# Early Works Noise Report

Highway 400 – Highway 404 Link (Bradford Bypass)
County Road 4 Early Works
GWP 2008-21-00

Ontario Ministry of Transportation

Project number: 60636190

March 2022

Delivering a better world

AECOM

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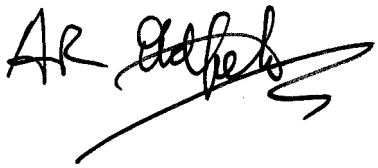
*AECOM: 2015-04-13*

## Quality information

**Prepared by**

James Au. P.Eng. INCE
Senior Acoustic Engineer

**Checked by**



Alan Oldfield, MEng, CEng(UK), P.Eng.
AVP, Department Manager – Air + EHS + Acoustics

## Revision History

| Revision | Revision date | Details |
|---|---|---|
| 0 | March 16, 2022 | Original Document |
| | | |
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| | | |

## Distribution List

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## Prepared for:

Ontario Ministry of Transportation

## Prepared by:

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# Appendicies

# 1. Introduction

The Ontario Ministry of Transportation (MTO) has retained AECOM Canada Ltd. (AECOM) to undertake the Early Works study for the grade separated bridge crossing at County Road 4 for the future Bradford Bypass (Highway 400 – Highway 404 Link) Project, in accordance with the provisions of the Ontario Regulation (O. Reg.) 697/21. The limits of construction work are located along County Road 4 from 8th Line to the intersection with 9th Line in the Town of Bradford West Gwillimbury and that area is referred to as the Study Area. This study will advance as an early works project for the Bradford Bypass. The new bridge will be designed to include the widening and underpass of County Road 4 approved by Simcoe County. The construction for the road widening and the bridge structure are referred to as the Project in this report. The Project extents are depicted in **Figure 1.**

The assessment of traffic noise from the overall Bradford Bypass will be conducted in a separate scope of work.

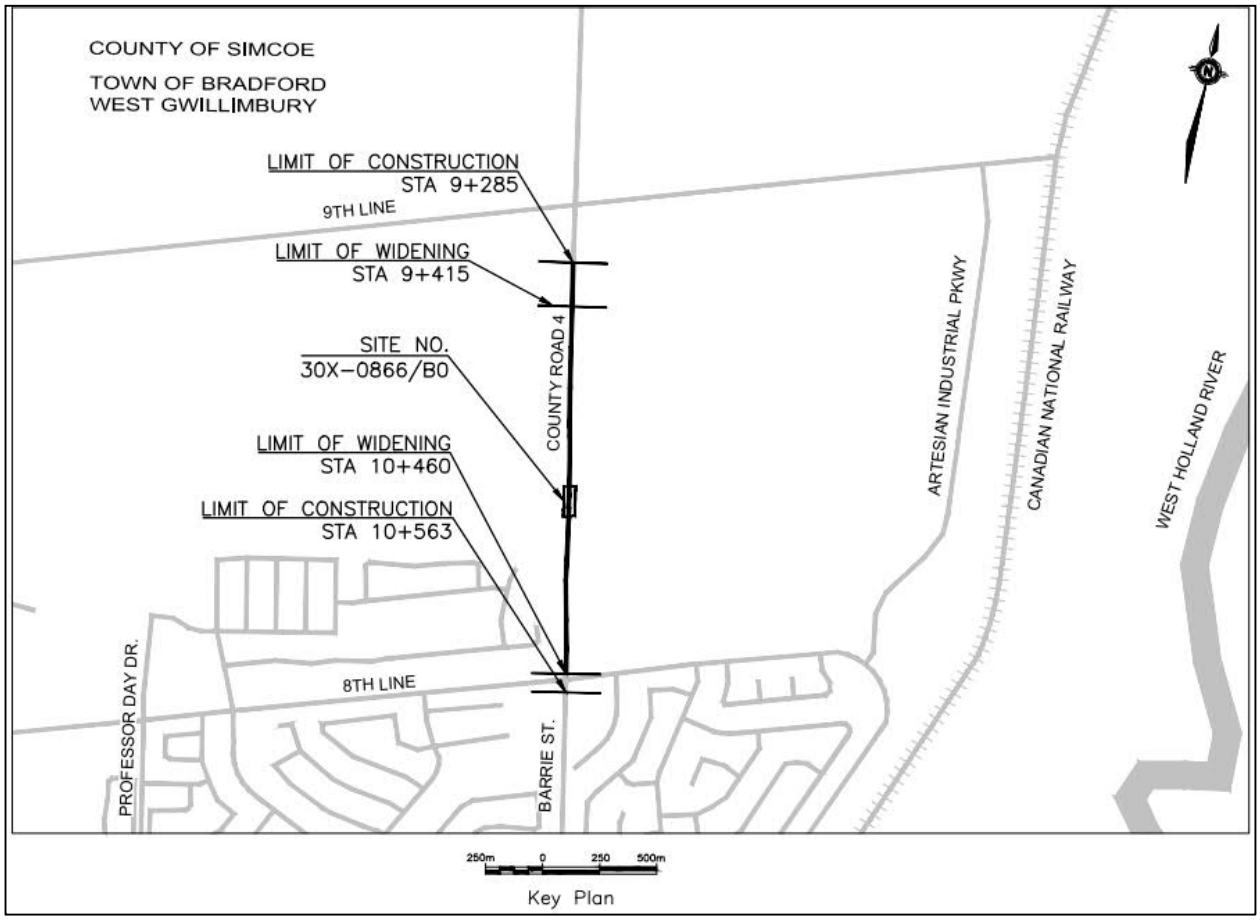
The purpose of this report is to provide a traffic noise assessment of the project area for the assessment of:

- Temporary detour of County Road 4 near the new bridge structure; and
- County Road 4 with change in grade with the proposed bridge structure

A figure showing the key plan of the project area is provided as **Figure 1**.

This report has been prepared in accordance with the methods and procedures recommended in the MTO Environmental Guide for Noise (reference #1 – the MTO Guide). Relevant guidelines from the Ministry of Environment, Conservation and Parks (MECP) and local municipal noise control bylaws are also considered in this assessment.

**Figure 1: Key Plan**




# 2. Environmental Noise Guidelines

## 2.1 Provincial Noise Guidelines

This assessment has been completed in accordance with the MTO's *Environmental Guide for Noise* (the MTO Guide) published in 2006. Under the MTO Guide, the "noise impact" is defined as the difference between the "No Project" and the "With Project" noise levels during the subject year of assessment (Horizon Year), which is typically 10 years post-construction.

The location of assessment is an outdoor location associated with the representative receptor. The MTO Guide requires that the most exposed side of a dwelling unit be assessed as part of an initial screening. Where the future noise level with the proposed improvements at the most exposed side result in a greater than 5 dBA increase over the future noise level without the proposed improvements; or the projected noise level is equal to or is greater than 65 dBA, the future noise level must be predicted in the OLA to determine the significance of the noise impact. Where the future noise level with the proposed improvements in the OLA result in a greater than 5 dBA increase over the future noise level without the proposed improvements; or the projected noise level is equal to or is greater than 65 dBA, the following must occur:

- noise control measures investigated within the right-of-way;
- if a minimum attenuation of 5 dBA can be achieved in the OLA averaged over first row receivers, the selected measures within the right-of-way are to be implemented.

The OLA can be situated on any side of a noise sensitive area which accommodates outdoor living activities, and is generally taken to be the backyard. For this assessment, the location has been taken as 3 metres from the façade with a height of 1.5 metres above ground level.

Where increases in noise levels are predicted, the mitigation efforts to be applied for the predicted change in noise level above the ambient and the projected noise level with the proposed improvements are shown in **Table 1**.

**Table 1: Mitigation Effort Required**

| Change in Noise Level Above Future Ambient[1]/Projected Noise Levels with Proposed Improvements | Mitigation Effort Required |
|---|---|
| < 5 dB Change<br>AND<br><65 dBA Overall | • None |
| ≥ 5 dB Change<br>OR<br>≥ 65 dBA Overall | • Investigate noise control measures on right of way<br>• Introduce noise control measures within right of way and mitigate to ambient if technically, economically, and administratively feasible.<br>• Noise control measures, where introduced, should achieve a minimum of 5 dBA attenuation, over first row receivers. |

The determination of whether or not mitigation is provided must be based on the review of technical, economical and administrative feasibility:

- Technical Feasibility: Review the constructability of the noise mitigation (i.e. design of wall, roadside safety, shadow effect, topography, achieve a 5 dBA reduction, ability to provide a continuous barrier)
- Economic Feasibility: Carry out a cost/benefit assessment of the noise mitigation (i.e., determine cost per benefited receiver)
- Administrative Feasibility: Determine the ability to locate the noise mitigation on lands within public ownership (i.e., provincial or municipal right-of-way)

The MTO Guide recognizes that an important assessment criterion for the existing noise sensitive areas (NSAs) is the change in noise level above ambient sound levels. **Table 2**, adapted from various sources (see footnote), complements the MTO Guide and represents the perceived impact of changes in sound level.

**Table 2: Perceived Impact of Increased Sound Levels[2]**

| Increased Sound Level Above Ambient (dB) | Perception | Perceived Impact |
|---|---|---|
| 0 to 3 | Potentially Perceptible | Minor |
| 3 to 5 | Perceptible | Low |
| 5 to 10 | Up to twice as loud | Medium |
| Greater than 10 | Twice as loud or greater | High |

## 2.2 Municipal Noise Guidelines

[1] Noise impact
[2] Adapted from "Engineering Noise Control, Theory and Practice" 4th edition, David A. Bies and Colin H. Hansen, 2009, and MOEE/GO Transit "Noise and Vibration Protocol" 1995

Noise in the Town of Bradford West Gwillimbury is regulated using Noise By-law 2008-083. As with most municipal guidelines, the By-law is directed mainly at typical residential and commercial concerns and addresses those concerns in a qualitative manner. The relevant sections of the By-law are presented below:

- General prohibitions
  - No person shall, at any time, emit, cause or permit to be emitted or cause any noise, created by:
    - The use of a horn, whistle, alarm bell, gong or the like, except for an auditory safety or warning device or chimes used in association with a religious establishment
    - The idling of a vehicle motor in excess of 30 minutes except
      - When such idling is recommended by the manufacturer of such vehicle and proof of such recommendation is provided by the vehicle operator upon the request of a police officer
      - When such idling is necessary to the basic function of the equipment on a vehicle such as concrete mixer on a concrete mixing truck, a lift platform, a refuse compactor or a heat exchange system
      - When the weather conditions require the vehicle to idle in order to keep in operation a heating or refrigeration system necessary for the welfare or preservation of the cargo of such vehicle
    - The operation of a combustion engine or pneumatic device without an effective exhaust or intake muffling device in proper working order and in constant operation
- Prohibitions by time and place
  - No person shall emit ,cause or permit to be emitted or caused any noise created by an activity listed in Schedule “A” of this By-law during the time and in the area such noise is prohibited as set out in Schedule “A”
- Schedule “A” items
  - The venting or release of steam, the operation of a generator or air filtration system, noise from grinding, milling, the operation of machinery, or the like is prohibited:
    - From 9:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in residential areas
    - From 11:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in other areas
  - Loading, unloading, packing, unpacking, delivering or otherwise handling any container, product or material unless necessary for the maintenance of essential services or for the moving of private household effects is prohibited:
    - From 9:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in residential areas
    - From 11:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in other areas
  - The operation of any tool including a hammer, saw, nail gun, lawnmower, staple gun, hedge trimmer, drill or the like is prohibited:
    - From 9:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in residential areas
  - The operation of construction equipment is prohibited:
    - From 7:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays) and at all times on Sundays and holidays in residential areas

A general recommendation is to provide a notice of works letter to the municipality prior to works outside of normal By-law hours, which will allow the municipality to notify area residents.

# 3. Noise Sensitive Areas

Predicted noise levels are assessed at NSAs. Land uses designated as noise sensitive by the MTO *Environmental Guide for Noise* consist of the following:

- Private homes such as single family residences;
- Townhouses;
- Multiple unit buildings, such as apartments with OLAs for use by all occupants; and
- Hospitals, nursing homes for the aged, where there are OLA's for the patients.

Additionally, the following land uses would qualify as a NSA, provided that a new freeway/highway corridor or route is planned:

- Educational facilities and day care centres, where there are OLAs for students;
- Campgrounds that provide overnight accommodation; and
- Hotels/motels where there are OLAs for visitors.

Land uses that do not qualify as noise sensitive by the MTO *Environmental Guide for Noise* consist of the following:

- Apartment balconies above ground floor;
- Educational facilities (except dormitories with OLA's);
- Churches;
- Cemeteries;
- Parks and picnic areas which are not inherently part of a NSA;
- Daycare centres; and
- All commercial and industrial areas.

In general, the areas adjacent to the project consist mainly of agricultural usages and lands zoned for future development, with scattered residences. However, there is a concentration of residences near 8th Line. The lands zoned for future development do not yet have committed land uses and are not considered further in this analysis.

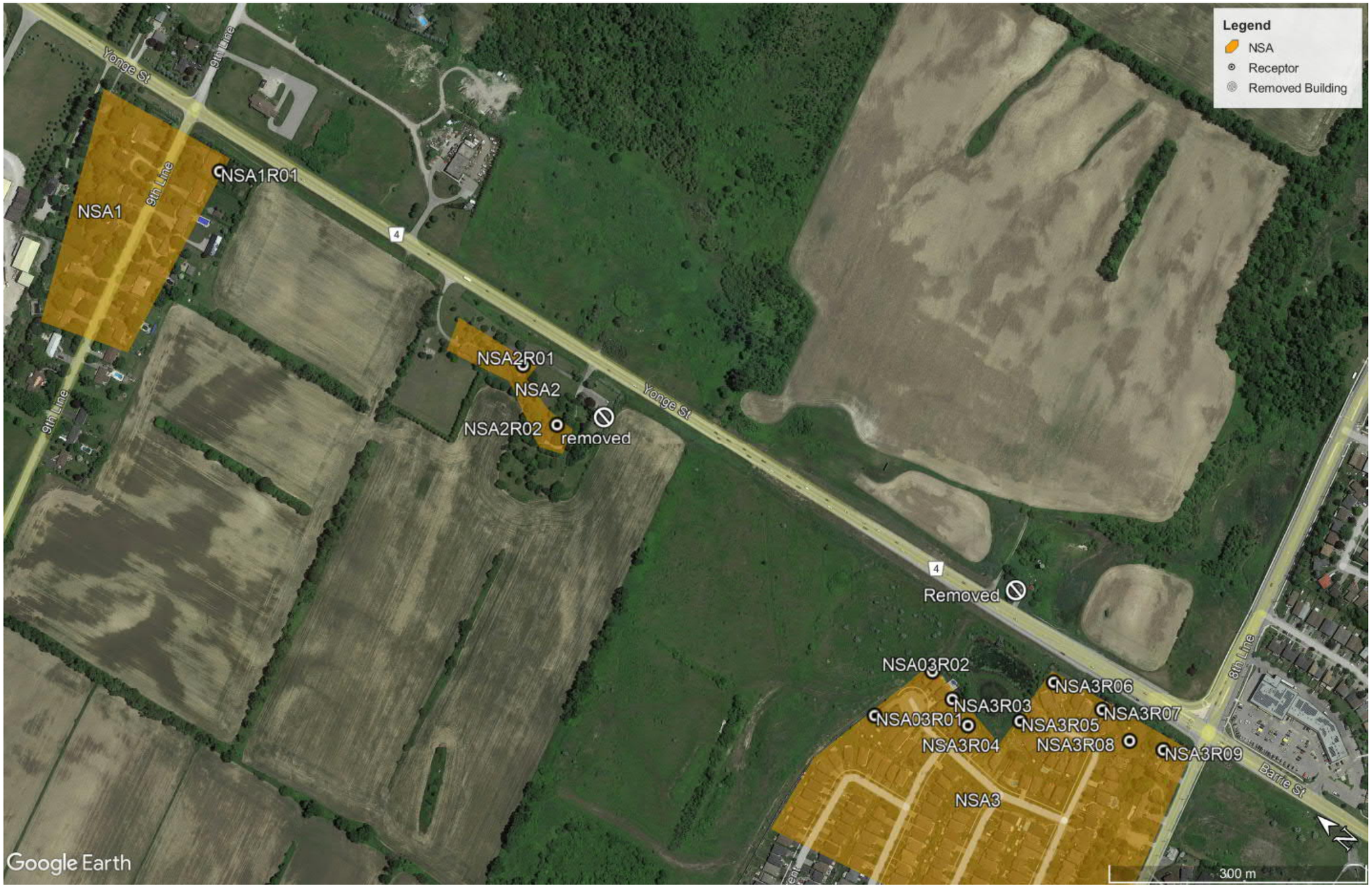
Assessed locations are presented in **Table 3** with locations provided on **Figure 2**.

**Table 3. Assessed Representative Noise Sensitive Locations**

| NSA | Representative Receptor | Receptors Represented | Description |
|---|---|---|---|
| NSA1 | NSA1R01 | 1 | Detached dwelling southwest corner of 9th Line and County Road 4 |
| NSA2 | NSA2R01 | 2 | Detached dwelling west side of County Road 4 approximately 450 metres south of 9th Line |
| | NSA2R02 | 1 | Detached dwelling west side of County Road 4 approximately 550 metres south of 9th Line |
| NSA3 | NSA3R01 | 1 | Detached dwelling north end of Meadowview Dr (west side) |
| | NSA3R02 | 3 | Detached dwelling north end of Meadowview Dr (east side) |
| | NSA3R03 | 3 | Detached dwelling east side of Meadowview Dr near Bannerman Dr |
| | NSA3R04 | 3 | Detached dwelling east side of Meadowview Dr near Bannerman Dr |

| NSA | Representative Receptor | Receptors Represented | Description |
|---|---|---|---|
| | NSA3R05 | 3 | Detached dwelling north end of Gardiner Dr |
| | NSA3R06 | 3 | Detached dwelling north end of Gardiner Dr |
| | NSA3R07 | 2 | Detached dwelling east side of Gardiner Dr |
| | NSA3R08 | 1 | Detached dwelling east side of Gardiner Dr |
| | NSA3R09 | 1 | Detached dwelling northwest corner of 8th Line and County Road 4 |

**Figure 2: NSAs and Representative Receptors**



# 4. Traffic Noise Impact Assessment

## 4.1 Noise Prediction Procedure

Traffic noise levels were calculated using the United States Federal Highway Administration's Traffic Noise Model Version 2.5 (TNM2.5). TNM2.5 was used on this project due to the complexity of the road alignment, and topography between the roadway and the assessed locations.

The prediction model inputs include the following:

- Road traffic data
  - Volumes
  - Speed limit
  - Vehicle composition (percentage Medium and Heavy Trucks)
- Ground characteristics
  - Roadway surface type (e.g. Asphalt, concrete)
  - Ground topography
  - Ground type between assessment locations and roadways
  - Roadway layout
  - Roadway profile
- Shielding effects
  - Berms
  - Barriers
  - Housing
  - Topographical features

As the County Road 4 is not considered a freeway, the assessment of the noise levels was based on the daytime 16 hour equivalent sound level ($L_{eq, 16hr}$) as required by the MTO Guide. The road surface was assumed to be constructed from typical asphalt and was modeled as the average surface type in TNM.

To assess the noise impact, the predicted "No Project" noise levels were compared to those of the predicted "With Project" noise levels. As the detour will only be in operation for the construction period, the last year of the detour usage of 2024 was used as the year of assessment. For long term road noise impacts, the horizon year of 2041 was used as the basis of assessment.

As required in the MTO Guide, noise levels on the most exposed side of a noise sensitive land use were calculated to determine if a noise mitigation investigation would be required. If a noise investigation was required, the noise levels were assessed at the OLA location, which is the point of assessment for noise mitigation as noted in the MTO Guide.

## 4.2 Traffic Data

Traffic data was provided by the design team in the form of Average Annual Daily Traffic (AADT). The detour is not expected to change the daily traffic volume. As per the traffic study report (Reference #8) completed as part of Simcoe County's 2012 Municipal Class Environmental Assessment, the road improvements (widening) will improve the service during the peak hours of traffic. The daily average annual traffic is not expected to change. Traffic was assumed to have a 90% day to 10% night distribution, typical of regional roads as per MECP guidelines. Commercial

vehicles comprise 4% of the traffic, while the distribution between medium and heavy trucks was assumed to be 5:8 (medium:heavy) as per the MTO Guide.

### 4.2.1 Temporary Detour

TNM accepts traffic data in hourly volumes. AADT information was converted into daytime hourly traffic data per lane for direct input into TNM. A summary of the traffic input is provided in **Table 4** below.

**Table 4. Daytime Average Hourly Traffic Data (2024)**

| Roadway | No Project – 2 lanes | | | | With Project – 2 lanes | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | Auto | Med Trk | Hvy Trk | Speed Limit (kph) | Auto | Med Trk | Hvy Trk | Speed Limit (kph) | |
| County Road 4 (AADT 21900) | 592 | 10 | 16 | 50/80 | 592 | 10 | 16 | 50/80 | 1, 2 |

*Notes: (1) hourly data by lane*

*(2) speed limit is generally 80 km/hr, however, changes to 50 km/hr from approximately 430 metres north of 8th Line.*

### 4.2.2 Change in Grade

Similar to the above, AADT information was converted into daytime hourly traffic data per lane for direct input into TNM. A summary of the traffic input is provided in **Table 5** below.

**Table 5. Daytime Average Hourly Traffic Data (2041)**

| Roadway | No Project – 2 lanes | | | | With Project – 4 lanes | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | Auto | Med Trk | Hvy Trk | Speed Limit (kph) | Auto | Med Trk | Hvy Trk | Speed Limit (kph) | |
| County Road 4 (AADT 25200) | 681 | 11 | 18 | 50/80 | 341 | 6 | 9 | 50/80 | 1,2 |

*Notes: (1) hourly data by lane*

*(2) speed limit is generally 80 km/hr, however, changes to 50 km/hr from approximately 430 metres north of 8th Line.*

## 4.3 Impact Assessment

Road geometry and traffic data were input into TNM to predict the noise levels for the various scenarios required to assess both the 2024 temporary detour and the 2041 change in grade. Assessment results are in the below subsections.

### 4.3.1 Temporary Detour

Predicted noise levels and the assessment results for the temporary detour of County Road 4 are presented in **Table 6** below.

**Table 6: Noise Impact Assessment – Temporary Detour**

| Assessment Location | Predicted $L_{eq,\ 16}$ (dBA) | | Change (dB) | Perceived Noise Impact | Below Criteria (Yes/No) | |
|---|---|---|---|---|---|---|
| | No Project | With Project | | | <5 dB Change | <65 dBA |
| NSA1R01 | 61 | 61 | 0 | Minor | Yes | Yes |
| NSA2R01 | 60 | 59 | -1 | Negligible | Yes | Yes |
| NSA2R02 | 54 | 54 | 0 | Minor | Yes | Yes |
| NSA3R01 | 49 | 48 | -1 | Negligible | Yes | Yes |
| NSA3R02 | 54 | 53 | -1 | Negligible | Yes | Yes |
| NSA3R03 | 45 | 45 | 0 | Minor | Yes | Yes |

| Assessment Location | Predicted $L_{eq, 16}$ (dBA) | | Change (dB) | Perceived Noise Impact | Below Criteria (Yes/No) | |
|---|---|---|---|---|---|---|
| | No Project | With Project | | | <5 dB Change | <65 dBA |
| NSA3R04 | 52 | 51 | -1 | Negligible | Yes | Yes |
| NSA3R05 | 50 | 48 | -2 | Negligible | Yes | Yes |
| NSA3R06 | 51 | 50 | -1 | Negligible | Yes | Yes |
| NSA3R07 | 58 | 59 | 1 | Minor | Yes | Yes |
| NSA3R08 | 58 | 58 | 1 | Minor | Yes | Yes |
| NSA3R09 | 52 | 52 | 0 | Minor | Yes | Yes |

Results in the above table show that the predicted noise level changes due to the temporary detour of County Road 4 are less than 5 dB, and the overall noise levels are less than 65 dBA, therefore consideration of noise mitigation is not required.

### 4.3.2 Change in Grade

Predicted noise levels and the assessment results for the change in grade of County Road 4 (including the widening to 4 lanes) are presented in **Table 7** below.

**Table 7: Noise Impact Assessment – Change in Grade**

| Assessment Location | Predicted $L_{eq, 24}$ (dBA) | | Change (dB) | Perceived Noise Impact | Below Criteria (Yes/No) | |
|---|---|---|---|---|---|---|
| | No Project | With Project | | | <5 dB Change | <65 dBA |
| NSA1R01 | 62 | 62 | 0 | Minor | Yes | Yes |
| NSA2R01 | 60 | 60 | 0 | Minor | Yes | Yes |
| NSA2R02 | 55 | 56 | 1 | Minor | Yes | Yes |
| NSA3R01 | 49 | 50 | 1 | Minor | Yes | Yes |
| NSA3R02 | 55 | 55 | 0 | Minor | Yes | Yes |
| NSA3R03 | 45 | 46 | 1 | Minor | Yes | Yes |
| NSA3R04 | 52 | 53 | 1 | Minor | Yes | Yes |
| NSA3R05 | 51 | 52 | 1 | Minor | Yes | Yes |
| NSA3R06 | 52 | 53 | 1 | Minor | Yes | Yes |
| NSA3R07 | 59 | 61 | 2 | Minor | Yes | Yes |
| NSA3R08 | 58 | 60 | 2 | Minor | Yes | Yes |
| NSA3R09 | 53 | 54 | <2 | Minor | Yes | Yes |

Results in the above table show that the predicted noise level changes due to the widening and change in grade of Country Road 4 are less than 5 dB, and the overall noise levels are less than 65 dBA, therefore consideration of noise mitigation is not required.

# 5. Noise Mitigation

Results in Section 4.3 indicates that noise controls are not required to address traffic noise.

The MTO Guide requires that the noise study should document assessment of construction noise. This has been addressed under a separate report (Construction Noise Report – Highway 400 – Highway 404 Link (Bradford Bypass) County Road 4 Early Works GWP 2008-21-00, AECOM).

# 6. Conclusions

The results of the assessment indicate that the noise levels due to the temporary detour, and the long term impact due to the change in grade of County Road 4 in Bradford West Gwillimbury will have a minor to negligible perceived noise increase at most receptors. At all locations, the predicted noise levels and changes in noise levels are below the MTO's criteria for noise mitigation investigation.

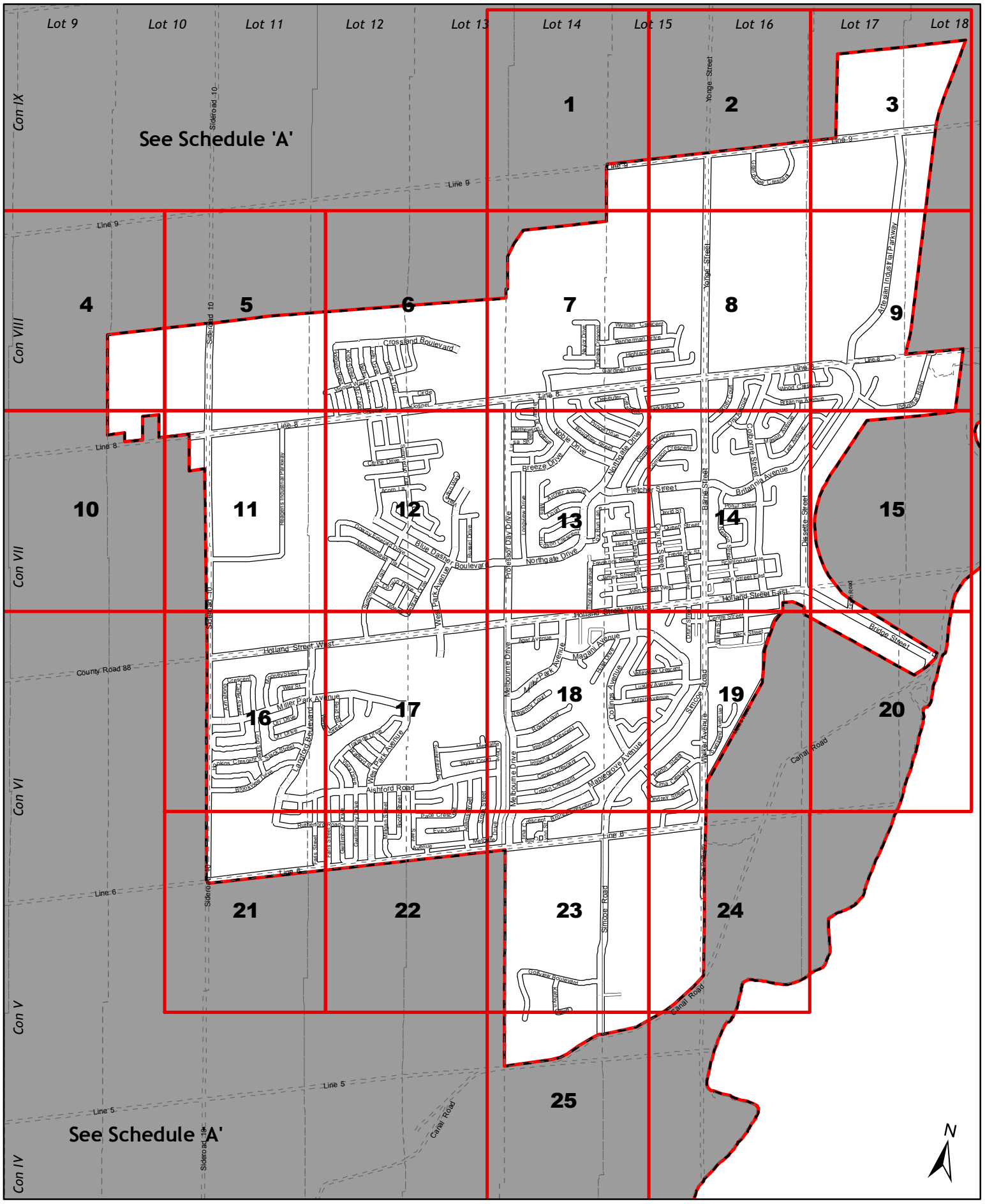
# 7. References

1. Ontario Ministry of Transportation, "Environmental Guide for Noise", October 2006.
2. Ontario Ministry of the Environment, Publication NPC-115: Construction Equipment.
3. Ontario Ministry of the Environment, Publication NPC-118: Motorized Conveyances.
4. Ontario Ministry of the Environment, Publication NPC-103: Procedures.
5. Town of Bradford West Gwillimbury, By-law 2008-083, retrieved November 2021.
6. David A. Bies and Colin H. Hansen, "Engineering Noise Control, Theory and Practice", 3rd edition, 2003.
7. Ministry of the Environment and Climate Change, Publication NPC-300
8. URS, County Road 4 Environmental Assessment Traffic Study Report. December 21, 2010.
9. United States Federal Transit Administration, "Transit Noise and Vibration Impact Assessment", May 2006.

# Appendix A – Zoning Plans

Zoning By-law 2010 - 050

Town of Bradford West Gwillimbury




1:30000

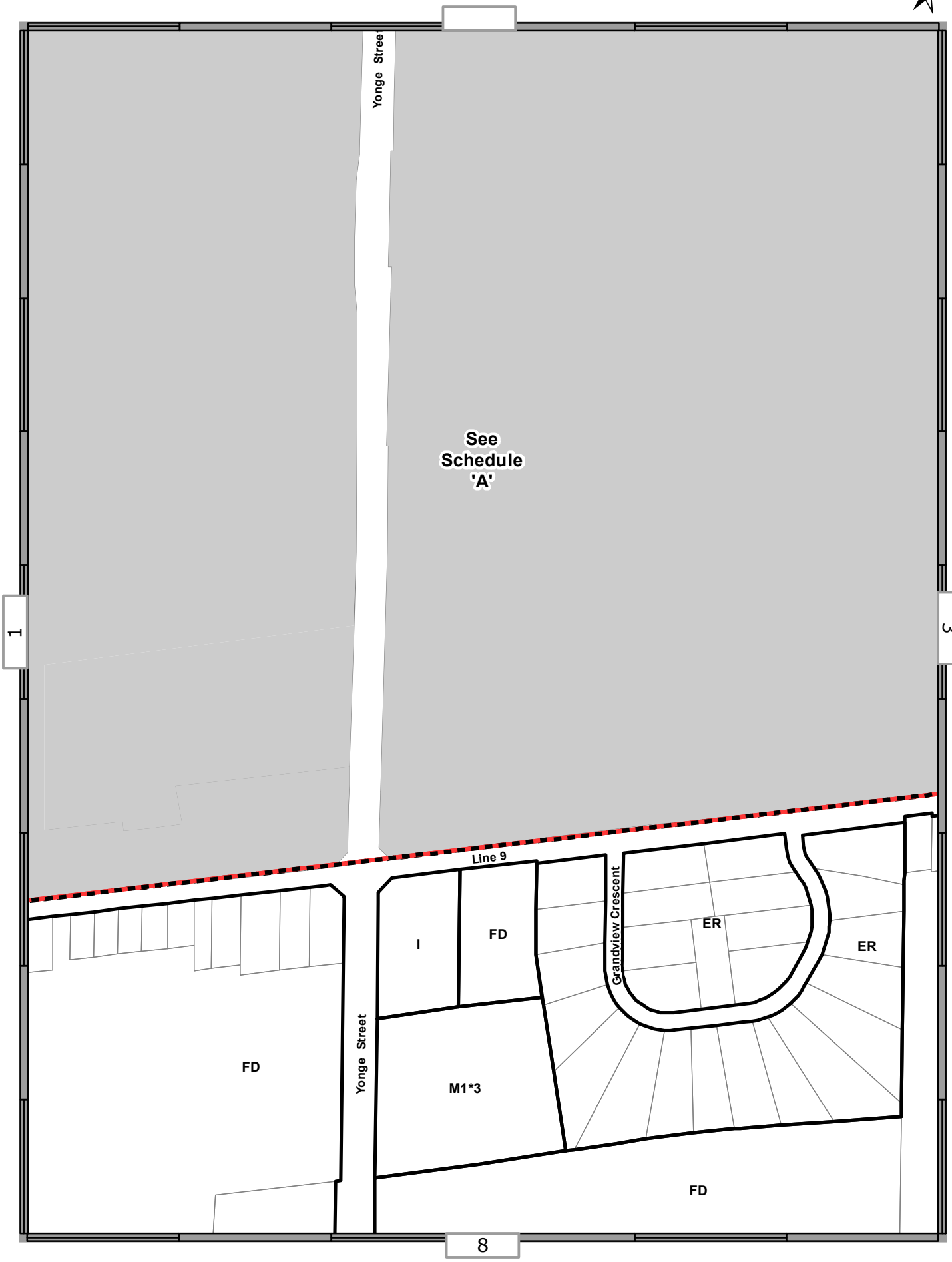
0 250 500 1,000 1,500 Meters

Bradford West Gwillimbury

## Schedule 'B' - Key Map

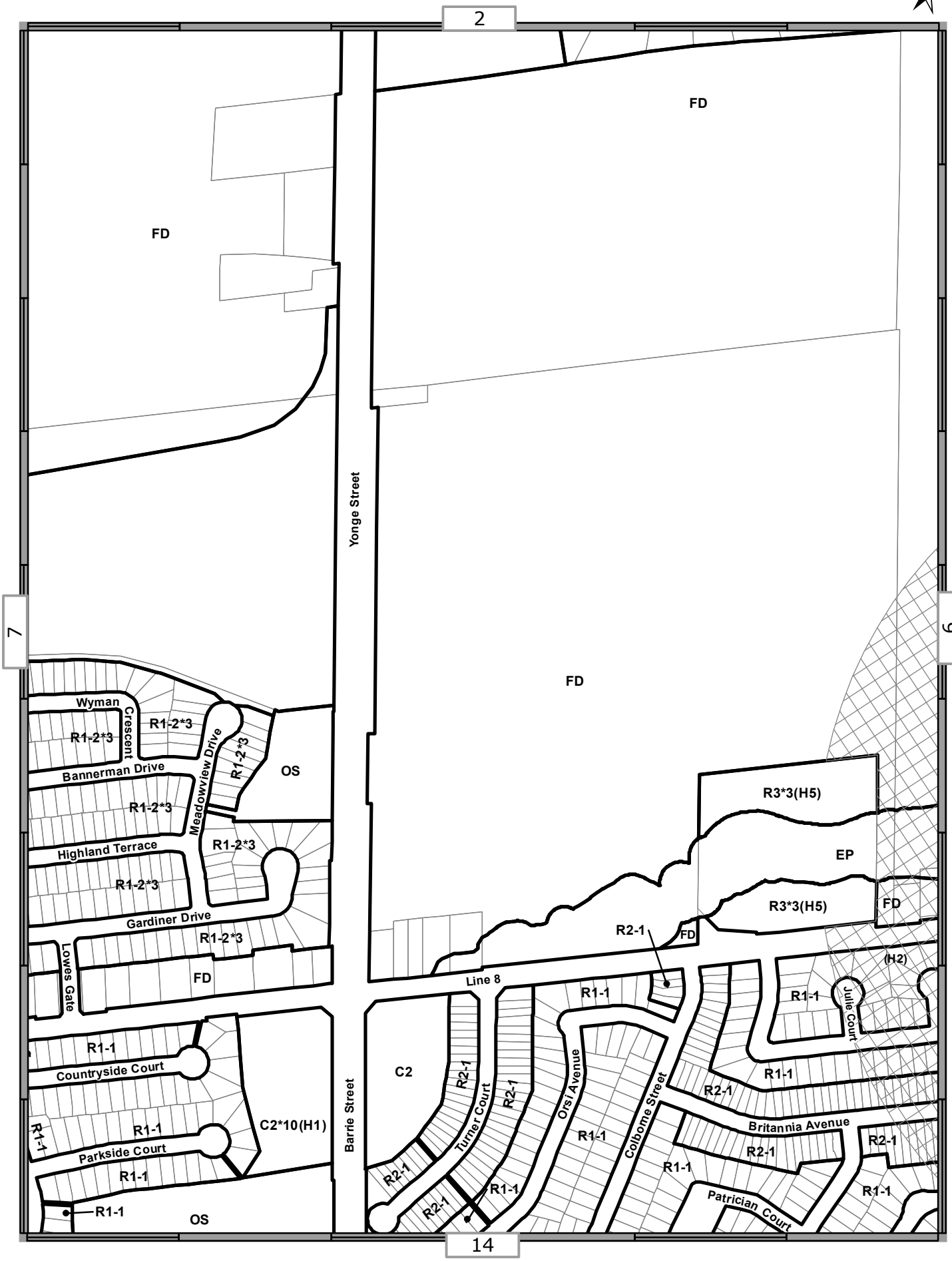
Town of Bradford West Gwillimbury
Zoning By-law 2010 - 050

# Schedule 'Schedule B' - Map #2



Town of Bradford West Gwillimbury
Zoning By-law 2010 - 050

# Schedule 'Schedule B' - Map #8



# Appendix B – Sample Calculation

| | | | | |
|---|---|---|---|---|
| <Organization?> | | | 8 December 2021 | |
| <Analysis By?> | | | TNM 2.5 | |
| | | | | |
| INPUT: TERRAIN LINES | | | | |
| PROJECT/CONTRACT: | <Project Name?> | | | |
| RUN: | <Run Title?> | | | |
| Terrain Line | Points | | | |
| Name | No. | Coordinates (ground) | | |
| | | X | Y | Z |
| | | m | m | m |
| Terrain Line2 | 3 | 614,494.2 | 4,886,937.5 | 250.00 |
| | 4 | 614,497.0 | 4,886,938.0 | 250.00 |
| | 5 | 614,504.0 | 4,886,941.0 | 250.00 |
| | 6 | 614,505.0 | 4,886,939.0 | 250.00 |
| | 7 | 614,513.0 | 4,886,935.0 | 250.00 |
| | 8 | 614,518.0 | 4,886,936.0 | 250.00 |
| | 9 | 614,529.0 | 4,886,945.0 | 250.00 |
| | 10 | 614,532.0 | 4,886,951.0 | 250.00 |
| | 11 | 614,537.0 | 4,886,953.0 | 250.00 |
| | 12 | 614,540.0 | 4,886,959.0 | 250.00 |
| | 13 | 614,544.0 | 4,886,959.0 | 250.00 |
| | 14 | 614,543.0 | 4,886,987.0 | 250.00 |
| | 15 | 614,539.0 | 4,887,001.0 | 250.00 |
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| | 17 | 614,531.0 | 4,887,048.0 | 250.00 |
| | 18 | 614,529.0 | 4,887,071.0 | 250.00 |
| | 19 | 614,530.8 | 4,887,074.0 | 250.00 |
| Terrain Line3 | 20 | 614,482.9 | 4,886,961.5 | 253.00 |
| | 21 | 614,489.0 | 4,886,962.0 | 253.00 |
| | 22 | 614,500.0 | 4,886,958.0 | 253.00 |
| | 23 | 614,533.0 | 4,886,970.0 | 253.00 |
| | 24 | 614,539.0 | 4,886,974.0 | 253.00 |
| | 25 | 614,538.0 | 4,886,985.0 | 253.00 |
| | 26 | 614,533.0 | 4,886,999.0 | 253.00 |

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| | 27 | 614,532.0 | 4,886,997.0 | 253.00 |
| | 28 | 614,530.0 | 4,886,999.0 | 253.00 |
| | 29 | 614,530.0 | 4,887,002.0 | 253.00 |
| | 30 | 614,527.0 | 4,887,002.0 | 253.00 |
| | 31 | 614,525.0 | 4,887,007.0 | 253.00 |
| | 32 | 614,520.0 | 4,887,011.0 | 253.00 |
| | 33 | 614,521.0 | 4,887,020.0 | 253.00 |
| | 34 | 614,519.0 | 4,887,029.0 | 253.00 |
| | 35 | 614,510.0 | 4,887,034.0 | 253.00 |
| | 36 | 614,512.0 | 4,887,042.0 | 253.00 |
| | 37 | 614,507.0 | 4,887,043.0 | 253.00 |
| | 38 | 614,506.9 | 4,887,043.0 | 253.00 |
| Terrain Line4 | 39 | 614,484.7 | 4,886,958.0 | 252.00 |
| | 40 | 614,487.0 | 4,886,958.0 | 252.00 |
| | 41 | 614,497.0 | 4,886,953.0 | 252.00 |
| | 42 | 614,504.0 | 4,886,958.0 | 252.00 |
| | 43 | 614,520.0 | 4,886,961.0 | 252.00 |
| | 44 | 614,528.0 | 4,886,965.0 | 252.00 |
| | 45 | 614,537.0 | 4,886,966.0 | 252.00 |
| | 46 | 614,541.0 | 4,886,968.0 | 252.00 |
| | 47 | 614,539.0 | 4,886,987.0 | 252.00 |
| | 48 | 614,534.0 | 4,887,003.0 | 252.00 |
| | 49 | 614,534.0 | 4,887,018.0 | 252.00 |
| | 50 | 614,532.0 | 4,887,022.0 | 252.00 |
| | 51 | 614,531.0 | 4,887,031.0 | 252.00 |
| | 52 | 614,527.0 | 4,887,039.0 | 252.00 |
| | 53 | 614,519.0 | 4,887,045.0 | 252.00 |
| | 54 | 614,517.0 | 4,887,050.0 | 252.00 |
| | 55 | 614,515.0 | 4,887,051.0 | 252.00 |
| | 56 | 614,516.0 | 4,887,056.0 | 252.00 |
| | 57 | 614,512.0 | 4,887,063.0 | 252.00 |
| | 58 | 614,511.0 | 4,887,074.0 | 252.00 |
| | 59 | 614,508.0 | 4,887,084.0 | 252.00 |
| | 60 | 614,505.0 | 4,887,089.0 | 252.00 |
| | 61 | 614,504.0 | 4,887,095.0 | 252.00 |
| | 62 | 614,500.0 | 4,887,099.0 | 252.00 |

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| | 63 | 614,499.0 | 4,887,104.0 | 252.00 |
| | 64 | 614,495.0 | 4,887,107.0 | 252.00 |
| | 65 | 614,487.0 | 4,887,108.0 | 252.00 |
| | 66 | 614,486.0 | 4,887,110.0 | 252.00 |
| | 67 | 614,475.0 | 4,887,112.0 | 252.00 |
| | 68 | 614,472.0 | 4,887,114.0 | 252.00 |
| | 69 | 614,459.0 | 4,887,114.0 | 252.00 |
| | 70 | 614,447.0 | 4,887,111.0 | 252.00 |
| | 71 | 614,445.0 | 4,887,114.0 | 252.00 |
| | 72 | 614,447.0 | 4,887,117.0 | 252.00 |
| | 73 | 614,431.0 | 4,887,117.0 | 252.00 |
| | 74 | 614,427.0 | 4,887,115.0 | 252.00 |
| | 75 | 614,417.0 | 4,887,115.0 | 252.00 |
| | 76 | 614,410.0 | 4,887,122.0 | 252.00 |
| | 77 | 614,407.0 | 4,887,128.0 | 252.00 |
| | 78 | 614,407.0 | 4,887,139.0 | 252.00 |
| | 79 | 614,417.0 | 4,887,161.0 | 252.00 |
| | 80 | 614,429.0 | 4,887,172.0 | 252.00 |
| | 81 | 614,432.0 | 4,887,178.0 | 252.00 |
| | 82 | 614,434.0 | 4,887,192.0 | 252.00 |
| | 83 | 614,437.0 | 4,887,200.0 | 252.00 |
| | 84 | 614,454.0 | 4,887,211.0 | 252.00 |
| | 85 | 614,464.0 | 4,887,213.0 | 252.00 |
| | 86 | 614,476.0 | 4,887,212.0 | 252.00 |
| | 87 | 614,485.0 | 4,887,203.0 | 252.00 |
| | 88 | 614,492.0 | 4,887,171.0 | 252.00 |
| | 89 | 614,492.0 | 4,887,165.0 | 252.00 |
| | 90 | 614,499.0 | 4,887,162.0 | 252.00 |
| | 91 | 614,498.0 | 4,887,184.0 | 252.00 |
| Terrain Line5 | 102 | 614,466.3 | 4,887,094.0 | 254.00 |
| | 103 | 614,465.0 | 4,887,093.0 | 254.00 |
| | 104 | 614,460.8 | 4,887,100.0 | 254.00 |
| | 105 | 614,453.0 | 4,887,098.0 | 254.00 |
| | 106 | 614,449.5 | 4,887,097.5 | 254.00 |
| | 107 | 614,442.0 | 4,887,098.0 | 254.00 |
| | 108 | 614,438.0 | 4,887,097.0 | 254.00 |

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| | 109 | 614,434.7 | 4,887,096.0 | 254.00 |
| | 110 | 614,432.0 | 4,887,098.0 | 254.00 |
| | 111 | 614,431.0 | 4,887,102.0 | 254.00 |
| | 112 | 614,423.0 | 4,887,100.0 | 254.00 |
| | 113 | 614,413.0 | 4,887,100.0 | 254.00 |
| | 114 | 614,409.0 | 4,887,102.0 | 254.00 |
| | 115 | 614,396.0 | 4,887,101.0 | 254.00 |
| | 116 | 614,393.0 | 4,887,104.0 | 254.00 |
| | 117 | 614,394.0 | 4,887,106.0 | 254.00 |
| | 118 | 614,408.0 | 4,887,109.0 | 254.00 |
| | 119 | 614,402.0 | 4,887,116.0 | 254.00 |
| | 120 | 614,400.0 | 4,887,120.0 | 254.00 |
| | 121 | 614,400.0 | 4,887,125.0 | 254.00 |
| | 122 | 614,393.0 | 4,887,134.0 | 254.00 |
| | 123 | 614,393.0 | 4,887,138.0 | 254.00 |
| | 124 | 614,398.0 | 4,887,147.0 | 254.00 |
| | 125 | 614,397.0 | 4,887,150.0 | 254.00 |
| | 126 | 614,405.0 | 4,887,153.0 | 254.00 |
| | 127 | 614,409.0 | 4,887,158.0 | 254.00 |
| | 128 | 614,412.0 | 4,887,159.0 | 254.00 |
| | 129 | 614,416.0 | 4,887,168.0 | 254.00 |
| | 130 | 614,422.0 | 4,887,174.0 | 254.00 |
| | 131 | 614,426.0 | 4,887,186.0 | 254.00 |
| | 132 | 614,423.0 | 4,887,193.0 | 254.00 |
| | 133 | 614,423.0 | 4,887,197.0 | 254.00 |
| | 134 | 614,424.0 | 4,887,202.0 | 254.00 |
| | 135 | 614,428.0 | 4,887,207.0 | 254.00 |
| | 136 | 614,438.0 | 4,887,211.0 | 254.00 |
| | 137 | 614,442.0 | 4,887,211.0 | 254.00 |
| | 138 | 614,458.0 | 4,887,218.0 | 254.00 |
| | 139 | 614,470.0 | 4,887,221.0 | 254.00 |
| | 140 | 614,478.0 | 4,887,221.0 | 254.00 |
| | 141 | 614,482.0 | 4,887,224.0 | 254.00 |
| | 142 | 614,485.0 | 4,887,224.0 | 254.00 |
| | 143 | 614,485.0 | 4,887,230.0 | 254.00 |
| | 144 | 614,480.0 | 4,887,231.0 | 254.00 |

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| | 145 | 614,466.0 | 4,887,230.0 | 254.00 |
| | 146 | 614,462.0 | 4,887,228.0 | 254.00 |
| | 147 | 614,452.0 | 4,887,227.0 | 254.00 |
| | 148 | 614,450.0 | 4,887,225.0 | 254.00 |
| | 149 | 614,438.0 | 4,887,225.0 | 254.00 |
| | 150 | 614,436.0 | 4,887,228.0 | 254.00 |
| | 151 | 614,430.0 | 4,887,231.0 | 254.00 |
| | 152 | 614,433.0 | 4,887,237.0 | 254.00 |
| | 153 | 614,433.0 | 4,887,253.0 | 254.00 |
| | 154 | 614,428.0 | 4,887,266.0 | 254.00 |
| | 155 | 614,423.0 | 4,887,274.0 | 254.00 |
| | 156 | 614,424.0 | 4,887,291.0 | 254.00 |
| | 157 | 614,444.0 | 4,887,322.0 | 254.00 |
| Terrain Line6 | 170 | 614,401.7 | 4,887,055.0 | 255.00 |
| | 171 | 614,404.0 | 4,887,057.0 | 255.00 |
| | 172 | 614,409.0 | 4,887,067.0 | 255.00 |
| | 173 | 614,408.0 | 4,887,079.0 | 255.00 |
| | 174 | 614,402.0 | 4,887,091.0 | 255.00 |
| | 175 | 614,397.0 | 4,887,097.0 | 255.00 |
| | 176 | 614,392.0 | 4,887,099.0 | 255.00 |
| | 177 | 614,369.0 | 4,887,101.0 | 255.00 |
| | 178 | 614,368.0 | 4,887,103.0 | 255.00 |
| | 179 | 614,371.0 | 4,887,106.0 | 255.00 |
| | 180 | 614,384.0 | 4,887,107.0 | 255.00 |
| | 181 | 614,389.0 | 4,887,110.0 | 255.00 |
| | 182 | 614,387.0 | 4,887,114.0 | 255.00 |
| | 183 | 614,387.0 | 4,887,119.0 | 255.00 |
| | 184 | 614,384.0 | 4,887,122.0 | 255.00 |
| | 185 | 614,384.0 | 4,887,151.0 | 255.00 |
| | 186 | 614,388.0 | 4,887,154.0 | 255.00 |
| | 187 | 614,390.0 | 4,887,160.0 | 255.00 |
| | 188 | 614,396.0 | 4,887,162.0 | 255.00 |
| | 189 | 614,398.0 | 4,887,168.0 | 255.00 |
| | 190 | 614,402.0 | 4,887,172.0 | 255.00 |
| | 191 | 614,406.0 | 4,887,172.0 | 255.00 |
| | 192 | 614,412.0 | 4,887,175.0 | 255.00 |

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| | 193 | 614,415.0 | 4,887,179.0 | 255.00 |
| | 194 | 614,419.0 | 4,887,181.0 | 255.00 |
| | 195 | 614,422.0 | 4,887,207.0 | 255.00 |
| | 196 | 614,428.0 | 4,887,211.0 | 255.00 |
| | 202 | 614,477.0 | 4,887,227.0 | 255.00 |
| | 198 | 614,468.0 | 4,887,227.0 | 255.00 |
| | 199 | 614,441.0 | 4,887,221.0 | 255.00 |
| | 200 | 614,430.0 | 4,887,222.0 | 255.00 |
| | 201 | 614,425.0 | 4,887,220.0 | 255.00 |
| | 202 | 614,417.0 | 4,887,220.0 | 255.00 |
| | 203 | 614,415.0 | 4,887,222.0 | 255.00 |
| | 204 | 614,408.0 | 4,887,224.0 | 255.00 |
| | 205 | 614,405.0 | 4,887,230.0 | 255.00 |
| | 206 | 614,399.0 | 4,887,233.0 | 255.00 |
| | 207 | 614,401.0 | 4,887,235.0 | 255.00 |
| | 208 | 614,416.0 | 4,887,234.0 | 255.00 |
| | 209 | 614,411.0 | 4,887,241.0 | 255.00 |
| | 210 | 614,410.0 | 4,887,262.0 | 255.00 |
| | 211 | 614,407.0 | 4,887,269.0 | 255.00 |
| | 212 | 614,408.0 | 4,887,289.0 | 255.00 |
| Terrain Line7 | 227 | 614,363.2 | 4,887,140.5 | 256.00 |
| | 228 | 614,370.0 | 4,887,129.0 | 256.00 |
| | 229 | 614,370.0 | 4,887,113.0 | 256.00 |
| | 230 | 614,375.0 | 4,887,109.0 | 256.00 |
| | 231 | 614,376.0 | 4,887,116.0 | 256.00 |
| | 232 | 614,373.0 | 4,887,124.0 | 256.00 |
| | 233 | 614,377.0 | 4,887,129.0 | 256.00 |
| | 234 | 614,379.0 | 4,887,135.0 | 256.00 |
| | 235 | 614,378.0 | 4,887,138.0 | 256.00 |
| | 236 | 614,380.0 | 4,887,155.0 | 256.00 |
| | 237 | 614,385.0 | 4,887,163.0 | 256.00 |
| | 238 | 614,387.0 | 4,887,170.0 | 256.00 |
| | 239 | 614,393.0 | 4,887,177.0 | 256.00 |
| | 240 | 614,394.0 | 4,887,181.0 | 256.00 |
| | 241 | 614,403.0 | 4,887,186.0 | 256.00 |
| | 242 | 614,404.0 | 4,887,189.0 | 256.00 |

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| | 243 | 614,408.0 | 4,887,192.0 | 256.00 |
| | 244 | 614,408.0 | 4,887,195.0 | 256.00 |
| | 245 | 614,412.0 | 4,887,197.0 | 256.00 |
| | 246 | 614,415.0 | 4,887,203.0 | 256.00 |
| | 247 | 614,417.0 | 4,887,214.0 | 256.00 |
| | 248 | 614,407.0 | 4,887,221.0 | 256.00 |
| | 249 | 614,399.0 | 4,887,224.0 | 256.00 |
| | 250 | 614,395.0 | 4,887,227.0 | 256.00 |
| | 251 | 614,395.0 | 4,887,229.0 | 256.00 |
| | 252 | 614,384.0 | 4,887,234.0 | 256.00 |
| | 253 | 614,383.0 | 4,887,236.0 | 256.00 |
| | 254 | 614,395.0 | 4,887,238.0 | 256.00 |
| | 255 | 614,387.0 | 4,887,244.0 | 256.00 |
| | 256 | 614,391.0 | 4,887,251.0 | 256.00 |
| | 257 | 614,390.0 | 4,887,260.0 | 256.00 |
| | 258 | 614,392.0 | 4,887,264.0 | 256.00 |
| | 259 | 614,392.0 | 4,887,271.0 | 256.00 |
| | 260 | 614,395.0 | 4,887,281.0 | 256.00 |
| | 261 | 614,395.0 | 4,887,291.0 | 256.00 |
| | 262 | 614,399.0 | 4,887,301.0 | 256.00 |
| | 263 | 614,408.0 | 4,887,312.0 | 256.00 |
| | 264 | 614,413.0 | 4,887,324.0 | 256.00 |
| | 265 | 614,420.0 | 4,887,335.0 | 256.00 |
| | 266 | 614,424.0 | 4,887,349.0 | 256.00 |
| | 267 | 614,422.0 | 4,887,353.0 | 256.00 |
| | 268 | 614,422.0 | 4,887,360.0 | 256.00 |
| | 269 | 614,424.0 | 4,887,362.0 | 256.00 |
| Terrain Line8 | 283 | 614,336.0 | 4,887,229.0 | 259.00 |
| | 284 | 614,336.0 | 4,887,237.0 | 259.00 |
| | 285 | 614,330.0 | 4,887,244.0 | 259.00 |
| | 286 | 614,335.0 | 4,887,246.0 | 259.00 |
| | 287 | 614,352.0 | 4,887,247.0 | 259.00 |
| | 288 | 614,354.0 | 4,887,251.0 | 259.00 |
| | 289 | 614,344.0 | 4,887,261.0 | 259.00 |
| | 290 | 614,351.0 | 4,887,270.0 | 259.00 |
| | 291 | 614,359.0 | 4,887,289.0 | 259.00 |

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| | 292 | 614,363.0 | 4,887,292.0 | 259.00 |
| | 293 | 614,370.0 | 4,887,305.0 | 259.00 |
| | 294 | 614,373.0 | 4,887,322.0 | 259.00 |
| | 295 | 614,379.0 | 4,887,332.0 | 259.00 |
| | 296 | 614,388.0 | 4,887,355.0 | 259.00 |
| | 297 | 614,393.0 | 4,887,361.0 | 259.00 |
| | 298 | 614,399.0 | 4,887,366.0 | 259.00 |
| | 299 | 614,405.0 | 4,887,368.0 | 259.00 |
| | 300 | 614,409.0 | 4,887,373.0 | 259.00 |
| | 301 | 614,409.0 | 4,887,379.0 | 259.00 |
| | 302 | 614,419.0 | 4,887,398.0 | 259.00 |
| | 303 | 614,422.0 | 4,887,410.0 | 259.00 |
| Terrain Line9 | 316 | 614,329.9 | 4,887,229.5 | 260.00 |
| | 317 | 614,331.0 | 4,887,231.0 | 260.00 |
| | 318 | 614,325.0 | 4,887,242.0 | 260.00 |
| | 319 | 614,319.0 | 4,887,245.0 | 260.00 |
| | 320 | 614,317.0 | 4,887,248.0 | 260.00 |
| | 321 | 614,339.0 | 4,887,249.0 | 260.00 |
| | 322 | 614,340.0 | 4,887,254.0 | 260.00 |
| | 323 | 614,338.0 | 4,887,257.0 | 260.00 |
| | 324 | 614,340.0 | 4,887,260.0 | 260.00 |
| | 325 | 614,338.0 | 4,887,263.0 | 260.00 |
| Terrain Line10 | 326 | 614,296.0 | 4,887,703.0 | 286.00 |
| | 327 | 614,299.0 | 4,887,704.0 | 286.00 |
| | 328 | 614,297.0 | 4,887,707.0 | 286.00 |
| | 329 | 614,301.0 | 4,887,713.0 | 286.00 |
| | 330 | 614,306.0 | 4,887,713.0 | 286.00 |
| | 331 | 614,311.0 | 4,887,716.0 | 286.00 |
| | 332 | 614,328.0 | 4,887,733.0 | 286.00 |
| | 333 | 614,326.0 | 4,887,742.0 | 286.00 |
| | 334 | 614,327.0 | 4,887,750.0 | 286.00 |
| | 335 | 614,331.0 | 4,887,752.0 | 286.00 |
| | 336 | 614,333.0 | 4,887,755.0 | 286.00 |
| | 337 | 614,346.0 | 4,887,781.0 | 286.00 |
| | 338 | 614,353.0 | 4,887,790.0 | 286.00 |
| | 339 | 614,360.0 | 4,887,809.0 | 286.00 |

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| | 340 | 614,365.0 | 4,887,810.0 | 286.00 |
| | 341 | 614,365.0 | 4,887,816.0 | 286.00 |
| | 342 | 614,369.0 | 4,887,823.0 | 286.00 |
| | 343 | 614,365.0 | 4,887,854.0 | 286.00 |
| | 344 | 614,363.0 | 4,887,856.0 | 286.00 |
| | 345 | 614,356.0 | 4,887,898.0 | 286.00 |
| | 346 | 614,354.0 | 4,887,899.0 | 286.00 |
| | 347 | 614,350.0 | 4,887,894.0 | 286.00 |
| | 348 | 614,338.0 | 4,887,888.0 | 286.00 |
| | 349 | 614,318.0 | 4,887,868.0 | 286.00 |
| | 350 | 614,305.0 | 4,887,861.0 | 286.00 |
| | 351 | 614,304.0 | 4,887,854.0 | 286.00 |
| | 352 | 614,282.0 | 4,887,833.0 | 286.00 |
| Terrain Line11 | 353 | 614,288.0 | 4,887,741.0 | 288.00 |
| | 354 | 614,294.0 | 4,887,748.0 | 288.00 |
| | 355 | 614,300.0 | 4,887,749.0 | 288.00 |
| | 356 | 614,310.0 | 4,887,756.0 | 288.00 |
| | 357 | 614,311.0 | 4,887,763.0 | 288.00 |
| | 358 | 614,320.0 | 4,887,768.0 | 288.00 |
| | 359 | 614,323.0 | 4,887,773.0 | 288.00 |
| | 360 | 614,322.0 | 4,887,777.0 | 288.00 |
| | 361 | 614,330.0 | 4,887,787.0 | 288.00 |
| | 362 | 614,344.0 | 4,887,800.0 | 288.00 |
| | 363 | 614,353.0 | 4,887,818.0 | 288.00 |
| | 364 | 614,353.0 | 4,887,823.0 | 288.00 |
| | 365 | 614,356.0 | 4,887,827.0 | 288.00 |
| | 366 | 614,357.0 | 4,887,838.0 | 288.00 |
| | 367 | 614,354.0 | 4,887,849.0 | 288.00 |
| | 368 | 614,350.0 | 4,887,855.0 | 288.00 |
| | 369 | 614,347.0 | 4,887,856.0 | 288.00 |
| | 370 | 614,340.0 | 4,887,857.0 | 288.00 |
| | 371 | 614,336.0 | 4,887,855.0 | 288.00 |
| | 372 | 614,326.0 | 4,887,845.0 | 288.00 |
| | 373 | 614,318.0 | 4,887,844.0 | 288.00 |
| | 374 | 614,314.0 | 4,887,839.0 | 288.00 |
| | 375 | 614,312.0 | 4,887,839.0 | 288.00 |

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| | 376 | 614,300.0 | 4,887,828.0 | 288.00 |
| | 377 | 614,298.0 | 4,887,825.0 | 288.00 |
| | 378 | 614,299.0 | 4,887,823.0 | 288.00 |
| | 379 | 614,287.0 | 4,887,813.0 | 288.00 |
| Terrain Line13 | 394 | 614,327.0 | 4,887,662.0 | 282.00 |
| | 395 | 614,329.0 | 4,887,666.0 | 282.00 |
| | 396 | 614,330.0 | 4,887,675.0 | 282.00 |
| | 397 | 614,338.0 | 4,887,681.0 | 282.00 |
| | 398 | 614,336.0 | 4,887,686.0 | 282.00 |
| | 399 | 614,336.0 | 4,887,692.0 | 282.00 |
| | 400 | 614,334.0 | 4,887,694.0 | 282.00 |
| | 401 | 614,336.0 | 4,887,708.0 | 282.00 |
| | 402 | 614,347.0 | 4,887,717.0 | 282.00 |
| | 403 | 614,348.0 | 4,887,725.0 | 282.00 |
| | 404 | 614,346.0 | 4,887,725.0 | 282.00 |
| | 405 | 614,346.0 | 4,887,727.0 | 282.00 |
| | 406 | 614,352.0 | 4,887,734.0 | 282.00 |
| | 407 | 614,354.0 | 4,887,741.0 | 282.00 |
| | 408 | 614,352.0 | 4,887,751.0 | 282.00 |
| | 409 | 614,357.0 | 4,887,757.0 | 282.00 |
| | 410 | 614,358.0 | 4,887,765.0 | 282.00 |
| | 411 | 614,363.0 | 4,887,773.0 | 282.00 |
| | 412 | 614,367.0 | 4,887,773.0 | 282.00 |
| | 413 | 614,368.0 | 4,887,770.0 | 282.00 |
| | 414 | 614,373.0 | 4,887,771.0 | 282.00 |
| | 415 | 614,375.0 | 4,887,791.0 | 282.00 |
| | 416 | 614,379.0 | 4,887,801.0 | 282.00 |
| | 417 | 614,377.0 | 4,887,808.0 | 282.00 |
| | 418 | 614,373.0 | 4,887,851.0 | 282.00 |
| | 419 | 614,370.0 | 4,887,860.0 | 282.00 |
| | 420 | 614,363.0 | 4,887,907.0 | 282.00 |
| | 421 | 614,357.0 | 4,887,929.0 | 282.00 |
| Terrain Line14 | 424 | 614,337.0 | 4,887,653.0 | 281.00 |
| | 425 | 614,345.0 | 4,887,678.0 | 281.00 |
| | 426 | 614,350.0 | 4,887,682.0 | 281.00 |
| | 427 | 614,346.0 | 4,887,684.0 | 281.00 |

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| | 428 | 614,348.0 | 4,887,686.0 | 281.00 |
| | 429 | 614,345.0 | 4,887,694.0 | 281.00 |
| | 430 | 614,347.0 | 4,887,700.0 | 281.00 |
| | 431 | 614,346.0 | 4,887,705.0 | 281.00 |
| | 432 | 614,352.0 | 4,887,709.0 | 281.00 |
| | 433 | 614,355.0 | 4,887,714.0 | 281.00 |
| | 434 | 614,358.0 | 4,887,713.0 | 281.00 |
| | 435 | 614,362.0 | 4,887,716.0 | 281.00 |
| | 436 | 614,362.0 | 4,887,740.0 | 281.00 |
| | 437 | 614,368.0 | 4,887,746.0 | 281.00 |
| | 438 | 614,367.0 | 4,887,752.0 | 281.00 |
| | 439 | 614,372.0 | 4,887,756.0 | 281.00 |
| | 440 | 614,375.0 | 4,887,756.0 | 281.00 |
| | 441 | 614,379.0 | 4,887,766.0 | 281.00 |
| | 442 | 614,382.0 | 4,887,796.0 | 281.00 |
| Terrain Line15 | 450 | 614,232.6 | 4,888,214.0 | 279.00 |
| | 451 | 614,234.4 | 4,888,213.0 | 279.00 |
| | 452 | 614,235.0 | 4,888,217.5 | 279.00 |
| | 453 | 614,239.0 | 4,888,213.5 | 279.00 |
| | 454 | 614,258.0 | 4,888,215.5 | 279.00 |
| | 455 | 614,262.2 | 4,888,219.0 | 279.00 |
| | 456 | 614,263.2 | 4,888,223.0 | 279.00 |
| | 457 | 614,267.0 | 4,888,224.5 | 279.00 |
| | 458 | 614,278.8 | 4,888,227.0 | 279.00 |
| | 459 | 614,295.0 | 4,888,219.0 | 279.00 |
| | 460 | 614,297.0 | 4,888,214.0 | 279.00 |
| | 461 | 614,300.0 | 4,888,217.0 | 279.00 |
| | 462 | 614,301.0 | 4,888,221.0 | 279.00 |
| | 463 | 614,304.0 | 4,888,216.0 | 279.00 |
| | 464 | 614,309.0 | 4,888,185.0 | 279.00 |
| | 465 | 614,314.0 | 4,888,170.0 | 279.00 |
| Terrain Line16 | 478 | 614,244.8 | 4,888,179.0 | 278.00 |
| | 479 | 614,249.0 | 4,888,175.0 | 278.00 |
| | 480 | 614,250.0 | 4,888,185.5 | 278.00 |
| | 481 | 614,259.0 | 4,888,176.5 | 278.00 |
| | 437 | 614,260.0 | 4,888,178.5 | 278.00 |

| | | | | |
|---|---|---|---|---|
| | 483 | 614,293.0 | 4,888,184.0 | 278.00 |
| | 484 | 614,297.0 | 4,888,167.0 | 278.00 |
| | 485 | 614,299.0 | 4,888,169.0 | 278.00 |
| | 486 | 614,304.0 | 4,888,169.0 | 278.00 |
| | 487 | 614,306.0 | 4,888,177.0 | 278.00 |
| | 488 | 614,309.0 | 4,888,177.0 | 278.00 |
| | 489 | 614,309.0 | 4,888,173.0 | 278.00 |
| | 490 | 614,315.0 | 4,888,154.0 | 278.00 |
| Terrain Line17 | 501 | 614,360.0 | 4,887,545.0 | 274.00 |
| | 502 | 614,376.0 | 4,887,572.0 | 274.00 |
| | 503 | 614,380.0 | 4,887,586.0 | 274.00 |
| | 504 | 614,391.0 | 4,887,596.0 | 274.00 |
| Terrain Line18 | 515 | 614,350.0 | 4,887,399.0 | 265.00 |
| | 516 | 614,359.0 | 4,887,408.0 | 265.00 |
| | 517 | 614,367.0 | 4,887,423.0 | 265.00 |
| | 518 | 614,379.0 | 4,887,439.0 | 265.00 |
| | 519 | 614,384.0 | 4,887,451.0 | 265.00 |
| | 520 | 614,397.0 | 4,887,468.0 | 265.00 |
| | 521 | 614,395.0 | 4,887,469.0 | 265.00 |
| | 522 | 614,395.0 | 4,887,471.0 | 265.00 |
| | 523 | 614,409.0 | 4,887,490.0 | 265.00 |
| | 524 | 614,413.0 | 4,887,493.0 | 265.00 |
| | 525 | 614,413.0 | 4,887,495.0 | 265.00 |
| Terrain Line19 | 537 | 614,526.0 | 4,887,084.0 | 250.00 |
| | 538 | 614,529.0 | 4,887,079.0 | 250.00 |
| | 539 | 614,528.0 | 4,887,077.0 | 250.00 |
| | 540 | 614,524.0 | 4,887,079.0 | 250.00 |
| | 541 | 614,520.0 | 4,887,088.0 | 250.00 |
| | 542 | 614,515.0 | 4,887,092.0 | 250.00 |
| | 543 | 614,510.0 | 4,887,107.0 | 250.00 |
| | 544 | 614,509.0 | 4,887,116.0 | 250.00 |
| | 0 | 614,506.0 | 4,887,119.0 | 250.00 |
| | 0 | 614,507.0 | 4,887,120.0 | 250.00 |
| | 0 | 614,502.0 | 4,887,123.0 | 250.00 |
| | 0 | 614,506.0 | 4,887,129.0 | 250.00 |
| | 545 | 614,505.0 | 4,887,137.0 | 250.00 |

| | | | | |
|---|---|---|---|---|
| | 546 | 614,508.0 | 4,887,139.0 | 250.00 |
| Terrain Line20 | 555 | 614,487.0 | 4,887,101.0 | 253.00 |
| | 556 | 614,478.0 | 4,887,103.0 | 253.00 |
| | 557 | 614,474.0 | 4,887,107.0 | 253.00 |
| | 558 | 614,464.0 | 4,887,106.0 | 253.00 |
| | 559 | 614,463.0 | 4,887,109.0 | 253.00 |
| | 560 | 614,455.0 | 4,887,109.0 | 253.00 |
| | 561 | 614,446.0 | 4,887,106.0 | 253.00 |
| | 562 | 614,428.0 | 4,887,106.0 | 253.00 |
| | 563 | 614,426.0 | 4,887,109.0 | 253.00 |
| | 564 | 614,430.0 | 4,887,110.0 | 253.00 |
| | 565 | 614,430.0 | 4,887,112.0 | 253.00 |
| | 566 | 614,416.0 | 4,887,112.0 | 253.00 |
| | 567 | 614,409.0 | 4,887,117.0 | 253.00 |
| | 568 | 614,404.0 | 4,887,126.0 | 253.00 |
| | 569 | 614,403.0 | 4,887,134.0 | 253.00 |
| | 570 | 614,408.0 | 4,887,149.0 | 253.00 |
| | 571 | 614,414.0 | 4,887,160.0 | 253.00 |
| | 572 | 614,429.0 | 4,887,180.0 | 253.00 |
| | 573 | 614,430.0 | 4,887,199.0 | 253.00 |
| | 574 | 614,435.0 | 4,887,205.0 | 253.00 |
| | 575 | 614,458.0 | 4,887,215.0 | 253.00 |
| | 576 | 614,470.0 | 4,887,217.0 | 253.00 |
| | 577 | 614,488.0 | 4,887,217.0 | 253.00 |
| | 578 | 614,489.0 | 4,887,221.0 | 253.00 |
| | 579 | 614,487.0 | 4,887,233.0 | 253.00 |
| | 580 | 614,471.0 | 4,887,235.0 | 253.00 |
| | 581 | 614,465.0 | 4,887,239.0 | 253.00 |
| | 582 | 614,469.0 | 4,887,246.0 | 253.00 |
| | 583 | 614,466.0 | 4,887,254.0 | 253.00 |
| | 584 | 614,444.0 | 4,887,279.0 | 253.00 |
| | 585 | 614,447.0 | 4,887,296.0 | 253.00 |
| | 586 | 614,450.0 | 4,887,296.0 | 253.00 |
| | 587 | 614,454.0 | 4,887,300.0 | 253.00 |
| | 588 | 614,455.0 | 4,887,304.0 | 253.00 |
| Terrain Line21 | 604 | 614,500.9 | 4,886,924.0 | 248.00 |

| | | | | |
|---|---|---|---|---|
| | 605 | 614,504.0 | 4,886,925.0 | 248.00 |
| | 606 | 614,503.0 | 4,886,928.0 | 248.00 |
| | 607 | 614,505.0 | 4,886,933.0 | 248.00 |
| | 608 | 614,516.0 | 4,886,931.0 | 248.00 |
| | 609 | 614,534.0 | 4,886,938.0 | 248.00 |
| | 610 | 614,538.0 | 4,886,945.0 | 248.00 |
| | 611 | 614,545.0 | 4,886,950.0 | 248.00 |
| | 612 | 614,547.6 | 4,886,957.0 | 248.00 |
| | 613 | 614,547.0 | 4,886,982.0 | 248.00 |
| | 614 | 614,544.0 | 4,886,995.0 | 248.00 |
| | 615 | 614,544.0 | 4,887,002.0 | 248.00 |
| Terrain Line22 | 616 | 614,481.1 | 4,886,965.5 | 254.00 |
| | 617 | 614,488.0 | 4,886,967.0 | 254.00 |
| | 618 | 614,494.0 | 4,886,966.0 | 254.00 |
| | 619 | 614,496.0 | 4,886,964.0 | 254.00 |
| | 620 | 614,502.0 | 4,886,966.0 | 254.00 |
| | 621 | 614,511.0 | 4,886,975.0 | 254.00 |
| | 622 | 614,517.0 | 4,886,977.0 | 254.00 |
| | 623 | 614,516.0 | 4,886,981.0 | 254.00 |
| | 624 | 614,505.0 | 4,886,993.0 | 254.00 |
| | 626 | 614,505.0 | 4,886,999.0 | 254.00 |

<Organization?>
<Analysis By?>
8 December 2021
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: <Project Name?>
RUN: <Run Title?>
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 20 deg C, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

| Receiver Name | No. | #DUs | Existing LAeq1h | No Barrier LAeq1h | | Increase over existing | | Type Impact | With Barrier | Noise Reduction | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Calculated | Crit'n | Calculated | Crit'n Sub'l Inc | | Calculated LAeq1h | Calculated | Goal | Calculated minus Goal |
| | | | dBA | dBA | dBA | dB | dB | | dBA | dB | dB | dB |
| NSA1R01 | 1 | 1 | 0.0 | 60.7 | 66 | 60.7 | 10 | ---- | 60.7 | 0.0 | 8 | -8.0 |
| NSA2R01_MES | 2 | 1 | 0.0 | 58.9 | 66 | 58.9 | 10 | ---- | 58.9 | 0.0 | 8 | -8.0 |
| NSA2R02_MES | 3 | 1 | 0.0 | 54.3 | 66 | 54.3 | 10 | ---- | 54.3 | 0.0 | 8 | -8.0 |
| NSA3R01_MES | 4 | 1 | 0.0 | 48.1 | 66 | 48.1 | 10 | ---- | 48.1 | 0.0 | 8 | -8.0 |
| NSA3R02 | 5 | 1 | 0.0 | 53.3 | 66 | 53.3 | 10 | ---- | 53.3 | 0.0 | 8 | -8.0 |
| NSA3R1_OLA | 6 | 1 | 0.0 | 44.5 | 66 | 44.5 | 10 | ---- | 44.5 | 0.0 | 8 | -8.0 |
| NSA3R03 | 7 | 1 | 0.0 | 50.5 | 66 | 50.5 | 10 | ---- | 50.5 | 0.0 | 8 | -8.0 |
| NSA3R04 | 8 | 1 | 0.0 | 48.4 | 66 | 48.4 | 10 | ---- | 48.4 | 0.0 | 8 | -8.0 |
| NSA3R05 | 9 | 1 | 0.0 | 49.9 | 66 | 49.9 | 10 | ---- | 49.9 | 0.0 | 8 | -8.0 |
| NSA3R06 | 10 | 1 | 0.0 | 58.7 | 66 | 58.7 | 10 | ---- | 58.7 | 0.0 | 8 | -8.0 |
| NSA3R07 | 11 | 1 | 0.0 | 58.2 | 66 | 58.2 | 10 | ---- | 58.2 | 0.0 | 8 | -8.0 |
| NSA3R08 | 12 | 1 | 0.0 | 51.8 | 66 | 51.8 | 10 | ---- | 51.8 | 0.0 | 8 | -8.0 |
| NSA3R09 | 13 | 1 | 0.0 | 55.5 | 66 | 55.5 | 10 | ---- | 55.5 | 0.0 | 8 | -8.0 |

| Dwelling Units | # DUs | Noise Reduction | | |
|---|---|---|---|---|
| | | Min | Avg | Max |
| | | dB | dB | dB |
| All Selected | 13 | 0.0 | 0.0 | 0.0 |
| All Impacted | 0 | 0.0 | 0.0 | 0.0 |
| All that meet NR Goal | 0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <Organization?> | | | | | 8 December 2021 | | | | | | | |
| <Analysis By?> | | | | | TNM 2.5 | | | | | | | |
| | | | | | | | | | | | | |
| INPUT: ROADWAYS | | | | | | | Average pavement type shall be used unless | | | | | |
| PROJECT/CONTRACT: | <Project Name?> | | | | | | a State highway agency substantiates the use | | | | | |
| RUN: | <Run Title?> | | | | | | of a different type with the approval of FHWA | | | | | |
| Roadway | | Points | | | | | | | | | | |
| Name | Width | Name | No. | Coordinates (pavement) | | | Flow Control | | | Segment | | |
| | | | | X | Y | Z | Control Device | Speed Constraint | Percent Vehicles Affected | Pvmt Type | On Struct? | |
| | m | | | m | m | m | | km/h | % | | | |
| Roadway2 | 3.7 | point216 | 216 | 614,301.0 | 4,888,280.0 | 281.00 | | | | Average | | |
| | | point215 | 215 | 614,301.6 | 4,888,276.5 | 281.00 | | | | Average | | |
| | | point214 | 214 | 614,303.0 | 4,888,270.0 | 281.00 | | | | Average | | |
| | | point213 | 213 | 614,307.1 | 4,888,249.0 | 281.00 | | | | Average | | |
| | | point212 | 212 | 614,309.6 | 4,888,236.5 | 281.00 | | | | Average | | |
| | | point211 | 211 | 614,310.4 | 4,888,232.5 | 281.00 | | | | Average | | |
| | | point210 | 210 | 614,311.2 | 4,888,229.0 | 281.00 | | | | Average | | |
| | | point209 | 209 | 614,312.0 | 4,888,224.5 | 281.00 | | | | Average | | |
| | | point208 | 208 | 614,317.6 | 4,888,196.5 | 281.00 | | | | Average | | |
| | | point207 | 207 | 614,321.1 | 4,888,178.5 | 281.00 | | | | Average | | |
| | | point206 | 206 | 614,327.2 | 4,888,147.0 | 281.00 | | | | Average | | |
| | | point205 | 205 | 614,332.1 | 4,888,121.5 | 281.00 | | | | Average | | |
| | | point204 | 204 | 614,336.6 | 4,888,098.5 | 281.00 | | | | Average | | |
| | | point203 | 203 | 614,340.0 | 4,888,081.0 | 281.71 | | | | Average | | |
| | | point202 | 202 | 614,340.5 | 4,888,078.0 | 281.63 | | | | Average | | |
| | | point201 | 201 | 614,346.3 | 4,888,048.0 | 282.00 | | | | Average | | |
| | | point200 | 200 | 614,347.6 | 4,888,042.0 | 282.00 | | | | Average | | |
| | | point199 | 199 | 614,351.6 | 4,888,021.5 | 282.00 | | | | Average | | |
| | | point198 | 198 | 614,352.6 | 4,888,017.0 | 282.00 | | | | Average | | |
| | | point197 | 197 | 614,352.7 | 4,888,016.0 | 282.00 | | | | Average | | |
| | | point196 | 196 | 614,355.6 | 4,888,001.5 | 282.00 | | | | Average | | |
| | | point195 | 195 | 614,356.1 | 4,887,999.0 | 282.00 | | | | Average | | |
| | | point194 | 194 | 614,356.5 | 4,887,997.0 | 282.00 | | | | Average | | |
| | | point193 | 193 | 614,358.6 | 4,887,987.0 | 282.00 | | | | Average | | |
| | | point192 | 192 | 614,360.0 | 4,887,979.5 | 282.00 | | | | Average | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point191 | 191 | 614,362.2 | 4,887,968.0 | 282.00 | | | | Average | |
| | | point190 | 190 | 614,362.7 | 4,887,966.0 | 282.00 | | | | Average | |
| | | point189 | 189 | 614,363.0 | 4,887,964.5 | 282.00 | | | | Average | |
| | | point188 | 188 | 614,363.6 | 4,887,961.5 | 282.00 | | | | Average | |
| | | point187 | 187 | 614,365.6 | 4,887,951.0 | 282.00 | | | | Average | |
| | | point186 | 186 | 614,368.1 | 4,887,939.0 | 282.00 | | | | Average | |
| | | point185 | 185 | 614,370.5 | 4,887,926.5 | 282.00 | | | | Average | |
| | | point184 | 184 | 614,371.2 | 4,887,923.0 | 282.00 | | | | Average | |
| | | point183 | 183 | 614,371.8 | 4,887,920.0 | 282.00 | | | | Average | |
| | | point182 | 182 | 614,372.8 | 4,887,915.5 | 282.00 | | | | Average | |
| | | point181 | 181 | 614,373.1 | 4,887,913.5 | 282.00 | | | | Average | |
| | | point180 | 180 | 614,373.9 | 4,887,909.5 | 282.00 | | | | Average | |
| | | point179 | 179 | 614,375.1 | 4,887,903.5 | 281.77 | | | | Average | |
| | | point178 | 178 | 614,377.8 | 4,887,889.5 | 281.32 | | | | Average | |
| | | point177 | 177 | 614,379.6 | 4,887,880.0 | 281.00 | | | | Average | |
| | | point175 | 175 | 614,381.6 | 4,887,870.5 | 281.00 | | | | Average | |
| | | point174 | 174 | 614,382.4 | 4,887,866.0 | 281.00 | | | | Average | |
| | | point173 | 173 | 614,383.9 | 4,887,858.0 | 281.00 | | | | Average | |
| | | point172 | 172 | 614,384.2 | 4,887,856.5 | 281.00 | | | | Average | |
| | | point171 | 171 | 614,387.6 | 4,887,839.5 | 280.00 | | | | Average | |
| | | point170 | 170 | 614,388.0 | 4,887,837.5 | 280.00 | | | | Average | |
| | | point169 | 169 | 614,388.8 | 4,887,833.5 | 280.00 | | | | Average | |
| | | point168 | 168 | 614,389.9 | 4,887,828.0 | 280.00 | | | | Average | |
| | | point167 | 167 | 614,390.6 | 4,887,824.5 | 280.00 | | | | Average | |
| | | point166 | 166 | 614,391.4 | 4,887,820.0 | 280.00 | | | | Average | |
| | | point165 | 165 | 614,392.1 | 4,887,816.5 | 279.89 | | | | Average | |
| | | point164 | 164 | 614,392.2 | 4,887,816.0 | 279.85 | | | | Average | |
| | | point163 | 163 | 614,394.1 | 4,887,806.0 | 279.00 | | | | Average | |
| | | point162 | 162 | 614,395.4 | 4,887,799.5 | 279.00 | | | | Average | |
| | | point161 | 161 | 614,396.5 | 4,887,794.0 | 279.00 | | | | Average | |
| | | point160 | 160 | 614,396.8 | 4,887,792.5 | 279.00 | | | | Average | |
| | | point159 | 159 | 614,397.6 | 4,887,788.5 | 279.00 | | | | Average | |
| | | point158 | 158 | 614,397.8 | 4,887,787.5 | 278.97 | | | | Average | |
| | | point156 | 156 | 614,398.1 | 4,887,786.0 | 278.73 | | | | Average | |
| | | point155 | 155 | 614,398.9 | 4,887,781.5 | 278.00 | | | | Average | |
| | | point154 | 154 | 614,400.4 | 4,887,774.0 | 278.00 | | | | Average | |
| | | point153 | 153 | 614,401.3 | 4,887,769.5 | 278.00 | | | | Average | |
| | | point152 | 152 | 614,402.5 | 4,887,763.5 | 278.00 | | | | | |
| Roadway3 | 3.7 | point269 | 269 | 614,405.9 | 4,887,762.5 | 277.97 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point268 | 268 | 614,405.2 | 4,887,766.0 | 278.00 | | | | Average | |
| | | point267 | 267 | 614,404.5 | 4,887,769.5 | 278.00 | | | | Average | |
| | | point266 | 266 | 614,403.1 | 4,887,777.0 | 278.00 | | | | Average | |
| | | point265 | 265 | 614,402.1 | 4,887,782.5 | 278.00 | | | | Average | |
| | | point264 | 264 | 614,401.0 | 4,887,787.5 | 278.89 | | | | Average | |
| | | point263 | 263 | 614,400.6 | 4,887,789.5 | 279.00 | | | | Average | |
| | | point262 | 262 | 614,399.8 | 4,887,794.0 | 279.00 | | | | Average | |
| | | point261 | 261 | 614,397.2 | 4,887,807.0 | 279.00 | | | | Average | |
| | | point260 | 260 | 614,395.4 | 4,887,816.5 | 279.80 | | | | Average | |
| | | point259 | 259 | 614,394.7 | 4,887,819.5 | 280.00 | | | | Average | |
| | | point258 | 258 | 614,394.1 | 4,887,823.0 | 280.00 | | | | Average | |
| | | point257 | 257 | 614,392.1 | 4,887,833.0 | 280.00 | | | | Average | |
| | | point256 | 256 | 614,390.9 | 4,887,839.5 | 280.00 | | | | Average | |
| | | point255 | 255 | 614,390.6 | 4,887,840.5 | 280.00 | | | | Average | |
| | | point254 | 254 | 614,387.4 | 4,887,857.0 | 281.00 | | | | Average | |
| | | point253 | 253 | 614,386.6 | 4,887,861.5 | 281.00 | | | | Average | |
| | | point252 | 252 | 614,385.6 | 4,887,866.0 | 281.00 | | | | Average | |
| | | point251 | 251 | 614,384.2 | 4,887,873.5 | 281.00 | | | | Average | |
| | | point250 | 250 | 614,382.9 | 4,887,880.5 | 281.00 | | | | Average | |
| | | point249 | 249 | 614,380.4 | 4,887,893.0 | 281.47 | | | | Average | |
| | | point248 | 248 | 614,377.1 | 4,887,910.0 | 282.00 | | | | Average | |
| | | point247 | 247 | 614,376.4 | 4,887,913.5 | 282.00 | | | | Average | |
| | | point246 | 246 | 614,374.2 | 4,887,924.5 | 282.00 | | | | Average | |
| | | point245 | 245 | 614,373.8 | 4,887,927.0 | 282.00 | | | | Average | |
| | | point244 | 244 | 614,372.2 | 4,887,935.0 | 282.00 | | | | Average | |
| | | point243 | 243 | 614,368.7 | 4,887,953.0 | 282.00 | | | | Average | |
| | | point242 | 242 | 614,367.3 | 4,887,960.0 | 282.00 | | | | Average | |
| | | point241 | 241 | 614,365.3 | 4,887,970.0 | 282.00 | | | | Average | |
| | | point240 | 240 | 614,363.9 | 4,887,977.0 | 282.00 | | | | Average | |
| | | point239 | 239 | 614,361.5 | 4,887,989.0 | 282.00 | | | | Average | |
| | | point238 | 238 | 614,360.2 | 4,887,995.5 | 282.00 | | | | Average | |
| | | point237 | 237 | 614,359.3 | 4,888,000.0 | 282.00 | | | | Average | |
| | | point236 | 236 | 614,357.9 | 4,888,007.0 | 282.00 | | | | Average | |
| | | point235 | 235 | 614,356.1 | 4,888,016.5 | 282.00 | | | | Average | |
| | | point234 | 234 | 614,353.0 | 4,888,032.0 | 282.00 | | | | Average | |
| | | point233 | 233 | 614,347.6 | 4,888,059.0 | 282.00 | | | | Average | |
| | | point232 | 232 | 614,343.4 | 4,888,080.0 | 282.00 | | | | Average | |
| | | point231 | 231 | 614,343.1 | 4,888,082.0 | 281.88 | | | | Average | |
| | | point230 | 230 | 614,342.2 | 4,888,086.5 | 281.90 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point229 | 229 | 614,335.9 | 4,888,120.5 | 281.00 | | | | Average | |
| | | point228 | 228 | 614,333.7 | 4,888,132.5 | 281.00 | | | | Average | |
| | | point227 | 227 | 614,328.8 | 4,888,159.0 | 281.00 | | | | Average | |
| | | point226 | 226 | 614,325.5 | 4,888,177.0 | 281.00 | | | | Average | |
| | | point225 | 225 | 614,321.1 | 4,888,201.0 | 281.00 | | | | Average | |
| | | point224 | 224 | 614,318.1 | 4,888,217.0 | 281.00 | | | | Average | |
| | | point223 | 223 | 614,316.4 | 4,888,226.0 | 281.00 | | | | Average | |
| | | point222 | 222 | 614,314.9 | 4,888,234.5 | 281.00 | | | | Average | |
| | | point221 | 221 | 614,314.5 | 4,888,236.5 | 281.00 | | | | Average | |
| | | point220 | 220 | 614,310.1 | 4,888,260.5 | 281.00 | | | | Average | |
| | | point219 | 219 | 614,308.1 | 4,888,271.0 | 281.00 | | | | Average | |
| | | point218 | 218 | 614,307.5 | 4,888,274.5 | 281.00 | | | | Average | |
| | | point217 | 217 | 614,306.3 | 4,888,281.0 | 281.00 | | | | | |
| Roadway4 | 3.7 | point441 | 441 | 614,402.6 | 4,887,762.0 | 278.00 | | | | Average | |
| | | point414 | 414 | 614,402.8 | 4,887,741.5 | 271.00 | | | | Average | |
| | | point413 | 413 | 614,409.9 | 4,887,704.0 | 270.25 | | | | Average | |
| | | point412 | 412 | 614,413.8 | 4,887,675.5 | 269.00 | | | | Average | |
| | | point411 | 411 | 614,416.2 | 4,887,659.5 | 268.50 | | | | Average | |
| | | point410 | 410 | 614,419.1 | 4,887,626.0 | 267.40 | | | | Average | |
| | | point409 | 409 | 614,420.1 | 4,887,615.0 | 267.00 | | | | Average | |
| | | point408 | 408 | 614,420.9 | 4,887,596.0 | 266.50 | | | | Average | |
| | | point407 | 407 | 614,421.6 | 4,887,576.5 | 266.00 | | | | Average | |
| | | point406 | 406 | 614,422.3 | 4,887,557.5 | 265.00 | | | | Average | |
| | | point405 | 405 | 614,423.2 | 4,887,538.5 | 264.50 | | | | Average | |
| | | point404 | 404 | 614,424.4 | 4,887,526.0 | 264.00 | | | | Average | |
| | | point403 | 403 | 614,429.4 | 4,887,476.0 | 261.50 | | | | Average | |
| | | point402 | 402 | 614,438.1 | 4,887,424.0 | 259.00 | | | | Average | |
| | | point401 | 401 | 614,449.2 | 4,887,378.0 | 257.00 | | | | | |
| Roadway5 | 3.7 | point439 | 439 | 614,592.1 | 4,886,849.5 | 245.00 | | | | Average | |
| | | point415 | 415 | 614,559.7 | 4,886,989.0 | 247.00 | | | | Average | |
| | | point416 | 416 | 614,548.8 | 4,887,043.0 | 249.00 | | | | Average | |
| | | point417 | 417 | 614,539.0 | 4,887,092.0 | 250.00 | | | | Average | |
| | | point418 | 418 | 614,528.9 | 4,887,141.0 | 251.75 | | | | Average | |
| | | point419 | 419 | 614,527.4 | 4,887,148.0 | 251.75 | | | | Average | |
| | | point420 | 420 | 614,515.3 | 4,887,189.0 | 253.25 | | | | Average | |
| | | point421 | 421 | 614,501.4 | 4,887,237.0 | 254.75 | | | | Average | |
| | | point422 | 422 | 614,484.1 | 4,887,284.0 | 255.00 | | | | Average | |
| | | point423 | 423 | 614,472.8 | 4,887,314.5 | 255.25 | | | | Average | |
| | | point424 | 424 | 614,467.4 | 4,887,331.0 | 255.50 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point425 | 425 | 614,452.8 | 4,887,379.0 | 257.00 | | | | | |
| Roadway4-2 | 3.7 | point443 | 443 | 614,449.2 | 4,887,378.0 | 257.00 | | | | Average | |
| | | point400 | 400 | 614,463.8 | 4,887,330.0 | 255.50 | | | | Average | |
| | | point399 | 399 | 614,469.2 | 4,887,313.0 | 255.25 | | | | Average | |
| | | point398 | 398 | 614,480.6 | 4,887,283.0 | 255.00 | | | | Average | |
| | | point397 | 397 | 614,497.8 | 4,887,236.0 | 254.75 | | | | Average | |
| | | point396 | 396 | 614,511.8 | 4,887,188.0 | 253.25 | | | | Average | |
| | | point395 | 395 | 614,523.8 | 4,887,147.0 | 251.75 | | | | Average | |
| | | point394 | 394 | 614,525.2 | 4,887,140.0 | 251.75 | | | | Average | |
| | | point393 | 393 | 614,535.3 | 4,887,091.0 | 250.00 | | | | Average | |
| | | point392 | 392 | 614,545.1 | 4,887,042.0 | 249.00 | | | | Average | |
| | | point391 | 391 | 614,556.0 | 4,886,988.5 | 247.00 | | | | Average | |
| | | point440 | 440 | 614,581.1 | 4,886,847.0 | 245.00 | | | | | |
| Roadway5-2 | 3.7 | point444 | 444 | 614,452.8 | 4,887,379.0 | 257.00 | | | | Average | |
| | | point426 | 426 | 614,441.8 | 4,887,425.0 | 259.00 | | | | Average | |
| | | point427 | 427 | 614,433.1 | 4,887,476.5 | 261.50 | | | | Average | |
| | | point428 | 428 | 614,428.1 | 4,887,526.5 | 264.00 | | | | Average | |
| | | point429 | 429 | 614,426.9 | 4,887,538.5 | 264.50 | | | | Average | |
| | | point430 | 430 | 614,426.1 | 4,887,557.5 | 265.00 | | | | Average | |
| | | point431 | 431 | 614,425.4 | 4,887,577.0 | 266.00 | | | | Average | |
| | | point432 | 432 | 614,424.7 | 4,887,596.0 | 266.50 | | | | Average | |
| | | point433 | 433 | 614,423.8 | 4,887,615.0 | 267.00 | | | | Average | |
| | | point434 | 434 | 614,422.8 | 4,887,626.0 | 267.40 | | | | Average | |
| | | point435 | 435 | 614,419.9 | 4,887,660.0 | 268.50 | | | | Average | |
| | | point436 | 436 | 614,417.6 | 4,887,676.0 | 269.00 | | | | Average | |
| | | point437 | 437 | 614,413.6 | 4,887,704.5 | 270.25 | | | | Average | |
| | | point438 | 438 | 614,406.5 | 4,887,742.0 | 271.00 | | | | Average | |
| | | point442 | 442 | 614,405.9 | 4,887,761.5 | 278.00 | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <Organization?> | | | | 8 December 2021 | | | | | | | | |
| <Analysis By?> | | | | TNM 2.5 | | | | | | | | |
| INPUT: TRAFFIC FOR LAeq1h Volumes | | | | | | | | | | | | |
| PROJECT/CONTRACT: | <Project Name?> | | | | | | | | | | | |
| RUN: | <Run Title?> | | | | | | | | | | | |
| Roadway | Points | | | | | | | | | | | |
| Name | Name | No. | Segment | | | | | | | | | |
| | | | Autos | | MTrucks | | HTrucks | | Buses | | Motorcycles | |
| | | | V | S | V | S | V | S | V | S | V | S |
| | | | veh/hr | km/h | veh/hr | km/h | veh/hr | km/h | veh/hr | km/h | veh/hr | km/h |
| Roadway2 | point216 | 216 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point215 | 215 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point214 | 214 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point213 | 213 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point212 | 212 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point211 | 211 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point210 | 210 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point209 | 209 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point208 | 208 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point207 | 207 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point206 | 206 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point205 | 205 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point204 | 204 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point203 | 203 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point202 | 202 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point201 | 201 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point200 | 200 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point199 | 199 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point198 | 198 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point197 | 197 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point196 | 196 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point195 | 195 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point194 | 194 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | point193 | 193 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point192 | 192 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point191 | 191 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point190 | 190 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point189 | 189 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point188 | 188 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point187 | 187 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point186 | 186 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point185 | 185 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point184 | 184 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point183 | 183 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point182 | 182 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point181 | 181 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point180 | 0 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point179 | 179 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point178 | 178 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point177 | 177 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point175 | 175 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point174 | 174 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point173 | 173 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point172 | 172 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point171 | 171 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point170 | 170 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point169 | 169 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point168 | 168 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point167 | 167 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point166 | 166 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point165 | 165 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point164 | 164 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point163 | 163 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point162 | 162 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point161 | 161 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point160 | 160 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point159 | 159 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point158 | 158 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point156 | 156 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | point155 | 155 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point154 | 154 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point153 | 153 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point152 | 152 | | | | | | | | | | |
| Roadway3 | point269 | 269 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point268 | 268 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point267 | 267 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point266 | 266 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point265 | 265 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point264 | 264 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point263 | 263 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point262 | 262 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point261 | 261 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point260 | 260 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point259 | 259 | 592 | 80 | 10 | 80 | 0 | 80 | 0 | 0 | 0 | 0 |
| | point258 | 258 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point257 | 257 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point256 | 256 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point255 | 255 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point254 | 254 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point253 | 253 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point252 | 252 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point251 | 251 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point250 | 250 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point249 | 249 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point248 | 248 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point247 | 247 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point246 | 246 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point245 | 245 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point244 | 244 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point243 | 243 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point242 | 242 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point241 | 241 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point240 | 240 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point239 | 239 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point238 | 238 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | point237 | 237 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point236 | 236 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point235 | 235 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point234 | 234 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point233 | 233 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point232 | 232 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point231 | 231 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point230 | 230 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point229 | 229 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point228 | 228 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point227 | 227 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point226 | 226 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point225 | 225 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point224 | 224 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point223 | 223 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point222 | 222 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point221 | 221 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point220 | 220 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point219 | 219 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point218 | 218 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point217 | 217 | | | | | | | | | | |
| Roadway4 | point441 | 441 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point414 | 414 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point413 | 413 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point412 | 412 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point411 | 411 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point410 | 410 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point409 | 409 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point408 | 408 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point407 | 407 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point406 | 406 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point405 | 405 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point404 | 404 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point403 | 403 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point402 | 402 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point401 | 401 | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roadway5 | point439 | 439 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point415 | 415 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point416 | 416 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point417 | 417 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point418 | 418 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point419 | 419 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point420 | 420 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point421 | 421 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point422 | 422 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point423 | 423 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point424 | 424 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point425 | 425 | | | | | | | | | | |
| Roadway4-2 | point443 | 443 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point400 | 400 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point399 | 399 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point398 | 398 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point397 | 397 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point396 | 396 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point395 | 395 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point394 | 394 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point393 | 393 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point392 | 392 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point391 | 391 | 592 | 50 | 10 | 50 | 16 | 50 | 0 | 0 | 0 | 0 |
| | point440 | 440 | | | | | | | | | | |
| Roadway5-2 | point444 | 444 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point426 | 426 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point427 | 427 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point428 | 428 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point429 | 429 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point430 | 430 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point431 | 431 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point432 | 432 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point433 | 433 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point434 | 434 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point435 | 435 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point436 | 436 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | point437 | 437 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point438 | 438 | 592 | 80 | 10 | 80 | 16 | 80 | 0 | 0 | 0 | 0 |
| | point442 | 442 | | | | | | | | | | |

<Organization?>
8 December 2021
<Analysis By?>
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: <Project Name?>
RUN: <Run Title?>

| Receiver Name | No. | #DUs | Coordinates (ground) X | Y | Z | Height above Ground | Input Sound Levels and Criteria: Existing LAeq1h | Impact Criteria LAeq1h | Impact Criteria Sub'l | NR Goal | Active in Calc. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | m | m | m | dBA | dBA | dB | dB | |
| NSA1R01 | 1 | 1 | 614,271.7 | 4,888,223.5 | 279.00 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA2R01_MES | 2 | 1 | 614,346.6 | 4,887,809.5 | 288.57 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA2R02_MES | 3 | 1 | 614,325.2 | 4,887,735.5 | 286.16 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R01_MES | 4 | 1 | 614,331.2 | 4,887,232.5 | 259.88 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R02 | 5 | 1 | 614,410.9 | 4,887,211.5 | 256.35 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R1_OLA | 6 | 1 | 614,317.5 | 4,887,227.5 | 260.61 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R03 | 7 | 1 | 614,397.5 | 4,887,175.5 | 255.53 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R04 | 8 | 1 | 614,390.6 | 4,887,140.0 | 254.26 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R05 | 9 | 1 | 614,434.9 | 4,887,100.5 | 254.00 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R06 | 10 | 1 | 614,495.9 | 4,887,102.5 | 252.27 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R07 | 11 | 1 | 614,511.4 | 4,887,040.5 | 253.00 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R08 | 12 | 1 | 614,506.0 | 4,886,991.5 | 254.00 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |
| NSA3R09 | 13 | 1 | 614,526.1 | 4,886,954.0 | 250.70 | 1.50 | 0.00 | 66 | 10.0 | 8.0 | Y |

<Organization?> 8 December 2021
<Analysis By?> TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: <Project Name?>
RUN: <Run Title?>

| Barrier | | | | | | | | | Points | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Type | Height | | If Wall | If Berm | | | Add'tnl | Name | No. | Coordinates (bottom) | | | Height | Segment | | | | |
| | | Min | Max | $ per | $ per | Top | Run:Rise | $ per | | | X | Y | Z | at | Seg Ht Perturbs | | | On | Important |
| | | | | Unit | Unit | Width | | Unit | | | | | | Point | Incre- | #Up | #Dn | Struct? | Reflec- |
| | | | | Area | Vol. | | | Length | | | | | | | ment | | | | tions? |
| | | m | m | $/sq m | $/cu m | m | m:m | $/m | | | m | m | m | m | m | | | | |
| Barrier3 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point3 | 3 | 614,339.0 | 4,887,228.0 | 258.78 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point4 | 4 | 614,321.2 | 4,887,230.5 | 260.51 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point5 | 5 | 614,320.3 | 4,887,222.5 | 260.28 | 6.00 | | | | | |
| Barrier4 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point6 | 6 | 614,449.5 | 4,887,080.0 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point7 | 7 | 614,442.1 | 4,887,097.0 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point8 | 8 | 614,429.2 | 4,887,093.0 | 254.19 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point9 | 9 | 614,435.1 | 4,887,080.5 | 254.26 | 6.00 | | | | | |
| Barrier5 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point10 | 10 | 614,461.8 | 4,887,089.0 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point11 | 11 | 614,457.4 | 4,887,098.5 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point12 | 12 | 614,446.6 | 4,887,095.5 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point13 | 13 | 614,449.8 | 4,887,087.0 | 254.00 | 6.00 | | | | | |
| Barrier6 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point14 | 14 | 614,474.8 | 4,887,079.0 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point15 | 15 | 614,483.8 | 4,887,097.0 | 253.29 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point16 | 16 | 614,472.1 | 4,887,103.5 | 253.29 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point17 | 17 | 614,464.1 | 4,887,090.0 | 254.00 | 6.00 | | | | | |
| Barrier7 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point18 | 18 | 614,493.8 | 4,887,079.0 | 254.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point19 | 19 | 614,500.9 | 4,887,094.5 | 252.29 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point20 | 20 | 614,488.2 | 4,887,101.5 | 252.89 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point21 | 21 | 614,478.7 | 4,887,084.0 | 254.00 | 6.00 | | | | | |
| Barrier8 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point22 | 22 | 614,489.9 | 4,887,060.0 | 254.08 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point23 | 23 | 614,506.3 | 4,887,065.5 | 252.52 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point24 | 24 | 614,503.4 | 4,887,075.0 | 252.90 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point25 | 25 | 614,491.8 | 4,887,072.0 | 254.00 | 6.00 | | | | | |
| Barrier9 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point26 | 26 | 614,490.3 | 4,887,044.5 | 254.68 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point27 | 27 | 614,504.4 | 4,887,049.5 | 252.77 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point28 | 28 | 614,502.2 | 4,887,062.0 | 252.84 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point29 | 29 | 614,487.5 | 4,887,058.0 | 254.23 | 6.00 | | | | | |
| Barrier10 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point30 | 30 | 614,494.8 | 4,887,030.5 | 255.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point31 | 31 | 614,509.4 | 4,887,035.0 | 253.03 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point32 | 32 | 614,505.6 | 4,887,047.5 | 252.75 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point33 | 33 | 614,487.2 | 4,887,042.5 | 254.98 | 6.00 | | | | | |
| Barrier11 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point34 | 34 | 614,496.9 | 4,887,013.5 | 255.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point35 | 35 | 614,509.4 | 4,887,015.0 | 253.72 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point36 | 36 | 614,508.1 | 4,887,029.5 | 253.40 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point37 | 37 | 614,488.7 | 4,887,027.5 | 255.00 | 6.00 | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrier12 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point38 | 38 | 614,484.8 | 4,886,993.5 | 255.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point39 | 39 | 614,499.6 | 4,886,987.0 | 254.67 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point40 | 40 | 614,505.5 | 4,887,000.0 | 253.95 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point41 | 41 | 614,488.2 | 4,887,009.0 | 255.00 | 6.00 | | | | | |
| Barrier13 | W | 0.00 | 30.48 | 0.00 | | | | 0.00 | point42 | 42 | 614,279.4 | 4,888,241.5 | 279.48 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point43 | 43 | 614,283.0 | 4,888,230.0 | 279.24 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point44 | 44 | 614,257.7 | 4,888,222.5 | 279.02 | 6.00 | | | | | |

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# Construction Noise Report

Highway 400 – Highway 404 Link (Bradford Bypass)
County Road 4 Early Works
GWP 2008-21-00

Ontario Ministry of Transportation

Project number: 60636190

March 16, 2022

# Statement of Qualifications and Limitations

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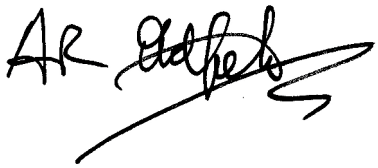
*AECOM: 2015-04-13*

## Quality information

**Prepared by**

James Au. P.Eng. INCE
Senior Acoustic Engineer

**Checked by**



Alan Oldfield, AVP, Department Manager – Air + EHS + Acoustics – Canada Region

## Revision History

| Revision | Revision date | Details |
|---|---|---|
| 0 | March 16, 2022 | Original Document |
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## Prepared for:

Ontario Ministry of Transportation

## Prepared by:

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# Tables



# Appendicies

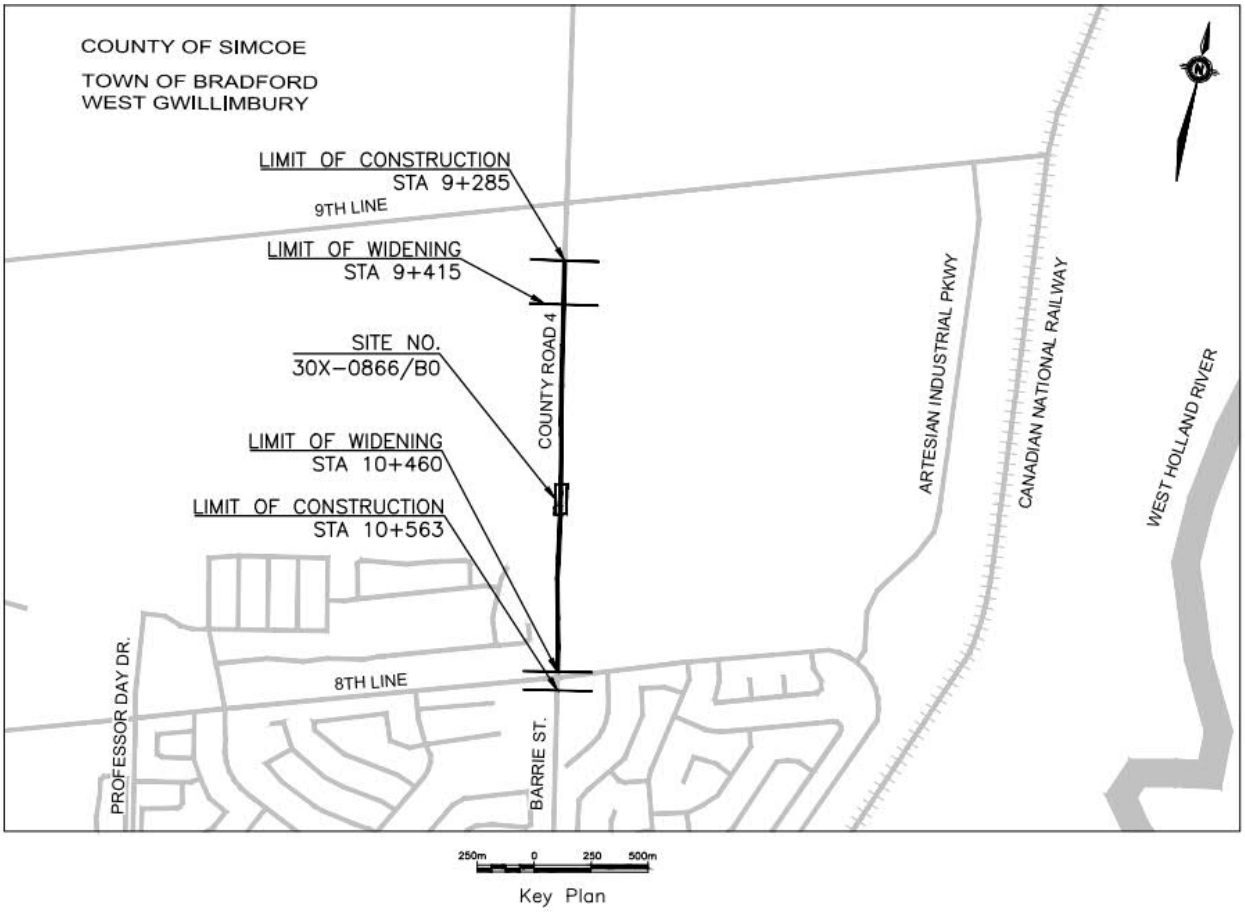
# 1. Introduction

The Ontario Ministry of Transportation (MTO) has retained AECOM Canada Ltd. (AECOM) to undertake the Early Works study for the grade separated bridge crossing at County Road 4 for the future Bradford Bypass (Highway 400 – Highway 404 Link) Project, in accordance with the provisions of the Ontario Regulation (O. Reg. ) 697/21. The limits of construction work are located along County Road 4 from 8th Line to the intersection with 9th Line within in the Town of Bradford West Gwillimbury and that area is referred to as the Study Area. This study will advance as an early works project for the Bradford Bypass. The new bridge will be designed to include the widening and underpass of County Road 4 approved by Simcoe County. The construction for the road widening and the bridge structure are referred to as the Project in this report. The Project extents are depicted in **Figure 1**.

AECOM Canada Ltd. has been retained by the Ontario Ministry of Transportation to study the early works of County Road 4 in advance of the Bradford Bypass construction. Simcoe County conducted an Environmental Assessment (EA) in 2012 for the widening of County Road 4 from 2 to 4 lanes. The Bradford Bypass will require the construction of a bridge structure for County Road 4 to pass over the Bradford Bypass. The early works will combine the construction of required bridge structure, and the widening of County Road 4 in the area near the bridge structure.

The purpose of this report is to document the construction noise assessment completed to evaluate the potential noise impacts of the construction works on the nearby Noise Sensitive Areas (NSAs). This report has been prepared in accordance with the methods and procedures recommended in the MTO Environmental Guide for Noise (Reference 1 – the MTO Guide). Relevant guidelines from the Ministry of the Environment, Conservation and Parks (MECP) and local municipal noise control bylaws are also considered in this assessment.

**Figure 1: Key Plan**



# 2. Construction Noise Guidelines

## 2.1 Provincial Guidelines

### 2.1.1 MTO Guidelines

The assessment of noise with regards to MTO projects is documented in the MTO Guide. The MTO Guide provides detailed guidance for the assessment of two categories, the long term traffic noise levels, and construction noise. The scope of this report is limited to construction noise. Long term traffic noise will be addressed under a separate report.

The MTO Guide requirements for construction noise are documented in Section 8.4 of the MTO Guide which states:

1. *NSAs must be identified during the project planning stage;*
2. *Potential noise impacts of construction equipment on NSAs must be identified. These might include impacts resulting from hours or type of operation or proximity of equipment;*
3. *Potential mitigation of noise impacts from construction equipment must be identified. These might include measures such as timing constraints, setbacks of certain operations from NSAs, or quieter equipment;*
4. *The technical and economic feasibility of various alternatives must be evaluated in order to select the appropriate construction noise control measures;*
5. *Municipal noise control bylaws must be reviewed for requirements that may cause hardship to the project. This can be a particular problem when the need for night construction work is identified; and*
6. *In certain situations, a contract may require work that is in contravention of a municipal noise control bylaw. As of April 2019, MTO no longer applies for noise by-law exemptions; please see* ***Section 2.2*** *for further details.*

The MTO Guide states that during construction, mitigation measures and a process to manage noise complaints are to be implemented and enforced. Despite compliance with any noise control measures identified in the contract documents, a persistent complaint must require a field investigation to determine noise level emissions. In this case, the Contract Services Administrator (CSA) must contact the MTO Acoustical Specialist. If noise level emissions for the construction equipment used exceed the sound level criteria for construction equipment contained in the Ministry of the Environment [now MECP] Model Municipal Noise Control By-law, MTO requires the contractor to comply with the sound level criteria where quieter alternative equipment is reasonably available.

### 2.1.2 MECP Guidelines

For construction noise, the MECP sets out sound emission standards for various types of construction equipment in their publications NPC-115 (Reference #2) and NPC-118 (Reference #3). The sound emission standards outlined in NPC-115 and NPC-118, for typical construction equipment and vehicles, are reproduced in the tables below (**Table 1** to **Table 5**). Please see NPC-103 for measurement procedures.

**Table 1. NPC-115 Quiet Zone and Residential Area Sound Emission Standards for Excavation Equipment, Dozers, Loaders, Backhoes or Other Equipment Capable of Being used for Similar Application**

| Maximum Sound Level (dBA) as determined using Publication NPC-103 – Procedures Section 6 | | |
|---|---|---|
| Date of Manufacture | Power Rating | |
| | Less than 75 kW | 75 kW and Larger |
| January 1, 1979 to December 31, 1980 | 85 | 88 |
| January 1, 1981 and after | 83 | 85 |

*Source: NPC-115 table 115-1*

**Table 2. NPC-115 Sound Emission Standards for Pneumatic Pavement Breakers**

| Standard | Date of Manufacture | Maximum Sound Level (dBA) as measured using Publication NPC-103 |
|---|---|---|
| Quiet Zone Sound Emission | January 1, 1979 and after | 85 |
| Residential Area Sound Emission | January 1, 1979 to December 31, 1980 | 90 |
| | January 1, 1981 and after | 85 |

*Source: NPC-115 table 115-2*

**Table 3. NPC-115 Sound Emission Standards for Portable Air Compressors**

| Standard | Date of Manufacture | Maximum Sound Level (dBA) as measured using Publication NPC-103 |
|---|---|---|
| Quiet Zone Sound Emission | January 1, 1979 to December 31, 1980 | 76 |
| | January 1, 1981 and after | 70 |
| Residential Area Sound Emission | January 1, 1979 and after | 76 |

*Source: NPC-115 table 115-3*

**Table 4. NPC-115 Sound Emission Standards for Tracked Drills**

| Standard | Date of Manufacture | Maximum Sound Level (dBA) as measured using Publication NPC-103, Section 6 |
|---|---|---|
| Quiet Zone and Residential Area Sound Emission | January 1, 1981 and after | 100 |

*Source: NPC-115 table 115-4*

**Table 5. NPC-118 Sound Emission Standards for Heavy Vehicles with Governed Diesel Engines**

| Date of Manufacture | Maximum Sound Level (dBA) as measured using Publication NPC-103, Section 9 |
|---|---|
| Prior to January 1 ,1979 | 100 |
| January 1, 1979 and after | 95 |

*Source: NPC-118 table 118-1*

# 2.2 Municipal Guidelines

MTO legal review has indicated that MTO and MTO agents are not subject to municipal By-laws, and are therefore not required to obtain exemption permits. However, MTO recognizes the impact noise can have on a community, and all reasonable attempts will be made to work within the requirements of local noise By-laws. Where this is not feasible, MTO will continue to provide clear and consistent communication with the municipality.

The Project is located in the Town of Bradford West Gwillimbury in Simcoe County, Ontario.

## 2.2.1 Town of Bradford West Gwillimbury

Noise in the Town of Bradford West Gwillimbury is regulated using Noise By-law 2008-083. The relevant sections of the By-law are presented below:

- General prohibitions

  - No person shall, at any time, emit, cause or permit to be emitted or cause any noise, created by:
    - The use of a horn, whistle, alarm bell, gong or the like, except for an auditory safety or warning device or chimes used in association with a religious establishment
    - The idling of a vehicle motor in excess of 30 minutes except
      - When such idling is recommended by the manufacturer of such vehicle and proof of such recommendation is provided by the vehicle operator upon the request of a police officer
      - When such idling is necessary to the basic function of the equipment on a vehicle such as concrete mixer on a concrete mixing truck, a lift platform, a refuse compactor or a heat exchange system
      - When the weather conditions require the vehicle to idle in order to keep in operation a heating or refrigeration system necessary for the welfare or preservation of the cargo of such vehicle
    - The operation of a combustion engine or pneumatic device without an effective exhaust or intake muffling device in proper working order and in constant operation

- Prohibitions by time and place
  - No person shall emit ,cause or permit to be emitted or caused any noise created by an activity listed in Schedule “A” of this By-law during the time and in the area such noise is prohibited as set out in Schedule “A”
- Schedule “A” items
  - The venting or release of steam, the operation of a generator or air filtration system, noise from grinding, milling, the operation of machinery, or the like is prohibited:
    - From 9:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in residential areas
    - From 11:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in other areas
  - Loading, unloading, packing, unpacking, delivering or otherwise handling any container, product or material unless necessary for the maintenance of essential services or for the moving of private household effects is prohibited:
    - From 9:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in residential areas
    - From 11:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in other areas
  - The operation of any tool including a hammer, saw, nail gun, lawnmower, staple gun, hedge trimmer, drill or the like is prohibited:
    - From 9:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays, Sundays and holidays) in residential areas
  - The operation of construction equipment is prohibited:
    - From 7:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays) and at all times on Sundays and holidays in residential areas

A general recommendation is to provide a notice of works letter to the municipality prior to works outside of normal By-law hours, which will allow the municipality to notify area residents.

# 3. Noise Sensitive Areas

NSAs in the context of an assessment as per the MTO Guide typically include the following land uses, provided that an outdoor living area is associated with them:

- Private homes such as single family residences (owned or rental)
- Townhouses (owned or rental)

- Multiple unit buildings, such as apartments
- Hospitals, nursing/retirement homes, etc.

Where a new freeway/highway corridor or route is planned, the following land uses would qualify as NSAs in addition to the land uses noted above:

- Educational facilities and day care centres, where there are OLA's for students
- Campgrounds that provide overnight accommodation
- Hotels / motels where there are OLA's (i.e. swimming pool area, etc.) for visitors

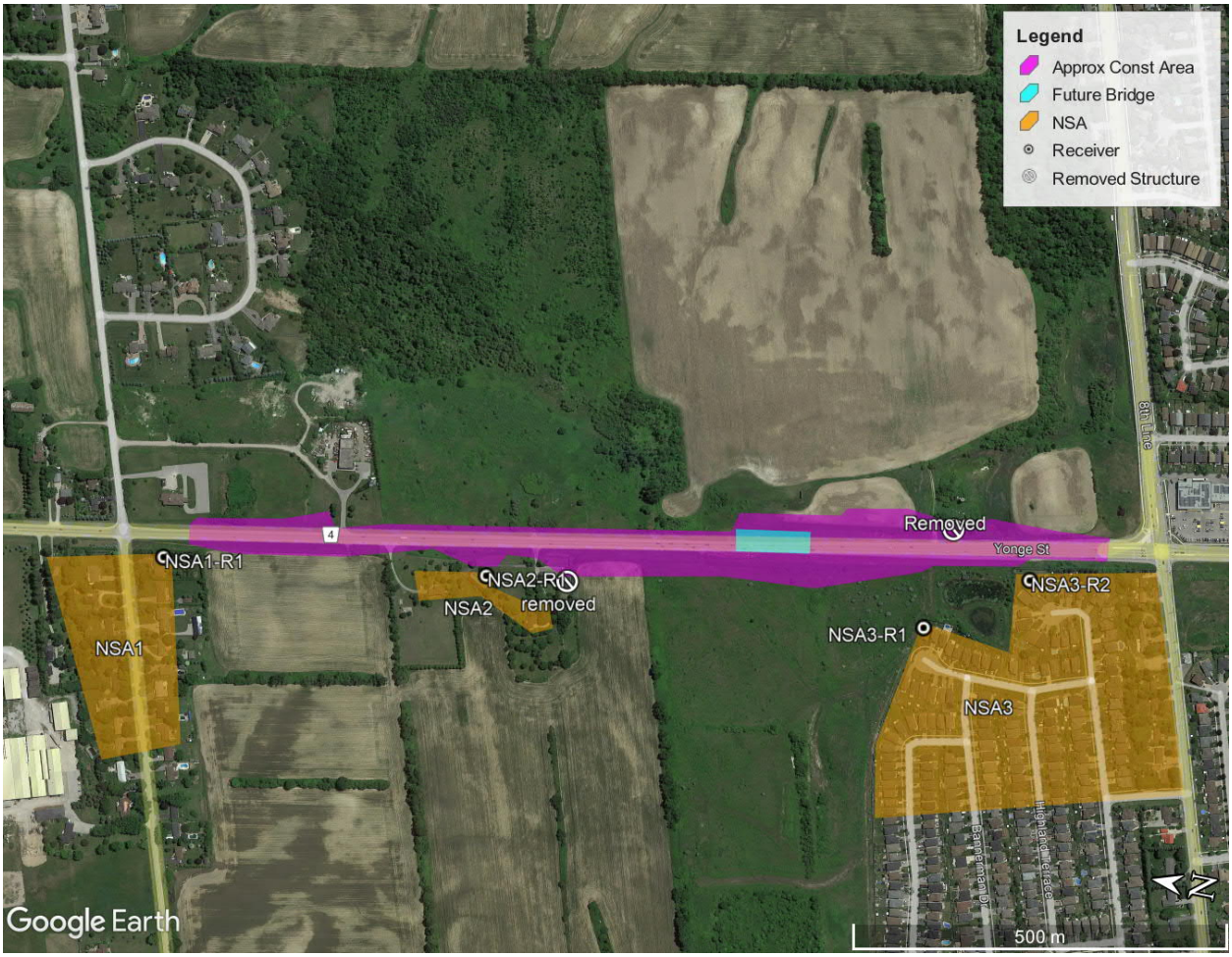
The area surrounding the Project is comprised of a mixture of commercial and residential usages. The nearest NSAs within 500 metres of the construction areas were identified for construction noise analysis.

Noise predictions were conducted at representative receptors which were selected to be representative of the locations with the worst case construction noise exposure for each NSA. Locations further removed from the construction site will have lower noise exposures from Project-related construction activities. A summary and description of the identified NSAs are provided in **Table 6**, with NSAs and representative receptor locations presented on **Figure 2**.

**Table 6: NSA Summary**

| NSA | Representative Receptors | Approximate Number of Front Row Receivers | Description |
|---|---|---|---|
| NSA1 | Detached Dwellings | 2 | Detached dwellings west side of Yonge Street (County Road 4) at 9th Line |
| NSA2 | Detached Dwellings | 3 | Detached dwellings west side of Yonge Street (County Road 4) 830 metres north of 8th Line |
| NSA3 | Detached Dwellings | 9 | Detached dwellings west side of Yonge Street (County Road 4) north of 8th Line |

**Figure 2: NSA Locations**




# 4. Construction Noise Assessment

## 4.1 Approach

The Provincial and Municipal noise guidelines applicable to this assessment do not define absolute construction noise level limits at receiver locations (i.e. residential dwellings) and construction noise is thus reviewed on a case by case basis.

Since the municipal By-laws concentrate on the control of construction during the evening/night time hours, and there is the potential for night time work, noise levels at receiver locations will be reviewed in this report. To gauge the potential for complaints during night time, recent construction noise projects for other Ontario government bodies and ministries were reviewed for night time construction noise performance limits. The review of recently completed construction noise projects for other Ontario government organizations has suggested that a night time eight (8) hour energy average (Leq 8hr) level of 70 dBA be used as the basis of assessment.

The construction activities involved in the Project vary over the Project area, and each receptor will have different worst case noise impacts from different activities. As such, this Construction Noise Assessment took the conservative approach of reviewing the predicted noise levels from the nearest construction areas/activities, with all equipment running, to each representative receptor. In some cases, multiple activities were reviewed.

Construction equipment noise levels were predicted at the representative receptors within each identified NSA. The predicted construction noise levels were then reviewed against the basis of assessment to estimate the noise impact of the construction noise within the identified NSAs. Also, as the operations of the construction equipment are currently unrestricted within each construction area, noise level predictions were made based upon the minimum separation distance between the construction areas and the NSAs.

## 4.2 Construction Equipment

Construction noise levels were predicted using reference equipment source levels and estimated equipment quantities for the different stages of construction. The US Federal Highway Administration Roadway Construction Noise Model (Reference #8 – RCNM V1.1) was used to predict noise levels for this assessment. This model was developed as a construction noise screening tool and allows users to analyze multiple pieces of equipment simultaneously at multiple receptor locations using simplified prediction assumptions. The effects of shielding (from buildings or other objects) are not accounted for in this prediction. The RCNM uses reference construction equipment noise levels and applies a distance correction to adjust for prediction location. The model uses an extensive database of equipment sound levels but note that the contractor's equipment may vary from these. Equipment reference sound levels are presented in **Table 7**. Note that usage factors are used to account for the difference between the referenced instantaneous maximum noise level and the average time weighted noise emissions. Assumed construction activities were broadly grouped into different types; removals/demolition, bridge construction, and road construction. Note at this stage, there is the potential for piling operations, therefore it has been reviewed in this assessment. Assumed equipment and construction types are presented in **Table 8**.

**Table 7: Construction Equipment Reference Sound Levels**

| Equipment Description | Sound Pressure Level at 15.2 m (dBA re 20µPa) at full power | Assumed Usage Factor (%) | Other Notes |
|---|---|---|---|
| Air Compressor | 78 | 40 | - |
| Backhoe | 78 | 40 | - |
| Crane | 81 | 16 | - |
| Compactor (ground) | 83 | 20 | - |
| Ready-mix Concrete Truck | 79 | 40 | - |
| Concrete pump truck | 81 | 20 | - |
| Concrete saw | 90 | 20 | - |
| Dozer | 82 | 40 | - |
| Delivery Equipment – Semi-Trucks & Dump Trucks | 77 | 40 | - |
| Excavator | 81 | 40 | - |
| Loader | 79 | 40 | - |
| Generator | 81 | 50 | - |
| Grader | 85 | 40 | - |
| Jackhammer | 89 | 20 | - |
| Mounted impact hammer (hoe ram) | 90 | 20 | - |
| Asphalt removal | 90 | 20 | (Use Pavement Scarafier) |
| Asphalt Paver | 77 | 50 | - |
| Roller | 80 | 20 | - |
| Piling Type 1 (impact) | 101 | 20 | Only one type of piling will be used |

| Equipment Description | Sound Pressure Level at 15.2 m (dBA re 20µPa) at full power | Assumed Usage Factor (%) | Other Notes |
|---|---|---|---|
| Piling Type 2 (vibratory) | 101 | 20 | Only one type of piling will be used |
| Piling Type 3 (bored piles) | 84 | 20 | Only one type of piling will be used |

*Source: RCNM measured maximum levels.*

**Table 8: Assumed Construction Equipment by Activity**

| Equipment Description | Removals | Bridge Construction | Potential Piling Type 1/2/3 | Road Construction |
|---|---|---|---|---|
| Air Compressor | X | X | X | X |
| Backhoe | X | X | - | X |
| Crane | - | X | X | - |
| Compactor (ground) | - | X | - | X |
| Ready-mix Concrete Truck | - | X | X | X |
| Concrete pump truck | - | X | X | - |
| Concrete saw | X | X | - | - |
| Dozer | X | - | - | X |
| Delivery Equipment – Semi-Trucks/hr & Dump Trucks | X | X | X | X |
| Excavator | X | X | - | X |
| Loader | X | X | - | X |
| Generator | X | X | X | - |
| Grader | - | X | - | X |
| Jackhammer | X | - | - | - |
| Mounted impact hammer (hoe ram) | X | - | - | - |
| Asphalt removal | X | - | - | - |
| Asphalt Paver | - | - | - | X |
| Roller | - | - | - | X |
| Piling Type 1/2/3 | - | - | X | - |

*Note: The Contractor equipment may differ from the assumed Construction Equipment*

*Only one type of piling will be used*

# 4.3 Construction Noise Assessment

Construction noise levels related to the Project were predicted as described above and are presented in **Table 9**. Note that some construction activities will have a minimal effect on NSAs located further away; as such, where construction activities were greater than 500 m away from an NSA, the noise impact from that activity was not calculated. Potential acoustic shielding from objects, such as buildings or visual berms, was not accounted for as the acoustic shielding performance from these objects could not be estimated.

**Table 9: Construction Noise Assessment Results**

| NSA ID | Representative Receptor | Approx. Distance (m) | Predicted Construction Noise Levels at Receptors (dBA – Leq,8hr) | | | | Above or Below Night Time Basis of Assessment | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | Removals | Bridge Construction | Potential Piling Type 1/2/3 | Road Construction | | |
| NSA1 | NSA1R1 | 35/765 | 83 | N/A[1] | N/A[1] | 79 | Above | 1 |
| NSA2 | NSA2R1 | 13/330 | 91 | 61 | 68/67/57 | 88 | Above | - |
| NSA3 | NSA3R1 | 72/181 | 77 | 67 | 73/73/62 | 73 | Above | - |
| NSA3 | NSA3R2 | 23/296 | 86 | 62 | 69/68/58 | 83 | Above | - |

*Note: First distance is to road works, second is to bridge works*

*(1) This location is further than 500 m from the bridge works. Noise level for bridge works area (bridge works and potential piling not calculated.*

The results in the above table indicate that construction noise levels due to the Project can range, depending on location and proximity to construction, between 61 and 91 dBA, with all four of the assessed representative locations above the 70 dBA night time basis of assessment, indicating that noise disturbance will be likely when construction is closest to the residences.

As noted above, the assessment is based upon conservative assumptions, such as the construction equipment operating at the closest point of the construction areas to the NSAs without any shielding effects. Actual achieved noise levels will likely be lower than the predicted noise levels.

The highest noise levels are due to select equipment (mounted impact hammer, pavement removal, jackhammer, and concrete saw) during the pavement removals and road construction. These activities are transient in nature and should not be in a single location for a long duration.

Of the three potential piling methods, augured piles would be the least disruptive.

Efforts should be taken to control noise levels, to minimize the disturbance to the NSAs surrounding the Project, and to decrease the potential for complaints. Further discussion on noise mitigation, recommendations and MTO noise control requirements are presented in **Section 5** below.

# 5. Recommendations

Construction noise is temporary in nature and will cease at the end of the construction activities; it can be a cause of disturbance to the surrounding noise sensitive areas. Although Ontario does not have any applicable regulatory noise level limits for construction noise impacts on NSAs, construction noise disturbance and potential for complaints can be reduced with the implementation of best practices and other noise control measures.

The MTO Guide requires that construction noise be controlled and mitigated. The responsibility of this is typically split between the construction contractor and contract administrator.

**Construction Contractor Requirements**

Construction contractor requirements are normally set out in Special Provision No 199F33 and Special Provision No. 199F31.

Special Provision No 199F33 is used to:

- Identify the extent of noise sensitive areas; and
- Stipulate constraints on construction noise with respect to Town of Bradford West Gwillimbury's noise control By-laws as follows:

  - Although the MTO does not require a noise By-law exemption, for works conducted:
    - From 7:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays) and at all times on Sundays and holidays in residential areas

    Submit a Notice of Works letter to the Town in advance of the works; which will allow the Town to notify area residents through the local councillor

- Equipment shall comply with the sound emission standards for construction equipment outlined in Ministry of Environment, Conservation and Parks (MECP) publications NPC-115 and NPC-118 (contractor to confirm latest version by contacting MECP[1]), which are the following:
  - NPC-115: Construction Equipment (copy provided in Appendix B)
  - NPC-118: Motorized Conveyances (copy provided in Appendix C)
- Where feasible, equipment with broadband backup alarms instead of the tonal backup alarms/beepers shall be utilized.
- Equipment shall be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts.
- Idling of equipment shall be restricted to the minimum necessary to perform the specified work.
- Stationary equipment shall be located as far away from sensitive locations as feasible.

Special Provision No. 199F31, Environmental Exemptions and Permits, is used to set out notification requirements for operation of construction outside of noise By-law limits.

For reference purposes, draft Special Provision No 199F31 and Special Provision No. 199F33 are provided in Appendix D and Appendix E respectively.

**Contract Administrator Requirements**

The contract administrator is required to:

- Setup a noise complaint process in accordance with the Ministry of Transportation's Environmental Guide for Noise.
- Investigate and address noise complaints in accordance with the MTO Guide.

Ensure that the construction contractor is in compliance with requirements of SP 199F31 and SP 199F33, and if not, require the necessary corrections to be implemented.

# 6. Conclusions

The results of the assessment indicate that noise levels due to construction activities of the Project area could be a source of disturbance and complaints at nearby NSAs. Noise mitigation recommendations to reduce the likelihood of complaints are provided in **Section 5**. Once the construction schedule is known and night time construction activities (and construction activities outside of the allowable By-law hours) are confirmed, a Notice of Works letter shall be submitted to the applicable municipality in advance of the works.

The assessment was based upon conservative assumptions and modeling, and actual achieved noise levels could be lower than documented above. However, provisions should be made for noise mitigation to address noise complaints.

[1] Available from the Ontario Ministry of Environment, Conservation and Parks – Client Services and Information Branch or Environmental Assessment and Permissions Branch
Phone: 416-314-8001 or 1-800-461-6290

# 7. References

1. Ontario Ministry of Transportation, “Environmental Guide for Noise”, October 2006.
2. Ontario Ministry of the Environment (now Ministry of the Environment, Conservation and Parks), Publication NPC-115: Construction Equipment.
3. Ontario Ministry of the Environment (now Ministry of the Environment, Conservation and Parks), Publication NPC-118: Motorized Conveyances.
4. Ontario Ministry of the Environment (now Ministry of the Environment, Conservation and Parks), Publication NPC-103: Procedures.
5. Town of Bradford West Gwillimbury, By-law 2008-083, retrieved November 2021.
6. David A. Bies and Colin H. Hansen, “Engineering Noise Control, Theory and Practice”, 3rd edition, 2003.
7. Ministry of the Environment and Climate Change (now Ministry of Environment, Conservation and Parks), Publication NPC-300
8. United States Federal Highway Administration, “Roadway Construction Noise Model User’s Guide”, January 2006.
9. Ontario Ministry of the Environment, Conservation, and Parks, Contact Information, http://www.infogo.gov.on.ca/infogo/home.html#orgProfile/183618/en - Retrieved 2021-11-26

# Appendix A: Example Calculation

Roadway Construction Noise Model (RCNM),Version 1.0

Report date 12-01-2021
Case Descri removals

---- Receptor #1 ----

| Description | Land Use | Baselines (dBA) Daytime | Evening | Night |
|---|---|---|---|---|
| NSA1R1 | Residential | 80 | 80 | 70 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (meters) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 35 | 0 |
| Backhoe | No | 40 | | 77.6 | 35 | 0 |
| Compactor (ground) | No | 20 | | 83.2 | 35 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 35 | 0 |
| Dozer | No | 40 | | 81.7 | 35 | 0 |
| Dump Truck | No | 40 | | 76.5 | 35 | 0 |
| Excavator | No | 40 | | 80.7 | 35 | 0 |
| Front End Loader | No | 40 | | 79.1 | 35 | 0 |
| Grader | No | 40 | 85 | | 35 | 0 |
| Paver | No | 50 | | 77.2 | 35 | 0 |
| Roller | No | 20 | | 80 | 35 | 0 |

Results

| Equipment | Calculated (dBA) *Lmax | Leq | Noise Limits (dBA) Day Lmax | Day Leq | Evening Lmax | Evening Leq | Night Lmax | Night Leq | Noise Limit Exceedance (dBA) Day Lmax | Day Leq | Evening Lmax | Evening Leq | Night Lmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compressor (air) | 70.4 | 66.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Backhoe | 70.3 | 66.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Compactor (ground) | 76 | 69 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Concrete Mixer Truck | 71.6 | 67.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | 74.4 | 70.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dump Truck | 69.2 | 65.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Excavator | 73.5 | 69.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Front End Loader | 71.9 | 67.9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Grader | 77.8 | 73.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Paver | 70 | 67 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Roller | 72.8 | 65.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total | 77.8 | 79.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| Description | Land Use | Baselines (dBA) Daytime | Evening | Night |
|---|---|---|---|---|
| NSA2R1 | Residential | 80 | 80 | 70 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (meters) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 13 | 0 |
| Backhoe | No | 40 | | 77.6 | 13 | 0 |
| Compactor (ground) | No | 20 | | 83.2 | 13 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 13 | 0 |
| Dozer | No | 40 | | 81.7 | 13 | 0 |
| Dump Truck | No | 40 | | 76.5 | 13 | 0 |
| Excavator | No | 40 | | 80.7 | 13 | 0 |
| Front End Loader | No | 40 | | 79.1 | 13 | 0 |
| Grader | No | 40 | 85 | | 13 | 0 |
| Paver | No | 50 | | 77.2 | 13 | 0 |
| Roller | No | 20 | | 80 | 13 | 0 |

Results

| Equipment | Calculated (dBA) *Lmax | Leq | Noise Limits (dBA) Day Lmax | Day Leq | Evening Lmax | Evening Leq | Night Lmax | Night Leq | Noise Limit Exceedance (dBA) Day Lmax | Day Leq | Evening Lmax | Evening Leq | Night Lmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Compressor (air) | 79.1 | 75.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Backhoe | 78.9 | 75 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Compactor (ground) | 84.6 | 77.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Concrete Mixer Truck | 80.2 | 76.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | 83.1 | 79.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dump Truck | 77.8 | 73.9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavator | 82.1 | 78.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Front End Loader | 80.5 | 76.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Grader | 86.4 | 82.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Paver | 78.6 | 75.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Roller | 81.4 | 74.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total | 0 | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| NSA3R1 | Residential | 80 | 80 | 70 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (meters) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 72 | 0 |
| Backhoe | No | 40 | | 77.6 | 72 | 0 |
| Compactor (ground) | No | 20 | | 83.2 | 72 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 72 | 0 |
| Dozer | No | 40 | | 81.7 | 72 | 0 |
| Dump Truck | No | 40 | | 76.5 | 72 | 0 |
| Excavator | No | 40 | | 80.7 | 72 | 0 |
| Front End Loader | No | 40 | | 79.1 | 72 | 0 |
| Grader | No | 40 | 85 | | 72 | 0 |
| Paver | No | 50 | | 77.2 | 72 | 0 |
| Roller | No | 20 | | 80 | 72 | 0 |

Results

| | Calculated (dBA) | | Noise Limits (dBA) | | | | | | Noise Limit Exceedance (dBA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | | Evening | | Night | | Day | | Evening | | Night |
| Equipment | *Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax |
| Compressor (air) | 64.2 | 60.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Backhoe | 64.1 | 60.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Compactor (ground) | 69.7 | 62.8 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Concrete Mixer Truck | 65.3 | 61.3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | 68.2 | 64.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dump Truck | 63 | 59 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Excavator | 67.2 | 63.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Front End Loader | 65.6 | 61.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Grader | 71.5 | 67.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Paver | 63.7 | 60.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Roller | 66.5 | 59.5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total | 0 | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |

*Calculated Lmax is the Loudest value.

---- Receptor #4 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| NSA3R2 | Residential | 80 | 80 | 70 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (meters) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 23 | 0 |
| Backhoe | No | 40 | | 77.6 | 23 | 0 |
| Compactor (ground) | No | 20 | | 83.2 | 23 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 23 | 0 |
| Dozer | No | 40 | | 81.7 | 23 | 0 |
| Dump Truck | No | 40 | | 76.5 | 23 | 0 |
| Excavator | No | 40 | | 80.7 | 23 | 0 |
| Front End Loader | No | 40 | | 79.1 | 23 | 0 |
| Grader | No | 40 | 85 | | 23 | 0 |
| Paver | No | 50 | | 77.2 | 23 | 0 |
| Roller | No | 20 | | 80 | 23 | 0 |

Results

| | Calculated (dBA) | | Noise Limits (dBA) | | | | | | Noise Limit Exceedance (dBA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | | Evening | | Night | | Day | | Evening | | Night |
| Equipment | *Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax |
| Compressor (air) | 74.1 | 70.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Backhoe | 74 | 70 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Compactor (ground) | 79.7 | 72.7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Concrete Mixer Truck | 75.2 | 71.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | 78.1 | 74.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dump Truck | 72.9 | 68.9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Excavator | 77.1 | 73.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Front End Loader | 75.5 | 71.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Grader | 81.4 | 77.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Paver | 73.6 | 70.6 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Roller | 76.4 | 69.4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total | 0 | 0 | 0 | | 0 | | 0 | | 0 | | 0 | | 0 |

*Calculated Lmax is the Loudest value.

---- Receptor #5 ----

| Description | Land Use | Baselines (dBA) Daytime | Evening | Night |
|---|---|---|---|---|
| | | 0 | 0 | 0 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (meters) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 0 | 0 |
| Backhoe | No | 40 | | 77.6 | 0 | 0 |
| Compactor (ground) | No | 20 | | 83.2 | 0 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 0 | 0 |
| Dozer | No | 40 | | 81.7 | 0 | 0 |
| Dump Truck | No | 40 | | 76.5 | 0 | 0 |
| Excavator | No | 40 | | 80.7 | 0 | 0 |
| Front End Loader | No | 40 | | 79.1 | 0 | 0 |
| Grader | No | 40 | 85 | | 0 | 0 |
| Paver | No | 50 | | 77.2 | 0 | 0 |
| Roller | No | 20 | | 80 | 0 | 0 |

Results

| | Calculated (dBA) | | Noise Limits (dBA) | | | | | | Noise Limit Exceedance (dBA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | | Evening | | Night | | Day | | Evening | | Night |
| Equipment | *Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax | Leq | Lmax |
| Compressor (air) | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Backhoe | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Compactor (ground) | | -7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Concrete Mixer Truck | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dozer | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Dump Truck | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Excavator | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Front End Loader | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Grader | | -4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Paver | | -3 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Roller | | -7 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Total | 0 | 6.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

*Calculated Lmax is the Loudest value.

Leq
N/A
N/A
N/A
N/A
N/A
N/A
N/A
N/A
N/A
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N/A

Leq
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0

Leq
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Leq
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Leq
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N/A

# Appendix B: Copy of NPC-115

Publication NPC-115

Construction Equipment

1. Scope

This Publication sets sound emission standards for various items of new construction equipment according to the date of manufacture of the equipment.

2. Technical Definitions

The technical terms used in this Publication are defined in Publication NPC-101 - Technical Definitions.

3. Sound Emission Standards

Tables 115-1 to 115-4 inclusive list Residential Area sound emission standards and Quiet Zone sound emission standards for specific items of new construction equipment measured in accordance with the procedures indicated.

TABLE 115-1

Quiet Zone and Residential Area Sound Emission Standards for Excavation Equipment, Dozers, Loaders, Backhoes or Other Equipment Capable of Being Used for Similar Application

| Maximum Sound Level as determined using Publication NPC-103 - Procedures, section 6 dBA | | |
|---|---|---|
| Date of Manufacture | Power Rating Less than 75 kW | Power Rating 75 kW and larger |
| January 1, 1979 to December 31, 1980 | 85 | 88 |
| January 1, 1981 and after | 83 | 85 |

TABLE 115-2

Sound Emission Standards for Pneumatic Pavement Breakers

| Standard | Date of Manufacture | Maximum Sound Level as measured using Publication NPC-103 - Procedures, section 7 dBA |
|---|---|---|
| Quiet Zone Sound Emission Standard | Jan. 1, 1979 and after | 85 |
| Residential Area Sound Emission Standard | Jan. 1, 1979 to Dec. 31 1980 | 90 |
| | Jan. 1, 1981 and after | 85 |

TABLE 115-3

Sound Emission Standards for Portable Air Compressors

| Standard | Date of Manufacture | Maximum Sound Level as measured using Publication NPC-103 - Procedures, section 7 dBA |
|---|---|---|
| Quiet Zone Sound Emission Standard | Jan. 1, 1979 to Dec. 31, 1980 | 76 |
| | Jan. 1, 1981 and after | 70 |
| Residential Area Sound Emission Standard | Jan. 1, 1979 and after | 76 |

TABLE 115-4

Sound Emission Standard for Tracked Drills

| Standard | Date of Manufacture | Maximum Sound Level as measured using Publication NPC-103 - Procedures, section 6. dBA |
|---|---|---|
| Quiet Zone and Residential Area Sound Emission Standard | Jan. 1, 1981 and after | 100 |

# Appendix C: Copy of NPC-118

Publication NPC-118

Motorized Conveyances

1. Scope

This Publication sets sound emission standards for motorized conveyances of various types.

2. Technical Definitions

(1) The technical terms used in this Publication are defined in Publication NPC-101 - Technical Definitions.

(2) Definitions Specific to this Publication

Heavy Vehicle

"Heavy vehicle" means a motorized conveyance having a registered gross weight of more than 4,500 kg.

3. Sound Emission Standards - Governed Diesel Engines

Table 118-1 lists for various years of manufacture, the sound emission standard for a heavy vehicle powered by a governed diesel engine when measured in accordance with the procedure set out in the Table.

TABLE 118-1
Sound Emission Standards for Heavy Vehicles with Governed Diesel Engines

| Date of Manufacture | Maximum Sound Level as Measured Using Publication NPC-103 - Procedures, section 9 |
|---|---|
| Prior to Jan. 1, 1979 | 100 |
| Jan. 1, 1979 and after | 95 |

4. Sound Emission Standards - Gasoline Engines

Table 118-2 lists for various years of manufacture, the sound emission standard for a heavy vehicle powered by an ungoverned gasoline engine, when measured in accordance with the procedure set out in the Table.

TABLE 118-2

UNDER PREPARATION

Publication NPC-118

Motorized Conveyances

1. Scope

This Publication sets sound emission standards for motorized conveyances of various types.

2. Technical Definitions

(1) The technical terms used in this Publication are defined in Publication NPC-101 - Technical Definitions.

(2) Definitions Specific to this Publication

Heavy Vehicle

"Heavy vehicle" means a motorized conveyance having a registered gross weight of more than 4,500 kg.

3. Sound Emission Standards - Governed Diesel Engines

Table 118-1 lists for various years of manufacture, the sound emission standard for a heavy vehicle powered by a governed diesel engine when measured in accordance with the procedure set out in the Table.

TABLE 118-1

Sound Emission Standards for Heavy Vehicles with Governed Diesel Engines

| Date of Manufacture | Maximum Sound Level as Measured Using Publication NPC-103 - Procedures, section 9 |
|---|---|
| Prior to Jan. 1, 1979 | 100 |
| Jan. 1, 1979 and after | 95 |

4. Sound Emission Standards - Gasoline Engines

Table 118-2 lists for various years of manufacture, the sound emission standard for a heavy vehicle powered by an ungoverned gasoline engine, when measured in accordance with the procedure set out in the Table.

TABLE 118-2

UNDER PREPARATION

# Appendix D: Draft Special Provision 119F31

**ENVIRONMENTAL EXEMPTIONS AND PERMITS**

Special Provision No. 199F31 Draft

The following environmental exemptions and permits are provided for the work.

| Exemption and Permit Identification | Exemption and Permit Details and Conditions |
|---|---|
| Town of Bradford West Gwillimbury Noise Control Bylaw No. 2008-083 | MTO and MTO agents are not subject to municipal By-laws, and is therefore not required to obtain exemption permits.<br><br>Make all reasonable attempts will be made to work within the requirements of noise By-law. Where this is not feasible, provide clear and consistent communication with the municipality<br><br>The town prohibits operation of any construction equipment in connection with construction from:<br>• 7:00pm – 7:00am next day (9:00 AM Saturdays)<br>• ALL DAY Sundays and holidays in residential areas |

The exemptions and permits do not relieve the Contractor of other obligations imposed by statute or by municipal bylaw.

WARRANT: When environmental exemptions and permits have been obtained for the work.

# Appendix E: Draft Special Provision 119F33

**CONSTRUCTION NOISE CONSTRAINTS**

Special Provision No. 199F33 Draft

**Noise Sensitive Areas**

This Special Provision covers the requirements for control of construction noise produced by the Contractor's operations. With the exception of any exemptions from municipal noise control bylaws that may be specified in the Contract Documents, these requirements do not relieve the Contractor of other obligations imposed by statute or by municipal bylaw.

Noise constraints in noise sensitive areas are as follows:

| **Noise Sensitive Area Limits** | |
|---|---|
| • Contract Limits | |
| **Constraint** | **Constraint Details** |
| Noise By-law limitations | Operation of construction equipment from 7:00 p.m. to 7:00 a.m. (to 9:00 a.m. on Saturdays) and at all times on Sundays and holidays in residential areas is not permitted unless a Notice of Works letter is submitted to the Town in advance of the works; which will allow the Town to notify area residents through the local councillor. |
| Equipment Sound Emission Standards | Equipment shall comply with the sound emission standards for construction equipment outlined in Ministry of Environment, Conservation and Parks publications NPC- NPC-115 and NPC-118 which are available from the.<br>Ministry of Environment, Conservation, and Parks<br>Client Services and Information Branch or<br>Environmental Assessment and Permissions Branch<br>Phone: 416-314-8001 or 1-800-461-6290<br><br>Where feasible, equipment with broadband backup alarms instead of the tonal backup alarms/beepers shall be utilized |
| Equipment Maintenance | Equipment shall be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts. |
| Equipment Operation | Idling of equipment shall be restricted to the minimum necessary to perform the specified work. |

| | |
|---|---|
| | Stationary equipment shall be located as far away from sensitive locations as feasible |
| Blasting and Piling | Blasting and piling operations shall be conducted in compliance with Ontario Provincial Standard Specification 120 and Ministry of Environment, Conservation and Parks publications NPC-119 |

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