Railway Vibration Analysis

Villalago Residences

Proposed Residential Townhouse Development

Highway 50 and 5 Sideroad
Town of Caledon

July 15, 2016
Project: 116-0170-100

Prepared for

Villalago Residences
% Treasure Hill Homes

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VALCOUSTICS
Canada Ltd.

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EXECUTIVE SUMMARY

Valcoustics Canada Ltd. (VCL) has prepared this report in support of the re-zoning application for the proposed residential development located near Highway 50 and 5 Sideroad in the Town of Caledon (Bolton).

This report addresses the potential vibration impact, due to train movements on the Canadian Pacific Railway (CPR) MacTier Subdivision on the proposed residential development.

Ground-borne vibration velocity magnitudes, measured on-site June 24, 2016, due to railway trains on the CPR MacTier Subdivision, did not exceed the Federation of Canadian Municipalities (FCM)/Railway Association of Canada (RAC) vibration guideline limit. Therefore, vibration mitigation measures are not mandatory for this development.

1.0 INTRODUCTION

Measurements of railway induced ground-borne vibration have been carried out to determine if vibration isolation of the proposed building foundations is warranted, relative to vibration guidelines recommended by FCM/RAC.

1.1 SITE

The site is located near Highway 50 and 5 Sideroad in the Town of Caledon.

The site is bounded by:

- existing commercial uses to the north (note that the existing 5 Sideroad, located on the site along the northern property line, will be removed as part of this development);
- existing residential uses to the east;
- the CPR MacTier Subdivision, with existing industrial uses beyond, to the south and southwest; and

- Highway 50/Queen Street South to the west, with existing industrial uses beyond, to the west.

A Key Plan is included as Figure 1. The study is based on the Site Plan prepared by One Riser Designs dated April 7, 2016. The Site Plan is included as Figure 2.

1.2 RAILWAY VIBRATION – CPR MACTIER SUBDIVISION

The CPR MacTier Subdivision is classified as a Principal Main Line. Rail activity includes freight traffic only. There is one mainline track in the vicinity of the site and one passing track. The grade of Highway 50 is elevated relative to the railway line, as there is an underpass for the railway.

Rail traffic data correspondence are included as Appendix A.

2.0 VIBRATION GUIDELINES

At the present time, there are no railway vibration guidelines in the land use approvals process in Ontario. However, in May 2013, the FCM and the RAC jointly released *"Guidelines for New Development in Proximity to Railway Operations"*. The FCM/RAC guideline recommends a maximum vibration threshold of 0.14 mm/sec roo-mean-square (RMS) (using a one second averaging time) between 4 Hz and 200 Hz.

The FCM/RAC guideline limit has been applied to the railway vibration analysis in this study.

3.0 METHOD

3.1 MEASUREMENT LOCATIONS

Vibration measurements were done at three locations and are labelled as Locations A, B and C on Figure 2.

Location B was located at the approximate location of the south corner of Block 1, corresponding to the closest building facade to the rail line. This was approximately 41 m from the centerline of the rail tracks. Locations A and C are approximately 61 m and 71 m, respectively, from the centre line of the rail tracks. Locations A and C, correspond to the closest facades of Blocks 5 and 19, respectively, to the rail line.

3.2 TRANSDUCER PLACEMENT

An accelerometer was used at each location to measure the ground-borne vibration generated by the train pass-bys. The accelerometer was securely mounted with a stud, onto the top surface of heavy metal plate and placed on the existing ground at-grade.

3.3 DATA ACQUISITION

A total of three railway movements (all freight trains) were monitored on June 24, 2016. Simultaneous recordings of the vibration signals were made at Locations A, B and C for each train pass-by. The vertical axis signal from each accelerometer was recorded digitally, using an NI

Sound and Vibration Assistant data acquisition and analysis system, and integrated from the measured acceleration to obtain the vibration velocity, in mm/s.

The accelerometers were calibrated prior to measurements with a Metra Meβ-und Frequenztechnik (MMF) vibration calibrator, model: VC20.

3.4 DATA ANALYSIS

Time histories of the overall integrated vibration velocity produced by each train pass-by were plotted using an RMS averaging time constant of one second. The analysis procedure conforms with the guidelines recommended by FCM/RAC.

4.0 RESULTS

Table 1 summarizes the maximum, measured, overall vibration velocity for each train pass-by, together with the train details.

Appendix B contains recorded time histories for the railway trains at each measurement location.

The train pass-bys produced maximum vibration velocity magnitudes ranging from:

- 0.05 to 0.10 mm/s at Location A;
- 0.07 to 0.14 mm/s at Location B; and
- 0.04 to 0.07 mm/s at Location C.

The overall vibration velocity magnitudes reported are the maximum (one second RMS averaging) that occurred for the duration of each individual pass-by.

The maximum overall ground-borne vibration velocities produced by the train pass-bys, did not exceed the vibration limits suggested by FCM/RAC. Therefore, mitigation is not required for this site.

5.0 CONCLUSIONS

The ground-borne vibration velocity magnitudes due to railway trains on the CPR MacTier Subdivision, measured at the closest building facade to the railway right-of-way, did not exceed the FCM/RAC vibration limit for any of the individual train pass-bys. Therefore, vibration mitigation measures are not required for this development.

6.0 REFERENCES

1. “Guidelines for New Development in Proximity to Railway Operations”, prepared for The Federation of Canadian Municipalities and the Railway Association of Canada, May 2013.

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TABLE 1

SUMMARY OF MEASURED OVERALL MAXIMUM VIBRATION VELOCITY MAGNITUDES OF CPR FREIGHT TRAINS

JUNE 24, 2016

Pass-by#	Train Details					Maximum Vibration Velocity[1] (mm/s)		
	Time/Period	Estimated speed (kph)	# of Locos	# of Cars	Direction	Location A[2]	Location B[2]	Location C[2]
1	16:33 – 16:37	50	3	128	Westbound	0.05	0.10	0.05
2	18:56 – 18:58	90	2	90	Eastbound	0.10	0.14	0.07
3	20:58 – 21:05	40	3	164	Westbound	0.05	0.07	0.04

Notes:

(1) Maximum overall vibration velocity occurring for the entire pass-by; one second RMS averaging.
(2) See Figure 2.

VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title: **Key Plan**	Date: **2016-07-13**	Figure: **1**
	Project Name: **Villalago Residences/Bolton**	Project No.: **116-0170-100**	

E:\AA\1160170\AreaPlan.cna

Date Plotted: 13.07.16

VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title: **Site Plan and Vibration Measurement Locations**	Date: **2016-07-13**	Figure: **2**
	Project Name: **Villalago Residences/Bolton - Railway Vibration**	Project No.: **116-0170-100**	

J:\2016\1160170\100\Analysis\Cadna\2016-05-24\for Figure 2_Villalago - Transportation.cna

Date Plotted: 14.07.16

APPENDIX A

RAIL TRAFFIC CORRESPONDENCE

Real Estate and Facility Management
800 – 1290 Central Parkway West
Mississauga, ON, L5C 4R3
www.cpr.ca

April 22, 2016

Via e-mail: Anthony@valcoustics.com

Valcoustics Canada Ltd.
30 Wertheim Court, Unit 25
Richmond Hill, Ontario L4B 1B9

Dear Sir/Madam:

Re: Rail Traffic Volumes, CP Mileage 20.48, Mactier Subdivision
Highway 50/Queen Street, Town of Caledon (Bolton), ON

This is in reference to your request for rail traffic data for a noise study in the vicinity of where Highway 50 intersects with the CP Rail corridor, being mile 20.48 of our Mactier Subdivision. The Mactier Subdivision is classified as a Principal Main Line.

The information requested is as follows:

1. Number of freight trains 0700 to 2300: 9
   Number of freight trains 2300 to 0700: 5

2. Average number of cars per train freight: 80
   Maximum cars per train freight: 188

3. Number of Locomotives per train: 2 (4 max)

4. Maximum permissible speed: 55 mph (88 kph)

5. The whistle signal is not routinely through the study area. Please note that the whistle may be sounded if deemed necessary by the train crew for safety reasons at any location.

6. There is one main line track with welded joints in the vicinity of the study area and one passing track with bolted joints along with an additional siding track north of the study area. Due to the additional tracks, trains will meet numerous times a day at in this area which may cause longer than usual train idling time while awaiting other trains to pass by.

The information provided is based on rail traffic over the past month to date. Variations of the above may exist on a day-to-day basis. Specific measurements may also vary significantly depending on customer needs.

Yours truly,

J Tomei

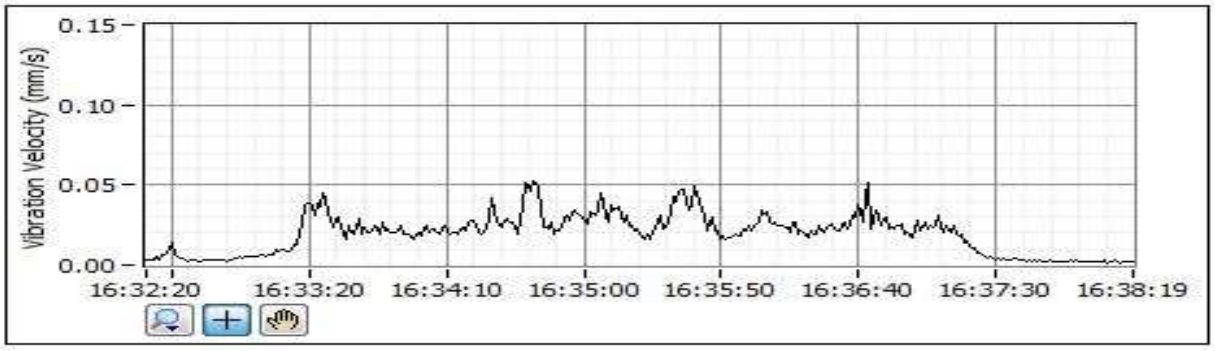
Josie Tomei
Specialist Real Estate Sales
& Acquisitions – Ontario
905-803-3429. josie_tomei@cpr.ca

APPENDIX B

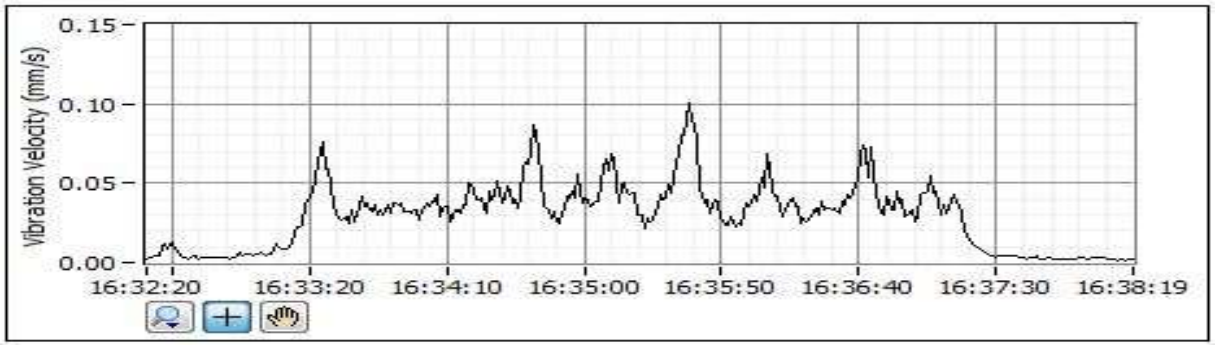
VIBRATION VELOCITY TIME HISTORIES DUE TO RAILWAY TRAIN PASS-BYS

Vibration Measurement #1

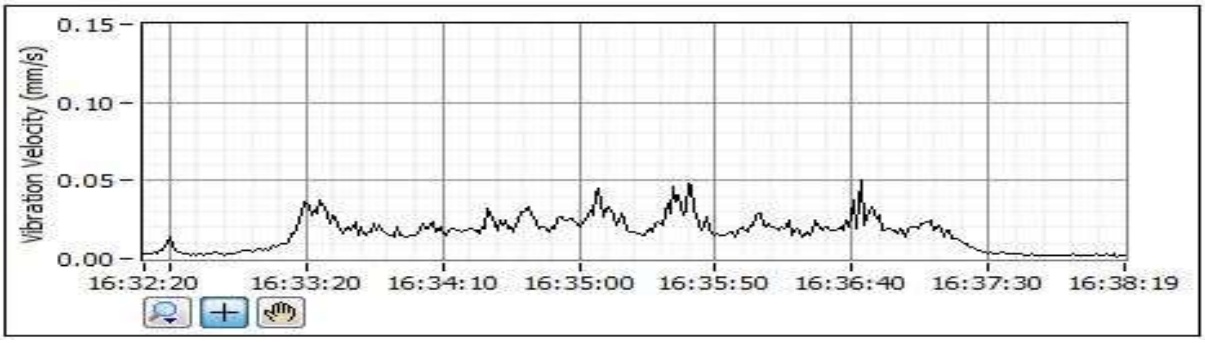
Overall Vibration Velocity



Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
A	16:33 – 16:37	CPR Freight (Westbound)	0.05



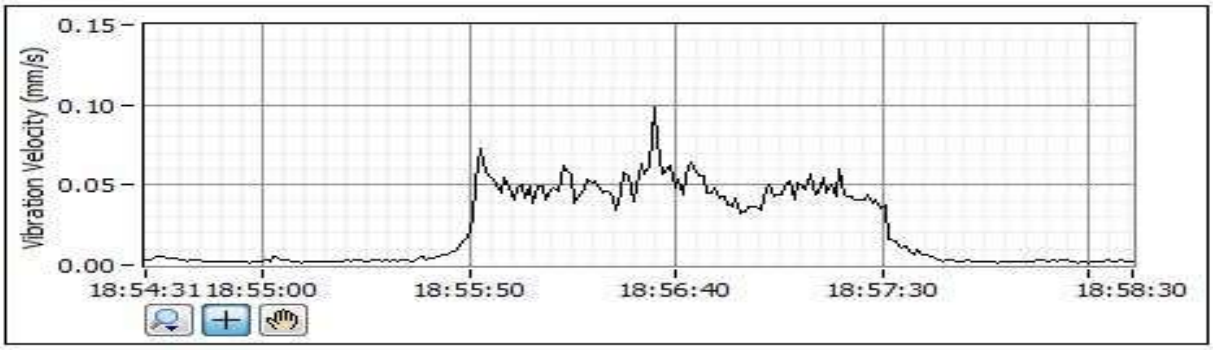
Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
B	16:33 – 16:37	CPR Freight (Westbound)	0.10



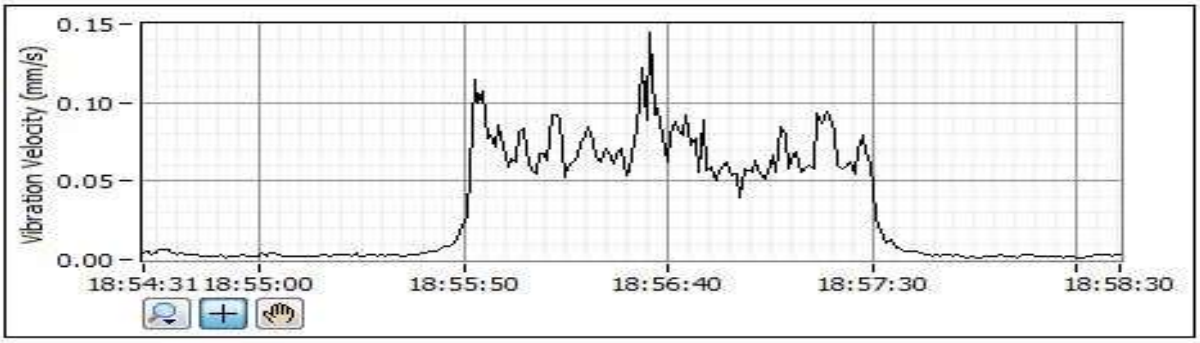
Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
C	16:33 – 16:37	CPR Freight (Westbound)	0.05

Vibration Measurement #2

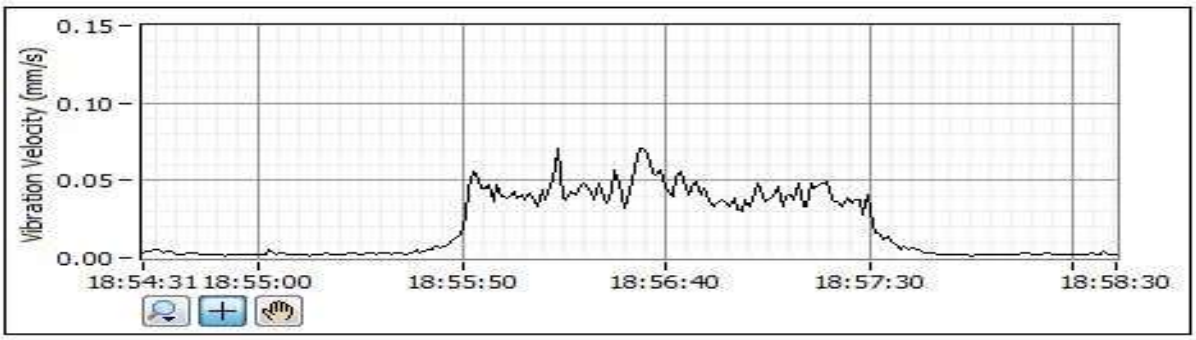
Overall Vibration Velocity



Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
A	18:56 – 18:58	CPR Freight (Eastbound)	0.10



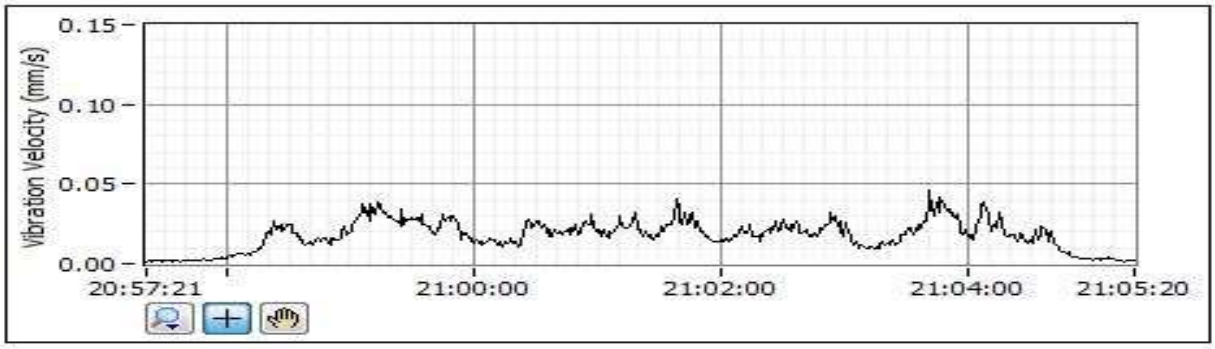
Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
B	18:56 – 18:58	CPR Freight (Eastbound)	0.14



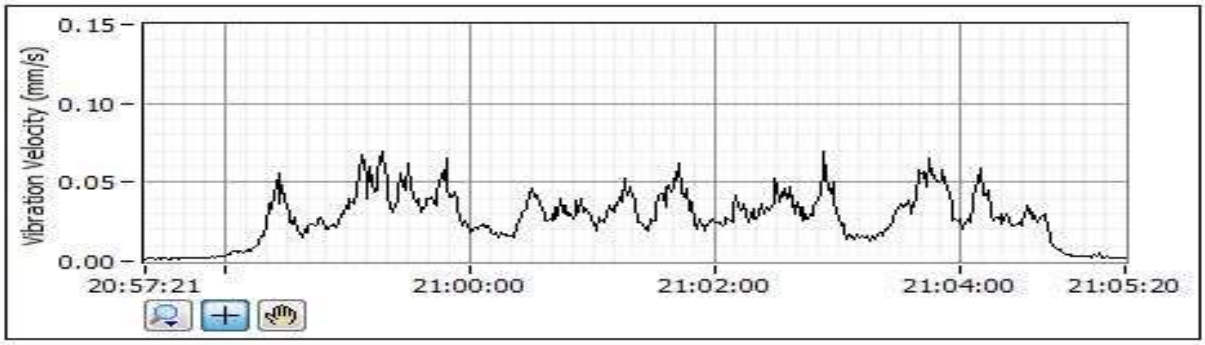
Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
C	18:56 – 18:58	CPR Freight (Eastbound)	0.07

Vibration Measurement #3

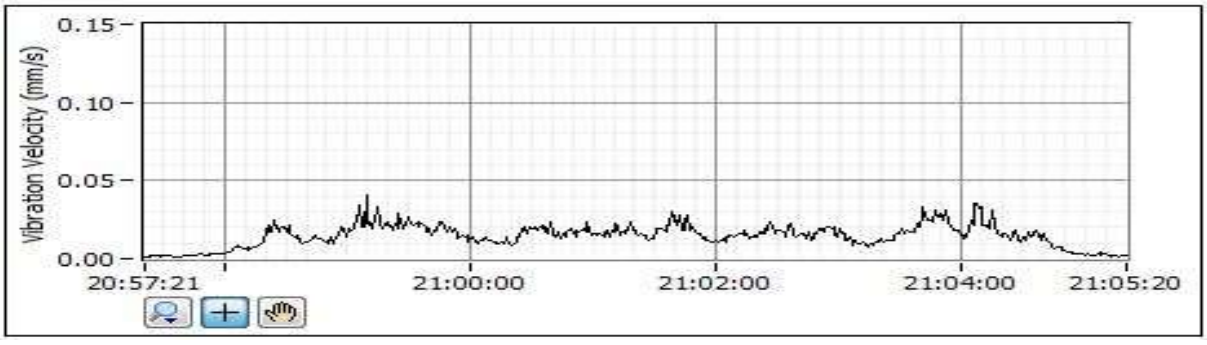
Overall Vibration Velocity



Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
A	20:58 – 21:05	CPR Freight (Westbound)	0.05



Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
B	20:58 – 21:05	CPR Freight (Westbound)	0.07



Location	Time	Pass-by's	Max. Vibration Velocity (mm/s)
C	20:58 – 21:05	CPR Freight (Westbound)	0.04