Slide IT

BRIDGE
LATERAL MOVE
TECHNOLOGY

U.S. Department of Transportation
Federal Highway Administration

SLIDE IN BRIDGE CONSTRUCTION (SIBC) FROM THE OWNER/POLICY MAKER PERSPECTIVE

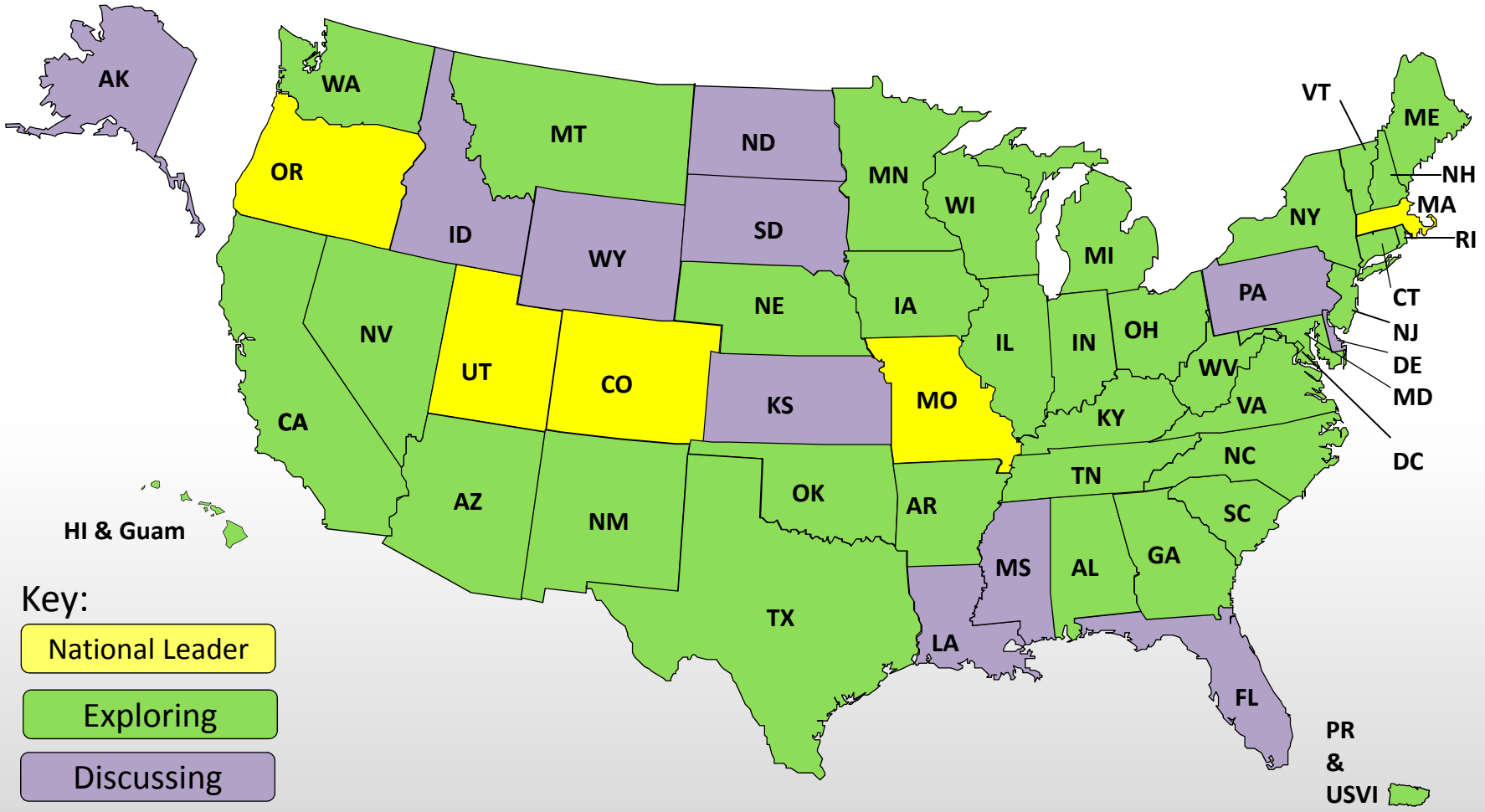
November 21, 2013; 11am-12pm MST

CDOT
DEPARTMENT OF TRANSPORTATION

Webinar Objective/Agenda

- Presentation Focus
  - Owners Perspective – discussion and examples of bridge system moves using lateral slides
  - "Lateral slides" vs. other system moves (e.g., SPMT, etc.)
- Key Presenters
  - Tim Cupples, FHWA Big Picture
  - Josh Laipply, CDOT Perspective
  - Ben Tang Featured Presentation

The Big Picture on SIBC



SIBC Implementation Guide

- Site Selection
- Design Considerations
- Cost Considerations
- Contracting/Procurement Considerations
- Construction Equipment and Techniques
- Sample Calculations
- Sample Details
- Sample Specifications

SIBC Webinars

- Owner/Policy Maker Perspective: Today's Webinar
- Engineer/Designer Perspective: January 2014
- Contractor/Constructor Perspective: February 2014
- Owner's perspective repeated once in 2014; other two perspectives each repeated twice in 2014

Web Based Training Modules

- Owner/Policy Issues
- Engineering of SIBC Projects
- Construction of SIBC Projects
- Interactive Training
- Professional Development Hour (PDH)
- In development
- Winter/Spring 2014

Instructor Led Training

- Do-it-yourself Brown Bag Presentation
- 1-hour SIBC Overview
- 4-hour SIBC Training
- 6 modular case study presentations (mix and match with other training options
- Train LTAP/TTAP (local/tribal technical assistance program) instructors
- Contract awarded
- Late Winter/early Spring 2014

IOWA STATE UNIVERSITY

Technical Information and Support

- National website
  - Source for technical information
  - Specs, details, case studies, etc.
- Technical Support Service Center
  - Technical assistance
  - Inquiries from state DOT, local public agencies, contractors, engineers
- Contract awarded
- Deliver Winter 2014

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Colorado DOT Perspective

- CDOT Experience with Bridge Slides
- FHWA Project Objective
- Building on Lessons Learned Across the Country

THE 4-D OF BRIDGE SLIDE-IN:

WHAT, HOW, WHY, AND WHEN

Benjamin Tang, P.E.
Bridge Preservation Manager
Oregon DOT, Salem OR

What is Driving the Change?

- Increasing traffic demand
- Increasing urban congestion
- Public demand for rapid project delivery
  - Infrastructure renewal needs
  - Can't be business as usual
- Safety
- Mobility
- Environmental impacts

Bridge Movement Systems

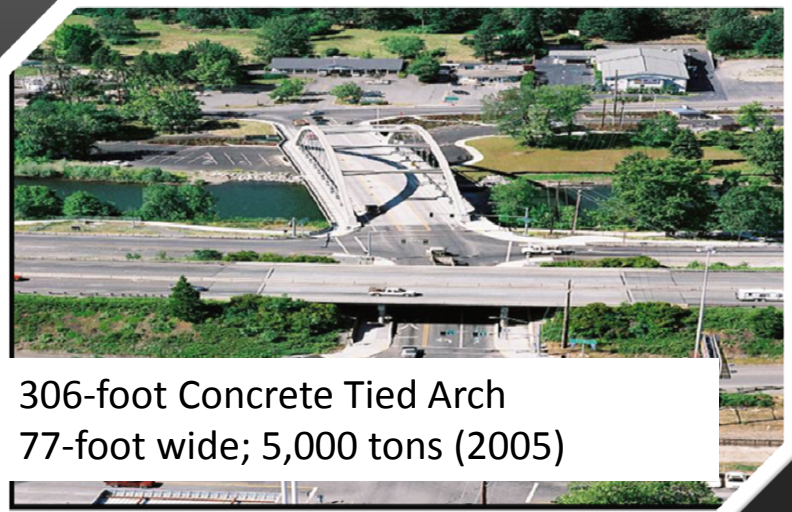
- Skidding (Sliding)
- Launching
- Lifting
- Pivoting
- Floating
- Self-Propelled Modular Transport (SPMT)

PBES: Prefabricated Bridge Elements and **Systems**

Oregon Lateral Slide-in Projects

Pudding River Truss (1940s)

OR 213 Jughandle Bridge Move (2012)

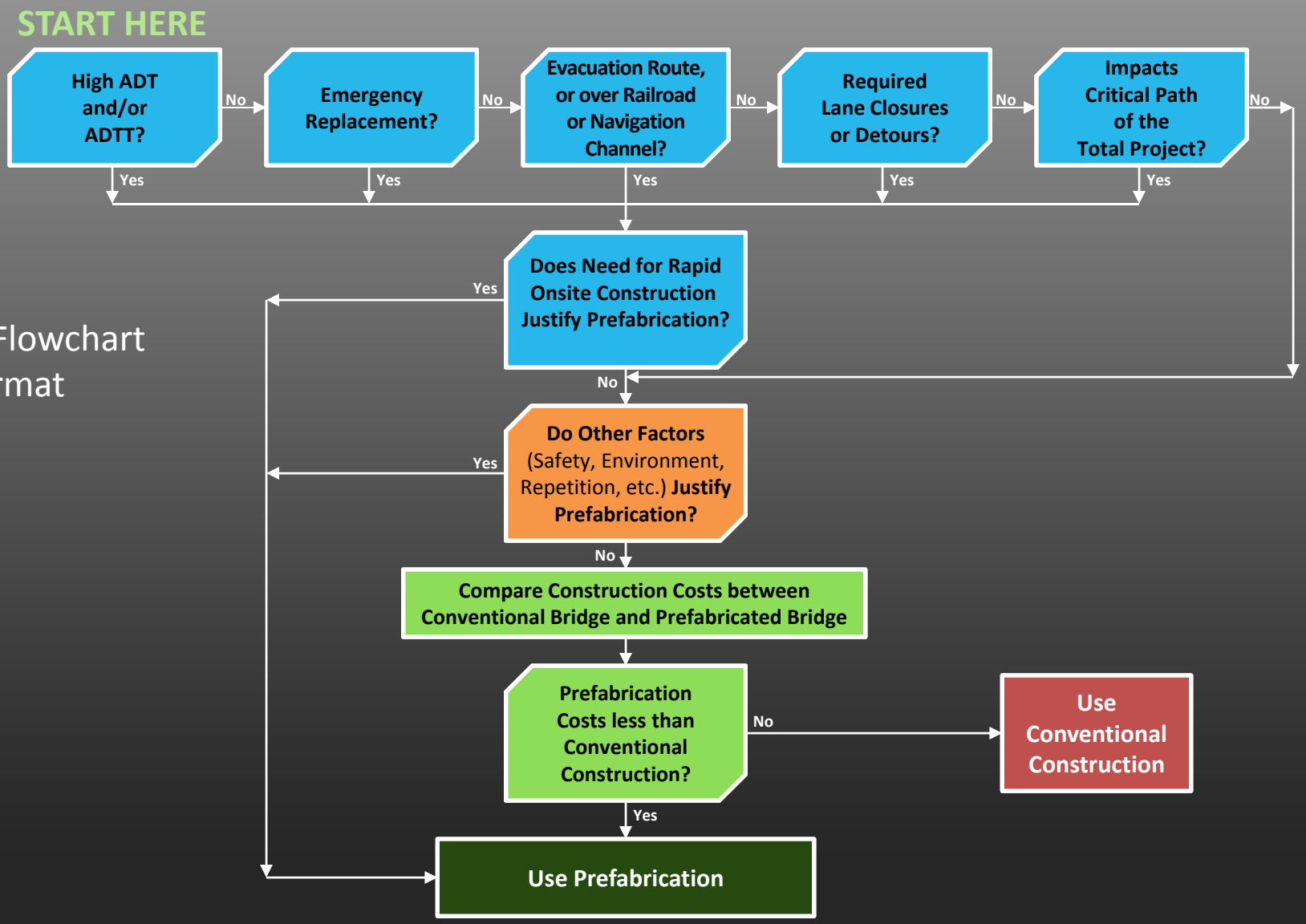


306-foot Concrete Tied Arch
77-foot wide; 5,000 tons (2005)

Sellwood Bridge Move (2013)

OR Route 38 - Elkton Bridges

1. Flowchart Format



2. Matrix Format

Questions to Determine Whether a Prefabricated Bridge Should Be Considered for This Project

Bridge Name:	

Question	Yes	Maybe	No
Does the bridge have high average daily traffic (ADT) and/or average daily truck traffic (ADTT), or is it over an existing high-traffic-volume highway?			
Is the bridge over a railroad or navigable waterway, or is it on an emergency evacuation route?			
Will traffic be subject to back-ups when using the bridge during construction, or be subject to excessive detours during construction of the bridge?			
Must traffic flow be maintained on the bridge during construction?			
Can the bridge be closed during off-peak traffic periods, e.g., nights and weekends?			
Does the bridge have multiple identical spans?			
Can the bridge be grouped with other bridges for economy of scale?			
Will roadway construction activities away from the bridge be completed quickly enough to make rapid installation of a prefabricated bridge a cost-effective solution?			
Can adequate time be allocated from project award to site installation to allow for prefabrication of components to occur concurrently with site preparation?			
Do worker safety concerns at the site limit conventional methods, e.g., adjacent power lines?			
Is the site in an environmentally sensitive area requiring minimum disruption (e.g., wetlands, air quality, noise)?			
Is the bridge location subject to construction time restrictions due to adverse impact on local businesses?			
Are there natural or endangered species at the bridge site that necessitate short construction time windows or suspension of work for a significant time period, e.g., fish passage or peregrine falcon nesting?			
If the bridge is on or eligible for the National Register of Historic Places, is prefabrication feasible for replacement/rehabilitation per the Memorandum of Agreement?			
Totals:			

How to use Decision-Making Matrix

- One or two factors may warrant use of PBES
- Alternatively, user may assign weights to factors
- In any case, a majority of “Yes” responses indicates PBES offers advantages
  - A more detailed evaluation

3. Narratives Decision Making Considerations

Considerations in Selecting a Prefabricated Bridge as the Construction Method of Choice

Costs related to the Maintenance of Traffic

Traffic management and user delay-related costs associated with bridge construction activities will significantly influence the selection of the most cost-effective bridge technology. Close cooperation with the agency's traffic analysis experts is critical to development of the traffic information described below.

- What are the agency costs per day for implementing the traffic control plan, e.g., costs for traffic control devices, flagging, maintenance of devices, lighting, temporary roadways, and maintenance of detours?

  Agencies implement traffic control plans for safety and to lessen the disruptive impacts of bridge replacement on highway users; these costs can significantly add to the cost of the replacement. Because prefabricated bridges can be installed in hours or days compared to weeks or months for conventional bridges, the prefabricated bridge can greatly reduce these traffic control costs.

  Guidance on cost estimating of traffic control plans is available from some States, such as California ("Traffic Management Plan Effectiveness Study," California Department of Transportation Traffic Operations Division, 1993). For conventionally built bridges, such costs can range from 5% to more than 30% of construction costs, although they are typically less than 10%. Values above 10% appear to occur in the case of smaller projects, where the set-up costs of the traffic control plans may be high relative to the overall project costs. Cost savings from the reduced duration of the traffic control plan can be estimated based on the reduced number of days of traffic control cost times the average daily cost of such measures for comparable bridge projects.

- What are the delay-related user costs per day?

  The quicker installation of prefabricated bridges will also reduce the costs to highway users associated with traffic queues and detours during the bridge installation. Users incur costs during installation due to increased vehicle miles traveled (using detours) and increased vehicle hours of delay (caused by queues that form in front of work zones or in over-capacity detours).

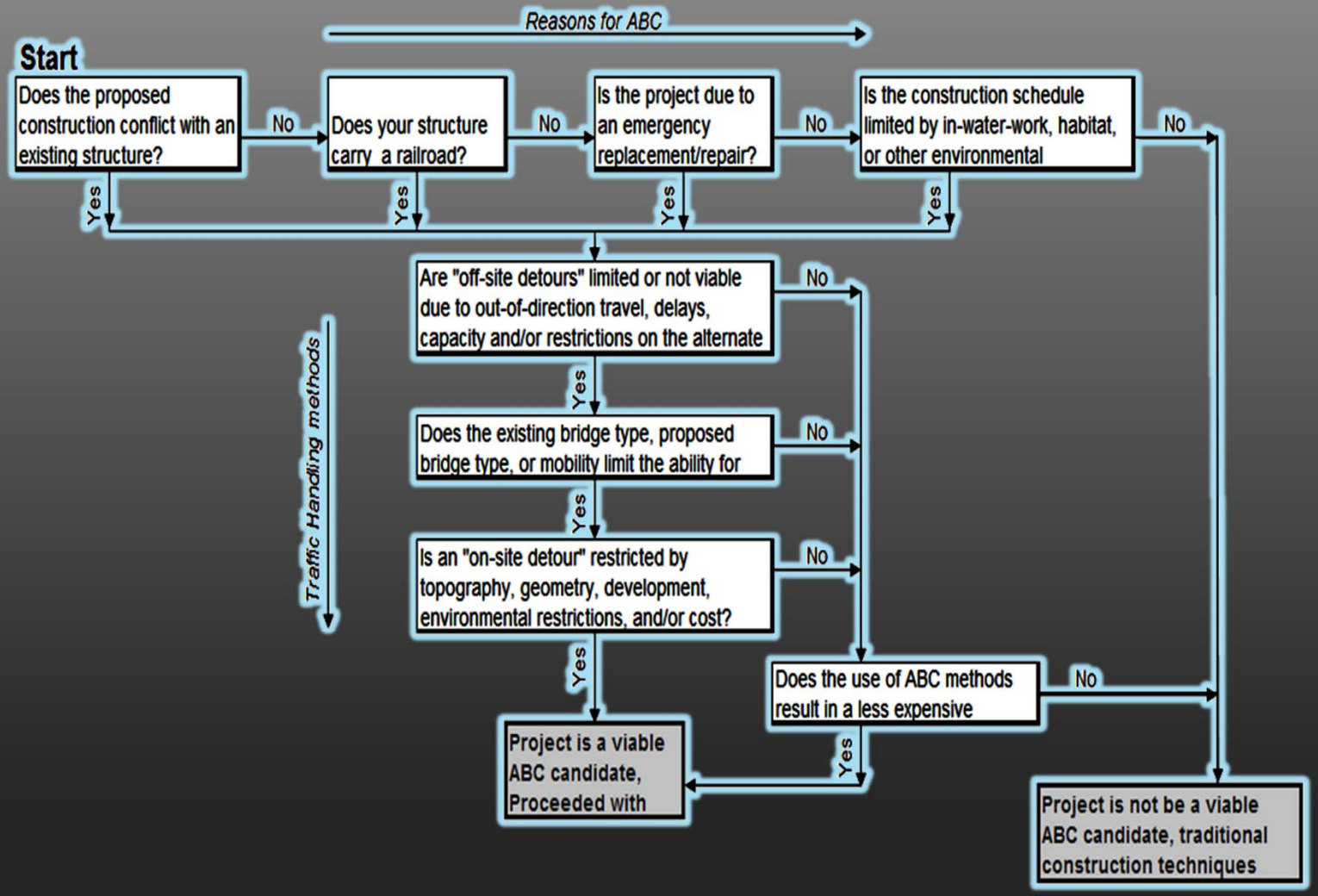
  The FHWA's QuickZone 2.0 (see http://www.tfhrc.gov/its/quickzon.htm) or various traffic simulation models (see next paragraph on FHWA's Traffic Analysis Toolbox) can be used to measure the degree to which expediting the construction will lower vehicle miles and hours of travel. Published monetary values (see U.S. DOT's "Revised Departmental Guidance: Valuation of Travel Time in Economic Analysis" (February 11, 2003) http://ostpxweb.dot.gov/policy/Data/VOTrevision1_2-11-03.pdf) can then be attached to these performance units to estimate the savings to the highway user. (QuickZone will automatically assign values to delay.)

  Numerous other traffic analysis products are available to capture the effects of work zones and bridge closures on traveler delay costs. In July

Decision Making Considerations (cont'd)

- Environmental Issues
- Availability of Prefabrication
- Site Conditions
- Design Considerations
- Available PBES Online Resources
  - General information; projects constructed to date; publications; research; upcoming events

ODOT Decision Making Flowchart



AHP Decision Making Tool

- Analytical Hierarchy Process (AHP) is designed to select the best option from a set of alternatives (e.g., ABC vs. Conventional) evaluated against several criteria
- Performs pairwise comparison to develop an overall priority ranking for each alternative
- Provides results with bar and pie charts
- Qualitative and quantitative results
- Documents the decision process with a report
- Process creates an excellent dialogue with stakeholders and decision makers

Delivery Methods

- Traditional design-bid-build (DBB)
- Design-build (i.e., low bid, best value, etc.)
- Other innovative contracting (i.e., PPP, CM/GC, A+B, etc.)
- Value engineering remains valid all times
- Emergency repair/replacement

If there is a will, there is a way….

Cost Considerations

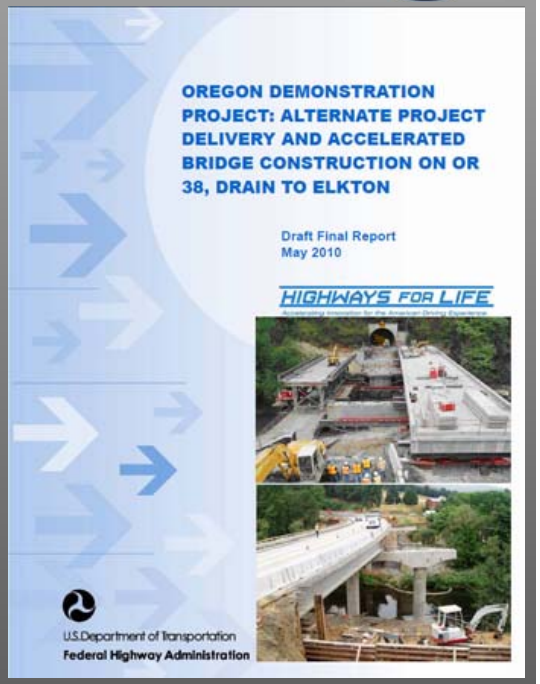
- Projects are becoming more complex
- Direct cost alone is not an acceptable measure
- Direct cost decisions have been challenged
- ABC project cost histories are still in the making and FHWA has published them
- Worth on tangibles and intangibles

Cost Considerations – AHP

- Direct costs (9 sub-criteria identified)
  - Construction cost
  - MOT
  - Design and construct detour
  - ROW
  - Project design and development
  - Essential services maintenance
  - Construction engineering
  - Inspection, maintenance and preservation
  - Toll revenue

Cost Considerations – AHP (cont'd)

- Indirect costs (6-subcriteria identified)
  - User delay
  - Freight mobility
  - Revenue loss
  - Livability during construction
  - Road users exposure
  - Construction personnel exposure
- Direct cost rule shall be challenged!

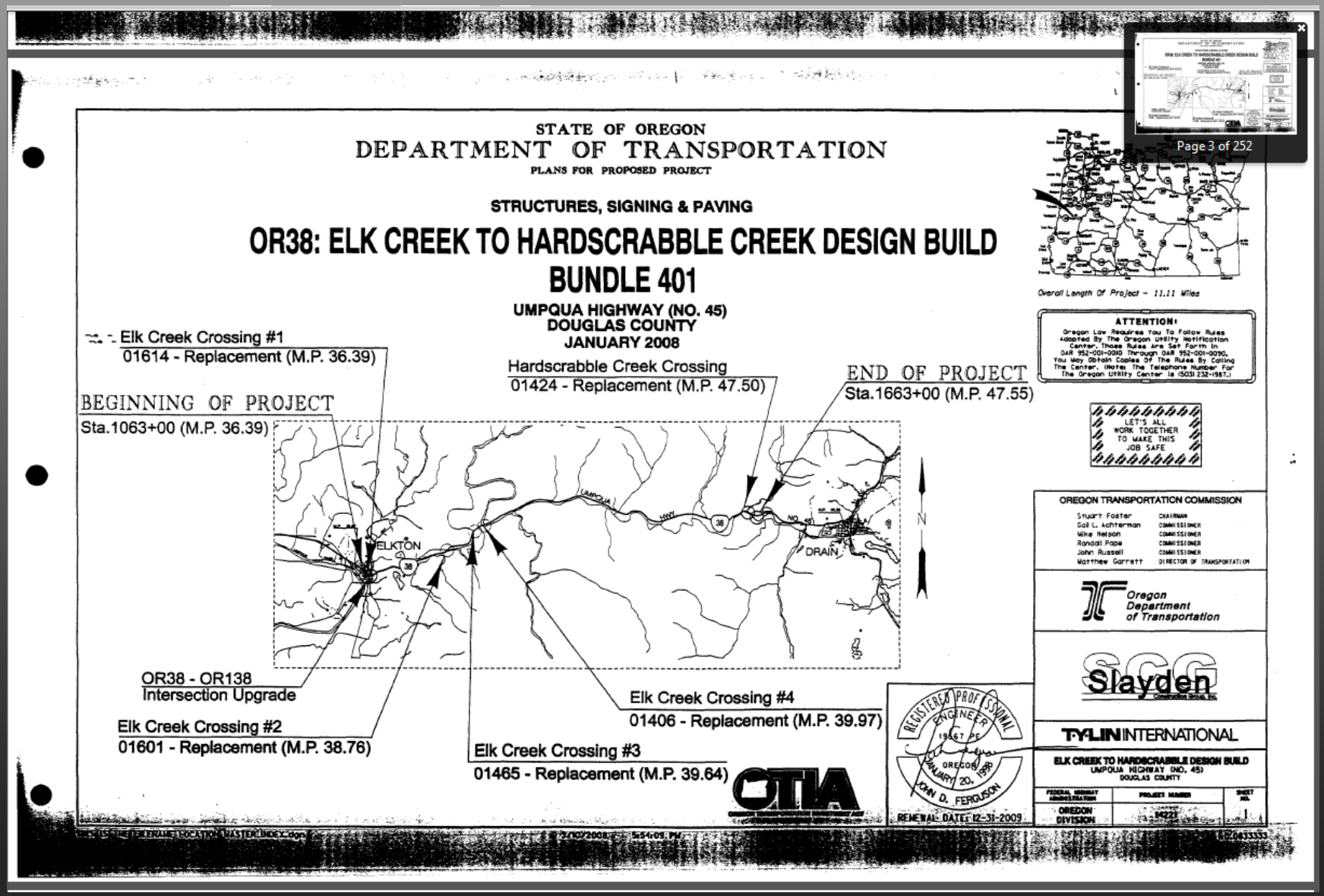


CASE STUDY: OR38 ABC BRIDGE MOVE

Design-Build Contract

Case Study: OR38

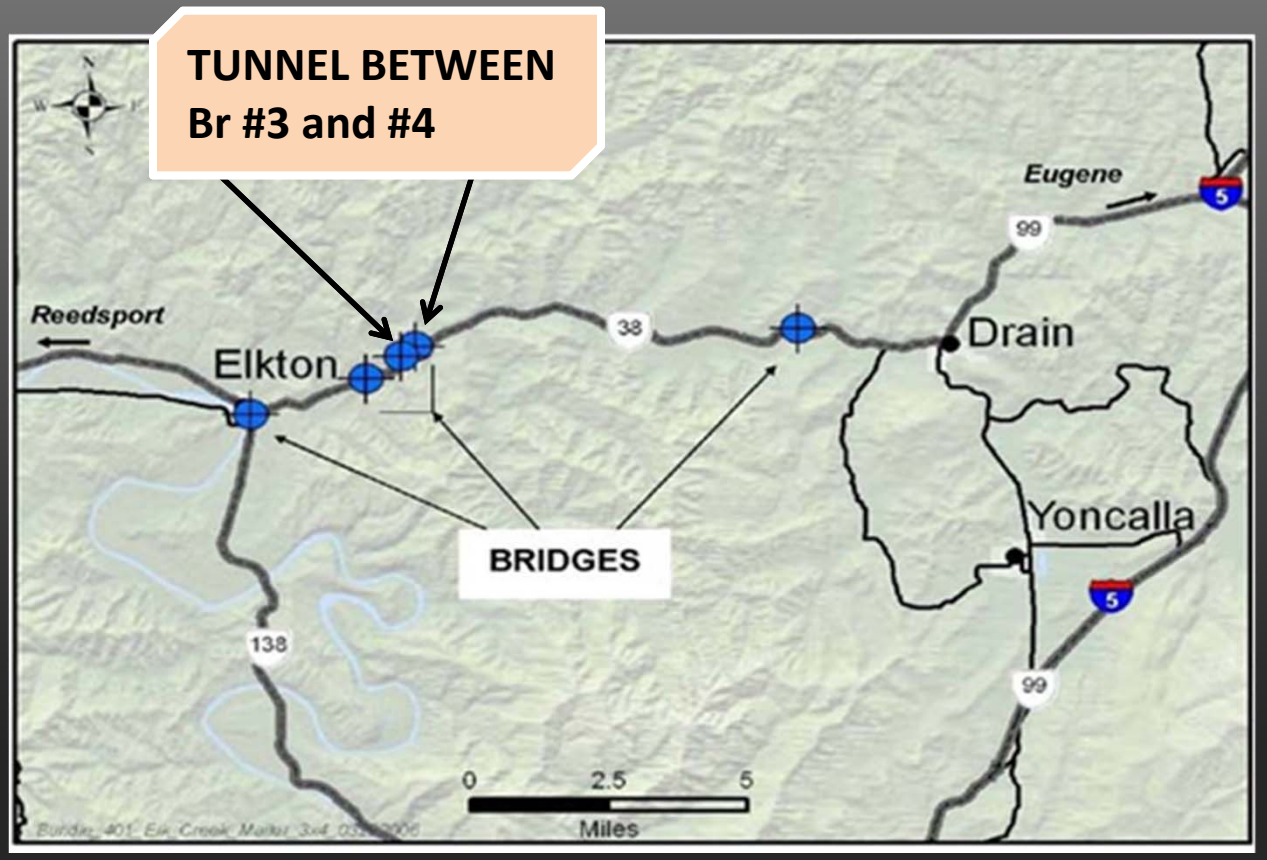
- Closed facility at 8:00pm Friday
- Moved out existing bridge off to one side
- Moved in new bridge into alignment
- Constructed approaches
- Opened to traffic Monday 5:00 am
  (total 57-hr closure)
- Highway for Life Project and Showcase 2008
- Report is available on FHWA Highways for Life (HfL) Website http://www.fhwa.dot.gov/hfl/summary/or/


STATE OF OREGON
DEPARTMENT OF TRANSPORTATION
PLANS FOR PROPOSED PROJECT
STRUCTURES, SIGNING & PAVING
OR38: ELK CREEK TO HARDSCRABBLE CREEK DESIGN BUILD
BUNDLE 401
UMPQUA HIGHWAY (NO. 45)
DOUGLAS COUNTY
JANUARY 2008
Elk Creek Crossing #1
01614 - Replacement (M.P. 36.39)
BEGINNING OF PROJECT
Sta.1063+00 (M.P. 36.39)
Hardscrabble Creek Crossing
01424 - Replacement (M.P. 47.50)
END OF PROJECT
Sta.1663+00 (M.P. 47.55)
ELKTON
DRAIN
UMPQUA
OR38 - OR138
Intersection Upgrade
Elk Creek Crossing #2
01601 - Replacement (M.P. 38.76)
Elk Creek Crossing #3
01465 - Replacement (M.P. 39.64)
Elk Creek Crossing #4
01406 - Replacement (M.P. 39.97)
Overall Length Of Project - 11.11 Miles
ATTENTION!
LET'S ALL WORK TOGETHER TO MAKE THIS JOB SAFE
OREGON TRANSPORTATION COMMISSION
Stuart Foster CHAIRMAN
Gail L. Achterman COMMISSIONER
Mike Nelson COMMISSIONER
Randall Pape COMMISSIONER
John Russell COMMISSIONER
Matthew Garrett DIRECTOR OF TRANSPORTATION
Oregon Department of Transportation
Slayden
TY LIN INTERNATIONAL
ELK CREEK TO HARDSCRABBLE DESIGN BUILD
UMPQUA HIGHWAY (NO. 45)
DOUGLAS COUNTY
REGISTERED PROFESSIONAL ENGINEER
OREGON
JANUARY 20, 1988
JOHN D. FERGUSON
RENEWAL DATE: 12-31-2009
OTIA
Page 3 of 252

Case Study: OR38

ADT: 3,900 (2004); 23% truck

50-mile detour – E-W route (I-5 – Reedsport)



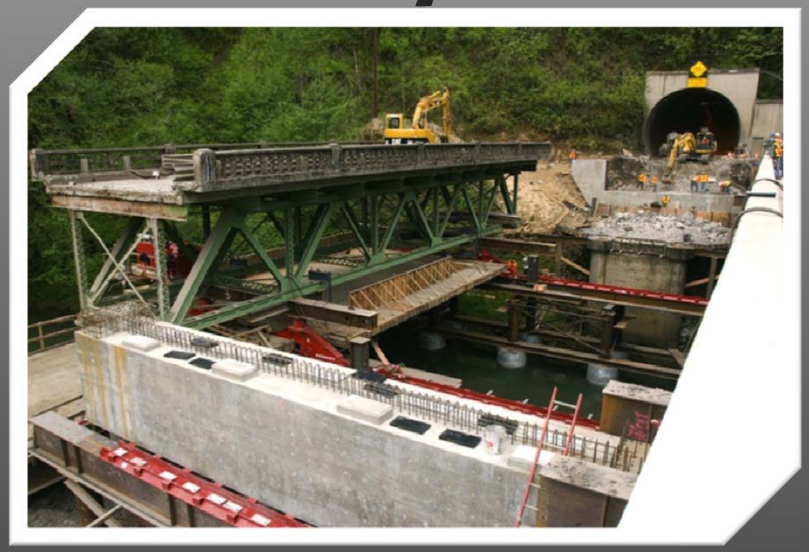
Case Study: OR38 Safety and Sustainable Issues

- Last 10 years – 28 crashes and 5 fatalities
- During construction – must avoid crashes at all costs
- Safeguards put into place as part of design
- Context Sensitive & Sustainable Solution (CS3)

Case Study: OR38/Elk Creek Bridge Move (5 Bridges in Bundle 401)

- Built in 1932: FO (two 12-ft lane with no shoulders)
- Tunnel between Br #3 and #4 – 50’ and 250’ away
- Salmon spawning river and sensitive environment
- Spotted owl nesting along the corridor
- Incentive/Disincentive: NTE 30 days (e.g., $4,500/day (option 1), or $20,000/day (option 2 – 56-hr closure))
- Bridge #3 – 320.5-ft long and 38.2-ft wide
- 3-span (56.5 ft – 207.5 ft – 56.5 ft) steel girder

Case Study: OR38 More Elkton photos



Case Study: OR38

Case Study: OR38

2.5-MINUTE TIME LAPSE VIDEO OF BRIDGE MOVE

Case Study: OR38

Contract Specifications: Specify Time of Closure

- Contractor was allowed one 5-calendar day full bridge closure period for jacking and sliding the new bridge into its final position
  - Lane Restrictions
    - Do not close any traffic lanes on Depot Street, Monday through Friday, between 6:00am and 8:00pm
    - Except for the 5-day full bridge closure required for moving the new bridge into final position
  - Do not close between 3:00pm on Fridays and 12:00 midnight on Sundays

Case Study: OR38

Contract Specifications: Ready to Work

- Before starting any bridge and pavement work, ensure that
  - All equipment, labor, and materials required to complete pavement replacement work and bridge deck waterproofing work are on hand
  - Or are guaranteed to be delivered

Case Study: OR38

Contract Specifications: Required Submittals

- Contractor submitted a critical path method (CPM) time-scaled bar chart work schedule
  - Priority of all major work
  - Beginning and end of each activity
  - Traffic control plan and schedule for closure
- Additional requirements
  - Required contractor's pre-qualification
  - Incentive/disincentive clauses
  - Liquidated damages (e.g., $500/15-min delayed opening; $2000 max/hour)

Case Study: OR38
Calculated Cost Savings

- StratBENCOST for all five bridges for the corridor improvement
  - National Cooperative Highway Research Program (NCHRP) cost benefit cost tool (based on additional 12-month required with conventional construction method)
- $1 million additional savings from not having to build detour bridges for Br. #3 and #4

Total Project Economic Benefit	
Type	**Value**
Mobility Savings	$311,230
Escalation Savings	$1,596,000
TOTAL	$1,907,230

Case Study: OR38

Risk Considerations

- Contractor's experience and capability – required prequalification
- Fully developed plans and procedures for the bridge move (CPM work items, schedules…)
- Traffic management, control and public notices (advance, during and after) – options allowed
- Survey must be accurate and controls put in place
- 24/7 technical support
- Route continuity is eliminated if ABC failed
- Spectator and crowd control on job site

No Bridge Too Big nor Too Small

- Suitable for bread-and-butter bridges
- Traffic handling requirements
- Any site location with adjacent room
- Eliminate building and demo of temporary bridge
- Eliminates unnecessary approach re-alignment
- Contractor can quickly adapt to this technology – closer to conventional construction
- Heavy duty equipment readily available today

Successful Bridge Slide Examples

- Several bridges in Oregon (OR 213-Jughandle, Sellwood, Depot Street, Elk Creek, Imnaha)
- 8th Street Overpass, Belleview, Washington
- I-80 Bay Bridge Section and Hard Scrabble Creek Bridge, California
- Rocky Ford and Wray, Colorado
- Echo, Utah
- Iowa, New York, Oklahoma, Missouri, etc.

I-5 Over Skagit River Span Slide (2013)

Emergency Replacement

http://www.wsdot.wa.gov/projects/i5/skagitriverbridgereplacement/

Summary

- How and why you get to an ABC decision on bridge sliding – shown some examples used successfully and effectively
- Several delivery methods under FHWA SEP 14 and other innovative contracting methods
- Cost considerations – when and how much
- Case Study – OR38 project Elkton, Oregon

QUESTION & ANSWER PERIOD

Kevin Thompson, URS Moderator (~15 minutes)

Q&A Panel Members: Ben Tang, Mike Arens, and Tony Marquez

NEXT STEPS

Kevin Thompson, URS (~5 minutes)

Bridge Slides and Contractor Methods

Echo, Utah (2013)

Rocky Ford, Colorado (2012) (2 bridges)

SIBC Website/Resources

- Resources and links posted at a new website created for this training program www.slideinbridgeconstruction.com
- Recording of today's webinar and Q&A will be posted for future reference
- For issues or questions regarding this website or training, please e-mail sibc@urs.com

Future SIBC Training Webinars

- Engineer/Designer Perspective
  - January 2014
- Contractor/Constructor Perspective
  - February 2014
- Owner/Policy Maker Perspective
  - **2nd Session:** March 2014
- Web training modules available in 2014

Special Notice: FIU ABC Center Webinar: *I-84 Dingle Ridge Road Bridge Slide*, Thursday, December 19, 2013 (1:00 – 2:00 p.m. Eastern)

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BRIDGE
LATERAL MOVE
TECHNOLOGY

U.S. Department of Transportation
Federal Highway Administration

THANK YOU FOR YOUR PARTICIPATION!

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