SR 520 Floating Bridge and Landings Project

Building the World’s Longest Floating Bridge

April 2017
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Floating Bridge and Landings Project - Building the World's Longest Floating Bridge
Introduction

Just as its predecessor did for more than a half century, the new, replacement State Route 520 floating bridge provides a vital social and commercial transportation link between Seattle and the growing, economically vibrant cities on the east side of Lake Washington. Just as importantly, the new bridge gives the region a safer and more reliable cross-lake route, with new, dedicated lanes for buses and carpools, and a separated path for nonmotorized travel between Seattle and the Eastside. At the time it opened in April 2016, the SR 520 floating bridge was named by Guinness World Records as the world’s longest floating bridge.

The Floating Bridge and Landings Project was a central part of a larger, ongoing megaproject that is reconstructing approximately eight miles of the SR 520 corridor, from I-405 in Bellevue to I-5 in Seattle. Other now-completed phases of the larger SR 520 Bridge Replacement and HOV Program involved construction of floating-bridge pontoons in Aberdeen, Washington, and rebuilding the highway’s Eastside segment between I-405 and Lake Washington’s east shore.

When the corridor’s reconstruction is fully completed in the late 2020s, all of SR 520’s major bridges will be replaced, the bus/carpool lanes and a regional bicycle/pedestrian path will extend from I-5 east to Redmond, and travelers will have safer access ramps and improved connections to transit and local streets.

This online “booklet” provides a broad overview of the new floating bridge, touching on its design, construction, key structural features, financing and 2016 Grand Opening.
Overview of the SR 520 Floating Bridge and Landings Project

- The SR 520 Floating Bridge and Landings Project replaced the old SR 520 floating bridge, as well as its East Landing in Medina and a section of the old west approach bridge, east of Foster Island in Seattle.

- Construction on the SR 520 Floating Bridge and Landings Project began in early 2012, and the new bridge opened to traffic in April 2016.

- At 7,708.5 feet long, end to end, the new structure is the world’s longest floating bridge. The old SR 520 floating bridge, 7,578 feet long, previously held that record.

Why did WSDOT replace the old SR 520 floating bridge and landings?

- After more than a half century of use, the old SR 520 floating bridge was showing its age. The bridge’s pontoons were vulnerable to windstorms and its fixed approaches were vulnerable to earthquakes.

- Additionally, the old bridge had only two lanes in each direction, no shoulders and no bus/carpool lanes. Adding transit/HOV lanes, shoulders and a bicycle/pedestrian path provides greater reliability and more options to accommodate growth in the region.

View videos explaining WSDOT’s rationale for replacing the old floating bridge, as well as videos of construction progress and more at bit.ly/wsdotvids.
The end result

- **A safer structure:** The new bridge has more than twice as many support pontoons, and they’re bigger and heavier, making the bridge resistant to sustained winds up to 89 mph.

- **Improved transit reliability and travel times:** There are two general-purpose lanes and one transit/HOV lane in each direction.

- **Wider, safer shoulders that allow disabled vehicles to pull out of traffic:** Outer shoulders on either side of the bridge are 10 feet wide; the old bridge’s outside shoulders were just 2 feet wide.

- **Ability to accommodate light rail if the region chooses to fund it in the future:** The new floating bridge is engineered to handle light rail by adding more supplemental pontoons.

- **A 14-foot-wide bicycle and pedestrian path on the north side of the bridge:** The path connects with local and regional trails in Seattle and the Eastside.

![A view of the new floating bridge just after it opened to traffic in April 2016.](image)

![The new bridge has more than twice as many support pontoons.](image)

![The new bridge has a 14-foot-wide bicycle and pedestrian path.](image)

Project timeline

The SR 520 Bridge Replacement and HOV Program has been in the works since 1997, when the Washington State Legislature funded a group to study the many options for transportation between the Eastside and Seattle. Over the next two decades, WSDOT worked with stakeholders on both sides of Lake Washington to define a “Preferred Alternative” and build the new floating bridge. Learn more about the environmental review process at wsdot.wa.gov/Projects/SR520Bridge/Library/I5Medina.htm.
Year | Progress
--- | ---
1997-2000 | Trans-Lake Washington Study to evaluate long-term needs and options to cross Lake Washington
2000-2004 | Trans-Lake Washington Project begins, which narrows options for crossing Lake Washington
Summer 2006 | Draft Environmental Impact Statement (DEIS) published, identifying a preliminary range of design options
2009 | Supplemental Draft Environmental Impact Statement (SDEIS) builds on the DEIS with a new set of six-lane alternative highway design options for public comment
Summer 2011 | Publication of the Final Environmental Impact Statement, which evaluates the preferred alternative and responds to public comments received on the DEIS and SDEIS
Late 2011 | Begin pontoon construction in Tacoma and Aberdeen
Early 2012 | Begin anchor construction in Kenmore
Spring 2012 | Begin bridge construction on eastern shore of Lake Washington
Spring 2016 | New floating bridge opens to drivers
Spring 2017 | Old floating bridge removed from Lake Washington

Key floating bridge facts

<table>
<thead>
<tr>
<th>Bridge Dimensions</th>
<th>Old Bridge</th>
<th>New Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>7,578 feet</td>
<td>7,708.5 feet</td>
</tr>
<tr>
<td>Number of standard travel lanes</td>
<td>2 each direction</td>
<td>2 each direction</td>
</tr>
<tr>
<td>Number of HOV lanes</td>
<td>0</td>
<td>1 each direction</td>
</tr>
<tr>
<td>Bicycle/pedestrian access</td>
<td>No</td>
<td>14-foot-wide shared-use path</td>
</tr>
<tr>
<td>Shoulder width</td>
<td>1 foot inside 2 feet outside</td>
<td>4 foot inside 10 feet outside</td>
</tr>
<tr>
<td>Roadway deck width (at midspan)</td>
<td>60 feet</td>
<td>116 feet</td>
</tr>
<tr>
<td>Deck height above water (at midspan)</td>
<td>6.5 feet</td>
<td>20 feet</td>
</tr>
<tr>
<td>West navigational channel clearance</td>
<td>44 feet</td>
<td>44 feet</td>
</tr>
<tr>
<td>East navigational channel clearance</td>
<td>64 feet</td>
<td>70 feet</td>
</tr>
<tr>
<td>Central drawspan</td>
<td>Yes</td>
<td>No drawspan</td>
</tr>
<tr>
<td>Date opened to traffic</td>
<td>August 28, 1963</td>
<td>April 11, 2016 (westbound) April 25, 2016 (eastbound)</td>
</tr>
<tr>
<td>Traffic volume</td>
<td>103,000 vehicles/day (pre-tolling)</td>
<td>77,000 vehicles/day (2016)</td>
</tr>
<tr>
<td>Sustained wind speeds built to withstand</td>
<td>57 mph; retrofitted for 77 mph</td>
<td>89 mph (100-year storm)</td>
</tr>
<tr>
<td>Expected service life</td>
<td>50+ years</td>
<td>75+ years</td>
</tr>
<tr>
<td>Number of pontoons</td>
<td>33</td>
<td>77</td>
</tr>
<tr>
<td>Size of biggest pontoons (longitudinal pontoons)</td>
<td>15 feet, 8 in. tall 60 feet wide 360 feet long 4,725 tons</td>
<td>28 feet tall 75 feet wide 360 feet long 11,000 tons</td>
</tr>
</tbody>
</table>
### Bridge Dimensions

<table>
<thead>
<tr>
<th></th>
<th>Old Bridge</th>
<th>New Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bridge width (including pontoons)</td>
<td>60 feet</td>
<td>195 feet with stability pontoons; 240 feet at cross pontoons</td>
</tr>
<tr>
<td>Number of anchors (all types)</td>
<td>58 anchors</td>
<td>58 anchors</td>
</tr>
<tr>
<td>Size of fluke anchors</td>
<td>33 feet wide</td>
<td>35 feet wide</td>
</tr>
<tr>
<td></td>
<td>16 feet, 9 in. tall</td>
<td>26 feet tall</td>
</tr>
<tr>
<td></td>
<td>77 tons</td>
<td>107 tons</td>
</tr>
<tr>
<td>Size of gravity anchors</td>
<td>26 feet by 26 feet</td>
<td>40 feet by 40 feet</td>
</tr>
<tr>
<td></td>
<td>13 feet tall</td>
<td>23 feet, 8.5 in. tall</td>
</tr>
<tr>
<td></td>
<td>132 tons</td>
<td>420 tons</td>
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</tbody>
</table>

### Ideas and engineering behind the SR 520 floating bridge

#### Why WSDOT built another floating bridge

**A long history of floating bridges in Washington state**

Washington state is the floating bridge capital of the world, with four of the five longest floating bridges. They are:

- SR 520 Gov. Albert D. Rosellini (Evergreen Point) Bridge (7,708 feet),
- I-90 Lacey V. Murrow Bridge (6,620 feet),
- SR 104 Hood Canal Bridge (6,521 feet),
- I-90 Homer M. Hadley Bridge (5,811 feet).

Floating bridges are not a uniquely Washington product. The Demerara Harbor Bridge in Georgetown, Guyana, is the world’s fourth-longest floating bridge (6,074 feet). It is made of steel pontoons. Norway has two large floating bridges - the Bergsøysund Floating Bridge (3,054 feet) and the Nordhordland Floating Bridge (5,295 feet).

Our neighbors to the north also have constructed a floating bridge to fit unique environments. In 1957, a concrete floating bridge was built across Lake Okanagan at Kelowna in south central British Columbia, Canada. Its floating length is 2,100 feet, with a design very similar to the Lacey V. Murrow Bridge.

*Construction of the old SR 520 floating bridge west approach on Lake Washington on March 20, 1962. Courtesy Seattle Municipal Archives (Image No. 70342). View more historical images at 520history.org*
Lake Washington's topography

WSDOT chose to build a floating bridge instead of a more conventional fixed or suspension bridge in part because of the unique natural features of Lake Washington:

- The deepest point in Lake Washington is 214 feet deep, and the bridge’s support towers would have to be approximately 630 feet in height, nearly the height of the Space Needle, to support the bridge. These massive towers would be out of character with the surroundings because they would create more noise and block views.

- Conventional fixed bridges, such as the Tacoma Narrows Bridge, are expensive to build in deeper waters with soft beds, such as Lake Washington.

- Suspension bridges need to travel in a fairly straight line. Because SR 520 is a curved corridor, a suspension bridge would not be possible.

How floating bridges work

How windstorms and waves affect floating bridges

Wind and wave forces are typically the controlling forces in the design of floating bridges. A major factor in wind and wave effects on floating bridges is called the fetch. The fetch is the unobstructed clear distance over the water that wind can travel to the bridge. The longer the fetch, the higher the wind and wave forces will be. In Lake Washington the critical fetch is to the southwest of the bridge, since the largest storms historically come from the southwest. Wind and wave forces cause the pontoons to bend, heave and twist, creating large stresses in the pontoons and anchor system. If a 100-year storm event were to occur, the pontoons are designed to prevent large cracks from developing that would allow water to leak in and sink the bridge.

How earthquakes affect floating bridges

In the case of the SR 520 floating bridge, its floating section is not affected directly by ground shaking from an earthquake because the bridge is composed of pontoons anchored to the bottom of Lake Washington. However, some very deep, low-frequency earthquakes can cause a seiche wave, a surface wave similar to a tsunami. A seiche in Lake Washington could cause the floating bridge to bend and heave at the lake surface,
adding large loads of pressure to the pontoons and anchor systems. A seiche in Lake Washington could also create an underwater landslide that could cause the pontoon anchors to slip or break. Typically, though, the waves from a seiche create less stress on the pontoons than wind-induced waves from a storm that occurs once every 100 years.

**How floating bridges are constructed**

Individual bridge pontoons are usually built on dry land next to a waterway, then floated and towed like barges to the bridge site. They are connected to grounded approach structures on each end, starting at the edge of the floating structure and then pieced together toward the eventual bridge’s center. The pontoons are held in place by enormous steel cables, generally hundreds of feet long, that are connected to anchors buried deep in the lakebed.

**How floating bridges float**

Floating bridges are made of large, watertight concrete pontoons connected rigidly end to end, upon which the roadway is built. Despite their heavy concrete composition, the weight of the water displaced by the pontoons is equal to the weight of the structure (including all traffic), which allows the bridge to float.

**Construction of the new floating bridge**

The new SR 520 floating bridge is the longest floating bridge in the world. Building a bridge that sits on the water comes with several highly unusual construction challenges as well as a few advantages.

**Construction locations**

Construction of the SR 520 Floating Bridge and Landings Project took place in several locations. Assembling the bridge and connecting it to the rest of SR 520 happened between the west and east shores of Lake Washington in Seattle and Medina.

Construction activities for the new floating bridge took place in four locations across Western Washington. Building the bridge’s components in Grays Harbor, Tacoma and Kenmore, then assembling the bridge on Lake Washington, provided more than a thousand jobs in the region.

The largest pontoons were towed from Grays Harbor to Lake Washington. These pontoons were constructed in Aberdeen as part of a separate contract.

We built 44 supplemental stability pontoons in Tacoma.

We also built bridge anchors and hundreds of precast roadway deck sections in Kenmore.

All of these components were floated to and assembled on Lake Washington to form the new SR 520 floating bridge.
Kenmore

Kiewit/General/Manson, A Joint Venture (KGM), the design-build contractor for the SR 520 Floating Bridge and Landings Project, built gravity anchors, fluke anchors and other precast concrete components in Kenmore. In August 2014, KGM completed construction of all 58 anchors needed for the new floating bridge, and completed final construction and placement of all 776 precast roadway deck sections in August 2015. These sections form the roadway for the new floating bridge. See the “Structural Components” section of this booklet for a photo of a precast deck section being placed.

Tacoma

Construction of the 44 supplemental stability pontoons built in Tacoma was completed in December 2014. These pontoons are attached to the larger longitudinal pontoons to provide additional stability and buoyancy (see the Pontoon section below for more information about the supplemental pontoons).

Aberdeen

The Pontoon Construction Project broke ground in February 2011 at a 54-acre site in Aberdeen. WSDOT and contractor Kiewit-General (K-G) built a casting basin facility featuring a concrete batch plant, on-site water treatment, and a 4-acre casting basin, in order to stage construction of 33 pontoons.

The new bridge’s largest pontoons are its 21 longitudinal pontoons. All built in Aberdeen, they later were joined together end to end on Lake Washington to form the backbone of the new floating bridge. The largest pontoons ever built in Washington, these pontoons are 360 feet long, 75 feet wide, nearly 30 feet tall, and weigh 11,000 tons. All told, the pontoon construction in Aberdeen required 112,000 cubic yards of concrete, 35,000 tons of steel rebar, and 2.7 million square feet of plywood formwork.

Crews in Aberdeen also built 10 of the new bridge’s supplemental stability pontoons, along with its two cross (or end) pontoons. The 33 pontoons constructed in Aberdeen were built in six cycles of around six to eight pontoons at a time. Once complete, each batch of pontoons was floated out of the casting basin, inspected, and then towed to Lake Washington. The final three pontoons that constituted the sixth and final pontoon cycle were floated out of the casting basin on March 9, 2015. They were towed to Lake Washington by tugboat and arrived on April 9, 2015.

The Grays Harbor pontoons were constructed under a separate contract from the Floating Bridge and Landings Project. More information about the Pontoon Construction Project can be found at www.wsdot.wa.gov/Projects/SR520/Pontoons.htm
Construction overview

The following images describe how the new floating bridge was built. Images are for illustrative purpose only and are not to scale.
Floating bridge pontoons

The entire bridge structure is kept afloat by 77 concrete pontoons. The pontoons are aligned in the configuration shown in the graphic below and are labeled alphabetically from west to east.

View a larger version of the floating bridge assembly graphic at bit.ly/bridgeassembly

Types of pontoons

The new SR 520 floating bridge is supported by three types of concrete pontoons: supplemental stability pontoons, longitudinal pontoons, and cross pontoons.

Longitudinal pontoons

These are the largest pontoons at approximately 360 feet long. They form the backbone of the bridge and support the roadway superstructure.

- The floating bridge has 21 longitudinal pontoons
- Constructed in Aberdeen facility
- Weight: 11,100 tons

Cross pontoons

Cross pontoons mark the ends of the floating bridge and the transition to the east and west approach structures.

- There are two cross pontoons, one at either end of the floating bridge
- Constructed in Aberdeen facility
- Weight: 10,100 - 10,550 tons

Supplemental stability pontoons

These smaller pontoons, when joined to the larger longitudinal pontoons, help stabilize and support the weight of the new floating bridge.

- The bridge has 54 supplemental stability pontoons
- Constructed in Aberdeen facility (10) and Tacoma facility (44)
- Weight: 2,500 - 2,820 tons
Bridge anchors and cables

Pontoon supporting the new SR 520 floating bridge are held in place by a series of woven steel cables. The cables, 3 1/8 inches thick and up to 1,000 feet long, are connected to three different types of anchors on the Lake Washington lakebed.

Bridge cable configuration

Types of anchors

Three different types of anchors secure the new bridge from shifting during wind and wave action. These types are fluke anchors, gravity anchors, and drilled shaft anchors.

**Fluke anchors**
- Dimensions: 35 feet x 26 feet x 17.5 feet
- Weight: 107 tons
- Quantity: 45
- Locations: Deep, soft soils of the lakebed and flat areas
- Manufactured: Kenmore
Completed fluke anchors are barged from Kenmore to the bridge-assembly site on Lake Washington. The graphic below shows how fluke anchors are placed in the lakebed.
Gravity anchors

- Dimensions: 40 feet x 40 feet x 23 feet
- Weight: 420 tons as built, 587 tons fully loaded
- Quantity: 8
- Locations: Solid soils with sloped topography, typically near shore. Underwater grading and installation of gravel creates a level footing for anchor placement.
- Manufactured: Kenmore

Workers aboard a derrick barge lower a 420-ton gravity anchor into Lake Washington.
Drilled shaft anchors

- Dimensions: 10-foot-diameter drilled shaft, 79 to 92 feet long
- Quantity: 5
- Locations: Solid soils near shore where gravity anchors may cause navigation hazard.
- Manufactured: Concrete cast in place from a barge on Lake Washington.
Other bridge components

Electrical components

Crews installed more than 300 miles of electrical wire and various electronic components and sensors along the bridge’s entire length -- all electronically linked both to a new bridge maintenance facility in Medina and to WSDOT’s northwest regional traffic-management center in Shoreline.

Structural components

Roadway deck: There are 776 precast deck panels that constitute the low-rise roadway deck. These panels were constructed in Kenmore. The high-rise roadway deck includes 23 cast-in-place deck spans, and four additional cast-in-place spans placed on the transition spans between floating and fixed sections of the bridge.
Deck support: The bridge deck is supported by 771 concrete columns and 331 concrete girders, large beams that the bridge deck rests upon.

Bridge barrier: There are 25,846 feet of barrier installed along the length of the bridge. The barriers separate the highway’s eastbound and westbound lanes, as well as the new regional shared-use path.
Noise walls: To minimize traffic noise in nearby areas, crews constructed 1,600 feet of noise walls along the north and south sides of the bridge in Medina.

Ballast: Pontoons float at their appropriate height due to 75,000 tons of ballast rock placed inside them.
Bridge maintenance facility and dock: A LEED-certified bridge maintenance facility and dock under the east approach of the bridge give maintenance staff improved access to the floating bridge.

Fire safety systems: Pipes, hydrants and pumps installed for the fire safety system provide firefighters with water to extinguish a fire if one should occur on the bridge.
Static and active traffic management systems: Modern traffic signage and electronic speed-limit notifications keep traffic flowing, with 105 new traffic signs and gantries installed.
**Stormwater drainage:** The new bridge’s innovative stormwater system entails 15,450 feet of piping, catch basins and “lagoons” within the supplemental pontoons to collect, filter and properly dispose of pollutants in roadway runoff.

**Safety and security systems:** The new floating bridge has state-of-the-art safety and security systems, including cameras on both the pontoons and the roadway that allow crews to monitor traffic on the bridge, and activity on the pontoons. In addition, each pontoon is individually monitored with high-tech float switches that notify the nearby maintenance facility of any water intrusion into the pontoons.
**Sentinels:** Four sentinels mark the transition between the floating bridge and its fixed approaches at the east and west ends. The LED lights in the sentinels feature numerous color options.

**Railing:** The bicycle and pedestrian path has 8,425 feet of specially designed railing to both keep people safe and allow unrestricted views of north Lake Washington.
Belvederes: These rest stops along the new regional shared-use path provide scenic viewpoints and informational displays for bicyclists and pedestrians.

Roadway grinding: The 34,580 square feet of roadway on the floating bridge features Next Generation Concrete Surface grind – grooves in the pavement to reduce traffic noise. Learn more about quieter concrete research in Washington state at www.wsdot.wa.gov/Business/MaterialsLab/QuieterPavement/
Approach bridges: This photo shows the two east approach bridges (at left) – one for westbound traffic, one for eastbound traffic – that connect to the new floating bridge near Medina. WSDOT also is building two new west approach bridges between the floating bridge and Seattle.

Medina viewpoint: One of the final tasks on the Floating Bridge and Landings Project is construction of a pedestrian trail and lakeside viewpoint in Medina. Shown here is the viewpoint construction site just south of the bridge.
How the floating bridge connects to land

A transition span connects the movable, floating bridge to the stationary, elevated bridge segment at the east approach. The transition span is made up of girders, each 190 feet long and 45 tons. On either end of the span, hinges allow the transition span to move up to 24 inches up and down or side to side to accommodate varying lake water levels.

Illustration of how the transition span fits between the floating and stationary bridges. View a larger graphic at bit.ly/TransSpan

This “trailer hitch” joint allows for motion and roll in all directions while holding the transition span in place.
The Grand Opening

The new floating bridge opened to traffic in April 2016 after five years of construction and more than a dozen years of planning, studies, design, and community outreach. To celebrate the completion of the newest and longest floating bridge in the world, WSDOT hosted a celebration for the public to experience the new structure just before it opened to traffic. The Grand Opening celebration (branded GO Long!) was held on April 2-3, 2016. More than 50,000 people participated.

GO Long! was staged as a fun, family-friendly event that also had an educational component. To that end, the event highlighted the extensive science, technology, engineering and math (STEM) involved in designing and building the bridge (Appendix Three contains the Grand Opening’s informational display boards).
Grand Opening activities

The GO Long! celebration included:

- A 10k run/walk event on the bridge that kicked off the celebration.
- A 20-mile bike ride featuring the SR 520 corridor, coordinated with the Cascade Bicycle Club.
- Continuous ribbon cutting: At both ends of the bridge, participants had the opportunity to cut a specially designed GO Long! ribbon as a keepsake, and pose for photos.
- Passport to the Bridge: Each guest received a Delta-sponsored Passport to the Bridge, which led them through each activity area to get a passport stamp, and presented a chance to win Delta Air Lines tickets.
- STEM activities: Kids of all ages experienced the STEM behind the construction and maintenance of the floating bridge, with activities highlighting stormwater treatment, Build-A-Bridge components and equipment, a deep-water diving team, a corridor driving simulator, and more.

Leading up to the Grand Opening, people engaged with the event through a “Name the Street Sweeper” contest and a photo contest on social media. ("Broom Hilda" was the winning name.) At the conclusion of the weekend of events, more than 30,000 people had attended the public celebration, 13,500 runners and walkers joined for the fun run, and 7,000 cyclists participated in the Ride the Bridge event.
Ribbon cutting

WSDOT also recognized the local leaders, tribes, and workers who played key roles in the planning, design, funding, and construction of the new SR 520 corridor. The SR 520 corridor travels through nine local jurisdictions, four legislative districts and two congressional districts, and constructing the corridor required cooperation and coordination with hundreds of stakeholders. Over 200 VIPs and their guests joined former Gov. Gary Locke and current Gov. Jay Inslee at the official bridge dedication and ribbon-cutting ceremony, during which the bridge was recognized by a Guinness World Records representative as the world’s longest floating bridge.

Bicycle and pedestrian path

The first completed segment of the new SR 520 regional shared-use path opened in early 2015 between 108th Avenue Northeast in Bellevue and the highway lid at Evergreen Point Road. In July 2016, the path extended west from the lid and onto the floating bridge as an out-and-back route. The path will cross Lake Washington in 2017 and, as SR 520 construction proceeds in Seattle on the Rest of the West elements, it eventually will reach I-5. On the Eastside, the path also connects to with a city of Bellevue trail that runs under I-405 and hooks up with the old SR 520 trail to downtown Redmond. View more information on biking the SR 520 corridor at bit.ly/520bikeped

The path gives users connections to local and regional trails and transit stops on both sides of Lake Washington, creating additional commuting and recreation opportunities.

On the new floating bridge, the 14-foot-wide, cross-lake trail includes belvederes to provide scenic viewpoints and resting areas for bikers, joggers and walkers. The path also has knee-level lighting all the way across the
bridge, a protective barrier between the path and adjacent traffic, and a specially designed railing that provides views of the lake while keeping foot-powered travelers safe. Bicyclists and pedestrians do not pay a toll to cross the bridge.

**Decommissioning the old SR 520 floating bridge**

After the floating bridge opened to traffic in April 2016, Kiewit/General/Manson, A Joint Venture (KGM) immediately began to remove the old SR 520 floating bridge from Lake Washington. The work continued until spring 2017.

In order to remove the old bridge from Lake Washington, KGM did the following:

- Broke up and removed the old bridge roadway deck and barriers
- Removed the east and west transition spans
- Removed pier columns
- De-tensioned and separated old pontoons
- Moved the old pontoons from their original locations to staging areas on the lake for further dismantling of components on top of the pontoons
- Removed old anchor cables

Between July 2016 and January 2017, all 31 of the old bridge’s pontoons were towed from Lake Washington through the Hiram M. Chittenden Locks in Ballard. The pontoons were kept intact and were sold to TrueNorth Operations Group. In the past, TrueNorth has converted used pontoons into docks, artificial reefs, and wharfs.
Other old bridge materials were dismantled and recycled. Some materials were dismantled on barges on Lake Washington, while others were dismantled on land. The majority of the bridge materials were hauled to concrete recycling facilities, where most of the materials were processed for reuse as dry aggregate for paving projects.
How can I get more information?

**E-mail:** SR520bridge@wsdot.wa.gov

**Twitter:** @WSDOT_520

**Mail:** Washington State Department of Transportation
SR 520 Bridge Replacement and HOV Program
999 3rd Avenue, Suite 2200
Seattle, WA 98104
Appendix one: Pontoon construction and repairs

How to build a pontoon

1. Set wall forms, rebar, and install post-tensioning ducts

2. Install interior precast panels and pour concrete in keel slab
   - Longitudinal pontoons: 90 precast panels
   - Cross pontoons: 57 precast panels
   - Supplemental stability pontoons: 9 precast panels

3. Pour concrete for exterior walls and joints between interior precast panels

4. Install top slab rebar and post-tensioning ducts

5. Pour top slab concrete

6. Remove wall forms and perform post-tensioning to add strength
In May 2012, cracking was discovered in one of the first pontoons built for the new SR 520 floating bridge. Action was immediately taken to modify the pontoons and ensure their 75-year design life.

The pontoons for the floating bridge were constructed during six separate construction periods, or cycles. All told, four of the Cycle 1 pontoons had to be repaired, while the design for four of the Cycle 2 pontoons was modified to prevent future cracking issues.

May - June 2012

Cracking is discovered in one of the Cycle 1 pontoons constructed in Aberdeen. WSDOT begins repairs on the affected pontoon and preemptive modifications on the other longitudinal pontoons. WSDOT then convenes a panel of experts to review the repairs, analyze the cause of pontoon cracking, and make recommendations for future pontoon construction cycles.

July 2012

The pontoon review panel endorses the repairs to the pontoons, and the pontoons are towed to Lake Washington.

August 2012

The pontoon review panel submits a report to WSDOT that reviews the repairs made on Cycle 1 pontoons and addresses the causes of the cracking. The panel also makes recommendations to correct pontoon spalling and cracking. The causes named by the panel include:

- The placement and location of post-tensioning ducts contributed to concrete spalling.
- Resistance to post-tensioning from interior precast walls caused end walls to crack.
- All quality assurance practices need to be fully implemented to monitor a variety of concrete properties, including concrete shrinkage, curing and thermal controls, and water/cement ratios, as well as length of wall pours.
Later in August, inspectors find water leaking between two cells in Pontoon V. The water had been used as ballast to keep the pontoon at a certain height on the water. The leak is repaired.

Inspectors also find moisture inside an end wall in Pontoon W.

**February 2013**

The pontoon review panel completes new recommendations on the pontoon cracking. The panel was reconvened in fall 2012 to review pontoon structural sufficiency, repairs to the existing pontoons, future options to reduce cracking, and long-term maintenance of the floating bridge.

Based on the findings of the expert review panel, WSDOT adds transverse post-tensioning to all longitudinal pontoons. Post-tensioning is a process where steel tendons are stretched through the top and bottom slabs and walls of the pontoons through a series of ducts to compress and strengthen the concrete. In Cycle 1, the longitudinal pontoons were post-tensioned lengthwise only. Adding transverse post-tensioning across the ends of the pontoons will help close cracks in the longitudinal pontoons’ end walls, particularly at the keel and top slabs.

**Transverse Post-Tensioning**

Crews retrofitted the Cycle 1 pontoons on Lake Washington with transverse post-tensioning and added transverse post-tensioning to the Cycle 2 pontoons under construction. Transverse post-tensioning was incorporated into the remaining longitudinal pontoons to be constructed.

**July 2013**

Pontoon W, a Cycle 1 pontoon, is floated to Harbor Island in Seattle for repairs at a Harbor Island dry dock.

**September 2013**

Repairs to Pontoon W are completed. Pontoon W is then floated to the Duwamish River, where six columns will be replaced due to shifting that occurred during a concrete pour.
SR 520 pontoon repairs in a coffer cell on Lake Washington

STEP 1
• Launch coffer cell into Lake Washington

STEP 2
• Lower coffer cell into lake to allow joining with pontoon.
• Install floats for stability and buoyancy.

STEP 3
• Join pontoon and coffer cell
• Pump water from coffer cell

NOT TO SCALE
For illustration purposes only
A steel coffer cell -- essentially a large, floating box -- was used to make in-water repairs to two pontoons for the new SR 520 floating bridge.

The 660-ton coffer cell is 35 feet tall, 45 feet wide, and 144 feet long. It provides a dry work environment where repairs can be made on the final two Cycle 1 pontoons (Pontoons U and V). As shown in the graphic above, the coffer cell is attached to the ends of the pontoons before water is pumped out of it. Once dry, crews are able to complete epoxy injections, crystalline waterproofing, transverse post-tensioning and application of carbon-fiber wrap.

View a video of repair procedures on YouTube at bit.ly/pontoonvid

**December 2013/January 2014**

Repairs to the pontoons on Lake Washington begin. Crews complete crack repairs and repairs to other construction anomalies, such as sections where steel rebar is exposed to water.

**June 2014**

All pontoon repairs are completed.
Appendix two: build your own floating bridge pontoons

Construction of the floating bridge pontoons represented a key milestone in a critical safety project. Using the printable pontoon templates linked below, you can build your own bridge.

Each pontoon is labeled according to its location within the final bridge structure. The dates signify when the pontoon arrived on Lake Washington.

For each pontoon, download and print the template file (each pdf is approximately 400 kb), cut along the indicated lines, and then fold your pontoon for final construction.

- Aug. 11, 2012: Pontoon V
- Aug. 14, 2012: Pontoon W
- Aug. 18, 2012: Pontoon VNW
- Aug. 19, 2012: Pontoon VSW
- Aug. 22, 2012: Pontoon U
- Sep. 22, 2012: Pontoon VNE and Pontoon VSE
- Sep. 30, 2012: Pontoon UNE and Pontoon USE
- Feb. 2, 2013: Pontoon UNW and Pontoon USW
- May 15, 2013: Pontoon T
- Jun. 7, 2013: Pontoon A
- Jul. 22, 2013: Pontoon TNW
- Jul. 23, 2013: Pontoon TSW
- Aug. 27, 2013: Pontoon TNE and Pontoon TSE
- Aug. 30, 2013: Pontoon S
- Oct. 17, 2013: Pontoon BSE
- Oct. 20, 2013: Pontoon Q
- Oct. 23, 2013: Pontoon R
- Oct. 29, 2013: Pontoon BSW
- Dec. 9, 2013: Pontoon SNE
- Dec. 10, 2013: Pontoon SSE
- Dec. 11, 2013: Pontoon SNW
- Dec. 12, 2013: Pontoon SSW and Pontoon RSW
- Dec. 13, 2013: Pontoon RNW and Pontoon RNE
- Dec. 14, 2013: Pontoon RSE
- March 13, 2014: Pontoon PSW and Pontoon PNW
- April 13, 2014: Pontoon P
- April 16, 2014: Pontoon O
- May 4, 2014: Pontoon M and Pontoon N
- May 8, 2014: Pontoon QNW, Pontoon BNW and Pontoon DSW
- May 9, 2014: Pontoon QSW and Pontoon OSW
- May 10, 2014: Pontoon ONW
- May 11, 2014: Pontoon NNW and Pontoon NSW
- May 12, 2014: Pontoon MNW
- May 13, 2014: Pontoon MSW
- Aug. 11, 2014: Pontoon B and Pontoon C
- Aug. 16, 2014: Pontoon D and Pontoon E
- Sept. 17, 2014: Pontoon BNE
- Sept. 18, 2014: Pontoon CNW and Pontoon CSW
• Sept. 22, 2014: Pontoon DNW
• Sept. 23, 2014: Pontoon ESW
• Sept. 24, 2014: Pontoon ENW
• Sept. 25, 2014: Pontoon KNW
• Oct. 1, 2014: Pontoon LSW
• Oct. 2, 2014: Pontoon KSW
• Oct. 3, 2014: Pontoon LNW
• Oct. 4, 2014: Pontoon L, Pontoon J, Pontoon GSW and Pontoon GNW
• Oct. 10, 2014: Pontoon L and Pontoon K
• Dec. 5, 2014: Pontoon INW and Pontoon ISW
• Dec. 6, 2014: Pontoon HNW, Pontoon HSW, Pontoon FNW and Pontoon FSW
• Dec. 7, 2014: Pontoon JNW and Pontoon JSW
• April 9, 2015: Pontoon G, Pontoon H, and Pontoon F
Appendix three: Grand Opening informational display boards

Click on any of the display boards that follow to see a larger image.
**Building the World’s Longest Floating Bridge**

**How do windstorms and waves affect floating bridges?**

Strong, wind-fueled waves cause lift forces on pontoons, which can lead to dynamic instability. When the lift force equals or exceeds the weight of the pontoon, it can cause the pontoon to lift off the water. Some pontoons are designed to rise and fall with the waves, while others are built to resist lift forces and maintain their position on the water. Designing a floating bridge to withstand these forces requires careful consideration of the materials and structures used, as well as the environmental conditions in which the bridge will operate.

**New bridge built to weather wicked winds and waves**

High winds and large waves are great for sails, but they’re a threat to floating bridges. The forces of strong, gusting winds can push a floating bridge off course, causing it to veer off the intended path. A well-designed floating bridge is built to withstand these forces, including strong anchor cables and heavy concrete pontoons, which are large floating segments that support the bridge. The pontoons are designed to be heavy enough to counteract the forces of strong winds and waves, ensuring that the bridge remains stable and safe.

**GO LONG SR 520 BRIDGE**

**Hey, let’s keep the noise down!**

Living near a busy highway can be hectic, but I’ve learned to love how quiet the new SR 520 bridge is at night. The new bridge incorporates advanced noise-reduction technologies to minimize the impact on nearby communities. Noise barriers, sound-absorbing materials, and other innovations have been implemented to reduce noise levels from the new bridge. As a result, residents can enjoy a quieter environment while still benefiting from the convenience of having a modern, efficient highway nearby.

**Who’s rebuilding state route 520?**

Since 2011, hundreds of people have been working hard to build a new SR 520 bridge. The project is a joint effort between the Washington State Department of Transportation (WSDOT) and multiple construction companies. The bridge is being built on a new alignment, following a design concept that includes a floating highway, a roadway, and a transit system. The project is expected to be completed by 2023, and it will significantly improve transportation for the region.

**WSDOT CREWS HAVE NEW TOOLS TO MAINTAIN AND OPERATE NEW BRIDGE**

There are more than 140 different workers on the new SR 520 floating bridge. One of the most exciting new tools they use is a drone that can inspect the entire bridge in just a few minutes. The drone has a wide range of capabilities, including high-resolution imaging and thermal scanning, which helps identify potential issues before they become serious problems. Using drones to inspect the bridge provides a safer and more efficient way to perform maintenance and repairs.

**SR 520: Where science, technology, engineering and math meet the road**

Floating bridges and other innovative transportation solutions require a multidisciplinary approach, combining expertise in civil engineering, materials science, environmental science, and more. The new SR 520 bridge is an example of how advancements in technology and science can be applied to create safer, more efficient, and more sustainable transportation solutions. Researchers and engineers are constantly working to improve the design and operation of floating bridges, ensuring that they remain a safe and viable option for transportation in the future.

**IMPROVING OUR REGION’S LOCAL PARKS AND NATURAL AREAS**

The South Lake Washington floating bridge will significantly reduce highway noise for nearby communities, including the70 acres of wetland mitigation at South Lake Washington Natural Area. This mitigation project is expected to be completed by 2023, and it will help ensure that the new bridge meets the environmental requirements for all projects. The bridge will also include a pedestrian path along Lake Washington, which will provide residents with a safe and enjoyable way to enjoy the natural beauty of the area.

**A DISPERSED WORK SITE**

Most of the work on the floating bridge will occur at a location on Lake Washington, while a portion of the work will take place on the new SR 520 bridge in Seattle. The dispersed work site allows for efficient management of resources and personnel, minimizing the impact on nearby communities and ensuring that the project stays on schedule.

**WSDOT CONSIDERS BUILDING A FLOATING HIGHWAY**

A floating highway is a new concept that could revolutionize transportation. By constructing a bridge over a body of water, WSDOT can create a direct route between two points without the need for overpasses or tunnels. This could significantly reduce travel times, improve safety, and reduce the impact on the environment. The new SR 520 bridge is one example of how this concept could be applied on a smaller scale, creating a floating highway that benefits the community while also providing a unique transportation experience.
Floating Bridge and Landings Project - Building the World's Longest Floating Bridge