

BURNABY MOUNTAIN GONDOLA: 2020 NOISE MODELLING SUMMARY

Purpose

The purpose of this memo is to share the summary findings of the 2020 preliminary noise monitoring and modelling analysis of the gondola operation and noise levels in the Forest Grove neighbourhood.

Noise monitoring and modelling will be updated as part of the 2023-2024 Business Case phase's Environmental Screening Review.

Key findings of noise modelling

- The potential for more noticeable noise anticipated with operation of the Burnaby Mountain Gondola project is expected to be from machinery and equipment located at the terminals.
- Along the route, the only source of noise is from the gondola cabins rolling over the towers. The 2020 design included some slight bends in the alignment at some towers that are less optimal from a noise and maintenance perspective – however the current conceptual design has eliminated these bends (straight alignment)
- The results of this noise modelling suggests that the Burnaby Mountain Gondola project will not contribute to noticeable operating noise effects within the Forest Grove neighbourhood.

Gondola technologies and noise generation question

Some different gondola systems in the region can generate more noise between terminals. For example, the Grouse Mountain Gondola (an aerial tram with two-100 person capacity cars) does produce a whirring or buzzing noise while in operation. The Grouse Mountain Gondola has been in operation for nearly 50 years (built in 1976). Improvements to gondola system technology, including the invention of the proposed 3S gondola system, have occurred since the Grouse Mountain Gondola was built. The 3S system does not produce whirring or buzzing noises.

2020 analysis

On October 19, 2020, TransLink received a technical memo on Burnaby Mountain Gondola Noise Modelling from its environmental consultant, Hemmera. This memo looked at baseline (existing) noise levels for the three route options being considered at the time and compared them to estimated noise levels generated by the project. The previous technical work identified Route 1 as the preferred route. This document summarizes the results of the Route 1 and the potential noise impacts on the Forest Grove neighbourhood.

The source of system-generated noise, proximate to the Forest Grove neighbourhood, would be when cabins pass over the towers. There is a gondola tower proposed south of Forest Grove near Production Way and Broadway and a gondola tower proposed north of Forest Grove on the north side of Gaglardi Way.

Baseline or existing noise levels were measured at Forest Grove Elementary from August 31 to September 1, 2020. Noise modelling considered BMG design line speed (27 km/hr) with towers modelled as point sources and were assumed to operate from 6:00 am to 1:00 am (consistent with SkyTrain).

As shown in the table below, the predicted Project noise level increase at residential receptors ranged from a low of 0.2 dB during the day, to a high of 0.6db at night, compared to measured baseline conditions.

Forest Grove Estimated Project Noise Increases (Modelling)

Type of Comparison	Daytime change (7am-10pm)	Nighttime change (10pm-7am)
Compared to measured baseline	0.2 dB	0.6 dB
Compared to modelled baseline	0.0 dB	0.2 dB

The technical memo concluded by comparing the above estimated noise increases with auditory perception levels. All increases noted above fall into the range of “not perceptible” to the human ear - increased sound level of 1db to 2 dB (with a 3dB increase noted as “barely perceptible”). This technical memo therefore considered that noise modelling suggests that the Burnaby Mountain Gondola project will not contribute to noticeable operating noise effects in nearby residential neighbourhoods.

The measured baseline noise levels in 2020 were lower than estimated through modelling for the existing conditions, possibly due to reduced vehicle and bus traffic volumes due to COVID, the noise attenuation effects from the dense foliage surrounding the Forest Grove neighbourhood, and also the timing coinciding with the summer closure of Forest Grove Elementary. It is further noted that the measured baseline noise levels, may be higher post-pandemic, as auto, truck and bus volumes return closer to their pre-pandemic levels over time.

Noise monitoring and modelling will be updated as part of the 2023-2024 Business Case phase’s Environmental Screening Review.

MEMORANDUM

Date:	October 19, 2020
To:	TransLink
From:	Hemmera
File:	104857-01
Re:	Burnaby Mountain Gondola Transit Noise Modelling

1.0 INTRODUCTION

TransLink is planning for the Burnaby Mountain Gondola Transit project (the Project) which would provide a fast, frequent, and reliable service between the SkyTrain network and Burnaby Mountain. TransLink is currently conducting a Multiple Accounts Evaluation (MAE) on three proposed routes:

- Route 1: Straight-line route from Production Way – University SkyTrain Station to Simon Fraser University
- Route 2: Eastern route from Production Way – University SkyTrain Station, travelling along Gaglardi Way, then changing direction to Simon Fraser University
- Route 3: Western route from Lake City Way SkyTrain Station, across Burnaby Mountain Golf Course, then changing direction to Simon Fraser University

This memorandum summarizes the results of noise modelling completed in support of the MAE.

2.0 PURPOSE AND SCOPE

The majority of noise associated with the Burnaby Mountain Gondola Transit project are from machinery and equipment located at the terminal stations. Along the route, the only source of noise is from the gondola cabins rolling over the ropeway at towers and angle stations. Exposure to increased noise levels as a result of the Project may contribute to public annoyance, sleep disturbance, and other health effects. Therefore, noise modelling was completed to evaluate potential Project-related noise effects on residential receptors.

Noise is measured in decibels, which expresses the ratio of the sound pressure level relative to a fixed reference value using a logarithmic scale. For environmental noise, the A-weighted decibel (dBA) is used as it represents the relative loudness perceived by the human ear which is less sensitive to low audio frequencies. Project-related noise is assessed based on the following metrics:

- Daytime sound level (L_d): This represents the average noise level over the daytime hours from 7:00 am to 10:00 pm.
- Nighttime sound level (L_n): This represents the average noise level over the nighttime hours from 10:00 pm to 7:00 am.

- Day-night sound level (L_{dn}): This represents the average noise level over a 24-hour period, with a 10 dB penalty added for nighttime noise to account of human's greater sensitivity to noise during this time.

As requested by TransLink, noise modelling was conducted on the following sections of the three route options based on their proximity to residential receptors:

- Route 1: Section from Tower 2 to Tower 3, over the Forest Grove neighbourhood
- Route 2: Section from Tower 3 to Tower 4, immediately east of the Forest Grove neighbourhood
- Route 3: Section from Tower 2 to Tower 3, over the Burnaby Mountain Golf Course, adjacent to the residential neighbourhood east of Arden Avenue.

The study areas for noise modelling were defined as the areas within a 300-m buffer of the sections of interest. These buffered areas were selected to represent the area of potential noise effects driven by the Project.

3.0 EXISTING CONDITIONS

Baseline or existing noise levels are used to provide context for predicted Project noise effects and to assess changes in overall noise levels. Baseline noise levels can be determined by measurement or estimation. For this study, baseline noise levels were primarily estimated based on a qualitative description of community characteristics and the average population density as summarized in **Table 1**. For Route 1, measured noise levels at Forest Grove Elementary from August 31 to September 1, 2020 are also shown. It is noted that measured noise levels were lower than estimated noise levels, potentially due to attenuation effects from the dense foliage surrounding the Forest Grove neighbourhood, and potentially due to reduced traffic levels during the measurement period as a result of the COVID-19 pandemic and the summer closure of Forest Grove Elementary.

4.0 NOISE MODELLING

Sound levels of the gondola at towers and angle stations were estimated based on measurement data provided by Leitner Poma Canada Inc. (2020). Sound levels outside towers were provided at line speeds from 4 to 7 m/s and extrapolated to a design line speed of 7.5 m/s to estimate potential Project-related noise from the proposed tower locations. In the absence of more specific data, sound levels outside (presumably) terminal stations were used to represent potential Project-related noise from the proposed angle stations. It is expected that terminal stations and angle stations would house similar machinery and equipment and therefore, the use of terminal station sound level data to represent sound levels from angle stations is expected to be reasonable.

Noise modelling was conducted using the Cadna-A sound propagation software. Towers and angle stations were modelled as point sources and were assumed to operate from 6:00 am to 1:00 am, consistent with TransLink's overall rapid transit network. Predicted Project-related sound levels at residential receptors are presented in **Table 2**. Also shown in the table are the predicted cumulative (i.e. baseline plus Project) sound levels, and the predicted change in sound levels due to the Project. Isoleth maps of predicted Project day-night sound levels are presented in **Figure 1** to **Figure 3**.

Table 1 Estimated and Measured Baseline Noise Levels

Route	Population Density ¹ (per km ²)	Community Type	Estimated Baseline Noise Level ² (dBA)			Measured Baseline Noise Level (dBA)		
			L _d	L _n	L _{dn}	L _d	L _n	L _{dn}
Route 1	3,800 to 5,440	Noisy Urban Residential	63.0	53.0	63.0	55.8	47.2	56.5
Route 2	2,740 to 3,800	Noisy Urban Residential	63.0	53.0	63.0	-	-	-
Route 3	2,330 to 3,570	Urban Residential to Noisy Urban Residential	58.0	48.0	58.0	-	-	-

Sources: (1) Census Mapper 2020, (2) Health Canada 2017

Note: Estimated baseline noise levels are provided as a range. The lower end of the range shown in the table is conservatively used for this study.

Table 2 Predicted Project-Related Noise Levels at Residential Receptors

Route	Maximum Predicted Project Noise Level (dBA)			Maximum Predicted Cumulative Noise Level (dBA)			Increase due to Project (dB)		
	L _d	L _n	L _{dn}	L _d	L _n	L _{dn}	L _d	L _n	L _{dn}
Route 1	42.3	38.8	45.9	63.0 (56.0)	53.2 (47.8)	63.1 (56.9)	0.0 (0.2)	0.2 (0.6)	0.1 (0.4)
Route 2	46.7	43.5	50.5	63.1	53.5	63.2	0.1	0.5	0.2
Route 3	44.5	41.0	48.1	58.2	48.8	58.4	0.2	0.8	0.4

Note: Cumulative noise levels presented are calculated based on estimated baseline noise levels presented in Table 1. Values in parentheses for Route 1 are calculated based on measured baseline noise levels.

5.0 CONCLUSION

To place the predicted Project-related sound level increases in context, qualitative auditory sensations are provided in **Table 3**.

Table 3 Auditory Perception to Sound Level Increases

Sound Level Increase (dB)	Auditory Perception
1 to 2	Not perceptible
3	Barely perceptible
5	Audible difference
10	Apparent doubling in sound

Source: Murphy and King 2014

For all three route options, the predicted Project-related sound level increase at residential receptors is less than 1 dB, well below the 3 dB threshold at which the human ear can begin to perceive a difference. Therefore, noise modelling suggests that the Burnaby Mountain Gondola Transit project will not contribute to noise effects in nearby residential neighbourhoods. Given these results, in terms of potential noise effects, there is no preferred route.

6.0 CLOSURE

This Report has been prepared by Hemmera for sole benefit and use by TransLink. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

7.0 REFERENCES

Census Mapper. 2020. Population Density (Canada Census 2016). Available online at: <https://censusmapper.ca>. Last accessed September 2020.

Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise.

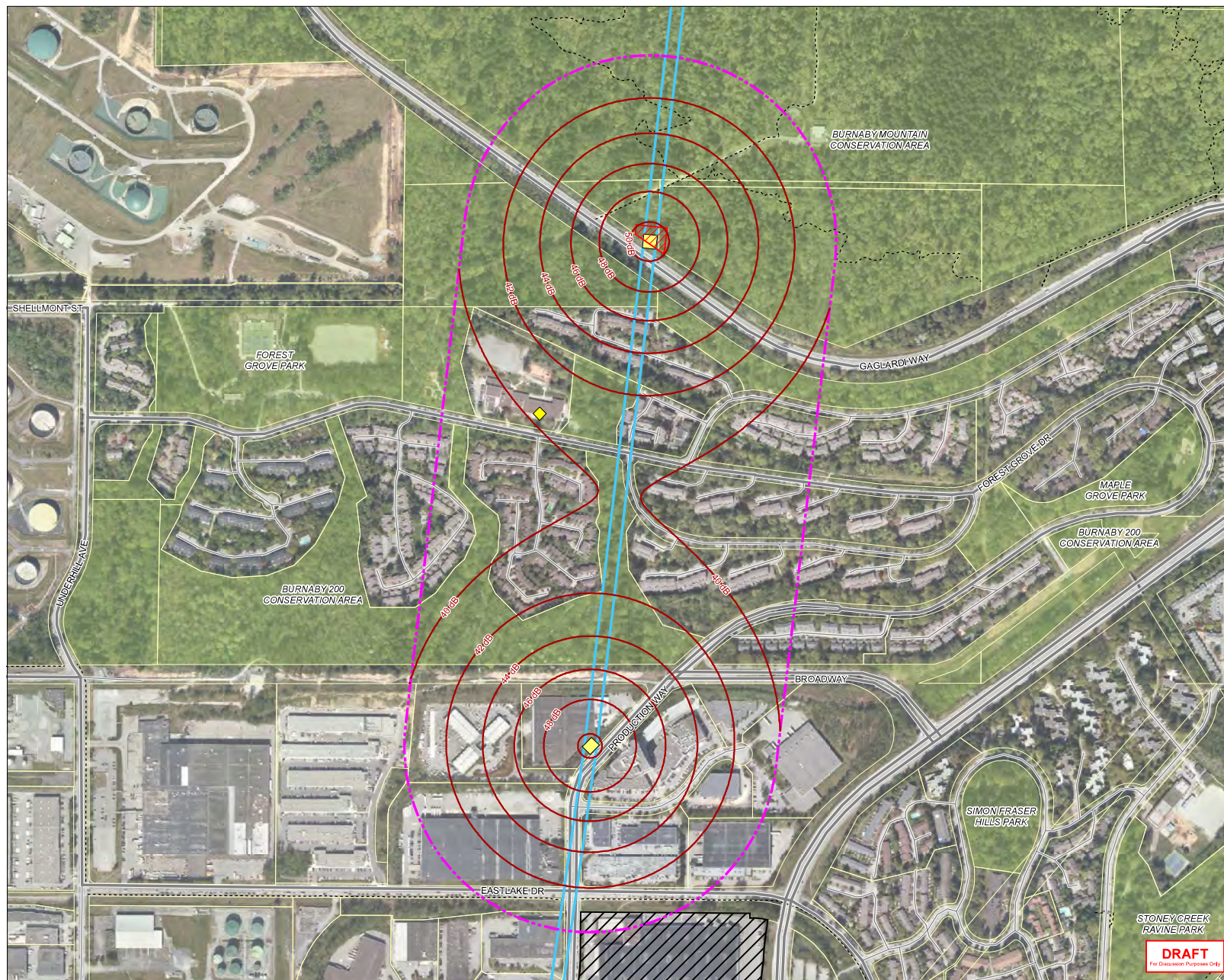
Leitner Poma Canada Inc. and SCJ Alliance. 2020. Burnaby Mountain Gondola, Task 2: 3S Gondola Technology Gondola Sound Emissions Summary. Prepared for TransLink.

Murphy, E. and E.A. King. 2014. Environmental Noise Pollution: Noise Mapping, Public Health, and Policy.

FIGURES

Burnaby Mountain Gondola Transit Project
Burnaby, British Columbia

Project Day-Night Noise Levels - Route 1

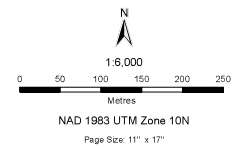


Legend

Baseline Noise Monitoring Location	Major Road
Noise Isopleth (dBA)	Local Road
Route 1 Right of Way	Urban Path or Trail
Route 1 Noise Study Area	Major Redevelopment Project
Tower	Park or Protected Area
Tree Clearing Area	Property Line

- Notes**
1. All mapped features are approximate and should be used for discussion purposes only.
 2. This map is not intended to be a 'stand-alone' document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

- Sources**
- Contains information licensed under the Open Government Licences - City of Burnaby & Government of British Columbia
 - Alignment: SCL Alliance Consulting Services, 2020
 - Aerial Image: City of Burnaby, 2018



104857-01 Production Date: Oct 16, 2020 Figure 1

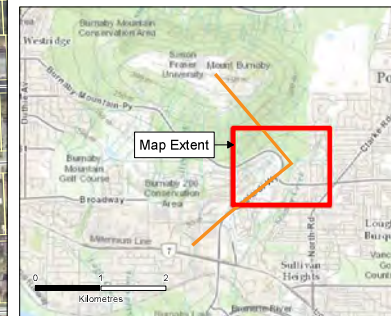


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Maple Grove Park (proposed) (M2) 2020-10-16 10:00 AM (GMT-8) - 104857-01_01 - Noise Level - 2020-10-16

Burnaby Mountain Gondola Transit Project
Burnaby, British Columbia

Project Day-Night Noise Levels - Route 2

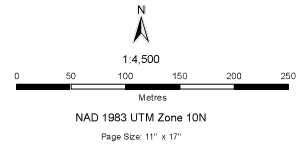


Legend

Noise Isopleth (dBA)	SkyTrain Station
Proposed Project Features	Millennium Line
Route 2 Right of Way	Major Road
Route 2 Noise Study Area	Local Road
Tower	Urban Path or Trail
Tree Clearing Area	Park or Protected Area
Turning Station	Property Line

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104857-01 Production Date: Oct 16, 2020 Figure 2

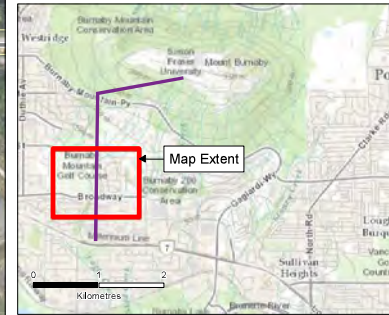
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Burnaby Mountain Gondola Transit Project
Burnaby, British Columbia

Project Day-Night Noise Levels - Route 3



Legend

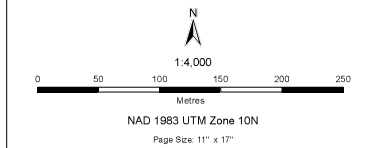
Noise Isopleth (dBA)	Major Road
Proposed Project Features	Local Road
Route 3 Right of Way	Urban Path or Trail
Route 3 Noise Study Area	Park or Protected Area
Tower	Property Line

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104857-01 Production Date: Oct 16, 2020 Figure 3

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