Noise Feasibility Study

Proposed Residential Development

Brock Road

Pickering, Ontario

Prepared for:

Madison Brock Limited
369 Rimrock Road
Toronto, Ontario
M3J 3G2

Prepared by:

Jingyi Guo

Reviewed by:

Mandy Chan, PEng

June 28, 2017

Project No: 01700338
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1 Introduction and Summary

Howe Gastmeier Chapnik Limited (HGC Engineering) was retained by Madison Brock Limited to conduct a noise feasibility study for a proposed low-rise residential development to be located at west of Brock Road and south of Dersan Street in the City of Pickering, Regional Municipality of Durham, Ontario. The proposed development will include a number of stacked townhouse blocks, street townhouse blocks and rear lane townhouse blocks. There are some existing residential areas along Brock Road and an existing cemetery on the east side of Brock Road. The study is required by the municipality as part of the site plan approval process.

The primary impacting noise source is road traffic on Brock Road. Relevant forecasted traffic data was obtained from the City of Pickering for Brock Road. Traffic data information was used to predict future traffic sound levels at the locations of the proposed developments. The predicted sound levels were compared to the guidelines of the Ministry of Environment and Climate Change (MOECC) and the Region of Durham to develop noise control recommendations for the proposed development.

The sound level predictions indicate that standard building envelope elements will ensure that indoor sound levels can comply with the MOECC noise criteria. Central air-conditioning is required for some specific units so that windows can be kept closed. Warning clauses are also recommended to inform residents of the possible traffic noise impact and the presence of nearby commercial facilities and existing cemetery. A detailed noise study should be performed when detailed floor plans, elevation drawings and grading plans are available to refine the glazing requirements and acoustical barrier requirements.

2 Site Description and Noise Sources

Figure 1 is a key plan indicating the location of the proposed development. The proposed development is located on the west side of Brock Road and south of Dersan Street in the City of Pickering, Ontario. The residential development site includes a number of stacked townhouses, street townhouses and rear lane townhouses. All blocks are 3-storey buildings. Prediction locations are indicated on Figure 2 for reference.
There are existing residences along Brock Road and an existing cemetery on the east side of Brock Road. To the southeast is a garden centre, significant noise impact due to the garden centre is not expected as traffic on Brock Road is the dominant noise source in the area.

3 Noise Level Criteria

3.1 Road Traffic Noise

Guidelines for acceptable levels of road traffic noise impacting residential developments are given in the MOECC publication NPC-300, “Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning”, release date October 21, 2013, and are listed in Table I below. The values in Table I are energy equivalent (average) sound levels [L_{EQ}] in units of A-weighted decibels [dBA].

<table>
<thead>
<tr>
<th>Area</th>
<th>Daytime L_{EQ} (16 hour)</th>
<th>Nighttime L_{EQ} (8 hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Bedroom Windows</td>
<td>55 dBA</td>
<td>50 dBA</td>
</tr>
<tr>
<td>Outdoor Living Area</td>
<td>55 dBA</td>
<td>--</td>
</tr>
<tr>
<td>Inside Living/Dining Rooms</td>
<td>45 dBA</td>
<td>45 dBA</td>
</tr>
<tr>
<td>Inside Bedrooms</td>
<td>45 dBA</td>
<td>40 dBA</td>
</tr>
</tbody>
</table>

Daytime refers to the period between 07:00 and 23:00. Nighttime refers to the time period between 23:00 and 07:00. The term “Outdoor Living Area” (OLA) is used in reference to an outdoor patio, a backyard, a terrace, or other area where passive recreation is expected to occur. Small balconies are not considered OLAs for the purposes of assessment. Terraces greater than 4 m in depth (measured perpendicular to the building façade) are considered to be OLAs.

The guidelines in the MOECC publication allow the daytime sound levels in an Outdoor Living Area to be exceeded by up to 5 dBA, without mitigation, if warning clauses are placed in the purchase and rental agreements to the property. Where OLA sound levels exceed 60 dBA, physical mitigation is required to reduce the OLA sound level to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible. The Region of Durham has accepted sound levels of
60 dBA in the OLA in the past.

A central air conditioning system as an alternative means of ventilation to open windows is required for dwellings where nighttime sound levels outside bedroom or living/dining room windows exceed 60 dBA or daytime sound levels outside bedroom or living/dining room windows exceed 65 dBA. Forced-air ventilation with ducts sized to accommodate the future installation of air conditioning is required when nighttime sound levels at bedroom or living/dining room windows are in the range of 51 to 60 dBA or when daytime sound levels at bedroom or living/dining room windows are in the range of 56 to 65 dBA.

Building components such as walls, windows and doors must be designed to achieve indoor sound level criteria when the plane of window nighttime sound level is greater than 60 dBA or the daytime sound level is greater than 65 dBA due to road traffic noise.

Warning clauses to notify future residents of possible noise excesses are also required when nighttime sound levels exceed 50 dBA at the plane of the bedroom or living/dining room window and daytime sound levels exceed 55 dBA in the outdoor living area and at the plane of the bedroom or living/dining room window due to road traffic.
4 Traffic Sound Level Assessment

4.1 Road Traffic Data

Traffic data for Brock Road was obtained from the City of Pickering and is provided in Appendix A. A forecasted AADT of 40000 vehicles per direction per day was applied for Brock Road in the analysis. A commercial vehicle percentage of 15% was split into 9.75% heavy trucks and 5.25% medium trucks during both daytime and nighttime. A day/night split of 90%/10% was used along with a speed limit of 70 km/h. Table II summarizes the traffic volume data used in this study. In the analysis, the traffic volume was split in half for each direction, northbound and southbound.

<table>
<thead>
<tr>
<th>Road Name</th>
<th>Cars</th>
<th>Medium Trucks</th>
<th>Heavy Trucks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brock Road</td>
<td>30 600</td>
<td>1 890</td>
<td>3 510</td>
<td>36 000</td>
</tr>
<tr>
<td></td>
<td>3 400</td>
<td>210</td>
<td>390</td>
<td>4 000</td>
</tr>
<tr>
<td>Total</td>
<td>34 000</td>
<td>2 100</td>
<td>3 900</td>
<td>40 000</td>
</tr>
</tbody>
</table>

4.2 Road Traffic Noise Predictions

To assess the levels of road traffic noise which will impact the study area in the future, sound level predictions were made using STAMSON version 5.04, a computer algorithm developed by the MOECC. Sample STAMSON output is included in Appendix B.

Prediction locations were chosen around the residential blocks to obtain a representation of the future sound levels at various dwellings with exposure to Brock Road. Sound levels were predicted at the plane of the 3rd storey bedroom and/or living/dining room windows during daytime and nighttime hours to investigate ventilation requirements. Blocks 1-4, 15-22 are stacked townhouses and rear lane townhouses without rear yards, while Block 5-14 are street townhouses with rear yards. Sound levels were also predicted in the center of rear yards to investigate acoustic barrier requirements. The results of these predictions are summarized in Table III.
Table III: Predicted Road Traffic Sound Levels [dBA], Without Mitigation

<table>
<thead>
<tr>
<th>Prediction Location</th>
<th>Description</th>
<th>Daytime – in the OLA L_{EQ-16 hr}</th>
<th>Daytime – at the Façade L_{EQ-16 hr}</th>
<th>Nighttime – at the Façade L_{EQ-8 hr}</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A]</td>
<td>Block 1, northeast corner</td>
<td>--</td>
<td>73</td>
<td>67</td>
</tr>
<tr>
<td>[B]</td>
<td>Block 15, southeast corner</td>
<td>--</td>
<td>64</td>
<td>58</td>
</tr>
<tr>
<td>[C]</td>
<td>Block 12, southeast corner</td>
<td>--</td>
<td>59</td>
<td>53</td>
</tr>
<tr>
<td>[D]</td>
<td>Block 16, southeast corner</td>
<td>--</td>
<td>62</td>
<td>55</td>
</tr>
<tr>
<td>[E]</td>
<td>Block 16, southwest corner</td>
<td>--</td>
<td>60</td>
<td>54</td>
</tr>
<tr>
<td>[F]</td>
<td>Block 12, middle of south side wall</td>
<td>--</td>
<td>54</td>
<td>47</td>
</tr>
<tr>
<td>[G]</td>
<td>Block 22, southeast corner</td>
<td>--</td>
<td>55</td>
<td>48</td>
</tr>
<tr>
<td>[H]</td>
<td>Block 5, middle of 2\textsuperscript{nd} unit rear yard OLA</td>
<td>64</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>[J]</td>
<td>Block 5, middle of 4\textsuperscript{th} unit rear yard OLA</td>
<td>60</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>[K]</td>
<td>Block 8, middle of 1\textsuperscript{st} house OLA</td>
<td>57</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

5 Discussion and Recommendations

The sound level predictions indicate that the future traffic sound levels will exceed MOECC guidelines at the dwelling units with exposure to Brock Road. The following discussion outlines the recommendations for acoustic barrier requirements, ventilation requirements, upgraded building façade construction, and warning clauses to achieve the noise criteria stated in Table I.

5.1 Outdoor Living Areas

The predicted daytime sound levels in the OLA’s of Block 5, first street townhouse will be up to 64 dBA, which is 9 dBA in excess of the MOECC’s limit of 55 dBA. Physical mitigation in the form of an acoustic barrier is required. A 2m high noise barrier will reduce the sound levels in the OLAs to 59 dBA. All noise barriers must return back to the dwelling units so that the rear yards are entirely shielded from the roadway. Barrier location is shown on Figure 3. The wall component of the barrier should be of a solid construction with a surface density of no less than 20 kg/m\textsupersquare. The walls may be constructed from a variety of materials such as wood, brick, pre-cast concrete or other concrete/wood composite systems provided that it is free of gaps or cracks within or below its extent.
The predicted daytime sound levels in the OLA’s of the remainder of the lots are 60 dBA or less. MOECC accepts sound levels of 5 dBA in excess of the limits in OLAs, thus physical mitigation will not be required in the rest of OLAs.

5.2 Indoor Living Areas and Ventilation Requirements

Central Air Conditioning
The predicted future sound levels outside the 3rd storey living room/dining room/bedroom windows of the dwellings on Block 1-4 will be greater than 65 dBA during the daytime hours and 60 dBA during the nighttime hours. To address these excesses, the MOECC guidelines recommend that the dwelling units be equipped with central air conditioning systems, so that the windows can be closed.

Provision for the Future Installation of Air Conditioning
The predicted future sound levels outside the 3rd storey living room/bedroom windows of the front rows of dwellings closest to Brock Road on Block 5-9, 11-13 and 15-16 will be between 51 and 60 dBA during the nighttime hours. To address these excesses, the MOECC guidelines recommend that these dwellings be equipped with forced air ventilation systems with ducts sized to accommodate the future installation of air conditioning by the occupant.

Figure 3 shows the ventilation requirements for the development. Window or through-the-wall air conditioning units are not recommended for any residential units because of the noise they produce and because the units penetrate through the exterior wall which degrades the overall noise insulating properties of the envelope. The location, installation and sound ratings of the outdoor air conditioning devices should minimize noise impacts and comply with criteria of MOECC publication NPC-300, as applicable. The guidelines also recommend warning clauses for all units with ventilation requirements.

5.3 Building Façade Constructions
Future sound levels on Block 1-4 along Brock Road will exceed 65 dBA during daytime hours and/or 60 dBA during nighttime hours. MOECC guidelines recommend that the windows, walls and doors be designed so that the indoor sound levels comply with MOECC noise criteria.
The required building components are selected based on the Acoustical Insulation Factor (AIF) value for road traffic. To do so, calculations were performed to determine the acoustical insulation factors to maintain indoor sound levels within MOECC guidelines. The calculation methods were developed by the National Research Council (NRC). They are based on the predicted future sound levels at the building facades, and the anticipated area ratios of the facade components (windows and walls) and the floor area of the adjacent room.

The minimum necessary specification for the building envelope for the Block 1-4 facades of dwellings is AIF-32 for bedrooms and AIF-33 for living/dining rooms, based on the possibility of sound entering the buildings through windows and walls. Preliminary floor plans and building elevations were reviewed. Any well sealed thermopane unit having a Sound Transmission Class (STC) rating of 33 will provide sufficient noise insulation as long as the window to floor area ratio is less than 32% for bedrooms and less than 25% for living/dining rooms.

Any exterior wall construction meeting the Ontario Building Code (OBC) will be acceptable for all the dwellings in the development. Any insulated metal exterior door meeting OBC requirements will be sufficient to provide noise insulation. If sliding patio doors are to be used in the dwellings, they must be included in the window area.

When detailed floor plans and elevations are available for Blocks 1-4, a detailed noise study should be performed to specify wall and window requirements with sufficient acoustical insulation based on actual window to floor area ratios.

The remaining units within the development will have daytime and nighttime sound levels at the top storey façade that are less than 65 and 60 dBA respectively. For these units, any exterior wall, and double glazed window construction meeting the minimum OBC will provide adequate sound insulation for the dwelling units.

5.4 Warning Clauses

The MOECC guidelines recommend that warning clauses be included in the property and tenancy agreements and offers of purchase and sale for all lots with anticipated traffic sound level excesses. The following noise warning clauses are required for specific dwellings as indicated in Table V.
A suggested wording for future dwellings with sound level excesses of the MOECC criteria but do not require physical mitigation measures is given below.

Type A:

Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment and Climate Change.

Suggested wording for future dwellings for which physical mitigation has been provided is given below.

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 City’s and the Ministry of the Environment and Climate Change’s noise criteria. The acoustical barrier as installed shall be maintained, repaired or replaced by the owner. Any maintenance, repair or replacement shall be with the same material, to the same standards and having the same colour and appearance of the original.

A suggested wording for future dwellings requiring central air conditioning systems is given below.

Type C:

This dwelling unit has been supplied with a central air conditioning system which 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 Environment and Climate Change.

A suggested wording for future dwellings requiring forced air ventilation systems is given below.

Type D:

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 and Climate Change.

These sample clauses are provided by the MOECC as examples, and can be modified by the Municipality as required.
6 Summary and Recommendations

The following list and Table V summarize the recommendations made in this report. The reader is referred to the Figure 3 and previous sections of the report where these recommendations are applied and discussed in more detail.

1. Acoustic barriers are required for the rear yards of the 1st to 3rd unit to Brock Road of Block 5. When grading plans are available, acoustic barrier heights should be refined.

2. Central air conditioning is required for the dwellings on Blocks 1-4, the blocks along Brock Road. Forced air ventilation systems with ducts sized to accommodate the future installation of central air conditioning by the occupant is recommended for dwellings on Blocks 5-9, 11-13 and 15-16. The location, installation and sound ratings of the air conditioning devices should comply with NPC-300, as applicable.

3. Upgraded building construction is required for the dwellings for Blocks 1-4. When detailed floor plans and building elevations are available, a detailed noise study should be performed. OBC construction is sufficient for the remaining dwellings.

4. Noise warning clauses should be included in the Development Agreements registered on titles, and in purchase, sale and lease agreements, to inform future owners of noise concerns.

Table IV: Summary of Noise Control Requirements and Noise Warning Clauses

<table>
<thead>
<tr>
<th>Block No.</th>
<th>Unit</th>
<th>Acoustic Barrier</th>
<th>Ventilation Requirements*</th>
<th>Type of Warning Clause</th>
<th>Upgraded Building Constructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>All</td>
<td>--</td>
<td>Central Air</td>
<td>A, C</td>
<td>BR: AIF-32 LR/DR: AIF-33</td>
</tr>
<tr>
<td>5</td>
<td>1st to 3rd unit closest to Brock Road</td>
<td>✓</td>
<td>Forced Air</td>
<td>B, D</td>
<td>OBC</td>
</tr>
<tr>
<td></td>
<td>Remaining Units in Block</td>
<td>--</td>
<td>Forced Air</td>
<td>A, D</td>
<td>OBC</td>
</tr>
<tr>
<td>6-9, 11-13, 15-16</td>
<td>All</td>
<td>--</td>
<td>Forced Air</td>
<td>A, D</td>
<td>OBC</td>
</tr>
<tr>
<td>10, 14, 17-22</td>
<td>All</td>
<td>--</td>
<td></td>
<td>A</td>
<td>OBC</td>
</tr>
</tbody>
</table>

Notes: -- no specific requirement
* The location, installation and sound rating of the air conditioning condensers must be compliant with MOECC Guideline NPC-300, as applicable.
LRDR – Living Room/Dining Room
BR – Bedroom
OBC – Ontario Building Code
6.1 Implementation

To ensure that the noise control recommendations outlined above are properly implemented, it is recommended that:

1. When architectural and grading plans are available for dwellings closest to Brock Road (Blocks 1 – 4), an acoustical consultant should review the plans to determine appropriate window and wall constructions and refine acoustic barrier requirements.

2. Prior to the acceptance for maintenance of this development, the Municipality’s building inspector or a Professional Engineer qualified to perform acoustical engineering services in the Province of Ontario should certify that the noise control measures have been properly incorporated.

3. Prior to assumption of the subdivision, the Municipality’s building inspector or a Professional Engineer qualified to perform acoustical engineering services in the Province of Ontario should certify that the noise control measures have been properly installed and constructed.
Figure 3: Proposed Site Plan Showing Barrier and Ventilation Requirements
Appendix A

Road Traffic Information
The Regional Municipality of Durham

Planning and Economic Development Department
Planning Division
605 ROSSLAND RD. E.
4TH FLOOR
P.O. BOX 623
WHITBY, ON L1N 6A3
CANADA
905-668-7711
1-800-372-1102
Fax: 905-666-6208
E-Mail: planning@durham.ca
www.durham.ca

Brian Bridgeman, MCIP, RPP
Commissioner of Planning and Economic Development

ROAD SEGMENT TRAFFIC FORECASTS FOR NOISE ANALYSES

This information is to be used as the basis for assessing the potential impacts of noise, generated by traffic on Provincial Highways and arterial roads, on proposed land uses that are sensitive (e.g., residential subdivisions). Arterial roads include existing and future Type A, B and C, as designated in the Durham Regional Official Plan.

Noise assessment reports recommend specific measures to be integrated into the design of sensitive developments to reduce road noise impacts to acceptable levels.

Provided For:

Name / Name of Firm: Sheeba Paul, HGC Engineering
Address: 2000 Argentia Rd., Plaza One, Suite 203, Mississauga, ON
Telephone: (905) 826-4044
Fax:

Location of Proposal:

West side of Brock Road, south of Dersan Street
Note: Planned widening of Brock Road to 6-lanes is for future HOV lanes.

Municipality: Pickering
Lot(s): Concession:
Durham Region File No. (if available):
Name of Property Owner (if available):

Date Request Received: May-11-17
Received By: Chris Leitch
Date Forecast Sent: May-17-17

<table>
<thead>
<tr>
<th>Name of Road Segment</th>
<th>Forecasted AADT*</th>
<th>No. of Lanes</th>
<th>% of Trucks</th>
<th>Heavy : Medium Truck Ratio</th>
<th>Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brock Road, north of Third Concession Road</td>
<td>40,000</td>
<td>6</td>
<td>15</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
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<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Average Annual Daily Traffic. Forecast based on ultimate development according to the Durham Regional Official Plan.
Appendix B

Sample STAMSON 5.04 Output
STAMSON 5.0  NORMAL REPORT  Date: 26-05-2017 15:34:13
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: a.te  Time Period: Day/Night 16/8 hours
Description: Predicted daytime and nighttime sound levels at the upper storey windows, at Prediction Location [A]

Road data, segment # 1: BrockSB (day/night)
-------------------------------------------
Car traffic volume : 15300/1700 veh/TimePeriod *
Medium truck volume : 945/105 veh/TimePeriod *
Heavy truck volume : 1755/195 veh/TimePeriod *
Posted speed limit : 70 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

  24 hr Traffic Volume (AADT or SADT): 20000
  Percentage of Annual Growth : 2.50
  Number of Years of Growth : 0.00
  Medium Truck % of Total Volume : 5.25
  Heavy Truck % of Total Volume : 9.75
  Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: BrockSB (day/night)
-----------------------------------------
Angle1  Angle2 : -90.00 deg  90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 22.00 / 22.00 m
Receiver height : 10.50 / 10.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: BrockNB (day/night)
-------------------------------------------
Car traffic volume : 15300/1700 veh/TimePeriod *
Medium truck volume : 945/105 veh/TimePeriod *
Heavy truck volume : 1755/195 veh/TimePeriod *
Posted speed limit : 70 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

  24 hr Traffic Volume (AADT or SADT): 20000
  Percentage of Annual Growth : 0.00
  Number of Years of Growth : 10.00
  Medium Truck % of Total Volume : 5.25
  Heavy Truck % of Total Volume : 9.75
  Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 2: BrockNB (day/night)
-----------------------------------------
Angle1       Angle2       :  -90.00 deg   90.00 deg
Wood depth   :  0       (No woods.)
No of house rows :  0 / 0
Surface      :  1       (Absorptive ground surface)
Receiver source distance :  32.00 / 22.00 m
Receiver height   :  10.50 / 10.50 m
Topography    :  1       (Flat/gentle slope; no barrier)
Reference angle:  0.00

Results segment # 1: BrockSB (day)
----------------------------------
Source height = 1.77 m
ROAD (0.00 + 70.80 + 0.00) = 70.80 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90</td>
<td>90</td>
<td>0.38</td>
<td>74.04</td>
<td>0.00</td>
<td>-2.30</td>
<td>-0.94</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>70.80</td>
</tr>
</tbody>
</table>

Segment Leq : 70.80 dBA

Results segment # 2: BrockNB (day)
----------------------------------
Source height = 1.77 m
ROAD (0.00 + 68.55 + 0.00) = 68.55 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90</td>
<td>90</td>
<td>0.38</td>
<td>74.04</td>
<td>0.00</td>
<td>-4.55</td>
<td>-0.94</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>68.55</td>
</tr>
</tbody>
</table>

Segment Leq : 68.55 dBA

Total Leq All Segments: 72.83 dBA

Results segment # 1: BrockSB (night)
------------------------------------
Source height = 1.77 m
ROAD (0.00 + 64.26 + 0.00) = 64.26 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90</td>
<td>90</td>
<td>0.38</td>
<td>67.51</td>
<td>0.00</td>
<td>-2.30</td>
<td>-0.94</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>64.26</td>
</tr>
</tbody>
</table>

Segment Leq : 64.26 dBA
Results segment # 2: BrockNB (night)
------------------------------------
Source height = 1.77 m
ROAD (0.00 + 64.26 + 0.00) = 64.26 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90</td>
<td>90</td>
<td>0.38</td>
<td>67.51</td>
<td>0.00</td>
<td>-2.30</td>
<td>-0.94</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>64.26</td>
</tr>
</tbody>
</table>

Segment Leq : 64.26 dBA
Total Leq All Segments: 67.27 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 72.83
(NIGHT): 67.27
STAMSON 5.0        NORMAL REPORT        Date: 26-05-2017 15:40:00
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: b.te  Time Period: Day/Night 16/8 hours
Description: Predicted daytime and nighttime sound levels at the upper storey windows, at Prediction Location [B]

Road data, segment # 1: BrockSB (day/night)
----------------------------------------------
Car traffic volume : 15300/1700  veh/TimePeriod  *
Medium truck volume :  945/105  veh/TimePeriod  *
Heavy truck volume :  1755/195  veh/TimePeriod  *
Posted speed limit :  70 km/h
Road gradient :  0 %
Road pavement :  1 (Typical asphalt or concrete)

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

  24 hr Traffic Volume (AADT or SADT):  20000
  Percentage of Annual Growth :  2.50
  Number of Years of Growth :  0.00
  Medium Truck % of Total Volume :  5.25
  Heavy Truck % of Total Volume :  9.75
  Day (16 hrs) % of Total Volume :  90.00

Data for Segment # 1: BrockSB (day/night)
----------------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  60.50 / 60.50  m
Receiver height           :  10.50 / 10.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: BrockNB (day/night)
----------------------------------------------
Car traffic volume : 15300/1700  veh/TimePeriod  *
Medium truck volume :  945/105  veh/TimePeriod  *
Heavy truck volume :  1755/195  veh/TimePeriod  *
Posted speed limit :  70 km/h
Road gradient :  0 %
Road pavement :  1 (Typical asphalt or concrete)

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

  24 hr Traffic Volume (AADT or SADT):  20000
  Percentage of Annual Growth :  0.00
  Number of Years of Growth :  10.00
  Medium Truck % of Total Volume :  5.25
  Heavy Truck % of Total Volume :  9.75
  Day (16 hrs) % of Total Volume :  90.00

Data for Segment # 2: BrockNB (day/night)
Angle1   Angle2 :  0.00 deg   90.00 deg
Wood depth :  0  (No woods.)
No of house rows :  0 / 0
Surface :  1  (Absorptive ground surface)
Receiver source distance :  70.50 / 70.50 m
Receiver height :  10.50 / 10.50 m
Topography :  1  (Flat/gentle slope; no barrier)
Reference angle :  0.00

Results segment # 1: BrockSB (day)
----------------------------------
Source height = 1.77 m
ROAD (0.00 + 61.71 + 0.00) = 61.71 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90</td>
<td>0.38</td>
<td>74.04</td>
<td>0.00</td>
<td>-8.37</td>
<td>-3.95</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>61.71</td>
</tr>
</tbody>
</table>

Segment Leq : 61.71 dBA

Results segment # 2: BrockNB (day)
----------------------------------
Source height = 1.77 m
ROAD (0.00 + 60.79 + 0.00) = 60.79 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90</td>
<td>0.38</td>
<td>74.04</td>
<td>0.00</td>
<td>-9.29</td>
<td>-3.95</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>60.79</td>
</tr>
</tbody>
</table>

Segment Leq : 60.79 dBA

Total Leq All Segments: 64.28 dBA

Results segment # 1: BrockSB (night)
------------------------------------
Source height = 1.77 m
ROAD (0.00 + 55.18 + 0.00) = 55.18 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
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</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90</td>
<td>0.38</td>
<td>67.51</td>
<td>0.00</td>
<td>-8.37</td>
<td>-3.95</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>55.18</td>
</tr>
</tbody>
</table>

Segment Leq : 55.18 dBA
Results segment # 2: BrockNB (night)
------------------------------------

Source height = 1.77 m

ROAD (0.00 + 54.26 + 0.00) = 54.26 dBA

<table>
<thead>
<tr>
<th>Angle1</th>
<th>Angle2</th>
<th>Alpha</th>
<th>RefLeq</th>
<th>P.Adj</th>
<th>D.Adj</th>
<th>F.Adj</th>
<th>W.Adj</th>
<th>H.Adj</th>
<th>B.Adj</th>
<th>SubLeq</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.38</td>
<td>67.51</td>
<td>0.00</td>
<td>-9.29</td>
<td>-3.95</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>54.26</td>
</tr>
</tbody>
</table>

Segment Leq : 54.26 dBA

Total Leq All Segments: 57.75 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 64.28
(NIGHT): 57.75