Caltrans Precast Concrete Committee Update

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Prestressed Concrete Specialist, Caltrans

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2010 Caltrans/PCMAC/Consultants Bridge Workshop
Current Committee Members

- Fritz Hoffman, SD
- Douglas Dunrud, SD
- Phil Lutz, SD
- Manode Kodsuntie, SD
- Eric Fredrickson, OSFP
- Say-Gunn Low, OSFP
- Jeremy S Wright, OSFP
- Keith Hoffman, METS
- Tom Ruckman, Specifications
- Cheryl Poulin, Construction
- Jim Ma, ESPD (Engineering Services Policy Development)
- Sue Hida, ESPD (Engineering Services Policy Development)
PC Committee Mission and Goal

Mission

➢ To Provide PRECAST (Policy, Resource, Expertise, Coordination, Assistance, Standards, Training)

Goal

➢ Provide Technical Support to Design and Construction for Precast Bridge Structures in CA
➢ Promote ABC by Using Precast Products
➢ Promote Prefabricated Bridge Elements and Systems (PBES) to Support FHWA “EDC” Initiative
Typical Cast-in-Place Falsework
California Precast Bridge Design Challenges

Current Bridge Data: CIP 70% +, Precast 25% -

WHY ???

Precast Advantages:
- Rapid construction
- Minimize falsework
- Reduce traffic disruptions on-site
- Improve safety for traffic and construction workers
- Minimize environmental impact
- Increase product quality

Precast Challenges:
- Seismic Design
- Construction Cost
- Longer Span
Precast Bridge Seismic Design

CONNECTION, CONNECTION, CONNECTION
California Precast Girder Bridge with Different Connections

Typical California Precast Girder/Bent Cap Connections:

- Drop Bent Cap Connection
- Inverted-T Bent Cap Connection
- Integral Drop Bent Cap Connection
- Integral Bent Cap Connection
Precast Girder Connection Design and Details

Drop Bent Cap Connection

- Continuous superstructure
- Pinned between superstructure and cap
- Column/footing connection has to be fixed
- Extend PC girder bottom strands
- Good seismic connection
Precast Girder Connection Design and Details

Inverted-T Bent Cap Connection

- Semi-continuous superstructure
- Considered as pinned between superstructure and cap
- Column/footing connection has to be fixed
- Seismic research study on-going
Precast Girder Connection Design and Details

Integral Drop Bent Cap Connection

- Continuous superstructure
- Fixed between superstructure and cap
- Column/footing connection could be pinned
- Good seismic connection
Precast Girder Connection Design and Details

**Integral Bent Cap Connection**
- Continuous superstructure
- Fixed between superstructure and cap
- Column/footing connection could be pinned
- Great seismic connection
## Current Precast Bridge Cost

### Year of 2008

<table>
<thead>
<tr>
<th>Bridge Name</th>
<th>Girder Type</th>
<th>New/Widen</th>
<th>Area</th>
<th>SQFT COST</th>
<th>Net Bridge Cost</th>
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</thead>
<tbody>
<tr>
<td>ANGELES CREST BRIDGE</td>
<td>Precast Bulb-Tee Girder</td>
<td>New</td>
<td>8,868</td>
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<td>New</td>
<td>7,830</td>
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<td>PUTTS LAKE UNDERCROSSING</td>
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<td>MIRA MESA BOULEVARD UC</td>
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<td>COUNTY LINE ROAD UC</td>
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<td>26,686</td>
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**Average:** $231.34

### Year of 2009

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<thead>
<tr>
<th>Bridge Name</th>
<th>Girder Type</th>
<th>New/Widen</th>
<th>Area</th>
<th>SQFT COST</th>
<th>Net Bridge Cost</th>
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<tbody>
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<td>HARBOR BLVD OC</td>
<td>Precast Bath-Tub Girder</td>
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<td>COAL CANYON RD UC</td>
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<td>$214.00</td>
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**Average:** $161.06
## Current California Bridge Cost

### DIVISION OF ENGINEERING SERVICES

#### BRIDGE SQUARE FOOT COST SUMMARY

**2009**

<table>
<thead>
<tr>
<th>Bridge Code</th>
<th>BRIDGE TYPE</th>
<th>TOTAL NUMBER OF BRIDGES</th>
<th>NUMBER OF BRIDGE WIDENED</th>
<th>AMOUNT**</th>
<th>SQ.FT. OF DECK</th>
<th>AVERAGE COST/SQ.FT.**</th>
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<tr>
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<td>RC SLAB</td>
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<td>RC T-BEAM</td>
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<td>22</td>
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<tr>
<td><strong>31</strong></td>
<td><strong>CIP/PS BOX GIRDER</strong></td>
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<td>44</td>
<td>PC/PS BOX GIRDER</td>
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<td>PC/PS BULB &quot;T&quot; GIRDER</td>
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<td>50</td>
<td>STEEL GIRDER</td>
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<td>$7,059,689</td>
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<td><strong>TOTALS</strong></td>
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<td><strong>74</strong></td>
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<td><strong>$462,805,115</strong></td>
<td><strong>2,411,971</strong></td>
<td><strong>$192</strong></td>
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</tbody>
</table>
Current PC Committee Working Items

LRFD Precast Guidance Materials for Designers:

1. Bridge Design Aids Chapter 6 (New Wide-Flange Girder, Box Section, Trapezoidal Section, Voided Slab Table)
2. Bridge Memo to Designers: 11-8 “Design of Precast Prestressed Girders”
4. Caltrans Standard Drawings:
   - Precast Prestressed I-Girder
   - Precast Prestressed Bulb-Tee Girder (Harped Strands 2 sheets, Debonded Strands 2 sheets)
   - Precast Prestressed Voided Slab
   - Precast Prestressed Wide-Flanged Girder (under-development)
   - Precast Deck Panel (under-development)
California Precast Girder Inventory and Span Capacity
California Precast-Pretensioned Girders

Precast Girder Shapes

- Common Used Shapes
  - California I-Girders
  - California Bulb-Tee
  - California Bath-Tub
  - California Voided Slabs
  - Precast Box Beams
  - Precast Delta Girders
  - CA WF Girder
California Precast-Pretensioned Girders

Common Shapes and Span Length Summary

<table>
<thead>
<tr>
<th>Girder Type</th>
<th>Possible Span Length</th>
<th>Preferred Span Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>California I-Girder</td>
<td>50’ to 125’</td>
<td>50’ to 95’</td>
</tr>
<tr>
<td>California Bulb-Tee Girder</td>
<td>80’ to 150’</td>
<td>95’ to 150’</td>
</tr>
<tr>
<td>California Bath Tub Girder</td>
<td>80’ to 150’</td>
<td>80’ to 100’</td>
</tr>
<tr>
<td>California Wide-Flange Girder</td>
<td>100’ to 200’</td>
<td>100’ to 180’</td>
</tr>
<tr>
<td>California Voided Slab</td>
<td>20’ to 70’</td>
<td>20’ to 50’</td>
</tr>
<tr>
<td>Precast Box Girder</td>
<td>40’ to 100’</td>
<td>40’ to 80’</td>
</tr>
<tr>
<td>Precast Delta Girder</td>
<td>60’ to 120’</td>
<td>60’ to 100’</td>
</tr>
<tr>
<td>Precast Double T Girder</td>
<td>30’ to 100’</td>
<td>30’ to 60’</td>
</tr>
<tr>
<td>Precast Rectangular Girder</td>
<td>30’ to 120’</td>
<td>30’ to 100’</td>
</tr>
</tbody>
</table>
California Wide-Flange Girder

**CALTRANS PRETENSIONED “WIDE-FLANGE” GIRDER**

**CALTRANS POST-TENSIONED “WIDE-FLANGE” GIRDER**

**SECTION PROPERTIES**
California Precast Girder Bridge Span Capacity

- Typical Precast Girder: 30’-180’
- Post-Tensioned Spliced Precast Girder: 100’-300’
- Segmental Precast Girder: 200’-450’
Two Methods for Post-Tensioned Spliced Precast Girders

Method 1: Splicing Girders Supported on Limited Falsework
Two Methods for Post-Tensioned Spliced Precast Girders

Method 2: Splicing Girders on the Ground (Without Falsework)
PT Spliced Precast Girder Advantages

- Very limited falsework or no falsework
- Longer spans
- Maximize vertical clearance
- Rapid construction
- Continuous superstructure with no joints
- Integral system between superstructure, bent cap and columns
- Seismic resistance connection
- Could be pinned at column bottom
- Smaller footing size
- Aesthetic pleasant
- Low construction cost