Traffic Control
Channelization Case Study

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• I-5: Willamette River (Boone) Bridge – Woodburn Case Study
• Design Considerations
• Summary and Next Steps
I-5 Case Study - Traffic Control Channelization
I-5: Willamette River (Boone) Bridge - Woodburn

Project Overview

Comparison of Channelization Options
I-5: Willamette River (Boone) Bridge - Woodburn

Project Overview

• 11.5 Miles, 3 lanes NB & SB
• 92-130,000 Vehicles per Day, 10-14% Trucks
• 6 Structures - Waterproof Membranes and Joints
• 59 Lane Miles plus Ramps, 64,000 Tons ACP using IC & Thermal Imaging
• Steel Beam/CRCP Repairs @ 2 Structures
• Lane Closures Sun-Fri: 1-Lane 9 pm - 5 am, 2-Lanes 10 pm - 4 am
I-5: Willamette River (Boone) Bridge - Woodburn

As-built Traffic Control - Summary

Contract Amount $8,215,000

- 21 Week Project Duration
  - 5 Weeks Bridges/Ramps
  - 10 Weeks I-5 Paving
  - 3 Weeks Striping
  - 3 Weeks Expansion Joints
I-5: Willamette River (Boone) Bridge - Woodburn

As-built Traffic Control

- Plastic Drum Lane Closures
- 15 mph Speed Reduction
- Utilized VMS and PCMS
- Truck-mounted Attenuators
- Traffic Control Supervisor
- Daily Safety/Debrief Meetings
As-built Traffic Control

- Rolling Slow Downs
- Smart Work Zone
- Lane Restriction Modifications
- Law Enforcement
## I-5: Willamette River (Boone) Bridge - Woodburn

### As-built Traffic Control - Summary

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
<td>All Lanes Open</td>
</tr>
<tr>
<td><strong>Night</strong></td>
<td>At least one lane open</td>
</tr>
<tr>
<td></td>
<td>(10.5 weeks per side)</td>
</tr>
<tr>
<td><strong>Traffic Delays</strong></td>
<td>5-60 minutes</td>
</tr>
<tr>
<td><strong>Queue Length</strong></td>
<td>0-2 Miles</td>
</tr>
<tr>
<td><strong>Work Window</strong></td>
<td>Approximately 8 hours</td>
</tr>
</tbody>
</table>

![Traffic Control Diagram]
I-5: Willamette River (Boone) Bridge - Woodburn

As-built Traffic Control – Production Challenges

• Reduced Efficiency/Quality
  – Average 1,425 tons/day
  – 5.5 Hrs Paving
  – 39 Transverse Joints (no corrective grinds)

• Reduced Statewide Paving Capacity

• Trucking
I-5 Willamette River (Boone) Bridge - Woodburn

As-built Traffic Control - Work Zone Statistics

- 5,000 Vehicles x 84 Shifts = 420,000 Vehicles Through WZ
- 100+ Property Damage Incidents
- 60+ Near Misses
- 1 Fatality & 1 Serious Injury
Channelization Option Comparison

- Temporary Concrete Barrier
- Moveable “Zipper” Barrier
- Total Closure
Temporary Concrete Barrier - Full Length
Temporary Concrete Barrier - Full Length

- 28' Minimum Traffic
- Workzone

<table>
<thead>
<tr>
<th>Full-Length Temp Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Work Zone</td>
</tr>
<tr>
<td>Law Enforcement</td>
</tr>
<tr>
<td>24-hr Lane Closures</td>
</tr>
<tr>
<td>TMA/VMS/PCMs etc.</td>
</tr>
<tr>
<td>Daily Safety Debrief Meetings</td>
</tr>
<tr>
<td>Significant Public Notice</td>
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</tbody>
</table>
## I-5: Willamette River (Boone) Bridge - Woodburn

Temporary Concrete Barrier – Full Length

Added Cost + $668,000

<table>
<thead>
<tr>
<th>Total Duration 9 weeks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 weeks</td>
<td>Set/Move Barrier</td>
</tr>
<tr>
<td>2 weeks</td>
<td>Bridges/Ramps</td>
</tr>
<tr>
<td>2 weeks</td>
<td>I-5 Paving</td>
</tr>
<tr>
<td>1 week</td>
<td>Striping</td>
</tr>
<tr>
<td>1 week</td>
<td>Expansion Joints</td>
</tr>
</tbody>
</table>
### All Work

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day and Night</strong></td>
<td>2 Lanes Open 4.5 weeks per side</td>
</tr>
<tr>
<td><strong>Daytime Traffic Impacts</strong></td>
<td>Public Outreach is <strong>Critical</strong></td>
</tr>
<tr>
<td><strong>24-hr Work Window</strong></td>
<td>20-hrs Paving (2 shifts)</td>
</tr>
<tr>
<td><strong>Estimated</strong></td>
<td>6,000 tons/day</td>
</tr>
</tbody>
</table>
I-5: Willamette River (Boone) Bridge - Woodburn

Temporary Concrete Barrier - Full Length

• Improved Work Zone Safety
• Improved Efficiency/Quality
  – Extended Work Windows
  – Fewer Transverse Joints
• Increased Trucking
Moveable “Zipper” Barrier
Moveable “Zipper” Barrier - Full Length

Full-length Zipper Barrier
- Smart Work Zone
- Law Enforcement
- 24-hr Lane Closure
- TMA/VMS/PCMS/etc.
- Daily Safety / Debrief Meetings
- Significant Public Notice
I-5: Willamette River (Boone) Bridge - Woodburn

Moveable “Zipper” Barrier – Full Length
Added Cost +$2,162,000

<table>
<thead>
<tr>
<th>Total Duration 11 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Weeks</td>
</tr>
<tr>
<td>5 Weeks</td>
</tr>
<tr>
<td>1 Week</td>
</tr>
<tr>
<td>2 Weeks</td>
</tr>
</tbody>
</table>
# I-5: Willamette River (Boone) Bridge - Woodburn

**Moveable “Zipper” Barrier – Full Length**

<table>
<thead>
<tr>
<th>All Work (Except Paving)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
</tr>
<tr>
<td>All Lanes Open</td>
</tr>
<tr>
<td><strong>Night</strong></td>
</tr>
<tr>
<td>1 Lane Open (4.5 weeks per side)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Paving</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day and Night</strong></td>
</tr>
<tr>
<td>2 Lanes Open (1 week per side)</td>
</tr>
</tbody>
</table>
I-5: Willamette River (Boone) Bridge - Woodburn

Moveable “Zipper” Barrier – Full Length

- **Daytime Traffic Impacts**
  - Public Outreach is Critical

- **Work Windows**
  - 8-hr Advance Night Work
  - 20-hrs Paving (2 shifts)

- Estimated 6,000 tons/day
I-5: Willamette River (Boone) Bridge - Woodburn
Moveable “Zipper” Barrier – Full Length

- Improved Work Zone Safety
- Improved Efficiency Quality (Fewer Transverse Joints)
- Increased Trucking
Total Closure
I-5: Willamette River (Boone) Bridge - Woodburn

Total Closure

- Reduced Cost - $1,333,000
- Total Duration 6-8 Work Days
  - 3-4 Day Closure NB
  - 3-4 Day Closure SB
- 24-hr Work Windows
  - 20-hrs paving (2 shifts)
- Estimated 10,000 tons/day
I-5: Willamette River (Boone) Bridge - Woodburn

Total Closure

- Complete Separation of Workers and Traffic
- Eliminates Transverse Joints
- Optimal Placement of Longitudinal Joints
- Resource Intensive
- Traffic Impacts
  - Extensive Public Outreach
<table>
<thead>
<tr>
<th></th>
<th>As-Built (Baseline)</th>
<th>Temporary Concrete Barrier</th>
<th>Moveable “Zipper” Barrier</th>
<th>Total Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Impact</strong></td>
<td>$0</td>
<td>+ 8% ($668K)</td>
<td>+ 26% ($2.2M)</td>
<td>-16% ($1.3M)</td>
</tr>
<tr>
<td><strong>Project Duration</strong></td>
<td>21 Weeks</td>
<td>9 Weeks</td>
<td>11 Weeks</td>
<td>1.5 Weeks</td>
</tr>
<tr>
<td><strong>Lane Restrictions</strong></td>
<td>21 Weeks Nighttime Lane Closures</td>
<td>9 Weeks 24-hr Lane Closures</td>
<td>9 Weeks Nighttime Lane Closures 2 Weeks 24-hr Lane Closures</td>
<td>6-8 Days of Re-routed Traffic</td>
</tr>
<tr>
<td><strong>Traffic Impacts</strong></td>
<td>Daytime open. Nighttime up to 1-hr delay</td>
<td>Increased Daytime delays. Reduced Nighttime delays. Extensive Public Outreach is Required</td>
<td>Highest Impact, Shortest Duration, Extensive Outreach</td>
<td></td>
</tr>
<tr>
<td><strong>Worker/Public Safety</strong></td>
<td>High traffic exposure</td>
<td>Reduced traffic exposure, positive worker protection, Clear Delineation</td>
<td>Complete Separation</td>
<td></td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>39 transverse joints, short paving windows</td>
<td>Less transverse joints, more consistent paving, daytime paving.</td>
<td>Allows Continuous Operations (Best)</td>
<td></td>
</tr>
</tbody>
</table>
Traffic Control Plans - Design Constraints

Lane Restrictions → Work Windows
- Highway Capacity - Can it be supported?
  - Urban and Rural environments
- Freight Mobility
  - Keep freight moving
- Delay Tolerances
  - Project-level Delay
  - Highway Segment-level Delay
  - Corridor/Regional Delay
Traffic Control Plans - Design Constraints

Site Conditions – Available Physical Width

• Number of Lanes
• Shoulder Width
• Bridge Widths
• Freight Mobility
  – Annual Permits vs. Oversize loads

Alternate Routes

• Availability
• Design Vehicle accommodation
Construction Schedule
• Contract Completion Date
• Interim Completion Dates for Staging
• Seasonal Completion Dates
  – Paving, striping, in-water work etc.

Traffic Control Plans - Design Constraints
Traffic Control Plans - Design Opportunities

ODOT Work Zone Decision Tree - Use to Evaluate
• Positive Separation opportunities
• Traffic Control Measures (TCM)

Considerations for TCM Selection
• Safety – Workers and Public Traffic
• Mobility and Accessibility
• Road User Delay
• Scope, Schedule and Budget
Traffic Control Plans - Design Opportunities

Positive Separation Measures

• Concrete Barrier
• Steel Barrier
• Moveable “Zipper” Barrier
• Mobile Barrier (Short-duration)
• Lateral Buffer Space (e.g. Closed lanes)
• Full Closure / Directional Closure
• Crossovers / On-site Diversions
Traffic Control Plans - Design Opportunities

Speed Control Measures
• Temp. Speed Zone Reductions
• OT Law Enforcement
• Radar Speed Trailers
• Roller-mounted PCMS
• Smart Work Zone Systems
  – Queue Detection, Travel Time, Construction Vehicle Ingress Warning
Traffic Control Plans - Design Opportunities

Speed Control Measures
• Temporary Transverse Rumble Strips
• Rolling Slow-downs
  – For TCD Set-up / Take-down
  – Standard Detail and Special Provision language available
Traffic Control Plans - Design Opportunities

Public Outreach
- Social Media and Print Media
- ODOT’s “Tripcheck” website
- ODOT Region Project websites
- Radio and TV
- Changeable Message Boards
  - Temporary – PCMS
  - Permanent – VMS
Connected & Automated Vehicles (CAV)

- Dependent on striping for lane detection and vehicle guidance
  - Temporary markings for stage construction become very important
- What about lane closures that only use Drums/Cones!? 
- Need for “Connected” Traffic Control Devices
  - Devices communicate through Waze, Here, TomTom
  - Alert drivers when Work Zone active, lane closures, etc.
  > Arrow Boards, PCMS
  > Flagger STOP/SLOW paddles
  > Variable Speed Limit (VSL) signs
The best work zone design and traffic management plan will maintain safety and mobility ... a balance that shall be analyzed continuously throughout the lifecycle of the project.”

Oregon Work Zone Safety Executive Steering Committee

ODOT Work Zone Traffic Control website

www.oregon.gov/ODOT/Engineering/Pages/Work-Zone.aspx
ODOT Work Zone Safety Goal

“Our work zone safety goal is zero fatalities and injuries, including ODOT employees, contractors, public safety professionals and the traveling public while efficiently moving people and goods.”

Oregon Work Zone Safety Executive Steering Committee

ODOT Work Zone Traffic Control website

www.oregon.gov/ODOT/Engineering/Pages/Work-Zone.aspx
Next Steps

• WZ Pilot Selection Team 2018-2019 Projects
• Analyze Data/Lessons Learned
• Develop Criteria/Perform. Requirements
• ODOT/Industry Staging Meetings
Questions ?