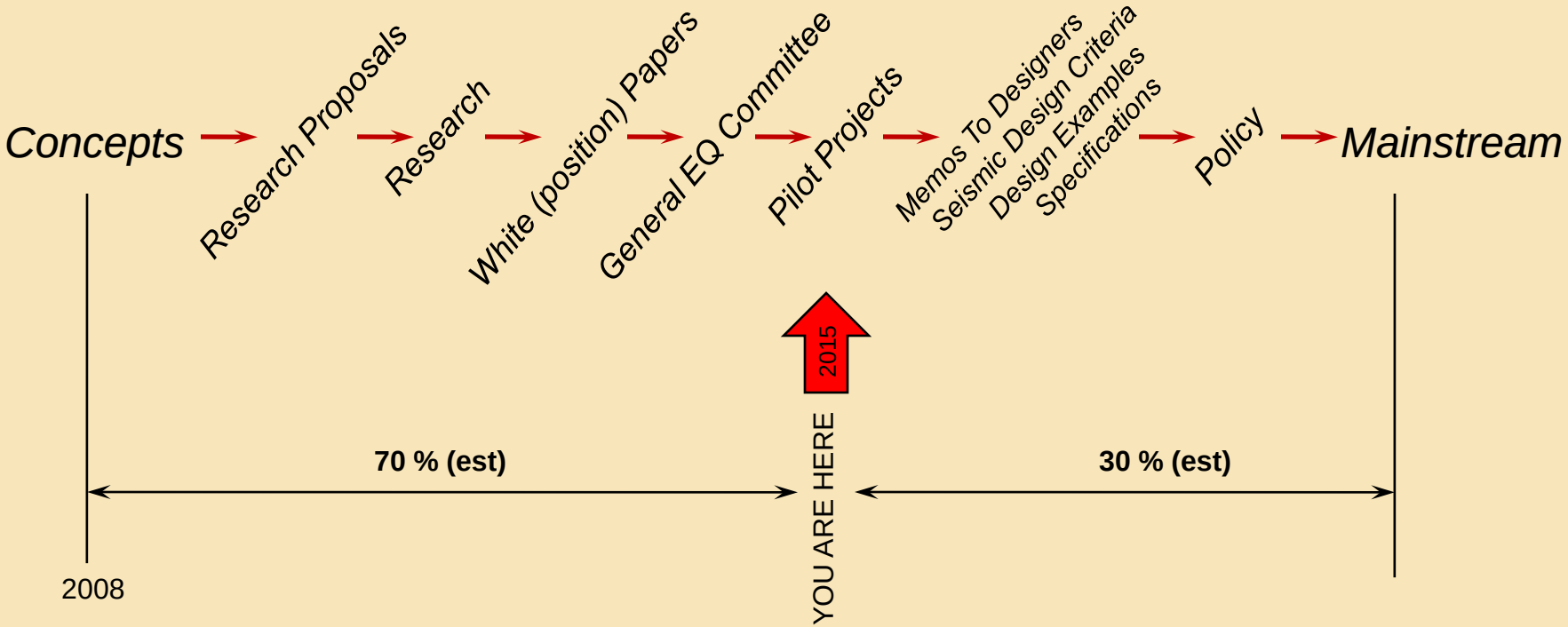
SHPR2 Solutions: Innovative Bridge Designs for Rapid Renewal
Sacramento, CA Peer-to-Peer Exchange Workshop May 19/20, 2015

Caltrans ABC Research & Implementation

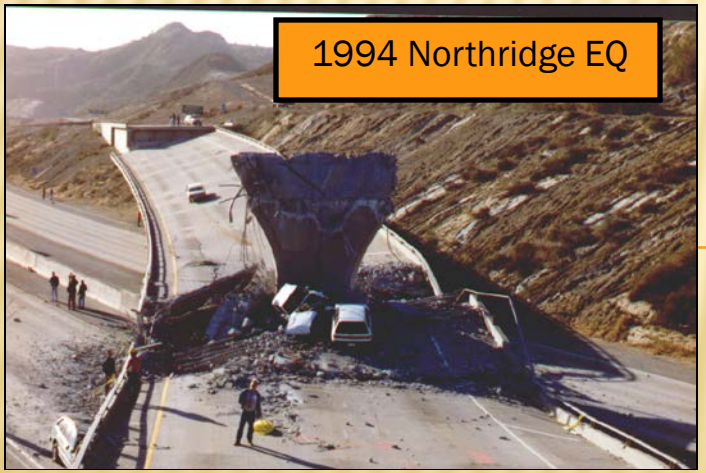
Ron Bromenschenkel, PE
Sr Bridge Engineer
Office of Earthquake Engineering & Research
Division of Engineering Services
California Department of Transportation

Caltrans ABC Timeline

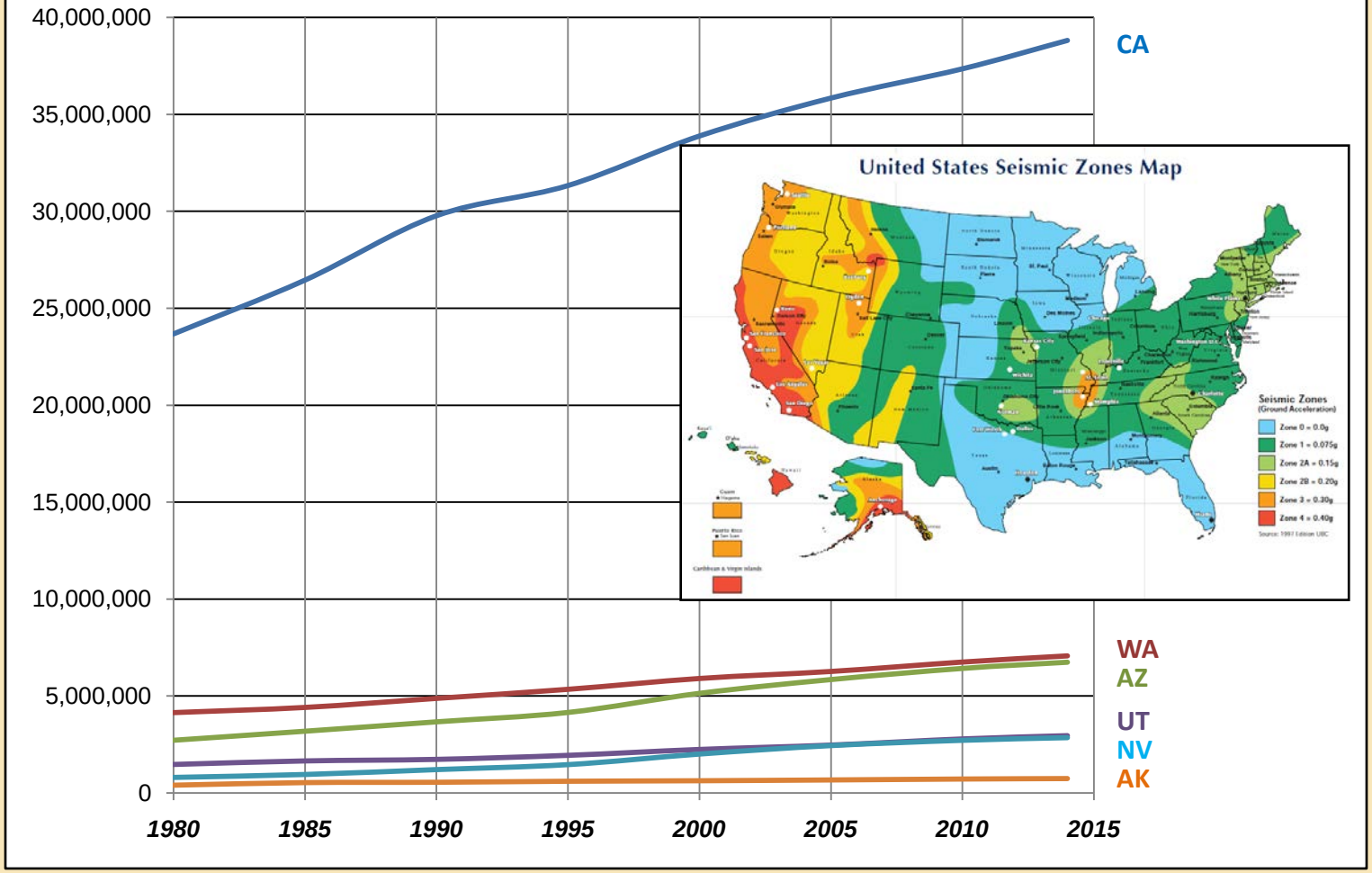


2014
Napa EQ

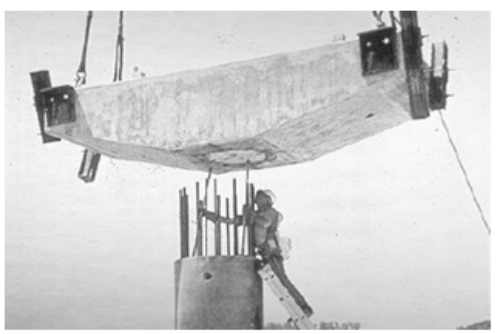
1989 Loma Prieta Earthquake



Western States Population: US Census Bureau



Precast Bent Caps in California's History



Getty Museum
Los Angeles, CA
1990's

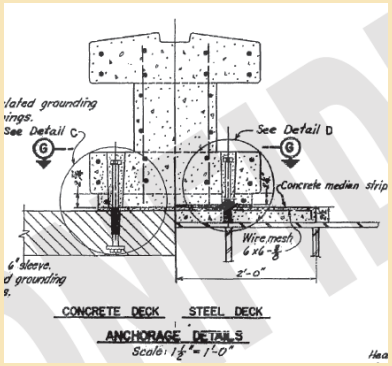
PC bent cap with grouted holes for column bars.

Precast Full Depth Deck Panels in California's History

High Street OC
Alameda, CA 1978

Structure replaced in 2012.

Precast Barriers in California's History



San Mateo Bridge
1967

PC barriers bolted to deck.

ABC Research Contracts

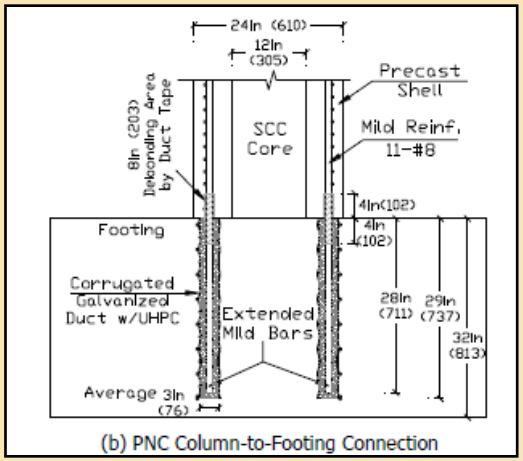
ABC Related Research at Caltrans

	Arena	Researcher	$$$
1	NGB - Column Conn. 65A0372	UNR	$ 307,815
2	CFT 1 59A0641-1972	UW	$ 384,503
3	CFT 2 65A0446-2417	UW	$ 399,539
4	Girder Continuity 1 59A0615	ISU	$ 609,000
5	Girder Continuity 2 65A0411	ISU	$ 462,000
6	Column Pins 65A0423	UNR	$ 279,539
7	PC Full Depth Decks 59A0519	UNR	$ 264,575
8	Structure Isolation TO1	SCSoln	$ 319,000
			$ 3,025,971

Denotes ongoing contracts

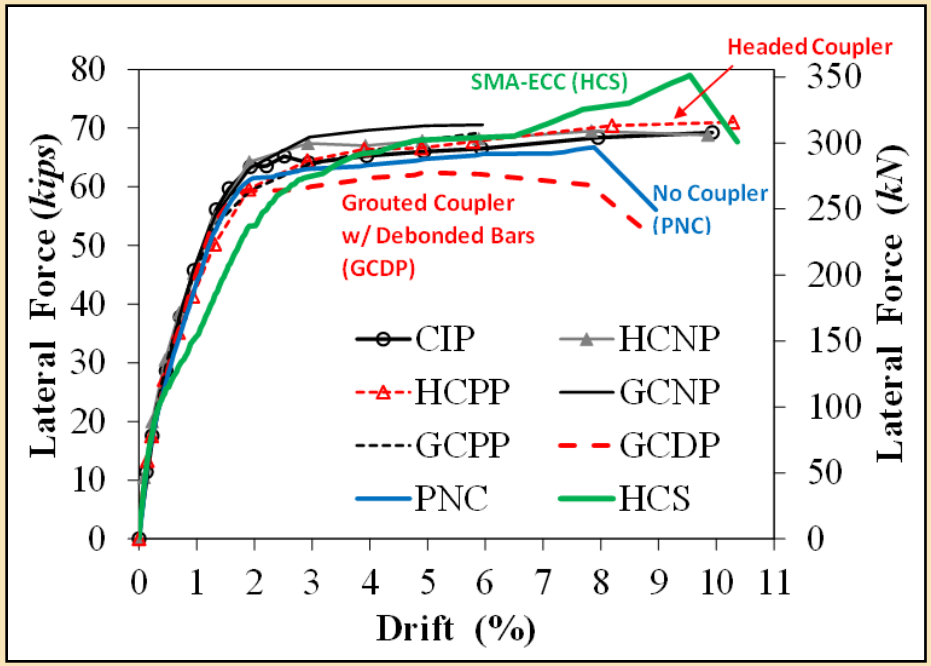
ABC Column Connection Research

PC Column with partially debonded bars plunged into Ultra High Performance Concrete filled voids



(b) PNC Column-to-Footing Connection

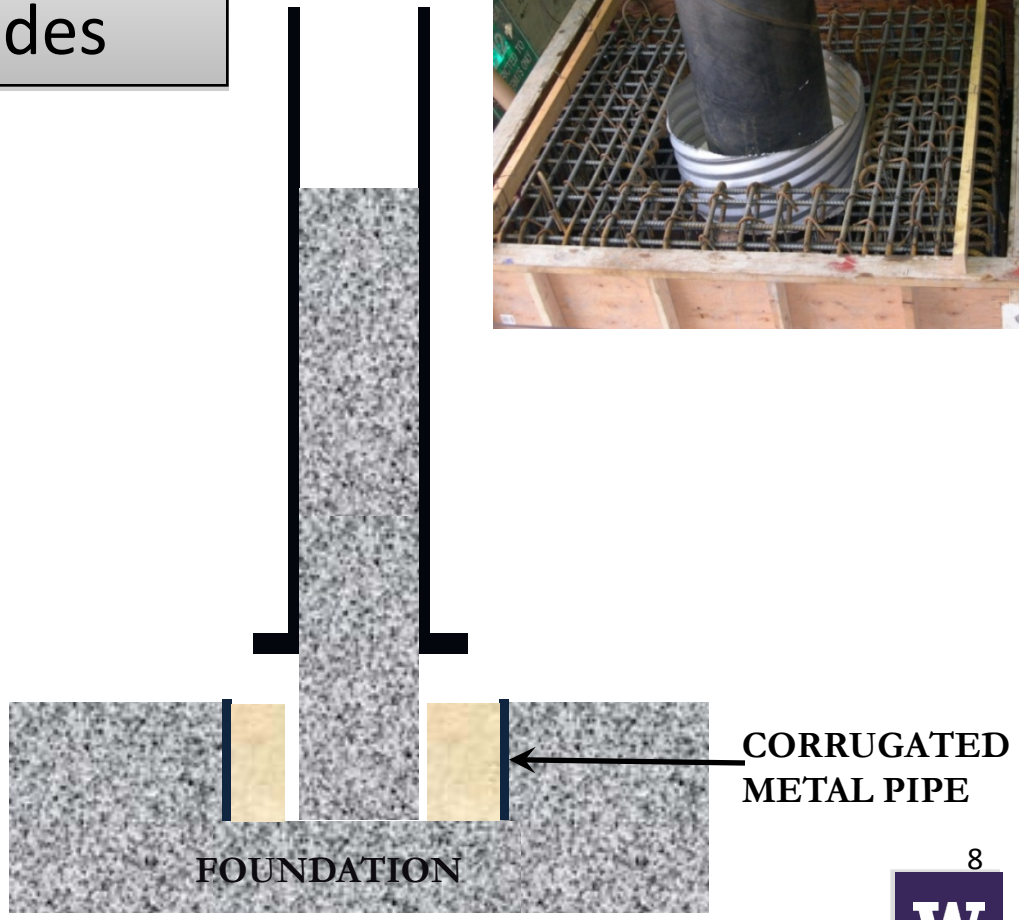
Testing at University of Nevada, Reno



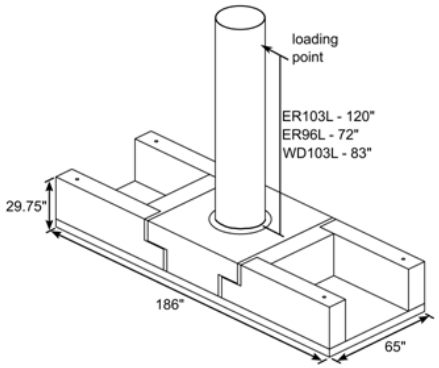
Design of CFT Connection

Isolation of Structural and Reinforcing Steel Trades

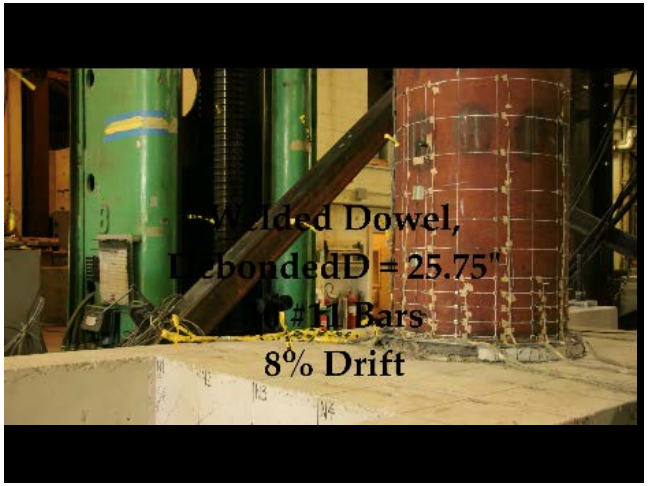
1. Build foundation cage
2. Install corrugated metal pipe
3. Cast foundation
4. Install and grout tube



Design of CFT Connection

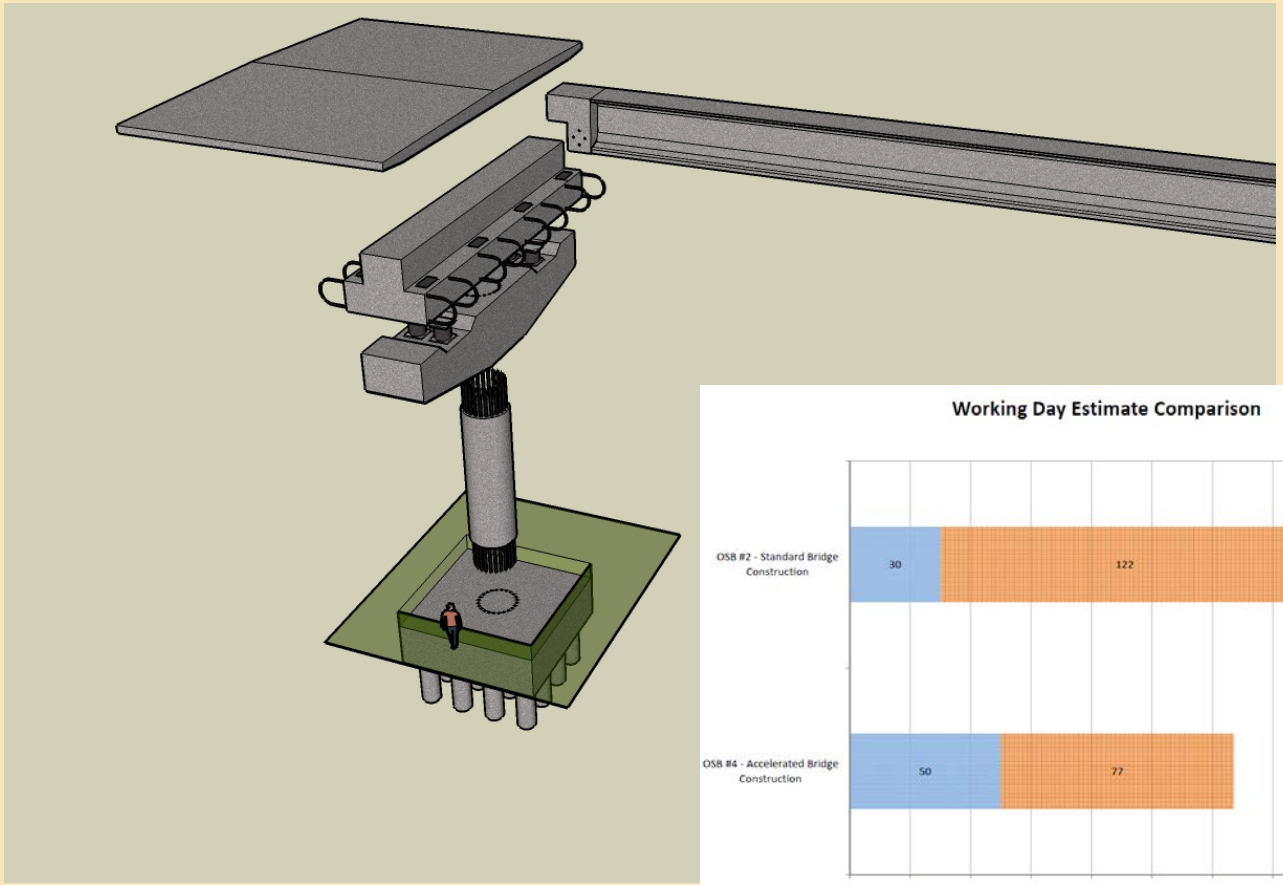


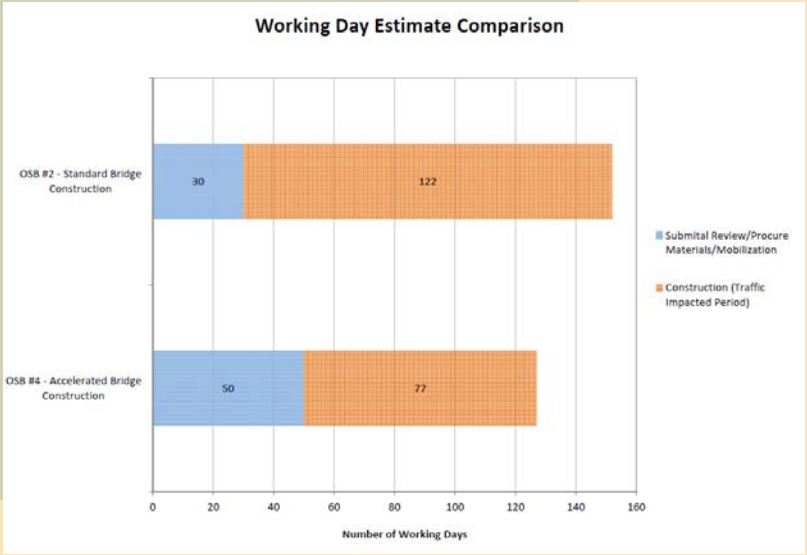
EMBEDDED METAL PIPE



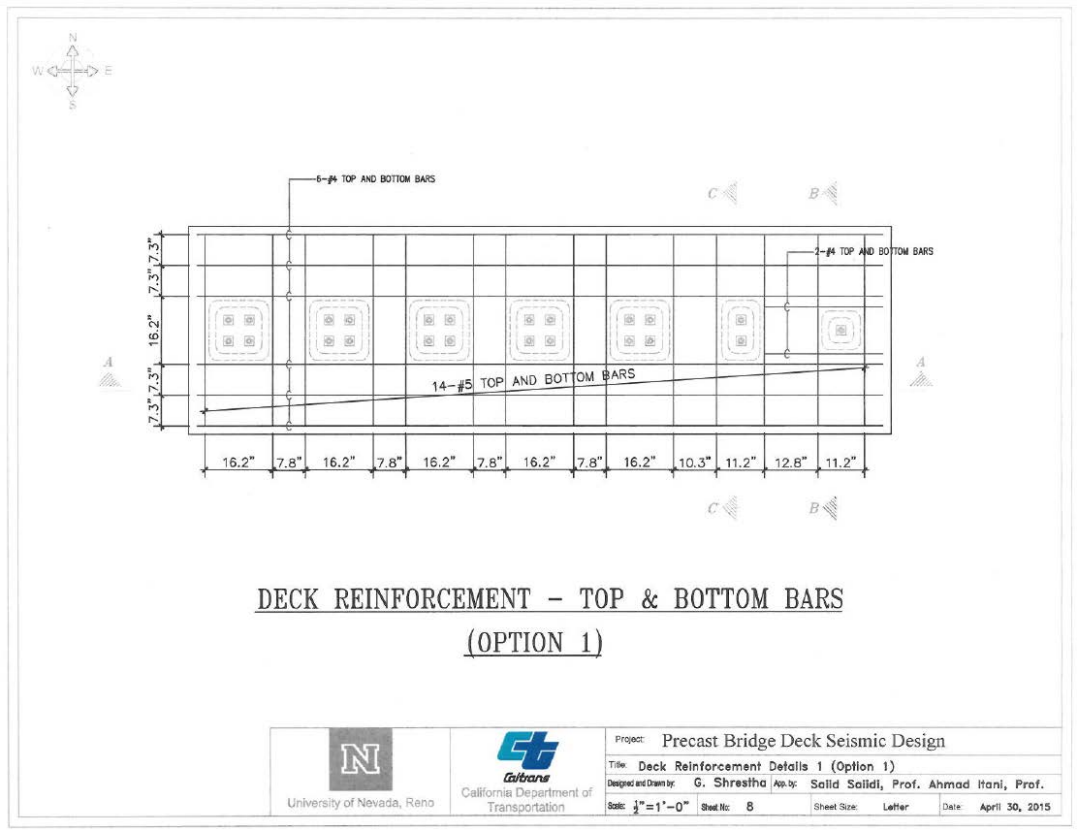
EMBEDDED WELDED BARS

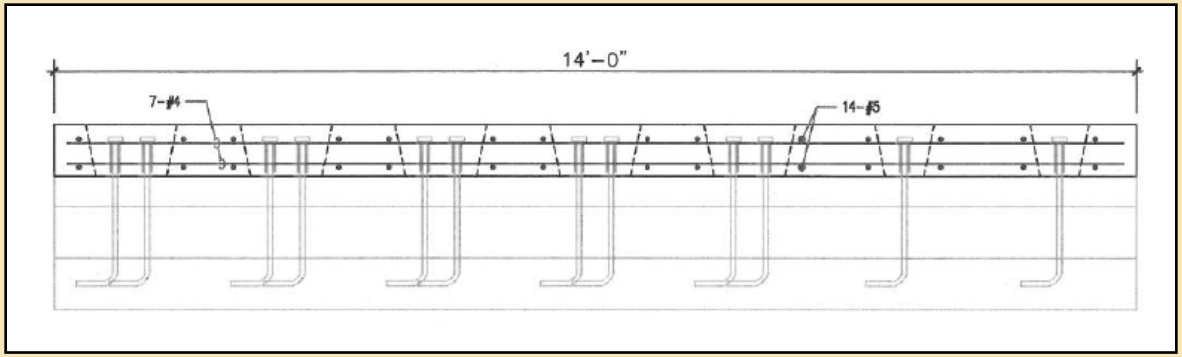
ABC Isolated
Ordinary Standard Bridge Components





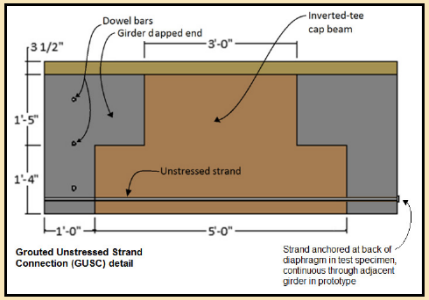
ABC Component Connection Research

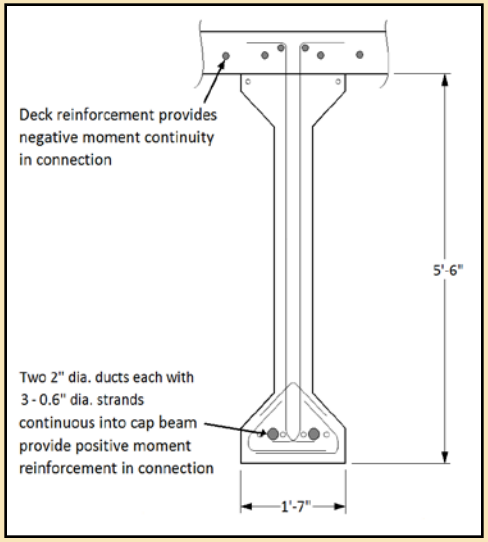




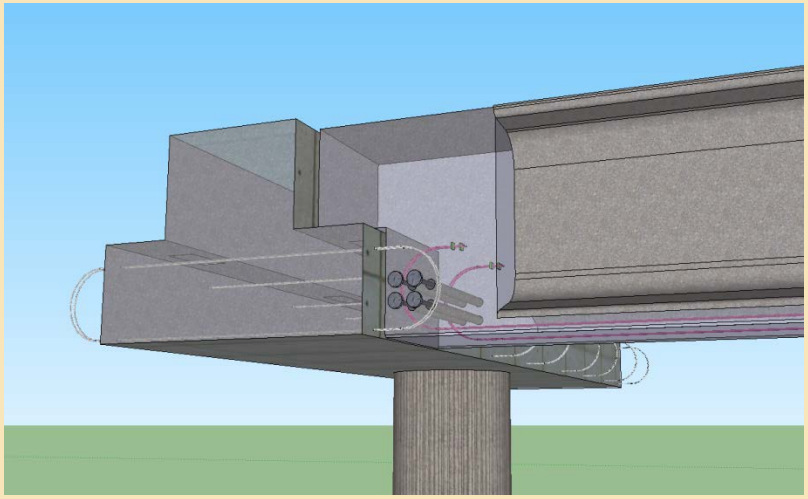
PC Girder Continuity through Bent Caps

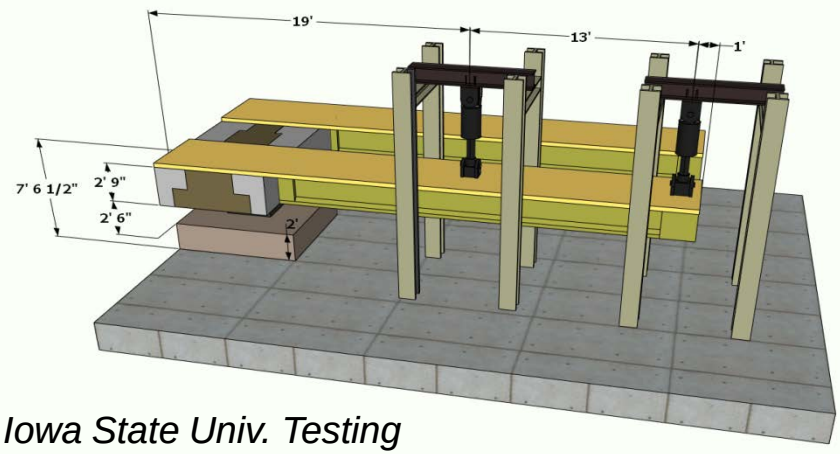
Unstressed Threaded Strand Continuity Alternative





Unstressed Strand Loop Continuity Alternative



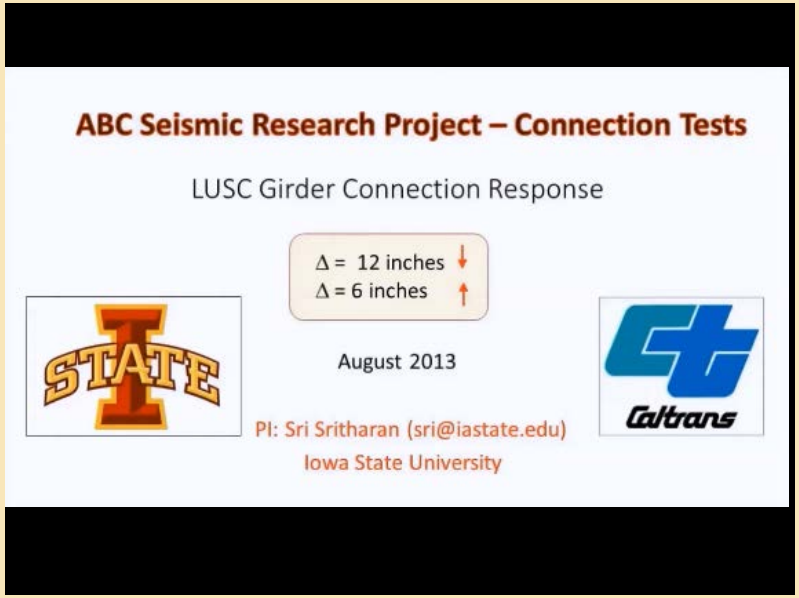


Iowa State Univ. Testing

PC Girder Continuity through Bent Caps

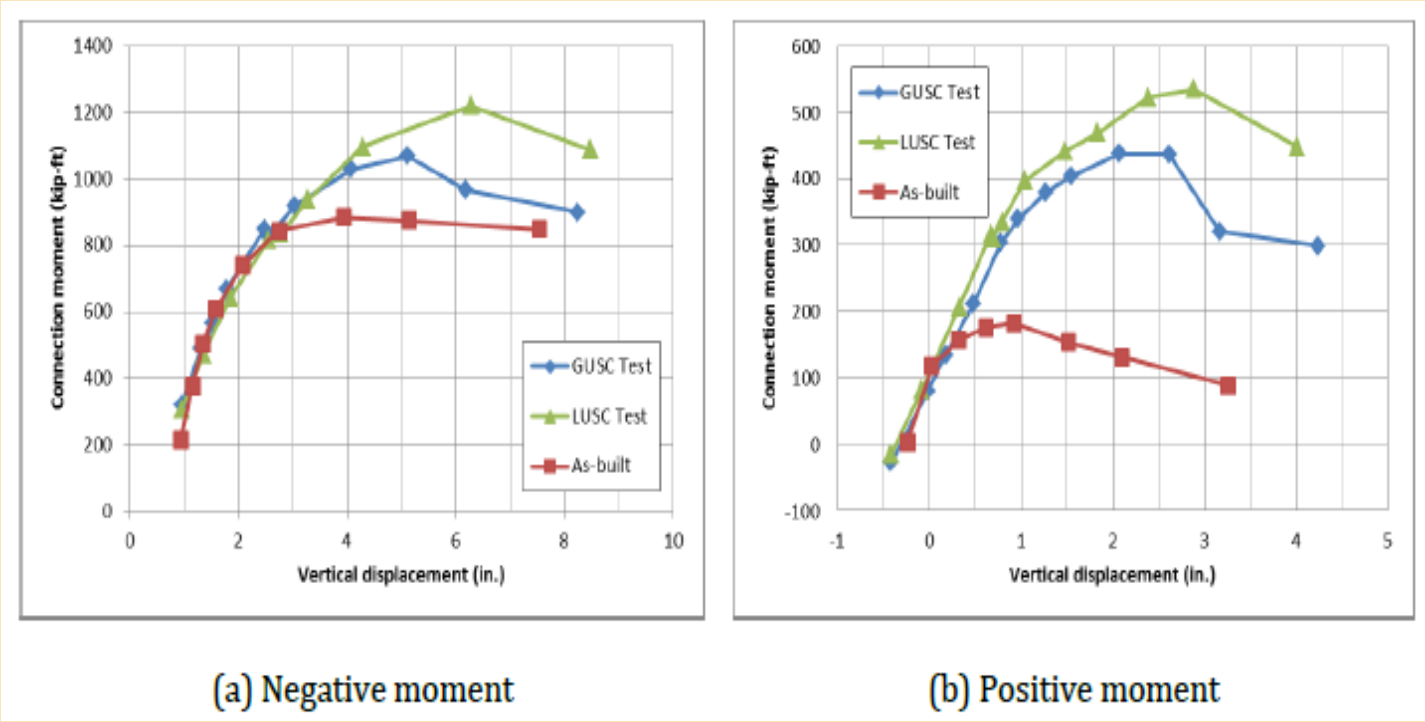
Iowa State Univ. Testing

Specimen 1 of 3 - Construction



Strand Loop Continuity testing

PC Girder Continuity through Bent Caps



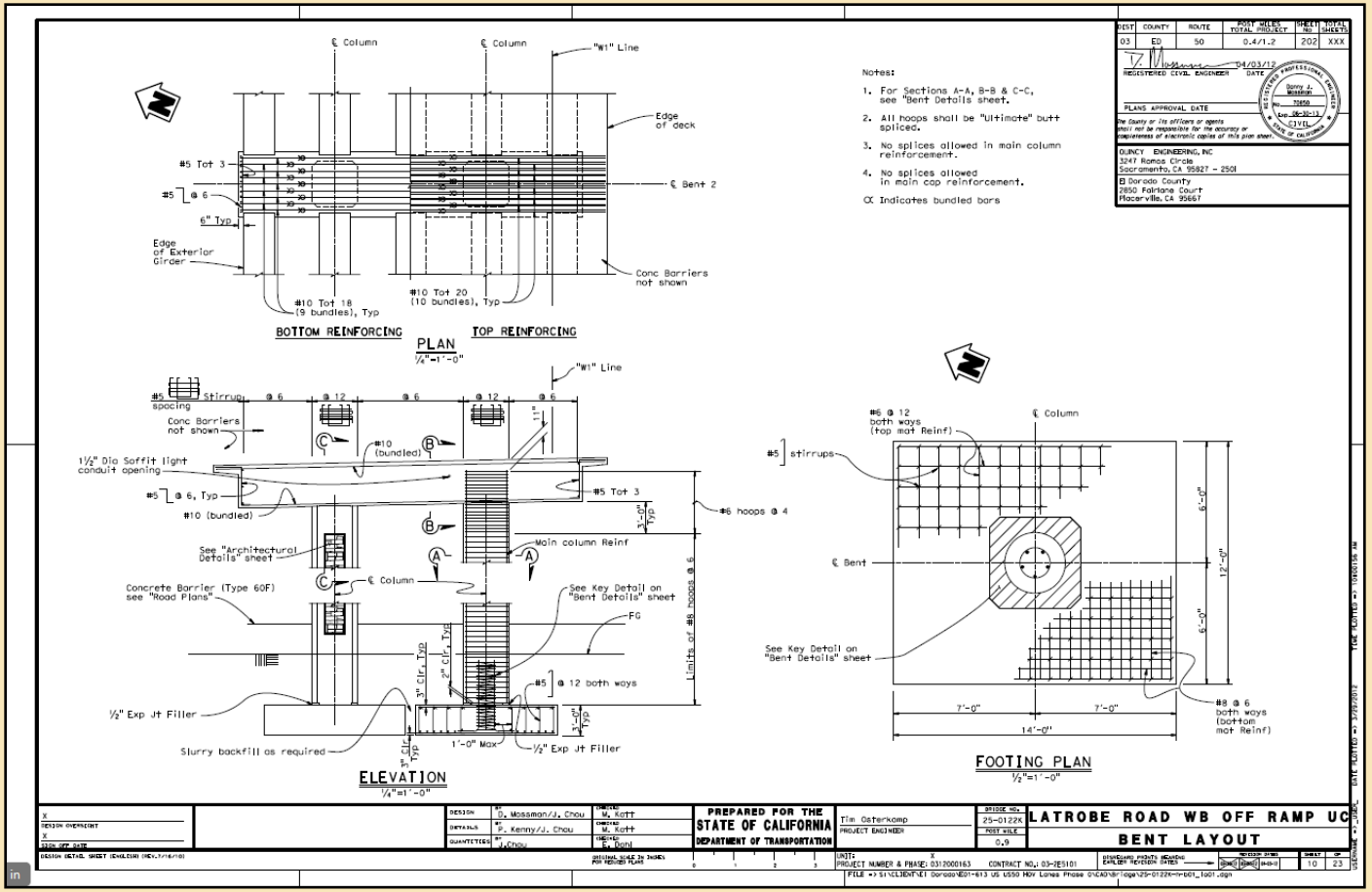
PC Girder Continuity
Hwy 50, El Dorado Hills, CA

Strand Tails Lapped and Tied into place for longitudinal continuity

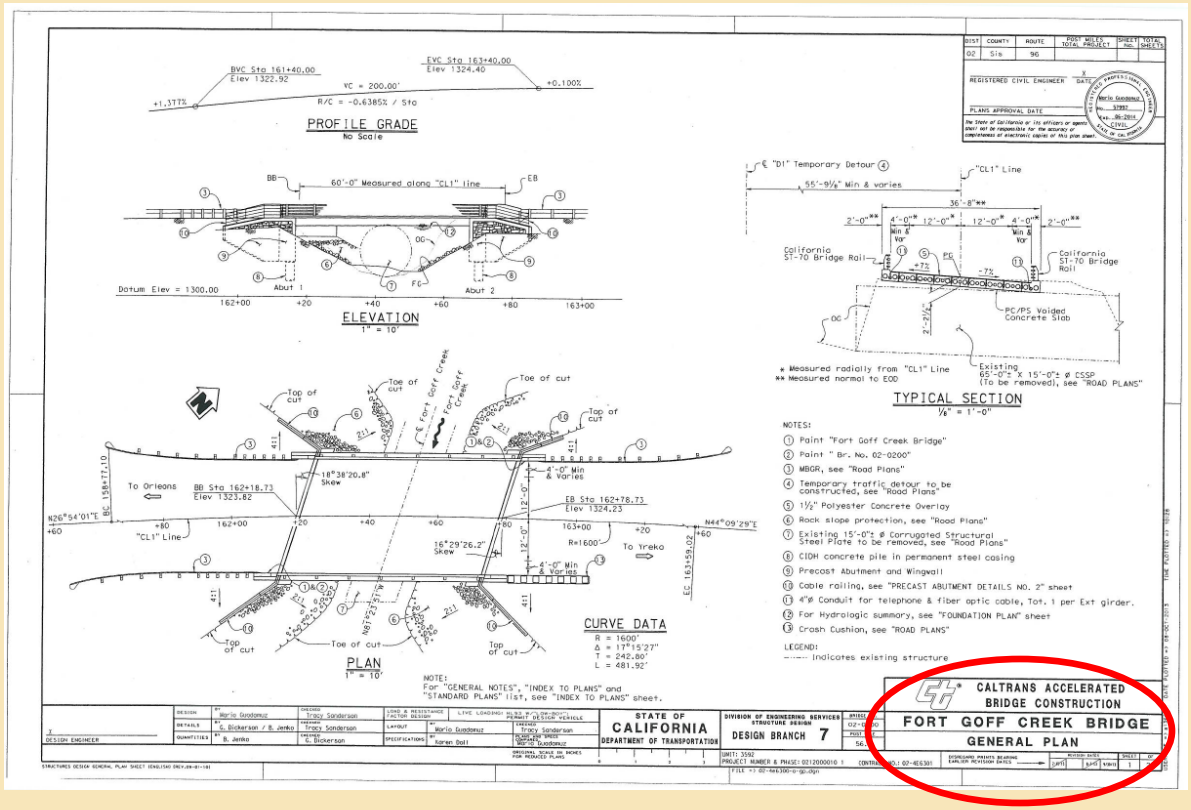
PC Girder Continuity
Hwy 50, El Dorado Hills, CA

Strand Tails Lapped and Tied into place for longitudinal continuity

PC Girder Continuity
Hwy 50, El Dorado Hills, CA



ABC Demonstration Project



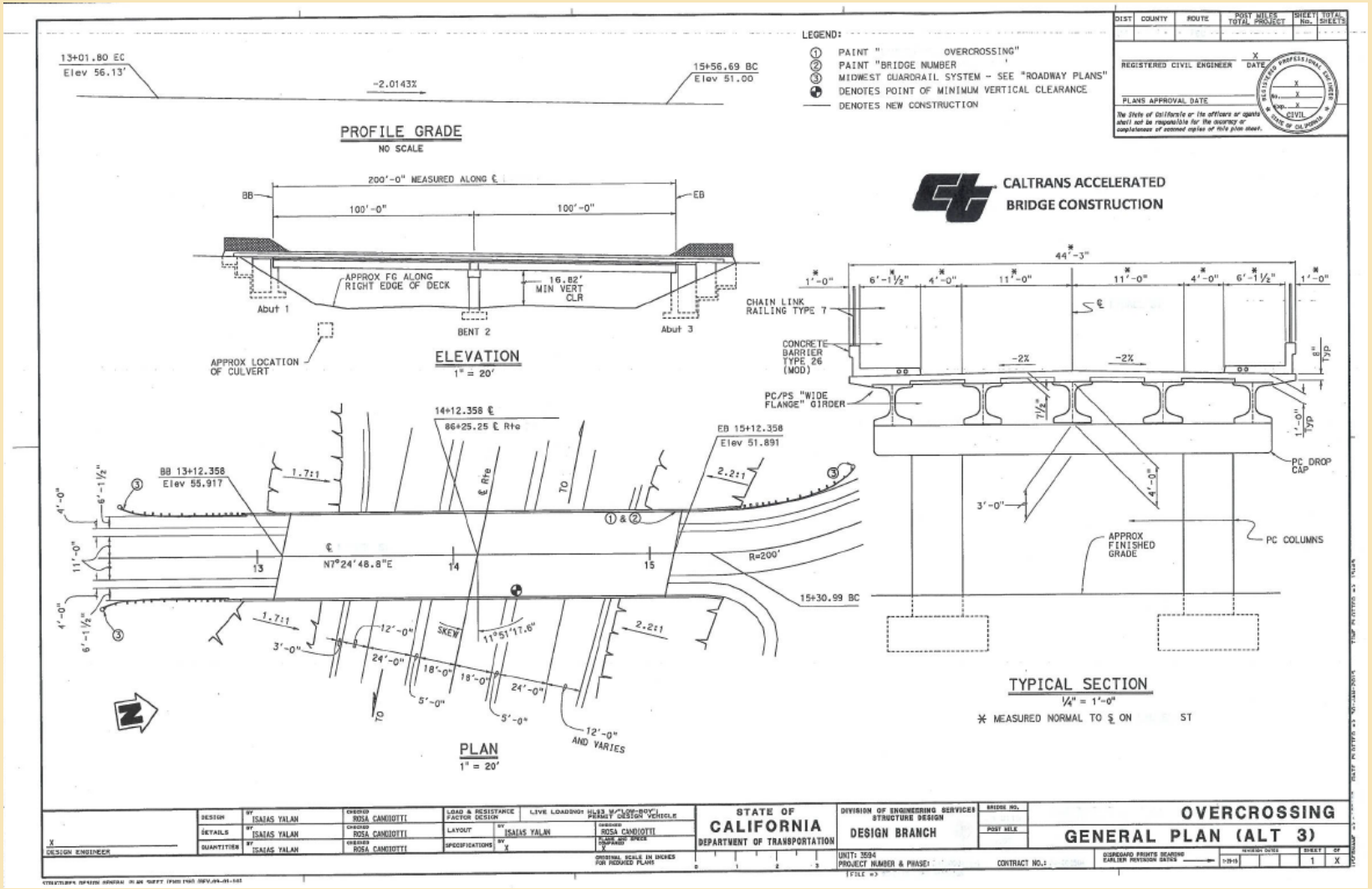
- Fort Goff Creek; SHRP2 funds
- PC Abutments
- PC Wingwalls
- PC Superstructure

ABC Multi-Span Pilot Projects

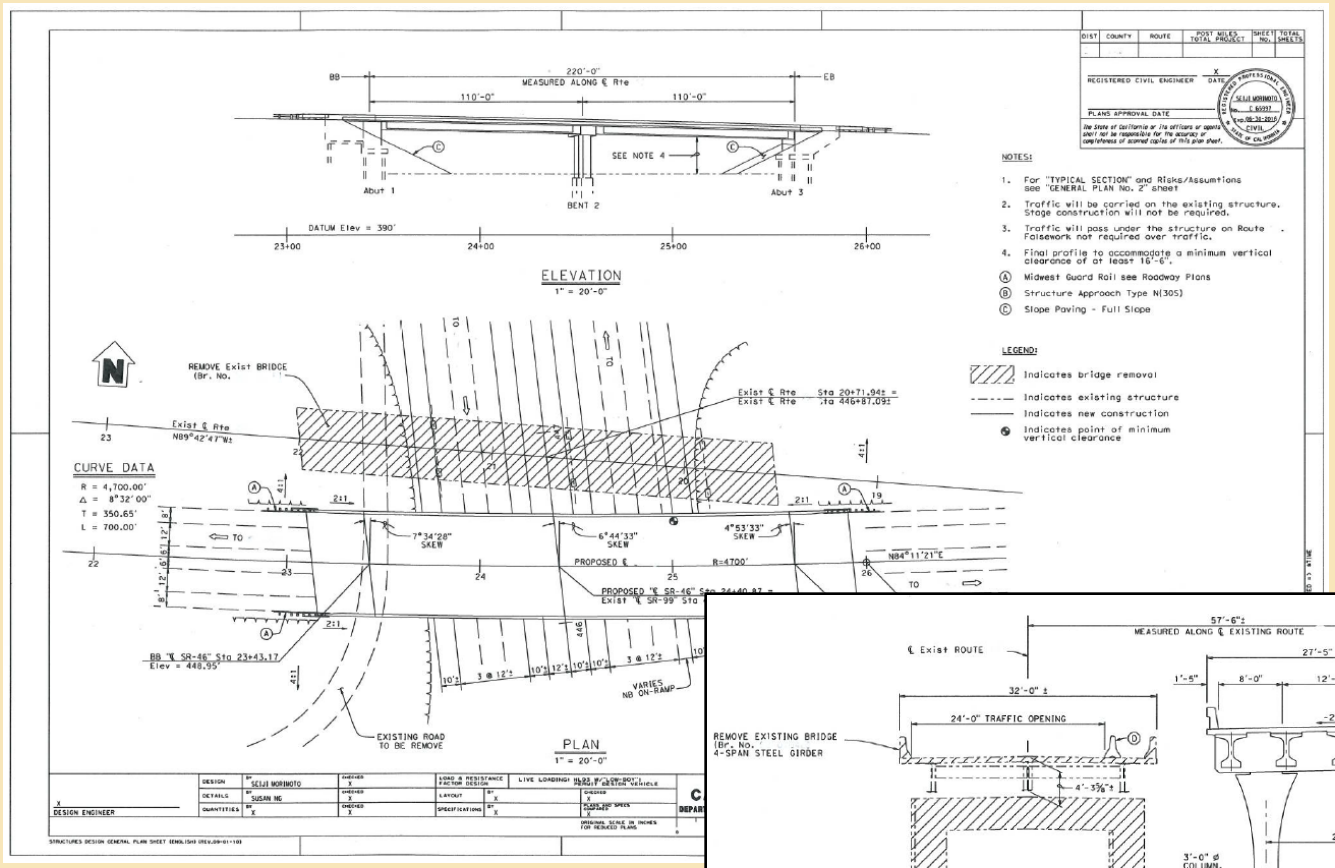
ACCELERATED BRIDGE CONSTRUCTION PILOT PROJECT CANDIDATES

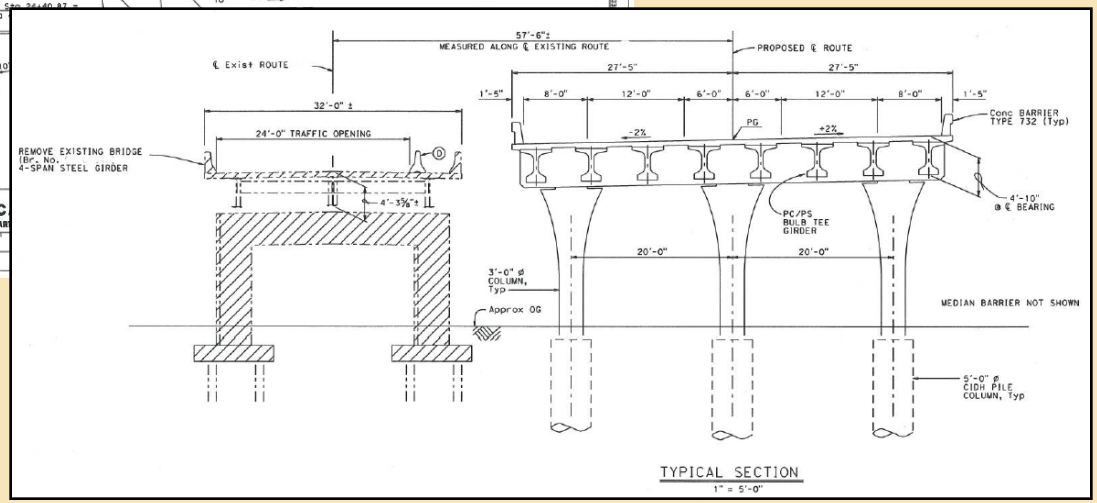
Pilot Project Ranking	Bridge Name Contract Number Location	Design Branch	Date Entered	Structure PS&E Date	W/BS Project Status (date of status)	Spans (Span Lengths)	Skew	Abutment	Girders	Bent Cap	Columns						Research Link*						
											Foundation	Length	Size	Columns per Bent	Top Fixity	Bottom Fixity	1	2	3	4	5	6	7
High	PP-1	6	10/13/14	8/17	160 10/15/14	3 (60-101-60)	< 1	Seat	PC/PS I	Inverted T	Footing on piles	26'	4'X9'	1	Fix	Fix	X		X				
High	PP-2	4	10/13/14	5/15	160 10/15/14	2 (133.5-133.5)	26	Seat	PC/PS Bulb-Tee	Drop Cap	6' CIDH	20'	5'	6	Fix	Fix	X		X		X		X
Low	PP-3	4	10/13/14	3/15	240 10/15/14	3 (34-30-34)	0	Diaphragm	PC Concrete Box	Drop Cap	16" Steel Pipe Pile	25'	16"	4	Fix	Fix		X					
Very Low	PP-4	4	10/13/14	11/16	150 10/15/14	2 (75-75)	0	Seat	PC/PS I	Drop Cap	4' CIDH		4'	3	Fix	Fix	X				X		
High	PP-5	9	10/13/14	9/15	160 10/15/14	2 (91-91)	12	Seat	PC/PS Concrete Box	Inverted T	Spread Footing	20	4'	3	Fix	Pin	X		X	X			
High	PP-6	9	10/27/14	8/14*	240 10/31/14	3 (27-34-27)	0	Diaphragm	PC Slab	Drop Cap	18" CISS	20'	18" CISS	4	Fix	Fix		X	X				
High	PP-7	6	10/13/14	9/15	240 10/15/14	2 (110-110)	4-8	Seat	PC/PS Bulb-Tee	Inverted T	60" CIDH	20'	4' with flare	3	Fix	Fix	X		X		X		

ABC Multi-Span Pilot Projects



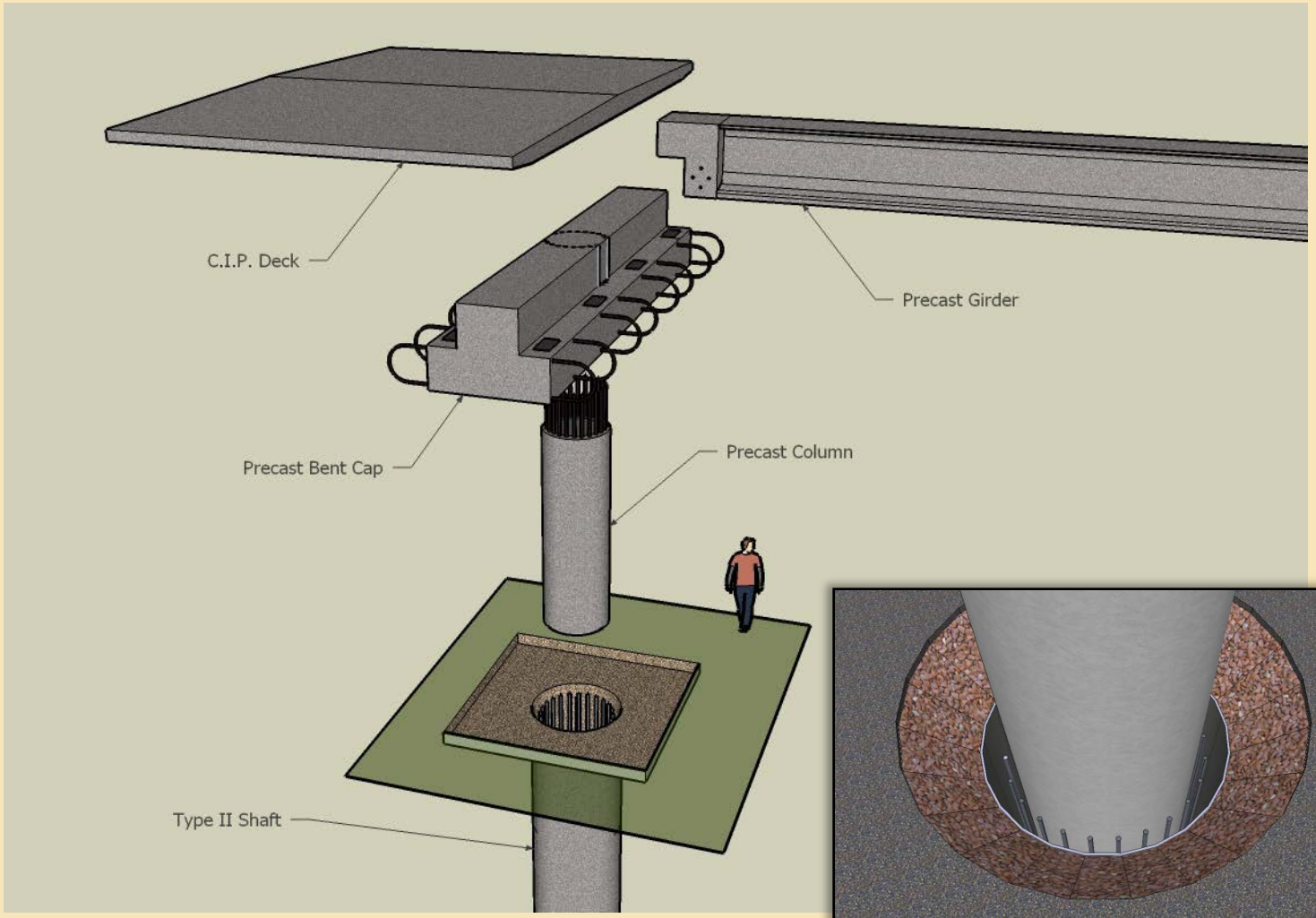
ABC Multi-Span Pilot Projects

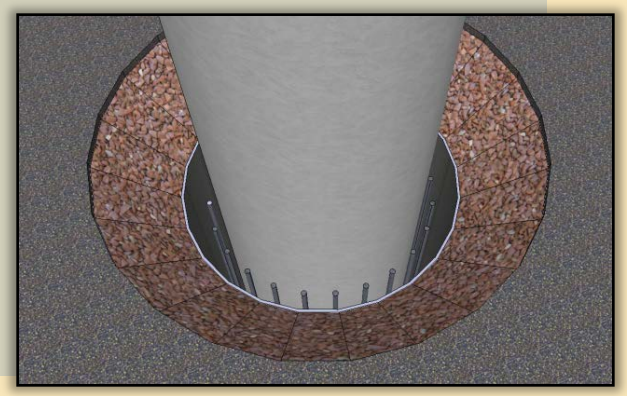




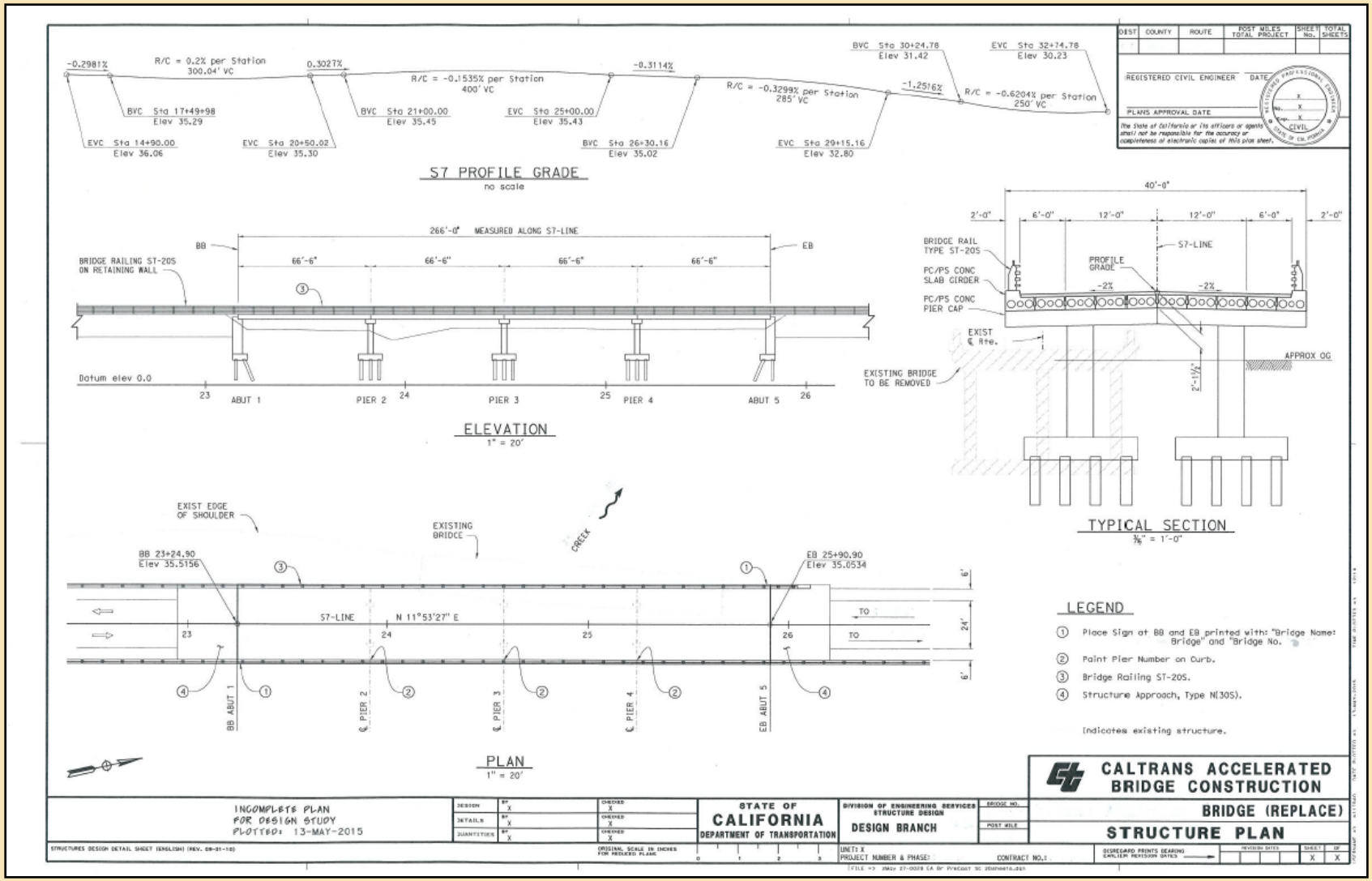
CALTRANS ACCELERATED BRIDGE CONSTRUCTION

ABC Multi-Span Pilot Projects





ABC Multi-Span Pilot Projects



DRAFT VERSION 06 MEMO TO DESIGNERS 20-20 • AUG 28, 2014

20-20 Seismic Design of Precast Bridge Systems

I. Intr

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PC

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DRAFT VERSION 04 ABC GUIDE TO DESIGNERS • AUG 6, 2014

Seismic ABC Details for PC Component Connections that Emulate CIP Bridge Systems

I. Introduction

All bridge systen

meeting the requi

In-Place (CIP) bri

meet the seismic

project specific r

Memos

Criteria

Examples

Caltrans Seismic ABC Connection Details

Detail Number	Sheet Title	Research Completed	Detail Created	Description
ABC-C01	ABC PRECAST COLUMN CONNECTION DETAIL NO. 1	✔	✔	Colmn-footing connection (PNC)
ABC-C02	ABC PRECAST COLUMN CONNECTION DETAIL NO. 2	✔	✔	Column-shaft connection (Type II)
ABC-C03	ABC PRECAST COLUMN CONNECTION DETAIL NO. 3			Column-cap connection
ABC-C04	ABC PRECAST COLUMN CONNECTION DETAIL NO. 4			Column-shaft connection (Type I)
ABC -G01	ABC PRECAST GIRDER GROUTED CONNECTION DETAIL	✔	✔	Grouted strand through cap *
ABC -G02	ABC PRECAST GIRDER LOOP CONNECTION DETAIL	✔	✔	Looped strand through cap *
ABC -G03	ABC PRECAST GIRDER LINK CONNECTION DETAIL	✔	✔	Strand link with chuck in cap
ABC -G04	ABC PRECAST GIRDER HOOK CONNECTION DETAIL	✔	✔	Bent strand anchored in cap
ABC -G05	ABC PRECAST GIRDER SPLICE CONNECTION DETAIL	✔		Strand with mechanical splice
ABC -G06	ABC PRECAST GIRDER LAP CONNECTION DETAIL	✔		Overlapped strands with chuck
ABC -G07	ABC PRECAST GIRDER BAR CONNECTION DETAIL	NA		Mild ultimate splice couplers in cap
ABC -D01	ABC PRECAST FULL DEPTH DECK PANELS			Longitudinal panels with pockets
ABC -A01	ABC ABUTMENT DETAILS NO. 1	NA		Precast units stressed on site
ABC -A02	ABC ABUTMENT DETAILS NO. 2			Precast units placed on site
ABC -B01	ABC BARRIER DETAILS - Type 736			Precast barrier w/CIP connection
ABC -F01	ABC FOOTING DETAILS			Precast units placed on site

* Cap may be PC

Thank You!