Foothill Transportation Corridor - South

An Evaluation Of Alternative Designs For FTC-S Connectors To I-5

Submitted To:

Transportation Corridor Agencies

Prepared and Submitted by:

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For
FTC-S Connectors To I-5

1. General Description

The Foothill-South Project, known as the South Orange County Transportation Infrastructure Improvement Project (SOCTIIP), is the extension of existing State Route 241 (SR 241) south from Oso Parkway to the Interstate 5 (I-5) near San Clemente in the vicinity of the Orange/San Diego County line. This extension would be operated as a toll road, as is the existing portion of SR 241, Foothill Transportation Corridor – North (FTC-N). Foothill Transportation Corridor – South (FTC-S) is the final segment of a public toll-road system that consists of the 241, 261, 133, and 73 Toll Roads. The public toll road system operated by the Transportation Corridor Agencies (TCA) is the largest network of toll roads in California.

FTC-S Connectors consisting of Southbound Connector (WS Line) and Northbound Connector (NE Line) are the two, two-lane freeway to freeway connectors providing a direct link to I-5 to and from the south bridging over San Mateo Creek. An evaluation of alternative I-5 direct connectors designs outlines the efforts and design options completed by Corridor Design Management Group (CDMG) in reducing the California Coastal Commission (CCC) San Mateo Creek and wetlands impacts. This evaluation includes summary of progressive design iterations on I-5 direct connectors and evaluation of other feasible structure types for I-5 direct connectors as provided in Section 2 and 3.

2. Summary of progressive design iterations on I-5 Direct Connectors

In 1994, the National Environmental Policy Act (NEPA) and Clean Water Act Section 404 Integration Process Memorandum of Understanding (NEPA/Section 404 MOU) set forth new policies that affect the FTC-S planning process. Since then, CDMG has conducted several Advance Planning Studies (APS) delineating the feasible structure types of I-5 direct connectors for the SOCTIIP Collaborative, the TCA along with the signatory agencies, NEPA/ 404 MOU agencies.

Conventional cast-in-placed prestressed (CIP/PS) concrete box girders are considered the preferred alternative for the I-5 director connectors after an evaluation based on weighed and balanced factors as alignment and geometry, cost, constructability, environmental, aesthetics and construction duration. The bridge type and bridge construction are illustrated in Attachment 1. Besides the layout of the preferred I-5 direct connector structures is adjusted to decrease the right-of-way width required to build the structures, the number of structural supports locating at inside of high value wetlands is also reduced to minimize impacts to wetlands in the vicinity of San Mateo Creek as outlined in the following discussion.

Figure 1 and 2 are general plans for the Southbound Connector (WS Line) and Northbound Connector (NE Line) respectively showing preferred bridge type configuration for an initial study performed in May 2001. WS Line was going south crossing San Mateo Creek at the east of the existing San Mateo Creek Bridge L/R then carrying the southbound traffic lanes over the existing I-5 southbound (SB) and northbound (NB) lanes before turning southeast to merge I-5 SB after passing Basilone Road Overcrossing (Replacement) as shown on Figure1. NE Line was located at the east of both I-5 NB main lanes and WS Line, and while it was crossing San Mateo Creek sufficient spaces between NE Line and WS Line are placed for a future SR 241/I-5 HOV direct connector to be constructed as shown on Figure 2. Basically, the I-5 direct connectors shown on Figure 1 and 2 are the same type bridge configuration for the initial studies performed in 2001 and earlier, and the variations are mainly the bridge and span lengths and the locations of outrigger bents of the SB Connector crossing the existing I-5 SB and NB. Four bents total were located in the wetlands for each of the preferred I-5 direct connectors crossing San Mateo Creek.

Saddleback Constructors (Saddleback) reevaluated the bridge configurations for the SB Connector and NB Connector with revised WS Line and NE Line under the direction of CDMG in 2004. The revised I-5 direct connectors by Saddleback were 1,070 and 1,010 meters in a total bridge length for the SB Connector (WS Line) and NB Connector (NE Line) respectively as shown on Figure 3 and 4. Both WS Line and NE Line were curving further west and merged to the future widening I-5 SB and NB at the south of Basilone Road Overcrossing (Replacement), which was planned to be a combination of two single span cast-in-placed reinforced concrete box girder rigid frame at the south and north for the I-5 direct connectors passing under and one two-span CIP/PS concrete box girder at the center bridge. The revised WS Line crossed the existing San Mateo Creek Bridge L/R with a skew angle about 20 degrees. The north part of the SB Connector consisted of seven 71m spans and a 50.5m end span supported by two outrigger bents, one located at close to the mid-bridge of the existing right bridge and another at the southerly of Abutment 1 of the existing left bridge, accompany a bent west of the future widening I-5 SB at the south and a column positioned at the existing I-5 median between the two outrigger bents, four bents positioned at the base of hillside without impacts on the wetlands in the vicinity of San Mateo Creek and the north abutment. Only the outrigger bent over the existing right bridge was located in the wetlands for the preferred SB Connector. The NB Connector was configured with 70 and 50 meters typical spans and end spans. Four bents total were located in the wetlands for the preferred NB Connector crossing San Mateo Creek.

CDMG further revised Saddleback's I-5 direct connectors with the relocated column locations and longer spans to not only minimizing impacts on wetlands but also considering aesthetic and structural issues for the newly studied configurations as shown on Figure 5, 6 and 7. For the SB Connector, a 105-meter long span was planned for the connector crossing over the existing right bridge with supporting single column bents at the embankment toe of the existing northerly abutment and the median of the existing I-5 SB and NB at the north and south respectively without encroaching San Mateo Creek and the future existing bridge widening. Although an outrigger bent is considered undesirable from both a structural and aesthetic standpoint, an outrigger bent was still proposed located south the columns which were supporting the 105m long span to avoid a span length considered excessive for the CIP/PS concrete box girder construction. This outrigger bent was supporting two 84m spans crossing over I-5 SB to keep a structural hinge in the superstructure away from the present or future traffic under the SB Connector for safety and maintenance. A three-span balanced graceful haunched superstructure was recommended for the 105m long span and adjacent south and north spans to be aesthetically elegant and to reduce the excessive weight imposed on the columns. The total length of the preferred SB Connector was about 871m with a typical span length of 80m except the end spans and the spans over I-5 SB and NB. The preferred SB Connector would avoid impacts on wetlands in the vicinity of San Mateo Creek. The preferred NB Connector was a 13-span bridge with 65m-10@80m-70m-55m span configuration from the south to the north ends and a total length of bridge 990m. Since it was longer than 300m for the projections of NE Line inside wetlands in the vicinity of San Mateo Creek, the 80m typical spans would be able to reduce the number of single column bent inside the wetlands from four to three while those columns aligned with the columns of the SB Connector and the existing piers. For both preferred I-5 direct connectors, the most northerly bent was located at the base of the hillside to avoid foundation construction on the steep slope, and the northerly abutment was positioned to fit into the hillside with a minimum amount of earthwork and without embankment spilling into the floodplain.

During cast-in-place construction with falsework built in the wetlands temporarily, the delivery of concrete, rebars, and prestressing would be carried through the trestle supported temporary accessed road to minimize the environmental impacts on the wetlands.

3. Evaluation of other feasible structure types for I-5 Direct Connectors

For the I-5 direct connectors crossing San Mateo Creek, perspective rendering for the preferred CIP/PS concrete box girder alternative and other feasible structure alternatives showing little or no impacts to the wetlands are included in Attachment 2. Cable-stayed, suspension and tied-arch bridges were three feasible design options eliminating supporting columns of NB Connector in the wetlands, if it was not an objection to the bridge tower/pylon height and/or an option to change the planned curved roadway alignment crossing San Mateo Creek to straight.

A cable-stayed bridge with a total main span length of approximately 320m would be fitted in thê planned curved NE Line roadway alignment with the supporting tower/pylon located just outside wetlands in the vicinity of San Mateo Creek. Balanced cantilever construction could be used to build the superstructure above San Mateo Creek in a symmetrical fashion about the main towers/pylons and have little impacts on the sensitive wetlands during bridge construction. The diamond shape towers/pylons would extend more than 60m above the roadway and result in not only the bridge being one of the most dominant landmarks in the area but also the required air clearance impacting on the military mission and operations at the Marine Corps Base at Camp Pendleton. The bridge site does not allow waterborne equipment to deliver and erect prefabricated bridge segments that make up a modern cable-stayed bridge to be built with optimal economics. Visual and military impacts plus lacking of cost competitive prohibit a cable-stayed bridge the preferred alternative.

A suspension bridge spanning the wetlands would be feasible only with a revision to the segment of planned curved NE Line crossing San Mateo Creek. A straight alignment of approximately 480m shifting east and tying to the planned NE Line at the ends was provided to have a longer than 320m main span carrying traffic lanes over the wetlands for the suspension bridge supported with two hollow-shaft reinforced concrete towers soaring more than 40m above the bridge deck. North abutment requiring deep cut of the existing hillside was located to incorporate greater than 0.2 span length ratio of the side span to the main span. The two towers coupled with the main cables and cable suspenders would create an entering a gateway experience as one driving through the bridge. A modern suspension bridge would be economically suited for spans in excess of 500m and multiple traffic lanes. The suspension bridge was ruled out to be the preferred alternative due to the impacts on NE Line alignment crossing San Mateo Creek and going north and high construction cost for the relative short main span length (320m), lacking of site accessible through waterway and narrow bridge width.

The planned curved NE Line alignment would be revised as outlined for the suspension bridge alternative to have a straight tied-arch bridge fitting into the area sensitive to wetlands in the vicinity of San Mateo Creek. Normally, a deck arch bridge is more structurally favored for vertical space underneath the bridge is available. A basket handle type (inclined ribs) through tied-arch bridge is proposed for the relatively limited distance from the deck surface to the creek. Generally, the basket handle rib form has higher horizontal rigidity with arch effect than the parallel rib form. A long main span length of approximately 320m coupling with inaccessible to the site through waterway preventing using a more cost effective tied-arch steel bridge with inclined network hangers (network arch). The steel box ribs would rise an estimated 30m above the bridge deck. The tied-arch bridge was also ruled out to be the preferred alternative due to the impacts on

NE Line alignment crossing San Mateo Creek and going north and high construction cost for the lacking of site accessible through waterway and heavy falsework in the wetlands during arch rib construction.

Structural Plans

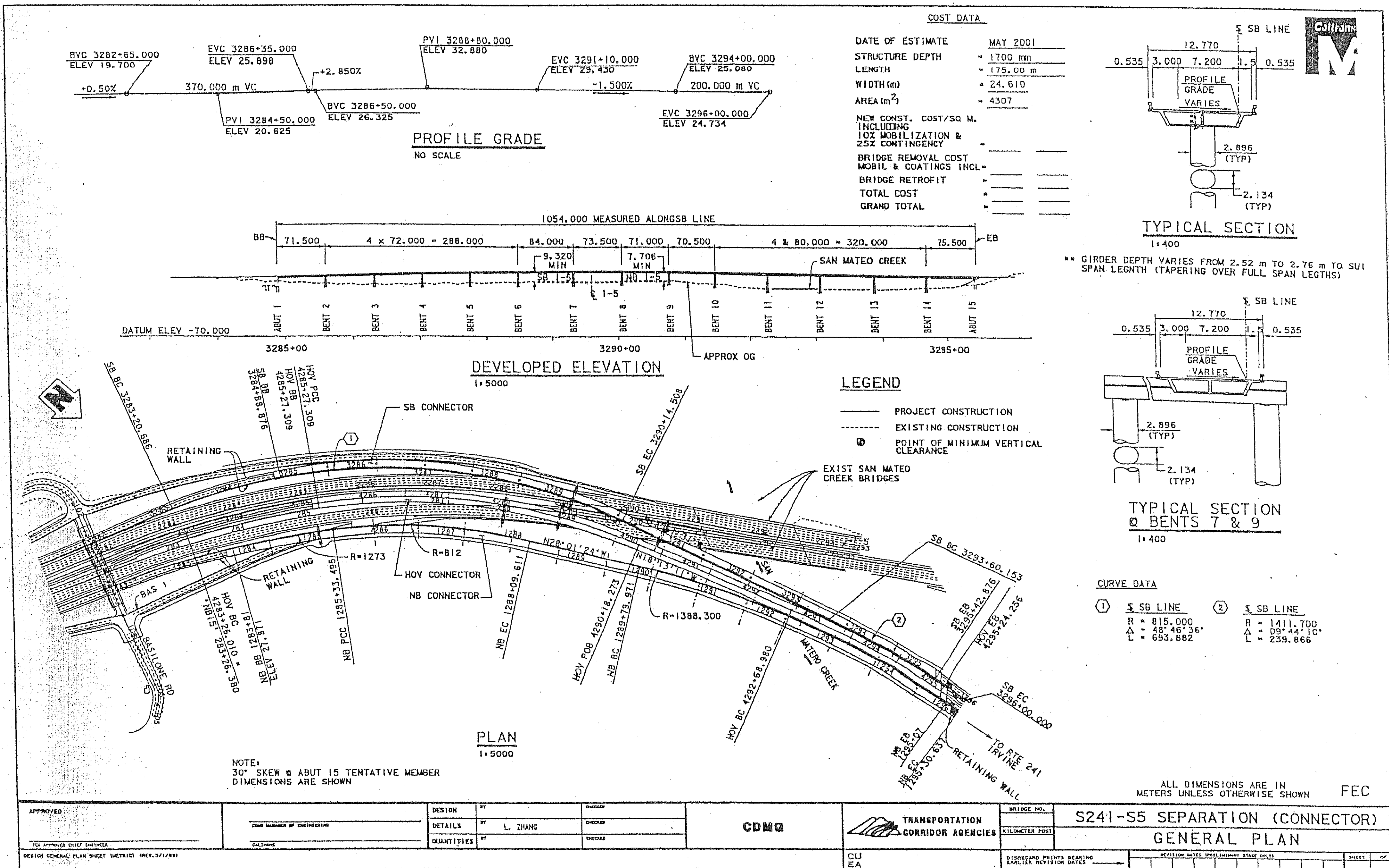

PROFILE GRADE
NO SCALE
BVC 3282+65.000 ELEV 19.700
+0.50%
370.000 m VC
EVC 3286+35.000 ELEV 25.898
+2.850%
PVI 3284+50.000 ELEV 20.625
BVC 3286+50.000 ELEV 26.325
PVI 3288+80.000 ELEV 32.880
EVC 3291+10.000 ELEV 29.430
-1.500%
BVC 3294+00.000 ELEV 25.080
200.000 m VC
EVC 3296+00.000 ELEV 24.734
COST DATA
DATE OF ESTIMATE = MAY 2001
STRUCTURE DEPTH = 1700 mm
LENGTH = 175.00 m
WIDTH (m) = 24.610
AREA (m²) = 4307
NEW CONST. COST/SQ M. INCLUDING 10% MOBILIZATION & 25% CONTINGENCY =
BRIDGE REMOVAL COST MOBIL & COATINGS INCL =
BRIDGE RETROFIT =
TOTAL COST =
GRAND TOTAL =
TYPICAL SECTION
1:400
℄ SB LINE
12.770
0.535
3.000
7.200
1.5
PROFILE GRADE VARIES
2.896 (TYP)
2.134 (TYP)
** GIRDER DEPTH VARIES FROM 2.52 m TO 2.76 m TO SUIT SPAN LEGNTH (TAPERING OVER FULL SPAN LEGTHS)
TYPICAL SECTION ℄ BENTS 7 & 9
1:400
1054.000 MEASURED ALONG SB LINE
BB
EB
71.500
4 x 72.000 = 288.000
84.000
73.500
71.000
70.500
4 & 80.000 = 320.000
75.500
9.320 MIN
7.706 MIN
SB I-5
NB I-5
℄ I-5
SAN MATEO CREEK
ABUT 1
BENT 2
BENT 3
BENT 4
BENT 5
BENT 6
BENT 7
BENT 8
BENT 9
BENT 10
BENT 11
BENT 12
BENT 13
BENT 14
ABUT 15
DATUM ELEV -70.000
3285+00
3290+00
3295+00
APPROX OG
DEVELOPED ELEVATION
1:5000
LEGEND
PROJECT CONSTRUCTION
EXISTING CONSTRUCTION
POINT OF MINIMUM VERTICAL CLEARANCE
EXIST SAN MATEO CREEK BRIDGES
SB BC 3283+20.686
SB BB 3284+68.876
HOV BB 4285+27.309
HOV PCC 4285+27.309
SB CONNECTOR
RETAINING WALL
R=1273
R=812
HOV CONNECTOR
NB CONNECTOR
NB PCC 1285+33.495
NB EC 1288+09.611
HOV BC 4283+26.010 = *NB15* 283+26.380
NB BB 1283+81 ELEV 27.871
BAS 1
BASILONE RD
N28°01'24"W
N18°13'11"W
HOV POB 4290+18.273
NB BC 1289+79.971
SB EC 3290+14.508
R=1388.300
HOV BC 4292+68.980
SAN MATEO CREEK
SB BC 3293+60.153
SB EB 3295+42.876
HOV EB 4295+24.256
SB EC 3296+00.000
NB EB 1295+07
NB EC 1295+30.637
RETAINING WALL
TO RTE 241 IRVINE
CURVE DATA
① ℄ SB LINE
R = 815.000
Δ = 48°46'36"
L = 693.882
② ℄ SB LINE
R = 1411.700
Δ = 09°44'10"
L = 239.866
PLAN
1:5000
NOTE:
30° SKEW @ ABUT 15 TENTATIVE MEMBER DIMENSIONS ARE SHOWN
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
FEC
APPROVED
DESIGN
DETAILS
L. ZHANG
QUANTITIES
CDMG
TRANSPORTATION CORRIDOR AGENCIES
CU
EA
S241-S5 SEPARATION (CONNECTOR)
GENERAL PLAN

FIGURE 1

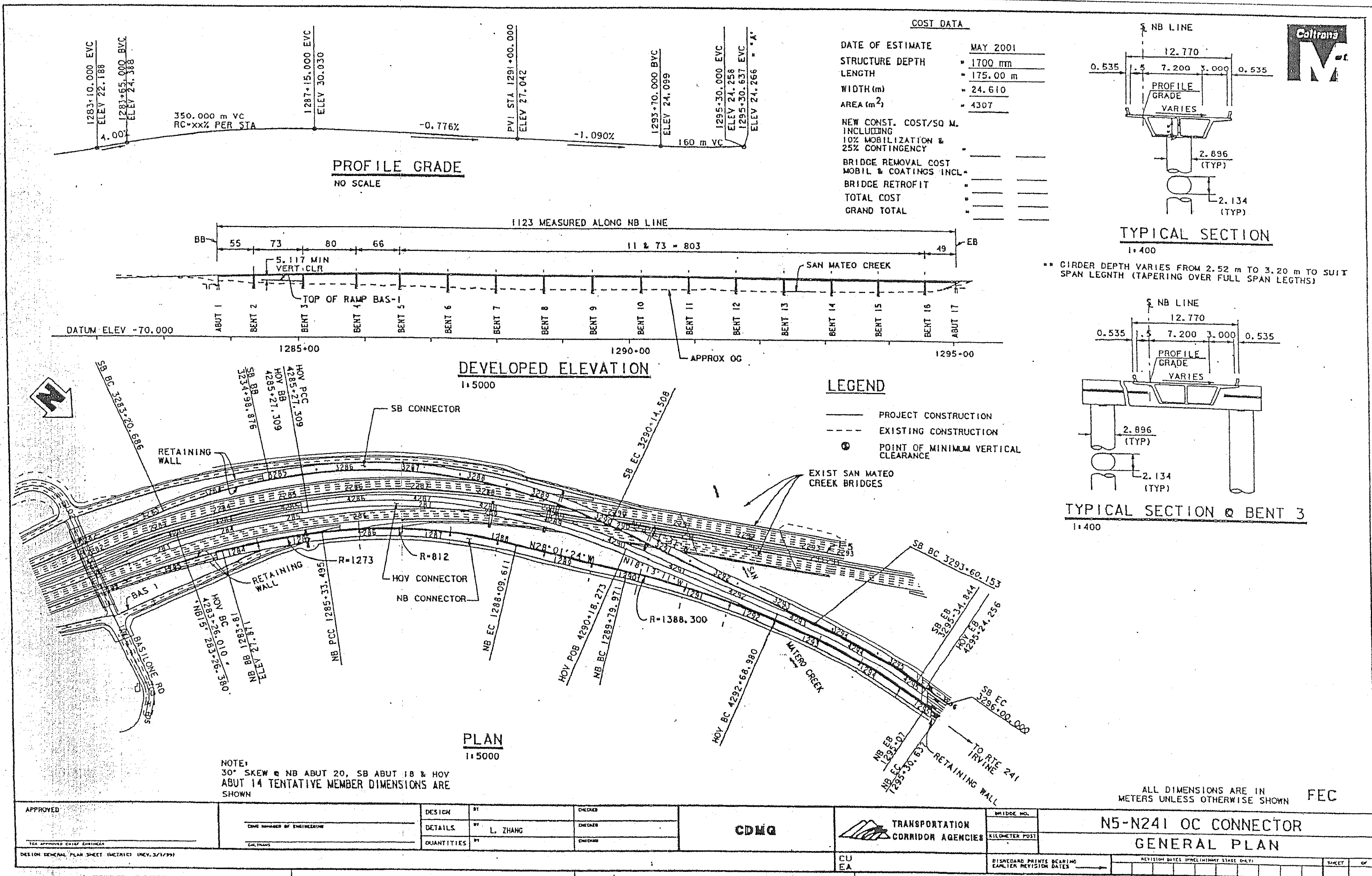
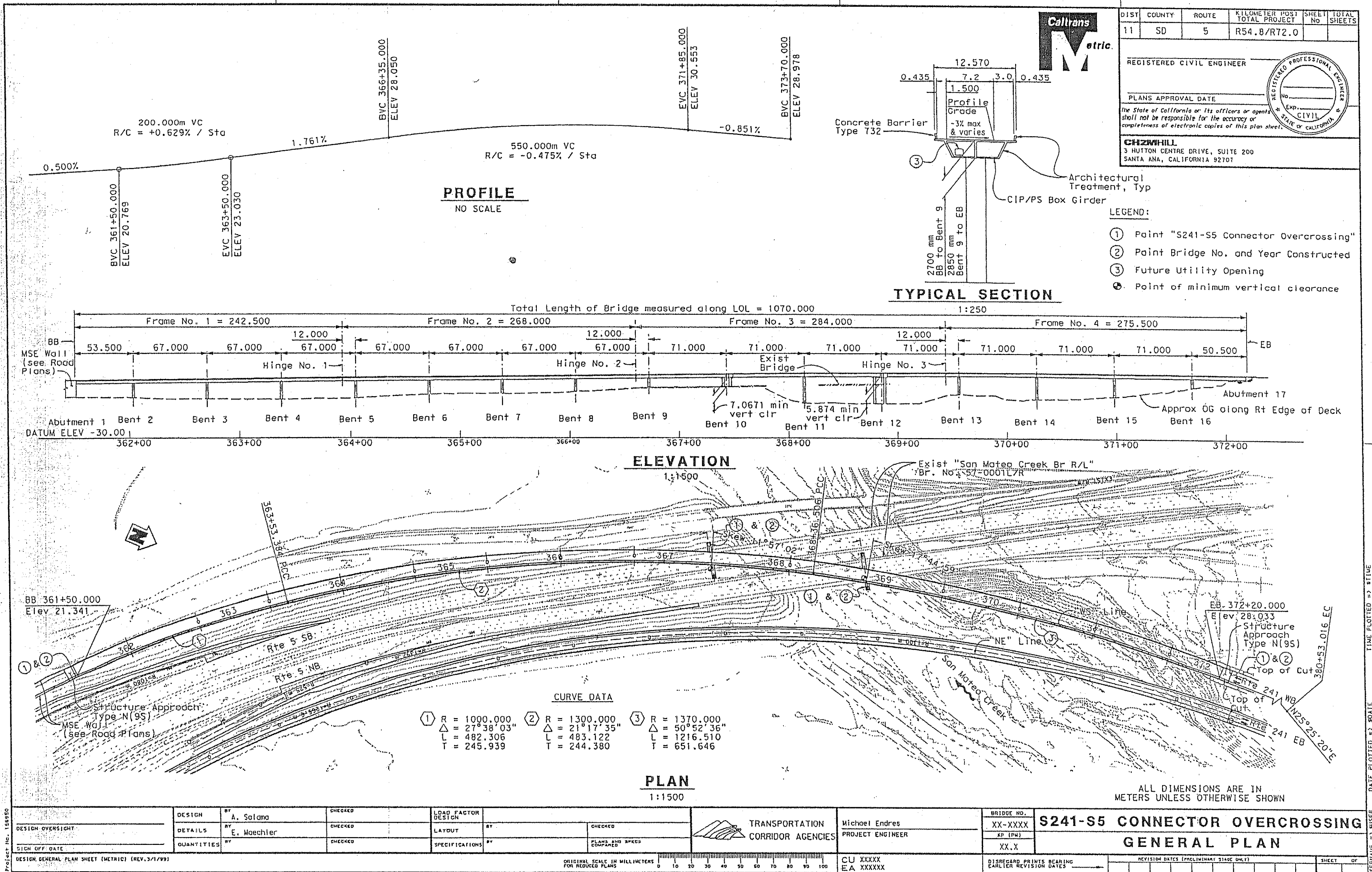
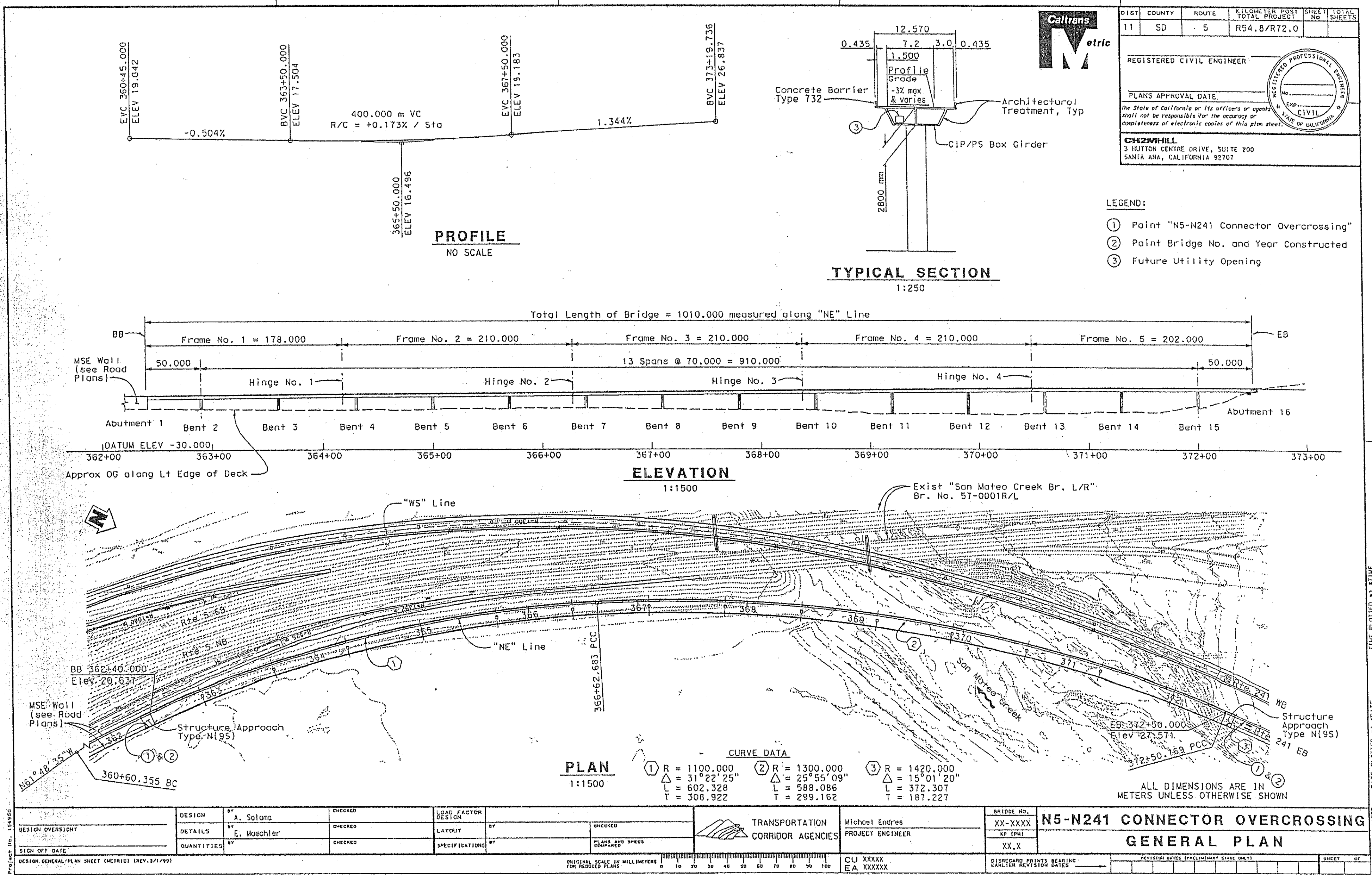

PROFILE GRADE
NO SCALE
350.000 m VC
RC=xx% PER STA
-0.776%
-1.090%
160 m VC
1283+10.000 EVC
ELEV 22.188
1283+65.000 BVC
ELEV 24.388
1287+15.000 EVC
ELEV 30.030
PVI STA 1291+00.000
ELEV 27.042
1293+70.000 BVC
ELEV 24.099
1295+30.000 EVC
ELEV 24.258
1295+30.637 EVC
ELEV 24.266 = "A"
COST DATA
DATE OF ESTIMATE = MAY 2001
STRUCTURE DEPTH = 1700 mm
LENGTH = 175.00 m
WIDTH (m) = 24.610
AREA (m²) = 4307
NEW CONST. COST/SQ M. INCLUDING 10% MOBILIZATION & 25% CONTINGENCY =
BRIDGE REMOVAL COST MOBIL & COATINGS INCL =
BRIDGE RETROFIT =
TOTAL COST =
GRAND TOTAL =
TYPICAL SECTION
1:400
** GIRDER DEPTH VARIES FROM 2.52 m TO 3.20 m TO SUIT SPAN LEGNTH (TAPERING OVER FULL SPAN LEGTHS)
TYPICAL SECTION @ BENT 3
1:400
NB LINE
12.770
0.535
7.200
3.000
PROFILE GRADE VARIES
2.896 (TYP)
2.134 (TYP)
1123 MEASURED ALONG NB LINE
55
73
80
66
11 & 73 = 803
49
BB
EB
5.117 MIN VERT CLR
TOP OF RAMP BAS-1
SAN MATEO CREEK
DATUM ELEV -70.000
ABUT 1
BENT 2
BENT 3
BENT 4
BENT 5
BENT 6
BENT 7
BENT 8
BENT 9
BENT 10
BENT 11
BENT 12
BENT 13
BENT 14
BENT 15
BENT 16
ABUT 17
1285+00
1290+00
1295+00
APPROX OG
DEVELOPED ELEVATION
1:5000
LEGEND
PROJECT CONSTRUCTION
EXISTING CONSTRUCTION
POINT OF MINIMUM VERTICAL CLEARANCE
SB BC 3283+20.686
SB BB 3234+98.876
HOV BB 4285+27.309
HOV PCC 4285+27.309
SB CONNECTOR
RETAINING WALL
SB EC 3290+14.508
EXIST SAN MATEO CREEK BRIDGES
R=1273
R=812
HOV CONNECTOR
NB CONNECTOR
N28°01'24"W
N18°13'11"W
R=1388.300
BAS 1
BASILONE RD
HOV BC 4283+26.010 = "NB15" 283+26.380
NB BB 1283+81 ELEV 27.871
NB PCC 1285+33.495
NB EC 1288+09.611
HOV POB 4290+18.273
NB BC 1289+79.971
HOV BC 4292+68.980
SAN MATEO CREEK
SB BC 3293+60.153
SB EB 3295+34.844
HOV EB 4295+24.256
SB EC 3296+00.000
TO RTE 241 IRVINE
NB EB 1295+07
NB EC 1295+30.637
PLAN
1:5000
NOTE:
30° SKEW @ NB ABUT 20, SB ABUT 18 & HOV ABUT 14 TENTATIVE MEMBER DIMENSIONS ARE SHOWN
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
FEC
APPROVED
DESIGN
DETAILS
L. ZHANG
QUANTITIES
CDMG
TRANSPORTATION CORRIDOR AGENCIES
CU
EA
N5-N241 OC CONNECTOR
GENERAL PLAN

FIGURE 2



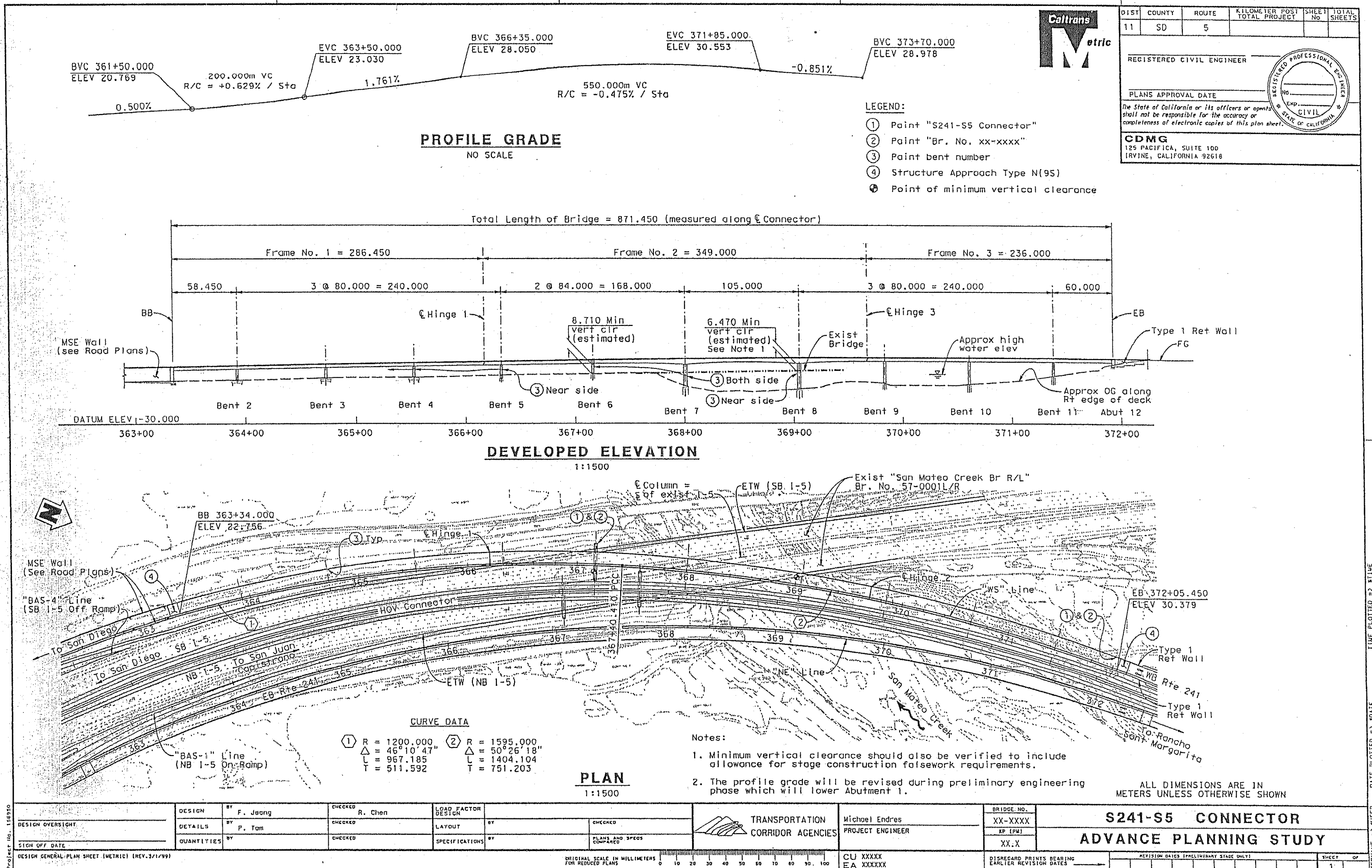
PROFILE
NO SCALE
200.000m VC
R/C = +0.629% / Sta
550.000m VC
R/C = -0.475% / Sta
0.500%
1.761%
-0.851%
BVC 361+50.000
ELEV 20.769
EVC 363+50.000
ELEV 23.030
BVC 366+35.000
ELEV 28.050
EVC 371+85.000
ELEV 30.553
BVC 373+70.000
ELEV 28.978
TYPICAL SECTION
1:250
Concrete Barrier Type 732
Architectural Treatment, Typ
CIP/PS Box Girder
2700 mm BB to Bent 9
2850 mm Bent 9 to EB
LEGEND:
① Point "S241-S5 Connector Overcrossing"
② Point Bridge No. and Year Constructed
③ Future Utility Opening
Point of minimum vertical clearance
Total Length of Bridge measured along LOL = 1070.000
Frame No. 1 = 242.500
Frame No. 2 = 268.000
Frame No. 3 = 284.000
Frame No. 4 = 275.500
Hinge No. 1
Hinge No. 2
Hinge No. 3
Exist Bridge
7.0671 min vert clr
5.874 min vert clr
Abutment 1
Abutment 17
Approx OG along Rt Edge of Deck
DATUM ELEV -30.00
ELEVATION
1:1500
Exist "San Mateo Creek Br R/L" Br. No. 57-0001L/R
BB 361+50.000
Elev 21.341
363+53.384 PCC
368+36.506 PCC
EB 372+20.000
Elev 28.033
Structure Approach Type N(9S)
MSE Wall (See Road Plans)
Rte 5 SB
Rte 5 NB
"NE" Line
San Mateo Creek
Rte 241 WB
Rte 241 EB
N25°25'20"E
380+53.016 EC
CURVE DATA
① R = 1000.000 Δ = 27°38'03" L = 482.306 T = 245.939
② R = 1300.000 Δ = 21°17'35" L = 483.122 T = 244.380
③ R = 1370.000 Δ = 50°52'36" L = 1216.510 T = 651.646
PLAN
1:1500
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
DIST 11 COUNTY SD ROUTE 5 KILOMETER POST TOTAL PROJECT R54.8/R72.0
REGISTERED CIVIL ENGINEER
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
CH2MHILL
3 HUTTON CENTRE DRIVE, SUITE 200
SANTA ANA, CALIFORNIA 92707
DESIGN A. Salama
DETAILS E. Waechler
TRANSPORTATION CORRIDOR AGENCIES
Michael Endres
PROJECT ENGINEER
BRIDGE NO. XX-XXXX
S241-S5 CONNECTOR OVERCROSSING
GENERAL PLAN
CU XXXXX
EA XXXXXX

FIGURE 3



PROFILE
NO SCALE
EVC 360+45.000 ELEV 19.042
BVC 363+50.000 ELEV 17.504
365+50.000 ELEV 16.496
EVC 367+50.000 ELEV 19.183
BVC 373+19.736 ELEV 26.837
-0.504%
400.000 m VC
R/C = +0.173% / Sta
1.344%
TYPICAL SECTION
1:250
12.570
0.435
7.2
3.0
1.500
Profile Grade
-3% max & varies
Concrete Barrier Type 732
Architectural Treatment, Typ
CIP/PS Box Girder
2800 mm
LEGEND:
① Paint "N5-N241 Connector Overcrossing"
② Paint Bridge No. and Year Constructed
③ Future Utility Opening
DIST 11
COUNTY SD
ROUTE 5
KILOMETER POST TOTAL PROJECT R54.8/R72.0
REGISTERED CIVIL ENGINEER
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
CH2MHILL
3 HUTTON CENTRE DRIVE, SUITE 200
SANTA ANA, CALIFORNIA 92707
Total Length of Bridge = 1010.000 measured along "NE" Line
Frame No. 1 = 178.000
Frame No. 2 = 210.000
Frame No. 3 = 210.000
Frame No. 4 = 210.000
Frame No. 5 = 202.000
50.000
13 Spans @ 70.000 = 910.000
Hinge No. 1
Hinge No. 2
Hinge No. 3
Hinge No. 4
BB
EB
MSE Wall (see Road Plans)
Abutment 1
Bent 2
Bent 3
Bent 4
Bent 5
Bent 6
Bent 7
Bent 8
Bent 9
Bent 10
Bent 11
Bent 12
Bent 13
Bent 14
Bent 15
Abutment 16
DATUM ELEV -30.000
Approx OG along Lt Edge of Deck
ELEVATION
1:1500
"WS" Line
"NE" Line
Exist "San Mateo Creek Br. L/R"
Br. No. 57-0001R/L
Rte 5 SB
Rte 5 NB
San Mateo Creek
BB 362+40.000
Elev 20.637
Structure Approach Type N(9S)
360+60.355 BC
N61°48'35"W
366+62.683 PCC
EB 372+50.000
Elev 27.571
372+50.769 PCC
Rte 241 WB
Rte 241 EB
PLAN
1:1500
CURVE DATA
① R = 1100.000 Δ = 31°22'25" L = 602.328 T = 308.922
② R = 1300.000 Δ = 25°55'09" L = 588.086 T = 299.162
③ R = 1420.000 Δ = 15°01'20" L = 372.307 T = 187.227
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
DESIGN A. Salana
DETAILS E. Maechler
TRANSPORTATION CORRIDOR AGENCIES
Michael Endres
PROJECT ENGINEER
BRIDGE NO. XX-XXXX
XX.X
N5-N241 CONNECTOR OVERCROSSING
GENERAL PLAN
CU XXXXX
EA XXXXXX

FIGURE 4



PROFILE GRADE
NO SCALE
BVC 361+50.000 ELEV 20.769
0.500%
200.000m VC R/C = +0.629% / Sta
EVC 363+50.000 ELEV 23.030
1.761%
BVC 366+35.000 ELEV 28.050
550.000m VC R/C = -0.475% / Sta
EVC 371+85.000 ELEV 30.553
-0.851%
BVC 373+70.000 ELEV 28.978
LEGEND:
1 Paint "S241-S5 Connector"
2 Paint "Br. No. XX-XXXX"
3 Paint bent number
4 Structure Approach Type N(9S)
Point of minimum vertical clearance
Total Length of Bridge = 871.450 (measured along ℄ Connector)
Frame No. 1 = 286.450
Frame No. 2 = 349.000
Frame No. 3 = 236.000
58.450
3 @ 80.000 = 240.000
2 @ 84.000 = 168.000
105.000
3 @ 80.000 = 240.000
60.000
BB
EB
℄ Hinge 1
℄ Hinge 3
8.710 Min vert clr (estimated)
6.470 Min vert clr (estimated) See Note 1
Exist Bridge
Approx high water elev
Type 1 Ret Wall
FG
MSE Wall (see Road Plans)
3 Near side
3 Both side
3 Near side
Approx OG along Rt edge of deck
Bent 2
Bent 3
Bent 4
Bent 5
Bent 6
Bent 7
Bent 8
Bent 9
Bent 10
Bent 11
Abut 12
DATUM ELEV -30.000
363+00
364+00
365+00
366+00
367+00
368+00
369+00
370+00
371+00
372+00
DEVELOPED ELEVATION
1:1500
℄ Column = ℄ of exist I-5
ETW (SB I-5)
Exist "San Mateo Creek Br R/L" Br. No. 57-0001L/R
BB 363+34.000 ELEV 22.756
3 Typ
℄ Hinge 1
1 & 2
℄ Hinge 2
MSE Wall (See Road Plans)
"BAS-4" Line (SB I-5 Off Ramp)
HOV Connector
"WS" Line
EB 372+05.450 ELEV 30.379
To San Diego
To San Diego SB I-5
NB I-5 To San Juan Capistrano
EB Rte 241
WB Rte 241
ETW (NB I-5)
"NE" Line
San Mateo Creek
Type 1 Ret Wall
To Rancho Sant Margarita
"BAS-1" Line (NB I-5 On Ramp)
CURVE DATA
1 R = 1200.000 Δ = 46°10'47" L = 967.185 T = 511.592
2 R = 1595.000 Δ = 50°26'18" L = 1404.104 T = 751.203
PLAN
1:1500
Notes:
1. Minimum vertical clearance should also be verified to include allowance for stage construction falsework requirements.
2. The profile grade will be revised during preliminary engineering phase which will lower Abutment 1.
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
Caltrans Metric
DIST 11 COUNTY SD ROUTE 5
REGISTERED CIVIL ENGINEER
PLANS APPROVAL DATE
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CDMG
125 PACIFICA, SUITE 100
IRVINE, CALIFORNIA 92618
DESIGN F. Jaong
DETAILS P. Tam
CHECKED R. Chen
TRANSPORTATION CORRIDOR AGENCIES
Michael Endres
PROJECT ENGINEER
BRIDGE NO. XX-XXXX
XX.X
CU XXXXX
EA XXXXXX
S241-S5 CONNECTOR
ADVANCE PLANNING STUDY

FIGURE 5

DIST 11 | COUNTY SD | ROUTE 5 | KILOMETER POST TOTAL PROJECT | SHEET No | TOTAL SHEETS

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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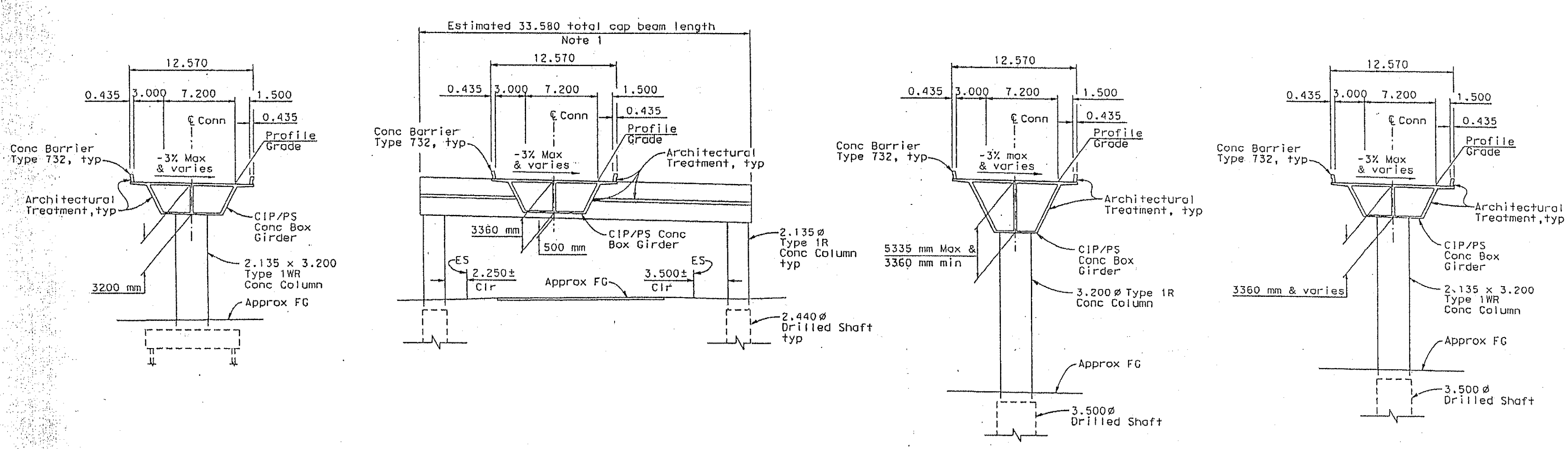
125 PACIFICA, SUITE 100
IRVINE, CALIFORNIA 92618



TYPICAL SECTION-FRAME 1
1:200

BENT 6

BENT 7 AND 8

TYPICAL SECTION - FRAME 2
1:200

TYPICAL SECTION-BENT 5 AND FRAME 3
1:200
Note 2

Notes:
1. Cap beam length at Bent 6 (outrigger bent) will be decided at Bridge Type Selection phase.
2. Column casing will be added to Bent 5 to increase column length.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT | DESIGN BY F. Jeong | CHECKED R. Chen | LOAD FACTOR DESIGN
DETAILS BY P. Tom | CHECKED | LAYOUT BY | CHECKED
SIGN OFF DATE | QUANTITIES BY | CHECKED | SPECIFICATIONS BY | PLANS AND SPECS COMPARED

DESIGN GENERAL PLAN SHEET (METRIC) (REV.3/1/99)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

TRANSPORTATION CORRIDOR AGENCIES

Michael Endres
PROJECT ENGINEER

CU XXXXX
EA XXXXXX

FILE => $REQUEST

BRIDGE NO. XX-XXXX
XP (PM) XX.X

DISREGARD PRINTS BEARING EARLIER REVISION DATES

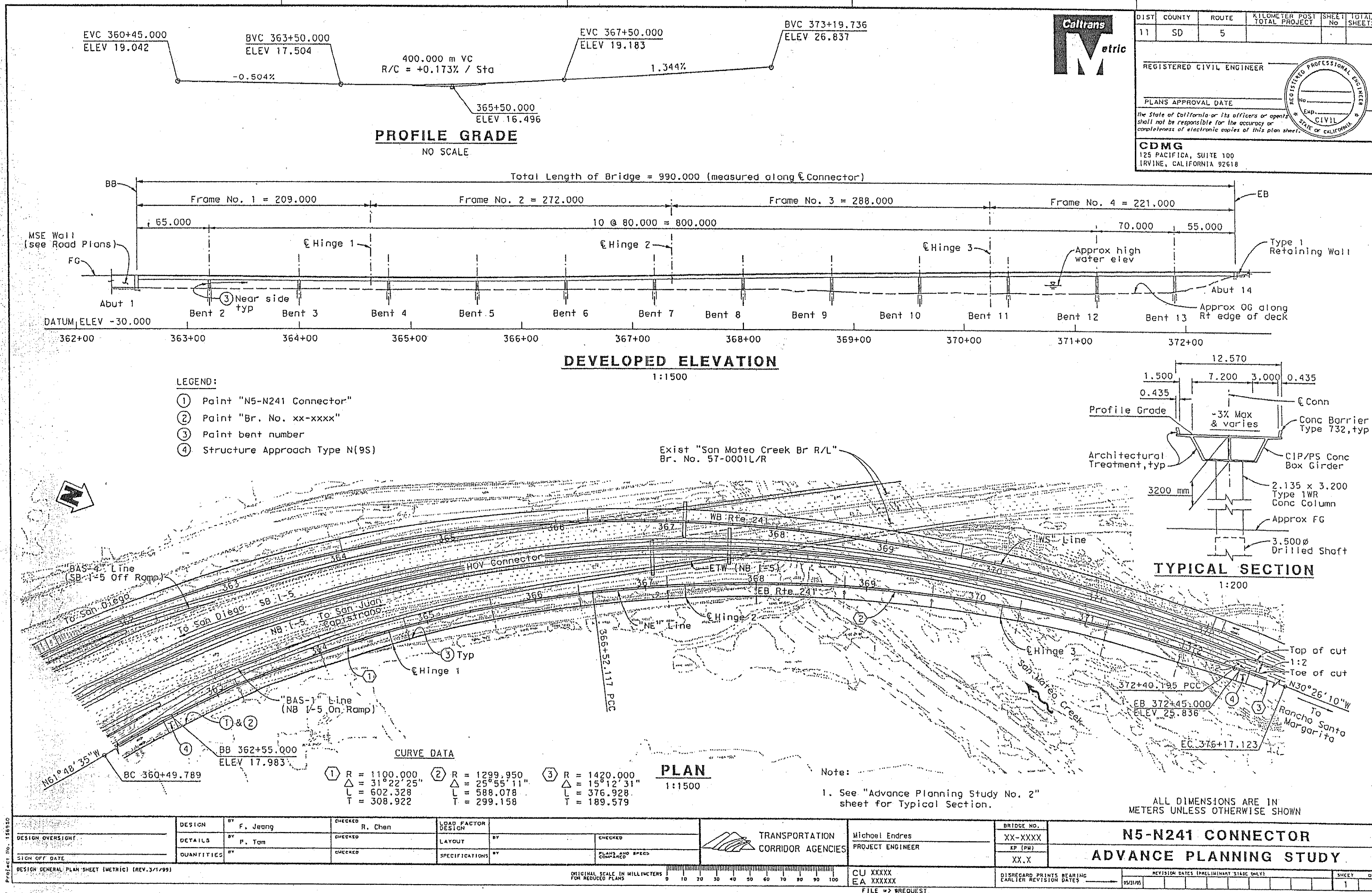
S241-S5 CONNECTOR
ADVANCE PLANNING STUDY

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 2 OF

Project No. 156960

FIGURE 6


PROFILE GRADE
NO SCALE
EVC 360+45.000 ELEV 19.042
BVC 363+50.000 ELEV 17.504
-0.504%
400.000 m VC
R/C = +0.173% / Sta
365+50.000 ELEV 16.496
EVC 367+50.000 ELEV 19.183
1.344%
BVC 373+19.736 ELEV 26.837
Total Length of Bridge = 990.000 (measured along ℄ Connector)
Frame No. 1 = 209.000
Frame No. 2 = 272.000
Frame No. 3 = 288.000
Frame No. 4 = 221.000
65.000
10 @ 80.000 = 800.000
70.000
55.000
BB
EB
MSE Wall (see Road Plans)
FG
℄ Hinge 1
℄ Hinge 2
℄ Hinge 3
Approx high water elev
Type 1 Retaining Wall
Abut 1
Abut 14
Approx OG along Rt edge of deck
③ Near side typ
Bent 2
Bent 3
Bent 4
Bent 5
Bent 6
Bent 7
Bent 8
Bent 9
Bent 10
Bent 11
Bent 12
Bent 13
DATUM ELEV -30.000
362+00
363+00
364+00
365+00
366+00
367+00
368+00
369+00
370+00
371+00
372+00
DEVELOPED ELEVATION
1:1500
LEGEND:
① Paint "N5-N241 Connector"
② Paint "Br. No. xx-xxxx"
③ Paint bent number
④ Structure Approach Type N(9S)
Exist "San Mateo Creek Br R/L" Br. No. 57-0001L/R
12.570
1.500
7.200
3.000
0.435
0.435
℄ Conn
Profile Grade
-3% Max & varies
Conc Barrier Type 732,typ
Architectural Treatment,typ
CIP/PS Conc Box Girder
3200 mm
2.135 x 3.200 Type 1WR Conc Column
Approx FG
3.500⌀ Drilled Shaft
TYPICAL SECTION
1:200
"BAS-4" Line (SB I-5 Off Ramp)
To San Diego
To San Diego SB I-5
NB I-5 To San Juan Capistrano
HOV Connector
WB Rte 241
ETW (NB I-5)
EB Rte 241
"NE" Line
"WS" Line
366+52.117 PCC
③ Typ
℄ Hinge 1
℄ Hinge 2
℄ Hinge 3
"BAS-1" Line (NB I-5 On Ramp)
① & ②
BB 362+55.000 ELEV 17.983
BC 360+49.789
N61°48'35"W
San Mateo Creek
Top of cut
1:2
Toe of cut
N30°26'10"W
To Rancho Santa Margarita
372+40.195 PCC
EB 372+45.000 ELEV 25.836
EC 376+17.123
CURVE DATA
① R = 1100.000 Δ = 31°22'25" L = 602.328 T = 308.922
② R = 1299.950 Δ = 25°55'11" L = 588.078 T = 299.158
③ R = 1420.000 Δ = 15°12'31" L = 376.928 T = 189.579
PLAN
1:1500
Note:
1. See "Advance Planning Study No. 2" sheet for Typical Section.
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
DIST 11 COUNTY SD ROUTE 5
REGISTERED CIVIL ENGINEER
PLANS APPROVAL DATE
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CDMG
125 PACIFICA, SUITE 100
IRVINE, CALIFORNIA 92618
DESIGN F. Jeong
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DETAILS P. Tom
TRANSPORTATION CORRIDOR AGENCIES
Michael Endres
PROJECT ENGINEER
BRIDGE NO. XX-XXXX
KP (PM) XX.X
N5-N241 CONNECTOR
ADVANCE PLANNING STUDY
CU XXXXX
EA XXXXXX

13

FIGURE 7

Attachment 1:

Bridge Type and Bridge Construction Illustration

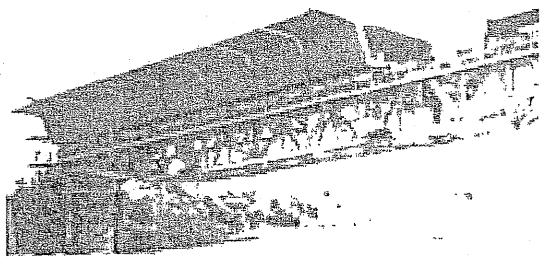
Bridge Type And Bridge Construction Illustration

The span length, cost, constructability and aesthetics of I-5/S-241 Connectors over I-5 and San Mateo Creek must be balanced with the environmental considerations and community impacts. The bridge alternatives and bridge construction are illustrated as the followings.

Concrete Segmental Bridge

A concrete segmental bridge is a bridge assembled in segments as opposed to conventional methods that build a bridge in very large sections thru ground supporting falsework. Concrete segmental bridges can be categorized by method of construction as span-by-span, incremental launching, balanced cantilever, or progressive cantilever.

Evans Crary Bridge, Florida

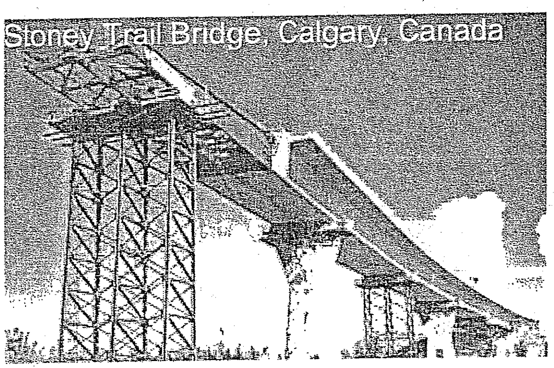


Span-by-span Construction

An entire span of segments is supported by a temporary truss or girder until it is post-tensioned and self-supporting. A falsework system can be used at the ends of bridges where the sites are low and flat.

Appropriate Span Length: 80 - 150 feet

Applicability to FTC-S Project: Not suitable for curved alignment with spans longer than 250'.



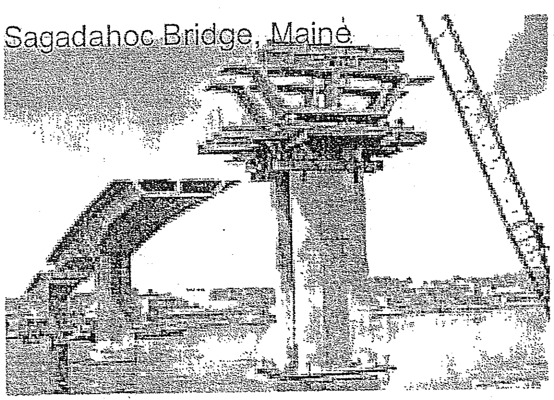
Stoney Trail Bridge, Calgary, Canada

Incremental launching Construction

A segment is attached to the previously completed bridge superstructure, and then the entire completed bridge is launched outward before the subsequent segment is assembled.

Appropriate Span Length: Up to 240 feet

Applicability to FTC-S Project: Suitable only for a constant radius curved alignment over creek and I-5 with outrigger bents and temporary supporting piers during construction. Not economical.



Sagadahoc Bridge, Maine

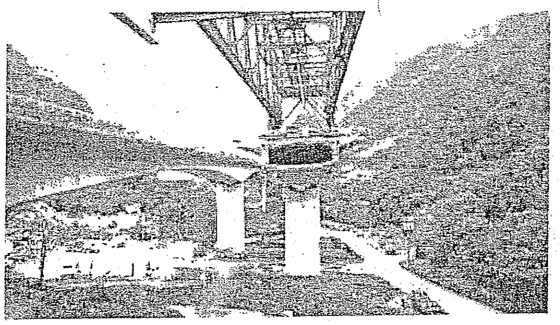
Balanced Cantilever Construction - Precast

A segment is attached to the previously completed bridge superstructure in a symmetrical fashion about a pier.

Appropriate Span Length: 160 - 450 feet

Applicability to FTC-S Project: Significant challenges in the hauling of heavy segments, and the lifting and erection of these same superstructure segments.

North Halawa Valley Structure, Hawaii



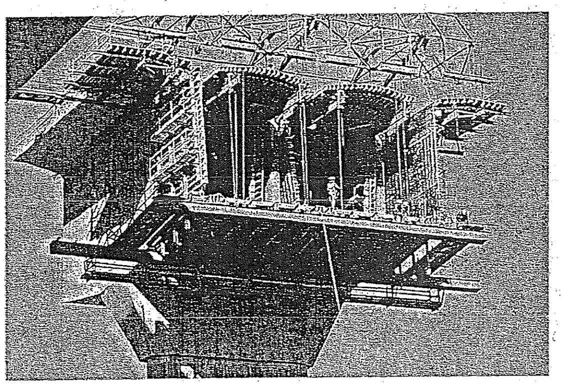
Balanced Cantilever Construction - Cast-in-place

The superstructure is constructed using a series of full depth cast-in-place segments in a symmetrical fashion about a pier. The previously erected superstructure segments support the relatively short traveling forms needed for casting the segments.

Appropriate Span Length: 260 - 750 feet

Applicability to FTC-S Project: Not economical due to the lacking of span repetitive, and delaying the beginning of superstructure construction in requiring specialized falsework, travelling forms and construction equipments.

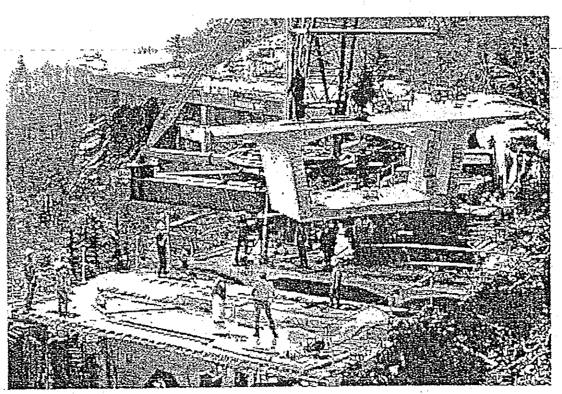
Vietnam Veterans Memorial Bridge, Virginia



Traveling Form

Form travelers consist of a sufficiently stiff steel frame to which form panels for the box girder segments are attached at the front. Working platforms on different levels that can be accessed from above are also suspended from the traveler. After advancing on rails on top of the superstructure, the traveler is anchored down to the previous cast segments. The traveler main beams are located either above the superstructure (overhead system) or below the superstructure (underslung system).

Linn Cove Viaduct, North Carolina



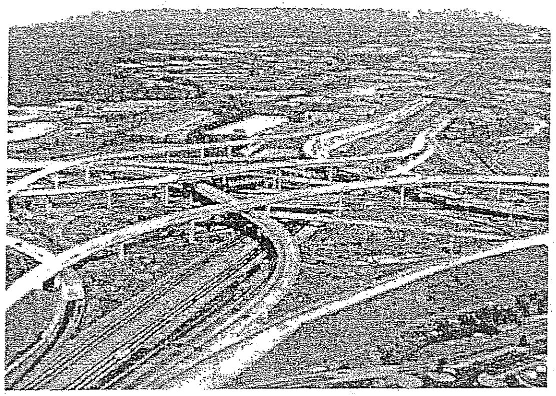
Progressive Cantilever Construction

The erection of multiple span bridges proceeds in one heading, often with temporary supports to limit stresses in the structure during erection.

Appropriate Span Length: 100 - 300 feet

Applicability to FTC-S Project: Not economical and significant challenges as balanced cantilever construction.

I-285 Atlanta Interchange Viaducts, Georgia



Concrete Box Girder Bridge - Cast-in-place Prestressed

A cast-in-place prestressed concrete box girder bridge is cast continuously on falsework with continuous draped tendons post-tensioned. It is the conventional Caltrans type bridge.

Appropriate Span Length: 100 - 400 feet

Applicability to FTC-S Project: It is feasible to build a cast-in-place prestressed concrete box girder on a long span falsework system across the creek and I-5 with a limited number of temporary supports.

Ford City Veterans Bridge, Pennsylvania

Steel Plate Girder Bridge

A steel plate girder bridge, a modern version of the log bridge, is spaced at regular intervals between piers.

Appropriate Span Length: 100 - 400 feet

Applicability to FTC-S Project: steel plate girder can accommodate the curvature readily. Significant challenges in the transportation of deep girders by truck, and the fabrication and erection of these same girders.

Storrow Drive Connector Bridge, Massachusetts

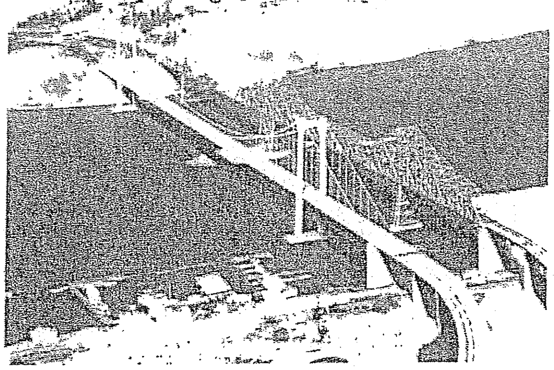
Steel Box Girder Bridge

A steel box girder bridge is a particular type of steel plate girder bridge where the girders form a closed hollow section which has high torsional rigidity.

Appropriate Span Length: 200 - 600 feet

Applicability to FTC-S Project: steel box girder can accommodate the horizontal curved alignment. Significant constructability considerations in fabricated girder sections, overland transportation, bridge fabrication and steel erection.

Carquinez Bridge, California



Truss Bridge

Truss Bridges consist of straight members arranged in triangle patterns. Long spans can be achieved by increasing the overall depth where the moment is greater.

Appropriate Span Length: 500 - 1,200 feet

Applicability to FTC-S Project: Not suitable for curved alignment over creek and I-5.

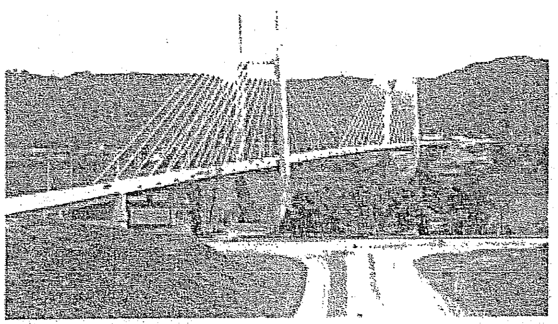
Suspension Bridge

The towers, the cables, and the anchors are the three main parts of a suspension bridges. The cables are suspended between towers and secured usually into a heavy mass of concrete at ends of bridge. The roadway is hung from the massive steel cables by the vertical suspender cables.

Appropriate Span Length: 1,500 feet and up

Applicability to FTC-S Project: Not suitable for curved alignment over creek and I-5.

Maysville Bridge, Kentucky



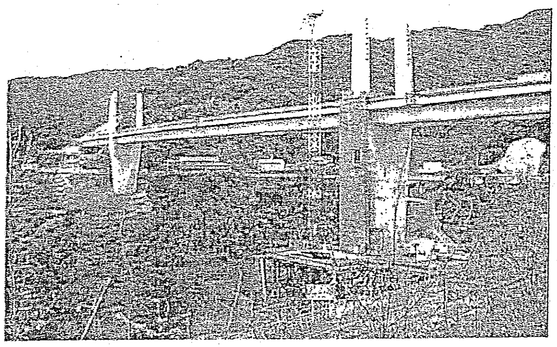
Cable-Stayed Bridge

In cable-stayed bridges, the roadway is supported by inclined cables, stays, passing over or attached to the towers. The cable-staged bridge requires smaller and lighter anchorages for the cables than the suspension bridge does.

Appropriate Span Length: 600 - 1,800 feet

Applicability to FTC-S Project: Long span bridge type not economical for the relatively short span length and curved alignment.

Himi Yumi Bridge, Nagasaki, Japan

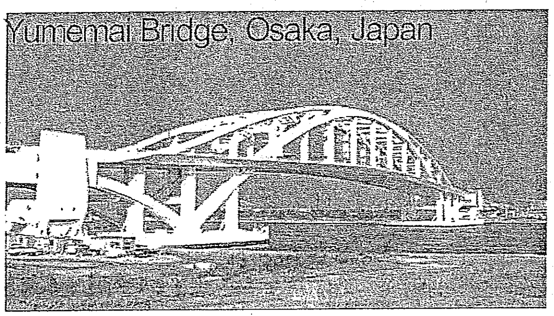


Extradosed Bridge

The extradosed bridge is a combination of a cable-stayed bridge and a segmental bridge. The stay-cables and the superstructure work in combination to carry the live load, allowing the superstructure to be more slender than a typical segmental bridge and the towers to be typically half the height above the deck than an equvalent cable-stayed bridge.

Appropriate Span Length: 300 - 900 feet

Applicability to FTC-S Project: Wide substructure not fitted in the center medium between SB I-5 and NB I-5 and not economical for the curved alignment.



Yumemai Bridge, Osaka, Japan

Arch Bridge

The arch bridge uses a curved arch made of either steel or concrete to transfer partially the weight of bridge and vehicles into a horizontal thrust against the supports at either end.

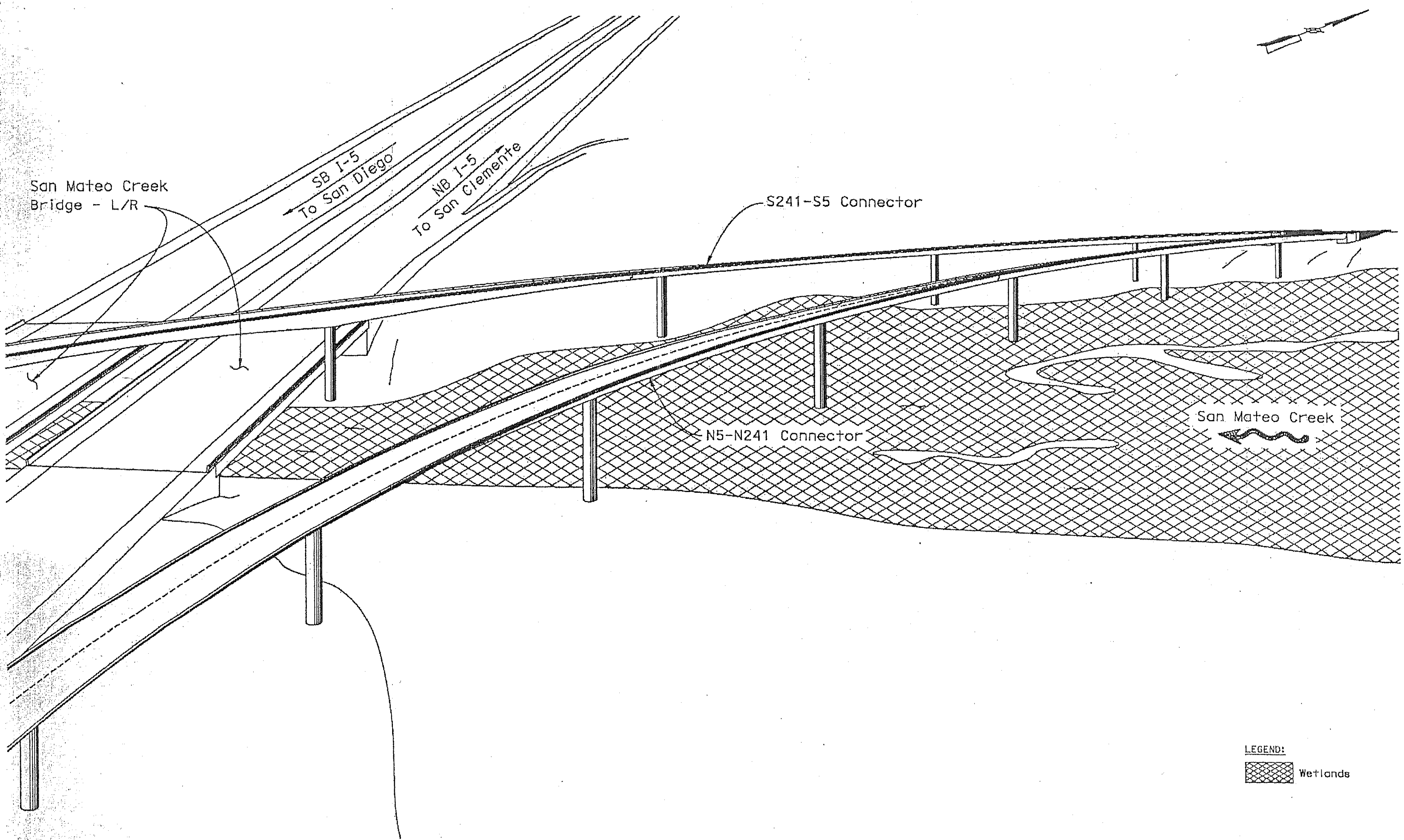
Appropriate Span Length: 500 - 1,200 feet

Applicability to FTC-S Project: Not suitable for curved alignment over creek and I-5.

Attachment 2:

Perspective Rendering for Other Feasible Structure Types

CONVENTIONAL CAST-IN-PLACE/PRESTRESSED (CIP/PS) CONCRETE BOX GIRDER



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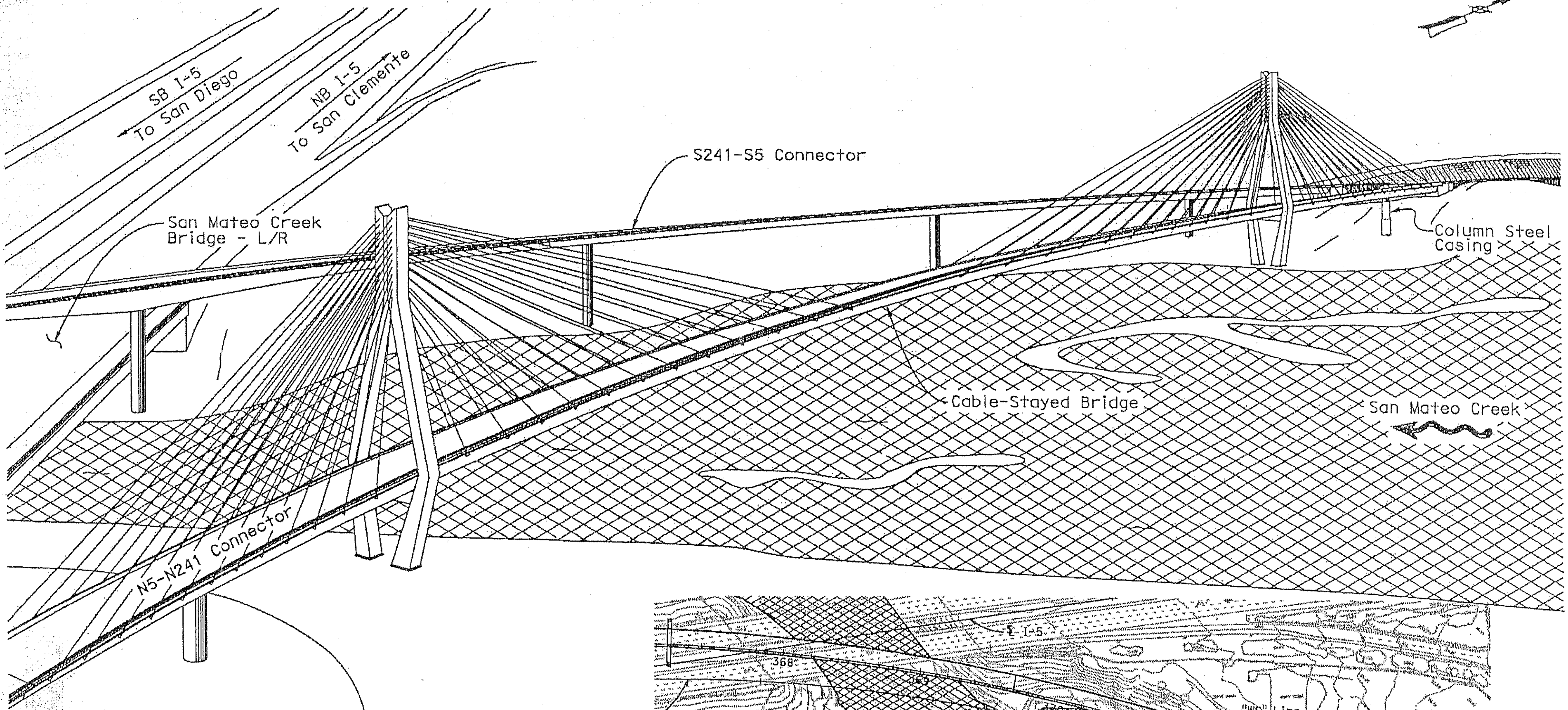
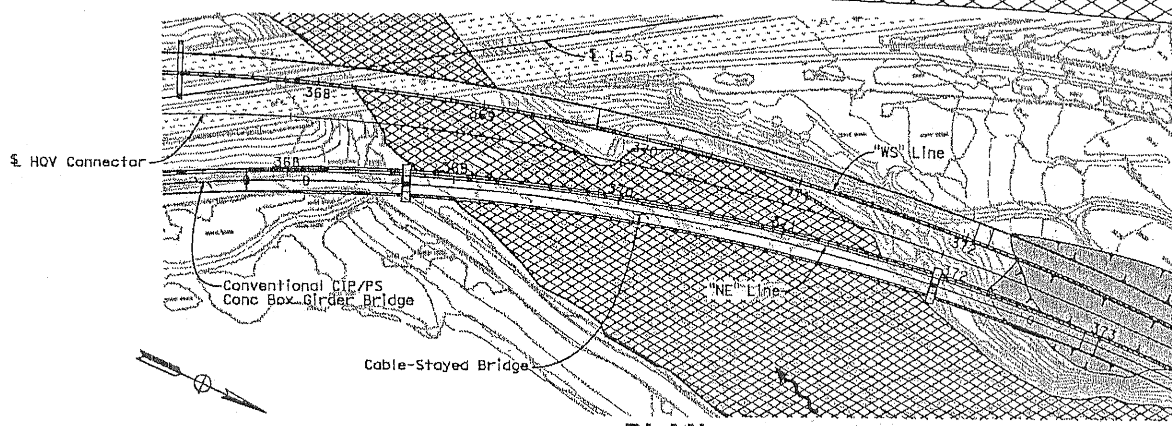
Transportation Corridor Agencies

CABLE-STAYED BRIDGE WITH PRESTRESSED (PS) CONCRETE BOX GIRDER





PLAN

LEGEND:

- Wetlands
- Excavation

Notes:

1. The main span length of the cable-stayed bridge over San Mateo Creek is estimated longer than 320 meters to have each tower/pylon located outside wetlands and fit in curved roadway alignment.
2. Deep cut of existing hillside will be required for north abutment construction.
3. The height of pylon above bridge deck is estiamted to be more than 60 meters.

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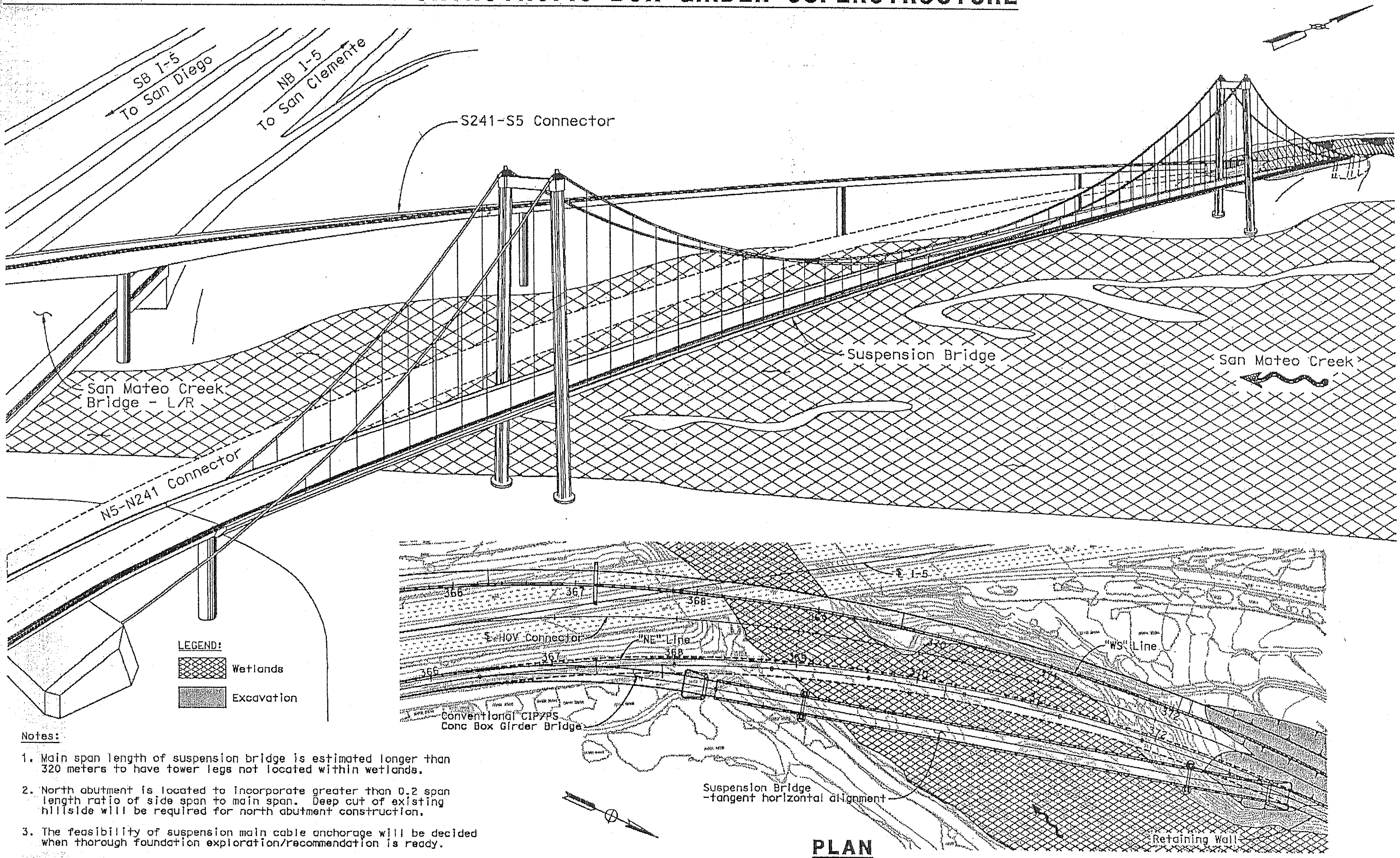
SUSPENSION BRIDGE - STEEL ORTHOTROPIC BOX GIRDER SUPERSTRUCTURE



PLAN

Notes:

1. Main span length of suspension bridge is estimated longer than 320 meters to have tower legs not located within wetlands.
2. North abutment is located to incorporate greater than 0.2 span length ratio of side span to main span. Deep cut of existing hillside will be required for north abutment construction.
3. The feasibility of suspension main cable anchorage will be decided when thorough foundation exploration/recommendation is ready.
4. The height of suspension towers above bridge deck is estiamted to be more than 40 meters.

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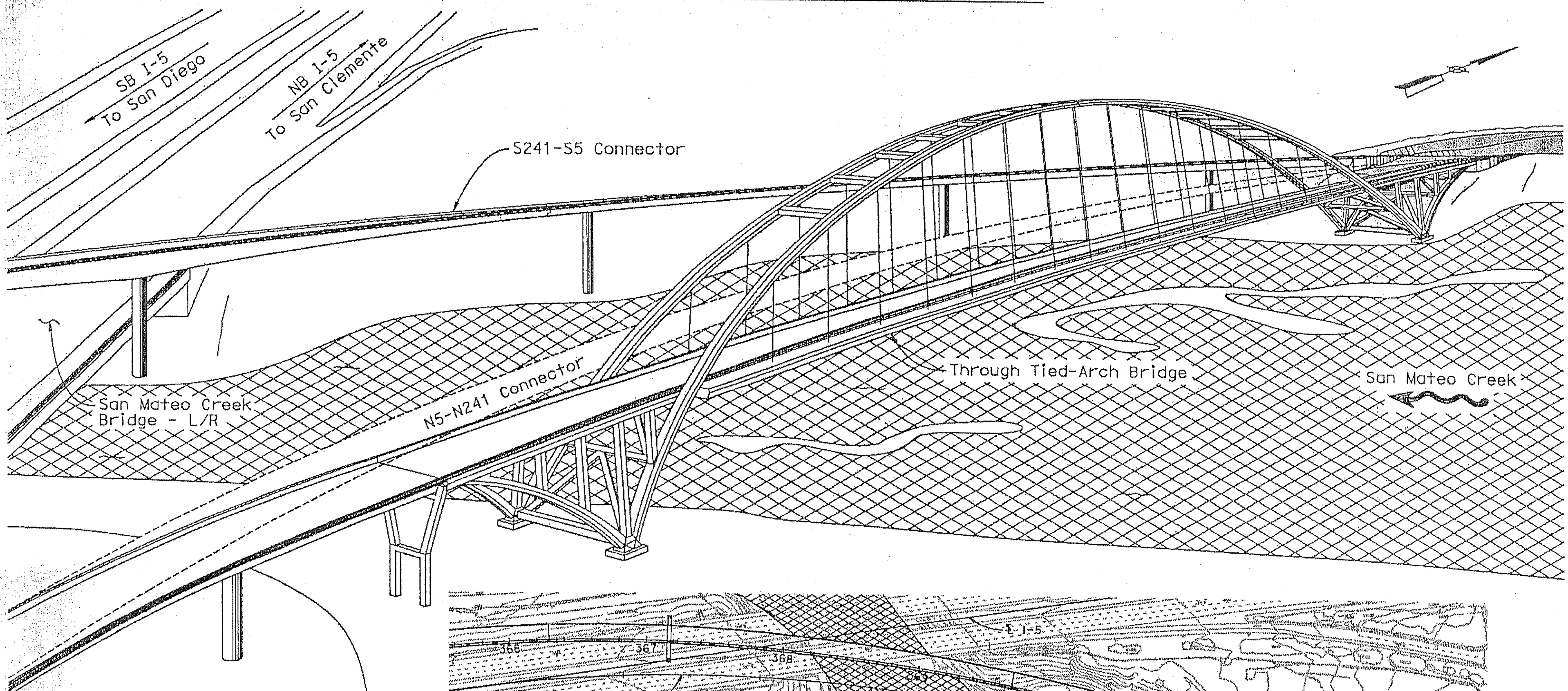
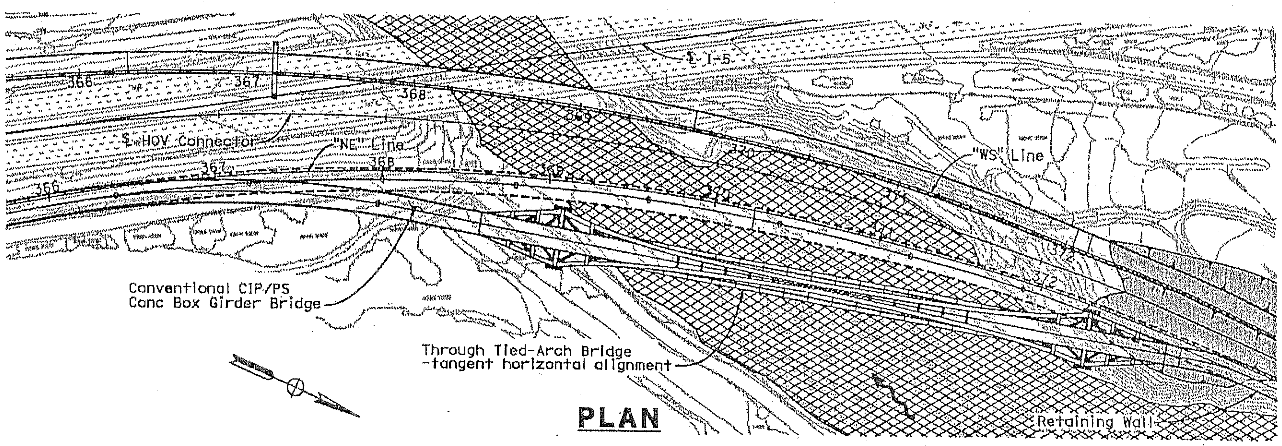
INCLINED RIBS (BASKET HANDLE TYPE) THROUGH TIED-ARCH BRIDGE





PLAN

LEGEND:

- Wetlands
- Excavation

Notes:

1. Main span length of inclined ribs (basket handle type) through tied-arch bridge is estimated longer than 320 meters.
2. The height of steel box ribs above bridge deck is estimated to be more than 30 meters.
3. The contractors should carefully plan steel box ribs and steel box girder fabrication, transportation and erection.

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