Railway Vibration Study Update

69 & 117 John Street

Proposed Residential Development

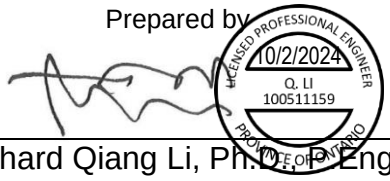
City of Mississauga

October 2, 2024
Project: 122-0393

Prepared for

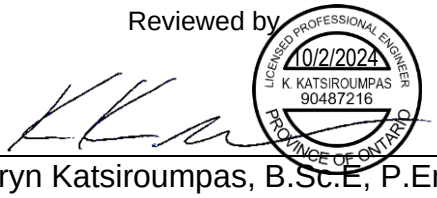
13545130 Canada Inc.

Prepared by



Richard Qiang Li, Ph.D., P.Eng.

Reviewed by



Kathryn Katsiroumpas, B.Sc.E, P.Eng.

VALCOUSTICS
Canada Ltd.

Version History

Version #	Date	Comments
1.0	April 19, 2024	Final – Issued to Client
2.0	October 2, 2024	Final – Issued to Client

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City of Mississauga

EXECUTIVE SUMMARY

Valcoustics Canada Ltd. (VCL) previously prepared a Railway Vibration Study dated April 19, 2024 for the proposed residential development to support the Official Plan Amendment (OPA) / Zoning By law Amendment (ZBA) application submission to the City of Mississauga. This Update has been prepared to address revisions to the architectural drawings.

The project will consist of three (3) towers that are 31, 30 and 20 storeys in height. A twelve (12) storey podium with two (2) levels of underground parking will be used to connect the towers.

The significant source of ground-borne vibration with potential for impact at the proposed development is rail traffic on Canadian Pacific Railway (CPR) Galt Subdivision and GO Transit Milton Line. Measurements of ground-borne vibration were done on site near the rail line. The rail traffic induced vibration velocity magnitudes are predicted to exceed the applicable vibration guideline limits at the proposed residential buildings.

Vibration mitigation measures are required for the proposed development.

1.0 INTRODUCTION

VCL previously prepared a Railway Vibration Study dated April 19, 2024 for the proposed residential development to support the OPA and ZBA application submission to the City of Mississauga. This Update has been prepared to address revisions to the architectural drawings.

The ground-borne vibration on site due to the train pass-bys was measured and compared with the vibration guidelines to determine the need for mitigation. The results are outlined herein.

1.1 THE SITE AND THE SURROUNDING AREA

The proposed development is located at 69 & 117 John Street in the City of Mississauga. The site is bounded by:

- CPR Galt Subdivision and GO Transit Milton Line, with existing residential dwellings beyond, to the north;
- Existing residential dwellings to the east;

- John Street, with existing residential dwelling beyond, to the south; and
- Existing storage facility, with existing commercial plaza and Hurontario Street beyond, to the west.

A Key Plan is included as Figure 1

1.2 THE PROPOSED DEVELOPMENT

The Project will consist of three (3) towers that are 31, 30 and 20 storeys in height, for Buildings A, B and C, respectively. A twelve (12) storey podium with two (2) levels of underground parking will be used to connect the towers. The underground parking structure extends beyond the footprint of the podium, towards the rail ROW.

This report is based on the architectural drawings prepared by Tregebov Cogan Architect, latest revised September 11, 2024 ("For Coordination"). The relevant plans from the drawings are included in Appendix A.

1.3 SOURCES OF VIBRATION

The anticipated vibration source with potential to impact the development is the rail traffic on the CPR Galt Subdivision and GO Transit Milton Line.

Ground-borne vibration due to vehicular movements on surrounding roadways is not expected to create significant impact on the proposed development and thus, has not been considered further in the analysis. There are no other sources of vibration in the vicinity of the site.

2.0 VIBRATION GUIDELINES

The Federation of Canadian Municipalities and the Railway Association of Canada jointly developed "Guidelines for New Development in Proximity to Railway Operations", dated May 2013 (herein referred to as the FCM/RAC guidelines). For residential developments, the FCM/RAC Guideline recommends a maximum vibration threshold of 0.14 mm/s root mean square (RMS, using a 1 second averaging time) between 4 Hz and 200 Hz (Reference 1).

Vibration mitigation is needed when the threshold is exceeded.

3.0 METHOD

3.1 MEASUREMENT LOCATIONS

Railway induced ground-borne vibration was measured at four (4) locations. Figure 2 shows the measurement locations on aerial photography from Google Maps, overlaid with the Site Plan and P2 (Parking) Floor Plan.

Locations A and C are located along the north property line on the rail right of way (ROW). Locations B and D are located approximately 30 m from the north property line (rail ROW), corresponding to the proposed above-grade building facades closest to the railway. However, the foundation for the underground parking structure will be located 18 m from the rail ROW.

Locations A and B were approximately 20 m east from the west property line of the site. Locations C and D were approximately 30 m west from the east property line.

3.2 TRANSDUCER PLACEMENT

Geophones were used to measure the vibration velocity produced by the train pass-bys. At each location, the geophone was placed into a small hole dug into the ground, approximately 50 mm below grade. The geophones were resting on compacted soil and were securely anchored with metal ground spikes.

3.3 DATA ACQUISITION

A total of six (6) train pass-bys, including two (2) CPR freight trains and four (4) GO trains, were monitored on November 23, 2022. Detailed information for the trains is summarized in Table 1.

The vibration signals were recorded simultaneously at all four locations for each train pass-by. The vertical axis signal from each geophone was recorded digitally, using a MetricPro Model MPV3C21 vibration data acquisition and analysis system at each location. The monitors recorded vibration velocity, in mm/s.

At each location the vibration data acquisition system recorded the ground-borne vibration continuously throughout the monitoring period. The system was set to record vibration at a sampling rate of 1000 samples per second.

TABLE 1: SUMMARY OF TRAIN PASS-BYS MEASURED ON 2022-11-23

Pass-by #	Time/Period	Train Type	Direction	# of Locomotives	# of Cars	Maximum Vibration Velocity(1) (mm/s) at each Location (2)			
						A	B	C	D
1	14:39 – 14:43	Freight	Westbound	2	98	0.88	NA (3)	0.55	0.06
2	16:08	GO	Westbound	1	12	0.32	0.02	0.15	0.02
3	16:53	GO	Westbound	1	12	0.28	0.02	0.15	0.02
4	17:39	GO	Westbound	1	12	0.20	0.01	0.16	0.02
5	17:47 – 17:50	Freight	Eastbound	2	127	1.08	0.10	0.68	0.07
6	17:52	GO	Westbound	1	12	0.31	0.02	0.17	0.02

Notes:

(1) Maximum overall vibration velocity occurring for the entire pass-by, one second RMS averaging.

(2) See Figure 2.

(3) The first train had already passed by the site before the vibration monitor was installed at this location.

3.4 DATA ANALYSIS

Time histories of the vibration velocity produced by each train pass-by were plotted using an RMS (root-mean-square) averaging routine with a time constant of one second. The analysis procedure conforms with the FCM/RAC guidelines.

4.0 RESULTS

Table 1 also summarizes the maximum measured overall vibration velocity (1-second RMS) for each of the train pass-bys measured at each location.

Appendix B contains recorded time histories for each railway train pass-by measured at each location.

The maximum overall vibration velocity magnitudes were:

- Location A: 1.08 mm/s;
- Location B: 0.10 mm/s.
- Location C: 0.68 mm/s; and
- Location D: 0.07 mm/s.

As indicated on the site plan, the northerly edge of the underground parking structure, is located approximately 18 m south of Locations A/C and 12 m north of Locations B/D. To be conservative, ground borne vibration between Locations A/C and Locations B/D can be assumed to decay linearly. Thus, the maximum railway vibration at the north edge of the podium foundation is predicted to be 0.31 to 0.49 mm/s.

The measured maximum vibration velocity magnitudes, due to the rail movements of the freight and GO trains, are within the 0.14 mm/s FCM/RAC Guideline limit for residential uses at the closest residential unit facade.

However, the predicted vibration magnitude (0.31 to 0.49 mm/s) at the closest edge of the underground parking structure exceeds the residential guideline limit of 0.14 mm/s. Given that the underground parking structure is structurally connected to the residential portions of the building, it is expected that the guideline limit for residential uses would be exceeded at the closest residential facade once the building is constructed, if mitigation is not provided. Thus, vibration mitigation is required for the proposed development.

5.0 MITIGATION MEASURES

Since the maximum vibration velocities are expected to exceed the FCM/RAC Guideline limit, vibration mitigation will be required for the residential portions of the proposed development. The vibration mitigation measures should be developed during the detailed design of the buildings. It is premature to develop the vibration mitigation design at this stage when the detailed design of the buildings has not been completed. However, mitigation options that could be implemented include perimeter and/or footing isolation of the underground parking structure; acoustic isolation joints between the residential portion of the building and part of the underground parking structure; increased setback to the underground structure; or a combination of these and other vibration isolation strategies.

6.0 CONCLUSIONS

Based on the on-site rail vibration measurements, the predicted ground-borne vibration velocity magnitudes at the proposed development, due to railway traffic on the CPR Galt Subdivision and GO Transit Milton Line, exceed the FCM/RAC Guideline residential vibration limits. Therefore, vibration mitigation measures are required for this development and should be developed as part of the detailed design.

7.0 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.

RL\KK\\tk\sk
69 & 117 John Street, Mississauga_Vibration v2_0 Fnl - Update

VALCOUSTICS Canada Ltd.
consulting acoustical engineers

Title: **Key Plan**		Date: **Sept. 30, 2024**	Figure: **1**
Project Name: **69 & 117 John St, Mississauga**		Project No.: **1220393.000**	

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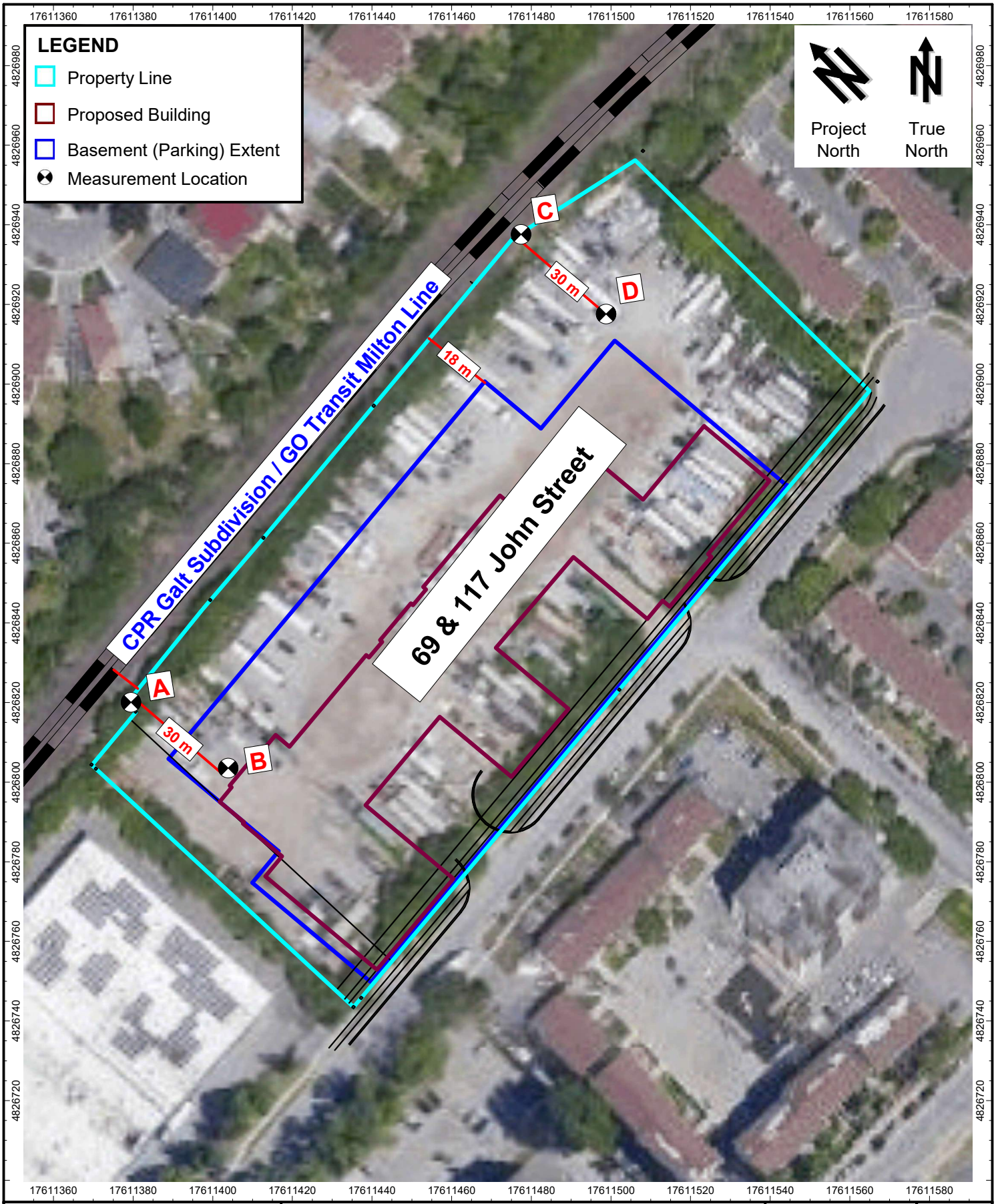
Date Plotted: 02.10.24



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consulting acoustical engineers

Title
Railway Vibration Measurement Locations

Measurement Date
Nov. 23, 2022

Figure
2

Project Name
69 & 117 John St, Mississauga

Project No.
1220393.000

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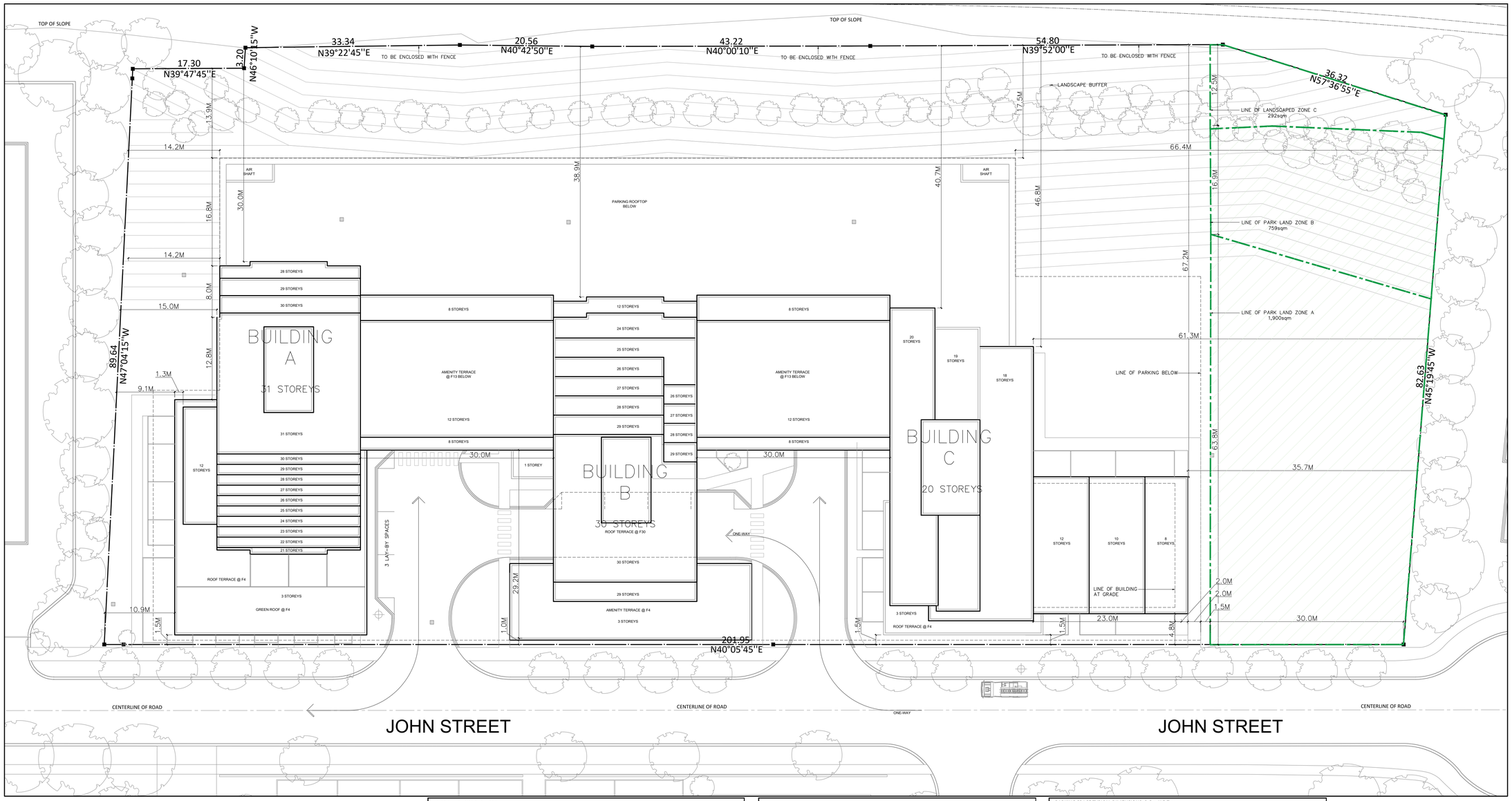
APPENDIX A

ARCHITECTURAL PLANS



3 SITE PLAN

Scale: 1:300

2 CONTEXT PLAN

Scale: 1:5000

LEGAL DESCRIPTION

PART OF LOT 15 CONCESSION 1. NORTH OF DUNDAS STREET
(GEOGRAPHIC TOWNSHIP OF TORONTO)

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

SITE DATA

LOT AREA	18,685 sq.m (1.87 hectare)
BUILDING AREA (GROUND FLOOR)	7,036 sq.m (38% of LOT AREA)
GROSS FLOOR AREA	100,379 sq.m
FLOOR SPACE INDEX (F.S.I)	5.37

FLOOR AREAS AND SUITES

TYPE	ARES (m²)				
COMMERCIAL	600				
	ARES (m²)	**1 BEDROOM**	**2 BEDROOM**	**3 BEDROOM**	**TOTAL UNITS**
PODIUM (F1-F12)	60,811	529	90	60	679
TOWER A	16,858	191	56	0	247
TOWER B	16,333	191	35	0	226
TOWER C	6,938	180	10	0	190
TOTAL	100,379	1,091	191	60	1,342

NOTES:
3.5% OF TOTAL UNITS DEDICATED TO RENTAL TENANCY AND *7%* OF TOTAL UNITS DEDICATED TO AFFORDABLE HOUSING
FLOOR AREAS REFLECT 1,000 sq.m FLOOR PLATES FOR TOWERS
FLOOR AREAS DO NOT EXCLUDE CIRCULATION SPACE

MIN. SUITE AREA	50 sq.m
AVERAGE AREA/SUITE (net)	63 sq.m
UNITS PER HECTARE (U.P.H)	717

LAND USE AT GRADE

PAVED AREA	2,130 sq.m	11%
LANDSCAPED AREA	6,860 sq.m	37%
PARK LAND	2,659 sq.m	14%
AREA OF BLDG. AT GRADE	7,036 sq.m	38%
	18,685 sq.m	**100%**

SETBACKS

PROVIDED

SOUTH SIDE (JOHN STREET)	VARIES 1.0 m – 30.2 m
WEST SIDE	VARIES 9.1 m – 15.0 m
NORTH SIDE (C.P.R RAILWAY)	VARIES 30.0 m – 67.2 m
EAST SIDE	VARIES 35.7 m – 66.4 m

BUILDING HEIGHTS

TOWER A HEIGHT TO TOP OF FLAT ROOF (TAKEN FROM ESTABLISHED GRADE LINE)	100 m
TOWER B HEIGHT TO TOP OF FLAT ROOF (TAKEN FROM ESTABLISHED GRADE LINE)	97 m
TOWER C HEIGHT TO TOP OF FLAT ROOF (TAKEN FROM ESTABLISHED GRADE LINE)	65 m

PARKING

REQUIRED

TYPE OF UNIT	NO. OF UNITS	PARKING RATIO	PARKING REQUIRED
1 BEDROOM	1,091	0.50	546
2 BEDROOM	191	0.50	95
3 BEDROOM	60	0.50	30
TOTAL RESIDENTIAL PARKING			**671**
VISITOR PARKING	1,342	0.11	148
TOTAL PARKING REQUIRED			**819**

PROVIDED

PARKING LEVEL	NEW RATIO PARKING SPACES
SURFACE	7
P+1 LEVEL	116
P+2 LEVEL	114
P1 LEVEL	282
P2 LEVEL	303
TOTAL	**822**

PARKING SPACE TYPICAL DIMENSIONS: 2.6 m X 5.7 m
BARRIER-FREE: 4.5 m X 5.7 m
DRIVEWAY: 7.00 m MIN. WIDTH

NOTES:
INCLUDES 18 BARRIER-FREE PARKING SPACES, 651 RESIDENTIAL SPACES AND 153 VISITOR SPACES
SURFACE LEVEL PARKING ARE SHORT-TERM VISITOR PARKING SPACES
PARKING RATIOS ARE BASED ON NEW REQUIREMENTS OF MISSISSAUGA CITY COUNCIL
INCLUDES 174 (20% OF REQ.) RESIDENTIAL EV SPACES AND 20 (10% OF REQ.) VISITOR EV SPACES

BICYCLE PARKING PROVIDED

SURFACE LEVEL	70 SPACES
BASEMENT LEVELS	807 SPACES
TOTAL ON SITE	**877 SPACES**

NOTES:
SURFACE LEVEL SPOTS ARE SHORT-TERM VISITOR SPACES

AMENITY SPACE

OUTDOOR REAR YARD (ON GRADE)	4,477 sq.m
PROVIDED SHARED OUTDOOR AMENITY (AT FLOORS 4 AND 13)	1,295 sq.m
INDOOR AMENITY (TOTAL OF FLOORS 4 AND 13)	1,531 sq.m
TOTAL	**7,303 sq.m**

NOTES:
OUTDOOR REAR YARD AMENITY SPACE EXCLUDES PRIVATE PATIOS AND RAILWAY BERM AREAS

LANDSCAPE AREAS

LANDSCAPE AREA (ON GRADE)	6,860 sq.m
OUTDOOR AMENITY (TOTAL OF FLOORS 4 AND 13)	1,531 sq.m
TOTAL	**8,391 sq.m**

NOTES:
OUTDOOR REAR YARD AMENITY SPACE EXCLUDES PRIVATE PATIOS AND RAILWAY BERM AREAS
DOES NOT INCLUDE ANY PART OF PARKLAND ZONES 'A' AND 'B'

1 STATISTICS

CONSULTANTS:

DATE	No.	ISSUE
2024-09-11	01	FOR COORDINATION

ARCHITECT:
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40 Saint Clair Avenue East, Suite 303
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OWNER:

PROJECT NAME:
69 & 117 JOHN ST.
MISSISSAUGA

DRAWING TITLE:
SITE STATISTICS, CONTEXT PLAN AND ROOF PLAN

PRINT DATE: 11-SEPT 2024

NORTH

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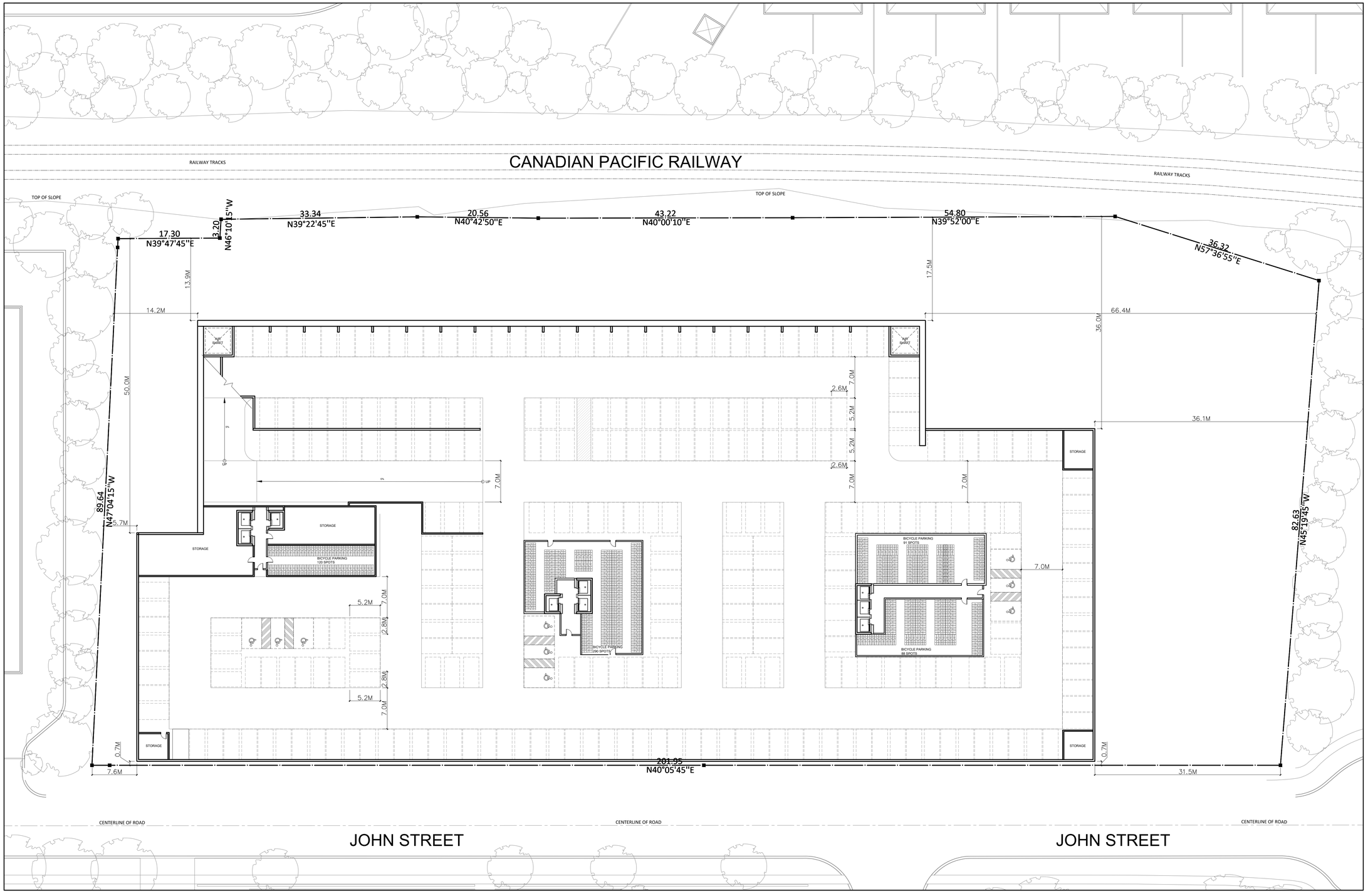

1 PARKING PLAN - P2

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CONSULTANTS:

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P2 PARKING PLAN

PRINT DATE: 11-SEPT 2024

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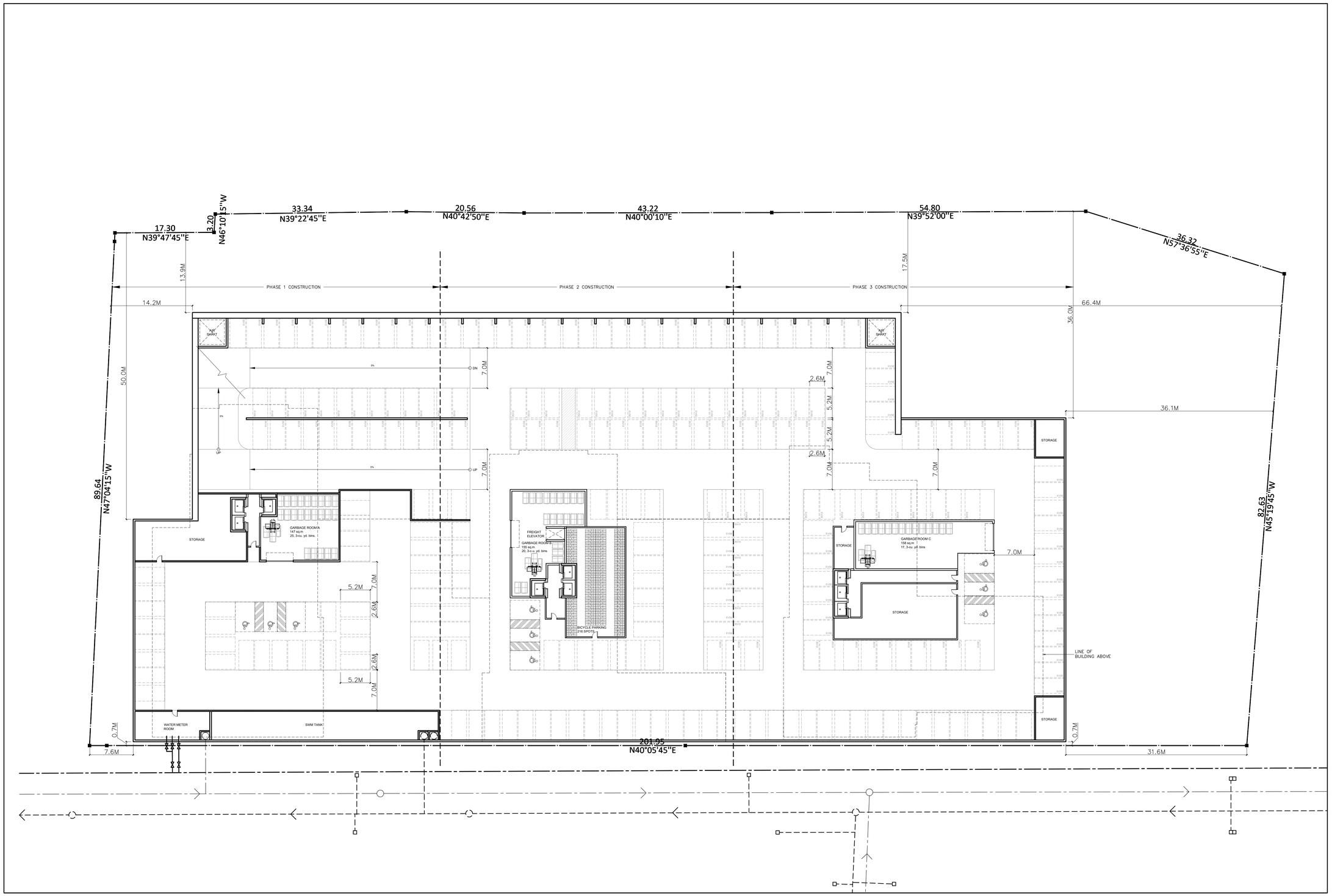

1 PARKING PLAN - P1

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DRAWING TITLE:

P1 - PARKING PLAN

PRINT DATE: 11-SEPT 2024

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PROJ. No.: 1101

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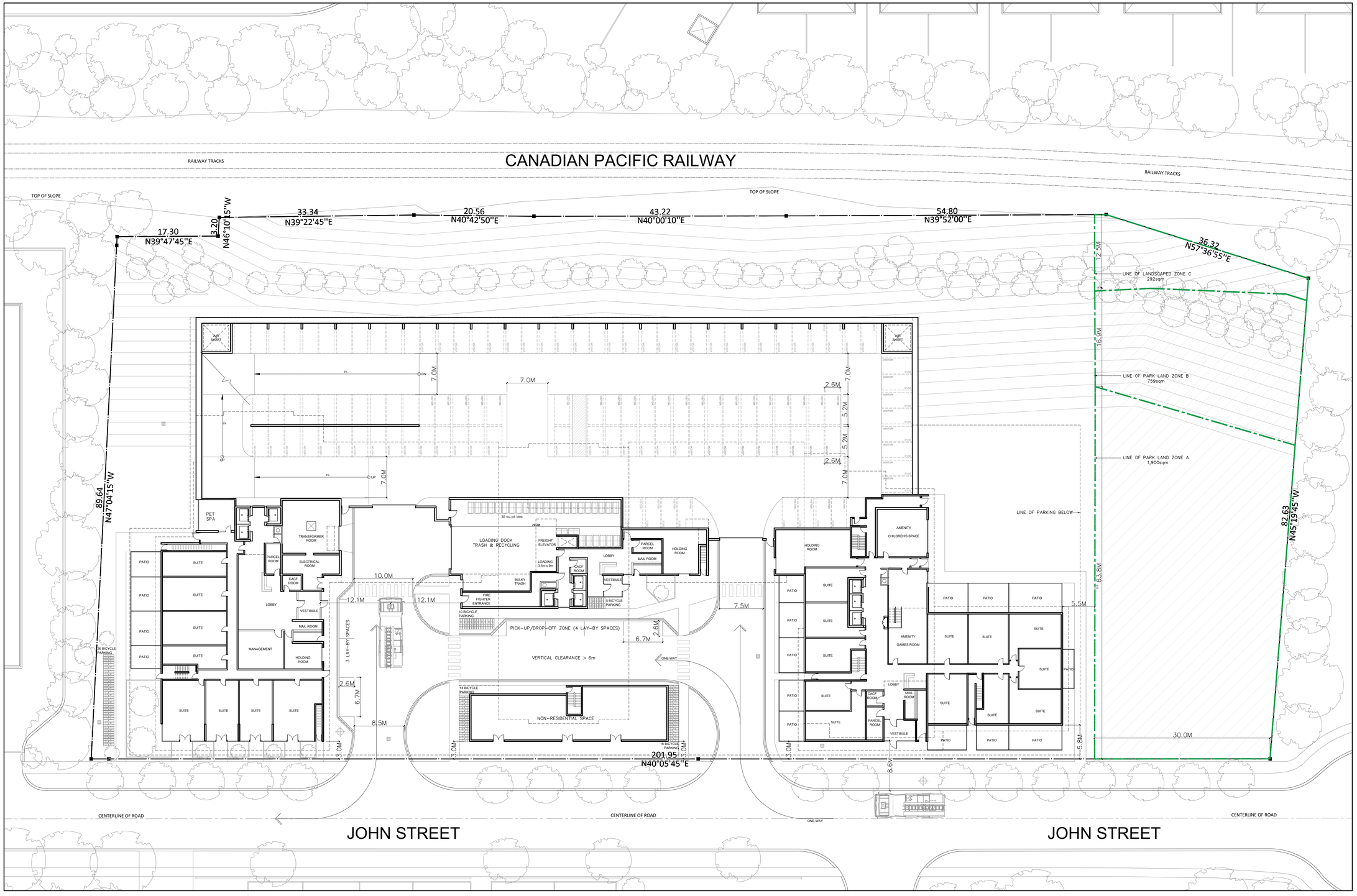

1 F1/SITE PLAN
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2024-09-11	01	FOR COORDINATION

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DRAWING TITLE:
F1/SITE PLAN

PRINT DATE: 11-SEPT 2024

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PROJ. No.: 1101

DEV APPLICATION NO:

SCALE: AS NOTED

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DWG NO. **A2.2**

CANADIAN PACIFIC RAILWAY

RAILWAY TRACKS

RAILWAY TRACKS

TOP OF SLOPE

TOP OF SLOPE

17.30
N39°47'45"E

3.20
N46°10'15"W

33.34
N39°22'45"E

20.56
N40°42'50"E

43.22
N40°00'10"E

54.80
N39°52'00"E

36.32
N57°36'55"E

89.64
N47°04'15"W

83.63
N45°19'45"W

201.95
N40°05'45"E

7.0M

2.6M

5.2M

10.0M

6.7M

7.5M

8.5M

3.0M

5.8M

PET SPA

TRANSFORMER ROOM

PARCEL ROOM

ELECTRICAL ROOM

CACF ROOM

LOBBY

VESTIBULE

MAIL ROOM

MANAGEMENT

HOLDING ROOM BELOW

PATIO

SUITE

25 BICYCLE PARKING

LOADING DOCK
TRASH & RECYCLING BELOW

BULKY TRASH

FIRE FIGHTER ENTRANCE

10 BICYCLE PARKING

5 BICYCLE PARKING

PARCEL ROOM

MAIL ROOM

HOLDING ROOM BELOW

PICK-UP/DROP-OFF ZONE (4 LAY-BY SPACES)

VERTICAL CLEARANCE > 6m

3 LAY-BY SPACES

ONE-WAY

13 BICYCLE PARKING

NON-RESIDENTIAL SPACE

16 BICYCLE PARKING

HOLDING ROOM BELOW

AMENITY
CHILDREN'S SPACE

AMENITY
UPPER LOFT
GAMES ROOM

LOBBY

MAIL ROOM

VESTIBULE

CENTERLINE OF ROAD

CENTERLINE OF ROAD

CENTERLINE OF ROAD

ONE-WAY

JOHN STREET

JOHN STREET

1 F1a FLOOR PLAN
1:300

CONSULTANTS:

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DRAWING TITLE:

F1a FLOOR PLAN

PRINT DATE: 11-SEPT 2024

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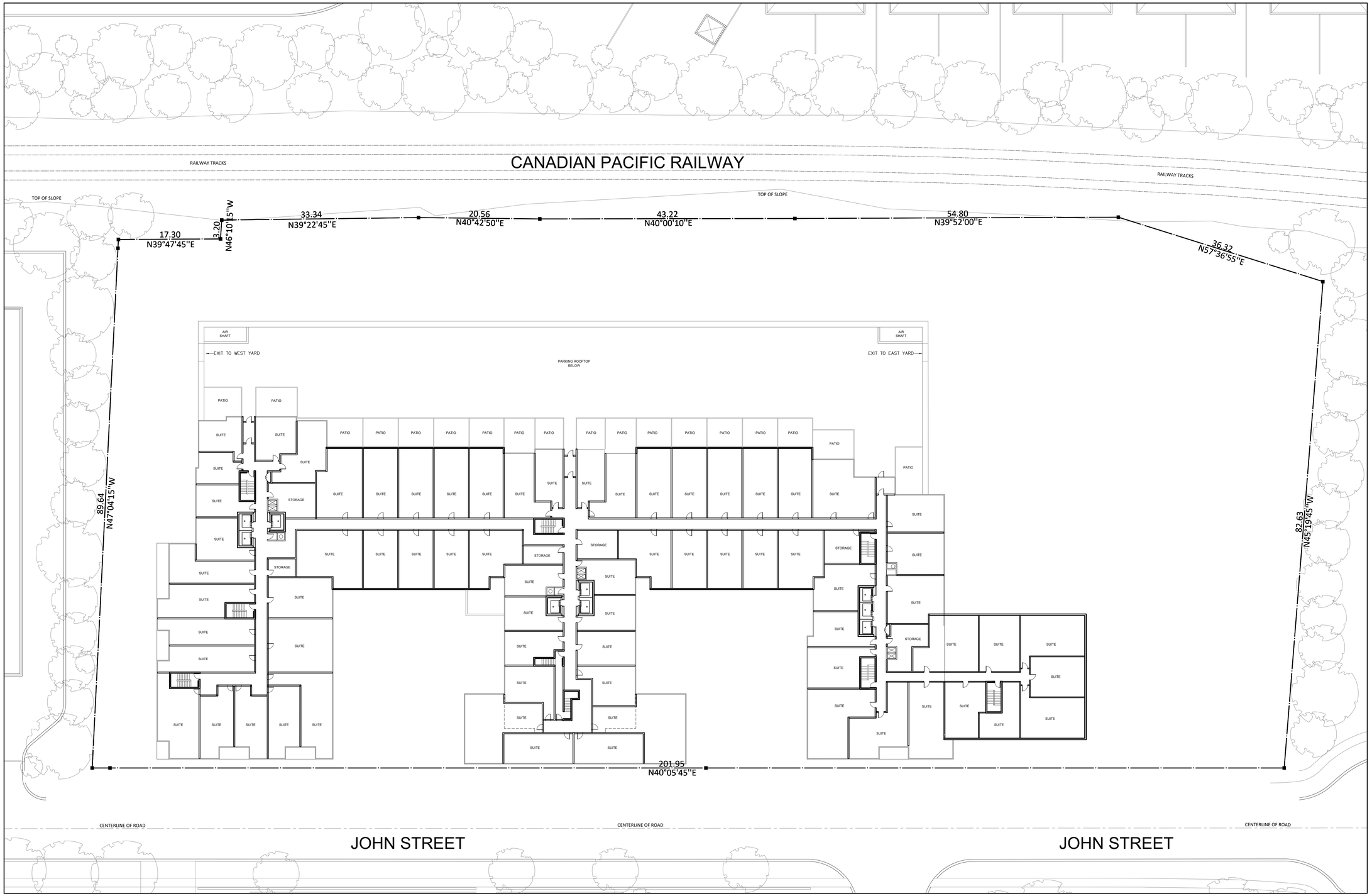

1 F2 FLOOR PLAN
1:300

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PROJECT NAME:
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DRAWING TITLE:
F2 FLOOR PLAN

PRINT DATE: 11-SEPT 2024

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DEV APPLICATION NO:
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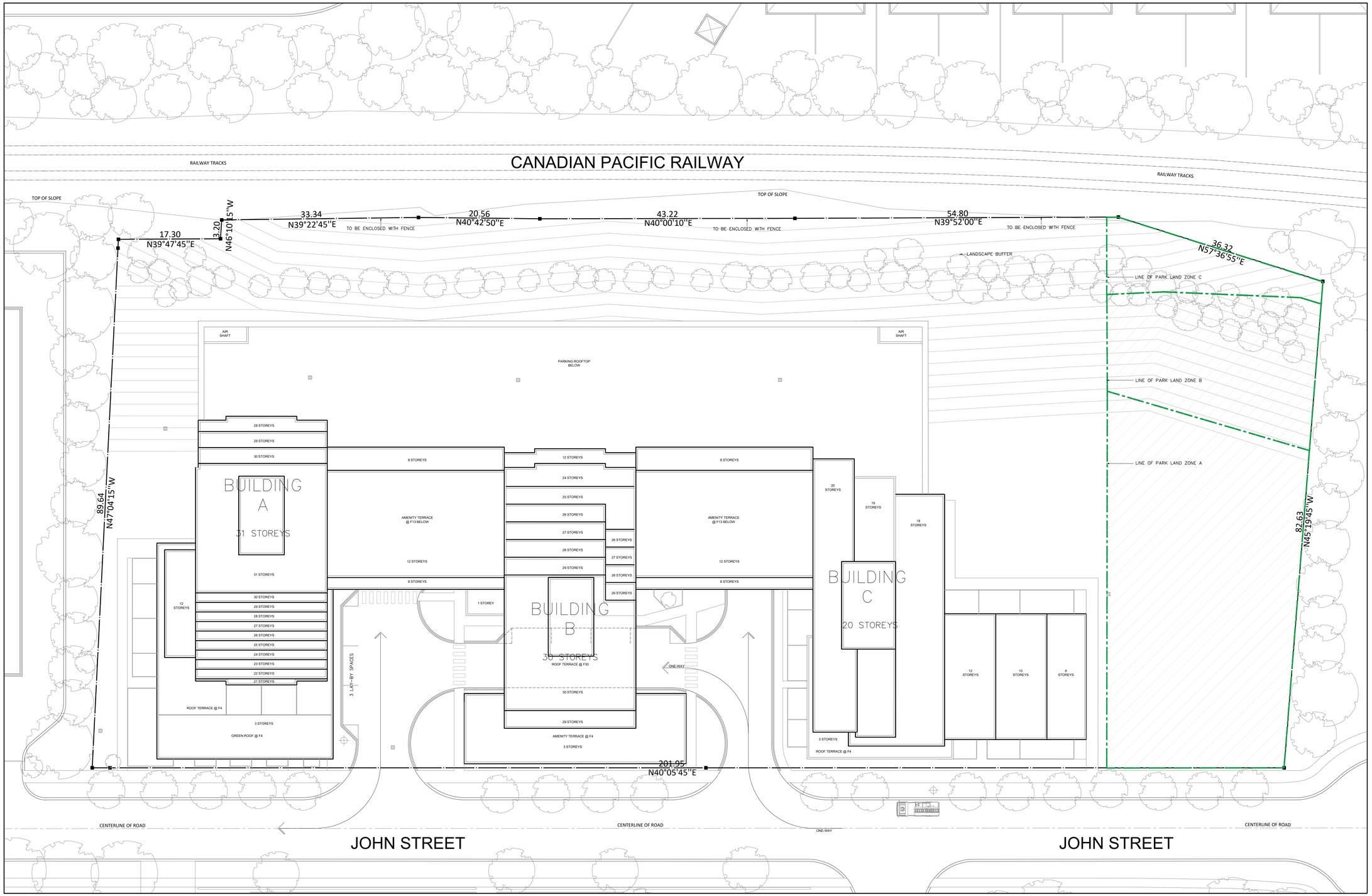

1 ROOF PLAN
1:300

CONSULTANTS:

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2024-09-11	01	FOR COORDINATION

ARCHITECT:
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OWNER:

PROJECT NAME:
69 & 117 JOHN ST.
MISSISSAUGA

DRAWING TITLE:
ROOF PLAN

PRINT DATE: 11-SEPT 2024

NORTH

PROJ. No.: 1101

DEV APPLICATION NO:

SCALE: AS NOTED

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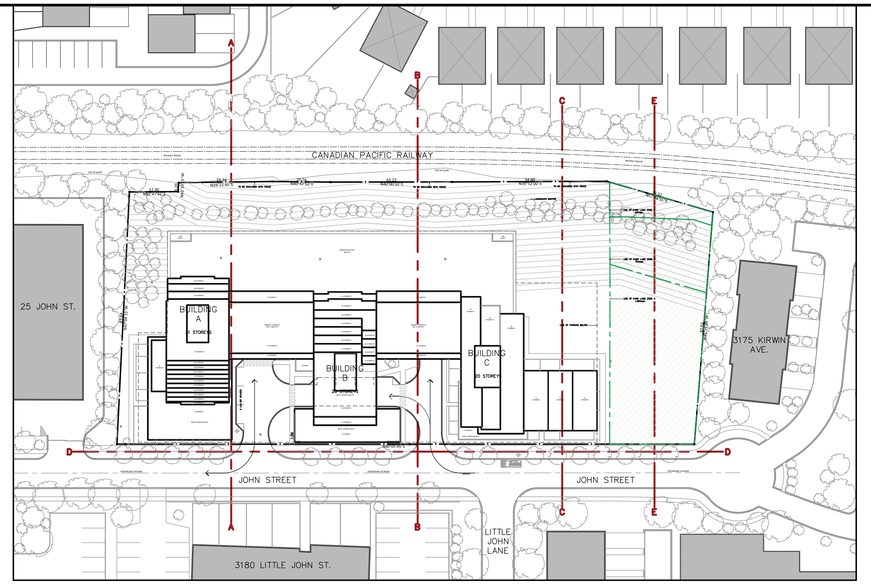
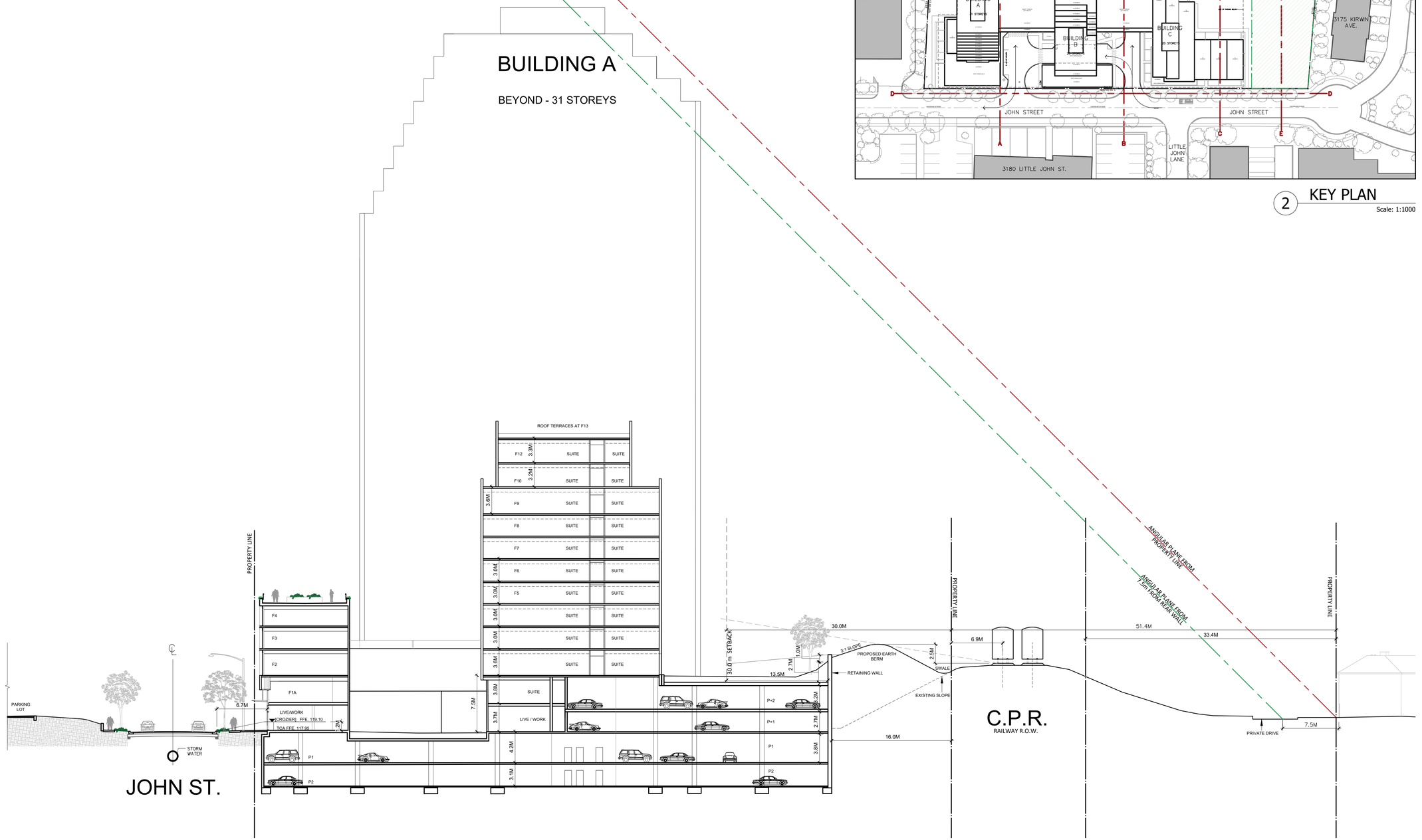


2 KEY PLAN

Scale: 1:1000



1 SECTION A-A

Scale: 1:250

CONSULTANTS:

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2024-09-11	01	FOR COORDINATION

ARCHITECT:
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OWNER:

PROJECT NAME:
69 & 117 JOHN ST.
MISSISSAUGA

DRAWING TITLE:
SECTION A-A
PODIUM SECTION

PRINT DATE: 11-SEPT 2024

PROJ. No.: 1101
DEV APPLICATION NO:
SCALE: AS NOTED
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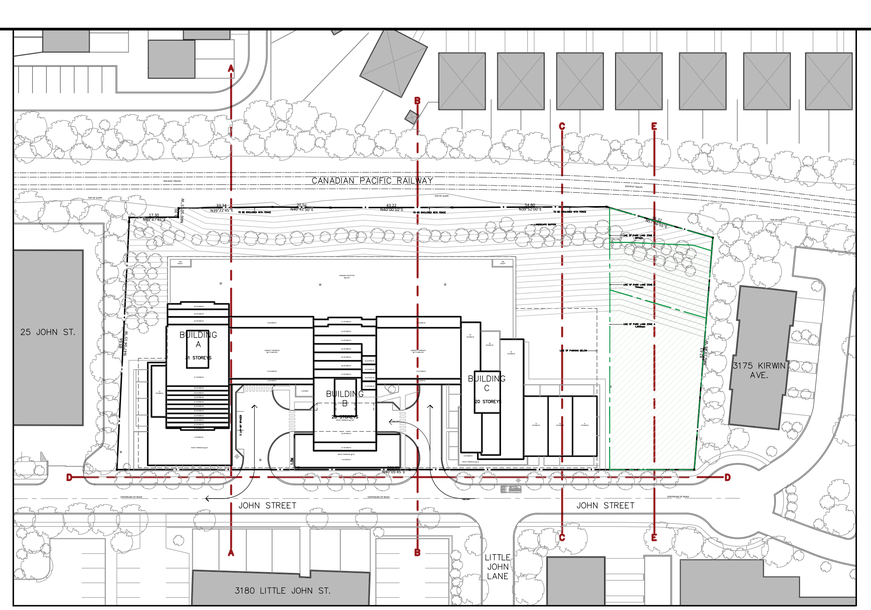

2 KEY PLAN

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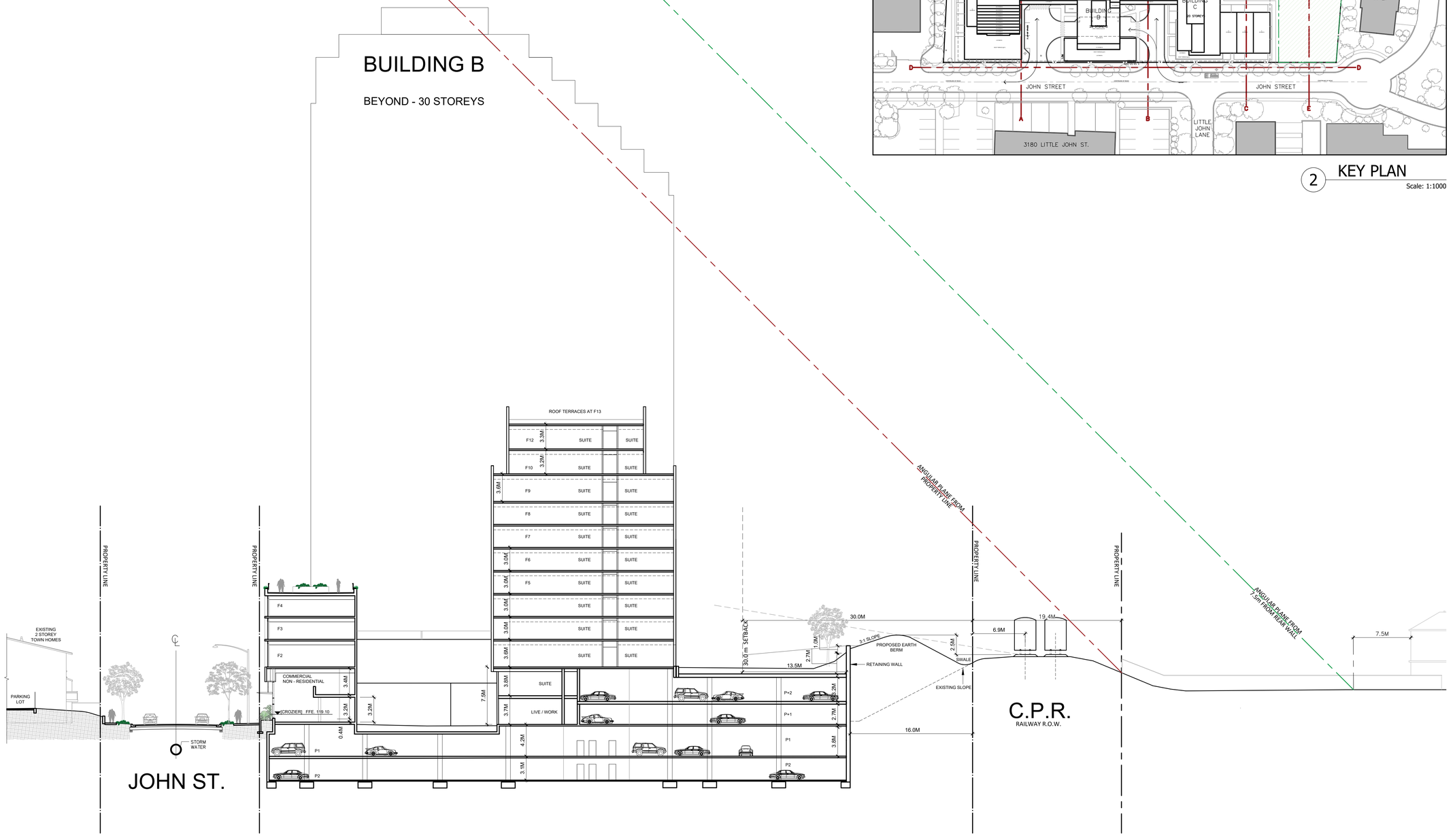


1 SECTION B-B

Scale: 1:250

CONSULTANTS:

DATE	No.	ISSUE
2024-09-11	01	FOR COORDINATION

ARCHITECT:
TREGEBOV COGAN *ARCHITECT*
40 Saint Clair Avenue East, Suite 303
Toronto, ON M4T 1M9
PHONE: 647.352.3350

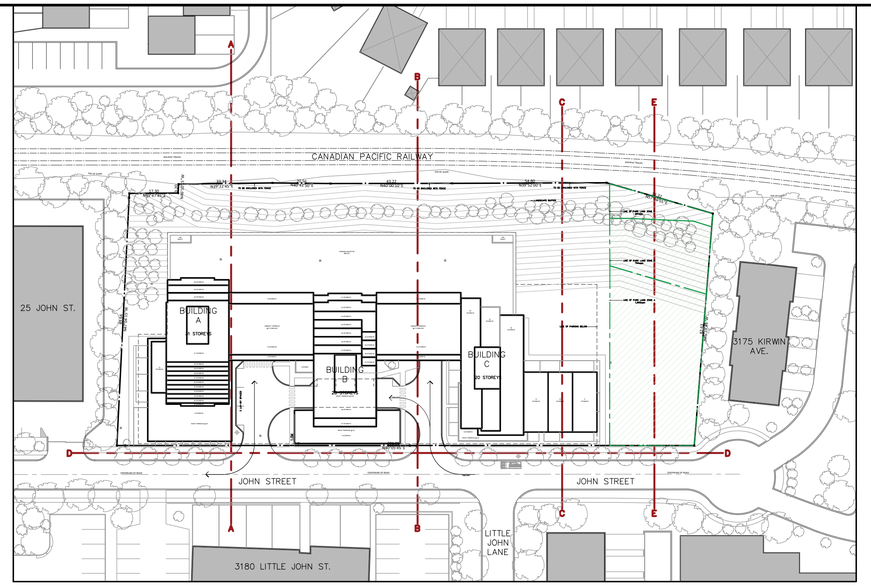
OWNER:

PROJECT NAME:
69 & 117 JOHN ST.
MISSISSAUGA

DRAWING TITLE:
SECTION B-B
PODIUM SECTION

PRINT DATE: 11-SEPT 2024

PROJ. No.: 1101
DEV APPLICATION NO:
SCALE: AS NOTED
DWG NO. **A3.1**
DRAWN BY: KT



2 KEY PLAN

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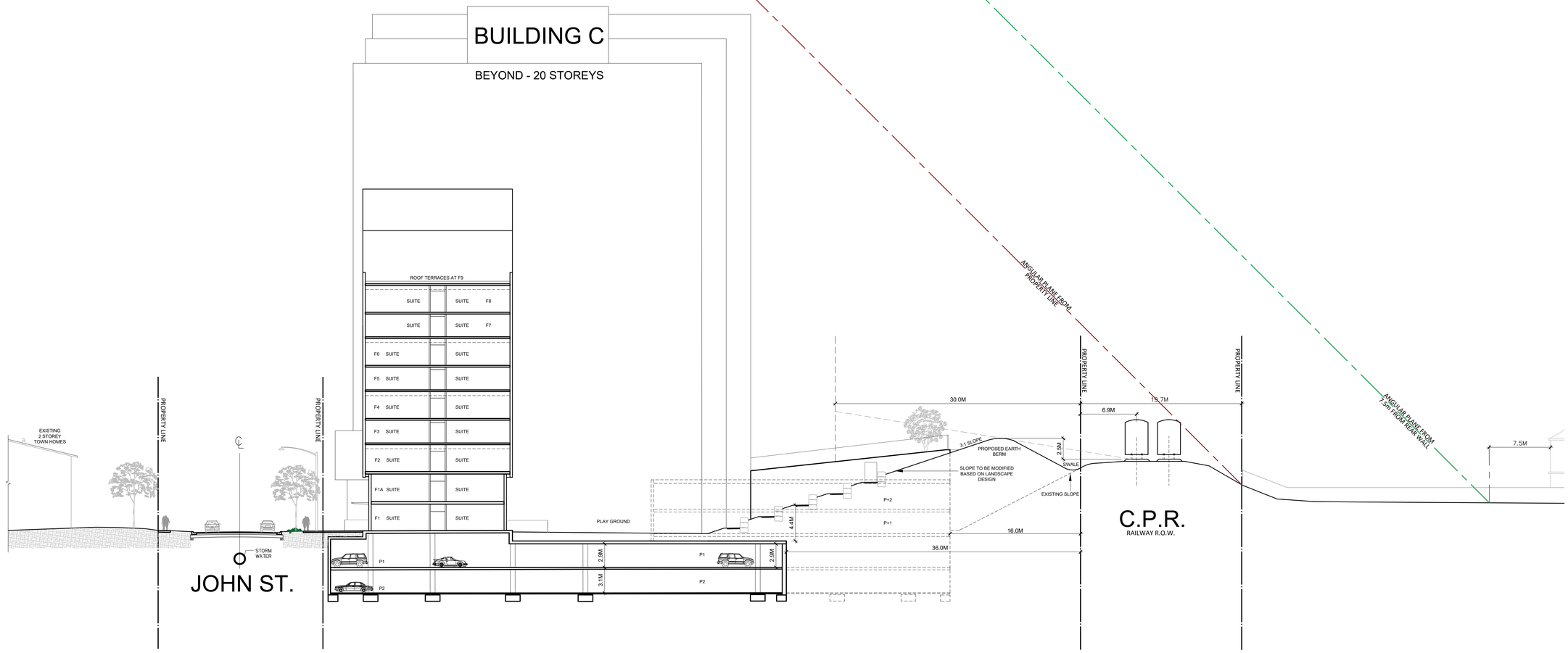


1 SECTION C-C

Scale: 1:250

CONSULTANTS:

DATE	No.	ISSUE
2024-09-11	01	FOR COORDINATION

ARCHITECT:

TREGEBOV COGAN *ARCHITECT*

40 Saint Clair Avenue East, Suite 303
Toronto, ON M4T 1M9
PHONE: 647.352.3350

OWNER:

PROJECT NAME:

69 & 117 JOHN ST.
MISSISSAUGA

DRAWING TITLE:

SECTION C-C
PODIUM SECTION

PRINT DATE: 11-SEPT 2024

PROJ. No.: 1101

DEV APPLICATION NO:

SCALE: AS NOTED

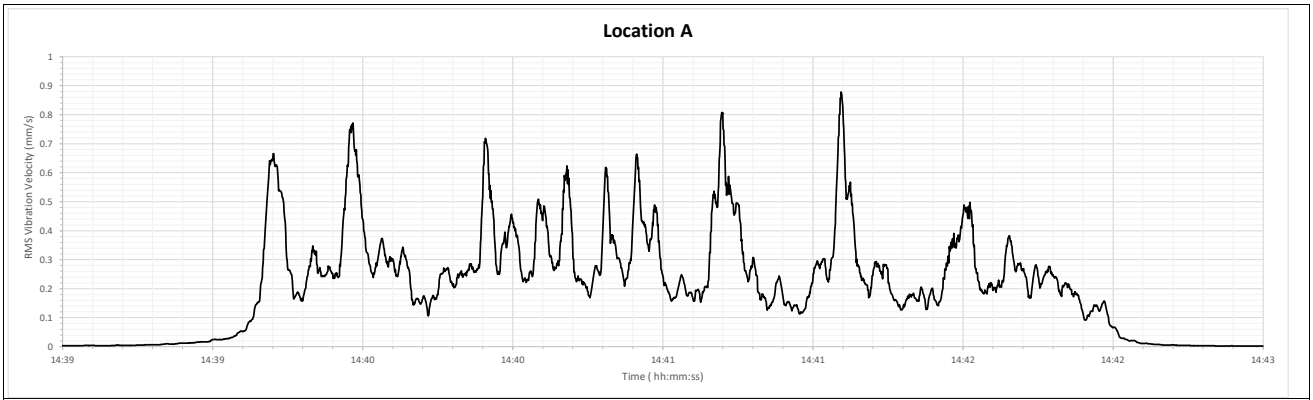
DWG NO. **A3.2**

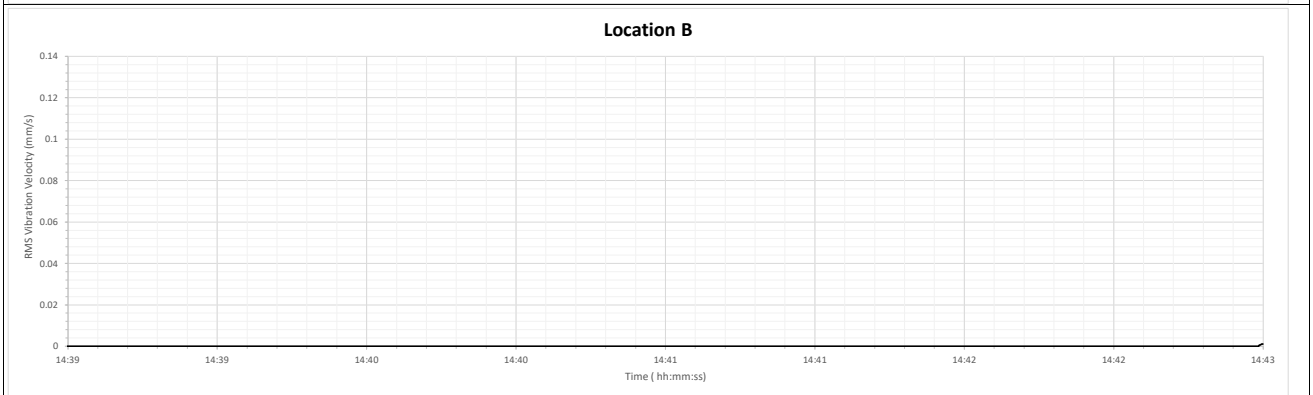
DRAWN BY: KT

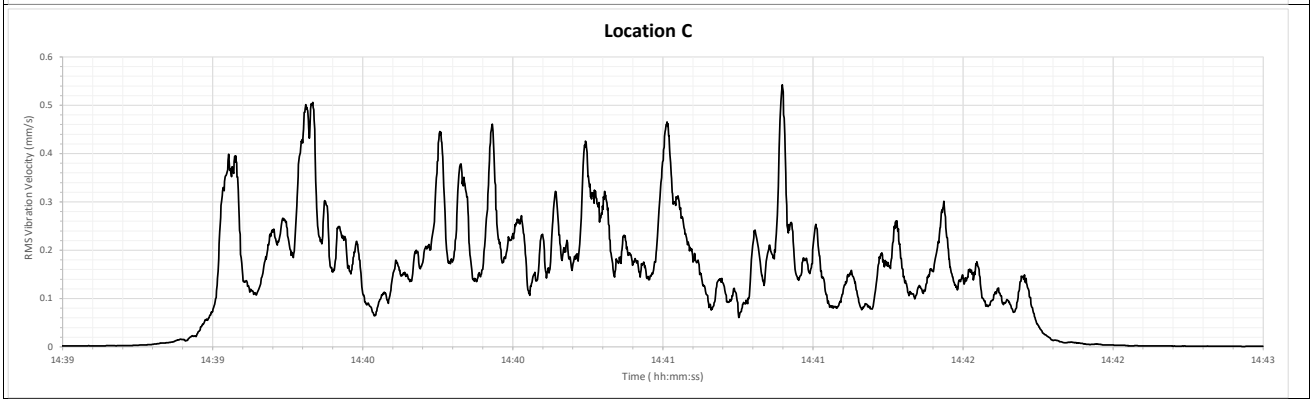
APPENDIX B

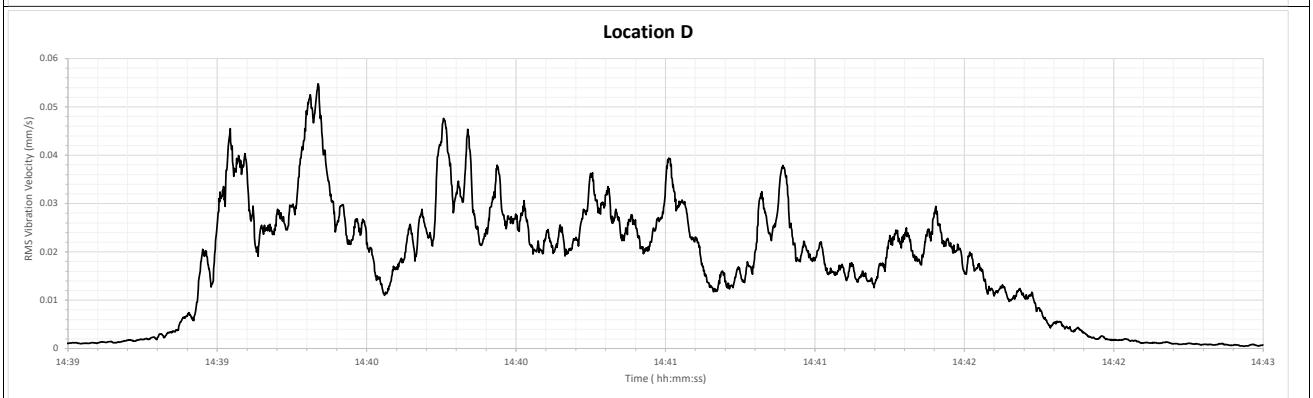
VIBRATION VELOCITY TIME HISTORIES DUE TO TRAIN PASS-BYS

Time History - Train Pass-by #1









VALCOUSTICS Canada Ltd.	Title: Railway Vibration Measurements - Vertical (Z) RMS Velocity Time History	Measurement Date: Nov 23, 2022	Figure: 1
	Project Name: 69 & 117 John Street, Mississauga	Project No.: 1220393.000	

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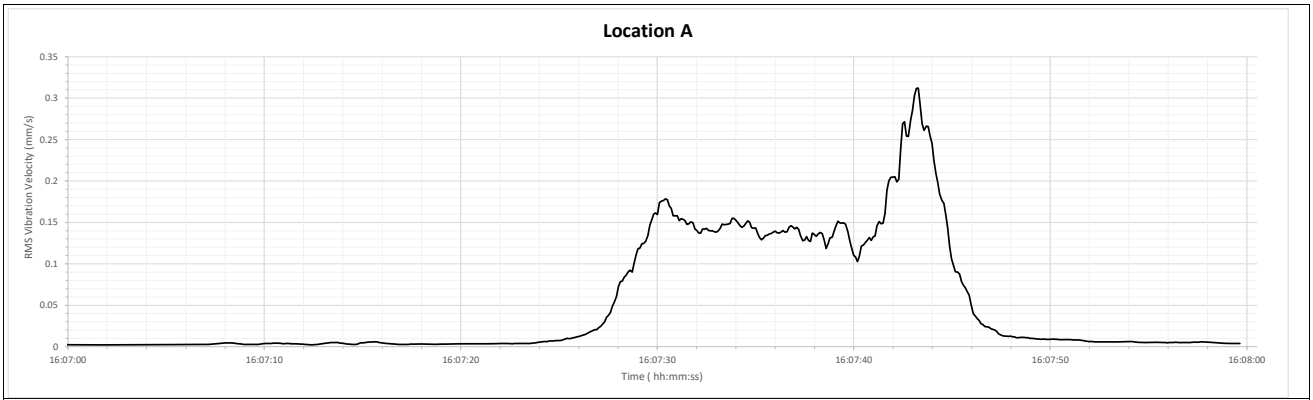
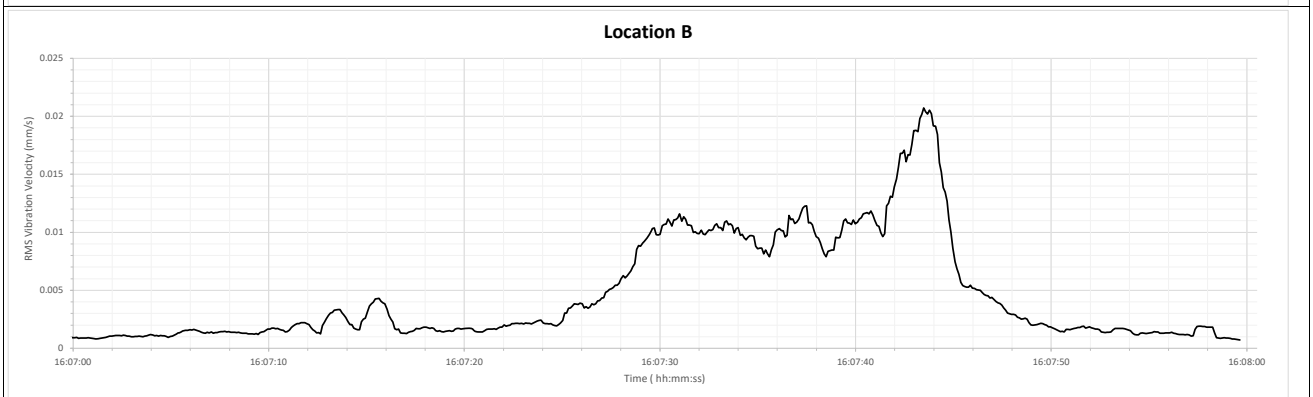
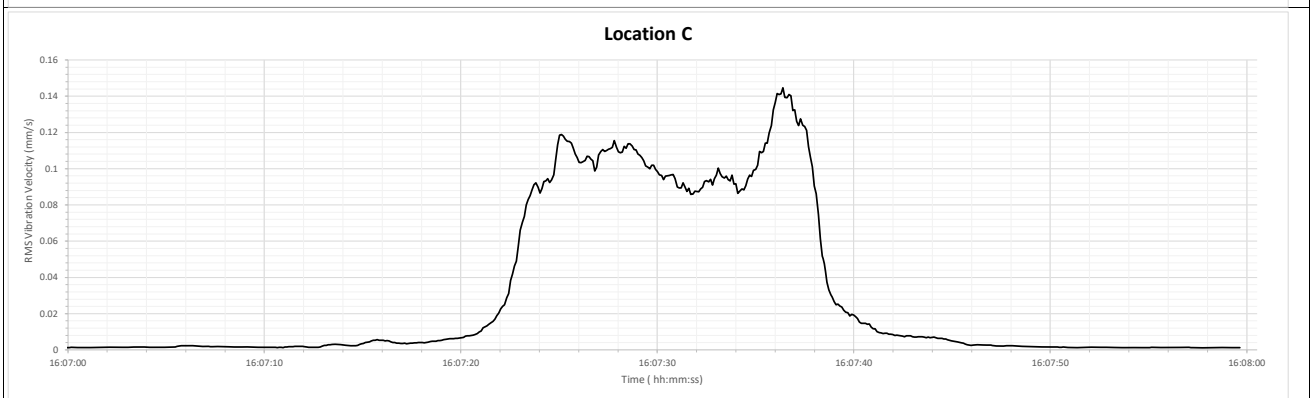
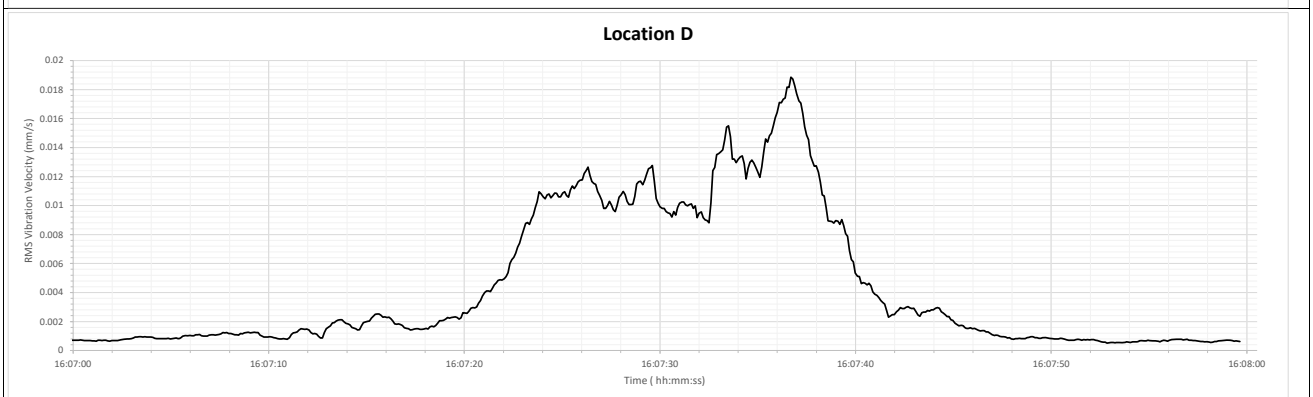
Time History - Train Pass-by #2









VALCOUSTICS Canada Ltd.	Title: Railway Vibration Measurements - Vertical (Z) RMS Velocity Time History	Measurement Date: Nov 23, 2022	Figure: 2
	Project Name: 69 & 117 John Street, Mississauga	Project No.: 1220393.000	

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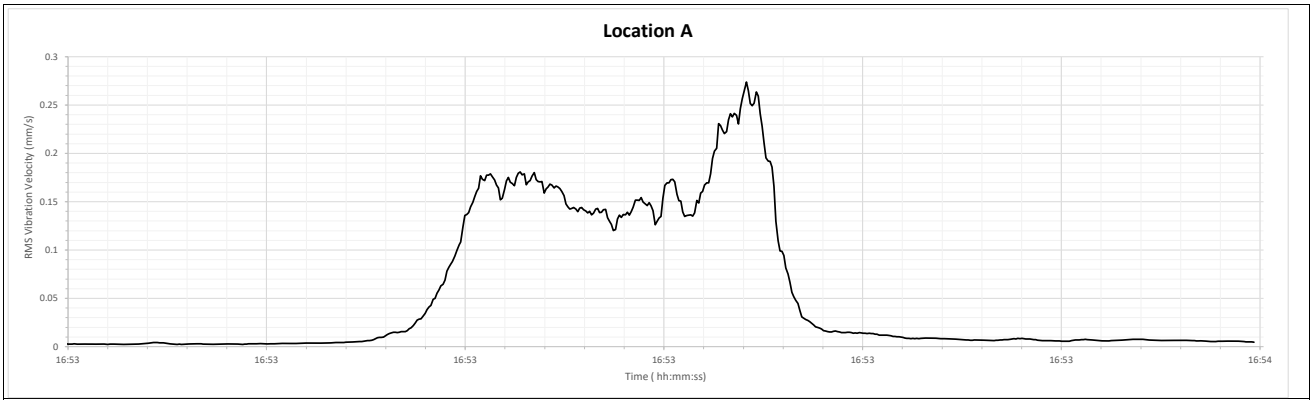
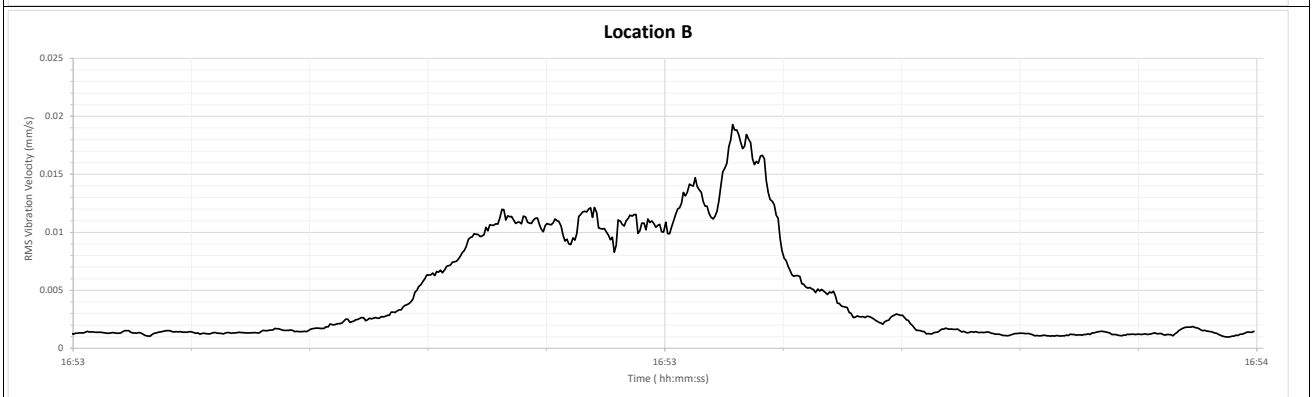
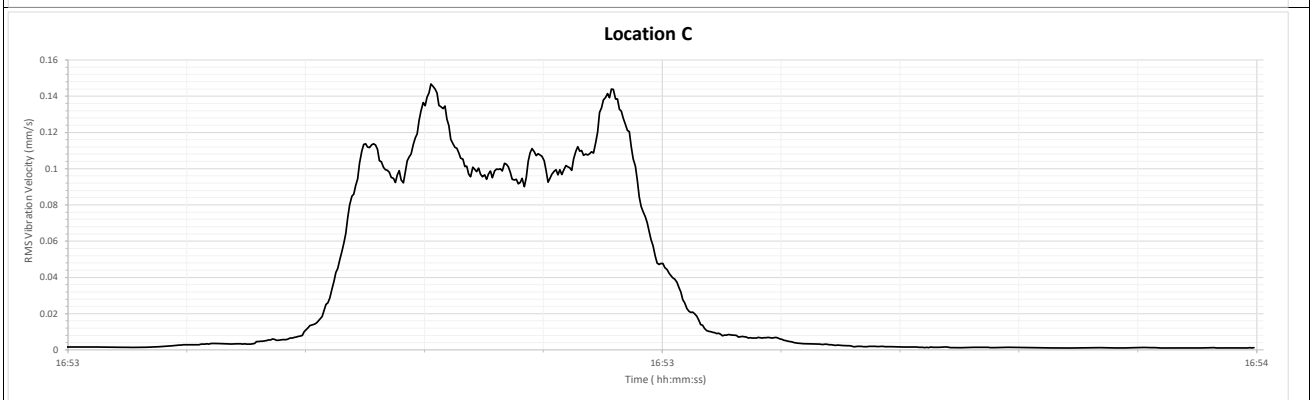
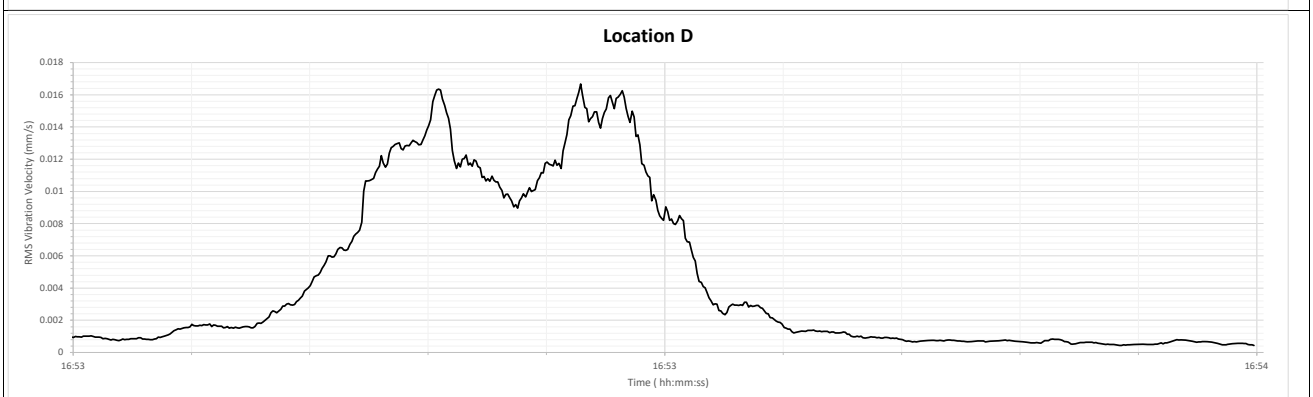
Time History - Train Pass-by #3









VALCOUSTICS Canada Ltd.	Title: Railway Vibration Measurements - Vertical (Z) RMS Velocity Time History	Measurement Date: Nov 23, 2022	Figure: 3
	Project Name: 69 & 117 John Street, Mississauga	Project No.: 1220393.000	

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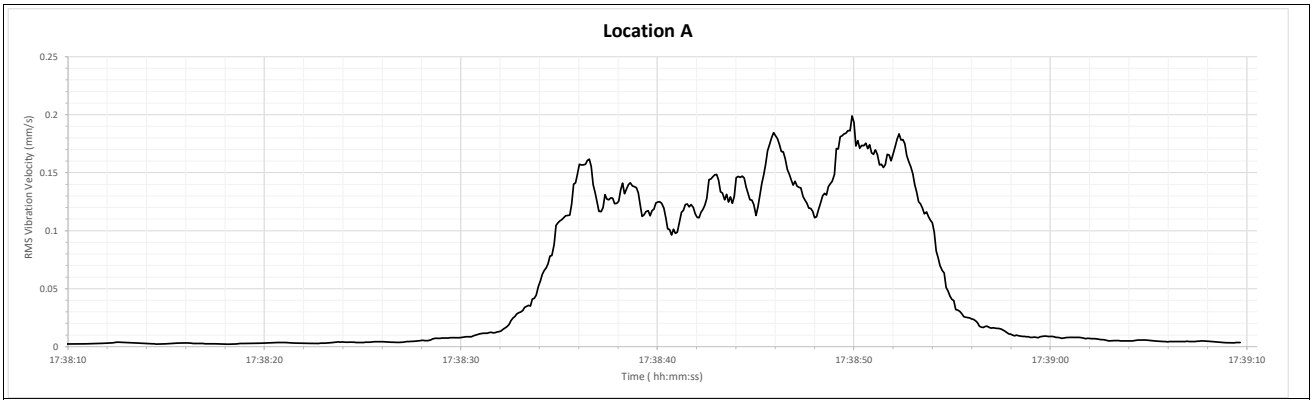
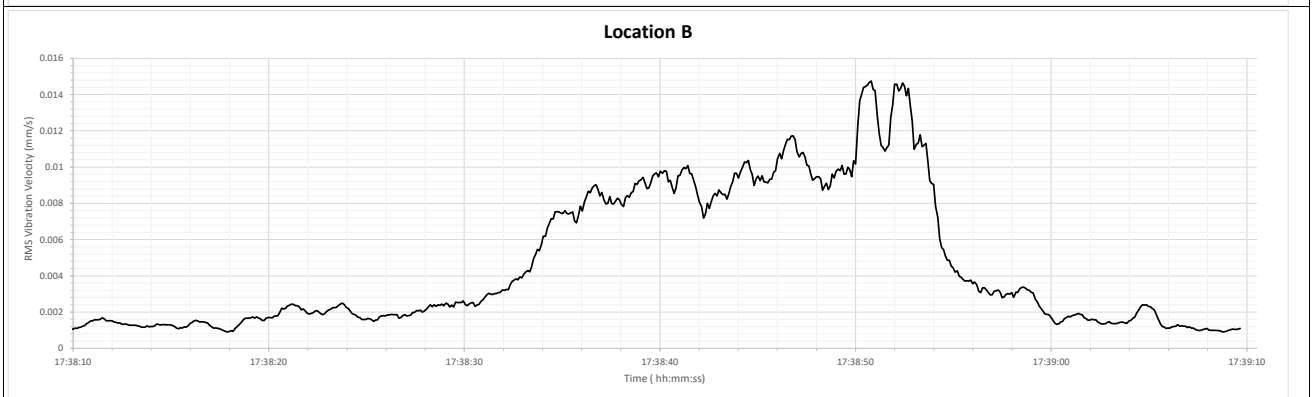
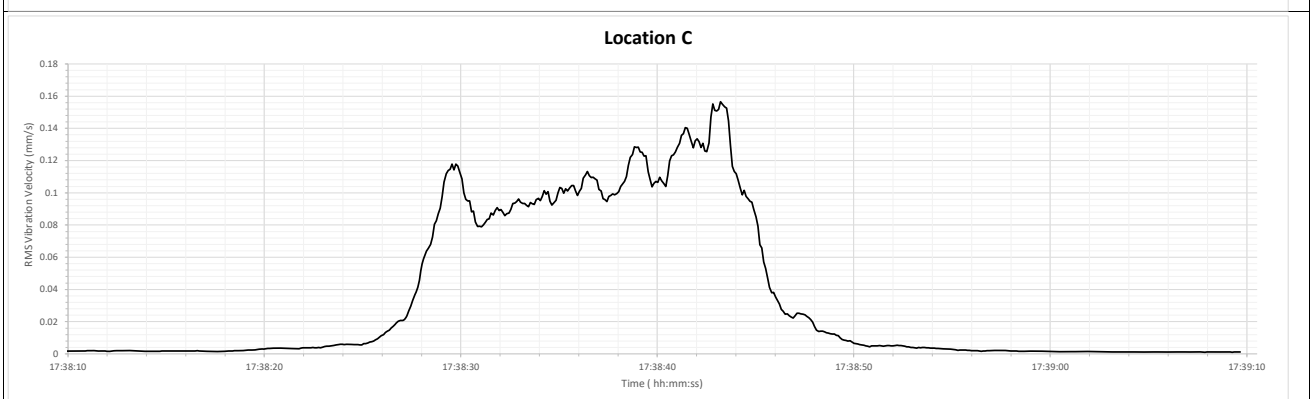
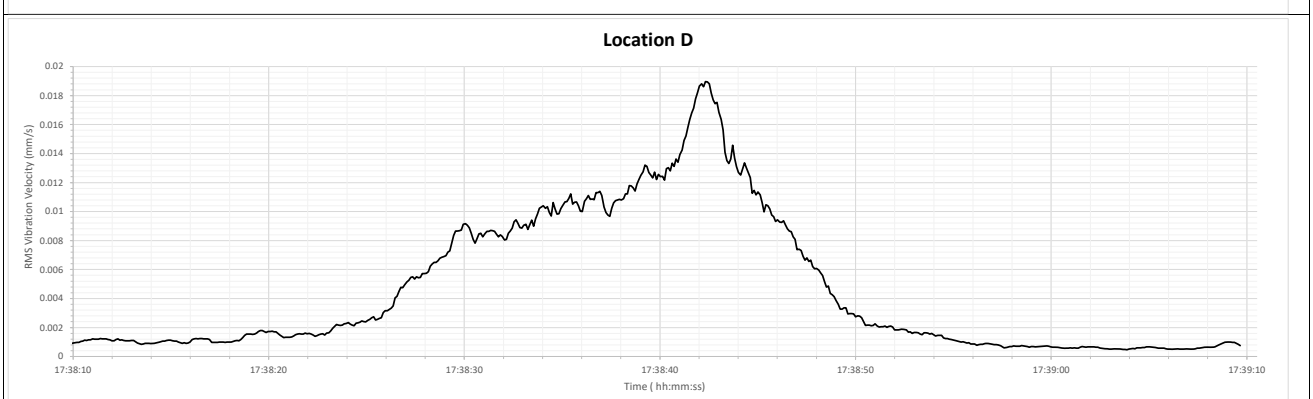
Time History - Train Pass-by #4









VALCOUSTICS Canada Ltd.	Title: Railway Vibration Measurements - Vertical (Z) RMS Velocity Time History	Measurement Date: Nov 23, 2022	Figure: 4
	Project Name: 69 & 117 John Street, Mississauga	Project No.: 1220393.000	

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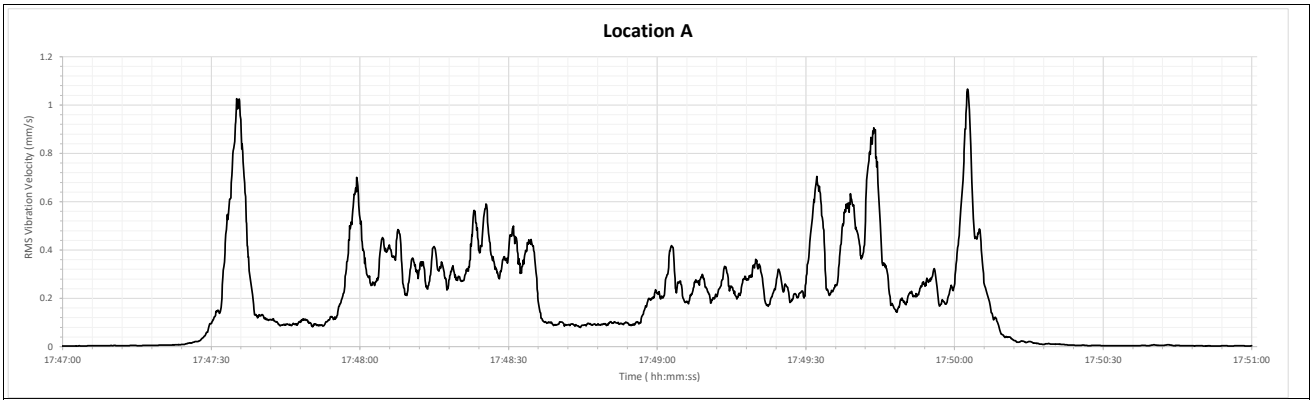
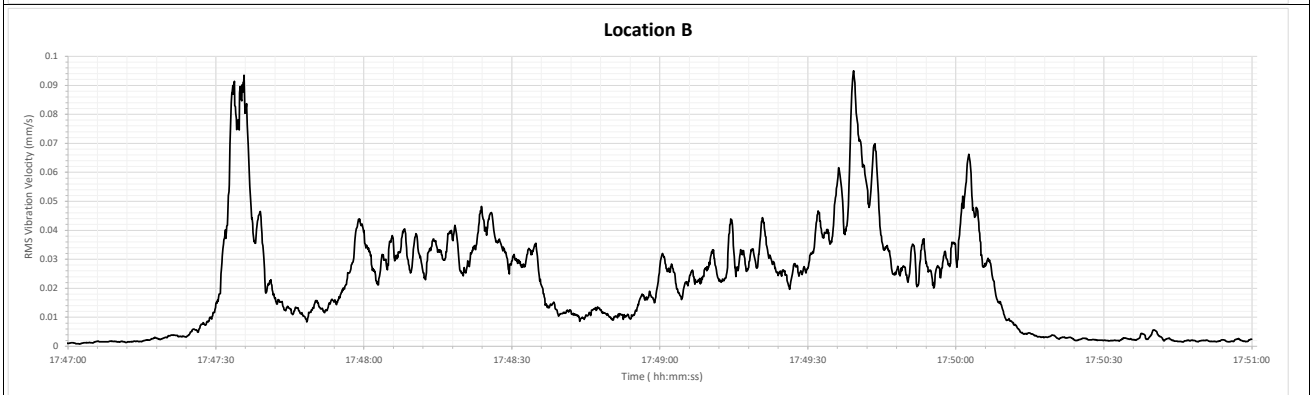
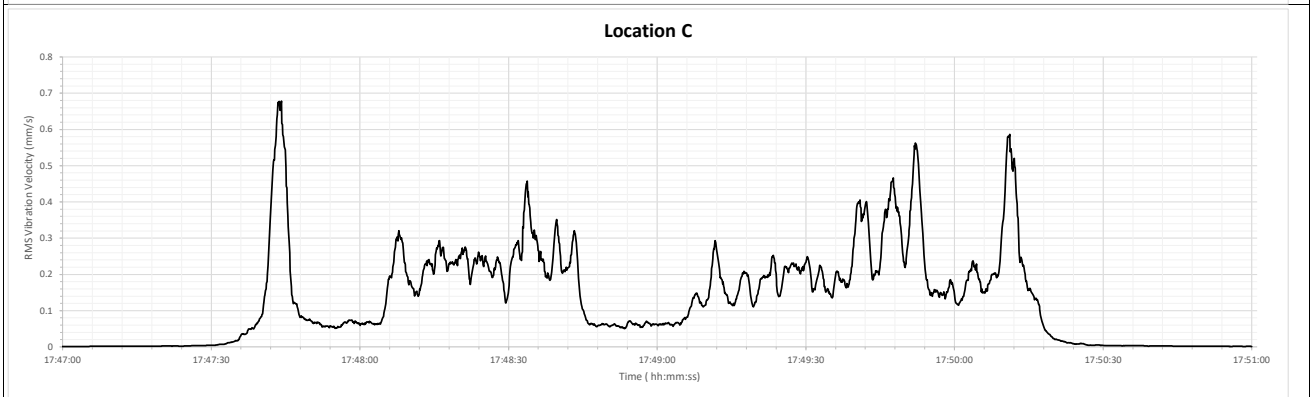
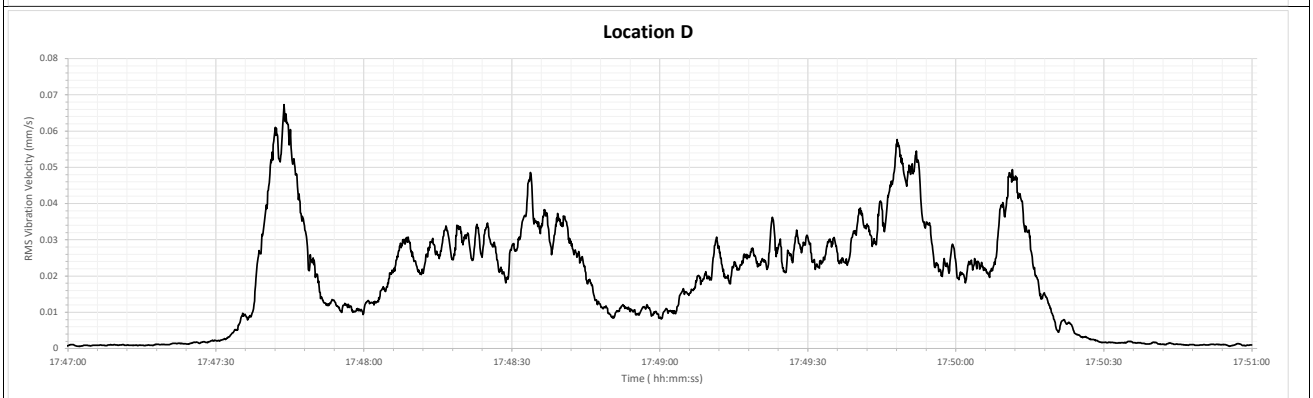
Time History - Train Pass-by #5









VALCOUSTICS Canada Ltd.	Title: Railway Vibration Measurements - Vertical (Z) RMS Velocity Time History	Measurement Date: Nov 23, 2022	Figure: 5
	Project Name: 69 & 117 John Street, Mississauga	Project No.: 1220393.000	

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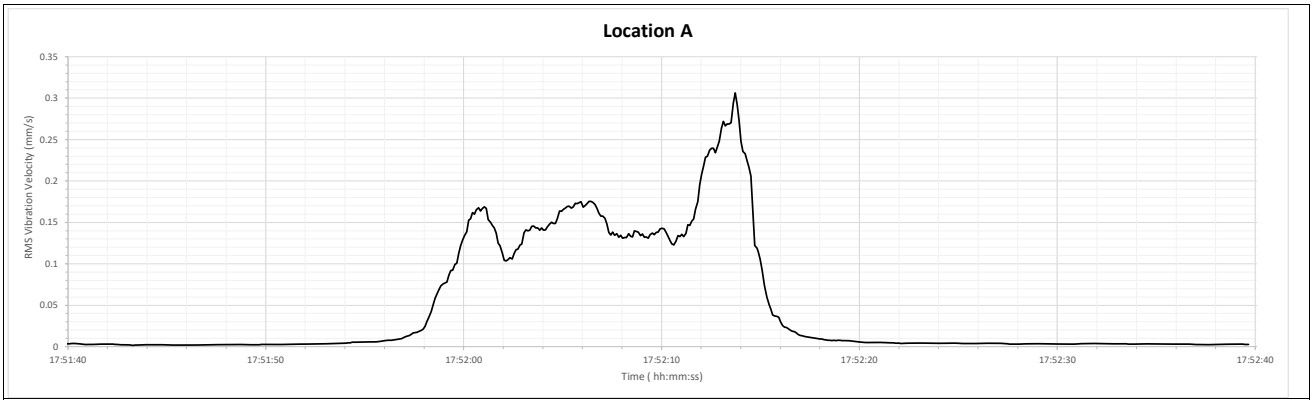
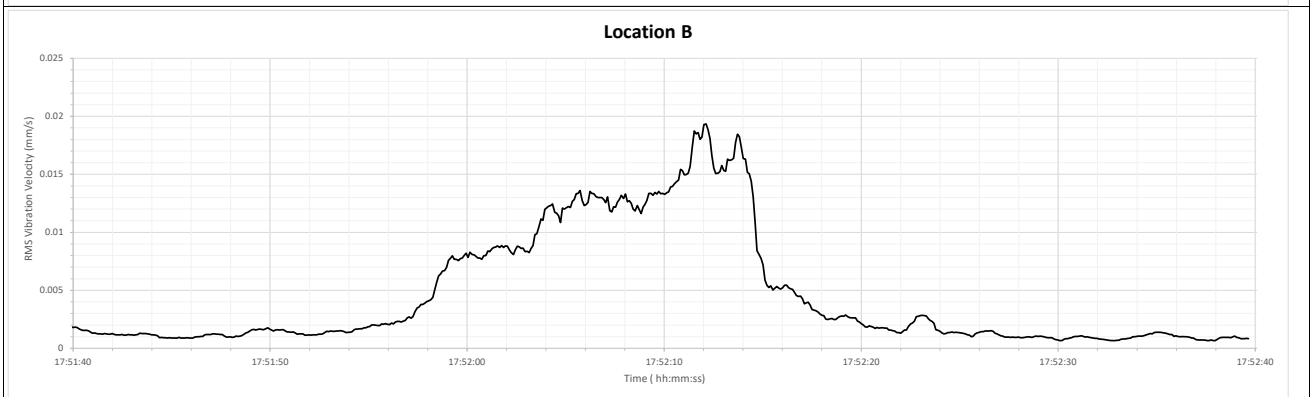
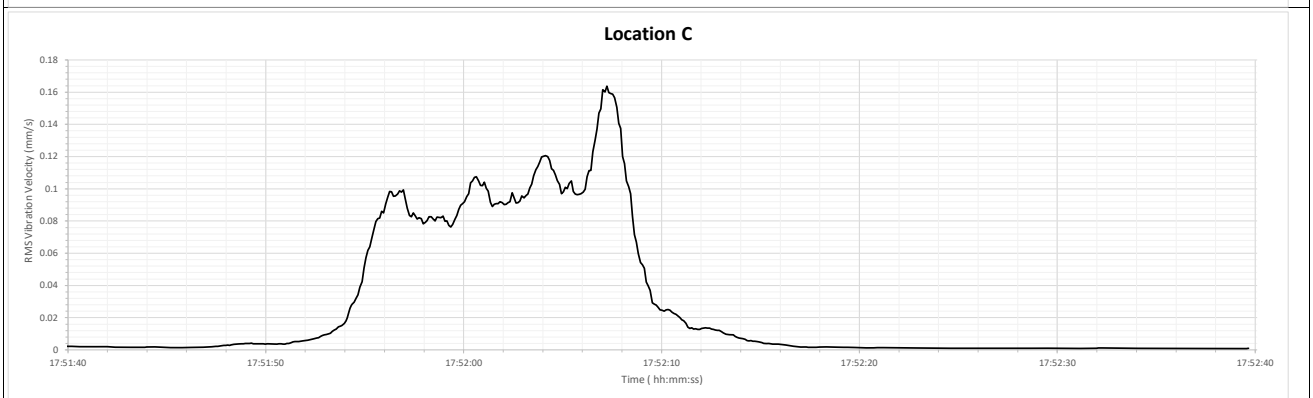
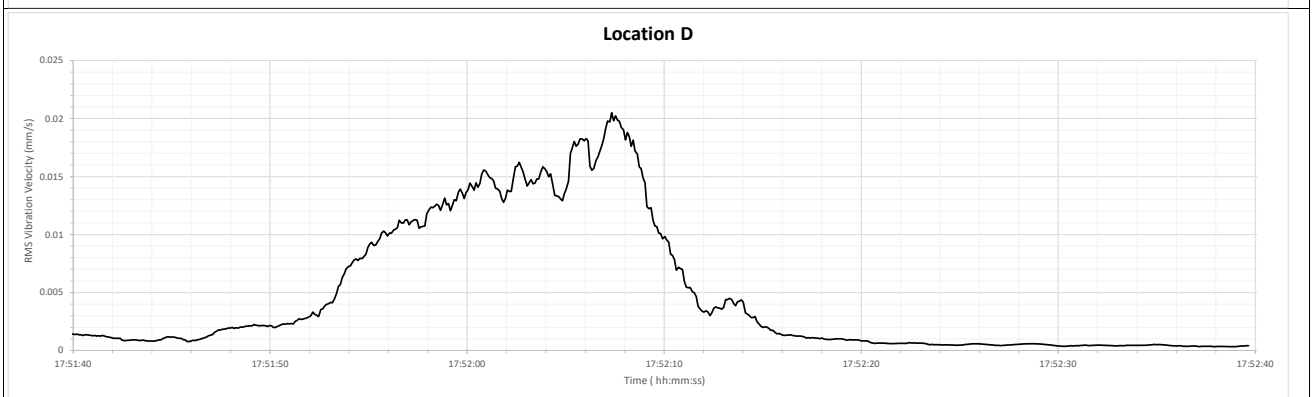
Time History - Train Pass-by #6









VALCOUSTICS Canada Ltd.	Title: Railway Vibration Measurements - Vertical (Z) RMS Velocity Time History	Measurement Date: Nov 23, 2022	Figure: 6
	Project Name: 69 & 117 John Street, Mississauga	Project No.: 1220393.000	

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