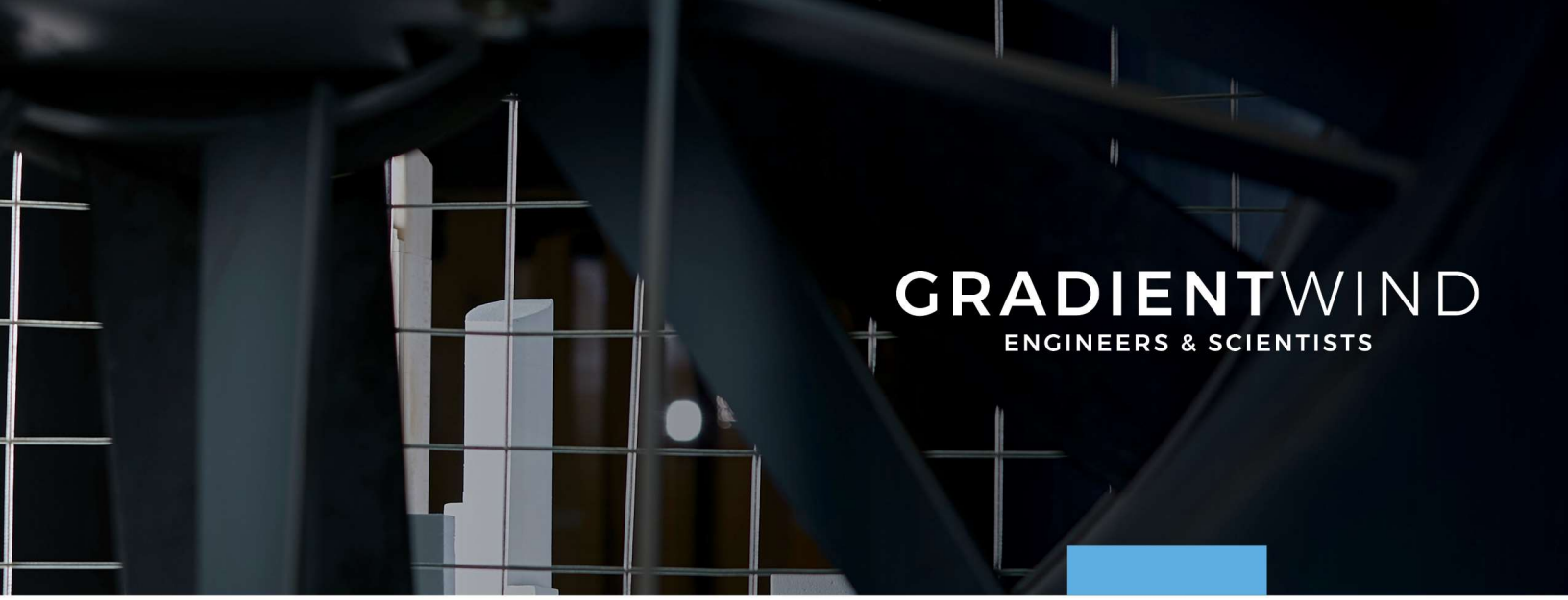
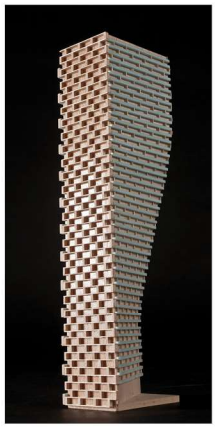


GRADIENTWIND
ENGINEERS & SCIENTISTS

ROADWAY TRAFFIC NOISE ASSESSMENT

847 Woodroffe Avenue
Ottawa, Ontario

Report: 20-041-Traffic Noise



May 8, 2020

PREPARED FOR

The Stirling Group
1148 Julia Court
Ottawa, ON K0A 1T0

Attn: Alison Stirling, Project Manager
alison@thestirlinggroup.ca

PREPARED BY
Efser Kara, MSc, LEED GA, Acoustic Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment performed for the proposed residential development located at 847 Woodroffe Avenue in Ottawa, Ontario. The proposed development comprises two long semi-detached residential buildings with rectangular planforms. Each building has two units with entrances on the east and west sides of the building. The buildings have two semi-basement units with enrances from north and south. The buildings are accessible via the west side (via Woodroffe Avenue) with parking extending down the center of the two buildings. The site is surrounded by low-rise residential buildings. The major source of roadway traffic noise is the Woodroffe Avenue, running along the west perimeter of the site. Figure 1 illustrates the site plan with the surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings prepared by Evolution Design & Drafting.

The results of the current analysis indicate that noise levels will range between 67 and 71 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 60 and 64 dBA. Noise levels are highest along the west side of the site, which is nearest to Woodroffe Avenue.

The noise levels predicted due to roadway traffic exceed the criteria required by ENCG for building components, therefore upgraded building components will be required. Due to the limited information available at the time of the study, which was prepared for a Zoning By-law Amendment (ZBA) submission application, detailed STC calculations could not be performed at this time. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the building.

Results of the calculations also indicate that the development will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. Warning Clauses will also be required in all Lease, Purchase and Sale Agreements.

A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by The Stirling Group to undertake a roadway traffic noise feasibility study to satisfy the requirements for a Zoning By-law Amendment (ZBA) application submission for the proposed residential development located at 847 Woodroffe Avenue in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local roadway traffic.

This assessment is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and the Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings prepared by Evolution Design & Drafting dated March 31st, 2020, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The subject site is located at 847 Woodroffe Avenue in Ottawa, Ontario. The proposed development comprises two long semi-detached residential buildings with rectangular planforms. Each building has two units with entrances on the east and west sides of the building. Also, buildings have two semi-basement units with enrances from north and south. The buildings are accessible via the west side (via Woodroffe Avenue) with parking extending down the center of the two buildings.

The major source of roadway traffic noise is Woodroffe Avenue, running along the west perimeter of the site. The site is surrounded by low-rise residential buildings. Figure 1 illustrates the site plan with the surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, and (ii) explore potential noise mitigation where required.

[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

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 level at a specific distance. While the power of a source is characteristic of 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 sound pressure 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 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For vehicular traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time-varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time-varying noise level over a period of time. For roadways and LRT, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 45 and 40 dBA for living rooms and sleeping quarters respectively for roadway, as listed in Table 1. Based on Gradient Wind's experience, more comfortable indoor noise levels should be targeted, towards 42 and 37, respectively, to control peak noise and deficiencies in building envelope construction.

TABLE 1: INDOOR SOUND LEVEL CRITERIA

Type of Space	Time Period	Leq (dBA)
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50
Living/dining/den areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 – 07:00	45
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[3]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[4]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[5].

The sound level criterion for outdoor living areas is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion. If these measures are not provided, prospective purchasers or tenants should be informed of potential noise problems by a warning clause.

[3] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[4] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

4.2.2 Theoretical Roadway Noise Predictions

Noise predictions were performed with the aid of the Ministry of the Environment, Conservations and Parks' (MECP) computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix A includes the STAMSON 5.04 input and output data.

Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split for all roads was taken to be 92% / 8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Two (2) receptor locations were chosen at the façades of the buildings as Plane of Window (POW) receptors.
- Receptor heights were taken to be on the highest floor of the buildings at the centre of the window. The receptor distances to roadway traffic and exposure angles are illustrated in Figure 3.

4.2.3 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[6] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

[6] City of Ottawa Transportation Master Plan, November 2013

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Woodroffe Avenue	4-Lane Urban Arterial-Undivided (4-UAU)	50	**30,000**

5. ROADWAY TRAFFIC NOISE RESULTS

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
			Day	Night
1	5.4	North Building – West Façade	71	64
2	5.4	North Building – North Façade	67	60

The results of the current analysis indicate that noise levels will range between 67 and 71 dBA at Plane of Window (POW) receptors during the daytime period (07:00-23:00) and 60 and 64 dBA during the nighttime period (23:00-07:00). Noise levels are highest along the west side of the site, which is nearest and most exposed to Woodroffe Avenue.

6. CONCLUSIONS AND RECOMMENDATIONS

The noise levels predicted due to roadway traffic exceed the criteria required by ENCG for building components, therefore upgraded building components will be required. Due to the limited information available at the time of the study, which was prepared for a Zoning By-law Amendment (ZBA) submission application, detailed STC calculations could not be performed at this time. A detailed review of the window and wall assemblies should be performed by a qualified engineer with expertise in acoustics during the detailed design stage of the building.

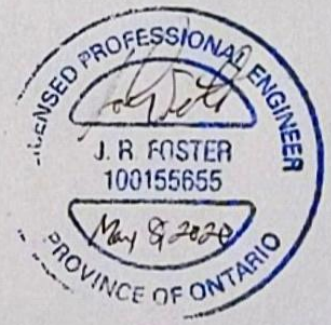
Results of the calculations also indicate that the development will require central air conditioning, or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment. Warning Clauses will also be required in all Lease, Purchase and Sale Agreements.

A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

This concludes our traffic noise assessment and report. 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.



Efser Kara, MSc, LEED GA
Acoustic Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #20-041-Traffic Noise

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ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
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PROJECT	847 WOODROFFE AVENUE TRAFFIC NOISE FEASIBILITY ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-041-1
DATE	APRIL 14, 2020	DRAWN BY	E.K.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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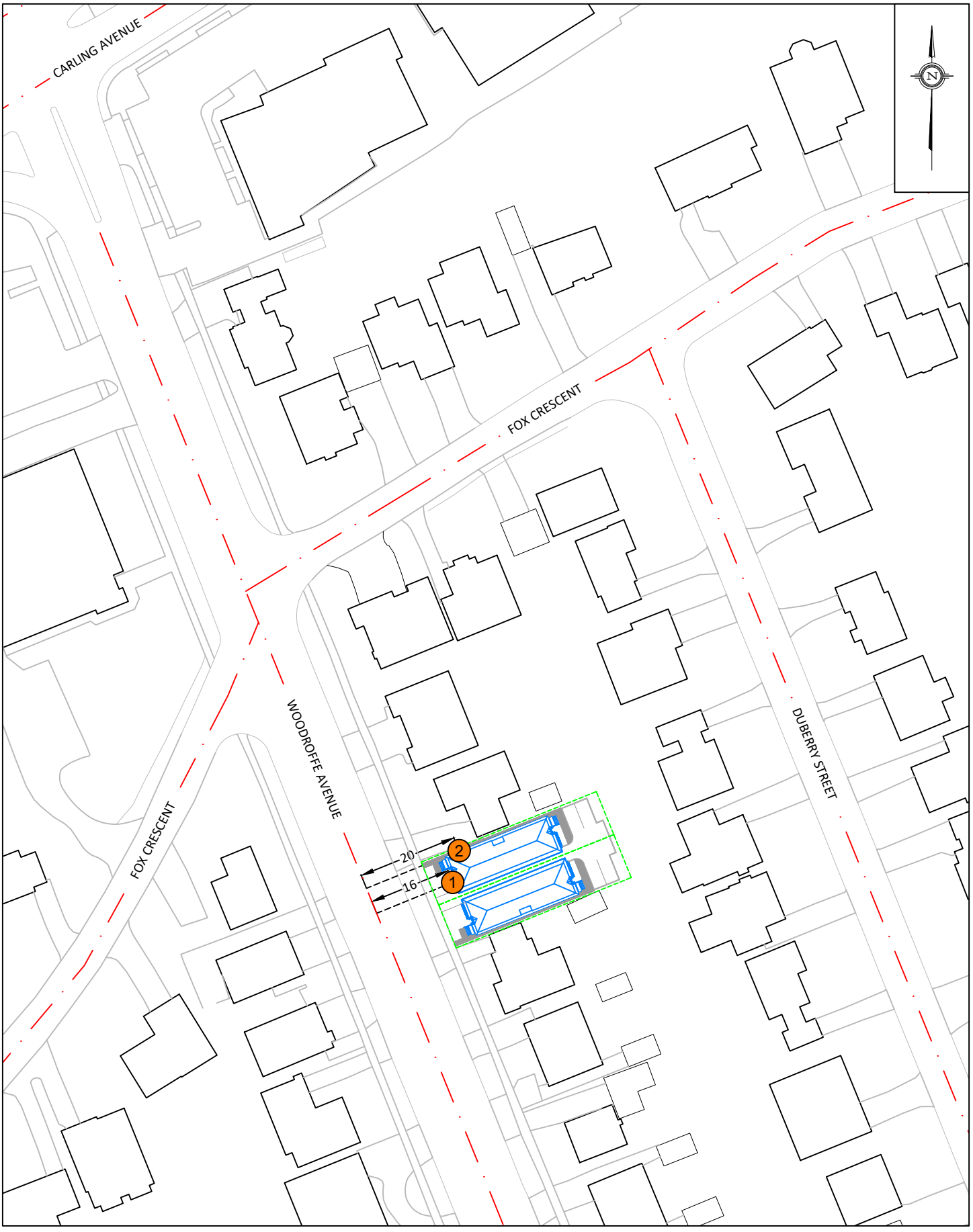
PROJECT	847 WOODROFFE AVENUE TRAFFIC NOISE FEASIBILITY ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-041-2
DATE	APRIL 14, 2020	DRAWN BY	E.K.

FIGURE 2:
RECEPTOR LOCATIONS



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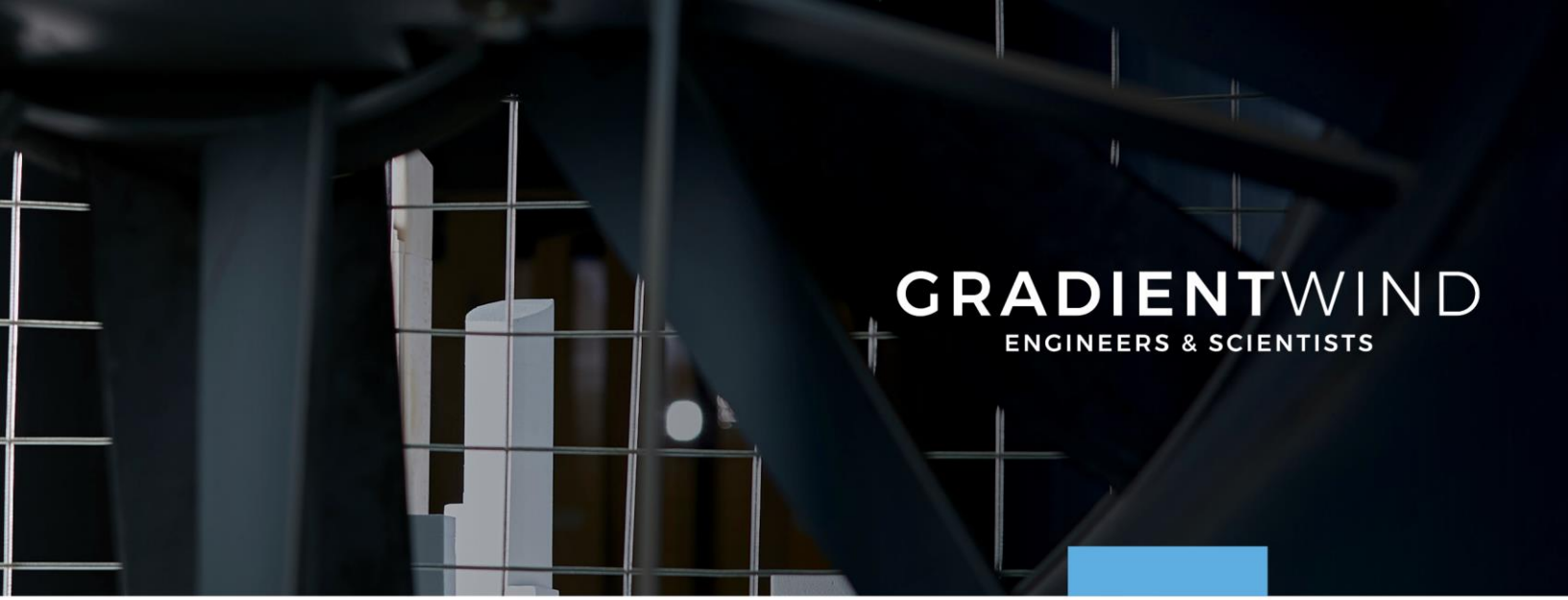
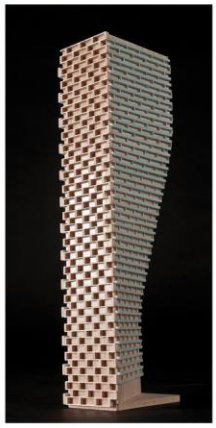
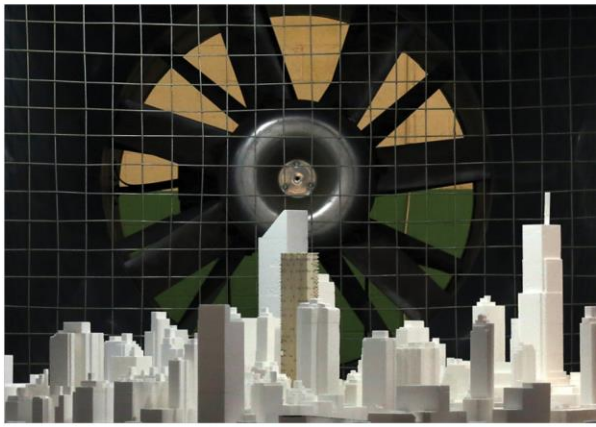
PROJECT	847 WOODROFFE AVENUE TRAFFIC NOISE FEASIBILITY ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-041-3
DATE	APRIL 14, 2020	DRAWN BY	E.K.

FIGURE 3:
STAMSON INPUT DATA
FOR RECEPTORS 1 & 2







APPENDIX A

STAMSON INPUT-OUTPUT DATA

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

STAMSON 5.0 NORMAL REPORT Date: 14-04-2020 14:11:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R01.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Woodroffe Av (day/night)

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Woodroffe Av (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 16.00 / 16.00 m
Receiver height : 5.40 / 5.40 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Woodroffe Av (day)

Source height = 1.50 m

ROAD (0.00 + 71.21 + 0.00) = 71.21 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	71.49	0.00	-0.28	0.00	0.00	0.00	0.00	71.21

Segment Leq : 71.21 dBA

Total Leq All Segments: 71.21 dBA

Results segment # 1: Woodroffe Av (night)

Source height = 1.50 m

ROAD (0.00 + 63.61 + 0.00) = 63.61 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	63.89	0.00	-0.28	0.00	0.00	0.00	0.00	63.61

Segment Leq : 63.61 dBA

Total Leq All Segments: 63.61 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.21
(NIGHT): 63.61

STAMSON 5.0 NORMAL REPORT Date: 14-04-2020 16:51:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r02.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Woodroffe Av (day/night)

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 30000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: Woodroffe Av (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 20.00 / 20.00 m
Receiver height : 5.40 / 5.40 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Woodroffe Av (day)

Source height = 1.50 m

ROAD (0.00 + 67.23 + 0.00) = 67.23 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	71.49	0.00	-1.25	-3.01	0.00	0.00	0.00	67.23

Segment Leq : 67.23 dBA

Total Leq All Segments: 67.23 dBA

Results segment # 1: Woodroffe Av (night)

Source height = 1.50 m

ROAD (0.00 + 59.63 + 0.00) = 59.63 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	63.89	0.00	-1.25	-3.01	0.00	0.00	0.00	59.63

Segment Leq : 59.63 dBA

Total Leq All Segments: 59.63 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 67.23
(NIGHT): 59.63