

**Conference Call with Expert Review Panel Members
Regarding Use of the I-90 Bridge for Light Rail Operations
June 7, 2006**

Present

Expert Review Panel: Tom Schmitt (via phone), Bill Lorenz (via phone), John Howell
Sound Transit and Consultant Team: David Beal, Isam Awad, Ron Perrone, Don Billen,
Andrea Tull, Paul Arnold, and Art Borst

WSDOT: Jugesh Kapur (via phone), Patrick Clark (via phone)

Expert Review Panel members indicated they wanted to discuss three questions that arose from previous Panel meetings and the review of the recent study titled, “East Corridor HCT – Summary of I-90 Floating Bridge (Homer Hadley) Studies”, dated March 2006. The questions include the following:

1. When the panel was briefed on the load test study they were told that the addition of light rail on the I-90 Bridge would bring the structure to 98% of its structural capacity. What are the implications of that, particularly in light of wind and wave conditions on the lake?
2. Panel members also recall hearing that the lake elevation fluctuates throughout the course of the year. How much fluctuation occurs? What are the potential effects on light rail operation, and how will the adjustments be made and who makes them?
3. Understanding that there are no comparable floating bridge structures with light rail operations in the world, why is the comparison with rail operations on suspension bridges appropriate? How can we be assured that light rail operations on the floating bridge environment will work?

Panel members noted that at the last meeting they recalled that for a one year storm the bridge would reach 98% structural capacity. This would be achieved after a variety of weight reduction strategies were implemented to accommodate light rail. WSDOT staff clarified that the bridge would reach 97% not 98% of allowable capacity.

WSDOT looked at a range of design loading scenarios. WSDOT considers a 1 year storm plus liveload to be their upper-end operational event. They determined that in a scenario that included the following assumptions - a one-year storm event from the north, with two fully loaded light rail trains passing each other on the bridge, and the general purpose traffic lanes fully loaded – that the I-90 bridge would reach 97% of its allowable structural capacity. This does not mean that the bridge is over-stressed based on its original design criteria, but it does come right up to that threshold of what is allowed.

Questions were asked about the affect of any storm (a 5-year or a 100-year storm) larger than a one-year storm. WSDOT staff stated that they would close the bridge for any storm event greater than a one-year storm from the north. So the allowable load capacity for a 5-year or 100-year storm would not be exceeded because the bridge would be shut down

It is important to note that the live load tests demonstrated that light rail operation will bring the bridge to 97% of its “allowable” capacity. Safety factors have been built into the allowable load capacity calculations. This is not the total structural capacity of the bridge.

A question was asked about the impact on the bridge if the load exceeded 100% of its allowable load capacity. WSDOT staff stated that this would not cause any sort of catastrophic failure, but could result in long-term fatigue in the structure, depending on the frequency that the allowable load capacity was exceeded. If this occurred often it could have the affect of shortening the life span of the bridge. ASHTO standards suggest that the useful life of the bridge should be approximately 75 years. A catastrophic event would only occur if the stress on the bridge resulted in cracks of significant size that resulted in large volumes of water entering the pontoons.

The fact that the bridge is at 97% of its allowable load should not hasten the long-term fatigue of the bridge. It is anticipated that the probability of the conditions that would result in the bridge achieving this load capacity (described above) are very low. It would be uncommon, even unlikely that the conditions would occur simultaneously.

A question was asked about the meaning of language in the report that states, “WSDOT also concluded that a comprehensive analysis of all remaining pontoons of the bridge should be done during final design.” This statement reflects the need to continue to analyze the impacts of light rail operations on the bridge as additional design work is completed. Further design will provide greater detail and understanding regarding the final configuration and weight of the track.

The floating bridge is designed to accommodate the fluctuations in lake level. The Army Corps of Engineers regulates the flow of water out of Lake Washington. The flows fluctuate depending on the time of year and the volume of rain the region has received. The lake can fluctuate up to 4.6 feet. The typical level of fluctuation in a given year is two feet. The design of the bridge and the light rail track accounts for fluctuations up to 4.6 feet. The proposed sliding rail design could accommodate this level of fluctuation.

The cables holding the bridge pontoons in place are set to allow for a two foot fluctuation in the level of the lake. Fluctuations greater than that would require adjustment of the cables by WSDOT.

There was discussion about the comparability of the two bridges studied in the report (Tagus River Bridge in Lisbon, and SkyBridge in Vancouver B.C.) to the I-90 Bridge. Tagus Bridge has longitudinal and vertical movement that is substantially greater than the anticipated movements on the I-90 Bridge. The movements on the SkyBridge are less than those expected on I-90.

It was suggested that the most critical movement is the angular (or vertical) rotation. On the Tagus River Bridge the vertical rotation is 3.5 degrees. It is anticipated that on the I-90 Bridge the vertical rotation will be 2 degrees. This would create angle change in the expansion joint that connects the floating portion of the bridge with the fixed portion. The rail spring assembly at the joint will be designed to absorb the angle on the transition joint changes. The rail would act somewhat like a damper on the transition joint.

It was noted that the transition span on the I-90 Bridge is 150 feet long. Given that length a single light rail car will not pass over more than one transition joint at a time. This will reduce the stress and load on the transition joints.

There are other bridges in the world that have similar transition joints – a recently completed bridge in Hong Kong is believed to have even larger movements than the Tagus River. Older bridges in New York also accommodate such movements but were not included in the study because of their use of bolted rather than welded rail.

Follow Up Questions

- What components of the bridge are stressed to 97% capacity when that load is achieved?
- At what load capacity does cracking begin to occur? Where would that cracking likely occur?
- What is the definition of “allowable capacity”?