Review of Navigational Clearances
Additional Considerations

Horizontal Navigational Width

Proposed Bridge Alignment
Additional Considerations

Horizontal Navigational Width

Proposed Bridge Alignment
Additional Considerations: Willamette River Transit Bridge  WRBAC Meeting 10.08.08

Horizontal Navigational Width

Proposed Bridge Alignment
Additional Considerations

Horizontal Navigational Width

Proposed Bridge Alignment
Additional Considerations

Horizontal Navigational Width
Additional Considerations

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Horizontal Navigational Width

680’ Span = 600’ clear
Investigations since 9.16.08 WRBAC meeting

- Independent Experts
  - Robert Sanders, Admiralty Attorney
  - Captain Steven Brown
- Tug and barge simulation
- Ross Island field trip
- US Coast Guard – Bridge Administrator Austin Pratt discussions
- Willamette River Harbor Safety Committee meeting
Independent Expert - Robert Sanders

- Graduate US Merchant Marine Academy
- Officer on ocean going vessels
- Attorney with Wood Tatum
  - Involved in all ocean going vessel casualties investigations involving Willamette River Bridges – 1970 to present
Independent Expert - Captain Steven Brown

- Recently retired Columbia River Pilot
- Numerous years of experience on both Columbia and Willamette Rivers
- Extensive experience in with tug/barges in Willamette River between Ross Island and Marquam bridges
Ross Island Sand and Gravel

• Existing
  – Ross Isle tug (59’) plus two 195’ barges = 449’ long and 40’ to 80’ wide – 4,500 tons
  – Dauby tug (84’) plus two barges (250’ + 244’) = 574 long by 80’ wide – 8,000 tons

• Future
  – Future Columbia River tows could be 675’ long and 80’ wide
  – Ocean going tugs/barge could be 550’ long and 100’ wide 15,000 tons
• Tug and Barge Simulation
  – Tug/barge path developed by TriMet
    • Based on video from Dauby tug and input from boat operators
    • Reviewed by Captain Steven Brown
  – Newlands and Company 3d model
Draft Environmental Impact Statement
Locally Preferred Alternative
Bridge alignment decision
July 2008

WRBAC Process
Many bridge types to promising few
Summer/Fall 2008

Public process on promising bridge types
Winter/Spring 2009

Final Environmental Impact Statement (FEIS)
Biological Assessment
Winter/Spring 2009 to Jan 2010*

Record of Decision (ROD)
April 2010*

Coast Guard Investigates the potential bridge and develops a "Finding of Fact" report with a recommendation to the Coast Guard Headquarters. Headquarters can approve or deny the permit. Based on reasonable navigational needs.
Summer 2010*

* subject to change based on Biological Assessment lengthy review process
“Some” Bridge Types

Length of Main Span to Budget

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Length (ft)</th>
<th>Clear Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Segmental</td>
<td>550</td>
<td>470</td>
</tr>
<tr>
<td>Wave Frame</td>
<td>680</td>
<td>600</td>
</tr>
<tr>
<td>Tied Arch</td>
<td>750</td>
<td>670</td>
</tr>
<tr>
<td>Through Arch</td>
<td>680</td>
<td>600</td>
</tr>
<tr>
<td>Extradosed</td>
<td>600</td>
<td>520</td>
</tr>
<tr>
<td>Cable Stayed</td>
<td>882</td>
<td>800</td>
</tr>
</tbody>
</table>
• Observations
  – Span length near 680’ appear “reasonable” (600’ clear)
  – Concrete segmental can be stretched to 550’ span (470’ clear) before cost would exceed cost other bridge types.
    • Very thick deck
    • Placement of piers in shallow water
    • Permitting risk
    • Aesthetics?
• Environmental Issues
  – Hazardous materials
    • In-water sediment and proposed cap
  – Fish and wildlife habitat
    • NOAA fisheries – biological assessment
    • BES
    • Placement of in-water piers
• Pier placement
  – Order of environmental preference
    • No piers
    • Deep water (greater than 20’ depth*)
    • On bank above Ordinary High Water
    • Shallow water (less than 20’ depth)
    • Active water edge
  – Criteria added to reflect concerns

*as measured from low water Columbia River Datum
“Many Bridges”

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1. Steel I-Girder

2. Steel Box

3. Concrete Segmental Box

4. Wave Frame Girder
5. Sail Blade Girder

6. Tied Arch

7. Continuous Through Arch

8. Cable Stayed Extradosed
9. Cable Stayed

10. Movable
   Swing – Hi/Low

11. Movable
   Vertical Lift – Hi/Low

12. Double Deck
   I-Girder/Composite
### “Some” Bridge Types

**Length of Main Span to Budget**

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</table>
Wave Frame

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Elevation

Plan
Wave Frame

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Tower Elevation

Foundation Plan

Cross Section
Through Arch

Elevation

Plan
Through Arch

Foundation Plan

Tower Elevation

Cross Section
Cable Stayed - 4

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Elevation

Plan
Cable Stayed - 4

Foundation Plan

Tower Elevation

Cross Section
Cable Stayed - 2

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Elevation

Plan
“Some” Bridge Types

Current Bridge Concepts

Concrete Segmental - 550’-0”
(470’ clear)

Wave Frame - 680’-0”
(600’ clear)

Tied Arch - 680’-0”
(600’ clear)

Through Arch - 680’-0”
(600’ clear)

Cable Stayed – 4 Pier - 795’-0”
(715’ clear)

Cable Stayed – 2 Pier - 860’-0”
(780’ clear)
Height Comparison

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1. Tram Tower 195'-6"
2. Concrete Segmented 100'-0"
3. Wave Frame 120'-0"
4. Tied Arch 223'-0"
5. Through Arch 180'-0"
6. Cable Stayed - 4 250'-0"
7. Cable Stayed - 2 270'-0"

0'- 0"  50'- 0"  100'- 0"  150'- 0"  200'- 0"  250'- 0"  300'- 0"
Concrete Segmental  Willamette River Transit Bridge  WRBAC Meeting 10.08.08

Examples
Tied Arch

Examples
Wave Frame

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Wave Frame

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Through Arch

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Through Arch

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Through Arch  Willamette River Transit Bridge  WRBAC Meeting 10.08.08
View Comparison

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East Abutment

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Pier Study

Wave Frame  Tied Arch
East Abutment  

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Pier Study

Cable Stayed – 4 Pier  
Cable Stayed – 2 Pier
View Comparison

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View Comparison  Willamette River Transit Bridge  WRBAC Meeting 10.08.08
Engineering, Cost and Constructability Studies
Engineering Studies

- Evaluate structural performance of options
- Define construction sequence
- Create computer models
- Analyze for service loads
- Analyze for seismic loads
Cable Stayed – 4

Tower Model

254’
This slide includes animation that shows how this bridge type would react to different stress during a seismic event. This animation file could not be linked to this site.

Mass Participation = 54.9%
Transverse Direction
Period = 3.87 seconds
This slide includes animation that shows how this bridge type would react to different stress during a seismic event. This animation file could not be linked to this site.

Mass Participation = 21.1%
Vertical Direction
Period = 1.63 seconds
This slide includes animation that shows how this bridge type would react to different stress during a seismic event. This animation file could not be linked to this site.

Mass Participation = 58.9%
Longitudinal Direction
Period = 0.62 seconds
Cost and Constructability Studies

- Determine member sizes and quantities
- National Constructors Group
  - Cost bases
  - Cost certainty
  - Constructability review
  - Contractor’s risk assessment
Evaluation Criteria

Prior Criteria
Cost

- Initial cost
- Cost escalation risk
- Constructability/schedule risk
- Life cycle cost/maintenance
Evaluation Criteria

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Fundamental Performance

- Number, location and size of piers
- Seismic performance
- Modal optimization of section
- Transit performance
- Navigational performance (width and vertical)
Evaluation Criteria

Architectural – Urban Design

Architectural

- Looking at the bridge – proportion and scale
- Being near the bridge – experience on greenway, walkways and river
- Being on the bridge – experience crossing the river
Urban Context

- Portland core values, traditions and symbolism
- Compatibility with existing context, fabric and adjacent bridges
- Reflection of current technology and innovation
Evaluation Criteria

Proposed Supplemental Criteria
Risk

- Cost escalation risk
- Design risk
- Constructability risk
- Schedule risk
- In-water construction work risk
Greenway

- Depth of span over greenway (vertical clearance)
- Width of span over greenway
- Length of span at greenway (column to abutment)
- Greenway trail user experience
- Flexibility for future greenway connection
Environmental – Sustainability

- Carbon footprint
- Resource use – availability of local materials
- Environmental impacts during construction
- Piers in or near known contaminated media
Bridge Operations

- Line of sight between modes
- OCS integration - complexity
- Emergency response on bridge
- Access for bi-annual inspections
Miscellaneous

- Utility duct bank integration
- Pier proximity to existing subsurface utilities
- Navigational maneuvering
Opportunities

- Ability to treat stormwater on bridge
- Addition of wildlife habitat on/under bridge
- Additional fish habitat near bridge
- Habitat enhancement on land
- Incorporate alternative energy
Thank you