



## **INFORMATIONAL MEMORANDUM**

**TO:** Community Development and Neighborhoods Committee

**FROM:** Jack Pace, Community Development Director

**BY:** Minnie Dhaliwal, Planning Supervisor

**CC:** Mayor Ekberg

**DATE:** May 17, 2017

**SUBJECT:** Light Rail Noise and Vibration Monitoring

### **ISSUE**

Update on the implementation of the Dispute Resolution Settlement Agreement between the City and Sound Transit regarding noise.

### **BACKGROUND**

Tukwila City Council approved the Unclassified Use Permit for the Link Light Rail and issued the Notice of Decision on Sept 21, 2004 (Attachment A). This approval required three years of noise and vibration monitoring and testing. Sound Transit conducted the first year testing in 2009 and the measurements identified several locations with noise or vibrations levels above the Federal Transit Administration's (FTA) criteria.

At that time Sound Transit implemented several interim mitigation measures to reduce noise and vibration impacts within the Tukwila segment of the Central Link Light Rail corridor; and did the second year compliance testing in 2010. In 2011, the Dispute Resolution Settlement Agreement was entered between the City and Sound Transit (Attachment B). The Settlement Agreement addressed noise and parking issues. This briefing is only regarding noise and a separate briefing will be scheduled to provide update on parking. As part of the Settlement Agreement Sound Transit agreed to install Type 1 noise wall near the Duwamish Neighborhood and Type 2 noise barriers at other three impacted locations. Subsequently in 2012 the proposed mitigation in four impacted areas was approved administratively (Attachment C). See Attachment D for the map of impacted locations.

Third year testing for 2011 was postponed until the Type 1 sound wall by the Duwamish Neighborhood was installed per the Settlement Agreement with the City. Results of the third year measurements conducted in October 2013 following installation of the Type 1 wall confirmed compliance with FTA noise and vibration criteria. Based on the third year testing results, Sound Transit agreed to perform an additional fourth year noise and vibration compliance test at three representative sites.

### **DISCUSSION**

The fourth year monitoring report (Attachment D) has been peer reviewed by the City's noise consultant, BRC Acoustics. The peer review report is included as Attachment E. The fourth year report includes testing site V4 near 14424 51<sup>st</sup> Ave S. At this location noise and vibration readings were taken approximately 15 feet east of the retaining wall (on the property owned by Sound Transit); along with measurements inside and outside the residence to confirm compliance. The City's peer review consultant BRC Acoustics confirmed Sound Transit's noise and vibration tests and recommended one additional sound measurement inside the residence

located at 14424 51<sup>st</sup> Ave to ascertain that ground borne noise meets the FTA criteria. Sound Transit has stated that the resident of the property has denied right-of-entry and this test cannot be performed. Due to the property owner's refusal to grant permission to access the property, Sound Transit has requested that the city accept the final report.

Additionally, Sound Transit has established a five-year replacement period for the three locations that currently have Type 2 noise barriers. These Type 2 noise barriers were installed in 2012 and are scheduled to be replaced this year. Sound Transit is required to obtain a noise variance any time night time work is planned. Noise variances to do night time work are processed administratively and include notification to the surrounding residential uses.

Sound Transit is required to continue to meet FTA noise and vibration standards including those approved under the Unclassified Use Permit and Type 2 decision dated Jan 24, 2012 (Attachment C). Additionally, Sound Transit is also required to continue to maintain Type 2 barriers and lubricators in good working condition so that noise standards continue to be met for the Tukwila segment of Link Light Rail. However, the requirements for monitoring and reporting to the City as stipulated by the Settlement Agreement have been met.

**FINANCIAL IMPACT**

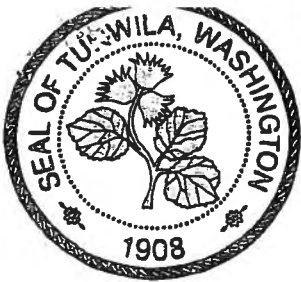
Not Applicable.

**RECOMMENDATION**

This item is for briefing only. Staff will send a written confirmation to Sound Transit that noise monitoring requirements have been met.

**ATTACHMENTS**

- A. Unclassified Use Permit Decision, 2004
- B. Dispute Resolution Settlement Agreement, 2011
- C. Administrative Decision approving the proposed noise mitigation measures, 2012.
- D. Final fourth year noise and vibration monitoring report by Sound Transit, 2016
- E. Peer review reports by the City's consultant BRC Acoustics, 2016



# City of Tukwila

Department of Community Development

Attachment A

Steven M. Mullet, Mayor

Steve Lancaster, Director

September 21, 2004

## NOTICE OF DECISION

TO: Rod Kempkes, Applicant for Sound Transit  
King County Assessor, Accounting Division  
Washington State Department of Ecology  
Agencies with Jurisdiction  
Parties of Record

This letter serves as a notice of decision and is issued pursuant to TMC 18.104.170 on the following project and permit approval.

### I. PROJECT INFORMATION

Project File Numbers: L03-057 Unclassified Use Permit  
L03-058 Shoreline Height Variance  
L03-060 Design Review

Applicant: Sound Transit Central Link Light Rail

Associated Files: L03-049 Shoreline Substantial Development Permit  
L03-059 Special Permission – Parking Determination

Comprehensive Plan Designation/Zoning District: The trackway will pass through LI, MIC/H, MIC/L, LDR, C/LI, O, RCM, MDR, and RC zoning. The South 154<sup>th</sup> Street Station and the north park-and-ride lot are zoned RC.

#### Project Description

Sound Transit has filed land use applications for construction of the Tukwila Freeway Route Project (TFR Project), the Tukwila portion of the Central Link Light Rail Project (see attached map). The TFR Project will include 4.9 miles of trackway, 87% of which will be elevated, and 70% of which will be in Washington State Department of Transportation right-of-way. A station is proposed at the southeast corner of the intersection of Southcenter Boulevard and International Boulevard with a transit center, two park and ride lots (north and south of Southcenter Boulevard), and street frontage improvements in both Tukwila and SeaTac. Along the trackway five detention ponds, three traction power substations, street improvements and a bridge over the Duwamish River directly west of the East Marginal Way South bridge will be built.

The TFR Project includes placing certain project facilities, such as the transit trackway columns, in Tukwila right-of-way (portions of East Marginal Way S., 52<sup>nd</sup> Ave. S. and Southcenter Blvd.). To mitigate the impacts of introducing these facilities into City right-of-way, the Sound Transit proposal includes a number of safety features (curbs, sidewalks, lighting) as well as utility undergrounding and

Notice of Decision by the Tukwila City Council

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stormwater control along these roadways. A new signalized street intersection will be built where the two park-and-ride lot driveways intersect across Southcenter Blvd. (approximately 420 feet east of International Blvd).

### Additional Findings

In addition to the Tukwila Comprehensive Land Use Policy Plan goals, objectives and policies recited in the Staff report, the following goals and policies are also relevant to this Unclassified Use Permit proposal:

#### Residential Neighborhoods Goals and Policies

**Goal 7.2 Noise Abatement – Residential neighborhoods protected from undue noise impacts, in order to ensure for all residents the continued use, enjoyment and value of their homes, public facilities and recreation, and the outdoors.**

Prevent community and environmental degradation by limiting noise levels.

Discourage noise levels which are incompatible with current or planned land uses, and discourage the introduction of new land uses into areas where existing noise levels are incompatible with such land uses.

Discourage noise levels incompatible with residential neighborhoods.

The “Final Design Noise Analysis” (Staff Report Attachment G15) prepared by Michael Minor and Associates (July 2004) and submitted by Sound Transit provides projected future noise and vibration levels using 90 percent design drawings. The impact analysis and proposed mitigation included in this analysis relate to existing development, and indicates, “New development and redevelopment along the alignment are not mitigated by the project” (page 1).

The “Final Design Noise Analysis” proposes two alternative means of mitigating identified noise impacts: noise barriers and residential sound insulation. Testimony provided by Sound Transit at the public hearing indicated their assessment of costs and benefits was a significant factor in determining which alternative mitigation strategy to propose.

The “Final Design Noise Analysis” identifies 25 buildings that will be impacted by light rail noise. Proposed mitigation for 16 of these is through construction of noise barriers. Proposed mitigation for the remaining 9 structures is through a “residential sound insulation program” (RSIP). Two of these 9 residential structures lie within areas zoned for heavy industrial use, while the remaining 7 lie within areas zoned for low-density residential use. The “Final Design Noise Analysis” refers to these 7 structures as receivers R8, R9A, R9B, R10, R11, R12 and R13.

The proposed residential noise insulation program will not mitigate light rail noise impacts received in affected residential yards, nor will it mitigate impacts upon planned residential development.

The Final Design Noise Analysis documents that in addition to the noise impacts the TFR project will create vibration impacts on 4 residential properties. The predicted noise and vibration levels at the specified receivers are based on field measurements of similar light rail vehicles in use in the Portland Tri-Met system. However local soil conditions as well as maintenance practices can affect the actual noise and vibration levels of the TFR project in operation. A monitoring program would provide



assurance that Sound Transit's obligation to mitigate noise and vibration impacts on Tukwila residents has been met. Monitoring over a 3-year period would document conditions through the first rail maintenance cycle.

Unless they are properly screened detention ponds can have a significant negative visual impact on their surrounding areas. This is of most concern in residential areas where lots and buildings tend to be smaller and there are higher expectations of visual quality than in industrial areas. Staff report Attachment G. 12 shows the locations of the 5 detention ponds Sound Transit has proposed in Tukwila.

- Ponds 1 and 2 are located in industrial zones and set back from public streets.
- Pond 3 between Macadam Road and I-5, north of 144<sup>th</sup>, is zoned LDR and is set back 25 feet from the edge of pavement on Macadam. A combination of existing trees and new understory shrubs is planned for screening. Sound Transit has proposed 1 gallon size trees at 15' spacing and 1 gallon shrubs at 5' spacing. While the visual impact of the detention pond will be immediate, it will take several years for that size plantings at that spacing to provide significant screening. Larger trees and shrubs would provide quicker, more complete screening from the road and nearby residences.
- Pond 4 at 146<sup>th</sup> Street and I-5 is zoned Office, is 80 feet from the nearest residence and surrounded by a wetland on two sides.
- Pond 5 at 151<sup>st</sup> Street and 52<sup>nd</sup> Avenue is zoned Office and is set back 45 feet from the 151<sup>st</sup> Street R-O-W. No existing trees will be retained in this setback area, instead Douglas fir and Western Hemlocks with associated understory plantings are proposed for screening. The pond will have some visibility from the streets and the second story of the residence directly to the south until these plantings grow significantly. Larger trees and shrubs would provide quicker, more complete screening at this location as well.

Sound Transit is in the process of developing a system-wide Systems Security Plan (SSP) through a Security Task Force that includes representatives from the Tukwila Police Department. The final SSP will require the concurrence of the Tukwila Police Chief. Initial procedures and staffing levels will be based on a Threat and Vulnerability Study. Day to day security on the Link Light Rail line and at the 154<sup>th</sup> Street Station will be provided by a private company under contract to Sound Transit. Sound Transit will also contract with Metro to provide Police services so that Metro should provide the first response to calls for service at the Station. Long term security of the light rail system will require periodic evaluation of security levels by all parties and adjustment of the SSP to address changing conditions.

## II. DECISION

### SEPA Determination

The Sound Transit SEPA responsible official has previously determined that the project creates a probable significant environmental impact and required preparation of an Environmental Impact Statement. Sound Transit has submitted copies of the Central Link Light Rail Transit Project Final Environmental Impact Statement (FEIS), the Tukwila Freeway Route Final Supplemental Environmental Impact Statement (FSEIS) and Addendum, and the Initial Segment Environmental Assessment (hereafter called "Environmental Documents").

The City's SEPA responsible official has determined that the Environmental Documents are fully adequate and in compliance with SEPA and that, in accordance with WAC 197-11-600, they may be used unchanged for the City's decisions on the Unclassified Use Permit, Shoreline Variance, Design Review, and all other permits and approvals required by the City for Sound Transit's Link Light Rail TFR Project, as proposed by Sound Transit.

## Decision on Substantive Permits

The City Council has determined, following an open record hearing, that the applications for an Unclassified Use Permit, Shoreline Height Variance and Design Review approval comply with applicable City and state code requirements and has approved those applications and proposed code modifications, subject to the following conditions, based on the findings and conclusions contained in the staff report (and expressly incorporated by reference into this notice) and this Notice of Decision.

Specific Zoning Code modifications approved pursuant to TMC 18.66.030:

1. The TFR Project shall not be subject to Zoning Code setbacks or height limitations. These regulations were drafted to regulate typical commercial and residential development and were not intended to apply to transportation improvements such as light rail or freeways.
2. Parcels which cannot comply with Zoning Code landscape standards due to the TFR Project vegetation clear zone requirements shall not be considered non-conforming to landscape standards.
3. Perimeter landscape requirements at the station and north parking lot sites may be modified in order to maximize the efficiency of the sites as long as the total required square footage of landscaping is provided.

L03-057 Unclassified Use Permit Conditions:

1. Within four months of groundbreaking at the South 154<sup>th</sup> Street Station site, Sound Transit shall construct either a temporary or permanent noise wall along the eastern edge of the lot.
2. If Sound Transit chooses to use the north parking lot as a temporary construction staging area, Sound Transit shall construct a temporary noise wall along the northern and eastern edges of the lot as approved by the City.
3. Prior to issuance of the building permit for the South 154<sup>th</sup> Street Station or north parking lot, Sound Transit shall demonstrate that the lighting plan will meet Illuminating Engineering Society of North America (IESNA) guidelines as approved by the City.
4. Sound Transit has proposed to retain areas of existing landscaping to provide screening of detention ponds and buffering of residences as shown on Attachment C. In the event that these existing trees and plants do not survive the construction of the TFR project, Sound Transit shall replace them according to the schedule at TMC 18.54.130(3) prior to issuance of an occupancy permit for the South 154<sup>th</sup> Street Station.
5. The size of the landscape screening materials that Sound Transit has proposed to plant along the west and north sides of detention pond 3 and between detention pond 5 and 151<sup>st</sup> Avenue South shall be increased. At least half of the shrubs shall be increased from 1 to 3 gallon containers and at least half of the trees shall be increased from 1 to 5 gallon containers.
6. Sound Transit shall design and construct noise walls on the elevated trackway to mitigate light rail noise impacts on residentially zoned property where projected noise levels exceed the FTA noise criteria as identified in the Final Design Noise Analysis dated July 2004. At receiver 8 the currently planned wall shall be extended and a continuous noise wall shall be constructed between receivers 9 A, 9 B, 10, 11, 12, and 13 as identified in Appendix E of the noise report.

7. Sound Transit shall develop a 3-year noise and vibration monitoring program for the TFR Project to be approved by the City. The 3-year period shall start from the start of revenue service. Monitoring shall be conducted at representative locations where impacts and mitigation have been identified in the Final Design Noise Analysis dated July 2004. If measured levels show that noise or vibration attributable to the TFR project exceed FTA criteria as identified in the Final Design Noise Analysis Sound Transit shall provide appropriate reasonable mitigation acceptable to the City.
8. The Systems Security Plan (SSP) referenced in the August 11, 2004 concurrence letter (staff report Attachment G. 5) shall be subject to the approval of the Tukwila Police Chief and include a requirement for all parties to the Plan to periodically evaluate the security at the Station and along the trackway. If a security problem is found the SSP shall include a process for Sound Transit to remedy the problem with the concurrence of the Tukwila Police Chief.

#### L03-058 Shoreline Variance

Staff recommends approval of a shoreline height variance to allow an increase in height from 35 feet to 50 feet above the ordinary high water mark for the TFR bridge over the Duwamish River.

#### L03-060 Design Review

Staff recommends approval of the station building, landscape design, site layout, and furnishings as reflected in the attachments to this report. The South 154<sup>th</sup> Street Station signage is not covered by this permit and will require separate applications and approvals. Three minor modifications are anticipated to the Station site:

- A slight realignment of the driveway;
- Addition of a City Light substation at the northeast corner, and
- Changes to the lighting plan to meet IENSA standards.

These and other minor changes should be subject to administrative approval by the appropriate Tukwila department director.

The Decision on this Application is a Type 5 decision pursuant to Tukwila Municipal Code §18.104.010. Other land use applications related to this project may still be pending.

### III. YOUR APPEAL RIGHTS

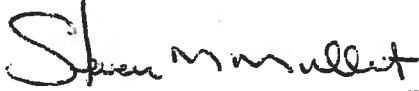
No administrative appeal of the City Council Decision is permitted.

Any party wishing to challenge the City Council Decision must file an appeal in King County Superior Court pursuant to the procedures and time limitations set forth in RCW 36.70C. An appeal challenging an EIS may be included in such an appeal. If no appeal of the City Council decision is properly filed in Superior Court within such time limit, the Decision on this permit will be final.

### IV. INSPECTION OF INFORMATION ON THE APPLICATION

Project materials including the application, any staff reports, and other studies related to the permits are available for inspection at the Tukwila Department of Community Development, 6300 Southcenter Blvd., Suite 100, Tukwila, Washington 98188 from Monday through Friday between 8:30 a.m. and 5:00 p.m. The project planner is Nora Gierloff, who may be contacted at 206-433-7141 for further information.

Property owners affected by this decision may request a change in valuation for their property tax purposes. Contact the King County Assessor's Office for further information regarding property tax valuation changes.



Mayor Steven Mullet  
City of Tukwila

Parties of Record

Keith Neal  
Gordon Allen  
Greg & Vanessa Zaputil  
Eric Schweiger  
Michael P. Griffin  
Chris Arkills/Dwight Pelz KC Council  
F. Wayne Stollatz  
Tuong van Tran  
Scott Luke  
Pauline Tamblyn  
Mark Maio  
Stephenie Kramer  
Melvin Easter  
Jennifer Mackay  
John Niles  
LeAnne Bremer  
Roger Lorenzen  
Norma Larson  
Craig Ward  
Jack Lattemann  
Tony Carosino  
Anna Bernhardt  
Peter Coates  
Hal Cooper  
Marv Loiselle

SPEEA

OCD Office of Archaeology  
Johnson Braund Design Group  
SPEEA  
CETA technical director  
Miller Nash LLP

City of SeaTac  
King County METRO

Agencies with Jurisdiction

Washington State Department of Transportation  
Seattle City Light  
Federal Transit Administration, Region 10  
Puget Sound Regional Council  
US Army Corps of Engineers  
Washington State Dept. of Fish and Wildlife  
U. S. Environmental Protection Agency



**Dispute Resolution Settlement Agreement Regarding Noise and Parking  
Between  
City of Tukwila, Washington  
And  
Sound Transit  
(Reference City Contract Number 04-086)**

The purpose of this Dispute Resolution Settlement Agreement is to confirm the agreement between Sound Transit and City of Tukwila regarding the issues discussed during the dispute resolution process initiated on November 9, 2010. Since the opening of the light rail system in July 2009, issues have arisen between the City and Sound Transit regarding noise and parking at the Tukwila International Boulevard Light Rail Station (Tukwila Station).

Over the past few months, Sound Transit and the City have met in a good-faith effort to resolve these disputes, as provided for in the Development and Transitway Agreement executed between our two agencies in December 2004. We have reached a mutually satisfactory resolution of the issues and both agencies remain committed to working together in a collaborative manner to see that the commitments included in this letter are completed in a timely and efficient manner.

To this end, the City and Sound Transit have agreed to settle the disputes as follows, subject to necessary approvals:

**Link Light Rail Noise Mitigation**

A dispute arose following initial noise level readings in the First Year Noise and Vibration Testing Results prepared by Michael Minor and Associates (dated December 9, 2009), which exceeded the FTA noise criteria in certain places along the Link Light Rail route in Tukwila.

The resolution to this dispute is as follows:

1. Sound Transit is currently in compliance with the FTA noise criteria, and will continue to comply with the FTA noise criteria throughout the City.
2. Sound Transit will install approximately 2700 feet of Type I noise barrier in the vicinity of the Duwamish River neighborhood area, replacing the existing Type II noise barrier. The existing Type 2 barriers in three other locations will remain.
3. Sound Transit will mitigate and maintain noise levels at all other locations along the alignment with measures that may include continued use of Type 2 noise barriers, rail grinding, track lubricators, residential sound insulation, or other measures as determined by Sound Transit to be necessary and effective.
4. Sound Transit will prepare a supplement to the 2010 noise report required under the Unclassified Use Permit addressing the proposed mitigation; a schedule for installing the Type 1 barriers, reasoning for proposing Type 1 barriers as mitigation in the Duwamish River neighborhood area; durability of Type 2 noise

*2 of 20 originals*

barriers; maintenance and/or replacement requirements for the Type 2 noise barriers; and commitment and schedule for monitoring. The supplement to the noise report will be submitted to the City within 30 days of the effective date of this Agreement.

5. The goal of the Parties is to maintain and monitor noise mitigation as necessary, and to sunset the monitoring requirement within two years following completion and submission of the 2011 Wheel-Rail Noise Study to the City, as contemplated by the original UUP noise condition, unless the Parties mutually agree to an extension. In 2011, the City will perform a review of the 2010 noise report and supplement including field measurements of noise and vibration. Sound Transit will not submit a 2011 noise and vibration report but will submit a 2012 report following installation of the Type 1 barrier, and will submit a 2013 final report.

Sound Transit will develop and implement a long-term noise maintenance and monitoring program based on recommendations in the 2011 Wheel-Rail Noise Study, authorized by the Sound Transit Board on March 10, 2011. Sound Transit will share the monitoring results with the City at various intervals, as recommended in the study.

6. The City will review the supplement to the 2010 noise report, for compliance with the original UUP noise condition. Any permit applications and nighttime noise variance application required for installation of the Type 1 noise mitigation will be reviewed administratively and concurrently. A public works permit (long term type D) will be required for installation of the Type 1 barriers, but a building permit is not required. There will be a public informational meeting and comment period for the above-mentioned actions and the City will issue its decisions in a timely manner. The City's decisions may be appealed to the City Hearing Examiner.

#### **Tukwila International Boulevard Light Rail Station Parking**

A dispute arose regarding the need for additional parking at the Tukwila Station, consistent with the City's 2004 Parking Determination.

The resolution to this dispute is as follows:

1. Conditions have changed since the 2004 Parking Determination was issued by the City. Sound Transit's long-term strategy is to extend light rail to South 200<sup>th</sup> Street on an accelerated schedule, subject to Sound Transit Board approval anticipated in July 2011, where 600 to 1050 additional parking stalls are currently planned. It is anticipated that the South 200<sup>th</sup> and University Link projects will be completed in 2016 when passenger service will commence. It is further anticipated that the addition of parking spaces south of the Tukwila Station, will provide an attractive alternative for some of the current users of Tukwila Station parking.

2. Sound Transit shall provide the Airport Link Extension Parking Demand Study to the City within 30 days of the effective date of this Agreement.
3. Sound Transit shall continue to monitor on-site and off-site Link Light Rail related parking utilization, and implement measures to help mitigate significant hide & ride parking should it occur as required by the 2004 Parking Determination.
4. Following a twelve month period of operation of the South 200<sup>th</sup> and University Link projects (2017), during which service levels and ridership are expected to normalize, Sound Transit will prepare and submit to the City a parking study for the Tukwila Station based on a mutually agreed upon scope of work. No other parking studies will be required until this time except the scope of work shall be submitted as part of the Parking Determination amendment request referenced in paragraph 6 below.
5. The City shall defer the requirements of the July 1, 2004 Parking Determination, including the requirement to provide additional parking at the Tukwila Station, until December 31, 2017, provided Sound Transit makes measurable progress to accelerate the extension to South 200<sup>th</sup>. The measurable progress shall include obtaining Sound Transit Board approval; obtaining all required permits from the City of SeaTac; and awarding the contract for construction so that additional parking is constructed prior to University Link opening.
6. Sound Transit and the City will work together in good faith to identify potential revisions to the 2004 Parking Determination consistent with this Agreement and Sound Transit will request amendments to the 2004 Parking Determination, together with all supportive documents before December 31, 2012. This will be processed as a Type II Decision pursuant to the City's Land Use Code.

The parties have executed this Agreement as of the last date indicated below. This Agreement shall become effective subject to approval by the Sound Transit Board.

SOUND TRANSIT

CITY OF TUKWILA

By Joan M. Earl  
Joan M. Earl, CEO

By Steve Lancaster  
Steve Lancaster, City Administrator

Date: July 28, 2011

Date: July 19, 2011





# City of Tukwila

Jim Haggerton, Mayor

## Department of Community Development

Jack Pace, Director

### NOTICE OF DECISION

January 24, 2012

TO: Jim Edwards, Sound Transit  
King County Assessor, Accounting Division  
Washington State Department of Ecology  
Agencies with Jurisdiction  
All Parties of Record

This letter serves as a notice of decision and is issued pursuant to TMC 18.104.170 on the following project and permit approval.

#### I. PROJECT INFORMATION

Project File Number: L03-057

Applicant: Sound Transit

Project Description: Sound Transit has requested the Director of Community Development approve the proposed noise mitigation in four impacted areas. Sound Transit is proposing to install Type 1 noise barriers for 2700 linear feet along the Duwamish neighborhood and the other three areas will continue to have Type 2 noise barriers. The request also includes a commitment to maintain noise levels below federal limits in all areas. The condition of approval of the Unclassified Use Permit requires Sound Transit to provide appropriate reasonable mitigation acceptable to the City for any additional noise impacts that were not anticipated during the original design of the system.

Location: Light Rail alignment in Tukwila

Comprehensive Plan

Designation/Zoning District The area of work is the Light Rail alignment. Various zoning districts adjoin the entire alignment.

#### II. DECISION

SEPA Determination: Sound Transit was the SEPA lead agency for the project and the Sound Transit SEPA Responsible Official has previously determined that the project creates a probable significant environmental impact and required preparation of an Environmental Impact Statement (EIS) on the project.

Decision on Substantive Permit: The City Community Development Director has determined that the application for approving the proposed noise mitigation does comply with applicable City and State code requirements and has approved the proposed mitigation, subject to the following conditions:



1. Sound Transit shall perform bi-weekly inspection of Type 2 acoustic barriers with particular attention to the material near the grommets as required within Attachment 5 Central Link Maintenance Matrix (Basic Track Patrol) included in the September 6, 2011, letter from Ahmad Fazel to Jack Pace. Sound Transit has stated that the performance life of the proposed Type 2 acoustic barriers is five to ten years. A replacement schedule of 5-10 years (or earlier if damaged) shall be established, unless Sound Transit can demonstrate that panels are still effective after that period and the noise levels continue to be below FTA levels. Sound Transit shall repair and replace the Type 2 barriers before the performance is impacted to ensure that FTA noise levels are not exceeded. Any damaged panels shall be replaced expeditiously. At this time some cuts/cracks in the material and some missing zip ties have been observed near receiver N3, where Acoustiblok is installed outside the chain-link fence. This damaged material shall be repaired or replaced within 30 days of the date of this decision.
2. Sound Transit is responsible for making repairs and maintaining the system. Sound Transit shall address any light rail noise complaints expeditiously. Sound Transit shall replace the existing lubricators with a more reliable system in the first quarter of 2012. Additionally, Sound Transit shall maintain all measures required to mitigate wheel squeal and repair and replace mitigation, as necessary.
3. Sound Transit shall develop and implement long-term noise maintenance and monitoring program based on recommendations of the 2011 Wheel-Rail Noise Study, authorized by the Sound Transit Board on March 10, 2011. Sound Transit shall submit a copy of the Wheel-Rail Noise Study to the City and shall share wheel/rail monitoring results at various intervals recommended by the study.
4. Sound Transit shall comply with the FTA noise criteria throughout the City at all times.
5. Sound Transit shall follow an overall track and vehicle maintenance plan including preventive maintenance for vehicles, wheels, track and wheel squeal mitigation as detailed in the the Central Link Maintenance Matrix (Attachement 5 of the letter from Ahmad Fazel to Jack Pace dated September 6, 2011).
6. Construction of the Type 1 noise barrier is expected to start in January 2012 with substantial completion expected in October 2012 and final completion in January 2013. Within 60 days of completion of construction, Sound Transit shall submit a noise and vibration report, followed by a final noise and vibration report one year later.
7. The concerns raised regarding vibration testing in the peer review comments shall be addressed in noise and vibration reports referenced in 6 above.

### **III. YOUR APPEAL RIGHTS**

The Decision on this Permit Application is a Type 1 decision pursuant to Tukwila Municipal Code §18.104.010. Other land use applications related to this project may still be pending.

No administrative appeal of a DNS or an EIS is permitted. One administrative appeal to the City Hearing Examiner of the Decision on the Permit itself is permitted.

A party who is not satisfied with the outcome of the Hearing Examiner appeal process may file an appeal in King County Superior Court from the Hearing Examiner's decision.

#### IV. PROCEDURES AND TIME FOR APPEALING

In order to appeal the Community Development Director decision on the Permit Application, a written notice of appeal must be filed with the Department of Community Development within 14 days of the issuance of this Decision, which is by February 7, 2012.

The requirements for such appeals are set forth in Tukwila Municipal Code Ch. 18.116. All appeal materials shall be submitted to the Department of Community Development. Appeal materials MUST include:

1. The name of the appealing party.
2. The address and phone number of the appealing party; and if the appealing party is a corporation, association or other group, the address and phone number of a contact person authorized to receive notices on the appealing party's behalf.
3. A statement identifying the decision being appealed and the alleged errors in the decision.
4. The Notice of Appeal shall identify (a) the specific errors of fact or errors in application of the law in the decision being appealed; (b) the harm suffered or anticipated by the appellant, and (c) the relief sought. The scope of an appeal shall be limited to matters or issues raised in the Notice of Appeal.
5. Appeal fee per the current fee schedule, additional hourly charges may apply. In addition all hearing examiner costs will be passed through to the appellant.

#### V. APPEAL HEARINGS PROCESS


Any administrative appeal regarding the Permit shall be conducted as a closed record hearing before the Hearing Examiner based on the information presented to the Community Development Director, who made the original decision. No new evidence or testimony will be permitted during the appeal hearing. Parties will be allowed to present oral argument based on the information presented to the Community Development Director before their decision was issued. The Hearing Examiner's decision on the appeal is the City's final decision.

Any party wishing to challenge the Hearing Examiner's decision on this application must file an appeal pursuant to the procedures and time limitations set forth in RCW Ch. 36.70C. An appeal challenging a DNS, an MDNS or an EIS may be included in such an appeal. If no appeal of the Hearing Examiner's decision is properly filed in Superior Court within such time limit, the Decision on this permit will be final.

#### VI. INSPECTION OF INFORMATION ON THE APPLICATION

Project materials including the application, any staff reports, and other studies related to the permits are available for inspection at the Tukwila Department of Community Development, 6300 Southcenter Blvd., Suite 100, Tukwila, Washington 98188 from Monday through Friday between 8:30 a.m. and 5:00 p.m. The project planner is Minnie Dhaliwal, who may be contacted at 206-431-3685 for further information.

Property owners affected by this decision may request a change in valuation for their property tax purposes. Contact the King County Assessor's Office for further information regarding property tax valuation changes.

  
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Department of Community Development  
City of Tukwila



November 21, 2016

Ms. Minnie Dhaliwal, Planning Supervisor  
City of Tukwila Department of Community Development  
6300 Southcenter Boulevard  
Tukwila, Washington 98188

Re: Final Noise and Vibration Testing Report for Sound Transit's Link Light Rail Tukwila Segment

Dear Ms. Dhaliwal:

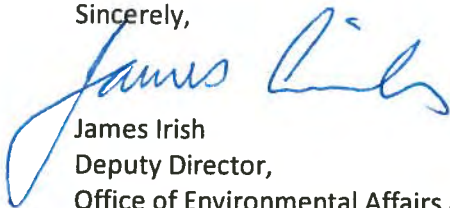
Please find attached the final Fourth Year Noise and Vibration Testing Results report from Michael Minor & Associates. The final report responds to comments from the City's peer review consultant (BRC), including:

- Letter Re: Sound Transit Link Light Rail Tukwila Segment Measurements of Vibration Levels. June 17, 2016
- Letter Re: Technical Review V Sound Transit Link Light Rail Tukwila Segment: Year 2015 Noise and Vibration Compliance Testing Report. January 8, 2016

The Fourth Year Report and the trend from previous years shows that the mitigation measures implemented by Sound Transit have reduced the noise and vibration from light rail operations to levels well below the FTA impact threshold. Although the City peer review testing of vibration at site V4 observed noticeable ground-borne noise levels inside the residence, the resident denied Sound Transit right-of-entry and a compliance test for ground-borne noise cannot be conducted. Since all measured noise and vibration levels are below FTA criteria, this report provides the final noise and vibration compliance testing required to meet City of Tukwila permit conditions.

Please provide written confirmation that the projects' noise and vibration testing and mitigation requirements from its Unclassified Use Permit are complete. If you have any questions please call me at (206) 398-5140.

Sincerely,



James Irish  
Deputy Director,  
Office of Environmental Affairs and Sustainability

cc: Jack Pace, City of Tukwila, DCD Director

Enclosure

Received

NOV 28 2016

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Development

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**Peter M. Rogoff**



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 Sound . Vibration . Air  
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Prepared for: James Irish, Sound Transit  
 Prepared by: Michael A. Minor  
 Date: November 17, 2016  
 Subject: Fourth Year Noise and Vibration Testing Results  
 Project: Tukwila Noise and Vibration Compliance Testing

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## Introduction

This memorandum summarizes the results of the fourth noise and vibration compliance testing along Sound Transit’s Tukwila light rail alignment, as required by the approved *Noise and Vibration Compliance Testing Program Link Light Rail: Tukwila Segment*, July 2, 2009 (Compliance Program, 2009). This fourth round of testing confirmed that all sites remain well below the Federal Transit Administration (FTA) noise and vibration criteria.

## Background

The City of Tukwila issued a “Notice of Decision” on September 21, 2004, which included 3-years of noise and vibration testing as part of the light rail project’s Unclassified Use Permit (UUP). Sound Transit conducted first year compliance noise and vibration monitoring in 2009 (*First Year Noise and Vibration Testing Results*, Revised December 9, 2009). The 2009 measurements identified several locations with noise or vibration levels above the FTA criteria.

Based on the 2009 results, Sound Transit implemented a number of mitigation measures to eliminate noise and vibration impacts within the Tukwila segment of the Central Link light rail corridor. Second year compliance testing in 2010 found that mitigation implemented by Sound Transit had reduced noise and vibration levels below the FTA criteria. Third year testing for 2011 was postponed until a Type 1 sound wall by the Duwamish Point Neighborhood was installed as agreed with the City. Results of the third year measurements, conducted in October 2013 following installation of the Type 1 wall, confirmed that all locations along the Tukwila light rail corridor were below the FTA noise and vibration criteria.

Table 1 provides a summary of the noise and vibration monitoring sites used in the previous three compliance measurements, including addresses, general information, and testing status for this report. Figure 1 provides an overview of the project area, existing sound walls constructed as part of the project, general locations identified with noise or vibration impacts in the First Year Testing Results (2009), locations of the wayside lubricators and new Type 1 (acoustical) barriers and Type 2 sound barriers. Also identified is a segment of track that was repaired to remedy a vibration impact at site V4.



Table 1. Noise and Vibration Monitoring Site Summary

Rec # <sup>1</sup>	Address <sup>2</sup>	Notes	Testing Recommendations
N1	11534 E Marginal Way	New Type 1 wall 2013. Noise levels below criteria.	Final 2015 compliance test at N1 the closest site in this area. <b>Completed.</b>
N1A	Interurban Place South near 40th Avenue South	New Type 1 wall 2013. Noise levels below criteria.	Final 2015 compliance test at N1 as site N1A further away. <b>Completed.</b>
N1B	S 119th Street at 40th Avenue South	New Type 1 wall 2013. Noise levels below criteria.	Final 2015 compliance test at N1 as site N1B further away. <b>Completed.</b>
N1C	Interurban Pl South (near 11918 Interurban Place S)	New Type 1 wall 2013. Noise levels below criteria.	Final 2015 compliance test at N1 as site N1C further away. <b>Completed.</b>
V1	12621 42nd Avenue S	Vibration levels below criteria for 3 years of testing, residences in this area are not occupied	Testing complete
N2	4066 S 128th Street	Type 1 wall, noise levels below criteria for 3 years of testing	Testing complete
N3	13404 48th Avenue S	Type 2 barrier. Noise levels below criteria, residence removed.	Testing complete
V2	13404 48th Avenue S	Vibration levels below criteria for 3 years of testing	Testing complete
N4	4834 S 136th Street	Type 1 wall. Noise levels below criteria for 3 years of testing	Testing complete
V3	4834 S 136th Street	Vibration levels below criteria for 3 years of testing	Testing complete
N5	4822 S 138th Street	Type 1 wall. Noise levels below criteria for 3 years of testing.	Testing complete
N6	King County Parcel #1523049072	Type 1 wall. Noise levels below criteria for 3 years of testing.	Testing complete
V4	14424 51st Avenue S	Repaired defective track in 2013	Final 2015 compliance test. <b>Completed.</b>
N6A	14914 51st Avenue S	Type 2 barrier. Noise levels below criteria, residence unoccupied.	Testing complete
N7	15171 52nd Avenue S	Type 2 barrier. Noise levels below criteria	Final 2015 compliance test at N8 as site N7 is farther away. <b>Completed.</b>
N8	5100 Southcenter Boulevard	Type 2 barrier. Noise levels below criteria	Final 2015 compliance test at N8 the closest site in this area. <b>Completed.</b>
N8A	15241 51st Avenue S	Type 2 barrier. Noise levels below criteria.	Final 2015 compliance test at N8 as site N8A is farther away. <b>Completed.</b>
N9	4918 Southcenter Boulevard	Type 1 sound walls. Noise levels below criteria for 3 years of testing.	Testing complete

**Table 1. Noise and Vibration Monitoring Site Summary**

<b>Rec #<sup>1</sup></b>	<b>Address<sup>2</sup></b>	<b>Notes</b>	<b>Testing Recommendations</b>
N10, N11	4908 Southcenter Boulevard	Type 1 sound walls. Noise levels below criteria for 3 years of testing.	Testing complete
N12	4908 Southcenter Boulevard	Type 1 sound walls. Noise levels below criteria for 3 years of testing.	Testing complete
N13, N14	3816 S 154th Lane	Type 1 and concrete sound walls. Noise levels below criteria for 3 years of testing.	Testing complete
Notes:			
1. Receivers are shown on Figure 1, detailed maps and figures are in Attachments C and D			
2. Address or parcel number			





## Summary of 2015 Test Results

Based on the Third year testing results, Sound Transit agreed to perform an additional fourth noise and vibration compliance test at three representative sites. The noise testing sites included a single test site near the Duwamish Point Neighborhood (revised site N1), representing the previous sites N1, N1A, N1B and N1C. Based on the most current test, noise levels in this neighborhood remain well below the criteria, with the measured light rail noise levels 7 dB or more below the FTA impact criteria.

The second noise testing site is near the curve where the alignment transitions from the west side of I-5 to the east, along SR 518 to the S 154th Street Park and Ride. This site was selected as it is near the curve where wheel squeal and rail flanging noise has occurred in the past, and is also near previous monitoring sites N7, N8, N8A, and N9. Based on current testing (revised site N8), noise levels in this area also remain well below the criteria, with the measured light rail noise levels 7 dB or more below the FTA impact criteria.

Finally, a vibration test was performed at three locations on site V4, which had past issues with defective track that was corrected. Testing in this area has been performed at several slightly different locations, including near the South 144th overpass, at the residence at 14424 51st Avenue S, and on the retaining wall between the houses and the trackway. This final testing includes a test approximately 15 feet east of the retaining wall, on Sound transit property, along with two measurement sites on the property, with transducers placed both inside and outside the residence, to assure compliance.

Vibration levels at the residence are well below the FTA criteria of 72 VdB, with a maximum 1/3 octave band velocity level of 62.6 VdB inside the residence and 58.1 VdB outside the residence. However, during the City peer review vibration testing at site V4, the peer review consultants observed that ground-borne noise inside the residence was noticeable and could be the reason for the complaints. In response to the peer review observation, Sound Transit pursued a test for ground-borne noise to compare noise measurements to the FTA criteria to verify compliance. A ground-borne noise test must be performed inside the building. The resident of the property denied right-of-entry and this test cannot be performed. Since all measured noise and vibration levels are below FTA criteria, this report provides the final noise and vibration compliance testing required to meet City of Tukwila permit conditions.

## Noise Compliance Verification Methods and Results

For this fourth round of testing, the project noise levels were predicted by measuring light rail pass-by levels, calculating the operational Ldn and comparing it to the FTA noise impact criteria based on the pre-project measured or predicted Ldn from the Final Design Noise Technical Report (2004). For this method, several pass-by measurements of the light rail vehicles is performed. The measured data includes the Lmax and the Single Event Sound Pressure Level (SEL). Using these measured noise levels for light rail pass-bys, and the methods in the FTA manual, the 24-hour Ldn noise level for light rail operations can be calculated using the proposed operational schedule (i.e., number of trains hourly throughout

the day, evening and nighttime). The schedule used for the noise projections is provided in Table 2. The results of the noise monitoring, FTA calculations and site specific Ldn noise levels are provided below.



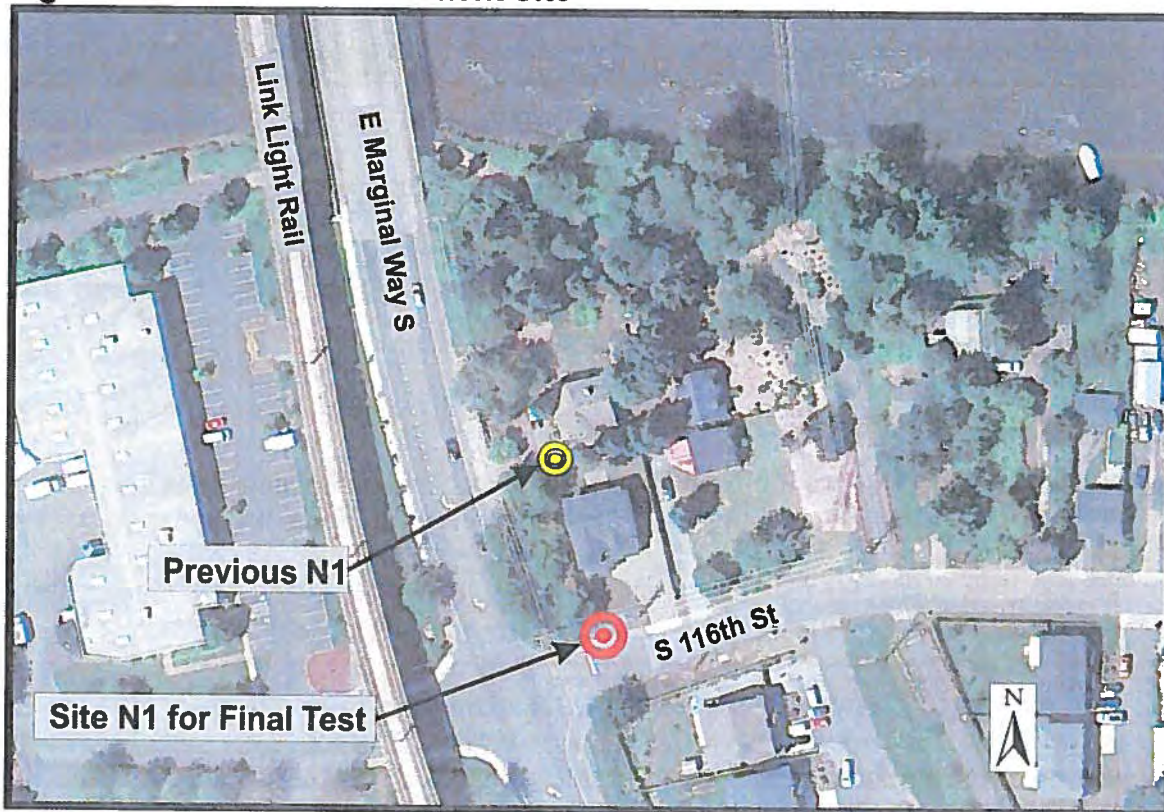
<b>Time of Day</b>	<b>Service Type</b>	<b>Hours</b>	<b>Headway</b>	<b>Cars per Train</b>
5:00 am - 6:00 am	Early/Late	1.0	15	2
6:00 am - 8:30 am	Peak	2.5	6	2
8:30 am - 3:00 pm	Base	6.5	10	2
3:00 pm - 6:30 pm	Peak	3.5	6	2
6:30 pm - 10:00 pm	Base	3.5	10	2
10:00 pm - 1:00 am	Early/Late	3.0	15	2

### **Duwamish Point Neighborhood**

The final N1 test was performed on the sidewalk on S 116th Street near the intersection with East Marginal Way S, approximately 35 feet from the curb of East Marginal Way S, and 130 feet from the light rail structure. The pre-project Ldn for this area was measured at 67 dBA, and based on this ambient level, a moderate impact occurs under the FTA criteria if project noise levels exceed 63 dBA Ldn. The measurement site is shown on Figure 2.

Measurements of 5 northbound and 5 southbound trains taken on March 27, 2015 produced a project Ldn of 56 dBA, or 7 dB below the FTA criteria. This reading is supported by the last pass-by testing performed in 2009, where the project Ldn was measured at 60 dBA. At that time the new Type 1 sound walls were not in place, however, the area did have the Type 2 sound barrier and the rails had recently been acoustically ground. The additional noise reduction of approximately 4 dB in 2015 (with Type 1 sound walls) compared to the 2009 noise levels (with the Type 2 sound barriers) is consistent with the acoustical benefits that occur with replacing the Type 2 sound barriers with Type 1 sound walls. The measurement results and analysis is provided in Table 3. It is important to note that although all attempts were made to have readings with minimal background noise, some of the readings do include other noise sources, and therefore the actual noise from light rail operations is expected to be lower than those presented.

Figure 2. N1 Noise Measurement Site



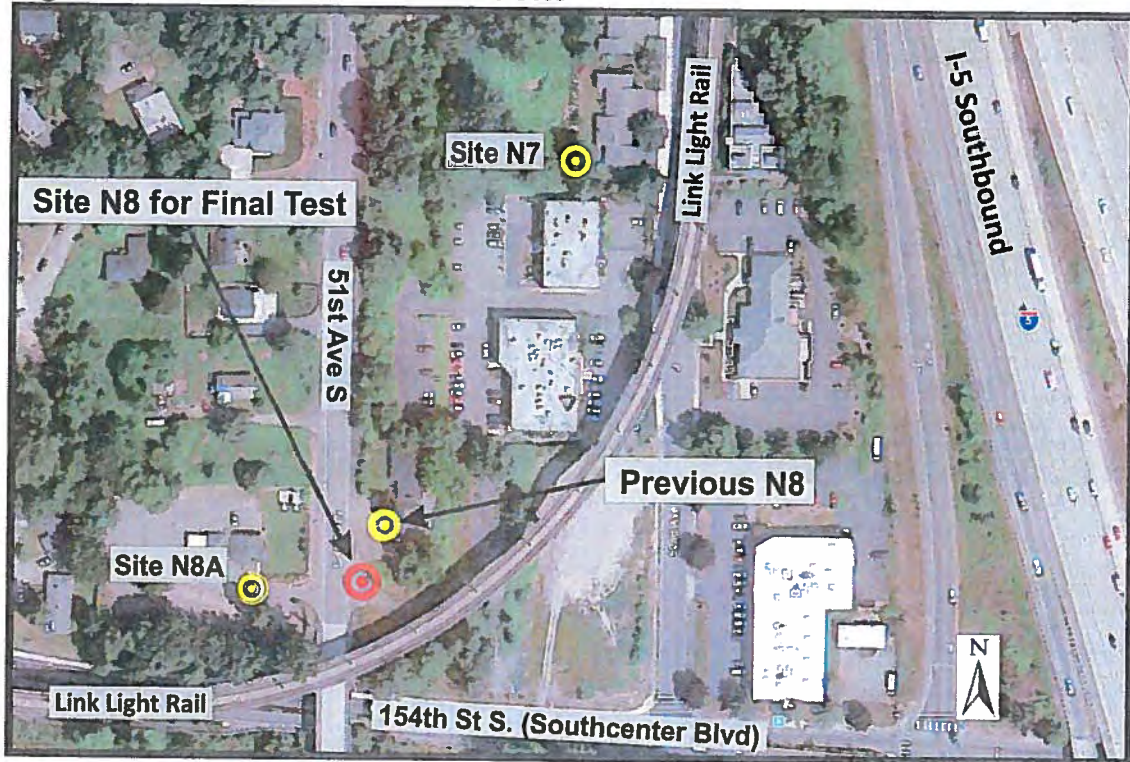
<b>Table 3. N1 Pass-By Measurements and Ldn</b>					
<b>Direction</b>	<b># Cars</b>	<b>L<sub>max</sub></b>	<b>SEL</b>	<b>Ldn Noise Levels in dBA</b>	
<b>Northbound Trains</b>					
NB	2	69.9	75.5		
NB	2	70.5	74.7		
NB	2	73.3	78.9		
NB	2	71.3	78.5		
NB	2	72.5	79.0		
<b>Minimum</b>		69.9	74.7		
<b>Maximum</b>		73.3	79.0		
<b>Energy Average</b>		71.5	77.3		<b>53.6 dBA (northbound)</b>
<b>Standard Deviation</b>		1.40	2.05		
<b>Southbound Trains</b>					
SB	2	67.4	73.3		
SB	2	71.7	78.6		
SB	2	71.1	77.6		
SB	2	66.8	70.7		
SB	2	70.7	75.1		
<b>Minimum</b>		66.8	70.7		
<b>Maximum</b>		71.7	78.6		
<b>Energy Average</b>		69.5	75.1		<b>51.4 dBA (southbound)</b>
<b>Standard Deviation</b>		2.27	3.21		
<b>Total Ldn and Impact Analysis</b>					
<b>Pre-Project Ldn (Measured during EIS)</b>				67 dBA	
<b>Total Project Ldn from Pass-by Measurements (combined north and southbound Ldn's)</b>				<b>56 dBA</b>	
<b>Impact Level: 63 dBA (moderate) 67 dBA (severe)</b>				No	
Notes:					
<ul style="list-style-type: none"> <li>The Ldn noise levels are calculated using the SEL and follow the methods in the FTA <i>Transit Noise and Vibration Assessment Manual</i>, April 2006 and schedule in Table 2.</li> <li>Ambient Ldn is without light rail operations.</li> <li>Ldn noise levels in <b>Bold-Red</b> typeface exceed the FTA criteria.</li> </ul>					

### I-5 to SR 518 Curve

The final measurement for the residences and Buddhist Temple near the curve at I-5 and SR 518 interchange was taken 80 feet from the structure along 51st Avenue S. This revised N8 site was approximately 70 to 80 feet from the previous N8, and 165 feet east of site N8A. Site N7, also nearby on 52nd Avenue S, is approximately 150 feet from the light rail structure, and has the added protection of an acoustical sound wall to the north. The pre-project Ldn for this area is 73 dBA, and under the FTA criteria, a moderate impact occurs if project noise levels exceed 66 dBA Ldn. The measurement site is shown on Figure 3.



Figure 3. N8 Noise Measurement Site



The noise sensitive structures in this area are near the curve where the light rail alignment transitions from I-5 to SR 518. As previously stated, lubricators have been installed just before the curves near SR 518 and just east of the 154<sup>th</sup> Street Park and Ride, effectively mitigating wheel squeal and flanging noise along this part of the corridor. In addition to the lubricators, a 912 foot Type 2 sound barrier was installed in the vicinity of 51st/52nd Avenues S and S154th Street, connecting the two existing Type 1 acoustic sound walls. Finally, rail grinding in this area in 2010 also contributed to the reduced light rail noise levels.

Five northbound and five southbound trains were measured at site N8 on March 27, 2015. The result of the measurements was a project Ldn of 61 dBA. This data was extrapolated for the residence and temple using distance corrections from the FTA manual. The results are a project Ldn at the residence of 59 dBA, or 7 dB below the FTA criteria, and at the temple, the project Ldn was 58 dBA, or 8 dB below the FTA criteria. Note, that the measured Ldn also includes noise from other sources, including traffic on SR 518, I-5, local roadways, and aircraft from SeaTac airport, and is likely higher than the actual noise levels from light rail operations. No noise impacts are predicted at any of the sites in this area. Table 4 provides a summary of the measured data and project Ldn projections.

<b>Table 4. N8 Pass-By Measurements and Ldn</b>				
<b>Direction</b>	<b># Cars</b>	<b>L<sub>max</sub></b>	<b>SEL</b>	<b>Ldn Noise levels in dBA</b>
<b>Northbound Trains</b>				
NB	2	71.0	81.0	
NB	2	71.9	82.7	
NB	2	73.2	84.0	
NB	2	71.3	81.8	
NB	2	70.0	80.0	
<b>Minimum</b>		70.0	80.0	
<b>Maximum</b>		73.2	84.0	
<b>Energy Average</b>		71.5	81.9	
<b>Standard Deviation</b>		1.18	1.54	
<b>Southbound Trains</b>				
SB	2	72.7	82.7	
SB	2	72.4	84.2	
SB	2	69.6	80.7	
SB	2	68.9	79.7	
SB	2	73.3	83.3	
<b>Minimum</b>		68.9	79.7	
<b>Maximum</b>		73.3	84.2	
<b>Energy Average</b>		71.4	82.1	
<b>Standard Deviation</b>		1.99	1.87	
<b>Total Ldn and Impact Analysis</b>				
<b>Pre-Project Ldn (Measured during EIS)</b>				73 dBA
<b>Total Project Ldn from Pass-by Measurements (combined north and southbound Ldn's)</b>				<b>61 dBA</b>
<b>Impact Level: 66 dBA (moderate) 72 dBA (severe)</b>				No
Notes:				
<ul style="list-style-type: none"> <li>The Ldn noise levels are calculated using the SEL and follow the methods in the FTA <i>Transit Noise and Vibration Assessment Manual</i>, April 2006 and schedule in Table 2.</li> <li>Ambient Ldn is without light rail operations.</li> <li>Ldn noise levels in <b>Bold-Red</b> typeface exceed the FTA criteria.</li> </ul>				

## Vibration and Ground-Borne Noise Level Compliance Methods and Results

The equipment used for the vibration measurements included a Rion Digital Recorder, PCB accelerometers, and PCB charge amplifiers. The L<sub>max</sub> and RMS average vibration velocity were calculated for each train pass-by. The “RMS average vibration velocity” is defined as the RMS average vibration velocity over the 3 decibel down points (relative to the 1-second RMS L<sub>max</sub>). The analysis included five northbound trains and four southbound trains. The recordings were analyzed using MATLAB routines to obtain the 1/3 octave band spectra of the vibration at 0.125 ms (1/8 second) intervals. Vibration measurements were taken at three

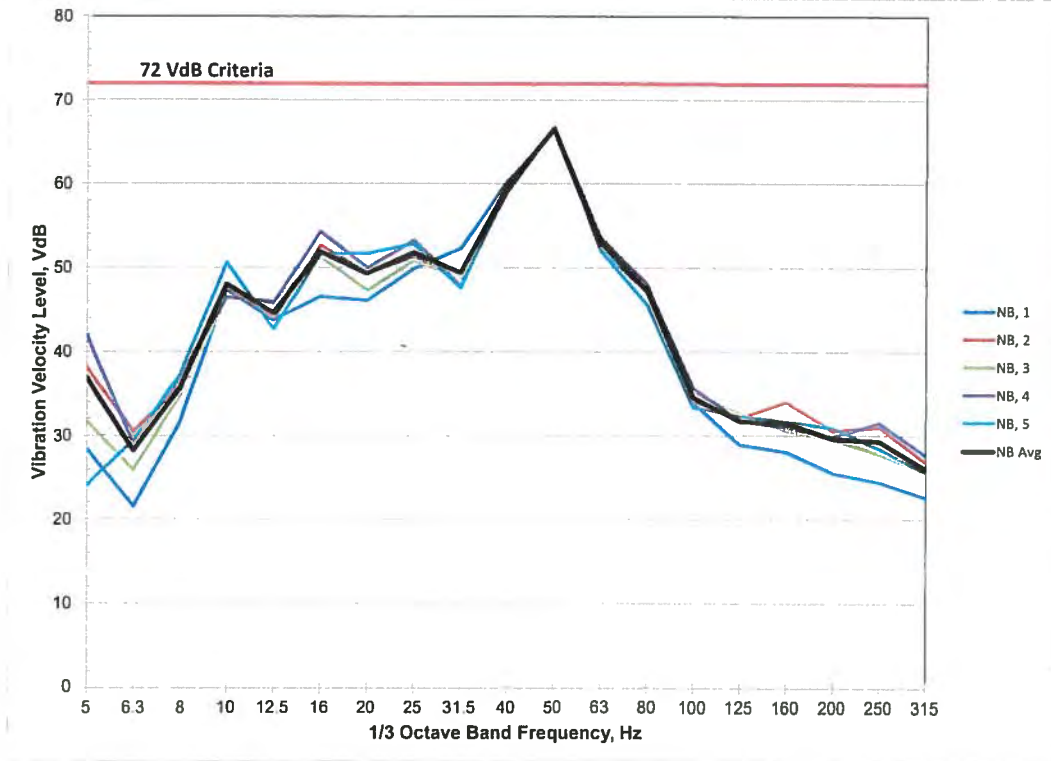


different locations on site V4 to verify continued compliance with the FTA vibration criteria. Vibration at site V4 has been consistently below FTA criteria since 2009 except in 2013 when a track defect caused vibration levels above the FTA criteria. However, that section of track was repaired in 2013 and vibration levels have remained well below the FTA criteria since the repairs were completed.

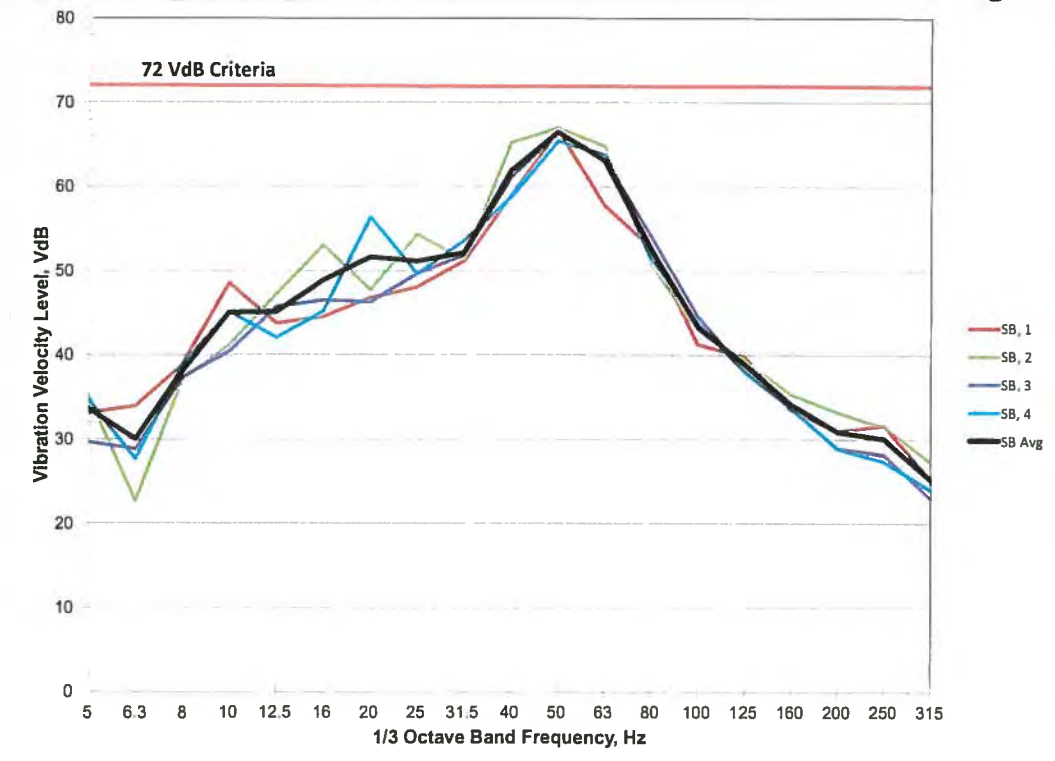
In November 2014, based on an additional complaint from the residence at 14424 51st Avenue S, vibration readings were taken on Sound Transit property, located between the tracks and the residence. This allowed for the measurements to be taken without obtaining a right of entry and respond to the complaint more quickly. Because the test site is between the residence and the retaining wall, but not on the retaining wall, vibration levels at this site would be expected to be greater than, or equal to, the vibration levels at the foundation of the residence.

The results of the test near the retaining wall, which are closer to the trackway than the property, show that the vibration levels are not exceeding the FTA Detailed Assessment impact threshold of 72 VdB for any 1/3 octave bandwidth. The maximum 1/3 octave band vibration level measured was 67.0 VdB for a southbound train, and 66.8 VdB for a northbound train. The maximum levels were at the 50 Hz frequency band in both directions. Based on these measurements, there is no exceedance of the FTA criteria, and the light rail vibration levels are approximately 5 VdB below the criteria in either direction. The data is provided in Figures 4 and 5 below.

**Figure 4. Northbound 1/3 Octave Vibration Levels near Retaining Wall**



**Figure 5. Southbound 1/3 Octave Vibration Levels near Retaining Wall**



For the final vibration compliance measurement at site V4, performed in March 2015, vibration measurements were performed inside and outside the residence at 14424 51st Avenue S to ensure compliance with the FTA criteria. Measurement locations were determined in consultation with the resident to reflect where the resident indicated vibration was most noticeable. The interior measurement was performed to get a more accurate vibration reading because the FTA criterion for annoyance at residences is based on the indoor vibration levels. The maximum 1/3 octave band vibration levels based on 5 northbound and 5 southbound train pass-bys, measured simultaneously inside and outside the residence, was 58.1 VdB at the exterior location, and 62.6 VdB for the interior location. The measured near track train vibration levels at the indoor measurement location are approximately 9 decibels below the FTA criteria of 72 VdB for residential land use.

Figures 6 through 9 provide plots of the vibration levels in VdB based on the frequency. Figure 10 provides a view of the property and the different locations where vibration testing was performed.

The City peer review (BRC Letter June 17, 2016) of vibration levels at site V4 stated that ground-borne noise levels inside the residence may be the source of the residents' complaints. Ground-borne noise is induced by vibration of the building floors and walls from light rail operation and is typically not measured for surface light rail because airborne noise from the train is predominant. As recommended by the City peer review Sound Transit pursued a compliance test for ground-borne noise within the residence to verify it is below the FTA criteria. A ground-borne noise test must be performed inside the building. However, the resident denied Sound Transit right-of-entry and a compliance test for ground-borne noise cannot be conducted. Several attempts were made to gain the needed right of entry from the resident to conduct the test, including multiple phone calls and an in person meeting with Sound Transit staff (August 9, 2016). The resident cited testing fatigue and skepticism of results as reason to deny additional testing.

Figure 6. Northbound 1/3 Octave Vibration Levels Residence Exterior

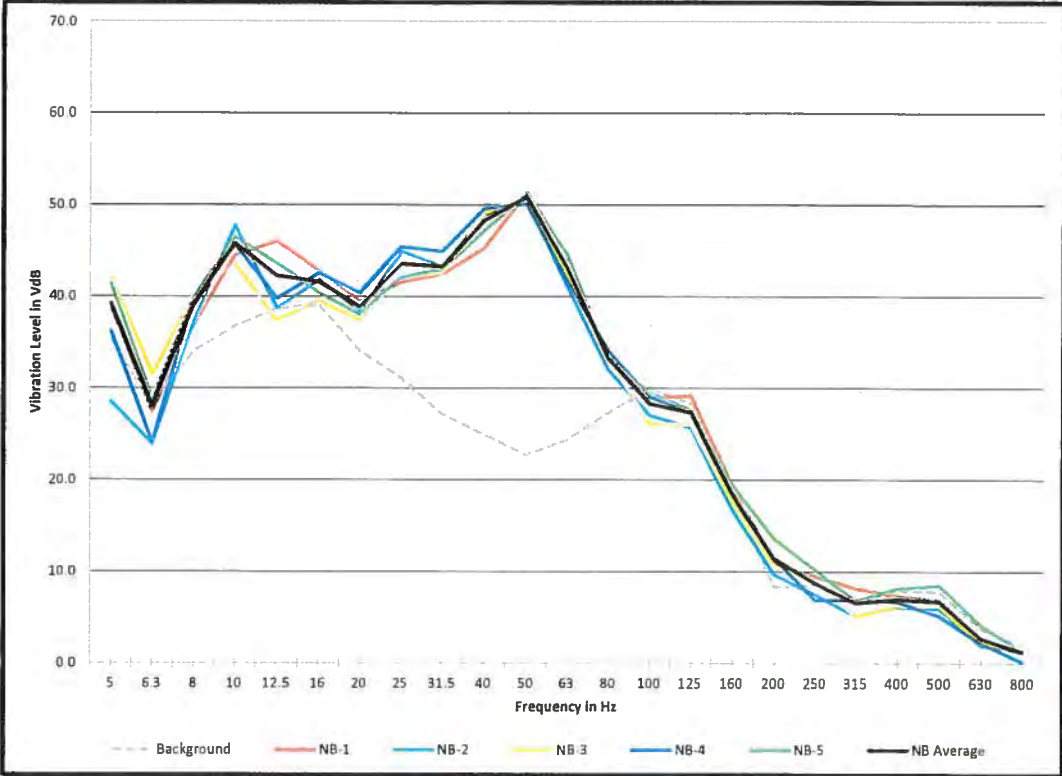
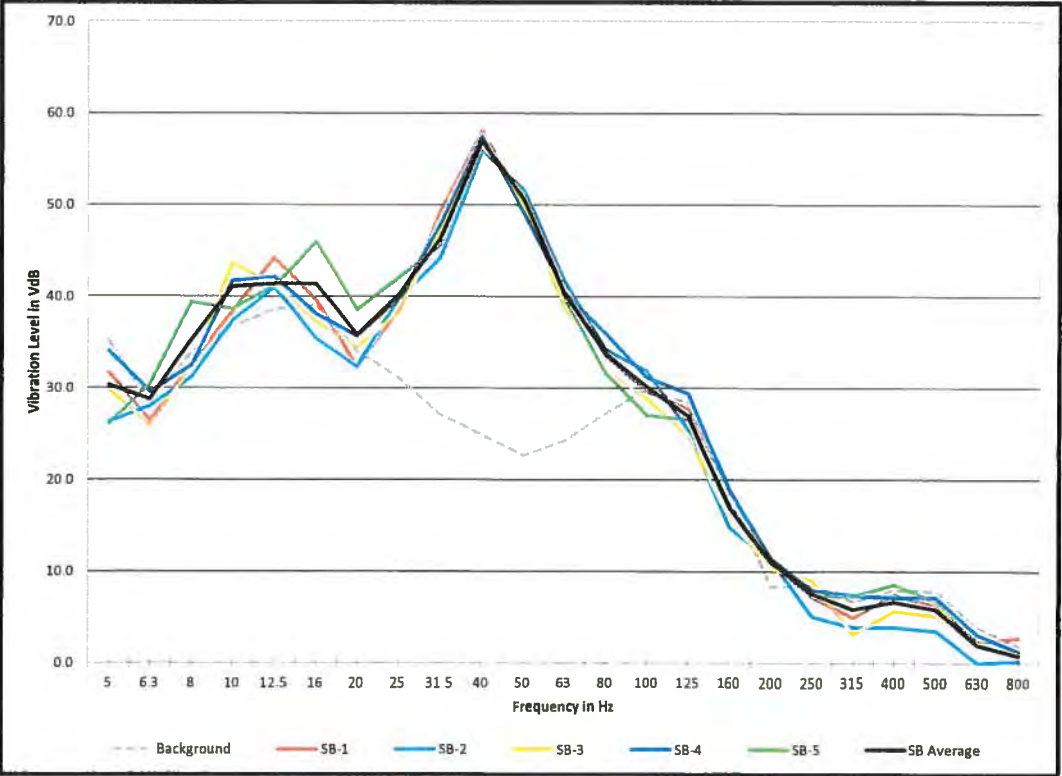
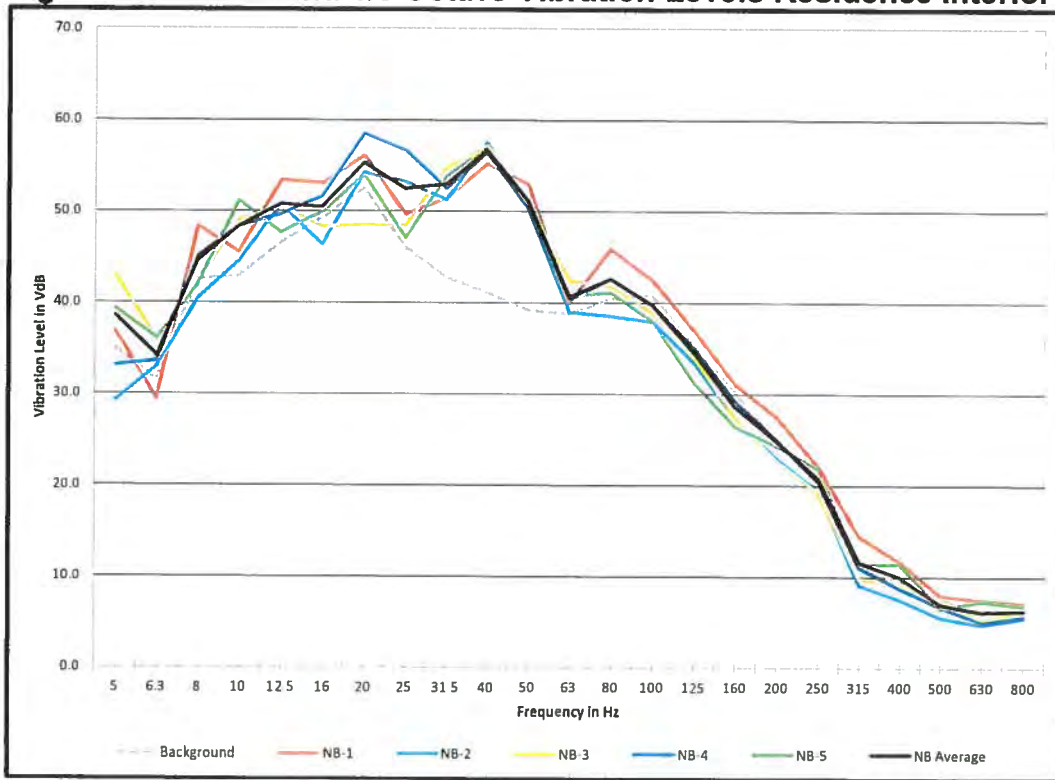


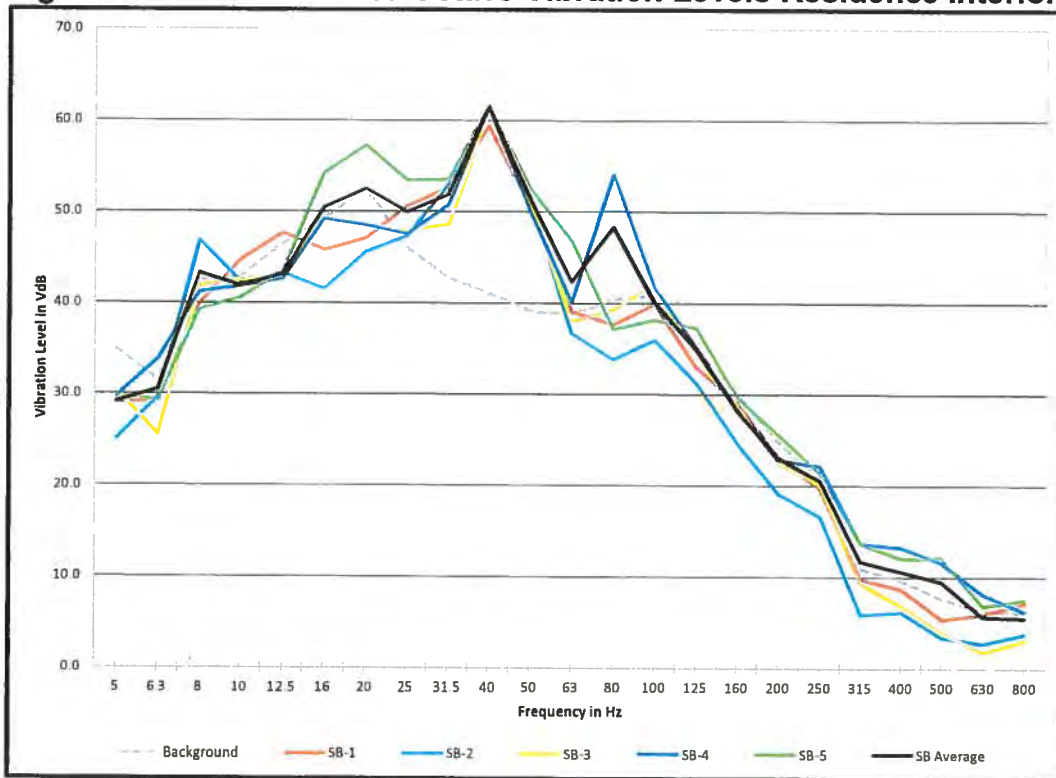
Figure 7. Southbound 1/3 Octave Vibration Levels Residence Exterior



**Figure 8. Northbound 1/3 Octave Vibration Levels Residence Interior**

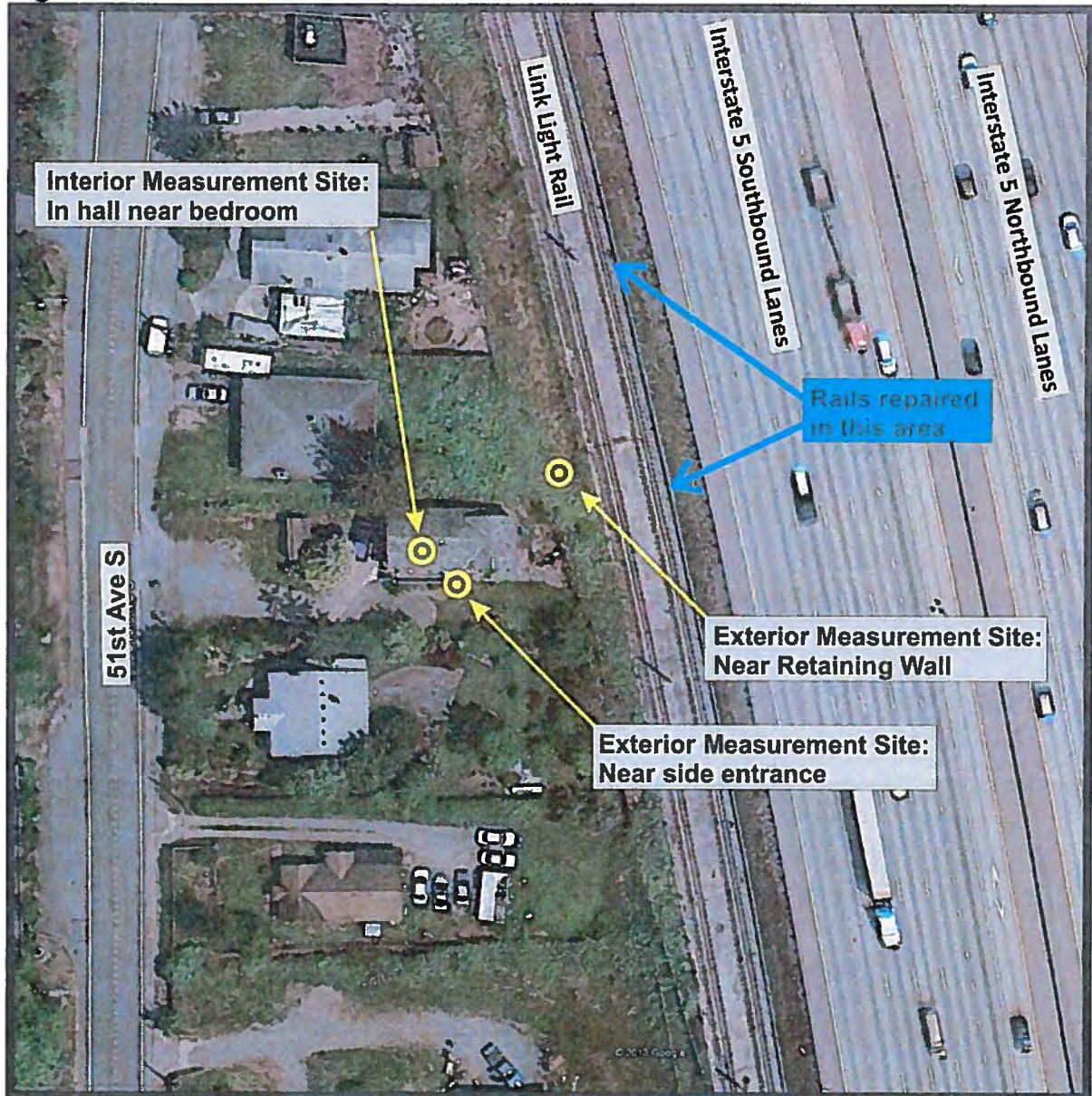


**Figure 9. Southbound 1/3 Octave Vibration Levels Residence Interior**





**Figure 10. Location of Vibration Measurements for Site V-4**



## Conclusion

The noise and vibration measurements performed in 2015 and the trend from previous years shows that the mitigation measures implemented by Sound Transit have reduced the noise and vibration from light rail operations to levels below the FTA impact threshold. The noise testing shows continued compliance well within FTA criteria, demonstrating that we have achieved long term compliance. The fourth noise and vibration compliance testing described in this memorandum completes the noise and vibration testing required by City of Tukwila permit conditions for all locations. Although the City peer review testing of vibration at site V4 observed noticeable ground-borne noise levels inside the residence, the resident denied Sound Transit right-of-entry and a compliance test for ground-borne noise cannot be conducted. Since all measured noise and vibration levels are below FTA criteria, this report

provides the final noise and vibration compliance testing required to meet City of Tukwila permit conditions.





January 8, 2016

Ms. Minnie Dhaliwal, Planning Supervisor  
City of Tukwila Department of Community Development  
6300 Southcenter Boulevard  
Tukwila, Washington 98188

Re: Technical Review V  
Sound Transit Link Light Rail Tukwila Segment:  
Year 2015 Noise and Vibration Compliance Testing Report

Dear Ms. Dhaliwal:

This letter presents our technical review of the Final-Year Noise and Vibration Compliance Testing report prepared by Michael Minor & Associates (MM&A) on May 14, 2015. The MM&A report represents the fourth set added to three previous annual noise and vibration compliance testing results.

The scope and methodology for the compliance testing were established in Sound Transit's Compliance Testing Plan dated May 16, 2009 and revised July 2, 2009 (hereafter referred to as the Compliance Testing Plan).

In preparing this letter, BRC Acoustics and Audiovisual Design reviewed the Report of Final-Year Noise and Vibration Testing prepared by Michael Minor & Associates and dated May 14, 2015.

In addition, BRC Acoustics conducted sound level measurements during Sound Transit light-rail pass-bys at selected receiver locations. BRC Acoustics is also tasked with conducting independent vibration measurements on residential property, pending written permission from the property owner.

## **REVIEW OF NOISE TESTING REPORT**

### **General Comments Regarding the Scope of the Noise Annual Review**

The 2015 Compliance Testing Report generally follows the prescriptions of Sound Transit's Compliance Testing Plan dated May 16, 2009. Most of the sound-measurement locations listed in the Plan were considered complete following the Third-Year Noise Testing Results submitted by MM&A on November 26, 2013 and peer-reviewed by BRC Acoustics on August 31, 2014.

The Final-Review report presents sound measurements at two remaining locations updated from the Compliance Testing Plan, results derived from the measurements, and applicable criteria for identifying impacts. No additional noise-mitigation measures are proposed.

Table 1 of the MM&A report is consistent with Table 7 from the Third Annual Compliance Report.

### **Baseline Sound Levels**

The data for Pre-Project Ldn entered in Tables 3 and 4 and in the discussion on pages 6 and 8 are consistent with the Monitoring Plan at both sites.

### **Allowable Project Sound Levels**

The Federal Transit Administration (FTA) criteria shown in Tables 3 and 4 of the 2015 Compliance Testing Report are consistent with the FTA Manual and with Sound Transit's Compliance Testing Plan.

### **Sound Measurement and Calculation Methodology**

The sound measurements reported on pages 5-10 of the 2015 Compliance Testing Report were conducted appropriately for evaluating potential noise impacts from Sound Transit trains. The measurement locations and methodology are consistent with the measurement plan proposed as part of the 2013 Compliance Testing Report.

In general, the calculations of 24-hour Ldn were conducted according to FTA methods, consistent with the Operational Schedule shown in Table 2 of the MM&A report. BRC Acoustics independently calculated 24-hour Ldn values using the passby sound levels reported in Tables 3 and 4 of the MM&A report and the Operational Schedule shown in Table 2. We found a slight discrepancy (0.8 dBA) in the Ldn from southbound operations in Table 3. The overall Ldn and the finding of compliance with FTA criteria are not affected, but we recommend revisiting the Ldn result.

In order to confirm the noise results of the 2015 Compliance Testing Report, BRC Acoustics conducted independent noise measurements of train pass-bys at selected receiver locations. Sound levels were measured on Tuesday, September 8, 2015 between 2:30 and 5 p.m. The measurements were conducted using a Bruel & Kjaer 2250 Real-Time Spectrum Analyzer. The weather during the measurements was cloudy with sun breaks, temperatures in the lower 70s degrees Fahrenheit and wind from the west-southwest at up to 5 mph.

Sound measurements of train pass-bys were conducted at Locations N1 and N8. In both cases, the locations, which differ slightly from Locations N1 and N8 used in previous annual reports, were those designated *for Final Test* in the MM&A 2015 report.

The results of the sound-level measurements by BRC Acoustics are tabulated in Attachment A to this letter. The tables also contain 24-hour Ldn levels from the measured pass-bys, calculated by BRC Acoustics using the operational schedule found in Table 2 of the 2015 Compliance Testing Report. The project Ldn determined by BRC Acoustics was within 3 dBA of the levels reported by MM&A at both locations. The results confirm the finding of no noise impacts, as reported by MM&A.

### **Noise Compliance Verification**

The characterization of noise impacts is correctly identified at the test sites listed in Tables 1 (denoted *Final Compliance Test*), 3, 4, and in the discussion in the Final Compliance Testing Report.

In Table 1, remove the reference to footnote 5 (pertaining to Receiver #N8A).

### **Sound Mitigation Measures**

According to the results presented in the 2010, 2013, and Final-Year (2015) Noise compliance Testing reports and the measurements and calculations conducted by BRC Acoustics, the noise mitigation measures implemented by Sound Transit have brought sound levels into compliance with FTA criteria.

During the observations by BRC Acoustics on September 8, 2015, there was minimal or no wheel squeal along the Tukwila corridor. The rail lubricators at the three locations near SR-518 continue to function properly.

## **REVIEW OF VIBRATION TESTING REPORT**

### **General Comments Regarding the Scope of the Vibration Annual Review**

The 2015 Compliance Testing Report generally follows the prescriptions of Sound Transit's Compliance Testing Plan dated May 16, 2009. Three of the four vibration-measurement locations listed in the Plan were considered complete following the Third-Year Vibration Testing Results submitted by MM&A on November 26, 2013. BRC Acoustics concurred with this characterization of location V1, V2, and V3 in the peer review dated November 24, 2014.

The 2015 Final-Review report presents vibration measurements at the remaining location (V4) updated from the Compliance Testing Plan, including results derived from the measurements, and applicable criteria for identifying impacts. No additional vibration-mitigation measures are proposed.

The entries related to vibration in Table 1 of the 2015 MM&A report are consistent with Table 7 from the Third Annual Compliance Report (2013).

Part of the 2015 peer-review scope, as assigned to BRC Acoustics, is to conduct independent vibration measures on the V4 property (14424 51<sup>st</sup> Avenue South). As of the date of this report, BRC has obtained verbal permission to access the property, but the property owner has not yet followed up with written permission. BRC's current assessment of MM&A's analysis and conclusions regarding V4 anticipates that our measurement results will be consistent with MM&A's, and remains subject to confirmation pending the results of our (future) independent vibration measurements.

### **Allowable Project Vibration Levels**

The Federal Transit Administration (FTA) criteria, as described on Page 11 of the 2015 Compliance Testing Report (72 VdB rms re: 1 micro-inch/sec for any 1/3-octave bandwidth), are consistent with the FTA Manual and with Sound Transit's Compliance Testing Plan.

### **Vibration Measurement and Calculation Methodology**

In the peer-review of Sound Transit's Third-Year Vibration Testing Report (BRC November 24, 2014), BRC recommended that vibration measurements at V4 be conducted directly adjacent to the residence, or inside the residence at either (1) slab on grade, or (2) top of foundation walls or footings, as the dwelling's actual construction conditions would dictate.

The measurement locations selected by MM&A for the 2015 Compliance Testing are described as (a) exterior, near side entrance, and (b) interior, in hall near bedroom. It is probable that the exterior measurement location is equivalent to BRC's recommendation. It is not possible to determine whether the interior location is equivalent to BRC's recommended locations. Since the interior location was selected by the property owner based on most noticeable vibration, we make the assumption that the location is indeed representative of worst-case interior vibration impacts, to be confirmed once BRC conducts independent measurements.

### **Vibration Compliance Verification**

Pending independent confirmation of the vibration levels shown in Figures 6 to 9 of the 2015 MM&A report, the characterization of vibration levels at test site V4 as being in compliance with FTA criteria appears to be valid.

## Vibration Mitigation Measures

According to the results presented in the 2010, 2013, and Final-Year (2015) Vibration Compliance Testing reports, and the pending vibration measurements by BRC Acoustics, the vibration-mitigation measures implemented by Sound Transit have brought vibration levels into compliance with FTA criteria and no additional vibration testing or mitigation development is required to satisfy the 2009 Compliance Testing Plan. We anticipate that our pending on-site measurements will most likely confirm the conclusions of the MM&A 2015 report.

### SUMMARY

Evaluation and review by BRC Acoustics, and our independent sound measurements, confirm that noise-mitigation and vibration-mitigation efforts undertaken by Sound Transit have brought sound and vibration levels from light-rail pass-bys into compliance with FTA criteria. The remaining priority proceeding forward continues to be maintaining the effectiveness of on-going sound and vibration mitigation measures.

If you have any questions or require additional information, please call.

Sincerely,  
BRC Acoustics & Audiovisual Design



Ioana Park, P.E.  
Senior Consultant, LEED AP BD+C



Dennis Noson, Ph.D.  
Senior Acoustical Consultant

**ATTACHMENT A**  
**SOUND MEASUREMENTS AND Ldn CALCULATIONS**



<b>Table A1. Pass-By Measurements and Ldn Levels for Site N1</b>				
<i>BRC Measured data from September 8, 2015</i>				
<b>Direction</b>	<b># Cars</b>	<b>Lmax</b>	<b>SEL</b>	<b>Project Ldn</b>
<b>Northbound Trains</b>				
NB	2	72.1	78.4	
NB	2	69.8	76	
NB	2	65.9	74.7	
NB	2	70.3	76	
<b>Minimum</b>		<b>65.9</b>	<b>74.7</b>	
<b>Maximum</b>		<b>72.1</b>	<b>78.4</b>	
<b>Energy Average</b>		<b>70.0</b>	<b>76.5</b>	
<b>Southbound Trains</b>				
SB	2	70.9	78.8	
SB	2	70.2	77.1	
<b>Minimum</b>		<b>70.2</b>	<b>77.1</b>	
<b>Maximum</b>		<b>70.9</b>	<b>78.8</b>	
<b>Energy Average</b>		<b>70.6</b>	<b>78.0</b>	
<b>Total Ldn and Impact Analysis</b>				
			<b>Pre-Project Ldn</b>	<b>67</b>
			<b>Project Ldn</b>	<b>57</b>
			<b>Impact Level = 63 dBA Ldn</b>	<b>No Impact</b>

<b>Table A2. Pass-By Measurements and Ldn Levels for Site N8</b>				
<i>BRC Measured data from September 8, 2015</i>				
<b>Direction</b>	<b># Cars</b>	<b>Lmax</b>	<b>SEL</b>	<b>Project Ldn</b>
<b>Northbound Trains</b>				
NB	2	67	77	
NB	2	71.5	78.1	
NB	2	68.1	75.7	
<b>Minimum</b>		<b>67</b>	<b>75.7</b>	
<b>Maximum</b>		<b>71.5</b>	<b>78.1</b>	
<b>Energy Average</b>		<b>69.3</b>	<b>77.0</b>	
<b>Southbound Trains</b>				
SB	2	74	80.4	
SB	2	70	79.2	
SB	2	72.4	79.4	
<b>Minimum</b>		<b>70</b>	<b>79.2</b>	
<b>Maximum</b>		<b>74</b>	<b>80.4</b>	
<b>Energy Average</b>		<b>72.4</b>	<b>79.7</b>	
<b>Total Ldn and Impact Analysis</b>				
<b>Pre-Project Ldn</b>				<b>73</b>
<b>Project Ldn</b>				<b>58</b>
<b>Impact Level = 66 dBA Ldn</b>				<b>No Impact</b>

June 17, 2016

Ms. Minnie Dhaliwal, Planning Supervisor  
City of Tukwila Department of Community Development  
6300 Southcenter Boulevard  
Tukwila, Washington 98188

*Re: Sound Transit Link Light Rail Tukwila Segment  
Measurements of Vibration Levels*

Dear Ms. Dhaliwal:

This letter presents the results of vibration-level measurements conducted by BRC Acoustics on May 12, 2016 at the residential property at 14424 51<sup>st</sup> Ave S. The measurements supplement BRC's report dated January 8, 2016 to complete the technical review of the Final-Year Noise and Vibration Compliance Testing report prepared by Michael Minor & Associates (MM&A) on May 14, 2015. The MM&A report represents the fourth set added to three previous annual noise and vibration compliance testing results.

The scope and methodology for the compliance testing were established in Sound Transit's Compliance Testing Plan dated May 16, 2009 and revised July 2, 2009 (hereafter referred to as the Compliance Testing Plan).

### **General Comments Regarding the Scope of the Vibration Annual Review**

The 2015 Final-Review report by MM&A presented vibration measurements at the remaining location (V4) updated from the Compliance Testing Plan, including results derived from the measurements, and applicable criteria for identifying impacts. No additional vibration-mitigation measures are proposed.

Part of the 2015 peer-review scope, as assigned to BRC Acoustics, was to conduct independent vibration measures on the V4 property (14424 51<sup>st</sup> Avenue South).

### **Allowable Project Vibration Levels**

The Federal Transit Administration (FTA) criteria, as described on Page 11 of the 2015 Compliance Testing Report (72 VdB rms re: 1 micro-inch/sec for any 1/3-octave bandwidth), are consistent with the FTA Manual and with Sound Transit's Compliance Testing Plan.

## BRC Vibration Measurements

To confirm the vibration results of the 2015 Testing Report, BRC Acoustics conducted independent measurements of train pass-bys at receiver location V4.

BRC Acoustics personnel was present at the residence between 2:35 and 3:23 p.m. on Thursday, May 12, 2016. Table 1 lists the times of light-rail pass-bys observed during that time interval and times of vibration measurements at the property. Some of the pass-bys occurred while the vibration transducer was being installed or relocated. No data were acquired during these events. The events are recorded in Table 1 to illustrate the time intervals between pass-bys.

<b>Time (p.m.)</b>	<b>Event</b>	<b>Vibration Measurement</b>
2:36	Train NB	No measurement
2:37	Train SB	No measurement
2:41	Train NB	No measurement
2:43	No event	Interior ambient level
2:49	Train NB	Interior
2:50	Train SB	Interior
2:59	Train NB	Interior
3:00	Train SB	No measurement
3:04	Train SB	No measurement
3:10	Train NB	No measurement
3:11	Train SB	No measurement
3:13	No event	Exterior Ambient level
3:15	Train SB	Exterior
3:19	Train NB	Exterior
3:20	Train SB	Exterior
3:22	Train NB	Exterior

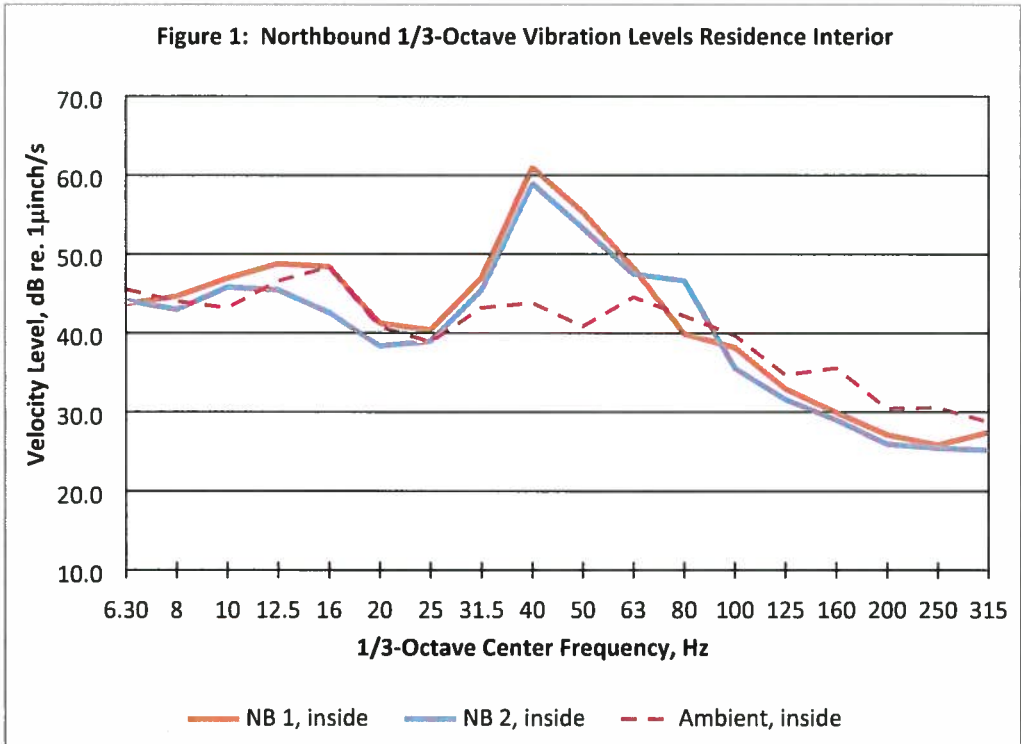
The events listed in Table 1 show the average time interval between pass-bys in each direction to be 6 minutes, which is consistent with the headway reported in the Operating Plan for the Airport Link (Attachment E, Third-Year Noise and Vibration Testing Results by MM&A, November 26, 2013).

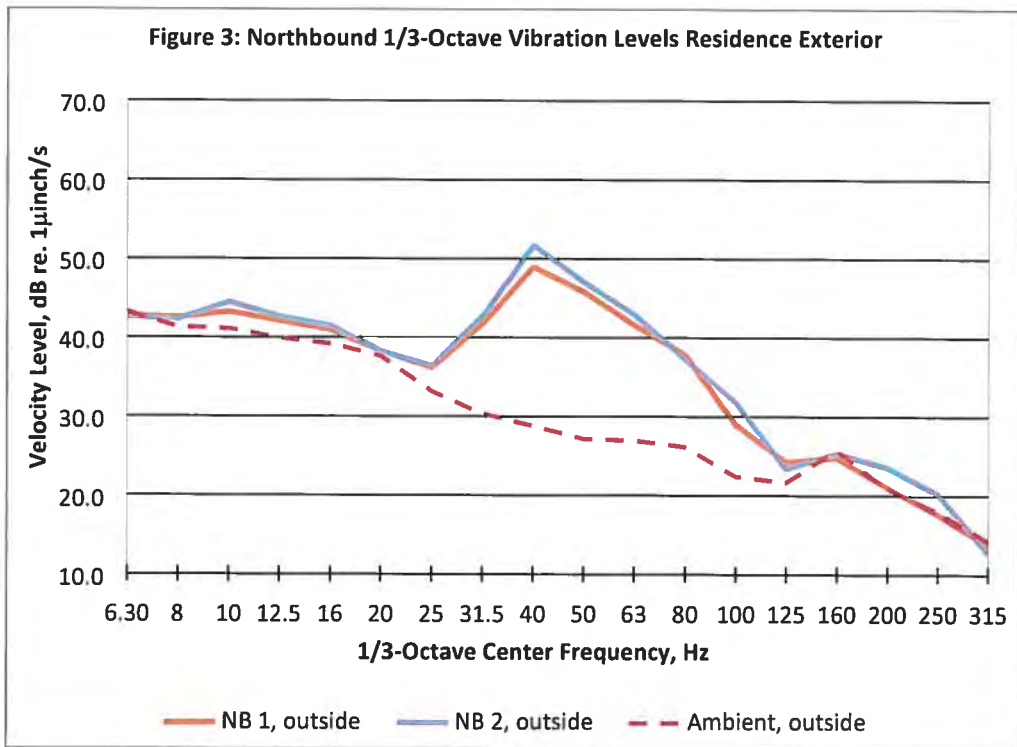
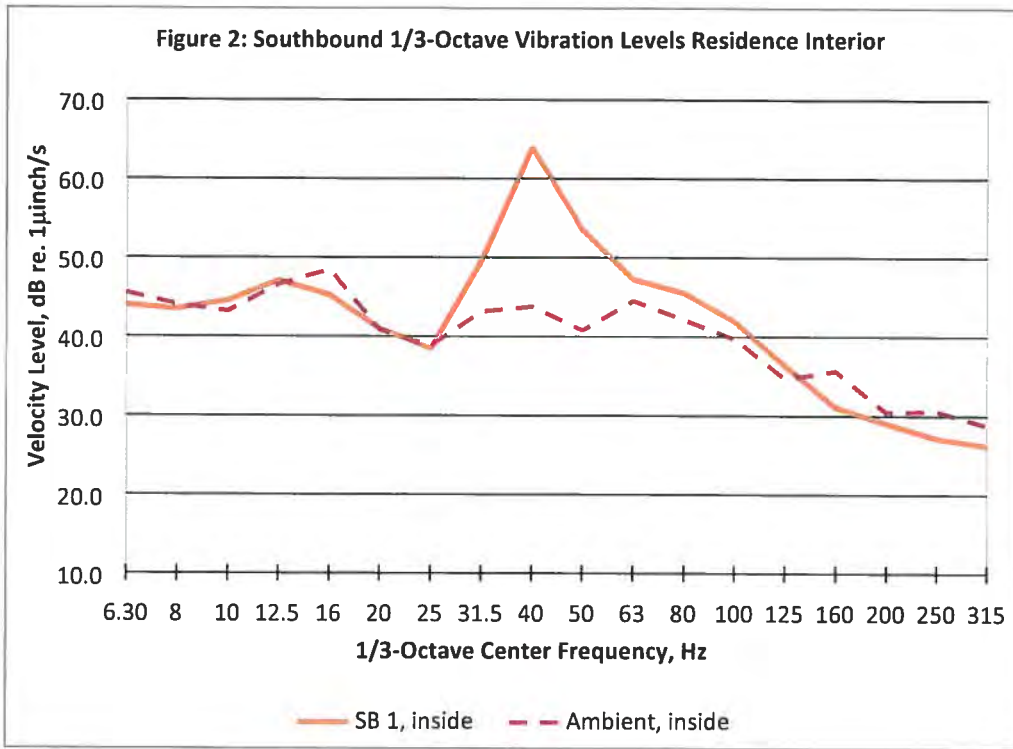
Vibration measurements were collected using a Bruel & Kjaer one-axis accelerometer and a Bruel & Kjaer hand-held analyzer, model 2250.

The weather during the measurements was clear, with temperatures in the low 70s degrees Fahrenheit and wind from the south at 5 mph or less.

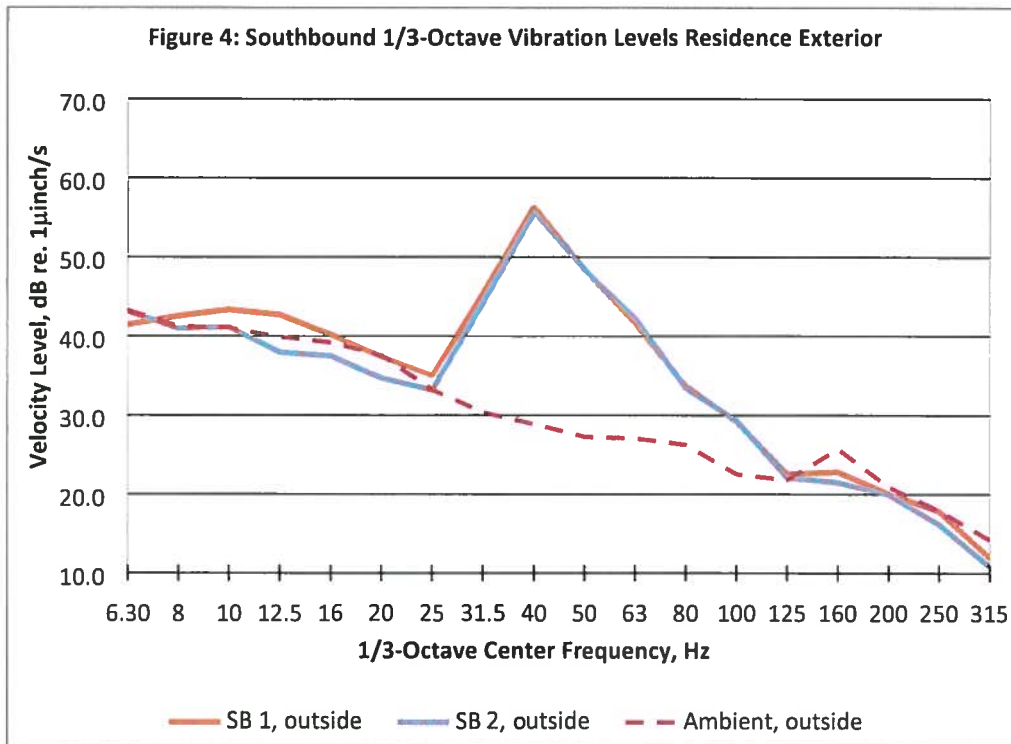
Measurements of vibration were collected at two locations on the property, one inside the residence, 18 inches from the east exterior wall (the façade nearest the light rail lines) and one on the ground immediately outside the residence on the south side near the east facade, at a location indicated by the Owner as unlikely to pierce the drain line. The interior measurement location was selected following reports by the homeowner regarding worst-case vibration level. The location was on the first floor of the residence (with a basement below).

The results of the vibration measurements are shown in Figures 1 to 4 as graphs of the vibration velocity level in VdB re. 1 micro-inch/second plotted against the frequency in 1/3-octave bands.









#### Evaluation and Compliance Verification at Location V4

The results shown in Figures 1 to 4 are in compliance with the FTA criterion of 72 VdB in any 1/3-octave band.

- The following additional observations pertain to the results reported in Figures 1 to 4:
- The highest vibration levels, both in the interior and exterior measurements, occur in the 1/3-octave band centered on 40 Hz. This is consistent with the most of the results reported by MM&A as part of the Sound Transit 2015 testing. One exception occurred in the vibration levels reported by MM&A for northbound pass-bys measured at the exterior of the residence, where the highest levels occurred in the 1/3-octave band centered on 50 Hz.
  - This is a minor differential between MM&A and BRC measurements, probably due to slight variations in train speed.
- The highest 1/3-octave vibration levels measured by BRC Acoustics were within 2 to 3 VdB of the levels reported by MM&A as part of the 2015 testing results.
- BRC Acoustics results showed vibration levels from southbound (near-track) pass-bys exceeding levels from far-track pass-bys by 3 to 4 VdB.

## **Vibration Mitigation Measures**

According to the results presented in the 2010, 2013, and Final-Year (2015) Vibration Compliance Testing reports, and the vibration measurements by BRC Acoustics in May 2016, the vibration-mitigation measures implemented by Sound Transit have brought vibration levels into compliance with FTA vibration criteria.

## **Ground-Borne Noise**

During the period of our interior observation of train pass-by vibration, we noted that vibration-induced noise was very distinctly present in the ambient background noise of the residence, and it is very possible that this is the source of complaint to the City by the Owner, rather than the vibration itself.

BRC Acoustics did not conduct sound measurements at the same time as the vibration measurements reported in the previous sections. The method prescribed in Section 11.2.2 of the FTA Manual can be used to estimate A-weighted sound levels in a typical residential space from the measured vibration levels in 1/3-octave bands. Using this method, it was estimated that the measured vibration levels could result in ground-borne sound levels in the range of 31 to 33 dBA range.

The FTA criterion for frequent ground-borne noise events received in residences is 35 dBA (FTA, Table 8-1). Since the preliminary estimates show ground-borne noise approaching this criterion and since the sound was clearly audible in the residence, further consideration of the sound levels by Sound Transit may be warranted.

**Summary**

Evaluation and review by BRC Acoustics, and our independent sound and vibration measurements, confirm that noise-mitigation and vibration-mitigation efforts undertaken by Sound Transit have brought sound and vibration levels from light-rail pass-bys into compliance with FTA vibration criteria. However, it is recommended that Sound Transit conduct one additional sound measurement inside the residence to ascertain that ground-borne noise meets the sound-level criteria listed in Table 8-1.

If you have any questions or require additional information, please call.

Sincerely,  
BRC Acoustics & Audiovisual Design



Dennis Noson, Ph.D.  
Senior Acoustical Consultant



Ioana Park, P.E..  
Senior Consultant, LEED AP BD+C