San Francisco-Oakland Bay Bridge
East Span Seismic Safety Project

Contract 59A0040

SELF-ANCHORED SUSPENSION BRIDGE

DESIGN CRITERIA

07/15/02

100% Submittal

NOTE: THIS INCLUDES W2, E2 AND T1

Reference: Criter20r22

Prepared by T.Y.Lin International/Moffatt & Nichol Engineers, a Joint Venture

1. GENERAL

The bridge shall be designed in accordance with "Caltrans Bridge Design Specifications Manual (1995) (BDS)," modified or augmented as detailed in this design criteria.
In addition to bridge and site specific criteria, pertinent sections of the following standards or codes have been employed for such modifications or augmentations.

• "AASHTO Guide Specifications for Design and Construction of Segmental Concrete Bridges", 1999 Edition, with Addenda through 1998	"AASHTO Seg."
• "Proposed LRFD Guide Specifications for Design of Segmental Concrete Bridges", S. I. Units, March 1997	"LRFD Seg."
• "AASHTO Standard Specifications for Highway Bridges", 16th Edition, 1992	"AASHTO"
• "AASHTO LRFD Specifications for Highway Bridge Design" 2nd Edition, 1998, AASHTO, Washington, DC, 1994	"AASHTO LRFD"
• "Sacramento Regional Transit District Light Rail Design Criteria", May 1993	"Sac. LRT"
• "San Francisco-Oakland Bay Bridge East Span Seismic Safety Project Light Rail Transit Design Criteria", 1999	"SFOBB LRT"
• "Improved Seismic Design Criteria for California Bridges: Provisional Recommendations" ATC-32 Report, June 30, 1996	"ATC-32" Report
• "Proposed Design Specifications for Steel Box Girder Bridges", FHWA-TS-80-205, FHWA, Washington, DC, 1980	
• "Guide Specifications and Commentary for Vessel Collision Design of Highway Bridges" Volume I: Final Report, February, 1991	
• "Recommended Practice for Planning, Designing, and Constructing Fixed Offshore Platforms – Working Stress Design", API RP2A-WSD 20th Ed. 1993	
• "Recommended Practice for Planning, Designing, and Constructing Fixed Offshore Platforms – Load and Resistance Factor Design" – API RP2A-LRFD 1st Ed. 1993	
• "AISC Manual of Steel Construction Load & Resistance Factor Design" (LRFD) , 1999 Edition	"AISC LRFD"
• "AISC Manual of Steel Construction", 9th Edition, 1989	"AISC"
• "ANSI/ASCE", 7-95 Standard	"ANSI / ASCE"
• Stability Design Criteria, 5th Edition, SSRC	
• West Wind Laboratory Report, Monterey, California, May, 2001	"WWL Report"

• Transportation and Traffic Engineering Handbook, Institute of Transportation Engineers, 1976	"THAT"
• Technical Specifications for Suspension Structures	"Suspension Contract" Document
• Hydraulic Modeling and Scour Analysis, T.Y. Lin / Moffatt & Nichol, JV Report , October 31, 1999	"Scour" Report
• Seismic Ground Motion for SFOBB, East Span Seismic Safety Project, Furgo, Earth Mechanics, JV Report, February 2001	"Seismic Ground Motion" Report
• AASHTO Guide Specifications and Commentary for Vessel Collision Design of Highway Bridge, 1991	"AASHTO Vessel Collision"
• Bridge Welding Code, AWS D1.5M, 1996	"AWS D1.5"
• Structural Welding Code – Steel AWS D1.1, 1998	"AWS D1.1"
• AISC – Seismic Provisions for Structural Steel Buildings, April 1997	"AISC – Seismic Provisions"
• "The strength and ductility of steel bridge piers based on loading tests" by K. Kawashima, G. MacCrae, and K. Hasegawa, Public Works Record Institute, Journal of Research Vol. 29, March 1992	"Kawashima et al" Report
• Technical Specifications for Skyway Sidewalks	
• "Recommended Design Loads for Bridges" by the Committee on Loads and Forces on Bridges of the Committee on Bridges of the Structural Division, July 1981	"Design Loads for Bridge" Report
• "East Bay Bridge Vessel Collision Analysis", Moffatt & Nichol	"Vessel Collision Analysis" Report
• "Frictional Resistance Between Cable and Saddle Equipped with Frictional Plates" by K. Hasegawa, H. Kojima, M. Sasaki, and K. Takena, Journal of Structural Engineering, Vol. 121, No. 1, January 1995, Paper No. 4042	"Hasegawa et al" Paper
• "Slip Behavior of Cable Against Saddle Suspension Bridges" by K. Takena, M. Sasaki, K. Hata, and K. Hasegawa. Journal of Structural Engineering, Vol. 118, No. 2, February 1992, Paper No. 1309	"Takena et al" Paper
• SFOBB East Span; Seismic Design Criteria Basis, SDCB, June 27, 2000	"SDCB"
• Axial Pile and Drivability Main Span-East Pier and Skyway Structures, Fugro and Earth Mechanics Report, March 2001	"Axial Pile and Drivability" Report
• Lateral Pile Design for Main Span Pier E2 and Skyway, Fugro and Earth Mechanics Report, February 2001	"Lateral Pile Design" Report
• San Francisco Oakland Bay Bridge –New Self Anchored Suspension Span Wind Studies Final Report, January 2002	

6. STRUCTURAL STEEL

6.1 MATERIALS

Unless modified herein, or specified in the BDS, structural steel shall comply with the AASHTO and ASTM Materials Specifications.

6.1.1 Structural Steel

The following steels shall be used:
ASTM A709M Gr. 345, ASTM A709M HPS 485W, ASTM A514M Gr. 690, and Shear Link Gr. 345

Shear Link Gr. 345

Yield Strength, min.	345 MPa (50 ksi)
Yield Strength, max.	380 MPa (55 ksi)

6.1.2 Structural Steel Connection

High Strength Bolts	ASTM A325-X, ASTM A490-X
Main Cable Strand Anchor Rod, Suspender Socket Anchor Rod, East Saddle Tie Rod, East Saddle Anchor Rods, Tower Anchor Bolts, Tower Saddle Tie Rods, and Pier E2 Bearing and Shear Key Anchor Bolts	ASTM A354 Gr. BD
Cable Band Bolts, West Deviation Saddle Anchor Rods, West Deviation Saddle Bolts, and West Jacking Saddle Bolts	ASTM A354 Gr. BC
Dowels	ASTM A633 Gr. E
Cap Screws	ASTM A240 Type 316

6.1.3 Main Cable

Parallel zinc coated carbon steel wire, diameter 5.40 mm (including coating)

Tensile Strength, min.	1,760 MPa	(254 ksi)
Yield Point, min.	1,350 MPa	(195 ksi)
Proportional Limit, min.	900 MPa	(131 ksi)
Design elastic modulus	200,000 MPa	(29,000 ksi)
Zinc coating	Class A	

6.1.3.1 Suspenders

Wire Rope	ASTM A603 – Class A zinc coating	
Wire Strength, min.	1,350 MPa	(195 ksi)
Design elastic modulus	138,000 MPa	(20,000 ksi)

6.1.3.2 Wrapping Wire

ASTM A510 Gr. 1010

Tensile Strength, min.	450 MPa	(65 ksi)