SR-35 Bridge Feasibility Study

Navigation Baseline Report

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Prepared for
Southwest Washington Regional Transportation Council

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INTRODUCTION

In the Columbia River Gorge National Scenic Area, three bridges span the Columbia River to connect Oregon and Washington:

- The Bridge of the Gods at Cascade Locks (RM 148);
- The Hood River - White Salmon (SR-35) Bridge at Hood River (RM 169.8); and
- The Dalles California Highway (I-197) Bridge at The Dalles (RM 191.4).

The small communities along the banks of the Columbia River in the Bonneville pool rely on the bridges as a vital transportation route. A local grassroots effort identified concerns regarding safety, bridge operation, and maintenance issues on the SR-35 Bridge, and the Southwest Washington Regional Transportation Council is conducting a feasibility study to address these concerns.

Any modification, upgrading, or replacement of the bridge must consider existing and potential vessel traffic to ensure navigation is not impeded or safety compromised. The navigation baseline report addresses navigation issues by:

- Describing the existing SR-35 Bridge and navigation channel condition;
- Identifying vessel characteristics, traffic, and any problems transiting through the existing bridge; and
- Estimating the potential future vessel requirements.

CURRENT AUTHORIZATIONS

SR-35 Hood River Bridge

Built in 1924, the SR-35 Bridge connects the communities of Hood River in Oregon with Bingen and White Salmon in Washington. Currently operated as a toll bridge by the Port of Hood River, the steel bridge is 4,418 feet long with 20 piers used to span the Columbia River.

In 1937, following construction of Bonneville Dam, a vertical lift span was added to the bridge to accommodate the increased vessel traffic allowed by the creation of the Bonneville pool. The bridge's lift span is located between Piers 8 and 9, near the center of the bridge. The horizontal clearance at the lift span is 246 feet, which is narrower than the navigation channel. The bridge has vertical clearances of 148 feet in the fully open position and 67 feet when closed, relative to the normal Bonneville pool elevation of 73.0 feet Mean Sea Level (MSL). The full Bonneville pool elevation is 77.0 feet MSL.

Navigation Channel

The Congressionally authorized navigation channel on the Columbia River above Vancouver is designed to accommodate shallow draft vessels and facilitate barge shipments on the Columbia-Snake River system. The 84.5-mile segment of the channel between Vancouver, Washington, and The Dalles Dam (RM 191.4) was first authorized in 1937, spurred by navigation opportunities provided by the Bonneville pool. Channel dimensions are authorized to provide a 300-foot-wide by 27-foot-deep channel. The U.S. Army Corps of Engineers currently maintains the channel to a depth of 17 feet.

VESSEL TRAFFIC

Commercial Vessels

Commercial traffic through the Vancouver-The Dalles reach includes tugs and barges for commodity movements in addition to cruise ships. Cargo shipments are generally downbound movements of agricultural products to Lower Columbia River deep draft ports for export and upbound movements of petroleum, fertilizers, and chemicals for consumption in the hinterland. Three to four tons of cargo move downstream for each cargo ton moved upstream.

Several barge lines, including Foss Maritime, Shaver Transportation, Bernert Barge Lines, Hickey Marine, and Tidewater Barge Lines operate tugs and barges on the Columbia-Snake system and pass through the SR-35 Bridge. Barge lines typically use one tug to move multiple barges with the combination of vessels termed a barge configuration or tow. Columbia-Snake River barge configurations are somewhat restrained by the size of the dam locks on the system, although a new lock at Bonneville Dam removed the largest system constraint in 1993. System locks are 86 feet wide and range between 650 feet and 675 feet in length. U.S. statistics for 1999 show that the average tow size through all the locks on the Columbia River is three barges.[1]

Cruise and tourist vessel traffic through Hood River includes sternwheelers and cruise ships and is more seasonal than barge traffic. During the fall and spring, small cruise ships from Alaska work the Columbia-Snake system with daily bridge crossings varying between one and three. In addition, two large sternwheelers, the *Queen of the West* and the *Columbia Queen,* travel the reach on a year-round basis, typically combining for four bridge crossings weekly.

[1] U.S. Army Corps of Engineers, Water Resources Support Center, Alexandria, VA, 5/31/00

Origin-Destination Patterns

Upriver Cargo Movements

Generally loaded in the Portland-Vancouver area, upbound cargoes are primarily petroleum products with other cargoes including chemicals, empty containers, manufactured equipment and goods, waste and scrap material, and radioactive materials. Petroleum products move upriver to Umatilla, Pasco, and Lewiston. In addition, the U.S. Navy typically moves four to eight barges of radioactive material annually from Bremerton to Hanford.

Upbound cargo tonnage moving through the Vancouver-The Dalles reach is summarized below.

Upbound Cargo Tonnage (million tons): 1980 - 2000[2]

	1980	1985	1990	1995	2000
Total Tons:	3.5	2.1	2.1	3.3	3.2

Downriver Cargo Movements

Barge cargo moving downriver to Lower Columbia River ports is predominantly grain. Additional commodities include wood chips, chemicals, pulp and paper products, aggregate, and manufactured equipment and goods. Grain is loaded from elevators located between The Dalles and Lewiston. Wood chips move out of shallow draft facilities at Boardman and Lewiston. Empty petroleum barges move downstream after unloading at Umatilla, Pasco, and Lewiston while full containers return to the Portland Harbor from Boardman, Umatilla, Pasco, and Lewiston. Gravel and aggregate barges are loaded at The Dalles, Umatilla, and Wishram.

Downbound tonnage moving through the Vancouver-The Dalles reach is summarized below.

Downbound Cargo Tonnage (million tons): 1980 - 2000[3]

	1980	1985	1990	1995	2000
Total Tons:	7.2	6.2	7.6	8.3	7.4

Clearance Requirements

Columbia-Snake system barge widths typically measure 42 feet with doublewides at 84 feet. Individual barge lengths vary between 150 feet and 300 feet. However, lock sizes limit tow configurations to a total length of 650 feet if the dam is to be transited without breaking the

[2] U.S. Army Corps of Engineers, Waterborne Commerce Statistics, Part 4
[3] U.S. Army Corps of Engineers, Waterborne Commerce Statistics, Part 4

tow. Fully loaded barges on the Columbia River system generally draw 13.5 feet, compared to nine-foot drafts on the Mississippi and Ohio River systems.

A tow's vertical clearance is usually dictated by the tug size rather than barge size. Today's "tower" tugs extend +55 feet above the waterline although tug heights can usually be reduced to below 50 feet by lowering the masts. The railroad bridge that crosses the Snake River just downstream of the Tucannon River (Snake River Mile 61.5) has a limiting vertical clearance of 52 feet with no lift capacity. In comparison, the SR-35 Bridge has 67 feet of vertical clearance when closed, which has not been a problem for existing barge traffic.

During high water events, the larger cruise ships, such as the *Queen of the West* and the *Columbia Queen*, may require the bridge to open. With the stacks and masts up, the air draft of the *Queen of the West* is 61 feet with the *Columbia Queen* reaching 70 feet. To avoid opening the bridge, both vessels can lay back their stacks and masts when the water is high in order to clear the SR-35 Bridge when only 55 feet of vertical clearance is available. However, one drawback to the cruise ships laying back stacks and masts is that the mast-mounted radar becomes inoperable. During fog or inclement weather, the loss of radar creates a hazard for a vessel.

Trip Frequency

Statistics on commercial traffic on U.S. waterways are compiled annually by the U.S. Army Corps of Engineers in conjunction with the Department of Commerce. Historic data are available for the Vancouver-The Dalles reach and are summarized below.

Vessel Trips through Vancouver-The Dalles Reach[4]

	1980	1985	1990	1995	2000
Upbound:	7,498	5,754	5,234	2,555	1,980
Downbound:	7,307	5,754	5,174	2,556	1,907
Avg. Daily:	41	32	28	14	10

The above numbers reflect motorized commercial vessels only and do not include barges. However, Commerce Statistics and previously referenced sources confirm that tows through the reach average three barges to one tugboat.

Statistics indicate that there has been a decrease in the number of vessel trips through the reach in the 1990s. Cargo tonnage has increased, however, during the same period. Vessel trip decline may be due to changes in reporting methods or the new lock opening at Bonneville.

[4] U.S. Army Corps of Engineers, Waterborne Commerce Statistics, Part 4

Recreational Vessels

Recreational traffic in the vicinity of the SR-35 Bridge includes a wide variety of interests such as windsurfers, kiteboarders, fishing, sailing, and recreational cruising.

Origin-Destination Patterns

Fishing vessels, windsurfers, and kiteboarders typically launch on the Oregon side at the Port of Hood River Marine Sailpark at River Mile 169, just downstream of the SR-35 Bridge. Windsurfers tend to stay in the vicinity of the marina and do not roam up or downriver while kiteboarders have a similar to slightly wider range. Fishing vessels have the widest range of the three, moving both upstream and downstream of the marina.

Recreational launch facilities on the Washington side are located at Bingen (mile 172) and Drano Lake (mile 162), both of which are several miles from the bridge.

Clearance Requirements

Most sailboats have masts extending 40 to 45 feet above the water's surface. However, larger sailboats and racing boats may have masts between 65 feet and 100 feet. These vessels currently require lifting of the bridge to traverse under SR-35.

Trip Frequency

In December 1999, the Oregon State Marine Board released its triennial report summarizing boating statistics for the state. The closest specified launch site to the SR-35 Bridge is the Port of Cascade Locks, which recorded an average of 259 vessel trips from October 1997 to September 1998. An additional 246 vessel trips were reported in Hood River County for the Columbia River with a launch site not specified. Activities reported to the Marine Board indicated that the vessels launched from the Port of Cascade Locks were predominantly sailing while the generic Hood River County launches were strongly oriented towards fishing.

Bridge Openings

Based on discussions with Port of Hood River personnel, the bridge only opens once or twice a month. The general barge traffic and cruise lines do not typically require the bridge to open. Examples of conditions that require opening of the lift span include high water in the Bonneville pool, barges carrying cranes or heavy equipment, and high-masted sailboats. Since the bridge crosses a navigation channel, the U.S. Coast Guard requires the bridge to be raised monthly as a maintenance check.

Most of the bridge lifts are not concentrated in a specific season but rather relate to the level of the Bonneville pool. One exception involves barges transporting cranes and heavy

equipment for inwater construction projects. The equipment movement generally occurs between November and February, relative to the inwater fishery work window. During high water periods, the Port of Hood River raises the bridge for vessels that typically do not require the service. High water events on the Bonneville pool can reach 86.7 MSL which reduces the bridge's vertical clearance to 54 feet (closed) and 135 feet (fully open).[5]

NAVIGATION DIFFICULTIES

Commercial Vessels

Barge configurations currently experience problems with the existing SR-35 Bridge and navigation channel. The navigation channel and bridge opening are not lined up with the westerly winds, forcing barges to tack through the bridge. The westerly winds in the area of the bridge blow at an angle from the Oregon bank to the center of the bridge's lift span. To compensate for the westerlies blowing empty barges sideways, the barges set a course at an angle to the Oregon bank and tack to the navigation channel at the bridge. Compounding the problem is the bridge opening, at 246 feet wide, being narrower than the navigation channel (300 feet). Over the past seven years, the Port of Hood River recalled two or three barges that have scraped through the bridge opening but not caused any significant damage.

Commercial vessels did not report any problems regarding time delays or traffic congestion since the reaches upstream and downstream of the bridge are straight and allow vessels to safely pass.

Recreational Vessels

Recreational vessel traffic did not report any navigation difficulties with the bridge. The possibility of conflicts between the recreational and commercial vessel traffic was mentioned as barges currently dodge windsurfers and small recreational vessels that are in the navigation channel.

FUTURE VESSEL TRENDS

Commercial Vessels

Expansion of the Bonneville Lock in 1993 occurred after an extensive study and authorization process. The new lock accommodates the standard Columbia River double tow width of 84 feet. It is unlikely that tug and/or barge sizes will increase in the near to medium term as any increase in width would require a substantial capital investment to retrofit system locks.

[5] Datum for the channel is the Bonneville Pool Elevation, 70.0 feet above Mean Sea Level (MSL).

There does not appear to be a market trend toward larger vessels or increased capacity. Additionally, the Endangered Species listings in Pacific Northwest waterways have made any commercial activity suspect. Commercial operators would like to increase the number of barge trips in the future but realistically foresee the volume of vessel trips as stable.

The expectation among operators and tourism elements is that the number of cruise ships through the reach will be increasing over the next few years. A contributing factor to the expansion of cruise ships is the upcoming two-year bicentennial celebration of the Lewis & Clark Expedition. Demand is anticipated to increase as people have shown interest in retracing the expedition's route.

Recreational Vessels

No changes to recreational vessel size are anticipated that would affect bridge navigability. There could be a decrease in recreational vessel trips if fishing restrictions are increased. The larger recreational issue is the conflict between commercial traffic and sailboarders, windsurfers and kiteboarders. The prevalence of recreational activities on the river almost year-around increases the potential for navigational conflicts associated with the SR-35 Bridge.

DESIGN GUIDANCE

Horizontal Clearance

The U.S. Army Corps of Engineers provides design guidance for shallow draft navigation channels.[6] Guidance varies depending on whether the channel is in a straight reach, one with bends, through a bridge or abutment, and whether traffic is two way or one-way. The existing Hood River Bridge is located in a straight stretch of the river. The Corps recommends the following minimum widths for various tow configurations in straight reaches.

	Channel Width, Feet	
Tow Width, Feet	Two-Way Traffic	One-Way Traffic
105	300	185
70	230	150
50	190	130

Corps guidance further states that the minimum channel width should provide for the width occupied by the tow, clearance between the tow and channel limits, and clearance between tows for two-way traffic. It suggests that "reasonable limits" for two-way traffic in straight

[6] U.S. Army Corps of Engineers, *Layout and Design of Shallow Draft Waterways*, 1982

river stretches is 20 feet between tow and channel limits, and at least 50 feet between tows when passing. Applying the Corps' "reasonable limits" formula results in a 258 feet horizontal clearance as shown below:

20' clearance + 84' tow + 50' between tows + 84' tow + 20' clearance = 258'

However, Corps guidance also indicates that navigation channels through bridges should be somewhat larger than the designed width of the channel, depending on variables such as bridge approach, winds, and currents. Applying Corps guidance for under bridge clearances would result in a minimum horizontal clearance of 300 feet, matching the navigation channel width. The Corps guidance also provides an allowance for larger navigation channels through bridges if the winds and currents impair vessels' navigability.

The Columbia River Towboat Association, U.S. Coast Guard, and other river users were contacted to determine if the proposed 300-foot horizontal clearance fulfilled navigation requirements. Feedback from river pilots indicated that the horizontal clearance needed to be wider than 300 feet since the strong winds around the SR-35 Bridge affect tows, particularly with empty barges. The Columbia River Towboat Association (CRTA) described the local winds around the SR-35 Bridge as treacherous and noted that the winds "often force a tow to transit the opening at an angle that leaves very little space between the tow and bridge piers" (February 10, 2003 letter, attached). The CRTA noted that tows experience "difficult and sometimes hazardous" situations navigating the existing SR-35 Bridge in windy conditions. The CRTA members indicated that a 300-foot-wide opening for the new SR-35 Bridge would not provide for safe navigation whereas a 450-foot-wide opening would be reasonable.

Comparing the existing bridge opening of 246 feet with the typical barge tow lengths of 600 to 650 feet indicates that the winds would not need to turn the barge tows very far off the navigation channel alignment before the potential for a collision arises. While the Corps guidance provides for an increase in navigational channel width due to winds, a wind allowance factor is not established as each situation requires an assessment of the local conditions. For the SR-35 Bridge, the input from the CRTA and other river users provides the most knowledgeable information on the local winds. Consequently, the recommended horizontal clearance for the SR-35 is expanded to be at least 450 feet to account for the local conditions. In addition, barges would have an easier time traversing the bridge if the navigation channel was shifted to align better with the winds.

Vertical Clearance

Vertical clearances at the SR-35 Bridge have not impaired navigation in any meaningful way. Bridge openings occur approximately twice a month, either during high-water periods or for maintenance checks mandated by the U.S. Coast Guard. Through discussions with the U.S.

Coast Guard, a new fixed bridge across the Columbia River would need to provide a vertical clearance on the order of 80 feet.

The Columbia River Towboat Association, U.S. Coast Guard, and other river users were contacted to determine if the proposed 80-foot vertical clearance fulfilled navigation requirements. The CRTA and other river users contacted accepted the proposed vertical clearance of 80 feet with emphasis placed on contacting users involved with cruise ships and moving large cranes. The large construction cranes moved via barges require 80 feet of vertical clearance with the spuds raised. Alternatively, the gantry's location at 70 feet above the water provides the minimum clearance needed as the spuds can be dropped to transit a bridge. Large cruise ships on the Columbia River currently require around 60 feet of vertical clearance and do not foresee needing more than 80 feet of clearance in the future. In addition, the trend for newer cruise ships is to have masts and stacks that can be dropped, reducing their minimum clearance requirements relative to some older vessels.

SUMMARY

Historic commercial traffic through the SR-35 Bridge has not encountered safety hazards resulting in loss of life or severe damage. However, modification or replacement of the bridge presents opportunities to improve conditions affecting navigation and thereby prepare for future growth in commercial and recreational traffic on the system. Three design elements are primary:

- The navigation channel under the bridge should have horizontal clearance equal to or greater than 450 feet.
- The recommended vertical clearance under the bridge is 80 feet above the full pool elevation of 77 feet MSL. At a minimum, the vertical clearance could be measured relative to normal pool elevation of 73 feet MSL.
- Channel alignment should allow tugs and barges to be aligned with the westerly winds that now hit on the diagonal and cause control problems, especially for tows with empty barges.

Design proposals should be reviewed by commercial river users to ensure that their navigability issues are addressed. These discussions should be preliminary to the U.S. Coast Guard permitting process.

REFERENCES

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ATTACHMENT

Columbia River Towboat Association, February 10, 2003 letter

COLUMBIA RIVER
TOWBOAT ASSOCIATION
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February 10, 2003

Cynthia Lowe
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Re: SR-35 Bridge at Hood River

Dear Cynthia:

In response to your request for input from the towboat industry, we asked the members of the Columbia River Towboat Association to respond to the proposal to build a new bridge at Hood River with a fixed opening for navigation. One configuration would have the opening 80 feet high and 300 feet wide. Although no one voiced concern with the 80-foot height, each of the responding companies objected to the 300-foot width.

The present opening is only 246 feet wide. All of the companies have experienced navigational difficulties at the bridge, and there have been numerous close calls. The winds in this area can be treacherous and often force a tow to transit the opening at an angle that leaves very little space between the tow and the bridge piers. Typical tows can run over 600 feet in length, much larger than the tows of 1924, when the bridge was built, and it is difficult and sometimes hazardous for these tows to navigate the current bridge opening in the wind.

If a new bridge is to be built, we ought to plan for safe navigation. A 300-foot opening would be only marginally safer than the present opening, and still inadequate. We would prefer a much wider opening. Our captains have suggested an opening twice as wide as the 300-foot proposal, but we think that our members would support a 450-foot opening as a reasonable compromise.

Regards,

Captain Larry Johnson
Chairman

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