

COST ESTIMATE
MEMORANDUM



To
Sean Batty, ASLA
TriMet

From
Semyon Treyger, PE SE
HNTB Corporation

Project
Willamette River Transit Bridge

Cc

Subject
Cost Estimate Assumptions

Date
10/30/2008

The following memorandum has been prepared to document the inclusions and exclusions assumed in the preliminary estimates of probably construction cost for the Willamette River Transit Bridge. These estimates have been developed based on the preliminary design drawings for the work included in the bridge design-build contract. This includes work from abutment to abutment and assumes unit prices as of January 2009. The bid items include all equipment, materials, labor, preparation, and quality control testing to complete the particular work element.

Specific aspects included within the estimate are:

- Hazardous material disposal – assumes handling, testing and disposal as hazardous waste of all structure excavation and drilling spoils in the upper 10' of soils removed from abutment 1, pier 2, and tower 3;
- Lighting – includes poles, conduit, junction boxes, and wire for pedestrian, trackway, and navigational lighting;
- Superstructure concrete – deck, floor-beams, edge beams, anchorages including falsework, formwork, work temporary supports, blockouts for rail and second pour concrete, finishing and painting;
- Superstructure steel-arch ribs, stiffening girder, hangers, floorbeams; stay cables and anchorages;
- Post-tensioning – including strands or bar, tensioning, and testing;
- Structure excavation – includes excavation and disposal (except hazardous materials);
- Cofferdam – installation, sealing, dewatering, and removal assuming drilled shafts;
- Drilled shafts – includes barge mobilization, drilling, temporary casing, concrete, reinforcing steel, and testing;
- Tower concrete – includes tower, pile cap, cross-beam, work platforms, falsework, formwork, temporary supports, finishing, painting, and waterproofing;
- Tower steel - includes steel anchor head for stay cables;

- End pier concrete – includes bent cap, columns, falsework and formwork, finishing and painting;
- Abutment concrete – includes wingwalls, formwork, finishing and painting;
- Miscellaneous bridge appurtenances – includes utility blockouts, hangers, conduit, and signs;
- Deck drains – decks drains and storm sewer pipe;
- Stay cables – includes tensioning; and
- Steel Reinforcement – Includes the following estimated reinforcement quantities:
 - Abutment Concrete: 100 lbs/cy
 - Bent 2 & 5 Columns: 300 lbs/cy
 - Bent 2 & 5 Bent Cap: 150 lbs/cy
 - Towers: 340 lbs/cy
 - Tower Pile Caps: 100 lbs/cy
 - Superstructure Concrete: 150 lbs/cy
- Contingencies – Includes typical minor bridge costs not identified above including:
 - Contractor's management and administration
 - Temporary in-water access
 - Temporary drainage
 - Fish salvage
 - Erosion / sediment control
 - Work containment plan & system
 - Quality control & testing
 - Construction surveying
 - Pavement striping.

Costs which are not included in the estimate are:

- Construction cost escalation;
- Pier protection;
- Overhead catenary poles, wires, and electrical system;
- LRT track, rail, connections, and second pour concrete for track;
- Aesthetic lighting;
- Environmental monitoring and mitigation;
- Utility monitoring, relocation, or new on-structure utilities;
- General embankment, retaining walls, end panels, and pavement at the bridge approaches;
- Storm water detention or treatment;
- Stray current mitigation;
- Scour protection;
- Ground improvements / lateral spreading mitigation;
- Accent/Architectural illumination systems;
- Provisions for art;
- Final design costs for the design-builder's engineer (assumed at 6-8% of construction cost);
- Final design review costs for TriMet's consultant (assumed at 3-4% of construction cost);
- Owner's construction engineering, inspection, management, and quality assurance (assumed 10-12% of construction cost);

- Review of contractor's submittals, shop drawings, erection manual, etc by TriMet's consultant (assumed 3-4% of construction cost);
- Owner's cost; and
- Owner's contingencies.

Data Entry for 10/28/08 Working Group Meeting



| Consultant Team - TriMet Ranking | | | | | |
|----------------------------------|-----|-----|-----|--------------|--------------|
| Bridge Types ("Some" to "Few") | | | | | |
| 10/28/2008 | | | | | |
| Code | 4 | 6 | 7 | 8 | 9 |
| Wave frame | | | | Cable Stay'd | Cable Stay'd |
| Center-to-center Span Width | 680 | 680 | 680 | 795 | 860 |

| Screening Criteria ("Some" to "Few") | | Scores range from 1 to 5: 5 = best, 3 = neutral, 1 = worst | | | | | |
|--------------------------------------|--|--|-------------|-------------|-------------|-------------|---|
| Cost | | 3.00 | 1.00 | 2.00 | 4.00 | 4.00 | Cost Category Averages |
| | Initial cost | TBD | TBD | TBD | TBD | TBD | Lower anticipated bid cost = better |
| | Life cycle cost - Maintenance | 3 | 1 | 2 | 4 | 4 | Concrete = better, Steel = worse |
| Risk | | 3.36 | 2.09 | 1.55 | 3.82 | 3.82 | Risk Category Averages |
| | Cost escalation risk (Superstructure) | 3 | 1 | 2 | 4 | 5 | More concrete = better, More steel = worse |
| | Foundations - Geotechnical | 3 | 1 | 1 | 3 | 3 | Bigger = higher risk, distance from bore holes |
| | Design risk | 3 | 2 | 1 | 4 | 5 | More common = better |
| | Bid risk | 1 | 5 | 2 | 4 | 4 | More uncommon = added cost = worse |
| | Schedule risk | 2 | 2 | 3 | 5 | 5 | Fabrication and erection |
| | In-water construction risk | 5 | 2 | 1 | 4 | 3 | Fewer pier and smallest piers in water = better |
| | Navigational Permitting - horizontal clearance | 3 | 2 | 1 | 4 | 5 | Wider = better |
| | Navigational Permitting - vertical clearance | 4 | 1 | 1 | 5 | 3 | Thinner deck = better |
| | Navigational Permitting - maneuvering | 5 | 2 | 1 | 4 | 3 | Piers further from PDX Spirit dock= better |
| | Bridge width over shallow water | 3 | 3 | 3 | 1 | 3 | Verify with NOAA |
| | Permitting risk (In-water Environmental) | 5 | 2 | 1 | 4 | 3 | Piers in shallow water = worse |
| Fundamental Performance | | 3.67 | 3.17 | 2.83 | 3.00 | 3.00 | Fundamental Performance Category Averages |
| | Total number of piers | 3 | 3 | 3 | 3 | 5 | Fewer better |
| | Location of piers | 5 | 4 | 3 | 2 | 1 | Less square foot in least sensitive area= better (verify when size information available) |
| | Size of piers | 5 | 4 | 3 | 1 | 2 | Smaller is better |
| | Seismic performance | 3 | 2 | 2 | 5 | 5 | More flexible = better |
| | Modal optimization of section | 3 | 3 | 3 | 5 | 3 | Structure below deck or at sides = better |
| | User comfort - deflection/vibration | 3 | 3 | 3 | 2 | 2 | Less deflection/sway/vibration = better |
| Architectural | | 4.67 | 1.33 | 3.33 | 2.33 | 3.33 | Architectural Category Averages |
| | Looking at the bridge - proportion and scale | 5 | 1 | 4 | 3 | 2 | |
| | Being near the bridge - experience on greenway, walks and river | 4 | 1 | 2 | 3 | 5 | |
| | Being on the bridge - experience crossing the river | 5 | 2 | 4 | 1 | 3 | |
| Urban Context | | 5.00 | 1.00 | 2.00 | 3.33 | 3.33 | Urban Context Category Averages |
| | Portland core values, traditions and symbolism | 5 | 1 | 2 | 4 | 3 | |
| | Compatibility with existing context, fabric and adjacent bridges | 5 | 1 | 2 | 3 | 4 | |
| | Reflection of current technology and innovation | 5 | 1 | 2 | 3 | 3 | |

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|---------------------------------------|--|--|---------------|---------------|---------------|---------------|--|
| Greenway | | 3.50 | 2.25 | 2.00 | 2.75 | 4.00 | Greenway Category Averages |
| | Depth of span over greenway (vertical clearance) | 4 | 1 | 1 | 5 | 3 | Thinner deck = better |
| | Bridge width over greenway | 3 | 3 | 3 | 1 | 3 | Narrower = better |
| | Length of span over greenway (distance column to abutment) | 2 | 4 | 3 | 1 | 5 | Greater span width = better |
| | Greenway trail user experience | 5 | 1 | 1 | 4 | 5 | Sense of space, illumination, detailing |
| Environmental - Sustainability | | 4.00 | 1.33 | 1.33 | 4.00 | 4.33 | Environmental Category Averages |
| | Environmental impacts during construction | 4 | 1 | 1 | 4 | 5 | Staging, false work, piers in sensitive areas = worse |
| | Resource use - availability of local material | 3 | 1 | 2 | 4 | 5 | Local is better = concrete |
| | In-water piers in or near proposed contaminated media cap | 5 | 2 | 1 | 4 | 3 | Pier in these areas in-water = worse |
| Bridge Operations | | 2.40 | 2.80 | 3.60 | 4.40 | 2.00 | Bridge Operations Category Averages |
| | Line of sight between modes | 2 | 3 | 4 | 5 | 2 | Clear line of sight = better |
| | OCS integration - complexity | 2 | 3 | 3 | 5 | 1 | Structure below deck or at sides = better |
| | Emergency response on bridge | 2 | 3 | 4 | 5 | 2 | Structure below deck or at sides = better |
| | Extent of inspection | 1 | 2 | 3 | 5 | 4 | |
| | Access for inspections | 5 | 3 | 4 | 2 | 1 | Structure on sides or below = worse, Taller structures = worse |
| Miscellaneous | | 4.50 | 2.50 | 2.25 | 3.25 | 2.25 | Miscellaneous Category Averages |
| | Utility duct bank integration | 5 | 3 | 3 | 1 | 3 | Concealed = better, Exposed = worse |
| | Pier proximity to existing subsurface utilities | 5 | 1 | 1 | 3 | 2 | Piers further from water/gas mains = better |
| | Accommodates asymmetric loading | 3 | 3 | 3 | 5 | 3 | |
| | Accommodation of curved greenway spans | 5 | 3 | 2 | 4 | 1 | Highest cost per SF ABOVE greenway span = worst |
| Opportunity | | 3.00 | 3.00 | 3.00 | 4.00 | 3.25 | Opportunity Category Averages |
| | Ability to treat stormwater on bridge | 3 | 3 | 3 | 5 | 3 | Deck flexibility for location of treatment |
| | Additional wildlife habitat on/under bridge | 1 | 3 | 3 | 5 | 5 | Bats under bridge |
| | Additional fish habitat near bridge | 5 | 3 | 3 | 4 | 3 | Bridge pier near active edge = opportunity to improve habitat |
| | Habitat enhancements at staging site | 3 | 3 | 3 | 2 | 2 | Restoration of staging areas = large better |
| | Incorporate alternative energy | 3 | 3 | 3 | 3 | 3 | |
| Total Score | | 162.00 | 102.00 | 106.00 | 158.00 | 148.00 | Number of criteria Scored |
| Rank | | 1 | 5 | 4 | 2 | 3 | 45 |
| Percentage spread - highest to lowest | | 100.0% | 63.0% | 65.4% | 97.5% | 91.4% | |

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|--------------------------------------|---------------------------------------|--|---------------|---------------|---------------|---------------|
| Weight | Category | 4 | 6 | 7 | 8 | 9 |
| 15.00 | Cost | 45.00 | 15.00 | 30.00 | 60.00 | 60.00 |
| 15.00 | Risk | 50.45 | 31.36 | 23.18 | 57.27 | 57.27 |
| 15.00 | Fundamental Performance | 55.00 | 47.50 | 42.50 | 45.00 | 45.00 |
| 10.00 | Architectural | 46.67 | 13.33 | 33.33 | 23.33 | 33.33 |
| 10.00 | Urban Context | 50.00 | 10.00 | 20.00 | 33.33 | 33.33 |
| 10.00 | Greenway | 35.00 | 22.50 | 20.00 | 27.50 | 40.00 |
| 10.00 | Environmental - Sustainability | 40.00 | 13.33 | 13.33 | 40.00 | 43.33 |
| 10.00 | Bridge Operations | 24.00 | 28.00 | 36.00 | 44.00 | 20.00 |
| 3.00 | Miscellaneous | 13.50 | 7.50 | 6.75 | 9.75 | 6.75 |
| 2.00 | Opportunity | 6.00 | 6.00 | 6.00 | 8.00 | 6.50 |
| 100.00 | Total Weighted Score | 365.62 | 194.53 | 231.10 | 348.19 | 345.52 |
| | Rank | 1 | 5 | 4 | 2 | 3 |
| | Percentage spread - highest to lowest | 100.0% | 53.2% | 63.2% | 95.2% | 94.5% |
| | | 0.0% | 9.8% | 2.2% | 2.3% | -3.1% |

Highest Score per category

- 60.00
- 57.27
- 55.00
- 46.67
- 50.00
- 40.00
- 43.33
- 44.00
- 13.50
- 8.00