Appendix A

Summary of TBSRP Financial Status

Summary of Funding Status

The Seismic Retrofit Bond Act of 1996 (Proposition 192), approved by the voters on March 26, 1996, provided $790 million for Toll Bridge Seismic Retrofit. In 1997, Senate Bills (SB) 60 (Kopp, Chapter 327, Statues of 1997) and 226 (Kopp, Chapter 328, Statues of 1997) were signed into law establishing funding for seismic retrofit of seven out of a total of nine state-owned toll bridges including the replacement of the East Span of the San Francisco Oakland Bay Bridge. AB 1171 (Dutra, Chapter 907, Statutes of 2001) provided project specific funding in the amount of $4.637 billion. AB 1171 also authorized the Department to utilize up to an additional $448 million of State Highway Account funds to mitigate cost increases if needed.

The Toll Bridge Seismic Retrofit Program consists of seven of the nine state-owned toll bridges in California. Two of the toll bridges have subsequently had their tolls removed reducing the number of state-owned toll bridges today to seven. The toll bridges are the largest and most complicated bridges in the state to be seismically retrofitted. Nowhere in the world have bridges as complex as these been retrofitted. Five of the seven bridges (71 percent) have been completed. The total budget as outlined in AB 1171 for retrofitting the toll bridges is $4.637 billion plus $448 million in contingency funds. As outlined in the Department's August 2004 report to the Legislature, the current estimated costs to complete the Toll Bridge Retrofit Program is now $7.405 billion plus an additional $900 million for program contingencies.

Comparison of AB 1171 and August 2004 Cost Estimates (dollars in millions)

Bridge	AB 1171	August 2004
Existing Benicia Martinez[1]	$ 190	$ 180
Carquinez (eastbound)[2]	$ 125	$ 115
Richmond – San Rafael	$ 665	$ 914
San – Diego Coronado	$ 105	$ 105
Vincent Thomas	$ 62	$ 59
San Mateo – Hayward	$ 190	$ 165
SFOBB – New East Span	$2,600	$5,130
SFOBB – West Span	$ 700	$ 737
Subtotal	$4,637	$7,405
Remaining Program Contingencies[3]	$ 448	$ 900
TOTAL	$5,085	$8,305

[1] The seismic retrofit of the existing Benicia-Martinez Bridge is a separate project from the Regional Measure 1 project to construct a new parallel bridge.

[2] The 1927 westbound Carquinez Bridge has been replaced by a new bridge and will be removed as part of the Regional Measure 1 program.

[3] AB 1171 authorizes the Department to utilize up to an additional $448 million of State Highway Account funds to mitigate any cost increases above the specified $4.637 billion estimated costs.

Appendix B

Summary of Outreach Feedback

Summary of Input from Industry and Stakeholders

PEER REVIEW SUMMARY

Federal Highway Administration (FHWA) Peer Review Team (PRT)
The self-anchored suspension (SAS) design has the lowest overall relative risk compared with cable-stayed (CS) or Skyway alternatives. However, the PRT associated risk with uncertainty and the SAS is more certain today even if its constructibility is high risk. The Skyway has potential cost savings if public opposition to the design concept does not result in significant schedule slippage and cost escalation. The PRT report was brief with respect to complexity of design, potential for delay, and consideration of costs.

Independent Review Team (IRT)
Immediately adopt the redesign option and select either cable-stayed alternatives 3 or 5. The estimated net cost savings exceed $600 million and can be built by 2011-2012. Immediately deal with the current main span E2/T1 marine foundation contracts.

Seismic Safety Peer Review Panel (SSPRP)
The SFOBB Seismic Safety Peer Review Panel (SSPRP), which has provided reviews throughout the development of the project, was reconvened for the purpose of providing the Department an independent review of various alternatives under consideration for the SFOBB main span of the east span structure type, as presented by the Independent Review Team (IRT).

In summary, the SSPRP is very concerned that delays in the execution of the main span for the new east span of SFOBB will increase the seismic exposure and risk and that quick redesigns of the bridge could result in different levels of seismic safety, functionality, and reliability from the standards currently established for the SAS. Expedient completion of this important seismic safety project is and should be the overriding consideration.

INDUSTRY SUMMARY

Cleveland Bridge
Cleveland Bridge is not planning to bid in the U.S. at this time due to bonding costs, but offered advice. Cable-stayed bridges are common, accepted technology. Steel orthotropic decks in California are problematic. The SAS steel tower has very heavy sections to be lifted. For a safe, quick, best value option, consider using accepted technology. A cable-stayed bridge with a concrete deck is what may give that value; except how well it performs in a seismic event is still a question. Cleveland Bridge managers would anticipate about $500 to $600 million in savings with a cable-stayed bridge. They recommend hiring a firm with cable supported bridge construction expertise to assist the Department with its construction contract management activities.

Kiewit Pacific Company
Kiewit met with Caltrans and offered advice on contract changes that would lower risk and attract bidders from their perspective. Suggestions include increasing the stipend to

$2.5 million, which will be paid to all bidders whether or not the contract is awarded. They suggested increasing the Time Related Overhead (TRO). Due primarily to the size and required specifications, there is no domestic fabrication capacity available for the saddles. Kiewit suggested that the Department require domestic steel with an exception for the saddles. Time requirements for shop drawings should be reduced from 50 days to 30 days with a 15 re-submittal requirement. Pre-bid qualification to be considered for erection procedures. Sea Transportation risk is an issue. The specification for shipping tie downs have an impact of potentially having a load rejected, increasing cost and risk issues.

American Bridge
American Bridge (AB) met with Caltrans executives and offered advice primarily on the SAS and cable-stayed alternatives. AB stated that fabrication and the logistics of getting the fabricated materials to the job site are the most difficult aspects of this project. Construction of the bridge is known technology and did not present an unusual amount of risk. "Risk" dollars were not included in this project, over and above what is typically done with any large construction project. Any project of this size (regardless of design) carries financial risks for the contractor and for sureties. AB remains confident the SAS can be built without significant issues, time growth, or cost growth. There are no "hidden showstoppers" that they are aware of. Though engineering issues exist, AB thinks they are all resolvable. The key to success is a close working relationship and quick turn around of shop drawings and issue resolution. CS construction at this scale will be complicated and challenging. Construction of anything of this scale will be complicated and challenging.

Nippon Steel Corporation
The Agency Secretary met with representatives from Nippon Steel Corporation in Tokyo, Japan on November 13, 2004. Nippon suggested the least risky course of action is to refine SAS, which they recommend over cable-stayed alternatives. They advised the State to review erection methods and specifications to reduce costs and increase competition. A general review of specifications was recommended. The focus was on finding ways to lower risk, review schedules, and provide flexibility in fabrication to the extent possible.

Design Firms
The solicitation of consulting firms involved key firms with design experience in cable-stayed and segmental bridges. Specific questions with respect to the alternatives considered were emailed to five consulting firms (HDR, Parsons, EarthTech, Buckland & Taylor, and DMJM-Harris). It should be noted that the time for responding to the questionnaire was relatively short and little time was available for research. In general, the responses focused on constructibility and design issues with each of the alternatives. All firms agreed that any of the alternatives are possible but that at least 18 months to two years is needed to finish the design.

California Alliance for Jobs
A brief discussion with Jim Earp, Executive Director of California Alliance for Jobs was held Thursday, November 18, 2004. Jim indicated that he understood from earlier meeting discussions in September, that there were concerns in getting industry

representatives to the table. Jim indicated that he was not interested in technical comments, but offered to review the attendance taken at the various meetings held to date and would provide feedback on the participation from industry. Jim basically offered to help insure that we had a good representation from industry.

Contractors Executive Group

The financial package for the project must be in order before re-bidding the project. Consider including an American Welding Society Panel to review welding inspection and specifications to reduce inspection times and reduce the materials quality assurance requirements. Get rid of Alternative 2 and add a steel deck to 3 and 4. Alternative 5 is noted as the easiest to build. Also reduce the number of temporary structures thereby reducing the cost of the project.

Associated General Contractors

A discussion with Tony Grasso of AGC focused on ways to continue input from AGC with respect to alternatives under consideration. A letter requesting continued input was sent on November 18, 2004.

OUTREACH TO ENVIRONMENTAL INTERESTS

Resource and Regulatory Agencies

No new impacts appear to be created by any of the options under consideration. NOAA-Fisheries suggested that additional mitigation is not anticipated and that all efforts would be made to amend the existing Biological Opinion for listed fish. NOAA would work to expedite amendment to the Incidental Harassment Authorization for marine mammals, but could not promise a specific date. U.S. Fish and Wildlife Service representatives felt that amendment of the existing Biological Opinion for birds would not be possible without mitigation. BCDC clarified that 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 SAS. U.S. Coast Guard representatives said that amendments to the existing bridge permit would be most complicated for options that narrowed the navigation channel and added new piers. RWQCB representatives stated that the 401 Certification could be processed administratively, but the Waste Discharge requirements would require a public hearing by the Board. California Department of Fish and Game representative restated the issue of intensity of changed impacts would determine the level of negotiation and additional mitigation.

Public Interest Groups

A total of six organizations were represented at a briefing including Save the Bay, Friends of Five Creeks, BayKeeper, Sierra Club, East Bay Bicycle Coalition and Golden Gate Audubon Society. There was concern about the vulnerability of the pedestrian bicycle path to project cost cutting and that changes in the amount of Bay fill should be accompanied by additional mitigation proportionate to the increased impact.
Although no new impacts are foreseen it was the change in the intensity of the impacts that was a concern and that public consideration through the permit hearing process be completed. Other issues included concern that additional dredging not disturb contaminants in Bay muds, concern that demolition impacts be adequately considered.

Sierra Club clarified that it would not comment on bridge aesthetics and will defer to Golden Gate Audubon Society on resource impact issues, and that the feasibility of reconsidering the Retrofit strategy

OUTREACH TO THE FINANCIAL INDUSTRY

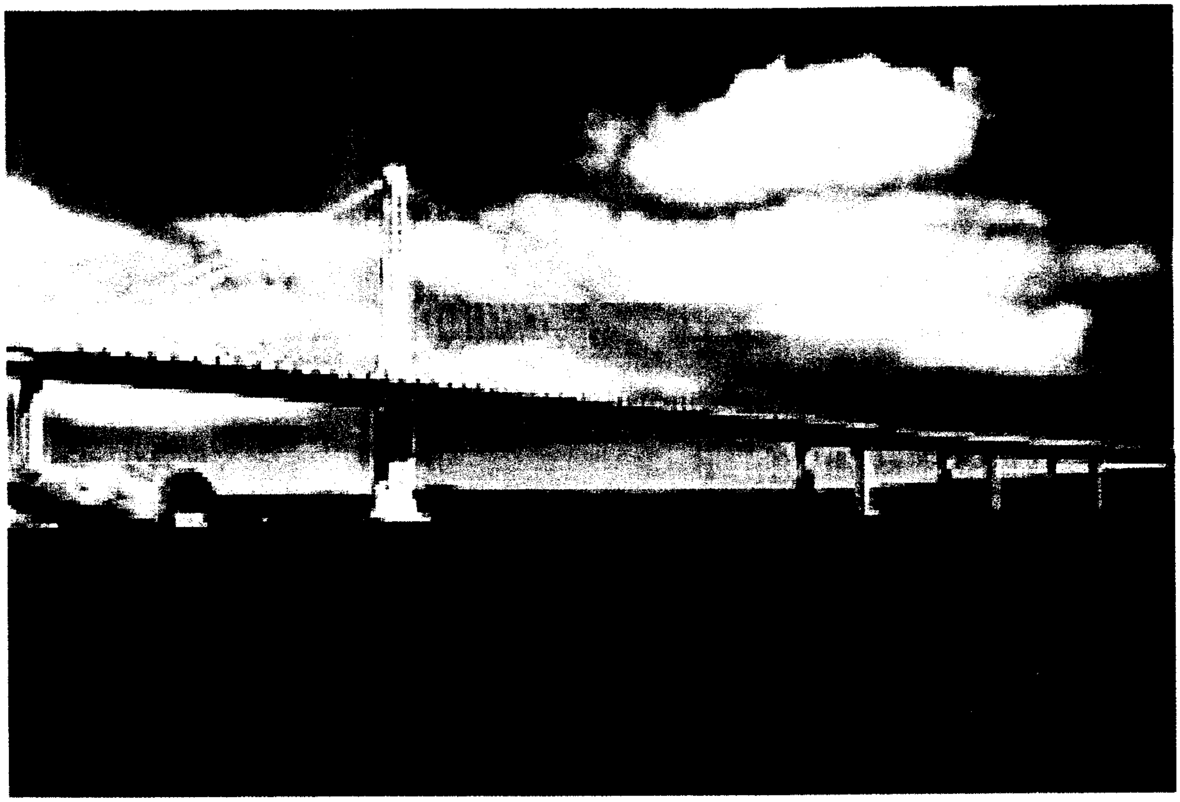
Surety Firms

Less prescriptive requirements could result in lower costs; room for improvement exists in current bid documents. A dedicated team on the owner's side is needed to facilitate interaction between to the Engineer of Record and the contractor, to address questions and proposals in a timely fashion. Having the Department design the temporary works of the current SAS design will not reduce risk or cost; clear and unambiguous design criteria will help reduce risk and hopefully costs. For the existing SAS design, construction techniques are unprecedented and present the contractors with considerable risk.

Appendix C

IRT Executive Summary

Independent Review Team Final Report



East Span San Francisco Oakland Bay Bridge Seismic Safety Project

November 19, 2004

Contract No. 53A0063
Task Order No. 330

In collaboration with

Value Management Strategies, Inc.

San Francisco Oakland Bay Bridge Seismic Retrofit Program

INDEPENDENT REVIEW TEAM - FINAL REPORT

To the reader:

This Final Report reflects the work performed by the Independent Review Team (IRT) for the State of California to document our analysis and findings relating to the East Span of the San Francisco Oakland Bay Bridge (SFOBB) Seismic Safety Retrofit project. This is a very complex project and there are many issues large and small that have been considered in order to advance our study to the point of making final recommendations.

Our recommendations to redesign the main span using a Cable-Stayed bridge are based on broad experience and a sufficient amount of technical analysis provided by the members of the IRT. Ultimately, more engineering work must be performed to complete the project to the point where it is ready for construction. Time is of the essence. There must be a will exercised from all affected parties for the savings anticipated in our report to be realized. With savings forecasted to exceed $600 million and a significant reduction in risk, it is clear that extraordinary efforts will be required on everyone's part in order to best serve the people of the state. We look forward to assisting the State of California and those who will use the SFOBB in advancing the best solution possible for this very important project.

Thomas R. Warne, PE
Chairman, Independent Review Team

Raymond McCabe, PE
C61571

Thomas G. Schmitt, PE

John Lamberson

Tim McGowan

John Hesler

R. Terry Hays

San Francisco Oakland Bay Bridge Seismic Retrofit Program

INDEPENDENT REVIEW TEAM - FINAL REPORT

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Executive Summary

1. EXECUTIVE SUMMARY

1.1 Introduction

This report documents the findings and conclusions to date for the Independent Review Team (IRT) for the San Francisco Oakland Bay Bridge (SFOBB) Seismic Retrofit Program. It covers both the initial work of the IRT prior to September 30, 2004, as well as the subsequent analysis conducted after that date to confirm several key issues with respect to the redesign concepts. Finally, it contains recommendations offered by the IRT for the State of California in moving ahead with this critical project.

The Independent Review Team (IRT) was first constituted for the SFOBB Seismic Safety Retrofit Program in September 2003. The impetus behind the original formation of the IRT was the single bid on the E2/T1 foundation contract that was 62% over the engineer's estimate. The IRT offered Caltrans a series of recommendations that were combined with a variety of agency-led initiatives, and the project was re-bid. This effort resulted in additional bidders and a re-bid price approximately $50 million lower than the single bid.

In May of 2004, bids were opened on the main span SAS unit after a lengthy bid period, with only a single bid being submitted by a team composed of American Bridge, Nippon Steel, and Fluor. This single bid was for approximately $1.4 billion using foreign steel ($1.8 billion using domestic steel), whereas the engineer's estimate was $780 million. As explained later in the report, a combination of factors contributed to the excessive cost, the first and foremost being the structure type (SAS) and the complexity and the risks associated in building a single tower self-anchored suspension bridge of this magnitude and at this location. The IRT was again asked to assess the viability, risks, and other characteristics of the following three available alternatives:

1. Assess the pros and cons for awarding the SAS contract to the American Bridge team
2. Assess the pros and cons of re-bidding the SAS contract with modifications to the contract
3. Assess the pros and cons of redesigning the SAS main span and bidding this alternative

1.2 Initial IRT Findings

In September 2004 the IRT recommended to the State of California that the single bid from American Bridge be rejected for several reasons:

- The state could not legally award the contract without adequate funding in place
- The single bid likely did not reflect the market price for the SAS
- That redesign options existed which could save the state over $500 million and substantially reduce the risks of cost and schedule over-runs likely to occur in building the SAS design

In making the above recommendation, the IRT had also looked into the potential cost savings and schedule impacts associated with several redesign options as described in Section 2.3. These included:

1. Redesign of the SAS to include a concrete tower and a redesigned, simpler superstructure

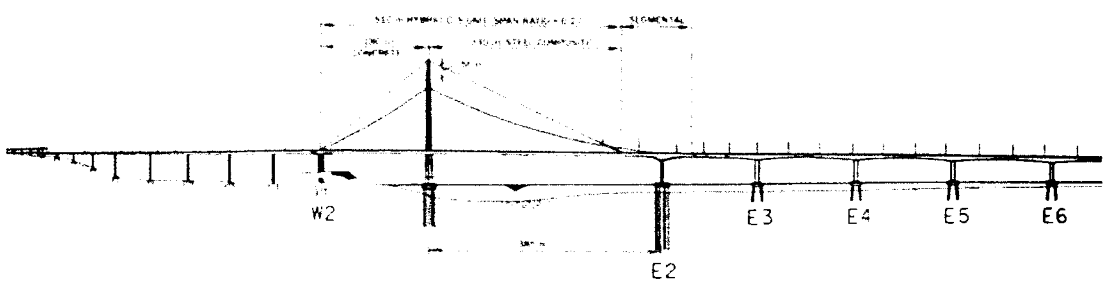
2. Extension of the Skyway
3. Several cable-stayed options

The preliminary evaluations indicated that:

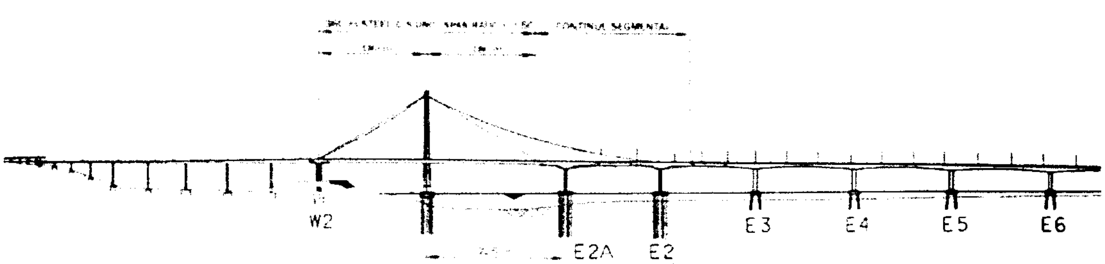
- The savings potential associated with the redesign of the SAS were not of a sufficient magnitude to make this an attractive option.
- The Skyway option would have similar or smaller cost savings than the Cable-Stayed option; it does not represent a "Signature Structure," and was not one of the bridge types recommended by the Metropolitan Transportation Commission (MTC) and Bay Bridge Design Task Force. For these reasons the IRT did not perform further analysis on the Skyway. Basic Skyway information is included in comparison tables, and the IRT developed a construction schedule to satisfy a Caltrans request.
- The cable-stayed options provided the highest level of flexibility, structural efficiency, construction advantages, cost savings, and risk reduction.

Thus the Cable-Stayed option was judged the most attractive. As there are many factors that affect the EIS, technical, schedule, and cost issues differently, three uniquely different cable-stayed concepts were developed, each having certain advantages and disadvantages.

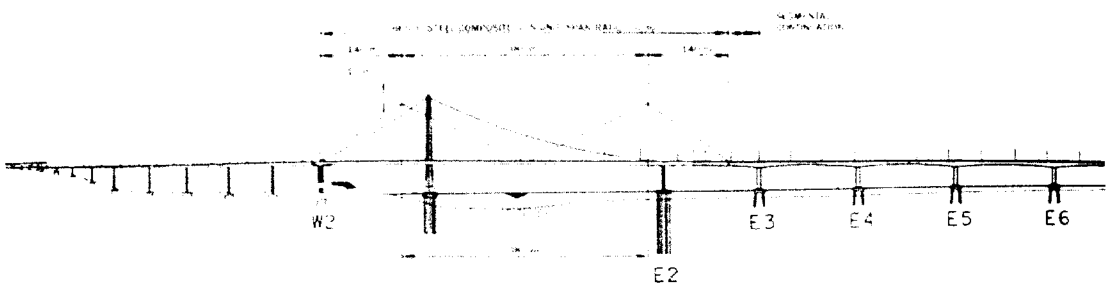
Alternate 1: A single-tower two-span option with 180m – 385m spans



Alternate 2: A single-tower two-span option with 180m – 225m spans



Alternate 3: A two-tower three-span option with 140m – 385m – 140m spans



Alternates 1 and 2 are similar in general appearance to the SAS. While Alternates 1 and 3 provide a navigational span of 385m, Alternate 2 provides only a 225m main span. While Alternate 1 tower height exceeds the 160m limit and Alternate 2 requires an additional pier in the bay, it is our understanding that the requirement for the 385m span and tower height limitations are stakeholder preferences and not design requirements. Discussions on these different redesign choices are given later in Sections 4-6.

1.3 Additional IRT Analysis (Phase 2)

Phase 2 of the IRT's work, which is the focus of this report, consisted of completing a sufficient amount of preliminary technical analysis to further resolve several key issues with respect to the above Cable-Stayed alternatives. The key issues examined in this second phase included:

1. Could the Cable-Stayed alternatives meet the seismic design criteria for the SFOBB
2. Determination of the foundation sizes for the Cable-Stayed alternatives, since this was a major element of the environmental impact with a redesign
3. Assess the environmental consequences of any redesigned bridge options
4. Assess the impacts to YBI and Skyway segments
5. Develop more refined cost estimates and schedule impacts, considering the outcome of items 1 to 3 above

In addition to the preliminary technical analysis, contractor type cost estimates were also developed independently by a Construction Specialist who also provided an independent verification of the construction schedules. An environmental specialist provided independent verification of schedule assumptions related to environmental issues, as well as an assessment of the possible environmental consequences emanating from a redesign. The estimated savings for the Cable-Stayed redesign options include costs of impacts to other contracts, delay costs to the foundation contract, and redesign costs.

The IRT was also required to complete the second phase of the study report by the 19th of November 2004 to facilitate a decision making on the redesign vs. re-bidding of the SAS.

Due to the compressed time schedule and the global nature of the issues to be resolved, the cable-stayed alternatives were prioritized for the second phase investigation in the following manner.

- Alternate 1 was studied first, as this was the one requiring the tallest tower, largest of the foundations, and the highest seismic demands for the towers, foundations, and the interfaces.

- Alternate 3 was studied next, as this was initially estimated to have the shortest construction schedule and the largest of potential cost savings. Also, since it is a two-tower, three-span structural configuration, its technical issues are quite different from the single tower, two-span Alternate 1 or 2.
- The foundation and seismic issues associated with Alternate 2 can be inferred from Alternate 3 due to similar tower height and foundation size. Thus Alternate 2 was set aside initially until the design developments on Alternates 1 and 3 were sufficiently advanced. The limitations on schedule and resources did not permit Alternate 2 to be directly developed. However, the results obtained from Alternates 1 and 3 were sufficient to conclude on the key issues of Alternate 2.

As described later in Section 3, the original SAS foundation/seismic models were used in the preliminary design development process to make a direct comparison with the SAS. As noted later, the analysis procedure adopted is aimed at providing conservative results for this initial study. Further, all design checks for the foundations and interface piers at W2 and E2 were made in accordance with the original design criteria. Design checks for the concrete towers were made with performance criteria more stringent than used for the SAS due to the early stage of development. The seismic performance demands obtained in further stages of design development and analysis are expected to be lower than predicted at this stage. ***This conservative approach provides further confidence in the results of the IRT's analysis.***

1.4 IRT Conclusions

The results of the additional analysis by the IRT of the advantages, issues, and other factors are summarized in Table 1 for easy reference. The major conclusions from the Phase 2 preliminary design development work are:

1. **Seismic Performance:** The Cable-Stayed alternatives can meet or exceed the seismic design criteria for the SFOBB East Span Project. This includes meeting the strain levels with foundation elements, concrete towers, piers, superstructure, shear link performance, and all other elements that govern the seismic performance and safety aspects of the bridge. The concrete towers can be designed to meet the seismic performance requirements of the project. Further information regarding the seismic performance can be found in Sections 3.2.3, 4.2(2), and 6.2(2).
2. **Foundations:** In general, it can be concluded that the foundation sizes and number of piles can remain the same (in some cases the foundations can be smaller) with all of the alternatives. The as-designed SAS foundations can be used for the largest of the Cable-Stayed alternatives (Alternate 1). This assessment is based on similar pile capacity estimates used for the SAS design. However, a review of rock strength data reveals that the pile design used for SAS is extremely conservative. As shown later, the adaptation of a more refined design approach should allow shortening of the drilled shafts at the main tower T1, even for Alternate 1. For other alternates, foundation size can be reduced through redesign, or SAS foundations can be used as is with minor modifications.
3. **Environmental Issues:** The Cable-Stayed design was fully evaluated in the project's Final EIS. Based on the technical analysis performed, the foundation sizes are ***not*** expected to increase for the Cable-Stayed alternatives. There is sufficient reserve capacity in the as-designed SAS foundations at this stage of development that the need to increase their size is hard to comprehend. Further information regarding the foundation capacity can be found in Sections 3.2.3, 4.2(2), and 6.2(2). However, should additional pile capacity be needed for any reason whatsoever, piles can be added within the existing foundation footprints without impacting the foundation sizes.

Thus, the only environmental issues anticipated are the change of structure type from SAS to Cable-Stayed for all three of the alternatives, the height of the tower above elevation 160.0m for Alternate 1, and the need for one additional foundation in the bay for the Alternate 2. The temporary piers required under the SAS design would be eliminated under the Cable-Stayed alternatives.

Both the SAS and cable-stayed designs were fully evaluated as design options under the Preferred Alternative in the SFOBB's Final Environmental Impact Statement (FEIS) that was completed in 2001. The FEIS concluded that the overall environmental impacts of these two options were virtually identical. ***All necessary environmental work can be accomplished through a reevaluation process with minor modifications to existing permits as necessary.*** Additional environmental documentation and modification of existing permits for the Cable-Stayed alternatives can be accomplished in a 9-month period.

Table 2 at the end of the Executive Summary compares the Environmental Intrusions of the various Cabled-Stay alternatives, and the Skyway option to the original SAS design.

4. **Impacts to YBI and Skyway Interfaces:** In general, all of the options considered had little or no impact to the YBI interface. In any case, if some change is needed to the YBI interface, it can be incorporated into the design, as it is still under development. On the Skyway side, some of the schemes (for example, Alternate 1, transition option A) have no impact to the interface, whereas other schemes would have some resolvable design issues. These would simply be designed into the interface and appropriate changes made to the Skyway contract.

5. **Cost Savings:** The estimated net cost savings for Alternates 1 and 3 exceed $600 million. Further, there is an additional estimated savings in excess of $250 million for potential additional costs during construction, as the Cable-Stayed design is judged to have less risk with respect to its fabrication and erection. The same can be inferred for Alternate 2. These cost savings are based on the assumed base price of $1.58 billion ($1.4 billion on the SAS recent bid and $178 million on E2/T1).

6. **Schedule Impacts:** All of the Cable-Stayed alternatives can be constructed by or before the theoretical SAS construction timeline. However, if construction were to proceed on the SAS design, there are overwhelming reasons to expect significant schedule creep during construction; thus, all of the Cable-Stayed alternatives provide significant schedule advantages over the SAS. Detailed schedules were developed for the Cable-Stayed alternates in two scenarios. The first scenario assumed no redesign (except some minor potential adjustments) of the foundations, and the second scenario assumed that the foundations would be significantly redesigned. The detailed schedules developed for the different alternates under these two scenarios are given in Section 7. The feasibility of the use of existing SAS foundations provides schedule advantages in addition to the direct economic advantages.

7. **SAS Risks:** One of the elements of the SAS Bridge that the IRT was asked to review concerned the risk characteristics associated with the construction of the SAS. The single-tower SAS of this size and constructed in this environment is a first-of-a-kind bridge. Even though a bid has been received, there is no reasonable assurance that it could be built within the bid price and schedule. Section 9 details numerous risks associated with constructing the SAS. These risks could add several years to the schedule for completing the SAS design. In addition, it is recommended to budget a construction contingency of $350,000,000 to address these items if the SAS design is

pursued. Experience indicates that first-of-a-kind major bridges have a high potential for construction claims, added costs, and schedule delays.

8. **Project Delivery Method:** There are two primary project delivery methods: Design-Bid-Build and Design-Build. Based on the knowledge and experience of the IRT members, it is recommended that design-build **not** be used for the completion of the Main Span of the SFOBB project if the SAS approach is retained. This is largely due to the complexity of the SAS design and inexperience of Caltrans in utilizing design-build, especially on such a complex project.

   Design-build could be considered with a cable-stayed alternative, as there is not the level of complexity, uncertainty, and inexperience with the cable-stayed design as there is with the SAS. Design-build could be considered for the cable-stayed design if the following conditions were met.

   - Obtain authorization to use design-build from the legislature
   - Validate that the environmental requirements and coordination issues with resource agencies will not be a detriment to the design-build process
   - Prepare Caltrans with the policies and procedures to go forward using design-build
   - Validate that there are costs or time savings associated with using design-build on a cable-stayed alternative

   If the analysis of the project results in affirmative answers to all of these questions, then design-build should be considered. Additionally, it is the recommendation of the IRT that if design-build is utilized for the Cable-Stayed alternative, then Caltrans should immediately secure the services of a project management consultant with experience in the development and management of large design-build projects. The IRT does ***not*** recommend advancing design-build on either the SAS or the Cable-Stayed alternative if the project is going to be self-managed by Caltrans.

1.5 IRT Recommendations

Based on the findings from our study, the IRT recommends proceeding with the redesign of a selected Cable-Stayed alternate. As there are significant cost impacts associated with delays to the current E2/T1 foundation contract, time is of the essence. Alternate 1 offers the most advantages with respect to schedule, and Alternate 3 offers the most in estimated cost savings. Alternate 2 requires evaluation of an additional foundation in the bay, which has potential for schedule delay and offers no real advantage over Alternate 1 or 3.

The IRT offers the following recommendations for the State of California:

1. Immediately adopt the redesign option and select either Cable-Stayed Alternative 1 or 3 as the course of action for moving forward on the main span of the SFOBB.
2. Immediately procure the services of an engineering consulting firm to complete the design work related to the Cable-Stayed option selected in #1 above.
3. Immediately complete a detailed cost analysis for the Cable-Stayed option selected for inclusion in the program budget for the TBSRP for presentation to the legislature.
4. Immediately develop a course of action to deal with the current E2/T1 contract under construction by Kiewit.
5. Immediately start the environmental reevaluation process and any necessary permit modifications.

Table 1: Evaluation of Cable-Stayed Alternatives

		SAS Design	Cable-Stayed Redesign Options			Additional Comments
			Alternate 1	Alternate 2	Alternate 3	
A. Environmental Issues						
1	Tower top elevation	160.0m	217.0m	160.0m	147.0m	Alternate 1 tower height exceeds the 160.0m stipulated for the SAS[1]. Requires a minor revision to the EIS.
2	Navigational span	385.0m	385.0m	225.0m	385.0m	Alternate 2 navigational span is 40% less than the 385.0m for the SAS. Requires a minor revision to the EIS.
3	Structure appearance	Very similar to CS Alternates 1 and 2	Very similar to the SAS	Very similar to the SAS	Somewhat different from the SAS, yet a signature form	Requires a minor revision to the EIS for cable-stayed bridges.
4	Number of foundations	W2, T1 (main tower) and E2	Same as the SAS, with reduced pile lengths at T1	One additional foundation required	Same as the SAS with E2/T1 shifted 40m to the west	Alternate 2 requires a revision to the EIS to allow an additional foundation in the bay.
5	Foundation sizes	Baseline sizes	Same as the SAS	Can be smaller than the SAS	Can be smaller than SAS	No increase in foundation sizes anticipated. For Alternates 2 and 3, the foundation sizes could be reduced[2].
6	Temporary piers in the bay	Required. Significant cost item	Not required	Not required	Not required	Cable-stay superstructures are constructed without temporary piers.
7	Additional NEPA review	None	Reevaluation	Reevaluation	Reevaluation	CS already evaluated in the EIS and was found to have impacts that were virtually identical to that of the SAS.
8	Modification of permits	None	Minor	Moderate	Minor	CS-related changes would be minor. Elimination of temporary piers would be viewed as beneficial by Resources Agencies.

[1] It is our understanding that this is a stakeholder preference
[2] One additional bay foundation is needed for Alternate 2

		SAS Design	Cable-Stayed Redesign Options			Additional Comments
			Alternate 1	Alternate 2	Alternate 3	
B.	**Seismic Safety & Seismic Performance**					
1	Foundations	SAS design criteria – foundations	Same as SAS	Same as SAS	Same as SAS	These elements were checked against the same design criteria as the SAS, using the seismic demands obtained from the same ADINA foundation/seismic model used in the design of the SAS. In the final design, these elements can be designed to be well within the strain limits stipulated.
2	Piers W2 and E2	SAS design criteria – piers	Same as SAS	Same as SAS	Same as SAS	
3	Shear links	SAS design criteria – shear links	Same as SAS	Same as SAS	Same as SAS	
4	Superstructure	SAS design criteria – super structure	Same as SAS	Same as SAS	Same as SAS	
5	Concrete tower	Essentially elastic response under SEE	Meets or exceeds SAS performance criteria	Meets or exceeds SAS performance design criteria	Meets or exceeds SAS performance design criteria	The strain limits used to check the seismic performance of the concrete tower for SEE are the same as those used for FEE in the SAS design[3]. In addition, the cable arrangement provides considerably more global stability and enhances overall seismic performance and safety.
6	Overall seismic safety	Essentially elastic response under SEE	Meets or exceeds SAS performance criteria	Meets or exceeds SAS performance design criteria	Meets or exceeds SAS performance design criteria	
C.	**Interface Issues**					
1	YBI side	Baseline case	Not an Issue	Not an Issue	Not an Issue	The YBI side is still in the design phase. Any modifications needed are expected to be relatively minor and can be incorporated into the design
2	Skyway side	Baseline case	Transition Option A has no impact Transition Option B require some design evaluation	Transition Option A has no impact Transition Option B require some design evaluation	Requires design revision to shorten the length of the Skyway superstructure. Relatively minor change to the design	All three CS alternates can be used in a manner that requires little or no change to the Skyway. However, as with Alternate 1, Transition Option B, there are benefits to be gained if some changes can be made to the Skyway.

[3] The SAS design criteria allow some limited damage at the higher magnitude SEE event and allows no damage at the lower magnitude FEE event. The concrete tower design checks under the SEE event meets the no-damage requirements stipulated for the FEE event.

		SAS Design	Cable-Stayed Redesign Options			Additional Comments
			Alternate 1	Alternate 2	Alternate 3	
D. Other						
1	Design Life	150 years (for the SAS and Skyway). Baseline design life	Same as the SAS and Skyway	Same as the SAS and Skyway	Same as the SAS and Skyway	The deck design and performance for the cable-stayed options would be the same as the SAS or Skyway, depending on the final deck type selection[4].
E. Schedule						
1	No foundation redesign	—	Completion in late 2010	Not applicable	Completion in early 2010[5]	There is some schedule advantage with Alternate 1, as the existing foundations can be used as-is (with only minor modifications)[6].
2	Foundations redesigned	—	Not applicable	Completion in late 2010	Completion in late 2010	
F. Cost Savings						
1	Savings in construction	—	$673,000,000	$700,000,000[7]	$829,000,000	The additional savings is the estimated difference between the potential for construction cost additions between the SAS and the CS.
2	Additional savings	—	$250,000,000	$250,000,000	$250,000,000	
3	Total potential savings	—	$923,000,000	$950,000,000	$1,079,000,000	

[4] See Section 3.2.1

[5] The existing foundations are too big for optimal design of this alternate. Redesign is preferred from a technical point of view to achieve better overall performance

[6] The potential foundation contract delay claims can best be minimized with Alternate 1

[7] Would depend on the terms and conditions of modifications to the existing foundation contract to include the additional foundation or potential re-bidding of the foundation contract

Table 2: Environmental Intrusion Comparison

	SAS	Skyway	Cable Stayed Options		
			Alternate 1	Alternate 2	Alternate 3
Maximum Tower Height	160 meters	None	217 meters	160 meters	147 meters
Cable System Appearance	Sag cable with vertical taut cables	None	Inclined taut cables	Inclined taut cables	Inclined taut cables
Visual Impact of Main Span [a]	48,310 m^2 Baseline Signature Span	8,500 m^2 (C) 5,700 m^2(S) No Signature Span	57,885 m^2 Enhanced Signature Span	30,600 m^2 Reduced Size of Signature Span	52,200 m^2 Enhanced Signature Span
Total Piers in Bay	44 [b]	45	44	45	44
Net Fill in Bay (Acres)	2.61 [c]	2.66	2.61	2.60	2.60
Temporary Foundations in Bay	Yes	Concrete – No Steel – Yes	No	No	No
Deck Height at Highest Point	Baseline	Same	Same	Same	Same
Superstructure Profile Thickness	5.5 meters	15 meters (C) 10 meters (S)	5.0 meters	5.0 meters	5.0 meters
Navigational Channel (Clearance)	42.6 meters	33.1 meters (C) [d] 38.1 meters (S)	43.1 meters	43.1 meters	43.1 meters
Navigational Channel (Width)	385 meters	260 meters (C) 205 meters (S)	385 meters	225 meters	385 meters
Biological Impact	Baseline	Slight Increase	No change	Slight reduction	Slight reduction
Historic/Cultural Resources	Baseline	No change	No change	No change	No change
Archeological Impacts	Baseline	No change	No change	No change	No change

[a] Visual Impact of Main Span considers the total square meters for the tower, cables and deck in the elevation view. The tower below the deck is not included in the calculations

[b] Source – Figure 2-10.1 of Final EIS

[c] Source – Table 4.9-2 of Final EIS

[d] 22% reduction from the minimum clearances shown for the SAS

Appendix D

PRT Executive Summary

U.S. Department of Transportation
Federal Highway Administration

SAN FRANCISCO–OAKLAND BAY BRIDGE PROJECT

PEER REVIEW

DECEMBER 2004

San Francisco–Oakland Bay Bridge Project: Peer Review

DECEMBER 2004

Executive Summary

After the 1989 Loma Prieta and 1994 Northridge earthquakes, the State of California enacted the State Toll Bridge Seismic Retrofit Program in 1997 to improve the safety and reliability of critical transportation infrastructure assets in California. One of the critical elements to successfully finishing the program is completion of the San Francisco–Oakland Bay Bridge (SFOBB) project. This project consists of 16 separate contracts, including the proposed self-anchored suspension (SAS) bridge contract.

Caltrans advertised the SAS contract in February 2003 and opened bids in May 2004. The single bid received (in the amount of $1.4 billion using foreign steel) exceeded the $740 million of funding available for the SAS portion of the SFOBB. The California Legislature was unable to develop a funding package to address the additional cost and the contractor's bid was allowed to expire.

In September 2004, the California Secretary of Business, Transportation and Housing asked the Federal Highway Administration (FHWA) for assistance in moving the SFOBB project forward. FHWA assembled the Peer Review Team (PRT), which convened November 1–5, 2004. The team examined project alternatives identified by Caltrans and assessed the risk that each might not achieve its key objectives. It is important to note that the PRT did not perform any independent analysis of technical issues (seismic performance), environmental documentation, cost estimation, or constructability, but relied exclusively on data presented by Caltrans, the Independent Review Team (IRT), the project design team (T.Y. Lin International/Moffatt & Nichol), and Bechtel. In the risk assessment, the PRT considered the quality and reliability of the data presented on the basis of the design development of the different alternatives, which range from a 100 percent design completion for the current SAS design to less than 5 percent design completion for some of the other alternatives.

Each of the six project alternatives we evaluated provides a solution to the SFOBB problem, but can be affected by uncertainty and associated impacts. These impacts typically affect project cost and schedule, either directly or indirectly. We identified, quantified, and prioritized technical, cost, and schedule; environmental; management; and public acceptance and expectation risks.

The alternatives and their overall impacts follow:

- *Rebid the current SAS design (Alternative 1).* A small number of SAS bridges have been constructed worldwide. The design is a technological innovation that employs materials of limited availability and requires complex methods of construction. These factors impact construction risk and as a result cost of construction. At the same time, the completeness of its design and environmental approvals mitigate the ability of third parties to delay the project.

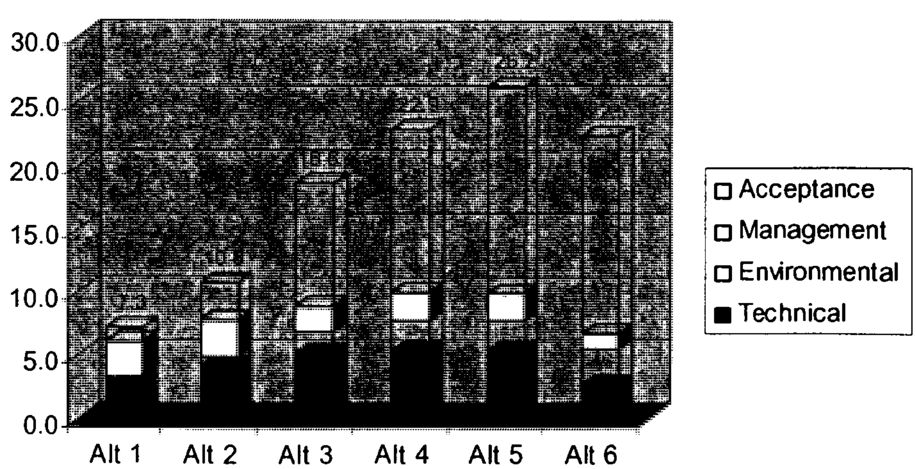
- *SAS with concrete tower (Alternate 2).* This alternative poses the same risks as Alternative 1 with the additional complication that some minor modifications to the environmental permits may be required.

- *Cable-stayed (Alternatives 3, 4, and 5).* The construction industry is familiar with this type of bridge, reducing construction risks. A significant pool of suppliers exists for the necessary materials, further reducing risk. If bid as a single large contract, bonding and insurance costs will be significant. All of the cable-stayed alternatives may require revisiting existing permits, which could involve significant effort to resolve concerns.

- *Skyway bridge design (Alternative 6).* The most significant risks associated with this alternative are community acceptance and revisiting most of the permits. Construction cost would be significantly lower than for the other alternatives because it involves relatively standard bridge construction processes. Because of the construction methods employed, the opportunity to break the work into smaller contracts may arise, thereby reducing the cost of bonding.

Figure ES-1 shows the associated risk scores for each alternative by risk type.

Figure ES-1. Summary of Risk Scores by Alternative



The selection of a preferred alternative is a matter of trading risk for expected cost and schedule benefits. In essence, the State of California's tolerance for risk should be the deciding factor in selection. The results of this analysis provide the State's leadership with the information necessary to make that decision.

During the course of the study, we identified several potential actions that Caltrans might consider to enhance the probability of successful project completion. They generally apply across all alternatives, and we enumerate them in Chapter 4.

Appendix E

Seismic Safety Peer Review Panel Comments

Seismic Safety Peer Review Panel
East Crossing
San Francisco Oakland Bay Bridge

November 4, 2004

Dr. Brian Maroney
SFOBB Design Manager
California Department of Transportation
Sacramento, California

Subject: East Crossing SFOBB

Dear Dr. Maroney:

The Seismic Safety Peer Review Panel (SSPRP) for the above project met on October 25, 2004, with representatives from Caltrans, FHWA, the design team (T.Y.Lin Intl.) and the VA-IRT (Independent Review Team) to review the status of the South-South Detour Design Build contract on YBI and the progress on the SAS or deep water portion of the East Bay Spans. The meeting was held in the Public Information Building @ Pier 7, SAS Field Office, 333 Burma Rd., Oakland California and was attended by all four PRP members. The presentation consisted of four parts, namely (1) a construction overview by Pete Siegenthaler (Caltrans), (2) an overview of the South-South Detour design/construction developments by Tom Ostrom (Caltrans), (3) a status report of the SAS bridge structure by Brian Maroney (Caltrans), and (4) a summary of the VA-IRT studies by HNTB (Ray McCabe and Sena Kumarasena). The SSPRP has the following comments and questions on the presentations:

1) Construction Progress:

While the SSPRP appreciates the construction progress on W-2 (100%), E-2 and T-1 (15%), and in particular the Skyway (60%), the SSPRP is especially concerned with the push back and uncertainties of the completion date for the entire project due to problems with the SAS contract. Once again, the SSPRP wants to remind Caltrans and the general public of the reasons and urgency of this important seismic safety project, namely to be prepared for the next big seismic event in the greater Bay Area and the life safety and functionality issues associated with a potential failure of the existing East Bay bridge. The projected seismic hazard for the Bay area and the seismic risk posed by the vulnerable existing bridge requires the most expeditious completion of the East Crossing Bridge Replacement Project.

2) South-South Detour:

The South-South Detour consists of three distinct portions, namely the West tie-in to the transition structure and tunnel, the double deck steel Viaduct Section, and the East tie-in to E-2. The design–build project is proceeding rapidly with the central viaduct section, yet uncertainties still seem to prevail with the tie-in structures. Without the benefit of design calculations, the SSPRP expressed concerns with the proposed isolation concept via lead-core rubber bearings on top of individual very flexible pier-shafts, which results in lengthening the structural response period into the >4-5sec. range where our knowledge on seismic input motions is not very reliable. Furthermore, this flexible structure ties into a very stiff transition structure on the West side and into a very complicated articulated east transition to E-2. The SSPRP has the following concerns, namely (1) that simple push-over analyses are insufficient to capture the dynamic response of a structure with the type of stiffness changes and articulations described, and (2) that the uncertainties with the completion of the SAS portion may result in a longer exposure of the detour structure than initially expected and with it the seismic input may need to be revisited. Most importantly, however, is the current lack of detailed design information from the design-build contactor to Caltrans and the SSPRP team to allow a meaningful assessment of the proposed project and the seismic performance. In particular, possible delays from the SAS portion of the bridge may provide the opportunity to conduct a more thorough design and performance evaluation of this important and very difficult detour structure.

3) SAS Contract Status:

The single bid received for the SAS, as well as the high bid price for both foreign and domestic steel construction have led to a delay in the award of this section of the new bridge and put the SAS portion on the critical path for completion of this important seismic safety project. The SAS decision tree presented inevitably results in completion delays for the overall project and prolonged exposure to seismic risk for the public. While the SSPRP understands the prudence of a reevaluations of all options, including re-bidding, re-design, and changes in structure and contacting type, in a region of high seismicity, and environmental sensitivity, and in the framework of legislative mandates, all options need to be evaluated under the most important constraint, namely seismic safety; the only reason why we are building a new bridge. While there was never any question from the beginning of the project that other bridge types are technically possible and less expensive, the current bridge design was a direct result of an extensive community/environmental process with subsequent legislative backing. Any change in bridge type or geometry could result in multi-year delays which are unacceptable from a seismic safety point of view! Furthermore, with recent and continuing increases in material and construction costs it is not clear that project delays will result in overall cost savings!

4) VA-IRT Study:

The VA-IRT study presented summaries of four alternate bridge designs with some technical evaluation for two of them. The SSPRP made it clear from the beginning of the presentation that there is no question that other bridge types can be designed for this location, and that other bridge types are expected to be less expensive than the currentlydesigned Steel SAS; all these issues were discussed and agreed upon during the MTC/EDAP community decision process for the signature bridge. The key issues with a redesign are (1) the effects on and the interaction with already designed and fully or partially constructed portions of the bridge, (2) the possible delays caused by a reopening of the environmental and political process, and (3) the technical equivalency of the alternate designs to the as-designed SAS in terms of seismic safety, functionality, and reliability

The VA-IRT showed once again that other bridge alternatives exist even within the already executed design/construction boundary conditions, however, the level of design analyses presented did not convince the SSPRP that quantities, seismic response, and interaction with the adjacent structures are sufficiently developed and understood to allow an evaluation of cost savings. The SSPRP recognizes the extraordinary amount of work completed by the VA-IRT in a very short time frame, yet cautions about premature conclusions from the studies presented to date. Questions that could not be answered during the SSPRP meeting concerned simple DL quantities and stress levels in the tower legs, strain levels in the tower legs (e.g. under the SEE the values of 2% strain shown for the concrete are too high for an important and critical structural element such as a tower leg and at 0.2% too low to be realistic), as well as ductility levels in E-2 with the increased DL and stiffness changes. It is completely unrealistic to expect that a seismic design and evaluation of alternate bridge types to the SAS can be completed in a two week time frame without the potential danger of a technical disconnect, namely an evaluation of a structure that will be different in seismic performance and reliability than the current SAS design. Furthermore, the SSPRP recommends a detailed comparison of quantities and seismic response of the VA-IRT proposed cable stayed bridge (Alt-1, FHWA Alt-3) with the cable stayed bridge alternative which had been designed and developed by the design team as part of the 30% design development for the EDAP evaluation. This 30% design development, scaled-up to the existing span geometry should be able to serve as a good first reality check for quantities, DL stress levels, foundation sizes, and seismic response limit states. Furthermore, it should be recognized that this 30% design development of a cable stayed alternative was subsequently rejected by EDAP, indicating the possible delays a change in structure type could cause to get the appropriate regulatory (environmental), community, and legislative acceptance.

In summary, the SSPRP is extremely concerned that delays in the execution of the signature span for the new Bay Bridge will increase the seismic exposure and risk and that quick redesigns of the bridge could result in different levels of seismic safety, functionality, and reliability from the standards currently established for the SAS. Expeditious completion of this important seismic safety project is and should be the overriding consideration.

Very truly yours,

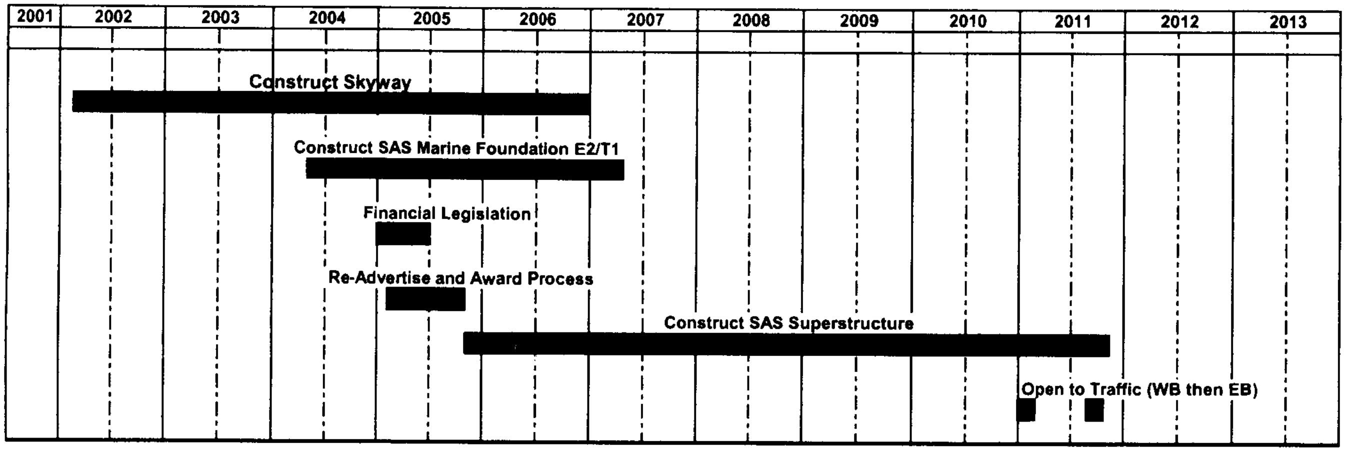
Joseph P. Nicoletti, Chair
Seismic Safety Peer Review Panel

Appendix F

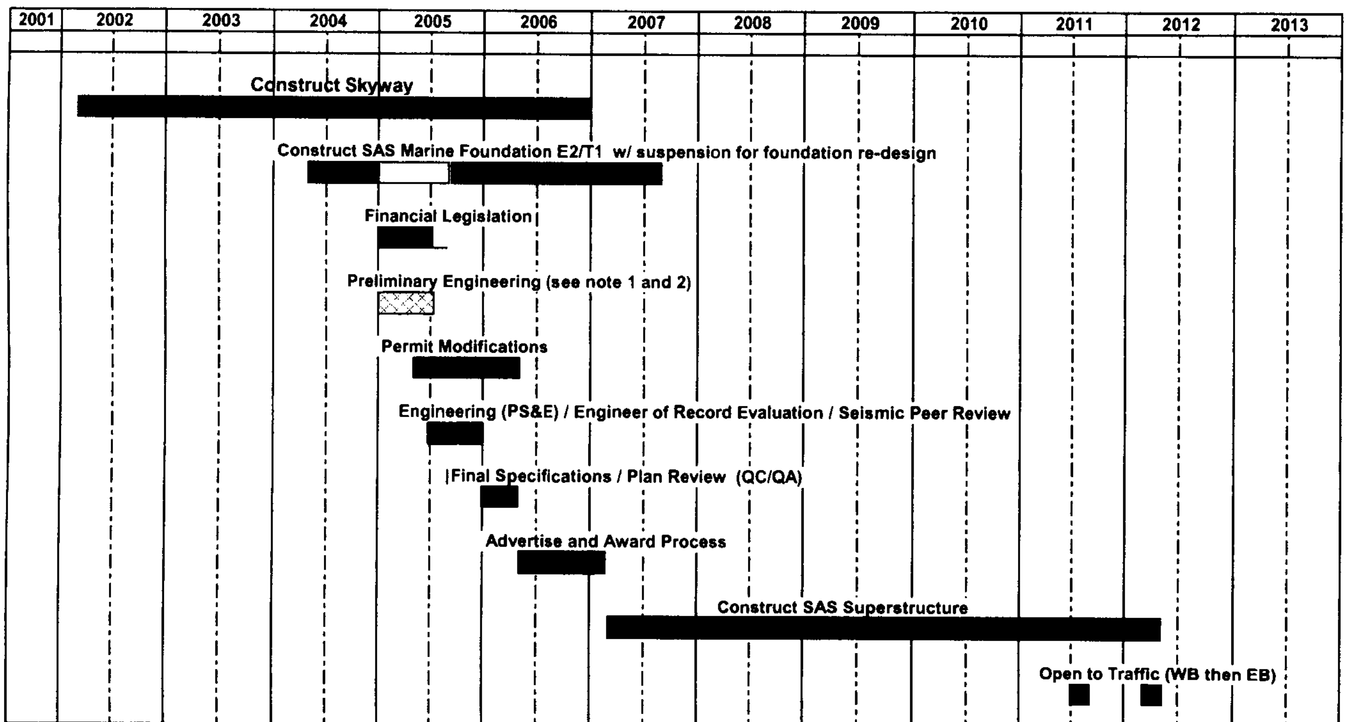
Detailed Alternative Schedules

Schedules for Main Span Alternatives

Re-bid SAS - Alternative 1



Re-design SAS Main Span - Alternative 2 (w/ Concrete Tower)

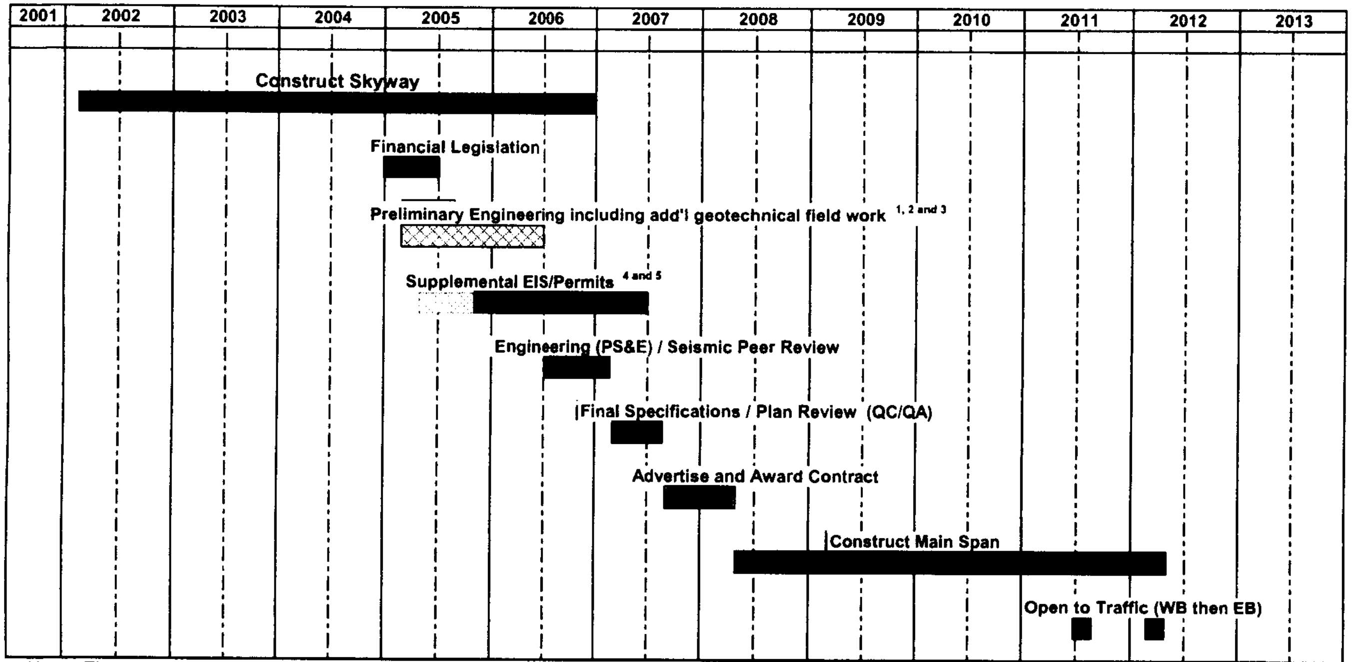


Note: These schedules are conservative based on normal procurement processes. The Department will make every effort to accelerate these processes.

[1] This assumes the current Engineer of Record completes the design changes.

[2] Design Sequencing is not assumed due to uncertainty of cost growth that would be associated with a major bridge design.

Re-design Main Span - Cable-Stayed Bridge - Alternatives 3 to 5



Note: These schedules are conservative based on normal procurement processes. The Department will make every effort to accelerate these processes.

[1] It is assumed the current Engineer of Record (EOR) will complete the new design. It new EOR chosen, then add 9 months for procurement (includes technical design definitions) and global analysis.

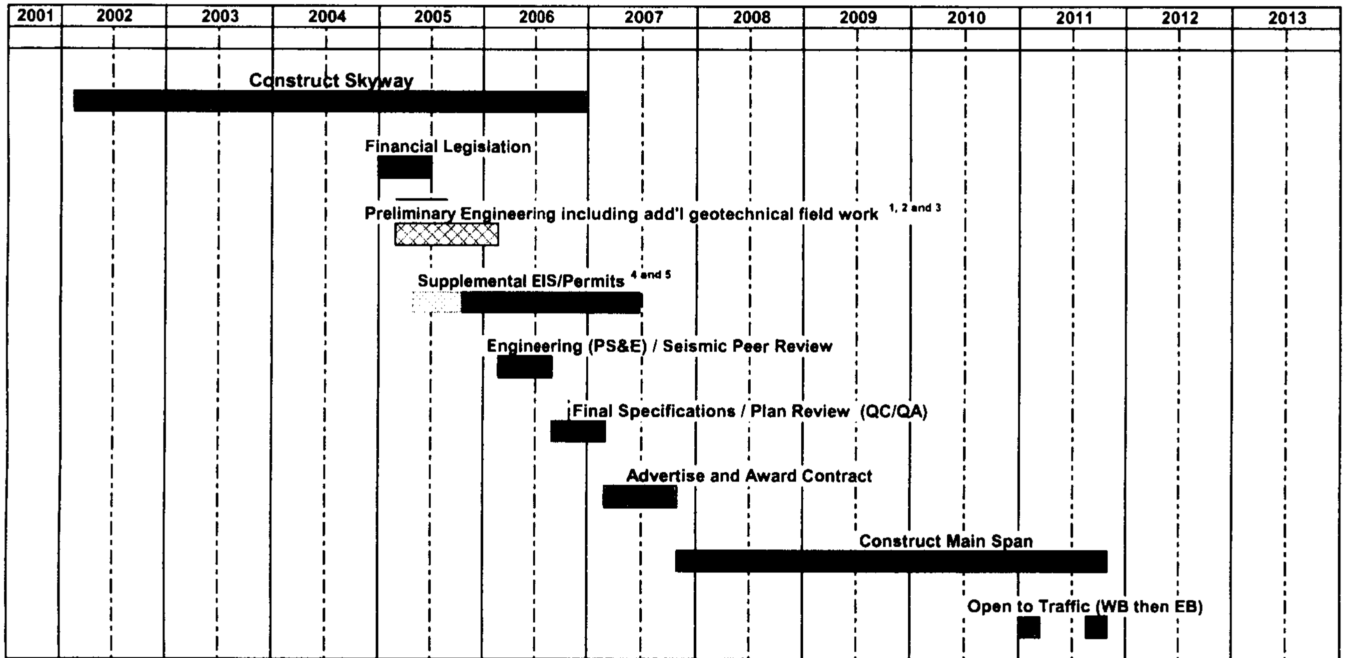
[2] Design Sequencing is not assumed due to uncertainty of cost growth that would be associated with a major bridge design.

[3] Design - Build is not assumed due to complexity of the environmental process, existing East Span design on adjacent sides of this design, and the complexity of the unique EOR issues.

[4] The represented schedule does not reflect the uncertainty of success due to the Coast Guard concerns over the restricted navigation channel should the new design require such restriction.

[5] The represented schedule does not reflect the uncertainty associated with the public process.

Re-design Main Span - Skyway Bridge - Alternative 6



Note: These schedules are conservative based on normal procurement processes. The Department will make every effort to accelerate these processes.

[1] It is assumed the current Engineer of Record (EOR) will complete the new design. It new EOR chosen, then add 9 months for procurement (includes technical design definitions) and global analysis

[2] Design Sequencing is not assumed due to uncertainty of cost growth that would be associated with a major bridge design.

[3] Design - Build is not assumed due to complexity of the environmental process, existing East Span design on both adjacent sides of this design, and the complexity of the unique EOR issues.

[4] The represented schedule does not reflect the uncertainty of success due to the Coast Guard concerns over the restricted navigation channel should the new design require such restriction.

[5] The represented schedule does not reflect the uncertainty associated with the public process.

Appendix G

Risks Related to the SFOBB Main Span Alternatives

RISKS RELATED TO SFOBB MAIN SPAN ALTERNATIVES FOR THE EAST SPAN SEISMIC SAFETY PROJECT

SAFETY RISKS	Alternative 1: SAS	Alternatives 3-5: Cable-Stayed	Alternative 6: Skyway
Seismic Safety	• Has been designed and modeled to meet seismic safety. • Independently checked. • Independently peer reviewed.	• Can be designed and modeled to meet seismic standards. • Seismic safety verification dependant on 60% design. • Requires additional independent checks and peer review.	• Can be designed and modeled to meet seismic standards. • Seismic safety verification dependant on 60% design. • Requires additional independent checks and peer review.
Design	• Design more complex. • Design complete.	• Design complex. • Design conceptual (5 percent).	• Design conventional. • Design conceptual (5 percent).
Environmental (Permits)	• All permits in place.	• BCDC permit would involve public hearings. • USCG amendment to bridge permit likely required (concerns about impacts to navigational channel). • USFWS amendment to Biological Opinion likely required (concerns about bird impacts although none shown currently to listed species). • PRT viewed risks as manageable.	• BCDC permit would involve public hearings. • USCG amendment to bridge permit likely required (concerns about impacts to navigational channel). • USFWS amendment to Biological Opinion likely required (concerns about bird impacts although none shown currently to listed species). • PRT viewed risks as manageable.
Impact on Adjacent Structures	• Adjacent structures designed for SAS.	• Impact to: W2, T1, E2, Skyway, and Yerba Buena Island viaduct.	• Impact to: W2, T1, E2, Skyway, and Yerba Buena Island viaduct.
Potential Award Date	• Fall 2005	• Spring 2008	• Fall 2007
Schedule (open to traffic)[1] IRT TY Lin Bechtel Department	• 2011 • 2011 • 2012 • 2012 - 2013	• 2010 • 2013 • 2013 • 2012 - 2014	• 2012 • 2012 • ---- • 2011 - 2013
Design Phase[1]	• Design is complete.	• 18-24 months to procure designer and complete design. • Difficult interface with adjacent structures.	• 12-18 months to procure designer and complete design. • Less difficult interface with adjacent structures.
Construction Phase[1]	• Construction will be very difficult. • Potential for delay is very high.	• Construction will be difficult. • Potential for delay is high.	• Construction will be less difficult. • Some potential for delay.

[1] These schedules are conservative, based on normal procurement practices. The Department will make every effort to accelerate this process.

RISKS RELATED TO SFOBB MAIN SPAN ALTERNATIVES FOR THE EAST SPAN SEISMIC SAFETY PROJECT

COST RISKS	Alternative 1: SAS	Alternatives 3-5: Cable-Stayed	Alternative 6: Skyway
State Legislation	• Fiscal package required. • Extension of CEQA exemption required. • Extension of seismic retrofit procurement provisions required.	• Fiscal package required. • Extension of CEQA exemption required. • Extension of seismic retrofit procurement provisions required. • Legislation required to allow redesign.	• Fiscal package required. • Extension of CEQA exemption required. • Extension of seismic retrofit procurement provisions required. • Legislation required to allow redesign.
Constructibility	• Designed. • Reviewed. • Very unconventional construction.	• Very preliminary design. • More review needed (IRT has conducted initial review). • Unconventional construction.	• Very preliminary design. • More review needed (Substantial Bay Area experience with this bridge type). • Conventional construction.
Pool of Bidders[1]	• Up to two.	• Four to six.	• At least one.
Capital Cost IRT TY Lin/MN Bechtel Department	• - • $1.2-1.4B • $1.9-2.1B • $1.8-2.1B	• $0.75-0.9B • $1.0-1.5B • $1.7-1.8B • $1.5-1.7B	• Up to $1.1B • $0.8-1.0B • $1.3-1.7B • $1.3-1.6B[1]
Project Management/Capital Outlay Support	• Significant construction complexities create potential for higher support costs.	• Will require redesign costs. • Construction complexities may lead to higher support costs.	• Will require redesign costs. • Lower support costs anticipated due to conventional construction.

AESTHETIC RISKS	Alternative 1: SAS	Alternatives 3-5: Cable-Stayed	Alternative 6: Skyway
Local Expectations and Acceptance	• High acceptance in 1998.	• Previously rejected by region in 1998. • Limited opposition expected today.	• Previously rejected by region in 1998. • Some opposition expected today.
Aesthetics (Look of Bridge)	• Has had public consensus.	• Similar appearance to SAS.	• Not a cable-supported structure.

IRT estimate includes:
- Capital cost of the main span, and main span foundations E2/T1 and W2 (modifications).
- No cost for impacts to adjacent contracts.
- Design costs ($25 million).
- Escalation to mid-point of construction.
- Contingencies of $100M are included in the cable-stayed estimate.

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 to on going contracts.
- Design costs.
- Escalation – 5% per annum was used for specific portions of the work.
- Contingency was developed based on a probable risk analysis.

TYLin/MN estimate include:
- 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 to on going contracts.
- Design costs ($30 to $50 million).
- Escalation – no indication that the estimate was escalated to mid-point of construction.
- Contingency – a specific contingency was not provided other than the estimated cost range shown.

Department 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 to on going contracts.
- Design costs ($65 million).
- Escalation – estimates are escalated to the mid-point of construction.
- Contingency – 10% to 15% on re-advertise, 20% to 30% on redesign.

[1] Based on Industry outreach program
[2] These costs could increase by $200M if there is a substantial delay in obtaining permits.