RESEARCH, DESIGN, and CONSTRUCTION of CALIFORNIA ABC COLUMN-TO-CAP and GIRDER-TO-CAP CONNECTIONS

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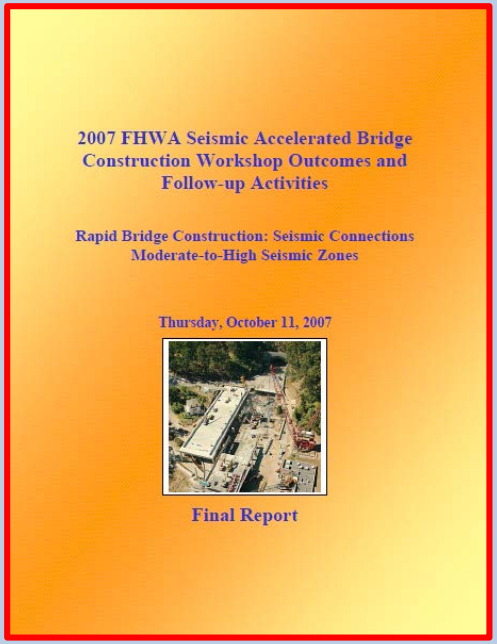
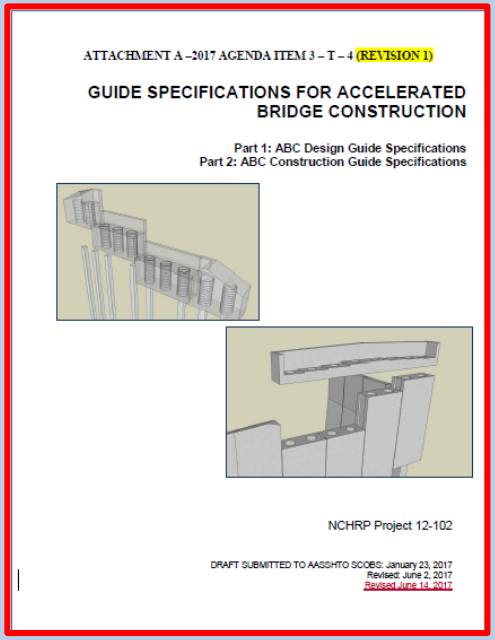
California Department of Transportation

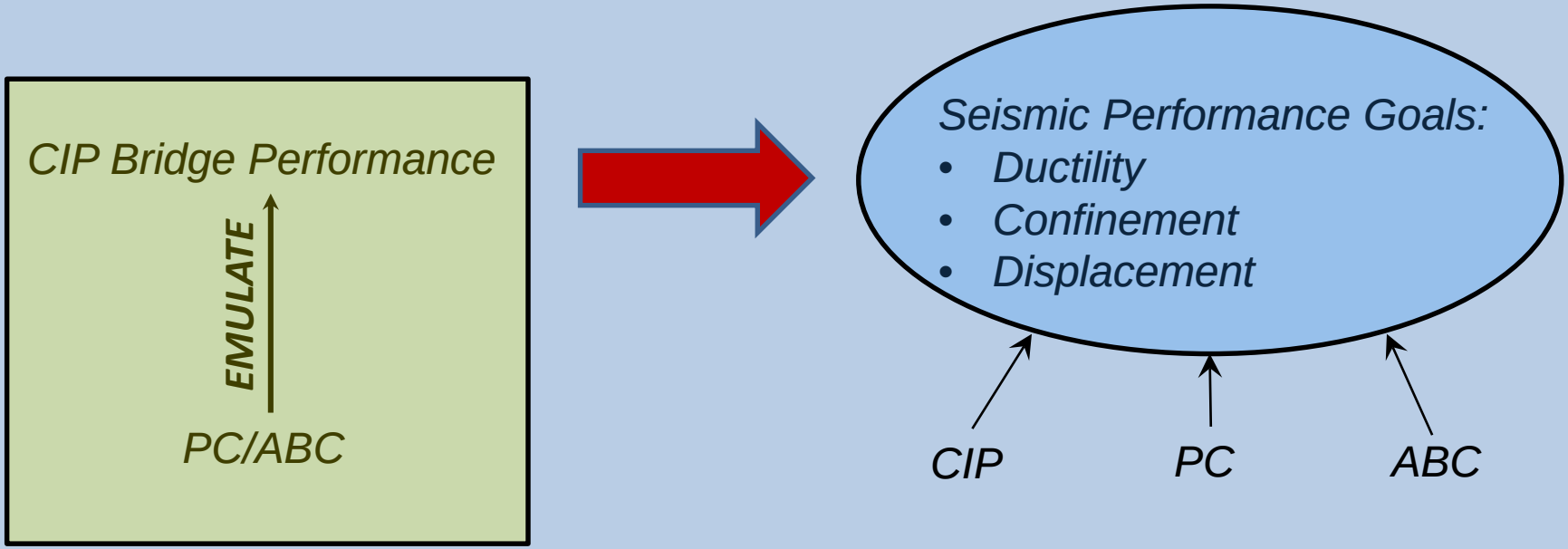
Caltrans ABC Timeline

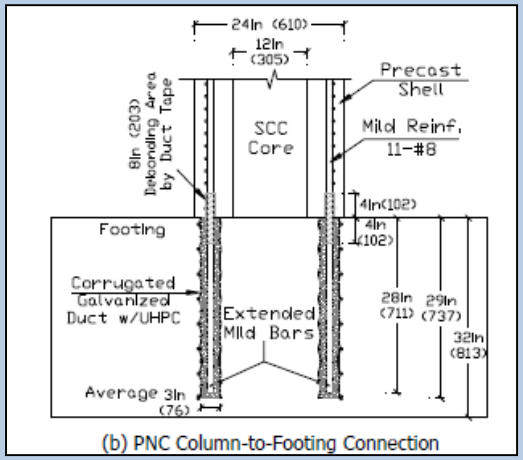
Concepts → Research Proposals → Research → White (position) Papers → General EQ Committee → Pilot Projects → Memos To Designers / Seismic Design Criteria / Design Examples / Specifications → Policy → Mainstream





A Better Model…

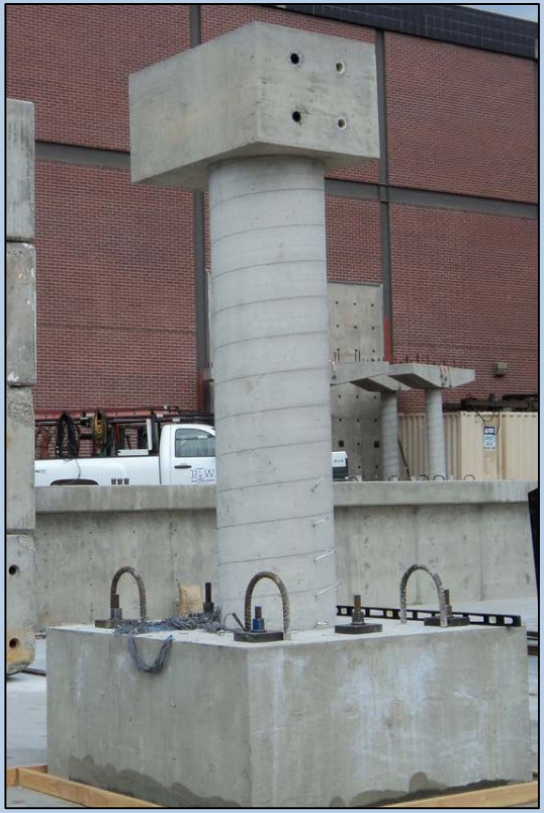




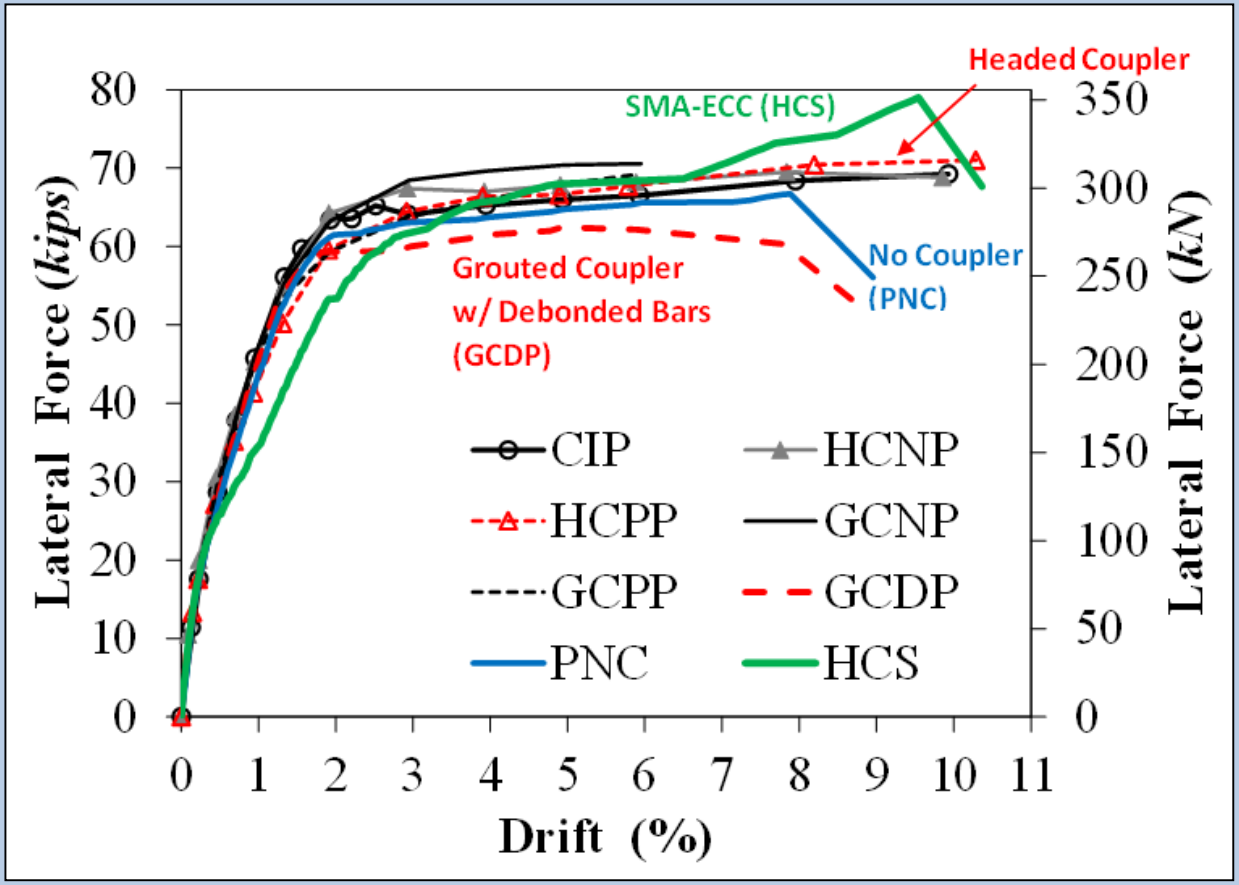
(b) PNC Column-to-Footing Connection

ABC full-moment PC Column connections into bent cap and footings feature CIP construction or grouted ducts with either HS grout or UHPC.

PC Column with Sleeve Connection as tested at UNR



PC Column-to-Footing Connection Test Results



Bar and duct development into footings and PC caps is based on a review of Caltrans research at the University of Nevada, Reno. Couplers are not used in plastic hinge zones to connect columns to other elements.

Caltrans SDC 2.0

8.2.2 Reinforcement Splices in Seismic Critical Members

8.2.2.1 No-Splice Zones

The "No-Splice Zones" for SCMs shall correspond to the plastic hinge regions specified in Section 5.3.2. No-Splice Zones shall be clearly identified on the plans.

Except as specified herein, splicing of main flexural reinforcement shall not be permitted in No-Splice Zones.

C8.2.2.1

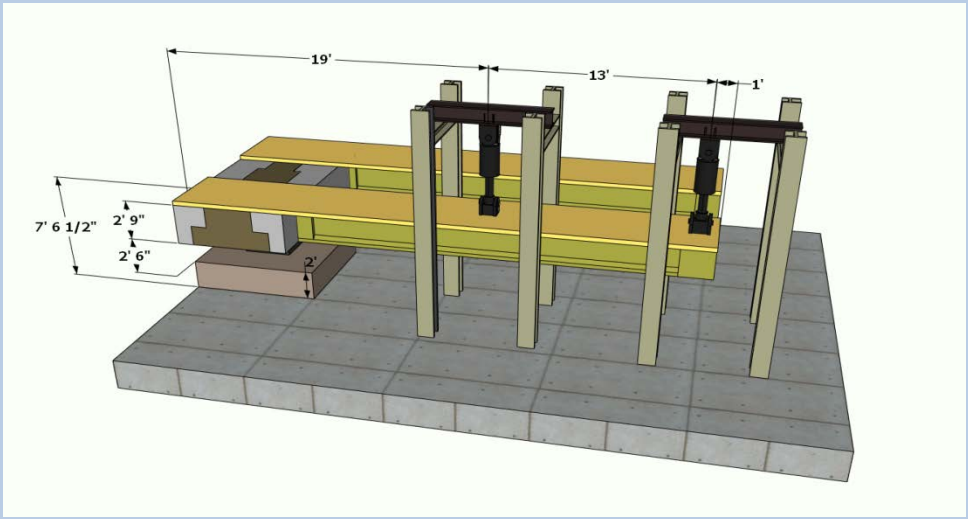
The No-Splice Zone in seismic critical members may be shown on plans either as a fixed dimension or as a fraction of the height or length of the member.

The "No-splice" requirement for seismic critical members is applicable to both cast-in-place and precast construction.

Table 8.2.1-1 Splice Requirements for Longitudinal Reinforcement

Member	Location	Splice Type
All SCMs	Inside plastic hinge region	Not allowed, except as specified in Section 8.2.2.1
	Outside plastic hinge region	Ultimate butt

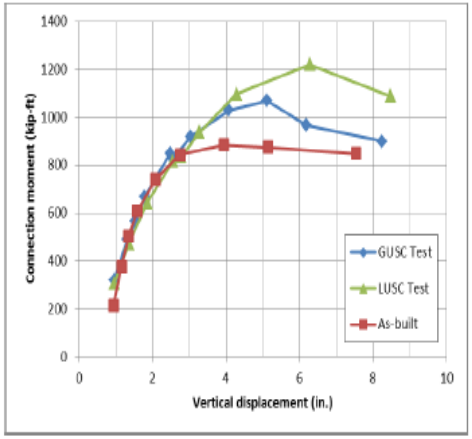
PC Girder-to-Cap Tests



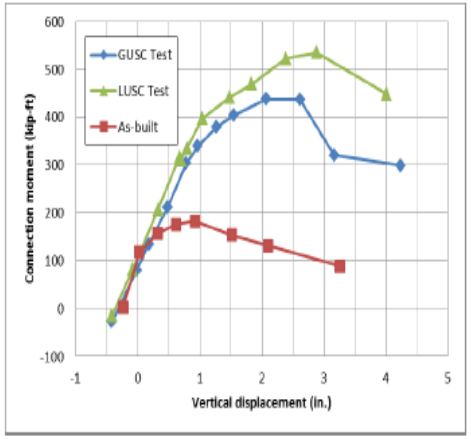
Iowa State University investigated existing PC girder-to-cap connections. Six improved connection alternatives were then proof-tested.

FEM was also used to quantify bar and strand strain in connections through a follow-on consultant contract.

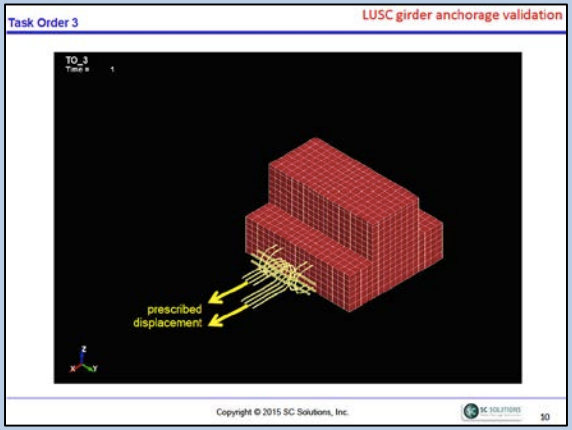
PC girder continuity through bent caps will be a requirement in Caltrans SDC 2.0.



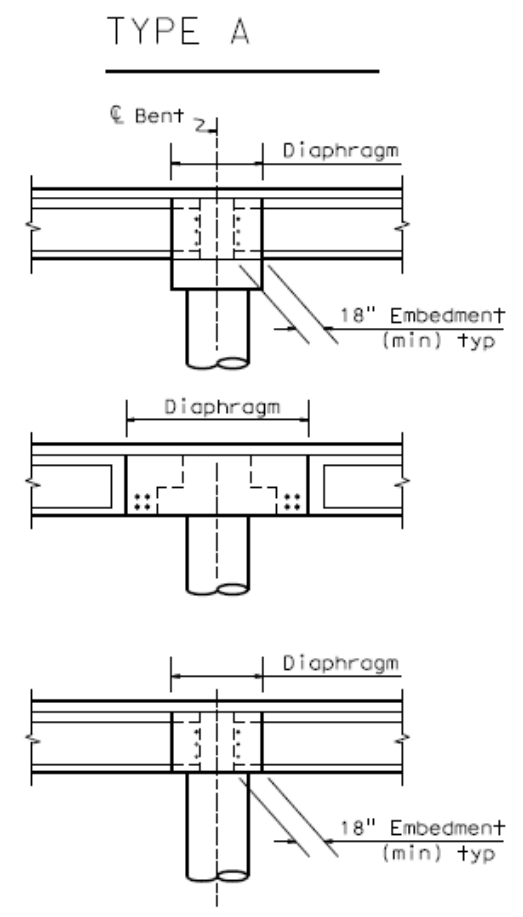
(a) Negative moment



(b) Positive moment

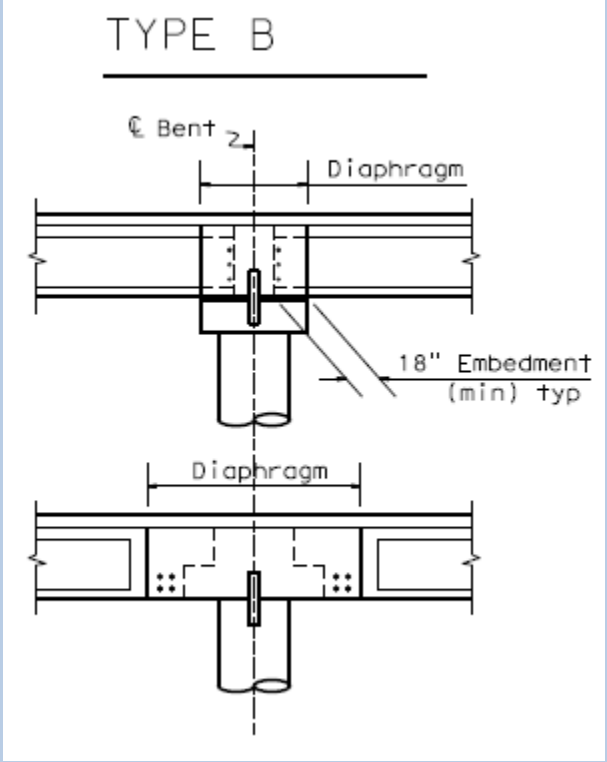


PC Girder-to-Cap Integral Connection



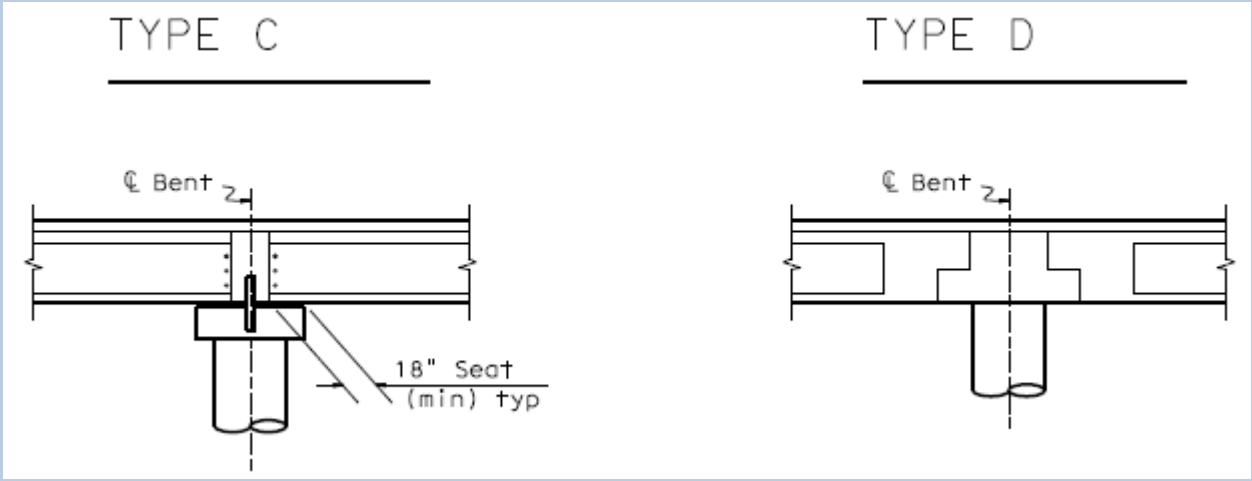
PC girders with positive and negative moment continuity having full column moment fixity using drop-caps or flush soffit situation are classified as Type ‘A’ connections in SDC 2.0.

PC Girder-to-Cap Continuity Column Pin Connection



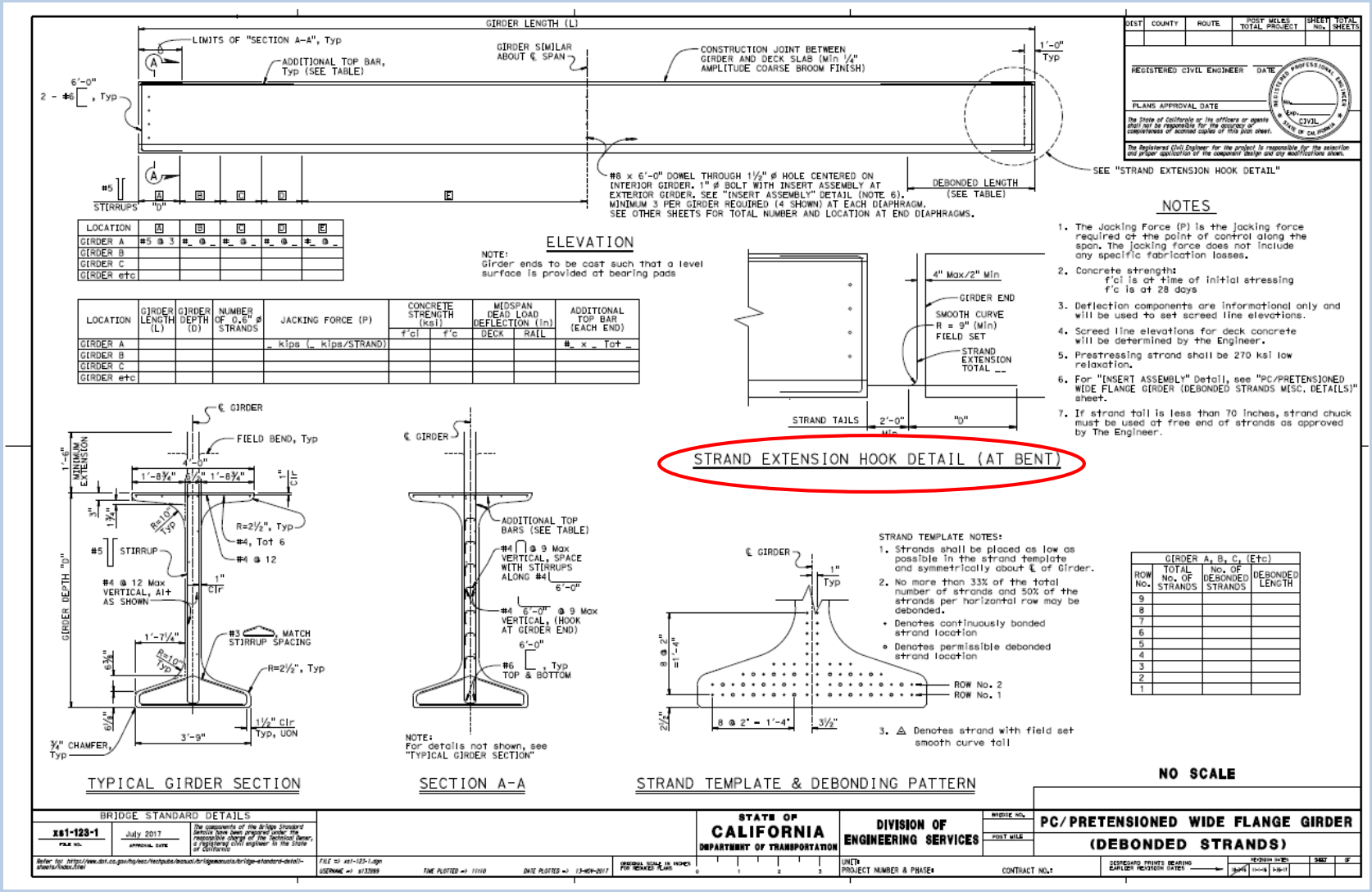
PC girders with positive and negative moment continuity having no column moment fixity using drop-caps or flush soffit situation are classified as Type ‘B’ connections in SDC 2.0.

PC Girder-to-Cap Detail
Negative Moment Continuity

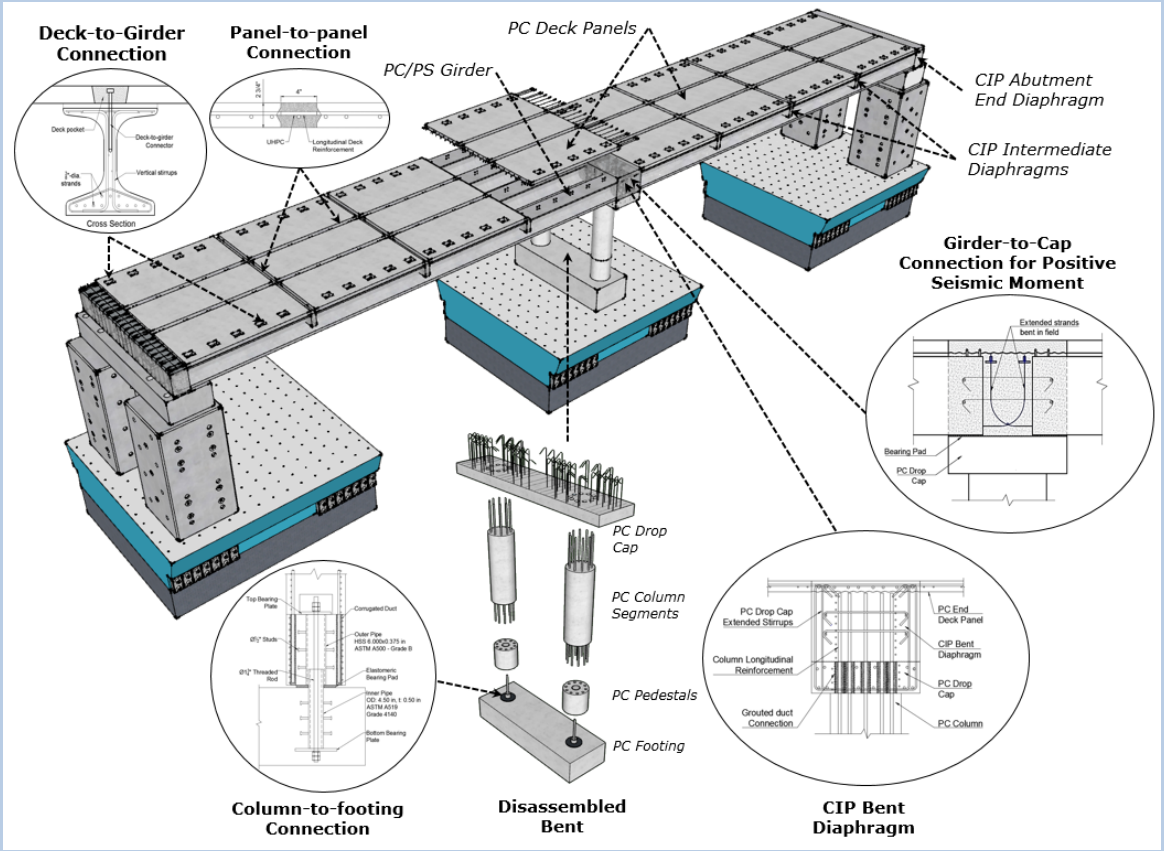


Type ‘C’ and ‘D’ connections feature negative moment continuity, and are allowed where PGA < 0.6g.

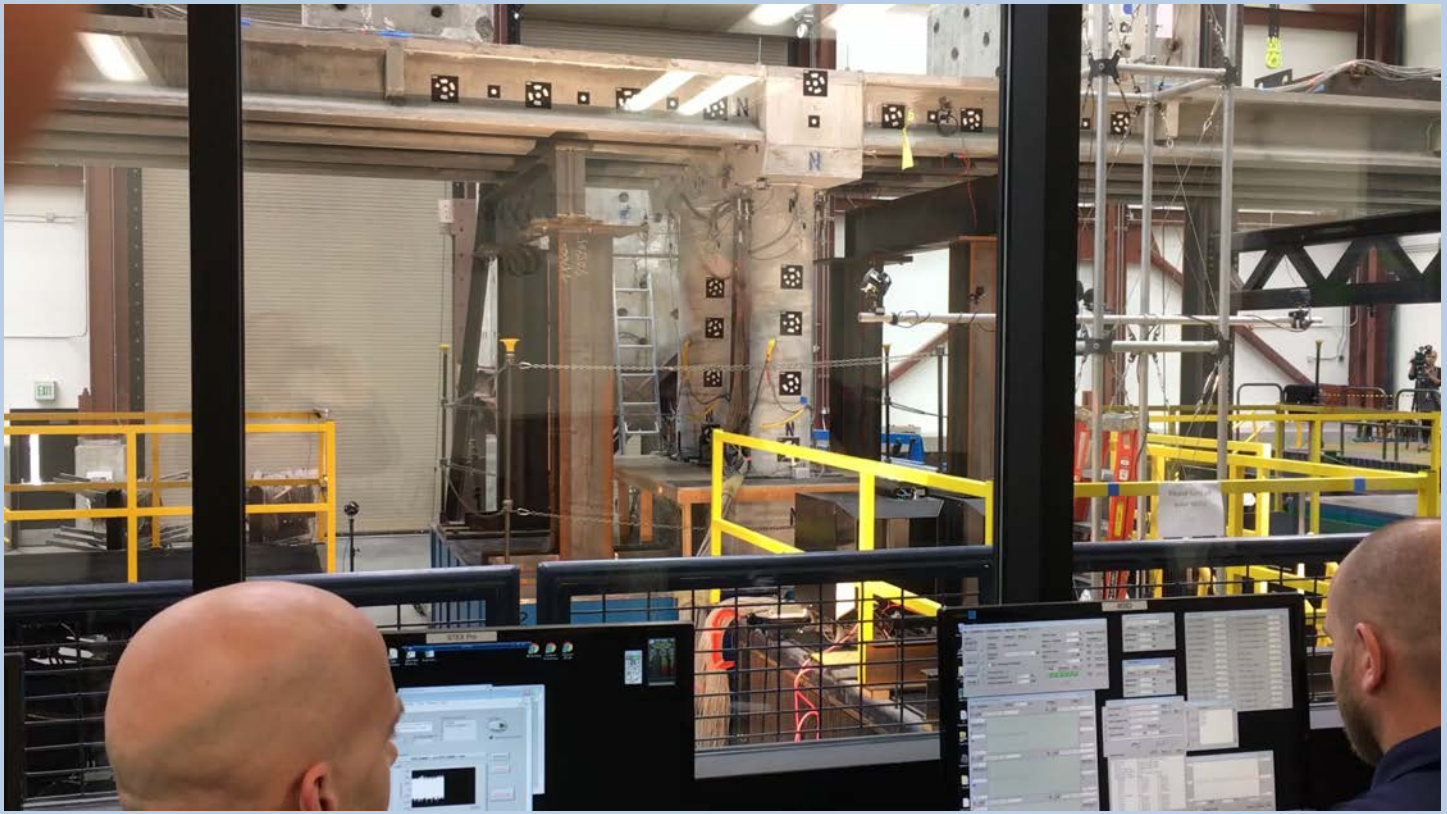
Proposed Design XS Sheet for PC Girder Continuity Details with strand



ABC System Bridge Research Component Compilation Tests



ABC System Bridge Research
Component Compilation Tests



UNR Video at 1.75
Design EQ

ABC Bridge Construction
Laurel Street Bridge replacement

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[2]

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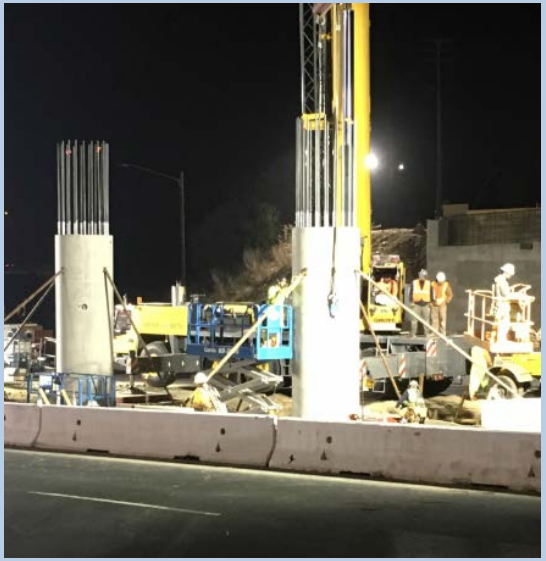

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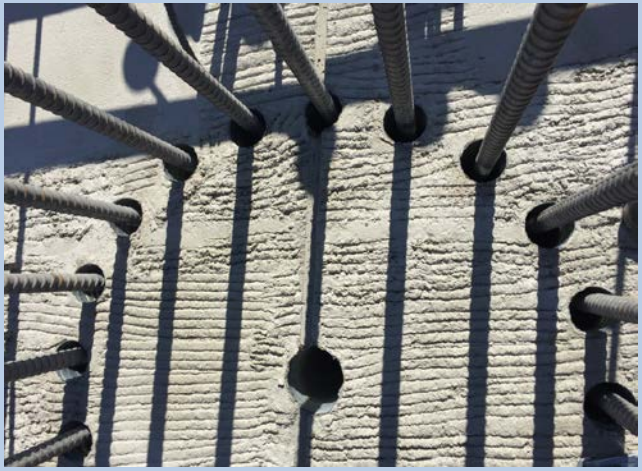
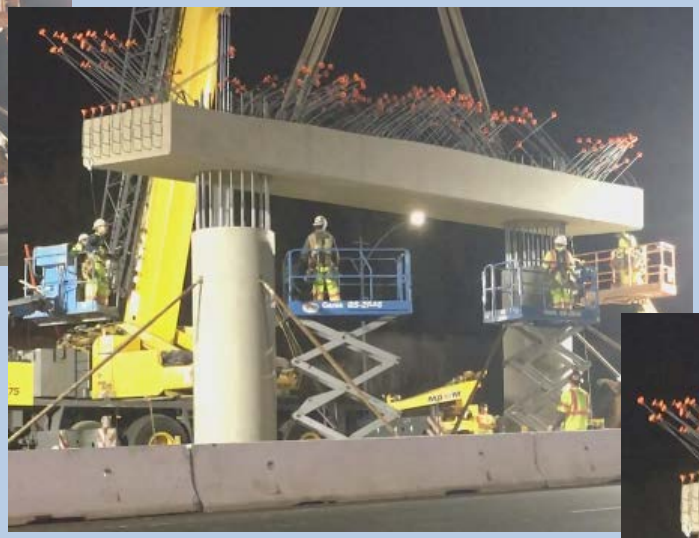
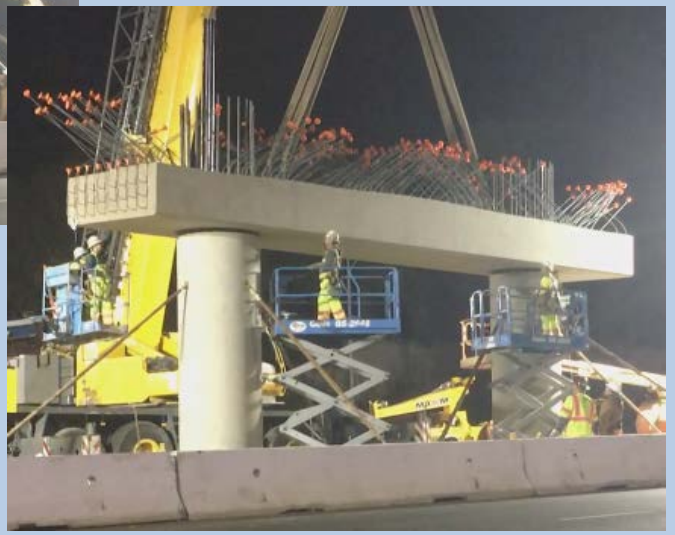
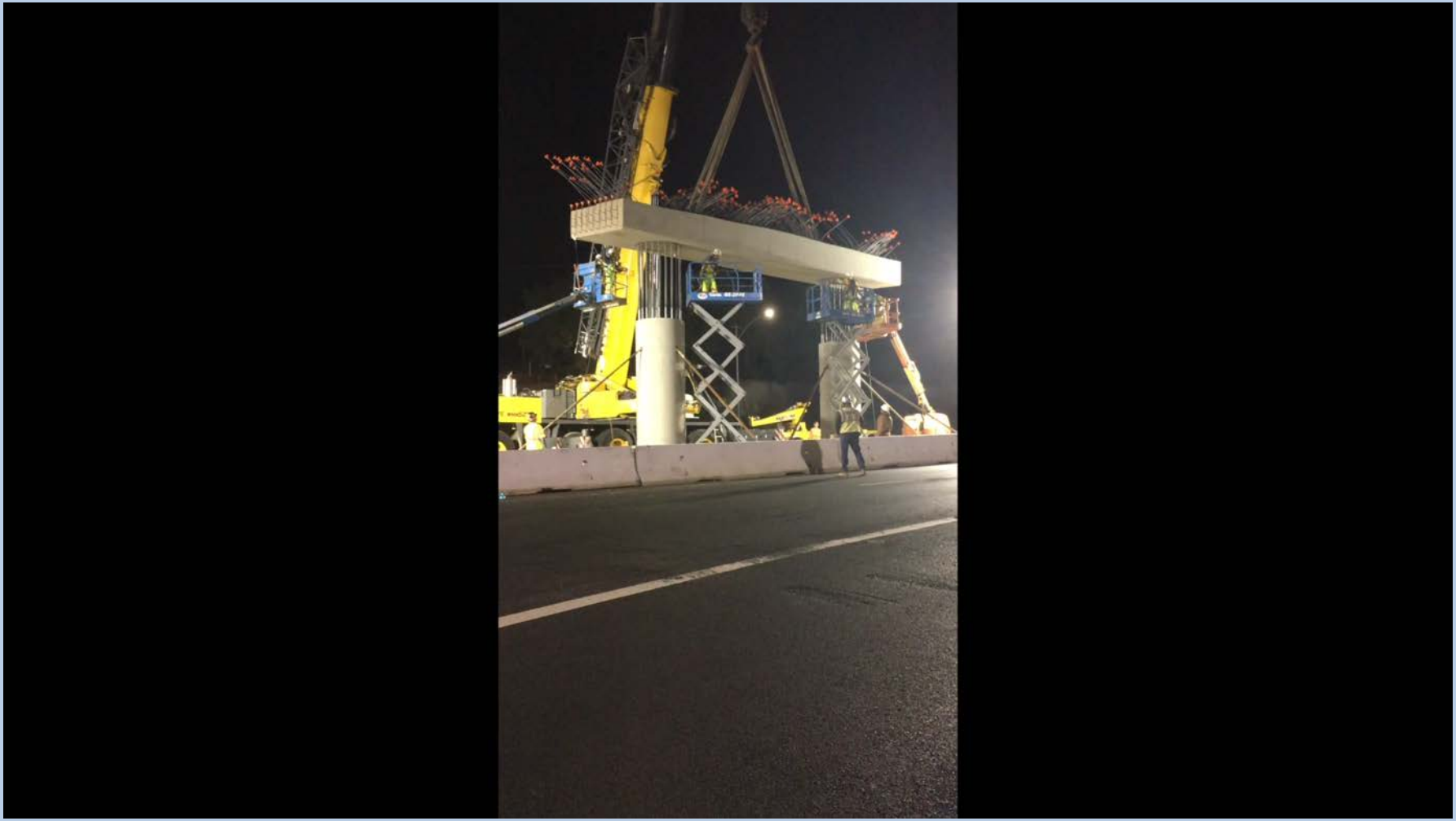


ABC Bridge Construction
Laurel Street Bridge replacement

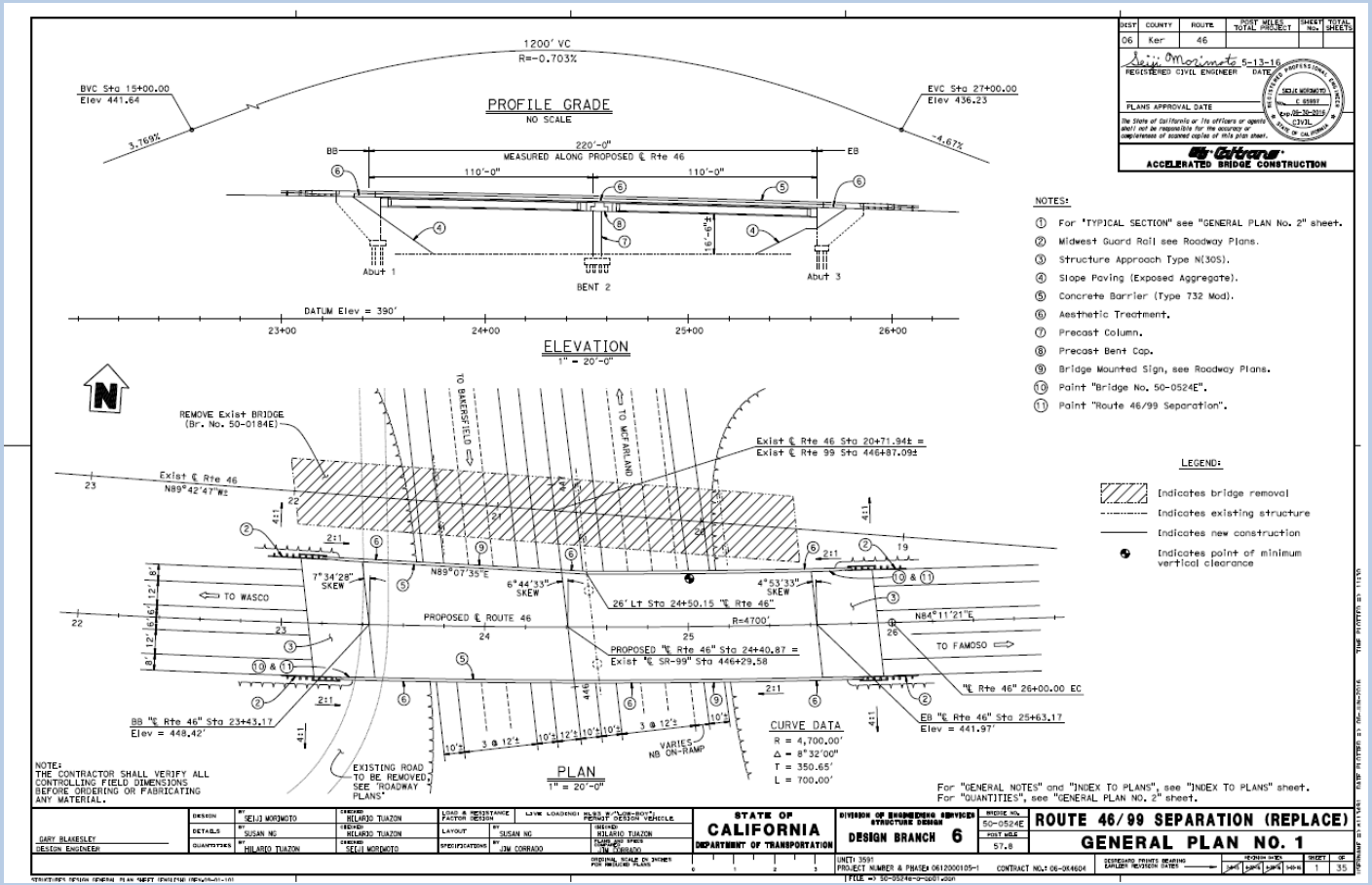




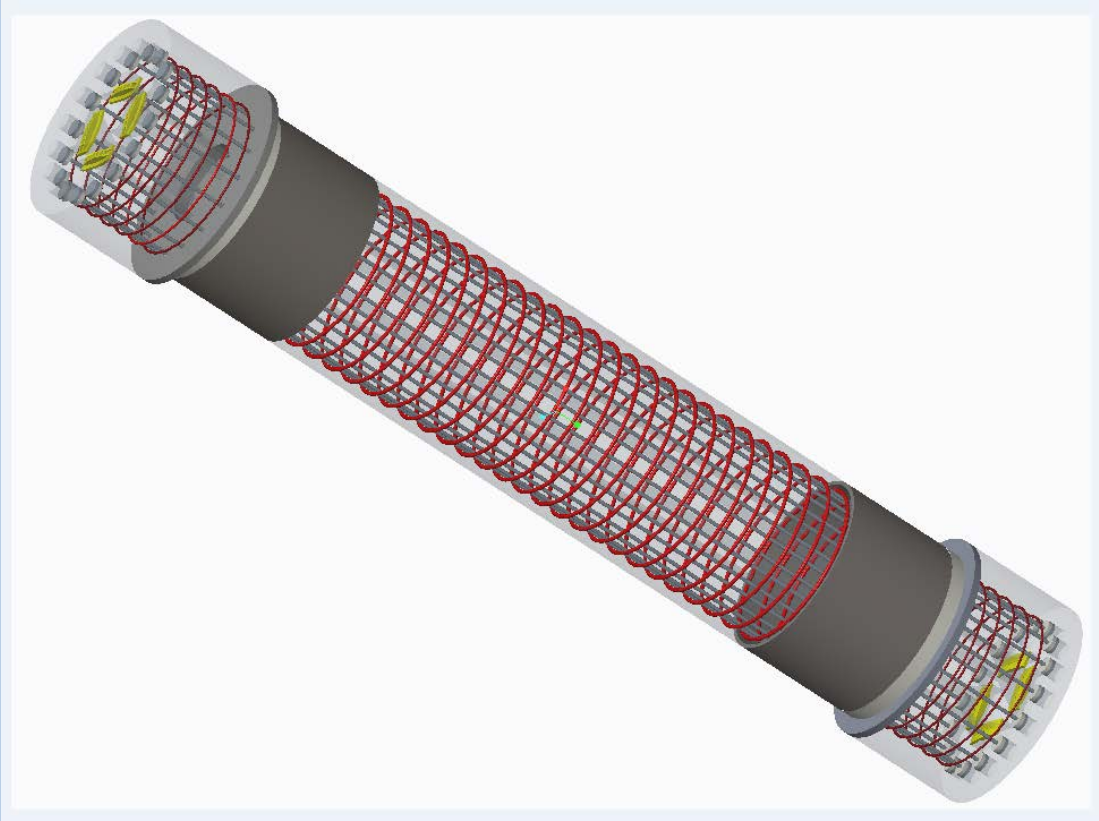
ABC Bridge Construction
Laurel Street Bridge replacement



Second two-span ABC Bridge
Route 46/99 Separation [2018]

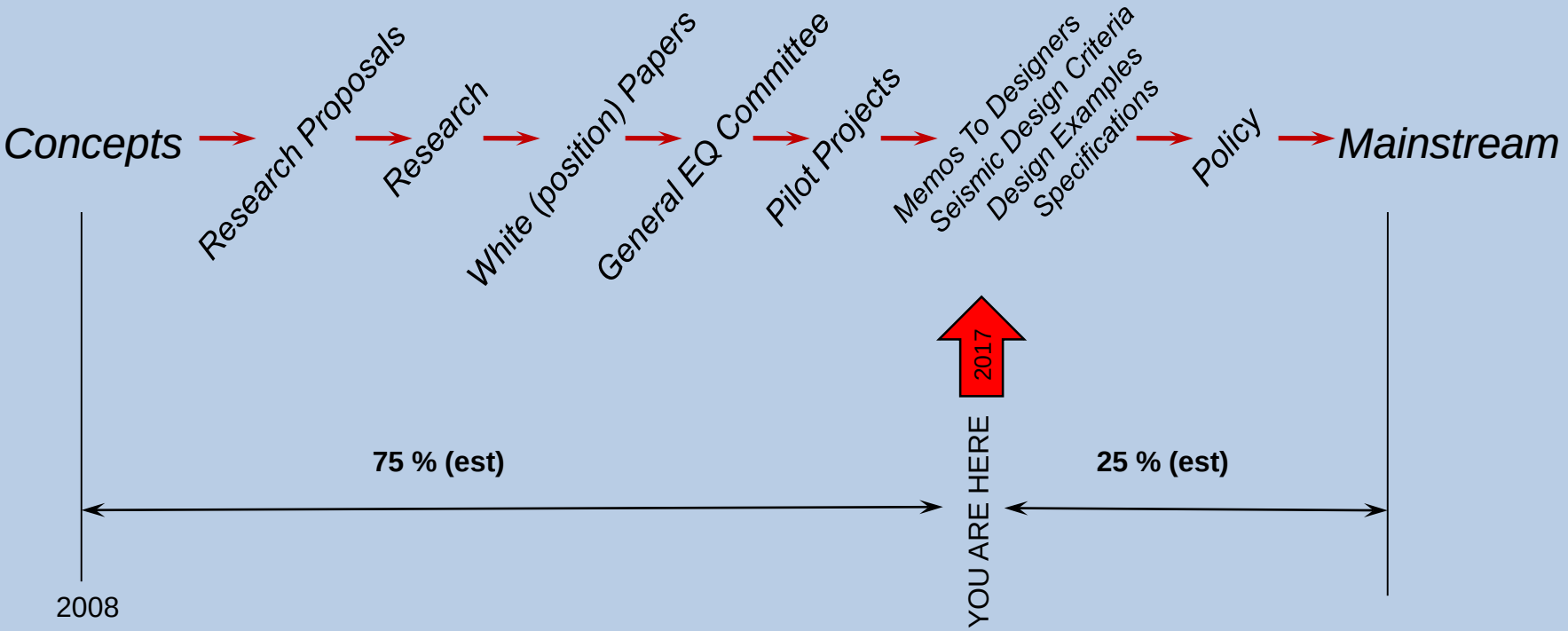


Future Column Design Concepts ABC/non-ABC 'Recovery Column'



- Prefabricated modular design- inserts into cap & footing
- Target 16% drift
- Re-centering capabilities
- Mild & PS steel
- 2012 Concept currently in research phase

Caltrans ABC Timeline



Questions?..... Comments?.....