SkyTrain Noise Mitigation Study
Phase 1

Recommendation Report and
Implementation Plan – Summary

July 2020

TRANS/LINK

Introduction

In response to noise concerns from residents along the Expo and Millennium Lines, TransLink conducted a SkyTrain Noise Study in 2018. You can find more details in the technical report or the summary report.

The study recommended that TransLink investigate the feasibility and effectiveness of six noise mitigation measures:

1.   Improvements to switch maintenance practices

2.   Investigation of harder rail steel as a measure to improve long-term rail condition

3.   Re-introduction of top of rail friction modifiers to improve long-term rail condition

4.   Improvements to rail grinding practices to improve long-term rail condition

5.   Rail dampers to reduce noise radiated from the rails and hence reduce overall noise

6.   Development of guidelines for new developments near SkyTrain

These investigations were divided into two phases. Phase 1 involved studying all noise mitigation measures except for the top of rail friction modifiers and improvements to grinding practices, which require more time to investigate and are being addressed in Phase 2 (through 2020 and beyond).

TransLink contracted the services of SLR Consulting to lead the SkyTrain noise analyses and mitigation investigations. SLR is an environmental consultancy with expertise in transportation noise, vibration, and noise control design. SLR has conducted assessments for all forms of rail systems, working with transit agencies around the world.

This summary document provides an overview of SLR's findings and recommendations from Phase 1 for future consideration by TransLink.

Key Findings and Recommendations

1. SWITCH MAINTENANCE INVESTIGATION

Investigation Objective:

To understand the potential to improve monitoring and maintenance of switches (a mechanical component of the track that enables a SkyTrain to change lines at junctions) to reduce train passby noise.

Results:

- Replacing worn switches can reduce noise levels by at least 10 dB and possibly more.

- Grinding maintenance can reduce noise levels by 3-4 dB and help preserve switches in a quieter condition.

- Grinding produces minimal noise benefits for severely worn switches, demonstrating how critical it is to monitor the condition of switches and undertake regular maintenance starting from when new switches are installed.

Recommendations:

Regular grinding maintenance on switches helps prolong the life of the rail, improve ride quality and safety, and reduce noise for both transit passengers and nearby residents. It is recommended that an ongoing switch monitoring and maintenance program is implemented to reduce train passby noise. With more than 100 switches around the SkyTrain system, this will require increased resources on an ongoing basis.

What is dB?

The decibel, or dB, is a unit for measuring the sound pressure level (think of it like measuring the psi of a tire, but for sound volume).

2. HARDER RAIL STEEL INVESTIGATION

Investigation Objective:

To quantify the noise benefits and costs of using harder rail steel for future SkyTrain rail replacement programs and other projects.

Results:

- Using harder rail steel is expected to result in annual average noise level reductions of 5 dB in the long term on the Expo Line.

- Areas with harder rail steel require less frequent grinding, which could free up capacity to address specific problem areas when required.

Recommendations:

The recommendation to specify harder rail steel in all future rail purchases within SkyTrain's rail replacement program was implemented in early 2020. The additional capital cost of harder rail steel represents less than 0.5% of the overall cost of rail replacement and is expected to be balanced by the cost savings associated with reduced grinding requirements and longer asset life.

3. TOP OF RAIL FRICTION MODIFIERS INVESTIGATION (IN PROGRESS)

Investigation Objective:

To evaluate the effectiveness of friction modifiers when applied between the wheel tread and the top of the rail. When applied correctly, friction modifiers adjust friction, reduce wear and roughness of the wheels and rails, and lessen noise.

Results:

- While friction modifiers are expected to have system-wide noise benefits by reducing rail roughness and corrugation growth rates, investigations into this mitigation measure are still in progress.

Recommendations:

Recommendations will be released in the Phase 2 Recommendation Report and Implementation Plan.

Did you know...

Running rail is available in a range of hardness specifications to suit different needs. Original SkyTrain lines used relatively soft rail steel, but some newer sections use harder rail.

What is rail corrugation?

Rail corrugation is a wave-like wear pattern which gradually forms on top of the rail after repeated train passes. Highly corrugated rail produces the loud roaring noise occasionally heard on some sections of SkyTrain.

4. RAIL GRINDING INVESTIGATION (IN PROGRESS)

Investigation Objective:

To investigate the use of acoustic rail grinding (a special grinding practice that produces a very smooth surface finish to the rail to reduce noise as much as possible) by measuring rail roughness and corrugation growth rates periodically at several test sites with various rail hardness.

Results:

- While we anticipate that acoustic rail grinding will minimize noise levels immediately after rail grinding, investigations into this mitigation measure are still in progress.

Recommendations:

Recommendations will be released in the Phase 2 Recommendation Report and Implementation Plan.

5. RAIL DAMPERS INVESTIGATION

Investigation Objective:

To establish a preferred rail damper design that is optimized for the SkyTrain system.

Results:

- Rail dampers reduce noise levels by up to 6 dB in corrugated track sections along the SkyTrain system.

Recommendations:

It is recommended that rail dampers are installed on 3.2km of track on the Expo Line. These high priority sections are located in residential areas exposed to the highest noise levels.

Did you know...

As SkyTrain cars roll over rails, roughness levels grow and noise gradually increases. Rail grinding involves removing a thin layer from the top of the rail to smooth out roughness, eliminate small defects, and maintain the shape of the rail.

What is a rail damper?

Rail dampers are clipped to the rails to absorb vibration and reduce radiated noise.

6. GUIDELINES FOR NEW DEVELOPMENTS NEAR SKYTRAIN

Objective:

To develop a set of noise mitigation guidelines to assist regional developers and planning authorities in the construction of new residential buildings near SkyTrain.

Results:

• Following a series of three workshops with stakeholders from Metro Vancouver municipalities near SkyTrain, interim guidelines for new noise sensitive residential developments have been prepared.

Recommendations:

It is recommended that ownership of the guidelines be transferred to an appropriate office of the BC Government, as administering environmental noise guidelines is outside of TransLink's remit. Further consultation with various stakeholders is likely required prior to finalization.
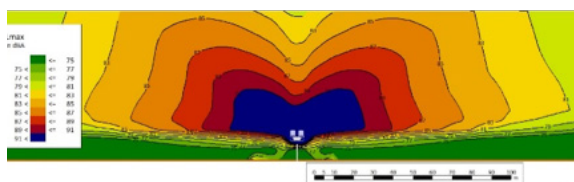
Did you know...

Noise exposure and sleep disturbance can be reduced in residential developments by using higher quality windows and other building materials that block higher noise levels.
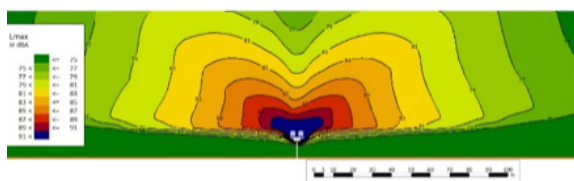
IMPLEMENTATION

Four scenarios have been presented to illustrate the current variation in noise and the outcomes associated with implementing the noise mitigation measures.
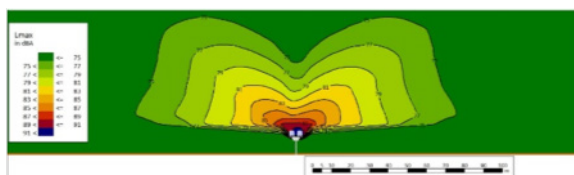
Each figure demonstrates how train passby noise levels vary with distance and height relative to the tracks. This is represented as vertical cross-sections of the SkyTrain track in an area with an elevated guideway and parapet noise barriers.
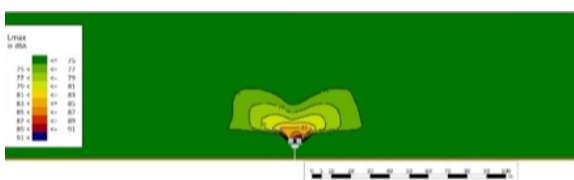

Scenario #1 –This figure shows what the noisiest areas (mostly on the original Expo Line) are currently like in times when the rail surface condition is at its worst before grinding.

Scenario #2 – This figure represents an intermediate rail surface condition and noise level and is 5 dB quieter than Scenario #1. In areas of the SkyTrain system where harder rail steel is already in use, this is a common scenario.

Scenario #3 – This figure represents a good rail surface condition and is 10 dB quieter than Scenario #1. This noise level is common around the network after grinding takes place.

Scenario #4 – This figure shows that by adding rail dampers when the rail is in good surface condition, noise levels can be reduced even further.

If the study recommendations are considered and implemented by TransLink, the variation in noise levels will be reduced between maintenance and grinding cycles. This would make the system quieter more often, without needing more frequent rail grinding.

Why don't we use rail grinding more frequently?

Increased grinding reduces the life of the rail, meaning that rails would need to be replaced more often.

NEXT STEPS

Some noise mitigation measures from Phase 1 are already being implemented. In most locations, you will not hear a sudden reduction in noise. These noise mitigation measures aim to make train noise levels more stable and consistent so that there are no longer times when the noise level is noticeably worse than others.

Throughout 2020 and beyond, TransLink will continue with Phase 2 noise mitigation investigations, including the top of rail friction modifiers and improvements to grinding practices, as these require more time to study.

An updated Recommendation Report and Implementation Plan will be shared following Phase 2. These recommendations will be for future consideration by TransLink. They will help to inform priorities for future investments with the intent of reducing noise levels and improving the liveability of communities near the SkyTrain system.

For more information and to view the technical report, visit the project webpage: translink.ca/noisestudy

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