

ODOT's ABC PROGRAM FHWA EDC Initiative

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Fremont Bridge – floated and lifted 1973



ODOT - Project Samples

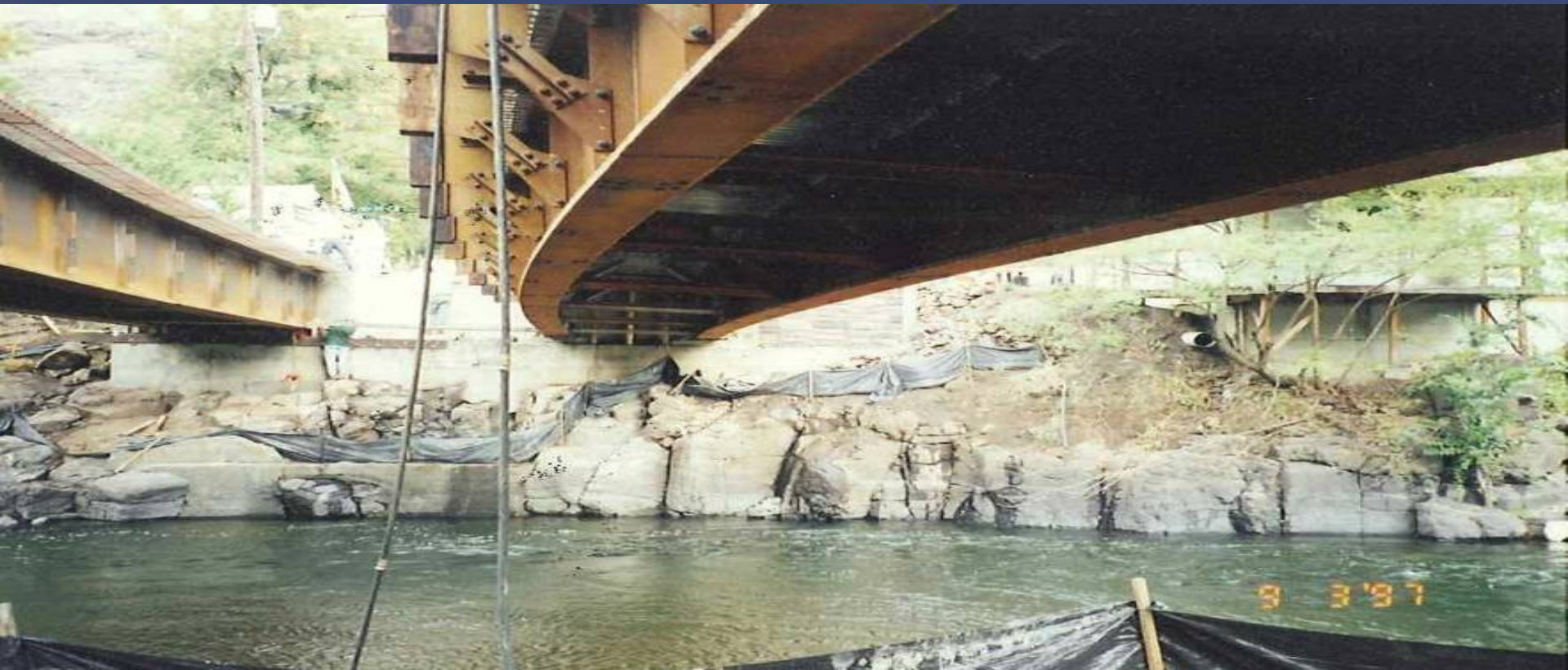
ODOT has completed 16 projects and more are on the way...

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



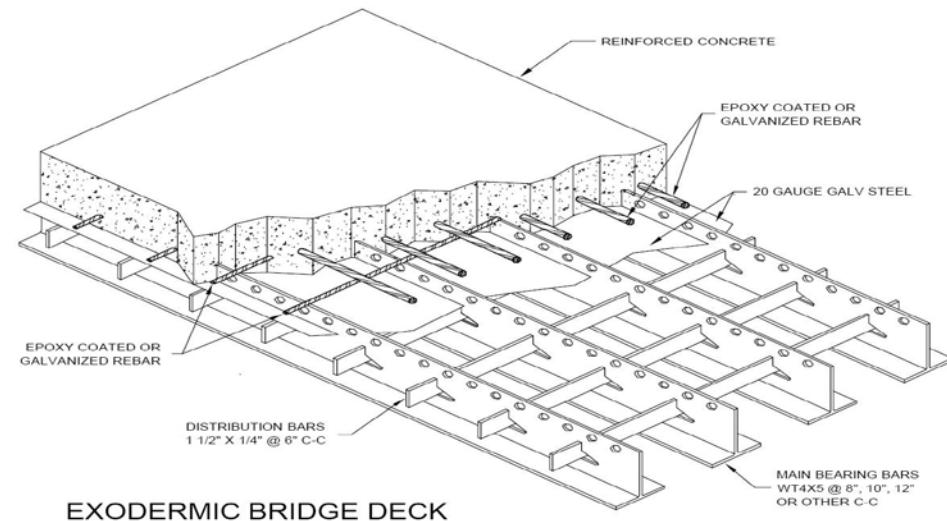
I-5 Trunnion Replacement (1997)



- ▶ 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



5 day closure to slide bridge into place

306-foot Concrete Tied Arch

77-foot wide

5,000 tons



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?

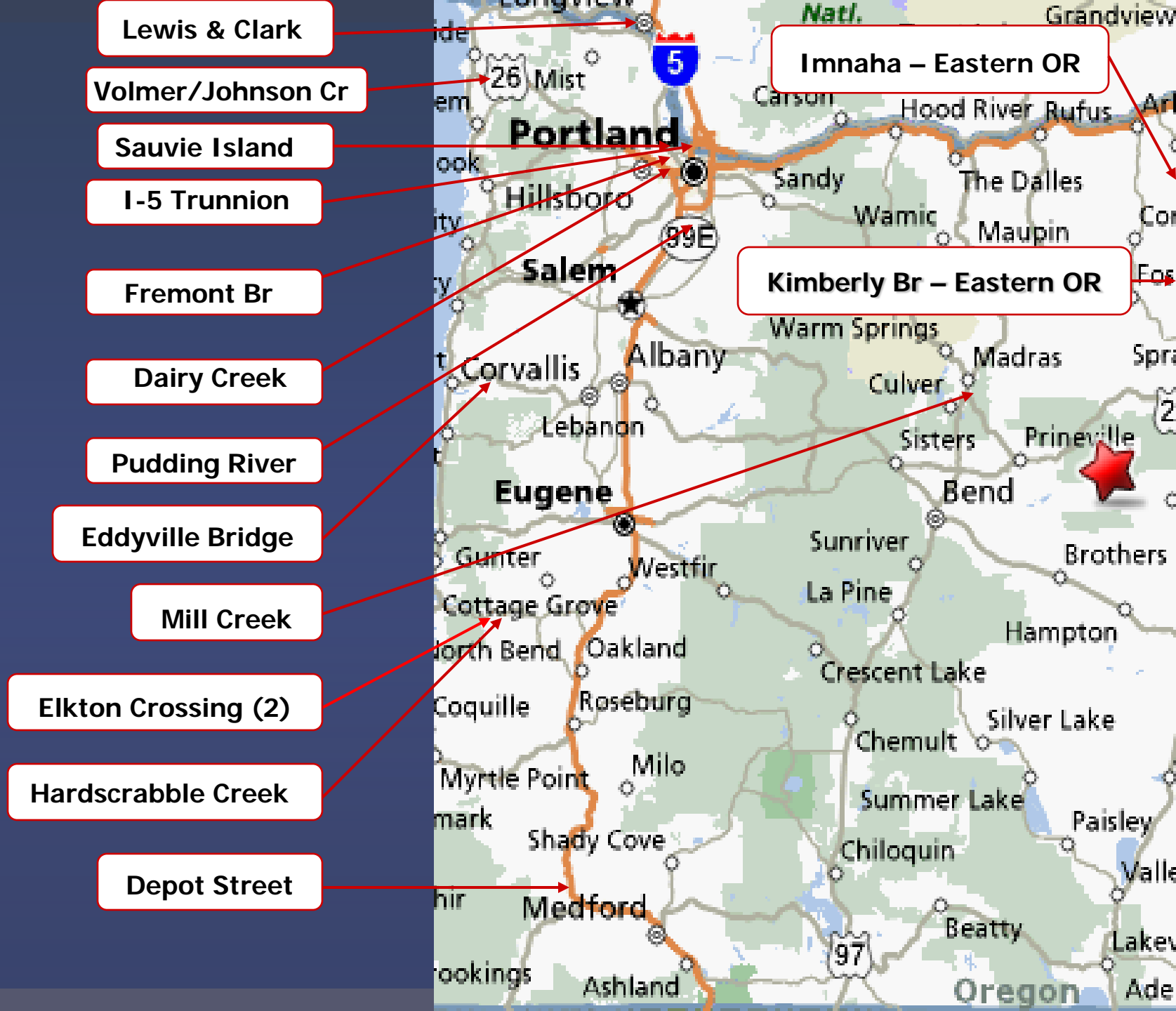
- ▶ **What:** A process applies to incorporating innovative technologies, contracting methods, decision making framework
- ▶ **How:** design and construction techniques and/or prefabricated elements and systems (PBES)
- ▶ **Why:** to minimize impacts to the traveling public, local community and environment.

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



Lewis & Clark

Volmer/Johnson Cr

Sauvie Island

I-5 Trunnion

Fremont Br

Dairy Creek

Pudding River

Eddyville Bridge

Mill Creek

Elkton Crossing (2)

Hardscrabble Creek

Depot Street

Imnaha – Eastern OR

Kimberly Br – Eastern OR

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

http://www.oregon.gov/ODOT/HWY/BRIDGE/standards_manuals.shtml

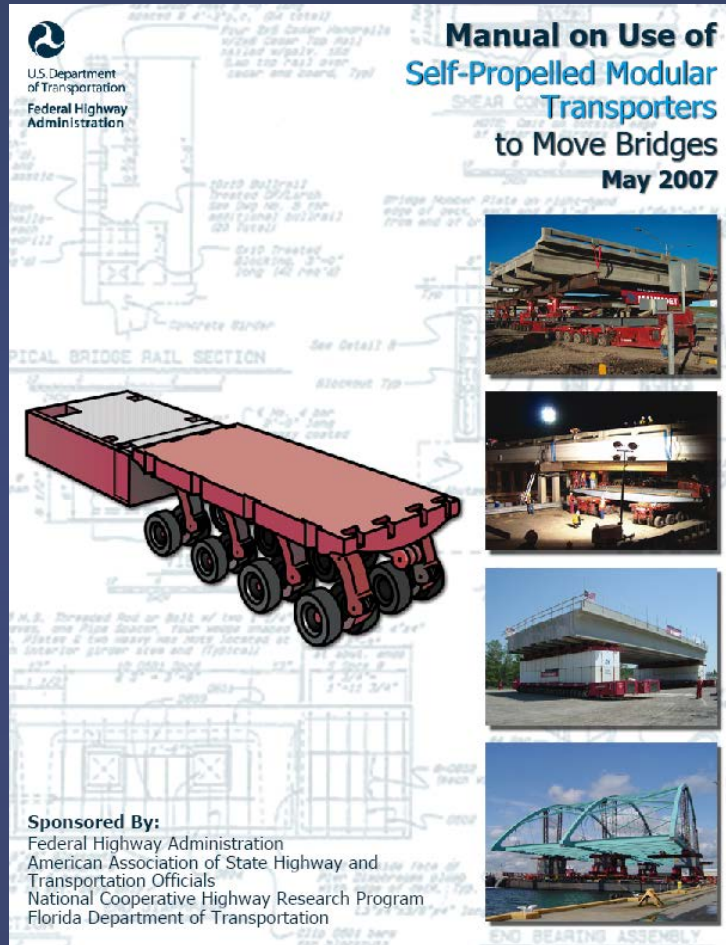
ODOT BDDM – Outline Cont.

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

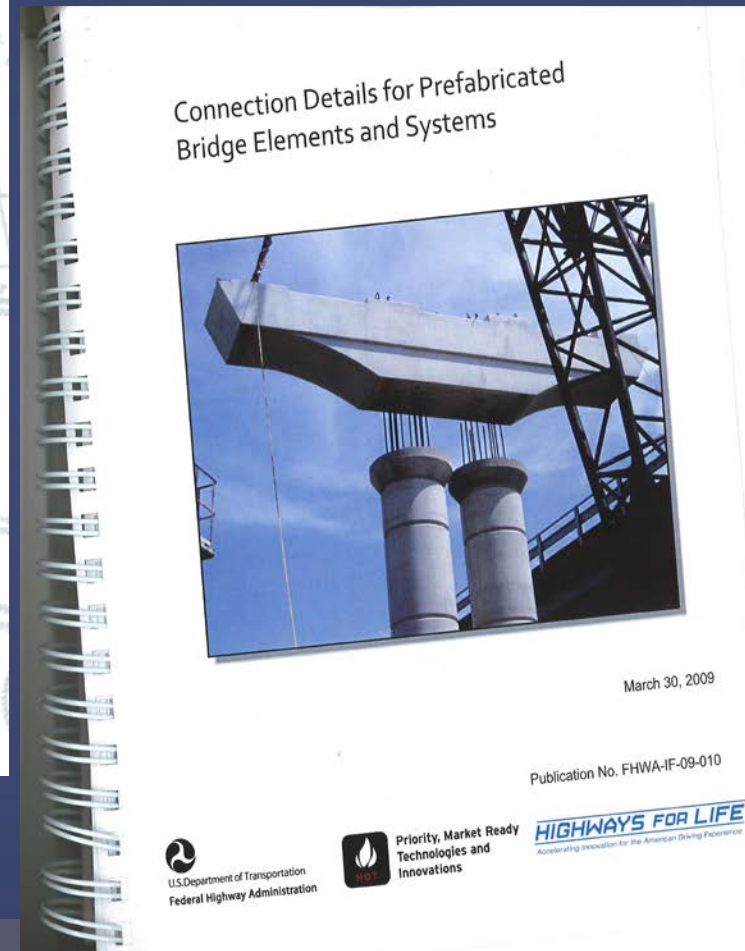
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FHWA Resources: SPMT & Connection Details

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



- State of Practice
- 150+ connection details



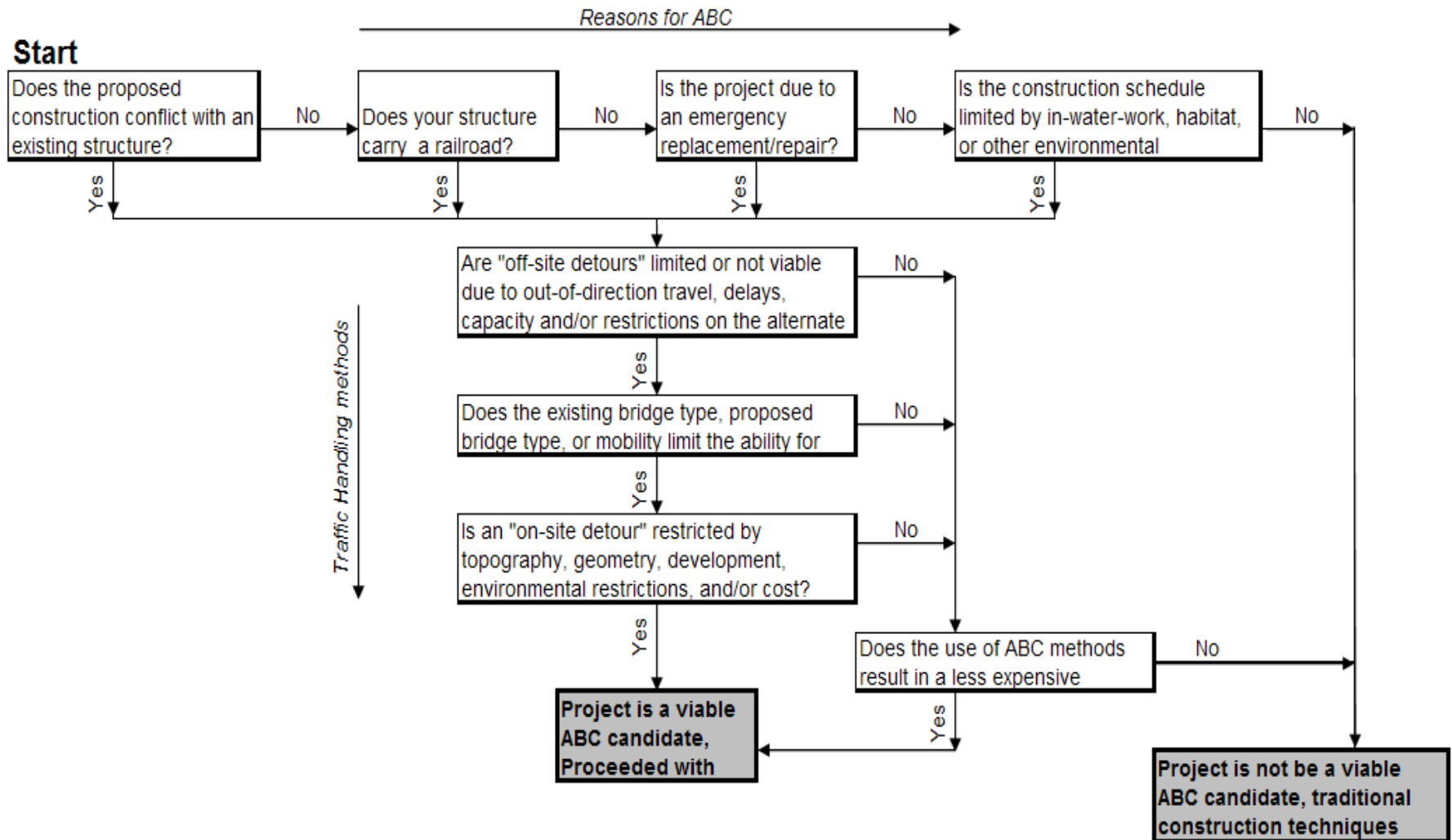
Owner's Cost Consideration

- ▶ 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



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 Jan 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

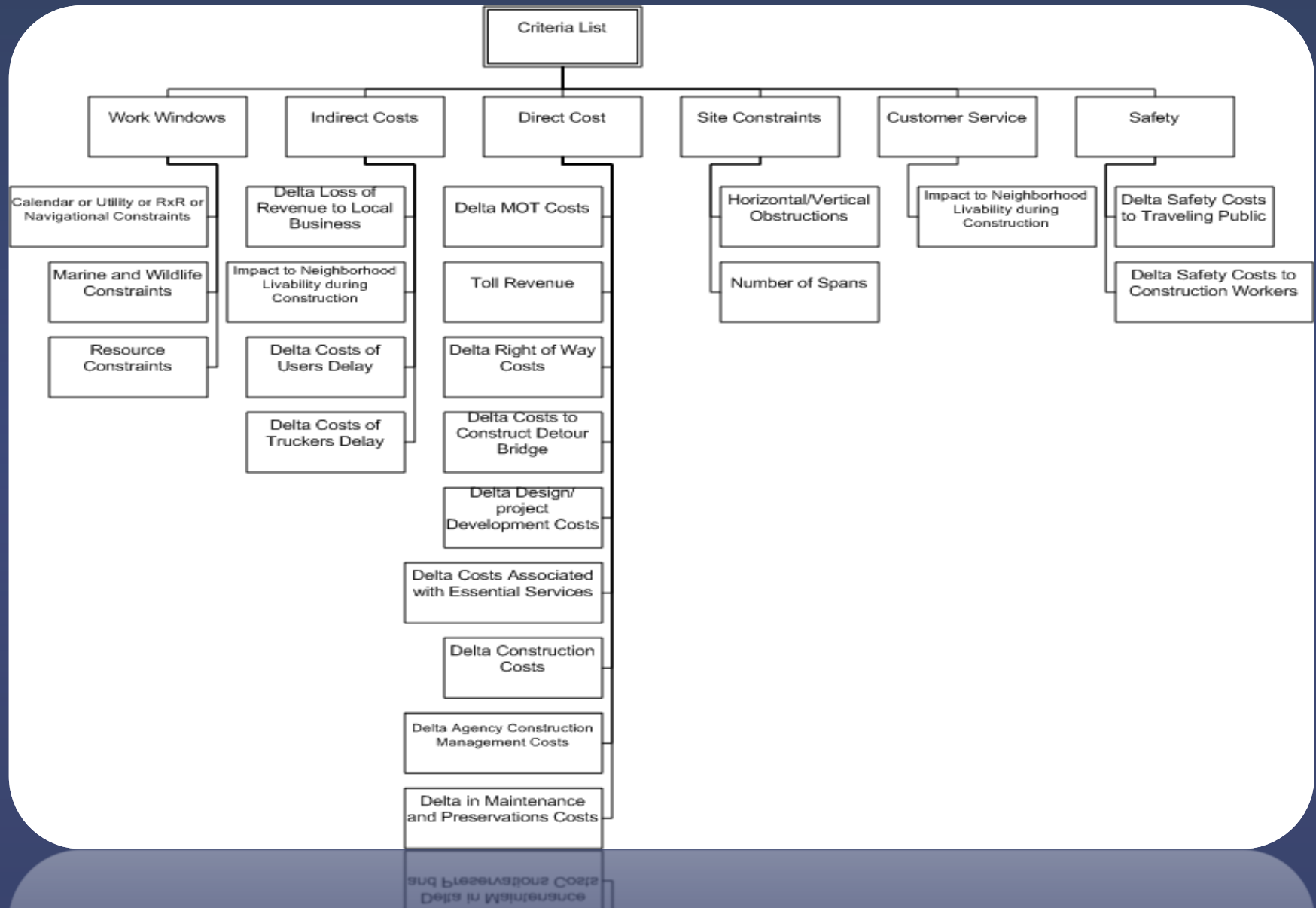
► Target User Population

- 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

Decision Hierarchy



Elk Creek Project

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

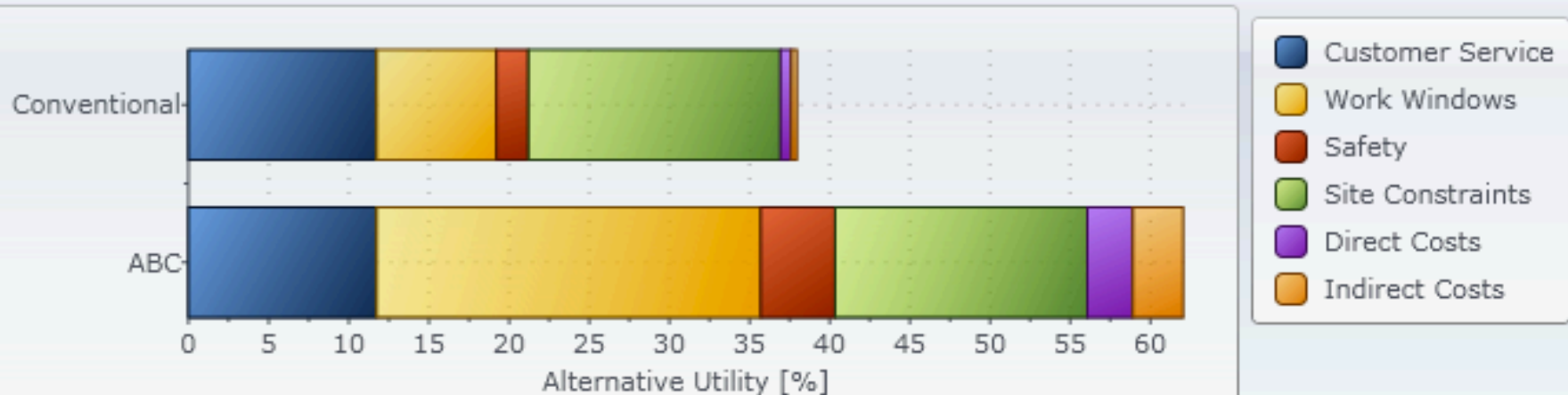


Chart Data

Alternative	Total	Customer_Service	Work_Windows	Safety	Site_Constraints	Direct_Costs	Indirect_Costs
ABC	62.050	11.730	23.970	4.640	15.730	2.830	3.150
Conventional	37.950	11.730	7.480	1.990	15.730	0.670	0.350

Precast Deck System

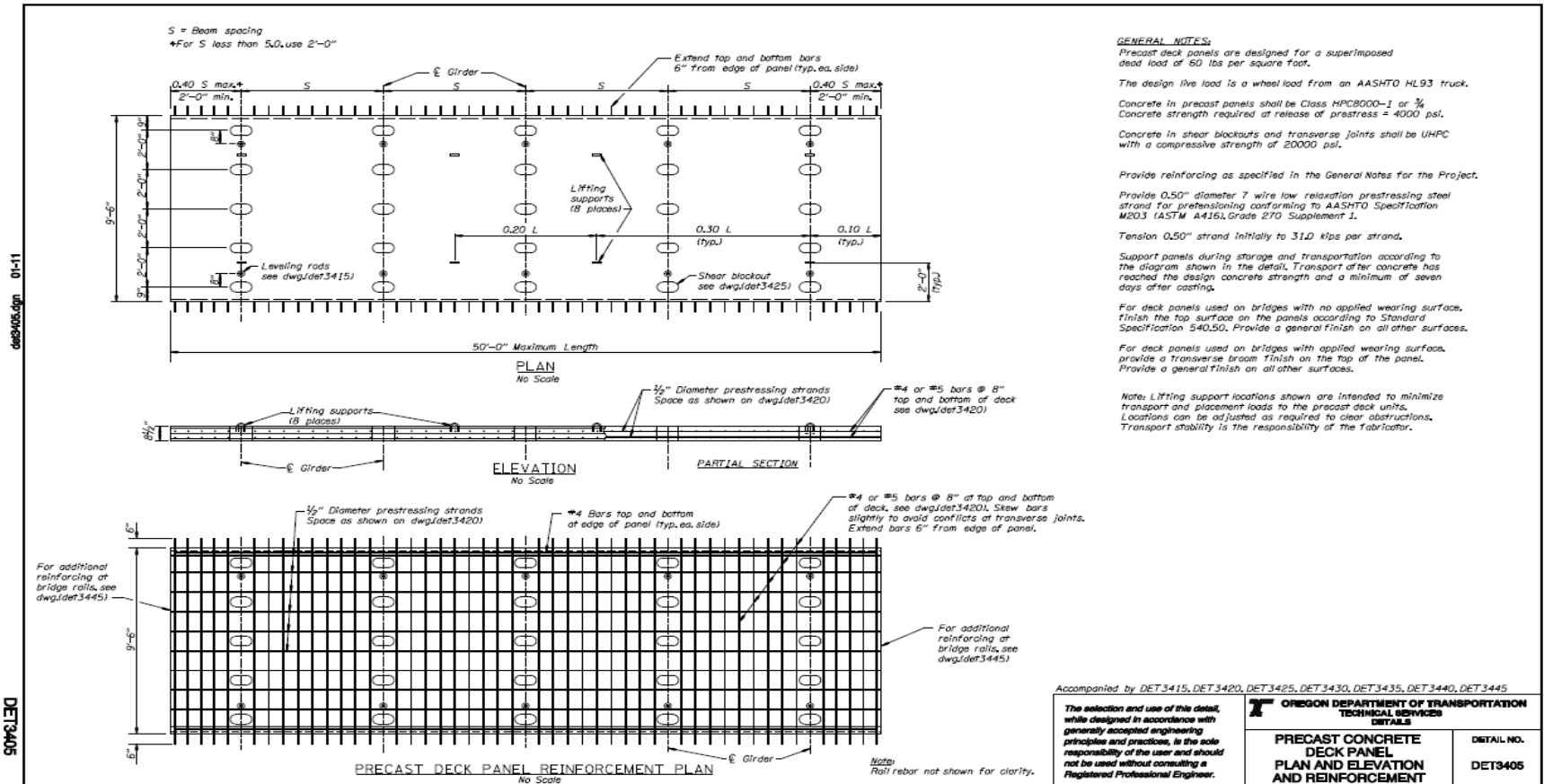




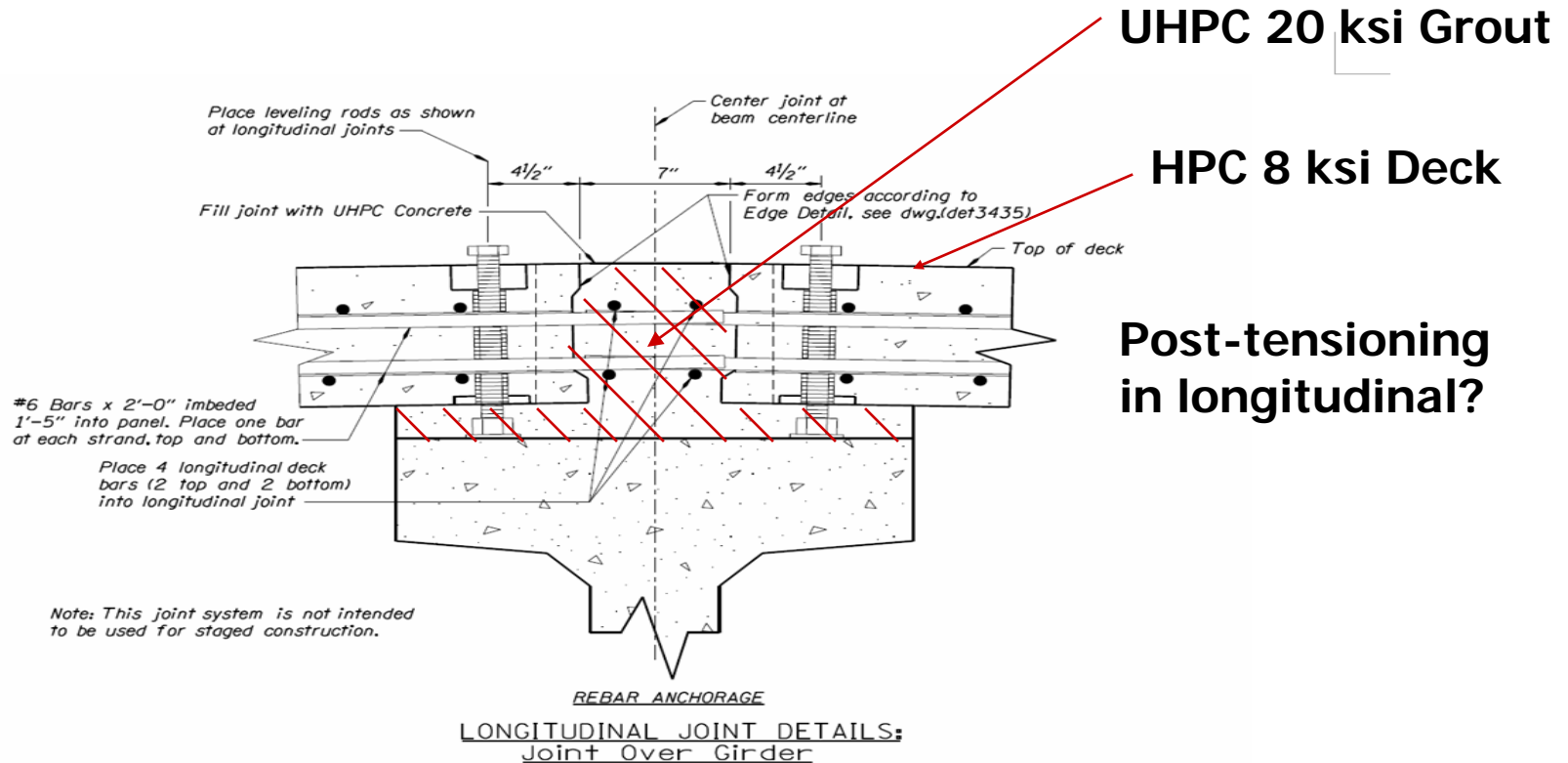
ODOT Precast PS Deck System

- ▶ 1st 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

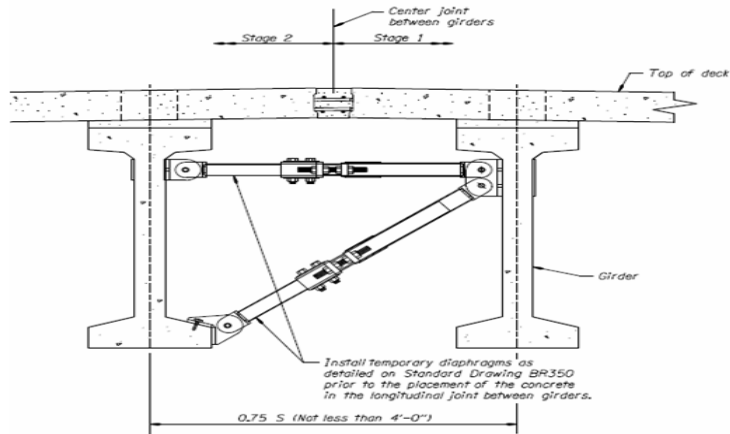
Precast PS Deck System for ABC



Precast PS Deck System - Joint Details

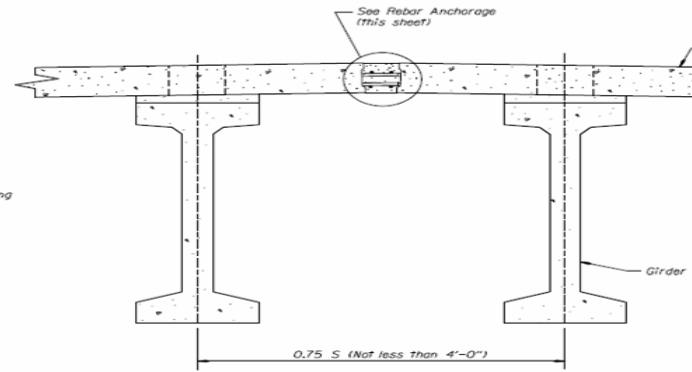


Temp. Bracing for Staged Construction



LONGITUDINAL JOINT WITH STAGE CONSTRUCTION
No Scale

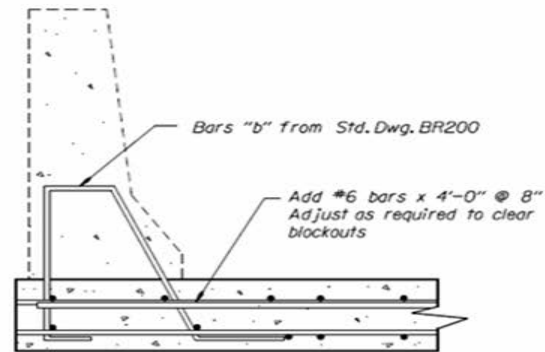
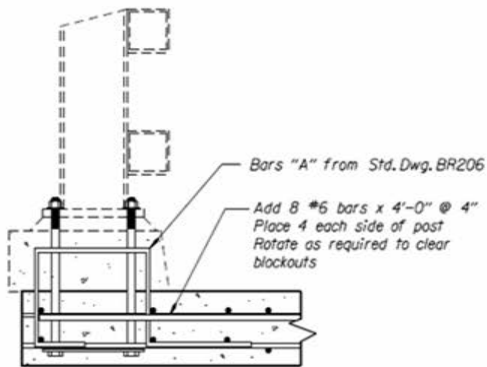
S = Typical girder spacing



LONGITUDINAL JOINT WITHOUT STAGE CONSTRUCTION
No Scale

Construction Set

Railings on Precast Deck System



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