Independent Review Team

San Francisco Oakland Bay Bridge Seismic Retrofit Program

Executive Summary
Preliminary Findings
September 30, 2004
To the reader:

This Executive Summary of the Preliminary Report of the work performed by the Independent Review Team is provided to the State of California to document our findings to date. This is a very complex project and there are many issues large and small that must be considered in order to advance our study to the point of making a final recommendation. To that end, it must be understood that additional analysis is anticipated in order to achieve the level of certainty necessary to make the significant financial and policy choice of which of the three alternatives the state should select to complete the main span of the East Span of the SFOBB Seismic Safety Retrofit project. Our recommendation to advance Options 2 and 3 is based on our best analysis and we believe reflects a sound technical and financial approach. We look forward to assisting the State of California and those who will use the SFOBB in advancing the very best solution possible for this very important project.

Thomas R. Warne, PE
Chairman, Independent Review Team
Executive Summary  
Preliminary Report

I. Background

The Toll Bridge Seismic Retrofit Program (TBSRP) was established in response to the need to preserve critical structures in the state against possible future seismic events. The program is composed of a number of projects including the Richmond-San Rafael Bridge and replacing the East Span of the San Francisco Oakland Bay Bridge (SFOBB). The last major project to be completed as part of the TBSRP is the East Span of the SFOBB. The East Span replacement is divided into 16 contracts, the most notable of which is the signature main span located just east of Yerba Buena Island known as the Self Anchored Suspension (SAS) bridge.

The Self Anchored Suspension (SAS) was selected through an extensive public process and adopted as the preferred alternative for the Environmental Impact Statement (EIS) and the Record of Decision (ROD) signed by the Federal Highway Administration (FHWA).

In May of 2004, bids were opened on the SAS with only a single bid being submitted by a team composed of American Bridge, Nippon Steel and Flour. This single bid was for approximately $1.4 billion whereas the engineer’s estimate was $780 million.

The Independent Review Team (IRT) was first constituted for the San Francisco Oakland Bay Bridge Seismic Safety Retrofit Program in September 2003. Thomas R. Warne, PE, a nationally recognized transportation professional was invited to chair the effort and additional individuals from the transportation industry were invited to complete the membership of the IRT. Each member of the IRT is a professional with specific expertise in some area of large project delivery or other such elements relative to the TBSRP. Abbreviated curricula vitae for each member of the IRT are found in Appendix A. 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 studied the circumstances surrounding the single bid for the E2/T1 foundation contract, sought input on a variety of contracting and materials issues and otherwise considered how Caltrans might create a more competitive bidding situation. Ultimately, the IRT offered Caltrans a series of recommendations that were combined with a variety of agency led initiatives and the project was rebid. The savings from this joint effort netted the State of California approximately $50 million in the second round of bidding where four teams competed for the chance to build the E2/T1 foundations. A summary of the report by the IRT on this project is found in Appendix B.

Subsequent to this first engagement the IRT provided Caltrans with information on a variety of issues including certain provisions of the SAS contract and possibilities for
improving the project and result in greater competition and lower prices. A brief summary of those recommendations is found in Appendix C. This work concluded in April of this year with no further activity on the part of the Independent Review Team until September 3, 2004 when they were called in to assist in with the SAS main span contract where again only a single bid was received by Caltrans.

The IRT has provided information to the State of California and Caltrans regarding possible alternatives for moving the SAS contract forward and achieving the financial goals and schedule objectives. This Executive Summary of the IRT’s Preliminary Findings is a reflection of the progress to date on this complex issue.

II. Scope of Work

The Independent Review Team was reactivated on September 3, 2004 with the express purpose of offering input and recommendations regarding alternatives for the State of California in advancing the SAS main span project and the appropriate action relating to the single bid received from the team composed of American Bridge, Nippon Steel and Fluor.

In doing this, the IRT has been asked to assess the viability, risks and other characteristics of the three available alternatives. These include:

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

In addition, the IRT has been charged with evaluating the possible environmental impacts associated with a redesign as well as any schedule issues consequent to this approach.

III. Three Alternatives

There are three available alternatives to the State of California for advancing the main span work of the East Span of the SFOBB. They are:

Option 1-Award the contract to the American Bridge team
Option 2-Rebid the SAS contract with modified terms and conditions
Option 3-Redesign the main span

Each of these options has pros and cons, as well as an element of risk. A brief summary of the pros and cons for each option including some commentary is provided below:

Option 1-Award the contract to the American Bridge team
Pros
1. Caltrans has a bid in hand
2. Known starting or base price for the work
3. No further environmental analysis or permitting is required
4. The project continues to advance towards completion

Cons
1. Single bid doesn’t ensure the most competitive price for the state
2. Significant constructibility concerns expressed by contractors
3. Complex fabrication issues with bridge components
4. One-of-a-kind bridge with little or no US experience in its construction
5. High risk of schedule delays
6. High risk of cost overruns
7. Limited sources for some specialty materials
8. High cost ($200-300 million) for temporary throw-away work

This first option calls for extending the current period for contract award to the American Bridge team for an additional term of five months or more so that sufficient funding could be secured to finalize this contract. The timing of this circumstance is uncertain and the outcome of the final contract even more so. Under current procurement code in California, the state is unable to commit to any price adjustment or other concessions with a contractor prior to entering into a contract with that organization. Therefore, American Bridge would be required to hold their price constant from May 2004 until the state was in a position to execute a contract with them. With inflation in construction in the range of 5% per year and some materials, such as steel and cement, changing even more, it would be unfair for the state to expect American Bridge to hold their prices firm under such circumstances for any long period of time.

Perhaps the biggest problem with this option is the fact that the state only received one bid tender. The IRT accepts that American Bridge has stated this to be a fair price for the work to be performed. However, without the opportunity for competition there is little the state can rely on about this price and its value for the work desired. It is generally accepted in the contracting industry that owners achieve the most cost effective price when at least two bidders compete. When multiple bidders compete owners then know the market price of their project. At this point, Caltrans does not have this crucial information.

Option 2-Rebid the SAS with contract modifications
Pros
1. Possibility of one or two more bidders creates competition and reduces project costs
2. No further environmental analysis or permitting is required

Cons
1. Some project delay due to the timeframe required to rebid the project
2. Significant constructibility concerns expressed by contractors
3. Complex fabrication issues with bridge components
4. One-of-a-kind bridge with little or no US experience in its construction
5. High risk of schedule delays
6. High risk of cost overruns
7. Limited sources for some specialty materials
8. High cost ($200-300 million) for temporary throw away work

This option has many of the same pros and cons as Option 1-Award the contract to the American Bridge team. Two significant differences lie in the fact that Caltrans can modify the contract terms and conditions in order to create a better bidding environment and the hope that additional contractor teams will want to compete for the SAS work. In the first case, contract terms and conditions can make a substantial difference in how contractors view a project and ultimately price the work. If owners are fair about risk allocation, offer clear terms and conditions which reflect the complexity of the work and otherwise create a favorable environment for pursuit of the construction activities, this encourages contractors to offer competitive prices. This can be done while still guarding the public trust.

Regarding the second point, it is anticipated that at least two teams would need to offer bids on the SAS rebid to achieve some measure of competition. More would be desirable but given the limited population of contractors/contractor teams capable of building a project like the SAS little likelihood exists that the competition would include more than two or three teams. The risk to the state in following this option would occur if no team chooses to bid the SAS the second time around or if only one team bids it again. In the opinion of the IRT that California would then have little choice but to award the SAS on a rebid regardless of the prices submitted on the second round of bidding.

**Option 3-Redesign the main span**

**Pros**
1. Potential for significant cost savings to the state
2. Ability to meet the schedule objectives of the project and complete the work by 2011.
3. Increased competition
4. Ability to build a “signature” type structure
5. Availability of materials
6. Fabrication of materials is simplified

**Cons**
1. Possible conflicts with the E2/T1 SAS foundation contract
2. Cost of redesign of the main span
3. Cost of interface changes with the Skyway and Transition contracts
4. Additional environmental/permitting work
5. Time to complete additional environmental/permitting work
6. Need to change legislation regarding the SAS design
7. Possible schedule impacts to other projects

The final option available to the State of California is the redesign of the main span and the construction of an alternative bridge type. The technical details of this option are presented later. Essentially, this option recognizes that alternative bridge types could be
constructed which still achieve project objectives. These include modifications to the SAS design, the extension of the current skyway work to the east of the main span and the possible use of a cable-stayed design. The cost savings to the state are substantial for the latter two alternative bridge types when compared to the expense of building the SAS as currently envisioned. The cable-stayed alternative is the one considered to be most desirable for replacing the SAS design.

This option is not without risk. Such risks associated with a redesign center around the extent of possible environmental impacts that may occur as a consequence of changing to this new approach. Minimizing these impacts, as well as addressing those that do exist will be essential elements in the success of Option 3. It is the belief of the IRT that the savings are so compelling that to make a substantial effort in this regard is good public policy.

Regardless of the option selected, the IRT feels that any course of action must revolve around three imperatives:

- Fiscally realistic
- Technically sound
- Reflect sound public policy

It is with these imperatives in mind that the IRT has advanced its work and formulated its recommendations to the State of California.

IV. Redesign Alternatives

The as bid price for the Self Anchored Suspension Bridge (Superstructure and Foundations E2, T1) is approximately $1.6 billion with the foreign steel bid. This total includes both the cost for the SAS as well as the E2/T1 contract. It equates to a cost per square foot of deck area of over $4000 which is significantly out of the cost range of more typical (cable stayed bridges) at the same span length. While the project’s seismic criteria and local construction conditions can account for some of this difference, the following factors among others also contributed largely to the high cost:

1. Uniqueness of SAS Design
2. Construction Risk
3. Lack of Competition
4. Steel Fabrication Complexity
5. Construction Requirements (Need for Temporary Piers)

Based on experience and the significant amount of engineering work performed on the East Span Project to date, the following redesign alternatives are expected to result in cost savings of various amounts:

1. Redesign SAS
2. Continue Skyway
3. Redesign as Cable Stayed

In the discussion that follows it is to be noted that the evaluation and cost savings are based on preliminary study and further seismic analysis is required to confirm the potential cost savings and environmental impacts.

Redesign the SAS

The current self anchored suspension bridge could be redesigned by changing the steel tower to a concrete tower and the steel orthotropic superstructure to a steel composite (lightweight concrete) superstructure.

**Advantages:**
- Reduced Expensive Steel Fabrication
- Concrete Construction Familiar to Local Construction Community
- Potential for Increased Competition
- More Adaptable to Temporary Stayed Construction to Avoid Costly Temporary Piers
- Can Meet Project Schedule if Environmental Time Frame is Achieved (See Environmental Discussion)

**Disadvantages:**
- Larger Foundations (Environmental Issue)
- Larger Suspension Cable

**Potential Savings:** $100 – 200 million

Continue Skyway

The current skyway design could be continued to Pier W2 with various design modifications. This design would require additional costly foundations in the bay.

**Advantages:**
- Continuation of Construction Methodology Currently In Use
- Can Meet Project Schedule if Environmental Time Frame is Achieved (See Environmental Discussion)

**Disadvantages:**
- Not a Signature Bridge Solution
- Additional Costly Foundation in Bay
- Potential for Single Bidder (Advantage to Current Skyway Contractor)
- Higher Degree of Environmental Impact due to Additional Pier Requirements

**Potential Savings:** Greater than $500 million

Redesign to a Cable Stayed Bridge
Cable Stayed Bridges have continued to gain worldwide acceptance due to their beauty and economy. The cable stayed bridge was one of the alternates studied during the Type Selection Phase of the project in 1998 and gained stakeholder and public acceptance. Their advantages and cost efficiency are primarily related to the following factors:

1) Improved constructability
   - Proven and faster superstructure construction
   - Temporary piers not necessary in the Bay
   - Contractor familiarity with their construction
   - Simpler structural elements and details

2) High structural efficiency
   - Traditional superstructure construction (Steel composite) familiar to industry
   - Concrete Towers
   - U.S. Stay cable technology

3) Predictable costs above foundation level

4) Greatly increased competition
   - Reduced construction risk over SAS
   - General contractor pool – US Cable stayed bridges generally attract 4 or more bidders
   - Steel framing familiar to US steel fabricators
   - Multiple cable suppliers

The following cable stay redesign options are feasible given the current constraints in the project: Each is based on the use of concrete towers (single tower between roadways), a steel composite lightweight concrete superstructure, and two planes of cable stays (similar to the preferred arrangement studied in Type Selection Phase in 1998).

1) 180 m – 385 m Two Span (Figure 1)
   - Single Tower (55 m taller than SAS)
   - Moderate change in visual form
   - Same foundation locations as current SAS
   - Possible larger T1 foundation
   - Can meet project schedule provided environmental schedule can be achieved (See Environmental Discussion)

2) 180 m – 225 m Two Span (Figure 2)
   - Single tower (same height as SAS)
   - Moderate change in visual form
   - Same foundation locations as current SAS
   - One additional pier required in Bay
   - Possible same size E2, T1 foundations
• Can meet project schedule provided environmental schedule can be achieved (See Environmental Discussion)

3) 140 m – 385 m – 140 m Three Span (Figure 3)
• Two towers (same height as SAS)
• More extensive change in visual form
• Same number of foundations as SAS however require moderate shift in location
• Possible same size E2, T1 foundations
• Can meet/shorten project schedule provided environmental schedule can be achieved (See Environmental Discussion)

All the cable stayed options bring potential cost savings greater than $500 million however they have various degrees of environmental impacts (due to potential foundation increases in size and number and aesthetic considerations), adjacent contract impacts, and schedule impacts. Further seismic analysis is required to confirm the potential cost savings as well as other project impacts.

In order to meet the overall project schedule (completion 2011) with the redesign options requires immediate action. Clearly a not business as usual approach is necessary. Decision on the preferred redesign option needs to occur in the next 3-4 month period. The required design schedule while aggressive can be met based on the significant amount of existing project studies and data and on experience with other cable stayed bridges. The construction schedules are based on as built experience with numerous cable stayed bridges built in the US.

V. Environmental Issues

The environmental process surrounding the East Span of the SFOBB has been thorough and extensive in its outreach to the public and numerous stakeholders. The IRT has been impressed with the level of effort demonstrated by all in moving the project through this process to complete the Environmental Impact Statement (EIS) as well as securing the Record of Decision (ROD) from the Federal Highway Administration (FHWA).

This process has taken years to complete. While a cable-stayed bridge was one of the many alternatives originally considered, the SAS concept and design were ultimately advanced as the locally preferred alternatives for the project. At the time when these decisions were being made the understanding of the substantial cost differential between an SAS design and a cable-stayed alternative was not available.

The IRT understands that the EIS process does not consider cost as an element in making a decision for the locally preferred alternative. However, when two essentially equal alternatives progress through the process with similar environmental impacts, public policy makers involved in selecting between alternative can and should consider the fiscal implications.
The full extent of the environmental impacts for the SAS under Options 1 and 2 are known with a degree of certainty. However, unknown issues may arise during construction. In the case of Option 3, design and analysis must proceed to a higher level before definitive statements can be made about environmental impacts. This work can be done in a matter of months and will reveal the full extent to which a cable-stayed bridge would impact environmental issues or existing permits.

A number of possible environmental impacts may result from advancing a cable-stayed design. Questions must be answered concerning the foundations relating to design, construction, and final impact on the Bay. While the appearance of a cable-stayed bridge is very similar to an SAS, any concerns related to this visual issue would have to be fully considered before moving ahead with this design. Further analysis will offer the information needed to understand how extensive the environmental impacts are and what measures will be required to mitigate those impacts.

The extent of the impacts will determine whether a Supplemental Environmental Impact Statement (SEIS) will be required or if the changes can be accommodated with a Reevaluation. For its analysis, the IRT has assumed that the impacts are modest enough to allow the state to go through the environmental process in a period of 18 months. It is understood that this is an aggressive schedule given the years of analysis and consideration that led up to the original EIS document being approved. However, the IRT believes that many of the past issues and solutions will remain in place and that there is a renewed community will to advance the best technical and most cost effective solution. These two factors will allow for an efficient review effort that honors the environmental process and which reflects good public policy.

VI. Recommendation

The Independent Review Team has considered volumes of information and inputs while addressing the issues included in this scope of work. These efforts cover the past year and a variety of elements of the TBSRP. Given the preliminary information to date, the Independent Review Team is prepared to make a recommendation for the near term which we believe will lead to the best long-term solution for the main span of the SFOBB.

The recommendations of the IRT to the State of California are as follows:

1. **Do not award the contract to the current single bidder even if funds are secured in a timely manner.** This is the least desirable option and will likely result in the highest final cost for the project.
2. **The state should advance the main span project on two parallel courses which involve Option 2-Rebid the SAS contract with modified terms and conditions and Option 3-Redesign the main span.** In doing so, the state must utilize the next two months to further analyze the redesign cable-stayed alternatives to better understand their environmental/permitting issues as well as seismic and other performance characteristics. If, at the end of this period
the impacts of advancing a cable-stayed design are manageable and the savings compelling enough, then it is the belief of the IRT that this will be the most desirable course to follow. Meanwhile, Caltrans will continue to work on the contract terms and conditions of the SAS with an eye towards rebidding the project if Option 3 is found unworkable.

By advancing these two options the state will preserve the design and contract documents of the current SAS and the option to rebid with what appears to be the most cost effective solution for completion of the main span of the eastern portion of the SFOBB. This approach will lead the state on a positive course towards completion of the East Span of the SFOBB. It provides a solution that is technically sound, cost effective and reflective of sound public policy.
APPENDIX A

The Independent Review Team is composed of professionals from all areas of the transportation and construction industry. When formed in September 2003 the IRT had a membership of seven individuals. Since September 3, 2004 one individual, Tony Wilson has not been involved and two additional IRT members have been invited to participate. These two new members are Pat Gelb and Mike Davis who both have specific expertise in the environmental issues relating to the Bay Area and projects such as the East Span of the SFOBB. A summary of the curricula vitae for each member of the IRC is provided below:

Thomas R. Warne, P.E. is the president and founder of Tom Warne and Associates, a management and marketing consulting firm focusing on assisting public agencies, engineering consultants and contractors in their quest for effectiveness and profitability. Mr. Warne has been involved in a number of national organizations and initiatives through much of his career. He is a past President of the American Association of State Highway and Transportation Officials (AASHTO), and spent two years as the chairman of AASHTO’s Standing Committee on Highways, which is the Association’s main technical body for all standards development. He continues to be involved with numerous public policy initiatives at the national level. His major project engagements include the Woodrow Wilson Bridge, the Trans Texas Corridor, Pasadena Gold Line, University Light Rail, Legacy Highway, Tri-Rail Double Track, and other major projects and programs. Prior to starting his own firm, Mr. Warne served as the Executive Director of Utah Department of Transportation (UDOT). He was appointed in 1995 by Governor Michael O. Leavitt, and for six years led Utah’s third largest state agency of 1800 employees. While with UDOT he was responsible for the I-15 Reconstruction Project, which was finished 3 months ahead of schedule and $32 million under the $1.59 billion budget. The I-15 project established design-build as the process of choice for large, high profile highway construction projects. Mr. Warne served in numerous positions with the Arizona Department of Transportation (ADOT) and as ADOT’s Deputy Director and Chief Operating Officer (COO) for the last three years he was there. As the agency’s COO, he was responsible for the $4.5 billion regional freeway system program in the greater Phoenix metropolitan area. Mr. Warne also served as the State Construction Engineer for ADOT where he was responsible for state’s $500 million annual statewide construction program.

Tom Schmitt PE, RLS is the President of T & S Diversified, Inc. a company providing a number of services including management consulting which offers assistance with public sector administrative processes. Mr. Schmitt is a Civil Engineering graduate of Cal Poly Pomona and while in school he worked for California Department of Transportation. After graduating he became a Facility Engineer for E & J Gallo Winery, went on to be a Plant Engineer for Peter Paul Candy Company and then a representative for Garratt Callahan in Industrial Water Treatment until he joined the Arizona Department of Transportation (ADOT) as a Resident Engineer. He was later promoted to Area Engineer, Urban Highway Engineer and then District Engineer in Tucson where he was responsible for construction and maintenance for the Southwest portion of the state. Mr. Schmitt was then asked to be the Director of the Motor Vehicle Division where he was
responsible to collect approximately $1 billion per year in revenue for the transportation system. In his next position as Chief Engineer for ADOT he was responsible for an annual $800 million Capital Program. Mr. Schmitt helped pass the Design Build Legislation and oversaw the first three major Design Build projects while with ADOT. After retiring from his five year tenure as Chief Engineer, he spent several years with RBF Consulting developing their Public Works section in Arizona. He has had a very diverse career and provides a valuable perspective having worked in both the public and private sectors. Over the years, Mr. Schmitt has participated in a number of local and national committees including the Standing Committee on Highways (SCOH) with Association of State Highway and Transportation Officials (AASHTO) and The Association of General Contractors of America (AGC) Transportation Committee. He is also currently the Chairman of the Friends of Civil Engineering for the Arizona State University, Civil Engineering Department as well as Chairman of the Heavy Civil Committee for the Del E. Webb School of Construction.

John R. Lamberson, a graduate of the University of California, is a member of Lamberson Consulting, a management consulting company specializing in management issues and administrative processes for construction companies. Mr. Lamberson has made the construction industry the focus of his career, specializing in insurance and bonding services to contractors. Over the last three decades, he has been involved in providing surety bond guarantees and insurance policies internationally and within the United States. In addition, Mr. Lamberson has been a member and obtained leadership positions in many construction trade associations and surety industry organizations, such as serving as Chairman of the Associated General Contractors of America’s National Associate Members Council and chairing the Affiliate and Public Awareness Committees of the Associated General Contractors of California. Other memberships include Construction Financial Management Association, The Beavers, The Moles, Building Futures Council, The Associated General Contractors of America, and The Associated General Contractors of California. He has also aided in raising funds for education in construction and often lectures and writes articles for the construction industry. In 1994, Mr. Lamberson was named winner of AGC of California’s Associate Achievement Award for many years of outstanding service to the construction industry. He was the first insurance broker ever to receive this prestigious award.

Ray McCabe P.E. is a Senior Vice President of HNTB and is the firm’s National Director of Bridges and Tunnels, which provides national oversight to the firm's bridge and tunnel design services. He is a licensed engineer in four states including California and holds a BS degree in Civil Engineering from City College of New York as well as an MS degree in Structural Engineering from Polytechnic Institute of New York.

Ray McCabe has over 25 years of professional experience, during which time he has been responsible for the structural design and/or plan production of numerous long span, movable, and complex bridge projects. Recent bridge projects for which he has played a major design role include:

- The Charles River Bridge, Boston, MA
- Storrow Drive, Boston, MA
- Goethals Bridge, Staten Island, NY
- Maysville Bridge, Maysville, KY
• Blennerhasset Bridge, Parkersburg, WV
• Bandra Worli Sea Link, Bombay, India
• Delaware Memorial Bridge, Wilmington, DE
• Cooper River Bridge, Charleston, SC
• Dames Point Bridge, Jacksonville, FL
• Maumee River Bridge, Toledo, OH
• Cape Girardeau Bridge, MO
• Many others

In addition, Mr. McCabe was member of the Constructibility Review team for the East Span Seismic Safety Project for the SFOBB in March of 2002. He has authored over 10 papers on the design and construction of long-span bridges and has received two awards from the James F. Lincoln ARC Welding Foundation for his work.

Matthew “Tim” McGowan, is a construction industry consultant with nearly 50 years of experience. Between 1957 and 1993, Mr. McGowan was employed by J.H. Pomeroy & Co., the last thirteen years of which he was its president and CEO. The company has appeared in the Engineering News Record list of the largest 400 contractors in the United States. His construction career has focused primarily on ground support systems, deep foundations, bridges, marine construction and the pre-casting of structural concrete products for major over-water bridge structures. In addition to his technical experience, Mr. McGowan has provided arbitration, mediation and dispute resolution services to the construction industry for the past 10 years. Mr. McGowan is currently a member and co-chair of the six-person California Public Works Arbitration Committee which is responsible for managing the public works arbitration system in California. He has arbitrated and mediated disputes involving intent of contract documents; disputes between owners, architects and contractors; disputes between contractors, subcontractors and material suppliers; and disputes between subcontractors. He also has experience in arbitrating and mediating disputes involving labor contracts. He is past president of the Associated General Contractors of California and of the Pile Driving Contractors Association. He is a life member of the American Society of Civil Engineers.

Terry Hays, is a mechanical engineer with 30 years of experience in engineering, design and value management for a variety of applications. He has extensive experience in leading value engineering training seminars and workshops for government, municipal and industrial clients and has participated in many detailed value engineering studies of technical facilities and processes. Mr. Hays’ engineering assignments have included the design and development of components for the automobile industry, directing value engineering studies which focus on future products and development, structural analysis of new vehicles, and concept development for new products.

Mr. Hays has conducted over 350 VE studies on a wide range of Construction projects. He has served as project manager and principal team leader for indefinite quantity VE contracts with California Department of Transportation, Southwest and Pacific Divisions—Naval Facilities Engineering Command, New York City—Office of Management & Budget, and Corps of Engineers—Sacramento District.
Mr. Hays has been a leader in applying the Value Engineering process to the development of program concepts (FACD) and planning strategies. Terry is experienced in conducting customer/user focus panels to identify and understand critical project issues. Results of the focus panel are directly used during the VE study. Terry has integrated focus panel and VE techniques into the Partnering Sessions, Concept Development and Planning Studies he conducts. Mr. Hays wrote the chapter on value engineering for Maynard's Industrial Engineering Handbook – fourth edition, published by McGraw-Hill, Inc., 1992, and he has published several papers on Value Engineering and written training manuals on value engineering that covers construction projects, product designs, manufacturing processes, and administrative systems and procedures.

Pat M. Gelb is a Principle Project Manager with Parsons, with over 30 years' experience in transportation, including alternatives analysis, NEPA/CEQA environmental review and permitting, public outreach, regulation, and program evaluation. Assignments have emphasized project organization, management of schedule and budget, supervision of technical team, and preparation and processing of environmental documents and permitting for FHWA, FTA, Caltrans, and other state and local agencies.

She manages and directs San Francisco Office Transportation and Environmental Planning Departments. In this capacity she has provided environmental services to a variety of clients on significant and complex projects. Past projects include the Route 1 HOV Widening Project in Santa Cruz, for Santa Cruz County Regional Transportation Commission and Caltrans, District 6, Deputy Project Manager and Environmental Lead for accelerated schedule EIS/EIR for Phase 2 of the South Sacramento Corridor LRT Extension (FTA) for Sacramento RT, Environmental Lead for the New Transbay Terminal/Downtown Caltrain Extension/Joint Development/Redevelopment EIS/EIR (FTA), Environmental Lead for Sacramento Amtrak and Folsom Extensions EIS/EIR (FTA), for Sacramento Regional Transit. EIS/EIR (FTA) Coordinator for CalTrain Downtown San Francisco Extension Draft EIS/R (FTA) and others including the reconstruction of the Cypress Freeway.

Pat holds degrees from the University of California at Berkeley (M.A., 1967) and Stanford University (B.A., 1965).

Mike Davis provides environmental planning, transportation planning, community revitalization, and historic preservation; direction of environmental impact assessments, alternatives analyses (AAs), and environmental screening studies for transit and roadway projects; assessment of the environmental impacts of transportation projects, satisfying National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and associated federal, state, and local regulations; and preparation of environmental impact statements (EISs) for rail transit and highway projects and environmental assessments (EAs) for transit centers and roadway grade separations. Mike manages large-scale, controversial transportation environmental review projects. He is also a Jones & Stokes Learning Center instructor, co-teaching an annual series of courses addressing NEPA compliance for transportation projects throughout California. In addition, he has co-taught sessions in NEPA purpose and need development for the
U.S. Environmental Protection Agency, Region IX, and CEQA compliance for the North Region of the California Department of Transportation (Caltrans).

Mike Davis’ project experience includes San Francisco–Oakland Bay Bridge East Span Seismic Safety, I-80/I-680/SR12 Interchange Improvement Project, Jepson Parkway EIR/EIS—Solano Transportation Authority, Caldecott Tunnel Fourth Bore, Harkins Slough Bridge Replacement—Mark Thomas & Co./County of Santa Cruz, Warm Springs Extension—San Francisco Bay Area Rapid Transit District (BART), and others.

He holds an M.A. degree in Urban and Regional Planning from Texas A&M University, and a B.A. Geography, University of North Alabama, Florence, 1978
APPENDIX B

The original engagement of the Independent Review Team (referred to as the Independent Review Committee (IRC) at that time) was to consider the options available to Caltrans for advancing the E2/T1 foundation contract to construction. During the summer of 2003 the state had received a single bid for this project that was 65% above the engineer's estimate. Desiring to examine available alternatives Caltrans engaged the IRT to offer recommendations for moving the project ahead.

The Executive Summary of the IRC for this work is found below. A full copy of the final report can be made available from Caltrans.

Executive Summary

After the 1989 Loma Prieta earthquake, the California Department of Transportation (Caltrans) determined that the East Span of the San Francisco Oakland Bay Bridge from Yerba Buena Island to Oakland was vulnerable to further damage when another event occurred. The decision was made that the East Span of this critical transportation lifeline would need to be reconstructed to ensure the safety of the traveling public from future seismic activity.

For over a decade, the San Francisco Oakland Bay Bridge (SFOBB) Seismic Safety Program has progressed towards having a completely new East Span constructed. Two of the final contracts for this program are the E2/T1 foundation contract and the Self Anchored Suspension (SAS) signature bridge section adjacent to Yerba Buena Island. On August 19th, 2003, bids were opened for the E2/T1 foundations Contract (No. 04-0120E4), which is part of the East Span Seismic Safety Project for the San Francisco Oakland Bay Bridge (SFOBB). The single bid was approximately 62% ($81 million) over the engineer’s estimate of $129 million. After careful analysis Caltrans found this single bid to be unacceptable and rejected it on October 10th, 2003.

In response to the higher than expected bid on the E2/T1 foundation contract, Caltrans advanced two parallel and complimentary initiatives. First, the decision was made to repackage and re-bid the E2/T1 project with many substantive changes made to the requirements to the contract. Second, Caltrans determined that it would be appropriate to form an Independent Review Committee (IRC) that would objectively look at the E2/T1 contract in detail and various SAS project issues in order to advise the agency on future actions that would be advantageous to the state. This IRC is chaired by Thomas R. Warne, PE, former Executive Director of the Utah Department of Transportation and is composed of individuals whose professional credentials allow them to provide objective and critical analysis of the current bidding circumstances on the East Span projects.

The Independent Review Committee began their work on October 13, 2003 and concluded with a report to Caltrans on November 17, 2003. During this time the IRC assessed the elements of the E2/T1 and SAS contracts, made industry inquiries, reviewed the construction schedule, conferred with Caltrans project staff, and engaged in other
discussions and activities that provided insight and understanding concerning the current state of affairs on the East Span as well as an ability to offer constructive recommendations to Caltrans about future bidding strategies. This report contains summary information from that which was gathered by the IRC as well as the recommendations that it offers Caltrans for their future action.

The IRC’s work was completed in just over a month. Consequently, there was a limitation as to the depth that the members could delve on the various issues. However, the IRC is convinced that the recommendations in this report will assist Caltrans in containing costs and maintaining their schedule objectives. Principle among the recommendations to contain costs and achieve schedule goals is to create competition on future contracts through specification modification, adjustments to requirements and bidding/contract timing. In addition, the IRC has concluded that addressing the “Buy America” conditions of the earlier contracts will provide the most potential savings of any of the changes that might be adopted on the future East Span contracts.

The recommendations in this report should not be seen as all-inclusive but rather as a first step in adjusting bidding strategies, contract requirements and constructibility concerns with the East Span projects. Additional detailed work in the areas of construction sequencing/staging and other technical areas of these contracts would be appropriate in the future.
APPENDIX C

The IRC was engaged in early 2004 to examine alternatives relating to advancing the East Span of the SFOBB with particular interest in the main span or SAS project. The following is the draft report prepared for Caltrans by the IRC is included without its accompanying figures:

Independent Review Committee
SFOBB IRC Enhanced CRIP Specification Development
(TO-286)
Draft Report
April 5, 2004

Background

The Independent Review Committee (IRC) that was constituted in September 2003 was asked to further review the proposed Enhanced Cost Reduction Incentive Proposal (CRIP) specification recently developed by Caltrans staff. This request was based on earlier input by the IRC regarding the Enhanced CRIP and how it might be more effectively implemented to the benefit of Caltrans and the state of California.

In the IRC's draft report on the Enhanced CRIP requirements, it was noted that Requirement No. 11 which stated “Changes to the bridge's structural system that change the bridge's response to dynamic loading will not be considered, including but not limited to changes in parameters that change the wind effects, mass, stiffness or energy absorption characteristics” was extremely restrictive, and would thus eliminate any substantive changes to the bridge and consequential cost savings. Thus, Caltrans determined to have the IRC consider modifications to the parameters of Requirement No. 11 to further improve on the Enhanced CRIP specification.

Approach

Due to the specialized nature of this new analysis it was determined that only Tom Warne (IRC Chair, Tom Warne and Associates, LLC) and Raymond McCabe (IRC member, Chief Structural Engineer for HNTB) provide the requested review. On Wednesday, February 25, a conference call was conducted between John Tapping (CALTRANS), Brian Maroney (CALTRANS), Tom Warne (IRC) and Raymond McCabe (IRC) to further discuss the Enhanced CRIP the SAS bridge. The intent of the call was to further clarify the desires of Caltrans and how Requirement No. 11 might be changed.

While many topics were covered in the conference call, it was stated that CALTRANS' intent was to save as much time and money as possible through the Enhanced CRIP process. However, it was also affirmed and understood, that significant changes to the bridge (which would produce high cost savings) would have to go through the numerous organizations and review agencies for approval and thus there would be significant risk and perhaps low probability of success. Based on the input from this conference call the IRC members examined Requirement No. 11 as well as other options that might be feasible for Caltrans to pursue to achieve the time-savings and schedule objectives of this effort.
It is clear that the California Department of Transportation has been through an environmental and public involvement process for the East Span of the San Francisco Oakland Bay Bridge (SFOBB) that is probably without equal in the country. The level of public involvement was significant and involved numerous public bodies who provided Caltrans and one another with valuable input into the final product. Caltrans listened to this input and the current design and aesthetic elements of the East Span of the SFOBB are the products of that effort. Commitments made in the public involvement and environmental processes are viewed by Caltrans and their public partners with seriousness and any changes or modifications to the same would be carefully evaluated.

It is generally understood that to take a project back through a bridge type selection process is a high risk proposition and generally unsuccessful when small cost savings would result. In the case of the SAS Bridge, it appears that some potential major modifications to the bridge would result in significant cost savings. However, regardless of the potential cost savings, each proposed change warrants a close assessment of the associated risks, environmental implications, impacts on public commitments and other elements of the SFOBB program. While this brief report provides some insight into the potential options available to Caltrans, any new course of action must be examined in such a way so as to weigh the environmental/public involvement commitments and issues along with potential cost savings to the state.

**Assessment**

**Current Construction Cost and Potential Cost Savings**

The CALTRANS current estimate for the SAS contract is $800 million. Adding in the cost of the E2/T1 contract brings the bridge cost to approximately $1 billion. Feedback from the construction community indicates that the aggregate price tag may more realistically be in the 1.2 – 1.5 billion dollar range. This price tag is difficult to independently confirm and will probably be dependent on the contractor’s individual assessment on the risks associated with the project. Many factors impact the prices public agencies receive on their large transportation projects. Some of these factors include:

- Size of the project
- Complexity of the project
- Number of bidders
- Unusual contract requirements
- Specialized equipment
- Materials issues
- Contract provisions
- Other competing work in the US
- Other competing international work
- Surety issues

All told, a public agency must configure their contracts to mitigate these issues in order to receive the most competitive price possible for a given project.
The type of bridge selected for a given project is a major factor in the final cost to the public agency. Span length, seismic requirements and other issues are all part of the consideration given in the selection process. In the case of the SFOBB, a lengthy and complex environmental and public involvement effort preceded the selection of the Self Anchored Suspension (SAS) bridge and the preferred design that met both the engineering requirements of Caltrans as well as the aesthetic interests of the community.

The IRC considered the rewrite of Requirement No. 11 as well as possible cost saving associated with alternative bridge types that might emerge from either an Enhanced CRIP process or a re-evaluation by Caltrans of the SAS concept. For comparison purposes, alternative bridge types were compared based on their overall cost. Figure 1 shows order of magnitude costs (cost per sq. ft. of deck) vs. main span length for various bridge types based on today's dollar. These curves are based on data from numerous long span bridge projects in the United States and typical foundation conditions. Due to the generally poor foundation conditions and high seismicity in the Bay Area, foundation costs are substantially higher than typical foundations. Based on recent data, this increased foundation cost is in the range of 300 to 500 dollars per square foot. The dashed line shown in the figure represents an increase of $500/ft². Plotted on the graph are the Carquinez Bridge, Benecia Martinez Bridge (Bid Cost and Current Projected Cost) and SFOBB Skyway. Also plotted is the SAS bridge based on a range of costs from 1 to 1.5 billion. As can be seen, the SAS bridge is substantially higher in cost per square foot when compared to more typical long span bridge costs and thus the potential for large cost savings exists.

Cost Reduction Options

The Cost Reduction Options presented in this report by the IRC include both the re-write of Requirement No. 11 as well as options relating to modifications to the SAS and alternative bridge types. In an effort to quantify potential cost savings, a number of options have been considered. These options are illustrated in Figure 2, which also provides: approval risk with stakeholders, a range of potential cost savings, design process, schedule impact and the schedule risk. Included in the cost savings are: redesign costs (20 million), partial reconstruction of W2 (10 million), delay costs due to canceling the E2/T1 contract (10 million) and inflation. The options are limited to the two bridge types that were studied and presented during the preliminary phase, i.e. self anchored suspension and cable stayed.

Description of Options

Option 1-Enhanced CRIP

It is the IRC's belief that a substantive re-write of Requirement No. 11 will not preserve the SAS concept and achieve the cost savings desired by Caltrans. If significant savings are the desire of the agency then Options 2-5 are better avenues and would be advanced through means other than the Enhanced CRIP process. On the other hand if the SAS is to
be preserved as the chosen bridge type, and small savings are acceptable, then an Enhanced CRIP specification could be incorporated that would allow minor detail modifications that could result in minimal savings to the project. These are estimated to be on the order of $50 million. These changes would have minimal impact to the bridge’s performance characteristics and basically no visual impact. However, in general, it is the observation of the IRC that contractors generally do not incorporate substantial design changes into complex projects since these changes pose significant schedule risks. The IRC is also concerned that significant changes to the bridge and the associated cost savings are not appropriate for a CRIP process due to the sensitive nature of this project and the critical seismic issues.

**Option 2-SAS with Concrete Tower and Simplified Deck Design**

Option 2 is similar in most aspects to the current design except the tower is concrete and the superstructure is a simpler steel composite framing with a lightweight precast or cast in place deck.

**Option 3-Two Span Cable Stayed Bridge**

Option 3 is a two span cable stayed bridge with spans matching the current design (180, 385). The tower is concrete and is 55 m higher than the current tower to be more optimum and present a more world-class structure. The tower is located between the roadways and two planes of stays are anchored to the outside of the two roadways. If necessary, the tower could be kept to the height limitation of 160 meters with increased cost. The superstructure is simple steel framing with a light precast weight concrete deck.

**Option 4-Two Span Cable Stayed Bridge-Shorter Main Span**

Option 4 is a two span cable stayed bridge (180, 225) with a shorter main span (shortened by the equivalent of 1 additional approach span of 160 meters). The tower and superstructure is similar to Option 3.

**Option 5-Three Span Cable Stayed Bridge**

Option 5 is a conventional three span cable stayed bridge (140 – 385 – 140) with a main span equivalent to the current design. The back spans are 140 meters and thus require a westerly shift of the T1 and E2 foundations. Tower and superstructure are similar to Option 3.

**Schedule Impacts**

Based on the schedule dated October 28, 2003, the SAS contract would be completed February 2010 assuming a January bid opening. This bid opening has been pushed to May, 2004 thus the current anticipated completion would be June 2010 (i.e. 6 year construction duration). While time constraints on the IRC prevent a detailed schedule
analysis it has been possible to review the time impacts of the various options on the completion date of the East Span. The following descriptions provide a basic breakdown of the schedule impacts associated with the options presented in this report:

**Option 1 – Enhanced CRIP**

With a properly specified CRIP clause in the contract, it is anticipated that the contractor could make changes to his fabrication and erection methodology that would result in both cost savings and timesavings. The maximum timesavings have been estimated to be approximately 20 percent of the deck fabrication and erection duration or about 6 – 7 months.

**Options 2-5**

The IRC analysis of schedule impacts for these options has included the time involved for the environmental issues, permitting requirements as well as the actual design and construction elements of the contract. These schedules assume that modifications necessary to the EIS and associated permits could be completed in as little as a 6-month time frame or as long as two to three years. This has as much to do with “political will” as it does with the mechanics of the process. In addition, much of the redesign effort would be performed in parallel with the EIS reassessment. Based on these assumptions Options 2 and 3 are anticipated to take from six to eight years while Options 4 and 5 would take from five to seven years.

**Conclusion**

It is never an easy task to go back and revisit a structure type on a project as sensitive as the SFOBB. There are other projects around the country where this has been necessary but in no case has it been an easy process. However, in the case of the SFOBB, the potential cost savings using a different or modified structure may be too significant to ignore. Based on the limited knowledge of the IRC, the major issue that entered the final structure type selection was its aesthetics. Revisiting the stakeholders with the current project status, possible options (which are similar to what they voted on initially) with their associated cost savings and schedule impacts may be the prudent thing to do.
180m – 385m Two Span

Figure 1
180m – 225m Two Span

Figure 2
140m – 385m – 140m Three Span

Figure 3
Box 6, Folder 1

Item 5

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