RUBIDIUM
ENVIRONMENTAL



Noise Impact Assessment
for
5219 Upper Middle Road, Burlington

Submitted to: **Selva Chelliah**
Bloomfield Homes
77 Cedar Ridge Road
Stouffville, ON L4A 2H6

September 26, 2017

Rb# 2553



2017/09/26

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1.0 INTRODUCTION

Bloomsfield Homes (Bloomsfield). retained Rubidium Environmental (Rubidium) to prepare a Noise Impact Assessment in support of a proposed residential townhouse complex located at 5219 Upper Middle Road in Burlington. The purpose of this study is to determine the noise impact from vehicular traffic along Upper Middle Road, as well as any environmental noise impact for existing land uses surrounding the proposed development.

No sources of vibration concern were identified in the study area, as no associated industry or rail lines exist within 300m proximity to the proposed development. The proposed development is also not within any areas identified with any Transport Canada Noise Exposure Forecast (NEF) rating of 25 or above.

No heavy industrial facilities exist, or provincial highways exist within 1,000 meters of the proposed development. The closest arterial road, Appleby Line is located in excess of 700m to the South-West of the proposed development.

This study was conducted in accordance applicable environmental noise guidelines of the Region of Halton, and with the Ministry of the Environment and Climate Change (MOECC) Guidelines:

- Section 143 Halton Region Operational Plan
- NPC-300: Environmental Noise Guideline: *Stationary and Transportation Sources*
- LU -131: Noise Assessment Criteria in Land Use Planning
- Guideline D6: Compatibility between Industrial Facilities and Sensitive Land Uses
- City of Burlington guidance

1.1 Subject Site

Bloomsfield is proposing to construct a residential townhome development at 5219 Upper Middle Road in Burlington. The site currently contains an existing residential dwelling. The proposed development consists of approximately 22 freehold semi-detached, and attached townhomes abutting Upper Middle Road, as well as an internal road. This report characterizes the existing land uses surrounding the development inclusive of industrial, commercial, and municipal facilities within 300 metres of the site, and an expanded 1000m site model. The assessment was based on publicly available information, information gathered during multiple site visits of the area, and traffic data provided by the Public Works Department, Halton Region. The subject site is shown in Appendix A.

The subject site abuts Upper Middle Road. Upper Middle Road near the development is a 4 lane road which runs East West. It is not yet known whether the development will consist of 2 or 3 storey units. From a noise compatibility perspective, this impact will be immaterial.

The Region of Halton has acknowledged its intention to start construction in 2025, which would result in Upper Middle Road becoming a 6 lane road.

The surrounding land can be characterized as:

Table 1: Summary of surrounding land uses

North	Mixed Use: Predominantly Residential, and light commercial
East	Predominantly Agricultural Lands
South	Mixed Use: Institutional, and residential.
West	Mixed Use: Residential and light commercial

2.0 NOISE IMPACT ASSESSMENT

2.1 Road Noise Criteria

Road noise limits for new developments have been established by the Ministry of Environment & Climate Change (MOECC) in NPC – 300. The values for daytime, and evening hours are provided in Table 2 below:

Table 2: Noise Road Sound Level Limits

Time Period	L_{eq} (dBA)
07:00 to 23:00	55 (Measured at Outdoor Living Area, OLA) (OLA refers to a backyard, patio, terrace, etc)
23:00 to 07:00	50 (Measured at Plane of a Window)

If predicted noise levels at the Outdoor Living Area (OLA) and/or at the plane of a window (POW) are equal or less than the values in Table 2, no noise control measures are required. If predicted noise levels exceed Table 2 values, then the following clauses or actions are required:

Table 3: Required Noise Clauses, or Actions

Time Period	Location	Sound Power Level (dBA)	Requirements
07:00 to 23:00	OLA	< 55	No Requirements
		55 to 60	Barrier or Warning Clause Type "A"
		> 60	Barrier & Warning Clause Type "B"
07:00 to 23:00	POW	< 55	No Requirements
		>= 55	Provision for A/C, Warning Clause "C"
		>60	Central A/C & Warning Clause "D"
		> 65	Building Component Specification requirements
23:00 to 0:700	POW	< 50	No Requirements
		> 50	Provision for A/C & Warning Clause Type "C"
		>55	Building Component Specification requirements
		> 60	Central Air, Warning Clause Type "D", Specific Design Requirements

Where nighttime (23:00 to 07:00) sound power levels exceed 60 dBA, the residential dwellings must be designed such that the indoor sound as measured at the bedroom or living/dining room meets the following criteria:

Table 4: Indoor Sound Power Level Limits

Indoor Location & Time Period	Sound Power L_{eq} (dBA)
Living/Dining: (7:00 – 23:00)	45
Bedroom: (23:00 to 07:00)	40

The City of Burlington requires that developments have a maximum sound power limit of 55 dBA, or as close to 55 dBA as feasibly possible.

2.2 Road Traffic Volumes

Road traffic data was obtained from the Region of Halton for the intersection of Upper Middle Road and Imperial Way. Additional Traffic Movement Counts (TMC) where provided for Upper Middle Road at Sutton. The Ultimate Vehicle Count data, and Traffic Movement Count (TMC) is provided in Appendix B. The traffic study was based conducted on November 26, 2015. Given that Upper Middle Road is slated to become 6 lanes in 2025, a 2% adjustments for annual inflation were considered for the 10 year period from 2015 to 2025.

Vehicle Distribution was based on the average Total Count data as 93% car, 5% truck, and 2% heavy. Data taken from source in Appendix B.

Table 5a: Traffic Volumes (16 hour period from 7am to 11pm) Upper Middle Road (East/West)

Cars (Light)	Medium Trucks	Heavy Trucks
13972	751	301

Table 5b: Traffic Volumes (16 hour period from 7am to 11pm) Upper Middle Road (East/West) adjusted for 2025 inflation

Cars (Light)	Medium Trucks	Heavy Trucks
17032	916	367

Table 6: Traffic Volumes (8 hour period from 11pm to 7am) Upper Middle Road (East/West)

Cars (Light)	Medium Trucks	Heavy Trucks
583	31	13

Table 6: Traffic Volumes (8 hour period from 11pm to 7am) Upper Middle Road (East/West) adjusted for 2025 inflation

Cars (Light)	Medium Trucks	Heavy Trucks
711	38	15

* As development is close to Corpus Christi High School, vehicle traffic is limited to 40 km/h during peak AM-PM school rush hour traffic. The speed limit during these times are 40 km/h during these hours, Monday to Friday. To be conservative, traffic was modelled at 60 km/h during all daytime hours. During nighttime hours traffic was modelled at 60 km/h, the posted speed limit on Upper Middle road.

2.3 **Road Traffic Noise**

Predicted sound power levels for the most impacted dwelling in the development is:

Table 8: Predicted Road Traffic Noise

Time Period	Sound Power Level L_{eq} (dBA)							
	1st Row		1st Row Corner		2nd Row End		2nd Row	
	OLA	POW	OLA	POW	OLA	POW	OLA	POW
Day Time (7am to 7pm)	54.7	66.7	59.8	66.7	51.4	59.8	51.4	53.7
Night Time (7pm to 7am)		55.9		55.9		43.0		42.9

*note there is one Corner Unit which has the Outdoor Living Area (Backyard) facing Upper Middle Road. All though units effectively have the house acting as a noise barrier for the backyard. The end unit of the 2nd row is partially exposed to Upper Middle Road, where the 1st row of townhomes act as a barrier between -90 to 20 degrees.

The corresponding model case scenarios are described below as they correspond to the STAMSON Outputs found in Appendix C.

Case #	Description
1	1st Row OLA – Day
2	1st Row POW – Day with Various Barrier Heights
3	1st Row End (Corner Unit) OLA – Day
4	1st Row End (Corner Unit) POW – Day with Various Barrier Heights
5	2nd Row OLA - Day
6	2nd Row POW – Day
7	2nd Row (End unit) POW – Day with Partial Blockage
8	1st Row POW - Night
9	1st Row End (Corner Unit) – Night
10	2nd Row POW – Night
11	2nd Row (end unit) POW – Night with Partial Blockage

2.4 Environmental Noise

No sources of environmental noise were identified in the study area for this property. Environmental noise impacts at this development are considered not to be a concern. Short-term (30 minute averaging period) noise measurements where made with a Class I Sound Power Level meter during at between 8am and 9am, and again between 4:30pm and 5:30pm on March 2, 2017. All readings showed the sound power levels to be less than 45 dBA. It should be noted that this was not a long-term monitoring survey.

3.0 RECOMMENDATIONS

3.1 First Row (Closest to Upper Middle Road)

3.1.1 Outdoor Living Areas (OLAs)

The predicted daytime, and nighttime noise levels in the OLAs are below 55 dBA and require no further noise attenuation or warning clauses. The townhouses themselves effectively act as a noise barrier for the OLAs shielding them from the road noise.

3.1.2 Plane of Window (POW)

The predicted daytime noise levels at the POW are in excess of 60 dBA, and in excess of 55 dBA during nighttime hours at the first row of houses. It is recommended that this units be equipped with central air conditioning such that that the windows can remain closed, and that warning Clause Type "D" should be registered on title. Building components should be specified to ensure the indoor noise levels comply with the values listed in Table 4. It should be noted that the height of requirement for a noise barrier in this situation is not practical. As it would require a barrier of approximately 6m in height.

3.2 First Row Corner Unit (Closest to Upper Middle Road)

3.2.1 Outdoor Living Areas (OLAs)

The corner unit is the only property that has the OLA facing Upper Middle road. The predicted daytime noise levels are less than 60 dBA. It is recommended and required that a noise barrier be constructed along the southern portion of the property line facing Upper Middle road as shown in Appendix A. The acoustic barrier should have a minimum surface density of 20 kg/m^2, with minimal gaps. Where feasible, the barrier should be constructed to a minimum height to break the line-of-sight between the road and plane of the bedroom/living room windows. A minimum barrier height of 2.2m should be constructed. Warning Clause Type "B" should be registered on Title.

3.2.2 Plane of Window (POW)

The predicted daytime noise levels at the POW are in excess of 60 dBA, and in excess of 55 dBA during nighttime at the first row of houses corner unit. It is recommended that this units be equipped with central air conditioning such that that the windows can remain closed, and that warning Clause Type "D" should be registered on title. Building components should be specified to ensure the indoor noise levels comply with the values listed in Table 4. It should be noted that the height of requirement for a noise barrier in this situation is not practical. As it would require a barrier of approximately 6m in height.

3.3 **Second Row of Houses (furthest from Upper Middle Road) – End Unit**

3.3.1 Outdoor Living Areas (OLAs)

The predicted noise levels in the OLAs at the 2nd row of townhouses are below the action limit for any recommendations.

3.3.1 Plane of Window (POW)

The predicted daytime noise levels at the POW are in excess of 60 dBA, and in excess of 55 dBA during nighttime hours at the second row of houses end unit. Predicted nighttime noise levels are less than 55 dBA. It is recommended that this units be equipped with central air conditioning such that that the windows can remain closed, and that warning Clause Type "C" should be registered on title. Building components should be specified to ensure the indoor noise levels comply with the values listed in Table 4. It should be noted that the height of requirement for a noise barrier in this situation is not practical. As it would require a barrier of approximately 5m.

3.4 **Second Row of Houses (furthest from Upper Middle Road)**

3.4.1 Outdoor Living Areas (OLAs)

The predicted noise levels in the OLAs at the 2nd row of townhouses are below the action limit for any recommendations.

3.4.2 Plane of Window (POW)

The predicted noise levels in the POW at the 2nd row of townhouses are below the action limit for any recommendations.

4.0 BUILDING FAÇADE CONSTRUCTION

Predicted noise levels for the 1st row units and corner unit abutting Upper Middle Road have predicted noise levels at the POW in excess of 55 dBA (Table 3) during evening hours, and require building component specification are required to be specified using the Acoustic Insulation Factor (AIF). They are based on predicted sound levels at the building facades, and the anticipated ratios of the façade components (wall, windows, and doors) and the floor area of the adjacent room. The AIF was calculated for both the living room, and bedrooms using a standard window to floor ratio of 50%.

Table 9: AIF/STC Requirements

Area	AIF/STC	Window Glazing
Bedroom	AIF-29	3/13/3 (STC 30)
Living Room	AIF-27	3/13/3 (STC 30)

*Note due to the reflective nature of the road surface, all floors have been estimated to be equally impacted by the road noise.

Wall and door construction should fulfil the minimum requirements of the Ontario Building Code. All windows and doors should be tight sealing.

It is recommended that an Acoustical Engineering Consultant certify that the required noise mitigation measures have been incorporated into the builder's plans prior to construction, and also certify that the approved noise mitigation measures have been correctly installed prior to occupancy of the dwellings.

4.1 Warning Clauses

It is recommended that Warning Clauses Type "D" be inserted into all Offers and Agreements of Purchase and Sale for all units abutting Upper Middle Road, and that Clause Type "B" be added to the corner unit property as well.

Warning Clause Type "D":

> This dwelling unit has been supplied with a central air conditioning system which allows windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within noise criteria of the Municipality and the Ministry of the Environment.

Warning Class Type "B":

> Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic may

occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment's noise criteria.

The End Unit only of the 2nd Row of Townhouses is to have the following inserted into all Offers and Agreements of Purchase and Sale:

Warning Clause "C"

This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment.

5.0 SUMMARY OF RECOMMENDATIONS

The predictions of this assessment indicate that the proposed residential townhouse development is feasible. Road traffic noise impacts on the units abutting Upper Middle road are anticipated to exceed MOECC guideline values, and the following recommendations are made:

5.1 First Row (abutting Upper Middle)

- Equipping units with central air conditioning is recommended.
- Warning Clause D should be inserted into Offers and Agreements of Purchase and Sale

5.2 Corner Unit (Closest to Upper Middle)

- Acoustic Barriers are required to mitigate noise at the Outdoor Living Area (OLA)
- Equipping unit with central air conditioning
- Warning Clause D should be inserted into Offers and Agreements of Purchase and Sale
- Warning Clause B should be inserted into Offers and Agreements of Purchase and Sale

5.3 Second Row (End Unit Only)

- Equipping unit with central air conditioning
- Warning Clause C should be inserted into Offers and Agreements of Purchase and Sale.

5.4 Second Row

- No recommendations.

5.5 **Further Recommendations**

It is recommended that a detailed noise study be conducted at the Site Plan Stage. It is also recommended that a qualified Acoustical Engineer review the building plans at the Site Plan stage to ensure all recommendations for facades, window glazing, noise barriers, etc have been been incorporation into the building plans.

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APPENDIX A:

Site Plan



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ADDRESS: 3228 SOUTH SERVICE ROAD - SUITE 208 BURLINGTON, ON L7N 3H8	DRAWN BY: DS	CHECKED BY: RB	CLIENT'S NAME: Bloomfield Homes	CLIENT'S ADDRESS: 5219 Upper Middle Road	SCALE: As shown
RB#:	DATE: 2017-09-26	DRAWING NAME: Acoustic Separation Distance	REVISION #: 0	NOTES: None	

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APPENDIX B:

Turning Movement Count & Traffic Volume

Robin Brown

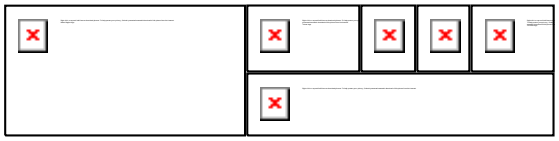
From: Sealey, Jonathan <Jonathan.Sealey@halton.ca>
Sent: March-10-17 3:35 PM
To: Robin Brown
Subject: RE: Traffic Data Request
Attachments: 103814 - eb & wb volume.xls; 103814 - wb speed.xls; 103814 - eb speed.xls; 10051801 - UPPER MIDDLE @ SUTTON.XLS; 10051801 - UPPER MIDDLE @ SUTTON.PDF

Good Afternoon,

The closest and most recent ATR data we have to Sutton/UMR and Corpus Christi is ID 103814 located on Upper Middle Road between Appleby Line and Imperial Way. I have attached the Volume and Class data, and the latest TMC at Upper Middle Road and Sutton in case it may be of assistance.

Please let me know if you have any questions

Jonathan Sealey
Traffic Operations & Safety Coordinator
Waste Management & Road Operations
Public Works
Halton Region
905-825-6000, ext. 7578 | 1-866-442-5866



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From: Robin Brown [mailto:rbrown@rb-enviro.com]
Sent: Thursday, March 09, 2017 2:20 PM
To: Access Halton
Subject: Traffic Data Request

Hi There,

Looking for traffic data closest to 5210 Upper Middle Road, Burlington. This is to be used for a noise impact study to support a proposed development.

Looking for the most recently available data. (ATR Count or AADT (average annual daily traffic)

Specifically,

- Upper Middle Road @ Sutton Drive
- Upper Middle Road near Corpus Christi High School

This is an urgent request.

Robin Brown, P.Eng, TSRP, QP
President
Rubidium Environmental
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3228 South Service Rd, Suite 208, Burlington, ON, L7N 3H8



Prepared For: Halton Region
Prepared By: *PYRAMID* Traffic Inc.
Location: REG. RD. #38 btwn Appleby Line & Imperial Way
Start Date: Thursday Nov 26, 2015

Site ID: 103814
Interval: 15 min.

Period Ending	Channel 1 EB	Channel 2 WB	Hourly Summary
0:15	4	11	
0:30	8	10	
0:45	5	9	
1:00	3	10	60
1:15	2	5	52
1:30	3	4	41
1:45	2	0	29
2:00	3	2	21
2:15	4	4	22
2:30	1	1	17
2:45	0	2	17
3:00	1	3	16
3:15	0	3	11
3:30	1	3	13
3:45	3	3	17
4:00	4	2	19
4:15	2	2	20
4:30	3	4	23
4:45	4	2	23
5:00	4	3	24
5:15	11	10	41
5:30	14	16	64
5:45	22	25	105
6:00	21	16	135
6:15	26	18	158
6:30	51	23	202
6:45	70	35	260
7:00	78	36	337
7:15	104	50	447
7:30	146	62	581
7:45	228	65	769
8:00	268	95	1018
8:15	269	178	1311
8:30	238	144	1485
8:45	197	134	1523
9:00	190	141	1491
9:15	161	98	1303
9:30	116	84	1121
9:45	90	76	956
10:00	82	61	768
10:15	69	70	648
10:30	74	68	590
10:45	65	82	571
11:00	88	72	588
11:15	67	94	610
11:30	66	85	619
11:45	77	102	651
12:00	76	97	664
12:15	96	96	695
12:30	104	107	755
12:45	94	104	774
13:00	100	106	807
13:15	93	96	804
13:30	84	112	789
13:45	70	109	770
14:00	86	104	754
14:15	102	89	756
14:30	122	111	793
14:45	100	185	899
15:00	102	132	943
15:15	98	141	991
15:30	114	163	1035
15:45	112	199	1061
16:00	119	209	1155
16:15	103	260	1279
16:30	105	240	1347
16:45	139	243	1418
17:00	138	301	1529
17:15	141	318	1625
17:30	135	241	1656
17:45	133	211	1618
18:00	160	251	1590
18:15	127	200	1458
18:30	132	174	1388
18:45	160	151	1355
19:00	115	131	1190
19:15	128	142	1133
19:30	105	132	1064
19:45	110	96	959
20:00	103	97	913
20:15	108	99	850
20:30	101	97	811
20:45	92	74	771
21:00	59	112	742
21:15	77	106	718
21:30	61	84	665
21:45	49	58	606
22:00	41	49	525
22:15	34	32	408
22:30	29	30	322
22:45	31	32	278
23:00	17	28	233
23:15	24	23	214
23:30	16	12	183
23:45	14	16	150
0:00	11	13	129

AM Peak: 1523

PM Peak: 1656

24 HR VOLUME: 15651

	Traffic Summary	Volume Count	car	truck	heavy
16	7am to 11pm	15024	13972	751	301
8	11pm to 7am	627	583	31	13

inflated to 2025 with 2% annual inflation

	Traffic Summary	Volume Count	car	truck	heavy
16	7am to 11pm	18314	17032	916	367
8	11pm to 7am	764	711	38	15

split cars medium truck

total count	car	truck	heavy	total
	4937	204	99	5240
	4504	254	143	4901
total	9441	458	242	10141
Percent	93%	5%	2%	

Upper Middle Rd @ Sutton Dr

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:30:00
To: 8:30:00

Municipality: Halton Region
Site #: 0000002168
Intersection: Upper Middle Rd & Sutton Dr
TFR File #: 4
Count date: 1-Oct-2014

Weather conditions:
Rain

Person(s) who counted:
Adriana

**** Signalized Intersection ****

Major Road: Upper Middle Rd runs W/E

North Leg Total: 1063
North Entering: 717
North Peds: 25
Peds Cross: ⋈

Heavys	5	2	7
Trucks	9	4	13
Cars	130	567	697
Totals	144	573	

Heavys	17
Trucks	24
Cars	305
Totals	346

East Leg Total: 1617
East Entering: 342
East Peds: 23
Peds Cross: ⧖

Sutton Dr

Heavys	Trucks	Cars	Totals
11	11	351	373

	Cars	Trucks	Heavys	Totals
	99	10	4	113
	221	2	6	229
	320	12	10	

Upper Middle Rd

N
W E
S

Heavys	Trucks	Cars	Totals
13	14	206	233
7	9	686	702
20	23	892	

Upper Middle Rd

	Cars	Trucks	Heavys	Totals
	1253	13	9	1275

Peds Cross: ⧖
West Peds: 14
West Entering: 935
West Leg Total: 1308

Comments

Upper Middle Rd @ Sutton Dr

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

Municipality: Halton Region
Site #: 0000002168
Intersection: Upper Middle Rd & Sutton Dr
TFR File #: 4
Count date: 1-Oct-2014

Weather conditions:
Rain

Person(s) who counted:
Adriana

**** Signalized Intersection ****

Major Road: Upper Middle Rd runs W/E

North Leg Total: 397
North Entering: 188
North Peds: 7
Peds Cross: ⋈

Heavys	2	0	2
Trucks	1	3	4
Cars	90	92	182
Totals	93	95	

Heavys	6
Trucks	19
Cars	184
Totals	209

East Leg Total: 741
East Entering: 411
East Peds: 8
Peds Cross: ⧖

Sutton Dr

Heavys	Trucks	Cars	Totals
7	8	390	405

Cars	Trucks	Heavys	Totals
90	9	0	99
300	7	5	312
390	16	5	

Upper Middle Rd

N
W E
S

Heavys	Trucks	Cars	Totals
6	10	94	110
2	7	226	235
8	17	320	

Upper Middle Rd

Cars	Trucks	Heavys	Totals
318	10	2	330

Peds Cross: ⧖
West Peds: 3
West Entering: 345
West Leg Total: 750

Comments

Upper Middle Rd @ Sutton Dr

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:15:00
To: 17:15:00

Municipality: Halton Region
Site #: 0000002168
Intersection: Upper Middle Rd & Sutton Dr
TFR File #: 4
Count date: 1-Oct-2014

Weather conditions:
Rain

Person(s) who counted:
Adriana

**** Signalized Intersection ****

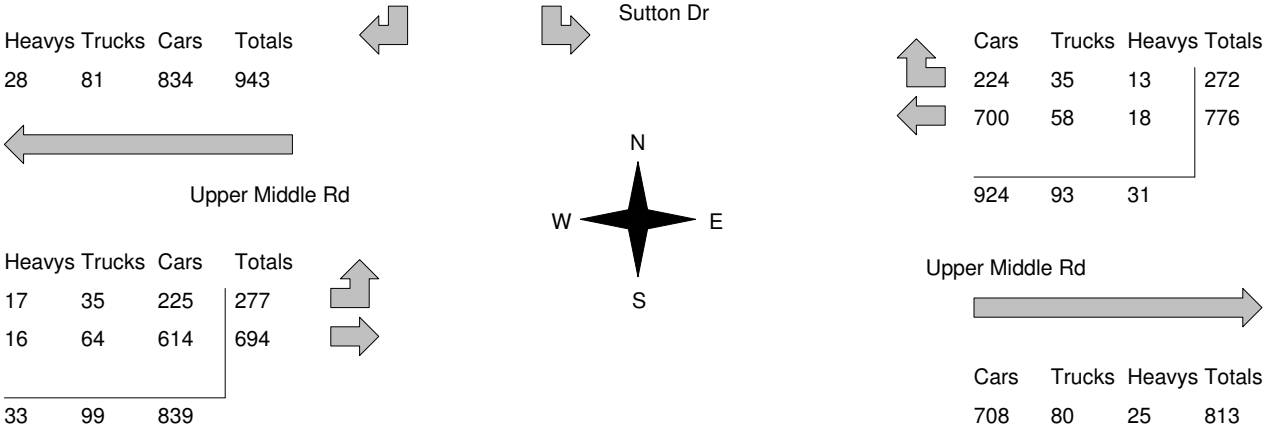
Major Road: Upper Middle Rd runs W/E

North Leg Total: 835
North Entering: 286
North Peds: 6
Peds Cross: ⋈

Heavys	10	9	19
Trucks	23	16	39
Cars	134	94	228
Totals	167	119	

Heavys	30
Trucks	70
Cars	449
Totals	549

East Leg Total: 1861
East Entering: 1048
East Peds: 6
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 0
West Entering: 971
West Leg Total: 1914

Comments

Upper Middle Rd @ Sutton Dr

Total Count Diagram

Municipality: Halton Region
Site #: 0000002168
Intersection: Upper Middle Rd & Sutton Dr
TFR File #: 4
Count date: 1-Oct-2014

Weather conditions:
Rain

Person(s) who counted:
Adriana

**** Signalized Intersection ****

Major Road: Upper Middle Rd runs W/E

North Leg Total: 5112
North Entering: 2660
North Peds: 73
Peds Cross: ⋈

Heavys	45	40	85
Trucks	79	70	149
Cars	884	1542	2426
Totals	1008	1652	

Heavys	125
Trucks	238
Cars	2089
Totals	2452

East Leg Total: 9484
East Entering: 4244
East Peds: 54
Peds Cross: ⧖

Sutton Dr

Heavys	Trucks	Cars	Totals
110	223	3780	4113

Upper Middle Rd

Heavys	Trucks	Cars	Totals
84	120	1109	1313
59	134	3395	3588
143	254	4504	

N
W E
S

Cars	Trucks	Heavys	Totals
980	118	41	1139
2896	144	65	3105
3876	262	106	

Upper Middle Rd

Cars	Trucks	Heavys	Totals
4937	204	99	5240

Peds Cross: ⧖
West Peds: 30
West Entering: 4901
West Leg Total: 9014

Comments

RUBIDIUM
ENVIRONMENTAL

APPENDIX C:

STAMSON

Case 1

UM1OLAD
STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:04:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 1st Row OLA - Day

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1
House density : 95 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 42.50 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Upper Middle

Source height = 1.19 m

ROAD (0.00 + 54.72 + 0.00) = 54.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.05	0.00	-4.52	0.00	0.00	-9.81	0.00	54.72

Segment Leq : 54.72 dBA

Total Leq All Segments: 54.72 dBA

TOTAL Leq FROM ALL SOURCES: 54.72

Case 2

UM1POWDB.TXT
STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:13:29
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 1st Row POW - Day - With Barriers

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 25.90 m
Receiver height : 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 2.00 m
Barrier receiver distance : 4.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.19 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.19	4.50	3.99	3.99

ROAD (0.00 + 66.67 + 0.00) = 66.67 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.05	0.00	-2.37	0.00	0.00	0.00	-0.16	66.52*
-90	90	0.00	69.05	0.00	-2.37	0.00	0.00	0.00	0.00	66.67

* Bright Zone !

Segment Leq : 66.67 dBA

Total Leq All Segments: 66.67 dBA

♀
Barrier table for segment # 1: Upper Middle

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
3.50	3.50	66.67	66.67
4.00	4.00	61.67	61.67
4.50	4.50	60.56	60.56
5.00	5.00	58.45	58.45
5.50	5.50	56.47	56.47
6.00	6.00	54.82	54.82
6.50	6.50	53.45	53.45
7.00	7.00	52.29	52.29
7.50	7.50	51.27	51.27
8.00	8.00	50.66	50.66

TOTAL Leq FROM ALL SOURCES: 66.67

Case 3

STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:21:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 1st Row End OLA - Day

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 22.80 m
Receiver height : 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 2.20 m
Barrier receiver distance : 3.10 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.19 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.19	1.50	1.46	1.46

ROAD (0.00 + 59.77 + 0.00) = 59.77 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.05	0.00	-1.82	0.00	0.00	0.00	-7.46	59.77

Segment Leq : 59.77 dBA

Total Leq All Segments: 59.77 dBA

♀
Barrier table for segment # 1: Upper Middle

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA

2.20	2.20	59.77	59.77
2.40	2.40	58.82	58.82
2.60	2.60	57.92	57.92
2.80	2.80	57.09	57.09
3.00	3.00	56.33	56.33
3.20	3.20	55.63	55.63
3.40	3.40	55.00	55.00
3.60	3.60	54.42	54.42
3.80	3.80	53.88	53.88
4.00	4.00	53.38	53.38

TOTAL Leq FROM ALL SOURCES: 59.77

Case 4

STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:24:41
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 1st Row End POW - Day

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 25.80 m
Receiver height : 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 2.20 m
Barrier receiver distance : 6.20 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Upper Middle

Source height = 1.19 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.19	4.50	3.70	3.70

ROAD (0.00 + 66.69 + 0.00) = 66.69 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.05	0.00	-2.36	0.00	0.00	0.00	-0.38	66.32*
-90	90	0.00	69.05	0.00	-2.36	0.00	0.00	0.00	0.00	66.69

* Bright Zone !

Segment Leq : 66.69 dBA

Total Leq All Segments: 66.69 dBA

Barrier table for segment # 1: Upper Middle

Barrier Height	Elev of Barr Top	Road dBA	Tot Leq dBA
2.20	2.20	66.69	66.69
2.70	2.70	66.69	66.69
3.20	3.20	66.69	66.69
3.70	3.70	66.69	66.69
4.20	4.20	60.91	60.91
4.70	4.70	59.20	59.20
5.20	5.20	57.42	57.42
5.70	5.70	55.85	55.85
6.20	6.20	54.51	54.51
6.70	6.70	53.35	53.35

TOTAL Leq FROM ALL SOURCES: 66.69

Case 5

UM2OLA.TXT
STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:39:05
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 2nd Row End OLA - Day

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 2
House density : 95 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 74.50 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Upper Middle

Source height = 1.19 m

ROAD (0.00 + 51.38 + 0.00) = 51.38 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.05	0.00	-6.96	0.00	0.00	-10.71	0.00	51.38

Segment Leq : 51.38 dBA

Total Leq All Segments: 51.38 dBA

TOTAL Leq FROM ALL SOURCES: 51.38

Case 6

UM2POW.TXT
STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:44:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 2nd Row POW - Day

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1
House density : 95 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 57.70 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.19 m

ROAD (0.00 + 53.74 + 0.00) = 53.74 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	69.05	0.00	-5.85	0.00	0.00	-9.45	0.00	53.74

Segment Leq : 53.74 dBA

Total Leq All Segments: 53.74 dBA

♀

TOTAL Leq FROM ALL SOURCES: 53.74
♀
♀

Case 7

UM2EPOW.TXT
STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 14:53:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 16 hours
Description: 2nd Row End POW - Day Partial Blockage

Road data, segment # 1: Upper Middle

Car traffic volume : 17032 veh/TimePeriod
Medium truck volume : 916 veh/TimePeriod
Heavy truck volume : 367 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 57.70 m
Receiver height : 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 20.00 deg
Barrier height : 6.00 m
Barrier receiver distance : 17.10 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.19 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.19	4.50	3.52	3.52

ROAD (0.00 + 51.22 + 59.09) = 59.75 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	20	0.00	69.05	0.00	-5.85	-2.14	0.00	0.00	-9.83	51.22
20	90	0.00	69.05	0.00	-5.85	-4.10	0.00	0.00	0.00	59.09

Segment Leq : 59.75 dBA

Total Leq All Segments: 59.75 dBA

♀

TOTAL Leq FROM ALL SOURCES: 59.75

Case 8

STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 15:03:47
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 8 hours
Description: 1st Row POW - Night

Road data, segment # 1: Upper Middle

Car traffic volume	: 711	veh/TimePeriod
Medium truck volume	: 38	veh/TimePeriod
Heavy truck volume	: 15	veh/TimePeriod
Posted speed limit	: 60	km/h
Road gradient	: 0	%
Road pavement	: 1	(Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2	: -90.00 deg	90.00 deg	
Wood depth	: 0	(No woods.)	
No of house rows	: 0		
Surface	: 2	(Reflective ground surface)	
Receiver source distance	: 25.90 m		
Receiver height	: 4.50 m		
Topography	: 1	(Flat/gentle slope; no barrier)	
Reference angle	: 0.00		

♀
Results segment # 1: Upper Middle

Source height = 1.18 m

ROAD (0.00 + 55.85 + 0.00) = 55.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.22	0.00	-2.37	0.00	0.00	0.00	0.00	55.85

Segment Leq : 55.85 dBA

Total Leq All Segments: 55.85 dBA

♀

TOTAL Leq FROM ALL SOURCES: 55.85
♀
♀

Case 9

UM1ENPOW.TXT
STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 15:06:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 8 hours
Description: 1st Row End POW - Night

Road data, segment # 1: Upper Middle

Car traffic volume : 711 veh/TimePeriod
Medium truck volume : 38 veh/TimePeriod
Heavy truck volume : 15 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 25.80 m
Receiver height : 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 2.20 m
Barrier receiver distance : 6.20 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.18 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

1.18 ! 4.50 ! 3.70 ! 3.70

ROAD (0.00 + 55.87 + 0.00) = 55.87 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.22	0.00	-2.36	0.00	0.00	0.00	-0.38	55.49*
-90	90	0.00	58.22	0.00	-2.36	0.00	0.00	0.00	0.00	55.87

* Bright Zone !

Segment Leq : 55.87 dBA

Total Leq All Segments: 55.87 dBA

♀

Case 10

STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 15:08:52
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 8 hours
Description: 2nd Row POW - Night

Road data, segment # 1: Upper Middle

Car traffic volume : 711 veh/TimePeriod
Medium truck volume : 38 veh/TimePeriod
Heavy truck volume : 15 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1
House density : 95 %
Surface : 2 (Reflective ground surface)
Receiver source distance : 57.70 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.18 m

ROAD (0.00 + 42.92 + 0.00) = 42.92 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.22	0.00	-5.85	0.00	0.00	-9.45	0.00	42.92

Segment Leq : 42.92 dBA

Total Leq All Segments: 42.92 dBA

♀

TOTAL Leq FROM ALL SOURCES: 42.92
♀
♀

Case 11

UM2SNPOW.TXT

STAMSON 5.0 NORMAL REPORT Date: 26-09-2017 15:12:15
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 8 hours
Description: 2nd Row End POW - Night Partial barrier

Road data, segment # 1: Upper Middle

Car traffic volume : 711 veh/TimePeriod
Medium truck volume : 38 veh/TimePeriod
Heavy truck volume : 15 veh/TimePeriod
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Upper Middle

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 57.70 m
Receiver height : 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 20.00 deg
Barrier height : 6.00 m
Barrier receiver distance : 17.10 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

♀
Results segment # 1: Upper Middle

Source height = 1.18 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.18	4.50	3.52	3.52

ROAD (0.00 + 40.39 + 48.27) = 48.93 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	20	0.00	58.22	0.00	-5.85	-2.14	0.00	0.00	-9.84	40.39
20	90	0.00	58.22	0.00	-5.85	-4.10	0.00	0.00	0.00	48.27

Segment Leq : 48.93 dBA

Total Leq All Segments: 48.93 dBA

♀

TOTAL Leq FROM ALL SOURCES: 48.93