



SR 520 Pontoon Construction Project Project update

Purpose and overview

The below SR 520 Pontoon Construction Project update was prepared by SR 520 Bridge Replacement and HOV Program staff to share with the Office of the State Treasurer. The information within is current as of May 21, 2013.

Key points

- In May 2012, WSDOT encountered concrete spalling damage, defined here as disruptive or bursting concrete cracking caused by post-tensioning forces, and end-wall cracking in four of the first six pontoons constructed during the first pontoon cycle for the new SR 520 floating bridge.
- WSDOT convened an expert review panel, which endorsed modifications to repair spalling and end-wall cracking in those four pontoons.
- When the four cycle 1 pontoons are repaired, the new bridge will meet its required 75-year design life.
- The second cycle of pontoons was recently completed, and included the recommended modifications. These pontoons have not had the issues found in cycle 1.
- We are proceeding through a series of change orders to address cycle 2 changes, changes to cycles 3 through 6, and impacts to the Floating Bridge and Landing project. Negotiations are under way to determine cost and schedule. The SR 520 Bridge Replacement and HOV Program has approximately \$180 million in contingency budget available for project changes.
- Cycle 2 negotiations are expected to be complete in two months. Changes to cycles 3 through 6 are expected to be complete this fall; and changes to the Floating Bridge and Landings contract are expected to be complete by the end of 2013. As we proceed through these changes we will gain a greater understanding of the cost and schedule impacts.
- It is likely that interim project milestones, such as opening the floating bridge to traffic, will be delayed several months. However, we will not know the impact to the overall completion schedule until negotiations with our contractors are complete.
- WSDOT has made technical, personnel, and organizational changes to help prevent the recurrence of these issues and new Secretary Transportation Lynn Peterson has called for an independent review of WSDOT's mega projects, including the SR 520 Program.

Executive summary

WSDOT is building 77 concrete pontoons to replace the aging and vulnerable SR 520 floating bridge on Lake Washington. Thirty-three of these pontoons are being built in Aberdeen as part of the Pontoon Construction Contract. In May 2012, WSDOT encountered concrete spalling damage and end-wall cracking in four of the first six pontoons built by contractor Kiewit-General. WSDOT convened an Expert Review Panel to analyze these issues, and K-G implemented spalling repairs before floating out the pontoons in late July 2012. The ERP issued

its first report in August 2012. Construction began on the second cycle of pontoons in Aberdeen in later summer 2012.

To repair the issues found in cycle 1, the Expert Review Panel was re-convened in October 2012. In its February 2013 report, the Panel found that spalling and end-wall cracking issues were due to an error in the pontoon design developed by WSDOT. The report included recommendations to correct the design and modify the pontoons built in cycle 1, and verified that repaired pontoons would be structurally sufficient to meet a 75-year design life. The modifications were then made to the pontoons in cycle 2, which were completed in late April 2013 and are not exhibiting the issues encountered in cycle 1. Modifications will be made to the cycle 1 pontoons in the coming months.

The program budget includes a risk and contingency reserve for risks and changes. The reserve was established following WSDOT's Cost Estimate Validation Program (CEVP) protocols which use a probabilistic model to estimate potential costs. Approximately \$180 million of the reserve remains. We are working with our contractors to assess impacts to the budget for cycle 2, cycles 3 through 6, and to the Floating Bridge and Landings project. Those negotiations are expected to be complete by the end of 2013. However, like any construction project, there are still inherent risks in the construction activities left to be completed.

To prevent future issues, WSDOT also convened an independent review to determine what led to problems with the pontoons. As a result, WSDOT made technical, personnel, and organizational changes to help prevent the recurrence of the issues experienced. Secretary Lynn Peterson also ordered a comprehensive program assessment for three of the agency's large-scale construction projects. The assessment will review the process used for key project decisions and how those decisions are documented to ensure the best accountability and project-delivery practices.

Background

The existing SR 520 floating bridge is vulnerable to heavy waves and windstorms and is at risk of a catastrophic failure. The new SR 520 floating bridge will be the world's longest floating bridge, will withstand winds up to 89 mph, and will serve the region for 75 years or more.

In order to build the new SR 520 floating bridge on an expedited schedule, WSDOT awarded two design-build construction contracts:

- **Pontoon Construction Project:** \$378 million contract with Kiewit-General Joint Venture. Work includes building a pontoon casting facility in Aberdeen, WA, and 33 pontoons at that facility. Pontoons will be constructed in a total of six cycles in Aberdeen, and include both 240-foot-long cross pontoons and all 21 of the 360-foot-long longitudinal pontoons needed for the new floating bridge.
- **Floating Bridge and Landings Project:** \$586.6 million contract with Kiewit/General/Manson, A Joint Venture. Work includes towing pontoons from casting facilities, building 44 additional smaller supplemental pontoons in Tacoma, and assembling the new floating bridge.



The SR 520 pontoon construction site in May 2012 - Aberdeen, WA

Construction is under way on both projects. As of May 2013, WSDOT has completed 24 of 77 pontoons needed for the new bridge. Fourteen pontoons are currently under construction, six in Aberdeen and eight in Tacoma.

Cycle 1 issues

In May 2012, WSDOT encountered concrete spalling (or chipping) during the post-tensioning process in one of the pontoons built by contractor Kiewit-General. Post-tensioning is a standard process applied to large concrete pontoons to provide additional strength. Four of the six pontoons built in cycle 1 required post-tensioning: three longitudinal pontoons and one cross pontoon (the smaller supplemental pontoons did not require post-tensioning). K-G implemented repairs on the spalled pontoon and pre-emptive modifications on the three other pontoons that required post-tensioning.

In addition, WSDOT encountered two cracking issues: shrinkage cracking discovered in Aberdeen, and end-wall cracking that had extended into the keel slabs after pontoons arrived in Tacoma or Lake Washington. Shrinkage cracks are cracks in concrete that result due to the temperature fluctuations during the concrete curing process. Cracks in the end wall that extended into the keel slab were due to the pontoon design developed by WSDOT.

Cycle 1 response strategies

Expert review panel – report #1

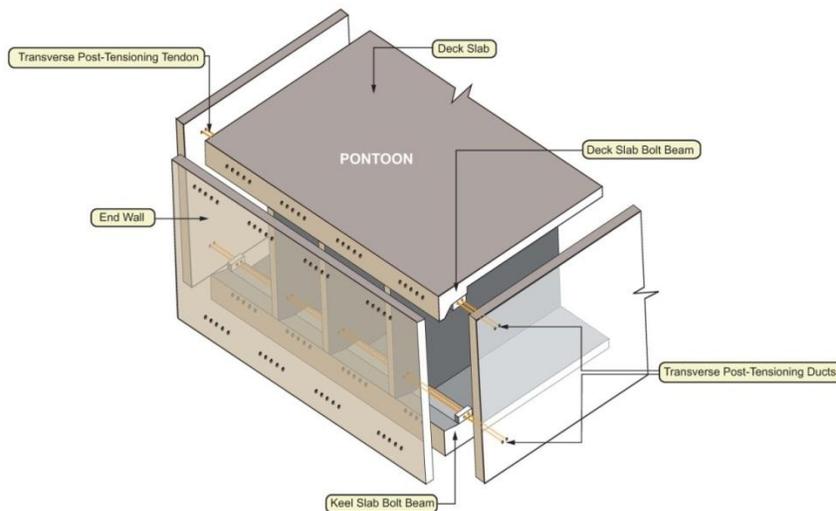
The SR 520 program convened an expert review panel to analyze the cause of concrete spalling, review spalling repairs made and to make recommendations for future pontoon construction cycles. The panel determined that the profile design of the post-tensioning ducts contributed to spalling, and that thermal controls need to be closely monitored to reduce shrinkage cracking.

In response, WSDOT modified the post-tensioning profile design for future construction cycles, and hired additional Quality Verification staff to monitor construction in Aberdeen. The State Materials Lab director was also assigned to oversee the Pontoon Construction Project.

Expert review panel – report #2

In October 2012, former Transportation Secretary Paula Hammond reconvened the expert review panel to conduct additional analysis of pontoon design, repairs, and construction management processes. In February 2013, the panel published their findings:

- A WSDOT error in the post-tensioning design caused spalling and end-wall and keel slab cracking in the pontoons.
- Adequate modeling of the transverse stresses was not performed by WSDOT bridge design engineers when designing the pontoons.
- The longitudinal and cross pontoons built in cycles 1 and 2 should be retrofitted (cycle 2 was under construction at the time of the recommendation report) with transverse post-tensioning to close and prevent cracks near the end walls.
- Once repairs and retrofits are made, the cycle 1 pontoons and the floating bridge are expected to perform to contract specifications and meet the required 75-year design life with normal maintenance.



Transverse post-tensioning modification

Internal review and findings

In addition to reconvening the expert review panel, former Transportation Secretary Hammond ordered an independent review of what led to problems with the pontoons. The independent review determined:

- Schedule pressure to have replacement pontoons for catastrophic failure drove many poor decisions.
- “Ways of doing business” – historical and cultural practices strongly influenced negative actions and decisions.
- Internal WSDOT communications were deficient.
- Bridge and Structures Office advanced pontoon plans and specs beyond that required by FHWA design-build requirements.
- Confusion on-site regarding construction administration responsibilities with schedule pressure was a factor.
- Inappropriate approval for post-tensioning tangent location change led to spalling.

In February 2013, Secretary Hammond retired from WSDOT and a new secretary, Lynn Peterson, was appointed by Governor Jay Inslee.

In response to the internal review findings, disciplinary actions have been taken, with one termination and another demotion. The SR 520 program office has also realigned its construction management team to more closely track and integrate with the pontoon construction team.

In addition, Secretary Peterson ordered a comprehensive program assessment for three of the agency’s large-scale construction projects. The assessment will review the process used for key project decisions and how those decisions are documented to ensure the best accountability and project-delivery practices.

Success with cycle 2, repairs for cycle 1

As recommended by the expert review panel, four cycle 2 pontoons were retrofitted with transverse post-tensioning while in the Aberdeen casting facility. These pontoons were completed in April 2013, and did not experience the spalling or cracking issues found in cycle 1.

WSDOT and contractor Kiewit/General/Manson are currently determining the process to add transverse post-tensioning to cycle 1 pontoons.

Budget and Schedule

The program budget includes a risk and contingency reserve for risks and changes. The reserve was established following WSDOT’s Cost Estimate Validation Program (CEVP) protocols which use a probabilistic model to estimate potential costs. Approximately \$180 million of the reserve remains (after execution of the cycle 1 changes). We are working with our contractors to assess impacts to the budget for cycle 2, cycles 3 through 6, and to the Floating Bridge and Landings project. Those negotiations are expected to be complete by the end of 2013. However, like any construction project, there are still inherent risks in the construction activities left to be completed.

It is likely that interim project milestones, such as opening the floating bridge to traffic, may be delayed several months. However, we will not know the impact to the overall completion schedule until negotiations with our contractors are complete. Those negotiations are expected to be complete in this fall.

Next steps

- WSDOT and its contractors are currently negotiating schedule and cost effects of pending cycle 1 cracking repairs. An announcement on any and all cost and schedule changes will be made after negotiations are complete.
- A change order in the amount of \$9.9 million was executed with Kiewit-General that compensates Kiewit for extra effort and additional time necessary to complete extra work required for the first cycle of pontoons. Negotiations for design changes and schedule effects continue.
- WSDOT will continue to model all design changes made to SR 520 bridge pontoons to ensure they meet the required design life for the new SR 520 floating bridge.
- Construction continues on cycle 3 bridge pontoons in Aberdeen. These pontoons will include transverse post-tensioning in their design and construction.
- Additional construction for the new floating bridge continues throughout Washington State at sites in Kenmore, Tacoma and on Lake Washington.