

GO Rail Network Electrification Transit Project Assessment Process

Study Summary: Noise & Vibration Assessment (Appendix G)

Scope of the Study

The scope of the GO Rail Network Electrification Transit Project Assessment Process (TPAP) involves electrification of the following GO Transit rail corridors:

1. Union Station Rail Corridor – From UP Express Union Station to Don Yard Layover
2. Lakeshore West Corridor – From just west of Bathurst St (Mile 1.20) to Burlington
3. Kitchener Corridor – From UP Express Spur (at Highway 427) to Bramalea
4. Barrie Corridor – From Parkdale Junction (off Kitchener Corridor) to Allandale GO Station
5. Stouffville Corridor – From Scarborough Junction (off Lakeshore East Corridor) to Lincolnville GO Station
6. Lakeshore East Corridor – From Don Yard Layover to Oshawa GO Station

The Noise & Vibration Impact Assessment Report for the GO Rail Network Electrification is composed of six parts (one for each rail corridor): i) Union Station Rail Corridor Assessment ii) Lakeshore West Rail Corridor Assessment iii) Kitchener Rail Corridor Assessment iv) Barrie Rail Corridor Assessment v) Stouffville Rail Corridor Assessment vi) Lakeshore East Rail Corridor Assessment

Recognizing that electrification of the GO network is a component of the over-arching Regional Express Rail (RER)/GO Expansion plan to provide electric trains running every 15 minutes or better, all day and in both directions within the most heavily travelled sections of the network, a comprehensive noise/vibration study was undertaken to examine the effects of the converting from present day diesel service levels to increased electric service¹ levels as part of the GO Rail Network Electrification TPAP.

The scope of the study also included consideration of operational noise effects associated with the proposed Tap locations/Traction Power Facilities as well as construction related noise and vibration effects and mitigation.

Approach/Methodology

The Ontario Ministry of Environment and Climate Change (MOECC) and GO Transit have a Draft Protocol for Noise and Vibration Assessment in place that Metrolinx follows, which includes:

- The 1995 draft Transit Noise and Vibration Protocol from the MOECC (formerly Ontario Ministry of Environment and Energy)/GO Transit; and
- The 2013 Noise Guideline (NPC-300) from the Ontario MOECC (this applies to stationary noise sources including train stations, covering things like, for example, announcements at the station).

The objective of the Noise & Vibration Impact Assessment study was to assess the effects on noise levels and nearby receptors due to the conversion from existing/present day (2015) diesel-based GO service levels (referred to as the Future No-Build scenario within the reports) to the Electric (2025) GO RER electric-based service levels (referred to as the Future Build Scenario within the reports), and to subsequently determine whether mitigation measures may be required to minimize adverse noise effects. A modelling exercise was completed in order to carry out this assessment.

Noise - Mitigation measures for noise were investigated for all points of receptors with a significant adjusted noise impact (i.e., where there was a 5 dB increase or greater) in accordance with the MOEE/GO Draft Protocol.

Vibration - The vibration assessment focused on the change between the existing vibration levels and the future vibration levels, as per the MOEE/GO Transit Draft Protocol for Noise and Vibration Assessment. Change in vibration levels may

¹ The electric RER scenario will entail a mixed diesel and electric fleet.

occur under the following circumstances: where there are changes in track alignment, addition of new track², and changes to or addition of special track work. The Protocol indicates that if vibration levels of any project exceed the higher of the existing vibration level, or 0.14 mm/s by 25% or more, vibration mitigation needs to be investigated.

Construction activities including the installation of traction power facilities, installation of OCS support foundation structures, OCS wiring, installation of bridge safety barriers, other bridge modifications, etc. were also assessed and mitigation measures recommended.

Summary of Key Impact Assessment Results

**Note - Appendix S contains mapping of identified receptors.*

Union Station Rail Corridor (USRC)

Noise

The Adjusted Noise Impact between Existing and Electric RER noise levels for USRC is summarised for the evaluated 6 representative receptors can be summarised as follows:

- 4 daytime adjusted noise impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 2 daytime adjusted noise impacts were deemed to be Noticeable (i.e., between 3 and 4.99) dB;
- 4 nighttime adjusted noise impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 1 nighttime adjusted noise impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB); and
- 1 nighttime adjusted noise impacts were deemed to be Significant (i.e., between 5 and 9.99 dB increase).

There are no adjusted noise impacts in the Electric RER scenario that were deemed to be Very Significant (i.e. greater than 10 dB increase).

Vibration

One receptor (R09) exceeded the vibration levels threshold during pass-bys of both GO trains and freight trains.

Lakeshore West Corridor

Noise

The Adjusted Noise Impact between Existing and Electric RER noise levels for the Lakeshore West corridor is summarised for the evaluated 77 representative receptors can be summarised as follows:

- 77 daytime Adjusted Noise Impacts were deemed to be insignificant (i.e., less than 2.99 dB);
- 35 nighttime Adjusted Noise Impacts were deemed to be insignificant (i.e., less than 2.99 dB); and
- 42 nighttime Adjusted Noise Impacts were deemed to be noticeable (i.e., between 3 and 4.99 dB).

There are no Adjusted Noise Impacts in the Electric RER scenario that were deemed to be significant (i.e., between 5 and 9.99 dB increase) or very significant (i.e., greater than 10 dB increase).

Vibration

There were no vibration exceedances along Lakeshore West requiring mitigation investigation.

² The scope of the Electrification project does not involve addition of tracks, however future tracks were considered as part of the Noise/Vibration assessment.

Kitchener Corridor

Noise

The Adjusted Noise Impact between Existing and Electric RER noise levels for the Kitchener corridor for the evaluated 3 representative receptors can be summarised as follows:

- 1 daytime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 2 daytime Adjusted Noise Impacts were deemed to be Significant (i.e., between 4.99 and 9.99 dB increase);
- 1 nighttime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 1 nighttime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB); and
- 1 nighttime Adjusted Noise Impacts were deemed to be Significant (i.e., between 4.99 and 9.99 dB increase).

There are no Adjusted Noise Impacts in the Electric RER scenario that were deemed to be Very Significant (i.e. greater than 10 dB increase).

Vibration

The area of interest identified along the Kitchener corridor is the addition of a track to accommodate RER service between Strachan Avenue and Bramalea GO Station, spanning the entire Study Area. Neither the existing nor future vibration for GO Train traffic at the nearest receptor near the track upgrade was predicted to exceed the lowest MOEE/GO Draft Protocol objective of 0.14 mm/s.

Barrie Corridor

Noise

The Adjusted Noise Impact between Existing and Electric RER noise levels for the Barrie corridor is summarised for the evaluated 139 representative receptors can be summarised as follows:

- 32 daytime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 58 daytime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB);
- 42 daytime Adjusted Noise Impacts were deemed to be Significant (i.e., greater than 5 dB increase).
- 7 daytime Adjusted Noise Impacts were deemed to be Very Significant (i.e., greater than 10 dB increase);
- 16 nighttime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 30 nighttime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB); and
- 63 nighttime Adjusted Noise Impacts were deemed to be Significant (i.e., between 5 and 9.99 dB increase); and
- 30 nighttime Adjusted Noise Impacts were deemed to be Very Significant (i.e., greater than 10 dB increase).

Vibration

It was identified that receptors R015, R032, R014, R027, R039 and R049 are the closest receptors to the proposed new track and switches along the Barrie corridor; therefore, the vibration assessment focused on these seven receptors. The predicted change in vibration level between existing conditions and future conditions is in excess of the 25% increase threshold set out in the Protocol, at all of the identified receptors except R027. In the case of receptors R015 and R032, the threshold is exceeded during pass-bys of both GO Trains and freight trains. In the case of receptors R014, R039 and R014, the threshold is exceeding only during freight pass-bys.

Stouffville Corridor

Noise

The Adjusted Noise Impact between Existing and Electric RER noise levels for the Stouffville corridor is summarized for the evaluated 86 representative receptors can be summarized as follows:

- 41 daytime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 27 daytime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB);
- 18 daytime Adjusted Noise Impacts were deemed to be Significant (i.e., greater than 5 dB increase).
- 18 nighttime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 7 nighttime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB); and
- 48 nighttime Adjusted Noise Impacts were deemed to be Significant (i.e., between 5 and 9.99 dB increase); and
- 13 nighttime Adjusted Noise Impacts were deemed to be Very Significant (i.e., greater than 10 dB increase);

Vibration

The areas of interest identified along the Stouffville corridor are the additional track to be placed between Kennedy GO station and Milliken Go Station, as well as near Unionville GO station, as well as the associated new switches. For GO train traffic passing over a new switch, the increase in predicted vibrations levels is in excess of the 25% increase threshold for nearby receptors. In areas where new track is added, but there is no special track work, vibration levels for all train types comply with the 0.14 mm/s objective.

Lakeshore East Corridor

Noise

The Adjusted Noise Impact between Existing and Electric RER noise levels for the Lakeshore East corridor is summarised for the evaluated 104 representative receptors can be summarised as follows:

- 68 daytime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 29 daytime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99) dB);
- 7 daytime Adjusted Noise Impacts were deemed to be Significant (i.e., between 5 and 9.99 dB increase);
- 42 nighttime Adjusted Noise Impacts were deemed to be Insignificant (i.e., less than 2.99 dB);
- 26 nighttime Adjusted Noise Impacts were deemed to be Noticeable (i.e., between 3 and 4.99 dB); and
- 36 nighttime Adjusted Noise Impacts were deemed to be Significant (i.e., between 5 and 9.99 dB increase).

Vibration

The area of interest identified along the Lakeshore East rail corridor is additional track that will be added between the Don River and the Scarborough Junction and between Guildwood GO Station and the Durham Junction, as well as the associated new switches. It was identified that receptors R021B, R023B, R037B, R043, R013, R027, R031 and R077 are the closest receptors to the proposed new track and switches; therefore, the vibration assessment focused on these eight receptors.

The predicted change in vibration level between existing conditions and future conditions is in excess of the 25% increase threshold set out in the Protocol, at all of the identified receptors except R027 and R031. In the case of receptors R021B and R023B, the threshold is exceeded during pass-bys of GO trains, other passenger trains and freight trains. In the case of receptors R037B and R043, the threshold is exceeded during pass-bys of GO trains and freight trains. In the case of R013 and R077, the threshold is exceeded during freight pass-bys only.

Tap Locations

Hydro One tap infrastructure is not considered a source of noise and therefore was not considered in the noise assessment.

Traction Power Facilities

In the case of traction power facilities, noise impacts were expressed in terms of maximum daytime and nighttime 1-hour equivalent sound levels and were compared to applicable limits, as set out in the MOECC's Environmental Noise Guideline, NPC-300.

The predicted noises impacts from traction power facilities at nearby receptors are below the MOECC applicable exclusion limits with the exception of:

- Gilford PS;
- Allandale TPS; and
- Scarborough TPS.

For additional more detailed information, please refer to the Noise & Vibration Impact Assessment Report (which is organized by rail corridor for easy reference) contained in Appendix G

Mitigation Recommendations

Based on the Adjusted Noise Impacts resulting from a project, an investigation of noise mitigation measures was undertaken. MOEE/GO Draft Protocol includes the following mitigation guidance:

- Mitigation should be considered where technically feasible. At the detailed design phase, other considerations, including operational, economic and administrative feasibility should be evaluated.
- If deemed feasible, the mitigation measures shall ensure that the predicted sound level from the GO Transit rail project is as close to, or lower than, the objective in the MOEE/GO Draft Protocol.

For the purposes of this study, it was assumed that noise mitigation would be limited to locations within the GO Transit right-of-way, and to be considered technically feasible, the mitigation measures should achieve at least a 5 dB reduction in noise at the first row of affected receptors. The investigation of mitigation for the purposes of this study was limited to noise barriers with heights of 5 m.

If the Adjusted Noise Impact at a receptor is deemed significant during the daytime period, technical feasibility of a noise barrier was evaluated based on the noise reduction achieved during the daytime period only. Similarly, if the Adjusted Noise Impact at a receptor was deemed significant during nighttime period, technical feasibility of a noise barrier is evaluated based on the noise reduction achieved during the nighttime period only. If the Adjusted Noise Impacts at a receptor were deemed significant during both the daytime and nighttime periods and noise reduction resulting from a noise barrier is at least 5 dB in either the daytime or nighttime period, the noise barrier was deemed technically feasible.

Union Station Rail Corridor

Noise

The barrier investigated for the Electric RER scenario, is considered technically feasible, as it achieves at least a 5 dB average reduction for the time period in which mitigation is required. **See Appendix S which shows the locations of technically feasible noise barriers.**

Vibration

In the case of receptor R09, the vibration threshold is exceeded during pass-bys of both GO trains and freight trains. Mitigation such as ballast mats, under sleeper pads or resilient fixation should be investigated for all the receptors with similar conditions (i.e., 18 m distance to proposed new tracks) as the evaluated receptors. **See Appendix S which shows Vibration Mitigation locations.**

Lakeshore West Corridor

Noise

As all Adjusted Noise Impacts for the Electric RER scenario were predicted to be not significant (i.e. there was less than 5 dB increase).

Vibration

No receptors were predicted to exceed the lowest MOEE/GO Draft Protocol objective of 0.14 mm/s for vibration, therefore investigation of noise and vibration mitigation was not required. **See Appendix S which shows Vibration Mitigation locations.**

Kitchener Corridor

Noise

Mitigation measures were investigated for all receptors with a significant adjusted noise impact (i.e., between 4.99 dB and 9.99 dB increase) in accordance with the MOEE/GO Draft Protocol. The daytime adjusted noise impacts were predicted to be significant for 2 receptors and the nighttime adjusted noise impacts were predicted to be significant for 2 receptors. Of the 2 barriers investigated for the Electric RER scenario, both are considered technically feasible, as they achieve at least a 5 dB reduction in sound levels at nearby receptors. **See Appendix S which shows the locations of technically feasible noise barriers.**

Vibration

No receptors were predicted to exceed the lowest MOEE/GO Draft Protocol objective of 0.14 mm/s, therefore investigation of vibration mitigation was not required. **See Appendix S which shows Vibration Mitigation locations.**

Barrie Corridor

Noise

Of the 102 noise barrier groupings investigated for the Electric RER scenario, 52 are considered technically feasible, as they achieve at least a 5 dB reduction in sound levels at nearby receptors. **See Appendix S which shows the locations of technically feasible noise barriers.**

Vibration

It was identified that receptors R015, R032, R014, R027, R039 and R049 are the closest receptors to the proposed new track and switches along the Barrie corridor; therefore, the vibration assessment focused on these seven receptors. The predicted change in vibration level between existing conditions and future conditions is in excess of the 25% increase threshold set out in the Protocol, at all of the identified receptors except R027. In the case of receptors R015 and R032, the threshold is exceeded during pass-bys of both GO Trains and freight trains. In the case of receptors R014, R039 and R014, the threshold is exceeding only during freight pass-bys. Mitigation such as ballast mats, under sleeper pads or resilient fixation should be investigated for all proposed new switches or other special track work within 140 m of receptors, or proposed new tracks within 15-25 m of receptors. **See Appendix S which shows Vibration Mitigation locations.**

Stouffville Corridor

Noise

Of the 51 noise barriers investigated for the Electric RER scenario, 33 are considered technically feasible, as they achieve at least a 5 dB reduction in sound levels at nearby receptors. **See Appendix S which shows the locations of technically feasible noise barriers.**

Vibration

For both GO train traffic and freight train traffic passing over a new switch, the increase in predicted vibrations levels is in excess of the 25% increase threshold for R06, R09 and R14. The exceedance of the objective at these three receptors is caused by the nearby (i.e., less than 40 m away from the receptors) addition of a special trackwork rail component (i.e., switch). Mitigation such as ballast mats, under sleeper pads or resilient fixation should be investigated for all receptors

with similar conditions (i.e., 40 m distance to proposed special trackwork). **See Appendix S which shows Vibration Mitigation locations.**

Lakeshore East Corridor

Noise

Of the 32 noise barrier groupings investigated for the Electric RER scenario, 26 are considered technically feasible, as they achieve at least a 5 dB reduction in sound levels at nearby receptors. **See Appendix S which shows the locations of technically feasible noise barriers.**

Vibration

The predicted change in vibration level between existing conditions and future conditions is in excess of the 25% increase threshold set out in the Protocol, at all of the identified receptors except R027 and R031. In the case of receptors R021B and R023B, the threshold is exceeded during pass-bys of GO trains, other passenger trains and freight trains. In the case of receptors R037B and R043, the threshold is exceeded during pass-bys of GO trains and freight trains. In the case of R013 and R077, the threshold is exceeded during freight pass-bys only. Mitigation such as ballast mats, under sleeper pads or resilient fixation should be investigated for all receptors with similar conditions (i.e., 75 m distance to proposed new switches or other special trackwork, or 20-25 m distance to proposed new tracks) as the evaluated receptors. **See Appendix S which shows Vibration Mitigation locations.**

Traction Power Facilities

- Lakeshore West: Noise mitigation recommendations for traction power facility stationary sources are not required;
- Kitchener: Noise mitigation recommendations for traction power facility stationary sources are not required;
- Barrie: Evaluation of more accurate sound levels for transformers and, if necessary, mitigation measures such as low noise fans or barriers will be investigated for the Gilford PS and Allandale TPS locations during detailed design;
- Stouffville: Mitigation measures such as low noise fans or barriers should be investigated at Scarborough TPS; and
- Lakeshore East: Noise mitigation recommendations for traction power facility stationary sources are not required.

Short Term Construction Phase

Noise

To minimize the potential for construction noise impacts, the following mitigation measures will be implemented during construction where possible:

- Although provincial agencies such as Metrolinx are not subject to municipal by-laws, Metrolinx (and its Contractor) will endeavour to adhere to these local by-laws as a best practice, where practical. As part of the electrification construction activities, nighttime work may be required. Although Metrolinx is exempt from municipal noise control by-laws that place limits on the timing of construction activity, Metrolinx (and their Contractor) will strive to adhere to such by-laws by limiting nighttime noisy activities wherever practical;
- All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order.
- The Contract documents should contain a provision that any initial noise complaint will trigger verification that the noise complaint is justified and the general noise control measures agreed to be in effect;
- In the presence of persistent noise complaints during construction, all construction equipment should be verified to comply with MOECC NPC-115 guidelines; and
- In the presence of persistent complaints during construction, and subject to the results of a field investigation, alternative noise control measures may be required, where reasonably available.

Vibration

To minimize the potential for construction vibration impacts, the following mitigation measures will be considered during construction where possible:

- Metrolinx Community Relations staff will communicate construction work (including requirements for nighttime work) and respond to inquiries from residents;
- Efforts should be made to maximize the distance between receptors and construction activities with high vibration potential such as a jackhammer, a hoe ram or large bulldozer and a vibratory roller;
- Construction equipment with potential to cause off-site vibrations will be operated as far away from vibration-sensitive sites as possible;
- Where possible, activities that have potential to cause off-site vibrations will be phased such that as few as possible are occurring simultaneously;
- Construction activities that have potential to cause off-site vibration during the night-time hours will be avoided whenever possible;
- The Contract documents shall contain a provision that any initial vibration complaint will trigger verification that the vibration complaint is justified and the general vibration control measures as agreed to are in effect;
- In the presence of persistent vibration complaints during construction, Metrolinx will consider implementing a measurement program to evaluate the vibration impacts;
- In the presence of persistent complaints during construction and subject to the results of a field investigation, alternative vibration control measures may be considered as required, where reasonably available; and
- It is recommended the vibration limits indicated in municipal by-laws not be exceeded. This may entail occasional monitoring of vibration levels during construction.

Next Steps/Future Work

During detailed design, the results and recommendations of the Noise/Vibration Impact Assessment Report will be reviewed for economic, operational, administrative and technical feasibility of the proposed noise barriers per the GO/MOEE Protocol.

Evaluation of more accurate sound levels for transformers and, if necessary, mitigation measures such as low noise fans or barriers will be investigated for the Gilford PS, Allandale TPS and Scarborough TPS locations during detailed design.

When the specifics of construction equipment are finalized, a more detailed construction vibration assessment will be completed prior to construction start. Consideration should be given to monitoring of vibration during vibration intensive activities, to confirm that levels do not approach those with potential of causing structural damage.