension has yet to be designed but because it is a more common type, the seismic performance is well understood and can be adequately incorporated into the design.

The Department considers that it is possible for Alternatives 3-5 to meet the seismic criteria. However, the relative seismic performance would depend upon the particulars of the design, engineering execution of the design, quality of construction, and maintenance of the structure. All else being equal, the simpler the structure is, the better the seismic performance is likely to be. A change in structure type is technically possible, however, it would require a greater degree of engineering, more precision, and a significant investment of added resources in time and money to develop a redesign. Given the current construction status, designing a substitute bridge type will be very challenging. It is also important to understand that a substitute bridge structure would never be as economically efficient as it could have been if the entire structure system had been designed at the beginning of the design.

COST

Bridge Type – A Skyway Structure Is a More Common Structure Type

The Skyway is a more conventional bridge type. A segmentally erected box girder has simpler elements to design, construct, and maintain. It is more of a determinate structure with more commonly understood technical design features. The SAS is a complex indeterminate structure and has more inherent construction risk that could translate into higher construction phase costs.

Foundations – SAS and Skyway Extension Comparable

The SAS and the Skyway extension are comparable in their foundation challenges. Both structures will have a combination of rock sockets or friction piles. The SAS pile caps are larger requiring larger lifting equipment than a Skyway extension structure. The Skyway extension will require piles to be built in deeper and faster flowing water than the current Skyway structure, but this is not seen as an onerous task. It is expected that there will be more scrutiny by environmental regulators on the Skyway extension's

Risks

impact on fish and marine mammals. The Skyway extension would have battered piles that are complicated to install. The SAS has no battered piles.

Materials – Skyway Materials Are Known and Less Expensive

Orthotropic box steel structures are difficult to construct to California's demanding standards. As discussed throughout the document, the SAS is a steel structure. The fabrication and welding requirements of the SAS will be challenging. A Skyway extension most likely would be a concrete structure with some steel. The Department has decades of expertise with concrete structures and this familiarity would minimize material issues.

Constructability – SAS Steel Is More Challenging than Skyway Concrete

The Skyway uses more common construction materials and techniques. Additionally, because over 65 percent of the originally planned Skyway structure is complete, the Department has experience in overcoming its constructability challenges. It is anticipated that the SAS structure will present challenges in steel fabrication, delivery, and erection, which could lead to construction delays and cost increases.

Investment – Large Sunk Costs if Change to Skyway

To choose the Skyway extension over the SAS means a loss of years of community consensus building. Additionally, the Department loses the value of the peer reviews, project design, and laboratory testing done to date on the SAS. The capital and support costs invested to date in the main span total over \$200 million.

The construction of the SAS began with the award of the Skyway contract. Further investments have been made with the Pier W2 contract and the E2/T1 and South South Detour contracts. These represent a considerable investment. All construction work to date was designed to work with the SAS structure. Contracts adjacent to the original SAS will be impacted. The large W2 pier will need to be retrofitted. The YBI design, which is now 95 percent complete, will need to be partially redone. The existing Skyway structure will need modification. Some elements of the work completed on the E2 and T1 foundations cannot be reused on a non-SAS design. Other elements could be used, by change order, to complete the foundation work for a Skyway extension. Some of the completed work on YBI may also need to be redone (utility lines from the utility power plant that run to W2). Finally the South-South Detour, a very complicated temporary structure, may also need to be redesigned.

Cost Growth

The remaining risk of cost growth for the SAS is in construction. The SAS is a technologically innovative design. When things haven't been done before, there is a risk of problems. Solving problems costs money, and there is a good deal of uncertainty associated with the construction phase of this design. All other areas of cost growth; including environmental/political, design, and advertisement, are not high risk for the SAS. In addition, two contractors have already expressed interest in re-bidding the SAS at reduced bid prices. However, the potential risk of cost growth during construction

Risks

cannot be ignored. The Department believes that these risks can be mitigated by initiatives described in the recommendation section of this report, but risk of cost growth still remains.

A Skyway extension has risk of cost growth related to environmental / political processes, design, advertisement, and construction. A full design needs to be developed for a Skyway extension. In the case of this project, a Skyway extension cannot be a fully optimized box girder bridge due to the boundary constraints of the now existing adjacent structures. Without some unusual contract bidding process, there is probably only one bidder interested in the Skyway extension work: the current Skyway contractor. Without competition or other options, the Department would be negotiating from an unfavorable position.

AESTHETICS

Environmental / Political – It Starts Over with a Skyway Extension

The Department has already completed the public review process for the SAS. The largest risk to expeditiously completing the environmental and permitting process is not over actual environmental issues. The predominant risk is re-opening the public debate over the project, and the difficulty of containing that debate once it is re-opened. From that perspective, Alternative 1 (SAS) has a significant advantage in having regional consensus being completely designed, and having the necessary environmental approval and permit to allow construction to begin, represents the lowest risk. Alternative 6 which diverges most completely from the public's expectation for a signature bridge and narrows the U.S. Coast Guard navigation channel, represents the highest risk to completing the process expeditiously.

The environmental and political process could result in long project delays, which would in turn erode potential savings and delay the completion of seismic safety. Finally, all construction projects have some degree of cost growth, but as discussed earlier, the potential for cost growth during construction is greater for the SAS than the Skyway.

Risks

OTHER FACTORS

There are three other factors that have an influence on cost and risk. They include “Buy America” requirements, implementation of an Owner Controlled Insurance Program (OCIP), and the use of enhanced bidder stipends. These issues are discussed in the following paragraphs.

Buy America

The original SAS design was advertised as a federalized project, which meant that all Federal "Buy America" requirements applied. During the advertisement phase, the high cost and limited availability of domestic steel fabrication continued to be brought up as a significant issue by potential bidders. In an early addendum, an "Alternative C" bidding provision was incorporated into the bid package that allowed bidders to also submit a bid based on the use of foreign steel suppliers and fabricators. When bids were opened on May 26, 2004, the low bid based on foreign steel was approximately \$400 million less than the domestic-based bid. Being more than 25 percent less than the domestic bid, the bidding contractor would have been allowed to use the foreign steel resources if the contract had been awarded. It was demonstrated that significant savings could be realized if this contract is either de-federalized or "Buy America" waivers are secured for specific portions of the SAS structure, such as the steel orthotropic deck section, the steel tower, and the very large steel castings. Exceptions require FHWA approval.

In general, Buy America provisions limit competition to only U.S. firms, which may result in higher costs. However, Buy America provisions are intended to keep jobs in the U.S. Steel industry labor unions and stakeholder agencies (e.g. National Steel Bridge Alliance) support Buy America provisions and have been effective in lobbying for Buy America provisions in the past. There is a potential risk to seeking such waivers or de-federalization and this action could result in litigation that may stop or significantly slow down progress. But there are also risks in allowing only domestic fabrication. During the SAS advertisement period, it became clear that no single fabrication facility exists in the U. S. that is large enough to handle this project. Some bidders were considering building a facility within the timeframe of the contract. Because the SAS structure is quite complex, there is a significant risk that such a task could not be accomplished successfully within the allotted contract time. The potential delays just in constructing new fabrication facilities, securing and training staff, and then assuring quality could be significant. Even if successful, this lack of multiple domestic facilities would limit competition, not just for steel fabrication, but possibly for prime contractors as well.

In summary, obtaining a Buy America waiver does not seem likely for this project. However, FHWA has indicated that the Department could de-federalize the Main Span contract without jeopardizing the federal status of the remaining SFOBB contracts. While de-federalization will carry with it political risks, its potential to increase competition and lower costs are considerable and cannot be ignored.

Risks

Controlled Insurance Programs

The Department is currently implementing a Contractor Controlled Insurance Program (CCIP) - on the San Francisco-Oakland Bay Bridge West Approach project and is contemplating an OCIP pilot program on some of the smaller bridge projects.

The basic concept of an OCIP is that the public entity or private owner embarking on a construction project purchases all the necessary insurance for the construction project, or series of projects. This insurance might include professional liability insurance, workers' compensation insurance, general liability insurance, excess liability insurance, and builder's risk, etc. Under an OCIP, the owner furnishes insurance, as specified in the construction contract documents, related to the exposures of the construction project and for the protection of the owner, contractors, and all tiers of subcontractors. The owner pays the cost of the specified insurance directly rather than paying such costs indirectly by inclusion of the costs in the Contractor's bid. Bids are solicited on an 'ex-insurance' basis; that is, bidders are instructed to include no loading in their bids for the insurance furnished by the owner.

The primary benefits of alternative insurance programs, such as OCIPs and CCIPs (CCIPs are similar in nature to OCIPs with the exception that the prime contractor furnishes the insurance for itself and all tiers of subcontractors rather than the owner furnishing the insurance), are purported cost savings and improved financial control. Cost savings are purportedly realized primarily as a result of good safety results and resultant savings on workers' compensation costs. General liability cost savings are purported because of volume purchasing power. In theory, the Contractor's charges for overhead and profit on insurance costs are eliminated or reduced under an OCIP. Purported cost savings under either an OCIP or CCIP may also result because of streamlined claim administration practices.

If the re-advertised SAS alternative is advanced, the Department does not believe OCIP implementation prudent for the following reasons:

- A significant amount of the work consists of off-site fabrication and will not be subject to OCIP benefits, thereby significantly limiting the potential savings.
- A reduced potential for savings owing to high workers compensation rates associated with marine work.
- Sheer project size and complexity does not lend itself to a new and untried process. Potential savings could easily be eliminated and cost could potentially increase if an OCIP was not implemented correctly. The Department believes this program should be piloted on a less complex, less costly project, in order to determine its appropriate applications and implementation procedures.

Similar concerns exist if a redesign alternative is advanced.

The Department believes that OCIP implementation for other select candidate projects, including the Oakland Touchdown, would be more appropriate and offer a greater opportunity for success, given the project particulars (e.g., land based site, on-site fabrication, and a well-defined project site).

Risks

Stipend

The Department earlier implemented a bidder compensation provision (stipend) to a discreet number (i.e., the second and third lowest responsible bidders) of bidders on selected SFOBB east span replacement projects. A bidder stipend serves as a catalyst to broaden the current bidding pool for the highly specialized and technically challenging projects of the SFOBB east span replacement. Moreover, a bidder stipend potentially results in cost savings passed on to the Department and taxpayer as a result of a greater number of qualified bidders and enhanced competitive bidding. Furthermore, a bidder stipend is an equitable mechanism to compensate bidders for the amplified pre-bid requirements and engineering complexity involved in bidding state-of-the-art and one-of-a-kind structures. If the SAS is re advertised, or if a redesign alternative is selected, the Department will aggressively pursue enhancement and changes to the current bidder compensation provision in the following ways:

- Provide bidder compensation to all responsible bidders with responsive bids, not just the second and third lowest responsive bids.
- Consider raising the bidder compensation amount (currently \$1 million on SAS) to an amount that may more equitably defray the costs of bid preparation.
- Provide bidder compensation to all responsive bidders in the event that the contract is not awarded through no fault of the bidder.

With these specification changes, enhanced bidder competition should be increased. Studies indicate that the addition of just one competitive bidder on such a project may result in significant savings to the Department and the taxpayer.

Overall Risk – SAS Is Known and Ready to Go to Construction

Overall, the predominant risks associated with Skyway are related to delay, politics, and bidding or negotiating the cost of the project. All of these risks are unknown and hard to mitigate. The risks associated with the SAS are related to the construction of a technologically innovative steel design. These risks have been studied and either mitigated or have strategies for mitigation. Considering the values for this project, the SAS has less risk of impacting the primary value, getting a seismically safe east span of the SFOBB in place as soon as possible while at the same time giving the best value to the public and providing an aesthetically acceptable structure.

Recommendations

RECOMMENDATIONS

The Department recommends moving forward with either Alternative 1 (Repackage and Re-advertise the SAS as a de-federalized contract) or Alternative 6 (Extend the Skyway to Yerba Buena Island). These recommendations are based on peer reviews, evaluation parameters, industry consultation, and expertise within the Department.

While Alternative 1 has a higher probability of cost growth during the construction phase, it has the high likelihood of meeting the key objective of achieving seismic safety.

To go forward with Alternative 1, the Department needs to take the following actions:

- Secure legislative funding approvals.
- De-federalize the Main Span contract
- Incorporate recommended industry improvements into the bid package.
- Re-advertise at earliest possible date, possibly prior to fully securing a funding plan.
- Request legislative authority to negotiate with a single bidder should only one bid be submitted.

The proposed modifications and enhancements to the bid package being considered include:

- Design of the temporary towers by State forces rather than the contractor in order to reduce risk costs in the bid for this item.
- Relieve the contractor to a greater extent from the risk of natural disaster damage costs.
- Utilize State-only funds (de-federalize) to allow higher competition on an international level to further reduce bid costs.
- Specify an enhanced cost-reduction-incentive-proposal (CRIP) with the contractor such that upon award there are incentives for cost saving proposals.
- Hire specialized steel bridge construction management expertise to assist with the Department's contract management efforts.

Alternative 6 has a greater potential for cost savings, but delays are possible due to community consensus and environmental issues. If significant, these delays will erode the potential savings and delay completion of seismic safety. However, the potential for savings are significant enough to justify consideration of this alternative.

To go forward with Alternative 6, the Department needs to take the following actions:

- Terminate the SAS marine foundation contract (E2/T1).
- Secure legislative funding and approval to proceed with an alternative design.
- Establish high-level urgency with the project's stakeholders.
- Pursue preliminary design and environmental evaluation as soon as possible.