FOR CONTRACT NO.: 03-1E5104

INFORMATION HANDOUT

MATERIALS INFORMATION

FOUNDATION REPORT FOR WEST BRANCH FEATHER RIVER

REVISED SEISMIC DESIGN FOUNDATION RECOMMENDATION

WEST BRANCH FEATHER RIVER BRIDGE RETROFIT PROJECT DESIGN CRITERIA

ROUTE: 03-But-70-28.3

Memorandum

Flex your power!
Be energy efficient!

To: KELLY ANN HOLDEN
Branch Chief, Branch 7
Division of Engineering Services
Structure Design – Mail Station 9-4/8I
Office of Bridge Design North

Attn: David Soon

Date: November 3, 2010

File: 03-BUT-70-PM 28.2
West Branch Feather River
(Seismic Retrofit)
Bridge No. 12-0134
Project ID 03 0000 0266
EA 03-1E5101

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: Foundation Report for West Branch Feather River Bridge

Scope of Work

Per your request, the Office of Geotechnical Design North (OGD-N) has prepared this Foundation Report for the proposed seismic retrofit on Highway 70. The request asks OGD-N to provide the nominal bearing resistances at all spread footing support locations and nominal resistances at all pile supported locations for a seismic loading analysis. This report includes review and evaluation of the existing West Branch Feather Bridge (Bridge No. 12-0134), As-Built bridge files and site visit. Data are shown on the "Log of Test Borings" (LOTBs).

Project Description

The West Branch Feather River Bridge is 2731 feet (ft) 0 inches (in) long. The bridge approach on the south end is 542 ft 9 in long and consists of six spans. The center truss section is 1805 ft 9 in long and is four spans. The north approach is 328 ft 6 inches long and has five spans. This structure is located north of the city of Oroville in Butte County and was built in 1962. The structures span over the West Branch Feather River section of Lake Oroville.

It is anticipated that the West Branch Feather Bridge Seismic retrofit will be limited to strengthening some superstructure members and providing supplemental supports at the top of the piers. Foundation work is not anticipated, pending final approval of a strategy meeting. The nominal bearing resistances at all spread footing support locations and nominal resistances at all pile supported locations are provided in this report for a seismic analysis to be performed by the structure engineer.

The As-Built datum used was the USGS 0.00 datum which is based off of the NGVD 29 datum.

Site Geology and Subsurface Conditions

Based on the Geologic Map of California, Chico Quadrangle (Saucedo, Wagner, 1992), the site consists of Paleozoic and Mesozoic metasedimentary rocks (ms), which consist of argillite, phyllite, chert, conglomerate, and breccia, some quartzite and volcaniclastic rocks, and includes argillite-matrix mélange.

The Geology Section of the Bridge Department conducted a foundation investigation study during December 1956 and January 1957. The study consisted of 41, one-inch drive sample borings. The deepest boring was 42 ft deep, and the lowest elevation driven to was 633 ft.

According to the Foundation Report dated July 29, 1957, by R.W. Reynolds of the Bridge Department, "The predominant rock type is essentially a brown to blue-grey, clay schist which appears for the most part to be gradational between a phyllite and a true schist. This area like most metamorphic zones is characterized by a constant gradational change of rock types within short distances. The rocks in the area include phylitte, shale, meta-conglomerate and limestone. These rocks excluding the limestone were noted gradationally passing from one to another throughout the site."

It also states, "Within the channel the fresh schist bedrock is well exposed with little or no alluvial sediments overlying the bedrock."

During a site visit in June 2010, the supports for the approaches appeared to be on competent metasedimentary bedrock.

Based on the subsurface investigation in December 1956 and January 1957, groundwater was not encountered. Since the subsurface investigation was completed before the construction of the Oroville dam, groundwater levels should be assumed to be at the elevation of Lake Oroville.

Scour Evaluation

A Hydraulics Report will not be provided for this project due to the fact that all retrofit work will be performed above high water level.

Corrosion Evaluation

No corrosion evaluation was performed because no drilling was performed. It is assumed the site is not corrosive.

Seismic Recommendations

Please refer to the memo Revised Seismic Design Recommendations by Reza Mahallati dated June 2, 2010 for seismic information.

As-Built Foundation Data

According to the Foundation Report dated July 29, 1957, by R.W. Reynolds of the Bridge Department, all of the support locations are founded on spread footings except Abutment 7a and Pier 7. Abutment 7a and Pier 7 are designed to be supported by 45 ton steel 10BP42 H-piles, but according to the Pile Driving Records, 10BP57 H-piles were used at Pier 7.

According to the As-Built General Plan and Foundation Plan, dated August 19, 1959, the existing bridge is founded on spread footings at Abutments 1, 11a, and 15, and Piers 2, 3, 4, 5 6, 8, 9, 10, 11, 12, 13, and 14. The following table shows the locations and elevations of the original spread footings.

Table 1. As-Built Spread Footing Elevations for Bridge No. 12-0134.

Support Location	Minimum Footing Width (ft)	Maximum Footing Elevation (ft)	Design Load (ksf)
Abut 1	7.2-13.5[1]	983.0-957.0[1]	20
Pier 2	6.0	975.5-953.0[1]	20
Pier 3	6.0	961.0-937.0[1]	20
Pier 4	6.0	954.0-934.5[1]	20
Pier 5	8.0	947.5-929.0[1]	20
Pier 6	6.0	929.0	20
Pier 8	54.0	690.0-673.0[1]	40
Pier 9	68.0	636.0-620.0[1]	40
Pier 10	62.0	636.0-618.0[1]	40
Pier 11	25.0	895.0	20
Abutment 11a	12.0	928.0	12
Pier 12	8.0	944.0-937[1]	12
Pier 13	6.0	969.0-943.0[1]	12
Pier 14	6.0	976.0-964.0[1]	12
Abutment 15	7.2-14.25[1]	1000.5-982.8[1]	12

Notes:

1. See Appendix A for details of stepped footings.

Abutment 7a and Pier 7 are founded on driven H-piles. Table 2 is based on the As-Built Plans and driven pile records.

Table 2. As-Built H-Pile Data Table for Bridge Number 012-134

Support Location	Type	Design Load (kips)	Bottom of Pile Cap Elevation (ft)	Average Pile Tip Elevations (ft)	Lowest Pile Tip Elevations (ft)	Highest Pile Tip Elevations (ft)
Abutment 7a	10BP42	90	924.0	890.6	885.9	895.9
Pier 7	10BP57	90	890.0	873.7	861.7	881.2

Foundation Recommendations

Per the request from Structure Design and conversations with the structure designer, these recommendations are for a seismic retrofit. The request asks OGD-N to provide nominal bearing resistances at all spread footings locations and nominal resistances at all pile locations for seismic analysis. According to the structure designer LRFD is used to evaluate the supports at all locations, therefore the Extreme Event value is needed for these supports. The Extreme Event values in Table 3 and Table 4 represent the values that Structure Design needs to complete their seismic design.

The Extreme Event values were given to Structure Design previously to begin the seismic analysis. According to the request it is anticipated that the existing abutment and pier supports will not require a retrofit.

Table 3. Footing Design Recommendations for the Seismic Retrofit of West Branch Feather River, Bridge Number 12-0134 [1]

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth[2] (ft)	LRFD		
					Service	Strength $\varphi = 0.45$	Extreme Event $\varphi = 1.0$
	B	L			Net Permissible Contact Stress, (ksf)	Factored Gross Nominal Bearing Resistance, (ksf)	Factored Gross Nominal Bearing Resistance, (ksf)
Abut 1	7.16-18.5[3]	10.0-23.125[3]	983.0-957.0[3]	2.0	N/A	N/A	60
Pier 2	6	60	975.5-953.0[3]	2.0	N/A	N/A	60
Pier 3	6	60	961.0-937.0[3]	2.0	N/A	N/A	60
Pier 4	6	44	954.0-934.5[3]	2.0	N/A	N/A	60
Pier 5	8	43.5	947.5-929.0[3]	2.0	N/A	N/A	60
Pier 6	10	15	929.0	2.0	N/A	N/A	60
Pier 8	54	66	690.0-673.0[3]	2.0	N/A	N/A	120
Pier 9	68	82	636.0-620.0[3]	2.0	N/A	N/A	120
Pier 10	62	82	636.0-618.0[3]	2.0	N/A	N/A	120
Pier 11	25	60	895.0	2.0	N/A	N/A	60
Abut 11a	12	24	928.0	2.0	N/A	N/A	36
Pier 12	8	30	944.0-937[3]	2.0	N/A	N/A	36
Pier 13	6	44	969.0-943.0[3]	2.0	N/A	N/A	36
Pier 14	6	60	976.0-964.0[3]	2.0	N/A	N/A	36
Abut 15	7.16-14.9[3]	10.0-30.16[3]	1000.5-982.8[3]	2.0	N/A	N/A	36

Notes:

1. See MTD 4-1 for definitions and applications of the recommended design parameters.
2. Minimum footing embedment is assumed to be two ft. based on the As-Built plans.
3. See Appendix A for details of stepped footings.

Table 4. Pile Design Recommendations for the Seismic Retrofit of West Branch Feather River, Bridge Number 12-0134

Support Location	Pile Type	Bottom of Pile Cap Elevation (ft)	Required Factored Nominal Resistance (kips)				Average Pile Tip Elevations (ft)	Lowest Pile Tip Elevations (ft)	Highest Pile Tip Elevations (ft)
			Strength Limit		Extreme Event				
			Comp. (Φ=N/A)	Tension (Φ=N/A)	Comp. (Φ=1.0)	Tension (Φ=1.0)			
Abutment 7a	10BP42	924.0	N/A	N/A	180	N/A	890.6	885.9	895.9
Pier 7	10BP57	890.0	N/A	N/A	180	N/A	873.7	861.7	881.2

Notes:
1. Tip elevations are from As-Built plans.

It has been proposed by the Office of Structure Design, that a retrofit of the substructure will not be undertaken. If it is later determined that the substructure does need to be retrofitted, OGD-N will require additional subsurface information, which may include drilling at the support locations. This data will be used for the design and constructability of the foundation retrofit.

Table 5. Spread Footing Data Table for Bridge Number 12-0134

Support Location	Load and Resistance Factor Design (LRFD)		
	Service Permissible Net Contact Stress (Settlement) (ksf)	**Strength** Factored Gross Nominal Resistance $\varphi = 0.45$ (ksf)	**Extreme Event** Factored Gross Nominal Bearing Resistance $\varphi = 1.00$ (ksf)
Abut 1	N/A	N/A	60
Pier 2	N/A	N/A	60
Pier 3	N/A	N/A	60
Pier 4	N/A	N/A	60
Pier 5	N/A	N/A	60
Pier 6	N/A	N/A	60
Pier 8	N/A	N/A	120
Pier 9	N/A	N/A	120
Pier 10	N/A	N/A	120
Pier 11	N/A	N/A	60
Abut 11a	N/A	N/A	36
Pier 12	N/A	N/A	36
Pier 13	N/A	N/A	36
Pier 14	N/A	N/A	36
Abut 15	N/A	N/A	36

Table 6. Pile Data Table for Bridge Number 12-0134

Location	Pile Type	Nominal Resistance		Average Pile Tip Elevations (ft)	Lowest Pile Tip Elevations (ft)	Highest Pile Tip Elevations (ft)
		Compression	Tension			
Abutment 7a	10BP42	180	N/A	890.6	885.9	895.9
Pier 7	10BP57	180	N/A	873.7	861.7	881.2

Notes:
1. Tip elevations are from As-Built plans.

PROJECT INFORMATION

Standard Special Provisions S5-280, "Project Information," discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressees of this report via electronic mail.

Data and information attached with the project plans are:

A. *As-Built Log of Test Borings for West Branch Feather River Bridge, Bridge Number 12-0134.*

Data and information included in the Information Handout provided to the bidders and contractors are:

A. *Foundation Report for West Branch Feather River Bridge, Bridge Number 12-0134, dated November 3, 2010.*
B. *Revised Seismic Design Recommendations, Bridge Number 12-0134, dated June 2, 2010.*

Data and information available for inspection at the District Office:

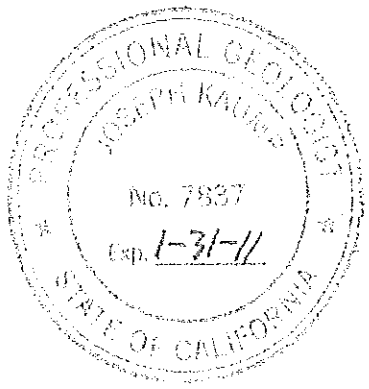
A. *N/A*

Data and information available for inspection at the Transportation Laboratory:

A. *N/A*

If any conceptual changes are made during final project design, the Office of Geotechnical Design North should review those changes to determine if these foundation recommendations are still applicable. If there are any questions, please contact Joe Kaump at 916 227-1044.

JOSEPH KAUMP, PG 7837
Engineering Geologist
Geotechnical Design - North

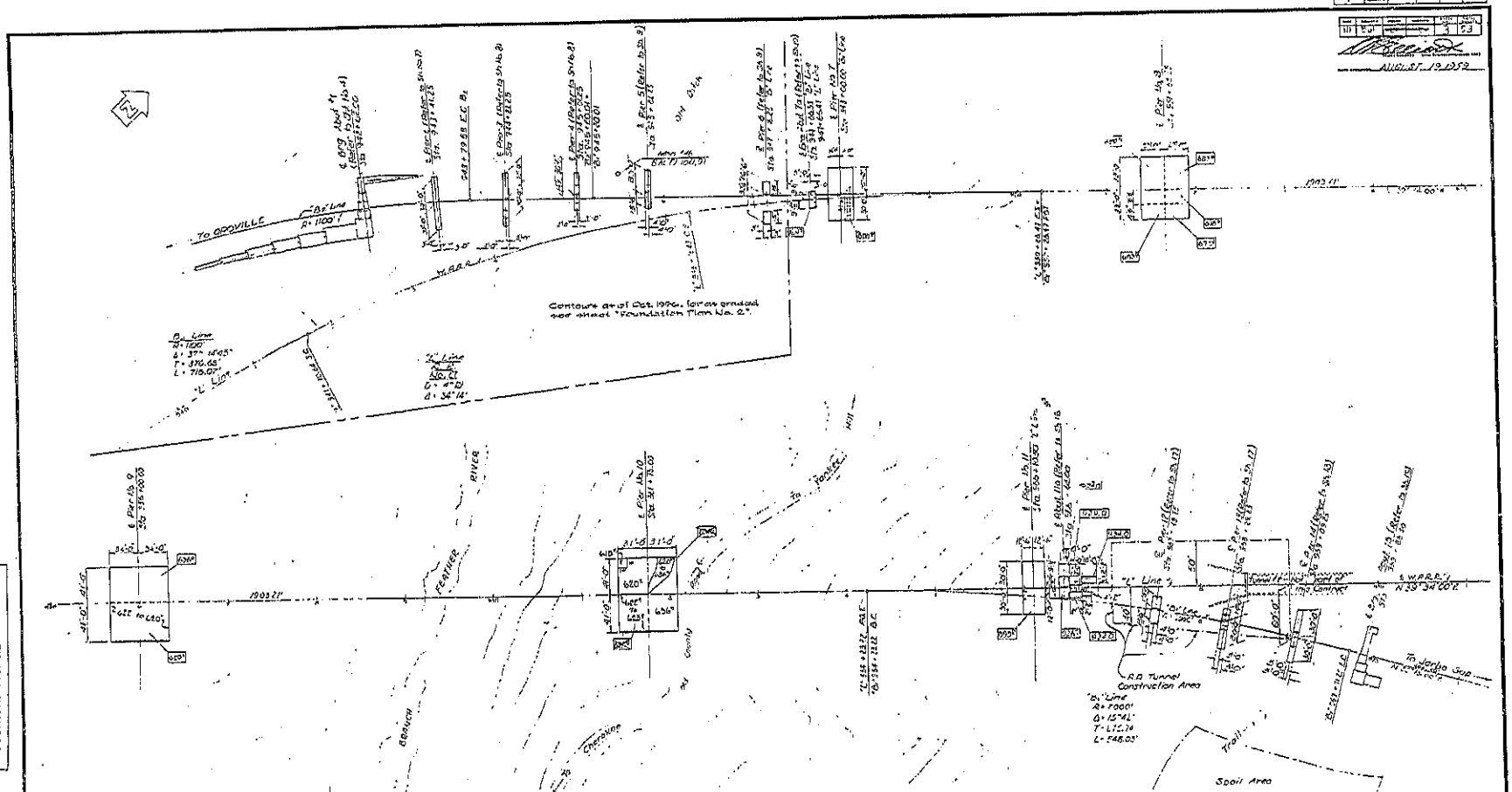


Attachment: Appendix A

c: Reid Buell
GDN File
John Holder - District Project Manager (E-copy)
Mark Willian GS Corporate (E-copy)
RE_Pending_File@dot.ca.gov
John Stayton - Structures Office Engineer (E-copy)
Julia Rockenstein - DME (E-copy)

Appendix A

AS BUILT PLANS
Contract No. 60-14T016
Date Completed
Document No. 30001408



Boat Marks

B.M. #46
Copper Nail in disc in 1" pipe
"State of Calif - Div of Highways 46"
Rt. Sta. "B1" 945 + 45 El. 1041.9

B.M. #47
"a chiseled on bedrock
10' Rt. Sta. "L" 959 + 55 El. 531.31

B.M. #48
Spike in top rock outcrop
112' Rt. Sta. "B1" 965 + 52 El. 904.40

Contours as of October 1958
Prior to grading of Highways and Railroad approaches.

Footing Design Loads	
Abut. 1 Piers 2 to 6	10 T/Sq. ft.
Piers 8, 9, 10	20 T/Sq. ft.
Pier 11	10 T/Sq. ft.
Abut. 11a Piers 12 - 14 Abut. 15	6 T/Sq. ft.

BRIDGE DEPARTMENT
DESIGN SECTION 3
Project Designer
Chief Designer
CHECKED
DETAILS
QUANTITIES
SPECIFICATIONS
Approved Recommended by

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WEST BRANCH FEATHER RIVER

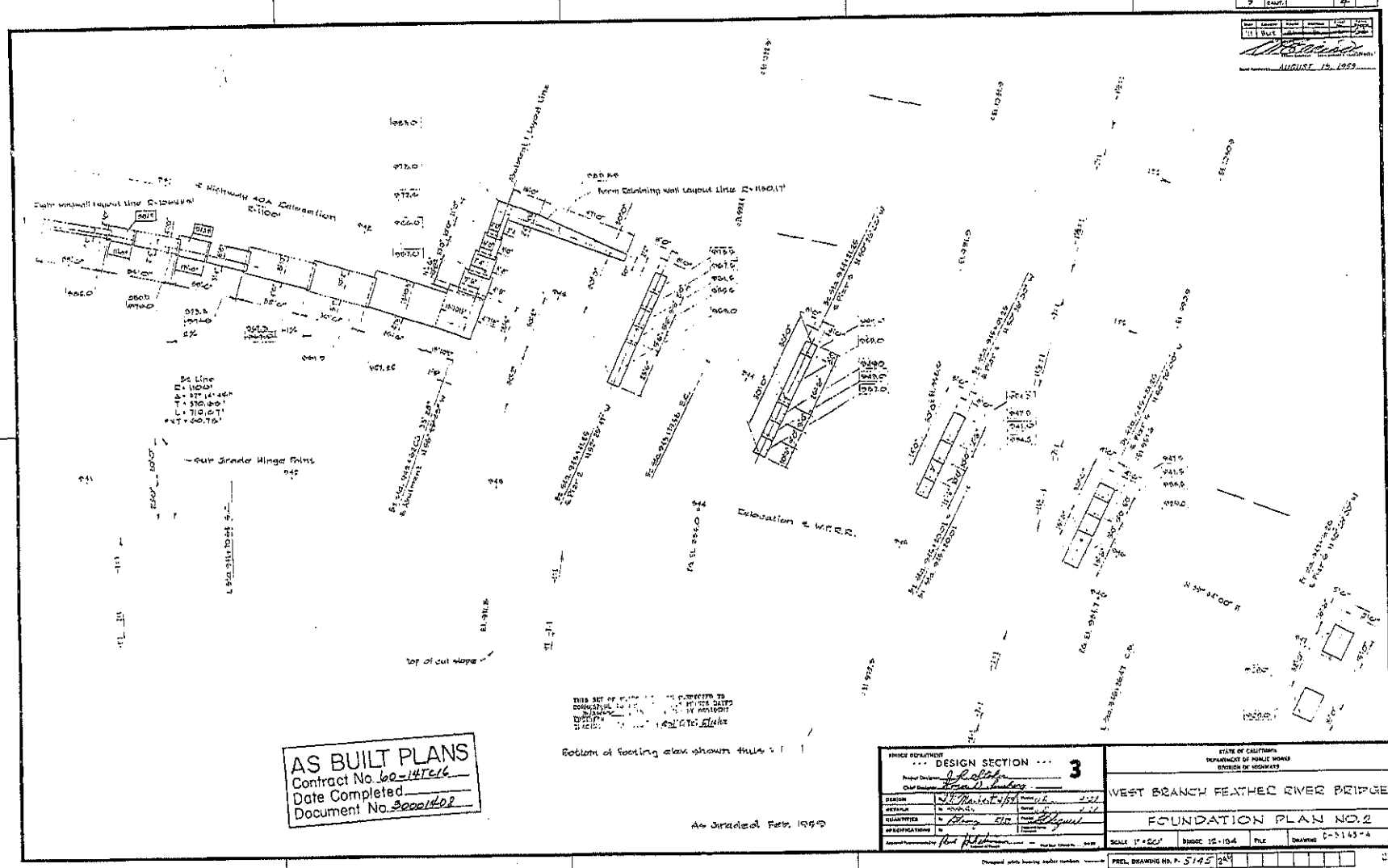
FOUNDATION PLAN NO. 1

SCALE 1" = 50' | BRIDGE 12-134 | FILE | DRAWING C 5145-3

PREL. DRAWING No. P. 5145

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL OF THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE / SIGNATURE / TITLE



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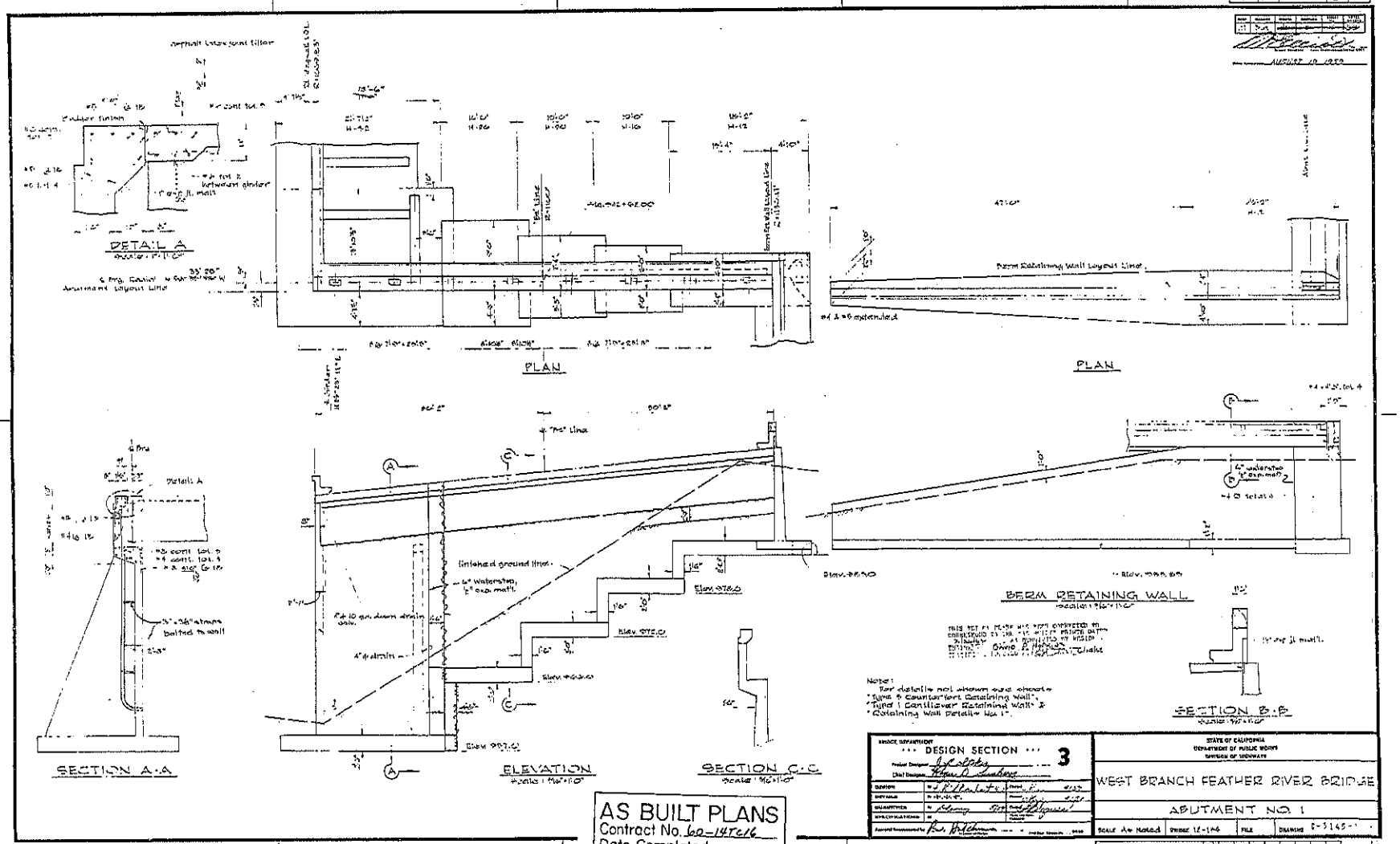

AS BUILT PLANS
Contract No. 60-14TC16
Date Completed
Document No. 30001408

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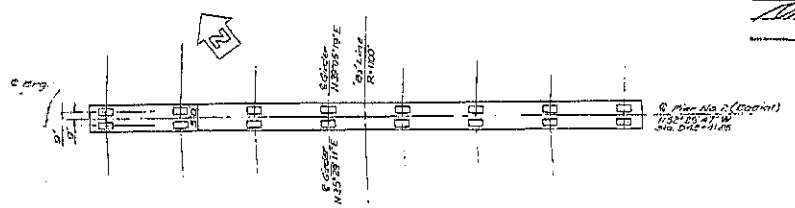
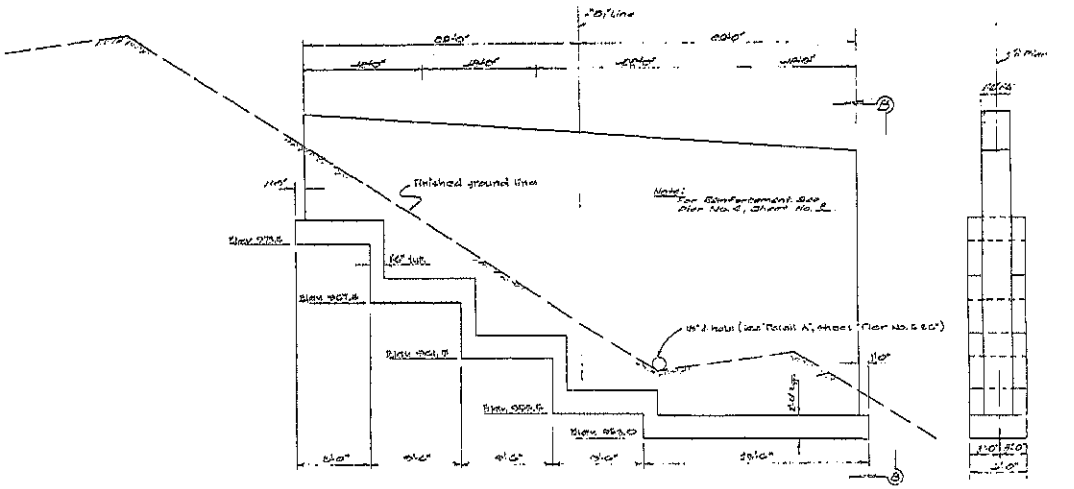
DATE / SIGNATURE / TITLE

DIST.	COUNTY	ROUTE	POST MILE	SHEET NO.	TOTAL SHEETS
7	CALIF.				

DIST.	COUNTY	ROUTE	POST MILE	SHEET NO.	TOTAL SHEETS
111	BUT			7	53

AUGUST 19 1960





VIEW B-B

PIER No 2

THIS PLAN IS APPROVED TO SUPERSEDE PLAN DATED [illegible] 19 [illegible] AS APPROVED BY HEADQUARTERS ENGINEER BY: [illegible] DATED 7/6/60

AS BUILT PLANS
Contract No. 60-147616
Date Completed
Document No. 3000402

BRIDGE DEPARTMENT	DESIGN SECTION	Sheet No. 3
Project Designer		
Chief Designer	Roger O. Mourning 10-58	
DESIGN	W. P. Mallard	Checked WPM
DETAILS	[illegible]	Checked [illegible]
QUANTITIES	W. M. Ellis	Checked L. E. Holquist 9-57
SPECIFICATIONS	[illegible]	Checked [illegible]
Approved for submittal	Paul A. Hutchinson	Bridge Engineer

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WEST BRANCH FEATHER RIVER BRIDGE

PIER No 2

SCALE 1/4"=1'-0"	BRIDGE 10-12147	FILE	DRAWING 5185-7

PRELIM. DRAWING NO. P. 5185

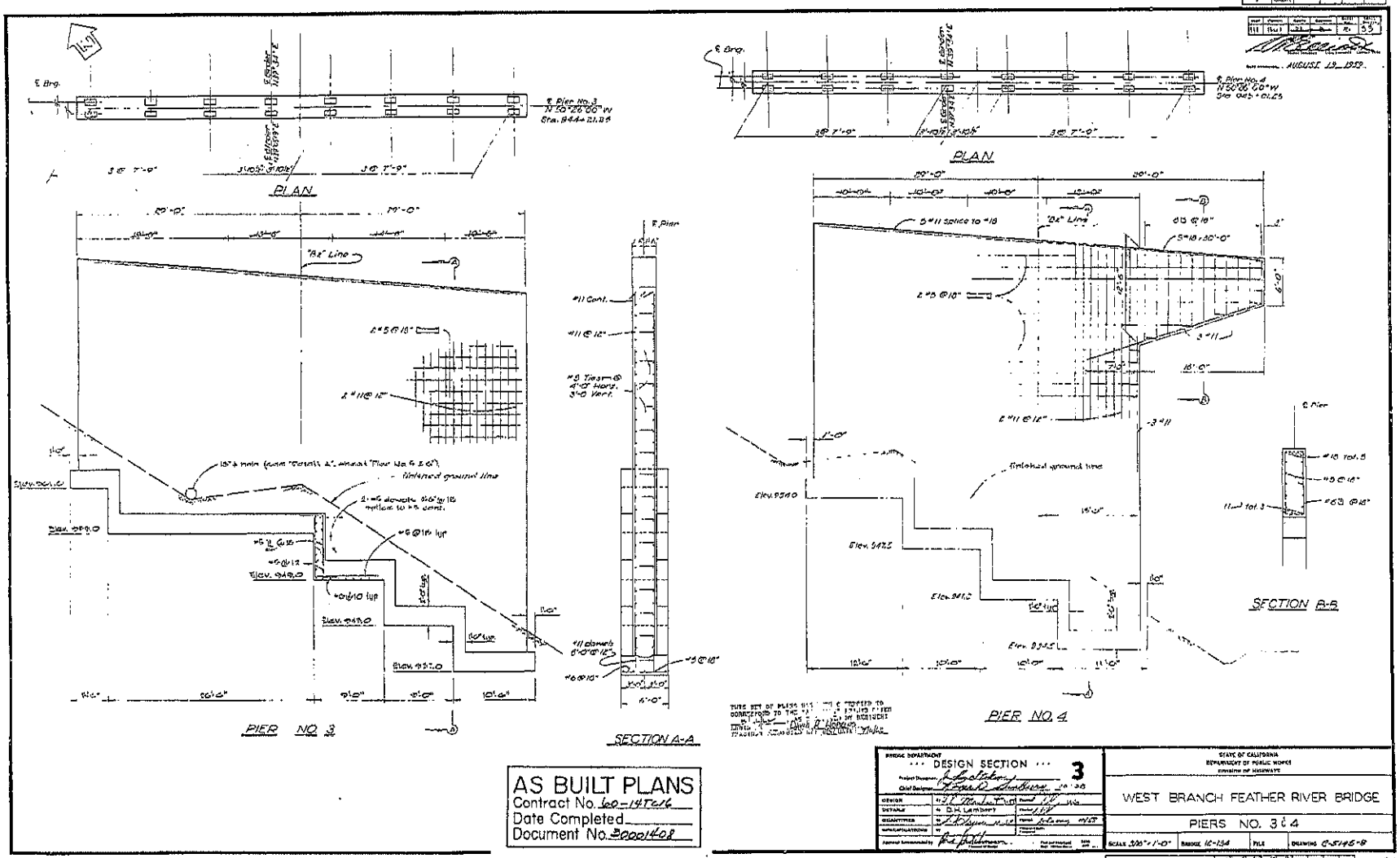
20	22	10	14	18			

27

7

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 12-1-60 SIGNATURE [illegible] TITLE [illegible]



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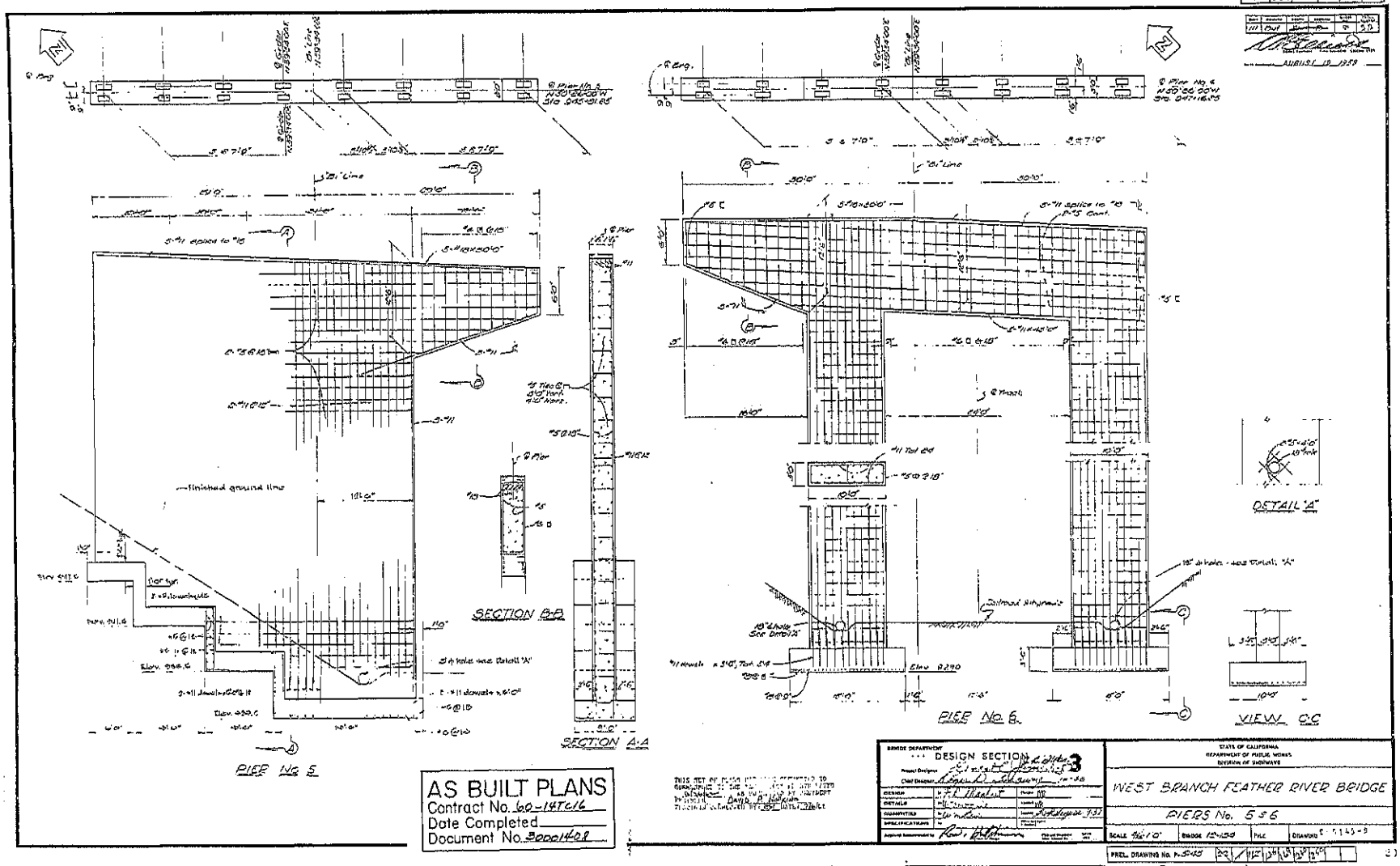

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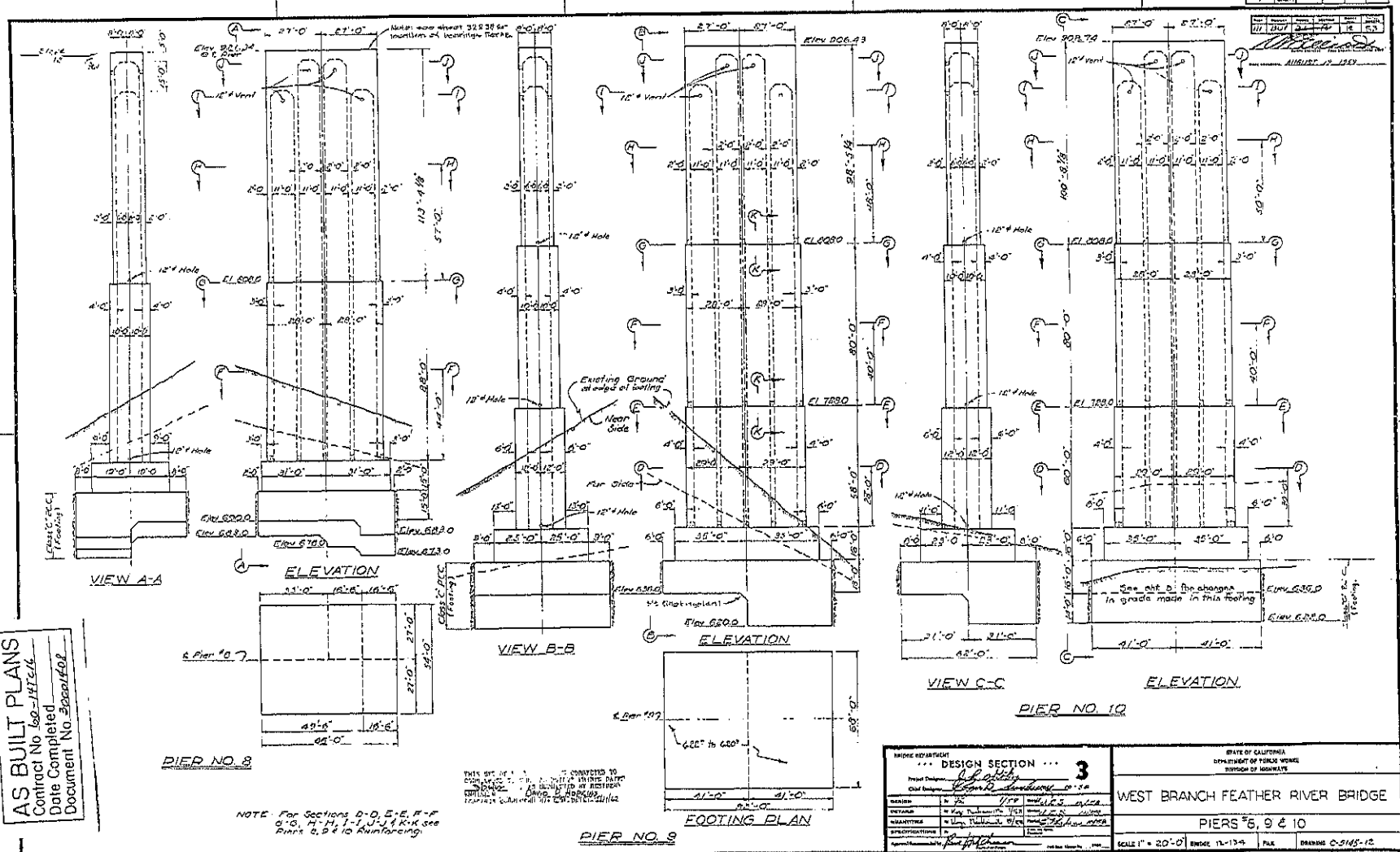

AS BUILT PLANS
Contract No. 60-141216
Date Completed
Document No. 3200402

DESIGN SECTION 3

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WEST BRANCH FEATHER RIVER BRIDGE

PIERS #8, 9 & 10

SCALE 1" = 20'-0" | BRIDGE 12-134 | FILE | DRAWING C-5145-12

PREL. DRAWING NO. P. 5145

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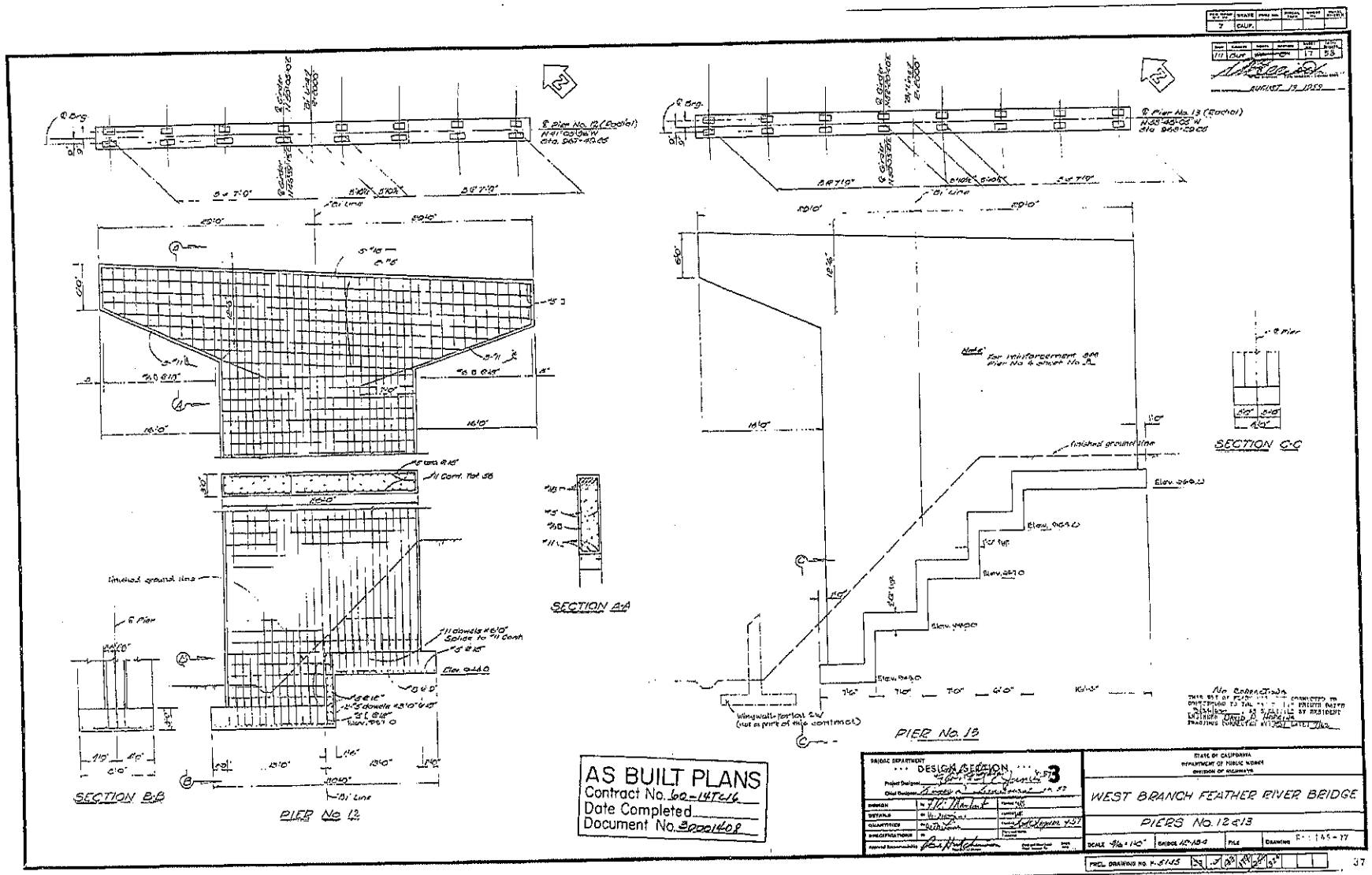

17

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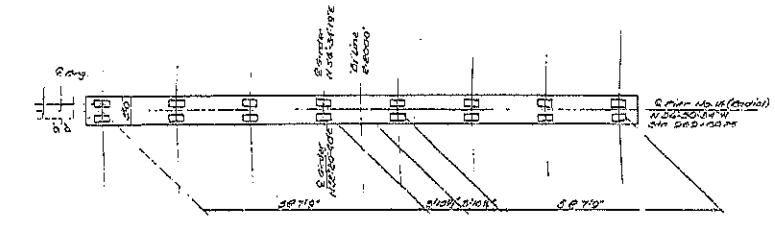
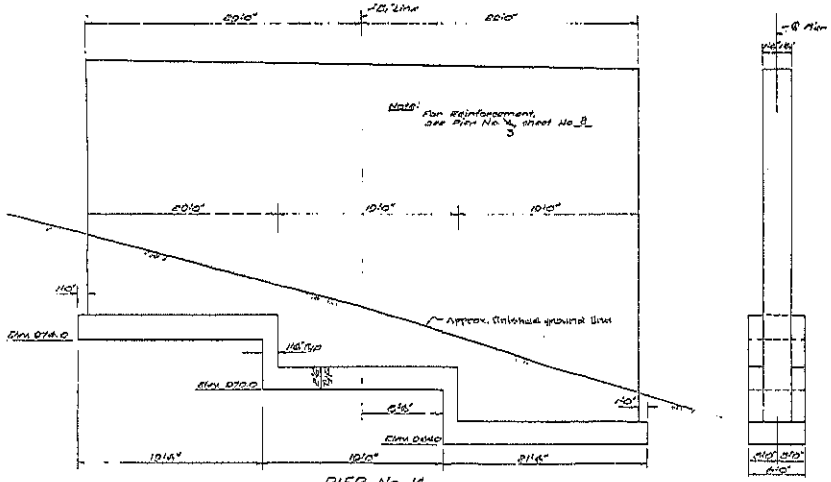
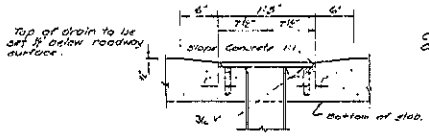


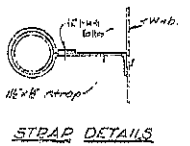


PIER No. 14

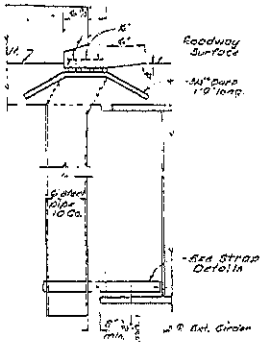
SIDE VIEW



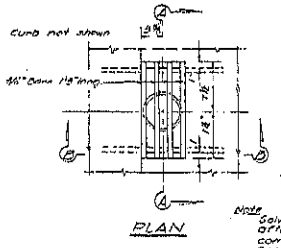
SECTION A-A



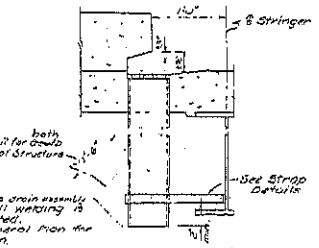
STRAP DETAILS



APPROACH DECK DRAIN



PLAN



TEUCO DECK DRAIN

SECTION B-B

Units and Approach Deck Drain for details not shown.

DRAIN DETAILS
No Scale

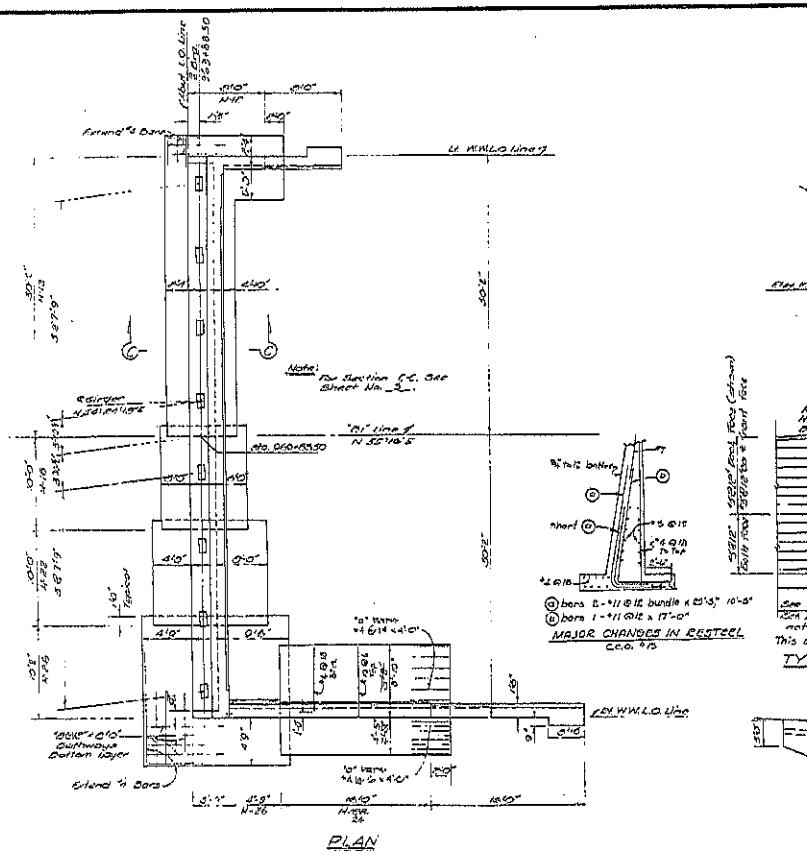
AS BUILT PLANS
Contract No. 60-147616
Date Completed
Document No. 20001408

DESIGN SECTION		STATE OF CALIFORNIA	
DESIGNED		DEPARTMENT OF PUBLIC WORKS	
DETAILED		DIVISION OF HIGHWAYS	
QUANTITIES		WEST BRANCH FEATHER RIVER BRIDGE	
SPECIFICATIONS		PIER No. 14	
APPROVED FOR RECOMMENDATION		SCALE ½"=1'-0" / DESIGN 42-1.04 / FILE / DRAWING 5145-16	
		PREL. DRAWING No. P-5145	

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL, ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

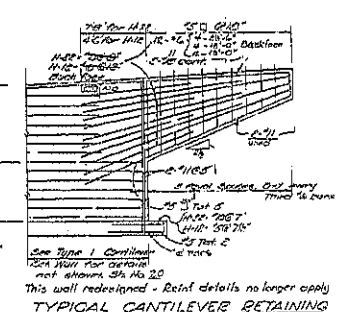
DATE ____ SIGNATURE ____ TITLE ____

18

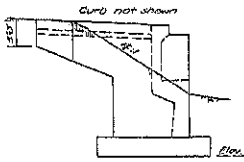


PLAN

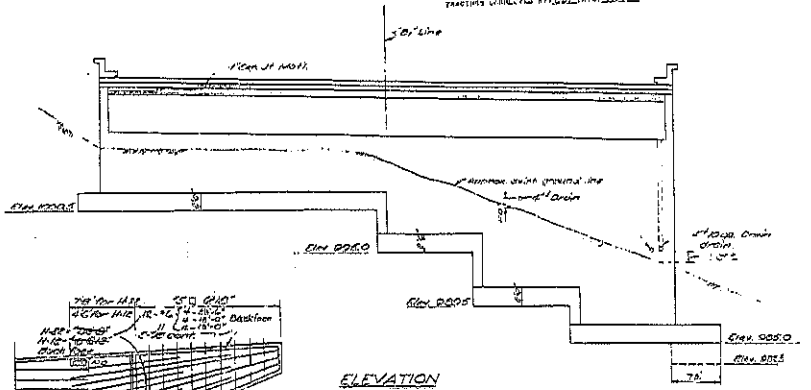
MAJOR CHANGES IN REBAR
C.O. #15



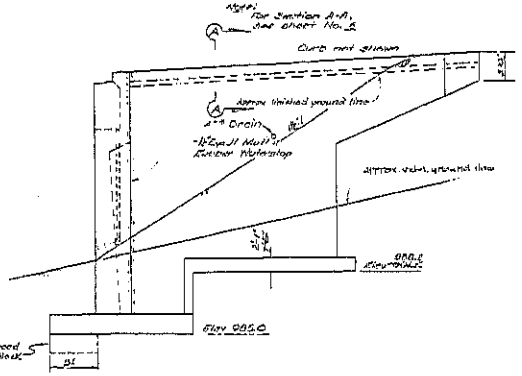
TYPICAL CANTILEVER RETAINING WALL BRACKET



LEFT WING WALL ELEVATION



ELEVATION



RIGHT WINGWALL ELEVATION

AS BUILT PLANS
Contract No. 60-141416
Date Completed
Document No. 3000408

DESIGN SECTION 3

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WEST BRANCH FEATHER RIVER BRIDGE

ABUTMENT No. 15

SCALE 3/8"=1'-0" | BRIDGE 10-113A | FILE | DRAWING 5-5145-10

PREL. DRAWING No. P-5145

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ____ SIGNATURE ____ TITLE ____

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. DAVID SOON
Senior Bridge Engineer
Division of Structure Design MS 9
Office of Bridge Design North
Bridge Design Branch 7

Date: June 2, 2010

File: 03-But-70-PM 28.2
03-1E5100
West Branch Feather Bridge
Br. No.12-0134

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5
OFFICE OF GEOTECHNICAL DESIGN - NORTH

Subject: Revised Seismic Design Recommendations

This report presents the seismic design recommendations for the above referenced located on State Highway 70 in Butte County. This report supersedes the previous seismic recommendations dated February 18, 2009. The revision is due to implementation of the newly adopted Caltrans Seismic Design Criteria (SDC) Version 1.5 for this project.

Based on the new Caltrans seismic map, the bridge is about 12.4 miles northwest of the nearest active fault of Bear Mountains fault zone (Swain Ravine fault zone section) with a fault identification number 30. This fault is referred to as normal fault with a dip angle of 90 degree and a vertical dip direction.

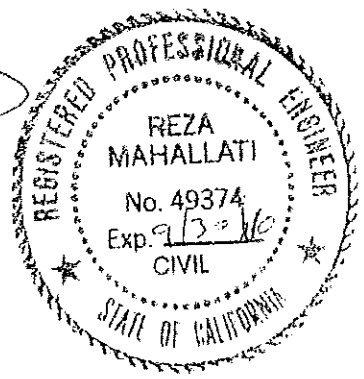
Based on the As-Built Log of Test Borings (LOTB) dated December 1956, the foundation materials generally consist of about 10 to 15 feet of residual soil mantle underlain by metamorphic rocks with an estimated shear wave velocity of 2500 feet per second.

The recommended design Acceleration Response Spectrum curve is based on an envelope of the probabilistic and deterministic spectral accelerations (SA). The probabilistic SA was estimated based on a 975-year return period (5% probability of exceedance in 50 years). The SA generated from the nearest fault is less than the minimum statewide ground motion, and therefore the attached ARS curve is an envelope of both probabilistic and the minimum SA. The peak bedrock acceleration is as shown on the attached ARS curve is about 0.2g.

The potential for surface rupture at the site due to fault movement is considered insignificant since there are no known faults projecting towards or passing directly through the project site.

The liquefaction analysis indicates minimal potential for soil liquefaction during a strong ground shaking at the site.

If you have any questions regarding the above recommendations, please call me at (916) 227-1033.



REZA MAHALLATI
Senior Materials and Research Engineer
Office of Geotechnical Design - North

Attachment
1- Appendix A – ARS Curve

c: Joe Kaump (OGD-N)
GDN File

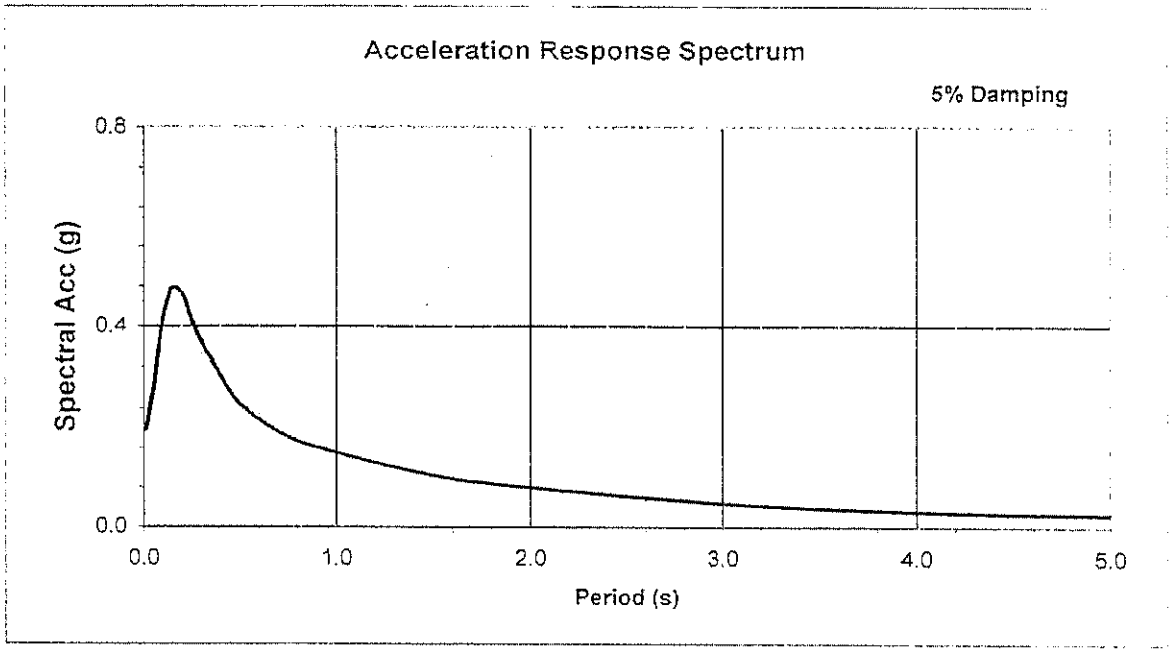
West Branch Feather River Bridge

Bridge No. 12-0134
EA No. 03-1E5101

Latitude 39.6660
Longitude -121.5312

Control Envelope

Period (s)	Sa(g)
0.010	0.197
0.020	0.210
0.030	0.237
0.050	0.275
0.075	0.348
0.100	0.414
0.120	0.445
0.150	0.476
0.200	0.466
0.250	0.413
0.300	0.369
0.400	0.303
0.500	0.248
0.750	0.182
1.000	0.151
1.500	0.104
2.000	0.080
3.000	0.048
4.000	0.032
5.000	0.025



Deterministic Procedure Data

Fault	Bear Mountains fault zone (Swain Ravine fault zone section)		R_{rup}	20.40	km
Fault ID	30		R_{jb}	20.40	km
Style	N		R_x	7.40	km
Mmax	6.5		V_{S30}	760	m/s
Dip	90	deg	$Z_{1.0}$	24	m
Z_{TOR}	0	km	$Z_{2.5}$	2.00	km

Notes

Please note the Design ARS curve is an envelope of minimum and probabilitic spectrum.

Final

Design Response Spectrum

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: BARTON NEWTON
State Bridge Engineer
Deputy Division Chief
Structure Policy and Innovation
Division of Engineering Services

From: KELLY ANN HOLDEN
Branch Chief, Bridge Design Branch 7
Office of Bridge Design North
DIVISION OF ENGINEERING SERVICES, STRUCTRUE DESIGN

Date: October 3, 2011
File: 03-But-70-PM 28.2
EA: 03-1E5101
Project ID: 03 0000 0266
West Branch Feather
River Bridge (Retrofit)
Br. No. 12-0134

Subject: Approval of West Branch Feather River Bridge Retrofit Project Design Criteria

The Office of Structure Design North has prepared contract plans for the retrofit and rehabilitation of the West Branch Feather River Bridge (Br. No. 12-0134). Being a Non-Standard bridge, the structure required a Project Specific Design Criteria (PSDC) to guide the evaluation and design of the retrofit. The PSDC was developed with the AASHTO LRFD, Caltrans Seismic Design Criteria, and other Caltrans reference materials.

Attached, for your approval, is the *West Branch Feather River Bridge (Seismic Retrofit) Project Specific Design Criteria*, dated October 3, 2011.

APPROVAL RECOMMENDED BY:

10/24/11
TOM OSTROM Date
Office Chief,
Office of Bridge Design North, Structure Design
Division of Engineering Services

APPROVED BY:

11/20/11
BARTON NEWTON Date
State Bridge Engineer & Deputy Division Chief
Structure Policy and Innovation
Division of Engineering Services

10/31/11
TONY MARQUEZ Date
Deputy Division Chief
Structure Design
Division of Engineering Services

Attachment

c: KHolden MKeever TMarquez
TOstrom SHida

West Branch Feather River Bridge (Seismic Retrofit)

03-But-70 PM 28.25
EA: 03-1E5101
Project ID: 03 0000 0266

Project Specific Design Criteria

October 3, 2011

Prepared By:
David Soon, Senior Bridge Engineer
California Department of Transportation (Caltrans)
Division of Engineering Services
Office of Bridge Design, North

1. Introduction

This Project Specific Design Criteria is for the seismic retrofit of the West Branch Feather River Bridge (Bridge Number 12-0134).

Pertinent sections of the following documents are to be used unless otherwise noted or revised in this Design Criteria.

- The design of bridge components shall be designed according to:
  1. *AASHTO LRFD Bridge Design Specifications*, Fourth Edition, 2007 (*AASHTO LRFD*) and *California Amendments*, December 31, 2008 (*CA*) – [*AASHTO LRFD w/ CA*].
  2. *AISC Steel Construction Manual*, 13th Edition – (*AISC*).
  3. Design and Details referencing Caltrans *Standard Plans, Revised Standard Plans* and Bridge Standard Details Sheets are based on Load Factor Design or Working Stress Design.
  4. Cal OSHA California Code of Regulations, Title 8, 1670 for Personal Fall Arrest System.
- The seismic evaluation of the existing and retrofitted structure shall be performed according to:
  1. Caltrans, *Seismic Design Criteria*, Version 1.5, August 6, 2009 – (*SDC 1.5*).
  2. Caltrans, *Guide Specifications for Seismic Design of Steel Bridges*, First Edition, December 2001 – (CA *Guide Spec Seismic Design of Steel Bridges*).
  3. Caltrans, *Bridge Memos to Designers* 20-1 and 20-4 *(MTD)*.

Exceptions and additions to these criteria are denoted below.

2. Bridge Category and Classification

'Bridge Category' is 'Ordinary'.

'Bridge Classification' is 'Non-Standard'.

This bridge is classified as 'Non-Standard' due to the double deck, long span steel truss spans and the multiple bent configurations of the approach spans. Vehicular traffic is supported by the top deck and railroad traffic is supported by the bottom deck of the truss spans.

3. Seismic Performance Criteria

All structural components shall be designed to have sufficient strength and/or ductility to ensure collapse will not take place (**No Collapse**) when subjected to the "Design Earthquake". Post Earthquake Damage Level may be Significant. Post Earthquake Service Level is No Collapse.

4. Seismic Design Acceptance Criteria

Steel Truss Bridge (Bent 7 to Bent 11)

- Components of the Steel Truss Bridge – nominal capacities shall be greater than seismic demands.
- Gusset Plate Connections – nominal capacities shall be greater than seismic demands.
- Footing – Ultimate Soil Bearing Capacities shall be greater than seismic demands.

Approach Spans (Frame 1: Abutment 1 to Bent 7 & Frame 2: Bent 11 to Abutment 15)

- The Approach Spans shall be evaluated and designed by the Displacement Ductility Approach as outlined in *MTD* 20-4 and *SDC 1.5*.
- The superstructure elements shall remain essentially elastic.
- The columns/pier walls of the Approach Spans, nominal capacities shall be greater than seismic demands.
- Uplift of Piers 2, 3, 13 and 14 is accepted as part of the longitudinal frame response.

5. Seismic Demands on Structural Components

Design Earthquake: Design Spectrum (DS) per *SDC 1.5*.

Application of Design Spectrum Load Combinations per *SDC 1.5*:
Case 1: 100% transverse loading + 30% longitudinal loading
Case 2: 100% longitudinal loading + 30% transverse loading

Seismic Component Force/Displacement Demands:

Steel Truss Bridge

- All Load Factors = 1.0.
- The component seismic load combination force demands for all steel truss bridge members shall be calculated by linear elastic analysis by applying the Design Spectrum to the Dead Loads and **with** an estimated railroad (RR) LL. The RR LL is estimated to be 8 kips per foot for this seismic analysis.

Approach Spans

- All Load Factors = 1.0.
- The seismic load combination forces and displacement demands shall be calculated by linear elastic analysis per *SDC 1.5*.

6. Material Properties

Existing Bridge:

- Concrete:

Reinforcement	$f_y = 40$ ksi	
Structure Concrete	$f'_c = 3.0$ ksi	

- Structural Steel

Carbon Steel:	$f_y = 33$ ksi	ASTM A7
Alloy Steel:	$f_y = 50$ ksi	ASTM A242
HS Bolts:		ASTM A325
Rivets:		ASTM A195

Seismic Retrofit

- Concrete:

Reinforcement	$f_y = 60$ ksi	ASTM A706
Structure Concrete	$f'_c = 3.6$ ksi	

- Structural Steel

Structure Steel		ASTM A36
HS Bolts:		ASTM A325

7. Capacities of Structural Components Resisting Seismic Loads

Steel Truss Bridge

- All Resistance Factors = 1.0, except for bolted and riveted joints. For bolted and riveted joints, see *AASHTO LRFD* Article 6.5.4.2.
- Steel Structure: Steel member capacities are calculated per:
  - *AASHTO LRFD w/ CA.* For all steel members, except noted below.
  - *AISC.* For Box Shaped Members:
    a. Yielding moment / flange and web local buckling.
    b. Limiting slenderness ratio (modified).
    c. Limiting width-thickness ratio.
    d. Reduction factor for slender elements.
    e. Buckling stress.

    For "I" Shaped Members:
    a. Limiting width-thickness ratio.
    b. Reduction factor for slender elements.
    c. Limiting slenderness ratio (modified).
    d. Buckling stress.
  - *CA Guide Spec Seismic Design of Steel Bridge.* Evaluation of length of unsupported gusset plates.
  - Exception to *AASHTO* LRFD and *California Amendments* to:
    - Article 6.14.2.8.3 modified as follows:

$$\varphi P_n = \text{min of} \begin{cases} \varphi_y * A_g * F_y \\ \varphi_u * A_n * F_u \\ R_r \end{cases}$$

- Concrete Structure: Reinforced concrete capacities are calculated per:
  - *SDC 1.5.*
  - *AASHTO LRFD w/ CA.*

Approach Spans

- All Resistance Factors = 1.0.
- Concrete Structure: Reinforced Concrete capacities are calculated per:
  - *SDC 1.5.*
  - *AASHTO LRFD w/ CA.*