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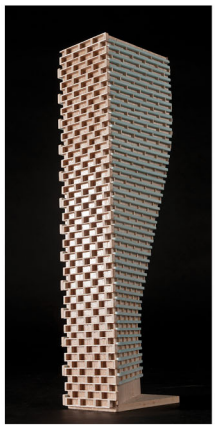
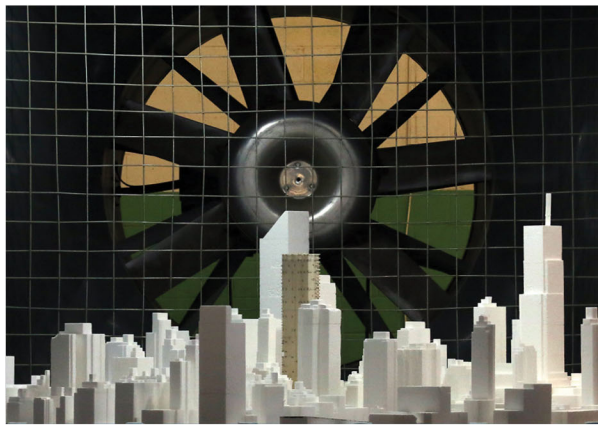
ROADWAY TRAFFIC NOISE ASSESSMENT

91-93 Holland Avenue
Ottawa, Ontario

REPORT: GW21-033 - Traffic Noise Study





January 23, 2025

PREPARED FOR

Derek Nicholson
c/o Chmiel Architects
109 Bank Street, Suite 200
Ottawa, ON, K1P 5N5

PREPARED BY

Efser Kara, MSc., LEED GA
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment undertaken for the proposed residential apartment development located at 91-93 Holland Avenue in Ottawa, Ontario. The development is a nine-storey building with commercial units at grade, and residential units comprising the remaining floors above. An outdoor amenity area is provided on the building rooftop. The major sources of traffic noise are Holland Avenue to the west of the site, and Wellington Street West to the south. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings of the development prepared by Chmiel Architects Inc., dated February 2024.

The results of the current analysis indicate that noise levels will range between 56 and 71 dBA during the daytime period (07:00-23:00) and between 49 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level (71 dBA) occurs along the front façade of the building, which is most exposed to Holland Road. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Table 4 and Figure 3.

Results of the calculations also indicate that the building will require forced air heating systems with central air conditioning, or similar mechanical system, which will allow occupants to keep windows closed and maintain a comfortable living/working environment. The following Type D Warning Clause[1] will be required on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Furthermore, sound levels at the rooftop amenity area fall below OLA criteria as noted in Section 4.2.1. Thus, mitigation at this area is not necessary.

[1] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 8

Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses. The building will be designed to comply with the ENCG Sound Level Limits and City of Ottawa Noise By-Law No. 2017-255.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Chmiel Architects, on behalf of Derek Nicholson, to undertake a roadway traffic noise assessmentfor the proposed residential apartment development located at 91 and 93 Holland Avenue in Ottawa, Ontario (hereinafter referred to as "study building" or "proposed development"). This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local roadway traffic.

The assessment is based on (i) theoretical noise prediction methods that conform to the City of Ottawa Environmental Noise Control Guidelines (ENCG); (ii) noise level criteria as specified by the ENCG guidelines; (iii) future vehicular traffic volumes corresponding to roadway classification and roadway traffic volumes obtained from the City of Ottawa[2]; and (iv) architectural drawings of the development prepared by Chmiel Architects Inc., dated February 2024.

2. TERMS OF REFERENCE

The proposed development is located at 91-93 Holland Avenue between Wellington Street West and Armstrong Avenue. The singular building comprises a nine-storey building plus mechanical penthouse, above one level of underground parking. The grade comprises of commercial space and a residential lobby facing Holland Avenue along the front facade. Access to the underground parking is provided by a ramp in the rear. Levels 2 through 9 comprise residential units with protruding balconies on the west and east façades. Above Level 9, the mechanical penthouse level comprises mechanical space along the east and an elevator lobby on the west which opens to a rooftop amenity terrace.

The study building is surrounded by mostly low-rise residential buildings to the east, west and north, with taller buildings to the south which front Wellington Street West and Holland Avenue. Directly on the south

[2] City of Ottawa Environmental Noise Control Guidelines, January 2016

side of the study building is a mid-rise apartment building of similar height, and farther south, a high-rise building fronting Wellington Street West.

The major source of traffic noise impacting the development is Holland Avenue directly to the west of the site, and Wellington Street West approximately 80 meters to the south. The Tunney's Pasture LRT Corridor and Highway 417 are each more than 500 meters to the north and south of the site respectively, and therefore are not included in the analysis.

The outdoor amenity areas analyzed in this assessment include both sides of the rooftop amenity. Although the development features private balconies, these are not considered to be noise-sensitive unless they are greater than 4 metres in depth, as per provincial noise guidelines. Figure 1 illustrates a site plan with surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, and (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4.2 of this report.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For vehicle traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time-varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time-varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00)/8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The NPC-300 guidelines specify that the recommended indoor noise limit range (that is relevant to this study) is 45 and 40 dBA for residence living rooms and sleeping quarters, respectively, as listed in Table 1. However, to account for deficiencies in building construction and to control peak noise, these levels should be targeted toward 47, 42, and 37 dBA.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [3]

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

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider

[3] Adapted from Table C-2, Part C, Section 3.2.3 of NPC-300
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125

the need for having windows and doors closed, which normally triggers the need for central air conditioning (or similar systems). Where noise levels exceed 65 dBA daytime, and 60 dBA nighttime building components will require higher levels of sound attenuation[5].

For designated Outdoor Living Areas (OLAs), the sound level limit is 55 dBA during the daytime period. An excess above the limit, between 55 dBA and 60 dBA, is acceptable only in cases where the required noise control measures are not feasible for technical, economic, or administrative reasons. The development proposes several terraces on top of the podium roof sections. As such, these terraces have been identified as noise sensitive OLAs and were included in the assessment. Furthermore, balconies and terraces extending less than 4 metres in depth from the façade do not require consideration as Outdoor Living Areas and were excluded from the analysis.

4.2.2 Roadway Traffic Volumes

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Class	Speed Limit (km/h)	Ultimate AADT	Day/Night Split	Truck Volume Percentages	
					Medium Truck	Heavy Truck
Holland Avenue	4-Lane Major Collector	50	**24,000**	92/8	7	5
Wellington Street West	2-Lane Urban Arterial	40	**15,000**			

[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[6] City of Ottawa Transportation Master Plan, November 2013

4.2.3 Theoretical Traffic Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix B includes the STAMSON 5.04 input and output data.

Roadway traffic noise calculations were performed by treating each roadway segment as a separate line source of noise, and by using proposed and existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Vehicle parameters such as truck traffic volume percentages, posted speed limit, and day/night split are summarized in Table 2.
- Default ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Noise receptors were strategically placed at 5 locations around the study area (see Figure 2).
- For select sources where appropriate, receptors considered the proposed and existing building as a barrier partially or fully obstructing exposure to the source.
- Receptor distances and exposure angles are illustrated in Figure A1 and A2.

5. RESULTS

5.1 Roadway Traffic Noise Levels

The results of the current analysis indicate that noise levels will range between 56 and 71 dBA during the daytime period (07:00-23:00) and between 49 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level (71 dBA) occurs along the front façade of the building, which is most exposed to Holland Road.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON Roadway Noise Level (dBA)	
			Day	Night
1	25.5	POW – 9th Floor – West Façade	71	63
2	25.5	POW – 9th Floor – North Façade	67	60
3	25.5	POW – 9th Floor – East Façade	56	49
4	28.5	OLA – Rooftop Terrace	53	N/A*
5	28.5	OLA – Rooftop Terrace	53	N/A*

**Nighttime noise levels not considered at OLA receptors, as per ENCG*

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components for the development. As discussed in Section 4.2, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels + safety factor). As per NPC-300 requirements, detailed STC calculations will be required to be completed prior to building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 3). Where specific updated building components are not identified, bedroom/living room/retail windows are to satisfy Ontario Building Code (OBC 2020) requirements.

TABLE 4: NOISE CONTROL REQUIREMENTS

Façade	Floor Number	Window STC (Bedroom/Living Room/Retail)	Exterior Wall STC	Warning Clauses	A/C
West	1-9	33/28	45	D	Yes
North	1-9	29			

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 56 and 71 dBA during the daytime period (07:00-23:00) and between 49 and 63 dBA during the nighttime period (23:00-07:00). The highest noise level (71 dBA) occurs along the front façade of the building, which is most exposed to Holland Road. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Table 4 and Figure 3.

Results of the calculations also indicate that the building will require forced air heating systems with central air conditioning, or similar mechanical system, which will allow occupants to keep windows closed and maintain a comfortable living/working environment. The following Type D Warning Clause[7] will be required on all Lease, Purchase and Sale Agreements, as summarized below:

Type D:

> *"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 the Environment."*

Furthermore, sound levels at the rooftop amenity area fall below OLA criteria as noted in Section 4.2.1. Thus, mitigation at this area is not necessary.

Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses. The building will be designed to comply with the ENCG Sound Level Limits and City of Ottawa Noise By-Law No. 2017-255.

[7] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 8

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

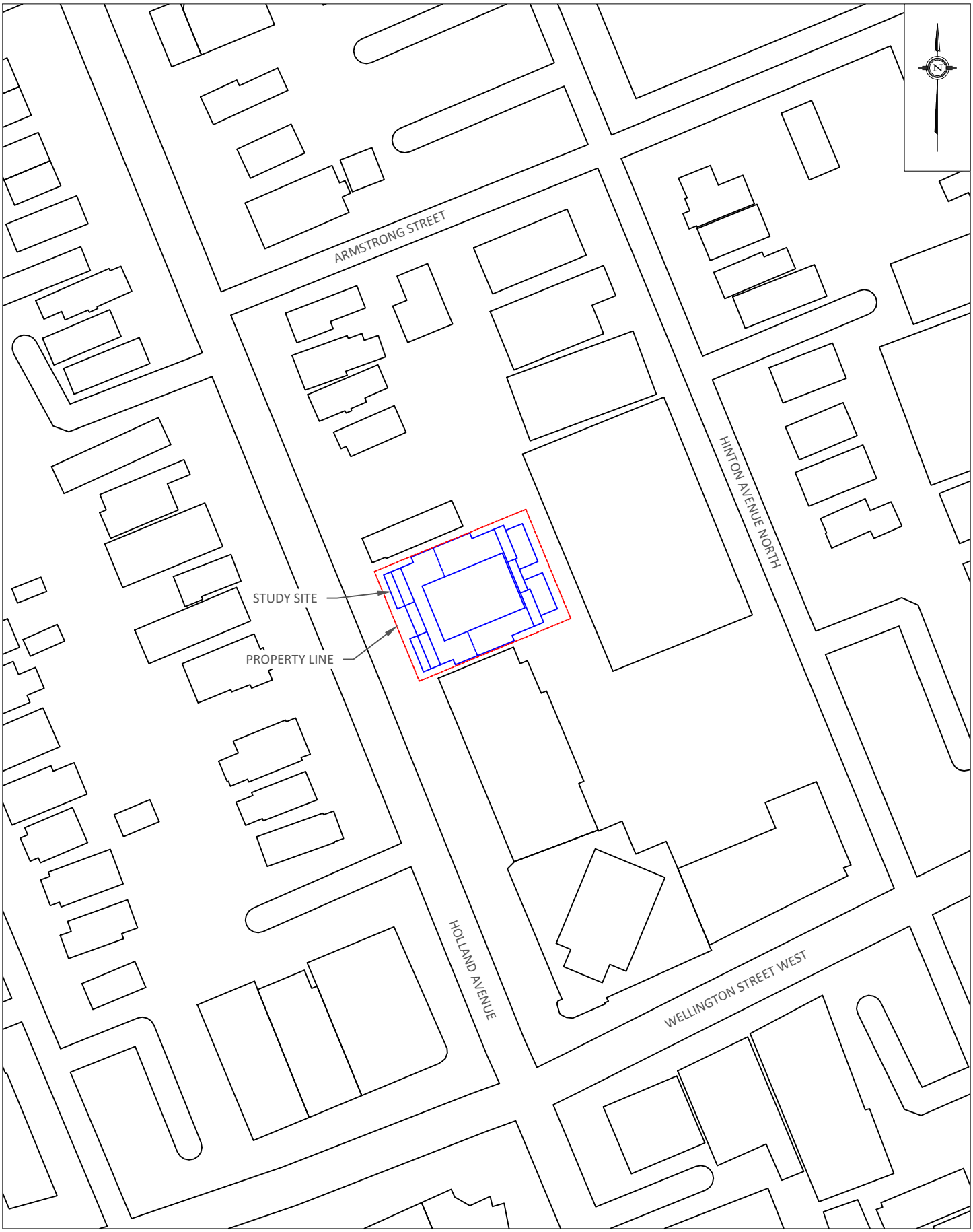
Sincerely,

Gradient Wind Engineering Inc.

Efser Kara, MSc, Leed GA.
Acoustic Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #21-033-Traffic Noise



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PROJECT	91-93 HOLLAND AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW21-033-1
DATE	MARCH 20, 2024	DRAWN BY	A.B.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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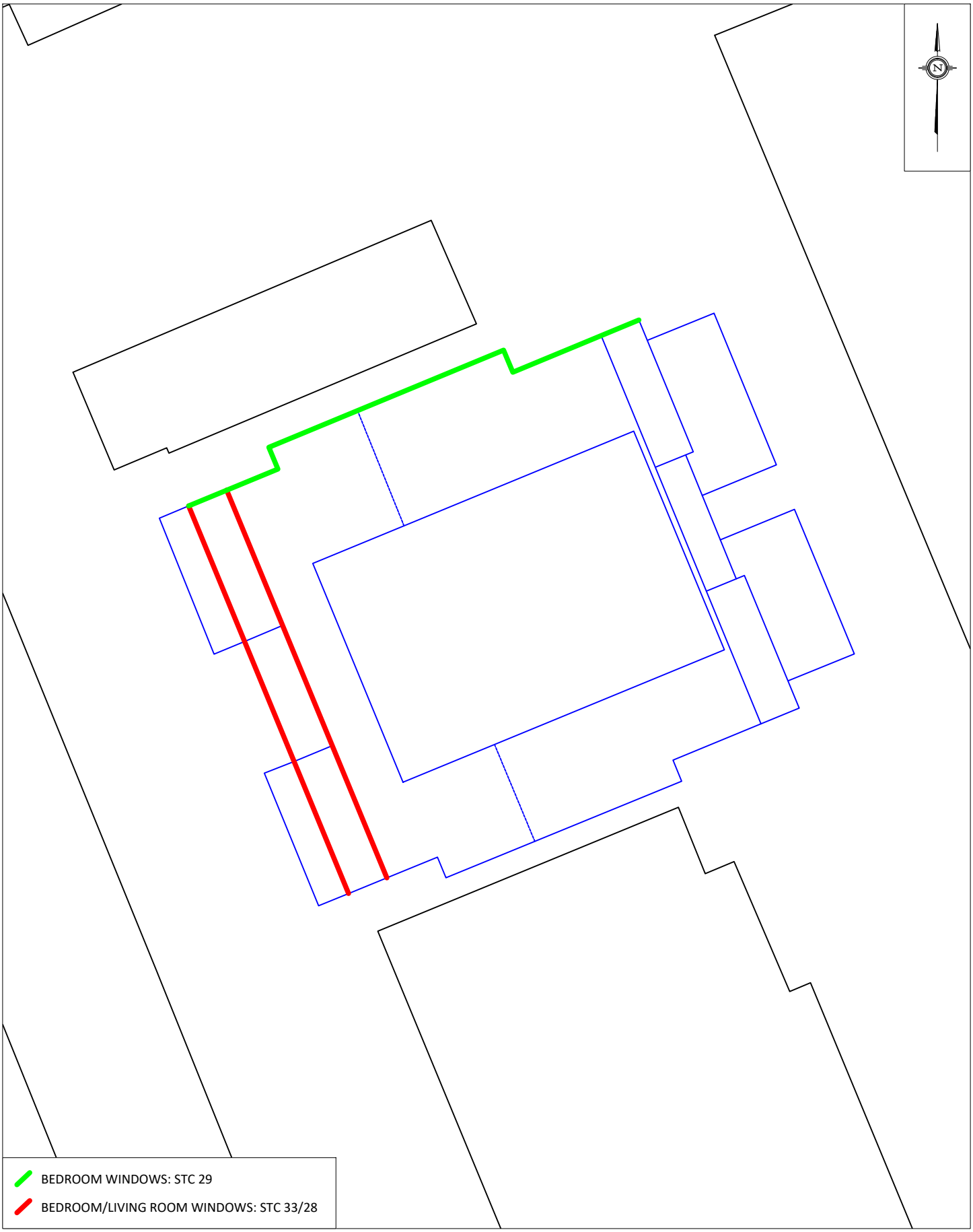
PROJECT	91-93 HOLLAND AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:250 (APPROX.)
DRAWING NO.	GW21-033-2
DATE	MARCH 20, 2024
DRAWN BY	A.B.

DESCRIPTION

FIGURE 2:
TRAFFIC NOISE RECEPTOR LOCATIONS



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PROJECT	91-93 HOLLAND AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:250 (APPROX.)	DRAWING NO.	GW21-033-3
DATE	MARCH 20, 2024	DRAWN BY	A.B.

FIGURE 3:
STC WINDOW REQUIREMENTS

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APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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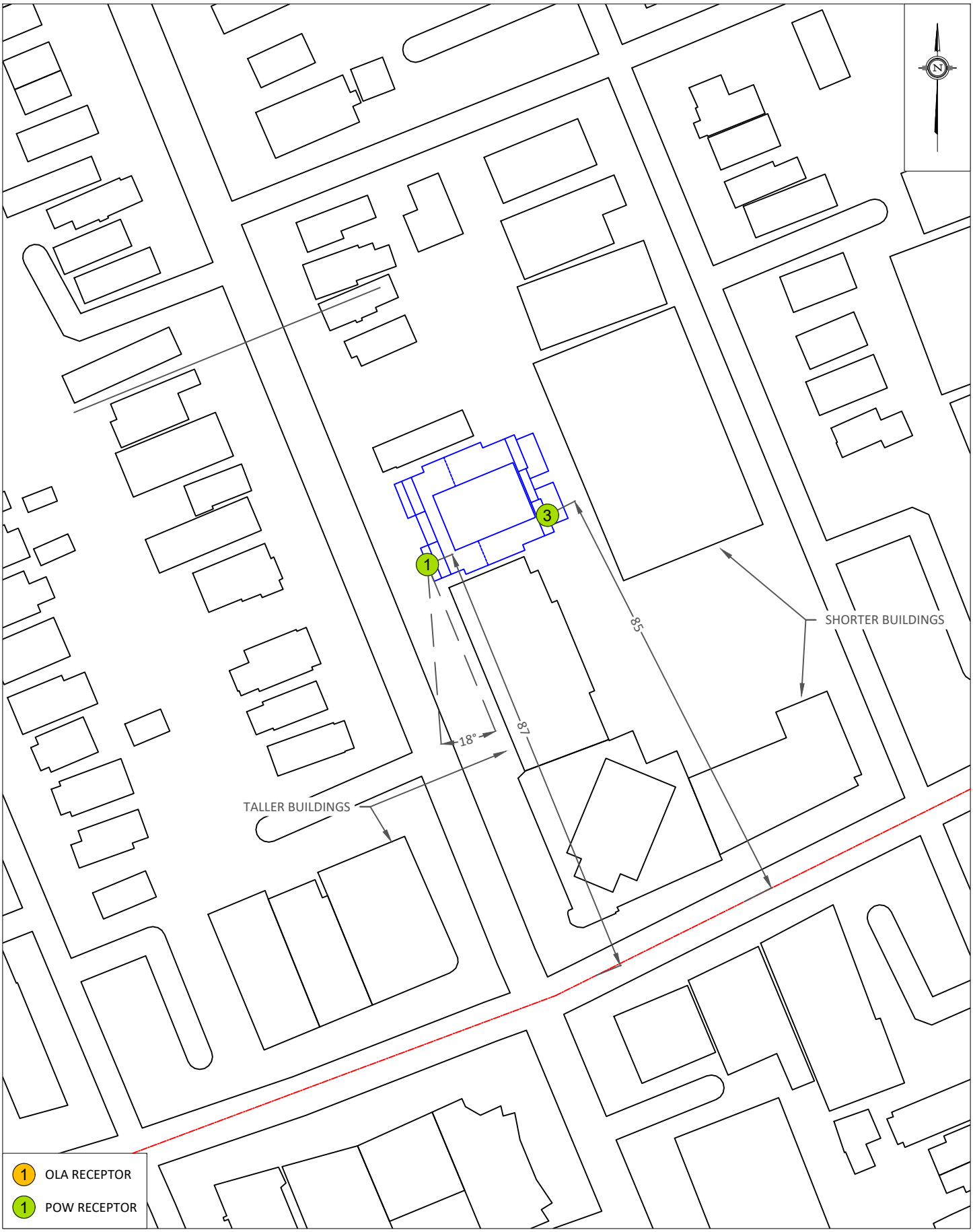
PROJECT	91-93 HOLLAND AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:500 (APPROX.)
DRAWING NO.	GW21-033-A1
DATE	MARCH 20, 2024
DRAWN BY	A.B.

DESCRIPTION

FIGURE A1:
RECEPTOR DISTANCES AND EXPOSURE ANGLES



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PROJECT	91-93 HOLLAND AVENUE, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW21-033-A2
DATE	MARCH 20, 2024
DRAWN BY	A.B.

DESCRIPTION

FIGURE A2:
RECEPTOR DISTANCES AND EXPOSURE ANGLES

STAMSON 5.0 NORMAL REPORT Date: 18-03-2024 12:41:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R1.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: Holland (day/night)
-------------------------------------------
Car traffic volume  : 19430/1690  veh/TimePeriod  *
Medium truck volume :  1546/134   veh/TimePeriod  *
Heavy truck volume  :  1104/96    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  24000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Holland (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Road data, segment # 2: Wellington (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 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):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00
```

```
Data for Segment # 2: Wellington (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   -72.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  87.00 / 87.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Holland (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 70.52 + 0.00) = 70.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  70.52   0.00   0.00   0.00   0.00   0.00   0.00  70.52
-------------------------------------------------------------------------------

Segment Leq : 70.52 dBA

Results segment # 2: Wellington (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 49.05 + 0.00) = 49.05 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -72   0.00  66.69   0.00  -7.63 -10.00   0.00   0.00   0.00  49.05
-------------------------------------------------------------------------------

Segment Leq : 49.05 dBA

Total Leq All Segments: 70.55 dBA

Results segment # 1: Holland (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.92 + 0.00) = 62.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  62.92   0.00   0.00   0.00   0.00   0.00   0.00  62.92
-------------------------------------------------------------------------------

Segment Leq : 62.92 dBA

Results segment # 2: Wellington (night)
```

```
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 41.45 + 0.00) = 41.45 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90    -72   0.00  59.09   0.00  -7.63 -10.00   0.00   0.00   0.00  41.45
-------------------------------------------------------------------------------

Segment Leq : 41.45 dBA

Total Leq All Segments: 62.95 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 70.55
                           (NIGHT): 62.95
```

```
STAMSON 5.0          NORMAL REPORT          Date: 18-03-2024 12:42:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R2.te                    Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Holland (day/night)
----------------------------------------
Car traffic volume  : 19430/1690  veh/TimePeriod  *
Medium truck volume :  1546/134   veh/TimePeriod  *
Heavy truck volume  :  1104/96    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  24000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Holland (day/night)
----------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  16.00 / 16.00  m
Receiver height           :  25.50 / 25.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Holland (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 67.23 + 0.00) = 67.23 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  70.52   0.00  -0.28  -3.01   0.00   0.00   0.00  67.23
-------------------------------------------------------------------------------

Segment Leq : 67.23 dBA

Total Leq All Segments: 67.23 dBA

Results segment # 1: Holland (night)
------------------------------------
```

```
Source height = 1.50 m

ROAD (0.00 + 59.63 + 0.00) = 59.63 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  62.92   0.00  -0.28  -3.01   0.00   0.00   0.00  59.63
-------------------------------------------------------------------------------

Segment Leq : 59.63 dBA

Total Leq All Segments: 59.63 dBA

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

STAMSON 5.0 NORMAL REPORT Date: 18-03-2024 14:04:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: Wellington (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    40 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):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Wellington (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  85.00 / 85.00  m
Receiver height           :  25.50 / 28.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Wellington (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.14 + 0.00) = 56.14 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  66.69   0.00  -7.53  -3.01   0.00   0.00   0.00  56.14
-------------------------------------------------------------------------------

Segment Leq : 56.14 dBA

Total Leq All Segments: 56.14 dBA

Results segment # 1: Wellington (night)
---------------------------------------
```

```
Source height = 1.50 m

ROAD (0.00 + 48.55 + 0.00) = 48.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  59.09   0.00  -7.53  -3.01   0.00   0.00   0.00  48.55
-------------------------------------------------------------------------------

Segment Leq : 48.55 dBA

Total Leq All Segments: 48.55 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.14
                           (NIGHT): 48.55
```

STAMSON 5.0 NORMAL REPORT Date: 18-03-2024 13:33:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: Holland (day/night)
-------------------------------------------
Car traffic volume  : 19430/1690  veh/TimePeriod  *
Medium truck volume :  1546/134   veh/TimePeriod  *
Heavy truck volume  :  1104/96    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  24000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Holland (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   61.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  20.00 / 20.00  m
Receiver height           :  28.50 / 28.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 61.00 deg
Barrier height            :  28.10 m
Barrier receiver distance :   4.00 / 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: Holland (day)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       28.50 !       23.10 !        23.10
```

```
ROAD (0.00 + 52.58 + 0.00) = 52.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     61   0.00  70.52   0.00  -1.25  -0.76   0.00   0.00 -15.93  52.58
-------------------------------------------------------------------------------

Segment Leq : 52.58 dBA

Total Leq All Segments: 52.58 dBA

Results segment # 1: Holland (night)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       28.50 !       23.10 !        23.10

ROAD (0.00 + 44.98 + 0.00) = 44.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     61   0.00  62.92   0.00  -1.25  -0.76   0.00   0.00 -15.93  44.98
-------------------------------------------------------------------------------

Segment Leq : 44.98 dBA

Total Leq All Segments: 44.98 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 52.58
                           (NIGHT): 44.98
```

```
STAMSON 5.0        NORMAL REPORT        Date: 18-03-2024 12:46:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R5.te                 Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Holland (day/night)
----------------------------------------
Car traffic volume  : 19430/1690  veh/TimePeriod  *
Medium truck volume :  1546/134   veh/TimePeriod  *
Heavy truck volume  :  1104/96    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  24000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Holland (day/night)
----------------------------------------
Angle1   Angle2           : -61.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  20.00 / 20.00  m
Receiver height           :  28.50 / 28.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -61.00 deg   Angle2 : 90.00 deg
Barrier height            :  28.10 m
Barrier receiver distance :   4.00 / 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: Holland (day)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       28.50 !       23.10 !        23.10
```

```
ROAD (0.00 + 52.58 + 0.00) = 52.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -61     90   0.00  70.52   0.00  -1.25  -0.76   0.00   0.00 -15.93  52.58
-------------------------------------------------------------------------------

Segment Leq : 52.58 dBA

Total Leq All Segments: 52.58 dBA

Results segment # 1: Holland (night)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       28.50 !       23.10 !        23.10

ROAD (0.00 + 44.98 + 0.00) = 44.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -61     90   0.00  62.92   0.00  -1.25  -0.76   0.00   0.00 -15.93  44.98
-------------------------------------------------------------------------------

Segment Leq : 44.98 dBA

Total Leq All Segments: 44.98 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 52.58
                           (NIGHT): 44.98
```