Accelerating Bridge Construction—Recent Applications in California

Paul Chung, P.E., M.E.
Jason Fang, P.E., Ph.D.
California Department of Transportation
California Acceleration Bridge Construction (ABC) mission

• Improve Mobility in a Expeditious Manner
• Speed up Project Delivery to meet increasing traffic demands
• Minimize roadway delay impact to the traveling public
• Minimize construction and reduce safety-related issues
• Minimize environmental impacts
• Meets “Every Day Counts” initiative
ABC Solutions

• Technical
  ✓ Prefabricating Bridge Elements and Systems (PBES)
    • Precast concrete super- and sub-structure-
      Majority of PBES in California
    • Steel & FRP superstructure
    • Segmental construction methods
      ✓ Launch or Roll-in (SPMT) girders/superstructures
  
• Contract and Construction
  – Double shifts
  – Disincentives and Incentives
ABC Project Applications in California

1999-2006 notable projects
• San Mateo Bridge: precast girder/semi-precast bent caps

2006-2011 notable projects
• I-40 (Barstow) Emergency Bridge Replace: precast girders, precast abutments
• Oakland MacArthur Mace I-580 Connector Span Replace: Steel plate girders
• SFO Bay Bridge – East Span Viaduct Retrofit: Superstructure Roll-In Move- Total 2.5 days
• Hardscrabble Creek Bridge Replace (Del Norte County): Superstructure Roll-In Move- Total 8 hours
2006-2011 notable projects [continued]

• I-5 (Santa Clarita) Truck Undercrossing Repair: Precast girders

• Russian River Emergency Bridge Replace: Precast girders

• I-10 HOV Widen- Segments 2 and 3:
  – Precast/Prestressing girders
  – CIP bridge columns, bents, abutments and deck
  – Post tensioning to make continuity
I-10 HOV Widen- Segments 2 and 3
I-10 HOV Widening Segments 2 & 3

Widen and restripe the I-10’s eastbound and westbound directions from Puente Avenue, City of Baldwin Park to City of Pomona, CA

- 14 bridges to be widened; 7 bridges use ABC
- Conventional CIP/PS is not feasible due to temporary clearance constraints
- Precast Girder/CIP Bent Cap - integral connections
Precast Girder/CIP Bent Cap Construction Sequence

Step 1: Construct abutments, bent footings and columns

Step 2: Erect precast/prestressed girders on temporary supports

Step 3: Construct bent caps

Step 4: Construct superstructure deck and abutment diaphragms

Step 5: Complete post tensioning

Step 6: Remove temporary supports
Gasoline tanker overturned on I-880 in Oakland, California-
April 29, 2007 at 3:52 AM
– Fire and extreme heat from the tanker fire
– Extreme heat caused the collapse of 2-spans on I-580
Upper Connector: steel girders and steel bent cap
I-40 (Barstow) Emergency Bridge Replace

- Precast abutment
I-40 (Barstow) Emergency Bridge Replace

Bridge completed in 28 days- from closure to reopening
Hardscrabble Creek Bridge (Replace)
District 1 - North Region
Recent ABC Project in California

2011-present: notable projects

- I-10 HOV Widen (8 bridge structures)
- SR-60 Paramount Blvd OC Emergency Replace
- I-805N BRT/HOV: Rose Canyon Bridge Overhead Widen
- I-710 East Yard Overhead Widen
- I-15/I-215 Devore Interchange Improvement structures
SR-60 Paramount Blvd OC Emergency Replace

- Location: Route 60, City of Montebello
- 4 span 250ft long and 96ft wide
- 4ft column & short diaphragm abutment
December 14, 2011 Tanker caught fire
8,800 gallons of fuel burned under the bridge
• Took more than 2 ½ hr to extinguish the fire
1st stage removal
New Paramount Bridge

Elevation

250'-0" (MEASURED ALONG Q OF PARAMOUNT BLVD)

125'-0"

RTE 60

125'-0"

Approx OG/FG

16'-6" CLEARANCE

BENT 2

ABUT 1

ABUT 3

PC/PS BULB TEE GIRDER

Approx FG/FG

TYPICAL SECTION
New Paramount Bridge

- New bridge 128 ft wide (32ft wider than existing bridge)
- PC Bulb-Tee girders-
- 2 Span bridge
- 5 Column bent
Girder/Inverted-T Cap Details

- Non Integral Inverted-T bent cap with fixed footing connections
  - Traffic operation during construction.
  - Faster construction advantage.
Milestone dates

- 12/15/2011 & 12/16/2011 Evaluation of existing Structure
- 12/16/2011 Bridge is Decided to be replaced 3:00PM
- 12/16/2011 Preliminary Geotechnical report ARS
- 12/17/2011 - 12/21/2011 Geotechnical drilling
- 12/21/2011 PDT meeting, bridge width was set at 108 ft.
- 12/28/2011 PDT meeting, bridge width increased 128 ft.
- 12/29/2011 Type Selection
- 1/2/2012 Revision of design for 128ft wide structure.
- 1/3/2012 BSDS from District
- 1/04/2012 Constructability meeting with Prefab companies
- 01/09/2012 Structure P&Q
- 01-20-2012 S PS&E
- 2/24/2012 RTL’d
- 2/24/2012 AT&T Utility line Relocation and Addendum
- 2/29/2012 Bid Opening & Contract award
- 3/1/2012 Removal of remaining portion structure
- 3/2/2012 Replacement bridge construction work begin
- 5/21/2012 Open for Traffic
Bent Cap;
Abutment 3 Backfill; Abutment 1 forming
4/17/2012
End Diaphragm & Shear Key
Pour 5/2/2012
Bridge Opening Ceremony
5/18/2012

• Final Bid 4.77 Million + 500,000 incentive = 5.3 Million
• Actual Construction duration 82 Calendar Days
San Diego I-805N HOV/BRT
Rose Canyon Bridge Overhead (Widen)

General Contractor: Skanska
Designer: AECOM
- Precast Girders
- CIP Inverted-T Bent Cap- partial drop
- Integral connection
• Improved girder/cap connections
• Integral connections
I-710 (Los Angeles) Long Life Pavement: East Yard OH (Widen)

• Bridge over UPRR Yard, City of Commerce
• 1,395 ft long and 120 ft wide
• Current- 5 lanes in each direction 11 ft wide w/ no shoulders
• Exist structure- 4 span simple supported steel plate girders
• Spans range in length from 58 ft to 117 ft
• Exist structure depth is 8’-4”
• New structure- Left and Right Widening to accommodate extra widths from 5x12’ lanes + 10’ shoulder in each direction
East Yard OH (Widen)

PC/PS Bulb-Tee Girders
Precast Bent Cap
RR restrictions on FW & time
Total Deck Area= 72,328 ft²
Cost Estimate= $21 million USD
Precast Drop Bent Cap

Column

Pile Shaft
NCHRP 12-74: Precast Bent Cap connection tests
UCSD/ Sac State

Photos by E. Matsumoto, Sac State U.
• NCHRP 12-74 - Precast Bent Cap connection tests
• UCSD/ Sac State

Photos by E. Matsumoto, Sac State U.
• Final Plans 10/2013
• Construction targeted 2014
Thank you
San Mateo Bridge, SF Bay Area

- Precast Girder
- Precast Bent Cap
Caltrans- San Mateo Bridge
Caltrans- San Mateo Bridge
Precast Bent Cap
Caltrans - San Mateo Bridge
Precast Bent Cap-Column connections
Caltrans- San Mateo Bridge
Precast I-Girder placement
Caltrans- San Mateo Bridge
I-15/I-215 Devore Interchange- Layout
San Bernardino County

Approximate Length: 5 Miles on I-15
I-15/I-215 Devore Interchange Design-Build Project

General Contractor: Atkinson Contractors
Primary Designer: URS
I-15/I-215 Devore interchange
Structures- $71 million USD

1. Kenwood Ave UC (left Widen)
2. Devore Rd (Replace)
3. West Connector (Widen)
4. 215/15 Separation (Widen)
5. W-S Connector
6. 215 Devore Rd Off-Ramp
7. SB 215 Connector
8. Kimbark Canyon Bridge (New)
9. SB 215 Over Kenwood (New)
10. NB15 Flyover (New)
11. NB 15 Truck Bypass (New)
12. Cajon Creek Br (widen) (LT/RT)
13. Glen Helen Rd (Widen)
14. Center Connector UC (widen)
15. Devore OH LT/RT (Widen)
16. Glen Helen Pkwy UC (LT/RT) widen
17. SB 15 Onramp connector (New)
18. Cajon Creek Bridge Ramp(widen)
Cajon Creek Br (widen) (LT/RT)