




Strategies and Practice of Accelerated Bridge Construction in California

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“One Mission – One Vision”

Enhance Mobility across California

- Need for Accelerated Project Delivery
 - ABC works towards reducing roadway delay impacts on the traveling public
 - ABC delivers projects early, provides speedy capital investments
- Minimize construction and safety-related issues, and environmental impacts
- Improve constructability, product quality and performance.





ABC National Efforts

- NCHRP 20-73 “Accelerating Transportation Project and Program Delivery: Conception to Completion”
- 2006 ABC Workshop, Reno, NV
- “Guidelines for Accelerated Bridge Construction using Precast/Prestressed Concrete Components”, PCI Northeast Bridge Technical Committee (2006)
- Seismic ABC Meeting at 2007 TRB Annual Meeting
- 2007 SABC meeting in San Diego
- 2008 FHWA ABC Conference in Baltimore, MD
- 2008 TRB SABC Collaboration Meetings
- UDOT ABC Standards Workshop report (anticipated April 2008)
- FHWA/WashDOT ABC Workshop (September 2008)
- FHWA Connections Manual (2008)



ABC XYZ?

- Technical
 - Prefabricating Bridge Elements and Systems (PBES) and erecting on-site
 - Precast concrete super- and sub-structure- Majority of PBES in California
 - Steel superstructure
 - Steel & FRP superstructure
 - Segmental construction methods (could be C.I.P.)
 - Launch or Roll-in (SPMT) girders/superstructures
- Contract and Construction
 - Double shifts
 - Disincentive and Incentives



California Issues

- Costs of ABC use
 - Construction and material costs
 - Projects programmed before ABC tools considered
- Industry reluctance- CIP the preferred method (typically not a speedy operation)
- Seismic performance objective risks

Engineering Services: [ABC- Council](#)

- Pursues further widespread ABC practice for future standard bridge projects



California ABC Strategic Plan

1. “Lessons” Learned Report and Survey
2. ABC Selection Criteria and Implementation
3. Industry Engagement
4. Construction Specifications Development
5. Technical Research and Development
6. Project Implementation- Pilot Program





Project Delivery Paradigm

1. New concept of “Time”

- ◆ “Time” critical to Stimulus and Recovery of Economy
- ◆ Expedite Construction Start Time- Create jobs to stimulate economy
- ◆ Accelerate Construction Time- Minimize traffic delay, safety, environmental impacts, save impact costs to the public
- ◆ Expedite Completion Time- Early Capital (infrastructure) Improvement help speedy recovery of economy



Project Delivery Paradigm

2. Product Performance Measure

- ◆ ABC selection depends on savings on
Total Cost $TC = CC + IC$
- ◆ CC = construction cost, IC = impact costs
- ◆ IC = user delay, economic impact, environmental impact, etc. based on
 - ◆ Construction Impact Time (CIT)- impact duration
 - Construction Completion Time (CCT)- duration
- ◆ Use “Time” ~ related to costs*
 - ◆ More research/study needed



Project Delivery- ABC

ABC Decision Criteria

- ◆ References: [FHWA Framework for Decision Making](#), [Washington DOT](#), & [Utah DOT ABC Decision Matrix](#)

Structure Type Selection- ABC Solution Evaluation

Implemented effective May 1, 2009

- Safety, Functionality, Construction Cost (Constructability), New measure- “Time”
- Provide CIT and CCT
- Use Design Impact Questionnaire to determine needs for ABC

ABC Solution Evaluation

A. Construction Impact Time (CIT)

Impact Level- Reduced Traffic Opening, Vertical Clearance, Environmental (Wetlands, River, etc.)

Bridge Name	Location	Temporary Traffic Opening				Falsework Depth	Comments
		Traffic Type	Opening		Duration		
			Height	Width			
Big Dalton Wash Bridge	Eastbound						
	Westbound						

Bridge Name	Location	Work Space Required*	Temporary Traffic Opening			Duration	Comments
			Direction	Traffic Type	Widths		
	Bent 2- Median of I-5 freeway	25-ft Wide	Northbound	Vehicle, Pedestrian		Three Months	Inside Shoulder

B. Construction Completion Time (CTT)

ABC Solution Evaluation



Design Impact Questionnaire

Given: CIT and CCT, and Structure Type: *CIP, Precast, or others*

Questions	Yes			No	
	1	2	3	4	5
General					
1. Is this an emergency bridge replacement?					
2. Is bridge on an emergency evacuation route or over railroad/waterway?					
3. Is there a funding requirement to accelerated project delivery?					
4. Is rapid recovery from natural/manmade hazards or rapid completion of future planned repair/replacement needed for this bridge?					
5. Is the bridge construction a critical path of the total project?					
6. Are there significant economic benefits if construction/project is completed ahead of schedule?					
Traffic					
7. Bridge carries high ADT or ADTT?					
8. Bridge over existing high ADT or ADTT facility?					
9. Bridge construction significantly impact traffic?					
a. Does it have high user-delay costs?					
10. Can the bridge be closed during off-peak traffic periods?					
11. Will the traffic control plan be significantly impacted?					



Design Impact Questionnaire

Construction	Yes	1	2	3	4	5	No
12. Do worker safety concerns at the site limit conventional methods, e.g., adjacent power lines or over water?							
13. Is the bridge location subject to construction time restrictions due to adverse economic impact?							
14. Does the site create problems for conventional methods of construction (falsework, concrete delivery, etc.)?							
Utilities							
15. Are there existing utilities/Railroad that impact the construction window?							
16. Are there existing utilities/Railroad that impact construction operations?							
Environmental							
17. Is the site environmentally sensitive area requiring minimum disruption (e.g. wetlands, air quality, and noise)?							
18. Are there natural or endangered species at the bridge site? a. Shorten construction window needed?							
19. Local weather limit the time of year for construction?							
20. Is the bridge on or eligible for the National Register or Historic Places, or a designated landmark structure?							
Total Scores							

- If Total Scores < 55, then provide an ABC structure alternative/solution.



ABC Solution- Partnering

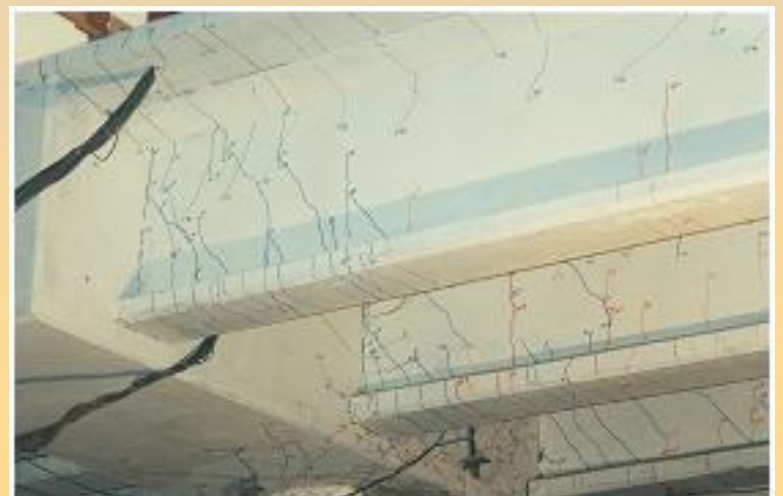
2. Making Decision with Partners

- ◆ Seek input and support from Project Management, Planning, Design, Traffic, TMP, Environmental, Construction
- ◆ When needed, coordinate with local transportation agencies, cities and counties.
- ◆ Include ABC alternatives in PSR/PR documents?
- Benefits: Improved communications and collaborations to yield a more efficient PS&E process.

Seismic Research- past

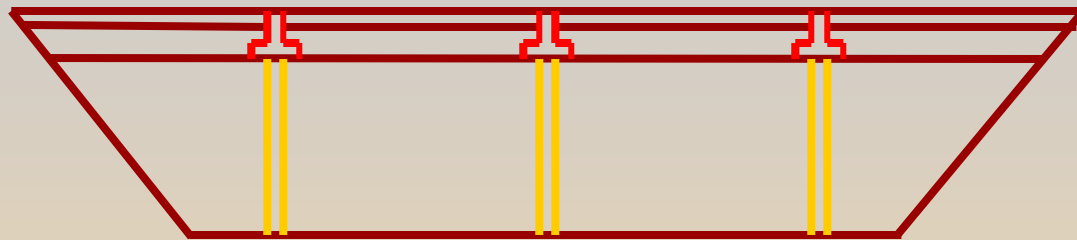
Spliced Girder Research- UCSD

- Superstructure Performance
 - Bent cap withstands plastic moment induced by column
 - Girders remain “Essentially Elastic” with small cracks
 - Post-tensioned bent cap clamps girders together

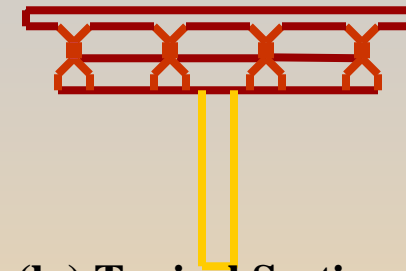


Seismic Research- current

- UCSD-Iowa State Inverted-Tee Bent Cap



(a.) Bridge Elevation



(b.) Typical Section

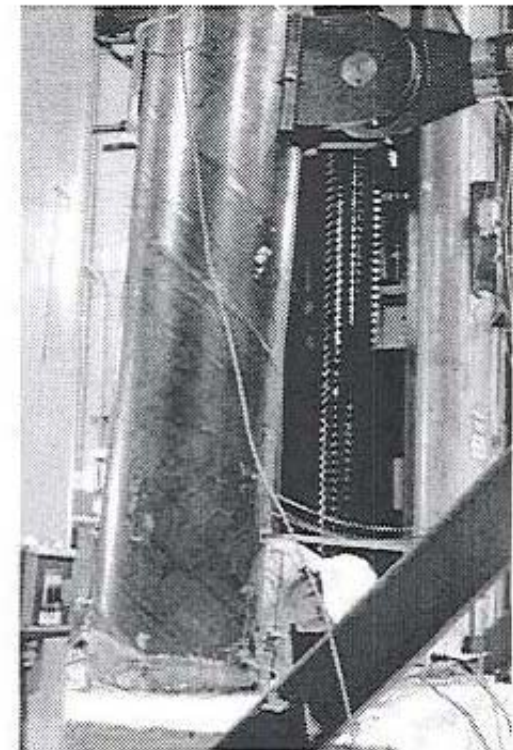
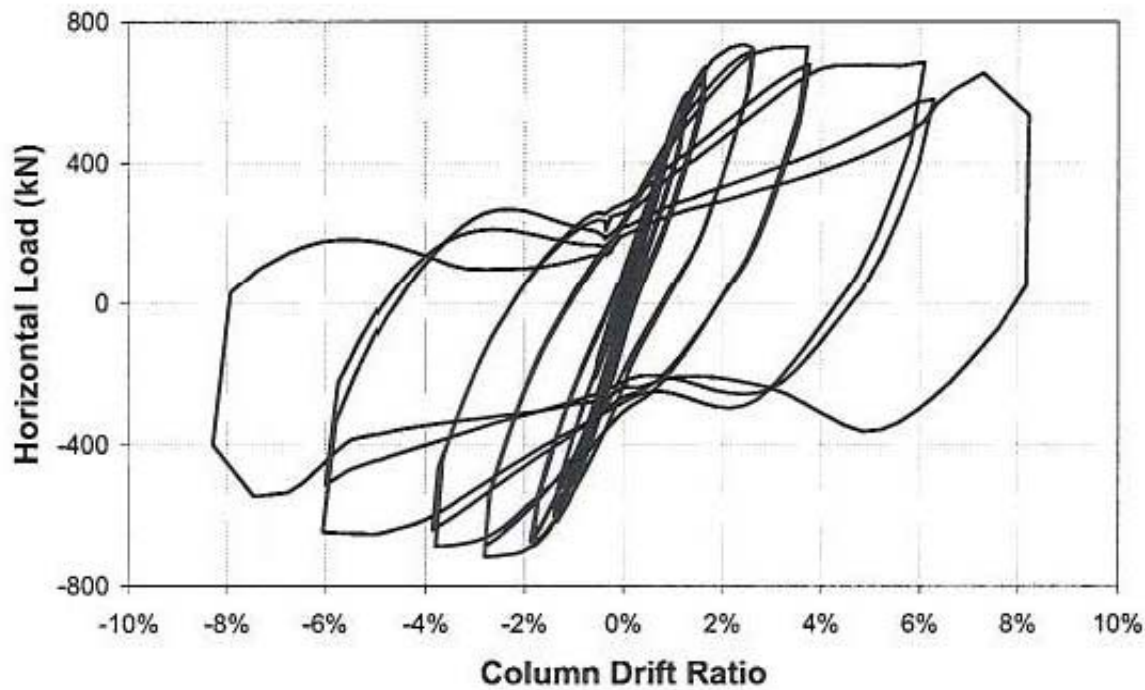


(c.) Section of cap between girders

- Precast Bent Connection Tests- U. Washington
- NCHRP 12-74 (UCSD) studying “jointed construction”
- Accelerated Column Construction Tests- U. Washington
- MCEER ABC research

Seismic Research- current

Steel Tube Column Testing- U.W.



Seismic Research- Call for Submission (CFS)



Next Generation Bridges (NGB)

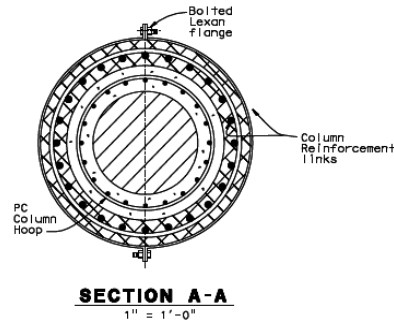
Precast Column connection to foundation


NOTES:

1. Match mark Main PC Column Reinf and Shaft Vertical Reinf.
2. Template required for placement of shaft vertical reinforcement.
3. Field fabricate Column Reinf Links as required.
4. Roughen surface to 1/4" amplitude.
5. All hoops are "Ultimate" butt splice continuous.
6. Plumb and support PC Column and provide grout seal.

LEGEND:

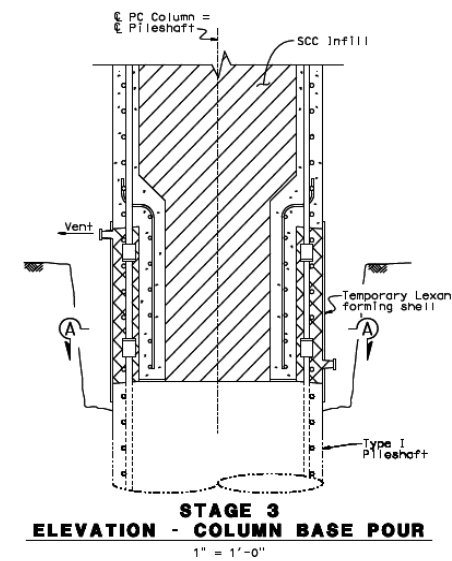
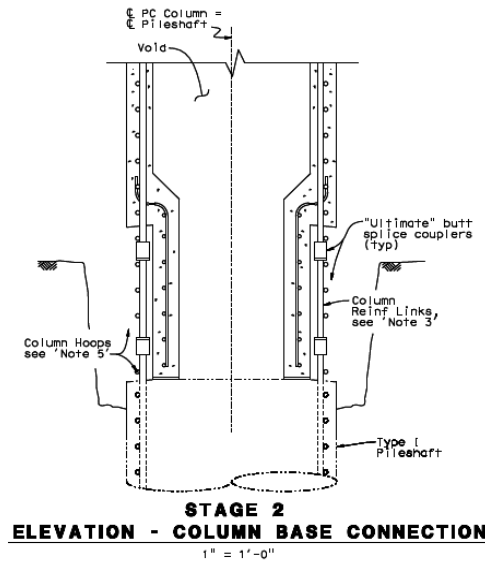
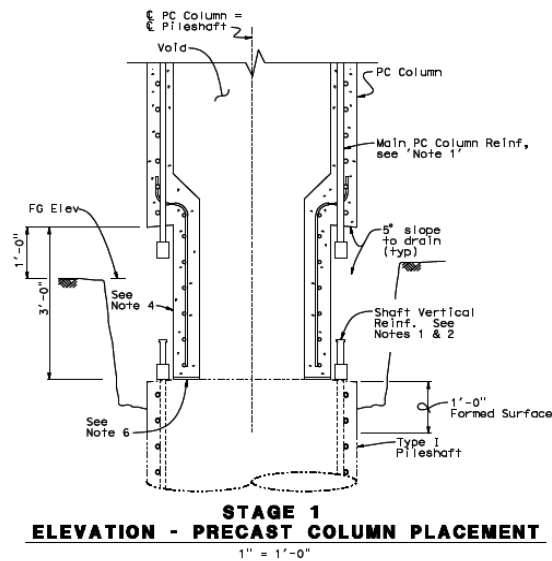
-  Denotes staged infill with SCC in column void grout in exterior joint region.
-  Denotes grout injection.



DIST.	COUNTY	ROUTE	POST MILE TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
REGISTERED ENGINEER - CIVIL					
					
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.

INCOMPLETE PLAN FOR DESIGN STUDY PRINTED
DATE: 03-13-09
OFFICE OF STRUCTURES DESIGN
STATE OF CALIFORNIA



NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

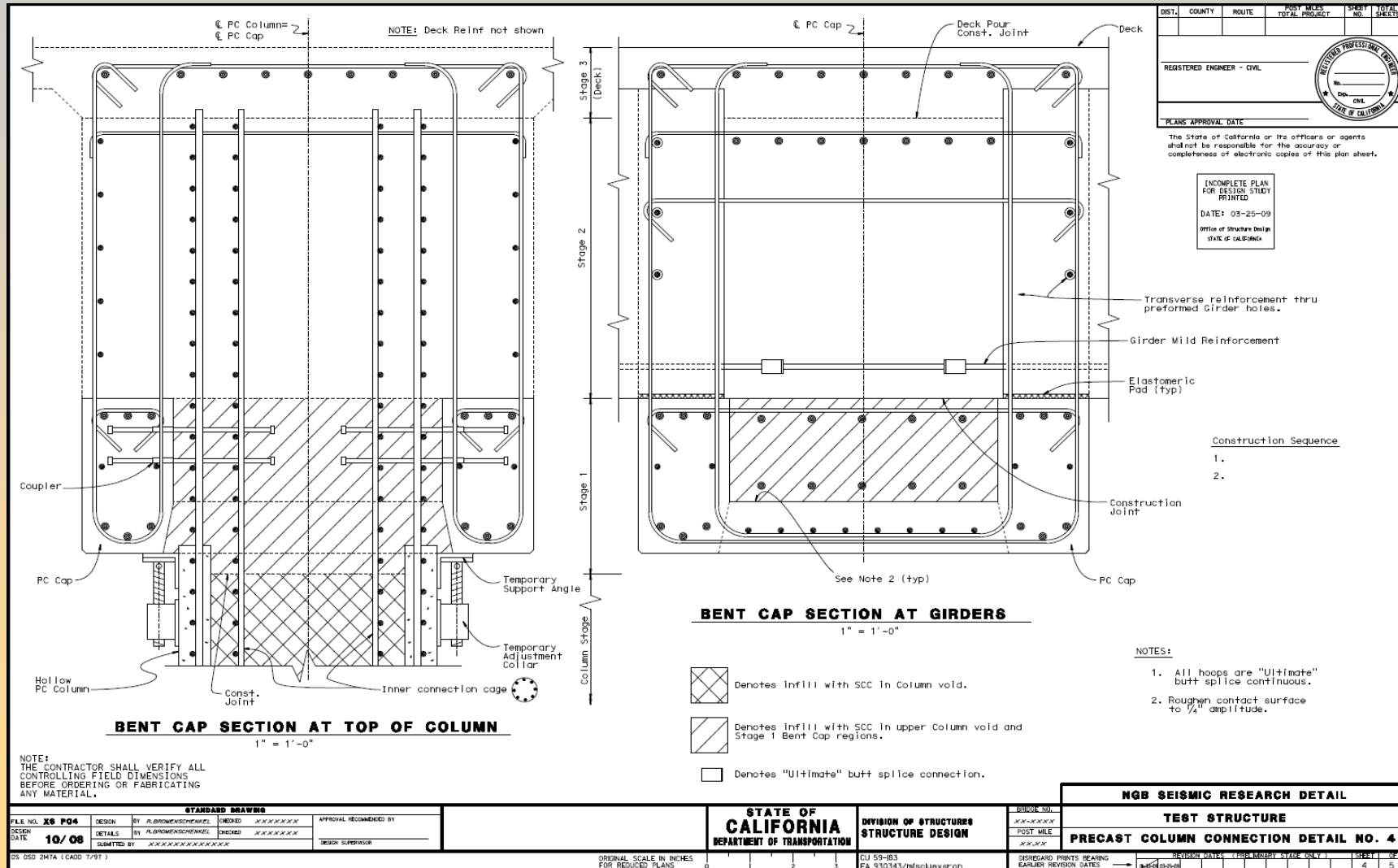
STANDARD DRAWING			
P.L.S. NO. X8 P02	DESIGN BY ALBROMSCHENKEL	DRAWN BY XXXXXXXXXX	APPROVAL RECOMMENDED BY
DESIGN DATE 10/06	DETAILS BY ALBROMSCHENKEL	CHECKED BY XXXXXXXXXX	DESIGN SUPERVISOR
SUBMITTED BY XXXXXXXXXXXXXXXXXX			

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN
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NGB SEISMIC RESEARCH DETAIL						
TEST STRUCTURE						
PRECAST COLUMN CONNECTION DETAIL NO. 2						
DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES (THIS DRAWING SHEET ONLY)					
	<table border="1"> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> </table>	1	2	3	4	5
1	2	3	4	5		

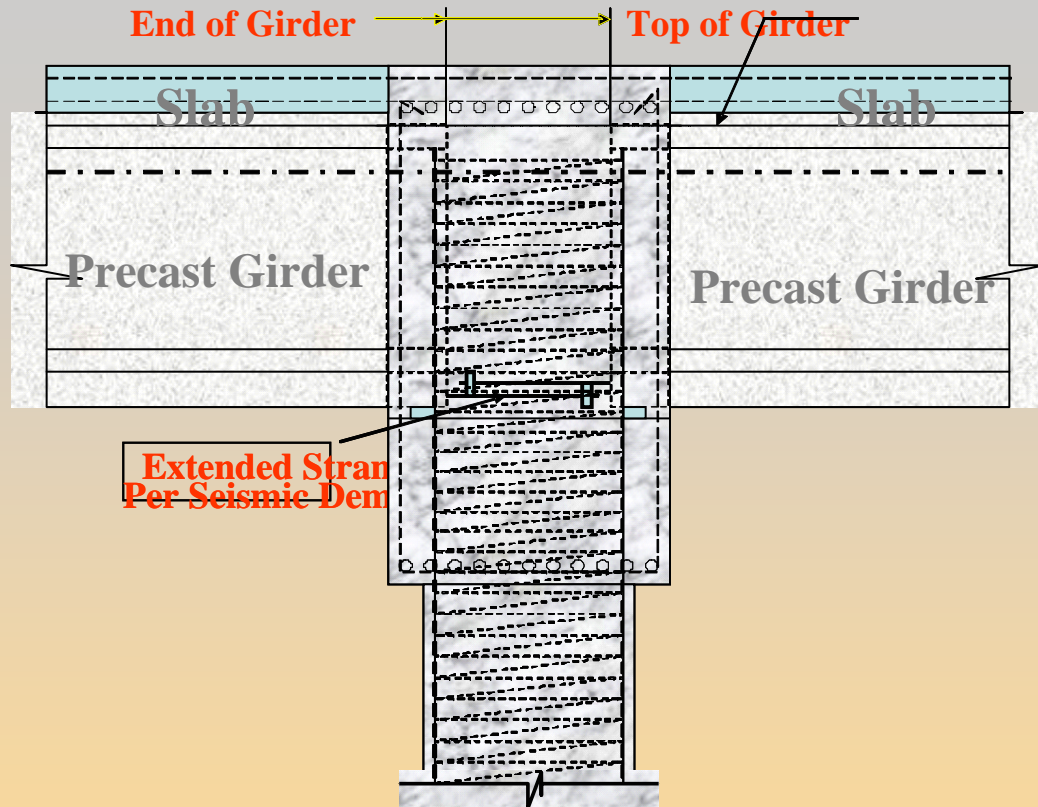
Seismic Research- CFS for NGB

Precast Column connection to Bent Cap



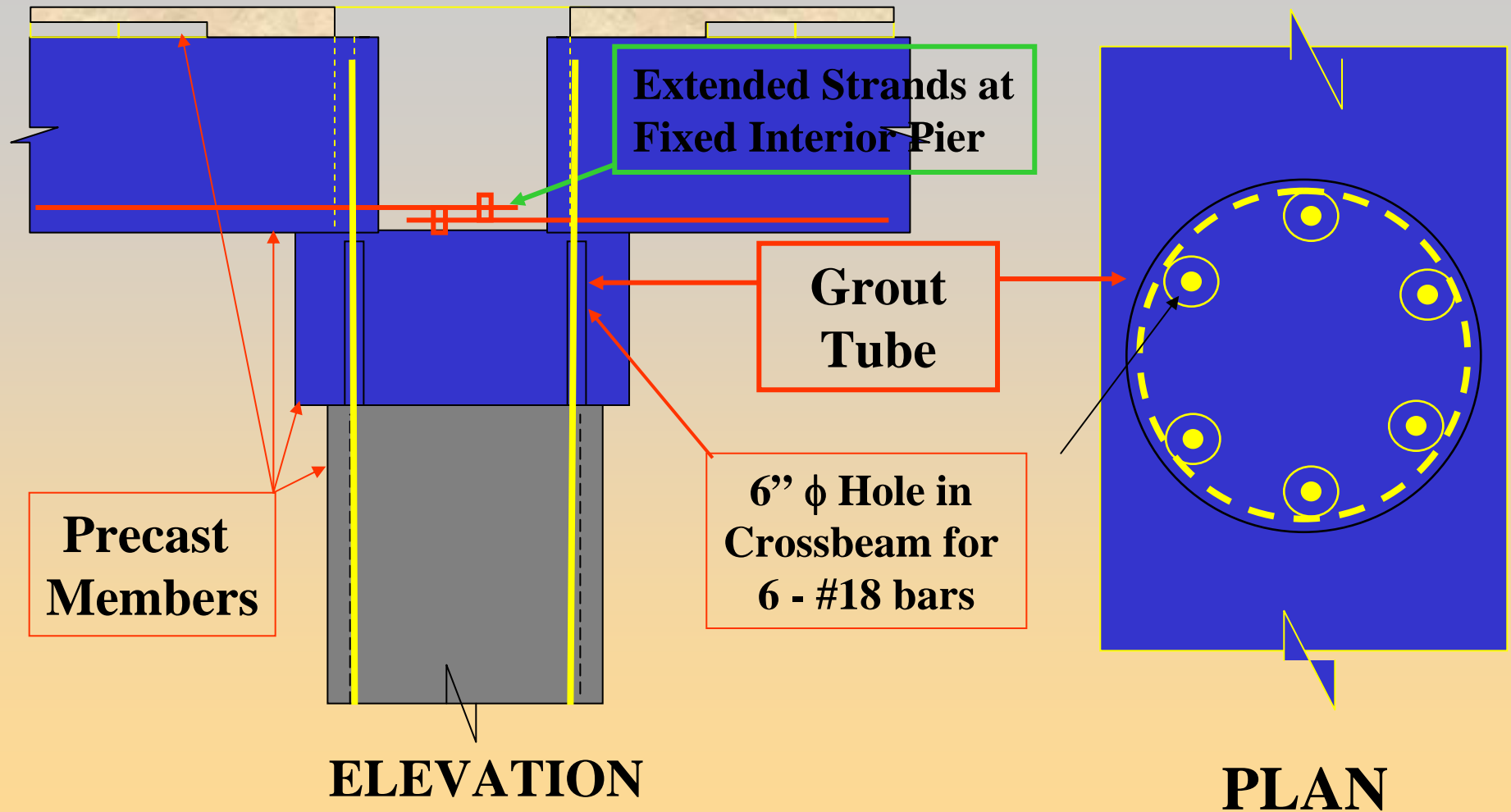
AASHTO/TRB Seismic Research Proposal

Fixed Intermediate Pier Connection



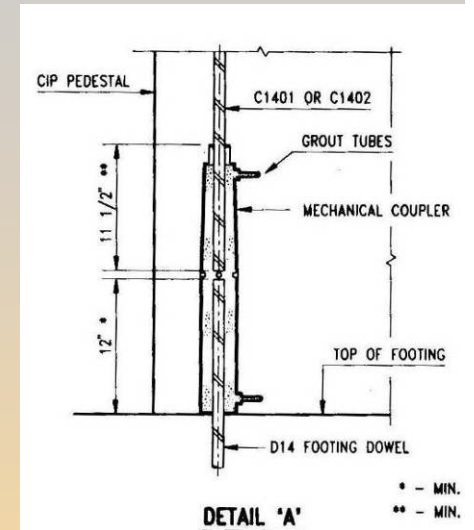
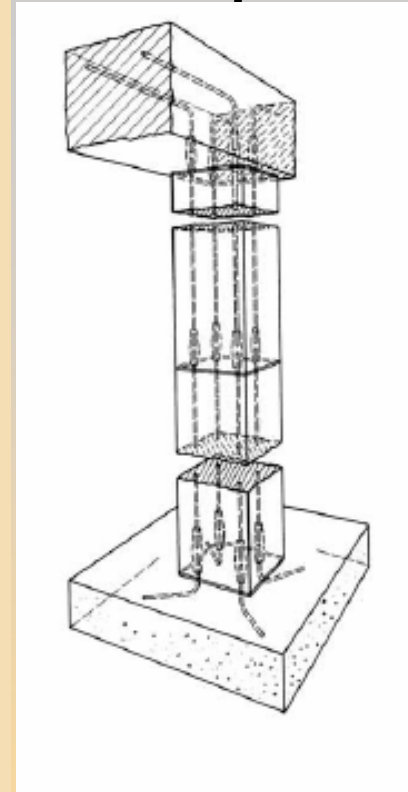
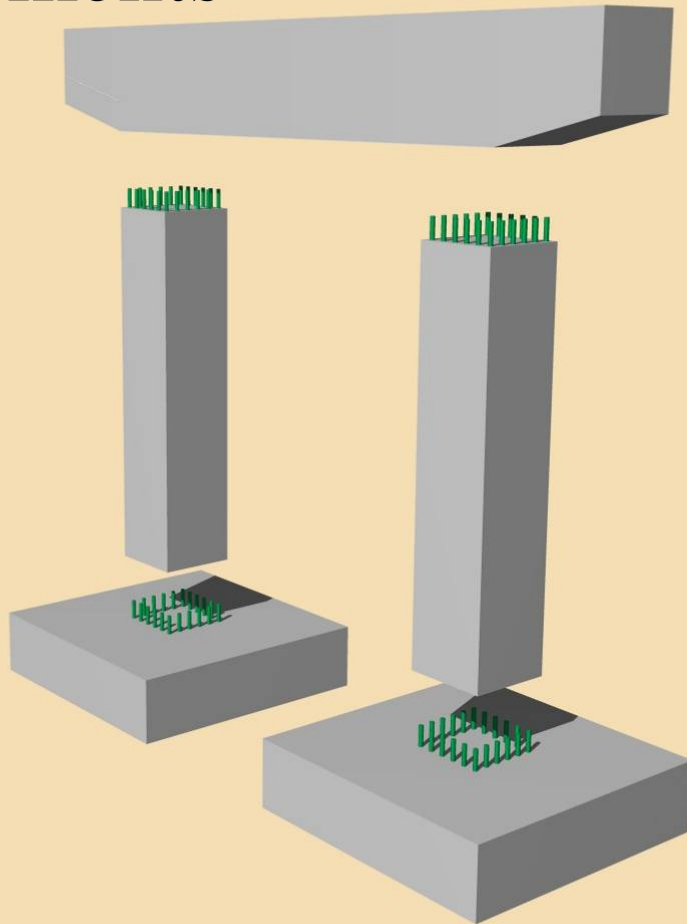
AASHTO/TRB Seismic Research Proposal

Precast Girder to Bent Cap



AASHTO/TRB Seismic Research Proposal

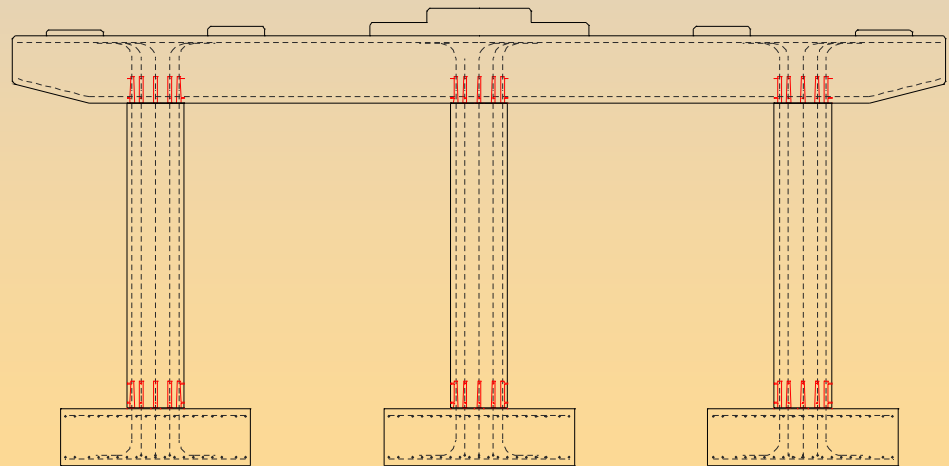
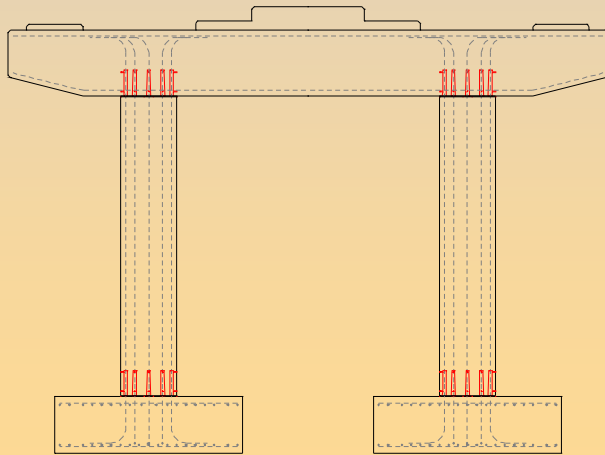
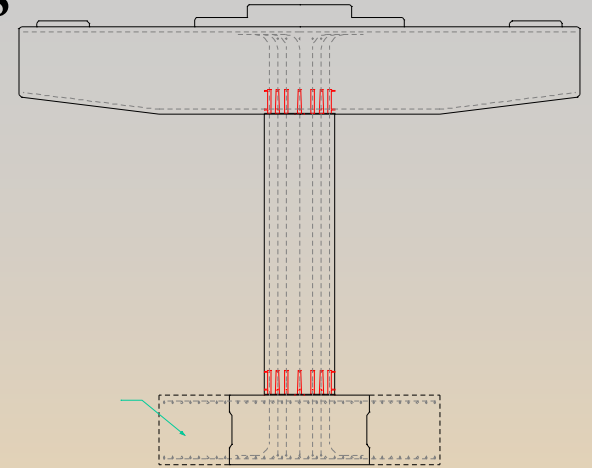
Grouted Reinforcing Splice Couplers- precast elements



- Florida DOT
- Georgia
- Northeast

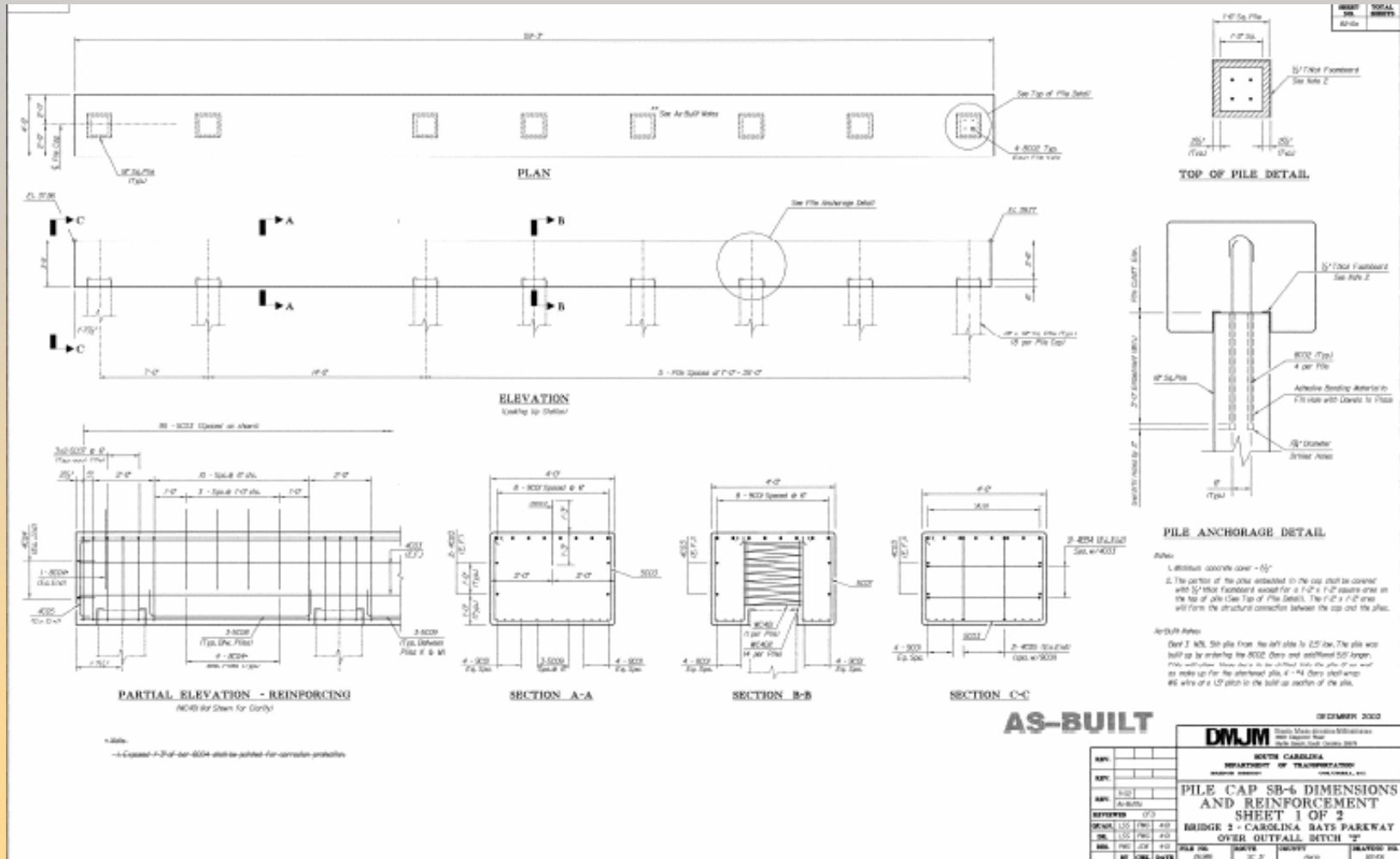
AASHTO/TRB Seismic Research Proposal

Grouted Reinforcing Splice Couplers



AASHTO/TRB Seismic Research Proposal

Precast Pile Cap





AASHTO/TRB Seismic Research Proposal



Precast Bent Cap- South Carolina



Industry Engagement



- Caltrans to sponsor workshop with consulting engineers, fabricators, erectors, trucking, and general contractors
 - a. Constructability
 - shapes, geometry, curvature, tolerances
 - b. Picking and transporting limits
 - c. New precast component & details solutions
 - d. New material applications
- Work with Industry to improve construction cost competitiveness



Future Action Item 2010/2011

1. Develop Cost Models
 - Input and support from Traffic and others
2. Develop formalized ABC Decision Criteria and Matrix based on Total Costs
 - Development needs collaboration from PM, Design, Traffic, and other PDT members
3. Implementation of the formal APD/ABC Decision Criteria and Matrix using Total Costs

ABC On-Line

Caltrans Division of Engineering Services - Microsoft Internet Explorer

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Address http://www.dot.ca.gov/hq/esc/Structure_Design/accel_bridge_construction/index.html Go Links

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Accelerated Bridge Construction

[FHWA Seismic ABC Workshop Report](#)

[ABC Lessons Learned](#)

[Caltrans ABC Strategic Plan](#)

QUICK LINKS

- Accelerated Bridge Construction
- LRFD Information
- Engineering Services General Directory
- Structure Specifications (SSPs)
- Bridge Standard "XS" Detail Sheets
- Seismic Hazard Map
- Structural Detailing Standards
- Preliminary Investigations Forms Site
- Civil Engineering Scholarships

RELATED LINKS

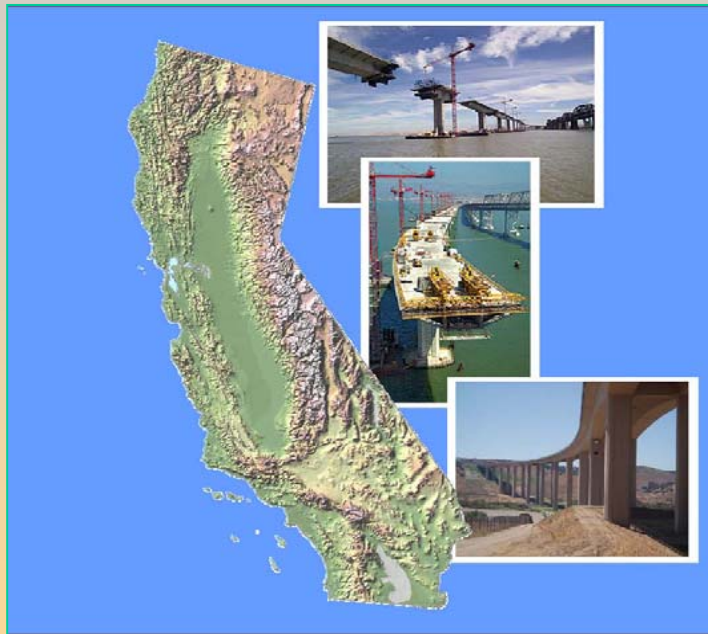
- Organization Chart
- Caltrans Design Program (Highway Design)
- Caltrans Toll Bridge Program
- Structure Maintenance & Investigations
- Structure Construction
- Structure Design Support & Earthquake Engineering

Start Paul Chung - In... Caltrans Divis... Microsoft Power... Internet 7:46 AM

http://www.dot.ca.gov/hq/esc/Structure_Design/accel_bridge_construction/

ABC On-Line

- FHWA Seismic ABC Workshop Report
- Caltrans ABC Strategic Plan
- ABC Lessons Learned Report- CA Applications



Caltrans ABC Strategic Plan
*Development of practice and policy for
Future bridge projects*

ABC- Advisory Council

August 2008
Version 1.1

August 2008



**Accelerated Bridge Construction
Applications in California**
A Lessons Learned Report

August 2008
Version 1.1



Concluding Remarks

- ABC critical to meet AASHTO SCOBS Grand Challenge #3: *Accelerating Bridge Construction*
- Planning essential to proper application
- National and regional coordination essential and exists
- Successful implementation requires innovation
 - Engage partners to succeed!