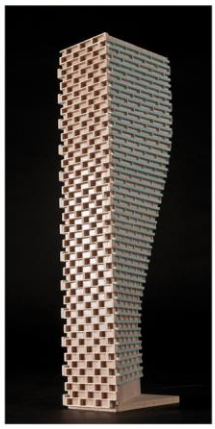
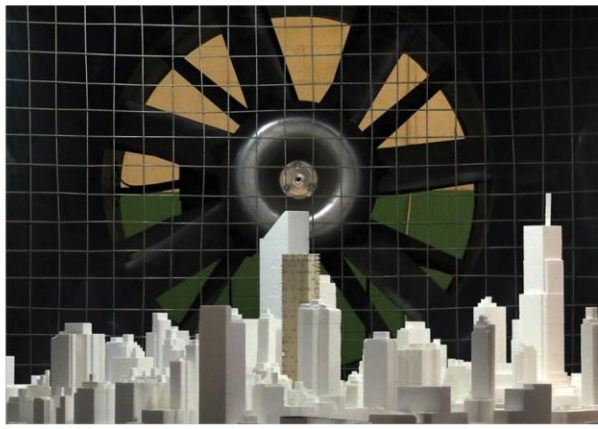
GRADIENTWIND
ENGINEERS & SCIENTISTS

# NOISE ASSESSMENT

50 Leikin Drive
Ottawa, Ontario

GRADIENT WIND REPORT: 23-001 –Noise





April 25, 2023

DRAFT

PREPARED FOR

**Canada Post**
**c/o Colliers Project Leaders**
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Ottawa, ON K1S 1V7


PREPARED BY

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# EXECUTIVE SUMMARY

This report describes a noise assessment in support of a Site Plan Application (SPA) for the industrial development located at 50 Leikin Drive in Ottawa, Ontario. The property is zoned for industrial / business park use and the development will comprise of a warehouse / sorting facility. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by aircraft flyovers; it also provides commentary on potential offsite impacts on surrounding noise sensitive areas.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings provided J.L. Richards & Associates Ltd., dated March 22, 2023. Assessment of aircraft noise has been based on the study site's proximity to the airport and the nearest Noise Exposure Forecast contour line, as per Schedule C14 in the City of Ottawa's Official Plan (OP).

For aircraft flyovers, sound exposure will approach the NEF/ NEP 32 which is equivalent to a 24-hour $L_{eq}$ of 64 dBA outside the buildings. The noise inside the dwellings would need to be reduced to 47 dBA for office / administration area. Typical commercial windows and curtain wall systems with STC rating of 35 is expected to be sufficient to attenuate aircraft noise. Due to aircraft noise, the following warning clause will be required on all Lease, Purchase and Sale Agreements for all buildings, see Section 6

The Canada Post Facility is located in an industrial business park, where the closest noise sensitive property (point of reception) is located more than 280 m to the south. As the closest point of reception is more the 100 m from the facility, a stationary noise assessment is not required for this facility, as per the ENCG and Official Plan policy 10.2.1 8). Therefore, it is our opinion that the new facility will not have an adverse impact on surrounding noise sensitive lands.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

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## 1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained Colliers Project Leaders on behalf of Canada Post Corporation, to undertake a noise assessment for the industrial development located at 50 Leikin Drive in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by aircraft flyovers; it also provides commentary on potential offsite impacts on surrounding noise sensitive areas.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[3] and Ministry of the Environment, Conservation and Parks (MECP)[4] guidelines. Noise calculations were based on architectural drawings provided J.L. Richards & Associates Ltd., dated March 22, 2023. Assessment of aircraft noise has been assessed based on the sites proximity to the airport and the nearest Noise Exposure Forecast contour line, as per Schedule C14 in the City of Ottawa's Official Plan (OP). It should be noted that under the city and provincial noise guidelines the development is not considered to be noise sensitive, nor is the site in proximity to noise sensitive land uses.

## 2. TERMS OF REFERENCE

The subject site is located at 50 Leikin Drive in Ottawa; situated on a parcel of land in the northwest quadrant of the intersection of Bill Leathem Drive and Leikin Drive. The property is zoned for industrial / prestige business park use and the development will comprise of a warehouse / sorting facility. The proposed footprint of the rectangular building will have an area of 20,280 square meters ($m^2$). 24 loading docks will be located along the west façade and 16 loading docks along the north façade. Surrounding the building will be a parking lots for trailers and employee parking.

While the subject property is not considered to be noise sensitive, Official Plan 10.2.2 requires all development inside the airport zoning boundary to consider aircraft noise.

[3] City of Ottawa Environmental Noise Control Guidelines, January 2016
[4] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

### 2.1 Potential Noise Impacts on Surroundings

The Canada Post Facility is located in an industrial business park, where the closest noise sensitive property (point of reception) is more than 280 m to the south. As the closest point of reception is greater than 100 m from the facility, a stationary noise assessment is not required for this facility, as per the ENCG and Official Plan policy 10.2.1 8). Therefore, it is our opinion that the new facility will not have an adverse impact on surrounding noise sensitive lands.

## 3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by aircraft flyovers, and (ii) ensure that interior noise do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4.2 of this report.

## 4. METHODOLOGY

### 4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic by that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level ($2\times10^{-5}$ Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

## 4.2 Aircraft Traffic Noise

### 4.2.1 Criteria for Aircraft Noise

As per the City of Ottawa, the ENCG[5] establishes the sound level criteria for aircraft noise with reference to the Ottawa Macdonald Cartier International Airport located near the intersection of Hunt Club Road and Limebank Road. There are four vicinity zones surrounding the Ottawa Macdonald Cartier International Airport that indicate the intensity of the noise levels within the area illustrated in Schedule C14 - Land Use Constraints Due to Aircraft Noise[6]. Noise generated from aircraft traffic is represented as Effective Perceived Noise Levels (EPNL), a unit of noise measurement that accounts for variations in the human perception of pure tones and noise duration. Plotted EPNL around airports are represented by Noise Exposure Forecast (NEF) and Noise Exposure Projection (NEP) contours which represent the current and future operations of the airport.

The NEF / NEP (NEP) contour lines define the region around the airport exposed to various levels of aircraft noise impacting noise sensitive areas, ranging from low to high outdoor noise levels. The Ottawa Airport Vicinity Development Zone is the furthest zone around the airport. Beyond NEF/NEP 25, aircraft noise is considered insignificant. The Airport Operating Influencing Zone (AOIZ) is the region representing 30 NEF/NEP contour where the noise levels have increased and will cause noise disruption to noise sensitive developments. No new noise sensitive development is allowed with in the AOIZ except for infill development, non-noise sensitive developments (industrial / employment). The composite line noise contour NEF/NEP 35 illustrates the area closest to the airport and is where the highest noise levels occur. Within this region, new developments are not permitted to be constructed in the outlined vicinity.

According to accepted research[7], Health and Welfare Canada states that people continuously exposed to NEF/NEP values less than 35 will not suffer adverse physical or psychological effects. Sociological surveys[8] have indicated that negative community reactions to noise levels may start at about 25 NEF/NEP. Table 3 identifies the sound level criteria for relevant indoor spaces exposed to aircraft noise. Where

[5] City of Ottawa Environmental Noise Control Guidelines, January 2016
[6] City of Ottawa Official Plan – Schedule C14 (Land Use Constraints Due to Aircraft Noise)
[7] CMHC, Road & Rail Noise: Effects on Housing
[8] Noise in Urban and Suburban Areas. Bolt, Beanik and Newman, Inc., Washington, January 1967

developments are within the AOIZ, building components must be designed to achieve the indoor criteria outlined in Table 3.

**TABLE 3: INDOOR AIRCRAFT SOUND LEVEL CRITERIA[9]**

| Type of Space | NEF/NEP | $L_{eq}$ (dBA) |
|---|---|---|
| **General offices, reception areas**, retail stores, etc. | 15 | 47 |
| Individual or semi-private offices, conference rooms, etc. | 10 | 42 |
| Living/dining/den areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, Sleeping quarters of hotels/motels | 5 | 37 |
| Sleeping quarters of residences, hospitals, nursing/retirement homes, etc. | 0 | 32 |

## 4.3 Indoor Noise Calculations (Aircraft Noise)

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common commercial walls built in conformance with the Ontario Building Code (2020) typically exceed STC 45, depending on exterior cladding, thickness and interior finish details. For example, brick veneer walls can achieve STC 50 or more. Standard commercially sided exterior metal stud walls have around STC 45. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40, depending on the window manufacturer, pane thickness and inter-pane spacing. As previously mentioned, the windows are the known weak point in a partition.

As per Section 4.2, when daytime noise levels from road and rail sources at the plane of the window exceed 65 dBA and 60 dBA respectively, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. Noise

[9] City of Ottawa Environmental Noise Control Guidelines, January 2016

calculations also need to be made when the aircraft noise exposure is above NEF / NEP 25 ($L_{eq-24hr}$ 57). The calculation procedure[10] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

Based on published research[11], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. The STC requirements for walls, windows, roof and exterior doors was evaluated using the software program INSUL by Marshall Day Acoustics. The indoor noise levels generated by aircraft noise were also assessed using INSUL. As per the ENCG, the STC requirements were determined for all building components impacted by aircraft noise, including the following:

- Exterior wall components for administration area
- Window and curtain wall glazing for administration area
- Exterior roof assembly above the administration area

The closest NEF/ NEP contour to the site establishes the required equivalent sound pressure levels for office areas, and the overall sound pressure in the geographical area being studied. For this noise assessment, the theoretical sound pressure levels produced by aircraft were found to be 64 dBA ($L_{eq-24hr}$). Once the 24-hour equivalent sound pressure is determined, the reference source spectrum provided in CMHC can be used to establish the full spectrum of aircraft sound pressure levels. The spectrum representing the 1/3 octave band sound pressure levels used to calculate the transmission of noise on each frequency band. Indoor and outdoor noise calculations were conducted using INSUL to develop the required noise performance of building components.

[10] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[11] CMHC, Road & Rail Noise: Effects on Housing

As detailed drawings of the building interiors were not yet available, the indoor and outdoor calculations were based on the following assumptions:

- Office / administrative area 1864 $m^2$
- Ceiling height is at 3.0 meters (m).
- Window / curtain wall area is 280 $m^2$
- Exterior wall area 30 $m^2$
- Low reverberation inside the room given typical office furnishings

As per NPC 300[12], the indoor aircraft noise was evaluated by converting the NEF/NEP to 24-hour equivalent sound pressure level. Since the development falls between within the NEF 30 -35 composite contour line, 32 was used as the NEF variable in the following equation NEF = $L_{eq(24)}$ – 32 dBA, used for the conversion. After the results were determined, INSUL was used to evaluate the building components attenuation to sound levels. Refer to Appendix A for the INSUL details and modelling of the assemblies.

## 5. RESULTS AND DISCUSSION

The development is located between the AOIZ and the 35 contour and requires the need for upgraded building components. The theoretical sound levels from the NEF/ NEP 62 were found to be equivalent to 64 dBA outside the buildings. The noise inside the dwellings would need to be reduced to 47dBA for general office and admiration.

Taking into consideration aircraft sources, the building components described below, or equivalent, should be considered in the building design to provide the necessary noise attenuation. The mitigation measures presented below are designed to mitigate the highest expected noise levels at all facades (i.e., 64 dBA).

Window and exterior walls were evaluated to determine the attenuation required for indoor sound levels assuming windows are closed. Exterior building components have been evaluated using INSUL to determine the necessary STC for proper indoor sound attenuation. The assemblies that were chosen to

[12] Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (NPC-300), August 2013

provide adequate sound insulation are based on and Gradient Wind's past experience. Refer to Appendix A for further STC details and modeling of the assemblies.

## EXTERIOR WALL STC REVIEW

The exterior walls of the development have been evaluated using INSUL to determine the required STC requirements established by ENCG. Greater mitigation in sound levels is achieved by higher STC ratings and are determined by the material selection of the exterior walls. Exterior wall components on all façades will require a minimum STC of 45, which will be achieved with steel frame construction.

The architectural detail for the exterior wall sample is listed below. Alternative assemblies are permissible provided they meet the same STC rating.

**Exterior Wall**

- Metal cladding
- 75 mm air space with semi ridged insulation
- Z-girts
- 152 mm metal studs
- 150 mm of acoustic batt insulation or semi ridged insulation
- 13 mm of gypsum board

*INSUL* Predicted STC Rating: 53

## ROOF STC REVIEW

The roof STC requirements were determined using the INSUL software by Marshall Day Acoustics. The assumed roof details are listed below. Alternative assemblies are permissible provided they meet the same STC rating.

**Roof**

- Pea gravel with roof membrane
- 75 m ridged insulation
- Corrugated steel deck
- Open web Steel Joist
- Suspended light steel grid
- Mineral fiber ceiling tile

*INSUL* Predicted STC Rating: 46

## WINDOW AND DOOR GLAZING STC REVIEW

The window and curtain wall STC requirements for the administration / office were also evaluated. Windows generally have lower sound attenuation in comparison to exterior walls or other building components. As a result, the STC level is lower than exterior walls, floors, roofs and exterior doors. The recommended architectural details for the windows are listed below. Alternative assemblies are permissible provided they meet the same STC rating.

**Window / Curtin wall**

- 6 mm inner pane
- 13 mm air space
- 6 mm outer pane

*INSUL* Predicted STC Rating: 36

It is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors.

As is typical for office / administration areas central air conditioning will be incorporated into the design of the building, allowing occupants to keep windows closed and maintain a comfortable working environment. Due to proximity to the airport, a Warning Clauses will be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

## 6. CONCLUSIONS AND RECOMMENDATIONS

For aircraft flyovers, sound exposure will approach the NEF/ NEP 32 which is equivalent to a 24 hour $L_{eq}$ of 64 dBA outside the buildings. The noise inside the dwellings would need to be reduced to 47 dBA for office / administration area. Typical commercial windows and curtain wall systems with STC rating of 35 is expected to be sufficient to attenuate aircraft noise. Due to aircraft noise the following Warning Clause will be required on all Lease, Purchase and Sale Agreements for all buildings:

> *Purchasers/building occupants are forewarned that this property is located in a noise sensitive area due to its proximity to Ottawa Macdonald-Cartier International Airport. In order to reduce the impact of aircraft noise in the indoor spaces, the office has been designed and built to meet provincial standards for noise control by the use of components and building systems that provide sound attenuation. In addition to the building components (i.e. walls, windows, doors, ceiling-roof), since the benefit of sound attenuation is lost when windows or doors are left open, this building has been fitted with a central air conditioning system to allow windows and doors to remain closed.*
>
> *Despite the inclusion of noise control features within the building, noise due to aircraft operations may continue to interfere with some indoor activities and with outdoor activities, particularly during the summer months. The purchaser/building occupant is further advised that the Airport is open and operates 24 hours a day, and that changes to operations or expansion of the airport facilities, including the construction of new runways, may affect the working environment of the employee's of this property/area.*
>
> *The Ottawa Macdonald-Cartier International Airport Authority, its acoustical consultants and the City of Ottawa are not responsible if, regardless of the implementation of noise control features, the purchaser/occupant of this building finds that the noise levels due to aircraft operations continue to be of concern or are offensive.*

The Canada Post Facility is in an industrial business park, where the closest noise sensitive property (point of reception) is more than 280 m to the south. As the closest point of reception is more the 100 m from the facility, a stationary noise assessment is not required for this facility, as per the ENCG and Official Plan policy 10.2.1 8). Therefore, it is our opinion that the new facility will not have an adverse impact on surrounding noise sensitive lands.

This concludes our noise assessment. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

Sincerely,

***Gradient Wind Engineering Inc.***



Essraa Alqassab, BASc
Junior Environmental Scientist
*GW23-001- Noise*

Joshua Foster, P.Eng.
Lead Engineer










# APPENDIX A

## INSUL CALCULATIONS

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

# Outdoor To Indoor Sound Transmission (v9.0.24)


Margin of error is generally within ±3 dB
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Job No.: Initials:jfoster
Date:2023-04-11
File Name:Admin office.inz

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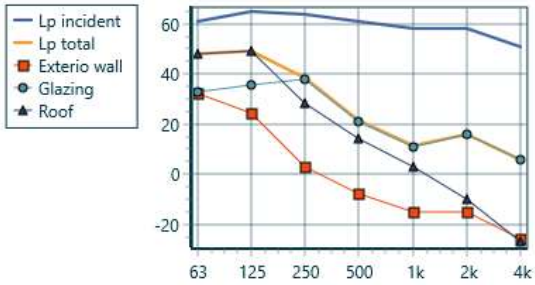


| Source | Octave Band Centre Frequency (Hz) 63 | 125 | 250 | 500 | 1k | 2k | 4k | Overall dBA |
|---|---|---|---|---|---|---|---|---|
| Incident sound level (freefield) | 61.0 | 65.0 | 64.0 | 61.0 | 58.0 | 58.0 | 51.0 | 64 |
| **Path** | | | | | | | | |
| Element 1 , STL | -14 | -26 | -46 | -54 | -58 | -58 | -62 | |
| Facade Shape factor Level diff. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Insertion Loss | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Area(+10LogA) [30 $m^2$] | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| Element sound level contribution | 32 | 24 | 3 | -8 | -15 | -15 | -26 | 10 |
| Element 2 , STL | -23 | -24 | -21 | -35 | -42 | -37 | -40 | |
| Facade Shape factor Level diff. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Insertion Loss | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Area(+10LogA) [280 $m^2$] | 24 | 24 | 24 | 24 | 24 | 24 | 24 | |
| Element sound level contribution | 33 | 36 | 38 | 21 | 11 | 16 | 6 | 30 |
| Element 3 , STL | -16 | -19 | -39 | -50 | -58 | -71 | -81 | |
| Facade Shape factor Level diff. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Insertion Loss | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Area(+10LogA) [1864 $m^2$] | 33 | 33 | 33 | 33 | 33 | 33 | 33 | |
| Element sound level contribution | 48 | 49 | 28 | 14 | 3 | -10 | -27 | 34 |
| **Receiver** | | | | | | | | |
| Room volume(-10LogV) [5632 m3] | -38 | -38 | -38 | -38 | -38 | -38 | -38 | |
| Reverberation time (s) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | |
| RT (+10LogT) | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | -3.0 | |
| Equation Constant | 11 | 11 | 11 | 11 | 11 | 11 | 11 | |
| Room sound level | 48 | 49 | 38 | 22 | 12 | 16 | 6 | 35 |
| **Level difference** | | | | | | | | LpAinc - LpARev,T0 |
| D2m,nT | 16 | 19 | 29 | 42 | 50 | 45 | 48 | 29 |

** Element descriptions:
#1: Exterio wall
#2: Glazing
#3: Roof

# Sound Insulation Prediction (v9.0.24)


Margin of error is generally within STC ±3 dB
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Job No.: Initials:jfoster
Date:2023-04-11
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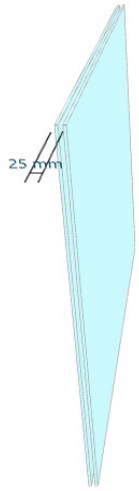



STC 36
OITC 28

Mass-air-mass resonant frequency = =192 Hz

Panel Size = 2.0 m x 1.5 m

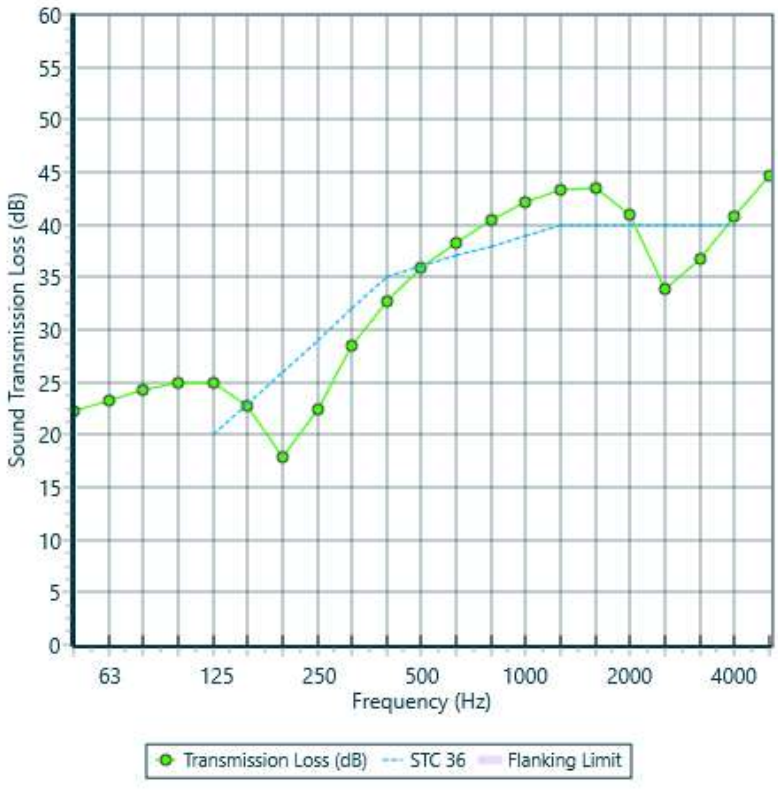
Partition surface mass = 29.8 kg/m²

## System description

Pane 1 : 1 x 6 mm Glass

air: 13 mm
Pane 2 : 1 x 6 mm Glass

| freq.(Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 22 | |
| 63 | 23 | 23 |
| 80 | 24 | |
| 100 | 25 | |
| 125 | 25 | 24 |
| 160 | 23 | |
| 200 | 18 | |
| 250 | 22 | 21 |
| 315 | 29 | |
| 400 | 33 | |
| 500 | 36 | 35 |
| 630 | 38 | |
| 800 | 40 | |
| 1000 | 42 | 42 |
| 1250 | 43 | |
| 1600 | 43 | |
| 2000 | 41 | 37 |
| 2500 | 34 | |
| 3150 | 37 | |
| 4000 | 41 | 40 |
| 5000 | 45 | |



# Sound Insulation Prediction (v9.0.24)


Margin of error is generally within STC ±3 dB
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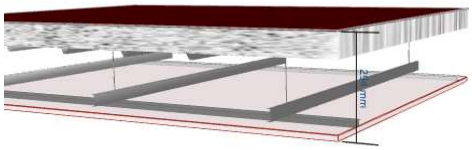


STC 46
OITC 29

Mass-air-mass resonant frequency = =92 Hz , 812 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 22.1 kg/m²

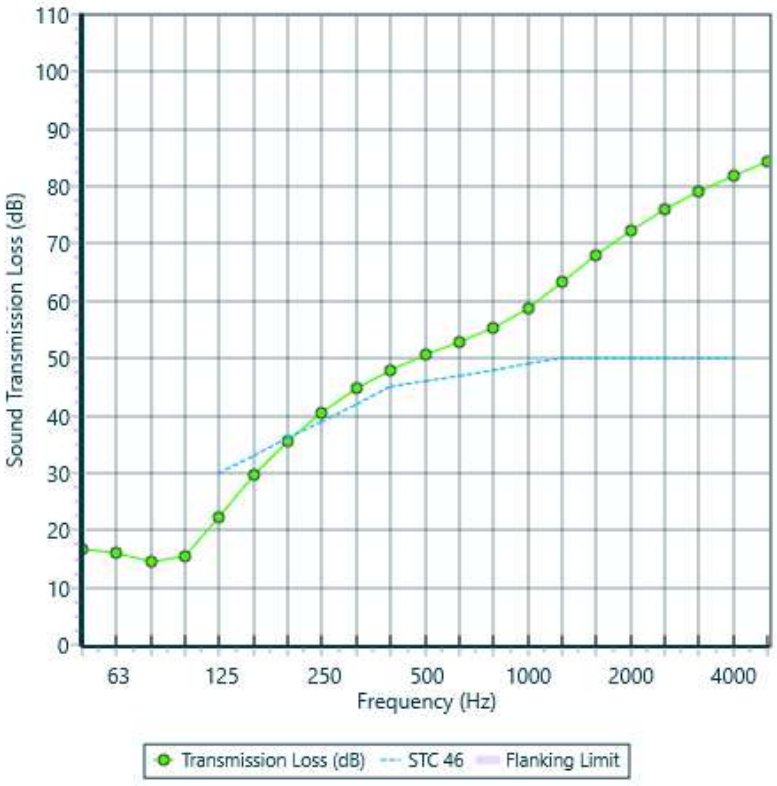
## System description

Panel 1 : 1 x 3 mm Asphalt Shingles (2.7lb/ft²)

Frame: PIR insulation board (warm roof) ; Cavity Width 75 mm
Panel 2 : 1 x 0.6 mm Steel Roofing (Imperial Rib)

Frame: Suspended Light Steel Grid (2E2 mm x 45 mm ), Stud spacing 600 mm ; Cavity Width 200 mm
Panel 3 : 1 x 15.9 mm Mineral fiber ceiling tile (Generic 0.8lbs/ft2)

| freq.(Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 17 | |
| 63 | 16 | 16 |
| 80 | 14 | |
| 100 | 15 | |
| 125 | 22 | 19 |
| 160 | 30 | |
| 200 | 36 | |
| 250 | 41 | 39 |
| 315 | 45 | |
| 400 | 48 | |
| 500 | 51 | 50 |
| 630 | 53 | |
| 800 | 55 | |
| 1000 | 59 | 58 |
| 1250 | 63 | |
| 1600 | 68 | |
| 2000 | 72 | 71 |
| 2500 | 76 | |
| 3150 | 79 | |
| 4000 | 82 | 81 |
| 5000 | 84 | |



# Sound Insulation Prediction (v9.0.24)


Margin of error is generally within STC ±3 dB
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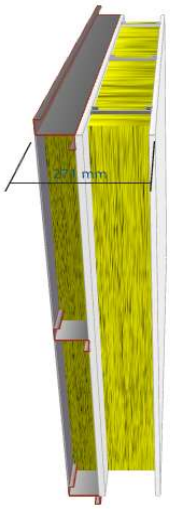

**STC 53**
OITC 34

Mass-air-mass resonant frequency = =60 Hz , 112 Hz

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 36.5 kg/m²

## System description

Panel 1 : 1 x 0.6 mm Steel

Frame: Z Girt (90 mm x 38 mm ), Stud spacing 600 mm ; Cavity Width 90 mm , 1 x Fibreglass (10kg/m3) 60mm Thickness 75 mm
Panel 2 : 1 x 15.9 mm DensGlass® Fireguard Georgia Pa

Frame: Steel Stud (1.0-1.6mm) (1.5E2 mm x 38 mm ), Stud spacing 600 mm ; Cavity Width 152 mm , 1 x Mineral wool I (3.8 lb/ft3) Thickness 152 mm ...
Panel 3 : 1 x 12.7 mm Type C Gypsum Board

| freq.(Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 13 | |
| 63 | 12 | 14 |
| 80 | 17 | |
| 100 | 22 | |
| 125 | 29 | 26 |
| 160 | 37 | |
| 200 | 43 | |
| 250 | 48 | 46 |
| 315 | 51 | |
| 400 | 53 | |
| 500 | 55 | 54 |
| 630 | 56 | |
| 800 | 58 | |
| 1000 | 60 | 58 |
| 1250 | 58 | |
| 1600 | 57 | |
| 2000 | 58 | 58 |
| 2500 | 57 | |
| 3150 | 59 | |
| 4000 | 66 | 62 |
| 5000 | 68 | |