Railway Vibration Study

Hurontario Street & Highway 410

Proposed Mixed-use Development

Town of Caledon

November 28, 2017
Project: 117-0183

Prepared for

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VALCOUSTICS

Canada Ltd.

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EXECUTIVE SUMMARY

Valcoustics Canada Ltd. (VCL) was retained to prepare a Railway Vibration Study as part of the Draft Plan application to the Town of Caledon for the proposed mixed-use development. The development will consist of 198 two-storey detached dwellings (Lots 1 to 198), 312 three-storey townhouse dwellings (Blocks 199 to 251), a commercial block, transit hub, storm water management facilities and wood lots.

The source of vibration from the environment with the potential to impact the project is rail traffic on the Orangeville Brampton Railway (OBRY) to the west of the site.

The on-site measured ground-borne vibration velocity magnitudes due to railway train pass-bys were below the vibration limits recommenced by the Federation of Canadian Municipalities (FCM) and the Railway Association of Canada (RAC) [1]. Therefore, vibration mitigation for buildings on this site is not required.

1.0 INTRODUCTION

This purpose of this study is to address the vibration impact on the subject site due to train pass-bys on the OBRY directly west of the site. Measurements of rail-induced ground-borne vibration were done to determine whether vibration isolation measures for the proposed development would be required.

1.1 DEVELOPMENT LOCATION AND SURROUNDING AREA

The proposed development is located to the west of the junction of Hurontario Street and Highway 410 in the Town of Caledon. The site is bounded by:

- future employment lands, with the Brampton Christian School beyond, to the north;
- Hurontario Street, with Highway 410 and existing single family residential dwellings beyond, to the east;

- existing single family residential dwellings to the south; and
- the existing OBRY and future proposed residential development to the west.

Figure 1 shows the Key Plan.

The assessment is based on the Draft Plan of Subdivision, prepared by Glen Schnarr & Associates Inc., dated September 12, 2017. Figure 2 shows the Draft Plan of Subdivision in reduced form.

1.2 THE PROPOSED DEVELOPMENT

The proposed site will consist of:

- 198 two-storey detached dwellings (Lots 1 to 198);
- 39 three-storey townhouse units (Blocks 199 to 206);
- 255 three-storey rear lane townhouse units (Blocks 207 to 248); and
- 18 three storey back to back townhouse units (Blocks 249 to 251).

The site is bisected with the future major arterial roadway Spine Road (Street A) and there will be a commercial block, a transit hub and an institutional block at the east end of the site. In addition, there will be a storm water management pond towards the south of the site and existing Woodlots/Wetlands & Buffers along the west side of the site that are to remain. The OBRY passes directly west of the southern portion of the site.

2.0 ENVIRONMENTAL VIBRATION IMPACT ON THE PROJECT

2.1 RAIL LINE

The OBRY railway is located directly west of the southern portion of the proposed development, approximately 69 m from the nearest proposed dwelling. The OBRY accommodates freight train movements only and services industries in the area.

2.2 VIBRATION GUIDELINES

At the present time there are no vibration guidelines in the land use approvals process in Ontario. In fact, there are no universally agreed on vibration criteria in general.

In lieu of any specific requirements from OBRY, the FCM/RAC guidelines [Reference 1] have been used in this assessment, as is typical.

2.2.1 FCM/RAC Guideline**s**

In May 2013, the FCM/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 RMS (using a 1 second averaging time) between 4 Hz and 200 Hz. [Reference 1]

2.3 VIBRATION MEASUREMENT

2.3.1 Measurement Locations

Figure 2 shows the two (2) vibration measurement locations used in this assessment.

- Location 1 - approximately 15 m east of the ROW; and
- Location 2 - approximately 30 m east of the ROW.

Note, the two monitoring locations are closer to the rail line than any of the proposed dwellings in the subject development. These locations were used as it was not possible to access farther into the site.

2.3.2 Transducer Placement

Geophones were used at each location to measure the vibration velocity. At each location, the geophone was placed approximately 200 mm below grade. The transducers were anchored using ground spikes and a gravel bag on top.

2.3.3 Data Acquisition

It is understood, via communications with OBRY, that there are typically train movements on this line two days a week, Tuesdays and Fridays. Thus, to measure an appropriate number of train pass-bys, continuous unattended vibration monitoring was done at the two measurement locations between Tuesday May 16 and Friday May 23, 2017.

The vertical axis signal from each of the geophones was recorded digitally at each location, using a MetricPro Model MPV3C21vibration data acquisition and analysis system.

At each location the vibration data acquisition system recorded the ground borne vibration continuously throughout the monitoring period. The system was set to monitor using a sample rate of 1024 samples per second.

A video camera was set up at Location 1 and used to determine the number of locomotives and rail cars for each train pass-by.

2.3.4 Data Analysis

Time histories of the measured overall vibration velocity (using a one-second RMS) of each train pass-by were plotted and compared to the vibration criterion. The analysis procedure conforms to the guidelines recommended by FCM/RAC.

2.3.5 Results

During the measurement period, a total of six train pass-bys were measured at Location 1 and 4 pass-bys were measured at Location 2.

Table 1 summarizes the maximum overall vibration velocity magnitudes (one second RMS) due to the train pass-bys at each location.

At Location 1, the maximum measured overall ground-borne vibration velocity was 0.10 mm/s. At Location 2, the maximum measured overall ground-borne vibration velocity was 0.07 mm/s.

At both locations, the measured overall ground-borne vibration velocities were less than the guideline limit of 0.14 mm/s for all train pass-bys. Thus, since the measured vibration at the monitoring locations was less than the criterion limit, the expected vibration velocity magnitudes at the locations representing the closest proposed dwellings to the rail line would also be less than the criterion limit, due to greater distance separation.

Appendix A shows the time histories of the vibration velocity for each train pass-by at each location in terms of one second RMS.

2.3.6 Mitigation

Based on the measured vibration velocities, vibration isolation measures are not required for any dwelling on this site.

3.0 CONCLUSION

The ground-borne vibration velocity magnitudes due to railway trains on the OBRY, measured at 15 m and 30 m to the railway right-of-way are below the criterion suggested by FCM/RAC. Therefore, vibration mitigation measures are not required for this development.

The vibration assessment should be reviewed if the Development Concept Plan is updated, especially if buildings are proposed within 15 m of the OBRY ROW.

4.0 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 ON-SITE MAXIMUM VIBRATION

Pass-by #	Train Details					Maximum Vibration Velocity (mm/s)[1]	
	Date	Time	# of Locomotives	# of Cars	Direction	Location 1	Location 2
1	May 16, 2017	19:40	1	6	Southbound	0.09	0.06
2	May 16, 2017	12:33	1	1	Northbound	0.09	0.06
3	May 19, 2017	09:54	1	5	Southbound	0.04	0.03
4	May 19, 2017	13:14	1	4	Northbound	0.10	0.07
5	May 23, 2017	13:40	1	2	Southbound	0.09	-[2]
6	May 23, 2017	14:38	1	5	Northbound	0.05	-[2]

Notes:

(1) Maximum RMS (one second averaging) vibration. See Appendix A for time history plots of vibration velocity.
(2) Vibration data not available.

No.	Revision/Issue	Date

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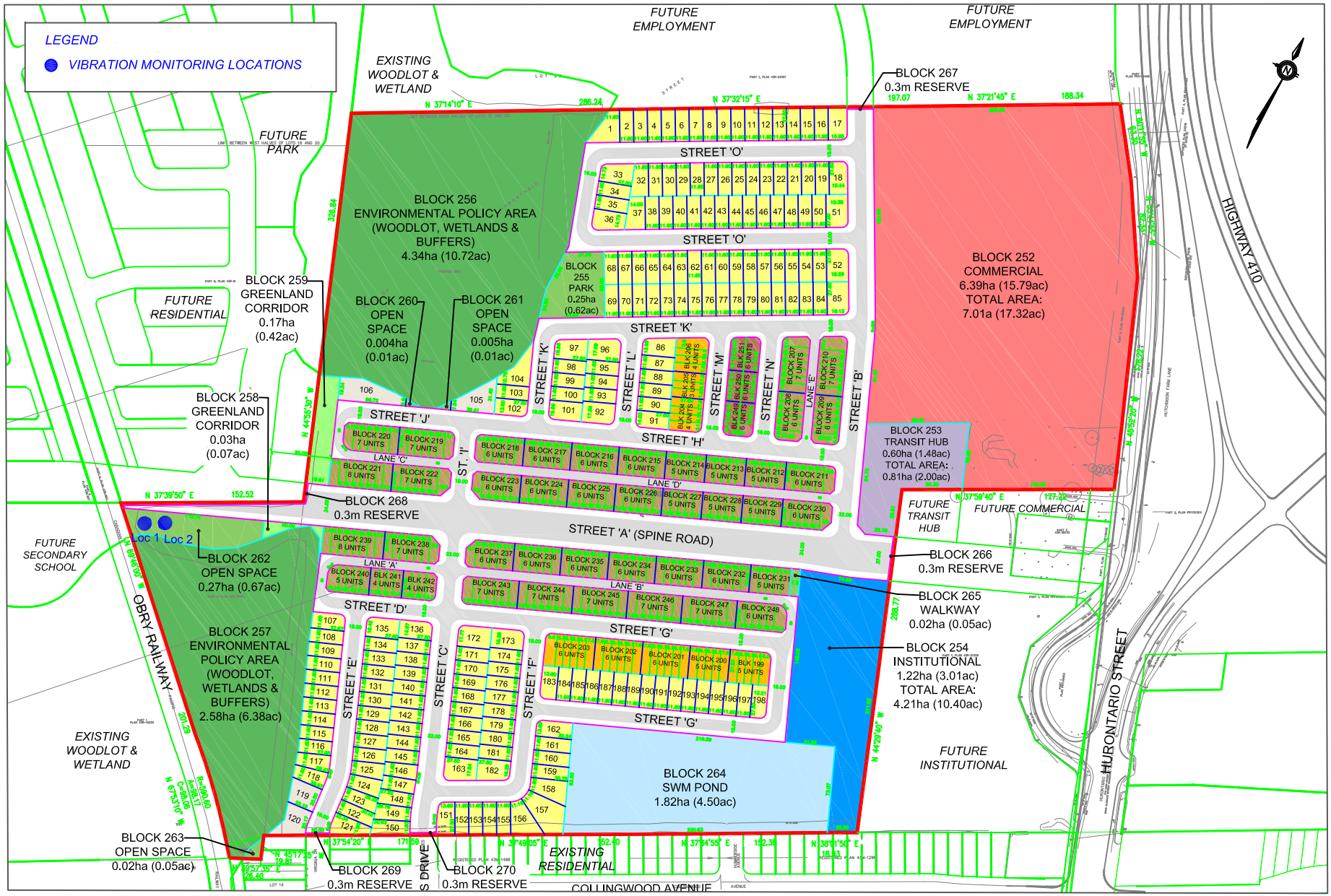
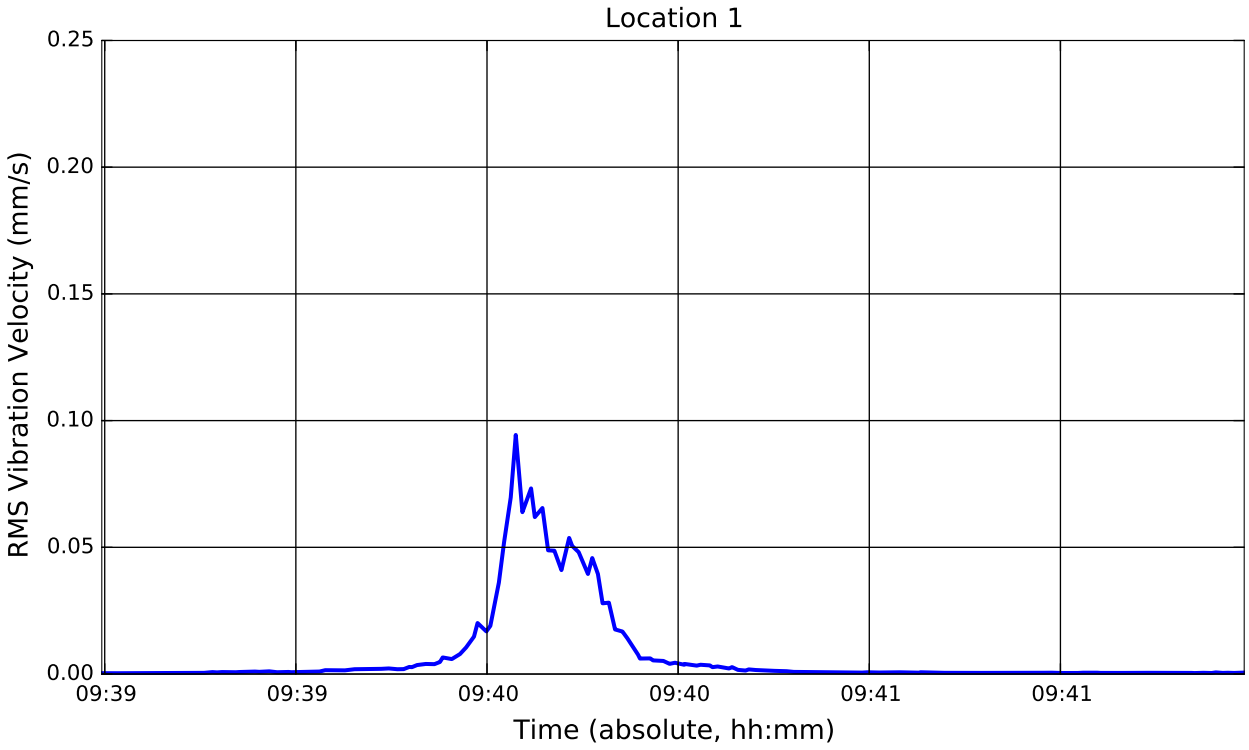
Title	Project No.	Date
Key Plan	117-0183	Nov 20, 2017
Project Name	**Scale**	**Figure**
Hurontario Street and Highway 410, Caledon	N.T.S.	1

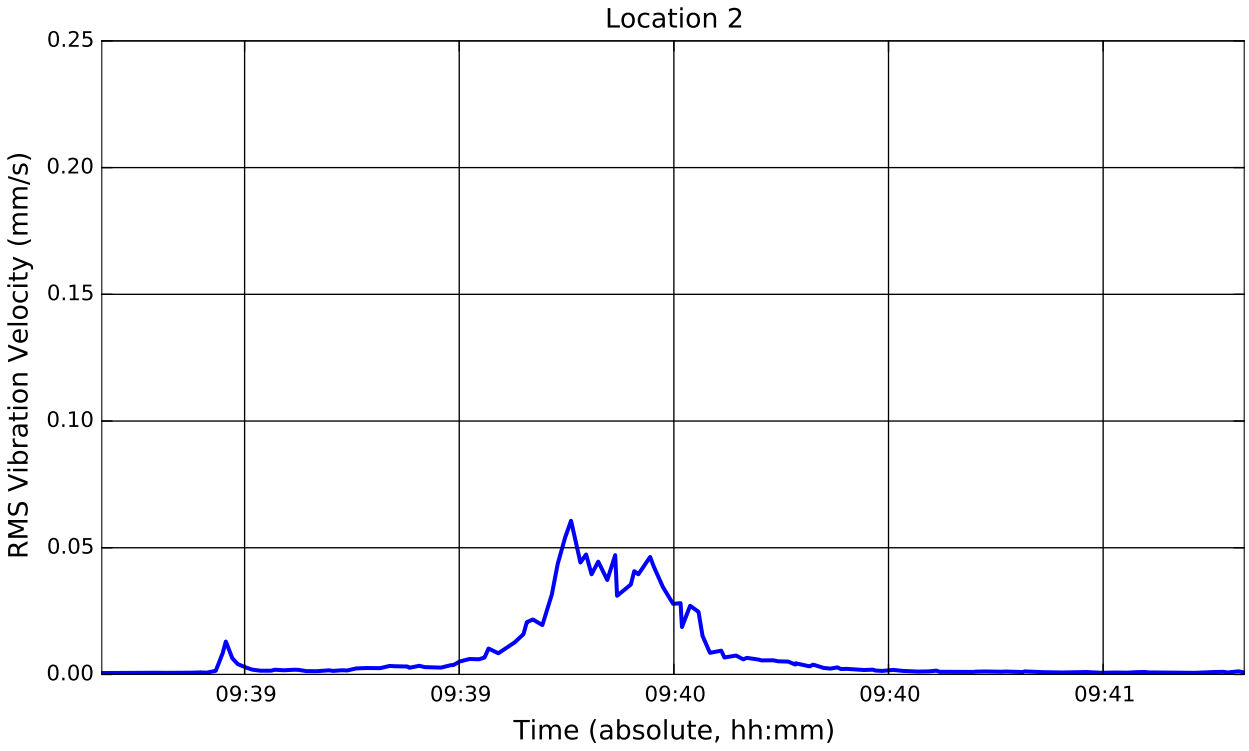


VALCOUSTICS Canada Ltd.	Title: Draft Plan of Subdivision	Date: 2017-11-20	Figure: 2
	Project Name: Hurontario Street and Highway 410, Caledon	Project No.: 117-0183	

APPENDIX A

VIBRATION VELOCITY TIME HISTORIES





	Title	Measurement Date	Figure
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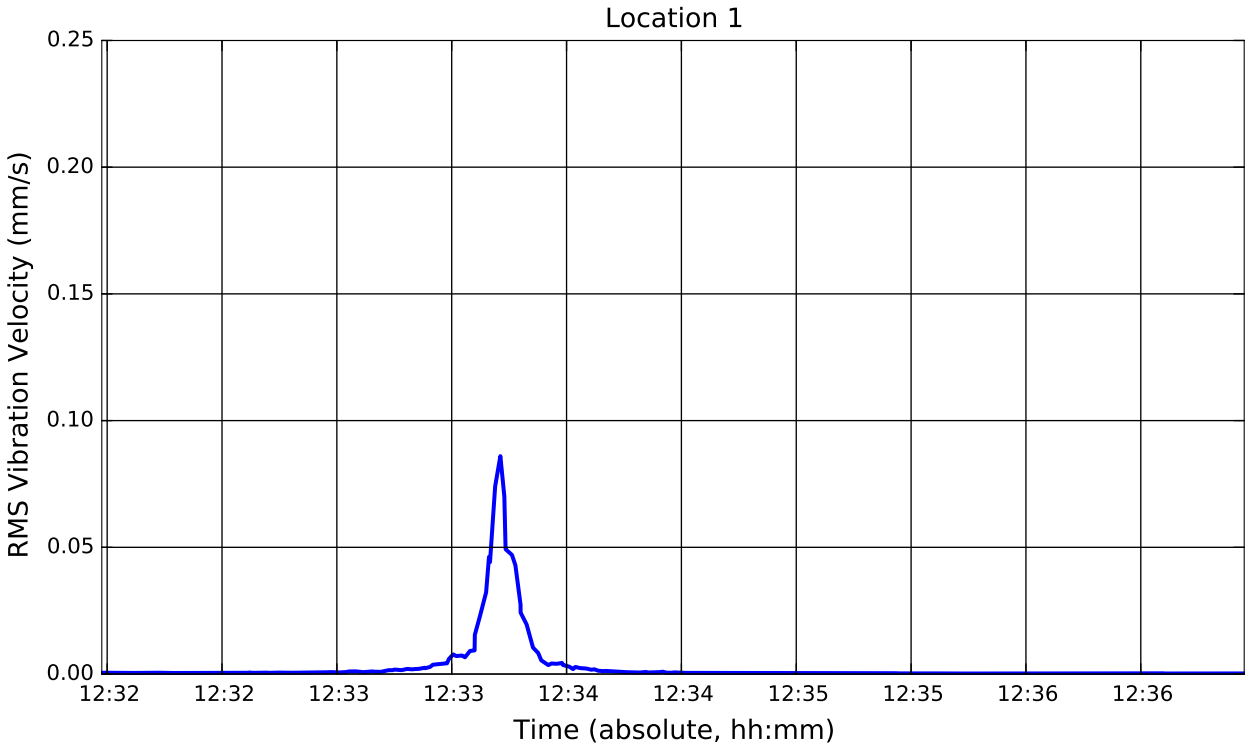
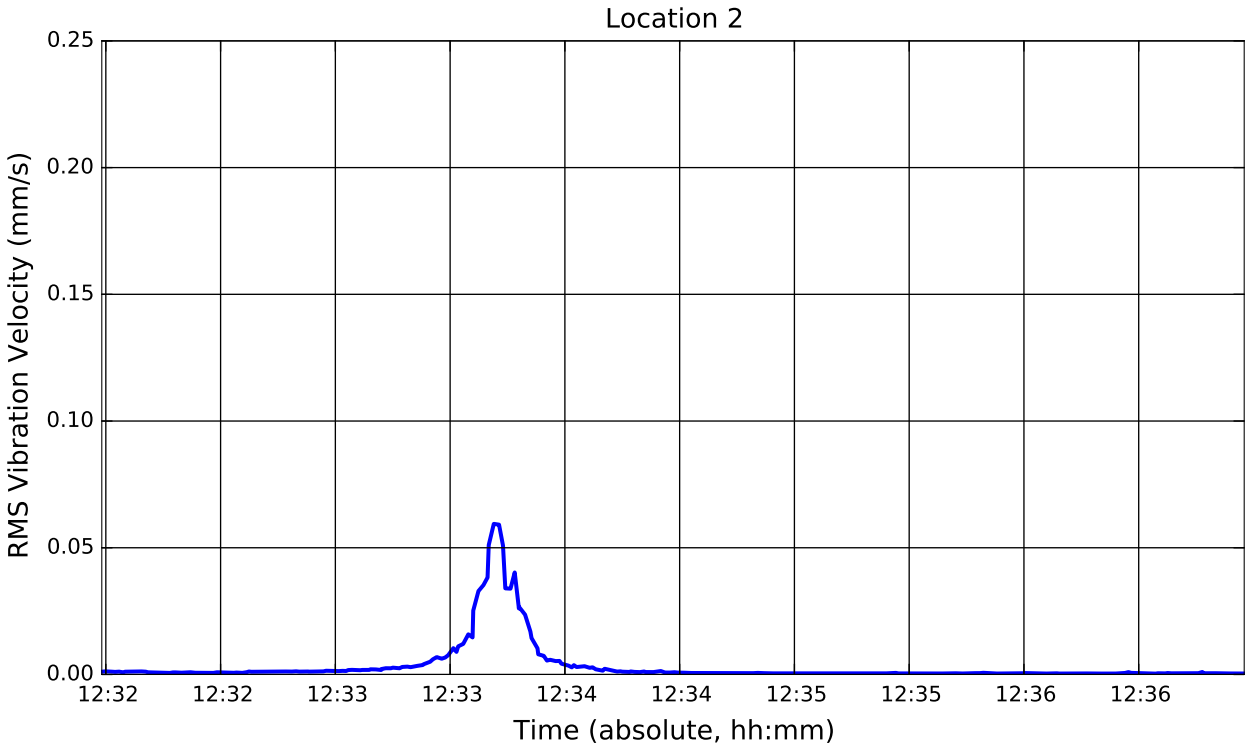
	Project Name	Project Num.	
	Hurontario Street and Highway 410	117-0183	





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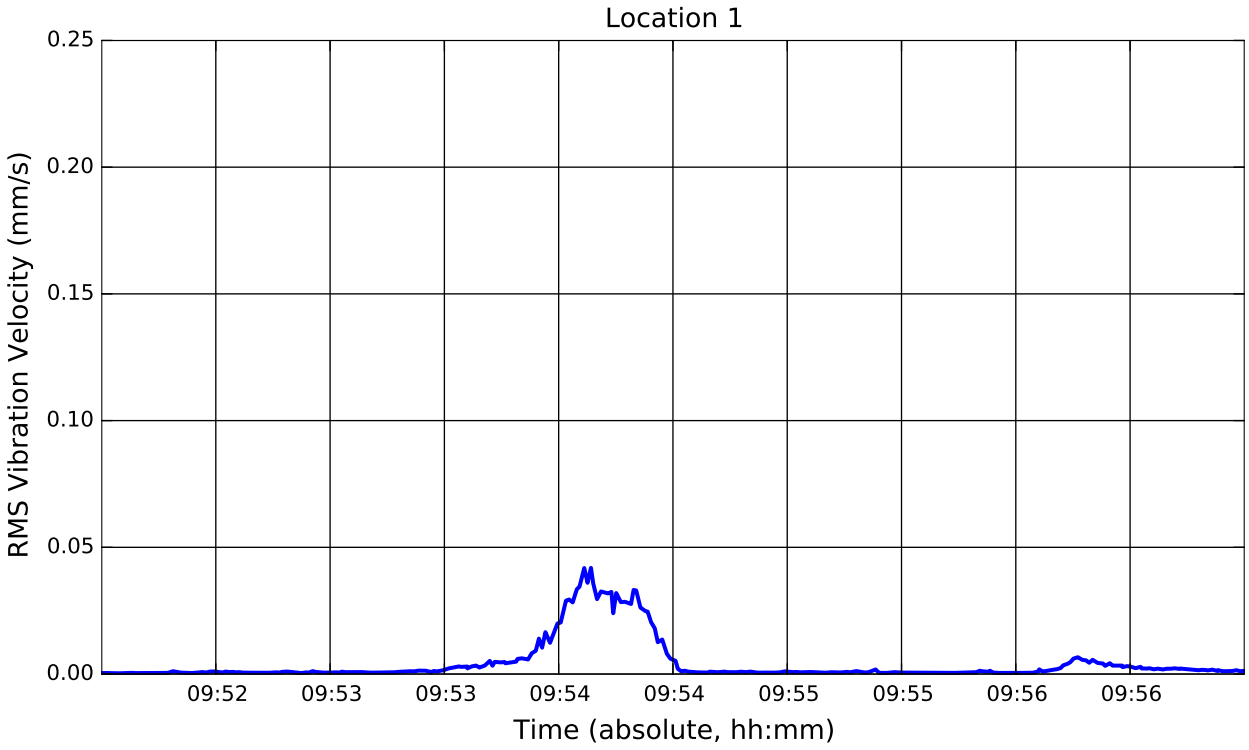
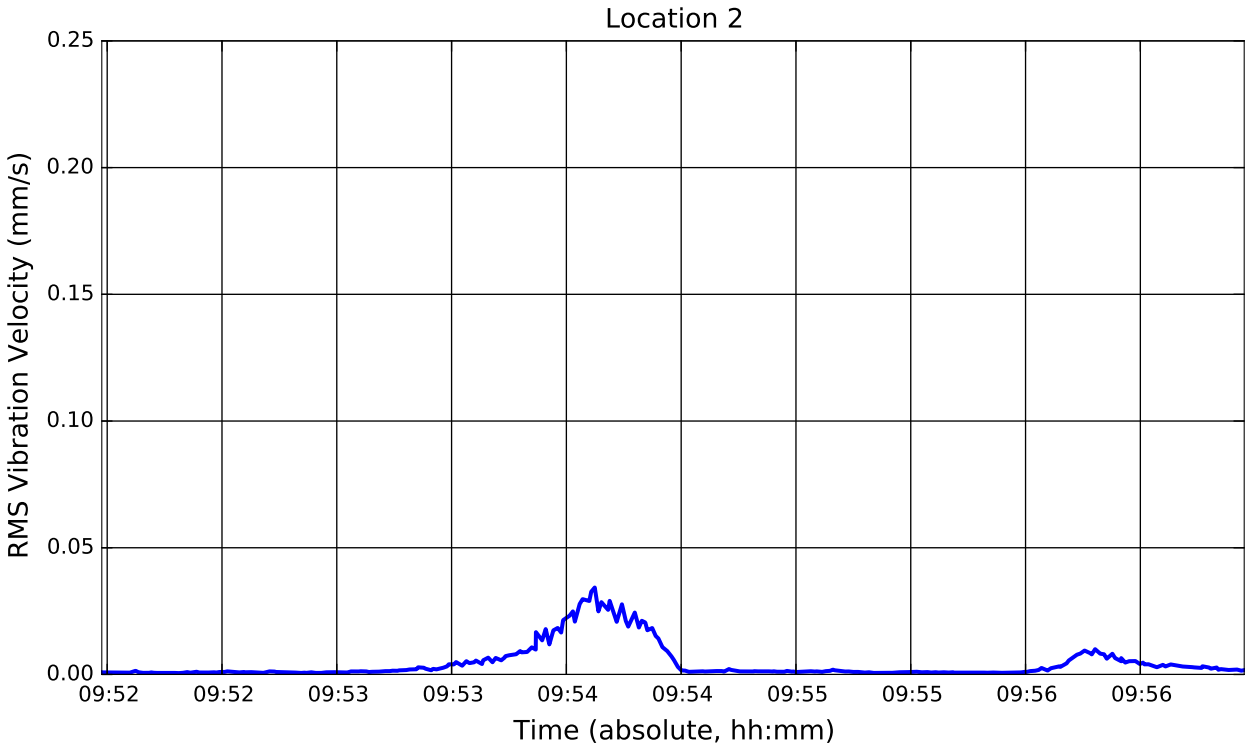
	Project Name Hurontario Street and Highway 410	Project Num. 117-0183	





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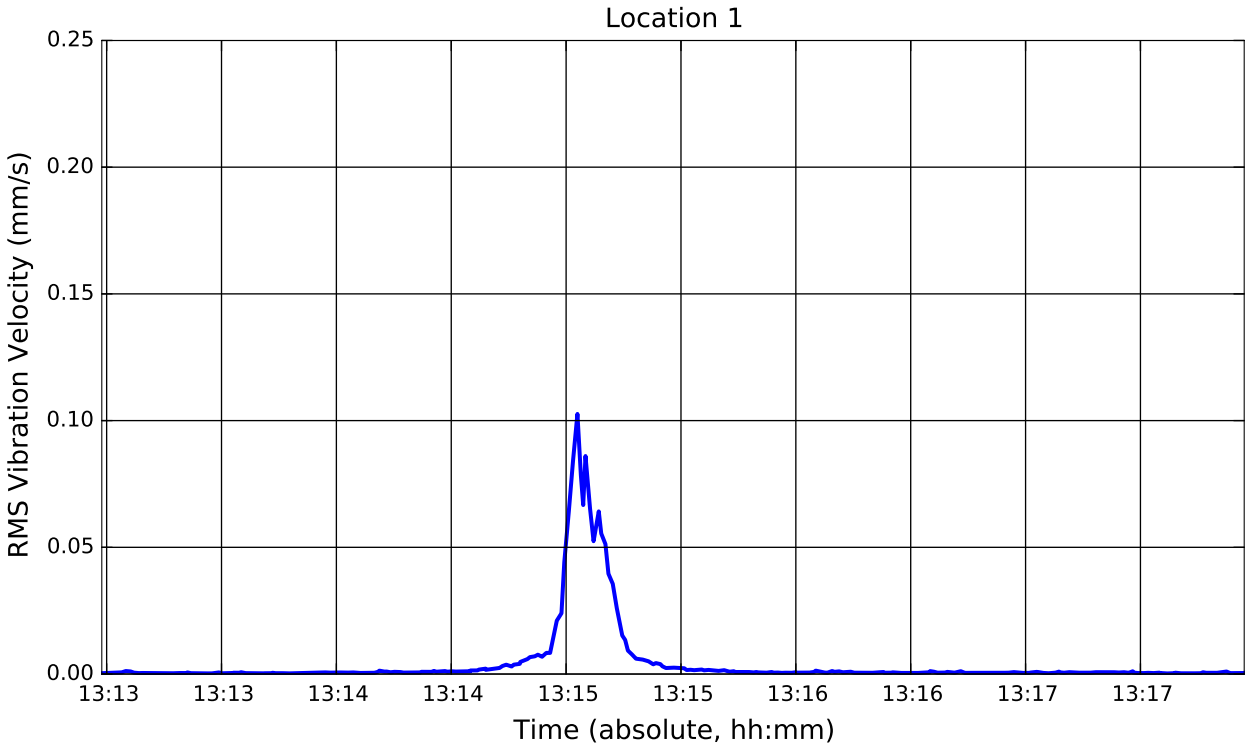

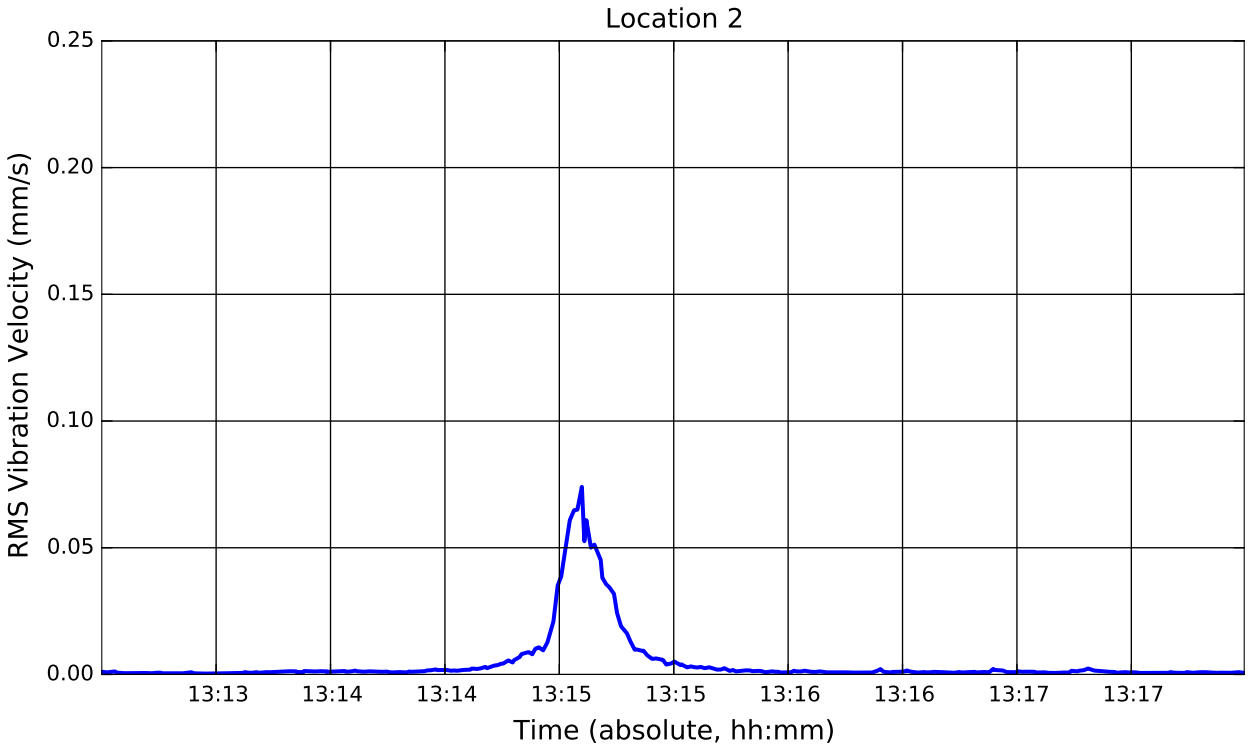

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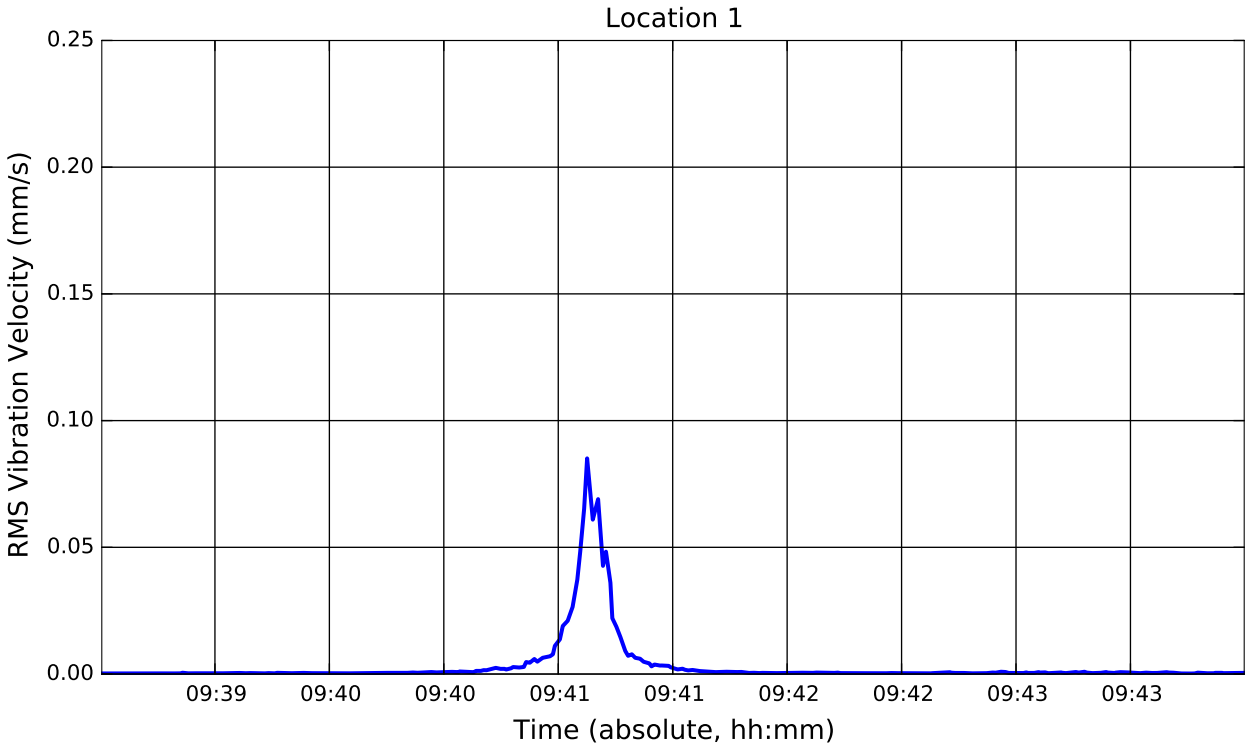
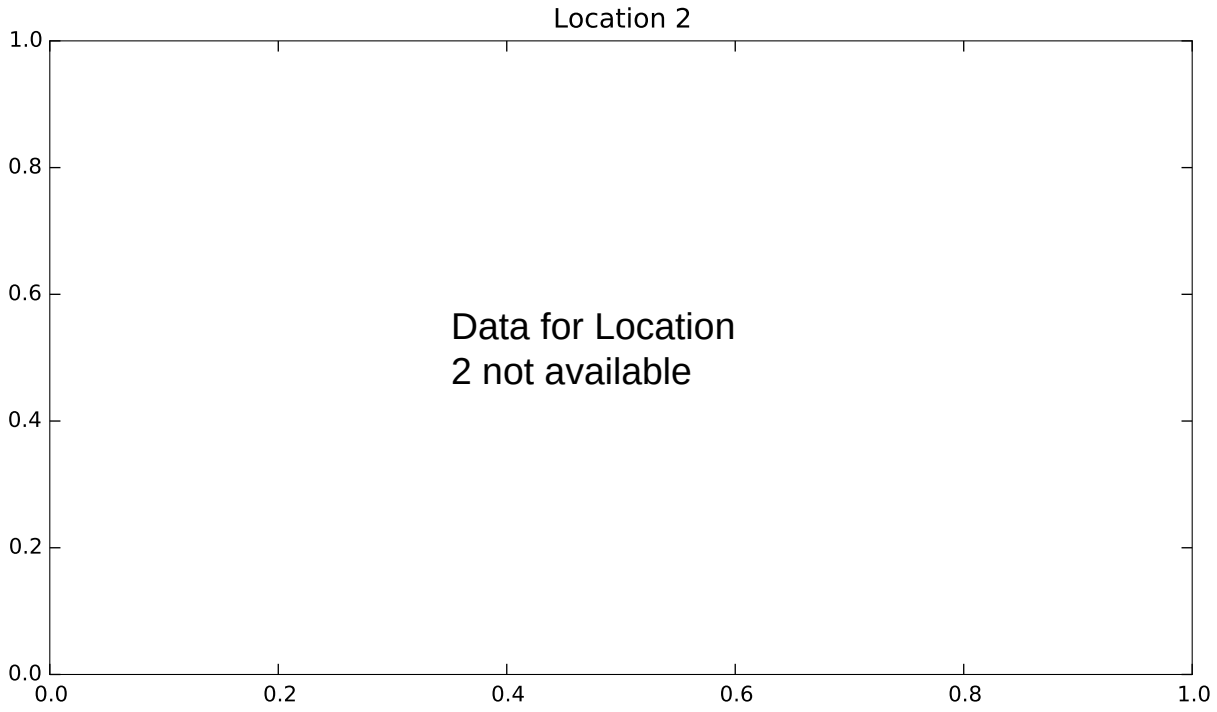
	Project Name	Project Num.	
	Hurontario Street and Highway 410	117-0183	





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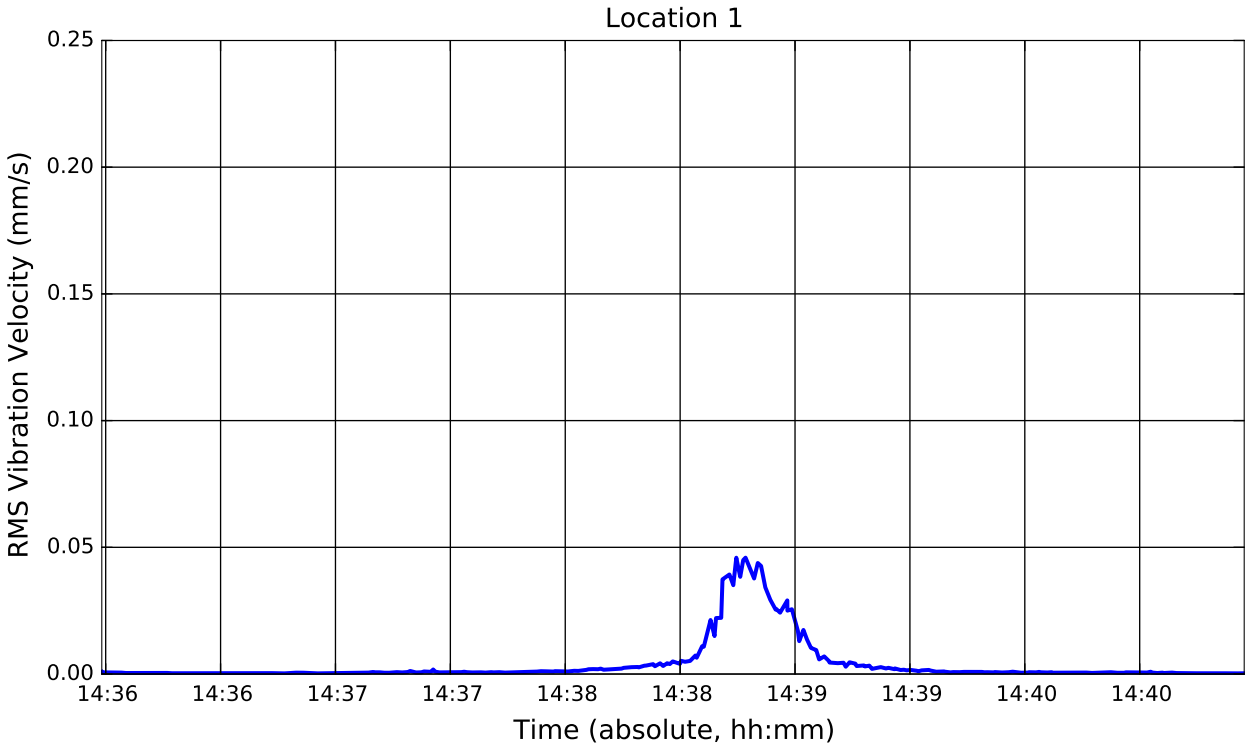

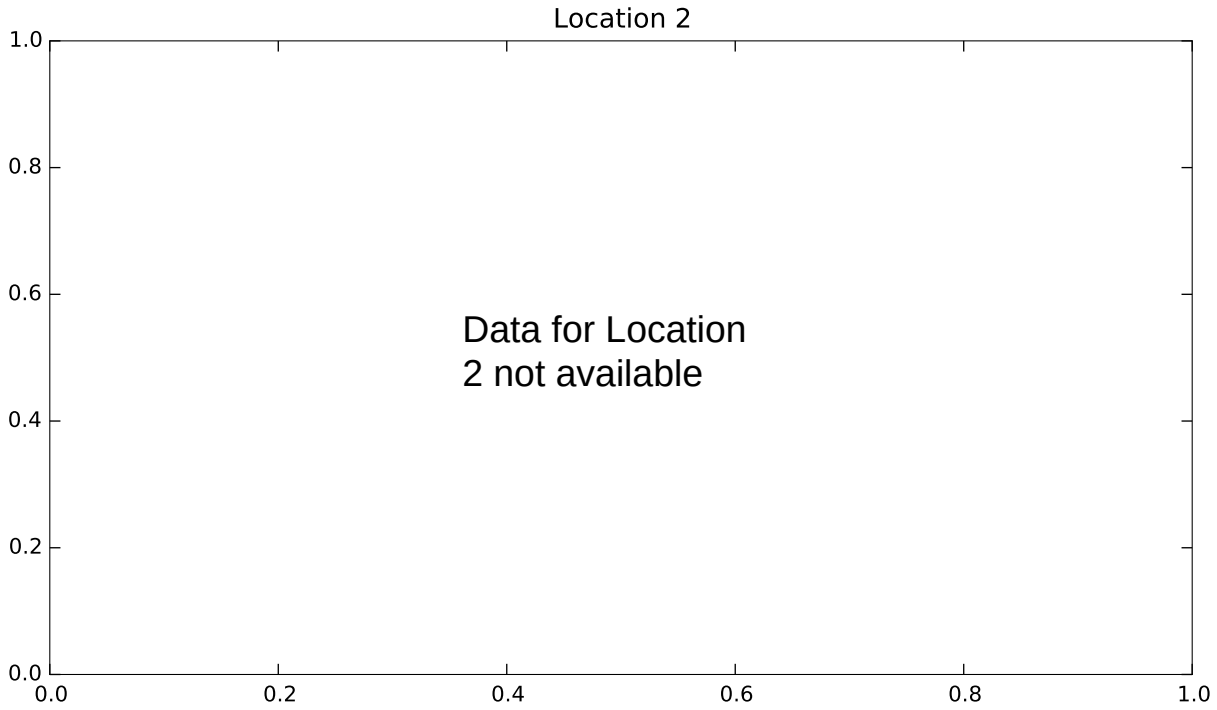

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