SR 520 Pontoon Construction

July 28, 2011

Aberdeen, WA
• Most of images and graphics provided by Kiewit—General but reformatted a bit.
• Images supplemented by J. Mahoney via July 28, 2011 site visit. All notes by JPM.
• Importantly, many thanks to Meagan McGrew along with her terrific Kiewit associates for the site visit arrangements.
Topics

• Introduction
• Casting Basin Construction
• Site Visit Views on July 28, 2011
• Pontoon Construction (as planned)
• Miscellaneous Project Information
Introduction
Project Management

• Phil Wallace, Project Director
• Cody Bishop, Contract Administrator
• Jeff Billows, Senior Project Engineer
Owner: Washington State Department of Transportation (WSDOT)

Contractor: Kiewit-General, a Joint Venture

Partners: Kiewit Bridge & Marine District, Sponsoring District (85%); Northwest District (12%); KECO (3%)

Contract Value: $367,330,000

Contract Model: Design-Build for the Casting Basin; Bid-Build for the Pontoon Construction

Pontoon Design: WSDOT Bridge & Structures Office
# SR 520 Bid Results

**SR 520 Pontoont Construction Design-Build Project**

**Best Value Determination 4.5.1**

**Best Value Determination Equation**

<table>
<thead>
<tr>
<th>Where</th>
<th>ABV</th>
<th>$P$</th>
<th>$TC$</th>
<th>Proposal Price $SP$</th>
<th>Apparent Best Value</th>
<th>Assigned Technical Credits</th>
<th>PROPOSER NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABV</td>
<td>$P$</td>
<td>$TC$</td>
<td>$SP$</td>
<td></td>
<td>$392,795,400$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>419,311,000</td>
<td>45,883,000.00</td>
<td>465,194,000.00</td>
<td>Flatiron/Graham/Turner A Joint Venture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-18,093,300</td>
<td>18,504,600.00</td>
<td>411,300.00</td>
<td>Skanska/Mowat/Manson A Joint Venture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>368,350,900</td>
<td>(1,020,900.00)</td>
<td>367,330,000.00</td>
<td>Kiewit-General A Joint Venture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>470,000,000</td>
<td>80,000,000.00</td>
<td>550,000,000.00</td>
<td>Example Calculation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The successful Proposal will be the one calculated to have the lowest Apparent Best Value.

**APPARENT BEST VALUE DESIGN BUILDER**: Skanska/Mowat/Manson A Joint Venture

**APPARENT 2ND BEST VALUE DESIGN BUILDER**: Kiewit-General A Joint Venture

**APPARENT 3RD BEST VALUE DESIGN BUILDER**: Flatiron/Graham/Turner A Joint Venture

*A Price Proposal that exceeds the Upset Amount will be considered nonresponsive and ineligible for award!*

**Upset Amount:** $392,795,400
520 Bridge Floating Bridge Replacement

- Portage Bay Bridge replacement
- West approach replacement
- Montlake interchange improvements, including Montlake Cut crossing expansion
- Floating bridge replacement
- East approach replacement
- I-5 interchange improvements

University District
Seattle
Medina
Pontoon Casting Project Location

Potential locations of the Pontoon Construction Project

Preferred alternative site

Location for the Advanced Construction Methods and Engineering effort

A.C.M.E.
Bridge Section

SR 520 bridge pontoon
Test section
120’L x 38’W x 28.5’H

120 feet
28.5 feet

38 feet
75 feet
160 feet

Not to scale
SR 520 Bridge Pontoon Configuration

Kiewit General Contract is to build the Blue Pontoons
Casting Basin Layout
Casting Basin Layout
17,000 CY of concrete will be required to complete the 33 pontoons.
Crane Service for Pontoons

Pontoon

El. -9.00

El. 16.00
Design Subcontractors:  HNTB, Prime Designer  
                        KPFF, Casting Basin Structural  
                        Shannon & Wilson, Geotechnical  
                        Floyd Snider, Environmental  
                        Columbia Sentinel, Naval Architect  

Construction Subcontractors:  Pacific Coast Steel, Rebar  
                              Grady Excavating, Trucking and Materials  
                              Cal Portland, Batch Plant Concrete Redi-Mix  
                              Farrow Construction, Casting Basin Slab  
                              AVAR, Post Tensioning  
                              Lakeside, Paving  
                              Sleed Construction, Dewatering  
                              PRR, Public Relations Consultant  

Construction Suppliers:  Jesse Engineering, Gate and Pontoon Metals  
                         Wayron, Casting Basin Piling/Basin Metals  
                         Bay View Concrete, Casting Basin Concrete  
                         Fibergrate, FRP Walkways
Casting Basin Construction
The Site—February 17, 2011
A Wet Site
Pile Driving
Initial 18” diameter piles to support the casting basin slab had a 70 ft. length. These were driven with about 5 ft. remaining (as shown here). Then an additional length of 65 ft. were welded on (total length 135 ft.) and driving continued. Purpose was to drive from the existing surface prior to major excavation given the poor underlying soil conditions.
705—18” piles were driven for the casting slab and jamb.
Hammer used to drive most of pipe piles. Energy per blow range 79,000 to 165,000 ft-lb
Cutting test in progress

Note: Piles were driven to required depth before excavation of the basin—hence required cutting in situ.
Plug and Pull Piles
Drainage System
Drainage Ponds
Required removal of 260,000 CY with a depth of 25 ft.
Excavation at Gate
Permanent Sheet Pile Wall at Gate
Rebar Installation for Base Slab
First Base Slab Pour – July 8, 2011

Slab is 18” thick
First Base Slab Pour – July 8th.
The basin slab requires 12,000 CY of concrete and 2,000 tons of rebar.
Finishing the Slab
Side slope rip rap will key into this wall.
Rip Rap On Slope
Start Crane Beam Falsework
Erect On Site Batch Plant
CAD Rendering – Gate Area
Sill and Jamb work for Gate

Chehalis River
Chehalis River

Temporary Sheet Pile Wall
CAD Rendering – Pre Cast Areas
Additional Site Views
July 28, 2011
Detention Ponds
View to West
Haul road dust control
Assembly and storage of pontoon formwork
Assembly of pontoon formwork
Assembly and storage of pontoon formwork
Note piles for crane rail support
Short wall formwork installation
Short wall formwork removal
Rip rap slope protection
Falsework for gate construction
Pontoon Construction
(as planned)
Keel Slab
Walls
Columns and Caps
Roadway
1. Install bondbreaker and layout pontoons  
2. Set exterior wall forms, inserts, and embeds  
3. Install keel slab and exterior wall rebar  
4. Set precast walls  
5. Pour keel slab  
6. F/P/S (form, pour, strip) interior wall closures  
7. F/P/S exterior walls  
8. F/P/S soffits  
9. Install access, post-tensioning, doors, and hatches  
10. Float out and clean up
Install bondbreaker and layout pontoons

(photos from pontoon construction for Hood Canal Bridge and ACME)
Set exterior wall forms, inserts, and embeds
Set exterior wall forms, inserts, and embeds
Install keel slab and exterior wall rebar
Install keel slab and exterior wall rebar
Set precast walls
Pour keel slab
Form, pour, strip walls
Form, pour, strip soffits/deck
Install access, p-t, doors, and hatches
Formwork Systems

• Unique Challenges
  – Deflection limited to L/1000 or 1/16” each form face
  – Concrete mix has ~ 28” spread (or slump flow test)
  – External vibrators are preferred based on ACME results

• Considered:
  – Manufactured systems
    • Aluma, PERI, DOKA, EFCO, Harsco
  – Job built forms
    • Steel faced with external vibration
    • Wood faced with external vibration
    • Wood faced with internal vibration
Test is a modified ASTM C143 (slump) but first the slump cone is completely filled without consolidation—then the cone is lifted—spread is measured. Other concrete aspects can be measured with this test such as the visual stability index (VSI) and viscosity.
Project Quantities

• Casting Basin Quantities
  – Piling = Casting Basin Slab – 643 Ea 18 inch piles
  – Bulkhead Wall – 77 Ea 24 inch piles
  – Crane Beam – 154 Ea 24 Inch piles
  – Excavation = 280,000 yards - (190,000 yards to stockpile)
  – Concrete = 16,000 cubic yards
  – Rebar = 2,000 Tons
  – Dredging = 82,000 cubic yards

• Pontoon Quantities
  – Concrete - Cast in Place = 91,500 cubic yards
    Pre-Cast = 20,600 cubic yards
  – Rebar = 35,000 Tons
  – Wall Form Work = 2,173,596 square feet
  – Soffit Formwork = 571,562 square feet
Schedule Milestones

• Record of Decision                January 10, 2011
• Permits Received - Start Work     February 17, 2011
• Cycle 1 Pontoons                  April 20, 2012
• Cycle 2 Pontoons                  September 11, 2012
• Cycle 3 Pontoons                  February 7, 2013
• Cycle 4 Pontoons                  July 9, 2013
• Cycle 5 Pontoons                  November 30, 2013
• Cycle 6 Pontoons                  May 7, 2014
• Project Physical Completion       July 6, 2014
• Aberdeen receives about 83” of rainfall/year.
• Piles: 18” diameter with 3/8” wall thickness on 17 ft. centers.
• 640 piles required for casting slab.
• Casting slab 165 ft wide by 18” thick by 910 ft long.
• Typical number of craft personnel on the job each day: 160. Peak employment will be about 300.
• Side slope for the basin is 2.5 to 1 (a bit steep). Rip rap on side slope falls into a 8 to 14” size range.
• Stormwater Management: Discharge of into Chehalis River must be ≤ 25 NTU. Currently discharging at about 6 NTU.
Each pontoon will weigh about 11,000 tons.

This project will construct 33 pontoons. Next contract to be let during August 2011 will construct an additional 44 pontoons (however, the smaller ones).

Kiewit bid for the casting basin design-build contract was about $80 million. Bob Dyer from WSDOT stated that the Kiewit design reduced the casting basin costs by about $100 million based on an earlier WSDOT design.

Pontoons: Post-tensioning longitudinally only. Keel slab thickness is 11” thick and the top slab is 9” thick. Wall slabs taper from 18” thick at the bottom to 16.5” at the top of the pontoon. Pontoon tolerance not to exceed 1/8”.

Recent grad needs: Autocad and design of formwork.