

Noise related to Réseau express métropolitain operation

Sources of noise produced by the REM

REM noise will be generated from two main sources: REM **car transit** and **fixed infrastructures**.

The technology chosen for the REM is an automated light rail system. This type of technology is quieter than heavy trains (no whistle at station arrival or alarm at grade crossings, electric brakes, etc.). Two major noise emission sources are associated with REM cars:

Noise emission source	Train speed at which this noise is predominant
Machinery noise (motor, ventilation, etc.)	When stopped or at low speed (entering and exiting the stations)
Noise from interaction between wheels and rails	At medium to high speed (when cars are in transit)

In terms of fixed infrastructures, the main noise emission sources will be the station systems (e.g. Heating, ventilation, or air conditioning), as well as the REM's power supply systems.

The perceived sound level will vary depending on the noise level at the source and the sound propagation conditions. For example, propagation depends on meteorological conditions or type of soil. Noise is also reduced according to distance from the railway, topography and the presence of natural or artificial obstacles.

A regulatory framework for the REM's noise impact

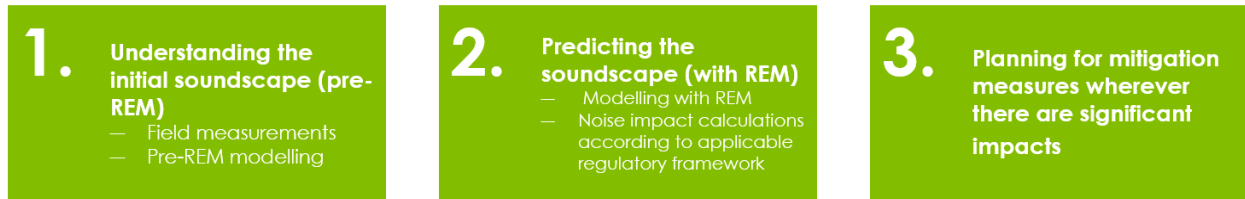
REM construction and operation are governed by a regulatory framework established by the Government of Québec.

The [Order in Council establishing the REM's conditions for authorization](#) (French only) mandates the use of a sound model of the REM in operation, implementation of the required mitigation measures wherever impact will be significant, and implementation of an ambient noise monitoring program. This obligation is listed under condition #6 of the environmental Order in Council.

Detailed sound modelling to determine required mitigation measures

Detailed sound modelling was done to assess the anticipated ambient noise of the REM in operation.

This consisted of three major steps, as illustrated below:



NouvLR, the consortium selected for REM construction, modelled the anticipated soundscape for the entire route, including noise from **REM car transit**. The purpose was to assess the anticipated sound impacts and determine mitigation measures that may be required, such as erection of permanent noise barrier walls along the route.

A large number of inputs were programmed into a specialized software to produce this REM sound model, including:

- Removal of noise from Exo trains on the Deux-Montagnes line
- Addition of REM noise, taking into consideration frequency and speed, structure elevation, route curves, various operating scenarios, etc.
- Consideration of ambient noise, road traffic, topography, proximity of residential areas, etc.

The fixed infrastructure is designed with mitigation measures at the source, such as the installation of silencers on the rails or construction of artificial barriers (e.g. walls).

Table to assess noise impact and required mitigation measures

Car transit: the Ministère des transports Québec's Policy on road noise

In the car transit sound model, the noise impact of the REM in operation was assessed at sensitive receptors installed on property lines, i.e. at residential, recreational and institutional (school, hospital, etc.) buildings located along the route.

To assess the noise impact of cars in transit, the analysis grid used is that found in the Ministère des transports' [Policy on road noise](#) (French only), which requires the implementation of mitigation measures when the noise impact assessed at sensitive receptors is significant.

The impact is considered significant when the difference between the actual and projected noise levels has a strong or medium impact, according to the Ministère des Transports du Québec's analysis grid:

Actual noise level (average over a 24-hour period)	Increase in noise level before generating a significant noise impact and requiring the implementation of mitigation measures*
Between 45 and 51 dBA	From 11 to 5 dBA - for a maximum of 56 dBA
Between 52 and 61 dBA	4 dBA

Actual noise level (average over a 24-hour period)	Increase in noise level before generating a significant noise impact and requiring the implementation of mitigation measures*
62 dBA	3 dBA
Between 63 and 69 dBA	2 dBA
From 70 dBA	1 dBA

* For more information regarding noise levels, please refer to the scale in Schedule 1.

The analysis table is based on 24-hour cumulative exposure. The criteria to be met are therefore based on the cumulative noise over a whole day, rather than on a single isolated passage of an REM car.

Fixed infrastructures: Instruction Note 98-01 from the Ministère de l'Environnement

For fixed infrastructures, the thresholds set by the Ministère de l'Environnement et de la Lutte contre les changements climatiques in its [Instruction Note 98-01](#) apply. When municipal regulations were more restrictive than the guidelines in the Instruction Note, the municipal parameters were used.

Instruction Note 98-01 is a tool that establishes noise limits to be respected, depending on the type of land use (residential, park, agricultural, industrial, etc.) and on whether it is day or night.

Zone	Noise criteria (dBA)	
	Day (7 a.m. to 7 p.m.)	Night (7 p.m. to 7 a.m.)
I: Territory intended for detached or semi-detached single-family dwellings, schools, hospitals or other educational, health or convalescent service establishments. Land of an existing dwelling in an agricultural zone	45	40
II: Territory for multi-dwelling units, mobile home parks, institutions or campgrounds	50	45
III: Land zoned for commercial or recreational park use	55	50
IV: Land zoned for industrial or agricultural purposes	70	70

Modelling results and the REM's role

Once modelling was completed, the REM team validated and ensured that:



- Modelling was done in accordance with government instructions
- The mitigation measures mitigate the impacts and help to meet governmental requirements along each separate REM branch.

The following are the general results of the noise modelling associated with car transit:

- For the **West Island and South Shore branches**, the noise level will remain dominated by highway noise. Noise barrier walls will be installed in the West Island sector.
- On the **Deux-Montagnes branch**, trains will be quieter than commuter trains, but more frequent. Noise barrier walls will be installed on certain segments between the Canora and Deux-Montagnes stations.
- For the Airport branch, no residential areas will be affected.

Required mitigation measures will be implemented **before the REM is commissioned**.

Erection of noise barrier walls to mitigate significant impacts

Noise barrier walls will be built in locations where the model indicated there would be significant noise impact from car transit. Since the primary source of noise comes from the interaction between the wheels and the rail, noise barrier walls are generally installed within the REM corridor, near the rails. When the noise wall is installed in close proximity to the noise source, effectiveness is increased and wall height can be decreased.

The noise barrier wall design selected is as follows:

- Noise walls will be erected on foundations, to protect them during the winter.
- They are pre-fabricated white panels made of 100% PVC, installed on galvanized steel posts.
- The panels are filled with noise insulation that absorbs the sound and prevents it from reverberating.

View from public



Railway face



Acoustic insulation

Monitoring during operating phase

During REM operation, a sound monitoring program will be implemented to ensure that mitigation measures are effective and noise levels are consistent with the detailed modelling. **If this monitoring program reveals significant impacts, additional measures will be implemented.**

In accordance with the environmental Order in Council and commitments made by the project office, ambient noise will be monitored during the summer after the 1st, 2nd, 3rd, 5th and 10th year of REM operation. Sound will be completely re-modelled on the 10th year.

Consult the complete modelizations for your sector

Appendix: Additional noise concepts

Sound intensity is measured in decibels or adjusted decibels (dB or dBA). This is a logarithmic scale. For example, an increase of 3 dBA is only slightly perceptible to the human ear, while an increase of 10 dBA is perceived as twice as loud as the initial noise level.

The scale below shows some examples of noise levels.

