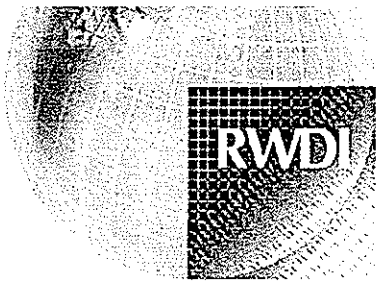


**APPENDIX F**

**NOISE AND  
VIBRATION ANALYSIS**



CONSULTING ENGINEERS  
& SCIENTISTS



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Date: November 23, 2007 RWDI Reference #: W07-5120A Pages (Including Cover): 3

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To: Scott Thorburn, P.Eng E-Mail: Scott\_Thorburn@URSCorp.com  
Company: URS Canada Inc.

CC: Mike Bricks E-Mail: MBricks@ecoplans.com

From: Scott Shayko E-Mail: Scott.Shayko@rwdi.com

RE: **Noise & Vibration Assessment, West Don Lands**

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## INTRODUCTION

RWDI AIR Inc. (RWDI) was retained by McCormick Rankin Corporation (MRC) to conduct an environmental noise and vibration study for the Toronto Transit Commission (TTC) Eastern Waterfront Project located in Toronto, Ontario. This study was limited to the proposed street car rails to be located on Cherry Street between King Street East and Eastern Avenue. This report presents the results of our studies.

## METHODOLOGY

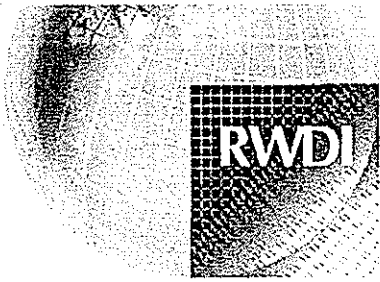
This study was based on the Transit Noise and Vibration Impact Assessment algorithms published by the U.S. Department of Transportation Federal Transit Administration (FTA). The FTA model was previously validated for modeling of TTC street car installations by comparison against noise and vibration measurements of existing tracks conducted by RWDI (RWDI Remove W07-5120C). Inputs to this assessment were from drawings of the proposed road and rail layouts (Alternative 3R-B) along Cherry Street and King Street.

The predicted noise levels were assessed against the MOE / TTC Transit Expansion Protocols. These guidelines state that the 16 hour equivalent sound level ( $L_{eq}(16h)$ ) for daytime operation must not exceed the higher of 55 dBA or the existing background ambient sound level, and that the 8 hour equivalent sound level ( $L_{eq}(8h)$ ) must not exceed the higher of 50 dBA or the existing background ambient sound level. The location for assessment of daytime noise levels is at the Outdoor Living Area (OLA) of each receptor, and the assessment of night-time noise levels is at the plane of the receptor's windows. Maximum rail pass-by noise levels ( $L_{max}$ ) are limited to 77 dBA to 80 dBA at any time of the night or day as assessed at the plane of the receptor's windows.

The predicted vibration levels were assessed against the CN Rail vibration level guidelines. These guidelines state that the vibration levels from a single pass-by should not exceed 0.144 mm/s RMS. The guidelines are applicable to the floor of a dwelling unit, but since calculation of building-borne vibration is beyond the scope of this study, assessment is made at the foundation of the receptors.

Both noise and vibration were assessed for six representative receptors in the expansion area. The receptors are referred to as NR1 through NR6. NR1, NR2 and NR3 are residential homes located at 460, 470, and 474 King Street East respectively. NR4 through NR6 are residential homes located at 33, 16, and 4 Cherry Street respectively. These receptors represent the worst case impacts expected from the rail expansion.

The vibration study was based on rail speeds of 35 km/h, on the track nearest each receptor. The study took into account special track work located at the intersection of Cherry Street and King Street. Since the CN Rail vibration guidelines are based on a worst-case pass-by, there is no consideration given to differences in levels of service during the daytime, evening, and night-time.



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The noise study was also based on rail speeds of 35km/h, at a distance equal to that from between the two tracks to the façade of each receptor. The study took into account "wheel squeal" produced by railcars rounding the corner at Cherry Street and King Street, and the TTC's expected operating times during the daytime, evening, and night-time. Background levels for the noise study were determined through road noise modeling using the Ontario Road Noise Method for Environment and Transportation (ORNAMENT) algorithm. Inputs to the ORNAMENT algorithm were based on traffic predictions for the project area.

### NOISE ASSESSMENT RESULTS

The predicted noise levels at each receptor are below the applicable guideline limits at each of the six receptors. Predicted levels are compared with guideline limits in Tables 1 and 2.

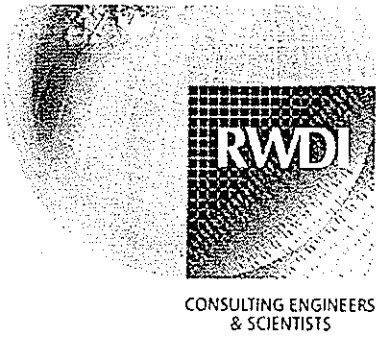
Table 1: Noise assessment results,  $L_{eq}$  assessment

Receptor ID	Time Period	Predicted Sound Level (dBA) <sup>(1)</sup>	Guideline Sound Level Limit (dBA) <sup>(1)</sup>	Meets Criteria?
NR1	Day	58	67	Yes
	Night	55	60	Yes
NR2	Day	60	68	Yes
	Night	57	61	Yes
NR3	Day	60	68	Yes
	Night	56	61	Yes
NR4	Day	53	61	Yes
	Night	49	55	Yes
NR5	Day	51	55	Yes
	Night	48	50	Yes
NR6	Day	46	55	Yes
	Night	43	50	Yes

Notes: 1. Sound levels are presented as  $L_{eq}(16)$  for daytime periods and  $L_{eq}(8h)$  for night-time periods

Table 2: Noise assessment results,  $L_{max}$  assessment

Receptor ID	Predicted Maximum Sound Level (dBA)	Guideline Sound Level Limit (dBA)	Meets Criteria?
NR1	67	77	Yes
NR2	68	77	Yes
NR3	69	77	Yes
NR4	69	77	Yes
NR5	69	77	Yes
NR6	61	77	Yes



**VIBRATION ASSESSMENT RESULTS**

The predicted vibration levels are compared with guideline limits in Table 3.

Table 3: Vibration Assessment Results

Receptor ID	Predicted Vibration Level (mm/s RMS)	Criteria (mm/s RMS)	Meets Criteria?
NR1	0.061	0.144	Yes
NR2	0.197	0.144	No
NR3	0.222	0.144	No
NR4	0.071	0.144	Yes
NR5	0.068	0.144	Yes
NR6	0.030	0.144	Yes

The predicted vibration levels are below the applicable guideline limits at NR1, NR4, NR5 and NR6. Predicted vibration levels at NR2 and NR3 are in excess of the guideline limits. These excesses are due primarily to the modeling of rail cars crossing the special track work at the corner of Cherry Street and King Street.

Actual vibration levels after installation will likely be lower than the predicted levels due to rail cars traveling at slower than modeled speeds, and due to conservatism in the FTA model for special track work. Since the intersection at Cherry Street and King Street is signalized, and there are to be transit stops located at both sides of the intersection, it is likely that street cars will travel through the intersection at less than full speed (35 km/h). Therefore, reduced impacts are expected. A speed limit of 20 km/h would be sufficient to eliminate all predicted excesses of the vibration criteria. It is recommended that the tracks be installed as proposed, and vibration levels be verified after installation. If levels are found to exceed the criteria during operation, rail speed limits could be lowered in the area of the special track work to mitigate the problem.

**CONCLUSIONS**

The predicted noise levels are below the guideline limits at each of the six receptors. The predicted vibration levels exceed the guideline limits at two of the six receptors. It is recommended that the project continue as planned, and vibration levels be verified at the two non-compliant receptors once installation is complete. Actual vibration levels are not expected to exceed the guideline limits.