Accelerating Bridge Construction - Seismic Connections

TRB Research Proposal Webinar
Objectives

- Review and discuss connection details considered good candidates for immediate use in regions of strong to moderate seismic hazards following testing.
- Discuss proposed connection details and formulate an updated research problem statement with specific research goals and timelines at the 2009 TRB meeting.
- Once funded, work would conclude rapidly, facilitating rapid technology deployment.
- Will seek national funding through AASHTO and NCHRP or other avenues within FHWA.
- In the absence of these options, consider pooled funding project(s).
Washington DOT - Precast System

- Precast Column
- Cast-In-Place Shaft
- Cast-In-Place Slab
- 3” thick Rubber Pad
- Confinement Zones
- Precast Bent Cap
- Precast Column
- Support Pad
- Cast-In-Place Shaft
Washington DOT
Precast Bent cap
SR 202 / SR 520

Duct Template

Tolerances - Tack Weld

Spirals
Washington DOT
Precast Bent cap
SR 202 / SR 520

1½ Hours +/-
Bent Cap Erection
Washington DOT - Fixed Intermediate Pier Connection

- End of Girder
- Top of Girder
- Precast Girder
- Extended Strands Per Seismic Demand
- Slab

[Diagram of the connection showing the various components and their locations]
Precast Substructure Research
U of Washington

Precast Members

ELEVATION

Extended Strands at Fixed Interior Pier

Grout Tube

6” φ Hole in Crossbeam for 6 - #18 bars

PLAN
Precast Girder to CIP Bent Cap

- Used by Washington DOT
Precast Girder to CIP Bent Cap
Why consider grouted couplers?

- They are very versatile
  - We can connect virtually any 2 precast elements together
- Connections can be made very quickly
- They can transfer axial, moment and shear forces
- They have been used for many years on bridges under traffic and in severe exposed environments
- Is it cost effective and easy to construct
- It is not proprietary
  - There are 3 companies that produce similar connectors
- We don’t need to change the way we design and detail bridges
Grouted Reinforcing Splice Couplers

- Emulates a reinforcing steel lap splice
- Used in precast parking garages and stadiums and bridges
Precast Cantilever Abutments
Mill Street, Epping NH
Precast Piers

- Florida DOT Detail
  - Edison Bridge
  - Highly corrosive environment
  - Excellent performance

- Also used in Georgia and Northeast PCI
Column to footing connection
Column to cap connection
Pier Types

- Single column hammerhead
- Two column bent
- Three column bent
Footings

- Full Precast
  - For smaller footings

Shim and grout under footing through ports in footing
Footings

- Partial Precast
  - For larger footings
  - Precast designed to support DL of bridge
  - CIP extensions designed for other loads

Precast Portion

CIP Extension

Shim and grout under footing through ports in footing
Previous Testing data

**Grouted Splice coupler @ end of column**
Previous Testing Data

Control Column w/o Grouted Splice Coupler
Caltrans- San Mateo Bridge
Caltrans- San Mateo Bridge

- 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
San Mateo Bridge-Mechanical Couplers
• SCDOT PCP to Pre-cast Cap Connection detail that was used for several bridges on a Design-Build project. This detail has not been adopted by SCDOT, but it is a candidate for research considerations.

• The SCDOT detail consists of 18” prestressed concrete piles used as pile extensions instead of reinforced concrete columns.

• The superstructure used is a flat slab superstructure, very common in our entire SC coastal region.
Precast Pile Cap - Carolina Bays Parkway, South Carolina
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Precast Pile Cap - Carolina Bays Parkway, South Carolina
Conway Bypass - Precast Bent Cap
Conway Bypass-
Precast Bent Cap
Conway Bypass-
Precast Bent Cap
Conway Bypass-
Precast Bent Cap
Discussions

- Open Forum
- Agree on Details to be Tested
- Identify Follow-up Action Items