ODOT’s ABC PROGRAM
FHWA EDC Initiative

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Fremont Bridge – floated and lifted 1973
ODOT has completed 16 projects and more are on the way...
Pudding River Bridge, Truss Replacement (1940’s)
Steel Structures (1997)

- Proven cost effectiveness and sustainable
- Plate Girders with precast deck panels
- Closure pour in the middle
I-5 Trunnion Replacement (1997)

- Delivered in 7 days
- 14 days ahead schedule
- Incentive $100k/day
- $1.4 M bonus.
Mill Creek Rapid Deck (2003) Replacement

- Deck cut & removed in sections
- Flexible schedule for work and traffic windows
- 540 ft of exodermic steel grid deck replaced in 24 days
Depot Street Bridge over Rogue River 2007

306-foot Concrete Tied Arch
77-foot wide
5,000 tons

5 day closure to slide bridge into place

Bridge Built Upstream Alongside

Mammoet Skids and Track
Elk Creek Bridge Move (2008)

Won 3 Awards: * APWA Project of the Year; * AASHTO America’s Transportation; and * ASCE Outstanding CE Achievement... & more
Oregon’s Experience with ABC

► Incentive/Disincentive approach

► Limit window of road closures duration

► Industry driven and State guidance (e.g. design-build)
Accelerated Bridge Construction (ABC)
What, How and Why?

► **What**: A process applies to incorporating innovative technologies, contracting methods, decision making framework

► **How**: design and construction techniques and/or prefabricated elements and systems (PBES)

► **Why**: to minimize impacts to the traveling public, local community and environment.
Introduction

► What’s driving ABC in Oregon?
► ABC Guidance in Bridge Design and Drafting Manual (BDDM)
► FHWA/States Pooled Fund Study on cost analysis and decision modeling
► Full depth precast deck system
► Summary
What’s Driving ABC in Oregon?

- Highway Network - Mobility
- I-5 North to Canada – South to Mexico
- Coastal Highway 101
- Open and Wide Natural and Wooded Terrain
- Serving communities and traffic corridors
- ABC has its place and is being exploited
Bridge Design & Drafting Manual (BDDM) Section 1.1.2.9 - Outline

► Introduction
► Decision making framework & Matrix
► Steel structures
► Concrete structures
► Full-depth deck & end panels and wingwalls
► Seismic related
► Use of SPMT

ODOT BDDM – Outline Cont.

► Geotechnical consideration
► QA/QC for prefabricated elements
► Cost consideration
► HYRISK economic analysis tool
► Project listing

FHWA Resources: SPMT & Connection Details

- Incredible machines
- Heavy lift X1000 tons
- Maneuverability
- Precision
- Distortion control
- Fastest erection scheme

Manual on Use of Self-Propelled Modular Transporters to Move Bridges
May 2007

Sponsored By:
Federal Highway Administration
American Association of State Highway and Transportation Officials
National Cooperative Highway Research Program
Florida Department of Transportation

- State of Practice
- 150+ connection details
Owner’s Cost Consideration

- Maintenance of traffic costs
- Owner agency’s operation costs
- Mobility
- HYRISK Tool by FHWA – ODOT is using this now
  - Road closure
  - Detour length
  - ADT, ADTT, traffic speed, vehicle occupancy rate...
  - Total community cost associated with closure
Decision Making Framework

► Decide when and where ABC would be most effective during early project planning

► Options allowed:
  ▪ Design-bid-build method OK
  ▪ Approved contractor’s alternate methods OK
  ▪ Design-build method OK

► Criteria in flowchart serves as a guide
Decision Making Flowchart in BDDM

Start
Does the proposed construction conflict with an existing structure?
Yes → Does your structure carry a railroad?
No → is the project due to an emergency replacement/repair?
Yes → is the construction schedule limited by in-water-work, habitat, or other environmental factors?
No → Reasons for ABC

Are "off-site detours" limited or not viable due to out-of-direction travel, delays, capacity and/or restrictions on the alternate?
Yes → Does the existing bridge type, proposed bridge type, or mobility limit the ability for?
No → Is an "on-site detour" restricted by topography, geometry, development, environmental restrictions, and/or cost?
Yes → Project is a viable ABC candidate, Proceeded with
No → Does the use of ABC methods result in a less expensive project?
Yes → Project is not be a viable ABC candidate, traditional construction techniques
No → Traffic Handling methods
ODOT-Lead Pool Funded Study

Cost Analysis and Decision Making
Current Pooled Fund Study TPF 5(221)

► Oregon – lead, FHWA, California, Iowa, Minnesota, Montana, Texas, Utah, and Washington State (8 States + FHWA)
► Professor Toni Doolen, Ph.D., Industrial Engineering, Oregon State University
► Contract awarded December 23, 2009
► TAC Kick-off Meeting held January 6-7, 2010
► 18-month study – ending June 2011.
Project Goals and Target Users

► Goals of Project
  ▪ ABC for ordinary bread & butter bridges
  ▪ Tool can be used to help with communications
  ▪ Create decision tool for engineers
  ▪ Apparent decision making – criteria driven

► Target User Population
  ▪ Project managers and Engineers
  ▪ Bridge owners and Budget office
Analytical Hierarchy Process (AHP)

► The AHP is based on previous research and is well-developed, tested, and validated (e.g. Saaty, 1990)

► An AHP uses series of pair-wise comparisons between criteria located at each level of a decision hierarchy
Elk Creek Project

- Project Stage: Completed
- Critical Factors: Site Constraints, Work Windows, and Customer Service
- Best Alternative: ABC

![Bar chart comparing Alternative Utility of Conventional and ABC with various factors like Customer Service, Work Windows, Safety, Site Constraints, Direct Costs, and Indirect Costs.]

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Total</th>
<th>Customer_Service</th>
<th>Work_Windows</th>
<th>Safety</th>
<th>Site_Constraints</th>
<th>Direct_Costs</th>
<th>Indirect_Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>62.050</td>
<td>11.730</td>
<td>23.970</td>
<td>4.640</td>
<td>15.730</td>
<td>2.830</td>
<td>3.150</td>
</tr>
<tr>
<td>Conventional</td>
<td>37.950</td>
<td>11.730</td>
<td>7.480</td>
<td>1.990</td>
<td>15.730</td>
<td>0.670</td>
<td>0.350</td>
</tr>
</tbody>
</table>
Precast Deck System
ODOT Precast PS Deck System

1\textsuperscript{st} project using UHPC grout for the joint
- 20,000 p.s.i. compressive strength

HPC PS deck panels (50 ft. by 9.5 ft for handling)
- 8,000 p.s.i. compressive strength
- Study - without longitudinal Post-Tensioning across joints
- Developed connection details
Precast PS Deck System for ABC

**General Notes:**
- Precast panel spans are designed for a superimposed dead load of 20 psf per square foot.
- Concrete in precast panels shall be Class C0600 or C060003.
- Concrete strength required at delivery is 4000 psi.
- Splices in joint tendons and transverse joints shall be T-100 with a compressive strength of 20000 psi.
- Provide reinforcing as specified in the General Notes for the Project.
- Provide 0.050" diameter T wire low relaxation prestressing steel wire for post-tensioning conforming to ASTM Specification A416, Grade 1777, Supplementary F.
- Tension 0.050" surround to 310 kips per panel.
- Support panels during storage and transportation according to the diagram shown in the details. Transport off gorge line has reached its design concrete strength and a minimum of 28 days after casting.
- For deck panels used on bridges with no applied wearing surface, include the service at the panels according to Table 3 of the Standard Specifications, Sheet 3 of the Standard Specifications, or at a general in-kind of the surface.
- For deck panels used on bridges with applied wearing surfaces, provide a transverse tension T wire on the top of the beams. Provide a general finish on other surfaces.
- Note: Lifting supports shown are intended to minimize transport and placement loads to the precast deck unit. Locations can be adjusted as required to clear obstructions. Transport stability is the responsibility of the fabricator.
Precast PS Deck System - Joint Details

- UHPC 20 ksi Grout
- HPC 8 ksi Deck
- Post-tensioning in longitudinal?

Diagram notes:
- Place leveling rods as shown at longitudinal joints.
- Fill joint with UHPC Concrete.
- #6 Bars x 2'-0" imbeded 1'-5" into panel. Place one bar at each strand, top and bottom.
- Place 4 longitudinal deck bars (2 top and 2 bottom) into longitudinal joint.

Note: This joint system is not intended to be used for staged construction.
Temp. Bracing for Staged Construction

LONGITUDINAL JOINT WITH STAGE CONSTRUCTION

LONGITUDINAL JOINT WITHOUT STAGE CONSTRUCTION

Construction Set:
Railings on Precast Deck System

- Bars "A" from Std. Dwg. BR206
- Add 8 #6 bars x 4'-0" @ 4'
- Place 4 each side of post
- Rotate as required to clear blockouts

- Bars "B" from Std. Dwg. BR200
- Add #6 bars x 4'-0" @ 8"
- Adjust as required to clear blockouts

Type F Barrier
No Scale
Summary

- ODOT encourages and supports ABC
- Guidance in BDDM is advisory
- Prefabricated elements, seismic connection details, cost study, standards, guides and specs available
- Pooled Fund Study for cost analysis and decision model in progress
- Full depth precast deck system