Report 00-X

Constructability: A case study in Transportation Project Delivery: San Francisco-Oakland Bay Bridge New East Span

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Sarah Picker

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16. Abstract

The Norman Y. Mineta International Institute for Surface Transportation Policy Studies (IISTPS) at San José State University conducted this study to review the issues and implications involved in the project in question. This text needs to be written. After thorough legal research, the project team reached the following conclusions:

SUMMARY OR PROBLEM:

1) The layout and text of this section will vary with each project.

RECOMMENDATIONS

1) This section number 16 of the technical report page may be written by the project team or extracted from the text of the final report by IISTPS staff or the editorial associate

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IISTPS
College of Business—BT550
San José State University
San Jose, CA 95192-0219
Tel (408) 924-7560
Fax (408) 924-7565
Email: iistps@iistps.cob.sjsu.edu

http://transweb.sjsu.edu

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EXECUTIVE SUMMARY

This paper will examine constructability issues for by a case study in transportation project delivery of the San Francisco Oakland Bay Bridge. This is a strategic analysis of a transportation industry process. It is a comprehensive in depth study of an important, current transportation infrastructure project delivery concept. The paper gives an example of the benefits for constructability considerations for the New East Span of The San Francisco-Oakland Bay Bridge (SFOBB).

Public works projects market represents opportunity for construction services. Public works represents vast expenditures of funds raised through income, property and use taxes, gas taxes, special district assessments and public bonds. These funds are administered through public agencies run by elected officials.

ASCE report card on the nations infrastructure for 2001 gives America's Infrastructure Poor+ rating. ASCE estimates that over 5 years, $1.3 Trillion dollars is needed to be invested in our infrastructure. [1] Infrastructure project delivery tools need to be developed to keep the infrastructure development spending in check.

The paper will define constructability, provide a description of the project delivery process and where constructability is being implemented, and provide a case study and the tools developed by the project manager to investigate constructability issues.

Caltrans mission is to increase mobility. One component is to provide infrastructure related to mobility. To provide the infrastructure, the transportation agency must be able to construct or build transportation features. To build it you must be able to bid. To bid, you must have contract documents (Plans, Specifications & Estimate (PS&E)). To bid and build, the PS&E has to be constructible.

The paper showcases ability to apply MTM coursework to practical professional conditions. The project is my individual effort to show a practical, integrated application of marketing, finance, operations, management information systems, organizational behavior to meet a transportation infrastructure project delivery.

Addressing constructability is asking; will it bid and award?

The Project Manager and Caltrans decision-makers have been given competing objectives in implementing transportation infrastructure project delivery: mobility, safety, jobs, economic development, environment and social equity. At times it seems difficult to gain agreement on a single direction or objective.

On one hand, project manager is responsible to investigate possible cost savings. Bid competition tends to lower costs. Cost savings are derived from competition. Increasing the number of bidders on a job is generally considered to increase competition and have cost savings benefits. The Project Manager must investigate all components of the process to realize cost savings wherever they may be.

One consideration is how to identify potential bidders. They are the primes contractors, subcontractors, suppliers, fabricators. They express interest in being able to participate in constructability process.

Also, The paper began as examination of how to internally manage a Buy America alternative bid within the competitive bidding process at Caltrans. The process used by Caltrans to analyze the contract bids from contractors needed to be modified to consider the particularities of a Buy America alternative bid process. Is there a communication tool or process that needs to be created to accommodate the changing face of transportation infrastructure development? I started to consider constructability through this analysis. I sought to define constructability and how it relates to the bid process.

CHAPTER 1 - CONSTRUCTABILITY

WHAT IS CONSTRUCTABILITY

John Haymaker describes constructability in his paper Multi-Disciplinary Semantic Models as "Constructibility may be defined as the optimum use of construction knowledge and experience in the planning and design of projects to achieve overall project goals. Overall project goals can be generally expressed as meeting customer needs for the least cost and least intrusion."[2]

Caltrans states that constructability is
"The optimum use of construction knowledge & experience in planning, design, procurement & field operations to achieve overall project objectives. They further definite constructability as, "the ease or expediency with which a facility can be constructed." [3]

Further, constructability may be described as "Construction planning and constructability analysis involves the integration of diverse, sometimes conflicting criteria into a coherent solution. This research investigates multi-disciplinary constructability analysis as a process of negotiation between multiple, domain specific semantic models. In practice, we theorize, semantic models are generated mentally to keep pace with a changing design. The process of negotiation involves mediation between these semantic models, looking for solutions that satisfy all the domains. Projects today contain a level of complexity where it is no longer a simple matter to mentally develop these domain specific semantic models, and even more challenging to conduct the negotiation between semantic models."[4]

Constructibility is the integration of construction expertise into the planning and design of a project so that the construction forces have the maximum opportunity to deliver the project in conformity with cost, quality, and schedule and safety objectives of the project's stakeholders. Others posit that constructability is "simply a matter of using features of the site itself to make the work easier and faster".[5]

A Project Manager committed to consider any improvement to the project through construction is considering constructability.

Constructability is asking, "Is it biddable, is there anything to be done that can make the PS&E more biddable?" Biddable means the project manager has explored every opportunity and alternative to make the plans and specs clear concise, errors and omissions. Two fundamental questions are "can it be built without significant contract change? And can the project be bid rationally?"[6]

Constructability is the incorporation of construction expertise into the design process so that it will meet all of the design requirements, including aesthetics, at the lowest reasonable cost of construction.[7]

It is an approach to project development, policies and resource availability and can be a key factor in determining the project scope and complexity.

WHY CONSIDER CONSTRUCTABILITY

Project Managers are given competing objectives: jobs, economic development, mobility, environment, social equity. It is difficult to gain agreement on a single direction or objective. Project Delivery process helps to define that objective as a public works project. Public works projects should distribute benefit and costs.

Further, the project manager is responsible to investigate possible cost savings. Cost savings are derived from competition. Increasing the pool of bidders on a job is generally considered to increase competition and have cost savings benefits. On the other hand, the project manager must keep the project delivery on schedule. Considering constructability helps create a balance between cost and schedule.

One goal of constructability is to minimize number and magnitude of Changes, Disputes, Cost overruns and delays during construction.[8] Another objective is construction documents that are biddable, buildable, operable and maintainable[9].

Considering constructability review helps to achieve a highly competitive bidding process.[10] This can be addressed by the project manager's identification, management, mitigation and delegation of risk as the assigned representative of the owner. Considering constructability can test whether that has happened.

Good Contract documents help create rational bids and to minimize problems during construction [11]. One objective is to distribute benefit and costs. This can be achieved by constructability review. Consider economics, availability of materials, site restrictions, local conditions, environmental considerations, maintenance, protection of traffic, construction safety.[12]

When project delivery uses the design-bid-build project procurement process, the issues of constructability arise in all phases. Design Constructability can be considered using tools developed at Caltrans.

One can consider constructability in terms of Caltrans Context Sensitive Solutions. This is a policy that outlines an approach that will make it possible for Caltrans to maintains its responsibilities for safe interregional mobility while being responsive to natural, cultural and build environments. The policy takes the best of the

department's creative and collaborative problem solving approaches and mainstreams them, with the purpose of making projects fit their surroundings more gracefully. Using this approach may be the only way large and complex projects can be delivered successfully.

Directive requires that attention be given to the following issues:

- Safe and efficient transportation for all users of the highway system
- Support for the Americans with disabilities act.
- Attainment of community goals and objectives.
- Transportation needs of low-mobility disadvantaged groups
- Support of the state's economic development
- Eliminating or minimizing the adverse effect on the environment, natural resources, public services, aesthetic features and the community
- Realistic financial estimates
- Cost-effectiveness

There are common factors between constructability and Concept sensitive Solutions such as cost-effectiveness, attainment of community goals.

One expert claims he has suffered through many years of building process that were unnecessarily difficult because constructability had not been considered.[13]

HOW TO CONSIDER CONSTRUCTABILITY

One way to consider constructability is, through the constructability review. In the broadest sense, the constructability review is the identification of project-specific issues, probable consequences and proposed mitigation recommendations[14]. The desired outcome is consistency, applicability, enforceability and comprehensiveness of the general condition ("front end" documents).[15] To develop high quality contract documents, it is suggested that the design team have a constructability review during the planning and design phase.[16] One goal of a constructability review is to identify means to minimize additional cost cause by latent market conditions, leading to contract time extension and extended overhead.[17]

To do this, the constructability review team must be able to recognize and understand the original intent of the designer, and introduce constructability in ways that hold true to that intent. Without this empathy for the design and the designer,

the result will be a constant battle of wills and territorial authority that is hugely detrimental to the constructability review process and the project.[18]

There should be someone on the team who understands means and methods. That person should have experience in construction practices, local considerations and the availability of different resources. The review team needs input from all of the following areas: Planning, Design, Construction, Operation, Maintenance.[19]

Constructability process needs to be considered from the planning stage through construction. One issue is the need for a process for integrating constructability review into the project development process or redefines how best to get the constructability review into the development process.

The team composition could change through the various stages. Use the team approach and have core members (such as planners, designers, construction personnel) and ad hoc members depending on the needs at the various process stages. Head team by a "constructability engineer" who has broad construction backgrounds and provides guidance and specific analysis of project constructability issues. Some ad hoc members may be project manager, structural designers, safety experts, right-of-way, traffic, AGC, and other experts. Should be an interactive cyclic process where the constructability review team reviews each phase.[20]

The reviewers assess the project specifications, plans, estimates, and schedule. A multidisciplinary team conducts the review and looks for ways to improve on the existing PS&E or ancillary procedures and issue resolutions. Constructibility review checks the construction drawings and specifications for consistency, clarity, and completeness. [21]

Constructibility review checks for applicability of construction installation technology, methodology and materials. It also should check for consistency between plans and site conditions.

Items of constructability review: Cross-check the structural, architectural, mechanical and electrical plans & Check plans for complete and accurate information & Check the specifications for complete and accurate information.[22]

For many, the constructability process has consisted of a constructability review of plans that are some percentage complete, It has general been thought necessary to complete plans to a certain level so that the constructability reviewer will have something to review. What a revised constructability review process emphasizes instead is that construction expertise must be brought in before any design is put to paper.

A construction expert would look at the proposed project through the eyes of the potential constructor and consider the advantages and disadvantages of the potential design alternatives, along with the scope of the project. A construction expert would also determine the type and size of contractor that could handle such a project and whether any would be available to bid on it.[23]

The team can ask, "can it be built". Critical aspects of this question would involve staging, environmental timing restrictions (noise restrictions, dredging), and the Endangered Species Act.[24]

The timing of constructability review should be coordinated with any Value Engineering review during the design phase. If value engineering adopts alternative construction methods, the alternative construction methods should be considered in the constructability review (i.e. value analysis before constructability review).

When used in a project delivery process consideration, constructability covers a wide range of topics. The constructability review is done throughout the project development process.

CHAPTER 2 PROJECT DELIVERY PROCESS

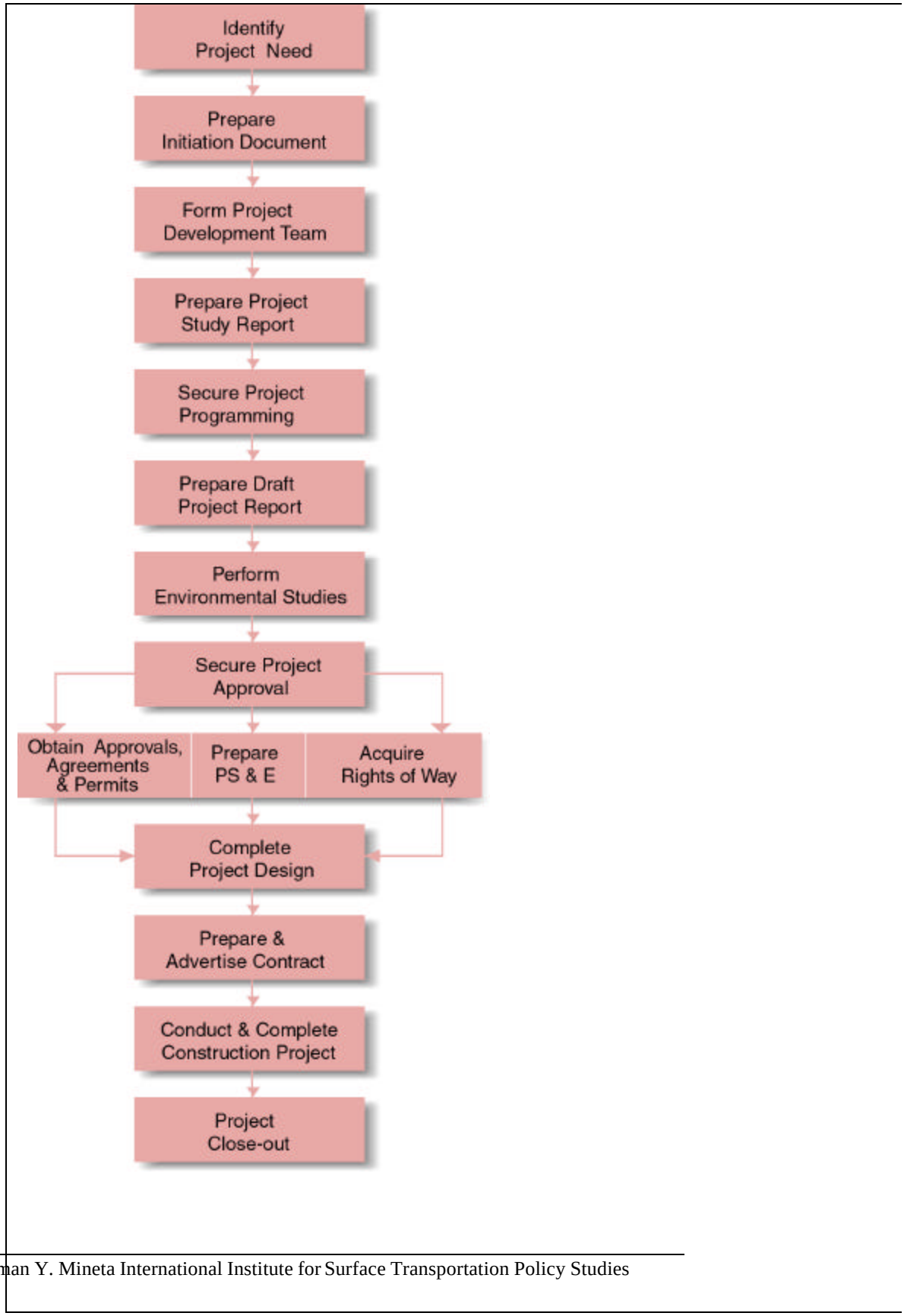
When used in a project delivery process consideration, constructability covers a wide range of topics. The constructability review is done throughout the project development process.

PROJECT DELIVERY

"The Caltrans project development process beings with feasibility studies and ends with a completed project. It melds engineering requirements, public involvement and federal and state approval steps, and is governed by a host of laws and regulations pertaining to programming, environmental effects, right of way acquisition and contracting for construction. Project development may take as little as a few weeks for an emergency project to restore interrupted transportation services, or decades, in the case of highly controversial projects involving relocation of large numbers of people and businesses or difficult environmental issues.

Many projects, even those that are limited in scope, can represent a severe intrusion on individuals and communities or a sensitive environment. The project development process has been designed through statute and regulations to provide many avenues for citizens and agencies to comment on project issues. Consideration of these issues may lengthen the process considerable."[25]

The project manager is ultimately responsible to ensure project delivery. A chart showing the project delivery process follows this page.


Identify Project Need
Prepare Initiation Document
Form Project Development Team
Prepare Project Study Report
Secure Project Programming
Prepare Draft Project Report
Perform Environmental Studies
Secure Project Approval
Obtain Approvals, Agreements & Permits
Prepare PS & E
Acquire Rights of Way
Complete Project Design
Prepare & Advertise Contract
Conduct & Complete Construction Project
Project Close-out

Caltrans project delivery process uses the design-bid-build concept and competitive bidding. The issues of constructability arise in all phases. This paper concentrates on efforts just before and during the competitive bid process. When considering the project delivery chart, that would relate to the boxes "Complete Project Design" and "Prepare & Advertise Project".

THE BID DOCUMENT

Caltrans cannot bid projects unless they are complete and buildable. A requirement of the California State Contract Act, Public Contract Code Section 10120 states, "Before entering into any contract for a project, the Department shall prepare full, complete, and accurate plans and specifications and estimates of cost, giving such directions as will enable any competent mechanic or other builder to carry them out."[26]

Competitive bidding contract law that makes Caltrans prepare PS&E that are biddable, that is, they increase competition. Biddable means the project manager has explored every alternative to make the plans and specs clear concise, errors and omissions.

The State Contract Act requires Caltrans to solicit bids and award to lowest responsible bidder based on plans, specifications and estimates prepared by Caltrans.

Contract law's main purpose is to provide public with best quality project, for the best price through a fair, efficient and clean bidding process. Public agencies are not given unfettered discretion to award bids, and contractors are held to exacting standards of performance once the job is underway.

California Public Contract Code was drafted to protect taxpayer funds from fraud and abuse and to provide for fair and efficient administration of public works contracts. Under the law, Caltrans projects are fully designed with plans and specifications,. The bidding process is a competitive bidding process. Surety bonds guarantee the performance and pay obligation. Contracts are awarded to the lowest bidder.

Bids are considered irrevocable offers. This is to protect the interests of the taxpayers. Award to lowest bidder eliminates favoritism, fraud and corruption. The state obtains highly competitive prices for public improvements and provides a level playing field so all qualified and bonded contractors can bid. Award to lowest bid

results in high competition, eliminates quality based selection and eliminates the opportunity for negotiated terms. A negative aspect is competitive bidding could somehow prevent value engineering suggestions from the contracting community.[27]

Errors in business judgment are not correctable errors in competitive bidding.[28]

PS&E

The project manager is responsible for project delivery; the initiation of a project, seeing it through a design process and construction. (Often, at Caltrans the concept of open to traffic means project completed or delivered.) An essential part of the project delivery process is the development of the plans, specifications and estimate (PS&E). In the development of the plans, specifications and estimates, the project manager must consider constructability.

The Caltrans PS&E document describes the processes, policies, and regulatory requirements and defines roles and responsibilities of various functional units at Caltrans as they relate to PS&E submittals. It is an essential resource for anyone trying to understand the complexities of project delivery. Completing the PS&E is basically finalizing the design in ways that it is understandable enough to build.

The Project Manager will ensure that the project design is complete, biddable and buildable prior to submitting the PS&E. the Project Manager should prepare or verify and approve project special provisions to ensure conformance with Caltrans requirements. He verifies prior to advertisement and at the time of advertising that the Engineer's Estimate is complete and represents a fair and reasonable price for the work to be done.

The PS&E development is creating the instructions from the owner to the contractor of what to build. The instructions consist of the project drawing or plans, the text or specifications, and the list of items to be bid on by the contractor. The instructions also include the use of the Standard Plans, the Standard Specifications, the Standard Special Provisions and directions found therein, and other relevant departmental data.

At draft PS&E all engineering work is completed, and the project is "PS&E Ready", it includes:

- Plans that are complete, biddable, and buildable.
- Project special provisions.
- Engineer's estimate which is a complete and accurate representation of the current anticipated costs.

Special Provisions

One component of the plans and specifications is the project Special Provisions. In the specials, engineers identify changes to the special provisions, which deviate, from standards or policy and include justification for all deviations with the PS&E submittal. One possible deviation to consider was "Buy America" and Foreign Material Waiver.

Estimate

The estimator is concerned with the cost items. Where common contract items have different item prices, the item price in the highway estimate file will prevail. Structures and highway estimators should agree in advance on prices of such common items.

When putting together the estimate: estimator must look to see if materials are available. Estimators should be on the lookout for items that are common to different construction activities. One such example is with temporary railing. Estimators for certain types of work may not be aware uses of temporary railing in the plans. The estimator should avoid duplicate quantities in the estimate. Another item would be retaining walls, which could be designed by more than one unit. In this case the same contract pay items should generally be used. When common, adjacent features such as, retaining walls and bridges are paid for with different sets of pay items, the plans must clearly indicate limits of payment for each pay item.

The Project Estimate of Cost has the components of Contract Items, Supplemental Work, State-furnished Materials and Expenses, and Contingencies.

Estimating item prices not an exact science and no estimator can be "right" all the time. However, estimators can prepare reasonable estimates of the cost of the work to be performed by the contractor. [29]

One thing estimator looks out for are material shortages. Material shortages may develop at unexpected intervals, causing an increase in material prices. Wages continually increase, although usually at a somewhat predictable rate. The time of year a project is advertised or constructed often affects prices.

Estimates must be current at the time the project is ready to list. Therefore, estimator will continuously review and update unit prices and estimates as conditions change. The estimator should review and update the estimate if the California Construction Cost Index is rising or falling frequently and rapidly.

One source of data used by the estimator is the caltrans Quarterly Report “Contract Items by Item Numbers.” -- This report contains all contract items with quantities and prices used in the past quarter, listed by item code number.

During the estimation process, one needs a forum to answer questions, clarify points, and resolve potential issues. This report gives two examples of the above. Using the bid readiness constructability procedures.

CHAPTER 3 PROJECT DESCRIPTION

SFOBB NEW EAST SPAN, SFOBB EAST SPAN SEISMIC SAFETY PROJECT

San Francisco-Oakland Bay Bridge East Span Seismic Safety Project was created in the wake of the 1989 Loma Prieta earthquake. The earthquake damaged a portion of the SFOBB. State seismic engineer experts concluded that replacing the bridge was the best choice for safety purposes.[30] The existing San Francisco-Oakland Bay Bridge is dangerously close to active earthquake faults. [31] The existing span is not expected to withstand a maximum credible earthquake MCE on the San Andreas Fault or Hayward Fault[32].

Designing this bridge demands critical input from best minds in seismic engineering. The project delivery schedule calls for haste – experts agree that a large earthquake on Hayward Fault would cause cataclysmic damage to the existing bridge.

Caltrans must ensure the New East Span would remain passable after a major earthquake. Community considerations include proper alignment and design a landmark bridge to give East Bay civic parity with San Francisco. There is a recognition that construction costs only go up with time.[33]

SFOBB will cover 656 meters across San Francisco Bay. The new bridge will be consist of: YBI Transition – the transition structure from the existing tunnel, Self Anchored Suspension Span - a 160 meter Single steel tower, with main cable and inclined suspenders supporting a steel orthotropic box deck of a 385-meter main span and 180-meter back span, Skyway - a cast-in-place concrete viaducts, and Oakland Touchdown, the transition to existing facilities on east end[34].

The project description from the environmental document, Environmental Impact Statement is included as Appendix 1.

STEEL

Infrastructure investments are steel-intensive and supplying and fabricating them represents a major market opportunity for steel industry. Infrastructure improvements increase the competitiveness of US steel industry and the steel industries manufacturing customers.

US Department of Transportation reports that for every $1 billion invested in infrastructure improvements, economic activity is stimulated by $2.6 billion. US Department of Transportation reports that for every $1 billion invested in infrastructure improvements approximately 42,100 jobs are created.

American Steel and Iron Institute (AISI) supports increased federal, state and local government spending for needed, productivity-enhancing infrastructure improvements. AISI also strongly supports Buy American provisions at the federal and state government levels. Especially for steel-intensive government construction and infrastructure projects.

AISI lobbied heavily for the Transportation Equity Act for the 21st Century (TEA-21). TEA-21 sets federal highway funding levels over the next six years.[35] TEA-21 will increase by 44 percent use of steel plate, shape, sheet and piles used in highway construction. Part of the increase is from TEA-21 bridge replacement and rehabilitation program, which is funded at $20.4 billion.

The steel industry is in financial crisis. It has been in crisis for decades. It is worst now than ever. Record import levels of unfairly traded steel and the continued expansion of global steel production capacity have cause domestic Steelmakers to be in the red. About 25 US Steelmakers have filed chapter 11 bankruptcy since 1998. Partly due to the global steel glut that sent prices to a 20 year low. [36]

The United States imported almost all its steel until after the Civil War. Steel is made by alloying iron with carbon to produce a harder, stronger metal that will take a much keener edge. Before the civil war, steel was very expensive to manufacture by the primitive methods then available, and its use was largely confined to high-value specialty products such as swords and precision instruments.

In 1901, the United States Steel Corporation, the largest industrial enterprise on earth, was established. Capitalized at $1.4 billion, it controlled more than 60 percent of the American market. After World War II, the steel industry continued to be the measure of the size and strength of national economies.

By 1969 the American steel production peaked. The country production rate was 141,262,000 tons. New, more efficient steel plants with much lower labor costs were being built abroad. The abroad plants began to give American steel companies increasing competition. Transportation expenses were decreasing.

Then in 1975 there was a major shakeout of the industry ensued. There was a plunge in steel production rate by 37 percent to only 89 million tons. Also, at that time, the steel industry employed 457,000 workers at very high wages.

By 1988, steel production had rebounded to 102,700,000 tons, but the number of steelworkers had declined to 169,000. Annual steel production per worker had more than tripled in thirteen years. However, the Domestic Steel Industry still

considers the industry to be in a crisis mode. They feel domestic suppliers need government support in overcoming the crisis.

In the years after the Civil War, the American steel industry grew with astonishing speed as the nation's economy expanded to become the largest in the world. Between 1880 and the turn of the century, steel production increased from 1.25 million tons to more than 10 million tons. By 1910 America was producing more than 24 million tons, by far the greatest of any country. [37]

Steel industry supported the remedy under Section 201 of the Trade Act of 1974 (Section 201). There was injury to the domestic steel industry caused by surging imports.

The rate should extend for at least four years. The range of products should include slabs, all flat roll, steel pipe and tubes and other long products. The tariff would also encourage consolidation and capacity reductions needed in the US industry.[38]

On March 3, President Bush announced temporary safeguards for steel industry, by increasing tariffs. The tariffs vary from 8 to 30 percent on imported steel as shown in table below.

Steel component types	tariff
Tim mill steel, Hot rolled bar cold rolled bar, Flat steel	30%
Stainless rod, Stainless steel bars, Circular welded tubular products, rebar	15%
Car fittings and flanges	13%
Stainless steel wire	8%
Slab steel	30% after first 5.4 millions tons are imported[39]

CHAPTER 4 CONSTRUCTABILITY TOOLS

This chapter describes several constructability tools developed in preparation to bid a contract for SFOBB identified as contract number 04-012064 and called "SAS/YBI." These tools help resolves matters essential to bidding the job. The discussion below is about the "tools", used to consider constructability. Development and implementation calls for close communication, team building, multi-disciniplinary team. In preparation to bid 04-012064 SAS/YBI, the project manager considered constructability issues and developed and/or implemented tools to overcome barriers to competitive bidding.

This examination of constructability involves the SFOBB New East Span contract project delivery and discussion of various constructability tools being used in the months prior to PS&E ready stage of project delivery.

It also means an examination of Caltrans bidding procedures to assess whether an alternative bid for Buy America was possible.

Tool 1 ECR SAS/YBI

Problem

A critical element of competitive bidding is having bidders. We asked, what can Caltrans do to increase competition. One way is identify potential bidders: (the primes, subcontractors, suppliers, fabricators) and allow them to participate in constructability review process.

We wanted to know whether anything in our plans and specs raise any red flags to contractors? If any red flags raised, we wanted to consider whether that could mean higher costs or a no bid issue.

ECR SAS/YBI was derived from the concept of constructability. Who best to advise Caltrans on constructability issues than the potential bidders? We had the experience that on SFOBB Skyway contract 04-012024, bids open Dec 19, 2001, that a bidder inquiry was submitted to Caltrans on November 15, 2001. The inquiry caused Caltrans to write an addendum to the specifications on December 13, 2001. Caltrans tries to avoid issuing addendum that cause the contractor to significantly change the bid so close to bid time. In the case of the Skyway, the addendum was issued much too close to bids open date.

We want the increase the opportunity for the contracting community to raise questions or concerns to Caltrans. We want to decrease addendum to contract documents during the bidding process. Caltrans recognizes that the contracting

community has lots of expertise to help us achieve the highest standards of contract documents. To increase the opportunity for contracting community to raise questions or concerns, we created a process to allow contractors to comment on plans and specs before advertise.

Solutions

We established procedures for contractors to provide input on constructability review called Enhanced Constructibility Review SAS/YBI. The ECR SAS/YBI allows suggestions from the contracting community. We wanted to advance out plans and specifications in draft phases. Before, project specific comments were mostly limited to the bidder inquiry response process, whereas with Enhanced Constructability Review SAS/YBI, the window of opportunity for contractor to comment pre-bid was extended to pre-advertise.

Advance selected draft plans and special provisions to contracting community for their review. Appendix 2 shows the web page developed for ECR SAS/YBI. The appendix information for the ECR SAS/YBI can also be accessed by through the Internet at www.dot.ca.gov/hq/esc/oe/ecr/index.html. The specifications available for review were related to structural steel for the most part. The plans were over 100 and also limited to mostly structural steel members. The plans are in .tif format.

Tool 2 Alternative Bid (Buy America)

Problem

On Jan 28, 2000, Governor Davis directed that federal funds to be used to augment seismic retrofit work on bay area bridges. He expressed that use of the funds would keep the jobs in California and free up local funds.[41] The intent was to maximize economic benefit of the project to the domestic steel industry. By incorporating federal funds, Federal Buy America regulations become applicable to the project.

Buy America provisions could put the bidder in the dilemma of not being able to perform the contract as promised. By California Contract Code, at the time bids are open, the bidder must have the necessary production, construction and technical equipment and facilities or has ability to obtain or gain such equipment and facilities, bidder must have the organization, experience, accounting and operational controls, and technical skills or have the ability to gain such organization experience, controls and skills and finally, the bidder must have adequate financial resources to perform the contract be able to comply with the required or proposed delivery or performance schedule.

For SAS/YBI, it is not clear that the domestic steel fabrication market can build all structural steel elements of the SAS/YBI 04-012064. There are milling equipment, tooling, transporting pieces and erection issues related to the steel market. Of most concern were the steel elements that are not normally built in the United States.

Does the US steel market have the infrastructure to fabricate the steel tower, orthotropic box main and back span and cable? If the answer is no, then Caltrans may need to consider an alternative bid process.

We attempted to see whether there is an exception or waiver to Buy America that could be implemented to allow foreign steel to be used on the job. We thought there could be a benefit to opening the market to more companies that can produce the orthotropic box and tower. To see if there is a way for a waiver, or an alternative bid, we needed to study the law. My original concept of paper was to work on alternative bidding process to increase constructability (increase competition to allow more bidders, if foreign steel could be used on the job, foreign suppliers could submit estimates to the prime contractors be used on job. If there are more opportunities for primes to collect estimates for items, then there is more competition and hence, lower price). This caused several of us at Caltrans to consider the regulations related to "Buy America." and Caltrans bidding process to consider how we might implement an alternative bid process.

Project background

The Structural steel elements of SAS/YBI 04-012064 are fabricated. They include vehicle decks orthotropic box girders, bicycle path orthotropic box girders, the suspension span tower, piles, piles caps, cable saddles, construction falsework, temporary approach structures, and suspension cable prefabricated parallel wire strand (PPWS).

The selected contract quantities gives the reader an idea of the immensity of the materials needed.

SAS Selected Quantities

Structural Concrete = 25,000 M^3

Bar Reinforcing Steel = 5,200,000 Kg

Structural Steel = 56,000,000 Kg

Saddle waiver <175 tons see waiver>

Orthotropic Box Girder = 30,500,000 Kg concerned for May 13

Tower Shaft = 13,500,000 Kg concerned for May 13

Main Cable = 5,200,000 Kg planning a waiver

Suspender Wires = 3,500,000 Kg planning a waiver (confirm with Steve Margaris)

Footing = 3,500,000 Kg

Furnished Piles (2.5 m x 95 mm) = 2200 meters[42]

Buy America

The first Buy American requirements applicable to government procurements were enacted during Depression. Purpose was to require the federal government or any of its grantees to spend taxpayers dollars only on goods produced in the United States.[43] Legislation referred to as "Buy American" Act, 1933. Part of government's response to the unemployment crisis of the Great Depression.

During debate in early 1933, Sen. James J Davis (R-PA) argued that support of the amendment would protect American jobs and American Industry. Opposing argument from Sen. William H. King (D-Utah) the amendment would destroy American trade and commerce relations with other countries.

The Buy America steel and iron requirements apply to all construction material made primarily of steel or iron and used in infrastructure projects. Transit or maintenance facilities, rail lines and bridges. These include structural steel or iron, steel or iron beams or columns and running rail, contact rail. [44]

The Surface Transportation Assistance Act of 1982 (STAA), Section 165 contains basic Buy America (B-a) stature applying to Federal –aid highway construction projects. Section 164 requires that Federal-aid funds may not be obligated for a project unless steel, cement and manufactured products are produced in the USA. FHWA final rule implementing Section 165 in the Jan 17, 1983 Federal Register noted that its previous B-A requirements had never covered "all manufactured products" and Congress had not specifically directed a policy change in STAA. Therefore, FHWA found it in the public interest to waive the B-A requirements for all manufactured products except steel manufactured products.

Cement was de-listed from the list of products March 9, 1984.

Sections 1041(a) and 1048 of the Intermodal Surface Transportation Efficiency Act (ISTEA) expanded B-A coverage to include iron and clarified Congressional intent that the application of a coating is a manufacturing process.[45]

Talking points prepared by FHWA are:

23 CFR 635.410(b) (as amended by 1991 ISTEA) contains the basic B-A rule. All permanently incorporated steel and/or iron materials used in the project be manufactured in the US. Manufactured means initial mixing and melting through the final shaping and coating processes.

The only exceptions are:

If the State permits alternative bid for foreign vs. domestic steel and iron and the total bid for the contract using foreign steel and iron is lower by more than 25% than the total bid using domestic source materials. The differential works like this: if the amount of the lowest responsive and responsible bid offering the item or material that is not procured in the USA is multiplied by 1.25 and is less than the amount of the lowest responsive and responsible bid offering the item produced in the USA.[46]

If the amount of foreign steel and iron materials is minimal, meaning it does not exceed 0.1 percent of the total contract value or $2500, whichever is greater

If FHWA approves a State waiver to permit use of foreign steel and/or iron.

Guidance by FHWA is that:

- all steel and iron materials are covered by B-A regardless of the percentage they compromise in a manufactured product or the form they take
- Minimum amounts of foreign steel and iron materials – less than $2500 total for steel and iron materials per project or 0.1 percent of the total project value, whichever is greater, may be used on Federal-aid projects
- The manufacture process for steel or iron materials is complete, and steel or iron product/component is produced when all grinding, drilling, and finishing of the steel or iron material has been accomplished. The steel or iron product may then be ready for use as such (i.e. fencing, posts, girders, pipe, manhole cover, etc.) or may be incorporated as a component in a further manufacturing process (i.e. prestressed concrete girders, reinforced concrete pile, traffic control devices, bearing pads, etc.)
- Applying a coating to a finished steel or iron product component is now subject to B-A. Coating includes epoxy coating, galvanizing, painting and any other coating that protects or enhances the value of the coated steel/iron product/component.
- A product containing both steel and/or iron and other components may be assembled outside the us and meet B-A requirements if the constituent steel and

iron components were manufactured domestically and are not modified at the assembly location prior to final assembly

- Likewise, the final project could be assembled in the US of foreign and domestic source components provided that the "value as delivered to the project site" of the foreign components include some pro-rata share of the shipping , assembly and testing costs.
- The Regional Administrator may grant a waiver for a specific product, project, geographic area or combination if: a. following B-A requirements is inconsistent with the public interest, b. insufficient quantities of satisfactory quality domestic products are available and c. only the Federal Highway Administrator may grant nationwide waivers, usually through he public rulemaking process.[47]

The idea was considered that an alternative bidding process to allow fabrication at international level:

The SAS/YBI contract contains complex plans and specifications for structural steel. The America Steel Market may not be able to fabricate and erect some of the steel superstructure elements.

Also, the option to use a bid alternative process so that cost saving could be made if needed.

The project manager had to study the factors leading to proposing an alternative bid process and a plan for implementation of the alternative bid process, should the need arise.

Why propose the Buy America alternative bid process, because it may have time and money savings to the project. Why save time – threat of earthquake, also, costs one million dollars (rule of thumb around caltrans) each month of delay. Could purchase foreign manufactured components at a lower cost. It is questionable that us market can supply some of the complex components. Don't have big enough mills to cast one piece, saddle. Orthotropic box hard, towers hard, cable can't be built here.

History of efforts by Caltrans to obtain waivers

Caltrans has requested three Buy America waivers from FHWA Regional Administrator. Three have been approved: 1) Tower saddle, single cast upper portion weighing 175 tons, 2) S-Wire cable wrapping 3) Macalloy bars-75 mm dia high strength A722 bar. Caltrans was considering another Buy America waiver request for the PPWS strand (including production of wire rod) was not submitted,

as domestic steel industry believes they can produce. Domestic steel companies are conducting a trial run to show they can satisfactorily produce wire rod. [48] OR has the trial run been completed and it been shown it cannot be produced domestically. Does anything we heard on May 13 support this (even though may 13 was not about cable).

In all cases, Caltrans found the members or pieces were not available domestically. [49]

1. Tower saddle (single cast upper portion, 175 tons)

2. S-wire cable wrapping

1. Macalloy Bars-75 mm diameter high strength A722 bars

FHWA approved all three of the waiver requests. It is possible Caltrans will make a fourth request for a waiver from domestic fabrication requirements to allow a supplier to meet Caltrans need for the PPWS strand (including production of the wire rod). Presently, North American Wire Rope is carrying out trial runs to prove to Caltrans that they can produce the wire rod according to the SAS special provisions.[50] If that effort is not successful, then the rope must be purchased in a foreign market.

Tool 3 May 13 Constructability Workshop

Problem

There was a need to discussion contractors constructability concerns with them in person.

Solution

A constructability workshop is held on the May 13, 2002. The workshop agenda, a portion of the slide presentations made and, a summary of the workshop are shown in Appendix 3. For more information, please go to www.dot.ca.gov/hq/esc/tollbridge/SFOBB/Sfobb.html.

Appendix 1

The purpose of the San Francisco-Oakland Bay Bridge (SFOBB) East Span Seismic Safety Project (East Span Project) is to provide a lifeline vehicular connection that:

- Connects Yerba Buena Island (YBI) in San Francisco and the SFOBB Toll Plaza in Oakland;
- Connects to a lifeline route linking the East Bay, San Francisco, and the San Francisco Peninsula;
- Maintains the current vehicular capacity of the existing East Span;
- Provides for safety of bridge users during a maximum credible earthquake (MCE); and
- Improves operational and safety design to meet current standards to the greatest extent possible.
-

The SFOBB East Span Project will provide a seismically upgraded vehicular crossing for current and future users. SFOBB East Span Project replacement bridge will include a bicycle/pedestrian path.[51]

1.2 NEED FOR PROJECT

The existing East Span must be replaced or retrofitted because it is not expected to withstand an MCE on the San Andreas or Hayward faults, it does not meet lifeline criteria for providing emergency relief access following an MCE, and it does not meet current operational and safety design standards.

The project is proposed to address the following major transportation needs and deficiencies identified specifically on the bridge between YBI and the SFOBB Toll Plaza:[52]

- Lifeline Connection - The existing SFOBB East Span does not provide a lifeline connection that is likely to survive or be usable after an MCE;
- People, Freight and Goods Movement - The existing SFOBB East Span is likely not to allow for high levels of people, freight, and goods movement following an MCE; and
- Current Roadway Design Standards - The existing SFOBB East Span does not meet current roadway operational and safety design standards.

Each of these needs is described in the following sections.

1.2.1 Lifeline Connection - The existing SFOBB East Span does not provide a lifeline connection that is usable after an MCE.

Improvements to the existing East Span are needed to address seismic safety deficiencies and provide a bridge crossing that is usable soon after a major seismic event. It is likely that the existing SFOBB East Span would develop multi-span failures leading to collapse and loss of life in the event of an MCE, even with the completion of the interim retrofit project. The East Span does not provide for public safety during an MCE.

Maximum Credible Earthquake

On the basis of research conducted since the 1989 Loma Prieta earthquake, U.S. Geological Survey (USGS) and other scientists conclude that there is a 70 percent probability of at least one magnitude 6.7 or greater quake, capable of causing widespread damage, striking the San Francisco Bay region before 2030. Major quakes may occur in any part of this rapidly growing region. This emphasizes the urgency for all communities in the Bay region to continue preparing for earthquakes. The seismic design criteria set for the East Span Project have been established as an 8 magnitude earthquake on the San Andreas fault or a 7-1/4 magnitude earthquake on the Hayward fault. The MCE on each of these faults is defined as the largest earthquake that appears to be reasonably capable of occurring based on current geological knowledge. While these values could be exceeded, the values represent the best estimates at this time. The probability of an MCE occurring on one of these faults is approximately one in four over the next two to three decades.

An MCE on either the San Andreas or Hayward fault would be expected to inflict far greater damage to the SFOBB than was experienced from the 1989 Loma Prieta earthquake, during which one section of the upper deck collapsed, killing one person. This is due to the potential for the epicenter of an event on either the San Andreas or Hayward fault to be nearer the bridge, as well as the expected greater magnitude of the MCE compared to that of the Loma Prieta earthquake (magnitude 7.1). It is estimated that an MCE with an 8 magnitude would generate in excess of 30 times more energy than the Loma Prieta earthquake. The feasibility of reopening the existing East Span to traffic following an MCE would be limited or precluded without the seismic safety improvements proposed in the East Span Project.

Lifeline Structure

The SFOBB provides a critical connection between San Francisco, the East Bay, and the I-80 corridor to the east. Designation by the California

Department of Transportation (Caltrans) of the SFOBB corridor as a lifeline system connection represents the State's intention to use the SFOBB to provide a high level of post-earthquake transportation service for emergency response and support for the safety and economic livelihood of the Bay Area. Combined with the West Span seismic retrofit (now under way), the retrofit of the west YBI viaduct and YBI tunnel, and the West Approach replacement, replacement of the East Span would complete the lifeline connection.

The criteria for state lifeline route designation and their applicability to the SFOBB East Span Project are listed below:

- The route provides emergency relief access through or across a potentially impacted region, connecting major population centers within the region - The SFOBB East Span links San Francisco and the San Francisco Peninsula with Oakland and the East Bay;
- For areas with more than one route providing interregional access, the route provides the most effective emergency relief access - The SFOBB, one of five toll bridges crossing San Francisco Bay, provides the shortest and most direct access between the cities of San Francisco and Oakland. The SFOBB provides a high-capacity (10-lane) direct connection between two major Bay Area communities (San Francisco and Oakland);
- The route provides direct or nearby access to and from major emergency response and recovery supply centers and staging areas - The SFOBB provides the most direct access between the medical centers in San Francisco and Oakland and the ports of San Francisco and Oakland; and
- The route provides access to an airport (military or civilian), seaport, major rail facility, or a major distribution center that would be involved in immediate relief activities - The SFOBB provides access to the Port of San Francisco and the Port of Oakland. It is near the Union Pacific Railroad yards at the Port of Oakland. It is part of the lifeline route that provides vehicular access to and from Travis Air Force Base in Fairfield, which would be a major distribution center providing immediate post-earthquake relief.

Cooperative earthquake response planning among Bay Area transportation providers focuses on the roles of agencies, including Caltrans, in post-earthquake response. Emphasis is placed on actions during the first 72 hours after an earthquake. Response scenarios do not call out procedures to be implemented at specified locations. Overall responsibilities for participating agencies are defined.

Caltrans preparedness planning consists of activities, including cooperation with the California Highway Patrol (CHP), in developing traffic control and evacuation procedures; activating emergency response resource centers; and establishing route recovery plans.
Although no detailed plan for a lifeline SFOBB post-earthquake use is defined, it can be anticipated that the structure would be used to transport heavy equipment, such as cranes and bulldozers, to work sites. The structure would also be used to distribute supplies from the San Francisco and Oakland ports to recovery centers. Automobile and bus transit traffic would likely be banned from the SFOBB so as not to interfere with emergency response, then would be restored on the SFOBB as feasible. As a lifeline vehicular bridge, the SFOBB would have the flexibility to move equipment and goods during post-earthquake recovery that cannot be accommodated by Bay Area Rapid Transit (BART) and ferry service.

1.2.2 People, Freight, and Goods Movement - The existing SFOBB East Span cannot maintain high levels of freight and goods movement following an MCE.

The SFOBB is a primary route for movement of freight and goods between the San Francisco Peninsula and the East Bay. It provides access for San Francisco to the intrastate and interstate trucking network in the East Bay and beyond. The SFOBB provides a link for seaport cargo and air freight delivery between the ports and airports in both San Francisco and Oakland. The bridge is also a link for local delivery of freight and goods.
Maintaining the capacity of the East Span to accommodate large volumes of truck traffic is important for distribution of freight and goods to facilitate economic recovery following an MCE. Disruption of this critical link in the transportation system by damage or failure due to an earthquake would require rerouting approximately 8,000 truck trips per day to other toll bridges, assuming these other bridges are not similarly damaged. Extended interruption of the capacity of the East Span to accommodate large numbers of trucks would have an adverse effect on the local and regional economy.

1.2.3 Current Roadway Design Standards - The existing SFOBB East Span does not meet current roadway design standards for operations and safety.

- Design standards are applied to bridge and roadway projects to provide a safe facility. The SFOBB East Span, constructed in the

1930s, does not meet all of the current mandatory and advisory design standards.

1.3 BACKGROUND

1.3.1 The San Francisco-Oakland Bay Bridge

The SFOBB is historically important in the Bay Area and worldwide. Construction of this structure began in 1933 and was completed and opened to traffic in 1936. At the time of its construction, the bridge was the world's longest vehicular bridge, and the YBI tunnel, a double-decked structure, was the largest bore tunnel of its time at 23 meters (76 feet) long by 15 meters (50 feet) wide by 15 meters (50 feet) high (see Figure 1-1 in Appendix A).

The SFOBB currently serves 272,000 vehicles each day. The SFOBB provides regional access between the San Francisco Peninsula and the East Bay. As a component of Interstate 80 (I-80), it is a critical link in the interstate highway network. The Dwight D. Eisenhower System of Interstate and Defense Highways, established in 1954 during Eisenhower's presidency, is a network of access-controlled and grade-separated highways designed to serve the national defense and to connect states and routes of continental importance in Canada and Mexico.

The SFOBB is a double-deck structure carrying five traffic lanes on each level. The West Span connects San Francisco to YBI. A concrete viaduct and approach ramps eastward from Fifth Street in San Francisco at the west end, 1,130 meters (3,707 feet) long, connect to the two suspension spans, each over 1,400 meters (4,593 feet) long. On the island, there are two concrete viaducts, 165 meters (541 feet) and 65 meters (213 feet) in length, at either end of the 164.4-meter (539-foot) long double-deck tunnel.

The East Span is the portion of the structure between YBI and Oakland. An 800-meter (2,625-foot) long viaduct extends from the YBI tunnel east portal eastward across the island. A series of steel truss spans carries the highway across the eastern portion of the Bay. The steel spans include a 737-meter (2,418-foot) cantilever truss adjacent to the island, followed by five high truss spans 155.1 meters (509 feet) each, and 14 shorter spans, which bring the roadways to the East Bay shoreline.

1.3.2 Overview of the Seismic Retrofit Program

Caltrans' design program to seismically retrofit State-owned, city, and county bridges has been highly influenced by recent earthquakes in

California. In particular, the 1971 San Fernando earthquake, the 1987 Whittier Narrows earthquake, the 1989 Loma Prieta earthquake, and the 1994 Northridge earthquake greatly influenced the direction, design, scientific research, and priorities of Caltrans' seismic retrofit program. These earthquakes prompted new research and funding for the seismic retrofit of transportation structures, which has included pioneering research and design focusing on the seismic behavior of large bridges. This has led to increased understanding of how bridges behave in earthquakes, new techniques for retrofitting existing bridges, and improved design criteria for new construction. Over the past three decades, this work has placed Caltrans at the forefront of the evolving field of seismic retrofit design.

1.3.3 Effects of the Loma Prieta Earthquake and a Maximum Credible Earthquake

On October 17, 1989, the Loma Prieta earthquake struck the San Francisco Bay Area. Its epicenter was in a sparsely populated area of the Santa Cruz Mountains, 97 kilometers (60 miles) away from the SFOBB. The California Office of Emergency Services (OES) reports that the earthquake caused 62 deaths and $5.6 billion in property damage, and 8,000 people were left homeless. Over 1,300 buildings were destroyed and 20,000 buildings were damaged. On the SFOBB, the earthquake caused a portion of the upper deck of the East Span to collapse onto the lower deck, resulting in one death. The East Span was closed for four weeks while the damage was repaired. Caltrans estimated that the increased delay experienced by commuters rerouted to other Bay crossings, including other modes such as ferries or BART, cost as much as $12 million.

The Association of Bay Area Governments (ABAG) conducted an assessment of the regional macroeconomic impacts of the Loma Prieta earthquake. ABAG concluded that the maximum loss to the Gross Regional Product was in the range of $181 to $725 million. ABAG noted that San Francisco suffered a significant loss ($73 million) in taxable sales activity, and that "a major portion of the loss in economic activity in San Francisco may have been due to a loss in transportation access." The Loma Prieta earthquake showed the vulnerability of the transportation system to a relatively distant earthquake. Future planning must recognize the likelihood and potential consequences of closer and more powerful events on the San Andreas and Hayward faults. An MCE on the San Andreas fault could generate over 30 times more energy than the Loma Prieta earthquake. An MCE on the Hayward fault could

generate about the same energy as the Loma Prieta earthquake. Damage from an MCE on either of these faults could be heavier and much more widespread compared to damage from the Loma Prieta earthquake, including the collapse of thousands of buildings, extensive infrastructure damage, and major loss of life. The magnitude of such a natural disaster would necessitate the kind of emergency access provided by the bridge retrofitted to lifeline standards. On the existing SFOBB East Span, an MCE could cause catastrophic bridge failure, potentially resulting in numerous immediate casualties and requiring many months to reopen the bridge or years to build a replacement. Immediate emergency response and more long-term economic recovery would be delayed.

1.3.7 Legislative Framework

The California Legislature has in various legislative findings and declarations expressed its intent to complete the seismic retrofit of State-owned and State-operated highways. Following the 1971 San Fernando Valley earthquake, seismic design standards for transportation facilities were reassessed in light of the unanticipated damage to certain roadway structures, and a retrofit program was begun. The extensive roadway damage caused by the 1989 Loma Prieta earthquake in northern California and the 1994 Northridge earthquake in southern California prompted an acceleration of the retrofit program, including several efforts to increase program funding. In 1991, the legislature authorized financing seismic retrofit projects from motor vehicle fuel tax revenues and additional funding mechanisms, declaring that "it is in the best interests of the people of California to immediately finance retrofit projects to make state highways safe during seismic events, and to offset any possible delays caused by these projects on approved state highway projects contained in the state transportation improvement program for 1990..." (Government Code, Chapter 5, Article 1, Amended: Statutes of 1991, Chapter 195).

In 1995, recognizing the increasing financial drain of the ongoing seismic retrofit program on limited funding resources, the legislature placed the Seismic Retrofit Bond Act of 1996, or Proposition 192, on the March 1996 ballot, declaring that "the completion of seismic safety retrofit work is essential to the welfare and economy of the state" (Government Code, Title 2, Division 1, Chapter 12.48, Article 1). This act, approved by the voters in 1996, authorized the sale of over $2 billion in state revenue bonds for financing retrofit improvements and temporarily suspended state statutes that were deemed to potentially delay or unnecessarily

encumber their implementation. The seismic retrofit and rehabilitation of the SFOBB East Span is a priority project under the state's accelerated retrofit program.

Senate Bills 60 and 226 were passed by the State Legislature and signed into law by the Governor on August 20, 1997. Together, these bills provide a financing mechanism and identify funding sources for seismic improvements for Bay Area toll bridges, including the SFOBB East Span. Senate Bill 60 establishes a one dollar toll surcharge on the seven Bay Area State-owned bridges and identifies additional funds available for seismic upgrades. State fuel tax revenues earmarked for seismic upgrade projects will fund approximately 33.4 percent of the project costs. State Seismic Retrofit Revenue Bonds issued by the State after voter approval of Proposition 192 in March 1996 will fund an additional 30.2 percent. The one dollar toll surcharge on Bay Area toll bridges for eight years will fund the remaining 36.5 percent.

Senate Bill 226 transferred programming authority for Bay Area toll bridges from the California Transportation Commission to the Metropolitan Transportation Commission. As a result, the Bay Area Toll Authority (BATA) is permitted to extend the period of toll surcharges to cover the cost of amenities. These include a cable-supported or other bridge design, improvements to the Transbay Transit Terminal (including possible relocation and/or ramp reconfiguration), and the addition of bicycle/pedestrian access on the SFOBB. Assembly Bill 2038, which amended Senate Bill 60 in June 1998, allows BATA to fund the addition of bicycle/pedestrian access to either the new East Span or the retrofitted West Span or both, within the restrictions set forth by Senate Bill 60 or a future toll surcharge extension.

Appendix 2

Appendix 3

ABBREVIATIONS AND ACRONYMS

Caltrans	California Department of Transportation
CPUC	California Public Utility Commission
CTC	California Transportation Commission
CTP	California Transportation Plan
DOT	Department of Transportation
FHWA	Federal Highway Administration
IISTPS	International Institute for Surface Transportation Policy Studies (the Mineta Transportation Institute)
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
MPO	Metropolitan Planning Organization
MTC	Bay Area Metropolitan Transportation Commission
RSTP	Regional Surface Transportation Program
SP	Southern Pacific Railroad
STIP	State Transportation Improvement Program (California)
TEA-21	Transportation Equity Act for the 21st Century (1998)
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIP	Transportation Improvement Plan
UP	Union Pacific Railroad
UPS	United Parcel Service
WP	Western Pacific Railroad

LITERATURE REVIEW

These two documents are useful in understanding the project delivery process at Caltrans.

CALTRANS PS&E GUIDE

This "Plans, Specifications and Estimates Guide" was developed by the Engineering Service Center - Office of Office Engineer (ESC-OE) to establish uniform procedures for preparing construction project contract documents consisting of plans, specifications and estimate (PS&E).

PS&E uniformity is essential for contract document processing intended to ensure conformity with State and Federal requirements and Caltrans policies prior to advertisement and award.

The PSE Guide outlines the information needed by District Office Engineer Units to prepare quality construction contract documents for submission to ESC-OE. In addition, it defines subsequent PS&E processing requirements and responsibilities, which are essential for advertisement, bid opening, and award.

THe edition OF THE PS&E GUIDE (DATED SEPTEMBER 1999) used for this report INCLUDES THE REVISIONS MADE IN SEPTEMBER 1999 TO THE JULY 1998 GUIDE EDITION.

HOW CALTRANS BUILDS PROJECTS

How Caltrans builds project

Caltrans Publications Unit, 916 323-5604[53]

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PRINCIPAL INVESTIGATOR

The authors should include the information they would like to have printed in this "About the Authors" section.

The text may include professional and educational accomplishments.

TEAM MEMBER

This text is about the other team members.

PRE-PUBLICATION PEER REVIEW

San José State University, of the California State University system, and the IISTPS Board of Trustees have agreed upon a peer review process required for all research published by IISTPS. The purpose of the review process is to ensure that the results presented are based upon a professionally acceptable research protocol.

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