# Section I.3:
# Noise and Vibration Control Measures

# RE35-1- WATERFRONT EAST LRT UNION STATION - QUEENS QUAY LINK

## Baseline Design Review Submission – Noise and Vibration Control Measures

Project # OISO52004

Prepared for:

**Toronto Transit Commission**
1900 Yonge Street, Toronto, ON M4S 1Z2

OISO52004-TEM-001 R0 Waterfront East LRT Union Station - Queens Quay Link Concept Design Review Submission

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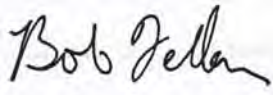
| Updated by: |  <br>Bob Felker<br>Principal Environmental Planner | Date:<br>07/06/2024 |

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## List of Acronyms and Abbreviations

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|---|---|
| BDRS | Baseline Design Review Submission |
| CALTRANS | California Department of Transportation |
| CDRS | Conceptual Design Review Submission |
| FTA | Federal Transit Administration |
| FHWA | U.S. Federal Highway Administration |
| LRT | Light Rail Transit |
| NVCM | Noise and Vibration Control Measures |
| OEM | Original Equipment Manufacturer |
| PDE | Preliminary Design and Engineering |
| RCNM | Roadway Construction Noise Model |
| TTC | Toronto Transit Commission |
| WELRT | Waterfront East LRT |
| WSP | WSP E&I Canada Limited |
| ZOI | Zone of Influence |

## 1.0 Introduction

WSP E&I Canada (“WSP”), formerly Wood Environment & Infrastructure Solutions a Division of Wood Canada Limited (“Wood”), has been retained by the Toronto Transit Commission (“TTC”) to complete the Preliminary Design and Engineering (PDE) to produce a Baseline Design (approximately 30% design completion) for the expansion of the existing Union Light Rail Transit (LRT) and Queens Quay LRT Stations and new running tunnel and portal as part of the Waterfront East LRT (WELRT) project (the “Project”).

The focus area of the Project is below grade between Union Station Loop and future Portal east of Bay Street on Queens Quay (including the Union and Queens Quay Stations). A Preliminary Noise Study has been prepared to support the PDE with respect to the acoustics, noise and vibration aspects of the design and to provide design recommendations for the following components:

1. Expansion of the TTC Union and Queens Quay **Stations**;
2. **Operations** of the streetcar between the Union Station Loop and the future Portal on Queens Quay; and
3. **Construction** of the station expansion, trackwork, streetcar tunnel and port structures under considerations of the Project.

A Conceptual Design Review Submission (CDRS, approximately 15% design completion) of the Project has been completed and a Preliminary Noise Study report (version R1, dated December 2020) (WSP E&I Canada, 16/12/2020) was included in the submission which identified the acoustics, noise and vibration design criteria for the Project and provided preliminary design recommendations.

This report is intended to support the Baseline Design Review Submission (BDRS, approximately 30% design completion) of the Project. A review of the CDRS submission against the criteria established in the previous Preliminary Noise Study report (version R1) has been conducted. Based on the information available from the CDRS submission and during the BDRS development, construction noise and vibration assessment has been performed and the results are documented in the updated Preliminary Noise Study report (version R2, dated July 2021) (WSP E&I Canada, July 2021). The results indicated the potential for sensitive receptors to be located within the identified ZOI’s for both construction noise and vibration. As such, Noise and Vibration Control Measures have been recommended for the Project.

## 2.0 Purpose of Measures

The purpose of this Noise and Vibration Control Measures (NVCM) document is to advise an approach to noise and vibration control during the construction of the Project. The NVCM is to be considered a living document that will evolve with the progression of the Project through detailed design and execution. Information gathered relative to construction activities and methods at stages closer to activities execution on site is the most reliable and accurate for an assessment of risks relative to construction impacts. Therefore, the items discussed in this NVCM are intended to provide a framework that

can be used for risk management and mitigation relative to potential noise and vibration impacts from construction. These items do not represent specific Project commitment given the early stages of the design.

## 3.0 Requirements of Measures

The NVCM is expected to address the Project approach to identify and manage the environmental aspect of noise and vibration effects of the Project construction. The following items should be considered in the NVCM:

- Include a schedule of proposed activities and efforts as well as required deliverables and inputs required to comply with appropriate noise and vibration requirements;
- Identify major noise and vibration producing construction activities and identify a plan to minimize, monitor and mitigate noise and vibration levels to the extent reasonably possible and consistent with the applicable guidance;
- Identify ground-borne and air-borne noise and vibration prediction and measurement procedures, and methods to evaluate ground-borne and air-borne noise and vibration from the construction;
- Provide a list of ground-borne and air-borne noise and vibration performance requirements;
- Identify possible mitigation measures to be applied so as to not exceed the appropriate noise and vibration requirements;
- Provide procedures for identifying potential representative sensitive receptors, including taking baseline measurements; and
- Provide procedures for conducting compliance verification measurements, measurement processes, measurement equipment and analysis methods, to confirm that the work performed as part of the project is consistent with applicable guidance.

Given the identified requirements, the following section (Section 4.0) provides discussions of noise and vibration considerations as recommended elements of the NVCM.

## 4.0 Noise and Vibration Considerations

### 4.1 Construction Activities

To assess the risks related to Project noise and vibration emissions requires a progressive approach to assessment and mitigation. The first step is to identify major noise and vibration producing construction activities.

The following activities, equipment, and site conditions associated with the construction of the Project may result in noise or vibration emissions:

- Deep foundation;

- Excavations;
- Demolition;
- Operation of diesel fueled construction equipment and generators; and
- On-site haul truck and other vehicular traffic.

The work activities are subject to modification through the course of the Project relative to emerging considerations and logistics. Any subsequent changes to the construction activities and schedule should be reviewed and, if needed, re-evaluated to identify the construction impacts.

## 4.2 Prediction Methods

Once the major noise and vibration producing construction activities have been identified, these inputs will be used to develop the Construction Noise Zone of Influence and Construction Vibration Zone of Influence assessments. The assessments will outline the prediction methods and the determination of impacts should be conducted according to generally accepted methods:

- For calculation of noise from construction: the U.S. Federal Transit Administration (FTA) Transit Noise and Impact Assessment Manual (FTA Manual) (Federal Transit Administration, September, 2018), U.S. Federal Highway Administration (FHWA) Road Construction Noise Model (RCNM) (U.S. Department of Transportation, Federal Highway Administration, 2006) or other standardized methods;
- For calculation of vibration from construction: the FTA Manual, the California Department of Transportation, Transportation and Construction Vibration Guidance Manual (CALTRANS Manual) (California Department of Transportation, April 2020), British Standard 5228-2 2009 (BS 5228) (British Standards Institution (BSI), 2009), or other standardized methods.

The Zone of Influence assessments will assess the expected emissions from construction activities and establish the expected zone of influence based on the applicable noise and vibration requirements. The key output of the assessments will be the identification of sensitive receptors within the zone of influence area, if any.

## 4.3 Performance Requirements

The performance requirements for construction noise and vibration levels include both source-based limits, i.e. limits of equipment noise and vibration emissions, as well as receiver-based limits. References can be sought from the following documentations:

- TTC Design Manual, DM-0106-00 Noise and Vibration, General (Toronto Transit Commission, Sep. 14, 2011);
- The City of Toronto Municipal Code, Chapter 591, Noise (City of Toronto Council, 2019);
- The Ministry of the Environment, Conservation and Parks, publication NPC-115, Construction Equipment (Ontario Minstry of the Environment and Climate Change, 1977);

- City of Toronto Municipal Code, Chapter 363, Article 5, Construction Vibrations (§363-5) (City of Toronto Council, 2019);
- U.S. Federal Transit Administration (FTA) Transit Noise and Impact Assessment Manual (FTA Manual) (Federal Transit Administration, September, 2018); and
- U.S. Federal Highway Administration (FHWA) Construction Noise Handbook (U.S. Department of Transportation, Federal Highway Administration, August 2006).

The above list includes both documentations directly relevant to the Project and guidance from Canadian and U.S regulatory agencies regarding vibration noise and vibration assessment. Other sources of noise and vibration performance requirements such as applicable laws or good industry practice may also be considered when needed.

### 4.4 Representative Sensitive Receptors

The Zone of influence Assessments will identify sensitive receptors, if any, and make a recommendation with respect to further effort to monitor or mitigate. If sensitive receptors are found to be within the noise or vibration zones of influence, it is recommended that a Baseline Noise and Vibration Measurement Plan be developed which outlines in detail the locations to be measured, the metrics to be collected, the duration of measurement and the specifications for the measurement equipment. The Baseline Noise and Vibration Measurement Plan would then be used as the starting point to develop the measurement aspects of the Monitoring, Mitigation and Compliance Verification Plan.

### 4.5 Monitoring, Mitigation and Compliance Verification

The Construction Noise/Vibration Monitoring, Mitigation and Compliance Verification Plan will, if warranted, identify a plan to minimize, monitor and mitigate noise and vibration levels to the extent reasonably possible and at least to meet the applicable noise and vibration requirements.

## 5.0 Noise and Vibration Management

### 5.1 General Approach

In order to address the risks related to construction noise and vibration, a three-stage approach is generally recommended:

- **Planning**: to identify potential risks from construction activities and define monitoring requirements where necessary;
- **Monitoring**: to verify that during construction activities noise and vibration levels are minimized and control measures, if in place, are effective; and
- **Communications**: to engage with community and stakeholders on potential noise and vibration from construction activities, as well as to address any complaints that may arise during the construction stage.

These stages form an integrated process of the NVCM. The noise and vibration considerations discussed in Section 4.0 are generally incorporated in the Planning and

Monitoring stages, and it is also recommended to establish a project Communication Protocol and integrated Complaints Protocol to include community engagement before work commences on site. Communications serve to minimize complaints and increase the public's understanding of the project by providing regular, timely and proactive updates of the construction and anticipated impacts. A Complaints Protocol should also be prepared that proactively addresses how to manage and respond to noise and vibration concerns. Where concerns may be predicted in advance, targeted consultation, if applicable, may be required.

## 5.2 Construction Best Practice

This section provides some examples of construction best practices which can be followed to minimize construction noise and vibration risks. These items are provided for reference purposes only as it is not the intent of this NVCM to define specific mitigation measures given the current level of Project design.

- Work Scheduling and Isolation:
  - Construction activities are scheduled and planned such that activities that generate higher levels of noise and/or vibration occur during day-time hours where feasible.
  - Utilize temporary sound barriers or hoarding as necessary to limit off-site noise emissions from specific work areas for small scale localized but high noise generating work.
  - Ensure construction equipment with significant noise and vibration emissions are operated as far as possible from sensitive receptors.
- Demolition Considerations:
  - Minimize drop heights of demolition waste materials into bins or trucks and whenever possible in order to reduce noise levels and line the bottoms of bins or trucks with rubber mats.
  - Using saws to break up existing asphalt and concrete instead of hydraulic hammers or jack hammers, wherever possible and practical.
- Vehicle and Machinery Operations:
  - Maintain equipment in good working order and exclude from site visually non-compliant emitters.
  - Engine preventative maintenance per Original Equipment Manufacturer (OEM) recommendations.
  - Identify designated truck routes which avoid proximity to potential receptors and identify appropriately low speed limits via signage.
  - Minimized drop heights during loading and unloading of trucks.
  - Use industry standard equipment and vehicle idle reduction initiatives, as possible. Provide direction for equipment which must be left running to have the maximum practical separation distance from potential receptors.
  - Use only equipment with all manufacturer available noise control technology options installed and in good working order.
  - Make every effort to reduce or eliminate tailgate banging.

- Optimize access to sites to reduce whenever possible backup. If backup of equipment is necessary, use of broad-band backup alarms on site is preferred.

## 6.0 Conclusions

This report presents the Noise and Vibration Control Measures (NVCM) prepared for the expansion of the existing Union Light Rail Transit (LRT) and Queens Quay LRT Stations and new running tunnel and portal as part of the Waterfront East LRT (WELRT) project.

A construction noise and vibration assessment has been performed for the Project, the results of which are documented in the updated Preliminary Noise Study report (version R2, dated July 2021) under a separate cover. Based on the potential for sensitive receptors to be located within the identified ZOI's for both construction noise and vibration, Noise and Vibration Control Measures (NVCM) have been recommended for the Project.

This report documents the key aspects of the NVCM prepared for the Project with the intent to provide a framework for risk management and mitigations relative to potential noise and vibration impacts from the construction. The NVCM is to be considered a living document that will evolve with the progression of the Project through detailed design and execution.