Stationary Noise Study

120 Hearst Way

Ottawa, Ontario

REPORT: *GmE* 13-027 Noise

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EXECUTIVE SUMMARY

Gradient Microclimate Engineering Inc. (*GmE*) was retained by Broccolini Construction Ottawa Inc. to perform a stationary noise assessment for the future development at 120 Hearst Way in Ottawa, Ontario. This report focuses on the outdoor noise impacts of the loading bays and rooftop mechanical equipment, such as heating, ventilation and air conditioning (HVAC) equipment. This study is based on architectural drawings provided by Broccolini Construction and surrounding street layouts and traffic data obtained from the City of Ottawa and recent site imagery.

Our assessment of noise impacts from the activities relating to the loading bays and rooftop mechanical equipment at 120 Hearst Way shows that they fall below the ENCG exclusionary noise level limits and will, therefore, not adversely impact the neighbouring residential properties.

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1. INTRODUCTION

Gradient Microclimate Engineering Inc. (*GmE*) was retained by Broccolini Construction Ottawa Inc. to perform a stationary noise assessment for the future development at 120 Hearst Way in Ottawa, Ontario. This report focuses on the outdoor noise impacts of the loading bays and rooftop mechanical equipment such as heating, ventilation and air conditioning (HVAC) equipment. This study is based on architectural drawings provided by Broccolini Construction Ottawa Inc. and surrounding street layouts and traffic data obtained from the City of Ottawa and recent site imagery.

2. TERMS OF REFERENCE

The focus of this detailed noise assessment is the future development of a Franklin Empire warehouse facility. The site is located on the north side of Hearst Way. Local surroundings include residential housing to the south, commercial developments to the east and west and Highway 417 to the north.

The main operating hours of the facility are expected to occur during daytime hours between 7:00 AM and 7:00 PM. One loading bay will be located on the northwest corner of the building with an estimated total of four (4) truck deliveries per day. Therefore, for modelling purposes it was assumed there would be one (1) idling truck over any one hour period for up to thirty (30) minutes during that period. No trucks will be on site during the nighttime hours between 7:00 PM and 7:00 AM. A private lane will be constructed around the property to service the loading bays. The activities of truck movements and loading and unloading of trailers has the potential to produce noise impacts at nearby sensitive residential receptors.

Elsewhere on site will be two rooftop air handling units. The air handling units were assumed to operate 100% of the time during a one-hour period for daytime hours, and 50% of the time during a one-hour period for nighttime operations.

3. OBJECTIVES

The main goals of the work are to assess the impact of the noise emanating from the rooftop mechanical equipment and idling trucks in the loading bay on nearby sensitive receptors, and to provide advice for mitigation as required by the outcome of the study.

4. METHODOLOGY

The impact of the external stationary noise sources on the nearby residential areas was determined by computer modelling. Stationary noise source modelling is based on the software program *Predictor* developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2. This computer program is capable of representing three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. The methodology has been used on numerous assignments, and has been accepted by the Ministry of the Environment (MOE) as part of Environmental Compliance Approvals, formally Certificate of Approval (C of A) applications.

4.1. Perception of Noise

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 of that source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Its measurement 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 represents the noise perceived by the human ear. With this scale, a doubling of sound power at the source results in a 3 dBA increase in measured noise levels at the receiver, and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

Stationary sources are defined in the City of Ottawa Environmental Noise Control Guide as: "*all sources of sound and vibration, whether fixed or mobile, that exist or operate on a premises, property or facility, the combined sound and vibration levels of which are emitted beyond the property boundary of the premises, property or facility, unless the source(s) is (are) due to construction*"[1].

[1] City of Ottawa Environmental Noise Control Guidelines, May 10, 2006, p. 22, Section 1.5.1

4.2. Stationary Noise Criteria

The equivalent sound energy level, L_{EQ}, provides a weighted 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 selected period of time. For stationary sources, the L_{EQ} is commonly calculated on an hourly interval, while for roadways, the L_{EQ} is calculated on the basis of a 16-hour daytime / 8-hour night time split.

Noise criteria taken from the City of Ottawa Environmental Noise Control Guidelines (ENCG) apply to outdoor points of reception on the property (for daytime operations), taken as the outdoor living area (OLA) at the property line, and the plane of the window (POW) (for nighttime operations). According to this document, based on MOE's NPC-205[2], the recommended maximum noise levels in an urban environment at the OLAs or POWs are 50 dBA between the hours of 7:00 AM and 7:00 PM, 47 dBA between the hours of 7:00 PM and 11:00 PM, and 45 dBA at the POWs between the hours of 11:00 PM and 7:00 AM, or alternately the noise produced by roadway traffic, whichever is greater[3]. As no nighttime traffic data is available, the ENCG 50 dBA and 45 dBA criteria will be used for daytime and overnight noise analysis, respectively.

4.3. Impulsive Noise Criteria

Impulsive noise is characterized as a single pressure pulse or a single burst of pressure pulses, and is expressed in terms of the Logarithmic Mean Impulse Sound Level (L_{LM}). Some examples of impulsive noise include gun shots, punch presses and blasting. In this instance, noise from the loading bay are associated with loading and unloading activities of the trailers, such as the movement of forklifts and picking up and dropping of pallets. These types of noises are known as impulsive noise and based on representative measurements produce an average mean logarithmic impulsive noise level of 75 dBA at 10 m. Since impulsive noise does not occur on a regular basis, its measurements are not added to the varying noise levels, measured as L_{eq}. The criteria requirements for stationary noise sources (as mentioned in Section 4.2) are also applied to impulsive noise levels.

[2] MOE, Sound Level Limits for Stationary Sources in Class 1 and 2 Areas (Urban), Publication NPC-205, Oct. 1995.
[3] City of Ottawa Environmental Noise Control Guidelines, May 10, 2006, Table 1.6.

4.4. Determination of Noise Source Power Levels

Based on the anticipated delivery schedule described previously, it was assumed the worst case scenario would be one truck movement at 20 km/h and one truck at the loading bay over any one-hour period. An assumed maximum idling time of thirty (30) minutes has been used to model the trucks at the loading bays. As the trucks are not operating for the entire one-hour duration period, an intermittence reduction factor of -3 dBA has been applied, in accordance to NPC - 104[4]. Noise levels were determined through field measurements for representative trucks operating at low speed and idling. Measurements indicated that typical idling truck noise is 70 dBA at 10 meters (m).

Noise levels for the rooftop mechanical equipment were supplied by AHU manufacture Lennox. Sound data for each unit and operating frequency are summarized in Table 1 below. The rooftop units were assumed to operate continuously and concurrently during the daytime, and intermittently over a half hour period in any given hour during nighttime operation. Therefore, an intermittence factor of -3 dBA has been applied to nighttime operations of the rooftop units (RTU) as per NPC-104. Figure 2 illustrates the location of each noise source corresponding to the labels in Table 1.

TABLE 1: SOUND DATA & OPERATING FREQUENCY OF STATIONARY NOISE SOURCES

RTU UNIT	SOUND POWER (Hz)								
	63	125	250	500	1000	2000	4000	8000	Total (dBA)
AHU 1 (S1)	84	83	79	79	74	69	65	60	88
AHU 2 (S2)	90	89	85	85	80	75	71	66	94
Idling Truck (S3)	65	78	87	93	93	91	88	83	98
Moving Truck (line source) (S4)	79	88	92	96	100	97	90	84	104

[4] MOE, Publication NPC-104 Sound Level Adjustments

4.5. Stationary Source Noise Predictions

Four individual noise sensor locations were selected to represent daytime (07:00 AM – 11:00 PM) noise levels at the outdoor living areas (OLA's) of the residential properties surrounding the study site in the *Predictor* model; with receptor heights set to 1.5 m above grade. Nighttime noise levels (11:00 PM – 07:00 AM) were measured at five locations at the plane of window (POW) with receptor heights of 4.5 m above grade to represent a second storey dwelling. Sensor locations are described in Table 2 and illustrated in Figure 2. Truck movements were represented as a line source in the *Predictor* model, while the rooftop mechanical equipment was represented as point sources. Air absorption was calculated assuming an air temperature of 20°C and a relative humidity of 60%. Hard surfaces such as roads, bodies of water and parking lots were modeled as reflective surfaces, while softer surfaces such as grass lands and parks were modelled as absorptive surfaces.

5. NOISE LEVELS

5.1. Steady State and Varying Noise Levels

Daytime noise levels at the nearby OLA's were found to be below the ENCG exclusionary noise limit of 50 dBA. Nighttime noise levels at the nearby POW's were found to be below the ENCG exclusionary noise limit of 45 dBA. As such, noise levels from the mechanical equipment, idling truck and truck movements will not exceed daytime and nighttime noise limits, as summarized in Tables 2 and 3 below and illustrated in Figures 3 and 4. Appendices A and B summarize noise impacts at each receptor location during daytime and nighttime hours, respectively.

TABLE 2: PREDICTED DAYTIME NOISE LEVELS AT POR

RECEPTOR	LOCATION	L_{EQ} SOUND LEVEL (dBA)	NOISE LEVEL CRITERIA (dBA)	MEETS ENCG CRITERIA
R 1	OLA – Near Southwest Corner of Site	46	50	Yes
R 2	OLA – Near South Side of Site	41		Yes
R 3	OLA – Near Southeast Corner of Site	44		Yes
R 4	OLA – Near Southeast Corner of Site	43		Yes
R 5	POW – Near Southwest Corner of Site	49		Yes
R 6	POW – Near Southwest Corner of Site	50		Yes
R 7	POW – Near South Side of Site	43		Yes
R 8	POW – Near Southeast Corner of Site	45		Yes
R 9	POW – Near Southeast Corner of Site	43		Yes

TABLE 3: PREDICTED NIGHTTIME NOISE LEVELS AT POR

RECEPTOR	LOCATION	L_{EQ} SOUND LEVEL (dBA)	NOISE LEVEL CRITERIA (dBA)	MEETS ENCG CRITERIA
R 5	POW – Near Southwest Corner of Site	33	45	Yes
R 6	POW – Near Southwest Corner of Site	34		Yes
R 7	POW – Near South Side of Site	38		Yes
R 8	POW – Near Southeast Corner of Site	39		Yes
R 9	POW – Near Southeast Corner of Site	37		Yes

5.2. Loading Bay Impulsive Noise Levels

Impact of impulsive noise emanating from the loading bays is expected to fall below the ENCG criteria, and will not adversely affect the surrounding residential properties, as illustrated in Table 4.

TABLE 4: PREDICTED OUTDOOR IMPACT NOISE LEVELS

RECEPTOR	LOCATION	L_{LM} DAYTIME NOISE		
		TRUCK BAY LEVEL (dBAI)	NOISE CRITERIA (dBA)	MEETS ENCG CRITERIA
R1	OLA – Near Southwest Corner of Site	38	50	Yes
R2	OLA – Near South Side of Site	38		Yes
R3	OLA – Near Southeast Corner of Site	33		Yes
R4	OLA – Near Southeast Corner of Site	30		Yes
R5	POW – Near Southwest Corner of Site	39		Yes
R6	POW – Near Southwest Corner of Site	38		Yes
R7	POW – Near South Side of Site	38		Yes
R8	POW – Near Southeast Corner of Site	36		Yes
R9	POW – Near Southeast Corner of Site	31		Yes

6. CONCLUSIONS

Our assessment of noise impacts from the activities relating to the loading bays and rooftop mechanical equipment at 120 Hearst Way shows that they fall below the ENCG exclusionary noise level limits and will, therefore, not adversely impact the neighbouring residential properties. Since noise levels from the facility fall below the ENCG criteria, no mitigation is required.

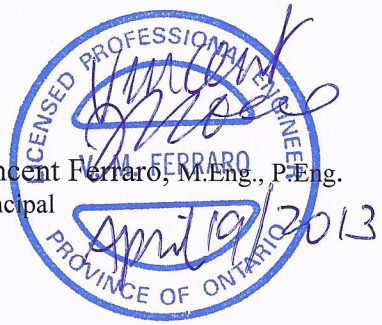
This concludes our assessment and report. If you have any questions or wish to discuss our findings please advise us. In the interim, we thank you for the opportunity to be of service.

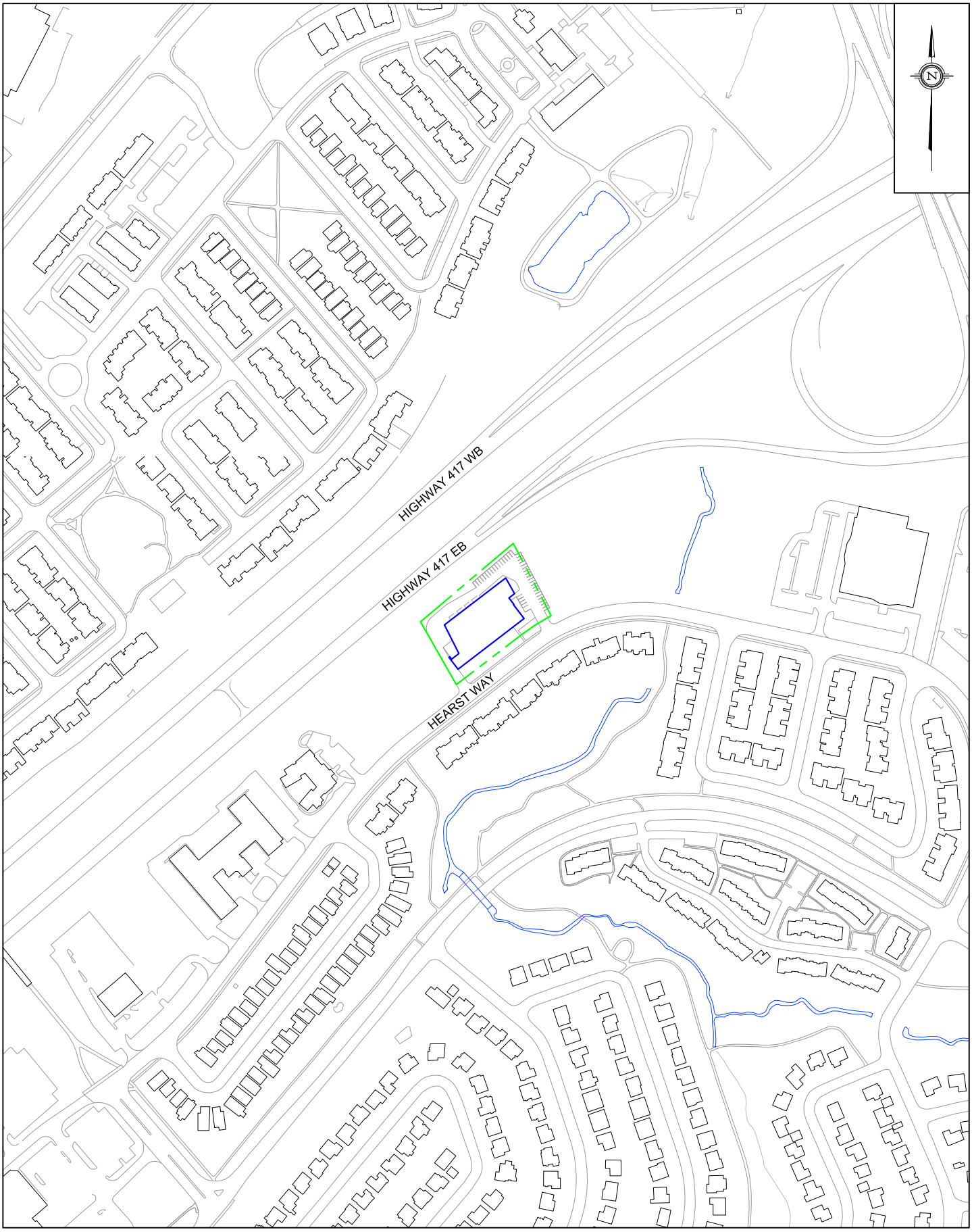
Yours truly,

Gradient Microclimate Engineering Inc.

Thomas Couper, B.A.Sc.
Project Engineer
GmE 13-027 Noise

Vincent Ferraro, M.Eng., P.Eng.
Principal





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PROJECT	120 HEARST WAY - STATIONARY NOISE STUDY
SCALE	1:4200 (APPROX.)
DRAWING NO.	GME13-027-1
DATE	APRIL 1, 2013
DRAWN BY	T.C

DESCRIPTION

FIGURE 1:
SITE PLAN & SURROUNDING CONTEXT

127 Walgreen Road
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GmE Gradient Microclimate Engineering Inc

PROJECT	120 HEARST WAY - STATIONARY NOISE STUDY		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GME13-027-2
DATE	APRIL 1, 2013	DRAWN BY	T.C

DESCRIPTION

FIGURE 2:
RECEPTOR & NOISE SOURCE LOCATIONS

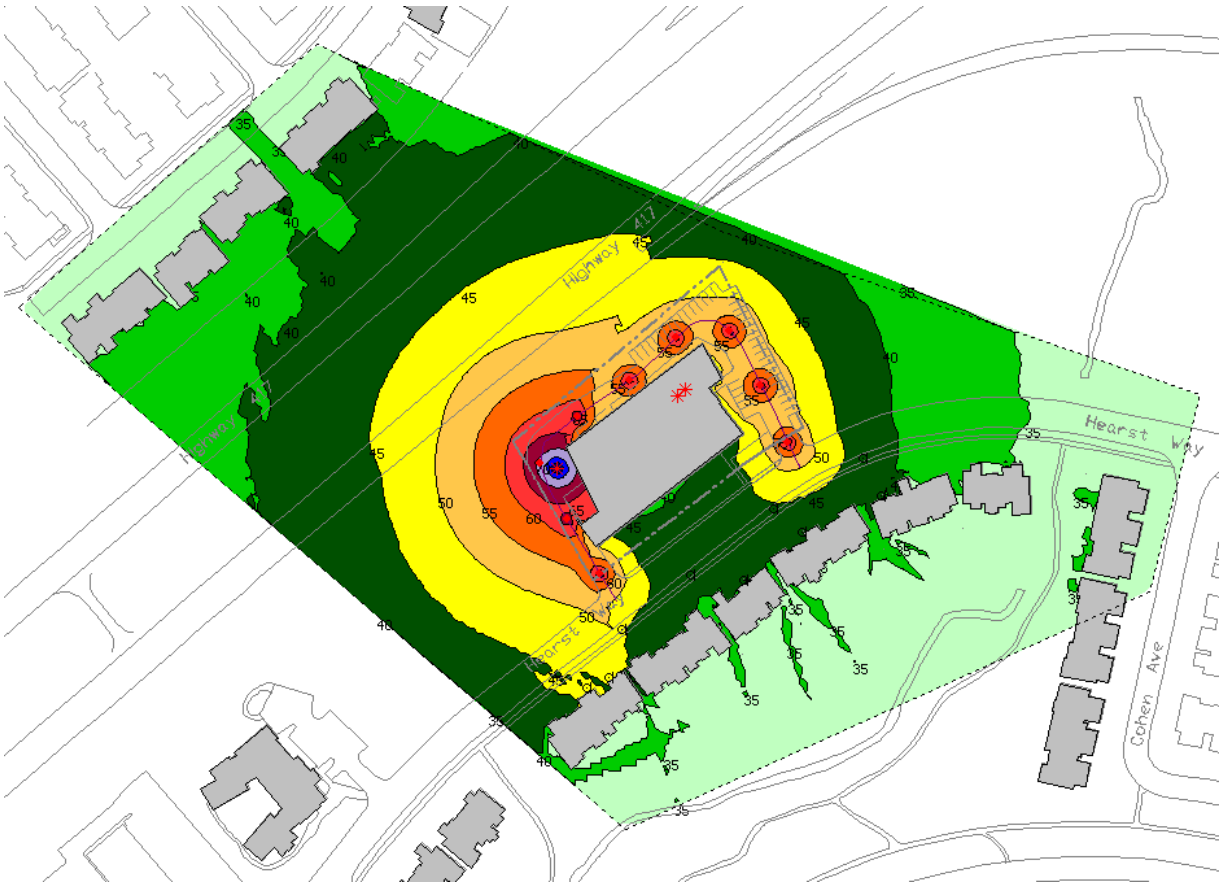


FIGURE 3: PREDICTED DAYTIME OUTDOOR NOISE LEVELS (ALL SOURCES)

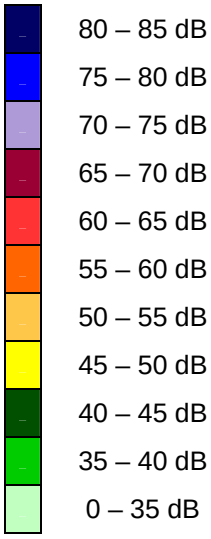
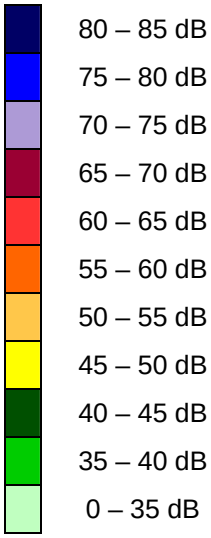


FIGURE 4: PREDICTED NIGHTTIME OUTDOOR NOISE LEVELS (AHU UNITS ONLY)



APPENDIX A

POINT OF RECEPTION NOISE IMACT TABLE

DAYTIME

TABLE A1: DAYTIME NOISE LEVELS AT R1

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	32.7	32.8	34.8	39.5	41.6	38.7	31.6	21.9	45.9
AHU - 1	25.6	23.8	18.2	19.5	14.2	8	-0.3	-14.5	29
AHU - 2	31.4	29.7	24.1	25.8	20.4	14.3	6	-8.2	34.9
Idle Truck	11.1	23.5	31.9	36.8	36.4	33.1	27.2	15.7	41.3
Moving Truck	18.7	27.1	30.6	35.5	39.9	37.2	29.6	20.7	43.3

TABLE A2: DAYTIME NOISE LEVELS AT R2

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	35.2	33.6	29.6	32.4	35.4	32.7	25	15.3	41.4
AHU - 1	28.3	26.3	20.6	21.2	15.1	8.6	0.8	-11.8	31.4
AHU - 2	34.2	32.3	26.6	27.5	21.3	14.9	7.2	-5.4	37.4
Idle Truck	4.7	13.5	17.7	20.4	18.8	14.8	10.6	1.4	25
Moving Truck	14.3	22.1	24.5	29.8	35.1	32.5	24.8	15.1	38.3

TABLE A3: DAYTIME NOISE LEVELS AT R3

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	37.2	35.6	32.4	35	38.7	36	28.5	19.2	44.1
AHU - 1	30	28	22	20.1	16.1	9.5	1.6	-10	32.9
AHU - 2	36.2	34.2	28.3	26.5	22.5	16	8.3	-3.4	39.1
Idle Truck	-1.1	7.4	12.1	17.7	15.9	13.6	14.7	-1.8	22.4
Moving Truck	17.6	25.9	29.4	34	38.5	35.9	28.3	19.2	41.9

TABLE A4: DAYTIME NOISE LEVELS AT R4

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	35.5	34.6	31.8	34.2	37	34.2	26.8	17.5	42.7
AHU - 1	28.1	26.7	21.9	21.4	15.6	9.7	2.5	-9.2	31.6
AHU - 2	34.6	33.3	28.6	28.5	23.3	18.4	12.7	3	38.3
Idle Truck	-4.6	3.9	8.7	11.6	12.1	14.6	11.8	-7.3	19.3
Moving Truck	16.5	24.6	27.9	32.5	36.7	34.1	26.5	17.3	40.2

TABLE A5: DAYTIME NOISE LEVELS AT R5

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	32	31.9	34.7	43	44	41.8	36.9	26.5	48.6
AHU - 1	25.1	23.7	19	20.5	14.9	9.3	2.2	-10.9	29
AHU - 2	30.9	29.4	24.8	24.5	19.2	14.1	7.5	-5.3	34.5
Idle Truck	14.4	24.9	33.6	42.7	43.4	41.3	36.7	26.3	47.9
Moving Truck	14.4	21.1	25	29.8	34.6	32.1	24.1	13.6	37.9

TABLE A6: DAYTIME NOISE LEVELS AT R6

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	32.7	33.6	38.5	44.3	45	42.8	37.9	27.6	49.8
AHU - 1	25.6	24.2	22.1	22	16.9	11.7	4.9	-7.7	30.1
AHU - 2	31.4	30	27.9	27.9	22.8	17.7	10.9	-1.6	35.9
Idle Truck	17.2	28.5	37.4	43.8	44.2	42.1	37.5	27.3	49
Moving Truck	16.2	24.5	28.5	33.3	37.2	34.5	26.6	16.6	40.7

TABLE A7: DAYTIME NOISE LEVELS AT R7

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	37.1	35.9	32.5	35.5	35.9	32.8	25.1	14.6	43.1
AHU - 1	30.1	28.8	24.2	26.3	20.9	15.6	9.1	-1.8	34.2
AHU - 2	36.1	34.8	30.1	32.3	27	21.8	15.5	4.8	40.2
Idle Truck	3.5	14.4	19.8	22.7	20.1	17.2	11.9	1.3	26.8
Moving Truck	14.5	21.3	26.1	30.9	35	32.2	24.3	13.8	38.4

TABLE A8: DAYTIME NOISE LEVELS AT R8

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	38	37	34.1	37.3	38.9	36	28.3	18.6	45
AHU - 1	30.9	29.6	24.9	26.8	21.4	16.1	9.6	-1.2	34.9
AHU - 2	37	35.7	31.1	33.1	27.7	22.5	16.3	5.8	41.1
Idle Truck	-0.1	8	13.5	18.9	16.3	12.6	6.9	-4.4	22.4
Moving Truck	18.5	25.9	29.8	34.4	38.5	35.7	28	18.3	42

TABLE A9: DAYTIME NOISE LEVELS AT R9

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	35.7	34.7	33.6	35.4	37.3	34.5	26.8	16.7	43.2
AHU - 1	28.4	27.1	24.9	24.8	19.6	14.7	8.8	-1.7	32.9
AHU - 2	34.7	33.5	31.3	31.2	26.1	21.4	15.9	6.4	39.3
Idle Truck	-3.5	4.5	13	16	13.4	14.6	7.7	-6.1	20.8
Moving Truck	15	22.9	27.9	32.6	36.8	34.2	26.3	16.1	40.2

APPENDIX B

POINT OF RECEPTION NOISE IMPACT TABLE

NIGHTTIME

TABLE B1: NIGHTTIME NOISE LEVELS AT R5

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	28.9	27.5	22.8	23	17.6	12.3	5.6	-7.3	32.5
AHU - 1	22.1	20.7	16	17.5	11.8	6.3	-0.8	-14	25.9
AHU - 2	27.9	26.4	21.8	21.5	16.2	11.1	4.5	-8.3	31.5

TABLE B2: NIGHTTIME NOISE LEVELS AT R6

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	29.4	28	25.9	25.9	20.8	15.6	8.9	-3.7	33.9
AHU - 1	22.6	21.2	19	19	13.9	8.7	1.9	-10.7	27.1
AHU - 2	28.4	27	24.8	24.9	19.8	14.6	7.9	-4.7	32.9

TABLE B3: NIGHTTIME NOISE LEVELS AT R7

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	34.1	32.8	28.1	30.3	24.9	19.7	13.4	2.7	38.2
AHU - 1	27.1	25.8	21.1	23.3	17.9	12.6	6.1	-4.8	31.2
AHU - 2	33.1	31.8	27.1	29.3	24	18.8	12.5	1.8	37.2

TABLE B4: NIGHTTIME NOISE LEVELS AT R8

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	35	33.7	29	31	25.6	20.4	14.1	3.5	39
AHU - 1	27.9	26.6	21.8	23.8	18.4	13.1	6.6	-4.2	31.9
AHU - 2	34	32.7	28.1	30.1	24.7	19.5	13.3	2.7	38.1

TABLE B5: NIGHTTIME NOISE LEVELS AT R9

SOURCE	NOISE LEVEL (dBA)								
	63	125	250	500	1000	2000	4000	8000	TOTAL
TOTAL	32.6	31.4	29.2	29.1	24	19.2	13.6	4	37.2
AHU - 1	25.4	24.1	21.9	21.8	16.6	11.7	5.8	-4.7	29.9
AHU - 2	31.7	30.4	28.3	28.2	23.1	18.4	12.9	3.4	36.3