

Independent Review and Assessment Feasibility for Addition of Light Rail Transit over I-90 Homer Hadley Bridge and Approach Bridges Preliminary Findings JTC Briefing

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Washington State Legislature Joint Transportation Committee Briefing

SC SOLUTIONS

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- **Team Members**
- **Discussion of Preliminary Findings**
- **Final Findings Schedule**

Independent Review Team Members and Qualifications

Steve Nikolakakos (Stray Current Control)
Ali Akbar Sohanghpurwala (Corrosion Control)
J. Thomas Bringloe (Marine Engineer)
Chuck Ruth (Structural Engineer)
Thomas Ballard (Structural Engineer)

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Preliminary Findings JTC Briefing

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IRT Activities to Date

April

- Bridge Field Trip
- General Discussion and Presentations by Sound Transit and Washington State DOT
- Definition of Study Issues
- Electrical Continuity Testing of Reinforcing Steel
- Team Assignments

May

- Additional Meetings and Conference Calls with Washington State DOT and Sound Transit to Identify and Resolve Issues
- Sound Transit and Washington State DOT Provided Additional Input for Resolution of Issues
- Describe Preliminary Issue Definitions to JTC

June

- Field Testing of Concrete Reinforcing Detection Equipment
- Developed Preliminary Findings and Reviewed with Washington State DOT and Sound Transit
- IRT Conducted Independent Assessments

Categories

- 1. General**
- 2. Stray Current Mitigation Measures**
- 3. Impact of LRT Track System Installation on the Bridge**
- 4. Floating Bridge Weight Mitigation Measures**
- 5. Track Bridge Expansion Joint Design and Prototype Testing**
- 6. Seismic Vulnerability of Approach Spans and Transition Span**

General

Issue T - Washington State DOT's and Sound Transit's Goal for Life Expectancy of Bridge (High Importance)

Resolution

- **Washington State DOT and Sound Transit agreed to a 100 year design life for the bridge.**
- **When light rail is installed, the remaining life for the bridge will be about 70 years.**

General

Issue K - Criteria Established for Independent Review Team to Evaluate Numerous Issues (High Importance)

Resolution

- **Sound Transit is preparing an East Link design criteria document consistent with the criteria applied to the North Link and Airport Link.**
- **The IRT recommends that Sound Transit provide policy level documentation whenever they chose to adopt design criteria that are less stringent than their own criteria where using existing facilities owned by other agencies.**

General

Issue W - Additional Needs and Changes Required for LRT Installation to meet "Blue Ribbon Panel" Recommendations (Low Importance)

Resolution

- **The Blue Ribbon Panel recommendations will not likely raise any project feasibility issues.**
- **They contain provisions that should be incorporated into the design , construction and operations.**
- **This will likely affect Washington State DOT and Sound Transit maintenance and operation procedures and priorities.**

Stray Current Mitigation Measures

Issue F - Sound Transit Adoption of North Link/Airport Link Stray Current Mitigation Design Criteria for Homer M. Hadley Floating Bridge Installation (High Importance)

Resolution

- **Sound Transit has agreed to utilize more stringent design criteria for stray current analysis.**
- **Provide collection mats with ground electrodes to dissipate stray current.**
- **Provide stray current monitoring system.**

Stray Current Mitigation Measures

Issue H - Stray Current and Cathodic Protection System Interference and Compatibility (High Importance)

Resolution

The IRT believes that a cathodic protection system provides another layer of defense against stray currents. Therefore the IRT recommends the following:

- The cathodic protection systems on the Homer Hadley and the Lacey V. Murrow bridges should be upgraded, if light rail is installed on the Homer Hadley Bridge.**
- Resources and plans must be in place to operate, monitor and adequately maintain the cathodic protection systems.**

Stray Current Mitigation Measures

Issue U - Methods for Identifying Stray Current Failure and Response/Repair Plan (Medium Importance).

Resolution

The plan as a minimum will include:

- **Remote monitoring of stray current at each stray current collector mat zone and at each ground electrode.**
- **Voltage measurement of each collector mat.**
- **Track-to-earth resistance measurements.**

Stray Current Mitigation Measures

***Issue Q - Modification of Current Bridge Inspection procedures if LRT
Approved (Low importance)***

Resolution

- **More stringent inspection procedures will be implemented to ensure safe operation of the system.**
- **The IRT recommends that inspection team include dedicated agency staff members with expertise in the following engineering disciplines:**
 - **Structural (Engineer with bridge preservation background)**
 - **Electrical (Engineer with cathodic protection background)**
 - **Material Science (Engineer with corrosion background)**

Impact of LRT Track System Installation on the Bridge

Issue N - Attachment of OCS Supports to Edge of Homer M. Hadley Floating Bridge Deck Cantilevers (High Importance)

Resolution

Sound Transit has provided conceptual attachment design and details that accommodate LRT loads and minimize roadway deck penetrations.

Impact of LRT Track System Installation on the Bridge

Issue O – Method(s) to be Utilized for Locating Rebar and Post Tensioning in the Bridge Deck (High Importance)

Resolution

- **Ground Penetrating Radar and X-Ray were successfully demonstrated for use on this project.**
- **Sound Transit is researching methods for attaching track supports to the deck which will minimize or eliminate penetrations.**
- **The Independent Review Team encourages the development of such alternative attachment methods. Such methods are more critical on the approach spans due to higher concentration of deck reinforcement.**

Impact of LRT Track System Installation on the Bridge

Issue E - Need for Lightning Arrestors on Floating Bridge and Approaches (Medium importance)

Resolution

- **A lightning protection system will be designed for the floating bridge.**
- **The IRT recommends:**
 - **Lightning protection system should be separate from the stray current system.**
 - **OCS support plate and bolts be electrically isolated from the pontoons.**

Impact of LRT Track System Installation on the Bridge

Issue G - Impact of Stray Current Dispersion in Lake Washington on Environment and Fish (Low Importance)

Resolution

Sound Transit has provided documentation that indicates the amount of stray current associated with LRT will not have a significant effect on the environment or fish.

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

Issue I - Analysis to Confirm Torsional Capacity of the Existing Bridge (High Importance)

Resolution

Calculations provided by Sound Transit have addressed this issue. The Independent Review Team's assessment is ongoing and a satisfactory resolution is expected soon.

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

***Issue S - Median Barrier Relocation Design, Attachment, Maintenance and
Drainage (High Importance)***

Resolution

- **Sound Transit provided preliminary design concepts that suggest three alternative approaches.**
- **Sound Transit and Washington State DOT will study all three alternatives to determine optimum alternative.**
- **The IRT recommends that the existing median barrier not be relocated.**

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

Issue P - Determining Strength and Resistance of Existing Concrete (Medium Importance)

Resolution

Sampling and testing is expected to be completed within a month. This will confirm some of the design assumptions.

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

***Issue L - Operation and Maintenance Coordination Agreement between
Sound Transit and Washington State DOT (Medium Importance)***

Resolution

Sound Transit has provided documentation that outlines development, review, and approval of a Sound Transit/Washington State DOT Operation and Maintenance Agreement for the Homer Hadley Bridge.

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

Issue B - Operational Restrictions for Combination of Train Loading and One-year Storm Loading from North (Medium Importance)

Resolution

- **Based on the IRT preliminary investigation, this issue does not present a serious operational limitation.**
- **Further investigation of this issue is ongoing and is expected to be completed soon.**

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

***Issue J - Analysis "North Wind" Storm Effects on Homer M. Hadley Floating
Bridge (Medium Importance)***

Resolution

IRT calculations indicate that the 1-year northerly storm conditions are less severe than the 1-year southerly storm conditions used in the previous assessment.

Weight Mitigation Measures
Effects of the LRT Loads on Bridge Elements

***Issue V - Effect of LRT Installation on Construction Operations Associated
With Anchor Cable Replacement (Low Importance)***

Resolution

- **Anchor cables can be replaced using small portable barge units latched together inside the channel between bridges, outfitted with all necessary lifting equipment.**
- **Anchor cable replacement can be performed without significant impact on personnel safety or cost of replacement.**

Rail Expansion Joint Design and Prototype Testing

Issue A - Track Bridge/Expansion Joint Design and Performance Criteria (High Importance)

Resolution

The IRT recommends an accelerated track bridge design, fabrication, and construction approach that includes the following:

- **Early start to the design is critical.**
- **Prototype fabrication and testing is essential.**
- **Design modification based on prototype testing.**
- **Fabrication of production track bridges.**
- **Special contracting approaches may be appropriate.**

Rail Expansion Joint Design and Prototype Testing

Issue M - Rider Comfort Performance for LRT Track Bridge at Expansion Joints (High Importance)

Resolution

The LRT vehicle will need to traverse the track bridge at reduced speed in order to assure rider comfort and safety.

Rail Expansion Joint Design and Prototype Testing

***Issue R - Storm water Drainage System Modifications under New LRT Track
Bridge at Expansion Joints (Low Importance)***

Resolution

Sound Transit has provided acceptable conceptual design and construction details for collection of storm water for discharge into existing drainage system.

Seismic Vulnerability of Approach Spans and Transition Span

Issue C - Seismic Vulnerability and Seismic Retrofit of Approach Spans and Transition Span (Medium Importance)

Resolution

- **The approach structures were designed to meet the seismic requirements at the time of construction. Considering the importance of the structure and the change of use associated with the LRT installation, current seismic retrofit standards should be met.**
- **The Independent Review Team recommends that a full seismic vulnerability study be performed prior to preliminary design.**
- **This could potentially lead to significant retrofit costs and schedule impacts and therefore the IRT recommends that this vulnerability assessment be accelerated.**

Seismic Vulnerability of Approach Spans and Transition Span

Issue D - West Approach Tunnel Design Criteria Consistency (Medium Importance)

Resolution

- **Although this issue is not within the charter of the Independent Review Team, the vulnerability of this structure could have an impact on the risk of down time and loss of revenue for the entire East Link.**
- **The Independent Review Team recommends that Sound Transit performs a full seismic vulnerability study of all existing structures that will be used for LRT prior to preliminary design.**

Schedule for Completion of Findings

- **July – August – Prepare and submit draft findings report. Stakeholder review and comment on draft study. Present final draft report and discuss comments.**
- **September – Submit final report to JTC at September meeting.**