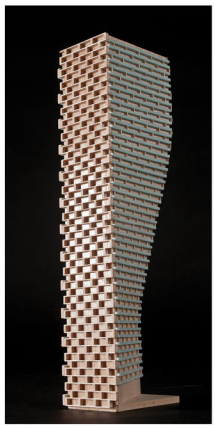
GRADIENTWIND
ENGINEERS & SCIENTISTS

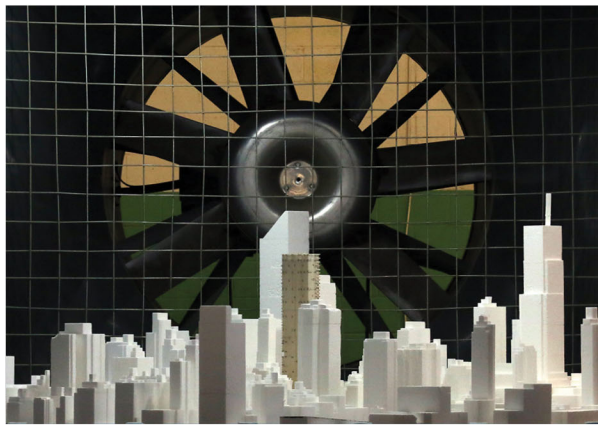
NOISE ASSESSMENT

1508 Thomas Argue Road
Carp, Ontario

GRADIENT WIND REPORT: 23-300 – Noise







March 5, 2025

PREPARED FOR

Big Steel Box
c/o Fotenn Planning & Design
396 Cooper Street, Suite 300
Ottawa, ON K2P 2H7

PREPARED BY

Joshua Foster, P.Eng., Lead Engineer
Ben Page, AdvDip, Junior Environmental Scientist

EXECUTIVE SUMMARY

This report describes a noise assessment in support of a Site Plan Application (SPA) for the industrial/commercial development located at 1508 Thomas Argue Road in Carp, Ontario. The property is zoned for industrial/commercial use, and the development will comprise of a mini storage facility which will have 96 permanent storage units made from shipping containers and additional storage for stacked containers. An accessory office building will be attached to the mini–storage facility. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by aircraft flyovers in and out of the Carp airport.

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 site plan drawings provided by Nicholas Caragianis Architect Inc., provided in March 2025 and typical office building detail drawings prepared by WSP, provided in January 2024. Assessment of aircraft noise has been based on the study site's proximity to the Carp 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 30 which is equivalent to a 24 hour L_{eq} of 62 dBA outside the building. The noise inside the office/administration area reaches 47 dBA with the building components provided in a typical Big Steel Box office configuration. Due to aircraft noise the following Warning Clause will be required on all Lease, Purchase and Sale Agreements for the office building, see Section 6.

The storage Facility is located next to the Carp airport, where the closest noise-sensitive property (point of reception) is more than 100 m. 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).

[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

TABLE OF CONTENTS

1. INTRODUCTION 1
2. TERMS OF REFERENCE 1
2.1 Potential Noise Impacts on Surroundings 2
3. OBJECTIVES 2
4. METHODOLOGY 2
4.1 Background 2
4.2 Aircraft Traffic Noise 3
4.2.1 Criteria for Aircraft Noise 3
4.3 Indoor Noise Calculations (Aircraft Noise) 4
5. RESULTS AND DISCUSSION 6
6. CONCLUSIONS AND RECOMMENDATIONS 9
FIGURES
APPENDICES
Appendix A – INSUL Calculations

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by BigSteelBox Corporation, to undertake a noise assessment for the industrial/commercial development located at 1508 Thomas Argue Road in Carp, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by aircraft flyovers from the Carp Airport.

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 by Nicholas Caragianis Architect Inc., provided in March 2025, typical office building detail drawings prepared by WSP, and aerial imagery. Assessment of aircraft noise has been assessed based on the site's proximity to the Carp 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 1508 Thomas Argue Road in Carp, Ontario; situated on a parcel of land northeast of the intersection of Wingover Private and Thomas Argue Road. The property is zoned for commercial use and the development will include a one-storey mini storage comprised of shipping containers and an ancillary office building. There will also be a storage area for stacked shipping containers. Access to the site is provided by a 2-lane entrance from Thomas Argue Road northwest of the site.

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. Figure 1 illustrates the subject site with the surrounding context.

[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 storage Facility is located next to the Carp airport, where the closest noise-sensitive property (point of reception) is more than 100 m. 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).

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 does 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 (2×10^{-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 Carp Airport, located at 1500 Thomas Argue Road. There is a single zone surrounding Carp Airport that indicates 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. Beyond NEF/NEP 25, aircraft noise is considered insignificant. The 30 NEF/NEP contour where the noise levels have increased will cause noise disruption to noise-sensitive developments. No new noise-sensitive development is allowed within the NEF/NEP 30 except for infill development, and 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 developments are within the AOIZ, building components must be designed to achieve the indoor criteria outlined in Table 3.

[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

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 and nighttime 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 calculations also need to be made when the aircraft noise exposure is above NEF / NEP 30 ($L_{eq\text{-}24hr}$ 62). The calculation procedure[10] considers:

[9] City of Ottawa Environmental Noise Control Guidelines, January 2016
[10] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

- 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 vary 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 were 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 office/administration area
- Window and curtain wall glazing for office/administration area
- Exterior roof assembly above the office/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 62 dBA ($L_{eq\text{-}24hr}$). 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 is 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.

[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 134 m^2
- Ceiling height is at 2.5 meters (m).
- Window / curtain wall area is 2.2 m^2
- Exterior wall area 72 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 within the NEF 30 contour line, 30 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 component's 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 NEF 25 to 30 contour line and indoor sound levels do not exceed the criteria for aircraft noise listed in section 4.2. The noise levels due to aircraft noise reach 47 dBA inside the offices, therefore, the building components specified below will be adequate in providing the necessary noise attenuation. The mitigation measures presented below are designed to mitigate the highest expected noise levels at all facades (i.e., 62 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 provide adequate sound insulation are based on Gradient Wind's experience. Refer to Appendix A for further STC details and modelling of the assemblies.

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

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 is determined by the material selection of the exterior walls.

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

Exterior Wall

- 14-gauge corrugated steel shipping container exterior
- 1/2” Spray Foam Insulation (Closed Cell – not acoustically significant)
- 2x4 Wood Studs @ 24” O.C.
- Batt Insulation (R14)
- 1” Rigid Insulation (R5 - not acoustically significant)
- 1/2” Gypsum Board
- Vinyl Cladding W/Batten and Trim on Seams, Ceiling Perimeter, and Corners

INSUL Predicted STC Rating: 45

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

- 14-gauge corrugated steel shipping container exterior
- 1” Spray Foam Insulation
- 2x6 Wood Studs @ 24” O.C.
- Batt Insulation (R20)
- 1” Rigid Insulation (R5)
- 1/2" Gypsum Board
- Vinyl Cladding W/Batten and Trim on Seams

INSUL Predicted STC Rating: 48

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
- 12 mm air space
- 6 mm outer pane

INSUL Predicted STC Rating: 35

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 Clause 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 30 which is equivalent to a 24 hour L_{eq} of 62 dBA outside the building. The noise inside the office/administration area reaches 47 dBA with the building components listed above. Typical commercial windows and curtain wall systems with an STC rating of 35 are 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 Carp e Airport. In order to reduce the impact of aircraft noise in the indoor spaces, the unit 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 unit has been fitted with a forced air heating system, all components of which are sized to accommodate the future installation of central air conditioning-by the owner/occupant. Despite the inclusion of noise control features within the dwelling unit, 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 living environment of the residents of this property/area. The Carp 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 dwelling finds that the indoor and/or outdoor noise levels due to aircraft operations are of or are offensive."*

The storage Facility is located next to the Carp airport, where the closest noise-sensitive property (point of reception) is more than 100 m. 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.

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.

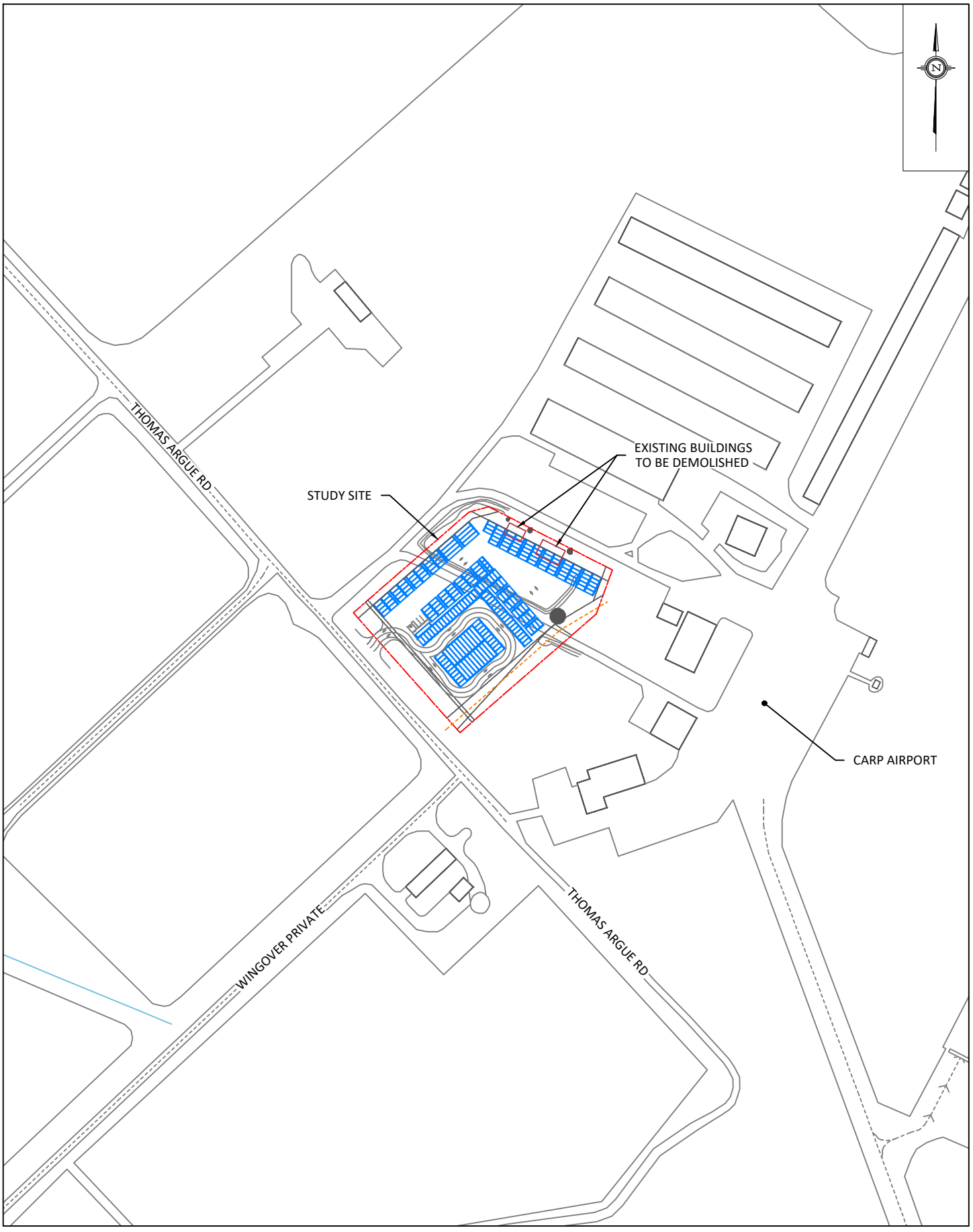
Sincerely,

Gradient Wind Engineering Inc.



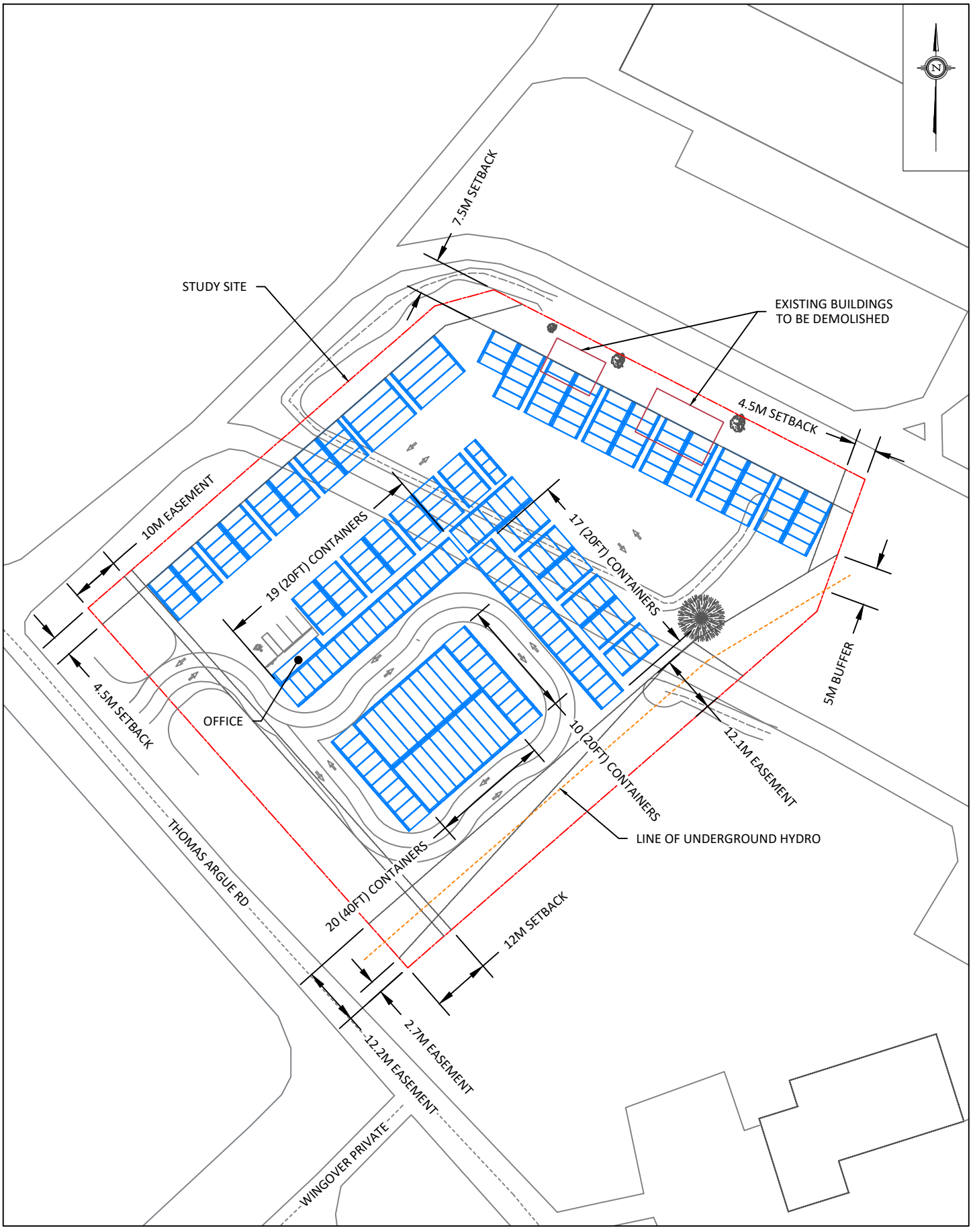
Benjamin Page, AdvDip.
Junior Environmental Scientist
GW23-300- Noise Assessment

Joshua Foster, P.Eng.
Lead Engineer



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ENGINEERS & SCIENTISTS
127 WALGREEN ROAD, OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	1508 THOMAS ARGUE ROAD, CARP AIRCRAFT NOISE STUDY		DESCRIPTION
SCALE	1:3000	DRAWING NO. 23-300-NOISE-FIG1	FIGURE 1: PROPOSED SITE PLAN AND SURROUNDING CONTEXT
DATE	APRIL 4, 2024	DRAWN BY B.P.	



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PROJECT	1508 THOMAS ARGUE ROAD, CARP AIRCRAFT NOISE STUDY		DESCRIPTION
SCALE	1:3000	DRAWING NO. 23-300-NOISE-FIG2	FIGURE 2: PROPOSED SITE PLAN AND SURROUNDING CONTEXT
DATE	APRIL 4, 2024	DRAWN BY B.P.	



APPENDIX A

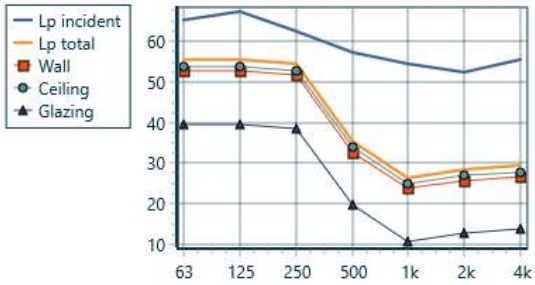
INSUL CALCULATIONS

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Outdoor To Indoor Sound Transmission (v9.0.24)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within ±3 dB
- Key No. 11036
Job Name:
Job No.: Initials:ANV Team
Date:2024-04-01
File Name:Office Sound Level - NEF 30.inz

Comment:



Source	Octave Band Centre Frequency (Hz) 63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	65.4	67.4	62.4	57.4	54.4	52.4	55.4	62
Path								
Element 1 , STL	-23	-25	-21	-35	-41	-37	-39	
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [72 m^2]	19	19	19	19	19	19	19	
Element sound level contribution	53	53	52	33	24	26	27	44
Element 2 , STL	-23	-25	-21	-35	-41	-37	-39	
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [59 m^2]	18	18	18	18	18	18	18	
Element sound level contribution	54	54	53	34	25	27	28	46
Element 3 , STL	-23	-25	-21	-35	-41	-37	-39	
Facade Shape factor Level diff.	0	0	0	0	0	0	0	
Insertion Loss	0	0	0	0	0	0	0	
Area(+10LogA) [2.2 m^2]	3	3	3	3	3	3	3	
Element sound level contribution	40	40	39	20	11	13	14	31
Receiver								
Room volume(-10LogV) [67 m3]	-18	-18	-18	-18	-18	-18	-18	
Reverberation time (s)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
RT (+10LogT)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Equation Constant	11	11	11	11	11	11	11	
Room sound level	55	55	54	35	26	28	29	47
Level difference								LpAinc - LpARev,T0
D2m,nT	15	17	13	27	33	29	31	17

** Element descriptions:
#1: Wall
#2: Ceiling
#3: Glazing

Sound Insulation Prediction (v9.0.20)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within STC ±3 dB
- Key No. 4807
Job Name:
Job No.: Initials:ANV Team
Date:3/14/2024
File Name:

Notes:



STC 45
OITC 28

Mass-air-mass resonant frequency = =78 Hz

Panel Size = 2.7 m x 4.0 m

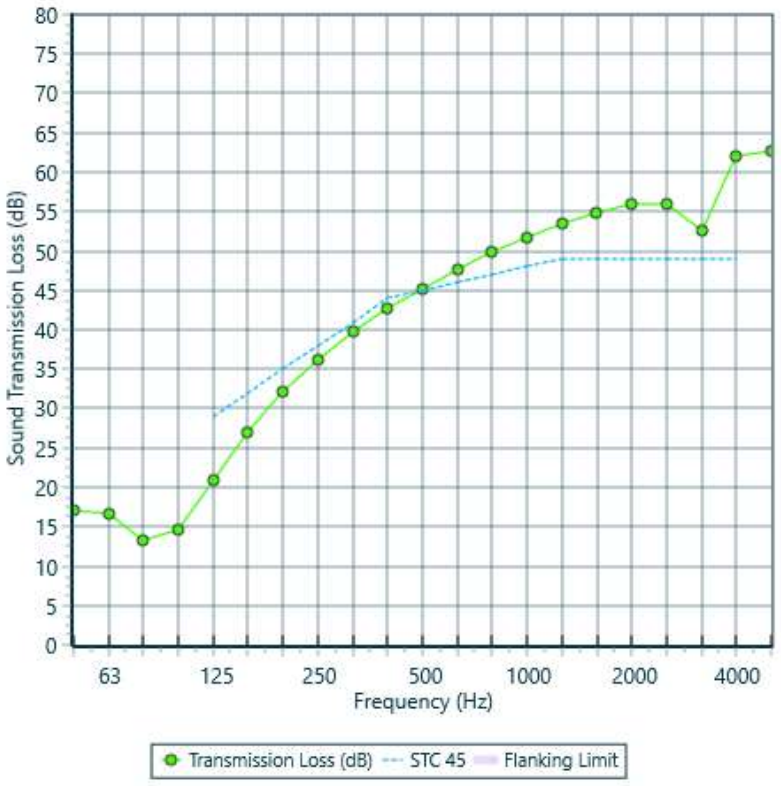
Partition surface mass = 23.9 kg/m²

System description

Panel 1 : 1 x 1.9 mm Steel

Frame: Timber stud (90 mm x 35 mm), Stud spacing 610 mm ; Cavity Width 90 mm , 1 x fiberglass (0.6 lb/ft3) Thickness 90 mm
Panel 2 : 1 x 12.7 mm Gypsum Board

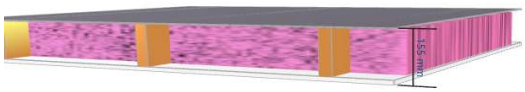
freq.(Hz)	TL(dB)	TL(dB)
50	17	
63	17	15
80	13	
100	15	
125	21	18
160	27	
200	32	
250	36	35
315	40	
400	43	
500	45	45
630	48	
800	50	
1000	52	51
1250	53	
1600	55	
2000	56	56
2500	56	
3150	53	
4000	62	57
5000	63	



Sound Insulation Prediction (v9.0.20)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within STC ±3 dB
- Key No. 4807
Job Name:
Job No.: Initials:ANV Team
Date:3/14/2024
File Name:

Notes:



STC 48
OITC 30

Mass-air-mass resonant frequency = =62 Hz

Panel Size = 2.7 m x 4.0 m

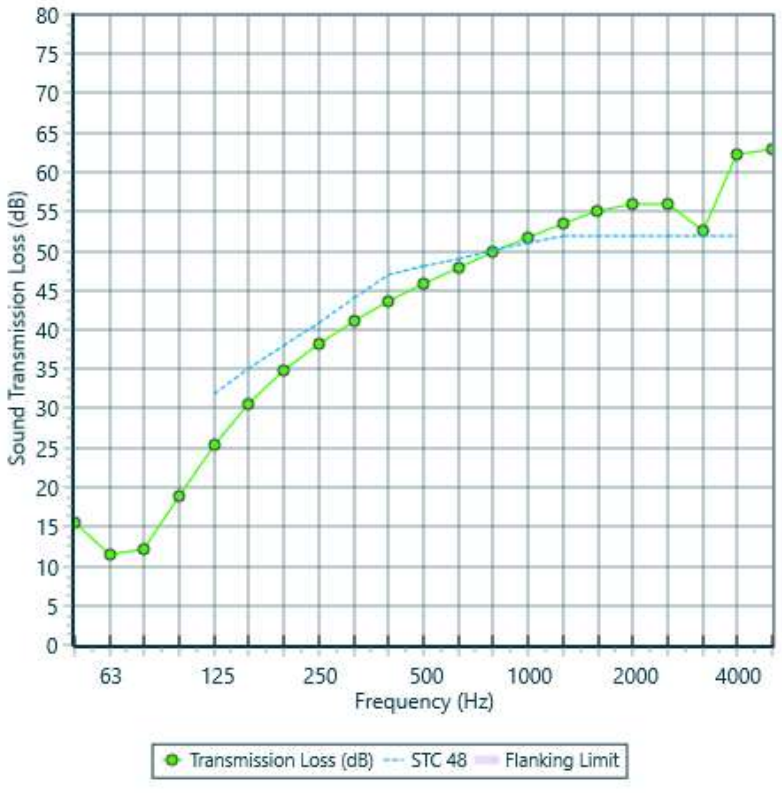
Partition surface mass = 24.4 kg/m²

System description

Panel 1 : 1 x 1.9 mm Steel

Frame: Timber stud (1.4E2 mm x 38 mm), Stud spacing 610 mm ; Cavity Width 140 mm , 1 x fiberglass (0.6 lb/ft3) Thickness 140 mm
Panel 2 : 1 x 12.7 mm Gypsum Board

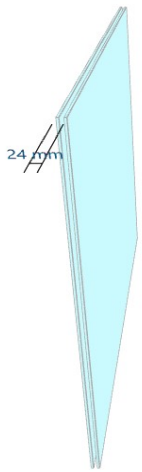
freq.(Hz)	TL(dB)	TL(dB)
50	16	
63	11	13
80	12	
100	19	
125	25	22
160	31	
200	35	
250	38	37
315	41	
400	44	
500	46	45
630	48	
800	50	
1000	52	51
1250	53	
1600	55	
2000	56	56
2500	56	
3150	53	
4000	62	57
5000	63	



Sound Insulation Prediction (v9.0.20)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within STC ±3 dB
- Key No. 4807
Job Name:
Job No.: Initials:ANV Team
Date:3/14/2024
File Name:

Notes:



STC 35
OITC 28

Mass-air-mass resonant frequency = =200 Hz

Panel Size = 2.0 m x 1.5 m

Partition surface mass = 30.2 kg/m²

System description

Pane 1 : 1 x 6 mm Glass

air: 12 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	25
160	24	
200	18	
250	21	21
315	28	
400	32	
500	35	35
630	38	
800	40	
1000	42	41
1250	43	
1600	43	
2000	41	37
2500	33	
3150	36	
4000	40	39
5000	44	

