



Appendix A-4

Noise and Vibration Impact Assessment

Noise and Vibration Impact Assessment

Conversion of Scarborough Rapid Transit Right-of-Way to Busway –
Transit and Rail Project Assessment Process

Toronto Transit Commission

60729927

August 2024

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Toronto Transit Commission

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Conversion of Scarborough Rapid Transit Right-of-Way to Busway – Transit and Rail Project Assessment Process

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Executive Summary

The Toronto Transit Commission is undertaking a Transit and Rail Project Assessment Process for the Conversion of Scarborough Rapid Transit Right-of-Way to Busway project, which aims to convert the north-south portion of the decommissioned Line 3 Scarborough corridor into a dedicated busway. As part of the Scarborough Rapid Transit decommissioning plan, two phases were developed. Phase 1 would see the Toronto Transit Commission operate an interim bus service on-street, which was planned to go into service by November 2023, however, due to the Scarborough Rapid Transit derailment in July 2023, interim bus service started in August 2023. The Toronto Transit Commission is currently advancing the detailed design of Phase 2, which involves converting the at-grade north-south portion of the Scarborough Rapid Transit right-of-way into a busway, allowing buses to operate in the converted busway between Ellesmere and Kennedy stations and continuing on existing transit priority lanes on Ellesmere Road between Ellesmere and Scarborough Centre stations, as implemented in Phase 1.

AECOM has been retained by the Toronto Transit Commission to assist with the completion of the Transit and Rail Project Assessment Process for Phase 2 of the Scarborough Rapid Transit decommission plan. This report assesses the noise and vibration impacts due to the Project.

The noise and vibration assessment was conducted for two main parts of the Project, the construction phase and the long term operations. As the Project is the replacement of a rail corridor with buses, vibration levels are expected to decrease as pneumatic tire vehicles operating on smooth surfaces generate negligible vibration levels in comparison with steel wheel rail vehicles. As such, the assessment of the operational phase concentrates on the noise impact.

Analysis of construction was conducted using assumed construction stages and associated equipment. Reference noise levels were sourced from the Federal Highway Administration's Roadway Construction Noise Model, and reference vibration levels were sourced from the United States Federal Transit Administration's Transit Noise and Vibration Impact Assessment document.

Construction noise analysis indicates that human annoyance due to construction noise is expected without the implementation of noise control measures. The sound quality from the construction of this Project is expected to be typical of construction activities at other civil engineering projects. Construction is temporary and will cease at the end of the construction periods and will decrease as construction moves along the corridor.

Construction vibration analysis indicates that there is the potential for building damage and vibration monitoring during construction is recommended. Although compliance with the City of Toronto By-law 514-2008 may not be required as a building permit may not be required, it can be used as a set of best practices to follow. Preliminary zone of influence figures are in **Appendix C**.

Recommendations to minimize construction noise and vibration are presented in **Section 6.1**.

The operational noise was assessed against Ministry of Energy and Environment¹ / Toronto Transit Commission Draft Protocol for Noise and Vibration Assessment for the Proposed Scarborough Rapid Transit Extension document dated May 11, 1993 (the Protocol). Noise from buses and existing roadways was modelled using the United States Federal Highway Administration's Traffic Noise Model algorithm implemented in the Cadna/A modelling package; noise from buses idling and accelerating away from the stops was also included in the noise model. Noise from the Scarborough Rapid Transit was modelled using the International Organization for Standardization 9613 prediction algorithm, using referenced noise levels from the Ministry of the Environment, Conservation and Parks's STAMSON modelling program. Results of the impact assessment indicated that noise mitigation investigation was required for residences on the west side of the corridor south of Lawrence Avenue East. Results of the investigation indicate that a noise barrier is not feasible. The analysis is presented in **Section 5.4** and general recommendations are provided in **Section 6.2**.

With the noise and vibration control implemented, the temporary noise and vibration during construction would be minimized, and the operational noise will be able to meet the applicable guideline limits.

1. Now operating as the Ministry of the Environment, Conservation and Parks

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1. Introduction

1.1 Project Overview

The Toronto Transit Commission is undertaking a Transit and Rail Project Assessment Process for the Conversion of Scarborough Rapid Transit Right-of-Way to Busway project, which aims to convert the decommissioned Line 3 Scarborough corridor into a dedicated busway. As part of the Scarborough Rapid Transit decommissioning plan, two phases were developed. Phase 1 would see the Toronto Transit Commission operate an interim bus service on-street, which was planned to go into service by November 2023, however, due to the Scarborough Rapid Transit derailment in July 2023, interim bus service started in August 2023. The Toronto Transit Commission is currently advancing the detailed design of Phase 2, which involves converting the at-grade north-south portion of the Scarborough Rapid Transit right-of-way into a busway, allowing buses to operate in the converted busway between Ellesmere and Kennedy stations and continuing service on-street along existing transit priority lanes on Ellesmere Road between Ellesmere and Scarborough Centre stations, as implemented in Phase 1.

AECOM has been retained by the Toronto Transit Commission to assist with the completion of the Transit and Rail Project Assessment Process for Phase 2 of the Scarborough Rapid Transit decommission plan. This report assesses the noise and vibration impacts due to the Project.

1.2 Study Process and Purpose

The Transit Project Assessment Process has been updated as of February 2024 to the Transit and Rail Project Assessment Process. The Transit and Rail Project Assessment Process is a proponent driven, self-assessment process that provides a stream-lined approach to completing an assessment of a project. It involves a pre-planning phase which includes consultation, assessment of impacts, development of measures to mitigate negative impacts, and documentation, and is followed by a regulated (up to 120 days) consultation and documentation period.

The purpose of this assessment is to determine the noise and vibration impacts during construction and operation of the Project, and identify appropriate mitigation measures and monitoring requirements that will be provided for potential adverse impacts.

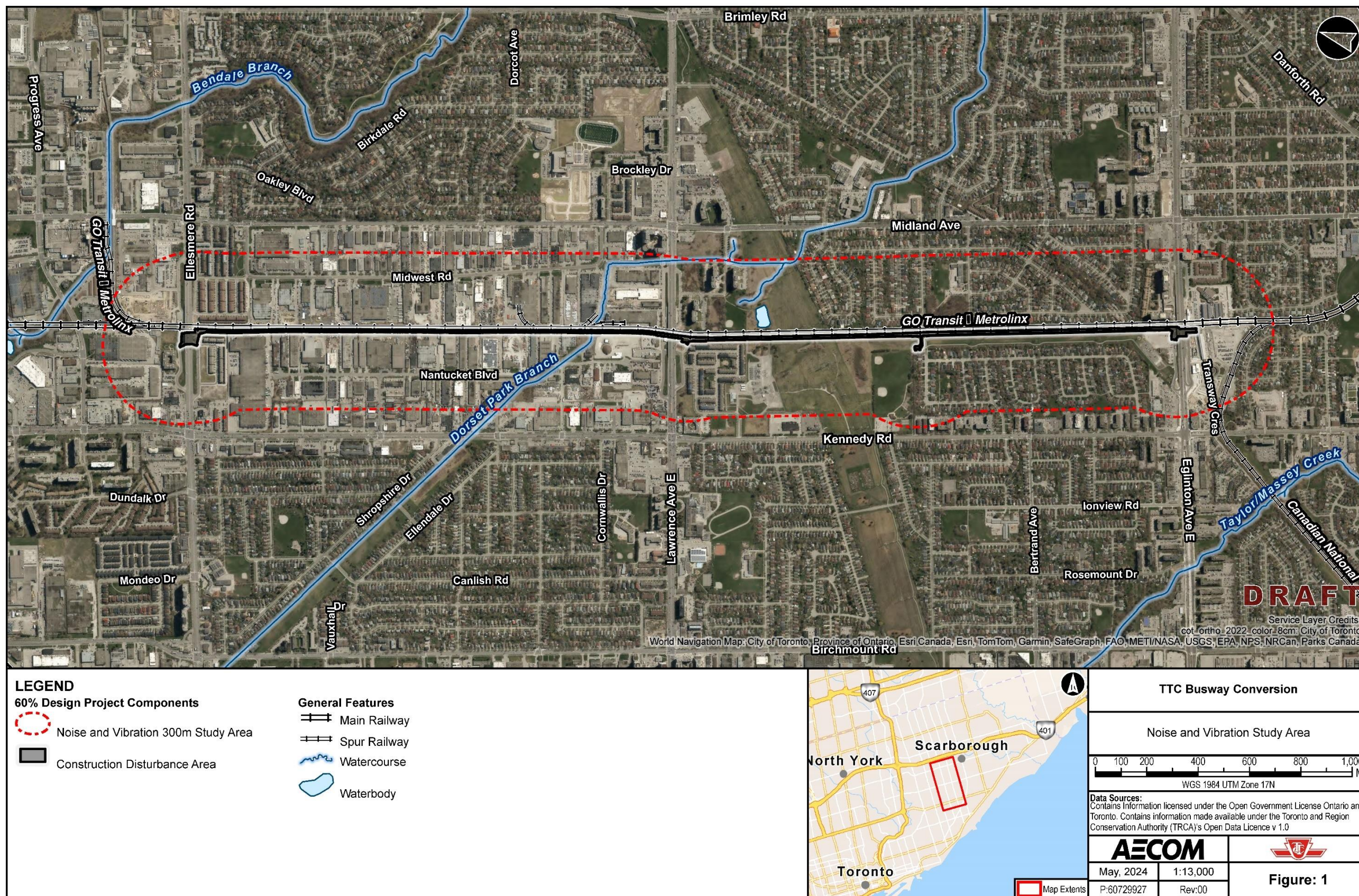
1.3 Study Area

The Project Area encompasses the area from the Toronto Transit Commission's Line 2 Kennedy Station, along the Line 3 right-of-way north to Ellesmere Station. The Protocol² adopted for this assessment does not provide a definition for the limits of a noise and vibration study area. As such, a review of various Ontario based noise and vibration guidance documents was conducted to determine an appropriate study area for the evaluation of a busway. The review has revealed that the Metrolinx Environmental Guide for Noise and Vibration Impact Assessment (2021) defines a study area, specifically for the assessments of busways, as the area within 300 metres of either side of the applicable roadway.

The Study Area is shown on **Figure 1**.

2. This assessment was conducted using the Ministry of Energy and Environment / Toronto Transit Commission Draft Protocol for Noise and Vibration Assessment for the Proposed Scarborough Rapid Transit Extension document dated May 11, 1993 (the Protocol). Note that the Ministry of Energy and Environment is now operating as the Ministry of the Environment, Conservation, and Parks.

Figure 1: Study Area



2. Methodology

The Study involves the completion of four main tasks:

- Baseline measurements.
- Construction Assessment.
- Operations Assessment.
- Documentation of recommendations for operations and construction.

An assumptions report was prepared in conjunction with the Toronto Transit Commission and submitted to the Ministry of the Environment, Conservation and Parks for comment prior to the assessment being conducted. The assumption report with assumptions used in this assessment is presented in **Appendix D**.

Baseline measurements were conducted to be characteristic of the background noise conditions in the noise sensitive areas surrounding the Project. Background vibration measurements were not necessary for the Project as the undertaking is the conversion of a rail line to a busway, which will decrease vibration levels. Further details of the baseline measurements are documented in **Section 3**.

The construction assessment was separated into two main components: noise and vibration. The construction noise was based upon different construction phases/activities, using assumed equipment quantities, and reference noise data. The data was used to prepare a noise prediction model, and results were compared to the background noise levels to determine the potential for human annoyance. Further details of the construction noise assessment are in **Sections 4.1.1** and **4.3.1**.

The construction vibration assessment was based upon the concept of a Zone of Influence. The Zone of Influence is the area where an applicable criterion is exceeded. This is determined by calculating the setback distance, from the construction equipment, where the vibration level meets the applicable criterion. Structures located within this setback distance would be over the criterion limit. Further details of the construction vibration assessment are in **Sections 4.1.2** and **4.3.2**.

The operations assessment was based upon the difference in the predicted ambient conditions, and the predicted conditions with the busway as per the definitions in the Protocol. As per discussions with the Ministry of the Environment, Conservation and Parks, for the purposes of assessment, the Scarborough Rapid Transit was to be considered as part of the existing ambient (see **Appendix E**). Where the difference in noise levels exceeded the criterion in the Protocol, noise mitigation was investigated for feasibility. Further details of the operations assessment are in **Section 5**.

Recommendations to minimize the project noise and vibration impacts were consolidated in **Section 6**.

3. Existing Conditions

3.1 Baseline Measurements

Baseline data was collected between May 6th and 10th 2024 using B&K type 2250 (Type 1) sound level meters, housed in environmental enclosures mounted to existing poles approximately 3 to 4 metres above the existing grade. An example noise monitor setup is shown on **Figure 2**. The baseline noise measurements were conducted in areas near the identified noise sensitive receptors to be representative of the ambient conditions. Noise sensitive receivers in context of this assessment are approved residential developments as well as nursing homes, group homes, hospitals, and other institutional land uses where people reside. Ambient conditions, as described in the Protocol, is the sound existing at the point of reception. This includes the noise from the existing road traffic and industry, and excludes transient noise from aircraft and railways, except for pre-existing Toronto Transit Commission rail operations.

Figure 2: Example Noise Monitor Setup



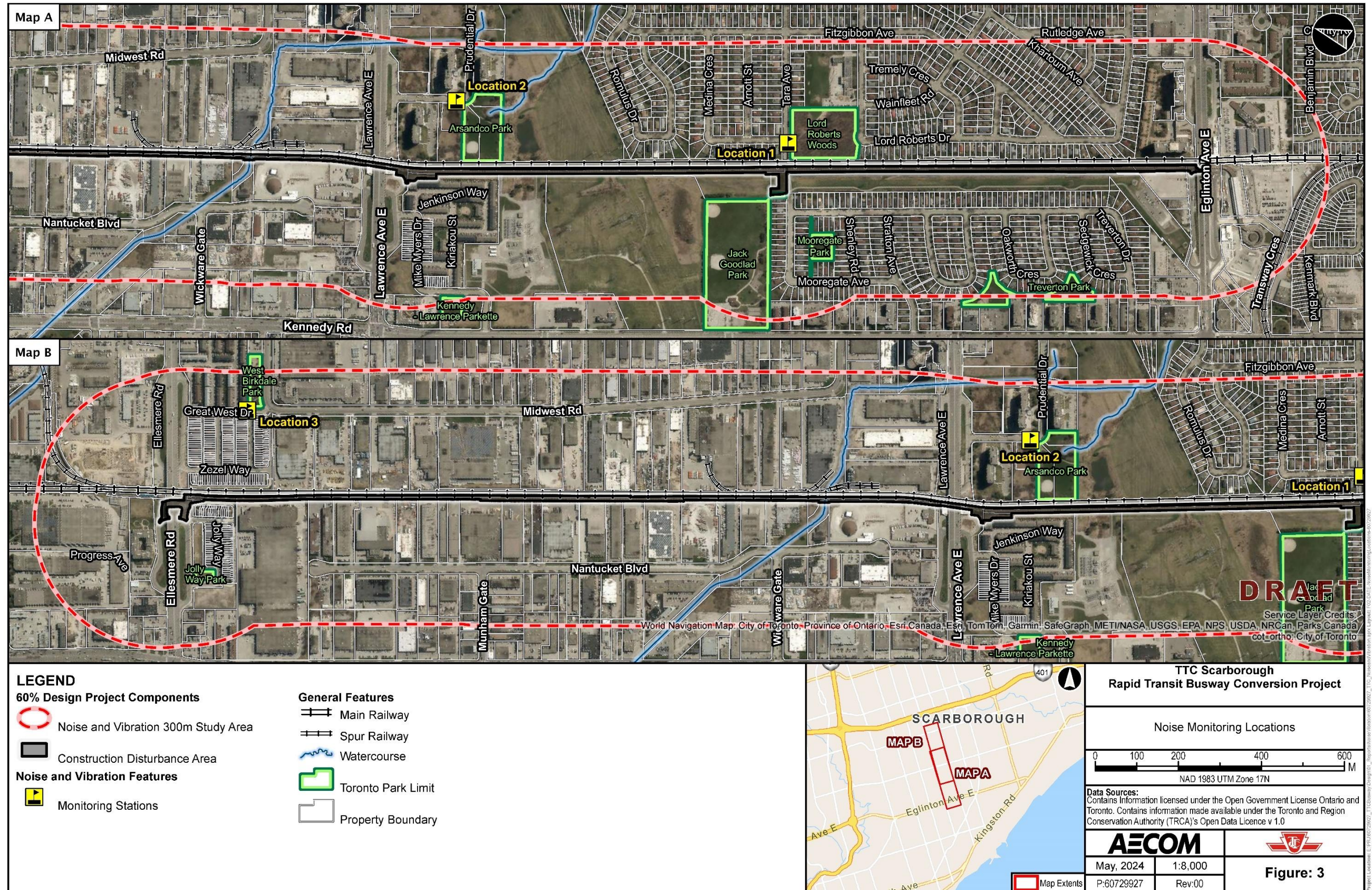
Given the presence of an existing GO Transit rail line adjacent to the Scarborough Rapid Transit corridor and to determine if any rail noise (GO Transit) had influenced the measurements, monitoring was conducted using 5 minute periods to determine if there were any high impact short duration events affecting the measurements. These were removed from the data set prior to processing into L_{eq} for the applicable time periods. Monitoring locations are shown on **Figure 3**, and a summary of monitoring results are presented in **Table 1**, with raw data provided in **Appendix A**.

Table 1: Baseline Monitoring Results

Location	$L_{eq,16hour}$ (Day) [A-weighted decibels]	$L_{eq,8hour}$ (Night) [A-weight decibels]	Average Daytime $L_{eq,1hour}$ [A-weighted decibels]	Average Nighttime $L_{eq,1hour}$ [A-weighted decibels]
Tara Ave	53	49	53	48
Prudential Drive	60	54	59	53
Great W Dr	62	57	62	55

As the Project is the conversion of an at grade rapid rail corridor to an at grade rapid busway, the vibration impacts due to the operation of the Project is expected to decrease (improve) from the base case of a rapid rail corridor. As such, vibration impact due to the operation of the Project is considered negligible and baseline vibration is not required.

Figure 3: Noise Monitoring Locations



4. Construction Assessment

Construction noise was reviewed based upon the expected equipment, construction phases, and expected operational areas. The majority of the construction activities will occur within the existing Scarborough Rapid Transit right-of-way, except for the connections to the existing roadways at Ellesmere Stop, Lawrence East Stop, and Kennedy Station, and the sidewalk connection at Tara Avenue Stop. Much of the existing concrete foundations of the Scarborough Rapid Transit corridor will be retained as the base of the paved surface. The major construction phases are expected to be:

- Removals (mainly existing rail) and utility works.
- Excavation, grading, and concrete works where additional foundation is needed.
- Shoring for deeper excavation (i.e., sewer connections at Lawrence East and Ellesmere).
- Paving.

A list of estimated construction equipment for each phase of construction is presented in **Table 2**. Quantities were estimated assuming an approximate 100 metre section of construction.

Table 2: Estimated Construction Equipment by Construction Type

Equipment Description	Removals and Utility Work	Excavation, Grading, and Concrete Works	Shoring	Paving
Backhoe	1	1	1	-
Excavator	1	1	-	1
Compaction Machine	-	1	-	-
Cement Trucks per hour	-	2	-	-
Concrete/Metal/Rail Saw	1	-	-	-
Crane – Mobile	1	-	1	-
Dump Trucks per hour	2	2	-	2
Semi-Trucks per hour	2	2	1	-
Generator	1	1	1	1
Front End Loader	1	1	-	-
Jackhammer	1	-	-	-
Skid Steers	2	2	-	2
Paver	-	-	-	1
Vibratory Roller	-	-	-	1
Vacuum Excavator	1	-	-	-
Potential Piles	-	-	1	-

The shoring works would be for deep excavation for sewer connections near the existing Lawrence East and Ellesmere Stations. As the method of shoring has not been finalized, three different type of piling methods were reviewed. Should less intensive shoring be used (e.g., trench boxes), the construction impacts of the shoring should be similar to the excavation scenario.

4.1 Criteria

4.1.1 Noise

Excessive noise, including construction noise, may interfere with human comfort and enjoyment from the use of certain spaces. Ontario does not have receiver-based construction noise level limits; however, the impact of construction noise should still be evaluated. The primary metric for measuring noise impact is the change in noise level above existing noise levels. **Table 3** below represents the perceived impact of changes in sound level. The significance of the noise impact by noise level difference is also presented in **Table 3**. The basis of comparison is usually the average background noise levels. For the purposes of this Project, the average 1-hour measured background noise level was compared to the predicted average construction noise levels from the Project.

Table 3: Perceived Impact of Increased Sound Levels³

Increased Sound Level Above Ambient (decibels)	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

According to the City of Toronto Noise By-law 878-2019 (section 591-3.1 D), government work (including this Project) is exempt from the requirements of the by-law.

4.1.2 Vibration

As construction is temporary, the assessment of construction vibration centres on the potential for building damage. Building damage may occur when there are excessive vibration impacts on a structure. Depending on the type of structure, there are different thresholds of damage. The assessment for potential building damage has been based

3. Adapted from “Engineering Noise Control, Theory and Practice” 4th edition, David A. Bies and Colin H. Hansen, 2009, and International Organization for Standardization R1996-1971E

upon the methodology as presented in the United States Federal Transit Administration’s Transit Noise and Vibration Impact Assessment document, which defines and provides threshold vibration damage limits for four different building types. The limits are summarized in **Table 4**.

Table 4: Building Type Definitions

Building Type	Description	Vibration Damage Criteria Peak Particle Velocity (millimetres per second)
Type I	Reinforced-concrete, steel or timber (no plaster)	12.70
Type II	Engineered concrete and masonry (no plaster)	7.62
Type III	Non-engineered timber and masonry buildings	5.08
Type IV	Buildings extremely susceptible to vibration damage	3.05

Construction vibration is also subject to City of Toronto By-law 514-2008, which requires that a vibration control form and study be submitted as part of a building permit application. As the construction for this Project is along an established transportation right-of-way, a building permit may not be required, although By-law 514-2008 can be used as best practices to be followed.

This assessment will identify the potential requirement for construction vibration monitoring and building condition surveys with respect to the requirements in By-law 514-2008. Requirements for monitoring and building inspections are triggered when a “zone of influence” (an area where construction vibration is predicted to be equal to or greater than 5 millimetres per second) extends beyond the legal boundaries of the construction site and encompasses any buildings on adjacent properties.

4.2 Assessment Locations

Representative assessment locations for the noise and vibration impact assessment were selected to be representative of the worst-case noise and vibration impacts due to the project. Receptors located with similar setbacks would have similar noise and vibration impacts, while receptors further away would have lower noise and vibration impacts.

Although the Protocol does not specifically address construction noise and vibration, and the Protocol’s applicability to receptors for the operational assessment can be adopted for the assessment of construction noise and vibration impacts. For the purposes of this assessment, the receptors for the construction noise assessment were the same as the operations assessment. Please see **Section 5.2** for further discussion on noise receptors.

Vibration receptors for the construction phase were taken as any non project structures that could be damaged due to construction vibration from the project. Instead of calculating the vibration impact at each possible structure along the project area, the construction vibration assessment determined at what setback distance from the project the applicable criteria was met, and reviewed mapping to determine if any structures were located within each applicable setback distance. (see **Section 4.3.2** for further details).

4.3 Impact Assessment

4.3.1 Noise

To predict the construction impact at each noise sensitive area during each phase of construction, each scenario described in **Table 2** was modelled. Each scenario considered the active construction areas generating the greatest noise impacts for each noise sensitive area. The active construction areas were assumed to be 100 metre sections per 8 hour shift along the Scarborough Rapid Transit corridor. For the purposes of this assessment, the noise impact was defined as the difference between the Project construction noise levels, and the existing background noise levels. Existing background noise levels used in the assessment were the average measured 1-hour L_{eq} for each of the day and night time periods (see **Table 1**). The background noise level used for the area between Eglinton Avenue East and the hydro corridor does not have noise contributions from Eglinton Avenue East. Receptors closer to Eglinton Avenue East would have lower realized impacts in comparison with the modelled impacts due to higher existing background noise levels. Receptors used in the impact assessment of construction noise were the same as the receptors used in the operations assessment.

Reference construction equipment noise source information was sourced from the Federal Highway Administration's Roadway Construction Noise Model. Noise sources were input into an environmental noise prediction algorithm (International Organization for Standardization 9613-2 implemented in Cadna/A software package) to predict the noise levels at the most exposed receptor locations within each noise sensitive area. The predicted noise levels were then compared to the background noise levels to determine the maximum noise impacts due to construction of the Project. The shoring is only needed in the areas where connections to existing stormwater sewers and other utilities are required in the areas of the new access roads to the busway near the existing Lawrence East and Ellesmere Stations. As the final shoring extents and footprints are not defined, there is potential for the shoring to extend further into the busway from those access points; construction impacts would be similar to the modelled receptors closest to the shoring.

A summary of the calculated construction noise impacts is presented in **Table 5**.

Table 5: Noise Impact in Decibels – Construction

Representative Receptor	Time Period	Removals and Utilities	Excavation, Grading, and Concrete Works	Shoring – Impact Type	Shoring – Vibrator Type	Shoring – Augured Type	Paving
R01	Day	14.4	13.6	11.5	11.5	2.2	11.9
R01	Night	17.8	16.9	14.5	14.5	5.1	15.2
R02	Day	15.7	14.9	19.4	19.4	8.3	13.2
R02	Night	23	22.1	26	26	16.1	20.4
R03	Day	9.9	9.3	16	16	2.1	7.6
R03	Night	16.4	15.7	19.2	19.2	8.5	14
R04	Day	9.7	9.1	11.5	11.5	-	7.3
R04	Night	18	17.3	12.8	12.8	2.2	15.6
R05	Day	3.8	3	-	-	-	1.3
R05	Night	11.8	11.1	-	-	-	9.4
R06	Day	10.1	9.3	9.8	9.8	-	7.6
R06	Night	18.5	17.7	18.8	18.8	9	16
R07	Day	4.3	3.6	-	-	-	1.8
R07	Night	13.5	12.8	9.3	9.3	-	11.1
R08	Day	10	9.3	-	-	-	7.6
R08	Night	14.2	13.4	4.9	4.9	-	11.7
R09	Day	11	10.2	17.5	17.5	7.4	8.5
R09	Night	14.8	14	22.9	22.9	13.2	12.3
R10	Day	16.8	16.1	24.6	24.6	12.3	14.4
R10	Night	23.3	22.5	29.2	29.2	18.9	20.7
R11	Day	16.9	16.3	15.3	15.3	4.1	14.6
R11	Night	24.2	23.4	19.5	19.5	9.1	21.6
R12	Day	15.4	14.9	10.1	10.1	-	13.1
R12	Night	22.7	22	12	12	2.1	20.2
R13	Day	14.8	14.4	5.1	5.1	-	12.6
R13	Night	22	21.2	6.1	6.1	-	19.5
R14	Day	13.7	13.4	-	-	-	11.7
R14	Night	22.4	21.7	5.1	5.1	-	19.9
R15	Day	14.8	14.2	12.4	12.4	2.8	12.5
R15	Night	15.6	14.7	6.2	6.2	-	13
R16	Day	9	8.4	-	-	-	6.7
R16	Night	8.6	7.9	-	-	-	6.1
R17	Day	14.1	13.8	-	-	-	12
R17	Night	14.3	13.9	-	-	-	12.1
R18	Day	12.7	12.3	-	-	-	10.5
R18	Night	15.7	15	-	-	-	13.3
R19	Day	12.6	12.3	-	-	-	10.5
R19	Night	13.4	13.2	-	-	-	11.4
R20	Day	12.8	12.5	-	-	-	10.7
R20	Night	12.9	12.5	-	-	-	10.7
R21	Day	13.3	13.1	-	-	-	11.3
R21	Night	14.2	14.1	-	-	-	12.3
R22	Day	14.4	14.5	-	-	-	12.6
R22	Night	15.4	15.5	-	-	-	13.7
R23	Day	17.3	18	-	-	-	15.7
R23	Night	19.8	20.5	-	-	-	18.3
R24	Day	9	9	-	-	-	7.1
R24	Night	11.8	12.1	-	-	-	10.2
R25	Day	12	12.3	-	-	-	10.5
R25	Night	12.4	12.7	-	-	-	10.8
R26	Day	12.1	12.3	-	-	-	10.5
R26	Night	12.5	12.7	-	-	-	10.8
R27	Day	11.1	10.9	-	-	-	9.2
R27	Night	11	10.9	-	-	-	9.1
R28	Day	13.3	12.8	-	-	-	11
R28	Night	13.5	12.9	-	-	-	11.2
R29	Day	12.6	11.9	-	-	-	10.2
R29	Night	12.4	11.8	-	-	-	10
R30	Day	13	13.1	-	-	-	11.2
R30	Night	13.3	13.4	-	-	-	11.6
R31	Day	11	11.1	-	-	-	9.3
R31	Night	13.9	14	-	-	-	12.2
R32	Day	9.7	9.7	-	-	-	8
R32	Night	13.2	13.3	-	-	-	11.5
R33	Day	9.5	9.4	-	-	-	7.7
R33	Night	10.8	10.8	-	-	-	9.1
R34	Day	9.8	9.7	-	-	-	7.9
R34	Night	11.8	11.8	-	-	-	10.1
R35	Day	11.2	10.7	-	-	-	9
R35	Night	11.3	10.8	-	-	-	9
R36	Day	16.8	16.3	-	-	-	14.6
R36	Night	18.6	17.7	-	-	-	16

As shown in **Table 5**, the noise impact is highest during the nighttime hours. Human annoyance due to construction noise is expected without the implementation of noise control measures. The sound quality from the construction of this Project is expected to be typical of construction activities at other civil engineering projects. Construction is temporary and will cease at the end of the construction periods and will decrease as construction moves along the corridor. Since this is a transportation corridor, construction impacts will be transient and move along once the construction activity has been completed in a particular area.

4.3.2 Vibration

The prediction of construction vibration levels was based upon methodology presented in the United States Federal Transit Administration’s Transit Noise and Vibration Impact Assessment guide. At this stage of the Project, it was assumed that all the construction equipment could operate anywhere within the indicated construction areas. Vibration levels were predicted to determine the separation distance required to be outside the City of Toronto’s construction Zone of Influence. Separation distances were also calculated to determine the distances where building damage criteria would be exceeded. These distances are presented in **Table 6** below.

Table 6: Vibration Building Damage Assessment

Equipment	Reference PPV (inches per second at 25 feet / 7.62 metre)	5 millimetres per second Zone of Influence [metres]	Building Damage Distance (Type II) [metres]	Building Damage Distance (Type III) [metres]
Jackhammers	0.035	2.4	1.8	2.4
Excavator	0.003	0.5	0.4	0.5
Backhoe	0.003	0.5	0.4	0.5
Compaction Machine	0.210	7.9	6.0	7.9
Semi Trucks	0.076	4.0	3.1	4.0
Concrete Pump Truck	0.076	4.0	3.1	4.0
Cement Trucks	0.076	4.0	3.1	4.0
Dump Trucks	0.076	4.0	3.1	4.0
Semi Trucks	0.076	4.0	3.1	4.0
Vibratory Roller	0.210	7.9	6.0	7.9
Impact Pile	1.518	29.4	22.5	29.4
Sonic or Vibratory Piler	0.734	18.1	13.8	18.1
Drill Rig	0.089	4.4	3.4	4.4

Residential areas are typically Type III buildings while commercial locations (e.g., hotels, nursing homes) were assumed to be Type II. No buildings have been identified as Type IV (extremely sensitive to vibration damage or interference) at the time of this report. Existing Toronto Transit Commission infrastructure that will be remaining are assumed to be protected as part of the construction contract (including the Highland Creek crossing north of Lawrence Avenue East) and have not been considered in this assessment.

The City of Toronto Zone of Influence was preliminarily mapped and is presented in **Appendix C**. The Zone of Influence for general construction was based upon the vibratory roller and compaction machines at 7.9 metres of separation. The Zone of Influence for the impact and vibratory piling/shoring was mapped separately as the separation distances for those activities was much greater at 29.4 and 18.1 metres respectively. Note that augured piling Zone of Influence would be less than the Zone of Influence for general construction activities.

As shown in **Appendix C**:

- Construction would be occurring immediately adjacent to bridge pillars at Eglinton Avenue East and Ellesmere Road, and the pedestrian bridge at Tara Avenue. These structures will be impacted by construction vibration.
- For general construction:
 - Residential location 154 Jenkinson Way will fall within the Zone of Influence for general construction.
 - Commercial locations at 51 and 85 Nantucket Boulevard fall within the Zone of Influence for general construction, and vibration levels may exceed the criteria for building damage for Type II structures.
- For shoring/piling:
 - Residential locations southwest of the existing Ellesmere Station would fall within the Zone of Influence.
 - Residential locations southwest of the existing Lawrence East Station would fall within the Zone of Influence.
 - Fewer locations would fall within the Zone of Influence if vibratory piles were used, and most locations would not be in the Zone of Influence if augured piles or trench boxes are used.

5. Operations Assessment

Vibration caused by rubber tire vehicles is generally not a concern on smooth pavement. As the Project is the conversion of an at-grade rapid rail corridor to an at-grade rapid busway, the vibration impacts due to the operation of the Project is expected to decrease (improve) from the base case of a rapid rail corridor. As such, vibration impacts from the operation of the Project is considered negligible, thus the assessment of the Project operation will concentrate on the noise impact.

5.1 Criteria

Noise from the operation of the busway will be assessed using the Ministry of Energy and Environment⁴ / Toronto Transit Commission Draft Protocol for Noise and Vibration Assessment for the Proposed Scarborough Rapid Transit Extension document dated May 11, 1993 (the Protocol). Noise levels for the transit operations within the public right of way are assessed using the 16 hour daytime and 8 hour nighttime equivalent sound levels. Noise level criteria are defined as the higher of the existing day/night time ambient noise levels or the minimum noise levels set out in **Table 7** below. Noise control is only warranted if the noise level criteria are exceeded by more than 5 decibels.

Table 7: Minimum Noise Level Criteria for Transportation Corridors

Time Period	Limit [A-weighted decibel]
16 hour day (07:00-23:00)	55
8 hour night (23:00-07:00)	50

The daytime noise level is to be assessed at an outdoor point of reception on a residential property greater than 15 metres from the centreline of the transit system. In Ontario, the outdoor assessment point for traffic (i.e., road and rail) is taken as an outdoor location intended and designed for the quiet enjoyment of the outdoor environment, and the specific location is taken as 3 metres from the midpoint of the building façade at a height of 1.5 metres.

4. Note that the Ministry of Energy and Environment now operates as the Ministry of the Environment, Conservation and Parks

The nighttime noise level is assessed at the plane of any bedroom window, greater than 15 metres from the centreline of the transit line. For this assessment, this was taken as the window on the highest floor, on the most exposed façade.

Where mitigation is considered, the mitigation is required to be technically, economically, and administratively feasible, with design target as close to or less than the noise limits as possible.

5.2 Assessment Locations

The Protocol applies to approved residential developments as well as nursing homes, group homes, hospitals, and other institutional land uses where people reside (noise sensitive receptors) and does not apply to commercial and industrial land uses. The Protocol does not specifically use the term noise sensitive receptors; the locations where the Protocol applies is typically labelled as noise sensitive receptors.

Representative receptors used in the assessment were selected to represent the worst-case noise impacts from the Project. Receptors with similar setback from the Project will have similar noise exposures and impacts; receptors further away will have lower Project noise impacts. Assessed representative receptors are presented in **Table 8** and **Figure 4**.

Table 8: Assessed Representative Noise Sensitive Receptors

Address	Description	Receptor ID
1000 Ellesmere Road	4 Storey Nursing Home	R01
117 Jolly Way	3 Storey Residence	R02
103 Jolly Way	3 Storey Residence	R03
87 Jolly Way	3 Storey Residence	R04
85 Jolly Way	3 Storey Residence	R05
74 Zezel Way	3 Storey Residence	R06
40 Zezel Way	3 Storey Residence	R07
2 Zezel Way	3 Storey Residence	R08
158 Jenkinson Way	3 Storey Residence	R09
154 Jenkinson Way	3 Storey Residence	R10
138 Jenkinson Way	3 Storey Residence	R11
118 Jenkinson Way	3 Storey Residence	R12
86 Jenkinson Way	3 Storey Residence	R13
84 Jenkinson Way	3 Storey Residence	R14

Address	Description	Receptor ID
301 Prudential Drive	16 Storey Multi-unit Residence	R15
64 Romulus Drive	1 Storey Residence	R16
52 Romulus Drive	1 Storey Residence	R17
48 Romulus Drive	2 Storey Residence	R18
40 Romulus Drive	1 Storey Residence	R19
26 Medina Crescent	1 Storey Residence	R20
14 Medina Crescent	1 Storey Residence	R21
2 Medina Crescent	1 Storey Residence	R22
76 Mooregate Avenue	1 Storey Residence	R23
163 Treverton Drive	2 Storey Residence	R24
145 Treverton Drive	2 Storey Residence	R25
127 Treverton Drive	2 Storey Residence	R26
111 Treverton Drive	1 Storey Residence	R27
53 Treverton Drive	2 Storey Residence	R28
49 Treverton Drive	1 Storey Residence	R29
139 Lord Roberts Drive	1 Storey Residence	R30
133 Lord Roberts Drive	2 Storey Residence	R31
109 Lord Roberts Drive	2 Storey Residence	R32
103 Lord Roberts Drive	1 Storey Residence	R33
89 Lord Roberts Drive	2 Storey Residence	R34
55 Lord Roberts Drive	1 Storey Residence	R35
2460 Eglinton Avenue East	18 Storey Multi-unit Residence	R36

Figure 4: Representative Receptor Locations



5.3 Impact Assessment

Similar to other traffic noise impact assessments/environmental assessments in Ontario, noise predictions were used to determine the noise impact from the Project. Design and traffic information was used to develop noise models using the International Organization for Standardization 9613 and United States Federal Highway Administration's Traffic Noise Model prediction algorithms implemented in the Cadna/A modelling package. Existing noise barriers along the corridor (east side around Tara Avenue, and developer installed noise barriers for residences along the west side of the corridor, south of the existing Lawrence East Station) were included in the noise model.

For the base case, noise source information for the Scarborough Rapid Transit was sourced from the Scarborough Rapid Transit reference level provided in the STAMSON V5.04 program (Ministry of the Environment, Conservation and Parks, 2000) and used to calibrate a noise model using the International Organization for Standardization 9613 prediction algorithm. Noise from buses and existing roadways were modelled using the appropriate vehicle types in the United States Federal Highway Administration's Traffic Noise Model prediction algorithm implemented in Cadna/A. The Scarborough Rapid Transit was not modelled in the Post Project scenario as the Project is the replacement of the Scarborough Rapid Transit with a busway. Traffic information is summarized in **Appendix B**.

After the assumptions report was prepared, Toronto Transit Commission further refined the bus operations for the nighttime period at Lawrence East Stop. For the nighttime prior to 2:00 am, based on existing stop usage data at Lawrence Avenue East and Kennedy Road, an average of 83% of buses would stop at Lawrence East Stop, with an average idling dwell time of 16 seconds. For the period from 5:00 to 7:00 am, 68% of buses would stop at Lawrence East stop, with an average idling dwell time of 21 seconds. Buses not serving a stop are required to travel at a speed of 20 kilometres per hour through the stop areas.

As per the Protocol, the noise assessment 'basis of assessment' was based on the higher of the predicted base case noise level, or the levels set out in **Table 7**. The impact, an increase in noise levels, is the difference between the predicted post Project noise level and the basis of assessment. The assessment of noise is based upon the A weighted decibel. A summary of the busway predicted noise levels and the predicted impact are presented in **Table 9** below.

Table 9: Busway Noise Impact Assessment Summary

Receptor	Time Period	Predicted Base Case Noise [A-weight decibel]	Basis of Assessment [A-weight decibel]	Predicted Post Project Noise [A-weight decibel]	Impact [decibels]
R01	Daytime $L_{eq,16\text{ hour}}$	55.4	55.4	56.2	0.8
R01	Nighttime $L_{eq,8\text{ hour}}$	50.8	50.8	52.0	1.2
R02	Daytime $L_{eq,16\text{ hour}}$	49.4	55.0	52.6	-
R02	Nighttime $L_{eq,8\text{ hour}}$	52.1	52.1	56.4	4.3
R03	Daytime $L_{eq,16\text{ hour}}$	46.6	55.0	47.8	-
R03	Nighttime $L_{eq,8\text{ hour}}$	48.3	50.0	50.4	0.4
R04	Daytime $L_{eq,16\text{ hour}}$	45.5	55.0	45.1	-
R04	Nighttime $L_{eq,8\text{ hour}}$	50.2	50.2	51.7	1.5
R05	Daytime $L_{eq,16\text{ hour}}$	39.7	55.0	36.4	-
R05	Nighttime $L_{eq,8\text{ hour}}$	43.6	50.0	45.8	-
R06	Daytime $L_{eq,16\text{ hour}}$	56.4	56.4	56.4	-
R06	Nighttime $L_{eq,8\text{ hour}}$	52.0	52.0	53.4	1.4
R07	Daytime $L_{eq,16\text{ hour}}$	42.9	55.0	42.3	-
R07	Nighttime $L_{eq,8\text{ hour}}$	45.6	50.0	45.3	-
R08	Daytime $L_{eq,16\text{ hour}}$	45.6	55.0	46.1	-
R08	Nighttime $L_{eq,8\text{ hour}}$	45.5	50.0	46.2	-
R09	Daytime $L_{eq,16\text{ hour}}$	56.2	56.2	56.1	-
R09	Nighttime $L_{eq,8\text{ hour}}$	53.1	53.1	53.5	0.4
R10	Daytime $L_{eq,16\text{ hour}}$	52.7	55.0	54.2	-
R10	Nighttime $L_{eq,8\text{ hour}}$	52.7	52.7	56.3	3.6
R11	Daytime $L_{eq,16\text{ hour}}$	52.5	55.0	55.9	0.9
R11	Nighttime $L_{eq,8\text{ hour}}$	52.9	52.9	58.9	6.0
R12	Daytime $L_{eq,16\text{ hour}}$	50.9	55.0	52.0	-
R12	Nighttime $L_{eq,8\text{ hour}}$	52.3	52.3	57.3	5.0
R13	Daytime $L_{eq,16\text{ hour}}$	50.1	55.0	49.1	-
R13	Nighttime $L_{eq,8\text{ hour}}$	51.6	51.6	56.2	4.6
R14	Daytime $L_{eq,16\text{ hour}}$	48.7	55.0	45.8	-
R14	Nighttime $L_{eq,8\text{ hour}}$	52.0	52.0	56.8	4.8
R15	Daytime $L_{eq,16\text{ hour}}$	55.6	55.6	56.6	1.0
R15	Nighttime $L_{eq,8\text{ hour}}$	44.3	50.0	50.0	-
R16	Daytime $L_{eq,16\text{ hour}}$	44.9	55.0	45.8	-
R16	Nighttime $L_{eq,8\text{ hour}}$	38.6	50.0	41.0	-
R17	Daytime $L_{eq,16\text{ hour}}$	48.7	55.0	48.4	-
R17	Nighttime $L_{eq,8\text{ hour}}$	42.6	50.0	44.6	-
R18	Daytime $L_{eq,16\text{ hour}}$	47.2	55.0	46.2	-
R18	Nighttime $L_{eq,8\text{ hour}}$	43.7	50.0	44.4	-
R19	Daytime $L_{eq,16\text{ hour}}$	46.8	55.0	45.9	-
R19	Nighttime $L_{eq,8\text{ hour}}$	41.3	50.0	42.2	-
R20	Daytime $L_{eq,16\text{ hour}}$	47.1	55.0	46.3	-
R20	Nighttime $L_{eq,8\text{ hour}}$	40.4	50.0	40.7	-
R21	Daytime $L_{eq,16\text{ hour}}$	48.0	55.0	48.2	-
R21	Nighttime $L_{eq,8\text{ hour}}$	42.6	50.0	45.5	-
R22	Daytime $L_{eq,16\text{ hour}}$	49.6	55.0	53.0	-
R22	Nighttime $L_{eq,8\text{ hour}}$	44.3	50.0	50.9	0.9
R23	Daytime $L_{eq,16\text{ hour}}$	48.0	55.0	54.8	-
R23	Nighttime $L_{eq,8\text{ hour}}$	42.7	50.0	52.0	2.0
R24	Daytime $L_{eq,16\text{ hour}}$	44.5	55.0	44.8	-
R24	Nighttime $L_{eq,8\text{ hour}}$	41.7	50.0	45.1	-
R25	Daytime $L_{eq,16\text{ hour}}$	49.2	55.0	50.4	-
R25	Nighttime $L_{eq,8\text{ hour}}$	43.4	50.0	47.7	-
R26	Daytime $L_{eq,16\text{ hour}}$	49.8	55.0	51.4	-
R26	Nighttime $L_{eq,8\text{ hour}}$	44.0	50.0	48.0	-
R27	Daytime $L_{eq,16\text{ hour}}$	50.5	55.0	52.2	-
R27	Nighttime $L_{eq,8\text{ hour}}$	44.2	50.0	48.1	-
R28	Daytime $L_{eq,16\text{ hour}}$	51.2	55.0	52.2	-
R28	Nighttime $L_{eq,8\text{ hour}}$	46.9	50.0	49.3	-
R29	Daytime $L_{eq,16\text{ hour}}$	52.8	55.0	53.3	-
R29	Nighttime $L_{eq,8\text{ hour}}$	46.1	50.0	47.7	-
R30	Daytime $L_{eq,16\text{ hour}}$	49.4	55.0	50.8	-
R30	Nighttime $L_{eq,8\text{ hour}}$	43.6	50.0	47.8	-
R31	Daytime $L_{eq,16\text{ hour}}$	48.0	55.0	47.9	-
R31	Nighttime $L_{eq,8\text{ hour}}$	44.5	50.0	46.4	-
R32	Daytime $L_{eq,16\text{ hour}}$	48.2	55.0	46.1	-
R32	Nighttime $L_{eq,8\text{ hour}}$	45.6	50.0	46.2	-
R33	Daytime $L_{eq,16\text{ hour}}$	48.1	55.0	46.0	-
R33	Nighttime $L_{eq,8\text{ hour}}$	43.3	50.0	43.0	-
R34	Daytime $L_{eq,16\text{ hour}}$	48.3	55.0	46.4	-
R34	Nighttime $L_{eq,8\text{ hour}}$	44.6	50.0	45.0	-
R35	Daytime $L_{eq,16\text{ hour}}$	49.0	55.0	47.6	-
R35	Nighttime $L_{eq,8\text{ hour}}$	41.4	50.0	41.5	-
R36	Daytime $L_{eq,16\text{ hour}}$	63.3	63.3	63.1	-
R36	Nighttime $L_{eq,8\text{ hour}}$	56.6	56.6	57.6	1.0

Results in **Table 9** indicate that the noise impact is above the noise mitigation investigation threshold at representative receptor R11 during the nighttime, and nearly over the threshold at R12, also during the nighttime period. These locations represent the town houses on the west side of the corridor, south of Lawrence Avenue East. The predicted noise levels at these locations are higher during the nighttime period due to the plane of window assessment location for the nighttime period as per the Protocol. Mitigation analysis is presented in the following section.

5.4 Mitigation Analysis

As per the Protocol, mitigation measures are required to be technically, economically, and administratively feasible, with design target as close to or less than the noise limits as possible.

Technical, economic, and administrative feasibility is further elaborated by the Ontario Ministry of Transportation:

- **Administrative Feasibility:** Determine the ability to locate the noise mitigation on lands within public ownership (i.e., provincial or municipal right-of-way).
- **Technical Feasibility:** Review the constructability of the noise mitigation (i.e., design of wall, roadside safety, shadow effect, topography, ability to provide a continuous barrier, etc.). As typical in Ontario, a noise barrier is considered feasible if a minimum attenuation of 5 decibel can be achieved, averaged over first row receptors.
- **Economic Feasibility:** Carry out a cost/benefit assessment of the noise mitigation (i.e., determine approximate cost per benefited unit).

Standard industry practices and standard noise mitigation barrier designs typically exist up to 5 metres in height. Barriers greater in height require non-standard designs and have escalating unit costs. As such, barriers up to 5 metres were considered in the mitigation investigation.

Noise barriers are typically the most effective close to the noise source, or receptor. As the receptors requiring noise mitigation investigation are 3 storeys in height (7.5 metres, 3rd floor window), noise mitigation was investigated closer to the busway. The investigated noise barrier was located in the right-of-way to meet the administrative feasibility goal. There are constraints on the proposed footprint of the noise barrier at the north end due to the Lawrence Avenue East contingency access driveway. Results were also calculated at R12 as that location was nearly over the mitigation investigation threshold.

Results of the investigation are presented in **Table 10** below.

Table 10: Mitigation Analysis – Technical Feasibility

Representative Receptor	Basis of Assessment [A-weighted decibel]	Predicted Post Project Noise (No Mitigation) [A-weighted decibel]	Predicted Post Project Noise (With Mitigation) [A-weighted decibel]	Reduction / Attenuation [decibels]
R11	52.9	61.7	55.4	3.5
R12	52.3	57.4	52.6	4.7

Results in the above table indicate that a 5 metre noise barrier extending 130 metres does not achieve the minimum 5 decibels of attenuation, and is thus not technically feasible to address nighttime noise levels at R11 and R12.

The assessment was conducted using conservative modelling assumptions resulting in assessed representative receptors R11 being exposed to more noise from idling and accelerating buses due to their proximity to the bus stops. Also note that the Protocol requires the assessment of nighttime noise levels at the assumed plane of window (3rd storey), where as road traffic noise assessments in Ontario typically only review noise levels for existing residences at the Outdoor Living Area. The assessment shows that the predicted noise levels meet the noise level limit during the daytime in the Outdoor Living Areas.

Should fewer buses serve Lawrence East stop, idle for a shorter duration, and/or transition to a lower noise emitting/electric fleet in the future, the noise impact would decrease. Note that the development located to the southwest of Lawrence East Station was built in 2003⁵, and would have been designed in accordance with Ministry of the Environment (now operating as the Ministry of the Environment, Conservation and Parks) guideline LU-131 (Noise Assessment Criteria in Land Use Planning) to address noise interior and exterior to the building. During the development process, the Toronto Transit Commission typically comes to an agreement with the developer to include warning clauses in the agreements of purchase and sale warning that the property is in close proximity to Toronto Transit Commission infrastructure which may result in interference (including noise and vibration) to the development.

5. <https://condos.ca/toronto/lawrence-village-3-23-brisby-mews-3-172-jenkinson-way-48-56-kiriakou-st>

6. Recommendations

6.1 Construction

6.1.1 Noise

The following general guidance is provided to decrease construction noise impacts:

- Avoid nighttime construction where possible near residences.
- Avoid the use of impact or sonic piling machines unless noise control (i.e., some sort of enclosure or acoustic shroud) is used. Specific requirements of noise control are to be determined during detail design based upon exact locations of operations.
 - Consider alternative methods such as installation using augured methods, or if possible, shoring using trench boxes.
- Although exempt from City of Toronto By-law 878-2019, attempt to abide by local noise by-laws and policies.
- Use equipment compliant with Ministry of the Environment publication Noise Pollution Control guidelines 115 and Noise Pollution Control guideline 118.
- Use of upgraded construction hoarding between construction equipment and noise sensitive receivers.
- Provide occupants of buildings in the vicinity of planned construction activity with the contact details of a person who can assist them with resolving issues related to construction noise, and setup a construction complaint process.
- Limit construction noise levels outside of construction areas (public areas) to a maximum of 85 A-weighted decibels to be compliant with Occupational Health and Safety requirements.
- Ensure all internal combustion engines are fitted with appropriate muffler systems.
- Take advantage of shielding from existing structures, objects, or stockpiles to shield residential locations from construction equipment.
- Minimize simultaneous operation of equipment where possible.
- Implement a noise idling policy on site (unless necessary for safety or equipment operations).

- Maximize distance between construction equipment operations and noise sensitive receptors where possible.
- Keep equipment in good maintenance.
- Limit equipment idling time to the minimum time necessary to complete specified tasks.
- Advise nearby residents of significant noise generating activities to minimize disruption.
- Consult with likely affected persons prior to commencement of works.
- Consider setting construction noise level limits appropriate to Project acceptable community response.
 - Guidance is available in International Organization for Standardization R1996 and the United States Federal Transit Administration’s Transit Noise and Vibration Impact Assessment guide. Construction noise levels less than 5 decibels above the pre-construction background are typically acceptable.
 - Consider noise monitoring to verify if construction noise limits are met.

The above guidance will be refined during further design to account for refined considerations such as:

- Time of operation.
- Exact areas of operation.
- Size of equipment.
- Concurrent usages.
- Refined staging plans.

6.1.2 Vibration

As indicated above, buildings above fall within the Zone of Influence as defined by City of Toronto By-law 514-2008. Although works on a transit corridor may not require a building permit, following the provisions of By-law 514-2008 is considered good practice. The Zone of Influence should be further developed and refined as design progresses to finalize the locations where vibration monitoring and preconstruction building inspections should be conducted. Please see **Table 6** for preliminary Zone of Influence for City of Toronto requirements, and setbacks to minimize the potential for building damage. The following recommendations are provided to limit the vibration impacts:

- Abide by all local vibration by-laws.
 - City of Toronto By-law 514-2008 requires a vibration study and a vibration control form to be submitted as part of the building permitting application.
 - Follow provisions in By-law 514-2008 regardless of application requirements.
 - Conduct vibration monitoring for locations within the Zone of Influence.
 - Conduct preconstruction building inspections for structures within the Zone of Influence.
 - Update Zone of Influence as design develops.
- Set vibration limits appropriate for the structure type, guidance can be found in the United States Federal Transit Administration’s Transit Noise and Vibration Impact Assessment Guide for Transit Noise and Vibration Impact Assessment, and City of Toronto specification GN117SS.
- Avoid impact or vibratory methods for shoring, consider augured method, or other lower impact forms of shoring such as trench boxes) where feasible.
- Use lower vibration equipment where feasible (e.g., smaller sized equipment).
- Use lower vibration processes where feasible (e.g., caisson drilling instead of impact piling).
- Operate construction equipment during periods where nearby structures are unoccupied when feasible.
- Avoid use of vibration generating equipment during the nighttime in residential areas, when feasible.
- Limit speed of vehicles entering and driving within the site.
- Provide smooth surfaces for vehicle movements when feasible.
- Maximize distance between equipment and sensitive receptors while receptors are occupied where possible.
- Inform occupants of buildings in the vicinity of planned construction activity a reasonable amount of time before construction begins.
- Provide occupants of buildings in the vicinity of planned construction activity with the contact details of a person who can assist them with resolving issues related to vibration generated by construction.
- Operate construction vehicles under lower vibration settings.
- Setup a construction vibration complaint process.

This assessment assumes that bridges and Toronto Transit Commission infrastructure immediate adjacent to, or affected by construction are being protected as part of the construction contract including Eglinton Avenue East, Lawrence Avenue East, Ellesmere Road, Highland Creek bridges, and Toronto Transit Commission Stations and ancillary facilities.

6.2 Operations

The results of the operations impact assessment indicate that noise mitigation is not feasible to address the nighttime noise levels at the residential development southwest of the existing Lawrence East Station. However, the daytime noise limit (typically the only location assessed during traffic noise impact assessment in Ontario) is met at these locations.

The buses modelled for this assessment are typical diesel type buses. The Toronto Transit Commission currently has a “Green Initiative” to decrease the air emissions of their bus fleet and has purchased some battery electric buses, which anecdotally have lower noise emissions as well. As newer and lower noise emitting buses come into the Toronto Transit Commission’s fleet, a recommendation would be to investigate the feasibility of using the lower noise emitting buses on the bus routes serving the busway.

Other general considerations include, investigating the use of larger bus shelters as a noise screen, encouraging the bus operators to accelerate slower while near the residents southwest of the existing Lawrence East Station, and distributing the bus stopping across the entire bus stop platform to further distribute the noise emissions where possible.

7. Conclusion

The existing Scarborough Rapid Transit corridor is being converted to a dedicated busway. Analysis indicates that a noise barrier is not technically feasible to address noise from the operation of the busway to meet Protocol limits. General considerations, if feasible, to decrease noise impact are the presented in **Section 6.2**.

Construction noise and vibration have also been reviewed as part of this assessment. The review has indicated that noise and vibration impacts on the surrounding sensitive receptors is likely. Guidance to decrease the construction noise and vibration impacts are summarized in **Section 6.1**. Preconstruction inspections and construction vibration monitoring is recommended.

With the noise and vibration control implemented, the temporary noise and vibration during construction would be minimized, and the operational noise will be able to meet the applicable guideline limits.

8. References

City of Toronto, 2008:

“By-law 514-2008 – Construction Vibration”

City of Toronto, 2019:

“By-law 878-2019 - Noise”

International Organization for Standardization, 1996:

International Organization for Standardization 9613-2: Acoustics - Attenuation of Sound during Propagation Outdoors Part 2: General Method of Calculation, Geneva, Switzerland

Metrolinx, 2021:

“Environmental Guide for Noise and Vibration Impact Assessment”

Ministry of the Environment, Conservation and Parks, 2000:

“STAMSON V5.04”

Ministry of the Environment, Conservation and Parks. 1993”

“Draft Protocol for Noise and Vibration Assessment for the Proposed Scarborough Rapid Transit Extension”

United States Federal Highway Administration, 2006:

“Road Construction Noise Model”

United States Federal Highway Administration, 2023:

“Traffic Noise Model”, Datakustik

United States Federal Transit Administration, 2018:

“Transit Noise and Vibration Impact Assessment”

Appendix A

Noise Monitor Data



Appendix B

Traffic Data



Road Traffic Distribution

MTO split for other roads

	%of total	%of trucks
MT	5	38%
HT	8	62%

Roadway	posted Speed	info from TTC/team email			Truck% calcs				Lanes	split		split vols		per hour 16/8		Per hour per lane	
		AADT	Truck%	Bus%	total trk type(bus+trk %)	%bus of trk type	%hvy of trk	day		night	day	night	day	night	day	night	
Ellesemere	50	30000	3	2	5	40%	37%	6	90%	10%	27000	3000	1687.5	375	281.3	62.5	
Lawrence	60	33000	2	2	4	50%	31%	6	90%	10%	29700	3300	1856.25	412.5	309.4	68.8	
Eglinton	50	49000	7	8	15	53%	29%	6	90%	10%	44100	4900	2756.25	612.5	459.4	102.1	

Trips per hour

Route/Branch	Early AM	Mon-Fri					
		AM Peak	Midday	PM Peak	EE	LE	
38A	4.00	4.00	4.00	4.00	4.00	4.80	3.00
38B		4.00	4.00	4.00	4.00		
129A	3.75	3.75	1.88	4.29	2.00	1.50	
129B	3.75	3.75	7.50	4.29	8.00	6.00	
131	5.00	5.00	4.00	5.00	4.00	3.00	
133	5.00	5.00	5.00	6.00	5.00	2.68	
903A		7.50	7.50	6.00	5.00		
903B	7.50						
938		4.00		4.00			
939	7.50	7.50	8.57	5.00	7.50	4.62	
985A	5.00	4.00	5.00	4.00	4.00	4.00	
Total trips per hour	41.50	48.50	47.45	46.57	40.30	24.79	
Avg Headway	1.45	1.24	1.26	1.29	1.49	2.42	
	01' 27"	01' 14"	01' 16"	01' 17"	01' 29"	02' 25"	

Time Parameters	Total (per dir)		per hour (per dir)	
	7AM-23:00	23:00-7AM	713.6582418	44.60364011
Monday-Friday:			60 km/hr	
Early Morning	05:00 - 07:00	2hrs		
A.M. Peak	07:00 - 09:00	2hrs		
Midday	09:00 - 15:00	6hrs		
P.M. Peak	15:00 - 19:00	4hrs		
Early Evening	19:00 - 22:00	3hrs		
Late Evening	22:00 - 26:00	4hrs		

Au, James

From: Wang, Joanne
Sent: May 3, 2024 2:24 PM
To: Au, James
Cc: Franklin, Jackie; Scott, Christopher
Subject: FW: Re: TTC Busway Conversion_Traffic Data Status

FYI

From: Gary.Papas@ttc.ca <Gary.Papas@ttc.ca>
Sent: Friday, May 3, 2024 2:07 PM
To: Wang, Joanne <joanne.wang@aecom.com>
Cc: Hassan, Jehad <jehad.hassan@ttc.ca>; Yuen, Merlin <merlin.yuen@ttc.ca>; Ho, Dominic <dominic.ho@ttc.ca>; Franklin, Jackie <jackie.franklin@aecom.com>; Scott, Christopher <Christopher.Scott@aecom.com>; Castillo, Andrea <andrea.castillo@ttc.ca>; Shantz, Aaron <Aaron.shantz@ttc.ca>; Hart-Bishop, Jordan <jordan.hart-bishop@ttc.ca>
Subject: RE: Re: TTC Busway Conversion_Traffic Data Status

This Message Is From an External Sender

This message came from outside your organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Report Suspicious

Hi Joanne,

Confirming during the day-time, between Kennedy and Ellesmere, the operating speed of trains were limited to 65km/h due to noise (design speed between stations is 80km/h) – and in late evening the operating speed between Kennedy and Lawrence Station was limited to 40km/h due to noise.

I believe this concludes all the necessary data requests. Let me know if I've missed anything.

Thanks Joanne,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

T: 416-393-3985 | M: 647-505-5139 | gary.papas@ttc.ca

Please note: At this time, TTC email accounts are not able to receive links.



Toronto Transit Commission
5160 Yonge Street, Suite 900
Toronto, ON M2N 6L9

From: Hart-Bishop, Jordan <Jordan.Hart-Bishop@ttc.ca>
Sent: Thursday, May 2, 2024 3:02 PM
To: Wang, Joanne <joanne.wang@aecom.com>; Papas, Gary <Gary.Papas@ttc.ca>
Cc: Hassan, Jehad <Jehad.Hassan@ttc.ca>; Yuen, Merlin <Merlin.Yuen@ttc.ca>; Ho, Dominic

SOUTHBOUND

Frz	Trip	Pattern	VehType	Block	INT	McCowan Static	Scarborough C	Midland Static	Ellesmere Stat	Lawrence East	Kennedy Arrive	Kennedy Station					
NO	0	S1500	70	361	I-S	5:45	5:46	5:48	5:50	5:53		5:58					
NO	0	AM5T25	70	362	I-S	5:52	5:53	5:55	5:57	5:59	6:02	6:03					
NO	0	AM5T25	70	363	I-S	5:57	5:58	6:00	6:02	6:04	6:07	6:08					
NO	0	AM5T25	70	365	I-S	6:02	6:03	6:05	6:07	6:09	6:12	6:13					
NO	0	AM5T25	70	366	I-S	6:07	6:08	6:10	6:12	6:14	6:17	6:18					
NO	0	AM5T25	70	361	I-S	6:12	6:13	6:15	6:17	6:19	6:22	6:23					
NO	0	AM5T25	70	362	I-S	6:17	6:18	6:20	6:22	6:24	6:27	6:28					
NO	0	AM5T25	70	363	I-S	6:22	6:23	6:25	6:27	6:29	6:32	6:33					
NO	0	AM5T25	70	365	I-S	6:27	6:28	6:30	6:32	6:34	6:37	6:38					
NO	0	AM5T25	70	366	I-S	6:32	6:33	6:35	6:37	6:39	6:42	6:43					
NO	0	AM5T25	70	361	I-S	6:37	6:38	6:40	6:42	6:44	6:47	6:48					
NO	0	AM5T25	70	362	I-S	6:42	6:43	6:45	6:47	6:49	6:52	6:53					
NO	0	AM5T25	70	363	I-S	6:47	6:48	6:50	6:52	6:54	6:57	6:58					
NO	0	AM5T25	70	365	I-S	6:52	6:53	6:55	6:57	6:59	7:02	7:03					
NO	0	AM5T25	70	366	I-S	6:57	6:58	7:00	7:02	7:04	7:07	7:08					
NO	0	AM5T25	70	361	I-S	7:02	7:03	7:05	7:07	7:09	7:12	7:13					
NO	0	AM5T25	70	362	I-S	7:07	7:08	7:10	7:12	7:14	7:17	7:18					
NO	0	AM5T25	70	363	I-S	7:12	7:13	7:15	7:17	7:19	7:22	7:23					
NO	0	AM5T25	70	365	I-S	7:17	7:18	7:20	7:22	7:24	7:27	7:28					
NO	0	AM5T25	70	366	I-S	7:22	7:23	7:25	7:27	7:29	7:32	7:33					
NO	0	AM5T25	70	361	I-S	7:27	7:28	7:30	7:32	7:34	7:37	7:38					
NO	0	AM5T25	70	362	I-S	7:32	7:33	7:35	7:37	7:39	7:42	7:43					
NO	0	AM5T25	70	363	I-S	7:37	7:38	7:40	7:42	7:44	7:47	7:48					
NO	0	AM5T25	70	365	I-S	7:42	7:43	7:45	7:47	7:49	7:52	7:53					
NO	0	AM5T25	70	366	I-S	7:47	7:48	7:50	7:52	7:54	7:57	7:58					
NO	0	AM5T25	70	361	I-S	7:52	7:53	7:55	7:57	7:59	8:02	8:03					
NO	0	AM5T25	70	362	I-S	7:57	7:58	8:00	8:02	8:04	8:07	8:08					
NO	0	AM5T25	70	363	I-S	8:02	8:03	8:05	8:07	8:09	8:12	8:13					
NO	0	AM5T25	70	365	I-S	8:07	8:08	8:10	8:12	8:14	8:17	8:18					
NO	0	AM5T25	70	366	I-S	8:12	8:13	8:15	8:17	8:19	8:22	8:23					
NO	0	AM5T25	70	361	I-S	8:17	8:18	8:20	8:22	8:24	8:27	8:28					
NO	0	AM5T25	70	362	I-S	8:22	8:23	8:25	8:27	8:29	8:32	8:33					
NO	0	AM5T25	70	363	I-S	8:27	8:28	8:30	8:32	8:34	8:37	8:38					
NO	0	AM5T25	70	365	I-S	8:32	8:33	8:35	8:37	8:39	8:42	8:43					
NO	0	AM5T25	70	366	I-S	8:37	8:38	8:40	8:42	8:44	8:47	8:48					
NO	0	AM5T25	70	361	I-S	8:42	8:43	8:45	8:47	8:49	8:52	8:53					
NO	0	AM5T25	70	362	I-S	8:47	8:48	8:50	8:52	8:54	8:57	8:58					
NO	0	AM5T25	70	363	I-S	8:52	8:53	8:55	8:57	8:59	9:02	9:03					
NO	0	AM5T25	70	365	I-S	8:57	8:58	9:00	9:02	9:04	9:07	9:08					
NO	0	AM5T25	70	366	I-S	9:02	9:03	9:05	9:07	9:09	9:12	9:13					
NO	0	AM5T25	70	361	I-S	9:07	9:08	9:10	9:12	9:14	9:17	9:18					
NO	0	AM5T25	70	362	I-S	9:12	9:13	9:15	9:17	9:19	9:22	9:23					
NO	0	AM5T25	70	363	I-S	9:17	9:18	9:20	9:22	9:24	9:27	9:28					
NO	0	AM5T25	70	365	I-S	9:22	9:23	9:25	9:27	9:29	9:32	9:33					
NO	0	AM5T25	70	366	I-S	9:27	9:28	9:30	9:32	9:34	9:37	9:38					
NO	0	AM5T25	70	361	I-S	9:32	9:33	9:35	9:37	9:39	9:42	9:43					
NO	0	AM5T25	70	362	I-S	9:37	9:38	9:40	9:42	9:44	9:47	9:48					
NO	0	AM5T25	70	363	I-S	9:42	9:43	9:45	9:47	9:49	9:52	9:53					
NO	0	AM5T25	70	365	I-S	9:47	9:48	9:50	9:52	9:54	9:57	9:58					
NO	0	AM5T25	70	366	I-S	9:52	9:53	9:55	9:57	9:59	10:02	10:03					
NO	0	AM5T25	70	361	I-S	9:57	9:58	10:00	10:02	10:04	10:07	10:08					
NO	0	AM5T25	70	362	I-S	10:02	10:03	10:05	10:07	10:09	10:12	10:13					
NO	0	AM5T25	70	363	I-S	10:07	10:08	10:10	10:12	10:14	10:17	10:18					
NO	0	AM5T25	70	365	I-S	10:12	10:13	10:15	10:17	10:19	10:22	10:23					
NO	0	AM5T25	70	366	I-S	10:17	10:18	10:20	10:22	10:24	10:27	10:28					
NO	0	AM5T25	70	361	I-S	10:22	10:23	10:25	10:27	10:29	10:32	10:33					
NO	0	AM5T25	70	362	I-S	10:27	10:28	10:30	10:32	10:34	10:37	10:38					
NO	0	AM5T25	70	363	I-S	10:32	10:33	10:35	10:37	10:39	10:42	10:43					
NO	0	AM5T25	70	365	I-S	10:37	10:38	10:40	10:42	10:44	10:47	10:48					
NO	0	AM5T25	70	366	I-S	10:42	10:43	10:45	10:47	10:49	10:52	10:53					
NO	0	AM5T25	70	361	I-S	10:47	10:48	10:50	10:52	10:54	10:57	10:58					
NO	0	AM5T25	70	362	I-S	10:52	10:53	10:55	10:57	10:59	11:02	11:03					
NO	0	AM5T25	70	363	I-S	10:57	10:58	11:00	11:02	11:04	11:07	11:08					
NO	0	S1330	70	365	I-S	11:03	11:05	11:07	11:08	11:11		11:17					
NO	0	S1330	70	366	I-S	11:10	11:12	11:14	11:15	11:18		11:24					
NO	0	S1330	70	362	I-S	11:17	11:19	11:20	11:22	11:24		11:30					
NO	0	S1330	70	363	I-S	11:24	11:25	11:27	11:29	11:31		11:37					
NO	0	S1330	70	365	I-S	11:30	11:32	11:34	11:35	11:38		11:44					
NO	0	S1330	70	366	I-S	11:37	11:39	11:41	11:42	11:45		11:51					
NO	0	S1330	70	362	I-S	11:44	11:46	11:47	11:49	11:51		11:57					
NO	0	S1330	70	363	I-S	11:51	11:52	11:54	11:56	11:58		12:04					
NO	0	S1330	70	365	I-S	11:57	11:59	12:01	12:02	12:05		12:11					
NO	0	S1330	70	366	I-S	12:04	12:06	12:08	12:09	12:12		12:18					
NO	0	S1330	70	362	I-S	12:11	12:13	12:14	12:16	12:18		12:24					
NO	0	S1330	70	363	I-S	12:18	12:19	12:21	12:23	12:25		12:31					
NO	0	S1330	70	365	I-S	12:24	12:26	12:28	12:29	12:32		12:38					
NO	0	S1330	70	366	I-S	12:31	12:33	12:35	12:36	12:39		12:45					
NO	0	S1330	70	362	I-S	12:38	12:40	12:41	12:43	12:45		12:51					
NO	0	S1330	70	363	I-S	12:45	12:46	12:48	12:50	12:52		12:58					
NO	0	S1330	70	365	I-S	12:51	12:53	12:55	12:56	12:59		13:05					

NO	0	PM5T25	70	364 I-S	18:00	18:01	18:03	18:04	18:07	18:10	18:11
NO	0	PM5T25	70	365 I-S	18:05	18:06	18:08	18:09	18:12	18:15	18:16
NO	0	PM5T25	70	366 I-S	18:10	18:11	18:13	18:14	18:17	18:20	18:21
NO	0	PM5T25	70	362 I-S	18:15	18:16	18:18	18:19	18:22	18:25	18:26
NO	0	PM5T25	70	363 I-S	18:20	18:21	18:23	18:24	18:27	18:30	18:31
NO	0	PM5T25	70	364 I-S	18:25	18:26	18:28	18:29	18:32	18:35	18:36
NO	0	PM5T25	70	365 I-S	18:30	18:31	18:33	18:34	18:37	18:40	18:41
NO	0	PM5T25	70	366 I-S	18:35	18:36	18:38	18:39	18:42	18:45	18:46
NO	0	PM5T25	70	362 I-S	18:40	18:41	18:43	18:44	18:47	18:50	18:51
NO	0	PM5T25	70	363 I-S	18:45	18:46	18:48	18:49	18:52	18:55	18:56
NO	0	PM5T25	70	364 I-S	18:50	18:51	18:53	18:54	18:57	19:00	19:01
NO	0	PM5T25	70	365 I-S	18:55	18:56	18:58	18:59	19:02	19:05	19:06
NO	0	PM5T25	70	366 I-S	19:00	19:01	19:03	19:04	19:07	19:10	19:11
NO	0	PM5T25	70	362 I-S	19:05	19:06	19:08	19:09	19:12	19:15	19:16
NO	0	PM5T25	70	363 I-S	19:10	19:11	19:13	19:14	19:17	19:20	19:21
NO	0	PM5T25	70	364 I-S	19:15	19:16	19:18	19:19	19:22	19:25	19:26
NO	0	PM5T25	70	365 I-S	19:20	19:21	19:23	19:24	19:27	19:30	19:31
NO	0	PM5T25	70	366 I-S	19:25	19:26	19:28	19:29	19:32	19:35	19:36
NO	0	PM5T25	70	362 I-S	19:30	19:31	19:33	19:34	19:37	19:40	19:41
NO	0	PM5T25	70	363 I-S	19:35	19:36	19:38	19:39	19:42	19:45	19:46
NO	0	PM5T25	70	364 I-S	19:40	19:41	19:43	19:44	19:47	19:50	19:51
NO	0	PM5T25	70	365 I-S	19:45	19:46	19:48	19:49	19:52	19:55	19:56
NO	0	PM5T25	70	366 I-S	19:50	19:51	19:53	19:54	19:57	20:00	20:01
NO	0	PM5T25	70	362 I-S	19:55	19:56	19:58	19:59	20:02	20:05	20:06
NO	0	PM5T25	70	363 I-S	20:00	20:01	20:03	20:04	20:07	20:10	20:11
NO	0	PM5T25	70	364 I-S	20:05	20:06	20:08	20:09	20:12	20:15	20:16
NO	0	PM5T25	70	365 I-S	20:10	20:11	20:13	20:14	20:17	20:20	20:21
NO	0	PM5T25	70	366 I-S	20:15	20:16	20:18	20:19	20:22	20:25	20:26
NO	0	PM5T25	70	362 I-S	20:20	20:21	20:23	20:24	20:27	20:30	20:31
NO	0	PM5T25	70	363 I-S	20:25	20:26	20:28	20:29	20:32	20:35	20:36
NO	0	PM5T25	70	364 I-S	20:30	20:31	20:33	20:34	20:37	20:40	20:41
NO	0	PM5T25	70	365 I-S	20:35	20:36	20:38	20:39	20:42	20:45	20:46
NO	0	S1330	70	366 I-S	20:40	20:41	20:43	20:45	20:47		20:53
NO	0	S1330	70	362 I-S	20:46	20:48	20:50	20:51	20:54		21:00
NO	0	S1330	70	363 I-S	20:53	20:55	20:56	20:58	21:00		21:06
NO	0	S1330	70	365 I-S	21:00	21:01	21:03	21:05	21:07		21:13
NO	0	S1330	70	366 I-S	21:06	21:08	21:10	21:11	21:14		21:20
NO	0	S1330	70	362 I-S	21:13	21:15	21:17	21:18	21:21		21:27
NO	0	S1330	70	363 I-S	21:20	21:22	21:23	21:25	21:27		21:33
NO	0	S1330	70	365 I-S	21:27	21:28	21:30	21:32	21:34		21:40
NO	0	S1330	70	366 I-S	21:33	21:35	21:37	21:38	21:41		21:47
NO	0	S1330	70	362 I-S	21:40	21:42	21:44	21:45	21:48		21:54
NO	0	S1330	70	363 I-S	21:47	21:49	21:50	21:52	21:54		22:00
NO	0	S1330	70	365 I-S	21:54	21:55	21:57	21:59	22:01		22:07
NO	0	S1330	70	366 I-S	22:00	22:02	22:04	22:05	22:08		22:14
NO	0	S1330	70	362 I-S	22:07	22:09	22:11	22:12	22:15		22:21
NO	0	S1330	70	363 I-S	22:14	22:16	22:17	22:19	22:21		22:27
NO	0	S1330	70	365 I-S	22:21	22:22	22:24	22:26	22:28		22:34
NO	0	S1330	70	366 I-S	22:27	22:29	22:31	22:32	22:35		22:41
NO	0	S1330	70	362 I-S	22:34	22:36	22:38	22:39	22:42		22:48
NO	0	S1330	70	363 I-S	22:41	22:43	22:44	22:46	22:48		22:54
NO	0	S1330	70	365 I-S	22:48	22:49	22:51	22:53	22:55		23:01
NO	0	S1330	70	366 I-S	22:54	22:56	22:58	22:59	23:02		23:08
NO	0	S1330	70	362 I-S	23:01	23:03	23:05	23:06	23:09		23:15
NO	0	S1330	70	363 I-S	23:08	23:10	23:11	23:13	23:15		23:21
NO	0	S1330	70	365 I-S	23:15	23:16	23:18	23:20	23:22		23:28
NO	0	S1330	70	366 I-S	23:21	23:23	23:25	23:26	23:29		23:35
NO	0	S1330	70	362 I-S	23:28	23:30	23:32	23:33	23:36		23:42
NO	0	S1330	70	363 I-S	23:35	23:37	23:38	23:40	23:42		23:48
NO	0	S1330	70	365 I-S	23:42	23:43	23:45	23:47	23:49		23:55
NO	0	S1330	70	366 I-S	23:48	23:50	23:52	23:53	23:56		24:02
NO	0	S1330	70	362 I-S	23:55	23:57	23:59	24:00	24:03		24:09
NO	0	S1330	70	363 I-S	24:02	24:04	24:05	24:07	24:09		24:15
NO	0	S1330	70	365 I-S	24:09	24:10	24:12	24:14	24:16		24:22
NO	0	S1330	70	366 I-S	24:15	24:17	24:19	24:20	24:23		24:29
NO	0	S1330	70	362 I-S	24:22	24:24	24:26	24:27	24:30		24:36
NO	0	S1330	70	363 I-S	24:29	24:31	24:32	24:34	24:36		24:42
NO	0	S1330	70	365 I-S	24:36	24:37	24:39	24:41	24:43		24:49
NO	0	S1330	70	366 I-S	24:42	24:44	24:46	24:47	24:50		24:56
NO	0	S1330	70	362 I-S	24:49	24:51	24:53	24:54	24:57		25:03
NO	0	S1330	70	363 I-S	24:56	24:58	24:59	25:01	25:03		25:09
NO	0	S1330	70	365 I-S	25:03	25:04	25:06	25:08	25:10		25:16
NO	0	S1330	70	366 I-S	25:09	25:11	25:13	25:14	25:17		25:23
NO	0	S1330	70	362 I-S	25:16	25:18	25:20	25:21	25:24		25:30

NORTHBOUND

Frz	Trip	Pattern	VehType	Block	INT	Kennedy Station	Lawrence East	Ellesmere Stat	Midland Static	Scarborough C	McCowan Arrive	McCowan Station
NO	0	AM5T25	70	361 I-S		5:58	6:01	6:04	6:05	6:07	6:09	6:12
NO	0	AM5T25	70	362 I-S		6:03	6:06	6:09	6:10	6:12	6:14	6:17
NO	0	AM5T25	70	363 I-S		6:08	6:11	6:14	6:15	6:17	6:19	6:22
NO	0	AM5T25	70	365 I-S		6:13	6:16	6:19	6:20	6:22	6:24	6:27
NO	0	AM5T25	70	366 I-S		6:18	6:21	6:24	6:25	6:27	6:29	6:32
NO	0	AM5T25	70	361 I-S		6:23	6:26	6:29	6:30	6:32	6:34	6:37
NO	0	AM5T25	70	362 I-S		6:28	6:31	6:34	6:35	6:37	6:39	6:42
NO	0	AM5T25	70	363 I-S		6:33	6:36	6:39	6:40	6:42	6:44	6:47
NO	0	AM5T25	70	365 I-S		6:38	6:41	6:44	6:45	6:47	6:49	6:52
NO	0	AM5T25	70	366 I-S		6:43	6:46	6:49	6:50	6:52	6:54	6:57
NO	0	AM5T25	70	361 I-S		6:48	6:51	6:54	6:55	6:57	6:59	7:02
NO	0	AM5T25	70	362 I-S		6:53	6:56	6:59	7:00	7:02	7:04	7:07
NO	0	AM5T25	70	363 I-S		6:58	7:01	7:04	7:05	7:07	7:09	7:12
NO	0	AM5T25	70	365 I-S		7:03	7:06	7:09	7:10	7:12	7:14	7:17
NO	0	AM5T25	70	366 I-S		7:08	7:11	7:14	7:15	7:17	7:19	7:22
NO	0	AM5T25	70	361 I-S		7:13	7:16	7:19	7:20	7:22	7:24	7:27
NO	0	AM5T25	70	362 I-S		7:18	7:21	7:24	7:25	7:27	7:29	7:32
NO	0	AM5T25	70	363 I-S		7:23	7:26	7:29	7:30	7:32	7:34	7:37
NO	0	AM5T25	70	365 I-S		7:28	7:31	7:34	7:35	7:37	7:39	7:42
NO	0	AM5T25	70	366 I-S		7:33	7:36	7:39	7:40	7:42	7:44	7:47
NO	0	AM5T25	70	361 I-S		7:38	7:41	7:44	7:45	7:47	7:49	7:52
NO	0	AM5T25	70	362 I-S		7:43	7:46	7:49	7:50	7:52	7:54	7:57
NO	0	AM5T25	70	363 I-S		7:48	7:51	7:54	7:55	7:57	7:59	8:02
NO	0	AM5T25	70	365 I-S		7:53	7:56	7:59	8:00	8:02	8:04	8:07
NO	0	AM5T25	70	366 I-S		7:58	8:01	8:04	8:05	8:07	8:09	8:12
NO	0	AM5T25	70	361 I-S		8:03	8:06	8:09	8:10	8:12	8:14	8:17
NO	0	AM5T25	70	362 I-S		8:08	8:11	8:14	8:15	8:17	8:19	8:22
NO	0	AM5T25	70	363 I-S		8:13	8:16	8:19	8:20	8:22	8:24	8:27
NO	0	AM5T25	70	365 I-S		8:18	8:21	8:24	8:25	8:27	8:29	8:32
NO	0	AM5T25	70	366 I-S		8:23	8:26	8:29	8:30	8:32	8:34	8:37
NO	0	AM5T25	70	361 I-S		8:28	8:31	8:34	8:35	8:37	8:39	8:42
NO	0	AM5T25	70	362 I-S		8:33	8:36	8:39	8:40	8:42	8:44	8:47
NO	0	AM5T25	70	363 I-S		8:38	8:41	8:44	8:45	8:47	8:49	8:52
NO	0	AM5T25	70	365 I-S		8:43	8:46	8:49	8:50	8:52	8:54	8:57
NO	0	AM5T25	70	366 I-S		8:48	8:51	8:54	8:55	8:57	8:59	9:02
NO	0	AM5T25	70	361 I-S		8:53	8:56	8:59	9:00	9:02	9:04	9:07

NO	0	AMST25	70	366 I-S	10:53	10:56	10:59	11:00	11:02	11:04	11:07
NO	0	AMST25	70	361 I-S	10:58	11:01	11:04	11:05	11:07	11:09	11:12
NO	0	AMST25	70	362 I-S	11:03	11:06	11:09	11:10	11:12	11:14	11:17
NO	0	AMST25	70	363 I-S	11:08	11:11	11:14	11:15	11:17	11:19	11:22
NO	0	S1330	70	365 I-S	11:17	11:20	11:23	11:24	11:26		11:30
NO	0	S1330	70	366 I-S	11:24	11:27	11:29	11:31	11:33		11:37
NO	0	S1330	70	362 I-S	11:30	11:33	11:36	11:38	11:39		11:44
NO	0	S1330	70	363 I-S	11:37	11:40	11:43	11:44	11:46		11:51
NO	0	S1330	70	365 I-S	11:44	11:47	11:50	11:51	11:53		11:57
NO	0	S1330	70	366 I-S	11:51	11:54	11:56	11:58	12:00		12:04
NO	0	S1330	70	362 I-S	11:57	12:00	12:03	12:05	12:06		12:11
NO	0	S1330	70	363 I-S	12:04	12:07	12:10	12:11	12:13		12:18
NO	0	S1330	70	365 I-S	12:11	12:14	12:17	12:18	12:20		12:24
NO	0	S1330	70	366 I-S	12:18	12:21	12:23	12:25	12:27		12:31
NO	0	S1330	70	362 I-S	12:24	12:27	12:30	12:32	12:33		12:38
NO	0	S1330	70	363 I-S	12:31	12:34	12:37	12:38	12:40		12:45
NO	0	S1330	70	365 I-S	12:38	12:41	12:44	12:45	12:47		12:51
NO	0	S1330	70	366 I-S	12:45	12:48	12:50	12:52	12:54		12:58
NO	0	S1330	70	362 I-S	12:51	12:54	12:57	12:59	13:00		13:05
NO	0	S1330	70	363 I-S	12:58	13:01	13:04	13:05	13:07		13:12
NO	0	S1330	70	365 I-S	13:05	13:08	13:11	13:12	13:14		13:18
NO	0	S1330	70	366 I-S	13:12	13:15	13:17	13:19	13:21		13:25
NO	0	S1330	70	362 I-S	13:18	13:21	13:24	13:26	13:27		13:32
NO	0	S1330	70	363 I-S	13:25	13:28	13:31	13:32	13:34		13:39
NO	0	S1330	70	365 I-S	13:32	13:35	13:38	13:39	13:41		13:45
NO	0	S1330	70	366 I-S	13:39	13:42	13:44	13:46	13:48		13:52
NO	0	S1330	70	362 I-S	13:45	13:48	13:51	13:53	13:54		13:59
NO	0	S1330	70	363 I-S	13:52	13:55	13:58	13:59	14:01		14:06
NO	0	S1330	70	365 I-S	13:59	14:02	14:05	14:06	14:08		14:12
NO	0	S1330	70	366 I-S	14:06	14:09	14:11	14:13	14:15		14:19
NO	0	S1330	70	362 I-S	14:12	14:15	14:18	14:20	14:21		14:26
NO	0	S1330	70	363 I-S	14:19	14:22	14:25	14:26	14:28		14:33
NO	0	S1330	70	365 I-S	14:26	14:29	14:32	14:33	14:35		14:39
NO	0	S1330	70	366 I-S	14:33	14:36	14:38	14:40	14:42		14:46
NO	0	S1330	70	362 I-S	14:39	14:42	14:45	14:47	14:48		14:53
NO	0	S1330	70	363 I-S	14:46	14:49	14:52	14:53	14:55		15:00
NO	0	S1330	70	365 I-S	14:53	14:56	14:59	15:00	15:02		15:06
NO	0	S1330	70	366 I-S	15:00	15:03	15:05	15:07	15:09		15:13
NO	0	S1330	70	362 I-S	15:06	15:09	15:12	15:14	15:15		15:20
NO	0	PMST25	70	363 I-S	15:11	15:14	15:17	15:18	15:20	15:22	15:25
NO	0	PMST25	70	364 I-S	15:16	15:19	15:22	15:23	15:25	15:27	15:30
NO	0	PMST25	70	365 I-S	15:21	15:24	15:27	15:28	15:30	15:32	15:35
NO	0	PMST25	70	366 I-S	15:26	15:29	15:32	15:33	15:35	15:37	15:40
NO	0	PMST25	70	362 I-S	15:31	15:34	15:37	15:38	15:40	15:42	15:45
NO	0	PMST25	70	363 I-S	15:36	15:39	15:42	15:43	15:45	15:47	15:50
NO	0	PMST25	70	364 I-S	15:41	15:44	15:47	15:48	15:50	15:52	15:55
NO	0	PMST25	70	365 I-S	15:46	15:49	15:52	15:53	15:55	15:57	16:00
NO	0	PMST25	70	366 I-S	15:51	15:54	15:57	15:58	16:00	16:02	16:05
NO	0	PMST25	70	362 I-S	15:56	15:59	16:02	16:03	16:05	16:07	16:10
NO	0	PMST25	70	363 I-S	16:01	16:04	16:07	16:08	16:10	16:12	16:15
NO	0	PMST25	70	364 I-S	16:06	16:09	16:12	16:13	16:15	16:17	16:20
NO	0	PMST25	70	365 I-S	16:11	16:14	16:17	16:18	16:20	16:22	16:25
NO	0	PMST25	70	366 I-S	16:16	16:19	16:22	16:23	16:25	16:27	16:30
NO	0	PMST25	70	362 I-S	16:21	16:24	16:27	16:28	16:30	16:32	16:35
NO	0	PMST25	70	363 I-S	16:26	16:29	16:32	16:33	16:35	16:37	16:40
NO	0	PMST25	70	364 I-S	16:31	16:34	16:37	16:38	16:40	16:42	16:45
NO	0	PMST25	70	365 I-S	16:36	16:39	16:42	16:43	16:45	16:47	16:50
NO	0	PMST25	70	366 I-S	16:41	16:44	16:47	16:48	16:50	16:52	16:55
NO	0	PMST25	70	362 I-S	16:46	16:49	16:52	16:53	16:55	16:57	17:00
NO	0	PMST25	70	363 I-S	16:51	16:54	16:57	16:58	17:00	17:02	17:05
NO	0	PMST25	70	364 I-S	16:56	16:59	17:02	17:03	17:05	17:07	17:10
NO	0	PMST25	70	365 I-S	17:01	17:04	17:07	17:08	17:10	17:12	17:15
NO	0	PMST25	70	366 I-S	17:06	17:09	17:12	17:13	17:15	17:17	17:20
NO	0	PMST25	70	362 I-S	17:11	17:14	17:17	17:18	17:20	17:22	17:25
NO	0	PMST25	70	363 I-S	17:16	17:19	17:22	17:23	17:25	17:27	17:30
NO	0	PMST25	70	364 I-S	17:21	17:24	17:27	17:28	17:30	17:32	17:35
NO	0	PMST25	70	365 I-S	17:26	17:29	17:32	17:33	17:35	17:37	17:40
NO	0	PMST25	70	366 I-S	17:31	17:34	17:37	17:38	17:40	17:42	17:45
NO	0	PMST25	70	362 I-S	17:36	17:39	17:42	17:43	17:45	17:47	17:50
NO	0	PMST25	70	363 I-S	17:41	17:44	17:47	17:48	17:50	17:52	17:55
NO	0	PMST25	70	364 I-S	17:46	17:49	17:52	17:53	17:55	17:57	18:00
NO	0	PMST25	70	365 I-S	17:51	17:54	17:57	17:58	18:00	18:02	18:05
NO	0	PMST25	70	366 I-S	17:56	17:59	18:02	18:03	18:05	18:07	18:10
NO	0	PMST25	70	362 I-S	18:01	18:04	18:07	18:08	18:10	18:12	18:15
NO	0	PMST25	70	363 I-S	18:06	18:09	18:12	18:13	18:15	18:17	18:20
NO	0	PMST25	70	364 I-S	18:11	18:14	18:17	18:18	18:20	18:22	18:25
NO	0	PMST25	70	365 I-S	18:16	18:19	18:22	18:23	18:25	18:27	18:30
NO	0	PMST25	70	366 I-S	18:21	18:24	18:27	18:28	18:30	18:32	18:35
NO	0	PMST25	70	362 I-S	18:26	18:29	18:32	18:33	18:35	18:37	18:40
NO	0	PMST25	70	363 I-S	18:31	18:34	18:37	18:38	18:40	18:42	18:45
NO	0	PMST25	70	364 I-S	18:36	18:39	18:42	18:43	18:45	18:47	18:50
NO	0	PMST25	70	365 I-S	18:41	18:44	18:47	18:48	18:50	18:52	18:55
NO	0	PMST25	70	366 I-S	18:46	18:49	18:52	18:53	18:55	18:57	19:00
NO	0	PMST25	70	362 I-S	18:51	18:54	18:57	18:58	19:00	19:02	19:05
NO	0	PMST25	70	363 I-S	18:56	18:59	19:02	19:03	19:05	19:07	19:10
NO	0	PMST25	70	364 I-S	19:01	19:04	19:07	19:08	19:10	19:12	19:15
NO	0	PMST25	70	365 I-S	19:06	19:09	19:12	19:13	19:15	19:17	19:20
NO	0	PMST25	70	366 I-S	19:11	19:14	19:17	19:18	19:20	19:22	19:25
NO	0	PMST25	70	362 I-S	19:16	19:19	19:22	19:23	19:25	19:27	19:30
NO	0	PMST25	70	363 I-S	19:21	19:24	19:27	19:28	19:30	19:32	19:35
NO	0	PMST25	70	364 I-S	19:26	19:29	19:32	19:33	19:35	19:37	19:40
NO	0	PMST25	70	365 I-S	19:31	19:34	19:37	19:38	19:40	19:42	19:45
NO	0	PMST25	70	366 I-S	19:36	19:39	19:42	19:43	19:45	19:47	19:50
NO	0	PMST25	70	362 I-S	19:41	19:44	19:47	19:48	19:50	19:52	19:55
NO	0	PMST25	70	363 I-S	19:46	19:49	19:52	19:53	19:55	19:57	20:00
NO	0	PMST25	70	364 I-S	19:51	19:54	19:57	19:58	20:00	20:02	20:05
NO	0	PMST25	70	365 I-S	19:56	19:59	20:02	20:03	20:05	20:07	20:10
NO	0	PMST25	70	366 I-S	20:01	20:04	20:07	20:08	20:10	20:12	20:15
NO	0	PMST25	70	362 I-S	20:06	20:09	20:12	20:13	20:15	20:17	20:20
NO	0	PMST25	70	363 I-S	20:11	20:14	20:17	20:18	20:20	20:22	20:25
NO	0	PMST25	70	364 I-S	20:16	20:19	20:22	20:23	20:25	20:27	20:30
NO	0	PMST25	70	365 I-S	20:21	20:24	20:27	20:28	20:30	20:32	20:35
NO	0	PMST25	70	366 I-S	20:26	20:29	20:32	20:33	20:35	20:37	20:40
NO	0	PMST25	70	362 I-S	20:31	20:34	20:37	20:38	20:40	20:42	20:45
NO	0	PMST25	70	363 I-S	20:36	20:39	20:42	20:43	20:45	20:47	20:50
NO	0	PMST25	70	364 I-S	20:41	20:44	20:47	20:48	20:50	20:52	20:55
NO	0	PMST25	70	365 I-S	20:46	20:49	20:52	20:53	20:55	20:57	21:00
NO	0	S1330	70	366 I-S	20:53	20:56	20:59	21:00	21:02		21:07
NO	0	S1330	70	362 I-S	21:00	21:03	21:05	21:07	21:09		21:13
NO	0	S1330	70	363 I-S	21:06	21:09	21:12	21:14	21:15		21:20
NO	0	S1330	70	365 I-S	21:13	21:16	21:19	21:20	21:22		21:27
NO	0	S1330	70	366 I-S							

NO	0	S1330	70	362 I-S	24:09	24:12	24:14	24:16	24:18	24:22
NO	0	S1330	70	363 I-S	24:15	24:18	24:21	24:23	24:24	24:29
NO	0	S1330	70	365 I-S	24:22	24:25	24:28	24:29	24:31	24:36
NO	0	S1330	70	366 I-S	24:29	24:32	24:35	24:36	24:38	24:42
NO	0	S1330	70	362 I-S	24:36	24:39	24:41	24:43	24:45	24:49
NO	0	S1330	70	363 I-S	24:42	24:45	24:48	24:50	24:51	24:56
NO	0	S1330	70	365 I-S	24:49	24:52	24:55	24:56	24:58	25:03
NO	0	S1330	70	366 I-S	24:56	24:59	25:02	25:03	25:05	25:09
NO	0	S1330	70	362 I-S	25:03	25:06	25:08	25:10	25:12	25:16
NO	0	S1330	70	363 I-S	25:09	25:12	25:15	25:17	25:18	25:23
NO	0	S1330	70	365 I-S	25:16	25:19	25:22	25:23	25:25	25:30
NO	0	S1330	70	366 I-S	25:23	25:26	25:29	25:30	25:32	25:36
NO	0	S1330	70	362 I-S	25:30	25:33	25:35	25:37	25:39	25:43

Appendix C

**Preliminary Construction Vibration
Zone of Influence**

A decorative graphic element consisting of a thick, dark green curved line that starts from the left edge of the page, dips down, and then rises to the right edge, creating a wave-like shape. The area below this line is filled with a solid dark green color.

Job Name: **TTC Scarborough Busway**
 Job Number: **60729927**
 Date: **24-May-24**

Title: **Vibration Zone of Influence**

Description: **Vibration Zone of Influence Inputs and Parameters**

$$PPV = PPV_{ref} * \left(\frac{D_{ref}}{D}\right)^{1.5}$$

$$D = D_{ref} * \left(\frac{PPV_{ref}}{PPV}\right)^{2/3}$$

$$L_v = L_{v,ref} - 30 \log\left(\frac{D}{D_{ref}}\right)$$

$$D = D_{ref} * 10^{\frac{L_{v,ref} - L_v}{30}}$$

$$L_v = 20 \log\left(\frac{v_{rms}}{v_{ref}}\right)$$

Reference Vibration Levels

Equipment	Reference PPV				Lv,ref				
	Dref		PPV		Dref		Vref		
	ft	m	in/sec	mm/s	ft	m	in	mm	
Hydromill (in rock)	25	7.62	0.017	0.432	25	7.62	75	0.000001	0.0000254
Clam Shovel	25	7.62	0.202	5.131	25	7.62	94	0.000001	0.0000254
Vibratory Roller	25	7.62	0.210	5.334	25	7.62	94	0.000001	0.0000254
HoeRam	25	7.62	0.089	2.261	25	7.62	87	0.000001	0.0000254
Large dozer	25	7.62	0.089	2.261	25	7.62	87	0.000001	0.0000254
Small dozer	25	7.62	0.003	0.076	25	7.62	58	0.000001	0.0000254
Caisson Drilling	25	7.62	0.089	2.261	25	7.62	87	0.000001	0.0000254
Trucks	25	7.62	0.076	1.930	25	7.62	86	0.000001	0.0000254
Jackhammers	25	7.62	0.035	0.889	25	7.62	79	0.000001	0.0000254
Excavator	25	7.62	0.003	0.076	25	7.62	58	0.000001	0.0000254
Backhoe	25	7.62	0.003	0.076	25	7.62	58	0.000001	0.0000254
Compaction Machine	25	7.62	0.210	5.334	25	7.62	94	0.000001	0.0000254
Semi Trucks	25	7.62	0.076	1.930	25	7.62	86	0.000001	0.0000254
Concrete Pump Truck	25	7.62	0.076	1.930	25	7.62	86	0.000001	0.0000254
Cement Trucks	25	7.62	0.076	1.930	25	7.62	86	0.000001	0.0000254
Dump Trucks	25	7.62	0.076	1.930	25	7.62	86	0.000001	0.0000254
Semi Trucks	25	7.62	0.076	1.930	25	7.62	86	0.000001	0.0000254
Vibratory Roller	25	7.62	0.210	5.334	25	7.62	94	0.000001	0.0000254
Impact Pile	25	7.62	1.518	38.557	25	7.62	112	0.000001	0.0000254
Sonic or Vibratory Piler	25	7.62	0.734	18.644	25	7.62	105	0.000001	0.0000254
Drill Rig	25	7.62	0.089	2.261	25	7.62	87	0.000001	0.0000254

Vibration Damage Criteria

Type	I	II	III	IV
in/sec	0.50	0.30	0.20	0.12
mm/s	12.70	7.62	5.08	3.05

Building Type definitions'
 Type I: Reinforced-concrete, steel or timber (no plaster)
 Type II: Engineered concrete and masonry (no plaster)
 Type III: Non-engineered timber and masonry buildings
 Type IV: Buildings extremely susceptible to vibration damage

Human Perception - ISO

Vrms	
in/sec	0.00394
mm/sec	0.10

Human Perception - FTA

Lv	
Threshold	65
Annoyance	75
sensitive equip	54

Threshold: Approximate threshold of Perception
 Annoyance: Approximate dividing line between barely perceptible and distinctly perceptible. Many find vibrations at this level annoying.
 Infrequent: Vibration only acceptable if infrequent number of events per day

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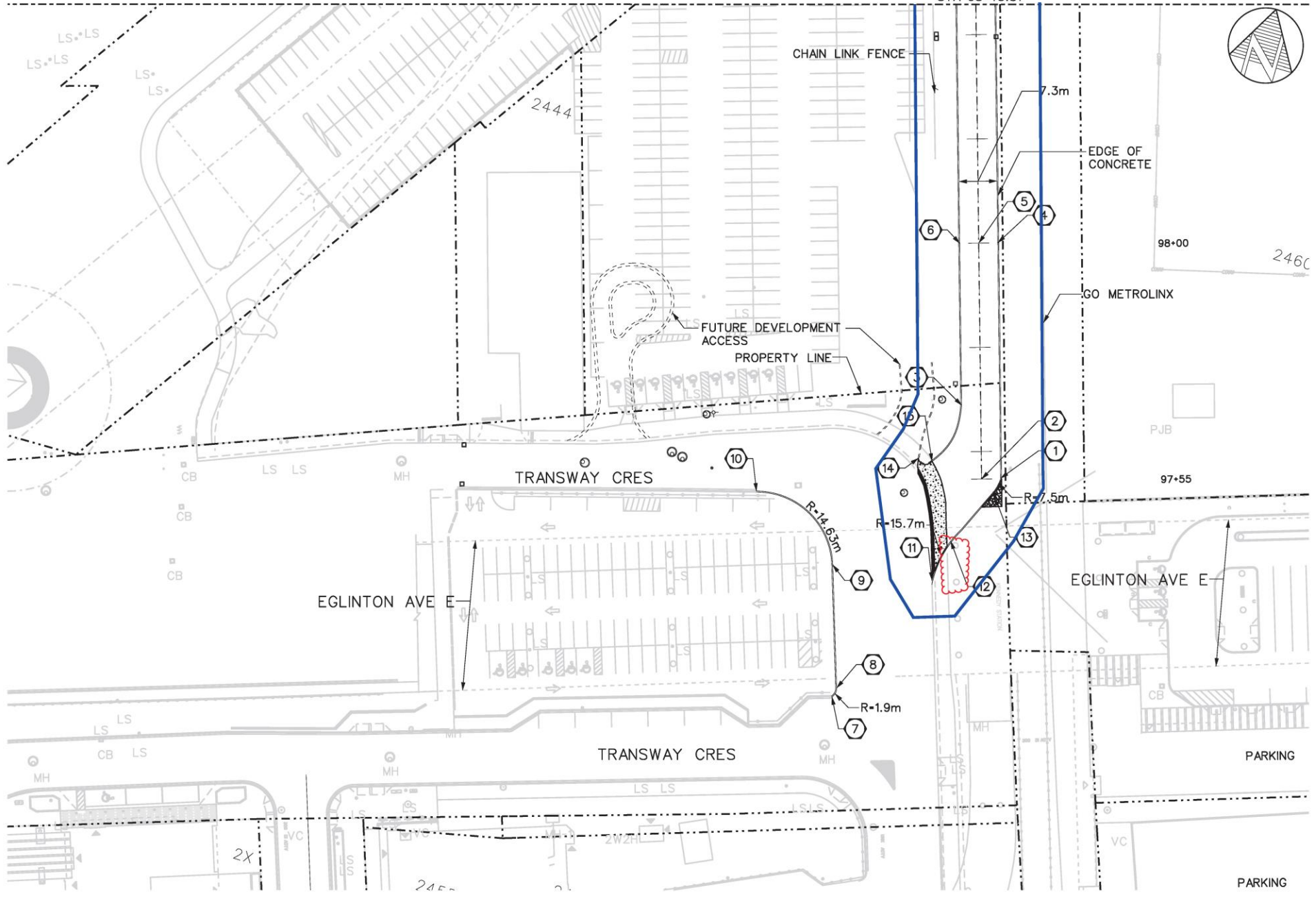
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FILENAME: 7s_plan_al_101.dgn

SHEET No. -

DRAWING No. J35-13-C101

FOR CONTINUATION SEE DWG.
MATCHLINE
C102

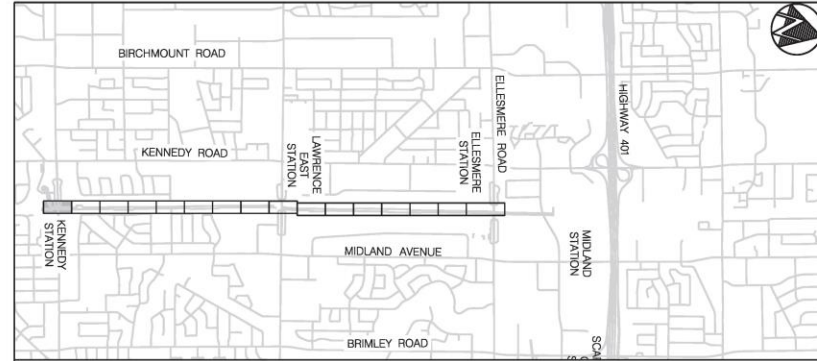


- LEGEND:**
- DENOTES NEW PRECAST CONCRETE CURB PER OPSD 603.020
 - DENOTES NEW 100mm ASPHALT AS PER SECTION 4 IN C433
 - DENOTES NEW CONCRETE
 - DENOTES EXISTING UNDERGROUND STRUCTURE
 - CB DENOTES EXISTING CATCHBASIN
 - MH DENOTES EXISTING MAINTENANCE HOLE

- NOTES:**
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	97+55	N 4843543.613	E 323862.624
2	97+55	N 4843542.526	E 323859.140
3	97+69.22	N 4843555.018	E 323851.419
4	98+00	N 4843586.845	E 323849.139
5	98+00	N 4843585.758	E 323845.654
6	98+00	N 4843584.671	E 323842.170
7		N 4843494.219	E 323843.571
8		N 4843496.106	E 323843.950
9		N 4843518.556	E 323836.466
10		N 4843527.941	E 323818.366
11		N 4843521.099	E 323855.588
12		N 4843529.406	E 323856.860
13		N 4843540.815	E 323861.950
14		N 4843542.897	E 323846.356
15		N 4843543.085	E 323849.040

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S.

- DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN A.GONZALES 2023/03/31
 CHECKED S.KIM 2023/03/31
 CORRECT A.SO 2023/03/31

SCALE

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
KENNEDY STATION
SHEET 1 OF 17

Contract: J35-13

 TORONTO TRANSIT COMMISSION
 ENGINEERING DEPARTMENT
 Dwg. No. **J35-13-C101**
 Rev. No. -
 Sheet No. -

Plot Date: 16-MAR-2023

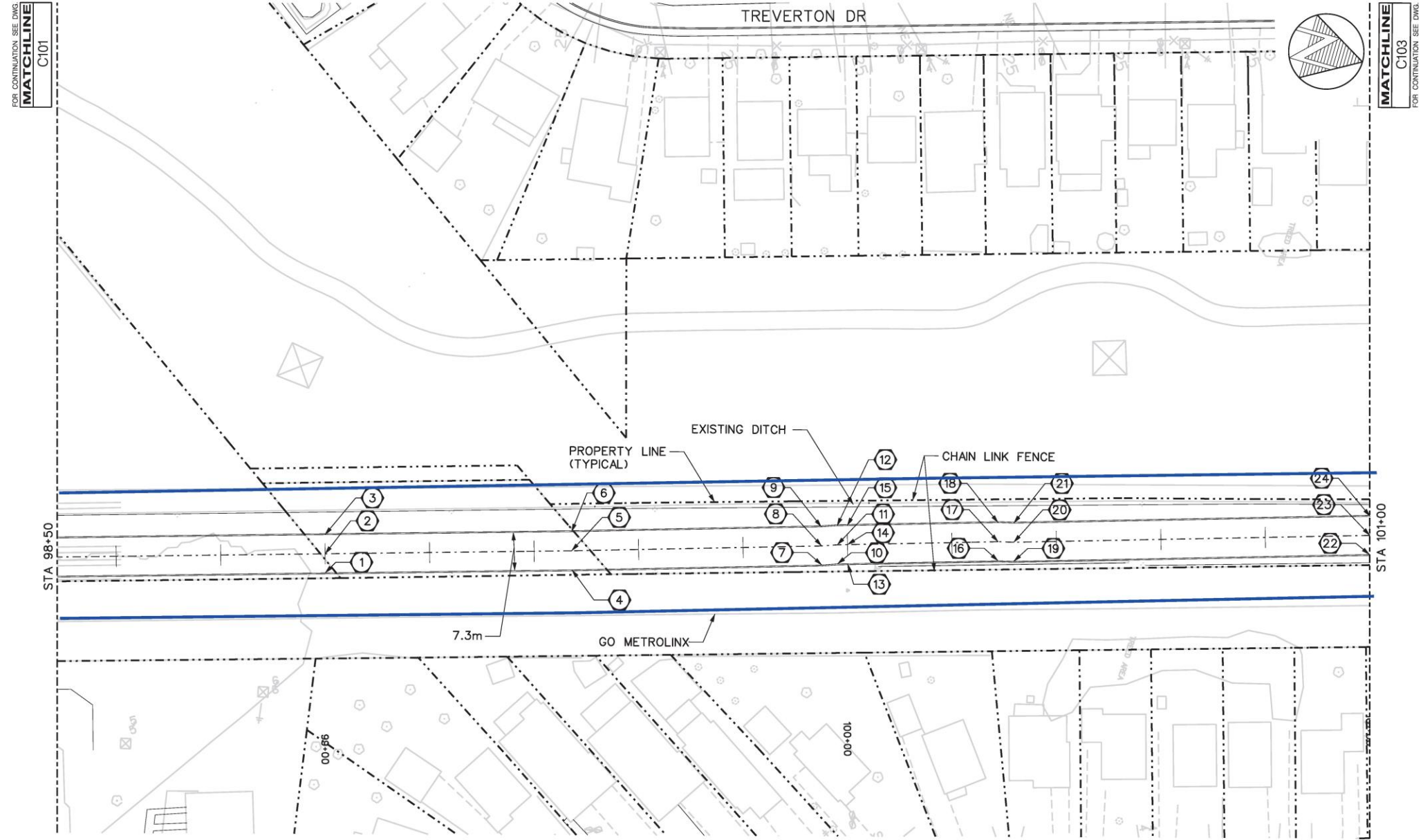
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_102.dgn

SHEET No. -

DRAWING No. J35-13-C102



PLAN

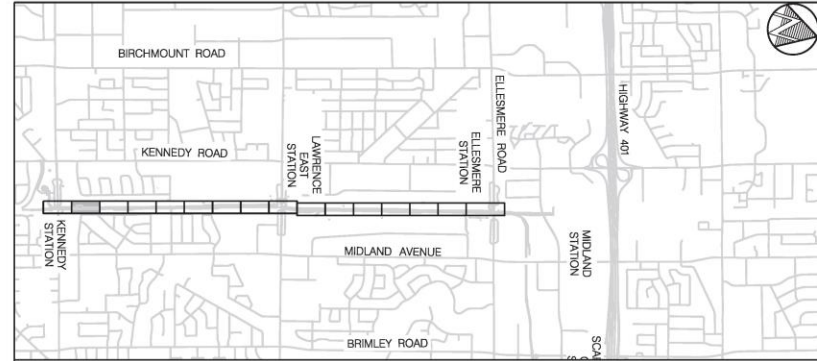
NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	99+00	N 4843682.279	E 323819.370
2	99+00	N 4843681.234	E 323815.873
3	99+00	N 4843680.190	E 323812.375
4	99+47.22	N 4843727.364	E 323805.307
5	PI: 99+47.22	N 4843726.267	E 323801.826
6	99+47.22	N 4843725.275	E 323798.311
7	99+95.04	N 4843772.934	E 323790.725
8	PI: 99+95.04	N 4843771.892	E 323787.235
9	99+95.04	N 4843770.762	E 323783.760
10	99+98.04	N 4843775.750	E 323789.671
11	PI: 99+98.04	N 4843774.693	E 323786.129
12	99+98.04	N 4843773.577	E 323782.702
13	100+00	N 4843777.594	E 323789.082
14	100+00	N 4843776.572	E 323785.741
15	100+00	N 4843775.446	E 323782.104
16	100+28.83	N 4843805.038	E 323780.307
17	PI: 100+28.83	N 4843803.992	E 323776.804
18	100+28.83	N 4843802.951	E 323773.310
19	100+31.83	N 4843807.939	E 323779.537
20	PI: 100+31.83	N 4843806.896	E 323776.044
21	100+31.83	N 4843805.851	E 323772.544
22	101+00	N 4843872.933	E 323758.762
23	101+00	N 4843871.822	E 323755.286
24	101+00	N 4843870.710	E 323751.809

PI= POINT OF INTERSECTION

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2023/03/31
CHECKED	S.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE			

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
98+50 TO 101+00
SHEET 2 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C102	Rev. No. - Sheet No. -

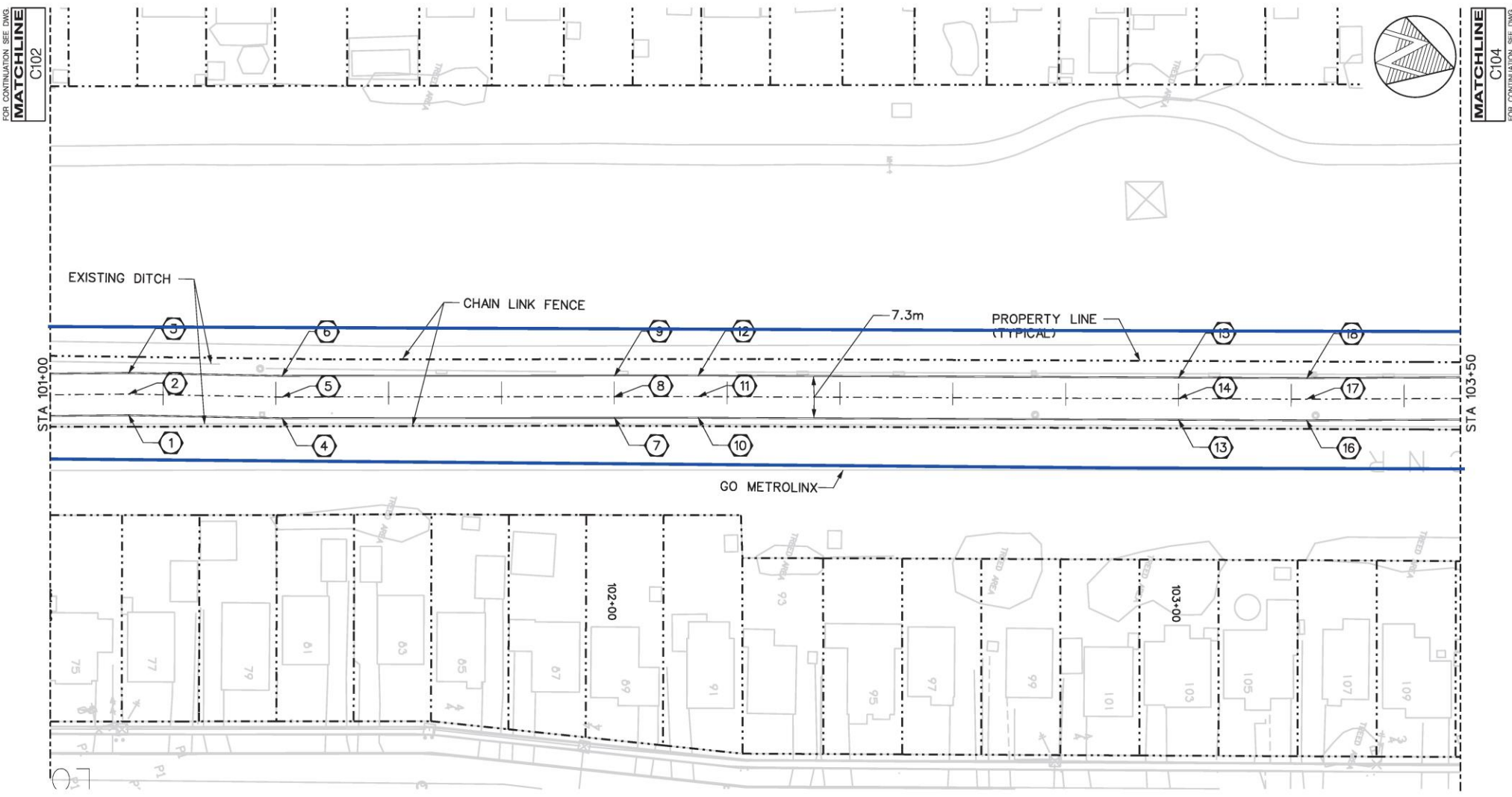
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_103.dgn

SHEET No.

DRAWING No. J35-13-C103



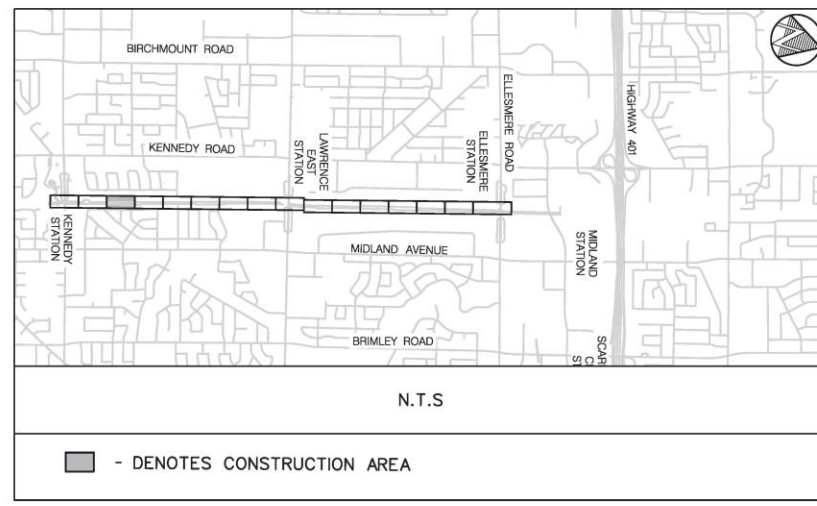
PLAN

NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	101+13.87	N 4843886.163	E 323754.742
2	PI: 101+13.87	N 4843885.038	E 323751.060
3	101+13.87	N 4843883.956	E 323747.574
4	101+41.07	N 4843912.248	E 323746.994
5	PI: 101+41.07	N 4843911.167	E 323743.507
6	101+41.07	N 4843910.087	E 323740.024
7	102+00	N 4843968.518	E 323729.477
8	102+00	N 4843967.435	E 323725.991
9	102+00	N 4843966.355	E 323722.505
10	102+14.85	N 4843982.693	E 323725.069
11	PI: 102+14.85	N 4843981.612	E 323721.583
12	102+14.85	N 4843980.535	E 323718.095
13	103+00	N 4844064.112	E 323700.192
14	103+00	N 4844063.045	E 323696.702
15	103+00	N 4844061.979	E 323693.211
16	103+22.70	N 4844085.827	E 323693.557
17	PI: 103+22.70	N 4844084.761	E 323690.067
18	103+22.70	N 4844083.694	E 323686.576

PI= POINT OF INTERSECTION



Typical Construction Preliminary ZOI
- 5 mm/s

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2022/03/31
CHECKED	S.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE			

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
101+00 TO 103+50
SHEET 3 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C103	Rev. No. - Sheet No. -

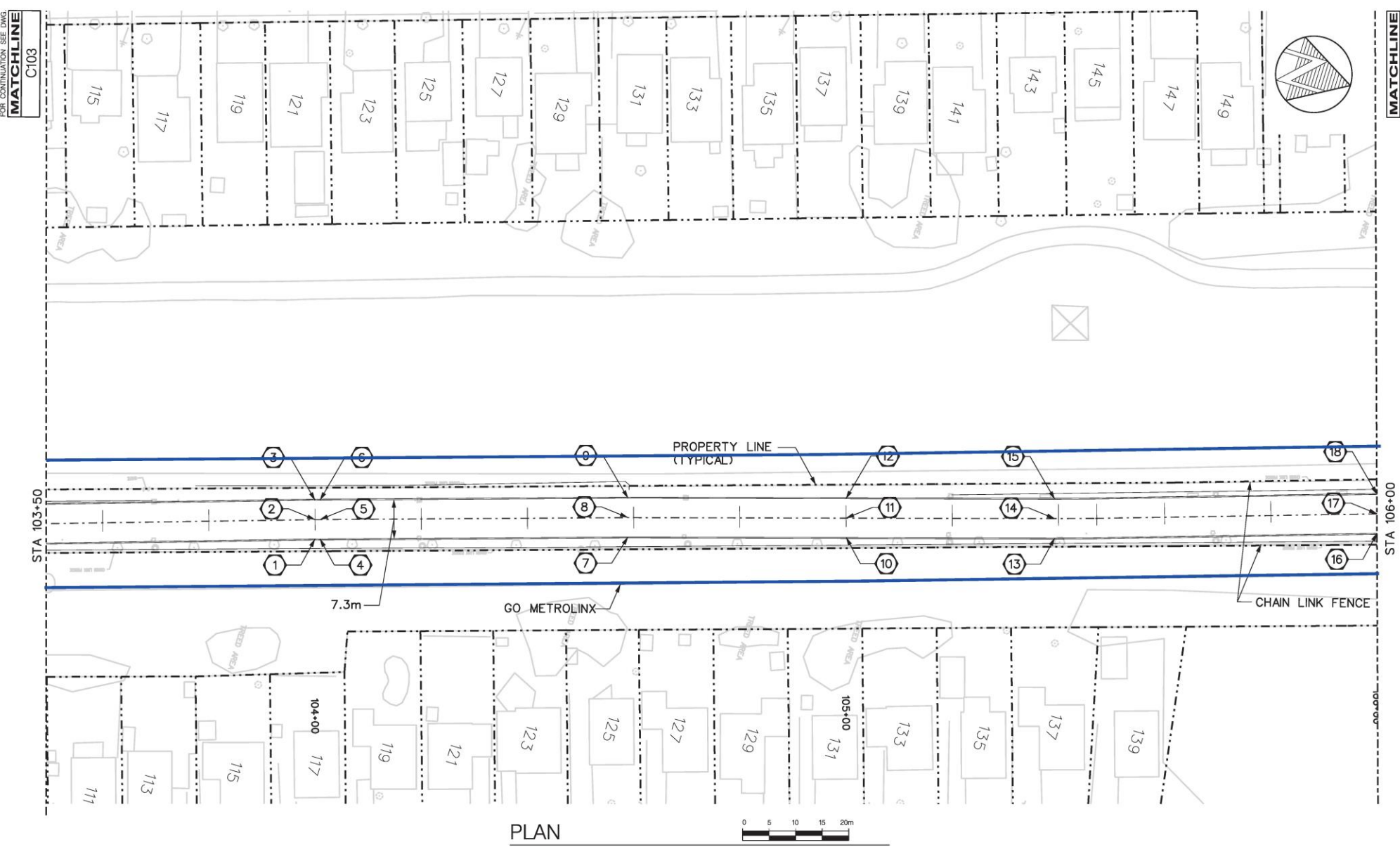
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

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SHEET No. -

DRAWING No. J35-13-C104



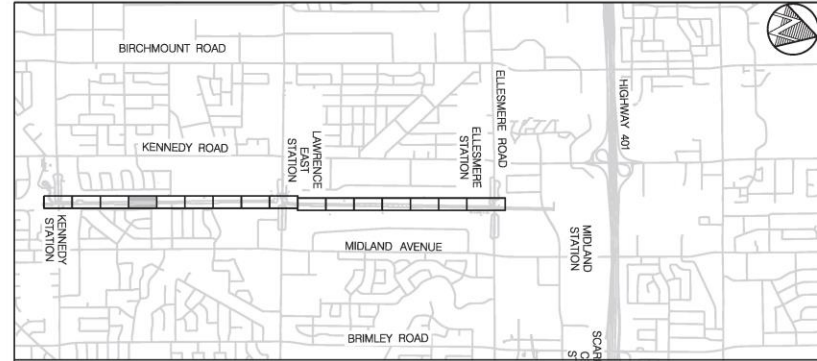
PLAN

NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	104+00	N 4844159.524	E 323670.335
2	104+00	N 4844158.484	E 323666.836
3	104+00	N 4844157.443	E 323663.337
4	104+00.93	N 4844160.411	E 323670.056
5	PI: 104+00.93	N 4844159.370	E 323666.557
6	104+00.93	N 4844158.330	E 323663.058
7	104+58.93	N 4844215.884	E 323653.106
8	PI: 104+58.93	N 4844214.848	E 323649.606
9	104+58.93	N 4844213.797	E 323646.111
10	105+00	N 4844255.288	E 323641.441
11	105+00	N 4844254.222	E 323637.950
12	105+00	N 4844253.155	E 323634.460
13	105+39.29	N 4844292.955	E 323630.291
14	PI: 105+39.29	N 4844291.904	E 323626.796
15	105+39.29	N 4844290.864	E 323623.297
16	106+00	N 4844350.851	E 323612.061
17	106+00	N 4844349.810	E 323608.562
18	106+00	N 4844348.766	E 323605.064

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2022/03/31
CHECKED	S.KIM		2023/03/31
CORRECT	A.SO		2023/03/31
SCALE	0 5 10 15 20m		

SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY

CONSTRUCTION LAYOUT
103+50 TO 106+00
SHEET 4 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No.	Rev. No.
J35-13-C104	-
Sheet No.	-

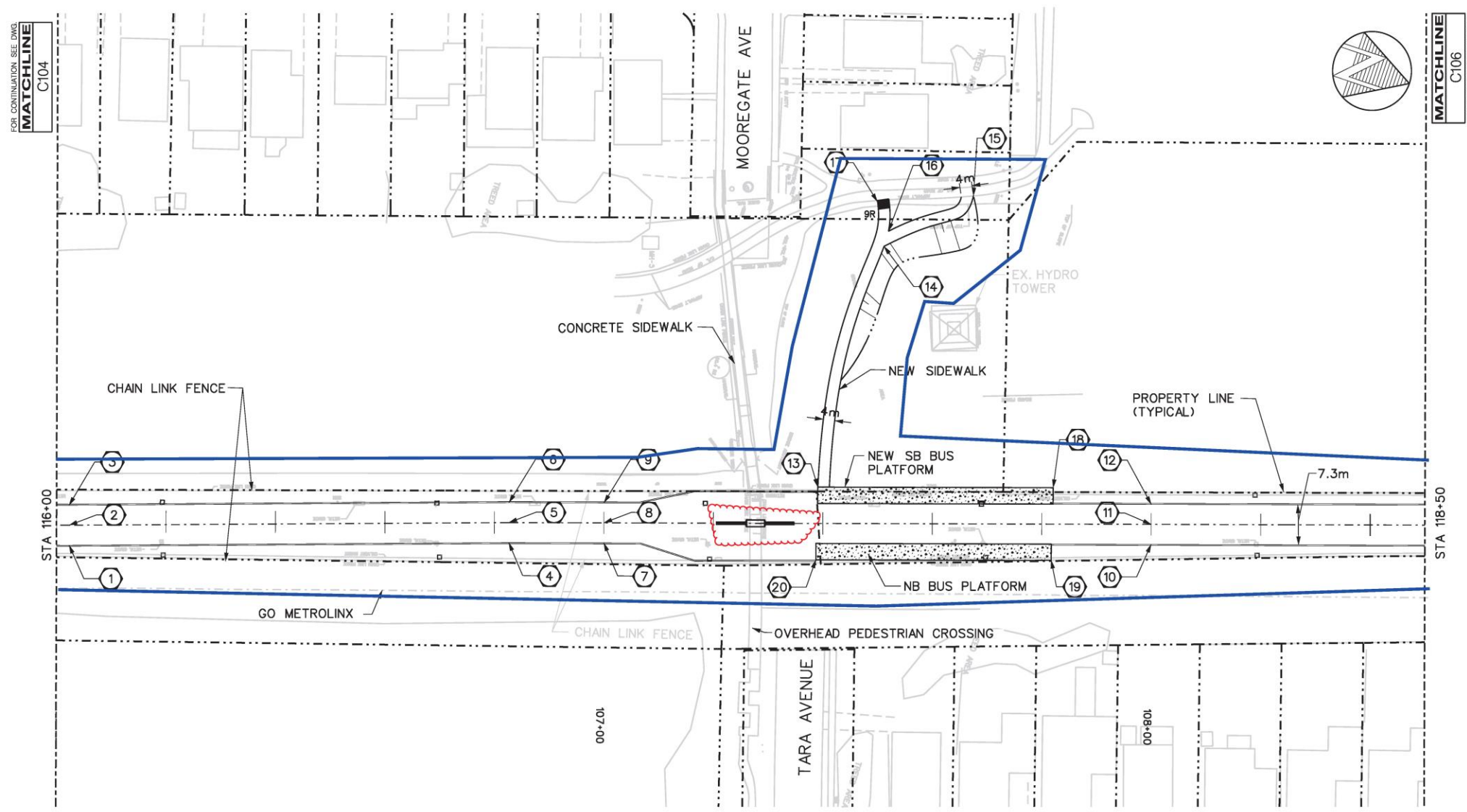
engbor03.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_105.dgn

SHEET No. -

DRAWING No. J35-13-C105



PLAN

NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	106+02.30	N 4844353.114	E 323611.345
2	PI: 106+02.30	N 4844351.999	E 323607.870
3	106+02.30	N 4844350.884	E 323604.394
4	106+82.64	N 4844429.495	E 323586.459
5	PI: 106+82.64	N 4844428.398	E 323582.978
6	106+82.64	N 4844427.301	E 323579.497
7	107+00	N 4844446.043	E 323581.227
8	107+00	N 4844444.946	E 323577.746
9	107+00	N 4844443.849	E 323574.265
10	108+00	N 4844541.394	E 323551.078
11	108+00	N 4844540.294	E 323547.598
12	108+00	N 4844539.193	E 323544.118
13		N 4844480.202	E 323559.624
14		N 4844478.366	E 323514.109
15		N 4844491.121	E 323500.379
16		N 4844478.297	E 323511.240
17		N 4844474.670	E 323506.504
18		N 4844521.193	E 323546.663
19		N 4844524.875	E 323559.385
20		N 4844483.893	E 323572.406

PI: POINT OF INTERSECTION

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S.

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2023/03/31
CHECKED	S.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE			

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
106+00 TO 108+50
SHEET 5 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C105	Rev. No. - Sheet No. -

engbor03.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

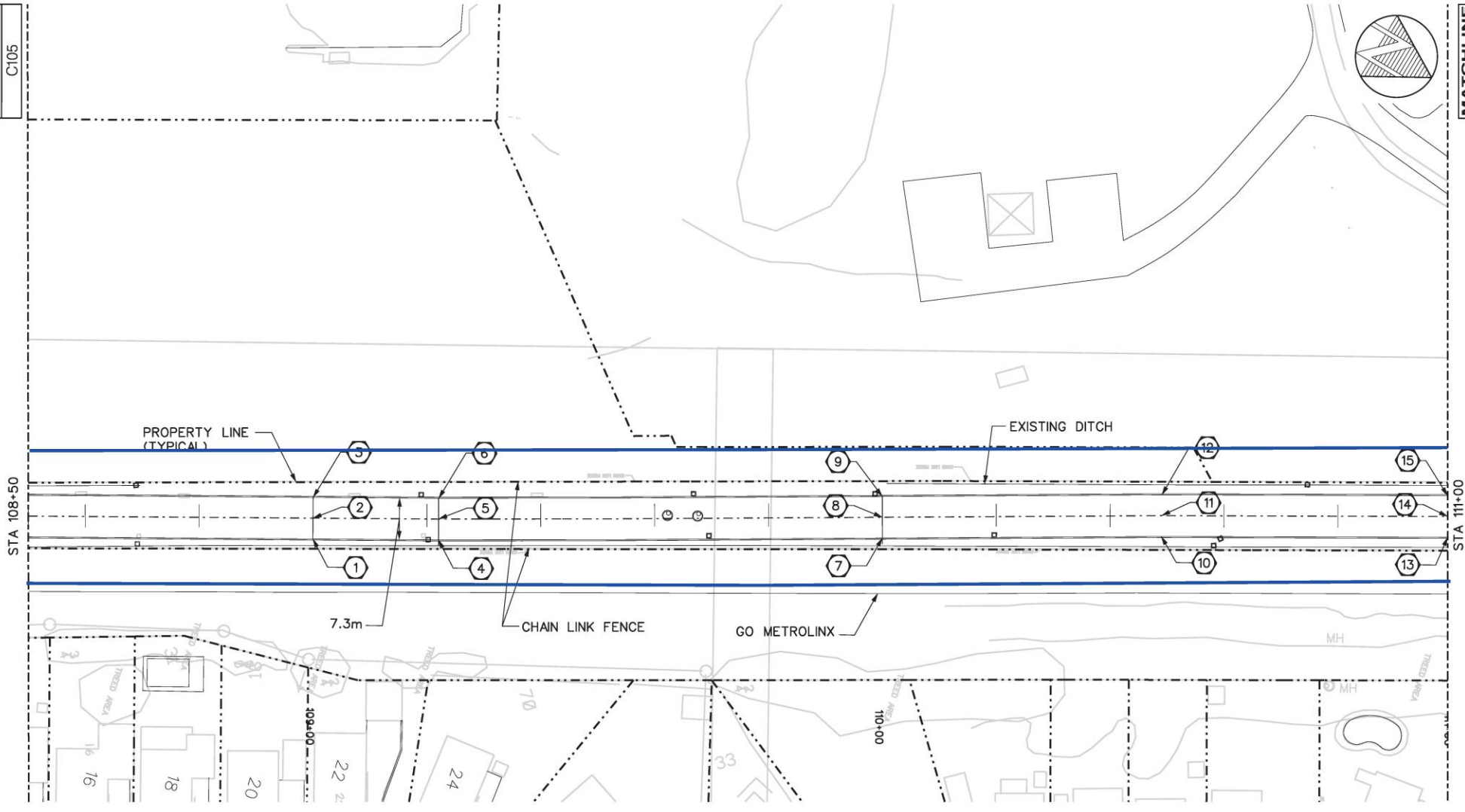
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SHEET No. -

DRAWING No. J35-13-C106

FOR CONTINUATION SEE DWG
MATCHLINE
C105

FOR CONTINUATION SEE DWG
MATCHLINE
C107



PLAN

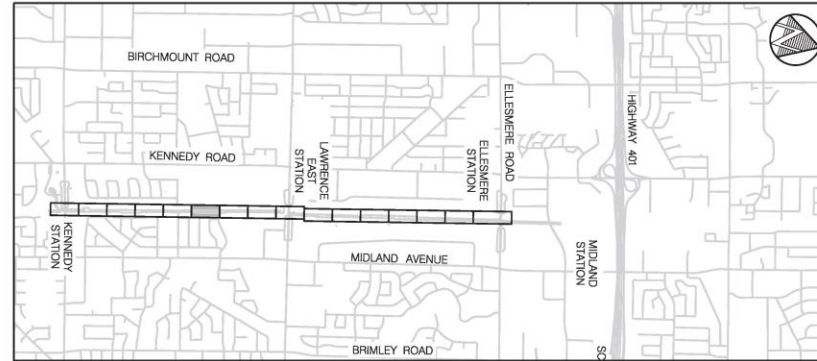
NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	109+00	N 4844636.845	E 323521.365
2	109+00	N 4844635.775	E 323517.875
3	109+00	N 4844634.705	E 323514.386
4	109+22.06	N 4844657.963	E 323514.890
5	PI: 109+22.06	N 4844656.863	E 323511.410
6	109+22.06	N 4844655.762	E 323507.929
7	110+00	N 4844732.219	E 323491.200
8	110+00	N 4844731.118	E 323487.720
9	110+00	N 4844730.018	E 323484.239
10	110+49.03	N 4844778.856	E 323476.230
11	110+49.03	N 4844777.812	E 323472.732
12	110+49.03	N 4844776.768	E 323469.234
13	111+00	N 4844826.875	E 323461.278
14	111+00	N 4844825.779	E 323457.796
15	111+00	N 4844824.684	E 323454.314

PI: POINT OF INTERSECTION

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S.

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2023/03/31
CHECKED	S.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE	0 5 10 15 20m		

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
108 + 50 TO 111 + 00
SHEET 6 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C106	Rev. No. - Sheet No. -

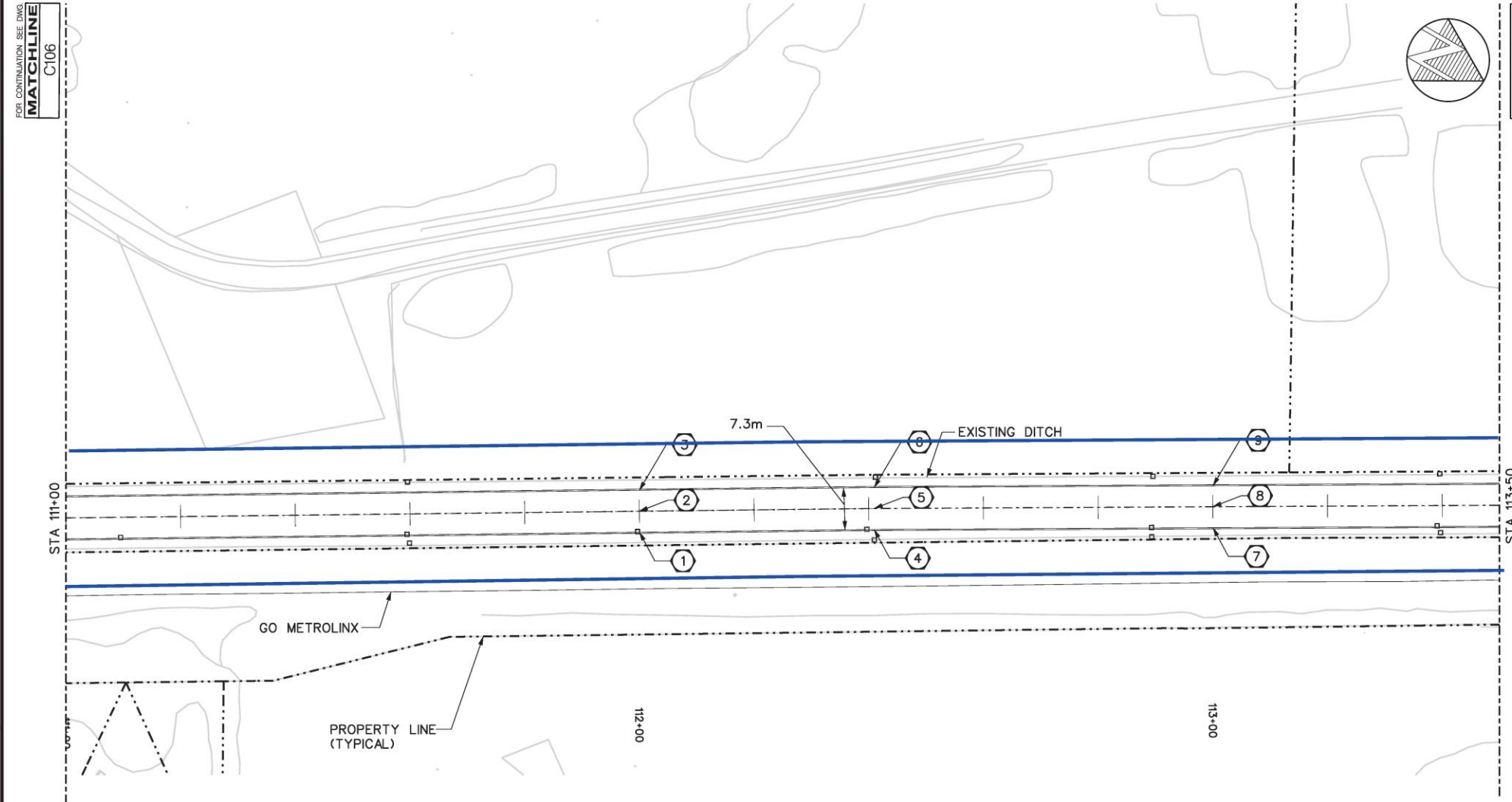
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_107.dgn

SHEET No. -

DRAWING No. J35-13-C107



PLAN

MATCHLINE
C108
FOR CONTINUATION SEE DWG.

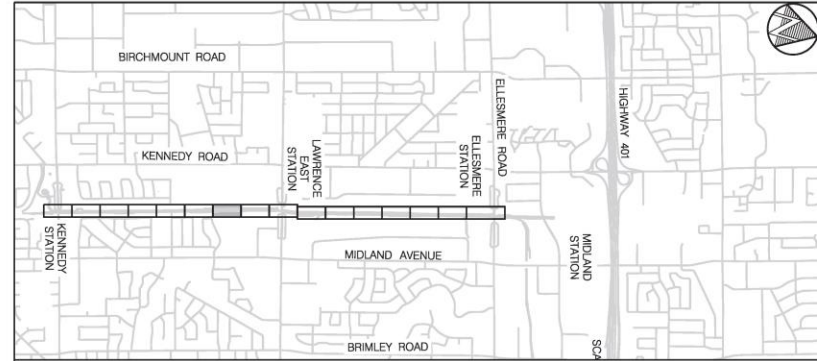
NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	112+00	N 4844923.103	E 323431.315
2	112+00	N 4844921.970	E 323427.845
3	112+00	N 4844920.926	E 323424.347
4	112+40.94	N 4844962.079	E 323419.179
5	PI: 112+40.94	N 4844961.035	E 323415.681
6	112+40.94	N 4844959.990	E 323412.184
7	113+00	N 4845018.583	E 323401.985
8	113+00	N 4845017.539	E 323398.487
9	113+00	N 4845016.495	E 323394.990

PI: POINT OF INTERSECTION

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2023/03/31
CHECKED	S.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE			

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
111+00 TO 113+50
SHEET 7 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C107	Rev. No. - Sheet No. -

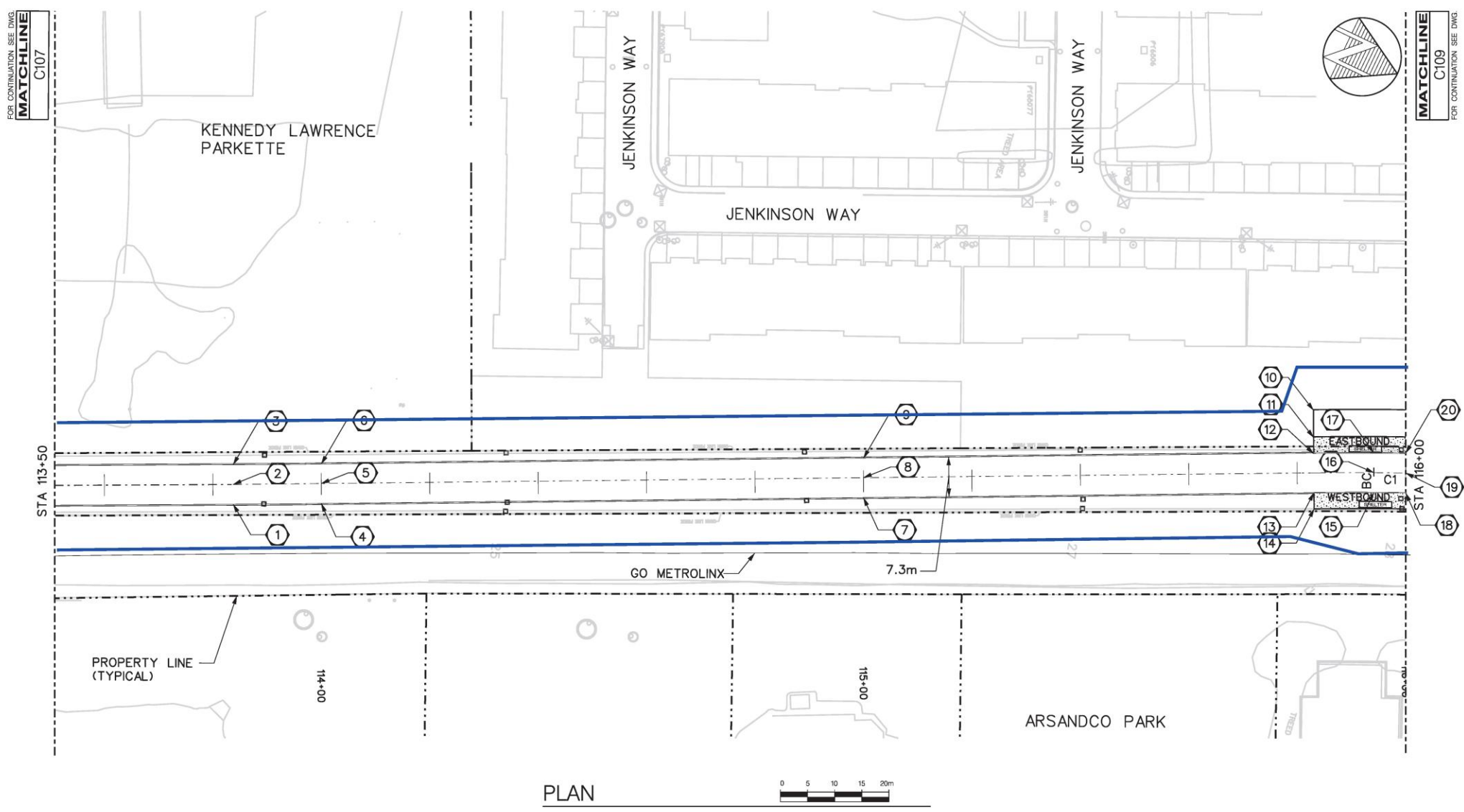
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_108.dgn

SHEET No. -

DRAWING No. J-35-13-C108



PLAN

NOTES:

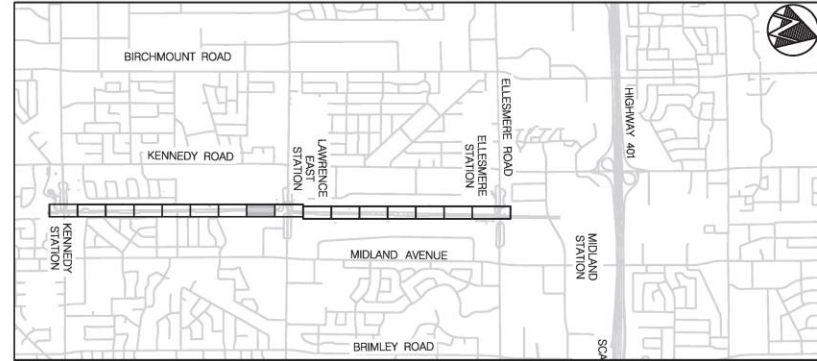
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	113+83.43	N 4845098.713	E 323377.602
2	PI: 113+83.43	N 4845097.661	E 323374.103
3	113+83.43	N 4845096.617	E 323370.609
4	114+00	N 4845114.237	E 323372.822
5	114+00	N 4845113.193	E 323369.328
6	114+00	N 4845112.150	E 323365.826
7	115+00	N 4845209.741	E 323343.159
8	115+00	N 4845208.688	E 323339.645
9	115+00	N 4845207.652	E 323336.164
10	115+82.31	N 4845284.638	E 323303.874
11	115+82.31	N 4845286.099	E 323308.657
12	115+82.31	N 4845286.960	E 323311.531
13	115+82.31	N 4845289.084	E 323318.515
14	115+82.31	N 4845289.975	E 323321.380
15	115+94.45	N 4845299.658	E 323315.317
16	BC: 115+94.45	N 4845298.613	E 323311.820
17	115+94.45	N 4845297.569	E 323308.324
18	116+00	N 4845305.268	E 323313.699
19	116+00	N 4845304.253	E 323310.193
20	116+00	N 4845303.212	E 323306.694

BC- BEGINNING OF THE CURVE
 EC- END OF THE CURVE
 PI- POINT OF INTERSECTION

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (BC)	END POINT (EC)
C1	355.00	67.99	10° 58' 20"	115+94.13	N 4845298.613, E 323311.820	116+61.95	N 4845365.578, E 323297.854

Typical Construction Preliminary ZOI
 - 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
 DRAWING
 NOT FOR CONSTRUCTION

DRAWN	A.GONZALEZ	YYYY/MM/DD	2023/03/31
CHECKED	S.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE	0 5 10 15 20m		

SRT BUS REPLACEMENT
 CONVERSION OF SRT ROW TO BUSWAY

CONSTRUCTION LAYOUT
 113+50 TO 116+00
 SHEET 8 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No.	Rev. No.
J35-13-C108	-
Sheet No.	-

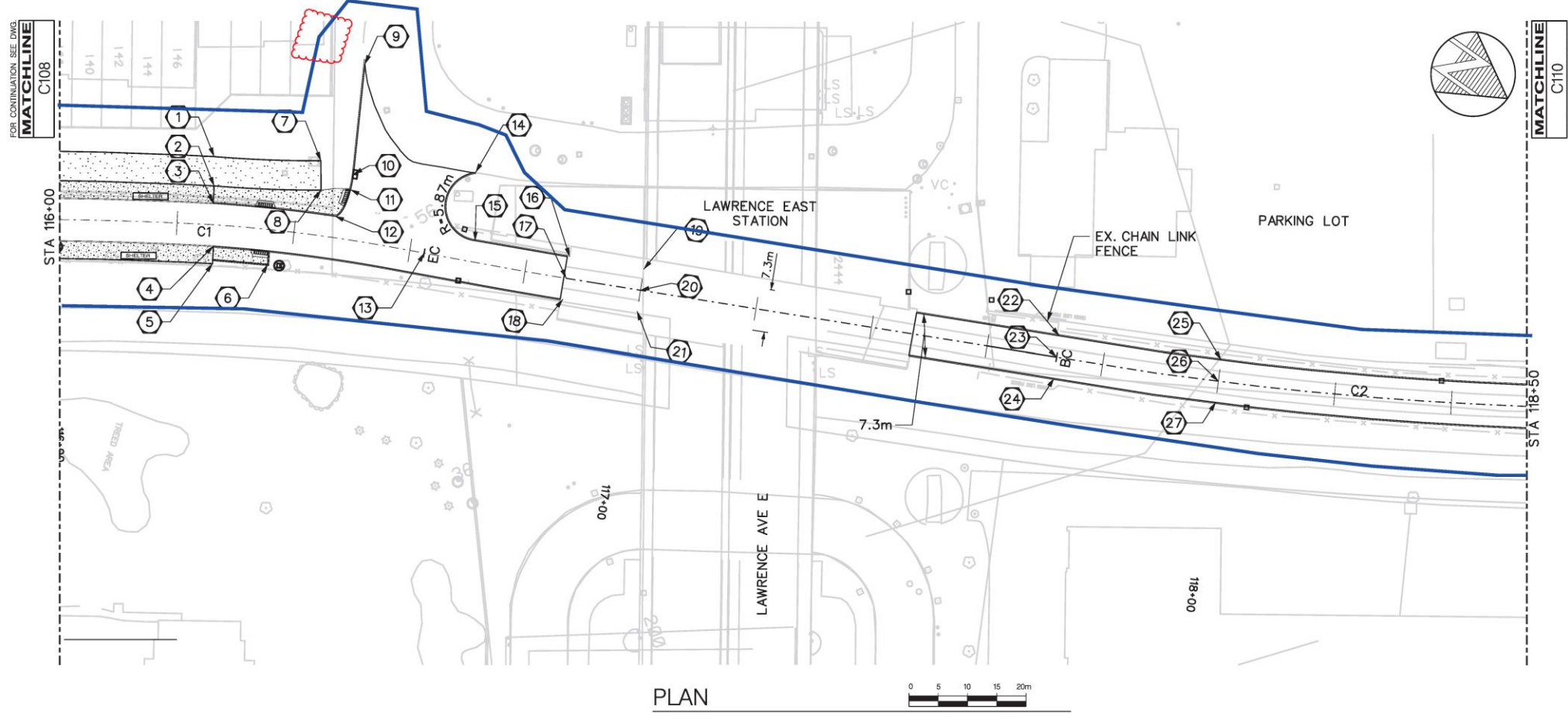
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_at_109.dgn

SHEET No. -

DRAWING No. J35-13-C109



NOTES:

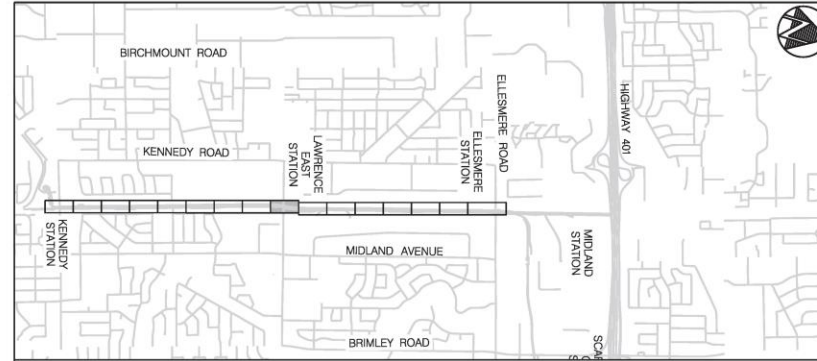
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	116+26.00	N 4845326.461	E 323292.331
2	116+26.00	N 4845327.894	E 323297.129
3	116+26.00	N 4845328.602	E 323300.048
4	116+26.53	N 4845330.776	E 323307.018
5	116+26.53	N 4845331.430	E 323309.933
6	116+36.10	N 4845340.509	E 323307.361
7		N 4845344.142	E 323287.785
8		N 4845345.608	E 323292.593
9		N 4845346.656	E 323269.819
10		N 4845350.148	E 323288.389
11		N 4845350.422	E 323291.073
12		N 4845349.194	E 323296.173
13		N 4845365.578	E 323297.854
14		N 4845370.046	E 323282.149
15		N 4845373.316	E 323293.335
16	116+87.14	N 4845389.579	E 323291.315
17	PI: 116+87.14	N 4845390.068	E 323295.023
18	116+87.14	N 4845390.545	E 323298.642
19	117+00	N 4845402.343	E 323289.744
20	117+00	N 4845402.820	E 323293.362
21	117+00	N 4845403.298	E 323296.981
22	117+71.90	N 4845473.776	E 323280.319
23	BC:117+71.90	N 4845474.253	E 323283.937
24	117+71.90	N 4845474.731	E 323287.556
25	118+00	N 4845501.319	E 323276.343
26	118+00	N 4845501.911	E 323279.945
27	118+00	N 4845502.503	E 323283.545

BC- BEGINNING OF THE CURVE
 EC- END OF THE CURVE
 PI- POINT OF INTERSECTION

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (EC)	END POINT (EC)
C1	355.00	67.98	10° 58' 20"	115+94.13	N 4845298.613, E 323311.820	116+61.95	N 4845365.578 E 323297.854
C2	733.00	104.58	8° 10' 30"	117+76.51	N 4845474.253, E 323283.937	118+76.51	N 4845576.443, E 323262.868

Typical Construction Preliminary ZOI
 - 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	D.AMADOR	YYYY/MM/DD	2023/03/31
CHECKED	M.KM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE	0 5 10 15 20m		

**SRT BUS REPLACEMENT
 CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
 116+00 TO 118+50
 SHEET 9 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No.	Rev. No.
J35-13-C109	
Sheet No.	

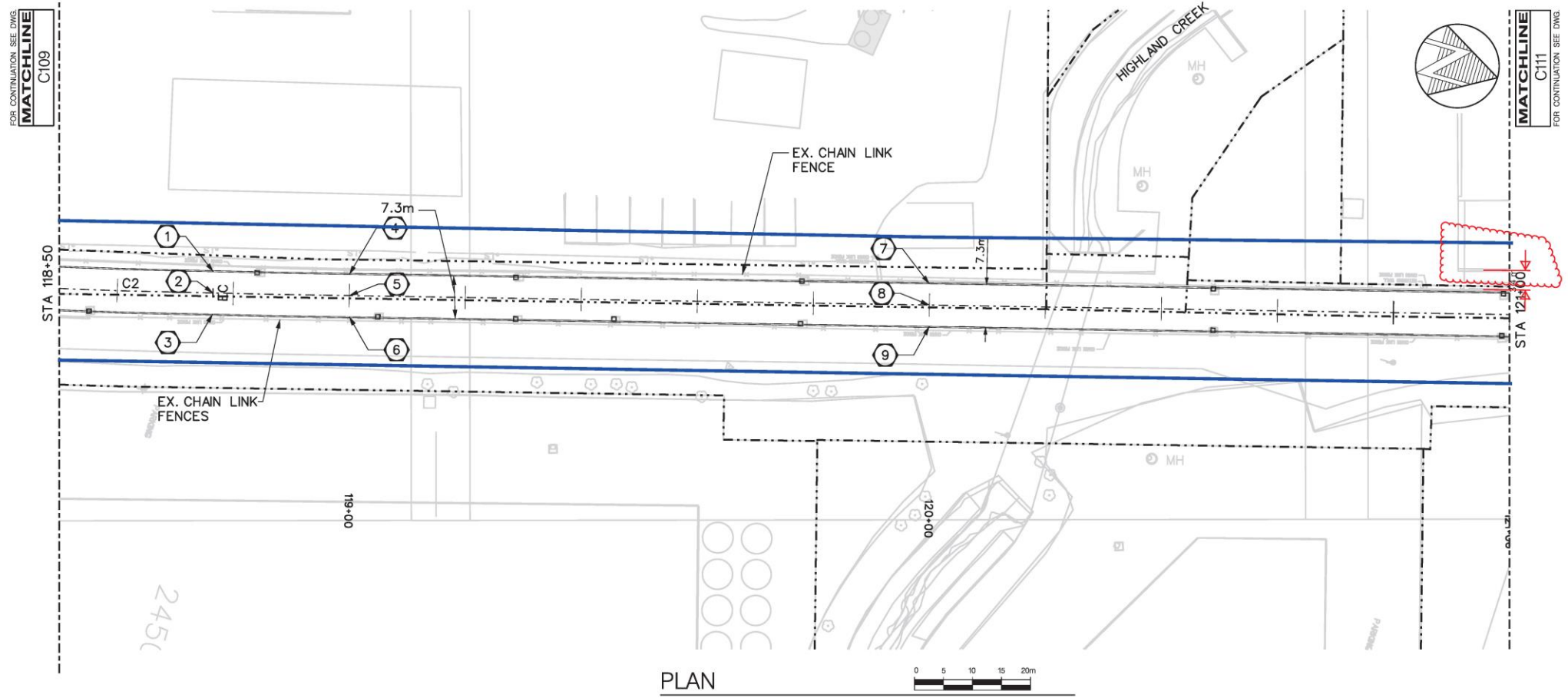
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_110.dgn

SHEET No. -

DRAWING No. J35-13-C110



NOTES:

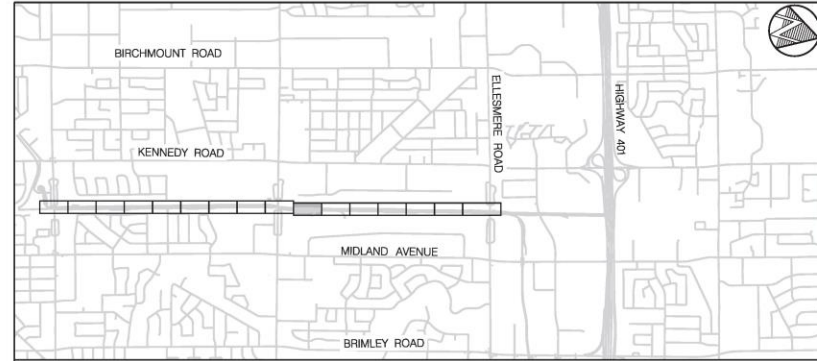
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	118+76.51	N 4845575.464	E 323259.352
2	EC: 118+76.51	N 4845576.443	E 323262.868
3	118+76.51	N 4845577.422	E 323266.384
4	119+00	N 4845598.037	E 323253.088
5	119+00	N 4845599.081	E 323256.585
6	119+00	N 4845600.126	E 323260.083
7	120+00	N 4845694.310	E 323226.043
8	120+00	N 4845695.355	E 323229.541
9	120+00	N 4845696.399	E 323233.038

BC- BEGINNING OF THE CURVE
 EC- END OF THE CURVE
 PI- POINT OF INTERSECTION

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (EC)	END POINT (EC)
C2	733.00	104.58	8° 10' 30"	117+76.51	N 4845474.253, E 323283.937	118+76.51	N 4845576.443, E 323262.868

Typical Construction Preliminary ZOI
 - 5 mm/s



N.T.S.
 - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	D. AMADOR	YYYY/MM/DD	2023/03/31
CHECKED	M. KIM	2023/03/31	
CORRECT	A. SO	2023/03/31	
SCALE	0 5 10 15 20m		

**SRT BUS REPLACEMENT
 CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
 118 + 50 TO 121 + 00
 SHEET 10 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C110	Rev. No. - Sheet No. -

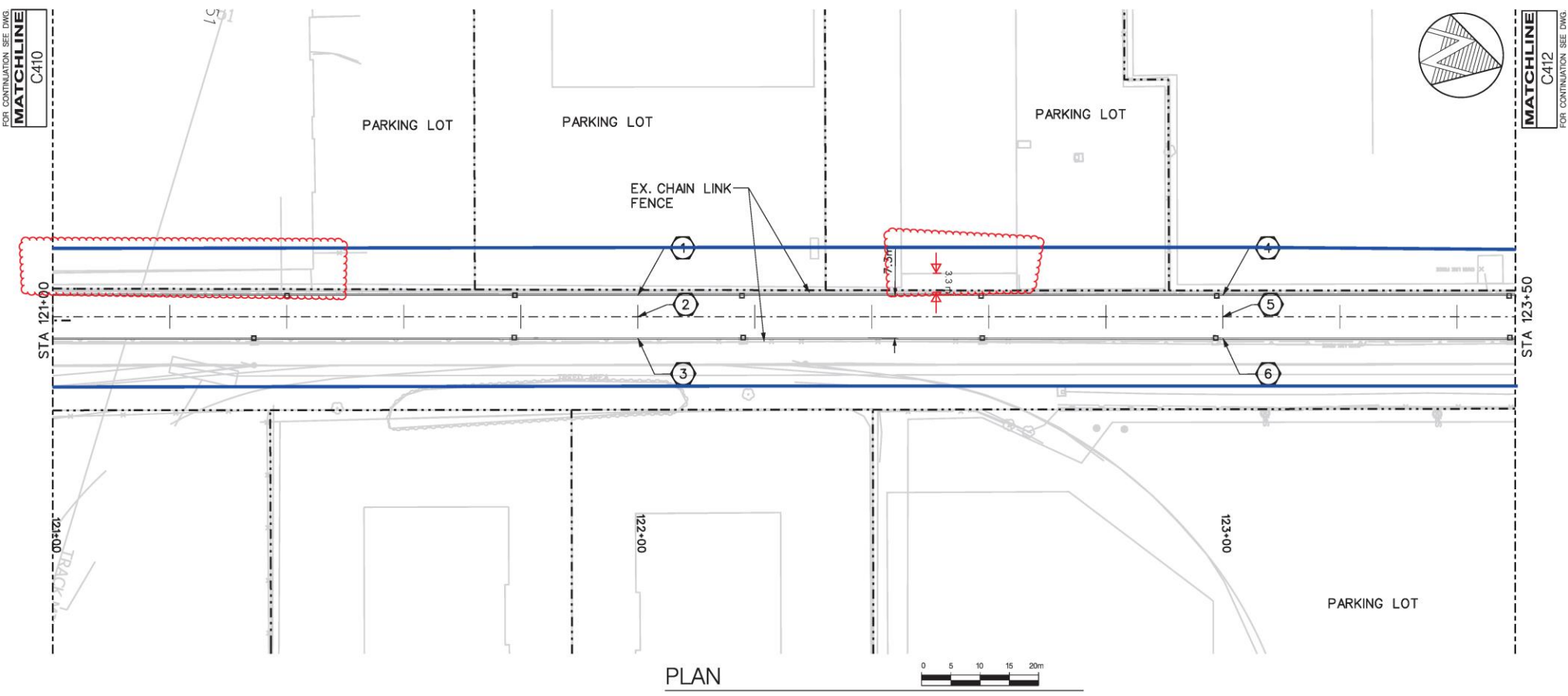
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_111.dgn

SHEET No. -

DRAWING No. J35-13-C111



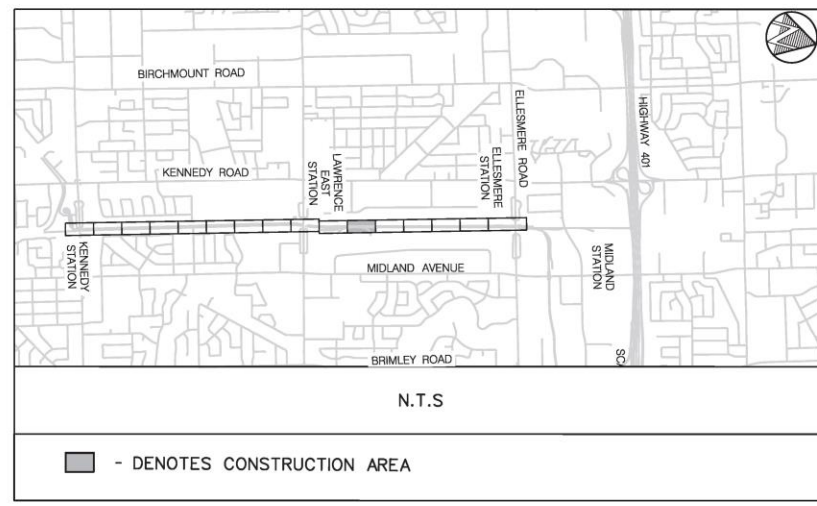
PLAN

NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	122+00	N 4845886.914	E 323171.937
2	122+00	N 4845887.902	E 323175.451
3	122+00	N 4845888.889	E 323178.965
4	123+00	N 4845983.188	E 323144.892
5	123+00	N 4845984.175	E 323148.406
6	123+00	N 4845985.162	E 323151.920

Typical Construction Preliminary ZOI
- 5 mm/s



REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	D. AMADOR	YYYY/MM/DD	2023/03/31
CHECKED	M. KIM	2023/03/31	
CORRECT	A. SO	2023/03/31	
SCALE	0 5 10 15 20m		

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
121+00 TO 123+50
SHEET 11 OF 17

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No.	Rev. No.
J35-13-C111	-
Sheet No.	-

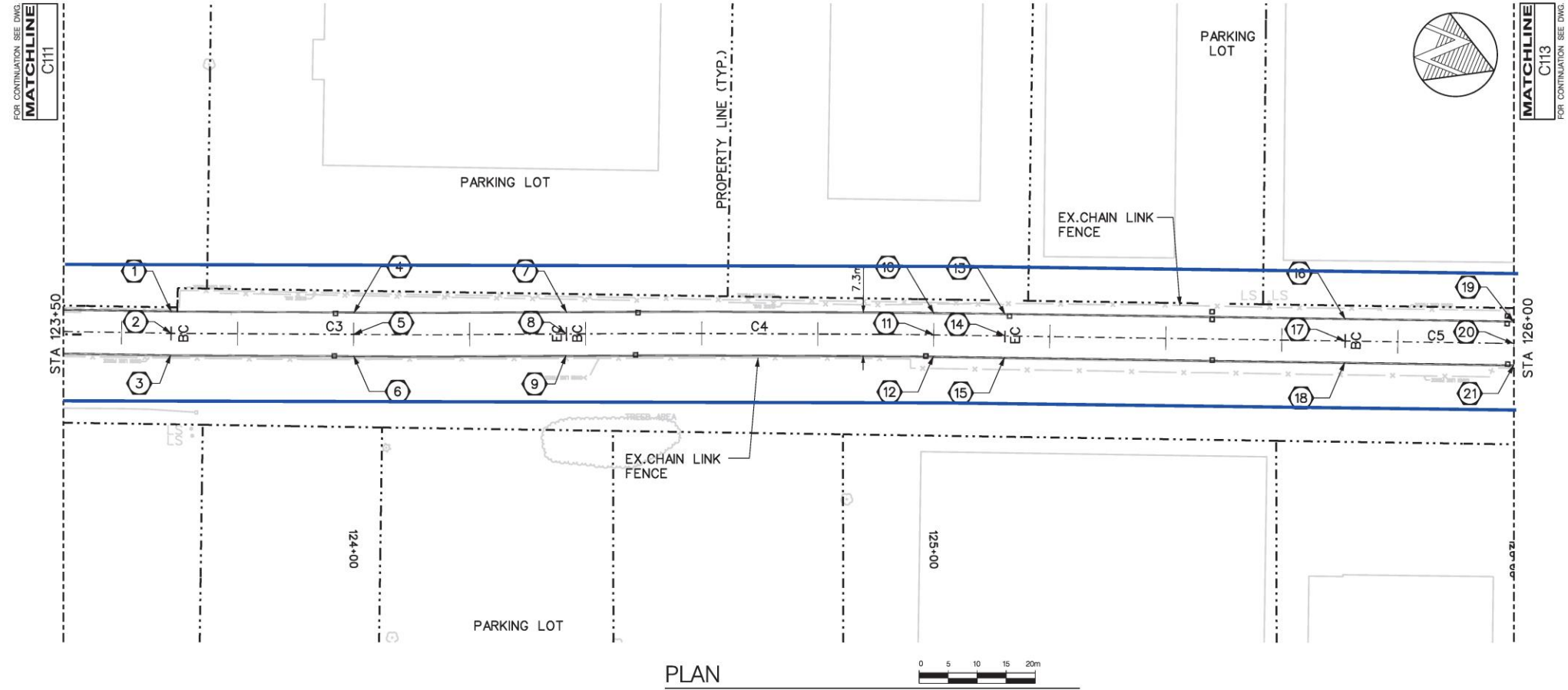
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_112.dgn

SHEET No. -

DRAWING No. J35-13-C112



NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	123+68.55	N 4846049.179	E 323126.354
2	BC: 123+68.55	N 4846050.167	E 323129.868
3	123+68.55	N 4846051.154	E 323133.382
4	124+00	N 4846079.336	E 323117.514
5	124+00	N 4846080.354	E 323121.032
6	124+00	N 4846081.379	E 323124.535
7	124+36.69	N 4846114.501	E 323106.953
8	EC/BC: 124+36.69	N 4846115.489	E 323110.468
9	124+36.69	N 4846116.476	E 323113.983
10	125+00	N 4846175.200	E 323088.979
11	125+00	N 4846176.193	E 323092.491
12	125+00	N 4846177.185	E 323096.004
13	125+12.27	N 4846187.009	E 323085.642
14	EC: 125+12.27	N 4846188.001	E 323089.154
15	125+12.27	N 4846188.994	E 323092.667
16	125+70.92	N 4846243.451	E 323069.691
17	BC: 125+70.92	N 4846244.444	E 323073.204
18	125+70.92	N 4846245.436	E 323076.716
19	126+00	N 4846271.391	E 323061.839
20	126+00	N 4846272.436	E 323065.338
21	126+00	N 4846273.480	E 323068.837

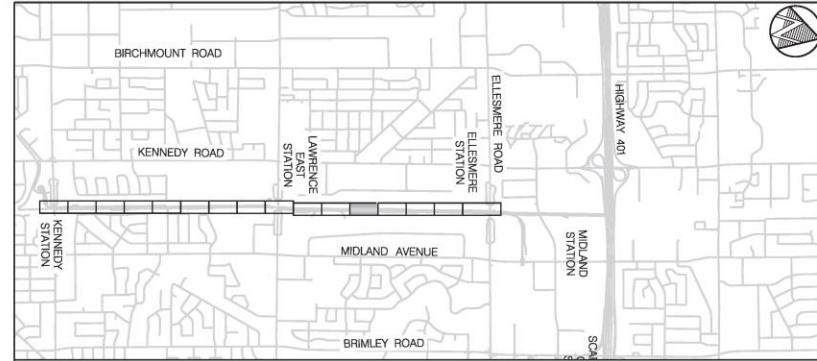
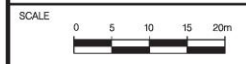
BC- BEGINNING OF THE CURVE
 EC- END OF THE CURVE
 PI- POINT OF INTERSECTION

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (EC)	END POINT (EC)
C3	4347.12	68.14	00° 53' 50"	123+68.55	N 4846050.167, E 323129.868	124+36.69	N 4846115.489, E 323110.468
C4	4006.05	75.58	1° 04' 50"	124+36.69	N 4846115.489, E 323110.468	125+12.27	N 4846188.001, E 323089.154
C5	4566.00	86.37	1° 05' 00"	125+70.92	N 4846244.444, E 323073.204	126+57.29	N 4846327.773, E 323050.509

Typical Construction Preliminary ZOI
 - 5 mm/s

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN: D.AMADOR 2022/02/04
 CHECKED: M.KIM 2023/03/31
 CORRECT: A.SO 2023/03/31



N.T.S

█ - DENOTES CONSTRUCTION AREA

**SRT BUS REPLACEMENT
 CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
 123 + 50 TO 126 + 00
 SHEET 12 OF 17

Contract: J35-13 Package:



TORONTO TRANSIT COMMISSION
 ENGINEERING DEPARTMENT
 Dwg. No. J35-13-C112 Rev. No. Sheet No. -

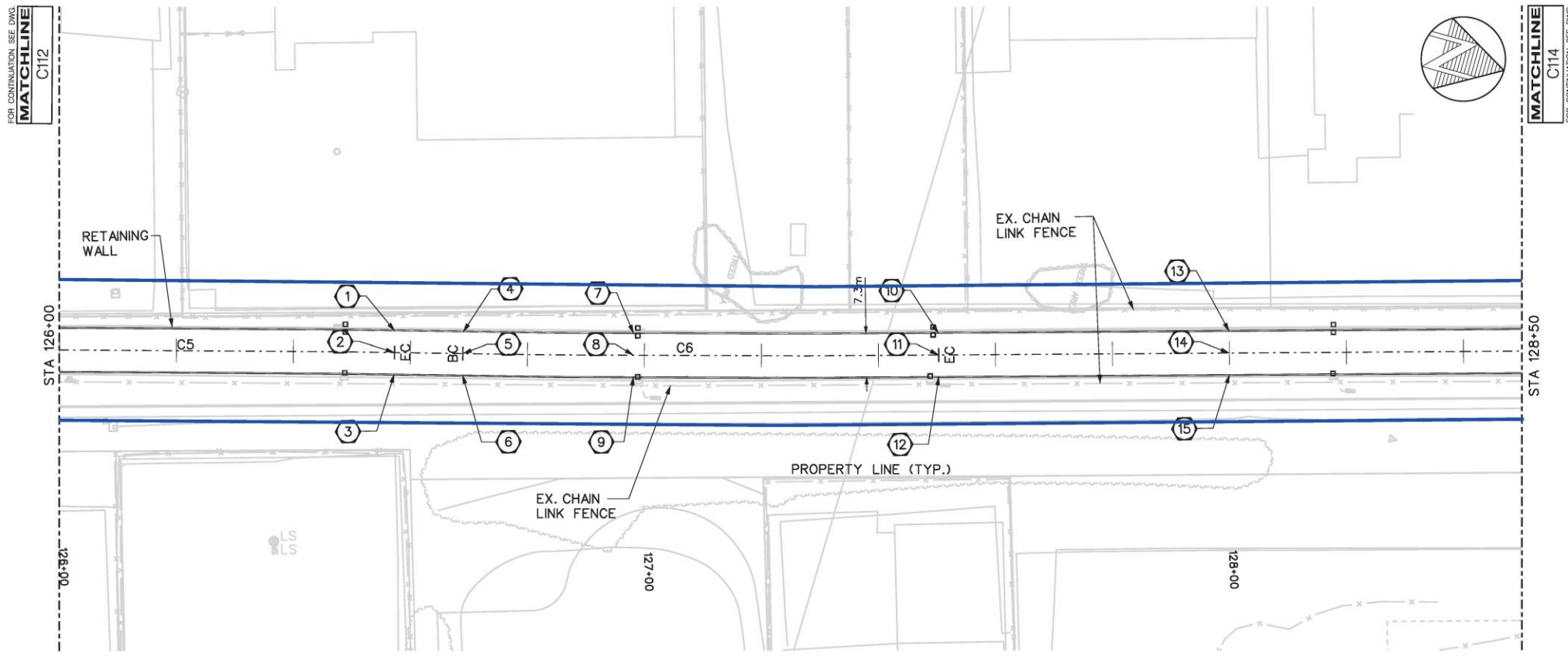
Plot Date: 16-MAR-2023

engbor03.dgn (BORDER) FEBRUARY 2, 2020

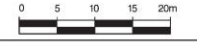
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SHEET No. - FILENAME: 7s_plan_al_113.dgn

DRAWING No. J35-13-C113



PLAN



NOTES:

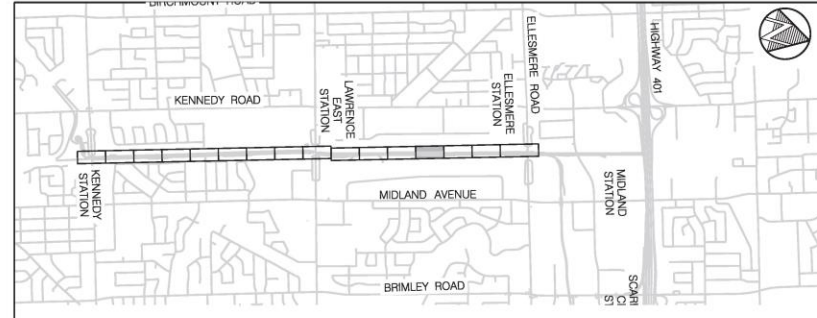
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	126+57.29	N 4846326.852	E 323046.977
2	EC: 126+57.29	N 4846327.773	E 323050.509
3	126+57.29	N 4846328.694	E 323054.040
4	126+69.08	N 4846338.149	E 323044.030
5	BC: 126+69.08	N 4846339.070	E 323047.562
6	126+69.08	N 4846339.991	E 323051.094
7	127+00	N 4846366.316	E 323036.539
8	127+00	N 4846367.275	E 323040.061
9	127+00	N 4846368.233	E 323043.583
10	127+50.31	N 4846416.538	E 323022.617
11	EC: 127+50.31	N 4846417.534	E 323026.129
12	127+50.31	N 4846418.530	E 323029.640
13	128+00	N 4846464.349	E 323009.067
14	128+00	N 4846465.343	E 323012.570
15	128+00	N 4846466.337	E 323016.082

BC- BEGINNING OF THE CURVE
 EC- END OF THE CURVE
 PI- POINT OF INTERSECTION

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (EC)	END POINT (EC)
C5	4566.00	86.37	1° 05' 00"	125+70.92	N 4846244.444, E 323073.204	126+57.29	N 4846327.773, E 323050.509
C6	4095.00	81.23	1° 08' 10"	126+69.08	N 4846339.070, E 323047.562	127+50.31	N 4846417.534, E 323026.129

Typical Construction Preliminary ZOI
 - 5 mm/s



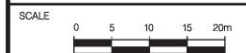
N.T.S.

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
 DRAWING
 NOT FOR CONSTRUCTION

DRAWN: D. AMADOR 2022/02/04
 CHECKED: M. KIM 2023/03/31
 CORRECT: A. SO 2023/03/31



SRT BUS REPLACEMENT
 CONVERSION OF SRT ROW TO BUSWAY

CONSTRUCTION LAYOUT
 126+00 TO 128+50
 SHEET 13 OF 17

Contract: J35-13 Package:

TORONTO TRANSIT COMMISSION
 ENGINEERING DEPARTMENT

Dwg. No. J35-13-C113 Rev. No. Sheet No. -

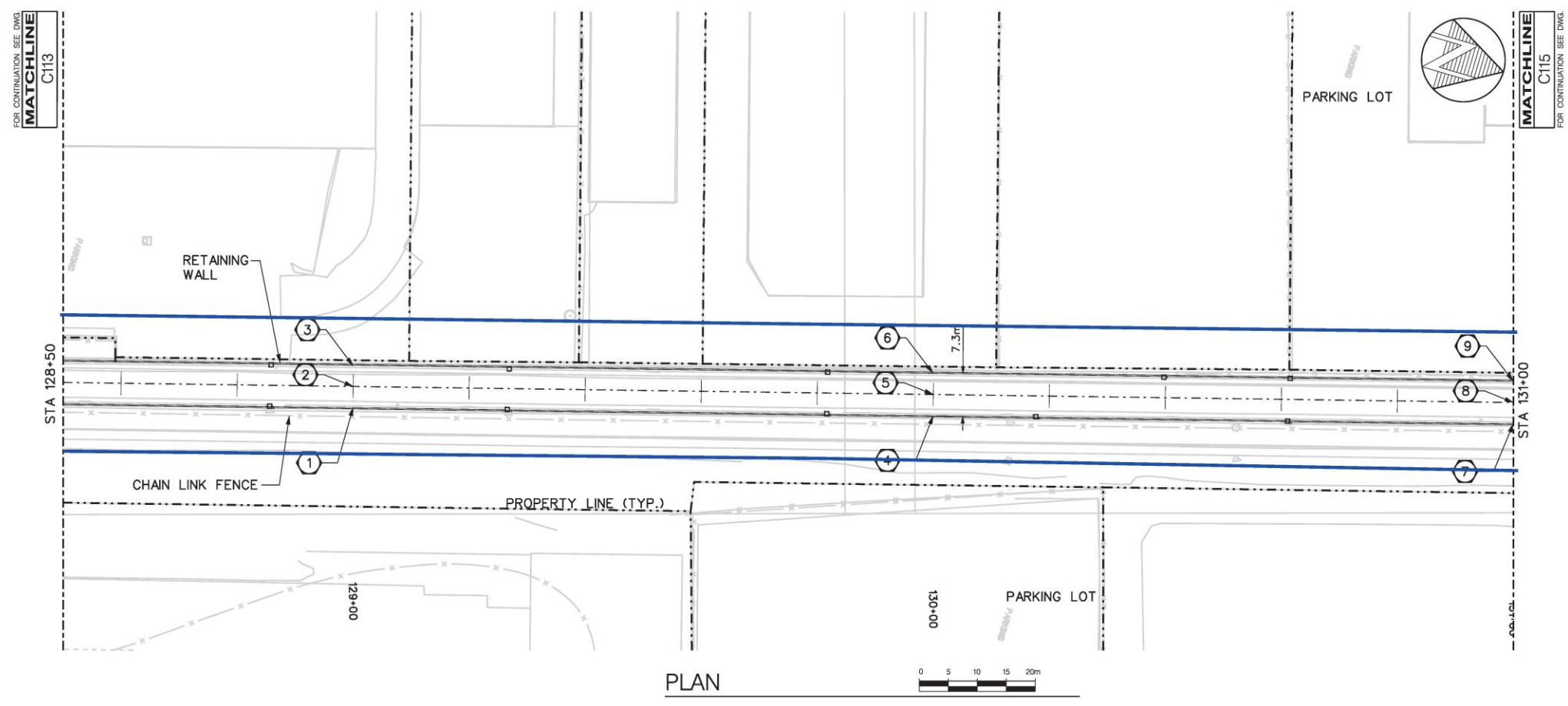
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_114.dgn

SHEET No. -

DRAWING No. J35-13-C114

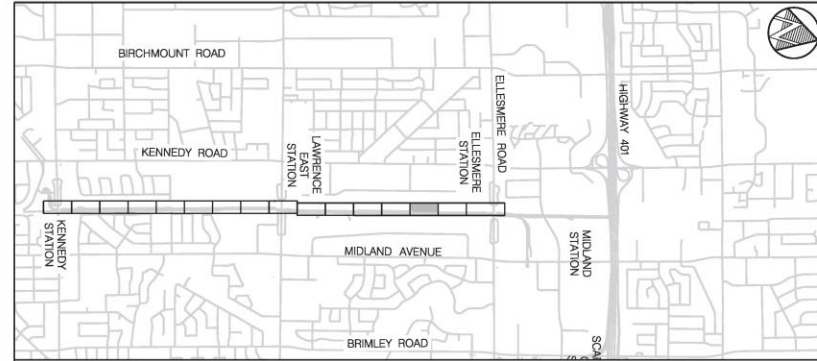


NOTES:

- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	124+00	N 4846562.574	E 322988.721
2	124+00	N 4846561.549	E 322985.287
3	124+00	N 4846560.531	E 322981.879
4	125+00	N 4846658.779	E 322961.432
5	125+00	N 4846657.755	E 322958.004
6	125+00	N 4846656.742	E 322954.613
7	126+00	N 4846754.995	E 322934.183
8	126+00	N 4846753.961	E 322930.720
9	126+00	N 4846752.927	E 322927.257

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN	D. AMADOR	YYYY/MM/DD	2022/02/07
CHECKED	M. KIM		2023/03/31
CORRECT	A. SO		2023/03/31
SCALE	0 5 10 15 20m		

**SRT BUS REPLACEMENT CONVERSION
OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
128+50 TO 131+00
SHEET 14 OF 17

Contract:	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No.	Rev. No.
J35-13-C114	-
Sheet No.	-

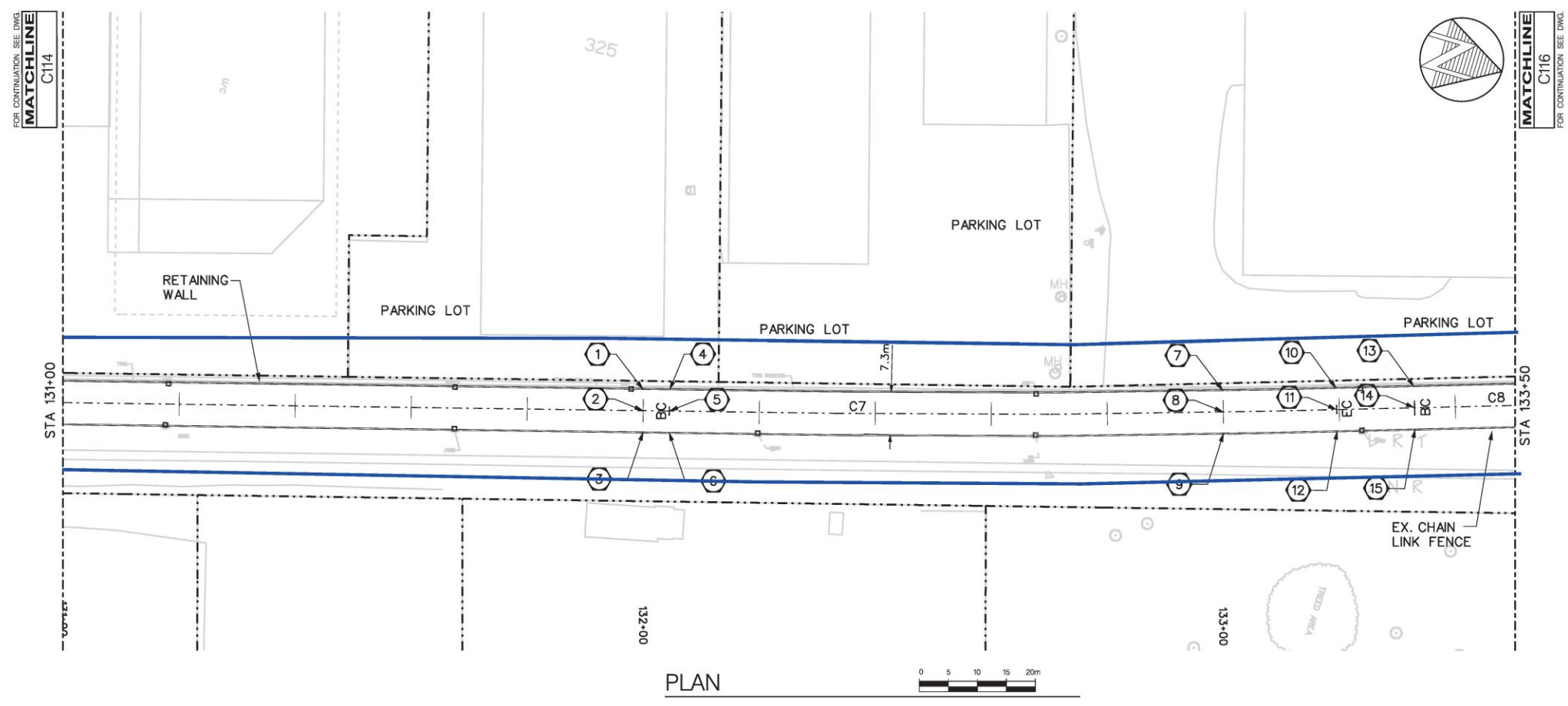
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_al_115.dgn

SHEET No. -

DRAWING No. J35-13-C115



NOTES:

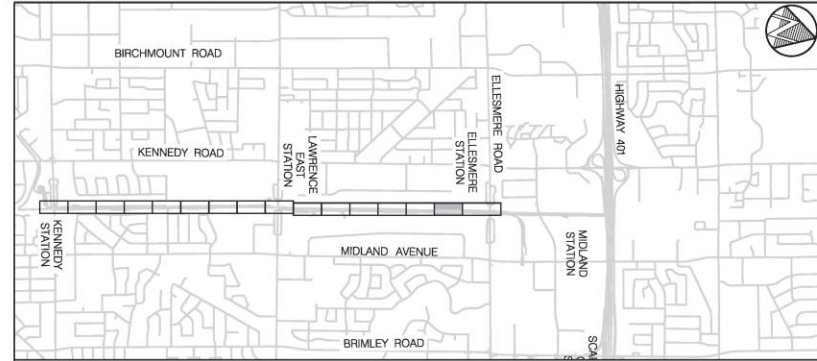
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	132+00	N 4846849.123	E 322899.939
2	132+00	N 4846850.167	E 322903.437
3	132+00	N 4846851.208	E 322906.936
4	132+04.96	N 4846853.505	E 322898.697
5	BC: 132+04.96	N 4846854.501	E 322902.208
6	132+04.96	N 4846855.496	E 322905.720
7	133+00	N 4846944.946	E 322871.543
8	133+00	N 4846946.039	E 322875.025
9	133+00	N 4846947.133	E 322878.507
10	133+19.55	N 4846963.534	E 322865.588
11	EC: 133+19.55	N 4846964.660	E 322869.060
12	133+19.55	N 4846965.786	E 322872.532
13	133+32.97	N 4846976.296	E 322861.449
14	BC: 133+32.97	N 4846977.422	E 322864.921
15	133+32.97	N 4846978.548	E 322868.393

BC- BEGINNING OF THE CURVE
 EC- END OF THE CURVE
 PI- POINT OF INTERSECTION

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (EC)	END POINT (EC)
C7	3557.00	115.04	1° 51' 10"	132+04.96	N 4846854.501, E 322902.208	133+19.55	N 4846964.660, E 322869.060
C8	2903.00	205.10	4° 02' 50"	133+32.97	N 4846977.422, E 322864.921	135+38.08	N 4847174.936, E 322809.843

Typical Construction Preliminary ZOI
- 5 mm/s



N.T.S

█ - DENOTES CONSTRUCTION AREA

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
131+00 TO 133+50
SHEET 15 OF 17

<p>DRAWN: D. AMADOR 2022/02/07</p> <p>CHECKED: M. KIM 2023/03/31</p> <p>CORRECT: A. SO 2023/03/31</p> <p>SCALE: 0 5 10 15 20m</p>	<p>Contract: J35-13 Package:</p> <p style="text-align: center;"></p> <p>TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT</p> <p>Dwg. No. J35-13-C115 Rev. No. - Sheet No. -</p> <p>Plot Date: 16-MAR-2023</p>
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60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

REVISIONS	

engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

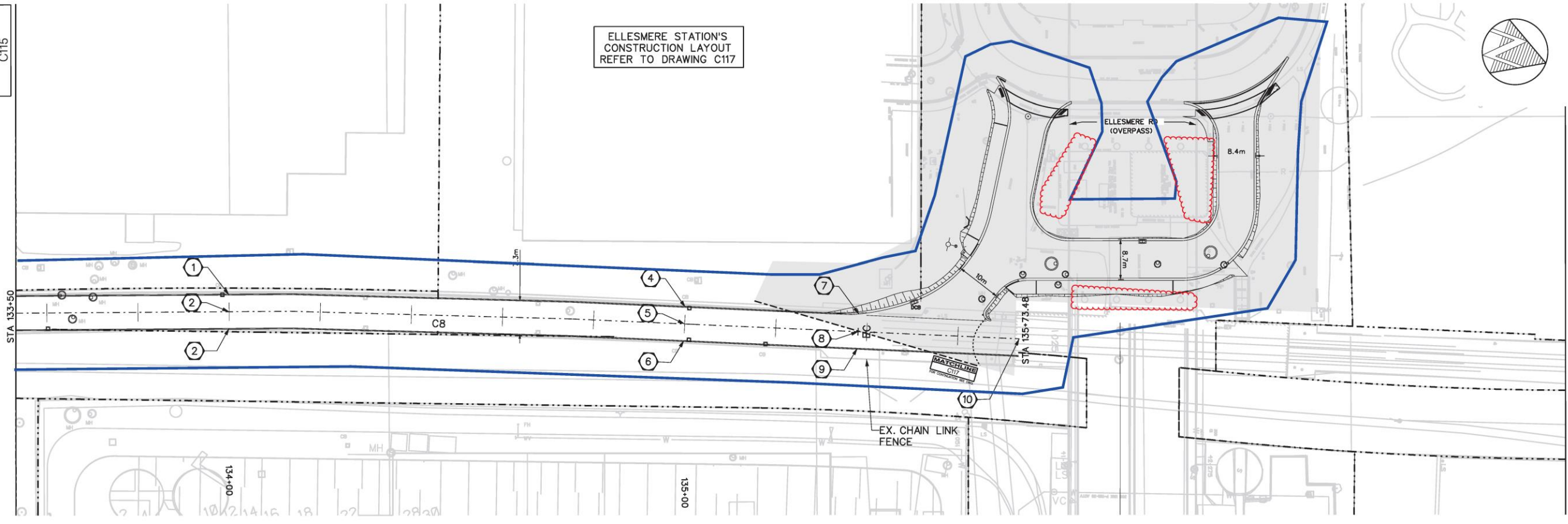
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SHEET No. -

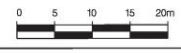
DRAWING No. SRTJ35-13-C116

FOR CONTINUATION SEE DWG
MATCHLINE
C115

ELLESMERE STATION'S
CONSTRUCTION LAYOUT
REFER TO DRAWING C117



PLAN



NOTES:

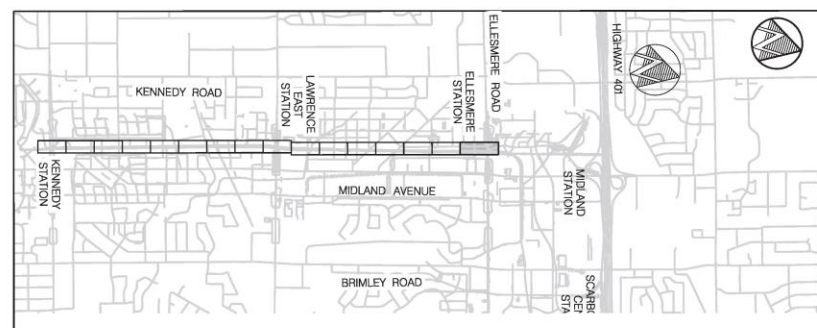
- REFER TO GENERAL NOTES ON DWG C001 AND PAVING NOTES ON DRAWING DWG C002.

ITEM	STATION	NORTHING	EASTING
1	134+00	N 4847040.387	E 322841.534
2	134+00	N 4847041.432	E 322845.032
3	134+00	N 4847042.476	E 322848.530
4	135+00	N 4847137.109	E 322815.538
5	135+00	N 4847137.994	E 322819.079
6	135+00	N 4847138.879	E 322822.620
7	135+38.08	N 4847173.998	E 322806.089
8	EC: 135+38.08	N 4847174.936	E 322809.843
9	135+38.08	N 4847175.822	E 322813.384
10	135+73.48	N 4847209.277	E 322801.257

CURVE	RADIUS (m)	LENGTH (m)	DELTA (Δ)	STATION (BC)	START POINT (BC)	STATION (EC)	END POINT (EC)
C8	2903.00	205.10	4° 02' 50"	133+32.97	N 4846977.422, E 322864.921	135+38.08	N 4847174.936, E 322809.843

BC= BEGINNING OF THE CURVE
EC= END OF THE CURVE
PI= POINT OF INTERSECTION

Typical Construction Preliminary ZOI
- 5 mm/s



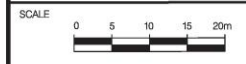
N.T.S

■ - DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW
DRAWING
NOT FOR CONSTRUCTION

DRAWN D.AMADOR 2022/02/07
CHECKED M.KIM 2023/03/31
CORRECT A.SO 2023/03/31



**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

CONSTRUCTION LAYOUT
133+50 TO 136+00 AND ELLESMERE STATION
SHEET 16 OF 17

Contract: J35-13 Package:
TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT
Dwg. No. **J35-13-C116** Rev. No. Sheet No.
Plot Date: 16-MAR-2023

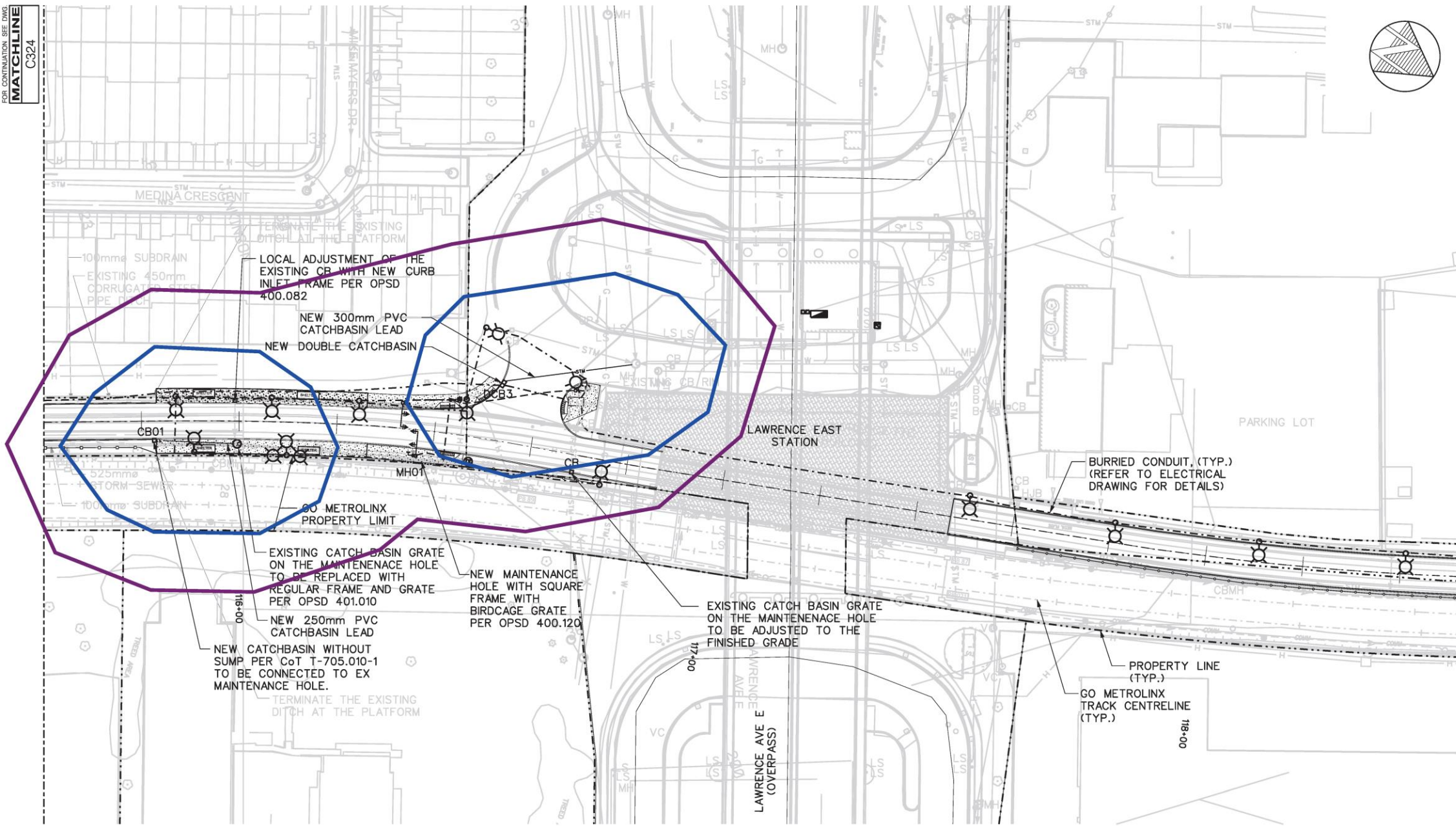
engbord3.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_un125.dgn

SHEET No.

DRAWING No. J35-13-C325



MATCHLINE C324

MATCHLINE C326

- LEGEND:**
- DENOTES EXISTING CATCH BASIN
 - DENOTES EXISTING WATER VALVE
 - DENOTES EXISTING WATER VALVE CHAMBER
 - DENOTES EXISTING MAINTENANCE HOLE
 - DENOTES EXISTING LIGHT STANDARD
 - DENOTES EXISTING FIRE HYDRANT
 - DENOTES EXISTING BELL CANADA PEDESTAL
 - DENOTES EXISTING UTILITY CAP
 - DENOTES NEW FIRE VALVE
 - DENOTES NEW WATER VALVE
 - DENOTES NEW PULL BOX
 - DENOTES NEW LIGHT STANDARD
 - DENOTES NEW DOUBLE CATCH BASIN
 - DENOTES NEW CATCH BASIN
 - DENOTES NEW STORM SEWER
 - DENOTES PROPERTY LINE

- NOTES:**
- ADJUST HANDWELLS, MAINTENANCE HOLES AND CATCH BASIN FRAME AND GRATE TO SUIT FINISHED GRADES.
EX. BIRD CAGE GRATE OF THE CATCHBASINS SHALL BE REPLACED WITH OPSD 400.020

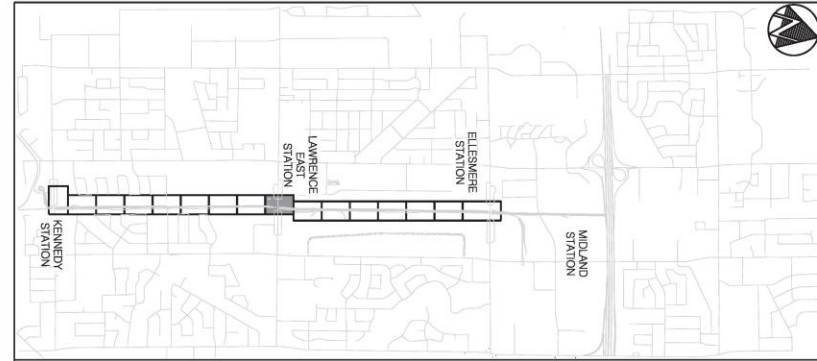
CATCH BASIN DATA TABLE				CB CONNECTION DATA			
STANDARD	STRUC. No.	RIM ELEV.	INVERT OUT	LEN. (m)	DIA (mm)	CLASS OF PIPE	SLOPE
T-705.010-1, OPSD 400.070	CB01	160.05	158.52	4.0	250	PVC DR35	MIN 1.0%
T-705.020, OPSD 400.070	DCB3	160.06	158.52	4.4	300	PVC DR35	MIN 0.7%

MAINTENANCE HOLE DATA TABLE				NOTE
STANDARD	STRUC. No.	RIM ELEVATION	INVERT IN	INVERT OUT
T-701.010, OPSD 400.120	MH01	MATCH EXISTING	157.302	157.298

CONNECTION DETAIL FOR THE EXIST. CONCRETE PIPE AT MH01 PER T-708.020

- Vibratory Pile ZOI
- Impact Pile ZOI

Preliminary Vibratory and Impact Pile ZOI



N.T.S

- DENOTES CONSTRUCTION AREA

REVISIONS

60% REVIEW DRAWING
NOT FOR CONSTRUCTION

DRAWN	D.AMADOR	YYYY/MM/DD	2022/04/08
CHECKED	M.KIM	2023/03/31	
CORRECT	A.SO	2023/03/31	
SCALE	0 5 10 15 20m		

**SRT BUS REPLACEMENT
CONVERSION OF SRT ROW TO BUSWAY**

NEW UTILITIES
115 + 60 TO 118 + 50
Mi. 58.23 TO 58.08
SHEET 9 OF 16

Contract: J35-13	Package:
TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT	
Dwg. No. J35-13-C325	Rev. No. / Sheet No.

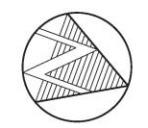
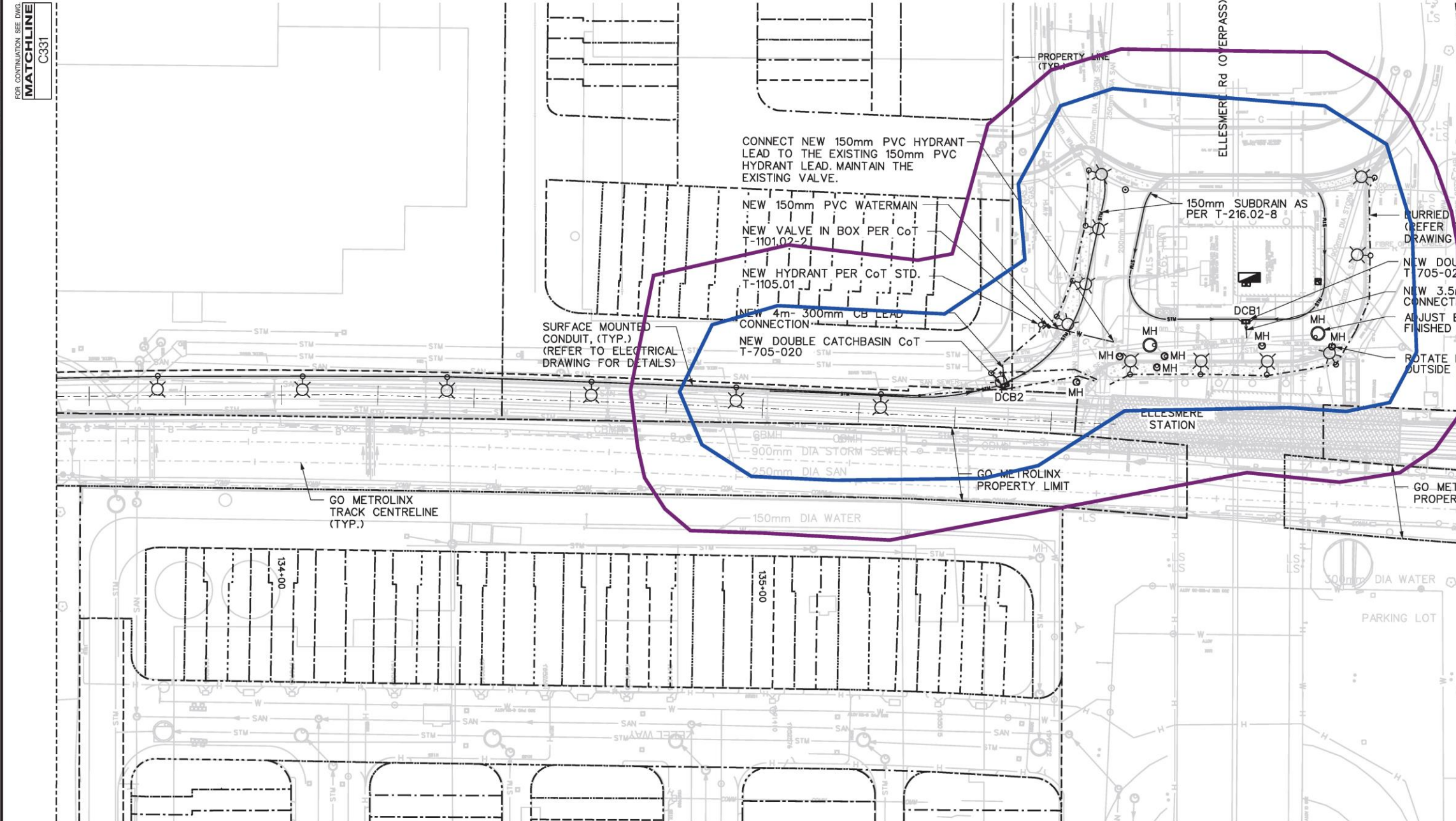
engbor03.dgn (BORDER) FEBRUARY 2, 2020

BLDG. REF. No.

FILENAME: 7s_plan_um132.dgn

SHEET No. -

DRAWING No. J35-13-C332



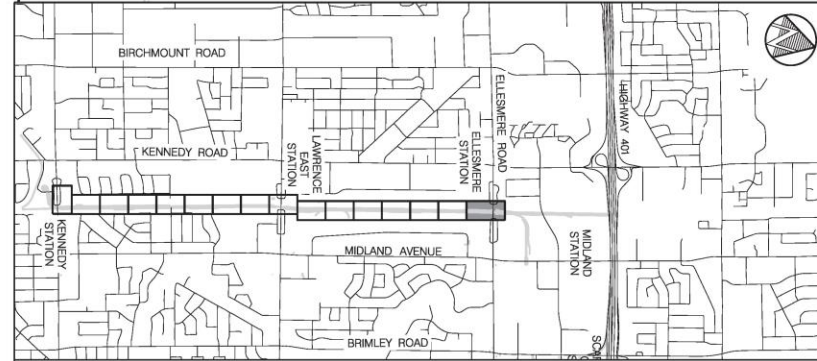
— Vibratory Pile ZOI
— Impact Pile ZOI
 Preliminary Vibratory and Impact Pile ZOI

- LEGEND:**
- CB DENOTES EXISTING CATCH BASIN
 - WV DENOTES EXISTING WATER VALVE
 - VC DENOTES EXISTING WATER VALVE CHAMBER
 - MH DENOTES EXISTING MAINTENANCE HOLE
 - LS DENOTES EXISTING LIGHT STANDARD
 - FH DENOTES EXISTING FIRE HYDRANT
 - PED DENOTES EXISTING BELL CANADA PEDESTAL
 - FC DENOTES EXISTING UTILITY CAP
 - FH DENOTES NEW FIRE HYDRANT
 - WV DENOTES NEW WATER VALVE
 - PB DENOTES NEW PULL BOX
 - LS DENOTES NEW LIGHT STANDARD
 - DCB DENOTES NEW DOUBLE CATCH BASIN
 - CB DENOTES NEW CATCH BASIN
 - STM DENOTES NEW STORM SEWER
 - W DENOTES NEW WATERMAIN
 - DENOTES PROPERTY LINE

NOTES:

- ADJUST HANDWELLS, MAINTENANCE HOLES AND CATCH BASIN FRAME AND GRATE TO SUIT FINISHED GRADES. EX. BIRD CAGE GRATE OF THE CATCHBASINS SHALL BE REPLACED WITH OPSD 400.020

CATCH BASIN DATA TABLE				CB CONNECTION DATA			
STANDARD	STRUC. No.	RIM ELEV.	INVERT OUT	LEN. (m)	DIA (mm)	CLASS OF PIPE	SLOPE
T-705.020, OPSD 400.070	DCB1	162.80	161.00	4.0	300	PVC DR35	MIN 0.7%
T-705.020, OPSD 400.070	DCB2	162.63	160.83	4.4	300	PVC DR35	MIN 0.7%



N.T.S. 0 5 10 15 20m

- DENOTES CONSTRUCTION AREA

REVISIONS	REVISIONS

CONSTRUCTION REVIEW DRAWING
 NOT FOR CONSTRUCTION

DRAWN D. AMADOR YYYY/MM/DD 2022/04/13
 CHECKED M. KIM 2023/03/31
 CORRECT A. SO 2023/03/31
 SCALE

**SRT BUS REPLACEMENT
 CONVERSION OF SRT ROW TO BUSWAY**

 NEW UTILITIES
 133+50 TO 136+00 AND ELLESMERE STATION
 Mi. 57.15 TO 56.99
 SHEET 16 OF 16

Contract: J35-13 Package:

 TORONTO TRANSIT COMMISSION
 ENGINEERING DEPARTMENT
 Dwg. No. J35-13-C332 Rev. No. Sheet No. -
 Plot Date: 17-APR-2024

Appendix D

Assumptions Report



Noise and Vibration Assumptions Report

Conversion of Scarborough Rapid Transit Right-of-Way to Busway –
Transit and Rail Project Assessment Process

Toronto Transit Commission

60729927

August 2024

Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“AECOM”) for the benefit of the Client (“Client”) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the “Agreement”).

The information, data, recommendations and conclusions contained in the Report (collectively, the “Information”):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the “Limitations”);
- represents AECOM’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

Authors

Report Prepared By:



James Au, P.Eng., INCE
Senior Acoustic Engineer

Report Checked By:



Leaman Chow, P.Eng.
Team Lead, Acoustic Engineer

Toronto Transit Commission

Noise and Vibration Assumptions Report

Conversion of Scarborough Rapid Transit Right-of-Way to Busway – Transit and Rail Project Assessment Process

Prepared for:

Toronto Transit Commission

Prepared by:

AECOM Canada Ltd.
1000-5090 Explorer Drive
Mississauga, ON L4W 4X6
Canada

T: 905 238 0007

www.aecom.com

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1. Introduction

AECOM Canada Ltd. has been retained by the Toronto Transit Commission to conduct a noise and vibration impact assessment for the proposed conversion of the Scarborough Rapid Transit to a dedicated busway between Kennedy and Ellesmere Station (the Project). The noise and vibration impact assessment will be submitted to the Ministry of the Environment, Conservation and Parks. Some assumptions are required to be used to complete the analysis. The purpose of this report is to document these assumptions to be used.

2. Assumptions for Traffic Noise

The following assumptions will be used for conducting the traffic noise analysis:

- Study will be conducted with respect to the Ministry of the Environment (now Ministry of the Environment, Conservation and Parks) / Toronto Transit Commission Draft Protocol for Noise and Vibration Assessment for the Proposed Scarborough Rapid Transit Extension (1993).
- As the Scarborough Rapid Transit was in operation since 1985 through 2023, it can be considered as part of the background noise conditions. Noise from the Scarborough Rapid Transit will be predicted at the assessment locations.
- Scarborough Rapid Transit noise source information will be sourced from the Ministry of Environment Conservation, and Park's STAMSON v5.04 modelling program, and used to calibrate a noise model prepared using the International Organization for Standardization 9613 prediction algorithm.
- Future bus noise will be based upon the United States Federal Highway Administration's Traffic Noise Model implemented in Cadna/A.
- Bus speed on the busway will be 60 kilometres per hour.
- Buses will idle for one minute at the bus stops.
- Bus volumes will be based upon traffic information provided by Toronto Transit Commission.
- The study area will be defined as 300 metres from the Project disturbance area and is based upon Metrolinx's Environmental Guide for Noise and Vibration Impact Assessment (2021).

- Existing noise from roadways will be predicted using the United States Federal Highway Administration’s Traffic Noise Model algorithm implemented in Cadna/A.
- Road traffic data will be sourced from the Toronto Transit Commission.
- Ground terrain information will be sourced from Toronto Transit Commission design drawings.
- Road traffic day/night split will be assumed to be 90%/10% based upon the assumption in the Ontario Road Noise Analysis Method for Environment and Transportation.
- Truck traffic percentages, where not available will be based upon the truck distribution in the Ontario Ministry of Transportation’s Environmental Guide for Noise.
- Background sound levels for areas not dominated by road noise will be measured with remote monitoring equipment.

3. Assumptions for Traffic Vibration

Vibration from vehicles with pneumatic tyres traveling on smooth asphalt surfaces are typically negligible and imperceptible. As this project involves the removal and replacement of rail transit service, vibration levels due to Toronto Transit Commission operations will decrease and the impact will be negligible and assessment is not required.

4. Assumptions for Construction Noise

Much of the existing concrete foundations will be used as the underlaying support of the final busway. As such, the construction will concentrate on the removals/modifications for installation of new utilities (lighting), excavation and grading of new bus stop areas, plus some concrete works, deep excavation/shoring for stormwater connections, and paving of the final busway surface.

As the shoring method has not been confirmed, impact, vibratory, and augered piles have been reviewed to determine potential impacts.

The following assumptions will be used for conducting the construction noise analysis:

- Construction equipment noise emissions will be modelled based upon source data in the United States Federal Highway Administration’s Road Construction Noise Model.
- Major construction stages assessed are:
 - Removals and utility works.
 - Excavation, grading and concrete works.
 - Shoring.
 - Paving.
- Equipment quantities for each stage will be assumed as per **Table 1**, based upon an assumed 50 metres working area per 8 hour shift.
- The study area will be defined as 300 metres from the Project disturbance area and is based upon Metrolinx’s Environmental Guide for Noise and Vibration Impact Assessment.

Table 1: Estimated Construction Equipment by Construction Type

Equipment Description	Removals and Utility Work	Excavation, Grading, and Concrete Works	Shoring	Paving
Backhoe	1	1	1	-
Excavator	1	1	-	1
Compaction Machine	-	1	-	-
Cement Trucks per hour	-	2	-	-
Concrete/Metal/Rail Saw	1	-	-	-
Crane – Mobile	1	-	1	-
Dump Trucks per hour	2	2	-	2
Semi-Trucks per hour	2	2	1	-
Generator	1	1	1	1
Front End Loader	1	1	-	-
Jackhammer	1	-	-	-
Skid Steers	2	2	-	2
Paver	-	-	-	1
Vibratory Roller	-	-	-	1
Vacuum Excavator	1	-	-	-
Potential Piles	-	-	1	-

5. Assumptions for Construction Vibration

As construction is a temporary activity that will cease at the end of the construction phase, analysis of construction vibration prioritizes the understanding of potential for damage to the surrounding structures. The following assumptions will be used for conducting the construction vibration analysis:

- Vibration levels will be predicted according to the United States Federal Transit Administration's procedures for construction vibration, and vibration sources.
- Construction equipment included in the analysis will be based upon the assumed equipment in **Table 1** above.
- Assessment locations will be identified based upon aerial and street imagery.
- Additional locations may need to be assessed should socio-economic studies and/or the cultural heritage studies identify other sensitive locations.
- Construction equipment operation will be based upon staging drawings provided by Toronto Transit Commission.
- Building damage criteria will be defined by the City of Toronto's by-law 514-2008 and the United States Federal Transit Administration's Transit Noise and Vibration Transit Noise and Vibration Impact Assessment Manual (2018).
- The study area will be defined as 300 metres from the Project disturbance area and is based upon Metrolinx's Environmental Guide for Noise and Vibration Impact Assessment.

Appendix E

**Correspondence with Ministry of the
Environment, Conservation and Parks**



FW: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>

Tue 2024-07-02 7:08 AM

To: Papas, Gary <Gary.Papas@TTC.ca>

Cc: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>

Good morning, Gary,

Please see email below from our noise reviewer. Can you kindly confirm what the anticipate timelines for submission of the noise and vibration report will be?

Thanks,

Cindy

From: Martella, Anthony (MECP) <Anthony.Martella@ontario.ca>

Sent: Friday, June 28, 2024 4:49 PM

To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>

Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Hi Cindy,

I have no additional comments at this time. Is the timeline to submit the reports still the same?

Regards,
Anthony

From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>

Sent: Friday, June 28, 2024 3:26 PM

To: Martella, Anthony (MECP) <Anthony.Martella@ontario.ca>

Cc: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>

Subject: FW: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Hello Anthony,

Please see the email below and attachment for additional information that refers to the grassy areas in the project study area.

Thanks,

Cindy

From: Gary.Papas@ttc.ca <Gary.Papas@ttc.ca>

Sent: Friday, June 28, 2024 3:23 PM

To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>

Cc: Merlin.Yuen@ttc.ca; joanne.wang@aecom.com; jackie.franklin@aecom.com; Jehad.Hassan@ttc.ca; Dominic.Ho@ttc.ca; Andrea.Castillo@ttc.ca

Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hi Cindy,

Just to add to my last email, I've attached the natural heritage features map which should give Anthony a good sense of the grassy area I was referring to in my last email.

Looking forward to his response.

Regards,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

T: 416-393-3985 | M: 647-505-5139 | gary.papas@ttc.ca

Please note: At this time, TTC email accounts are not able to receive links.



Toronto Transit Commission
5160 Yonge Street, Suite 900
Toronto, ON M2N 6L9

From: Papas, Gary

Sent: Friday, June 28, 2024 2:19 PM

To: 'Batista, Cindy (MECP)' <Cindy.Batista@ontario.ca>

Cc: Yuen, Merlin <Merlin.Yuen@ttc.ca>; joanne.wang@aecom.com; jackie.franklin@aecom.com; Hassan, Jehad <Jehad.Hassan@ttc.ca>; Ho, Dominic <Dominic.Ho@ttc.ca>; Castillo, Andrea <Andrea.Castillo@ttc.ca>

Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Hi Cindy,

To respond Anthony, we agree that a ground absorption of 0.35 is not appropriate for an asphalt only surface. However, the grounds between the busway corridor and houses is mainly grass; which typically has a ground absorption of 0.6. (or in ORNAMENT 0.66).

The 0.35 is a blended rate to account for some areas where a portion of the surface between the busway and the houses is paved.

Let us know if Anthony accepts our response, or would like to schedule a meeting to discuss further.

Regards,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

T: 416-393-3985 | M: 647-505-5139 | gary.papas@ttc.ca

Please note: At this time, TTC email accounts are not able to receive links.



Toronto Transit Commission
5160 Yonge Street, Suite 900
Toronto, ON M2N 6L9

From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Sent: Friday, June 28, 2024 12:08 PM
To: Papas, Gary <Gary.Papas@ttc.ca>
Cc: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>; Yuen, Merlin <Merlin.Yuen@ttc.ca>; joanne.wang@aecom.com; jackie.franklin@aecom.com; Hassan, Jihad <Jihad.Hassan@ttc.ca>; Ho, Dominic <Dominic.Ho@ttc.ca>; Castillo, Andrea <Andrea.Castillo@ttc.ca>
Subject: FW: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Hello Gary.

Please see the noise reviewer's comment directly below in response to your June 21st email. Let me know if a call with our noise expert would be helpful to discuss this remaining item.

Thanks,

Cindy

From: Martella, Anthony (MECP) <Anthony.Martella@ontario.ca>
Sent: Friday, June 28, 2024 12:00 PM
To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Hi Cindy,

The comparison meets my request from June 20. I do have one comment on the provided description in the email, though:

"used a 0.35 global ground absorption." A coefficient of 0.35 is too high for surfaces such as asphalt or concrete.

Regards,

Anthony Martella, M.Eng., P.Eng.
Senior Noise Engineer

Approvals Services Section | Environmental Permissions Branch | Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto ON M4V 1P5
Tel: (437) 881-5466 Fax: (416) 314-8452
E-mail: anthony.martella@ontario.ca

**If you have any accommodation needs or require communication supports or alternate formats, please let me know.
Si vous avez des besoins en matière d'adaptation, ou si vous nécessitez des aides à la communication ou des médias substitués, veuillez me le faire savoir.**

From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Sent: Friday, June 21, 2024 4:13 PM
To: Martella, Anthony (MECP) <Anthony.Martella@ontario.ca>
Cc: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>; Desautels, Solange (MECP) <Solange.Desautels@ontario.ca>
Subject: FW: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

Hello Anthony.

Please see TTC's responses below and attached documents.

Please let me know if you have any further comments.

Thanks,

Cindy

From: Gary.Papas@ttc.ca <Gary.Papas@ttc.ca>
Sent: Friday, June 21, 2024 3:51 PM
To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Cc: Merlin.Yuen@ttc.ca; joanne.wang@aecom.com; jackie.franklin@aecom.com; Jihad.Hassan@ttc.ca; Dominic.Ho@ttc.ca; Andrea.Castillo@ttc.ca; Desautels,

Solange (MECP) <Solange.Desautels@ontario.ca>

Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Noise Assumptions

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hi Cindy,

Thanks for coordinating Anthony's feedback with us. My consultant (AECOM) has prepared the comparison Anthony requested, please see summary below and corresponding attachments.

AECOM response:

Please see the TNM inputs in the attached files and description below for the information to provide two representative calculations using the latest version of TNM.

Please note the purpose of this exercises is not to recreate the entire noise model in TNM as TNM input is not simple for large amounts of data and objects that Cadna/A does accommodate (and is present in the model used in this noise assessment). The purpose is to provide a comparison of the noise predictions of the bus vehicle class at the same volumes between the Cadna/A and TNM models at similar distances, using a simplified models.

The TNM ground absorption was set for LAWN. While Cadna/A was set at 0.6, which is typical for grass. Comparison of the results are in the table below. The assessment of the busway conservative used a 0.35 global ground absorption.

Rec	Cadna/A	TNM3.2	Difference
T1	47.1	45.5	1.6
T2	56.9	56.1	0.8

The results in the table above indicate that the Cadna/A model will predict higher noise levels at distances of concern in the environmental assessment, however the difference in noise levels can be considered insignificant.

Please let me know if the above response is satisfactory, and if we can proceed with our N/V assumptions.

Regards,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

T: 416-393-3985 | M: 647-505-5139 | gary.papas@ttc.ca

Please note: At this time, TTC email accounts are not able to receive links.



Toronto Transit Commission
5160 Yonge Street, Suite 900
Toronto, ON M2N 6L9

From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Sent: Thursday, June 20, 2024 2:45 PM
To: Papas, Gary <Gary.Papas@ttc.ca>
Cc: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Subject: FW: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

Hello Gary.

Please see email below from the ministry's noise engineer in response to your June 17th email.

Let me know if you or your team has any further clarification questions.

Thanks,

Cindy

From: Martella, Anthony (MECP) <Anthony.Martella@ontario.ca>
Sent: Thursday, June 20, 2024 12:01 PM
To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

Hi Cindy,

I do have a comment as follows:

2. Based on the explanation, we can accept the TNM in Cadna/A for this project. Please assist our review process by providing at least two representative calculations using the latest version of TNM to show reasonable consistency of results. Thank you.

Regards,

Anthony Martella, M.Eng., P.Eng.
Senior Noise Engineer

Approvals Services Section| Environmental Permissions Branch | Ministry of the Environment, Conservation and Parks

135 St. Clair Avenue West, 1st Floor
Toronto ON M4V 1P5
Tel: (437) 881-5466 Fax: (416) 314-8452
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If you have any accommodation needs or require communication supports or alternate formats, please let me know. Si vous avez des besoins en matière d'adaptation, ou si vous nécessitez des aides à la communication ou des médias substituts, veuillez me le faire savoir.

From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Sent: Monday, June 17, 2024 9:34 AM
To: Martella, Anthony (MECP) <Anthony.Martella@ontario.ca>
Cc: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Subject: FW: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

Hello Anthony.

TTC has responded to your comments – see below. Can you kindly review and let me know if you have anything further to add.

They are not requesting a meeting at this time.

Cindy

From: Gary.Papas@ttc.ca <Gary.Papas@ttc.ca>
Sent: Monday, June 17, 2024 9:21 AM
To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Cc: Merlin.Yuen@ttc.ca; Dominic.Ho@ttc.ca; Andrea.Castillo@ttc.ca; Jehad.Hassan@ttc.ca; joanne.wang@aecom.com; Desautels, Solange (MECP) <Solange.Desautels@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Good morning Cindy –

I hope you had a nice weekend.

Thanks for the response below. **I think we're all on the same page.** For AQ, as per the MoM from May 3/24, existing conditions will represent SRT operations prior to decommissioning, and for future scenarios, the Future Build will include operations of buses on the busway, and the Future No-Build will consider the current interim bus replacement along Kennedy (northbound) and Midland (southbound).

I've inserted extracts from the MoM and the Assumptions Proposal below.

We've prepared the following responses to your other questions.

Comment
<p style="text-align: right;">Secti</p> <p>2. The assessment should not use the TNM algorithm implemented as part of another software package. Please provide justification as to which version that is approved by the FHWA should be used.</p>

3. Is there any verification that the sound emission levels of the TTC buses are consistent with the FHWA TNM sound emission levels?

4. Where background sound levels are supported by measurements, please be aware of nearby rail lines and ensure that noise from them is

5. Where it is applicable to refer to the MTO Environmental Guide for Noise, the latest version must be used.

Secti

6. Construction equipment emissions should also meet the requirements of NPC-115.

Please let us know if there are any concerns.

Regards,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

T: 416-393-3985 | M: 647-505-5138 | gary.papas@ttc.ca

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Toronto Transit Commission
5160 Yonge Street, Suite 900
Toronto, ON M2N 6L9

From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Sent: Monday, June 17, 2024 9:10 AM
To: Papas, Gary <Gary.Papas@ttc.ca>
Cc: Yuen, Merlin <Merlin.Yuen@ttc.ca>; Ho, Dominic <Dominic.Ho@ttc.ca>; Castillo, Andrea <Andrea.Castillo@ttc.ca>; Hassan, Jehad <Jehad.Hassan@ttc.ca>; joanne.wang@aecom.com; Desautels, Solange (MECP) <Solange.Desautels@ontario.ca>; Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

Morning Gary.

I've heard back from our noise reviewer and he stated the following in response to your email below: *The meeting minutes describe the existing condition as having the SRT. For noise impact assessments, we typically ask for a comparison of the future build and future no-build scenarios.*

Perhaps a meeting to clarify would be best.

Can you kindly provide a few dates and times that work for your team this week and next and I will schedule a meeting.

Regards,

Cindy

From: Gary.Papas@ttc.ca <Gary.Papas@ttc.ca>
Sent: Thursday, June 13, 2024 3:52 PM
To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Cc: Merlin.Yuen@ttc.ca; Dominic.Ho@ttc.ca; Andrea.Castillo@ttc.ca; Jehad.Hassan@ttc.ca; joanne.wang@aecom.com; Desautels, Solange (MECP) <Solange.Desautels@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

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Thanks Cindy, we will review and provide responses shortly.

Just wanted to flag the first bullet (as seen below):

1. The SRT cannot be included as part of the ambient sound level for determining sound level limits and the noise impact of the new busway, as it is no longer / will not be in operation. The Future Build and Future No-Build scenarios do not include SRT operation.

As per the approved meeting minutes, from our May 3/24 discussion with Ministry staff, we agreed that the SRT would represent existing conditions, prior to its decommissioning. Is it possible to remove this comment?

Regards,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

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From: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Sent: Thursday, June 13, 2024 3:19 PM
To: Papas, Gary <Gary.Papas@ttc.ca>
Cc: Yuen, Merlin <Merlin.Yuen@ttc.ca>; Ho, Dominic <Dominic.Ho@ttc.ca>; Castillo, Andrea <Andrea.Castillo@ttc.ca>; Hassan, Jehad <Jehad.Hassan@ttc.ca>; joanne.wang@aecom.com; Desautels, Solange (MECP) <Solange.Desautels@ontario.ca>; Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

Hello Gary.

Please find attached the ministry's noise comments on the noise assumptions report.

Please let me know if your team has any questions and I can arrange a call with our noise reviewer.

Regards,

Cindy

From: Gary.Papas@ttc.ca <Gary.Papas@ttc.ca>
Sent: Wednesday, June 5, 2024 1:32 PM
To: Batista, Cindy (MECP) <Cindy.Batista@ontario.ca>
Cc: Merlin.Yuen@ttc.ca; Dominic.Ho@ttc.ca; Andrea.Castillo@ttc.ca; Jehad.Hassan@ttc.ca; joanne.wang@aecom.com; Desautels, Solange (MECP) <Solange.Desautels@ontario.ca>
Subject: RE: [EXTERNAL] RE: Scarborough Busway Conversion - Air Quality Assumptions

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Wonderful – thank you for confirming Cindy.

We'll look out for the noise comments later this week.

Regards,

Gary Papas MSA, MCIP, RPP, PMP
Senior Manager – Project Development
Strategy & Customer Experience Group

T: 416-393-3985 | M: 647-505-5139 | gary.papas@ttc.ca

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