04-SF-80-KP 12.6/13.2
RU 4251 - EA 0120R1
Project Cost $84 million

Fact Sheet

EXCEPTION TO ADVISORY DESIGN STANDARDS

Prepared By: Karen Gemmill
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STATE OF CALIFORNIA

Submitted By:	Bob Zandipour Bob Zandipour Design Senior	4-8-03 Date	510-286-5709 Telephone
Recommended for Approval By:	Janet Adams Janet Adams Project Manager	4/11/03 Date	(286) 622-0505 Telephone
Approved By:	Dan McElhinney Dan McElhinney Chief Deputy District Director	4.21.03 Date	286.5906 Telephone

Caltrans Metric

1. PROPOSED PROJECT

A. Project Description

The State of California, Department of Transportation (Caltrans) proposes replacing the eastern span of the San Francisco/Oakland Bay Bridge (SFOBB) for seismic safety reasons. The span would be replaced from the Yerba Buena Island Tunnel east to the Oakland Shore, and the project will conform to existing conditions west of the Toll Plaza

A double-deck temporary bypass structure will be constructed to carry San Francisco - Oakland Bay Bridge (Bay Bridge) eastbound and westbound traffic to allow the demolition of the existing bridge and construction of the replacement bridge east of Yerba Buena Island. The bypass will align to the south of the existing bridge and will be a total of 580 meters (1850 ft or 1/3 mile) in length and will be referred to as the Temporary Bypass Structure (TBS). The physical constraints of the site and points of tie-in require both directions of the bypass to be placed on a viaduct structure.

The advisory exceptions discussed here are exclusively for the TBS.

B. Existing Highway

The SFOBB currently serves approximately 300,000 vehicles per day, and 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 network. The SFOBB East Span Seismic Safety Project provides 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.

C. Safety Improvements

The SFOBB project overall 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.

D. Total Project Cost

Total cost for project has been estimated to be $84 million.

2. NONSTANDARD FEATURES

See Advisory Design Exception Table, Attachment D.

3. ADVISORY STANDARD FOR WHICH EXCEPTION IS BEING REQUESTED

1. Superelevation Transition
   HDM Index 202.5(1) states that "A superelevation transition should be designed in accordance with the diagram and tabular data shown in Figure 202.5 to satisfy the requirements of safety, comfort and pleasing appearance."

   HDM Index 202.5(2) states that "Two-thirds of the superelevation runoff should be on the tangent and on-third within the curve."

2. Standards for Grade
   HDM Index 204.3 states that "Ramp grades should not exceed 8%"

3. Vertical Curves
   HDM Index 204.4 states that "For algebraic grade differences of less than 2% or design speeds less than 60 km/h, the minimum length of vertical curve should be 60m."

4. Design of Freeway Entrances and Exits
   HDM Index 504.2(2) states that "Design of freeway entrances and exits should conform to the standard designs illustrated in Figure 504.2A-B (single lane), and Figure 504.3L (two lane entrances and exits) and/or Figure 504.4 (diverging branch connections), as appropriate."

   HDM Index 504.2(4)(a) states that "The design speed at the exit nose should be 80 km/h or greater for both ramps and branch connections."

   HDM Index 504.2(4)(b) states that "The design speed at the inlet nose should be consistent with approach alignment standards. If the approach is a branch connection or diamond ramp with high alignment standards, the design speed should be at least 80 km/h."

5. Grade Line of Structures-Falsework
   HDM Index 204.8(5) states that "The normal minimum width of traffic openings and required falsework spans for various lane and shoulder combinations should be as shown in Table 204.8.

4. REASON FOR REQUESTING EXCEPTION

See Advisory Design Exception Table, Attachment D.

5. ADDED COST TO MAKE STANDARD

Because of the temporary nature of this project as well as the structural, environmental, and political constraints, the additional cost to make standard is an extremely large number. The double-deck temporary bypass structure is estimated to save $10 million and take 2 years off the overall scheduled construction time.

6. TRAFFIC DATA

The SFOBB currently serves approximately 300,000 vehicles per day. The westbound approaches to the SFOBB frequently operate at capacity during peak commute periods and are also heavily traveled during off-peak periods. The SFOBB generally operates just at capacity due to the metering of vehicles on the bridge by the San Francisco ramp system and metering lights at the SFOBB Toll Plaza. Traffic flow on the SFOBB is vulnerable to congestion due to stalls, accidents, lane closures required for bridge maintenance, and the lack of shoulders for clearing stopped vehicles.

The freeway ramps to and from the SFOBB from YBI typically operate with no more than 300 vehicles during the peak hour. Despite low traffic volumes, the ramps operate at capacity due to severely restricted design limitations (e.g., restricted merge lanes). All of the local streets in the project area (YBI, Treasure Island, and the Oakland Touchdown area) currently operate with low volumes of traffic.

In the future, peak-hour traffic demand for the approaches to the SFOBB are expected to increase. These increases will be due to increased demand for travel between the East and West Bay Area. However, traffic volumes on the bridge itself are expected to remain fairly constant due to the metering lights in the westbound direction at the Oakland Toll Plaza and the geometric meter in the eastbound direction in San Francisco. The geometric meter is a result of the three through lanes on eastbound I-80 and the two entrance ramps from downtown San Francisco merging at the beginning of the bridge.

7. ACCIDENT DATA

Table 1 shows the most recent traffic accident rates for eastbound and westbound traffic on I-80 between YBI and Oakland. The accident rate for eastbound I-80 is lower than the average accident rate for similar facilities in the State. However, the accident rate for westbound I-80 is higher in comparison to the average rate for similar facilities around the State. This may be attributed to several factors: the absence of shoulders on I-80, the nonstandard on-ramps and off-ramps, and high traffic volumes on I-80. The westbound may also be higher because the accident data includes the toll plaza, which has a difficult merge area at the bridge approach.

Table 1 Accident Data

Source: Caltrans District 4

Location	Period	Total Accidents	Fatalities	Injuries	Actual Accident Rate[1]	Average Accident Rate[2]
I-80 Eastbound	04/01/99 to 03/31/02	363	3	110	0.75	1.18
I-80 Westbound	04/01/99 to 03/31/02	827	0	194	1.72	1.18

[1] The Actual Accident Rate is the rate of accidents per million vehicles miles on the facility described
[2] The Average Accident Rate is the rate of accidents per million vehicles miles on similar facilities in the State.

Accident data for the three-year period from April 1999 to March 2002 indicate that a total of 363 accidents occurred on eastbound I-80, between the YBI viaduct and the Oakland toll plaza. Approximately 53% of these accidents were rear-end collisions and approximately 29% were side-swipe collisions. Accident data on westbound I-80 in this area revealed a total of 827 accidents for the same three-year period. Of these accidents, 61% were rear-end collisions and approximately 30% were side-swipe collisions.
Similar accident data were reviewed for the I-80 on- and off-ramps on YBI, east of the tunnel. During the three-year period from April 1999 to March 2002, two accidents occurred on the eastbound I-80 off-ramp, both involving hit objects, and three accidents occurred on the eastbound on-ramp, all rear-end collisions. The westbound on-ramp had two accidents, including one side-swipe collision and one involving a hit object. The westbound off-ramp had a total of seven accidents, all of which involved hit objects.

8. FUTURE CONSIDERATIONS

None.

9. PROJECT REVIEW AND CONCURRENCE

The proposed design exceptions were reviewed by Mike Thomas, HQ Geometric Reviewer, on January 7, 2003 and he concurred with the proposed design exceptions.

10. ATTACHMENTS

Attachment A - Location Map

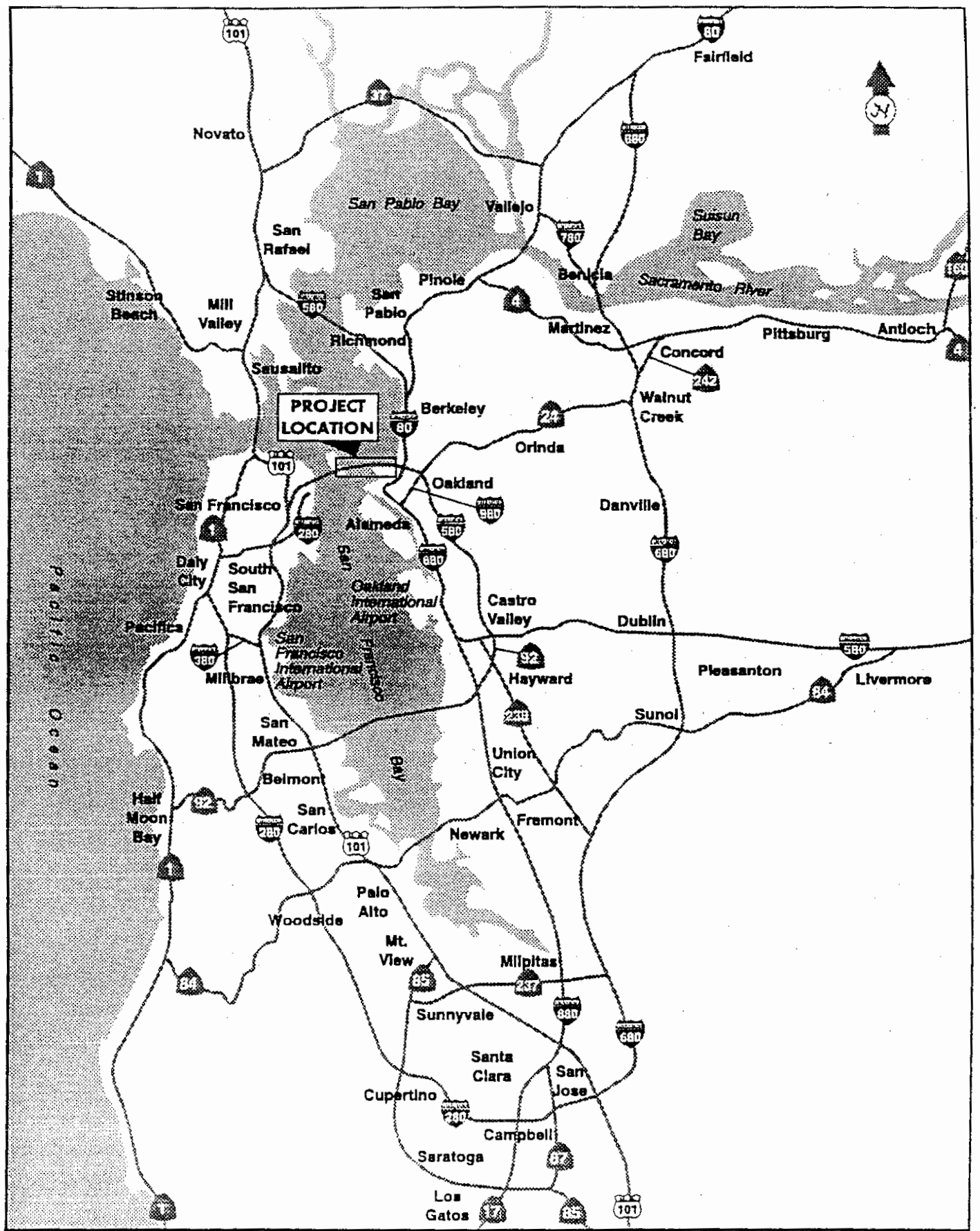
Attachment B - Project Area

Attachment C – Project Layout, Profiles, Superelevation and Typical Sections

Attachment D – Advisory Design Exception Table

Attachment A

Location Map



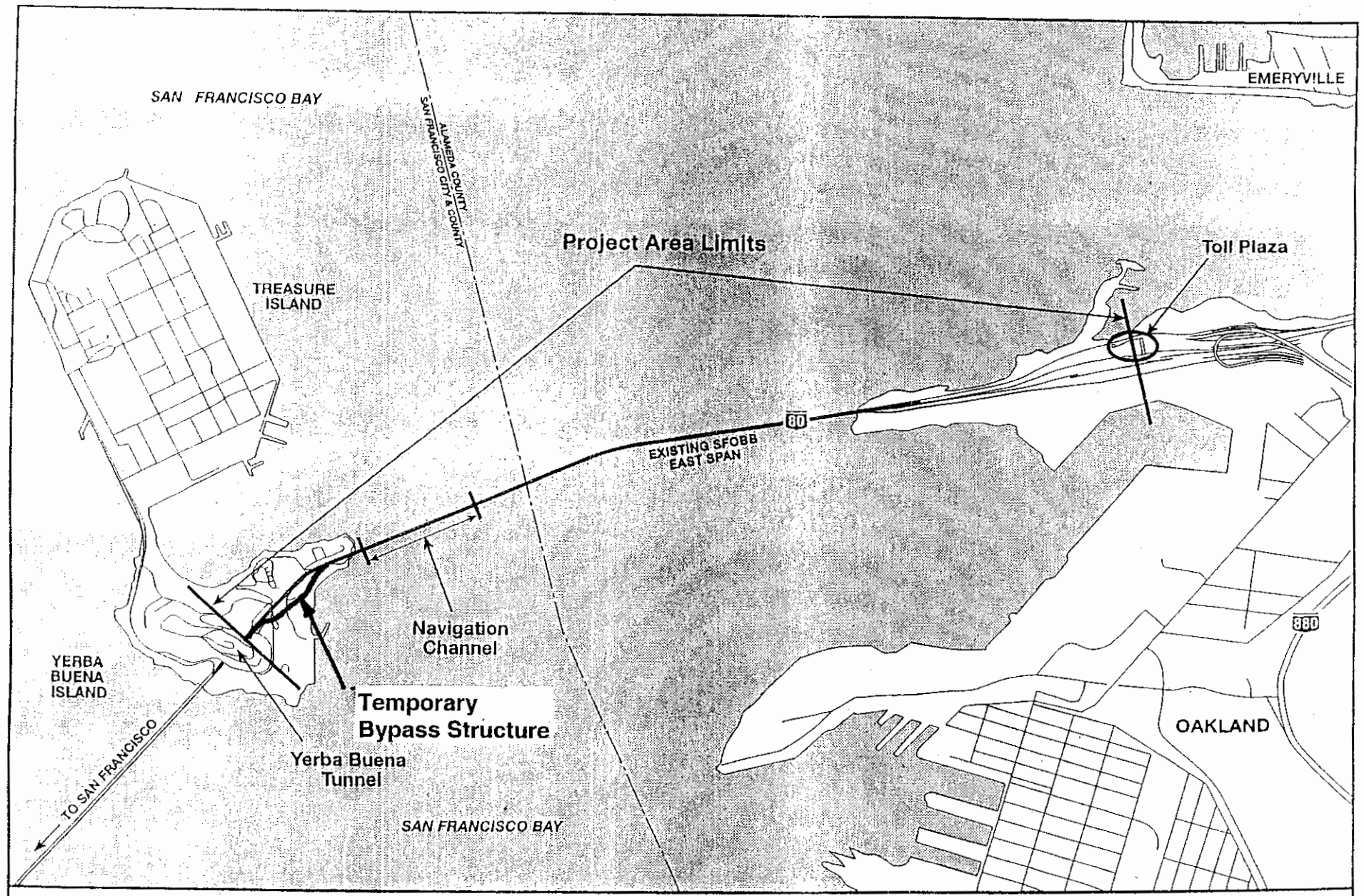
SFOBB EAST SPAN SEISMIC SAFETY PROJECT

GRAPHIC SCALE 0 10km

Project Location

Attachment B

Project Area



SFOBB
EAST SPAN
SEISMIC SAFETY
PROJECT

GRAPHIC SCALE 1:27,500
0 250 500 1000 m

Project Area Limits

PBQ&D F-2 8/16/98

Attachment C

Project Layout, Profiles, and Superelevation Diagrams

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TO SHE
04	SF	80	12.6/13.2		

Karen Gemmill 2/28/03
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Karen Gemmill No. C60173 Exp. 06/30/04 CIVIL STATE OF CALIFORNIA

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CHECKED BY	T. Dougherty	2/03	DATE REVISED	3/03

DESIGN OVERSIGHT: Bob Zandipour

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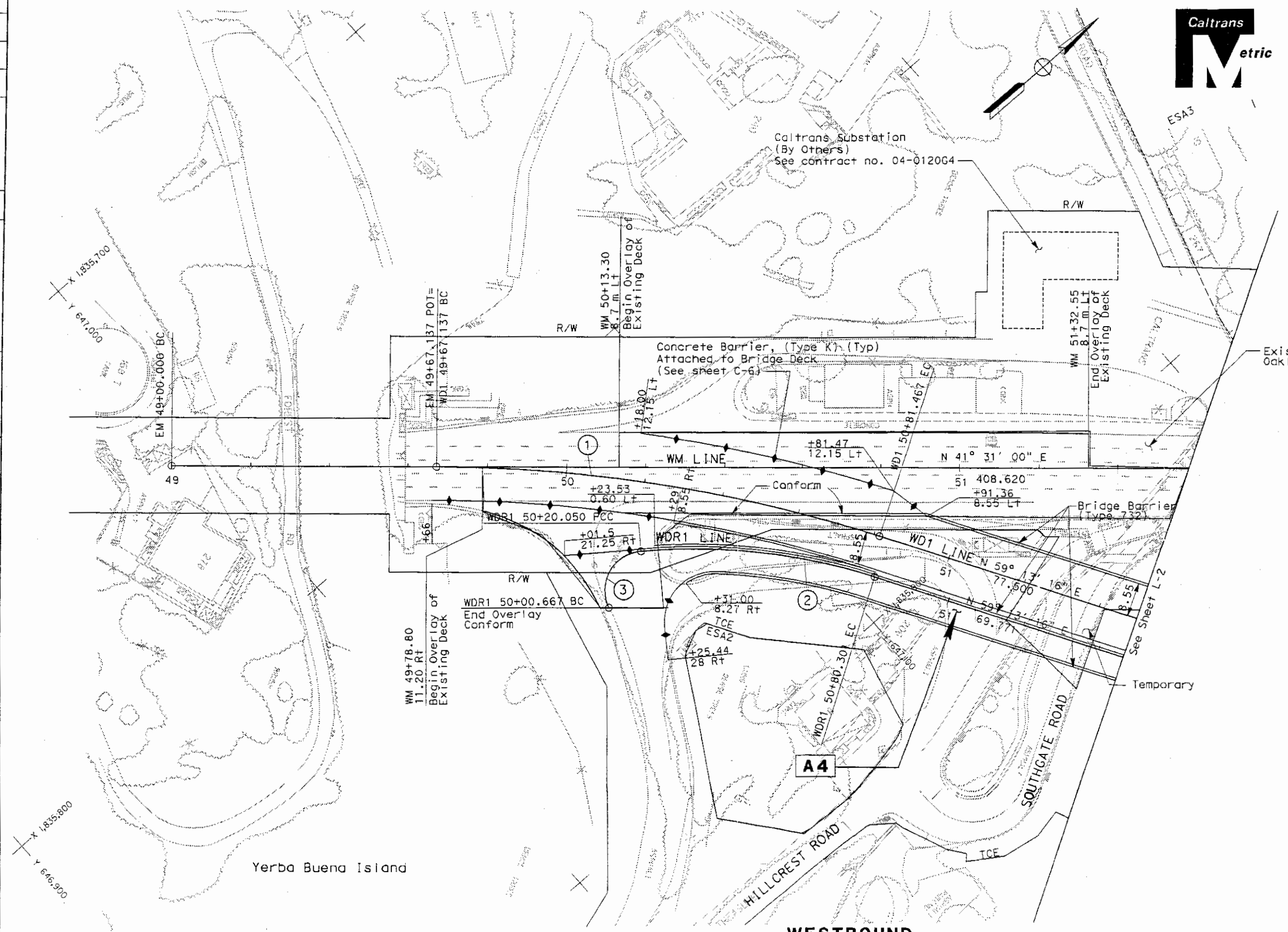

CURVE DATA						
NO.	R	Δ	T	L	N	E
1	370	17°42'16"	57.624	114.330	646 797.792	1 836 073.754
2	150	23°00'51"	30.537	60.251	646 978.963	1 835 968.235
3	10	111°03'22"	14.565	19.383	647 061.661	1 835 855.270

ADVISORY EXCEPTION LAYOUT

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

L-1

RELATIVE BORDER SCALE IS IN MILLIMETERS 0 20 40 60 80

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04	SF	80	12.6/13.2		

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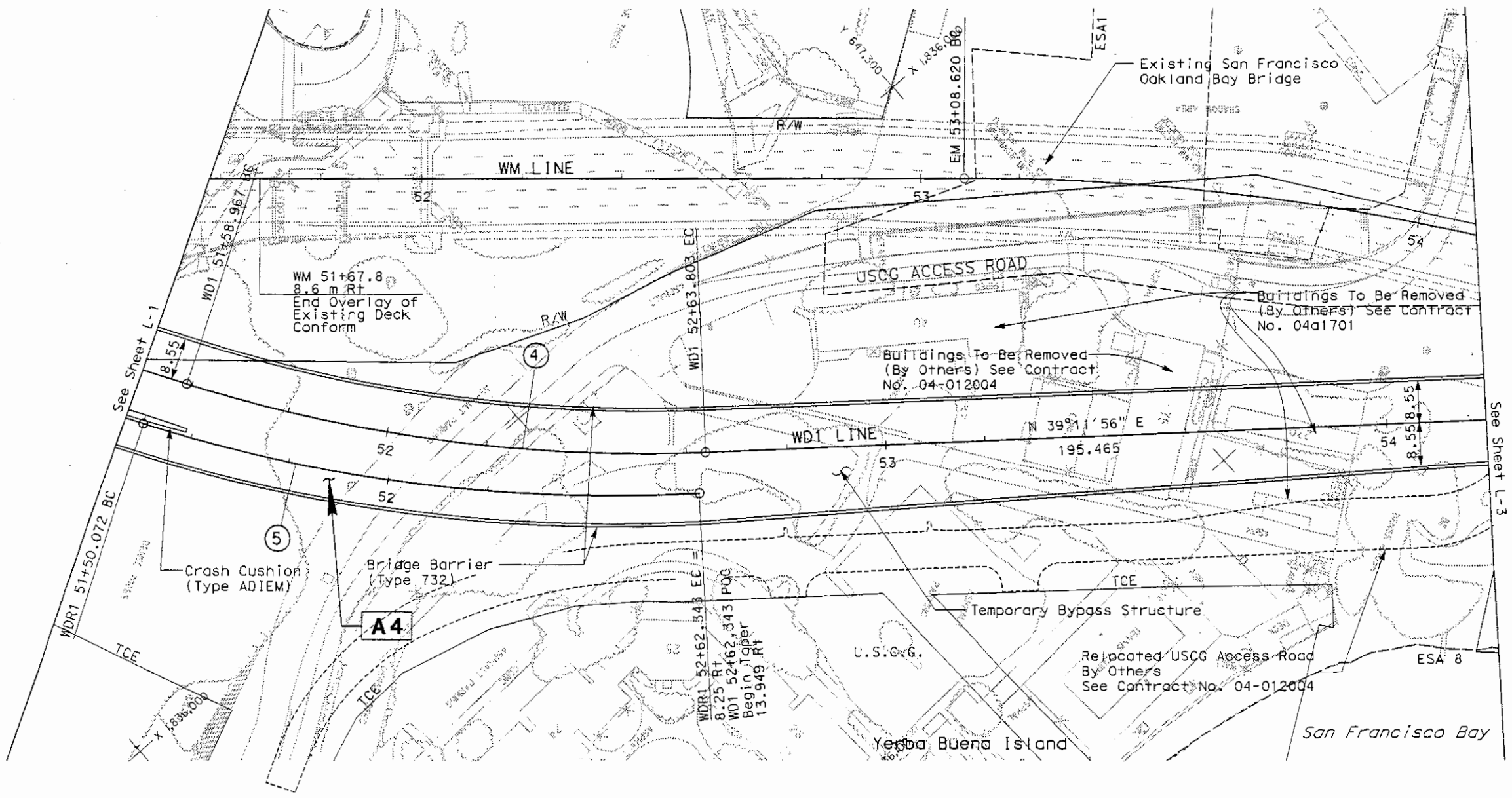

WESTBOUND

CURVE DATA						
NO.	R	Δ	T	L	N	E
4	300	20°01'20"	52.958	104.836	647 413.080	1 835 797.481
5	308.25	20°52'06"	56.764	112.271	647 408.371	1 835 793.680

For Notes, Abbreviations and/or Legend See Sheet L-1

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ADVISORY EXCEPTION LAYOUT

SCALE: 1:500

L-2

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04	SF	80	12.6/13.2		

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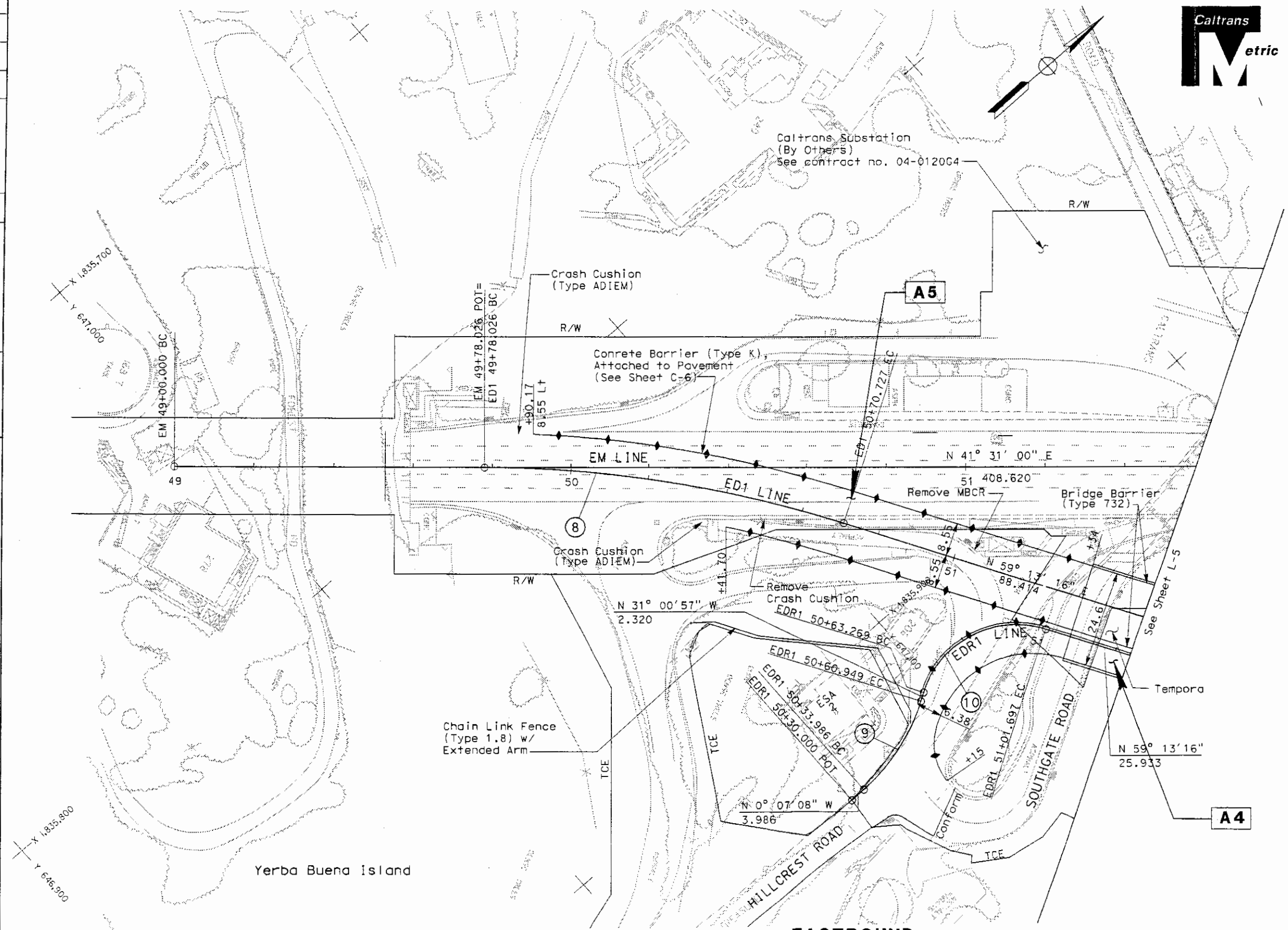

EASTBOUND

CURVE DATA						
NO.	R	△	T	L	N	E
8	300	17°42'17"	46.723	92.071	646 852.347	1 836 028.556
9	50	30°53'49"	13.818	26.963	647 068.980	1 835 879.058
10	24.5	90°14'13"	24.501	38.428	647 109.305	1 835 941.625

For Notes, Abbreviations and/or Legend See Sheet L-1

ADVISORY EXCEPTION LAYOUT

SCALE: 1:500

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L-4

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REVISED BY: 3/03
DATE REVISED:

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04	SF	80	12.6/13.2	

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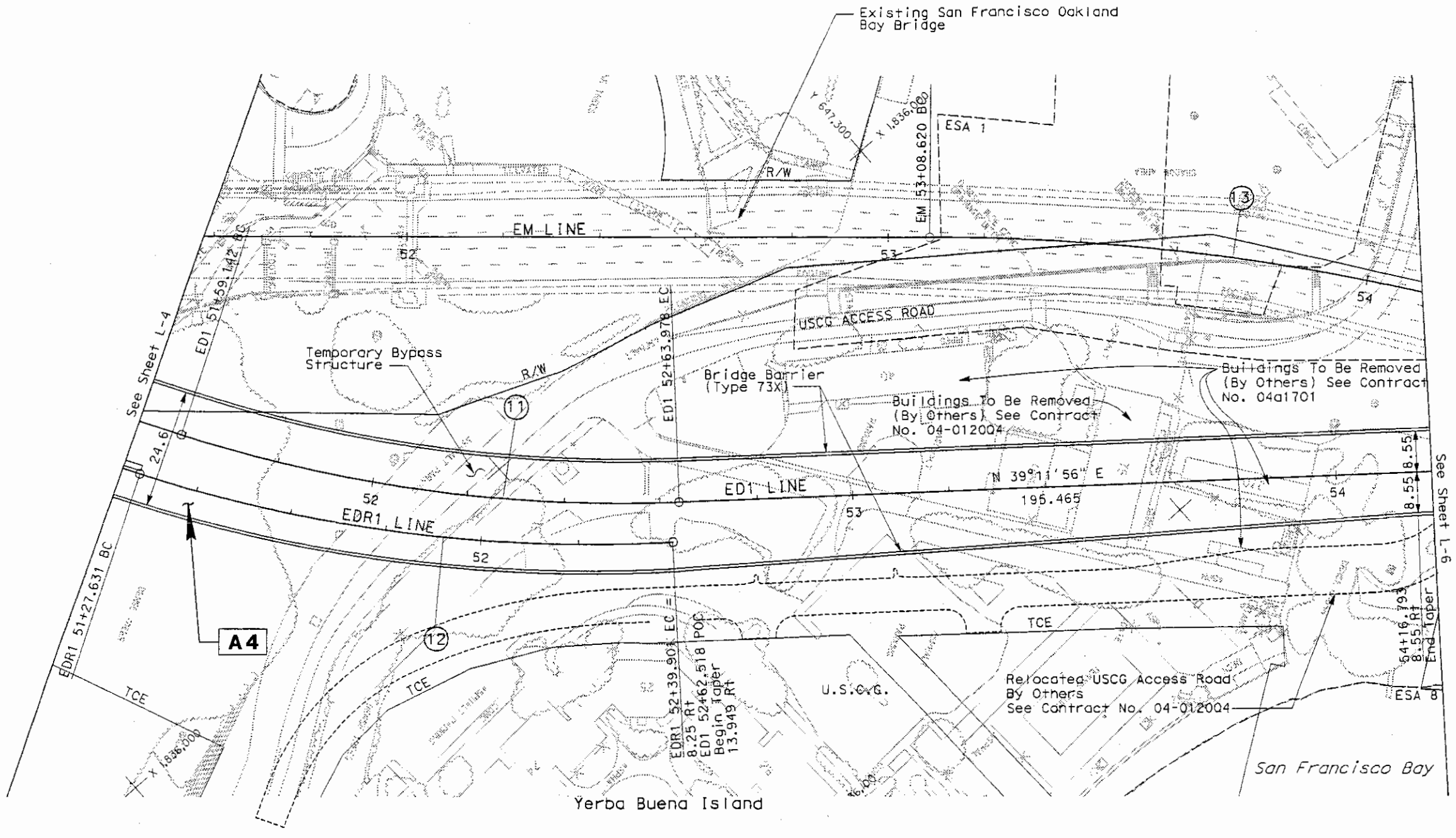

EASTBOUND

CURVE DATA						
NO.	R	△	T	L	N	E
11	300	20°01'20"	52.958	104.836	647 413.080	1 835 797.481
12	308.25	20°52'06"	56.764	112.271	647 408.371	1 835 793.680
13	457.20	27°30'42"	111.926	219.534	646 995.681	1 836 365.394

For Notes, Abbreviations and/or Legend See Sheet L-1

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ADVISORY EXCEPTION LAYOUT

SCALE: 1:500

L-5

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DATE REVISED: 3/03

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04	SF	80	12.6/13.2	

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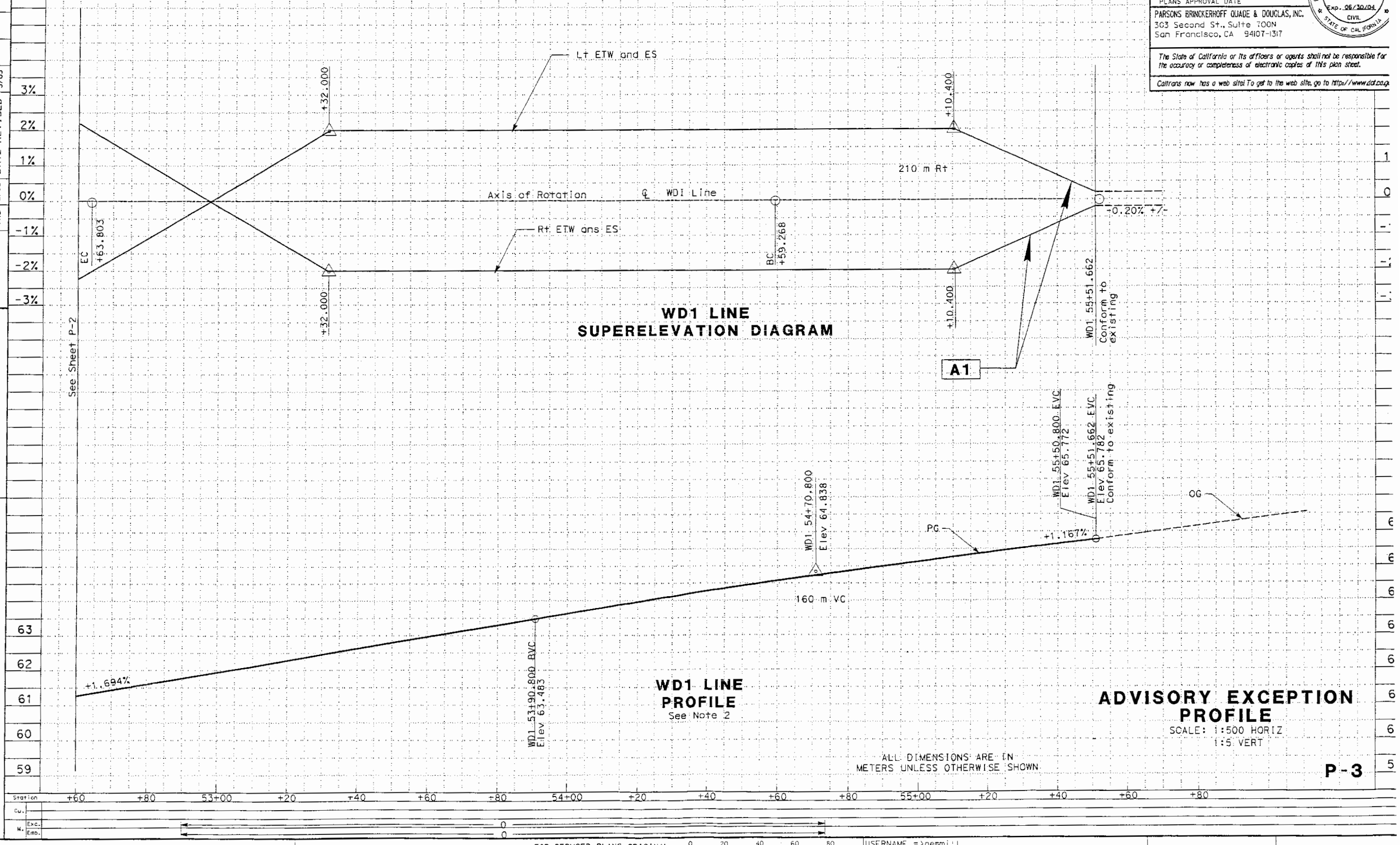

WD1 LINE SUPERELEVATION DIAGRAM

WD1 LINE PROFILE

See Note 2

ADVISORY EXCEPTION PROFILE

SCALE: 1:500 HORIZ
1:5 VERT

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P-3

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04	SF	80	12.6/13.2		

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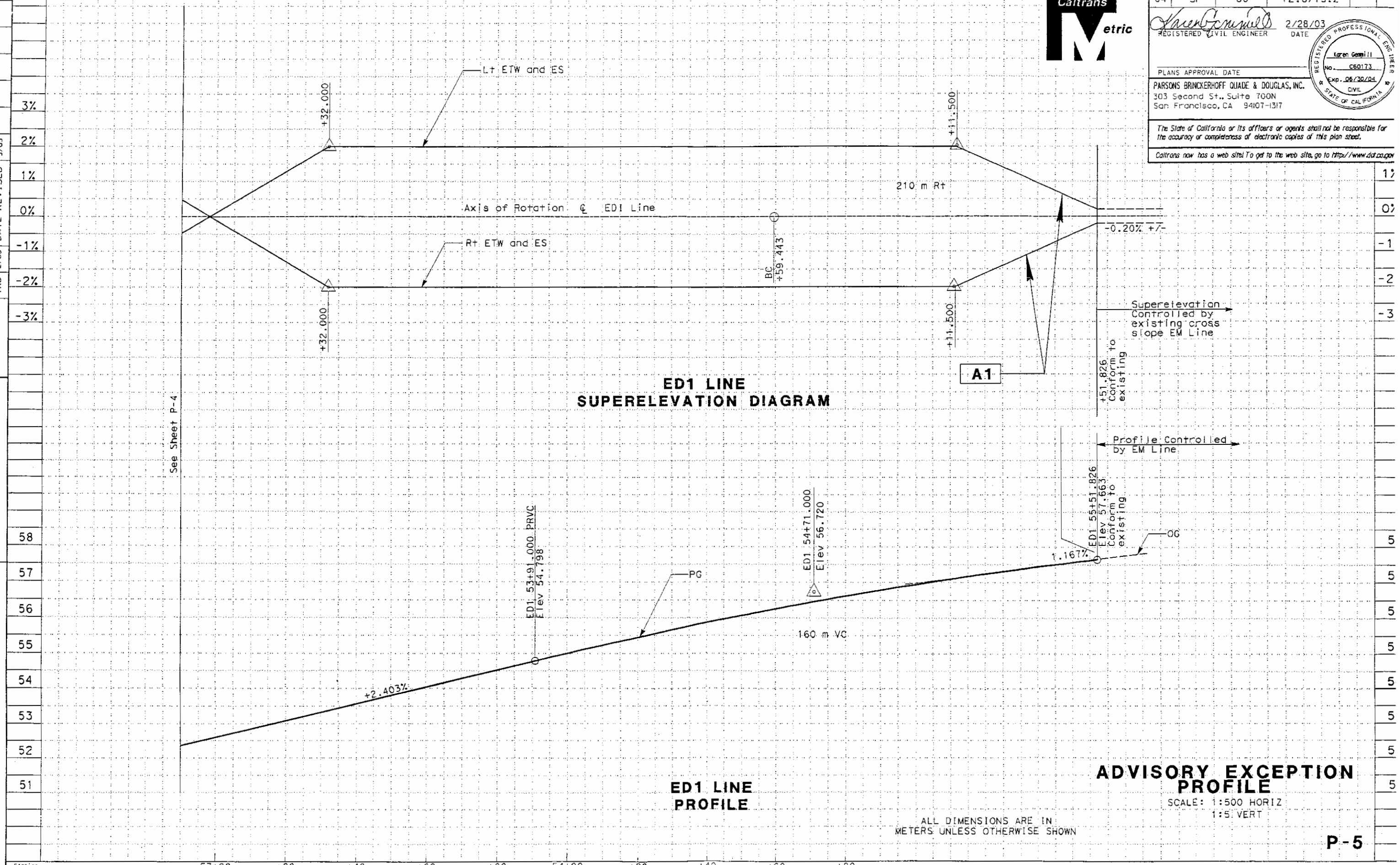

REVISED BY	KG	DATE REVISED	3/03
DATE	2/03		
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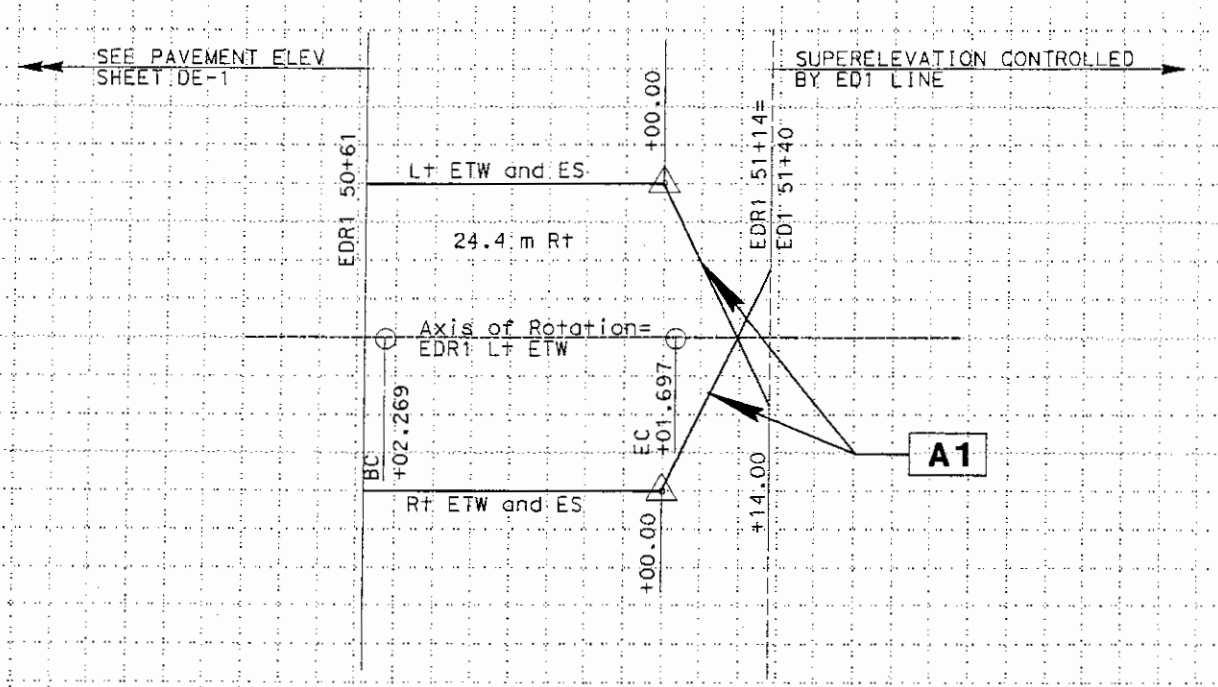
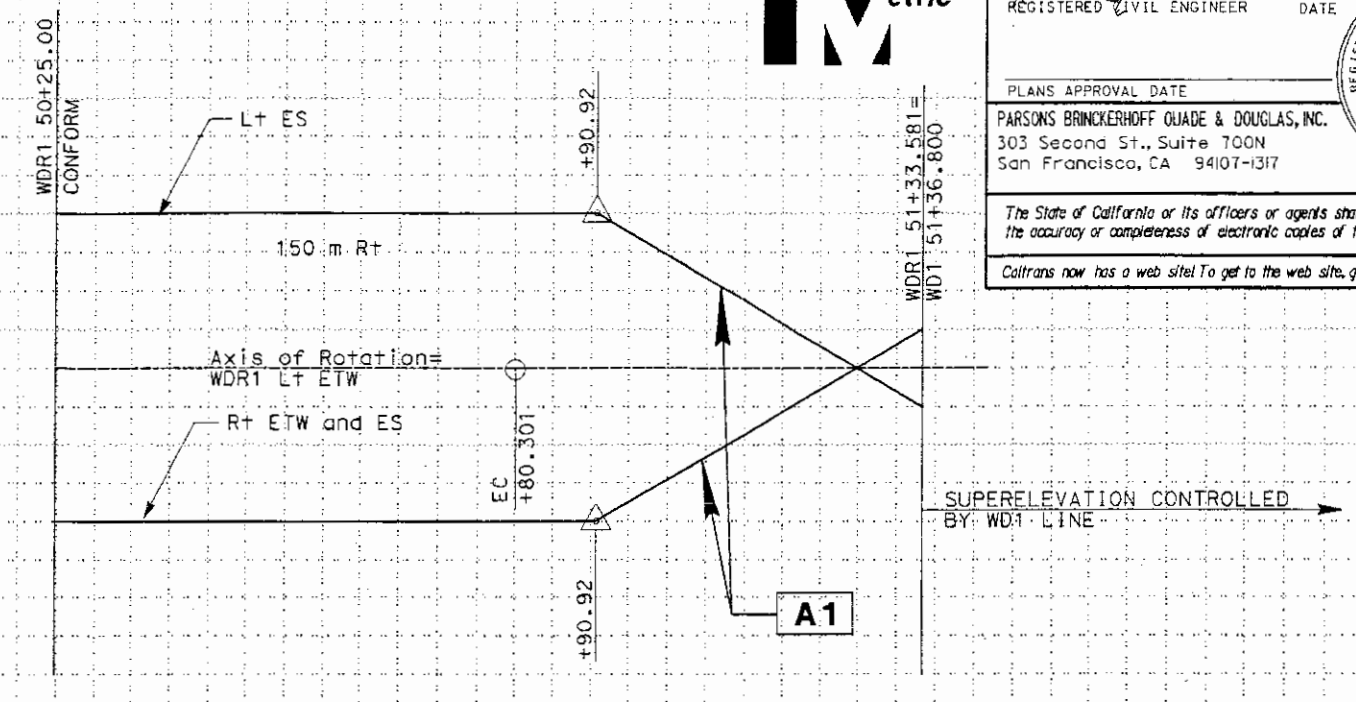
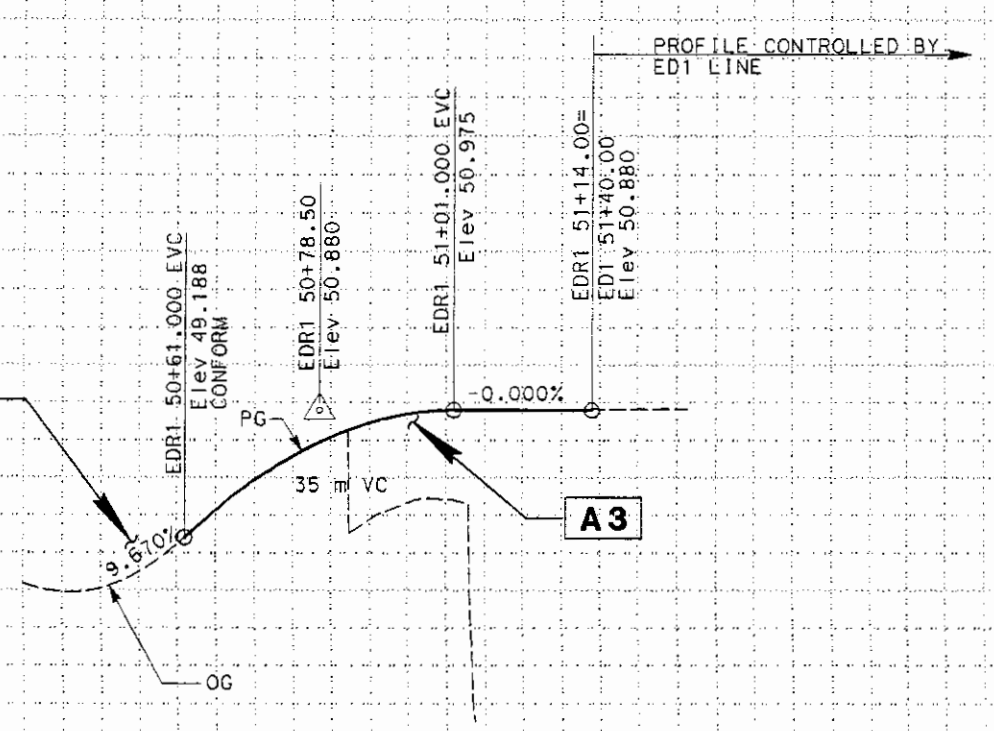


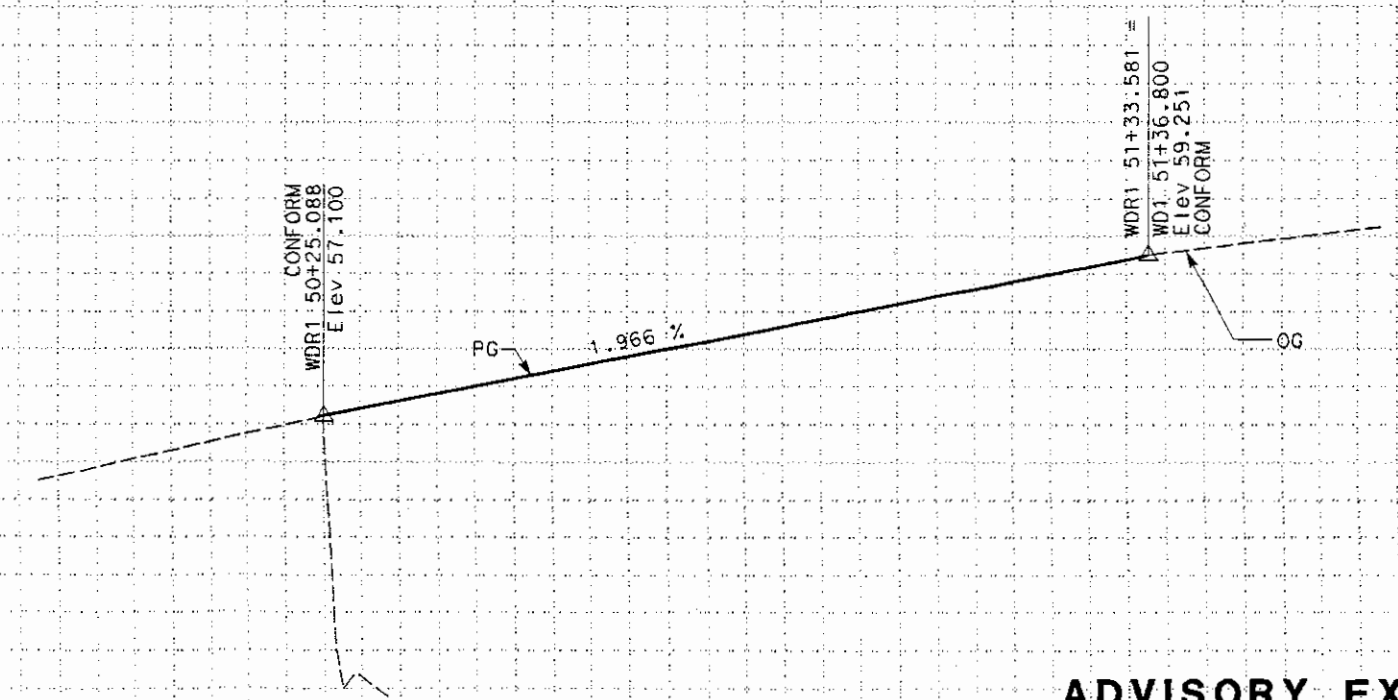
EDR1 LINE SUPERELEVATION DIAGRAM



WDR1 LINE SUPERELEVATION DIAGRAM



EDR1 LINE PROFILE



WDR1 LINE PROFILE

ADVISORY EXCEPTION PROFILE

SCALE: 1:500 HORIZ
1:5 VERT

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

P-6

Station	+20	+40	+60	+80	51+00	+20	+40	+80	51+00	+20	+40	+60
Cu.												
M. Exc.			X				O					
M. Emb.			X				O				+40	+60

CALCULATED/DESIGNED BY	KTG	DATE 2/03	REVISED BY KG
CHECKED BY	TKD	2/03	DATE REVISED 3/03
DESIGN OVERSIGHT	Bob Zandipour		

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EA 0120P1

Attachment D

Advisory Design Exception Table

SFOBB- Temporary Bypass Structure

Advisory Exceptions to Design Standards

Number	Nonstandard Feature	HDM Reference	Description	Station	Required Value	Nonstandard Value Applied For	Reason For Requesting Exception
A1	Superelevation Transition	Index 202.5(1), Figure 202.5A	Eastbound On-Ramp (200 m Rt, e=.02 m/m)	EDR1 51+00.00 to 51+10.00	45 m	10m	A superelevation transition length of 45 m was not obtained due short tangent length and the need to conform to the cross slope of the ED1 Line by Station 51+14. Although 10 m transition length does not meet the 45 m standard, it does comply with the 5% per 20m minimum criteria stated in Index 202.5(3)
			Westbound Off-Ramp (200 m Rt, e=.02 m/m)	WDR1 50+29.384 to 51+12.870	45 m	34m	A superelevation transition length of 45m was not obtained due to continuing on the same superelevation transition from 3% on the WD1 Line. Although 34 m does not meet the standard, it does comply with the 5% per 20m minimum criteria stated in Index 202.5(3).
		Index 202.5(2)	Eastbound Mainline (210 m Rt, e=.02 m/m)	ED1 54+59.443 to 55+70.613	2/3 Tangent 1/3 Curve	All on curve	The entire superelevation runoff takes place in the curve because of the need to conform to the existing cross slope of the existing structure (EM Line) by Station 55+51.826.
			Eastbound On-Ramp (24.4 m Rt, e=.02 m/m)	EDR1 50+61 to 51+01	2/3 Tangent 1/3 Curve	4/5 on Tangent 1/5 on Curve	The superelevation runoff takes place mostly on the tangent because of the need to conform to the cross slope of the ED1 Line by station 51+14.00.
			Westbound Mainline (210 m Rt, e=.02 m/m)	WD1 54+59.446 to 55+70.616	2/3 Tangent 1/3 Curve	All on curve	The entire superelevation runoff takes place in the curve because of the need to conform to the existing cross slope of the existing structure (WM Line) by Station 55+51.662.
			Westbound Off-Ramp (200 m Rt, e=.02 m/m)	WDR1 50+29.384 to 51+12.870	2/3 Tangent 1/3 Curve	All on tangent	The entire superelevation runoff takes place in the tangent because the WDR1 Line cross slope conforms to the WD1 Line until station 51+33.581 and then continues to transition at the same transition rate as the WD1 Line.
A2	Standards for Grade	Index 204.3 Index 504.2(5)	Eastbound Off-Ramp	EDR1 50+61 to 51+01	8%	9.67%	The required minimum profile grade of 8% is not attainable due to the structural design requirement of conforming to the ED1 Line profile by the proposed abutment location (Station 51+33) and by minimizing reconfiguration of the Southgate Road/Hillcrest Intersection and to the Island during this temporary condition. Once through the vertical curve, vehicles have about 130 m of acceleration length which is a significant improvement over the current design which does not provide an acceleration length.
A3	Vertical Curves	Index 204.4	Eastbound On-Ramp (A=8.2%, V=30 km/h)	EDR1 50+61 to 51+01	60 m	35 m	The required minimum curve length of 60m is not attainable due to the structural design requirement to conform to the ED1 Line profile by the proposed abutment location (Station 51+33) and by minimizing reconfiguration of the Southgate Road/Hillcrest Intersection and to the Island during this temporary condition.
A4	Freeway Entrances and Exits Standard Design Design Speed at Exit Nose Design Speed at Entrance Nose	Index 504.2(2) Figure 504.2B Index 504.2(4)(a) Index 504.2(4)(b)	Eastbound Off-Ramp	EDR1 50+30 to 51+27	In accordance with standard design	Is not in accordance with standard design	The standard Freeway Entrance design is not attainable due to the benefit of structural design benefit of conforming to the ED1 Line profile by the proposed abutment location (Station 51+33) and by minimizing reconfiguration of the Southgate Road/Hillcrest Intersection for this temporary condition. Despite the fact that a standard design was not obtained, the new design is a considerable improvement over the current design.
			Westbound Off-Ramp	WDR1 50+03 to 51+12	In accordance with standard design	Is not in accordance with standard design	The geometric design of the off-ramp is constrained by impacts to Historical Building no. 8 and the need to minimize the extent of this temporary structure. Despite the fact that a standard design was not obtained, the new design is a considerable improvement over the current design.
A5	Grade Line of Structures-Falsework	Index 204.8(5) Table 204.8	Eastbound Mainline	EM 50+20.00 to 51+15.8	21.9 m Traffic Opening 24.4 m Normal Span	16 m Traffic Opening 18.5m Normal Span	The minimum traffic opening width for five lanes of traffic required by Table 204.8 is based on 3.6 meter lanes with a 2.4 m outside shoulder and 1.5 meter inside shoulder. The minimum traffic opening width required in Table 204.8 is not attainable because of the temporary lane configuration required of five 3.2 meter lanes with no shoulder on either side. The span doesn include the 2.5 m for 2 k-rail and deflection space, which is consistent with note 1 in the table.