Bridge Type Selection
And Engineering Overview
"When the history of our time is written, posterity will know us not by a cathedral or temple, but by a bridge."

- Montgomery Schuyler, 1877
writing about the Brooklyn Bridge
Bridges & Society
# Typical Bridge Process

<table>
<thead>
<tr>
<th>Stakeholder/Community Input</th>
<th>NEPA EIS &amp; Location Study</th>
<th>Preliminary Design</th>
<th>Final Design</th>
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<td>Preferred Alignment/Location</td>
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<td>ROD</td>
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- Stakeholder/Community Input
- Public Hearings
- Preferred Alignment/Location
- ROD
- Bridge Type Study
- Bridge Design

[Diagram showing the process with colored bars indicating the stages of NEPA, Preliminary Design, and Final Design with respect to each activity.]
Bridge Design Process

1. Design Surveys
2. Alignment Concepts
3. Bridge Concepts
4. Geotechnical Investigation
5. Hydraulic Design
6. Preliminary Alignment
7. Identify Potential Bridge Types
8. EIS / Agency Review & Approval ROD
9. Preliminary Bridge Design
10. Structural Design
11. Plan Preparation
12. Construction
Typical Bridge Type Selection Process

Identify Potential Bridge Types for Each Alignment

Screen
- Preliminary Design
- Quantities
- Cost Estimates
- Construction Costs

Screen

Possible Bridge Types

Screening Criteria
- Engineering Constraints
- Aesthetics
- Contextual Integration
- Costs
- Environmental Impacts
- Agency Input
- Stakeholder Input

Feasible Bridge Types

Selected Bridge Types

Typical Bridge Type Selection Process
Screening of Alternatives
Girder Bridges

Abernethy Bridge, 1970 – Steel Haunched Girder
Girder Bridges
Girder Bridges

- Steel or Concrete
- I-Girders or Box Girders
- Easy to fabricate
- Easy to erect
- Replaceable slab
- Redundancy
- Unobstructed motorist view
- Longer spans require deeper sections
- Longer spans may require temporary falsework for erection
- Easy to widen in the future
Segmental Concrete
Segmental Concrete Bridges

- Cast-in-Place vs. Precast
- Erected in segments without falsework
- Balanced Cantilever vs. Span by Span
- Durability and maintenance
- Deck integral with structure
- Efficient for long spans/bridge lengths
- Difficult to widen in the future
Truss Bridges
Truss Bridges

Marquam Br. (1966) - Deck Truss

Sellwood Br. (1925) - Deck Truss

Broadway Br. (1913) - Through Truss (double-leaf bascule center span)
Truss Bridges
Truss Bridges

- Economical for longer spans vs. Girder Bridges
- Thru Truss vs. Deck Truss
- Prevalent for Oregon crossings 1920s-1930s
- Thru truss allows reduced section under the deck
- Potentially higher maintenance and inspection costs
- Difficult to widen in the future
Arch Bridges
Arch Bridges

Ross Island Br. (1926) - Deck Trussed Arch

Fremont Br. (1973) - Continuous Through Arch

Sauvie Island Br. (200?) - Tied Arch (behind)

Portland – Milwaukie LIGHT RAIL PROJECT
Arch Bridges
Arch Bridges

- Thru Arch vs. Deck Arch
- True (Thrust) Arch vs. Tied Arch
- Steel vs. Concrete
- Foundation Requirements
- Erection: Tiebacks, Float-in
- Replaceable Deck
- Difficult to widen in the future
Cable-Stayed Bridges
Cable-Stayed Bridges
Cable-Stayed Bridges

• Successor to the suspension bridge for spans up to 2000-ft
• Greater stiffness
• Steel vs. Concrete
• Roadway deck integral to structure
• Cantilevered construction helps environmental impacts
• Difficult to widen in the future
Suspension Bridges

St. Johns Bridge (1931) – Suspension Bridge
Suspension Bridges
Suspension Bridges

- Economical for long spans over 2000-ft
- Efficient use of material
- Well known construction method
- Highest cost among cable-supported bridges
- Susceptible to dynamic vibrations
- Higher maintenance and inspection costs
- Difficult to widen in the future
Moveable Bridges
Moveable Bridges

- Broadway Bridge (1913) – Double Leaf Bascule
- Burnside Bridge (1926) – Double Leaf Bascule
- Morrison Bridge (1958) – Double Leaf Bascule
- Steel Bridge (1912) – Vertical Lift Bridge
Moveable Bridges

Hawthorne Bridge (1910) – Vertical Lift Bridge
Moveable Bridges
Movable Bridges

• Low rise bridge shortens the overall crossing length
• Well known bridge type
• Difficult to achieve desired bridge aesthetics
• Marine traffic typically has priority over bridge traffic
• Higher maintenance and inspection costs
• Difficult to widen in the future
• Poor seismic performance