

NOISE IMPACT FEASIBILITY STUDY

CANADIAN TIRE STORE EXPANSION

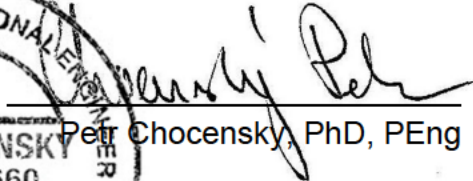
656 ERB ST. W., WATERLOO, ONTARIO

Prepared for:

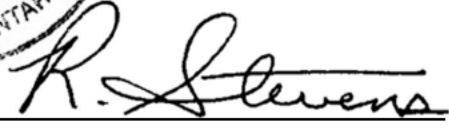
Canadian Tire Real Estate Limited
2180 Yonge St., 15th Floor
Toronto, Ontario, M4P 2V8

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1 INTRODUCTION AND SUMMARY

HGC Engineering was retained by Canadian Tire Real Estate Limited to undertake a Noise Impact Feasibility Study of the proposed expansion of the Canadian Tire store in Waterloo, Ontario. The study is required to support an application for a minor zoning by-law amendment from the local planning authorities.

The future sound levels from the facility following its expansion were determined at the adjacent noise sensitive locations using computational acoustical modeling. The results of the model were assessed against noise limits of the Region of Waterloo, which adopts the quantitative limits set out in Publication NPC-300 [1] of the Ontario Ministry of the Environment, Conservation and Parks (MECP). In accordance with the guideline, the assessment considers the potential noise impact during a “predictable worst-case hour” of operation, which is defined as a situation when the typically busy activity of the site coincides with an hour of low background sound.

The nearest noise-sensitive locations are residential homes and their outdoor amenity areas on adjacent properties immediately north of the site. Noise measurements taken at the site and its vicinity show that the existing sound levels from the Canadian Tire store are currently within the MECP noise limits. The proposed expansion of the store will have minimal effect on these results – the acoustic analysis confirms that the sound levels from the site following its expansion will remain within the MECP limits.

Details of the acoustic analysis are outlined below.

2 SITE DESCRIPTION

The store is located at 656 Erb Street West in Waterloo, Ontario. Figure 1 shows its location in the context of the surrounding community.

The facility is a Canadian Tire store located on the north side of the commercial plaza at the intersection of Erb Street and Erbsville Road. It consists of the main building – including the Canadian Tire store itself and a vehicle service centre – and an outdoor garden centre. The proposed extension consists of a new building partition that will expand the store several metres to the north



and replace the entire outdoor garden centre in the east part of the site. The proposed layout of the site is depicted in Figure 2.

The existing building is currently equipped with standard heating, ventilation & air conditioning (HVAC) units and several rooftop exhaust fans. There is also a garbage compactor on the west side of the building and an electrical inverter on the north side of the building associated with solar panels on the roof of the building. As part of the expansion, there will be one additional HVAC unit on the roof of the new building and the electrical inverter will be relocated to the northeast corner of the site, as shown in Figure 2.

The facility occasionally receives a tractor trailer, which parks at a loading dock at the west end of the facility. The truck is unloaded either manually, using hand trucks, or with a use a forklift. The forklift operates at the ground level where it transfers goods from the trailer to an open door of the loading dock.

At this store, trailers are not decoupled and left at the receiving docks and forklifts do not drive into the trailers for unloading, so there are no “impulse” noises (booms and bangs) from receiving activities, which can otherwise occur at some sites.

3 SOUND SOURCE SUMMARY

HGC Engineering visited the facility on April 21, 2023, and measured sound levels from the garbage compactor, electric inverter, and the forklift operating near the loading dock. None of the rooftop equipment, consisting of HVAC units and exhaust fans, was operating during the visit. Sound levels from the equipment that was not in operation and from the HVAC unit proposed at the building expansion were based on manufacturer’s sound data, included as Appendix A. The sound power emission levels of the sources are listed in Table 1 and source locations are shown in Figure 3.



Table 1: List of Sound Sources

ID	Description	Sound Power Level [dBA]
Existing Equipment		
EF1	Exhaust Fan	90
EF2A/B	Exhaust Fans	89
EF4	Exhaust Fan	93
AC1 to AC4	HVAC Units	93
AC5 & AC6	HVAC Units	72
	Garbage Compactor Motor	83*
	Forklift	92
	Electrical Inverter	80*
Future Equipment		
AC8	HVAC Unit – Building Expansion	93

*Including + 5 dB penalty to account for tonal character, in accordance with MECP guideline NPC-104

The sound emission levels from the sources above were input to a computational acoustical model to determine the overall sound levels of the facility during the predictable worst-case hour of operations.

The computational acoustical model used to determine the future sound levels of the store following its expansion was prepared using *CadnaA*, (version 2023 MR1), a software implementation of ISO Standard 9613-2.2 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation” [2] which accounts for reductions in sound levels due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures. The ISO method tends to be conservative as it assumes a moderate downwind condition (favouring propagation of sound from the source to a receiver) in all directions, at all times. This modeling technique is acceptable to the MECP and the Region of Waterloo.

The store operates from 8:00 to 21:00. Many of the items of equipment only operate sporadically, based on need. For example, the compactor only engages occasionally, and is controlled by an operator. The forklift only operates when truck is unloaded at the dock. The HVAC units cycle on and off depending on the heating and cooling requirements indoors. The exhaust fans are manually

controlled and used only occasionally, when needed. Nevertheless, this analysis conservatively assumes that all equipment operates continuously at the same time, during all daytime and evening hours (7:00 – 23:00). During the night-time hours (23:00 – 7:00), it was assumed that the HVAC units could cycle on and off, effectively operating 50 % of the time, due to the lower outdoor temperatures at night. The electrical inverter was conservatively assumed to operate continuously, including the night-time hours.

4 ASSESSMENT LOCATIONS

This study considers a total of six assessment locations that are marked as locations R1a/b through R3a/b in Figure 3. Locations R1a through R3a represent the upper-storey windows of the nearest two-storey residential dwellings, immediately north of the facility. The relative height of the windows was assumed to be 4.5 metres above grade. Generally, the upper-storey windows are the most-potentially impacted points on the properties since they are most exposed to elevated sources at the subject site and benefit least from ground absorption.

Locations R1b through R3b represent associated outdoor amenity areas within 30 metres of the respective dwellings, at a height of 1.5 metres above grade.

5 NOISE LIMITS

The applicable sound level limits for the purposes of this assessment are 50 dBA during daytime/evening hours (7:00 – 23:00) and 45 dBA during night-time hours (23:00 – 7:00) and were established in accordance with MECP Publication NPC-300, as follows:

Industrial or commercial activities are classified as *stationary sources* in the context of the MECP guideline. According to NPC-300, sound level limits for stationary sources apply at noise-sensitive points of reception, and are set as the greater of either:

- the applicable exclusion limit (which depends on the “acoustical class” of the area, as explained further below), or
- the minimum background sound level that occurs during the time period corresponding to the operation of the source under assessment, established as described below.



The guideline defines three classes of acoustical environments depending on the character of the background sound, referred to as Class 1, Class 2 and Class 3 areas. The acoustical environment near the proposed site is best characterized as a Class 1 area as the background sound is dominated by man-made sources including substantial traffic on the surrounding roadways during all hours of the day and night. The exclusion limits applicable to Class 1 areas are 50 dBA during daytime hours (7:00 – 23:00) and 45 dBA during nighttime hours (23:00 – 7:00).

Based on observations during the site visits and a review of traffic count data on surrounding roadways, the background sound levels can be as low as the exclusion limits above. Therefore, the exclusion limits above apply at the assessment locations.

Some types of sound have a special quality which may tend to increase their audibility and potential for disturbance or annoyance. For “tonal” sound, the MECP guideline NPC-104 [3] stipulates that an adjustment of 5 dBA is to be added to the measured source level. A tonal sound is defined as one which has a “pronounced audible tonal quality such as a whine, screech, buzz or hum”. The tonal adjustment has been included to sound levels from the compactor motor and the electrical inverter, based on observations during the site visit.

6 RESULTS

The results of the analysis – summarized in Table 2 – demonstrate that the sound levels from the proposed expansion will be within the applicable noise limits.

The sound levels at the nearest residential locations are predicted to range between 42 and 50 dBA during daytime hours (7:00 – 23:00), and between 36 and 44 dBA during night-time hours (23:00 – 7:00). These sound levels are within the daytime and night-time noise limits of 50 and 45 dBA, respectively.

Figures 4a and 4b show the predicted results in graphical form.



Table 2: Future Sound Levels

ID	Description	Future Sound Levels, Leq [dBA]		Noise Limits [dBA]		Meets Limits?
		7:00 – 23:00	23:00 – 7:00	7:00 – 23:00	23:00 – 7:00	
R1a	Residential Home (4.5 m AG)	50	39	50	45	Yes
R1b	Outdoor Amenity (1.5 m AG)	48	36	50	45	Yes
R2a	Residential Home (4.5 m AG)	48	42	50	45	Yes
R2b	Outdoor Amenity (1.5 m AG)	43	36	50	45	Yes
R3a	Residential Home (4.5 m AG)	46	44	50	45	Yes
R3b	Outdoor Amenity (1.5 m AG)	42	39	50	45	Yes

Sample calculations from the computational acoustic model are included as Appendix B.

7 CONCLUSIONS

The acoustical analysis indicates that sound levels from the proposed Canadian Tire store expansion will comply with the MECP noise limits. No special noise control measures are needed.

REFERENCES

1. Ontario Ministry of the Environment , Conservation and Parks Publication NPC-300, *Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning*, August, 2013.
2. International Organization for Standardization, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*, ISO-9613-2, Switzerland, 1996.
3. Ontario Ministry of the Environment, Conservation and Parks Publication NPC-104, *Sound Level Adjustments*, August, 1978.





Figure 1: Location Map



Figure 2: Assessment Locations



ACOUSTICS



NOISE



VIBRATION

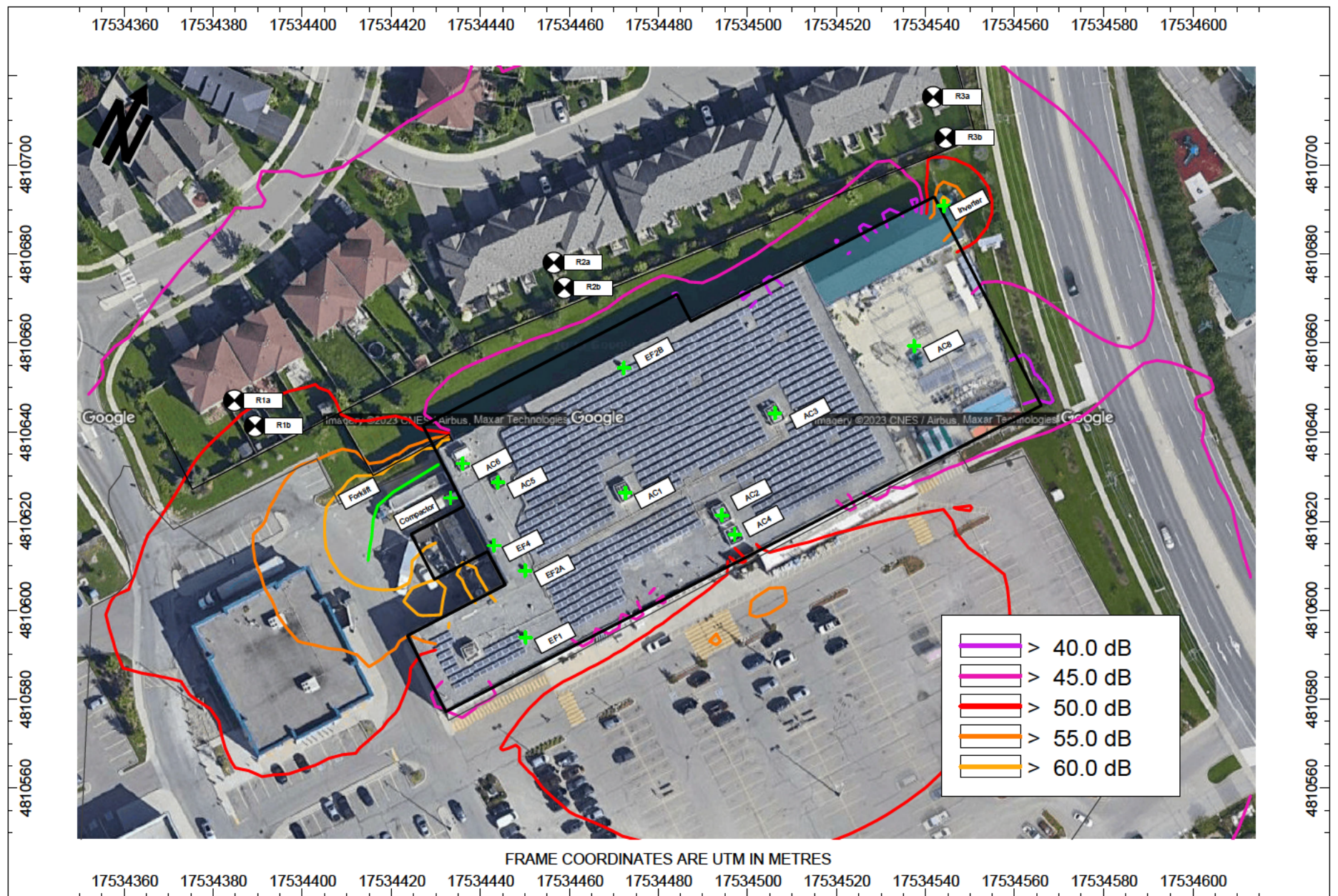


Figure 4a: Future Sound Level Contours, Leq [dBA] at 4.5 m Above Grade
Daytime Hours (7:00 - 23:00)



ACOUSTICS



NOISE



VIBRATION

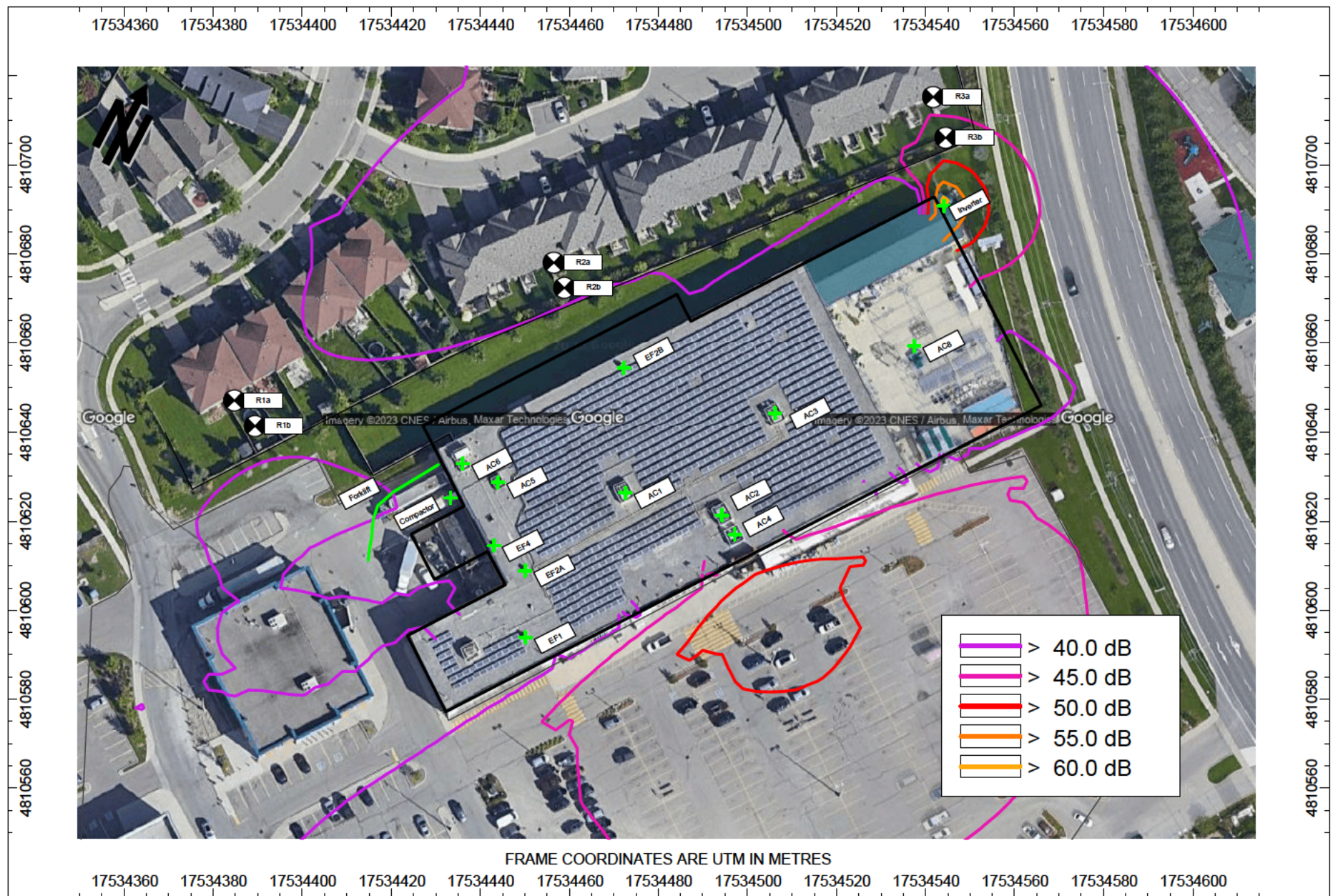


Figure 4b: Future Sound Level Contours, Leq [dBA] at 4.5 m Above Grade
Night-time Hours (23:00 - 7:00)



ACOUSTICS



NOISE



VIBRATION



ACOUSTICS



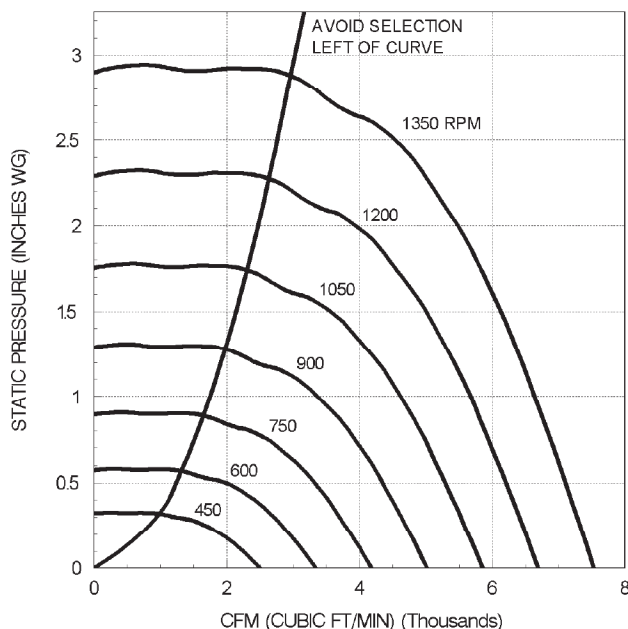
NOISE



VIBRATION

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VEBK 21 Air Performance



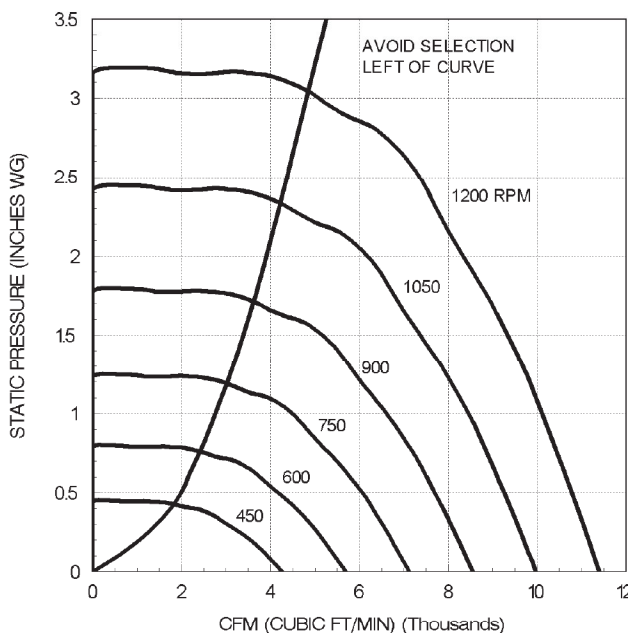
Performance certified is for installation type A - free inlet, free outlet.
Performance ratings (bhp) do not include transmission losses.
Performance ratings do not include the effects of accessories.

VEBK 21 Sound Performance

RPM	SP INCH W.G.	SOUND POWER RE 10^{-12} WATTS								
		OCTAVE BANDS								LWA
		1	2	3	4	5	6	7	8	
400	.000	59	59	55	54	55	52	45	38	59
	.000	67	73	66	63	63	64	58	51	69
600	.500	68	70	62	59	60	58	54	51	65
	.000	77	78	76	71	70	70	67	60	76
	.500	76	78	75	68	67	67	62	54	74
800	1.000	76	77	73	66	66	65	62	58	72
	.000	84	82	84	77	74	75	74	67	82
	.750	83	83	83	74	71	72	70	61	80
1000	1.500	82	83	81	72	70	71	68	65	78
	.000	89	86	90	82	78	78	79	73	87
	1.000	87	87	89	80	75	77	76	68	85
1200	1.500	87	87	88	79	74	76	74	68	84
	2.250	87	87	87	78	74	75	73	69	83
1325	.000	91	89	92	86	81	81	81	76	89
	1.000	90	90	91	84	79	79	79	72	88
	2.000	88	90	90	82	77	78	76	72	86
	2.500	88	90	90	82	76	77	76	62	86
	2.750	88	90	90	82	76	77	76	72	86

The sound power level ratings shown are in decibels, referred to 10^{-12} watts calculated per AMCA Standard 301. Values shown are for inlet L_{w1} sound power levels for installation Type A free inlet, free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.

VEBK 24 Air Performance



Performance certified is for installation type A - free inlet, free outlet.
Performance ratings (bhp) do not include transmission losses.
Performance ratings do not include the effects of accessories.

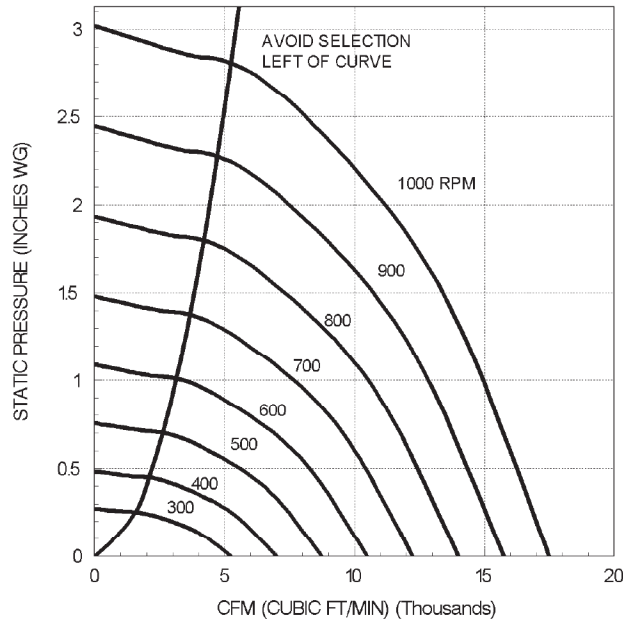
VEBK 24 Sound Performance

RPM	SP INCH W.G.	SOUND POWER RE 10^{-12} WATTS								
		OCTAVE BANDS								LWA
		1	2	3	4	5	6	7	8	
400	.000	67	66	62	61	62	56	50	44	65
	.000	76	75	71	69	69	66	60	54	73
550	.375	78	76	69	65	65	61	56	51	70
	.625	78	76	67	63	62	58	54	50	68
700	.000	83	82	79	74	74	73	67	61	79
	.500	84	83	77	71	71	70	63	58	77
	.750	83	83	77	70	69	67	62	57	75
	1.000	83	84	77	69	68	65	60	56	75
850	.000	88	88	85	79	78	79	73	67	85
	.500	89	89	84	77	76	77	70	65	83
	.750	89	90	84	76	75	76	69	64	82
	1.000	88	90	84	75	74	74	68	63	81
1000	1.500	88	90	84	73	72	71	66	62	81
	.000	91	92	90	84	81	83	78	72	89
	.500	92	93	90	83	80	81	76	70	88
	1.000	92	94	89	81	78	79	74	69	87
	1.500	91	94	90	80	77	77	72	67	86
1000	2.000	91	94	90	79	76	75	71	66	85

The sound power level ratings shown are in decibels, referred to 10^{-12} watts calculated per AMCA Standard 301. Values shown are for inlet L_{w1} sound power levels for installation Type A free inlet, free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.

VEBK 30

Air Performance



Performance certified is for installation type A - free inlet, free outlet.
Performance ratings (bhp) do not include transmission losses.
Performance ratings do not include the effects of accessories.

VEBK 30

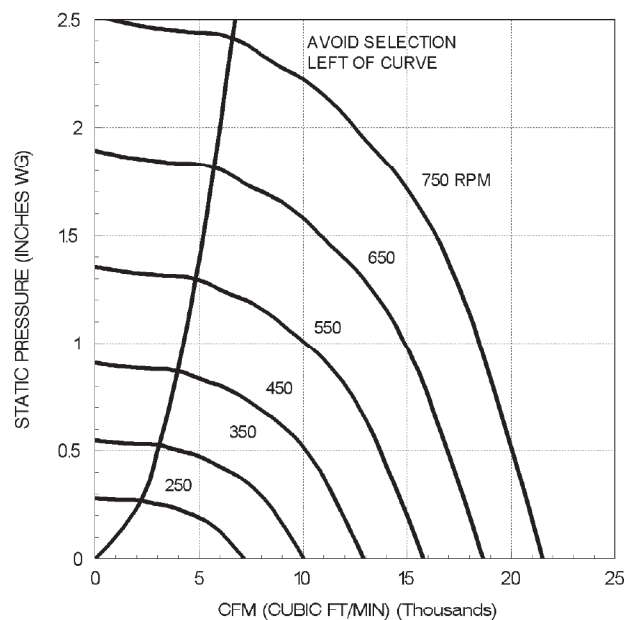
Sound Performance

RPM	SP INCH W.G.	SOUND POWER RE 10 ⁻¹² WATTS								
		OCTAVE BANDS								LWA
		1	2	3	4	5	6	7	8	
275	.000	64	62	60	60	56	49	44	38	61
375	.000	73	72	66	67	66	59	53	47	69
	.375	71	64	58	56	55	52	48	44	60
475	.000	78	78	74	72	71	66	60	54	75
	.375	76	74	68	65	64	61	56	52	69
	.625	76	73	65	62	61	58	55	50	67
600	.000	82	85	81	77	77	74	67	61	81
	.500	80	83	77	72	71	68	64	59	77
	1.000	81	81	73	68	66	65	61	57	73
725	.000	85	91	87	81	81	80	73	67	87
	.500	84	90	85	78	78	76	70	65	84
	1.000	85	88	81	74	72	71	67	63	80
	1.500	85	88	80	72	71	70	66	62	78
825	.000	88	93	91	85	84	83	77	71	90
	.500	86	93	89	83	82	80	75	70	88
	1.000	86	92	87	80	78	77	72	68	85
	1.500	87	91	84	76	74	73	70	66	82
	2.000	87	91	84	76	74	73	70	66	82

The sound power level ratings shown are in decibels, referred to 10⁻¹² watts calculated per AMCA Standard 301. Values shown are for inlet L_{wj} sound power levels for installation Type A free inlet, free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.

VEBK 36

Air Performance



Performance certified is for installation type A - free inlet, free outlet.
Performance ratings (bhp) do not include transmission losses.
Performance ratings do not include the effects of accessories.

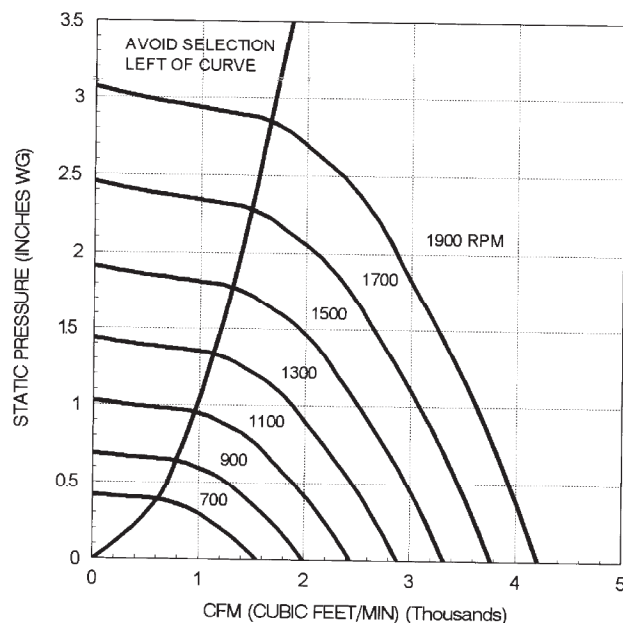
VEBK 36

Sound Performance

RPM	SP INCH W.G.	SOUND POWER RE 10 ⁻¹² WATTS								
		OCTAVE BANDS								LWA
		1	2	3	4	5	6	7	8	
250	.000	70	67	64	60	56	57	61	65	68
350	.000	79	77	73	69	65	64	67	71	75
	.500	75	68	62	59	56	53	49	42	62
425	.000	85	83	78	74	70	68	70	74	79
	.375	83	80	74	69	66	64	64	65	74
	.625	83	76	69	64	62	59	56	51	69
500	.000	89	88	83	79	75	71	72	76	83
	.500	88	85	79	73	70	67	68	69	78
	1.000	90	80	74	67	66	62	60	53	73
575	.000	92	92	87	83	79	75	75	78	86
	.500	91	90	85	78	75	72	72	73	83
	1.000	93	87	81	73	71	68	66	63	79
	1.500	94	85	78	71	70	66	64	58	77
650	.000	94	95	91	86	82	78	77	80	89
	.500	94	94	89	83	79	76	75	77	87
	1.000	94	92	87	80	76	73	72	71	84
	1.500	96	91	83	76	73	70	67	63	81
	1.750	96	90	82	75	72	69	67	61	81

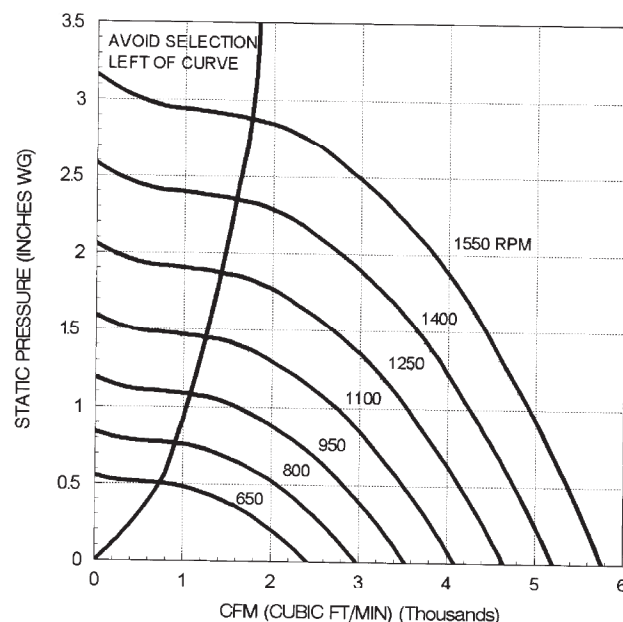
The sound power level ratings shown are in decibels, referred to 10⁻¹² watts calculated per AMCA Standard 301. Values shown are for inlet L_{wj} sound power levels for installation Type A free inlet, free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.

VUBK 15 AIR PERFORMANCE



Performance certified is for installation type A - free inlet, free outlet.
Performance ratings (bhp) do not include transmission losses.
Performance ratings do not include the effects of accessories.

VUBK 18 AIR PERFORMANCE



Performance certified is for installation type A - free inlet, free outlet.
Performance ratings (bhp) do not include transmission losses.
Performance ratings do not include the effects of accessories.

VUBK 15 SOUND PERFORMANCE

RPM	SP INCH W.G.	SOUND POWER RE 10 ⁻¹² WATTS								
		OCTAVE BANDS								LWA
		1	2	3	4	5	6	7	8	
550	.000	62	64	60	55	53	48	41	33	58
800	.000	73	75	72	67	63	59	53	45	70
	.375	72	74	71	68	64	60	55	49	70
1050	.000	80	81	81	76	70	67	61	54	77
	.375	79	80	79	76	71	67	62	56	77
	.750	81	79	79	76	72	68	63	58	78
1300	.000	84	87	87	82	76	72	68	61	84
	.750	83	86	86	82	78	73	68	63	84
	1.250	85	86	85	82	78	74	70	64	84
1550	.000	87	92	93	88	82	77	73	67	89
	.750	86	91	92	87	82	78	73	67	87
	1.250	87	91	91	87	83	78	74	68	89
	1.750	88	91	91	87	83	79	74	70	89
1750	.000	89	95	96	92	85	80	77	71	93
	1.000	88	94	95	91	86	81	76	71	92
	1.500	89	95	94	90	86	81	77	72	92
	2.000	89	95	94	90	86	82	78	73	92
	2.500	90	95	94	90	87	82	78	73	92

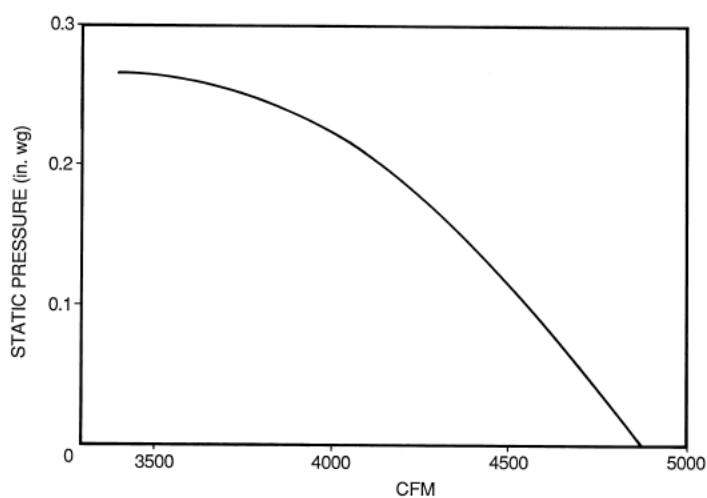
The sound power level ratings shown are in decibels, referred to 10⁻¹² watts calculated per AMCA Standard 301. Values shown are for inlet L_{wi} sound power levels for installation Type A free inlet, free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.

VUBK 18 SOUND PERFORMANCE

RPM	SP INCH W.G.	SOUND POWER RE 10 ⁻¹² WATTS								
		OCTAVE BANDS								LWA
		1	2	3	4	5	6	7	8	
550	.000	67	66	59	59	58	53	46	39	62
750	.000	76	75	70	66	66	62	56	49	70
	.500	72	70	64	59	58	56	52	46	64
950	.000	78	81	76	72	71	69	64	58	76
	.375	78	79	75	70	68	66	61	55	74
	.625	76	78	73	68	66	64	60	56	72
1150	.000	84	85	84	77	75	74	69	64	82
	1.000	82	82	80	72	70	69	65	61	77
	1.500	81	81	79	72	69	68	65	61	76
1350	.000	88	89	90	81	79	78	74	69	86
	1.000	87	87	87	78	75	74	71	66	83
	1.500	86	86	85	76	73	72	70	66	81
	2.000	86	85	85	76	73	72	69	66	81
1500	.000	91	91	94	84	81	81	77	72	89
	1.000	90	90	92	82	79	78	74	69	87
	1.500	89	89	90	80	77	76	73	69	86
	2.000	88	88	89	79	75	75	72	68	84
	2.500	89	88	89	79	75	75	72	68	84

The sound power level ratings shown are in decibels, referred to 10⁻¹² watts calculated per AMCA Standard 301. Values shown are for inlet L_{wi} sound power levels for installation Type A free inlet, free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301.

FAN PERFORMANCE USING ACCESSORY POWER EXHAUST (48HJ015,017)



OUTDOOR SOUND POWER (TOTAL UNIT)

UNIT 48HJ	ARI RATING (decibels)	A-WEIGHTED (db)	OCTAVE BANDS							
			63	125	250	500	1000	2000	4000	8000
004,005	76	76.0	55.9	66.0	64.0	66.2	68.4	64.5	61.7	57.3
006,007	80	80.0	59.1	68.9	68.7	71.9	74.0	68.9	65.7	59.0
008,009	82	82.0	62.2	69.3	71.5	74.7	76.2	72.9	68.7	61.5
012	84	84.0	64.6	71.1	73.3	76.9	77.6	73.7	70.6	63.7
014	86	86.0	63.7	69.9	72.5	78.2	81.1	77.3	73.3	66.8
015,017	88	87.6	90.8	88.7	86.4	84.3	83.5	78.4	75.6	66.8
020-024	82	81.7	90.2	84.8	80.7	79.0	77.6	71.4	66.7	60.7
028	85	84.9	90.0	86.3	83.6	82.9	80.3	74.9	71.4	66.5

LEGEND

ARI — Air Conditioning and Refrigeration Institute

NOTE: Indoor sound power is available in Carrier's Electronic Catalog Program (ECAT) for specific operating parameters.

Performance data — 50TJ (cont)



OUTDOOR SOUND POWER

UNIT 50TJ	SOUND RATING (dB)	A-WEIGHTED (dB)	OCTAVE BANDS							
			63	125	250	500	1000	2000	4000	8000
016	88 Bels	87.8	90.8	88.7	86.4	84.3	83.5	78.4	75.6	66.8
020	88 Bels	87.8	90.8	88.7	86.4	84.3	83.5	78.4	75.6	66.8
024	94 Bels	94.1	98.7	92.3	93.8	90.9	89.6	85.9	80.3	74.3
028	94 Bels	94.1	98.7	92.3	93.8	90.9	89.6	85.9	80.3	74.3

ACCESSORY/FIOP STATIC PRESSURE (in. wg)* — 50TJ016

COMPONENT	CFM				
	4500	5000	6000	7200	7500
EconoMiSer IV	0.04	0.05	0.07	0.09	0.10
Glycol Coil	0.22	0.26	0.35	0.44	0.46
Electric Heat (kW) 26/34	0.06	0.07	0.09	0.11	0.12
32	0.06	0.07	0.09	0.11	0.12
42/56	0.07	0.08	0.12	0.16	0.17
50	0.09	0.10	0.15	0.20	0.21
55	0.07	0.08	0.12	0.15	0.17
56/75	0.09	0.10	0.15	0.20	0.21
80	0.09	0.10	0.15	0.20	0.21
MoistureMiSer™ Dehumidification	0.05	0.05	0.07	0.10	0.11

LEGEND

FIOP — Factory-Installed Option

*The static pressure must be added to external static pressure. The sum and the evaporator entering-air cfm should then be used in conjunction with the Fan Performance tables to determine blower rpm and watts.

ACCESSORY/FIOP STATIC PRESSURE (in. wg)* — 50TJ020-028

COMPONENT	CFM					
	5400	6000	7200	9000	10,000	11,250
EconoMiSer IV	0.06	0.07	0.09	0.11	0.12	0.14
Glycol Coil	0.30	0.35	0.44	0.58	0.66	0.77
Electric Heat (kW) 26/34	0.08	0.09	0.11	0.15	0.17	0.20
32	0.08	0.09	0.11	0.15	0.17	0.20
42/56	0.11	0.12	0.15	0.19	0.21	0.24
55	0.11	0.12	0.15	0.19	0.21	0.24
56/75	0.14	0.15	0.20	0.24	0.26	0.29
80	0.14	0.15	0.20	0.24	0.26	0.29
MoistureMiSer Dehumidification	0.06	0.07	0.10	0.16	0.20	0.25

LEGEND

FIOP — Factory-Installed Option

*The static pressure must be added to external static pressure. The sum and the evaporator entering-air cfm should then be used in conjunction with the Fan Performance tables to determine blower rpm and watts.

FAN RPM AT MOTOR PULLEY SETTINGS*

UNIT 50TJ	MOTOR PULLEY TURNS OPEN												
	0	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6
016 (208/230, 460 v)†	††	††	1179	1150	1121	1093	1064	1035	1006	978	949	920	891
016 (208/230, 460 v)**	††	††	1559	1522	1488	1455	1422	1389	1356	1323	1289	1256	1227
016 (575 v)†	††	††	1429	1403	1376	1349	1323	1296	1269	1242	1215	1188	1159
020†	††	††	1095	1077	1058	1040	1021	1002	984	965	947	928	910
020**	††	††	1287	1265	1243	1222	1200	1178	1156	1134	1112	1091	1069
024†	††	††	1225	1209	1187	1165	1143	1120	1098	1076	1053	1031	1002
024**	††	††	1458	1434	1407	1381	1354	1328	1301	1275	1248	1222	1193
028†	††	††	1283	1269	1247	1225	1203	1182	1160	1138	1116	1095	1066
028**	††	††	—	—	1550	1524	1497	1470	1443	1415	1388	1361	1332

*Approximate fan rpm shown.

†Indicates standard drive package.

**Indicates alternate drive package.

††Due to belt and pulley size, pulley cannot be set to this number of turns open.



ACOUSTICS



NOISE



VIBRATION

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R1a Residential Home		17534384	4810647	4 5																
Src ID	Src Name	X	Y	Z	LxD	LxN	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	CmetD	CmetN	RefID	RefIN	LrD	LrN
AC1	Packaged HVAC Unit	17534466	4810626	8.6	93	90	50.1	0	0.0	0.3	4.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	38	35
AC2	Packaged HVAC Unit	17534494	4810623	8.6	93	90	52.0	0	0.0	0.3	5.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	35	32
AC3	Packaged HVAC Unit	17534504	4810643	8.6	93	90	52.7	0	0.0	0.3	4.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	35	32
AC4	Packaged HVAC Unit	17534498	4810617	8.6	93	90	52.3	0	0.0	0.3	5.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	35	32
AC5	Packaged HVAC Unit	17534440	4810630	8.1	72	69	46.9	0	0.0	0.0	4.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	20	17
AC6	Packaged HVAC Unit	17534434	4810633	8.1	72	69	45.6	0	0.0	0.0	2.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0	23	20
AC8	Packaged HVAC Unit	17534536	4810658	8.8	92	89	54.7	0	0.0	0.0	4.9	1.1	0.0	0.0	0.0	0.0	0.0	0.0	32	29
EF1	Exhaust Fan	17534456	4810593	7.9	90	--	49.5	0	0.0	-0.8	5.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	35	--
EF2A	Exhaust Fan	17534456	4810609	7.9	89	--	48.6	0	0.0	-0.5	5.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	35	--
EF2B	Exhaust Fan	17534466	4810656	7.9	89	--	49.9	0	0.0	0.5	4.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	34	--
EF4	Exhaust Fan	17534440	4810616	8.1	93	--	47.5	0	0.0	-0.5	4.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	41	--
	Garbage Compactor	17534434	4810625	1.5	83	--	45.5	0	0.0	1.7	6.4	0.2	0.0	0.0	0.0	0.0	3.7	3.7	32	--
	Electrical Inverter	17534544	4810691	2.0	80	80	55.4	0	0.0	2.4	18.2	2.5	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Forklift	17534446	4810624	0.7	91	--	43.6	0	0.0	0.7	1.7	0.3	0.0	0.0	0.0	0.0	1.4	1.4	46	--

R1b Outdoor Amenity Area		17534390	4810642	1 5																
Src ID	Src Name	X	Y	Z	LxD	LxN	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	CmetD	CmetN	RefID	RefIN	LrD	LrN
AC1	Packaged HVAC Unit	17534466	4810626	8.6	93	90	49.6	0	0.0	3.6	4.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	35	32
AC2	Packaged HVAC Unit	17534494	4810623	8.6	93	90	51.6	0	0.0	3.9	5.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	32	29
AC3	Packaged HVAC Unit	17534504	4810643	8.6	93	90	52.4	0	0.0	4.3	8.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	28	25
AC4	Packaged HVAC Unit	17534498	4810617	8.6	93	90	51.9	0	0.0	3.6	5.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	32	29
AC5	Packaged HVAC Unit	17534440	4810630	8.1	72	69	46.0	0	0.0	0.9	5.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	19	16
AC6	Packaged HVAC Unit	17534434	4810633	8.1	72	69	44.6	0	0.0	0.9	3.9	0.5	0.0	0.0	0.0	0.0	2.2	2.2	24	21
AC8	Packaged HVAC Unit	17534536	4810658	8.8	92	89	54.5	0	0.0	3.0	11.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	23	20
EF1	Exhaust Fan	17534456	4810593	7.9	90	--	48.8	0	0.0	0.4	7.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	33	--
EF2A	Exhaust Fan	17534456	4810609	7.9	89	--	47.8	0	0.0	1.3	6.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	33	--
EF2B	Exhaust Fan	17534466	4810656	7.9	89	--	49.5	0	0.0	3.4	4.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	31	--
EF4	Exhaust Fan	17534440	4810616	8.1	93	--	46.6	0	0.0	1.7	3.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	40	--
	Garbage Compactor	17534434	4810625	1.5	83	--	44.4	0	0.0	4.2	9.7	0.1	0.0	0.0	0.0	0.0	8.4	8.4	33	--
	Electrical Inverter	17534544	4810691	2.0	80	80	55.2	0	0.0	5.2	18.2	3.6	0.0	0.0	0.0	0.0	0.0	0.0	--	--
	Forklift	17534446	4810624	0.7	91	--	42.0	0	0.0	2.6	5.3	0.1	0.0	0.0	0.0	0.0	1.1	1.1	43	--

R2a Residential Home		17534456	4810678	4 5																
Src ID	Src Name	X	Y	Z	LxD	LxN	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	CmetD	CmetN	RefID	RefIN	LrD	LrN
AC1	Packaged HVAC Unit	17534466	4810626	8.6	93	90	45.7	0	0.0	0.3	7.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	39	36
AC2	Packaged HVAC Unit	17534494	4810623	8.6	93	90	47.7	0	0.0	0.4	8.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	37	34
AC3	Packaged HVAC Unit	17534504	4810643	8.6	93	90	46.6	0	0.0	0.3	7.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	39	36
AC4	Packaged HVAC Unit	17534498	4810617	8.6	93	90	48.3	0	0.0	0.4	8.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	36	33
AC5	Packaged HVAC Unit	17534440	4810630	8.1	72	69	45.2	0	0.0	0.1	7.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	19	16
AC6	Packaged HVAC Unit	17534434	4810633	8.1	72	69	44.9	0	0.0	0.1	6.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	20	17
AC8	Packaged HVAC Unit	17534536	4810658	8.8	92	89	49.4	0	0.0	0.0	5.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	37	34
EF1	Exhaust Fan	17534456	4810593	7.9	90	--	49.5	0	0.0	0.8	7.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	31	--
EF2A	Exhaust Fan	17534456	4810609	7.9	89	--	47.9	0	0.0	0.7	7.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	32	--
EF2B	Exhaust Fan	17534466	4810656	7.9	89	--	40.1	0	0.0	0.3	6.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	42	--
EF4	Exhaust Fan	17534440	4810616	8.1	93	--	47.3	0	0.0	0.6	6.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	39	--
	Garbage Compactor	17534434	4810625	1.5	83	--	46.2	0	0.0	2.6	21.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	12	--
	Electrical Inverter	17534544	4810691	2.0	80	80	49.9	0	0.0	1.9	18.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	8	8
	Forklift	17534442	4810623	0.7	91	--	47.6	0	0.0	2.5	15.2	0.1	0.0	0.0	0.0	0.0	0.8	0.8	27	--

Where: $Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl$ 

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VIBRATION

R2b		Outdoor Amenity Area		17534458	4810673	1 5														
Src ID	Src Name	X	Y	Z	LxD	LxN	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	CmetD	CmetN	RefID	RefIN	LrD	LrN
AC1	Packaged HVAC Unit	17534466	4810626	8.6	93	90	44.7	0	0.0	2.7	11.7	0.1	0.0	0 0	0 0	0 0	0.0	0.0	34	31
AC2	Packaged HVAC Unit	17534494	4810623	8.6	93	90	46.9	0	0.0	3.2	11.6	0.2	0.0	0 0	0 0	0 0	0.0	0.0	31	28
AC3	Packaged HVAC Unit	17534504	4810643	8.6	93	90	45.9	0	0.0	3.0	10.9	0.2	0.0	0 0	0 0	0 0	0.0	0.0	33	30
AC4	Packaged HVAC Unit	17534498	4810617	8.6	93	90	47.6	0	0.0	3.3	11.6	0.2	0.0	0 0	0 0	0 0	0.0	0.0	31	28
AC5	Packaged HVAC Unit	17534440	4810630	8.1	72	69	44.4	0	0.0	1.6	13.0	0.2	0.0	0 0	0 0	0 0	0.0	0.0	13	10
AC6	Packaged HVAC Unit	17534434	4810633	8.1	72	69	44.3	0	0.0	1.5	10.9	0.2	0.0	0 0	0 0	0 0	0.0	0.0	15	12
AC8	Packaged HVAC Unit	17534536	4810658	8.8	92	89	49.1	0	0.0	2.3	12.0	0.4	0.0	0 0	0 0	0 0	0.0	0.0	29	26
EF1	Exhaust Fan	17534456	4810593	7.9	90	--	49.0	0	0.0	3.7	10.8	0.2	0.0	0 0	0 0	0 0	0.0	0.0	26	--
EF2A	Exhaust Fan	17534456	4810609	7.9	89	--	47.2	0	0.0	3.3	11.0	0.2	0.0	0 0	0 0	0 0	0.0	0.0	27	--
EF2B	Exhaust Fan	17534466	4810656	7.9	89	--	38.3	0	0.0	1.5	11.0	0.1	0.0	0 0	0 0	0 0	0.0	0.0	38	--
EF4	Exhaust Fan	17534440	4810616	8.1	93	--	46.6	0	0.0	3.8	8.5	0.1	0.0	0 0	0 0	0 0	0.0	0.0	34	--
	Garbage Compactor	17534434	4810625	1.5	83	--	45.6	0	0.0	5.2	19.4	0.3	0.0	0 0	0 0	0 0	0.0	0.0	12	--
	Electrical Inverter	17534544	4810691	2.0	80	80	49.8	0	0.0	4.2	19.2	2.9	0.0	0 0	0 0	0 0	0.0	0.0	4	4
	Forklift	17534448	4810624	0.7	91	--	47.0	0	0.0	4.9	14.6	0.1	0.0	0 0	0 0	0 0	0.6	0.6	25	--

R3a		Residential Home		17534542	4810715	4 5															
Src ID	Src Name	X	Y	Z	LxD	LxN	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	CmetD	CmetN	RefID	RefIN	LrD	LrN	
AC1	Packaged HVAC Unit	17534466	4810626	8.6	93	90	52.0	0	0.0	0.3	5.0	0.6	0 0	0 0	0 0	0 0	0.0	0.0	35	32	
AC2	Packaged HVAC Unit	17534494	4810623	8.6	93	90	51.4	0	0.0	0.4	6.0	0.4	0 0	0 0	0 0	0 0	0.0	0.0	35	32	
AC3	Packaged HVAC Unit	17534504	4810643	8.6	93	90	49.0	0	0.0	0.3	5.7	0.4	0 0	0 0	0 0	0 0	0.0	0.0	38	35	
AC4	Packaged HVAC Unit	17534498	4810617	8.6	93	90	51.7	0	0.0	0.4	6.3	0.4	0 0	0 0	0 0	0 0	0.0	0.0	35	31	
AC5	Packaged HVAC Unit	17534440	4810630	8.1	72	69	53.3	0	0.0	0.1	4.8	1.0	0 0	0 0	0 0	0 0	0.0	0.0	13	10	
AC6	Packaged HVAC Unit	17534434	4810633	8.1	72	69	53.5	0	0.0	0.1	4.7	1.0	0 0	0 0	0 0	0 0	0.0	0.0	12	9	
AC8	Packaged HVAC Unit	17534536	4810658	8.8	92	89	46.0	0	0.0	0.0	7.2	0.3	0 0	0 0	0 0	0 0	0.0	0.0	39	36	
EF1	Exhaust Fan	17534456	4810593	7.9	90	--	54.6	0	0.0	0.8	5.2	0.7	0 0	0 0	0 0	0 0	0.0	0.0	29	--	
EF2A	Exhaust Fan	17534456	4810609	7.9	89	--	54.0	0	0.0	0.7	5.0	0.8	0 0	0 0	0 0	0 0	0.0	0.0	28	--	
EF2B	Exhaust Fan	17534466	4810656	7.9	89	--	50.3	0	0.0	0.5	4.2	0.7	0 0	0 0	0 0	0 0	0.0	0.0	33	--	
EF4	Exhaust Fan	17534440	4810616	8.1	93	--	54.0	0	0.0	0.7	4.3	0.4	0 0	0 0	0 0	0 0	0.0	0.0	33	--	
	Garbage Compactor	17534434	4810625	1.5	83	--	54.0	0	0.0	4.0	20.6	0.6	0 0	0 0	0 0	0 0	0.0	0.0	3	--	
	Electrical Inverter	17534544	4810691	2.0	80	80	38.9	0	0.0	0.3	0.1	1.9	0.0	0 0	0 0	0 0	2.7	2.7	41	41	
	Forklift	17534442	4810623	0.7	91	--	54.8	0	0.0	2.4	16.9	0.3	0 0	0 0	0 0	0 0	0.0	0.0	17	--	

R3b Outdoor Amenity Area		17534544	4810706	1 5																	
Src ID	Src Name	X	Y	Z	LxD	LxN	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	CmetD	CmetN	RefID	RefIN	LrD	LrN	
AC1	Packaged HVAC Unit	17534466	4810626	8.6	93	90	51.6	0	0.0	4.1	7.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	30	27	
AC2	Packaged HVAC Unit	17534494	4810623	8.6	93	90	50.9	0	0.0	4.0	9.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	29	26	
AC3	Packaged HVAC Unit	17534504	4810643	8.6	93	90	48.3	0	0.0	3.5	9.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	32	29	
AC4	Packaged HVAC Unit	17534498	4810617	8.6	93	90	51.1	0	0.0	4.1	9.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	28	25	
AC5	Packaged HVAC Unit	17534440	4810630	8.1	72	69	53.1	0	0.0	2.2	6.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	9	6	
AC6	Packaged HVAC Unit	17534434	4810633	8.1	72	69	53.3	0	0.0	2.0	5.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	10	7	
AC8	Packaged HVAC Unit	17534536	4810658	8.8	92	89	44.6	0	0.0	1.7	14.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	32	29	
EF1	Exhaust Fan	17534456	4810593	7.9	90	--	54.3	0	0.0	4.6	7.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	23	--	
EF2A	Exhaust Fan	17534456	4810609	7.9	89	--	53.7	0	0.0	4.5	6.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	24	--	
EF2B	Exhaust Fan	17534466	4810656	7.9	89	--	50.0	0	0.0	2.9	3.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	32	--	
EF4	Exhaust Fan	17534440	4810616	8.1	93	--	53.7	0	0.0	5.1	3.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	30	--	
	Garbage Compactor	17534434	4810625	1.5	83	--	53.8	0	0.0	8.2	16.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	4	--	
	Electrical Inverter	17534544	4810691	2.0	80	80	34.7	0	0.0	1.1	8.9	0.6	0.0	0.0	0.0	0.0	2.7	2.7	37	37	
	Forklift	17534442	4810623	0.7	91	--	54.6	0	0.0	6.0	13.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	17	--	

Where: $Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl$ 

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APPENDIX C

Consultant's Curriculum Vitae



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Education

PhD in Civil Engineering, Czech Technical University in Prague,
Faculty of Transportation Sciences, Prague, Czech Republic,
Masters Degree in Civil Engineering, Czech Technical University in Prague,
Faculty of Transportation Sciences, Prague, Czech Republic

Professional History

2010 to Present Project Engineer, HGC Engineering, Toronto, Canada
2003 to 2004/2006 to 2010 Project Engineer, EKOLAgrou, Czech Republic
2004 to 2005 Noise Review Engineer, Ministry of Health, Czech Republic

Experience

Dr. Chocensky's area of expertise covers acoustic assessments and noise mapping for large transportation and industrial projects. He has completed large-scale noise mapping projects for large urban areas, including noise emissions from airports, railways, and roadways. He is an expert in computerized noise modeling and the use of CadnaA modeling software.

Selected Projects

Strategic Noise Map for Prague International Airport, Prague, Czech Republic
Noise Monitoring to Assess Noise from Prague International Airport, Czech Republic
Strategic Noise Maps for Roads, Prague, Czech Republic
Noise Control Measures for Outer Transit Corridor, Prague, Czech Republic
Noise Control Measures for National Highway D11
Noise Control Measures for Railway Corridor Prague – Pilsen
Noise Map of the City of Prague
Noise Map of the City of Jihlava
The Bay Adelaide Centre, Toronto, Ontario
One York, Toronto, Ontario
Lafarge Canada Inc., various sites, Ontario
G.E. Booth Wastewater Treatment Facility, Mississauga, Ontario
Petro-Canada, Mississauga, Ontario
Vale & Kelly Mine, Sudbury, Ontario
Bunge, Hamilton, Ontario
Dufferin Concrete, various sites, Ontario
Dufferin Construction, various sites, Ontario
NOVA Chemicals, Corunna, Ontario
Kellogg Canada Inc., London, Ontario
Morrison-Hershfield Energy Centre, Windsor, Ontario

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Education

University of Waterloo, Bachelor of Applied Science
University of Waterloo, Master of Applied Science

Professional Memberships

Professional Engineers Ontario (PEO)
Designated Consulting Engineer, Province of Ontario (PEO)
Association of Professional Engineers and Geo-scientists of Manitoba (APEGM)
Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)
National Council of Acoustical Consultants (NCAC)
Canadian Acoustical Association (CAA)
Middle East Acoustic Society (MEAS)
Audio Engineering Society (AES), 1998/99 Chairman, Toronto Section
Air & Waste Management Association (AWMA), Vice Chair, Ontario Section

Professional History

1997 to Present	Principal, HGC Engineering, Mississauga
1994 to 1997	Senior Consulting Engineer, HGC Engineering, Mississauga
1990 to 1994	Project Engineer, Vibron Limited, Mississauga

Experience

Mr. Stevens conducts considerable work in the field of environmental assessment and control of noise from stationary and traffic sources. His list of projects includes environmental assessments for industrial, infrastructure and institutional facilities across North America and abroad. Mr. Stevens has provided expert testimony and made public presentations in variety of forums including criminal court, Ontario Municipal Board hearings, Niagara Escarpment Commission hearings, public meetings and open houses.

Selected Projects

Winnipeg International Airport Noise Impact Study, Manitoba, Canada
Helicopter Facility Noise Impact Study, Niagara, Ontario, Canada
Aguas de Rosarito Desalination Plant, Acoustic Assessment, Mexico
CELSE Porto de Sergipe 1,500 MW Power Plant, Acoustic Assessment, Brazil
Braskem EXXI petrochemical plant, Acoustic Assessment, Veracruz, Mexico
Ambatovy Nickel Mine & Plant, Acoustic Assessment, Madagascar
TransAlta gas turbine cogeneration plants in Windsor and Ottawa, Ontario
Great Yarmouth Power Plant, Noise Troubleshooting, UK
Enwave district cooling/steam plants in Toronto
Hydro One transmission stations throughout Ontario
Wastewater Treatment Facilities, Mississauga, Toronto, Milton
Vale Smelter Facility, Sudbury Ontario
Greenfield Energy Centre 1,500 MW Power Plant, Sarnia, Ontario
Natural Gas/Power Stations, Various Canadian provinces: AB, SK, MB, ON

