

10 October 2017

10-1380 R01R2 NV Monitoring 20171026.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Bert Musch

Dear Bert

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 01
4 October to 10 October 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street;
- 8 to 12 Castlereagh Street.

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 4 October to 10 October 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

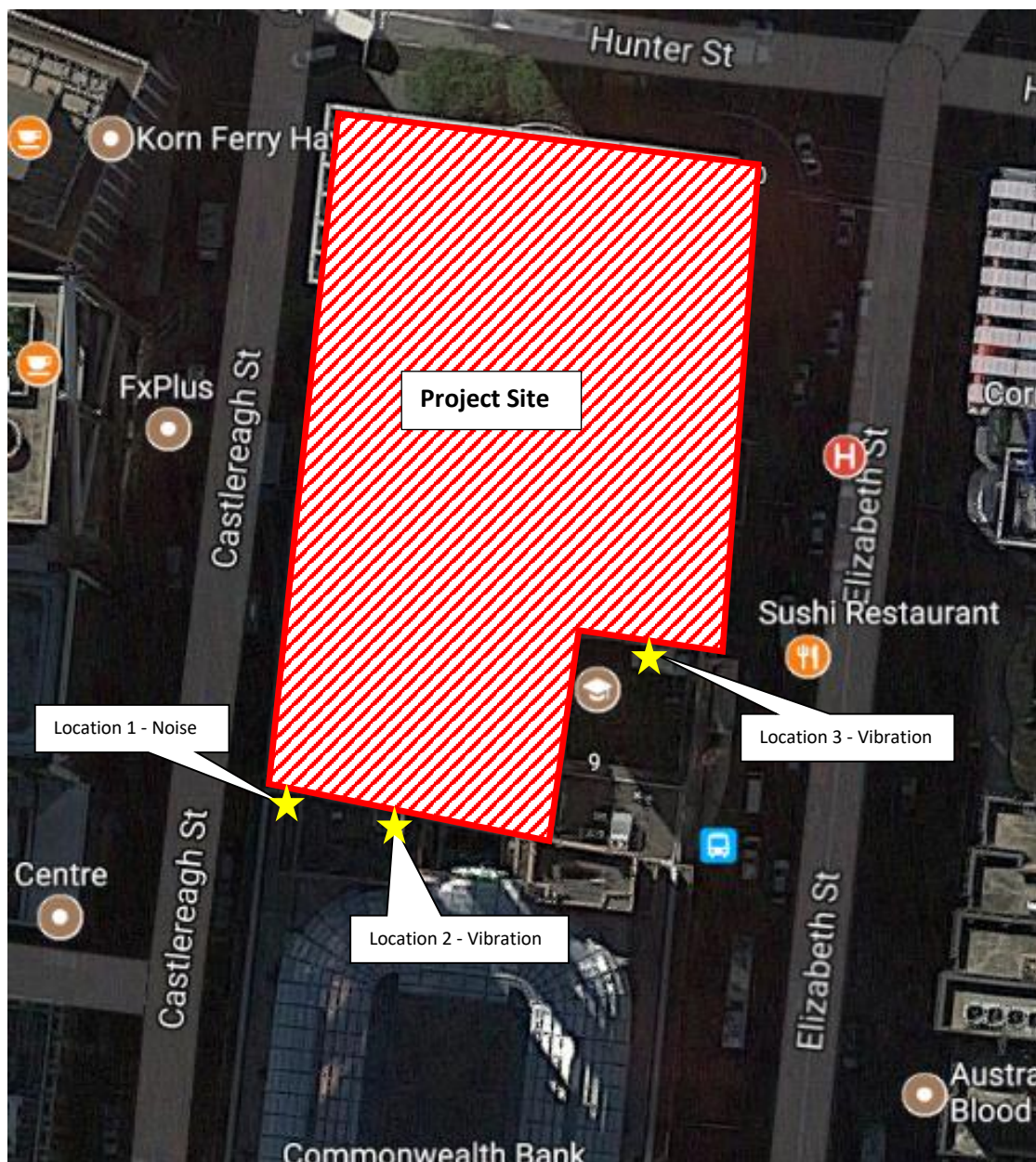
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations.

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Ground floor)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 4 October to 10 October 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
Wednesday, 4 October 2017	45	44	Complies	Complies
Thursday, 5 October 2017	45	44	Complies	Complies
Friday, 6 October 2017	45	44	Complies	Complies
Saturday, 7 October 2017	38	36	Complies	Complies
Sunday, 8 October 2017	41	40	Complies	Complies
Monday, 9 October 2017	46	44	Complies	Complies
Tuesday, 10 October 2017	45	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 3, respectively, during the period 4 October to 10 October 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
Wednesday, 4 October 2017	0.2	Complies
Thursday, 5 October 2017	0.2	Complies
Friday, 6 October 2017	0.1	Complies
Saturday, 7 October 2017	0.1	Complies
Sunday, 8 October 2017	0.1	Complies
Monday, 9 October 2017	0.2	Complies
Tuesday, 10 October 2017	0.1	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
Wednesday, 4 October 2017	0.2	Complies
Thursday, 5 October 2017	0.2	Complies
Friday, 6 October 2017	0.1	Complies
Saturday, 7 October 2017	0.1	Complies
Sunday, 8 October 2017	0.1	Complies
Monday, 9 October 2017	0.2	Complies
Tuesday, 10 October 2017	0.1	Complies

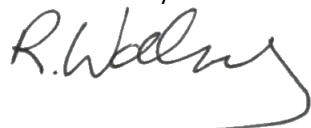
5 Conclusion

Noise monitoring conducted during the period 4 October to 10 October 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 4 October to 10 October 2017 found the ambient vibration levels to be below the vibration control limits.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

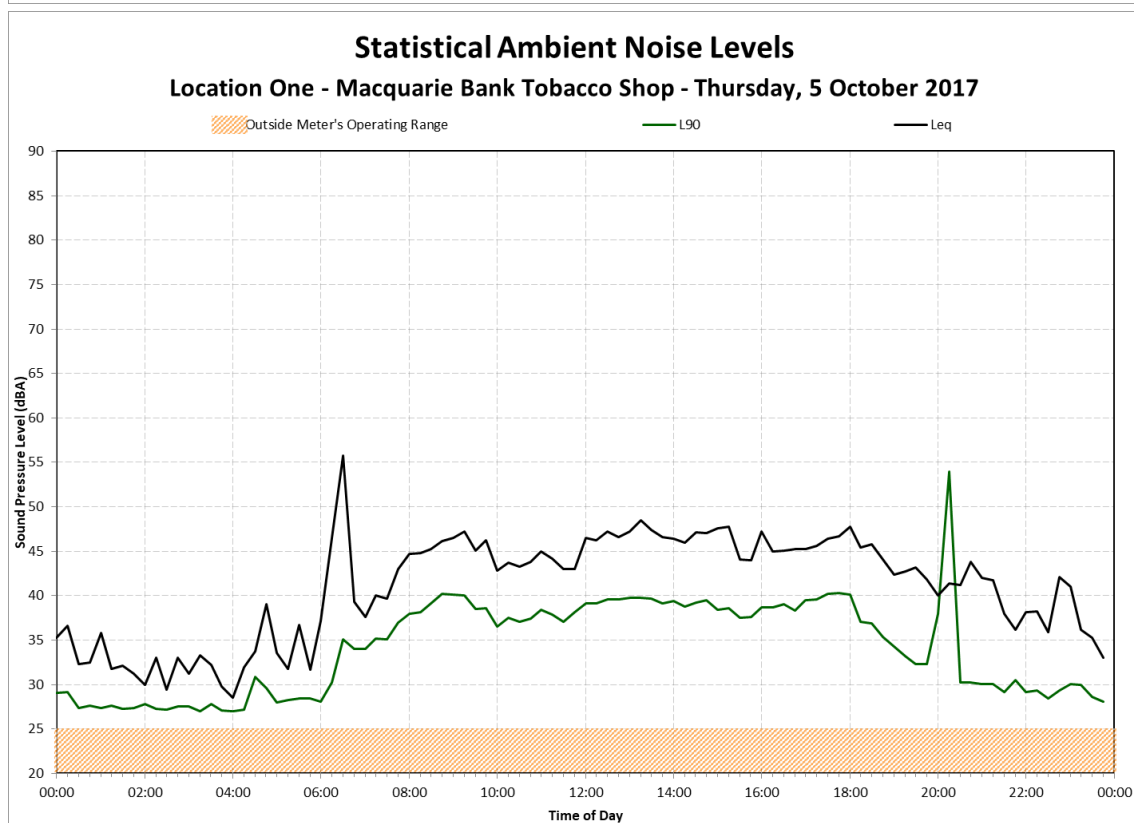
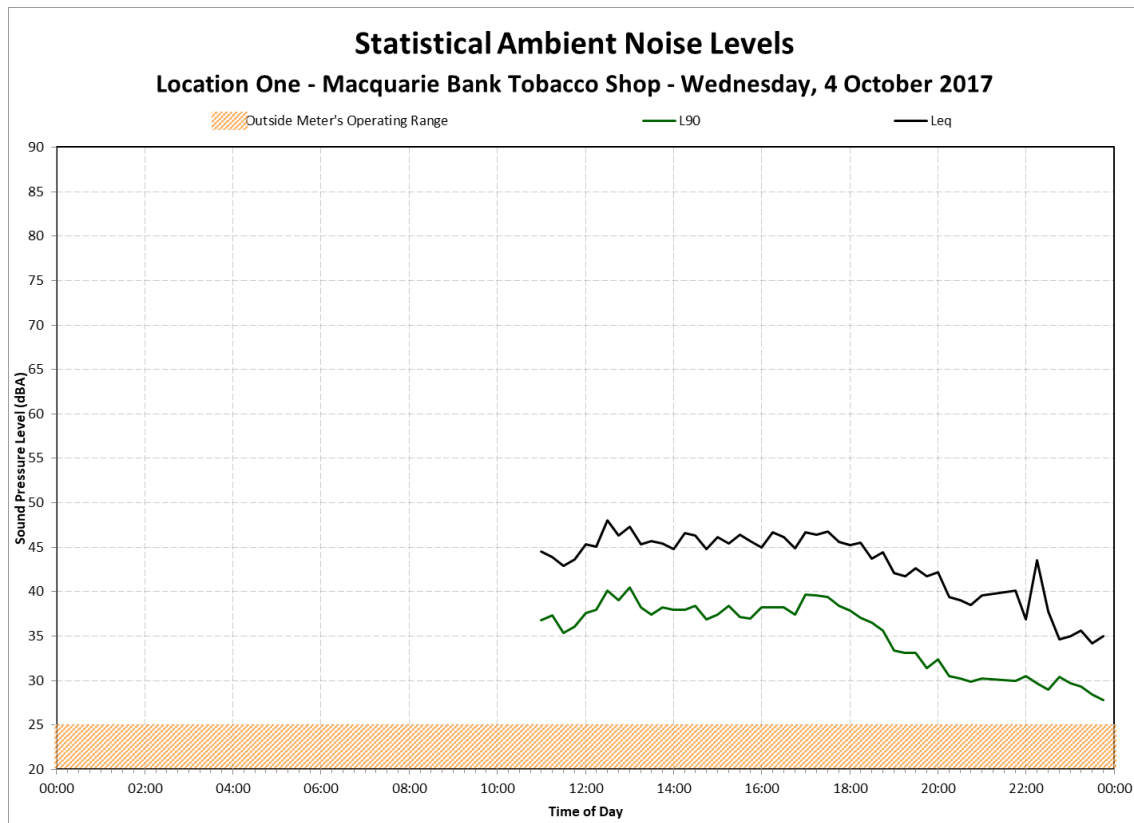
Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

Terminology Relating to Noise and Vibration

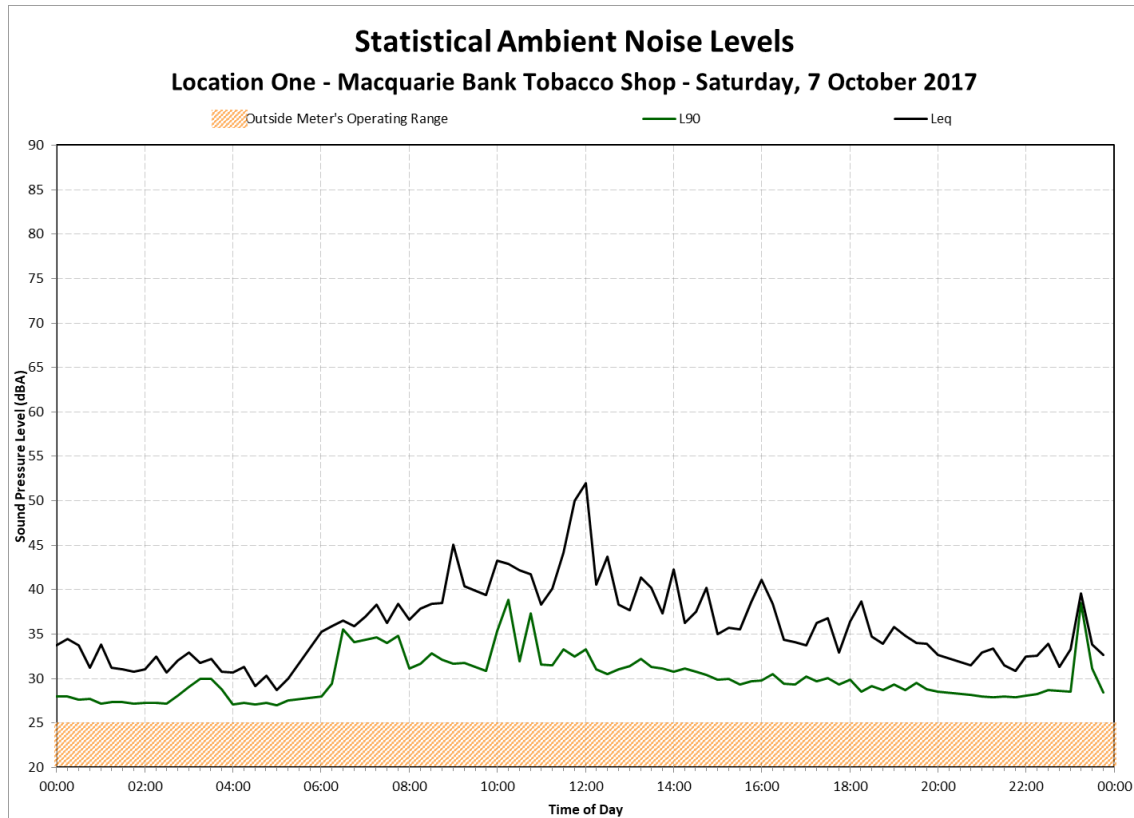
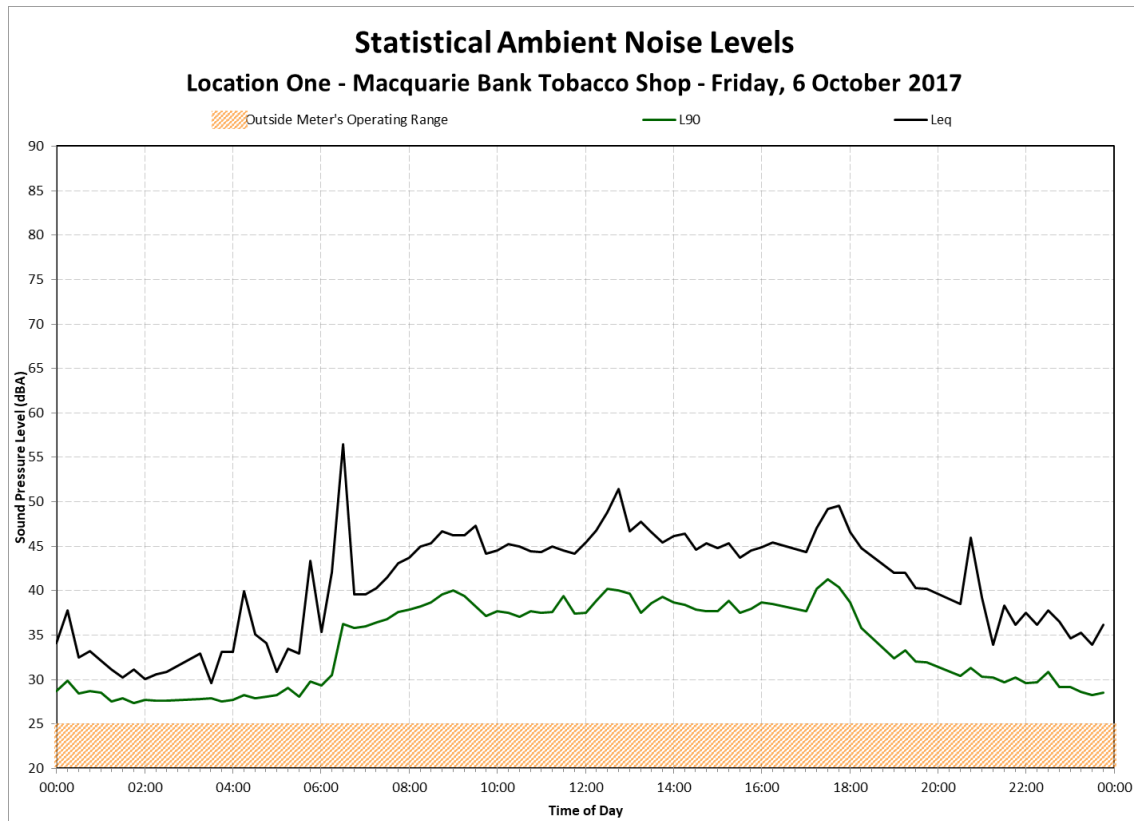
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	<p>The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula:</p> $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ <p>Note that the above formula is only valid for sound propagation in the free-field (see below).</p>
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	<p>When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period.</p> <p>The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s^{1.75}.</p>

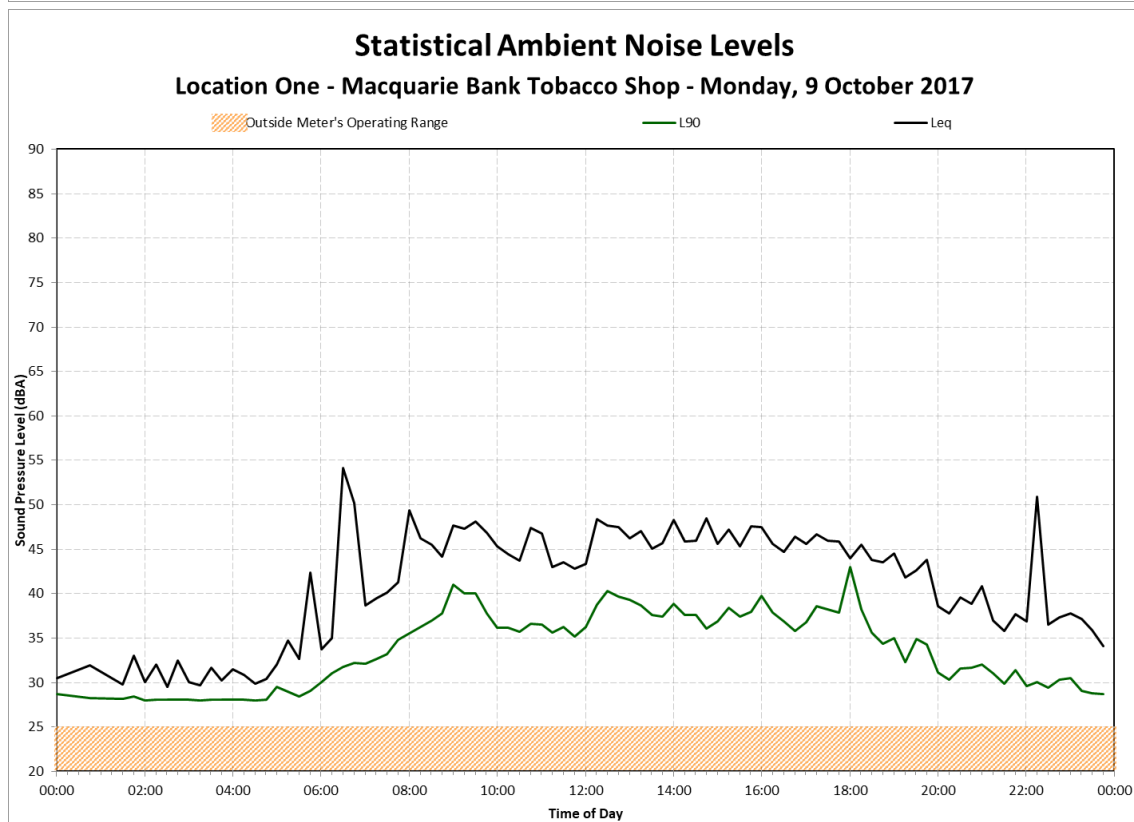
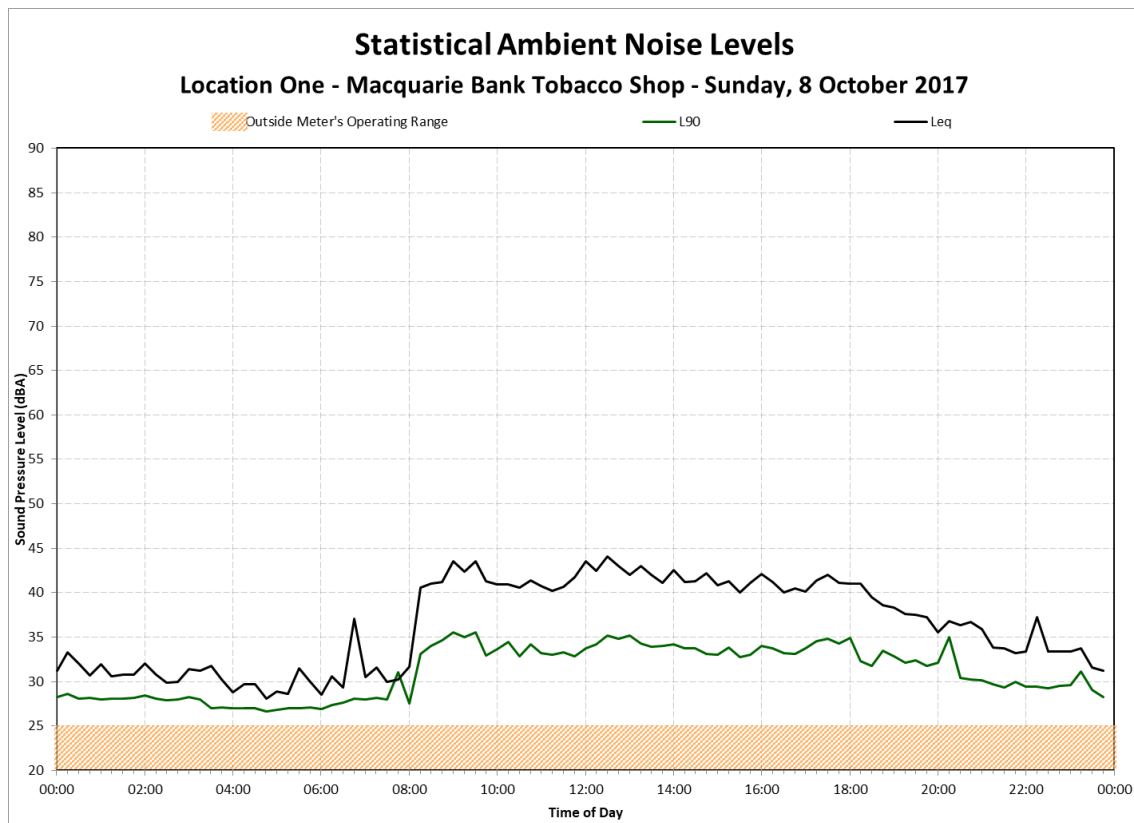


Appendix B

Daily Noise Levels

Location 1 – Macquarie Bank Tobacco Shop

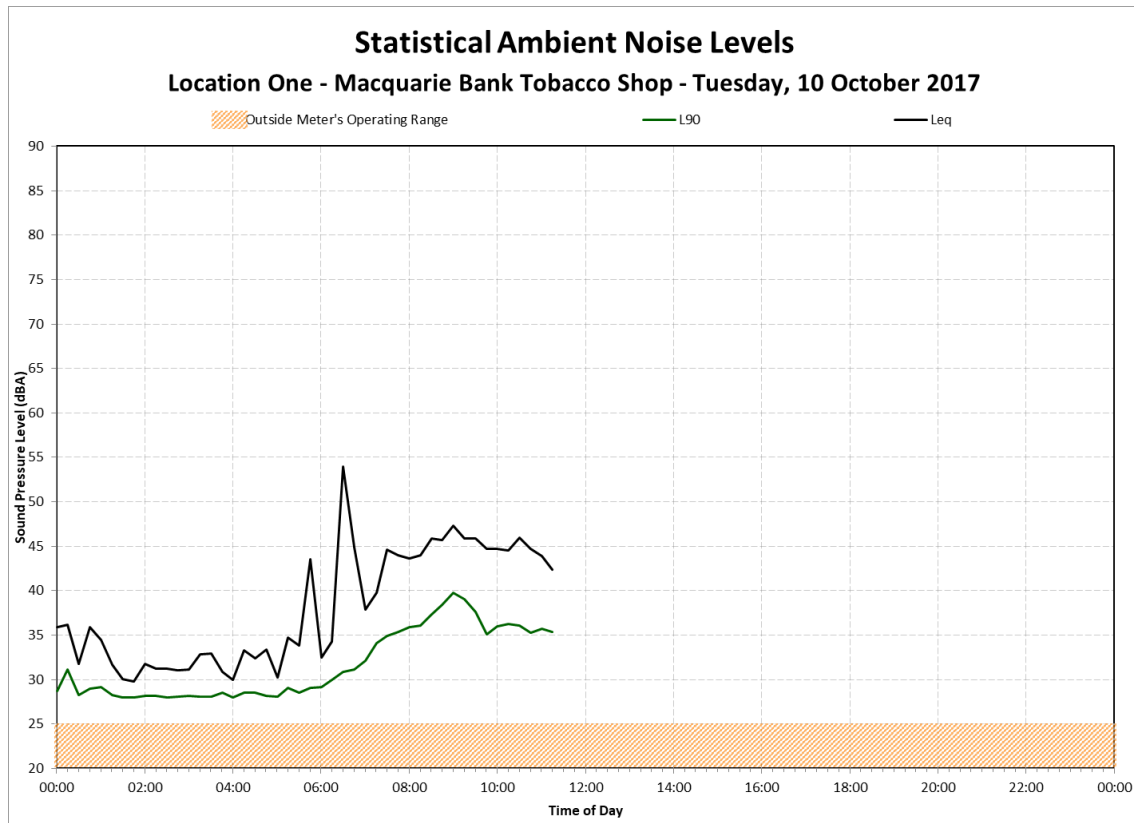




Appendix B

Daily Noise Levels

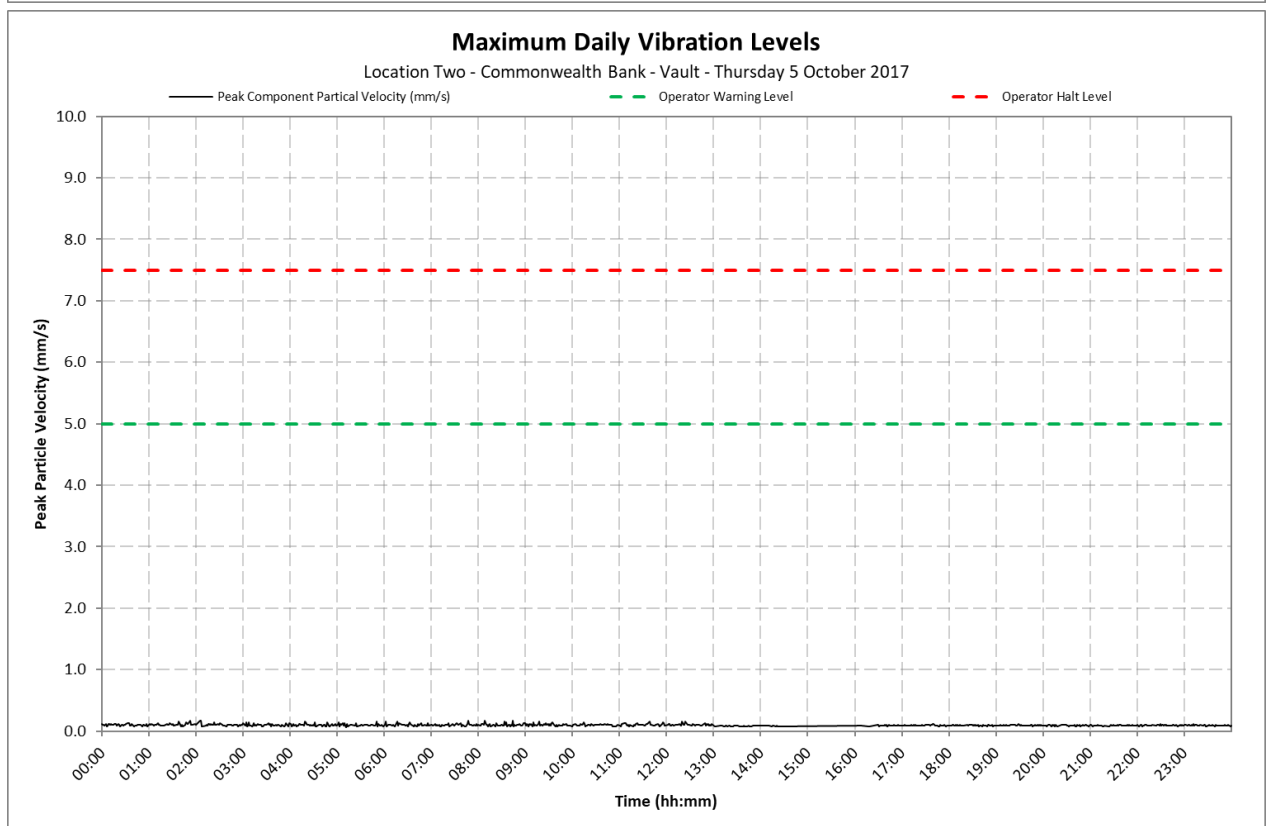
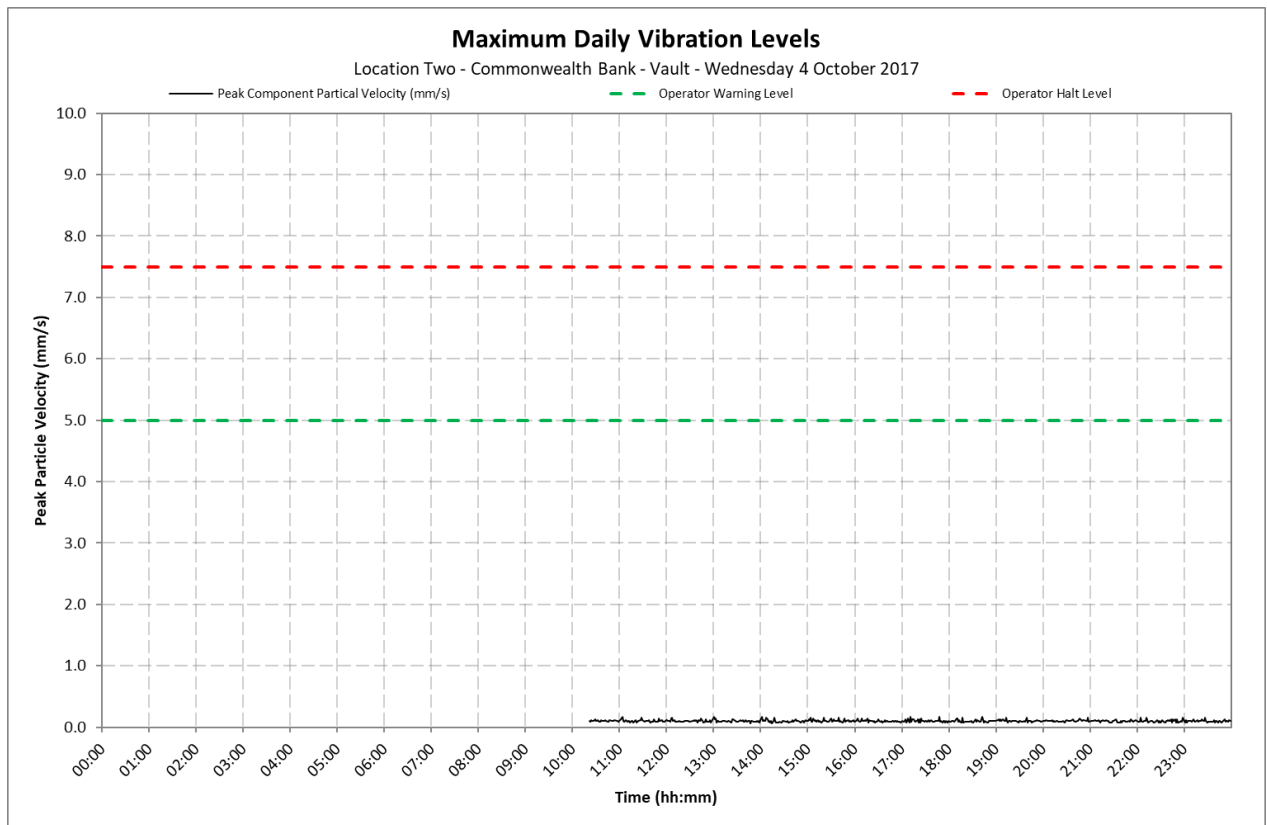
Location 1 – Macquarie Bank Tobacco Shop



Appendix C

Daily Vibration Levels

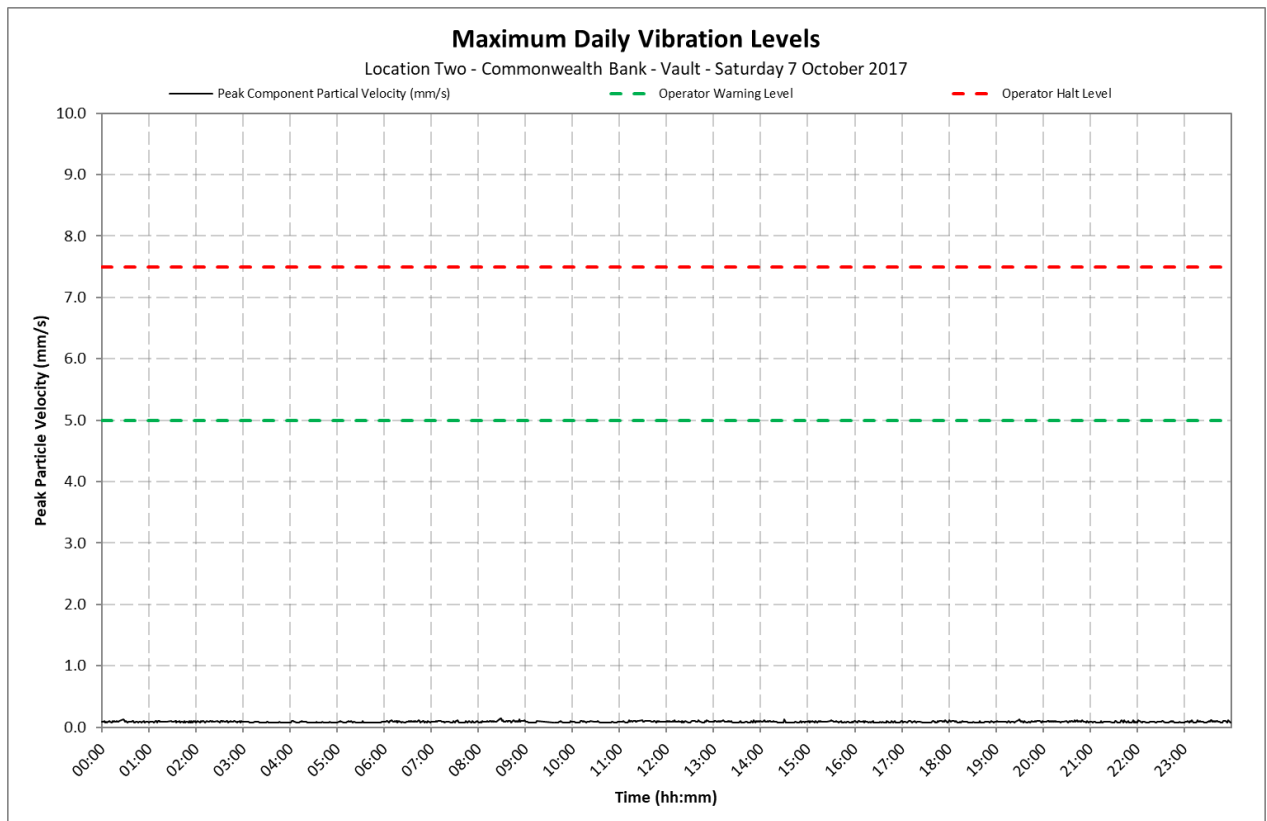
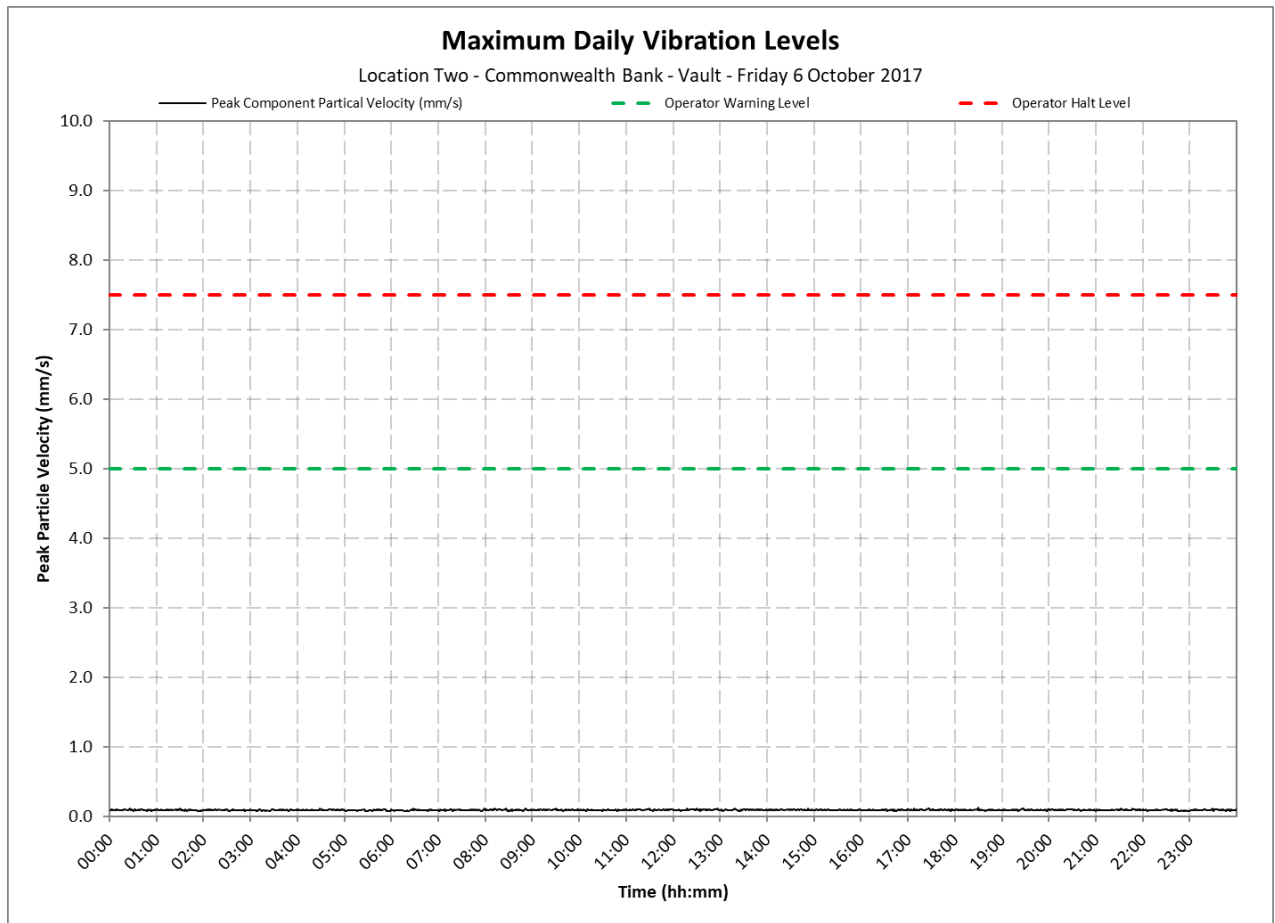
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

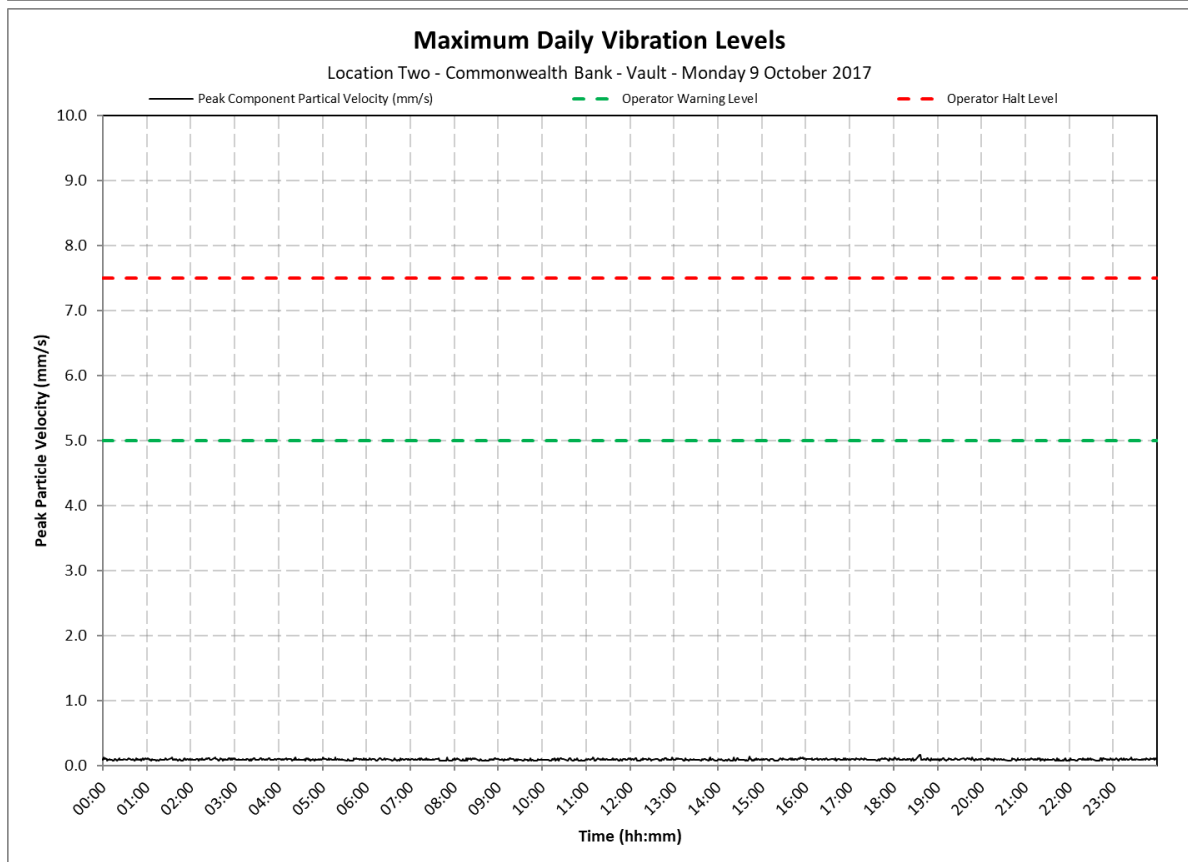
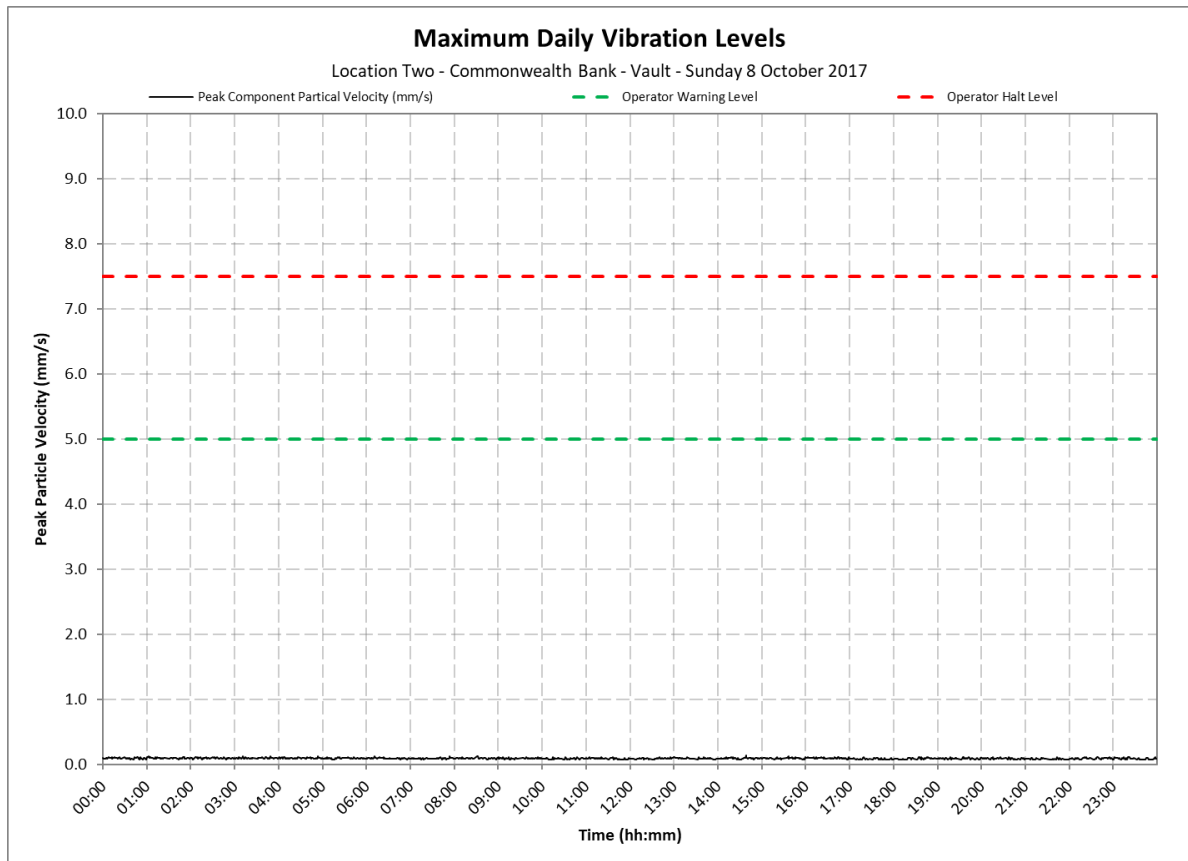
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

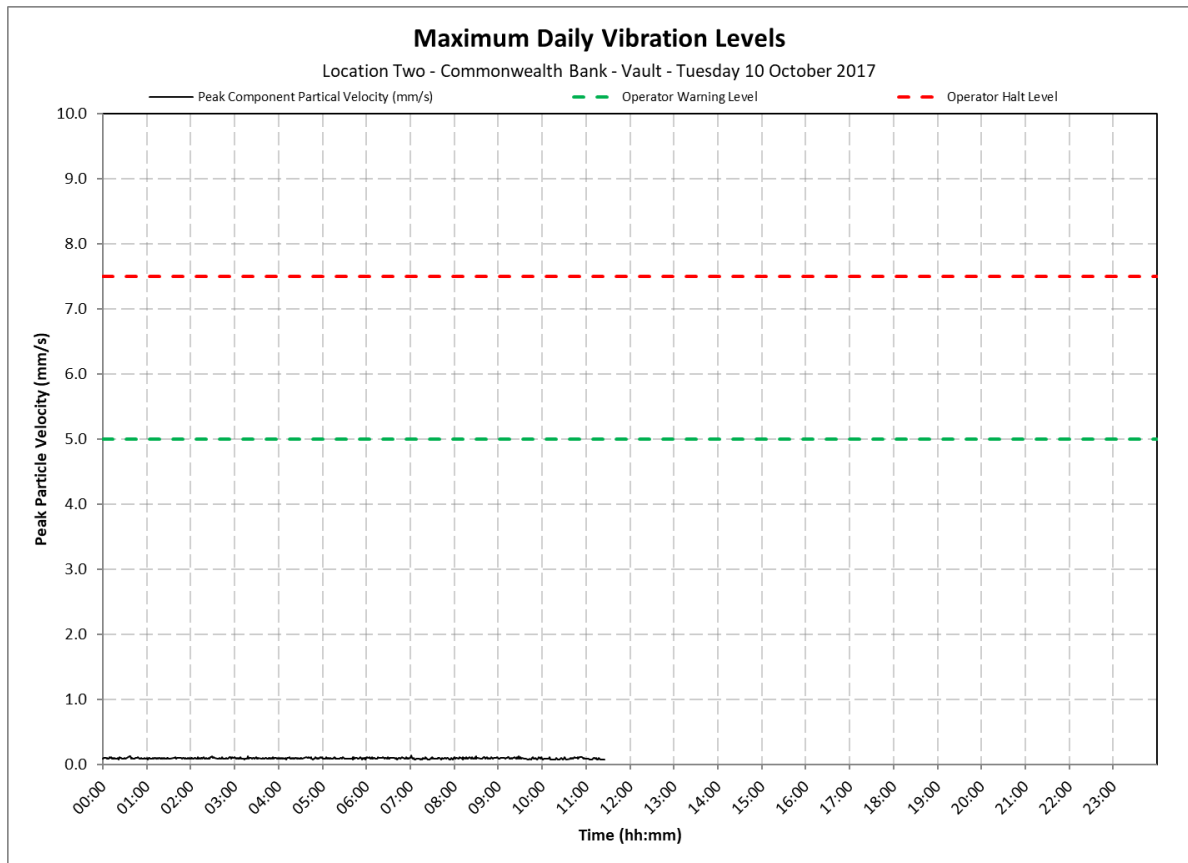
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

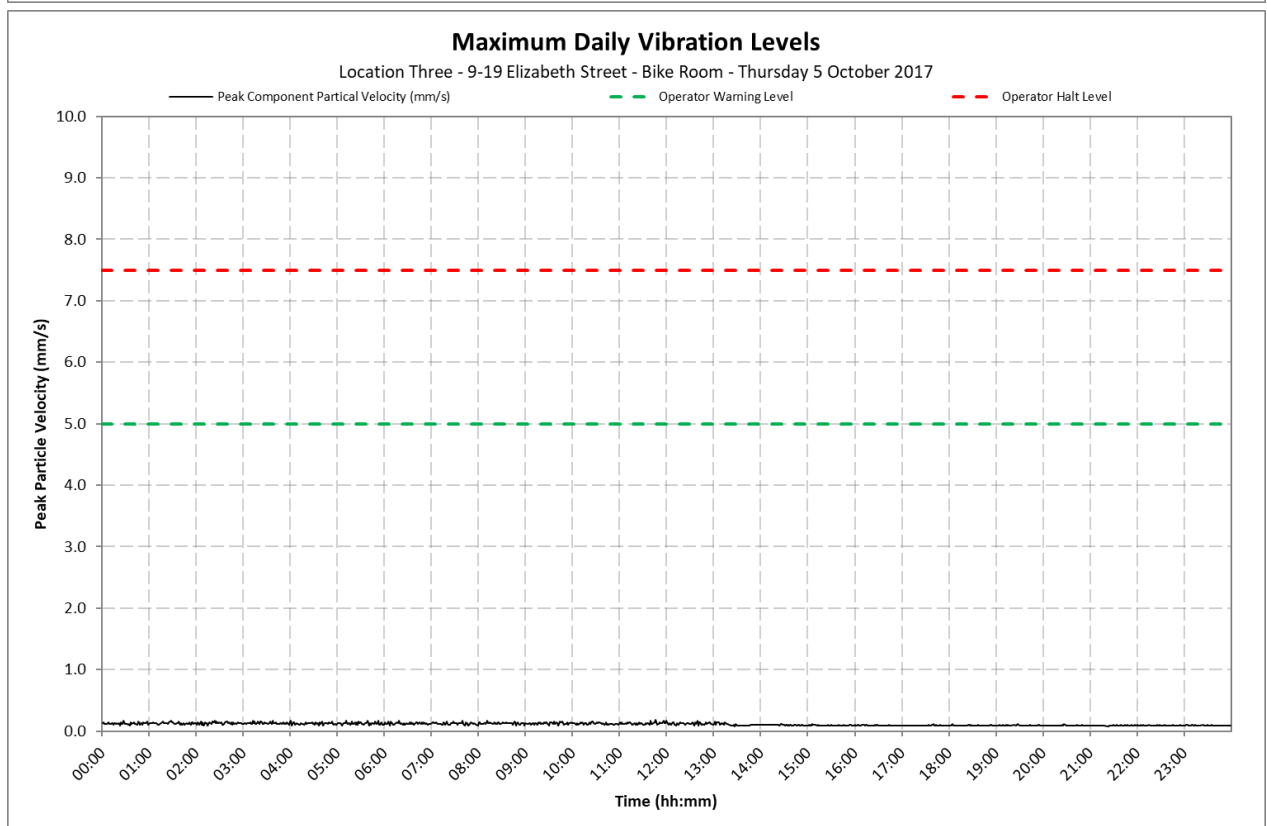
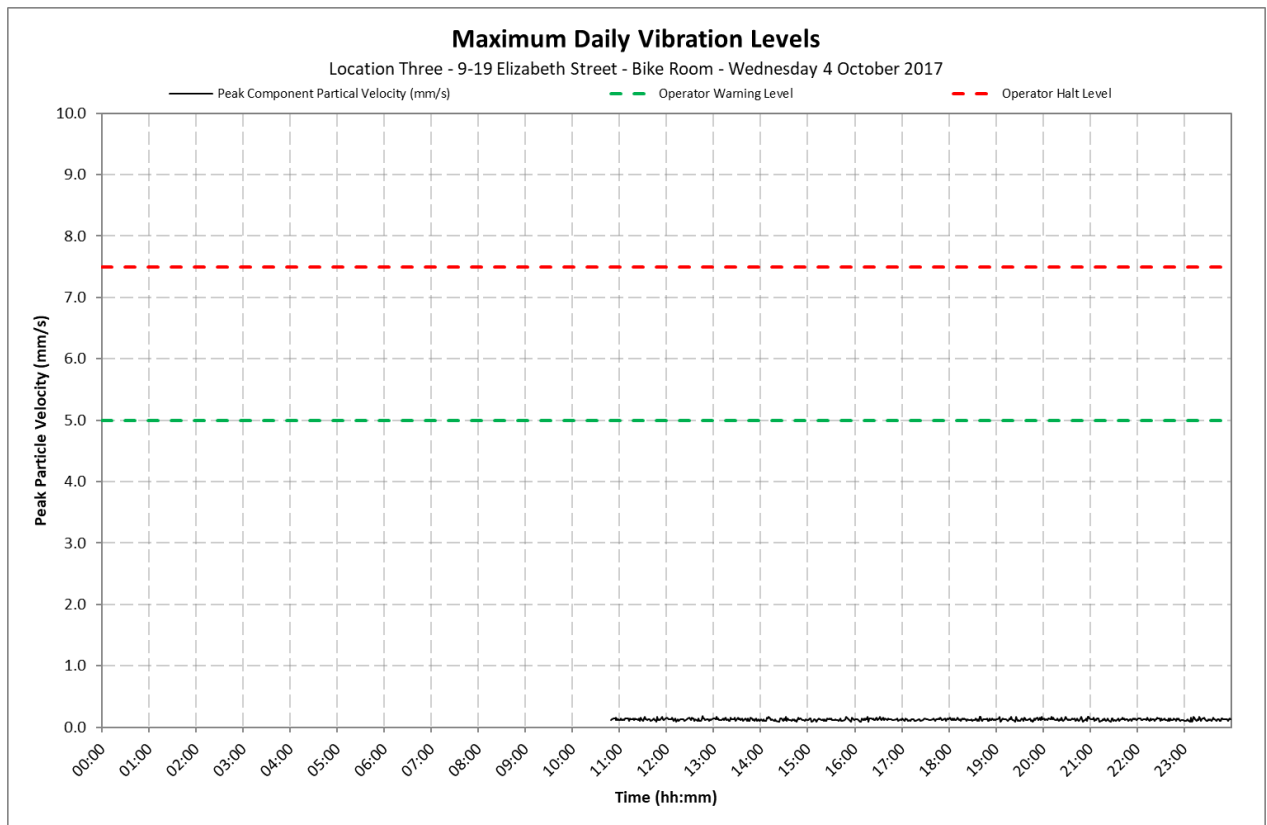
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

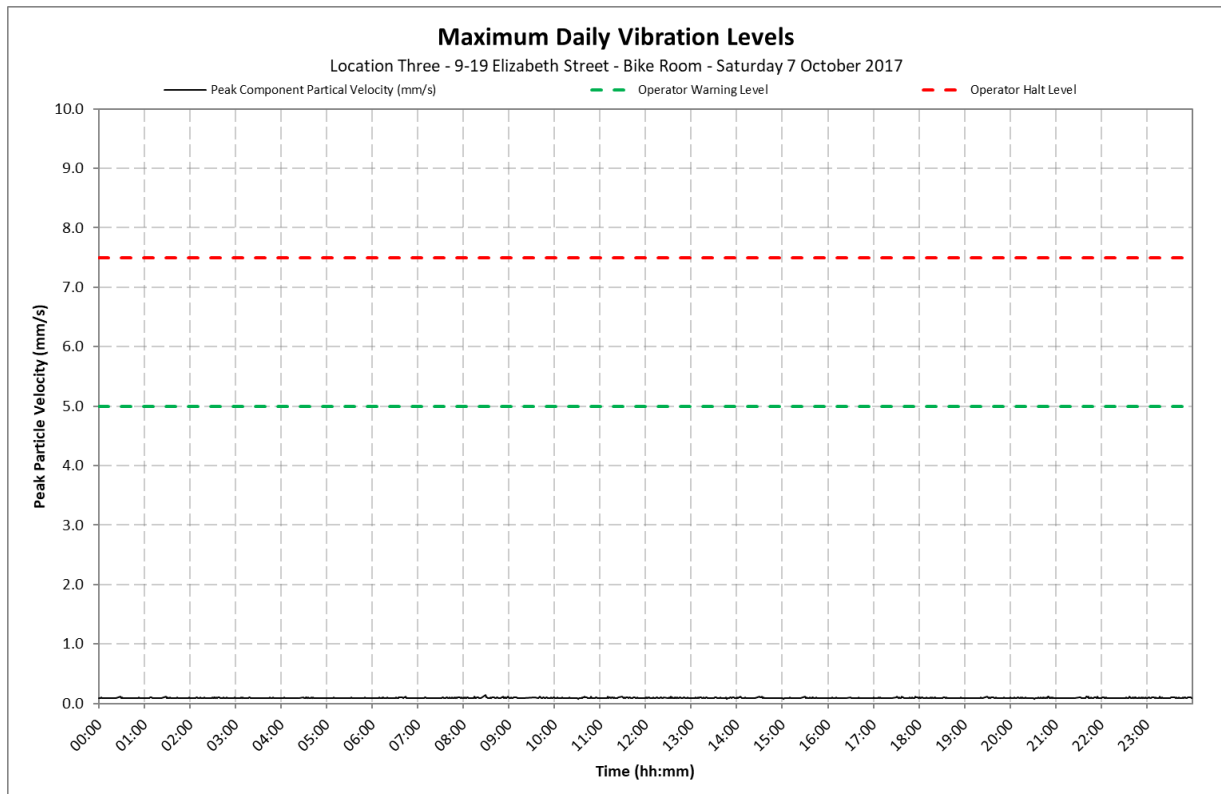
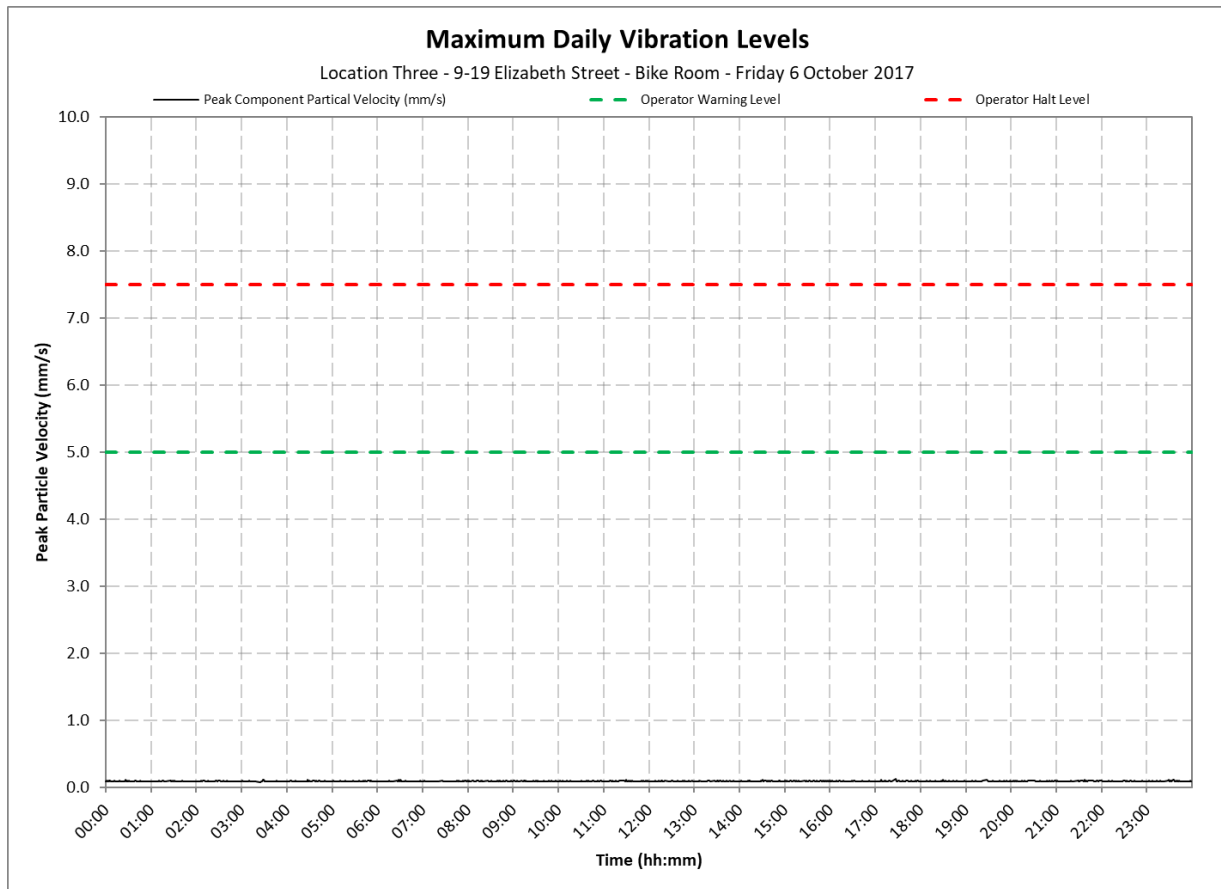
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

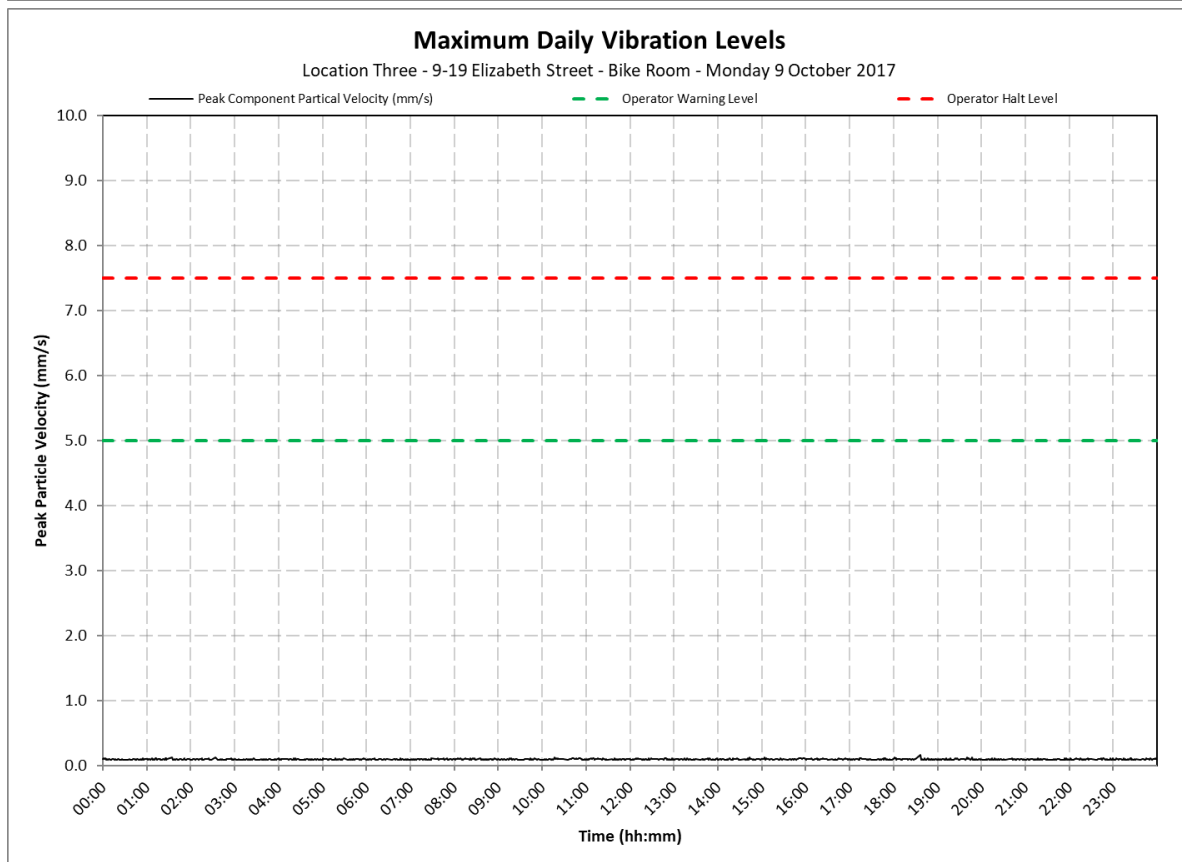
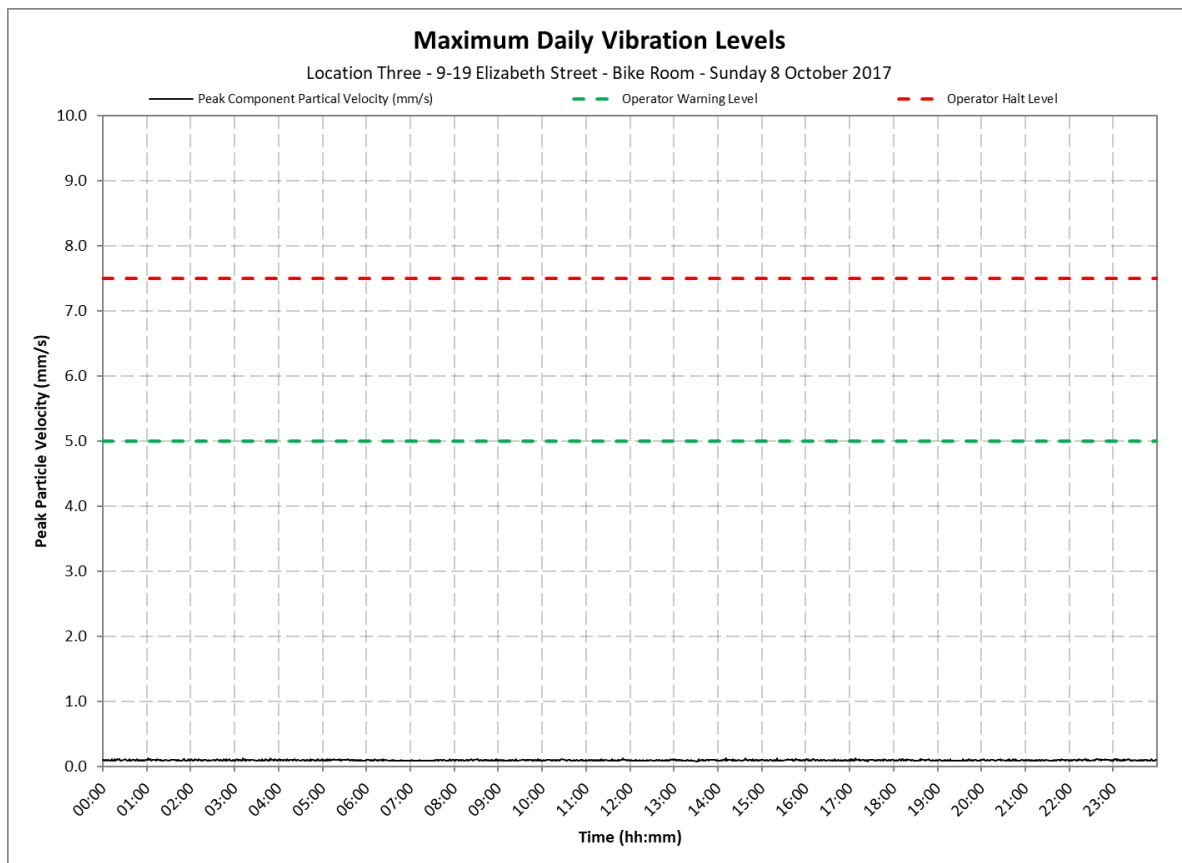
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

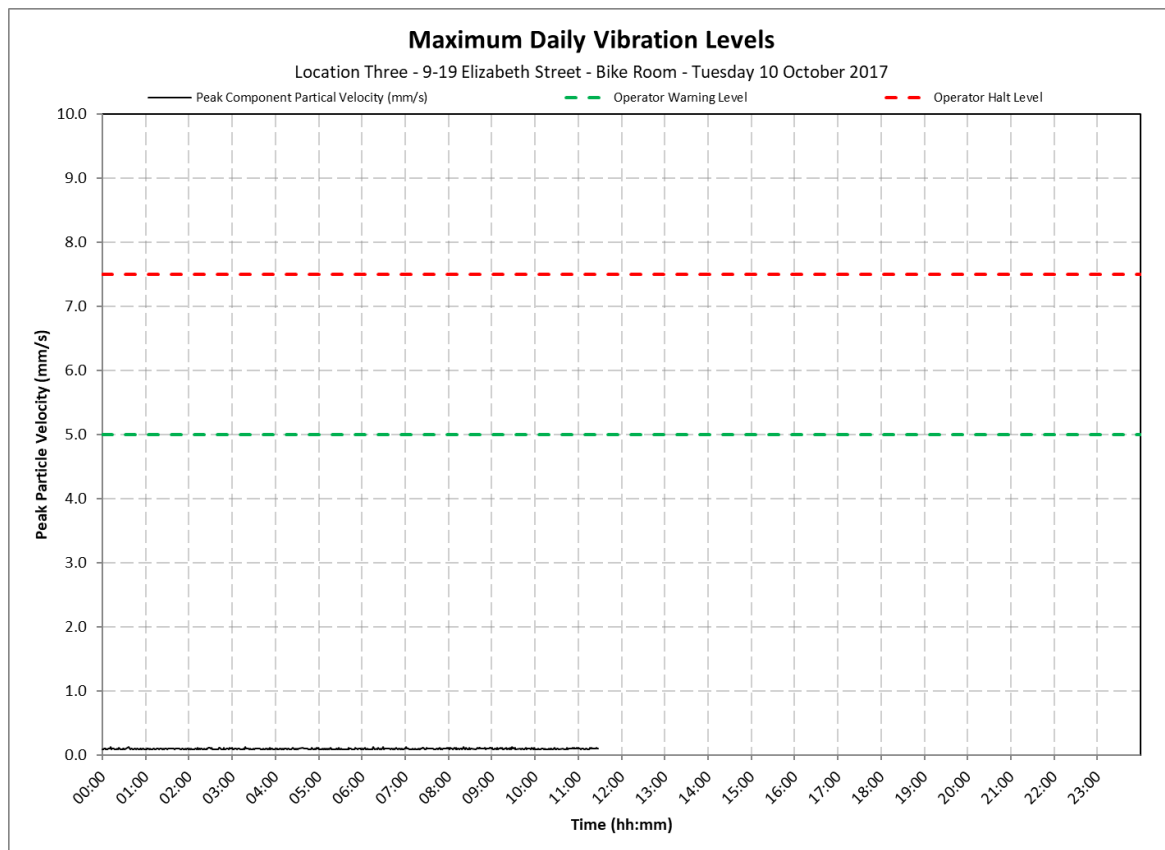
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room



19 October 2017

10-1380 R02R1 NV Monitoring 20171026.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Bert Musch

Dear Bert

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 02
10 October to 17 October 2017**

1 Introduction

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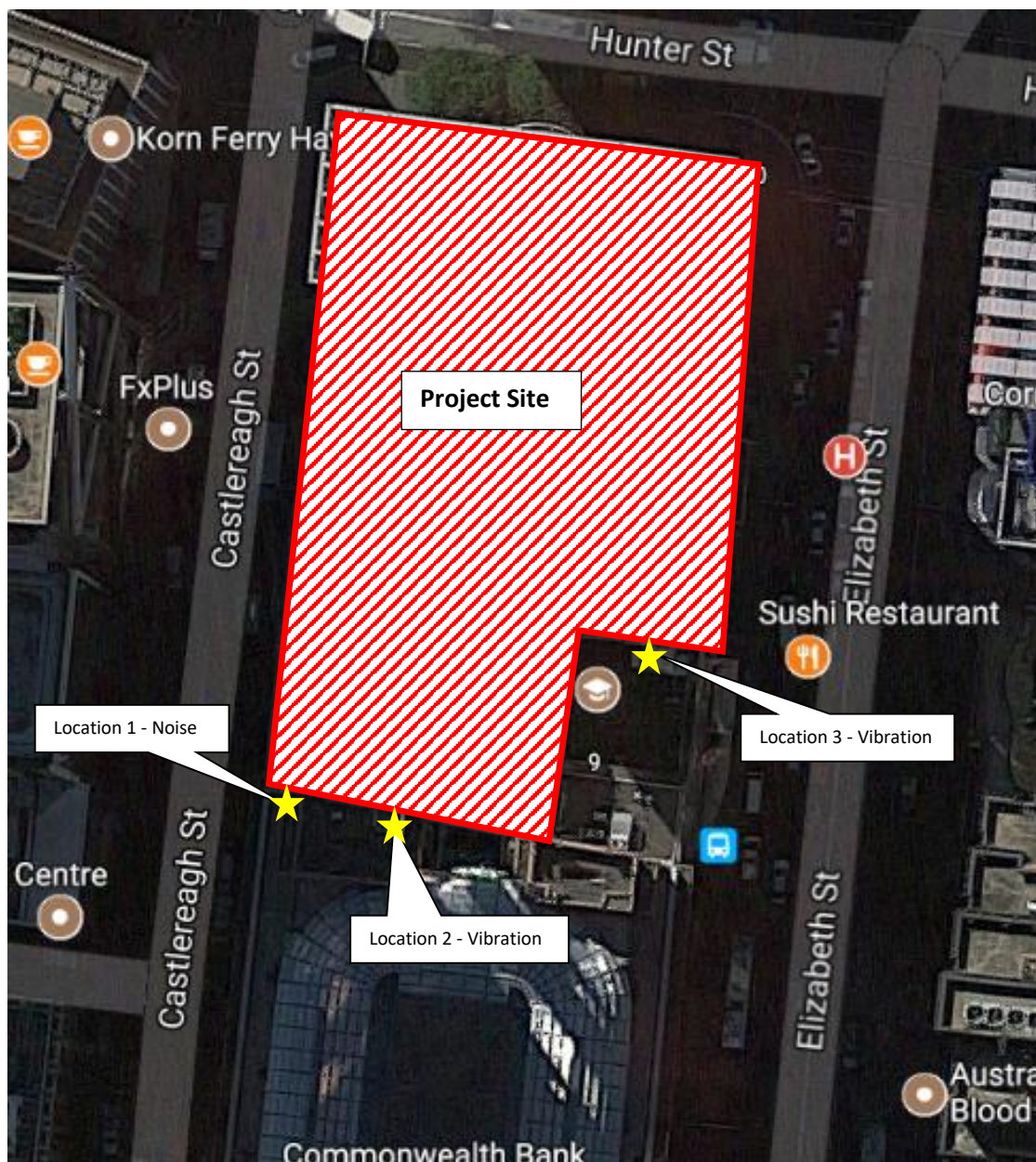
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Ground floor)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 10 October to 17 October 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
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12 October 2017	46	44	Complies	Complies
13 October 2017	45	45	Complies	Complies
14 October 2017	38	36	Complies	Complies
15 October 2017	35	34	Complies	Complies
16 October 2017	46	44	Complies	Complies
17 October 2017	46	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 3, respectively, during the period 10 October to 17 October 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
10 October 2017	0.1 mm/s	Complies
11 October 2017	6.0 mm/s	1 Event Above Warning Level
12 October 2017	6.7 mm/s	1 Event Above Warning Level
13 October 2017	4.0 mm/s	1 Event Above Early Warning Level
14 October 2017	2.0 mm/s	Complies
15 October 2017	0.2 mm/s	Complies
16 October 2017	1.0 mm/s	Complies
17 October 2017	1.3 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
10 October 2017	0.1 mm/s	Complies
11 October 2017	0.1 mm/s	Complies
12 October 2017	2.5 mm/s	Complies
13 October 2017	2.1 mm/s	Complies
14 October 2017	2.1 mm/s	Complies
15 October 2017	0.1 mm/s	Complies
16 October 2017	0.9 mm/s	Complies
17 October 2017	1.4 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 10 October to 17 October 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 10 October to 17 October 2017 found two events above the Operator Warning Level, and one event above the Early Warning Level at Location Two. All recorded ambient vibration levels however, were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

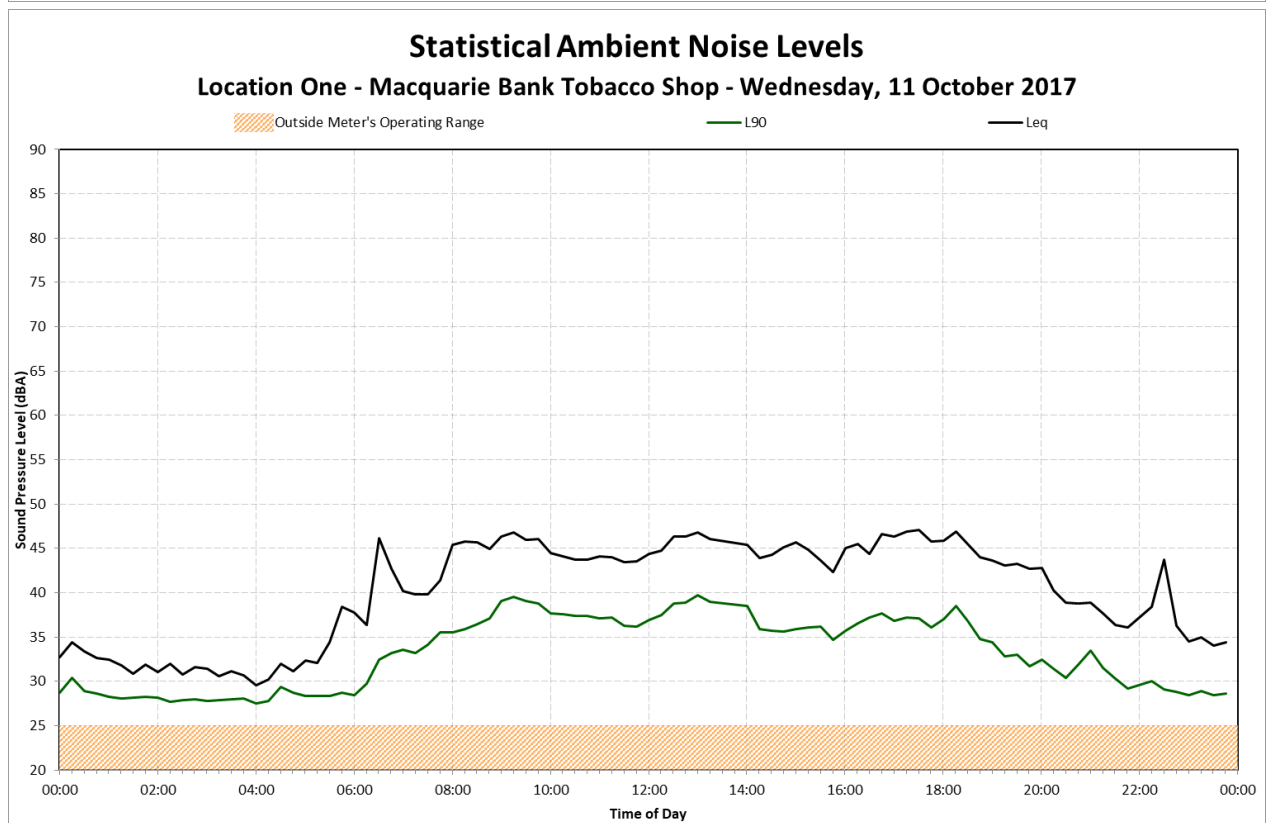
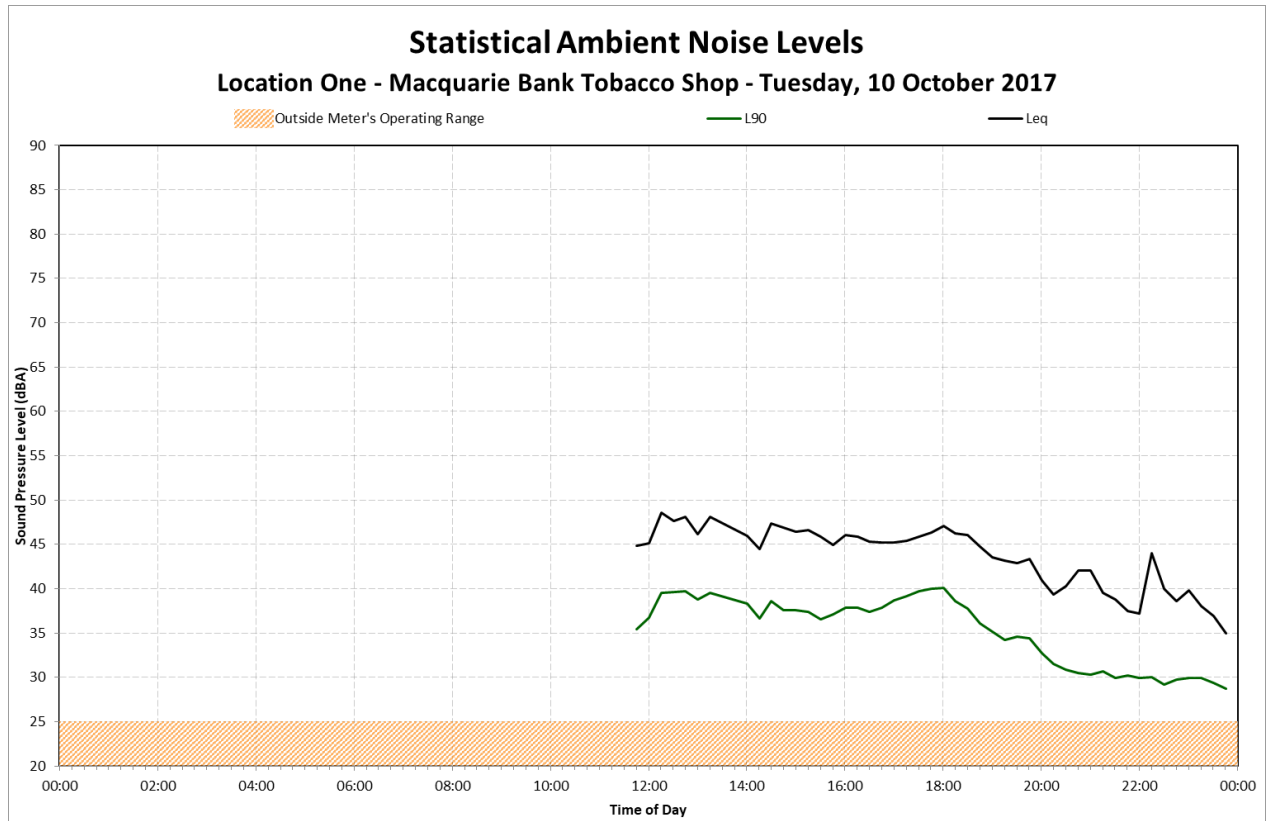
Terminology Relating to Noise and Vibration

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Reverberation	The persistence of sound in a space after a sound source has been stopped.
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Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

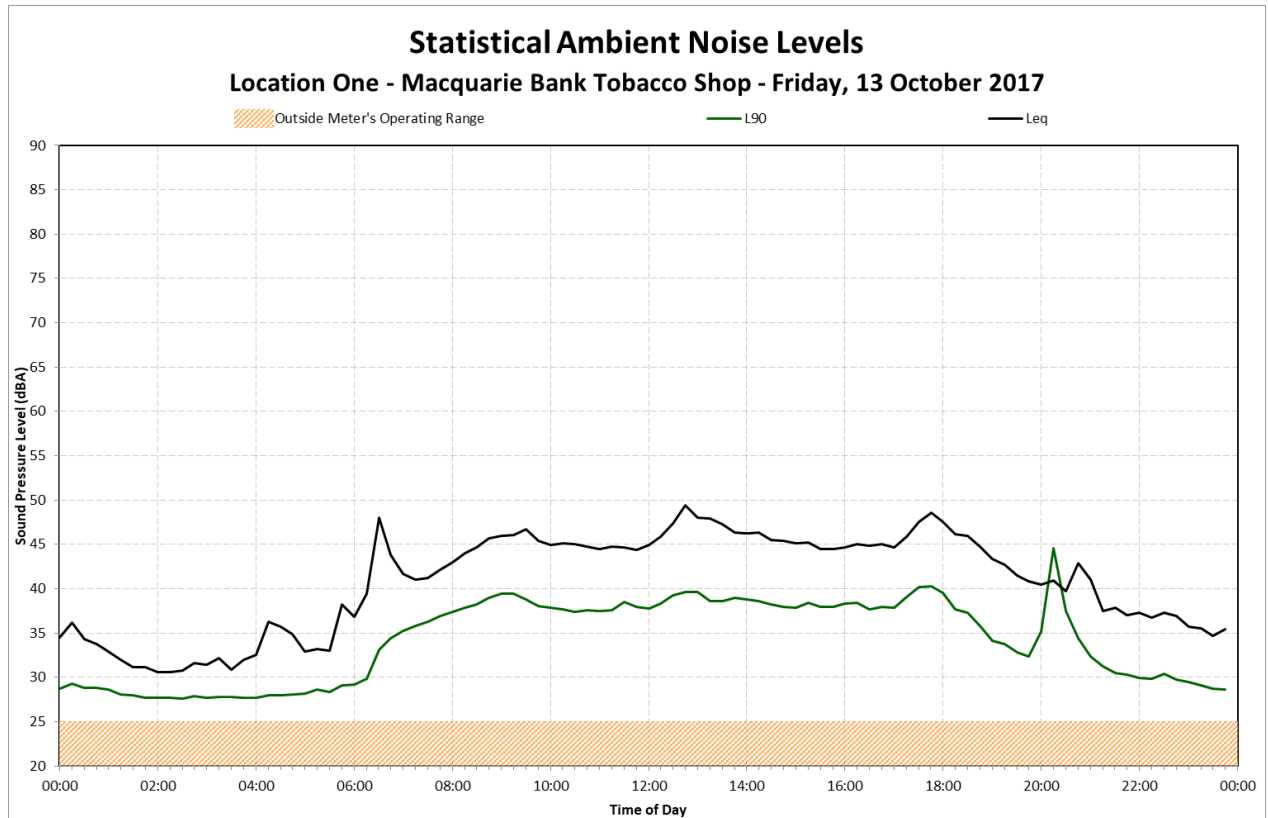
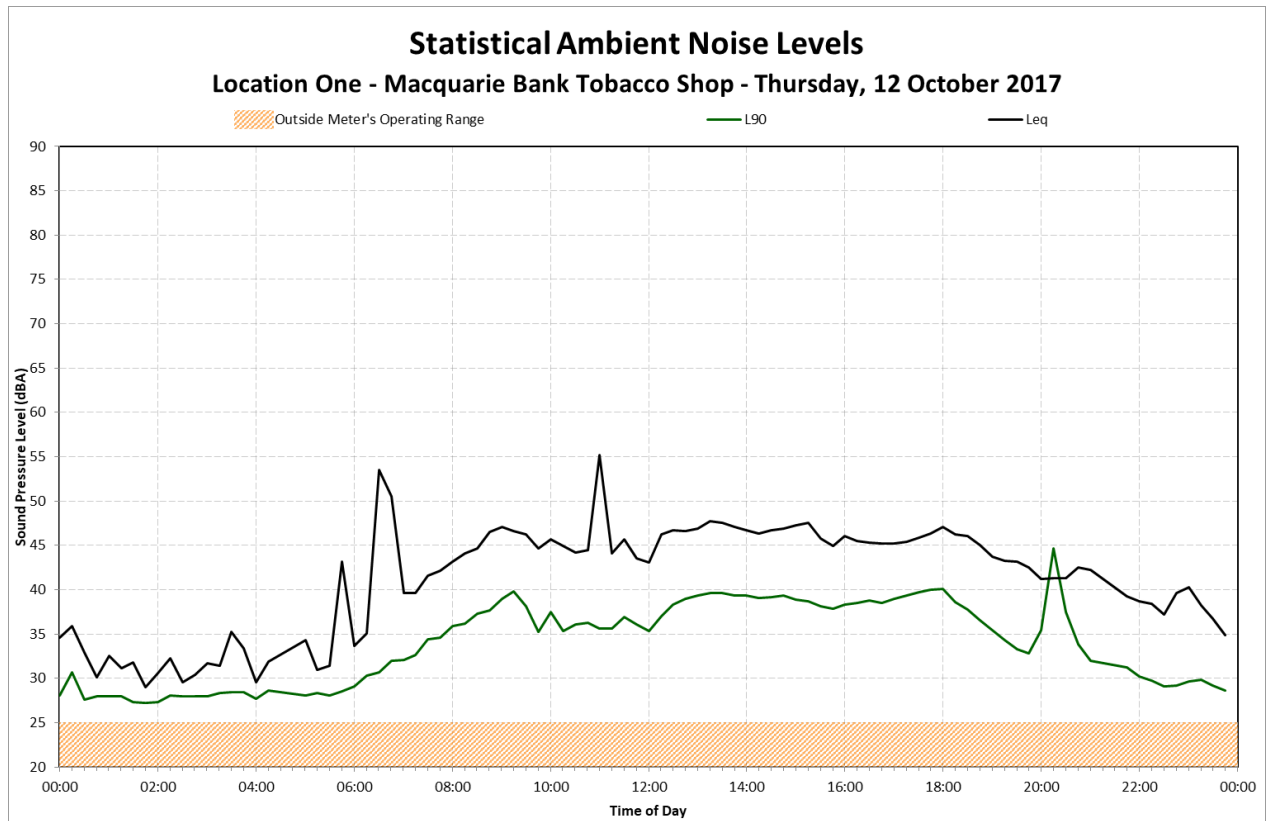
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

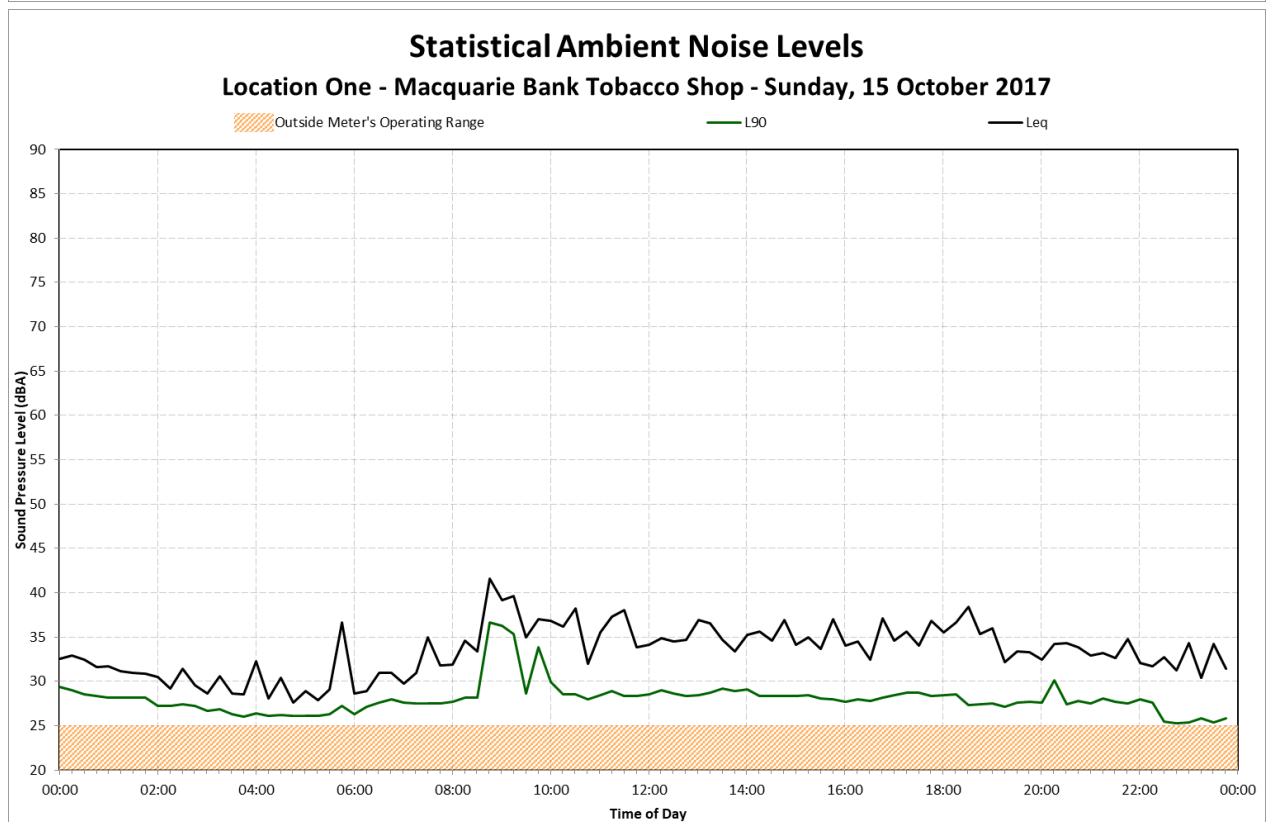
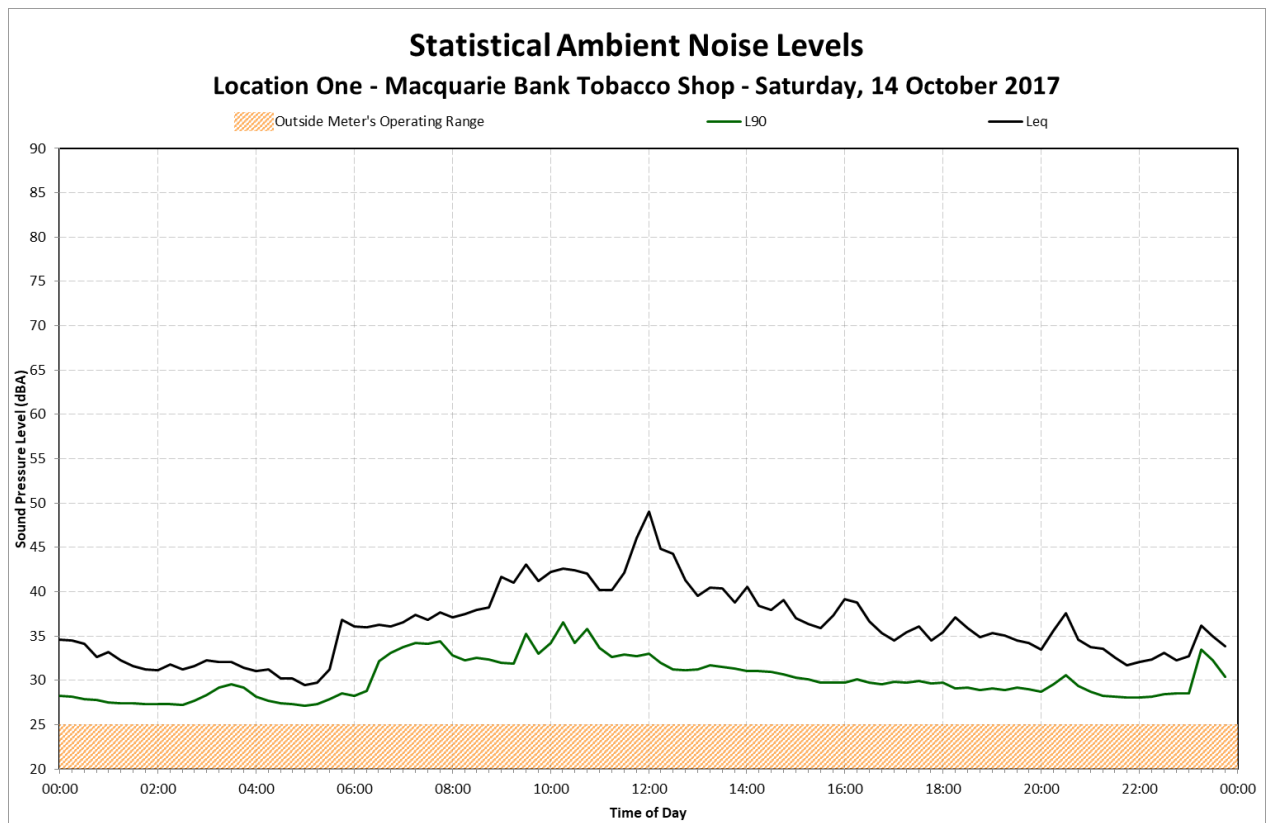
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

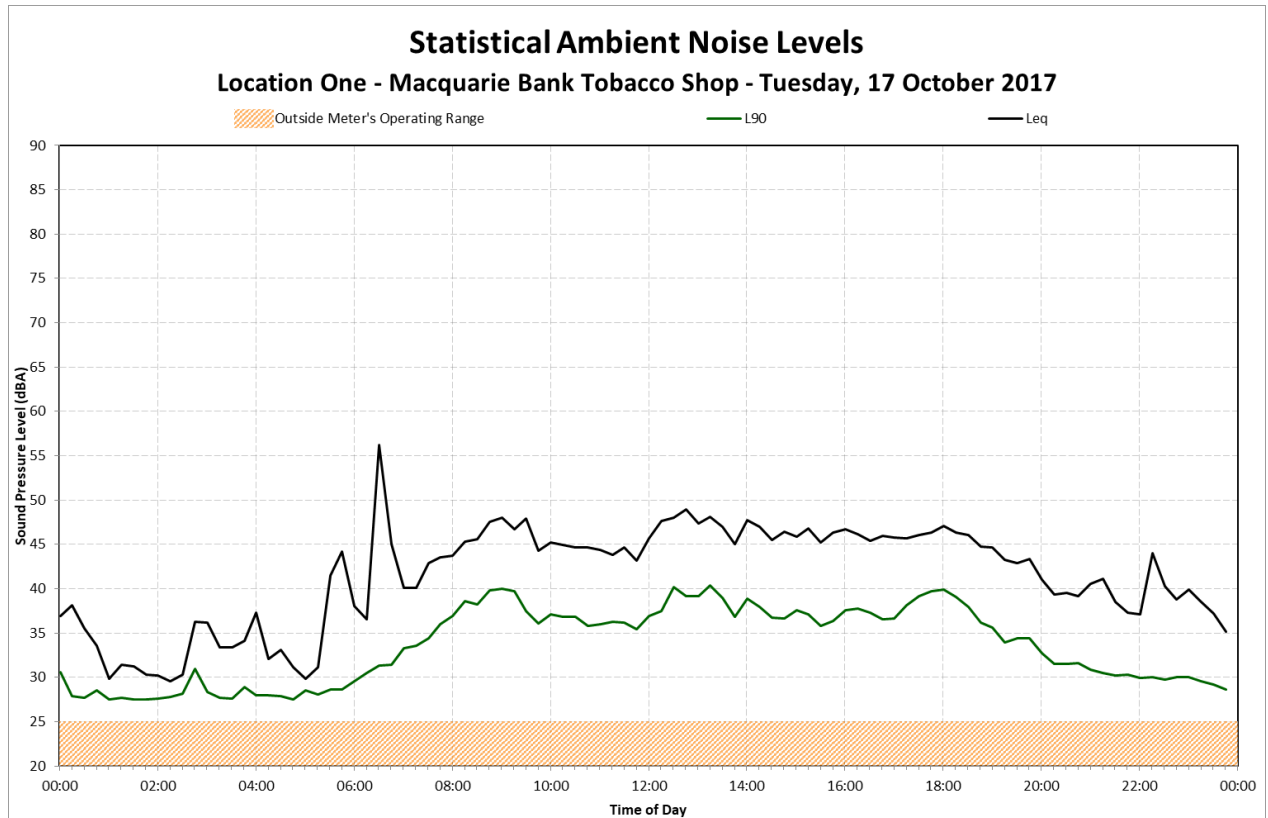
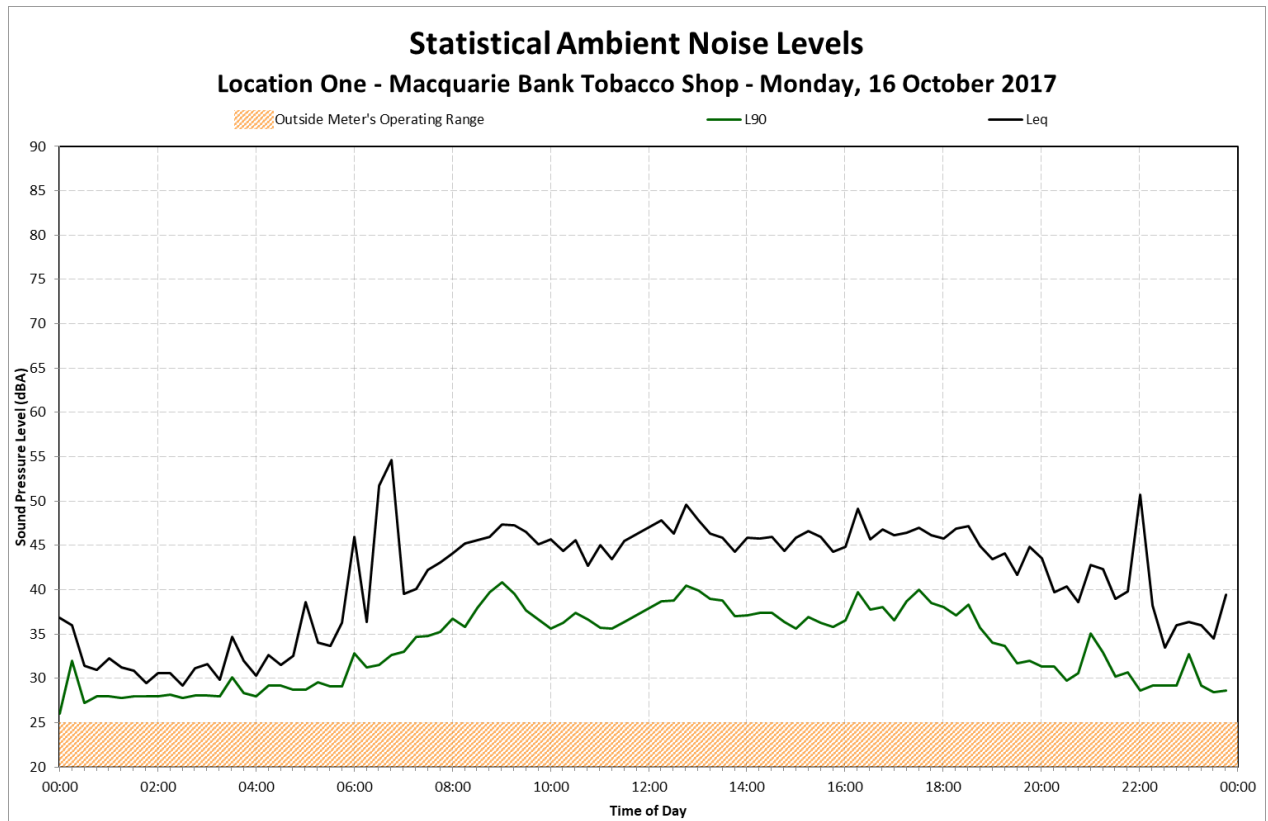
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Appendix B

Daily Noise Levels

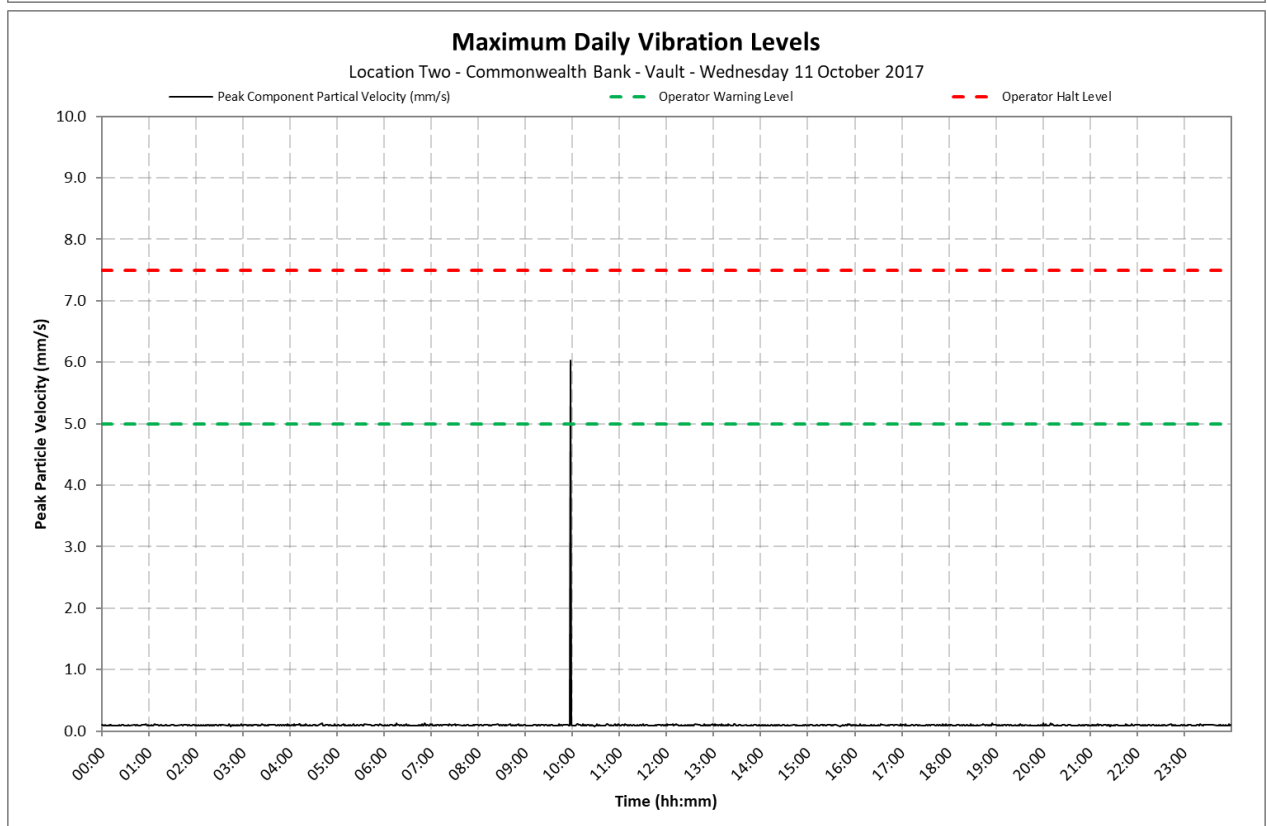
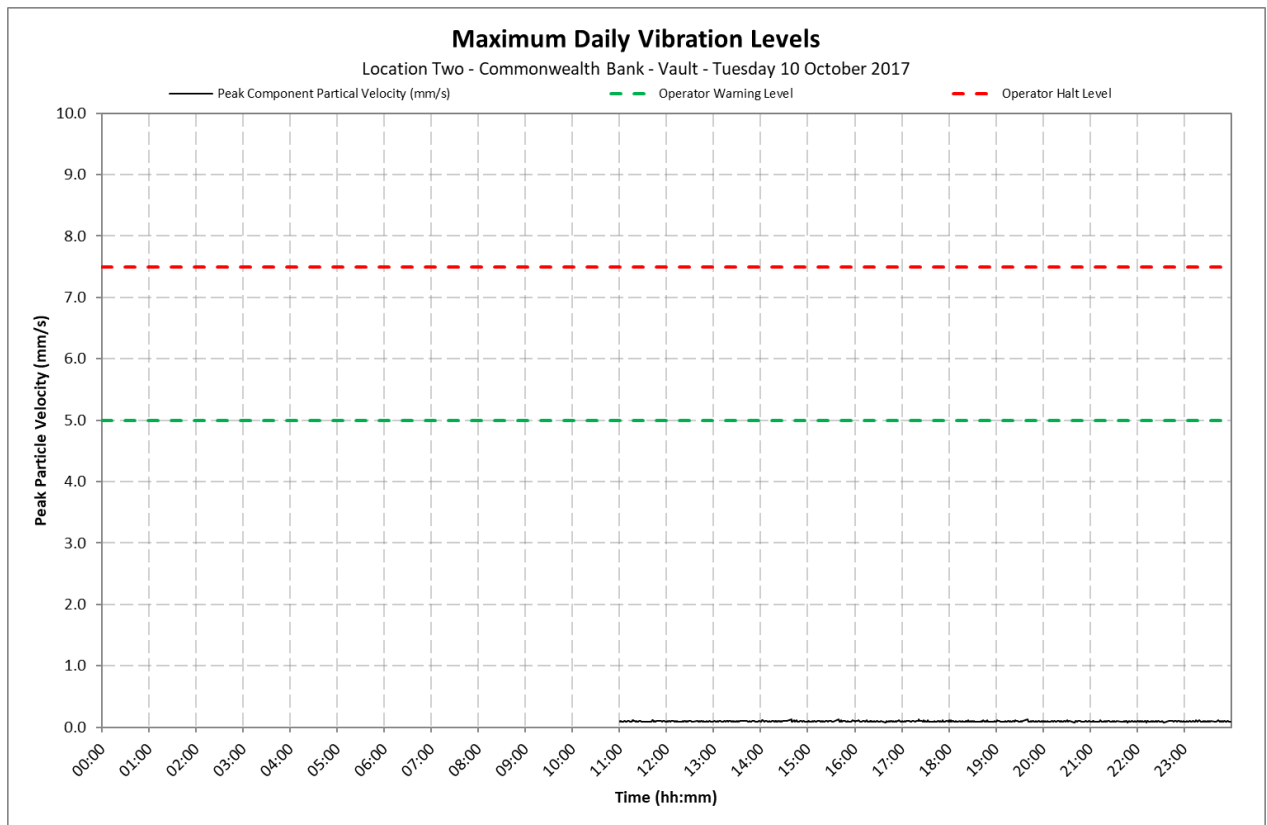
Location 1 – Macquarie Bank Tobacco Shop



Appendix C

Daily Vibration Levels

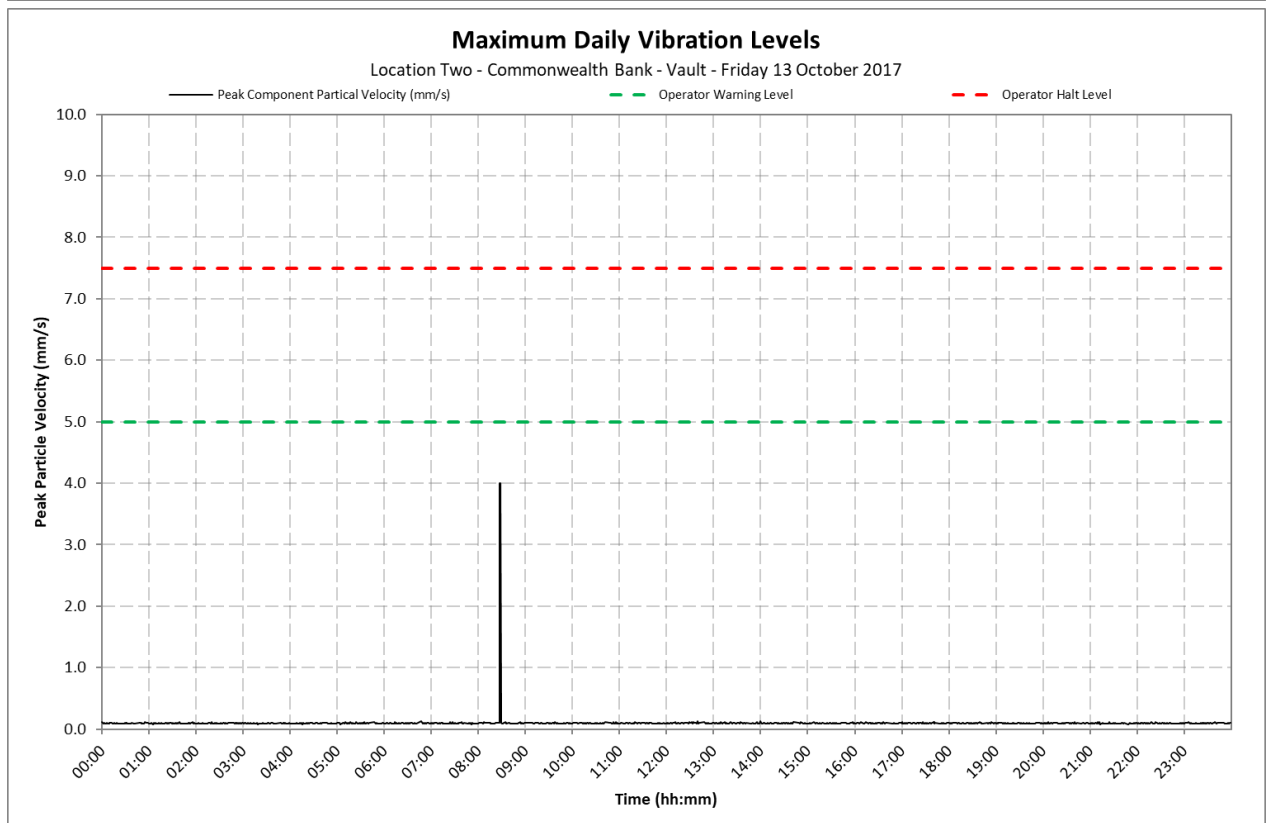
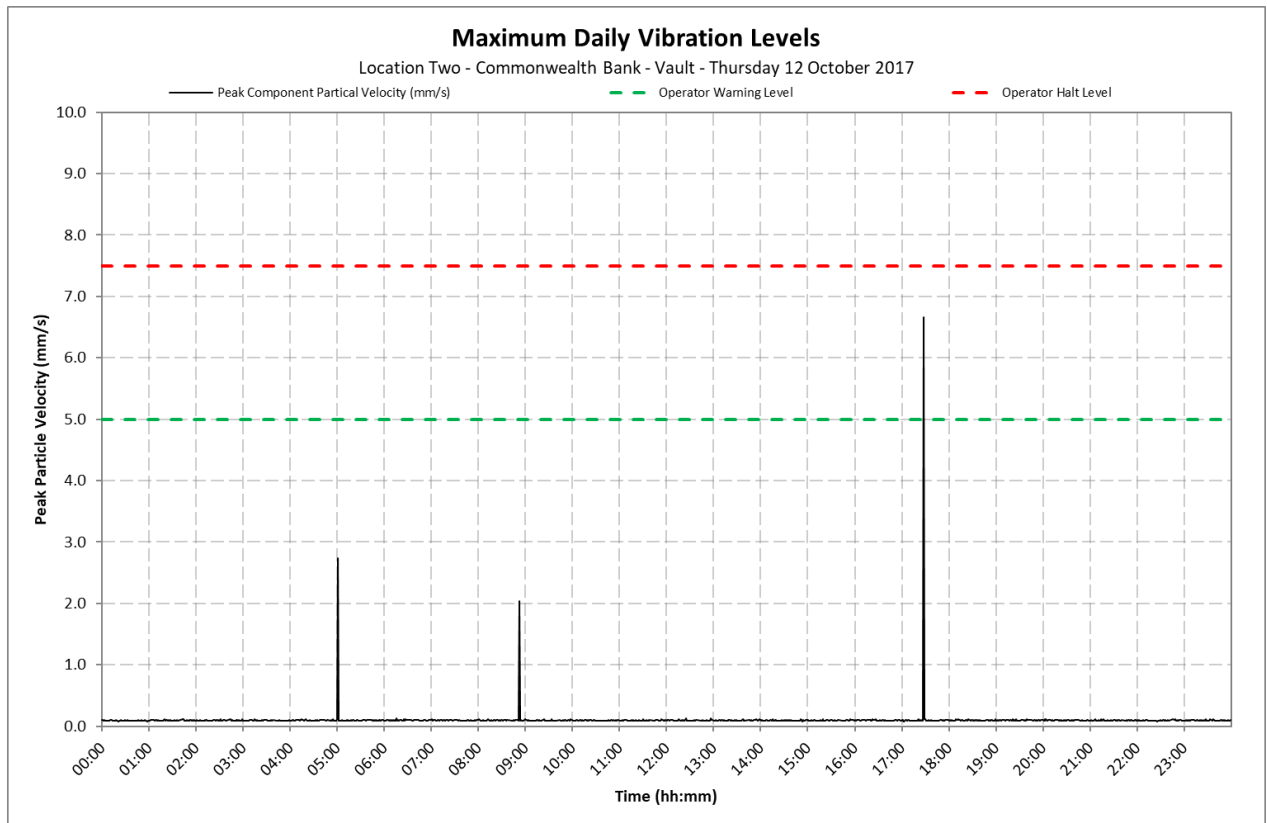
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

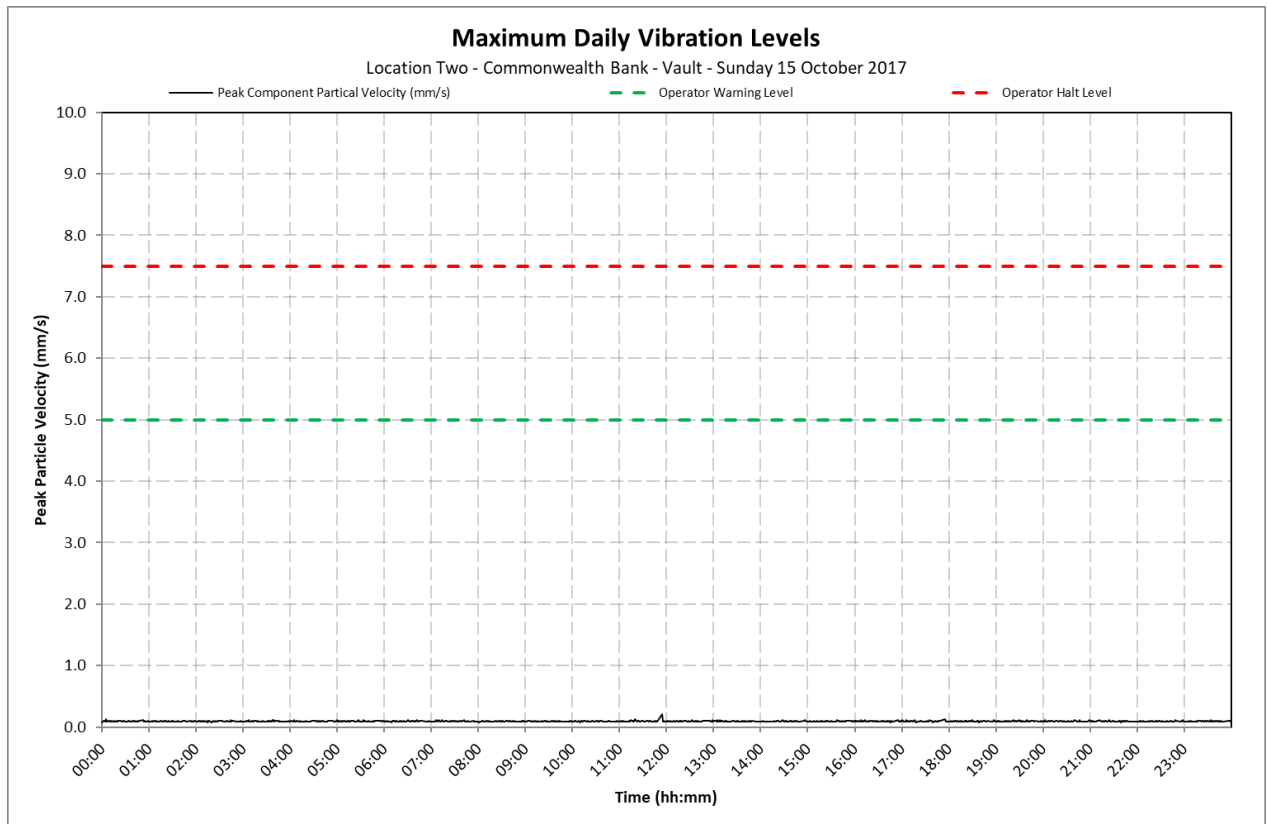
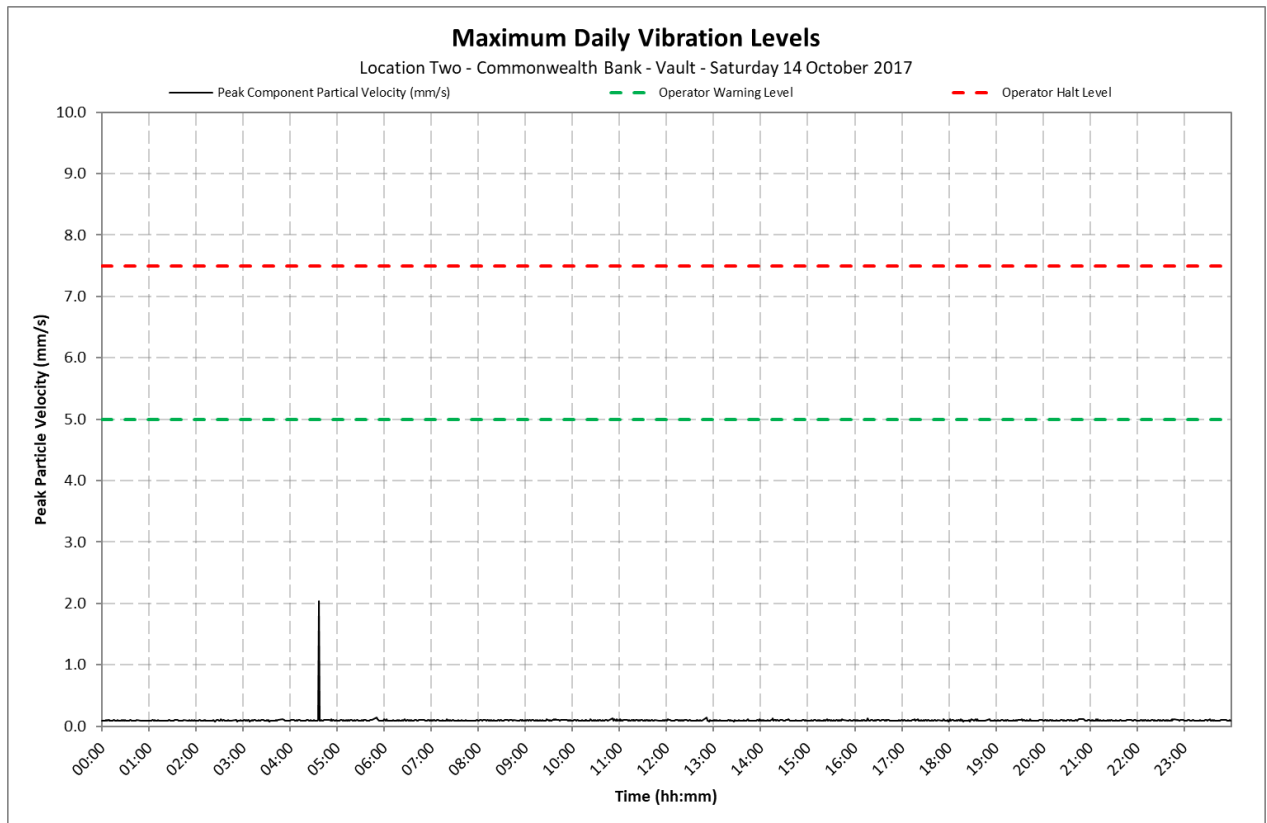
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

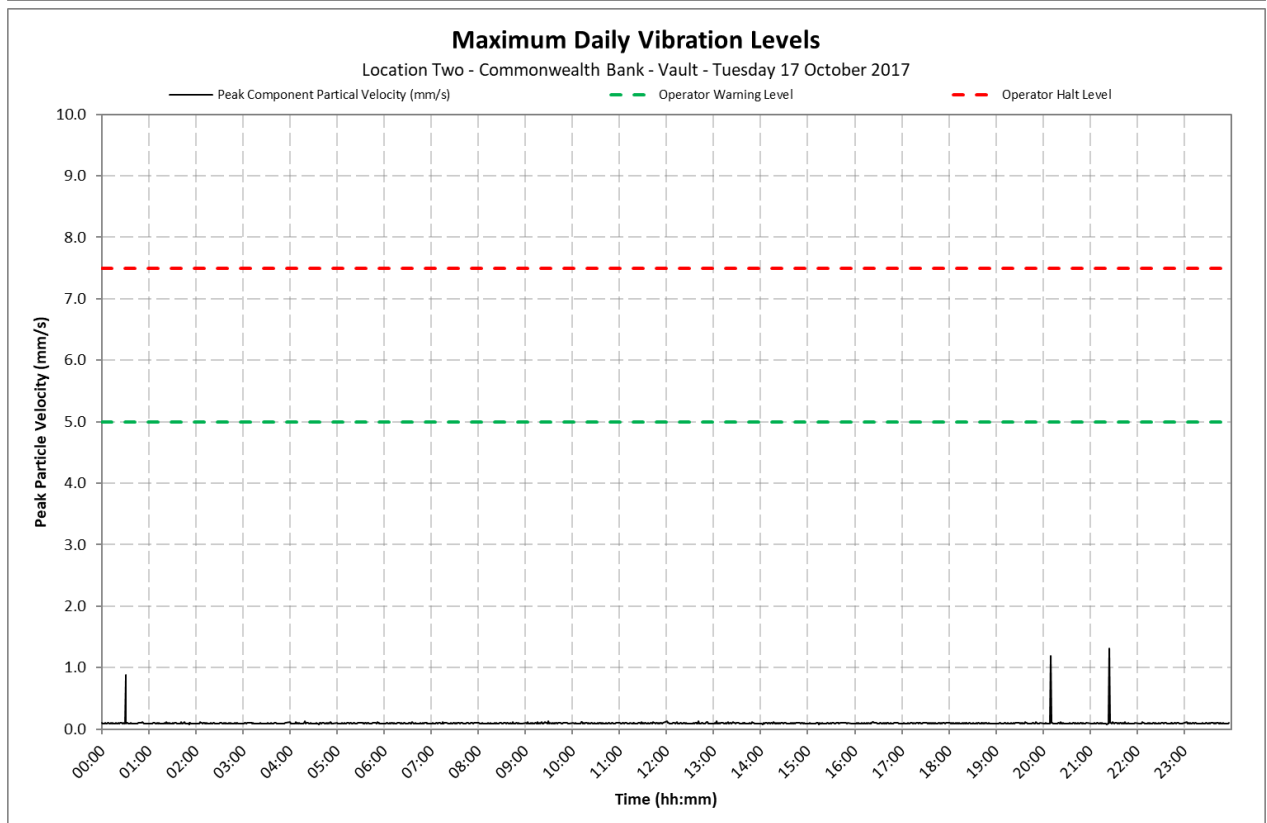
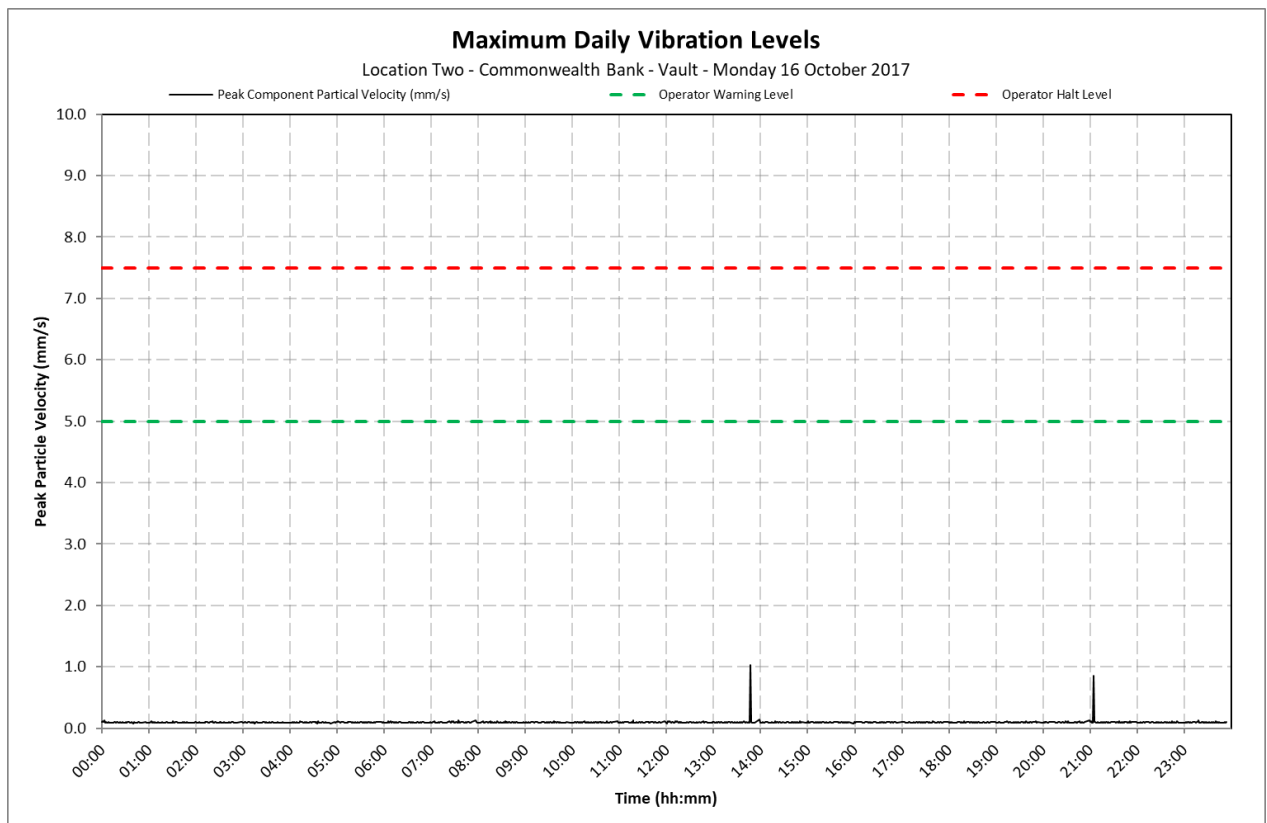
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

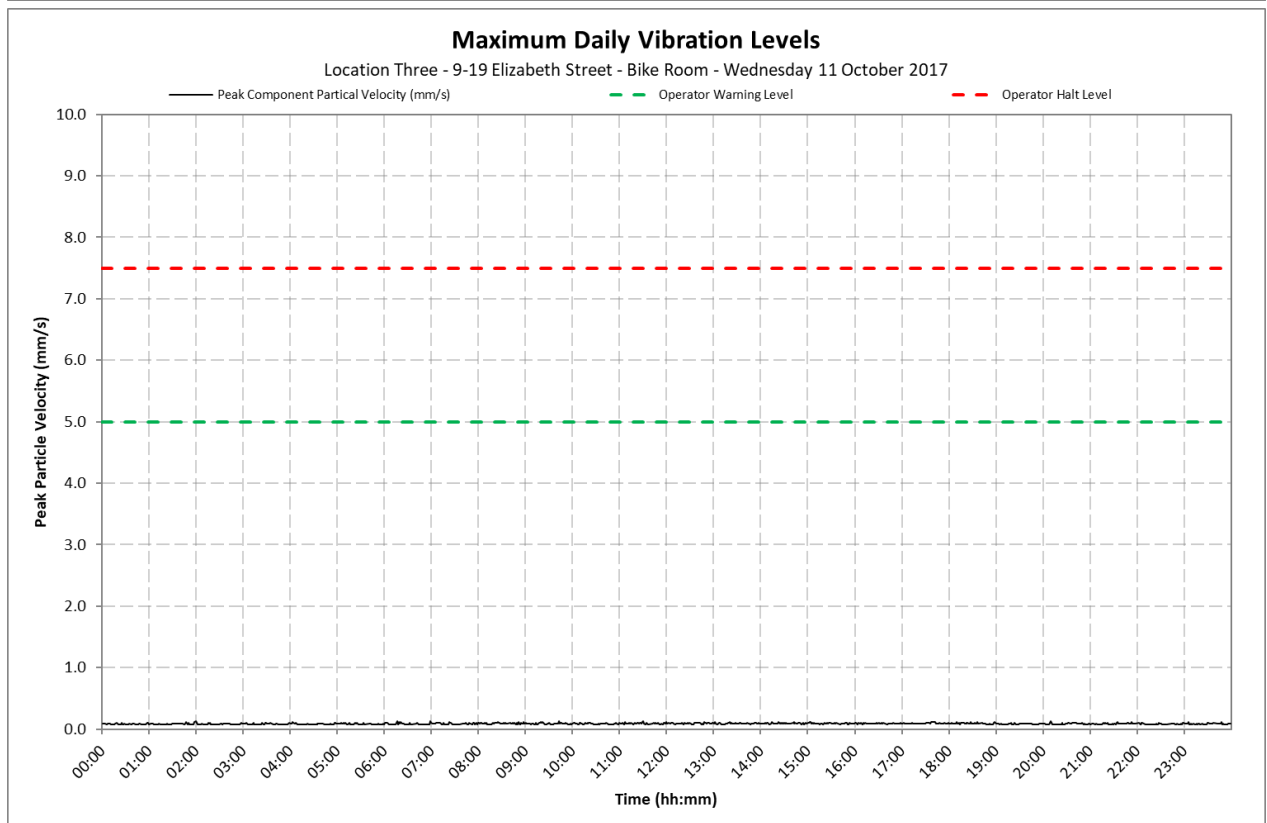
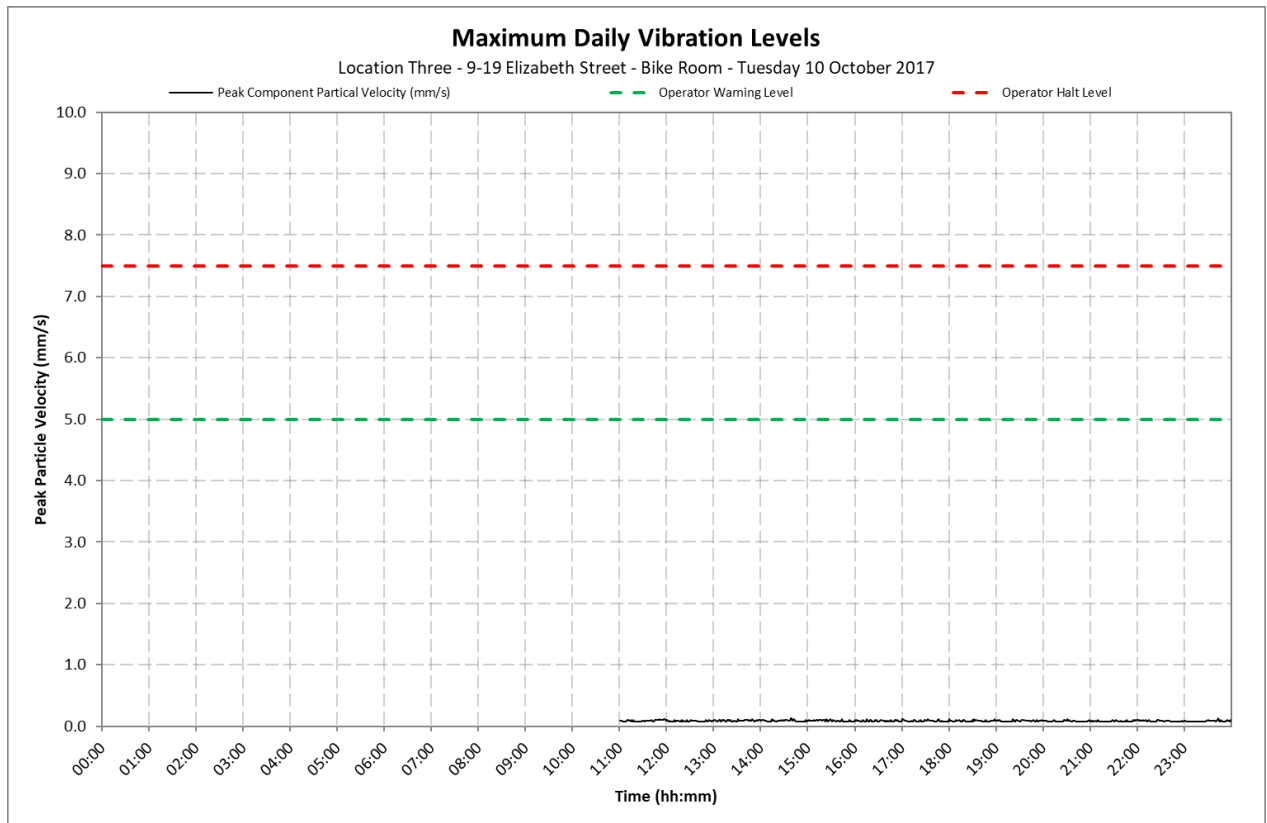
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

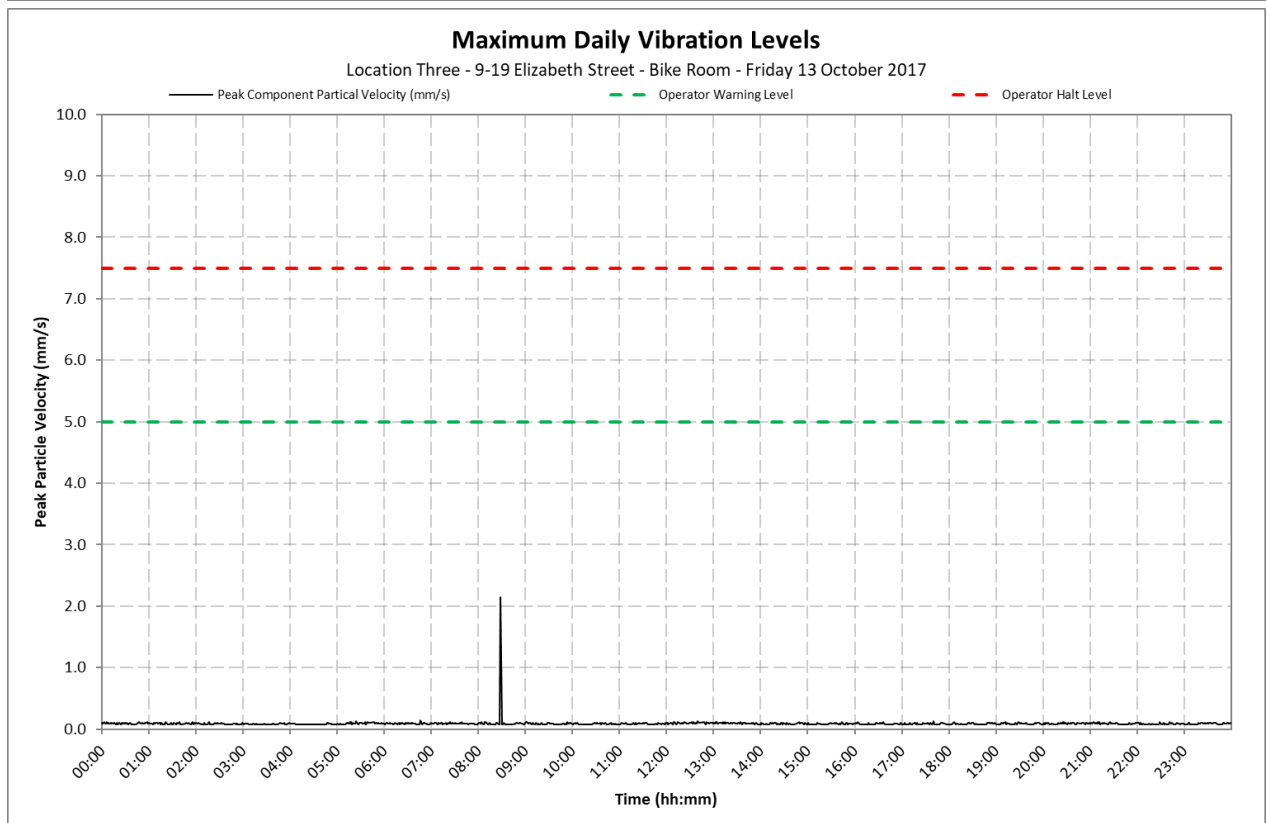
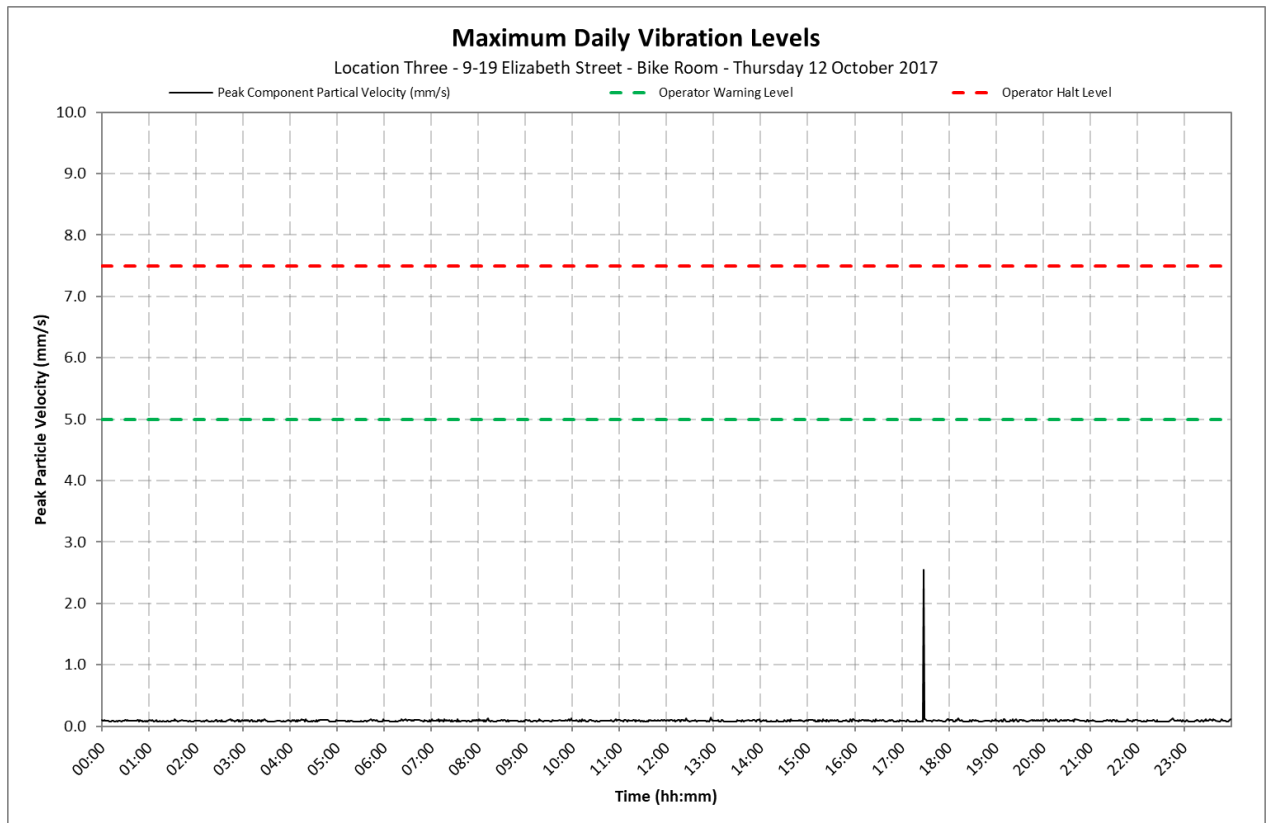
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

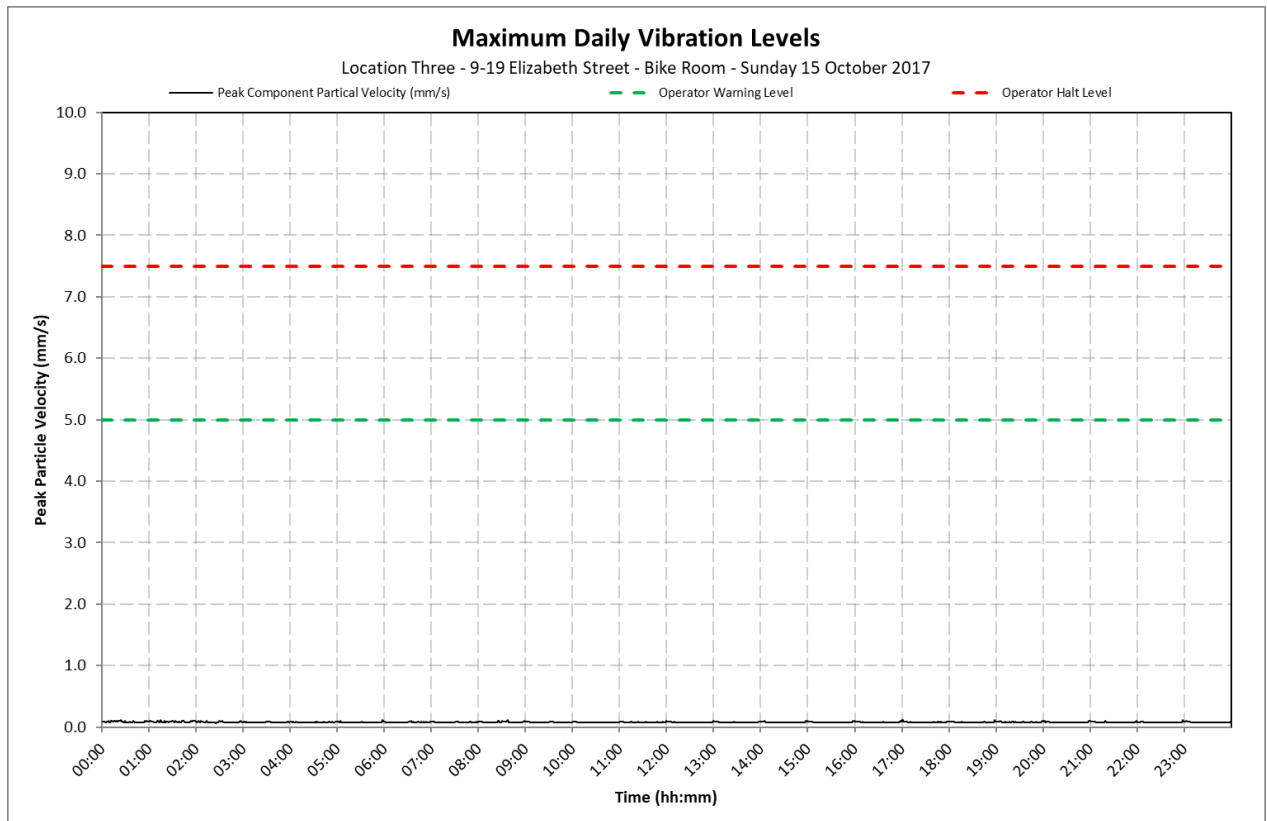
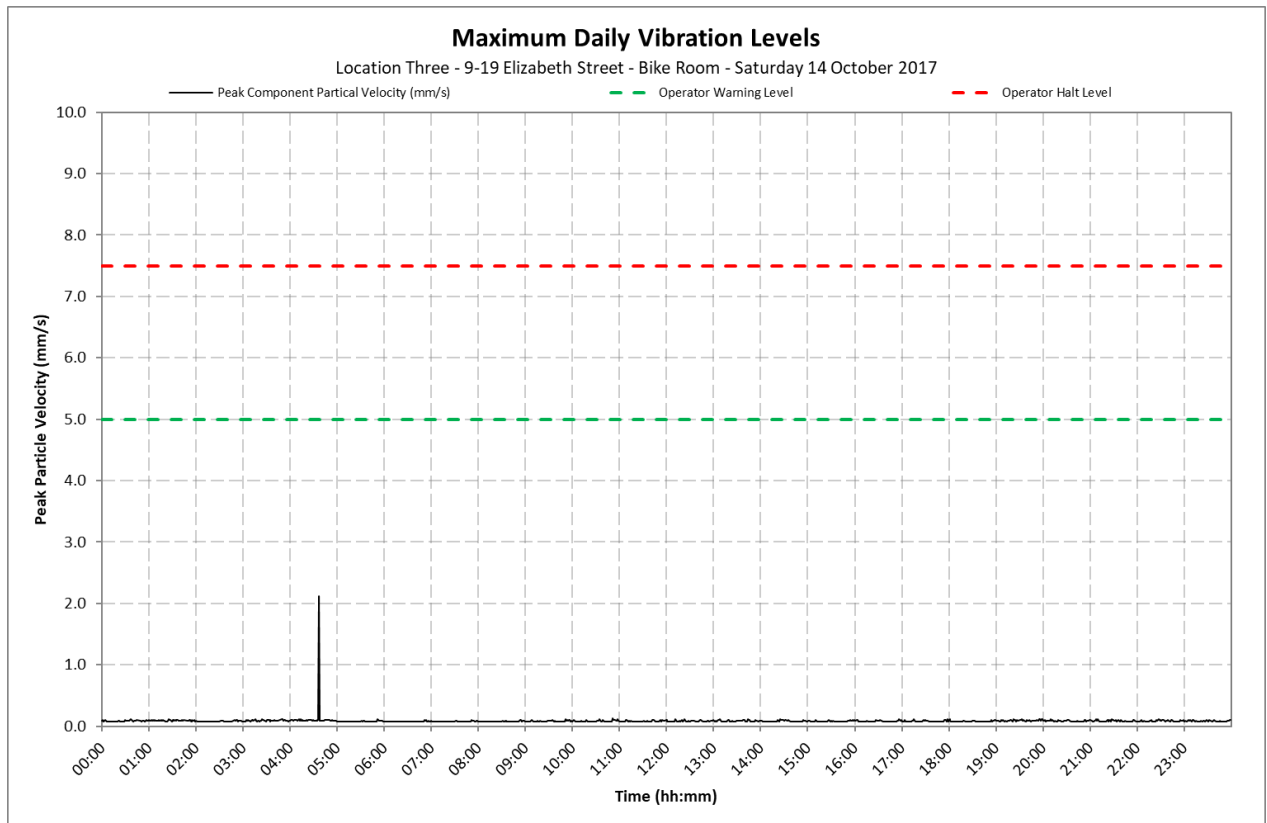
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

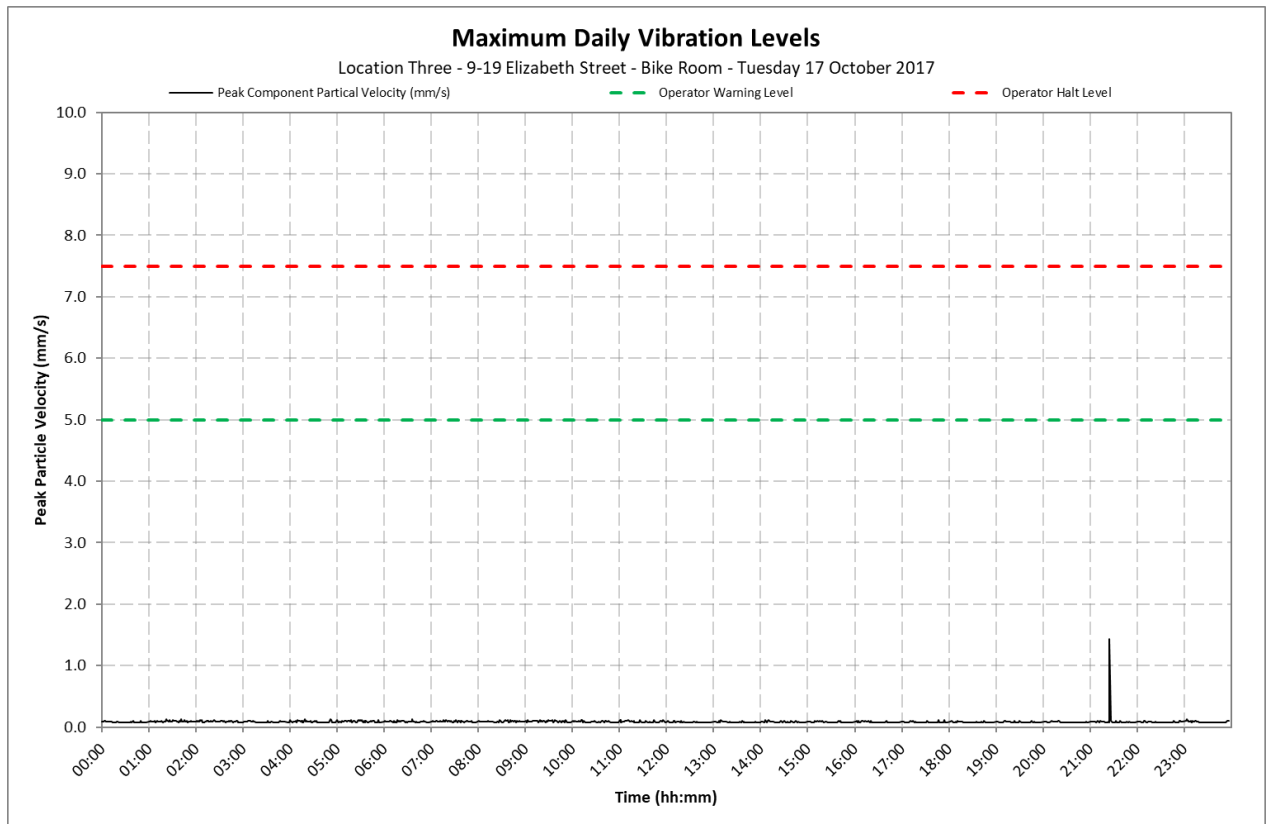
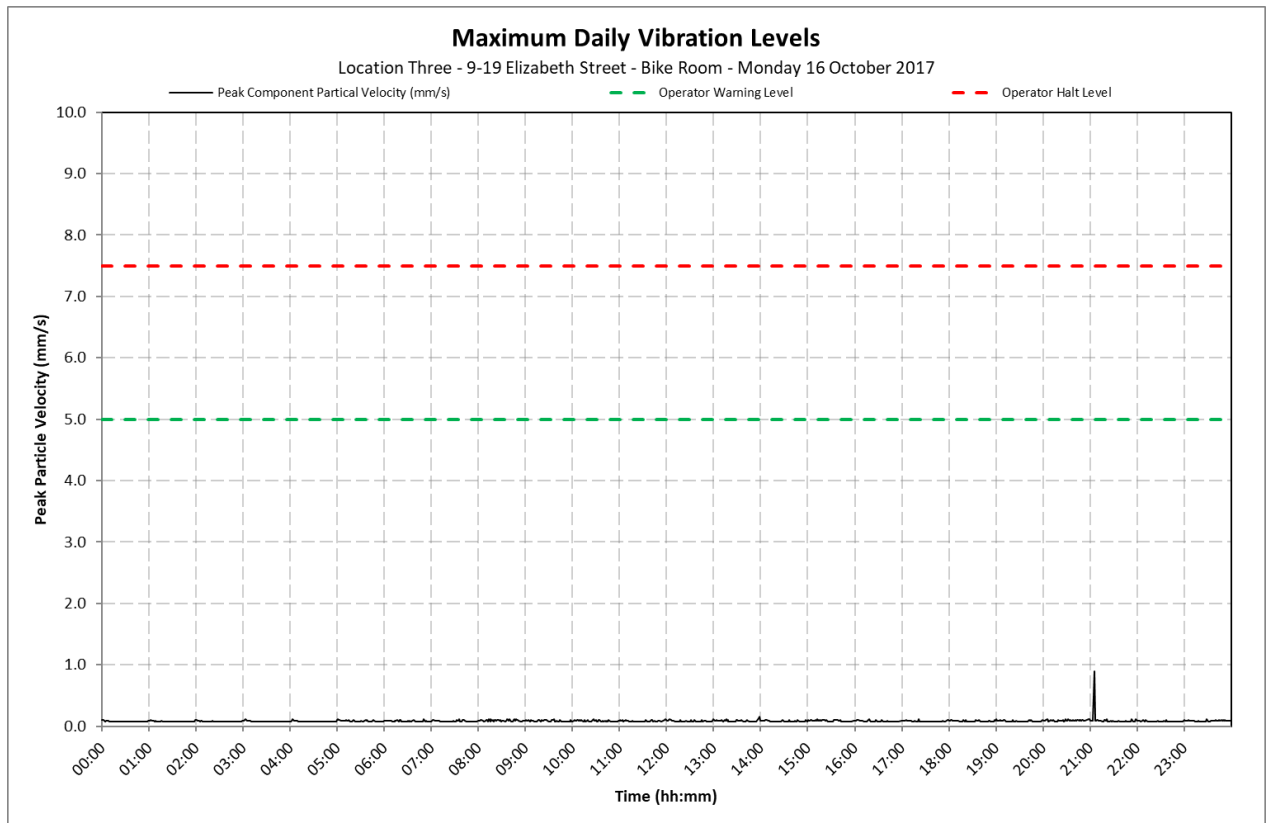
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room



26 October 2017

10-1380 R03R1 NV Monitoring 20171030.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Bert Musch

Dear Bert

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 03
18 October to 24 October 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 18 October to 24 October 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

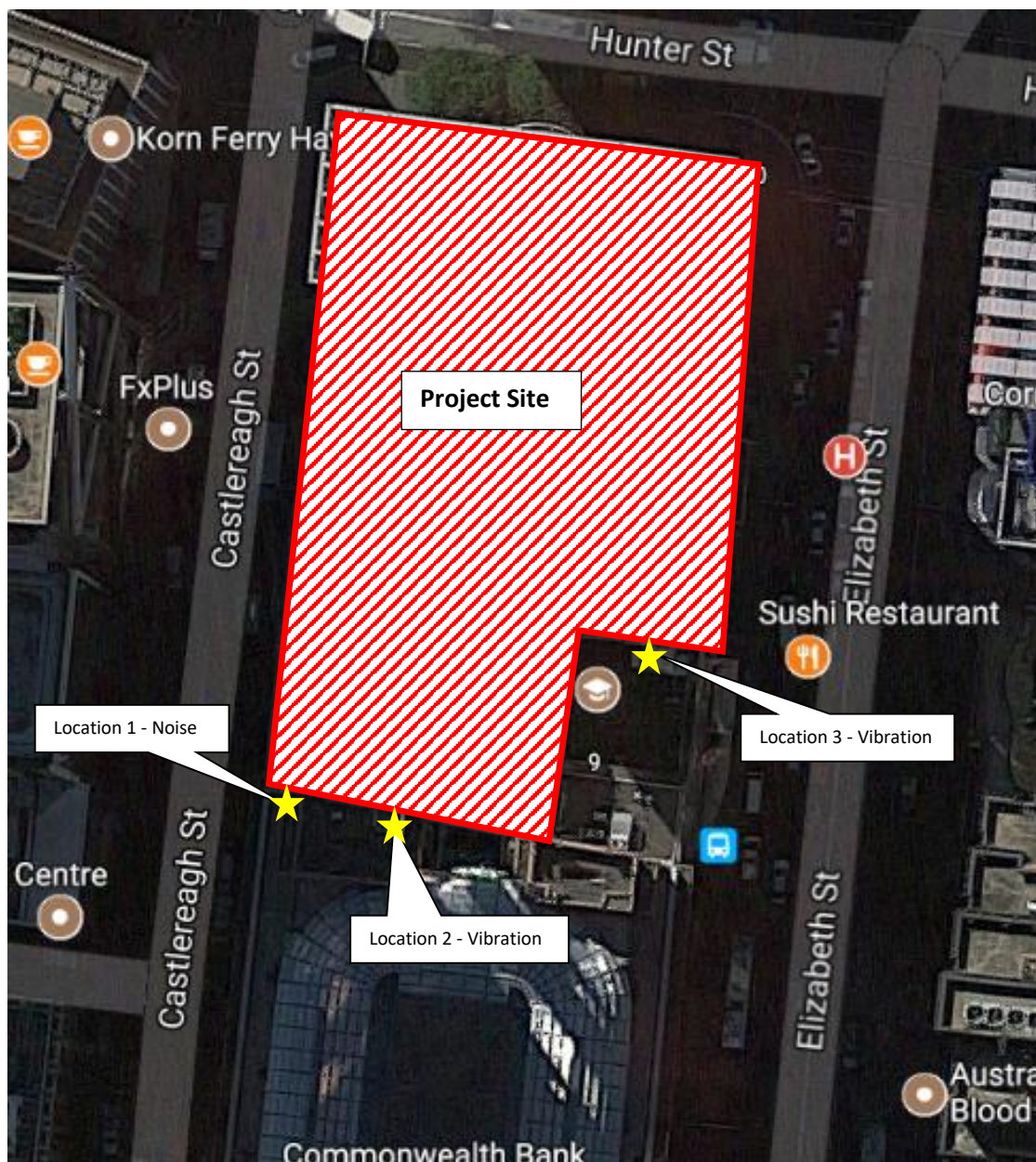
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Ground floor)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 18 October to 24 October 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
18 October 2017	46	45	Complies	Complies
19 October 2017	46	45	Complies	Complies
20 October 2017	48	46	Complies	Complies
21 October 2017	42	36	Complies	Complies
21 October 2017	38	37	Complies	Complies
23 October 2017	43	40	Complies	Complies
24 October 2017	45	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 3, respectively, during the period 18 October to 24 October 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
18 October 2017	0.8 mm/s	Complies
19 October 2017	2.3 mm/s	Complies
20 October 2017	0.3 mm/s	Complies
21 October 2017	0.8 mm/s	Complies
21 October 2017	0.1 mm/s	Complies
23 October 2017	1.0 mm/s	Complies
24 October 2017	0.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
18 October 2017	0.2 mm/s	Complies
19 October 2017	4.5 mm/s	1 Event Above Early Warning Level
20 October 2017	0.3 mm/s	Complies
21 October 2017	0.1 mm/s	Complies
21 October 2017	0.2 mm/s	Complies
23 October 2017	0.9 mm/s	Complies
24 October 2017	0.1 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 18 October to 24 October 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 18 October to 24 October 2017 found one event above the Operator Warning Level at Location Three. All recorded ambient vibration levels however, were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

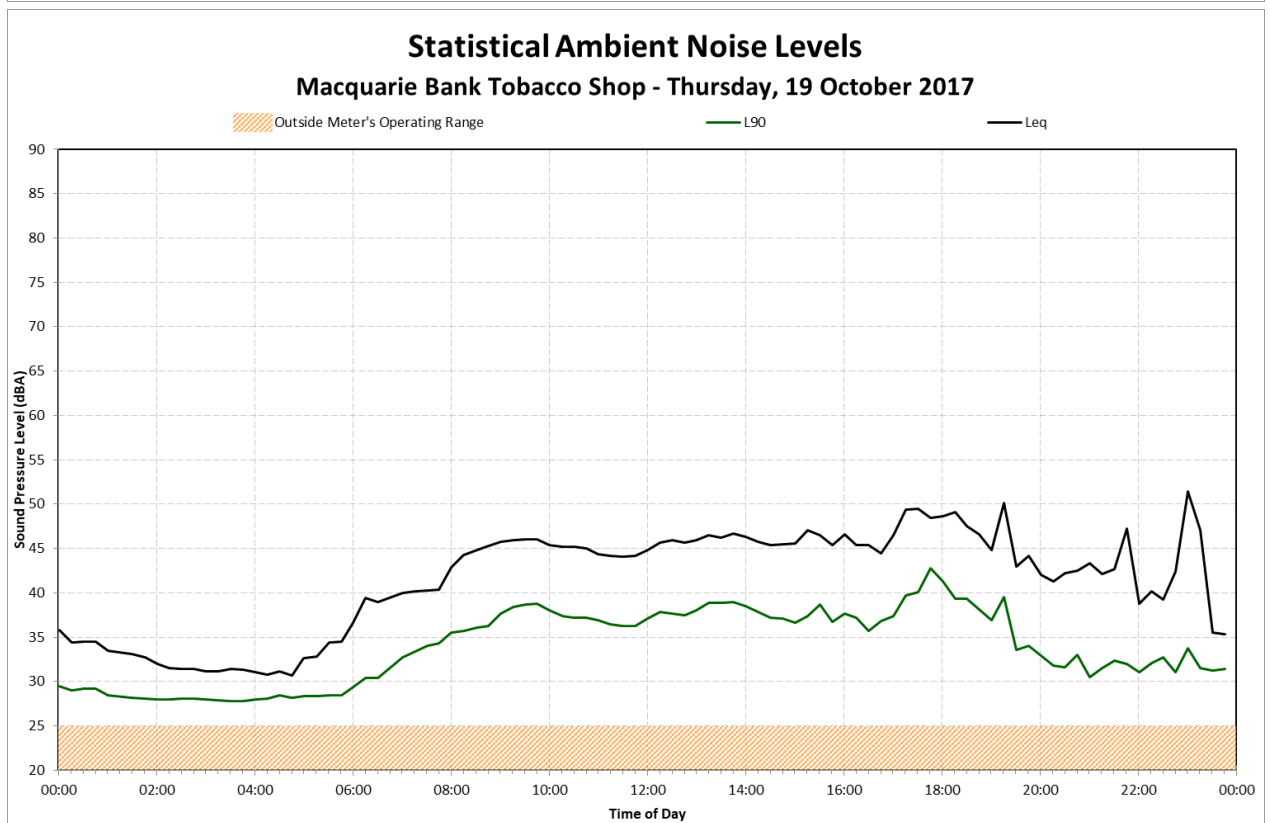
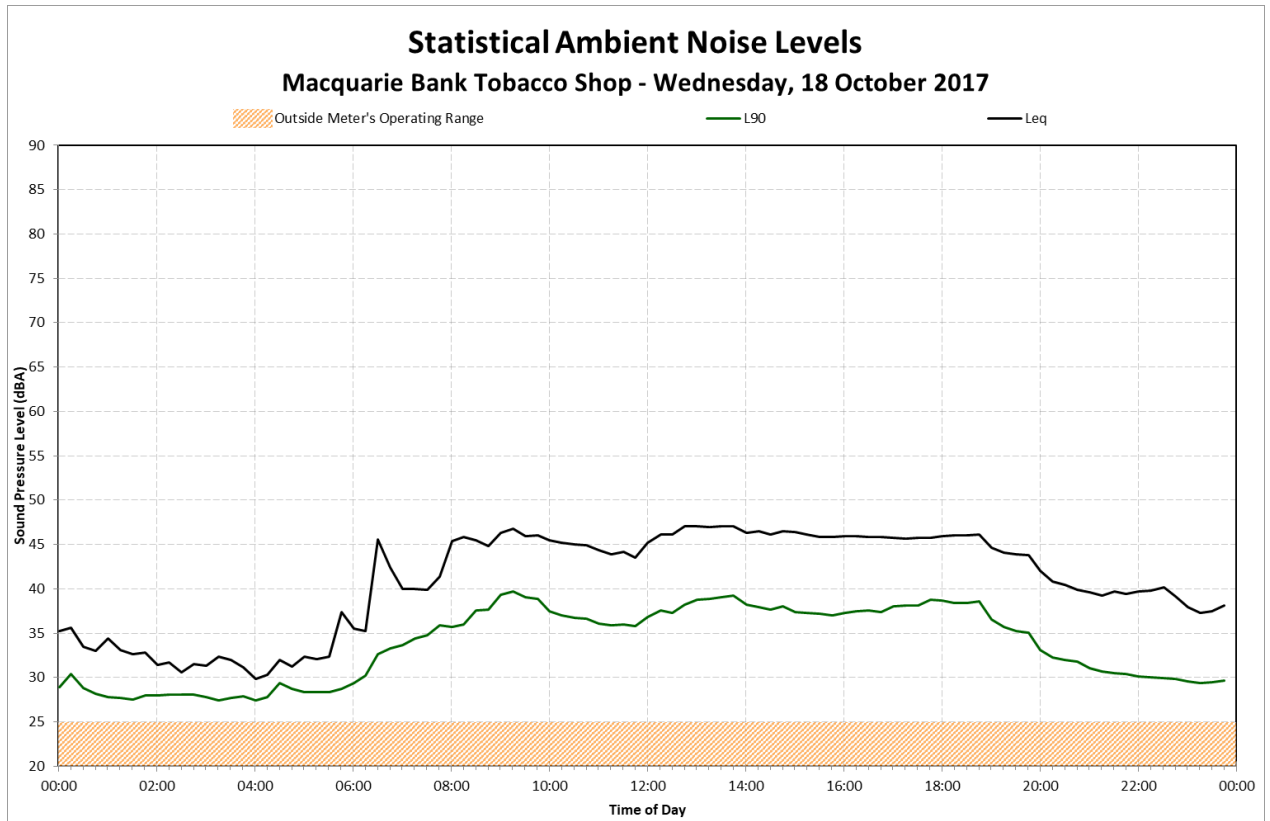
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

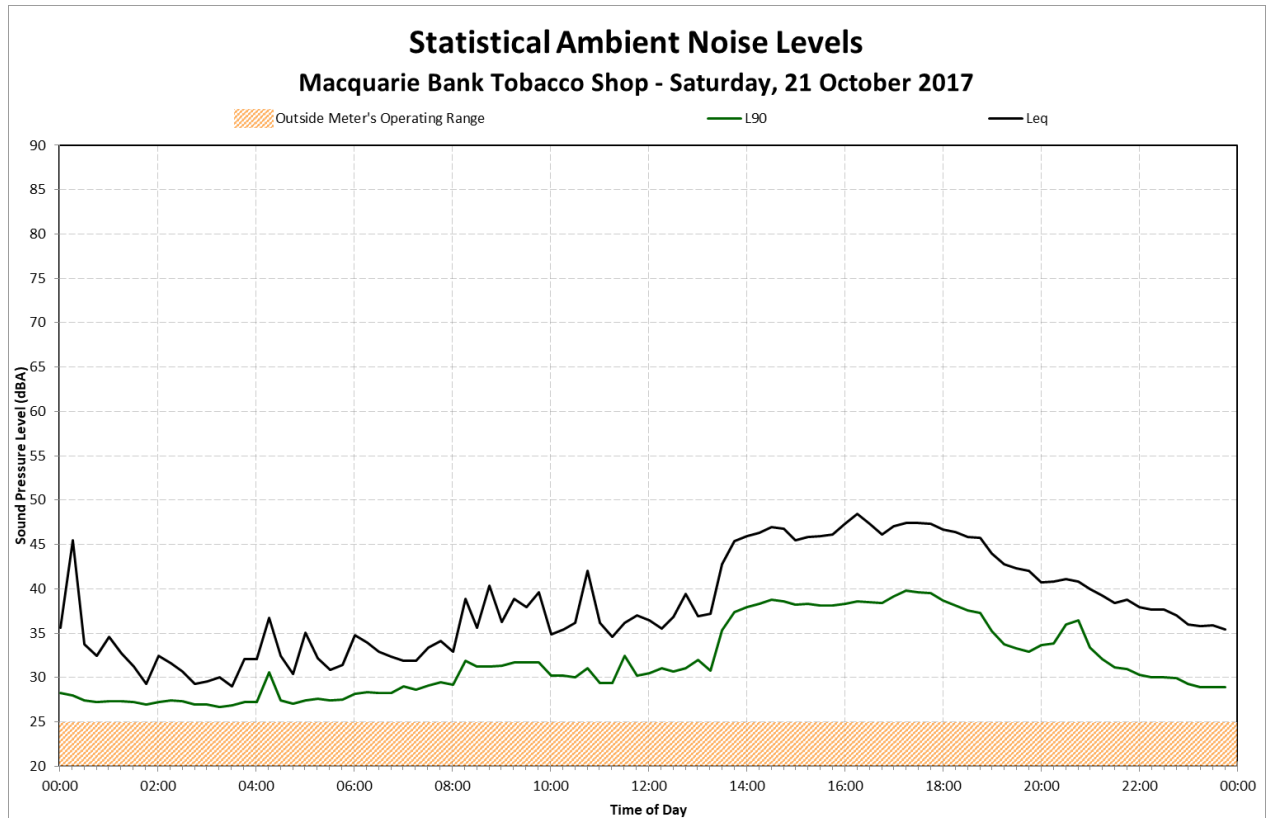
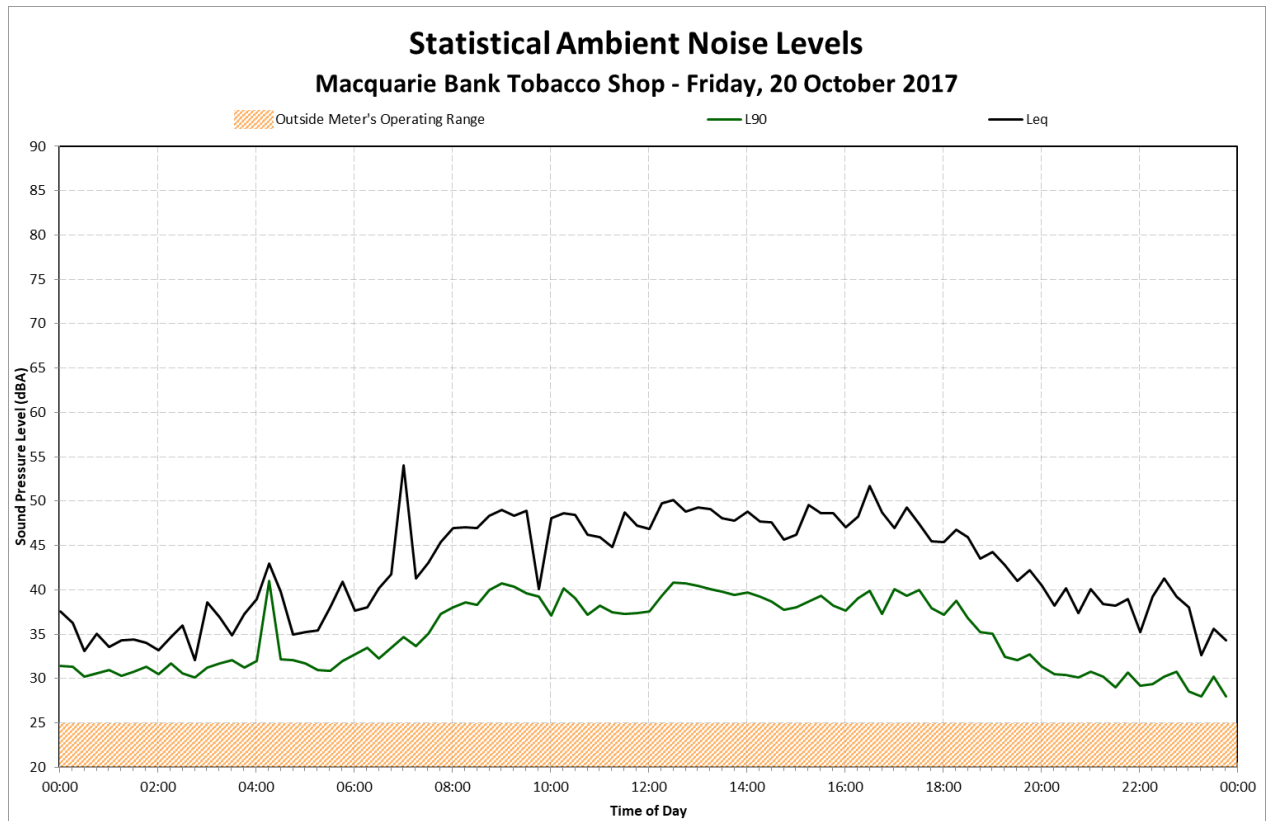
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

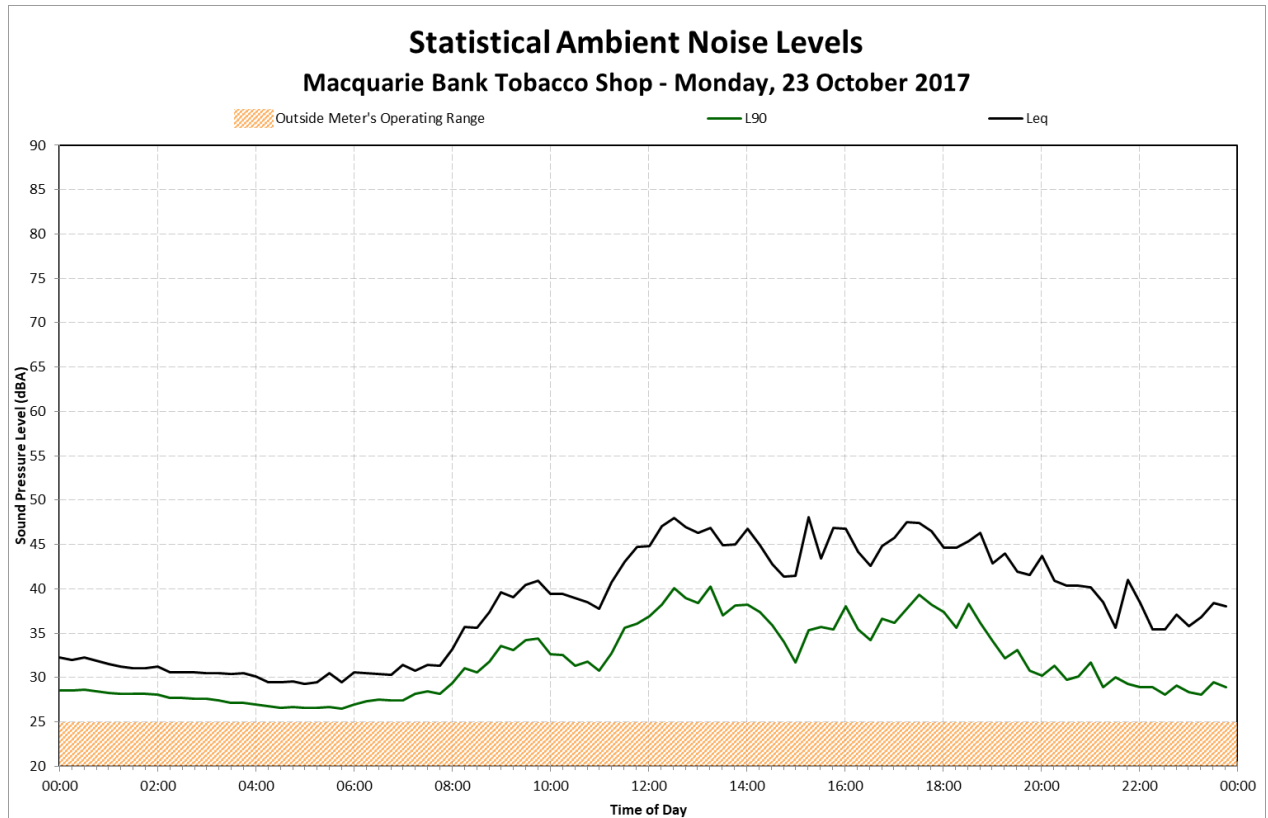
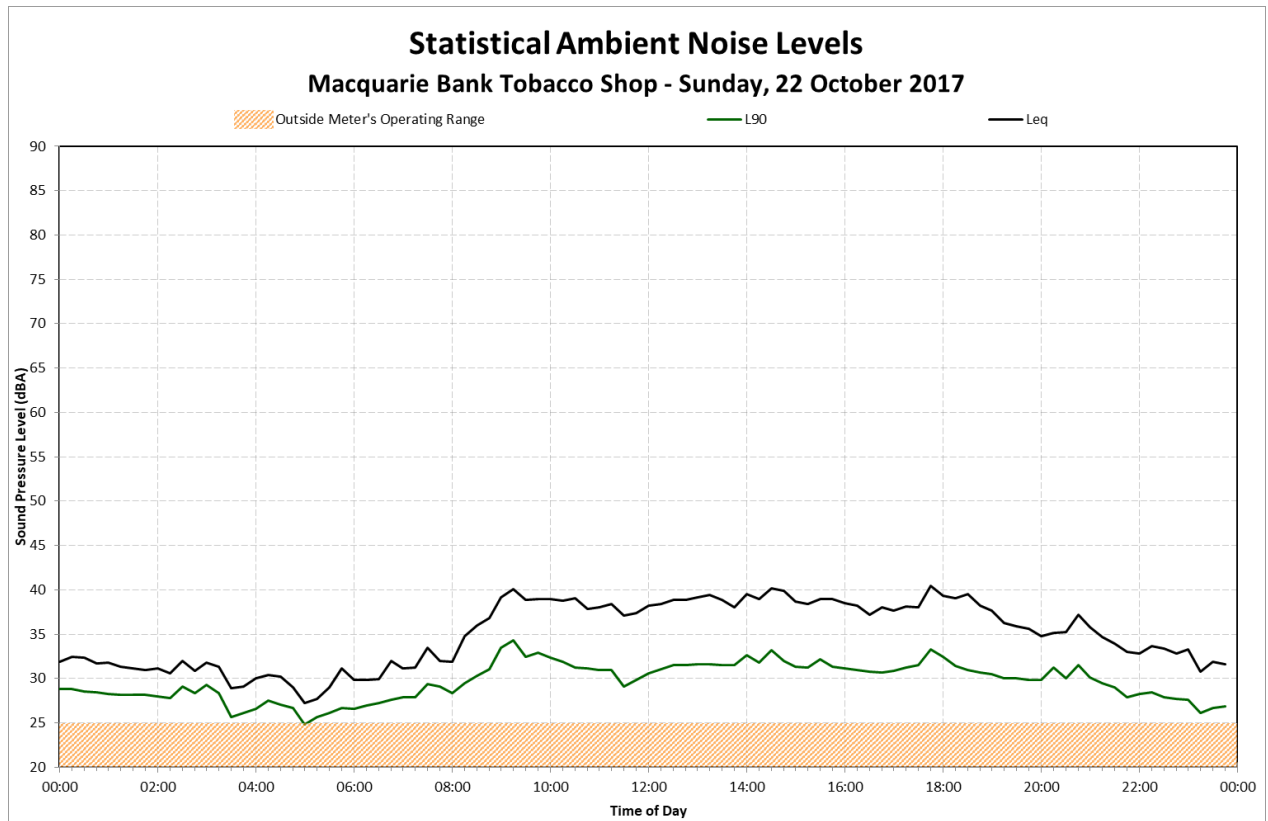
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

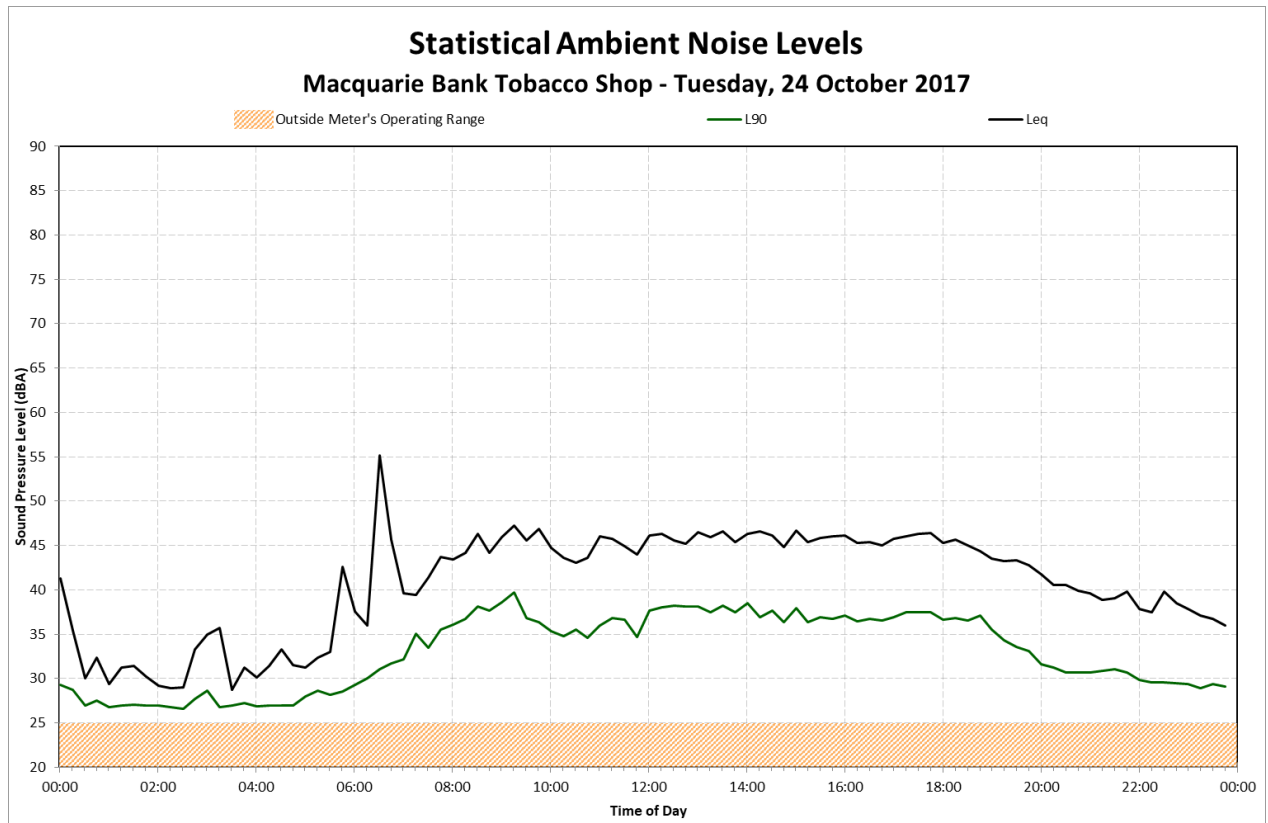
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

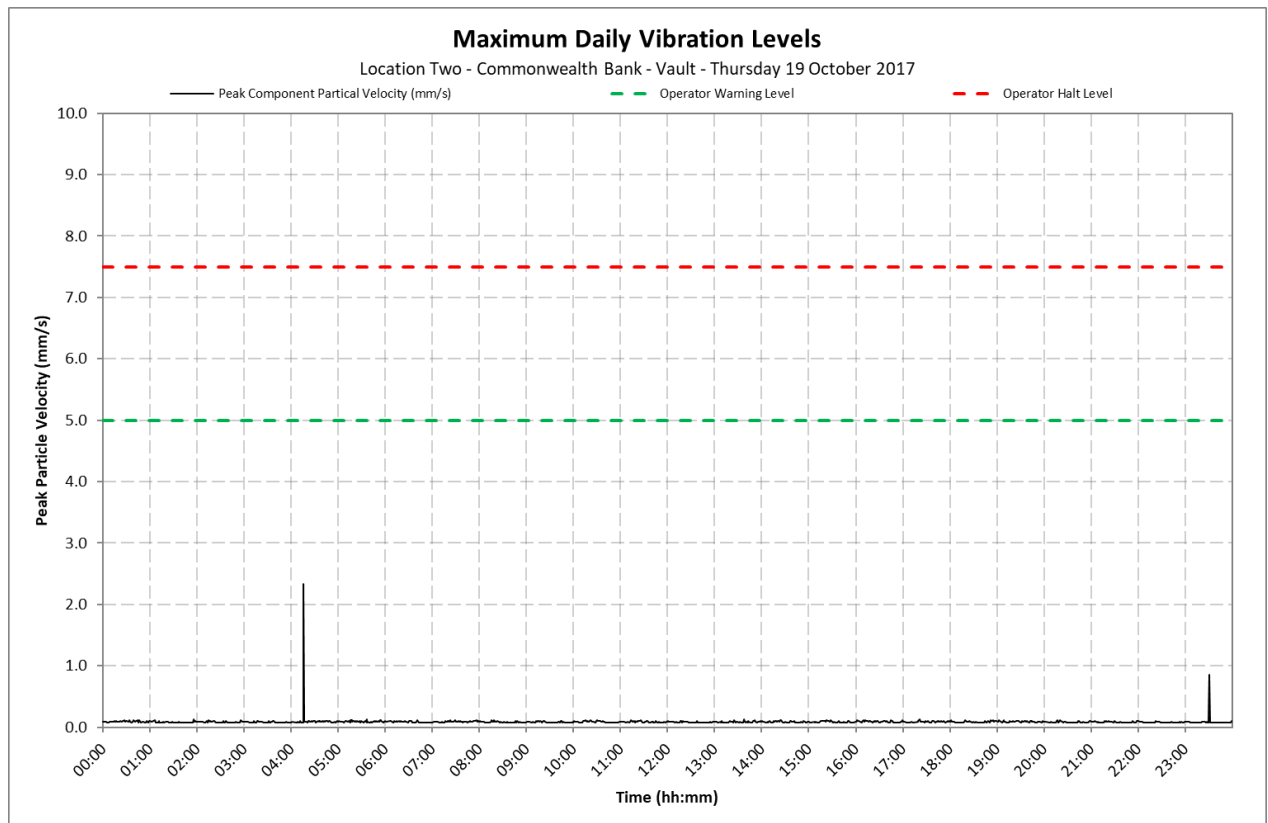
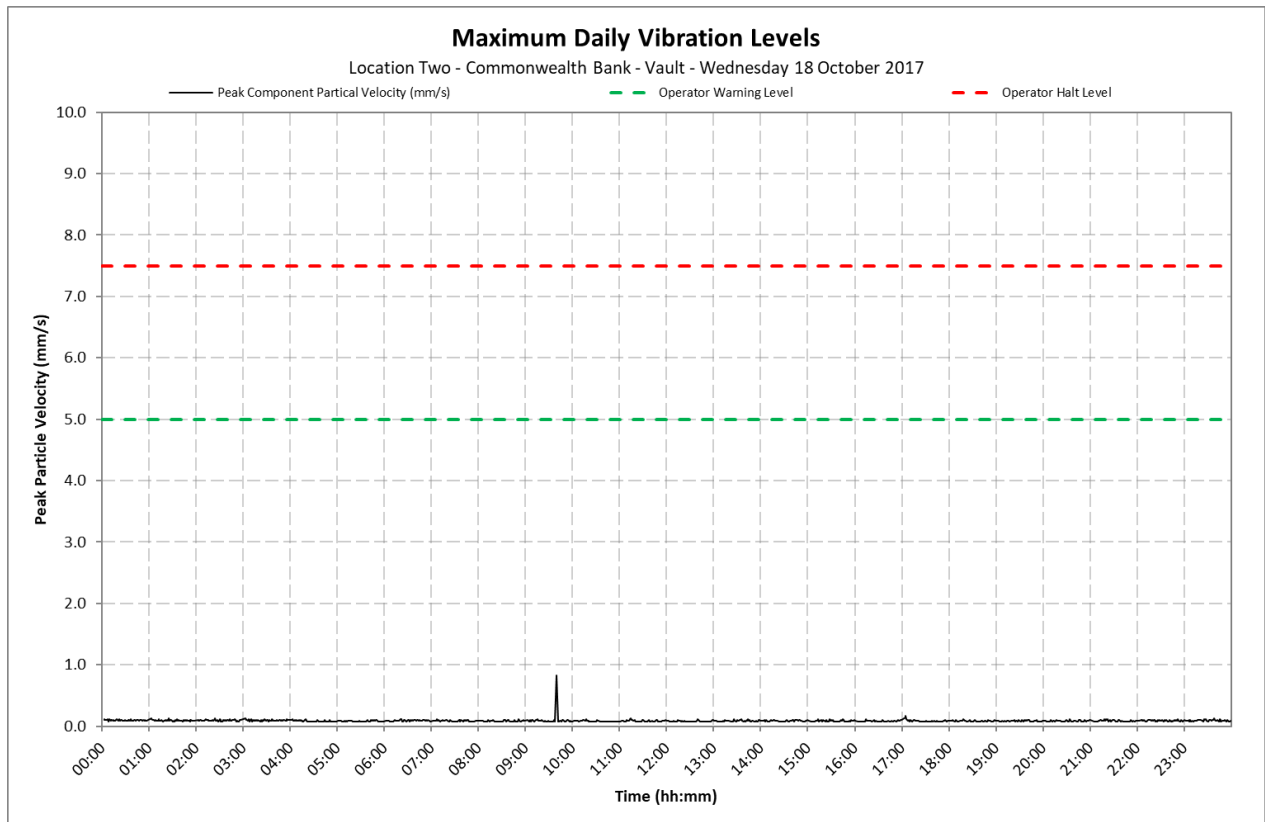
Location 1 – Macquarie Bank Tobacco Shop



Appendix C

Daily Vibration Levels

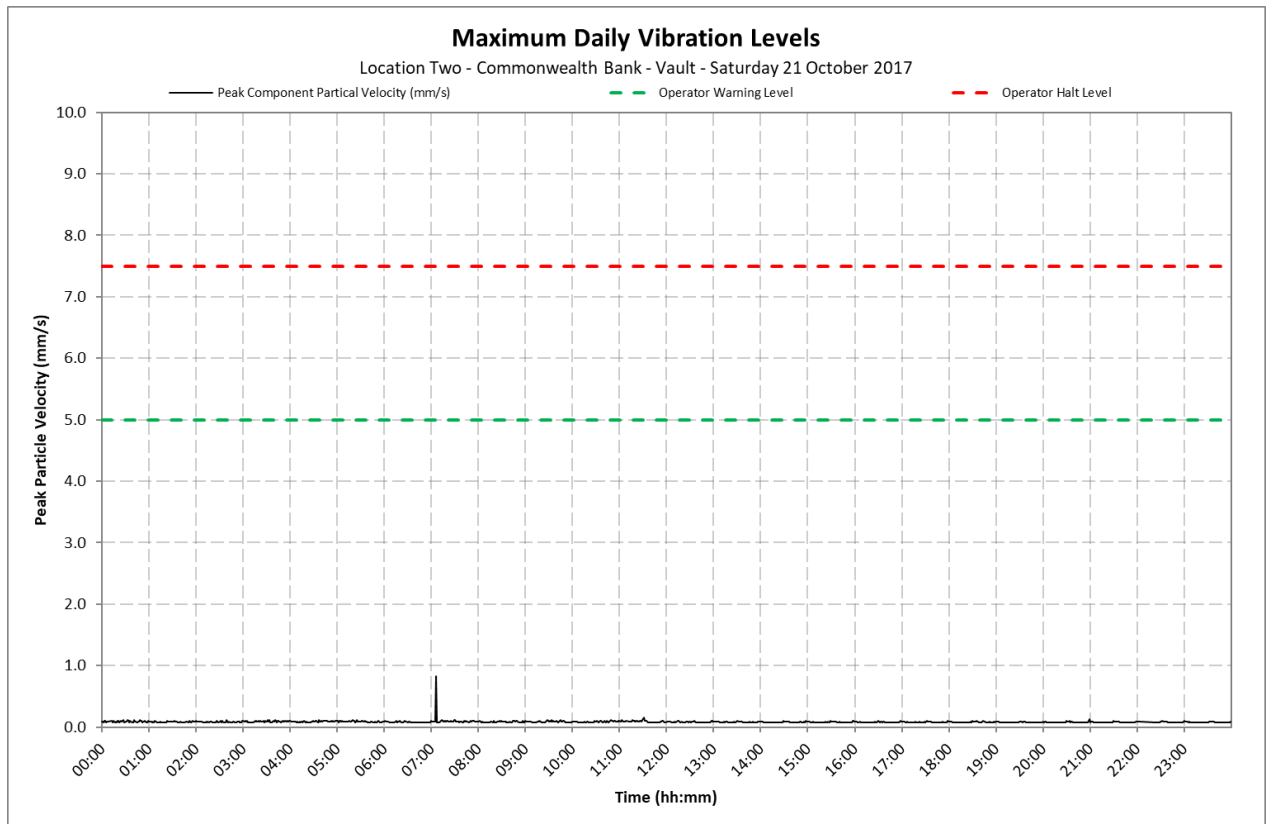
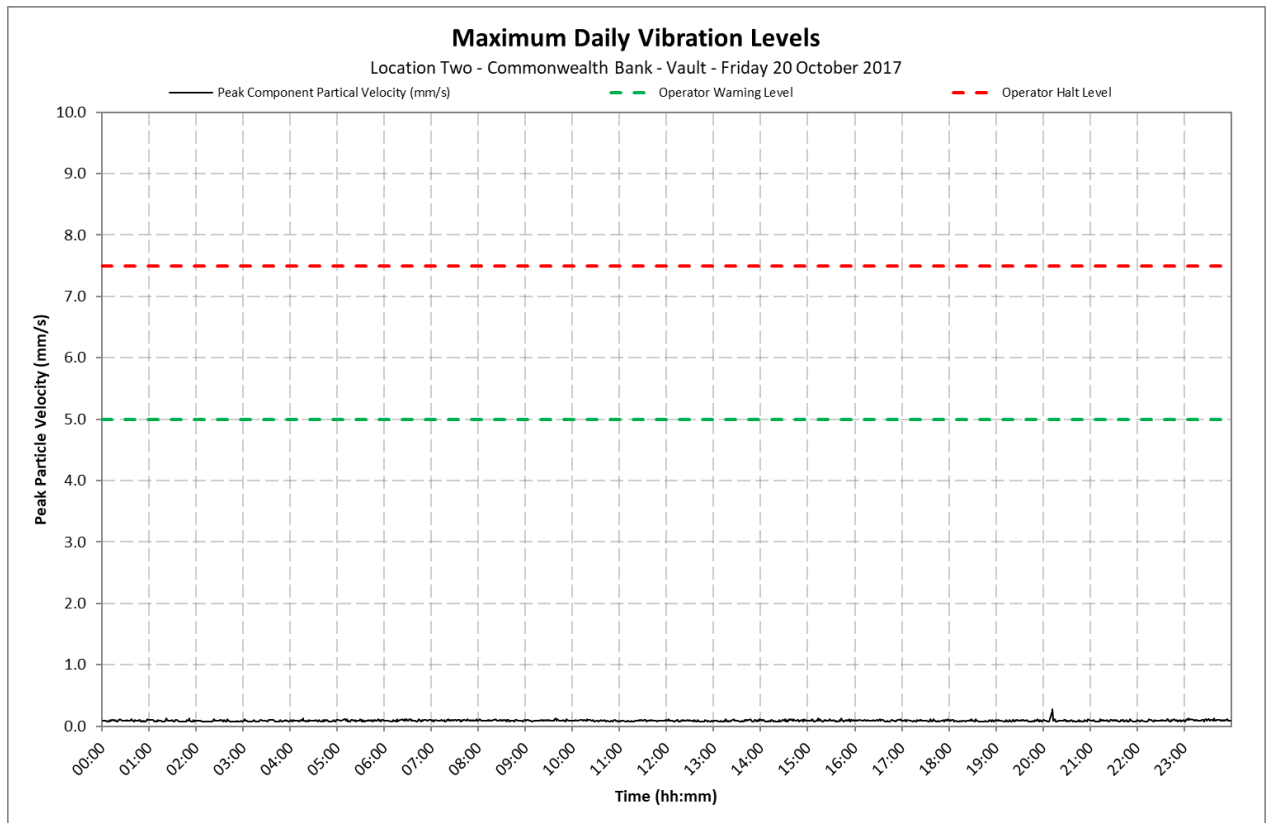
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

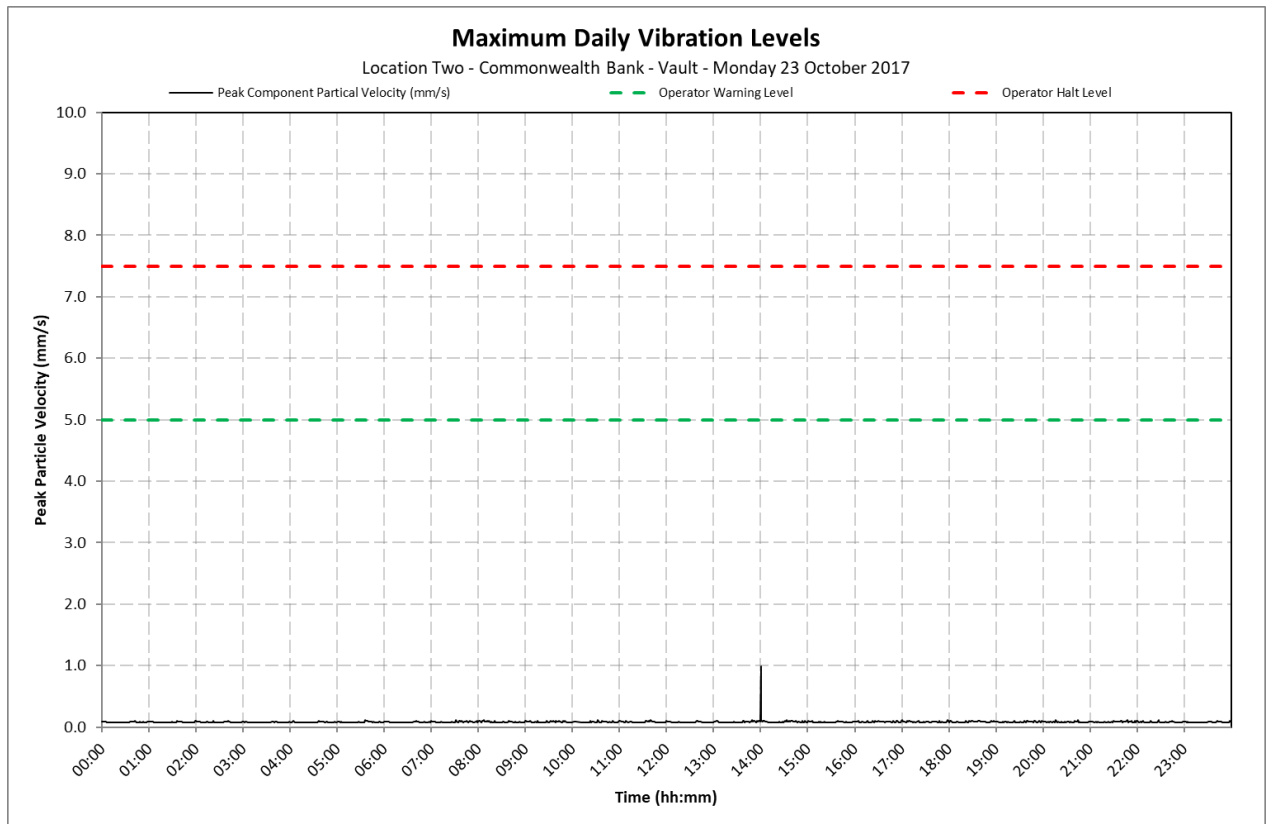
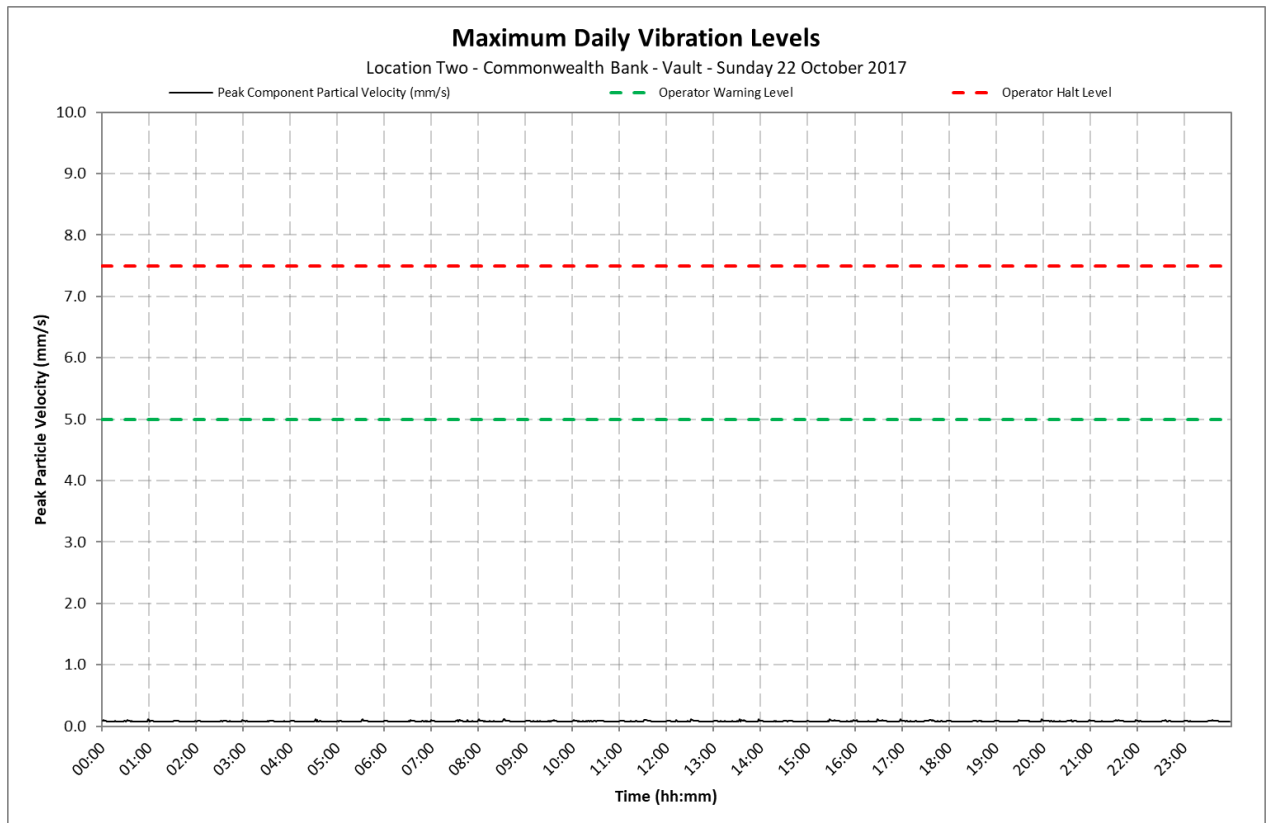
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

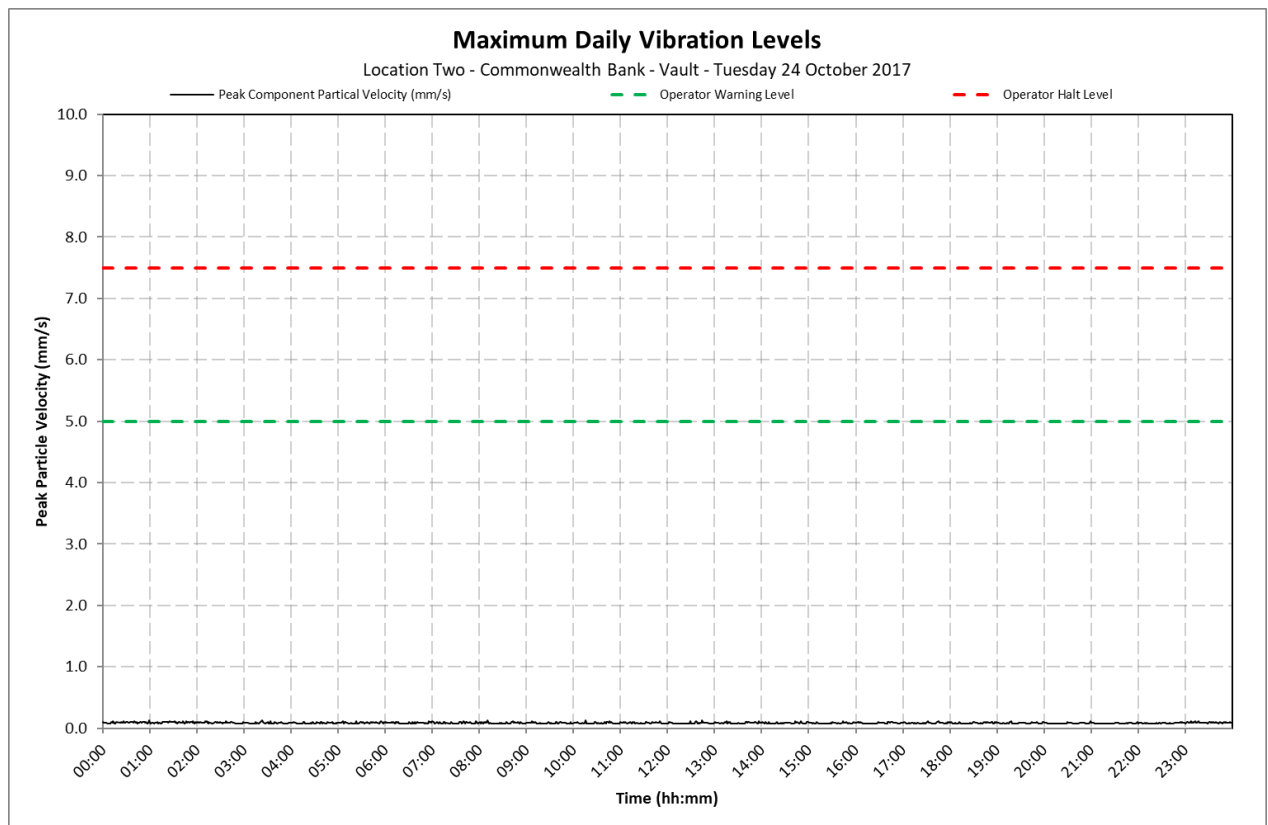
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

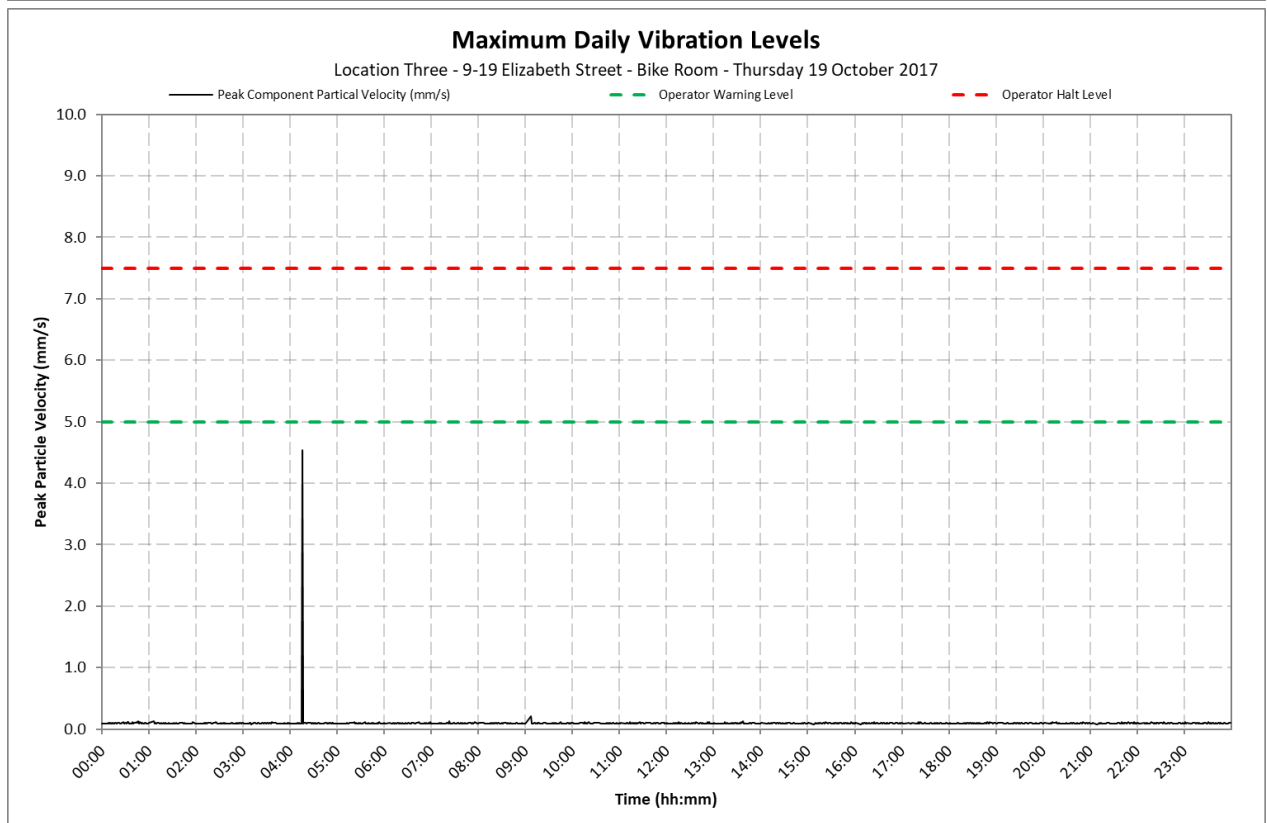
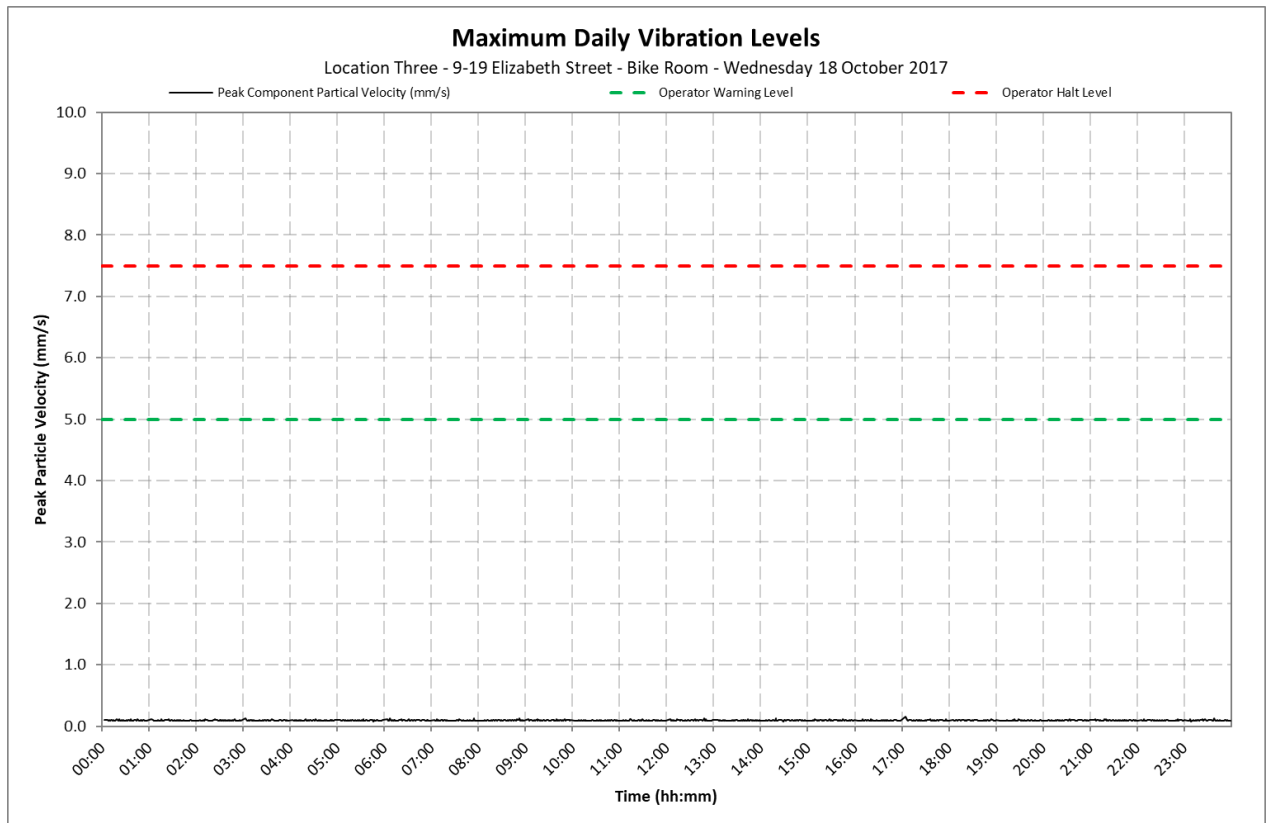
Location 2 - Commonwealth Bank - Vault



Appendix C

Daily Vibration Levels

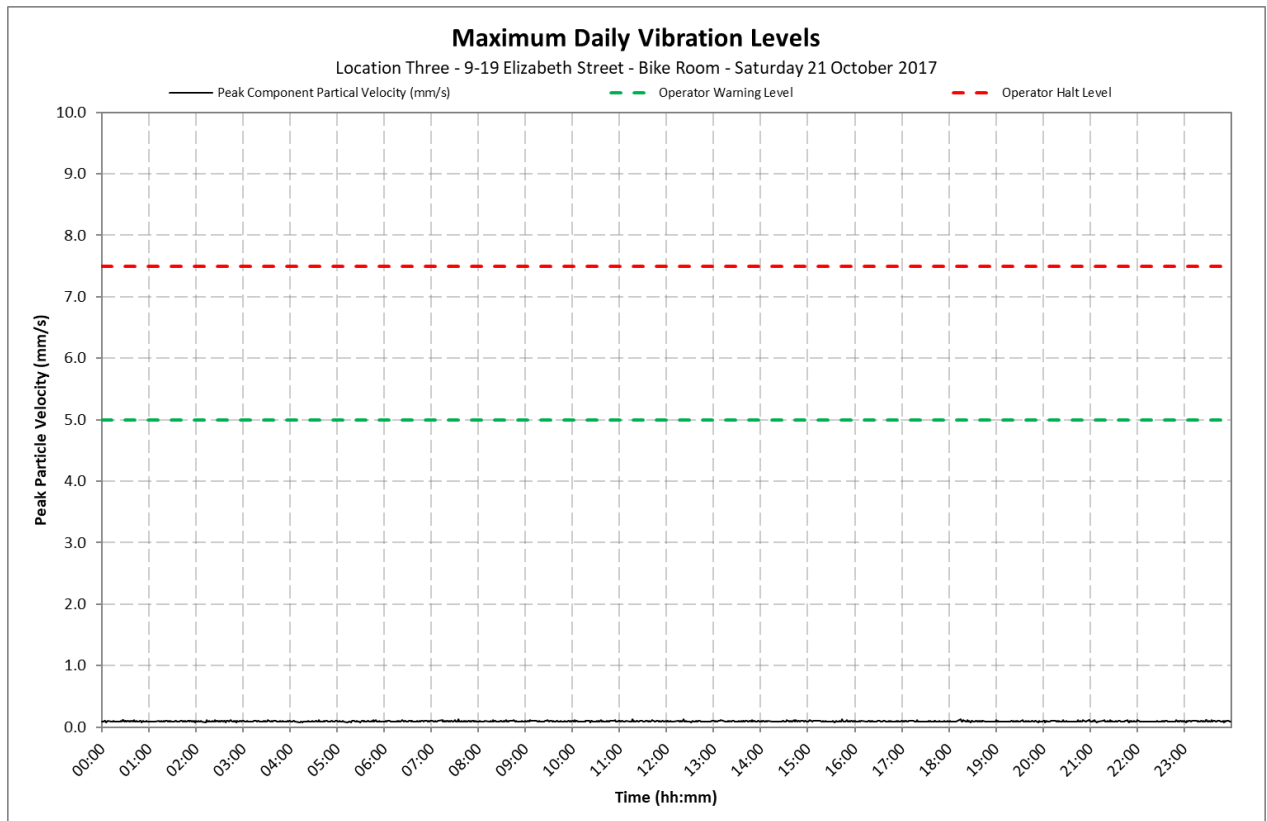
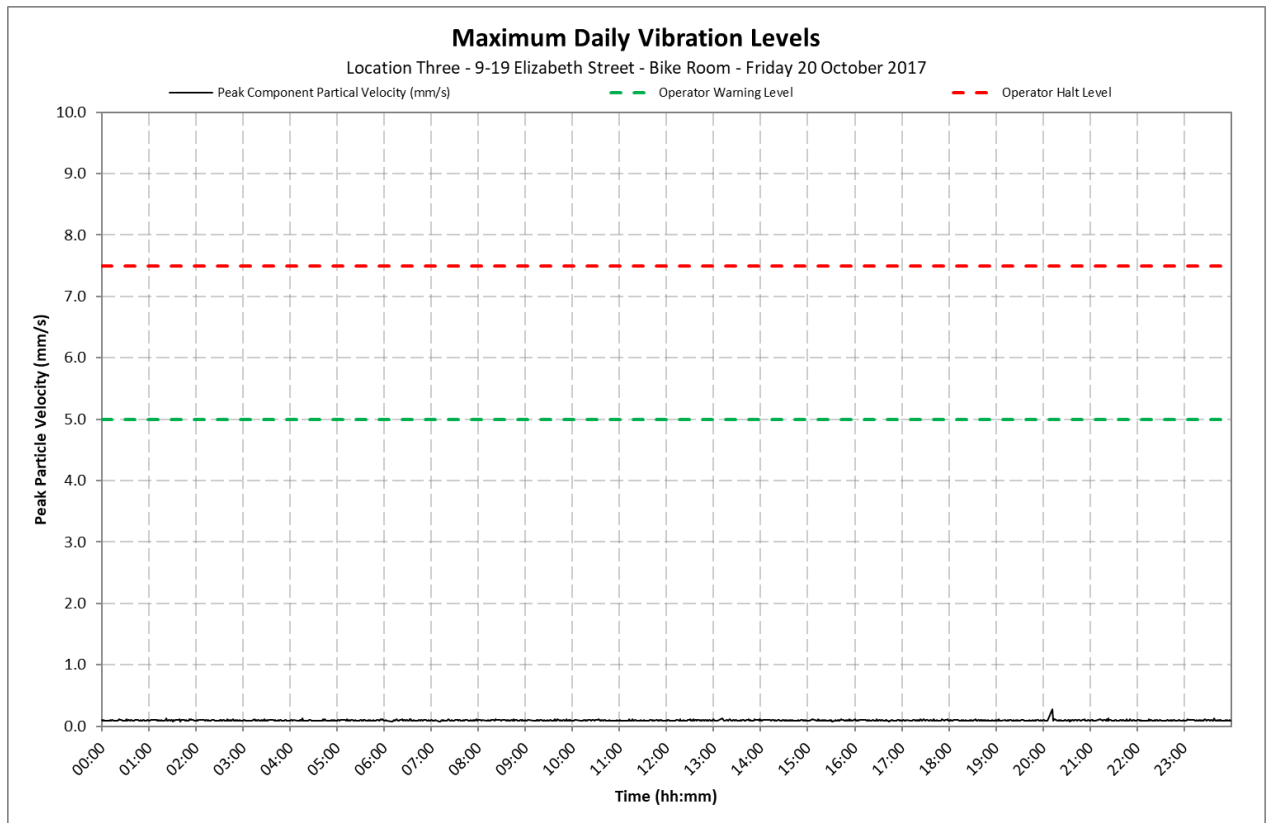
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

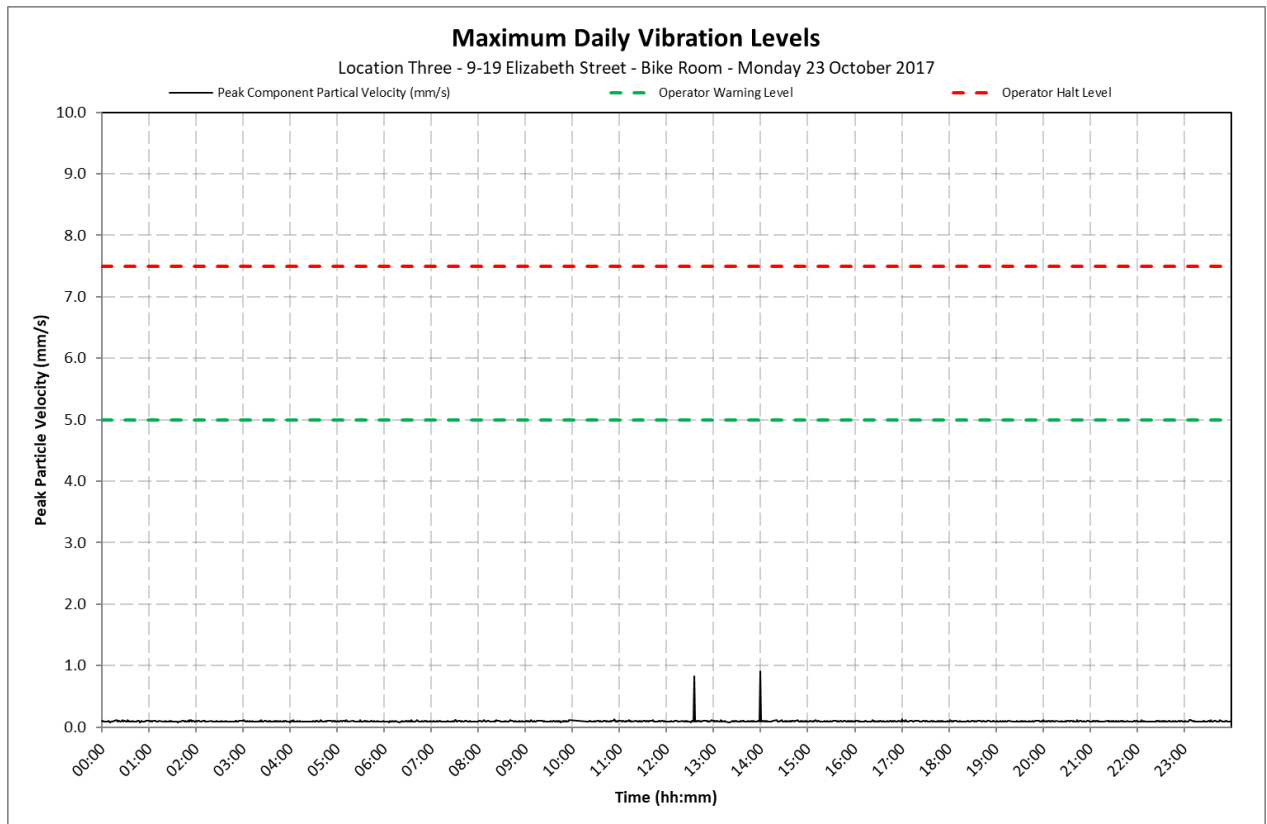
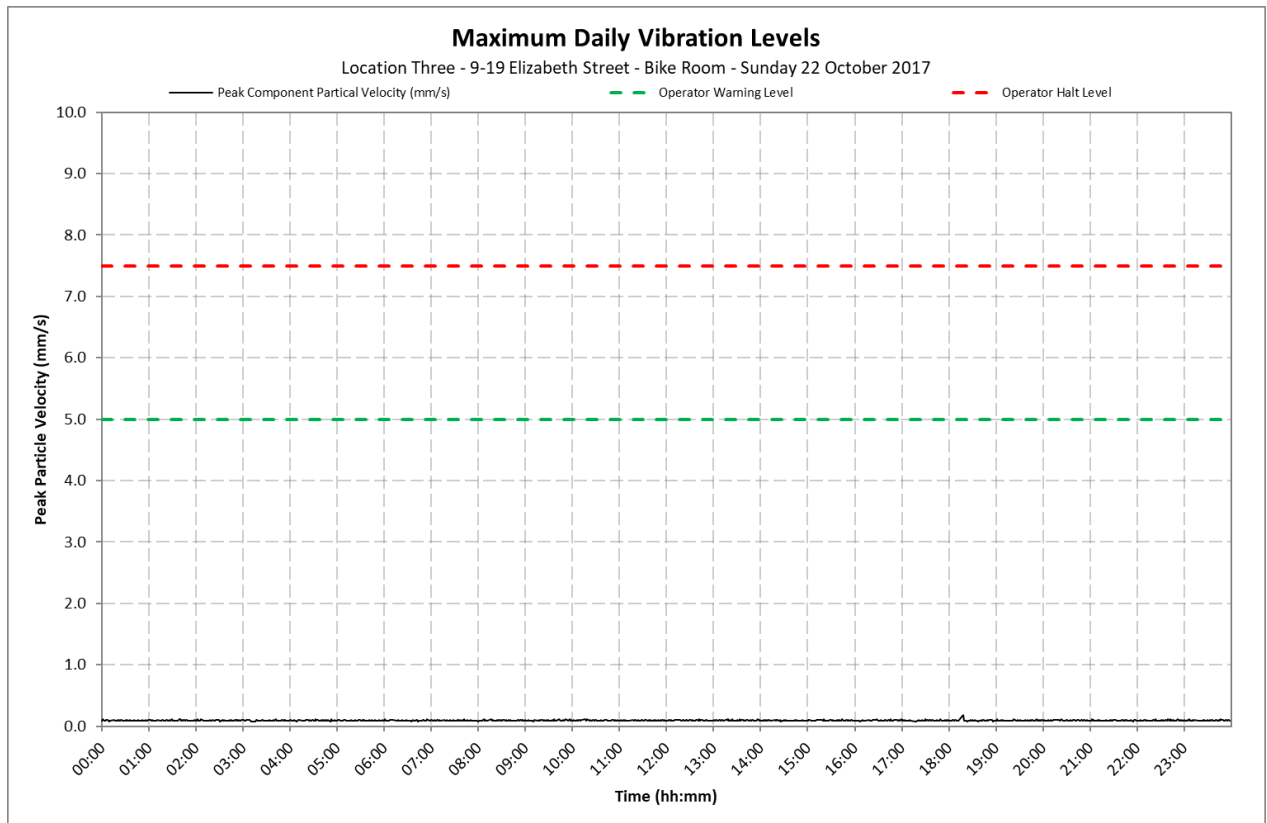
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

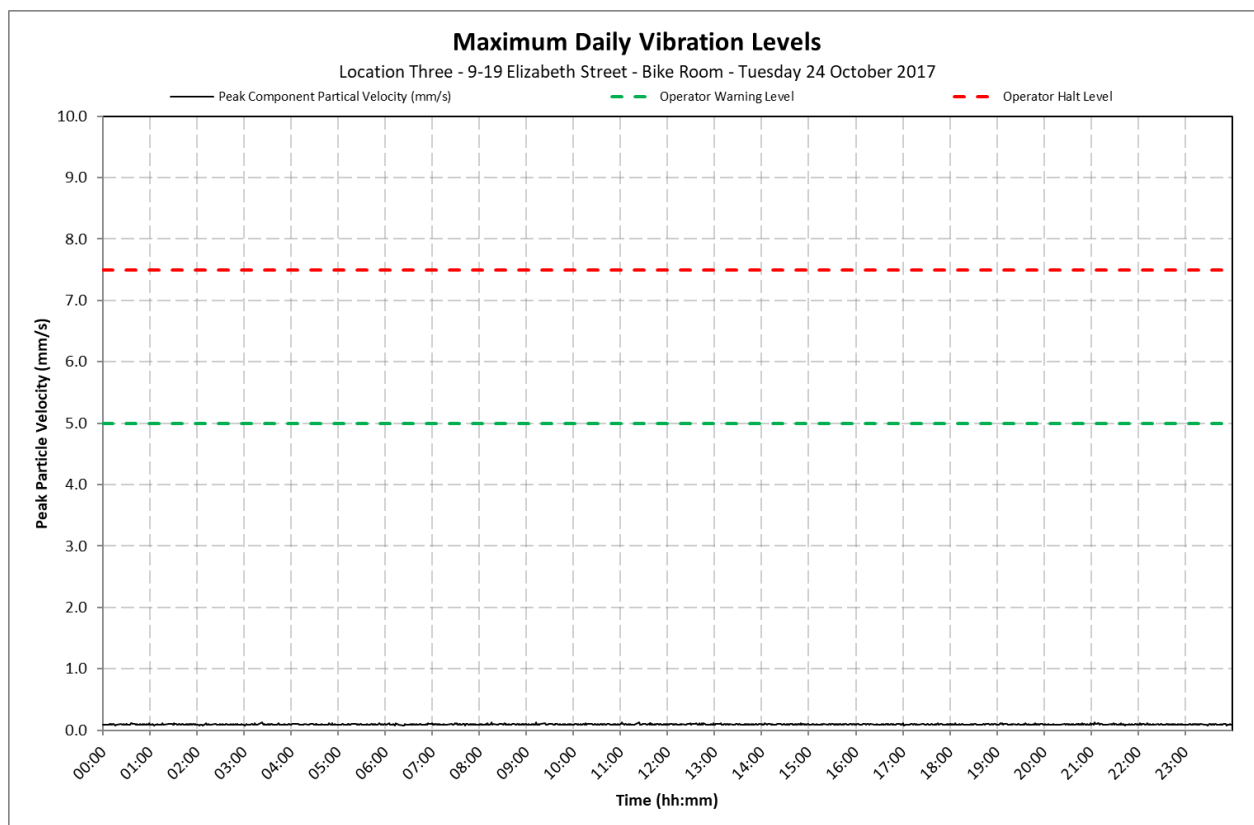
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room



3 November 2017

10-1380 R04 NV Monitoring 20171103.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Bert Musch

Dear Bert

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 04
25 October to 31 October 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 25 October to 31 October 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

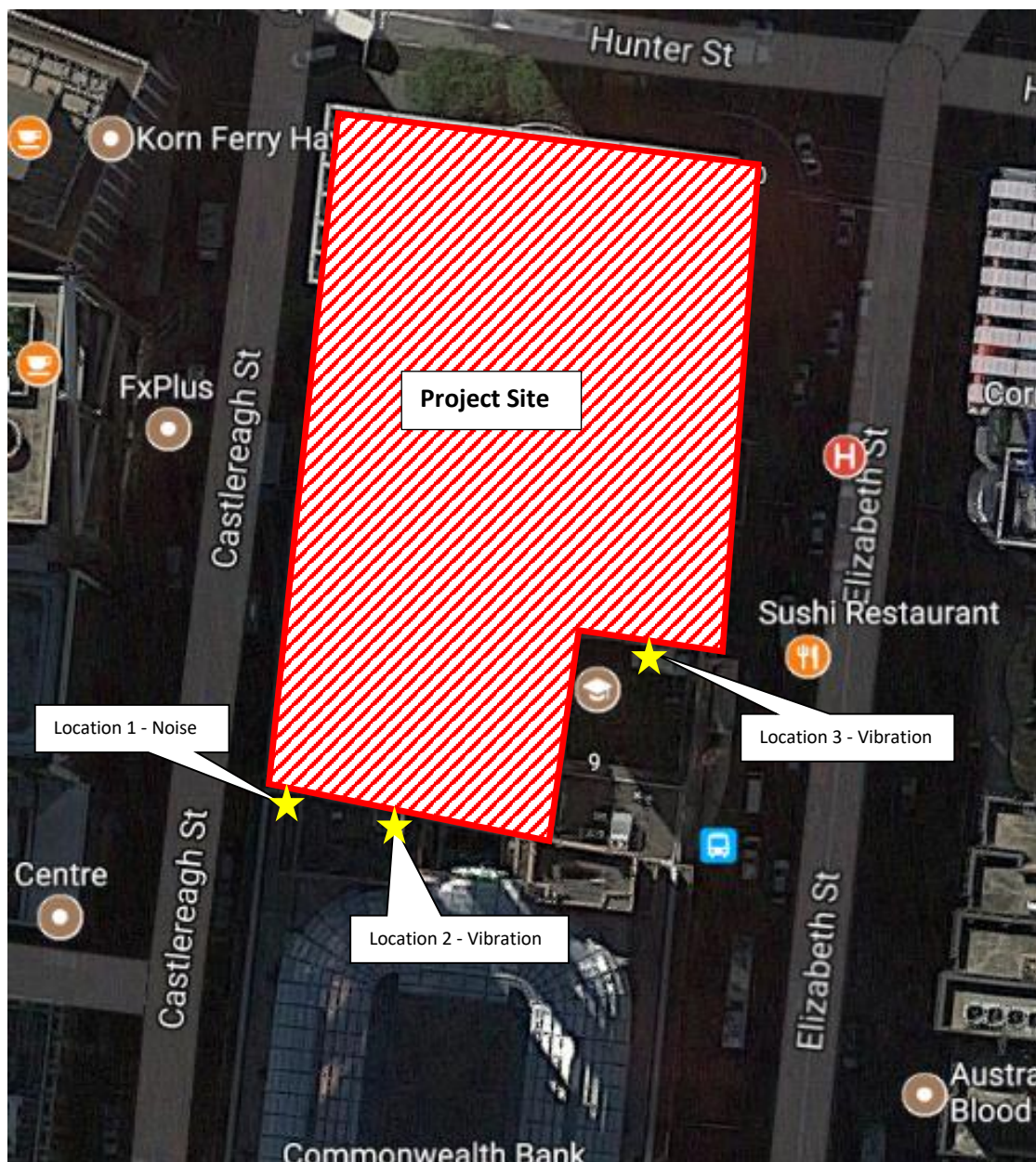
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Ground floor)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 25 October to 31 October 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
25 October 2017	46	44	Complies	Complies
26 October 2017	46	44	Complies	Complies
27 October 2017	46	45	Complies	Complies
28 October 2017	46	45	Complies	Complies
29 October 2017	34	33	Complies	Complies
30 October 2017	45	44	Complies	Complies
31 October 2017	45	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 3, respectively, during the period 25 October to 31 October 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
25 October 2017	2.2 mm/s	Complies
26 October 2017	0.1 mm/s	Complies
27 October 2017	0.1 mm/s	Complies
28 October 2017	0.1 mm/s	Complies
29 October 2017	0.2 mm/s	Complies
30 October 2017	0.1 mm/s	Complies
31 October 2017	0.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
18 October 2017	6.9 mm/s	1 Event Above Warning Level
19 October 2017	0.1 mm/s	Complies
20 October 2017	0.1 mm/s	Complies
21 October 2017	1.4 mm/s	Complies
21 October 2017	0.1 mm/s	Complies
23 October 2017	0.9 mm/s	Complies
24 October 2017	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 25 October to 31 October 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 25 October to 31 October 2017 found one event above the Operator Warning Level at Location Three. All recorded ambient vibration levels however, were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

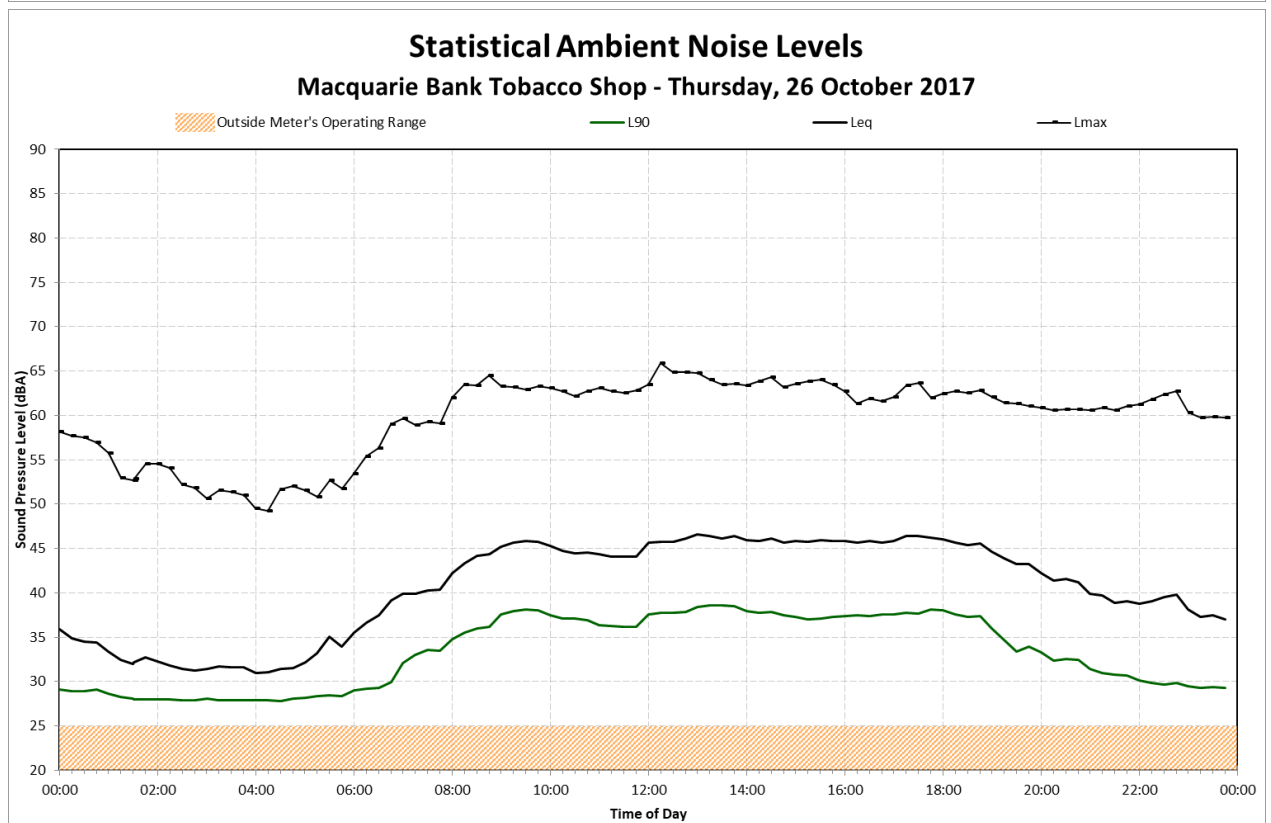
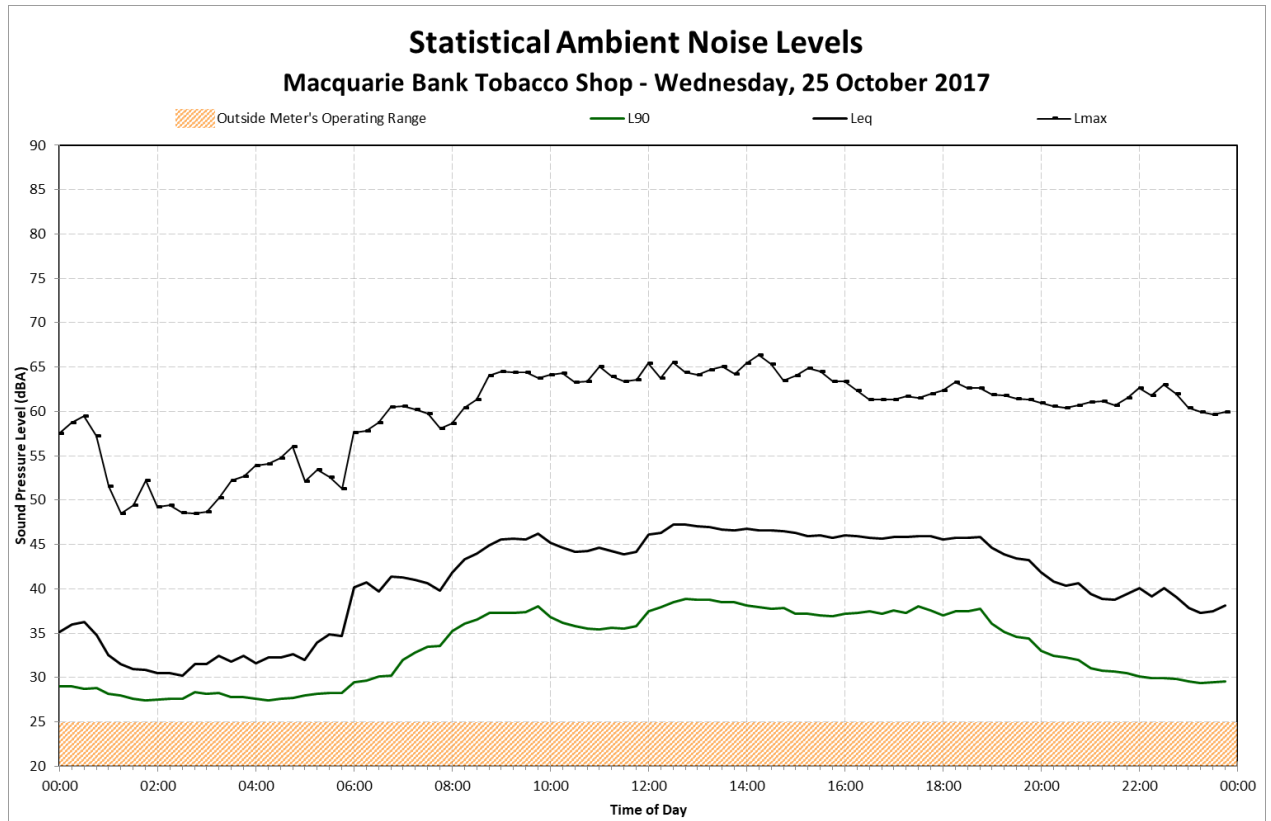
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
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Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quadr method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

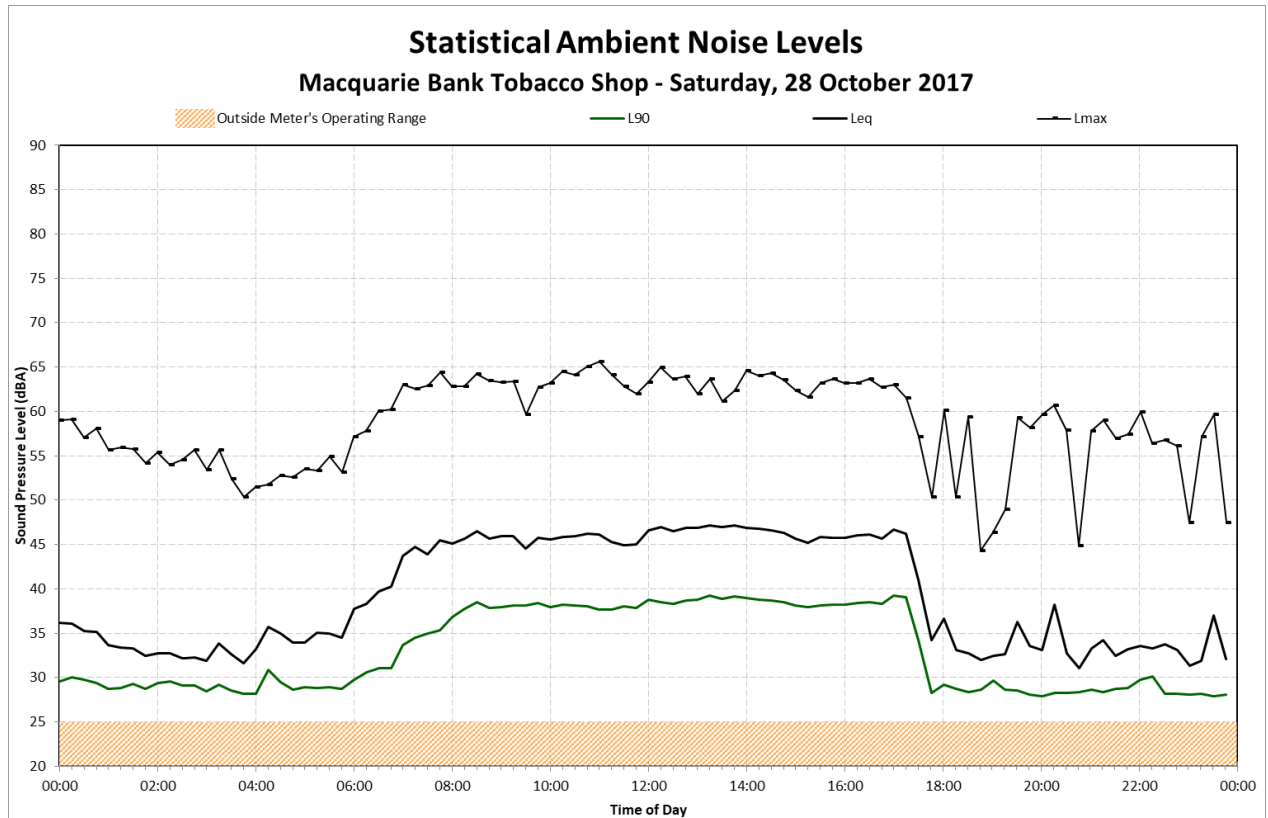
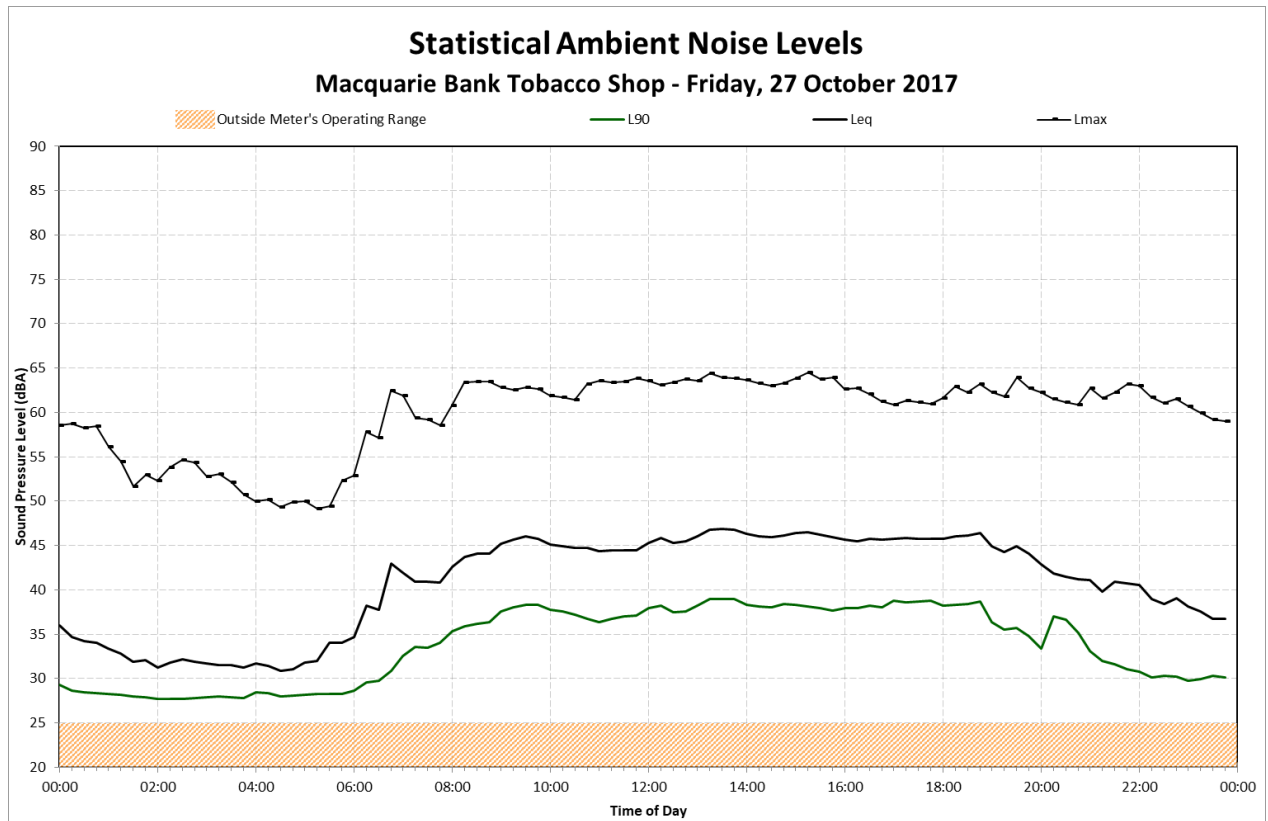
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

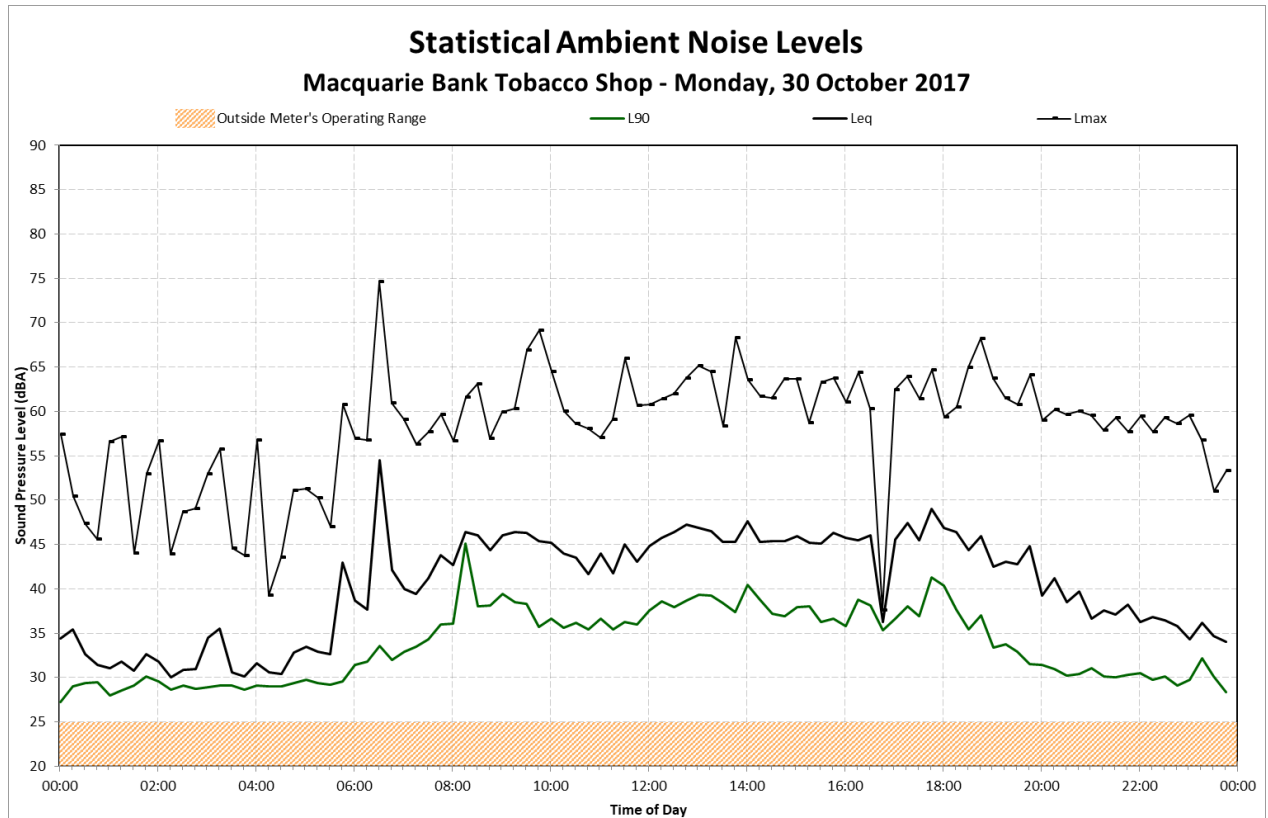
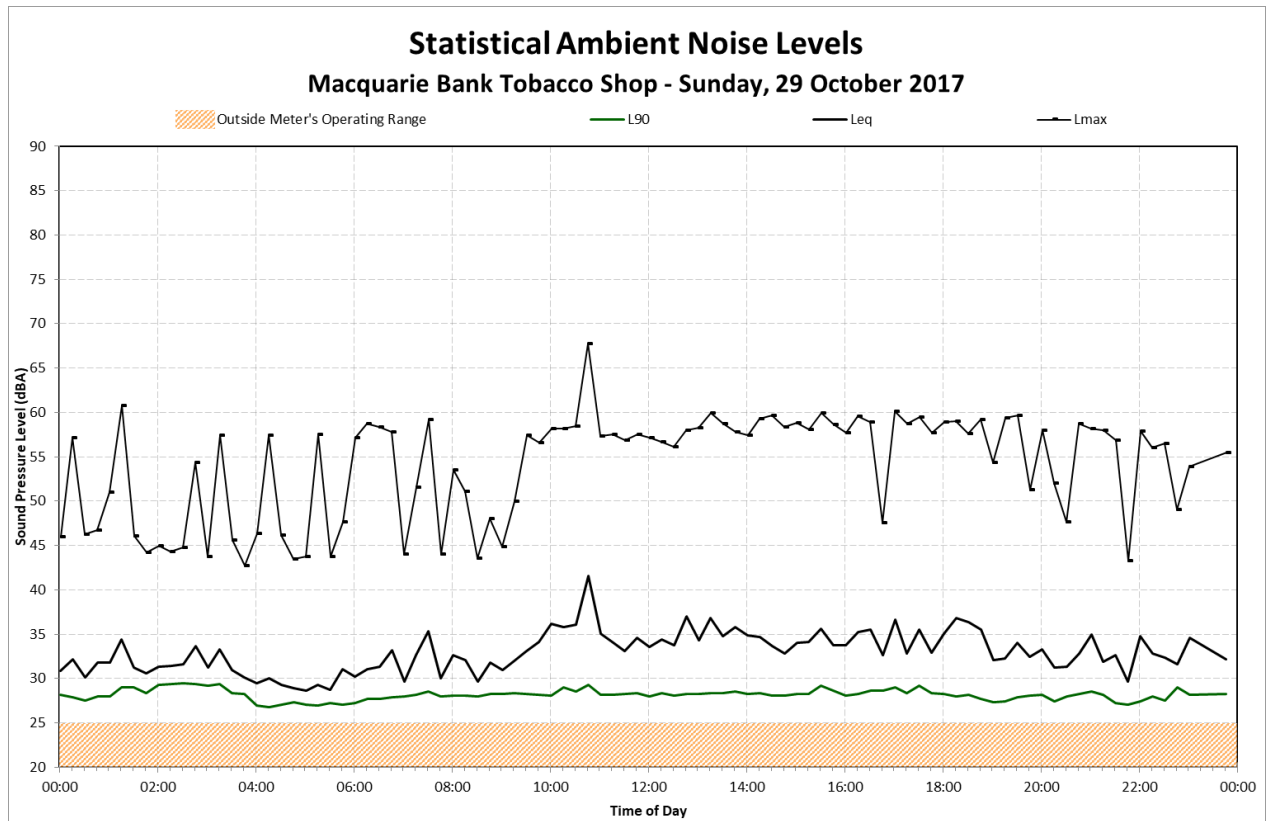
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

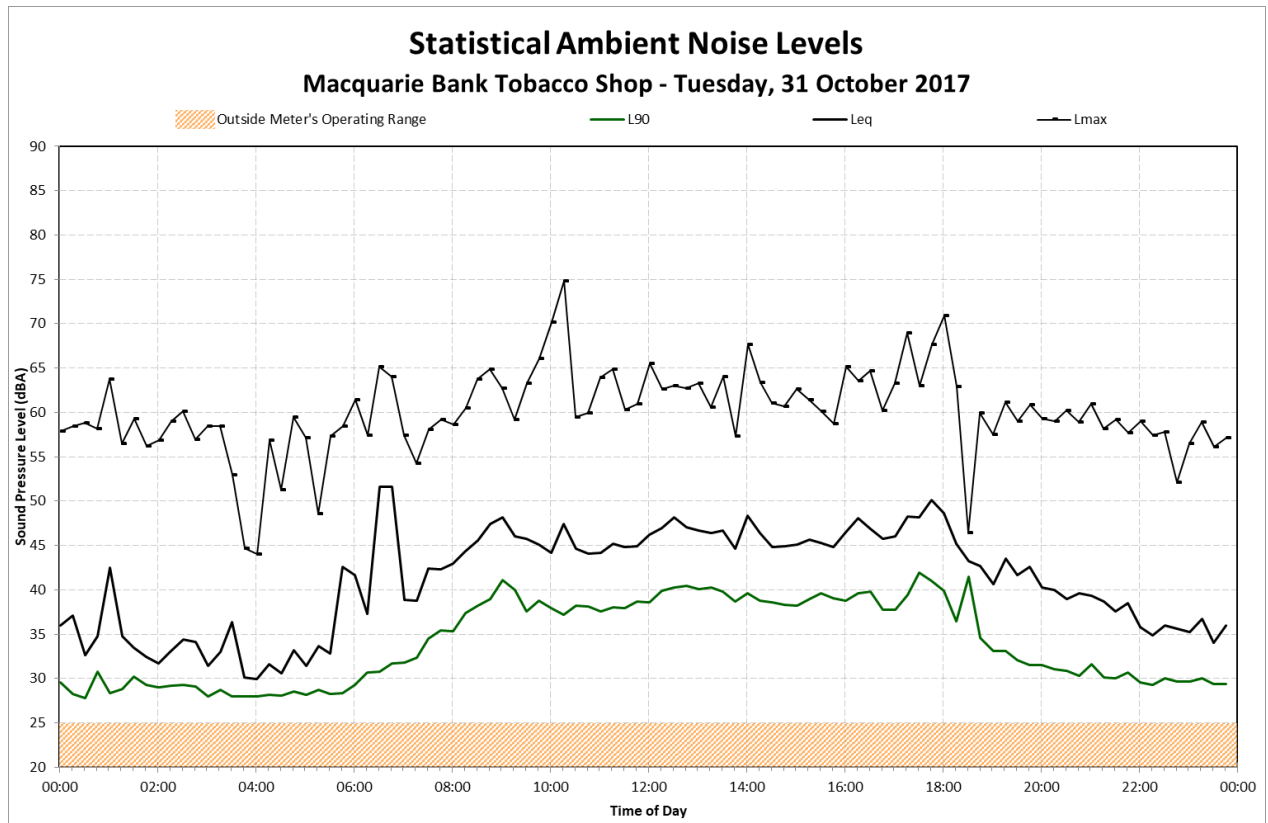
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

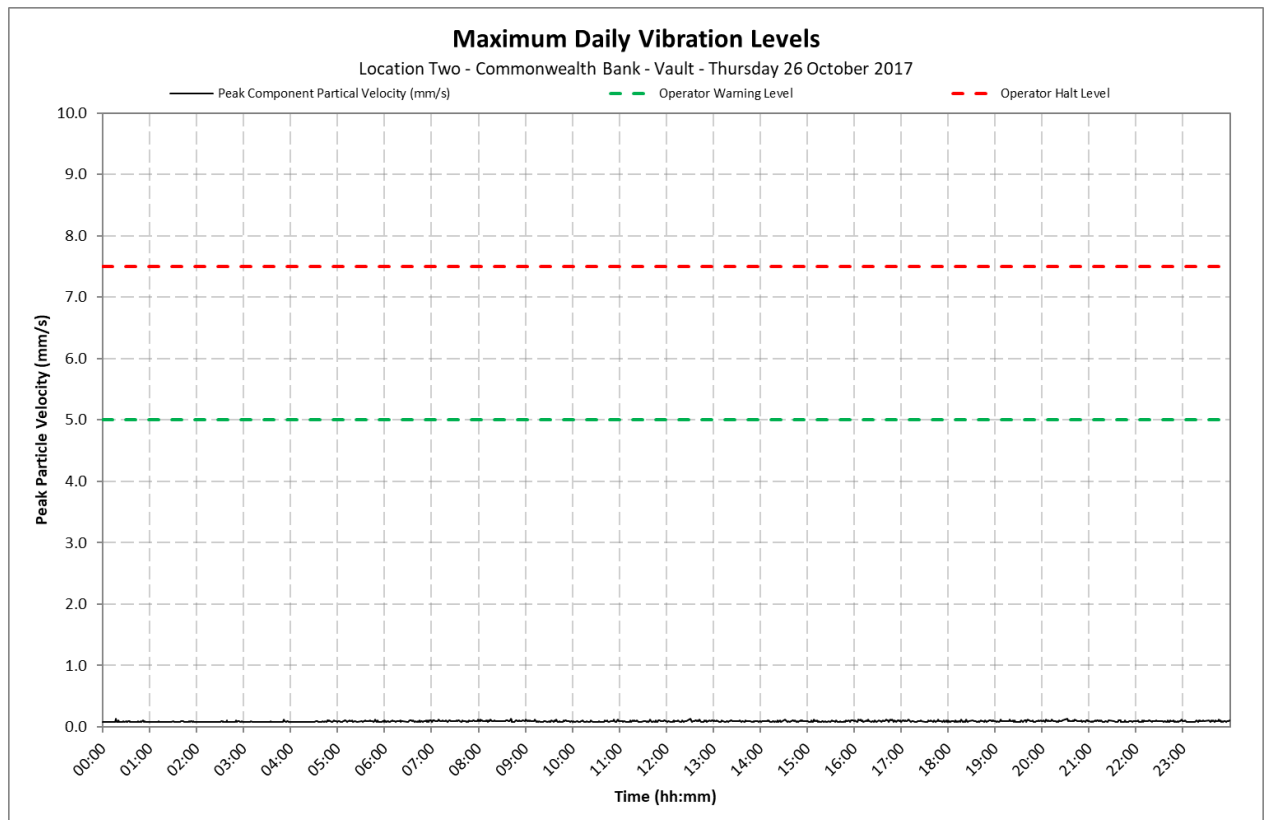
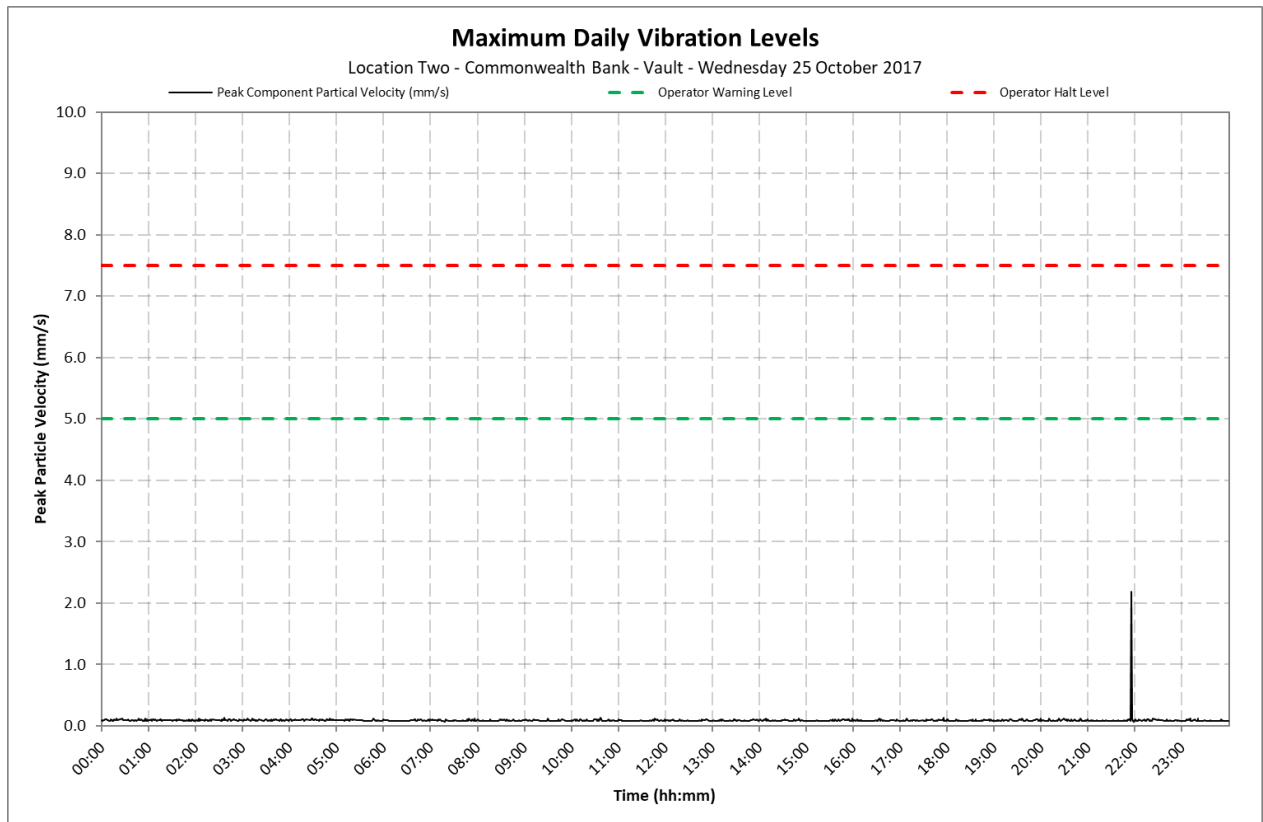
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

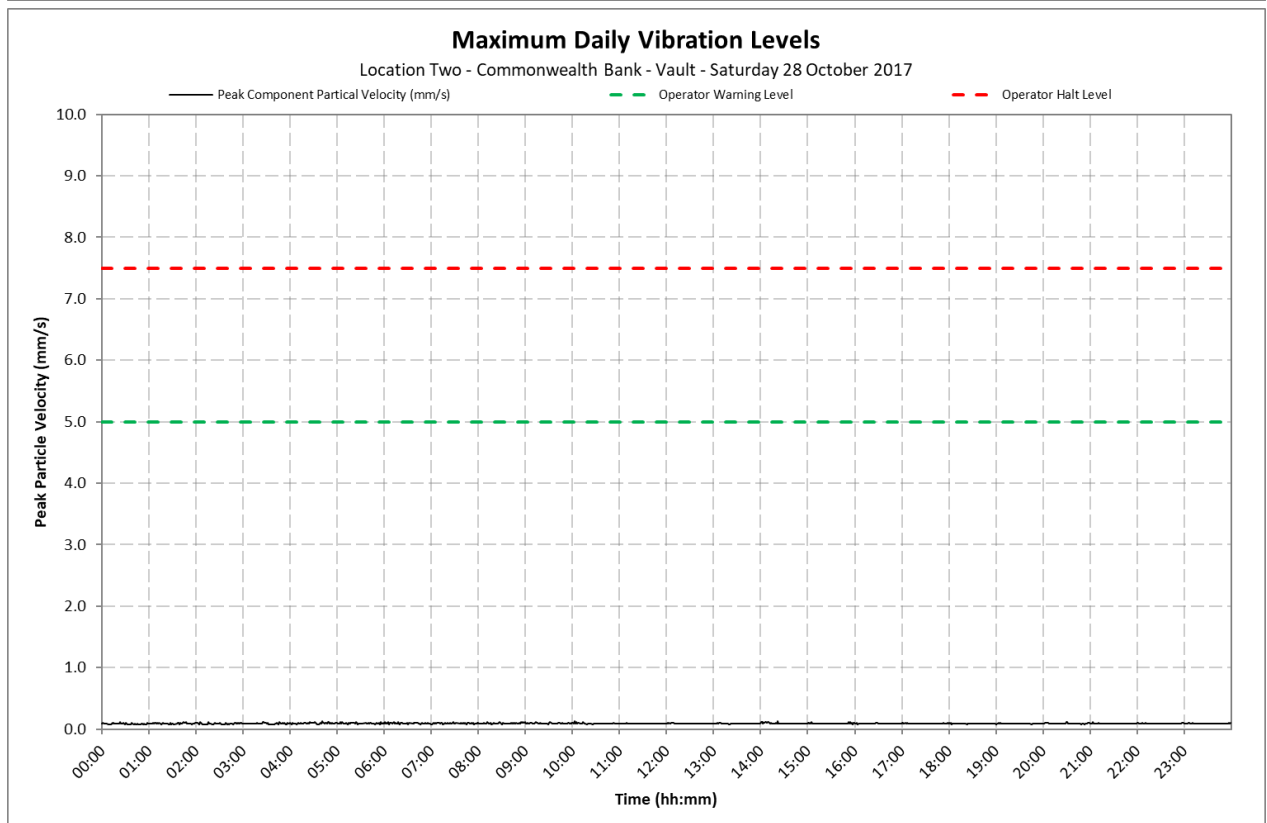
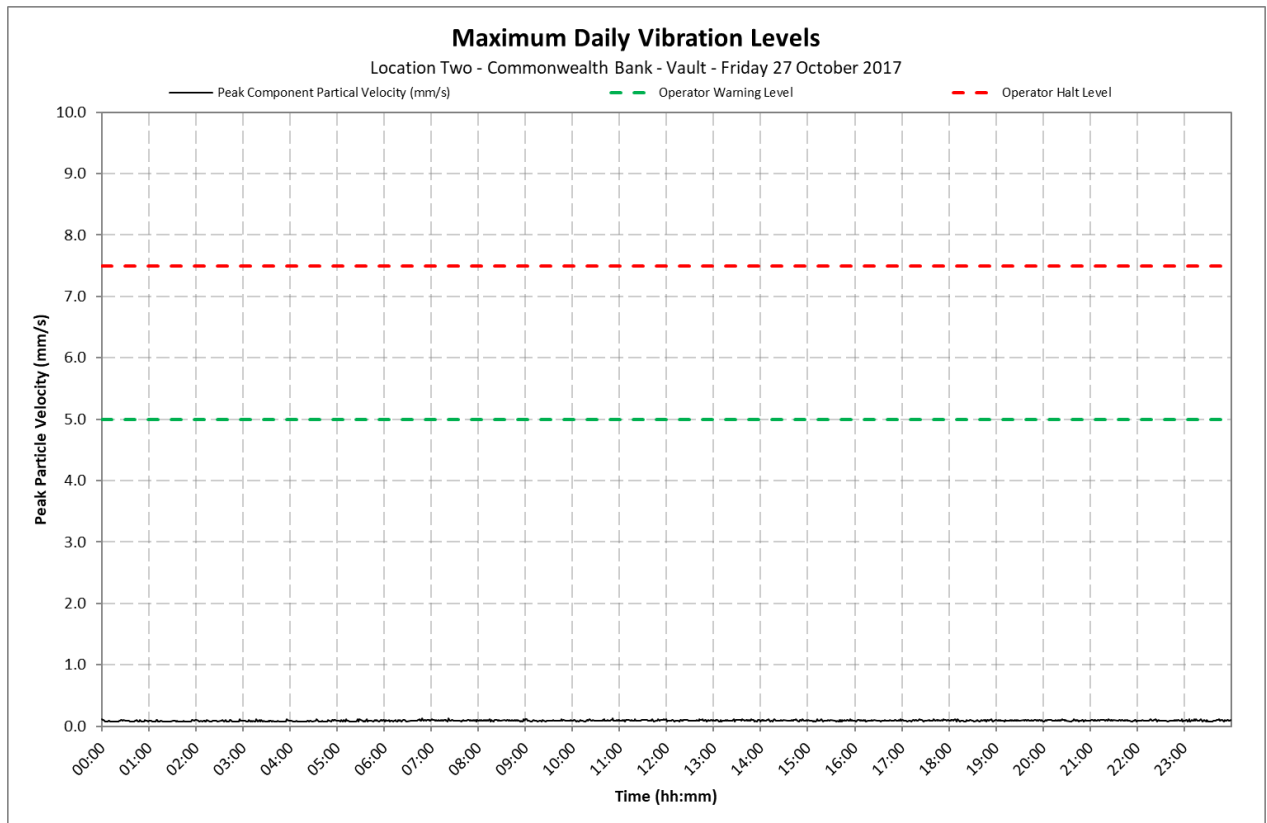
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

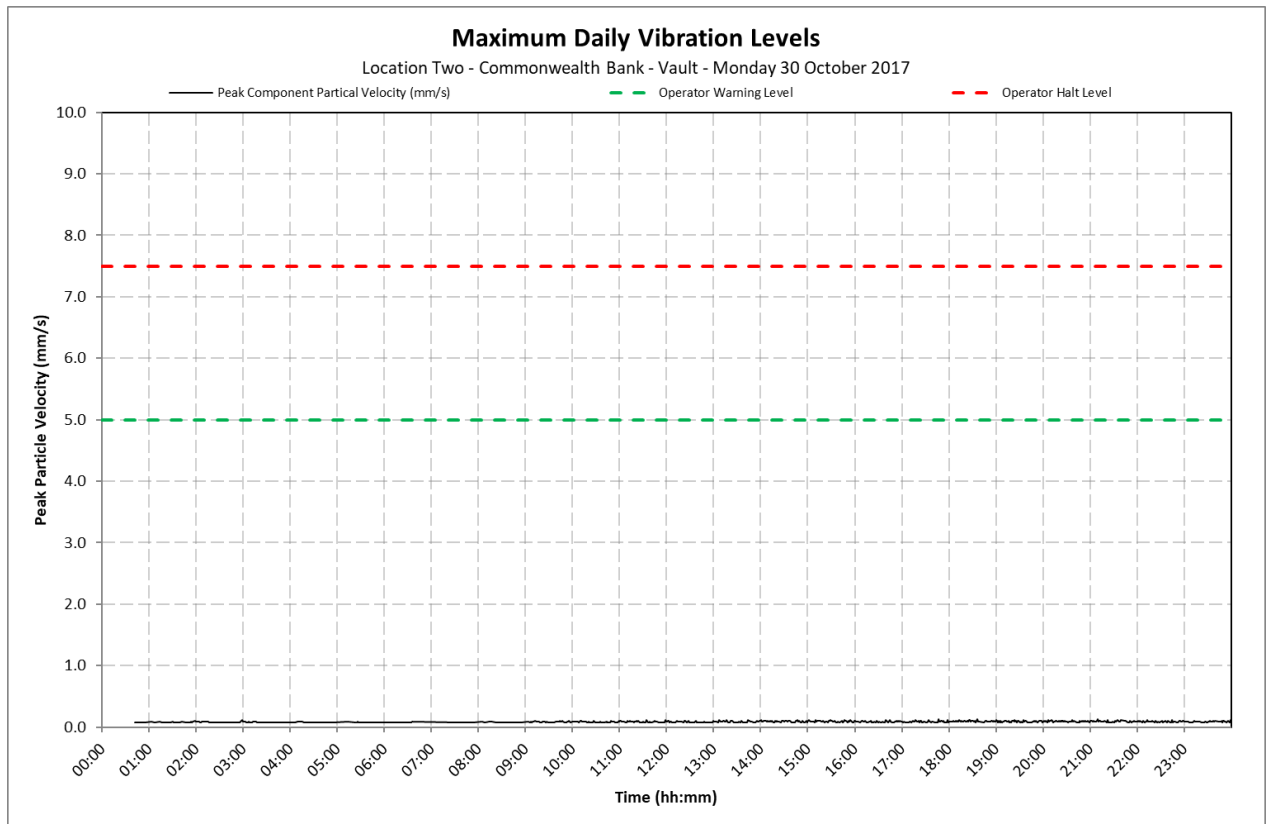
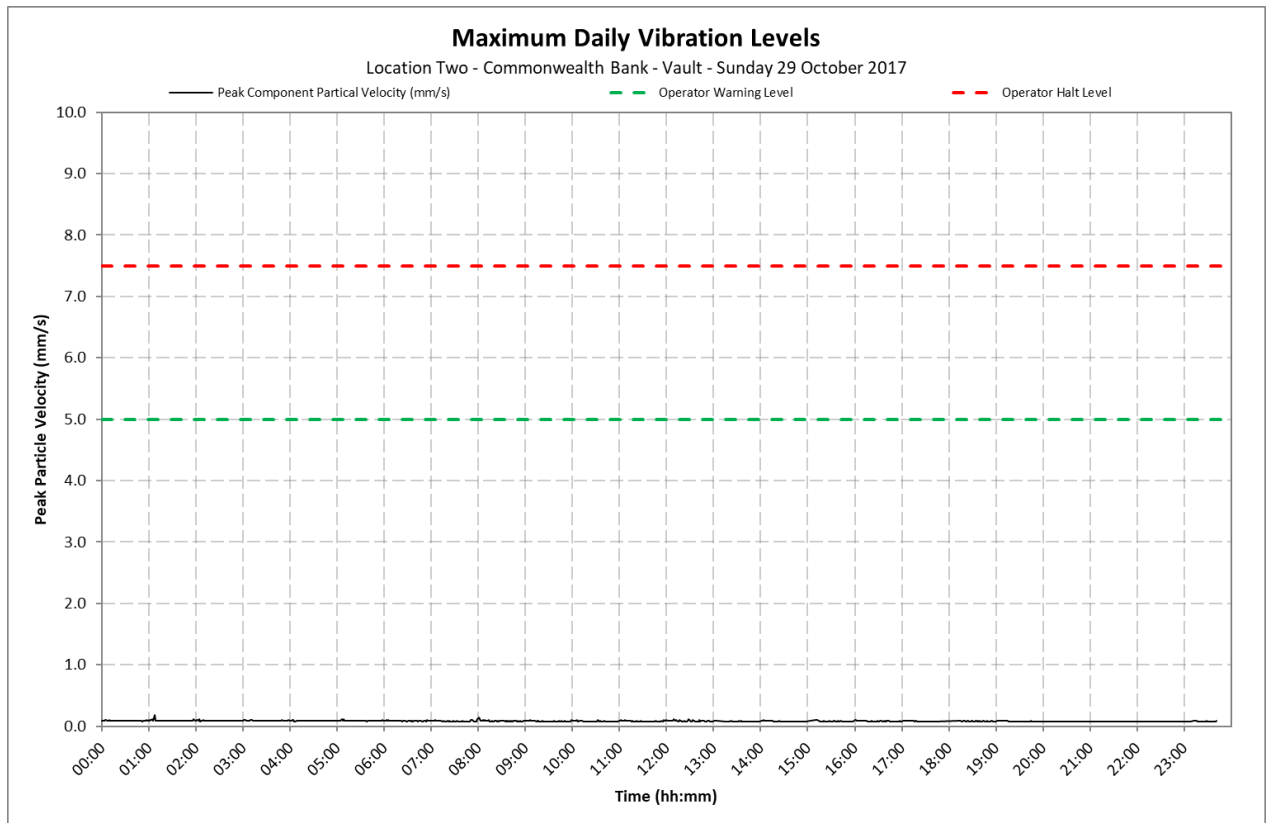
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

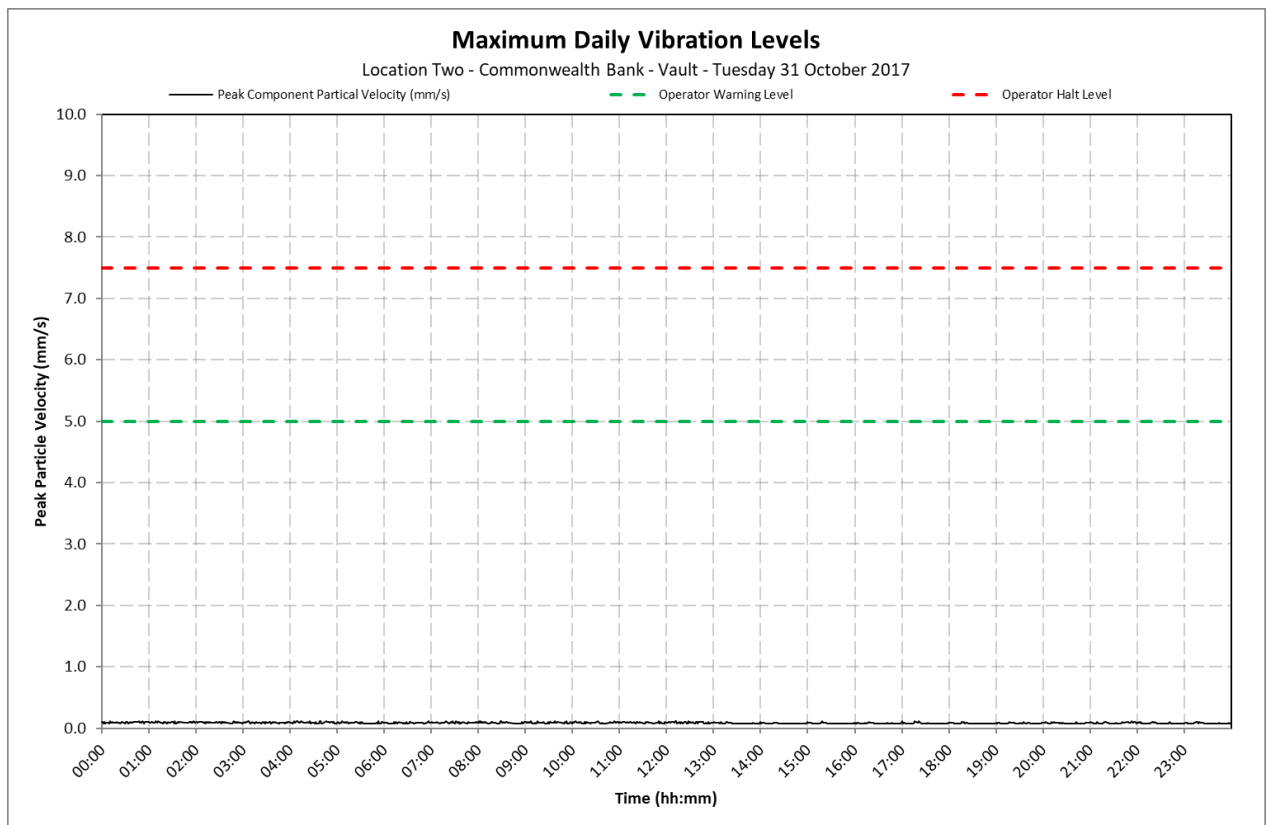
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

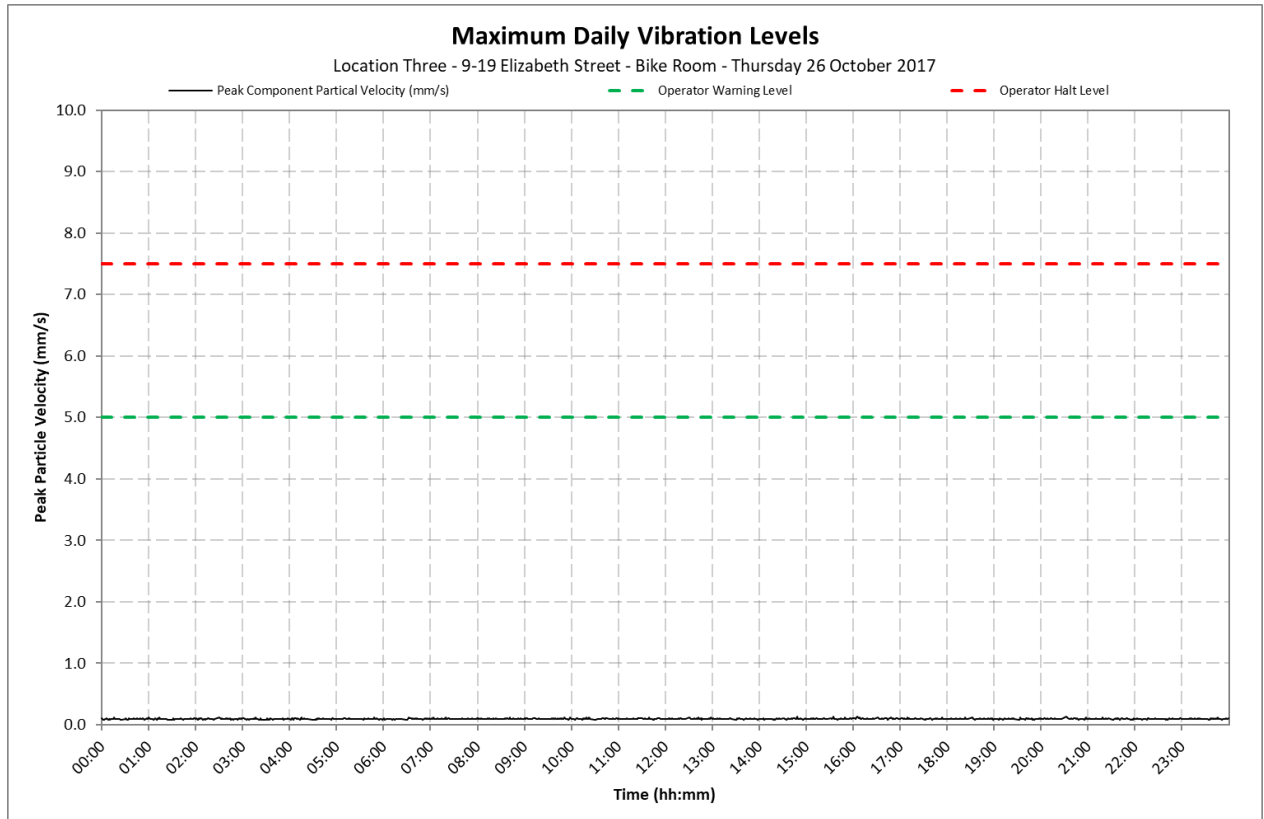
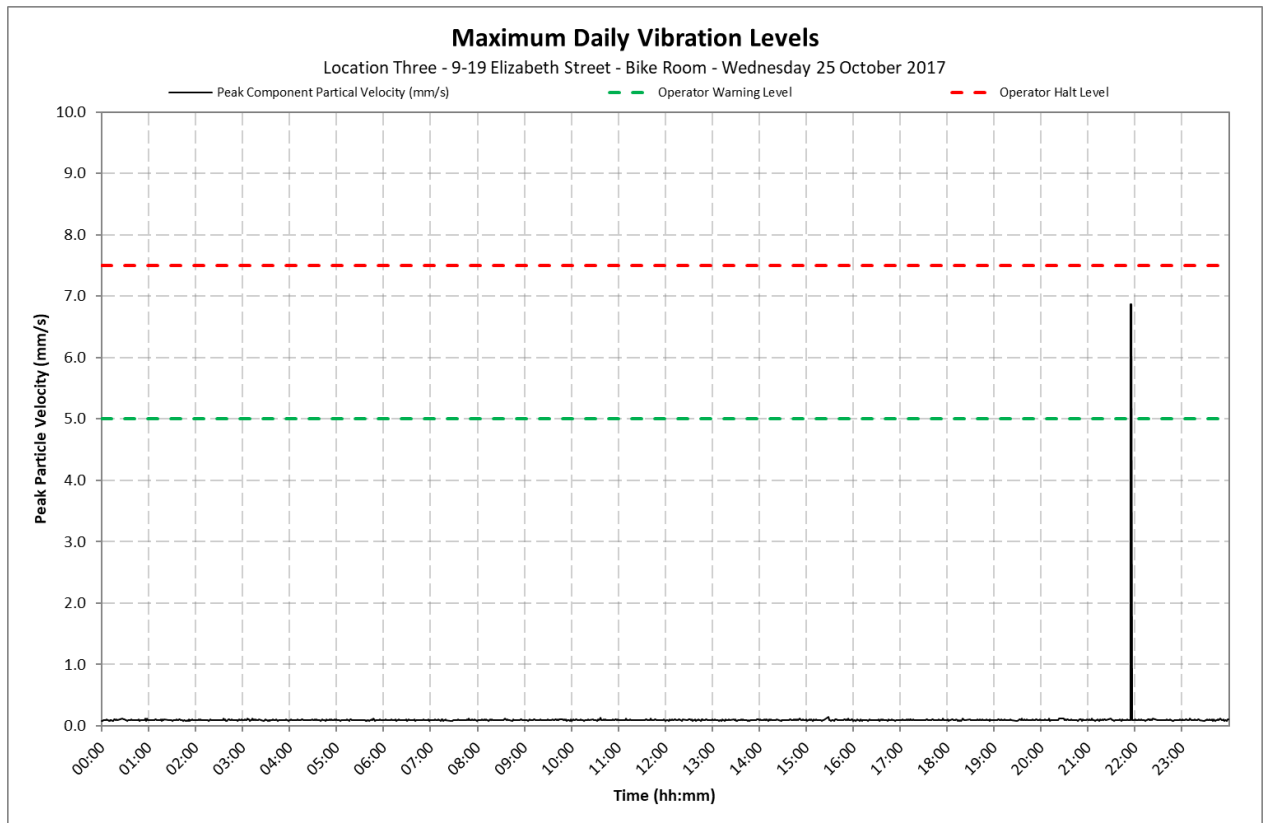
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

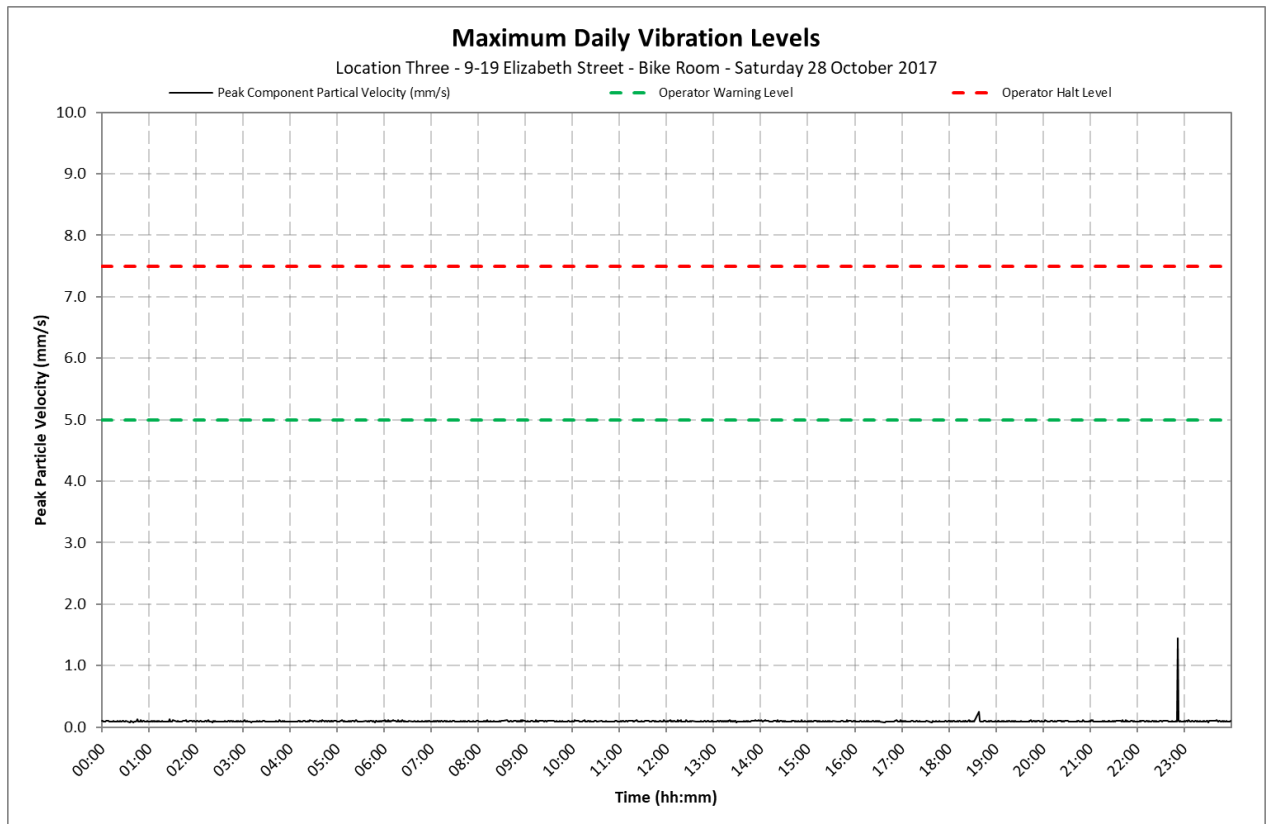
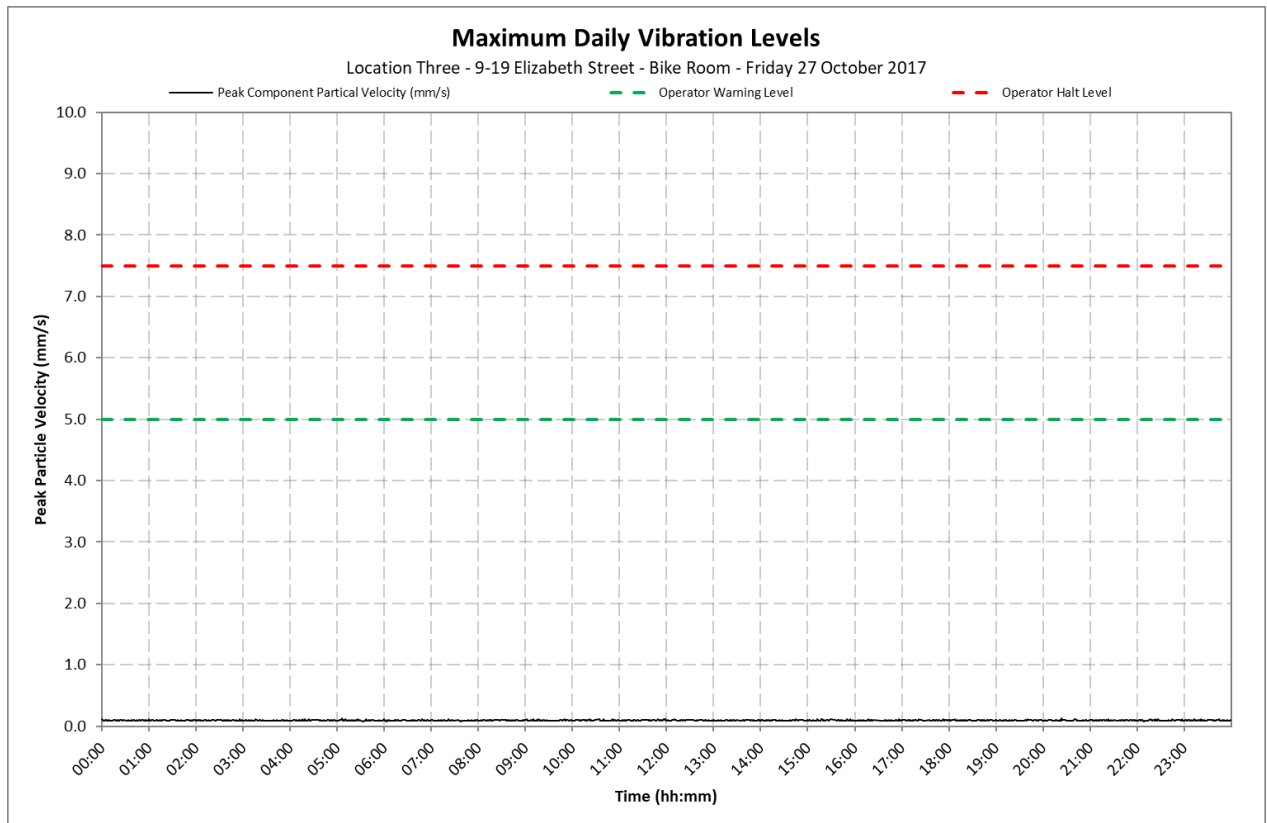
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

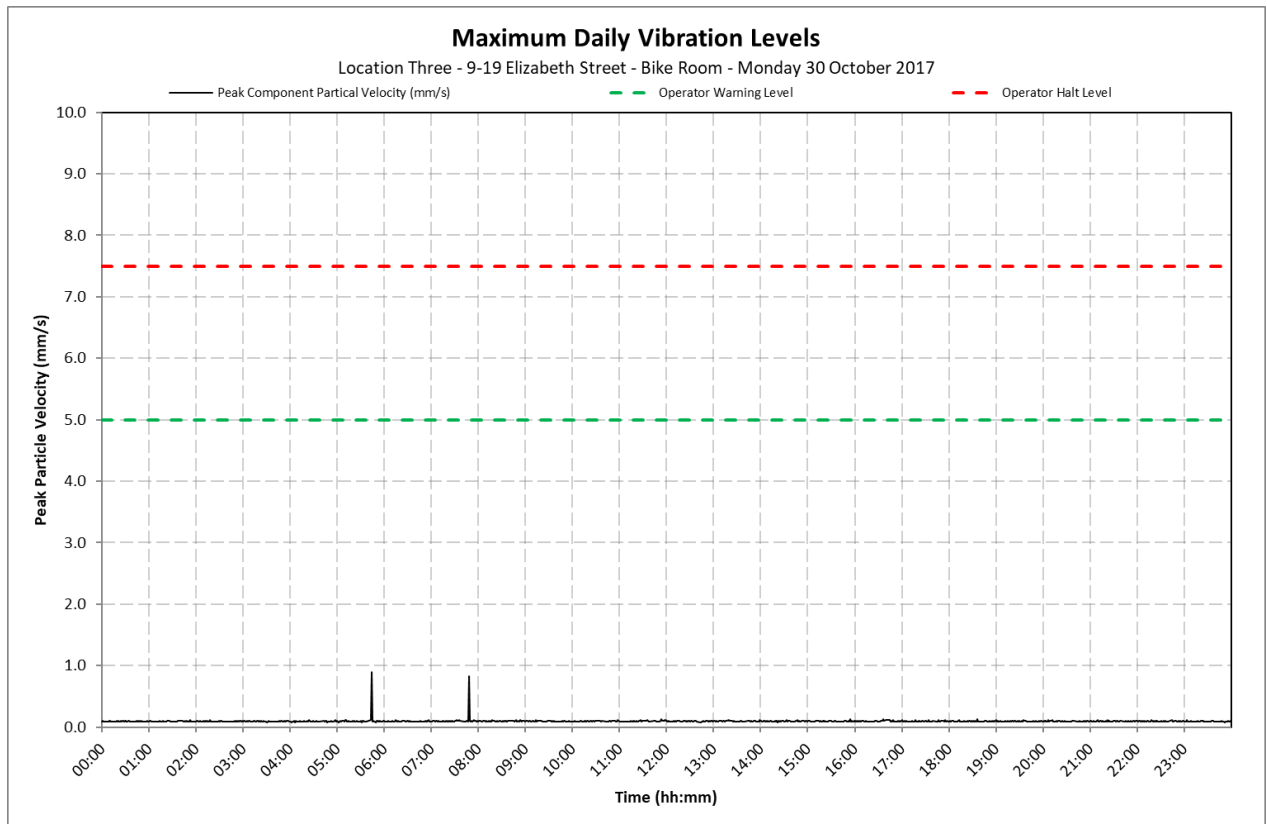
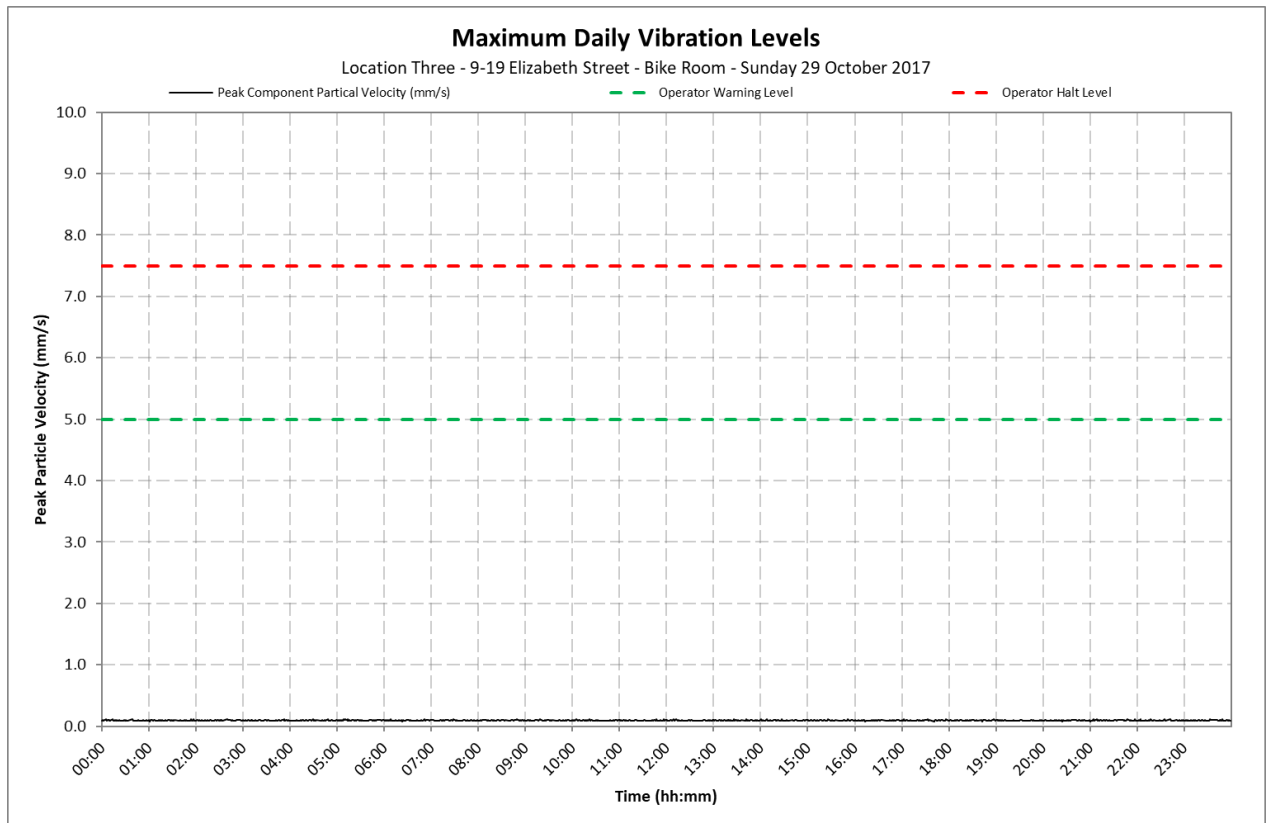
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

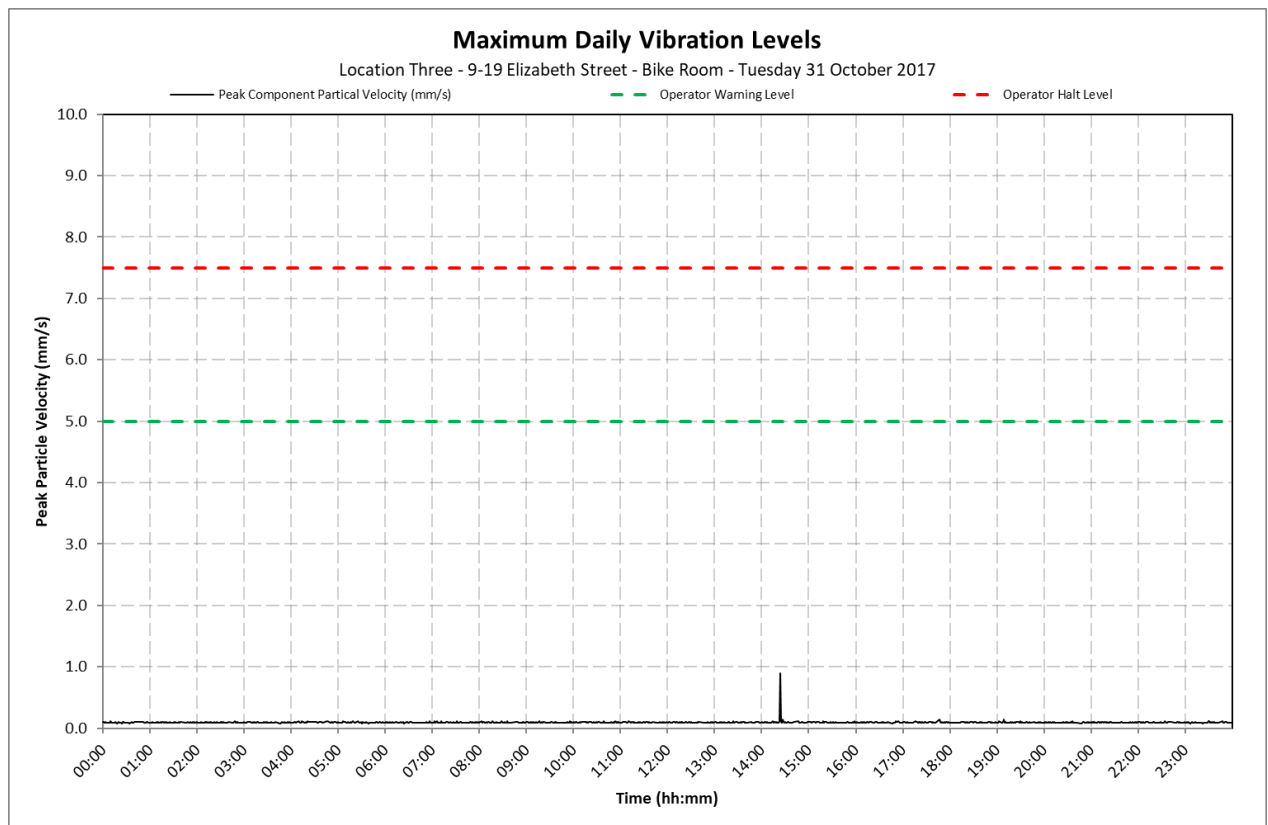
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





13 November 2017

10-1380 R05 NV Monitoring 20171113.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 05
1 November to 7 November 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 1 November to 7 November 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

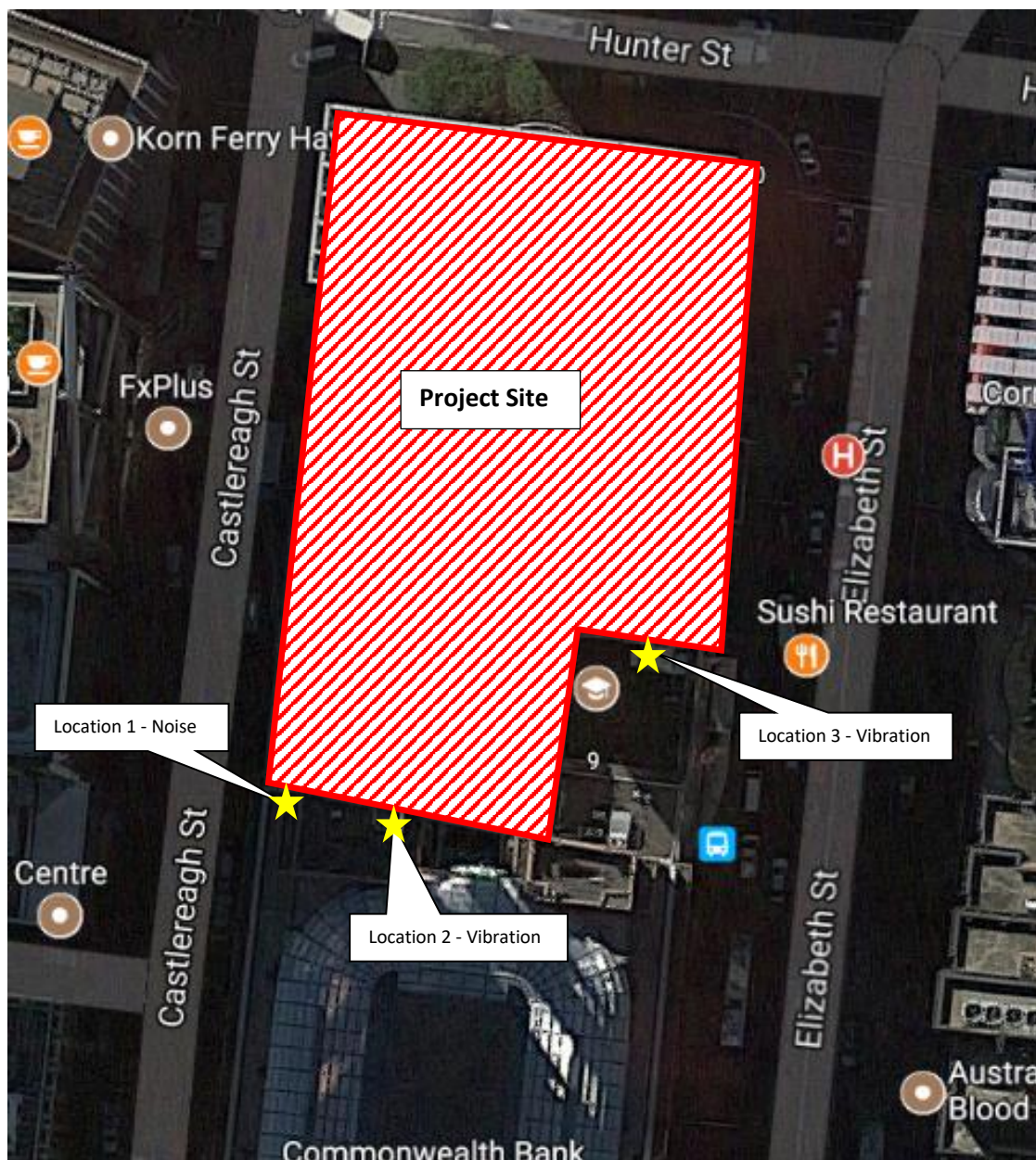
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Ground floor)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 1 November to 7 November 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
1 November 2017	46	44	Complies	Complies
2 November 2017	46	45	Complies	Complies
3 November 2017	46	44	Complies	Complies
4 November 2017	46	45	Complies	Complies
5 November 2017	42	41	Complies	Complies
6 November 2017	38	37	Complies	Complies
7 November 2017	43	42	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 3, respectively, during the period 1 November to 7 November 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
1 November 2017	0.1 mm/s	Complies
2 November 2017	1.0 mm/s	Complies
3 November 2017	0.1 mm/s	Complies
4 November 2017	0.8 mm/s	Complies
5 November 2017	0.1 mm/s	Complies
6 November 2017	5.2 mm/s	1 Event Above Warning Level
7 November 2017	0.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
1 November 2017	1.3 mm/s	Complies
2 November 2017	1.8 mm/s	Complies
3 November 2017	0.1 mm/s	Complies
4 November 2017	1.0 mm/s	Complies
5 November 2017	0.1 mm/s	Complies
6 November 2017	0.8 mm/s	Complies
7 November 2017	0.1 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 1 November to 7 November 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 1 November to 7 November 2017 found one event above the Operator Warning Level at Location Two. All recorded ambient vibration levels however, were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

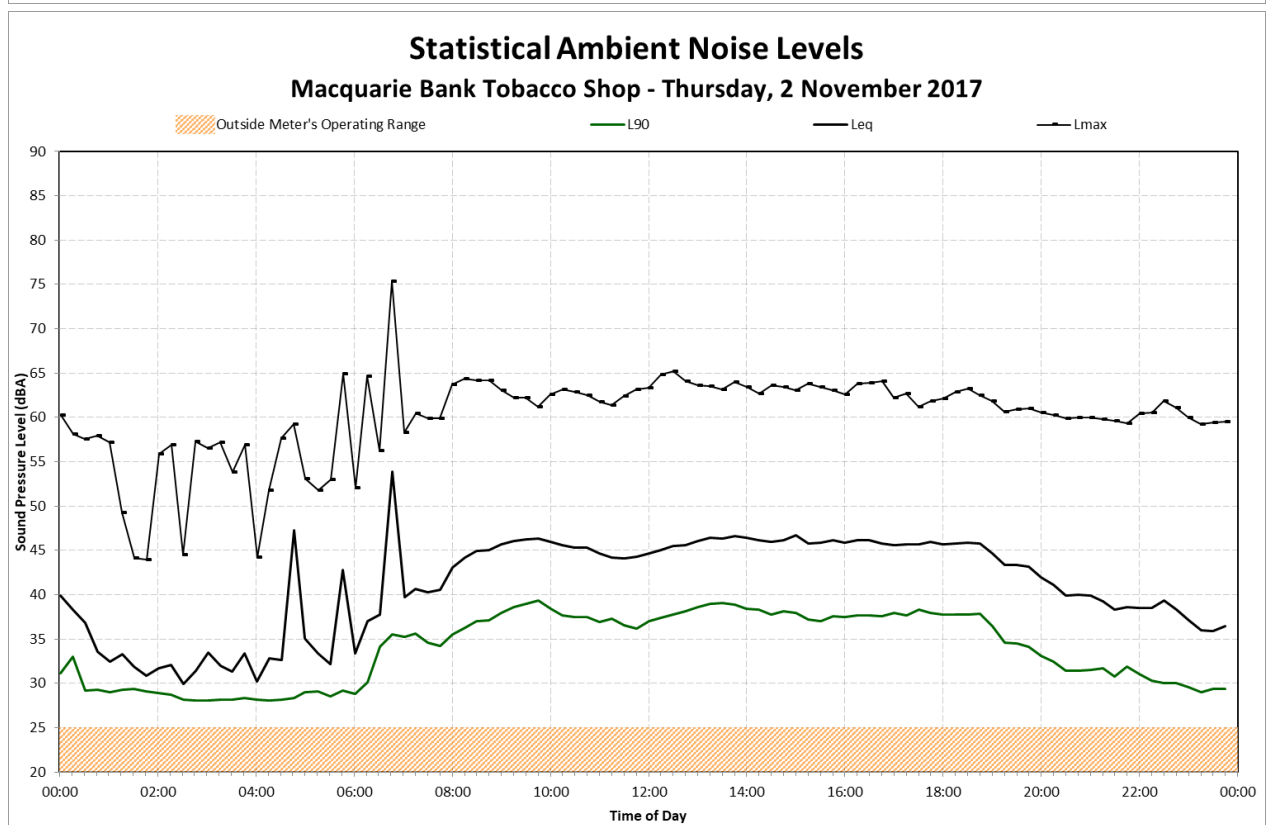
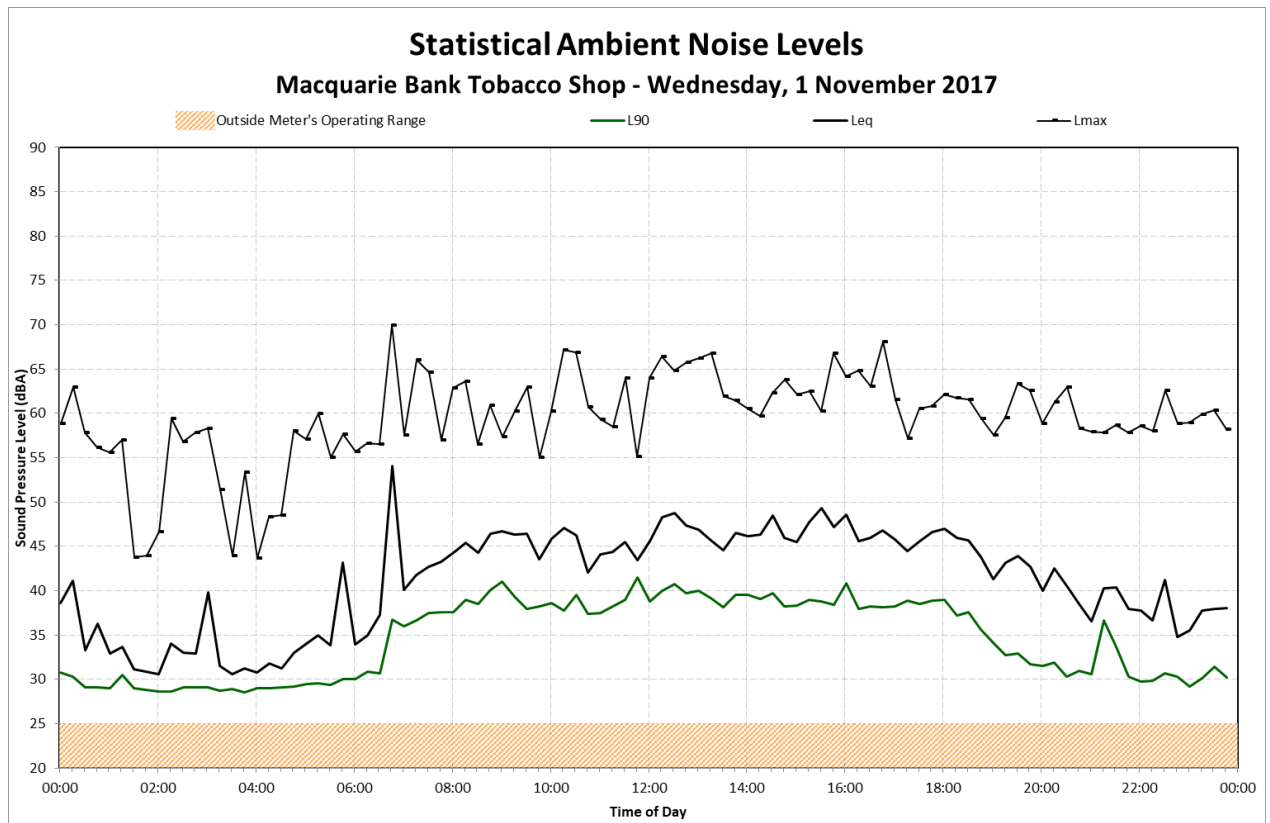
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

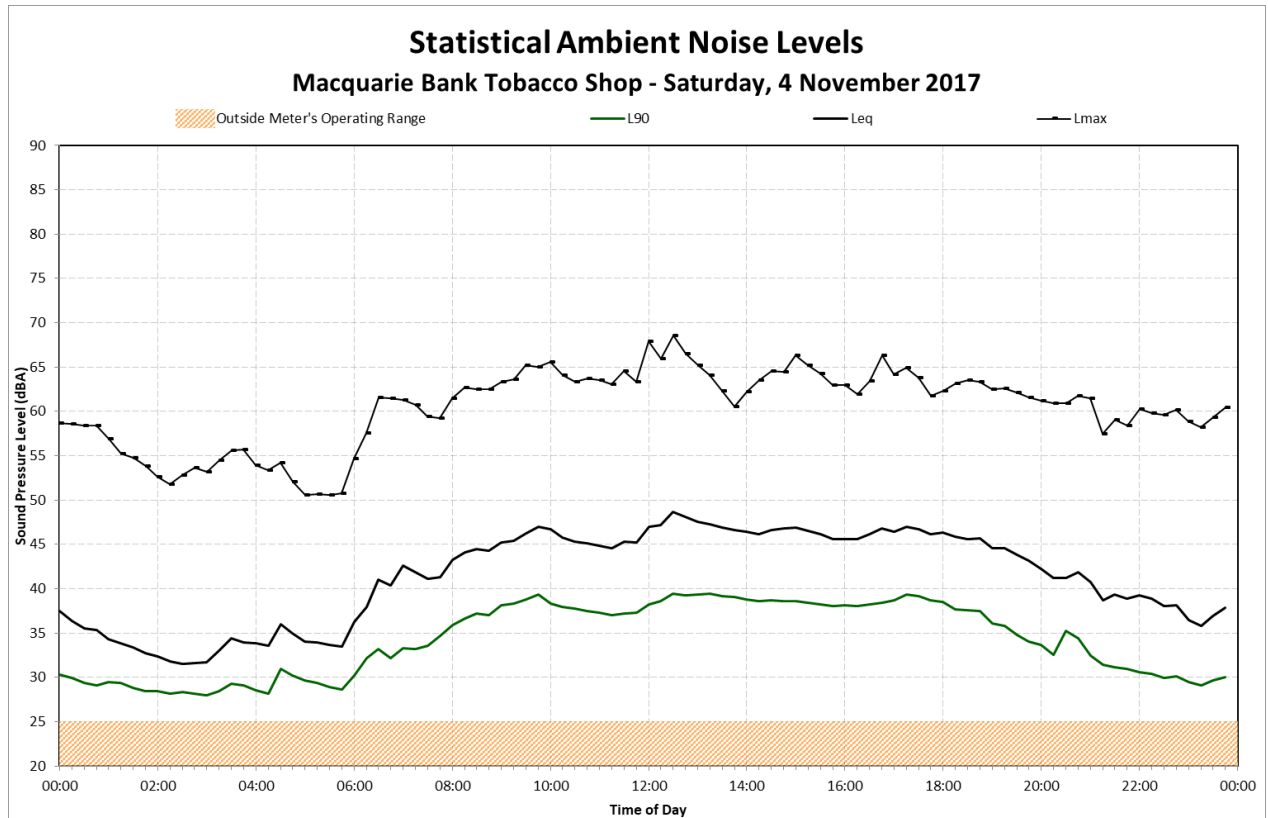
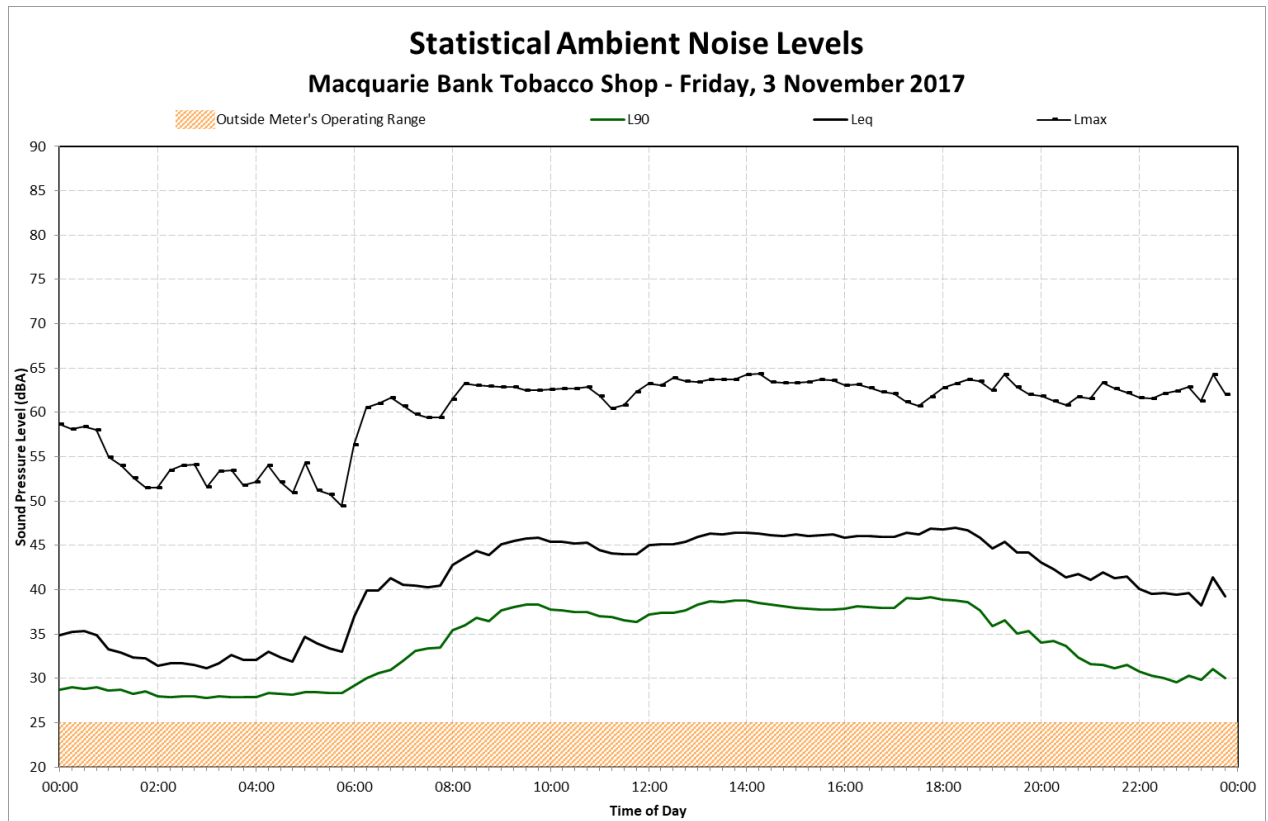
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

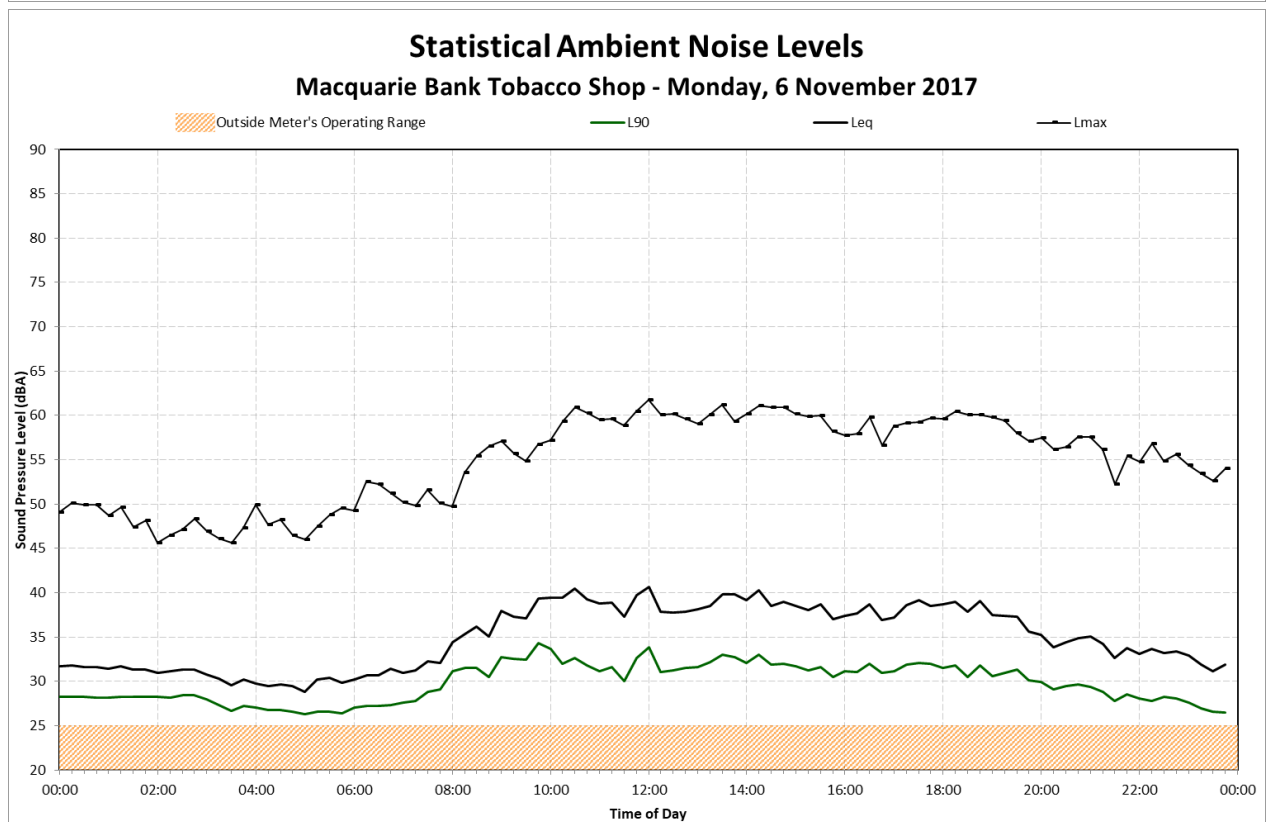
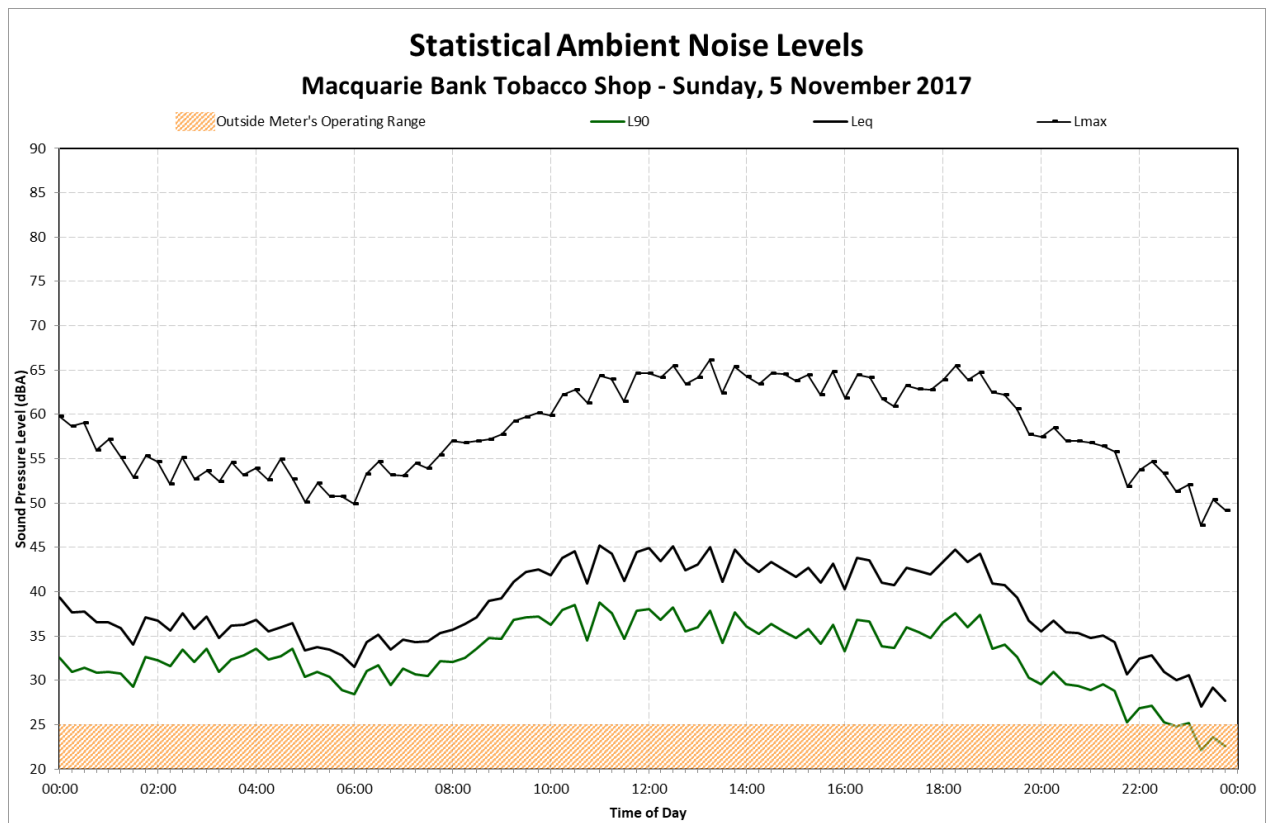
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

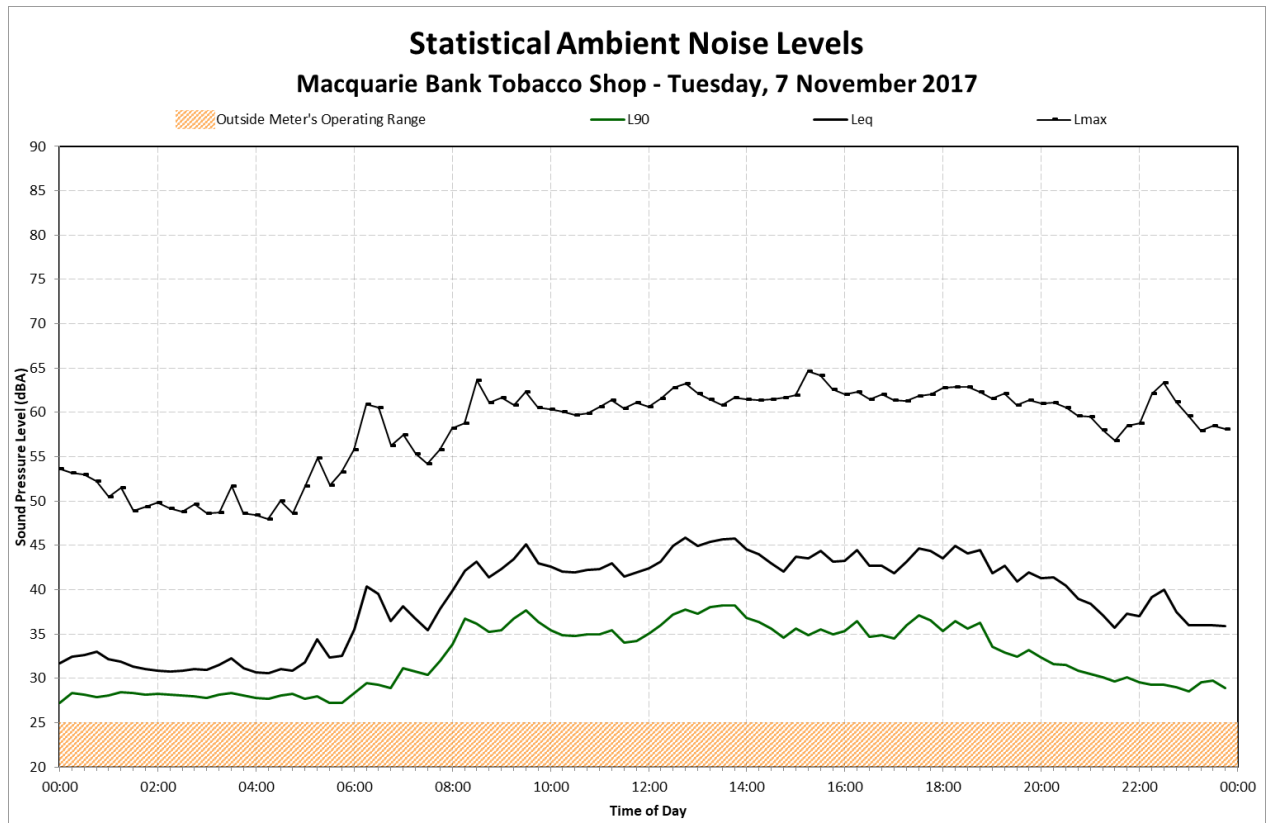
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

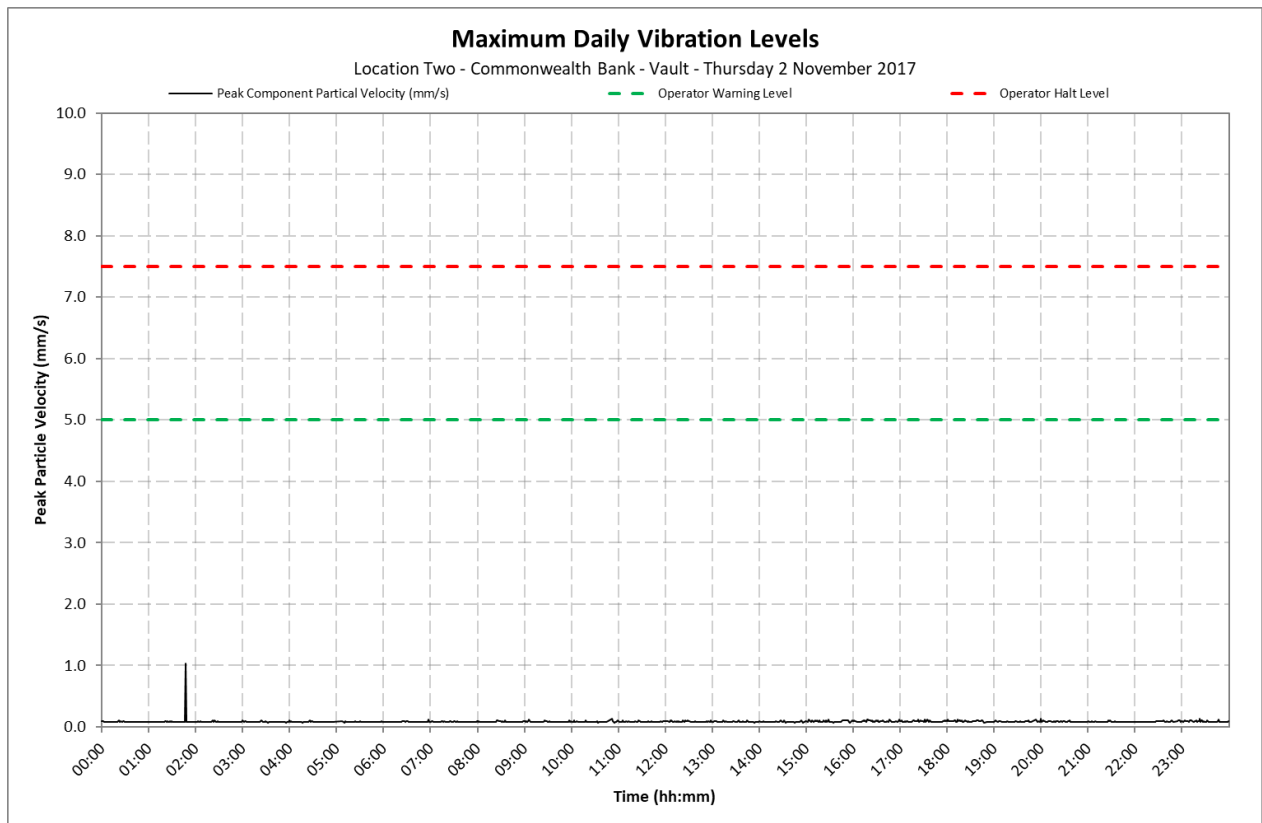
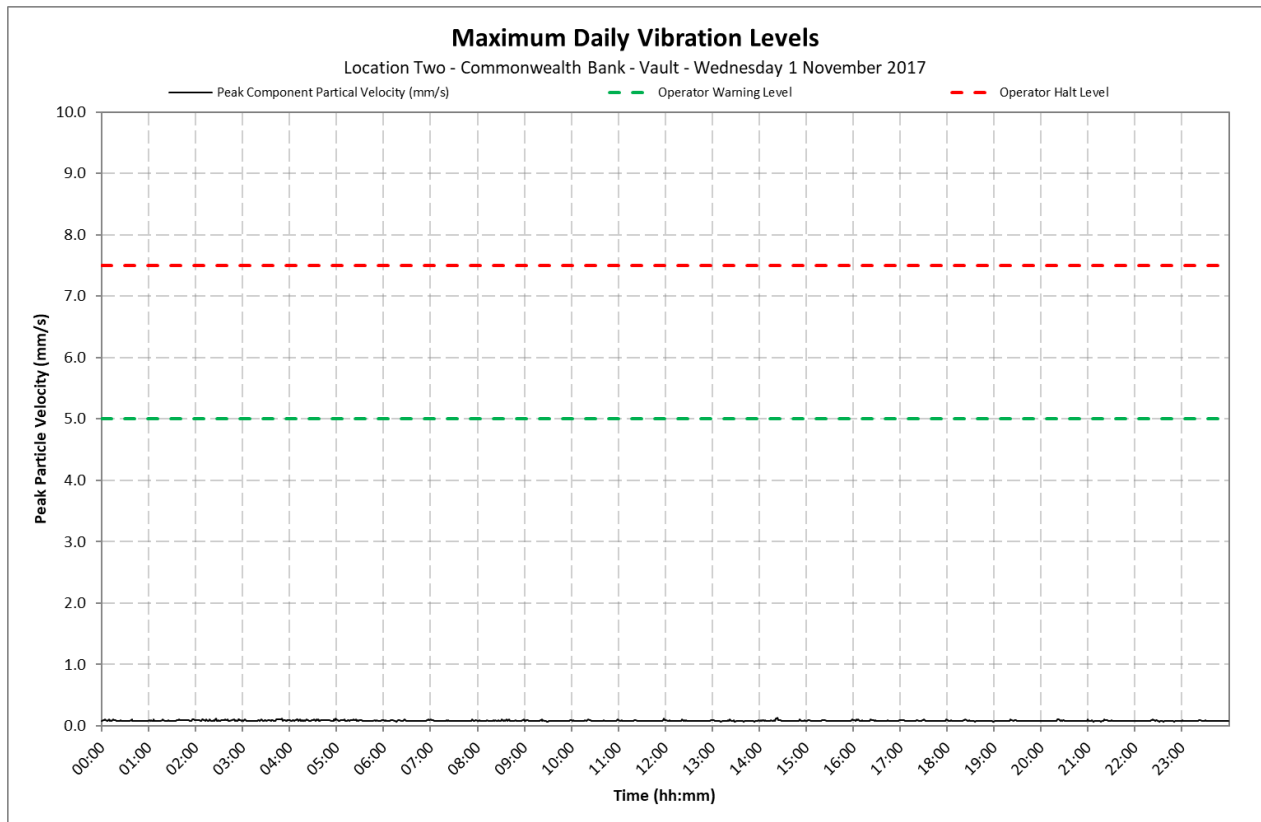
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

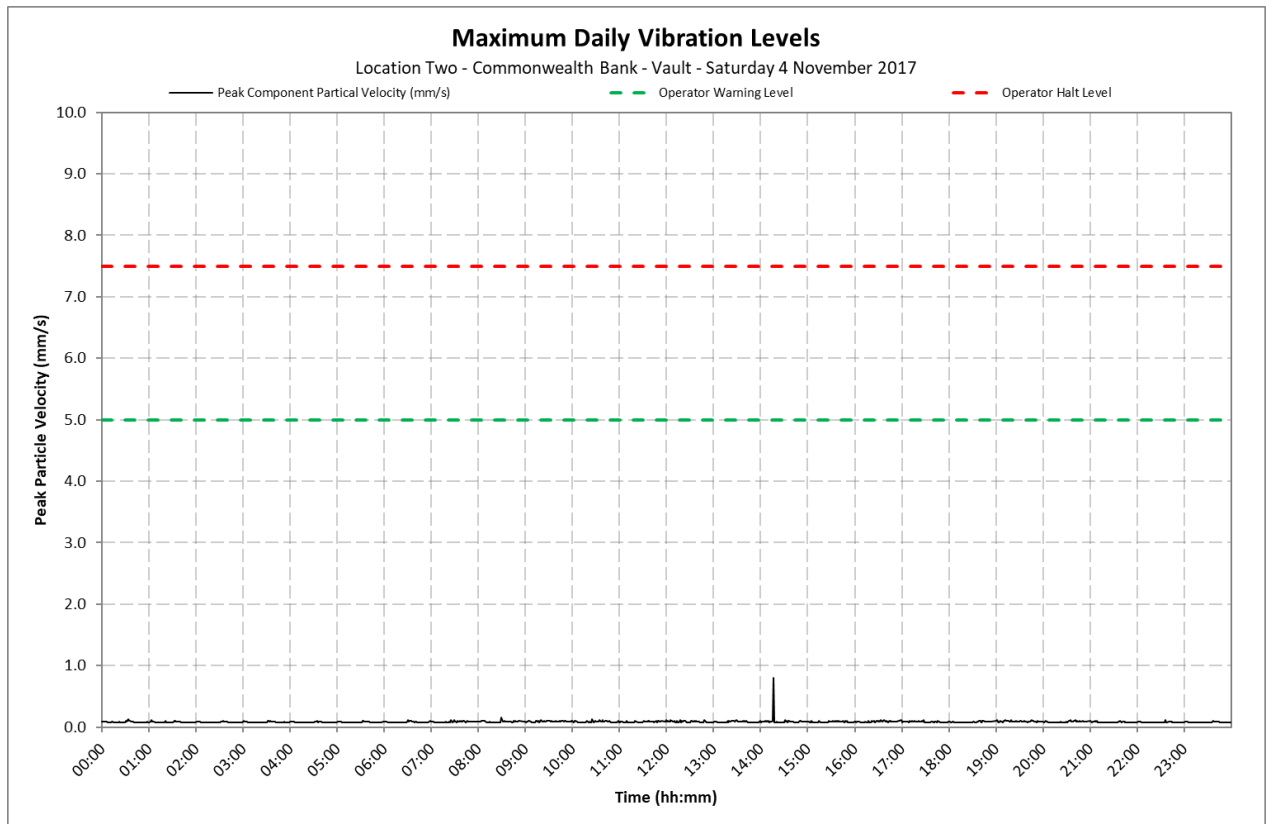
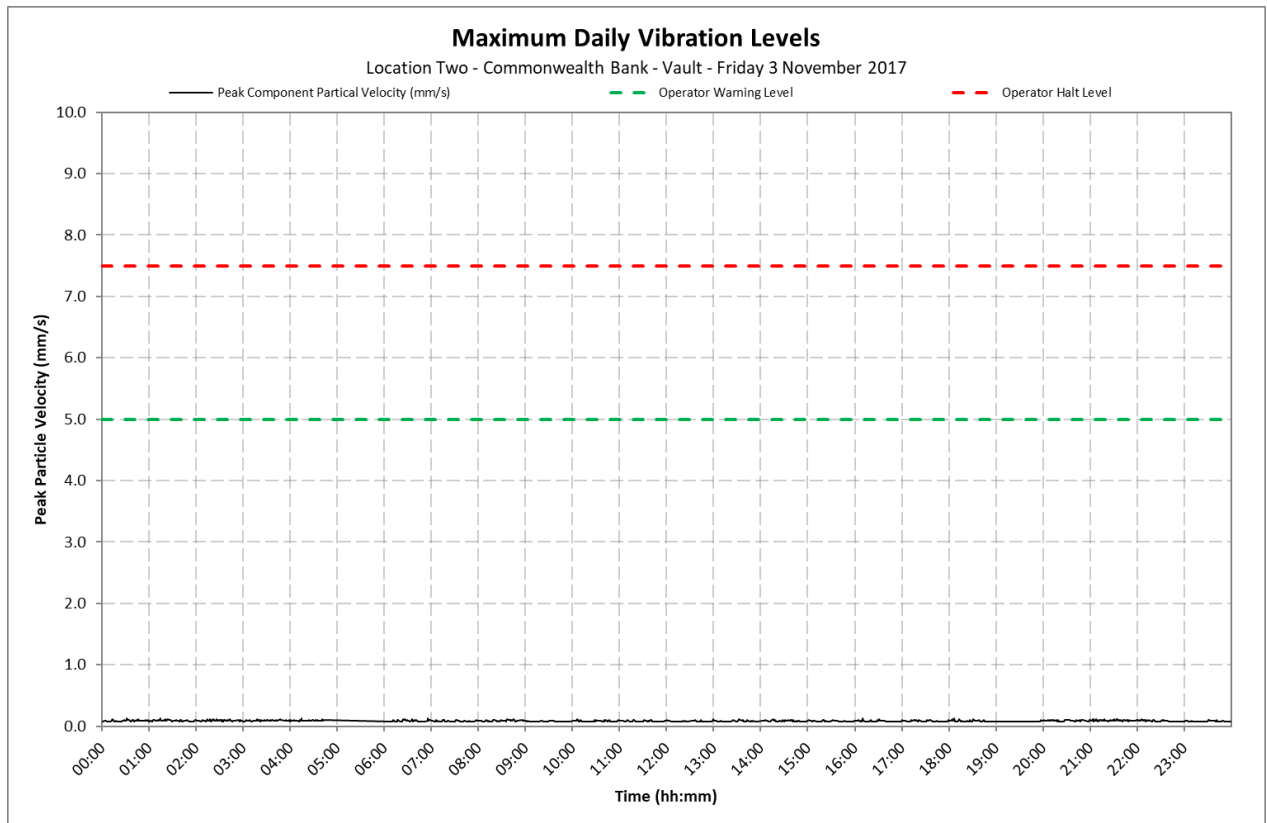
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

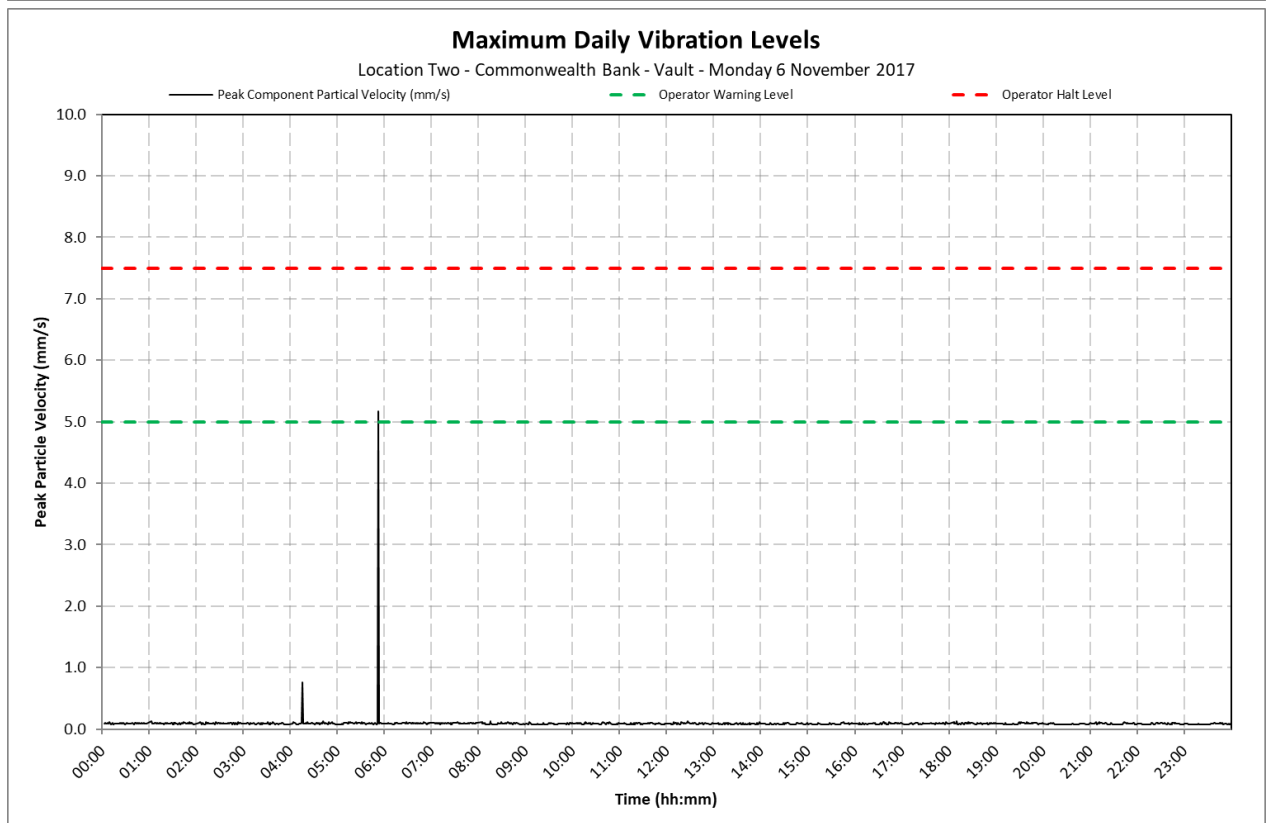
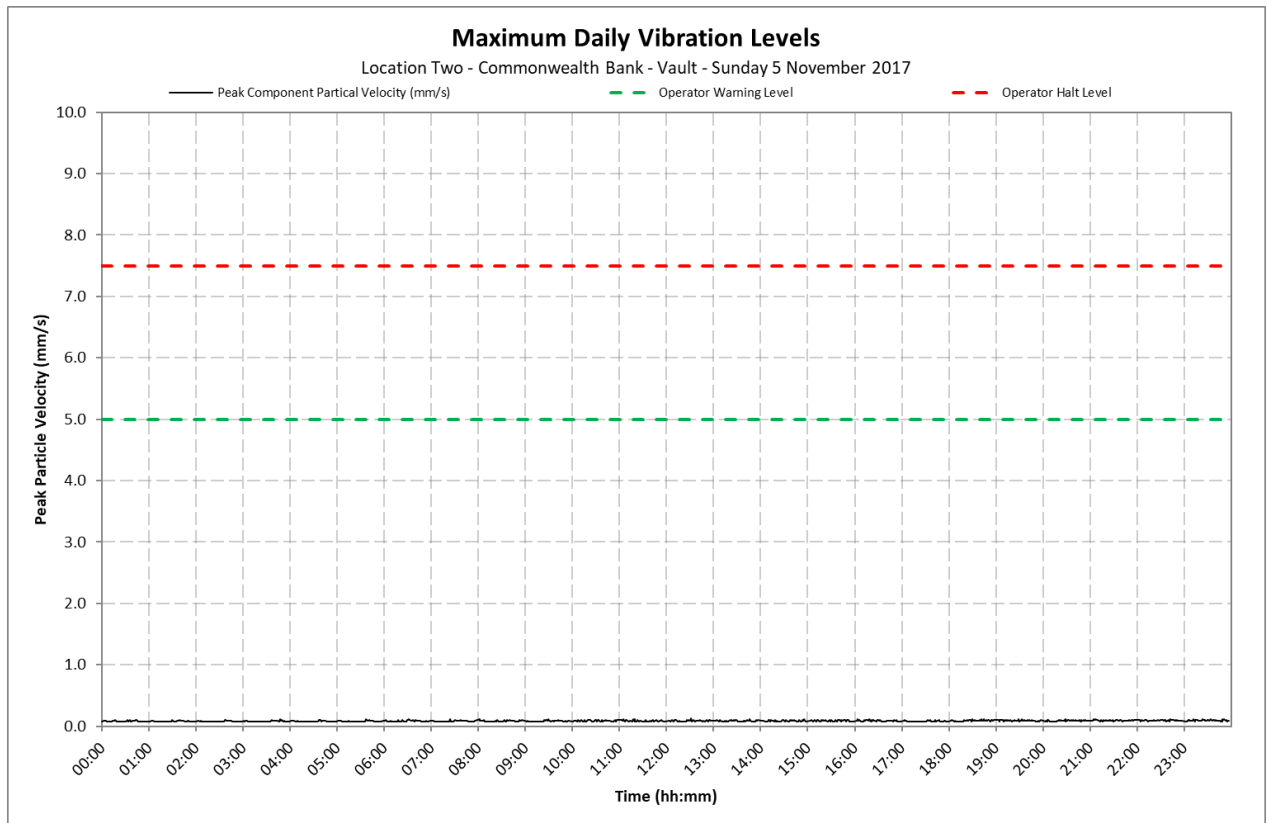
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

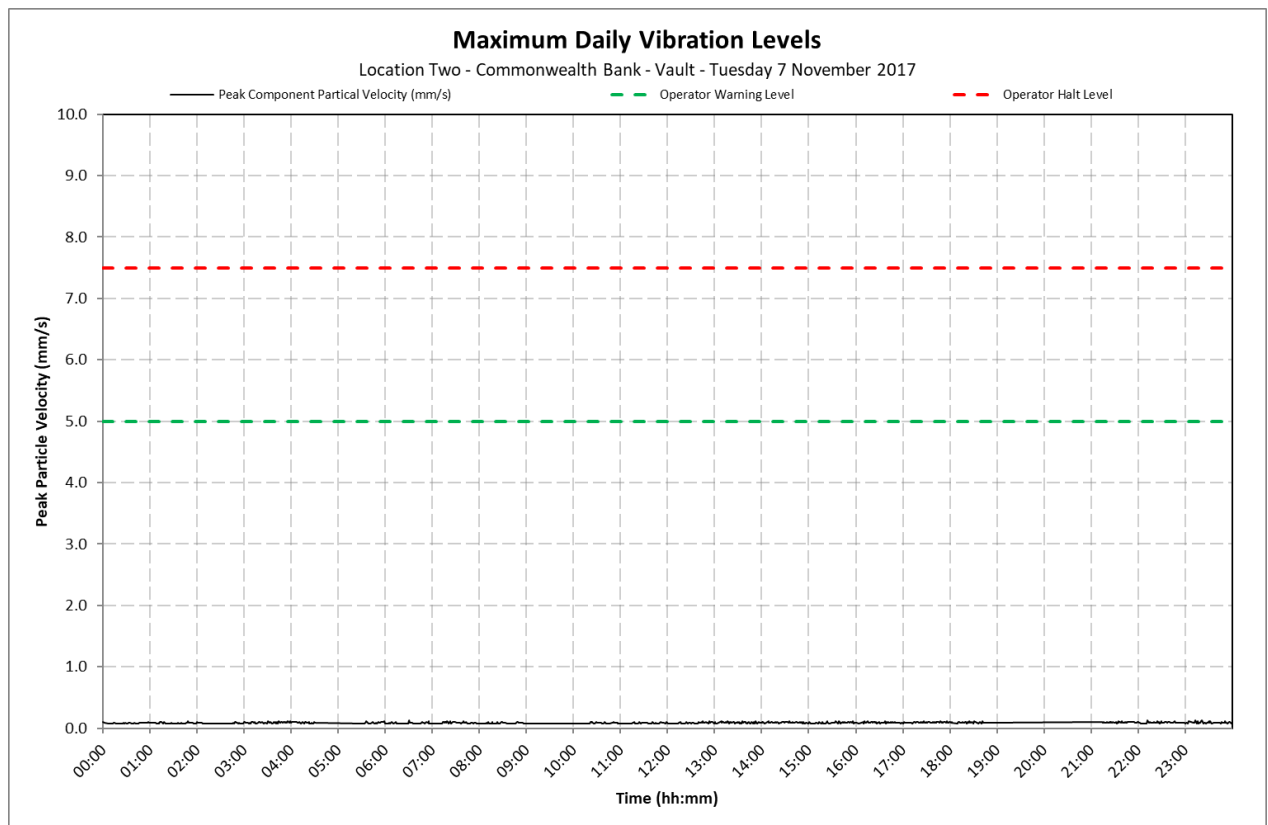
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

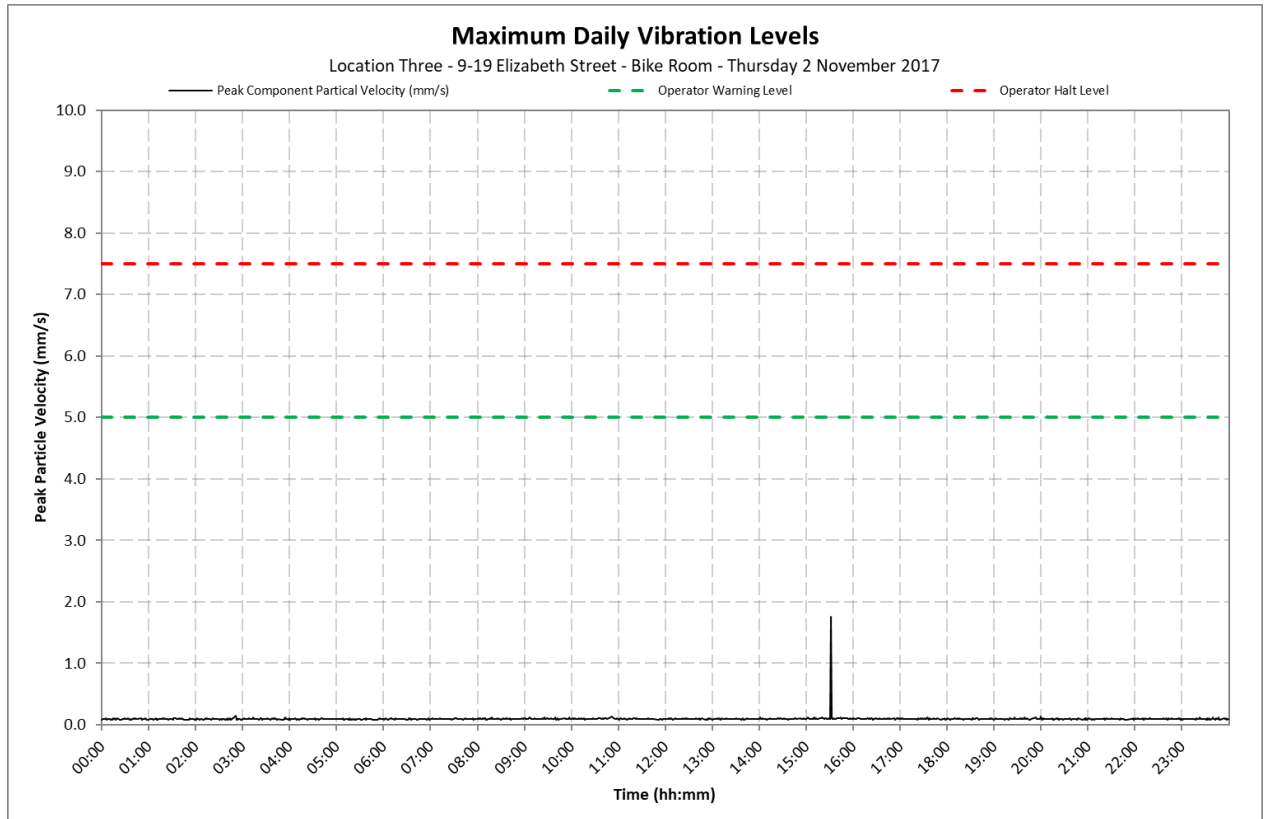
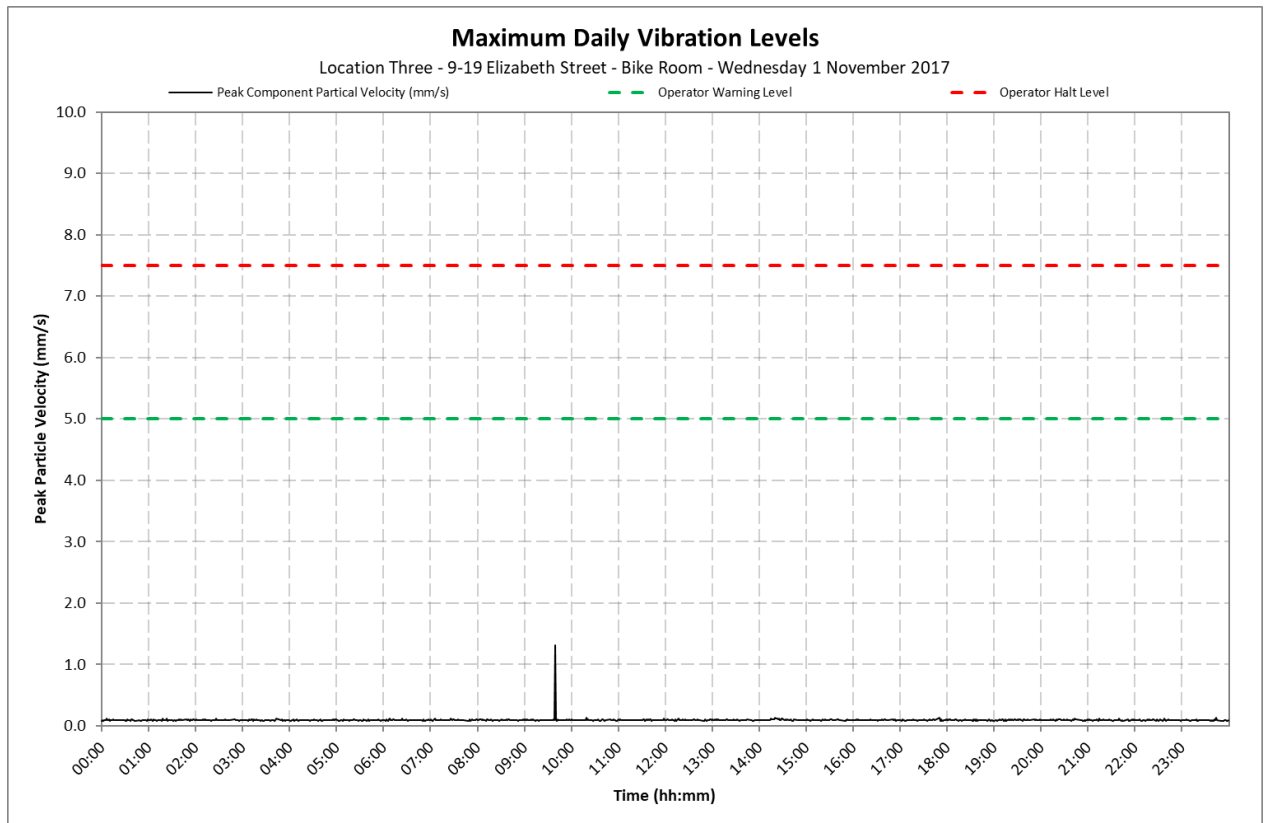
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

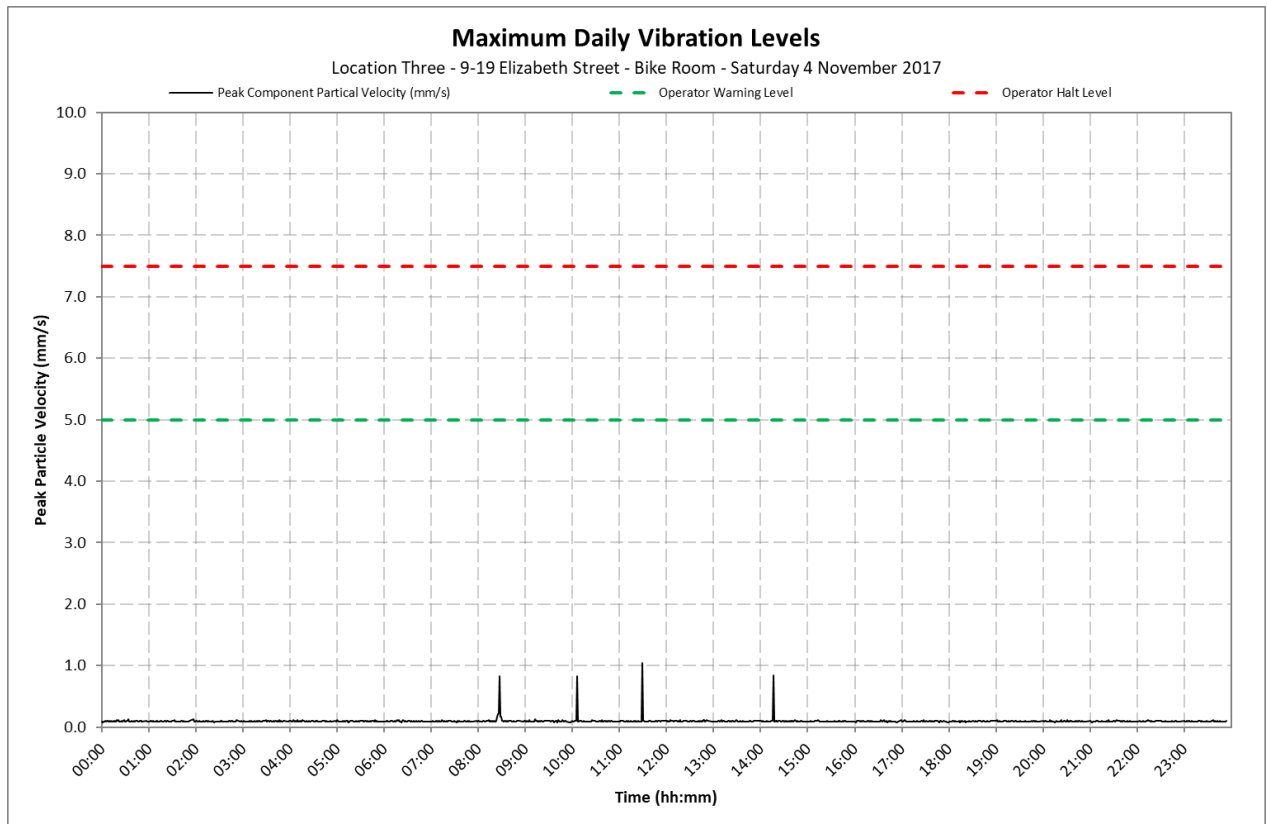
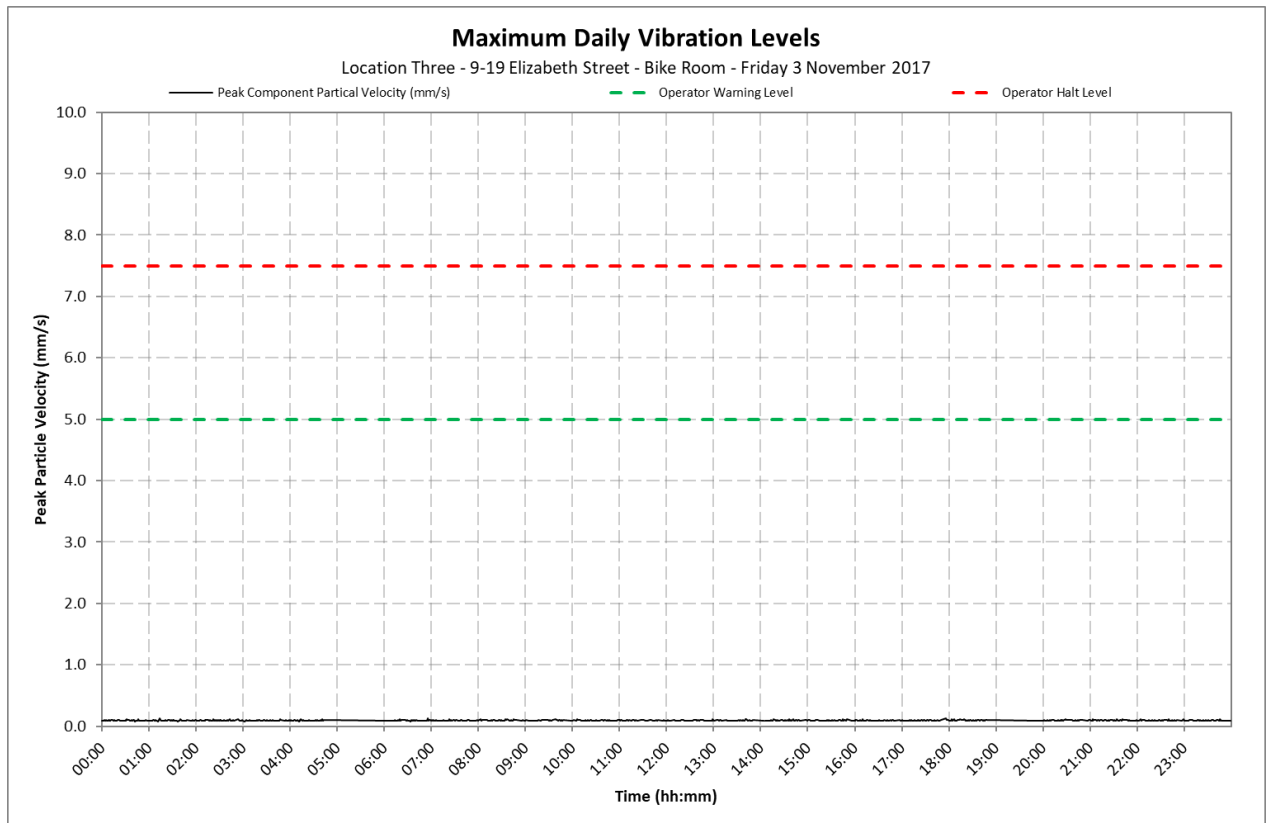
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

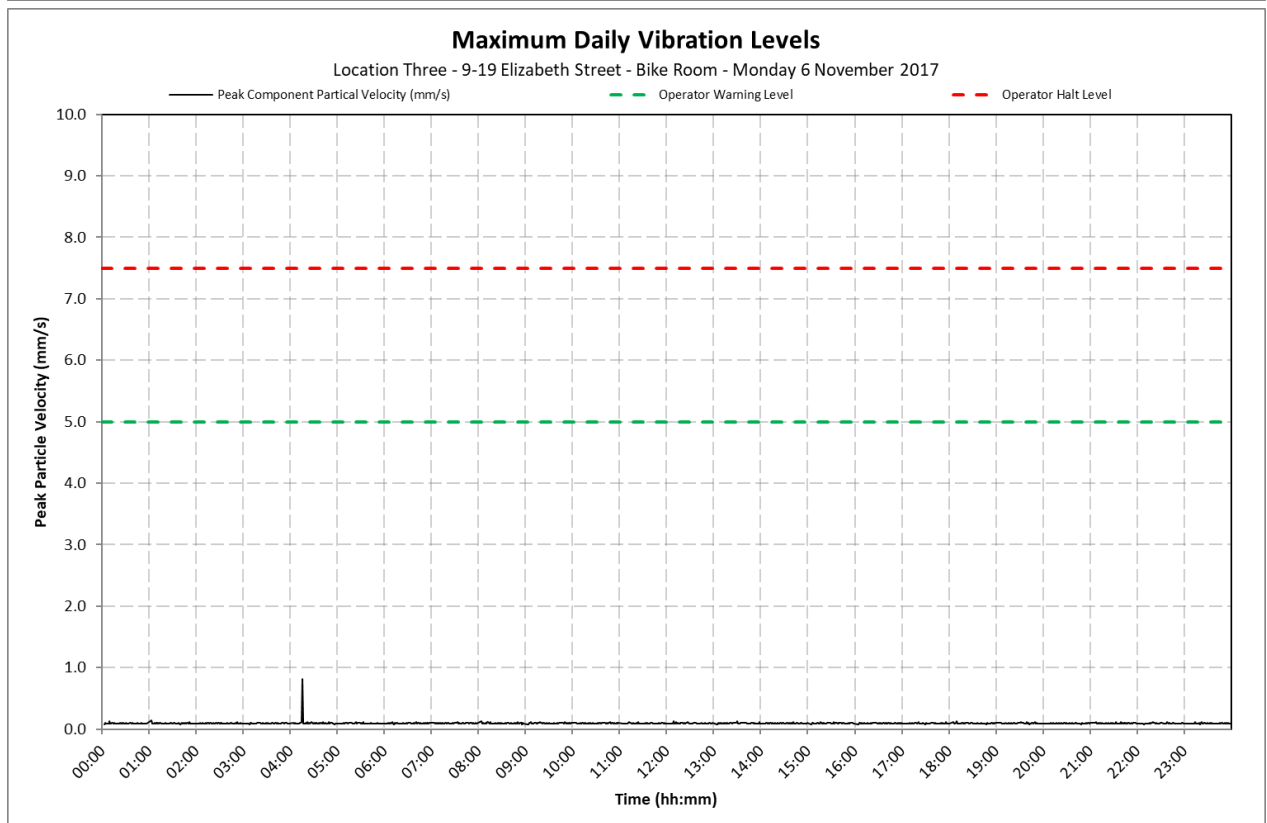
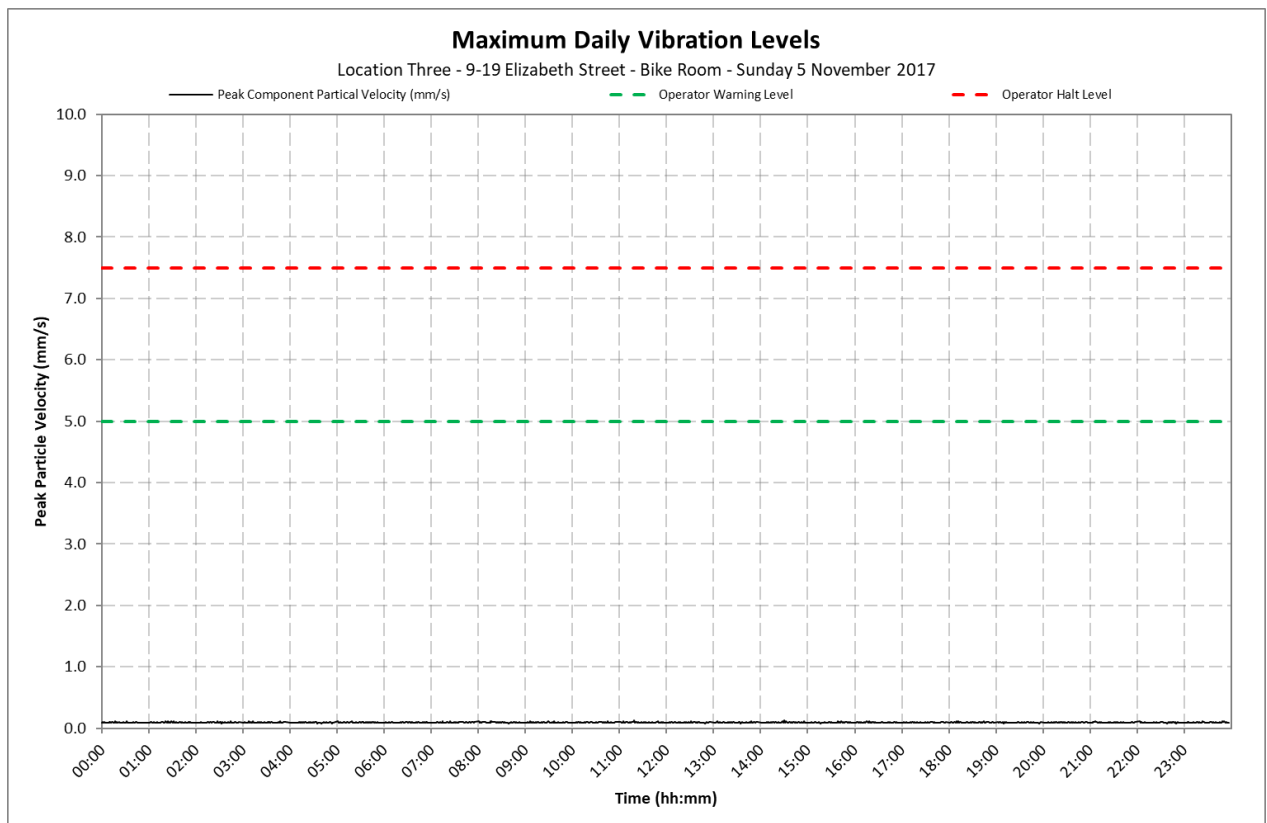
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

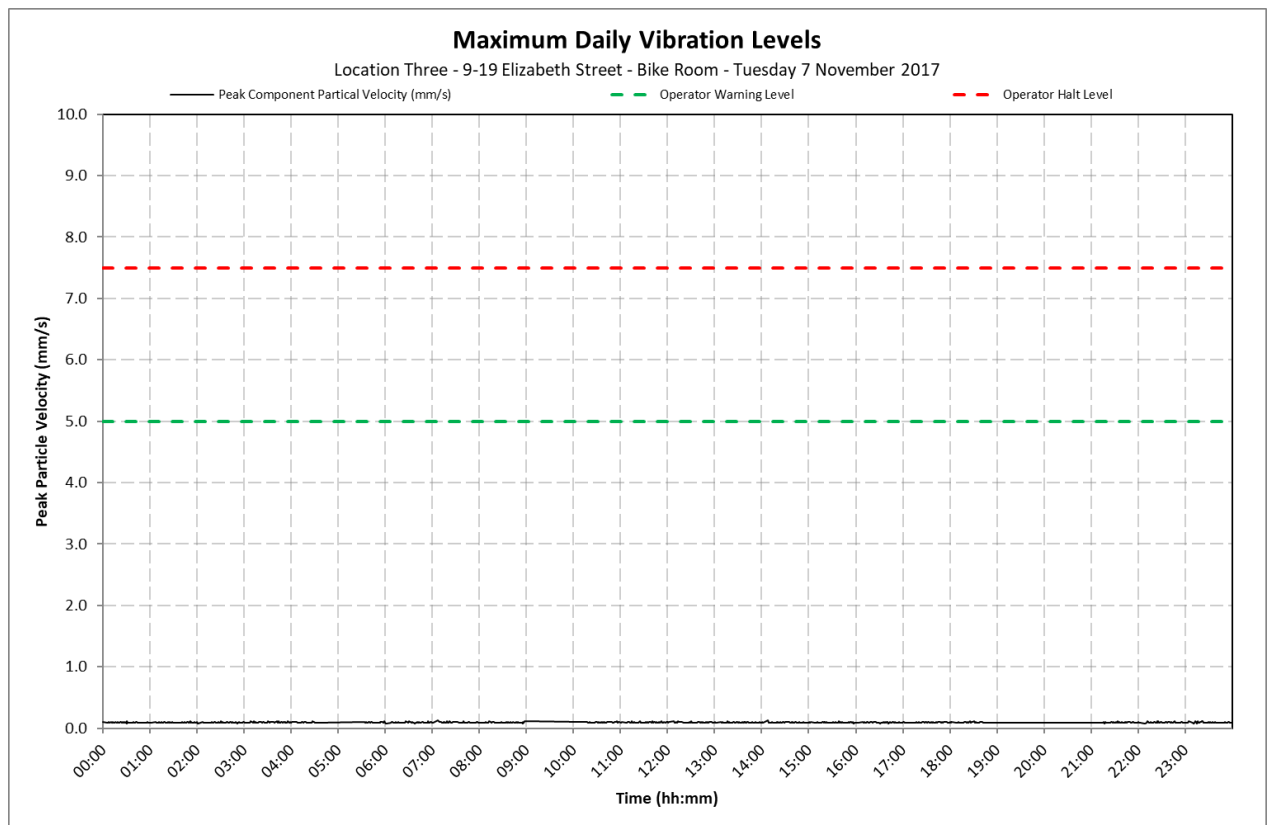
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





21 November 2017

10-1380 R06 NV Monitoring 20171120.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 06
8 November to 14 November 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 8 November to 14 November 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

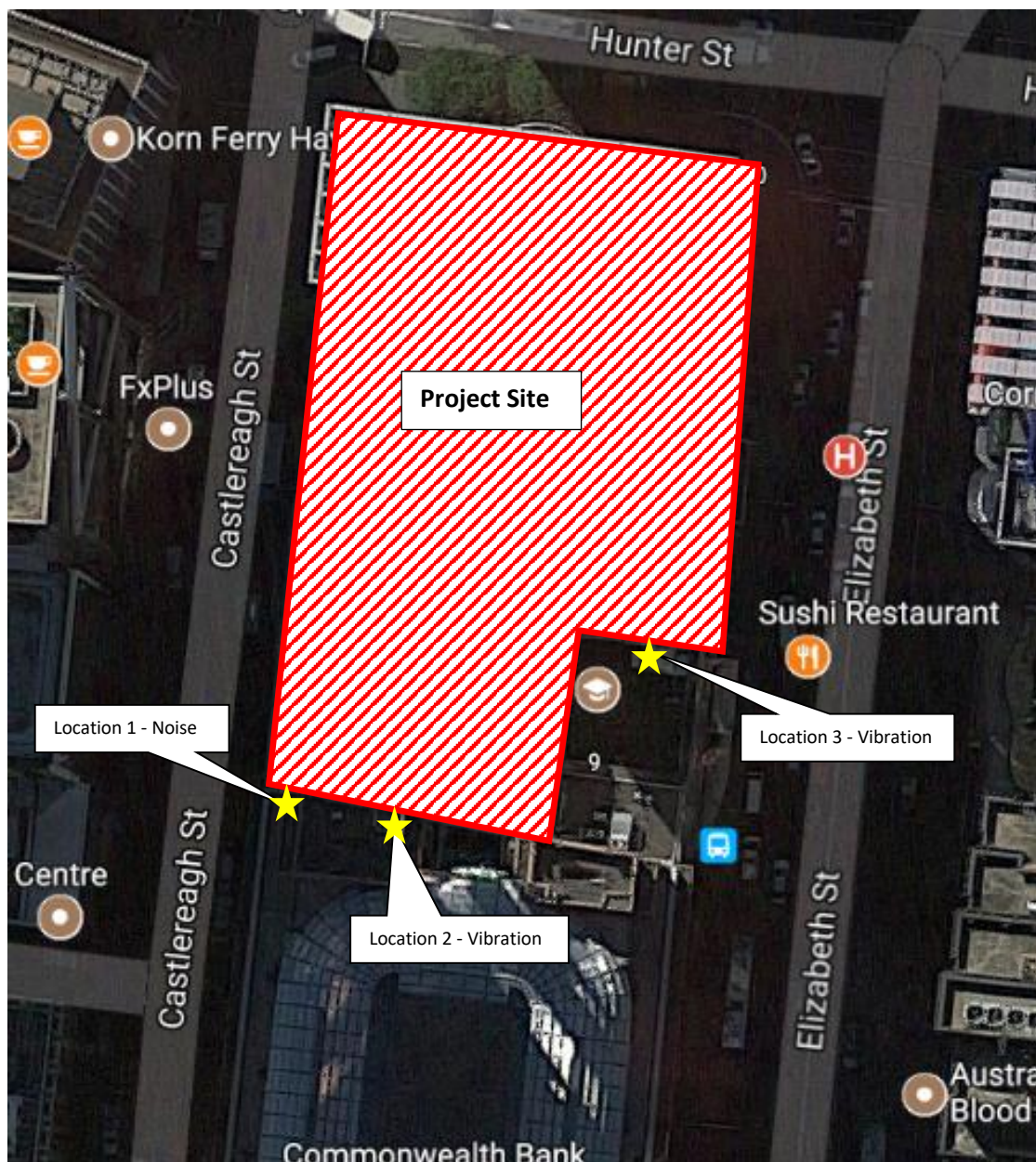
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Ground floor)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 8 November to 14 November 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
8 November 2017	45	45	Complies	Complies
9 November 2017	45	44	Complies	Complies
10 November 2017	45	44	Complies	Complies
11 November 2017	37	35	Complies	Complies
12 November 2017	35	34	Complies	Complies
13 November 2017	45	43	Complies	Complies
14 November 2017	45	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 3, respectively, during the period 8 November to 14 November 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
8 November 2017	2.3 mm/s	Complies
9 November 2017	2.7 mm/s	Complies
10 November 2017	0.1 mm/s	Complies
11 November 2017	1.5 mm/s	Complies
12 November 2017	0.1 mm/s	Complies
13 November 2017	0.2 mm/s	Complies
14 November 2017	0.9 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
8 November 2017	2.3 mm/s	Complies
9 November 2017	5.2 mm/s	1 Event Above Warning Level
10 November 2017	0.1 mm/s	Complies
11 November 2017	1.4 mm/s	Complies
12 November 2017	0.1 mm/s	Complies
13 November 2017	0.2 mm/s	Complies
14 November 2017	0.1 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 8 November to 14 November 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 8 November to 14 November 2017 found one event above the Operator Warning Level at Location Three. All recorded ambient vibration levels however, were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

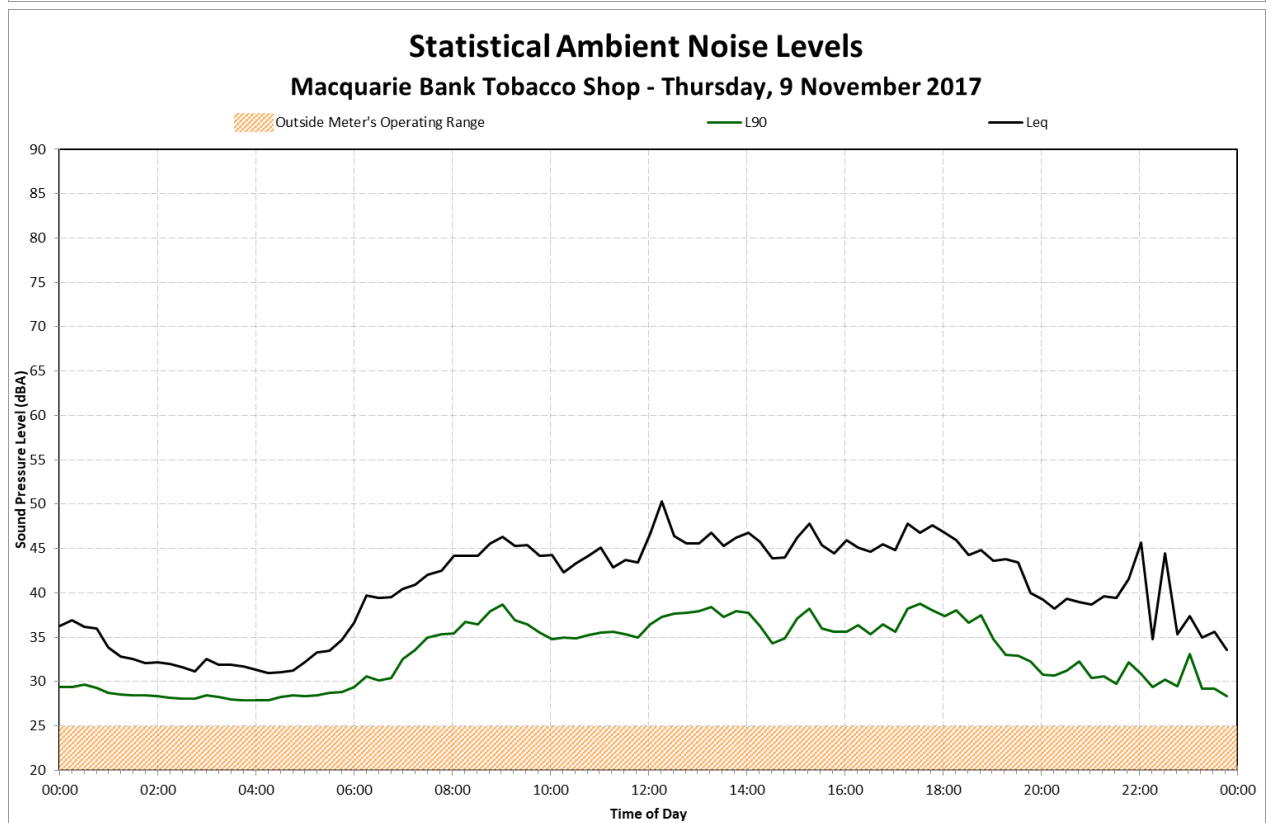
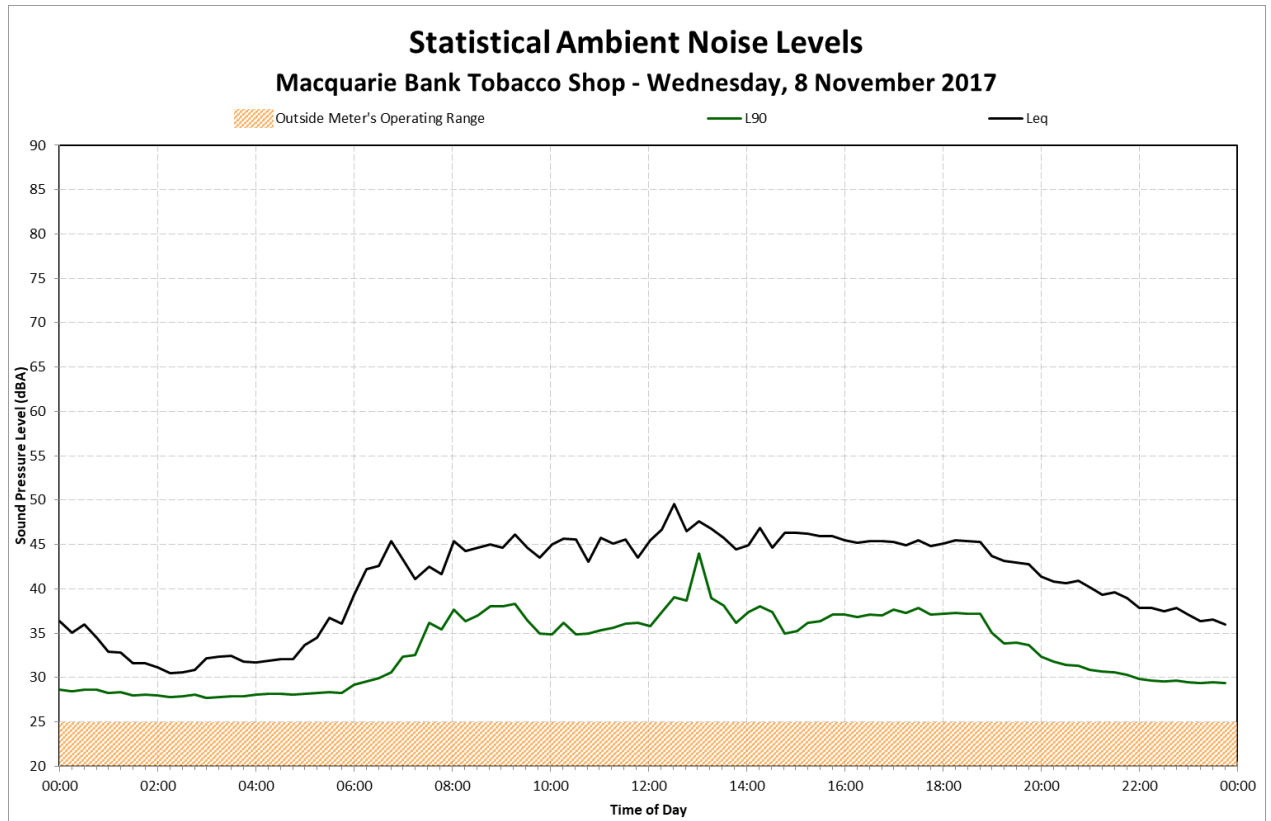
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

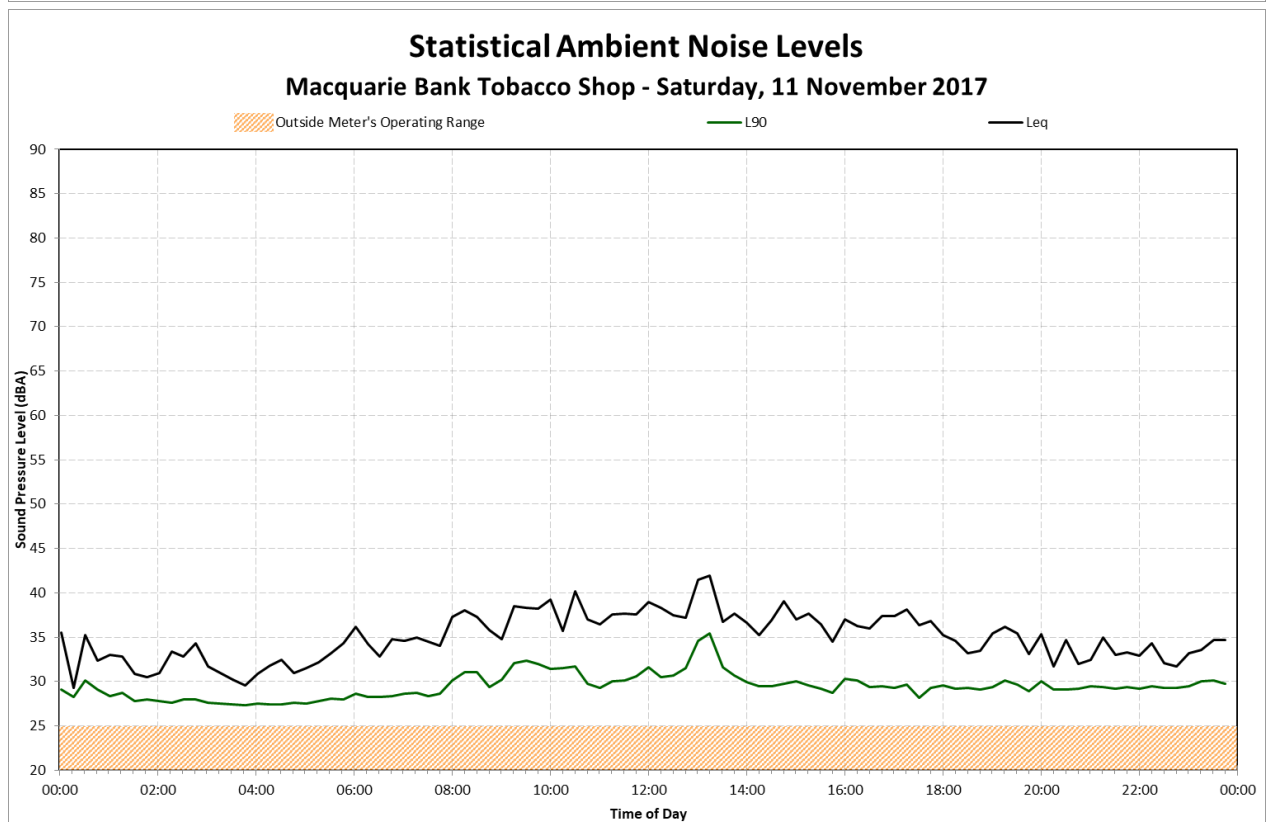
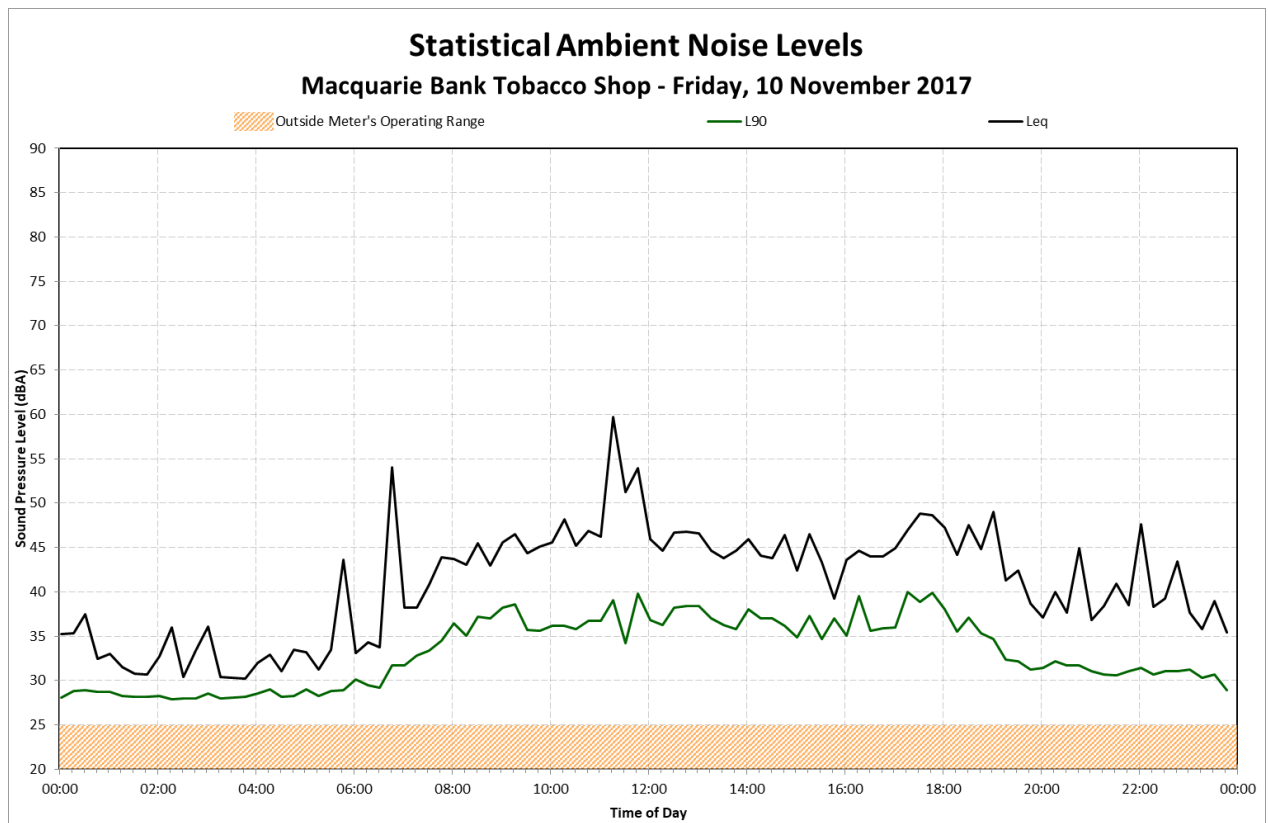
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

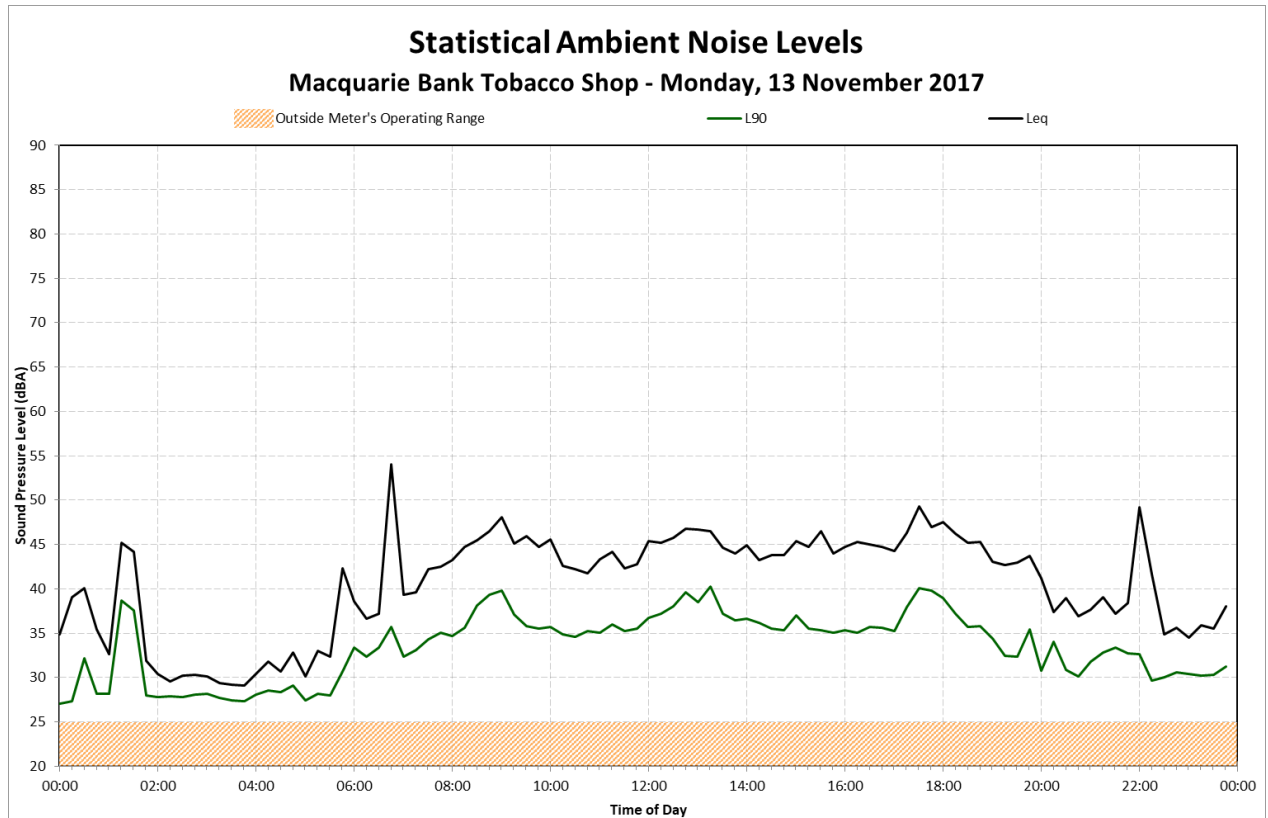
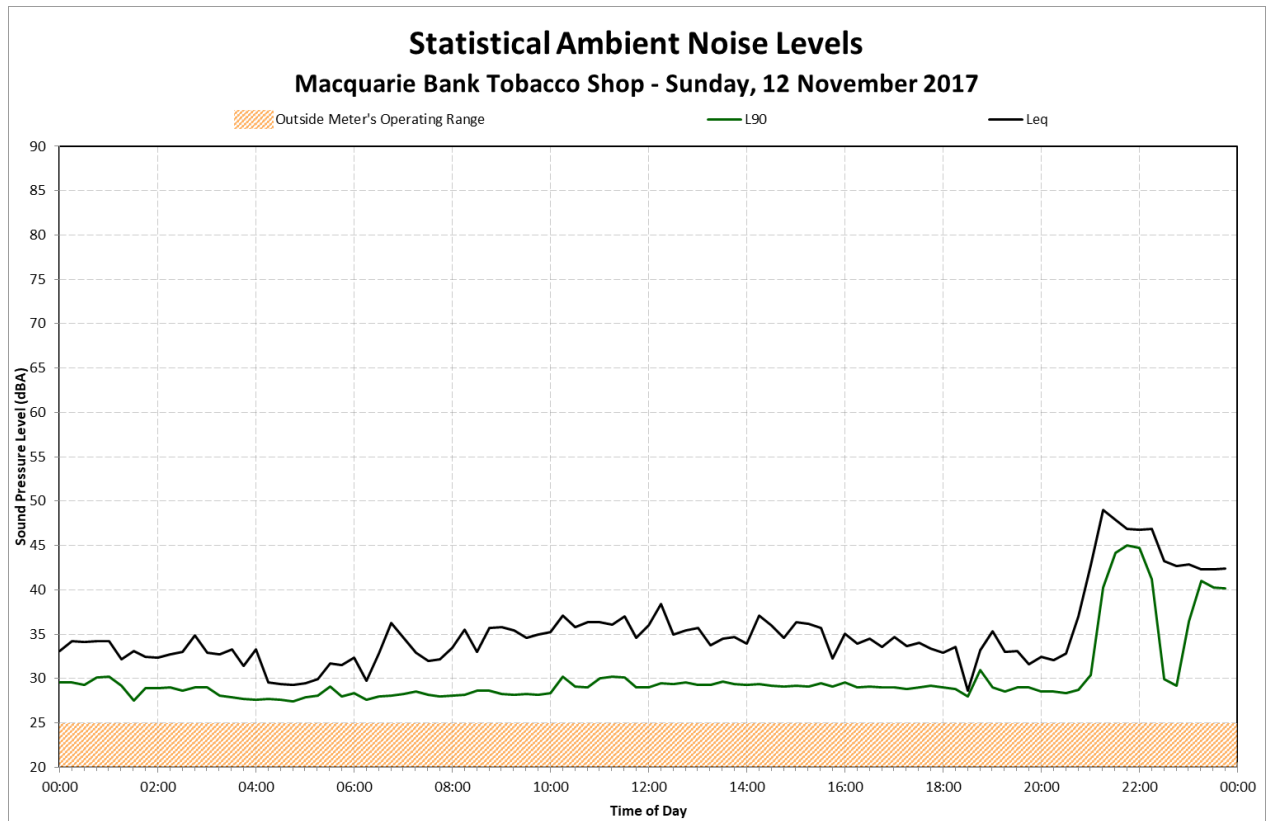
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

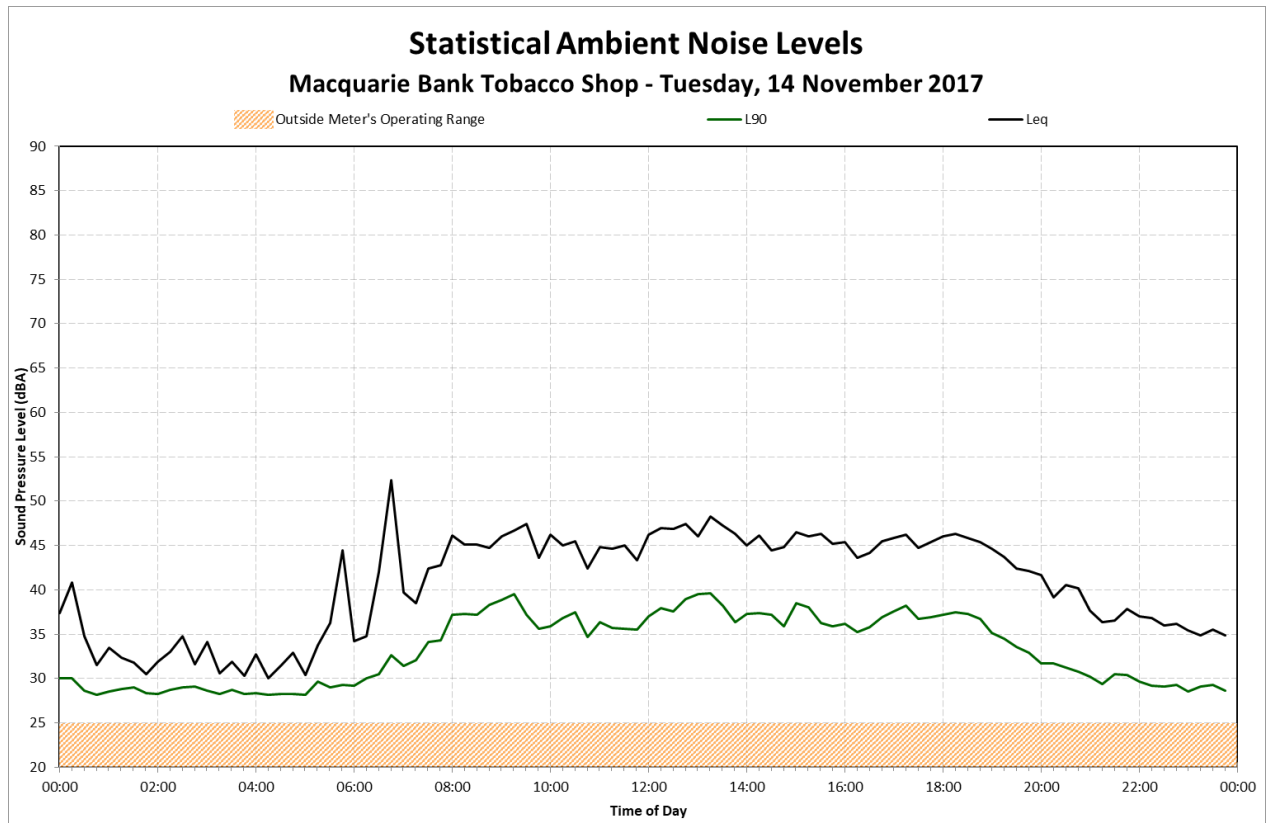
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

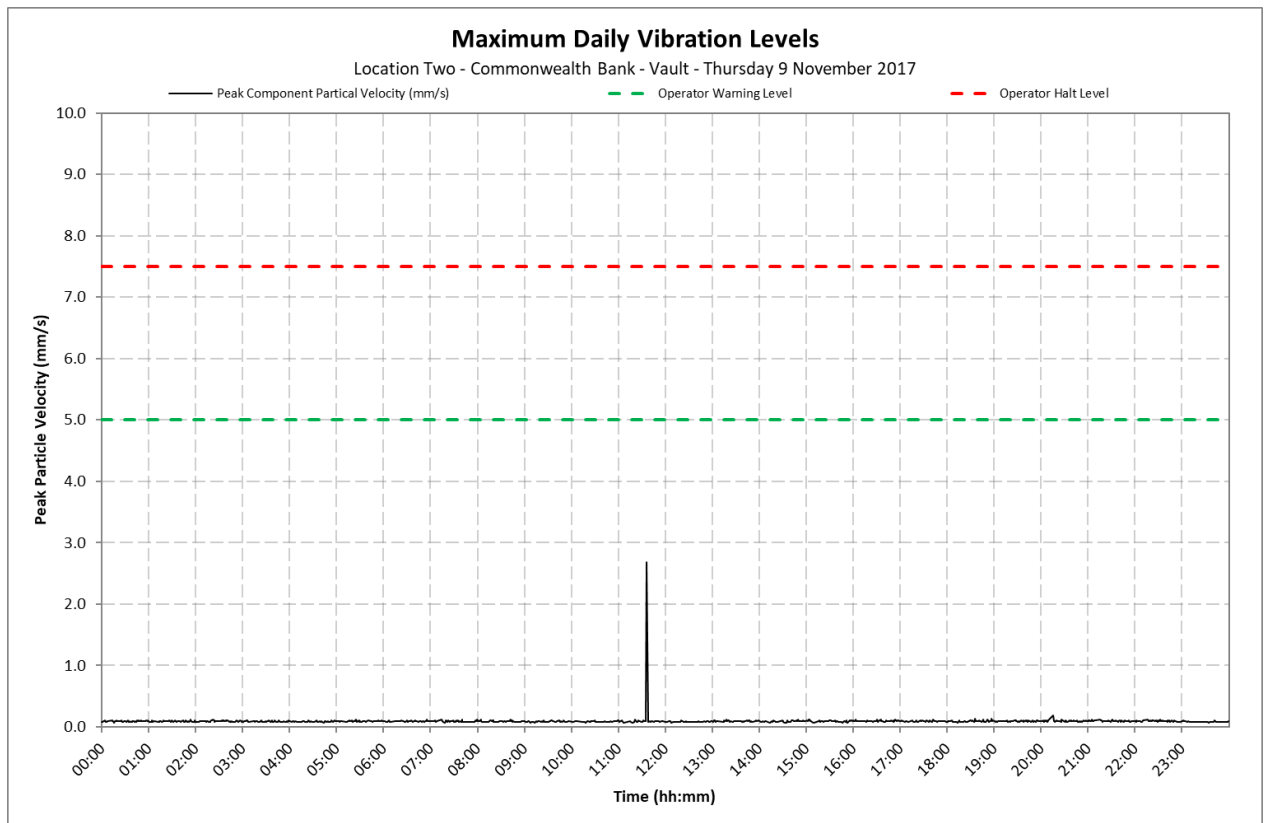
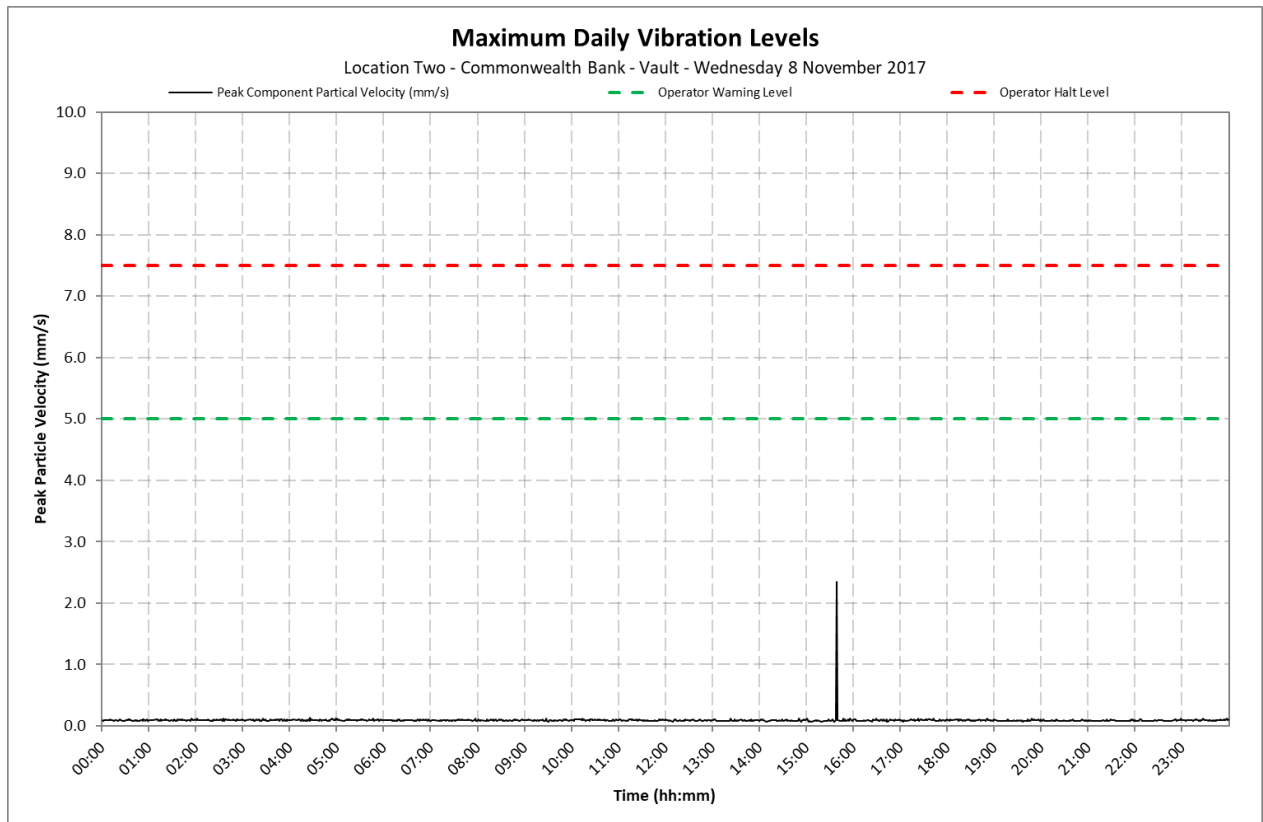
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

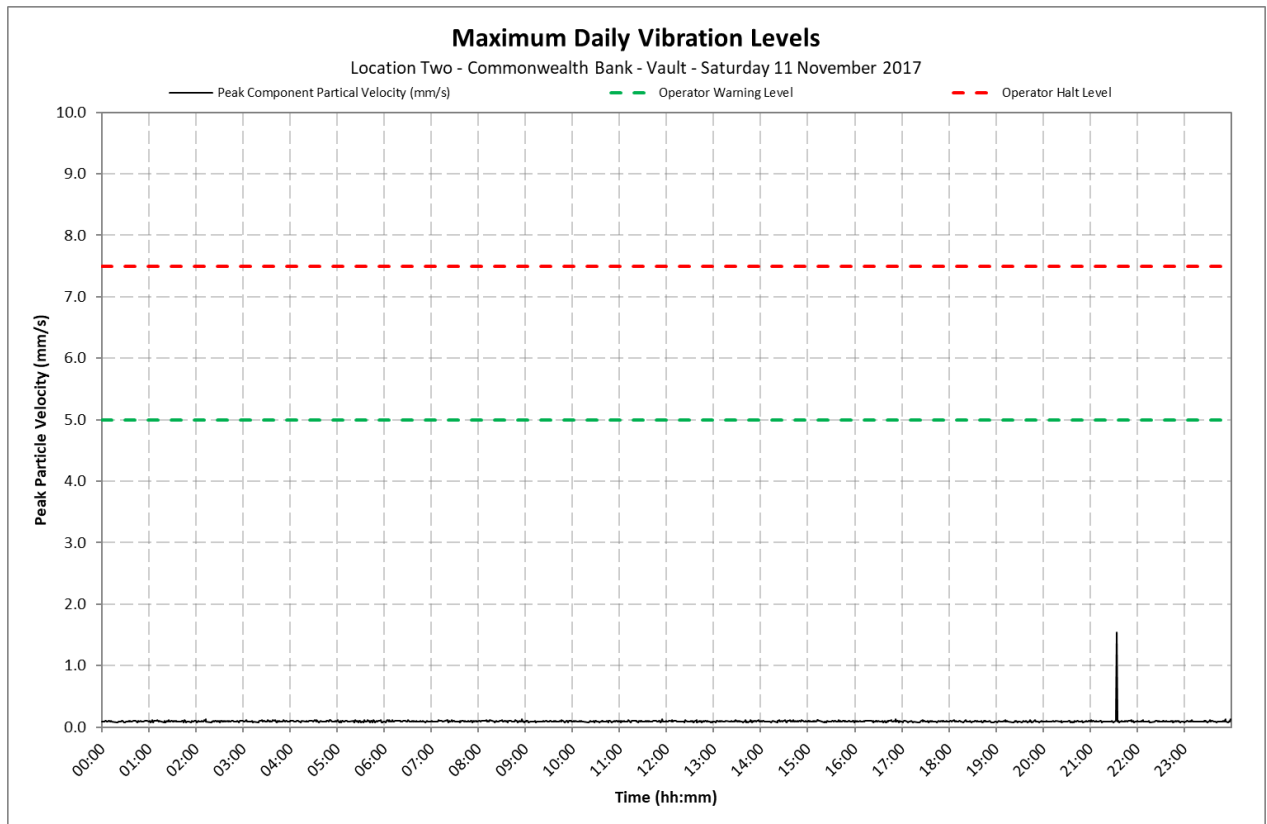
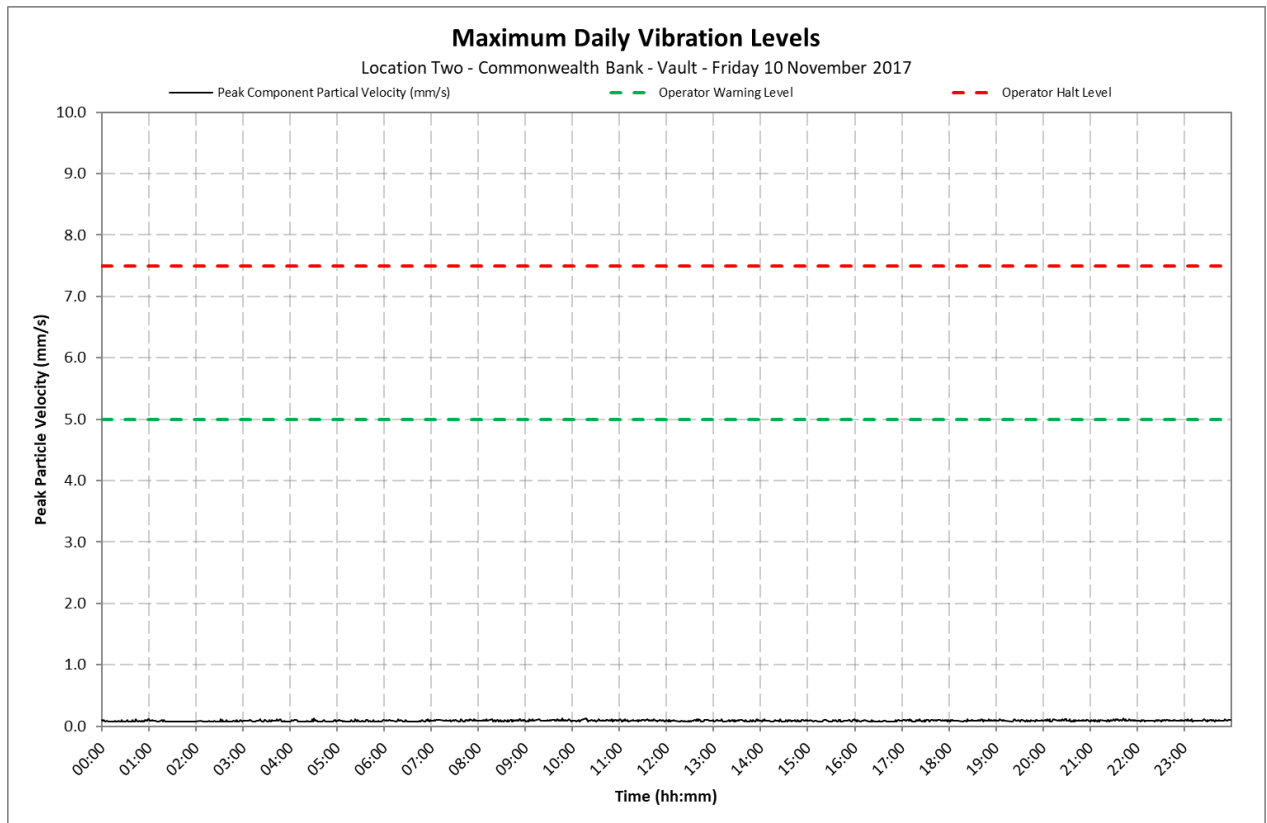
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

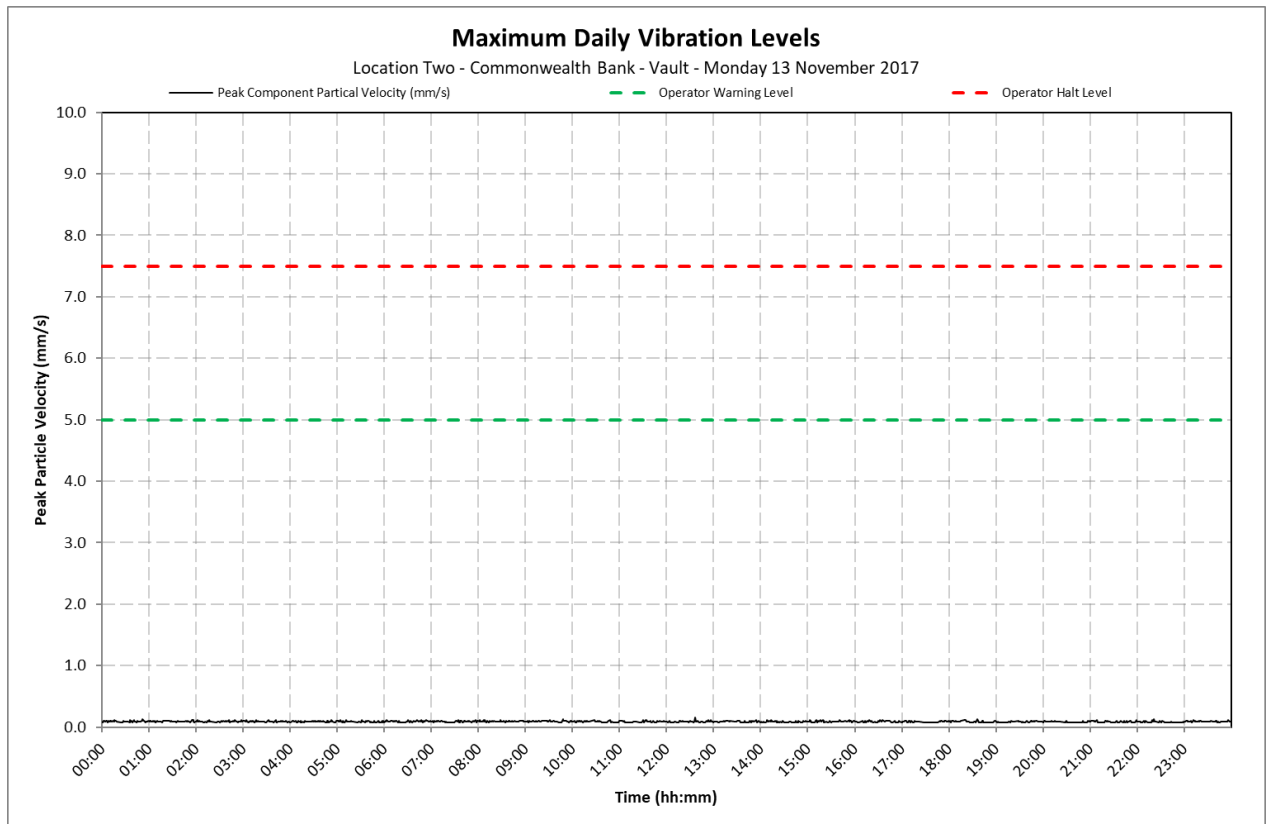
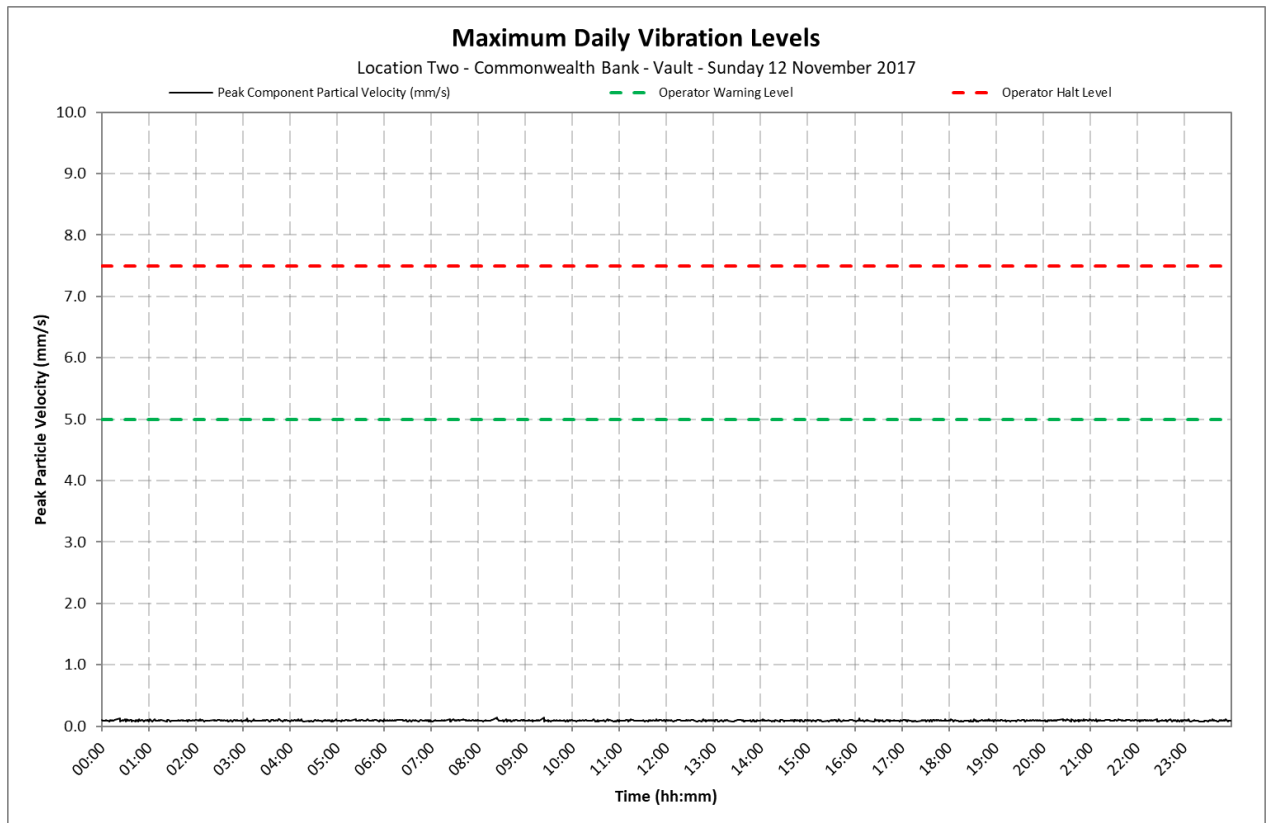
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

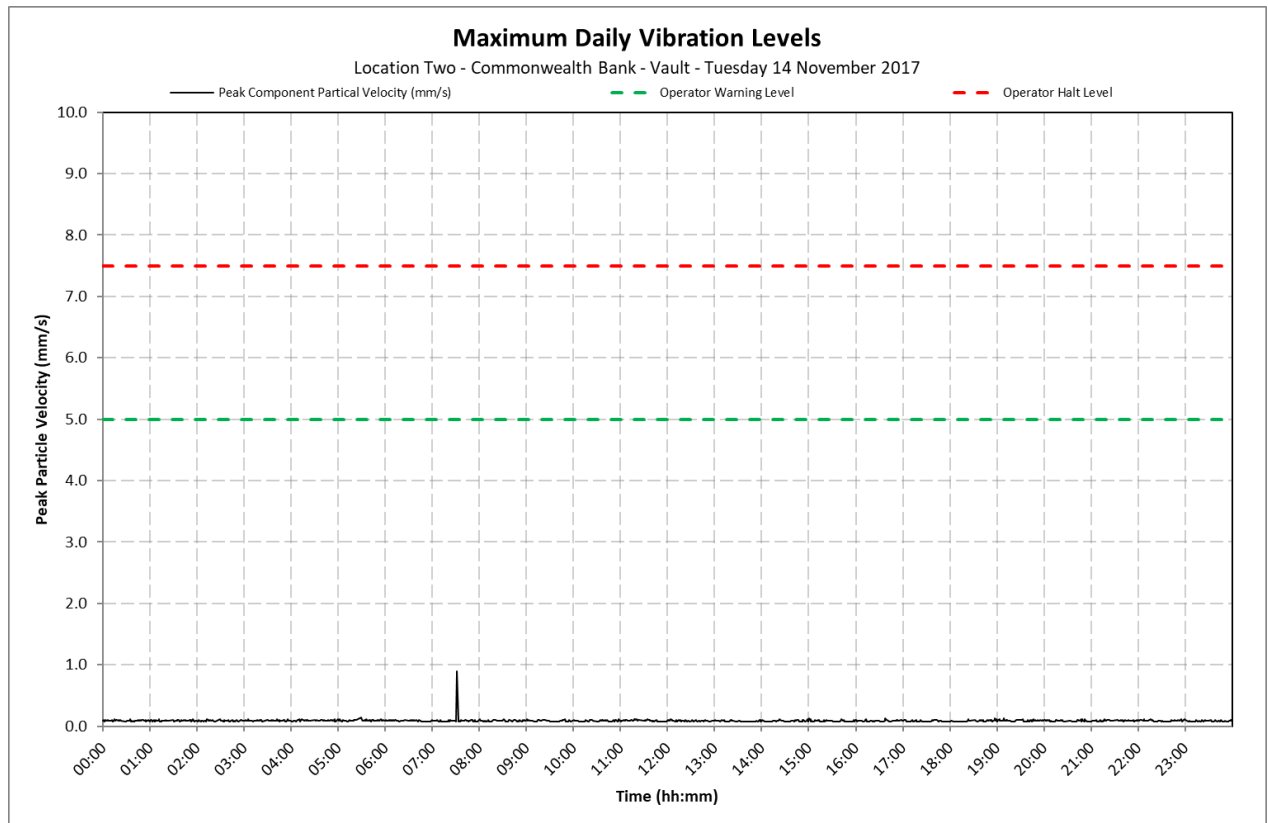
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

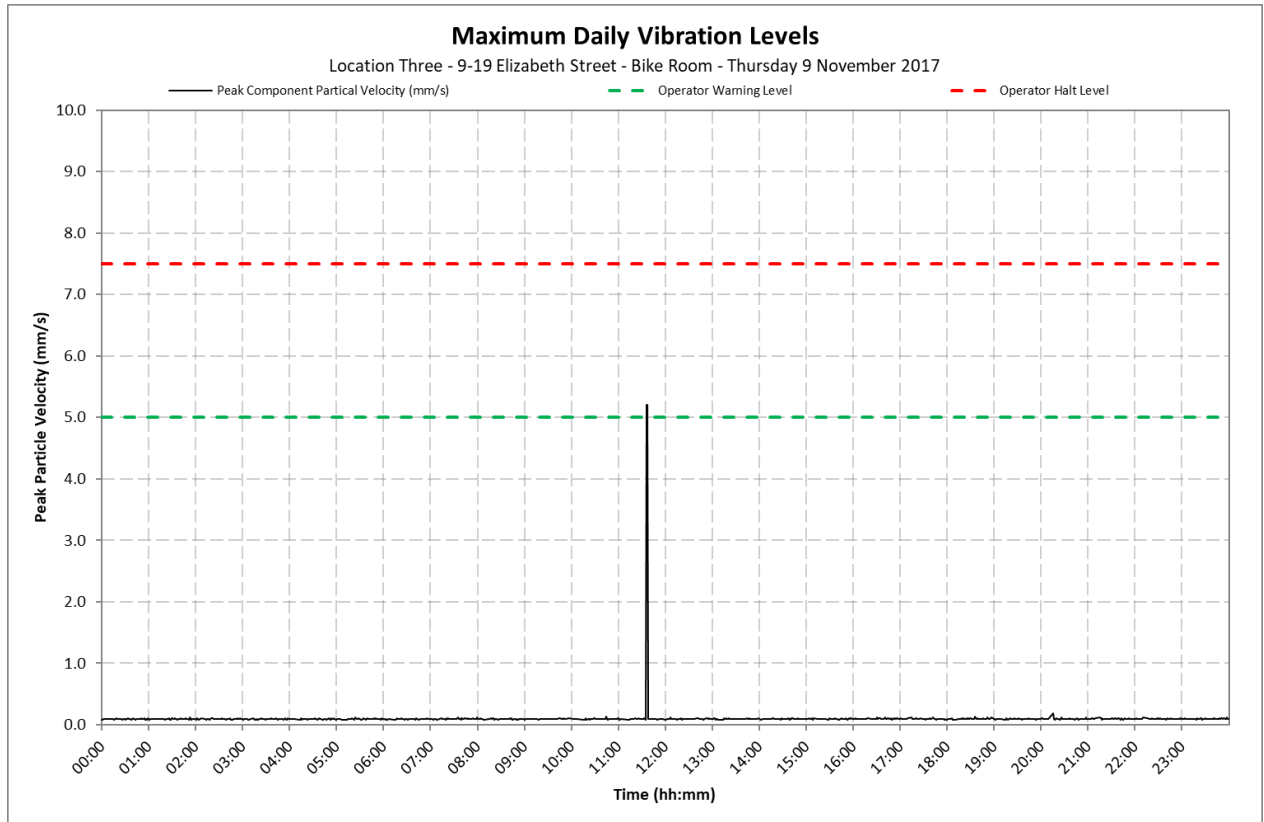
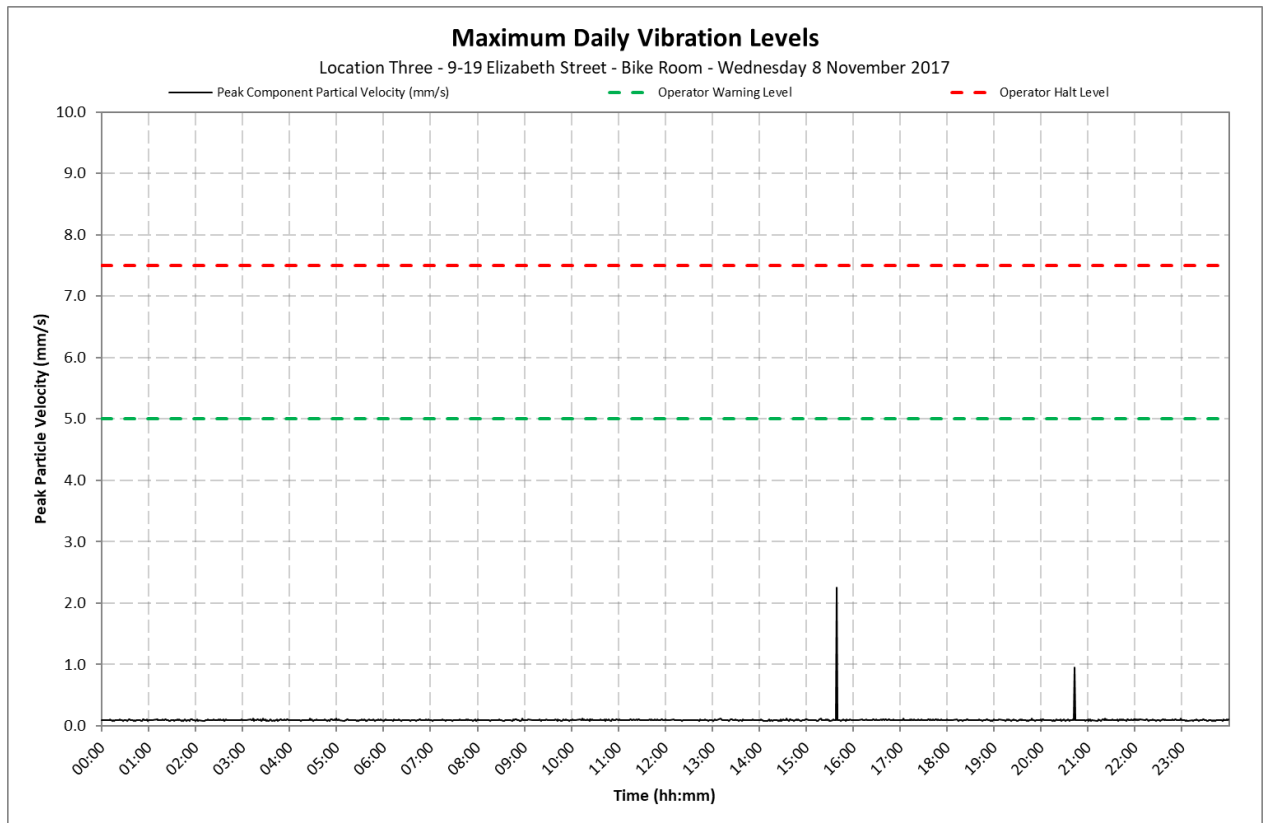
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

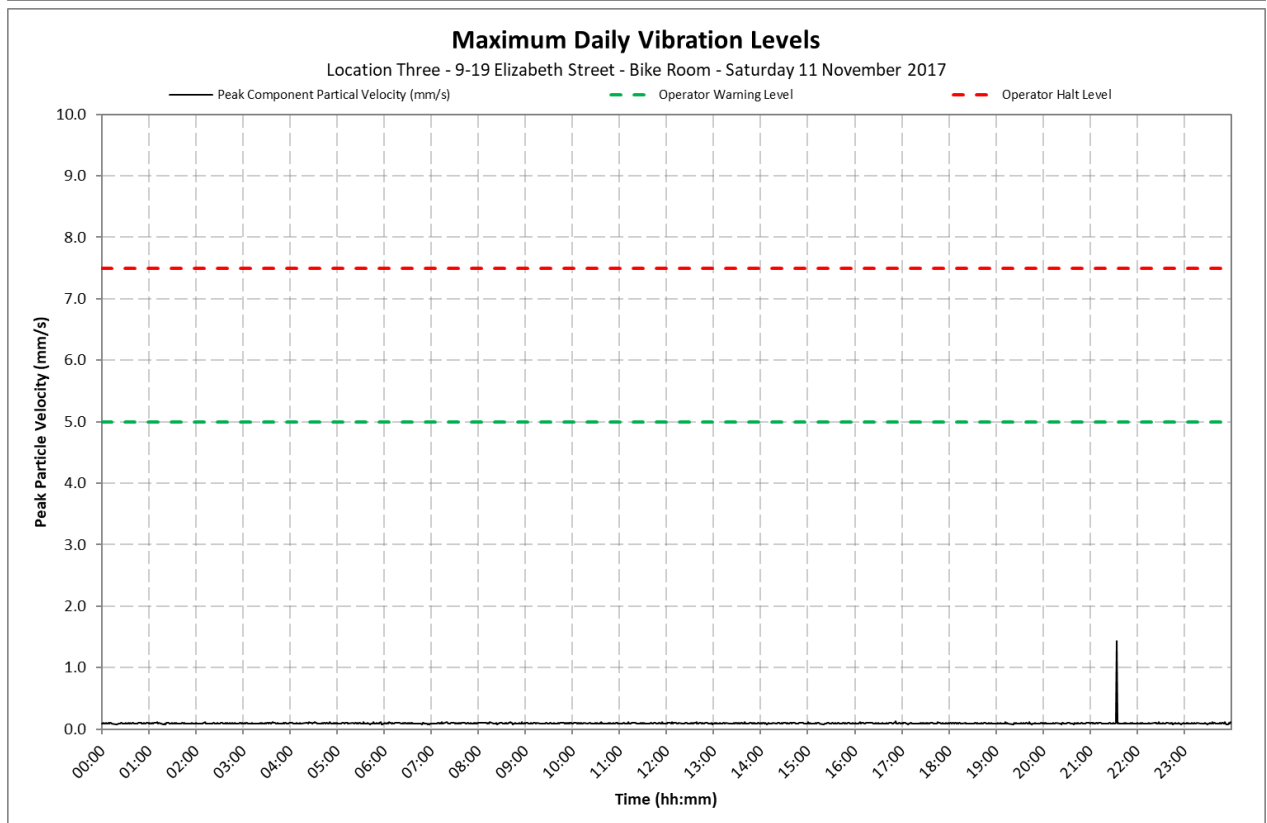
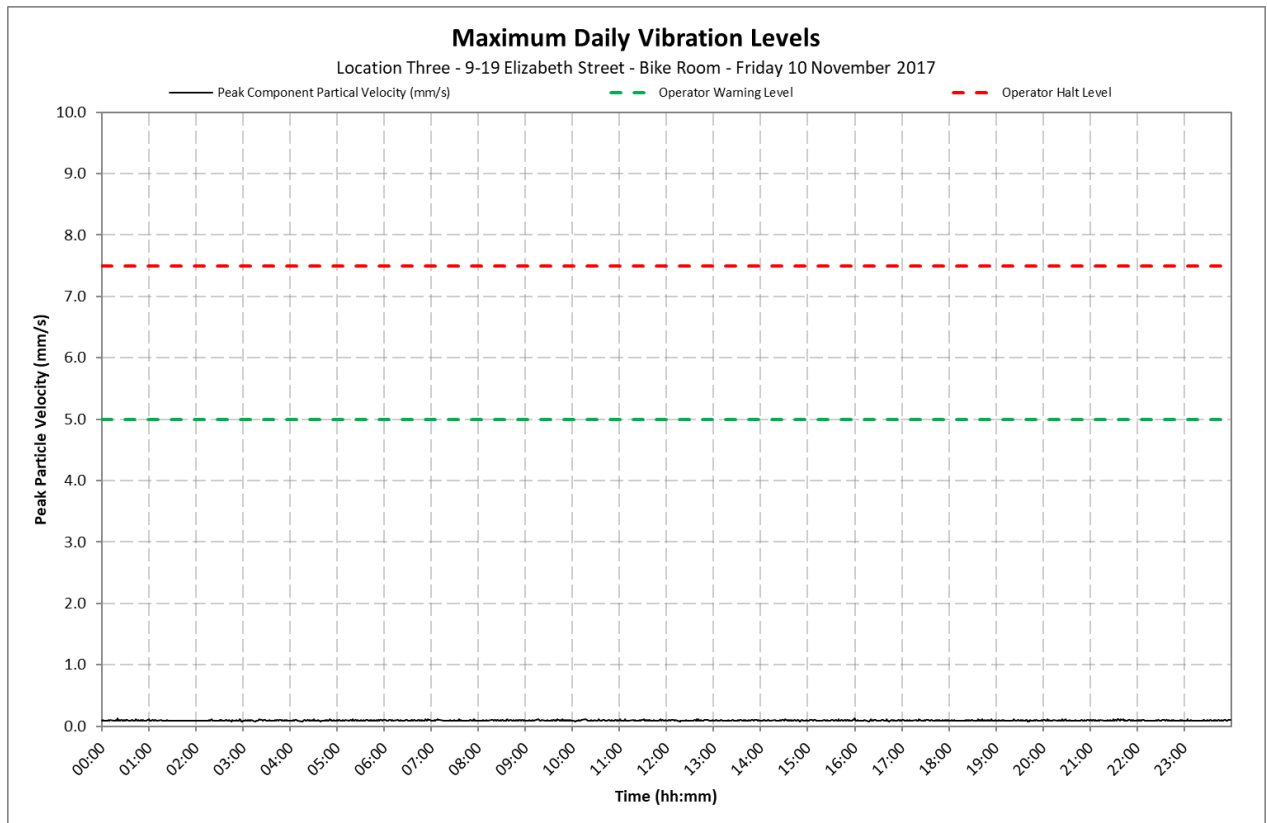
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

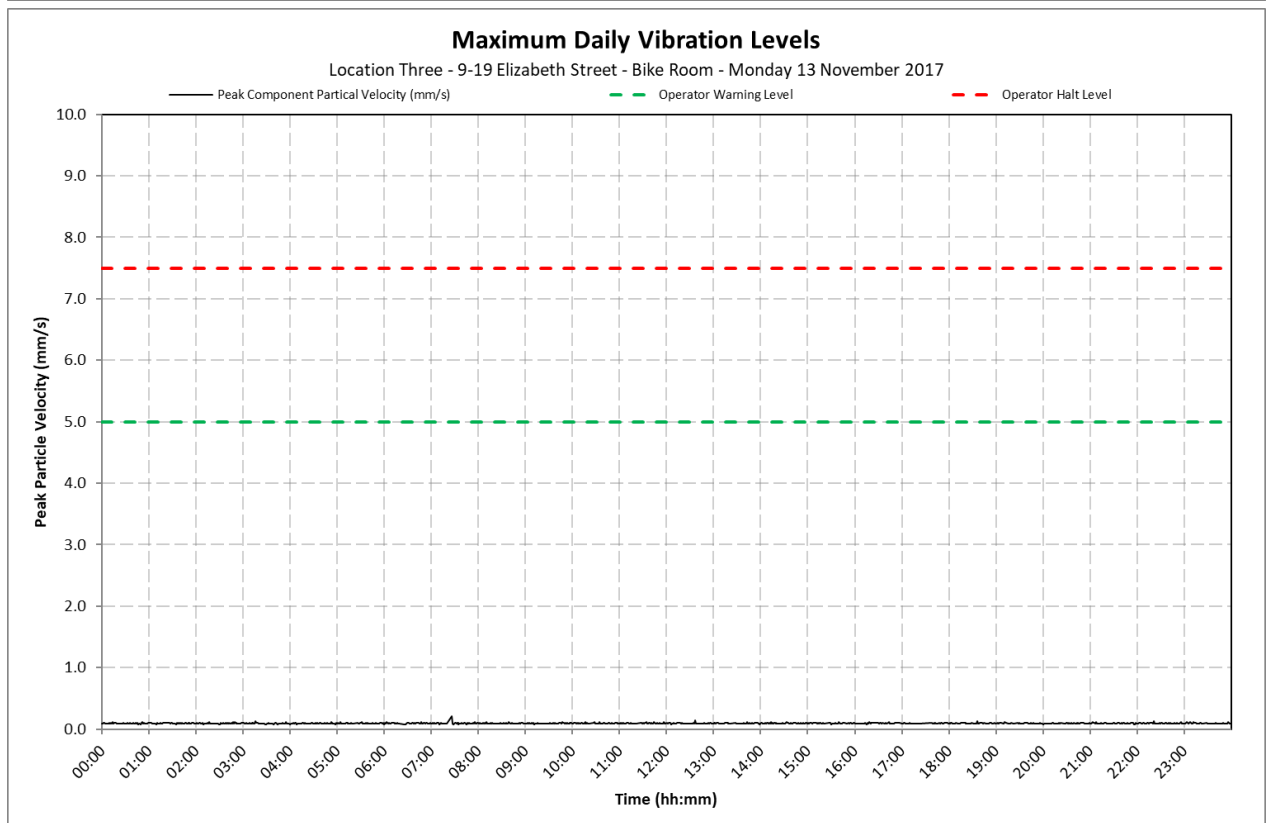
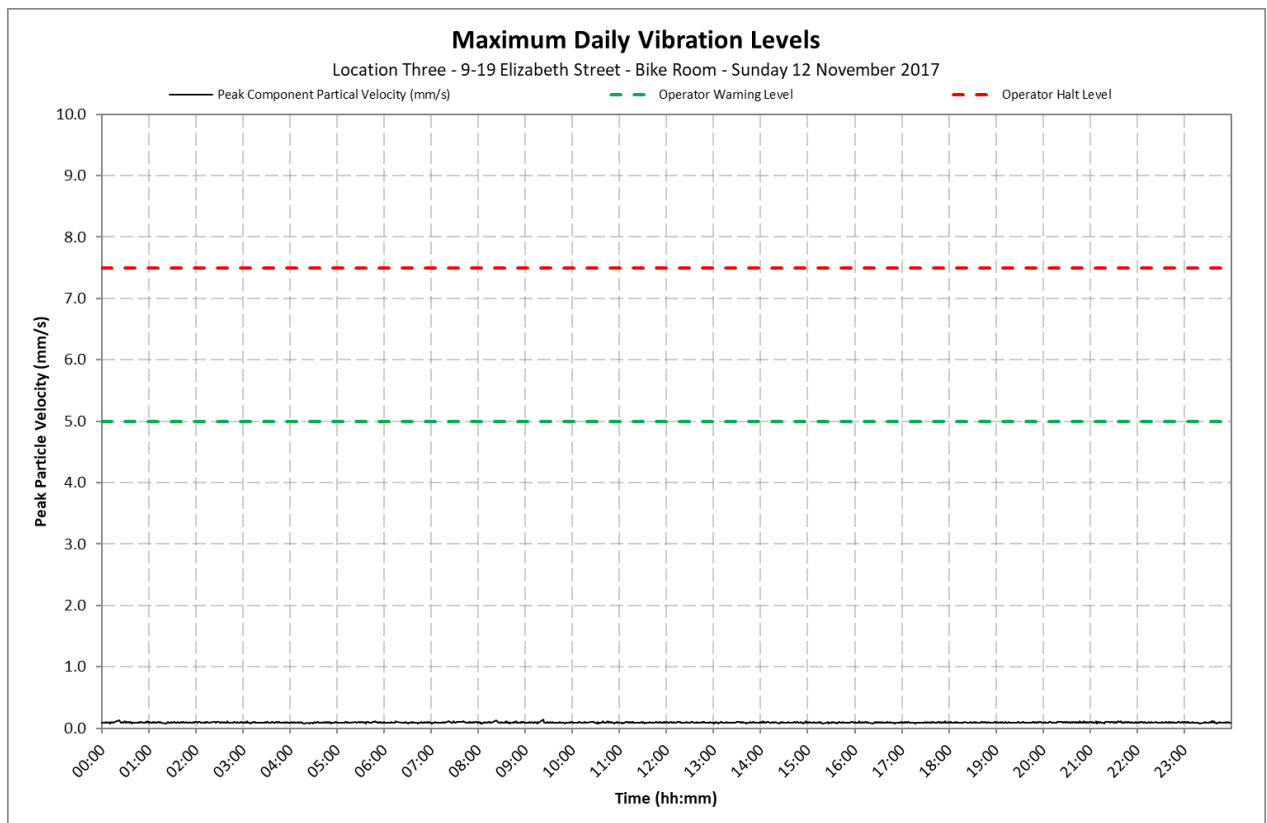
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

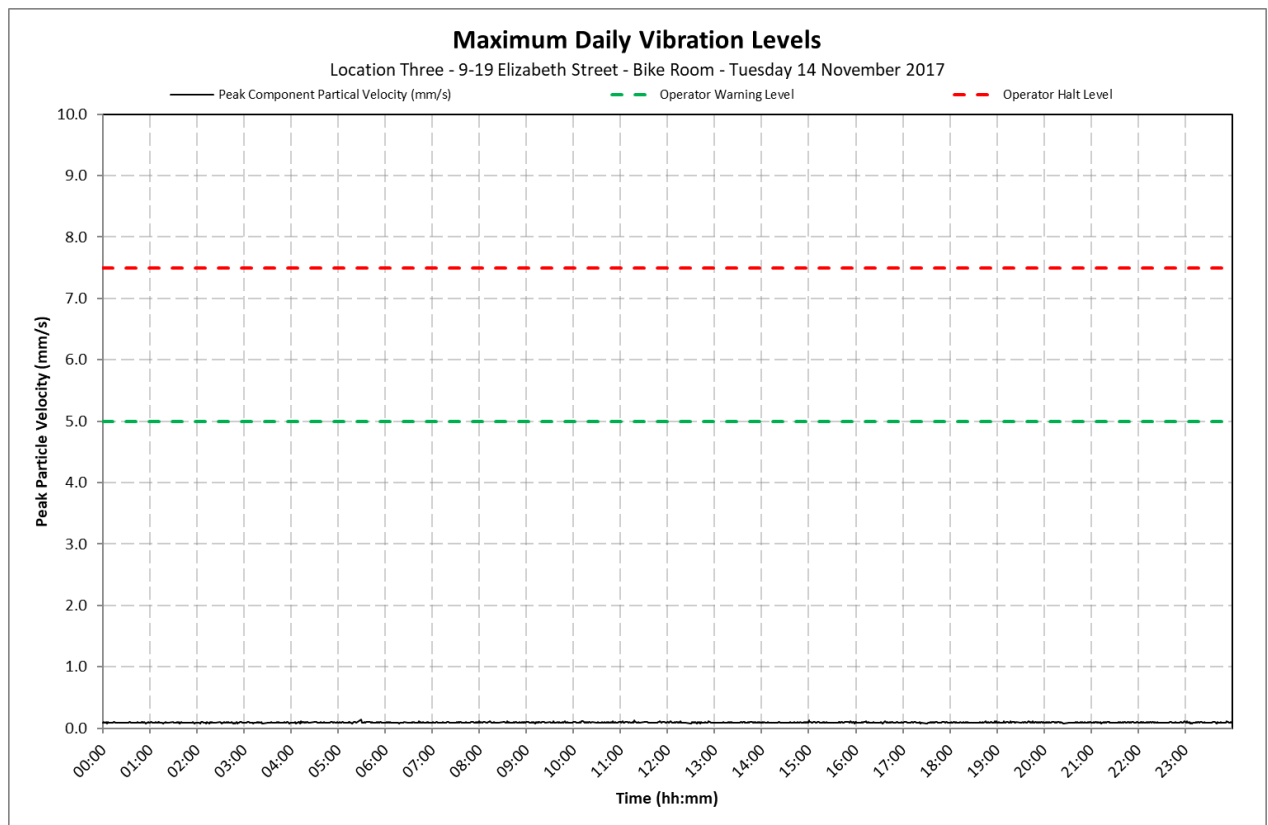
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





4 December 2017

10-1380 R08 NV Monitoring 20171204.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 08
21 November to 28 November 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 21 November to 28 November 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

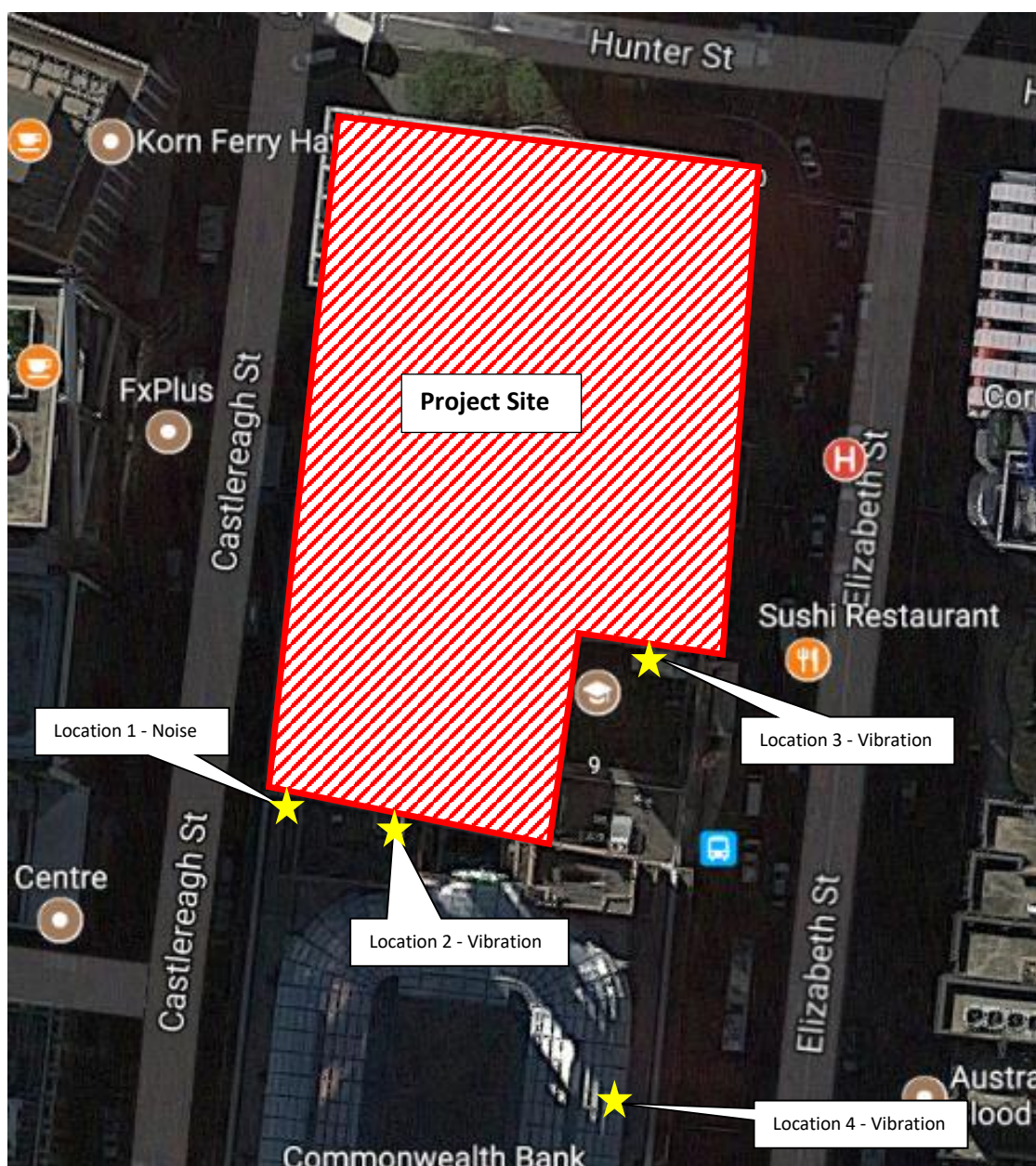
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 21 November to 28 November 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
21 November 2017	45	44	Complies	Complies
22 November 2017	46	44	Complies	Complies
23 November 2017	45	44	Complies	Complies
24 November 2017	45	44	Complies	Complies
25 November 2017	38	36	Complies	Complies
26 November 2017	34	33	Complies	Complies
27 November 2017	45	44	Complies	Complies
28 November 2017	45	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 21 November to 28 November 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
21 November 2017	0.4 mm/s	Complies
22 November 2017	0.2 mm/s	Complies
23 November 2017	2.4 mm/s	Complies
24 November 2017	0.6 mm/s	Complies
25 November 2017	0.3 mm/s	Complies
26 November 2017	0.4 mm/s	Complies
27 November 2017	1.0 mm/s	Complies
28 November 2017	0.7 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
21 November 2017	0.8 mm/s	Complies
22 November 2017	0.9 mm/s	Complies
23 November 2017	0.9 mm/s	Complies
24 November 2017	1.0 mm/s	Complies
25 November 2017	0.9 mm/s	Complies
26 November 2017	0.9 mm/s	Complies
27 November 2017	0.9 mm/s	Complies
28 November 2017	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 21 November to 28 November 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 21 November to 28 November 2017 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

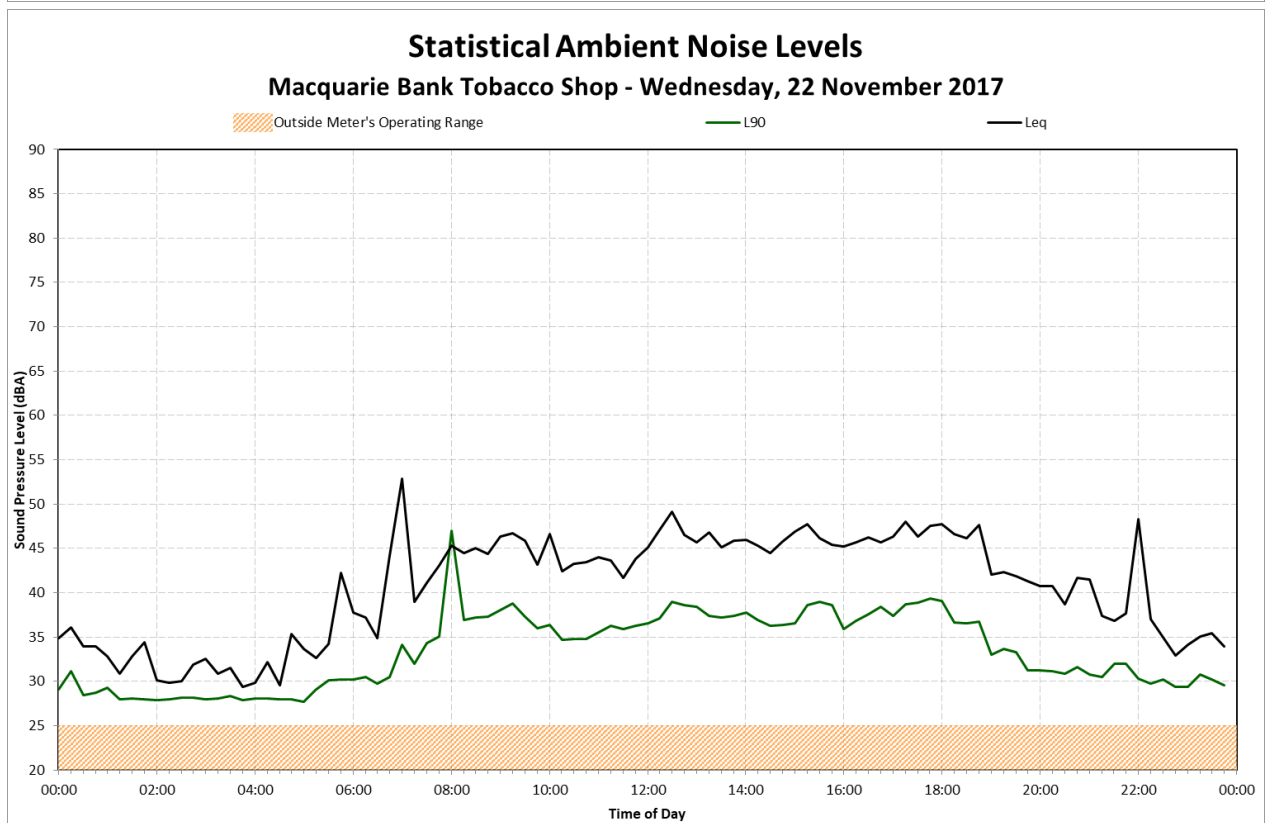
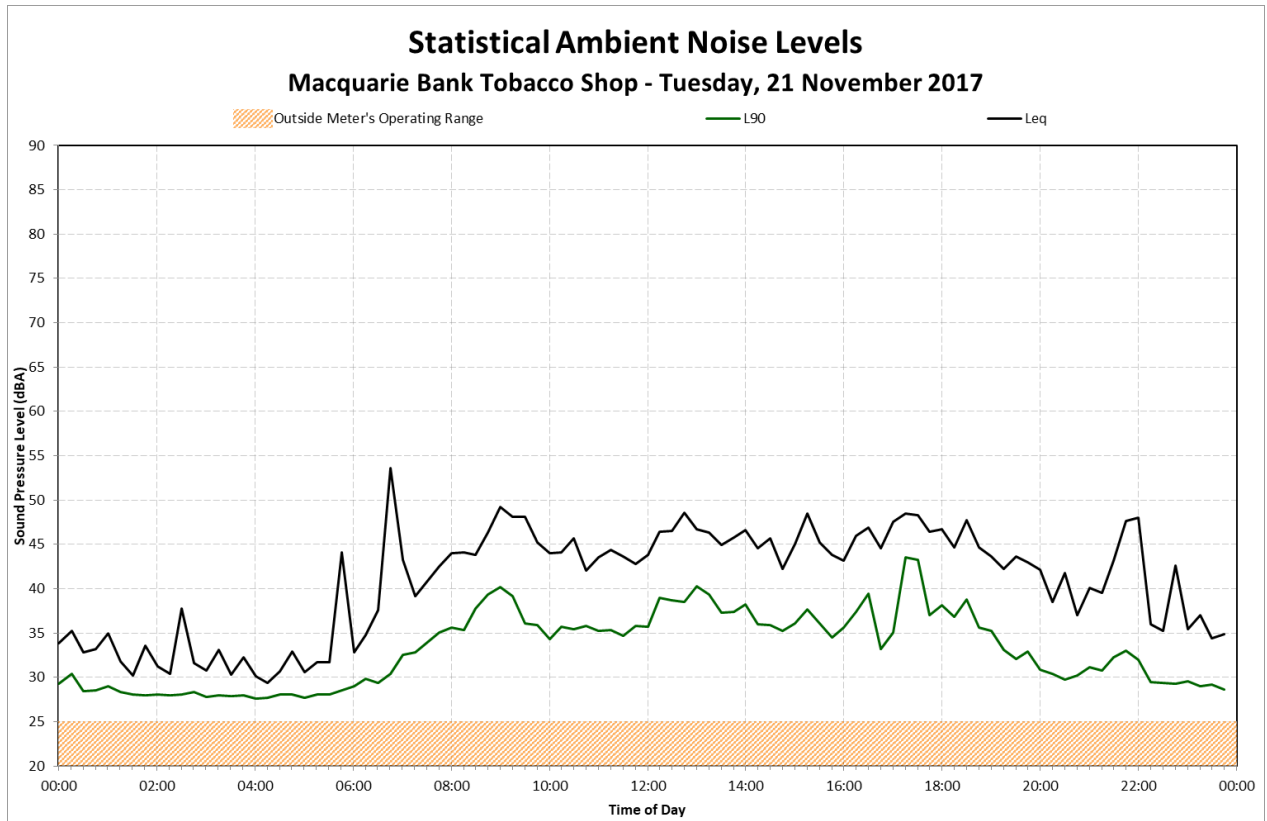
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Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
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Appendix B

Daily Noise Levels

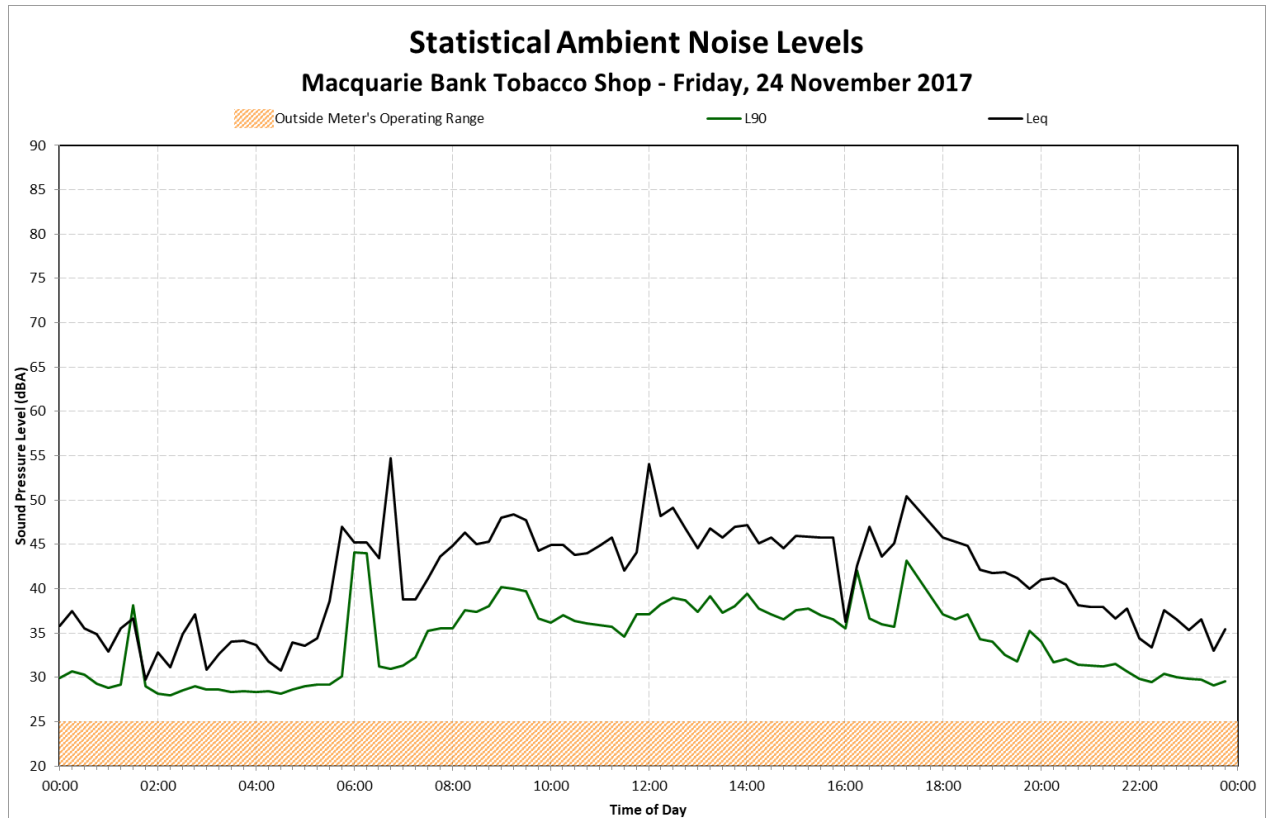
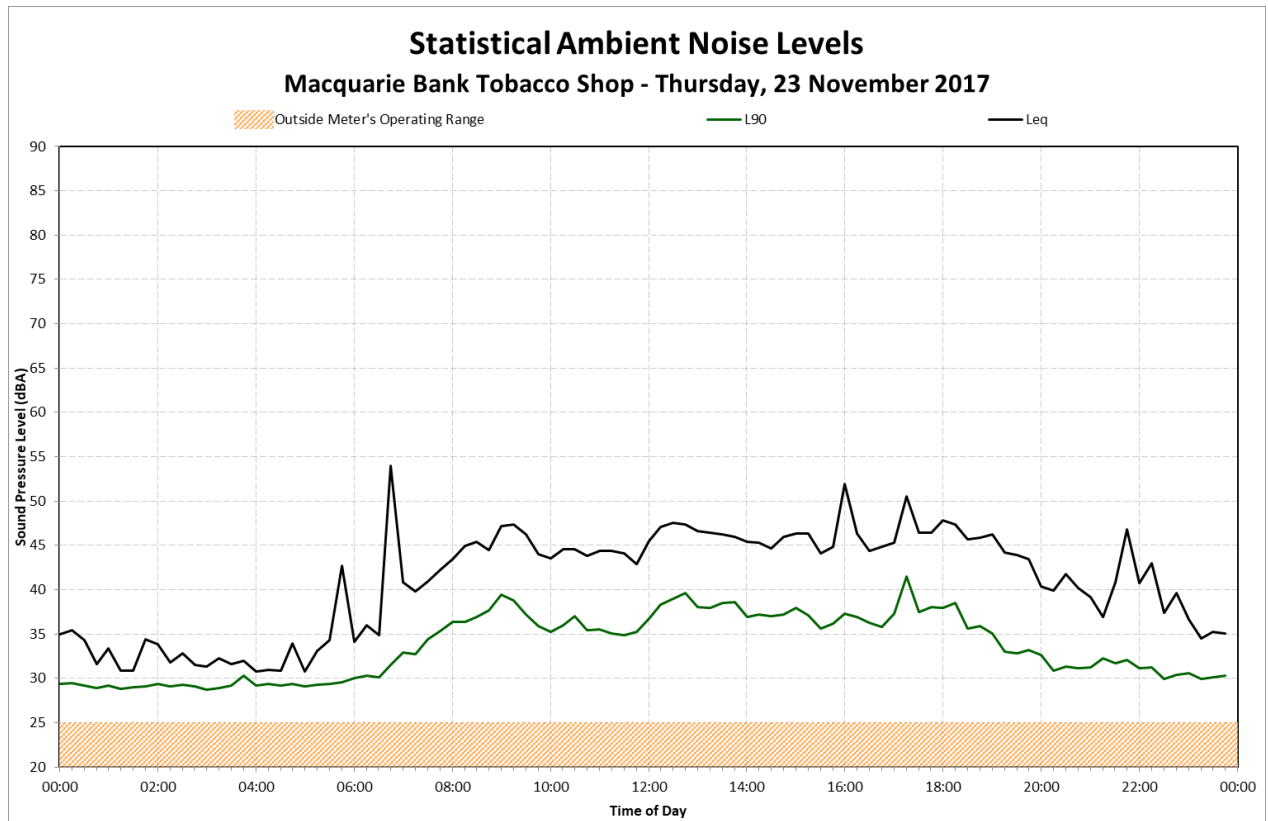
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

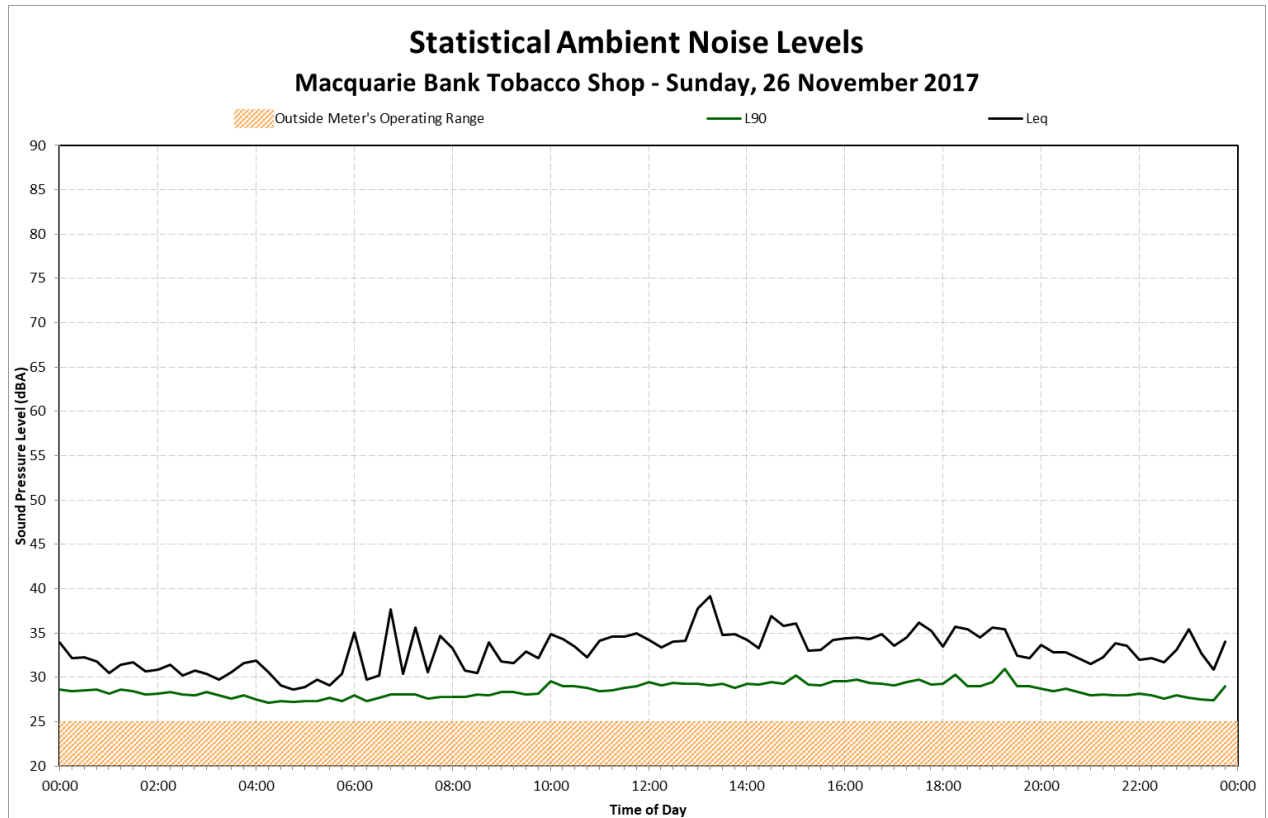
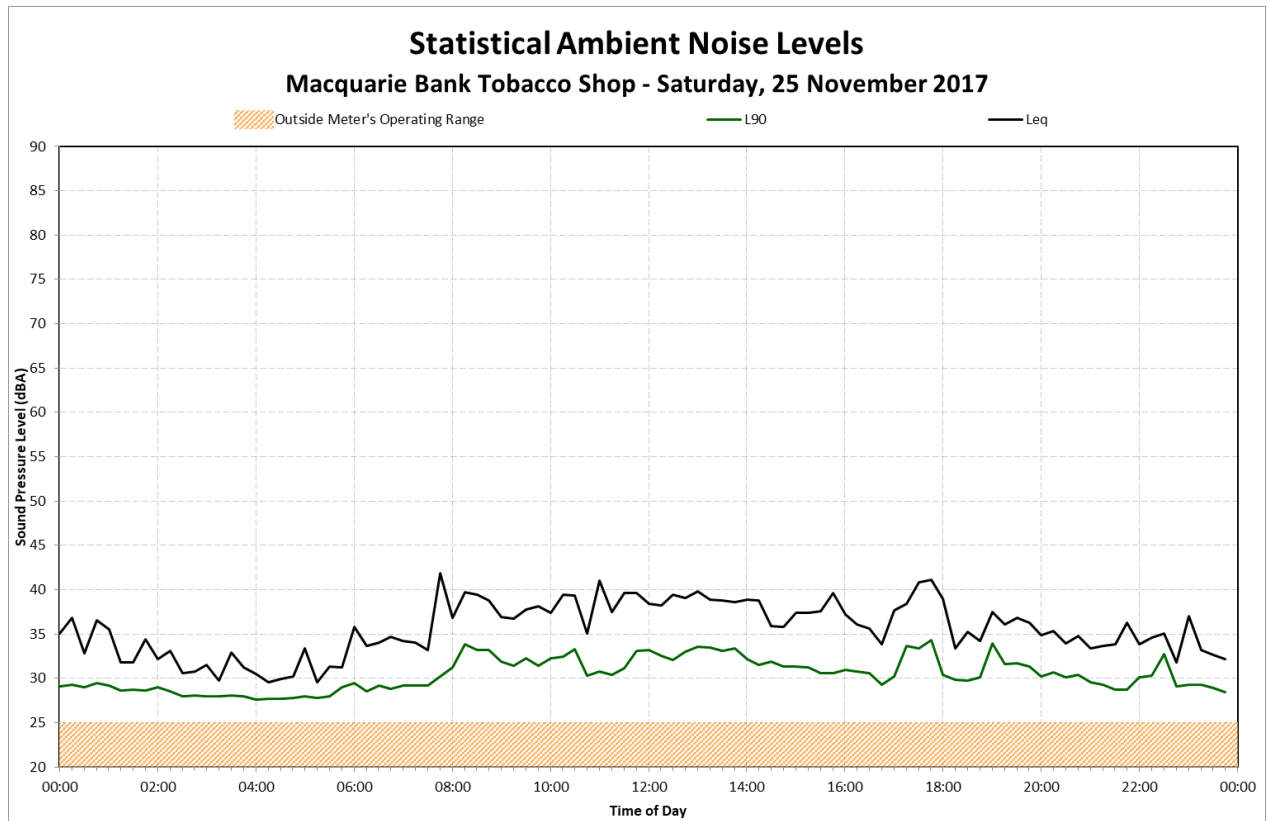
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

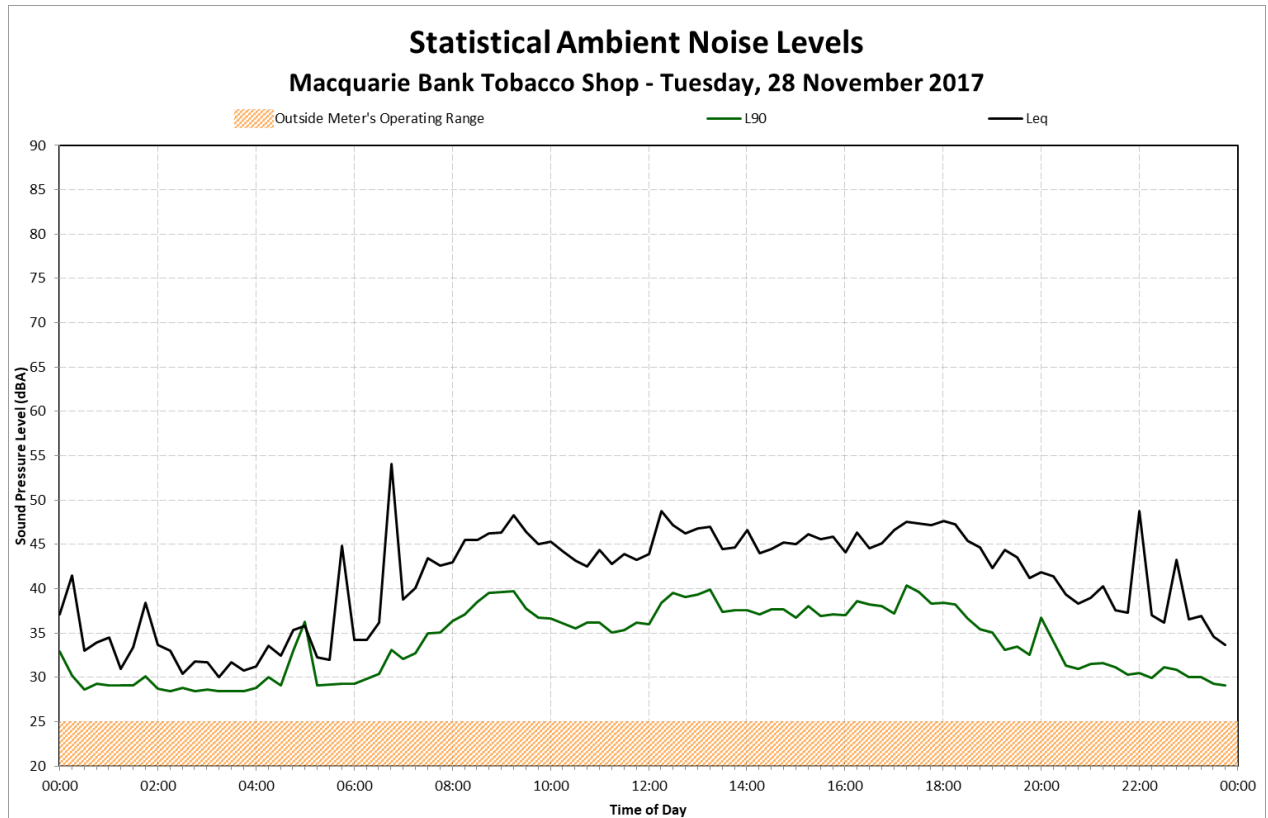
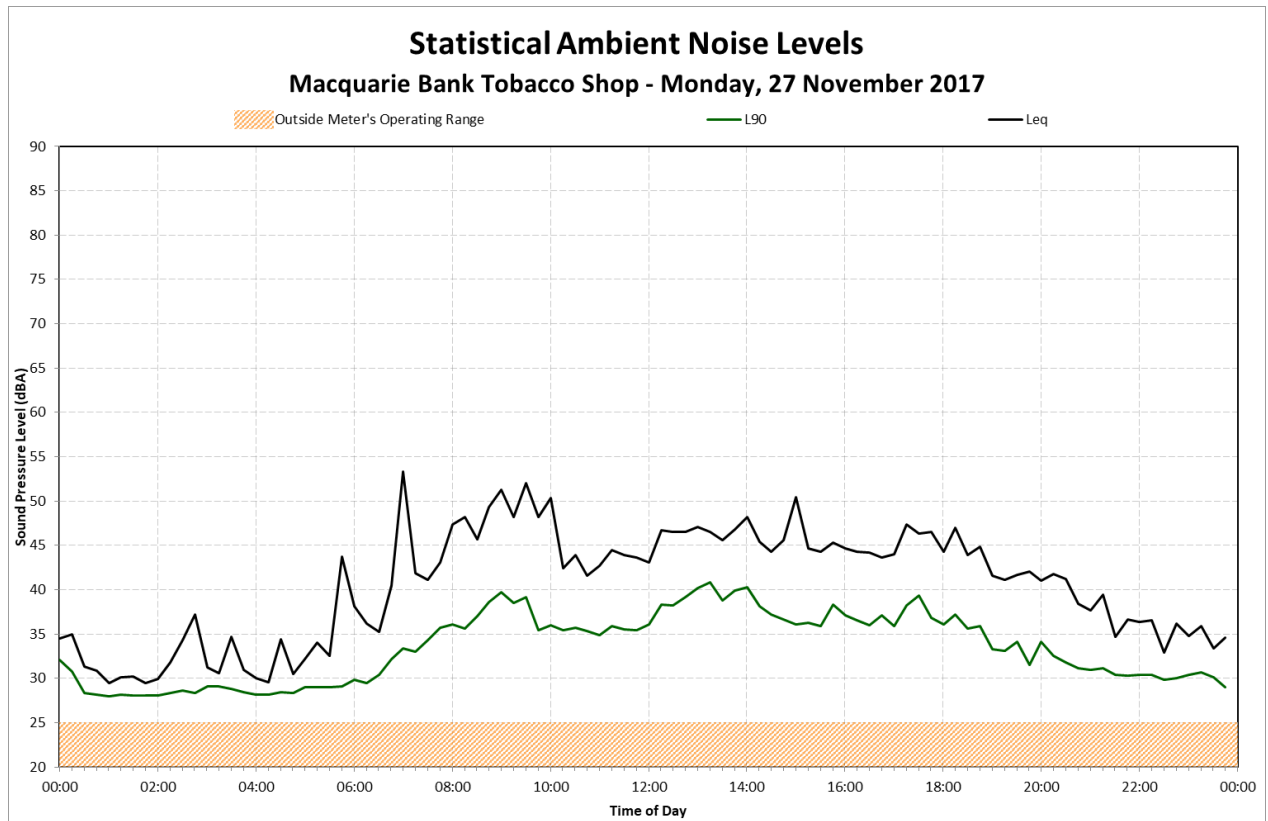
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

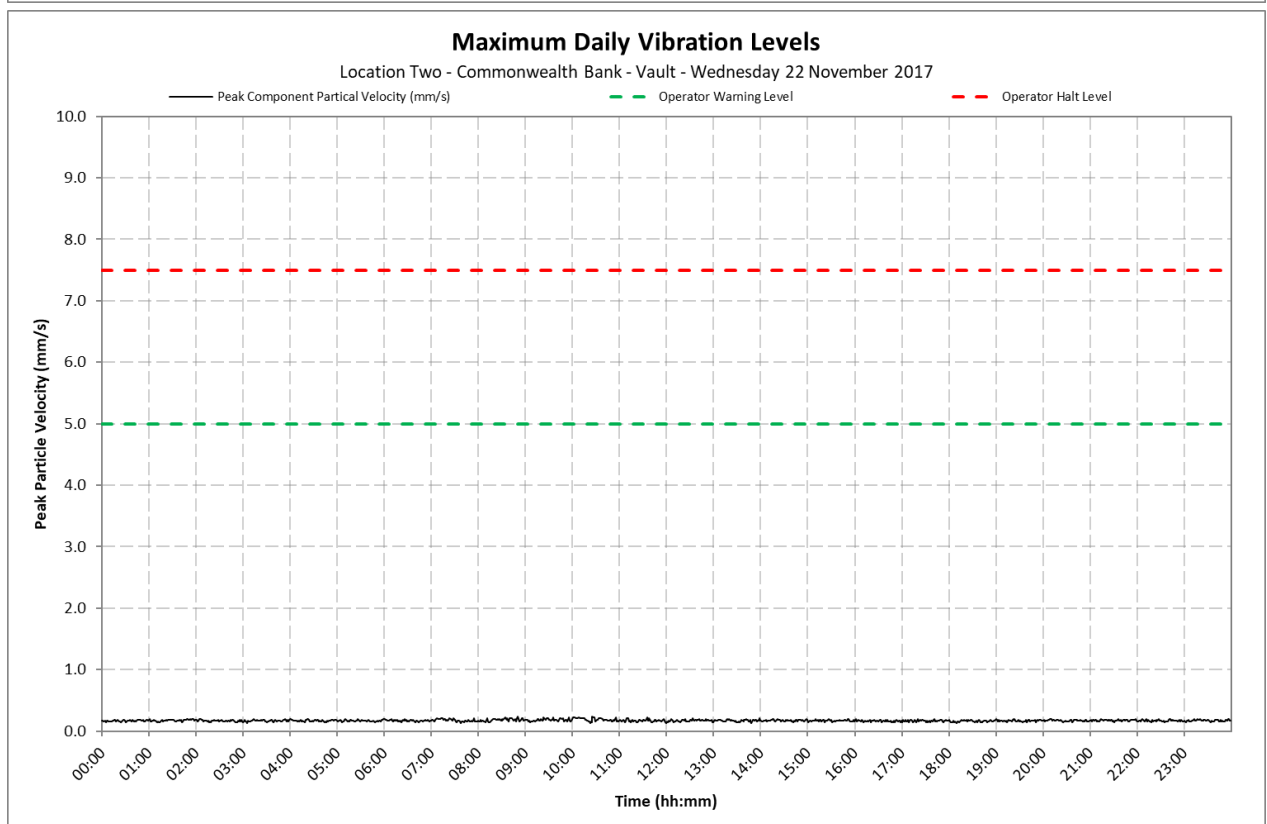
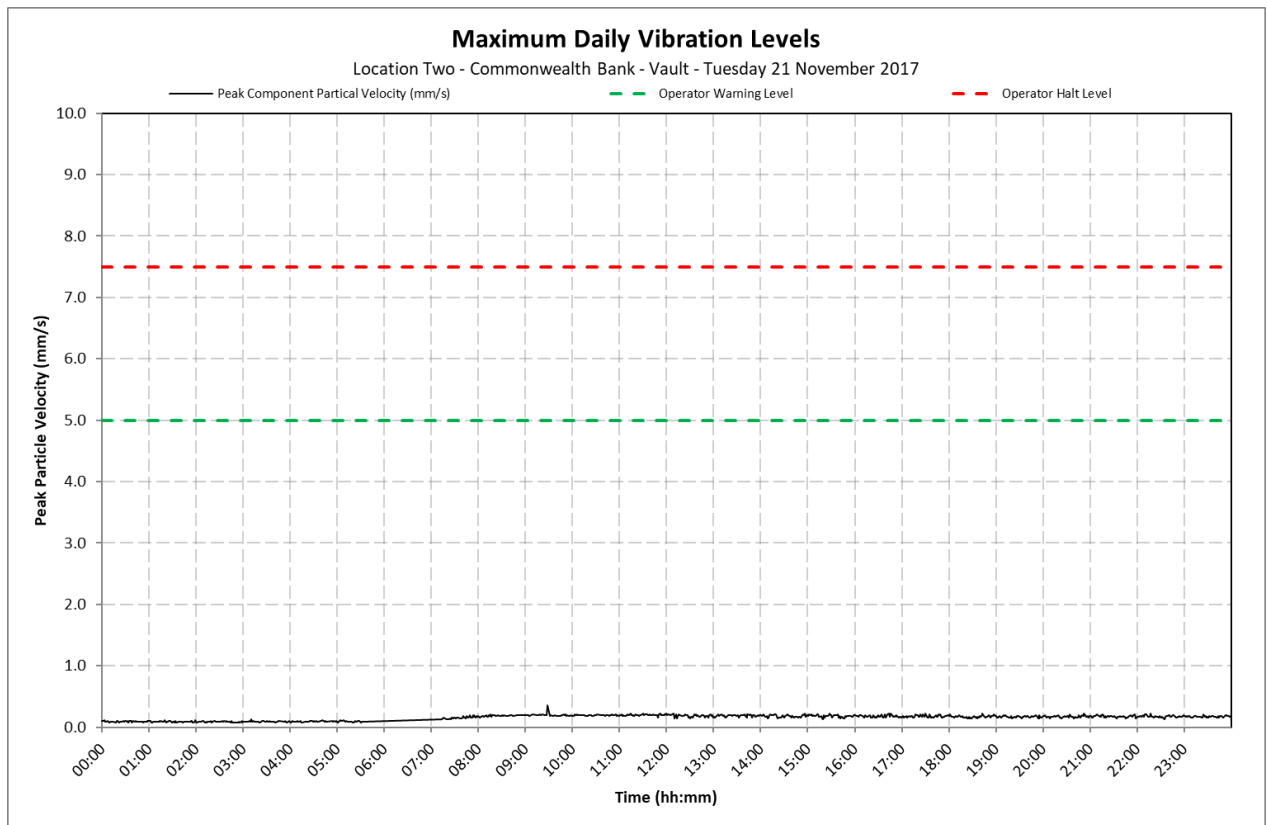
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

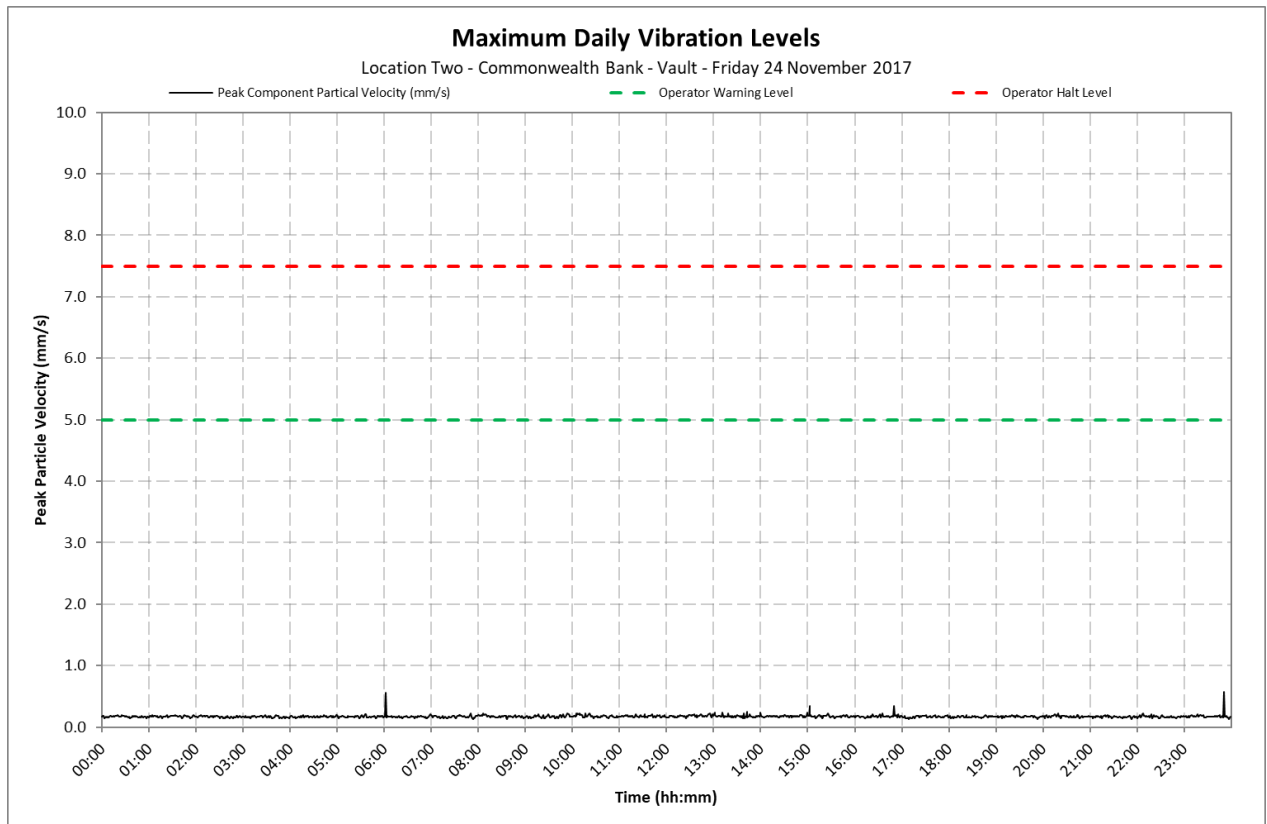
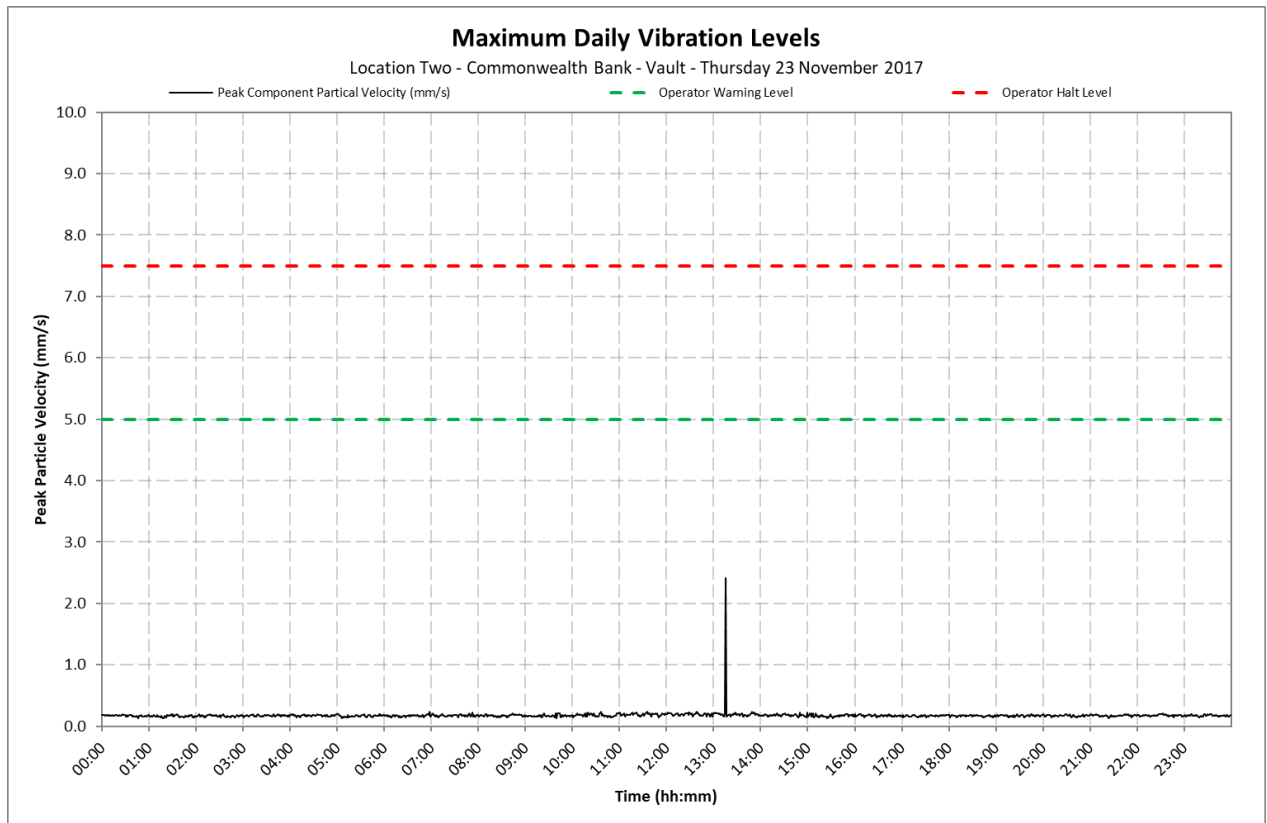
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

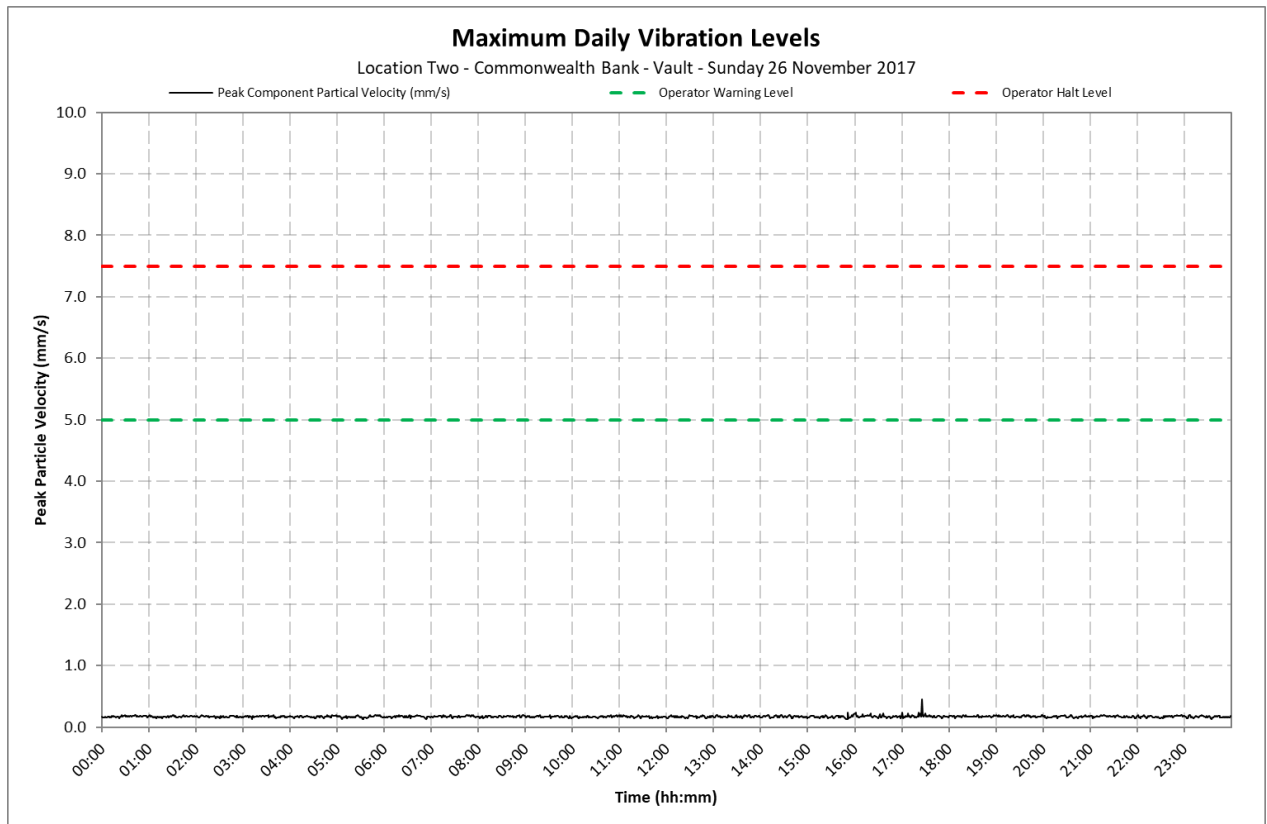
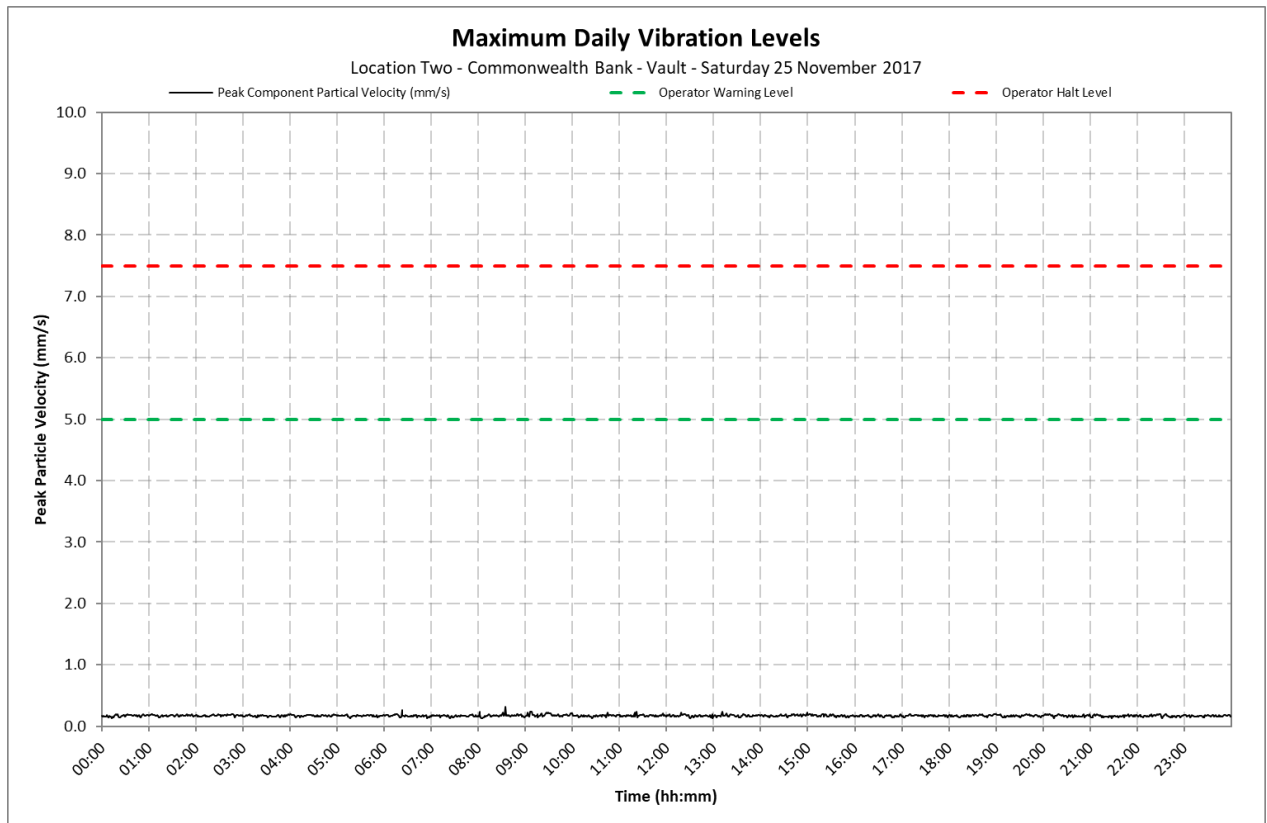
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

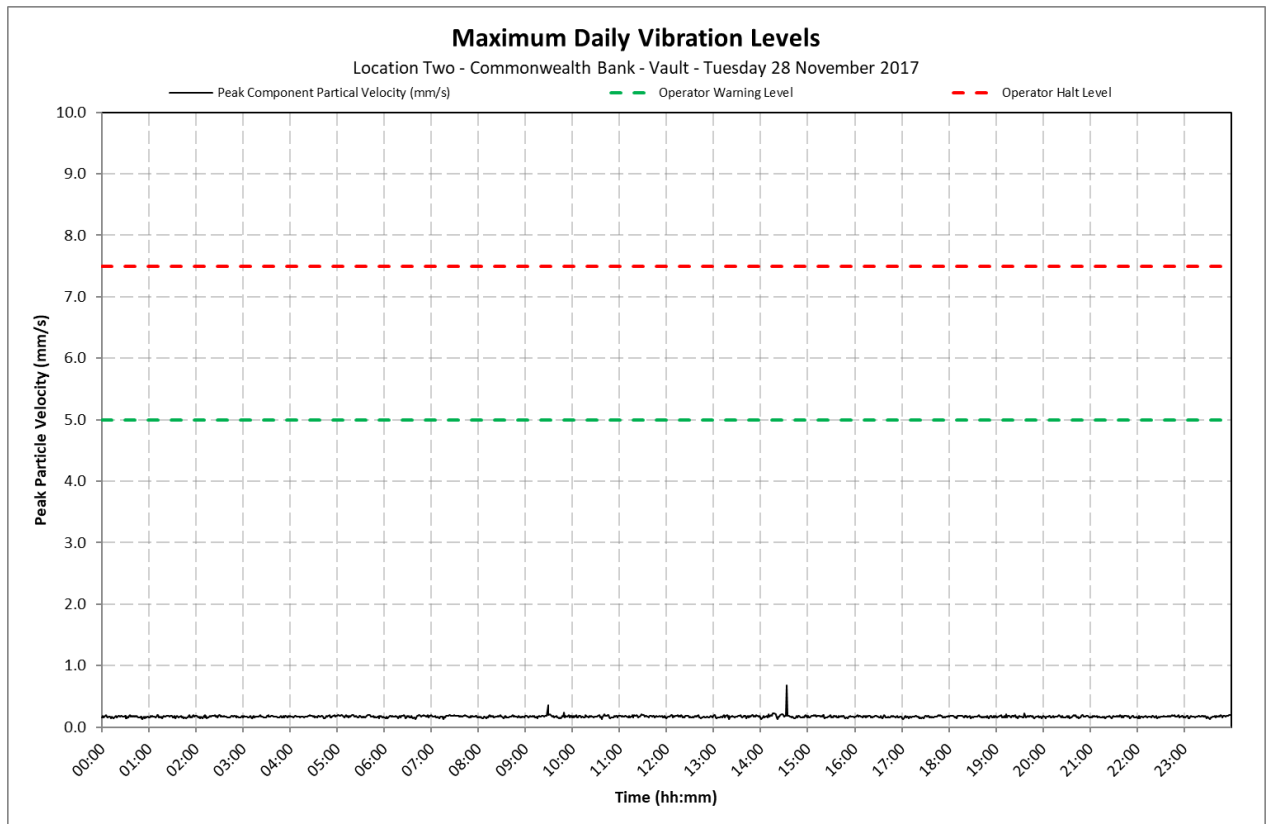
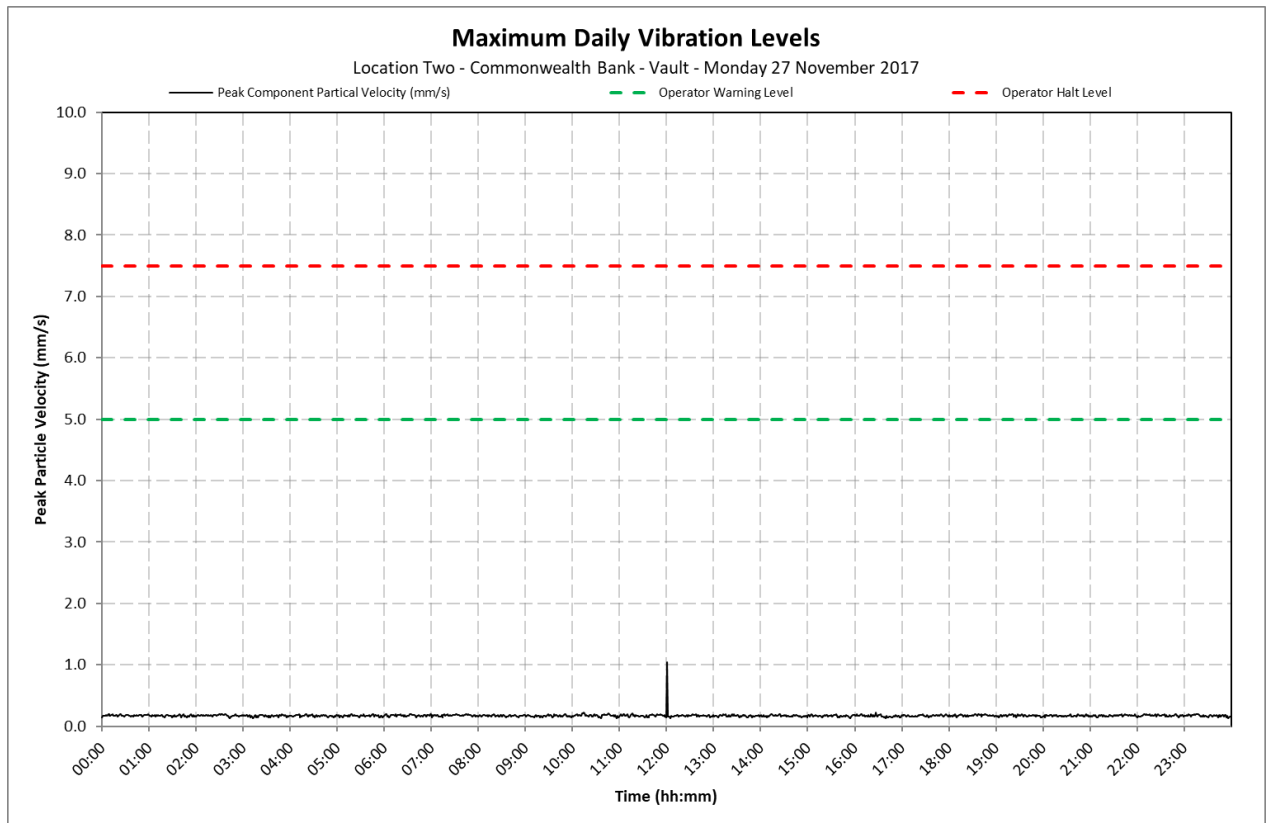
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

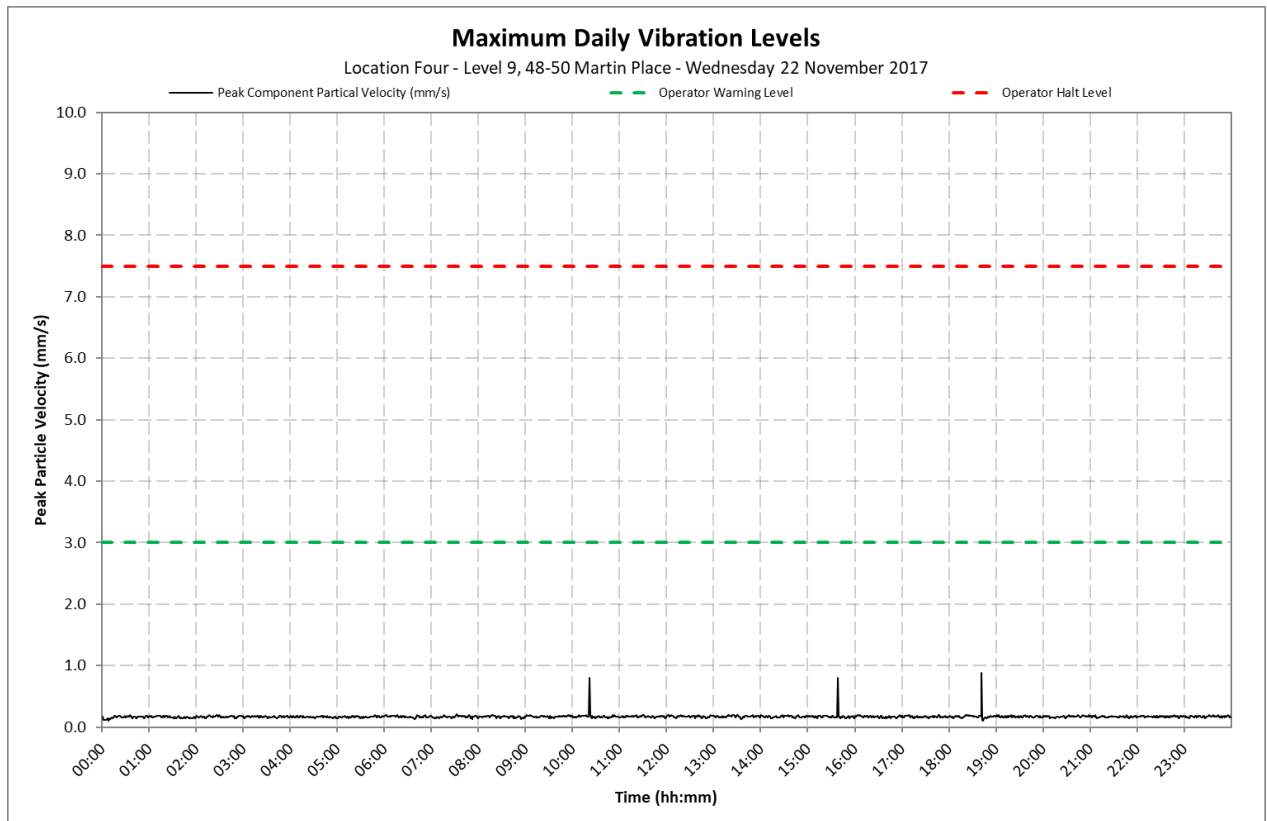
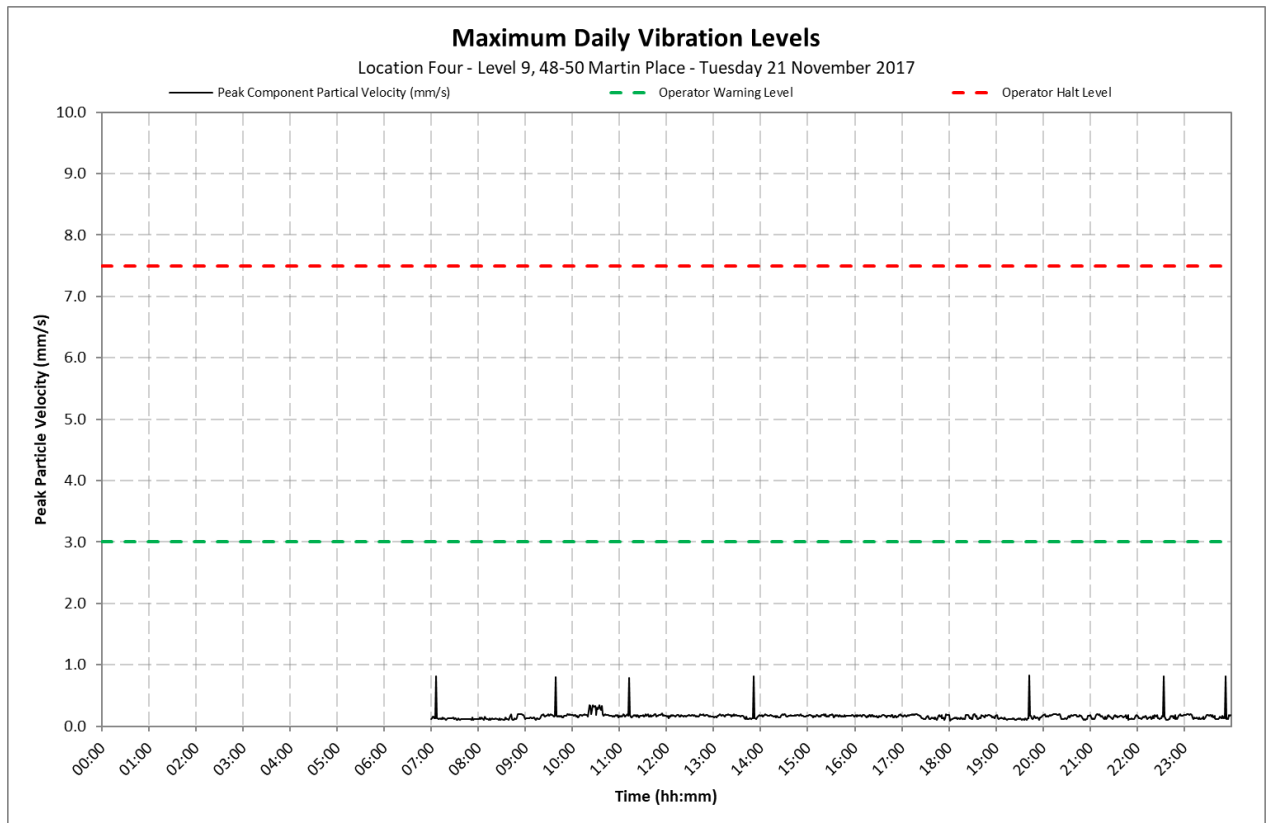
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

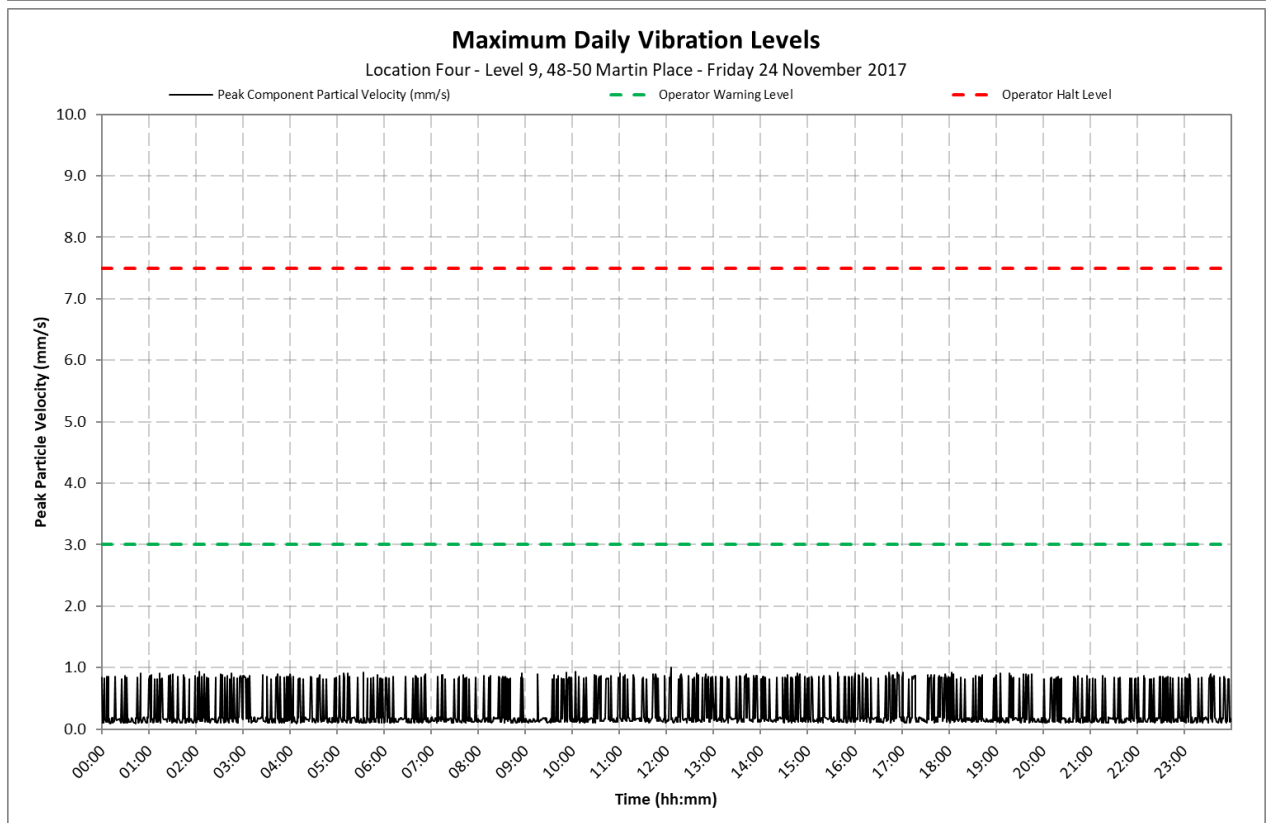
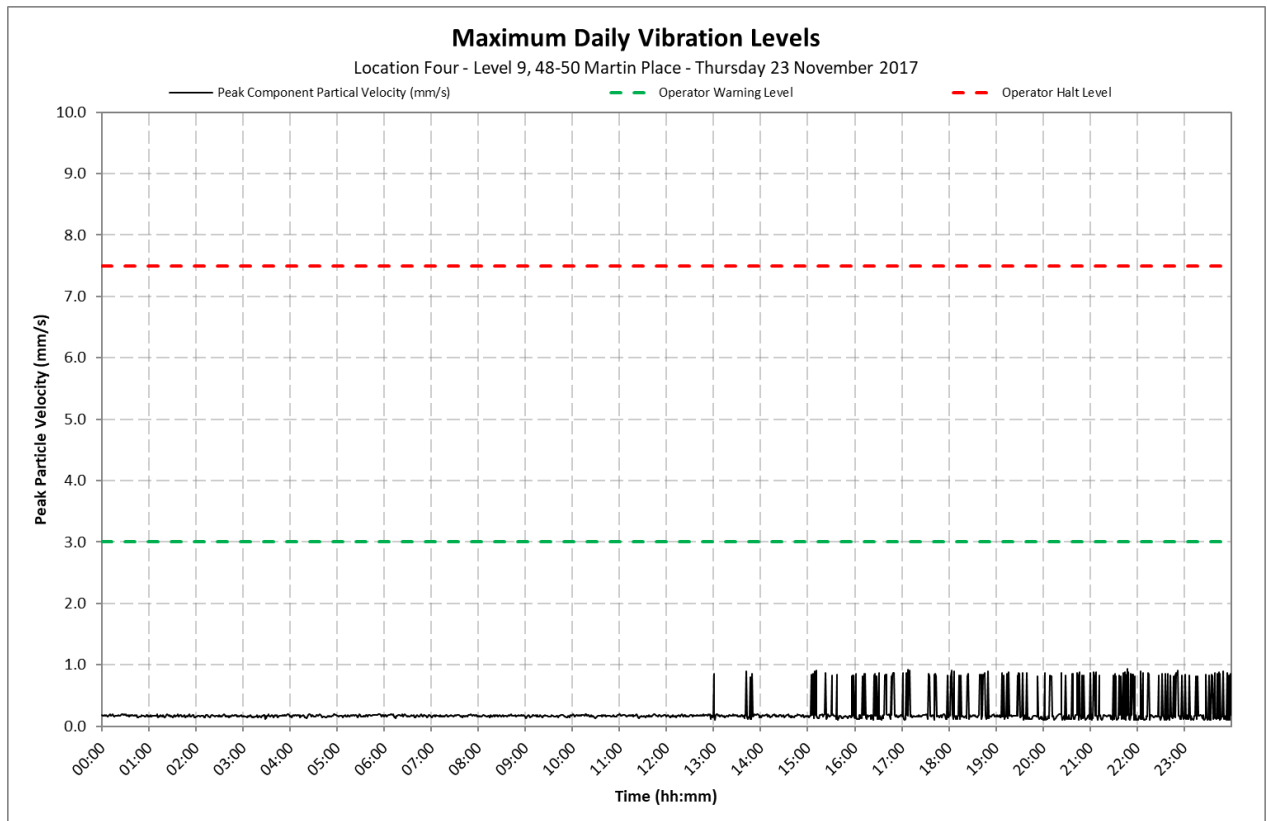
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

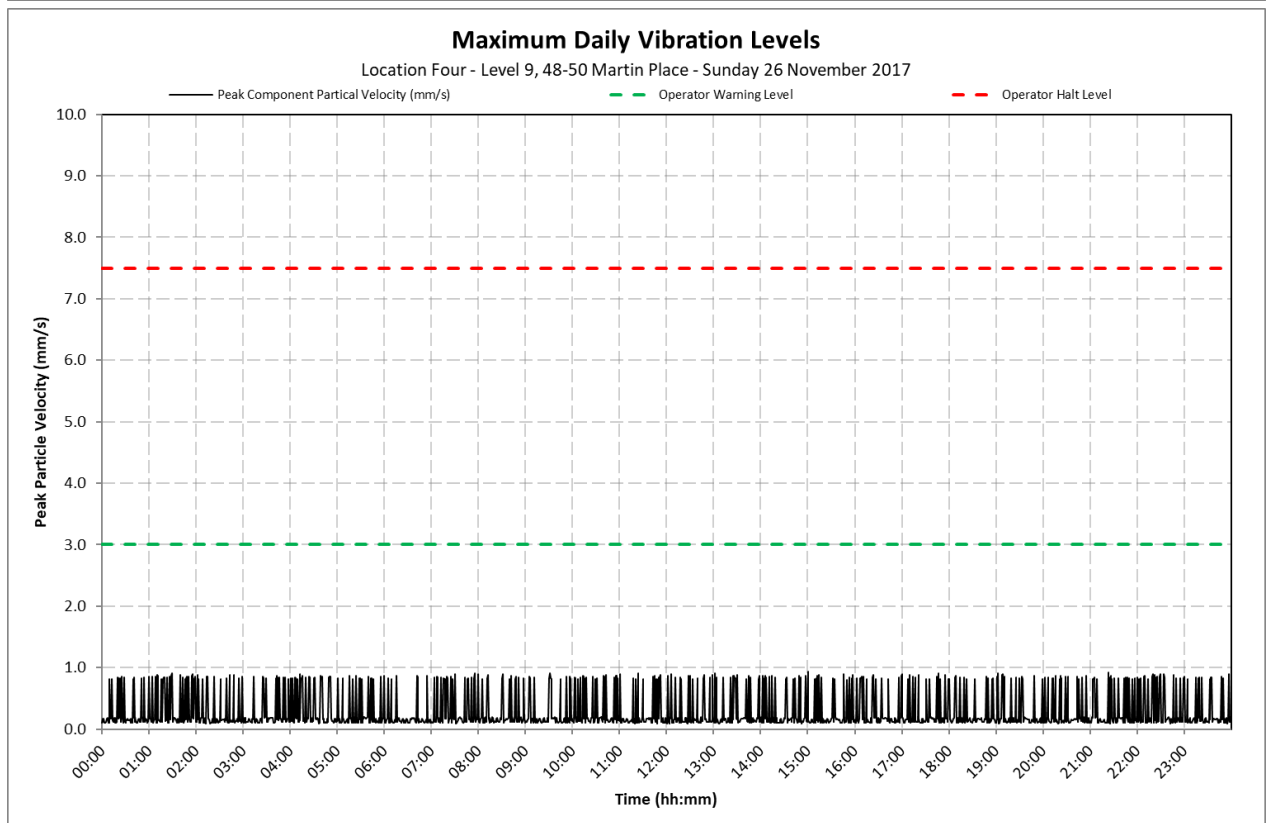
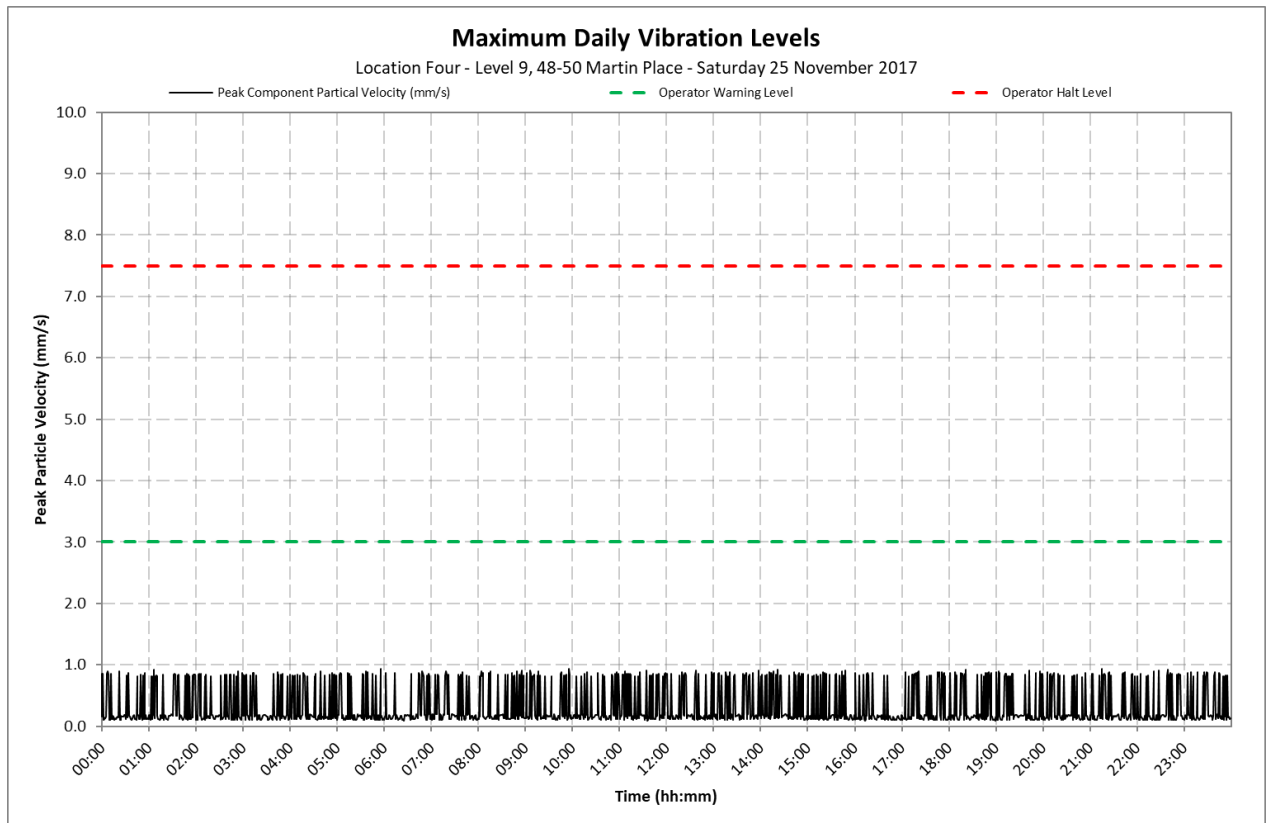
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

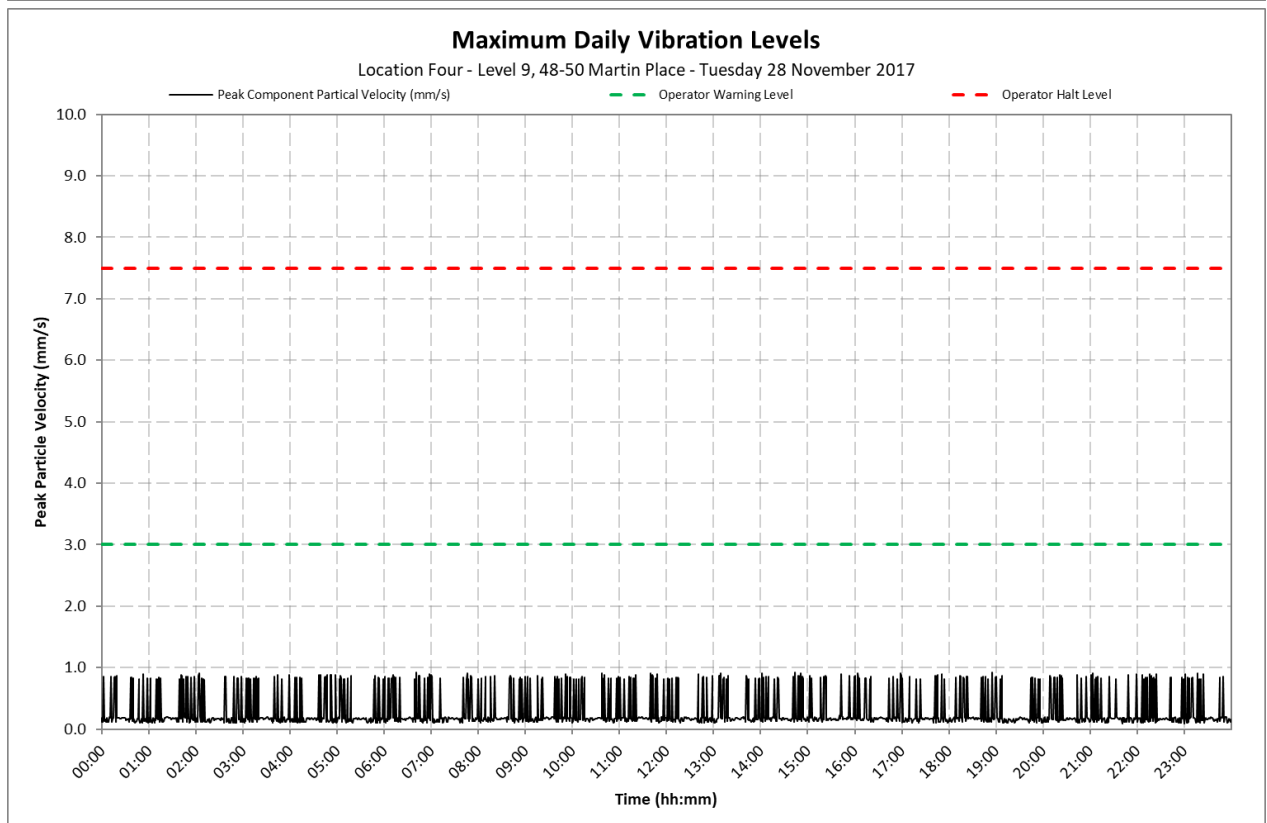
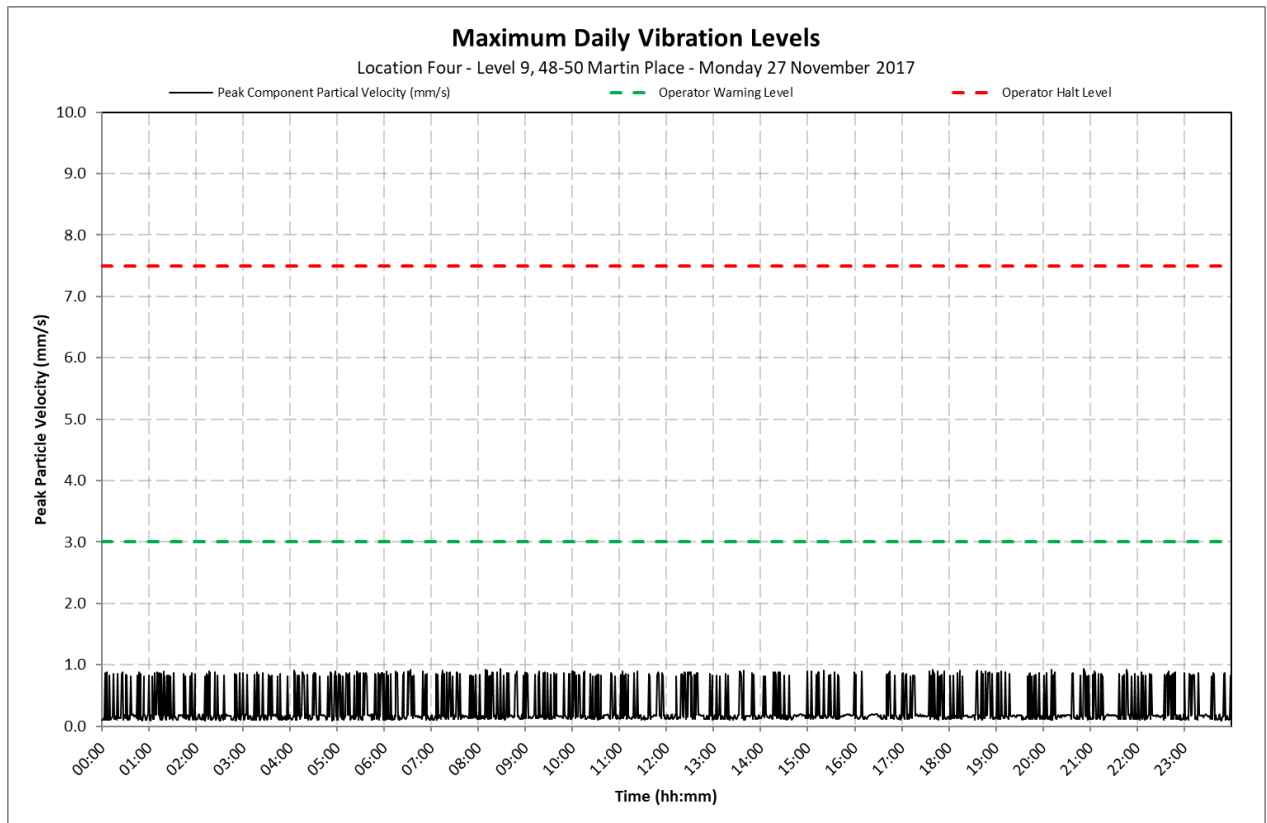
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





8 December 2017

10-1380 R09 NV Monitoring 20171208.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 09
28 November to 4 December 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 28 November to 4 December 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

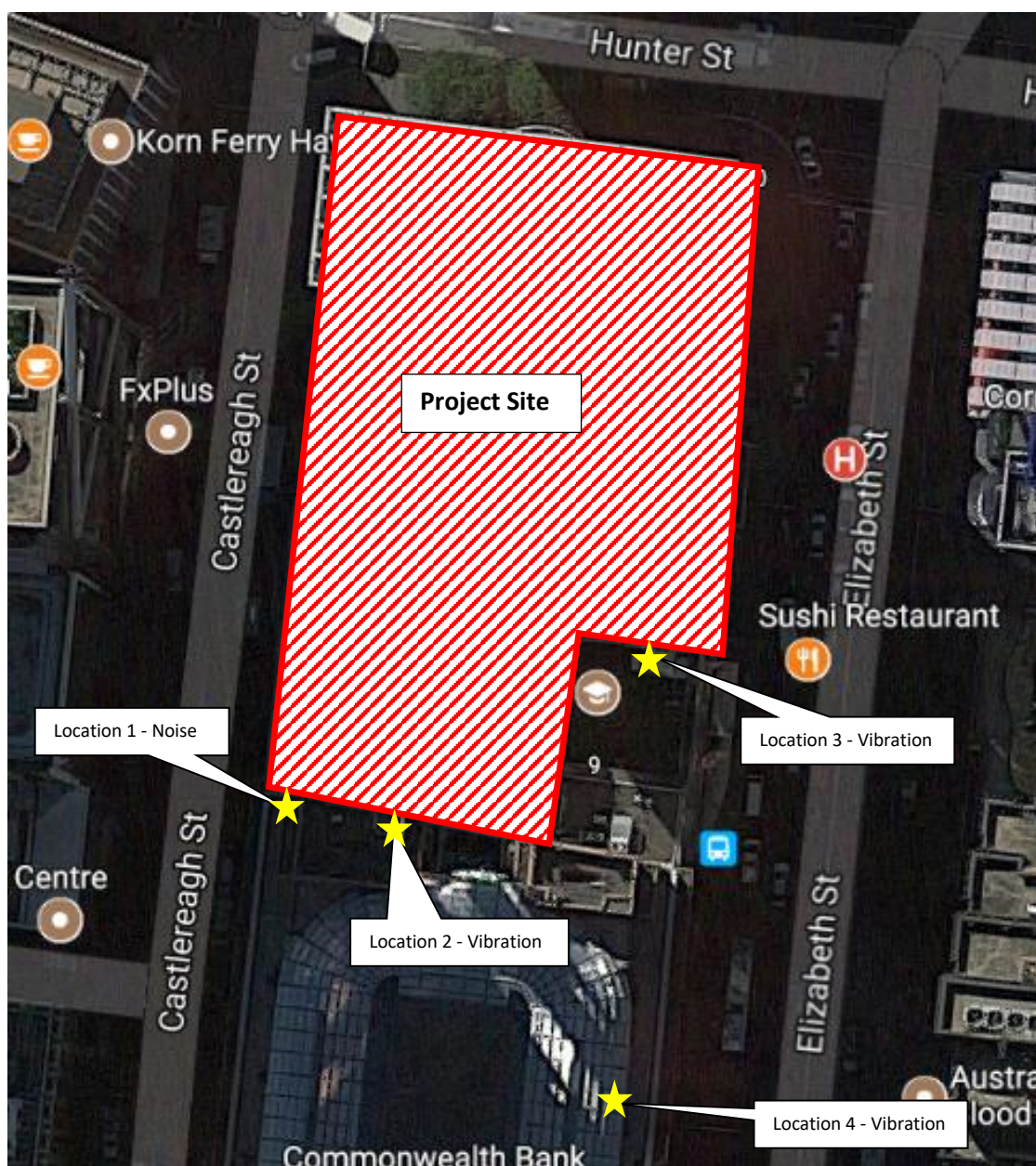
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 28 November to 4 December 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
28 November 2017	45	44	Complies	Complies
29 November 2017	45	44	Complies	Complies
30 November 2017	46	44	Complies	Complies
1 December 2017	45	43	Complies	Complies
2 December 2017	36	35	Complies	Complies
3 December 2017	42	41	Complies	Complies
4 December 2017	42	41	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 28 November to 4 December 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
28 November 2017	0.7 mm/s	Complies
29 November 2017	0.5 mm/s	Complies
30 November 2017	0.6 mm/s	Complies
1 December 2017	1.4 mm/s	Complies
2 December 2017	1.1 mm/s	Complies
3 December 2017	1.1 mm/s	Complies
4 December 2017	1.2 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
28 November 2017	0.9 mm/s	Complies
29 November 2017	1.0 mm/s	Complies
30 November 2017	1.0 mm/s	Complies
1 December 2017	0.9 mm/s	Complies
2 December 2017	0.9 mm/s	Complies
3 December 2017	0.9 mm/s	Complies
4 December 2017	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 28 November to 4 December 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 28 November to 4 December 2017 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

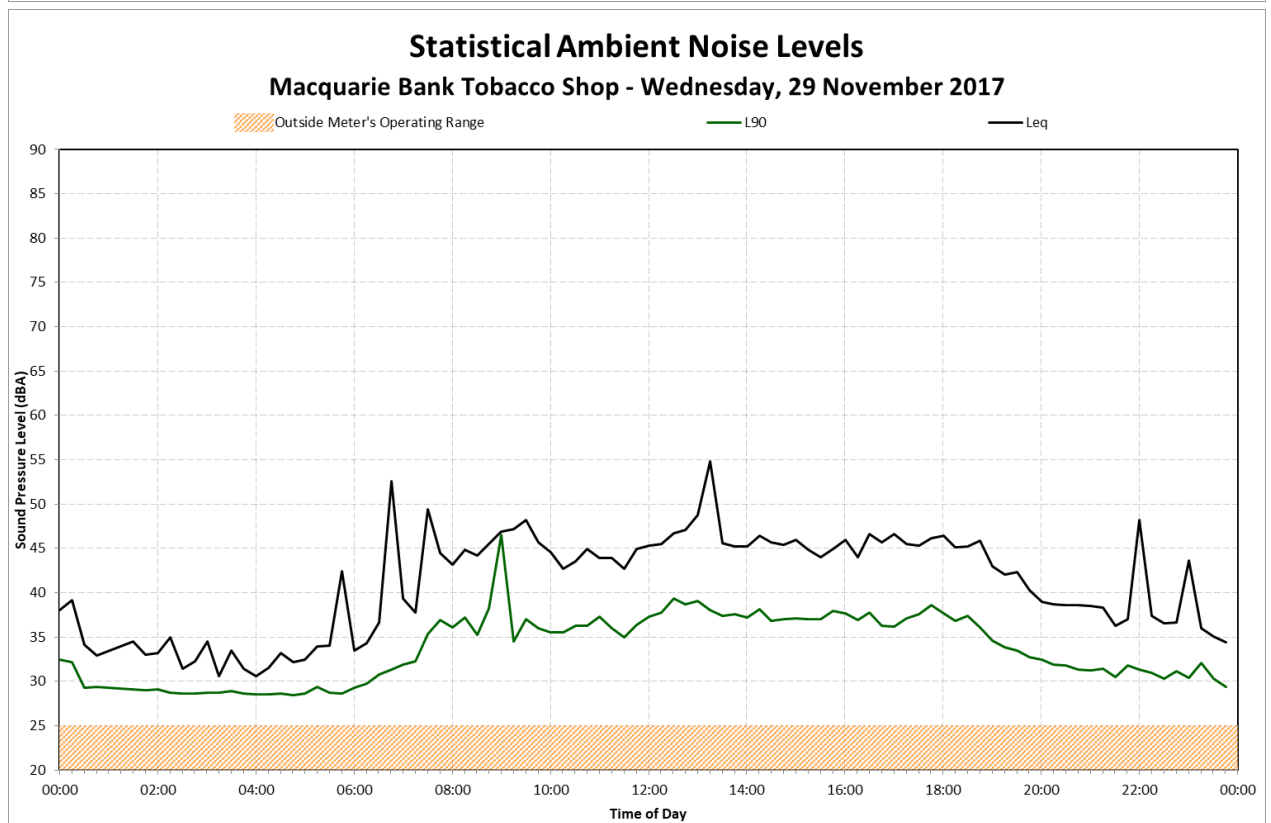
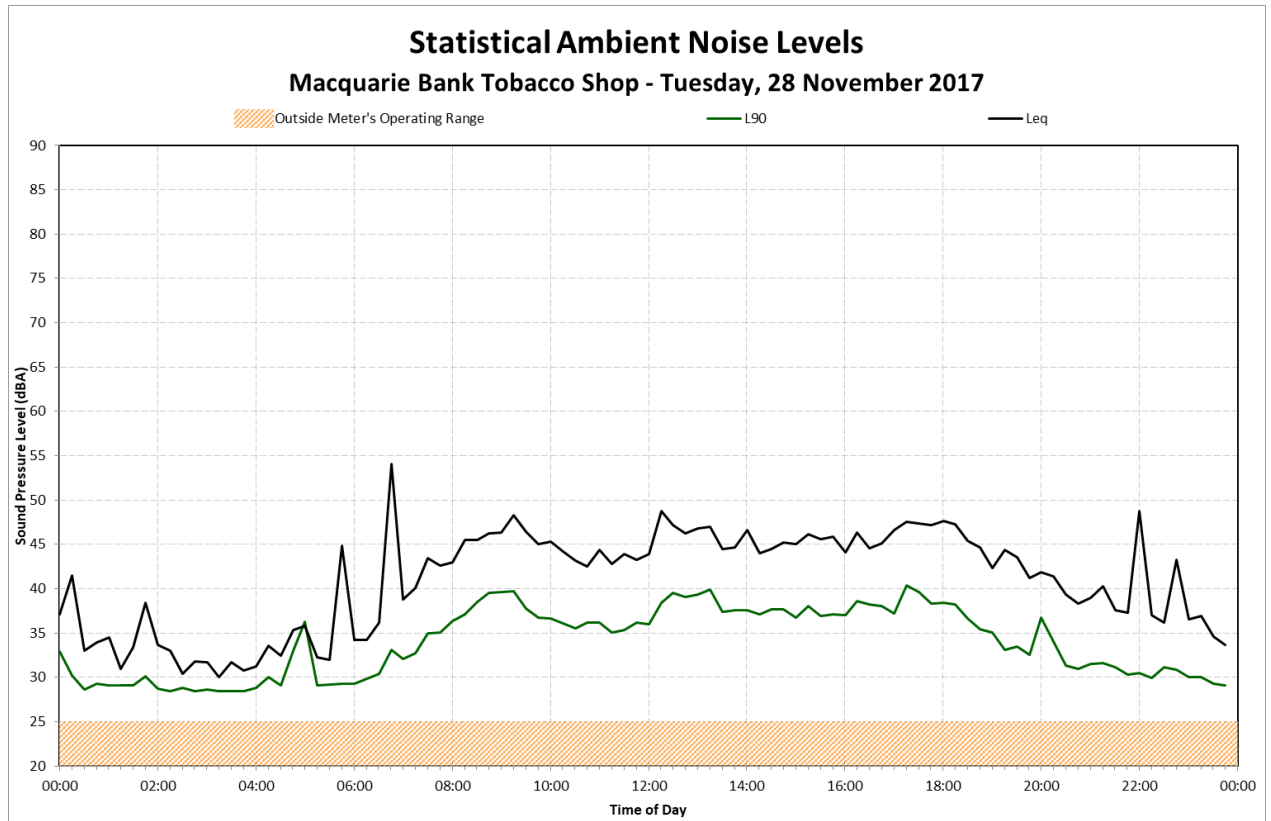
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

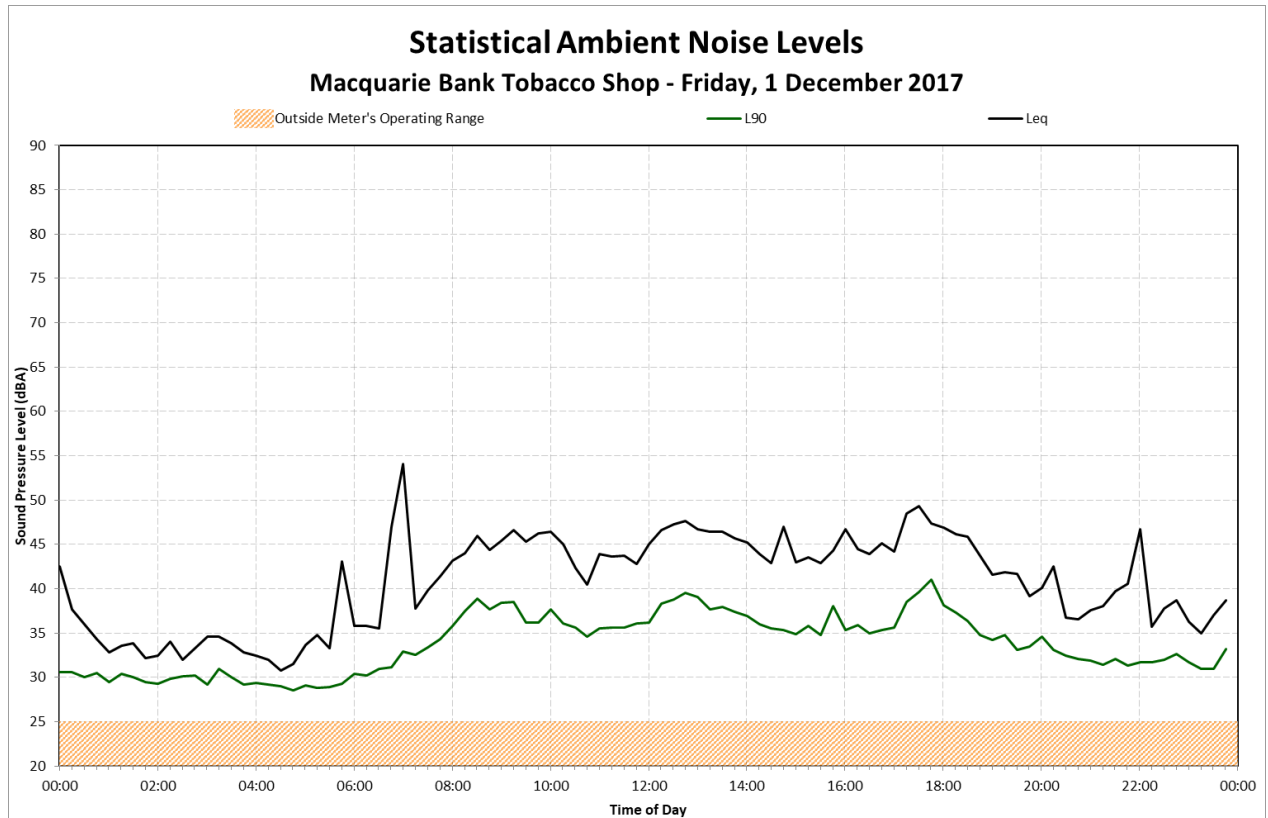
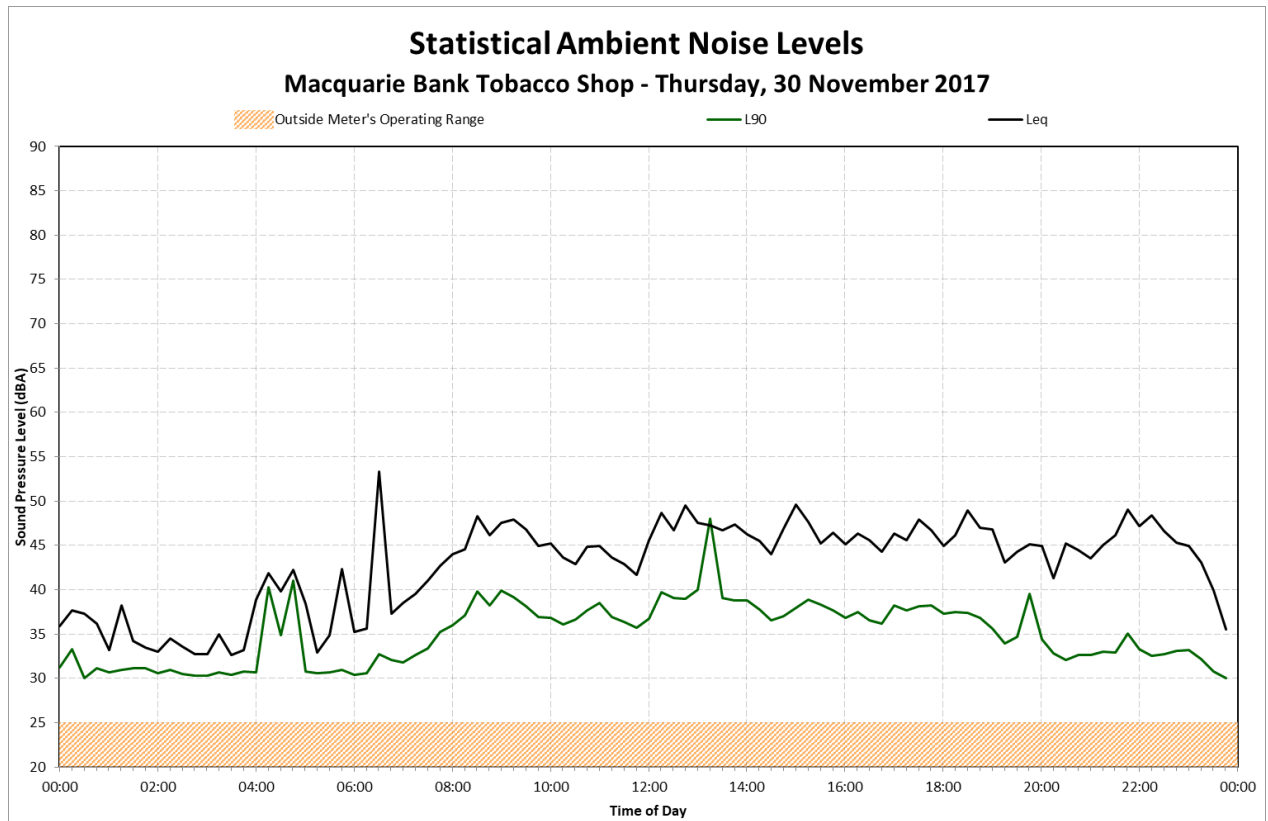
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

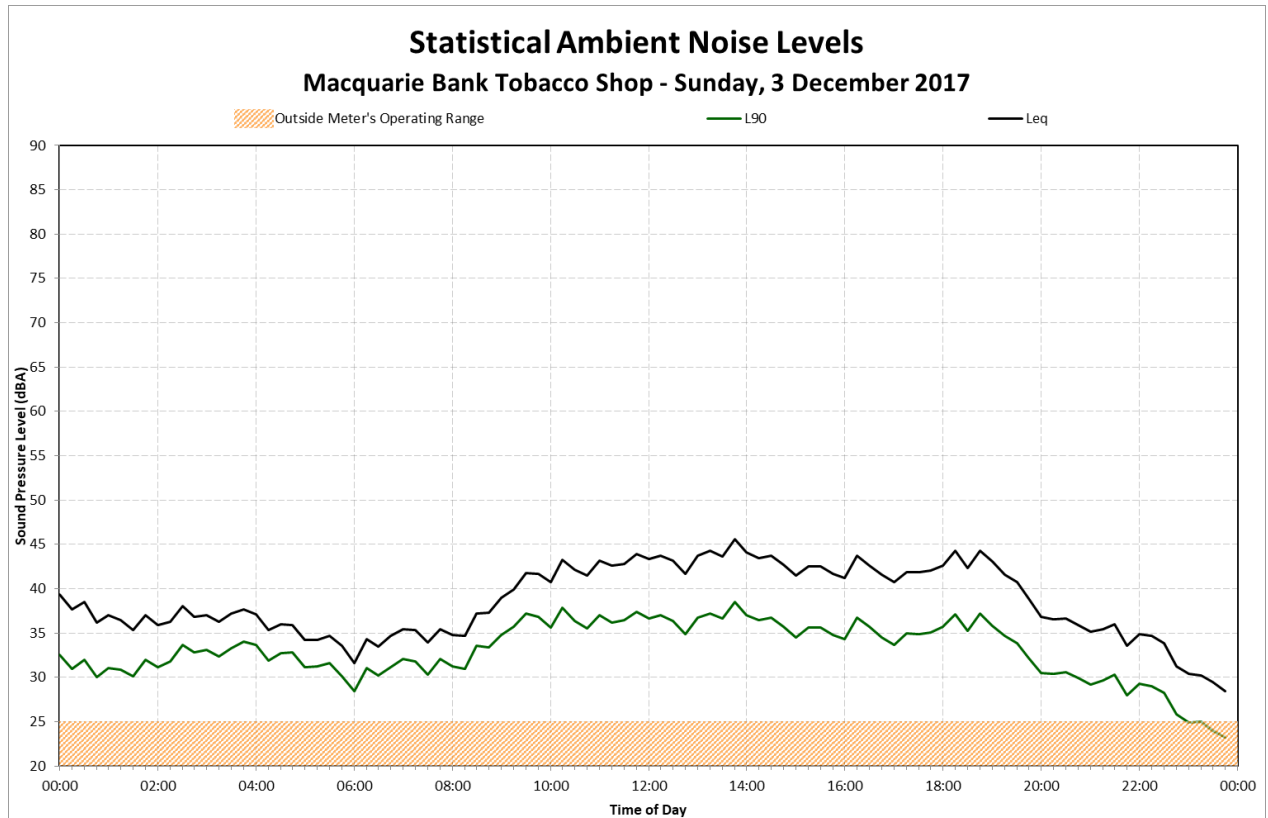
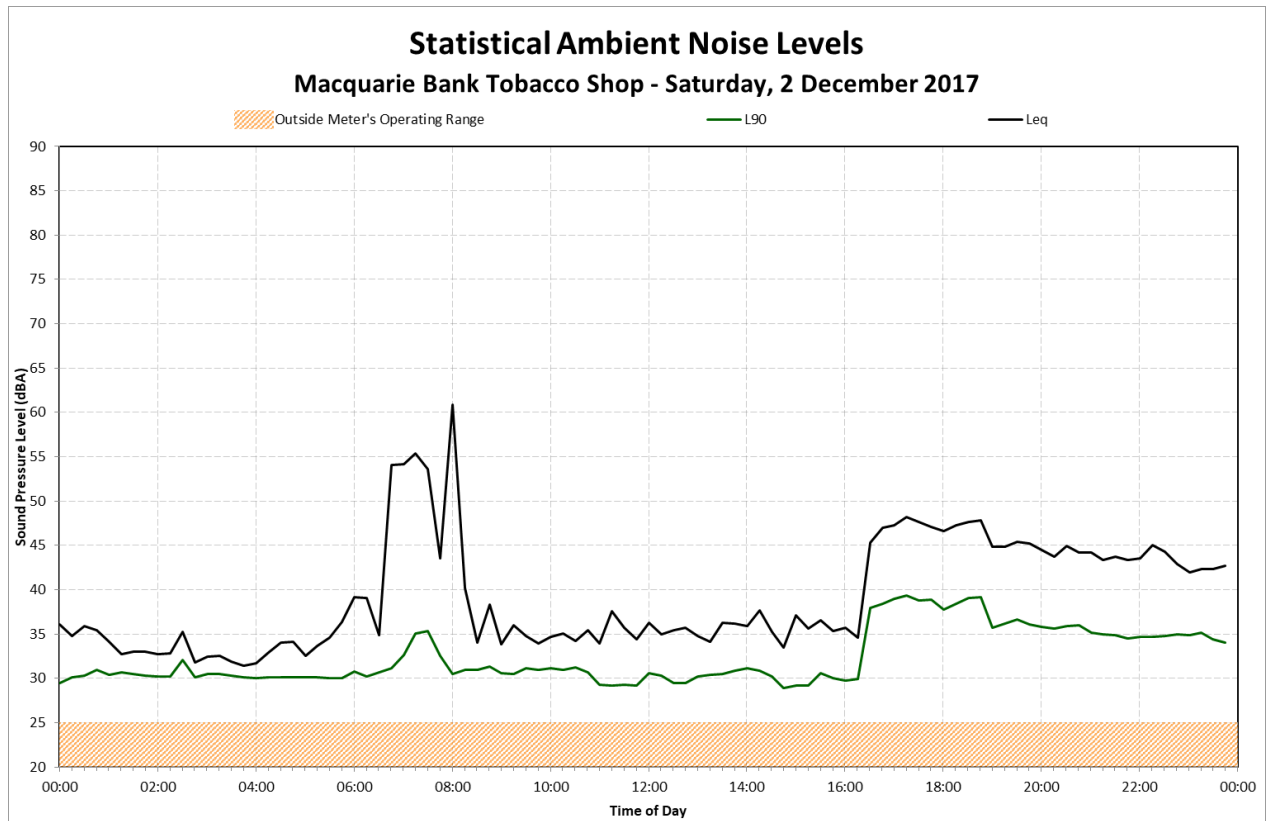
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

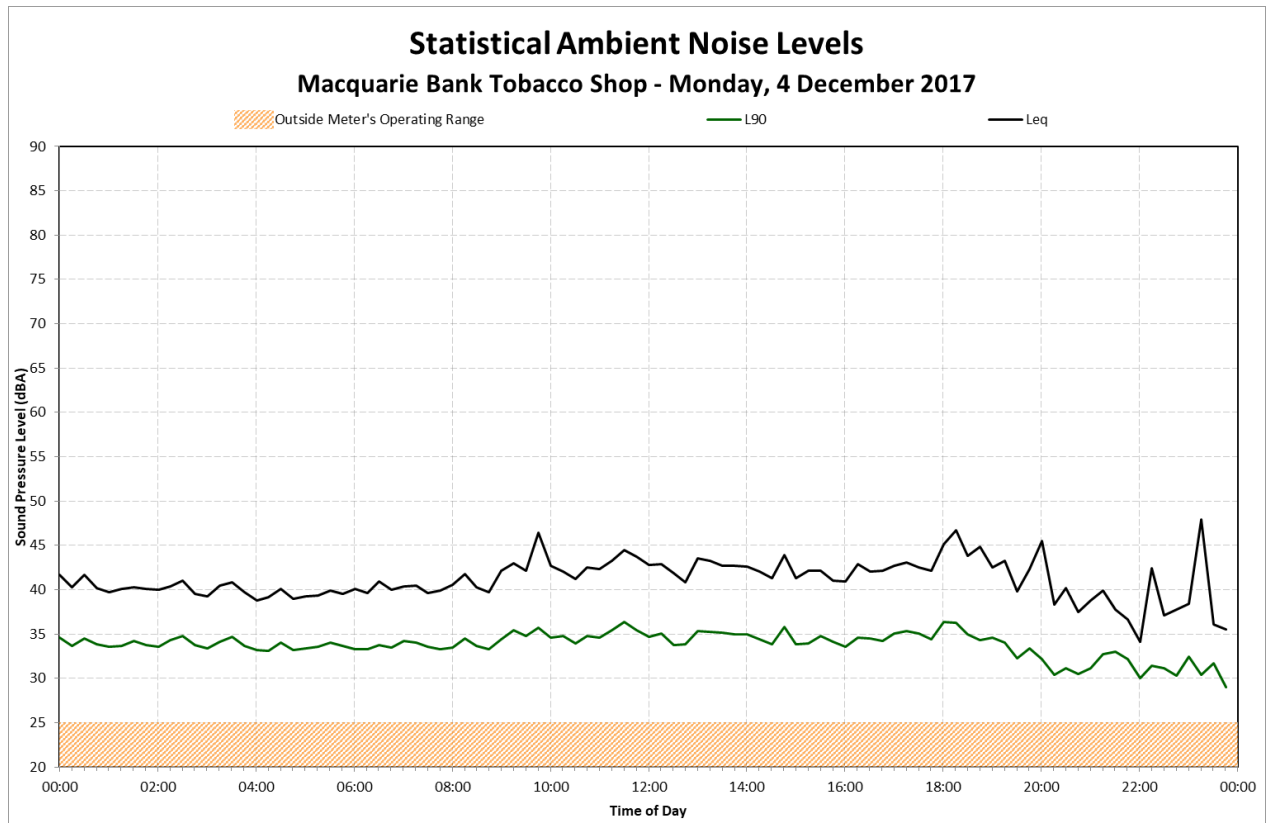
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

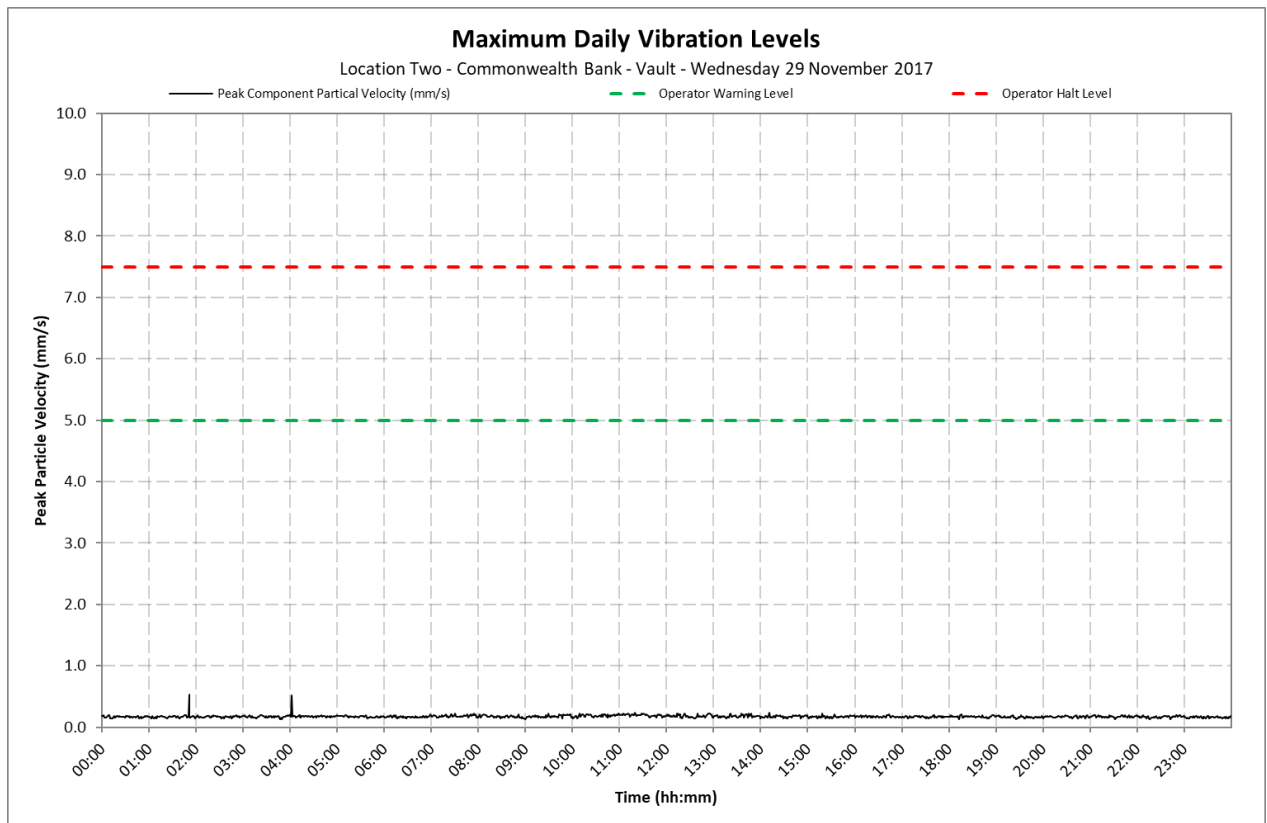
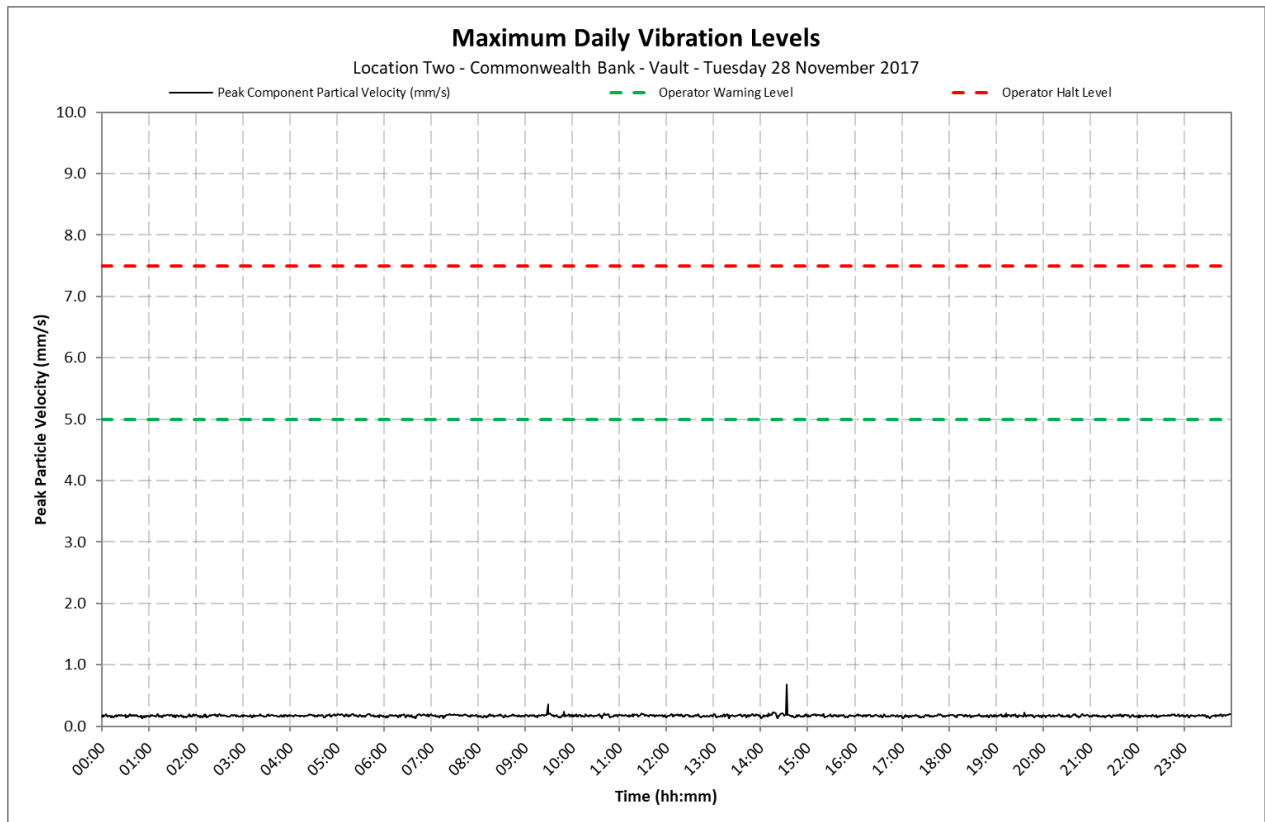
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

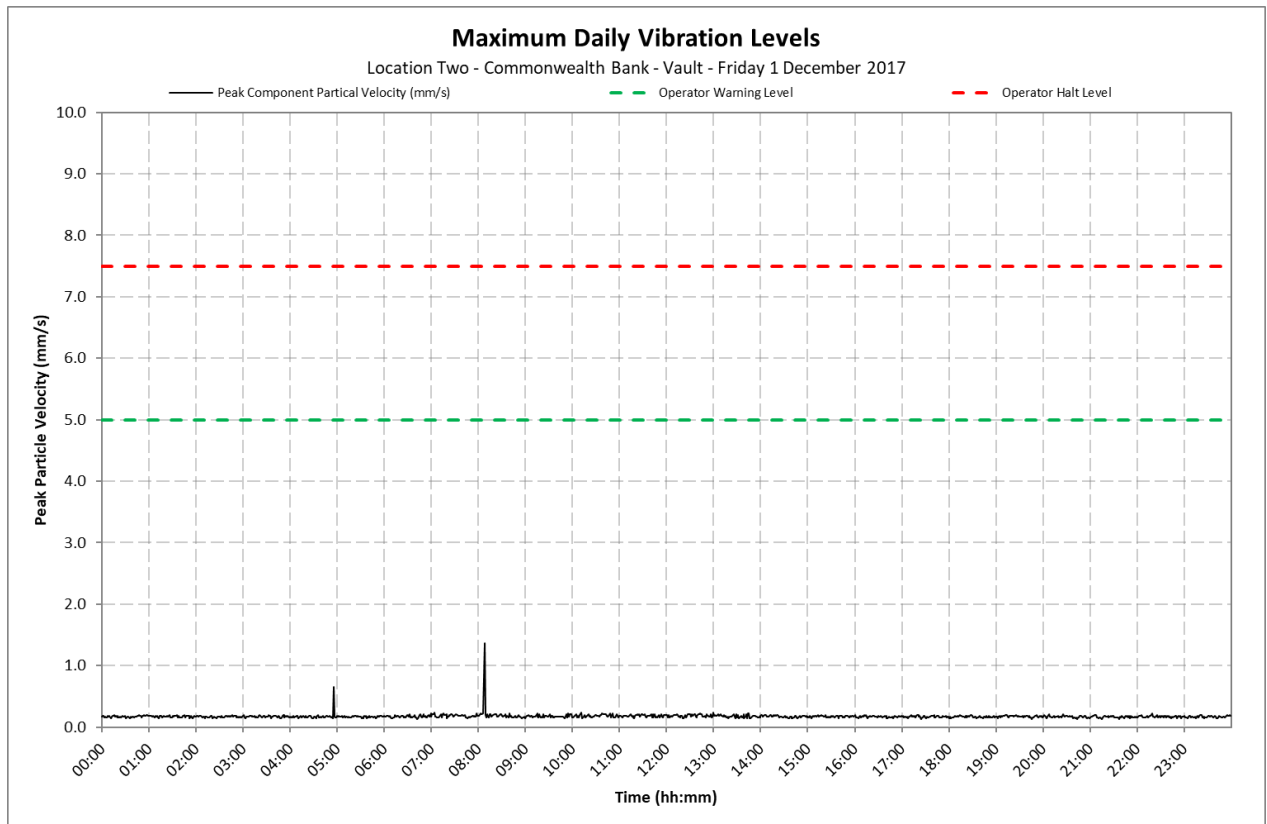
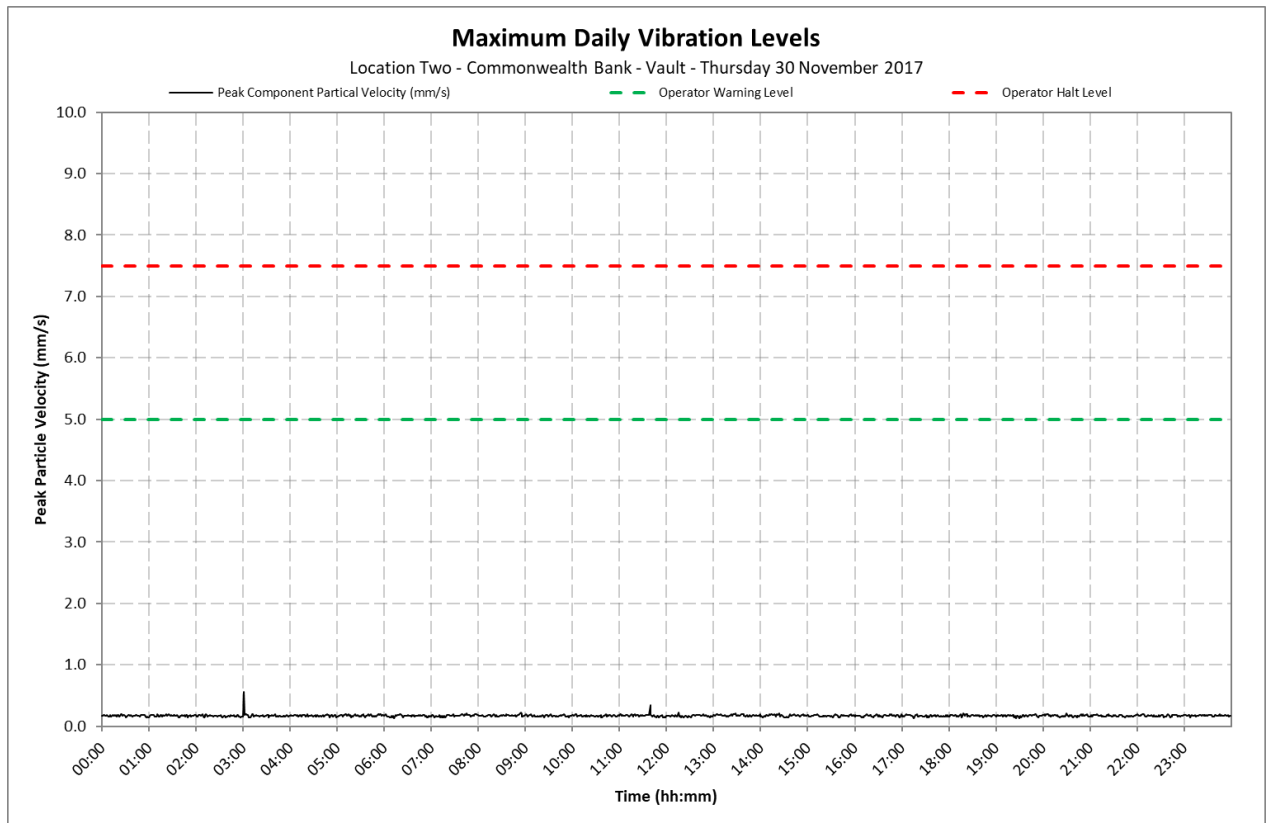
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

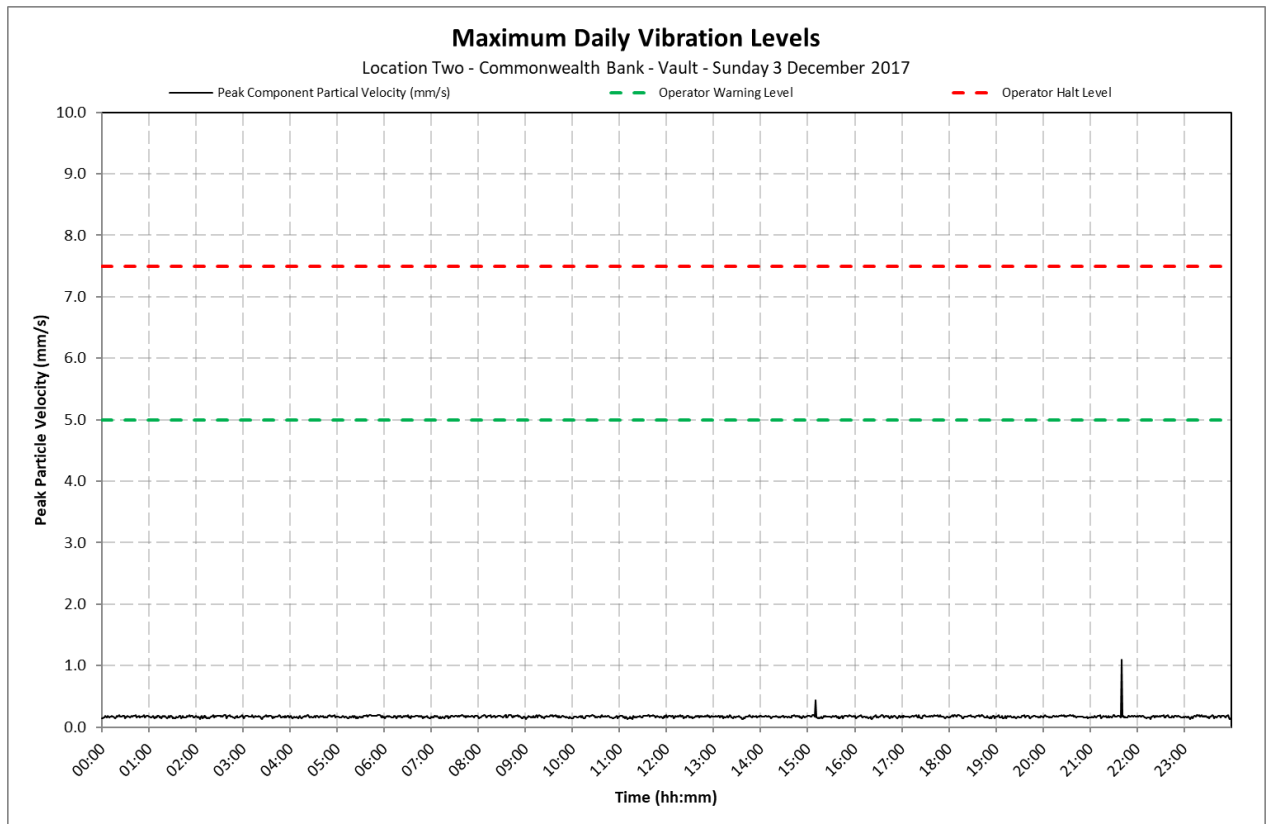
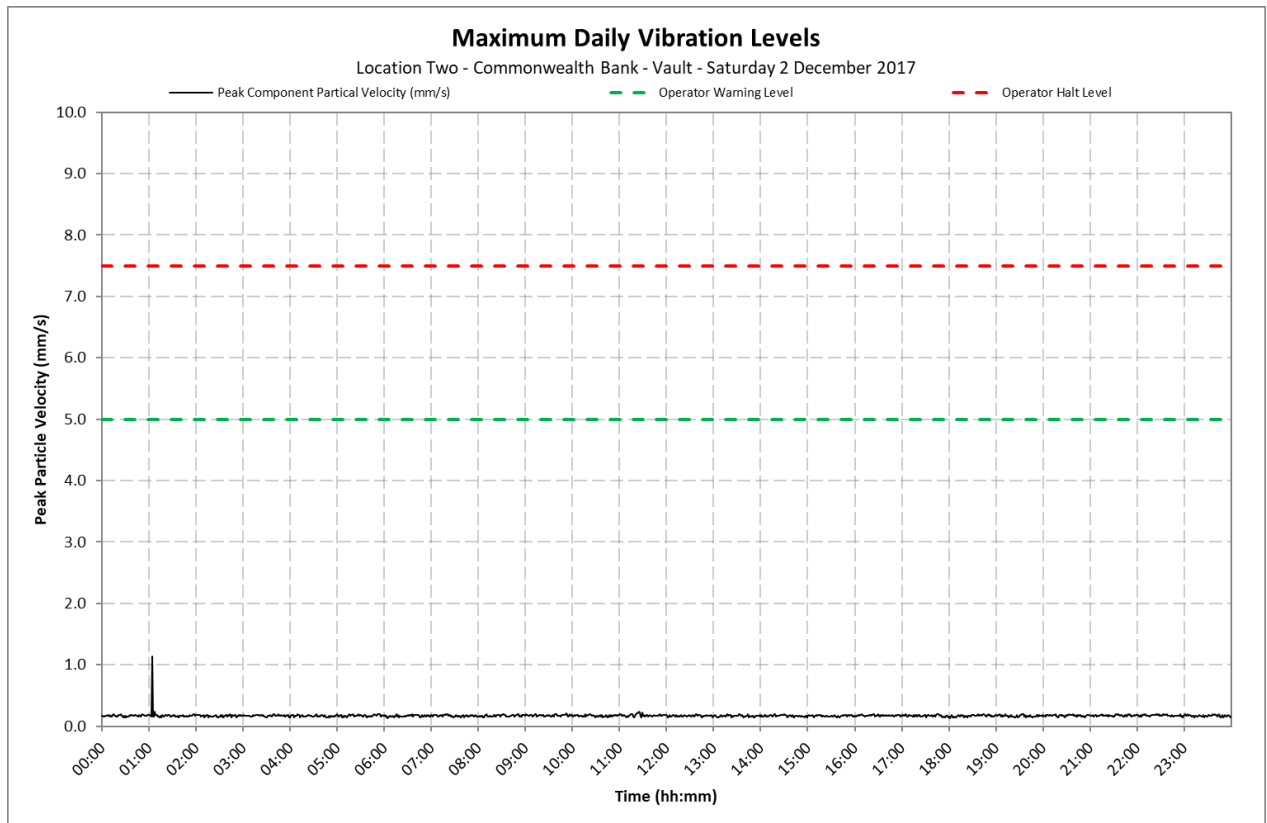
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

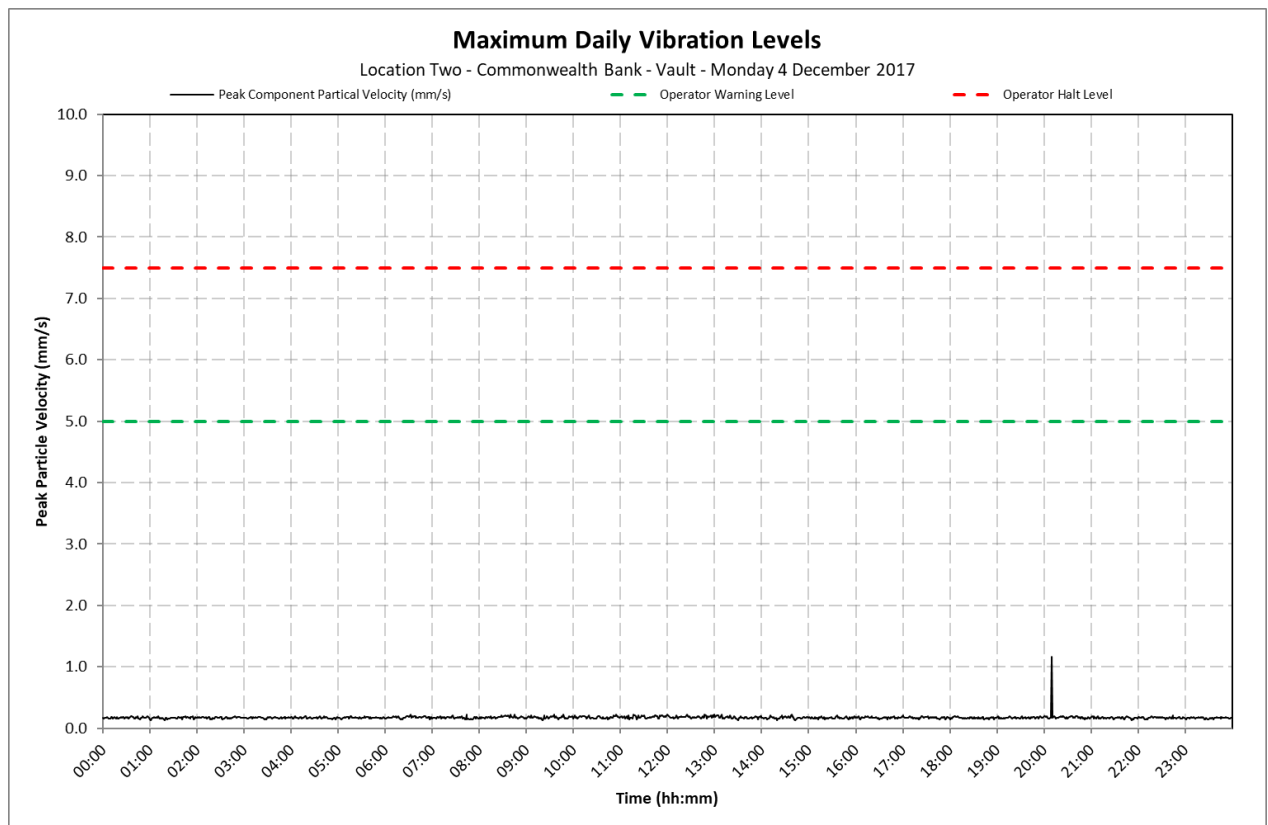
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

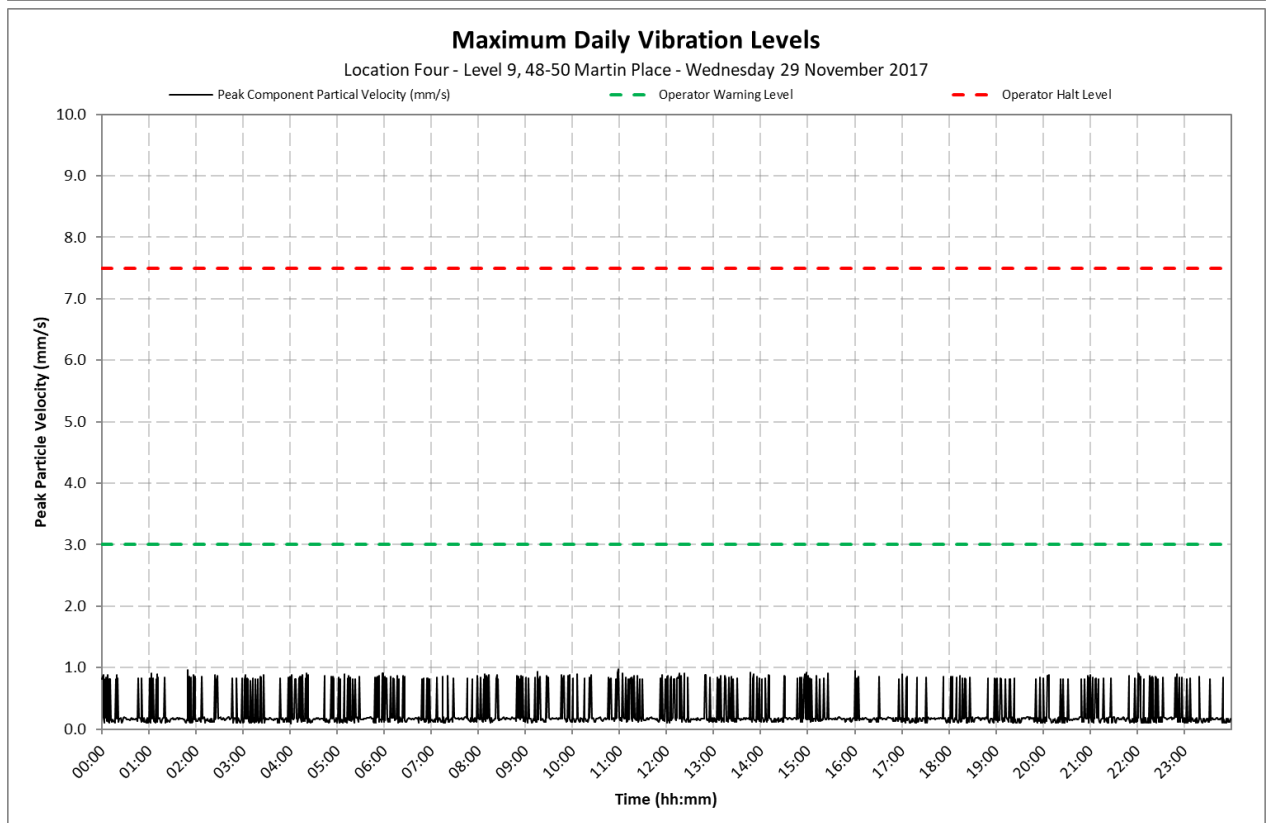
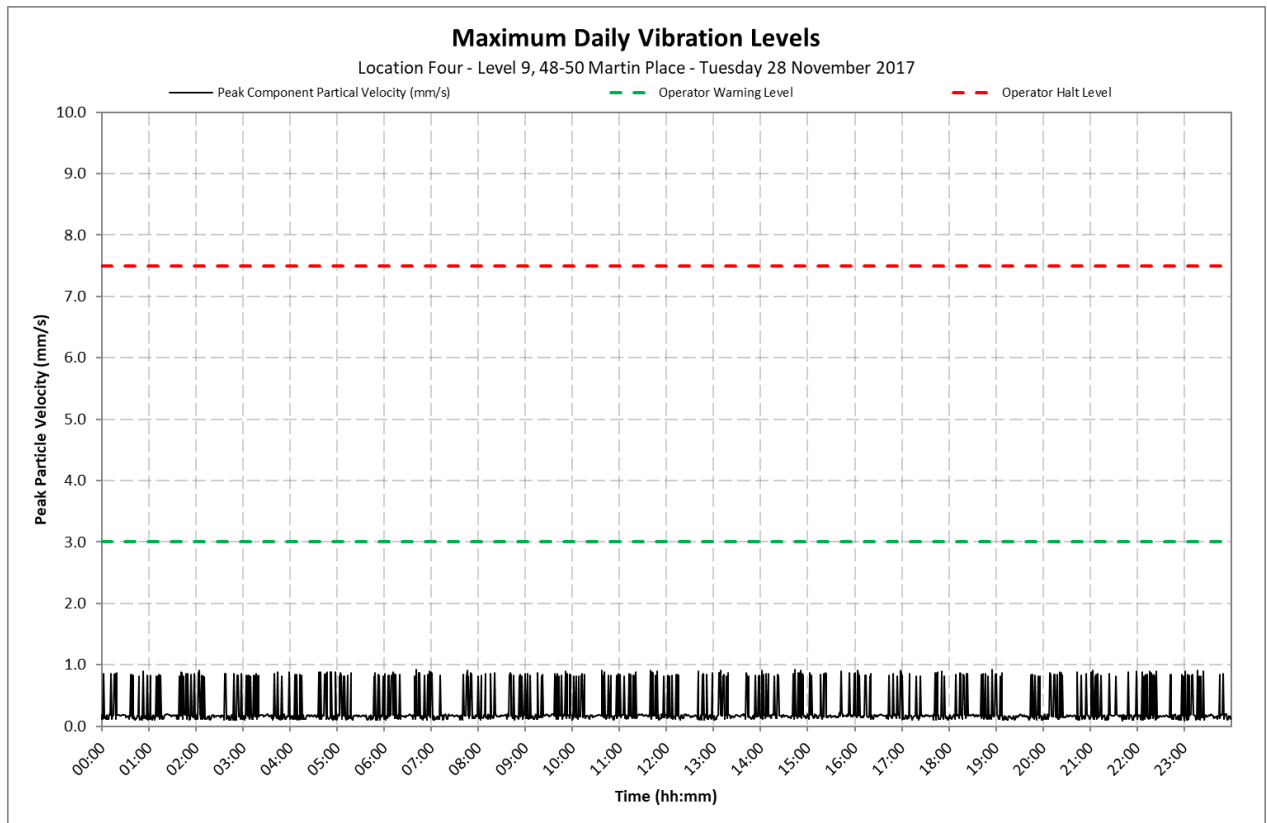
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

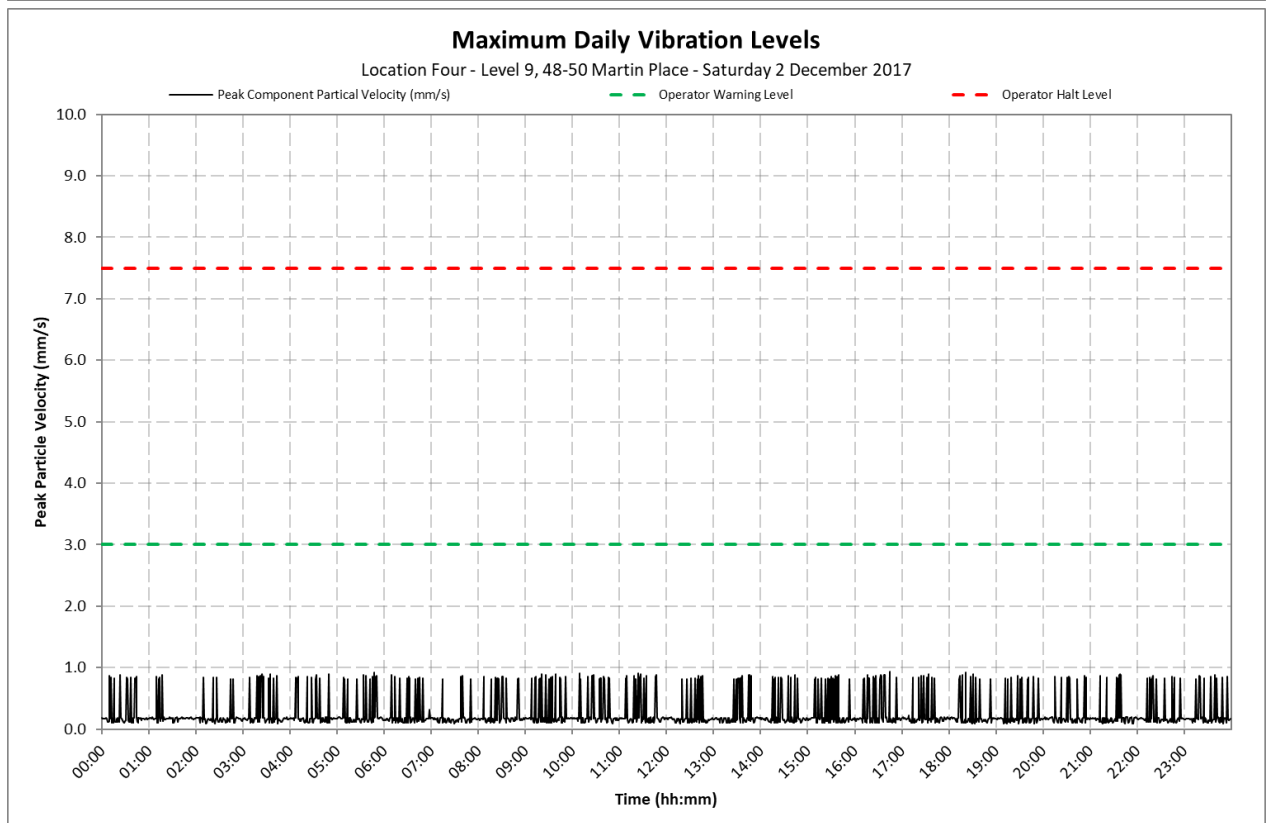
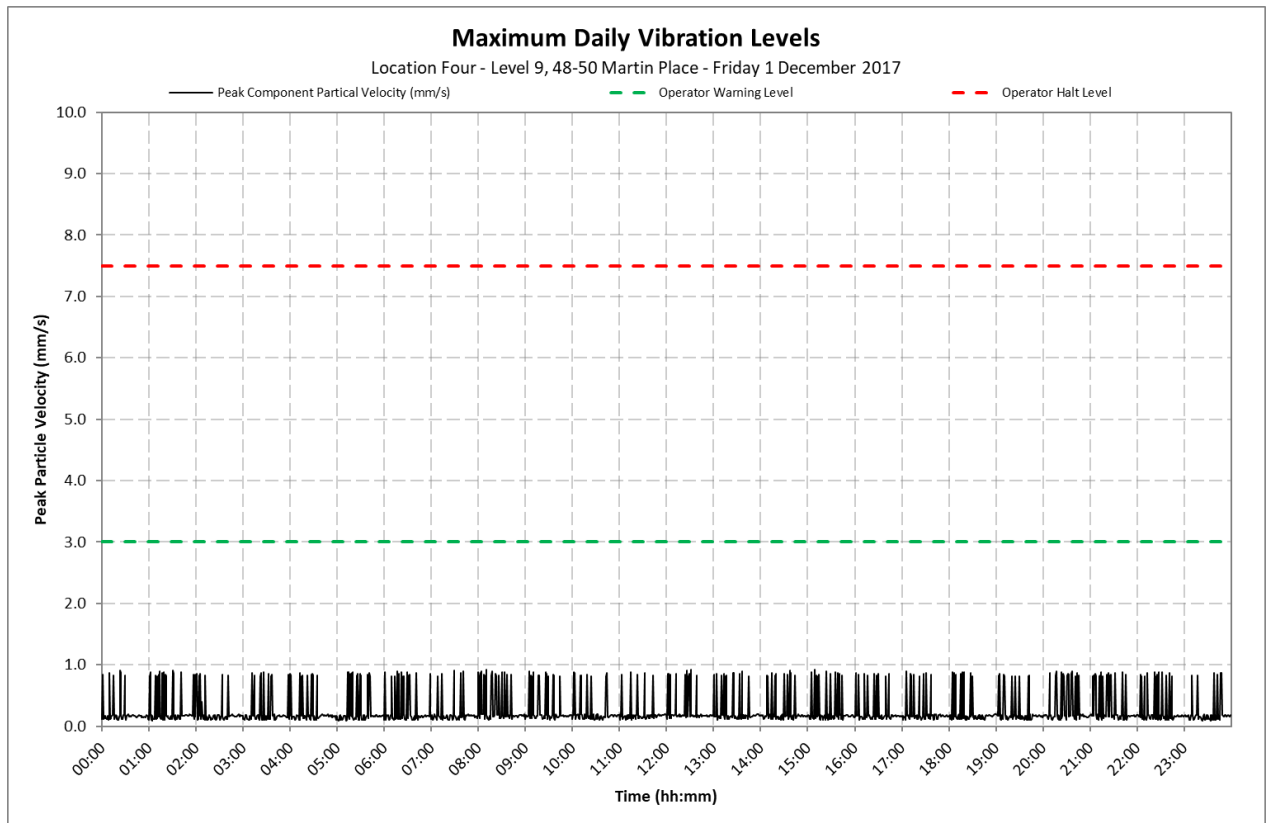
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

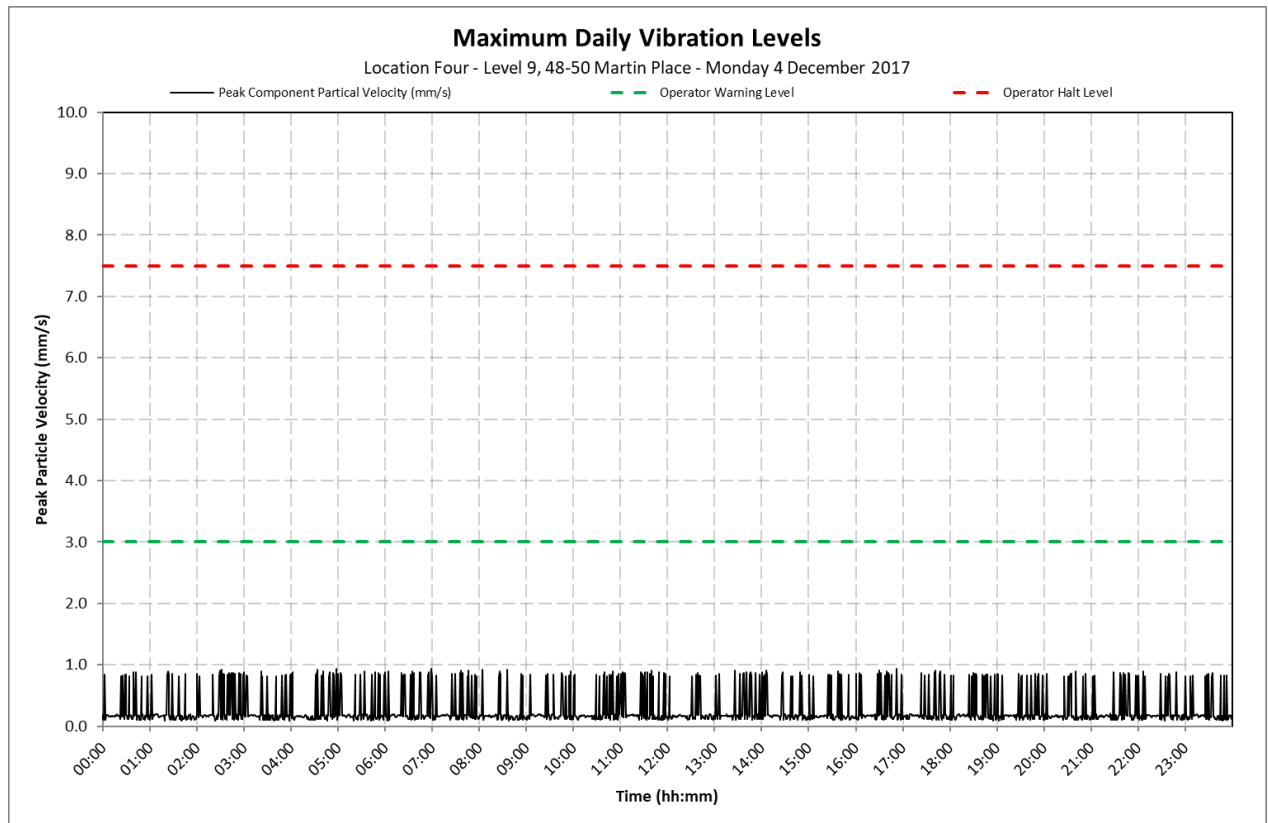
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place



12 December 2017

10-1380 R10 NV Monitoring 20171212.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 10
5 December to 11 December 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 5 December to 11 December 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

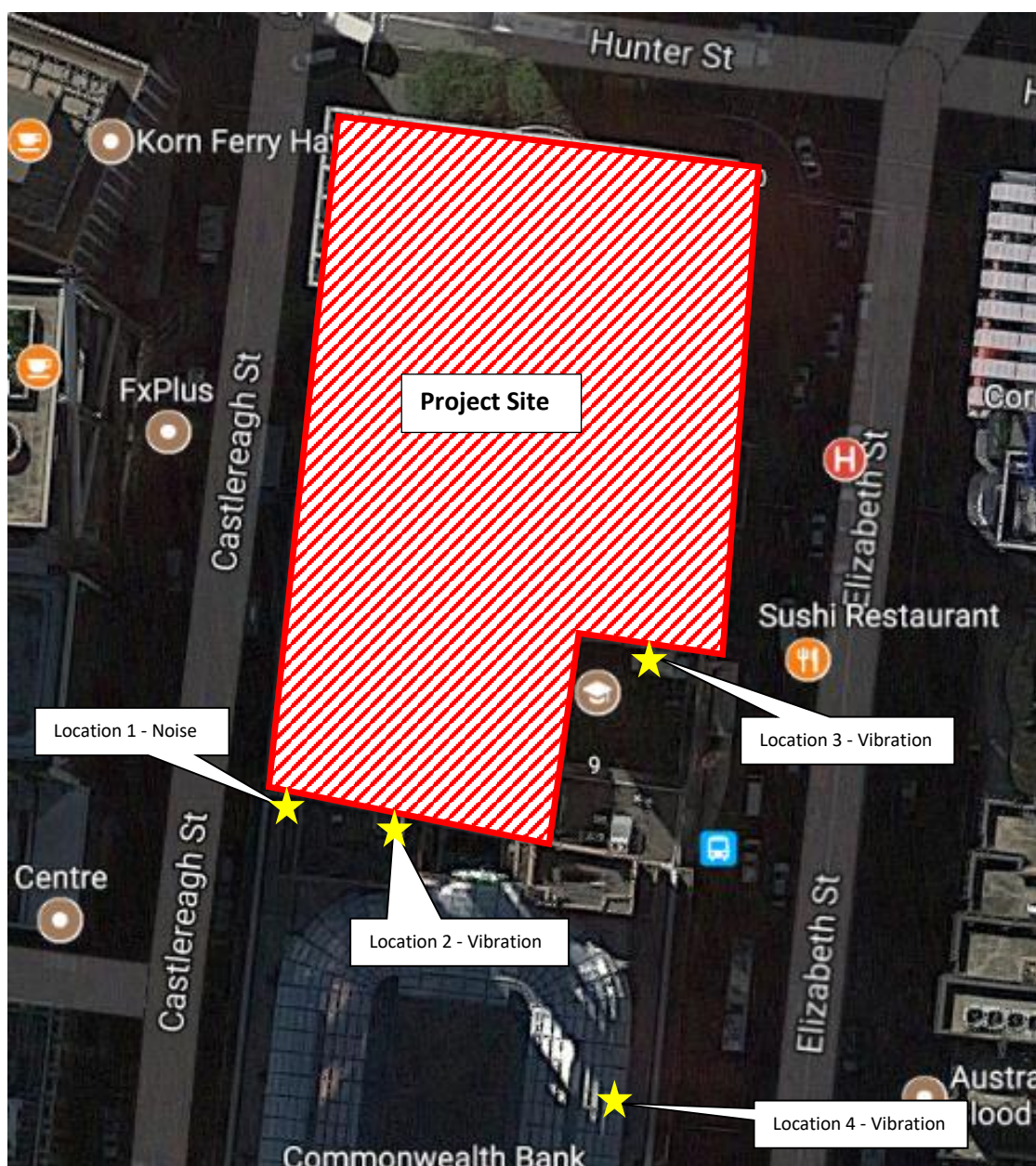
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 5 December to 11 December 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
5 December 2017	45	43	Complies	Complies
6 December 2017	45	44	Complies	Complies
7 December 2017	46	44	Complies	Complies
8 December 2017	46	44	Complies	Complies
9 December 2017	38	36	Complies	Complies
10 December 2017	34	33	Complies	Complies
11 December 2017	37	36	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 5 December to 11 December 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
5 December 2017	1.2 mm/s	Complies
6 December 2017	0.7 mm/s	Complies
7 December 2017	1.1 mm/s	Complies
8 December 2017	0.9 mm/s	Complies
9 December 2017	1.1 mm/s	Complies
10 December 2017	0.2 mm/s	Complies
11 December 2017	0.8 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
5 December 2017	0.9 mm/s	Complies
6 December 2017	1.0 mm/s	Complies
7 December 2017	1.0 mm/s	Complies
8 December 2017	1.0 mm/s	Complies
9 December 2017	1.0 mm/s	Complies
10 December 2017	0.9 mm/s	Complies
11 December 2017	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 5 December to 11 December 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 5 December to 11 December 2017 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

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Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

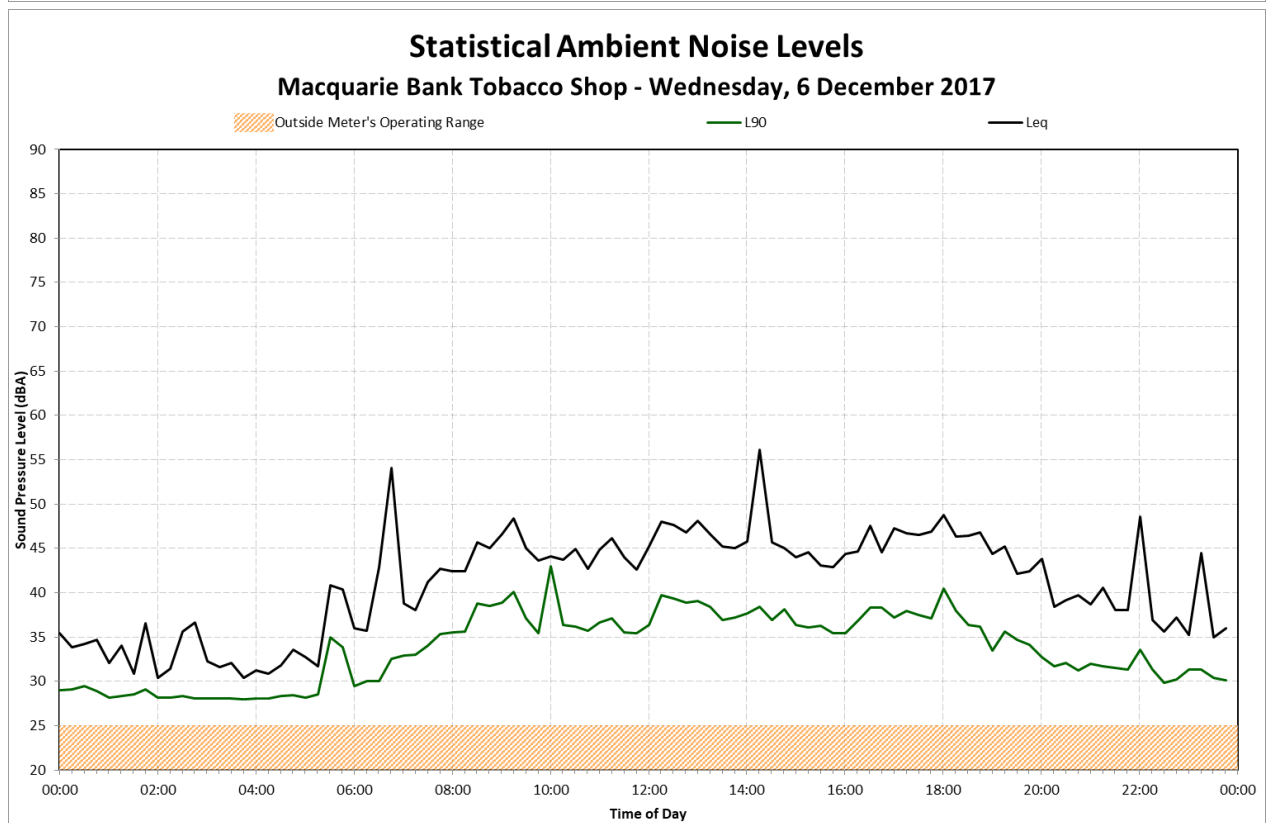
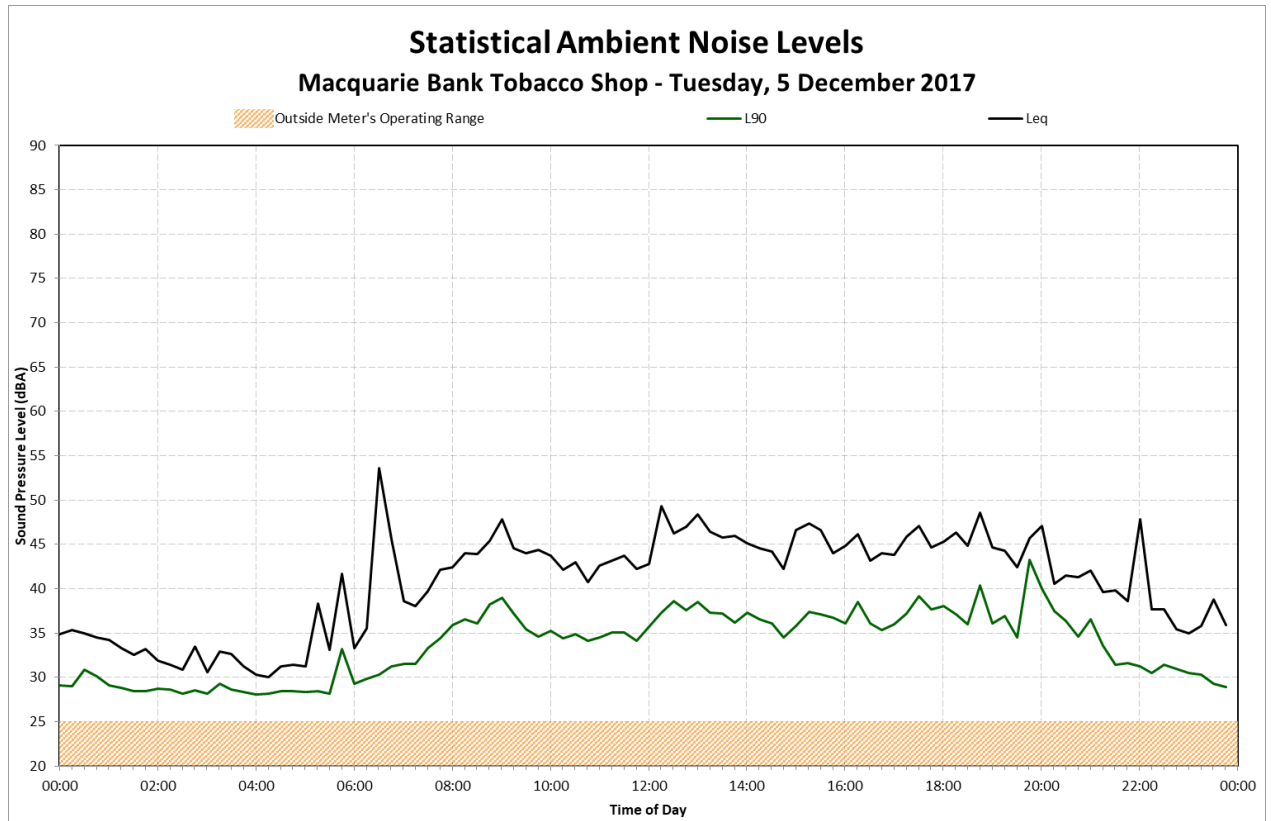
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Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
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Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
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Appendix B

Daily Noise Levels

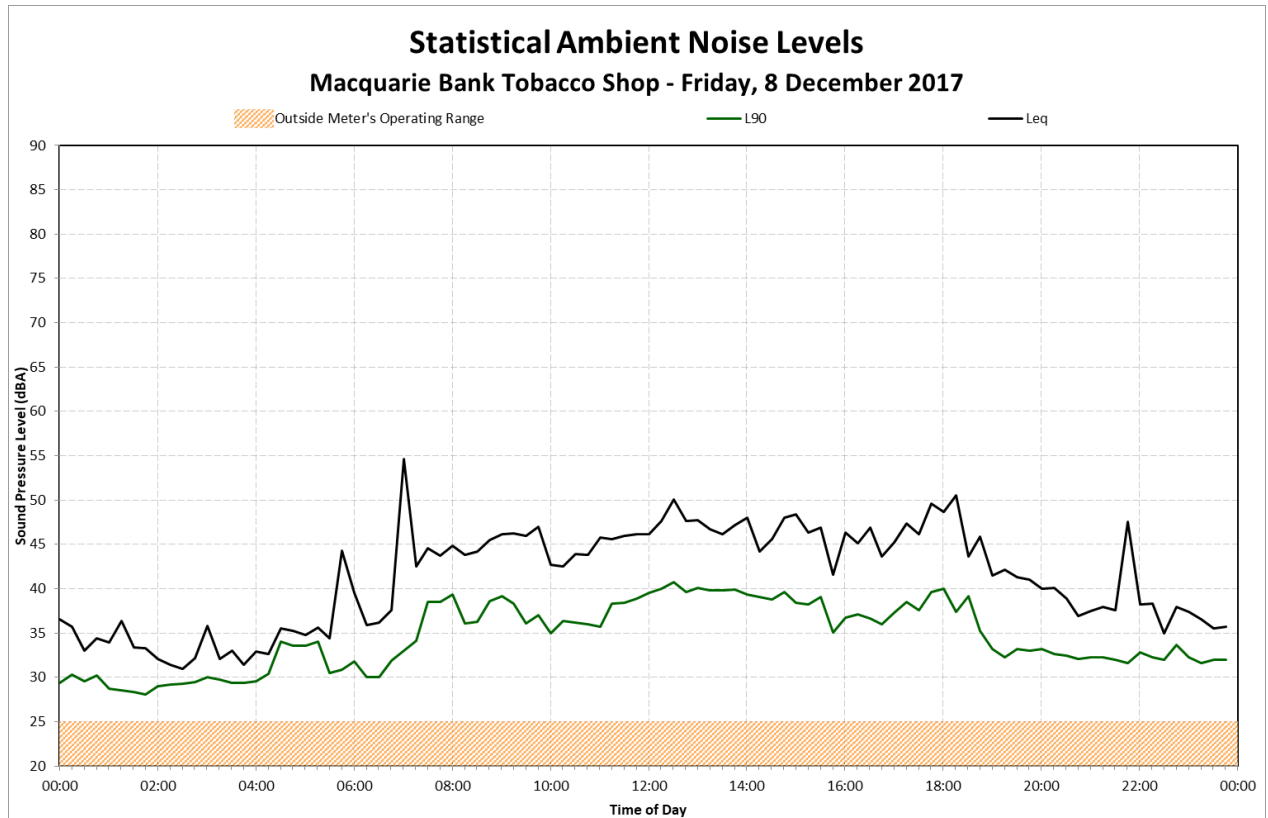
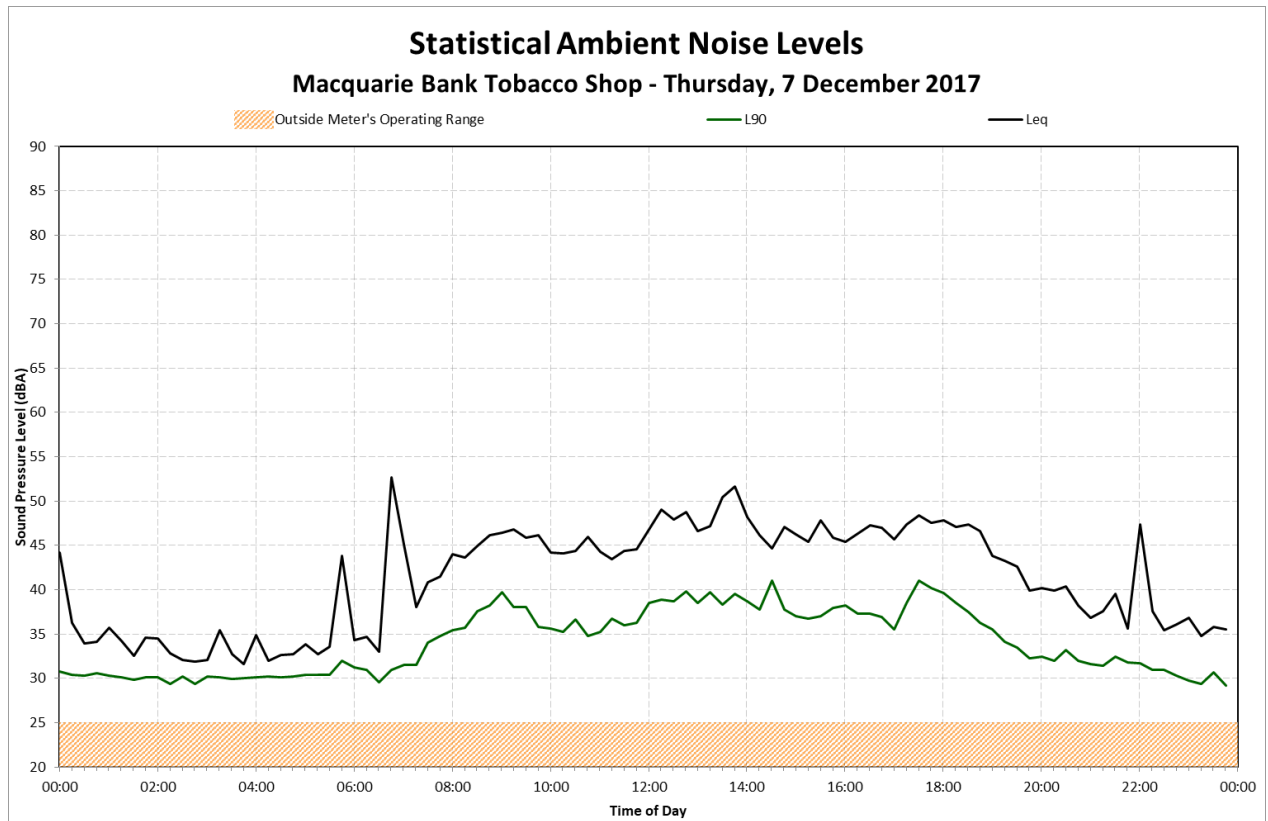
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

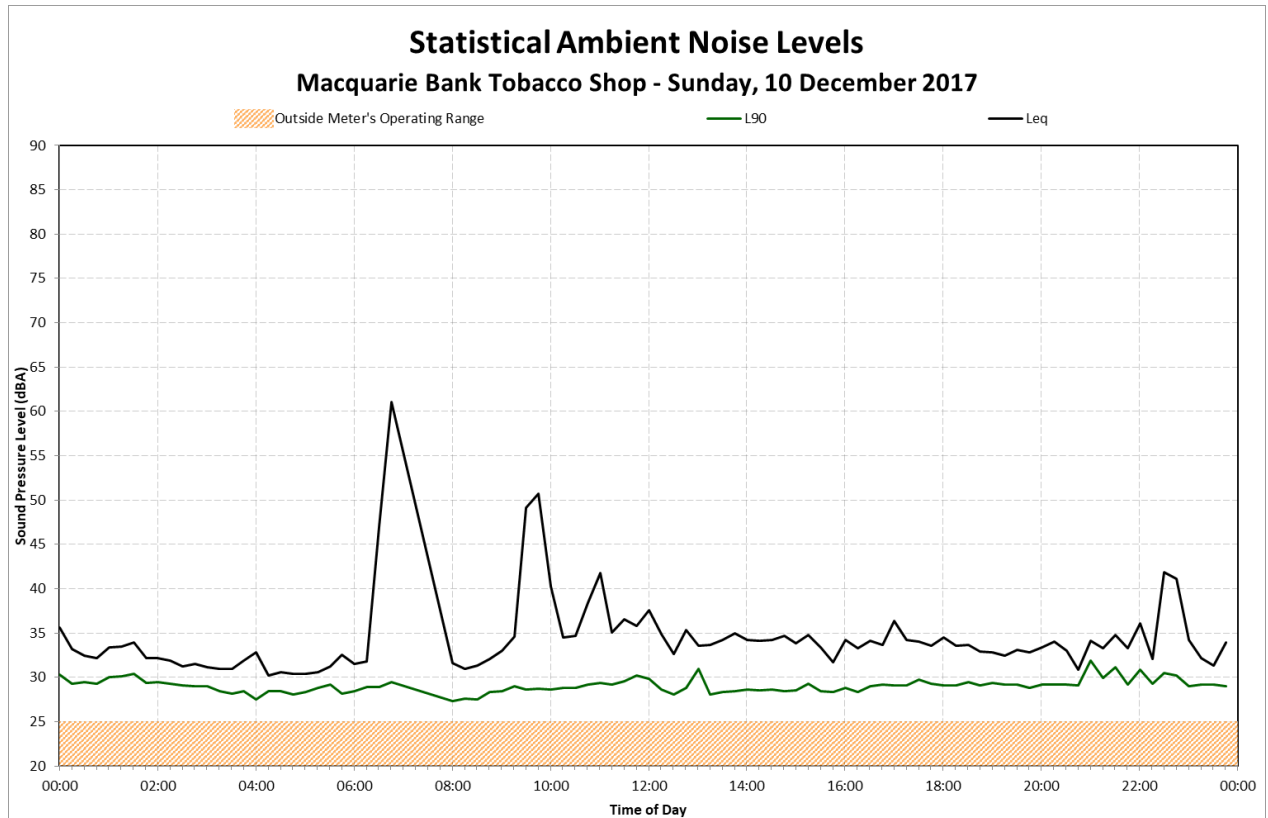
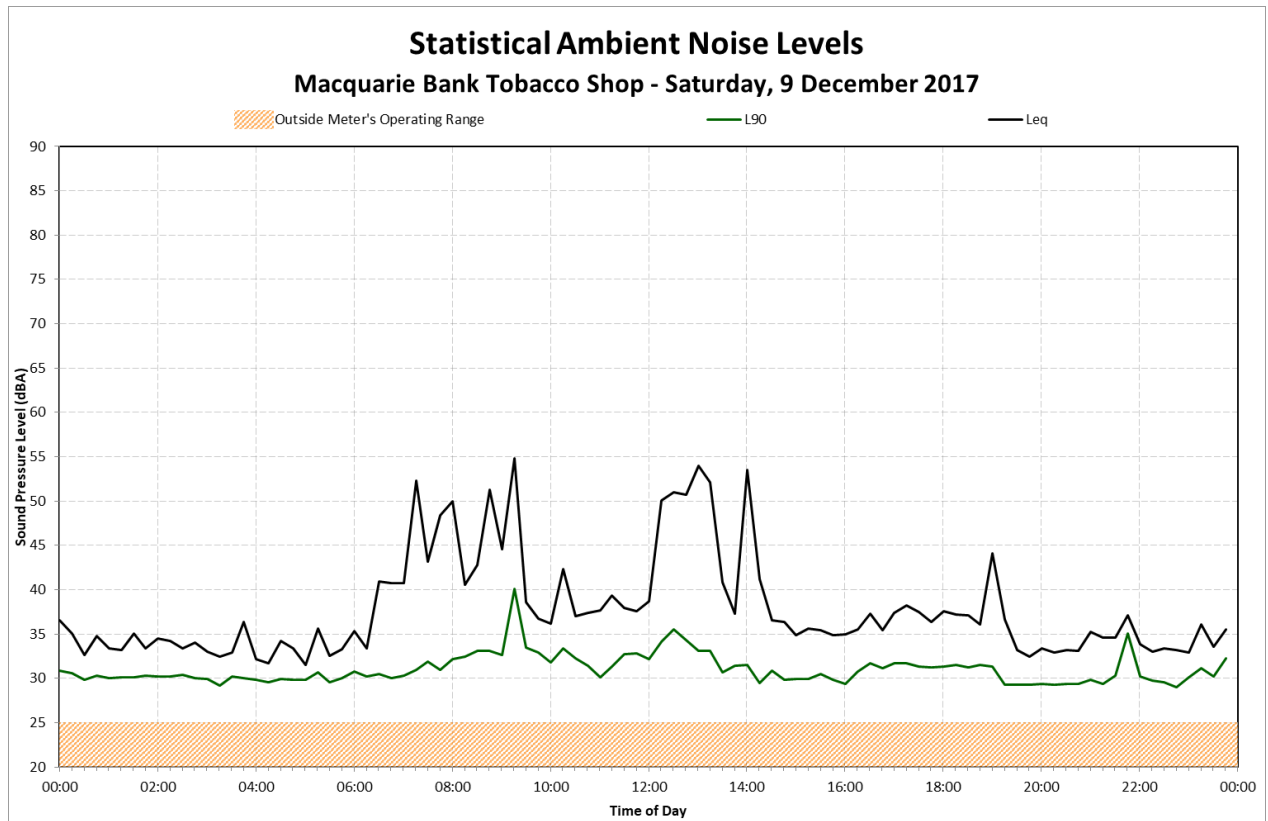
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

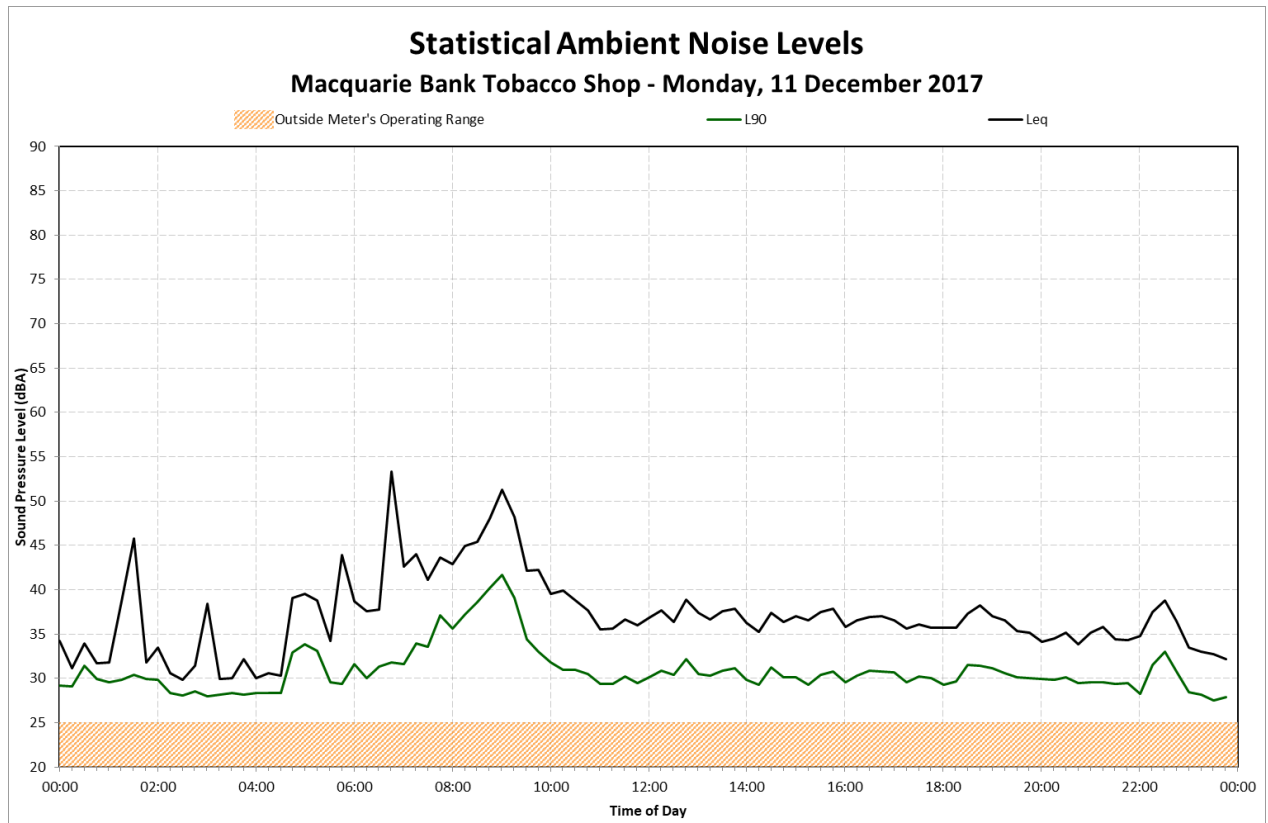
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

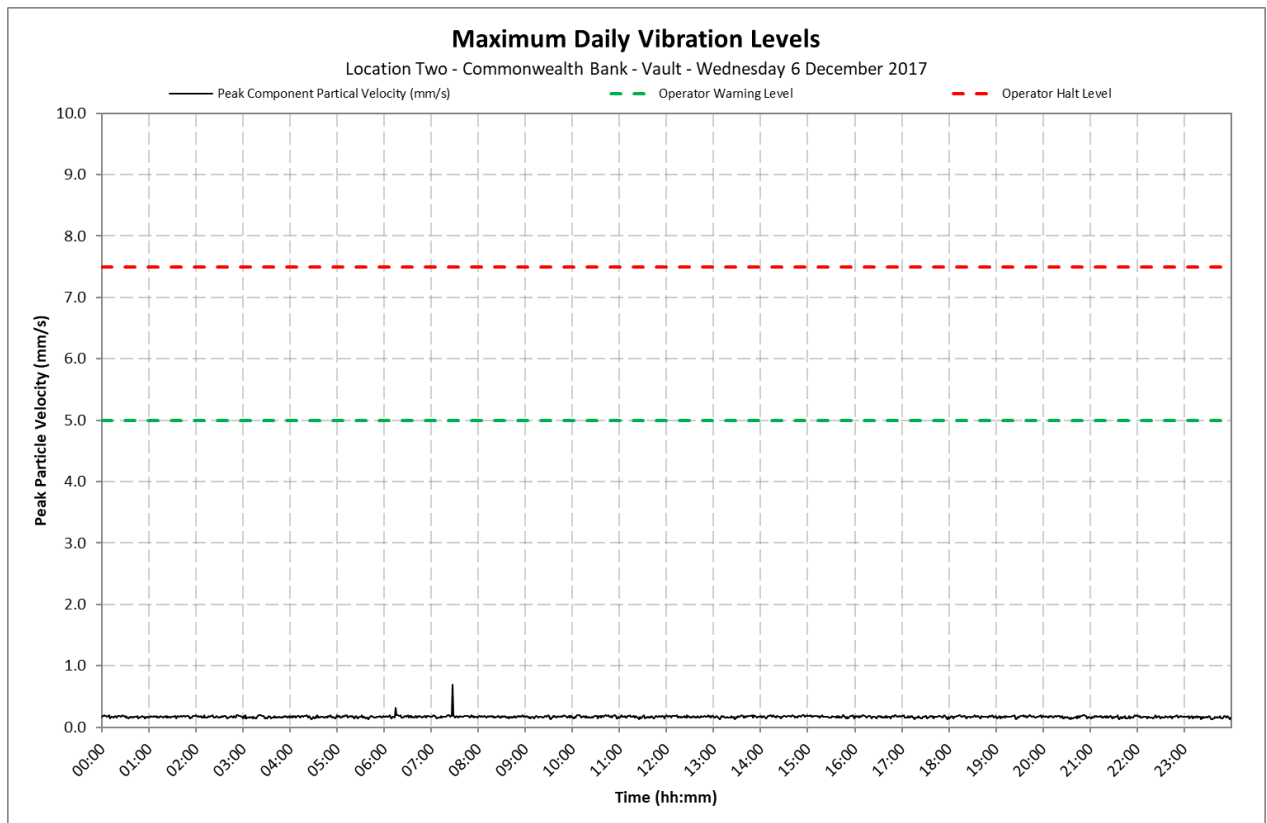
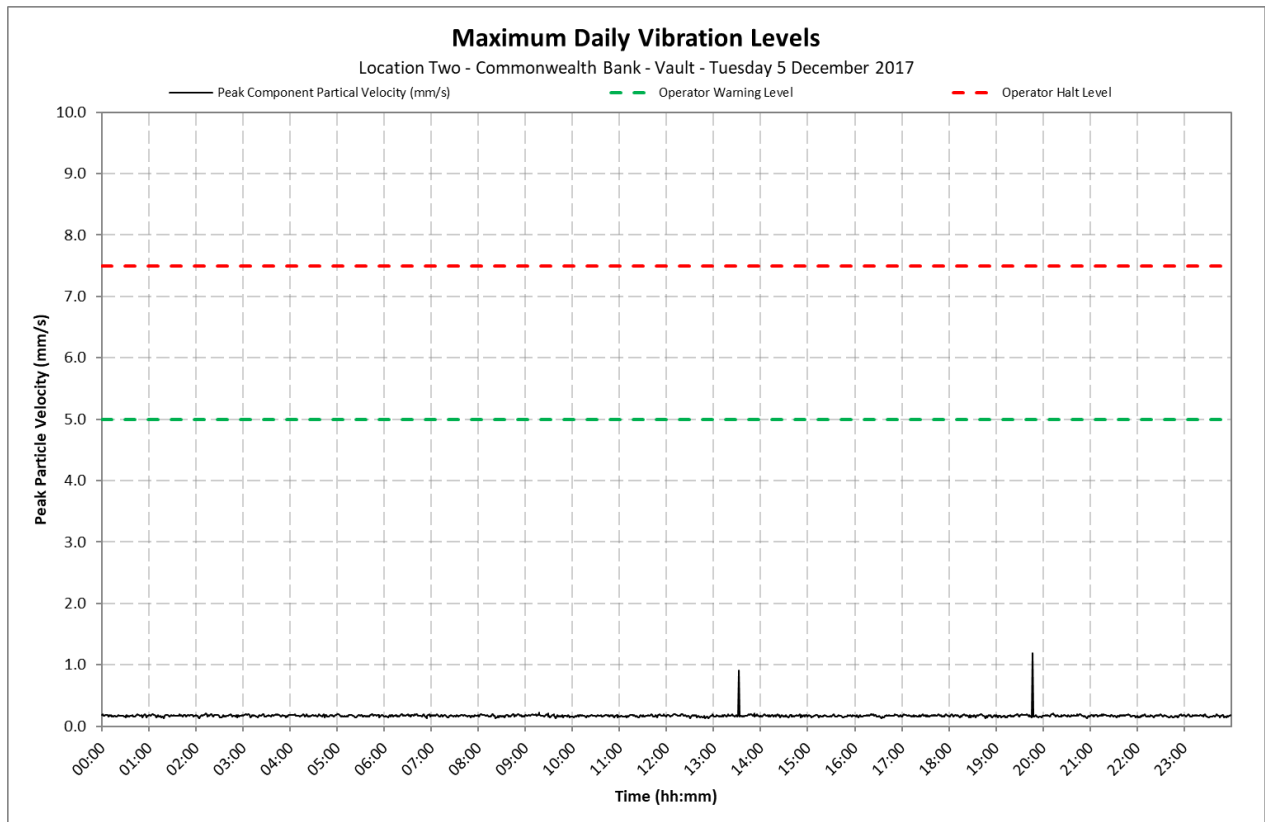
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

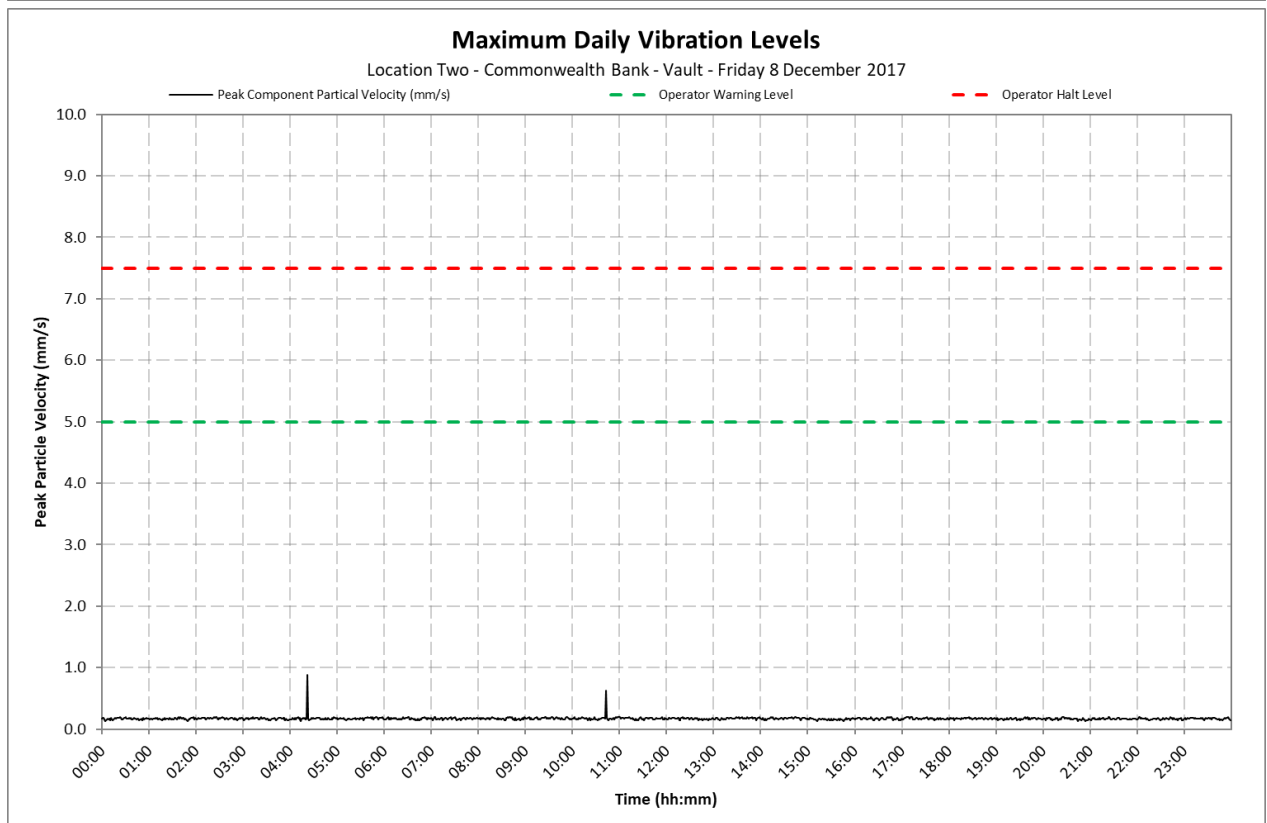
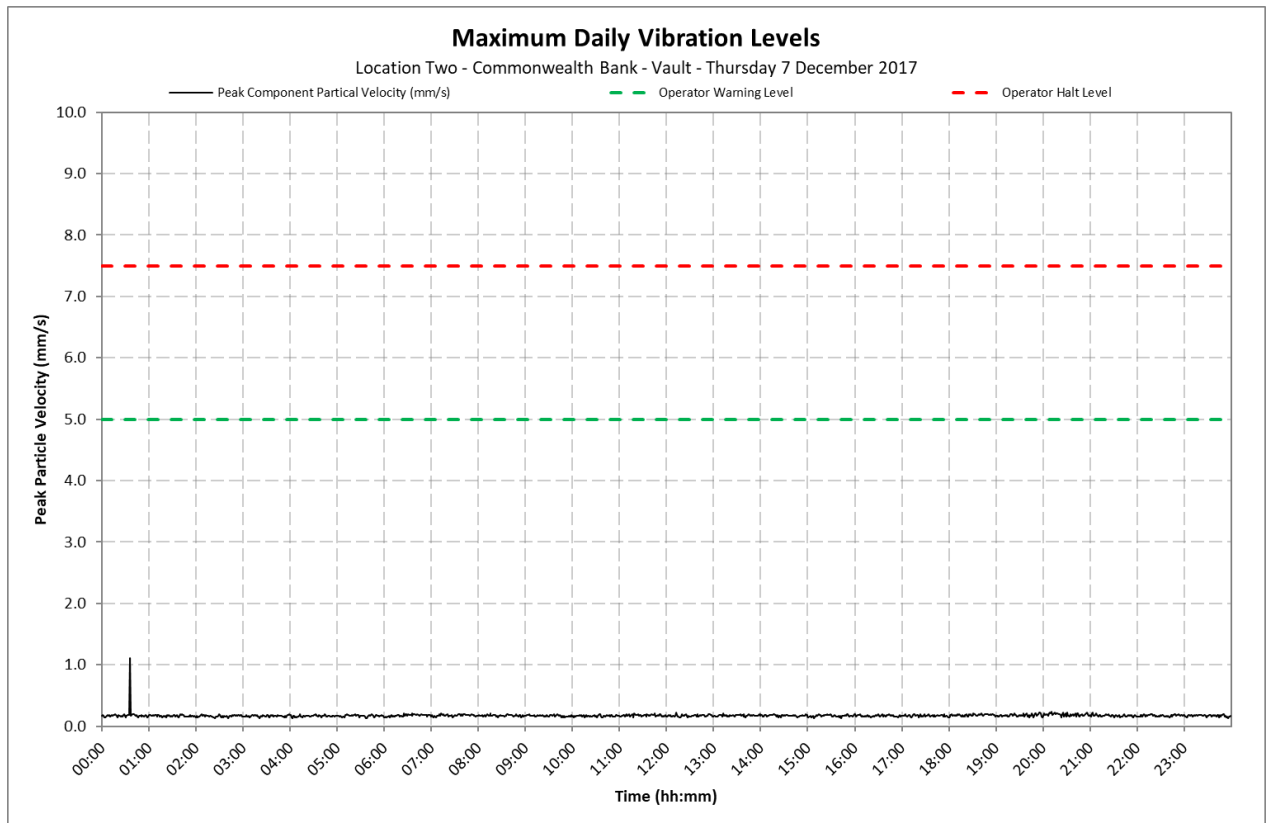
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

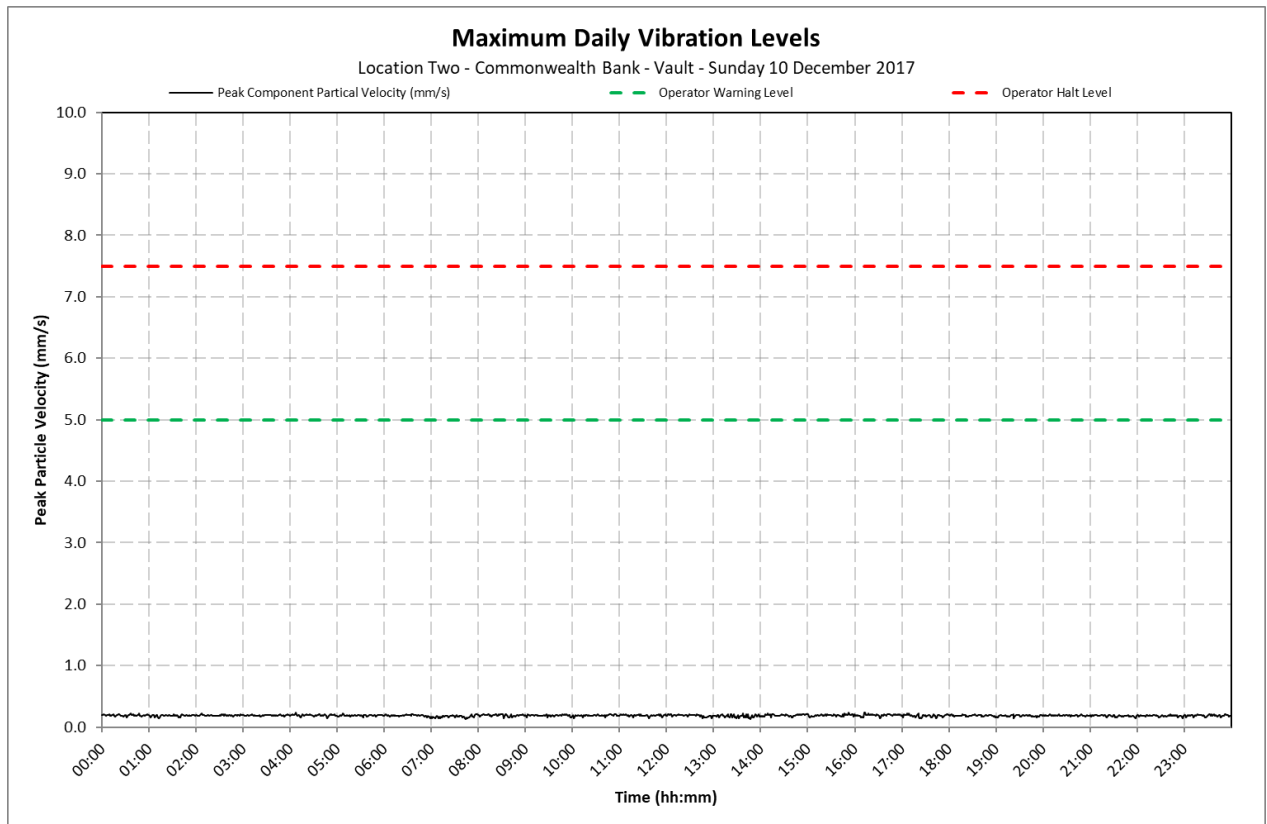
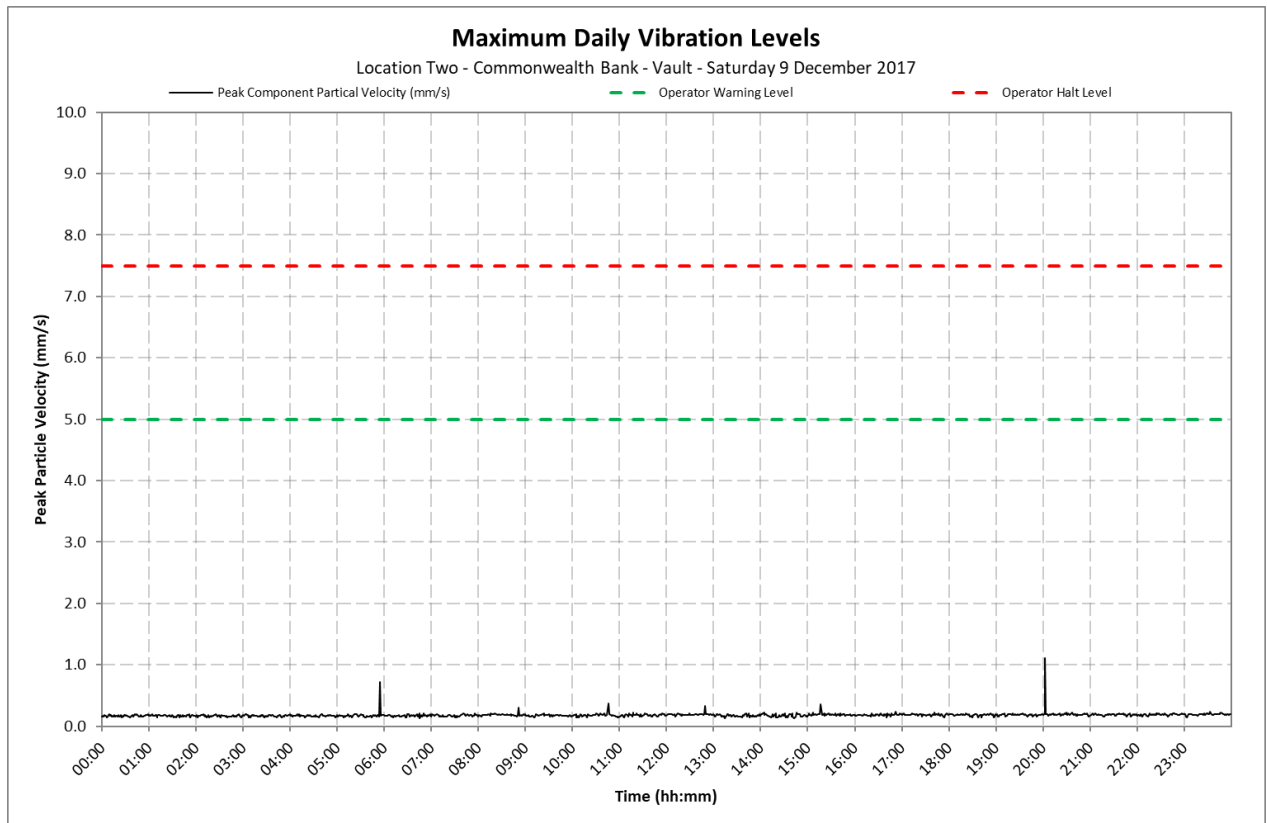
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

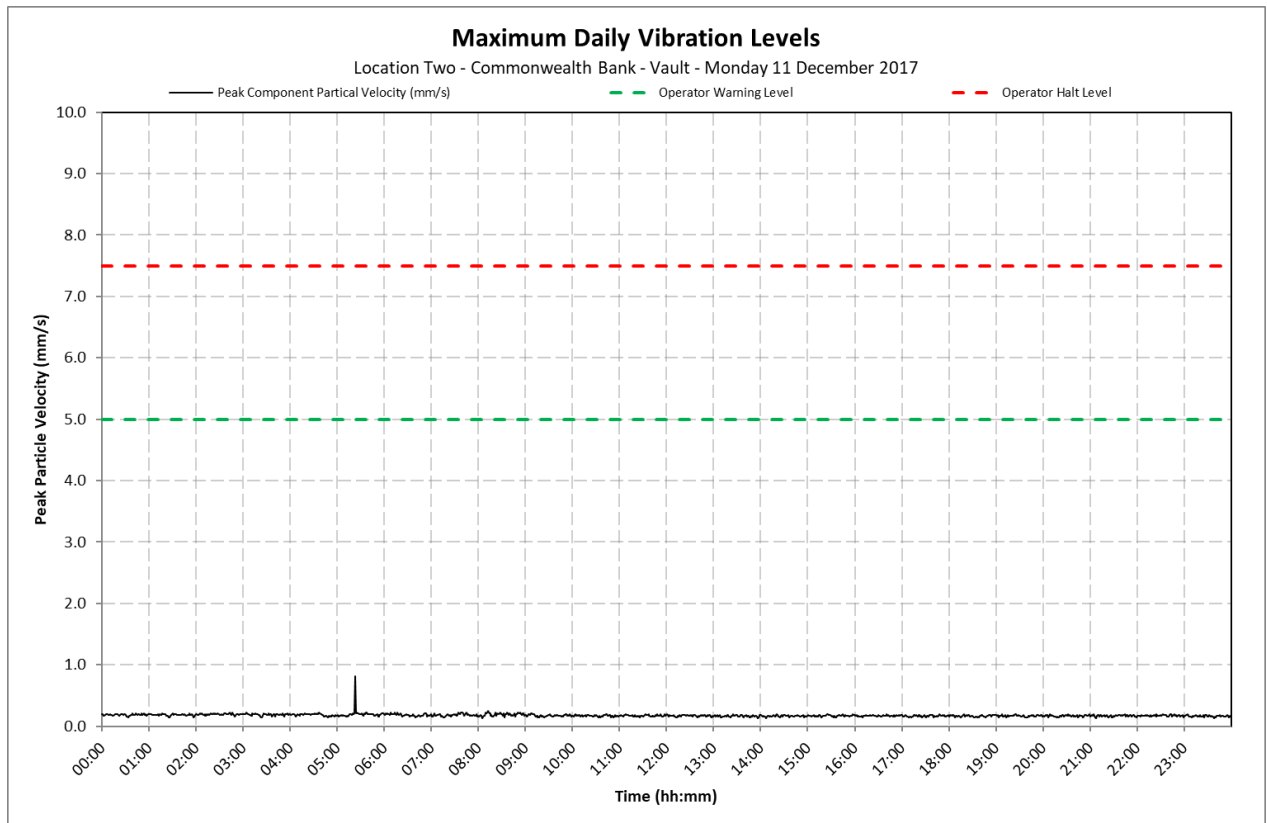
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

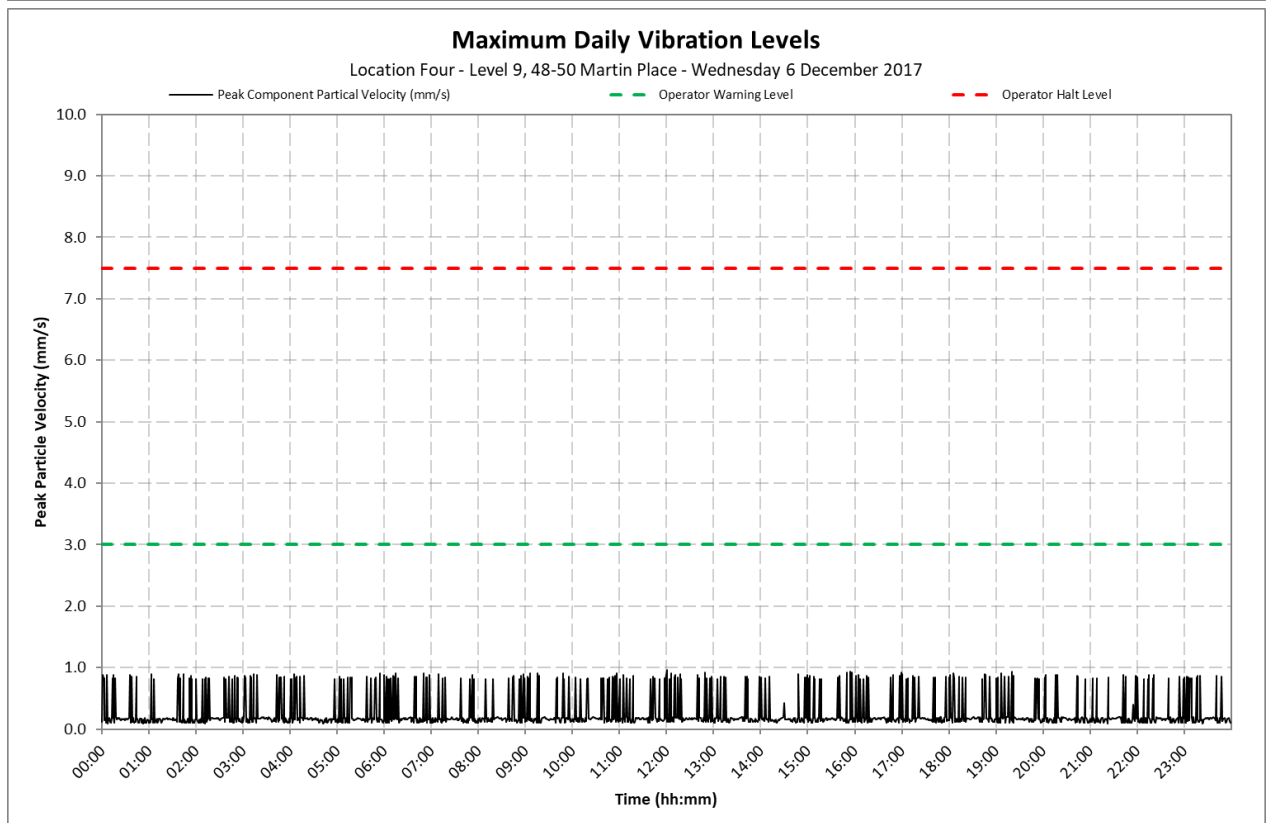
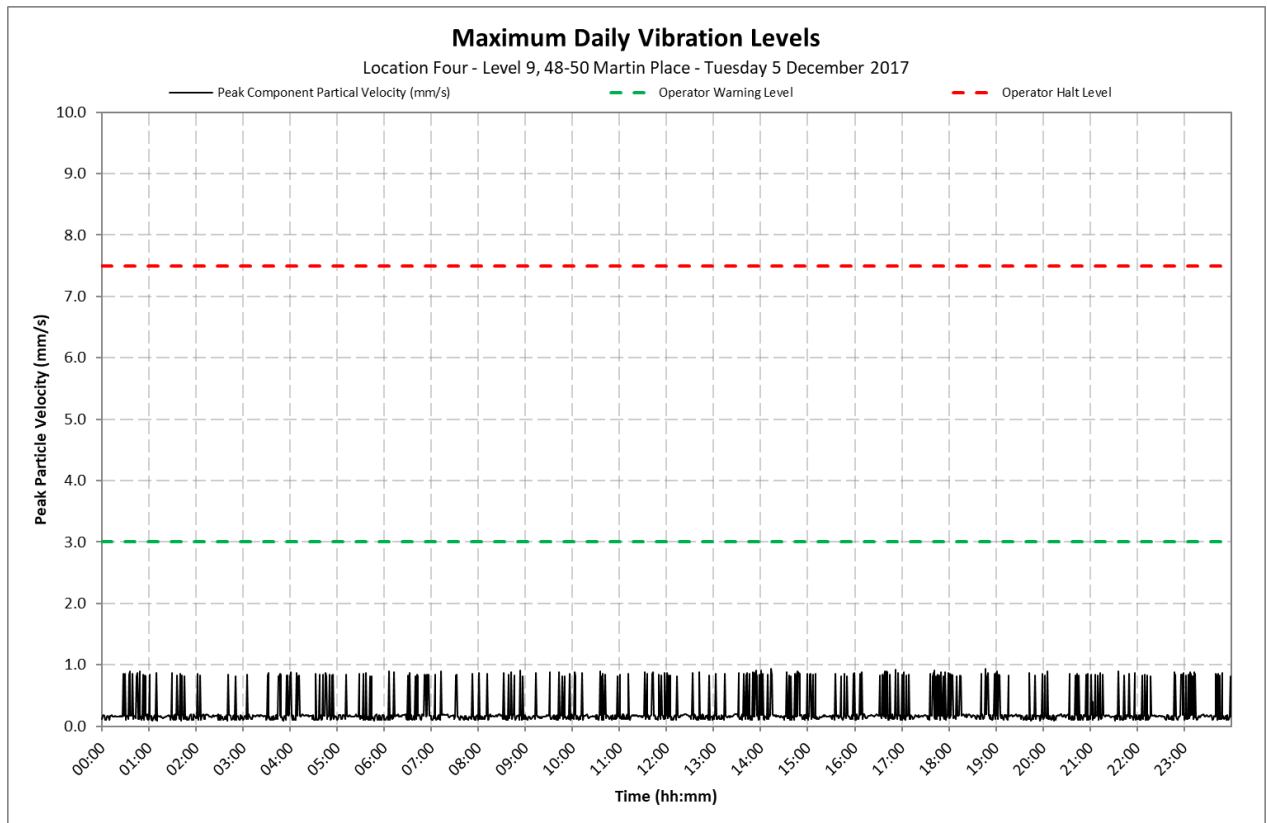
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

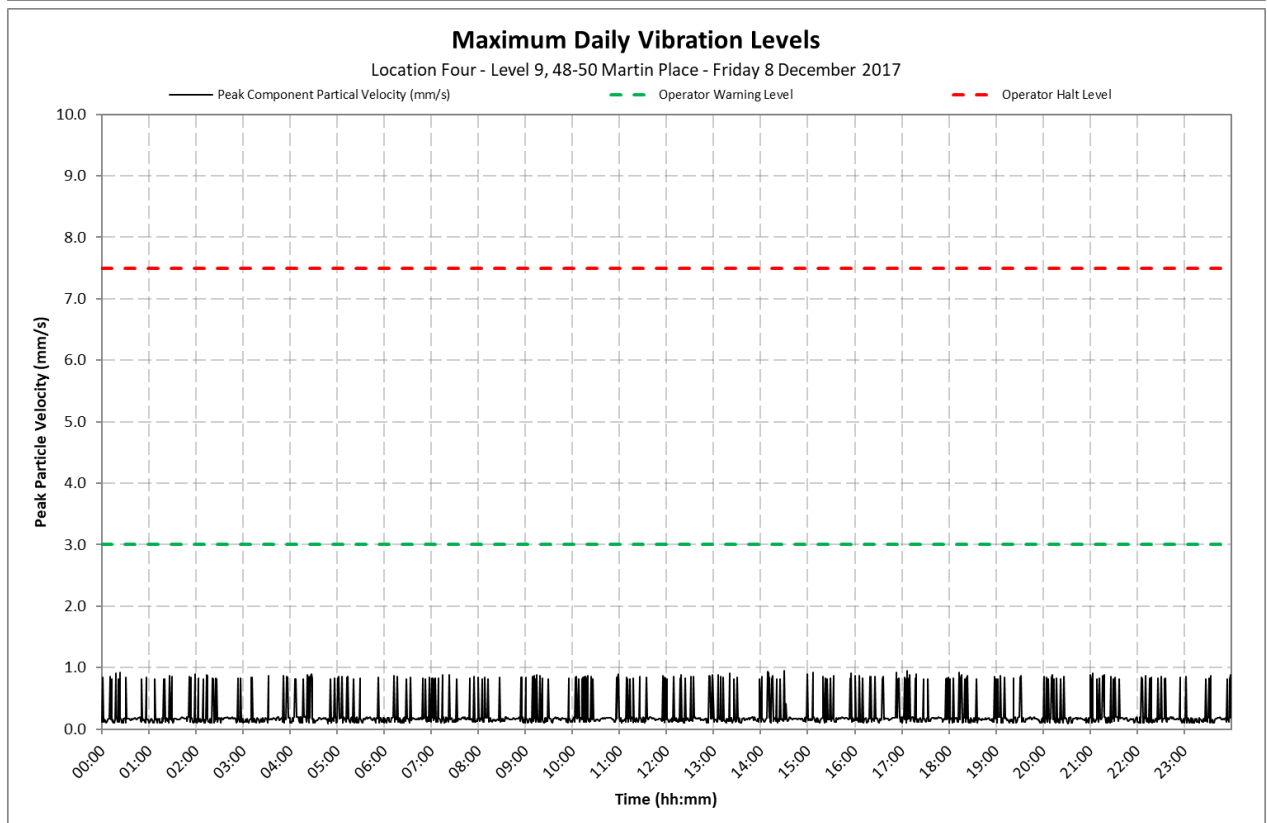
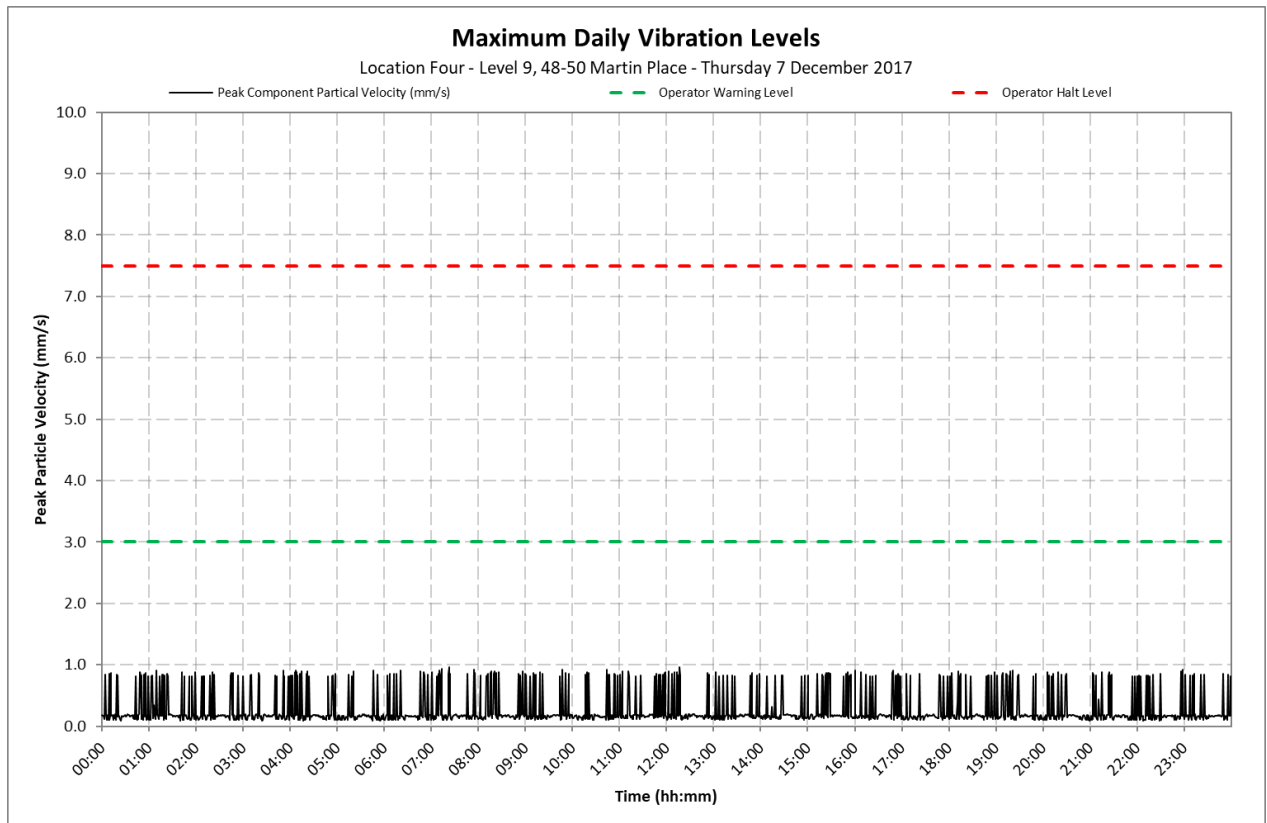
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

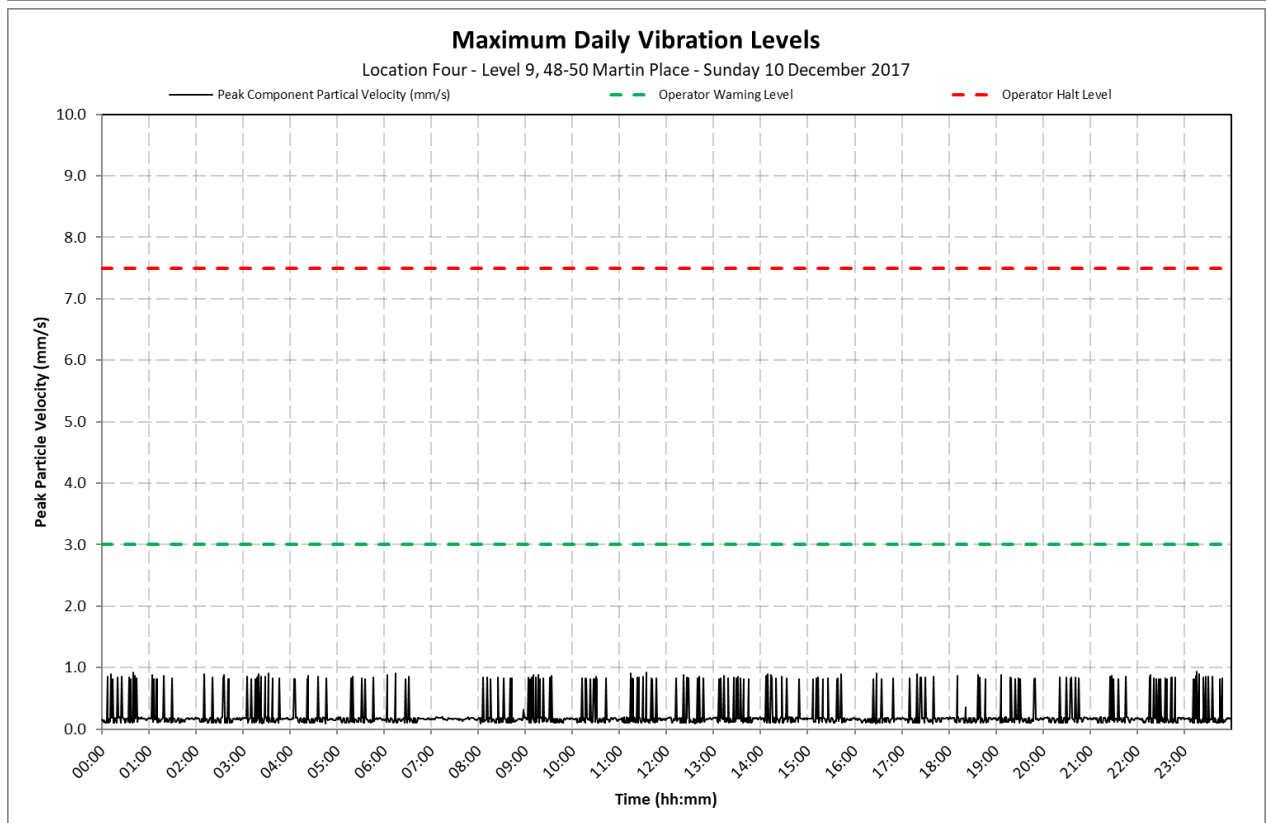
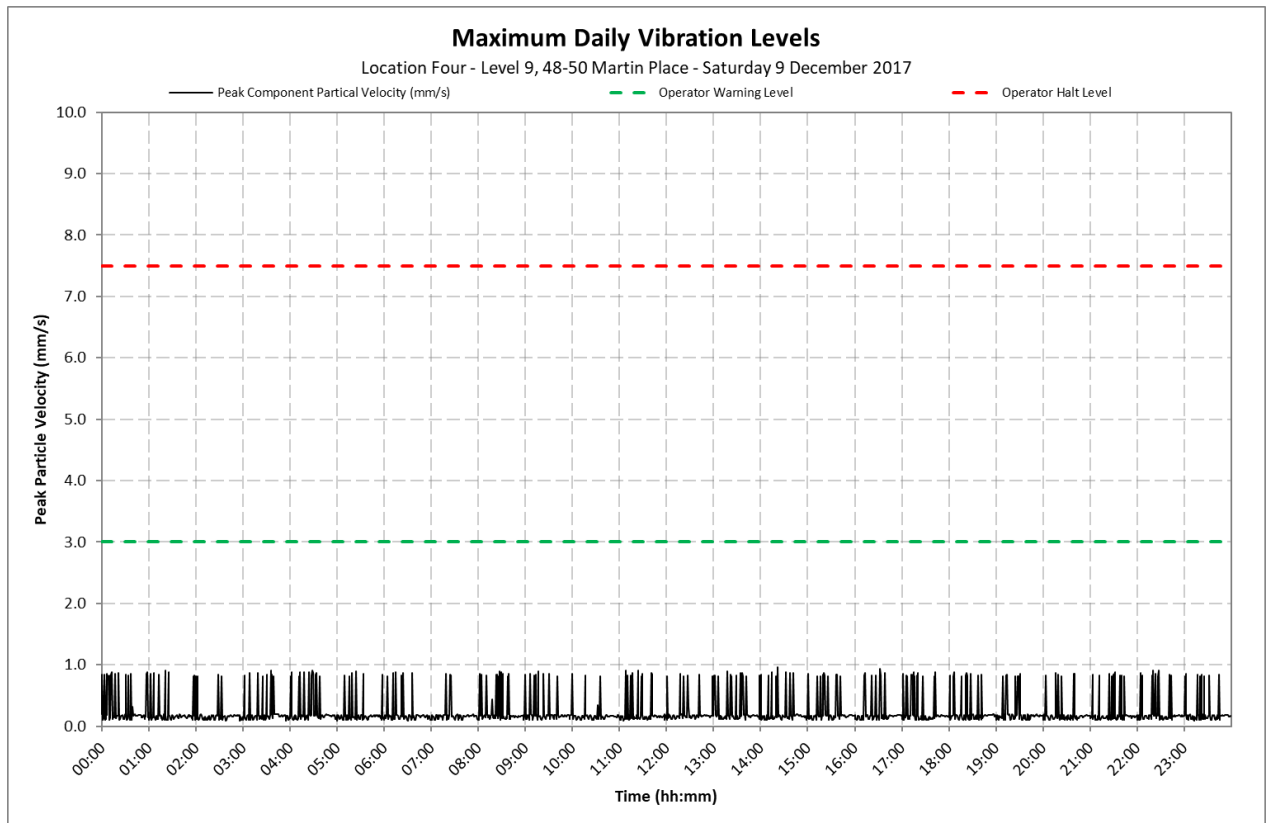
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

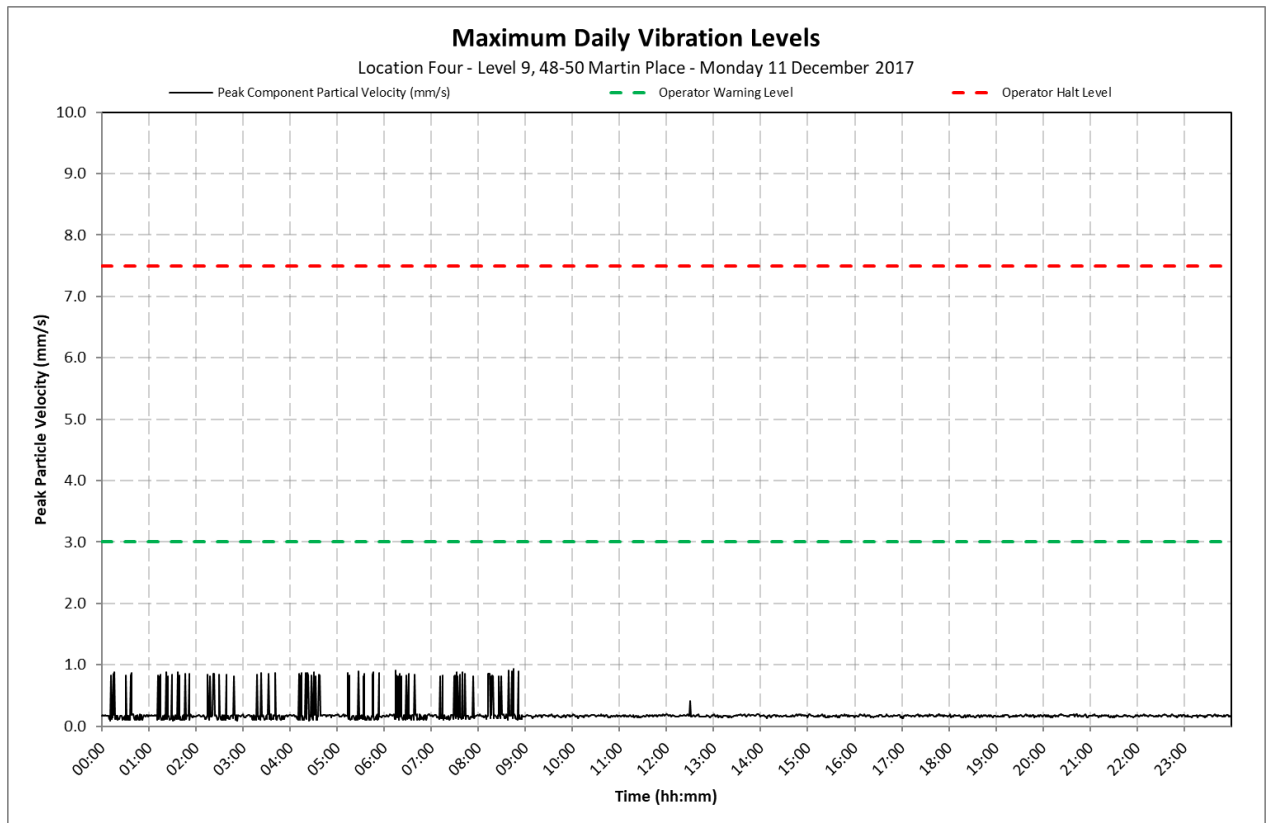
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place



22 December 2017

10-1380 R11 NV Monitoring 20171222.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 11
12 December to 18 December 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 12 December to 18 December 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

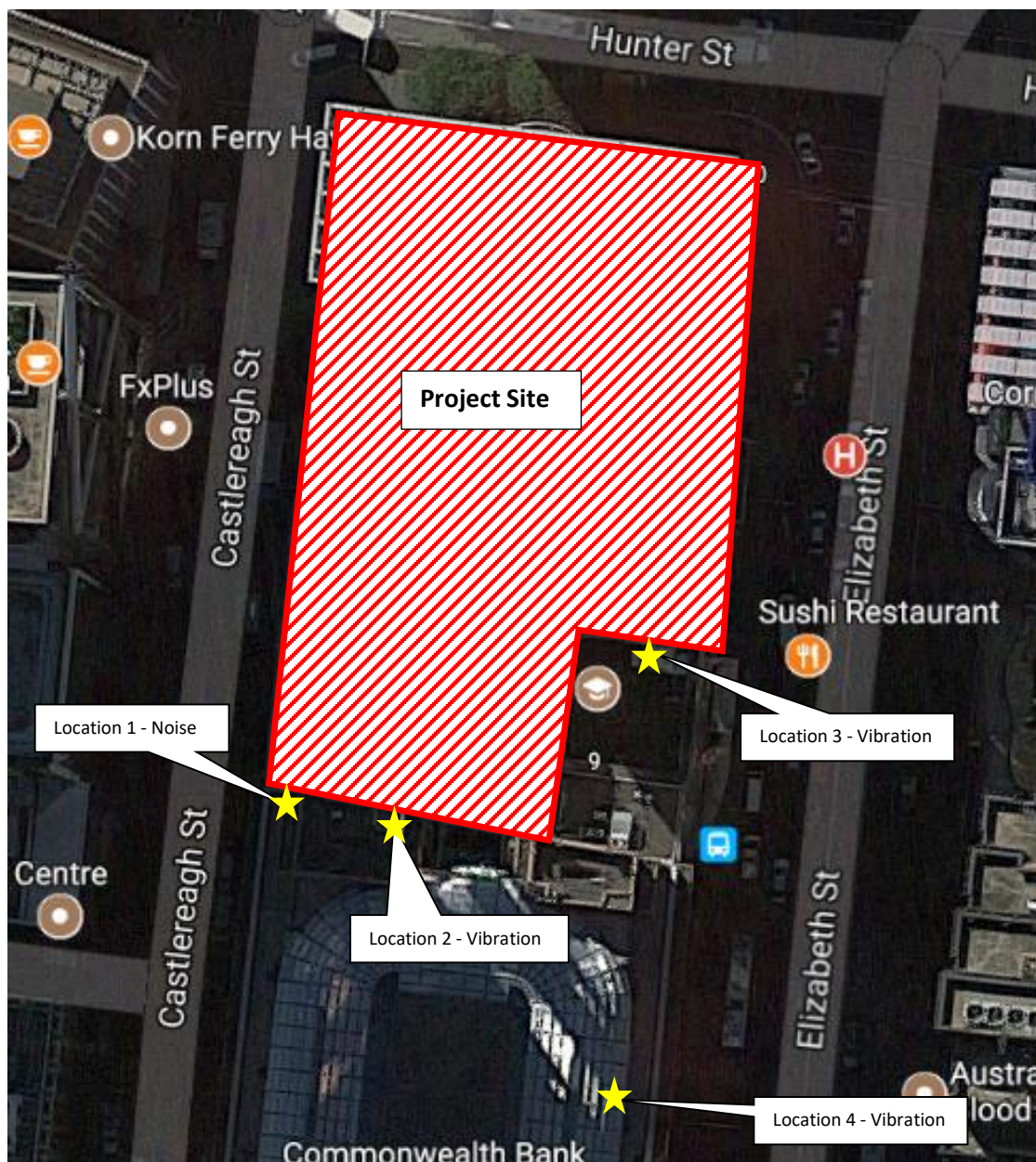
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 12 December to 18 December 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
12 December 2017	43	42	Complies	Complies
13 December 2017	45	44	Complies	Complies
14 December 2017	46	44	Complies	Complies
15 December 2017	46	45	Complies	Complies
16 December 2017	46	44	Complies	Complies
17 December 2017	39	39	Complies	Complies
18 December 2017	37	36	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 12 December to 18 December 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
12 December 2017	1.1 mm/s	Complies
13 December 2017	1.1 mm/s	Complies
14 December 2017	1.2 mm/s	Complies
15 December 2017	0.2 mm/s	Complies
16 December 2017	0.8 mm/s	Complies
17 December 2017	0.8 mm/s	Complies
18 December 2017	0.2 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
12 December 2017	0.9 mm/s	Complies
13 December 2017	1.0 mm/s	Complies
14 December 2017	0.9 mm/s	Complies
15 December 2017	1.0 mm/s	Complies
16 December 2017	0.9 mm/s	Complies
17 December 2017	0.9 mm/s	Complies
18 December 2017	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 12 December to 18 December 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 12 December to 18 December 2017 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

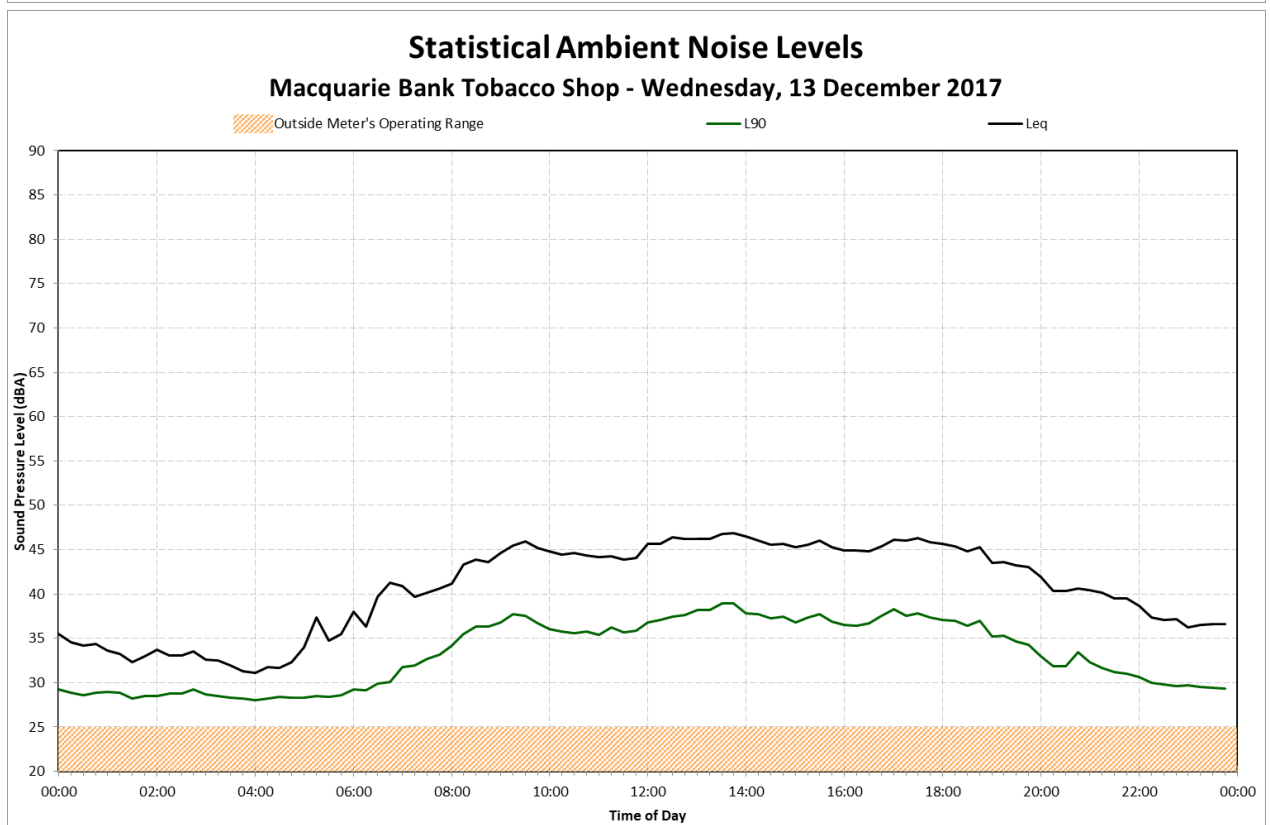
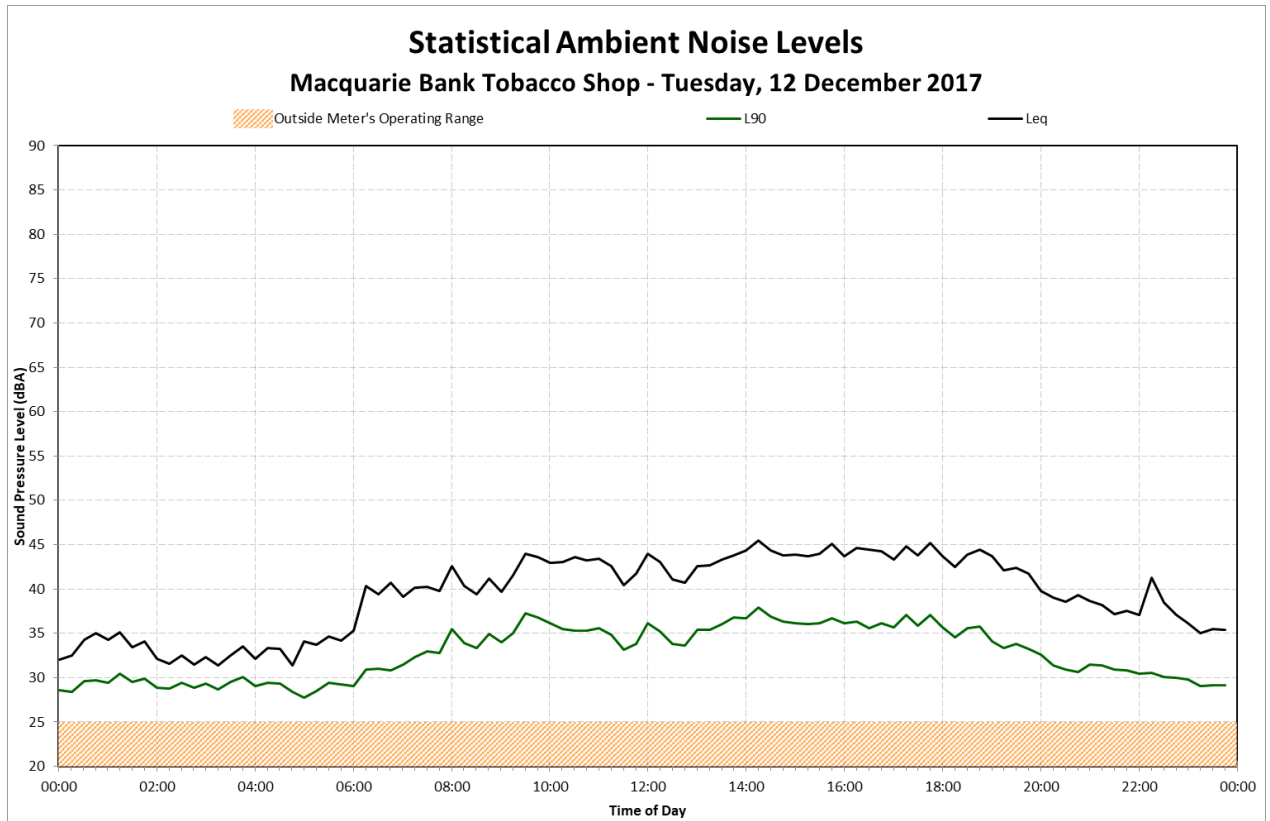
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

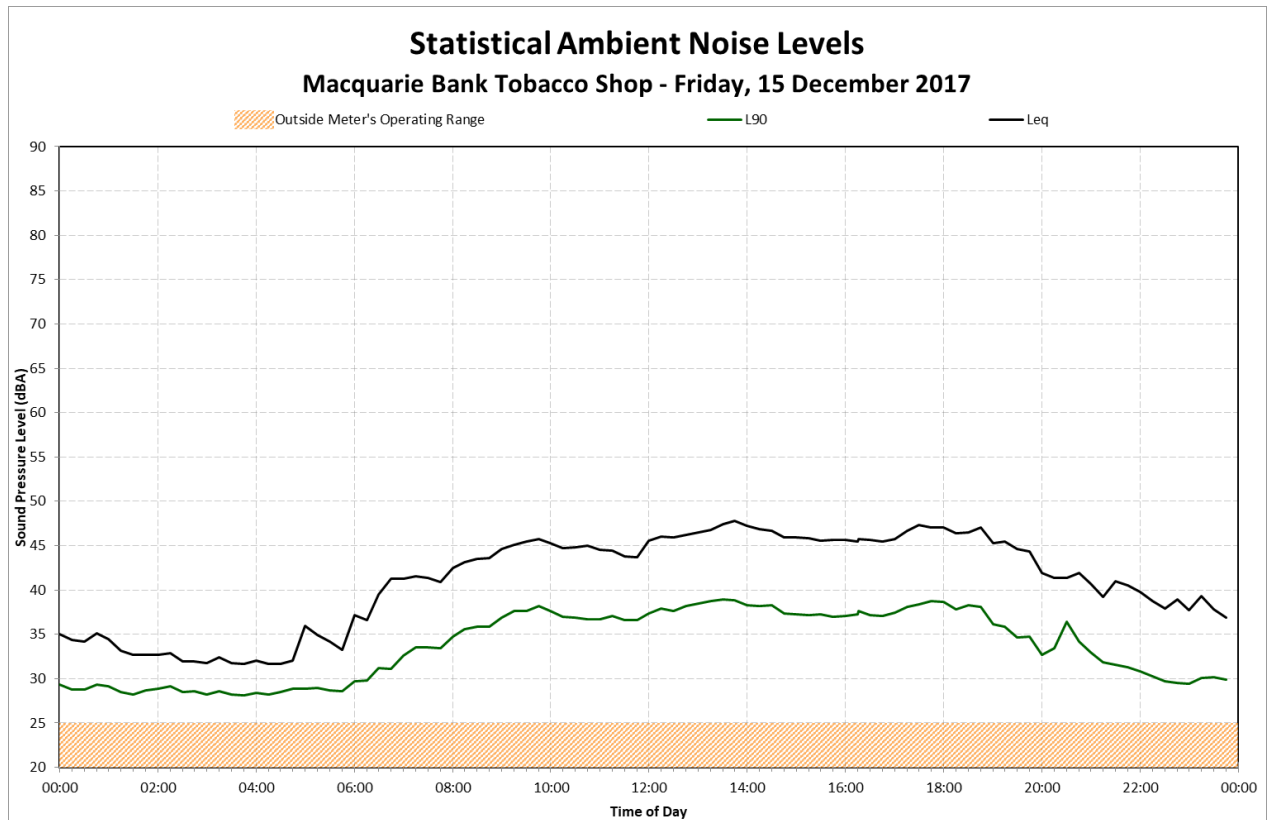
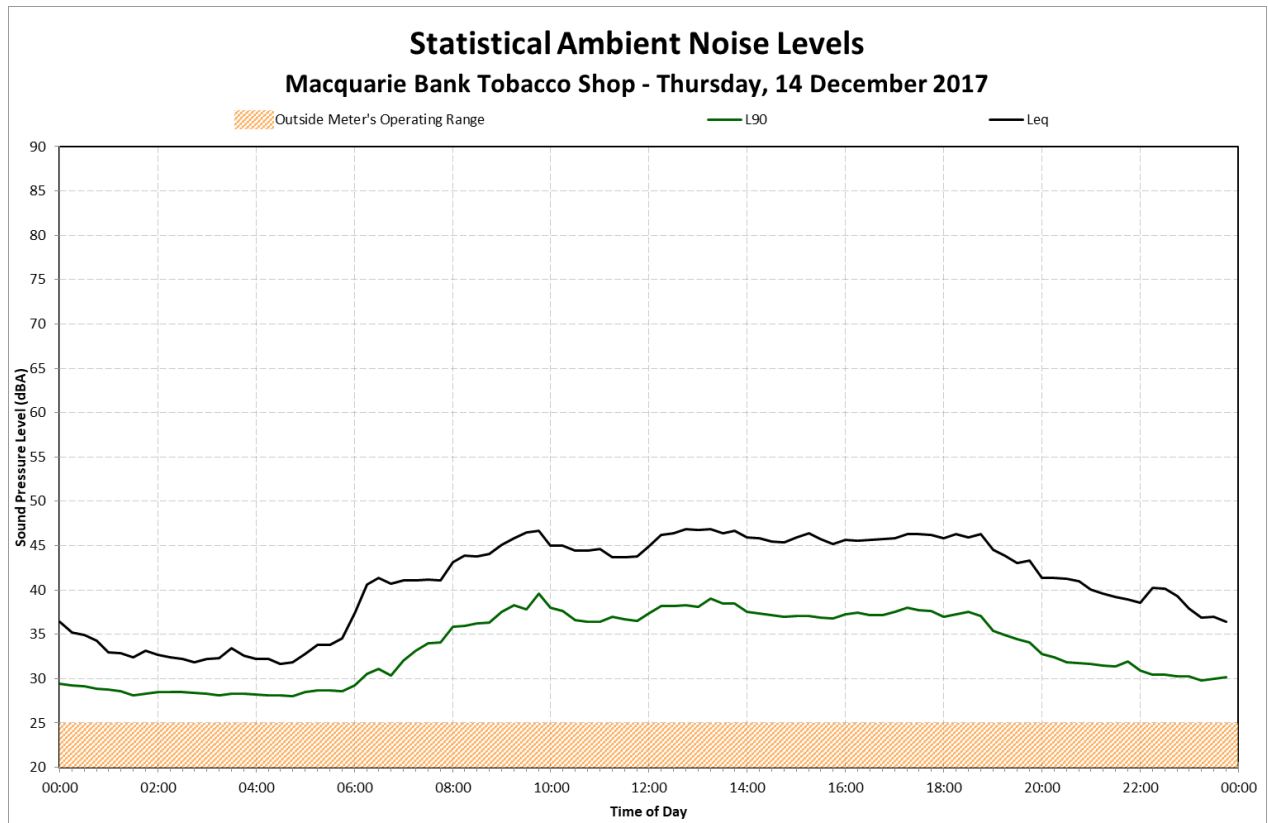
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

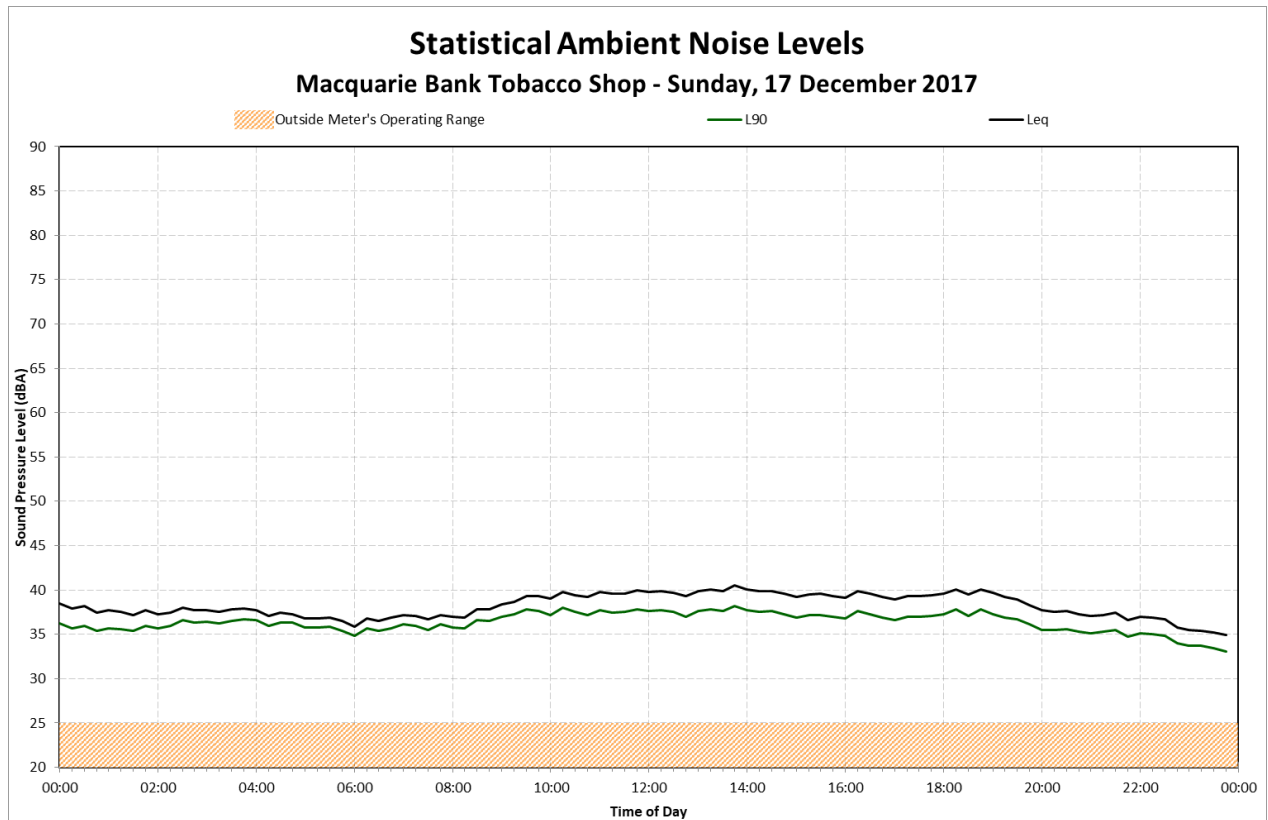
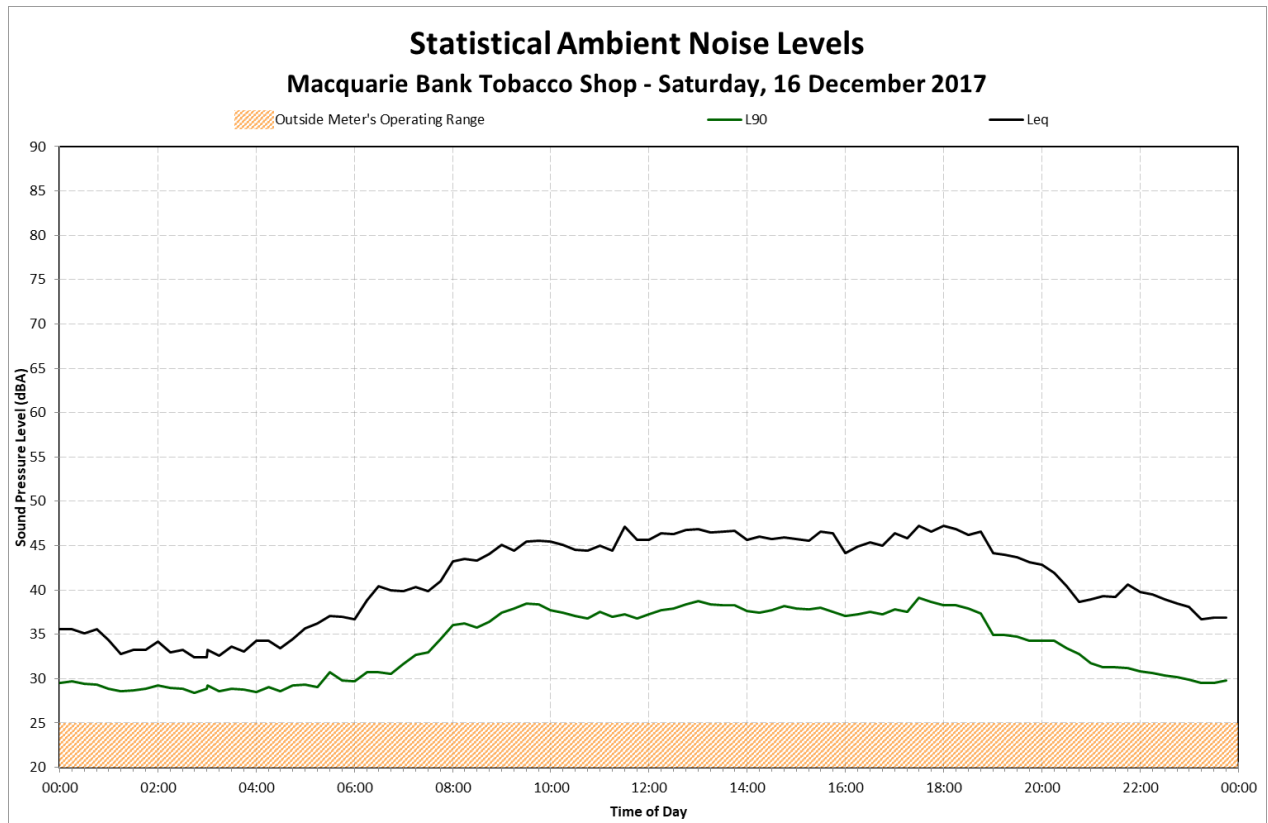
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

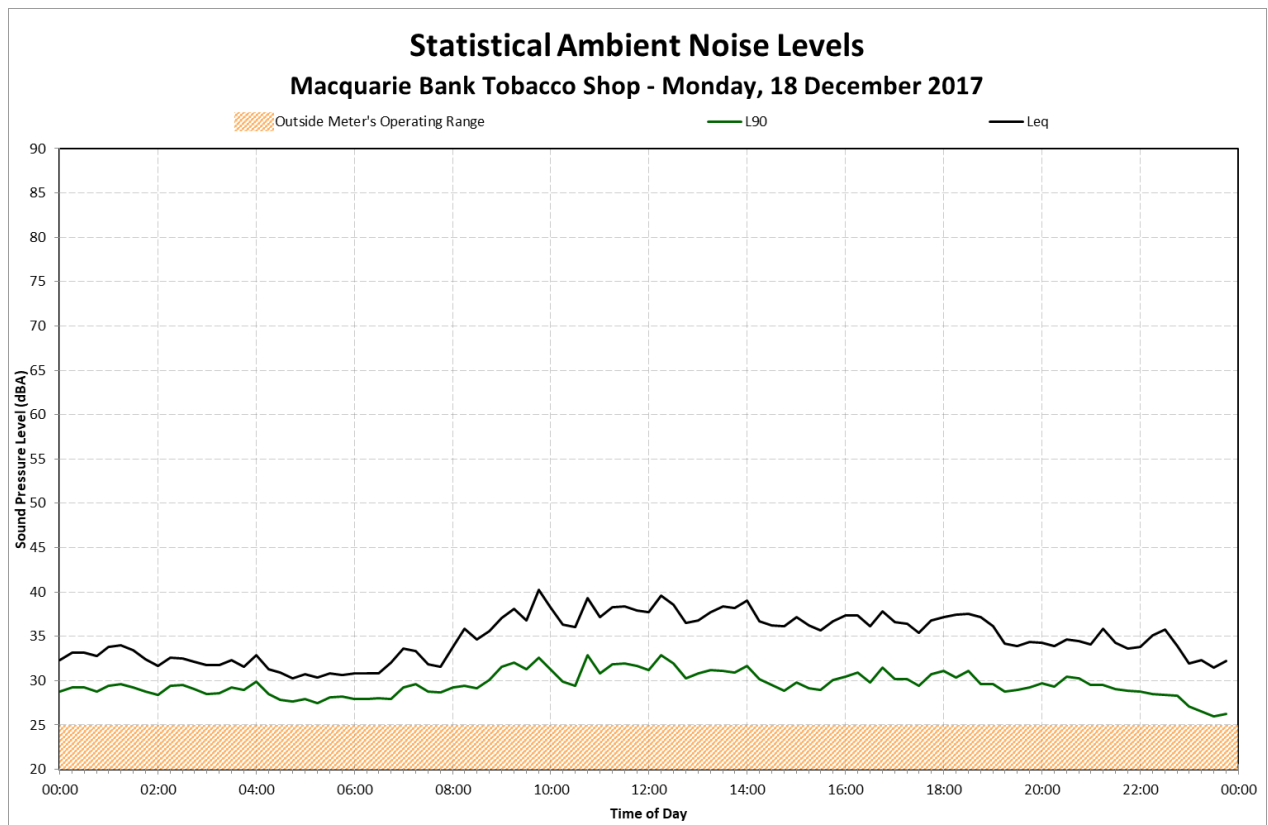
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

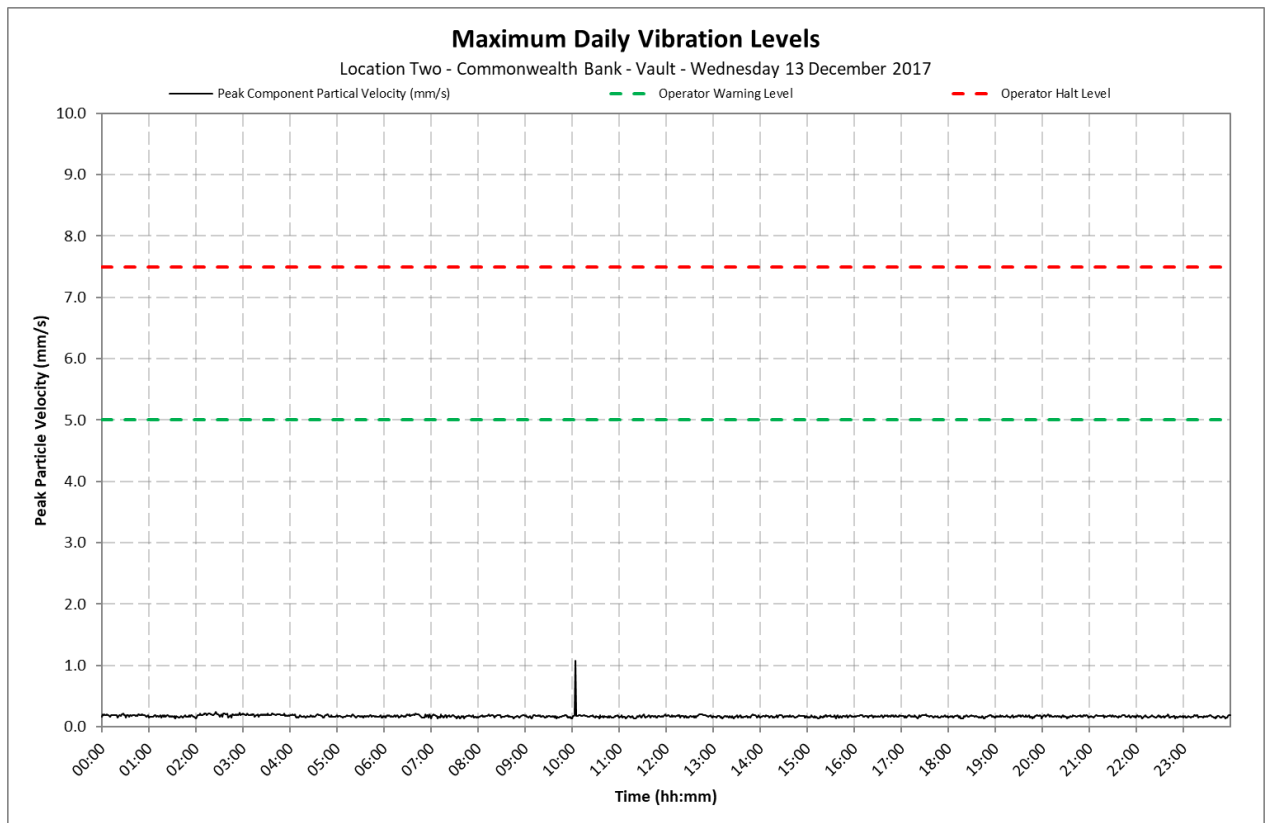
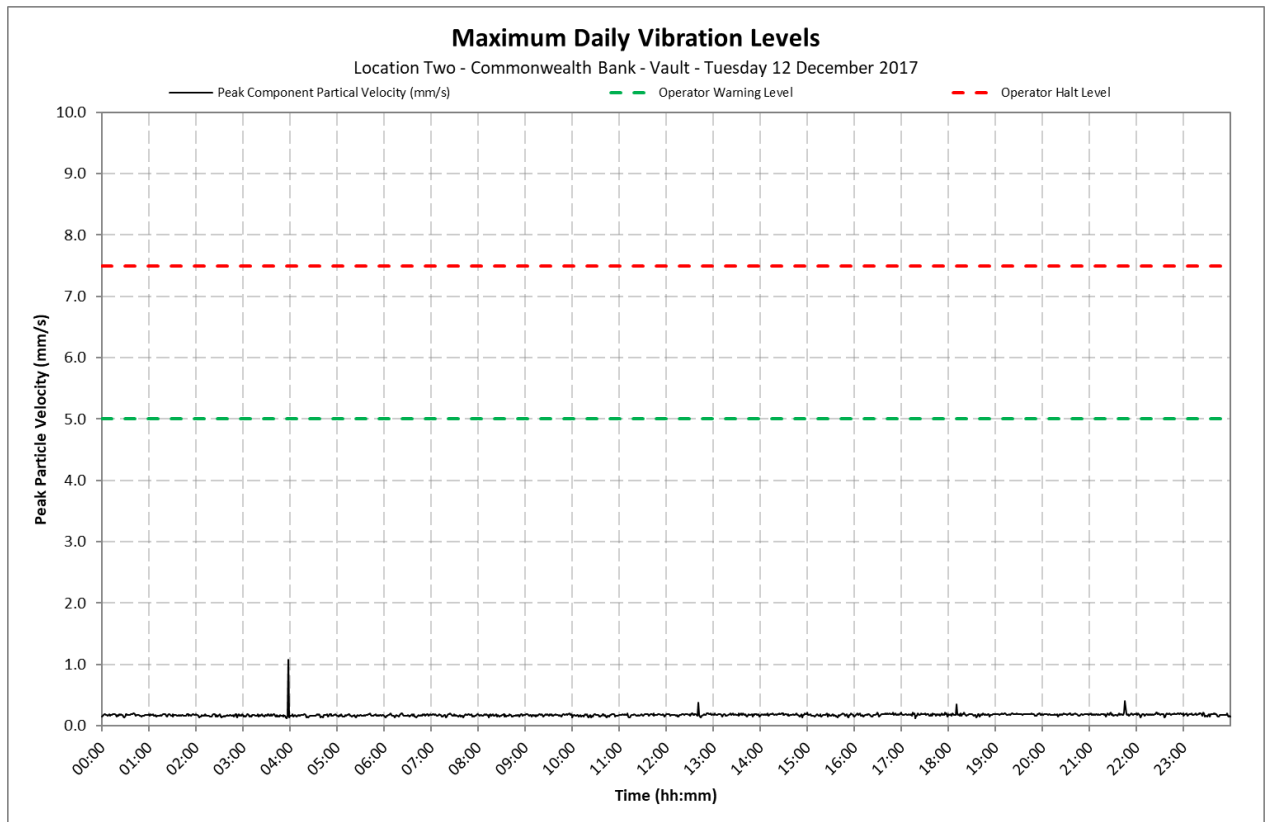
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

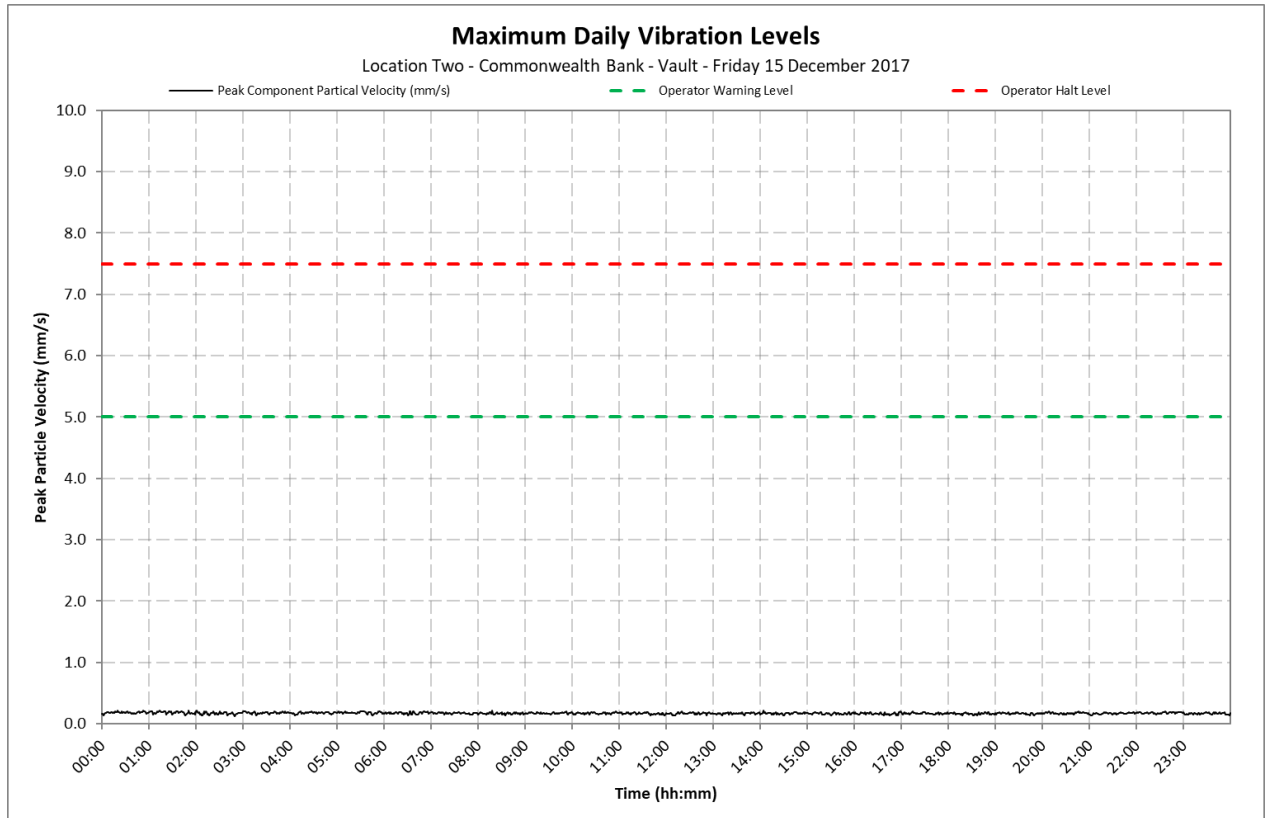
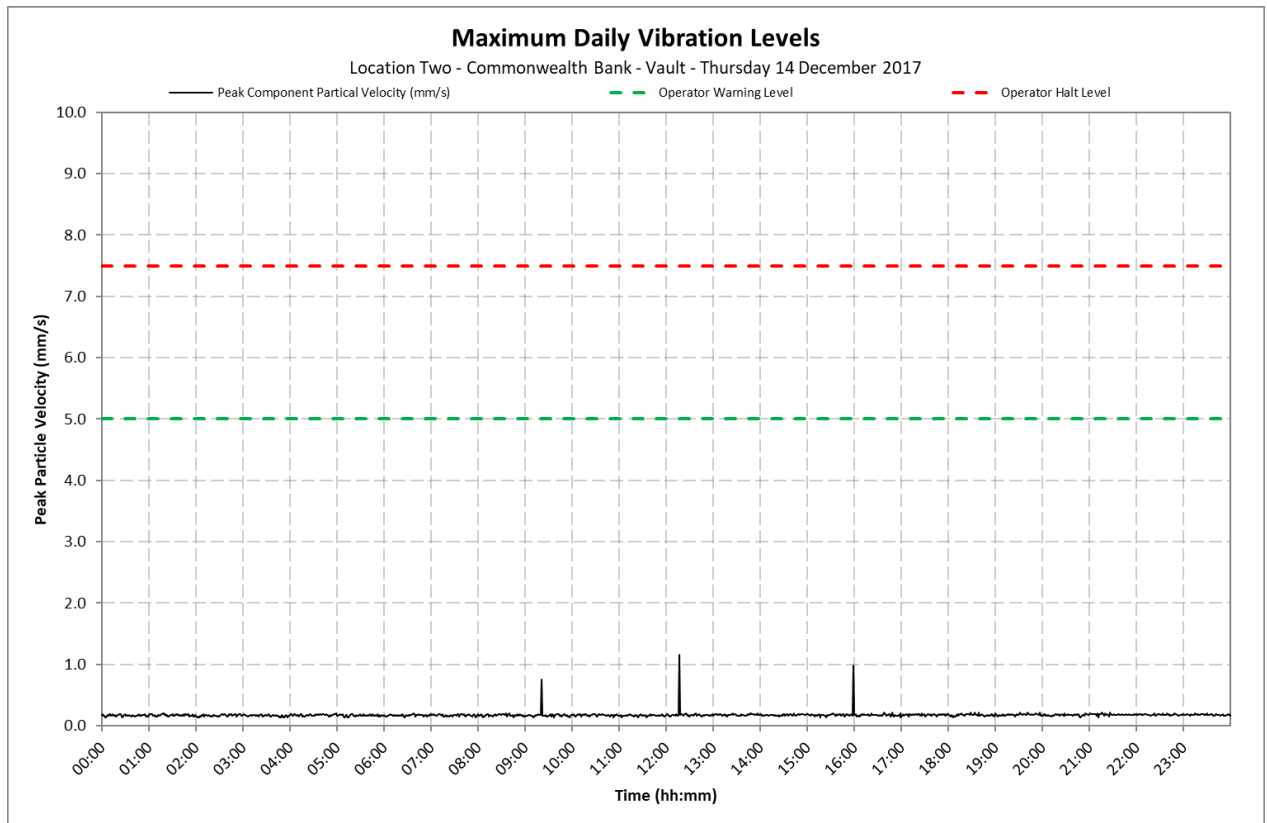
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

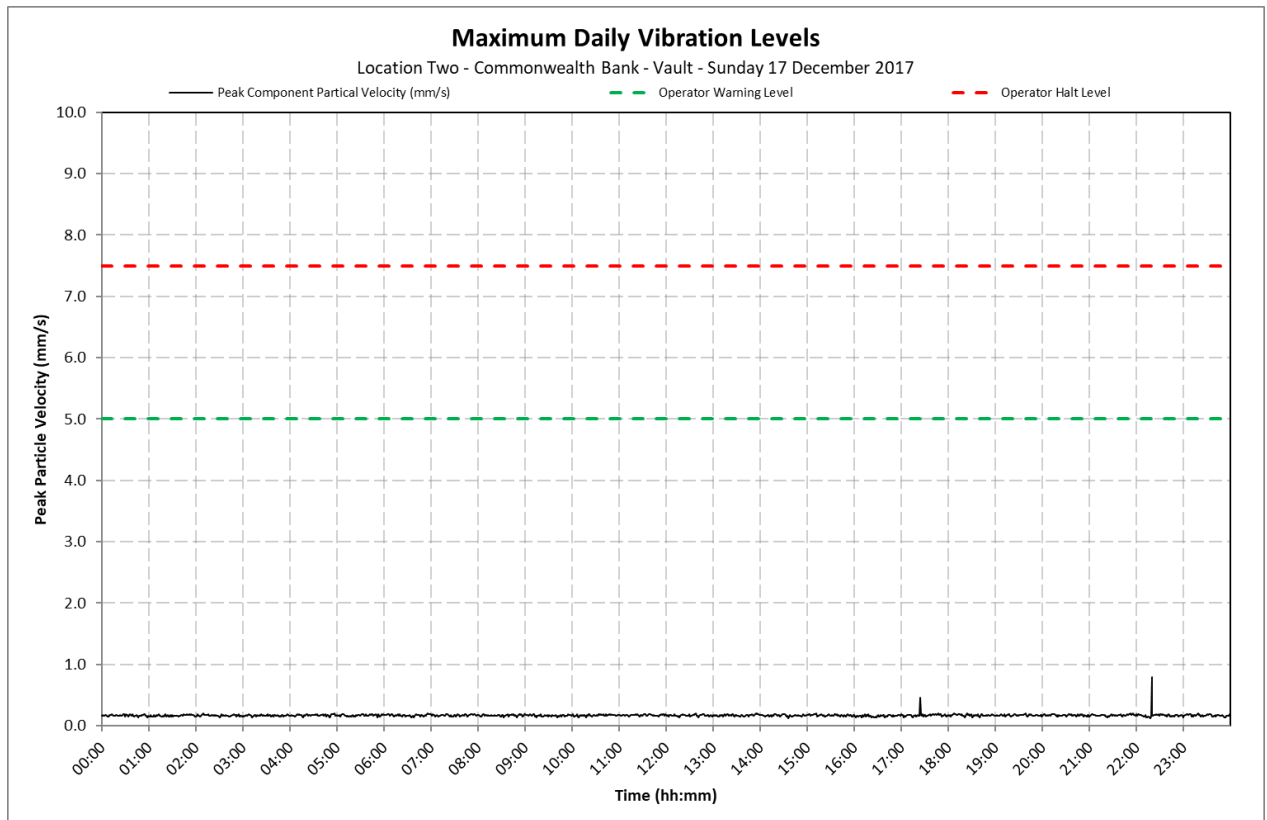
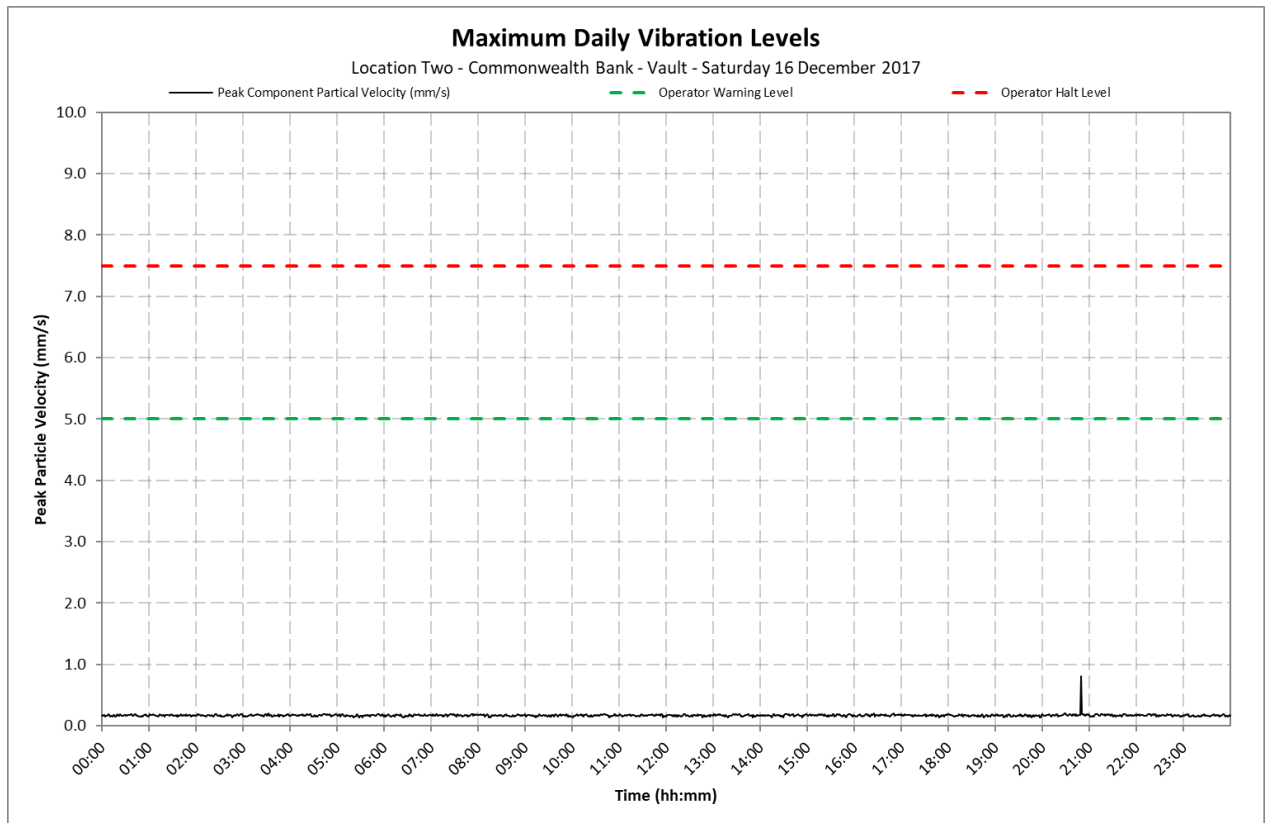
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

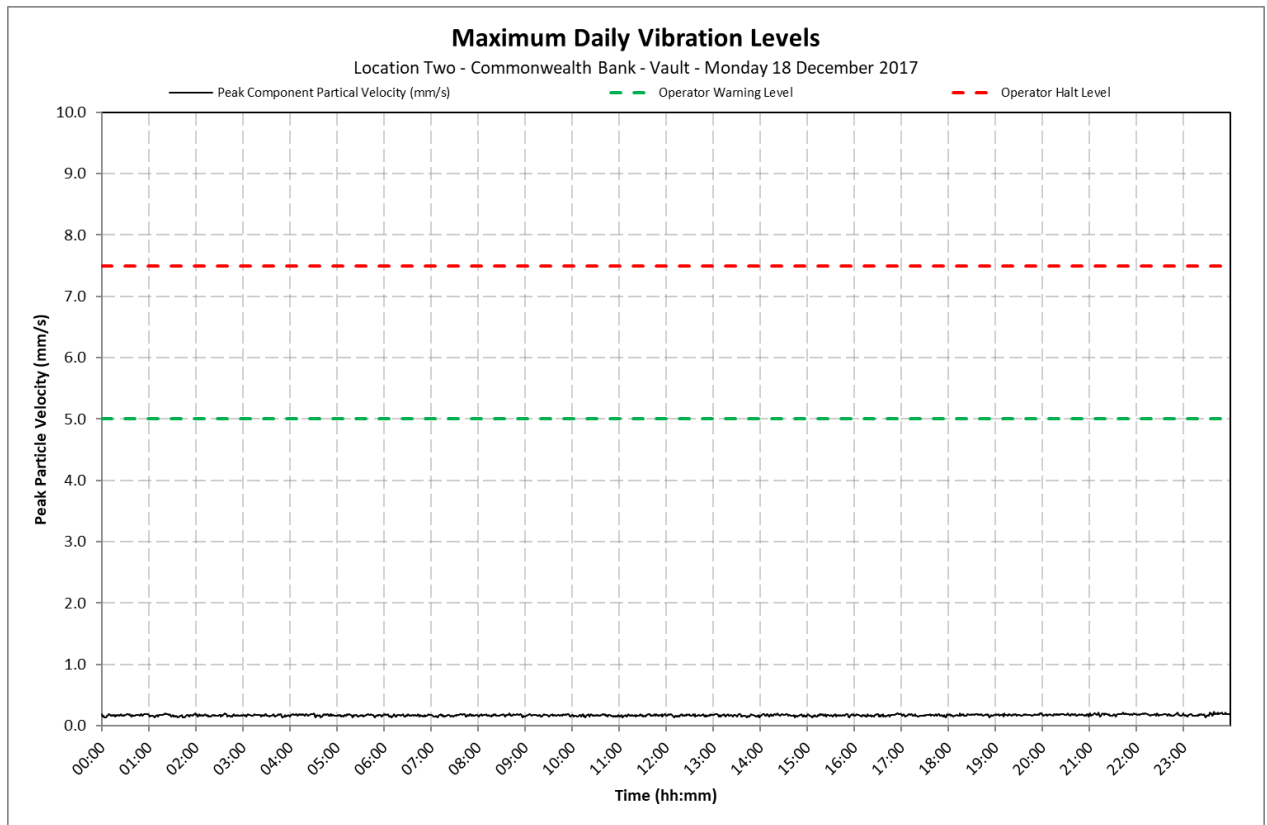
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

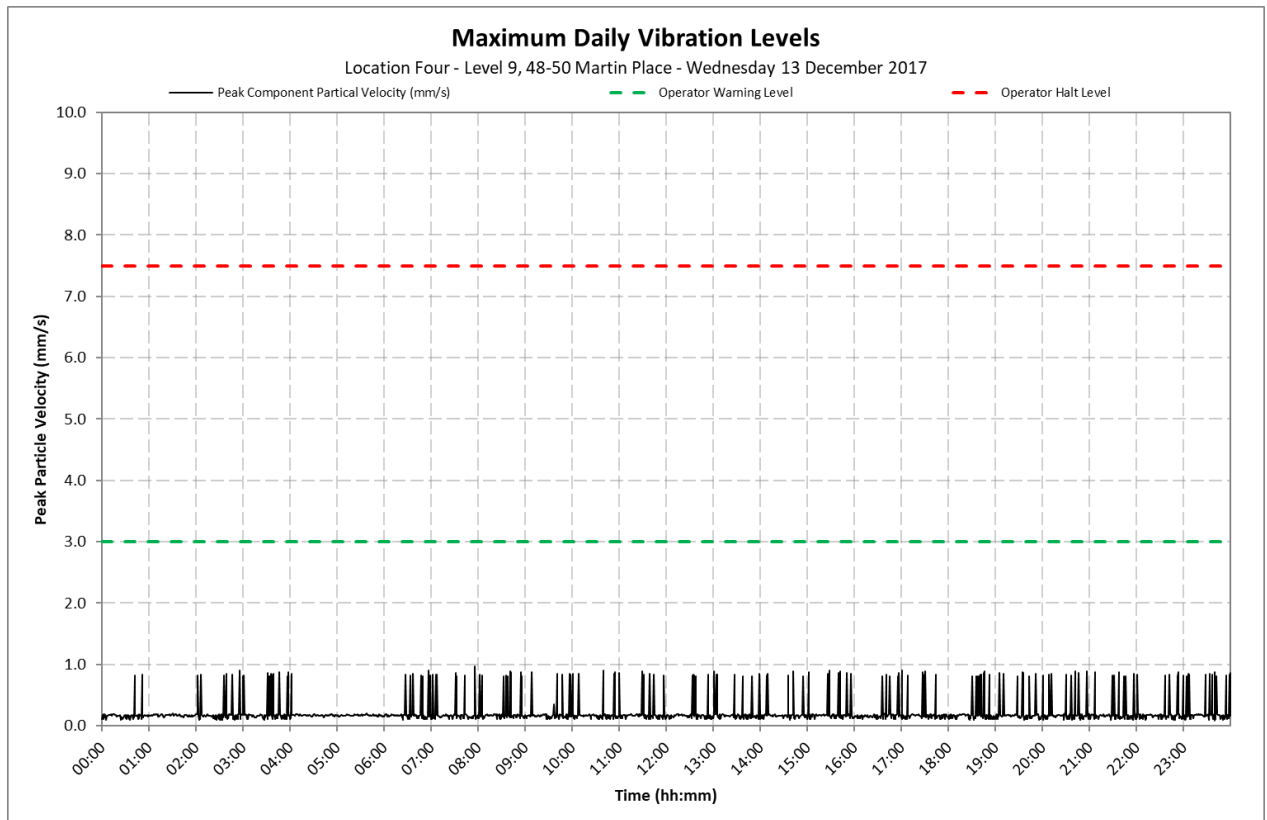
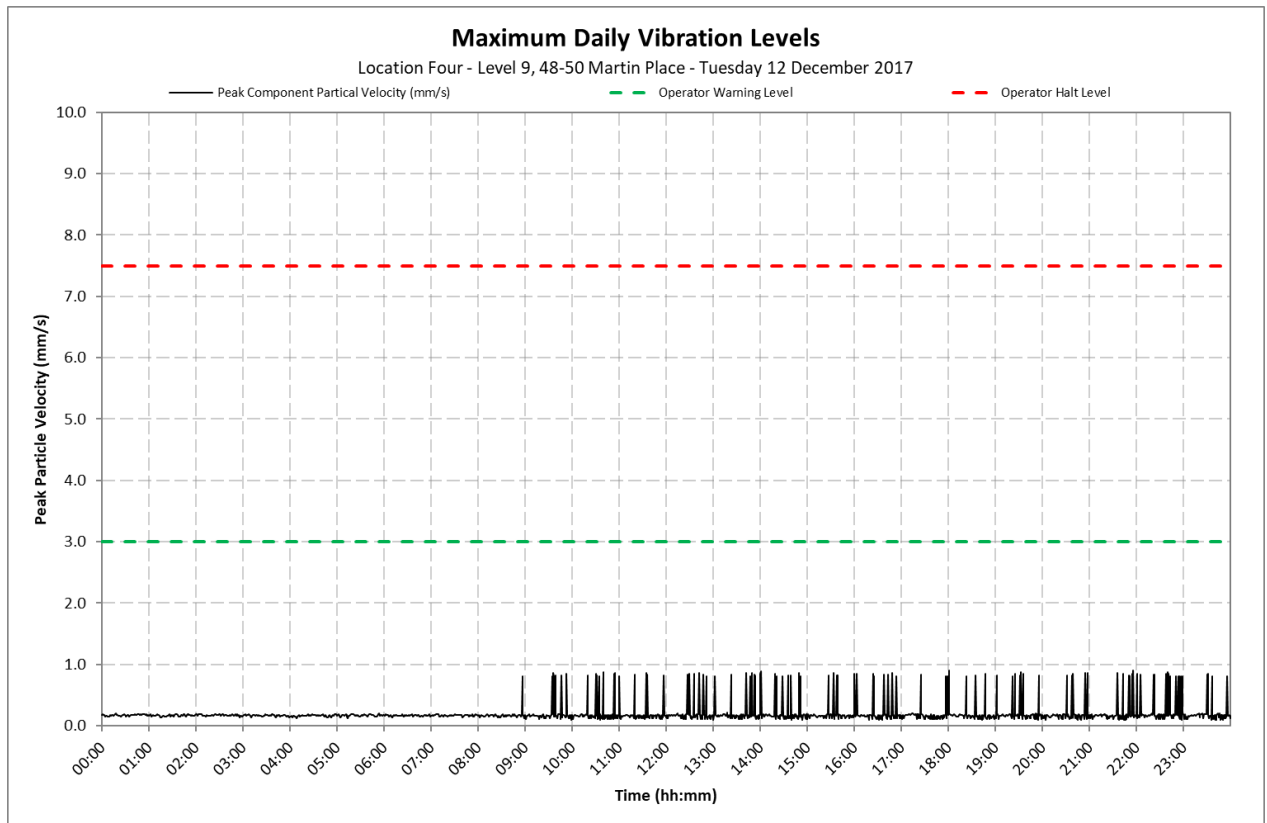
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

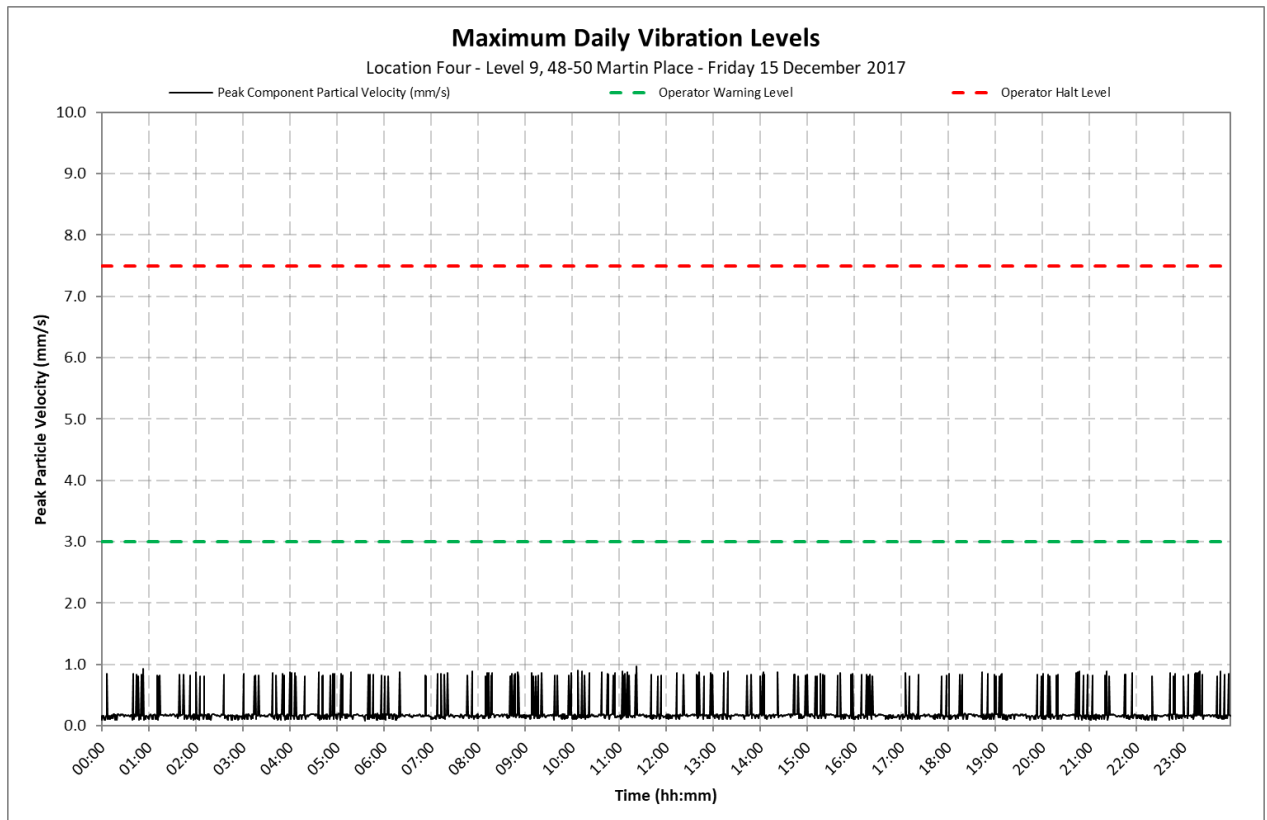
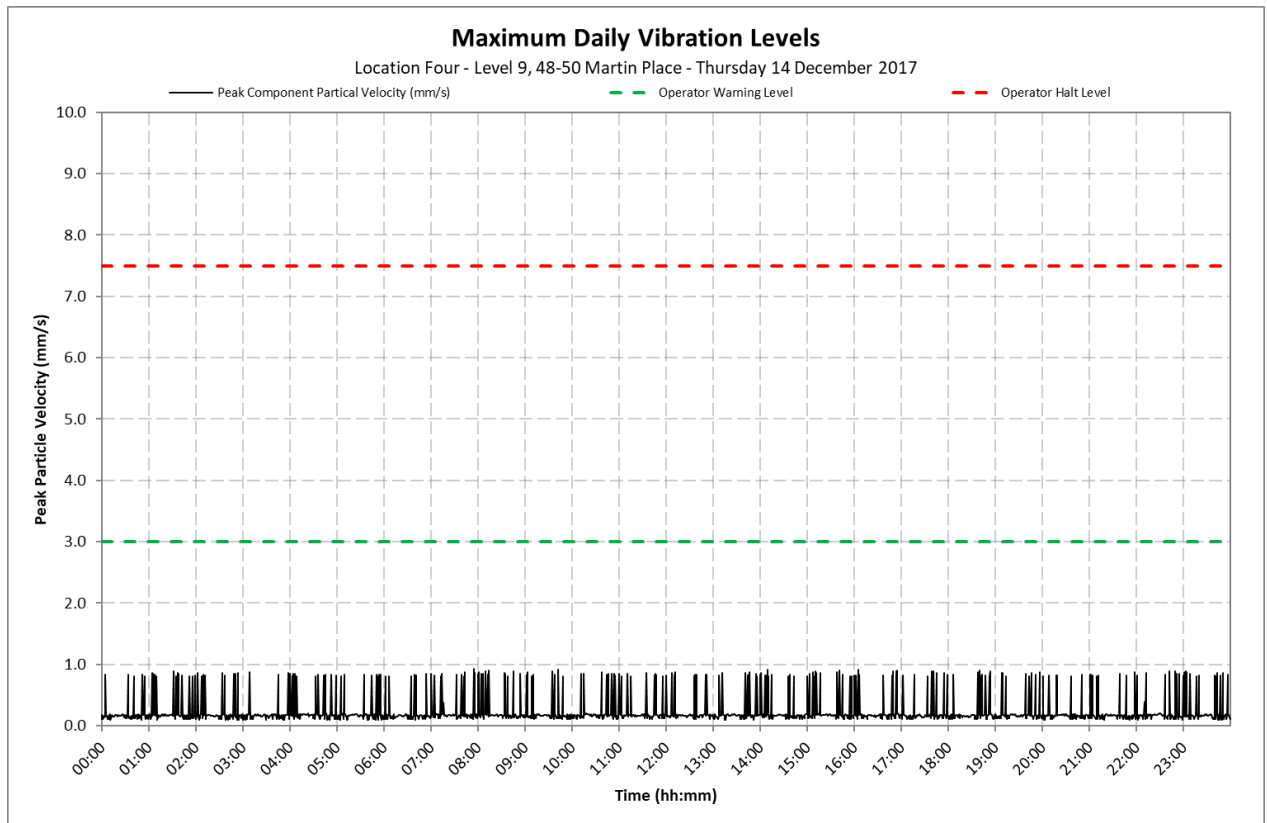
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

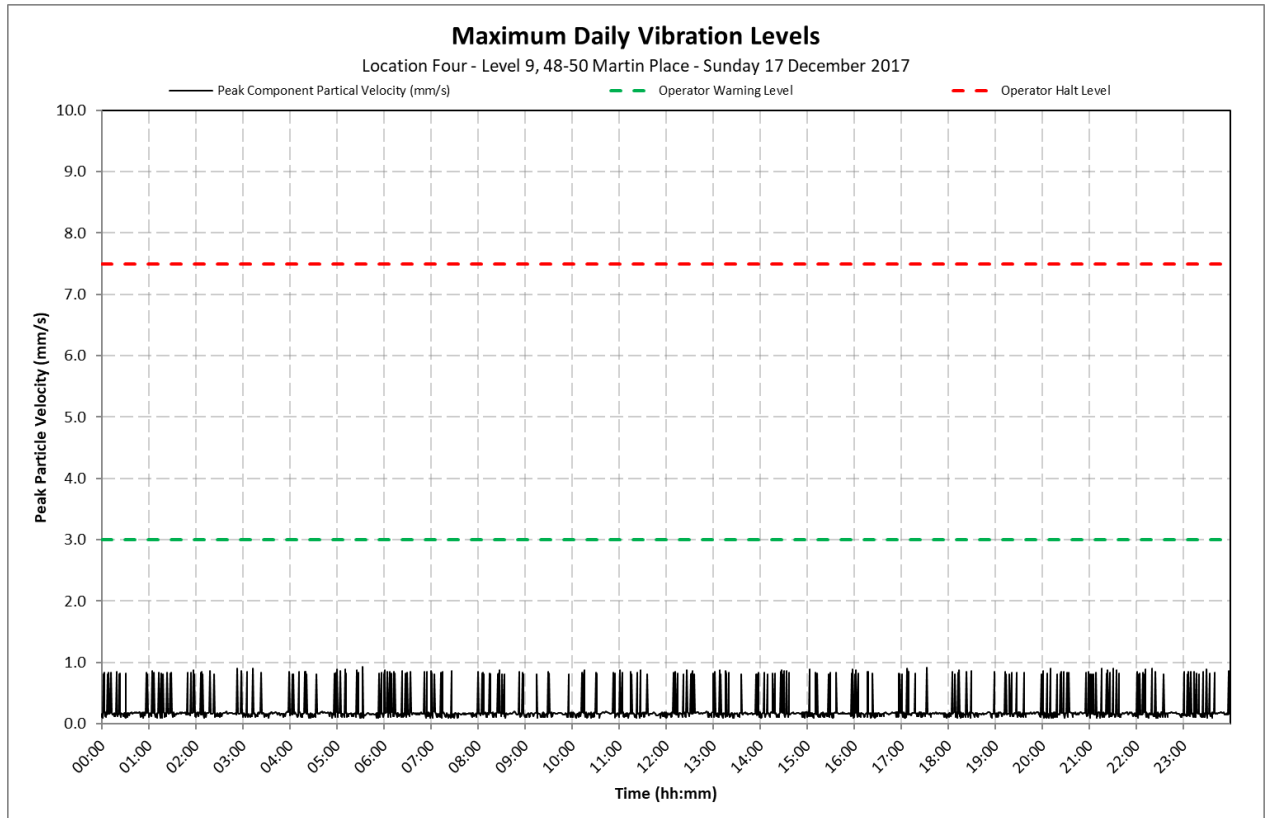
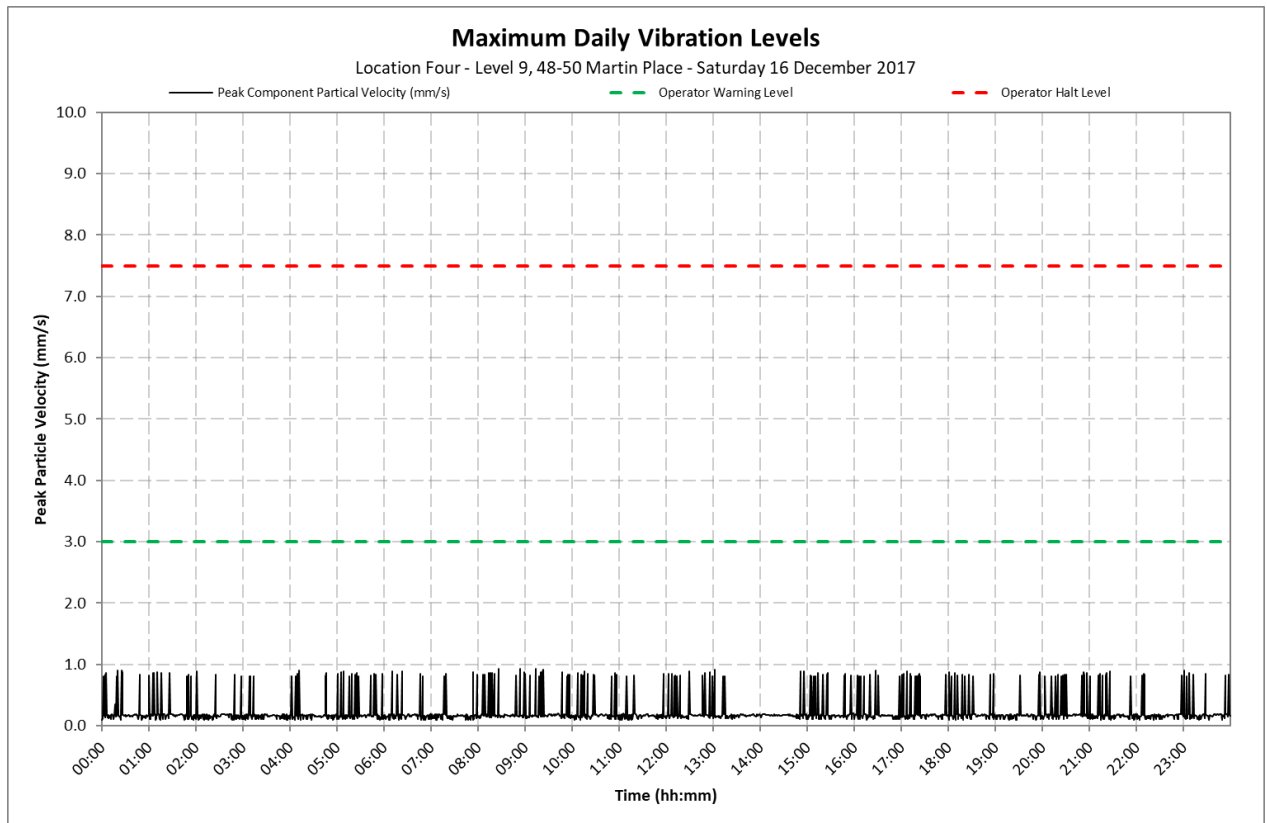
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

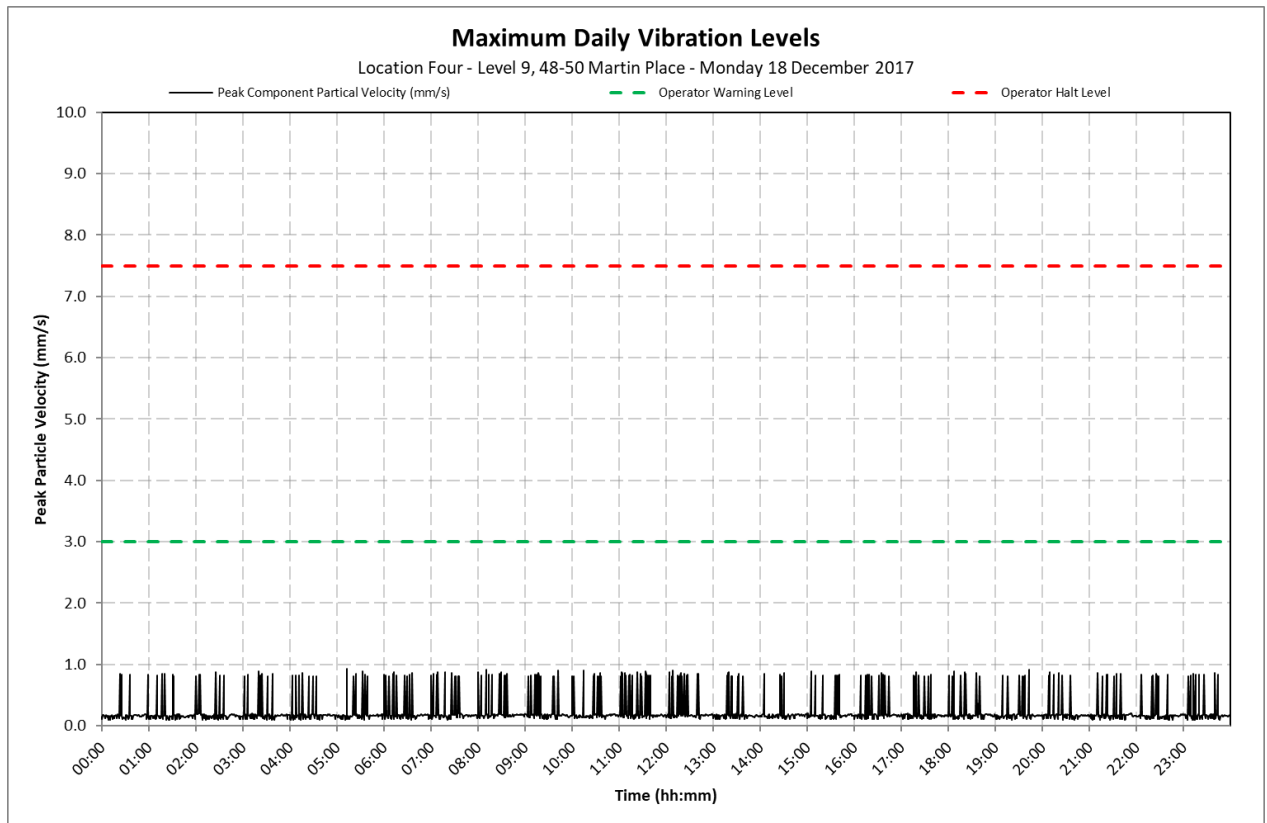
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





15 January 2018

10-1380 R12 NV Monitoring 20180115.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 12
19 December to 25 December 2017**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 19 December to 25 December 2017.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

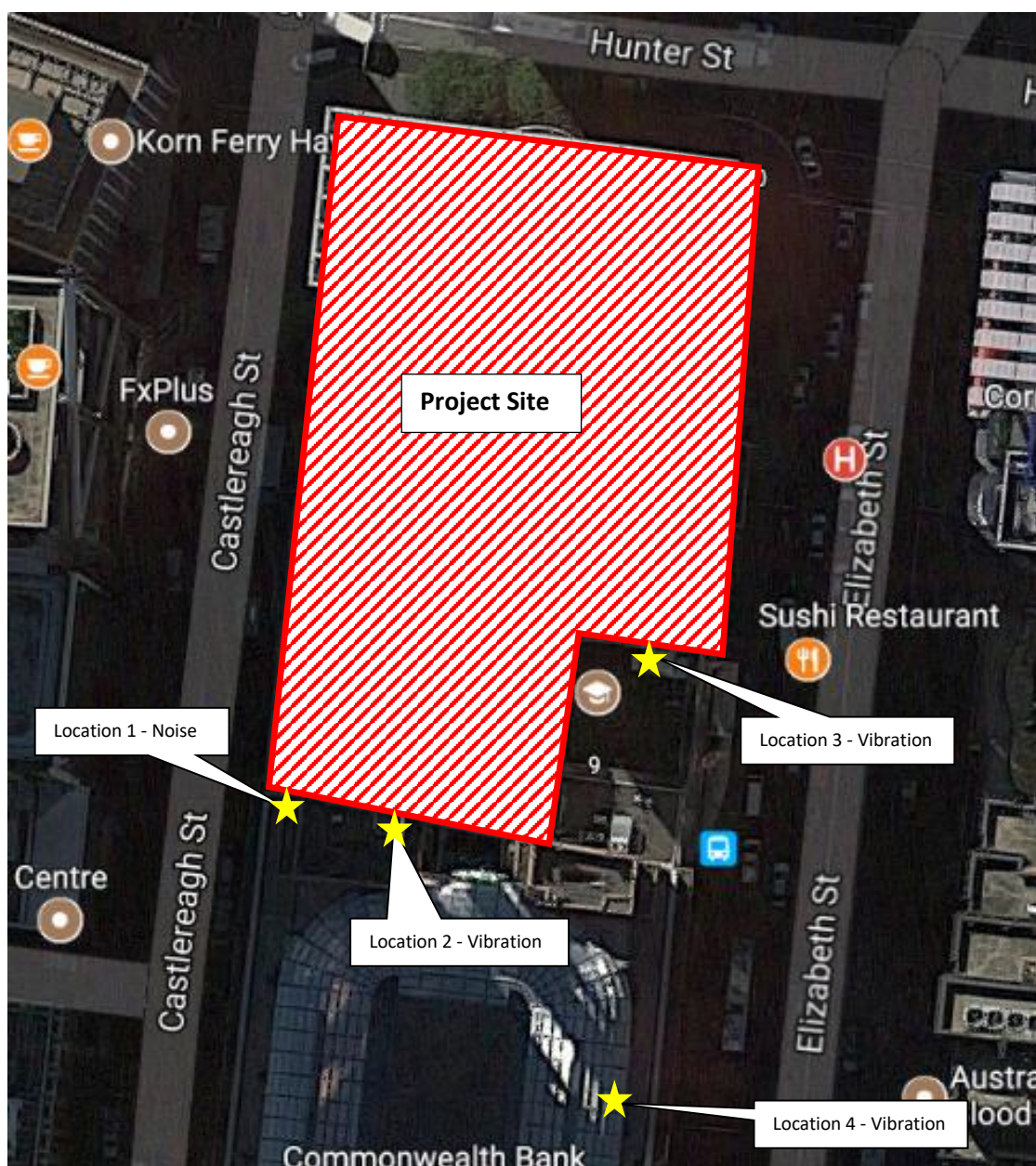
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 19 December to 25 December 2017. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
19 December 2017	43	42	Complies	Complies
20 December 2017	45	44	Complies	Complies
21 December 2017	45	44	Complies	Complies
22 December 2017	46	45	Complies	Complies
23 December 2017	46	44	Complies	Complies
24 December 2017	40	38	Complies	Complies
25 December 2017	38	36	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 19 December to 25 December 2017. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
19 December 2017	0.3 mm/s	Complies
20 December 2017	0.4 mm/s	Complies
21 December 2017	0.2 mm/s	Complies
22 December 2017	0.4 mm/s	Complies
23 December 2017	1.3 mm/s	Complies
24 December 2017	1.2 mm/s	Complies
25 December 2017	1.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
19 December 2017	0.9 mm/s	Complies
20 December 2017	0.9 mm/s	Complies
21 December 2017	0.9 mm/s	Complies
22 December 2017	0.9 mm/s	Complies
23 December 2017	0.9 mm/s	Complies
24 December 2017	1.0 mm/s	Complies
25 December 2017	1.0 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 19 December to 25 December 2017 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 19 December to 25 December 2017 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

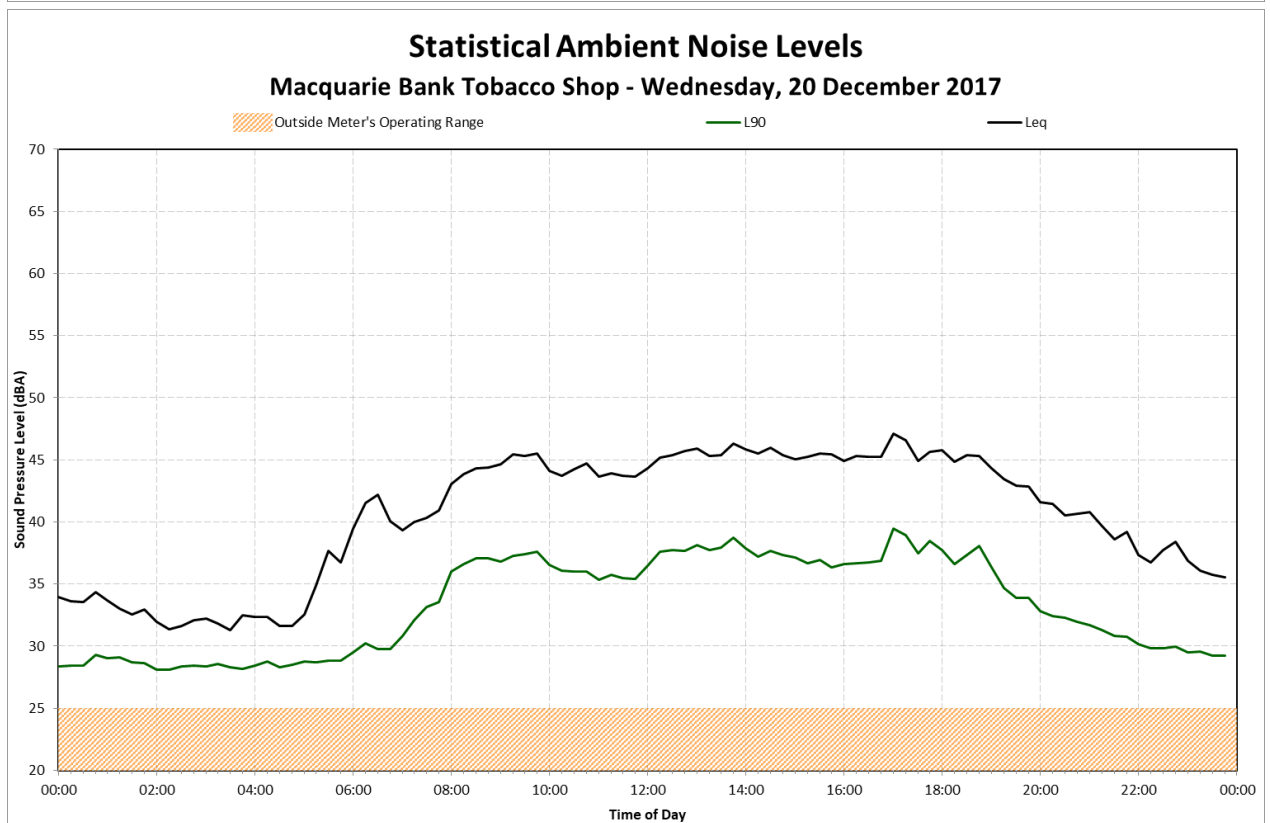
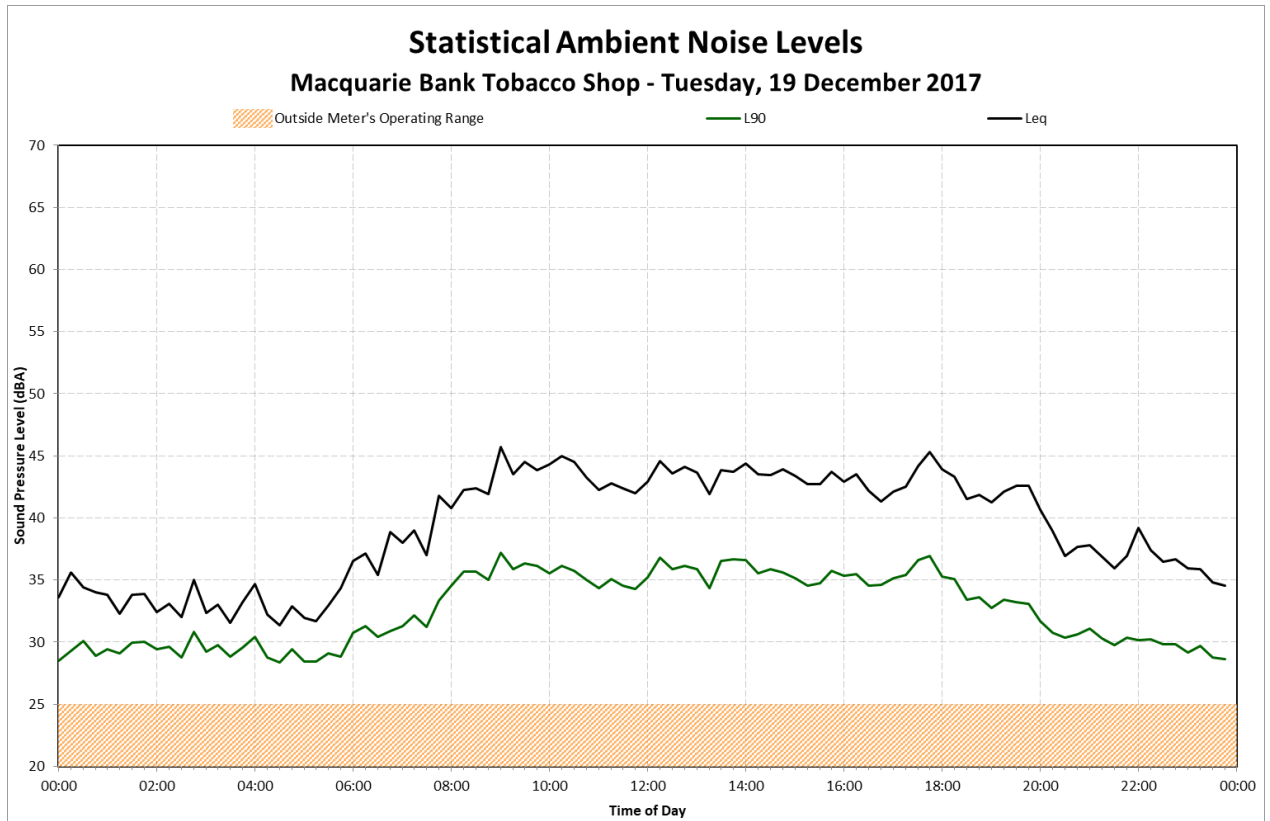
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
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Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
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PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quadr method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

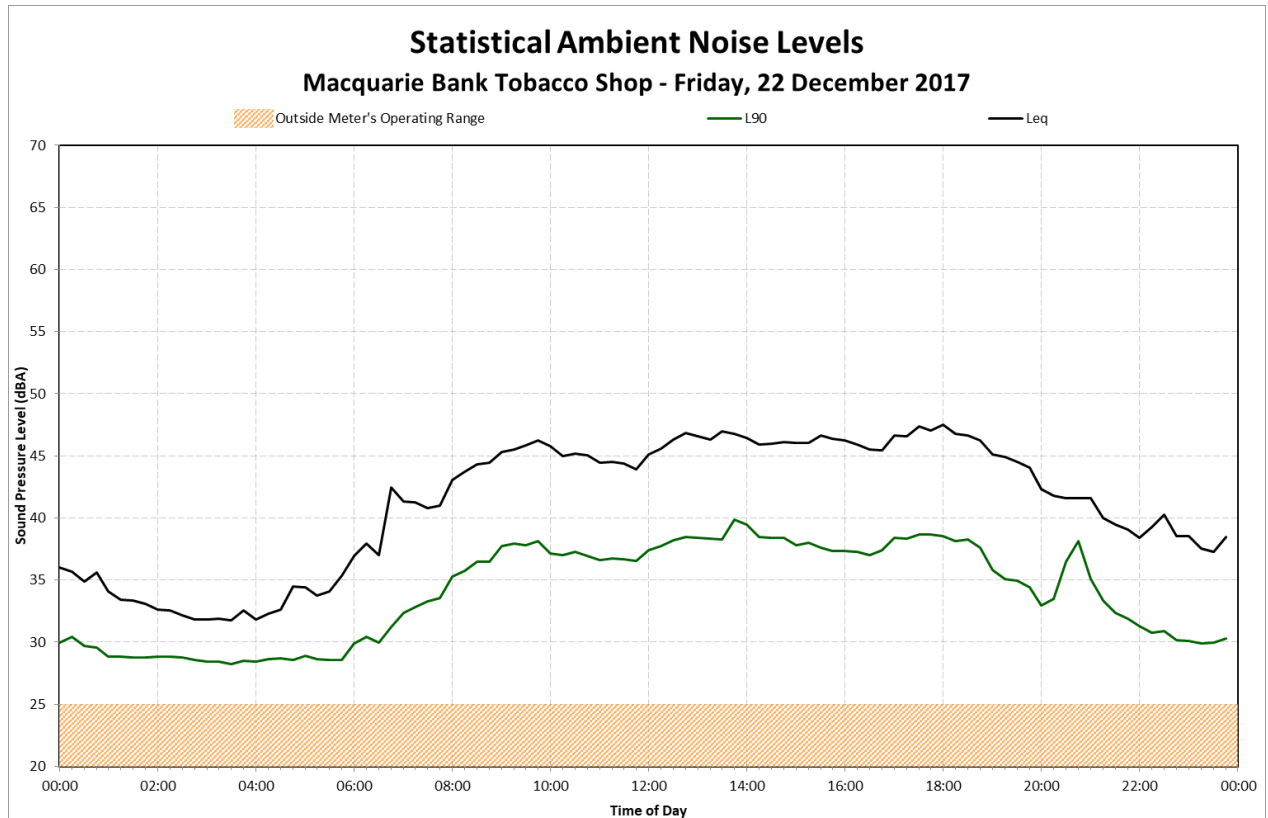
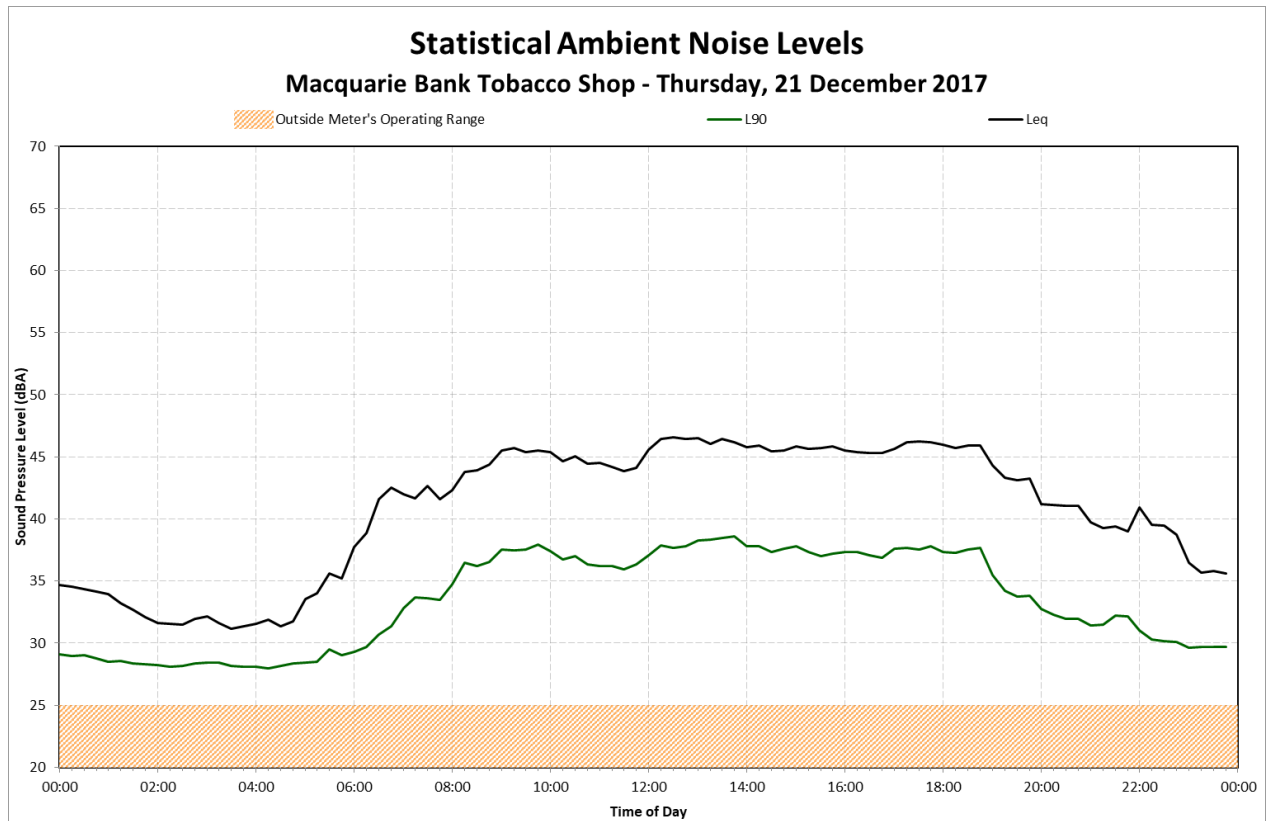
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

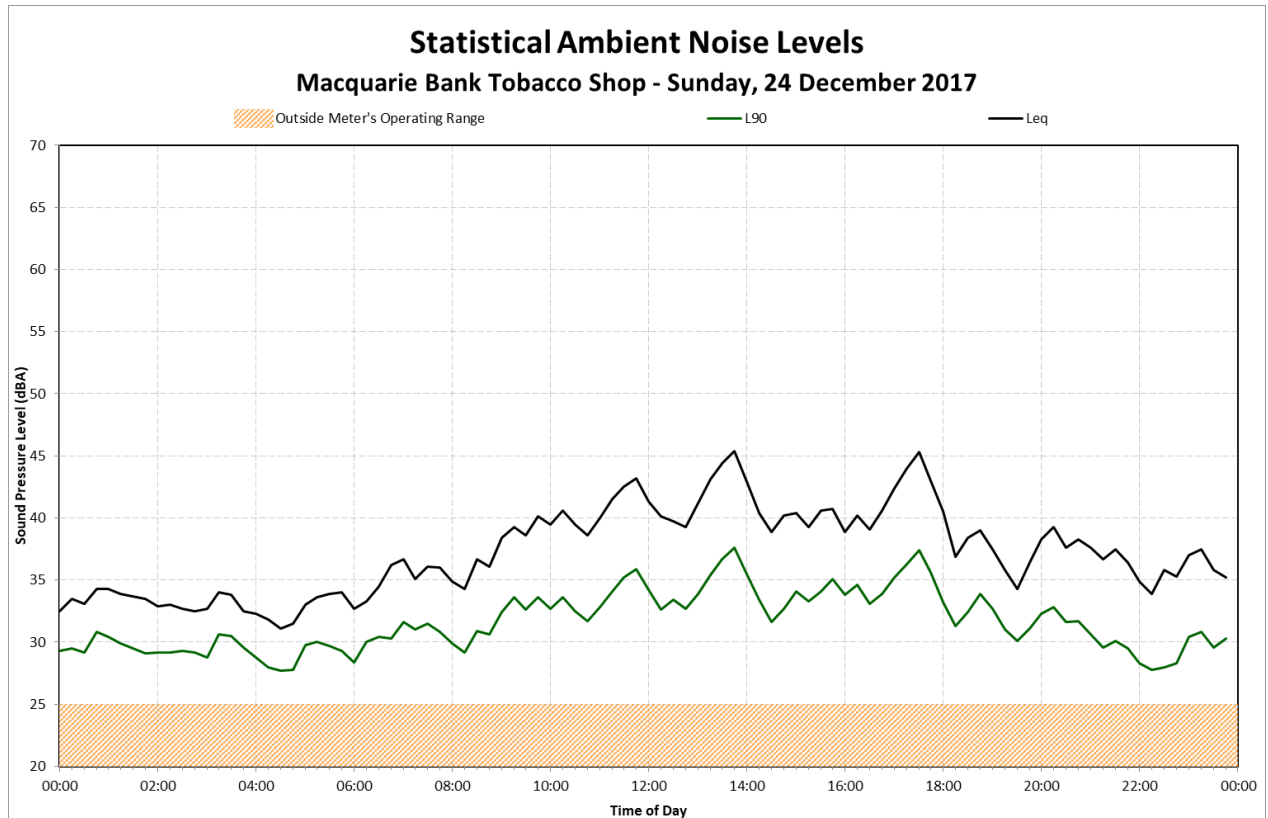
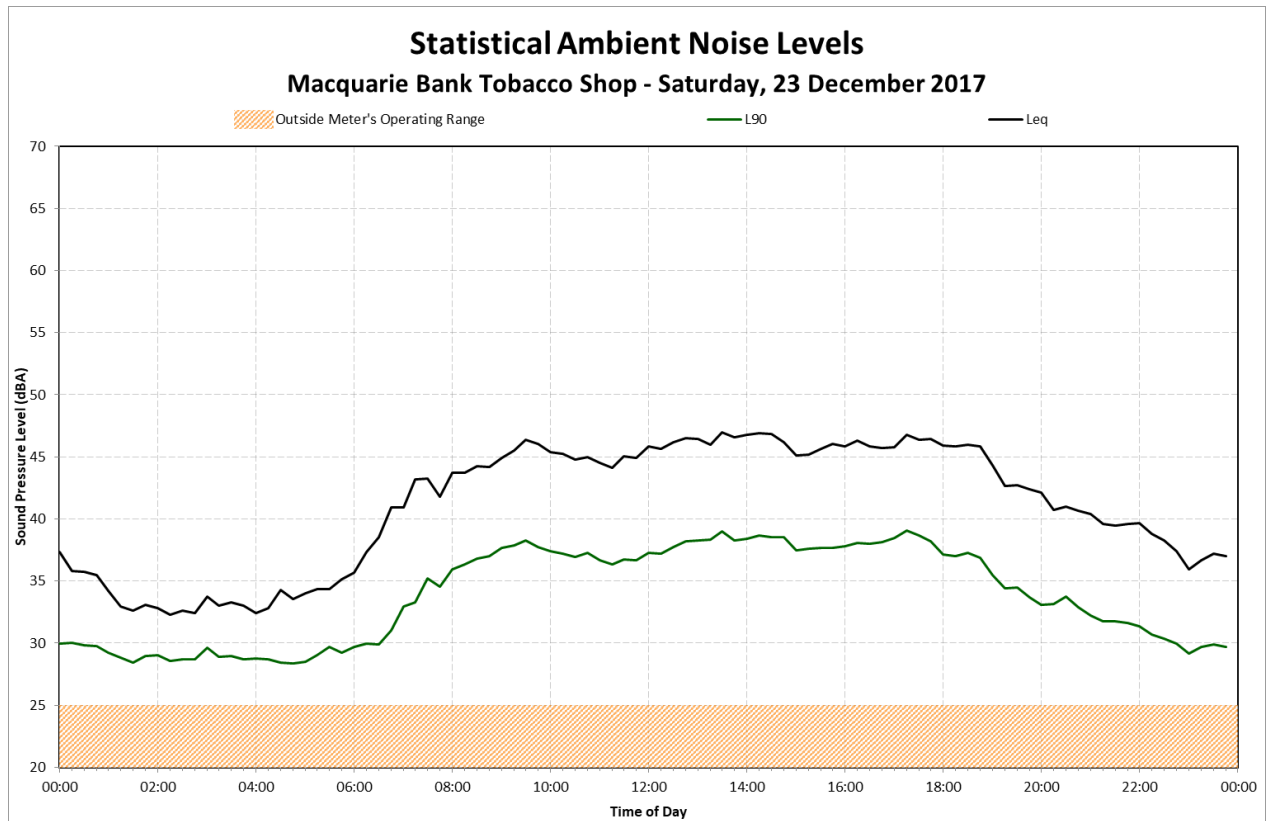
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

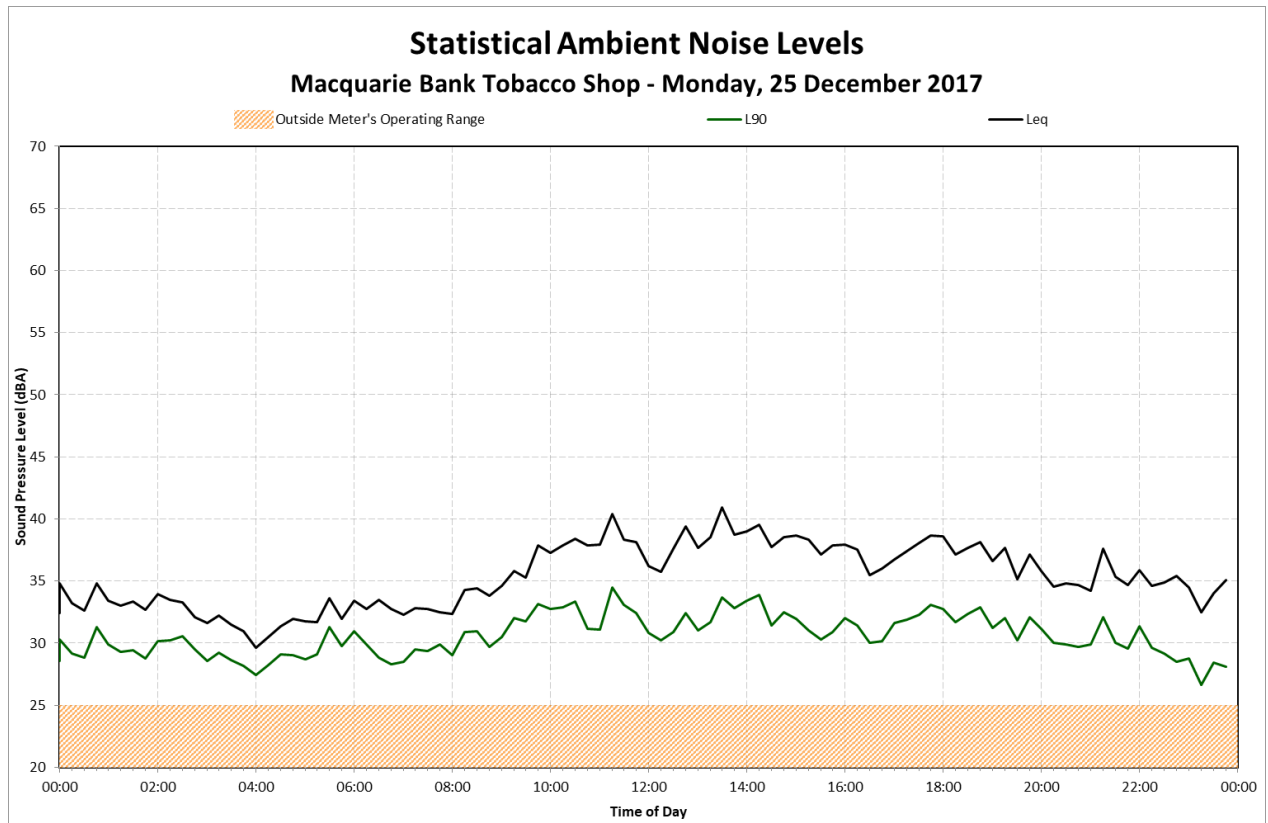
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

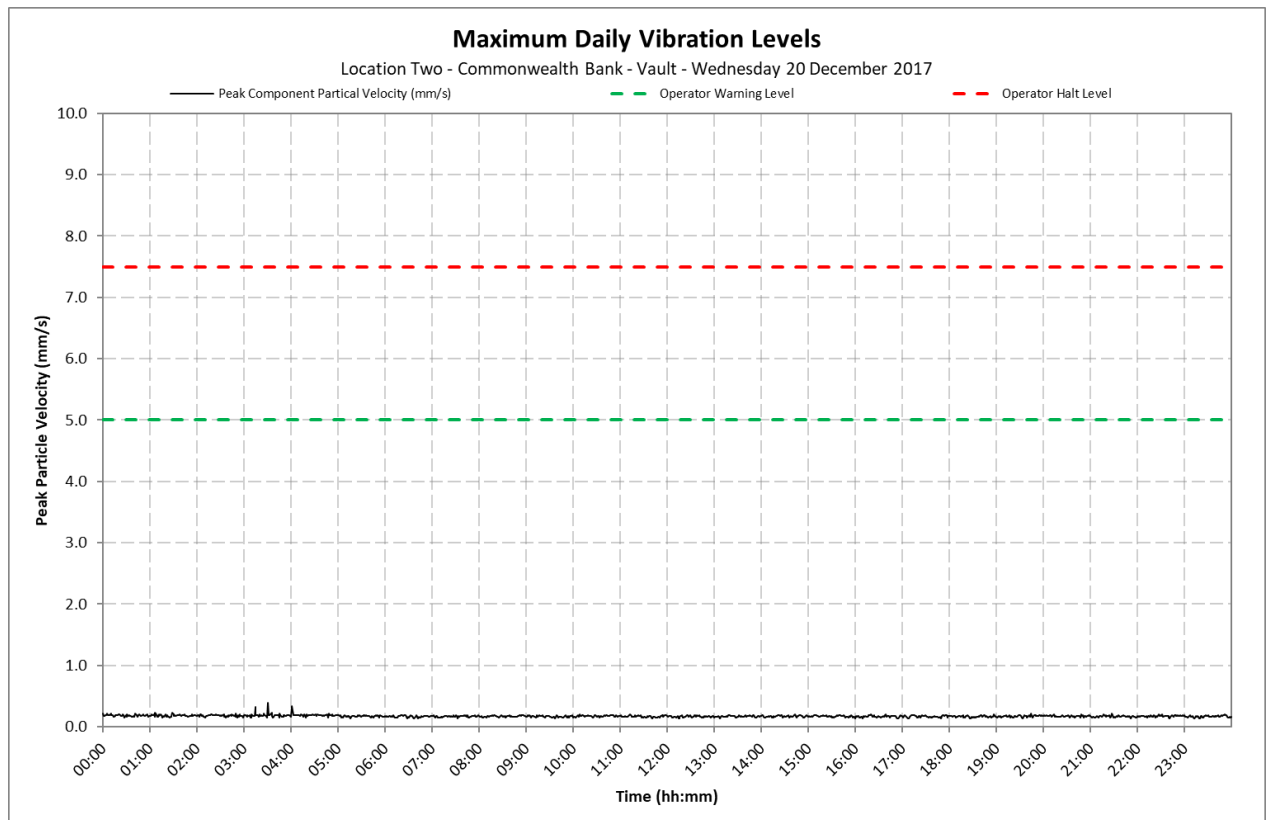
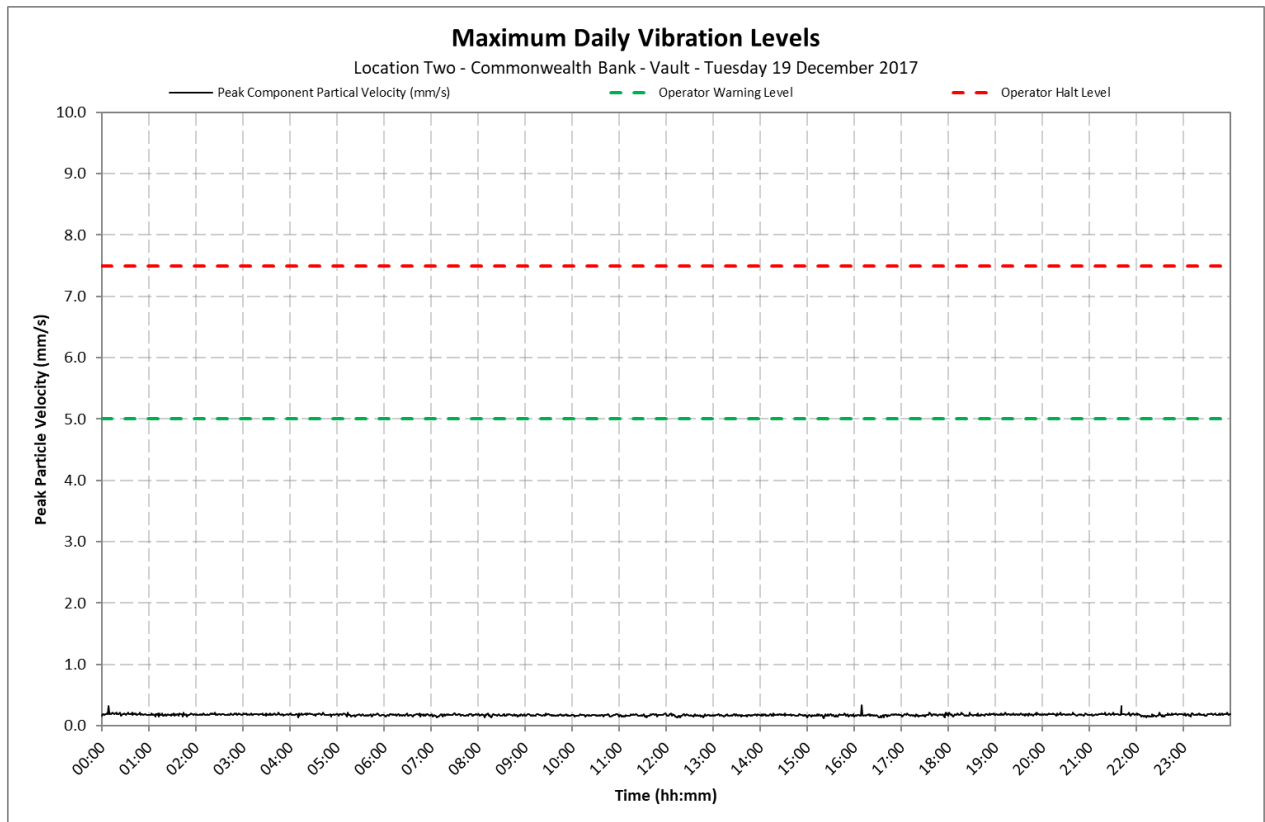
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

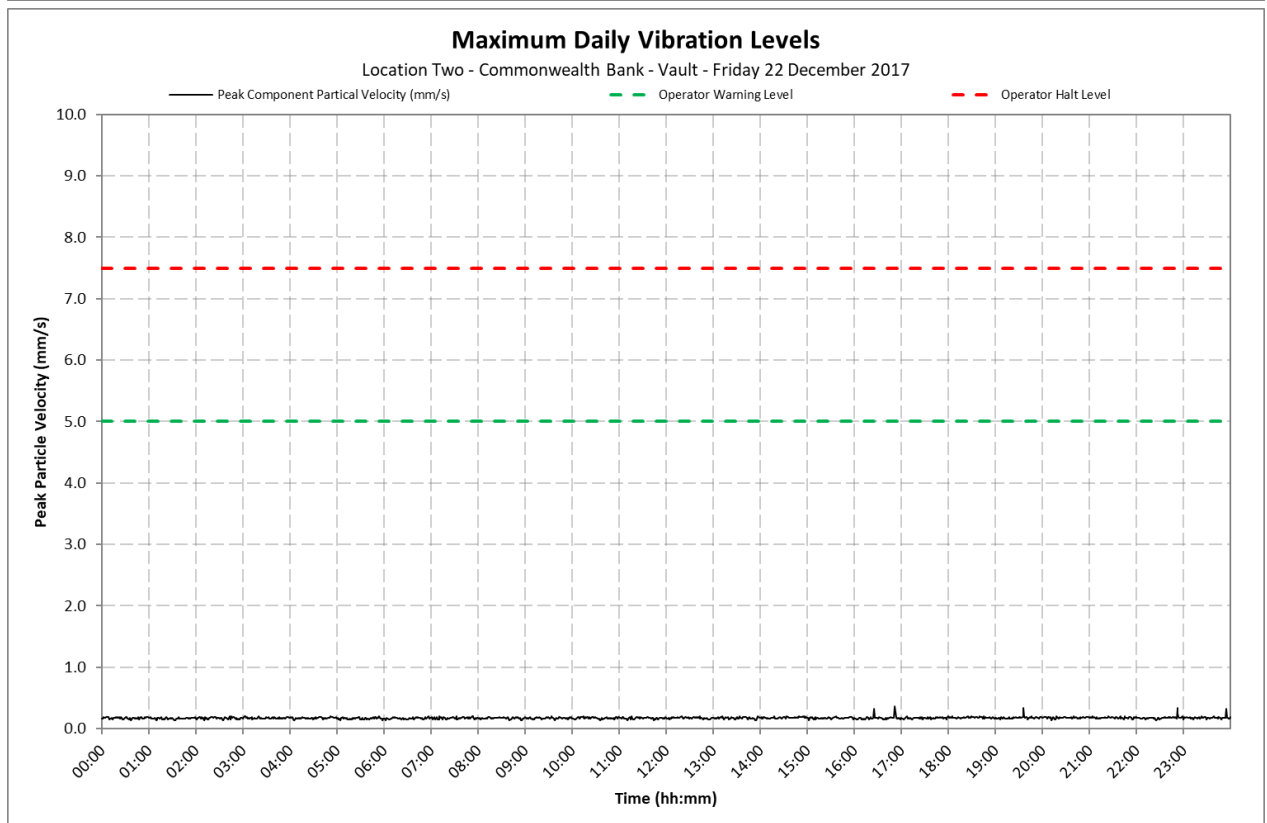
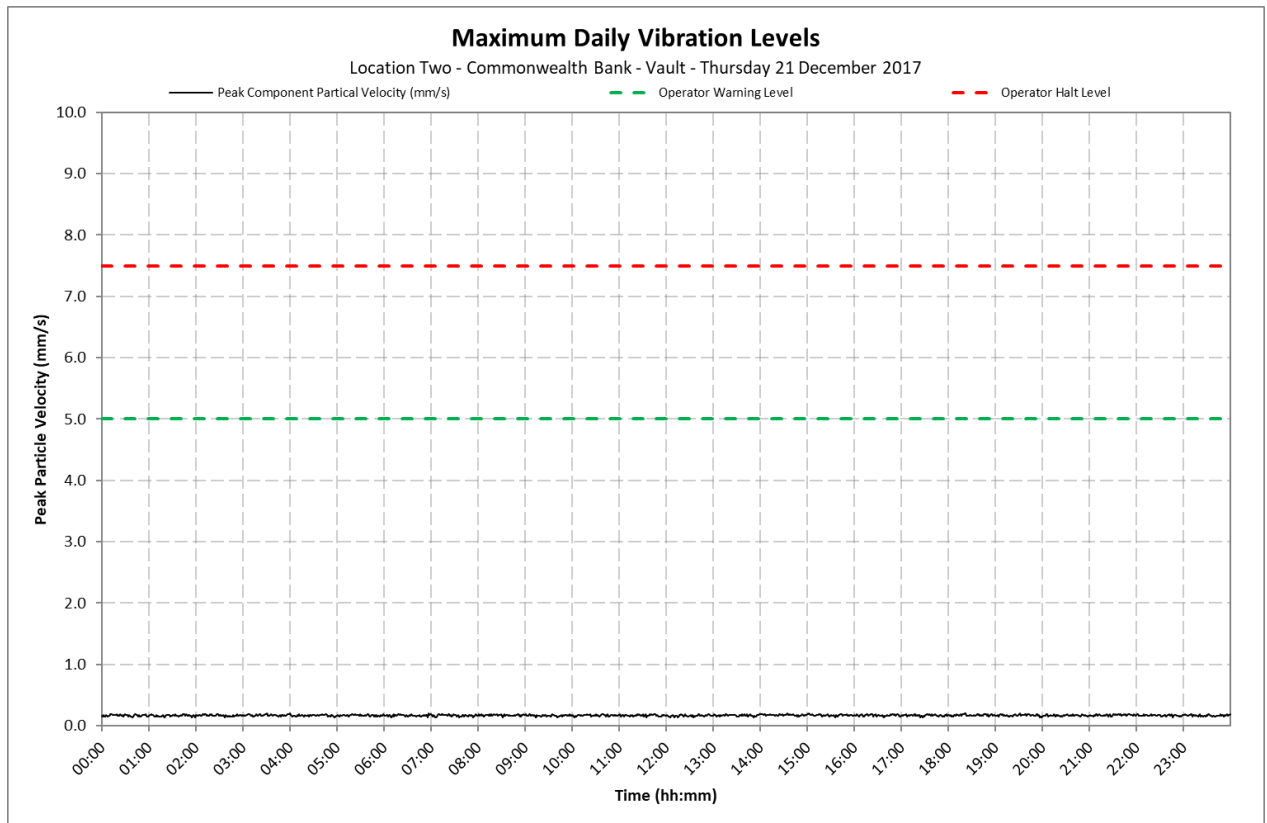
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

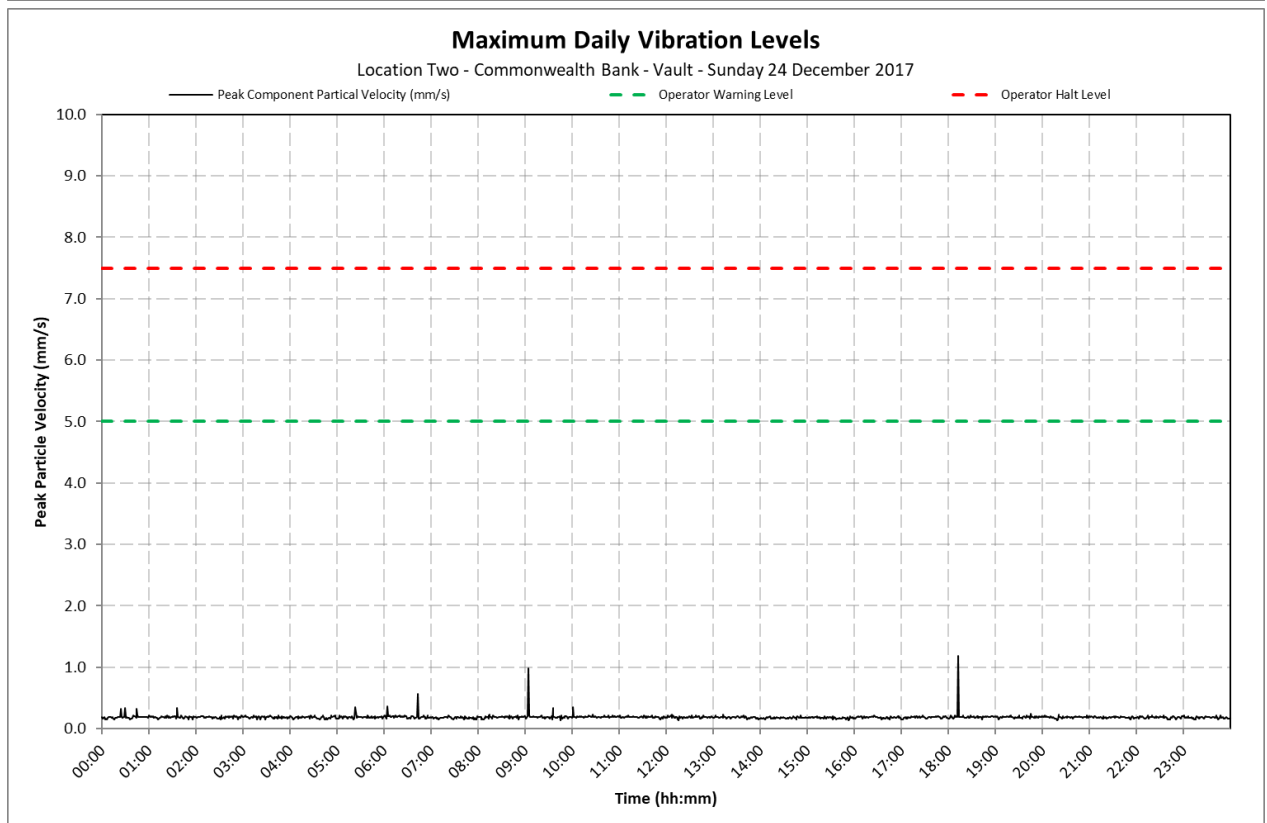
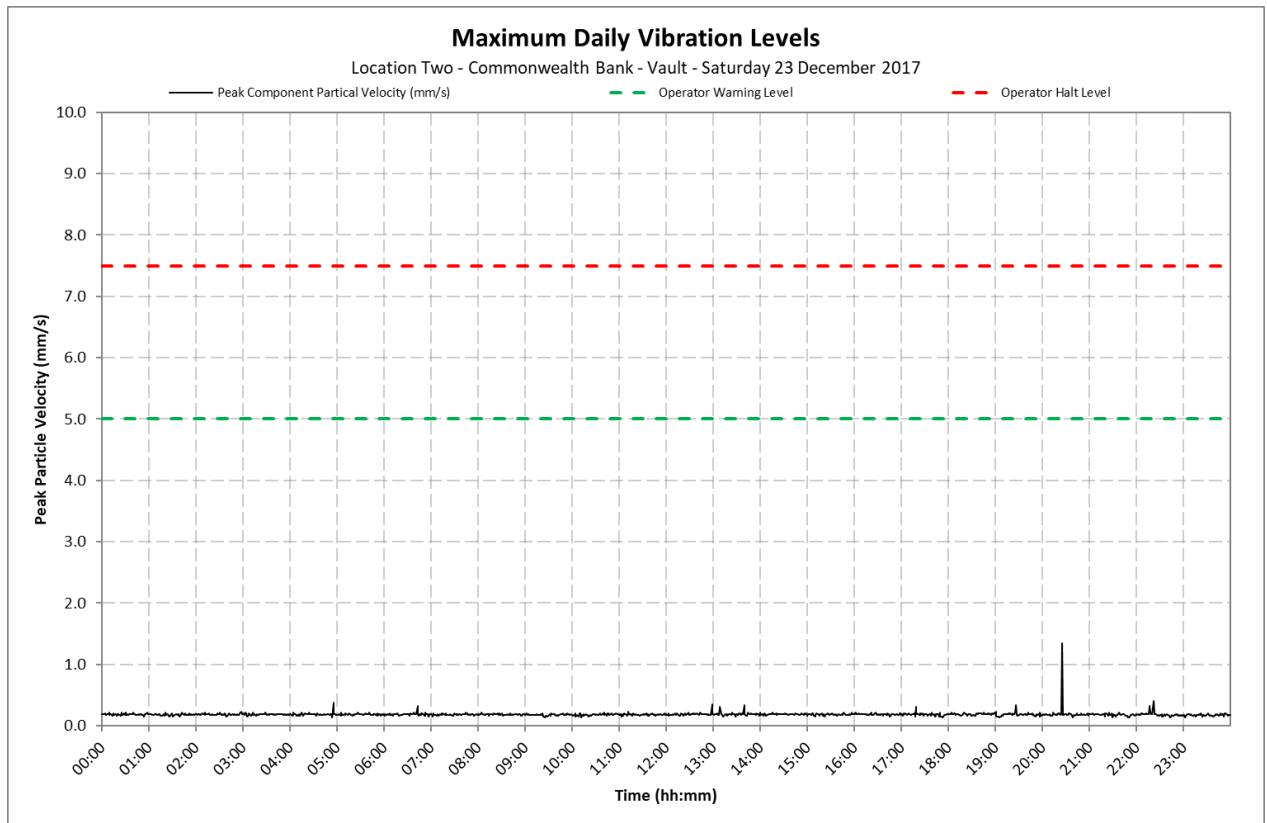
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

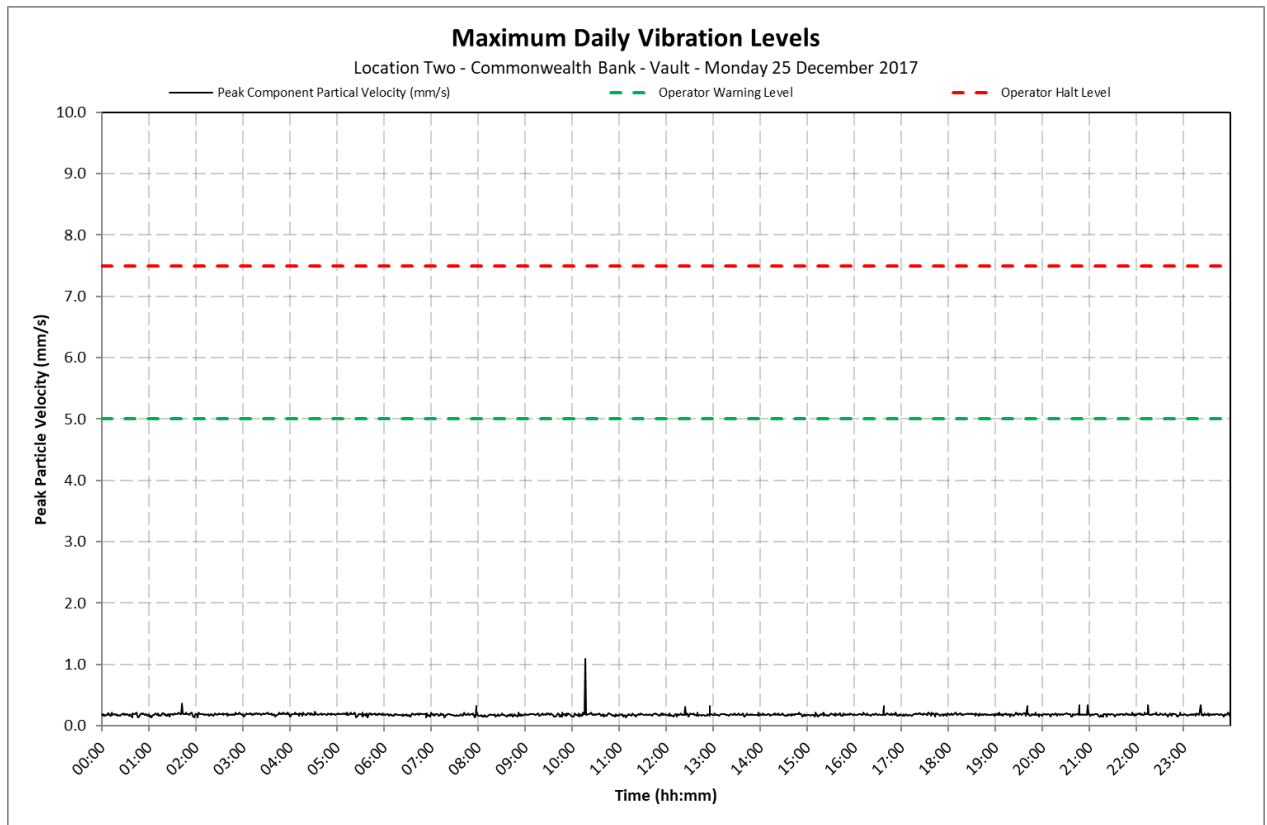
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

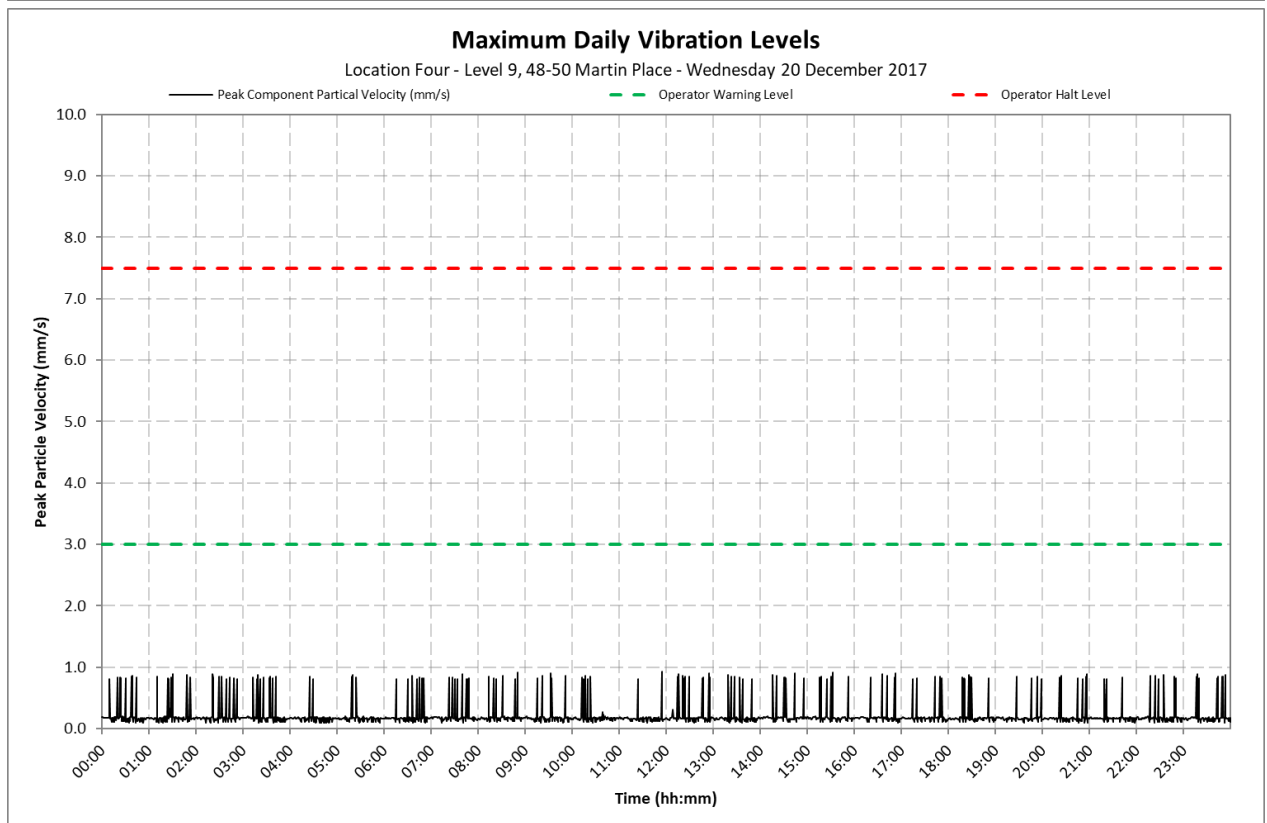
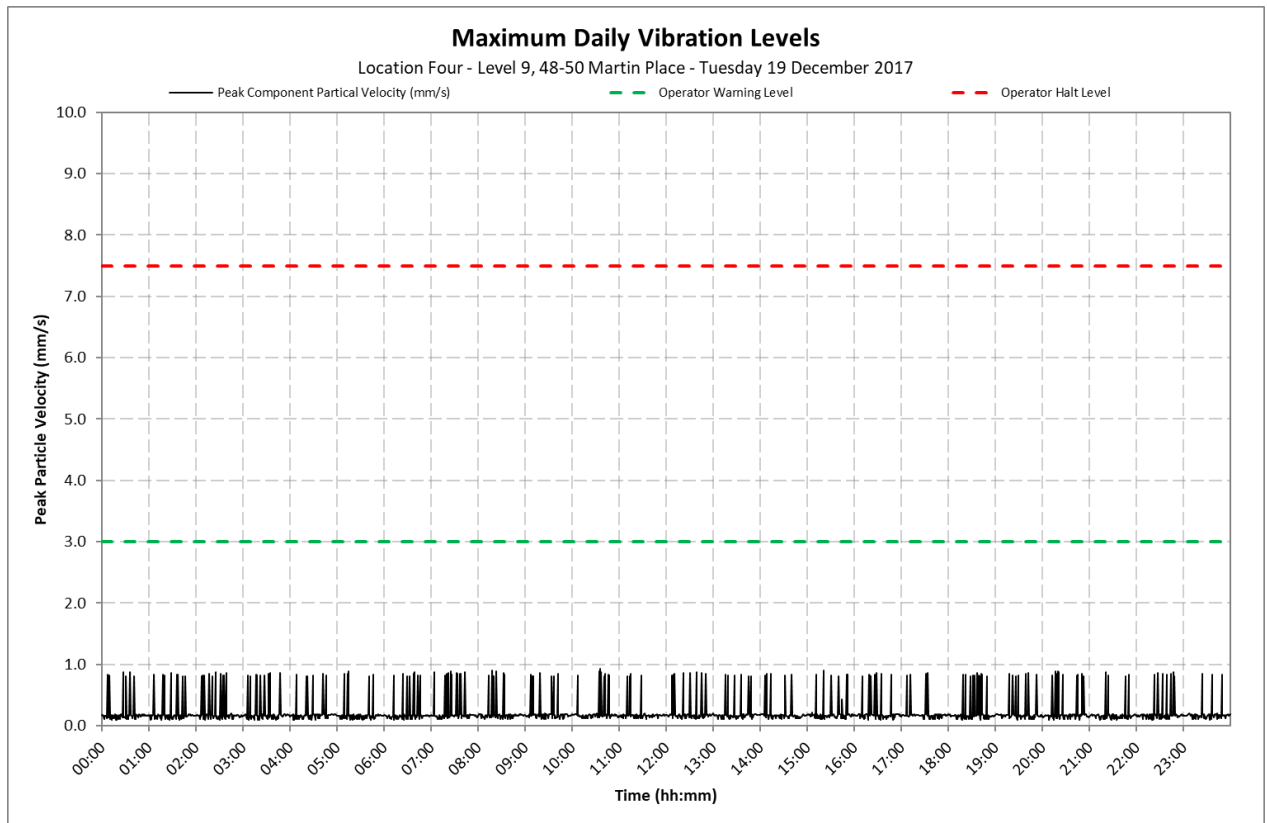
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

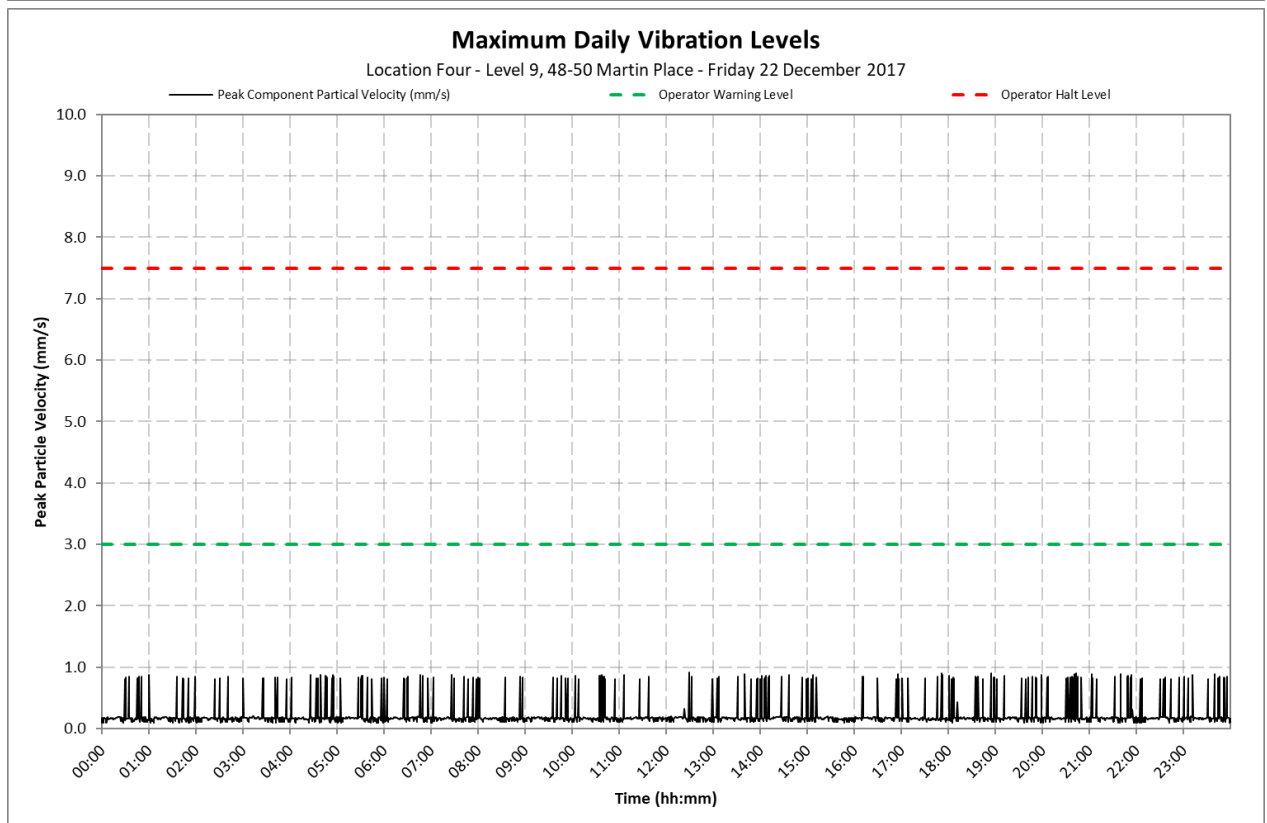
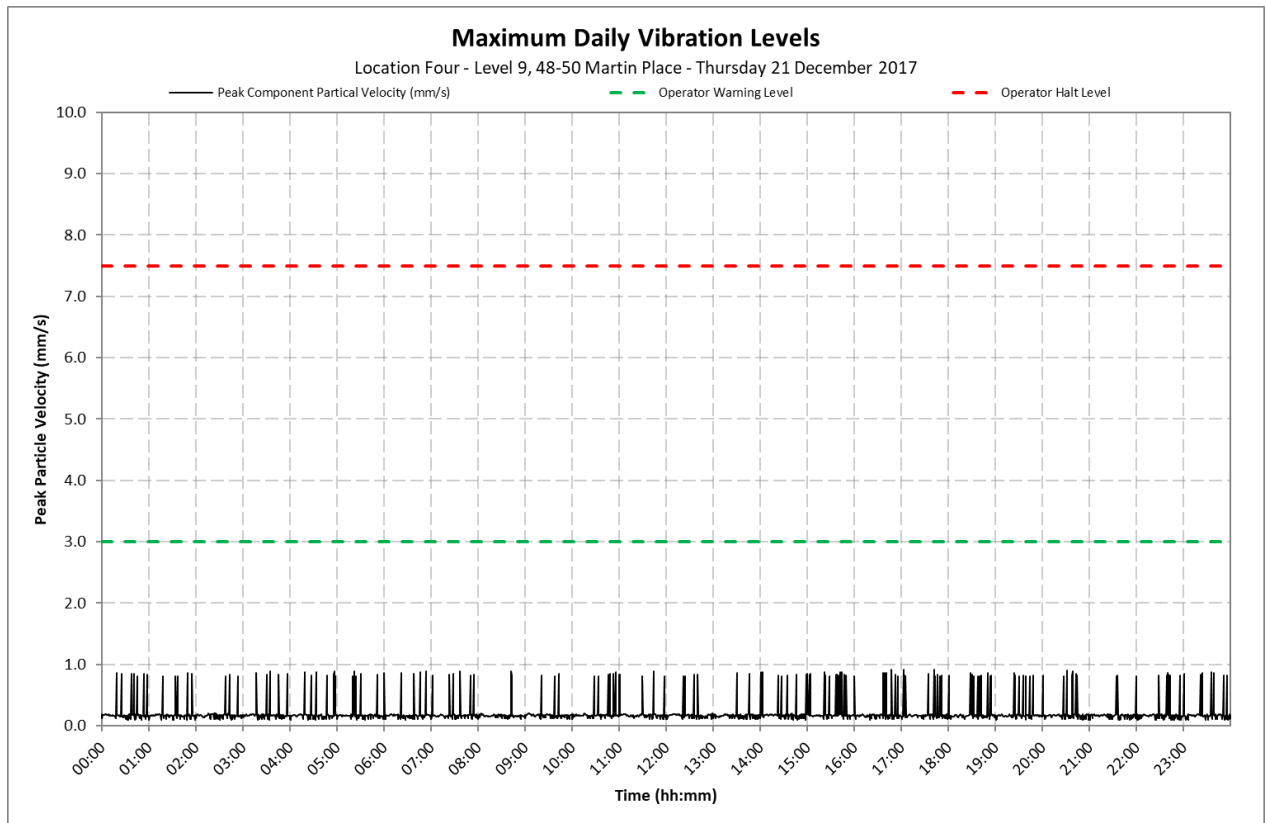
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

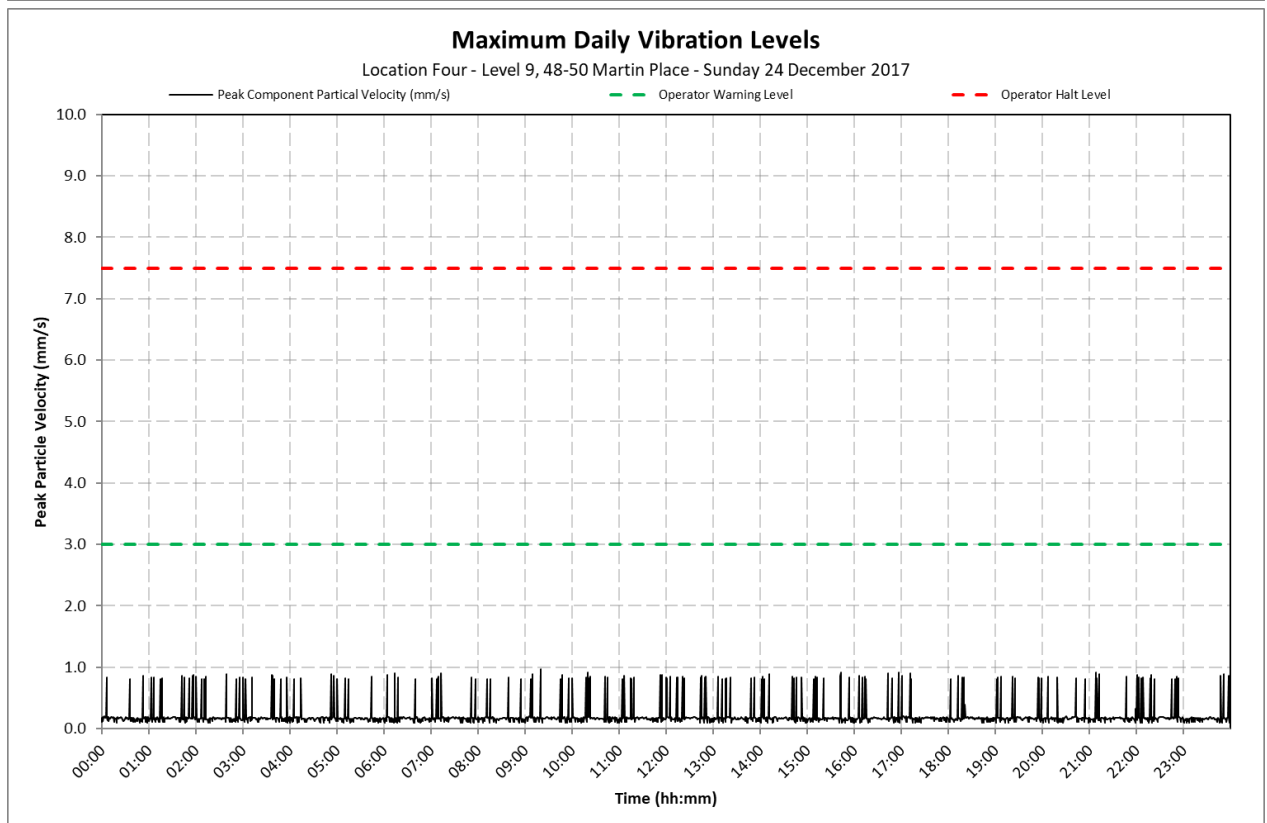
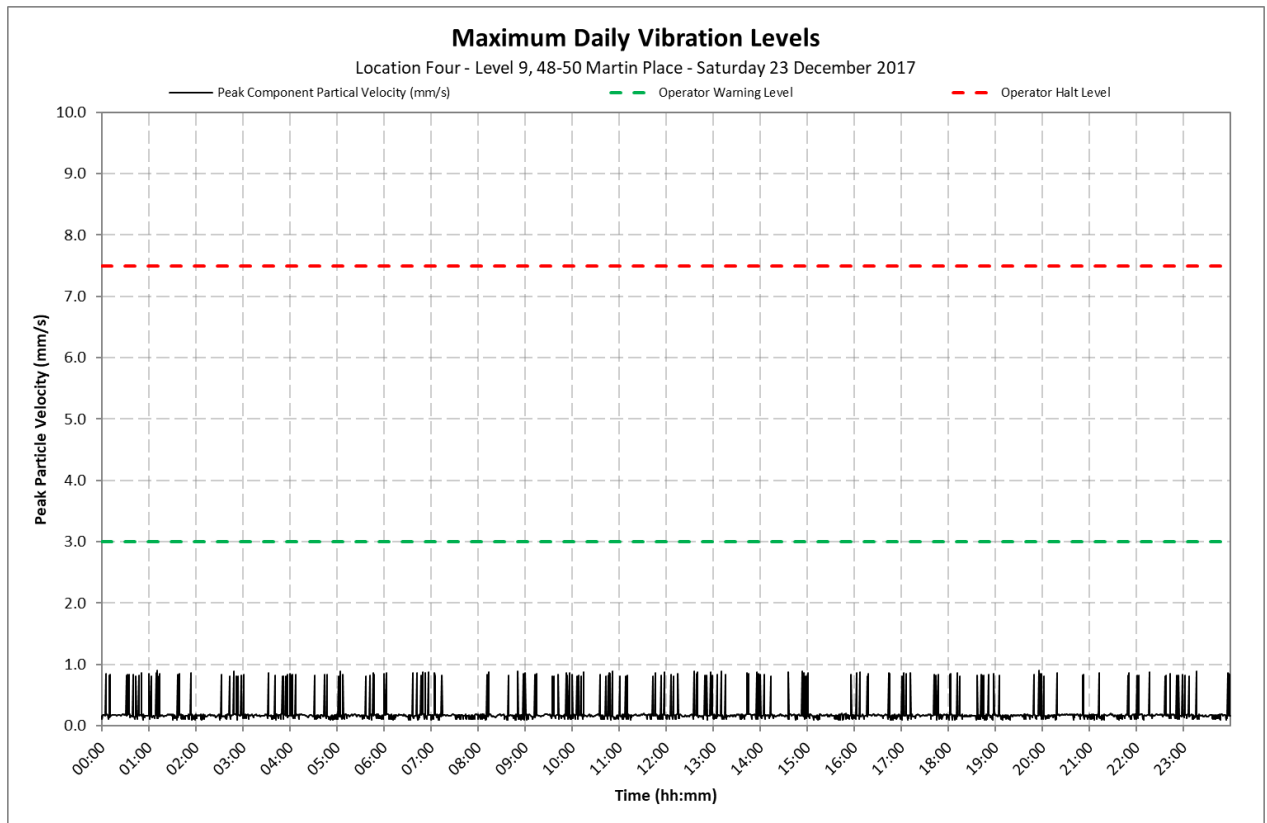
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

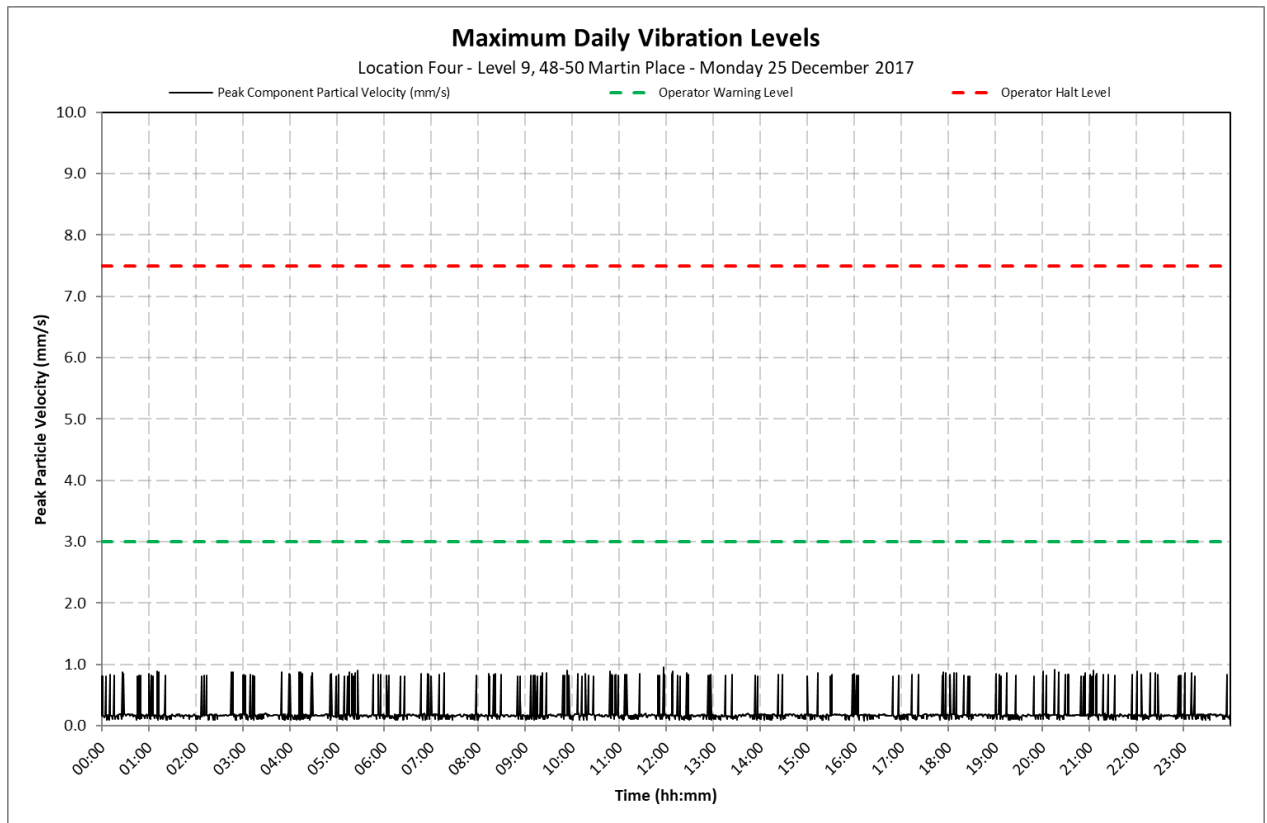
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place



15 January 2018

10-1380 R13 NV Monitoring 20180115.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 13
26 December 2017 to 1 January 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 26 December 2017 to 1 January 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

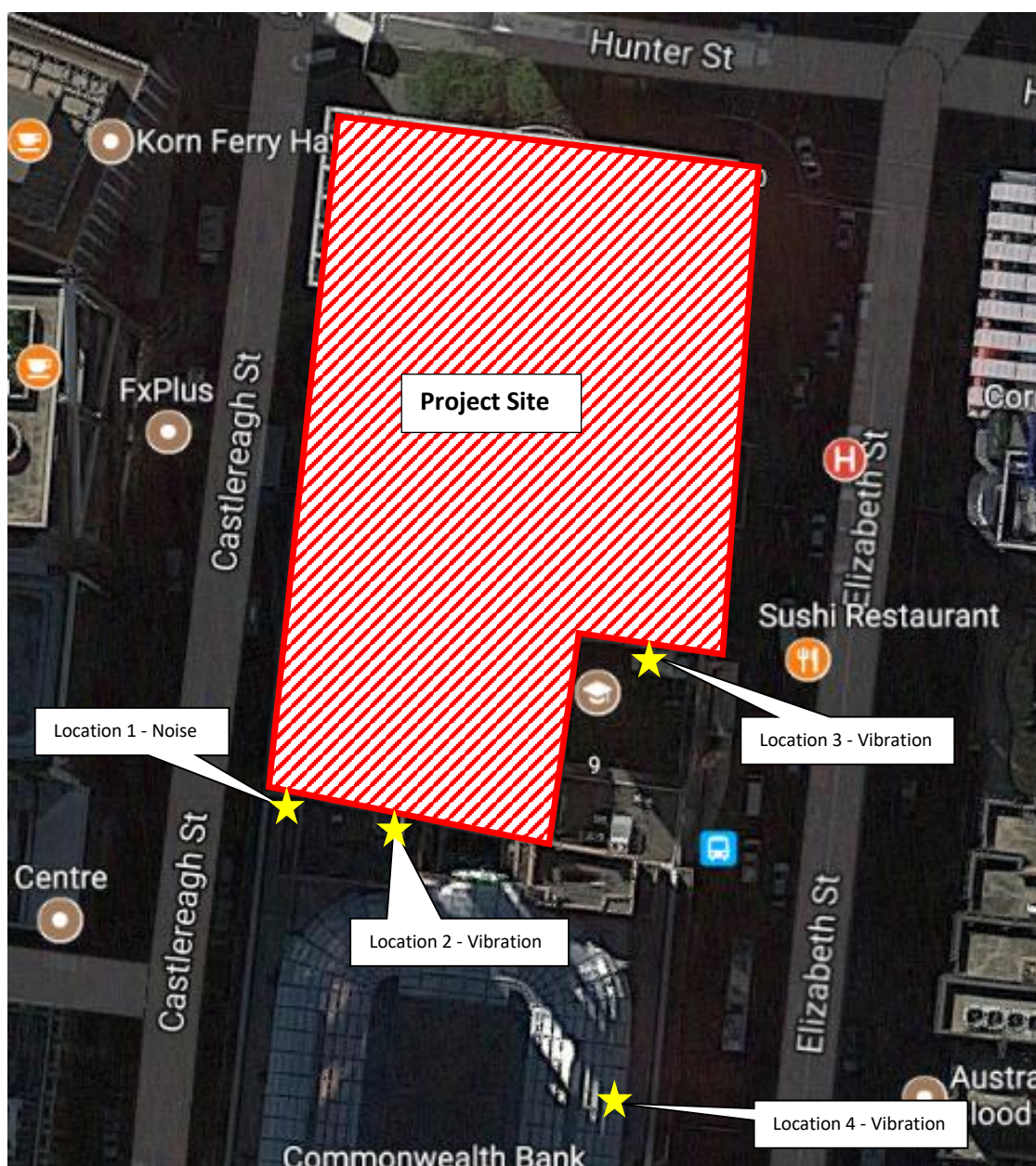
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 26 December 2017 to 1 January 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
26 December 2017	42	40	Complies	Complies
27 December 2017	45	44	Complies	Complies
28 December 2017	45	44	Complies	Complies
29 December 2017	46	45	Complies	Complies
30 December 2017	46	44	Complies	Complies
31 December 2017	39	37	Complies	Complies
1 January 2018	37	37	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 26 December 2017 to 1 January 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
26 December 2017	0.4 mm/s	Complies
27 December 2017	1.0 mm/s	Complies
28 December 2017	0.4 mm/s	Complies
29 December 2017	2.3 mm/s	Complies
30 December 2017	0.9 mm/s	Complies
31 December 2017	0.8 mm/s	Complies
1 January 2018	0.4 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
26 December 2017	0.9 mm/s	Complies
27 December 2017	0.9 mm/s	Complies
28 December 2017	0.9 mm/s	Complies
29 December 2017	0.9 mm/s	Complies
30 December 2017	0.9 mm/s	Complies
31 December 2017	0.9 mm/s	Complies
1 January 2018	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 26 December 2017 to 1 January 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 26 December 2017 to 1 January 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

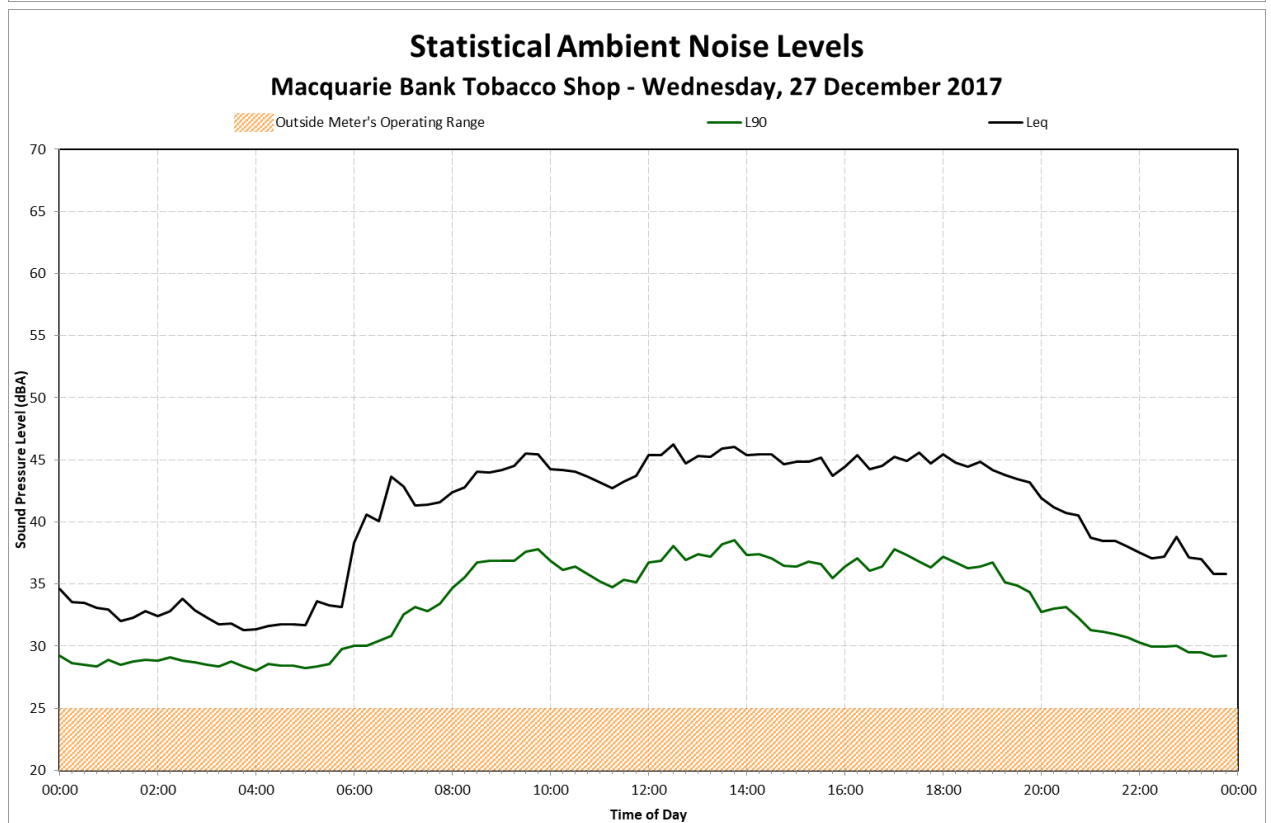
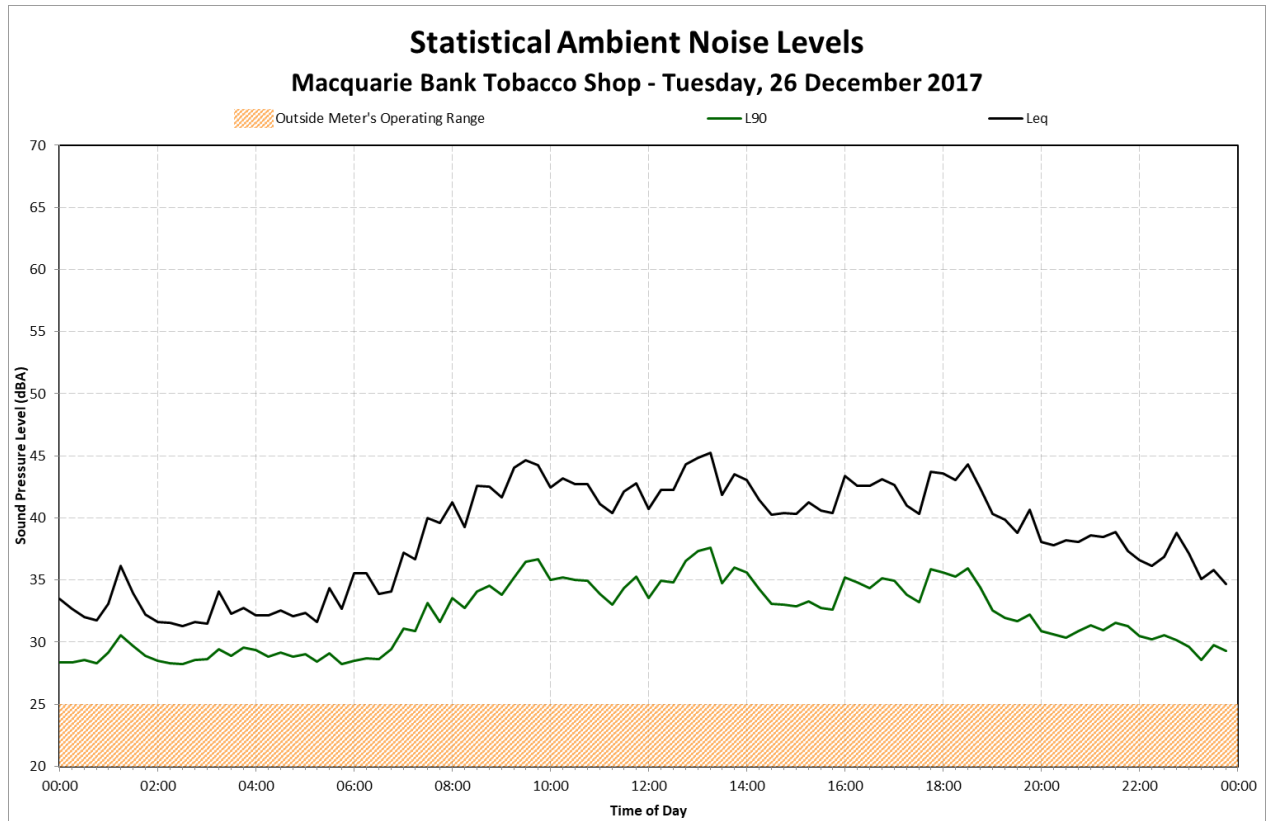
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

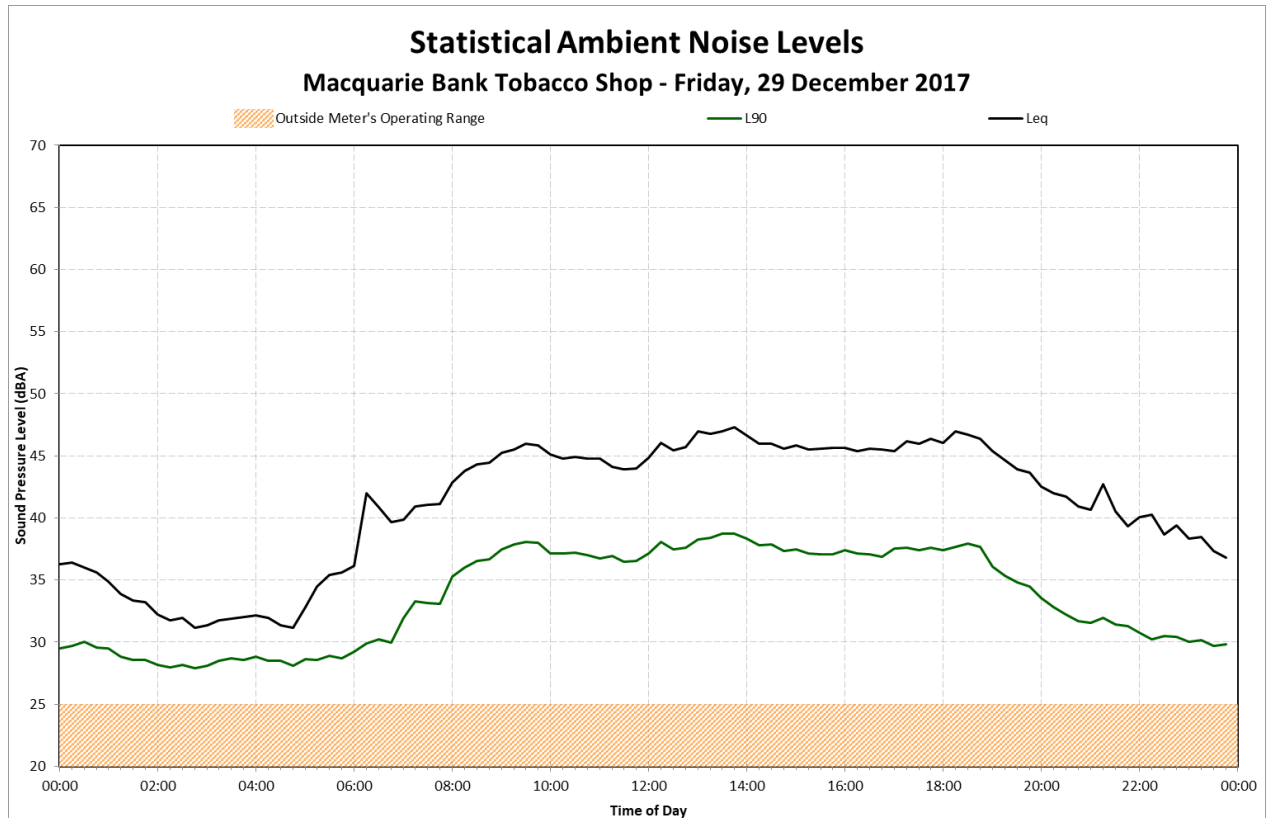
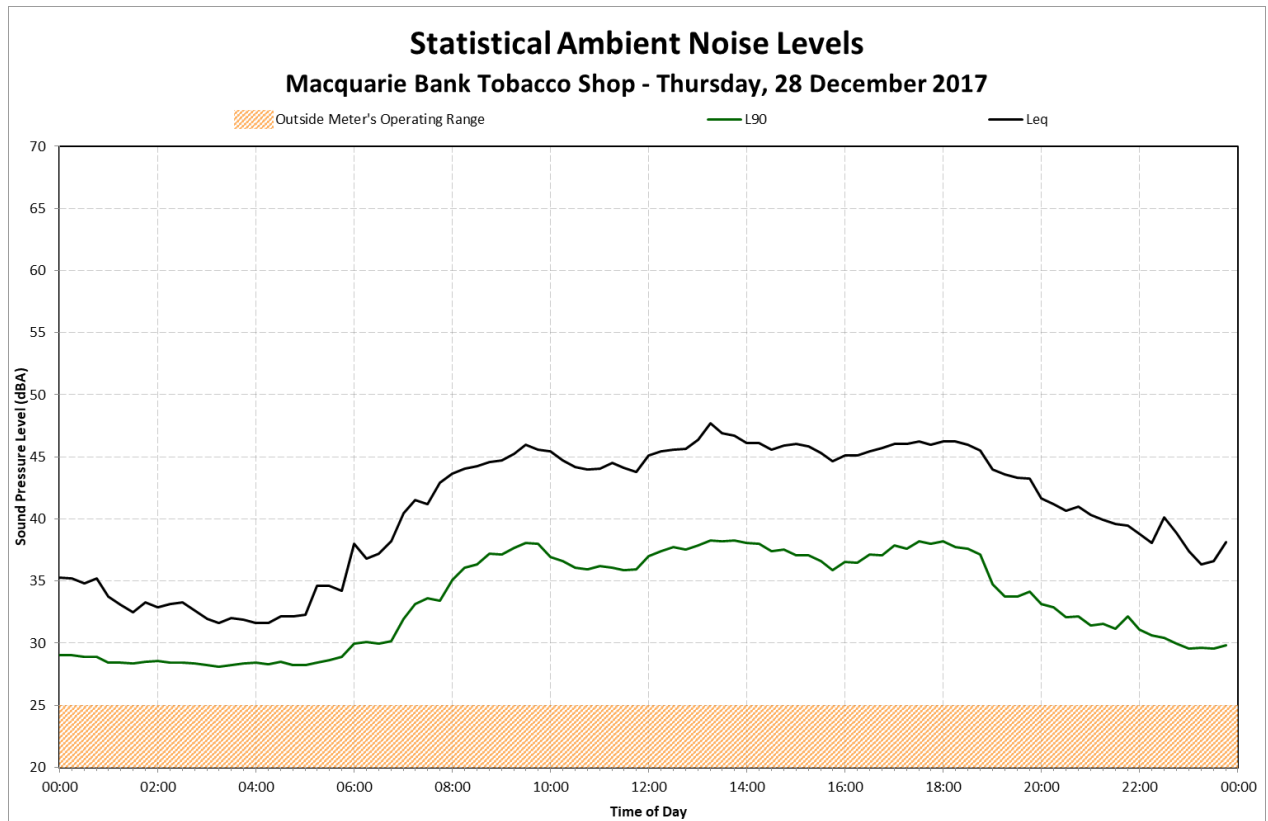
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

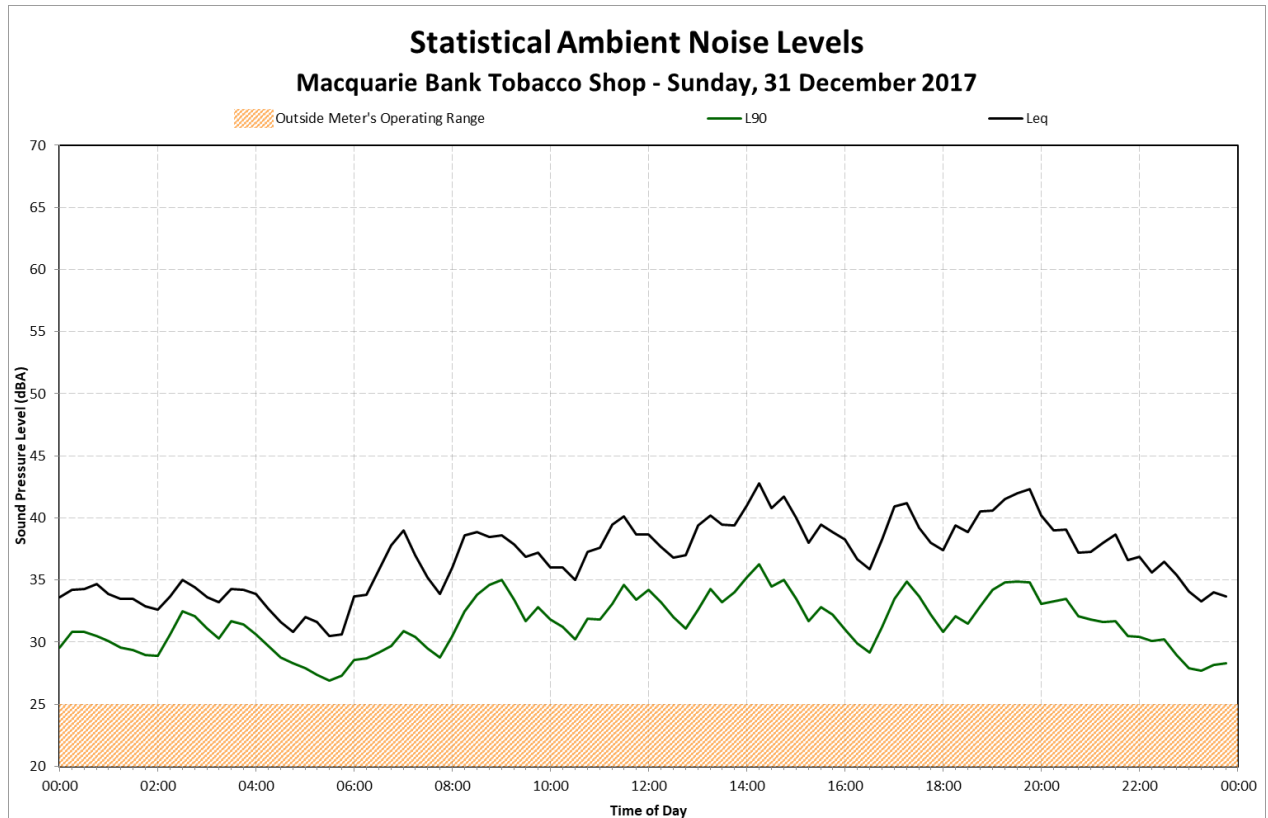
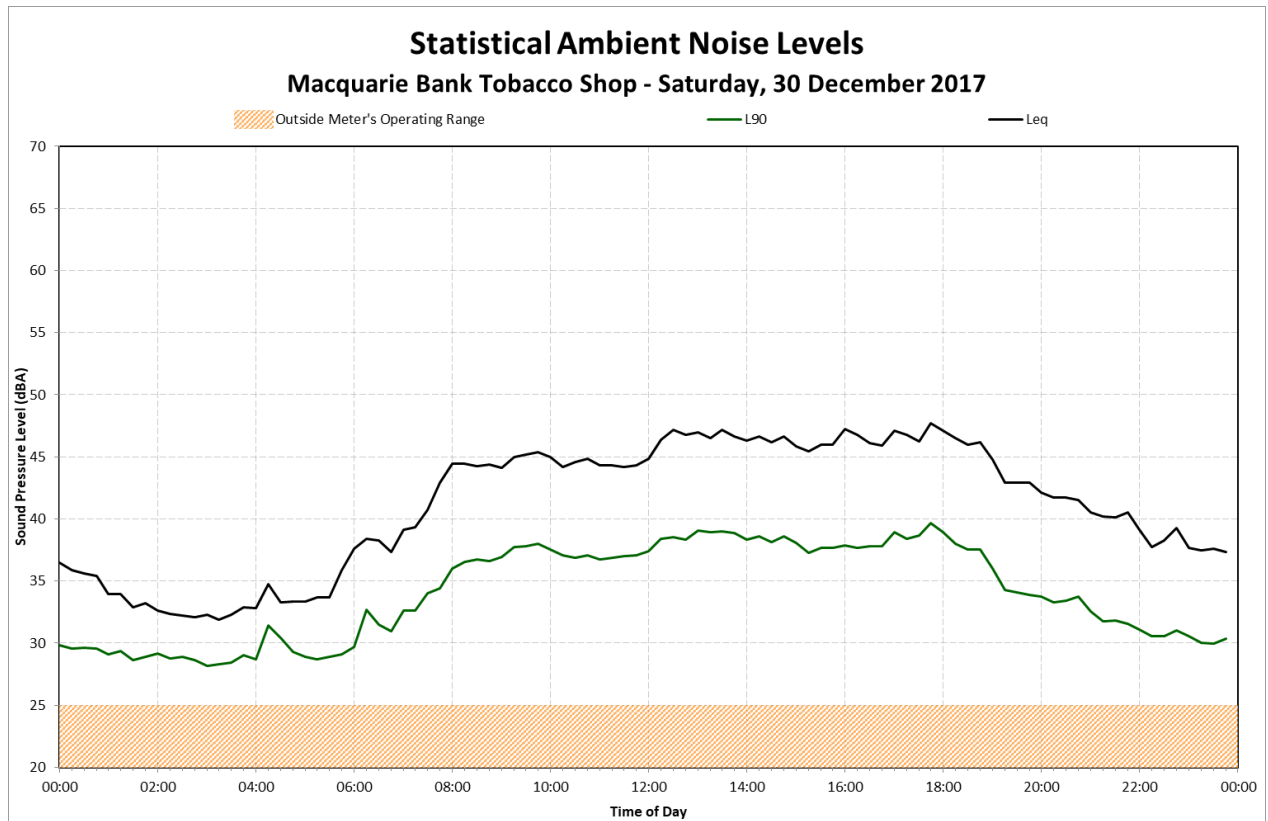
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

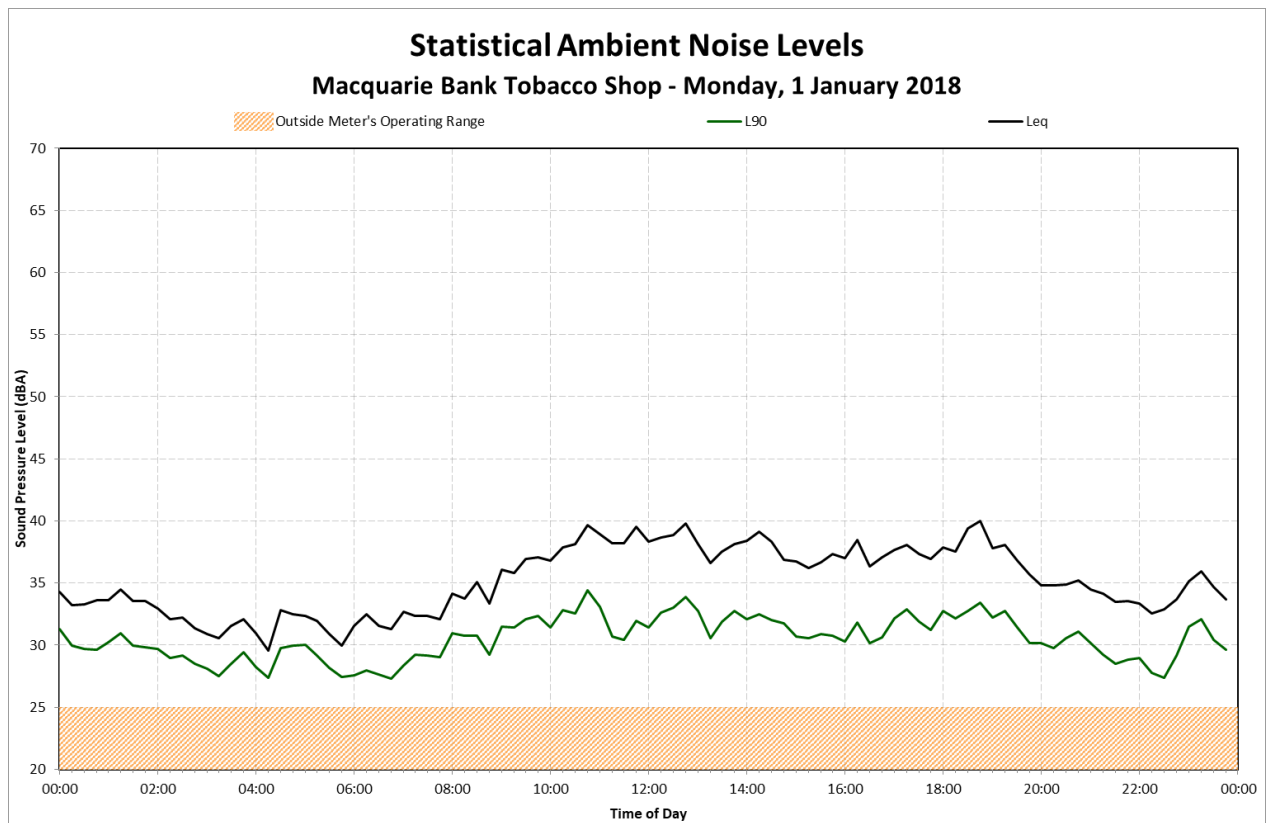
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

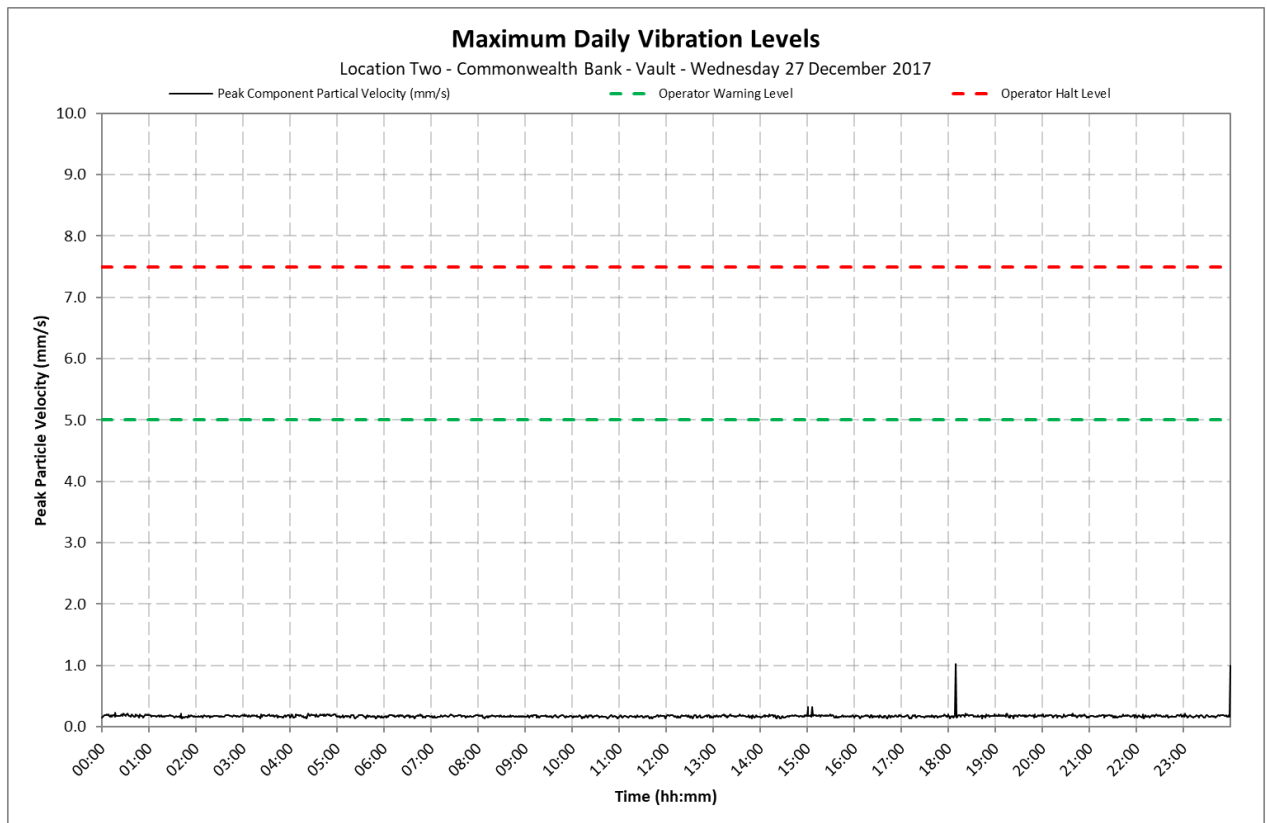
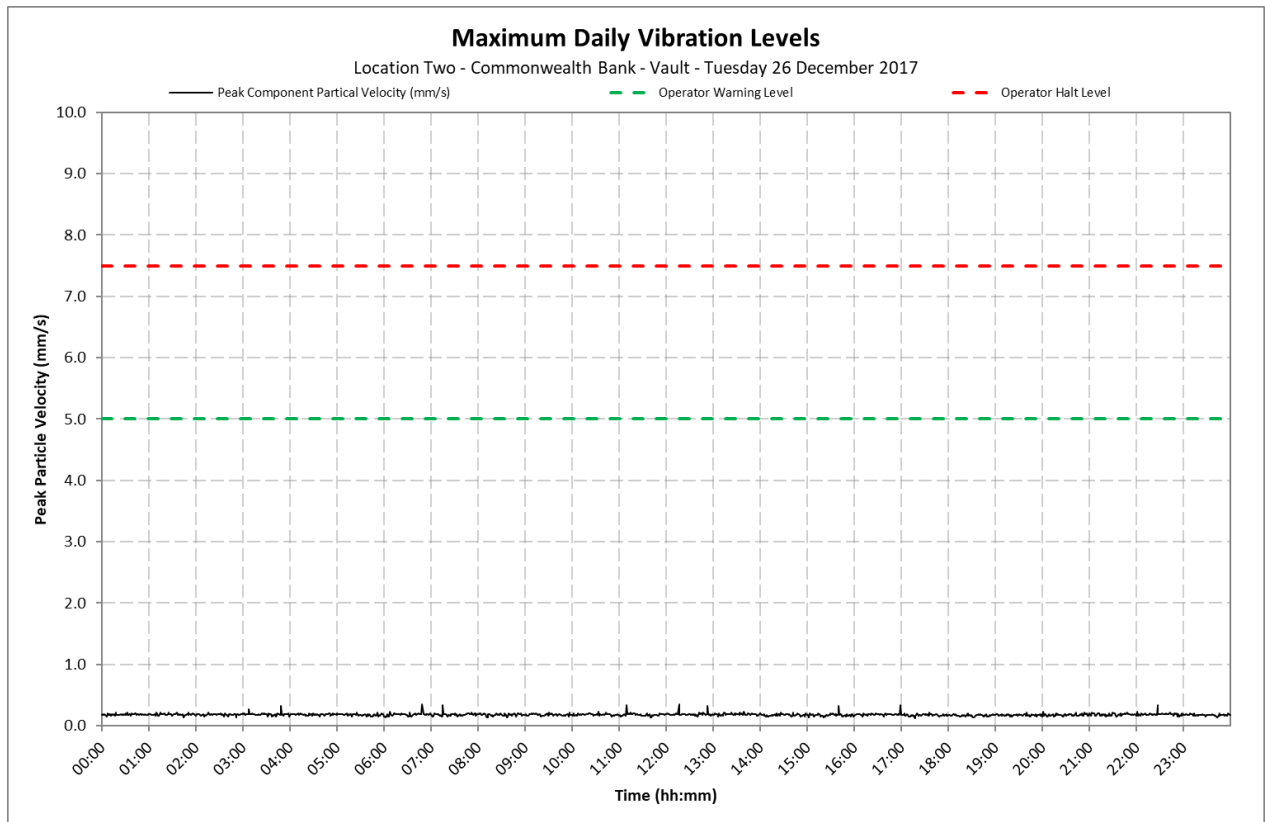
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

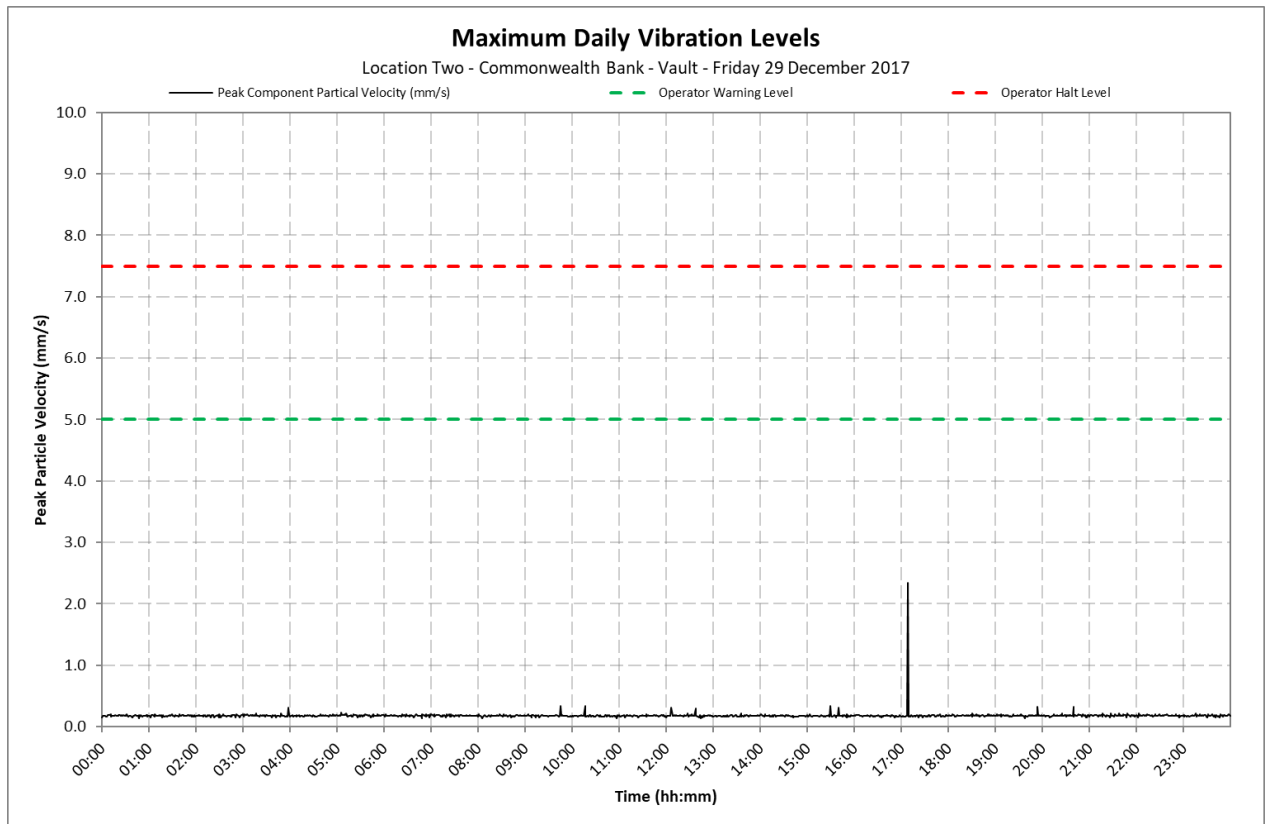
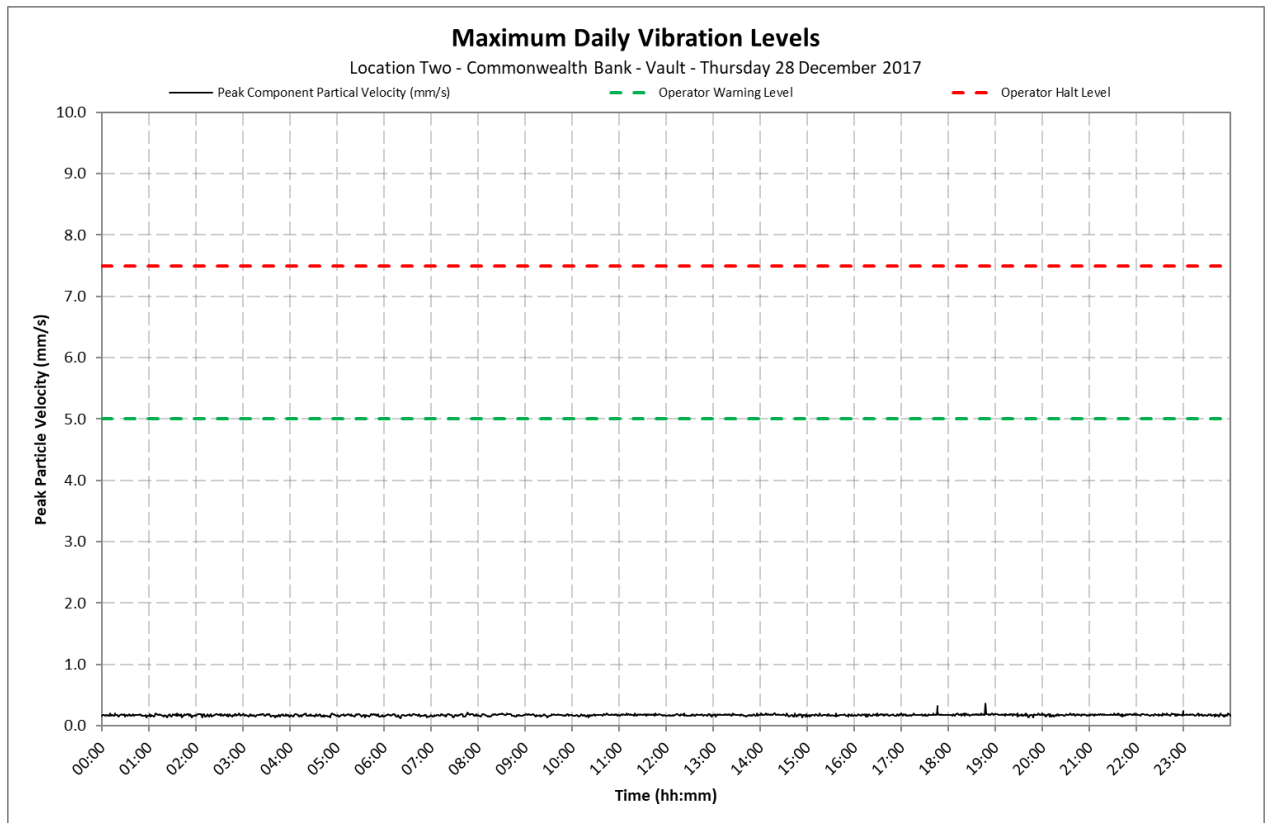
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

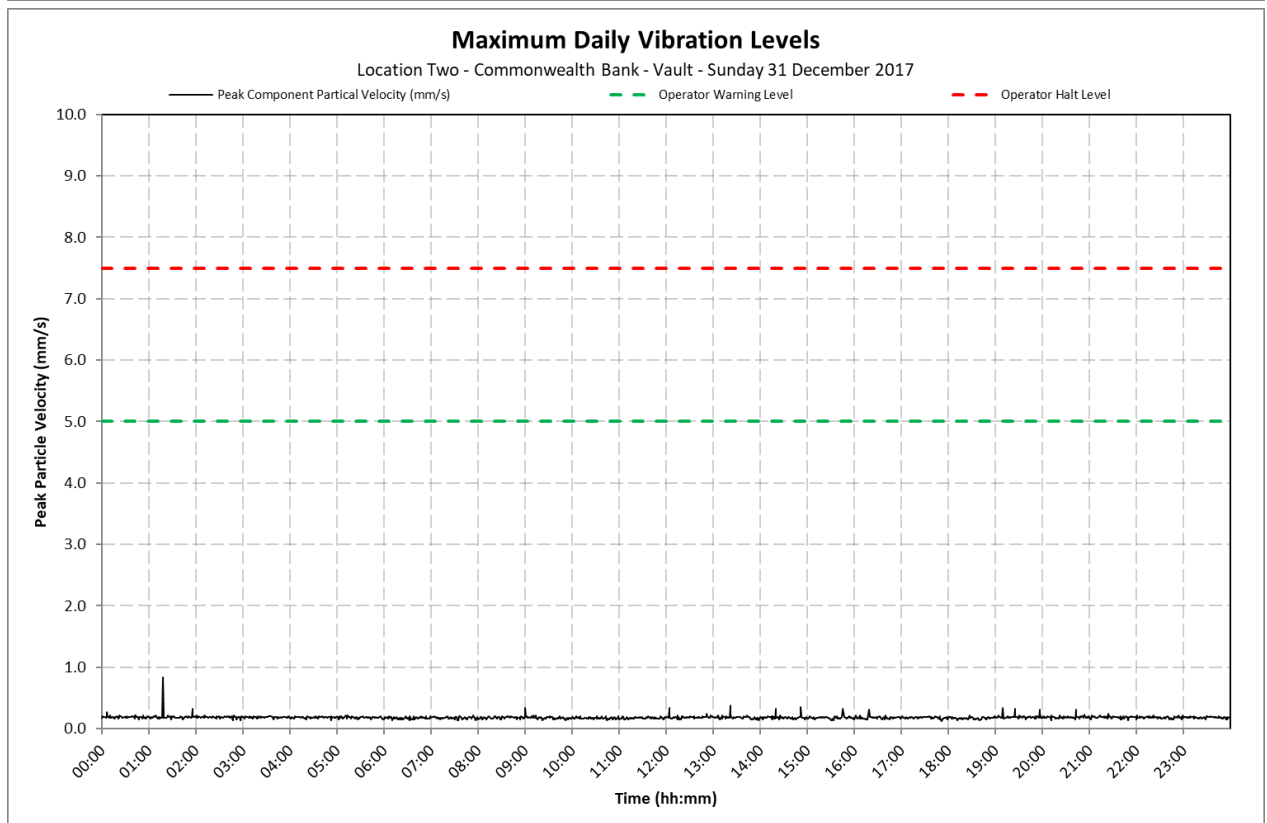
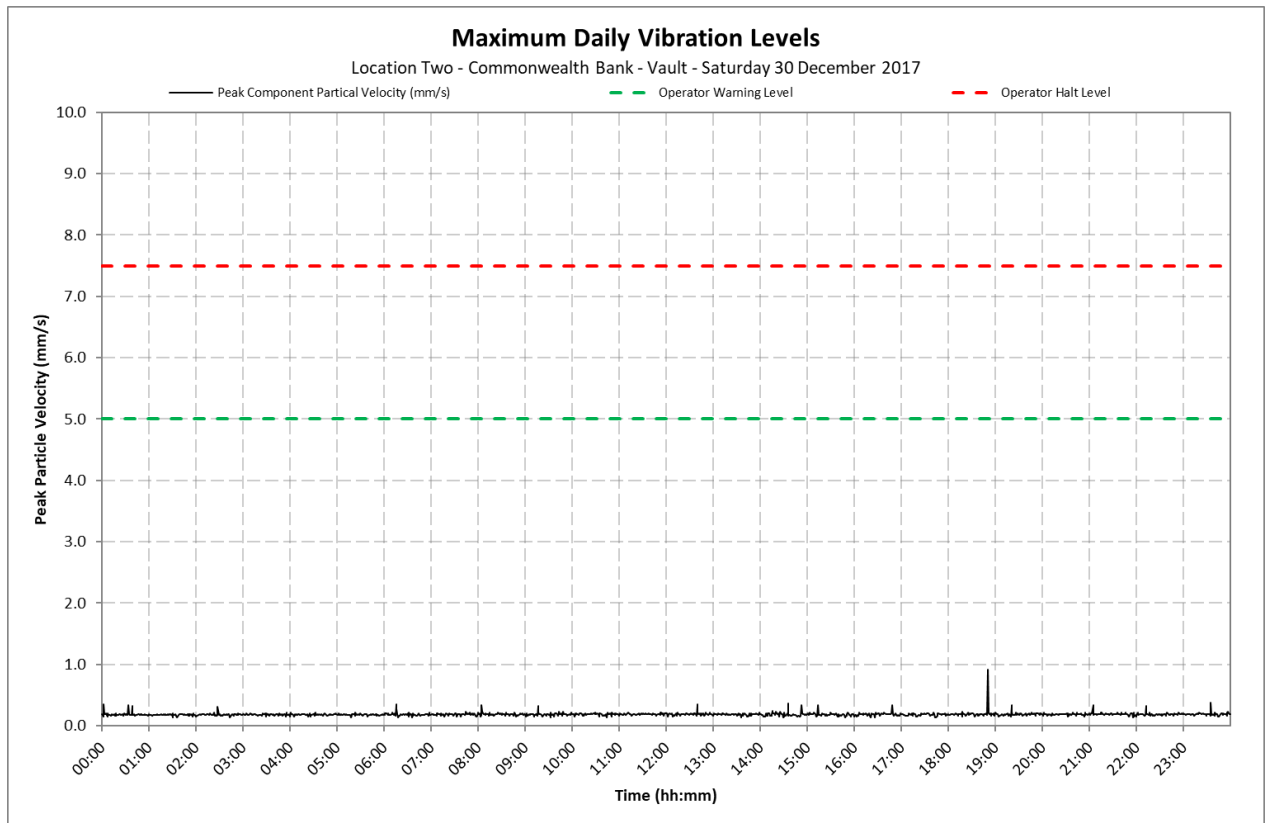
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

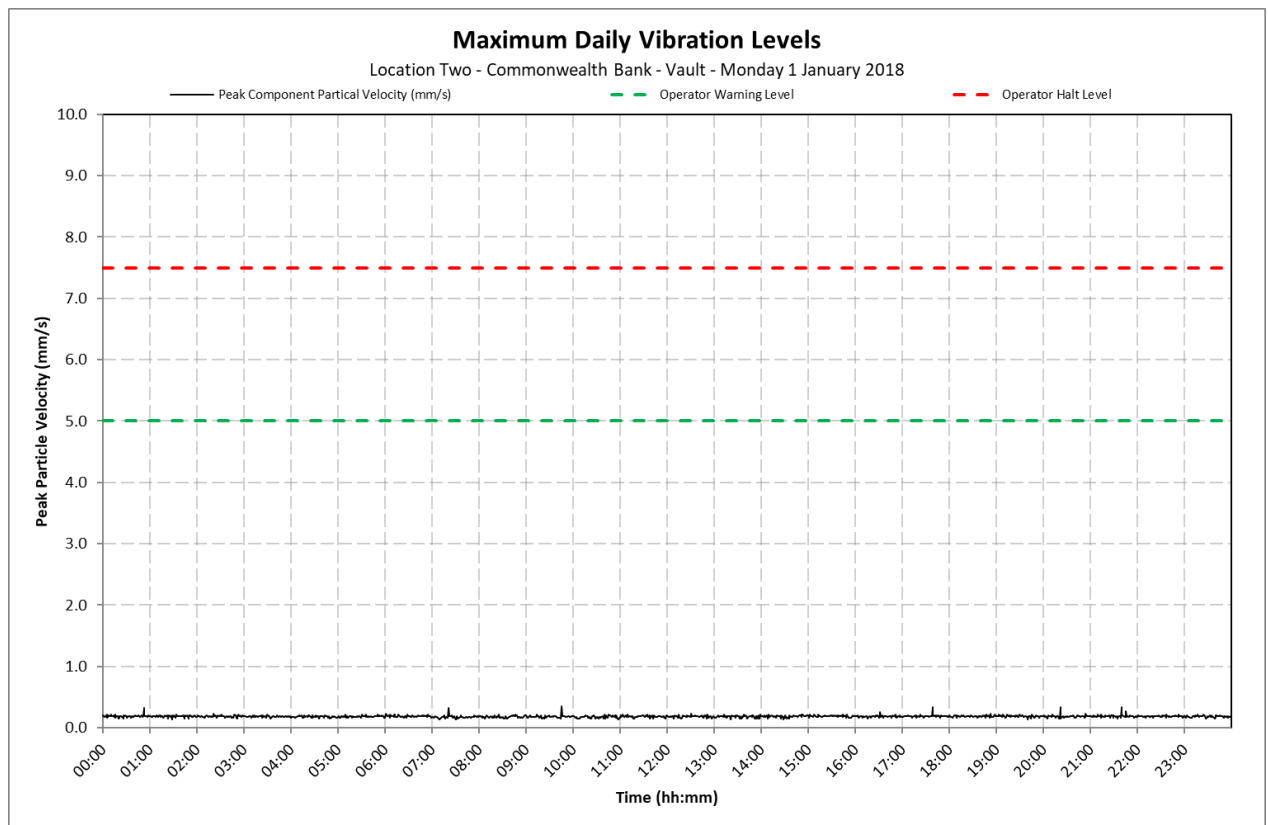
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

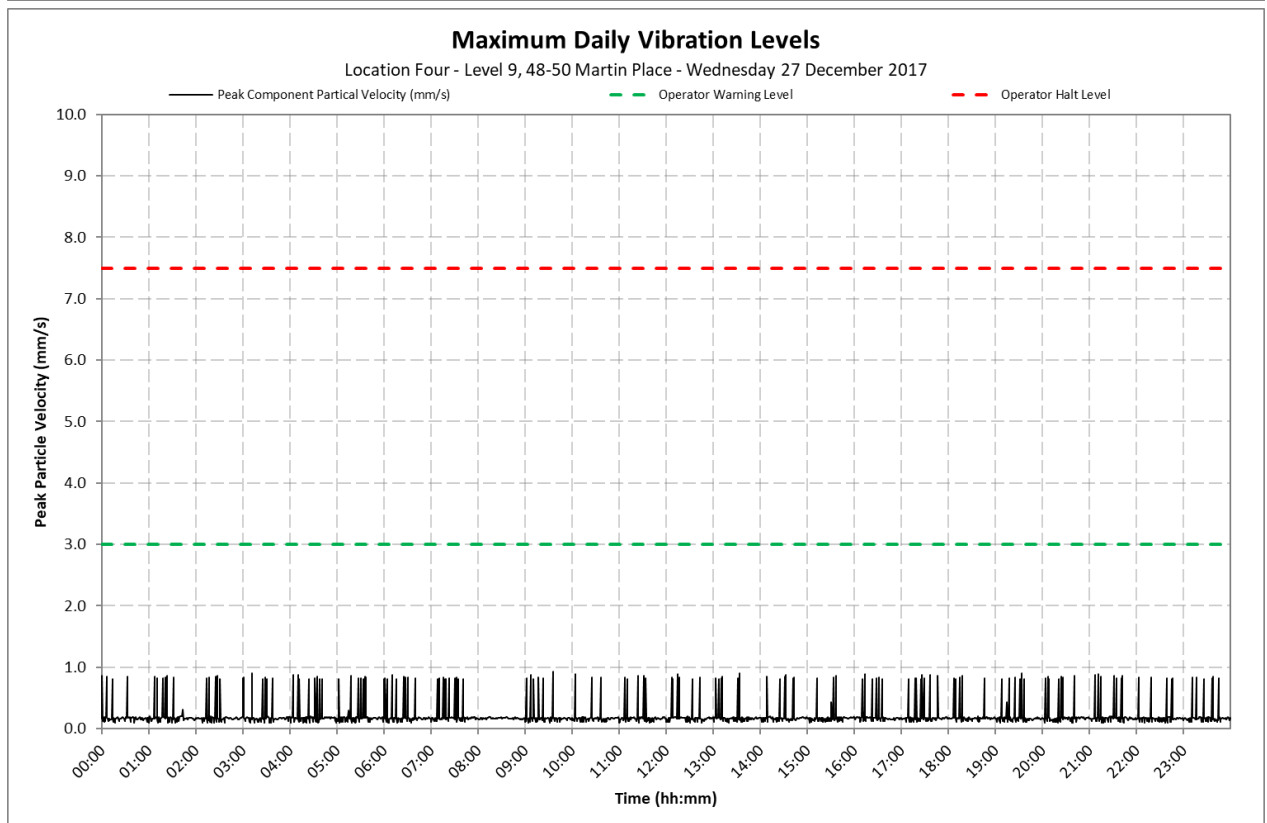
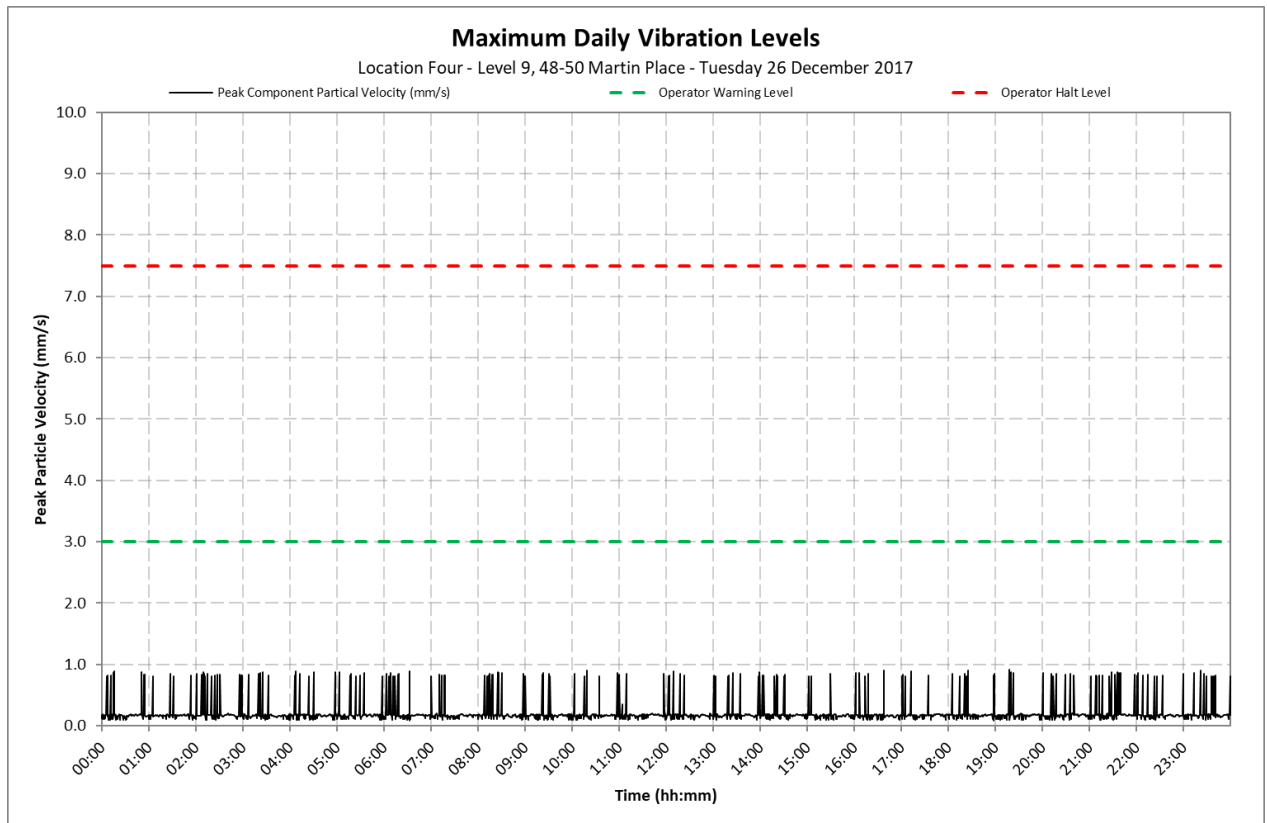
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

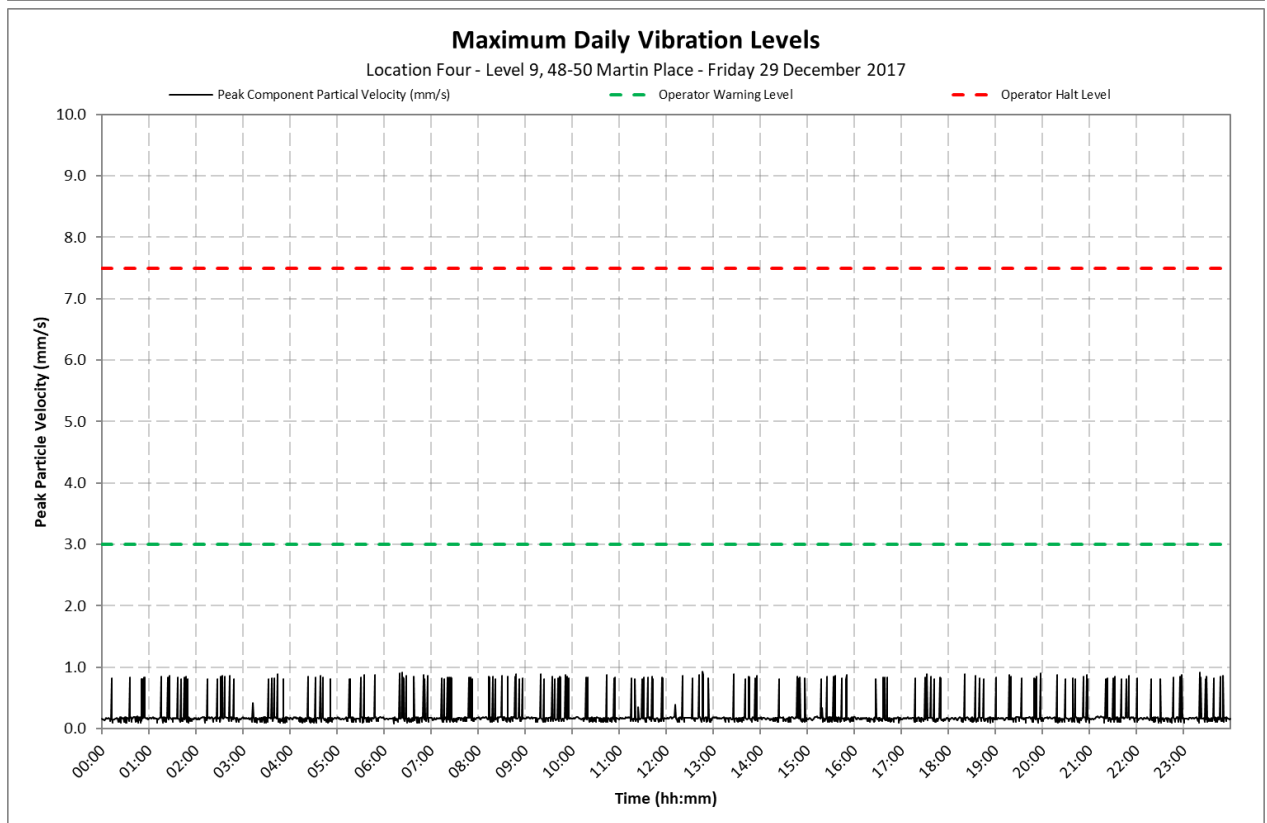
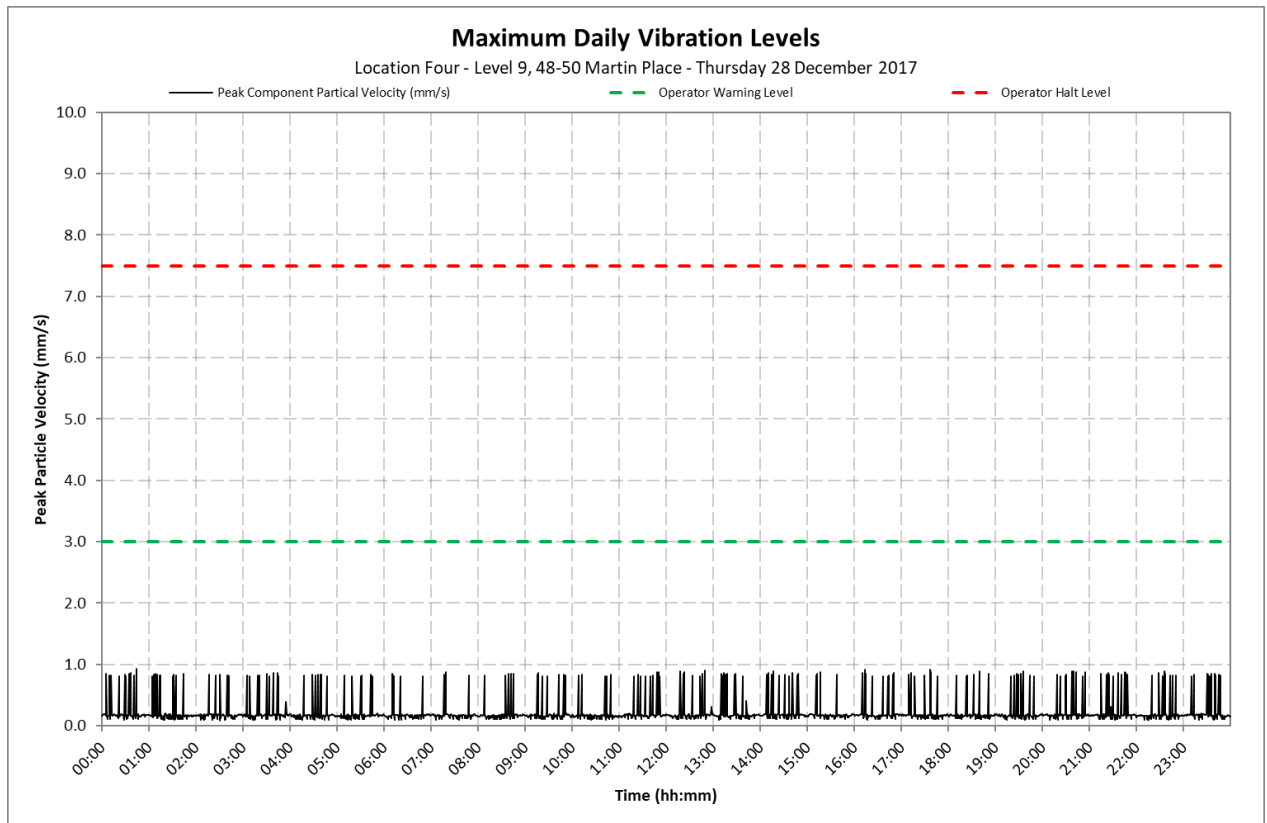
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

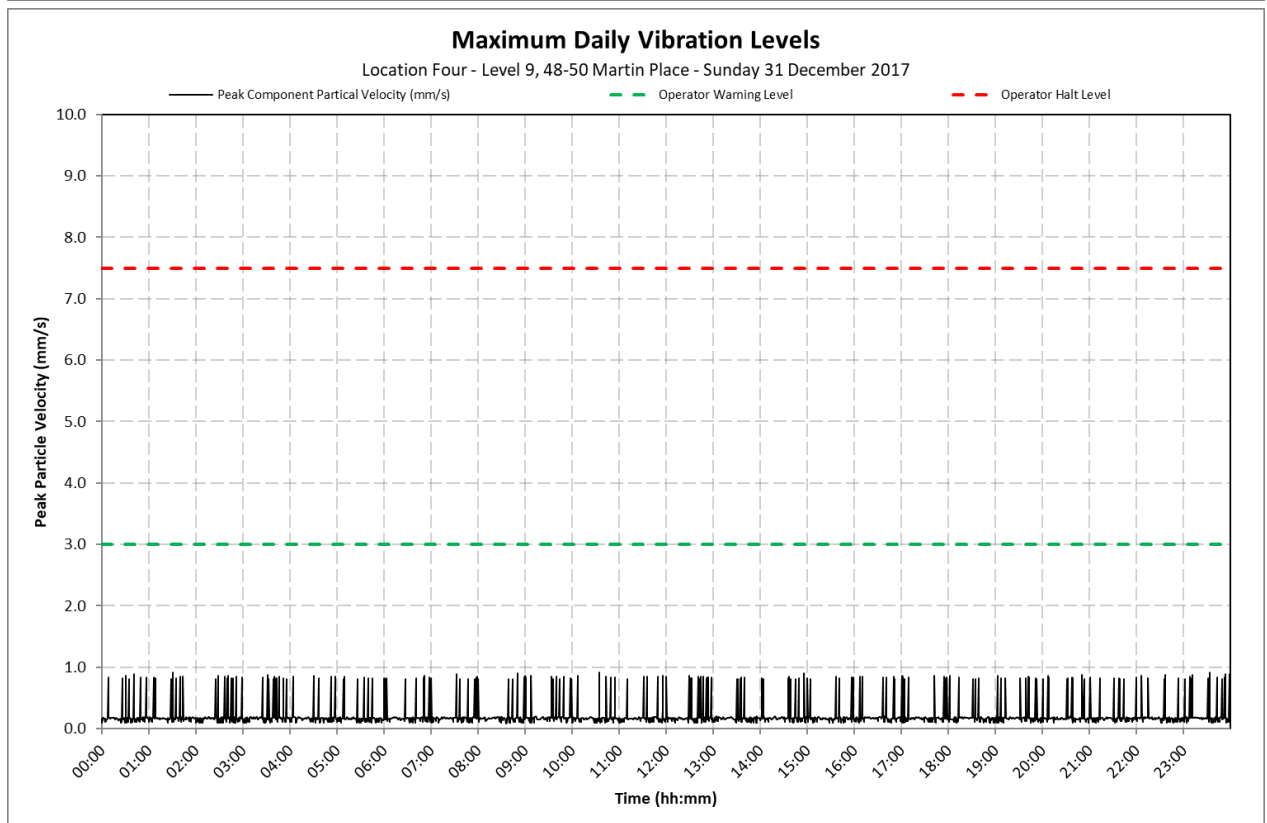
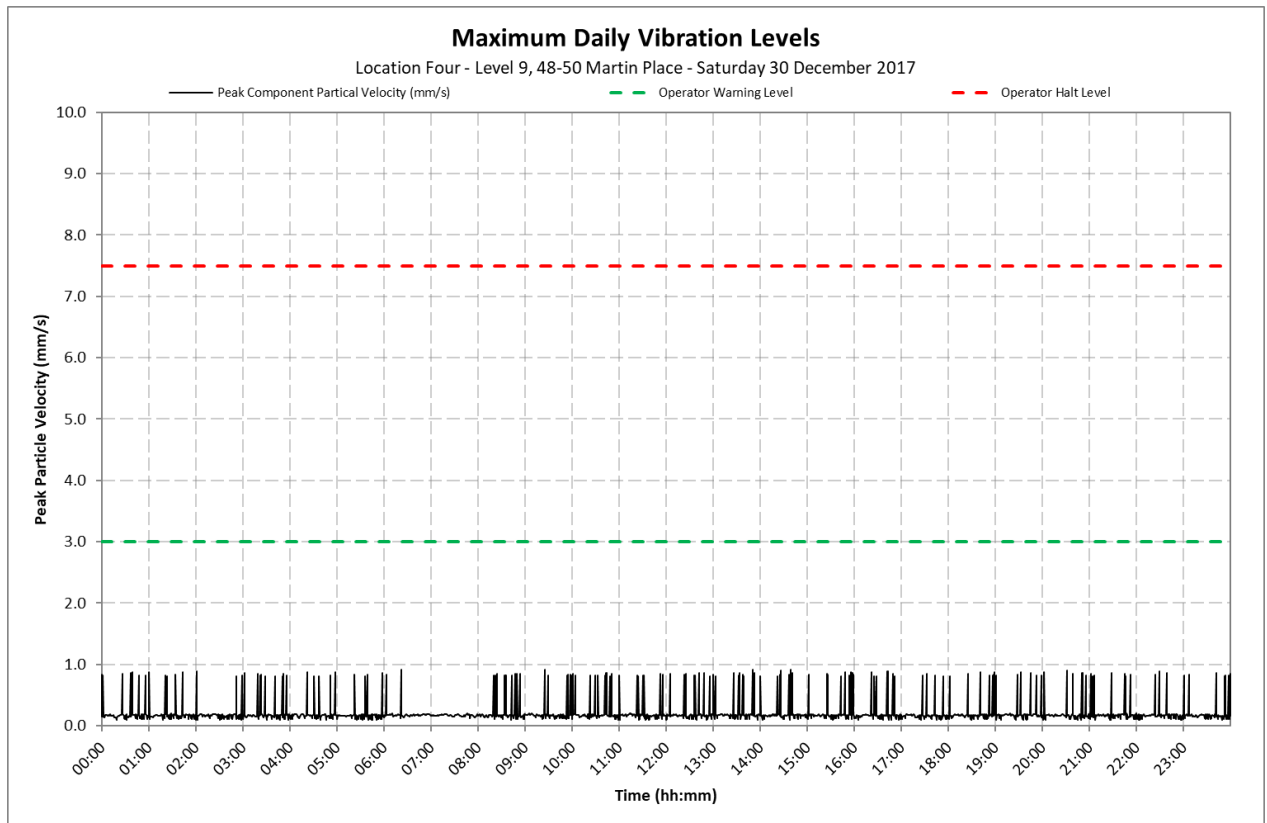
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

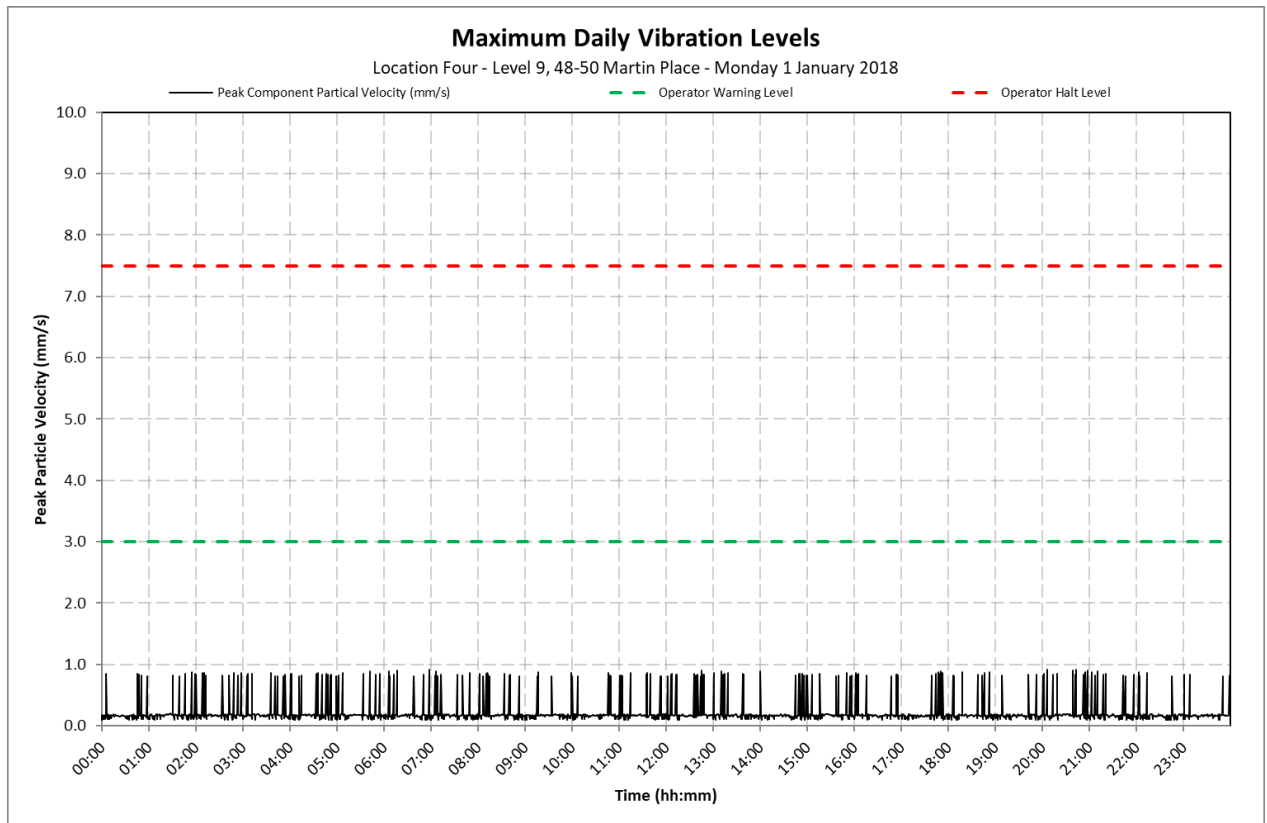
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





15 January 2018

10-1380 R14 NV Monitoring 20180115.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 14
2 January to 8 January 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 2 January to 8 January 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

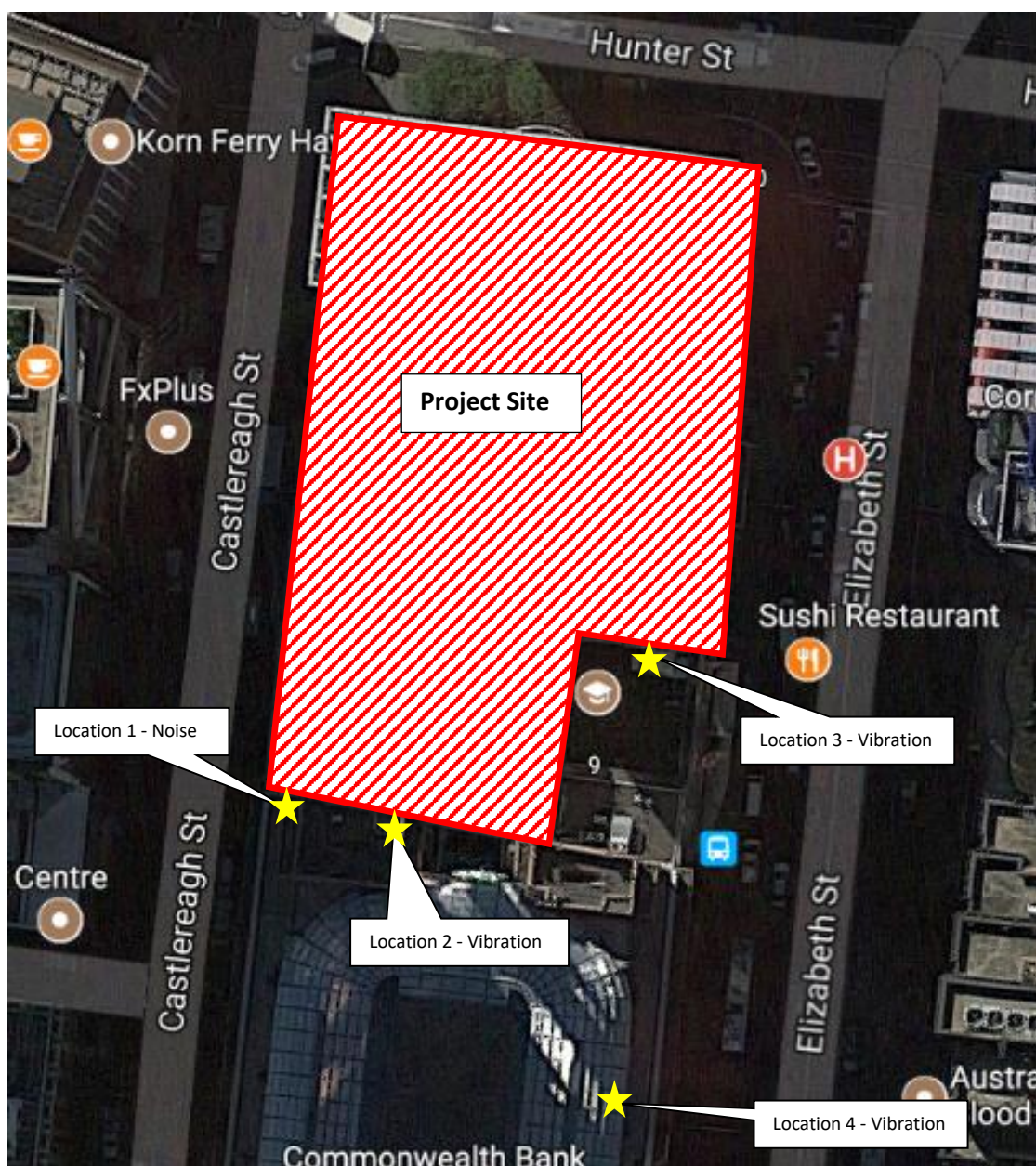
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 2 January to 8 January 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
2 January 2018	42	40	Complies	Complies
3 January 2018	44	43	Complies	Complies
4 January 2018	45	44	Complies	Complies
5 January 2018	46	44	Complies	Complies
6 January 2018	46	45	Complies	Complies
7 January 2018	39	38	Complies	Complies
8 January 2018	37	36	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 2 January to 8 January 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
2 January 2018	1.0 mm/s	Complies
3 January 2018	0.8 mm/s	Complies
4 January 2018	0.9 mm/s	Complies
5 January 2018	0.5 mm/s	Complies
6 January 2018	1.1 mm/s	Complies
7 January 2018	0.2 mm/s	Complies
8 January 2018	1.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
2 January 2018	0.9 mm/s	Complies
3 January 2018	1.0 mm/s	Complies
4 January 2018	0.9 mm/s	Complies
5 January 2018	0.9 mm/s	Complies
6 January 2018	0.9 mm/s	Complies
7 January 2018	0.9 mm/s	Complies
8 January 2018	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 2 January to 8 January 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 2 January to 8 January 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

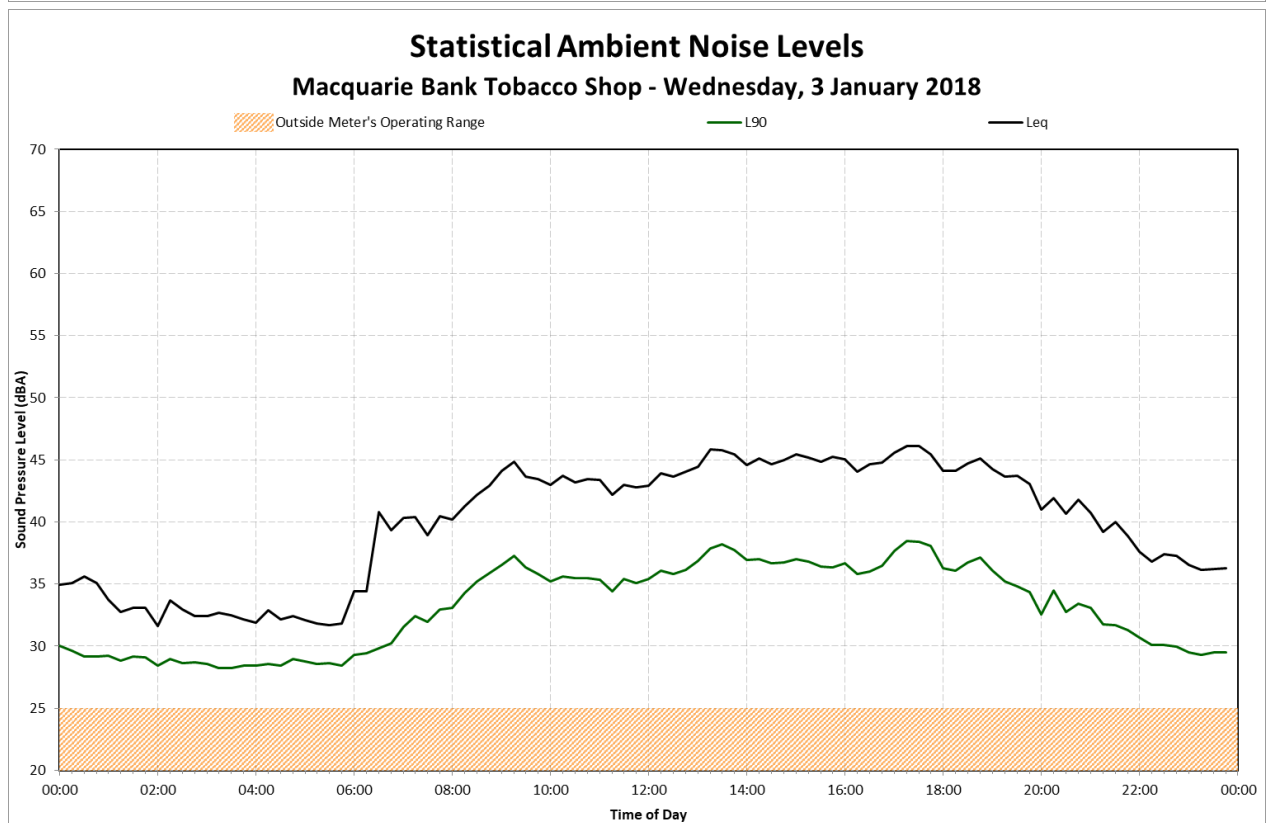
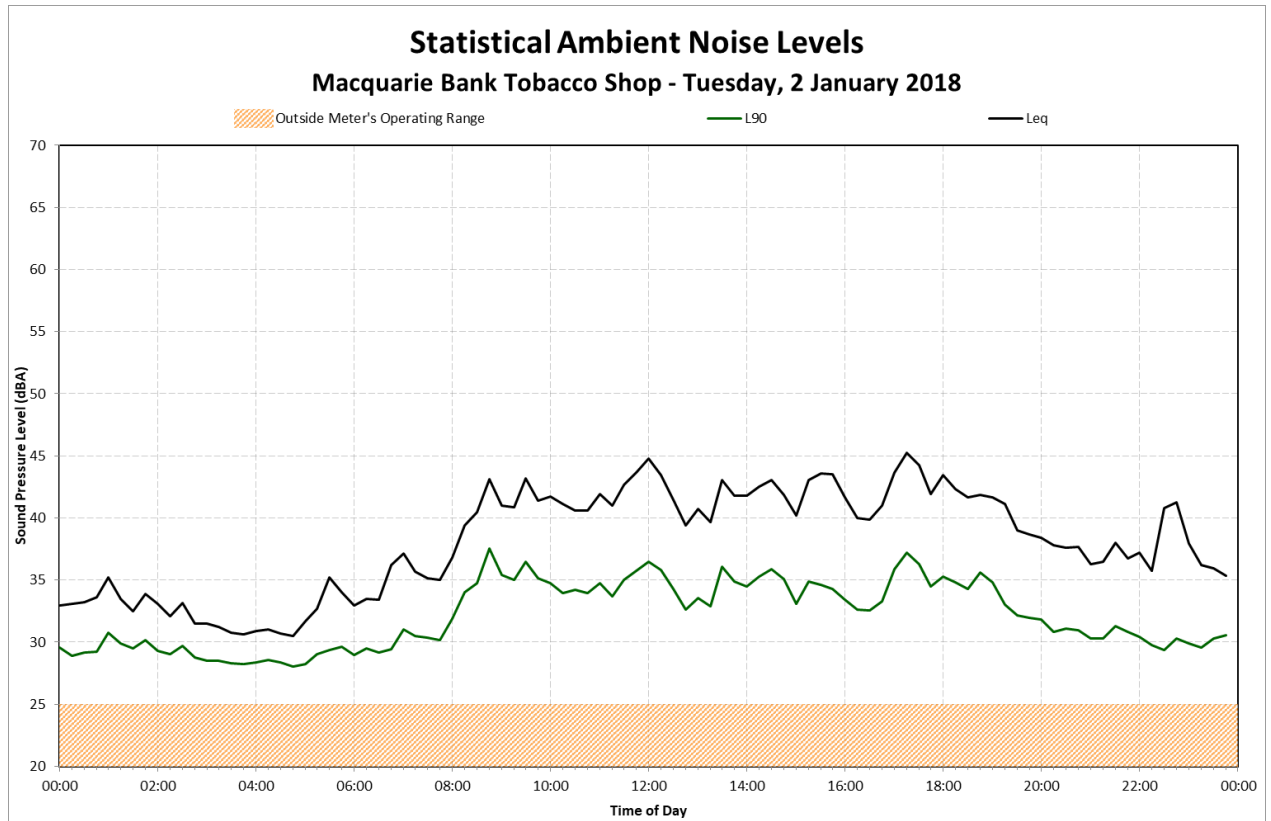
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

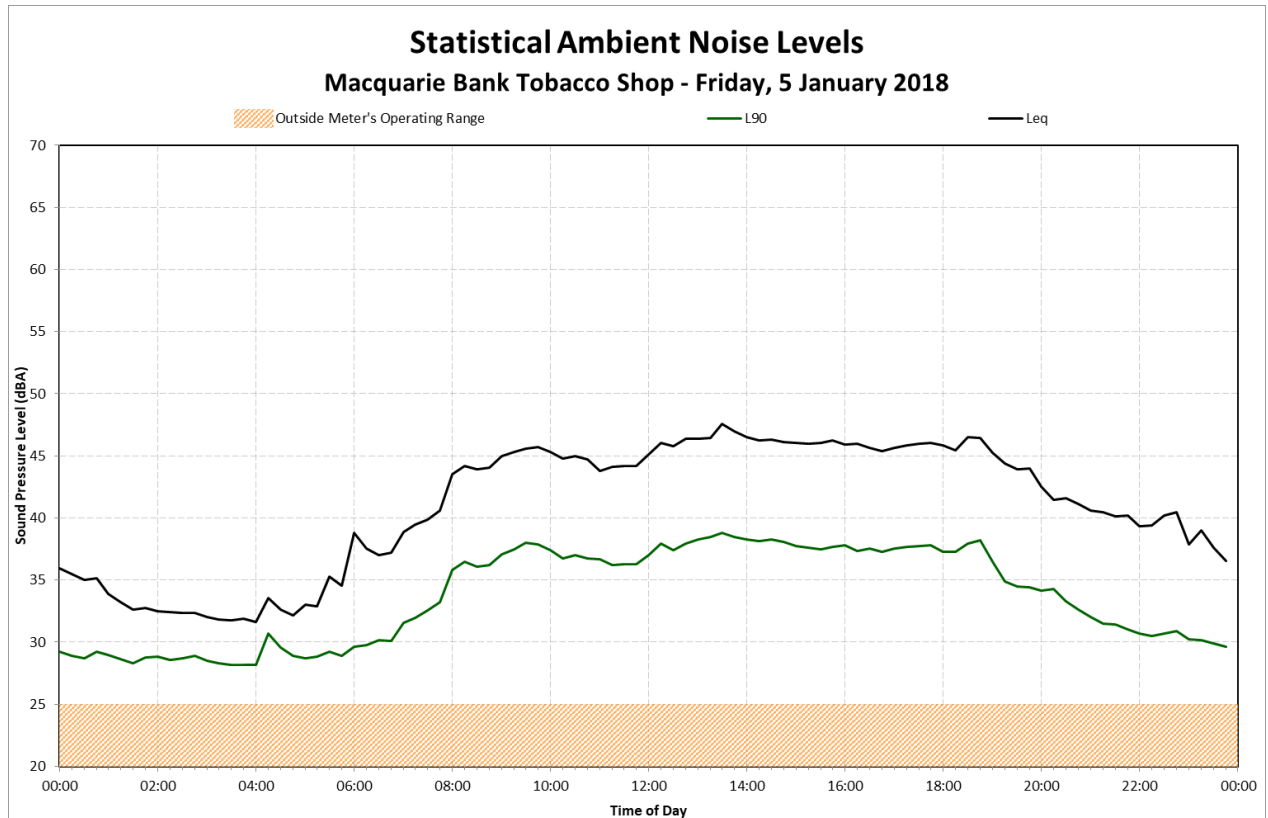
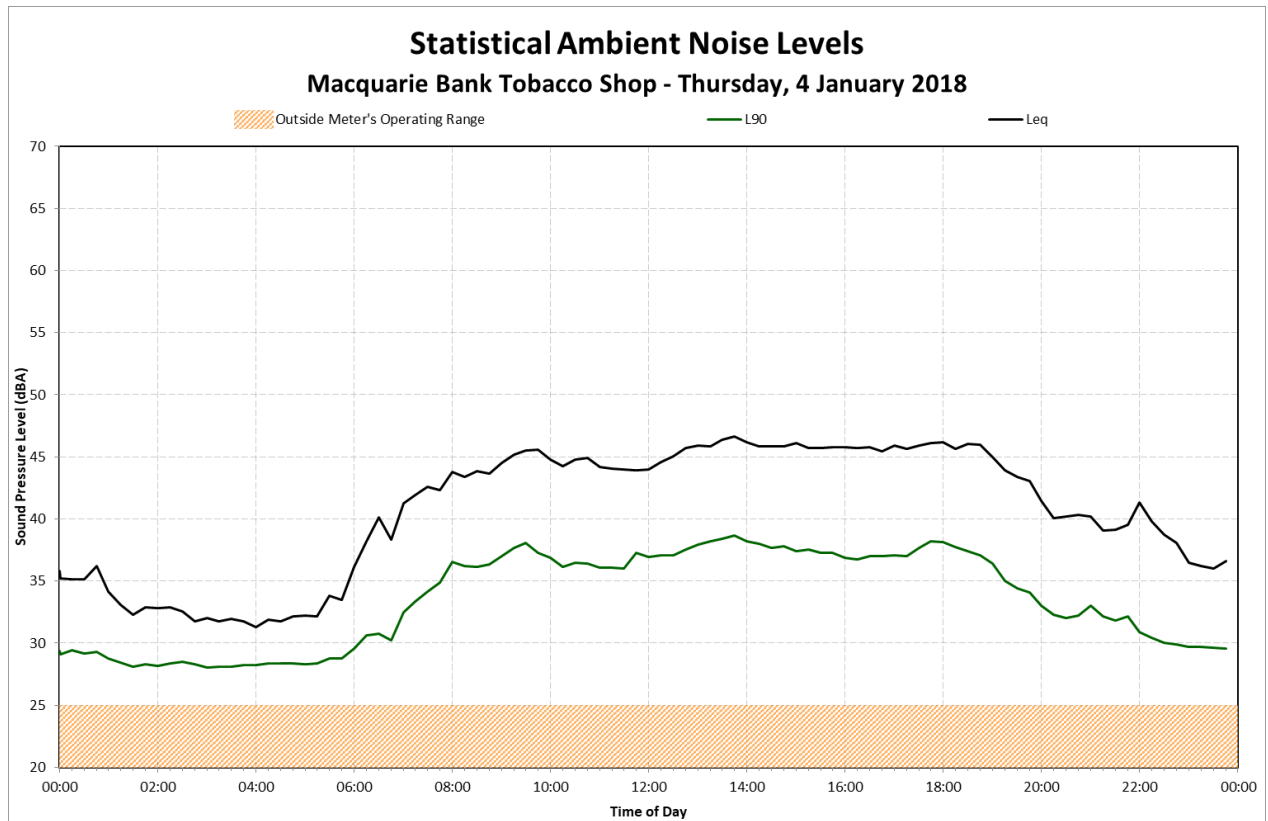
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

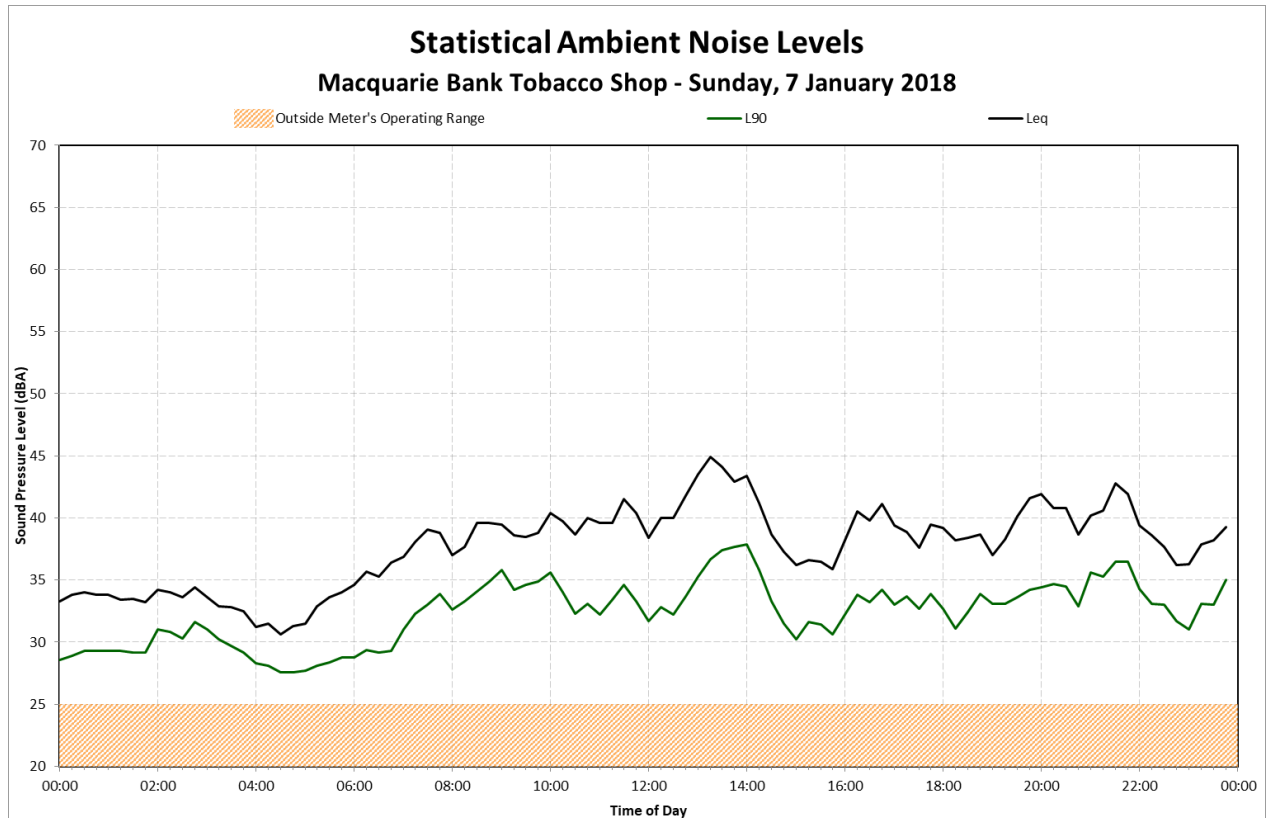
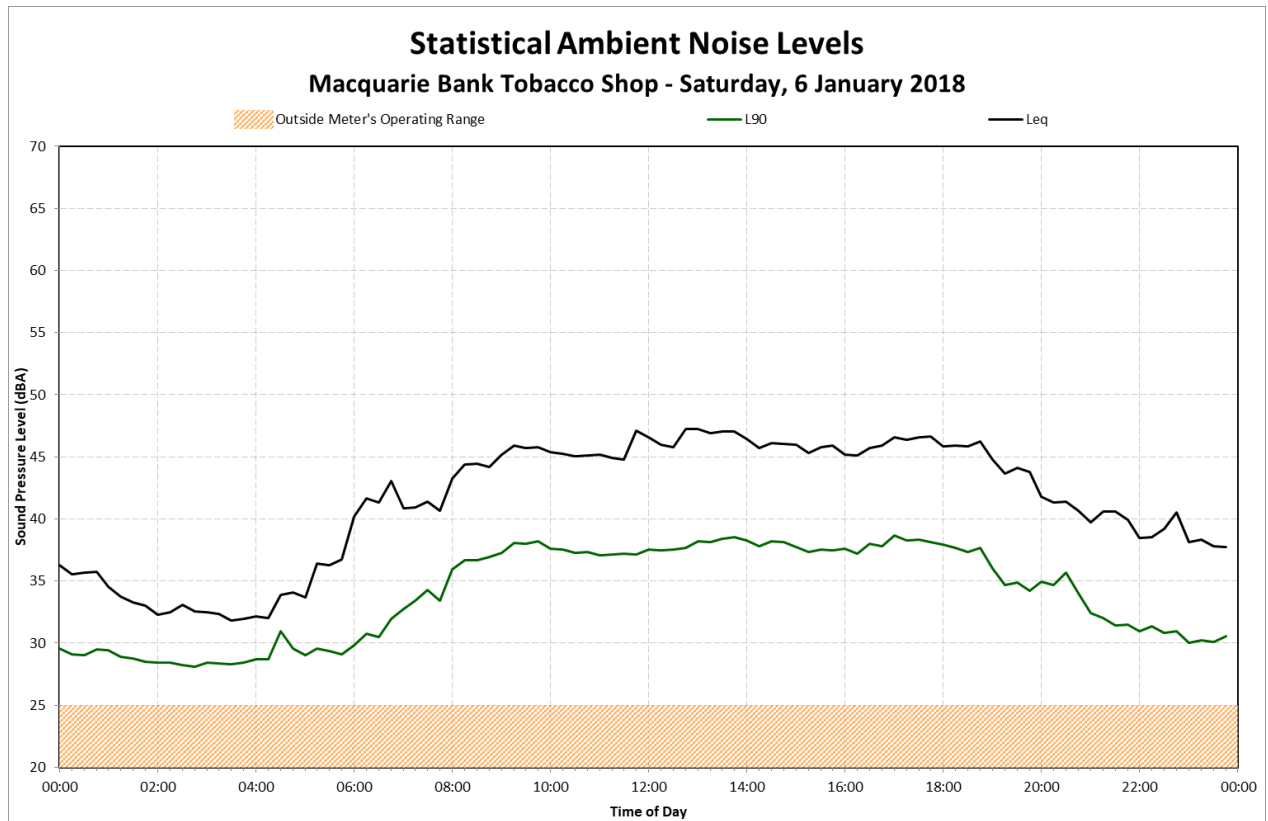
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

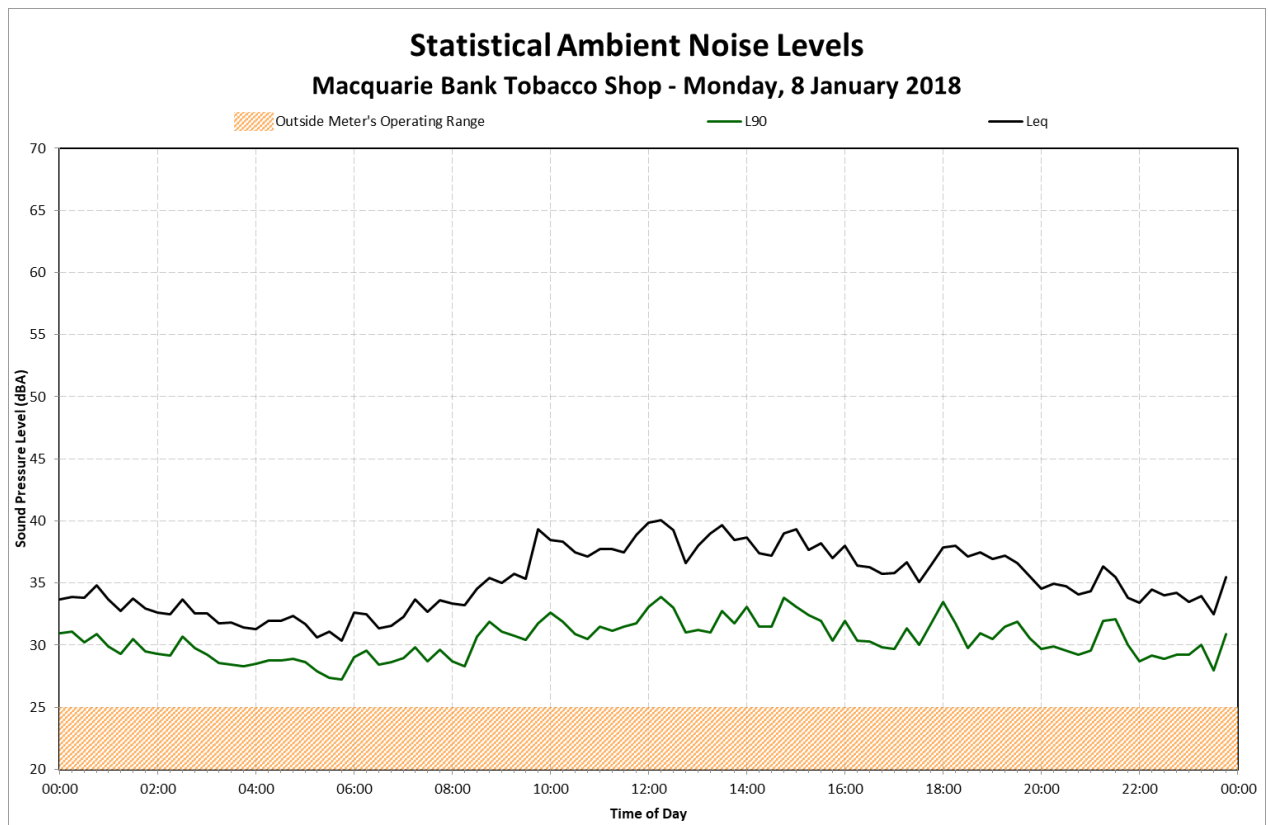
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

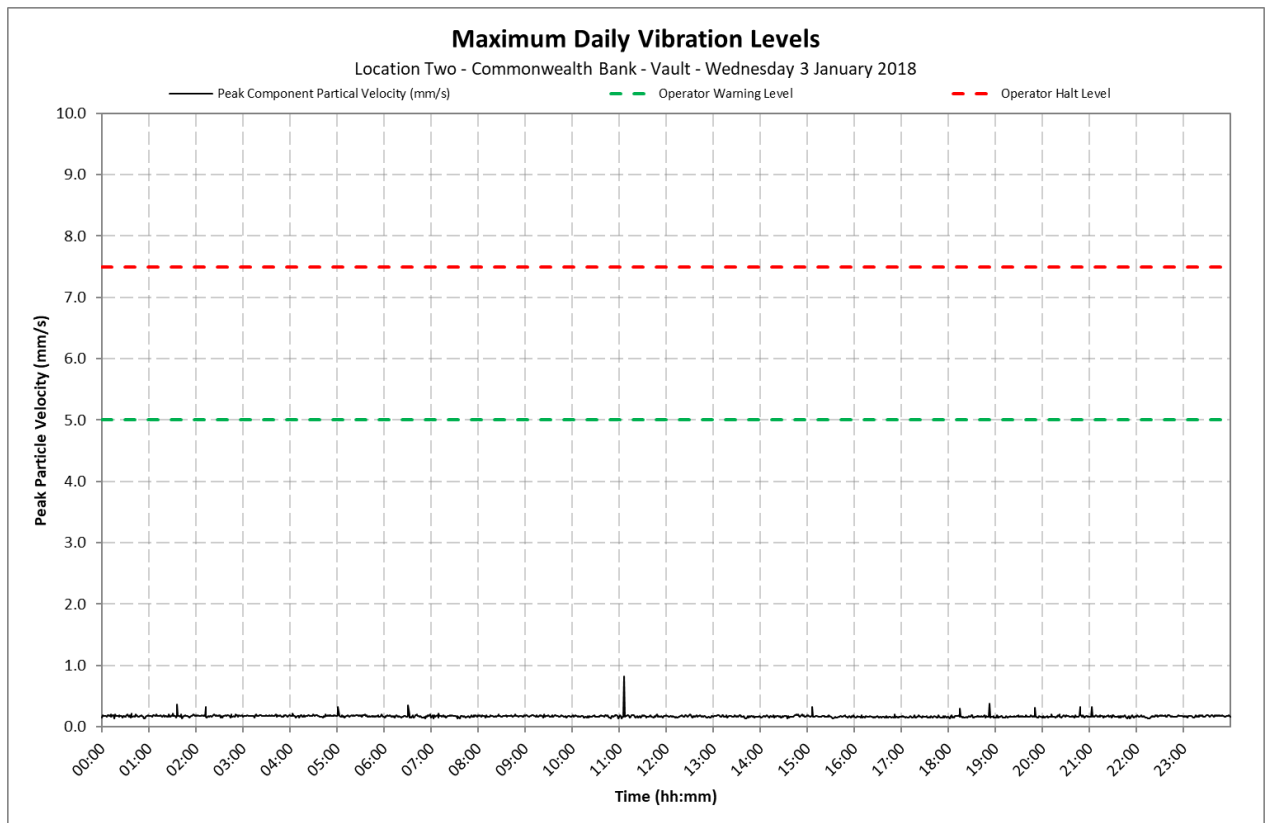
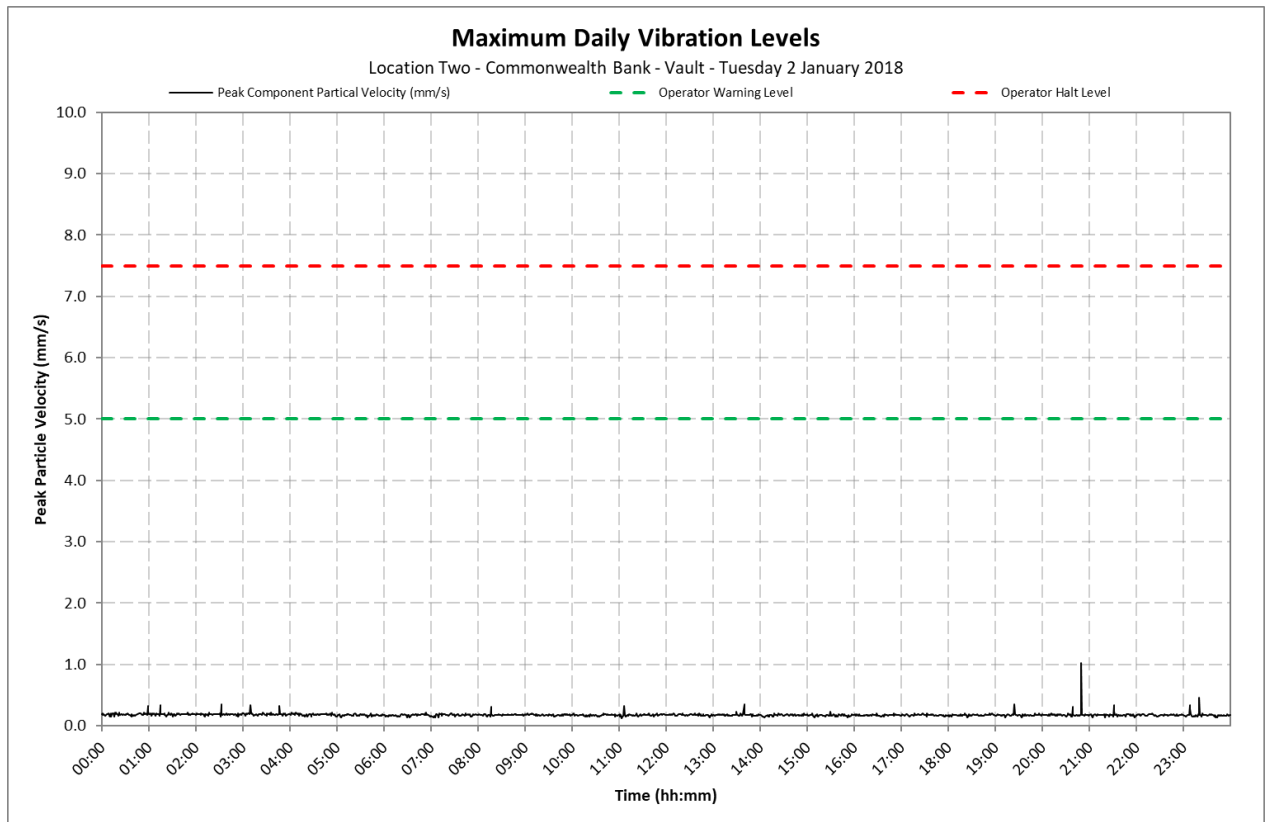
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

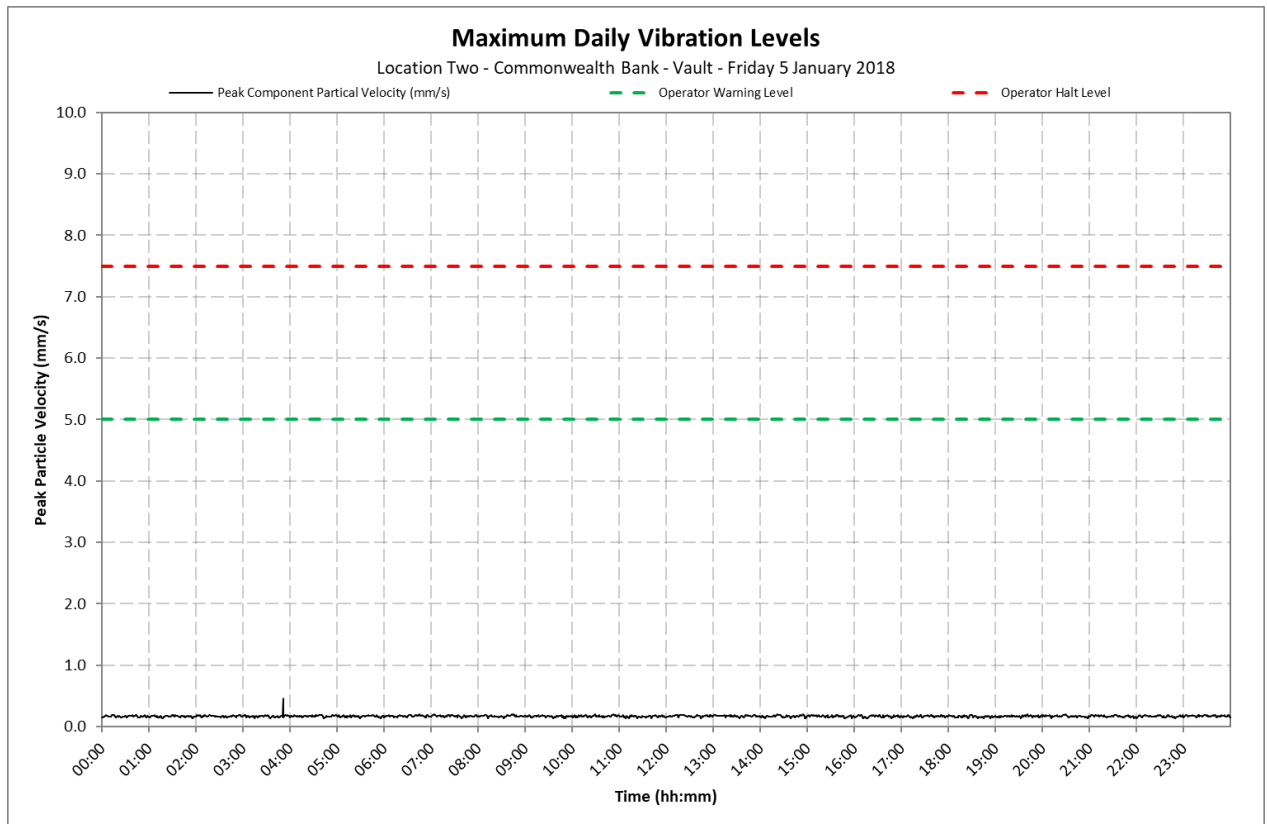
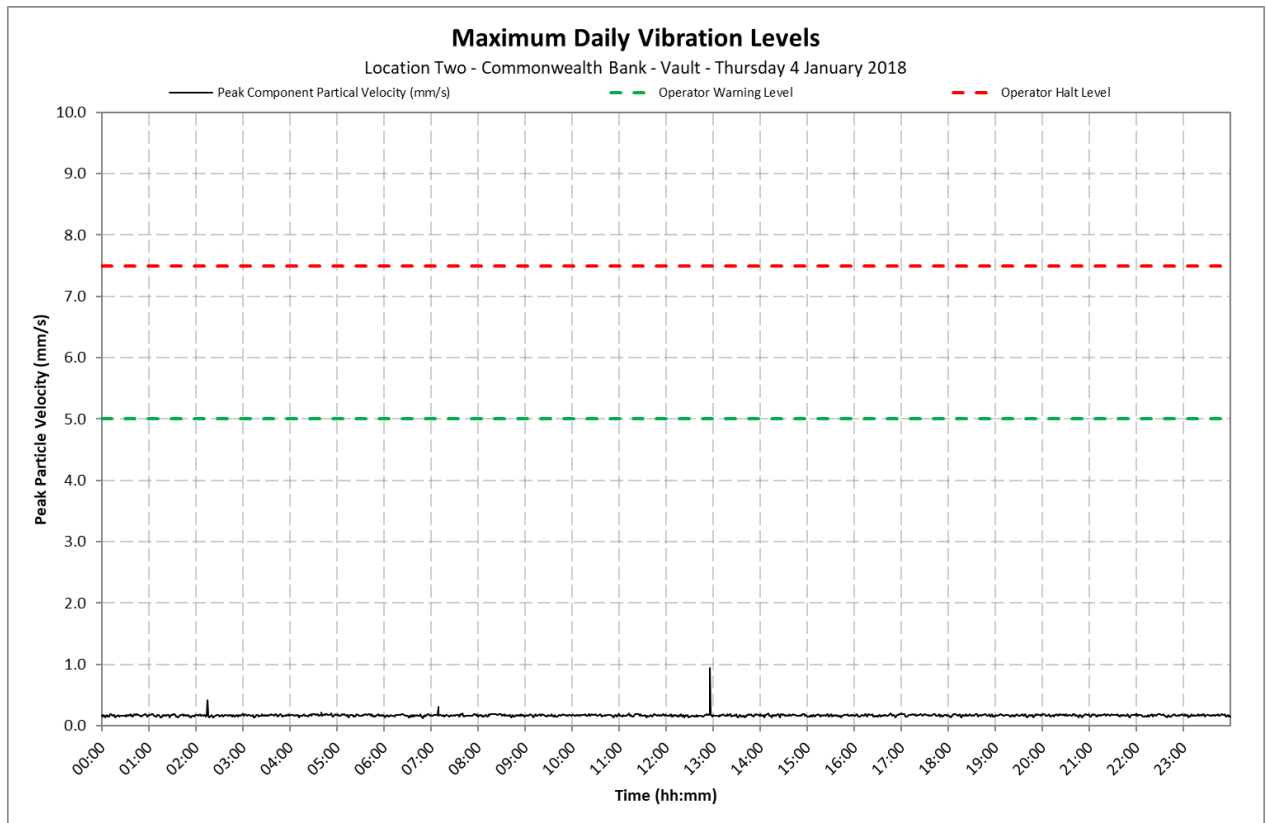
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

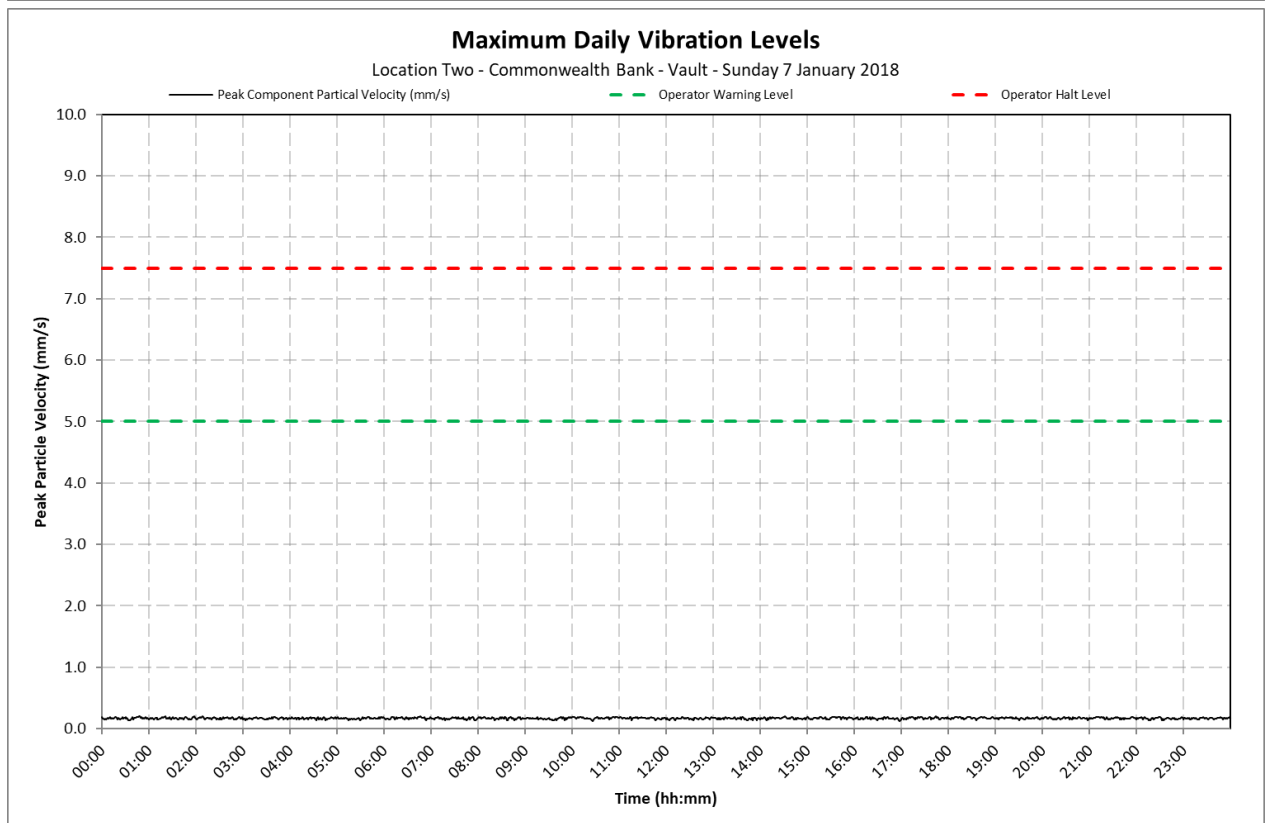
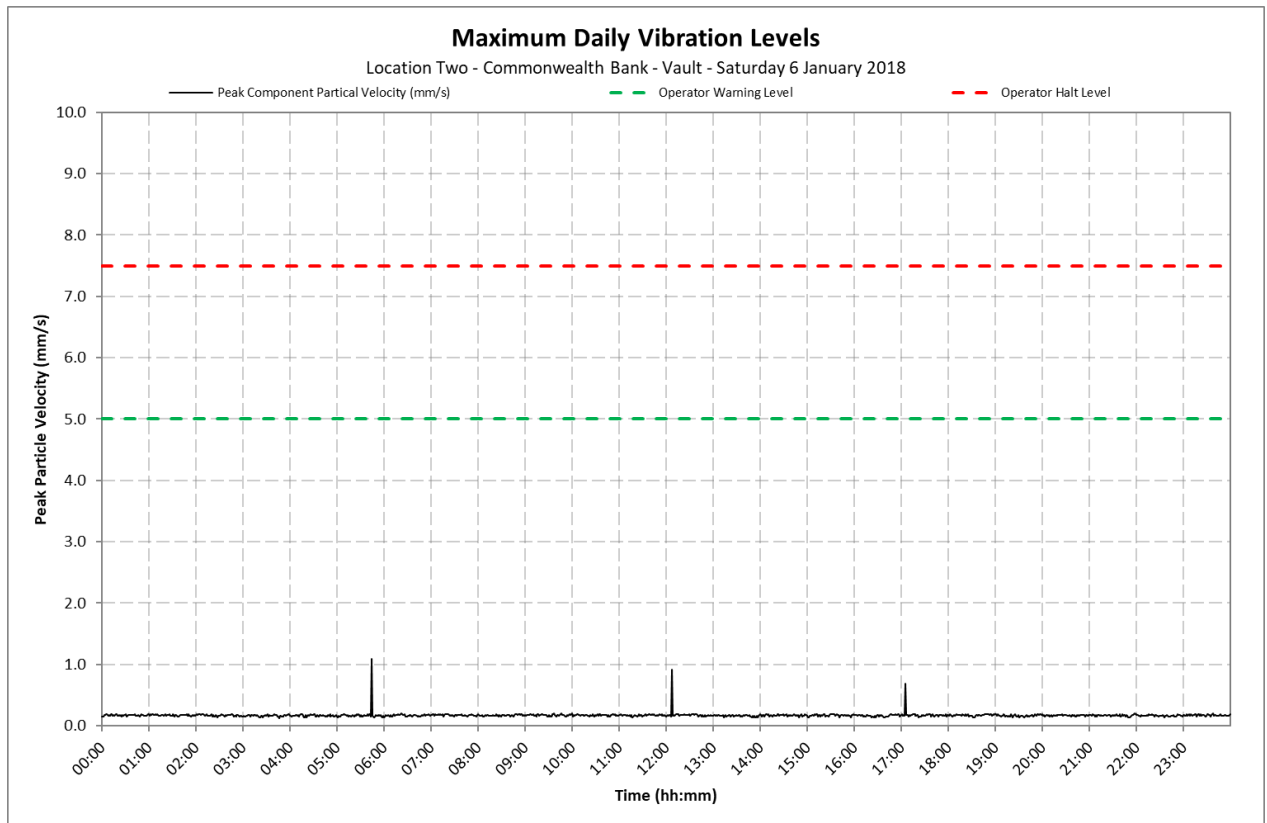
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

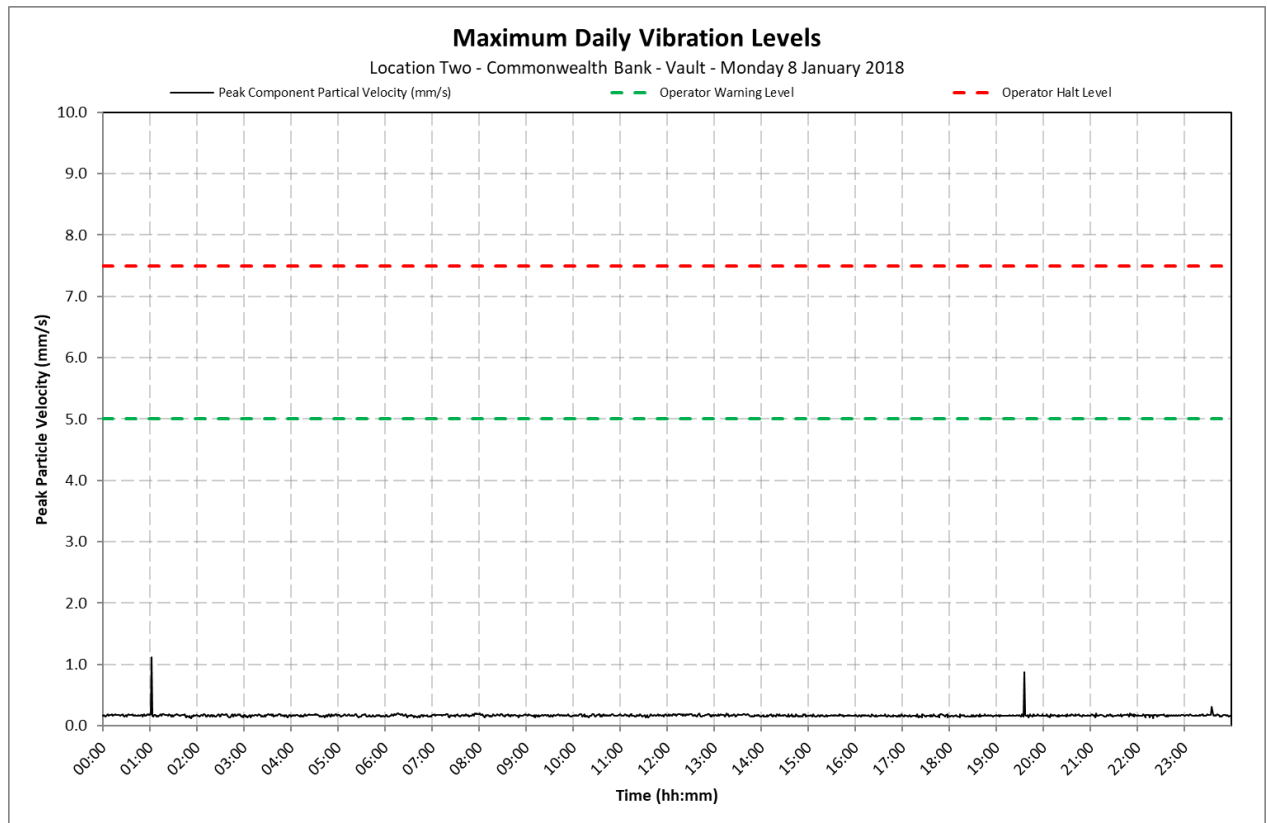
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

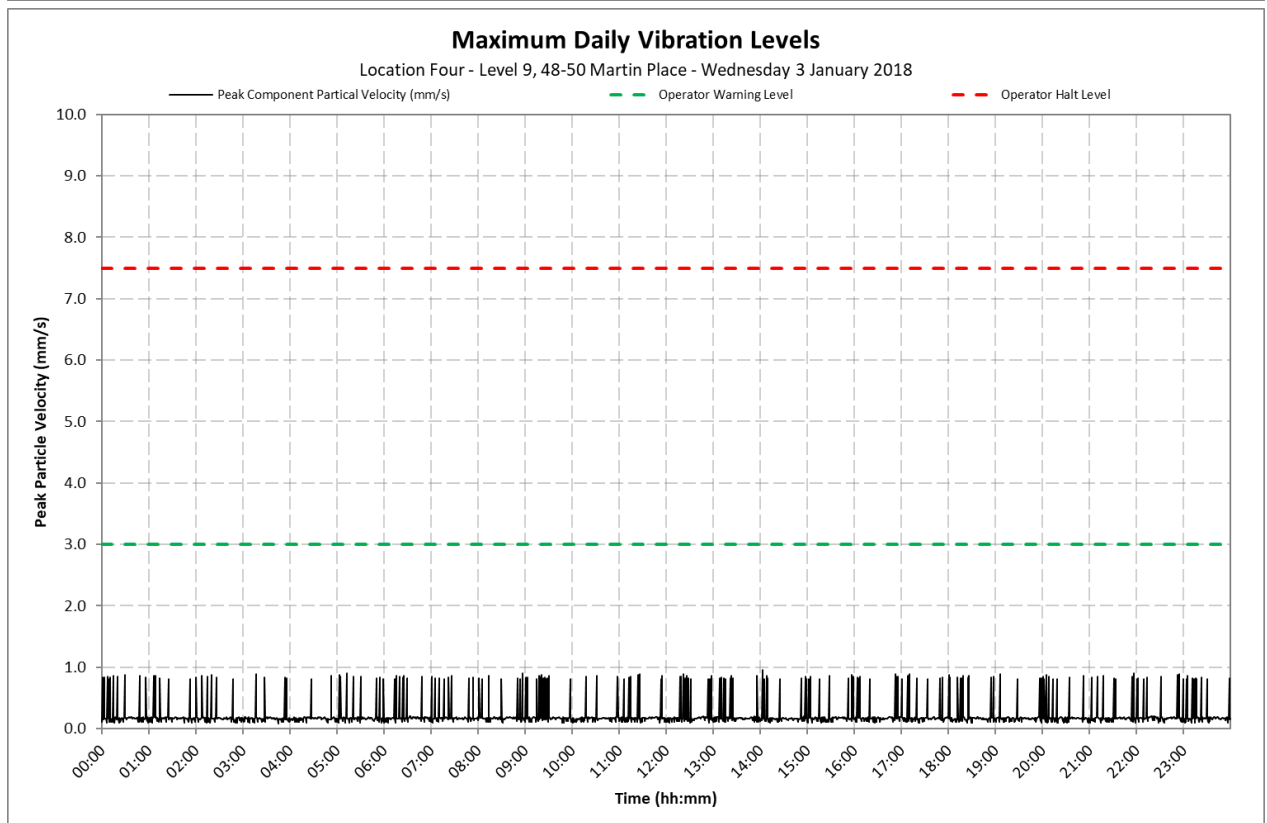
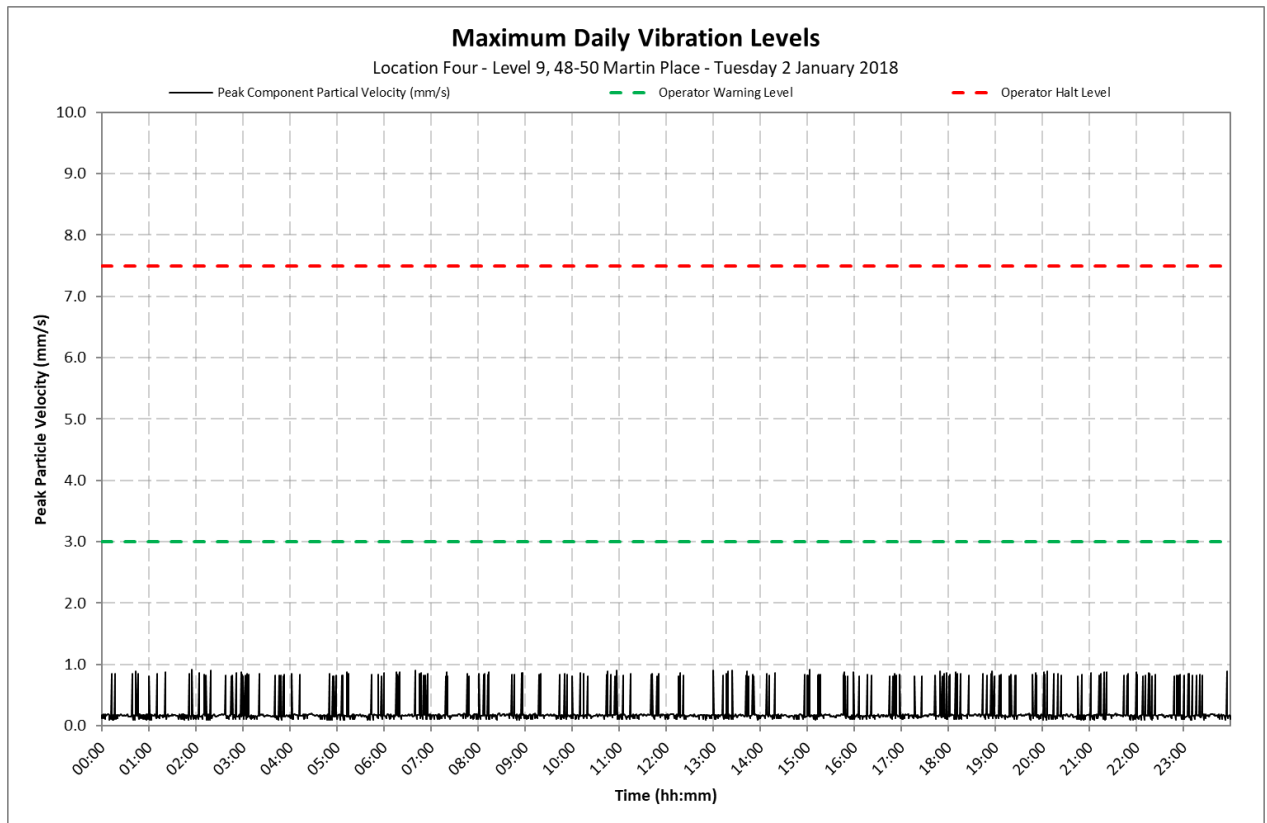
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

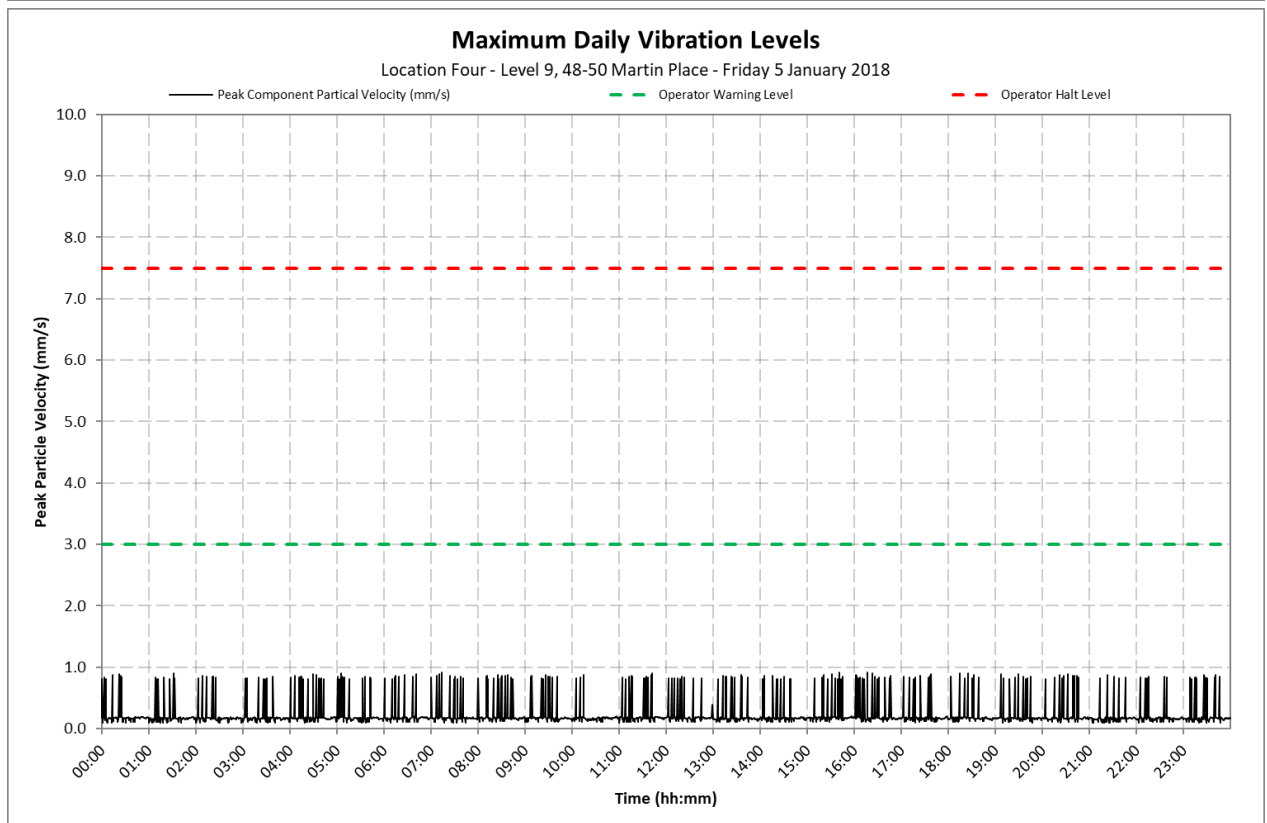
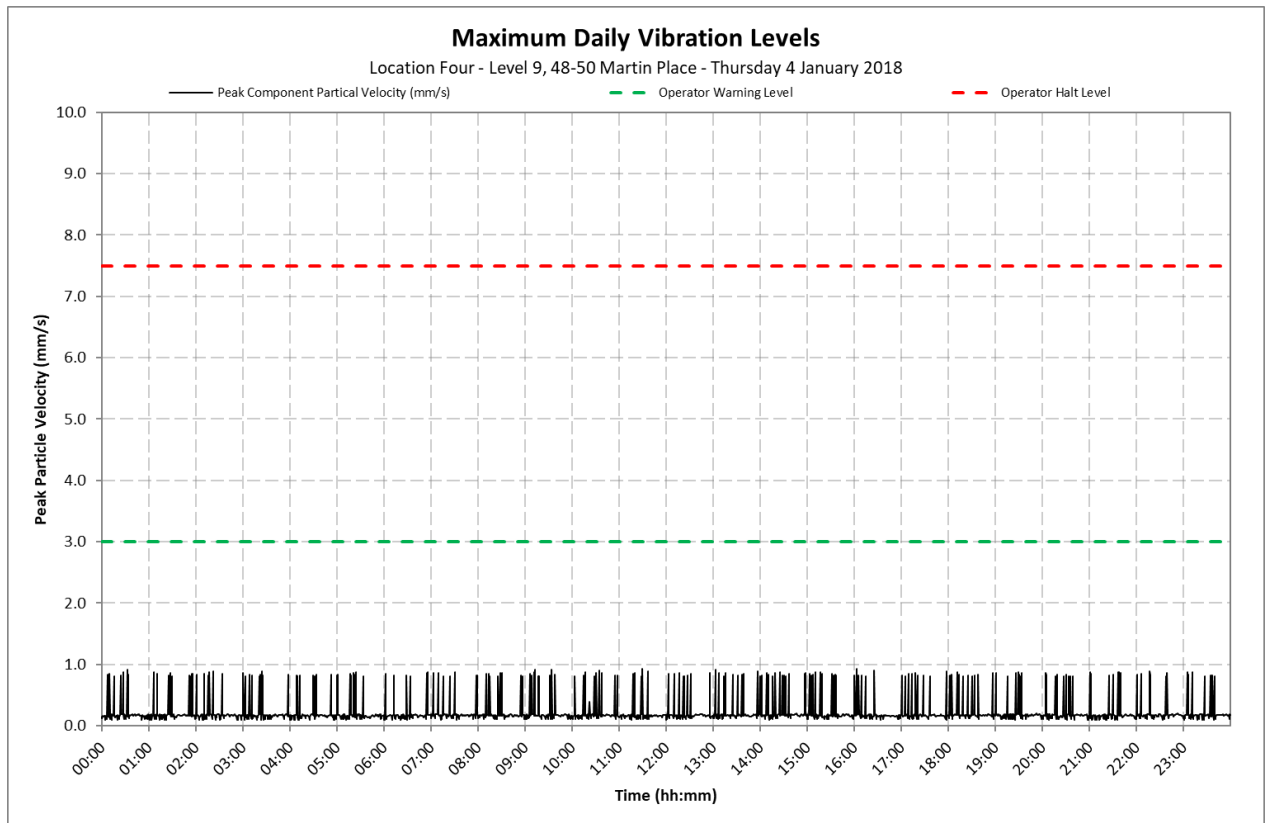
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

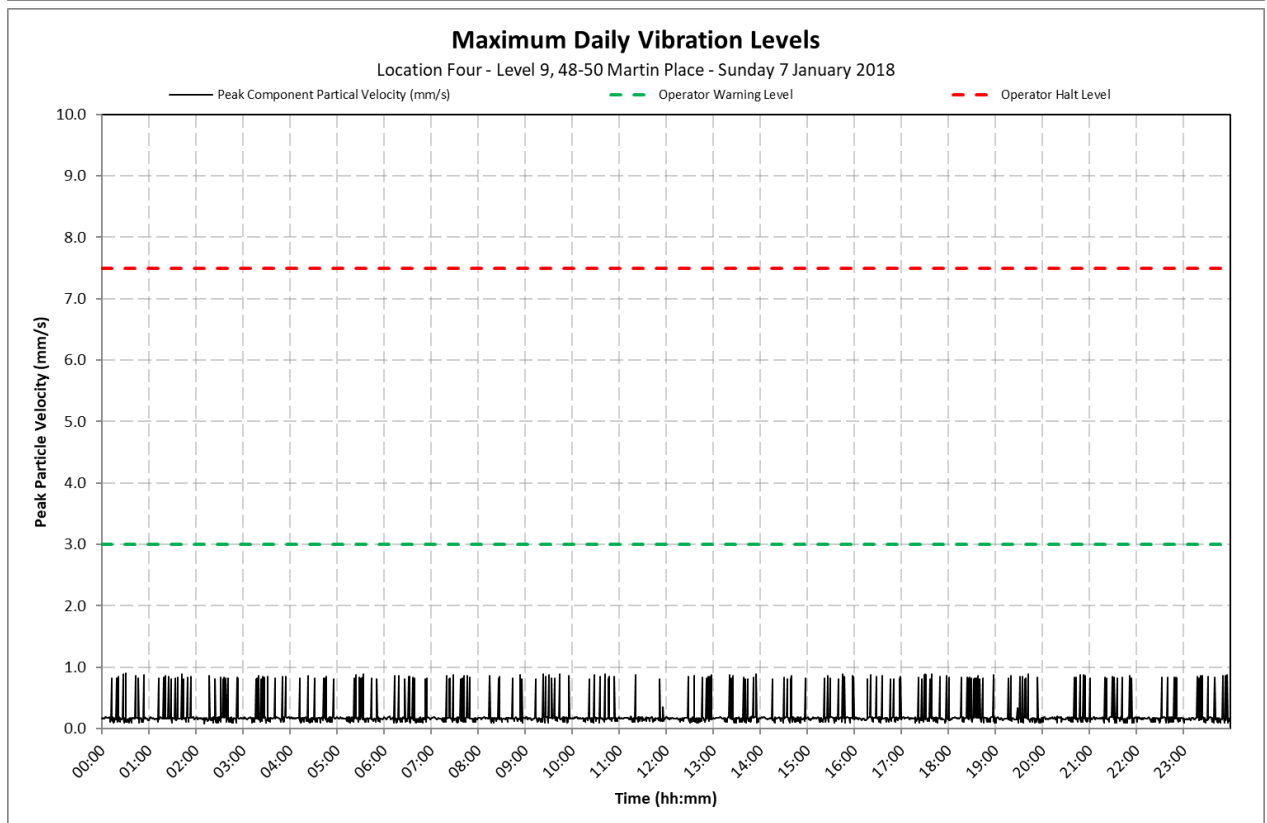
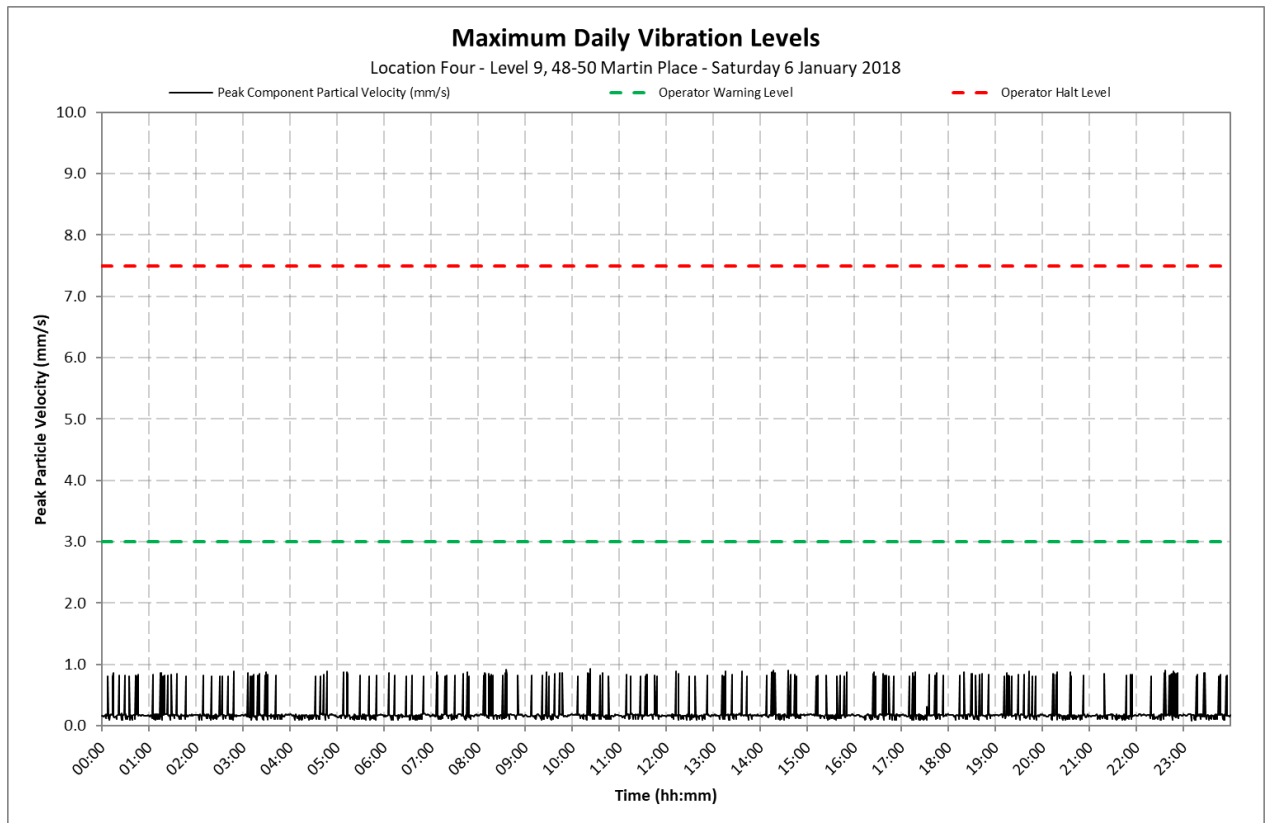
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

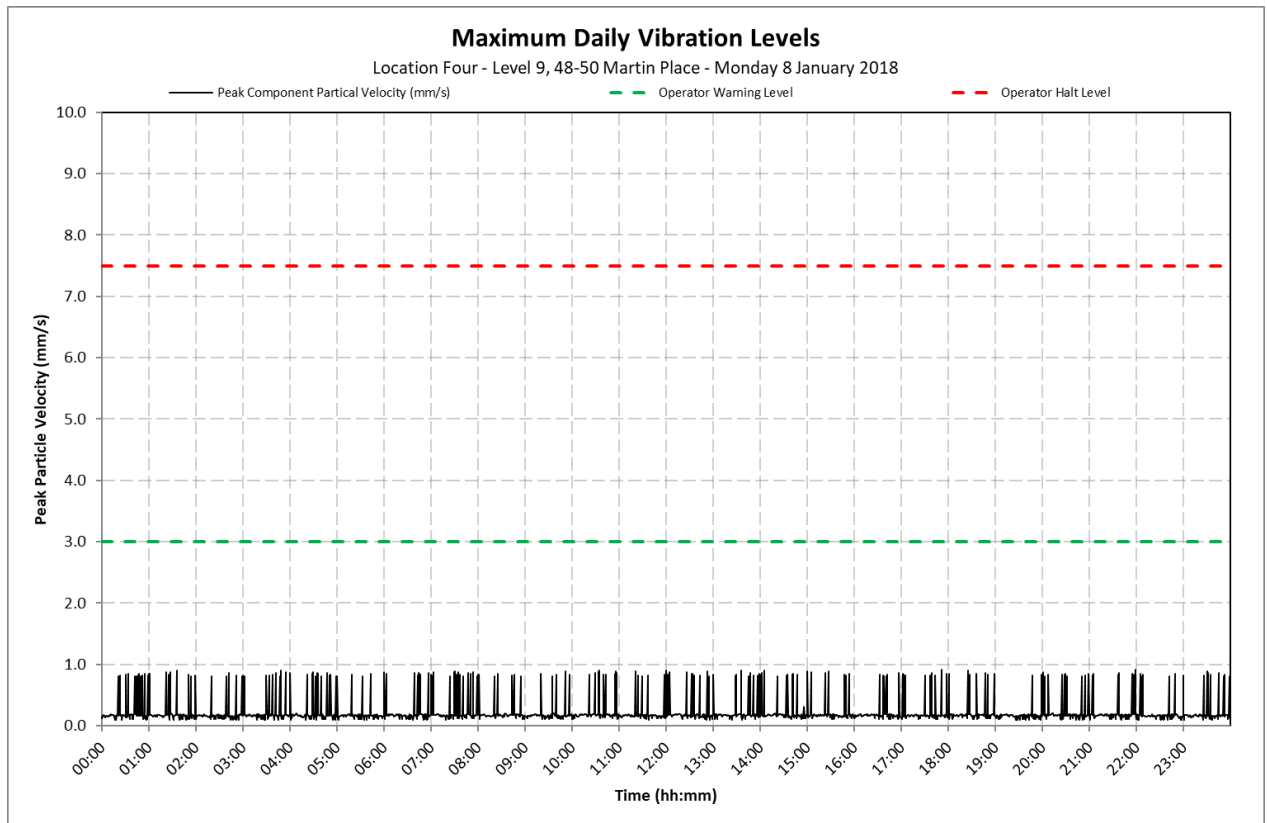
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





24 January 2018

10-1380 R15 NV Monitoring 20180124.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 15
9 January to 15 January 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 9 January to 15 January 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

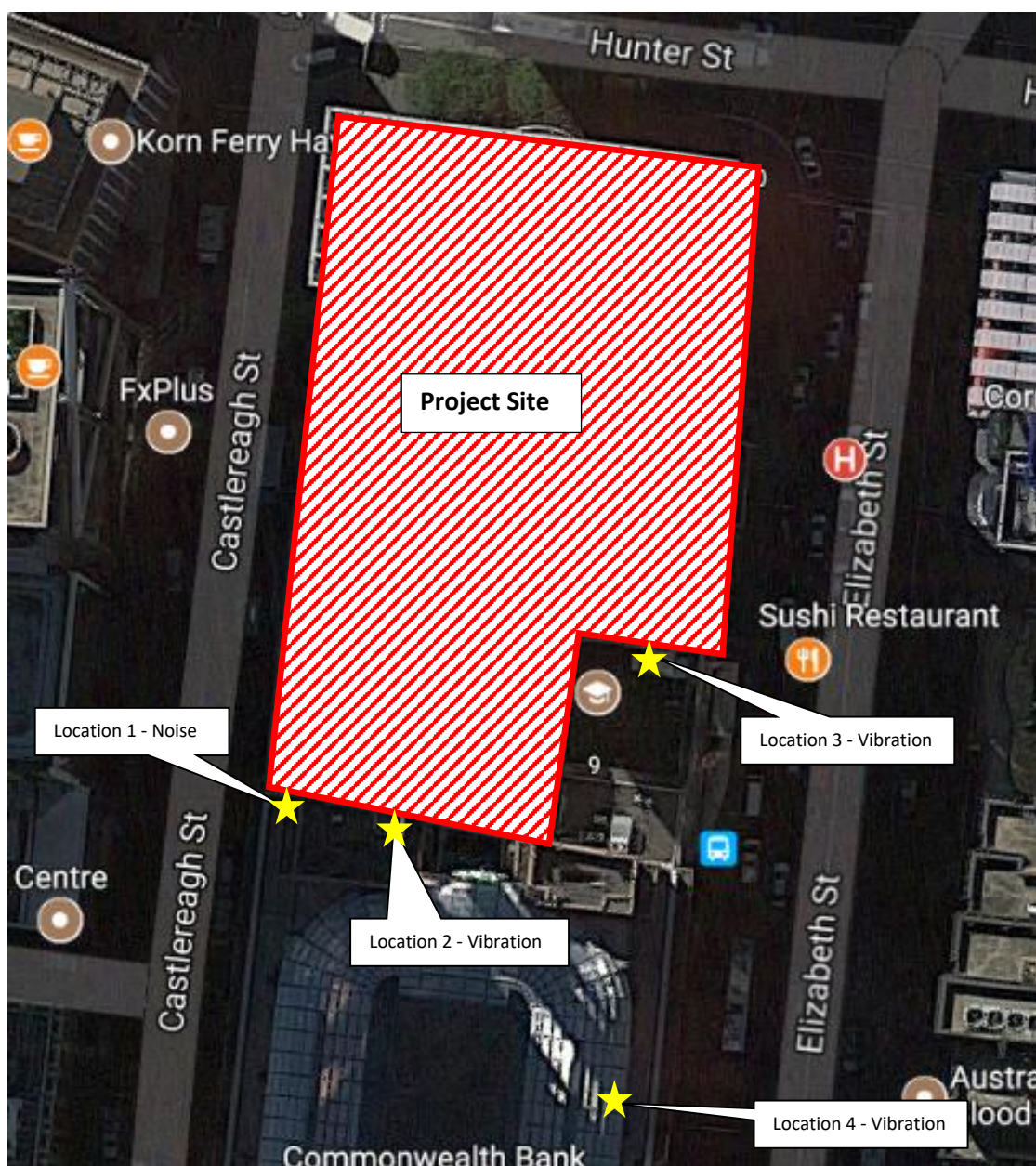
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 9 January to 15 January 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
9 January 2018	41	40	Complies	Complies
10 January 2018	44	43	Complies	Complies
11 January 2018	45	44	Complies	Complies
12 January 2018	46	44	Complies	Complies
13 January 2018	46	44	Complies	Complies
14 January 2018	40	38	Complies	Complies
15 January 2018	38	37	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 9 January to 15 January 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
9 January 2018	1.1 mm/s	Complies
10 January 2018	0.9 mm/s	Complies
11 January 2018	1.2 mm/s	Complies
12 January 2018	1.1 mm/s	Complies
13 January 2018	0.9 mm/s	Complies
14 January 2018	1.2 mm/s	Complies
15 January 2018	0.2 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
9 January 2018	1.0 mm/s	Complies
10 January 2018	0.9 mm/s	Complies
11 January 2018	1.0 mm/s	Complies
12 January 2018	0.9 mm/s	Complies
13 January 2018	1.0 mm/s	Complies
14 January 2018	0.9 mm/s	Complies
15 January 2018	1.0 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 9 January to 15 January 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 9 January to 15 January 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

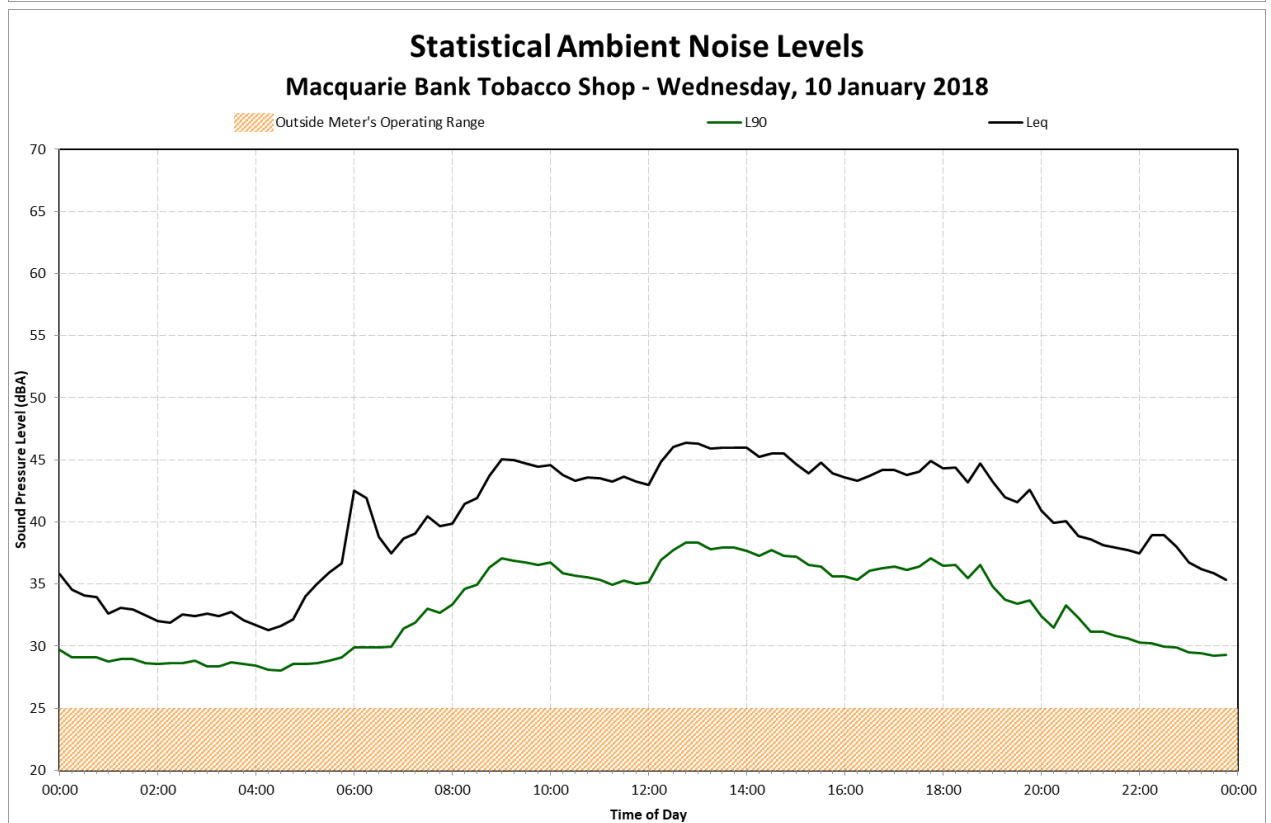
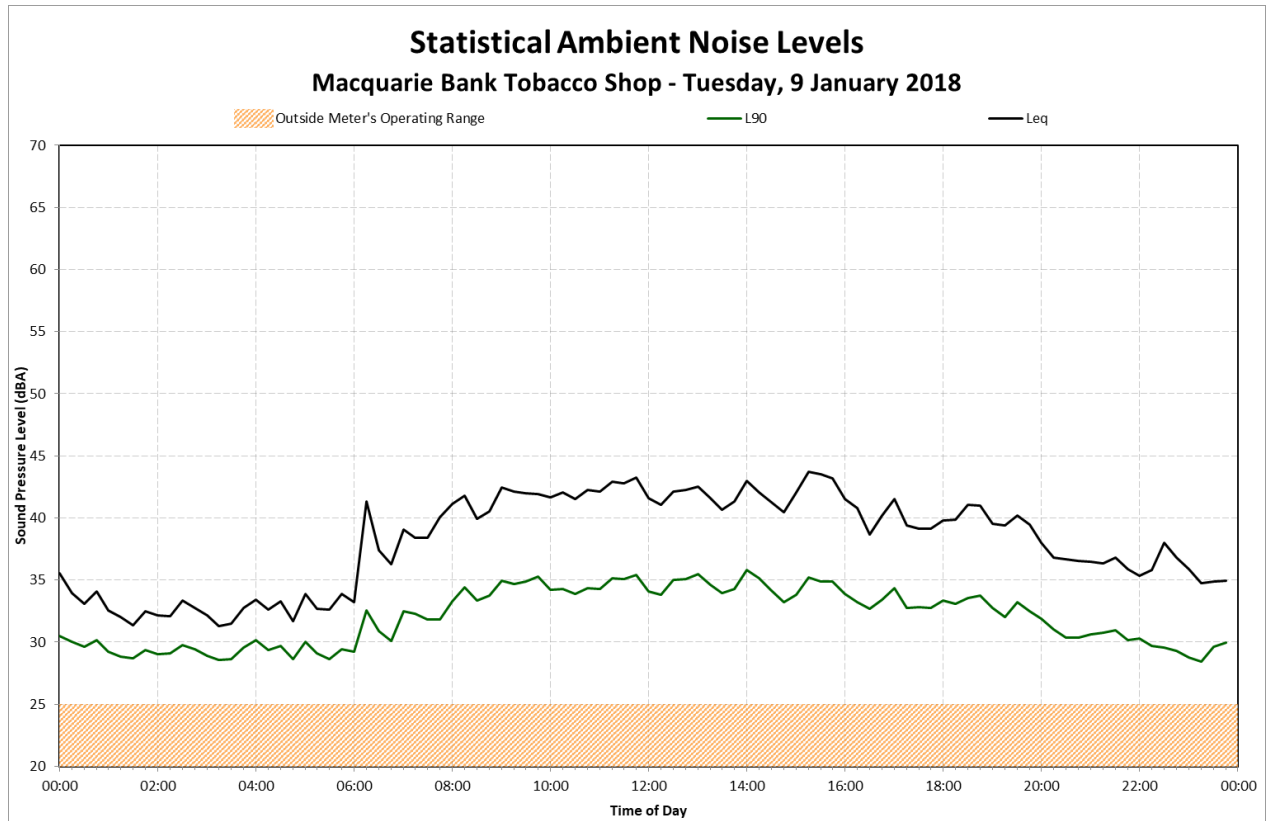
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Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
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Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
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L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
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PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

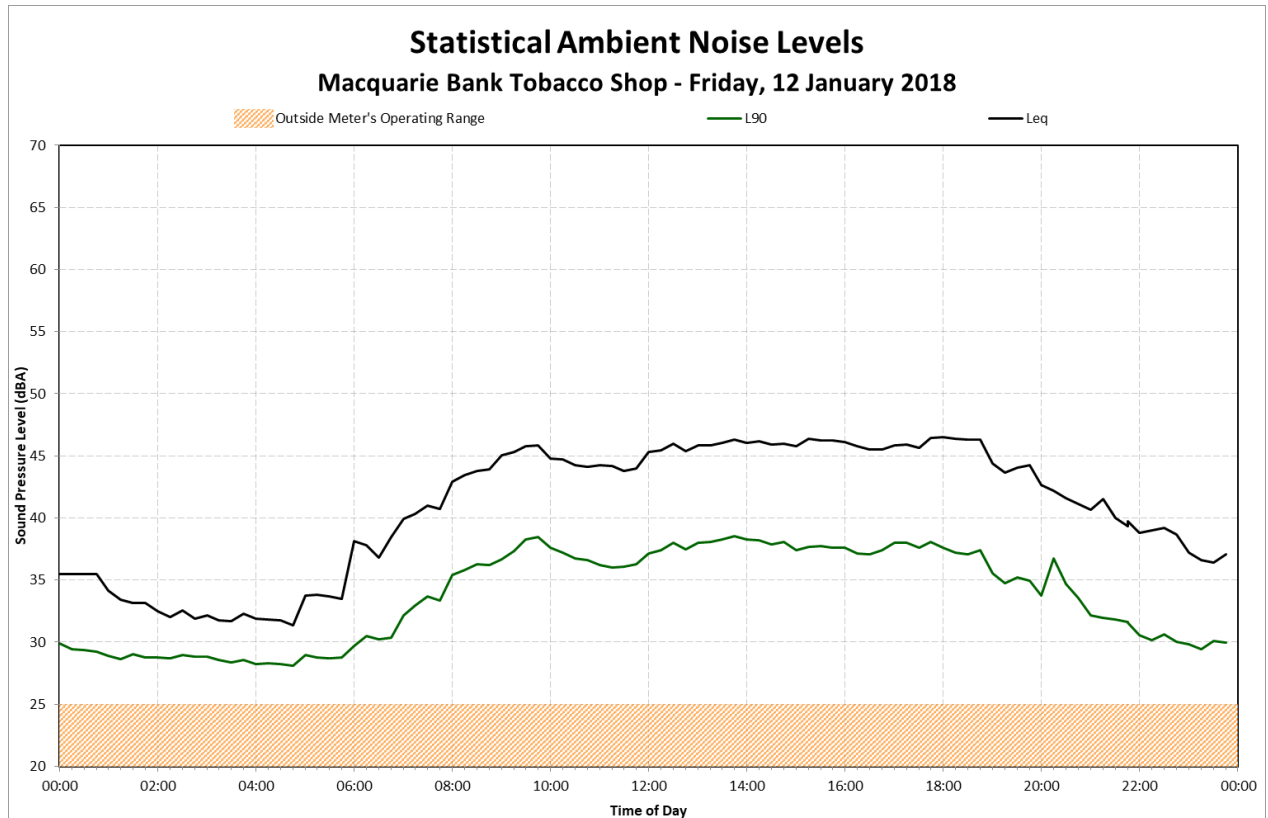
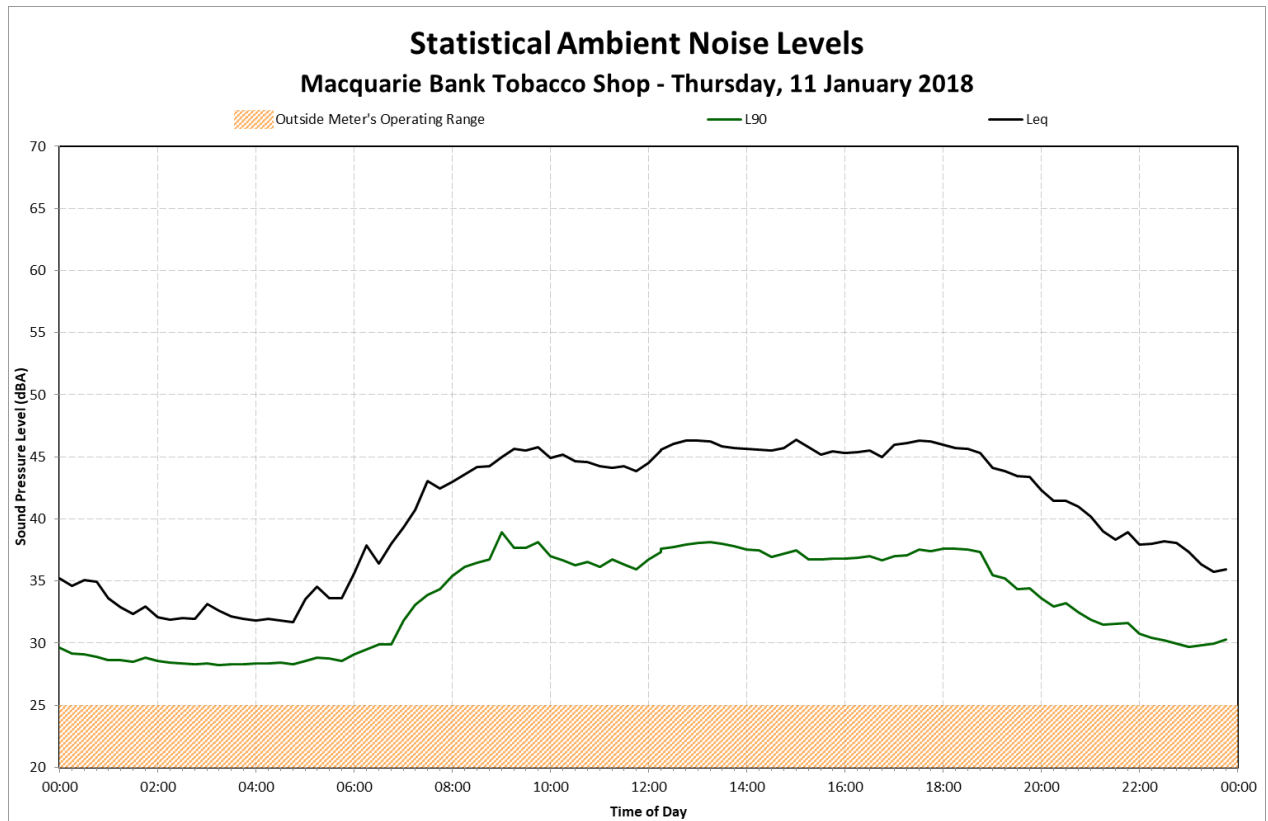
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

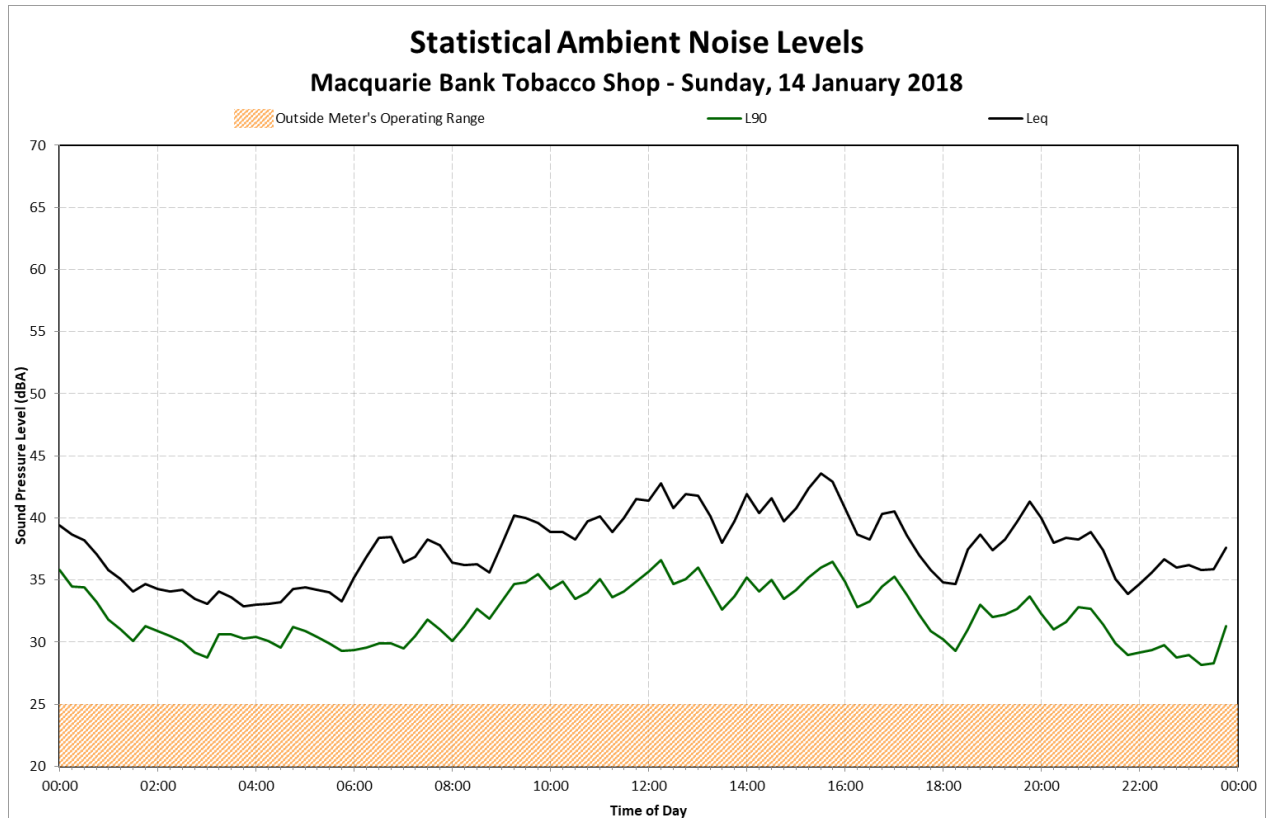
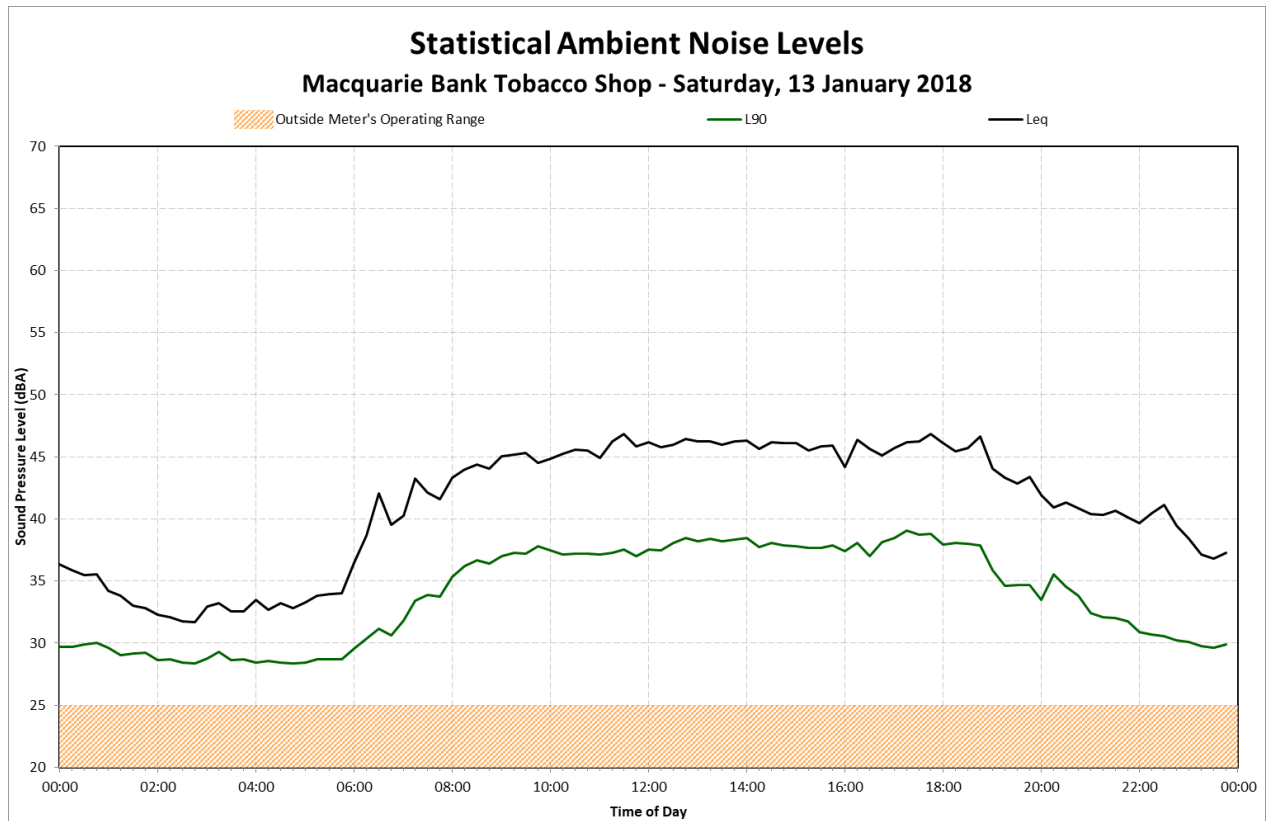
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

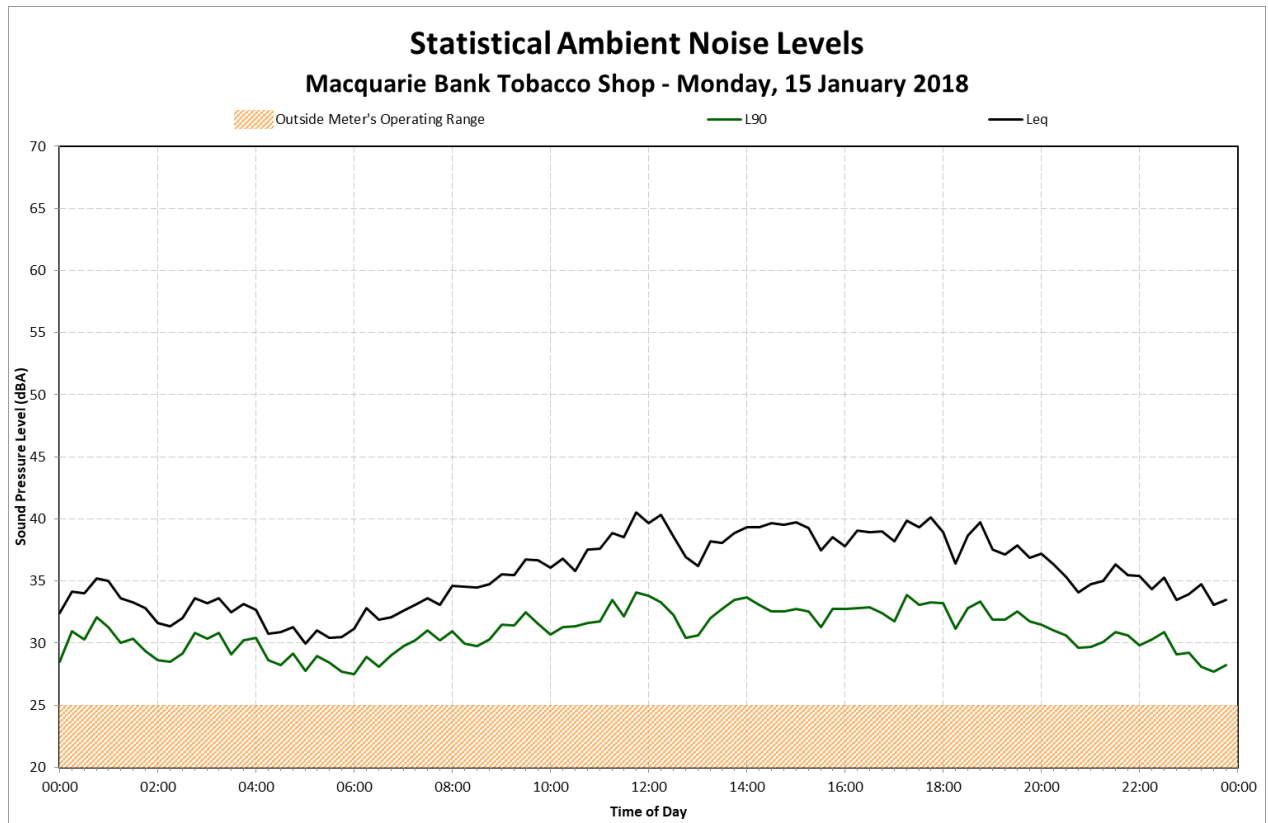
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

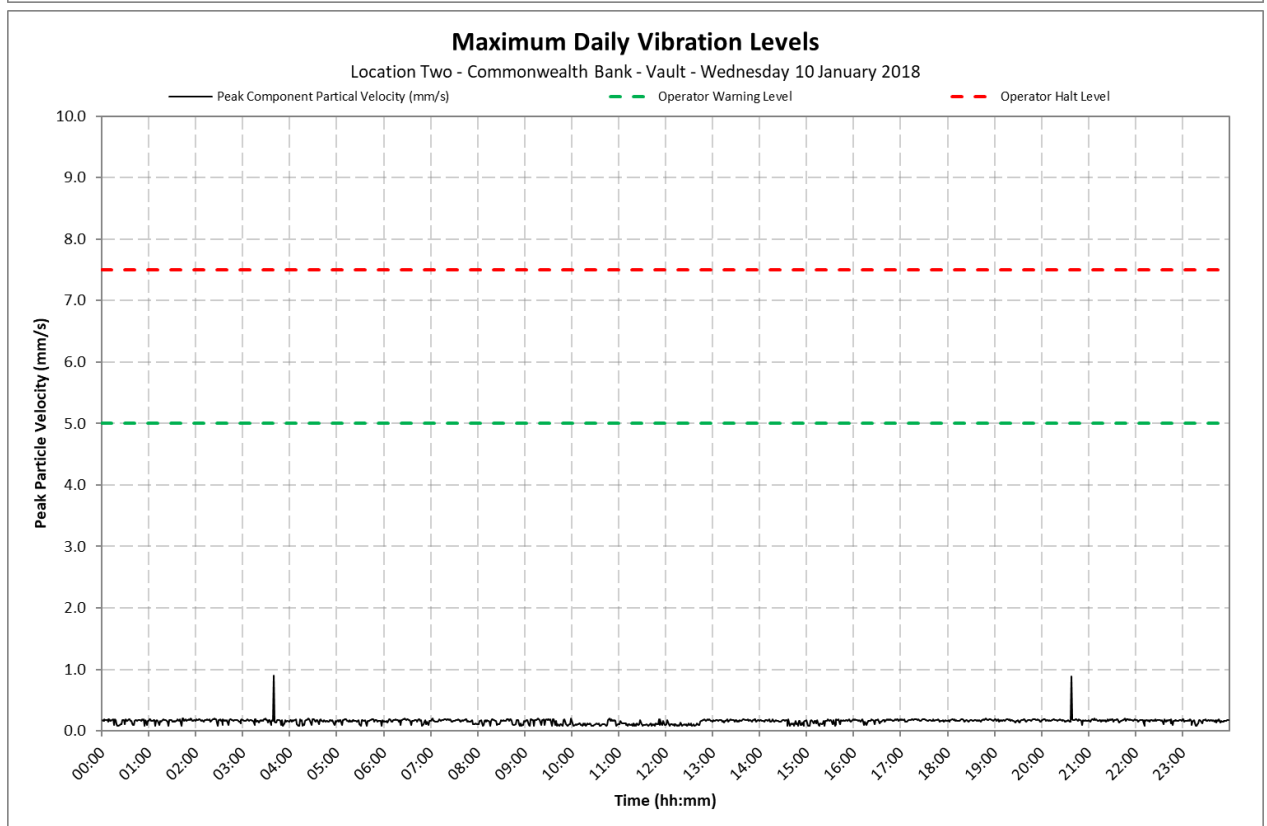
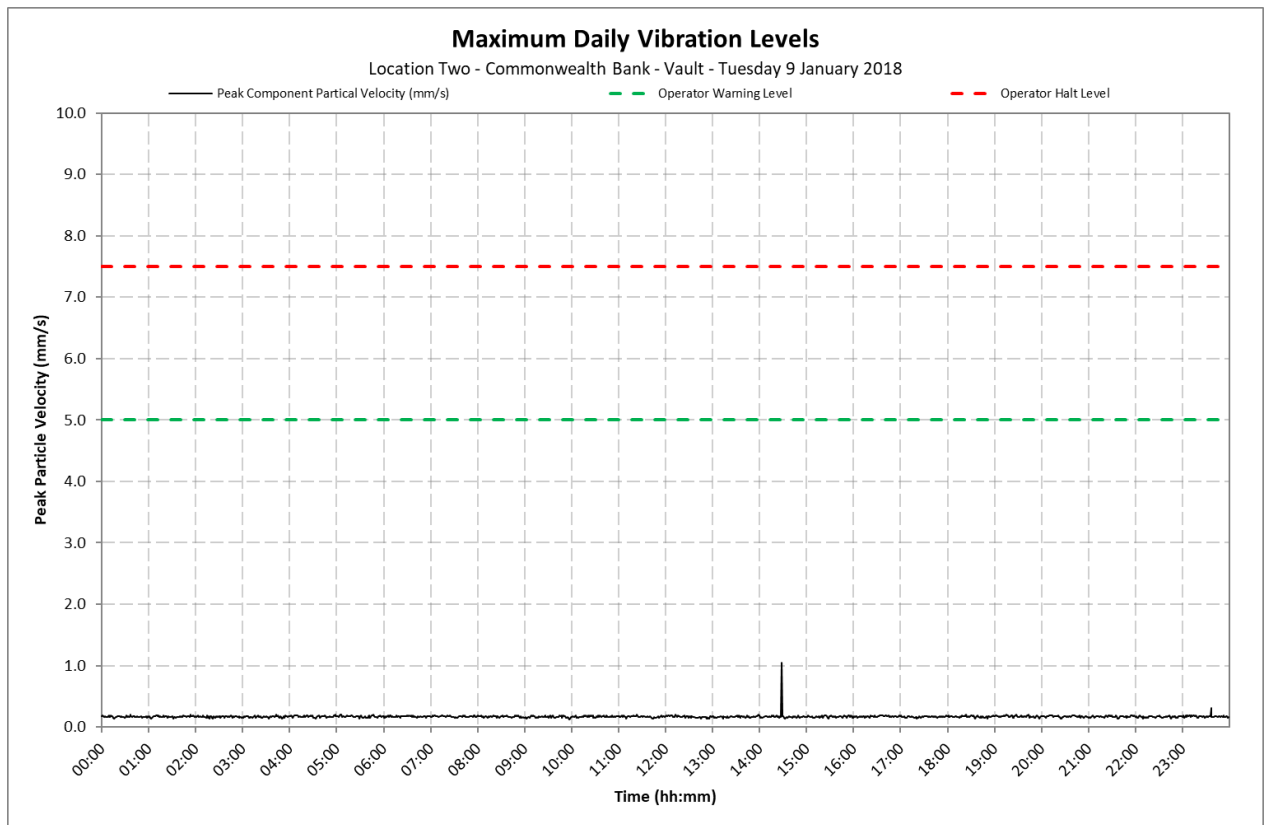
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

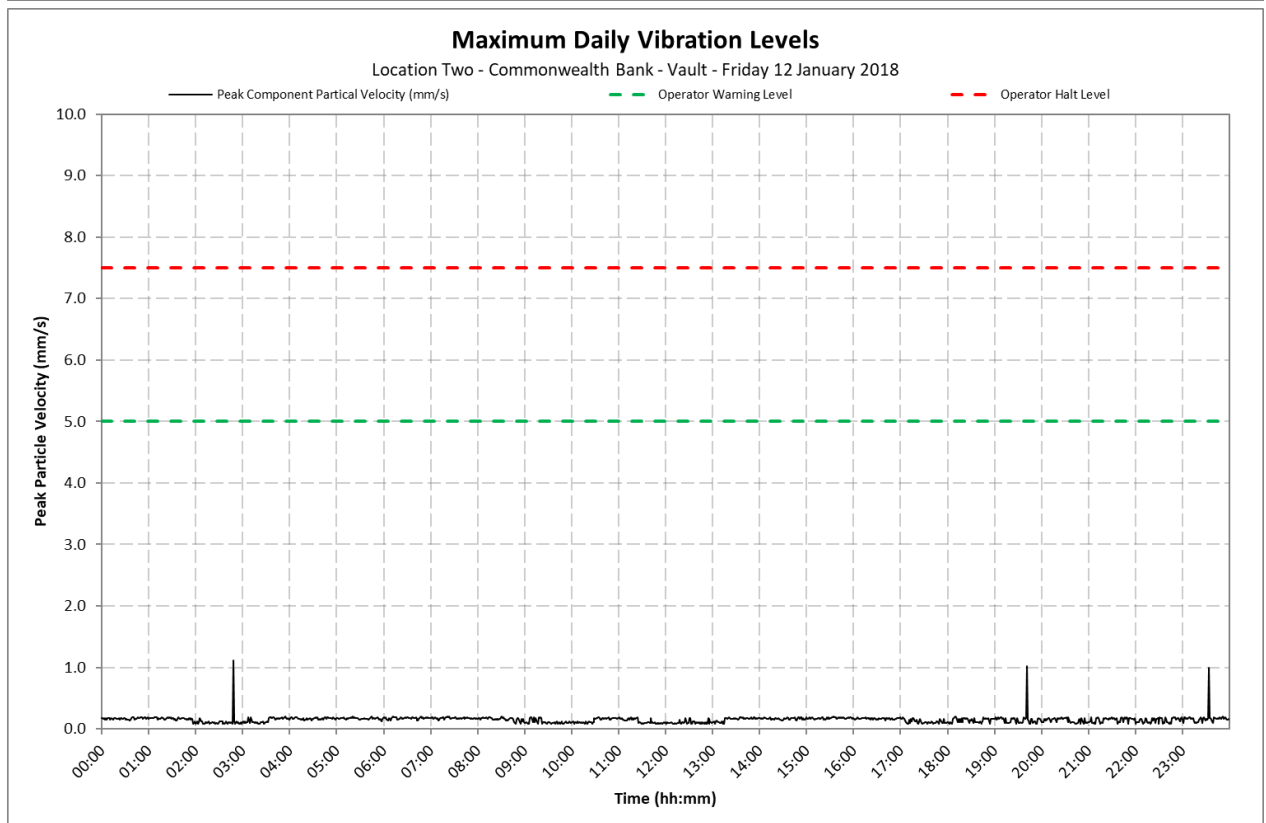
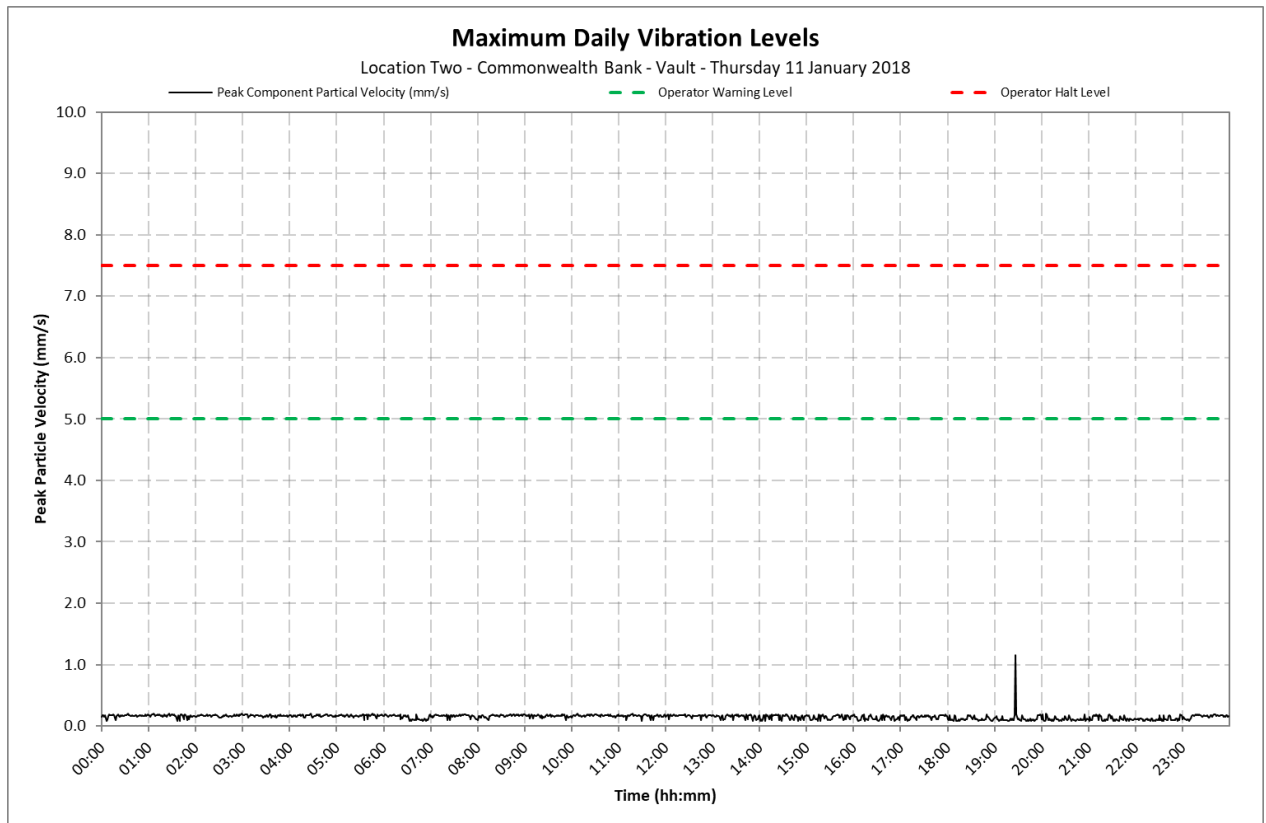
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

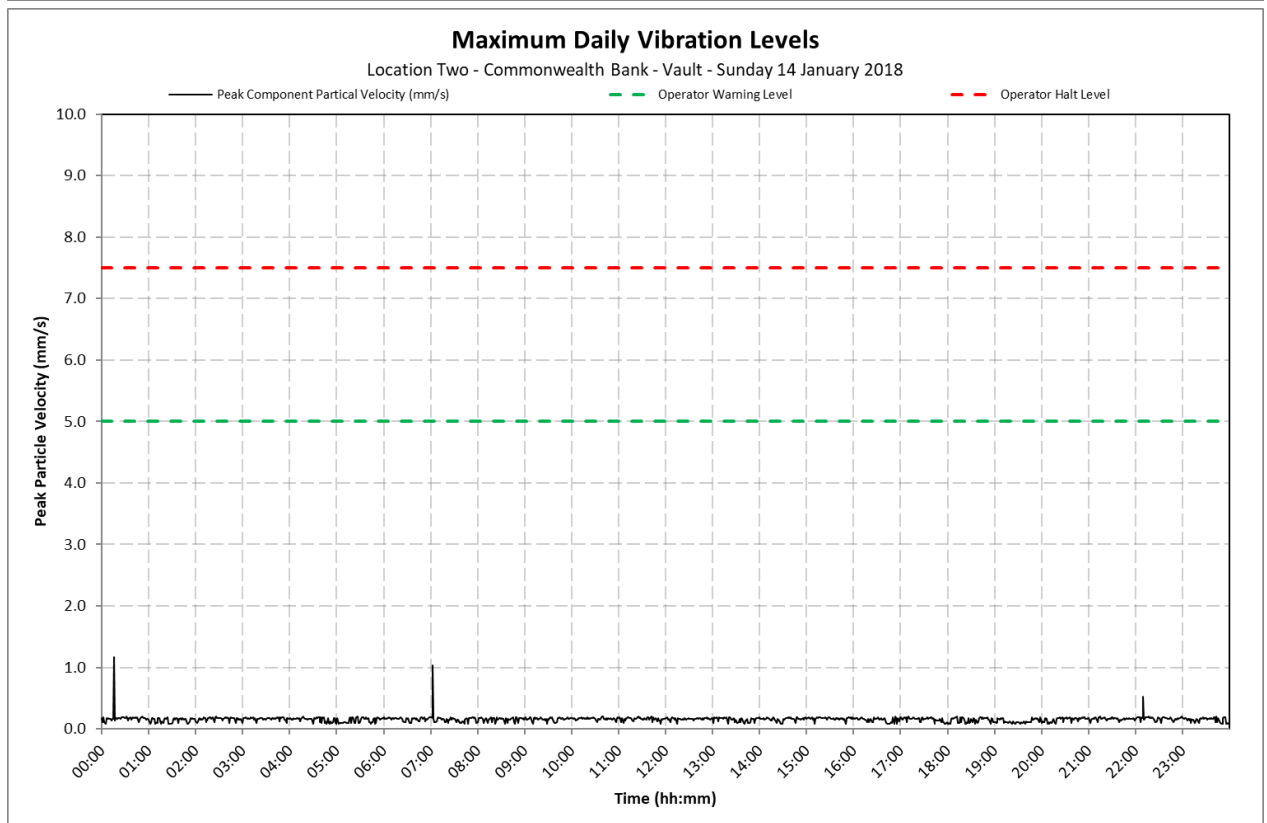
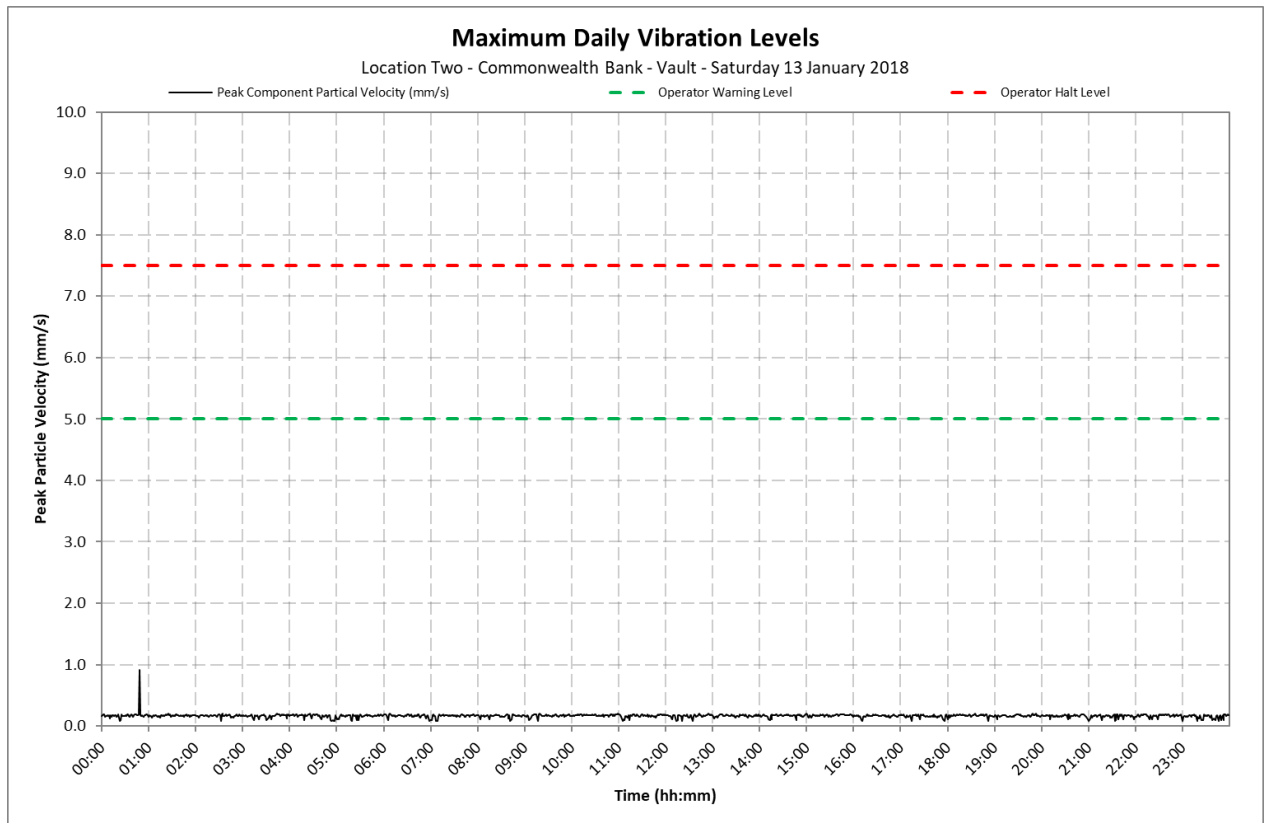
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

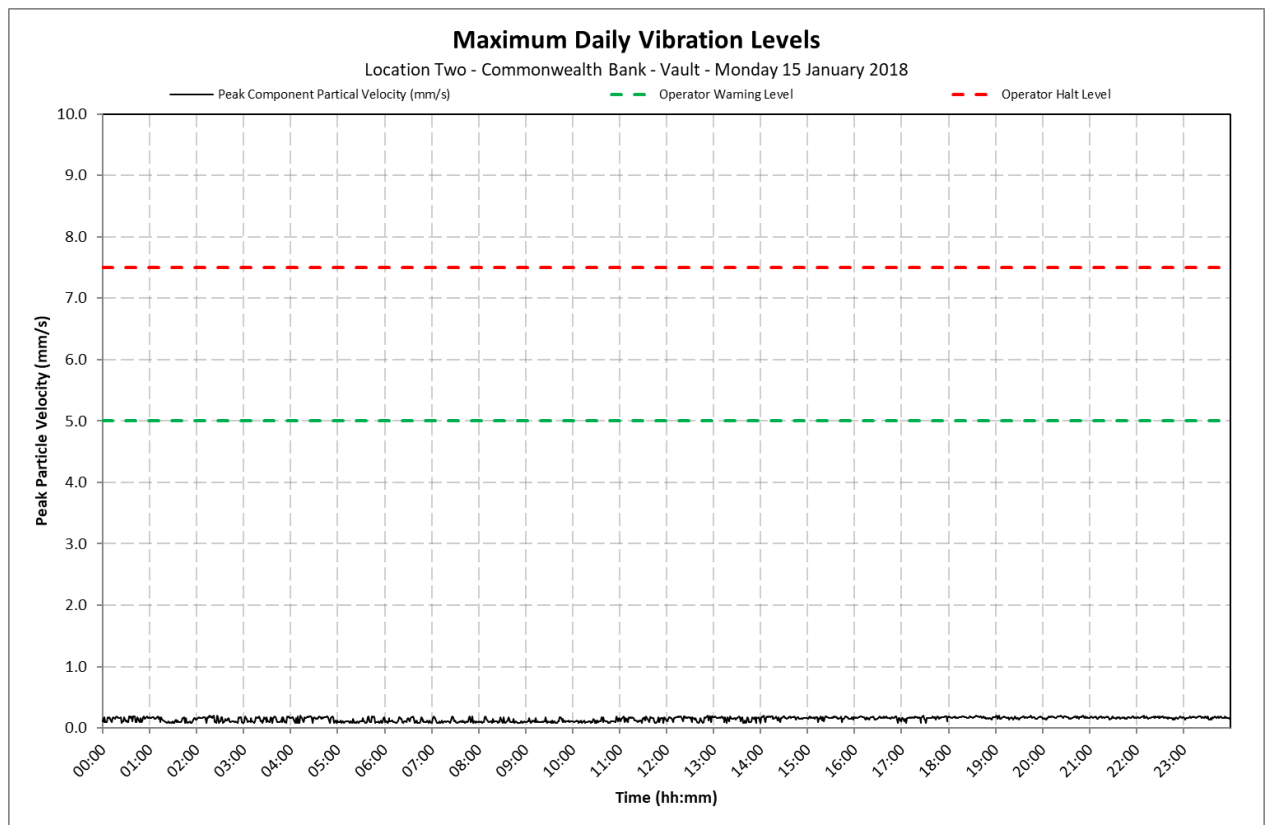
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

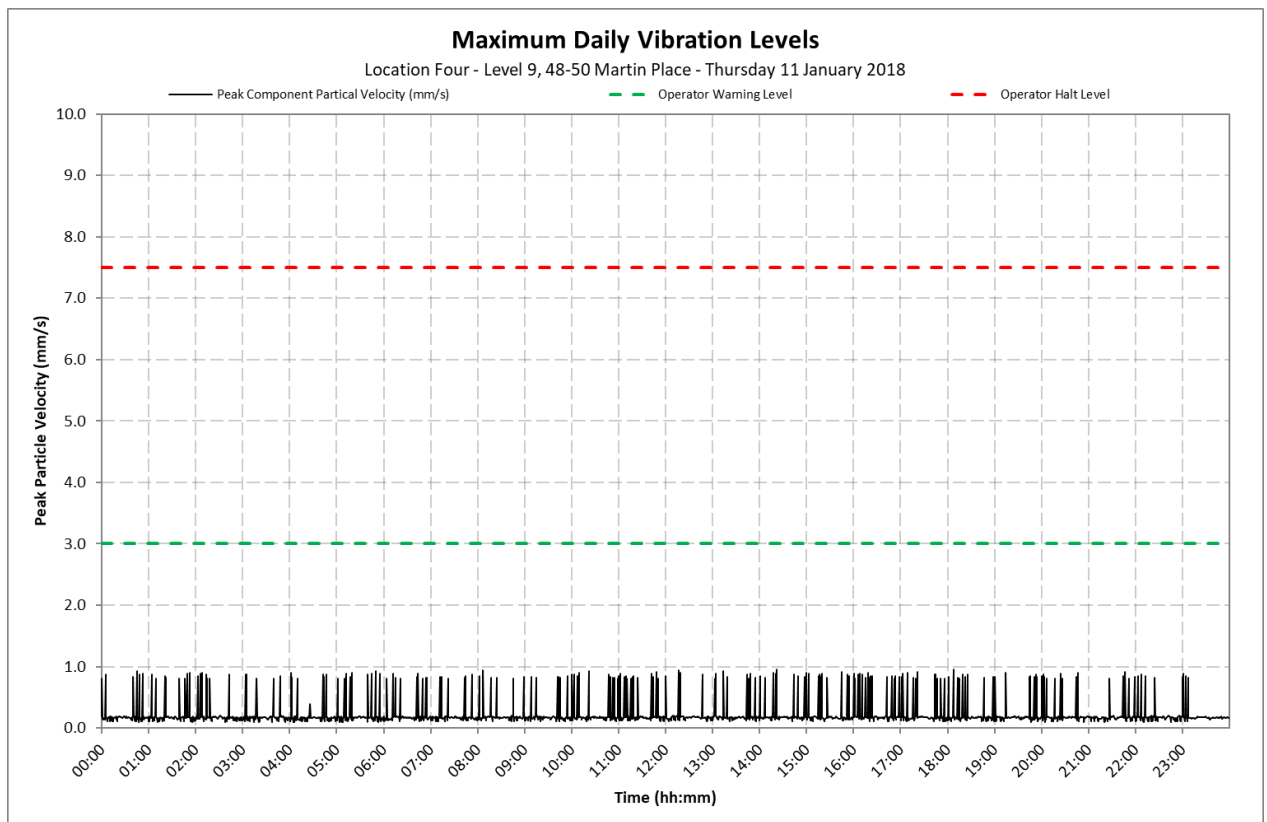
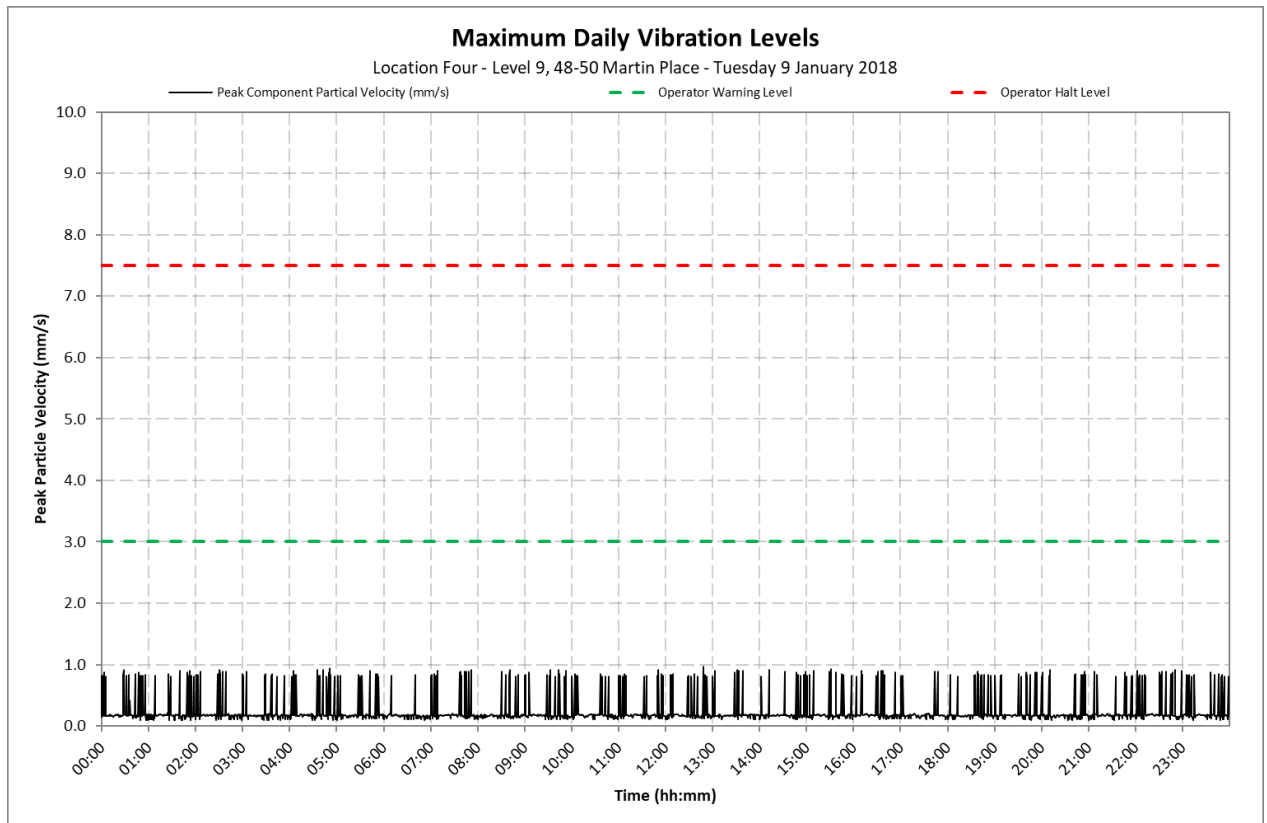
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

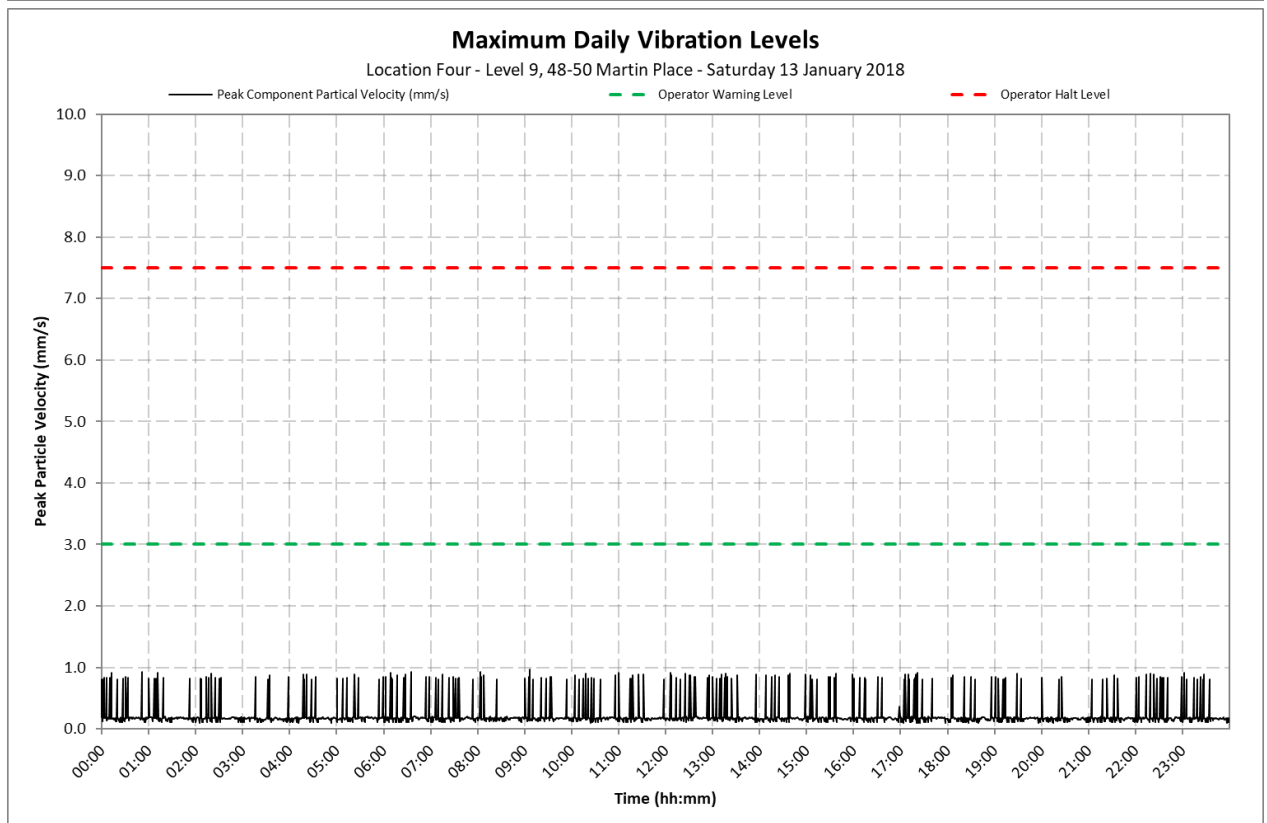
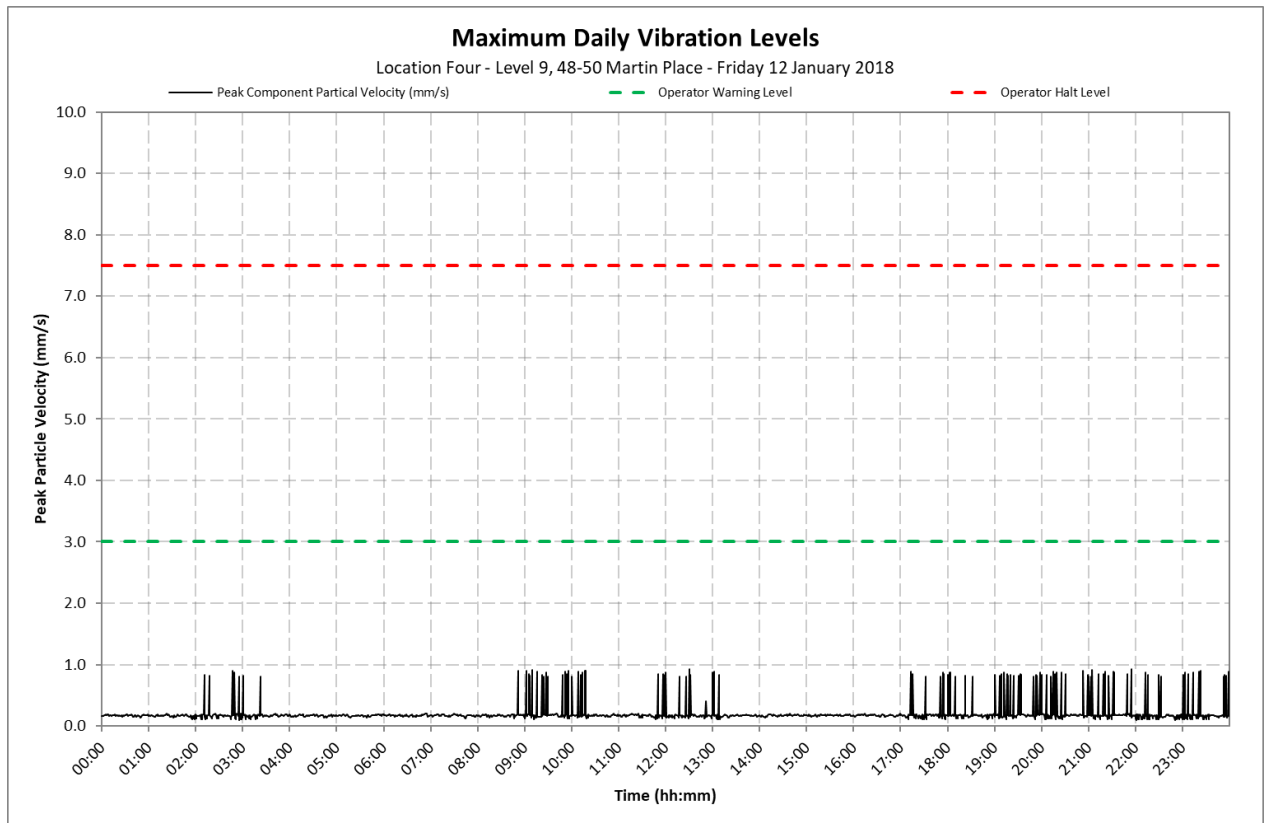
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

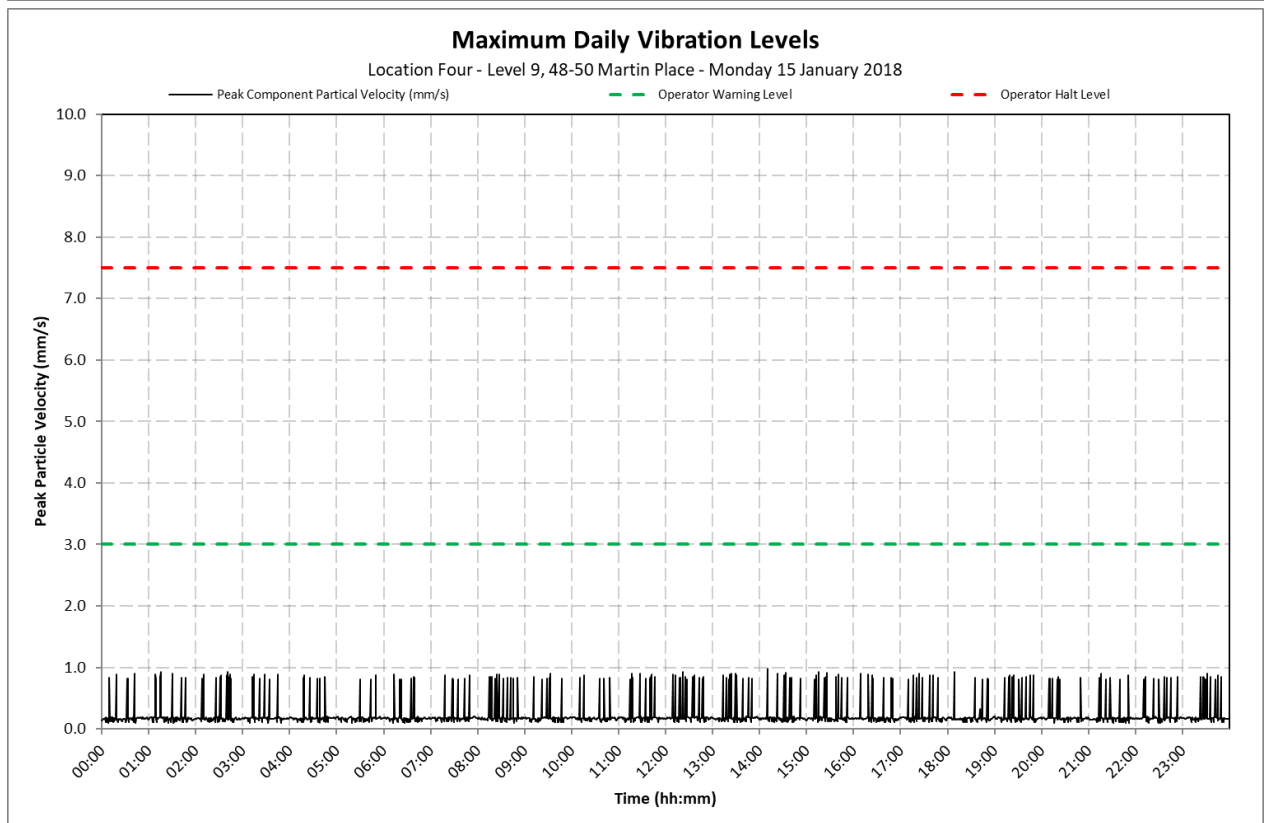
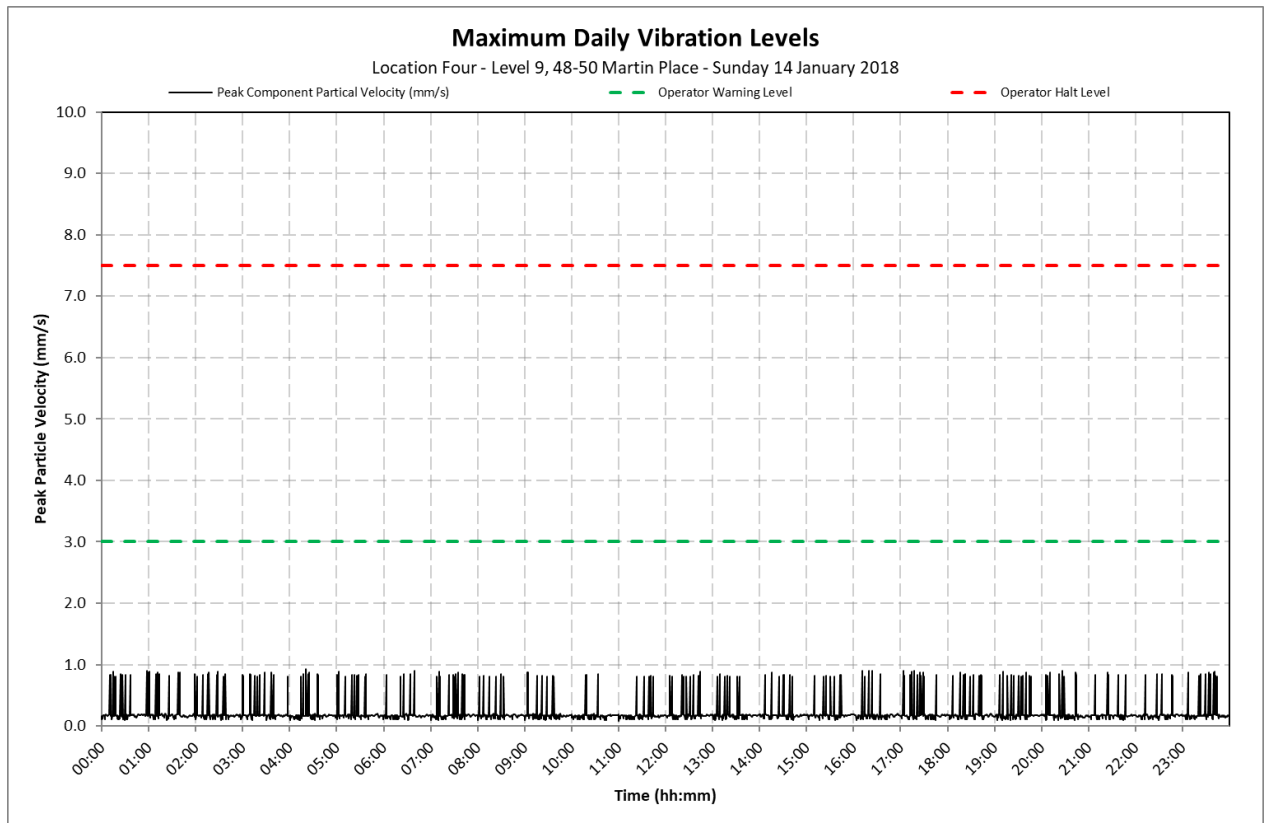
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





24 January 2018

10-1380 R16 NV Monitoring 20180124.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 16
16 January to 22 January 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 16 January to 22 January 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

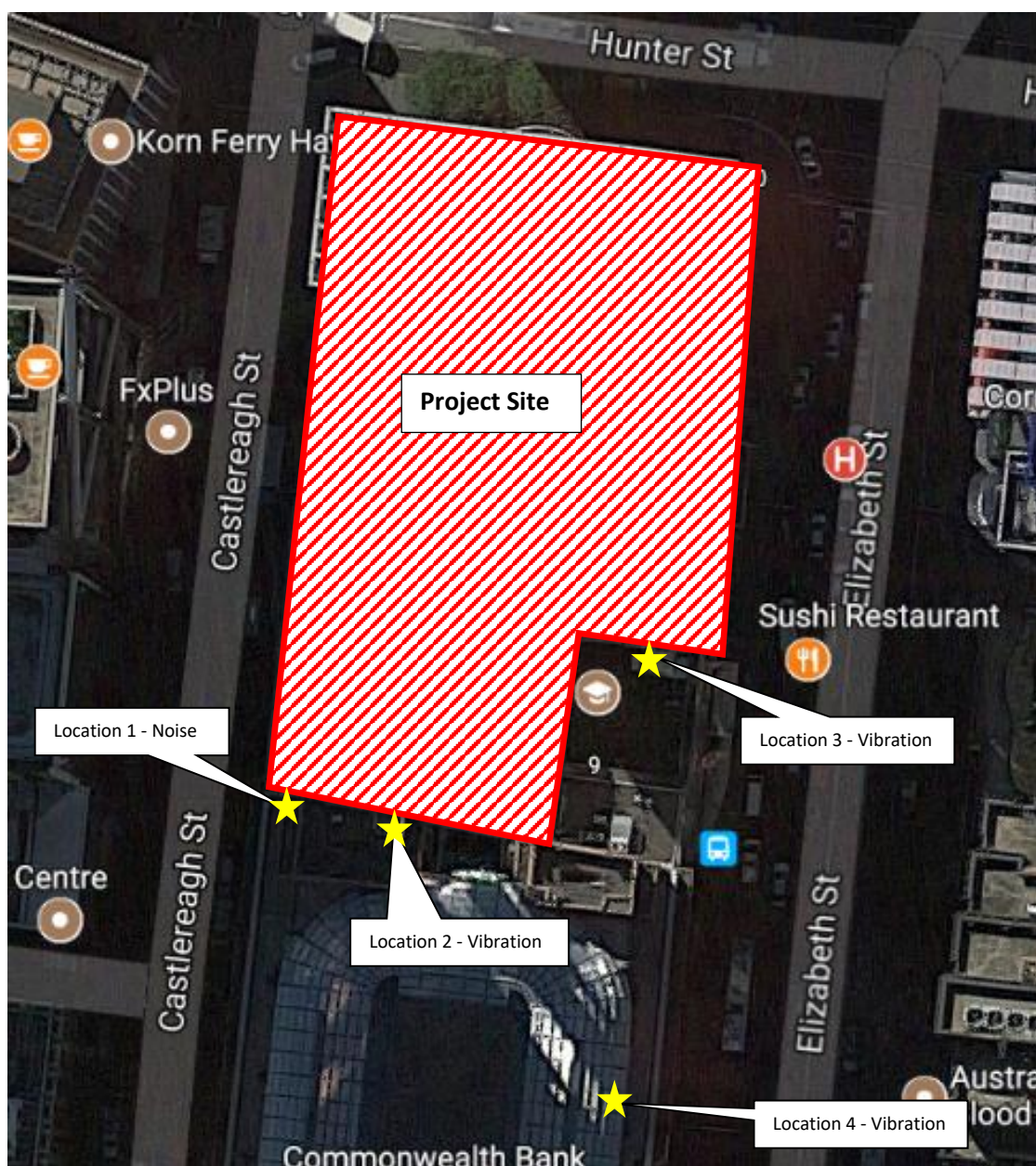
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 16 January to 22 January 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
16 January 2018	41	40	Complies	Complies
17 January 2018	44	43	Complies	Complies
18 January 2018	45	44	Complies	Complies
19 January 2018	45	44	Complies	Complies
20 January 2018	46	45	Complies	Complies
21 January 2018	39	38	Complies	Complies
22 January 2018	38	37	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 16 January to 22 January 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
16 January 2018	1.1 mm/s	Complies
17 January 2018	0.7 mm/s	Complies
18 January 2018	0.9 mm/s	Complies
19 January 2018	0.9 mm/s	Complies
20 January 2018	0.2 mm/s	Complies
21 January 2018	0.2 mm/s	Complies
22 January 2018	1.5 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
16 January 2018	0.9 mm/s	Complies
17 January 2018	2.2 mm/s	Complies
18 January 2018	1.0 mm/s	Complies
19 January 2018	1.0 mm/s	Complies
20 January 2018	1.0 mm/s	Complies
21 January 2018	0.9 mm/s	Complies
22 January 2018	1.0 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 16 January to 22 January 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 16 January to 22 January 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

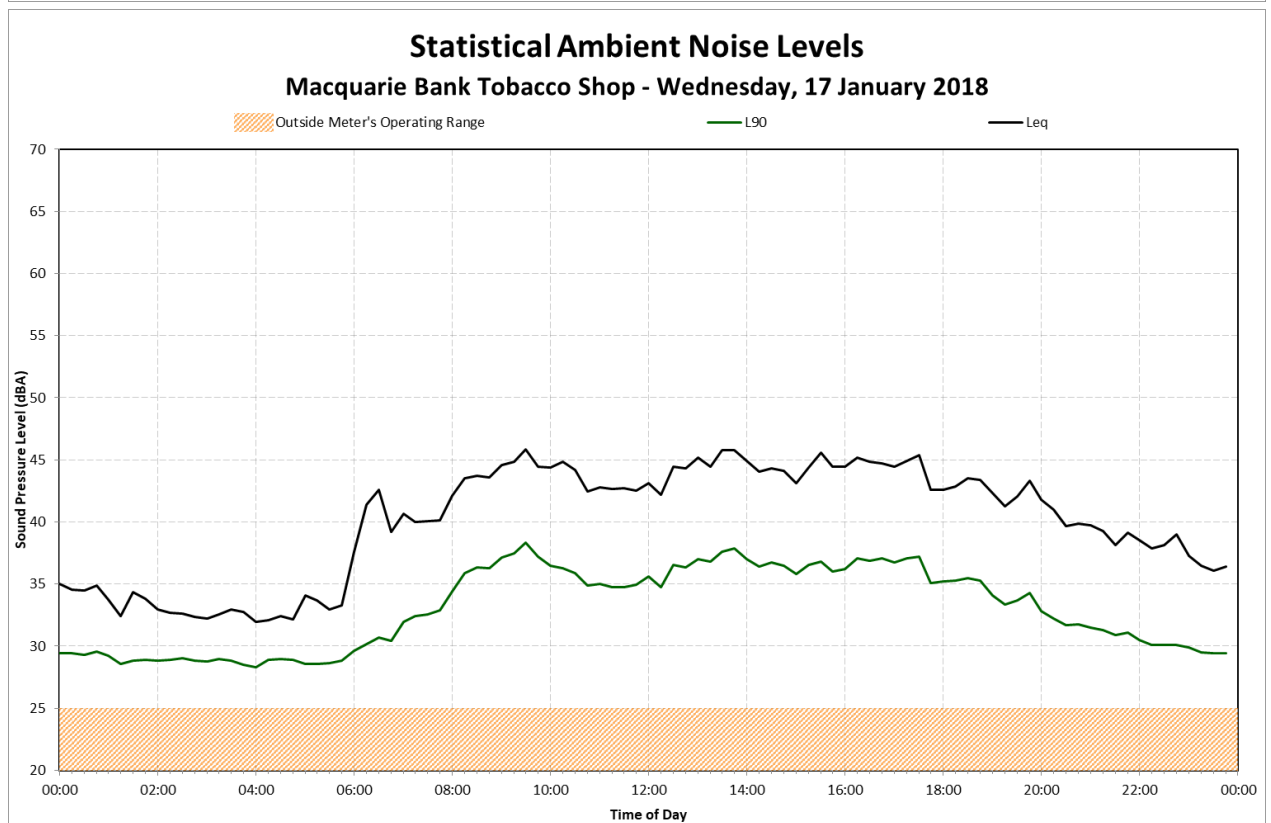
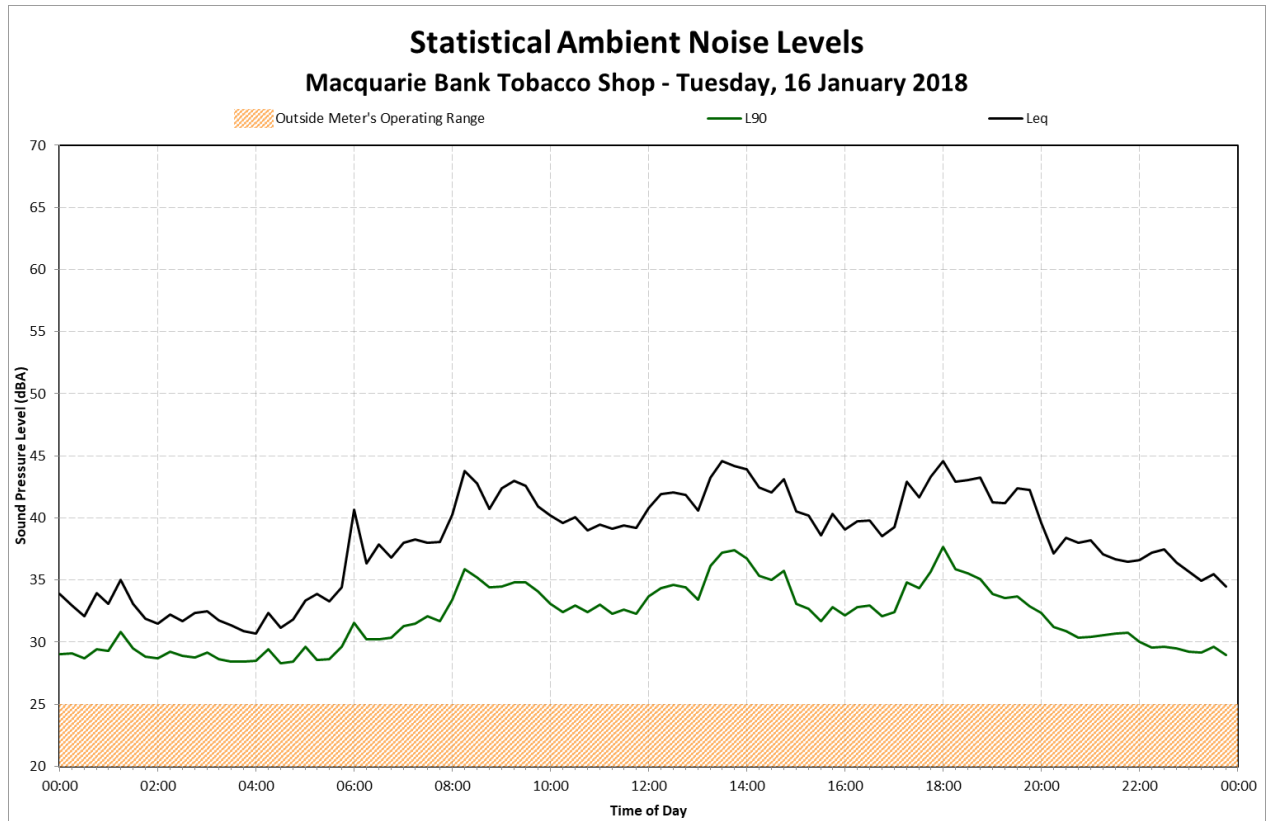
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

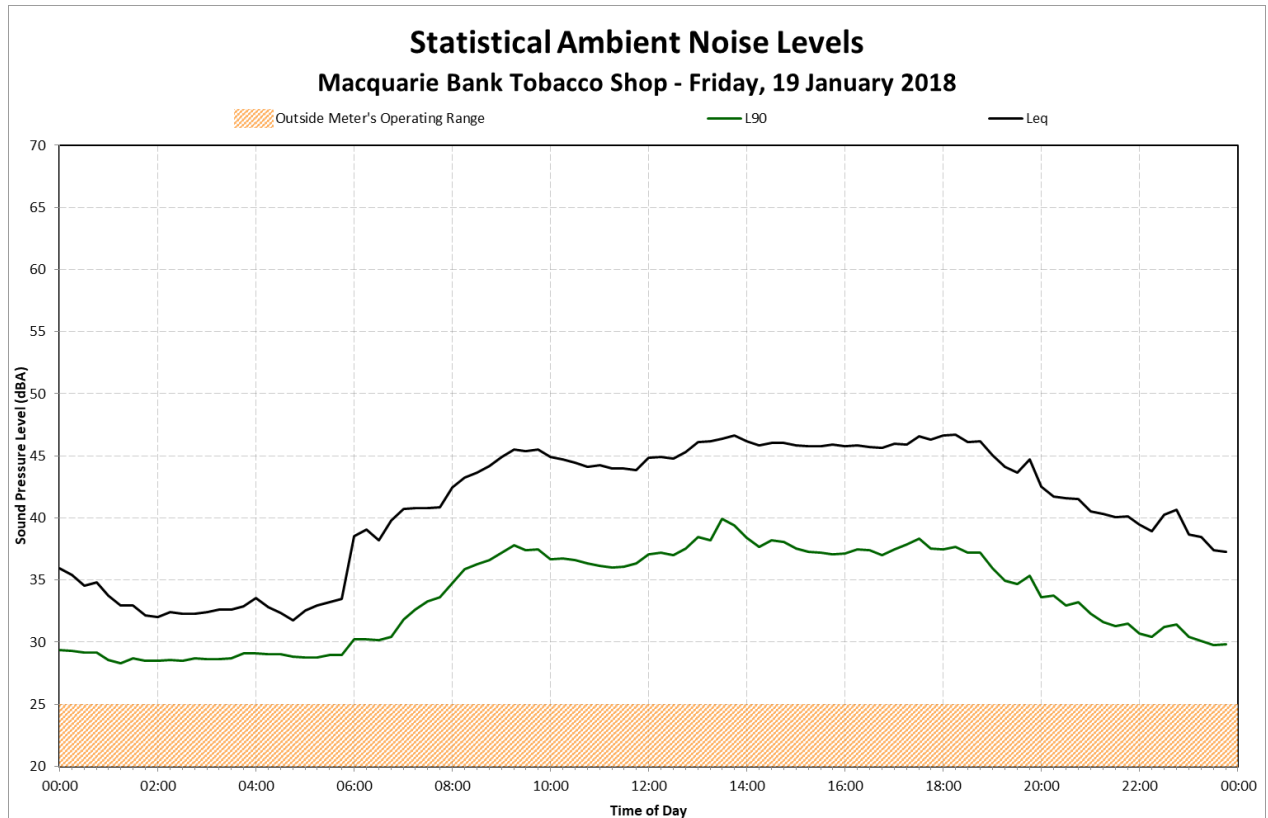
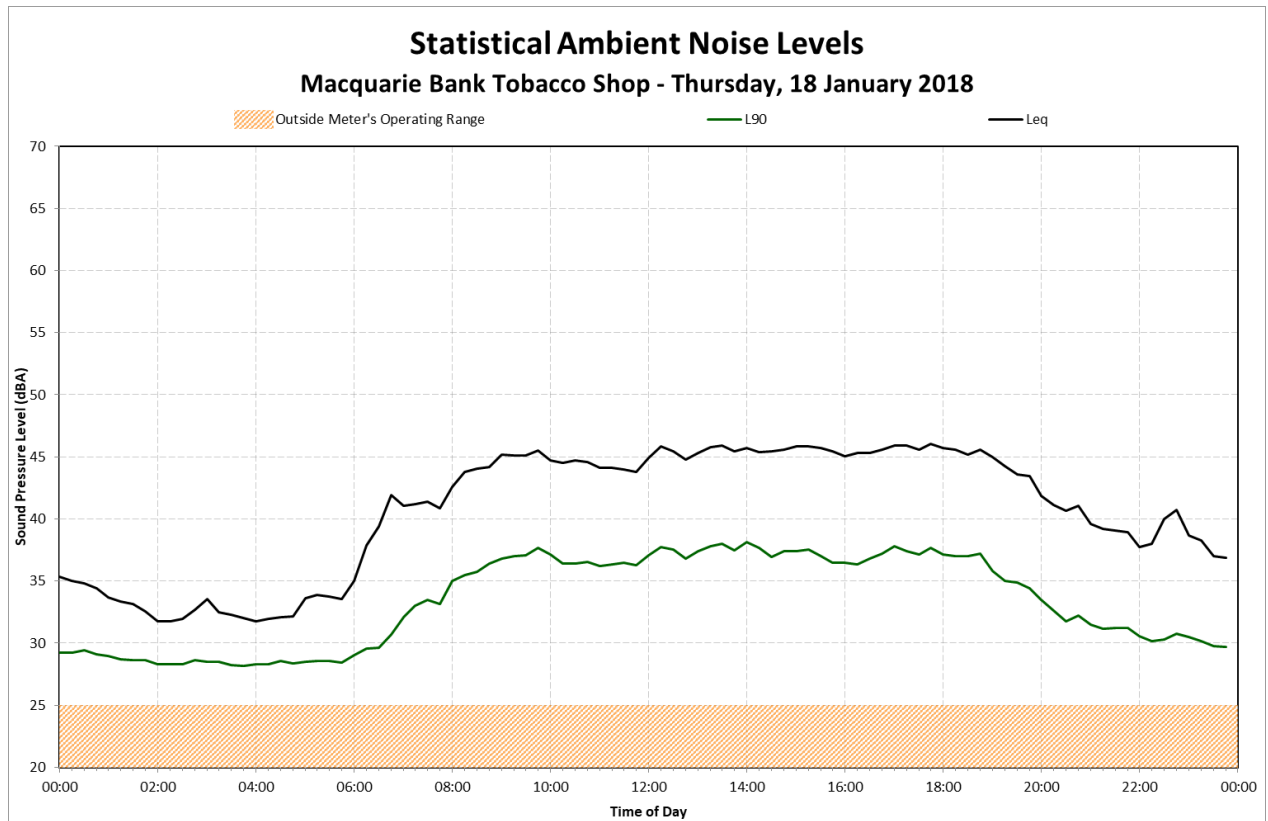
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

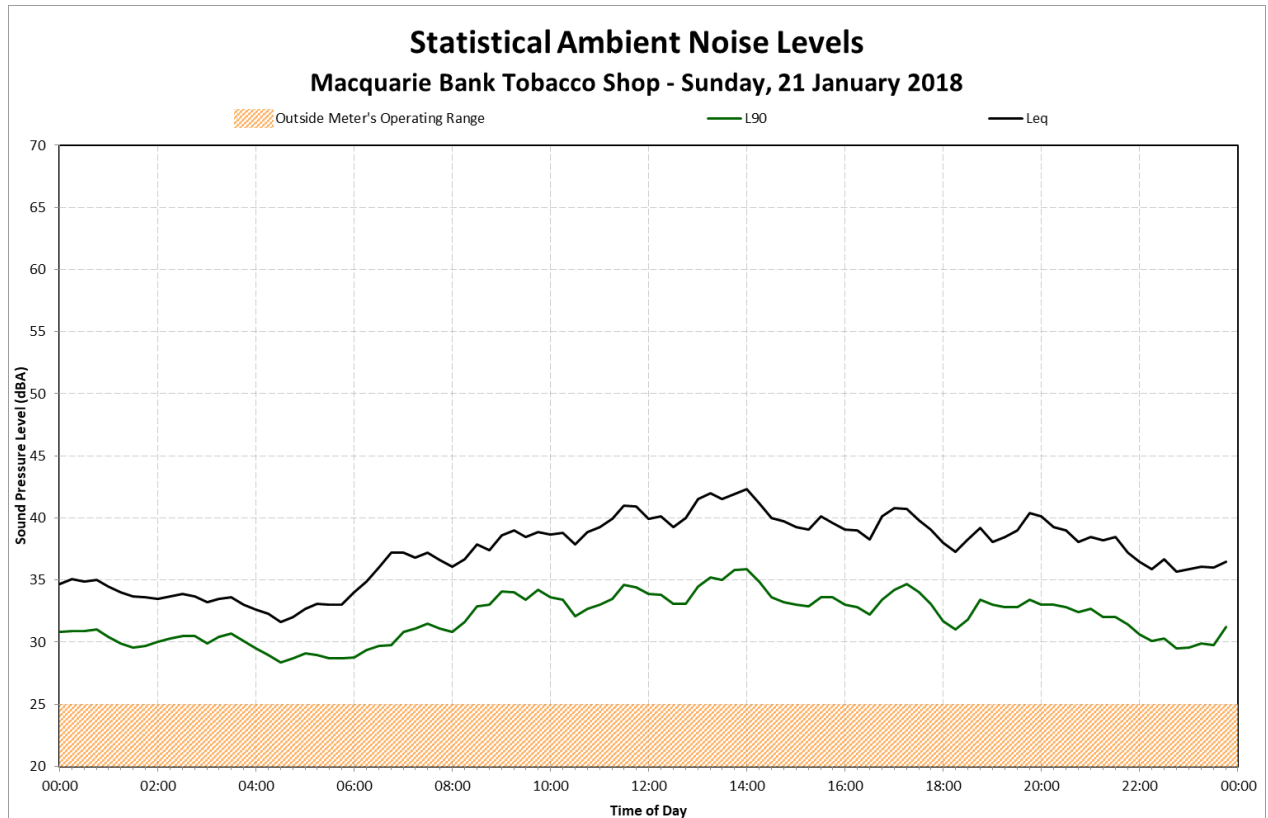
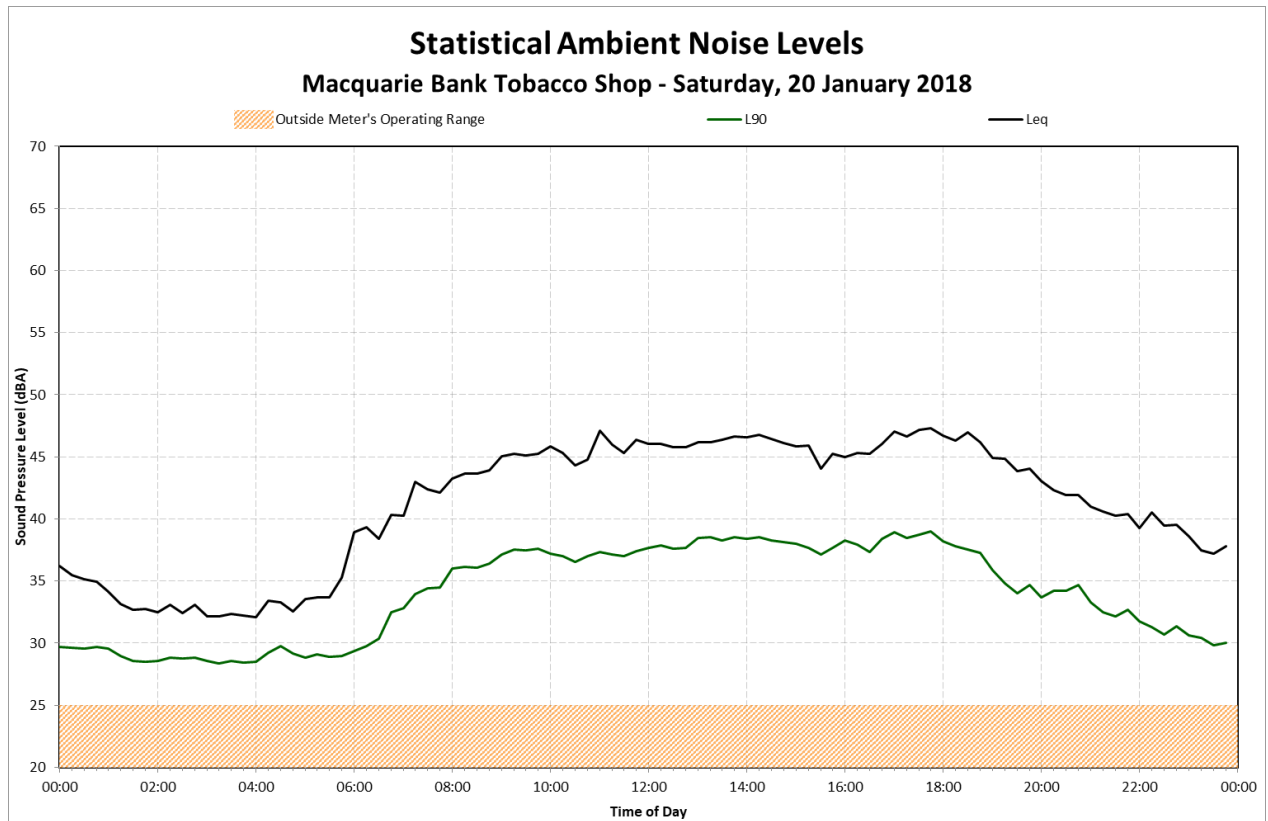
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

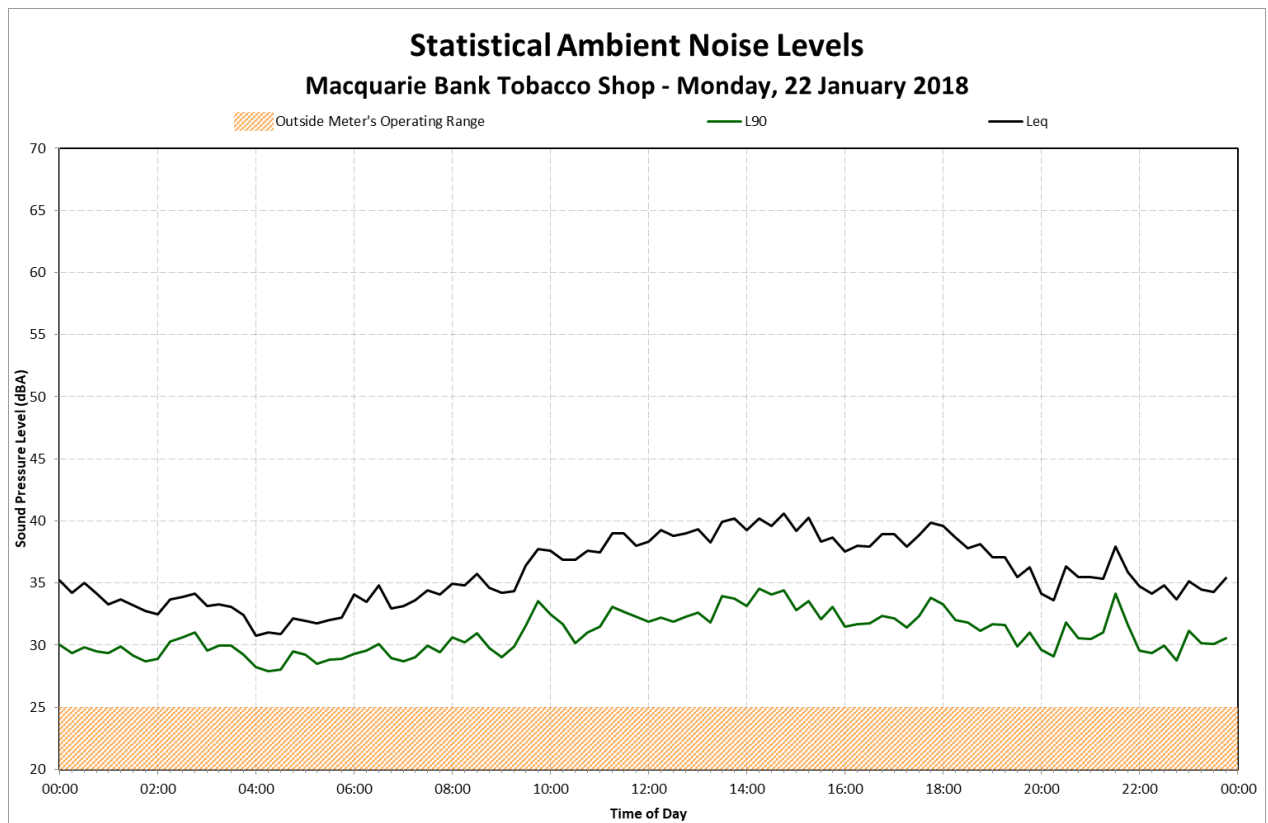
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

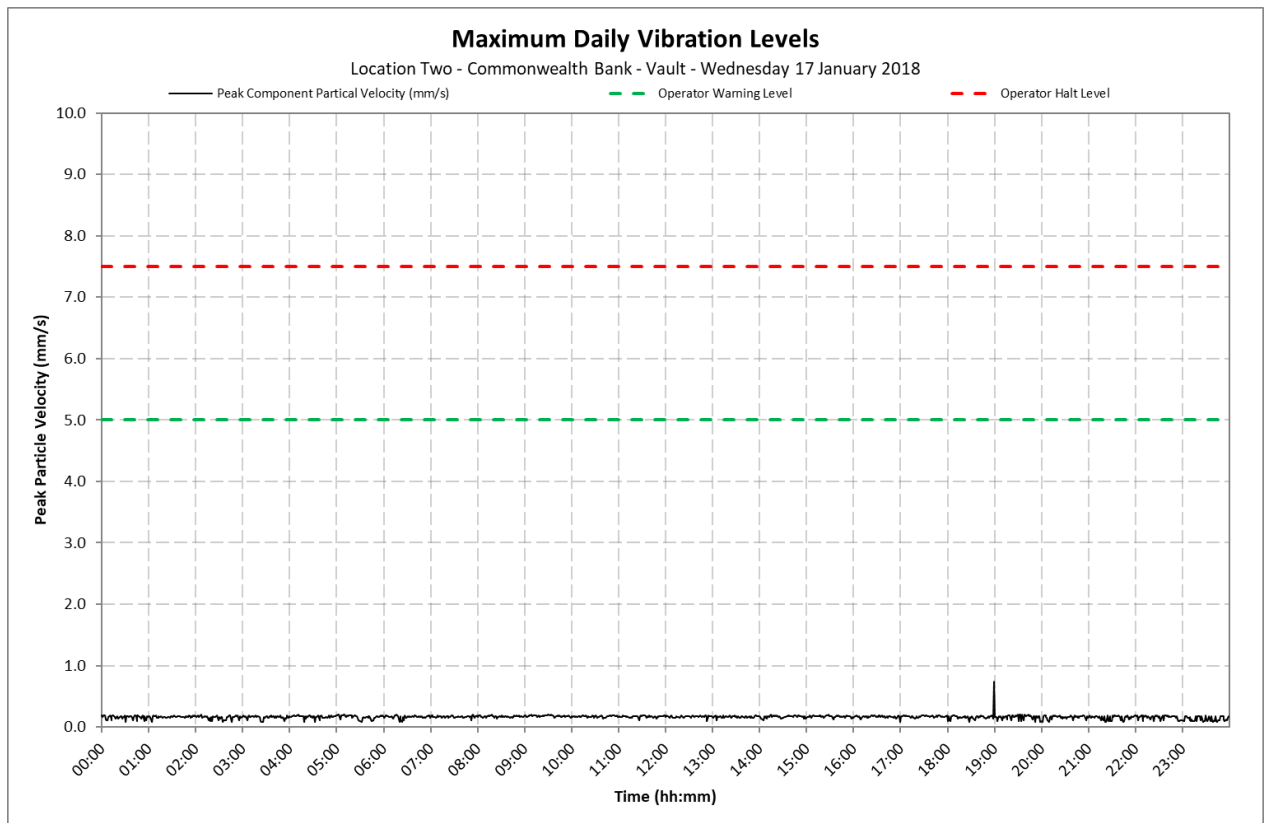
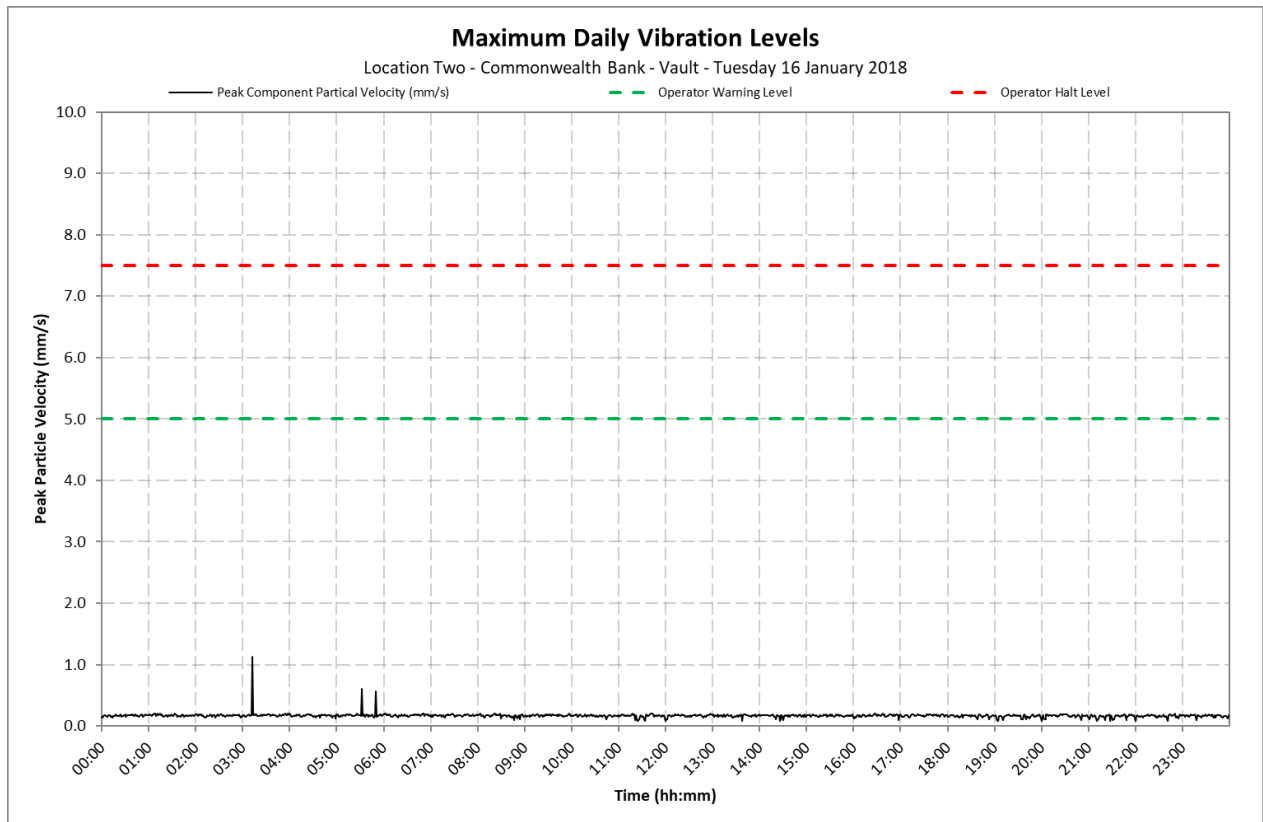
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

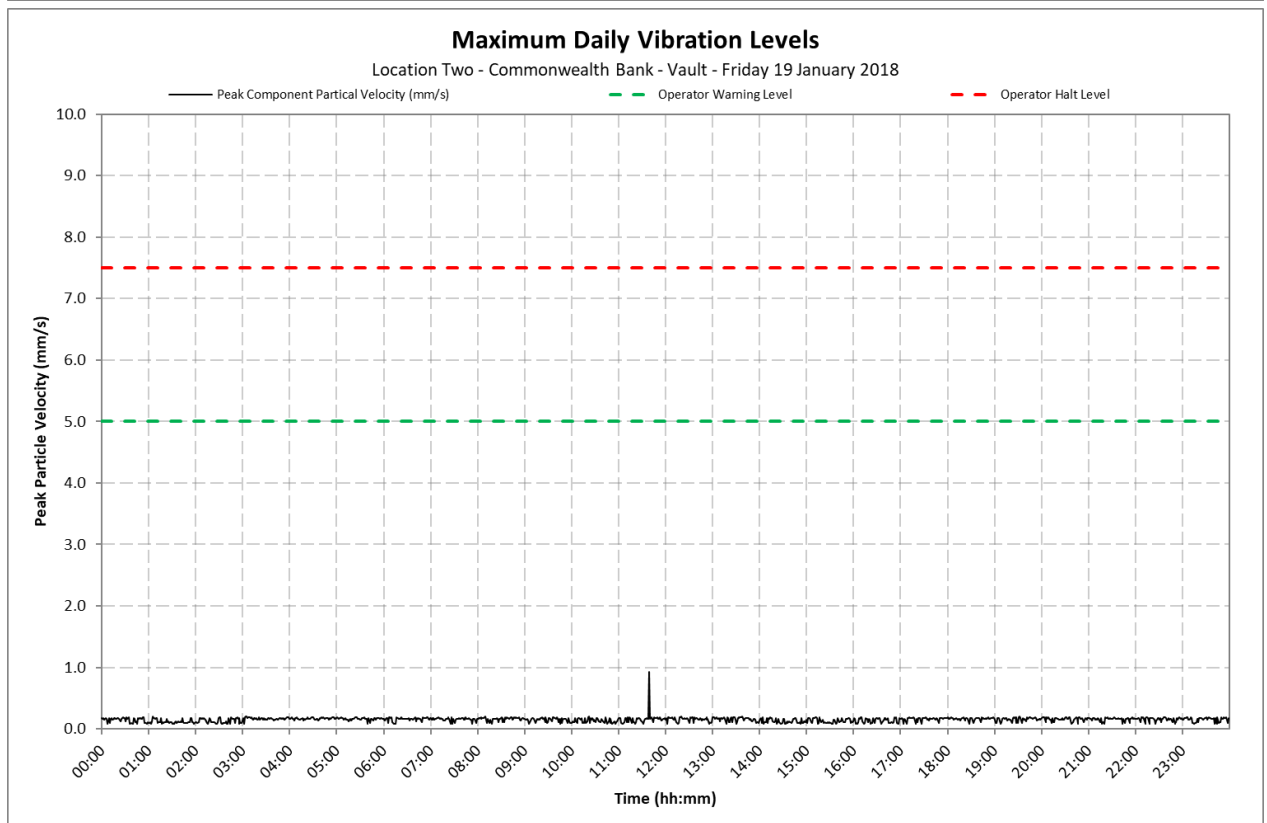
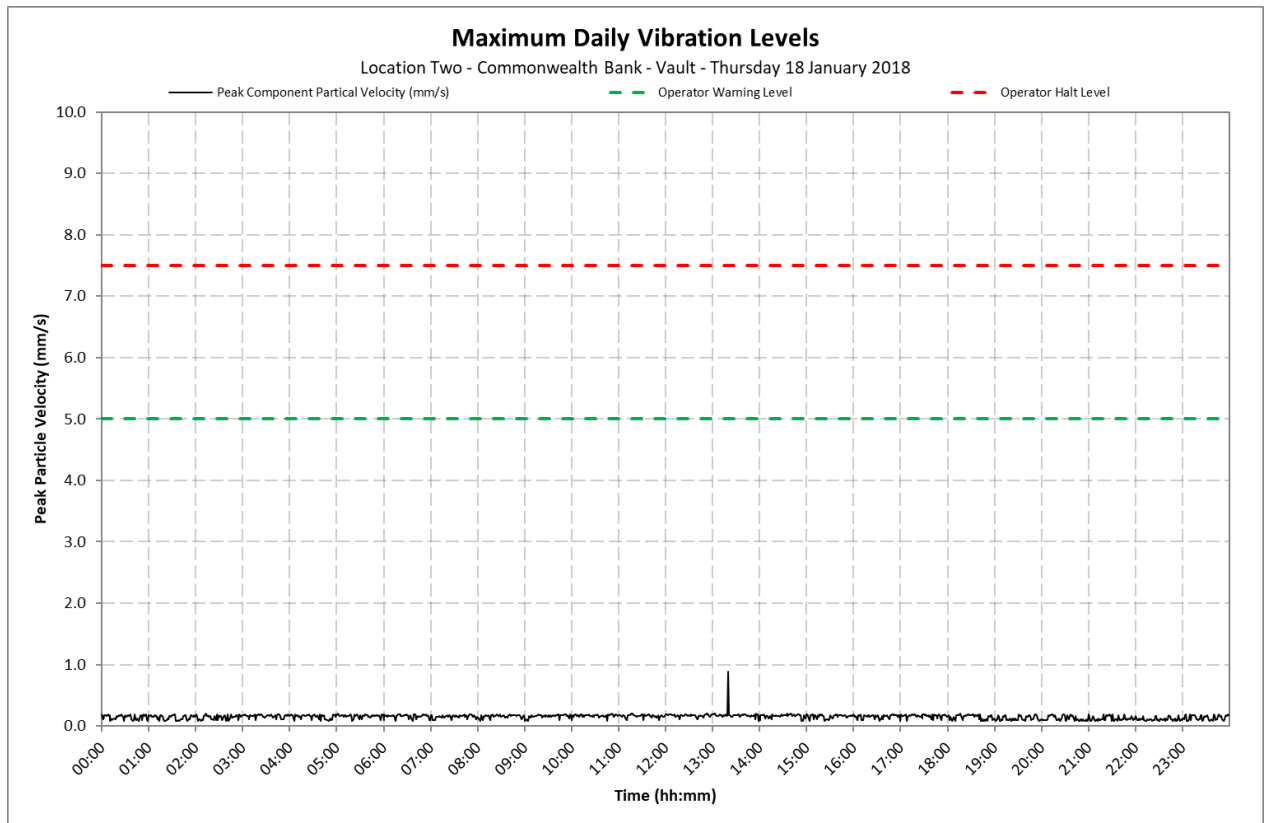
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

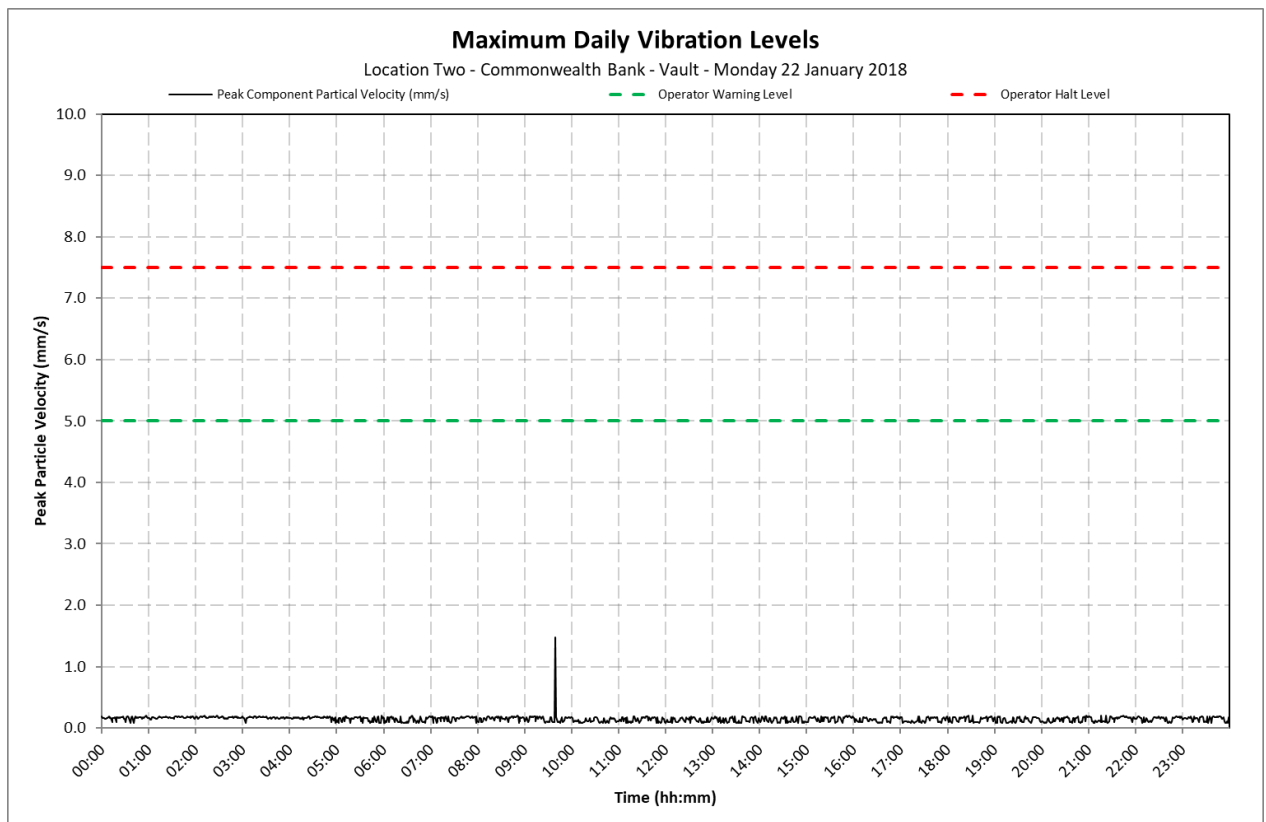
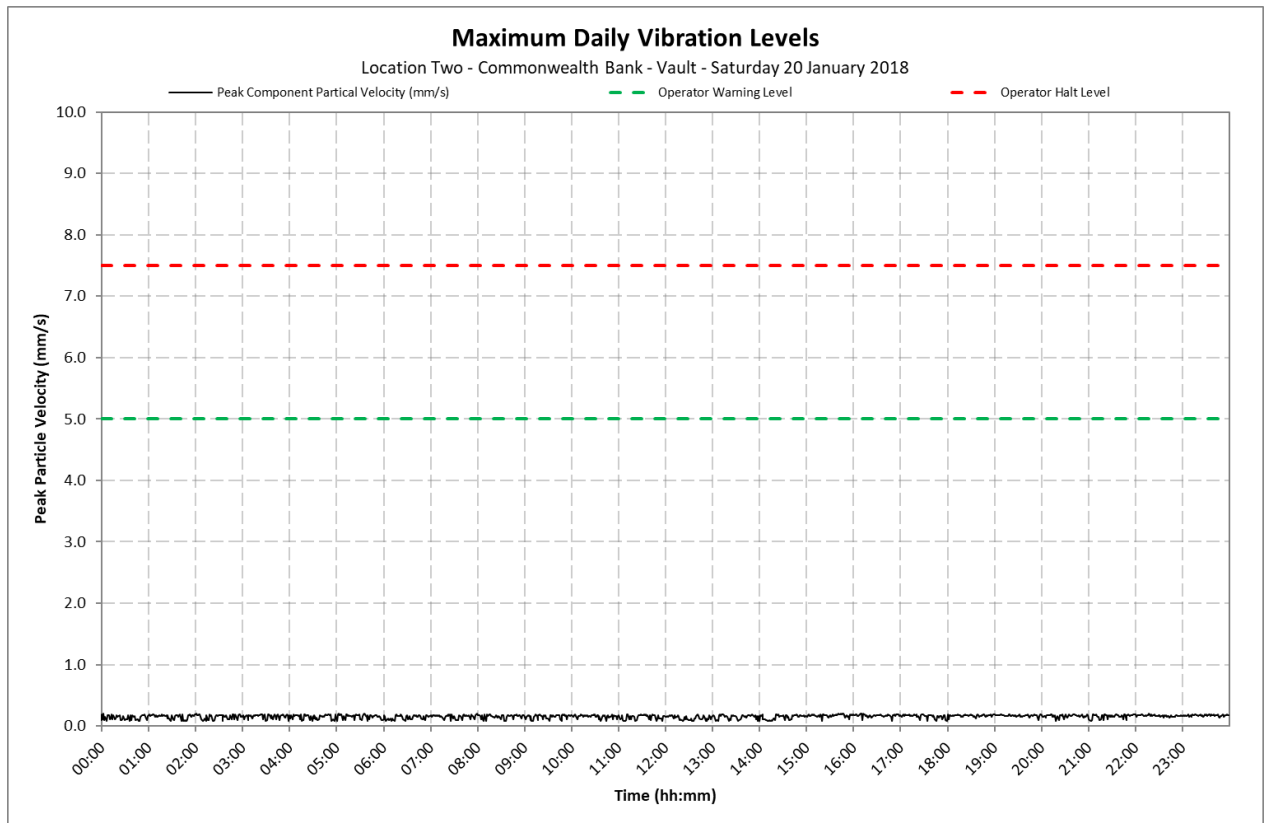
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

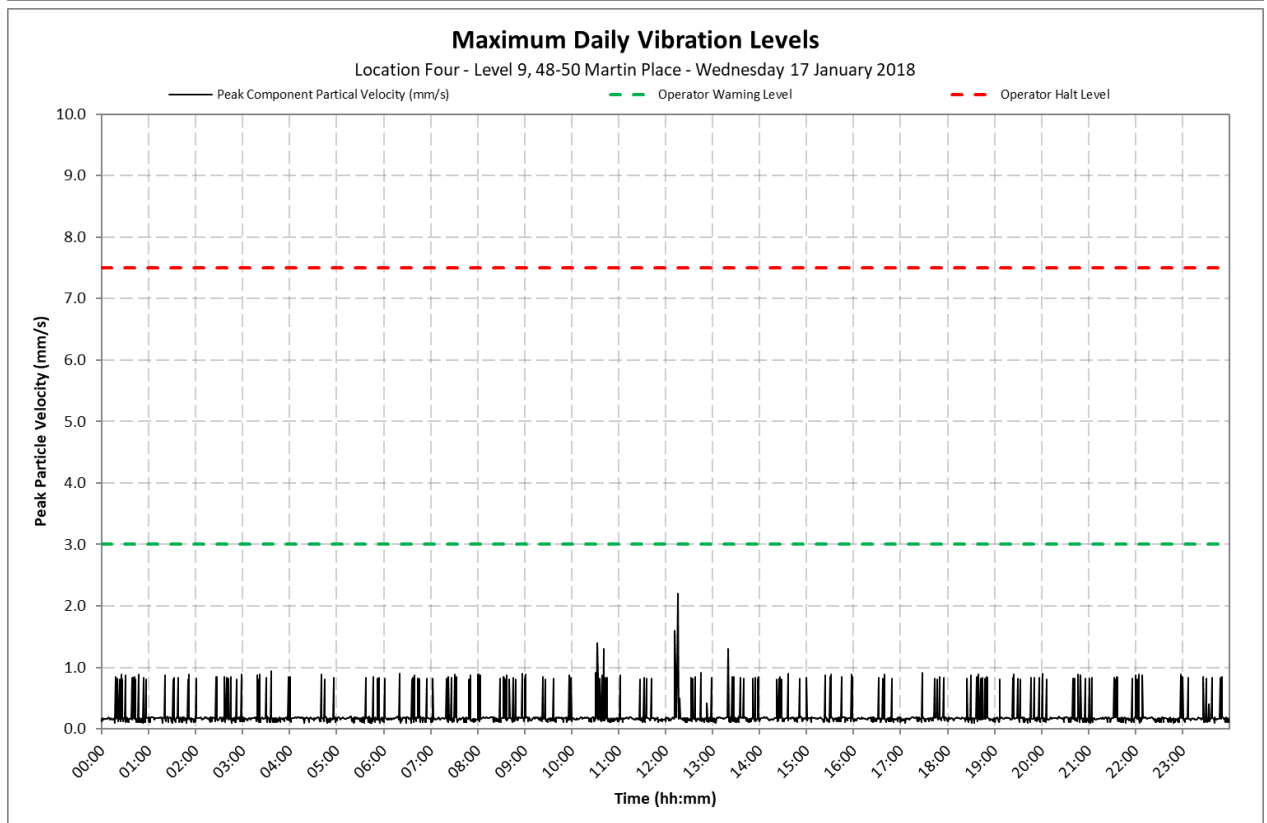
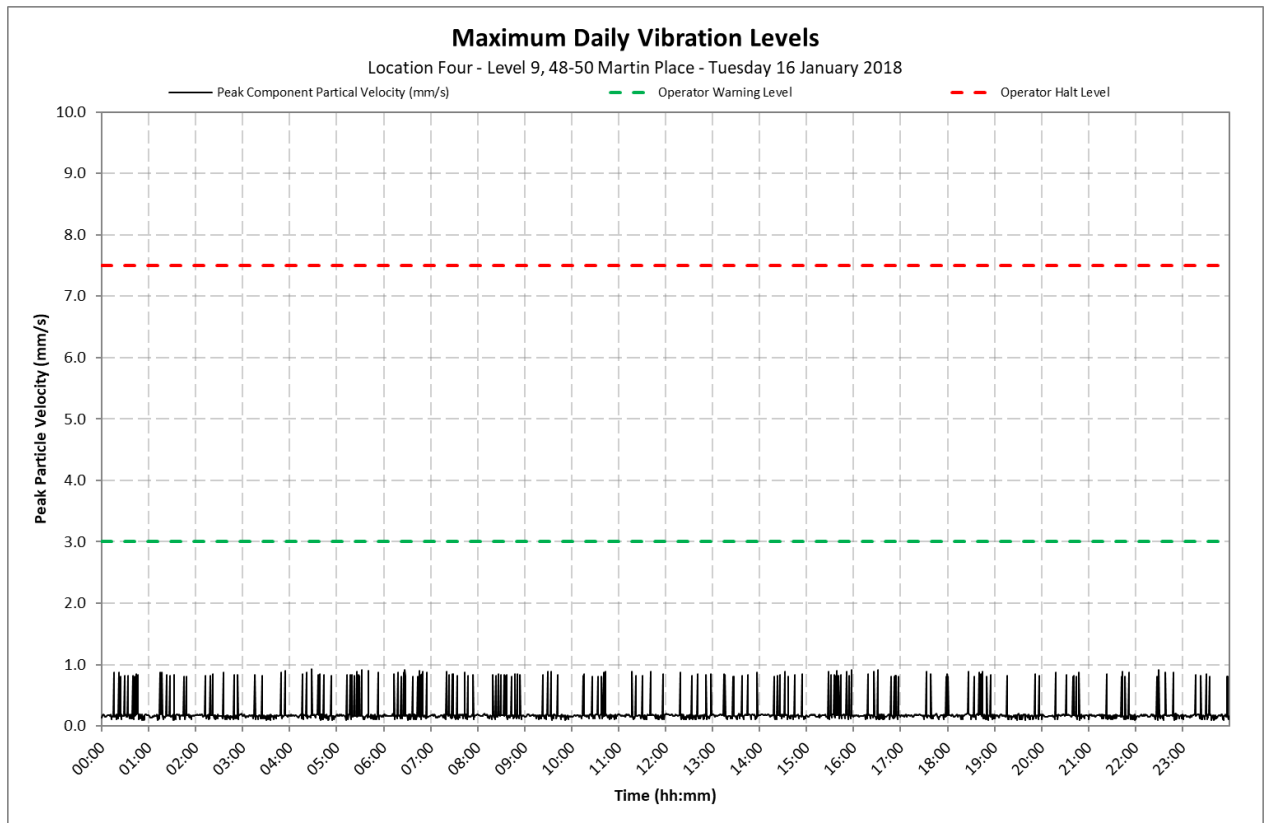
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

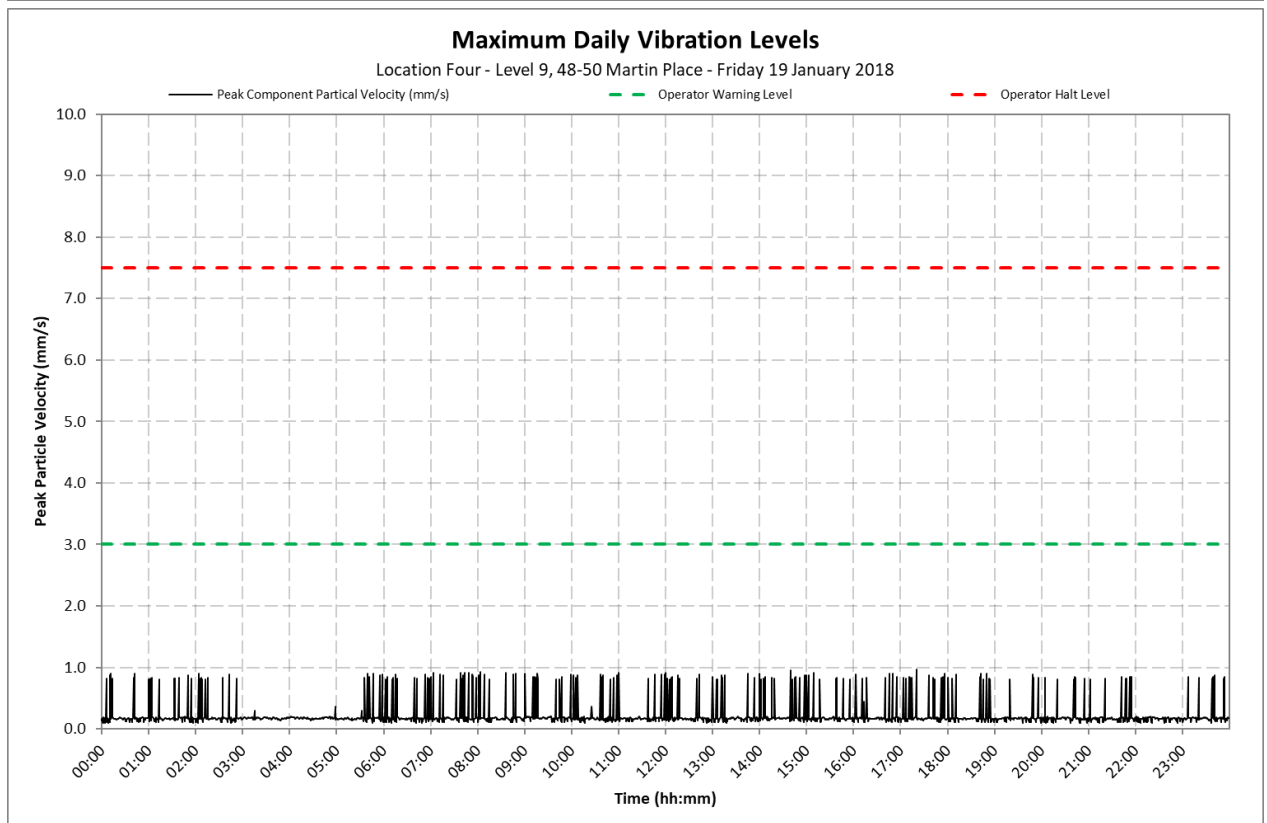
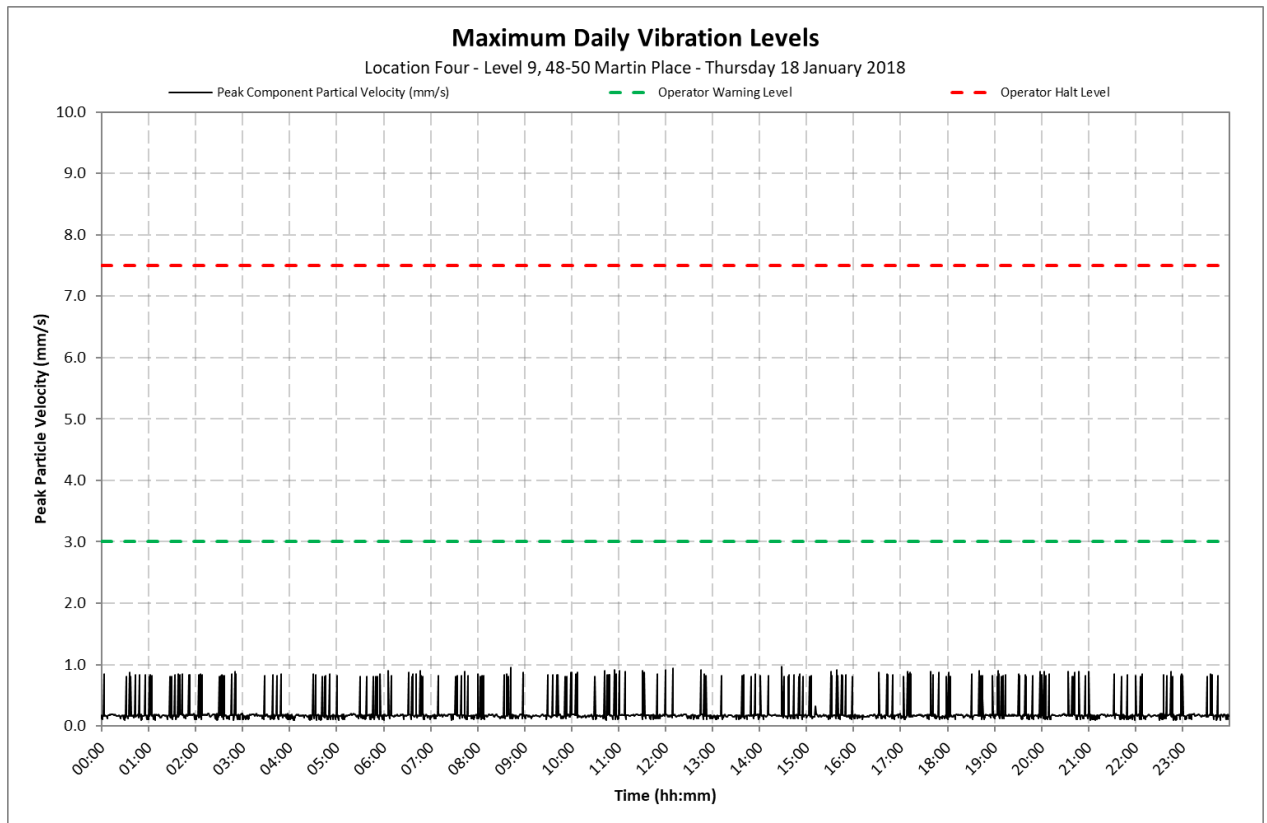
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

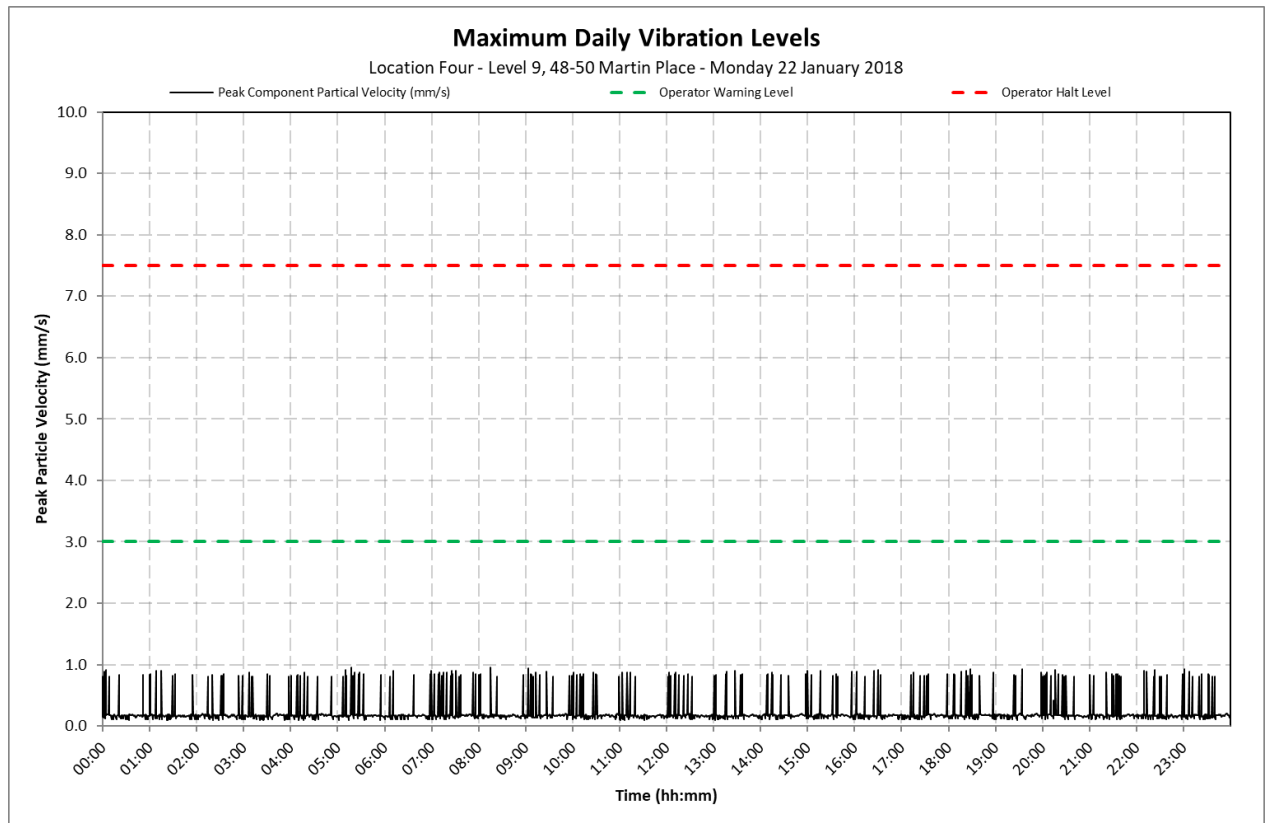
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





9 February 2018

10-1380 R17 NV Monitoring 20180209.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 17
23 January to 30 January 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 23 January to 30 January 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

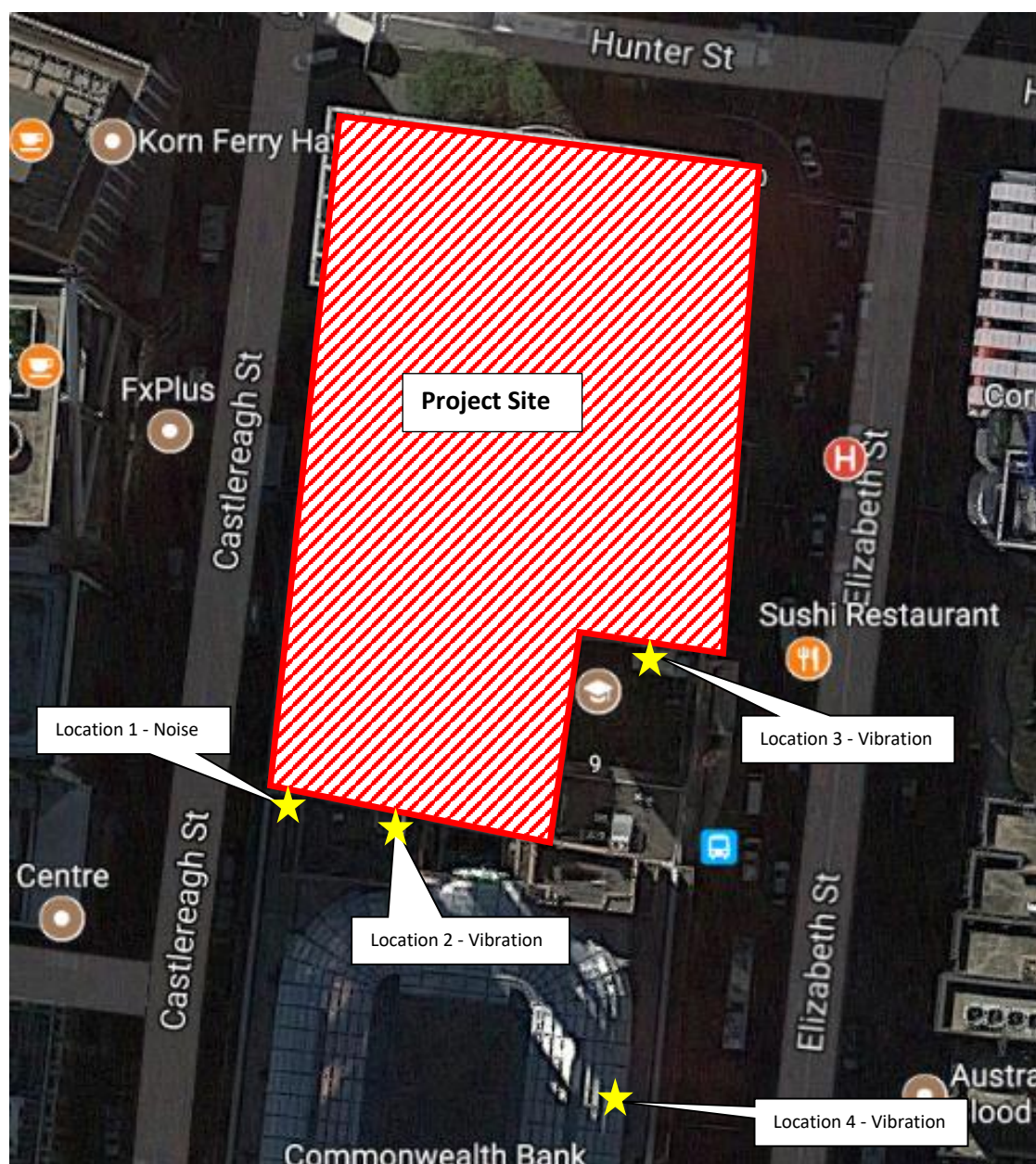
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 23 January to 30 January 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
23 January 2018	41	40	Complies	Complies
24 January 2018	44	43	Complies	Complies
25 January 2018	45	44	Complies	Complies
26 January 2018	46	44	Complies	Complies
27 January 2018	46	45	Complies	Complies
28 January 2018	41	40	Complies	Complies
29 January 2018	38	37	Complies	Complies
30 January 2018	41	40	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 23 January to 30 January 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
23 January 2018	0.2 mm/s	Complies
24 January 2018	0.7 mm/s	Complies
25 January 2018	0.2 mm/s	Complies
26 January 2018	0.8 mm/s	Complies
27 January 2018	0.2 mm/s	Complies
28 January 2018	1.1 mm/s	Complies
29 January 2018	1.3 mm/s	Complies
30 January 2018	1.0 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 4

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
23 January 2018	0.9 mm/s	Complies
24 January 2018	1.0 mm/s	Complies
25 January 2018	1.0 mm/s	Complies
26 January 2018	0.9 mm/s	Complies
27 January 2018	0.9 mm/s	Complies
28 January 2018	1.0 mm/s	Complies
29 January 2018	0.9 mm/s	Complies
30 January 2018 ¹	1.0 mm/s	Complies

Note 1: Monitor removed at 11.00 am on 30 January 2018.

5 Conclusion

Noise monitoring conducted during the period 23 January to 30 January 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 23 January to 30 January 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

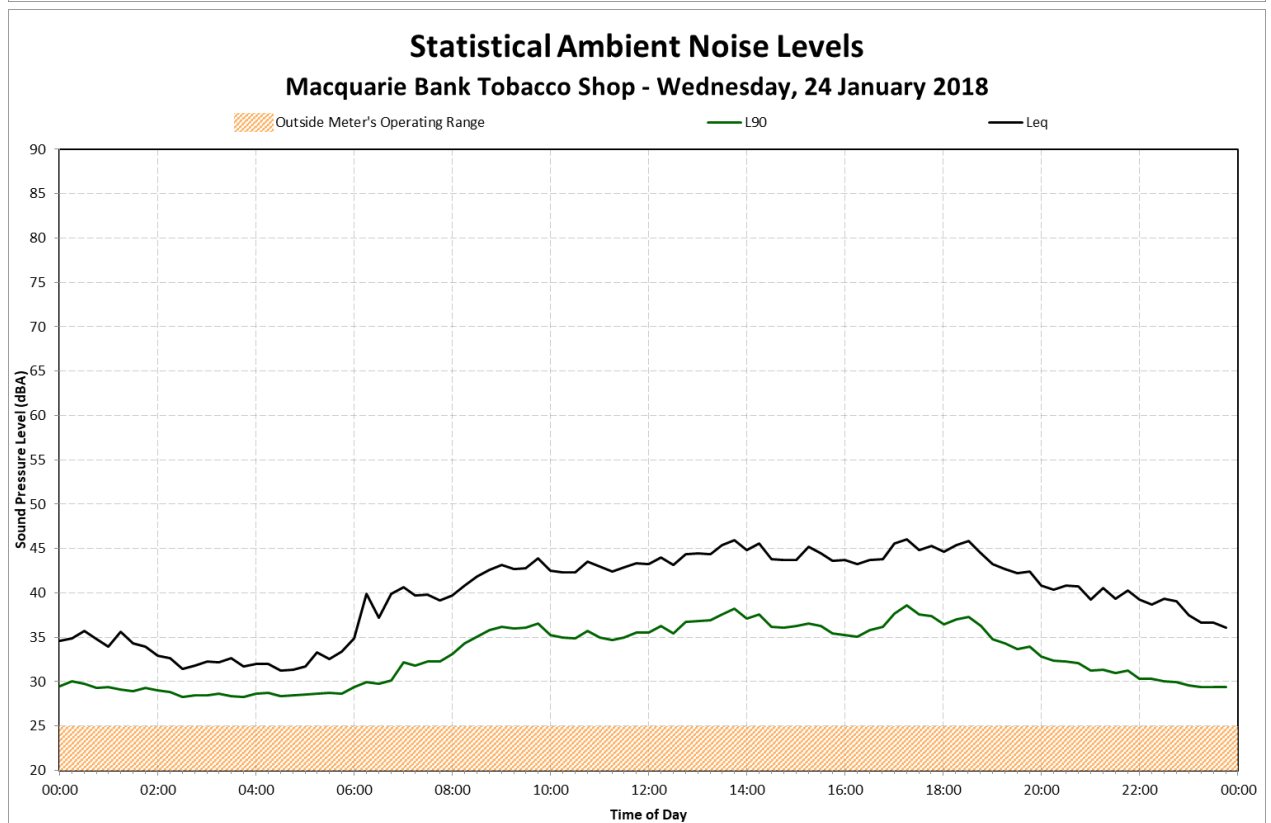
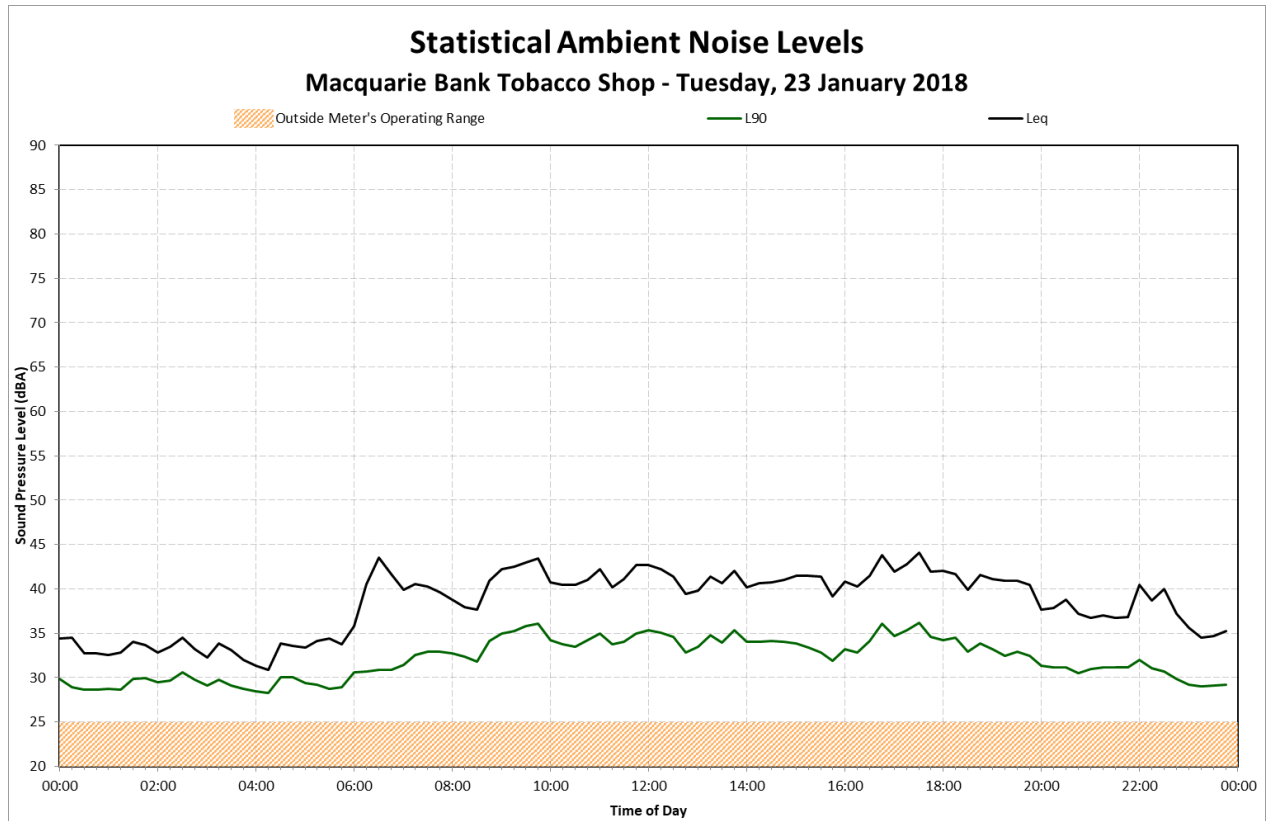
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Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
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DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
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Appendix B

Daily Noise Levels

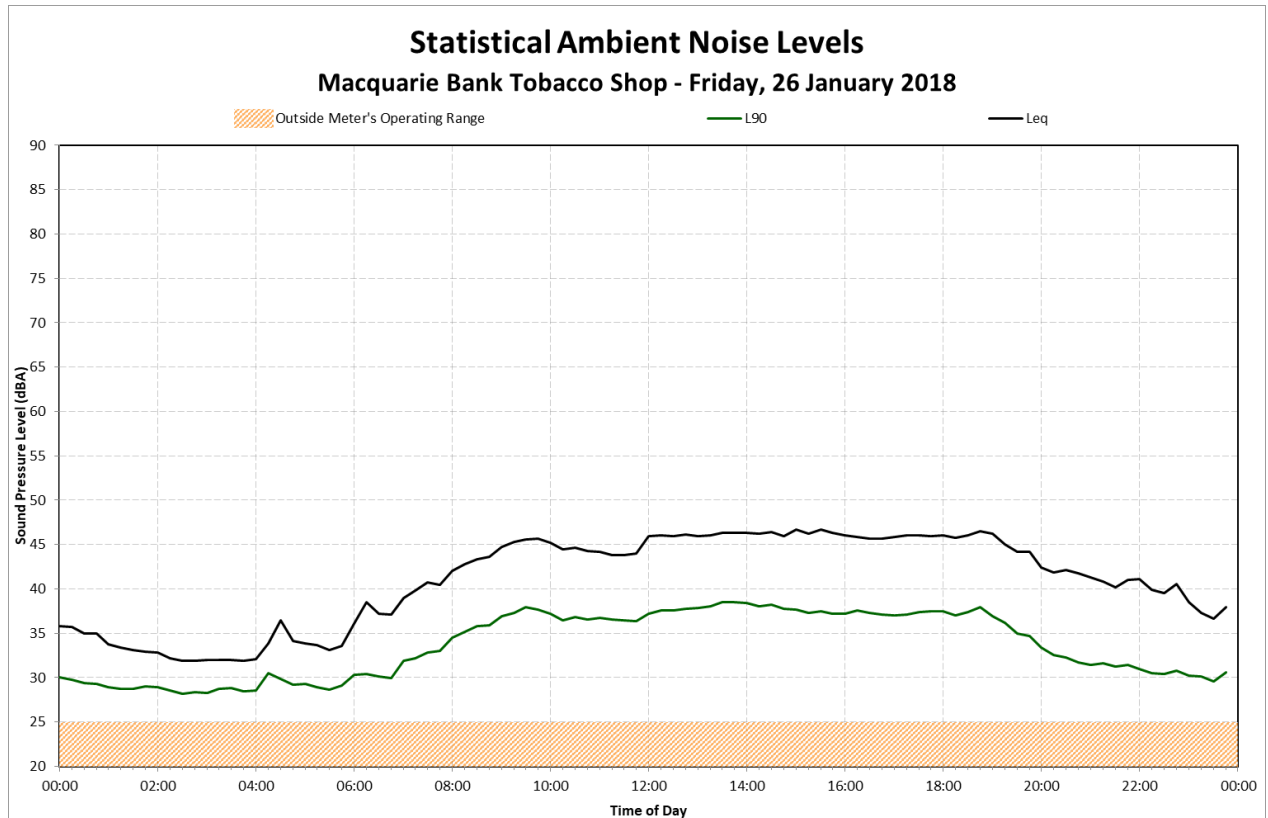
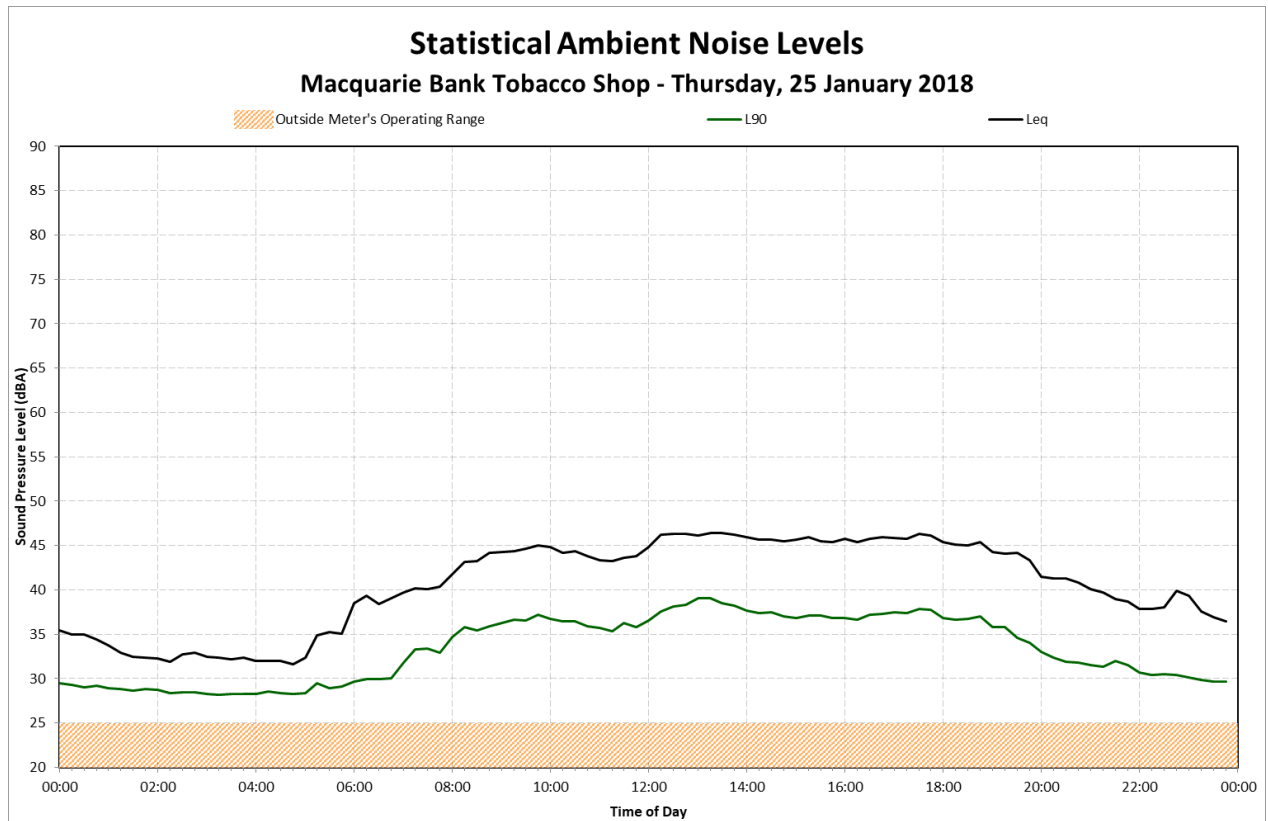
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

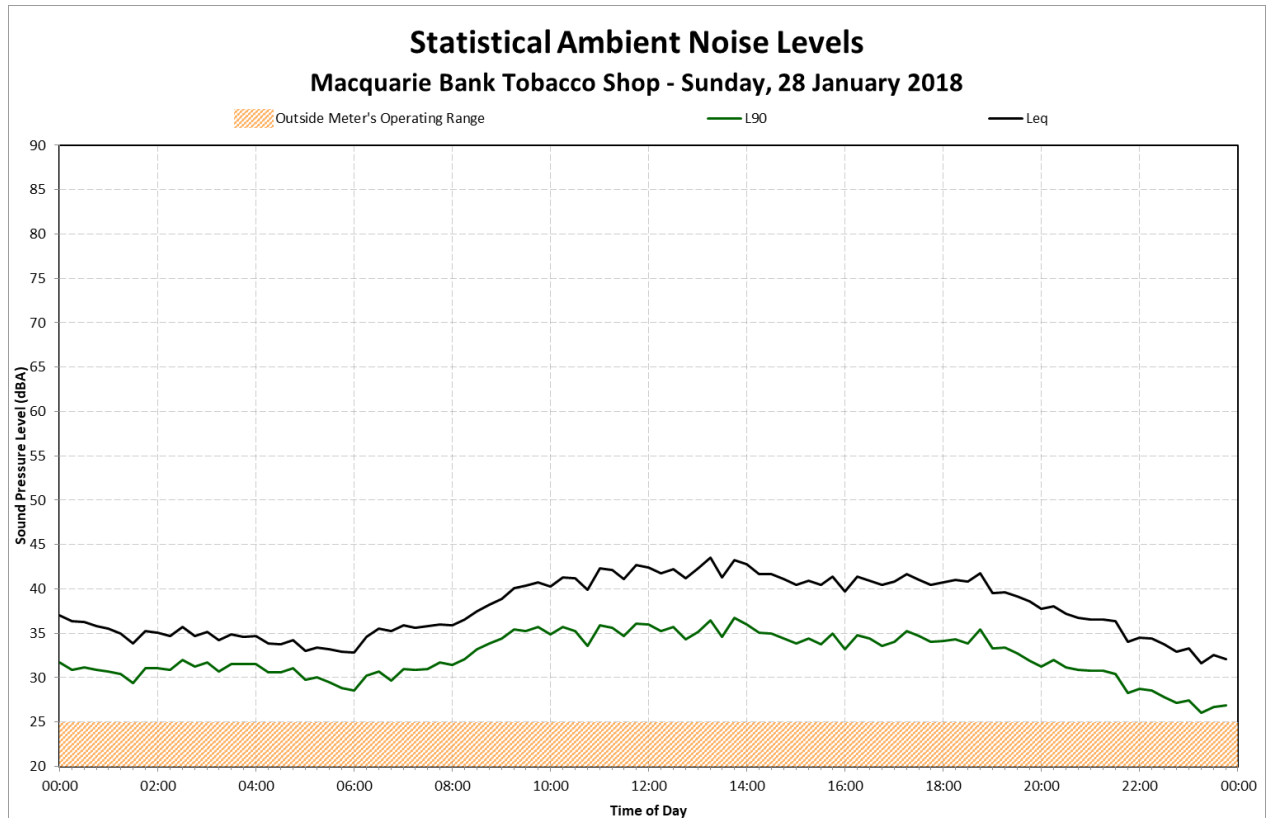
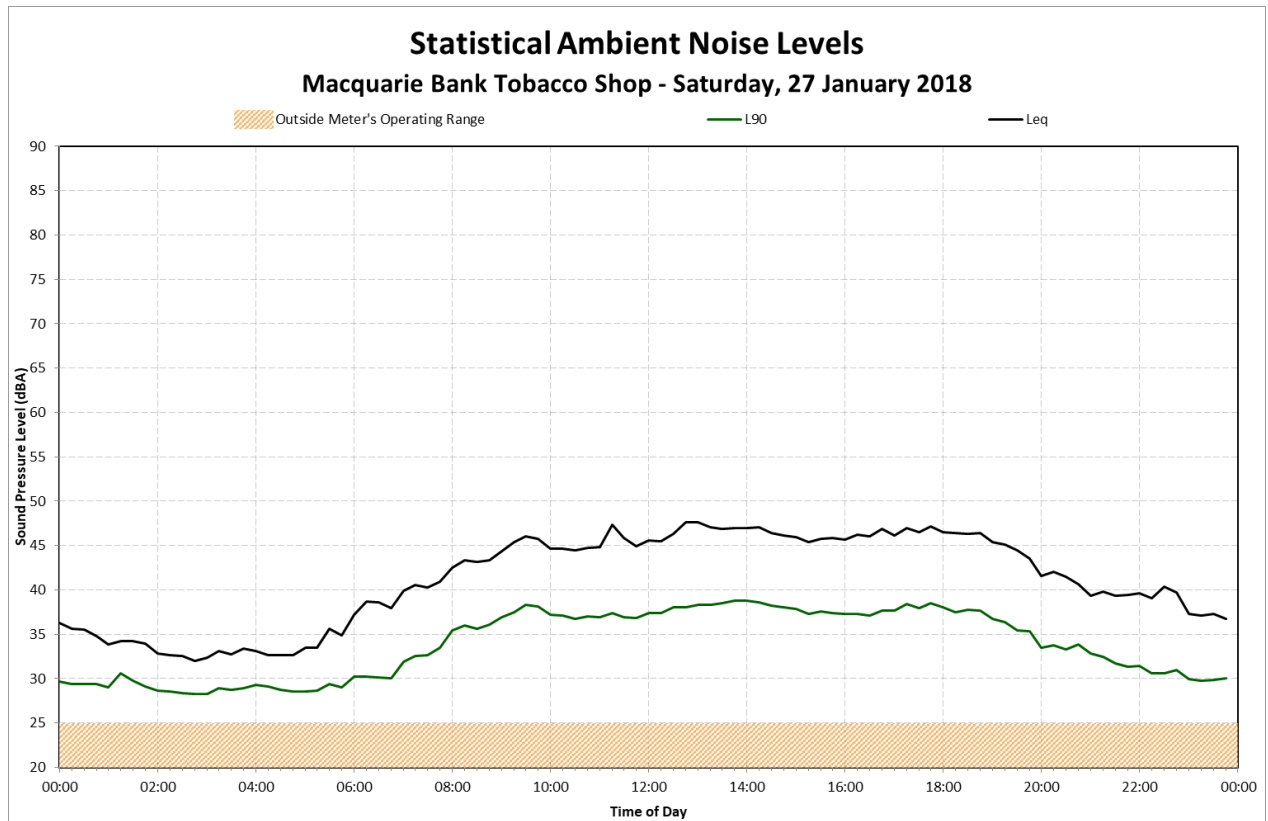
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

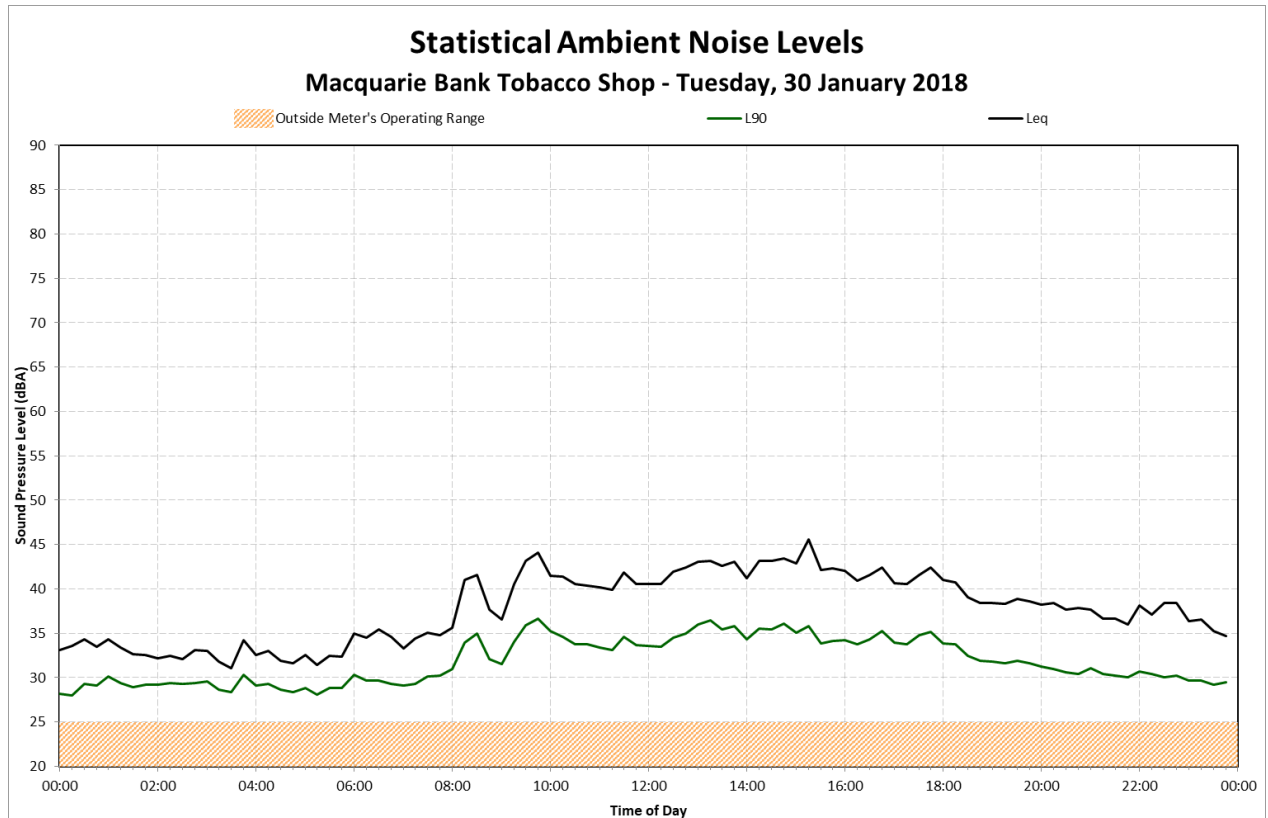
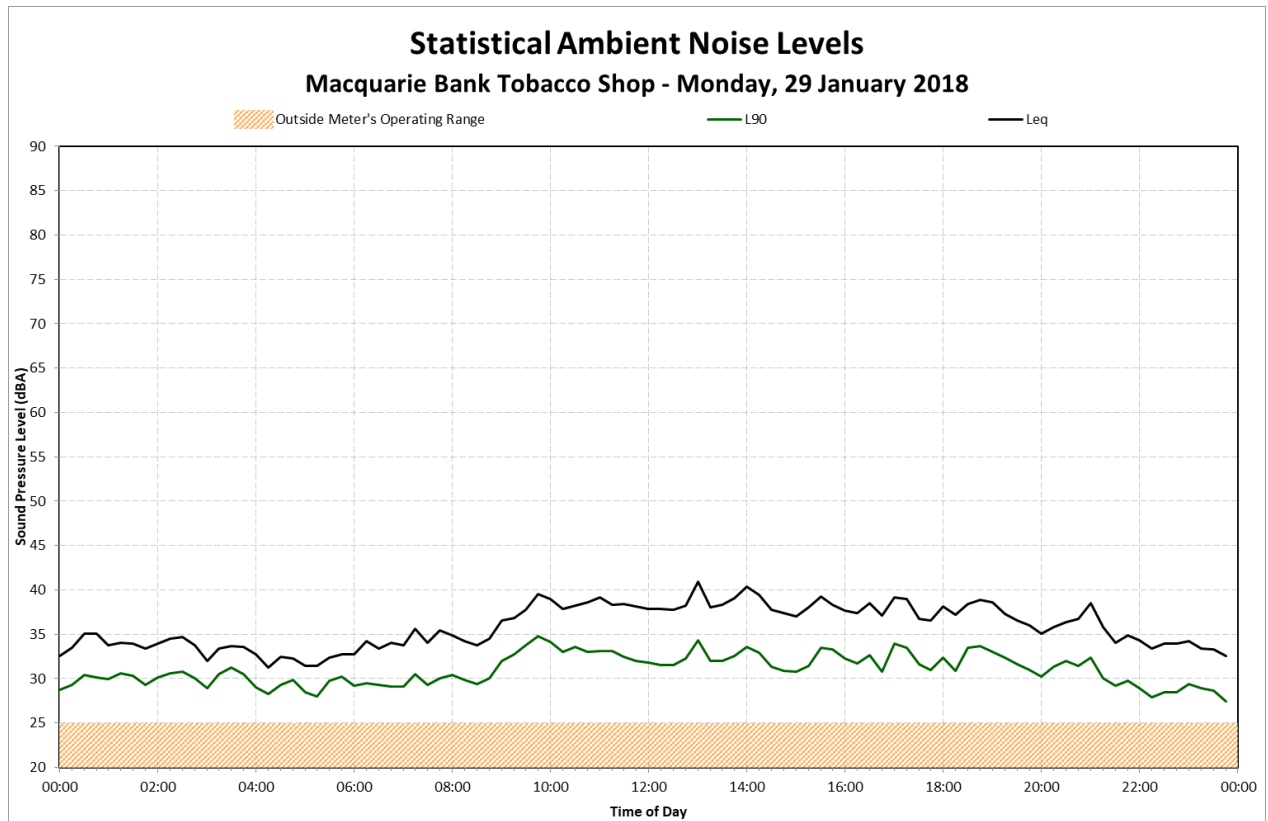
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

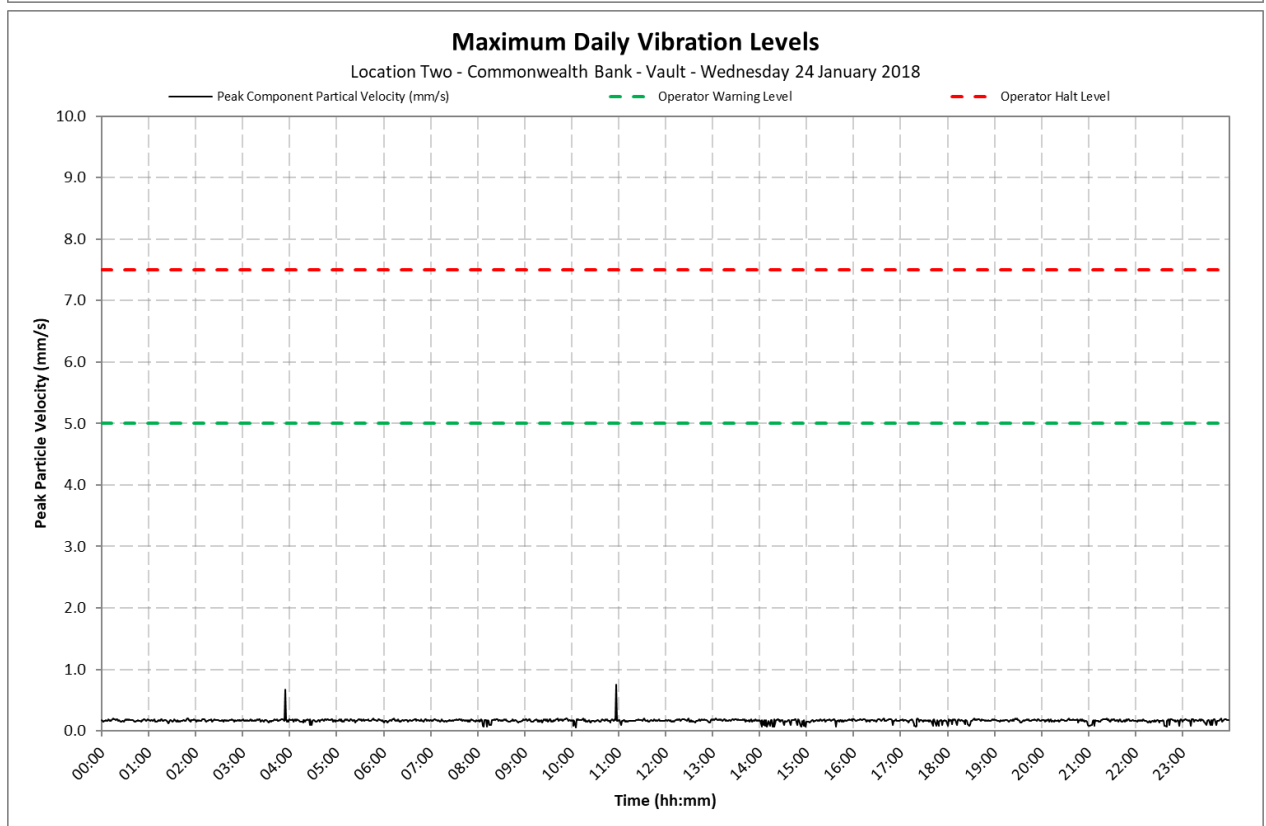
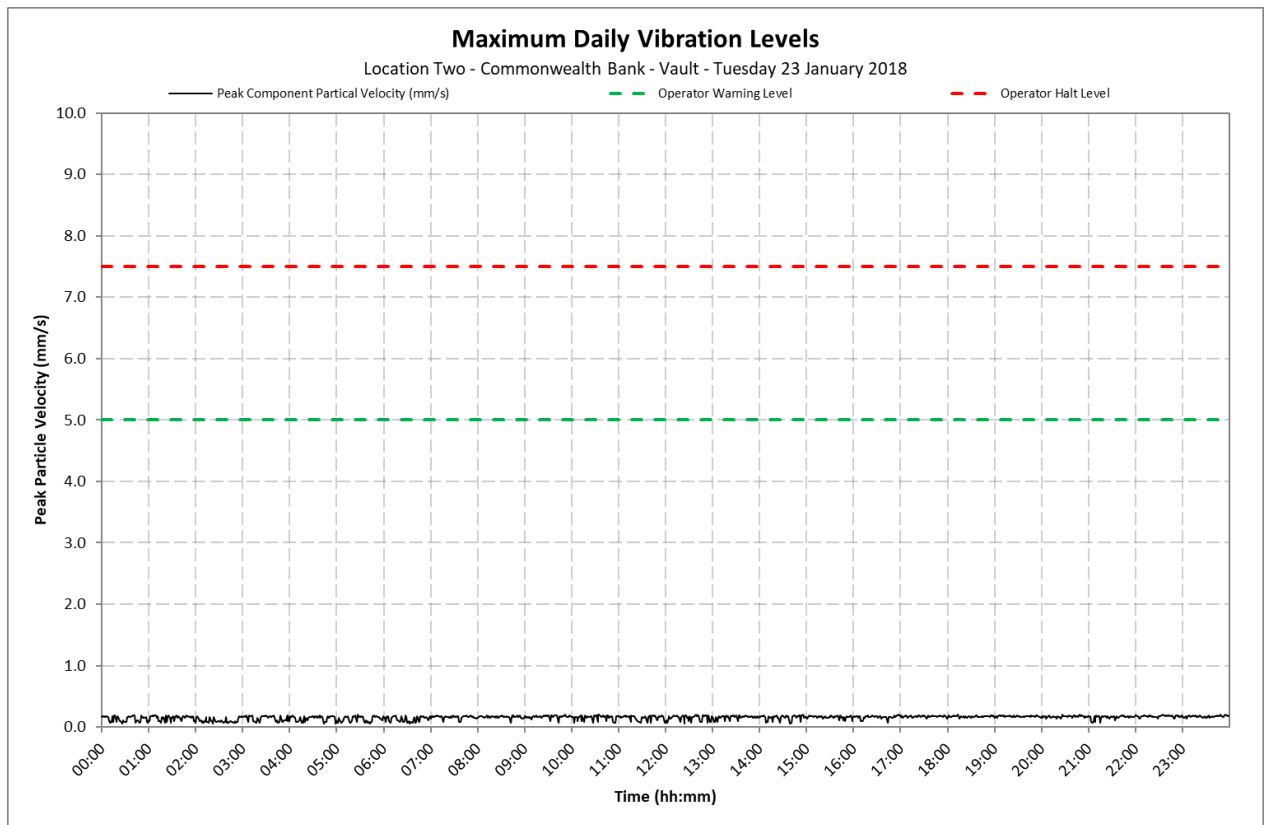
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

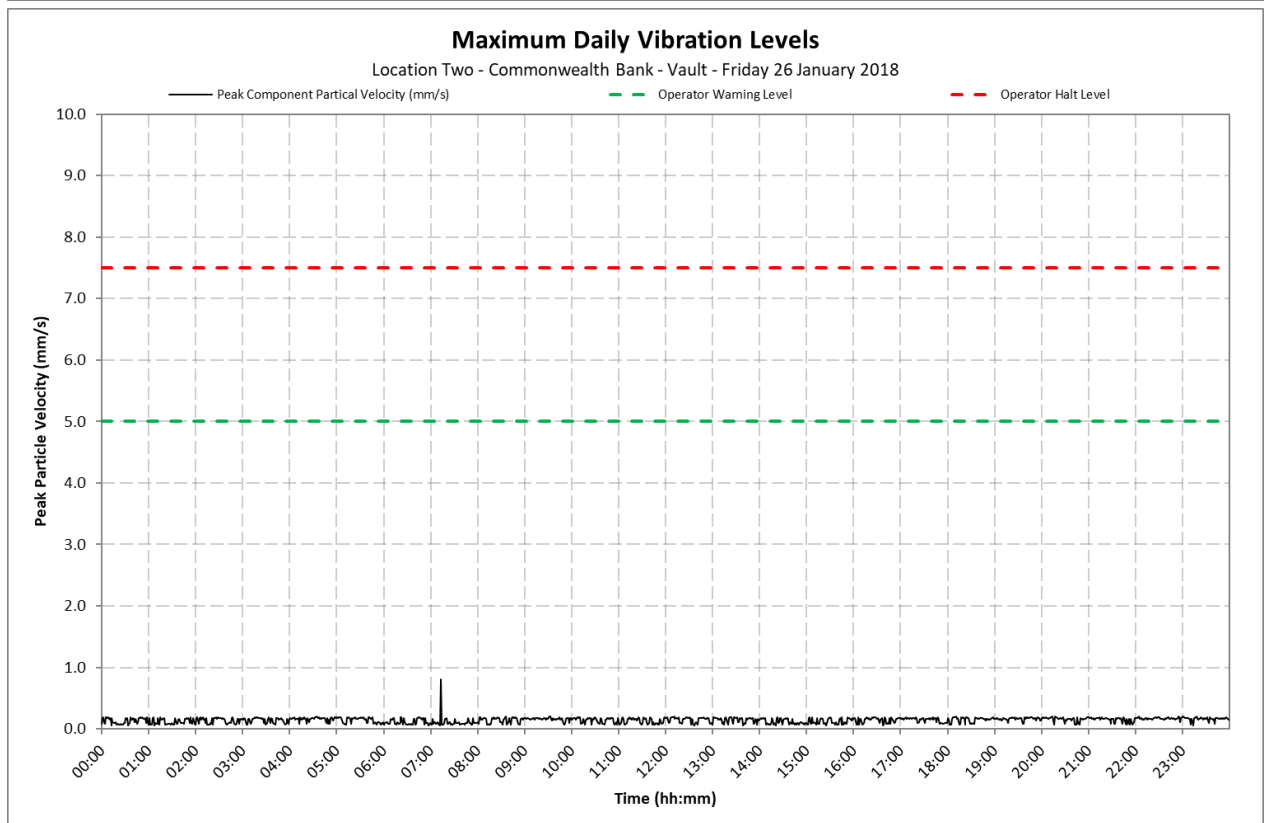
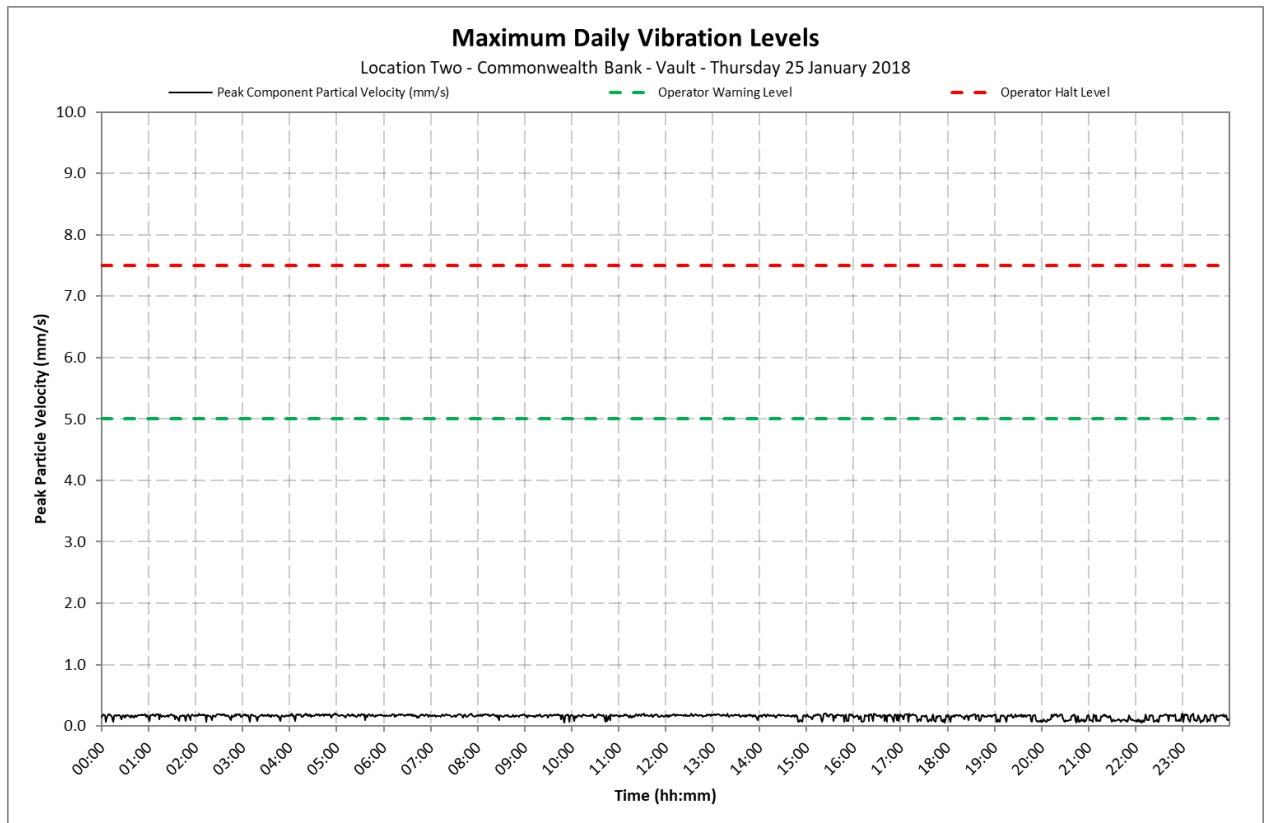
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

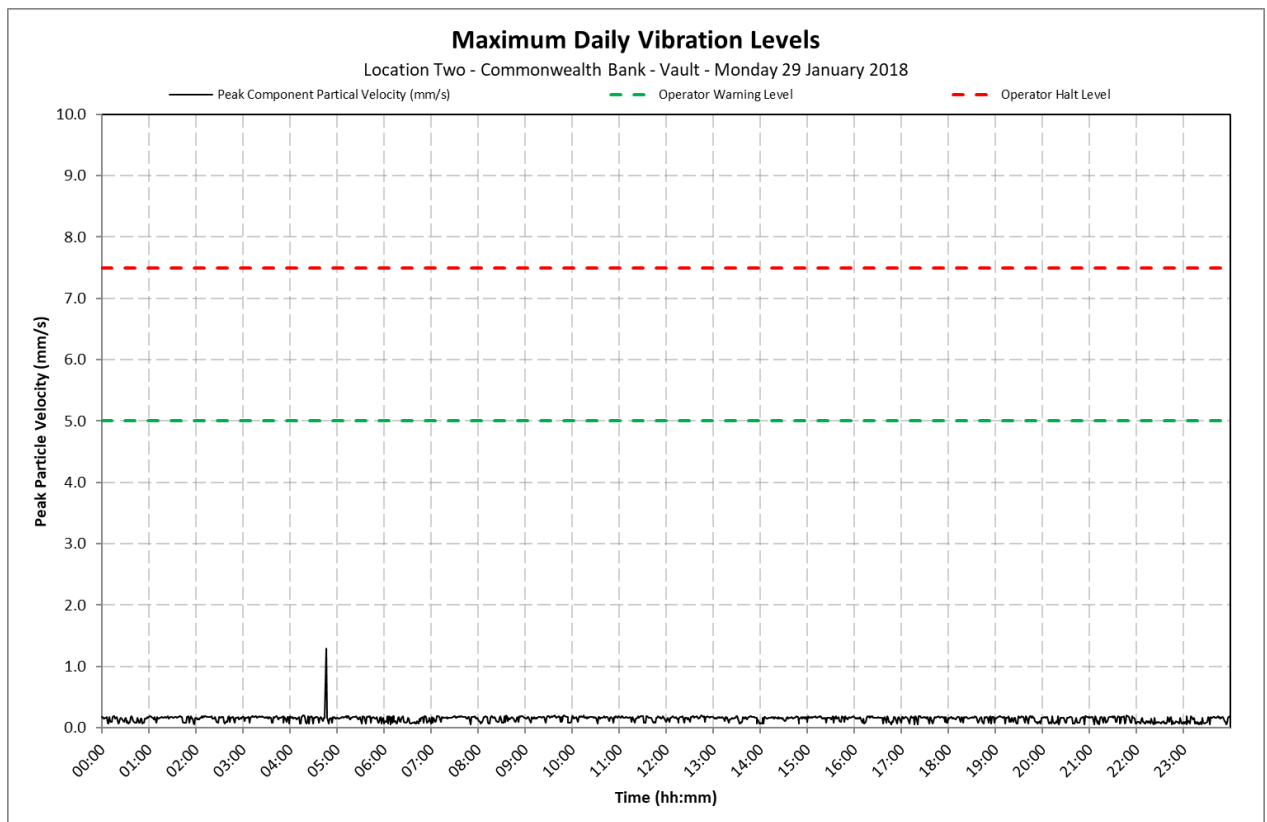
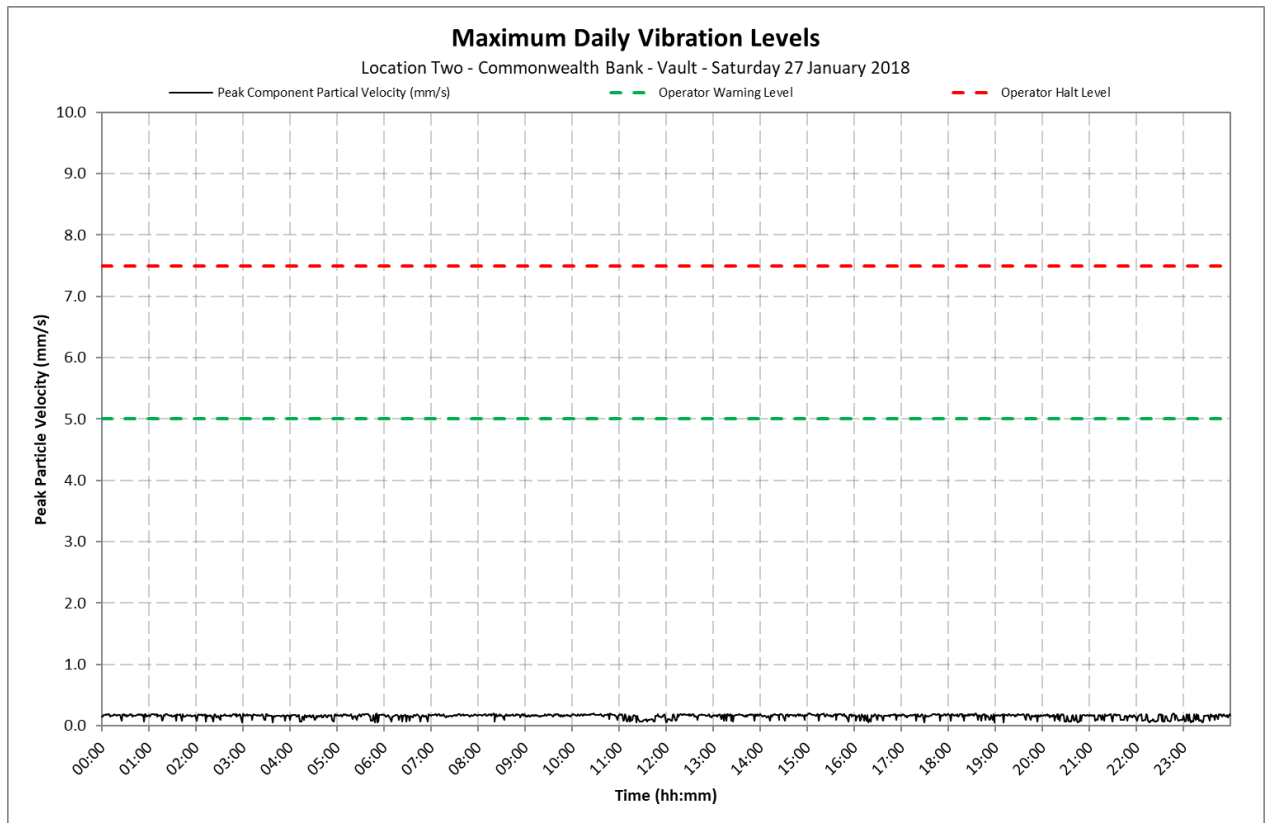
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

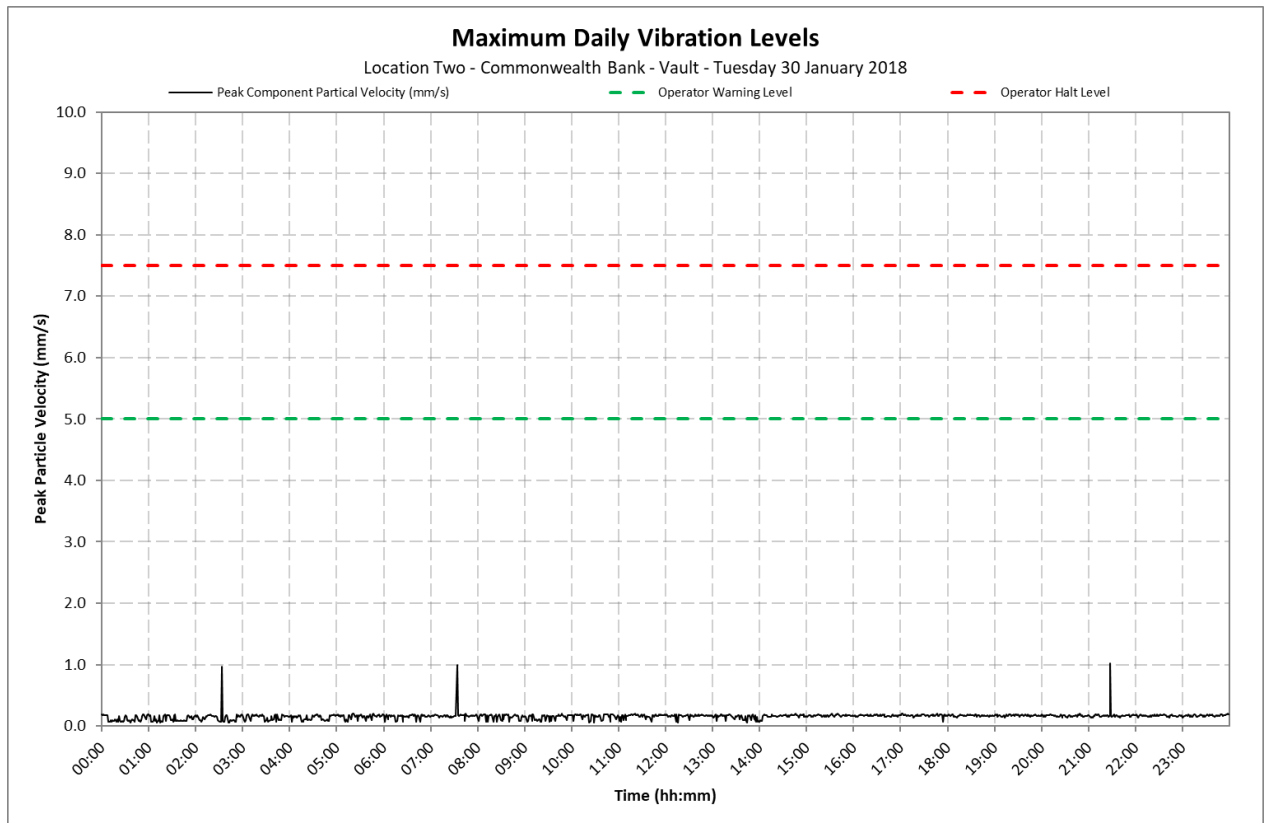
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

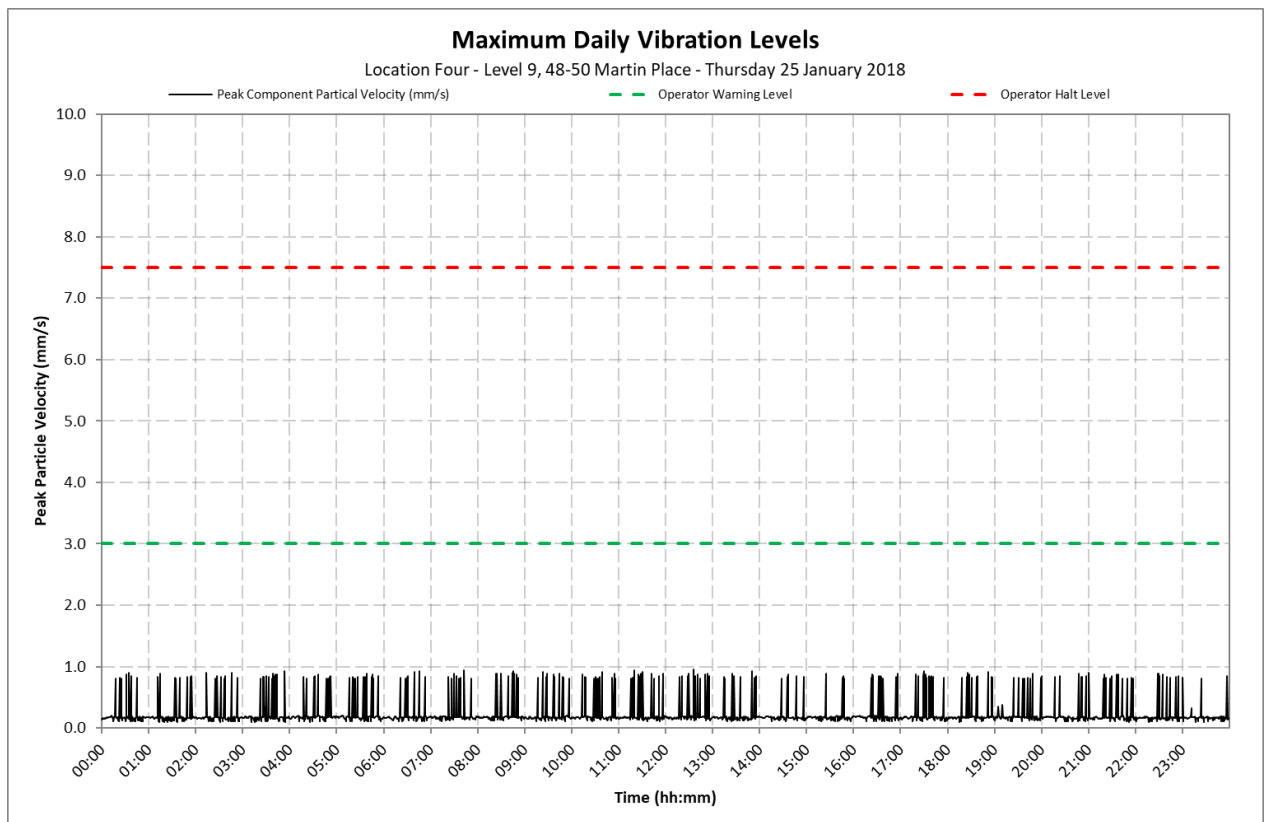
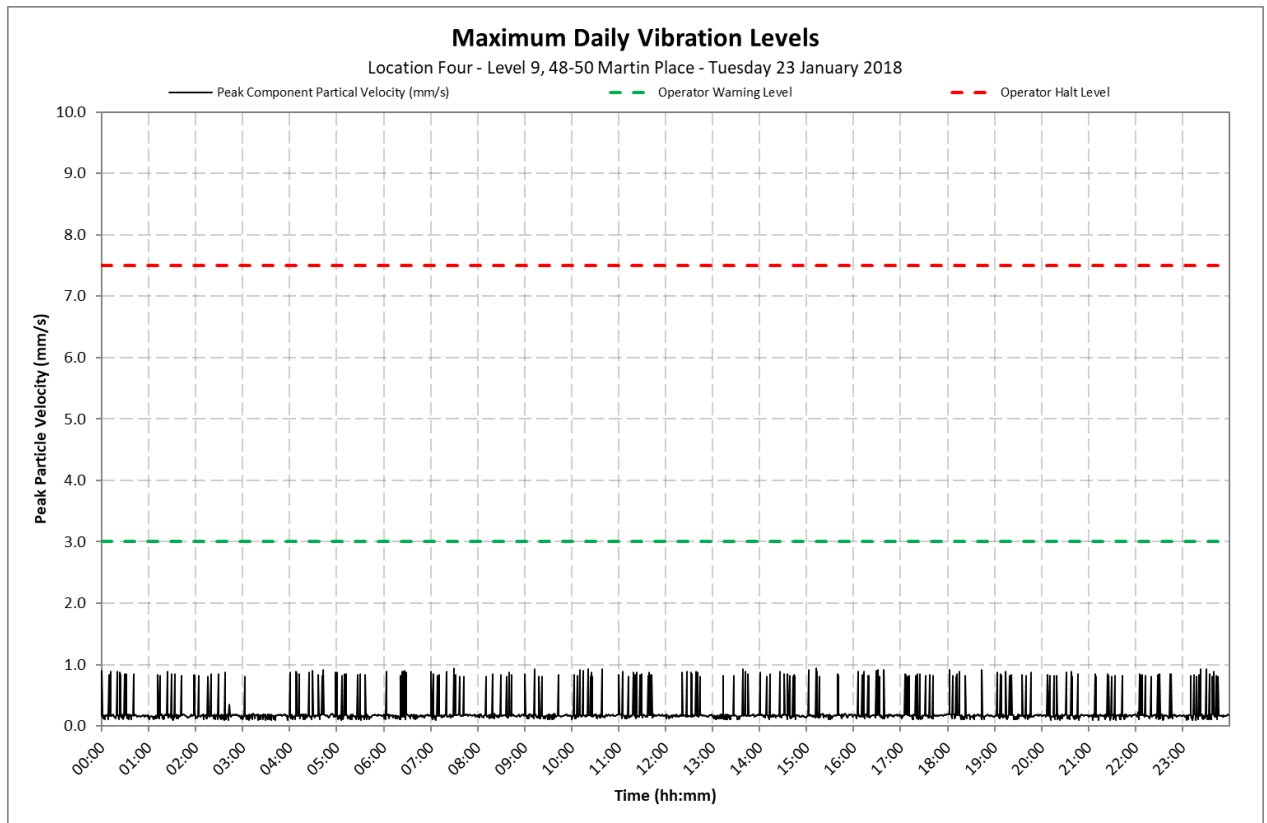
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

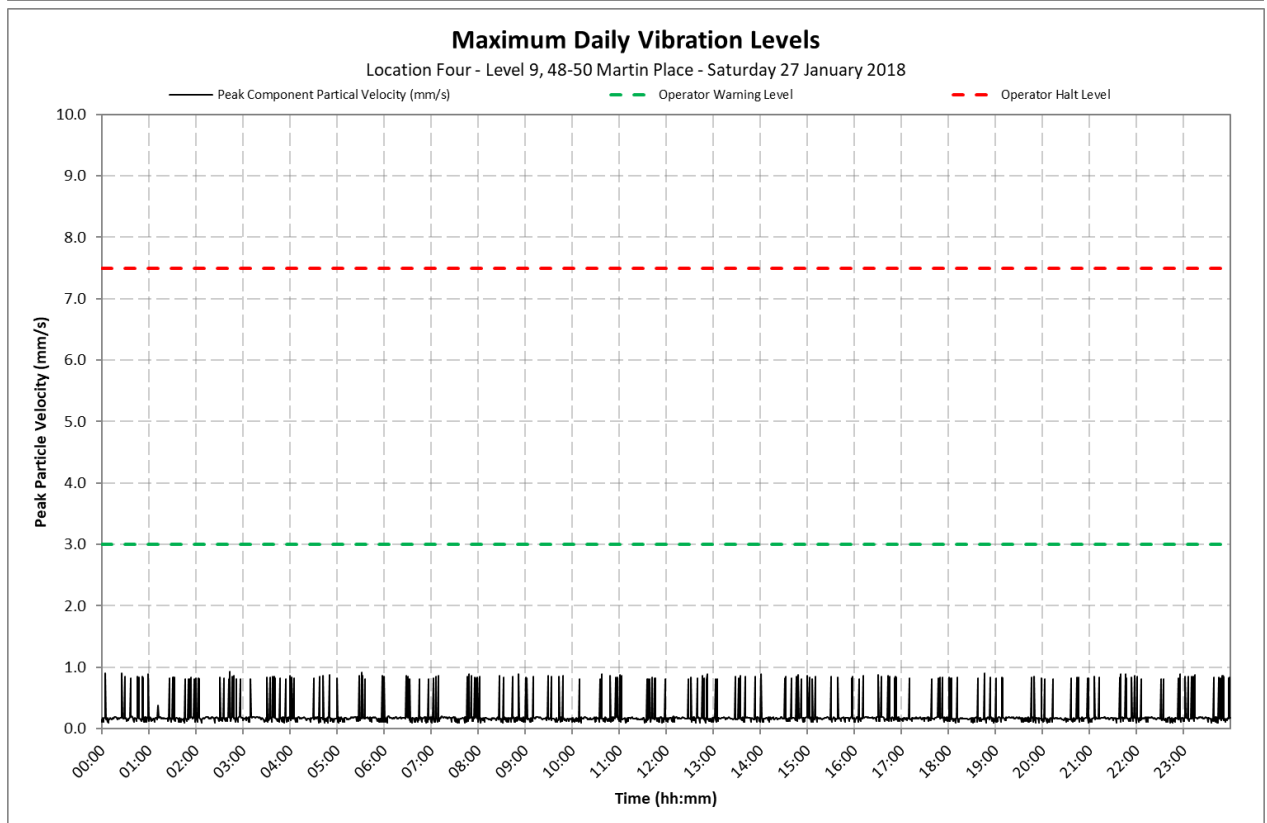
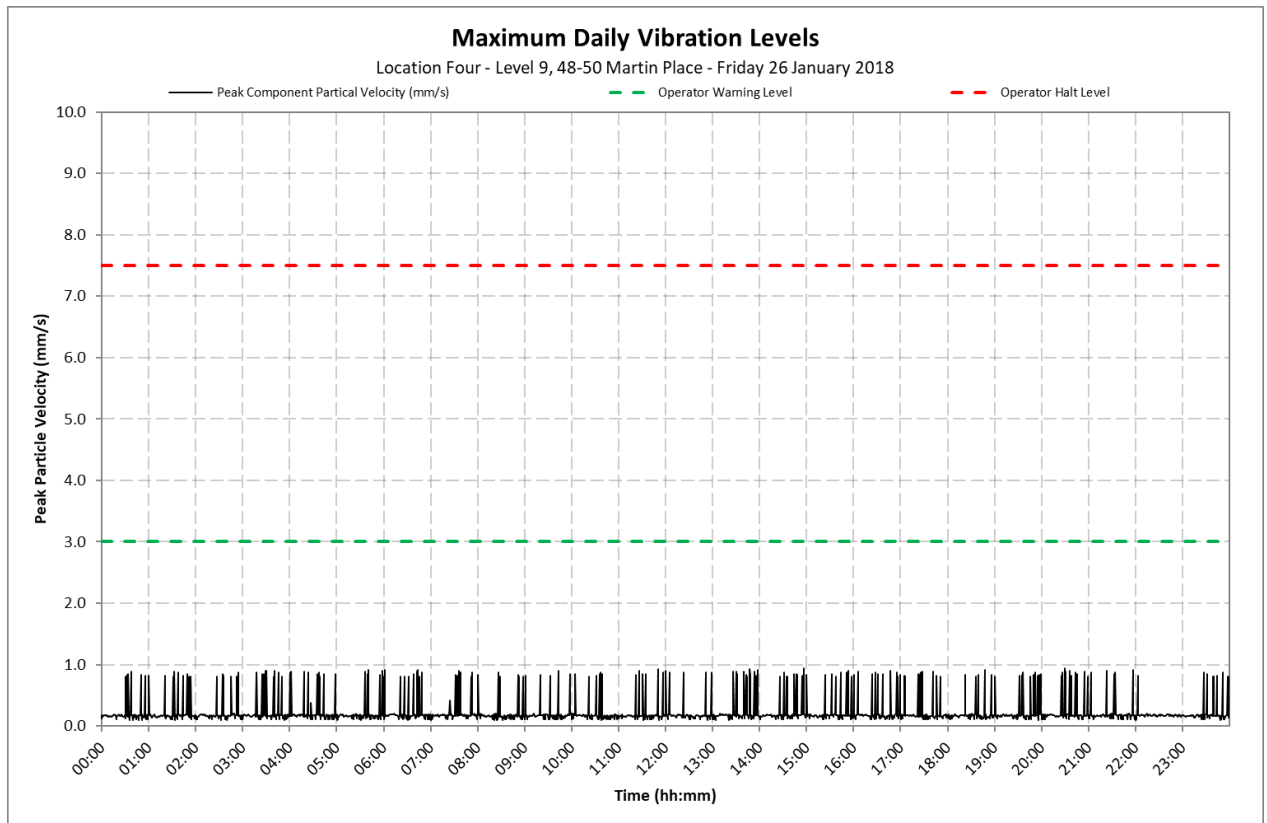
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

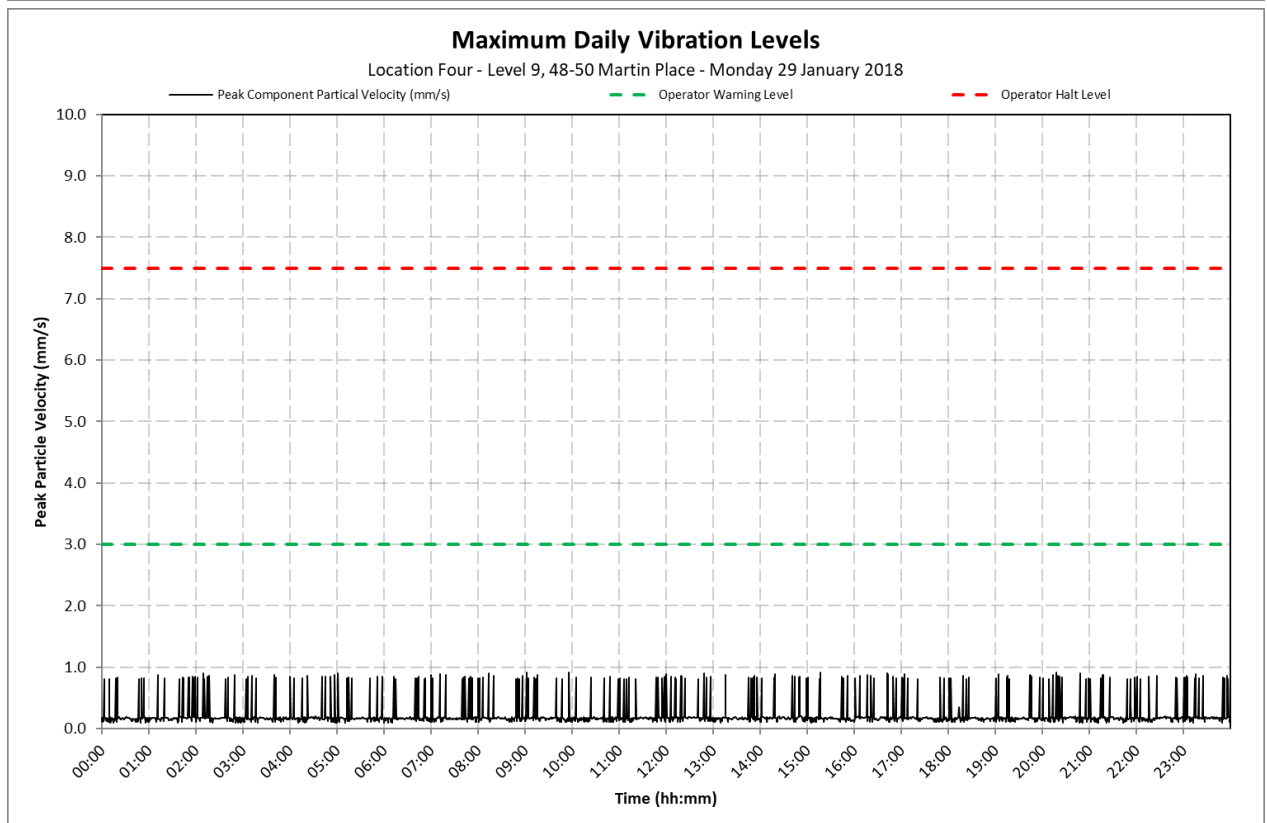
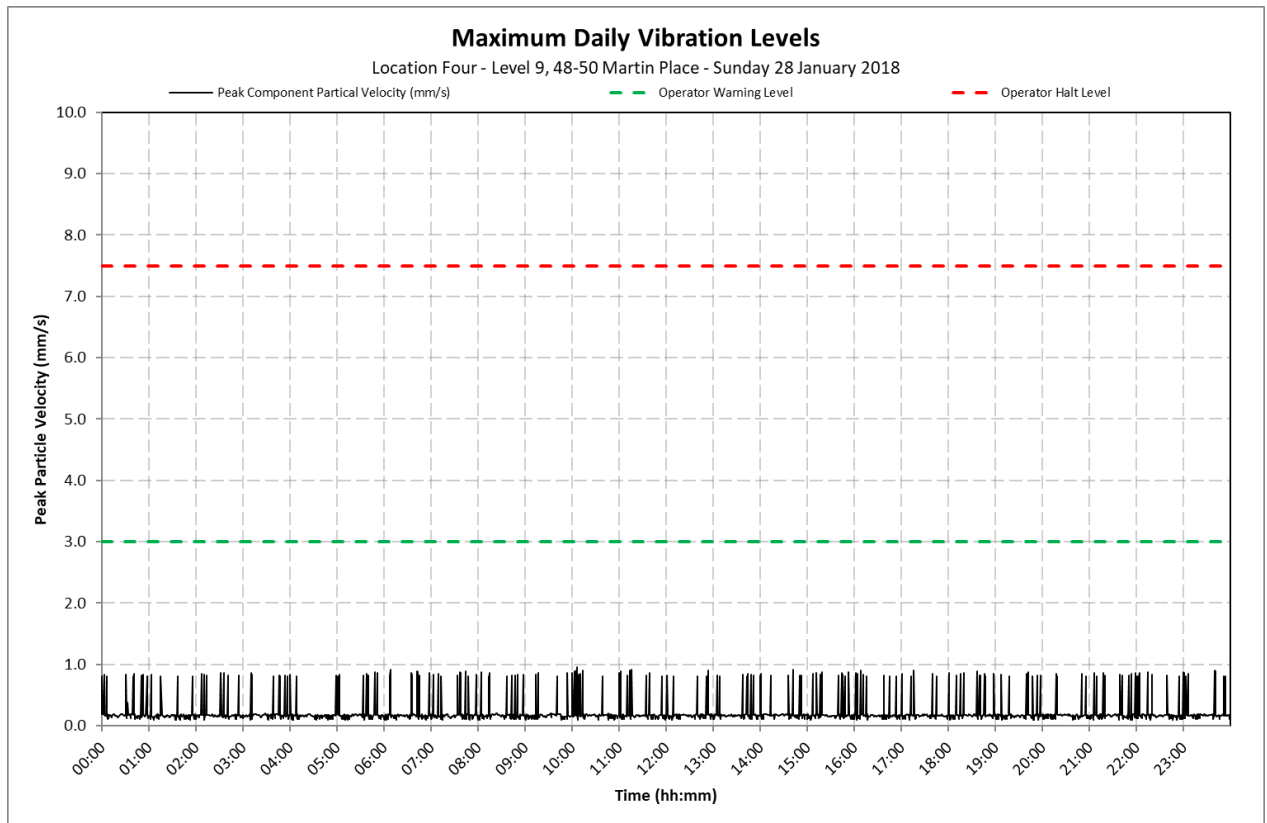
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

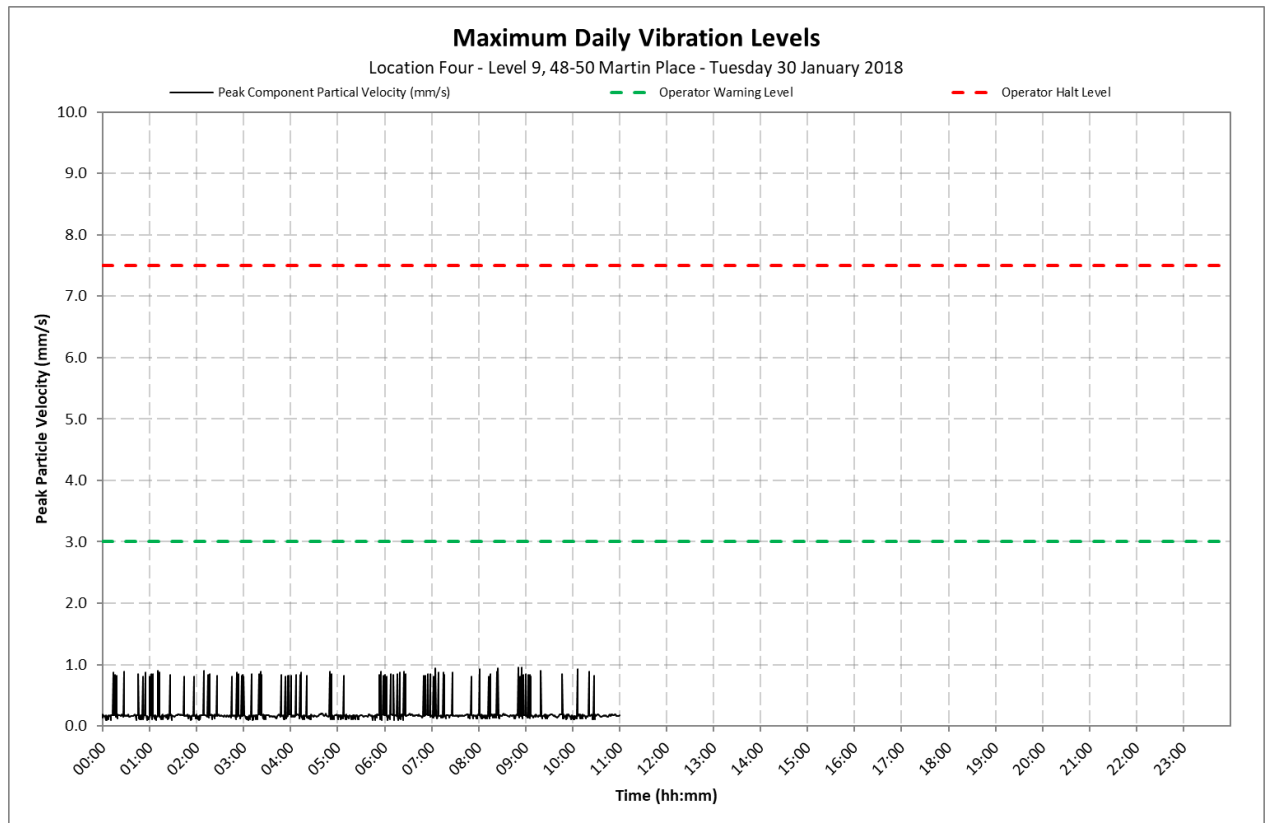
Location 4 - Level 9, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 4 - Level 9, 48-50 Martin Place





9 February 2018

10-1380 R18 NV Monitoring 20180209.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 18
31 January to 6 February 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 31 January to 6 February 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

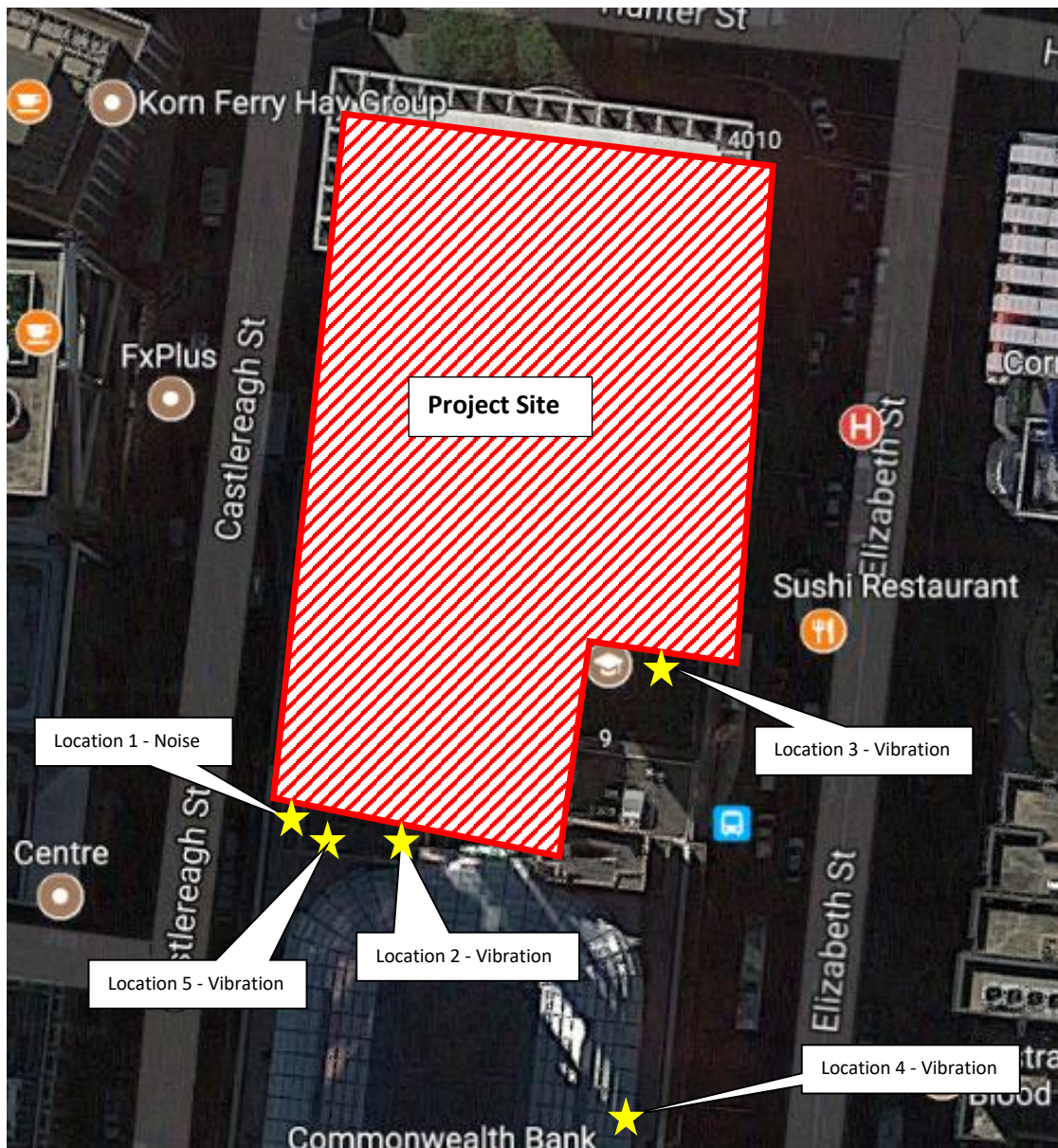
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 31 January to 6 February 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
31 January 2018	43	43	Complies	Complies
1 February 2018	45	44	Complies	Complies
2 February 2018	46	44	Complies	Complies
3 February 2018	45	45	Complies	Complies
4 February 2018	39	39	Complies	Complies
5 February 2018	38	37	Complies	Complies
6 February 2018	41	40	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 31 January to 6 February 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
31 January 2018	1.0 mm/s	Complies
1 February 2018	0.2 mm/s	Complies
2 February 2018	0.2 mm/s	Complies
3 February 2018	0.6 mm/s	Complies
4 February 2018	1.2 mm/s	Complies
5 February 2018	0.6 mm/s	Complies
6 February 2018	0.2 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
30 January 2018 ¹	0.2 mm/s	Complies
31 January 2018	0.3 mm/s	Complies
1 February 2018	0.2 mm/s	Complies
2 February 2018	0.4 mm/s	Complies
3 February 2018	0.4 mm/s	Complies
4 February 2018	0.4 mm/s	Complies
5 February 2018	0.2 mm/s	Complies
6 February 2018	0.4 mm/s	Complies

Note 1: Unit Installed at 11.00 am on 30 January 2018.

5 Conclusion

Noise monitoring conducted during the period 31 January to 6 February 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 31 January to 6 February 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

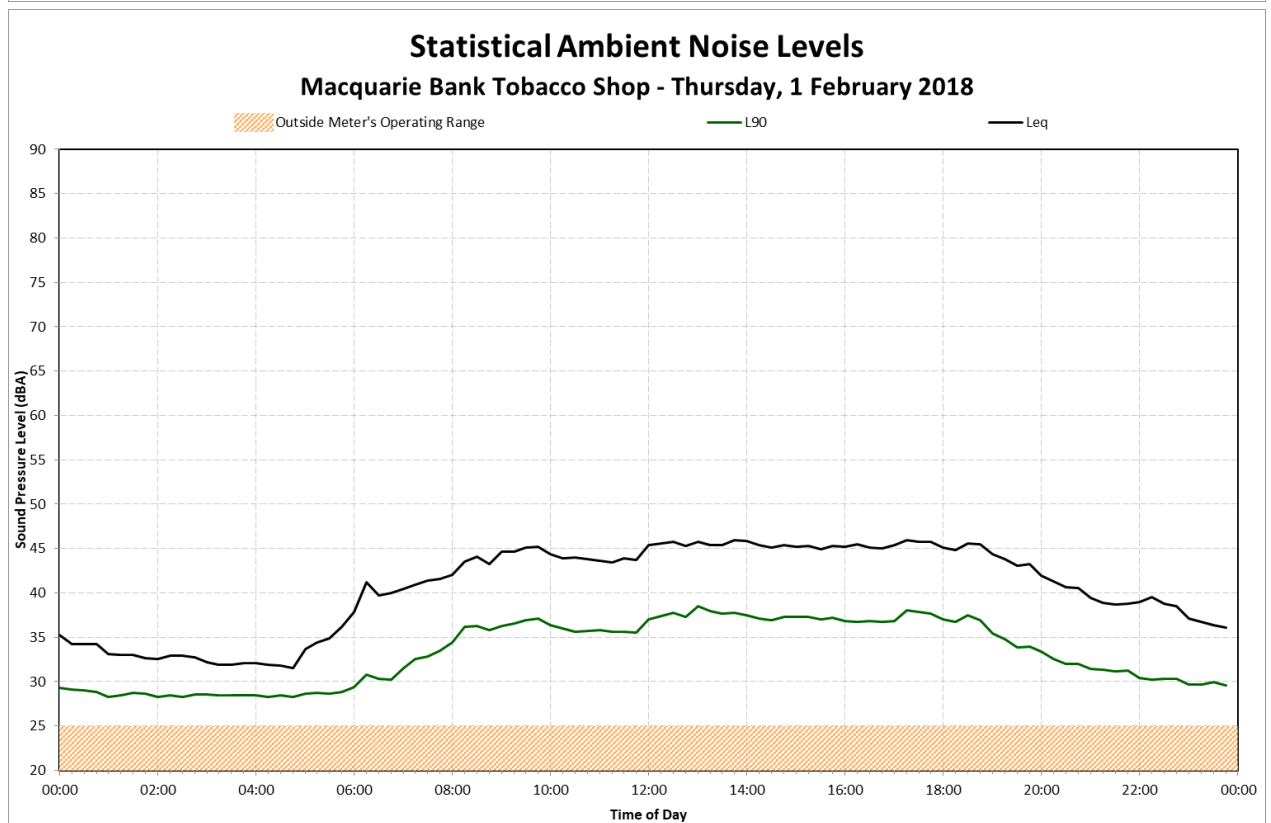
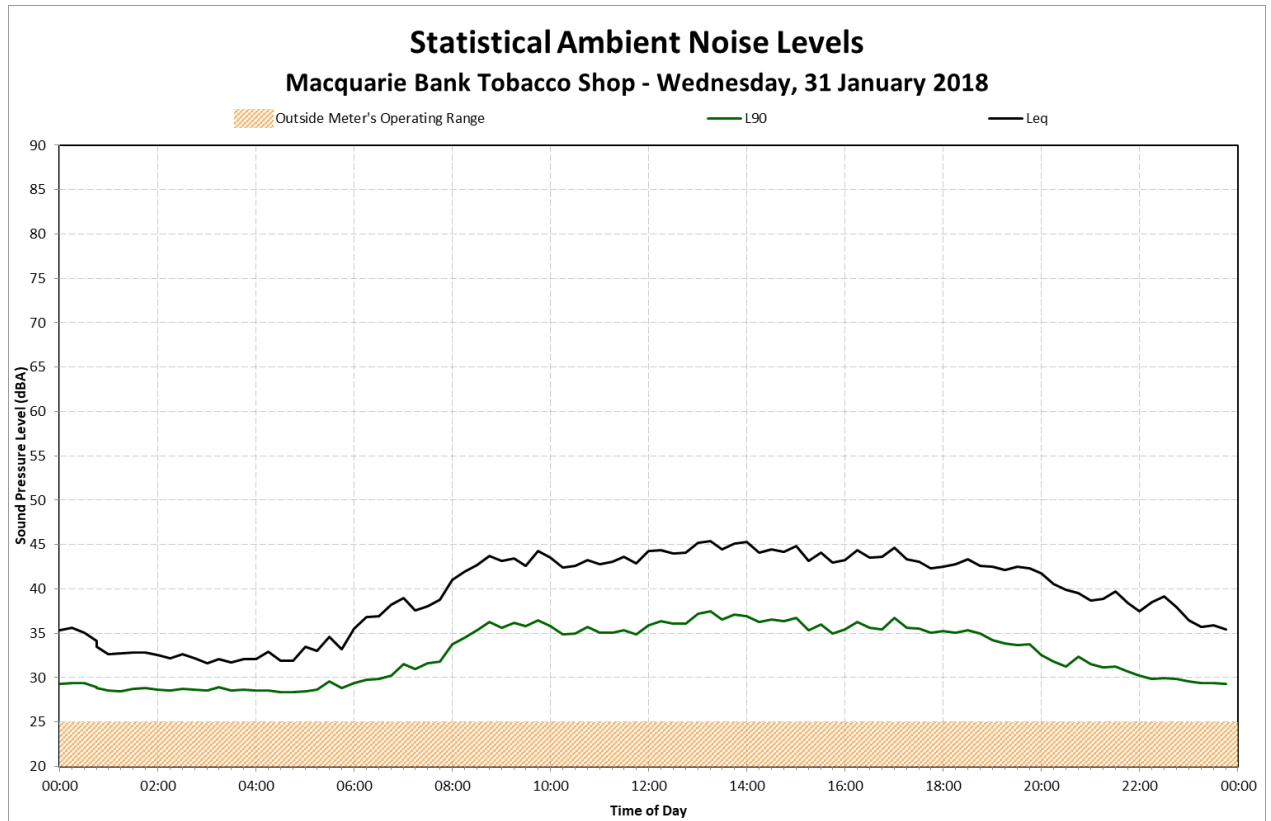
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

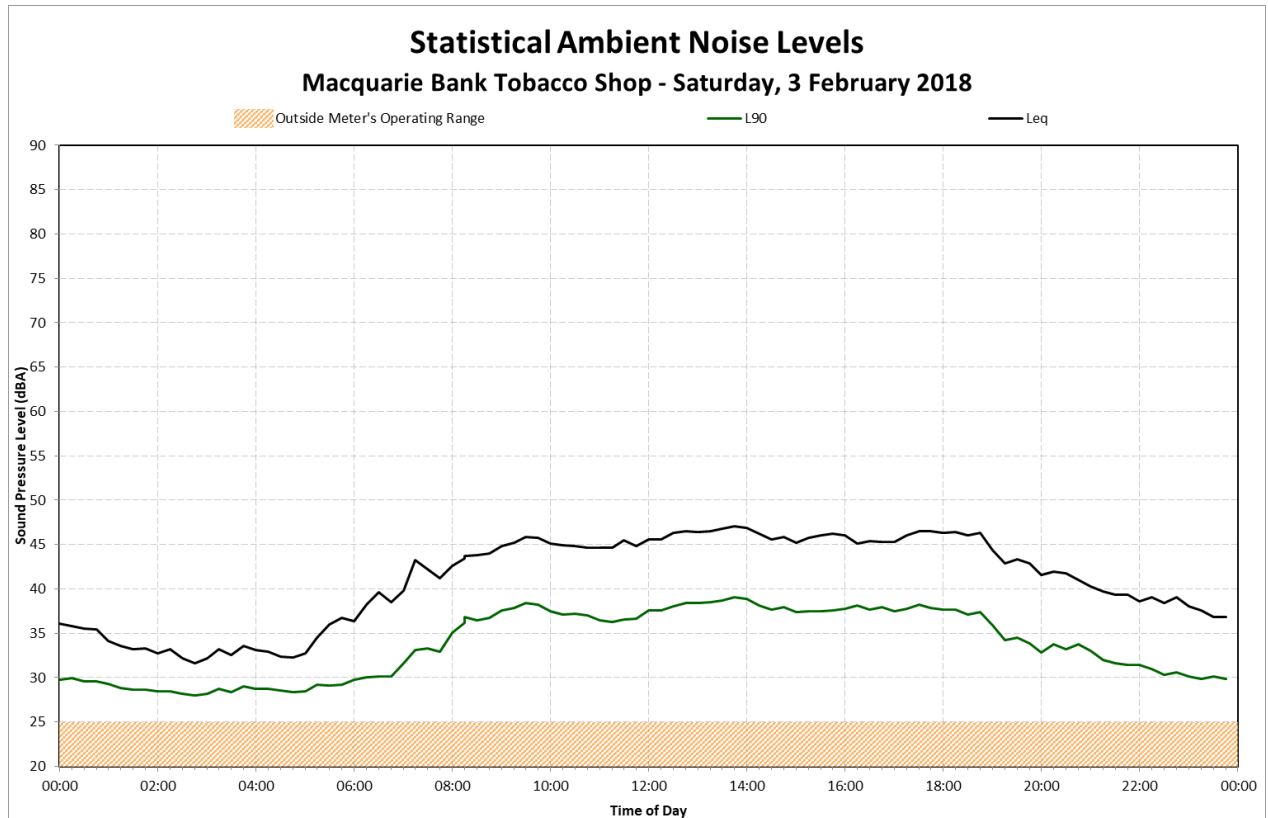
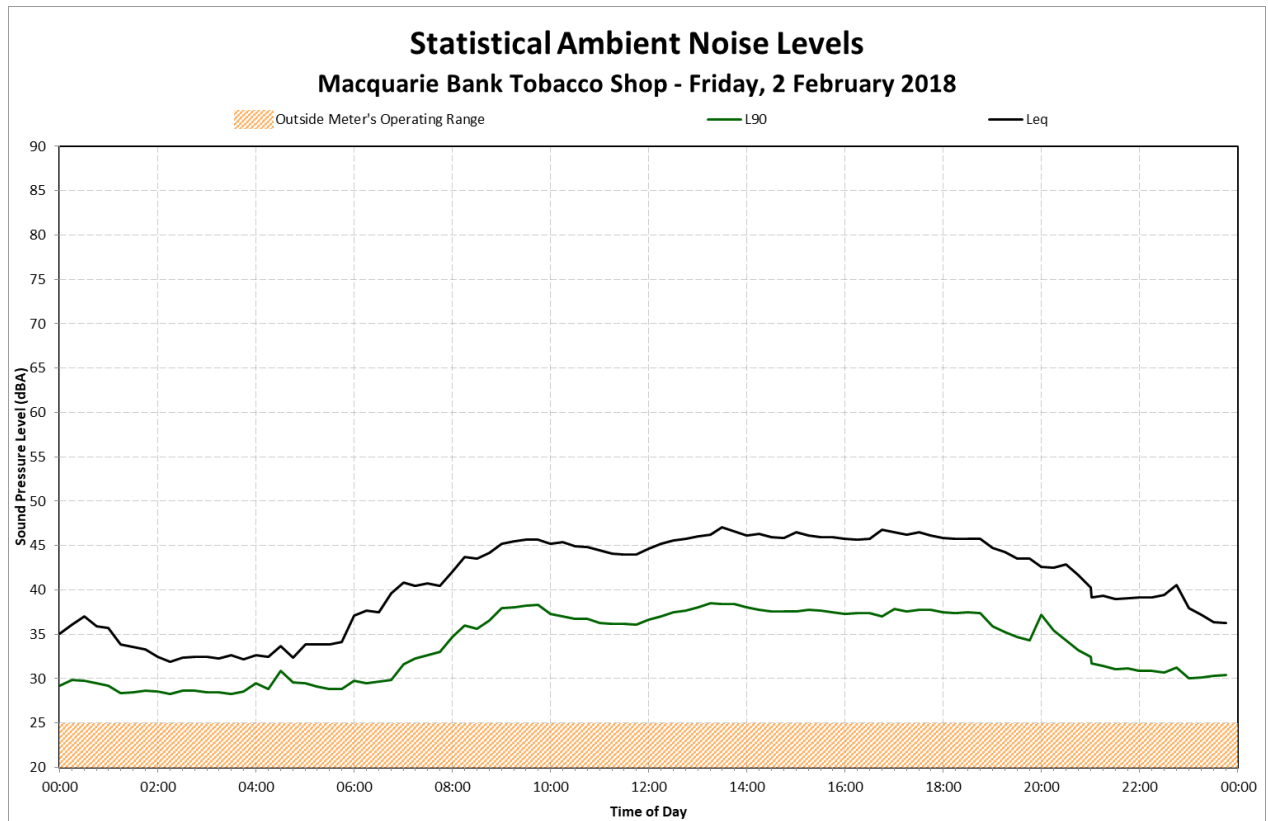
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

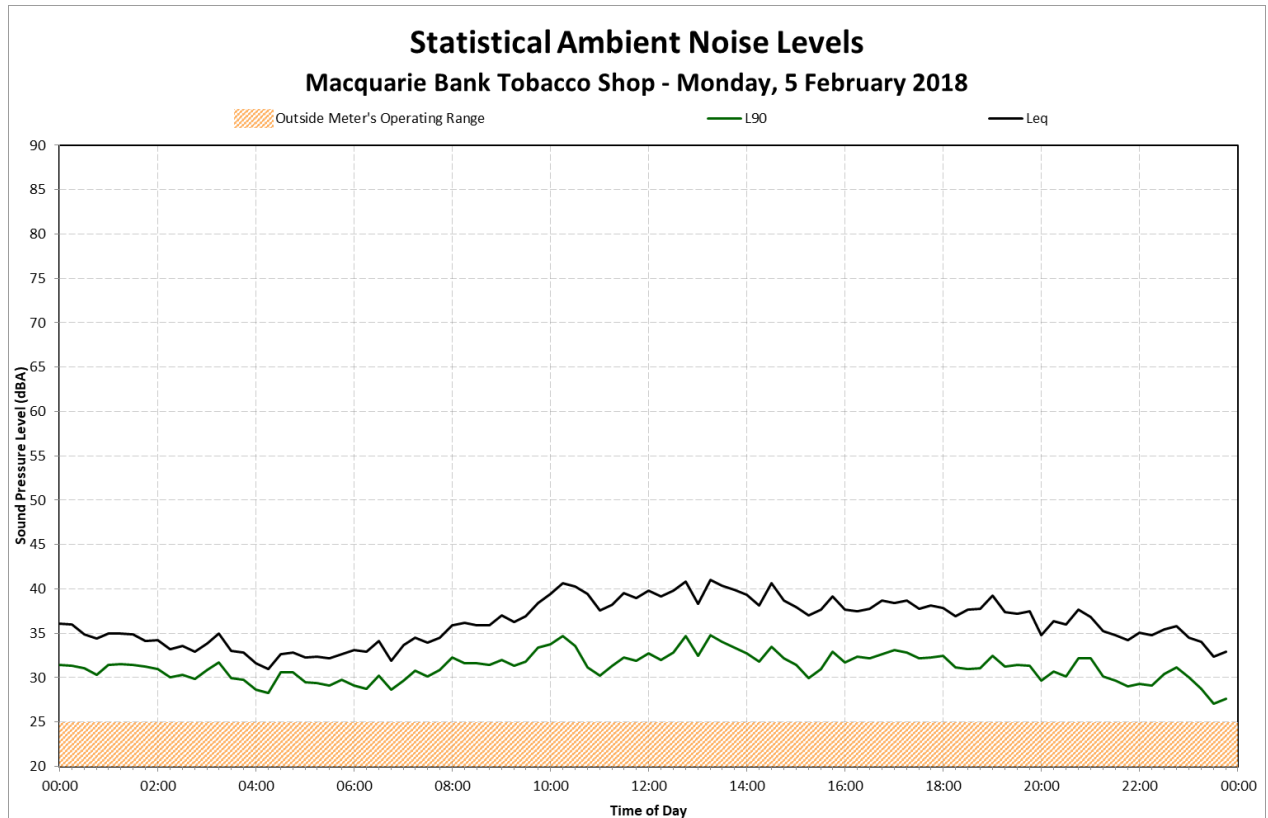
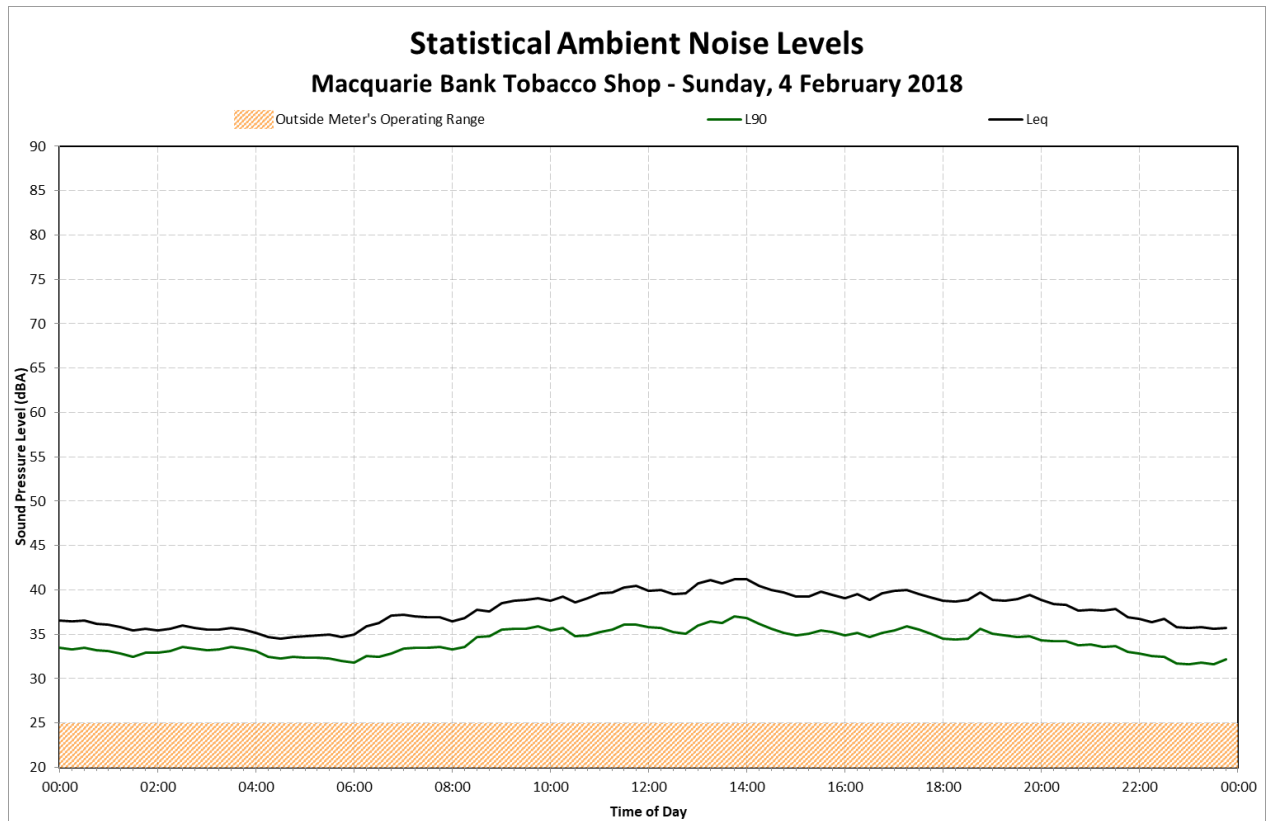
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

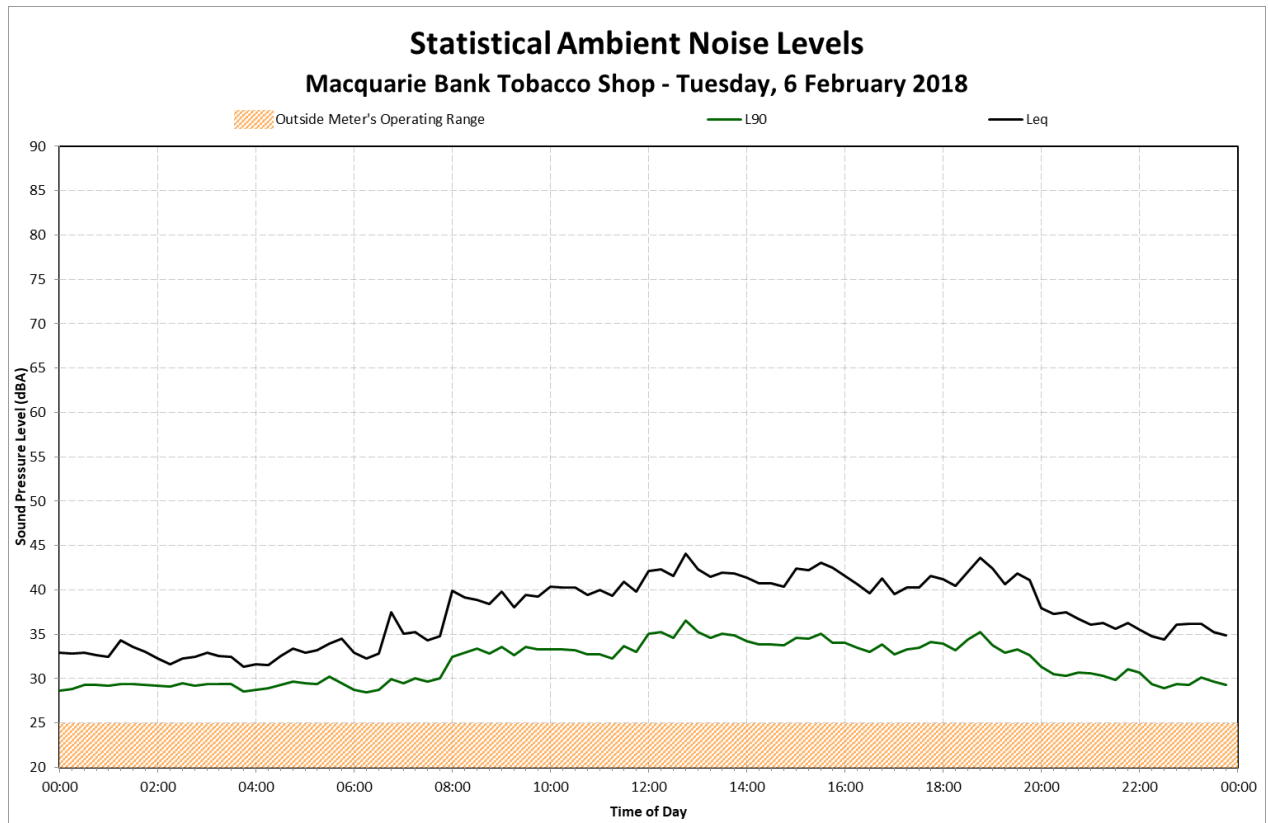
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

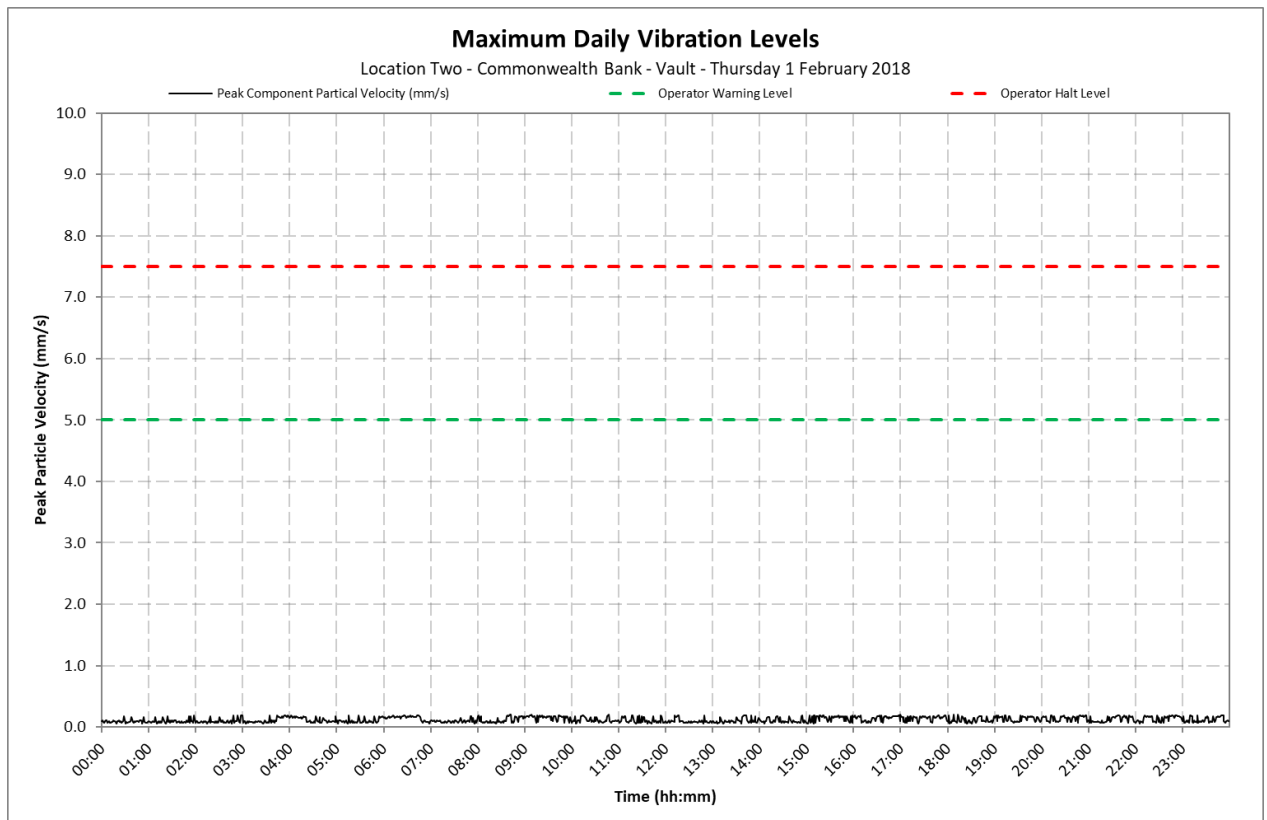
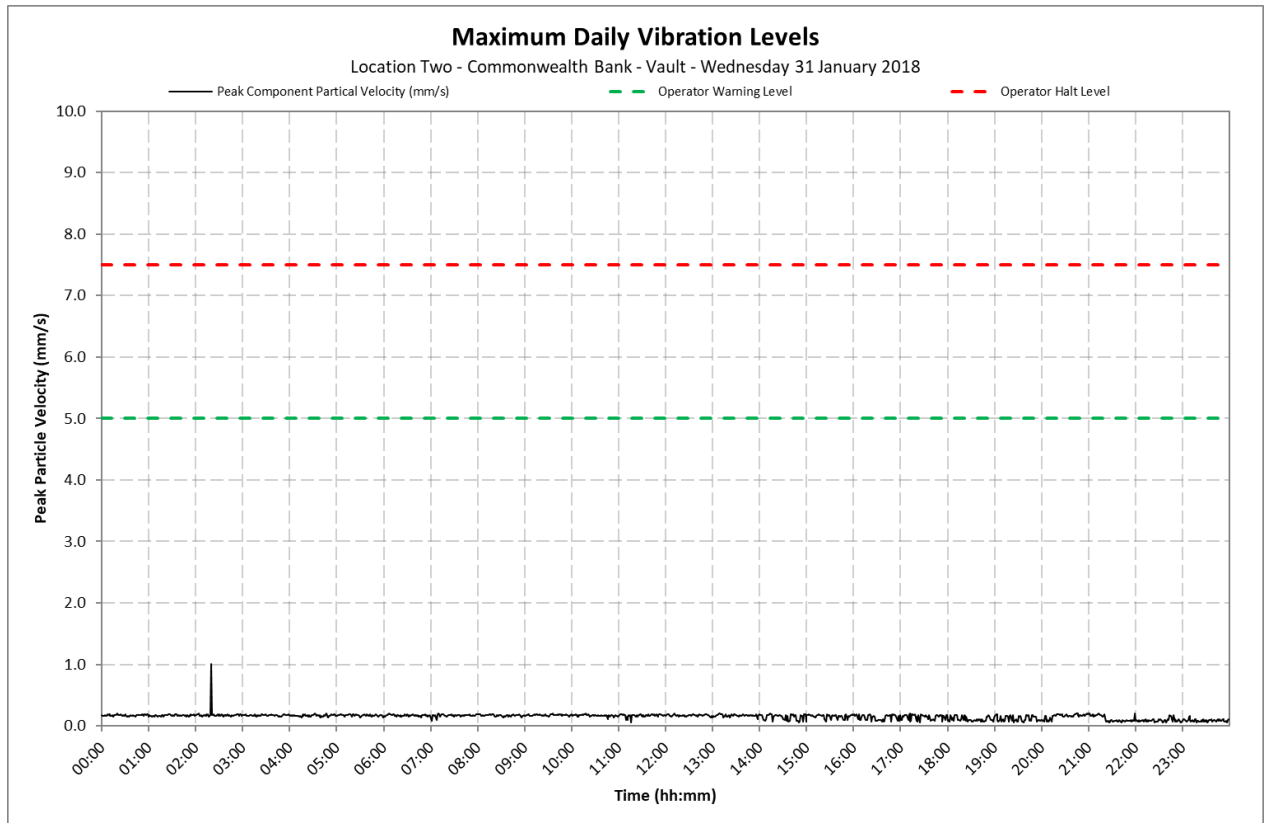
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

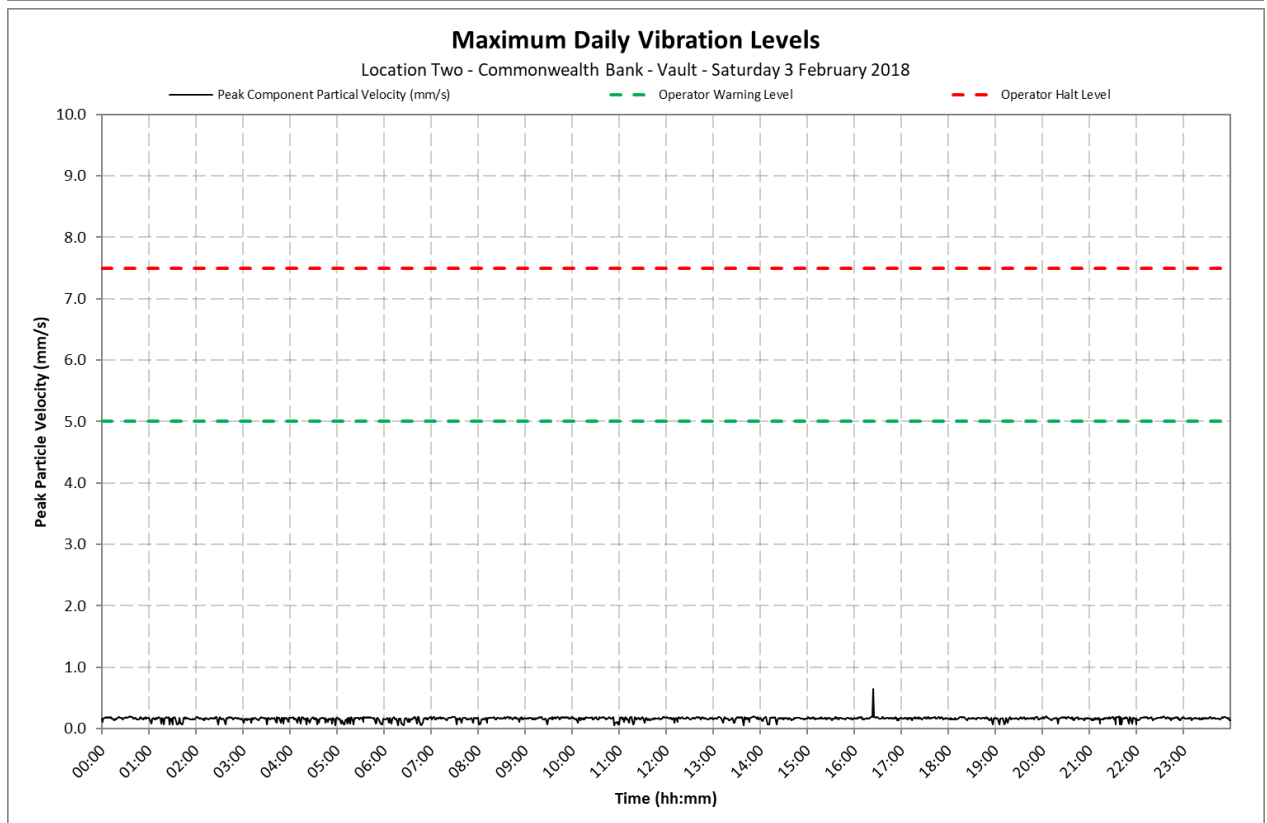
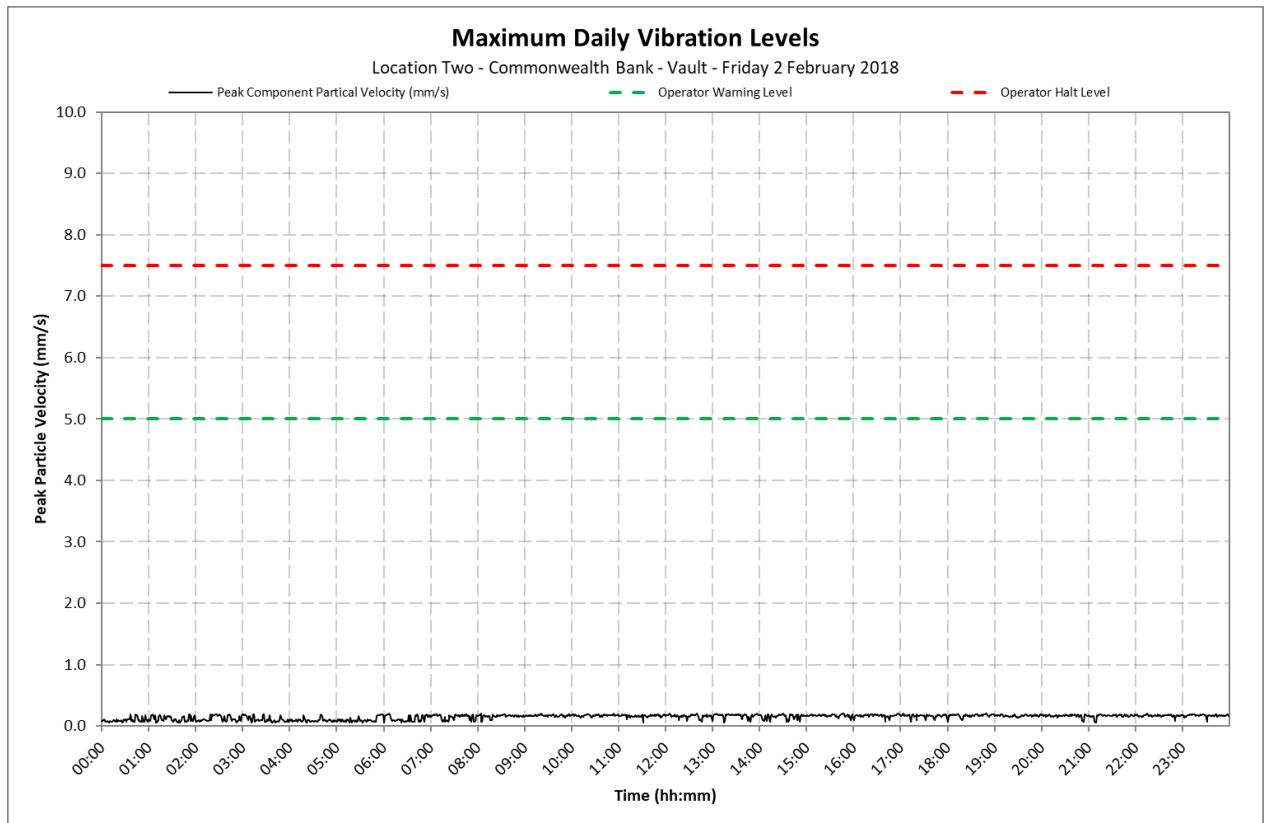
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

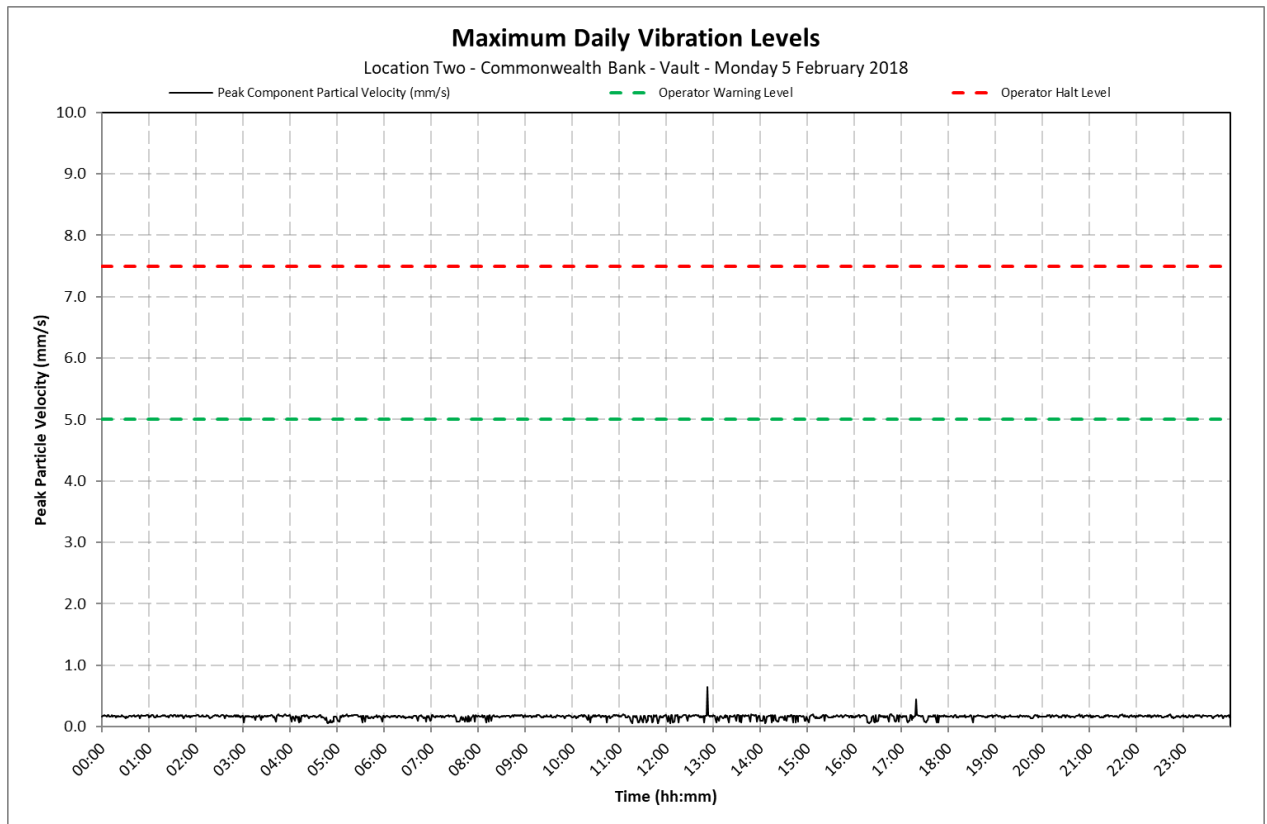
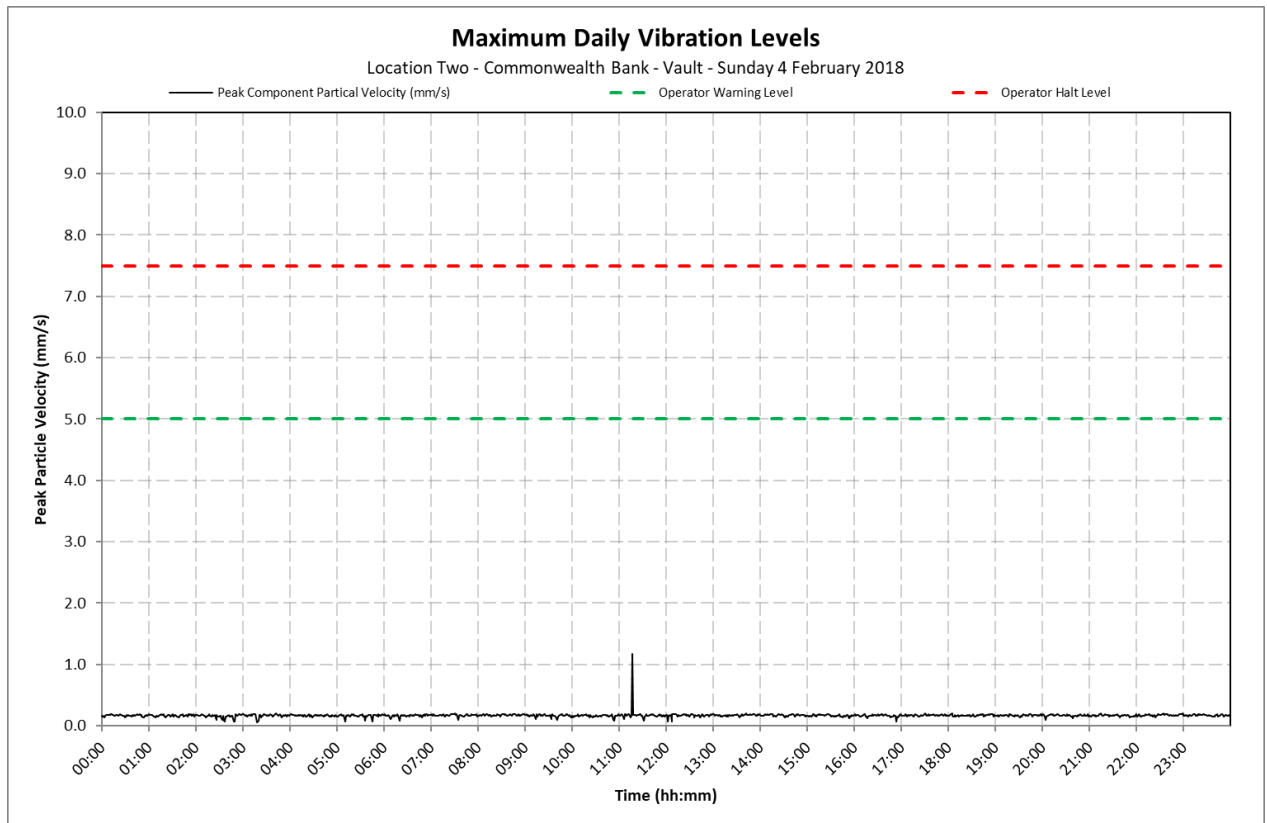
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

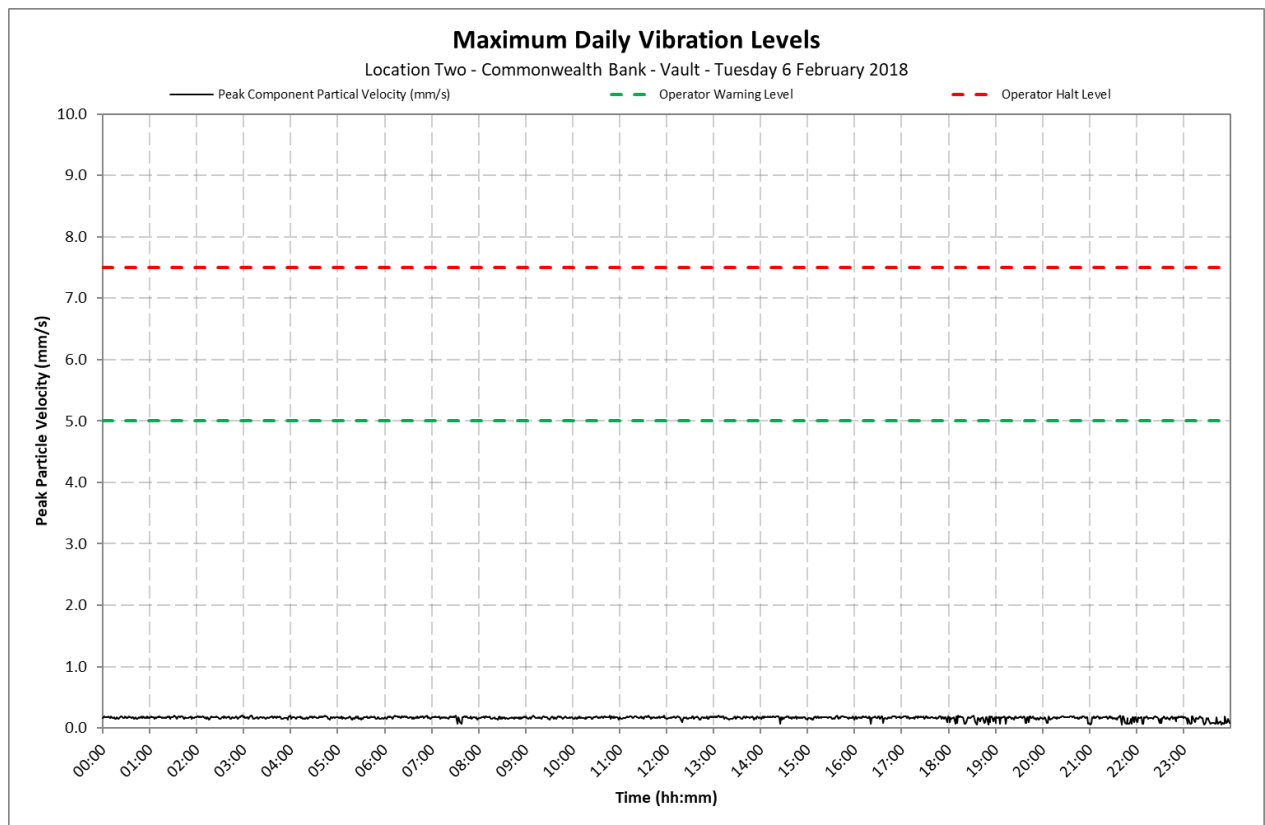
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

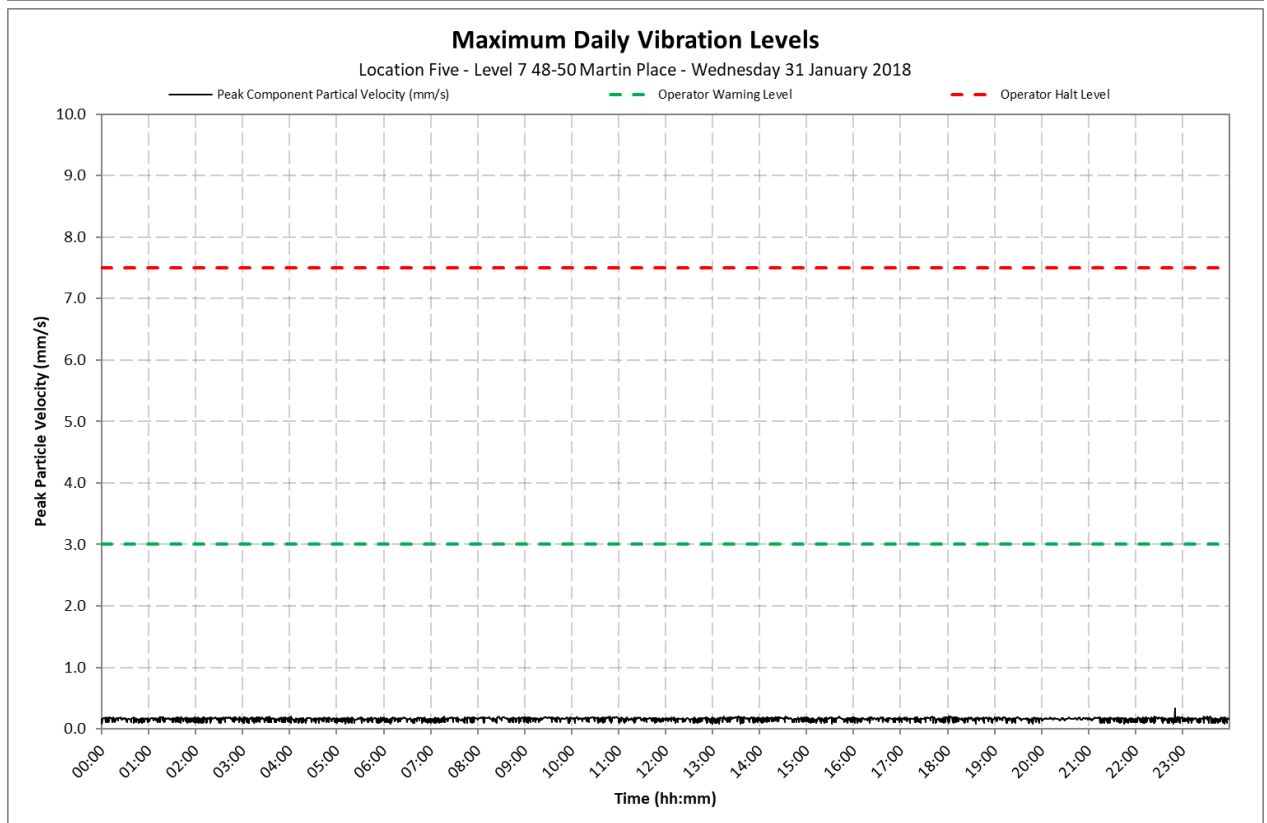
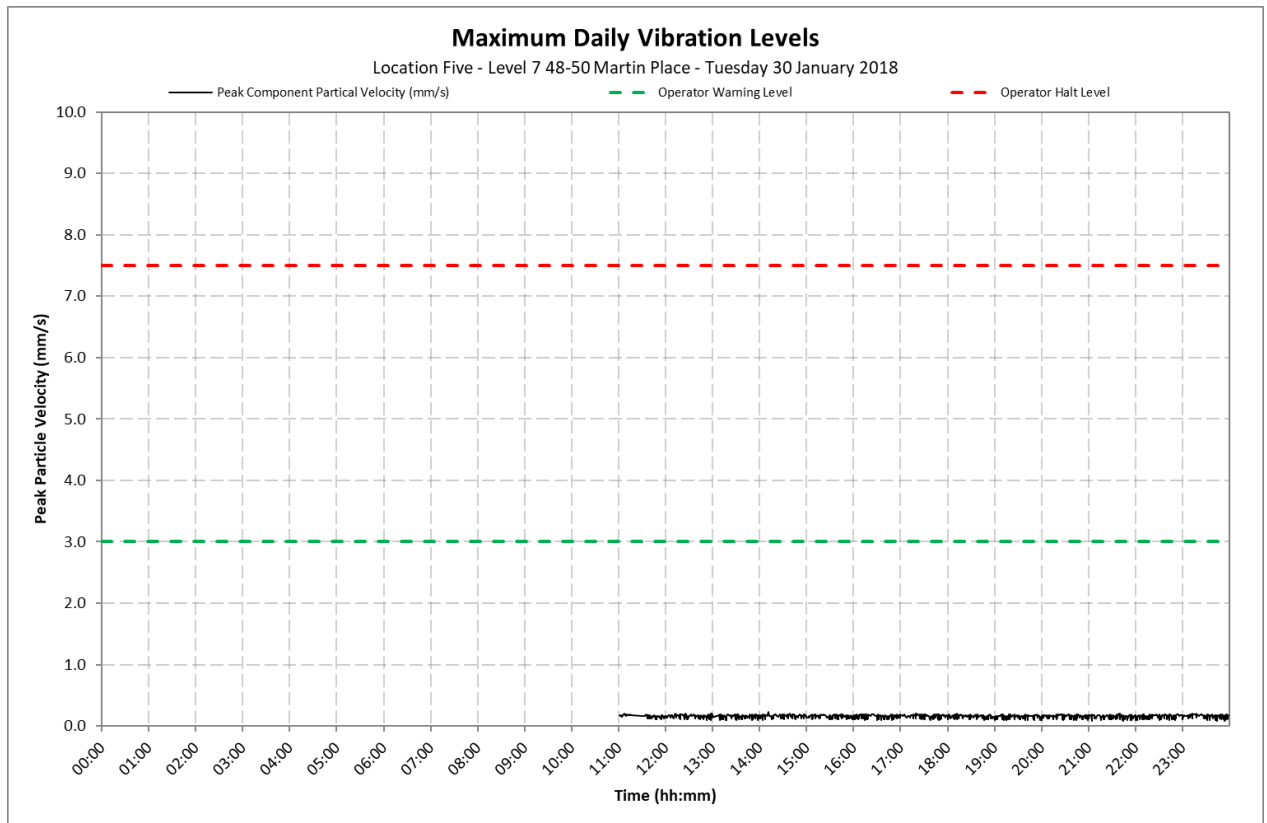
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

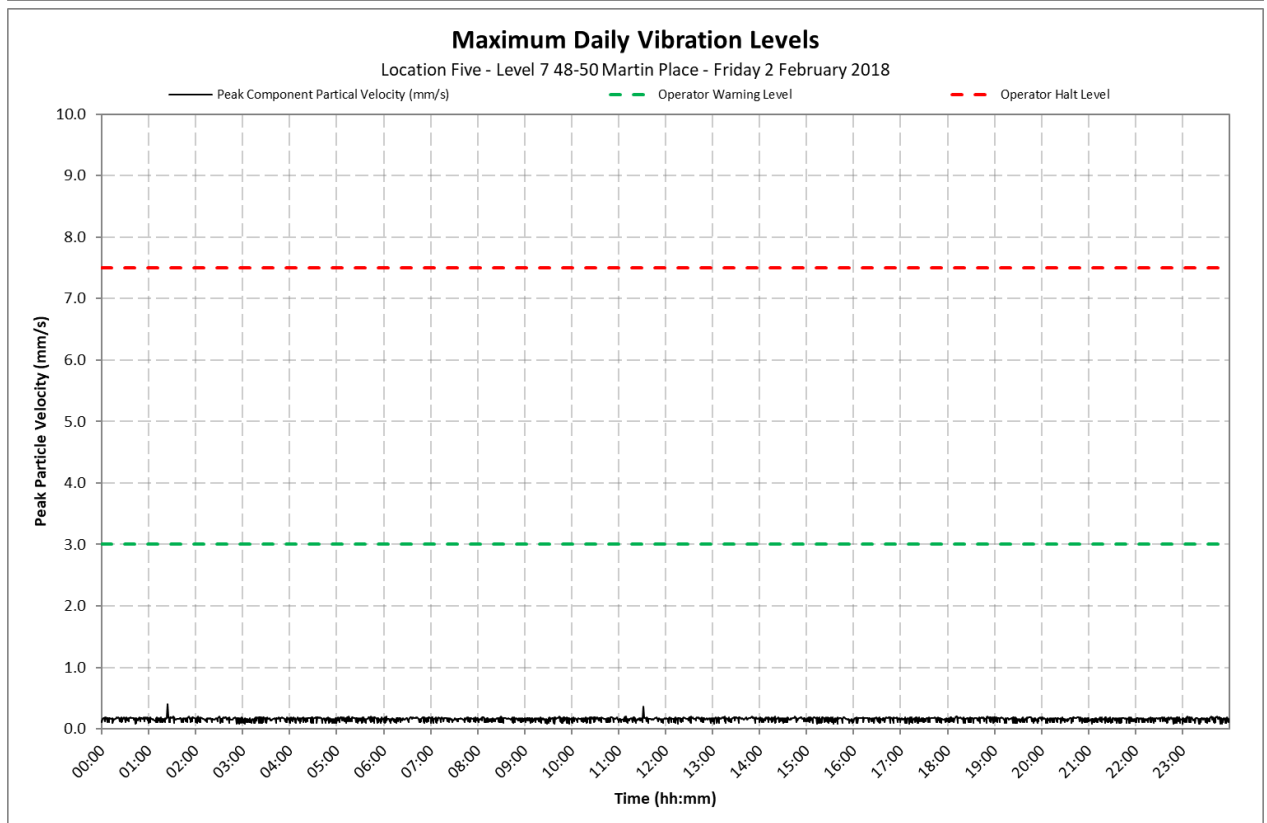
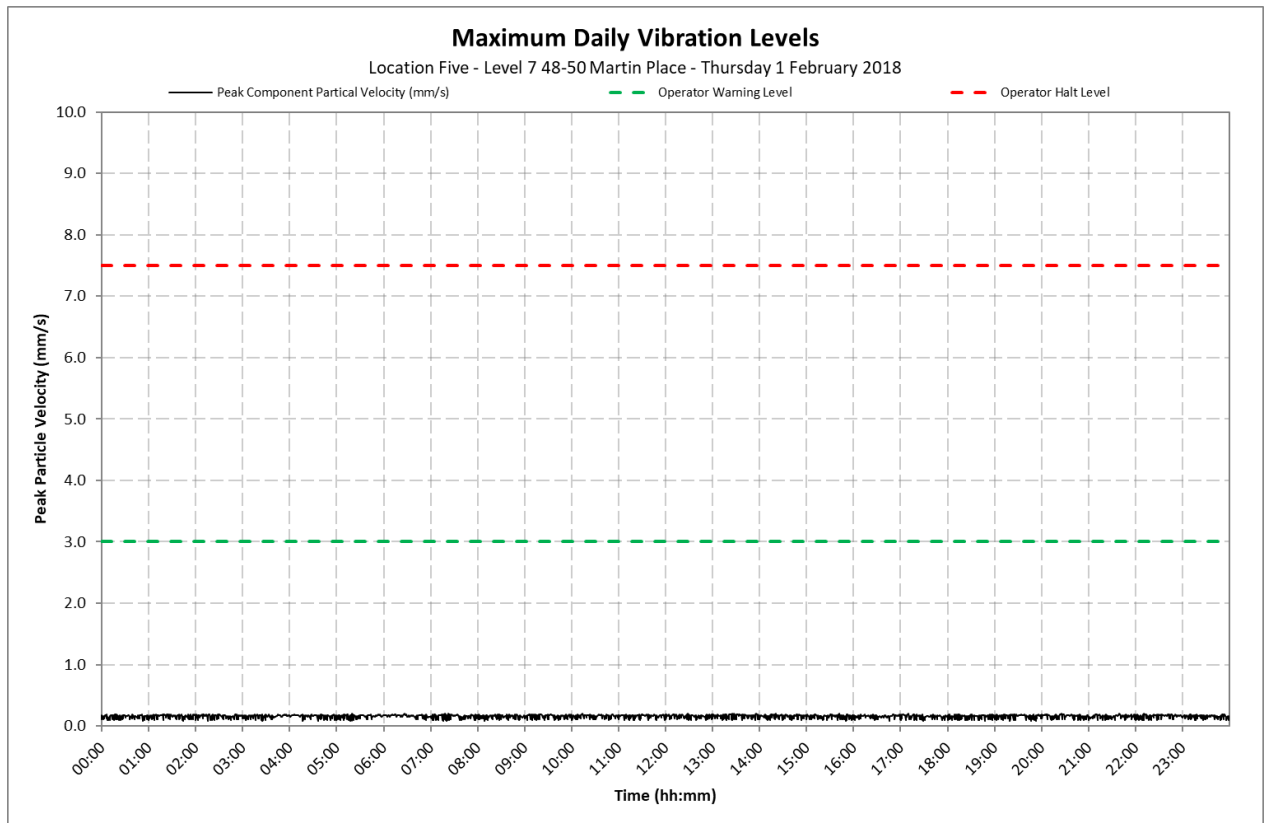
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

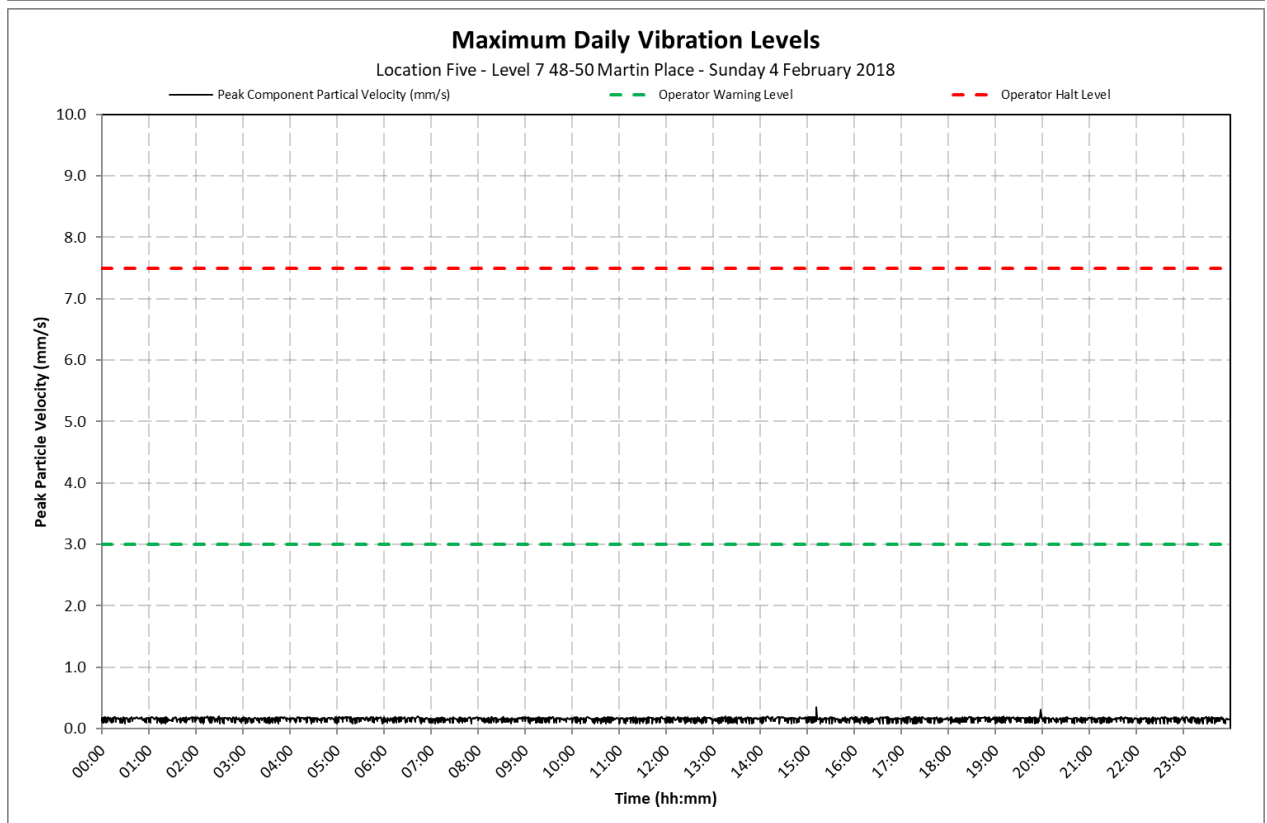
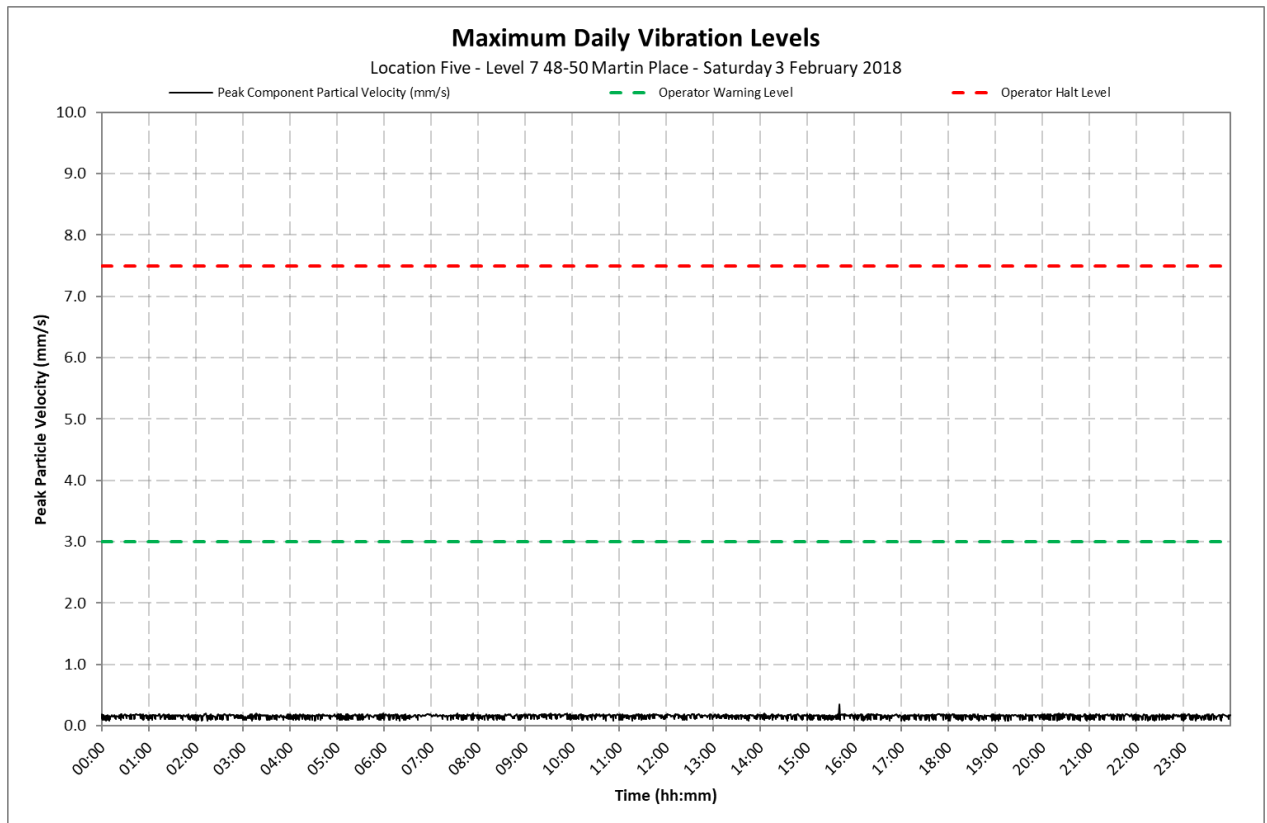
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

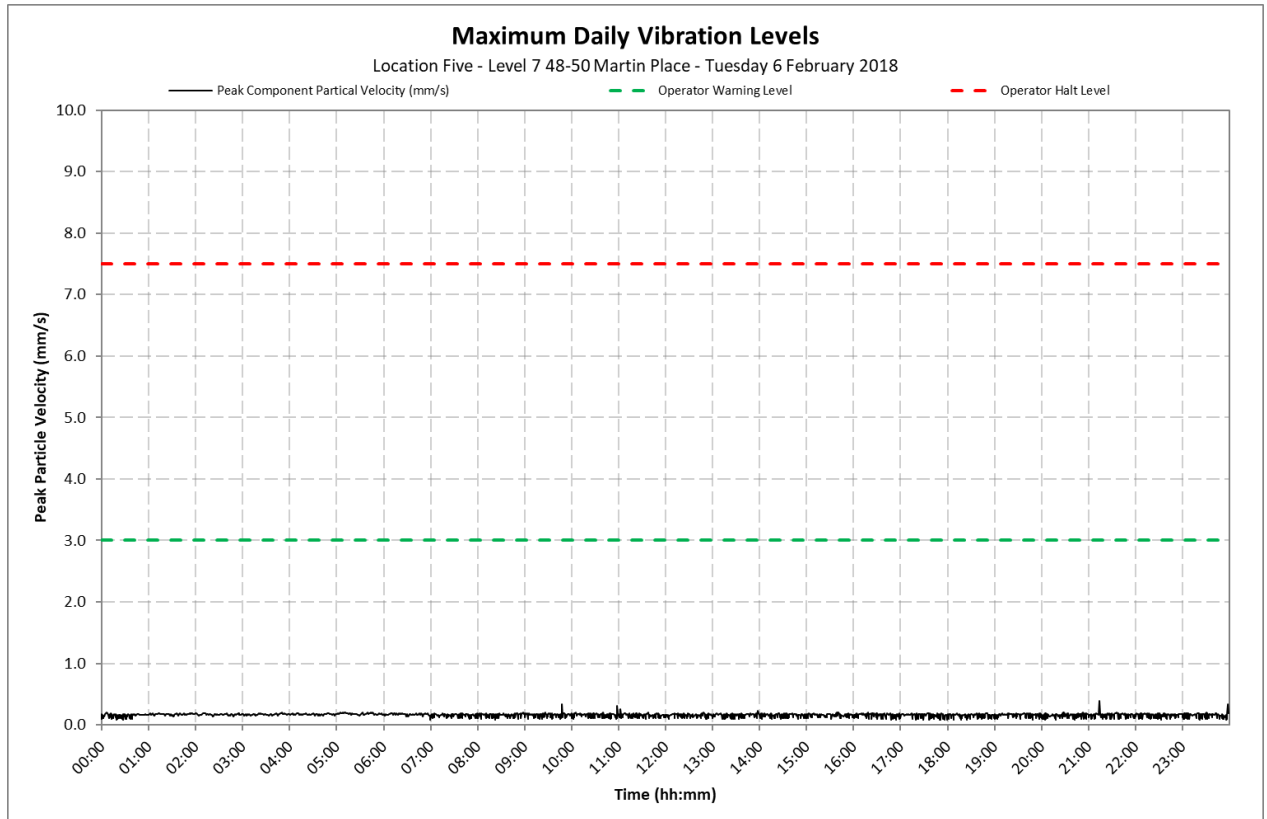
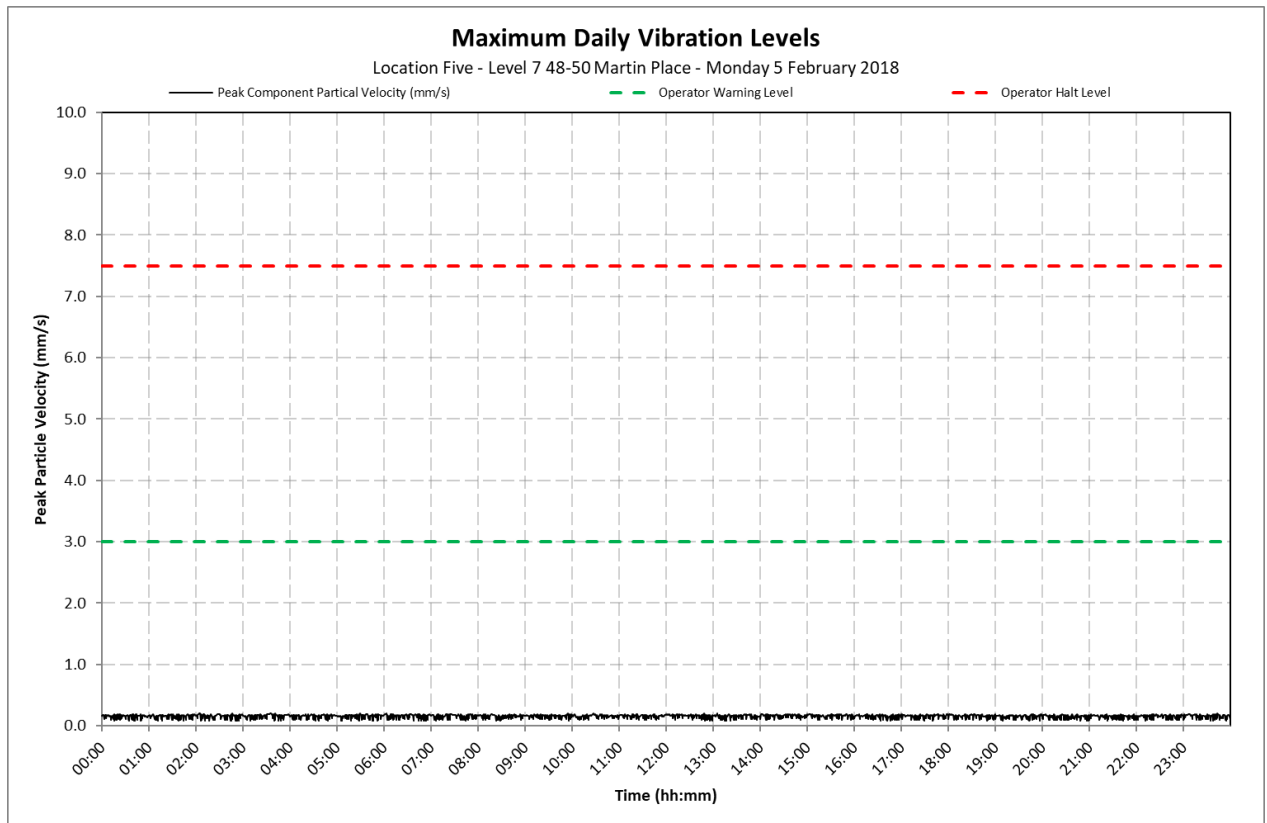
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



14 February 2018

10-1380 R19 NV Monitoring 20180214.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 19
7 February to 13 February 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 7 February to 13 February 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

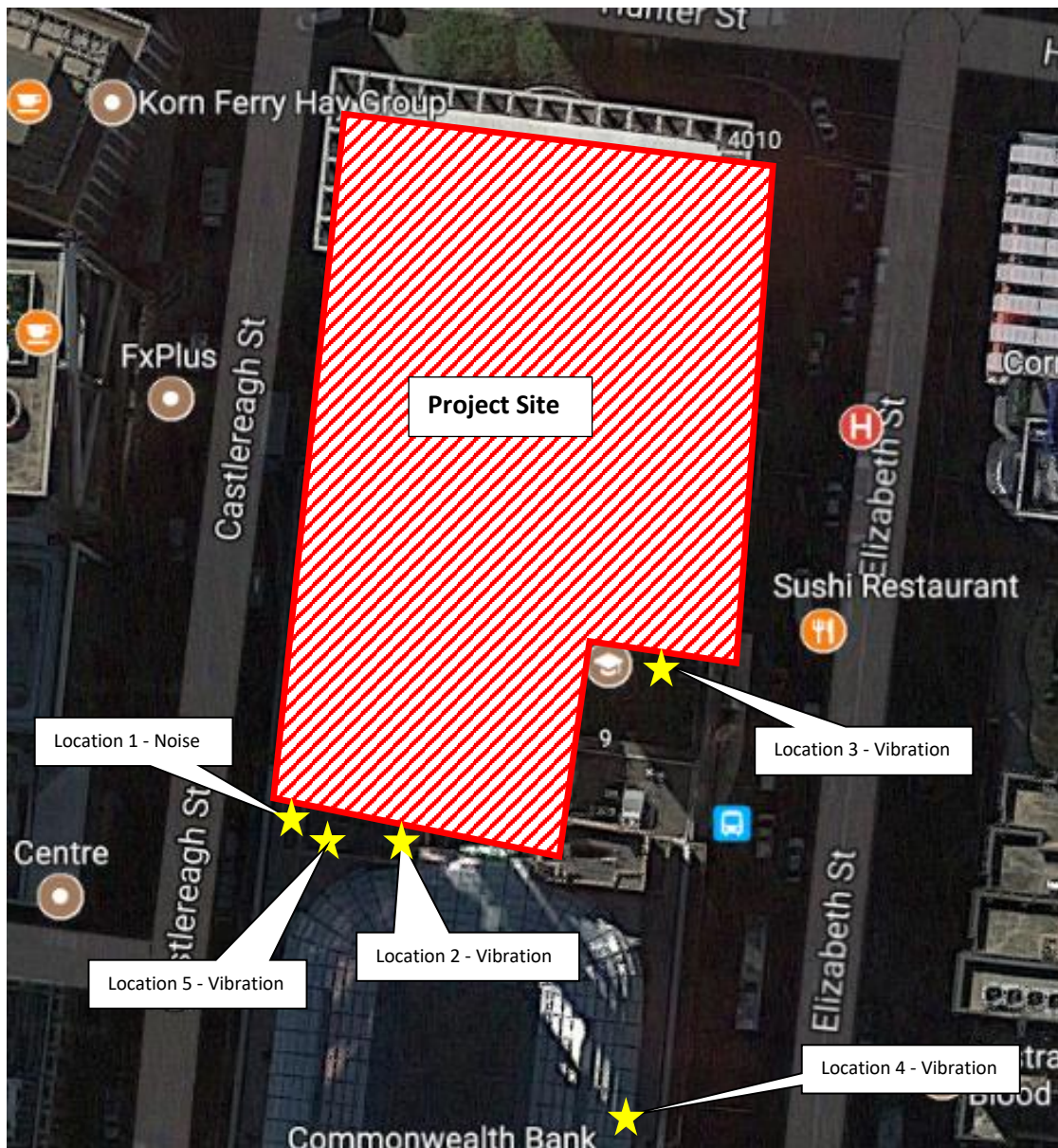
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 7 February to 13 February 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
7 February 2018	44	43	Complies	Complies
8 February 2018	45	44	Complies	Complies
9 February 2018	46	44	Complies	Complies
10 February 2018	46	45	Complies	Complies
11 February 2018	42	41	Complies	Complies
12 February 2018	38	37	Complies	Complies
13 February 2018	41	40	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 7 February to 13 February 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
7 February 2018	0.8 mm/s	Complies
8 February 2018	0.2 mm/s	Complies
9 February 2018	1.0 mm/s	Complies
10 February 2018	1.1 mm/s	Complies
11 February 2018	1.1 mm/s	Complies
12 February 2018	2.6 mm/s	Complies
13 February 2018	1.0 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
7 February 2018	0.2 mm/s	Complies
8 February 2018	0.5 mm/s	Complies
9 February 2018	1.2 mm/s	Complies
10 February 2018	1.1 mm/s	Complies
11 February 2018	0.4 mm/s	Complies
12 February 2018	1.0 mm/s	Complies
13 February 2018	1.0 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 7 February to 13 February 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 7 February to 13 February 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

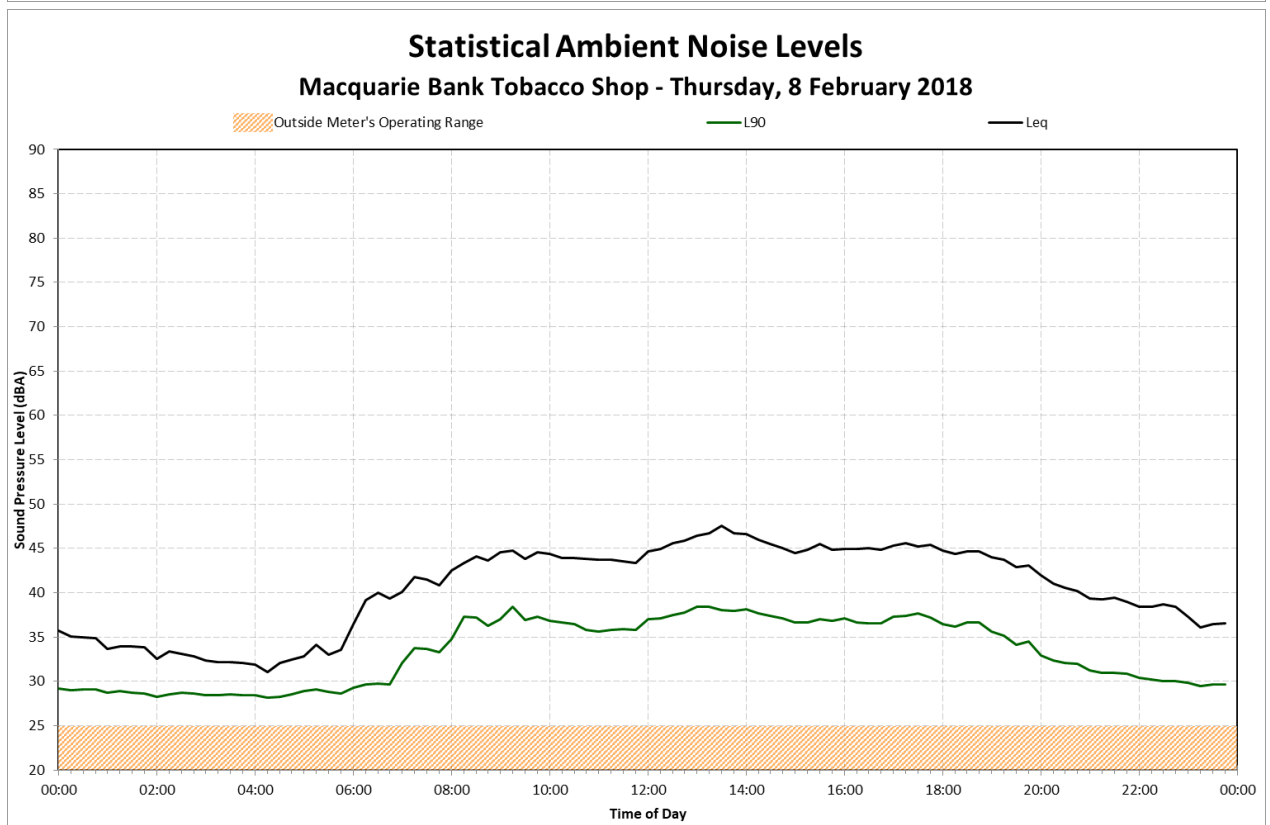
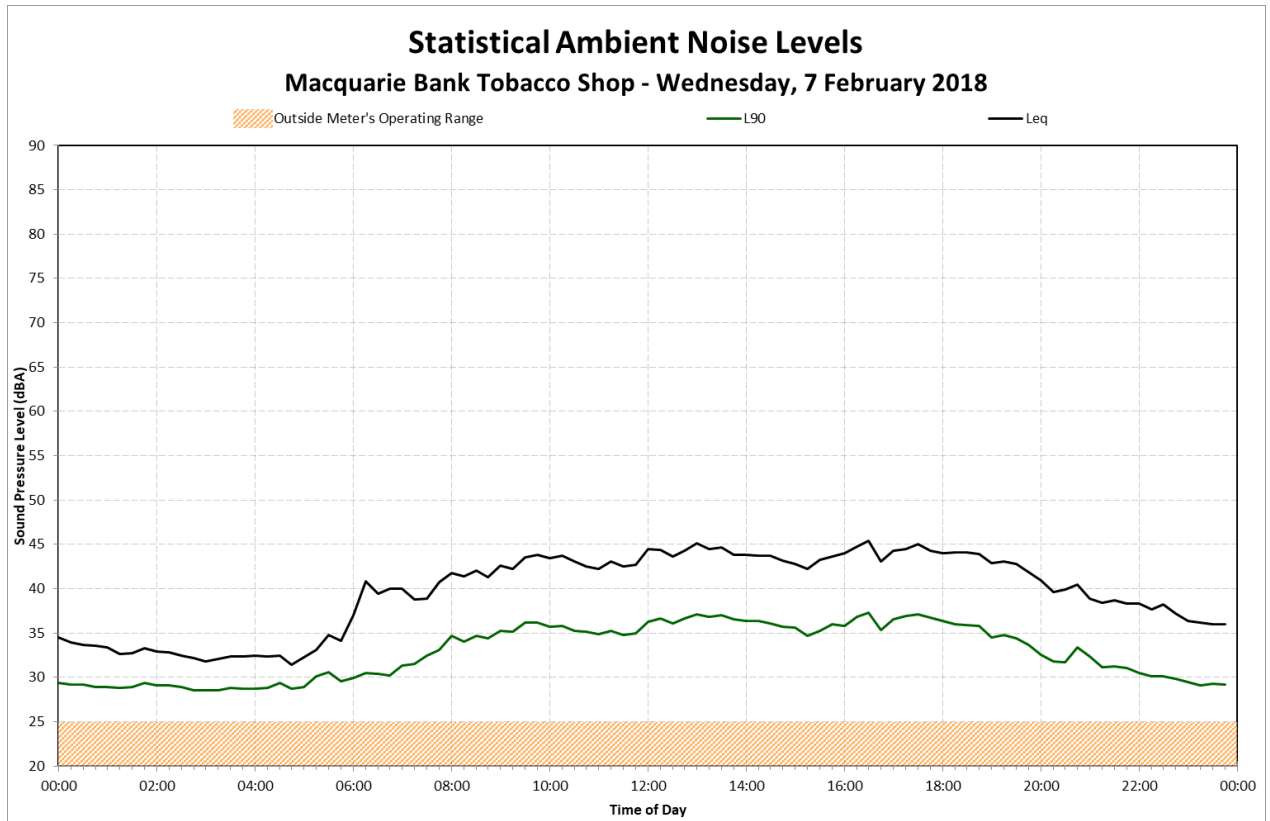
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
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Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

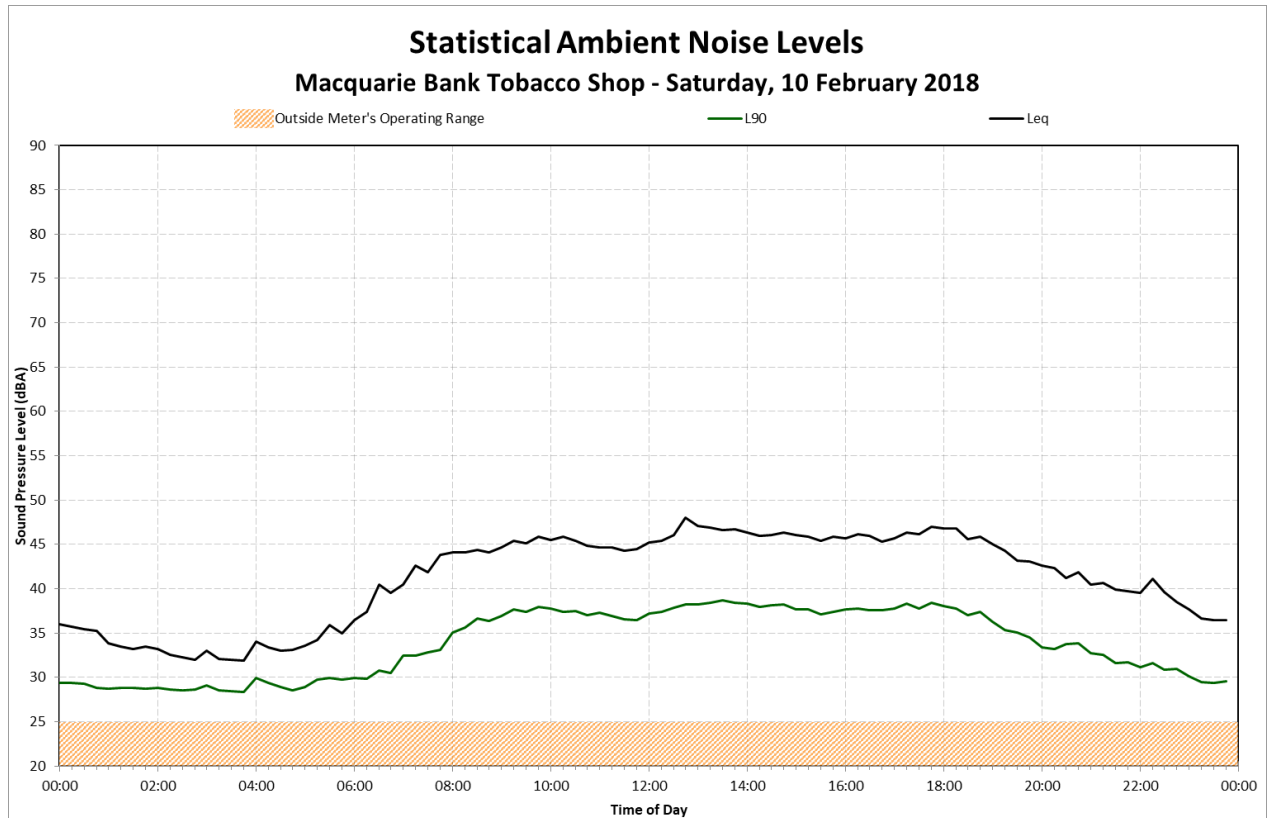
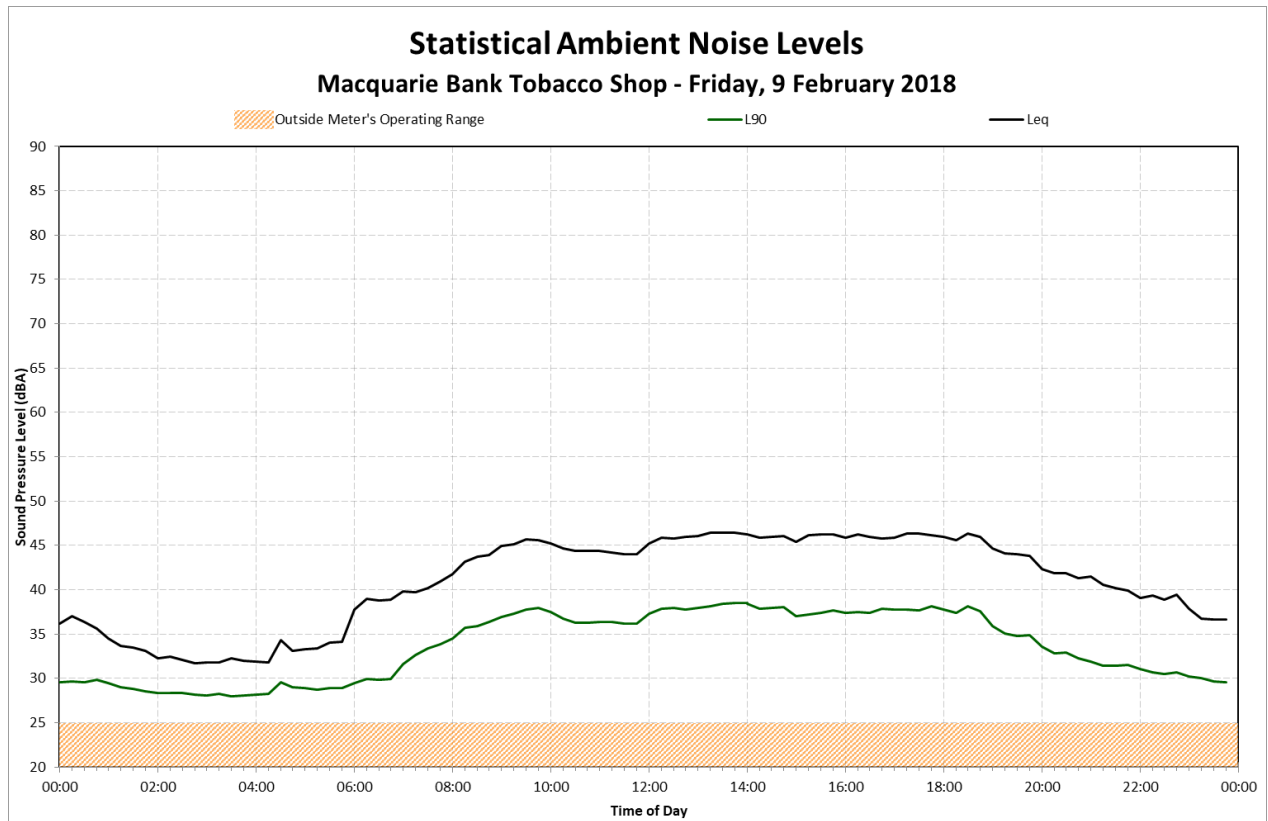
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

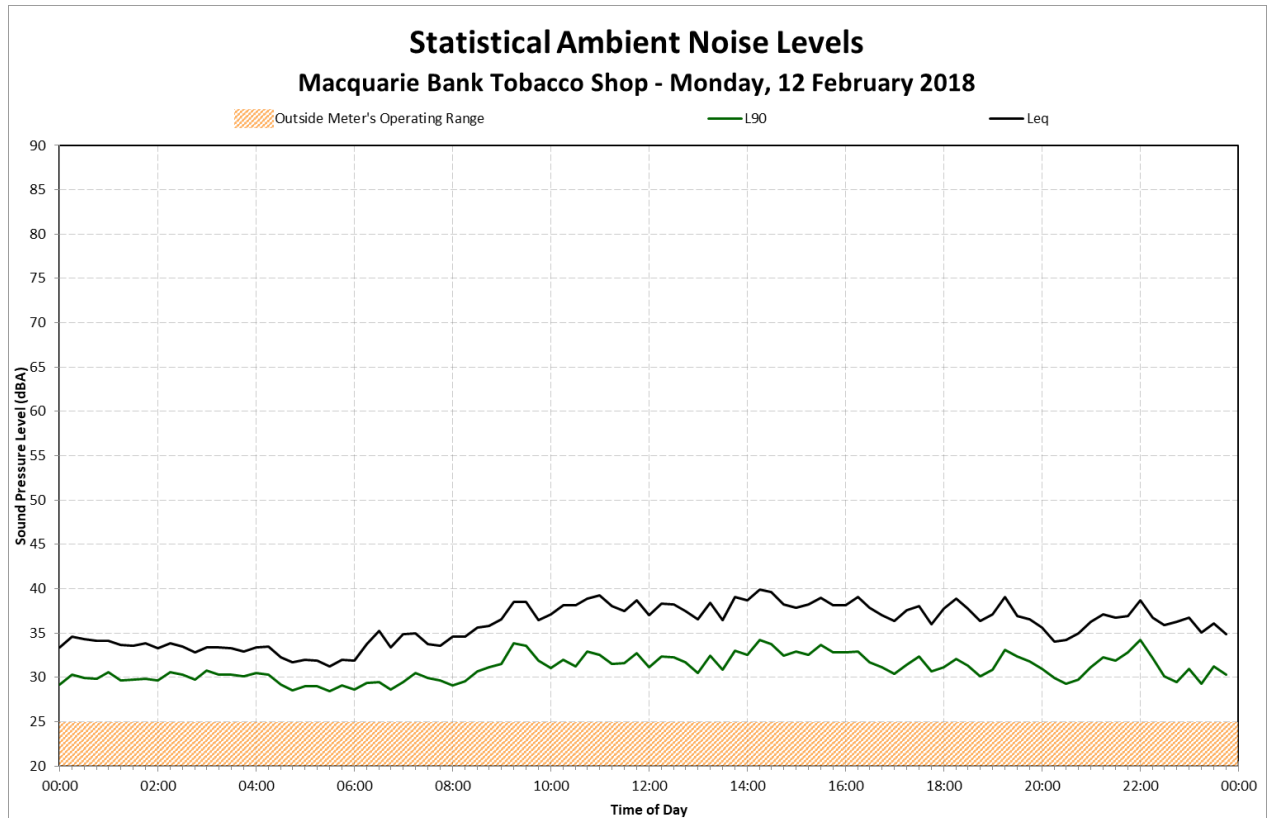
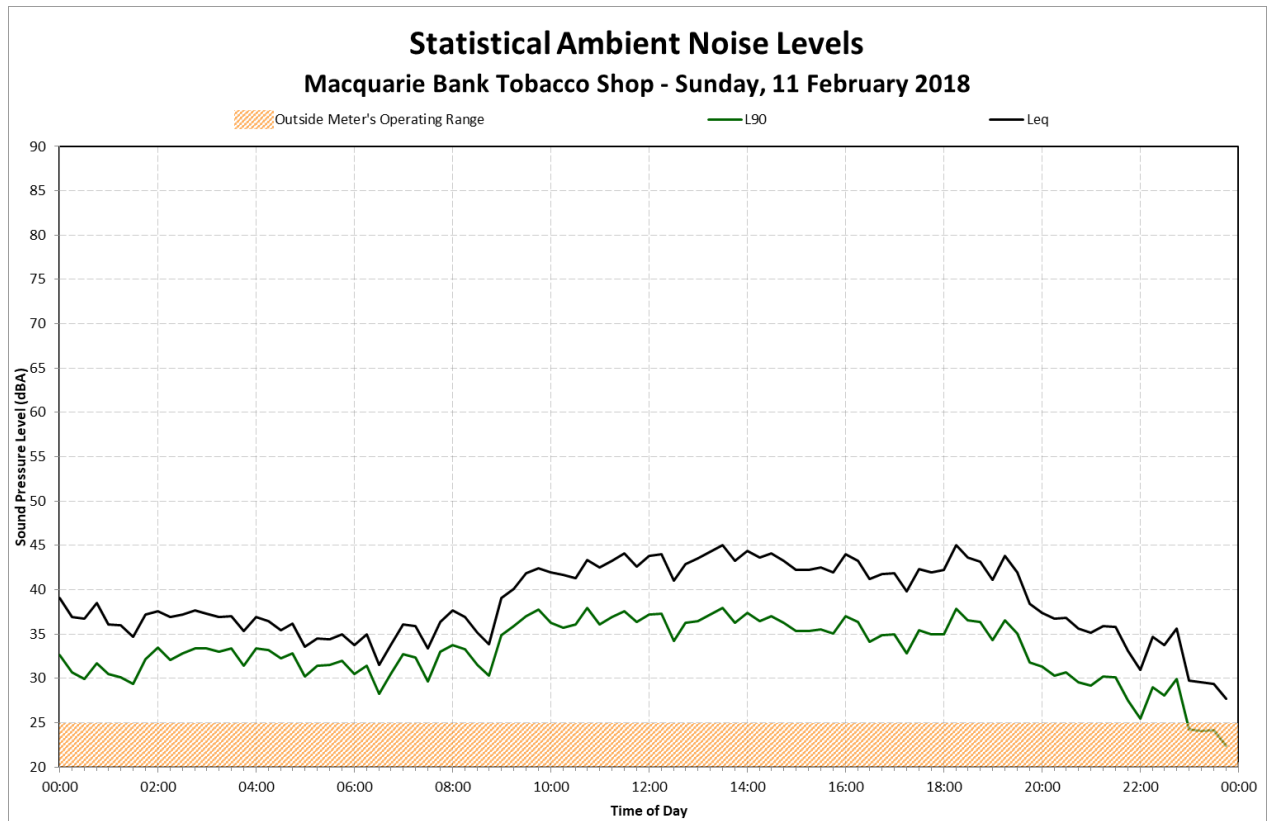
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

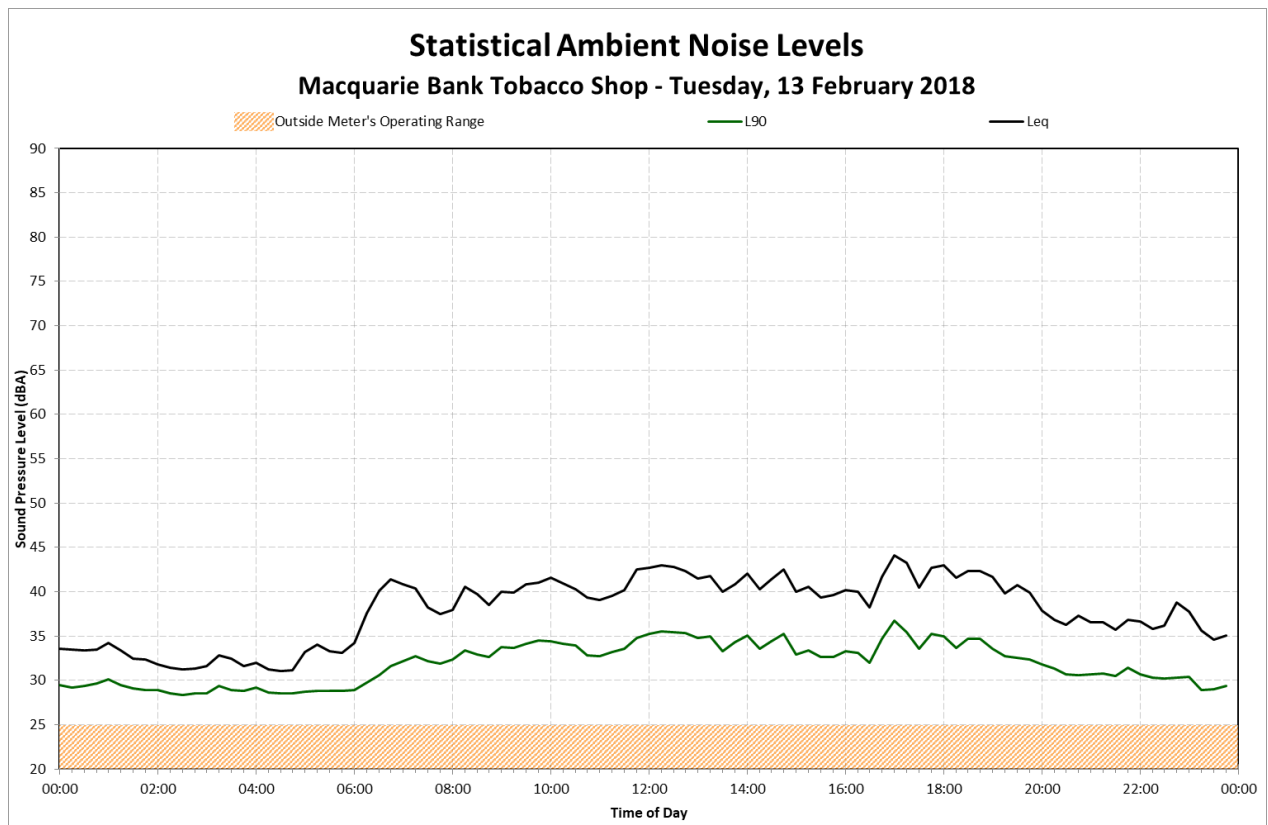
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

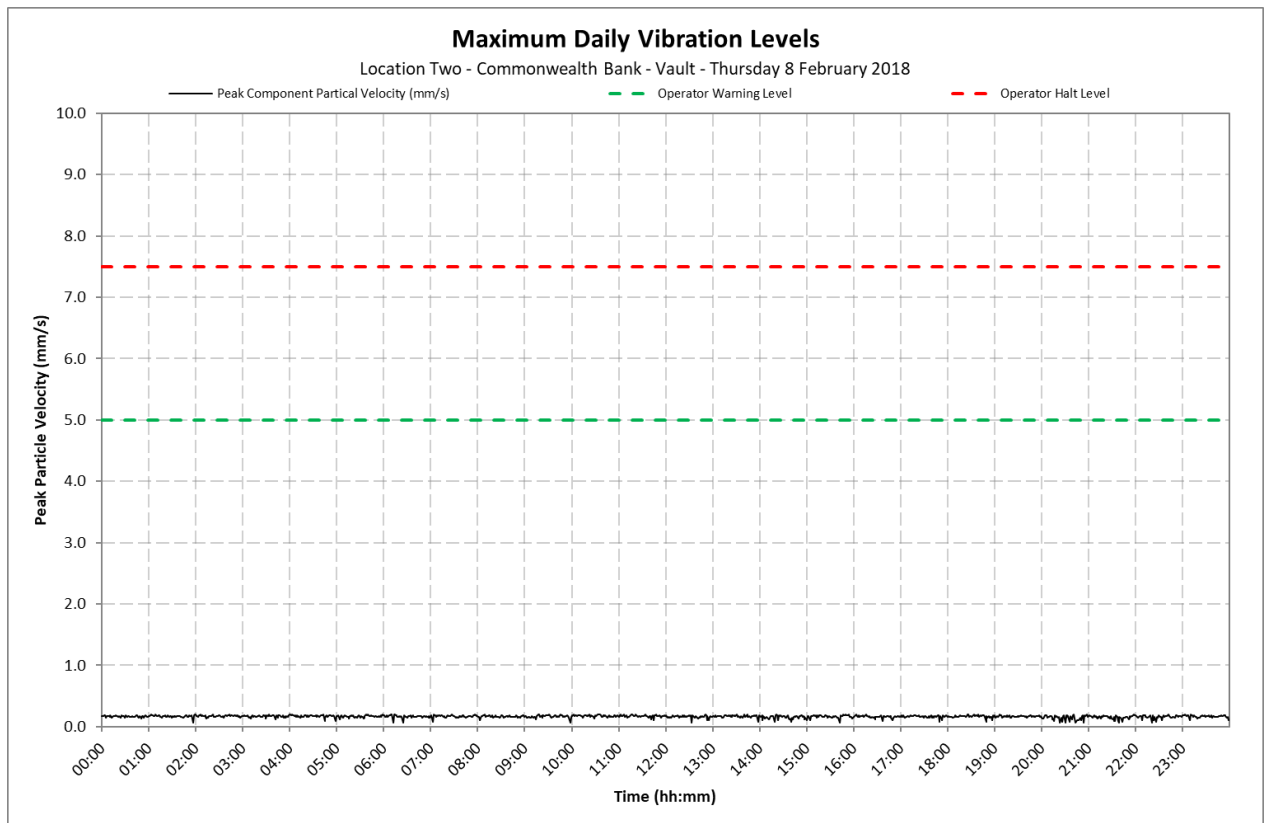
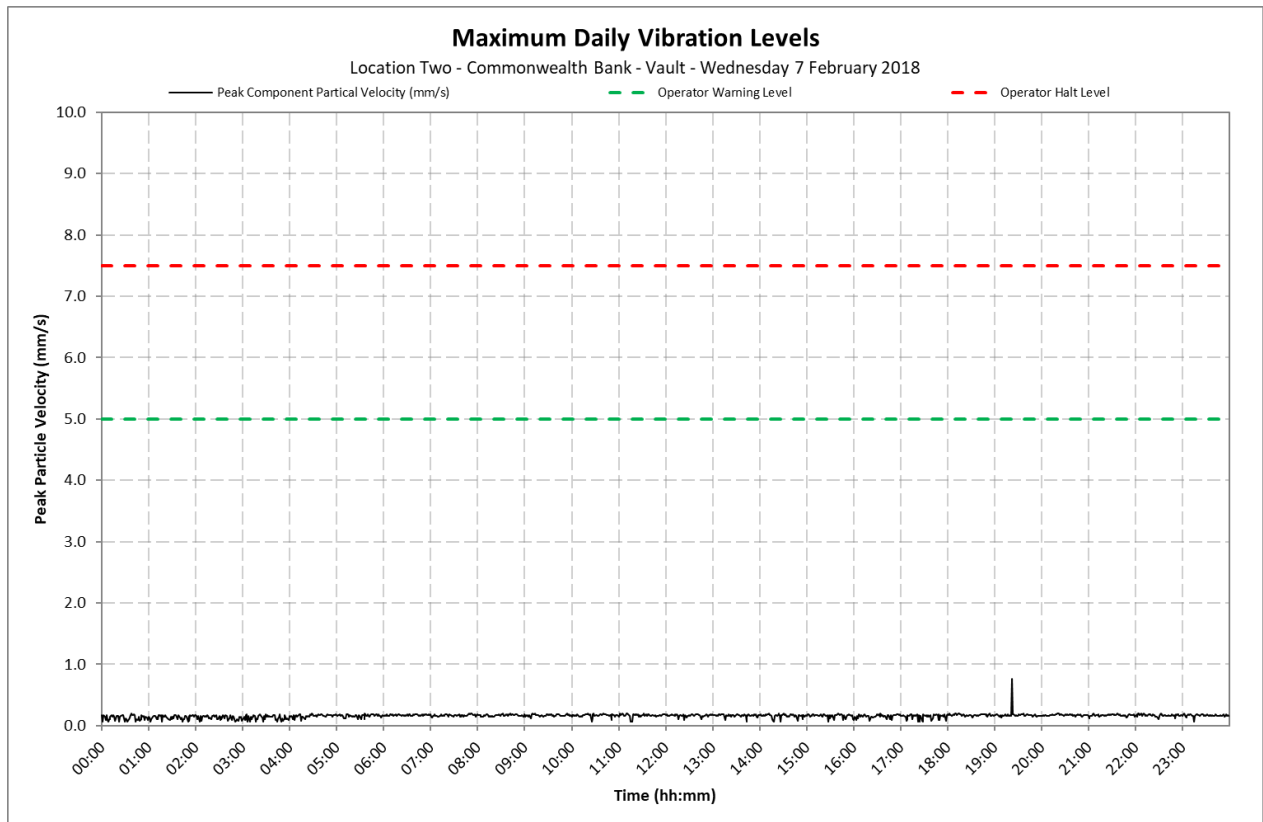
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

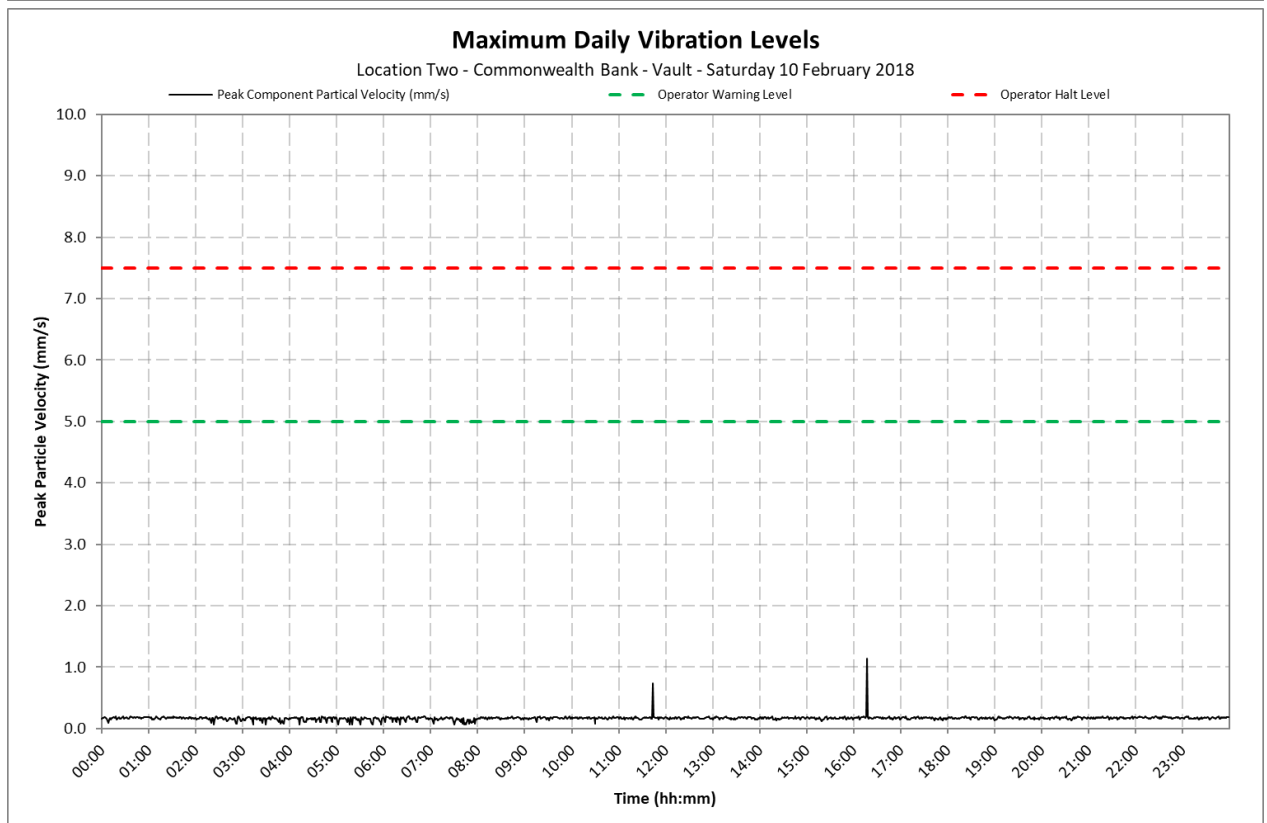
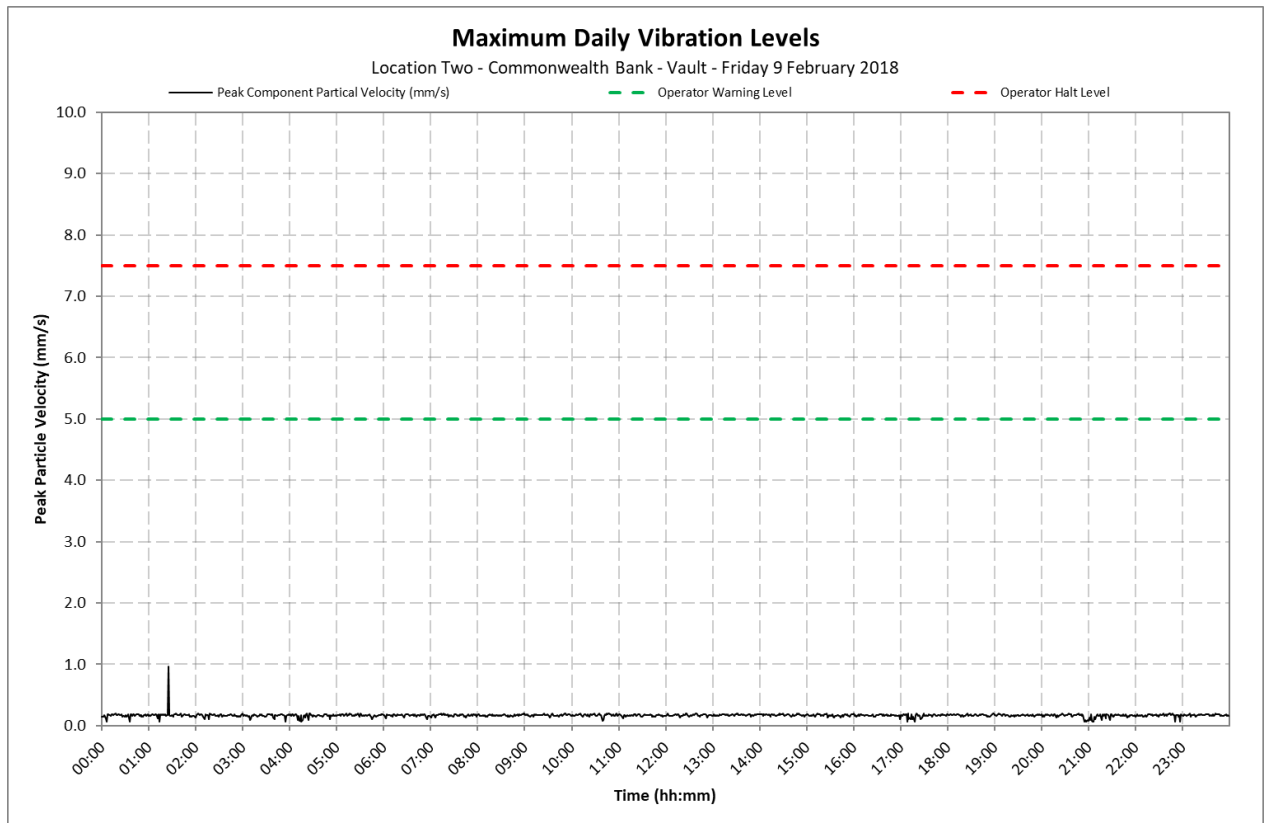
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

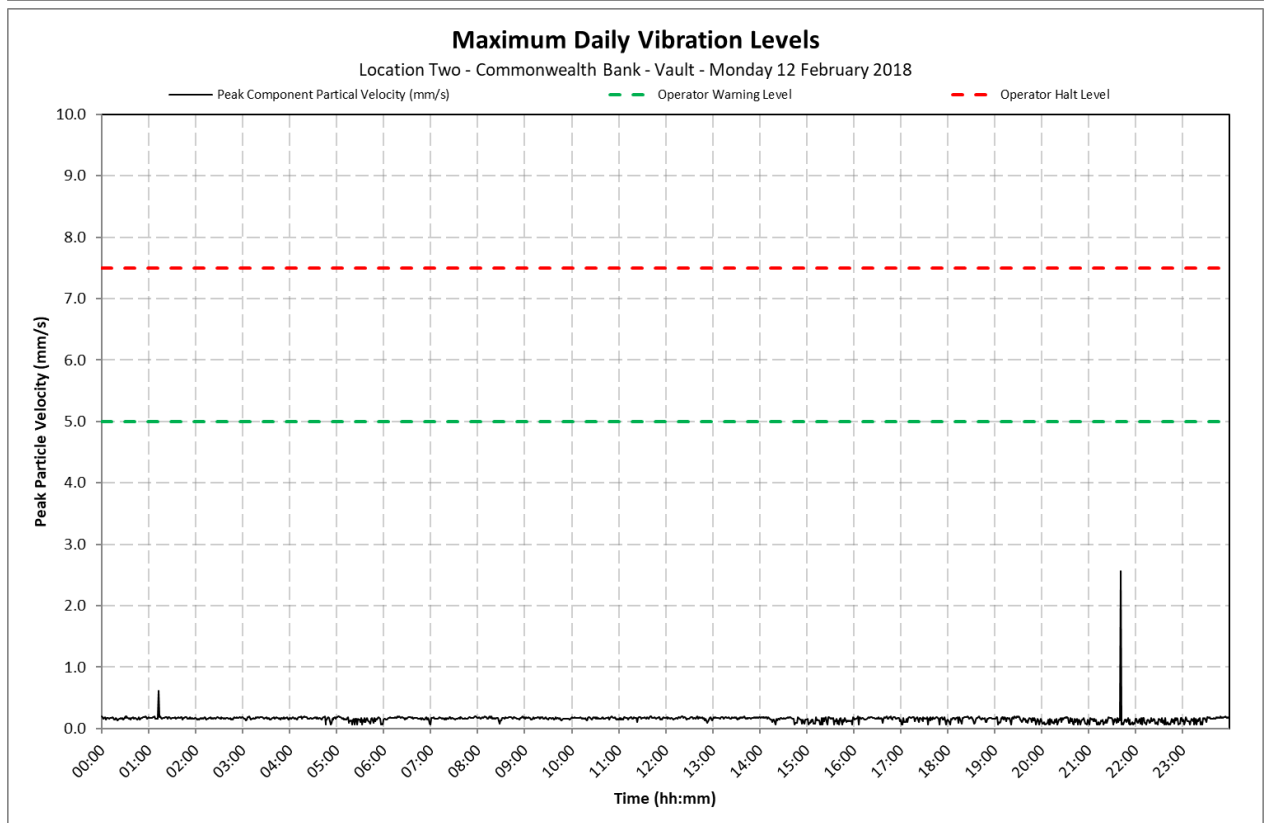
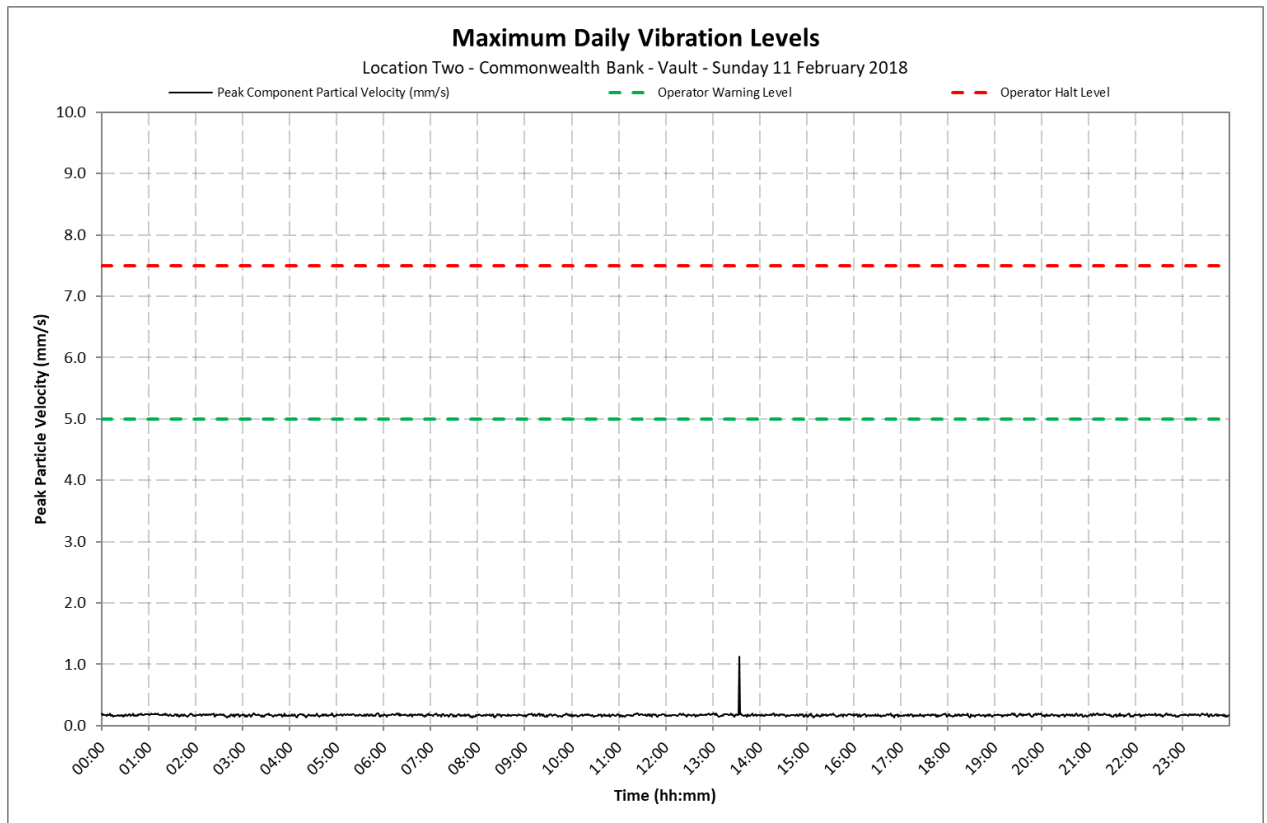
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

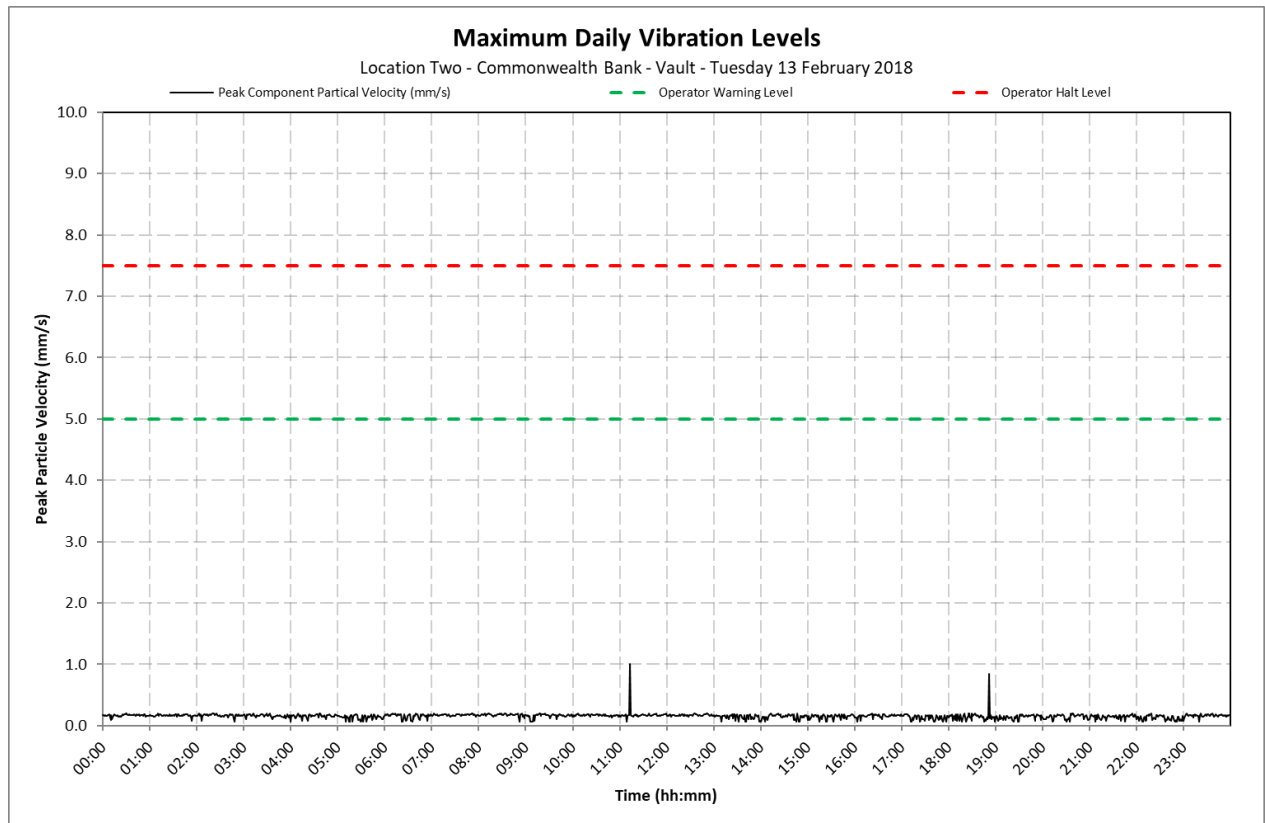
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

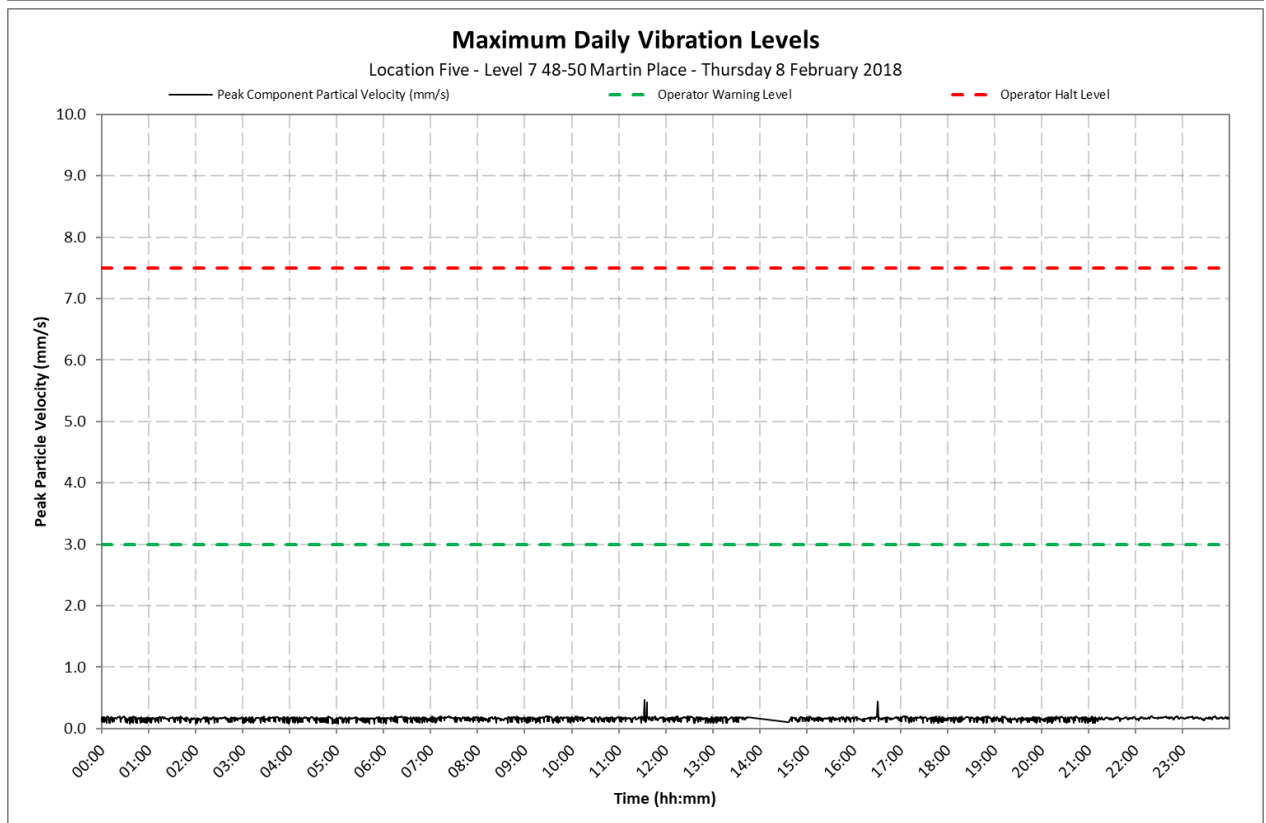
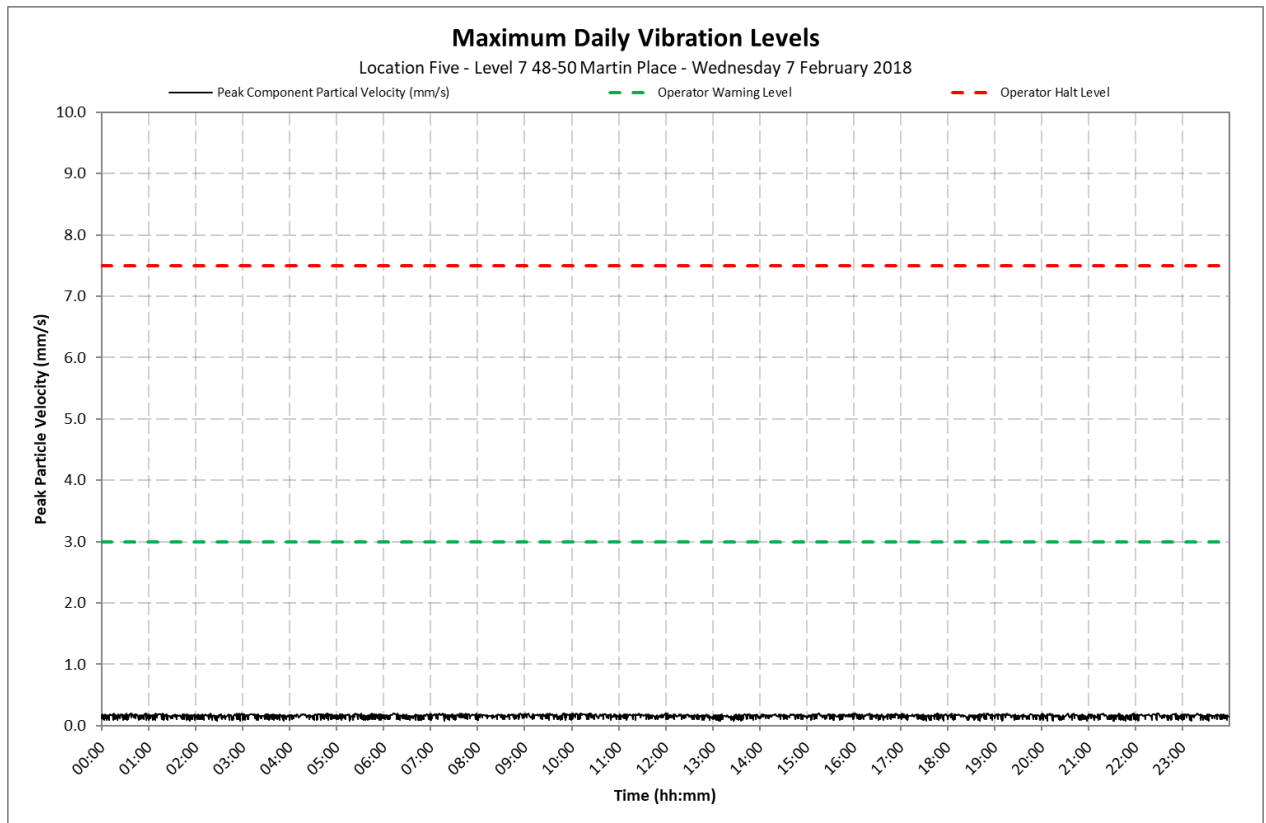
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

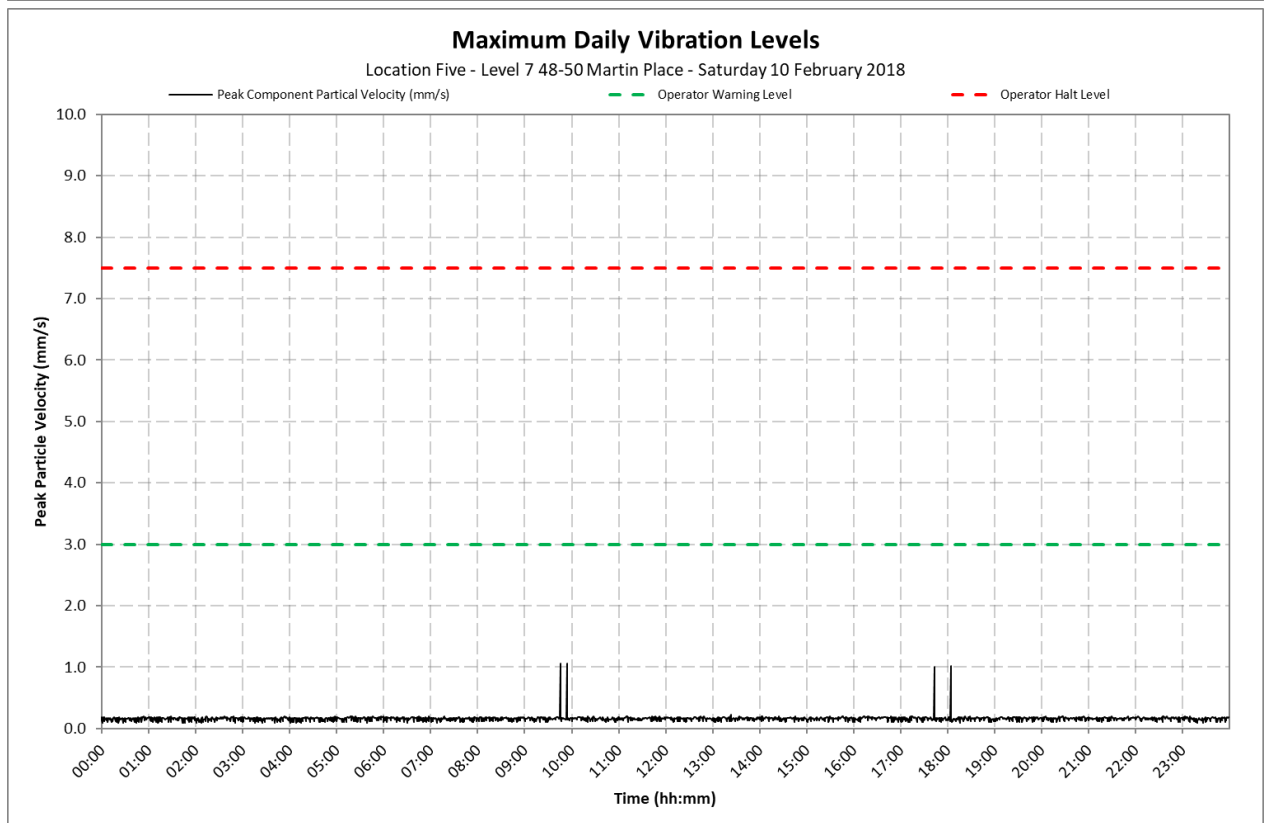
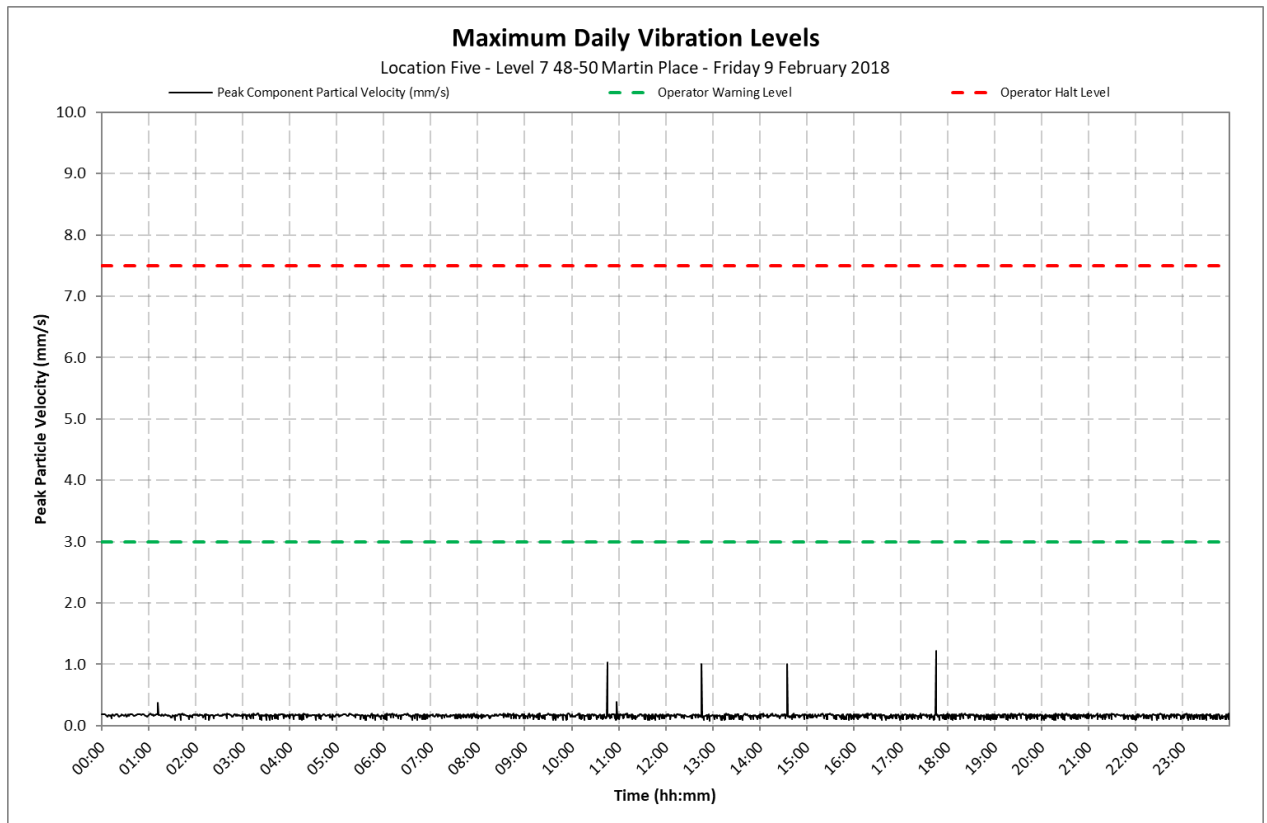
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

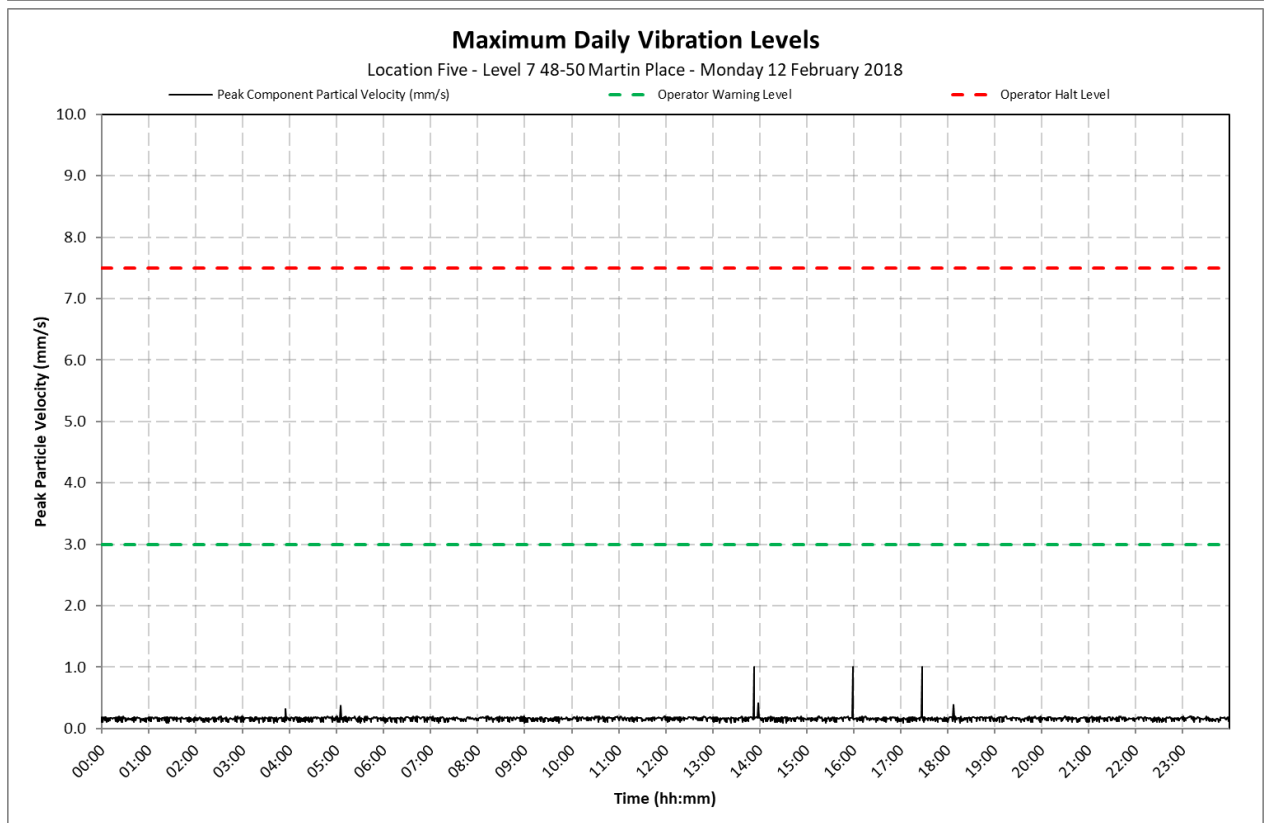
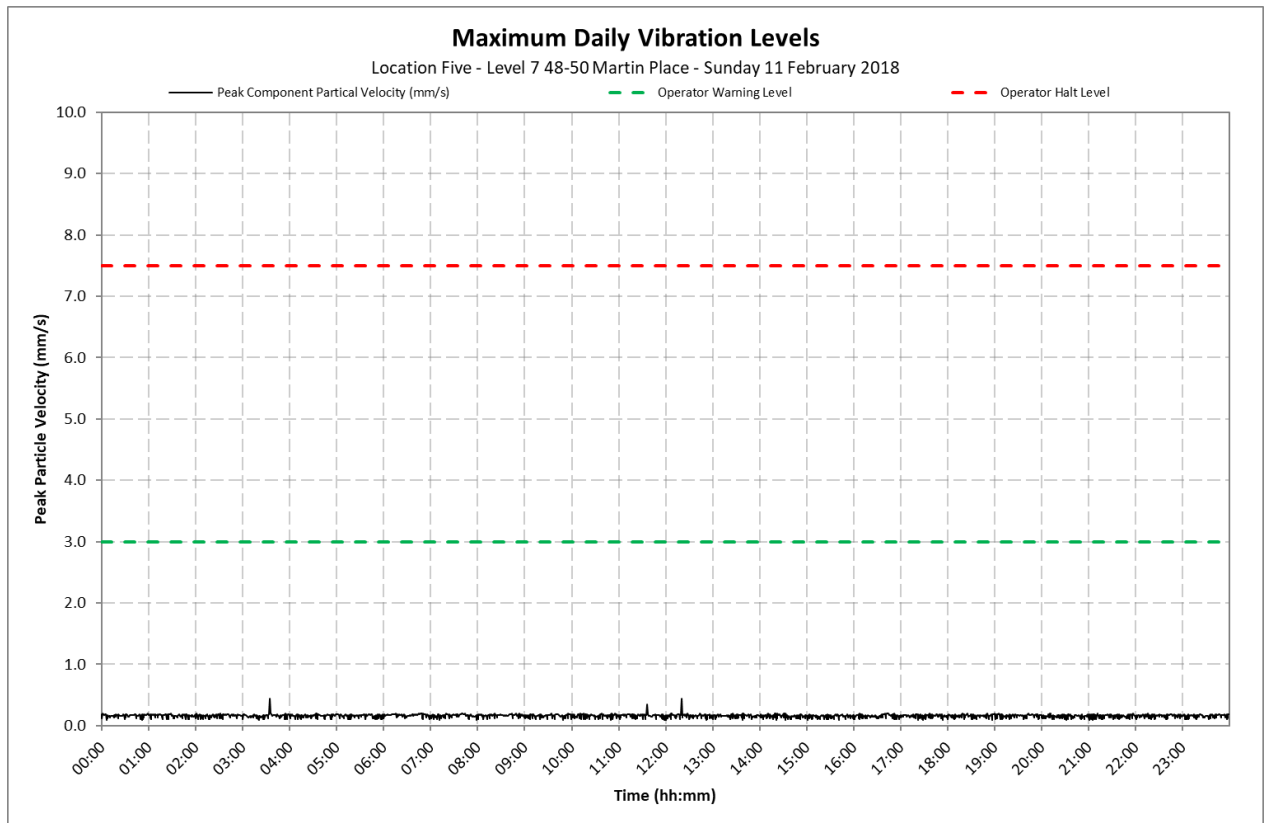
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

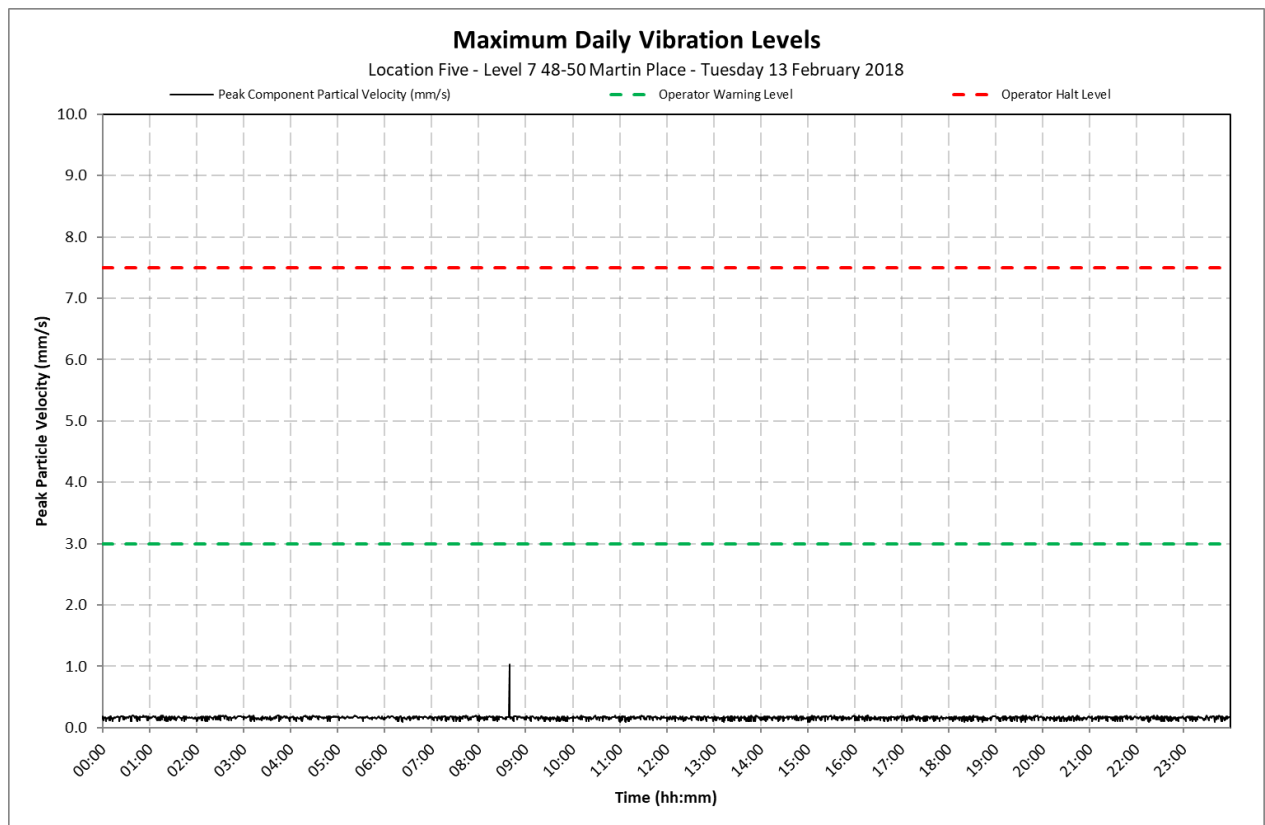
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place





22 February 2018

10-1380 R20 NV Monitoring 20180222.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 20
14 February to 20 February 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 14 February to 20 February 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

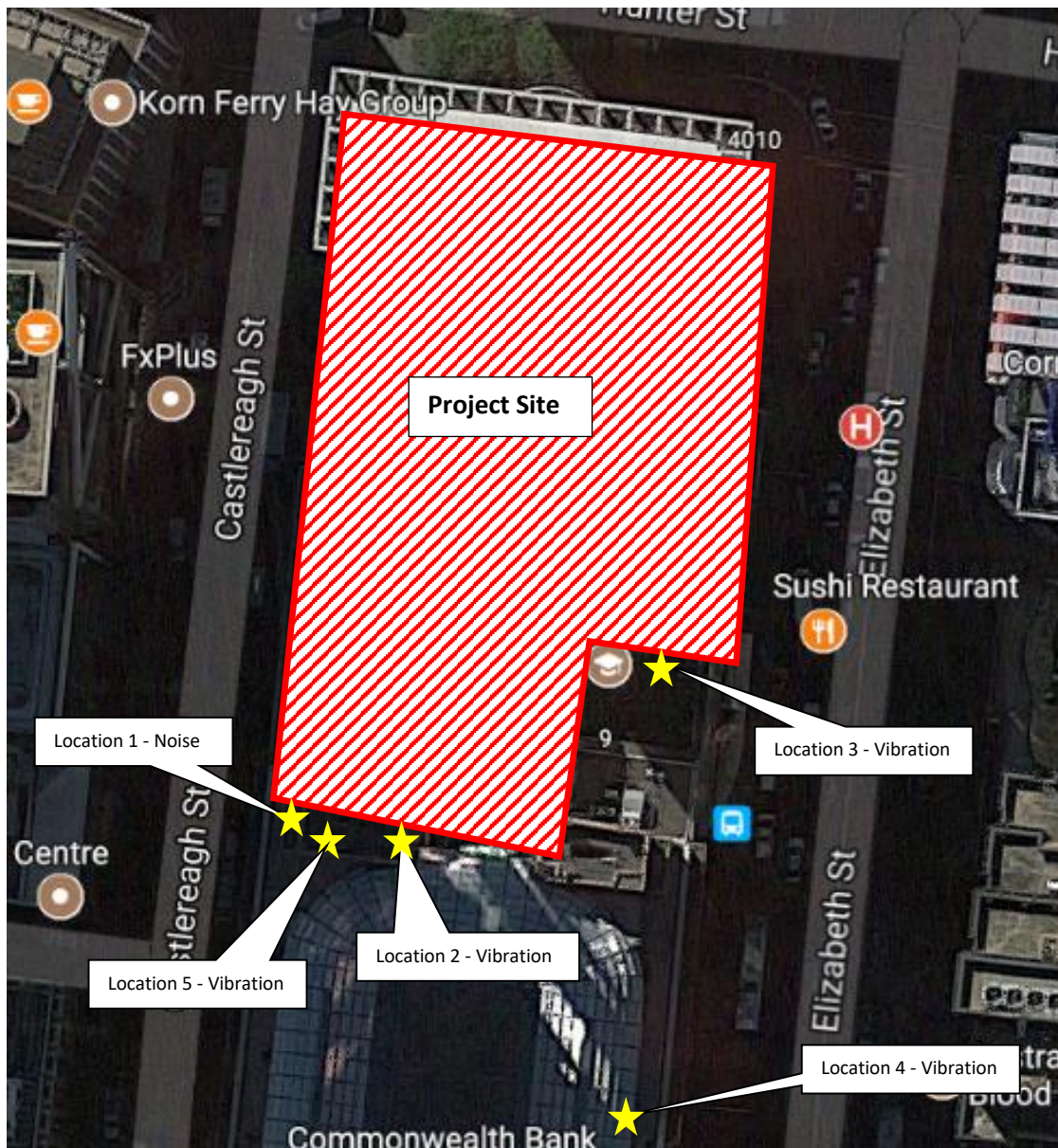
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 14 February to 20 February 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
14 February 2018	43	42	Complies	Complies
15 February 2018	44	43	Complies	Complies
16 February 2018	45	43	Complies	Complies
17 February 2018	46	44	Complies	Complies
18 February 2018	40	39	Complies	Complies
19 February 2018	38	37	Complies	Complies
20 February 2018	41	39	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 14 February to 20 February 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
14 February 2018	1.0 mm/s	Complies
15 February 2018	1.1 mm/s	Complies
16 February 2018	0.5 mm/s	Complies
17 February 2018	1.0 mm/s	Complies
18 February 2018	1.0 mm/s	Complies
19 February 2018	0.6 mm/s	Complies
20 February 2018	1.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
14 February 2018	1.0 mm/s	Complies
15 February 2018	1.0 mm/s	Complies
16 February 2018	0.2 mm/s	Complies
17 February 2018	1.2 mm/s	Complies
18 February 2018	1.0 mm/s	Complies
19 February 2018	1.0 mm/s	Complies
20 February 2018	1.0 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 14 February to 20 February 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 14 February to 20 February 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

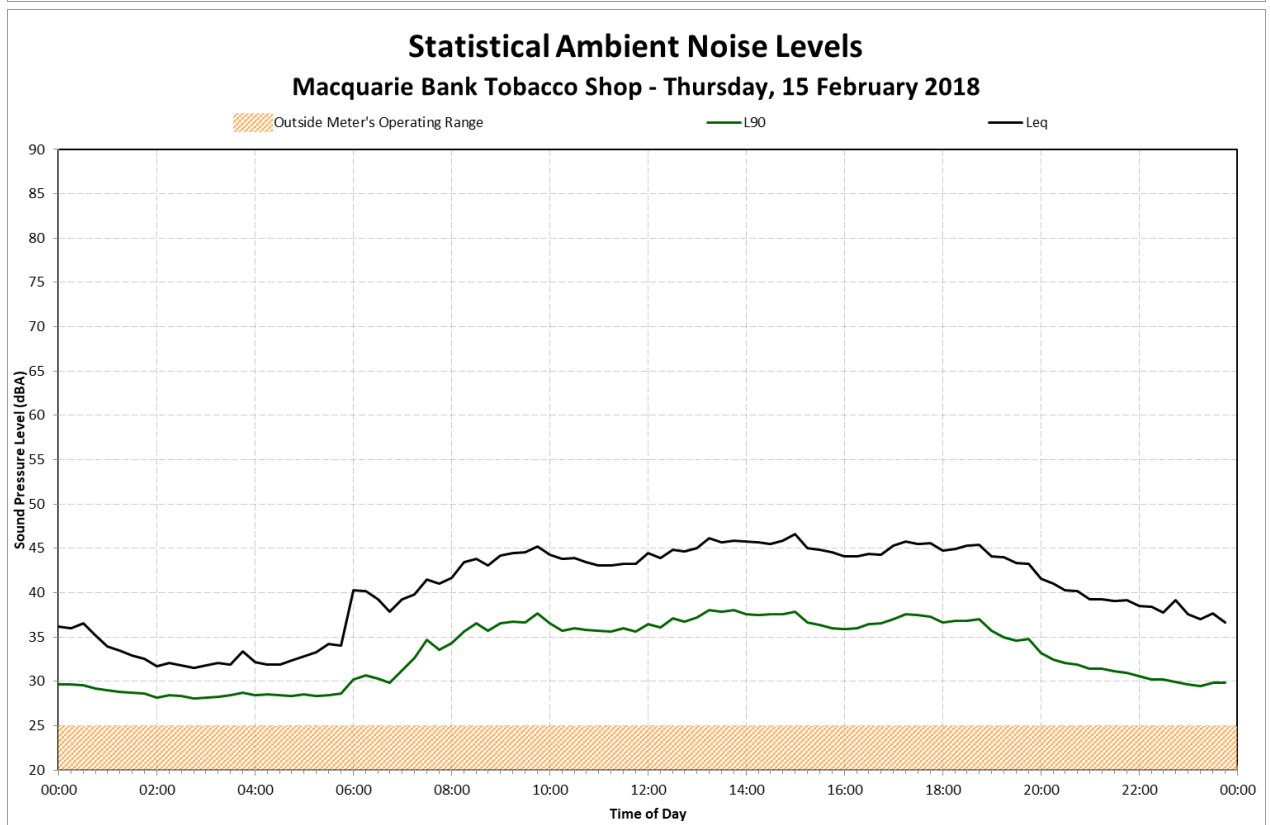
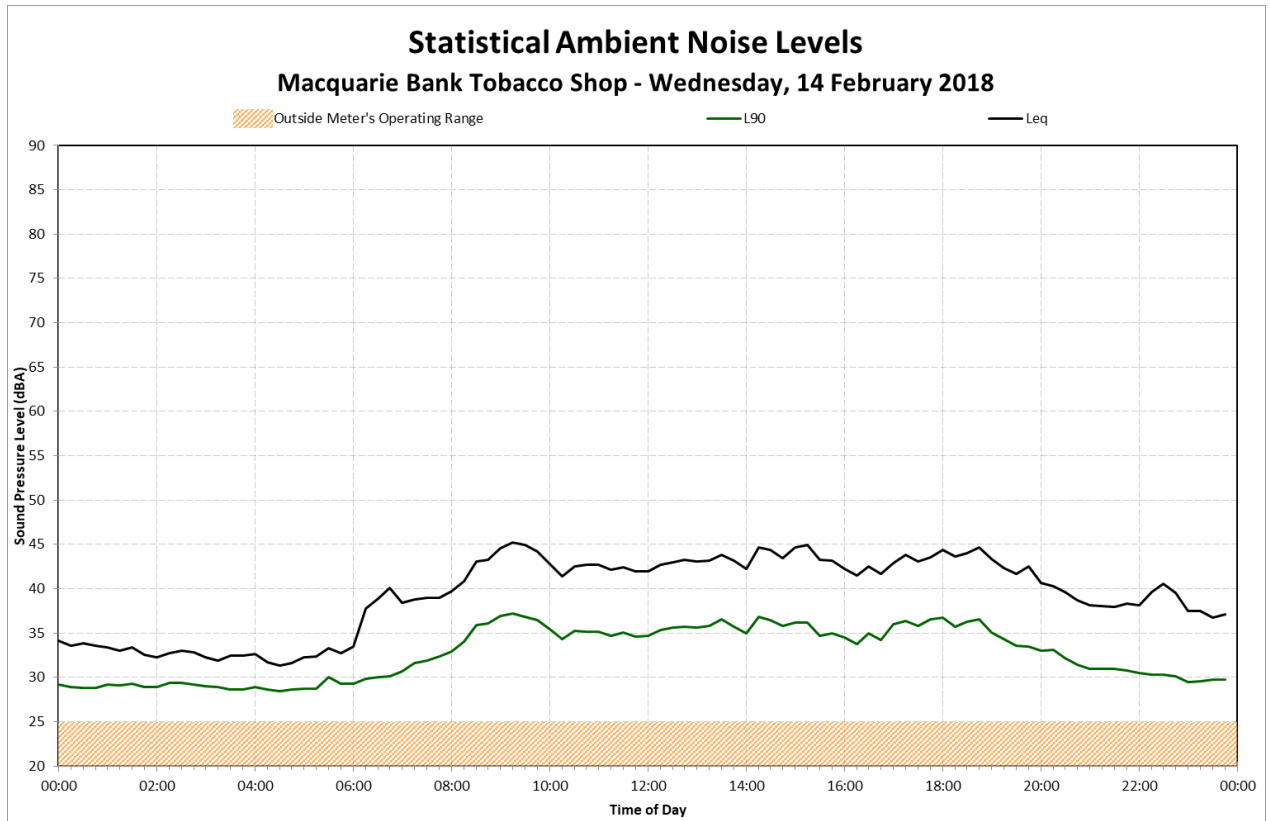
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

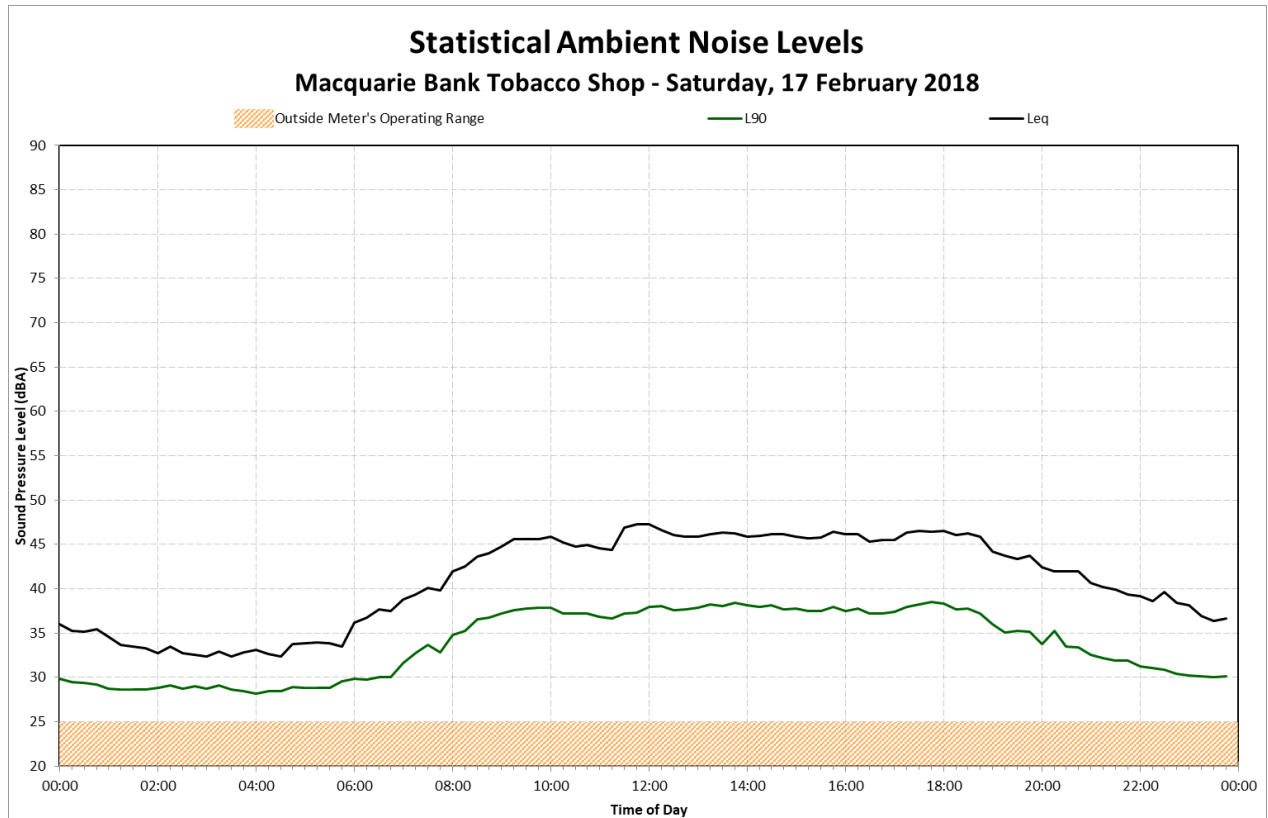
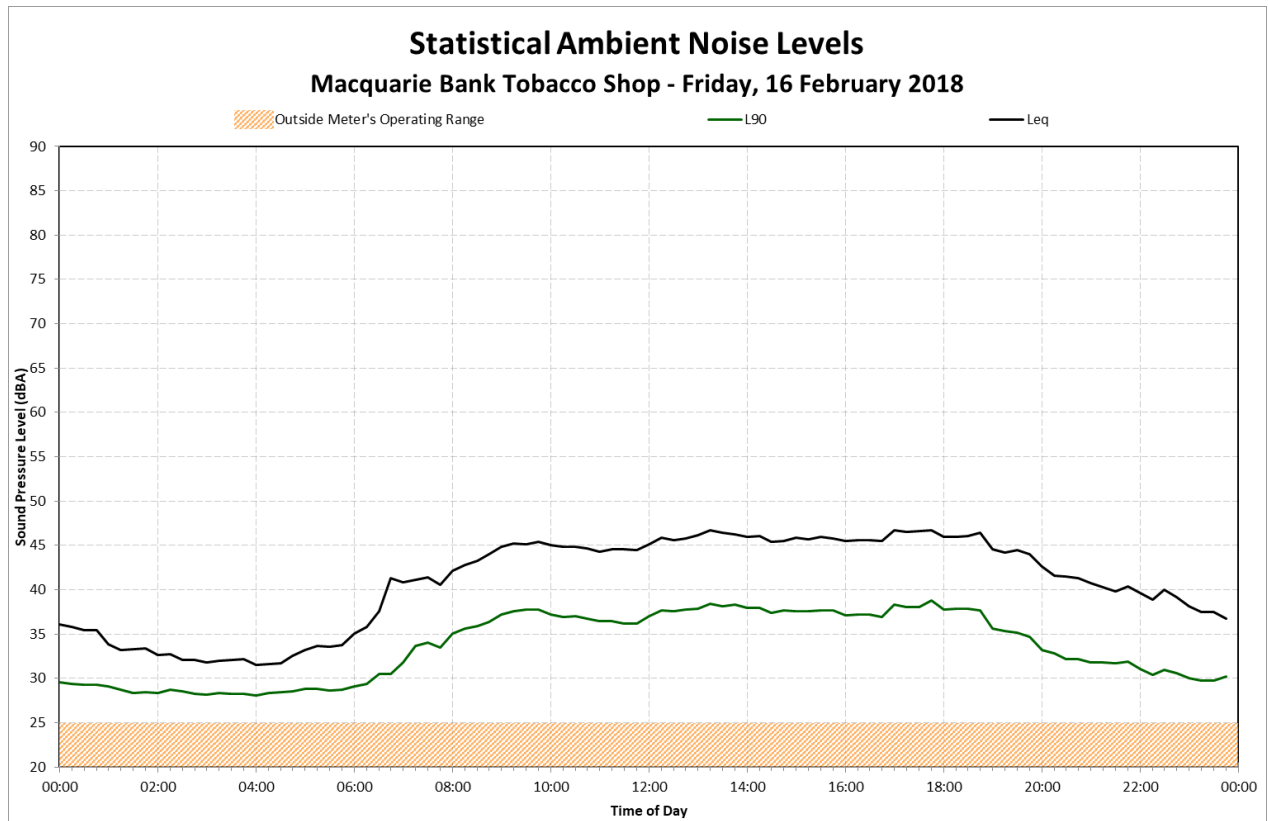
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

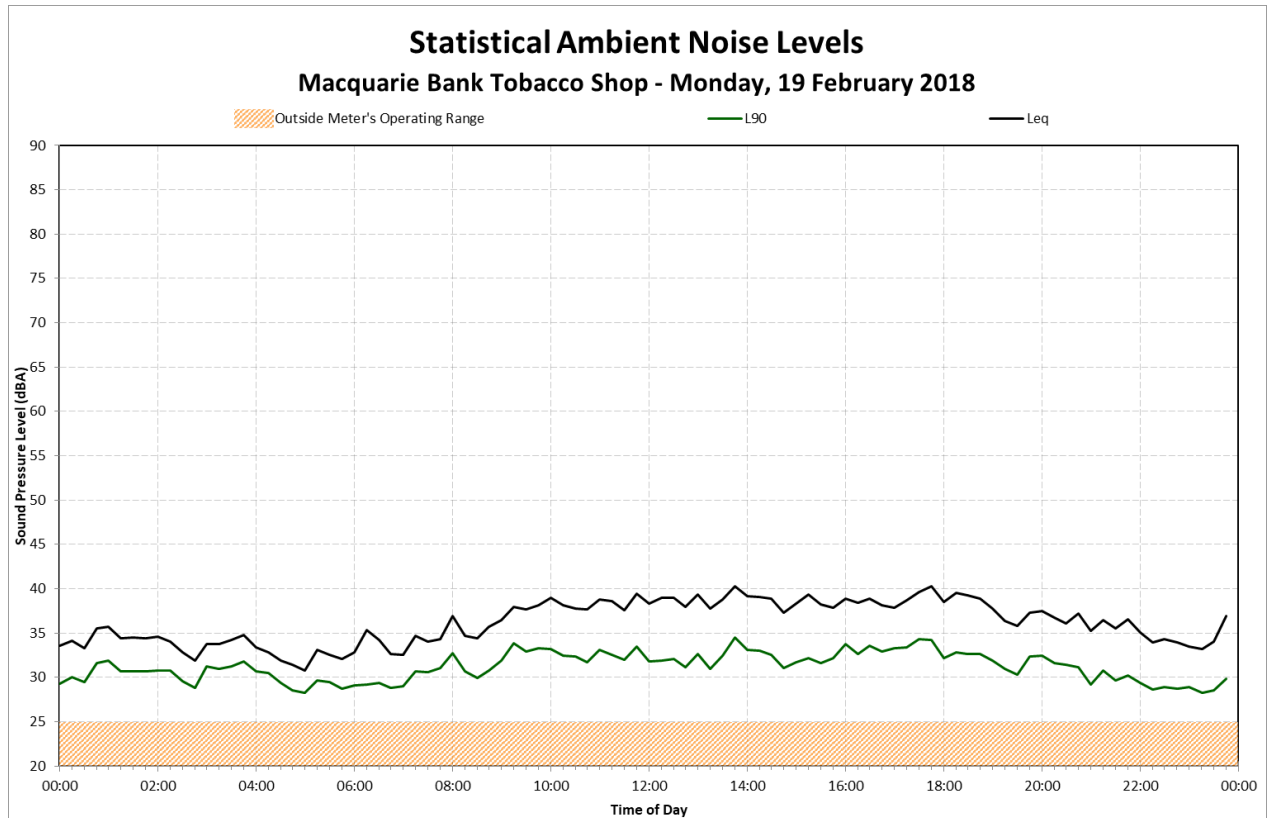
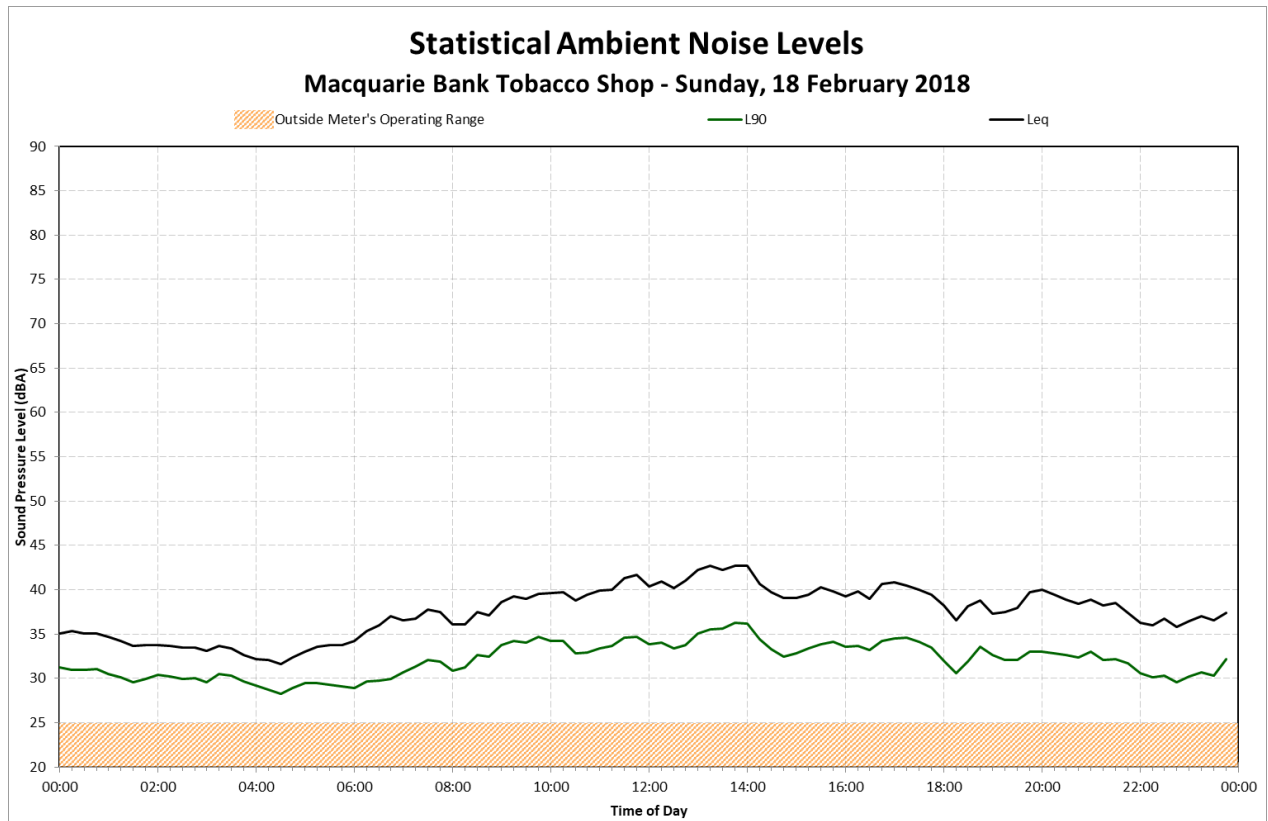
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

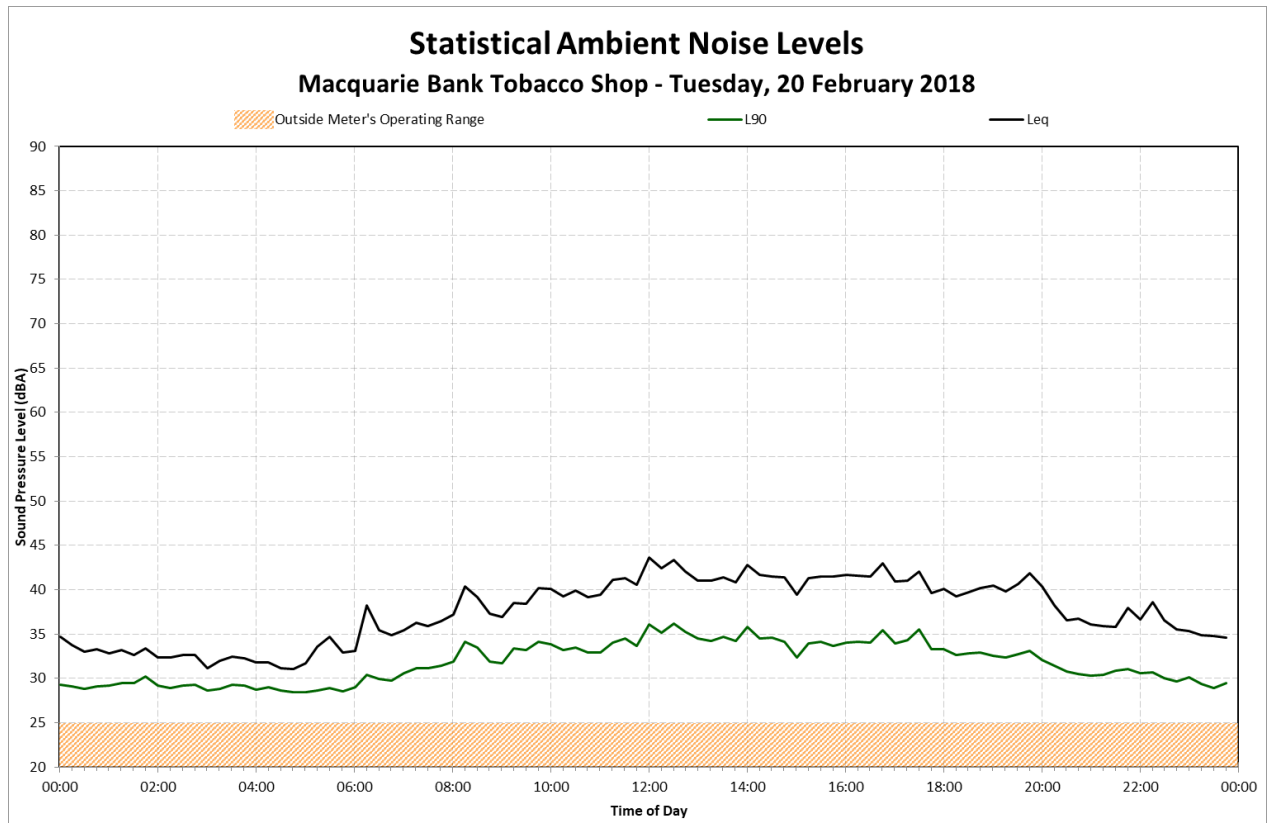
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

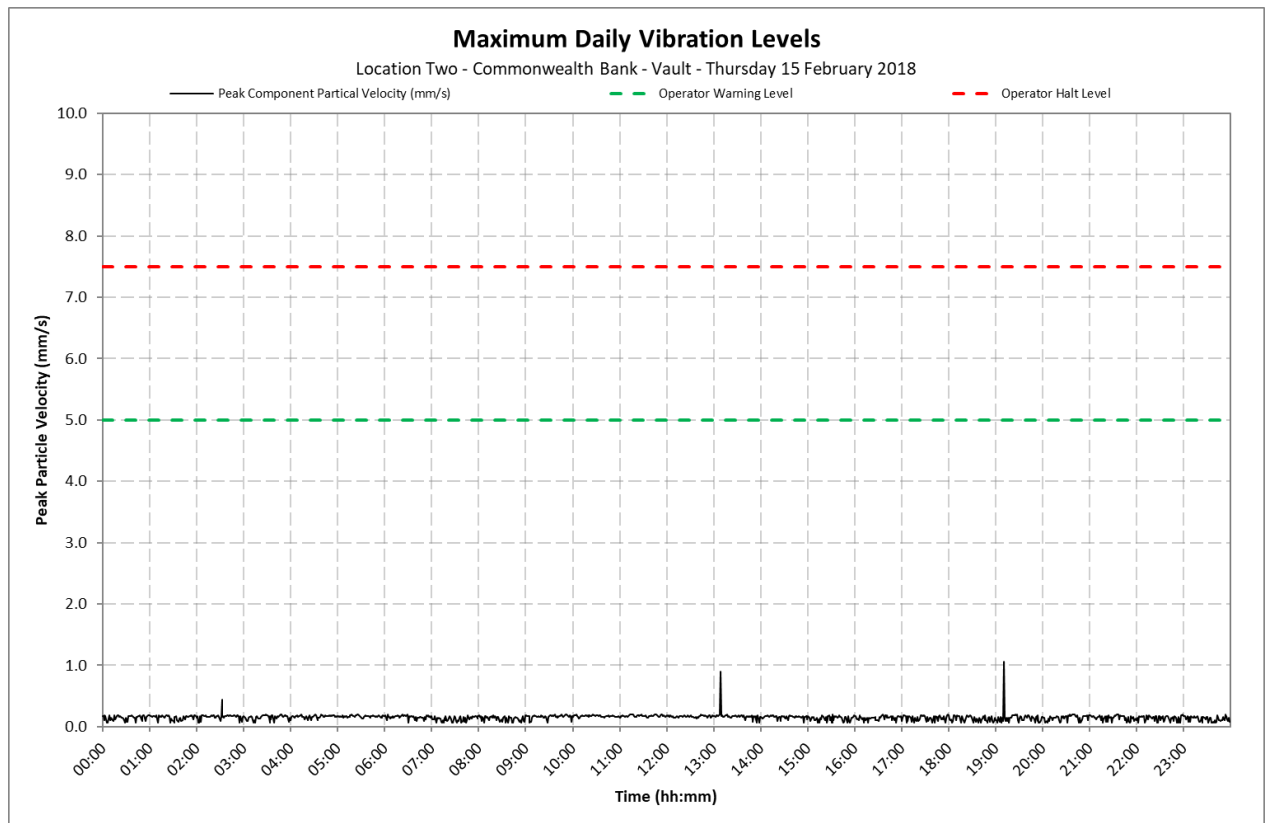
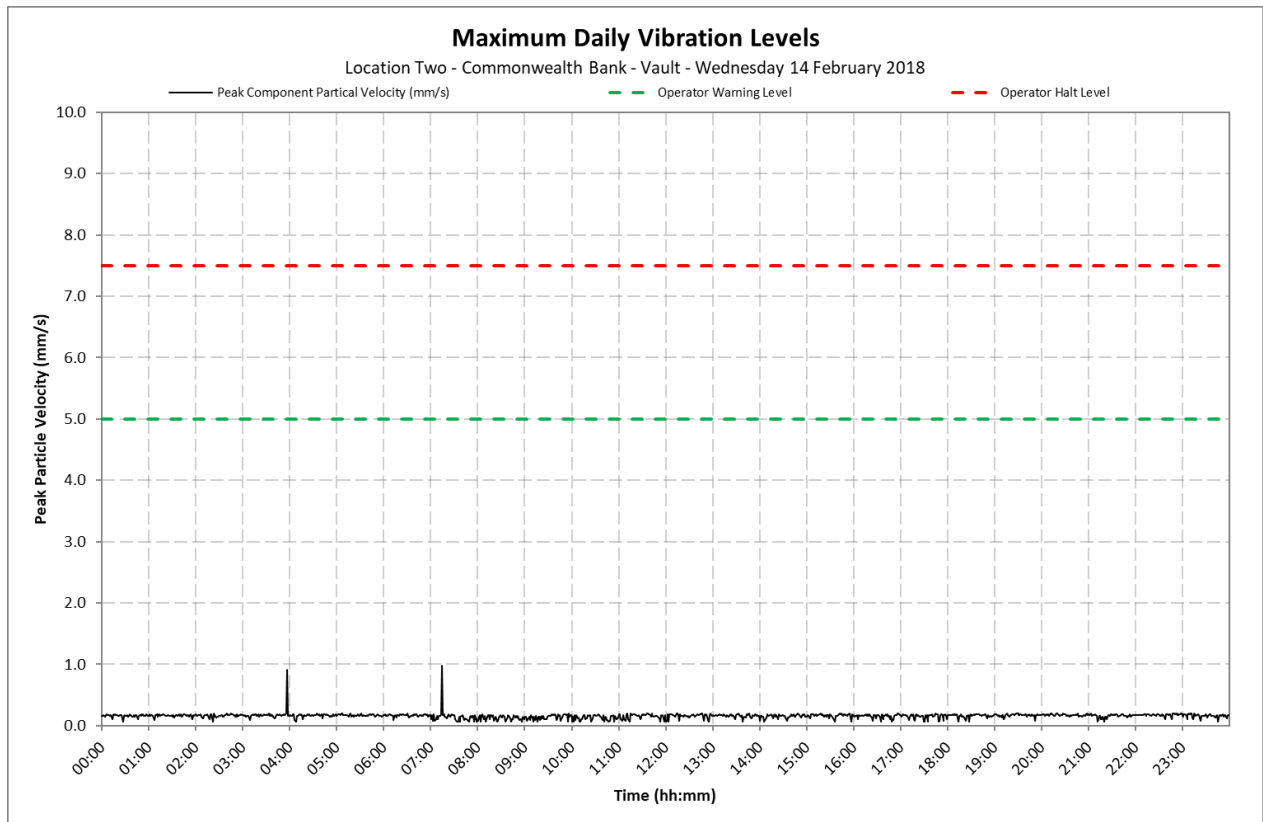
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

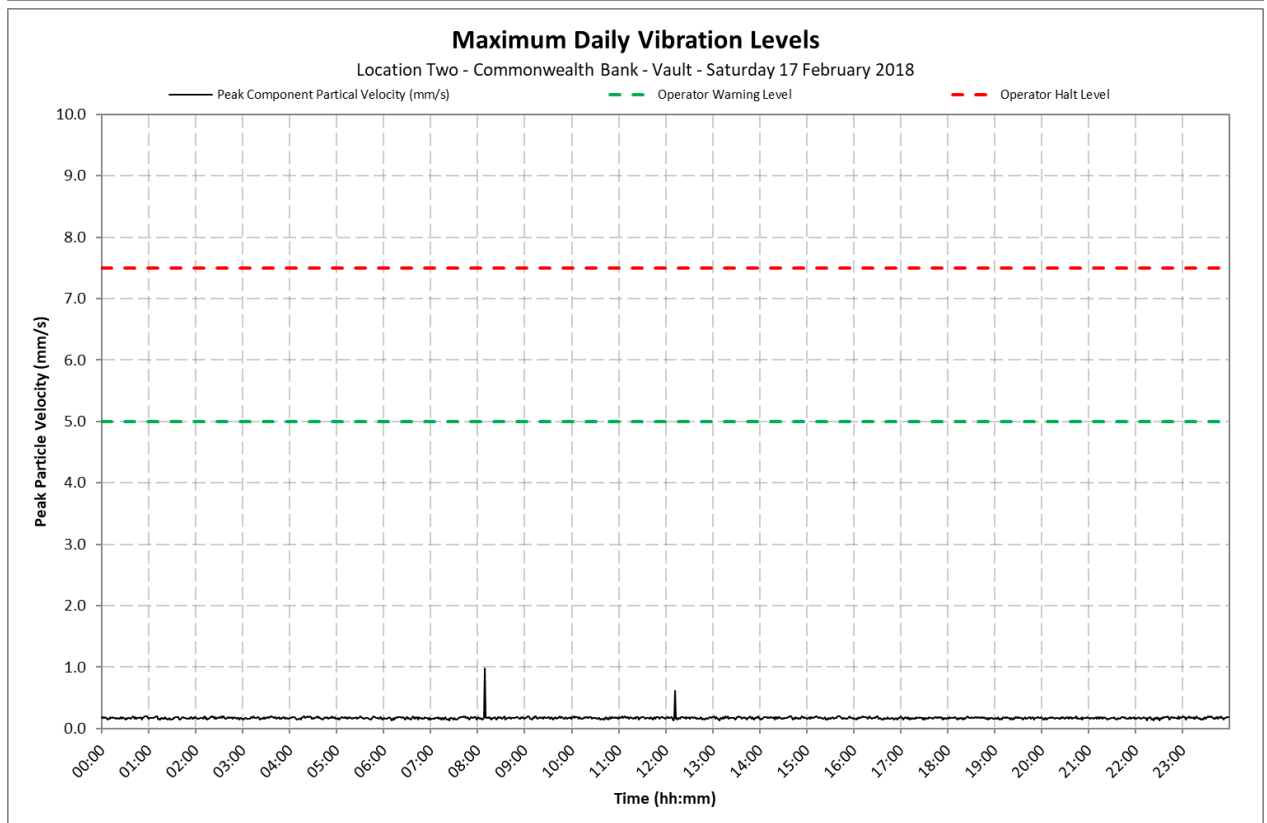
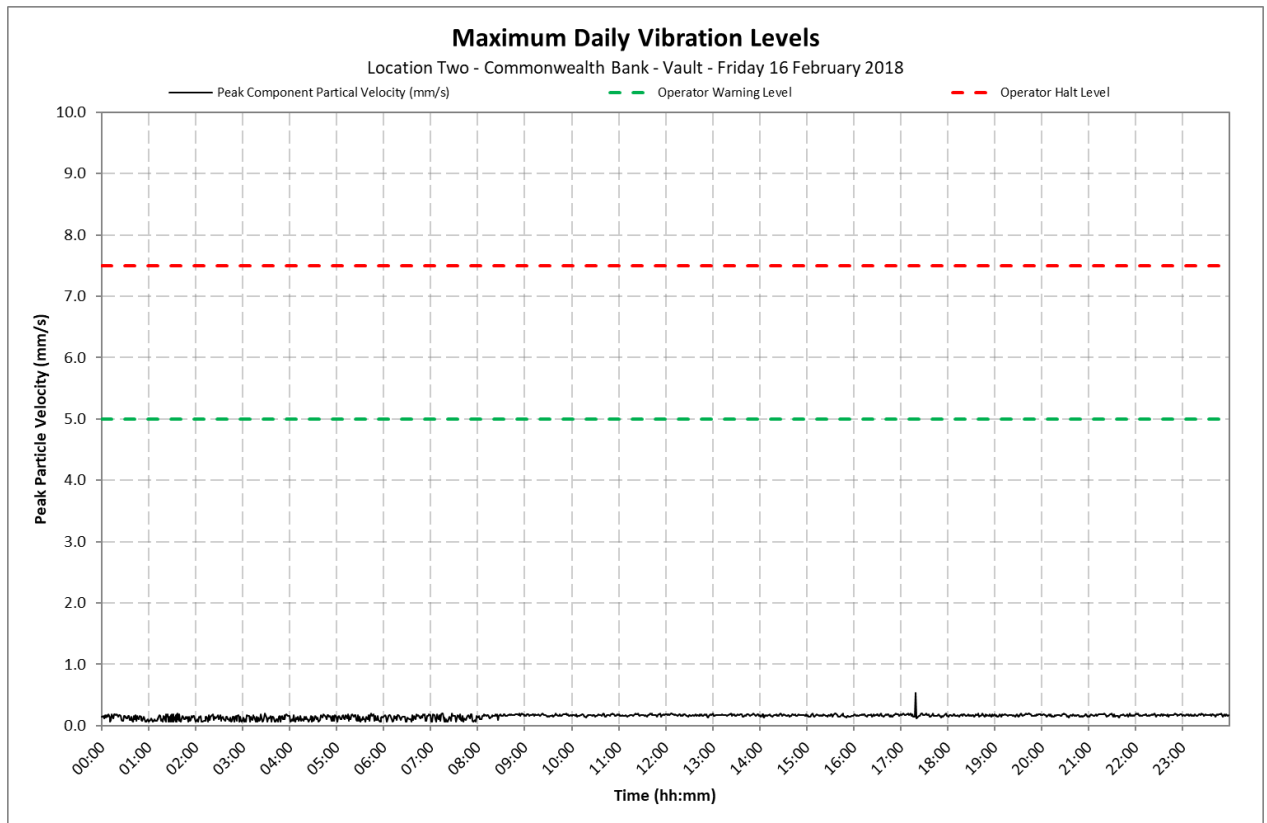
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

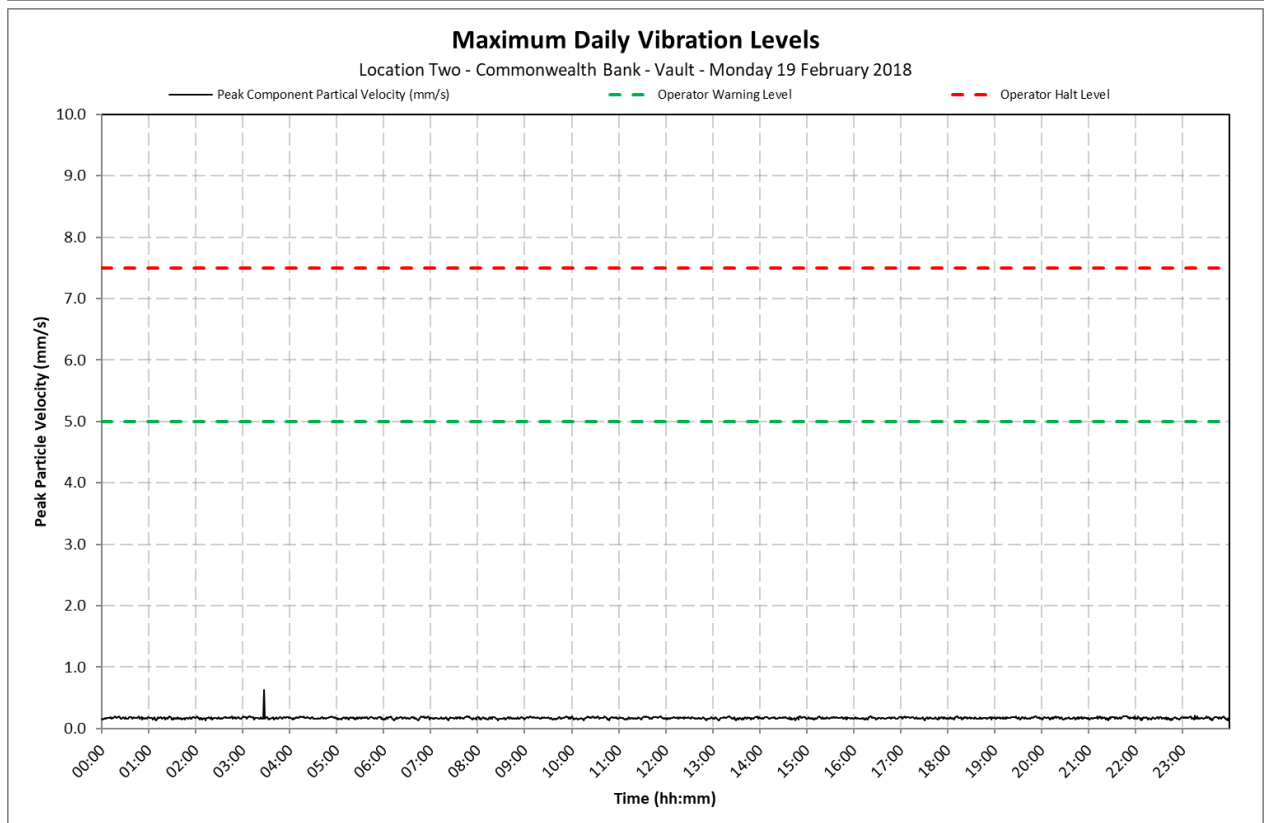
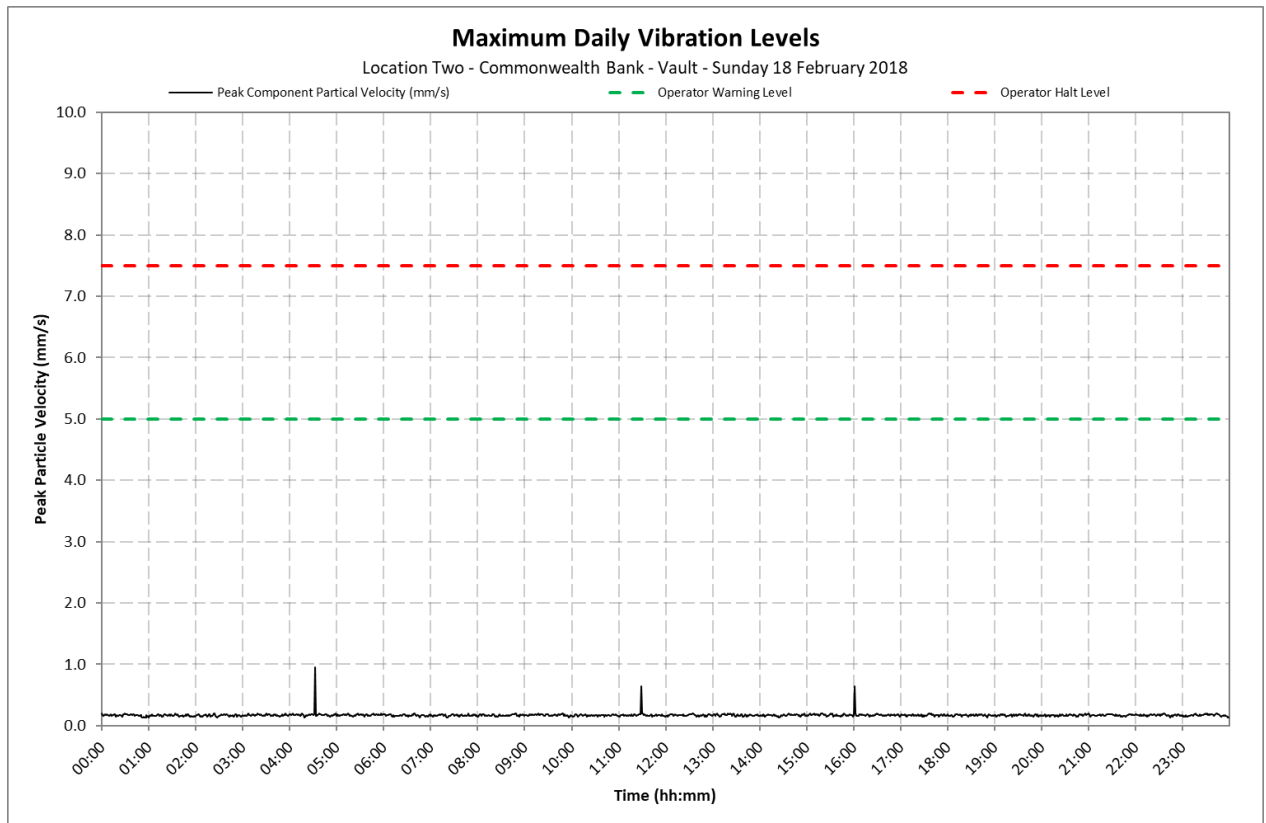
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

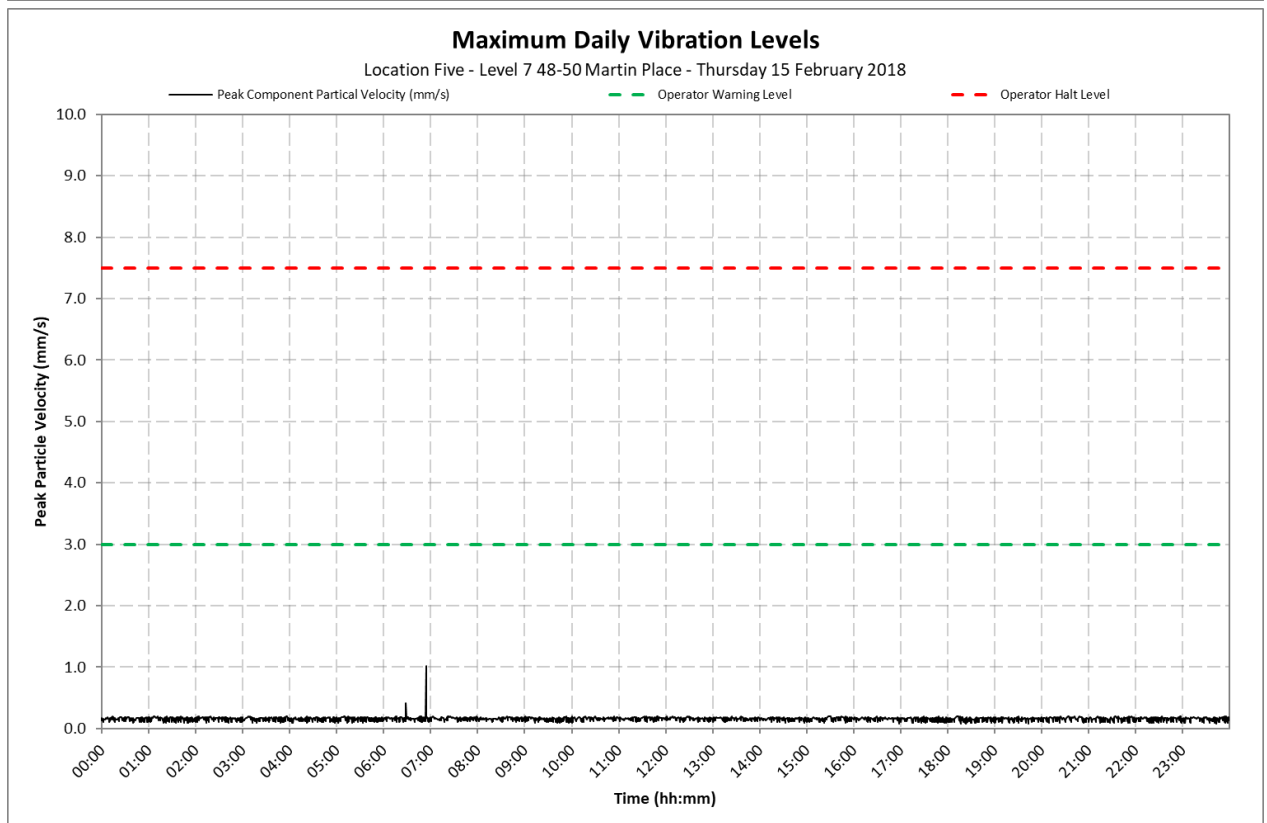
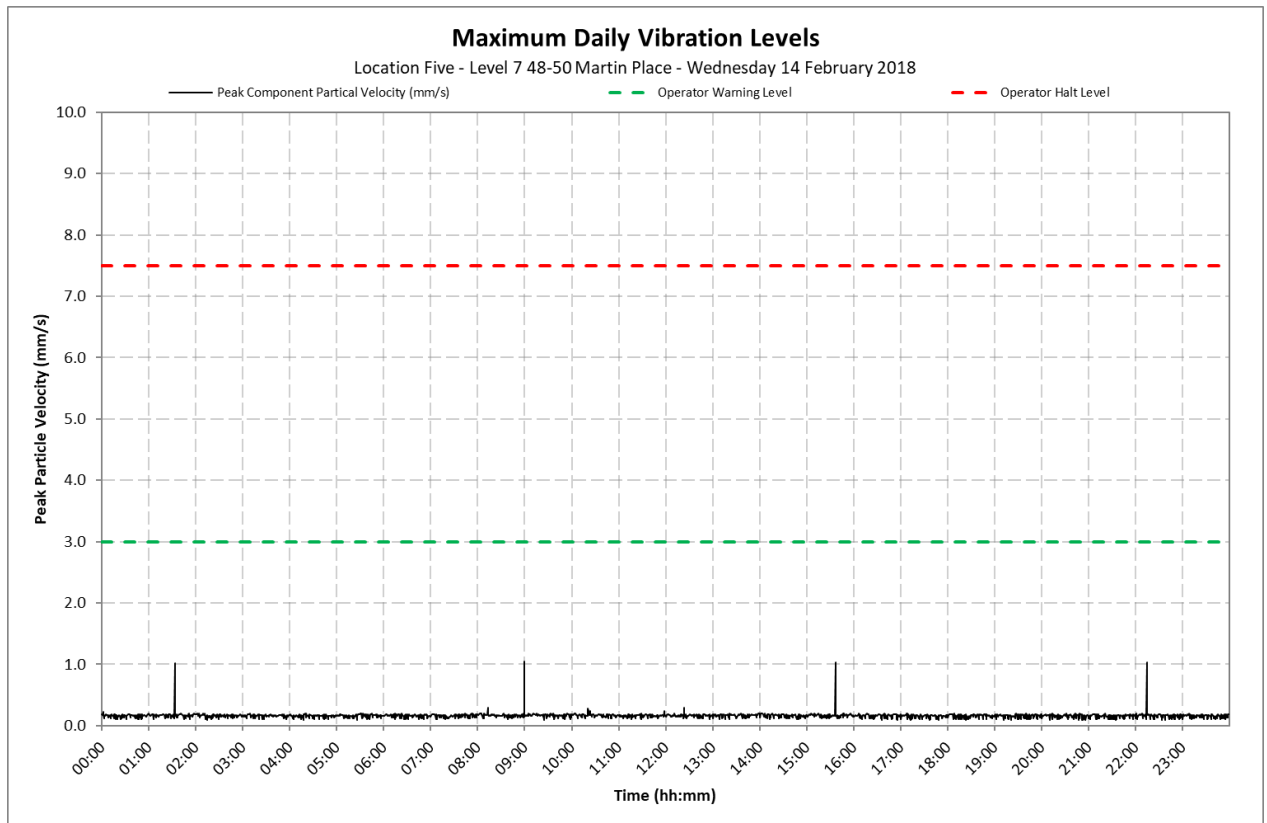
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

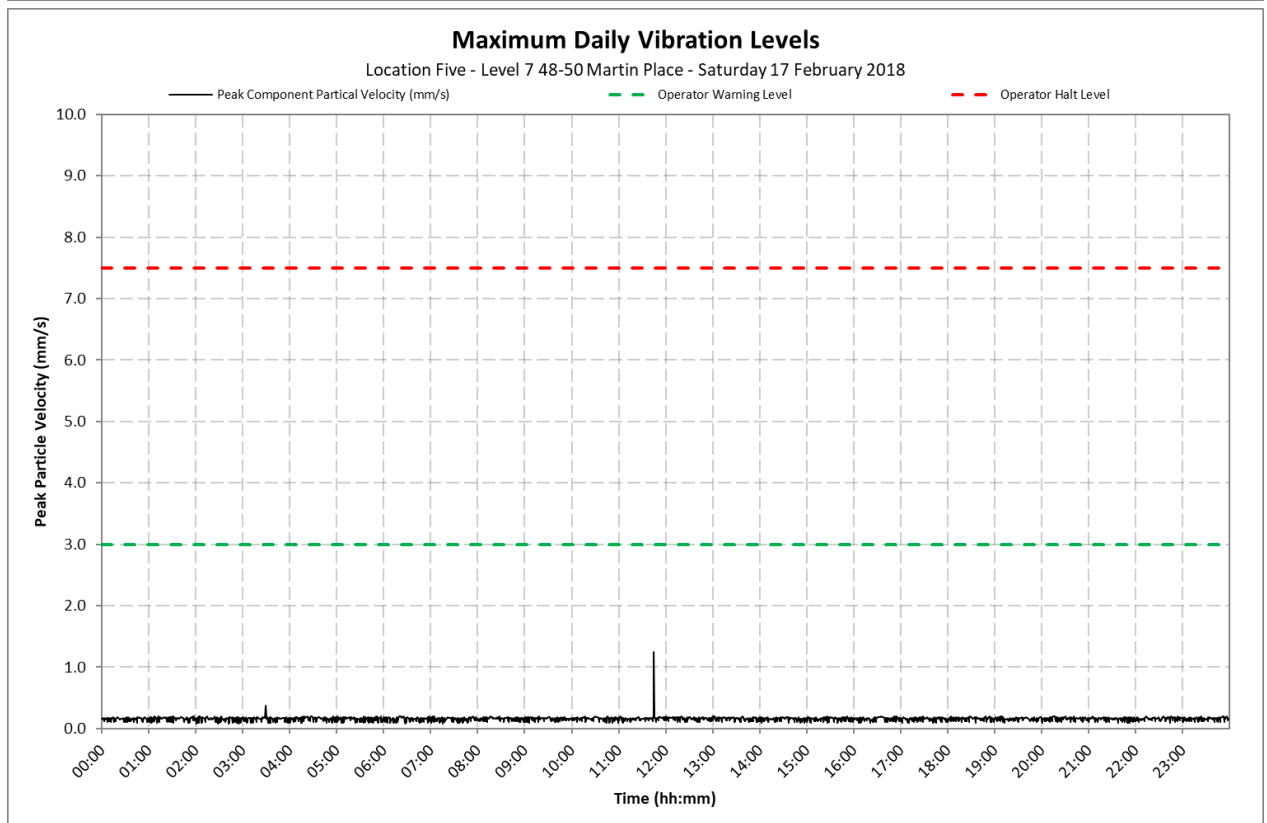
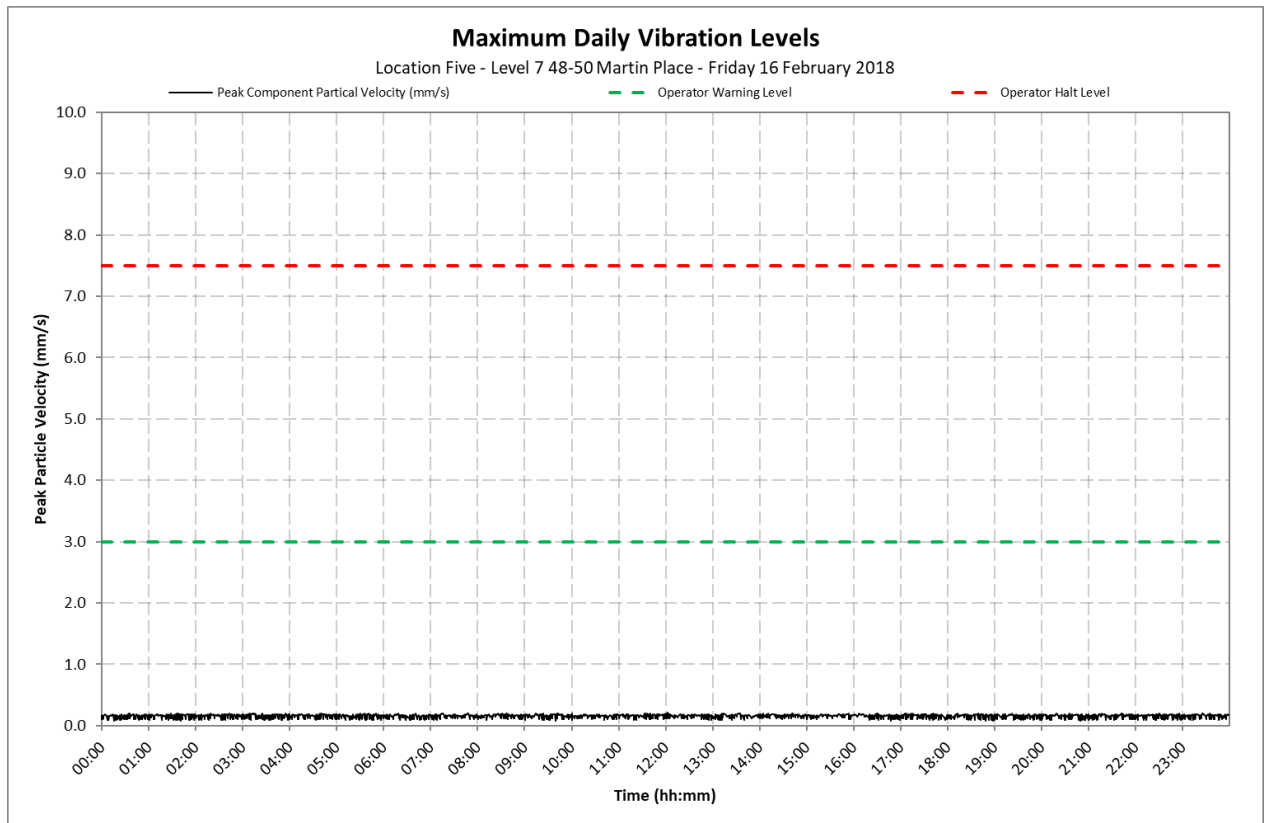
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

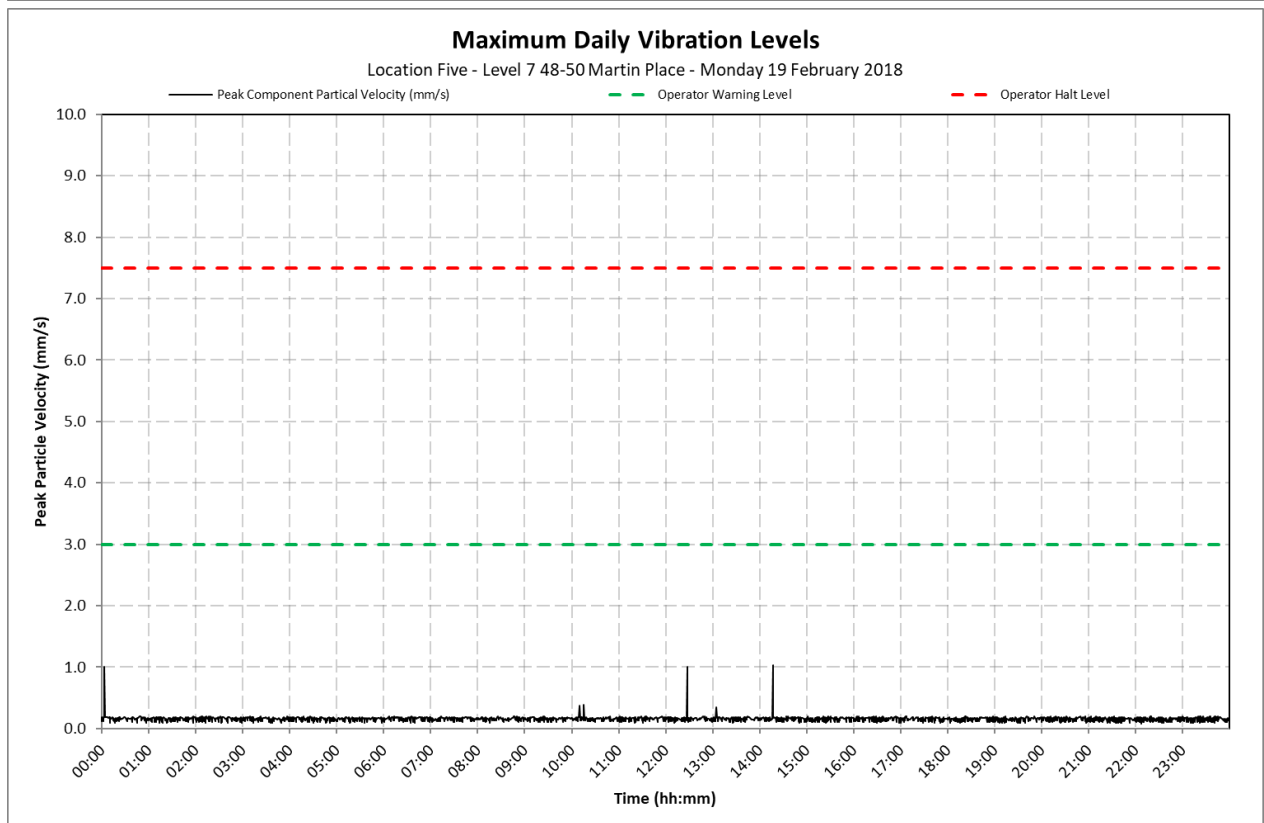
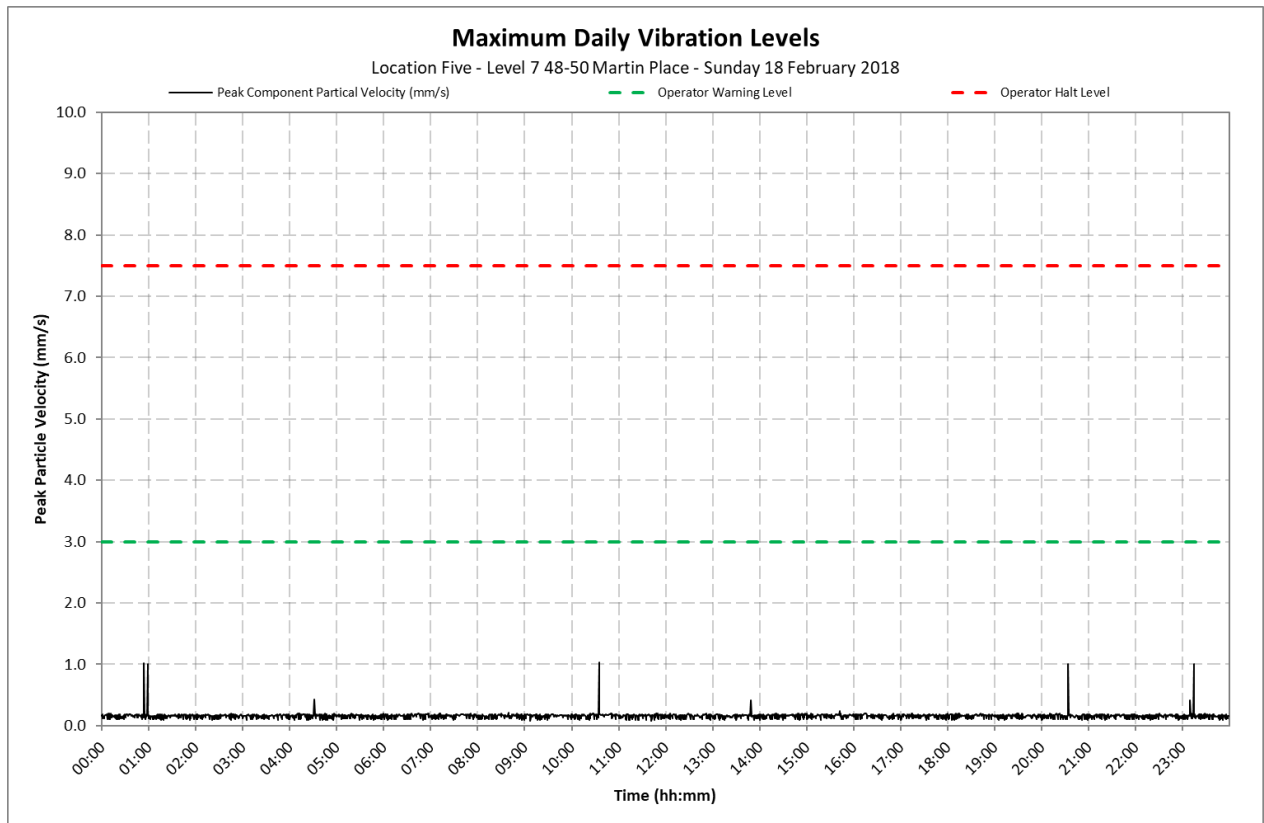
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

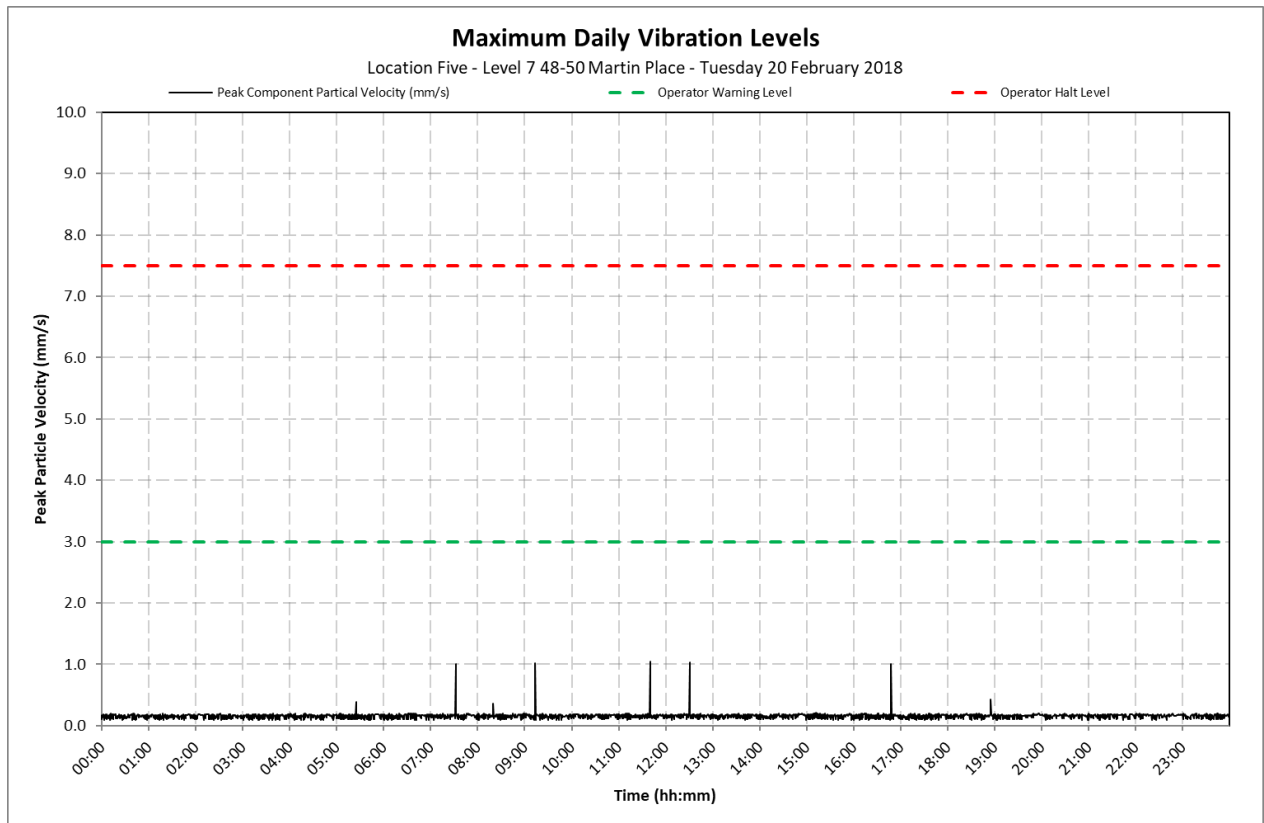
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



28 February 2018

10-1380 R21 NV Monitoring 20180228.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 21
21 February to 27 February 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 21 February to 27 February 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

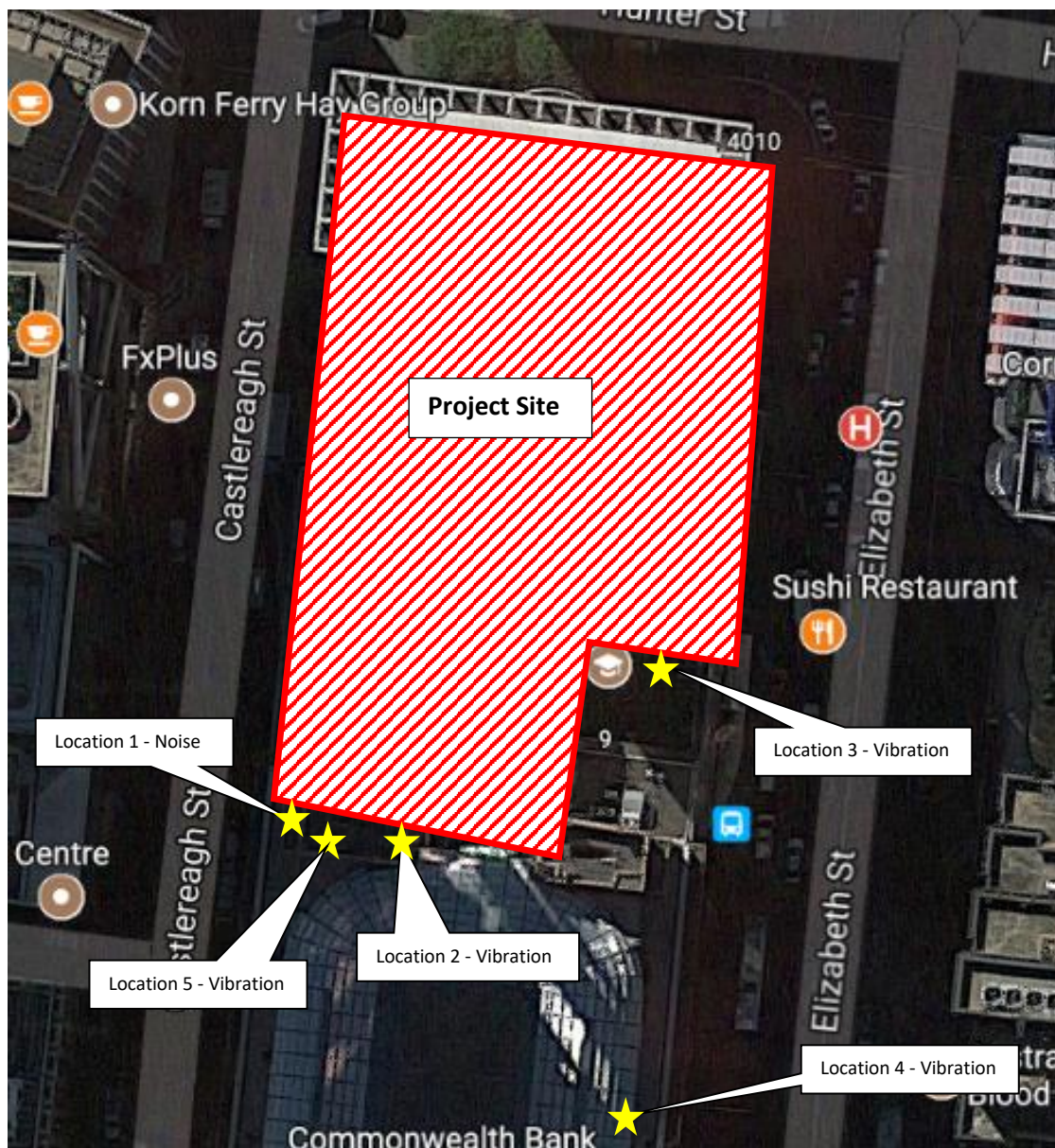
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 21 February to 27 February 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
21 February 2018	43	42	Complies	Complies
22 February 2018	45	44	Complies	Complies
23 February 2018	45	44	Complies	Complies
24 February 2018	45	44	Complies	Complies
25 February 2018	40	39	Complies	Complies
26 February 2018	39	37	Complies	Complies
27 February 2018	40	39	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 21 February to 27 February 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
21 February 2018	0.2 mm/s	Complies
22 February 2018	1.1 mm/s	Complies
23 February 2018	0.4 mm/s	Complies
24 February 2018	0.6 mm/s	Complies
25 February 2018	0.4 mm/s	Complies
26 February 2018	1.0 mm/s	Complies
27 February 2018	1.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
21 February 2018	0.3 mm/s	Complies
22 February 2018	0.2 mm/s	Complies
23 February 2018	0.9 mm/s	Complies
24 February 2018	0.3 mm/s	Complies
25 February 2018	0.2 mm/s	Complies
26 February 2018	0.2 mm/s	Complies
27 February 2018	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 21 February to 27 February 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 21 February to 27 February 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

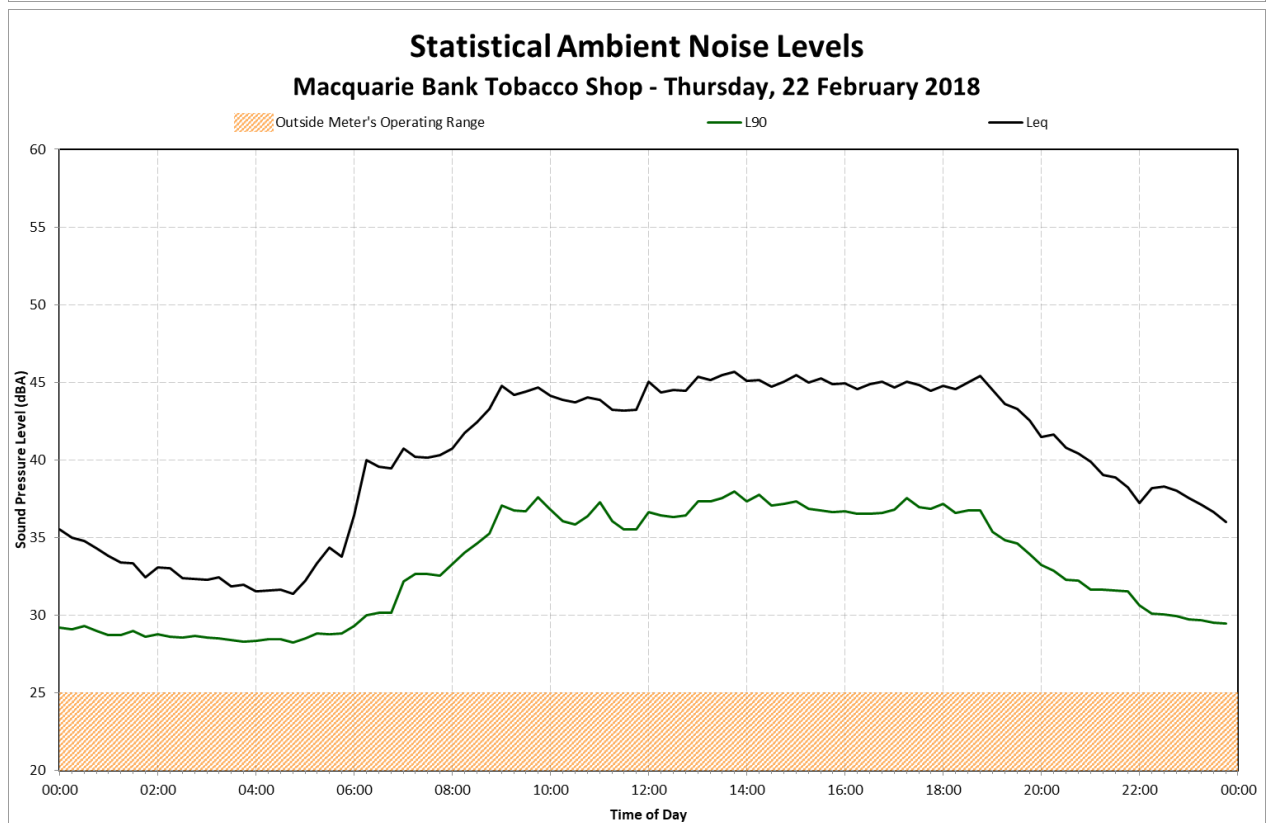
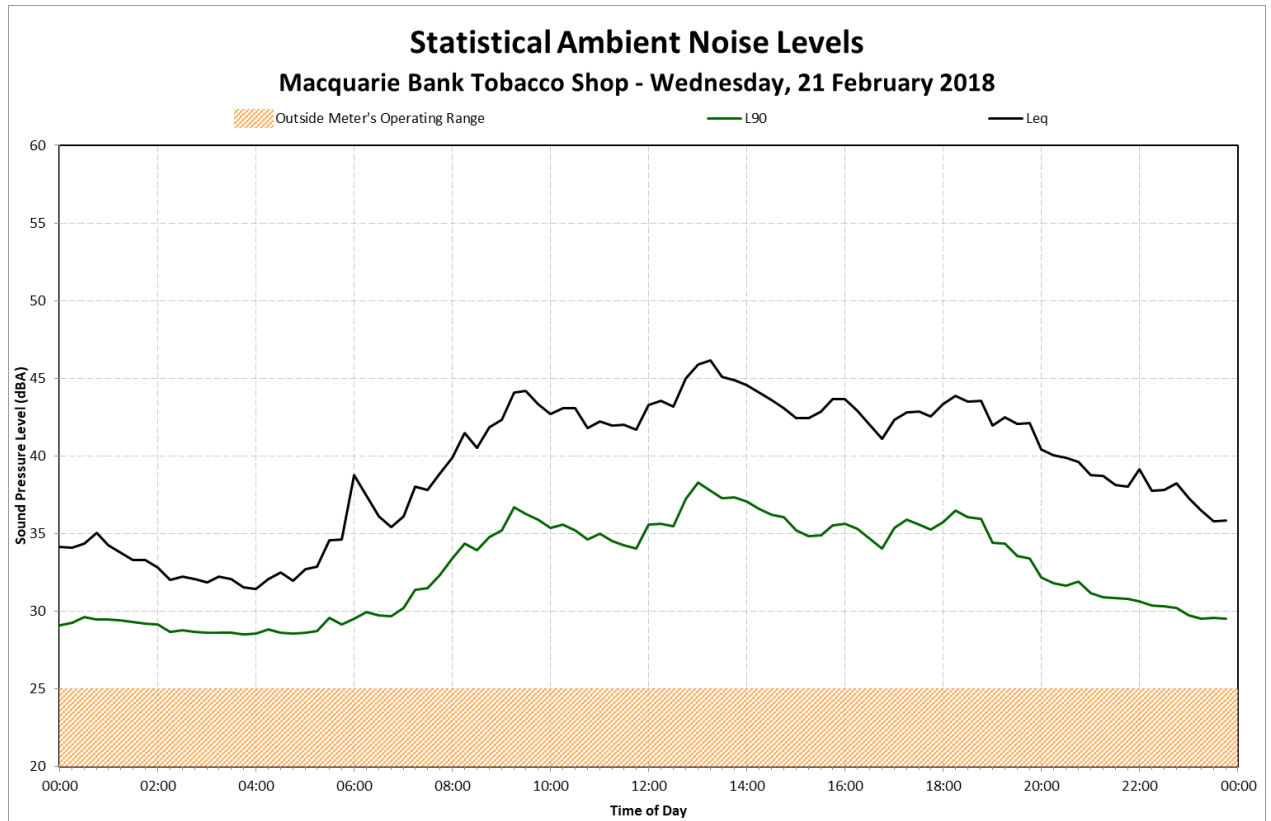
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

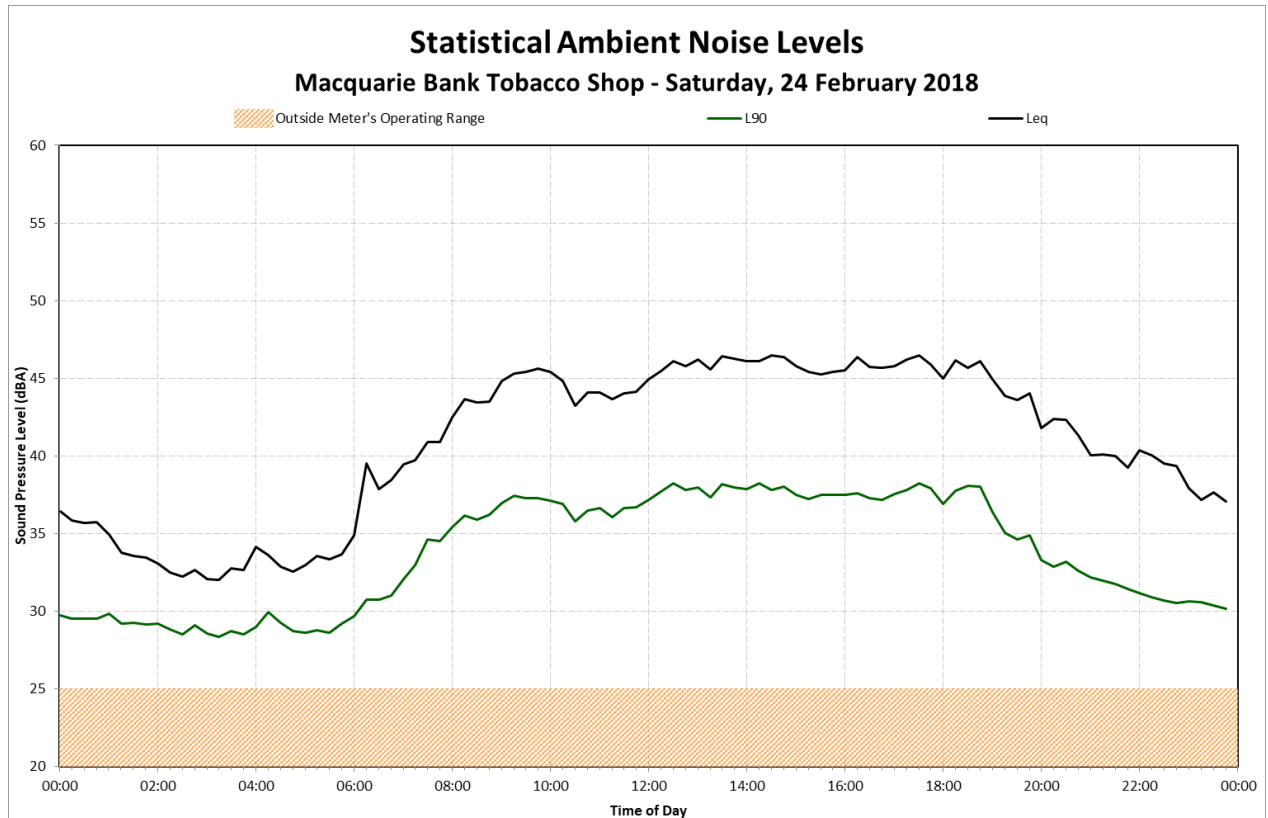
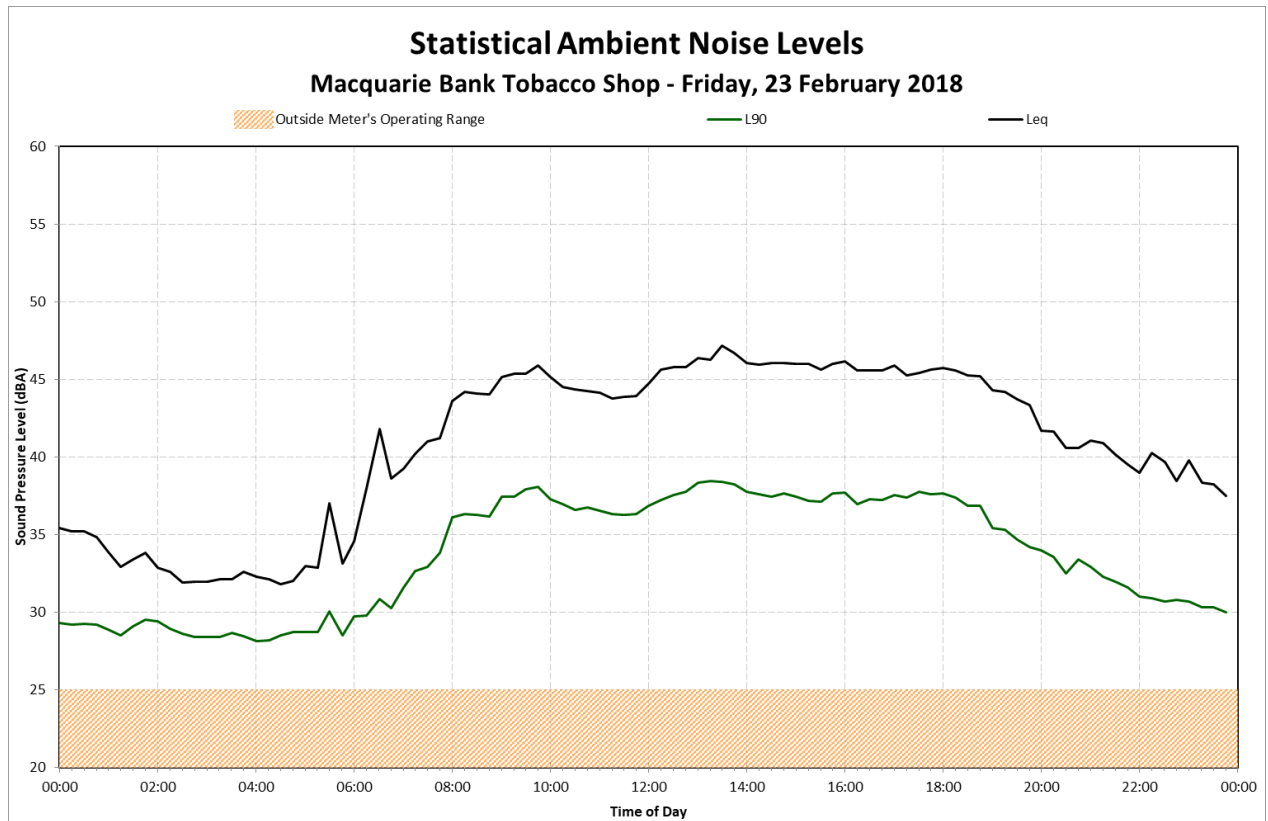
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

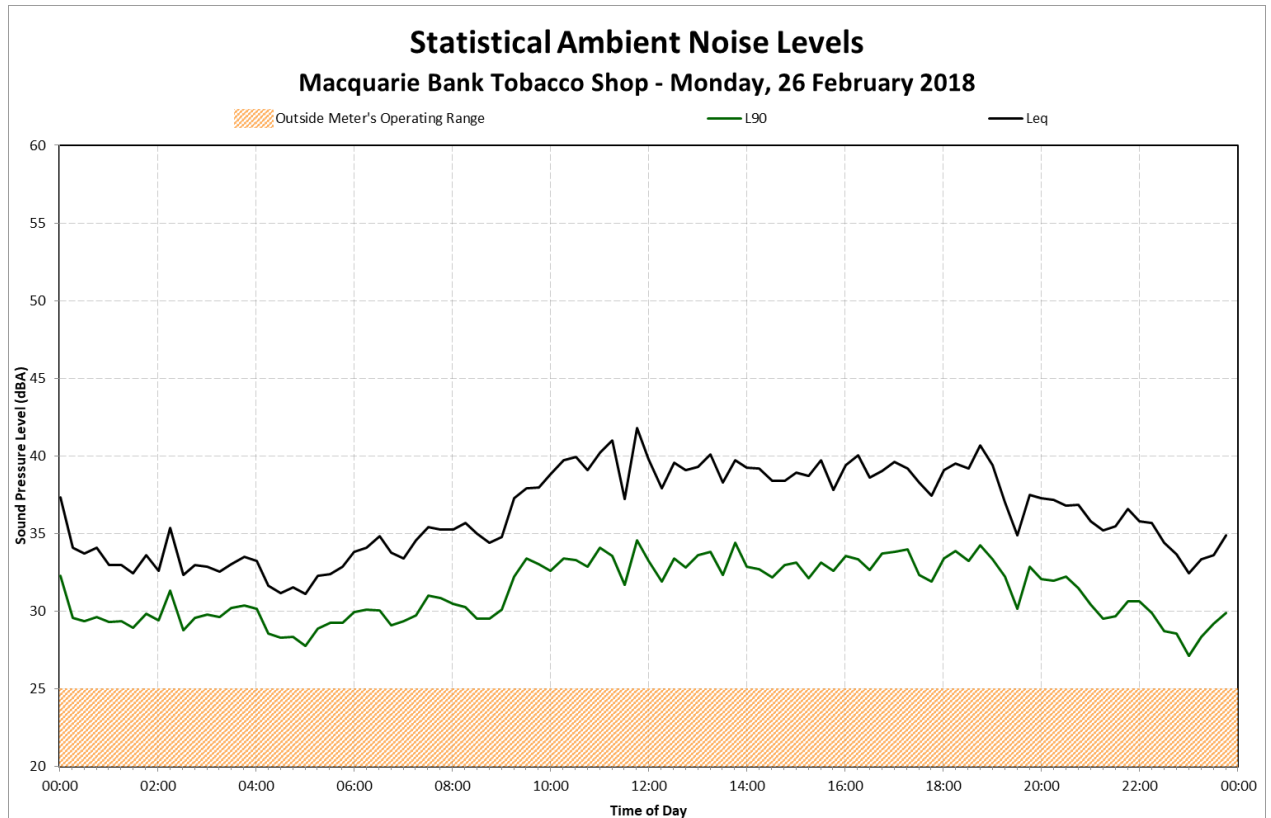
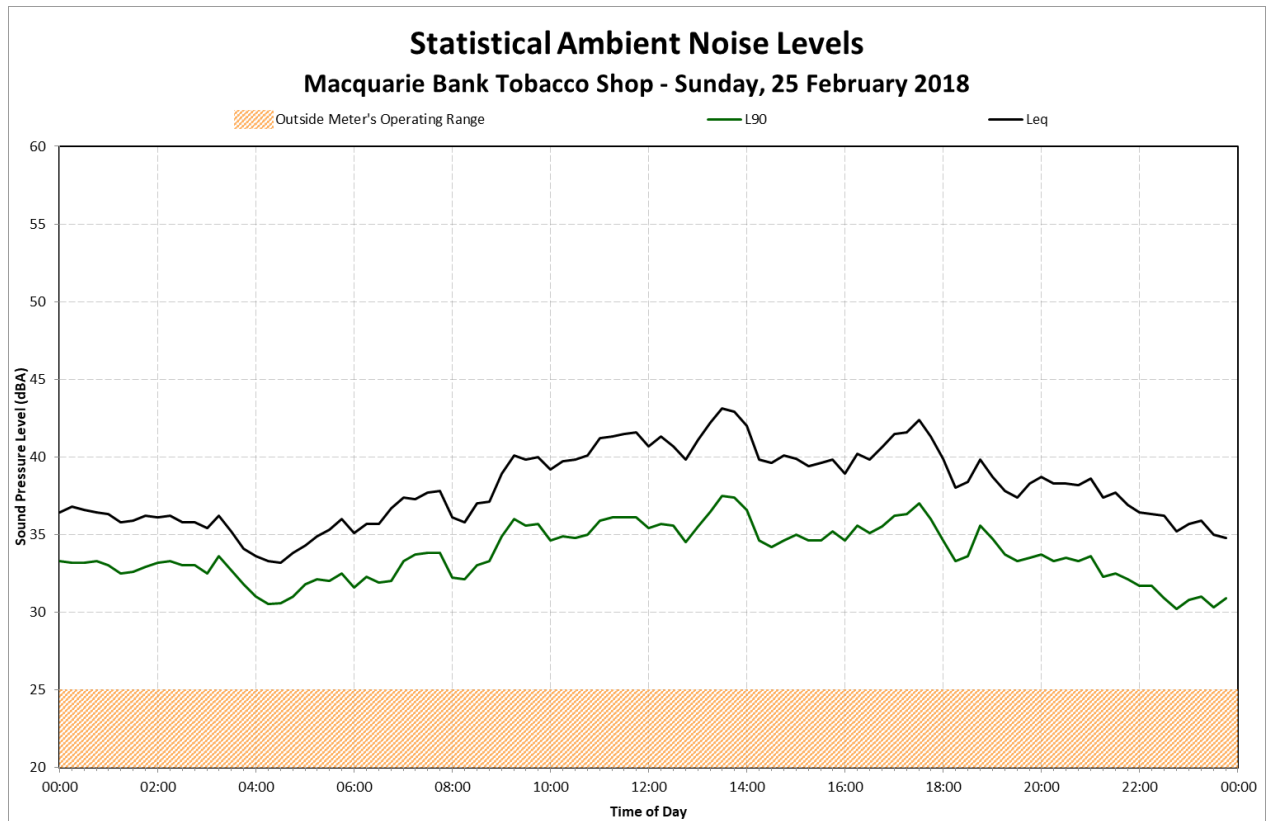
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

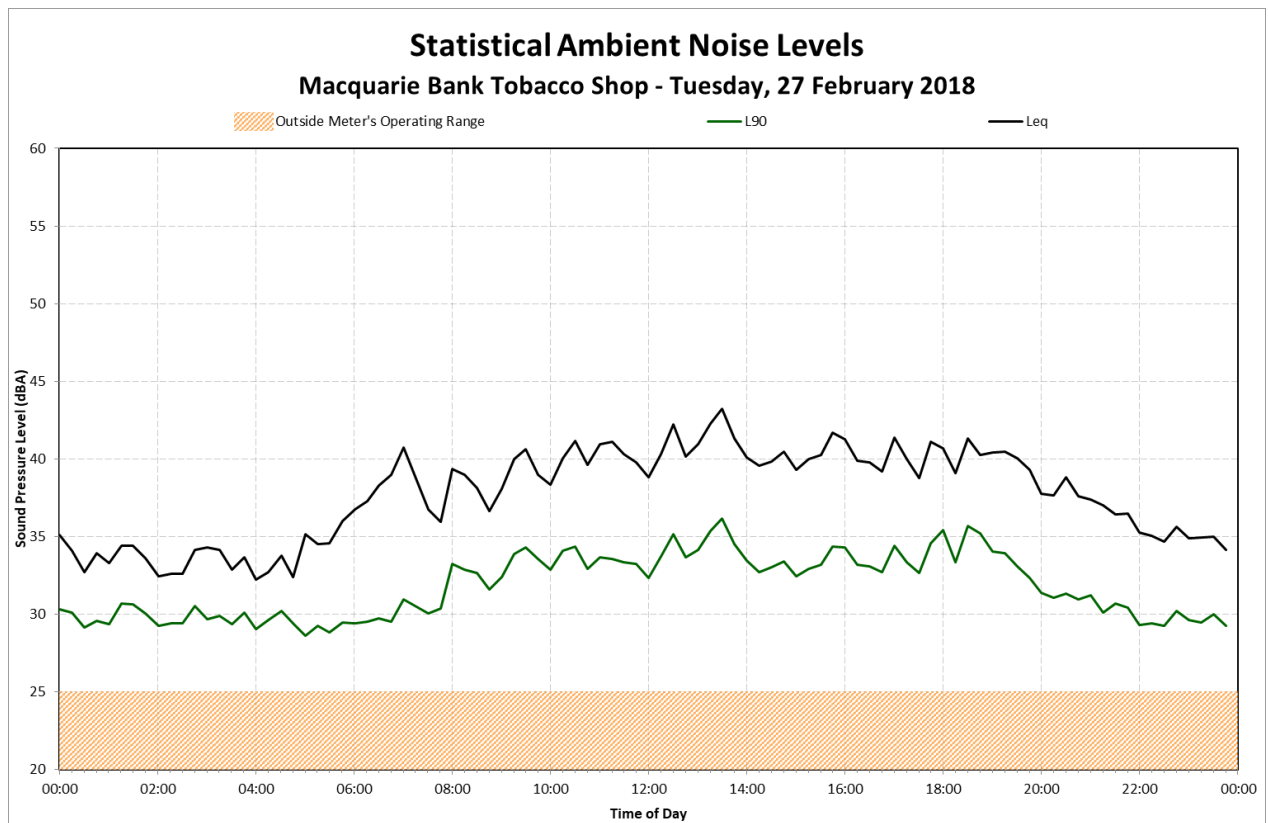
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

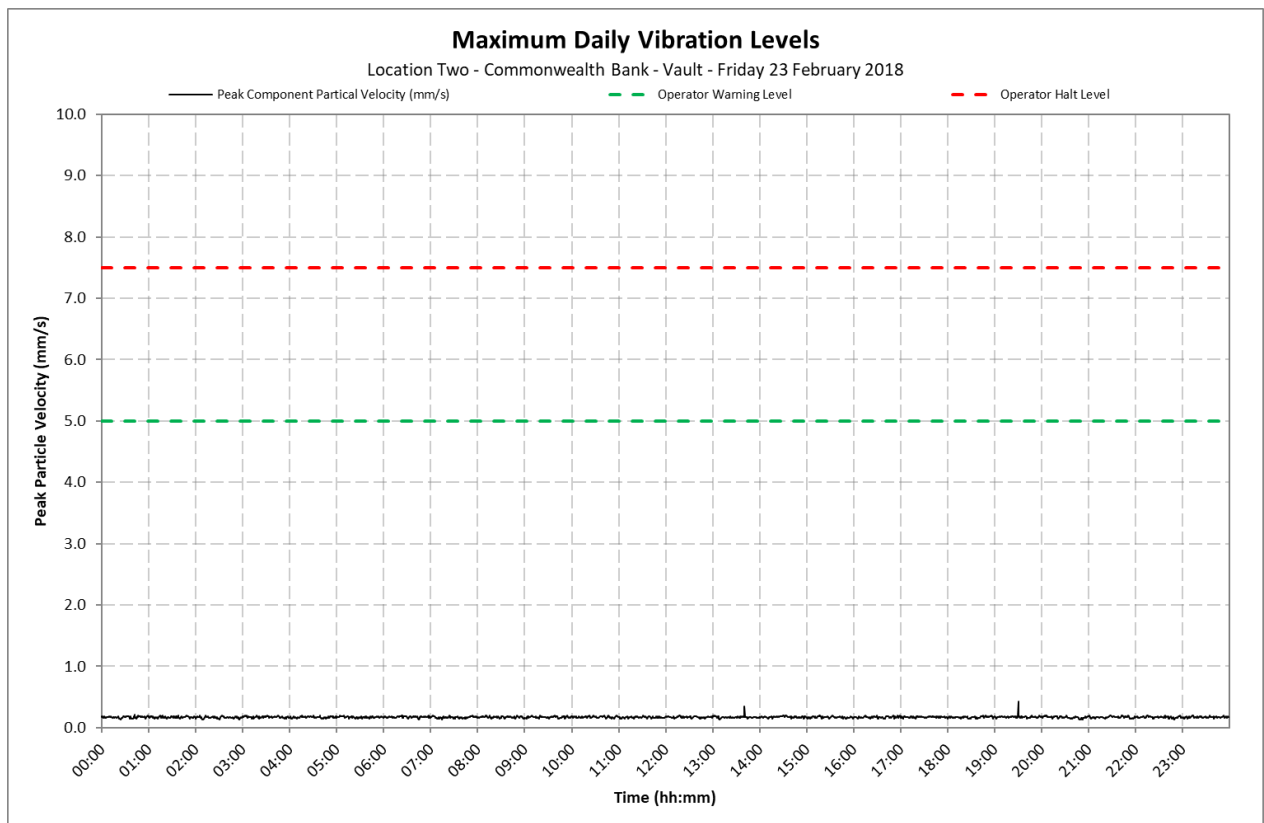
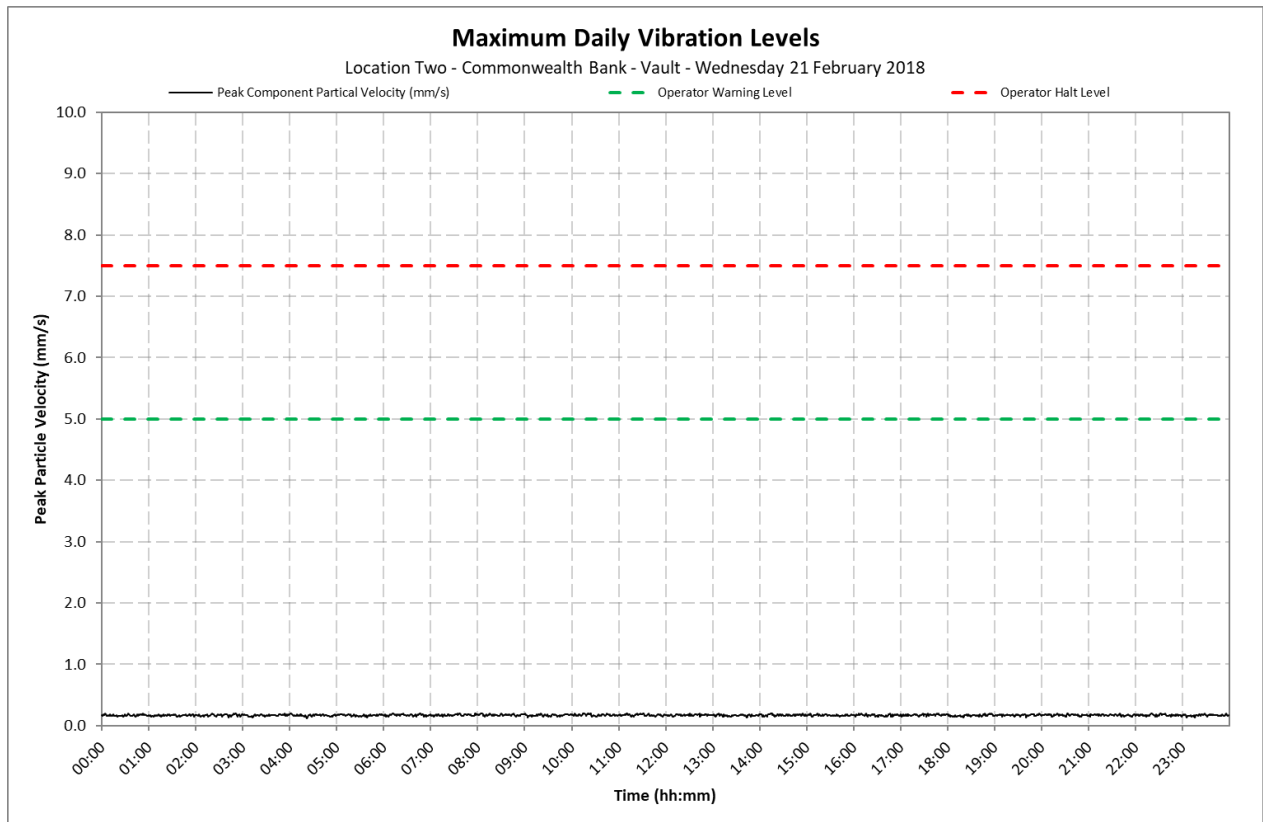
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

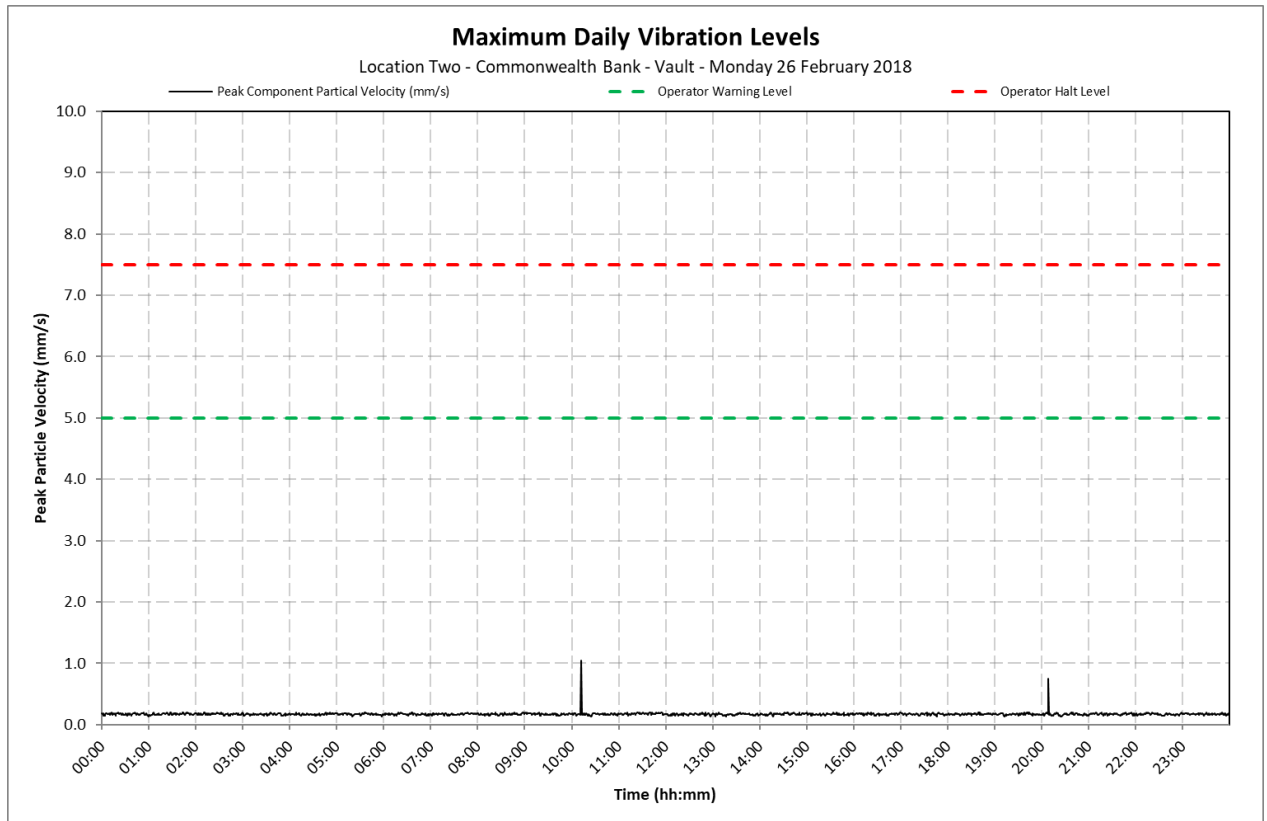
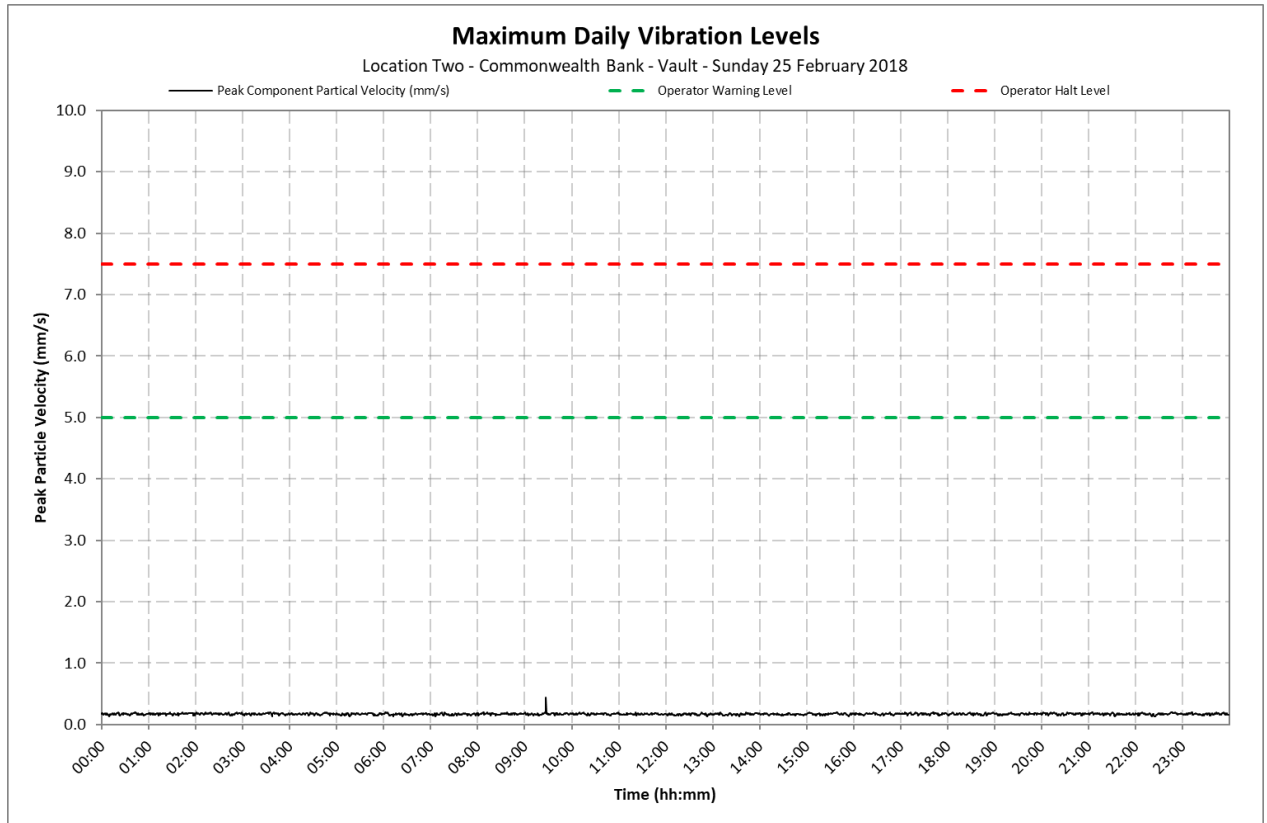
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

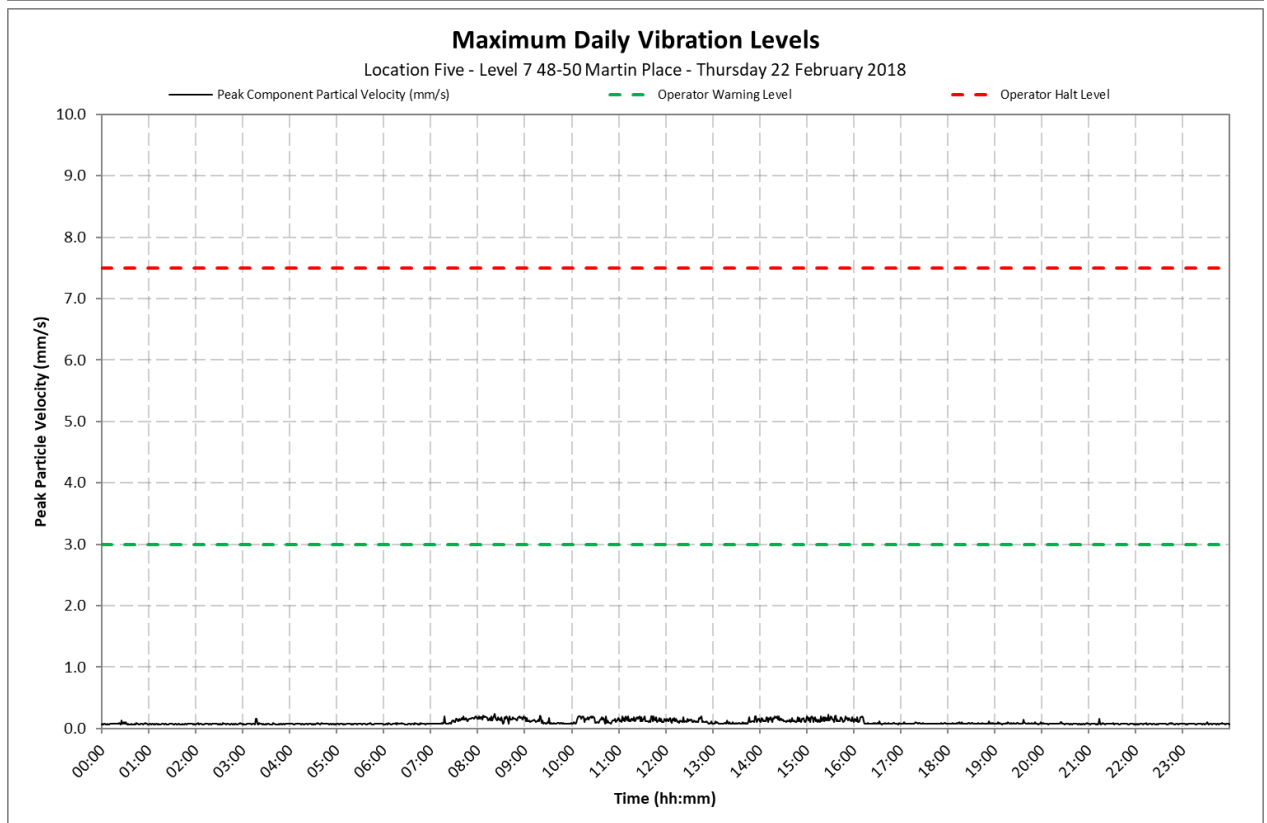
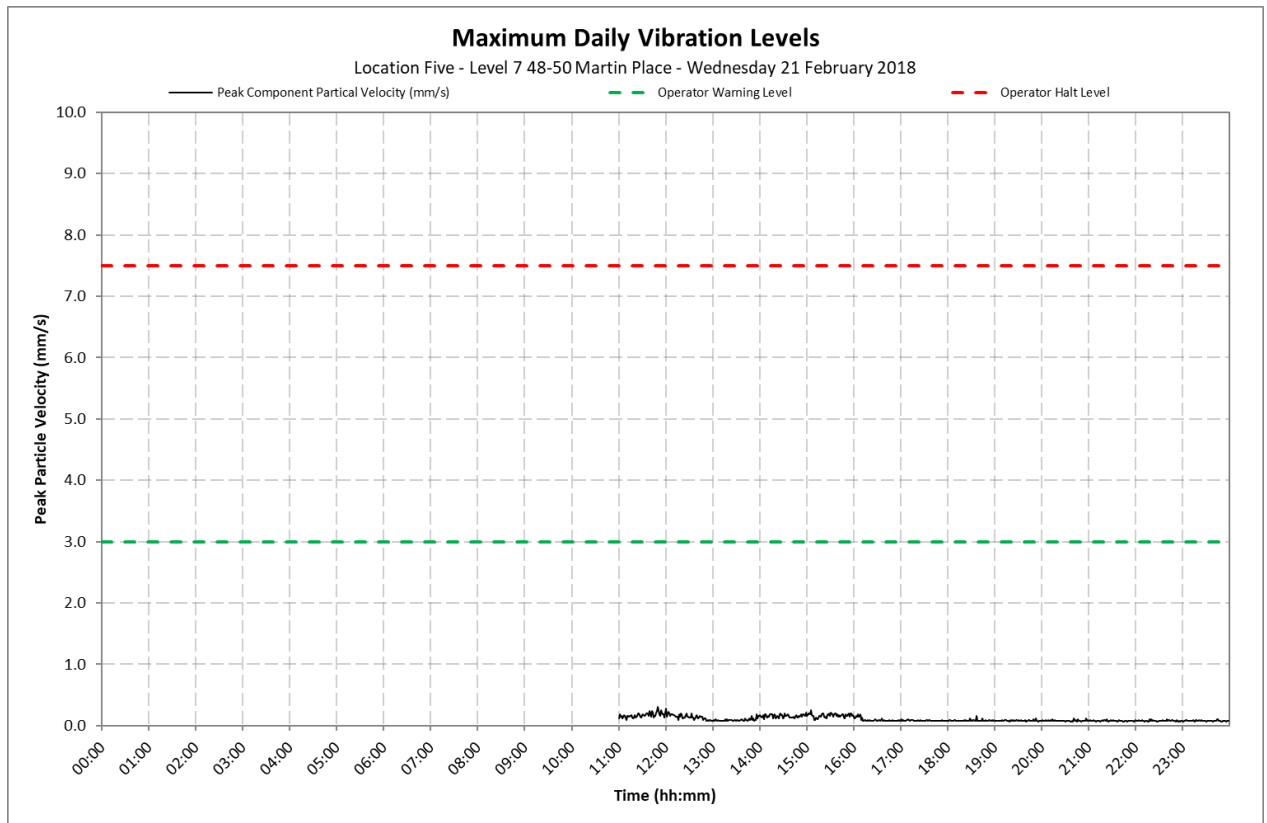
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

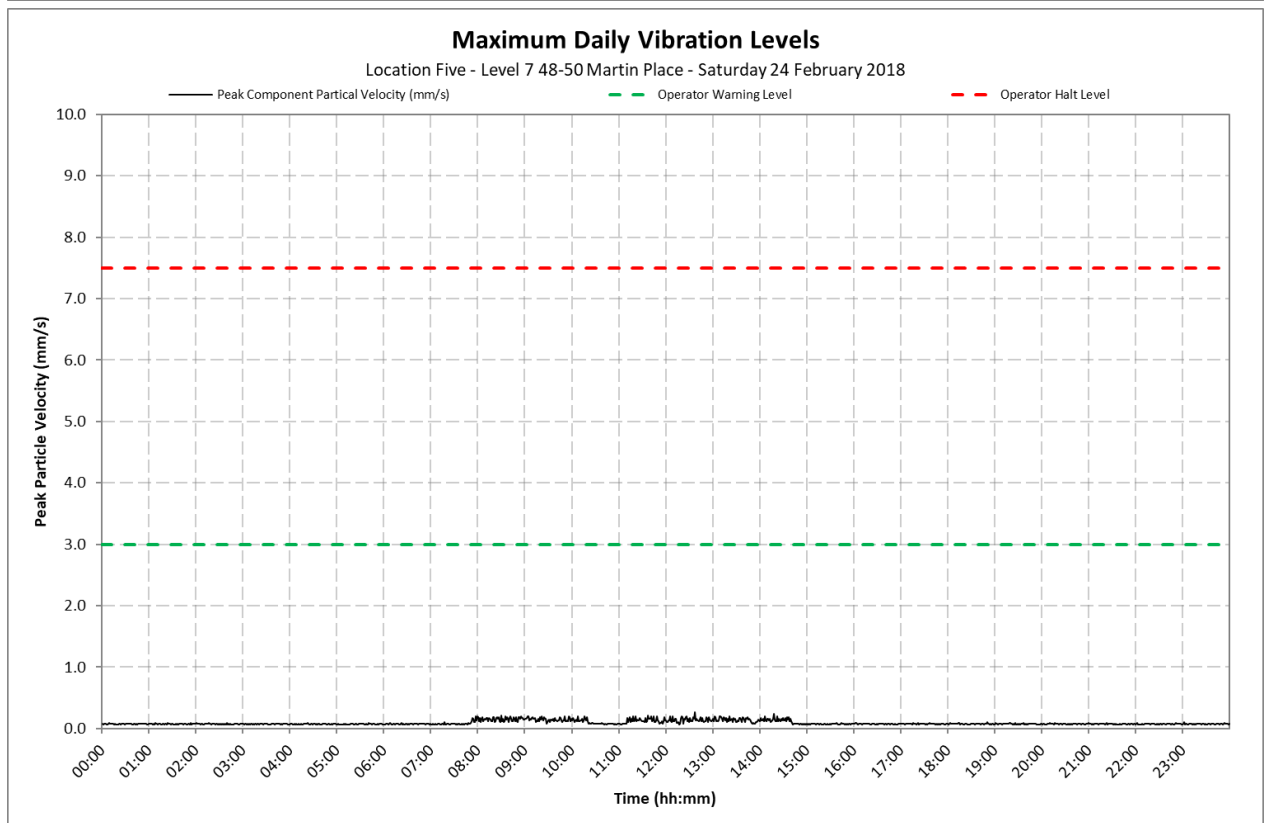
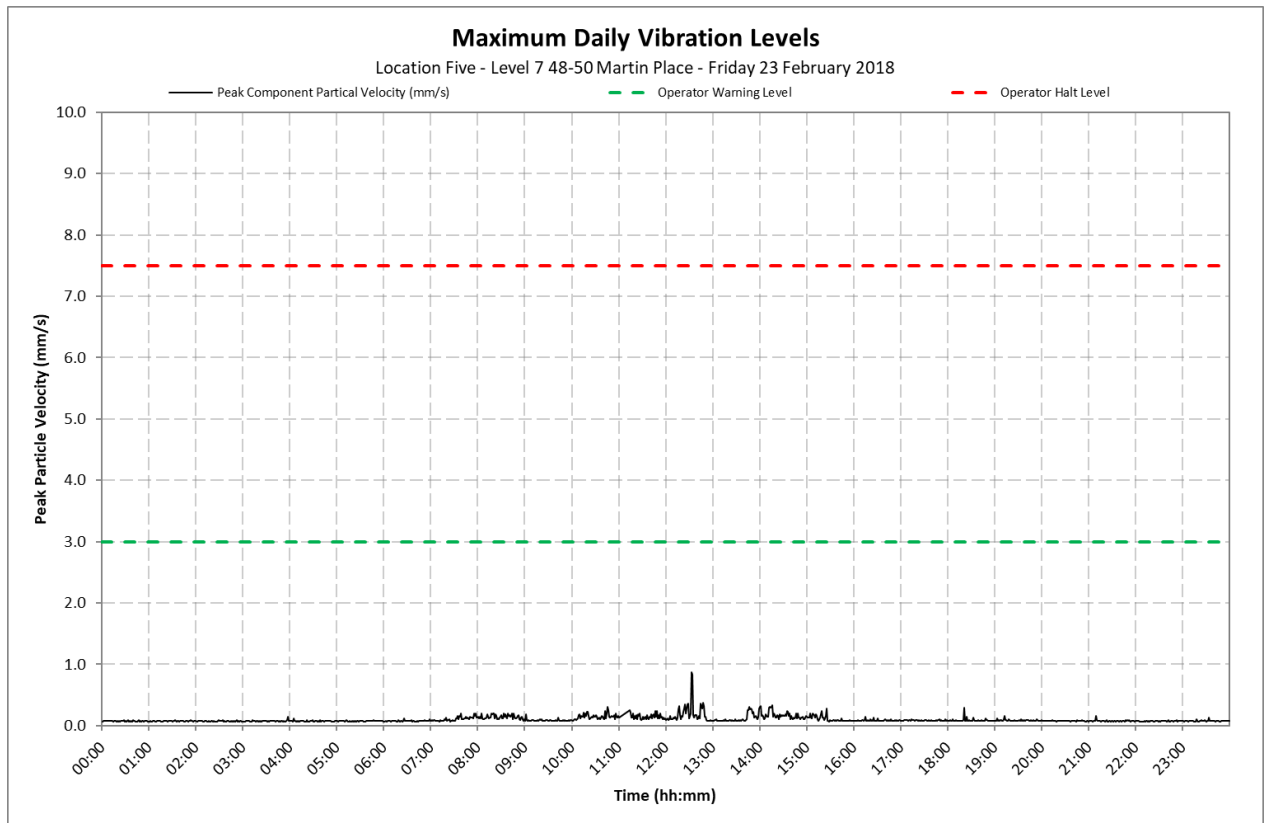
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

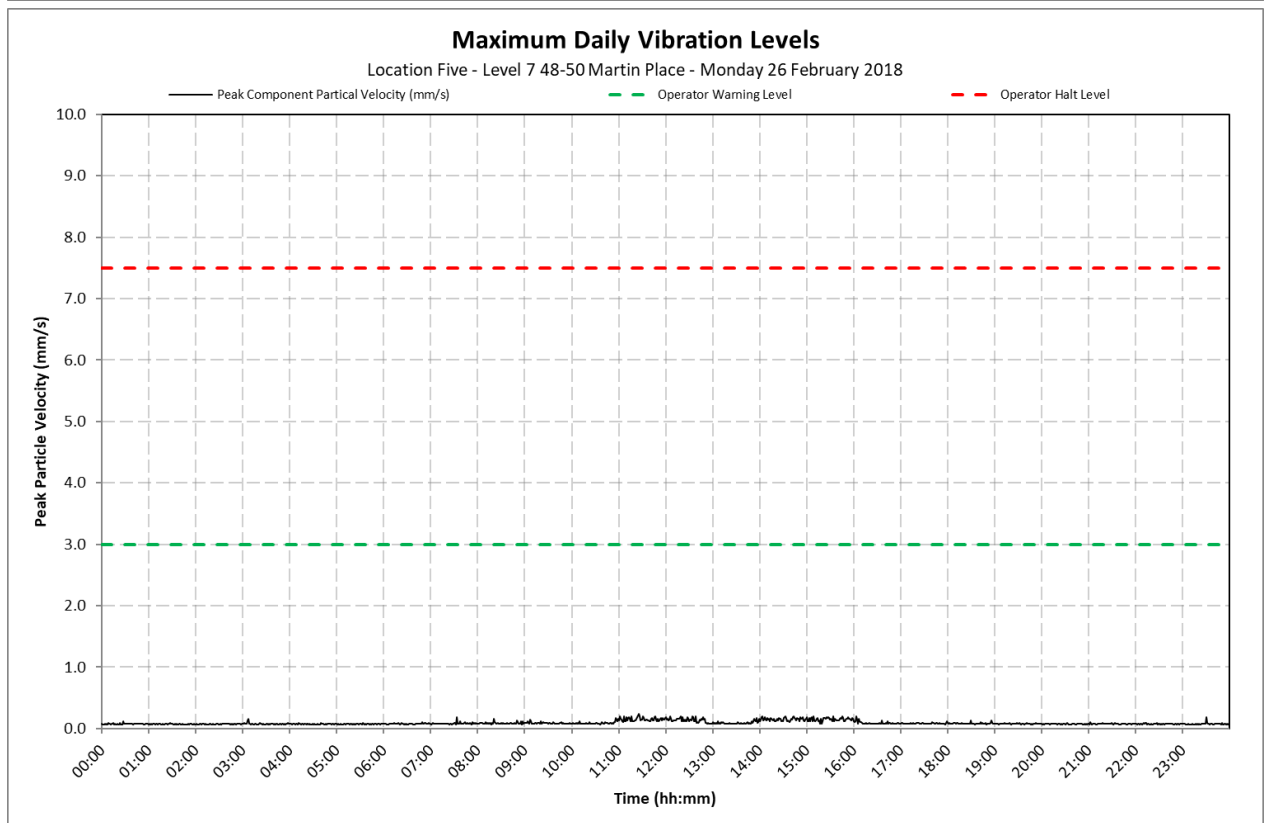
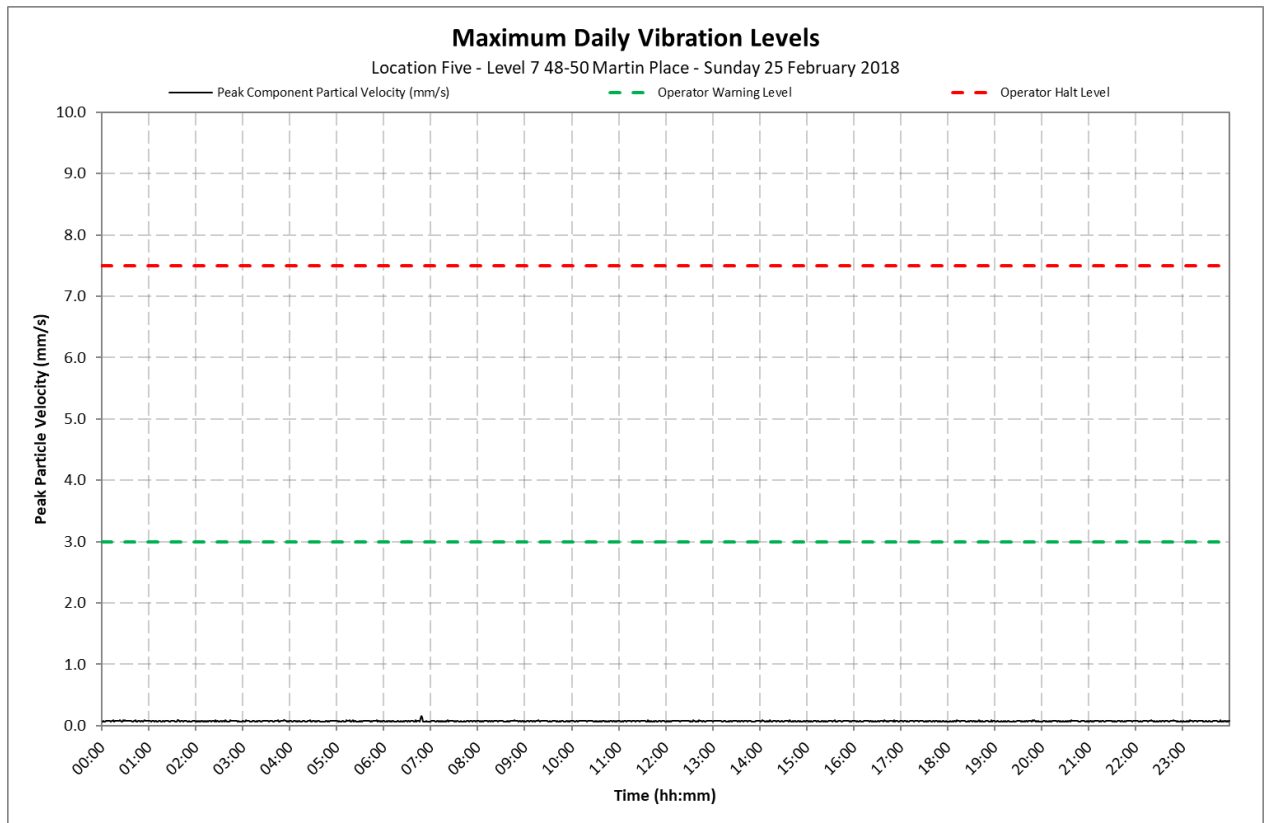
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

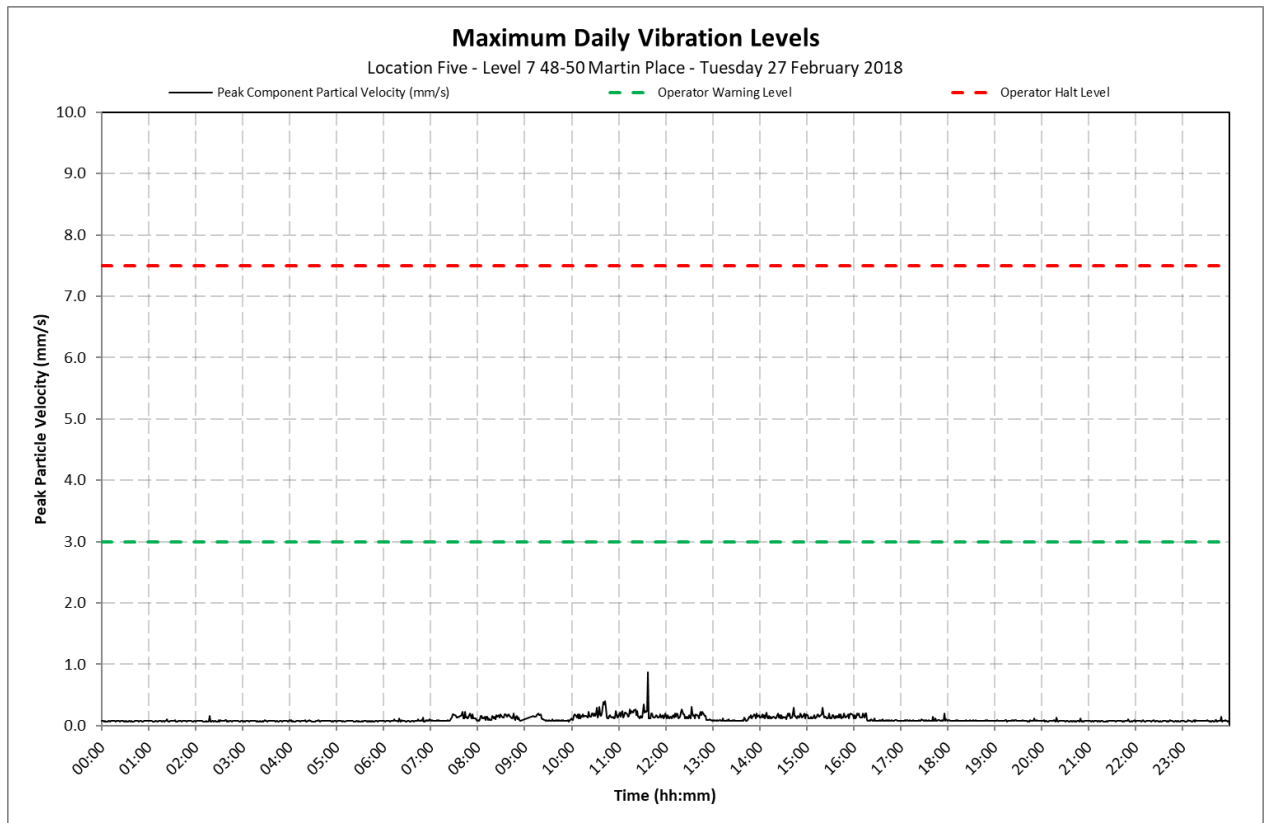
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place





7 March 2018

10-1380 R22 NV Monitoring 20180307.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 22
28 February to 6 March 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 28 February to 6 March 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

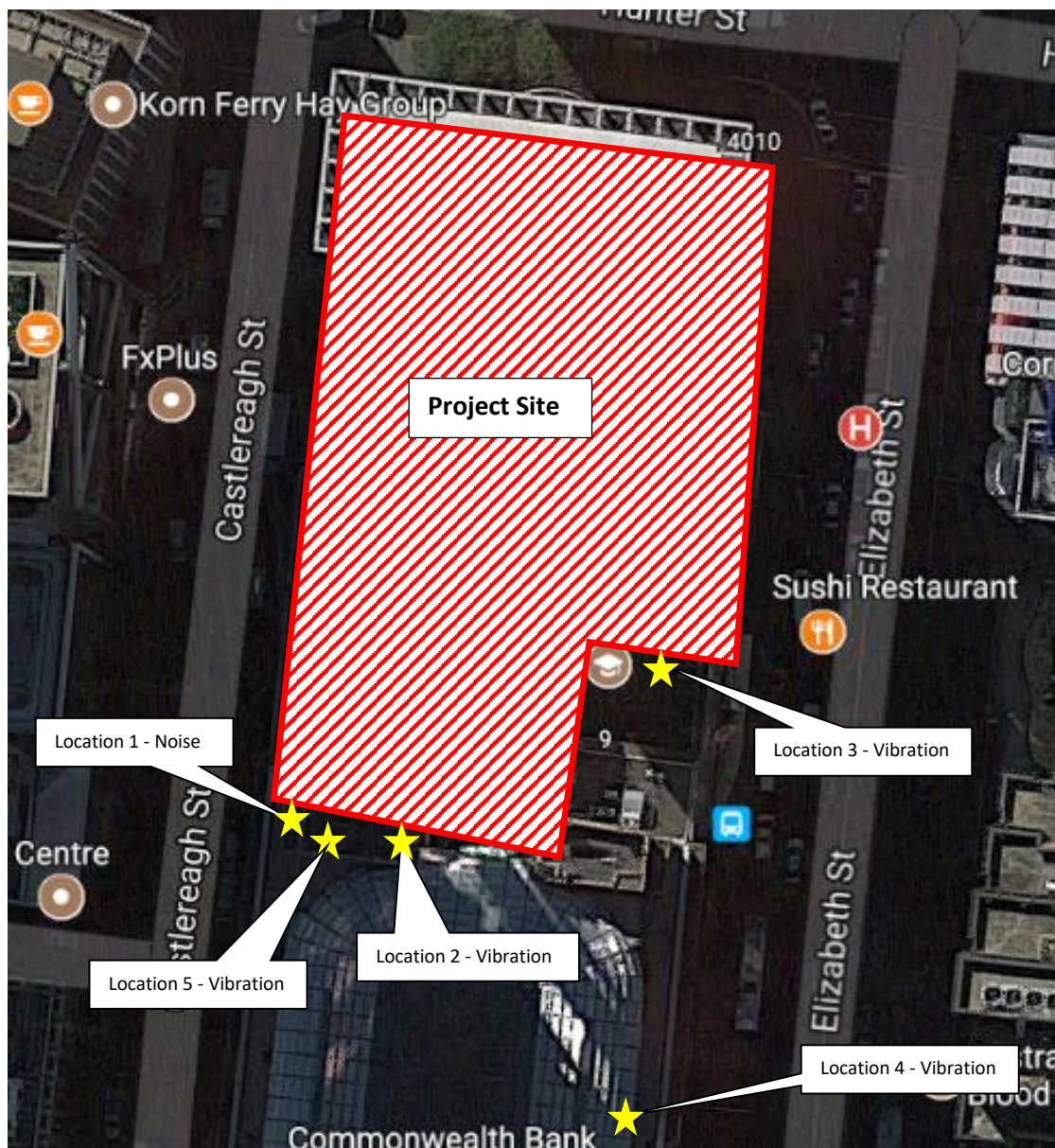
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 28 February to 6 March 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
28 February 2018	43	42	Complies	Complies
1 March 2018	45	43	Complies	Complies
2 March 2018	45	44	Complies	Complies
3 March 2018	45	44	Complies	Complies
4 March 2018	39	38	Complies	Complies
5 March 2018	38	37	Complies	Complies
6 March 2018	41	40	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 28 February to 6 March 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
28 February 2018	1.2 mm/s	Complies
1 March 2018	1.2 mm/s	Complies
2 March 2018	0.2 mm/s	Complies
3 March 2018	0.2 mm/s	Complies
4 March 2018	1.0 mm/s	Complies
5 March 2018	0.2 mm/s	Complies
6 March 2018	1.1 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
28 February 2018	1.0 mm/s	Complies
1 March 2018	0.9 mm/s	Complies
2 March 2018	1.0 mm/s	Complies
3 March 2018	0.4 mm/s	Complies
4 March 2018	0.1 mm/s	Complies
5 March 2018	0.3 mm/s	Complies
6 March 2018	0.9 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 28 February to 6 March 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 28 February to 6 March 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

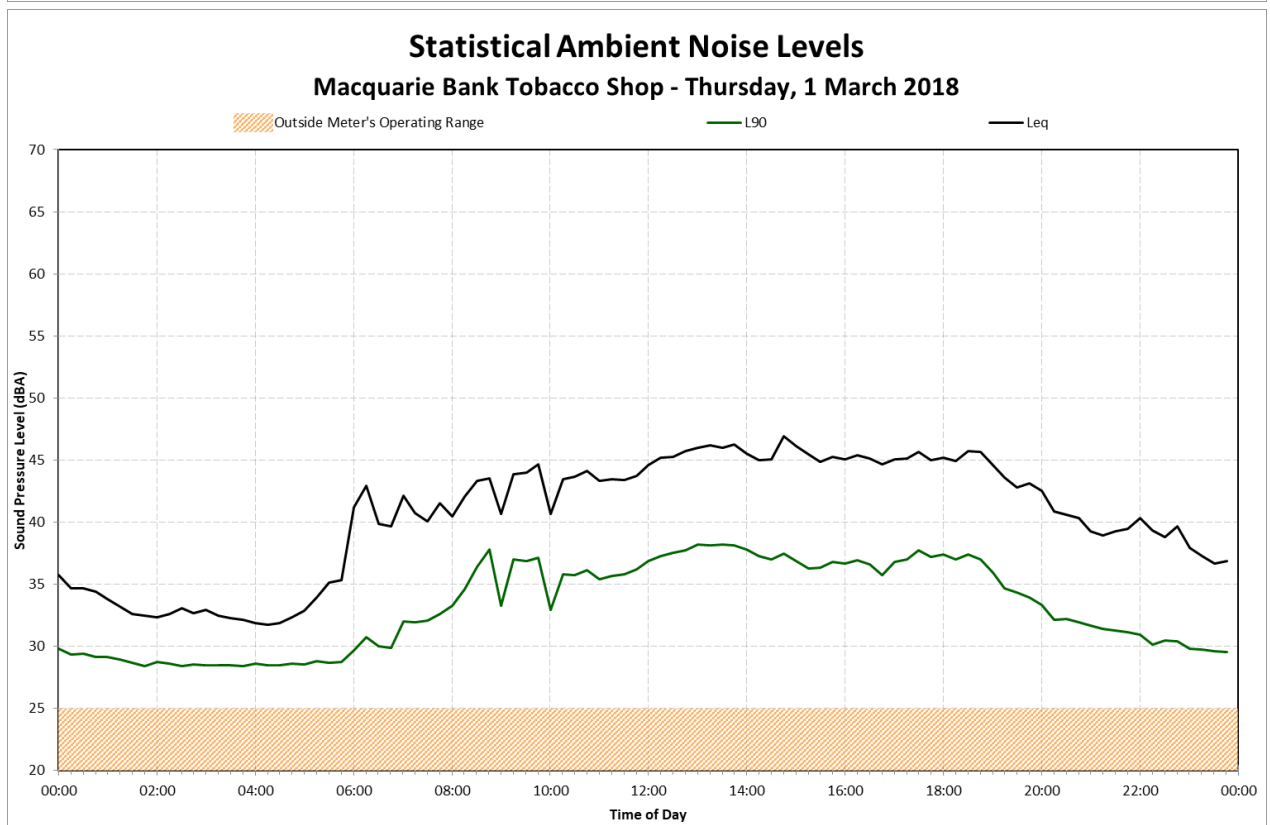
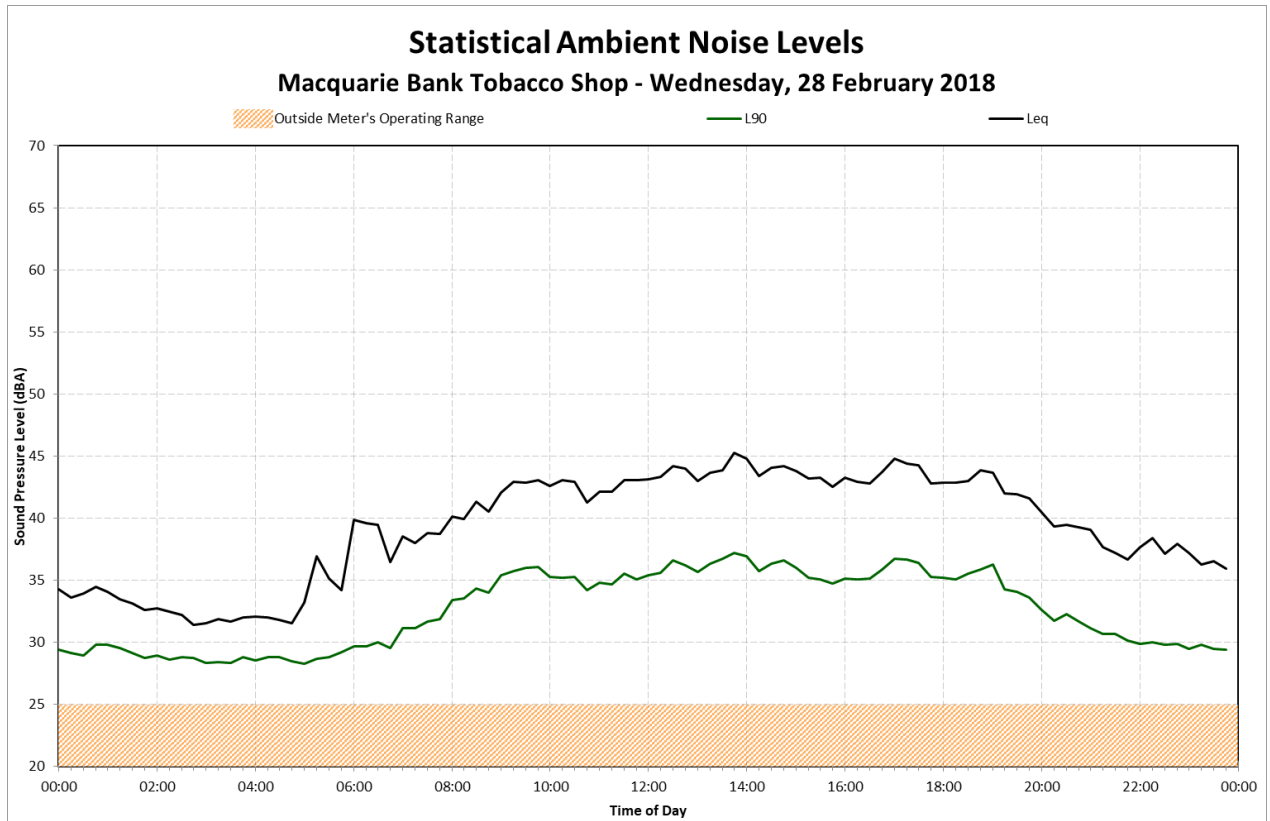
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

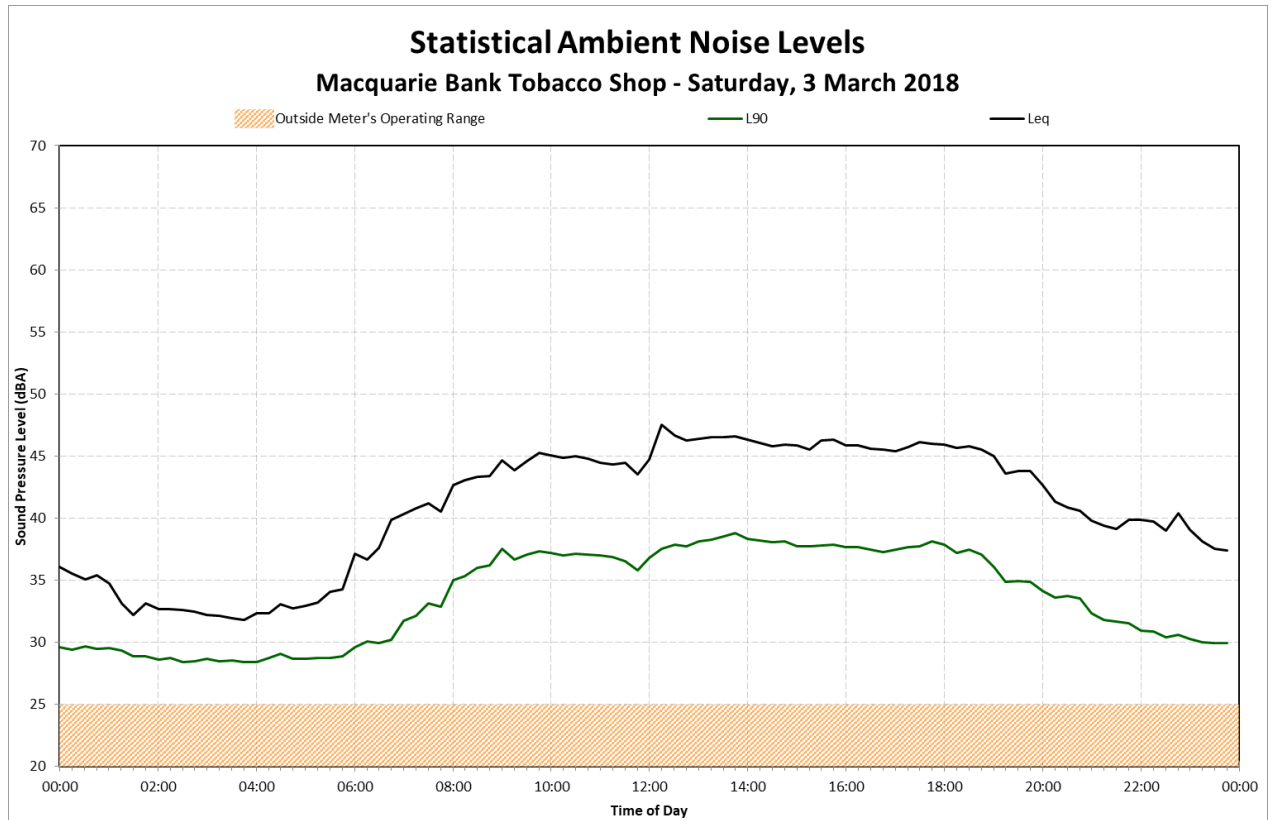
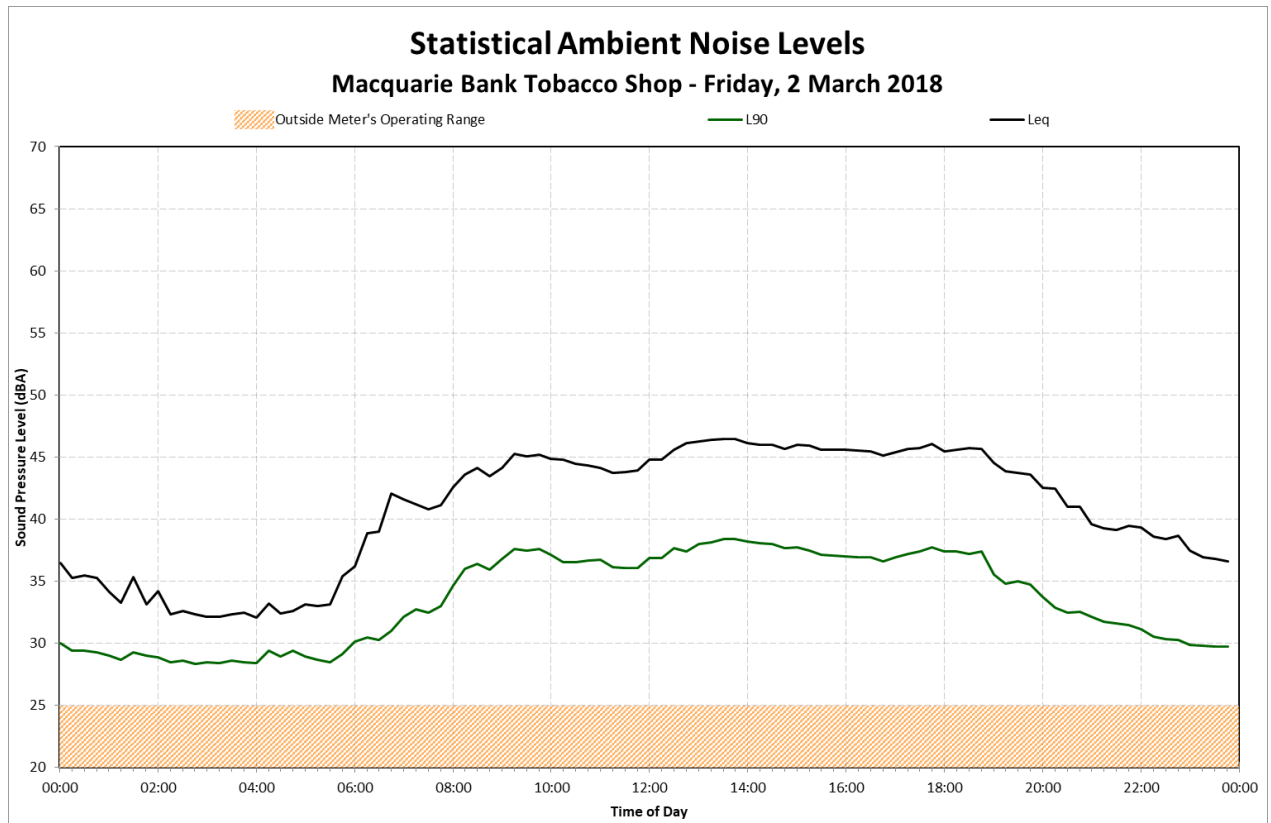
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

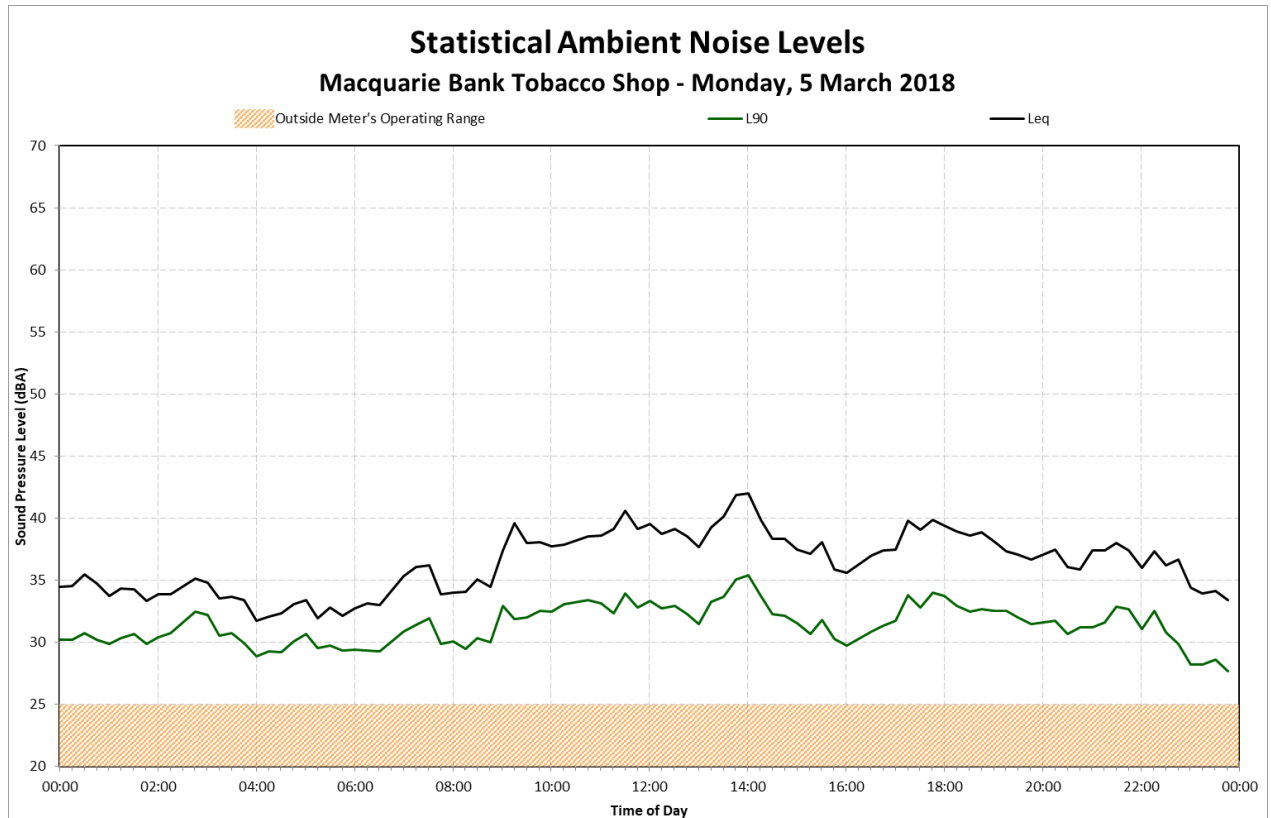
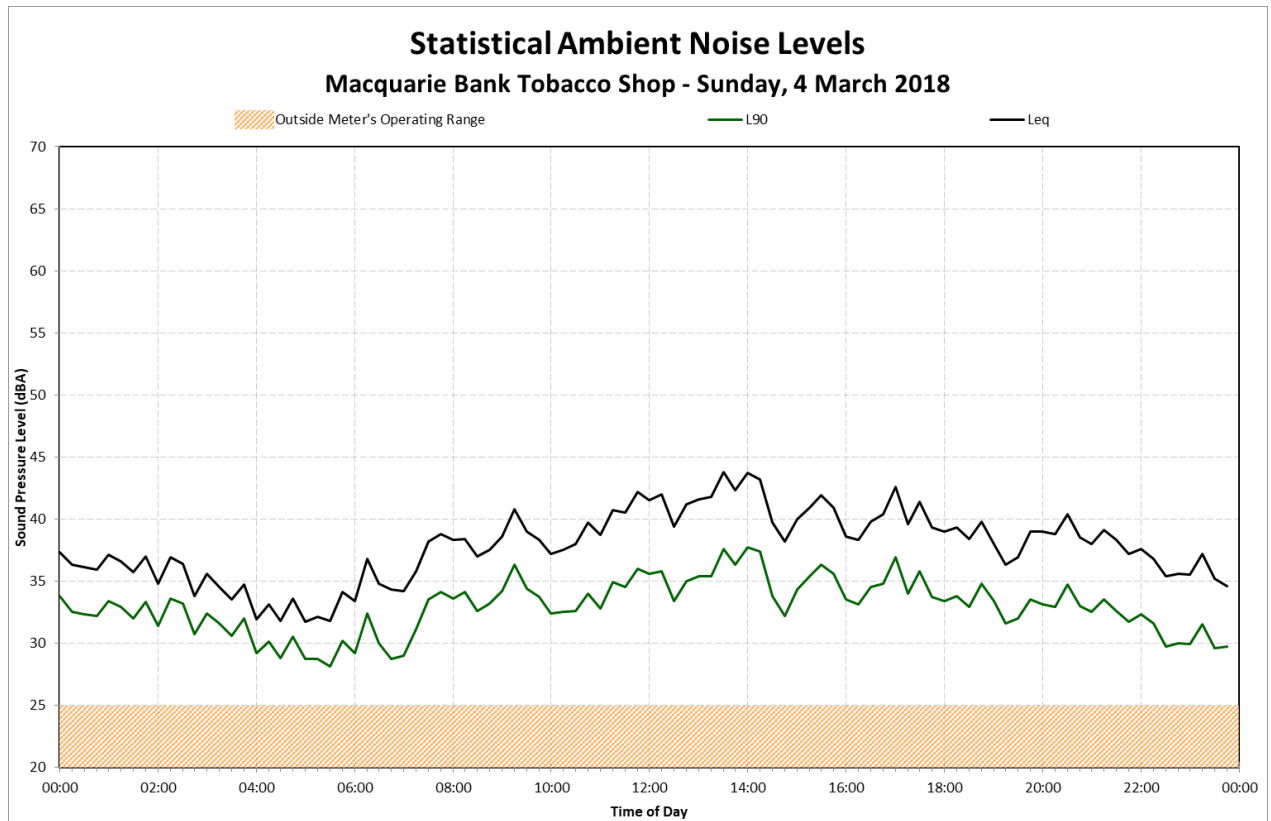
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

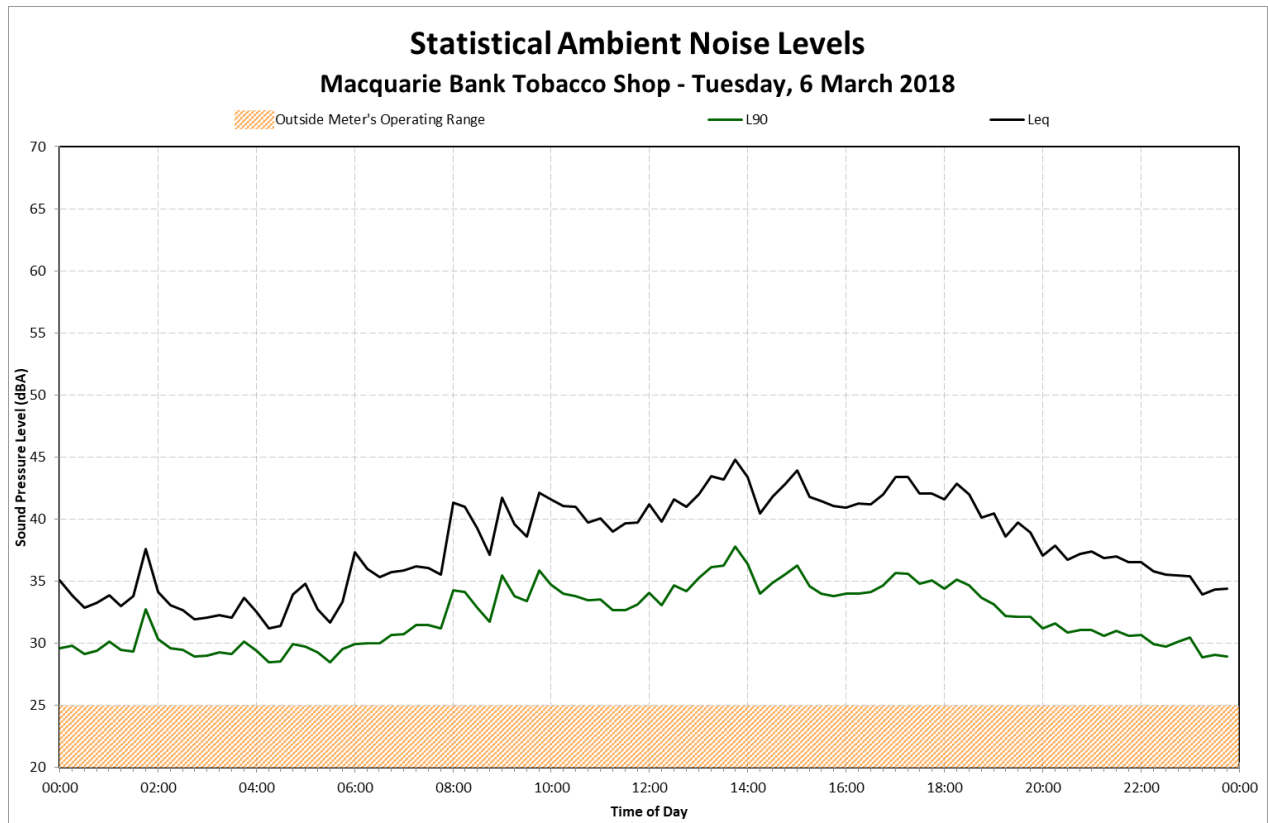
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

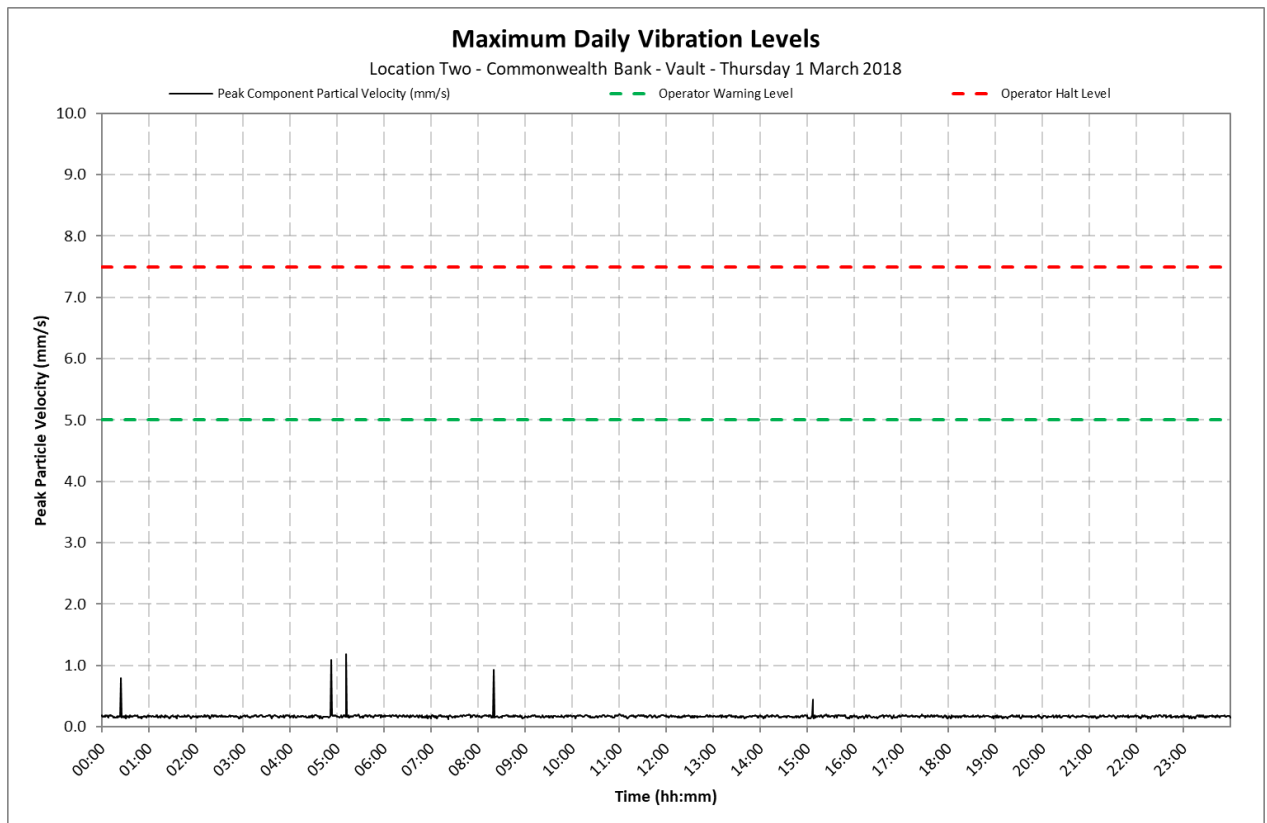
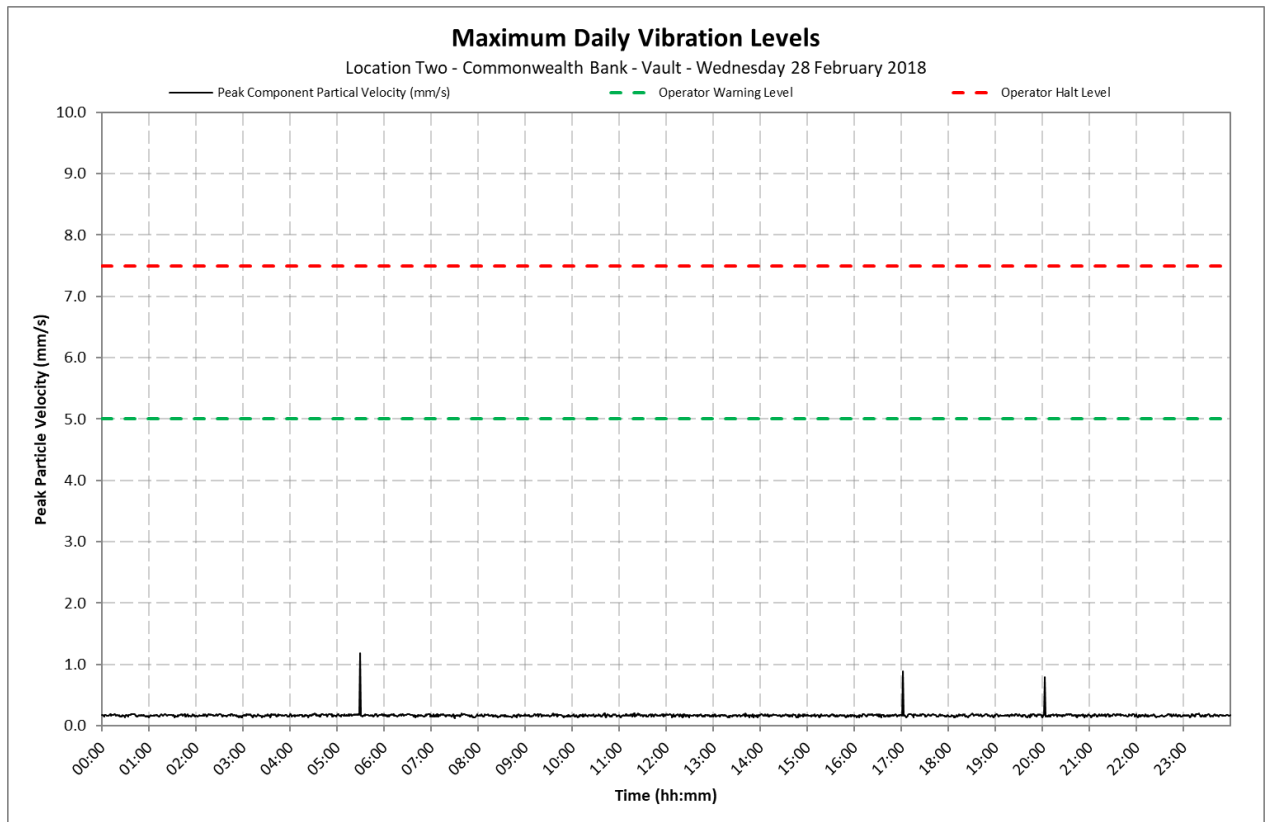
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

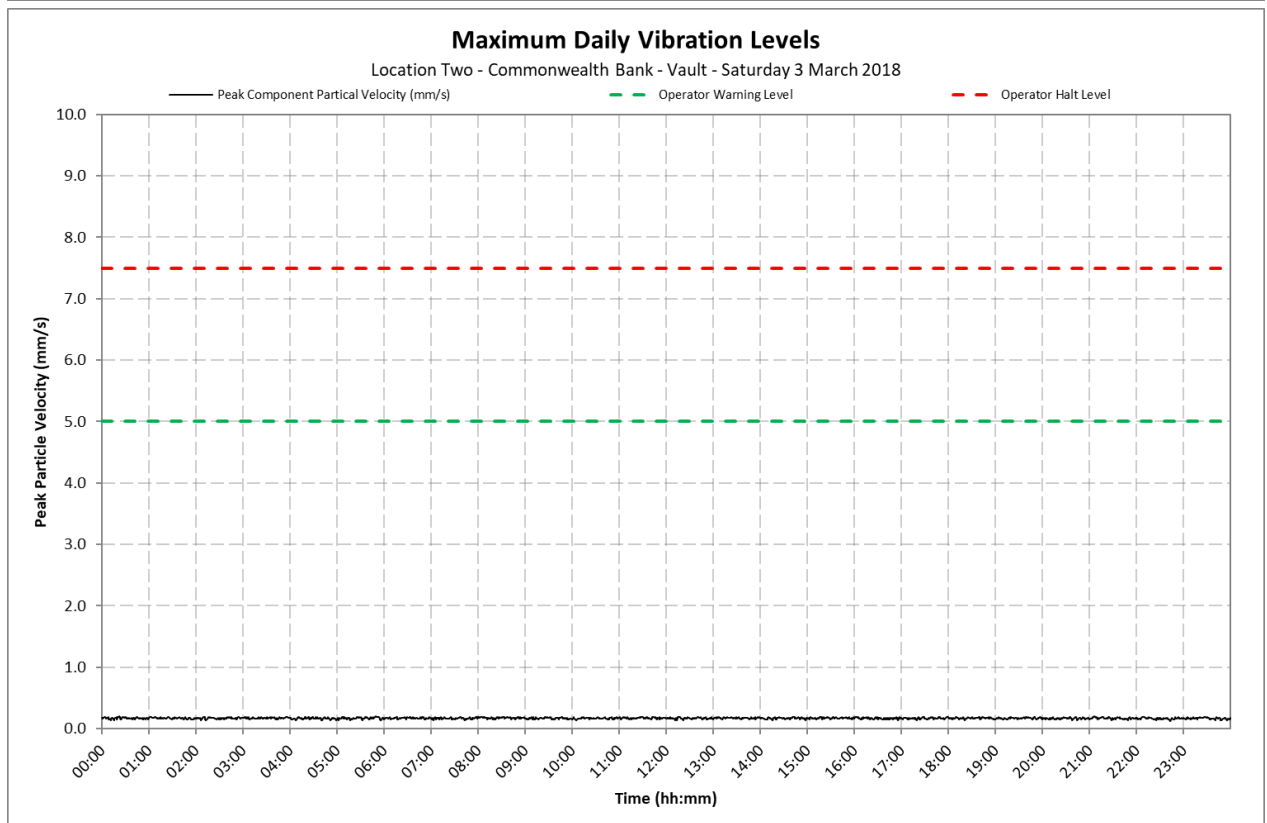
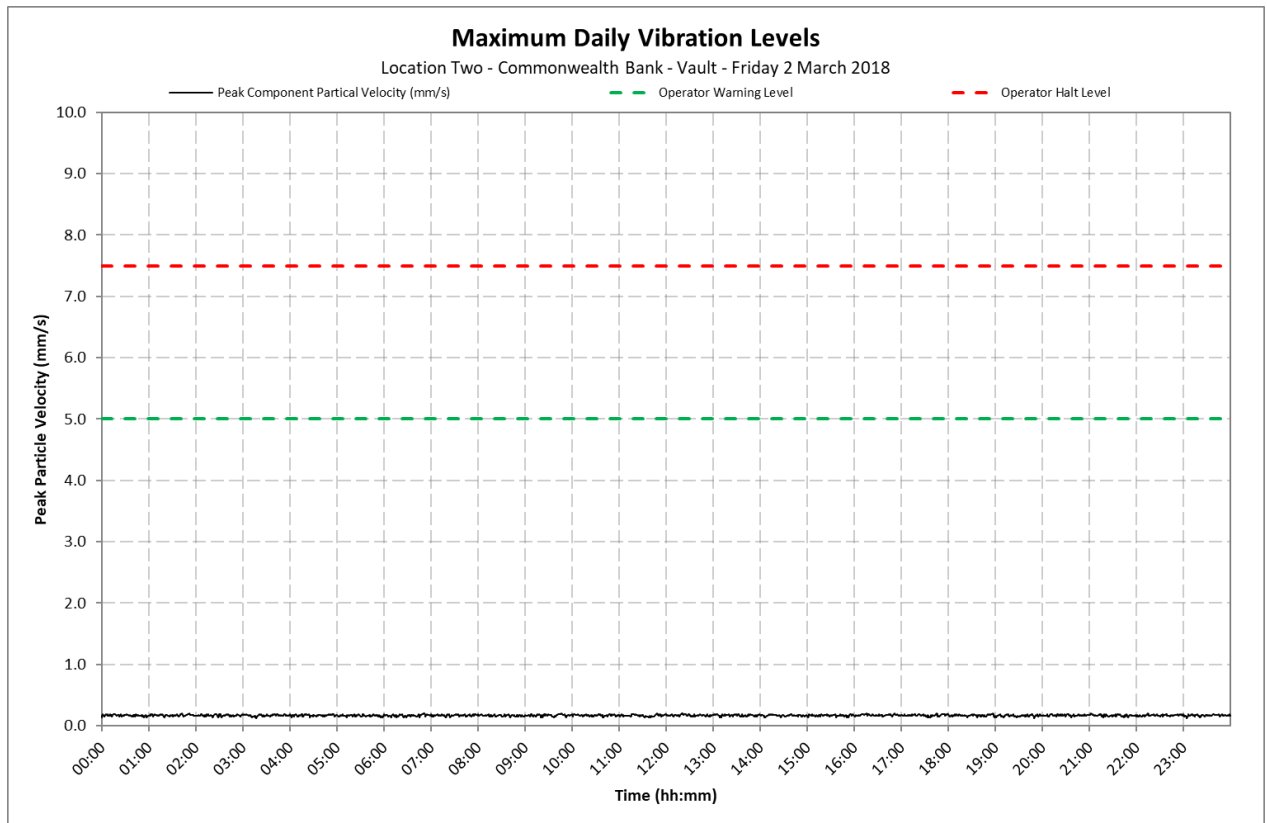
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

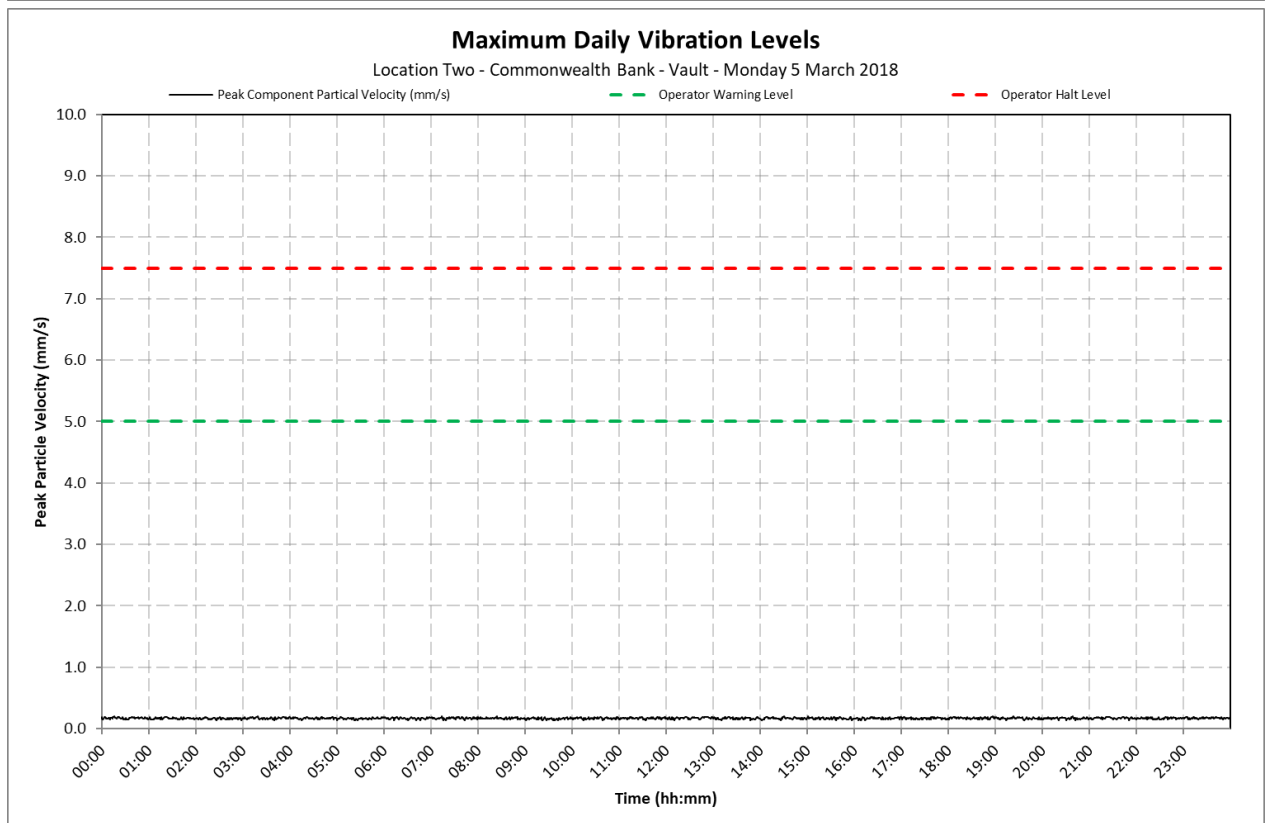
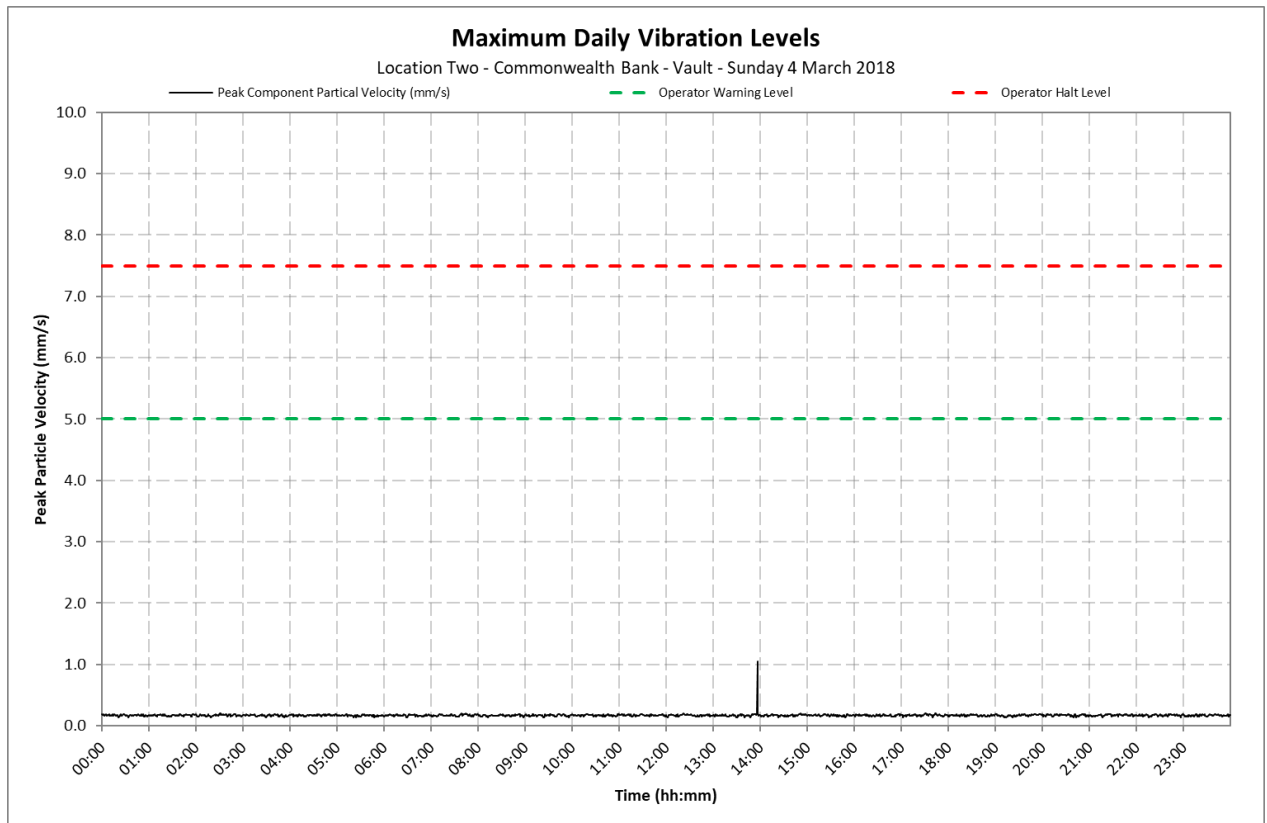
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

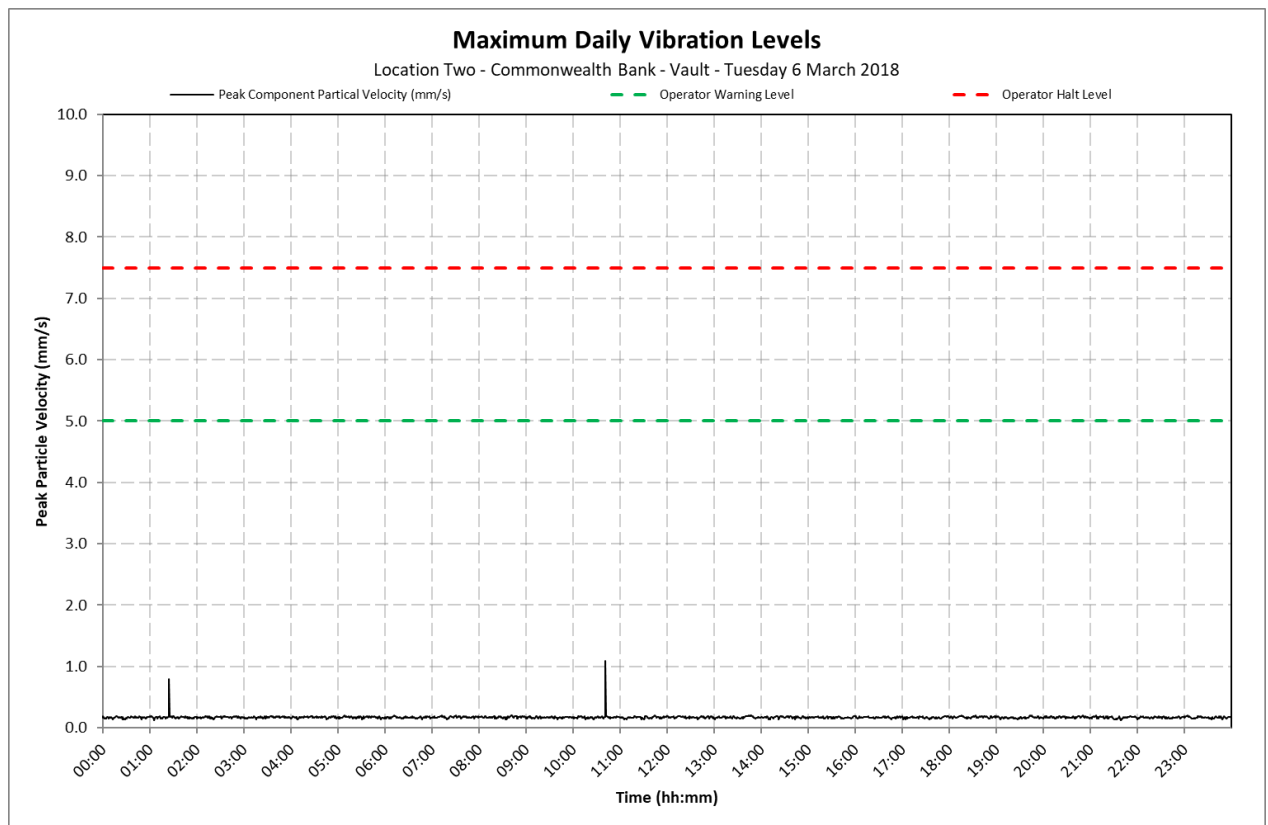
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

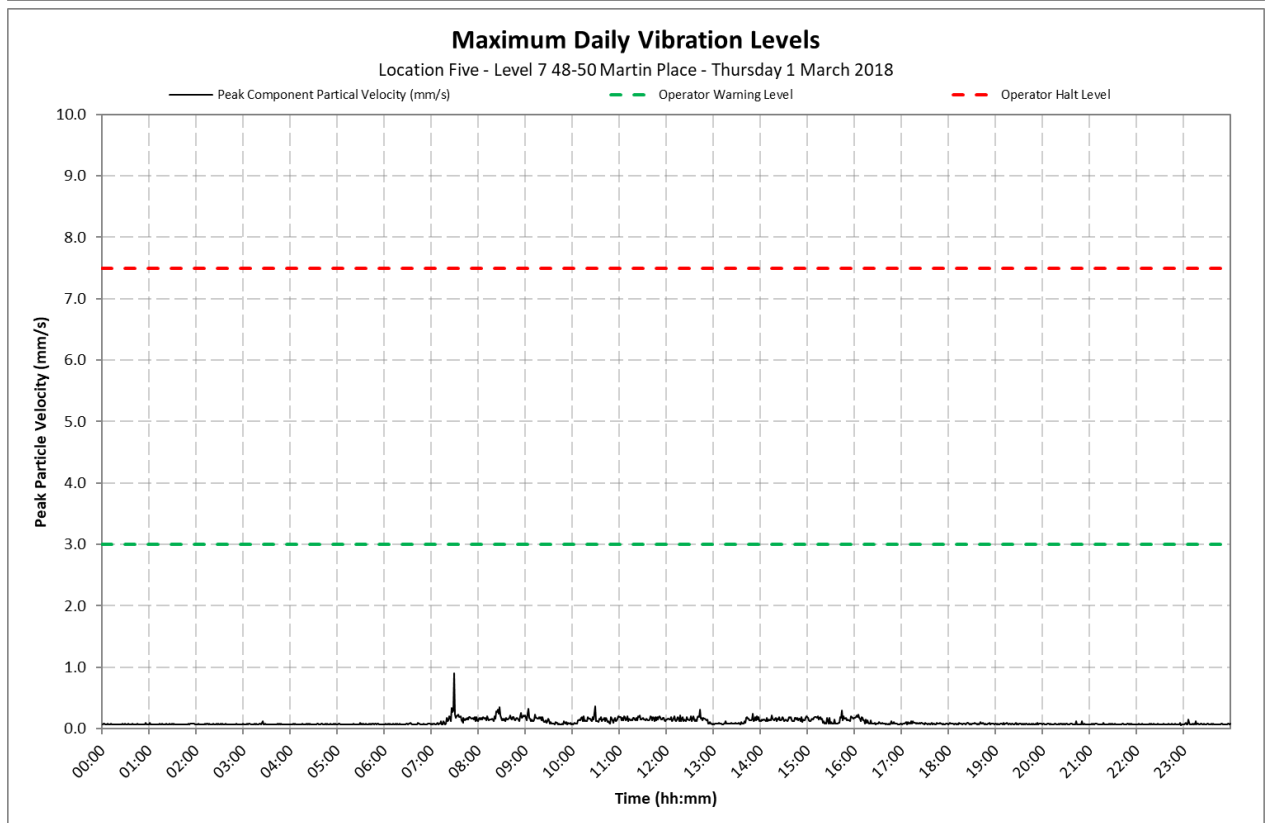
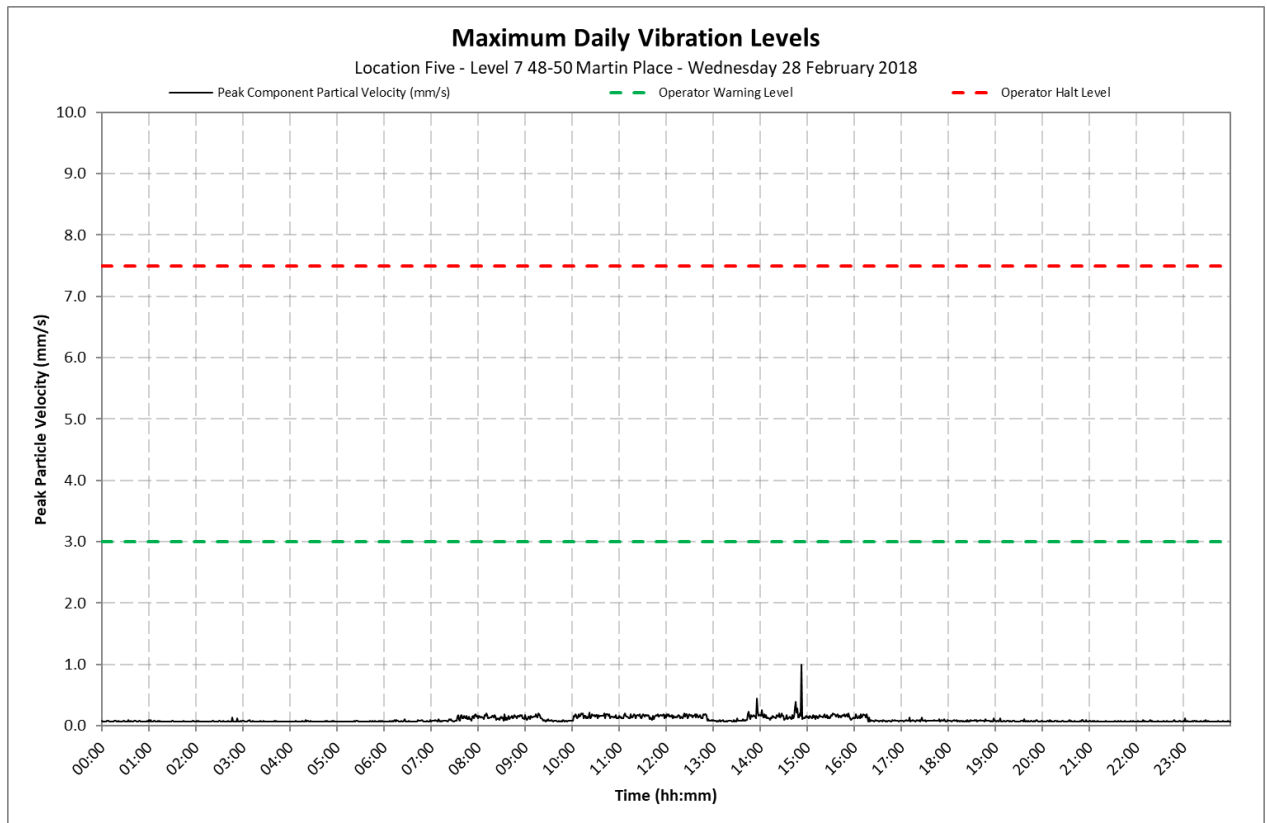
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

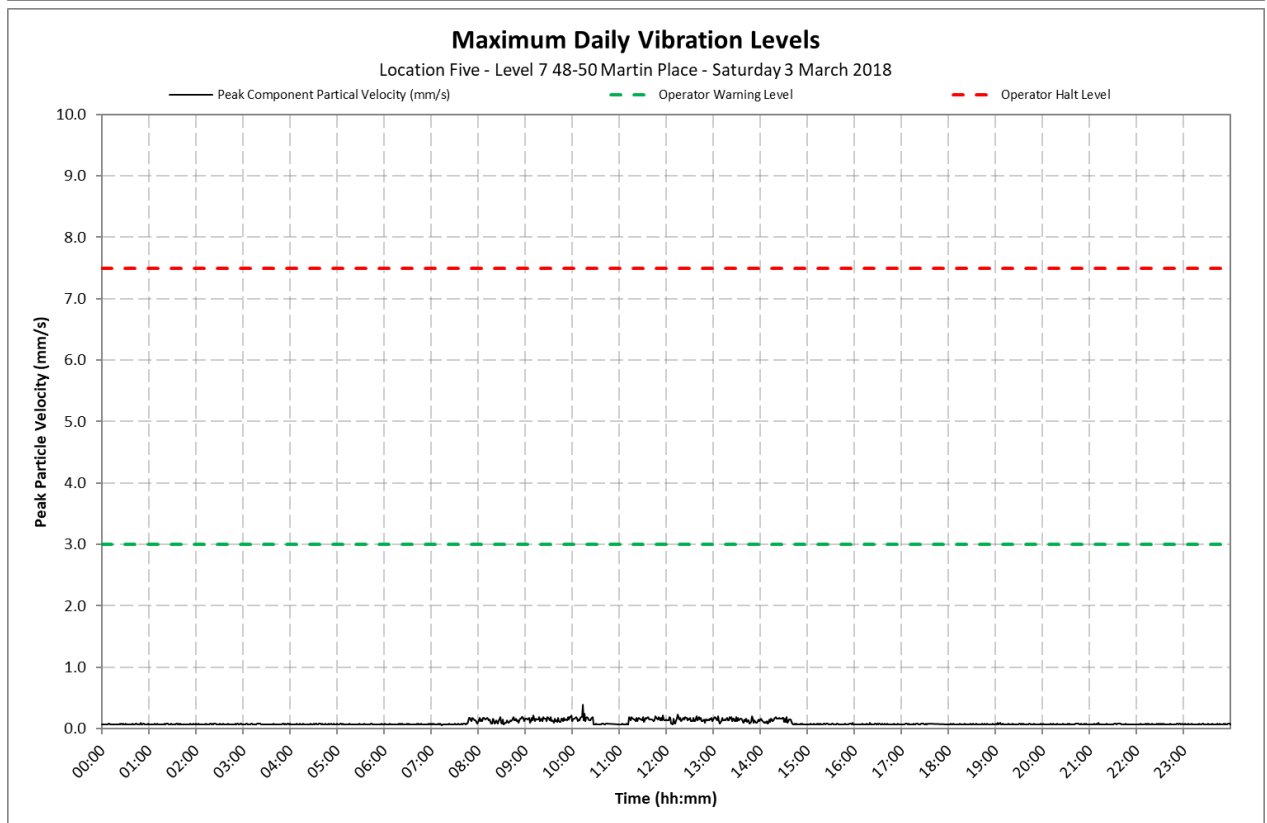
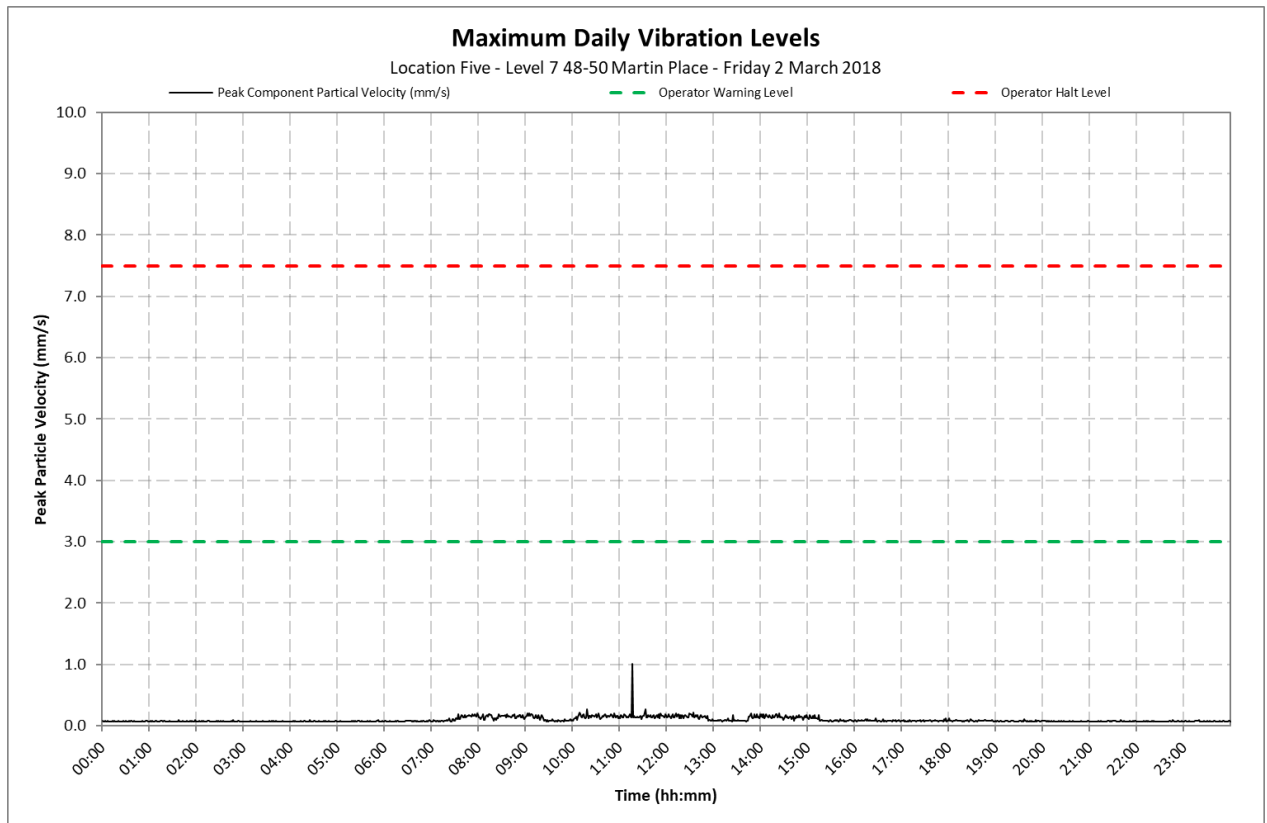
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

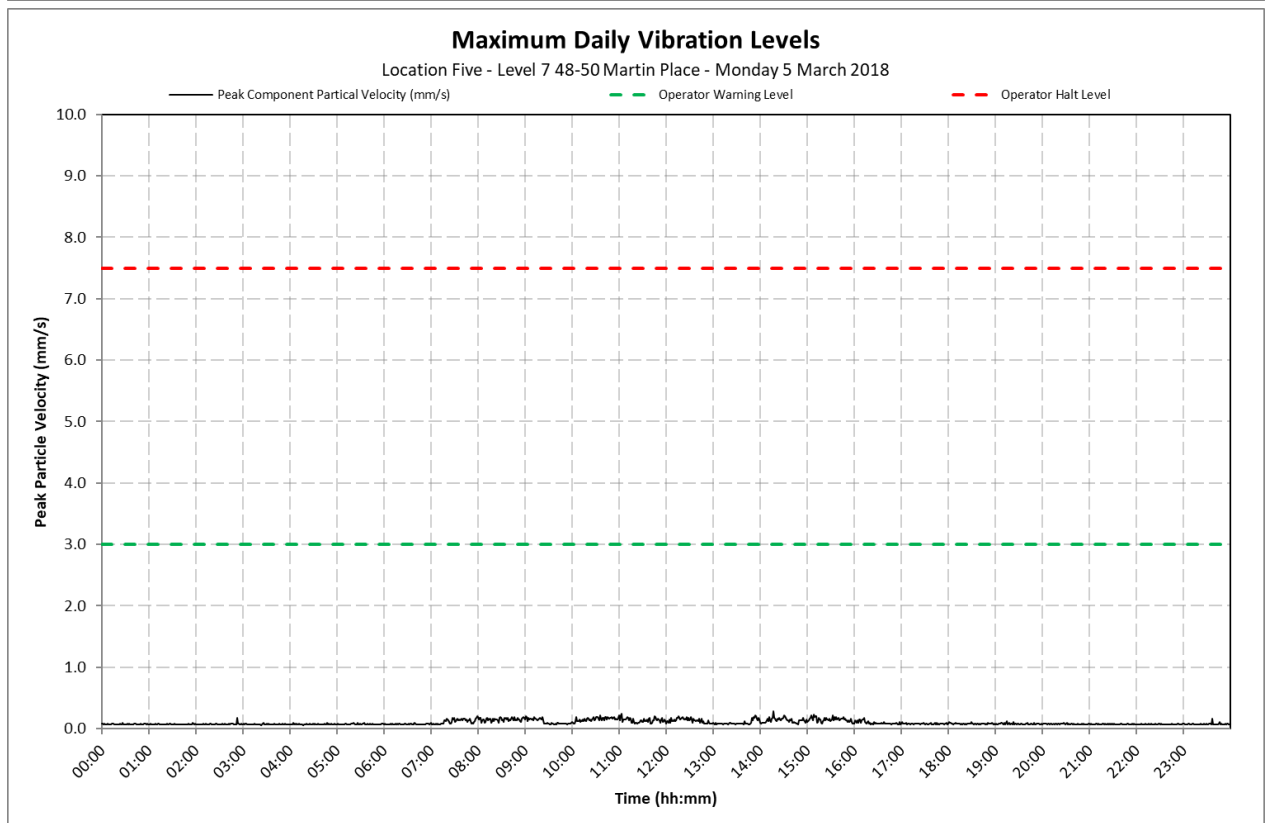
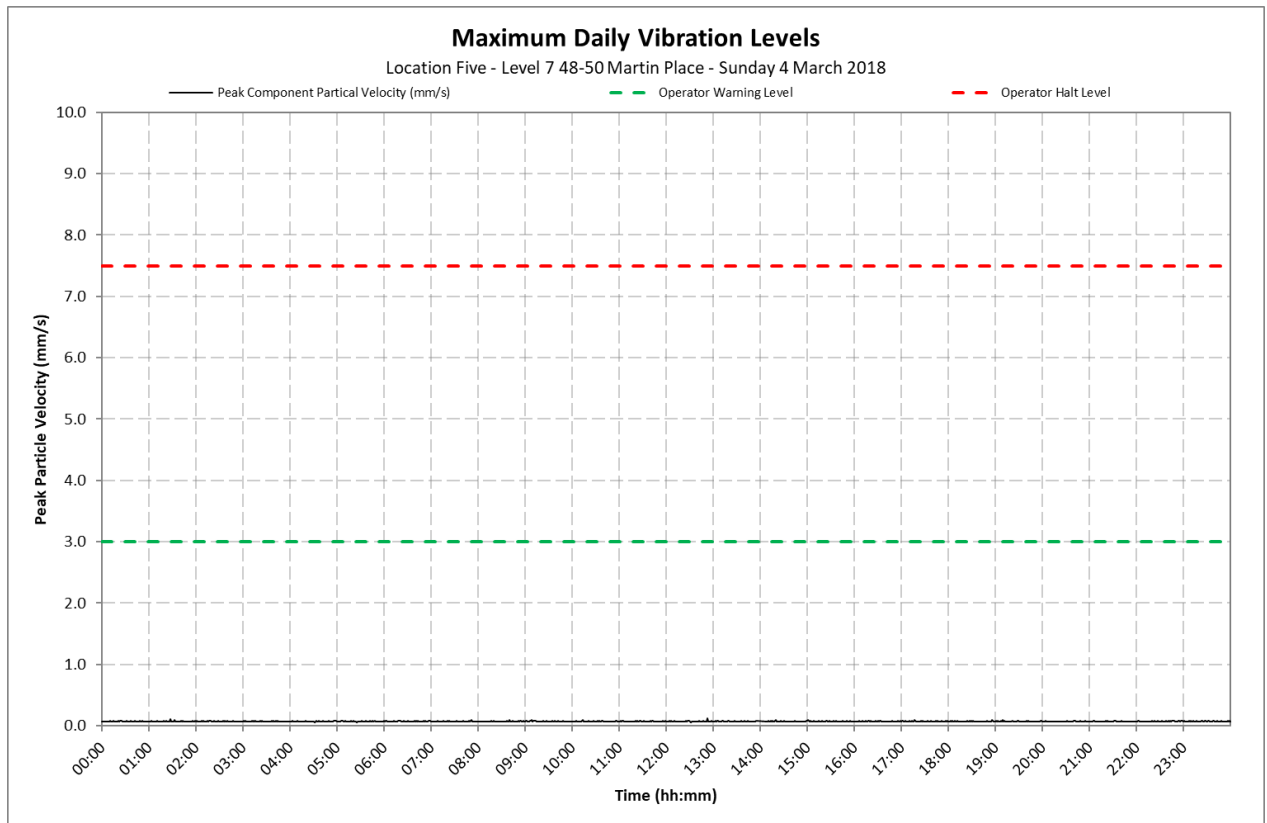
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

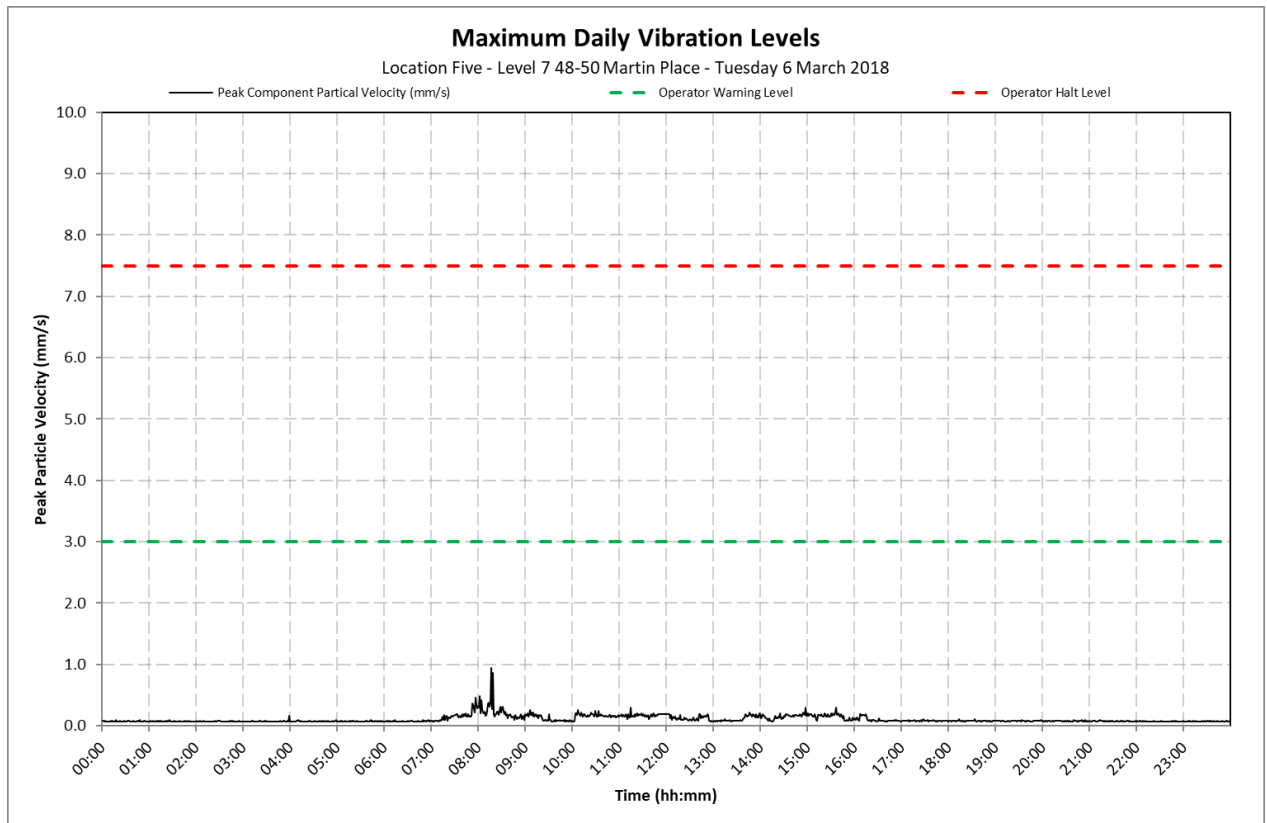
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



27 March 2018

10-1380 R24 NV Monitoring 20180327.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 24
14 March to 27 March 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 14 March to 27 March 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

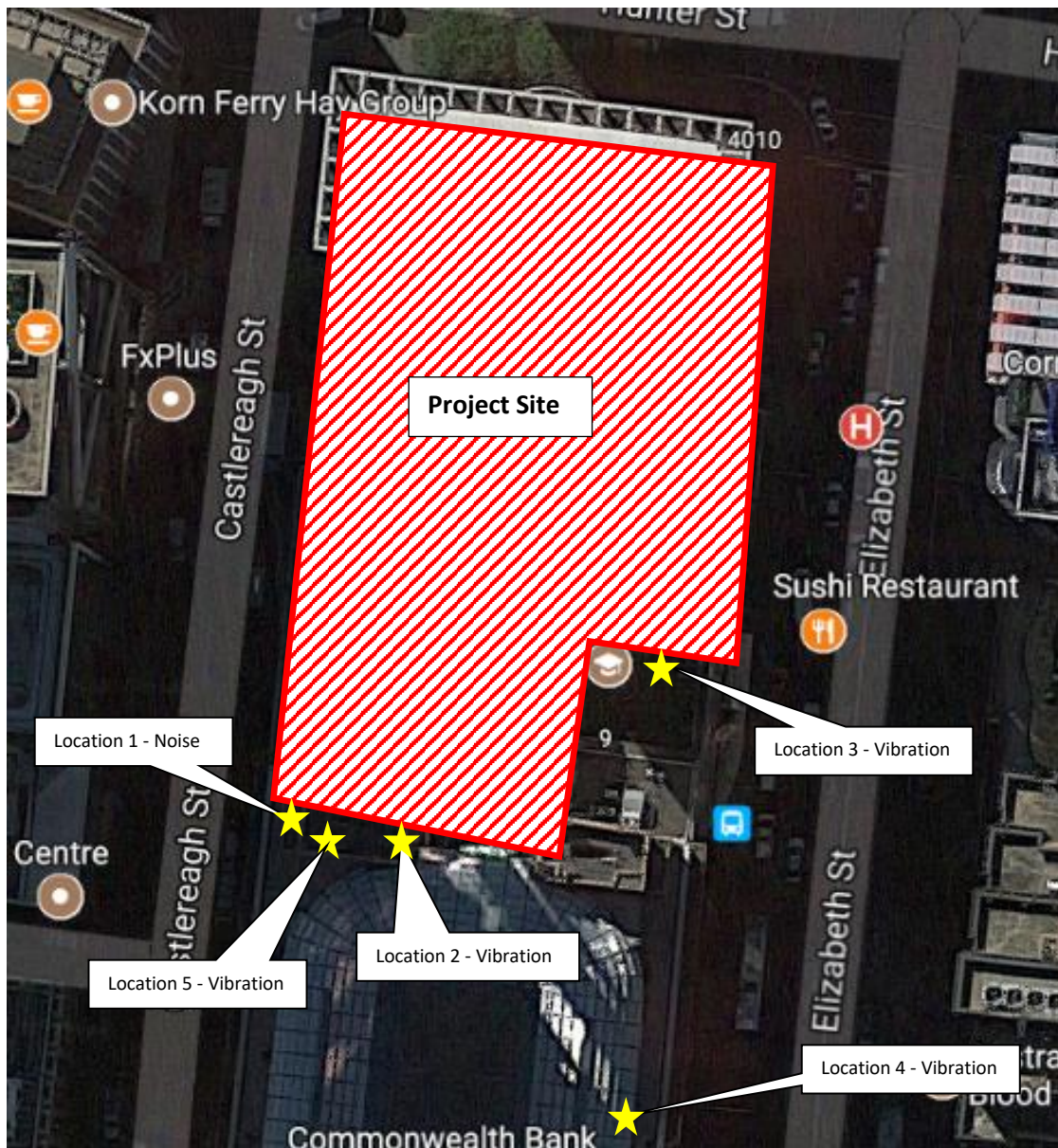
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 14 March to 27 March 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient LAeq(15minute) Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
14 March 2018	42	42	Complies	Complies
15 March 2018	44	43	Complies	Complies
16 March 2018	45	44	Complies	Complies
17 March 2018	45	44	Complies	Complies
18 March 2018	40	39	Complies	Complies
19 March 2018	39	38	Complies	Complies
20 March 2018	43	42	Complies	Complies
21 March 2018	44	43	Complies	Complies
22 March 2018	45	44	Complies	Complies
23 March 2018	45	44	Complies	Complies
24 March 2018	43	42	Complies	Complies
25 March 2018	39	38	Complies	Complies
26 March 2018	40	40	Complies	Complies
27 March 2018	41	40	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 14 March to 27 March 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
14 March 2018	0.7 mm/s	Complies
15 March 2018	0.6 mm/s	Complies
16 March 2018	0.3 mm/s	Complies
17 March 2018	0.3 mm/s	Complies
18 March 2018	1.0 mm/s	Complies
19 March 2018	0.2 mm/s	Complies
20 March 2018	1.0 mm/s	Complies
21 March 2018	1.1 mm/s	Complies
22 March 2018	1.1 mm/s	Complies
23 March 2018	0.9 mm/s	Complies
24 March 2018	0.8 mm/s	Complies
25 March 2018	0.9 mm/s	Complies
26 March 2018	1.0 mm/s	Complies
27 March 2018	0.6 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
14 March 2018	0.5 mm/s	Complies
15 March 2018	0.9 mm/s	Complies
16 March 2018	1.0 mm/s	Complies
17 March 2018	1.1 mm/s	Complies
18 March 2018	0.1 mm/s	Complies
19 March 2018	1.4 mm/s	Complies
20 March 2018	1.1 mm/s	Complies
21 March 2018	0.8 mm/s	Complies
22 March 2018	0.4 mm/s	Complies
23 March 2018	0.9 mm/s	Complies
24 March 2018	0.6 mm/s	Complies
25 March 2018	0.2 mm/s	Complies
26 March 2018	0.4 mm/s	Complies
27 March 2018	0.4 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 14 March to 27 March 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 14 March to 27 March 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

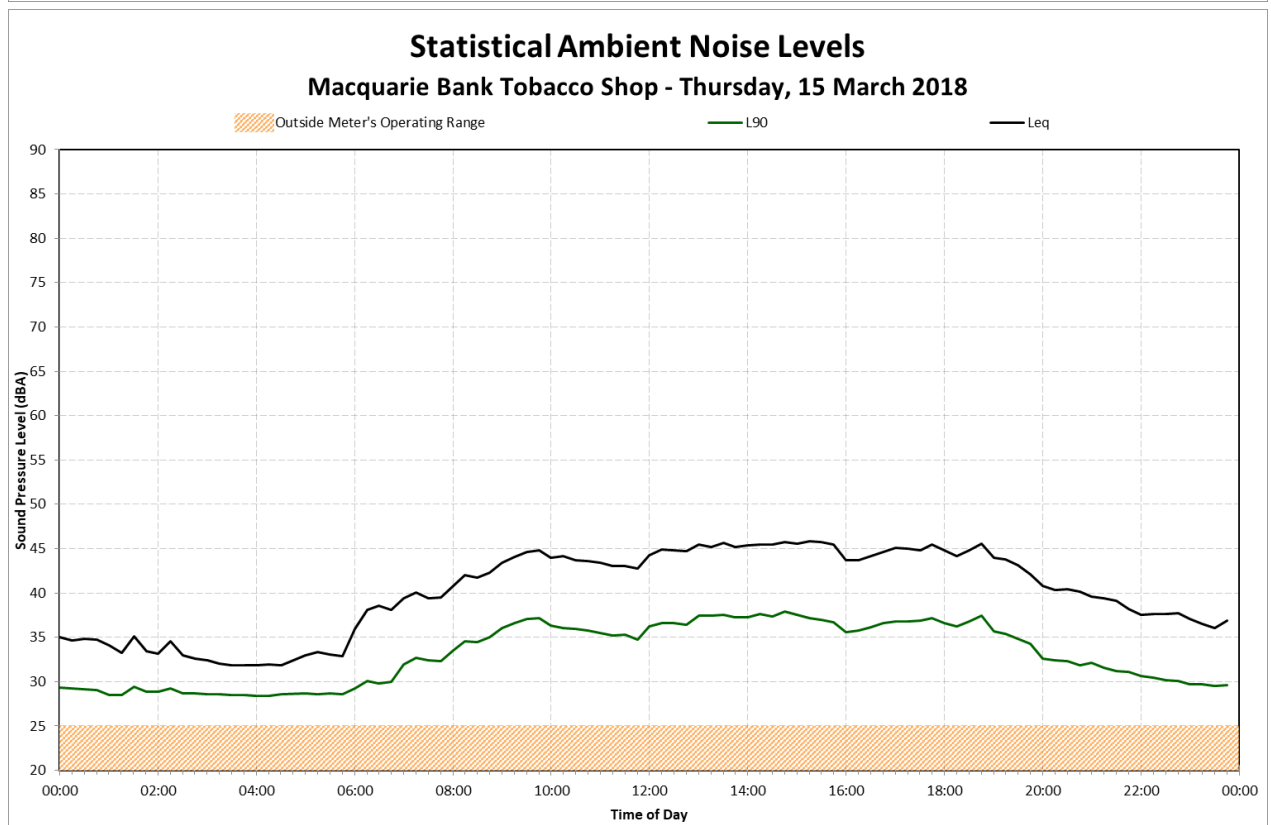
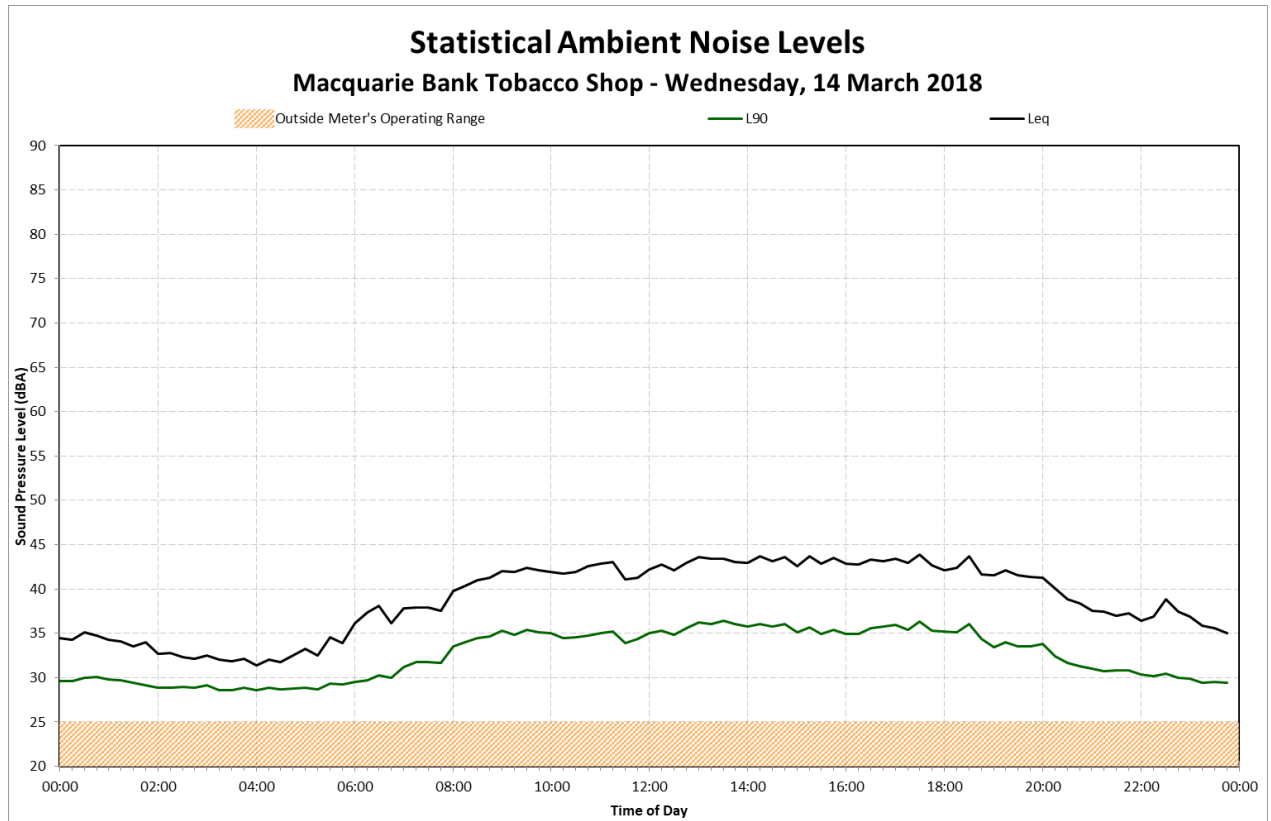
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

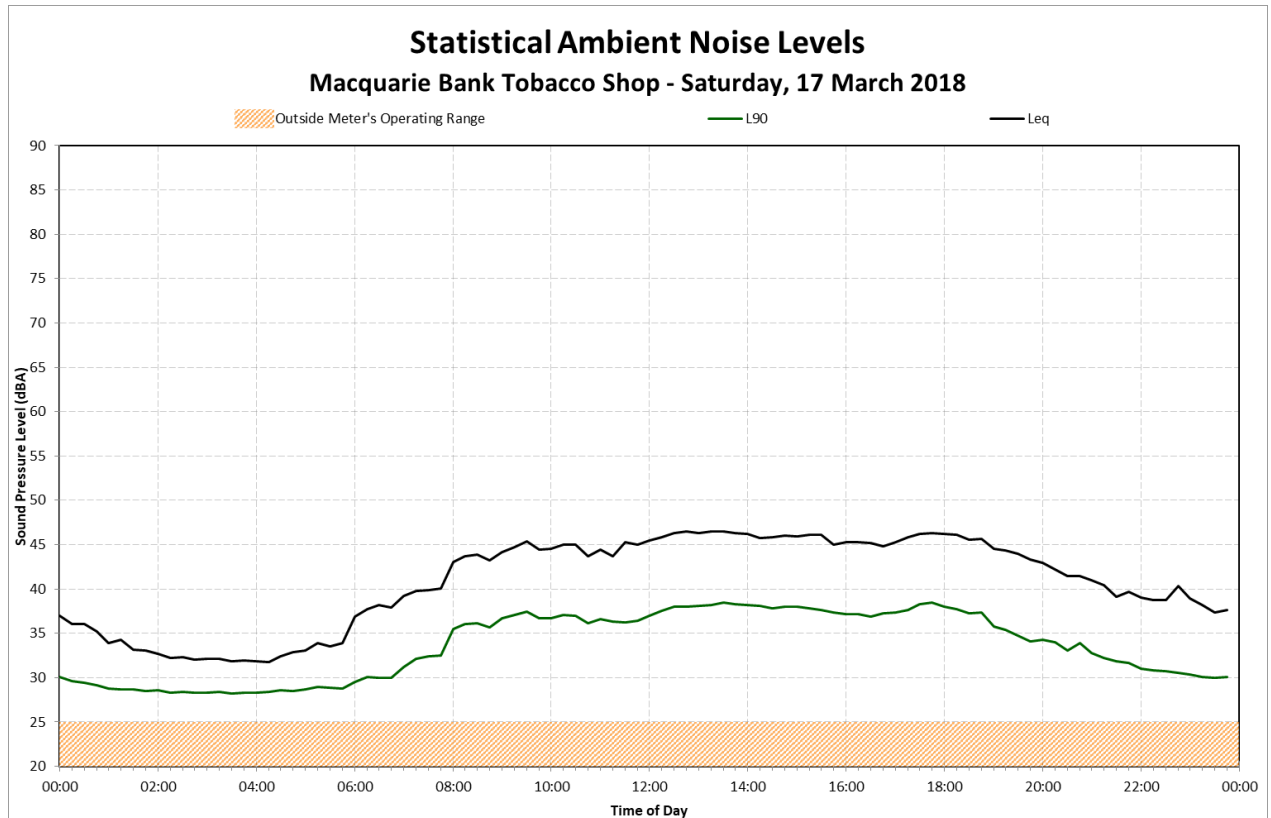
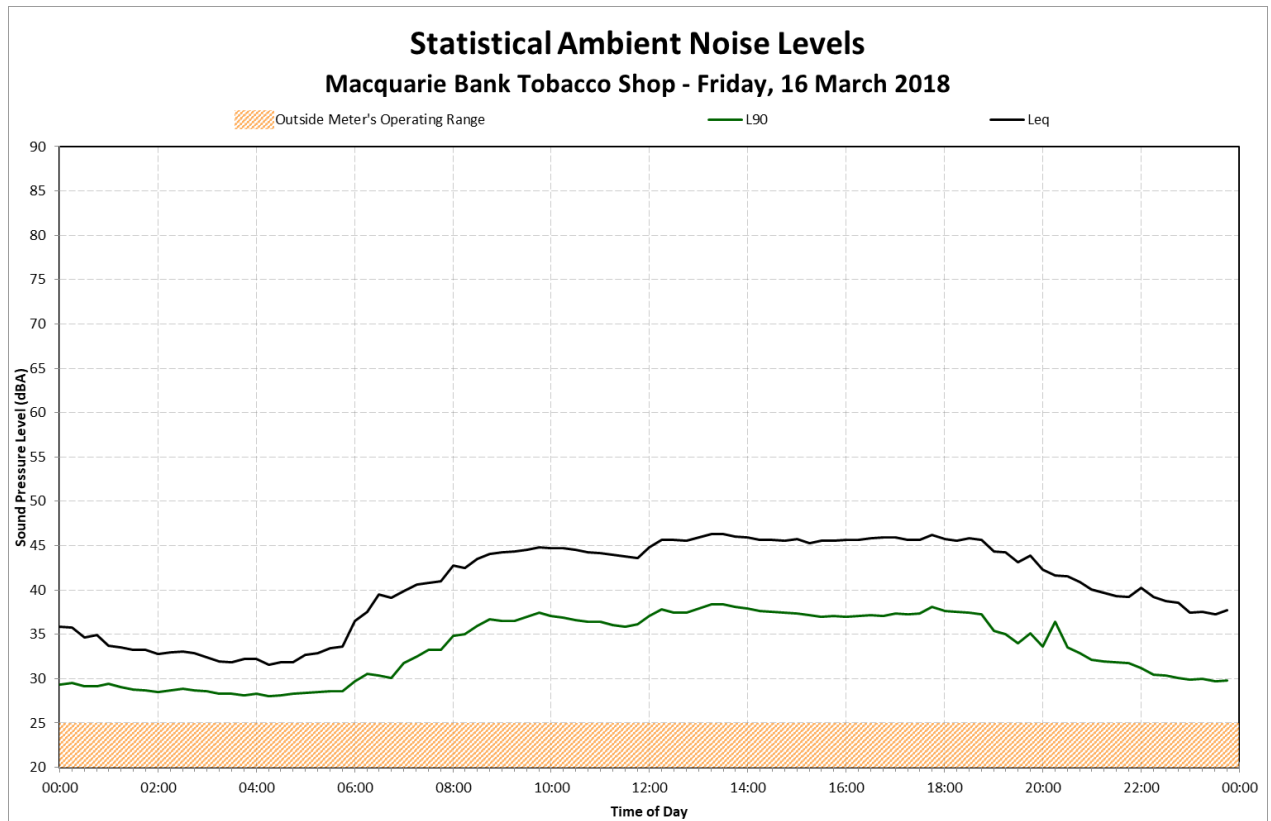
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

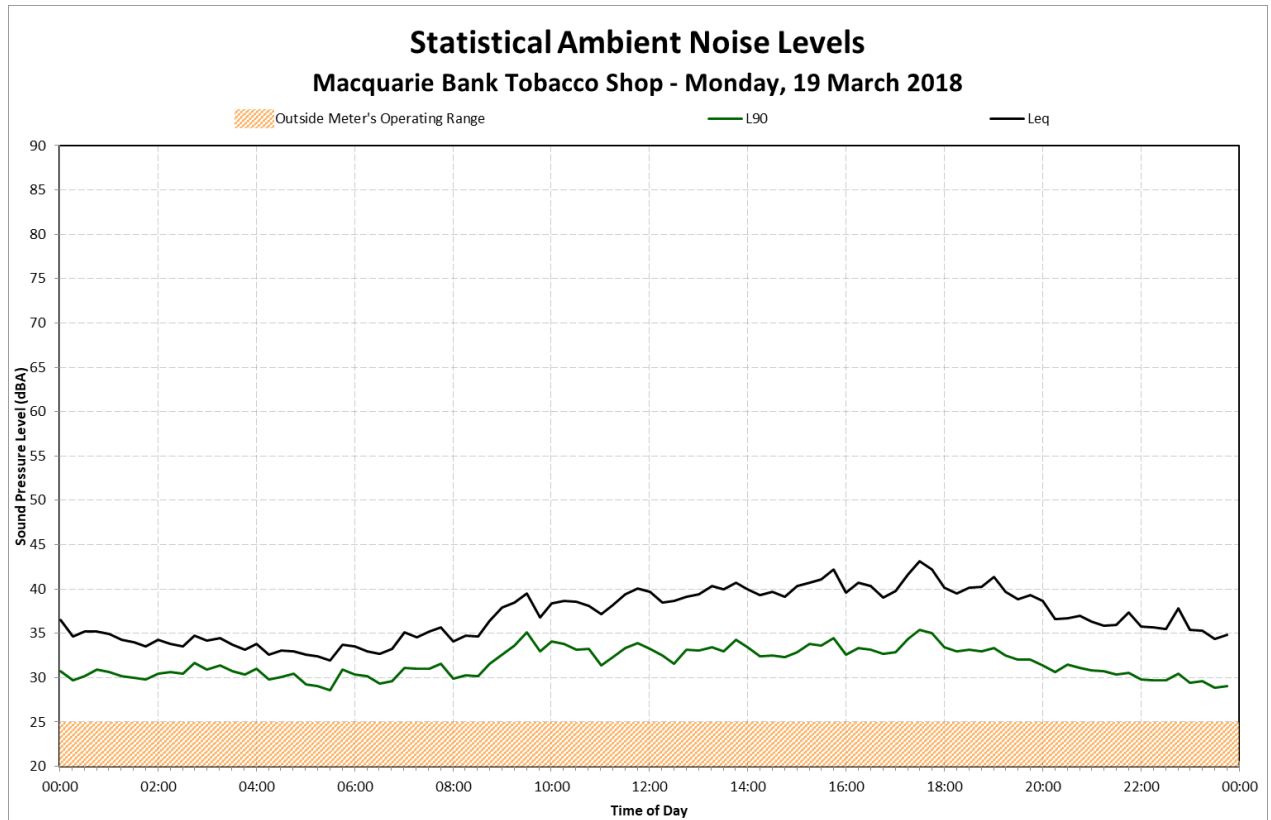
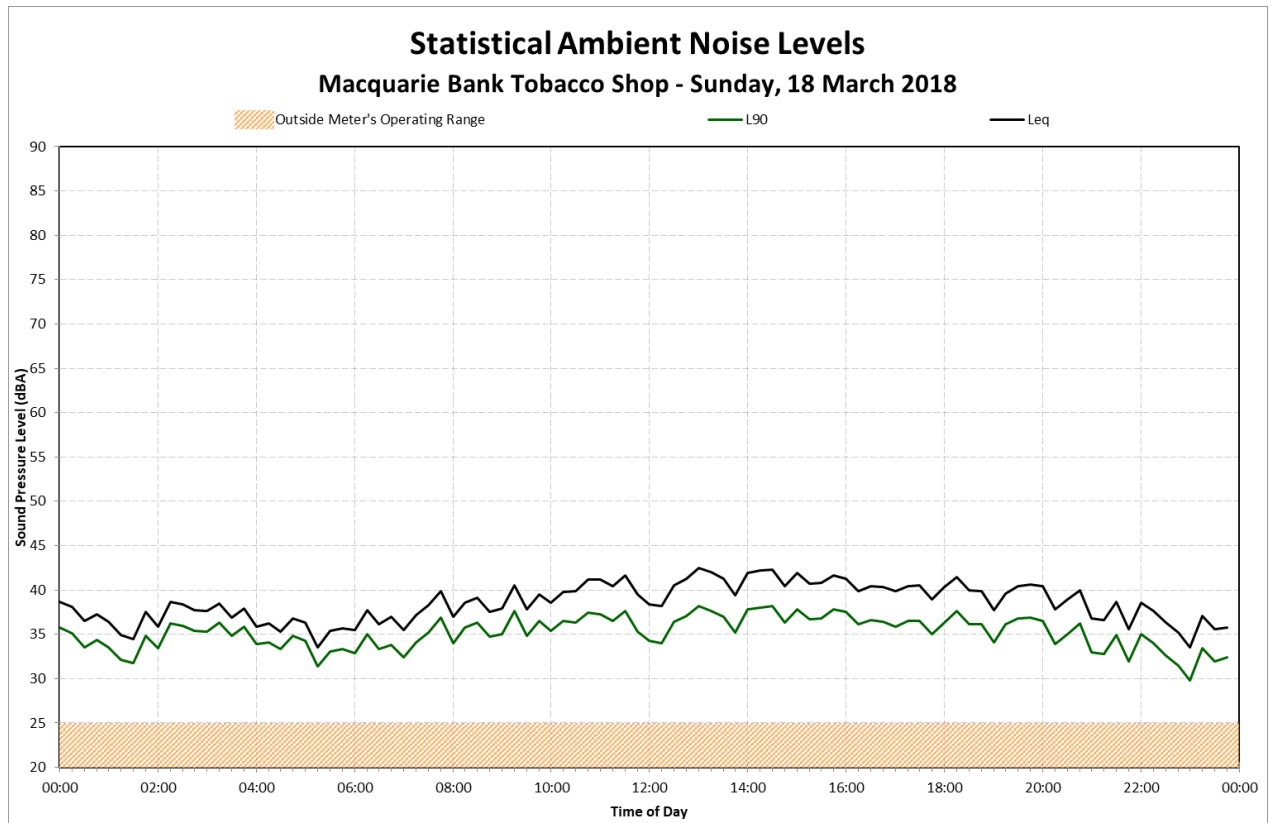
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

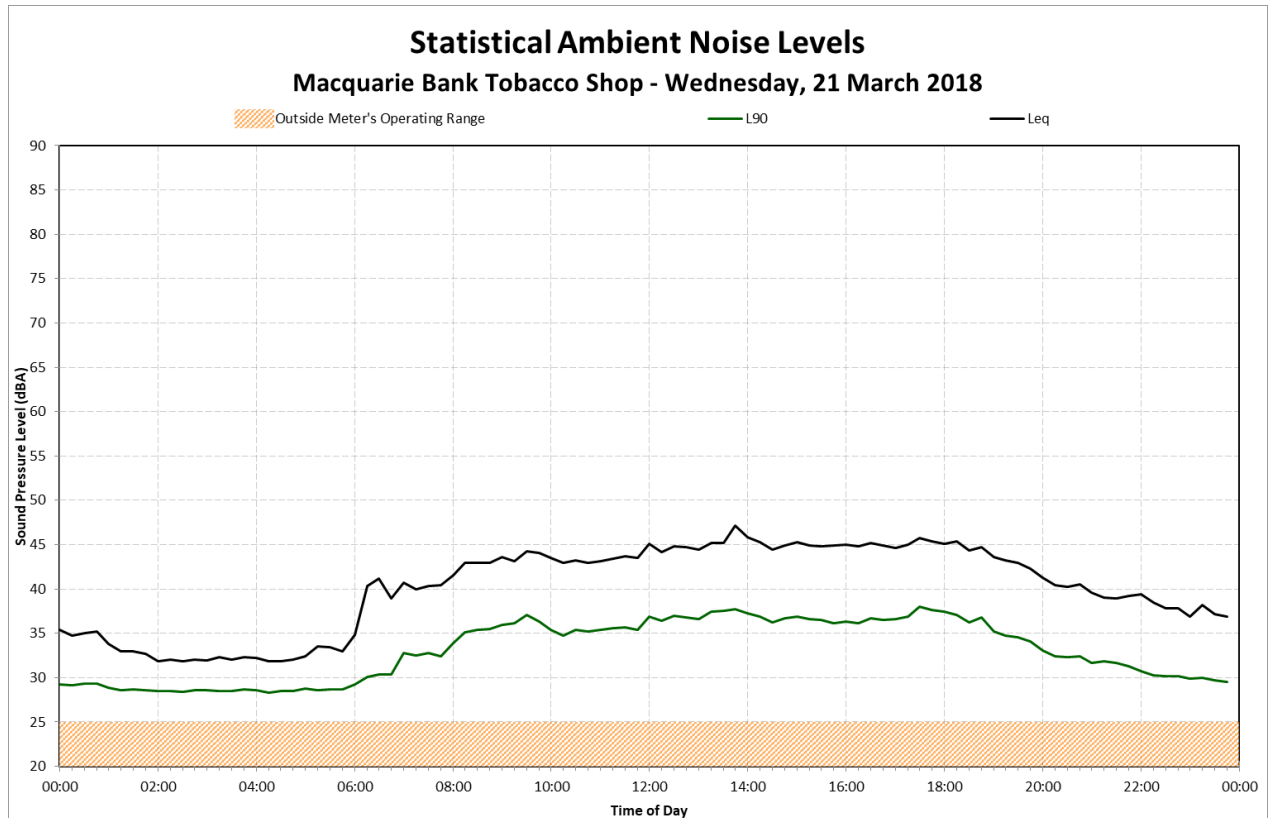
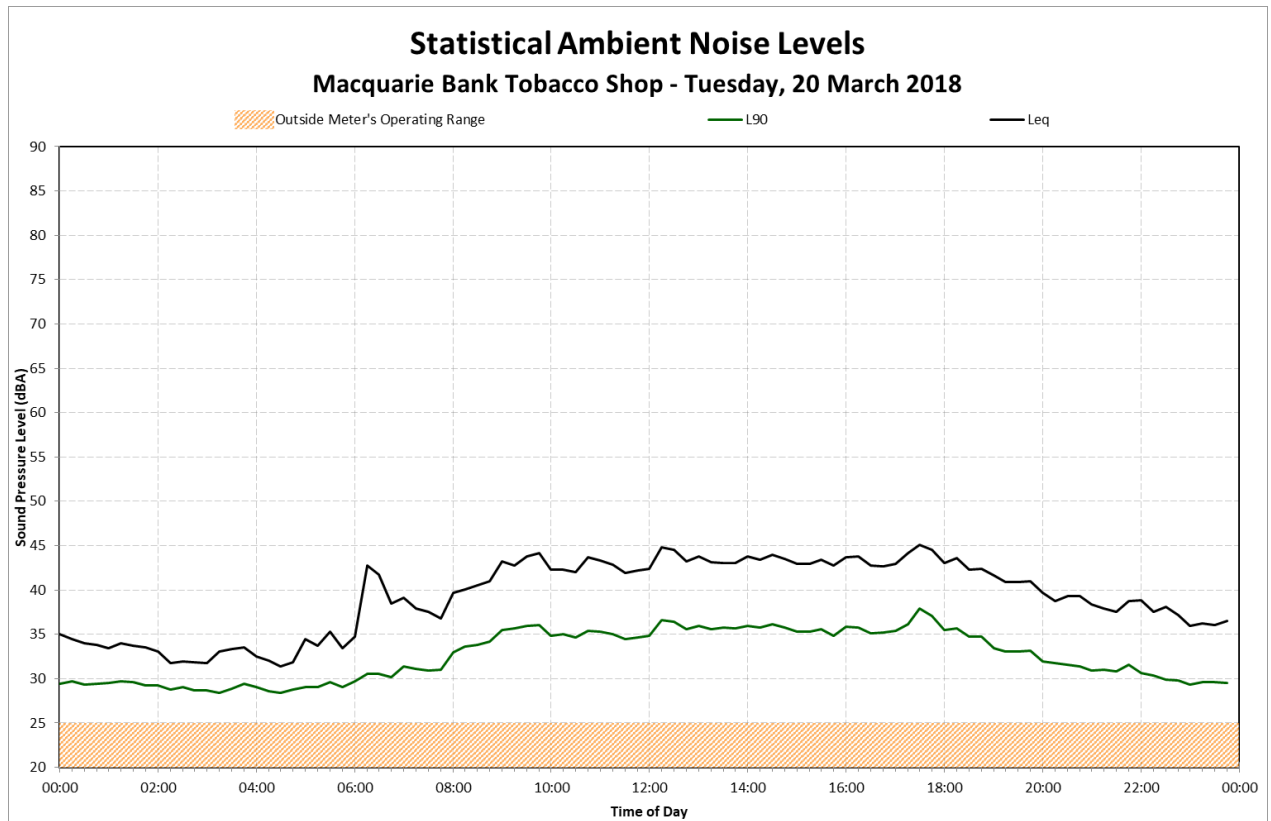
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

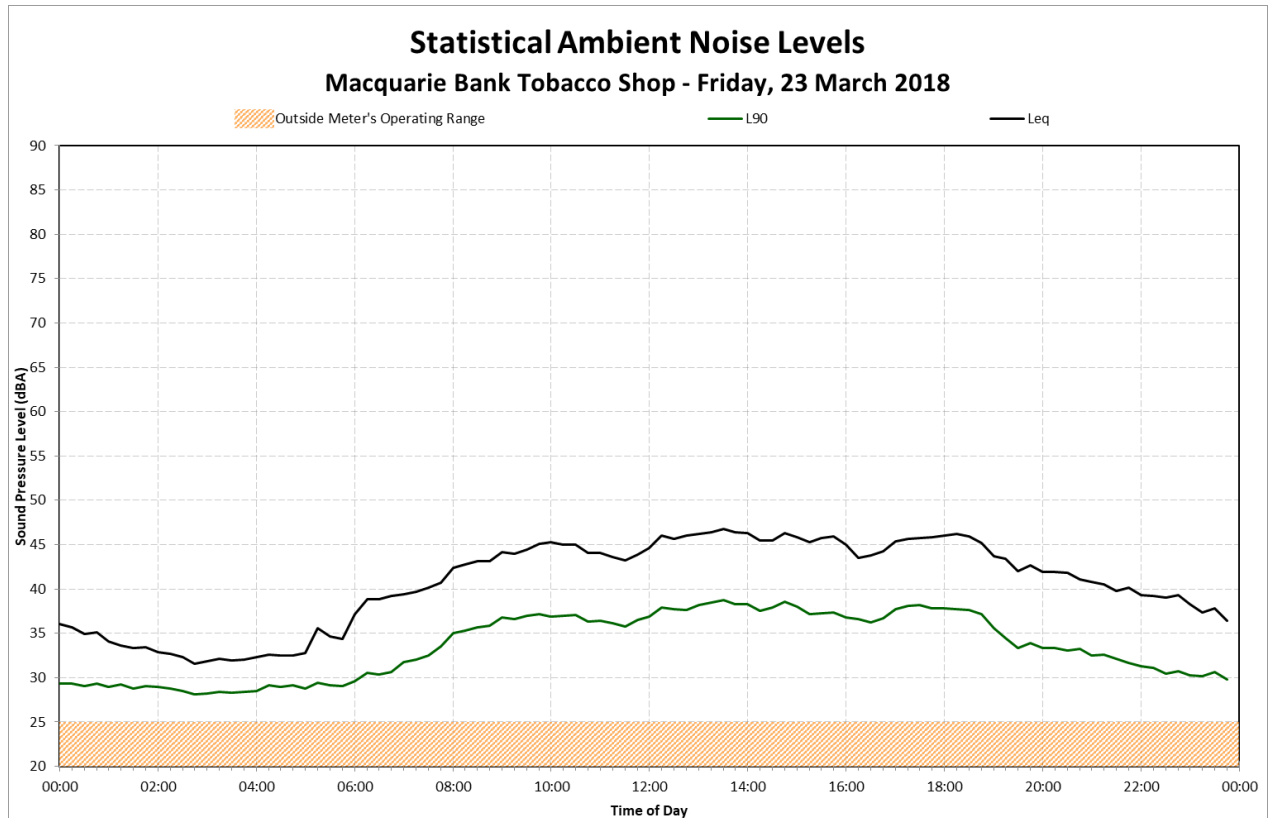
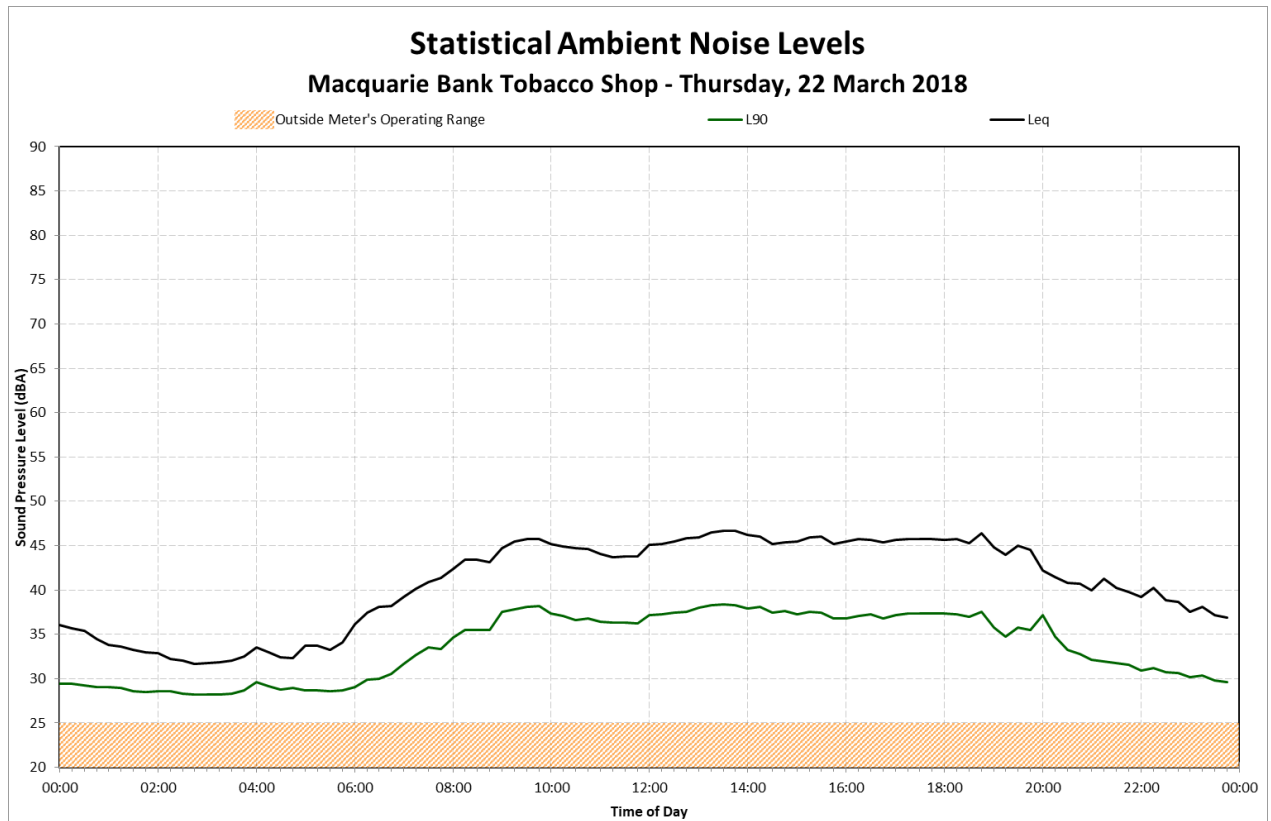
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

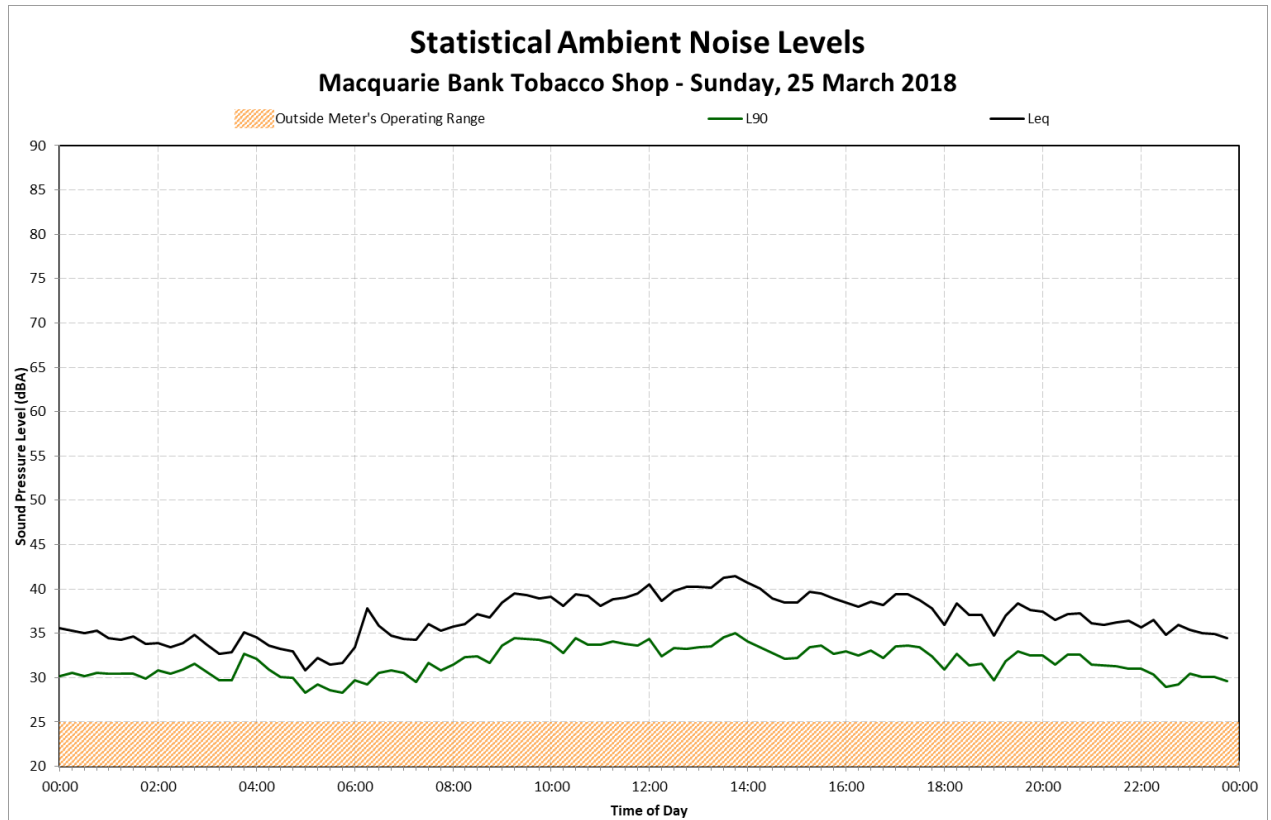
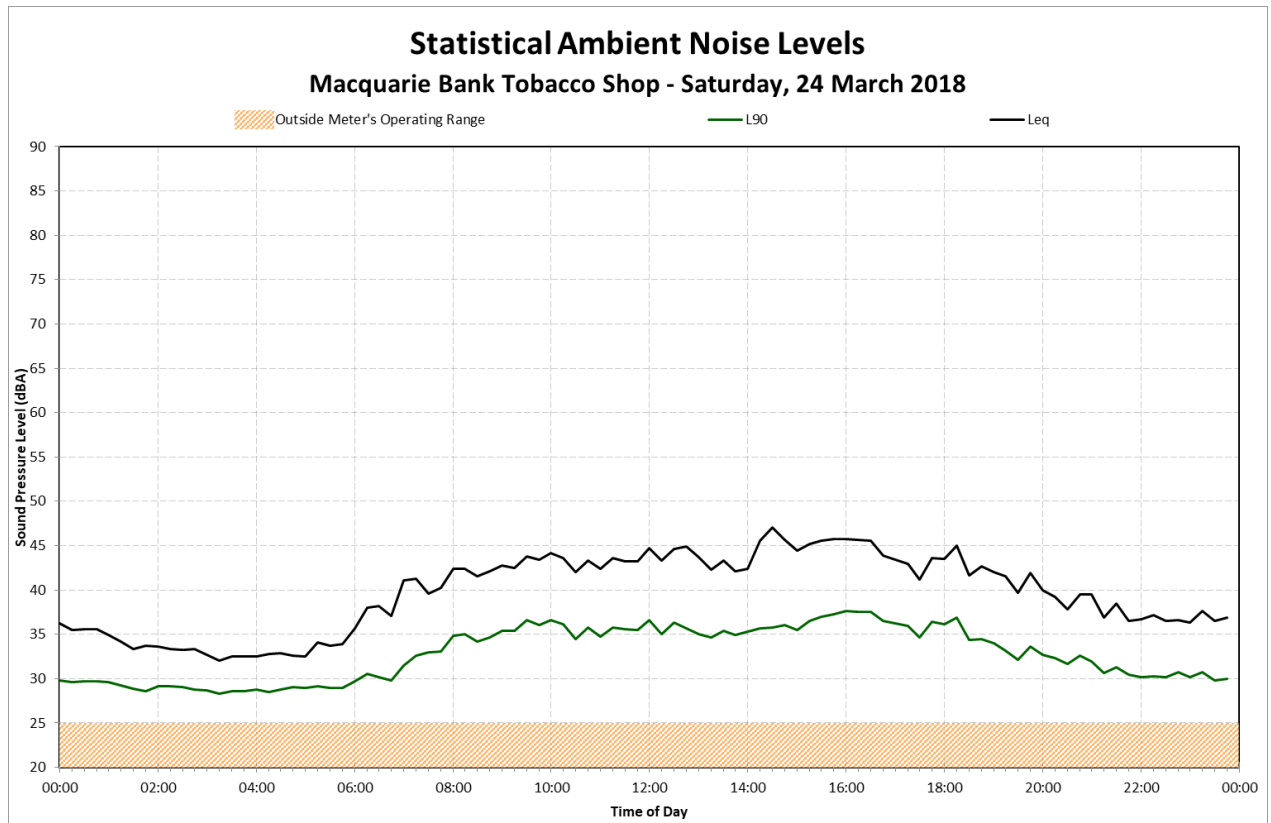
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

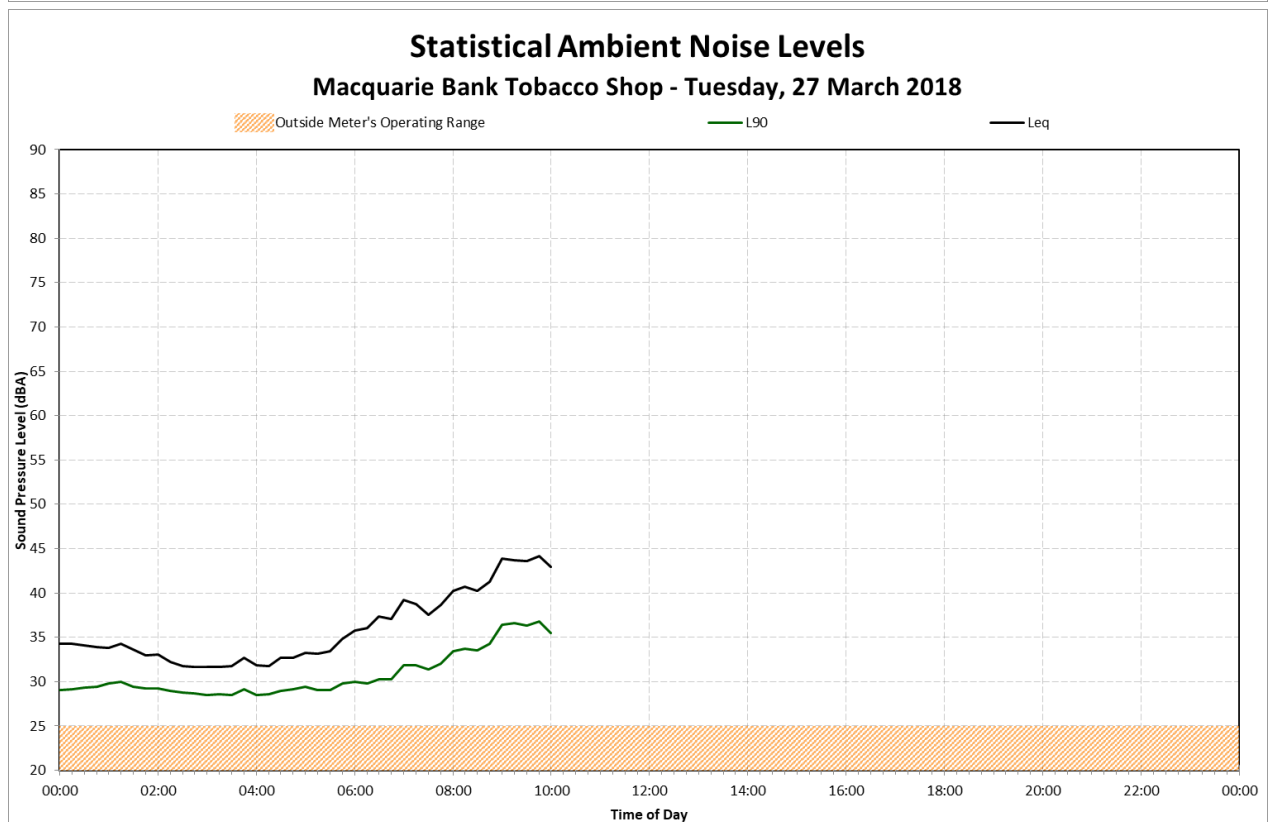
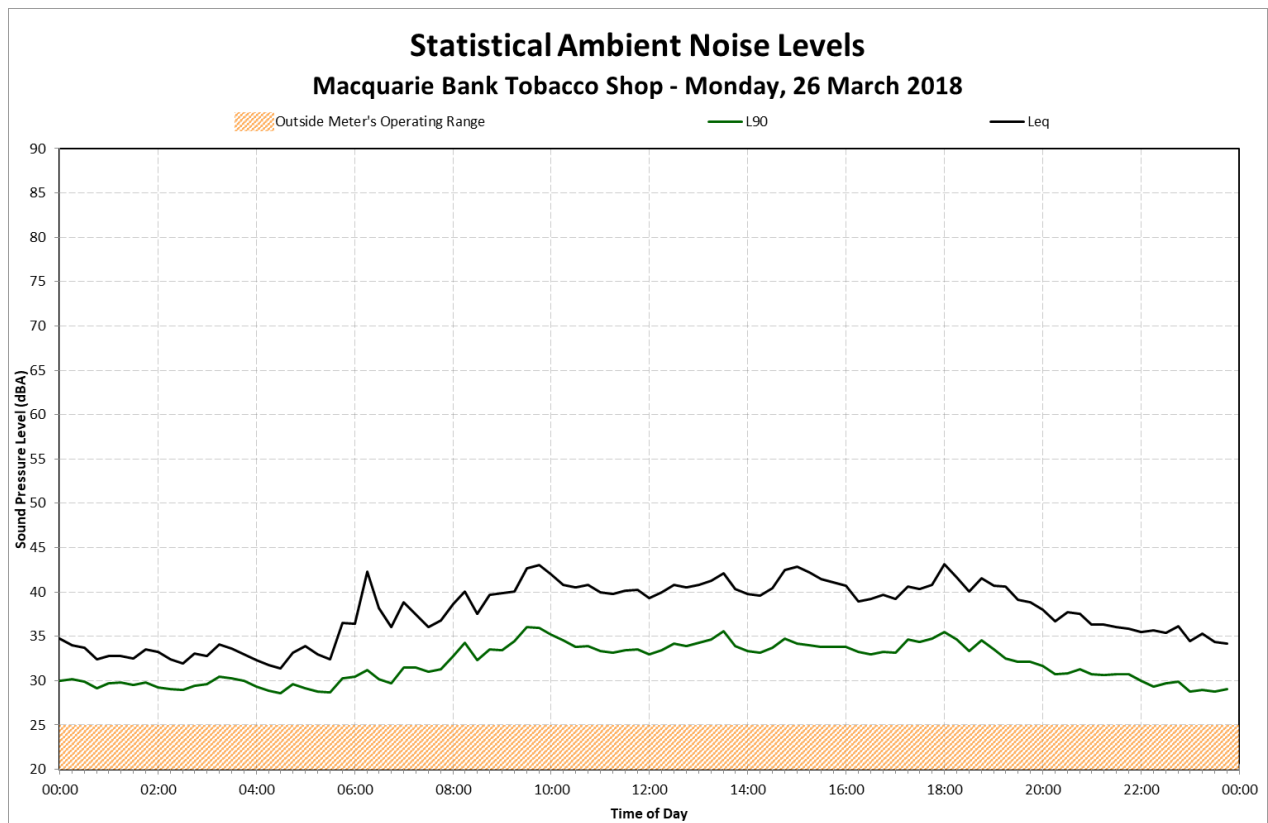
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

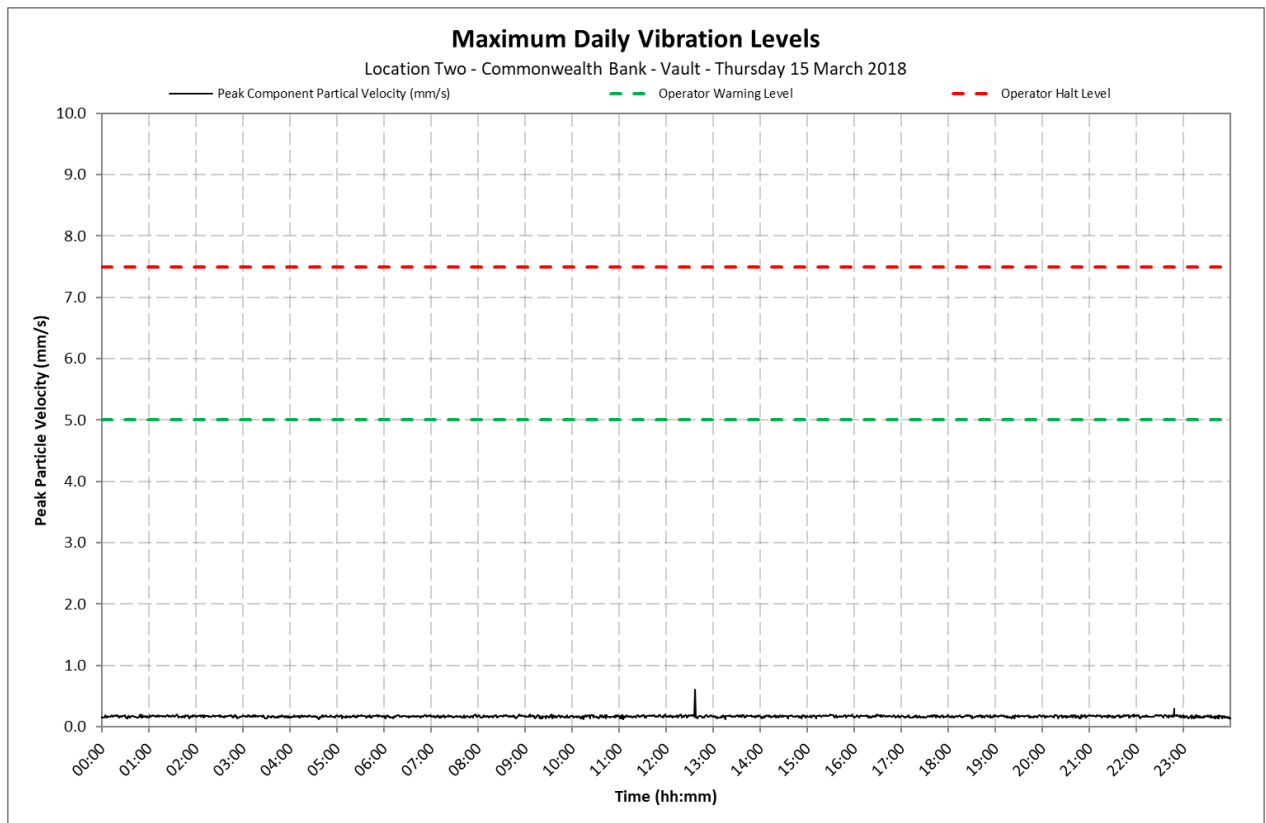
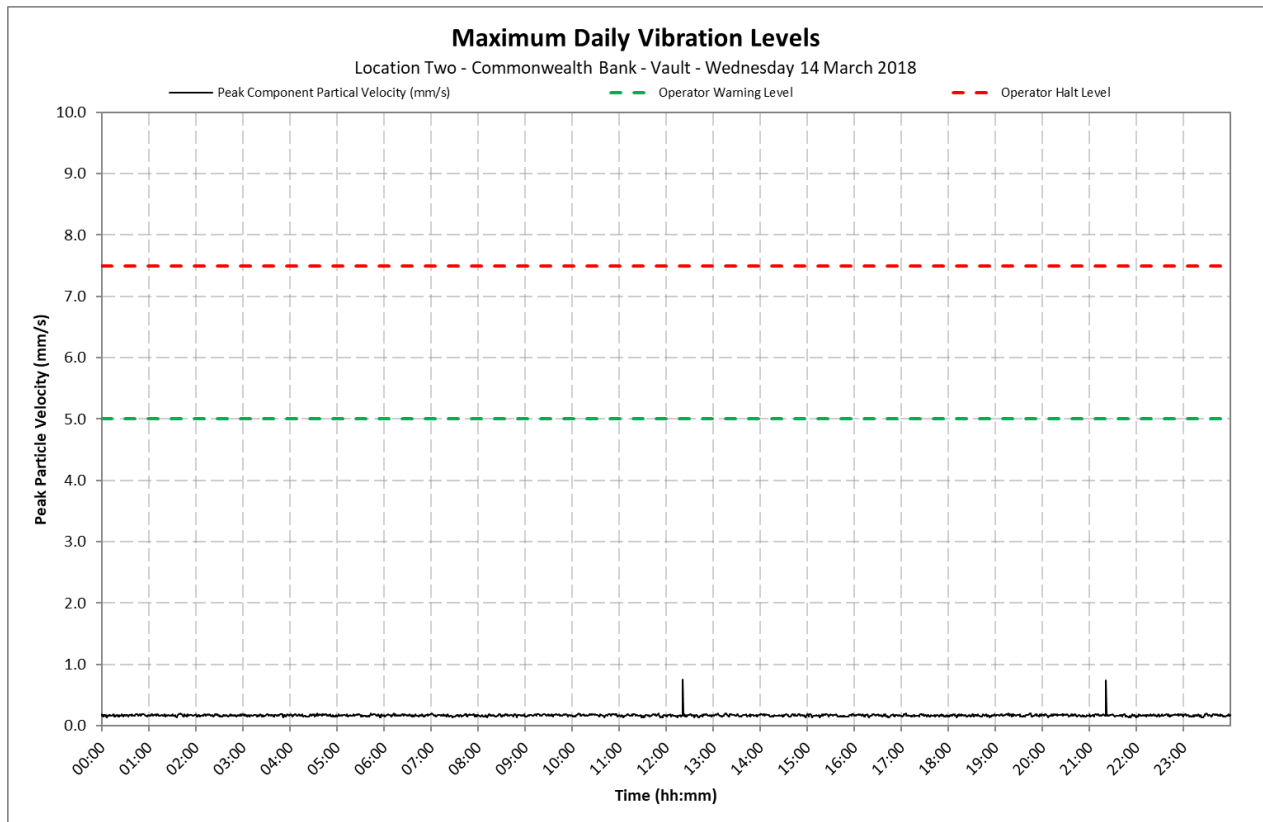
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

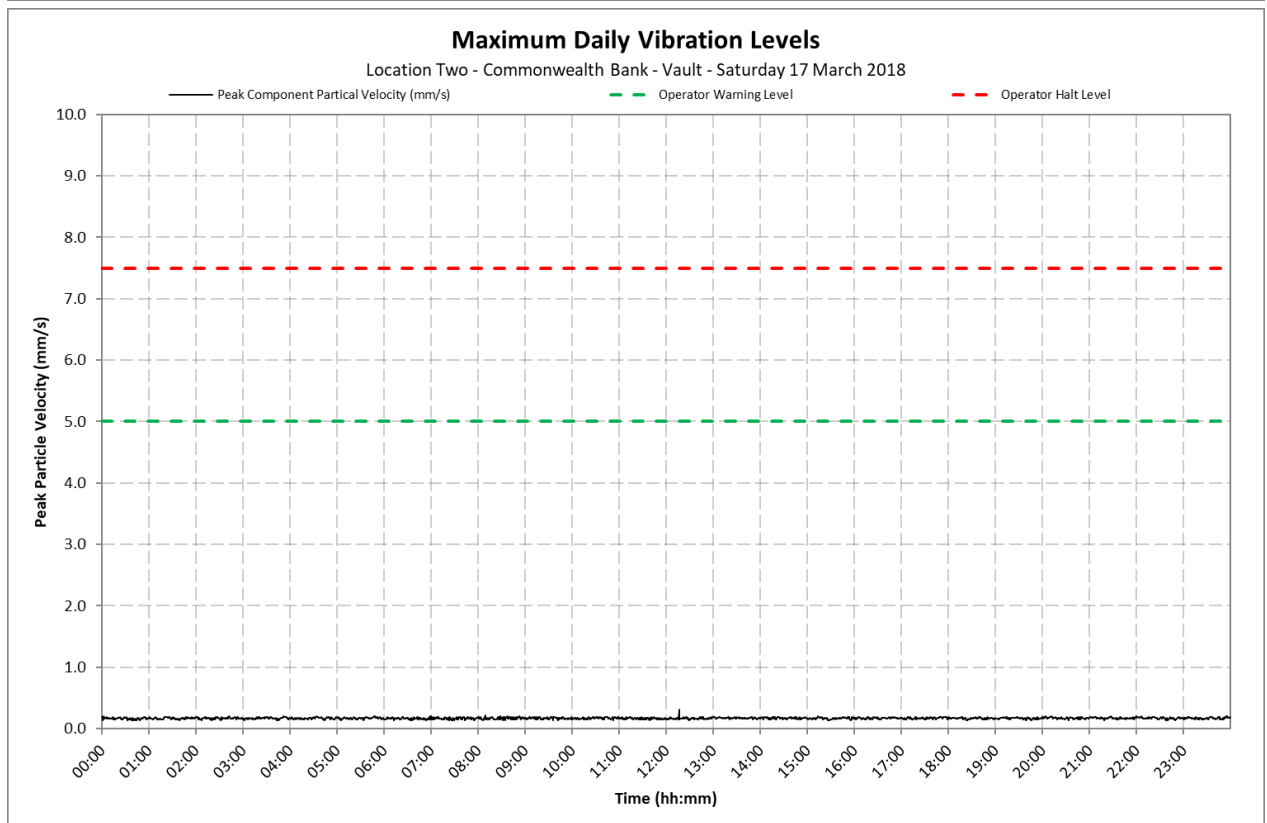
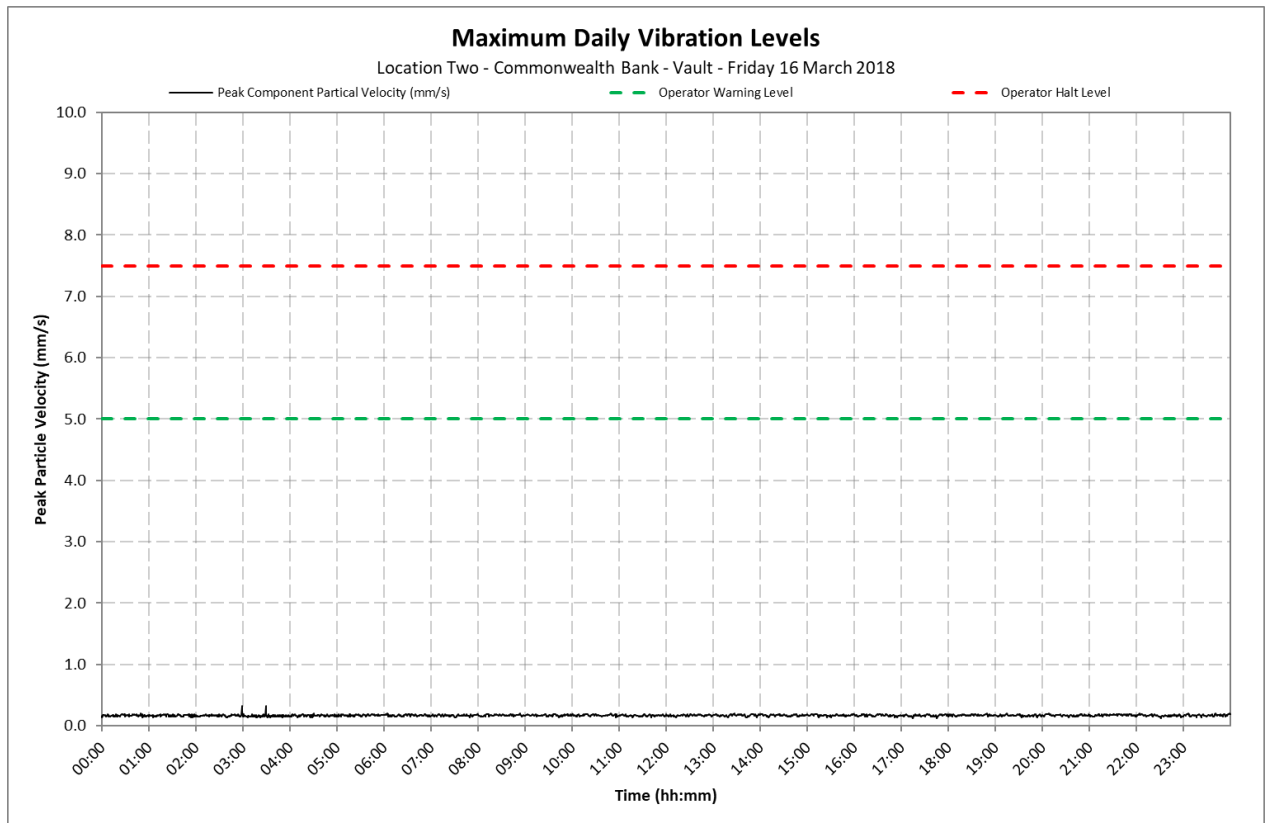
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

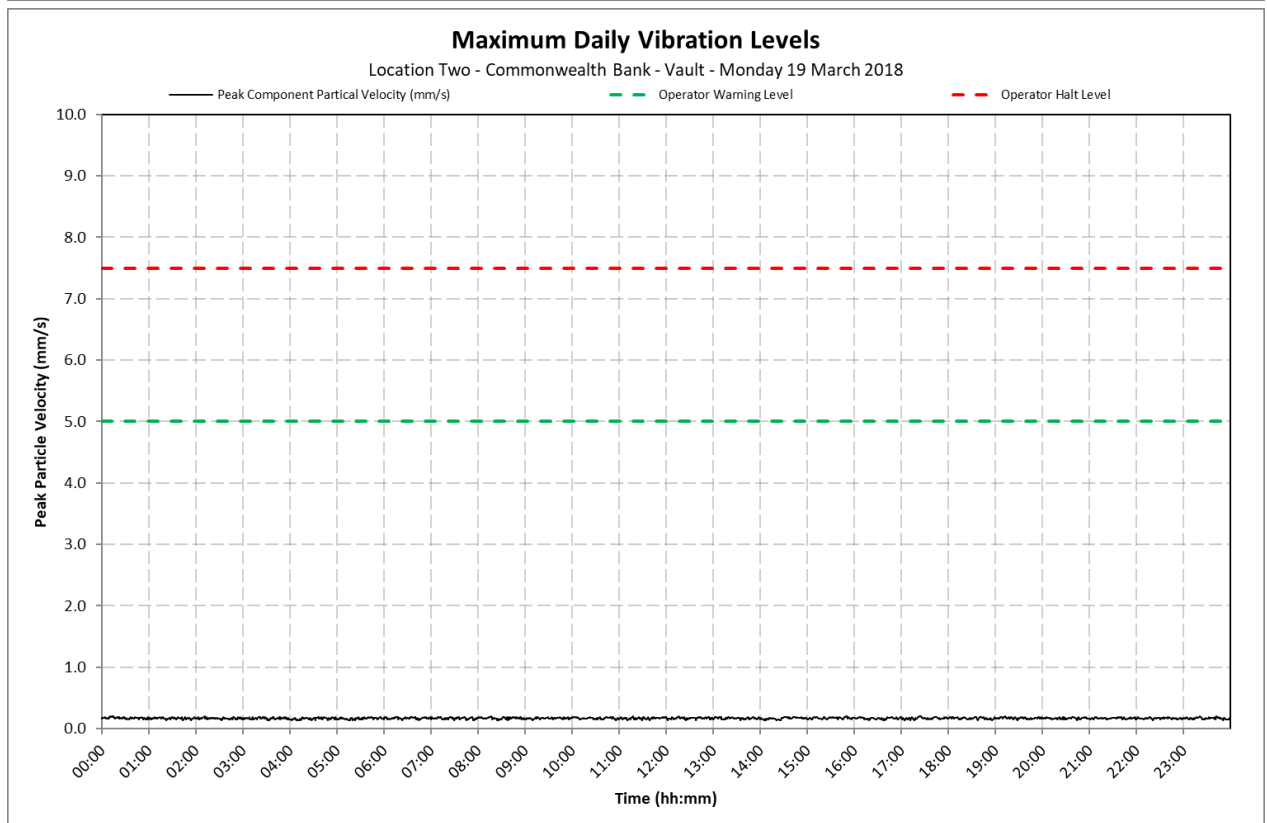
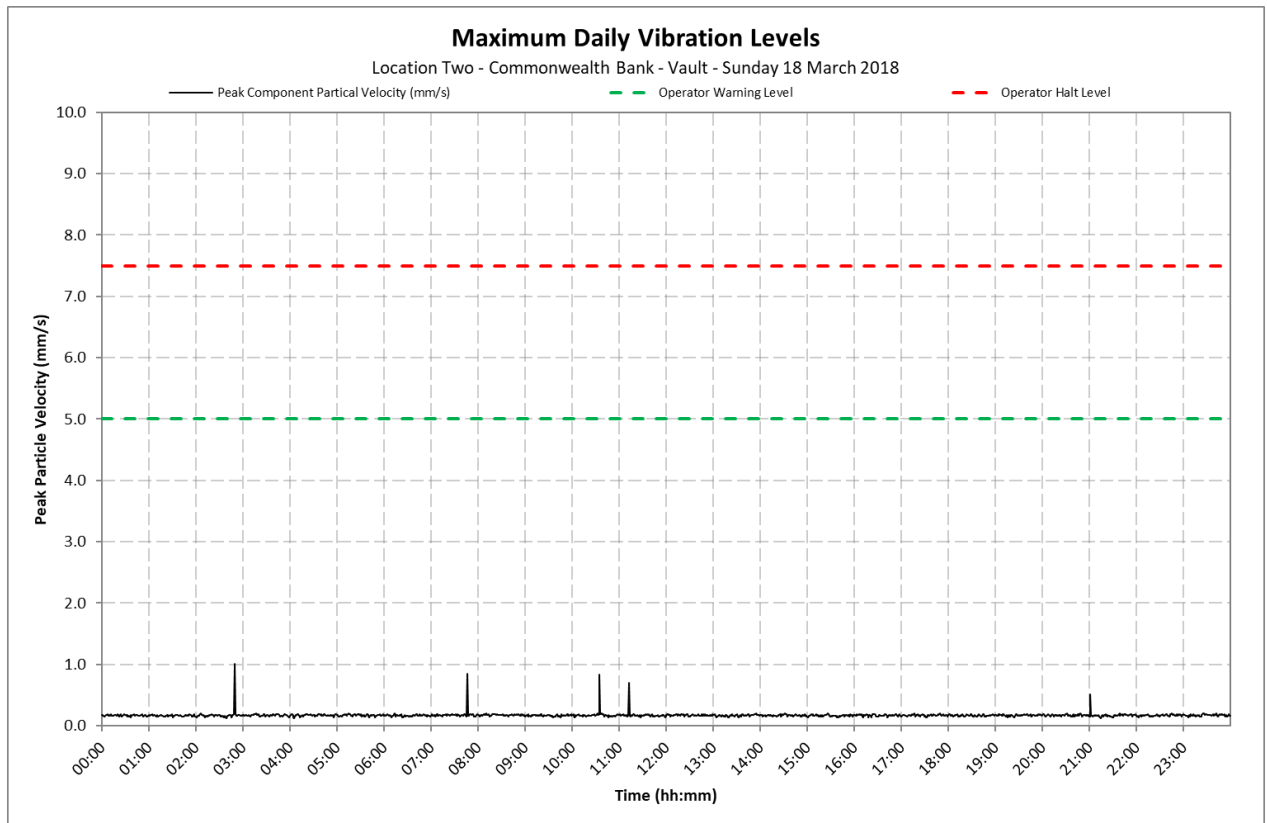
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

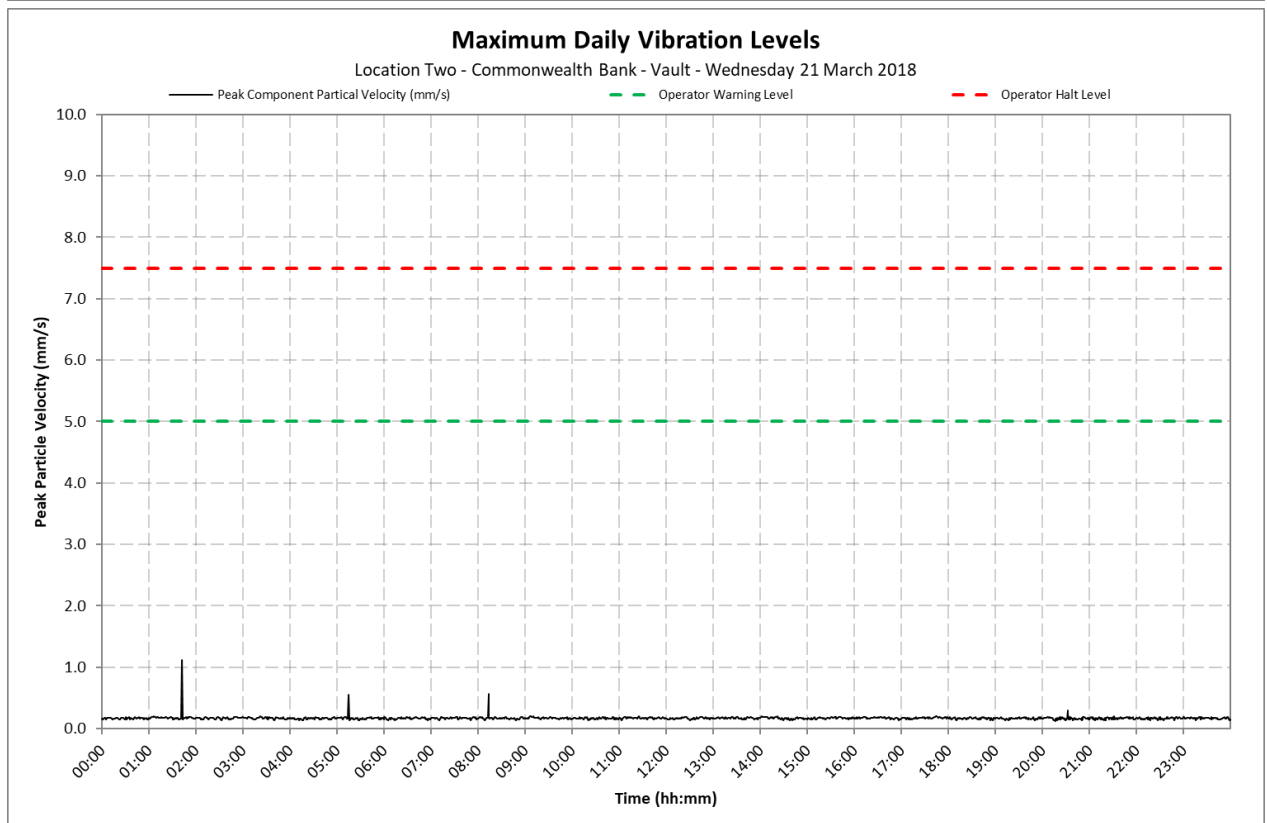
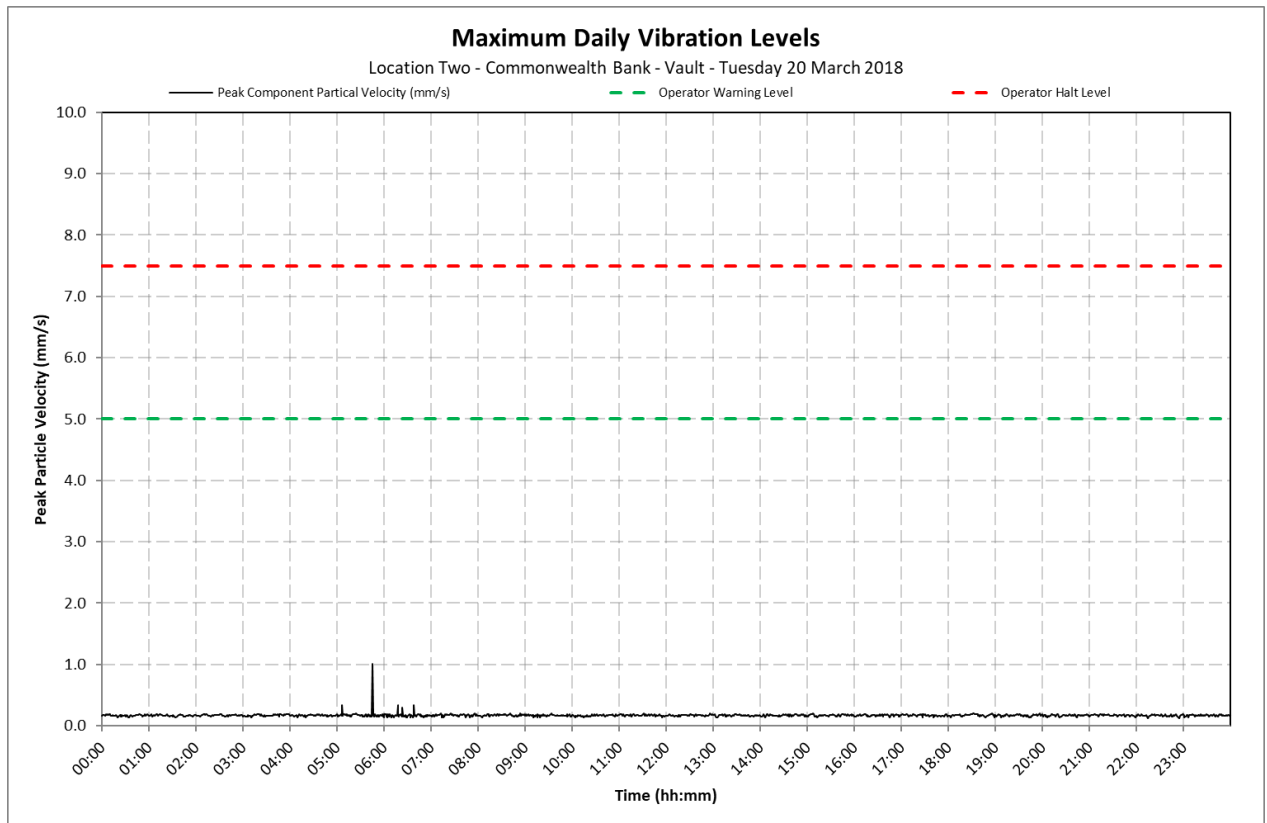
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

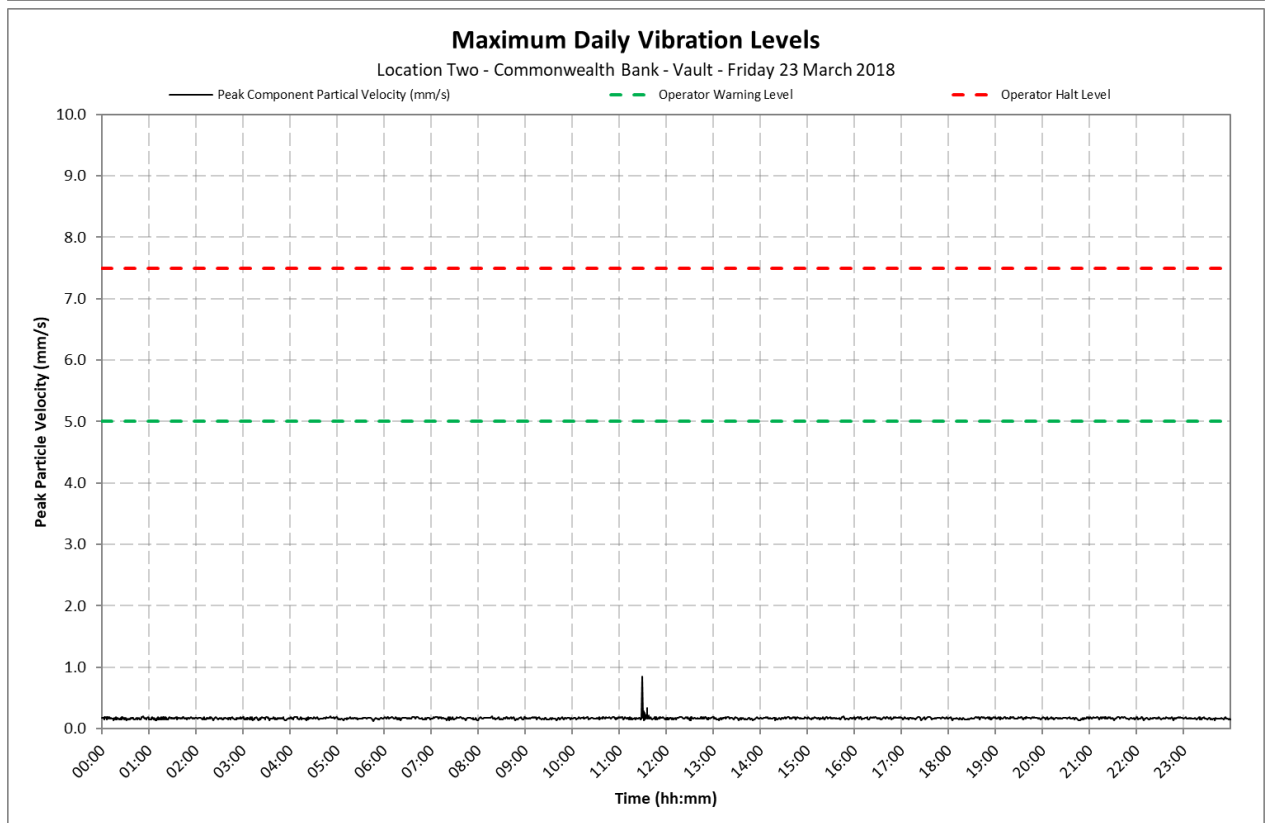
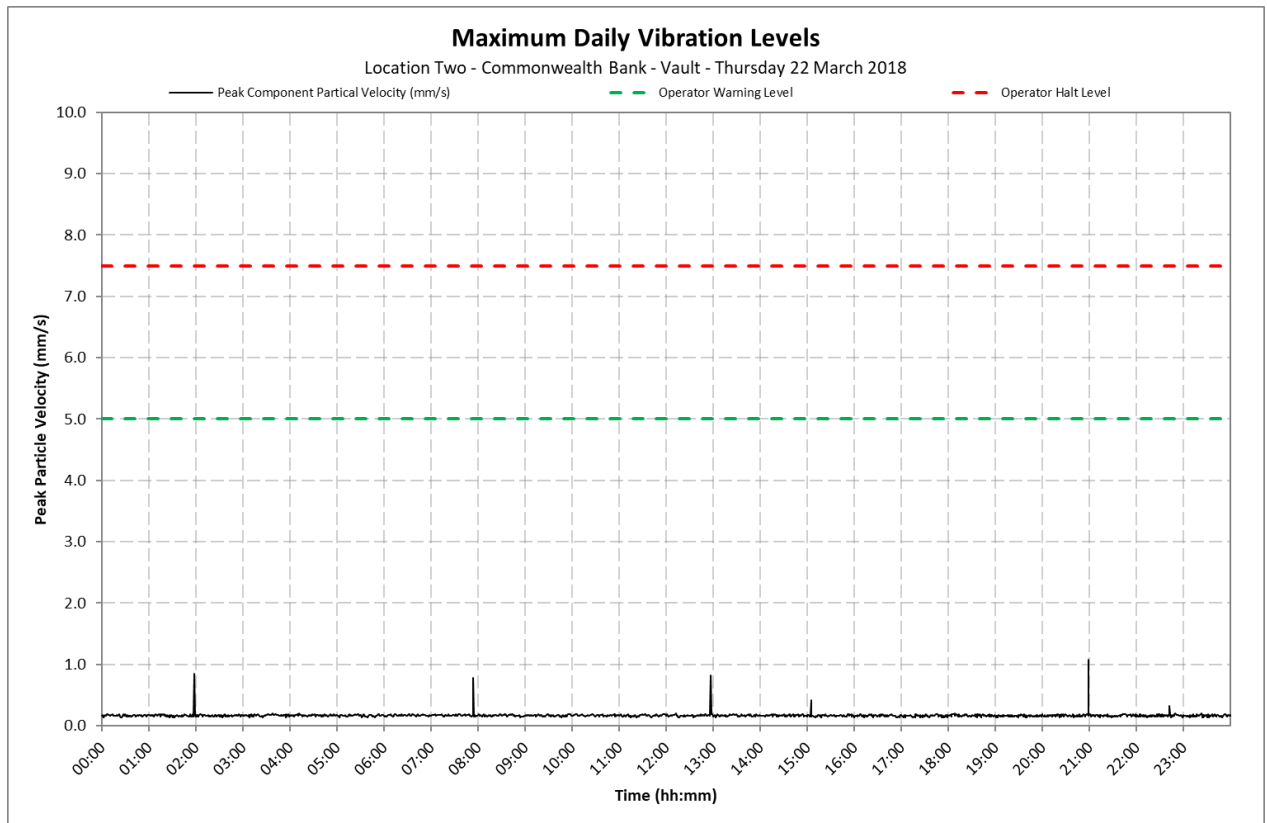
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

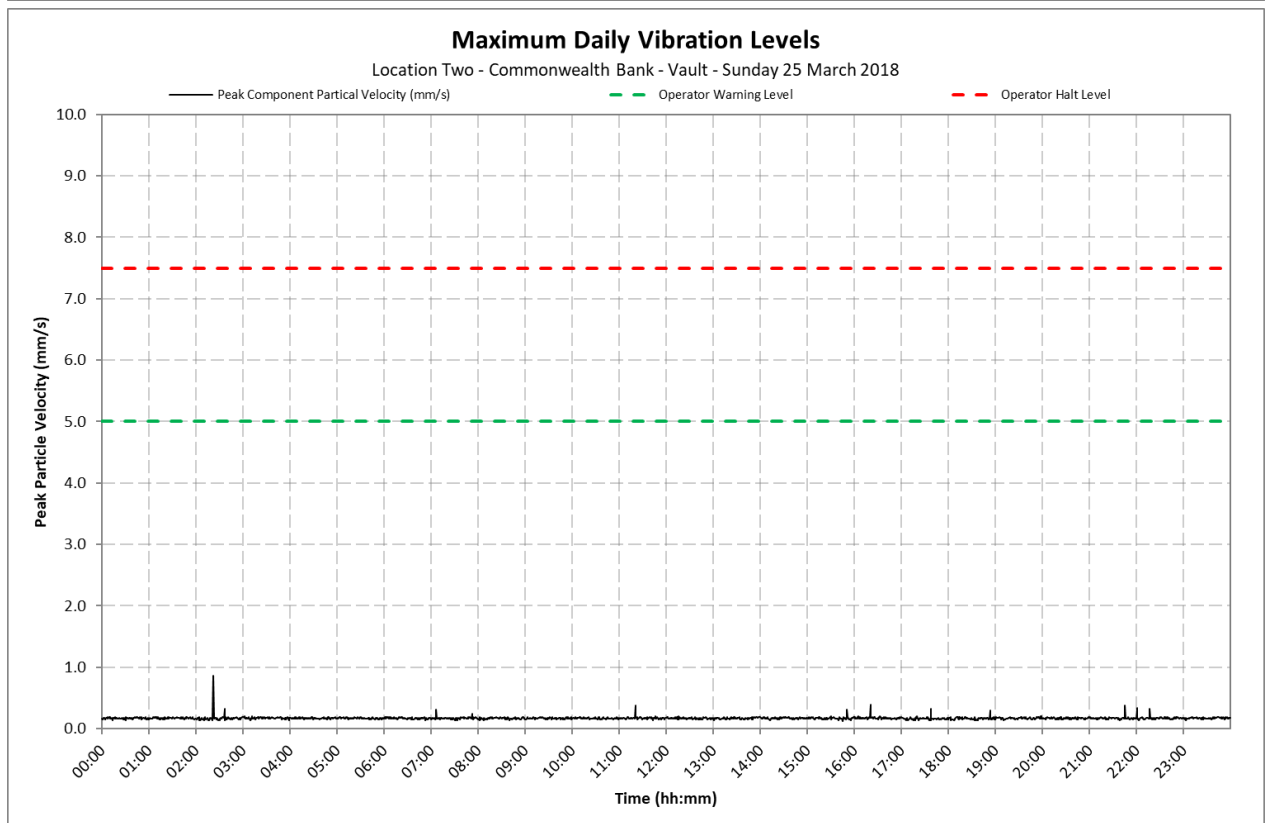
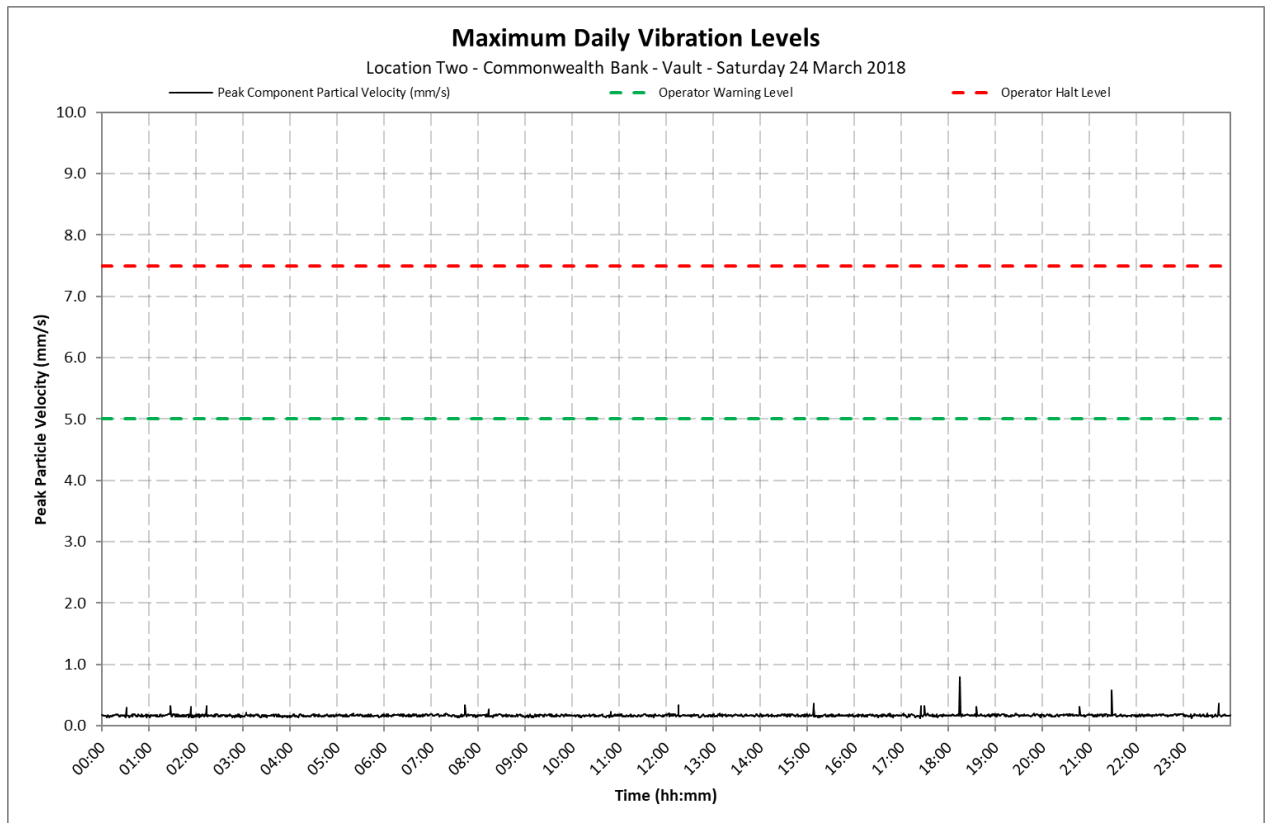
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

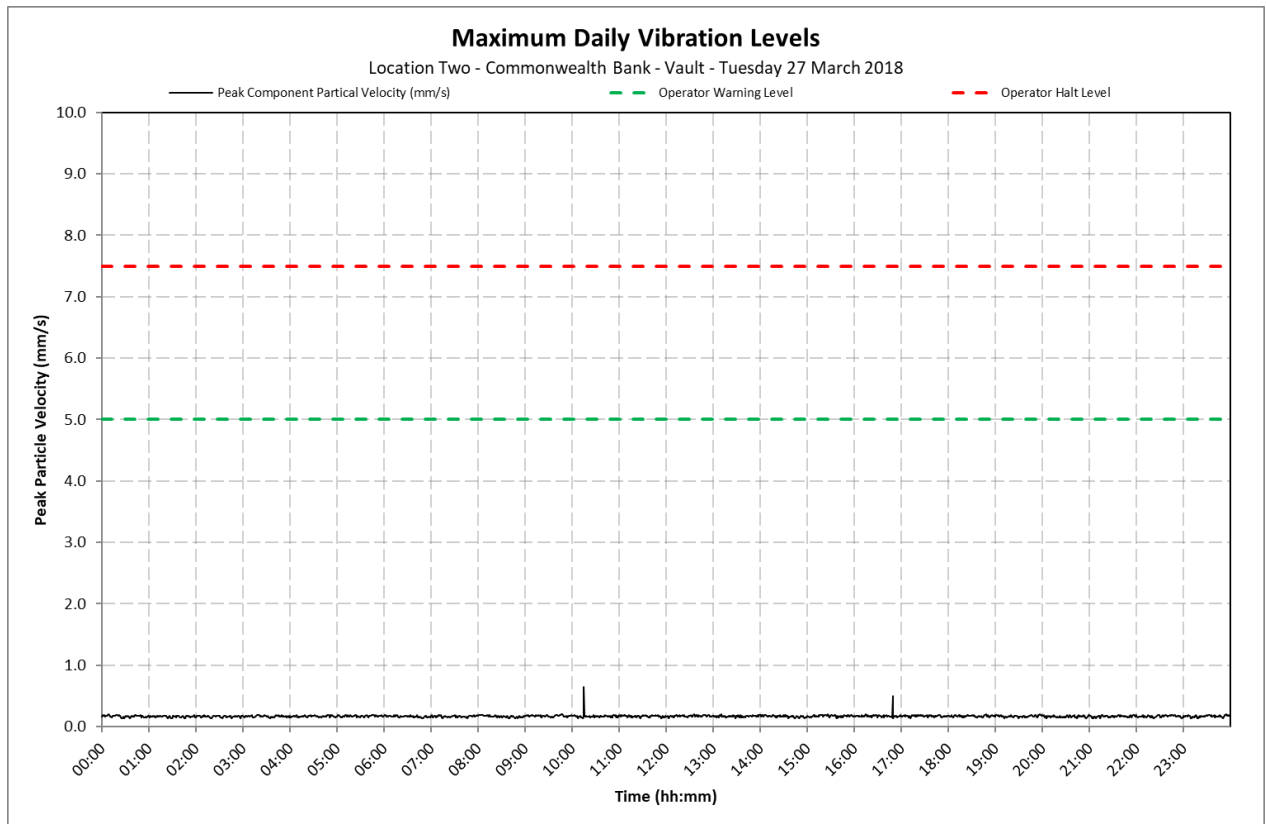
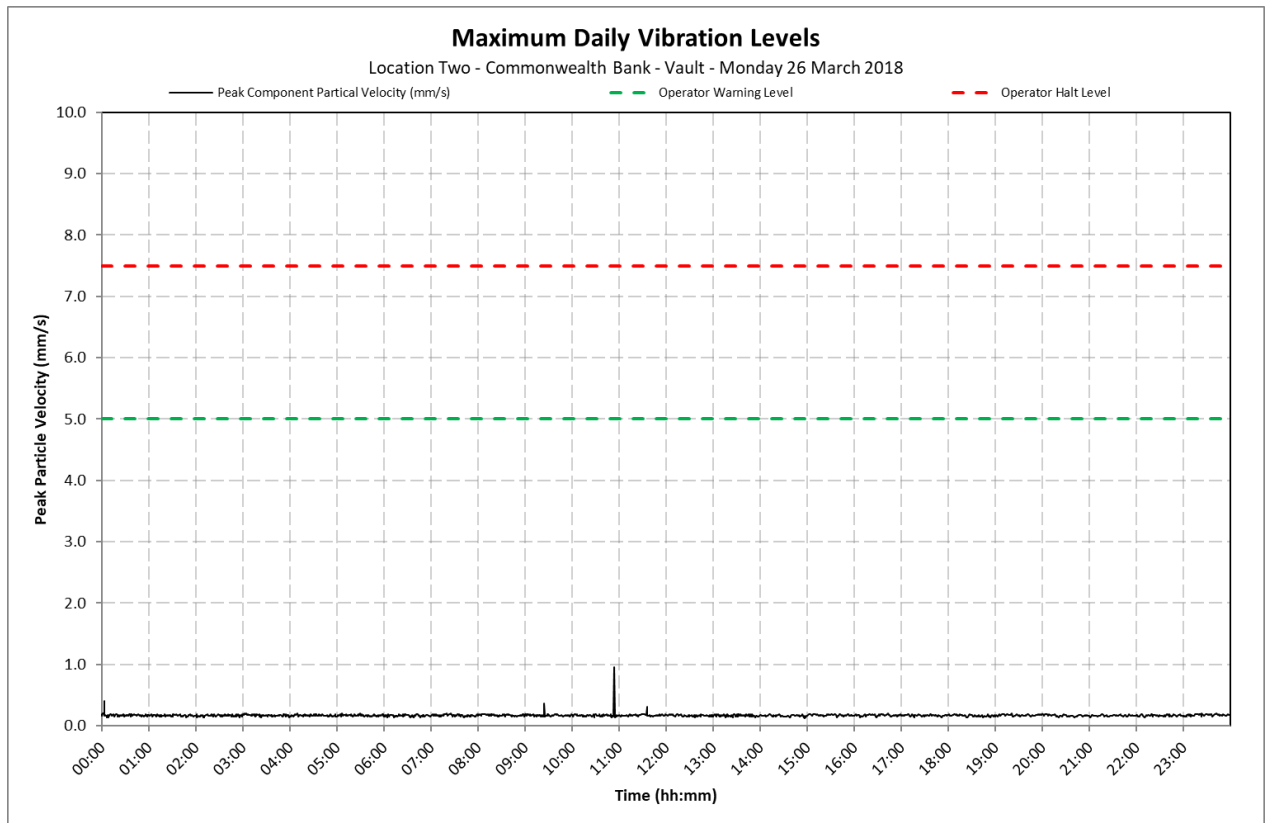
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

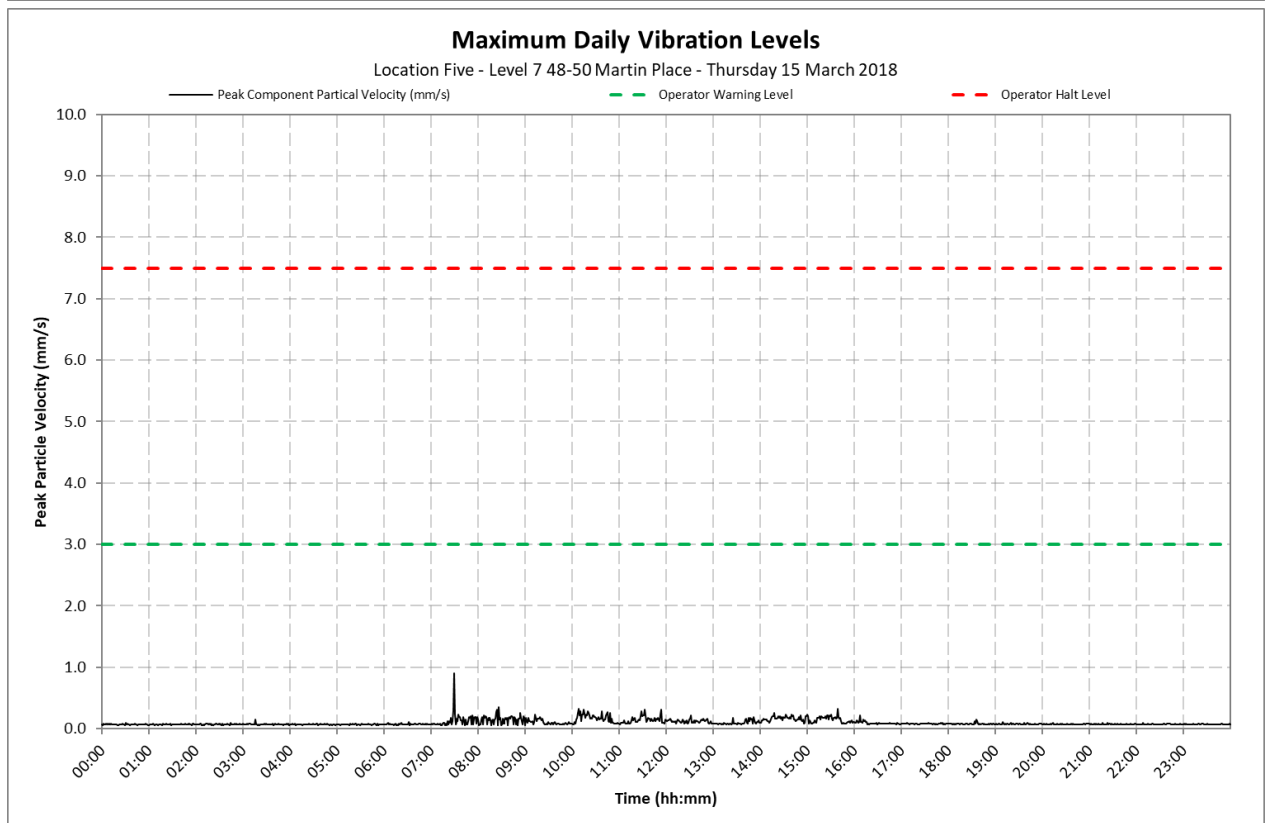
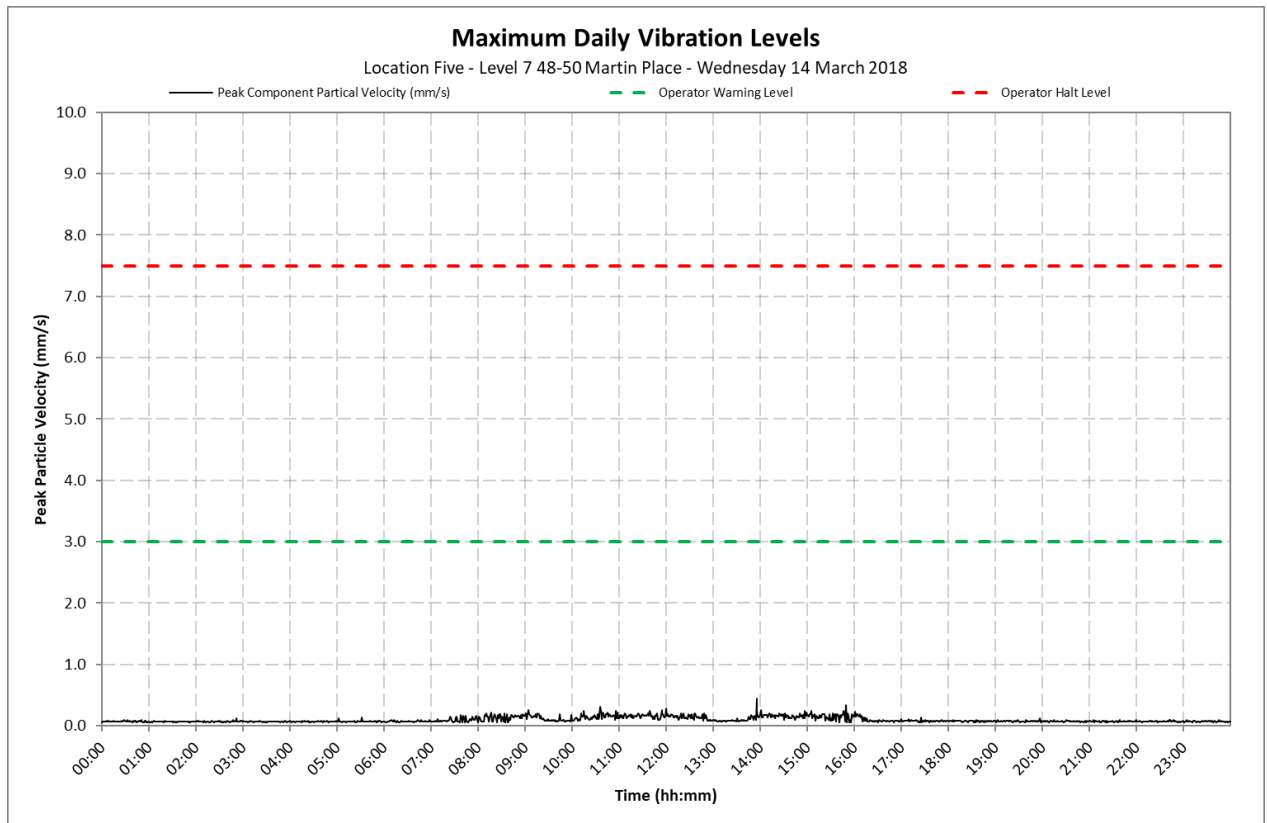
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

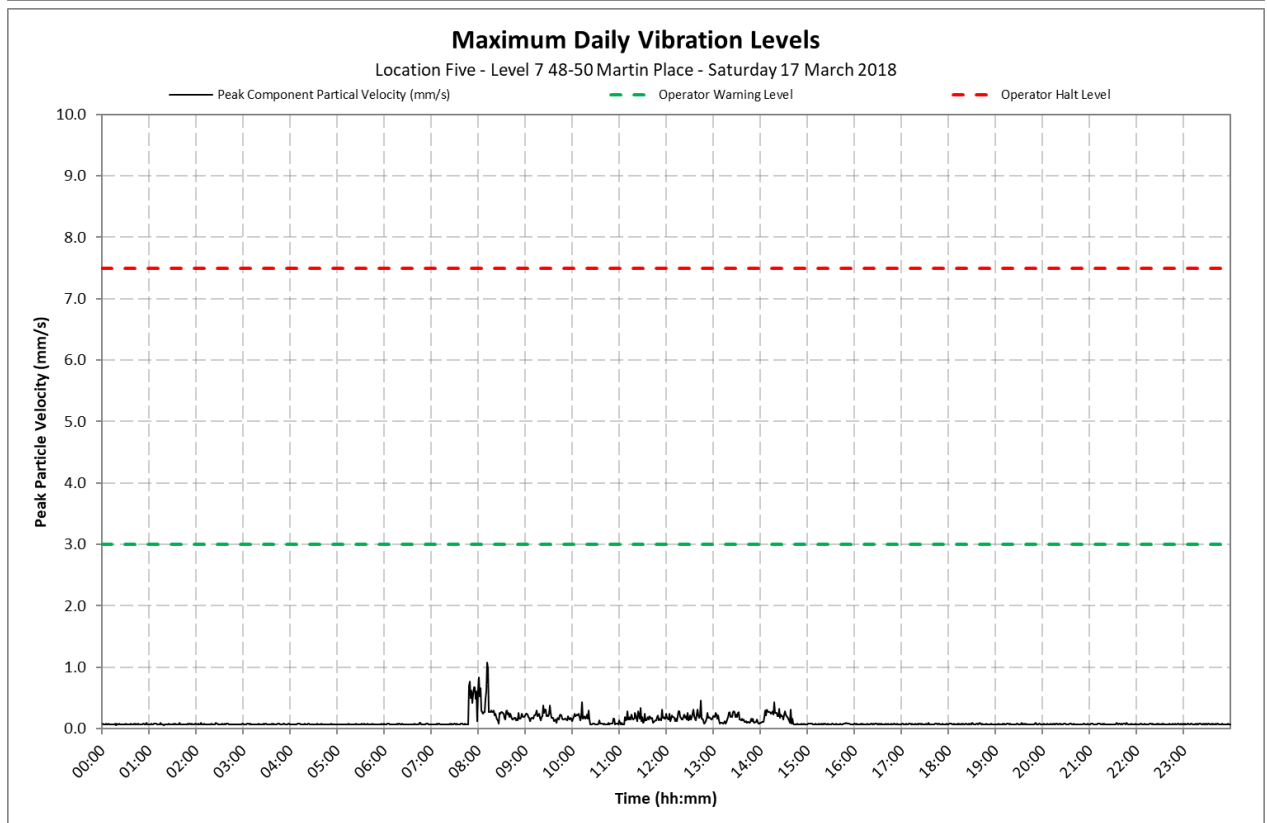
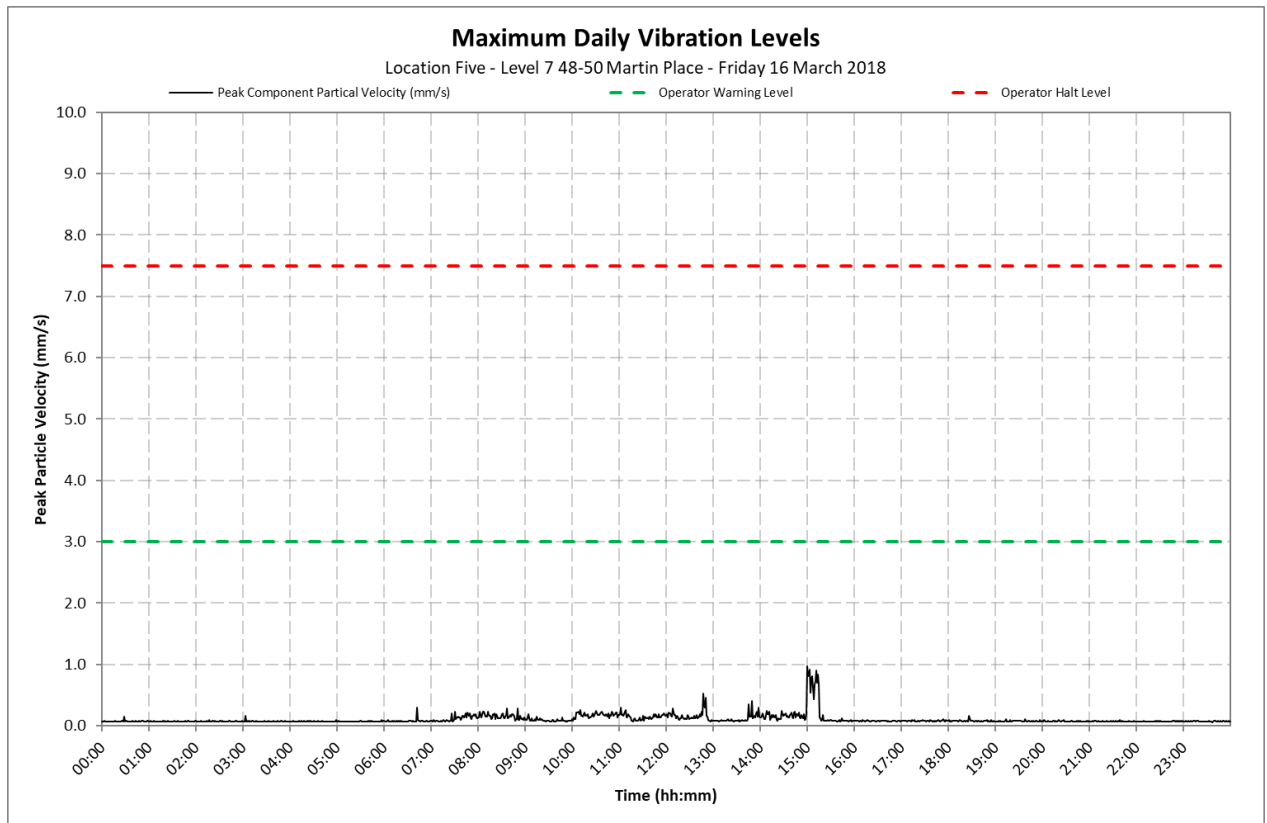
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

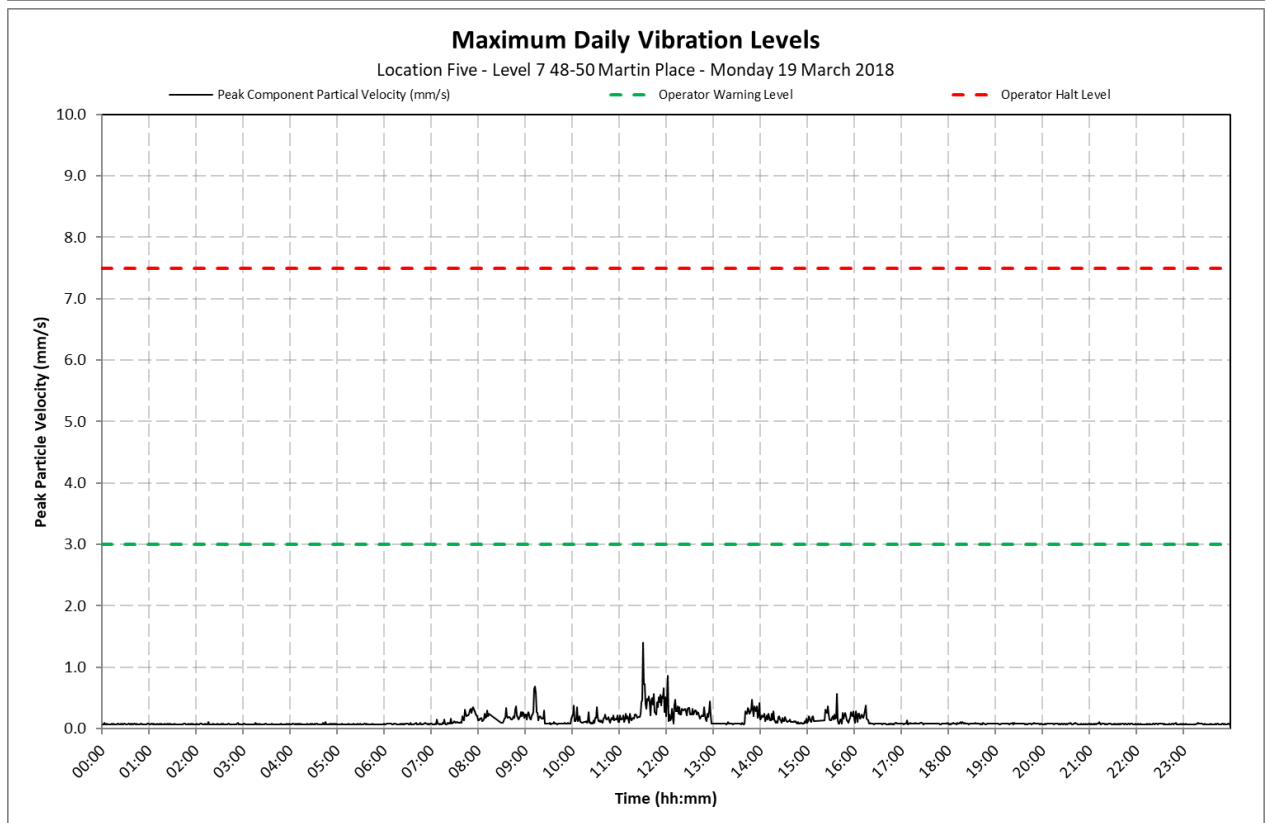
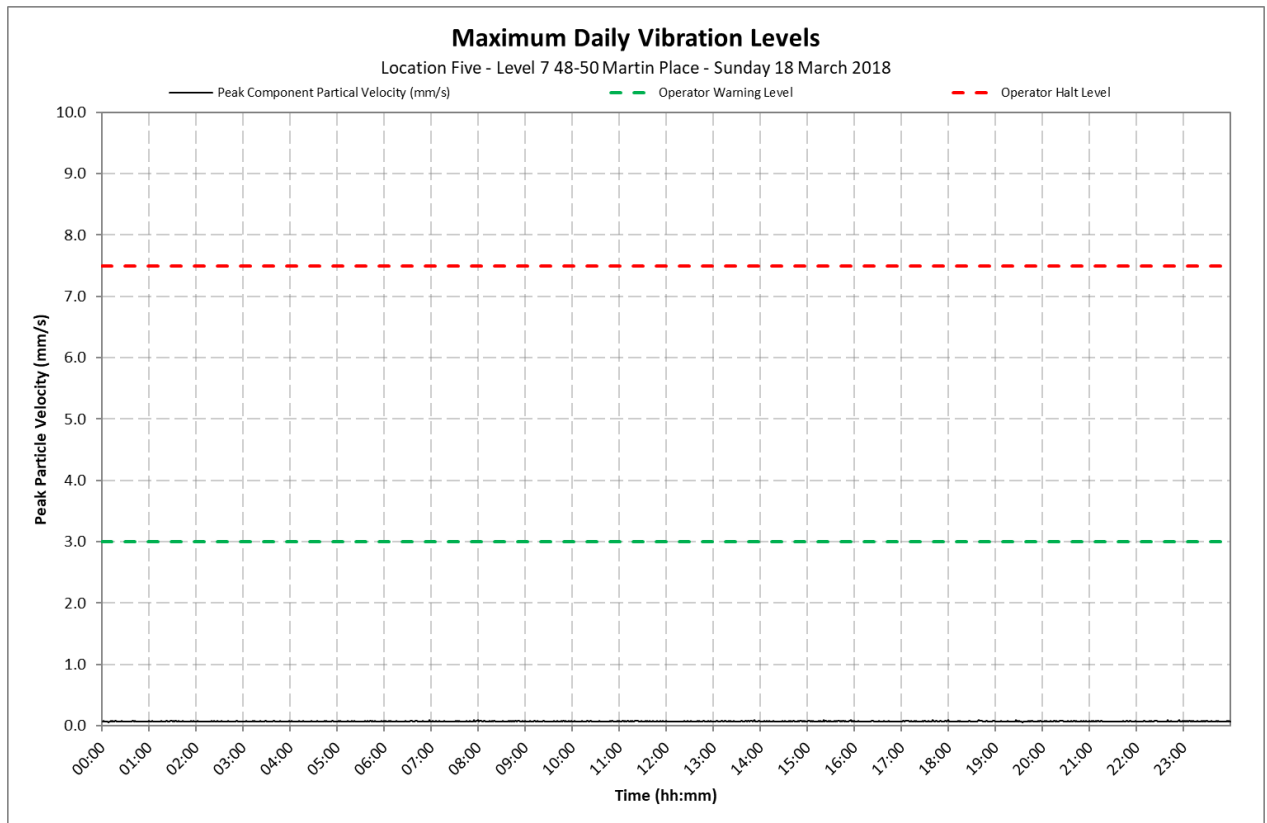
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

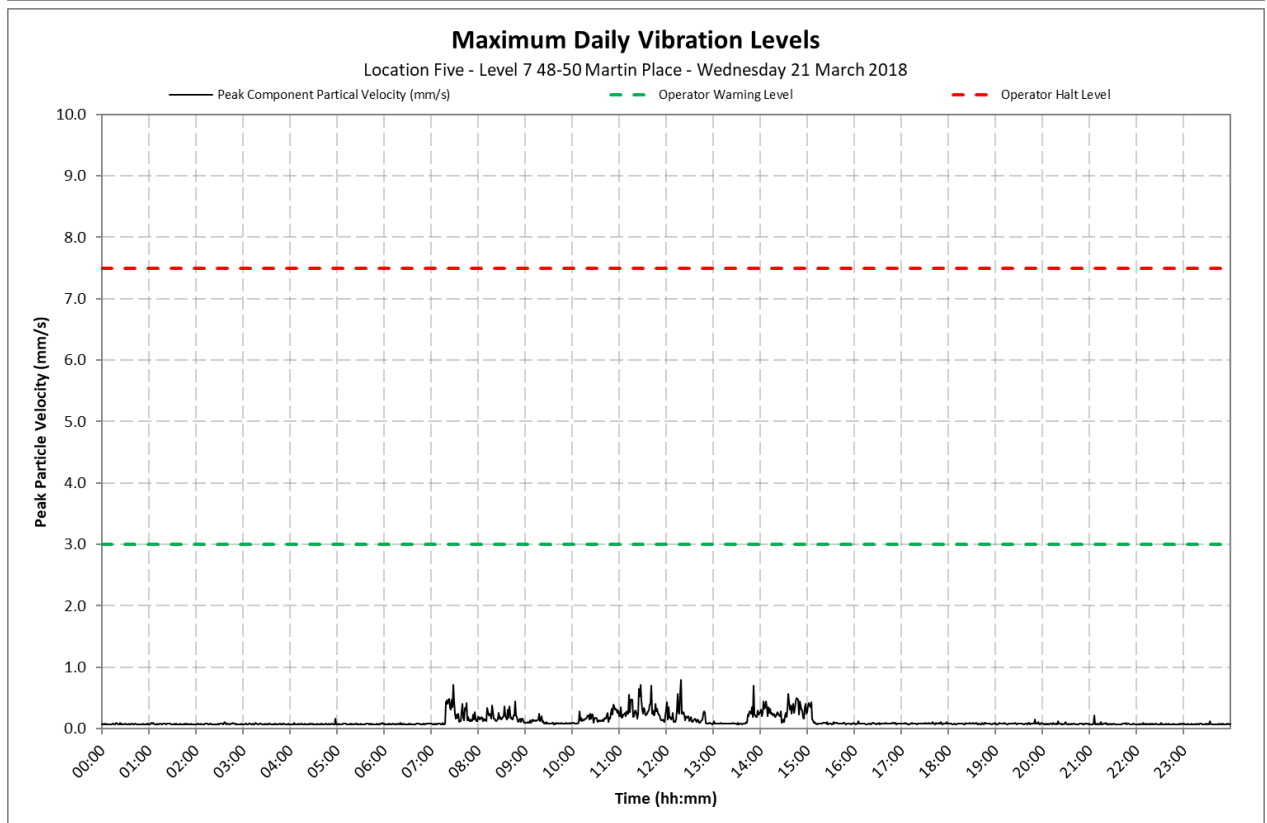
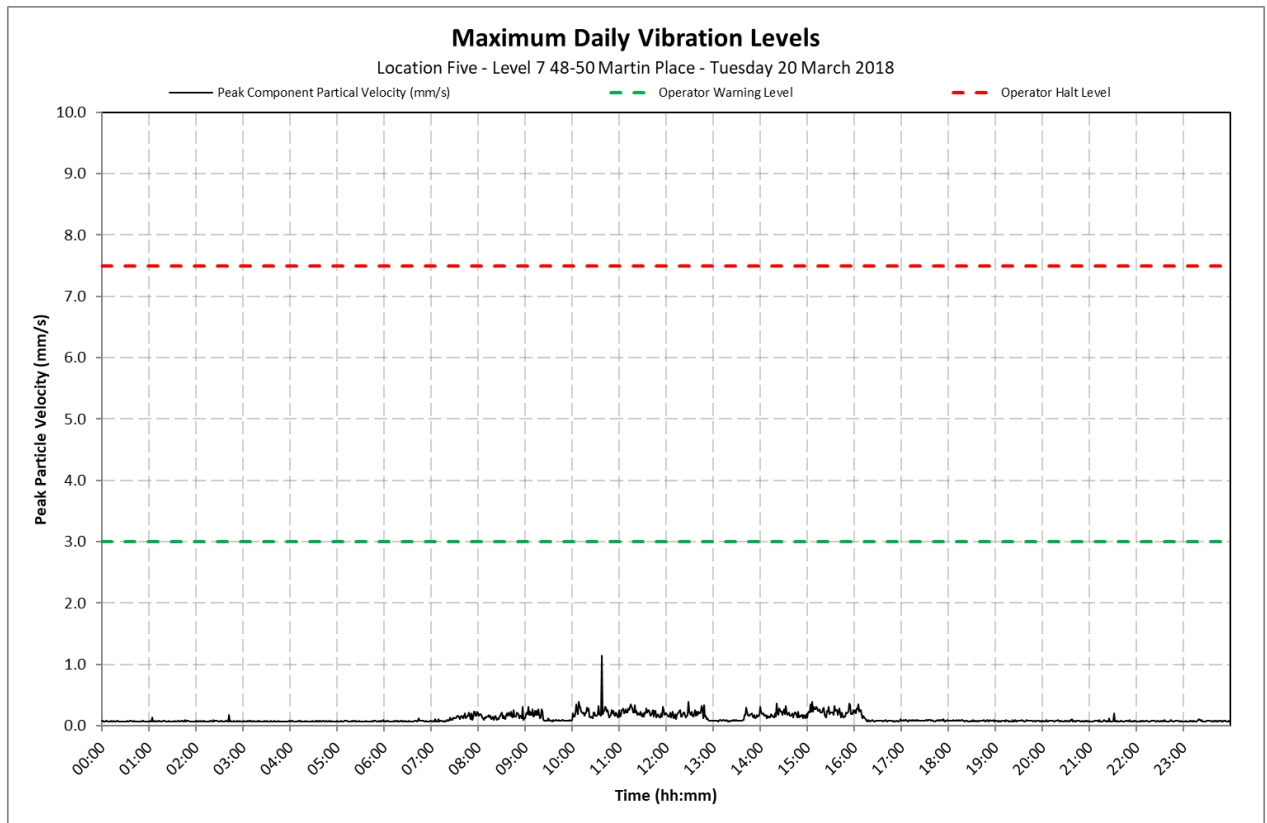
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

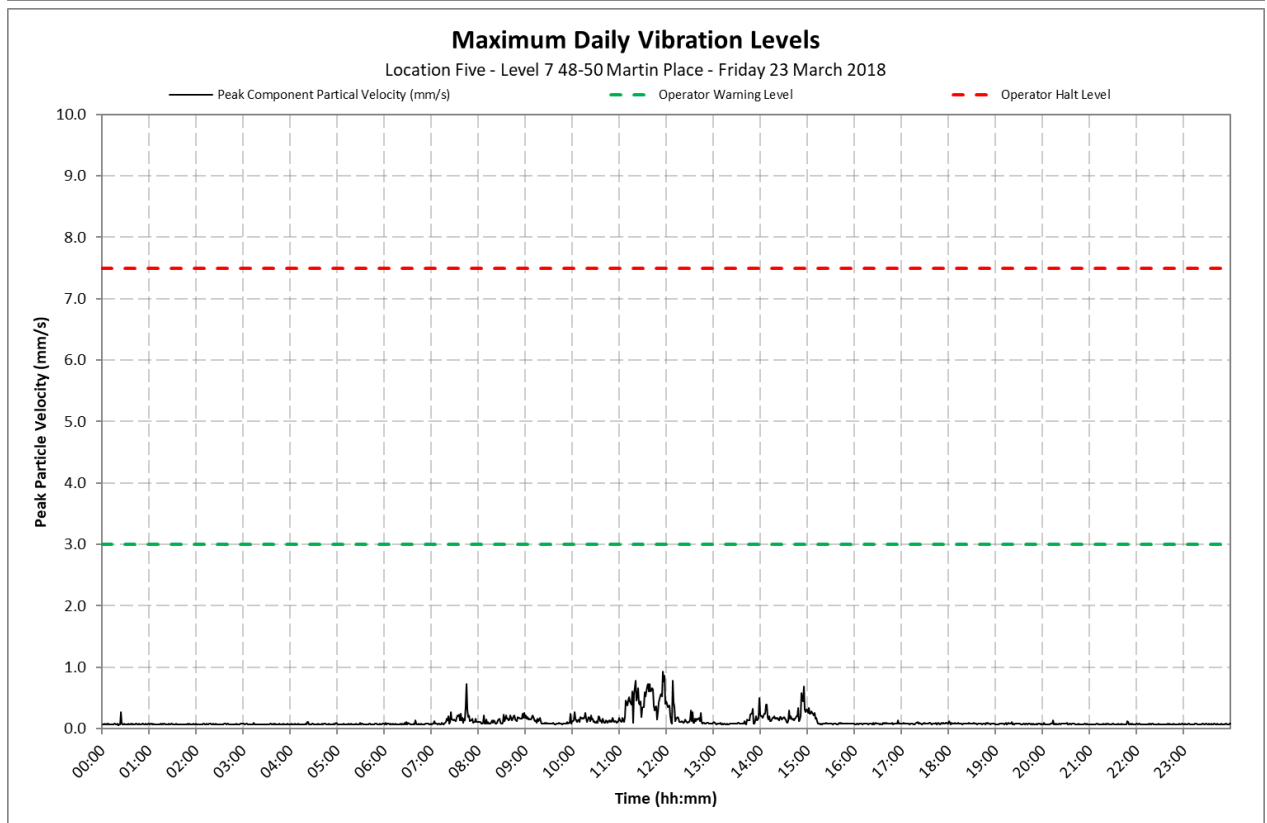
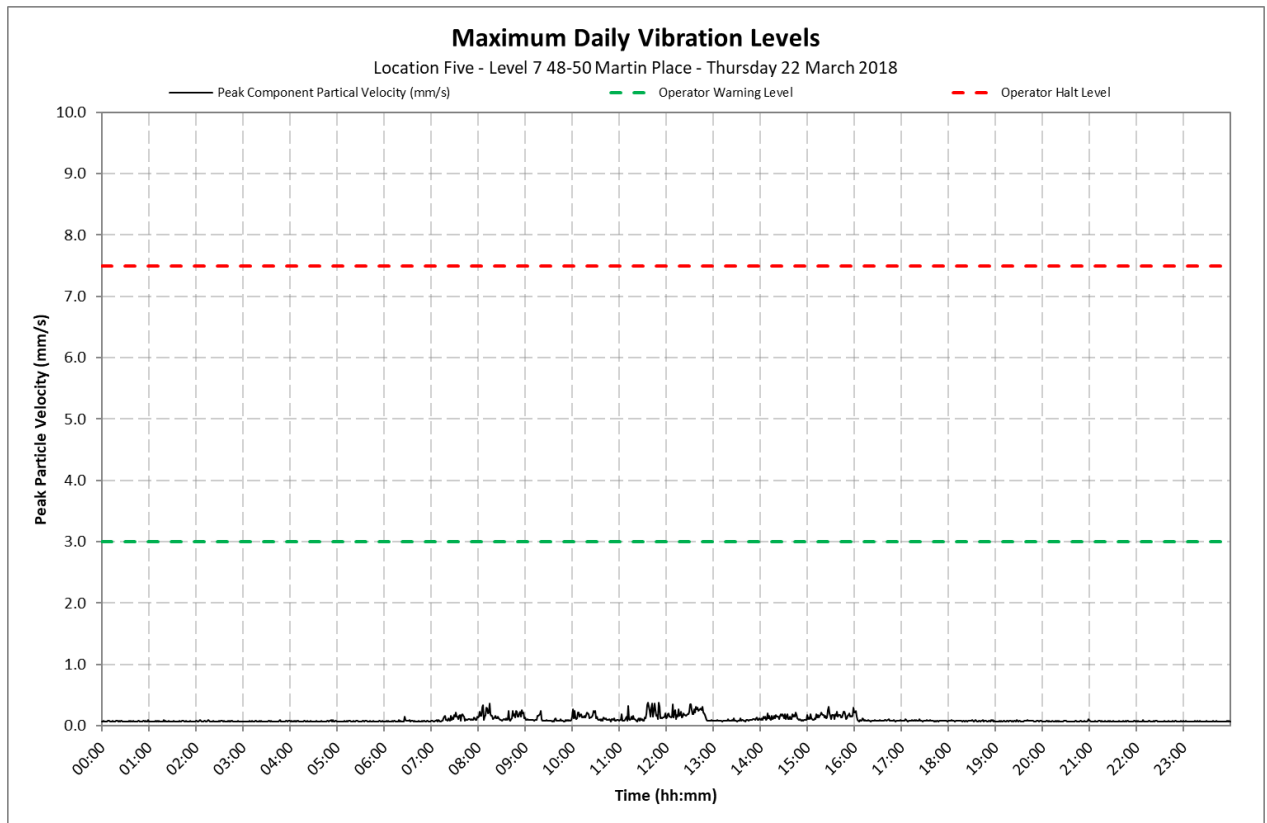
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

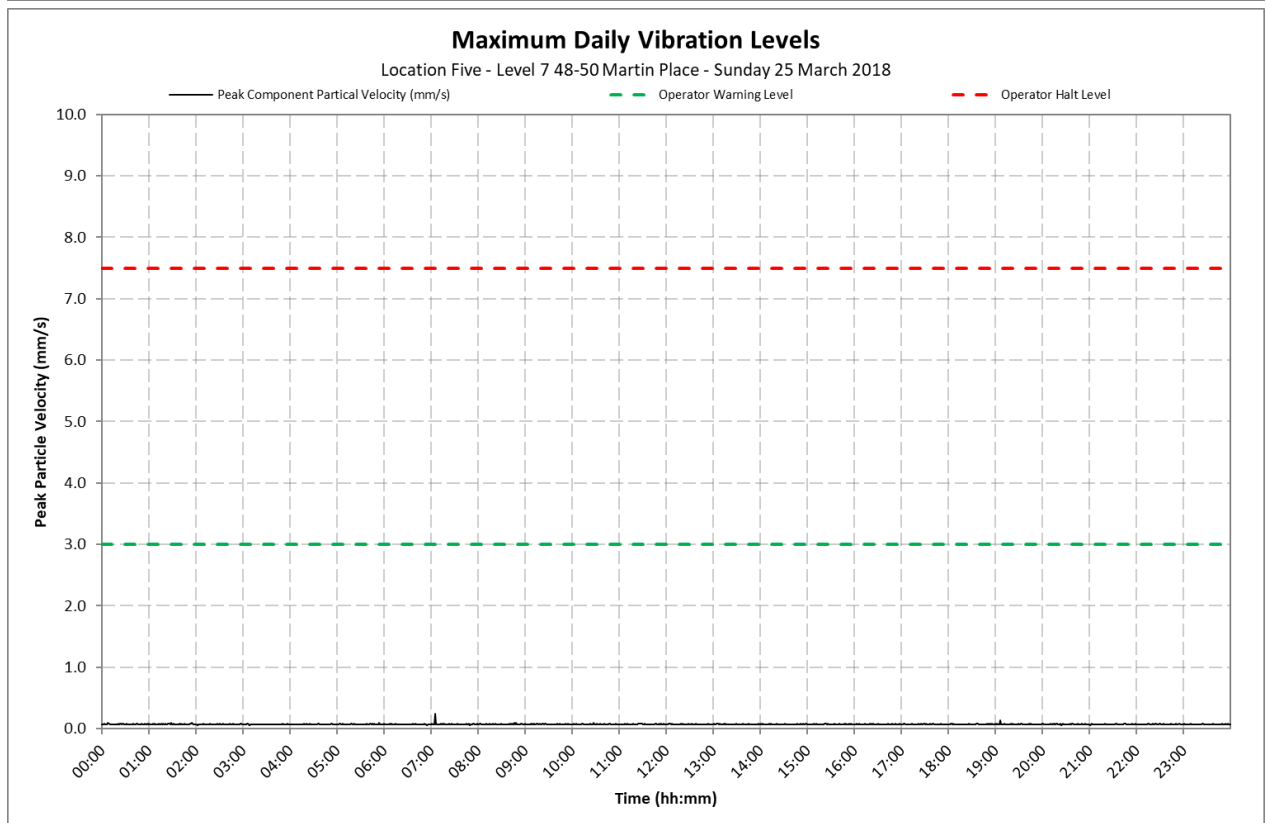
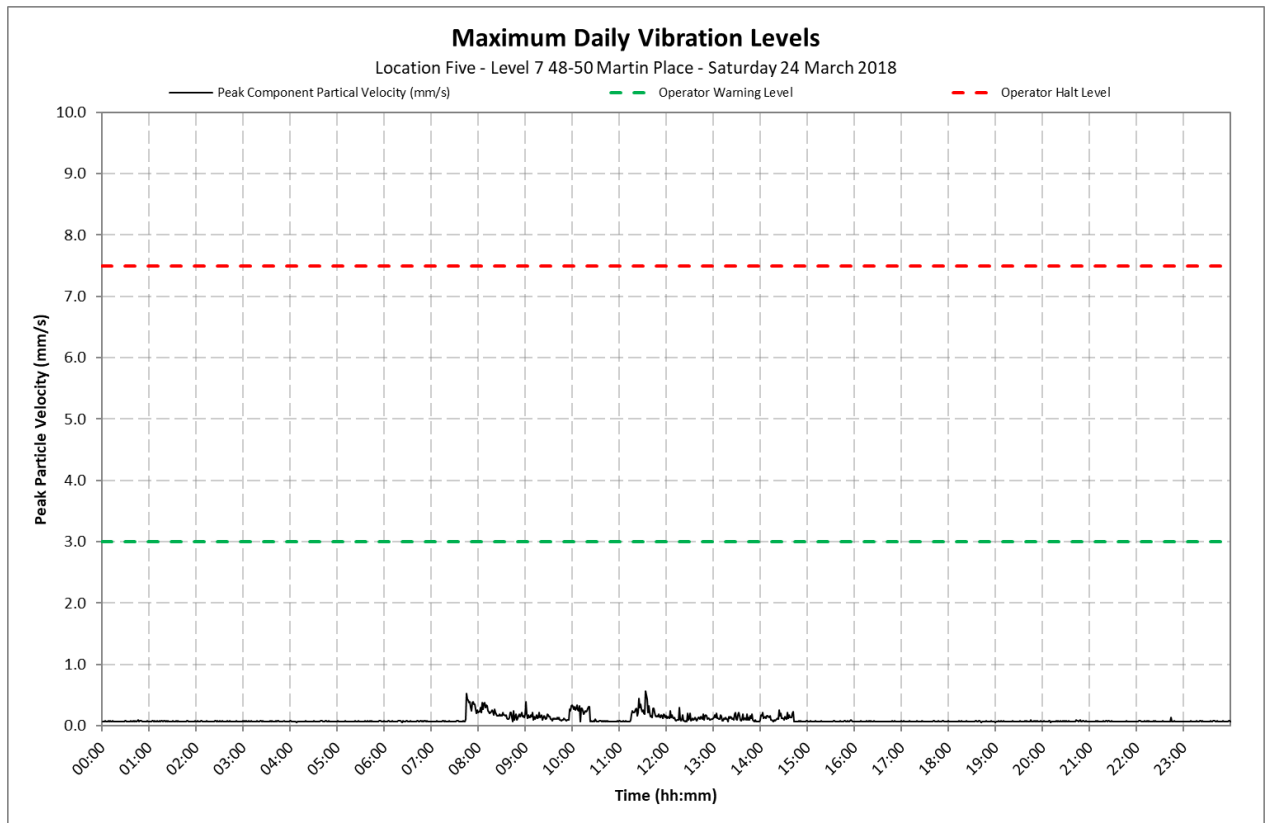
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

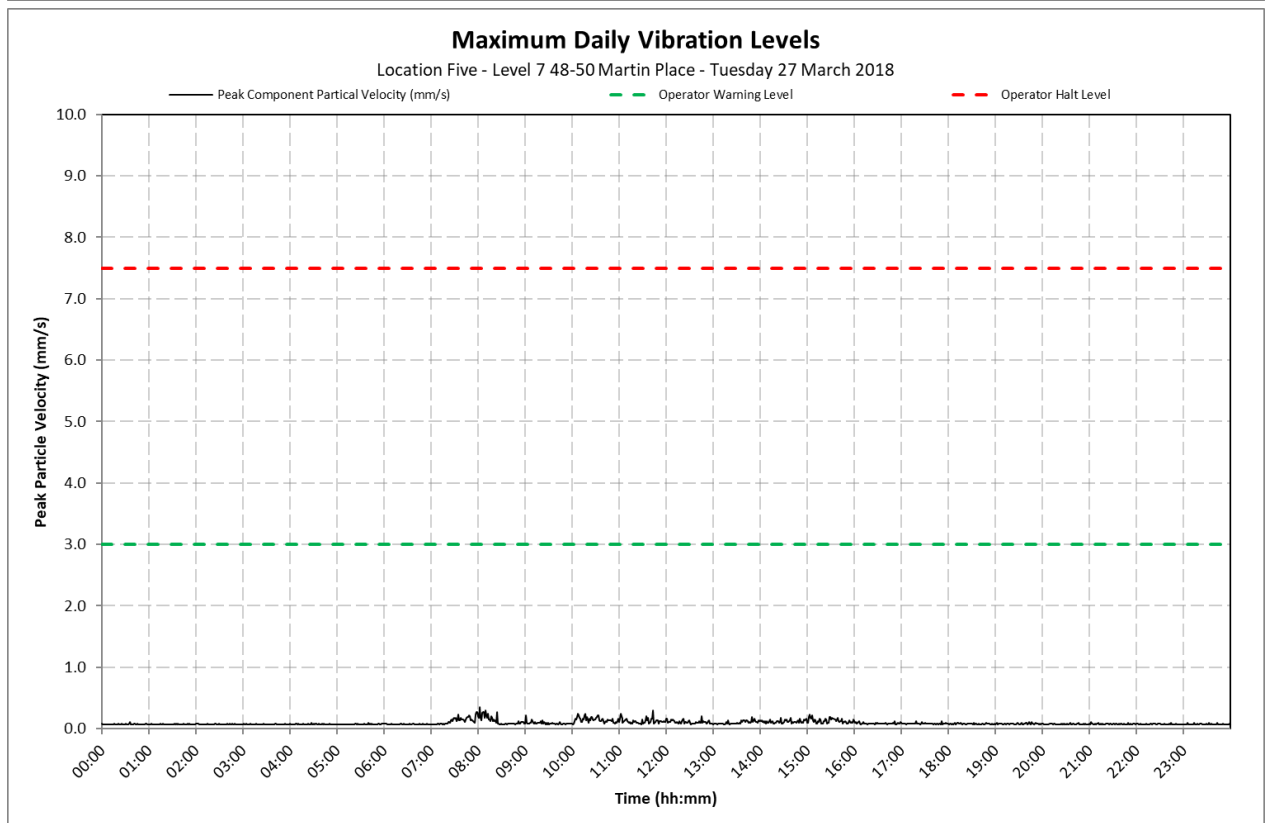
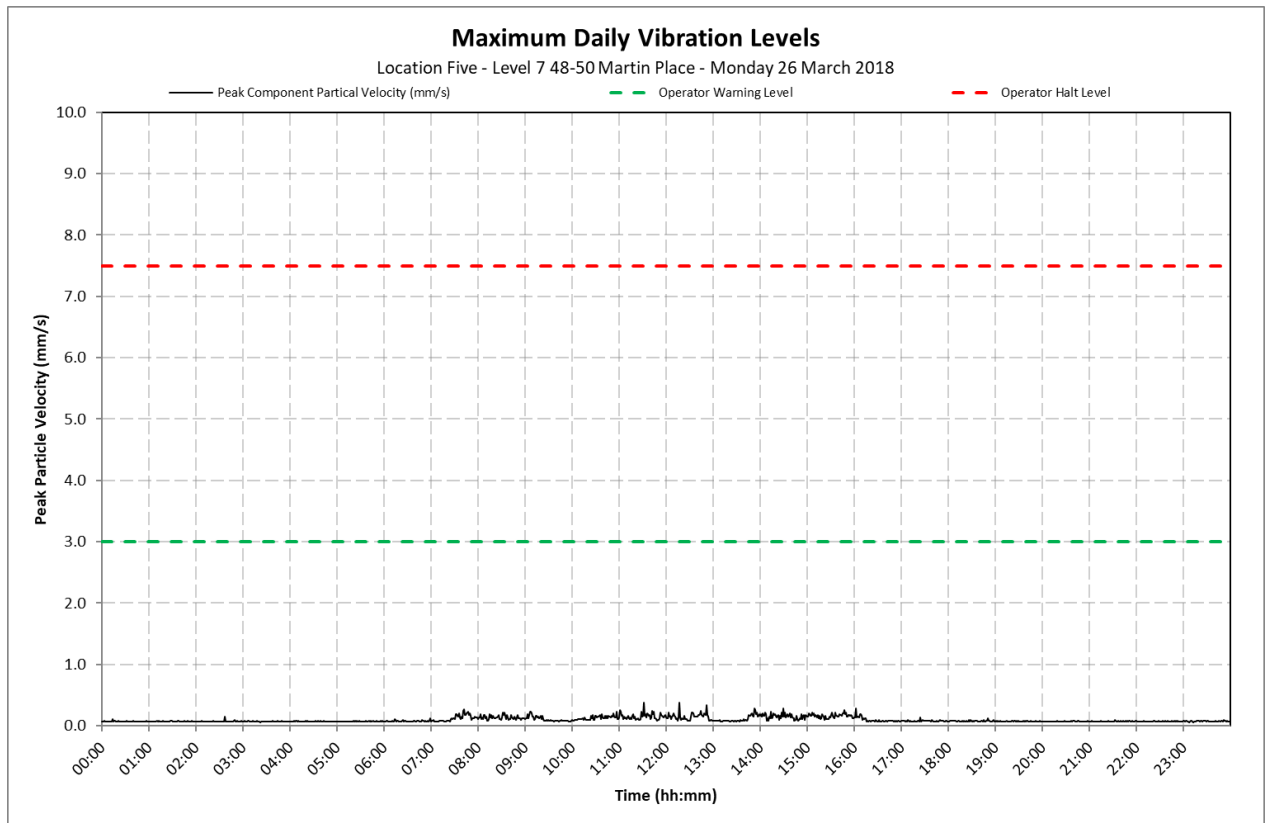
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place





10 April 2018

10-1380 R25 NV Monitoring 20180416.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 25
28 March to 10 April 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 28 March to 10 April 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

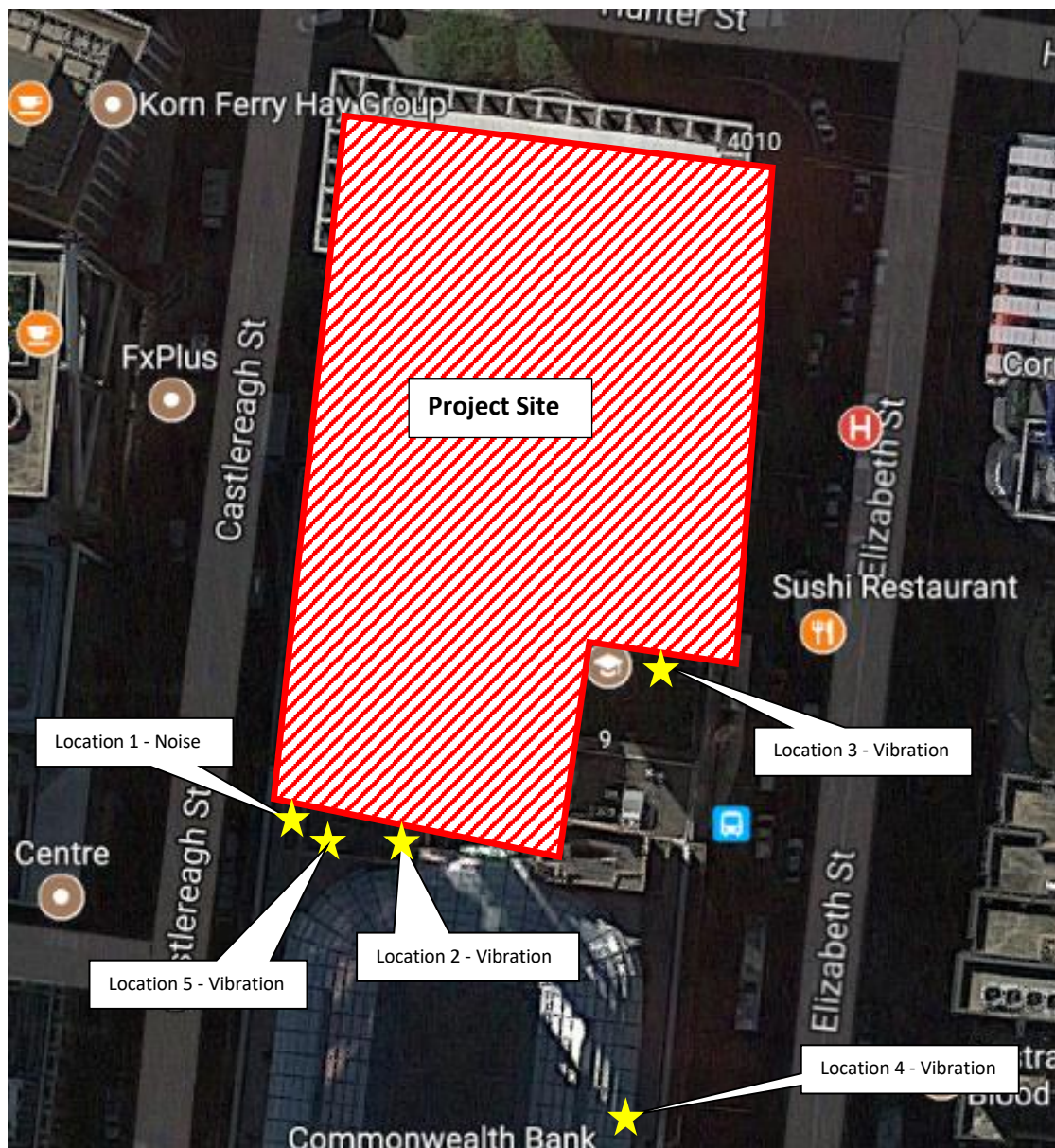
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 28 March to 10 April 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient LAeq(15minute) Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
28 March 2018	46	45	Complies	Complies
29 March 2018	46	44	Complies	Complies
30 March 2018	35	34	Complies	Complies
31 March 2018	40	39	Complies	Complies
1 April 2018	39	38	Complies	Complies
2 April 2018	40	39	Complies	Complies
3 April 2018	46	44	Complies	Complies
4 April 2018	46	44	Complies	Complies
5 April 2018	45	43	Complies	Complies
6 April 2018	40	40	Complies	Complies
7 April 2018	41	40	Complies	Complies
8 April 2018	34	34	Complies	Complies
9 April 2018	45	44	Complies	Complies
10 April 2018	46	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 28 March to 10 April 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
28 March 2018	1.1 mm/s	Complies
29 March 2018	0.4 mm/s	Complies
30 March 2018	2.1 mm/s	Complies
31 March 2018	1.0 mm/s	Complies
1 April 2018	0.4 mm/s	Complies
2 April 2018	0.7 mm/s	Complies
3 April 2018	0.4 mm/s	Complies
4 April 2018	0.2 mm/s	Complies
5 April 2018	0.2 mm/s	Complies
6 April 2018	0.4 mm/s	Complies
7 April 2018	0.3 mm/s	Complies
8 April 2018	0.4 mm/s	Complies
9 April 2018	0.4 mm/s	Complies
10 April 2018	1.5 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
28 March 2018	0.6 mm/s	Complies
29 March 2018	0.3 mm/s	Complies
30 March 2018	0.2 mm/s	Complies
31 March 2018	0.1 mm/s	Complies
1 April 2018	0.1 mm/s	Complies
2 April 2018	0.9 mm/s	Complies
3 April 2018	0.5 mm/s	Complies
4 April 2018	0.9 mm/s	Complies
5 April 2018	0.4 mm/s	Complies
6 April 2018	1.1 mm/s	Complies
7 April 2018	0.4 mm/s	Complies
8 April 2018	0.1 mm/s	Complies
9 April 2018	0.9 mm/s	Complies
10 April 2018	0.3 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 28 March to 10 April 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 28 March to 10 April 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

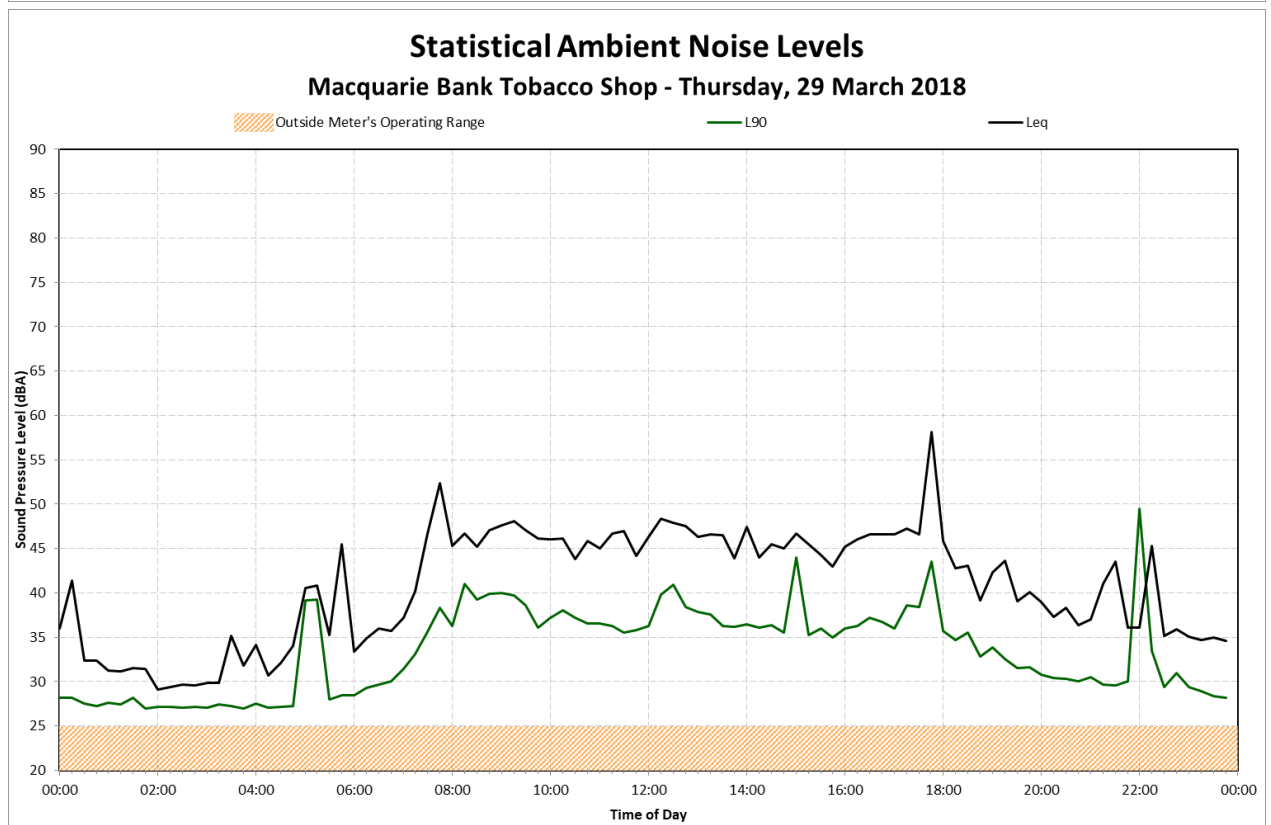
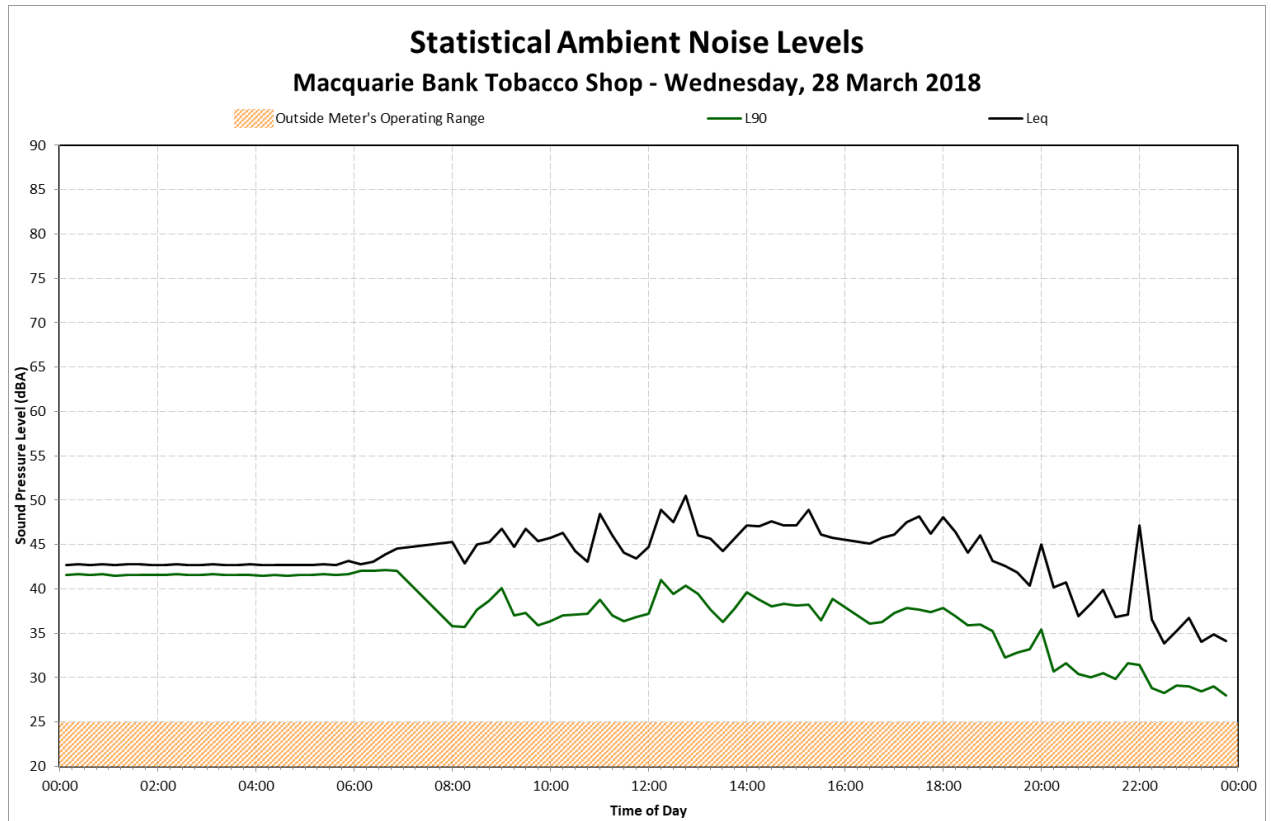
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Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
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L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
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Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

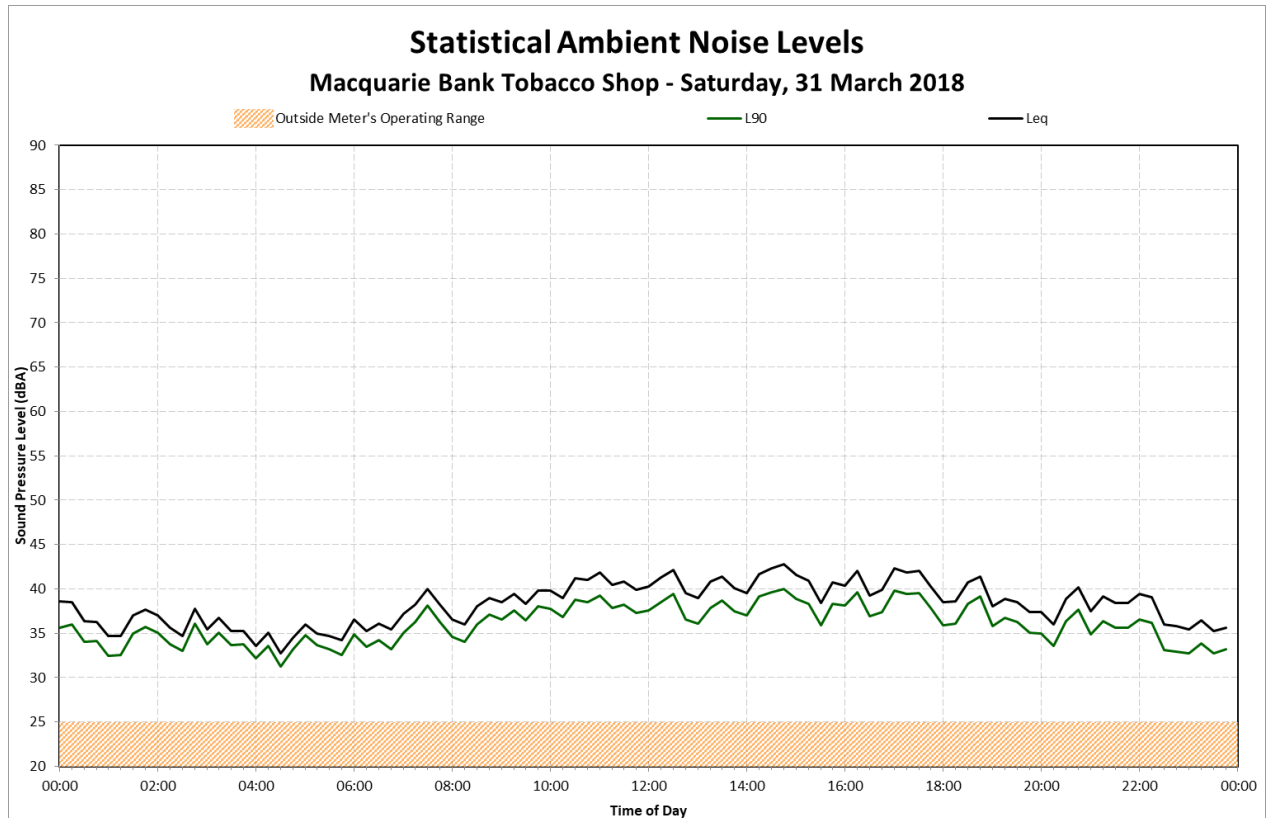
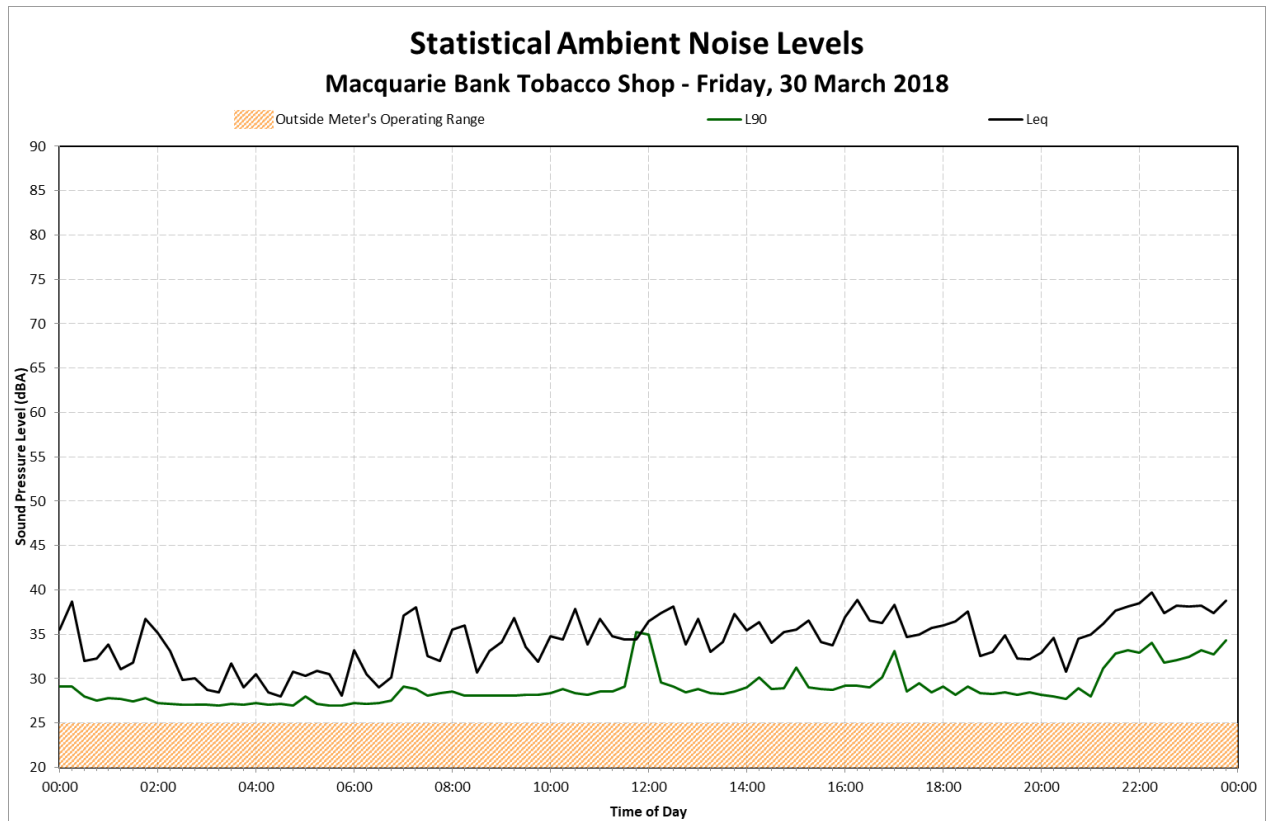
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

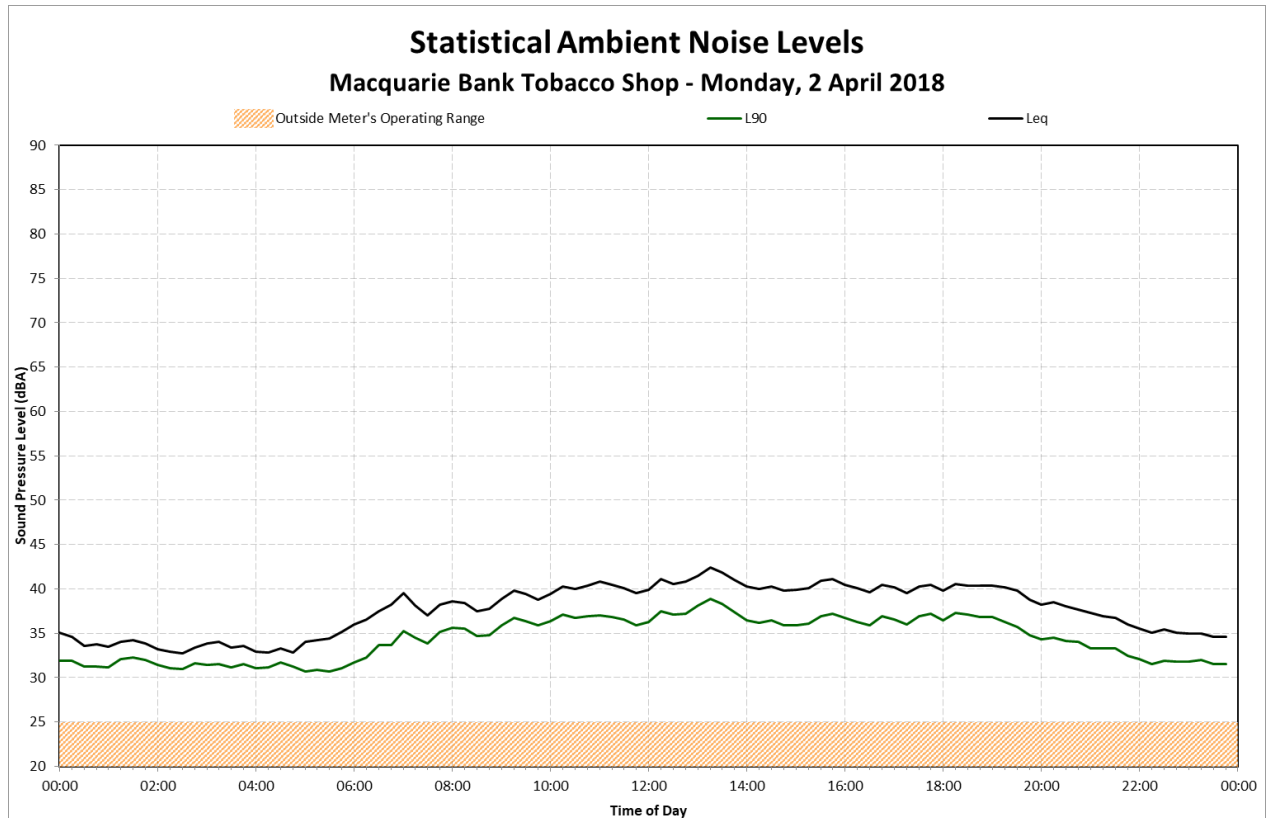
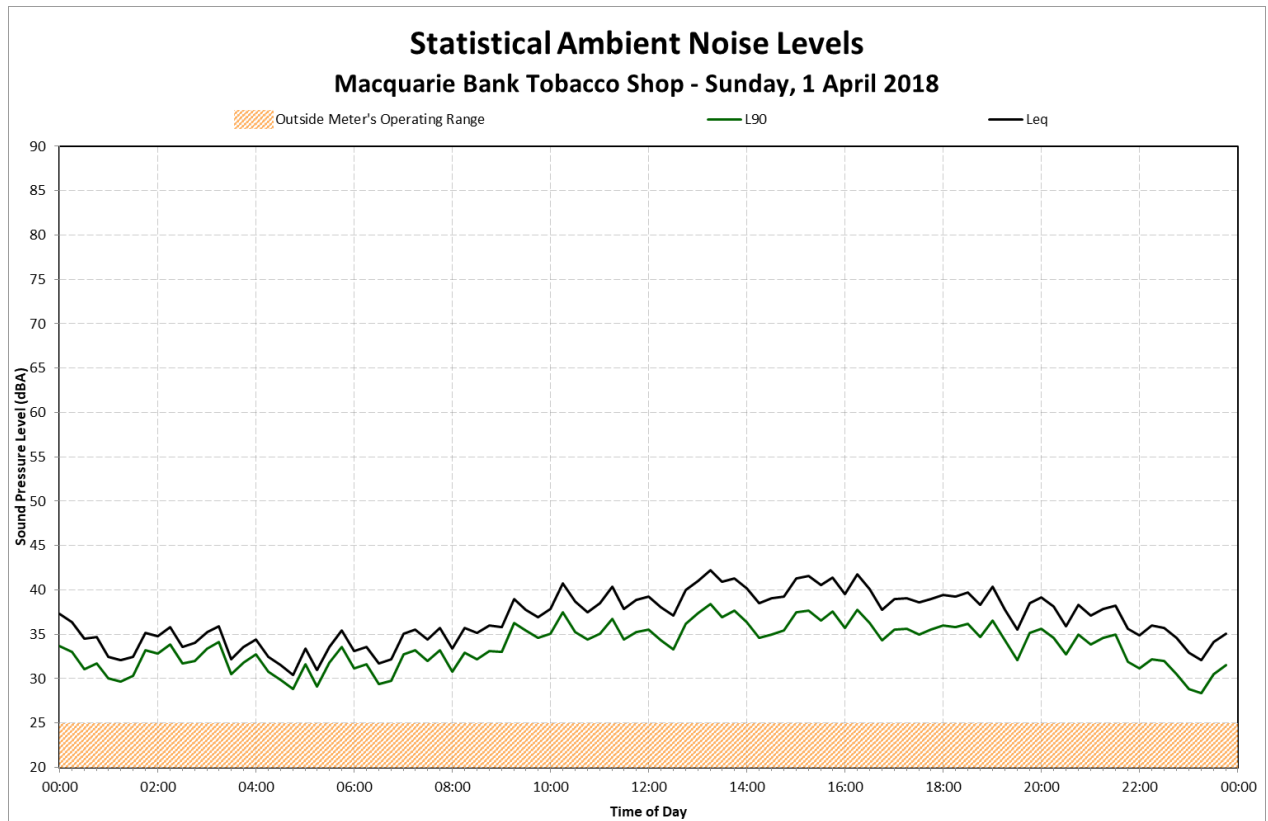
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

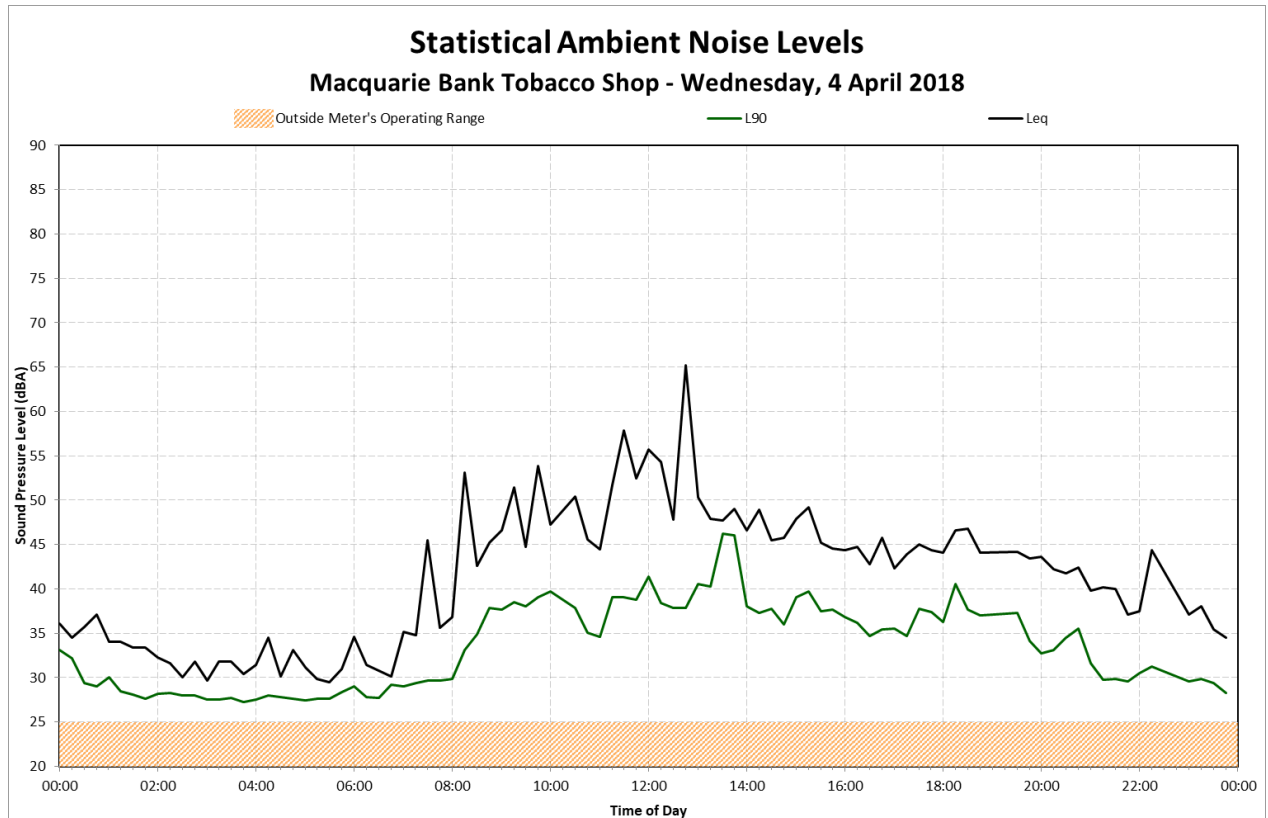
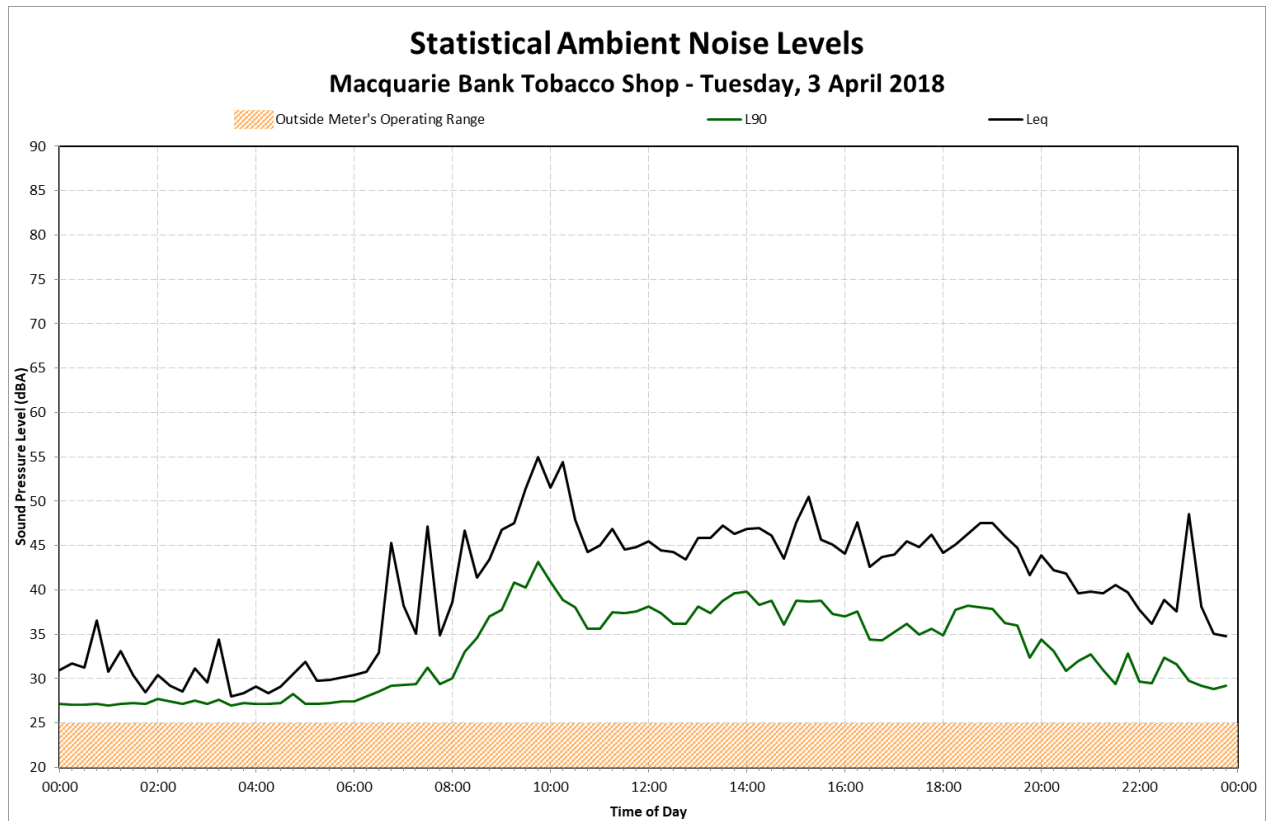
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

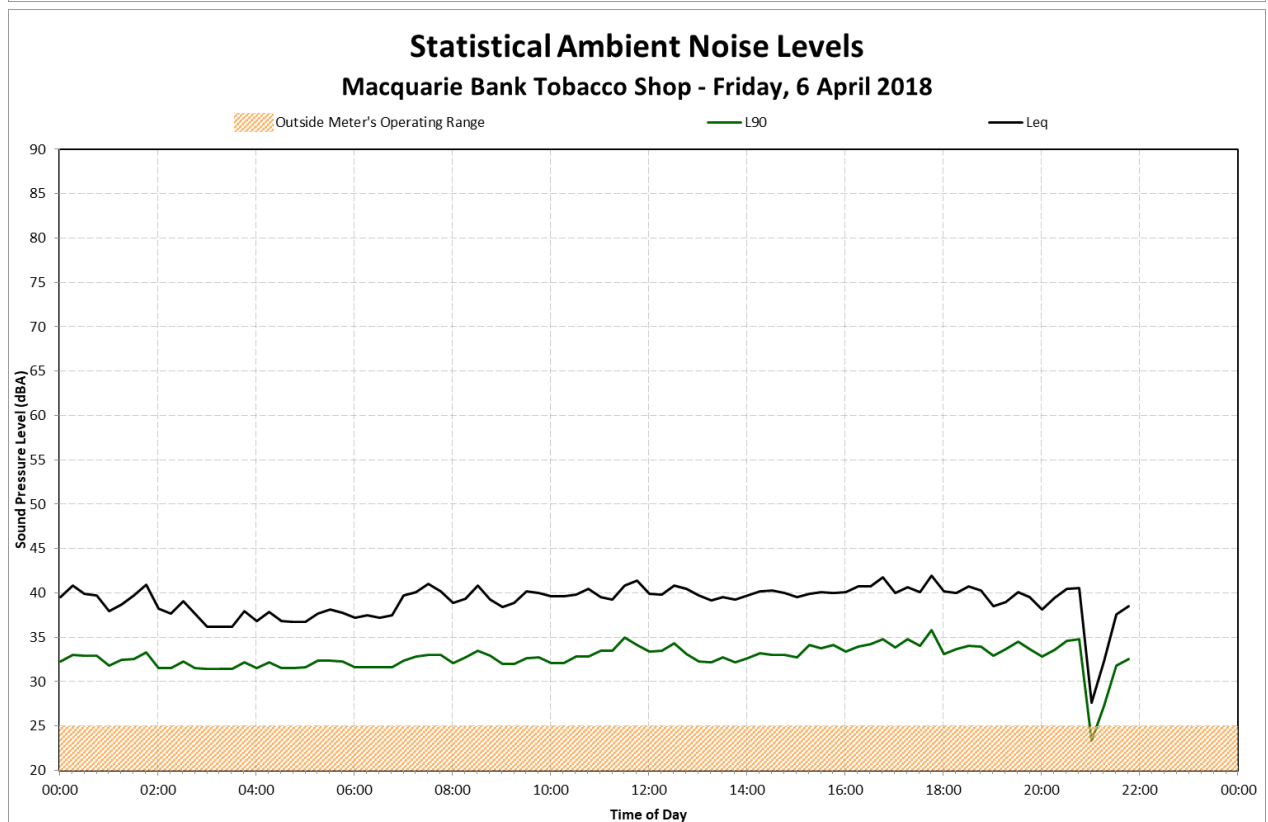
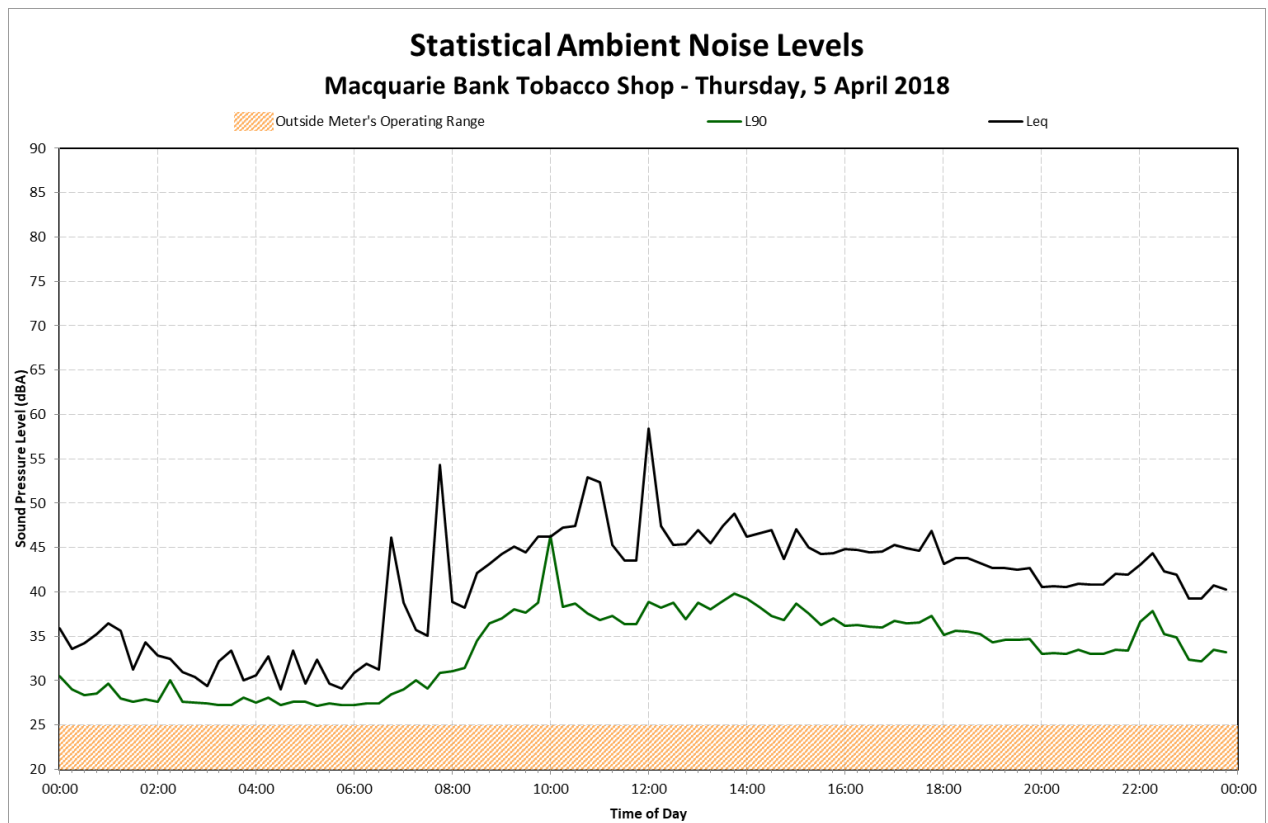
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

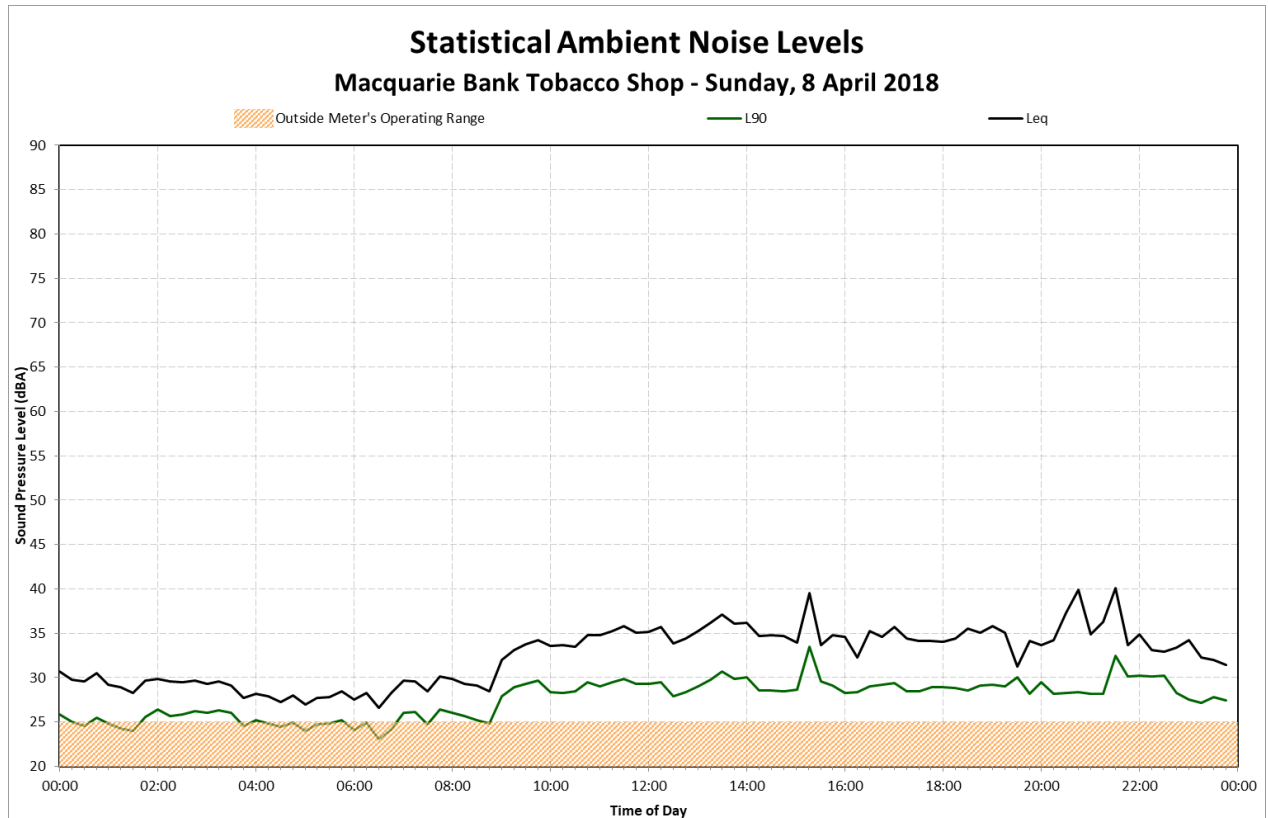
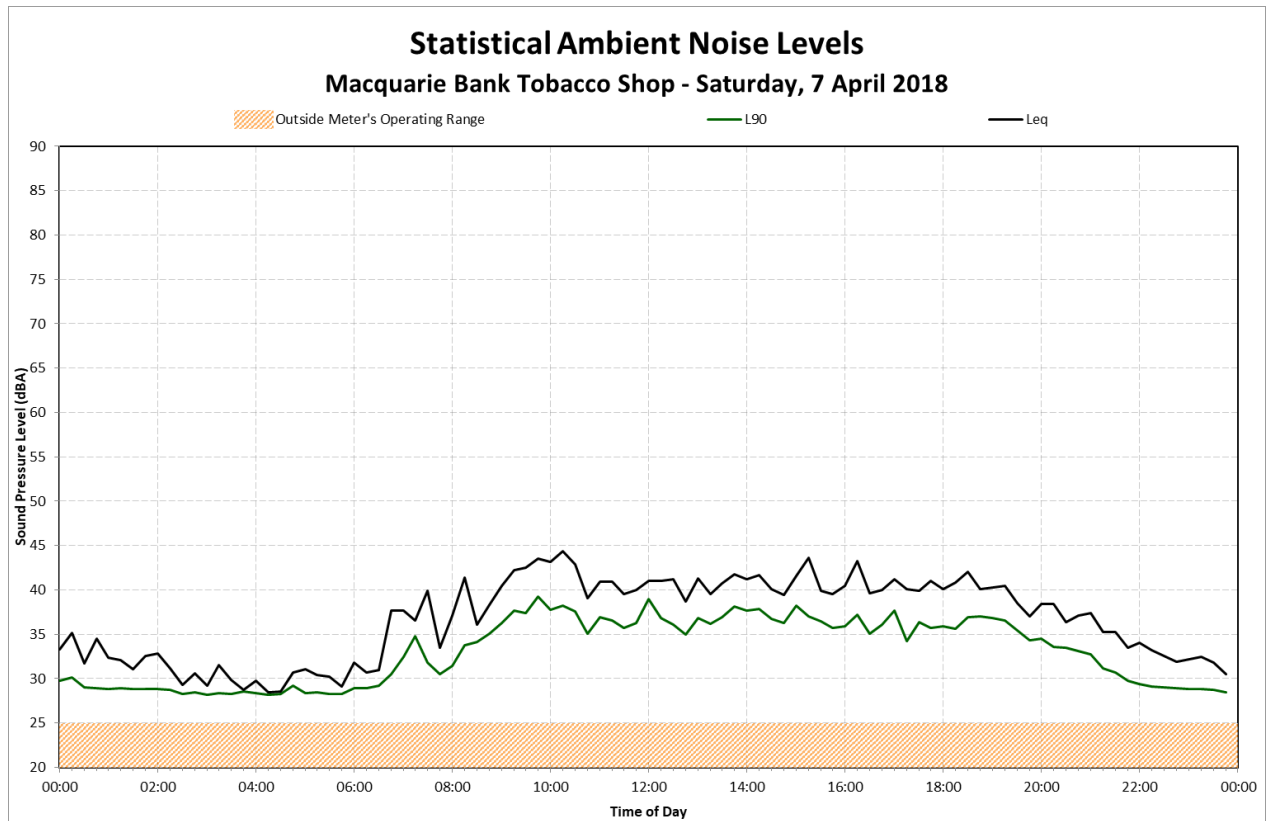
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

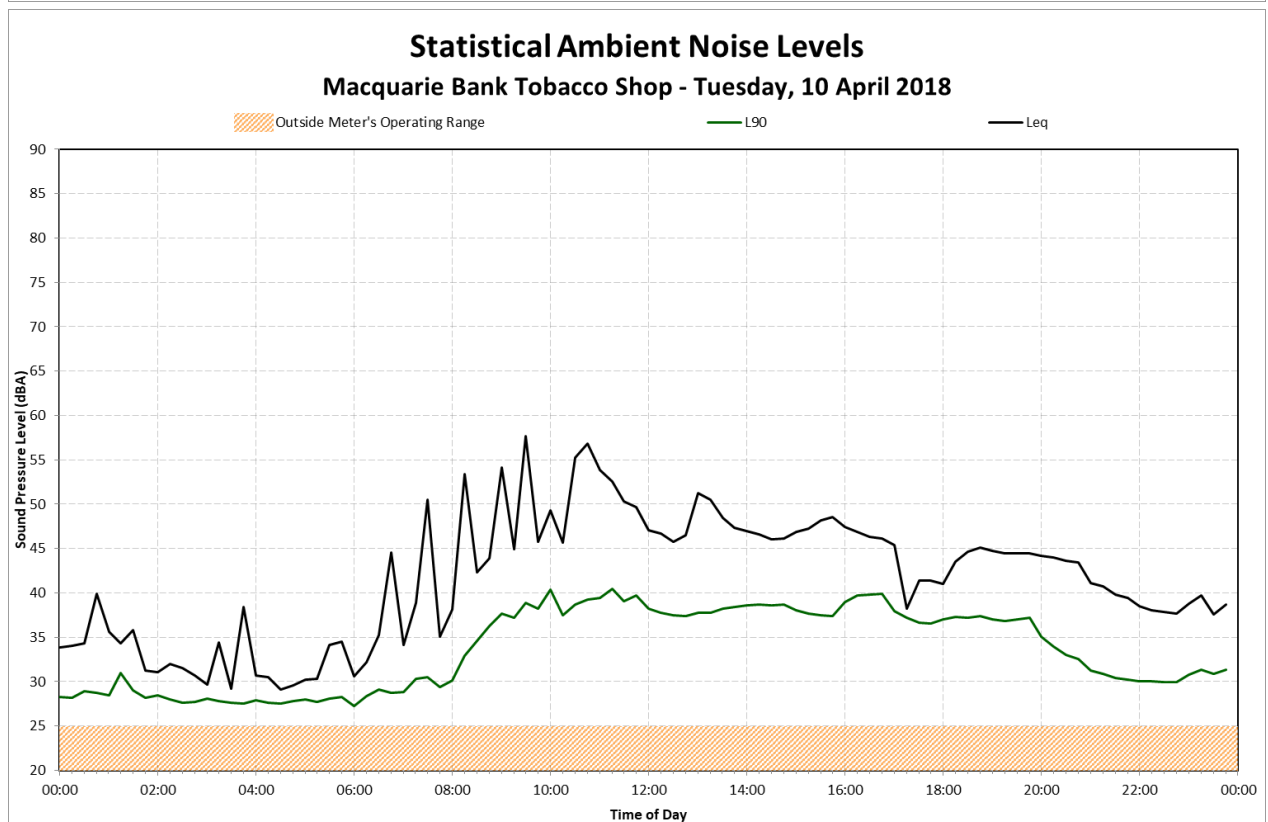
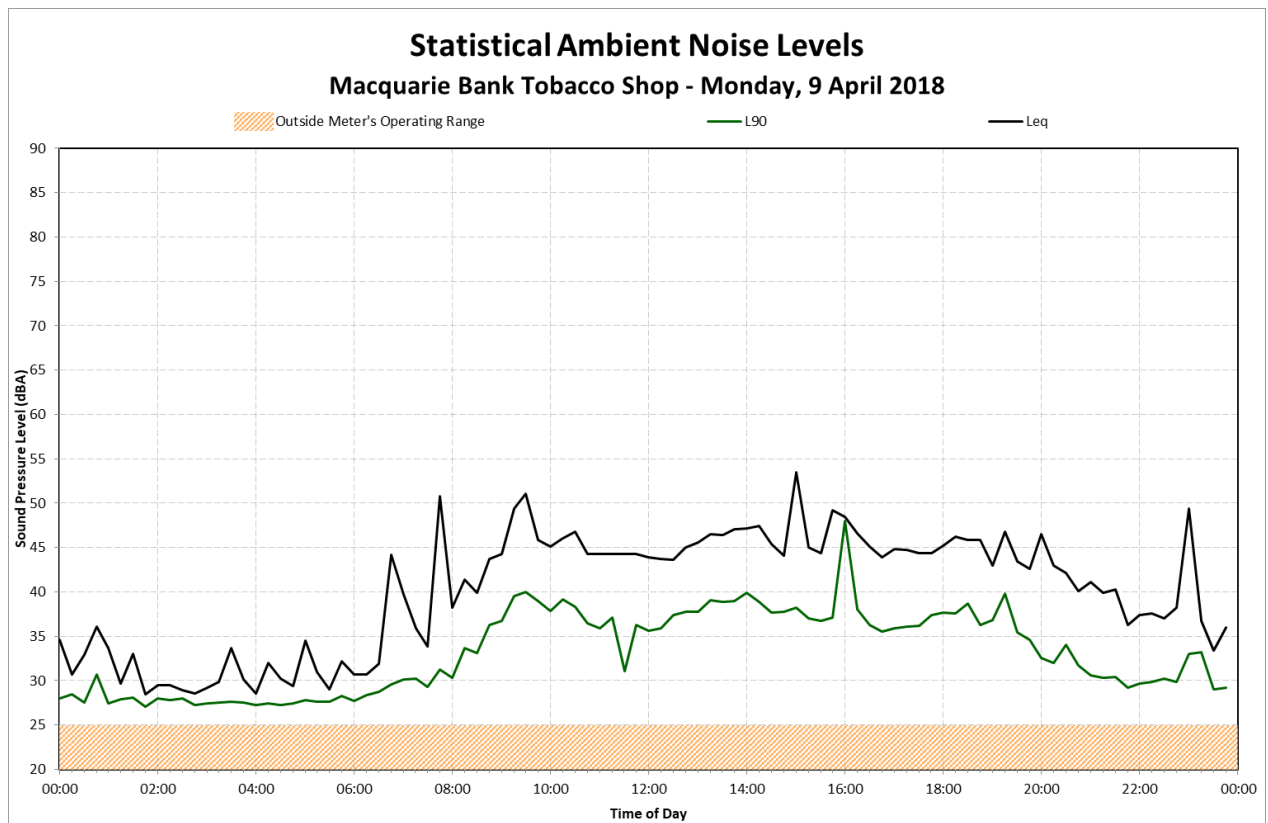
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

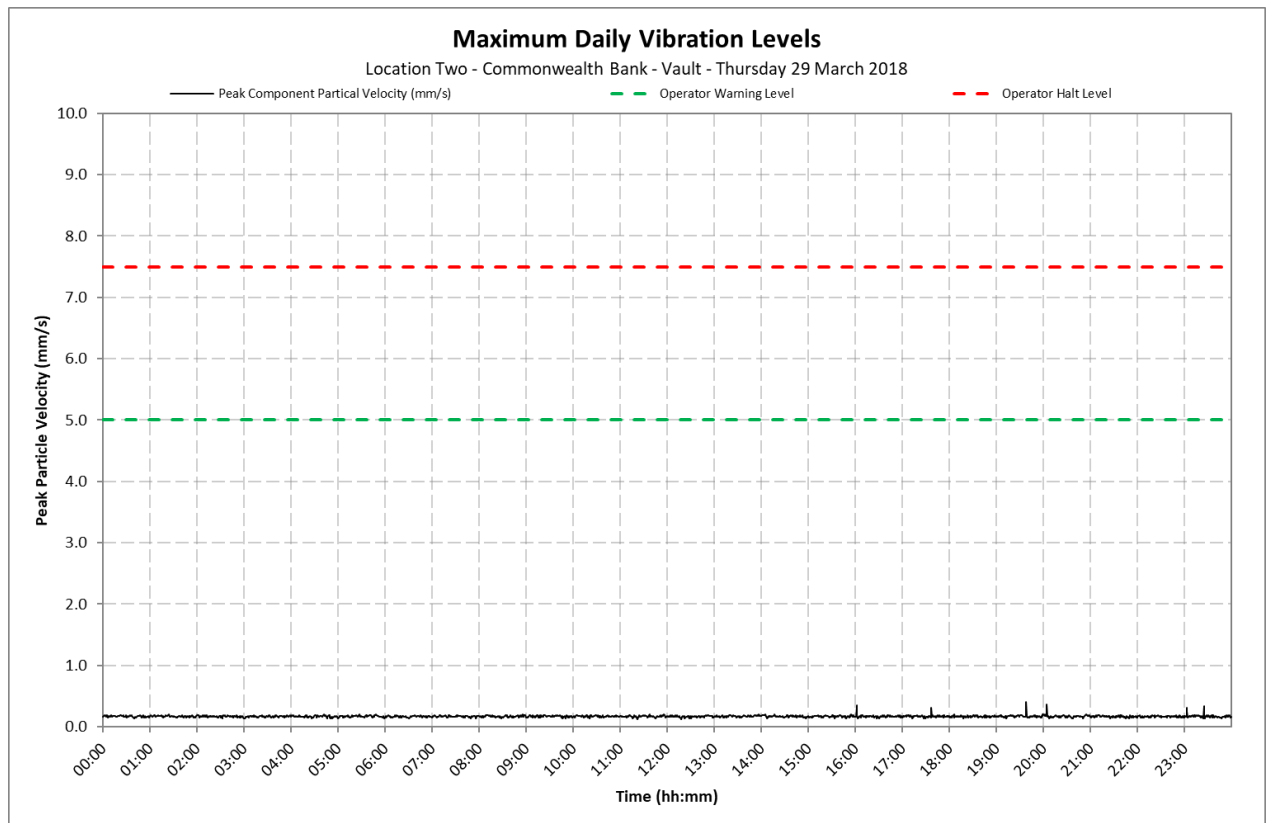
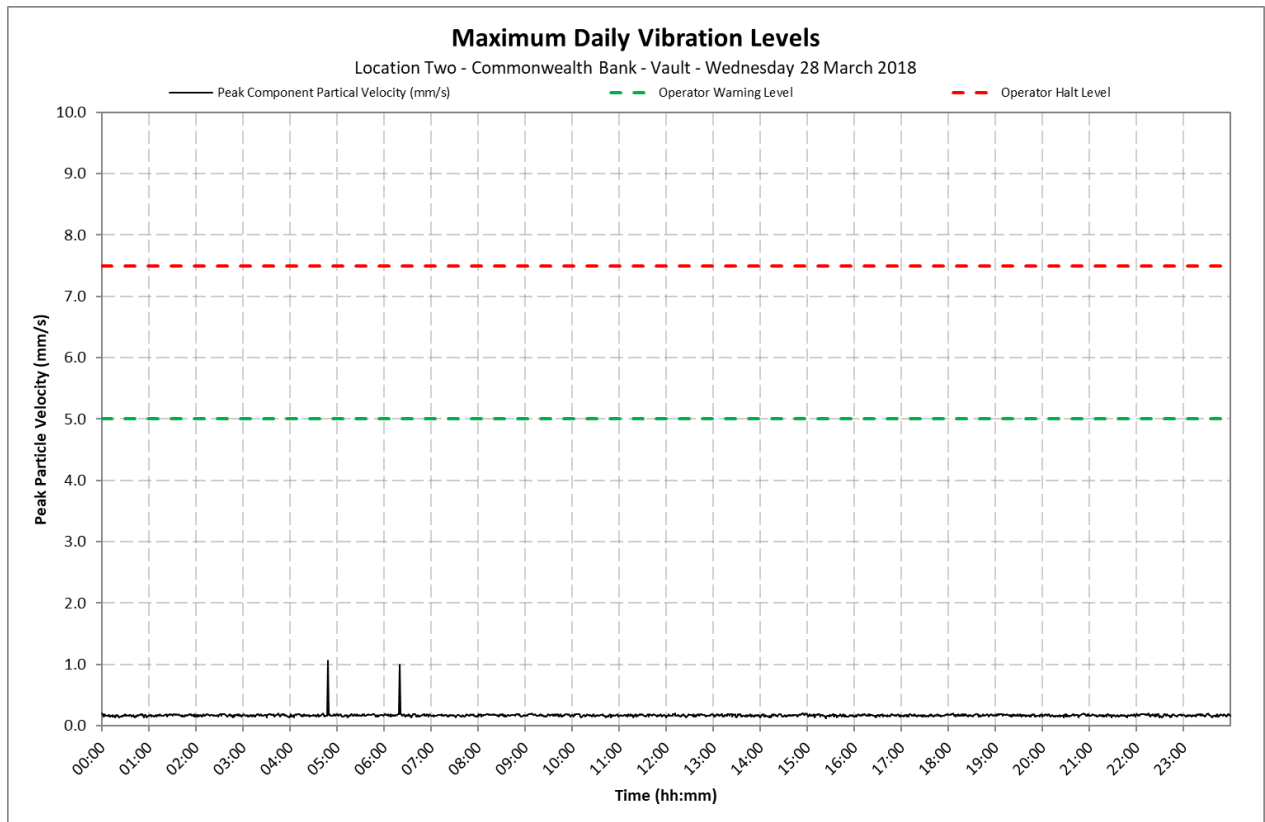
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

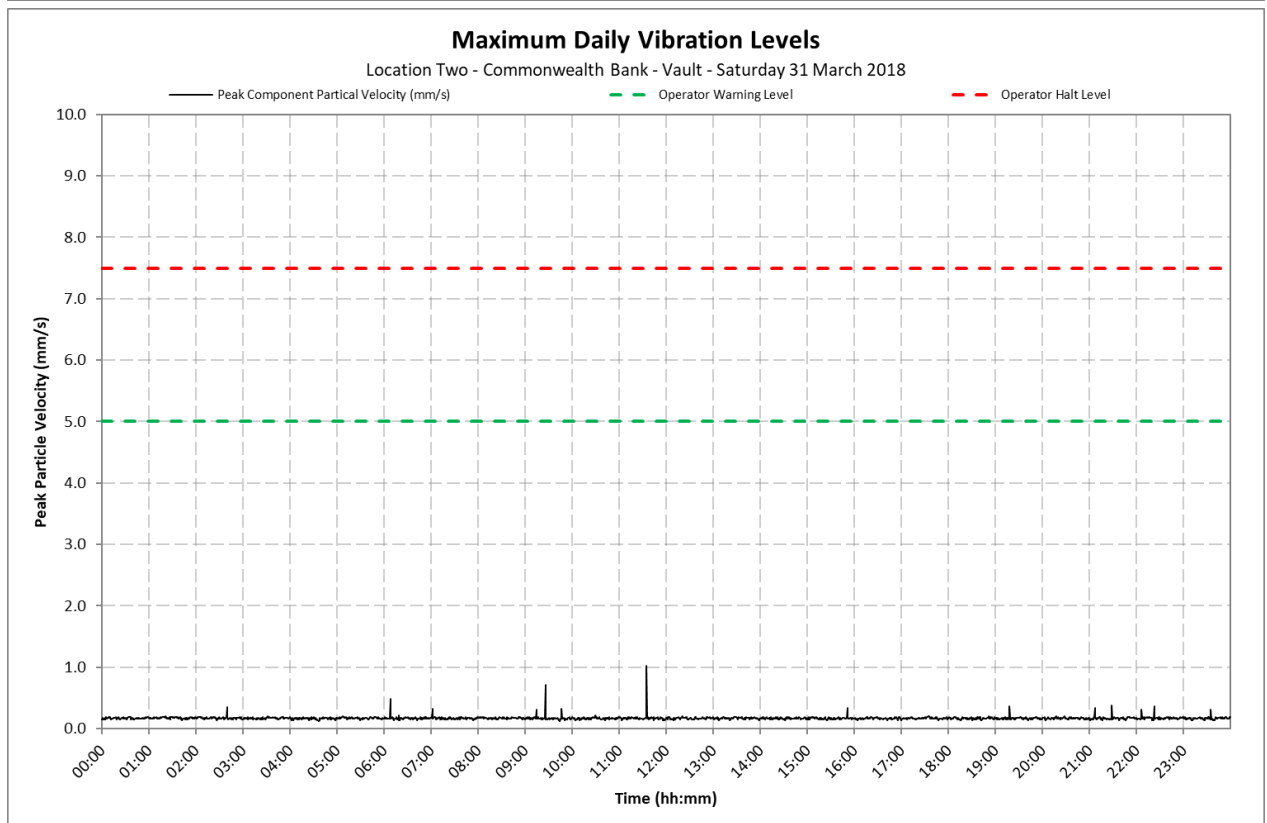
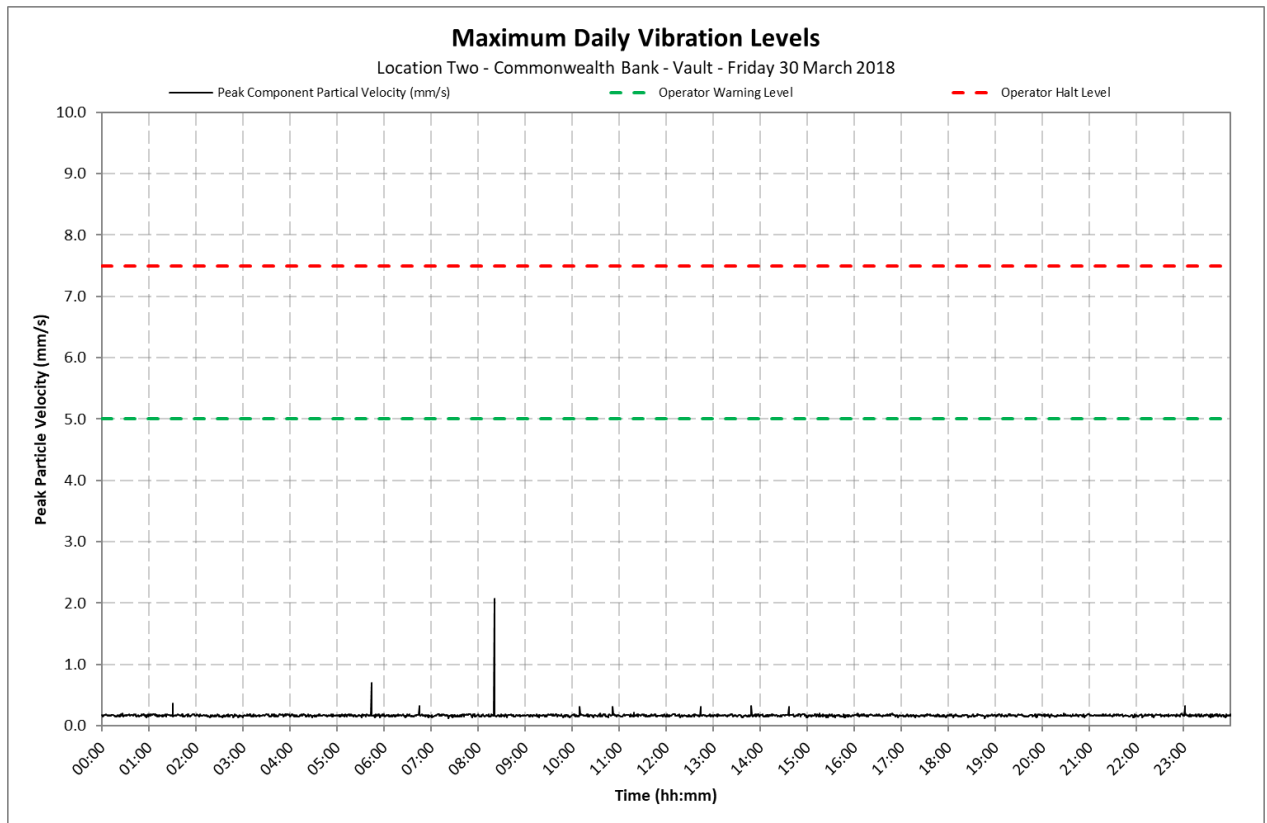
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

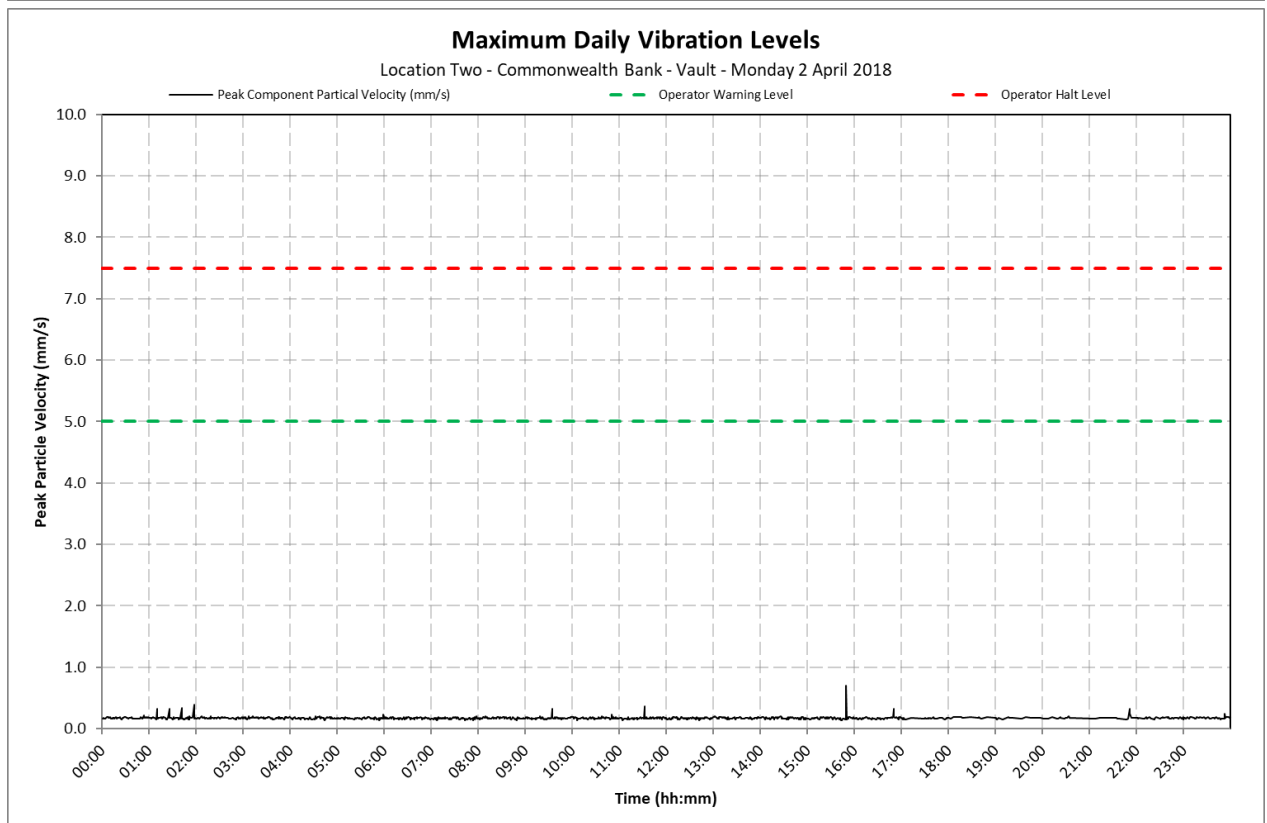
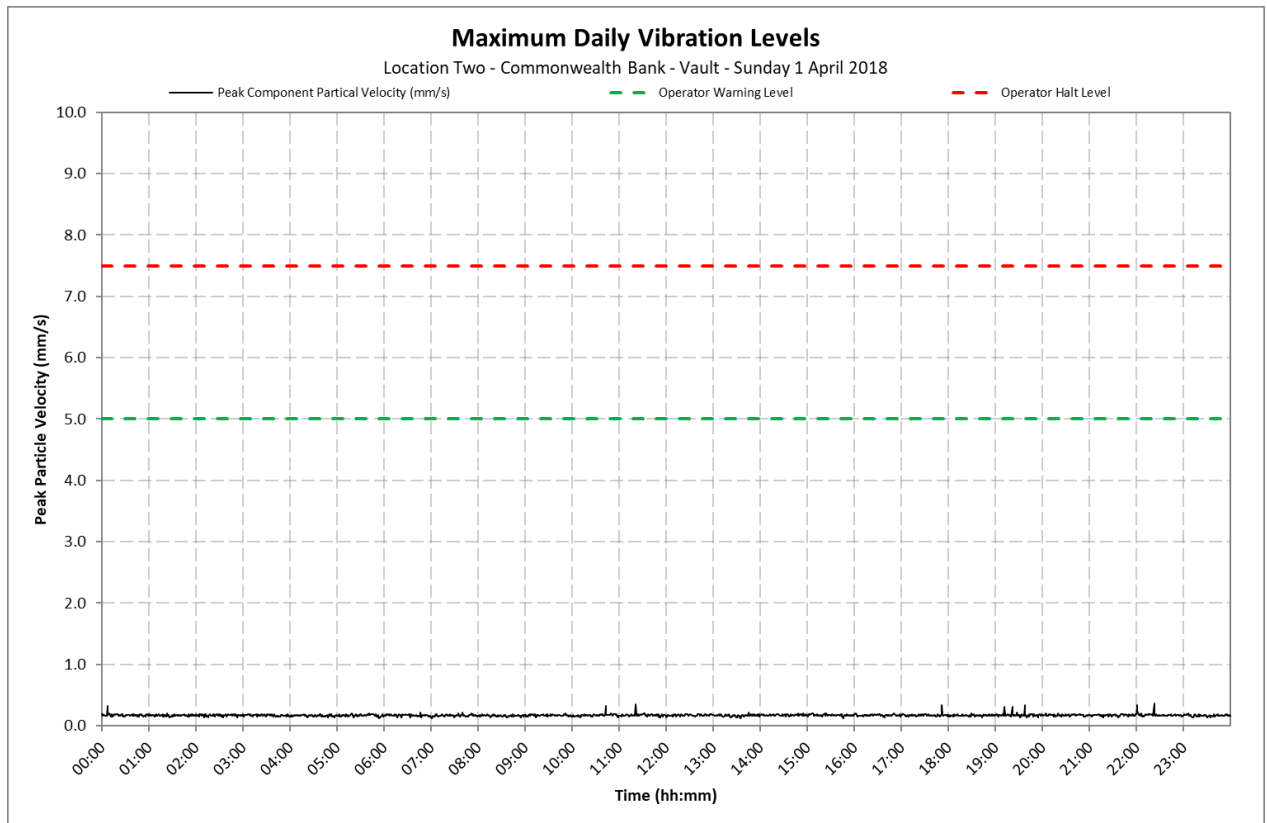
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

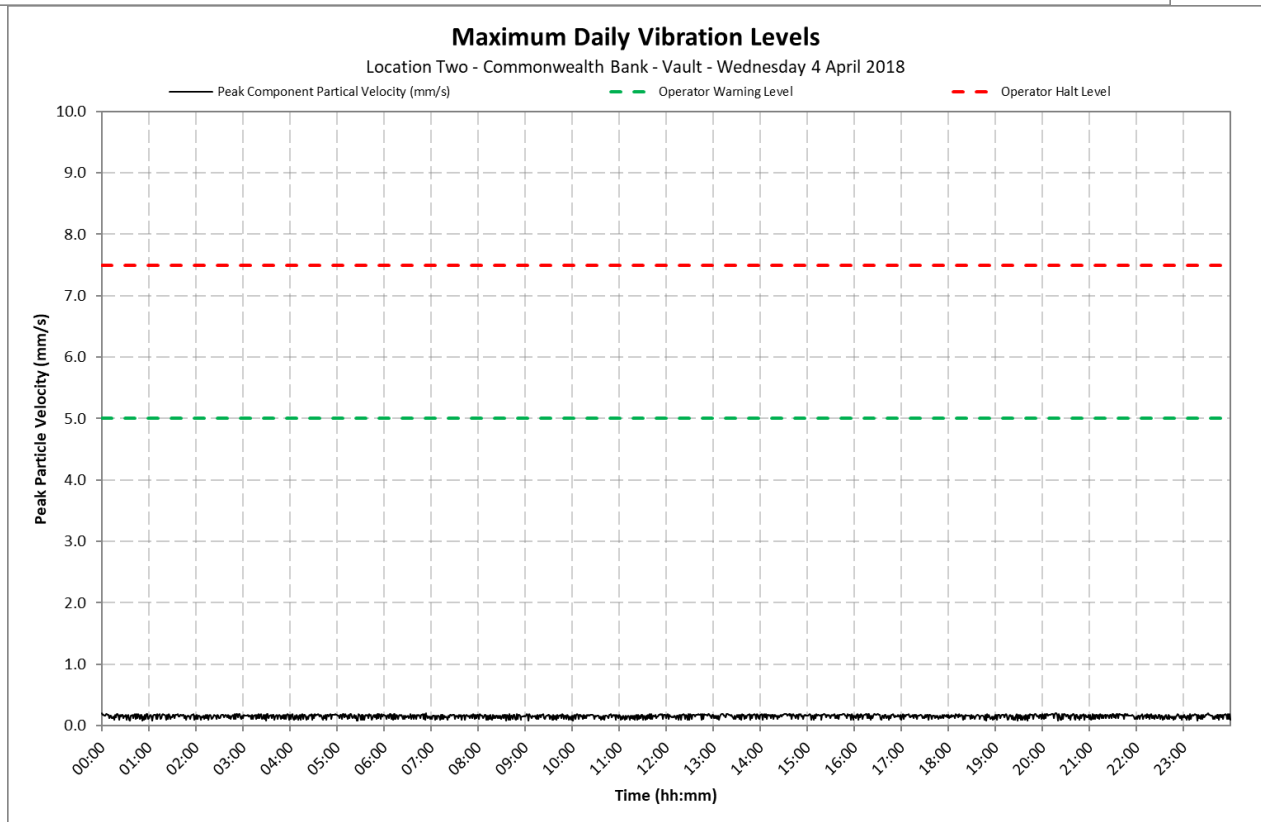
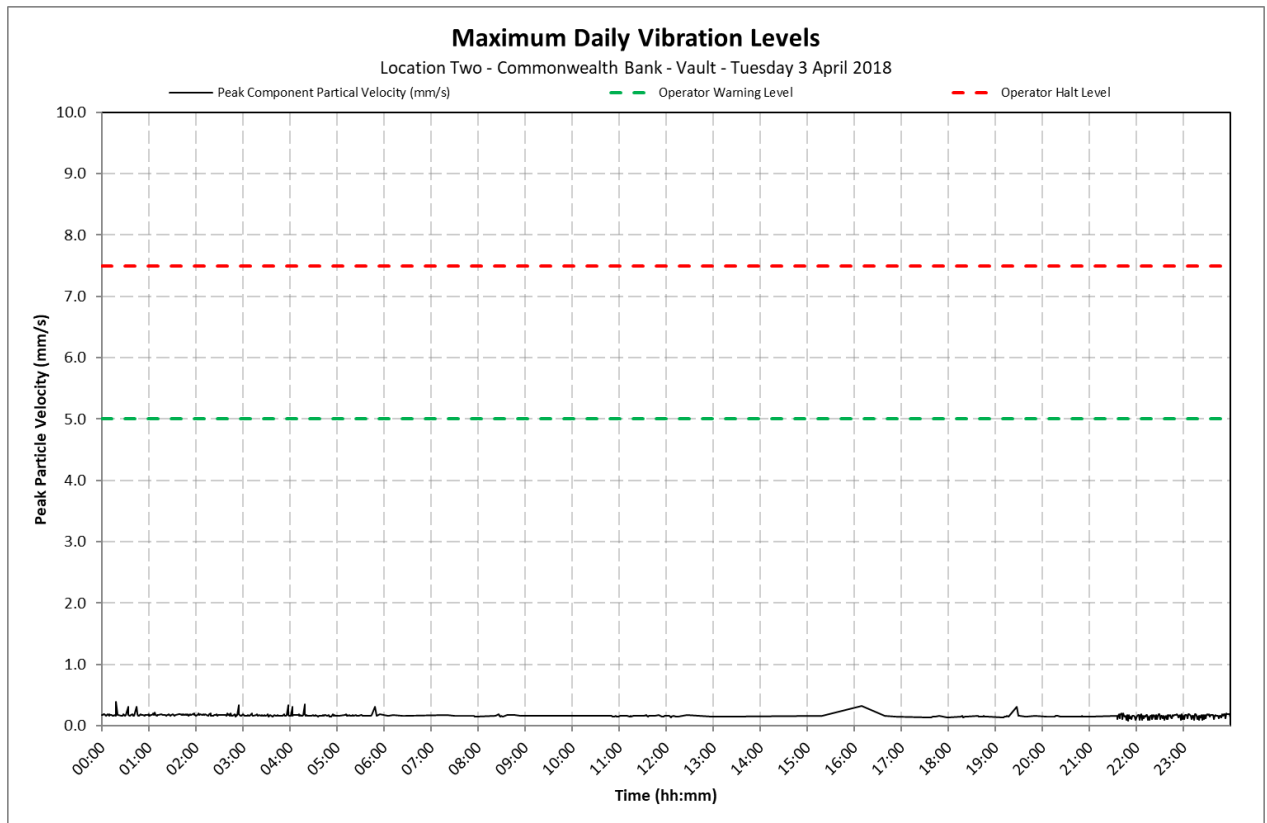
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

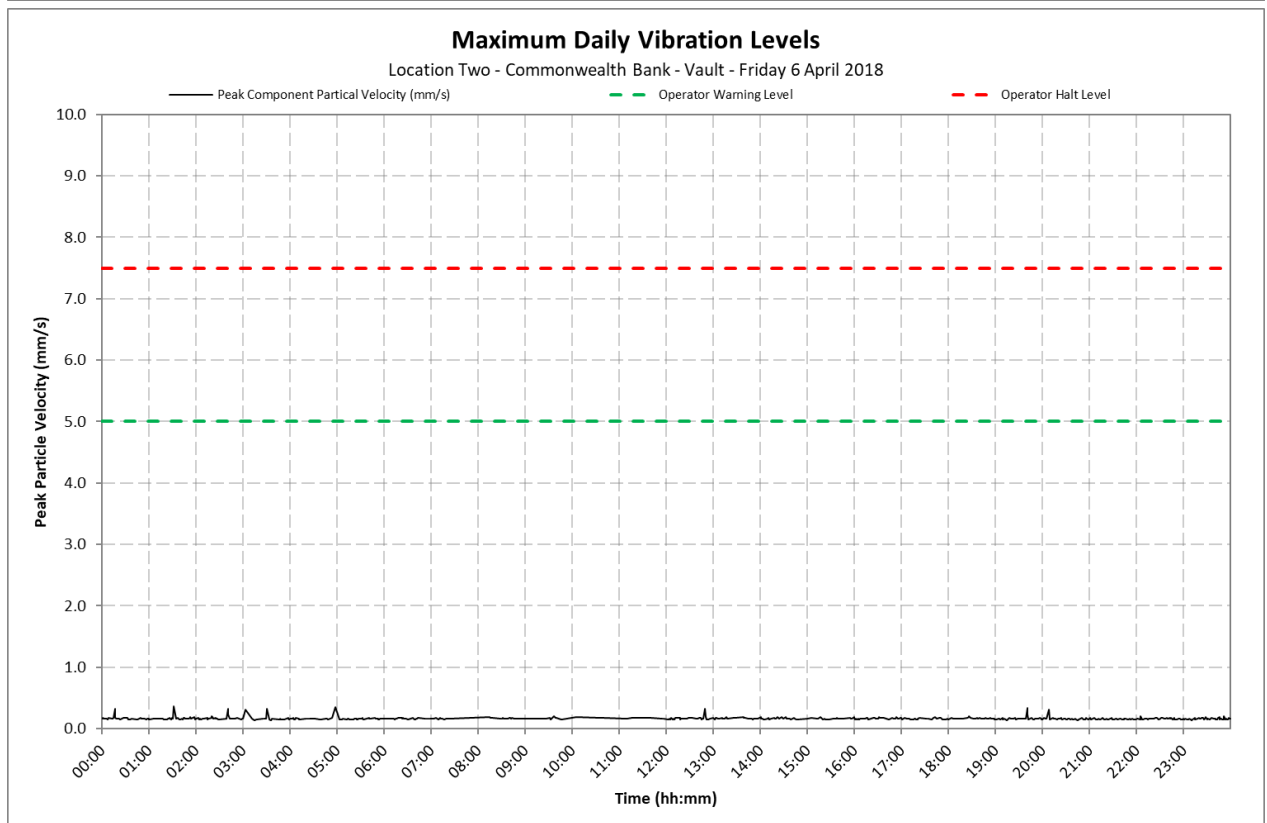
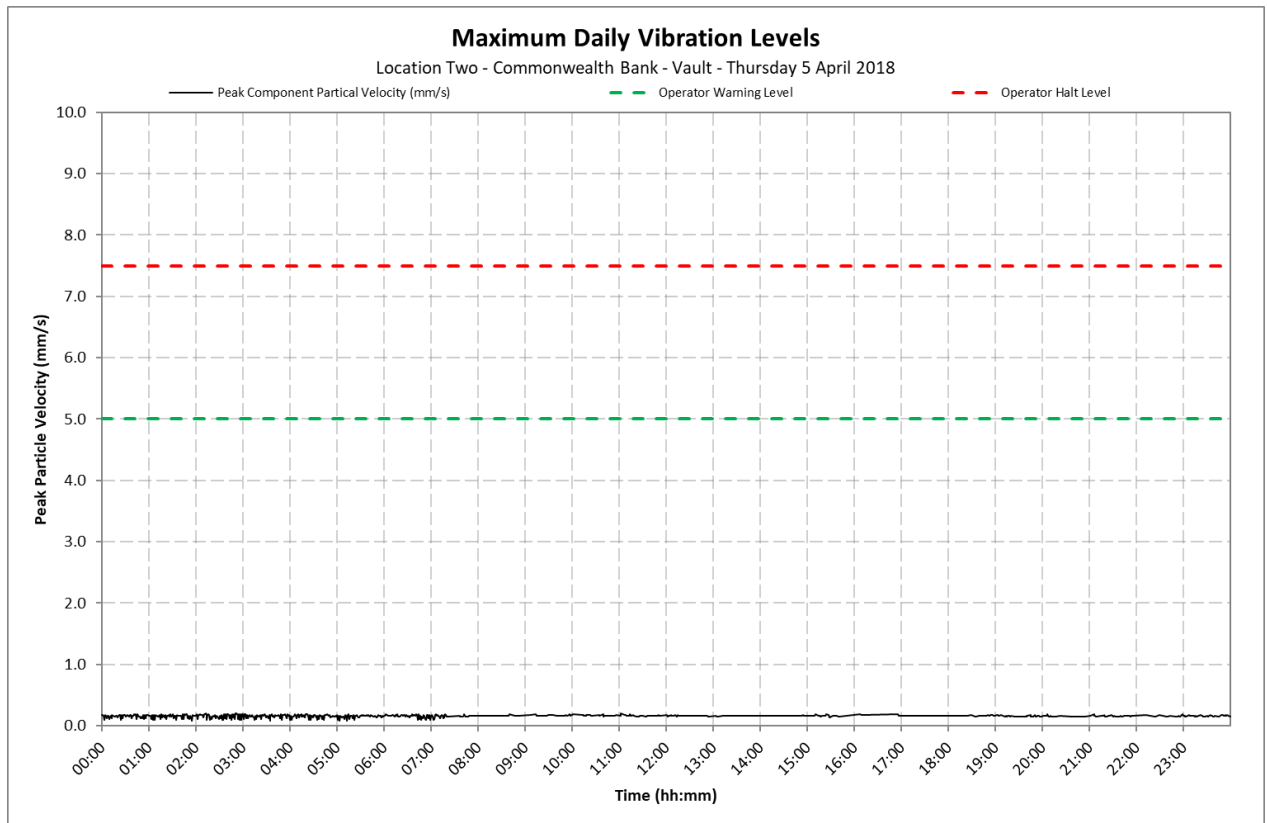
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

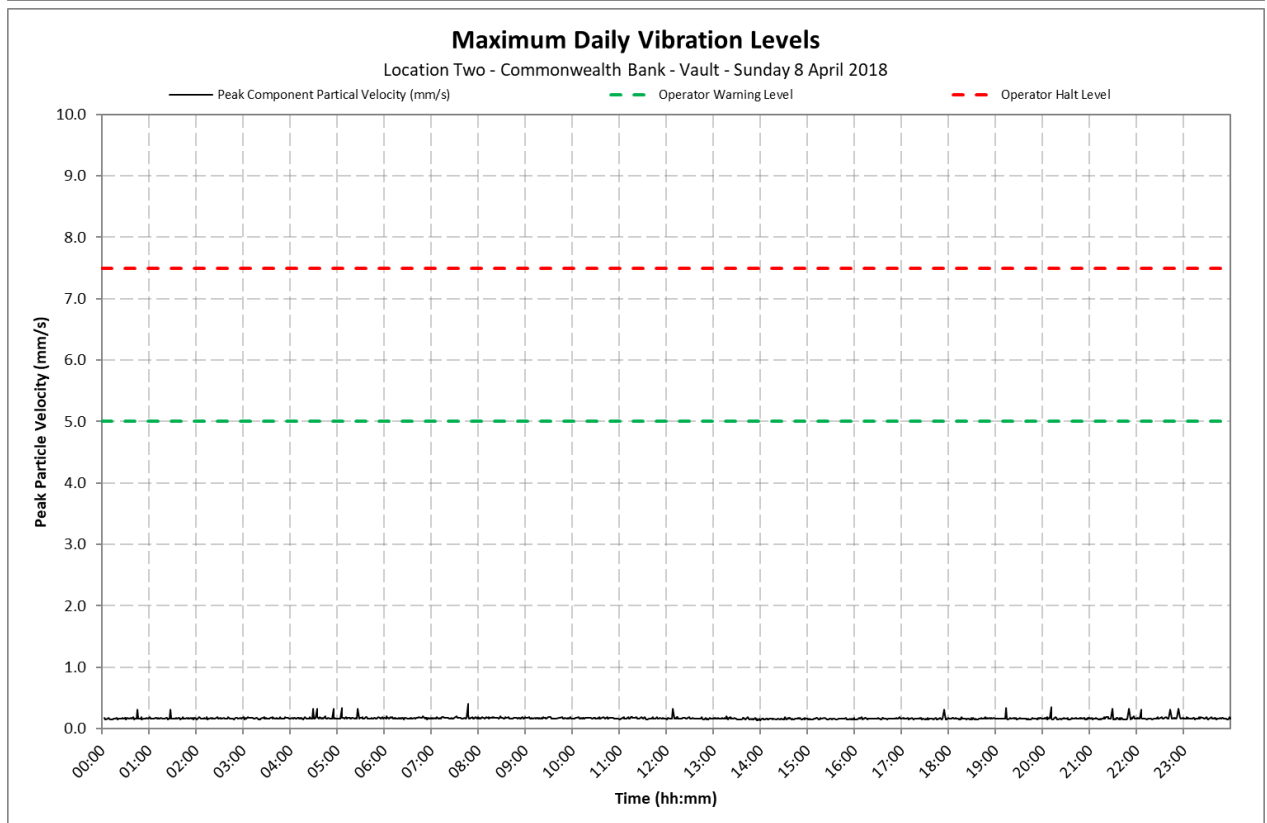
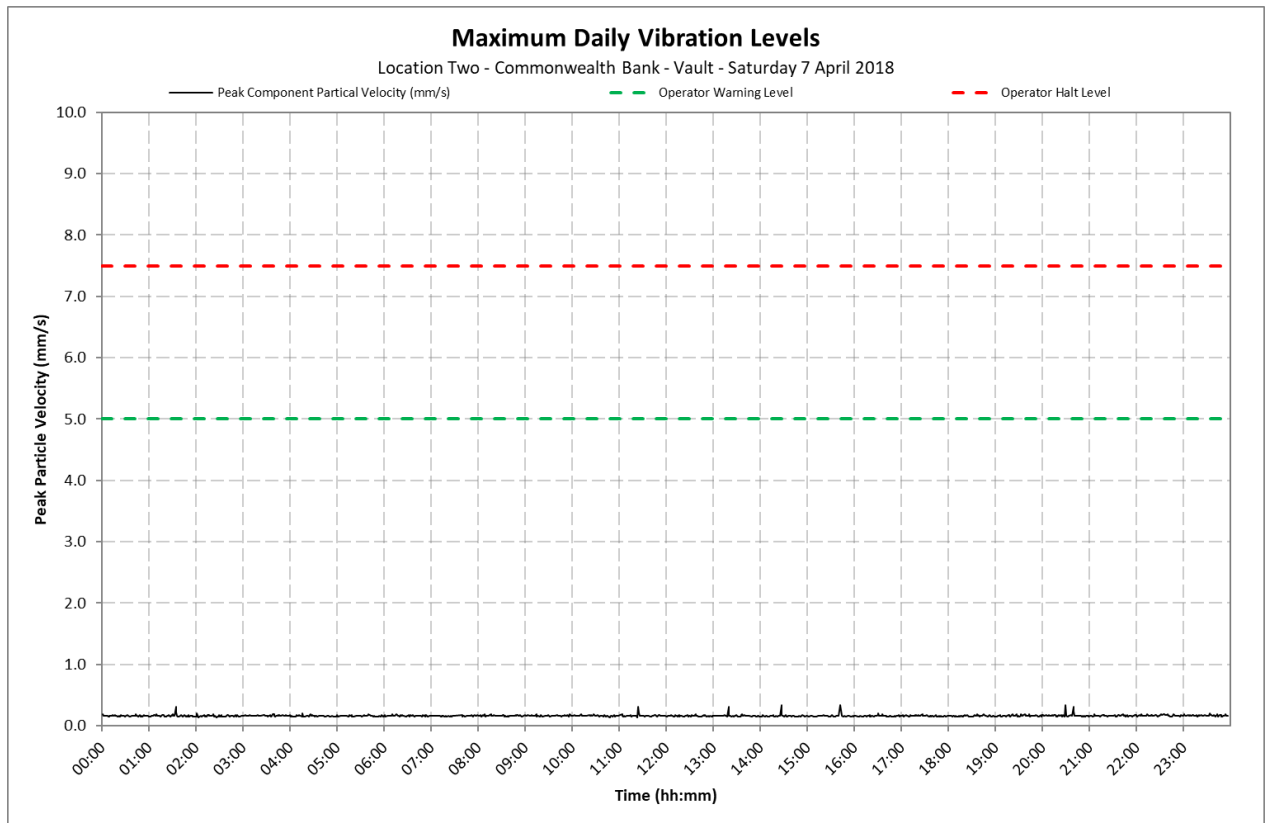
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

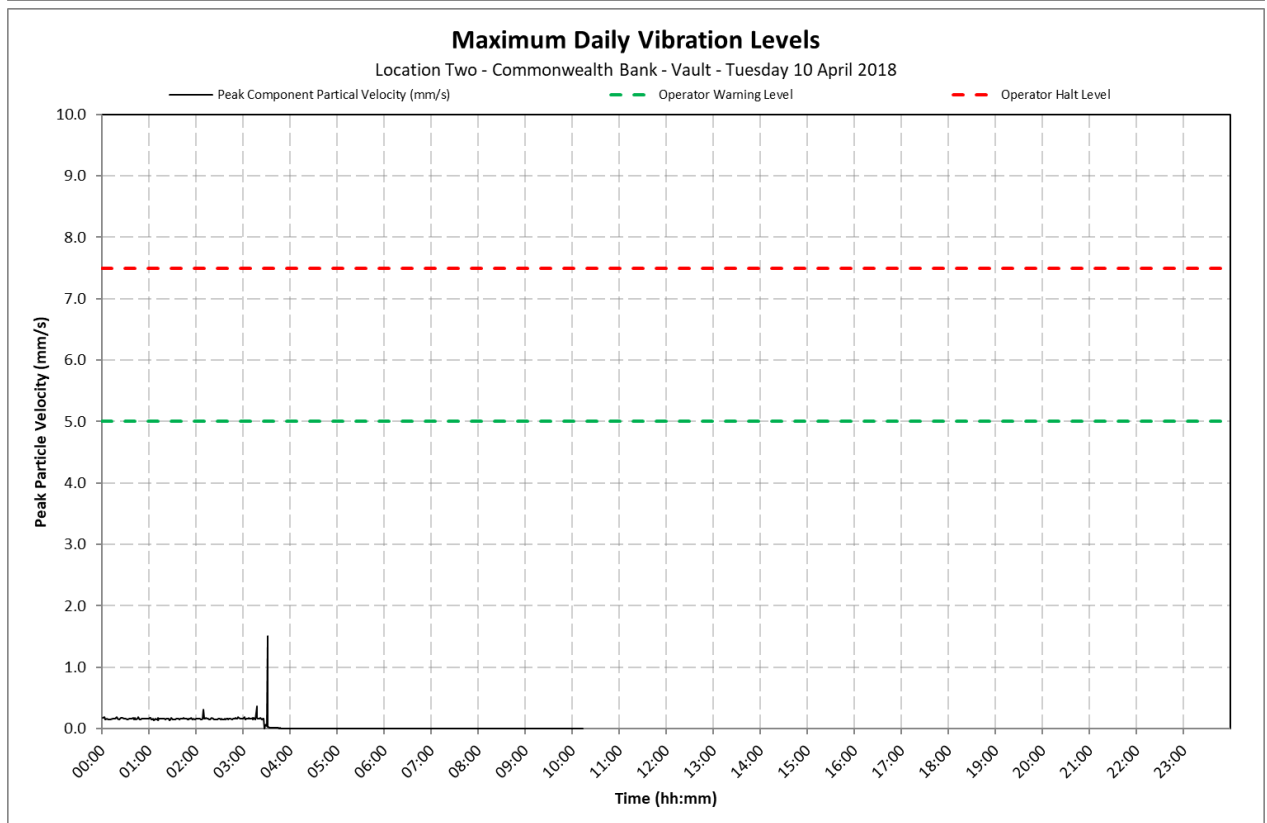
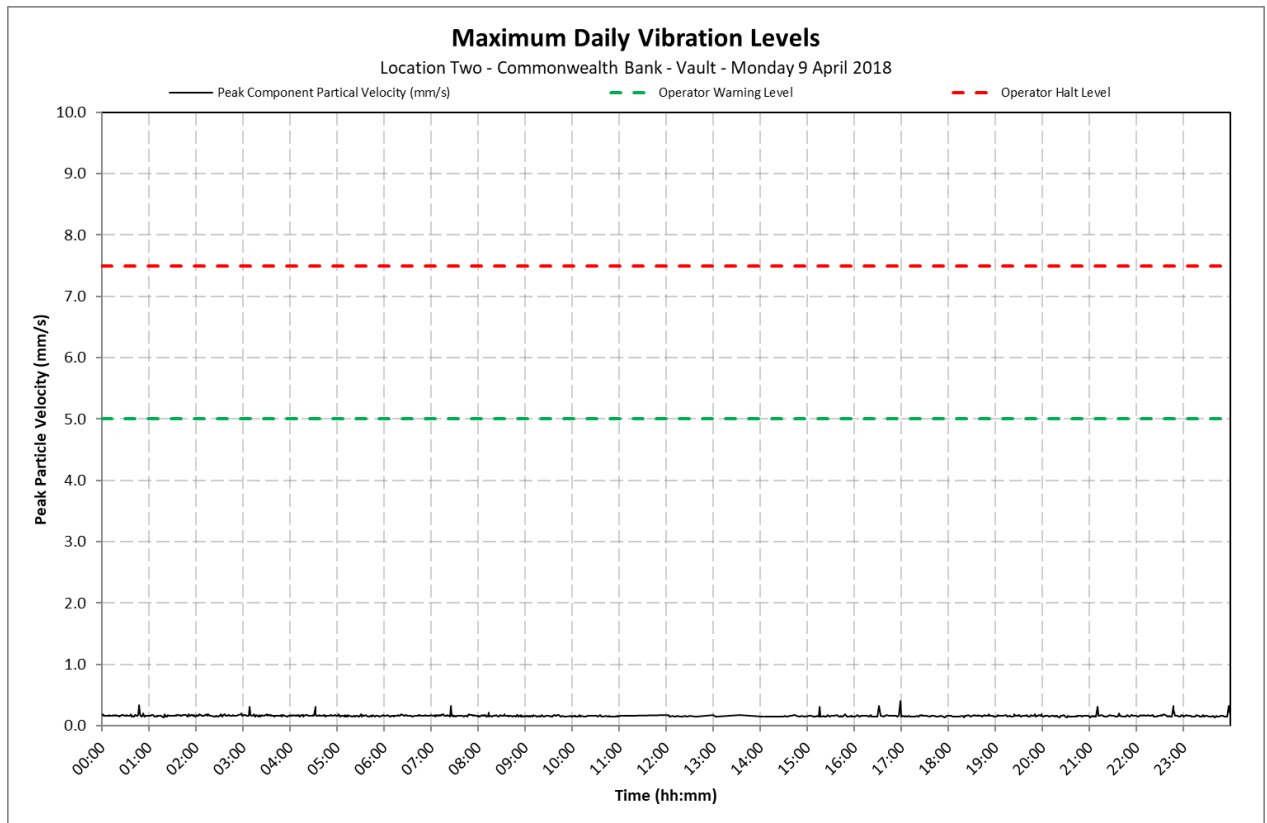
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

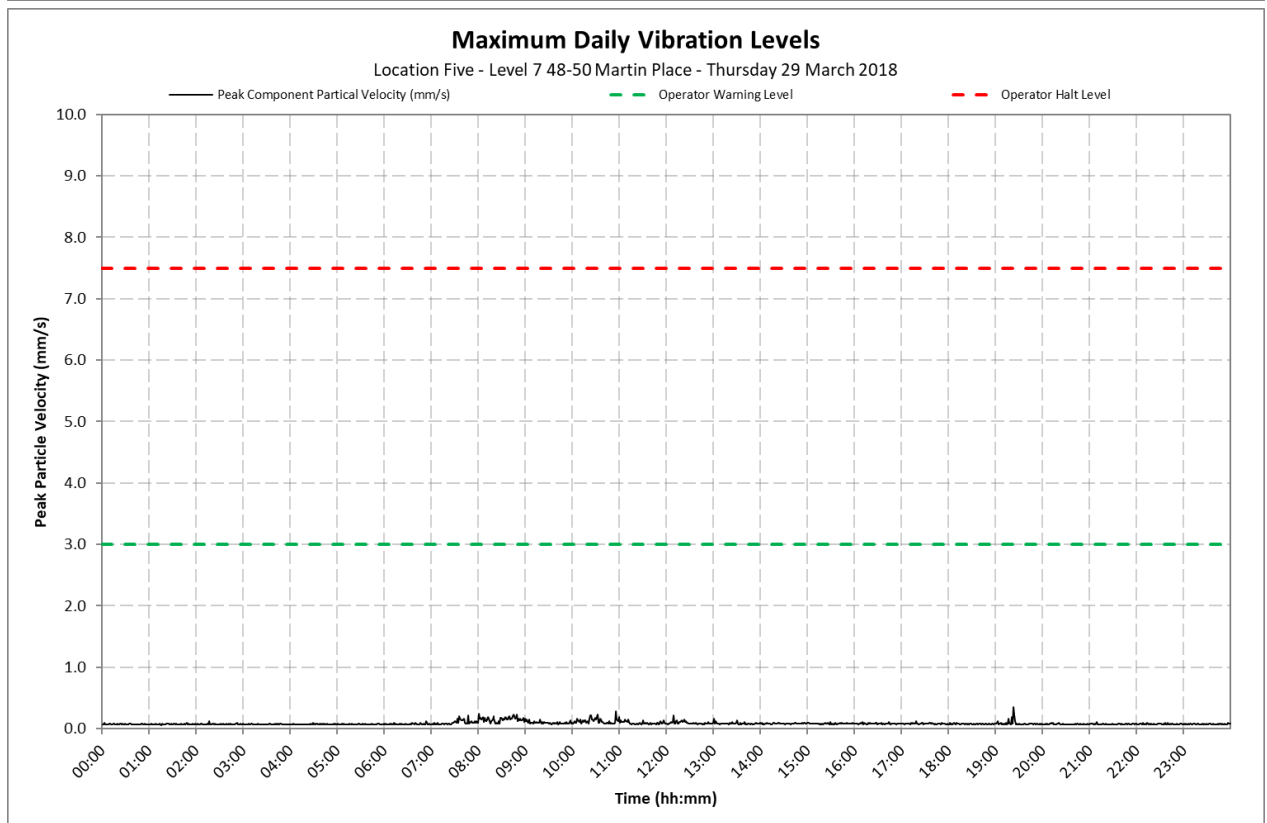
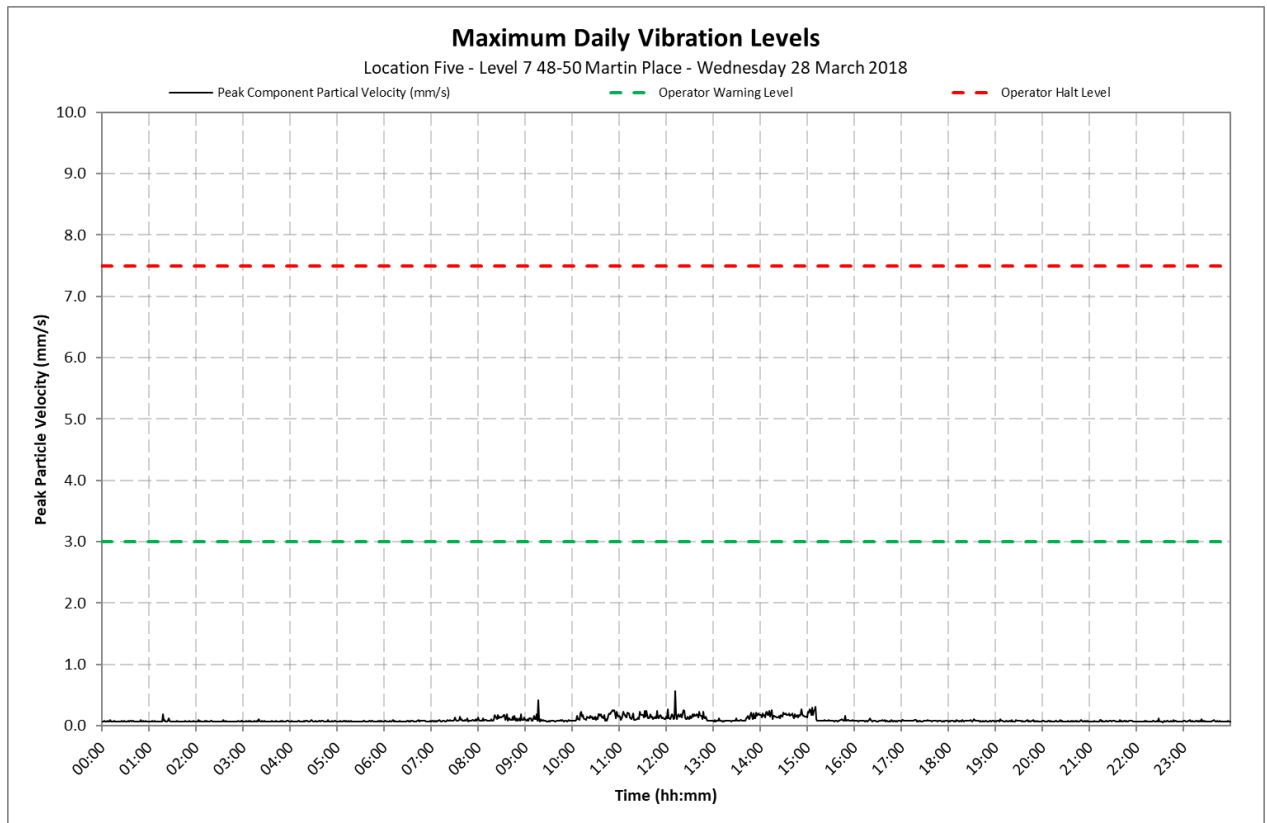
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

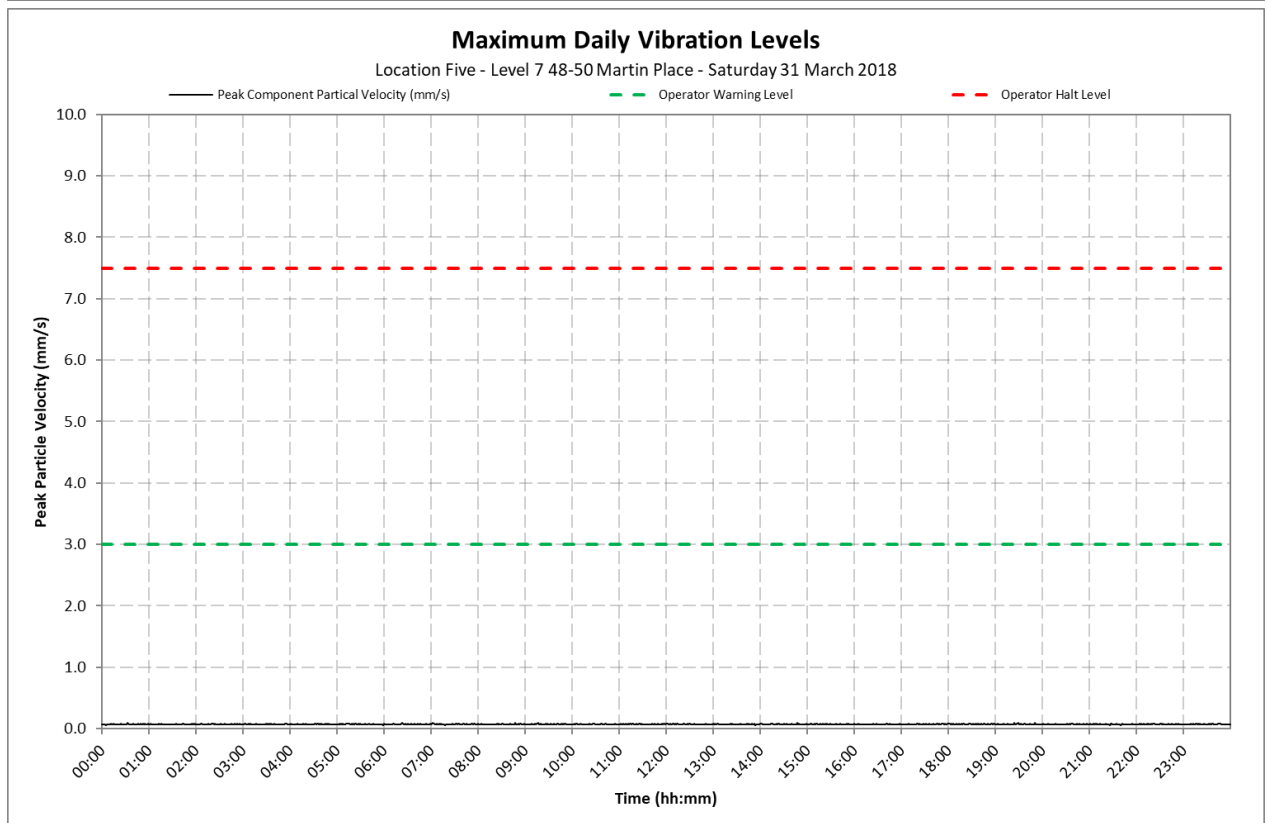
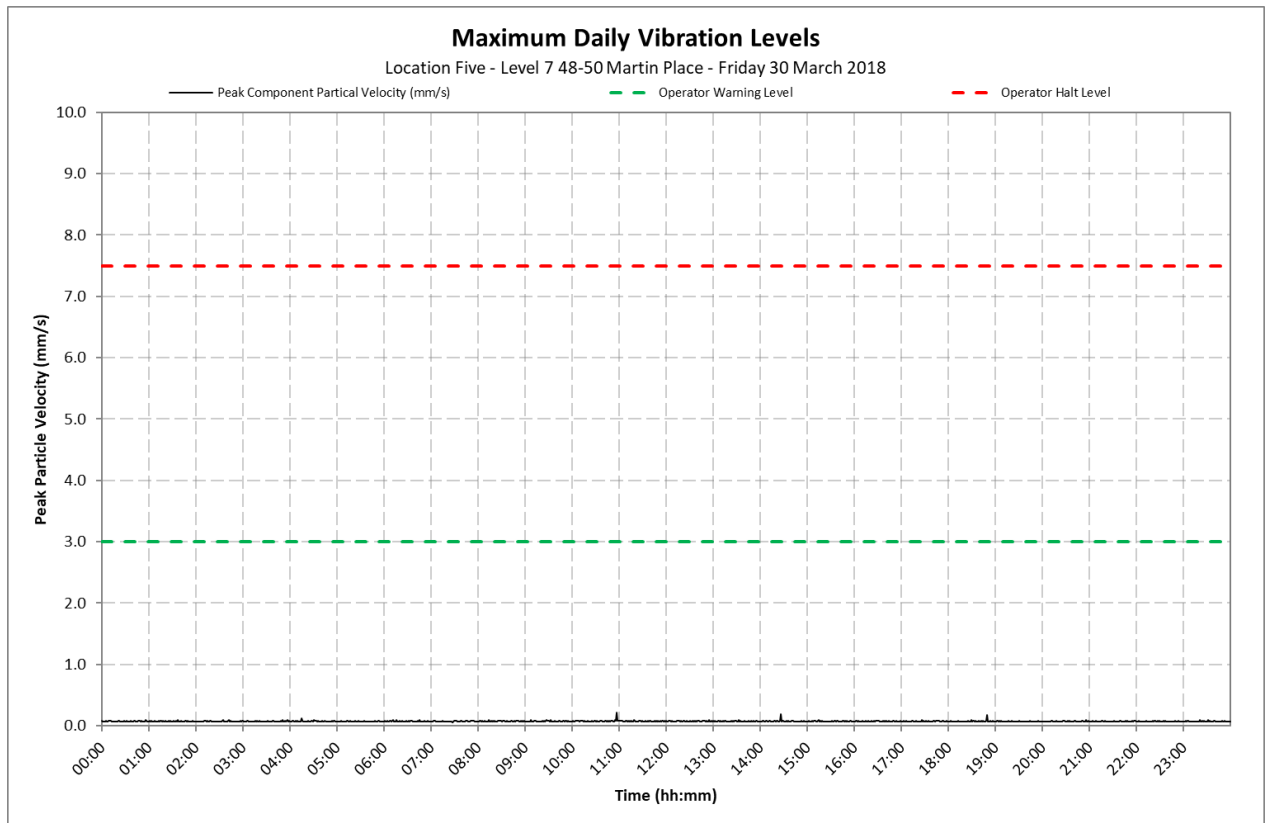
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

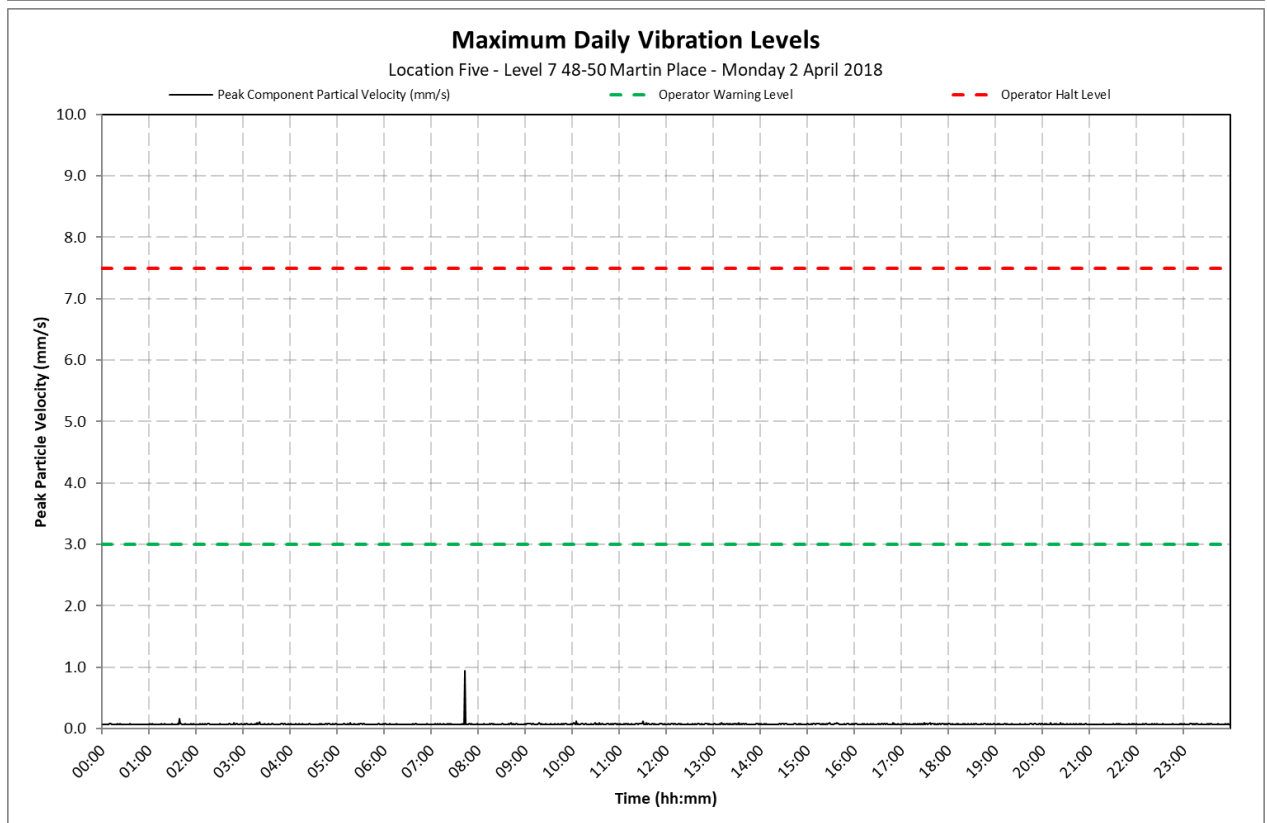
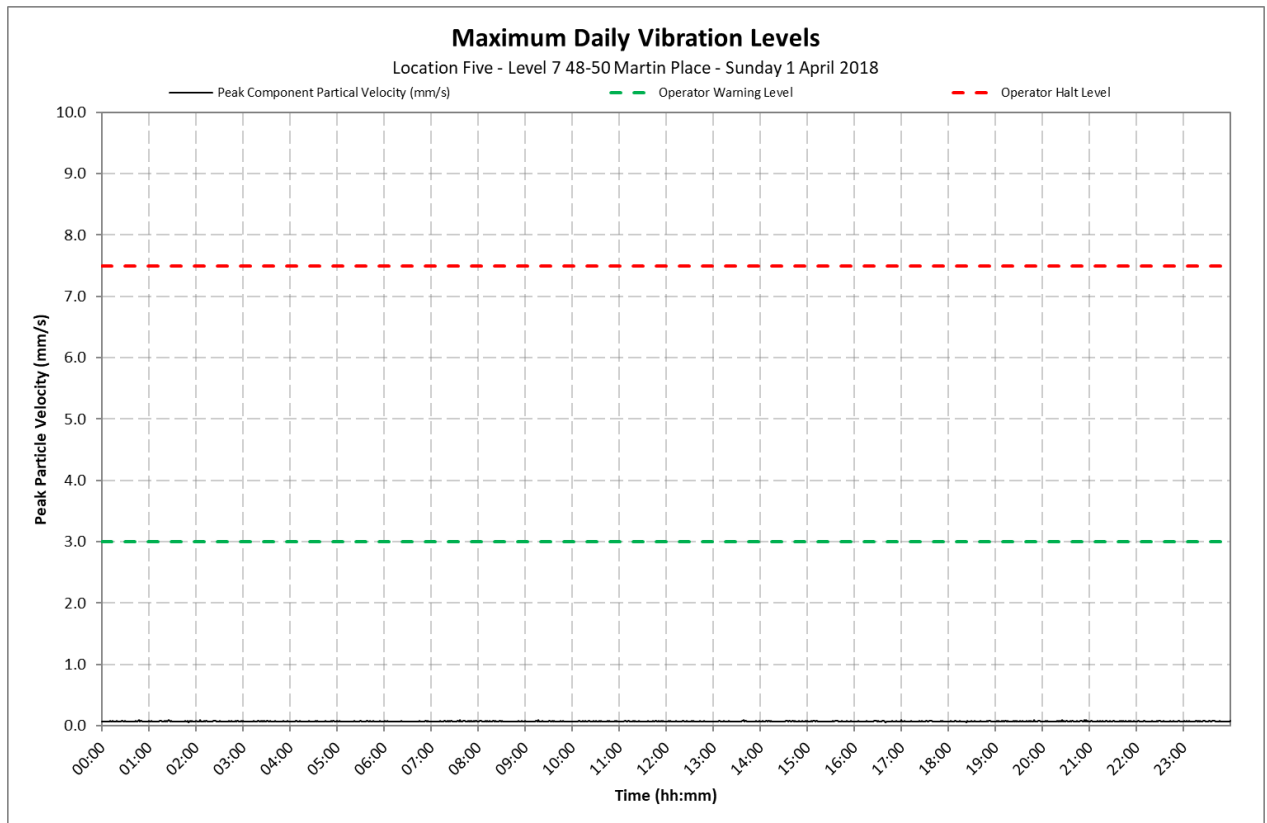
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

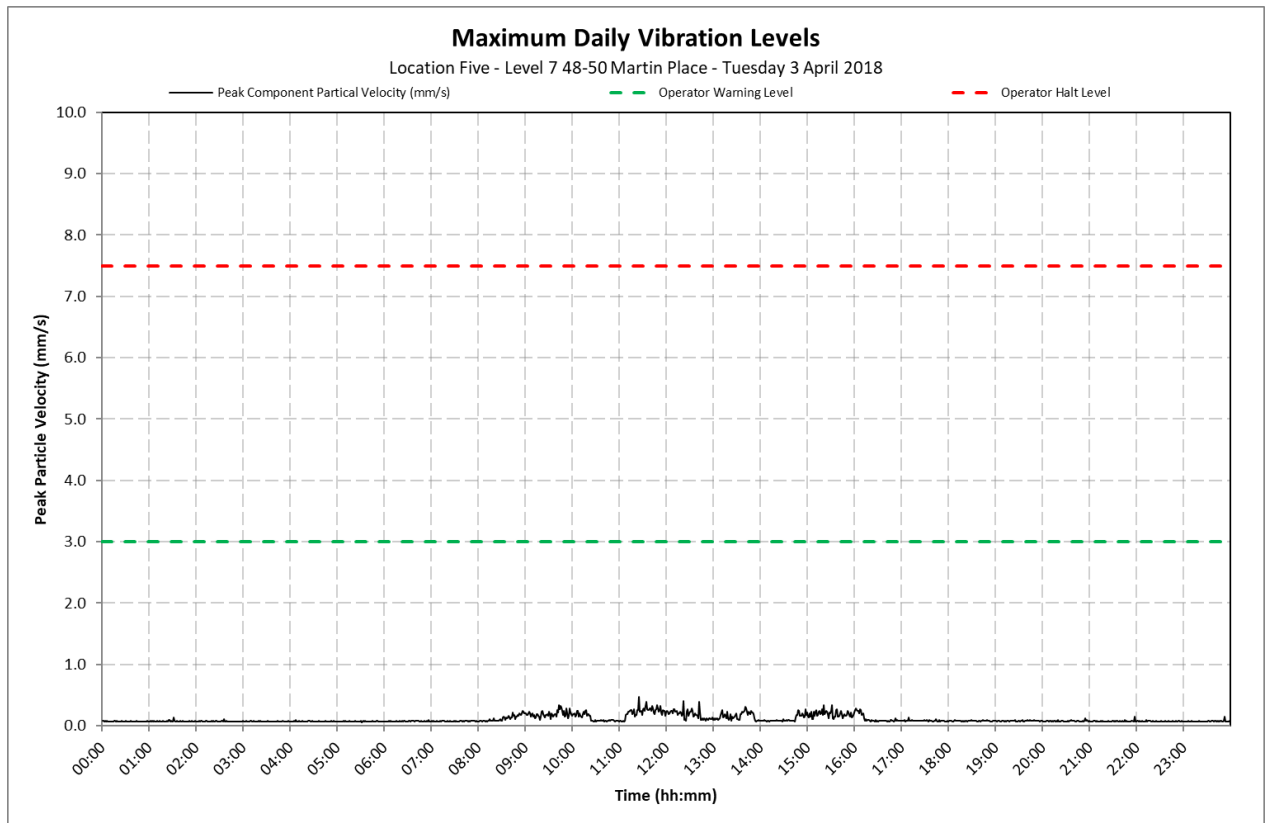
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



26 April 2018

10-1380 R26 NV Monitoring 20180426.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 26
11 April to 24 April 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 11 April to 24 April 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

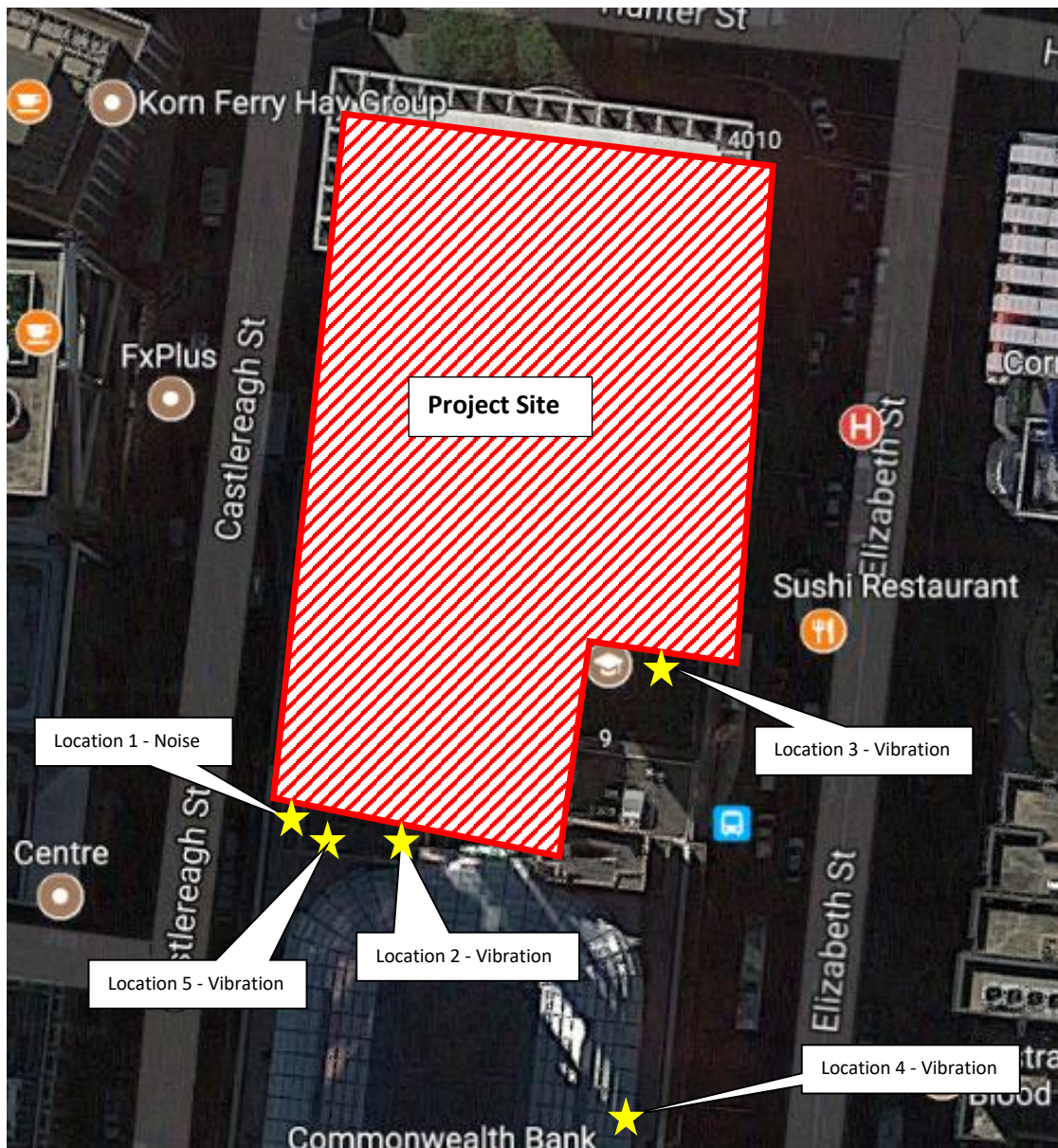
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 11 April to 24 April 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient LAeq(15minute) Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
11 April 2018	47	45	Complies	Complies
12 April 2018	47	45	Complies	Complies
13 April 2018	45	43	Complies	Complies
14 April 2018	40	39	Complies	Complies
15 April 2018	40	39	Complies	Complies
16 April 2018	37	34	Complies	Complies
17 April 2018	40	37	Complies	Complies
18 April 2018	45	43	Complies	Complies
19 April 2018	47	45	Complies	Complies
20 April 2018	46	44	Complies	Complies
21 April 2018	42	41	Complies	Complies
22 April 2018	40	39	Complies	Complies
23 April 2018	37	35	Complies	Complies
24 April 2018	40	37	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 11 April to 24 April 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
11 April 2018	0.6 mm/s	Complies
12 April 2018	0.6 mm/s	Complies
13 April 2018	0.7 mm/s	Complies
14 April 2018	0.3 mm/s	Complies
15 April 2018	0.5 mm/s	Complies
16 April 2018	0.6 mm/s	Complies
17 April 2018	0.6 mm/s	Complies
18 April 2018	0.6 mm/s	Complies
19 April 2018	0.6 mm/s	Complies
20 April 2018	0.5 mm/s	Complies
21 April 2018	0.6 mm/s	Complies
22 April 2018	0.3 mm/s	Complies
23 April 2018	0.5 mm/s	Complies
24 April 2018	0.7 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
11 April 2018	0.8 mm/s	Complies
12 April 2018	0.5 mm/s	Complies
13 April 2018	0.5 mm/s	Complies
14 April 2018	0.5 mm/s	Complies
15 April 2018	0.1 mm/s	Complies
16 April 2018	0.5 mm/s	Complies
17 April 2018	0.5 mm/s	Complies
18 April 2018	0.4 mm/s	Complies
19 April 2018	0.2 mm/s	Complies
20 April 2018	0.4 mm/s	Complies
21 April 2018	0.2 mm/s	Complies
22 April 2018	0.1 mm/s	Complies
23 April 2018	0.2 mm/s	Complies
24 April 2018	0.2 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 11 April to 24 April 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 11 April to 24 April 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

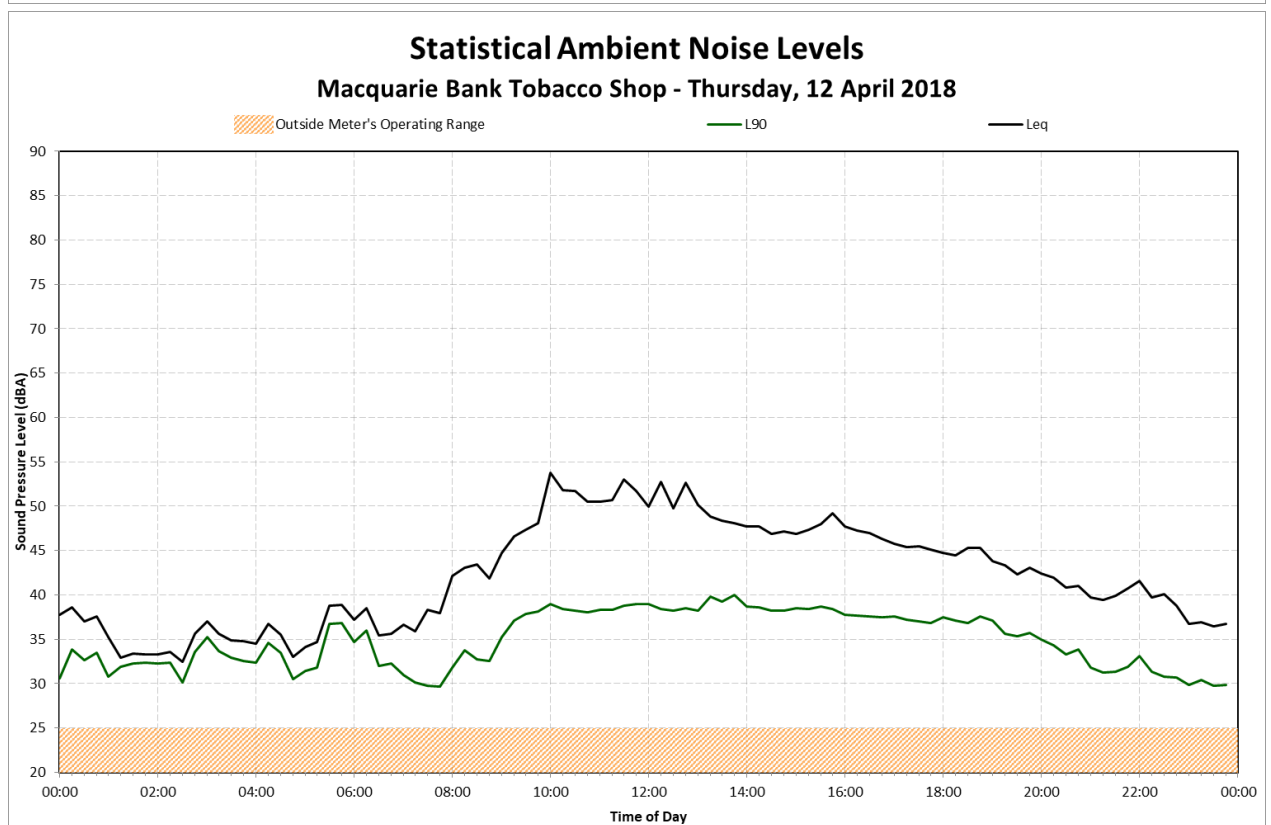
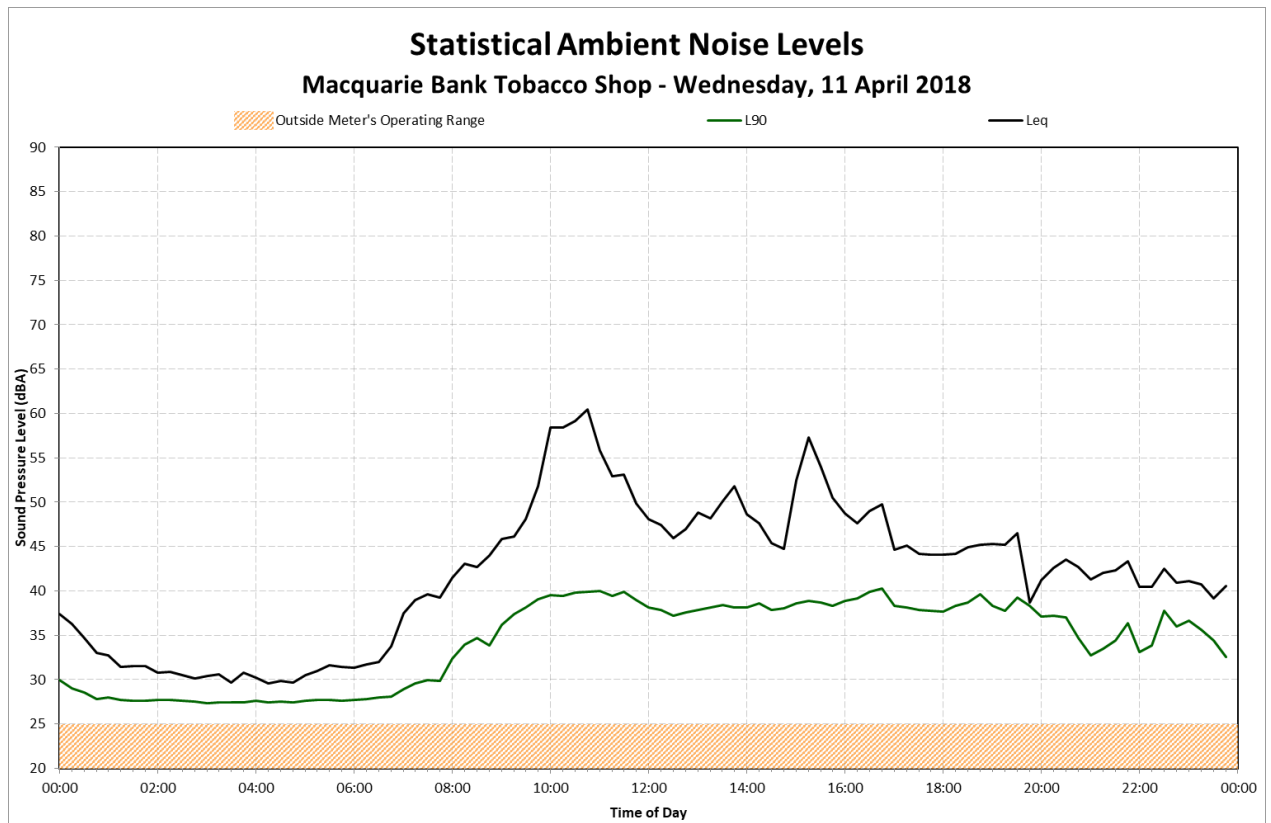
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
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PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
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Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

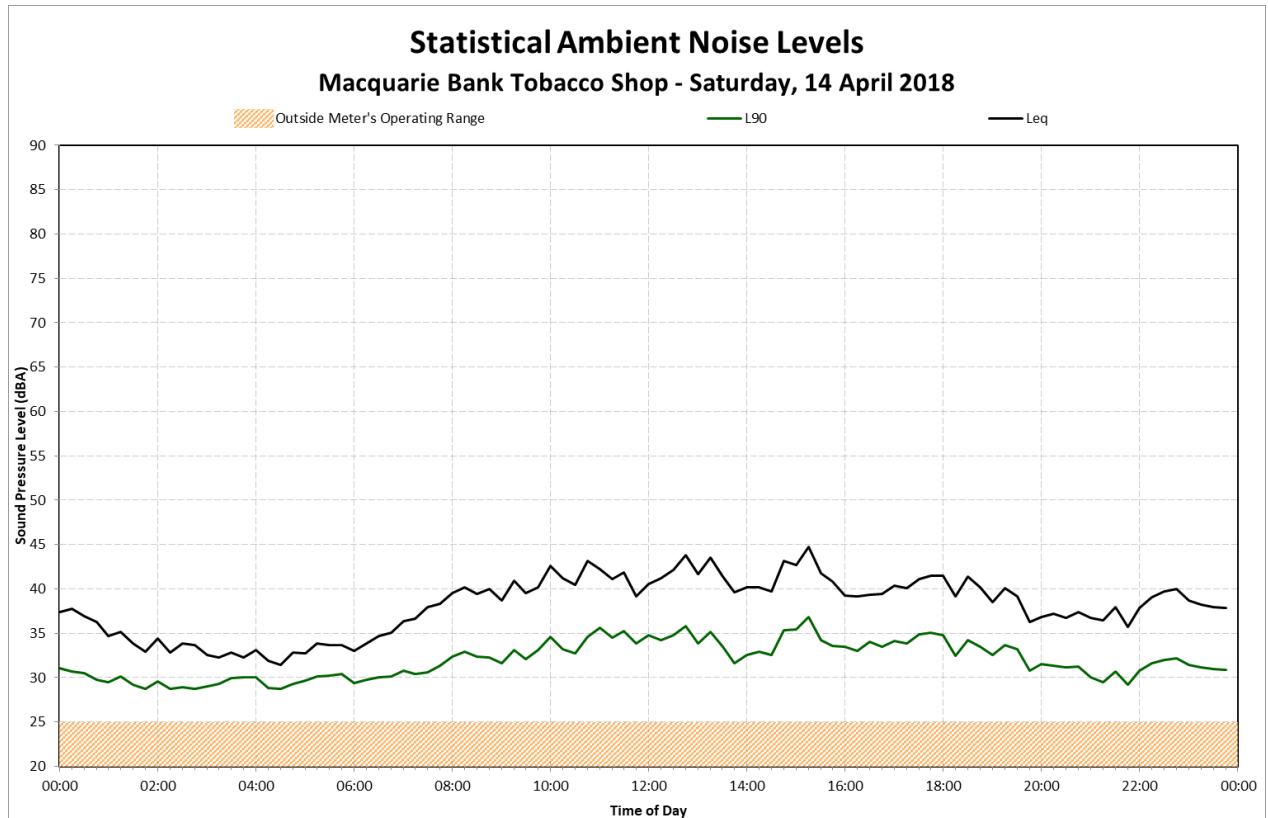
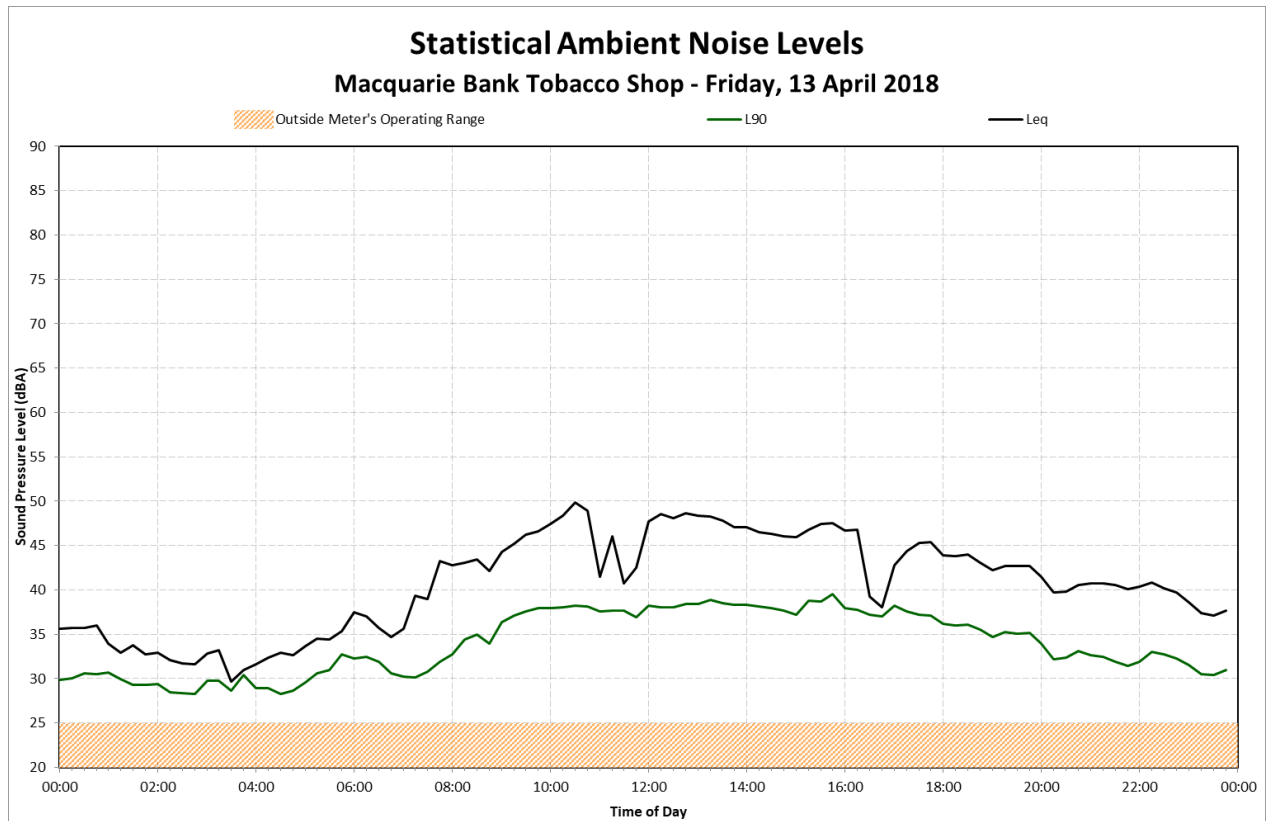
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

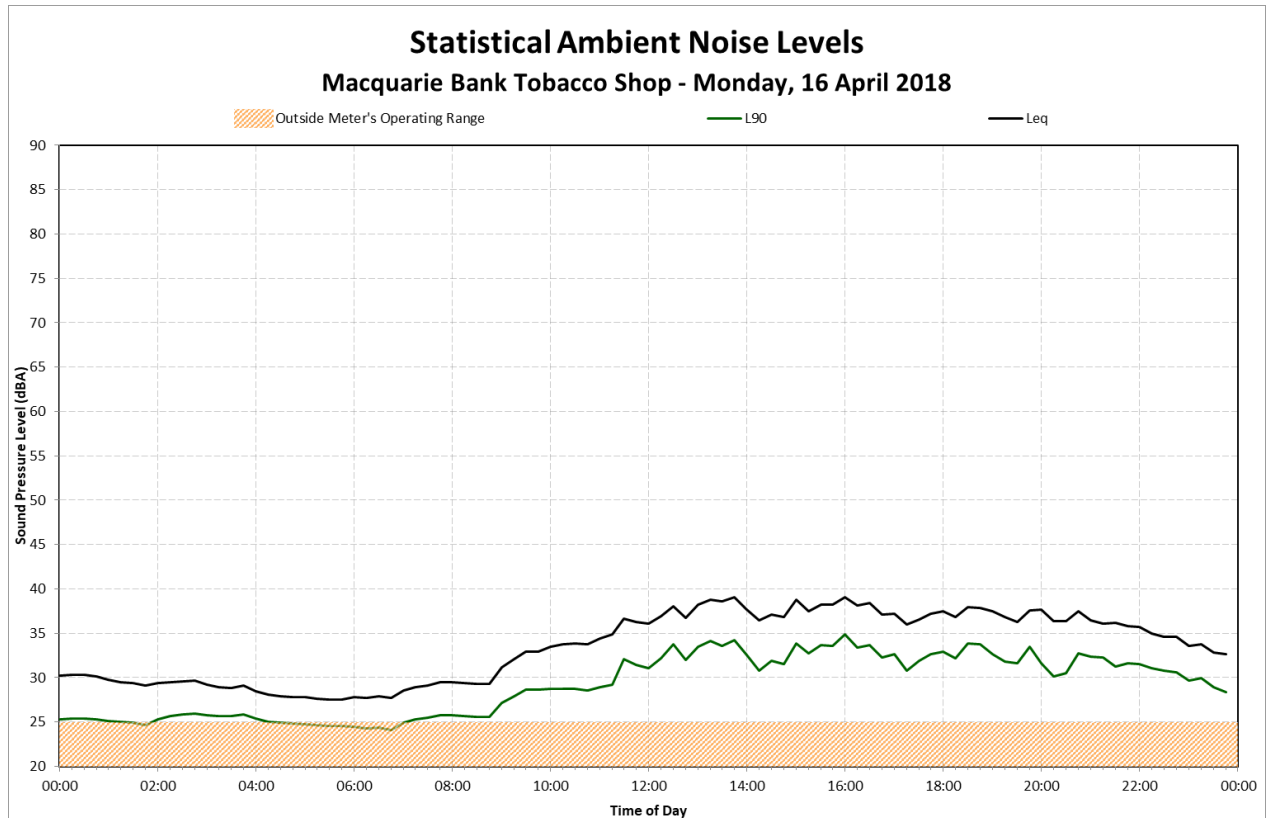
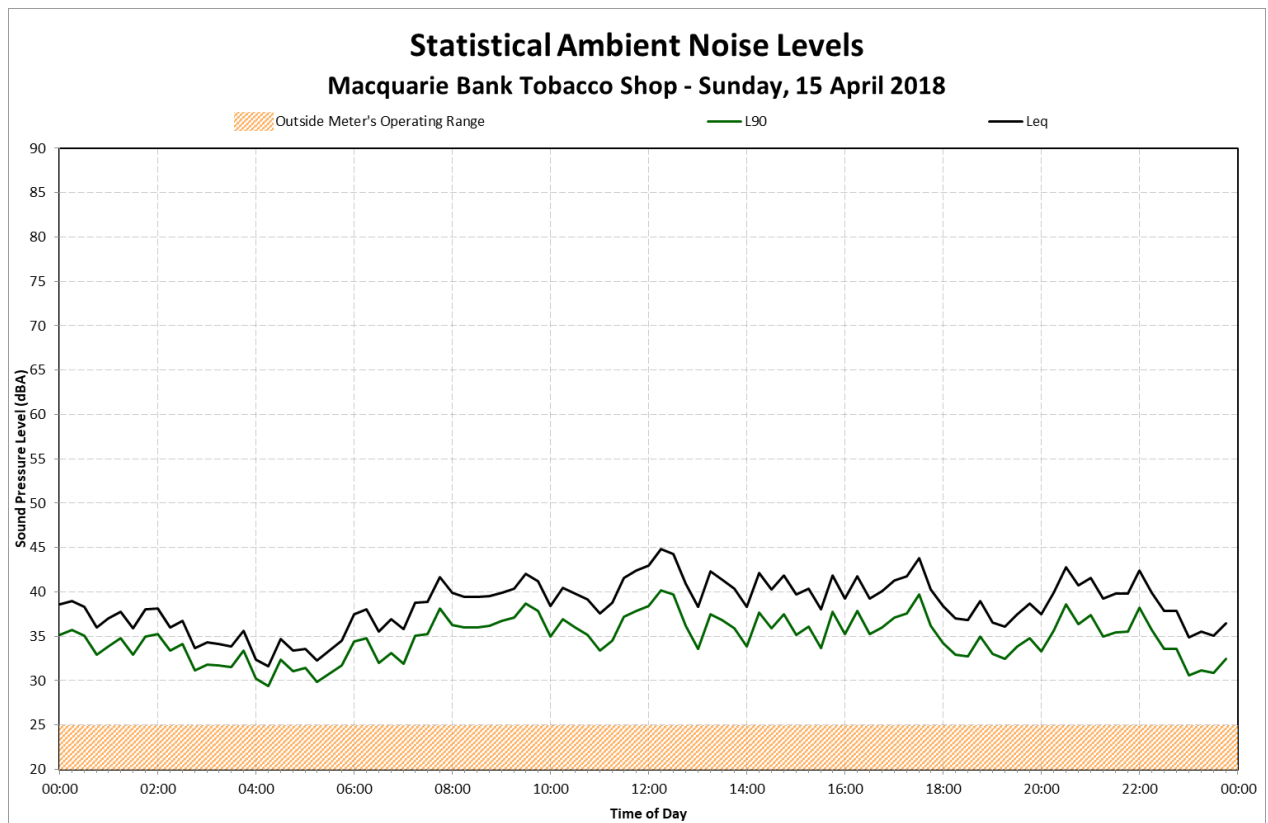
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

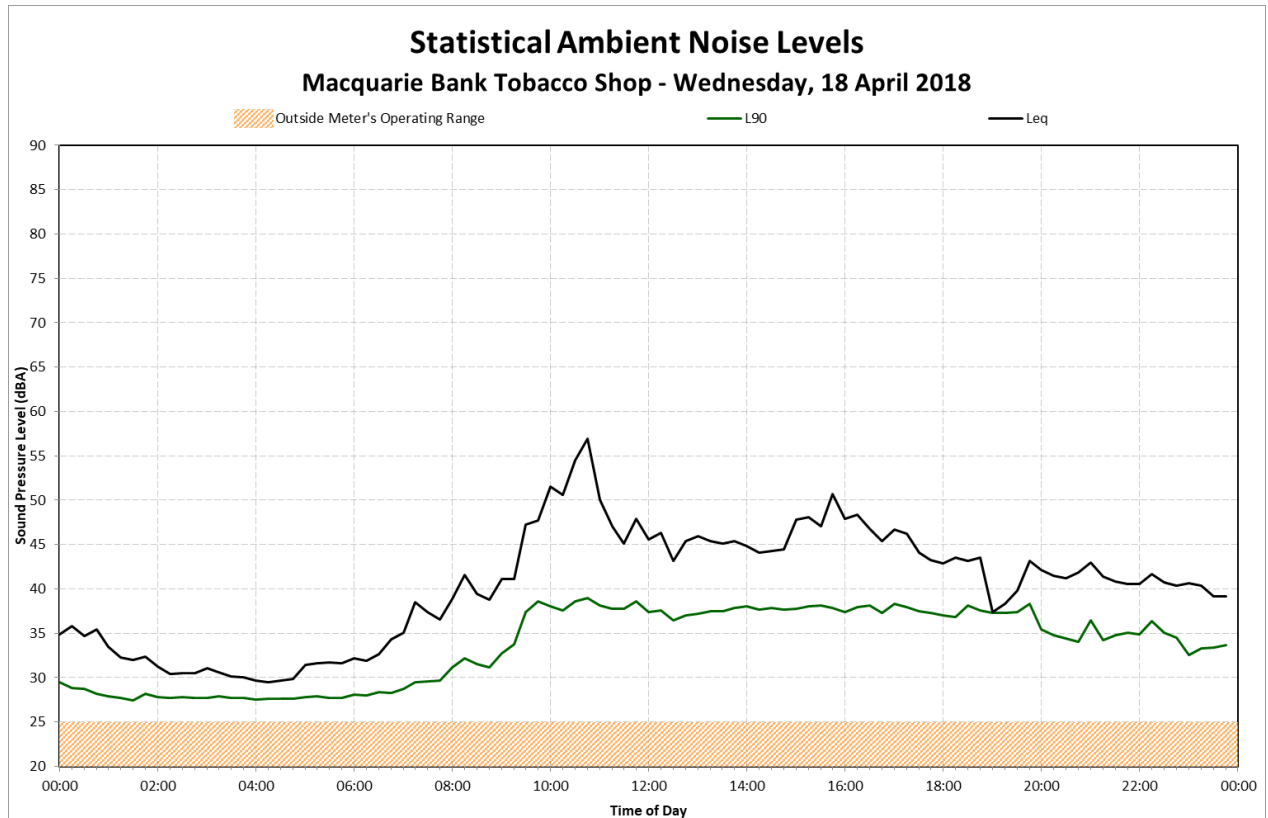
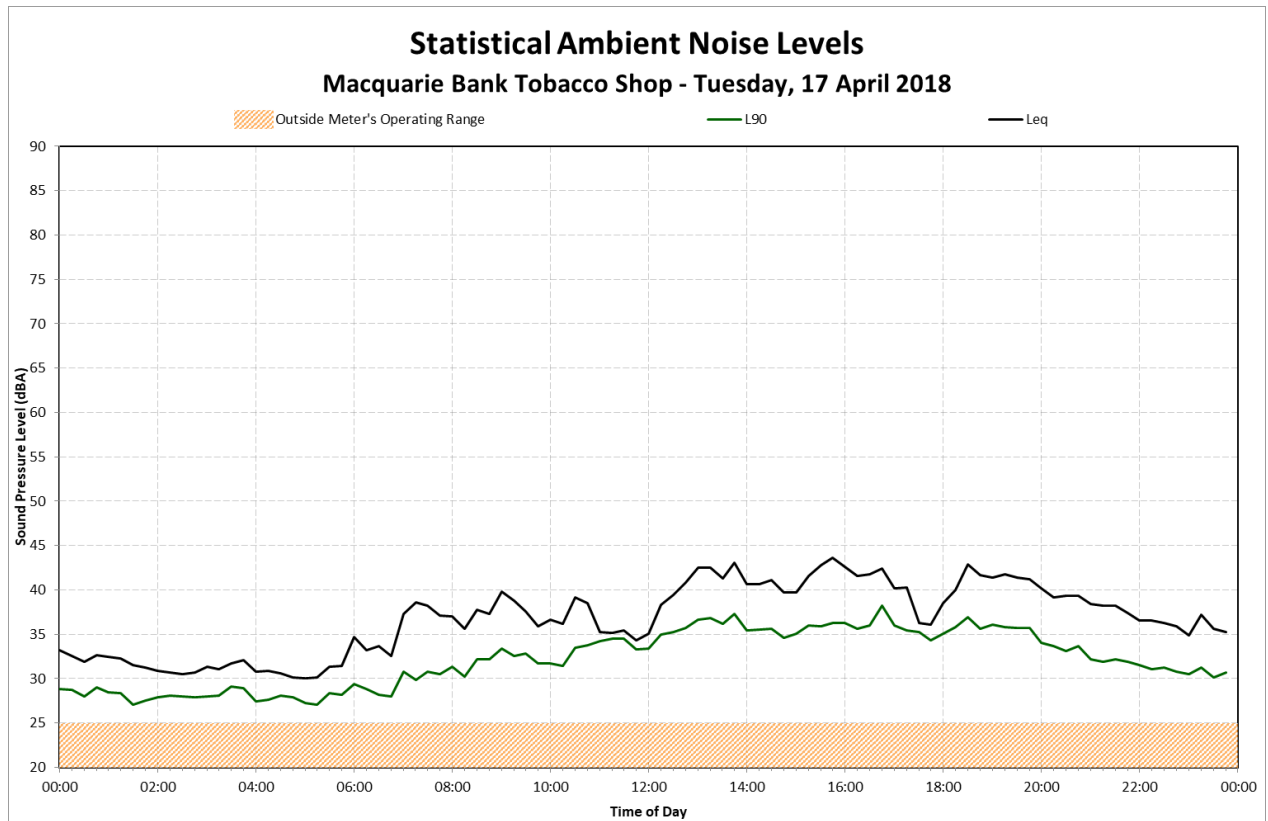
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

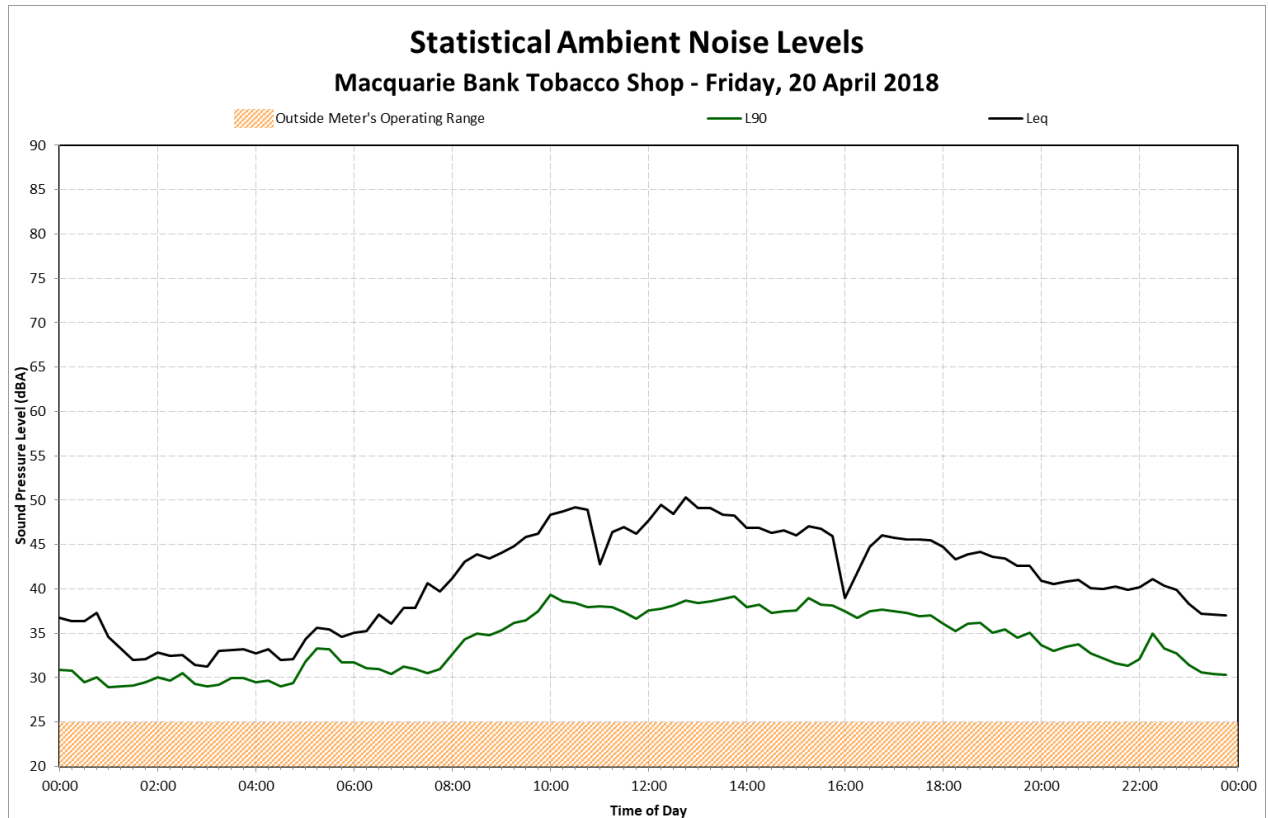
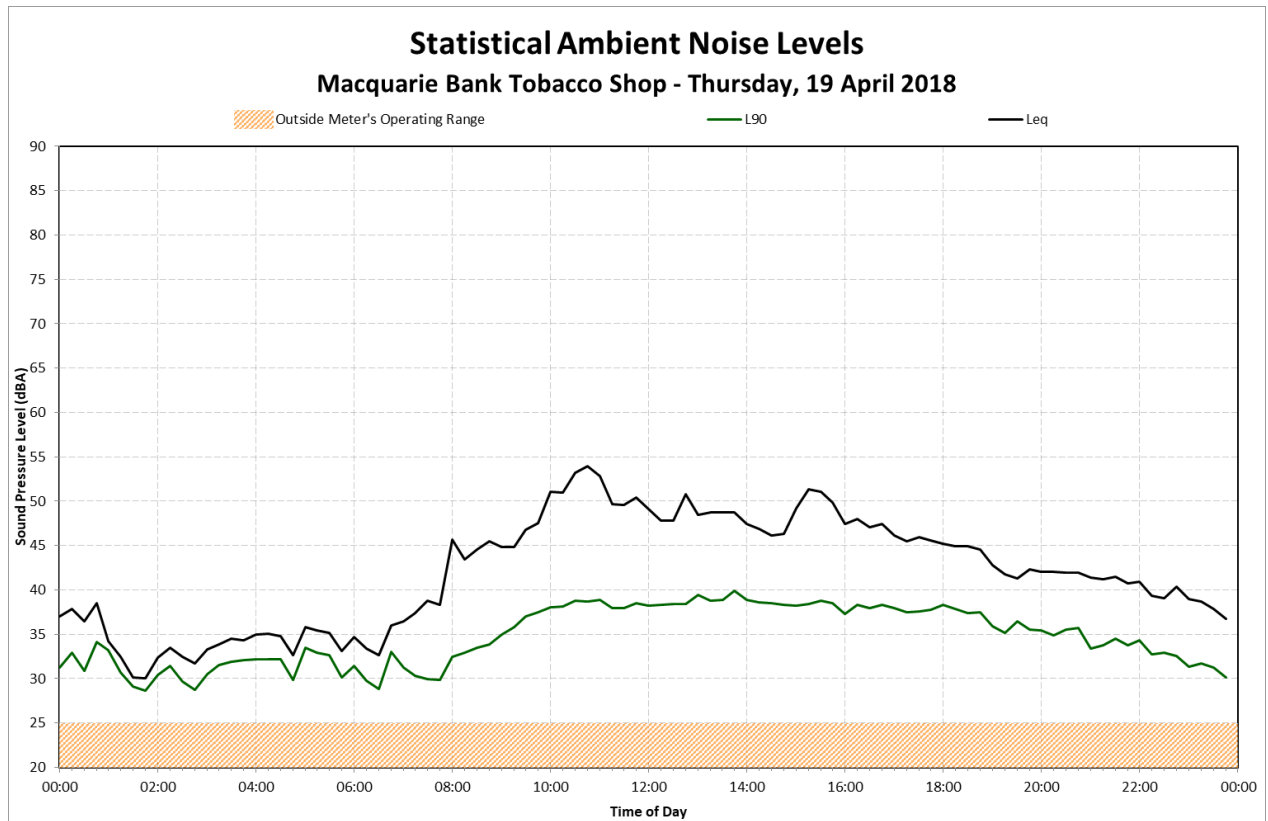
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

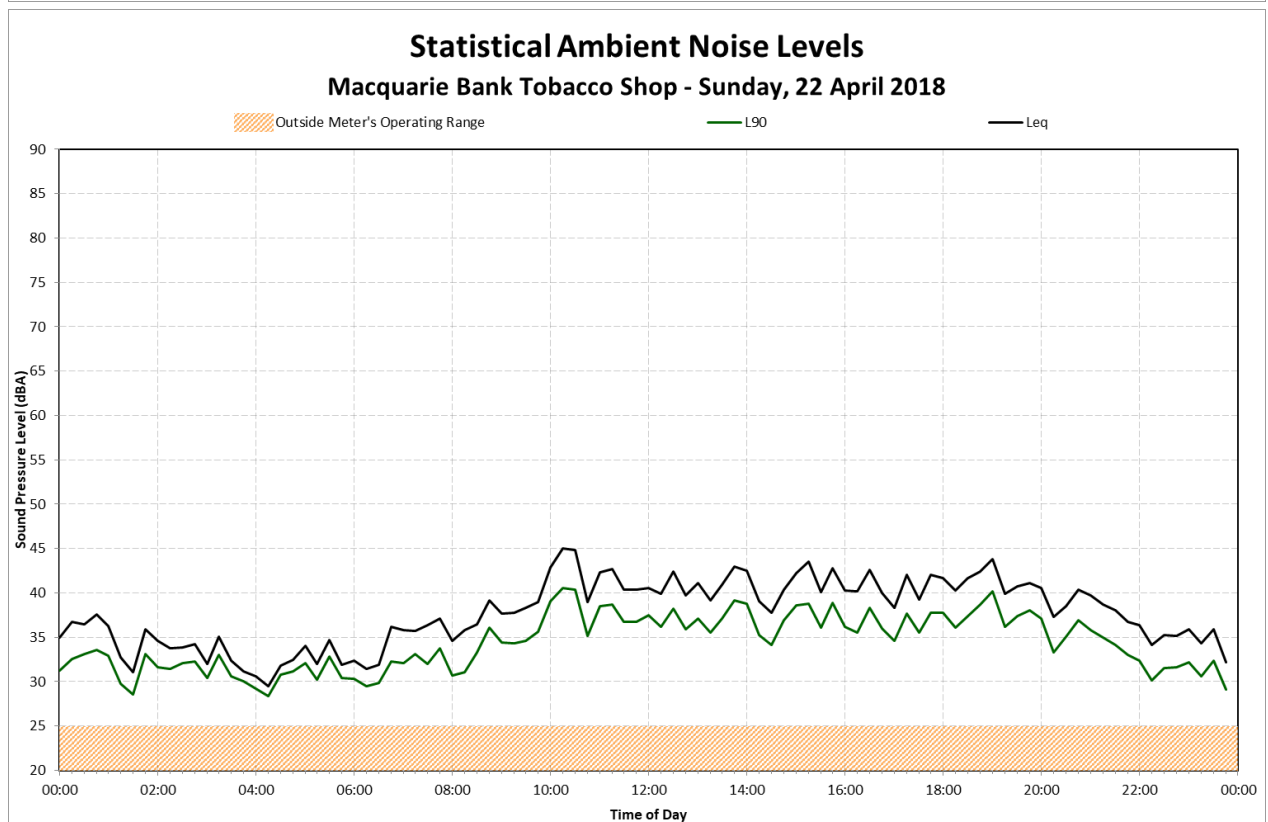
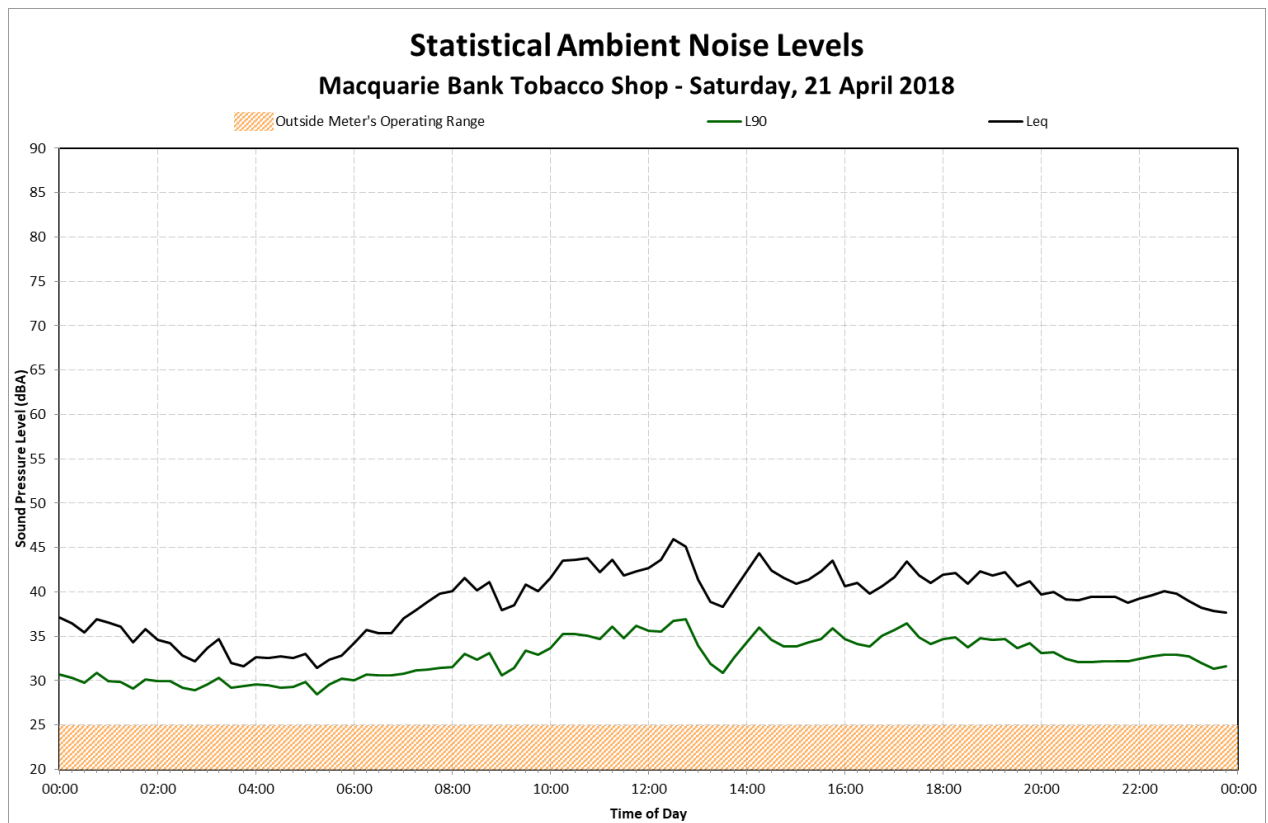
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

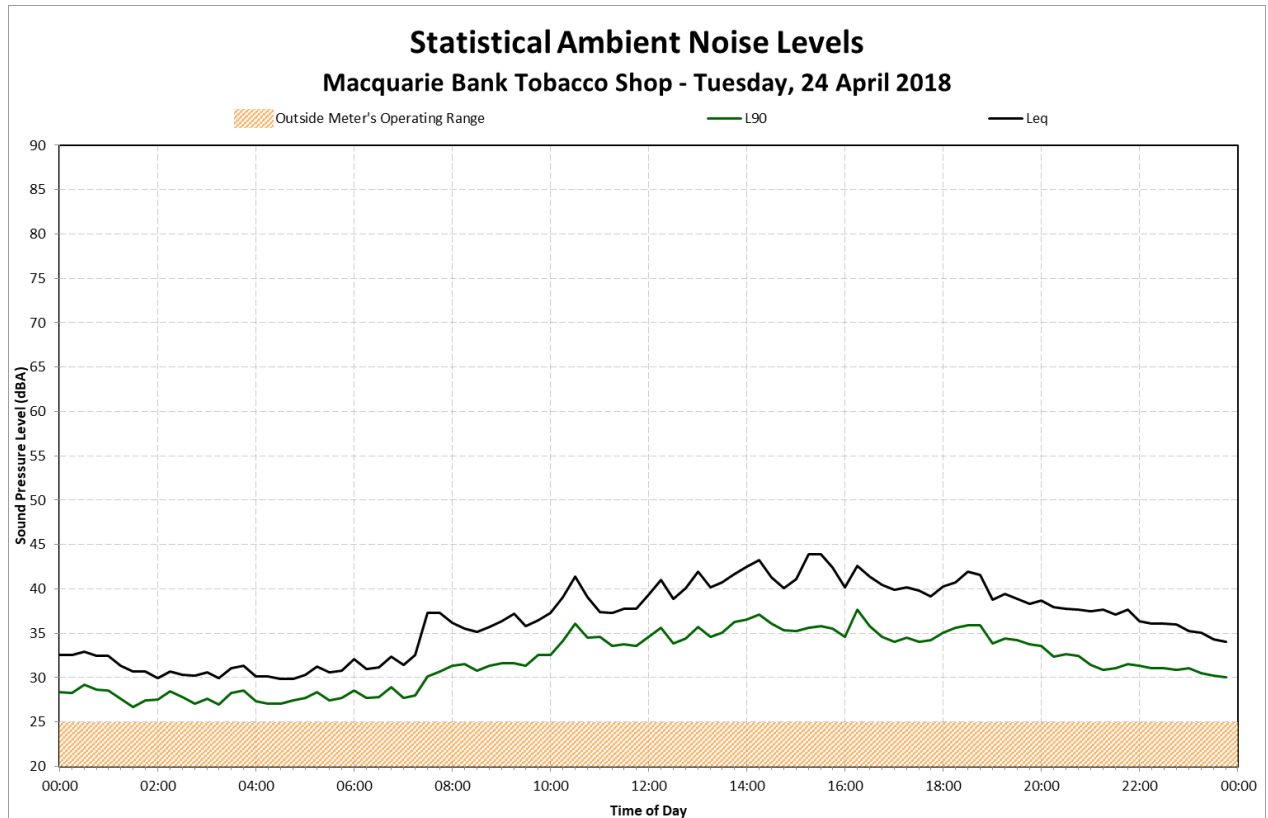
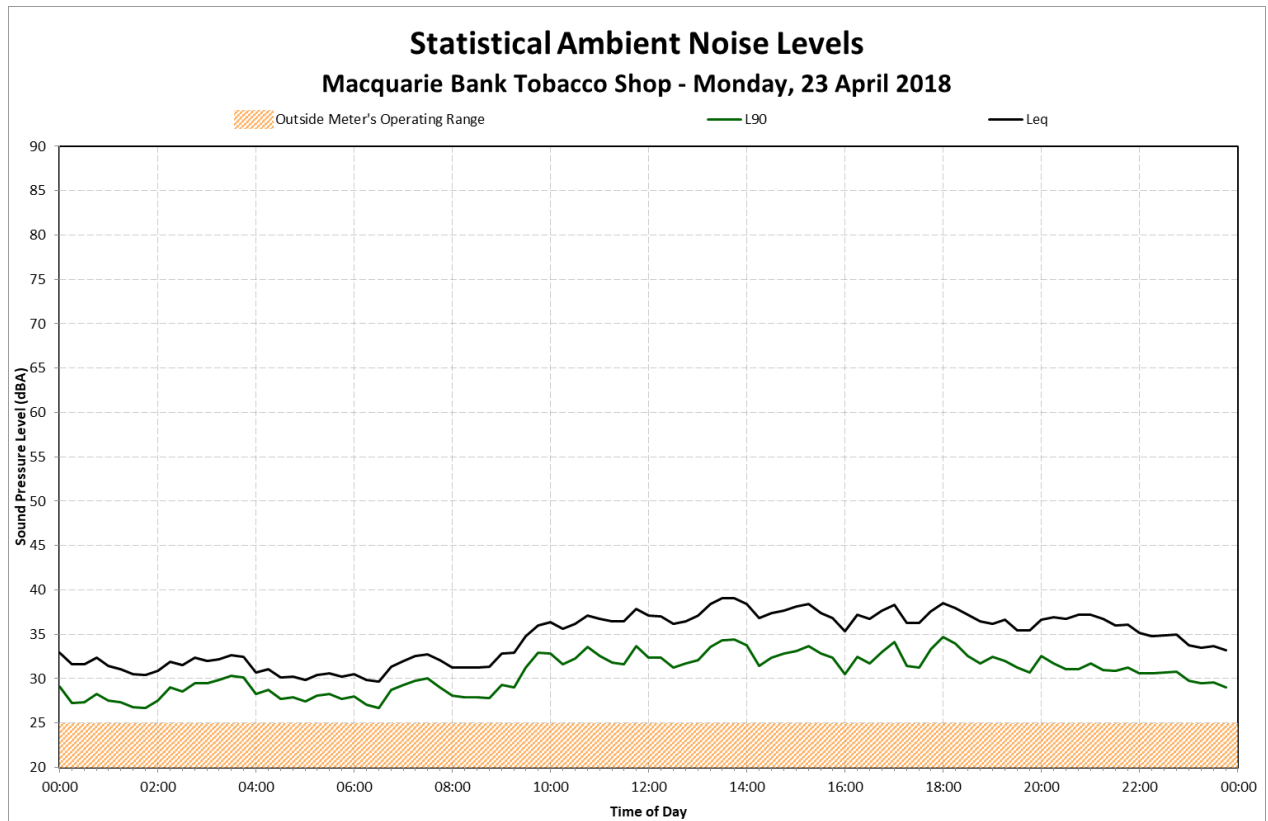
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

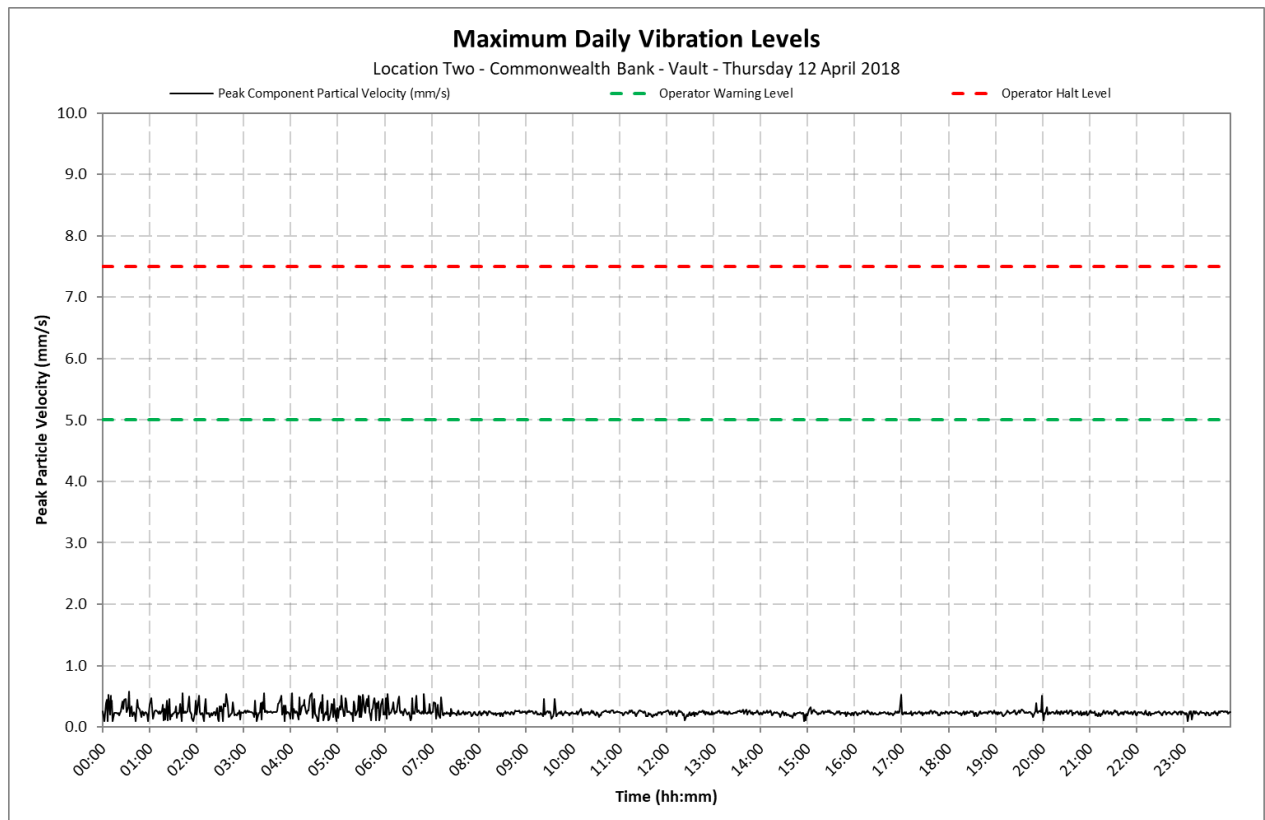
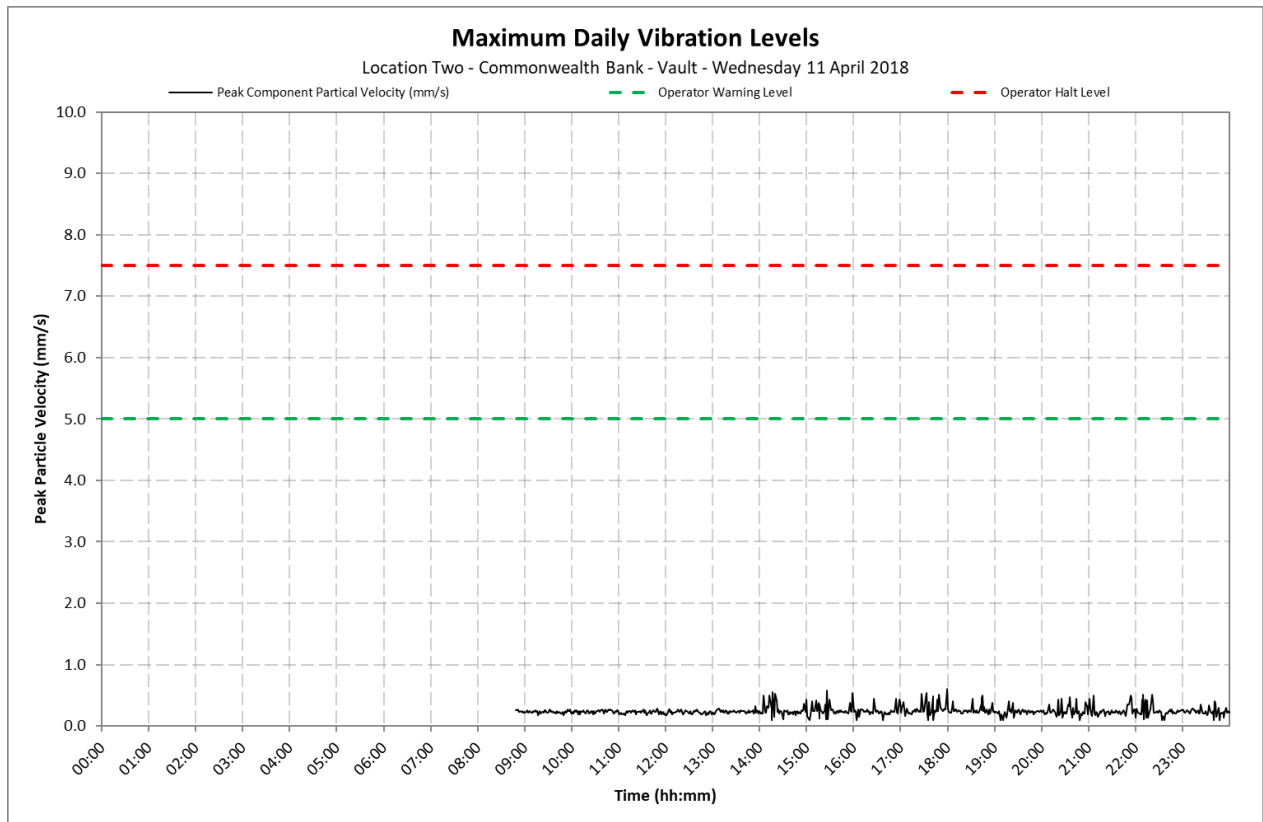
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

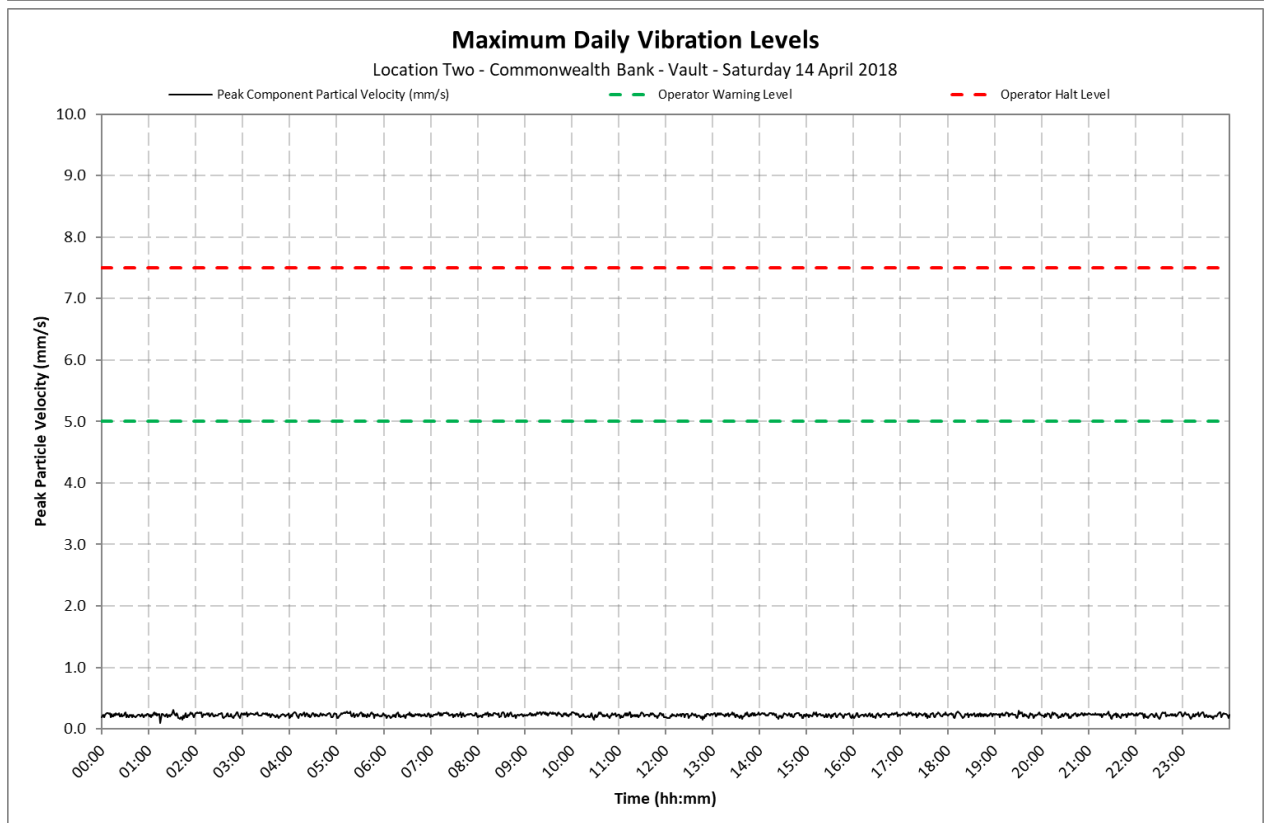
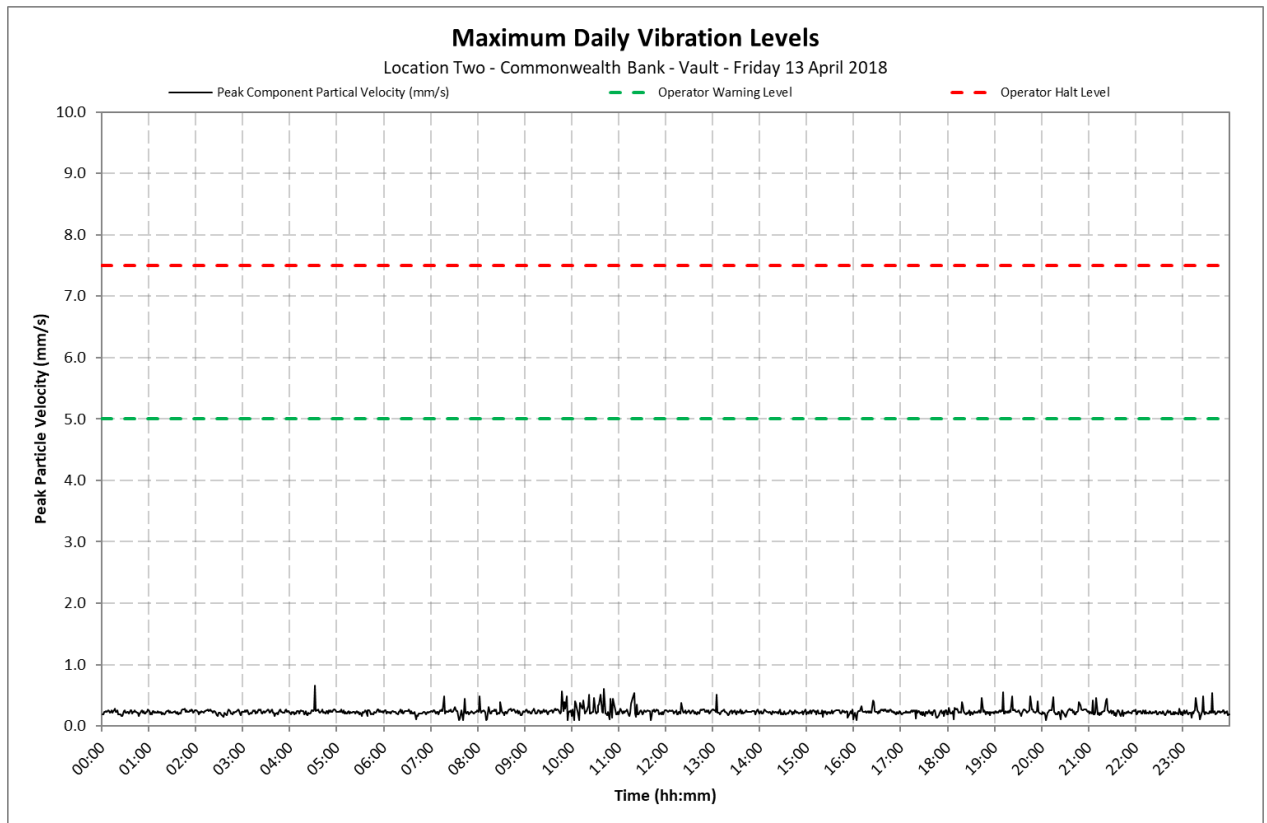
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

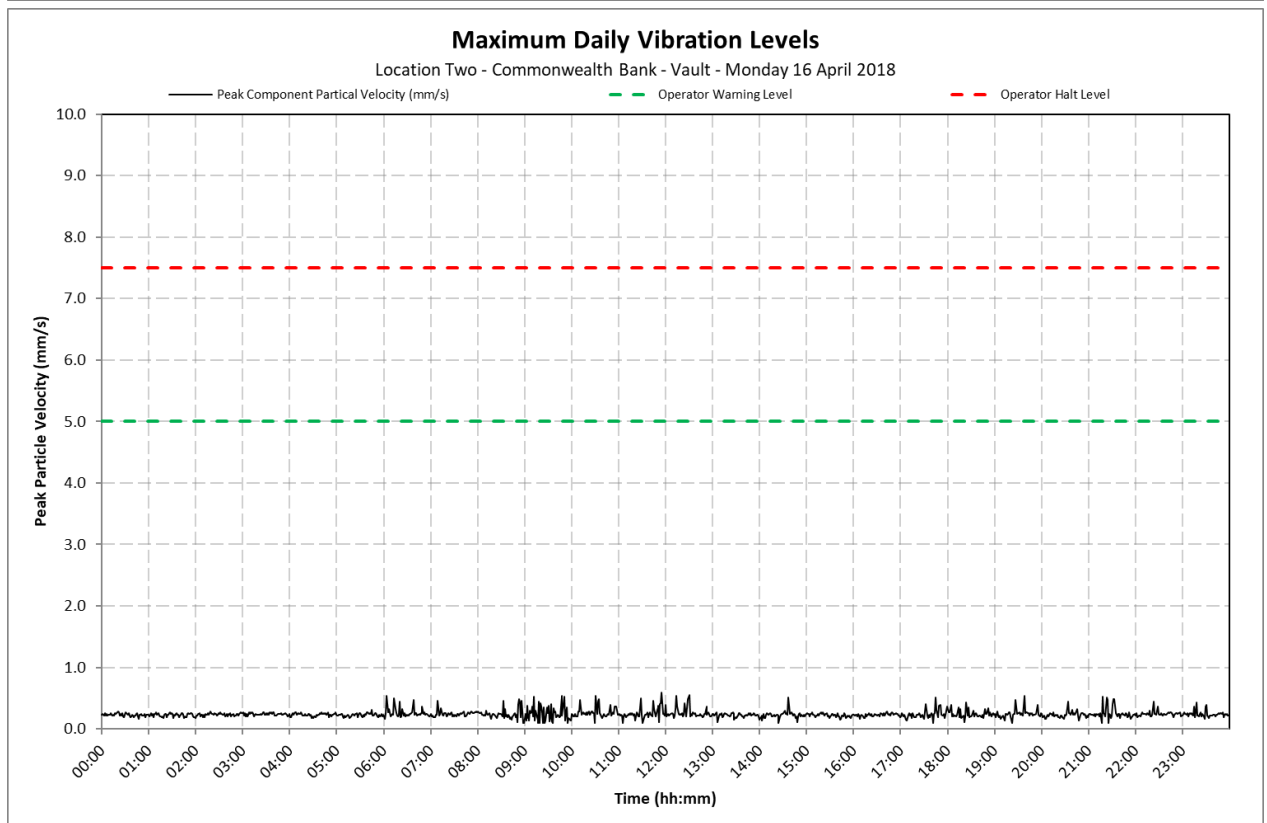
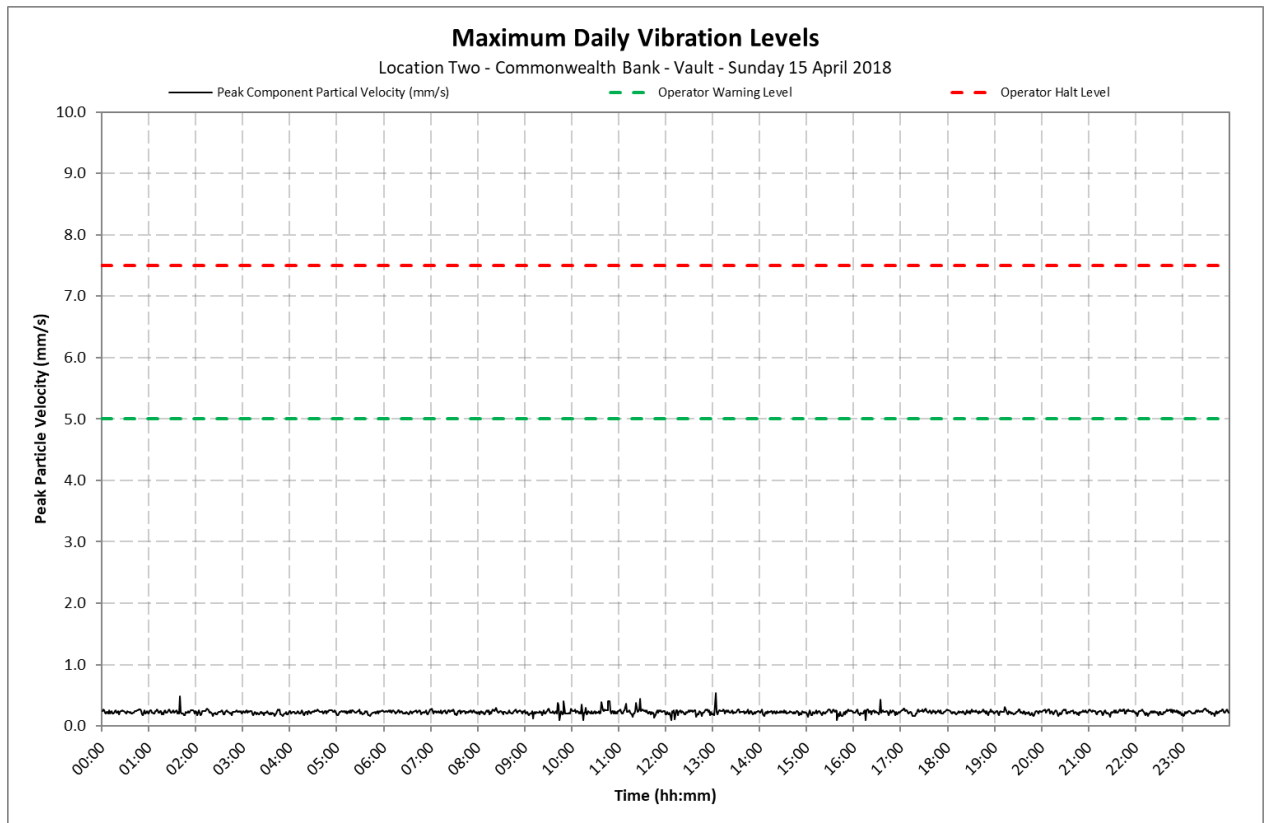
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

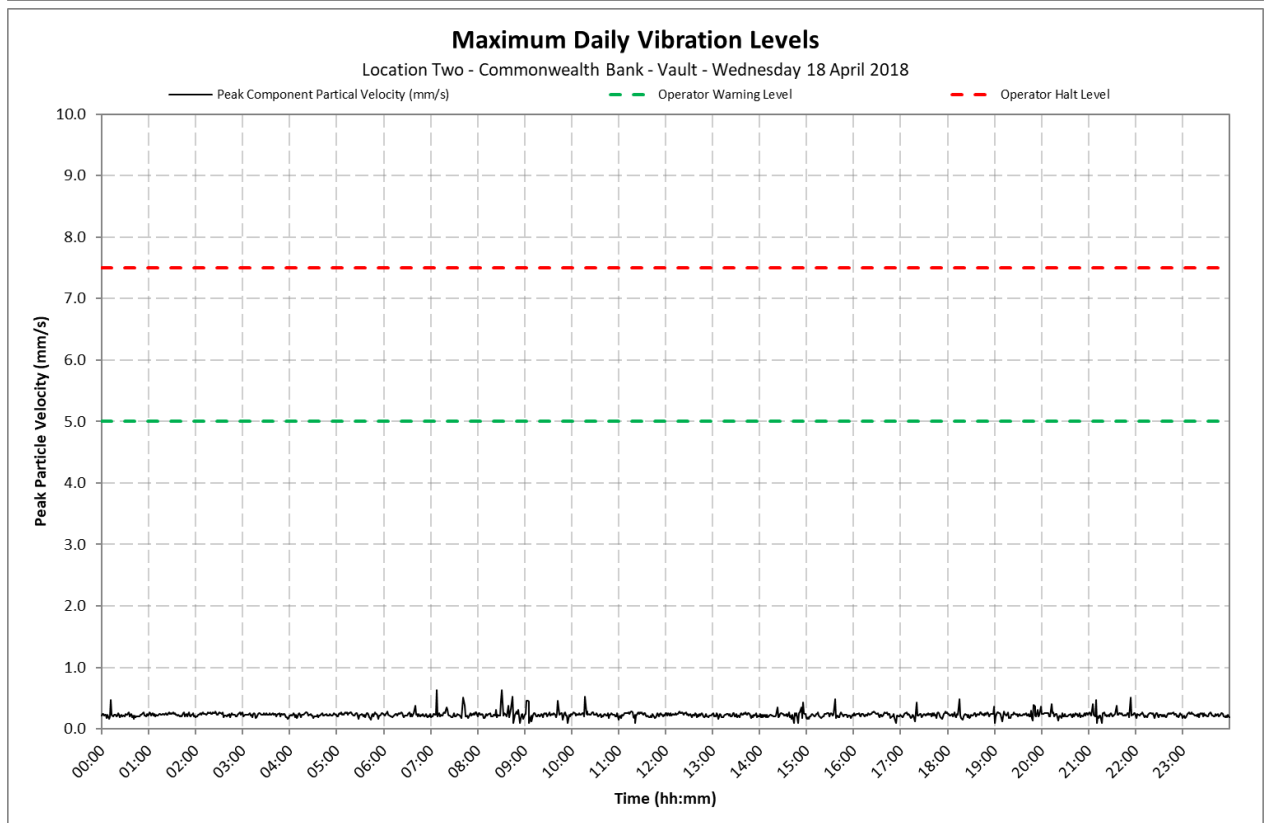
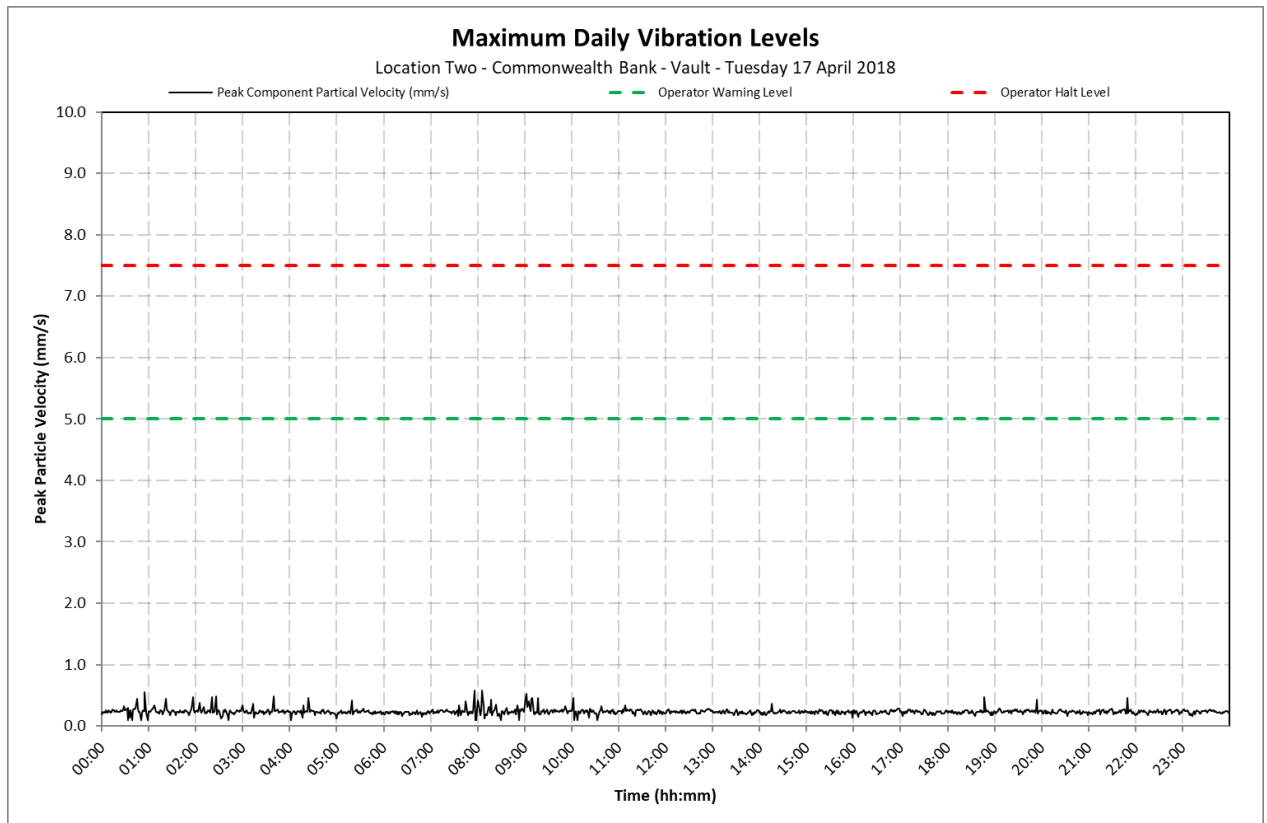
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

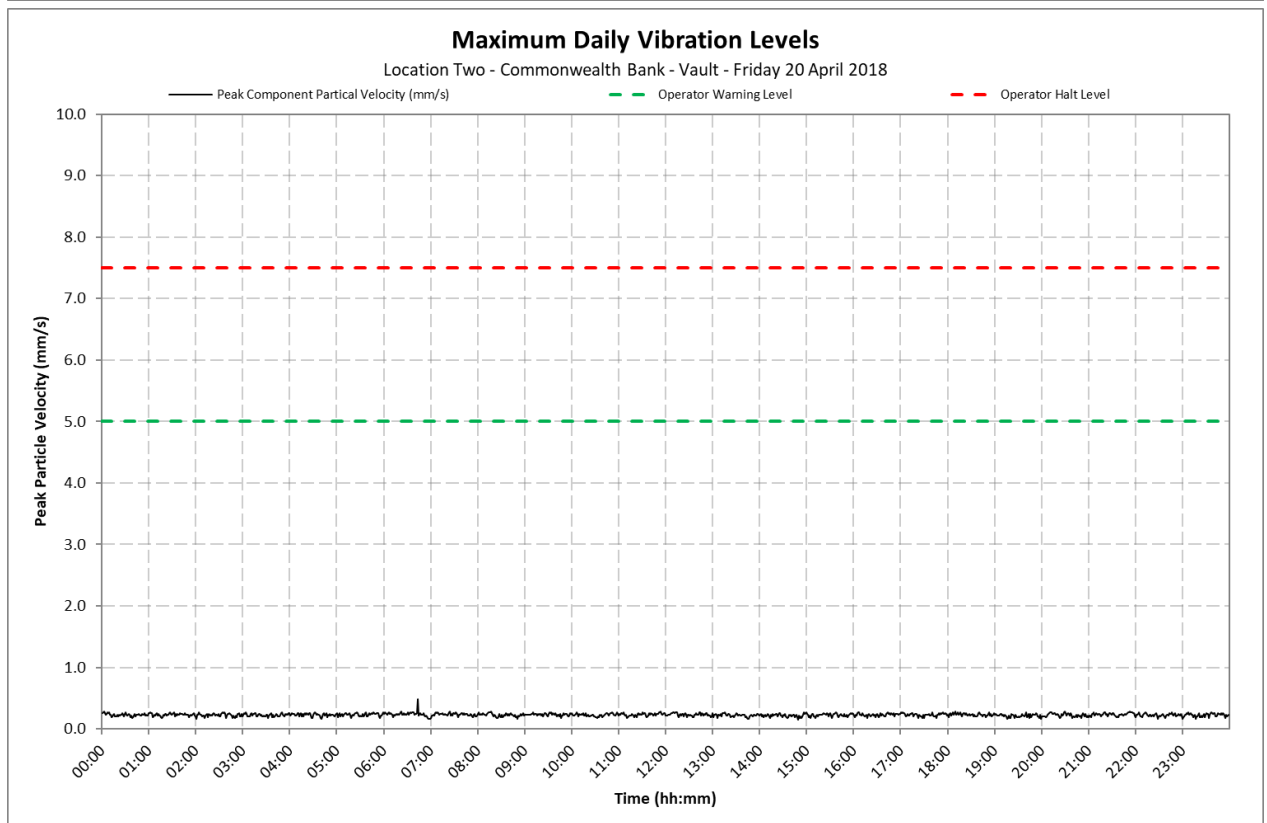
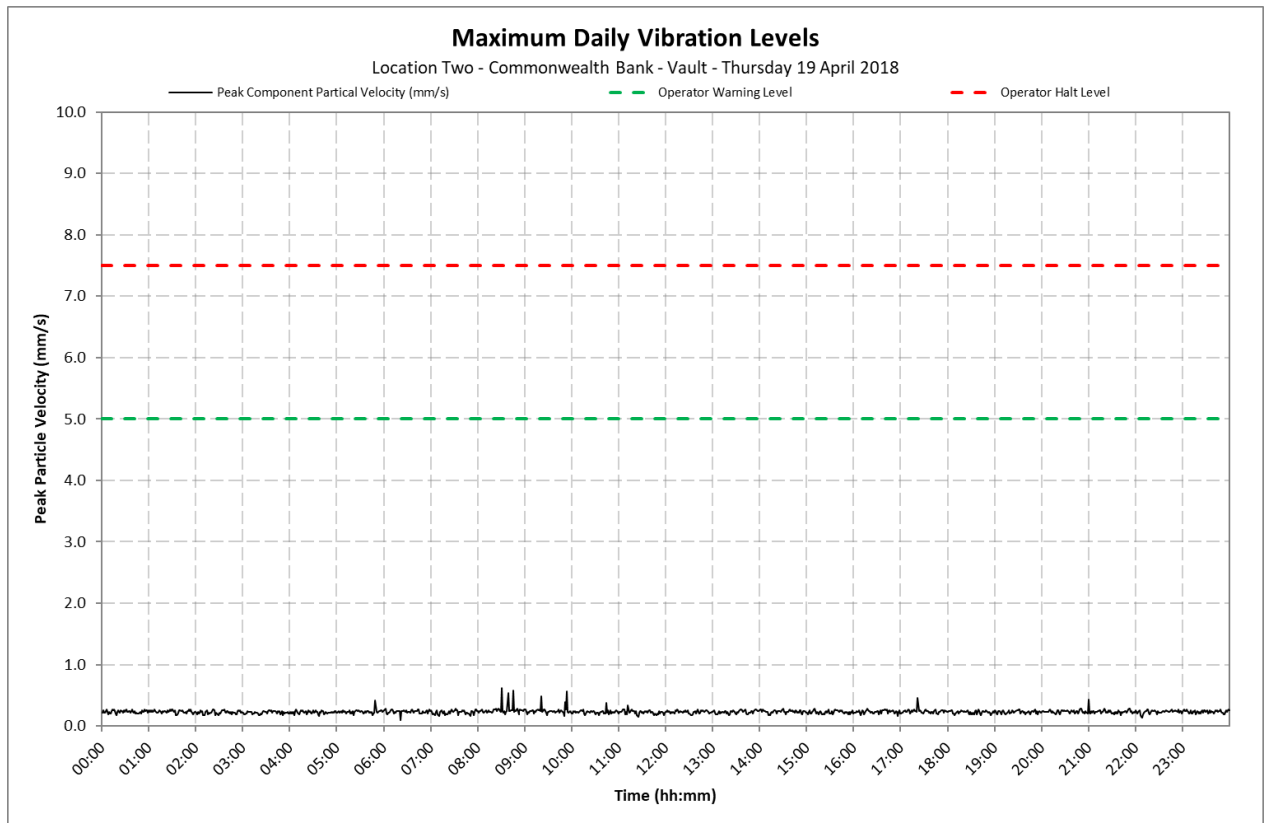
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

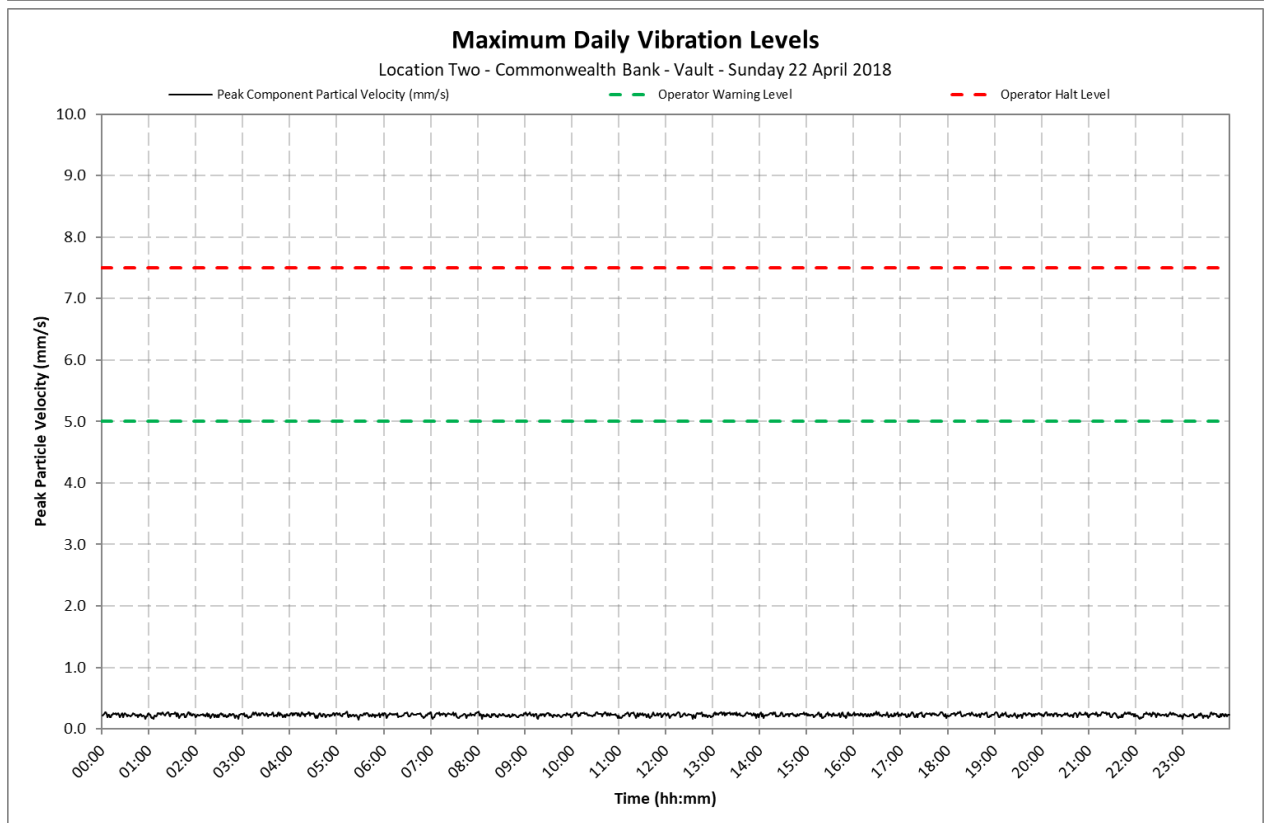
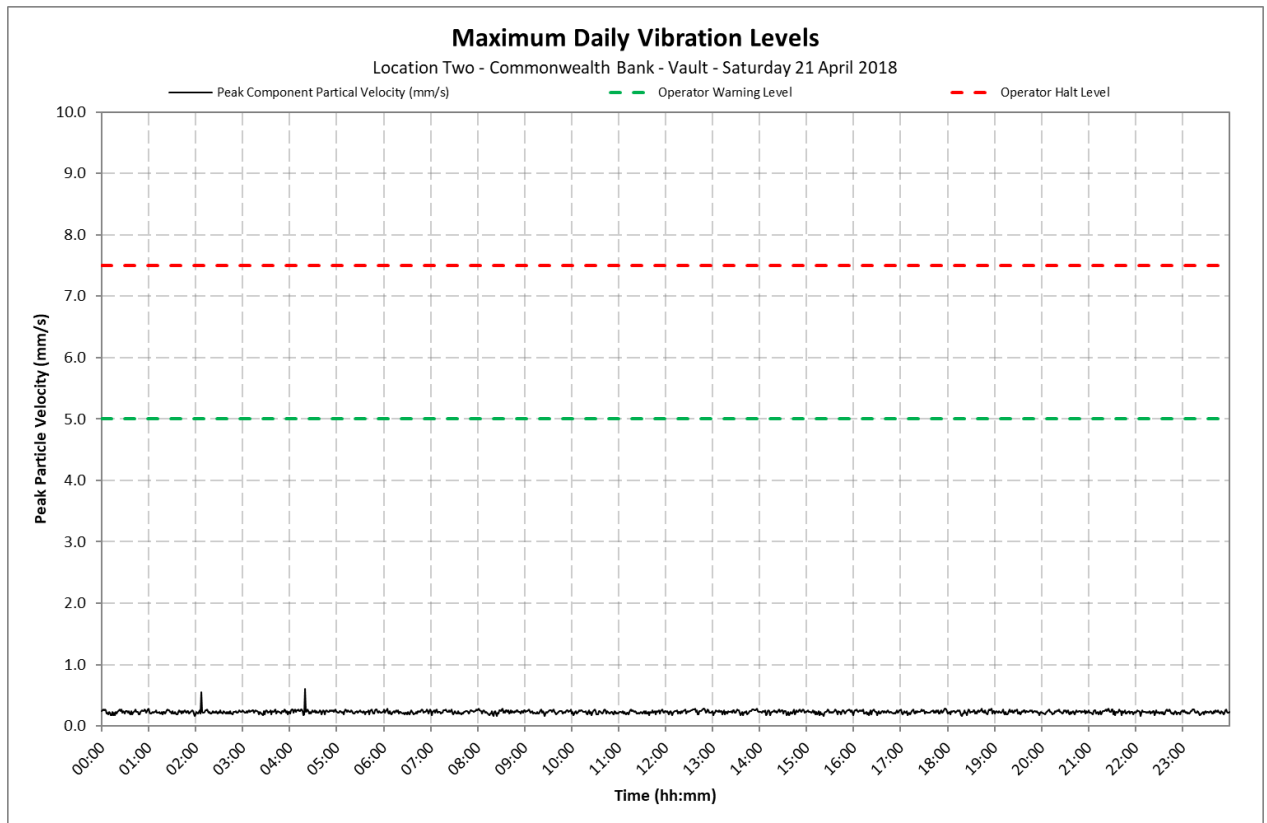
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

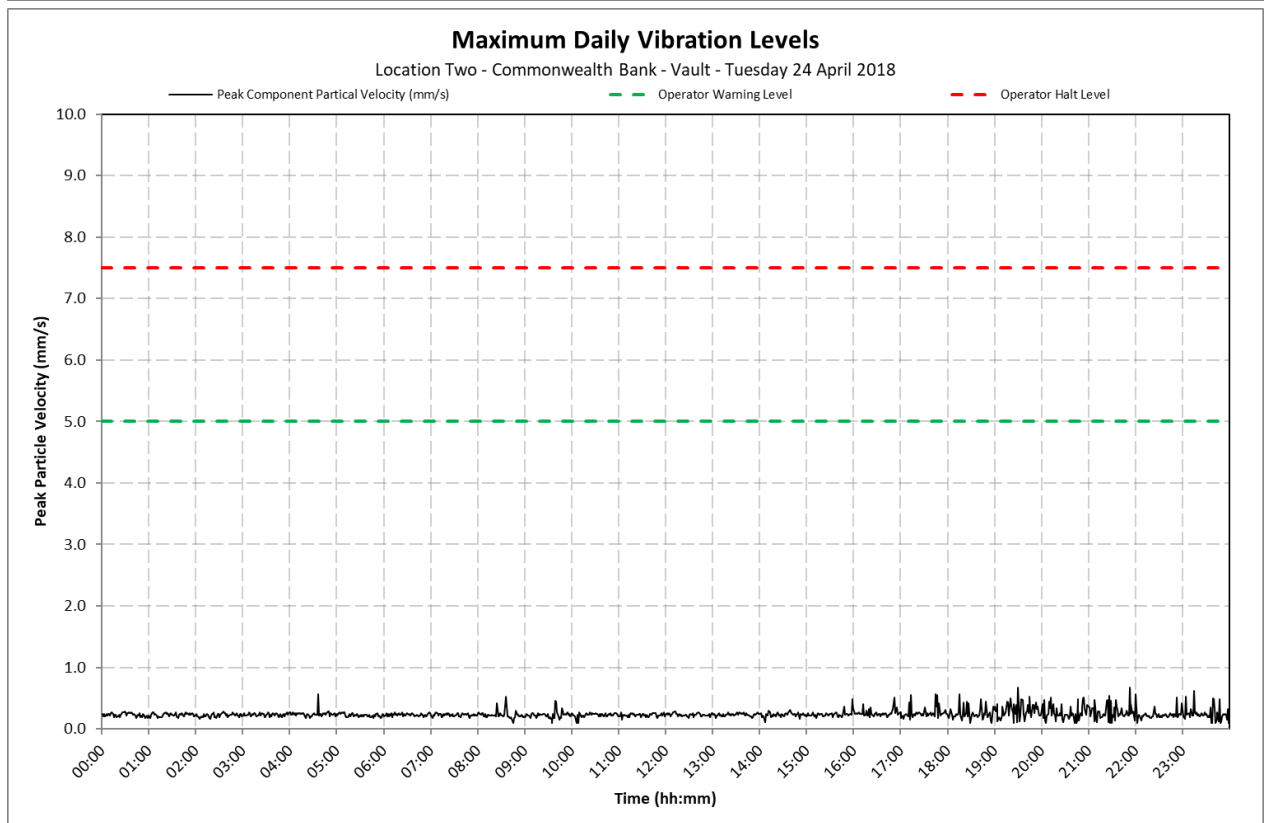
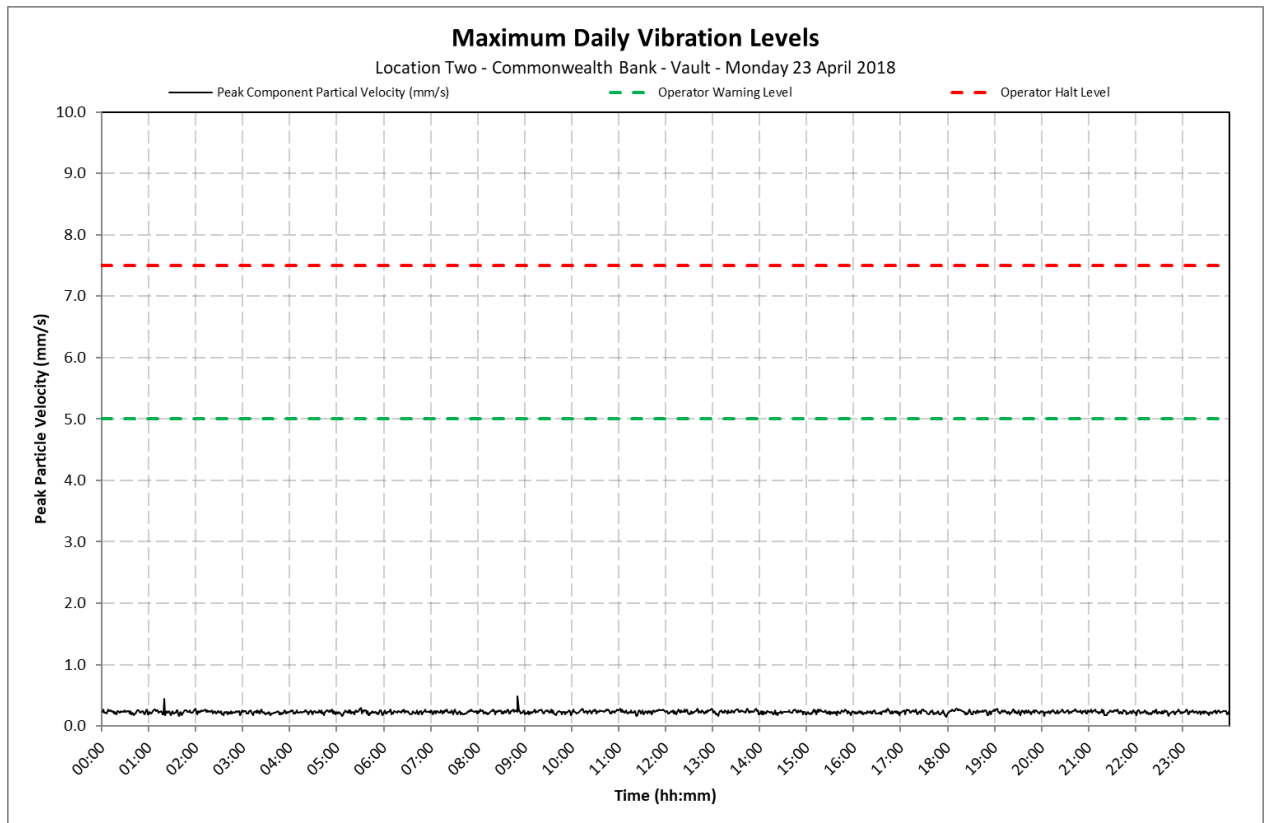
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

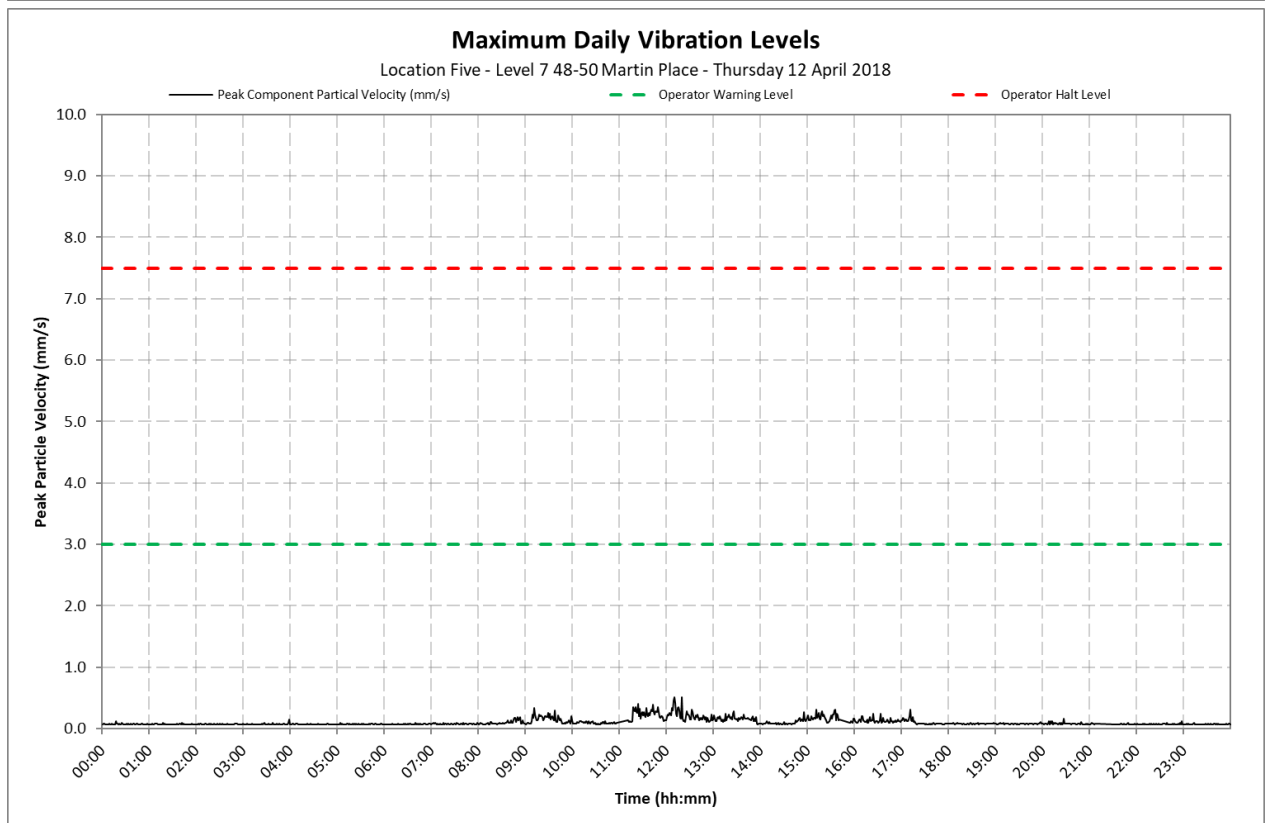
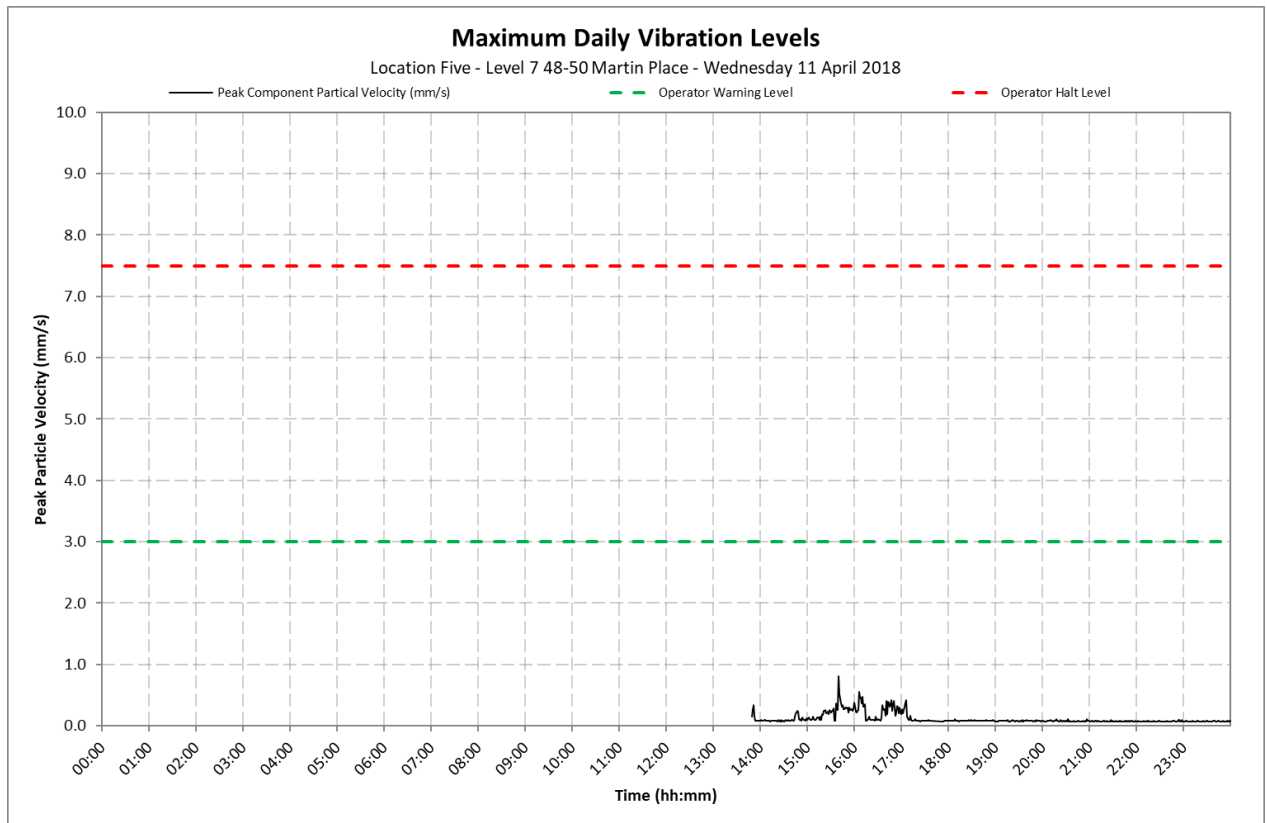
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

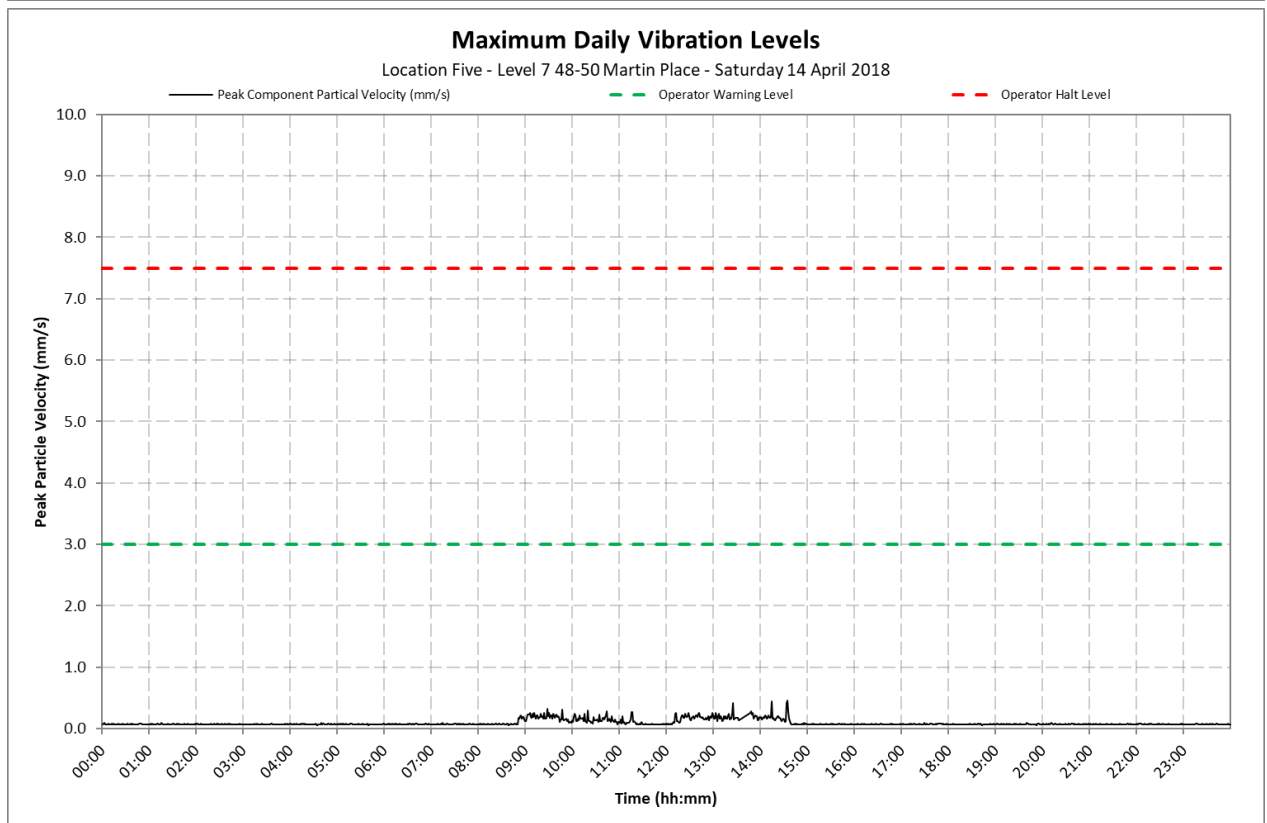
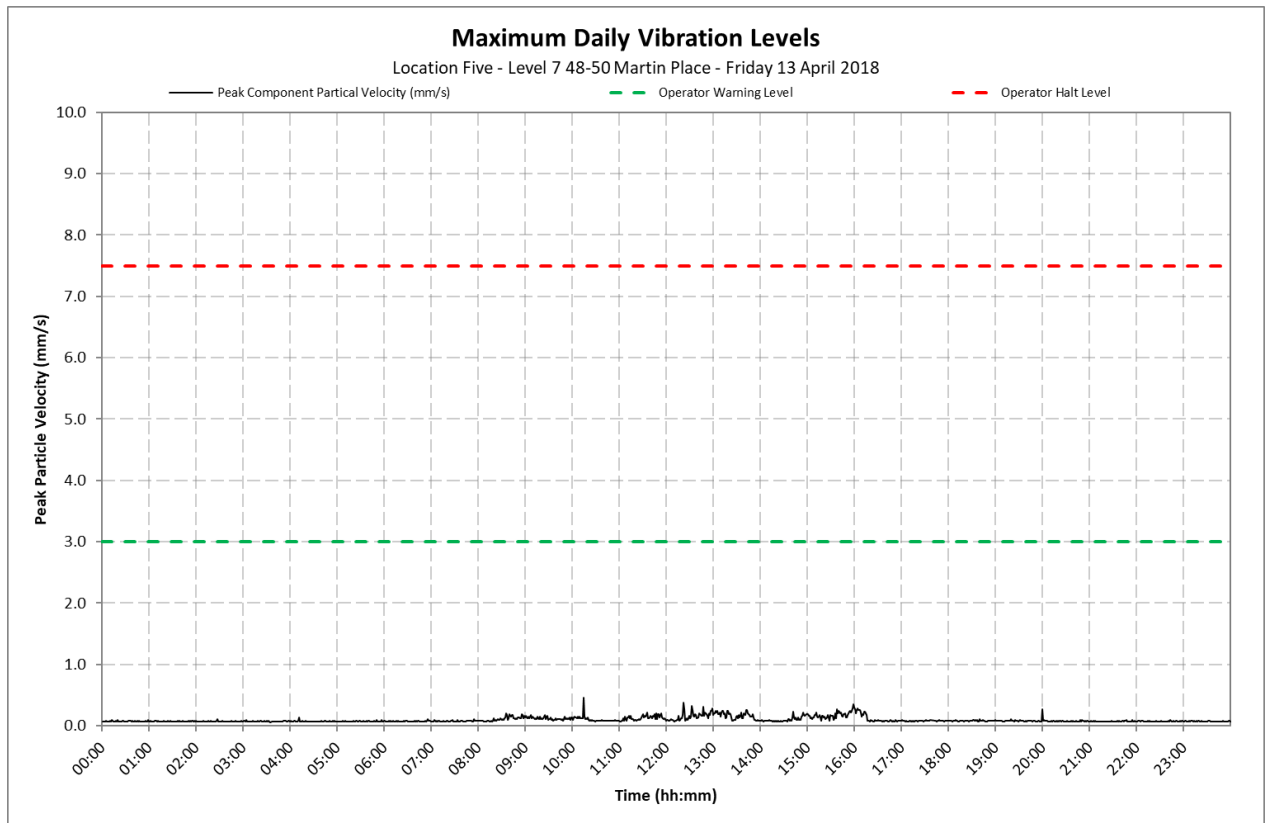
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

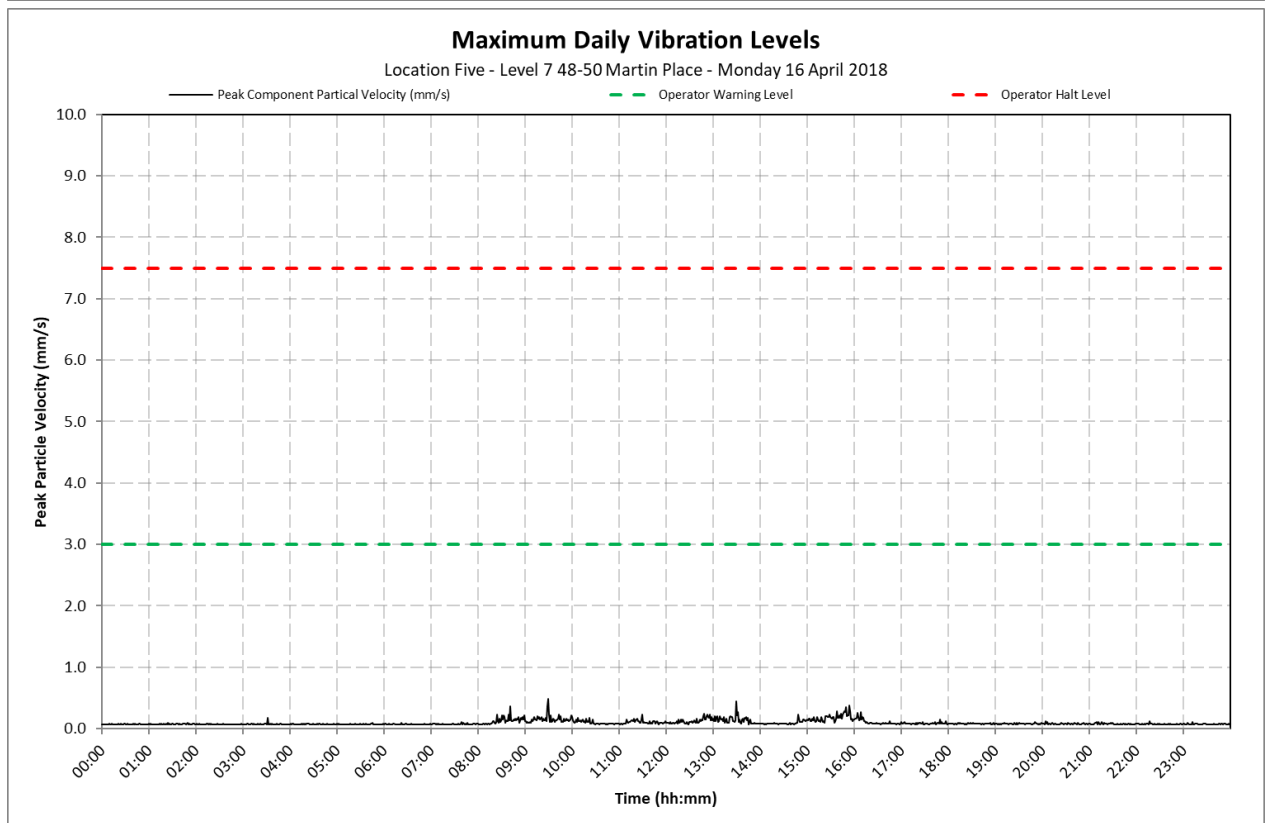
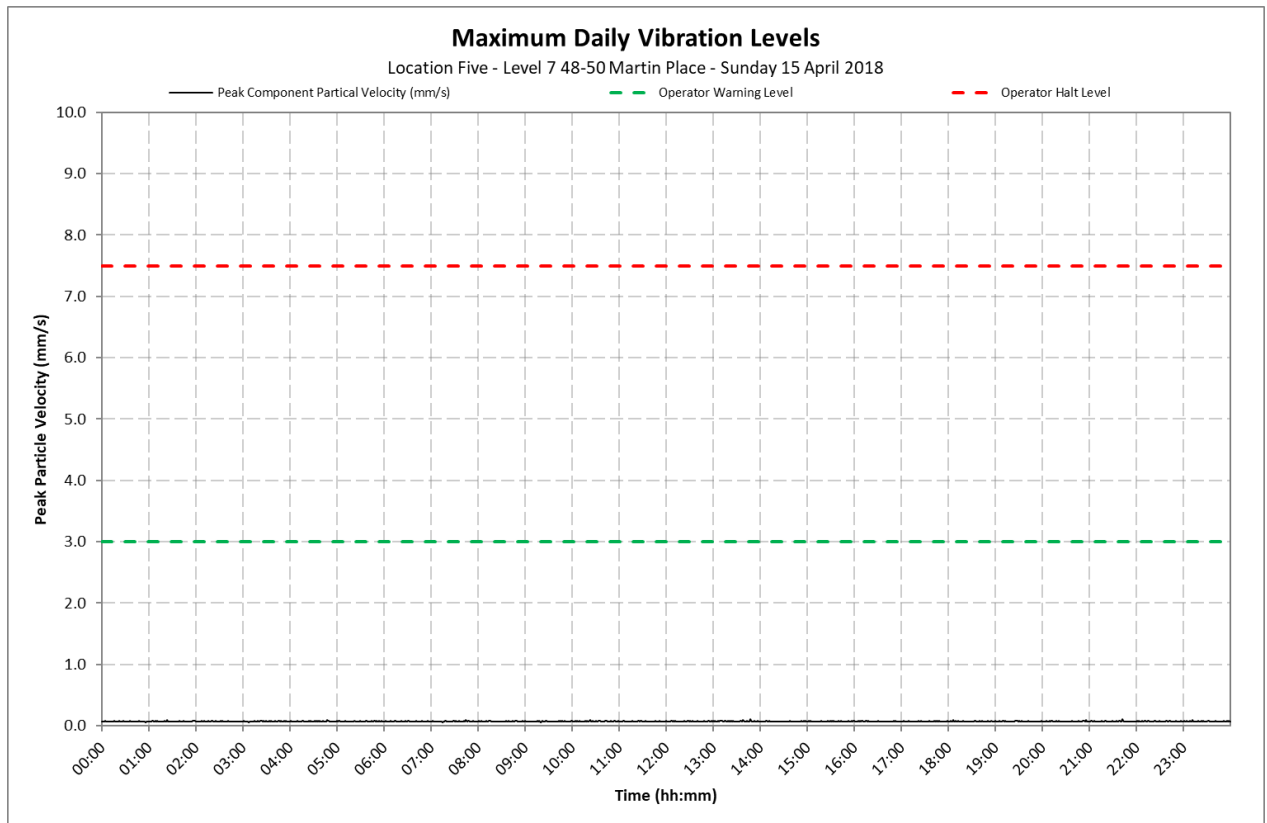
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

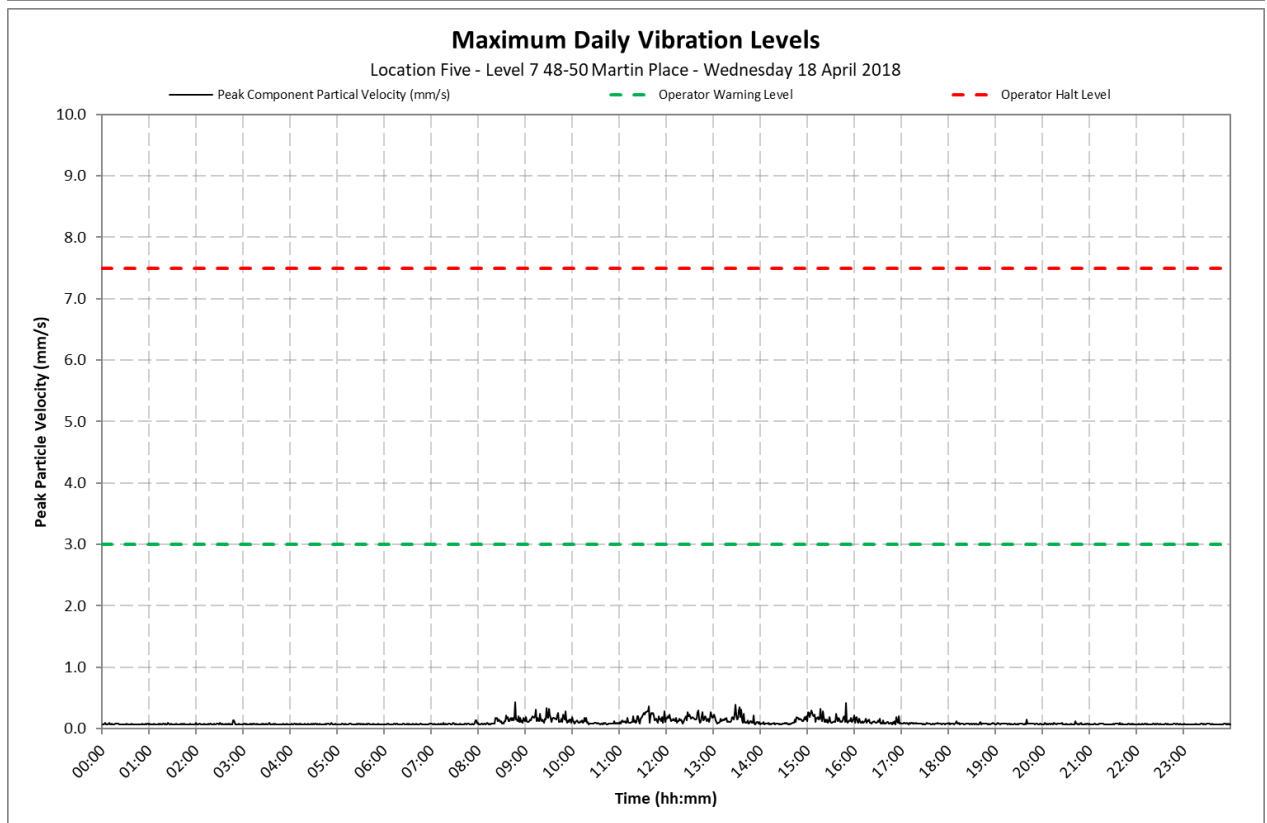
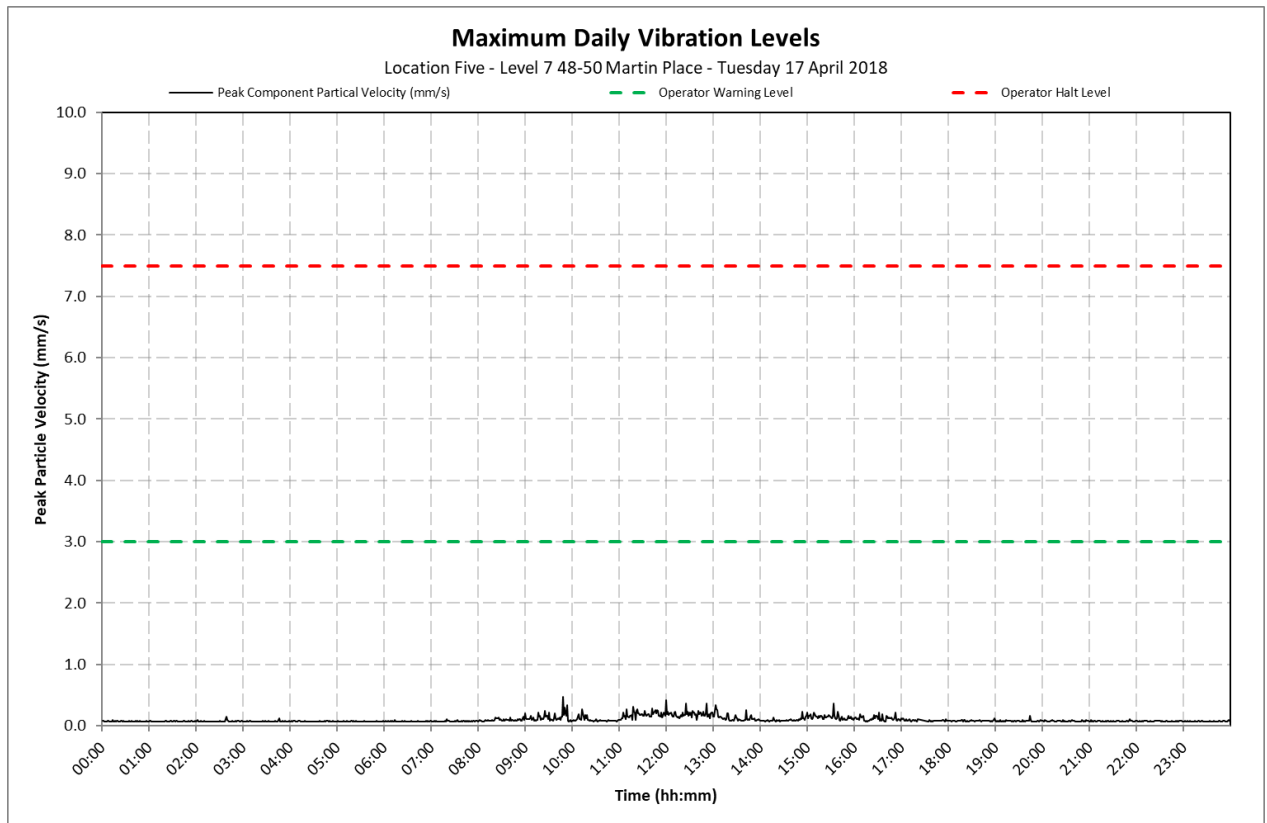
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

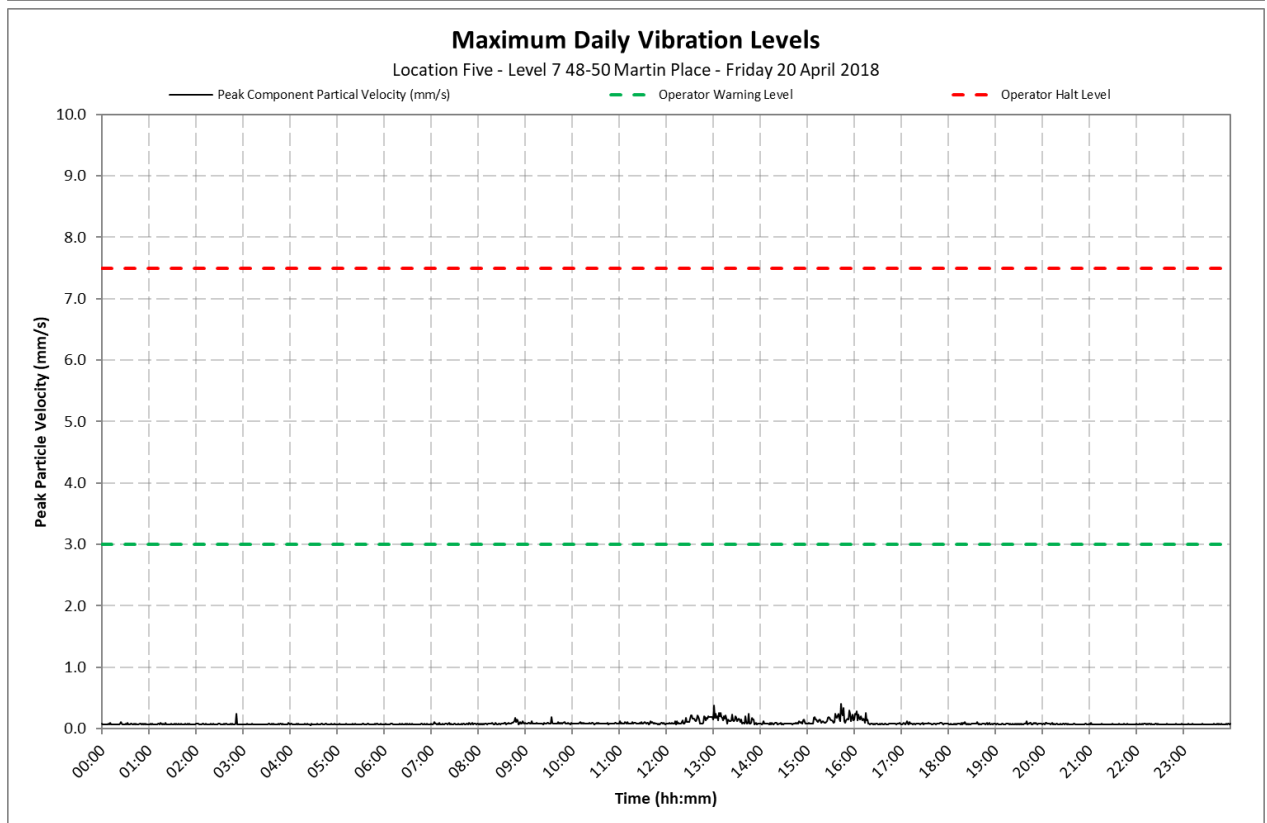
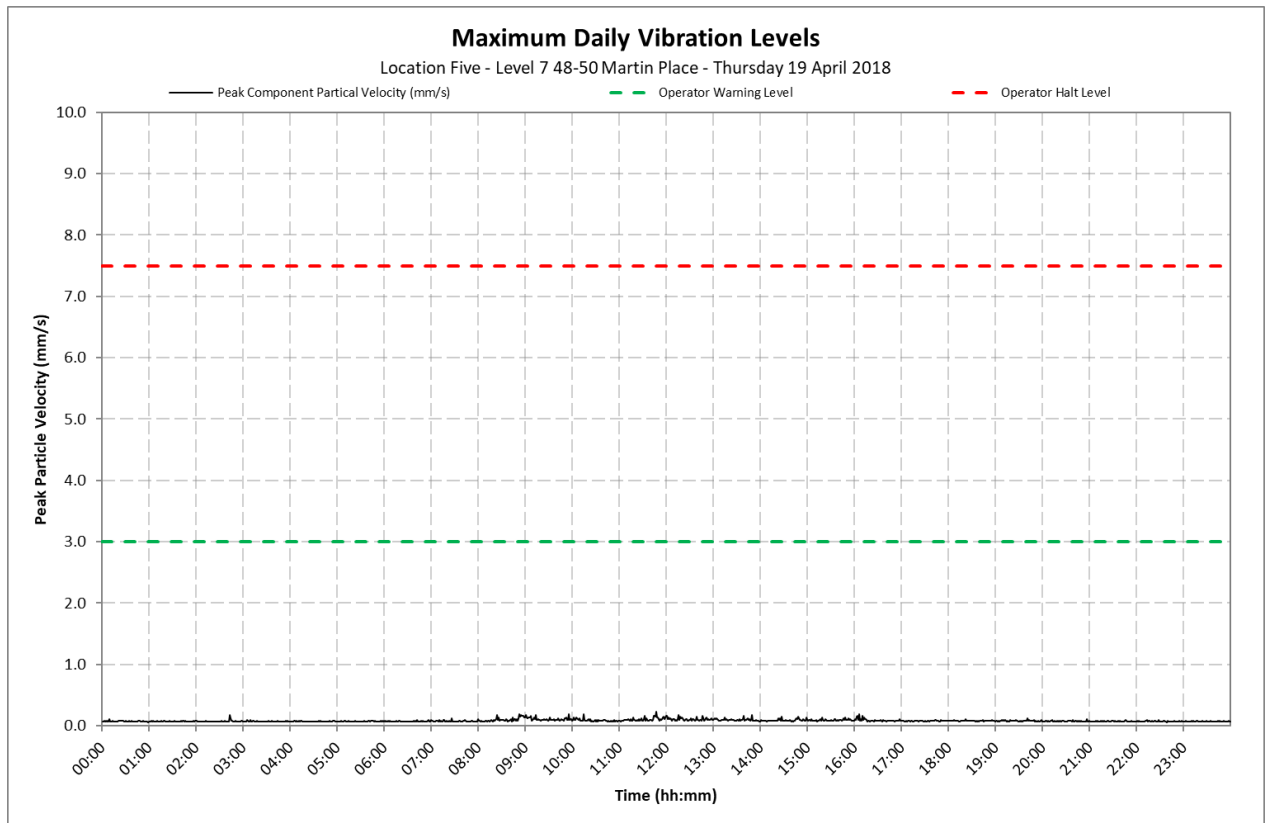
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

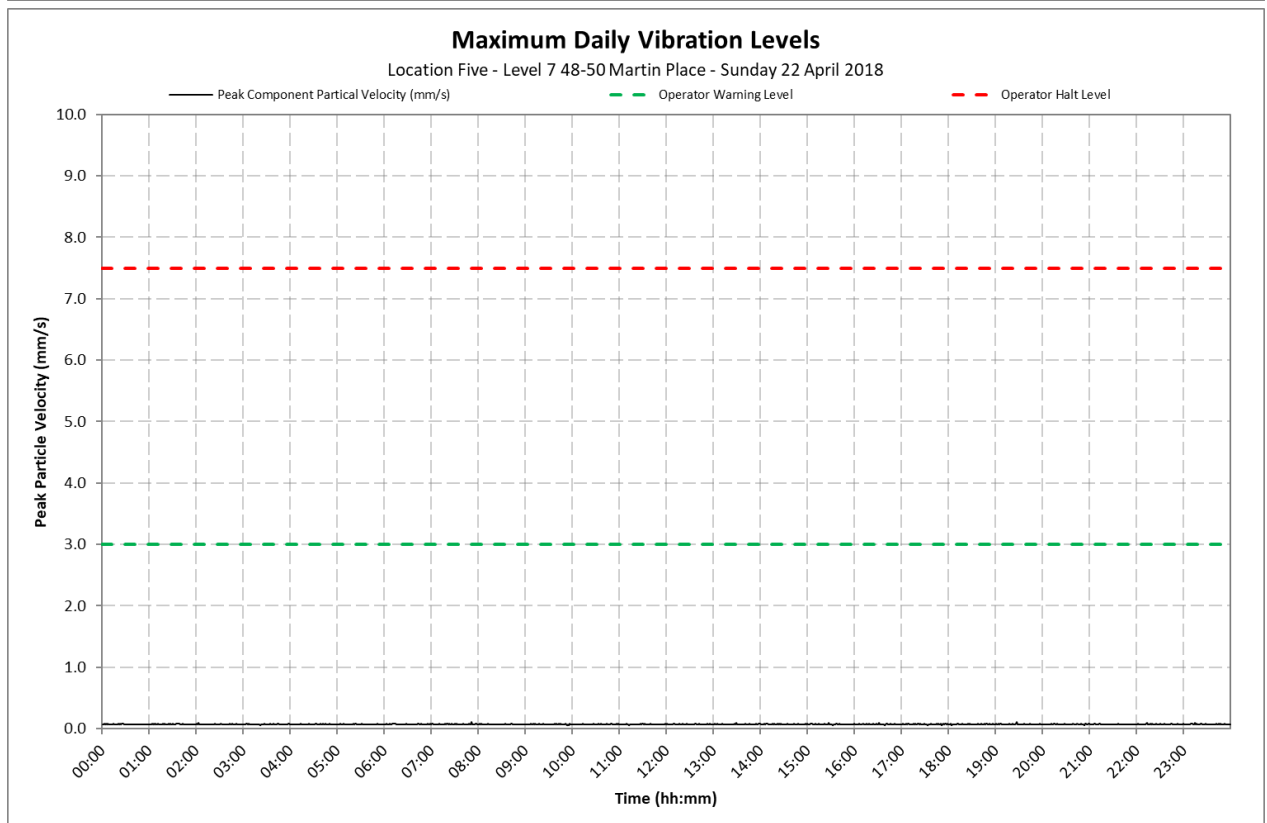
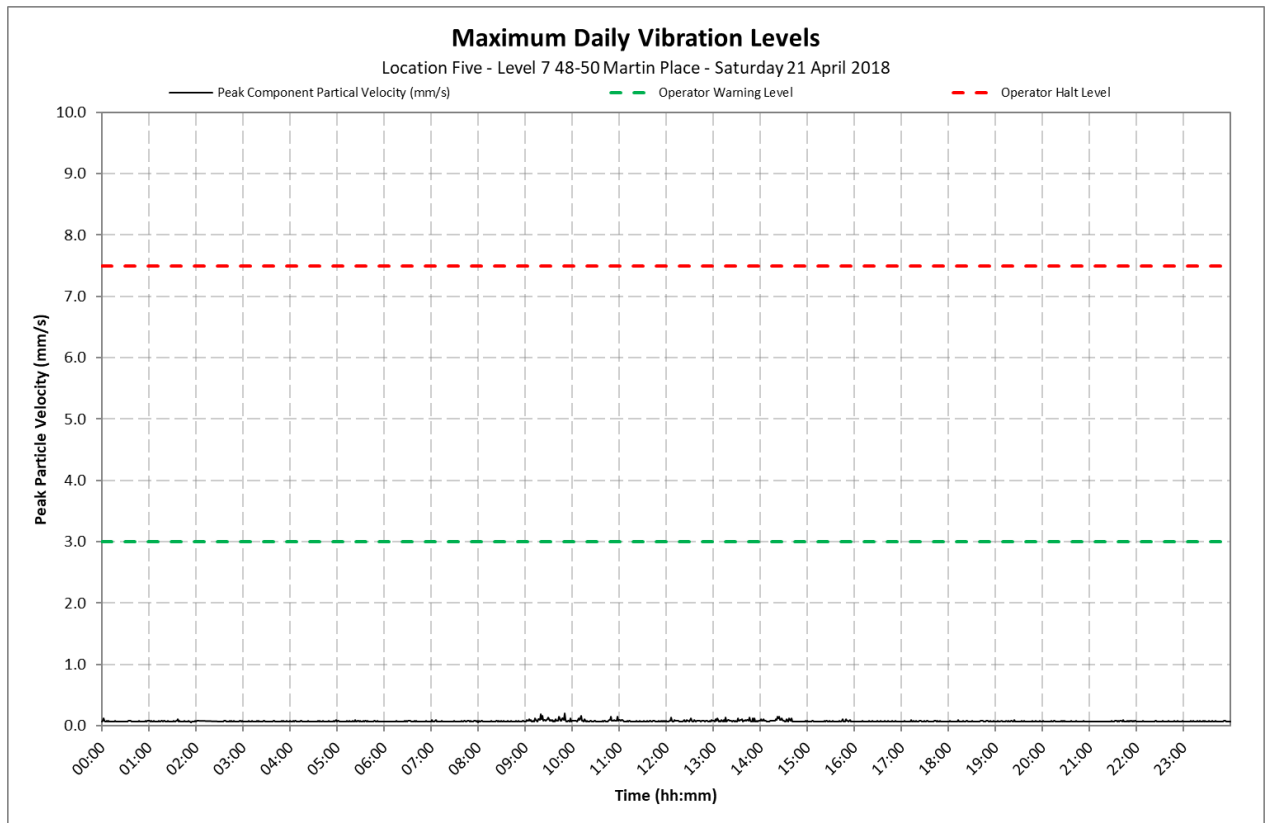
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

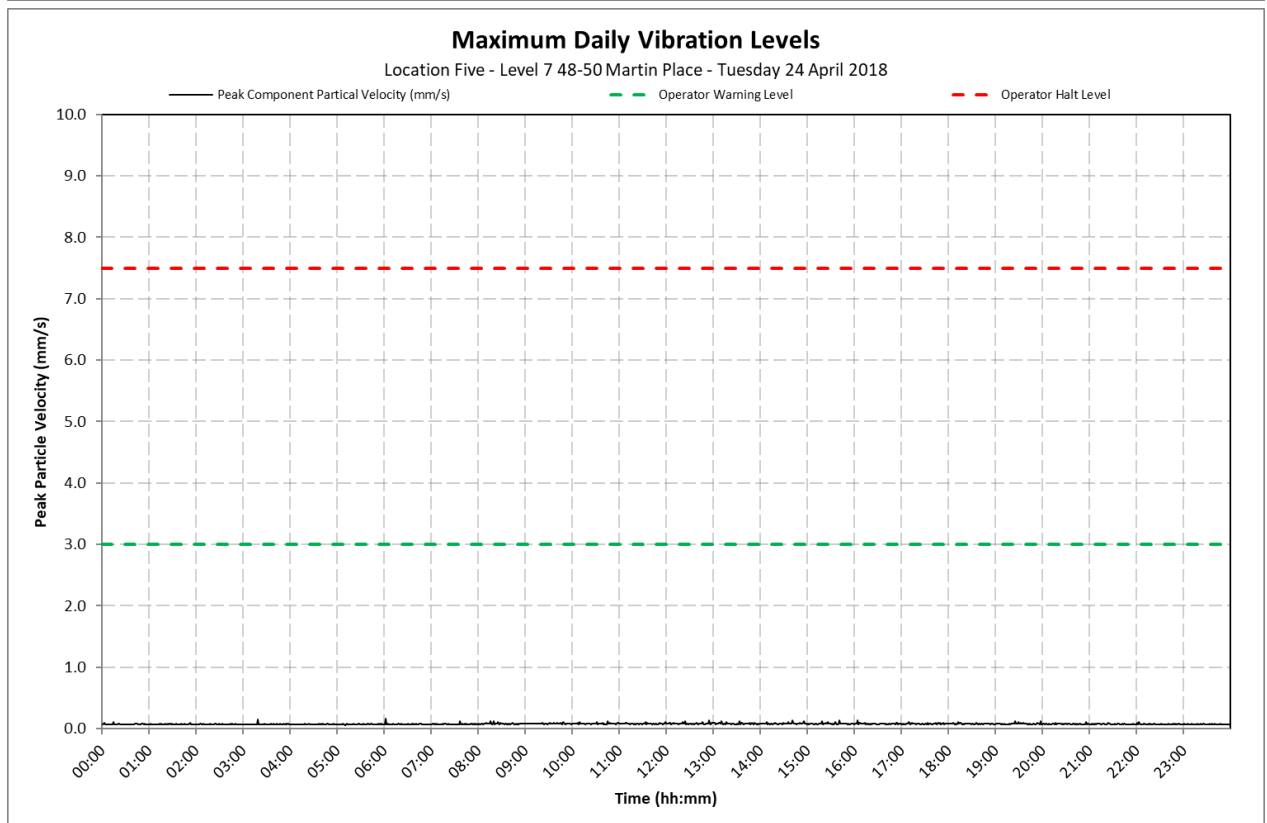
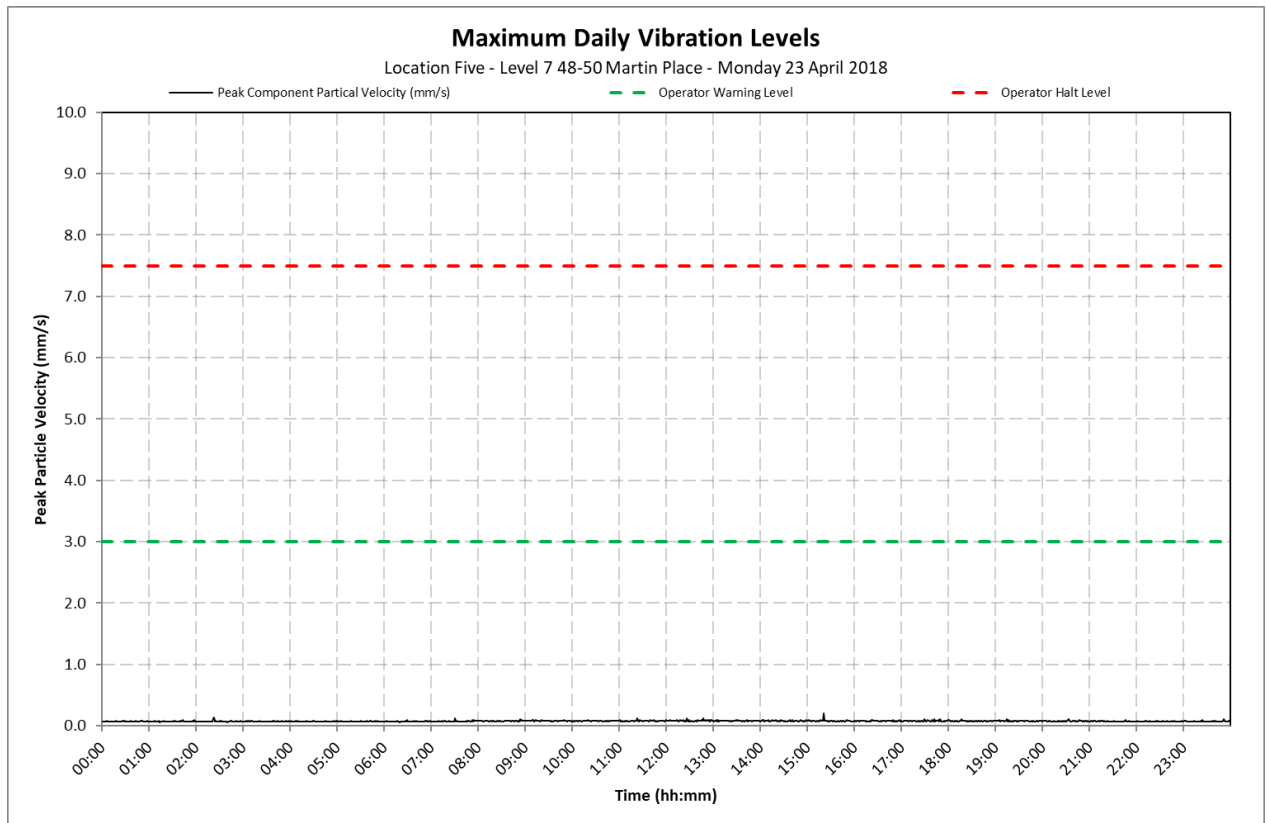
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



7 May 2018

10-1380 R27 NV Monitoring 20180507.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 27
25 April to 7 May 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 25 April to 7 May 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

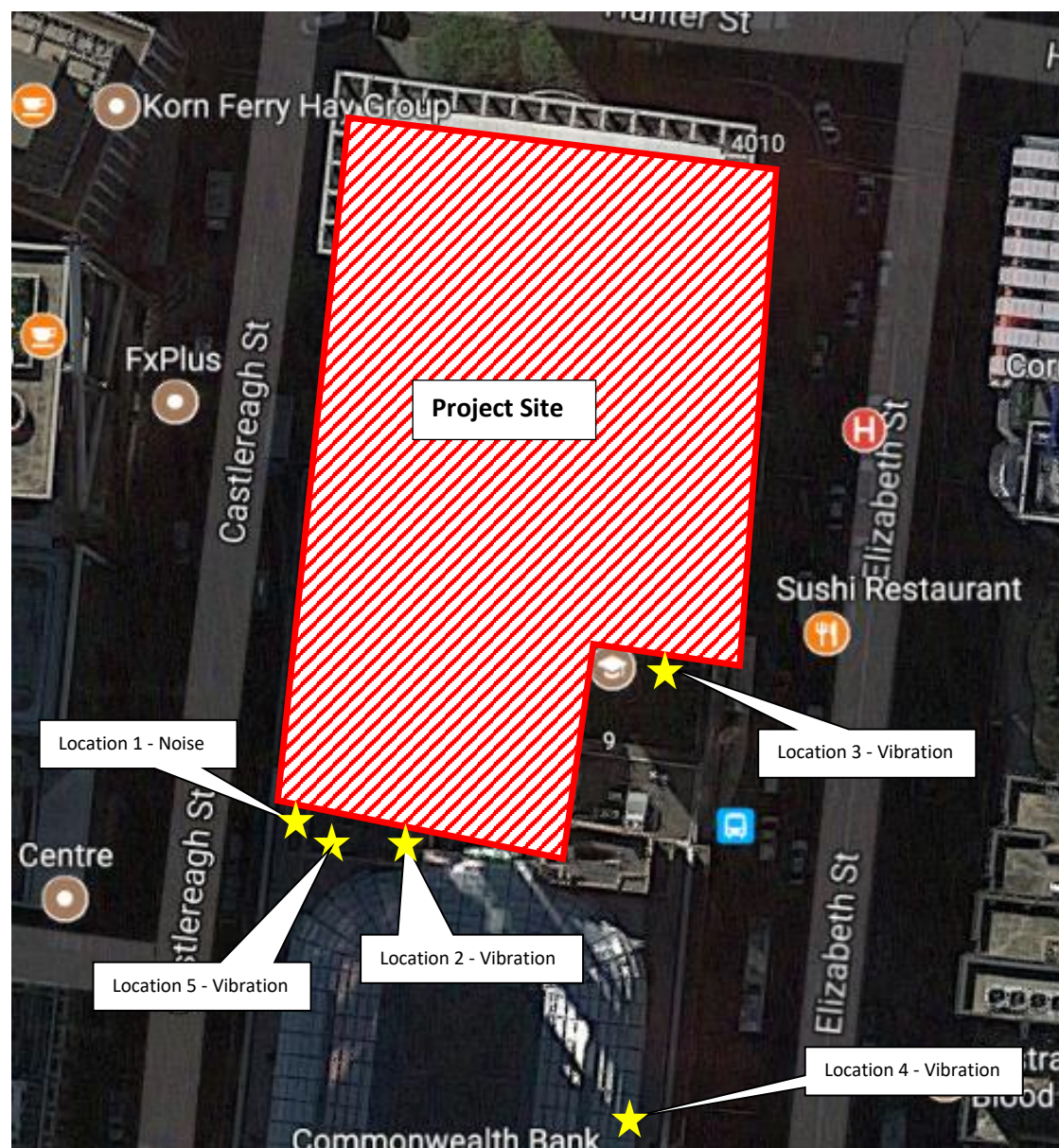
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 25 April to 7 May 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
25 April 2018	44	41	Complies	Complies
26 April 2018	46	43	Complies	Complies
27 April 2018	42	40	Complies	Complies
28 April 2018	41	39	Complies	Complies
29 April 2018	38	37	Complies	Complies
30 April 2018	39	37	Complies	Complies
1 May 2018	43	42	Complies	Complies
2 May 2018	46	45	Complies	Complies
3 May 2018	46	43	Complies	Complies
4 May 2018	40	40	Complies	Complies
5 May 2018	41	40	Complies	Complies
6 May 2018	39	37	Complies	Complies
7 May 2018	39	37	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 25 April to 7 May 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
25 April 2018	0.7 mm/s	Complies
26 April 2018	0.6 mm/s	Complies
27 April 2018	0.6 mm/s	Complies
28 April 2018	0.6 mm/s	Complies
29 April 2018	1.5 mm/s	Complies
30 April 2018	0.6 mm/s	Complies
1 May 2018	0.6 mm/s	Complies
2 May 2018	0.6 mm/s	Complies
3 May 2018	0.7 mm/s	Complies
4 May 2018	0.6 mm/s	Complies
5 May 2018	0.6 mm/s	Complies
6 May 2018	0.6 mm/s	Complies
7 May 2018	1.9 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
25 April 2018	0.3 mm/s	Complies
26 April 2018	0.9 mm/s	Complies
27 April 2018	0.7 mm/s	Complies
28 April 2018	0.6 mm/s	Complies
29 April 2018	0.1 mm/s	Complies
30 April 2018	0.6 mm/s	Complies
1 May 2018	0.4 mm/s	Complies
2 May 2018	0.6 mm/s	Complies
3 May 2018	0.3 mm/s	Complies
4 May 2018	0.6 mm/s	Complies
5 May 2018	0.5 mm/s	Complies
6 May 2018	0.1 mm/s	Complies
7 May 2018	0.4 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 25 April to 7 May 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 25 April to 7 May 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

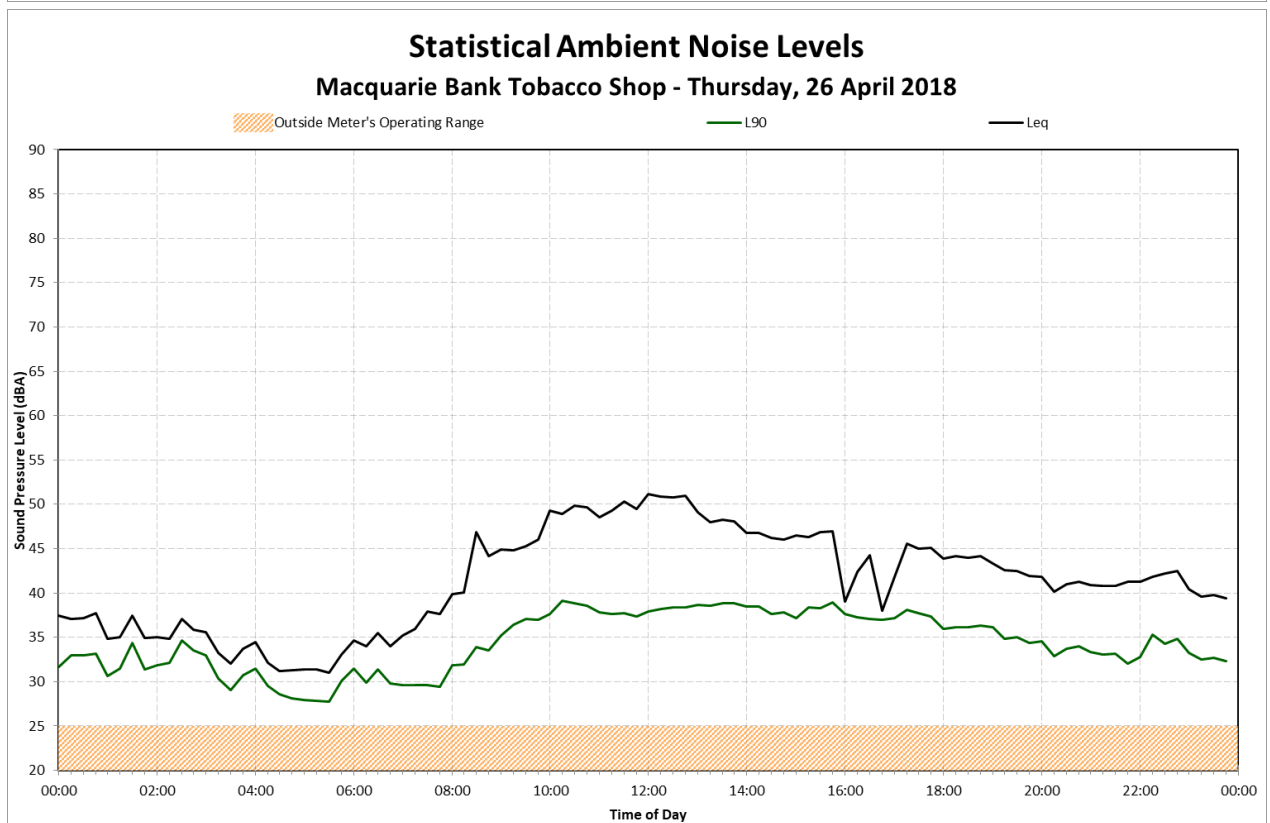
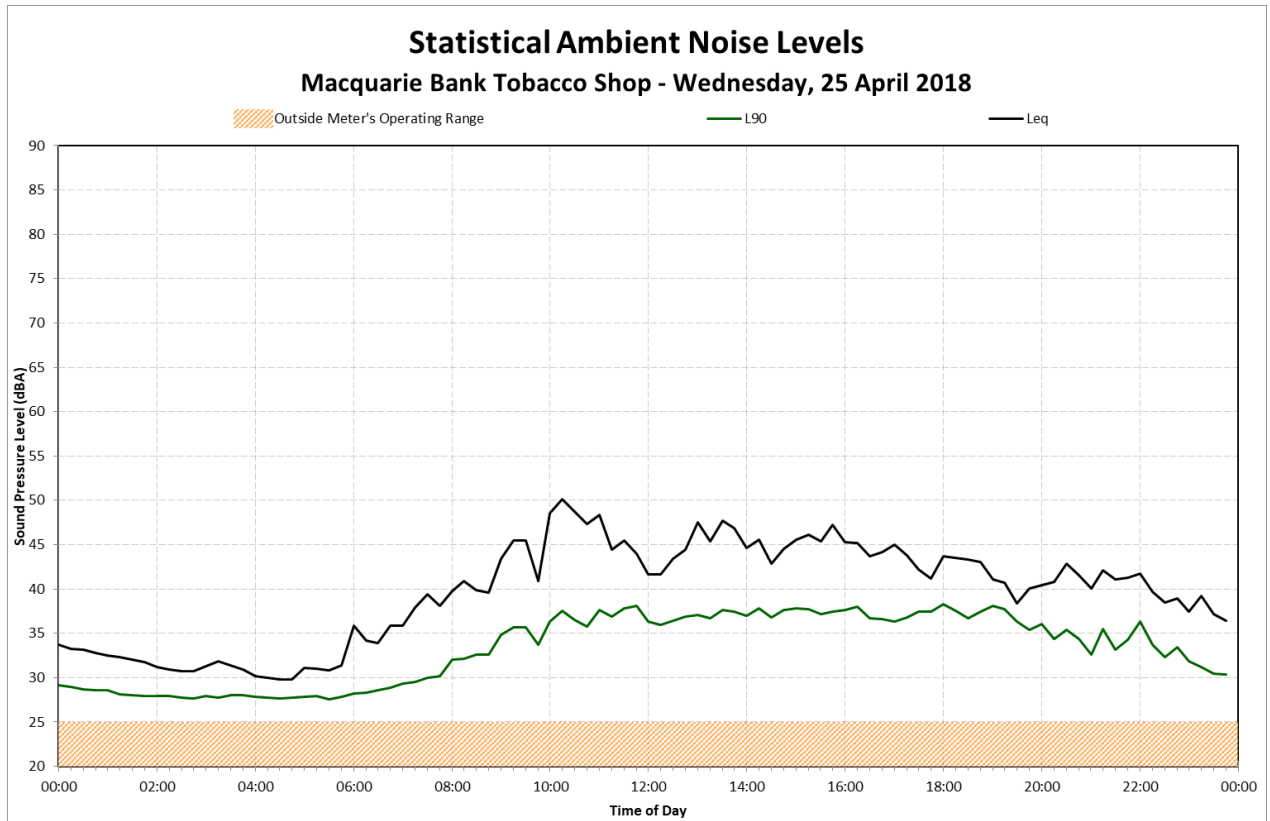
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

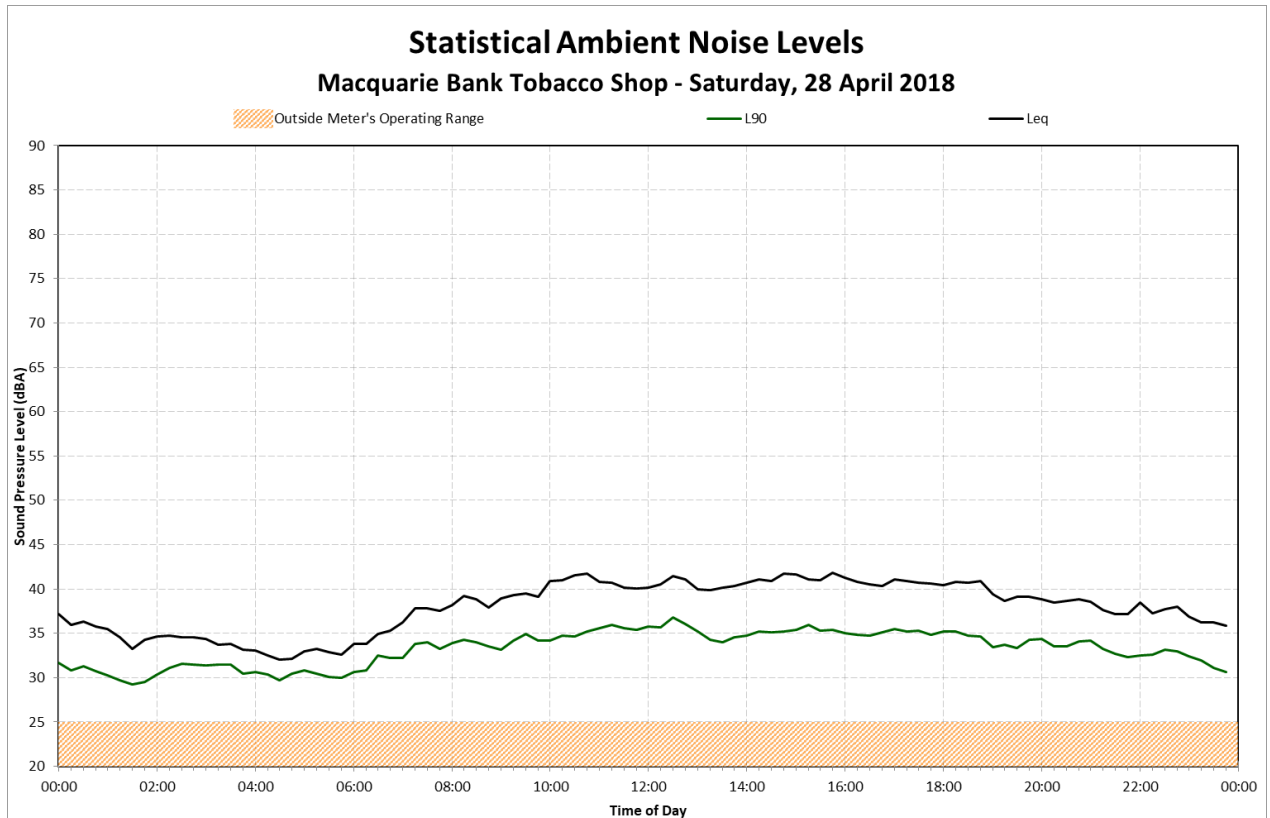
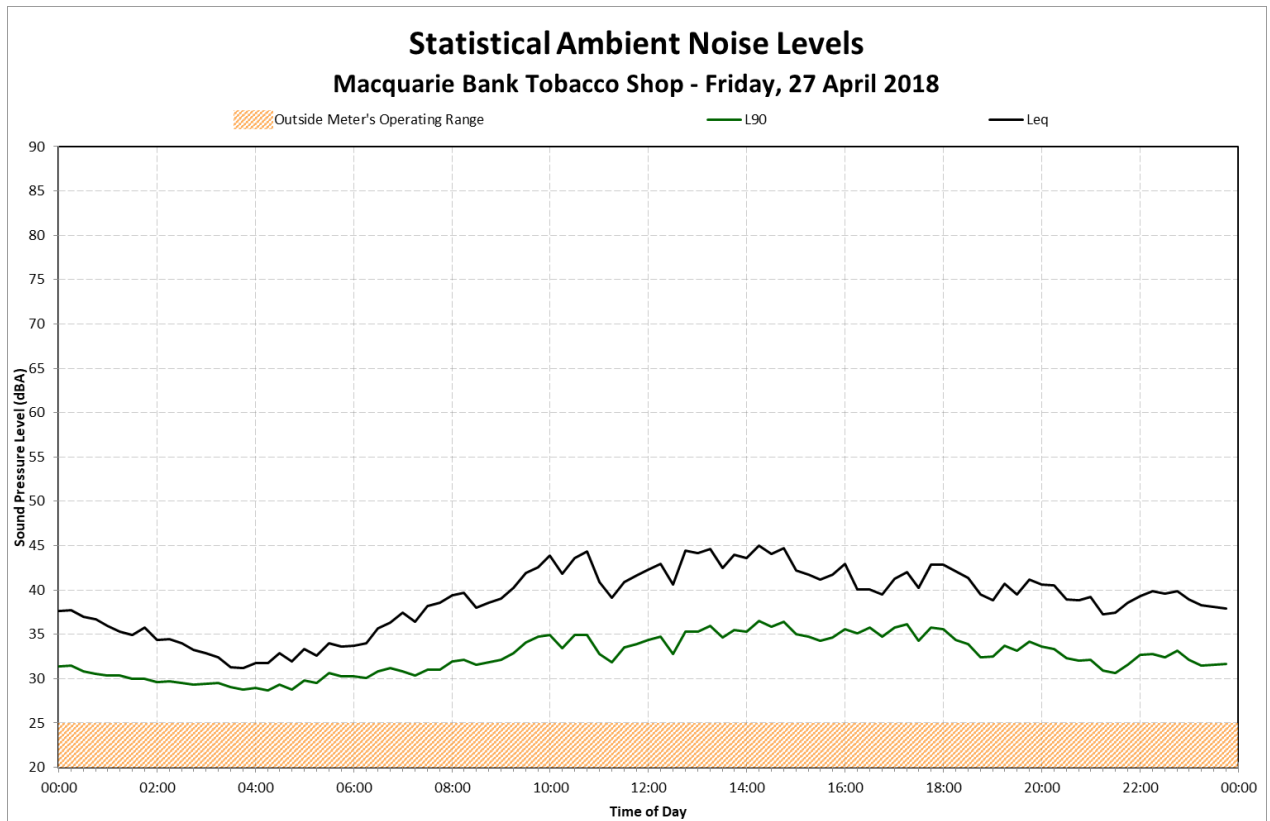
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

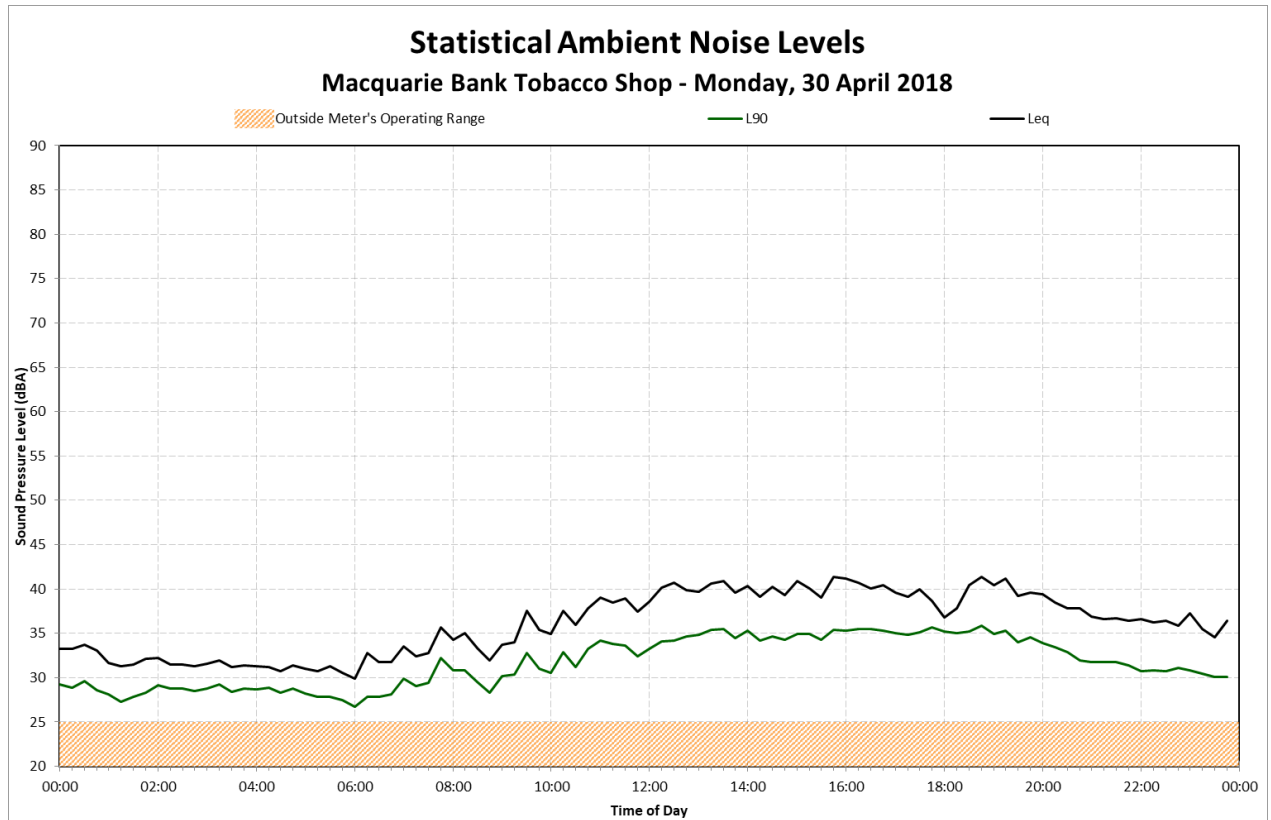
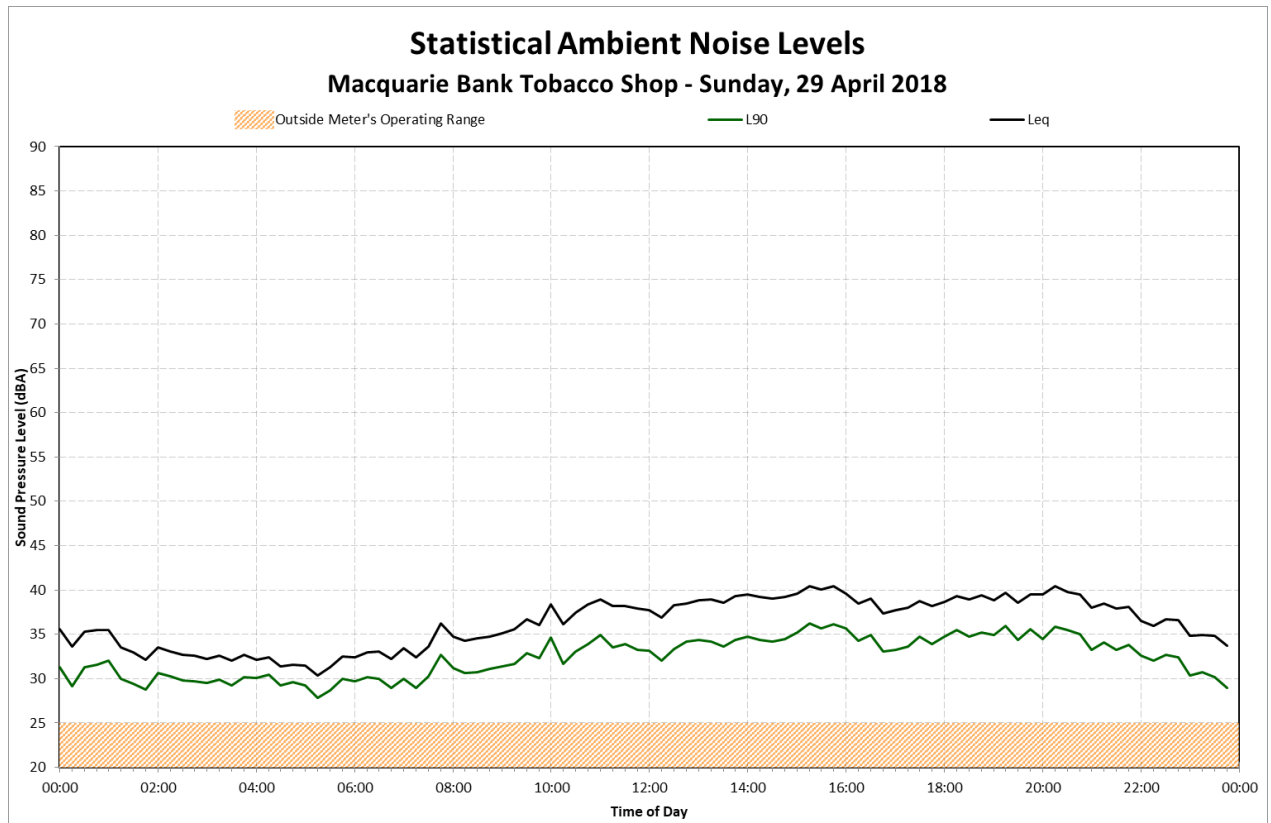
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

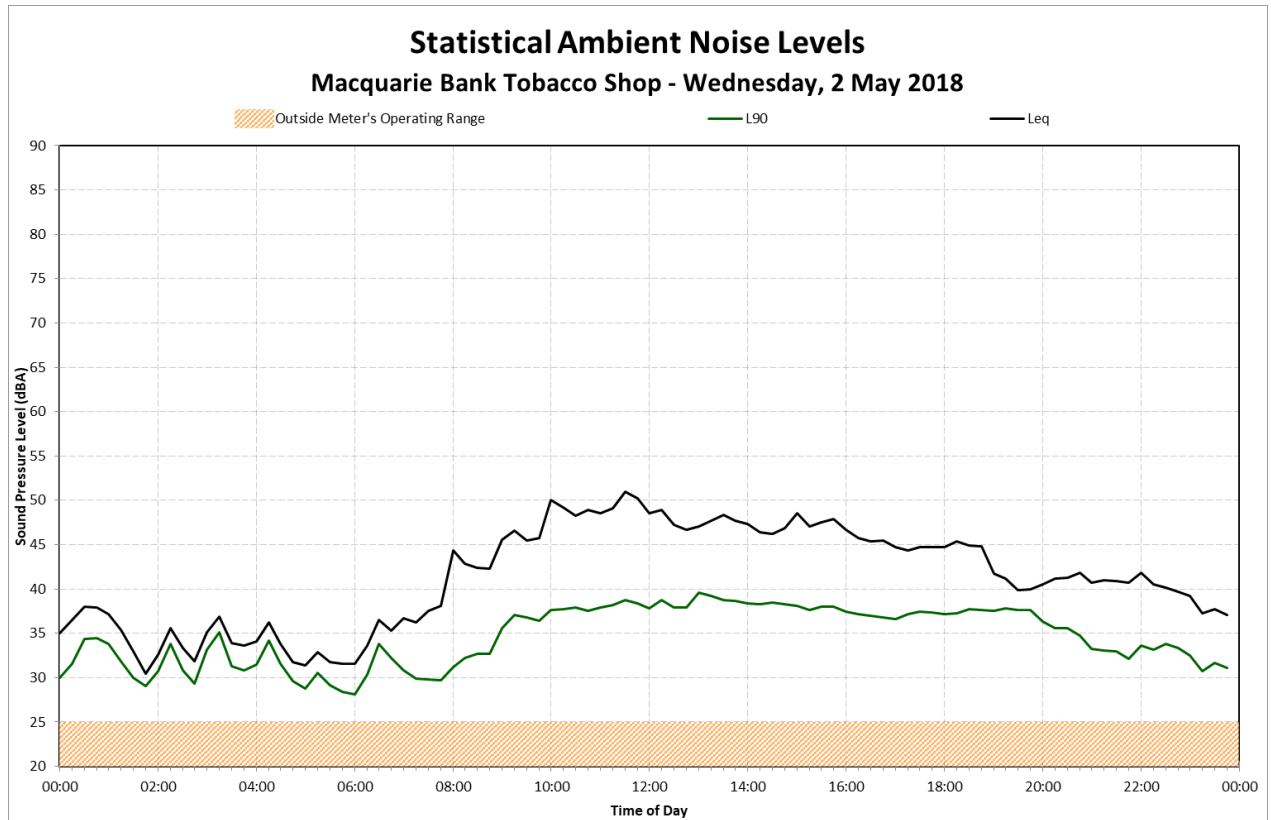
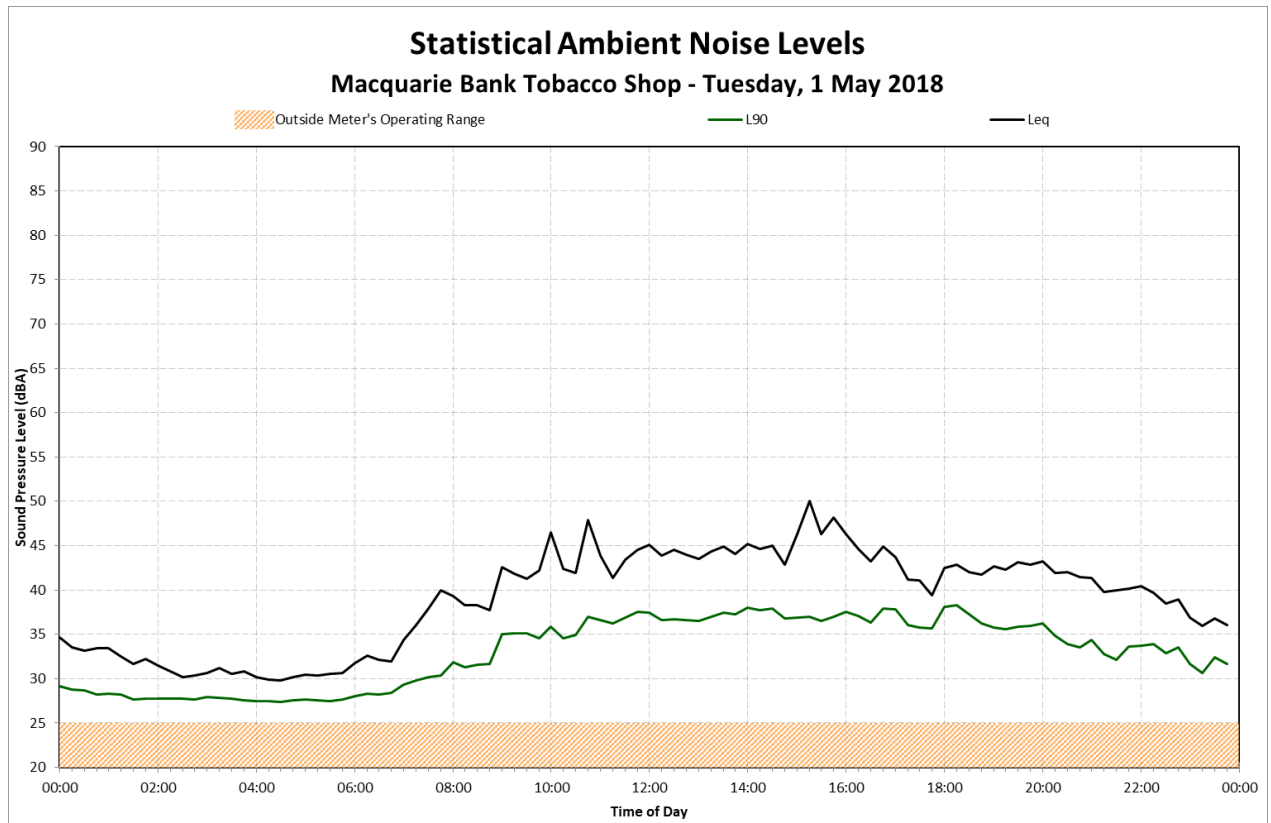
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

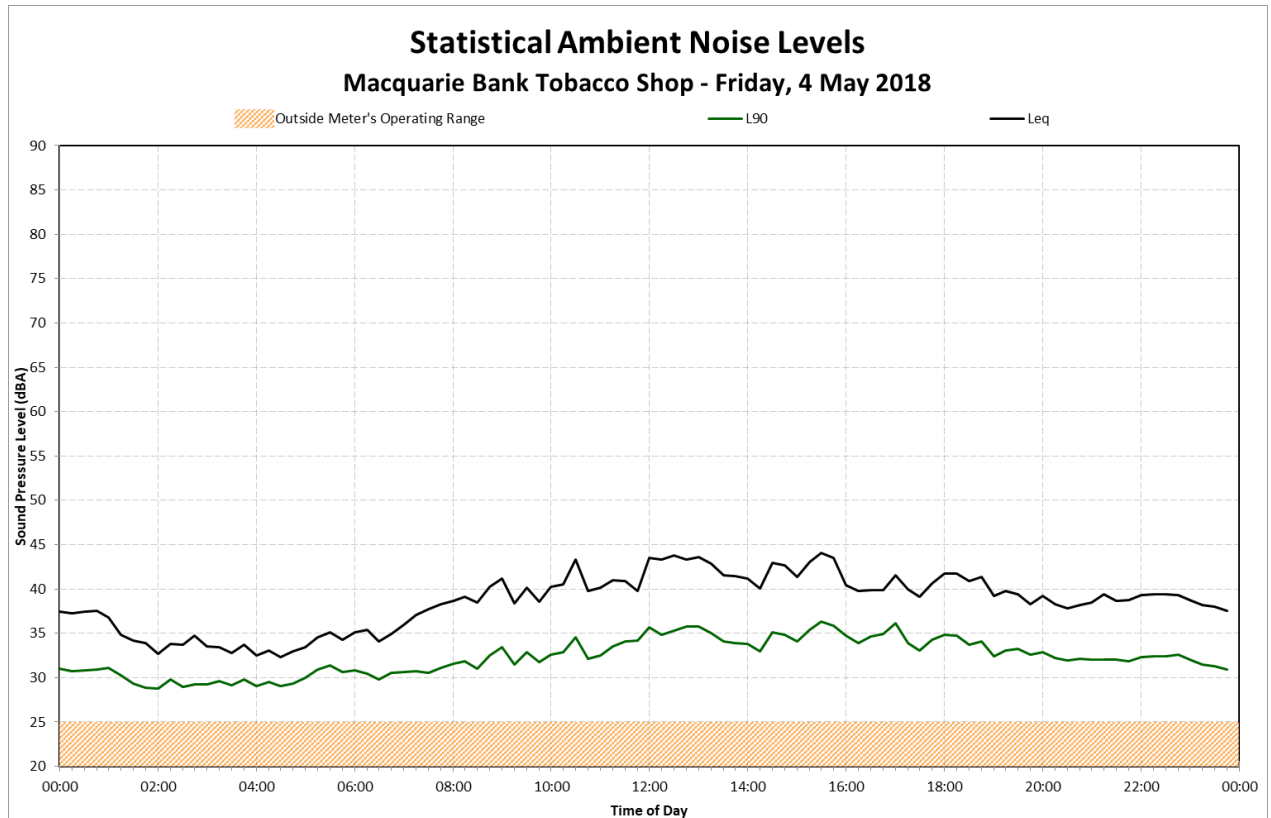
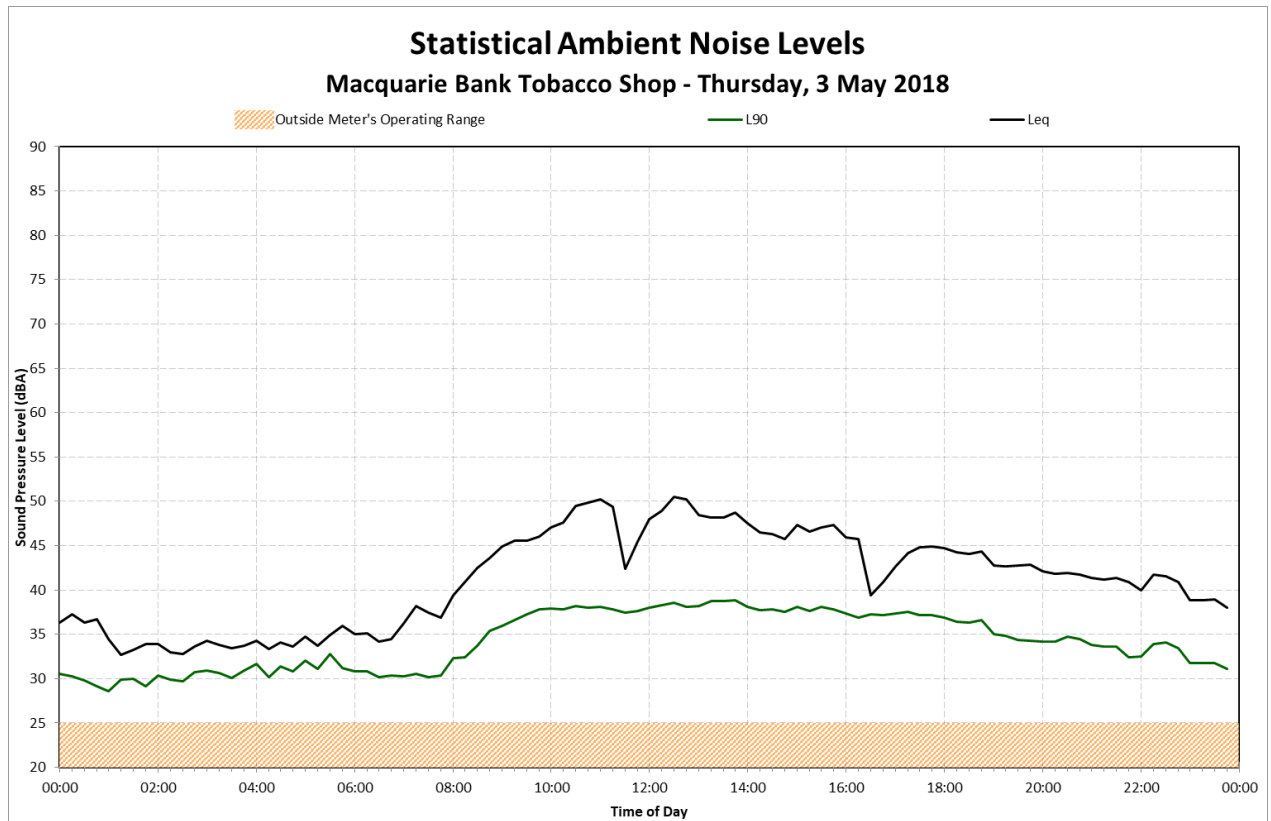
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

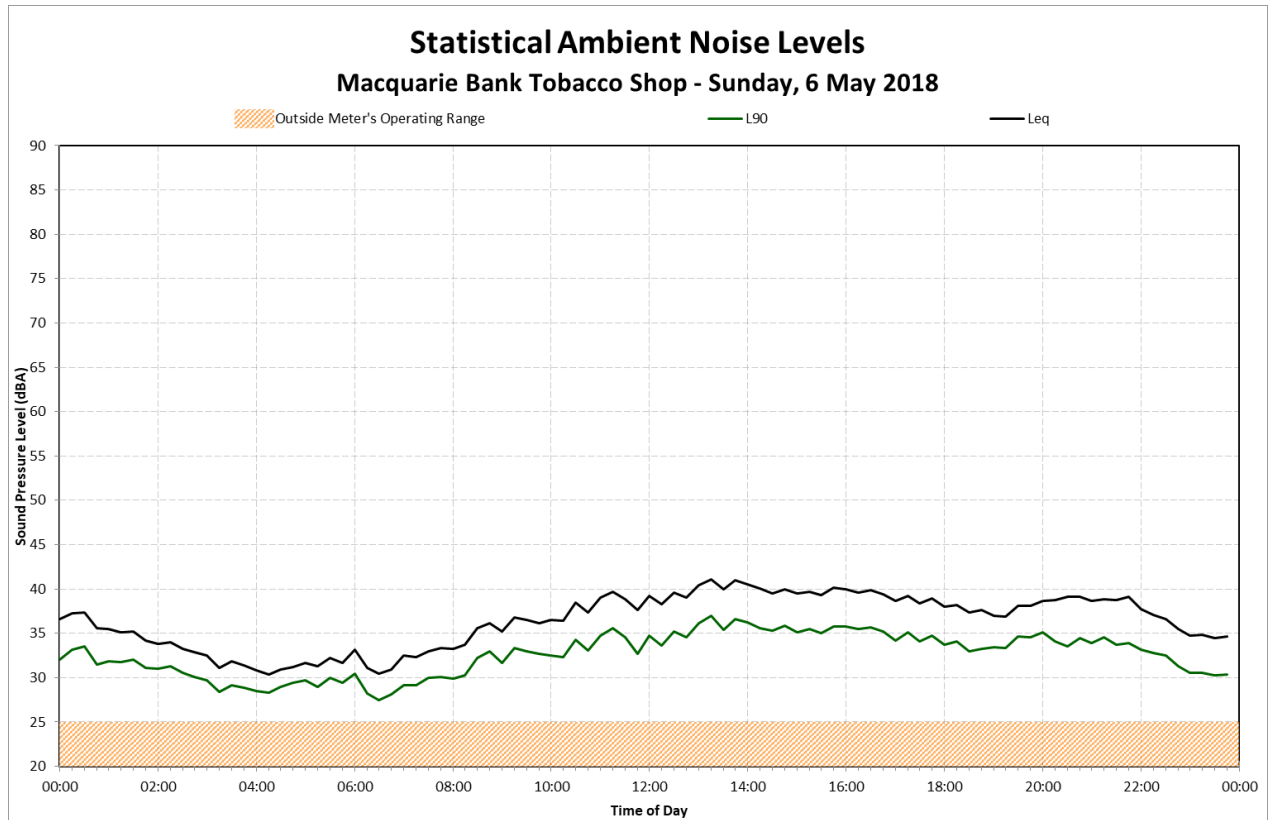
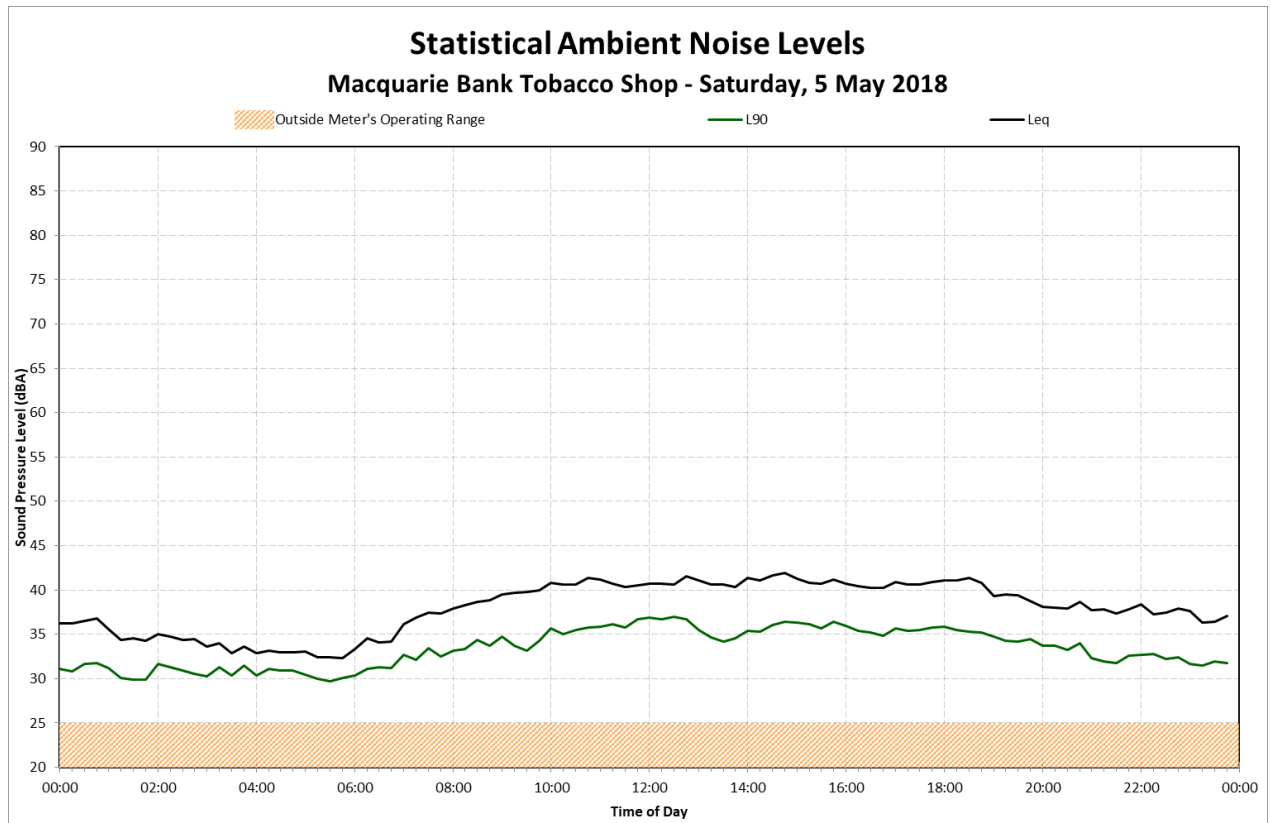
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

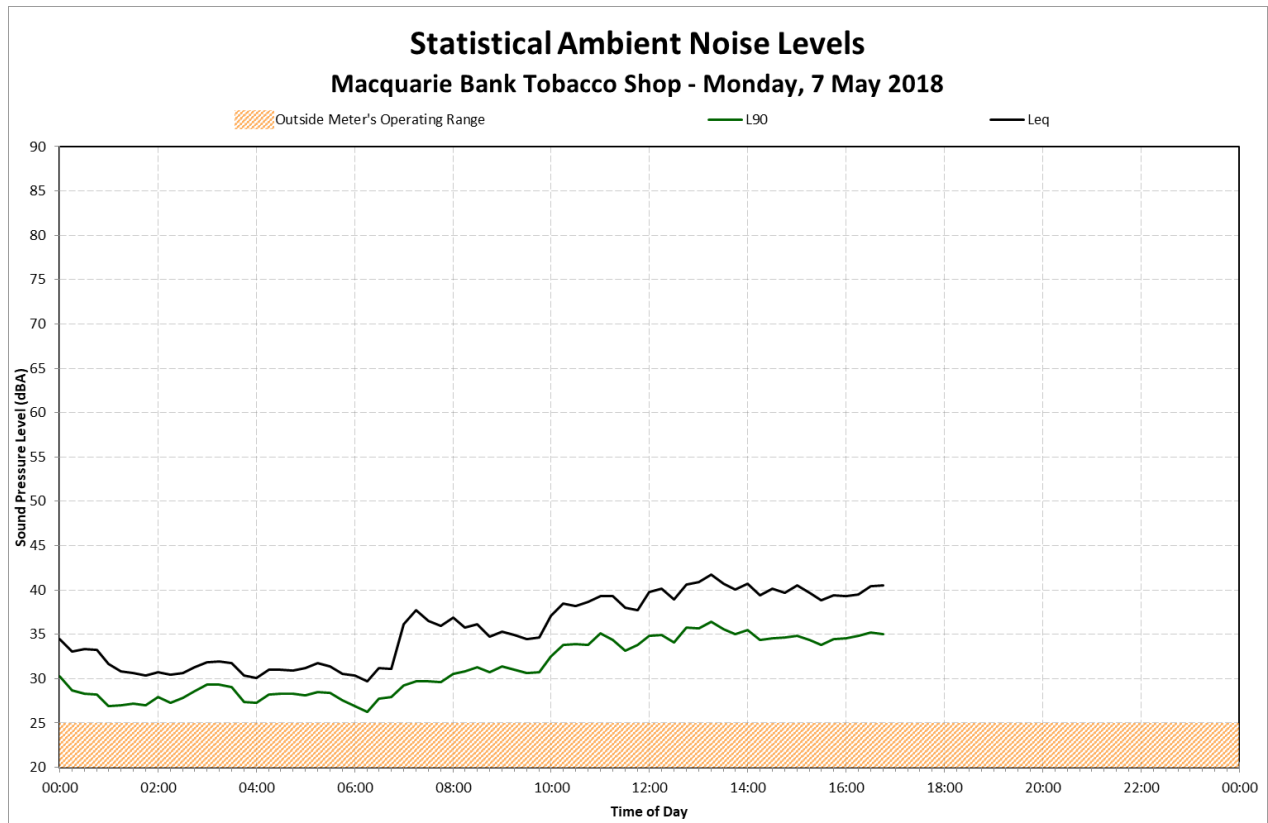
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

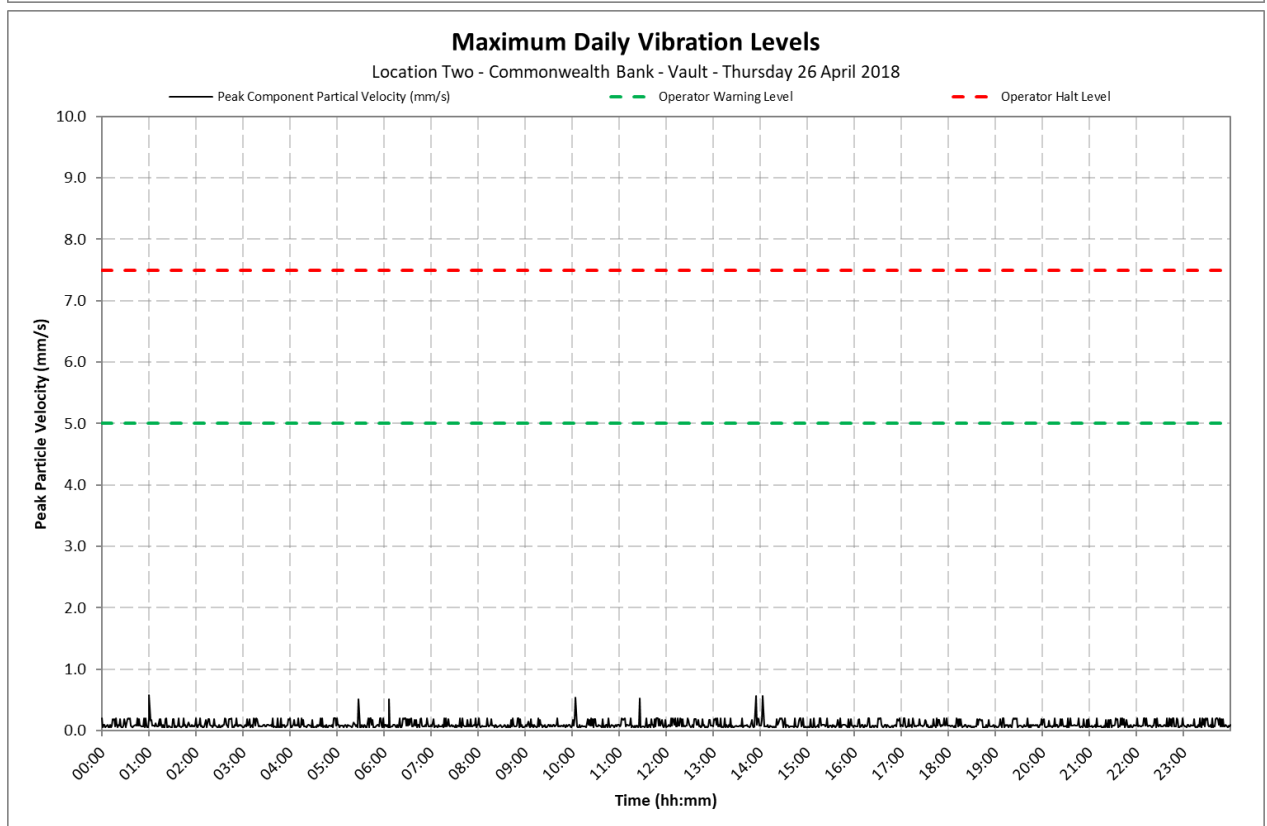
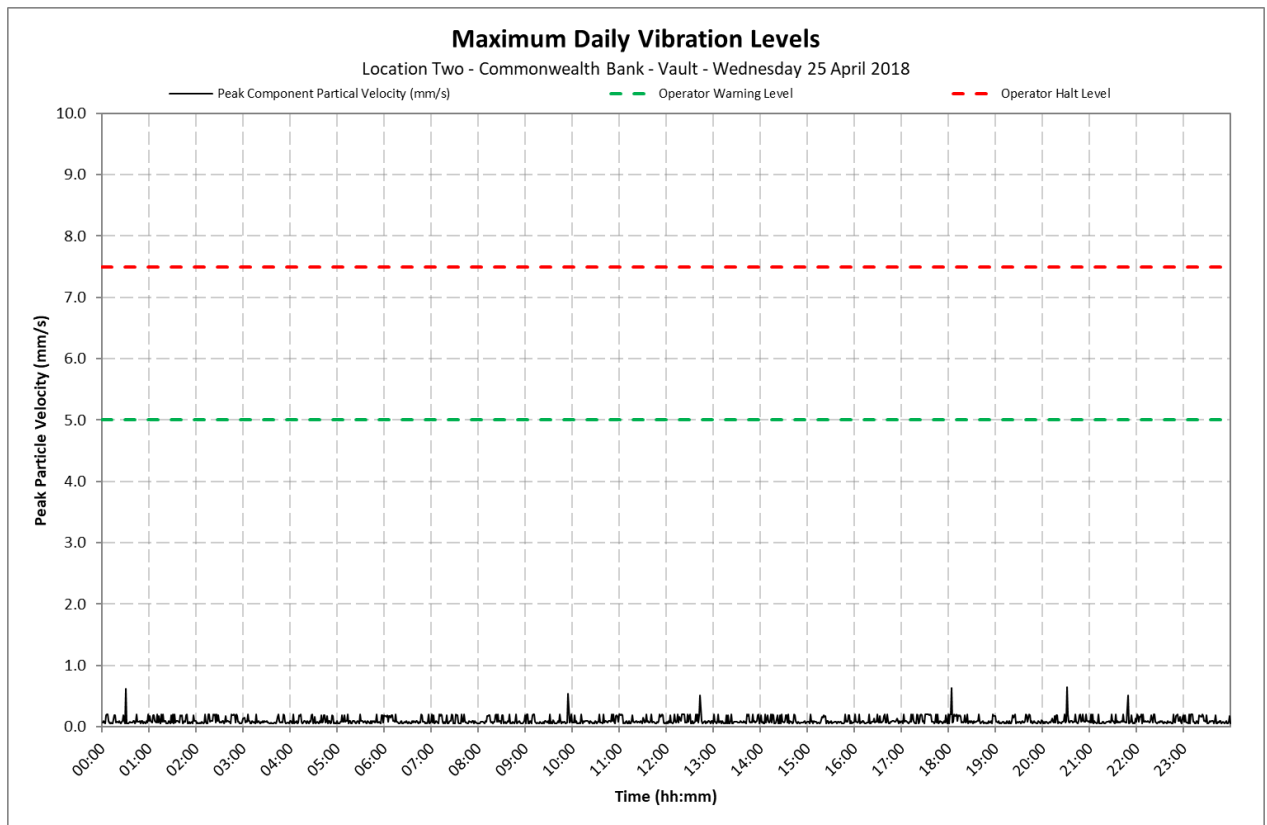
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

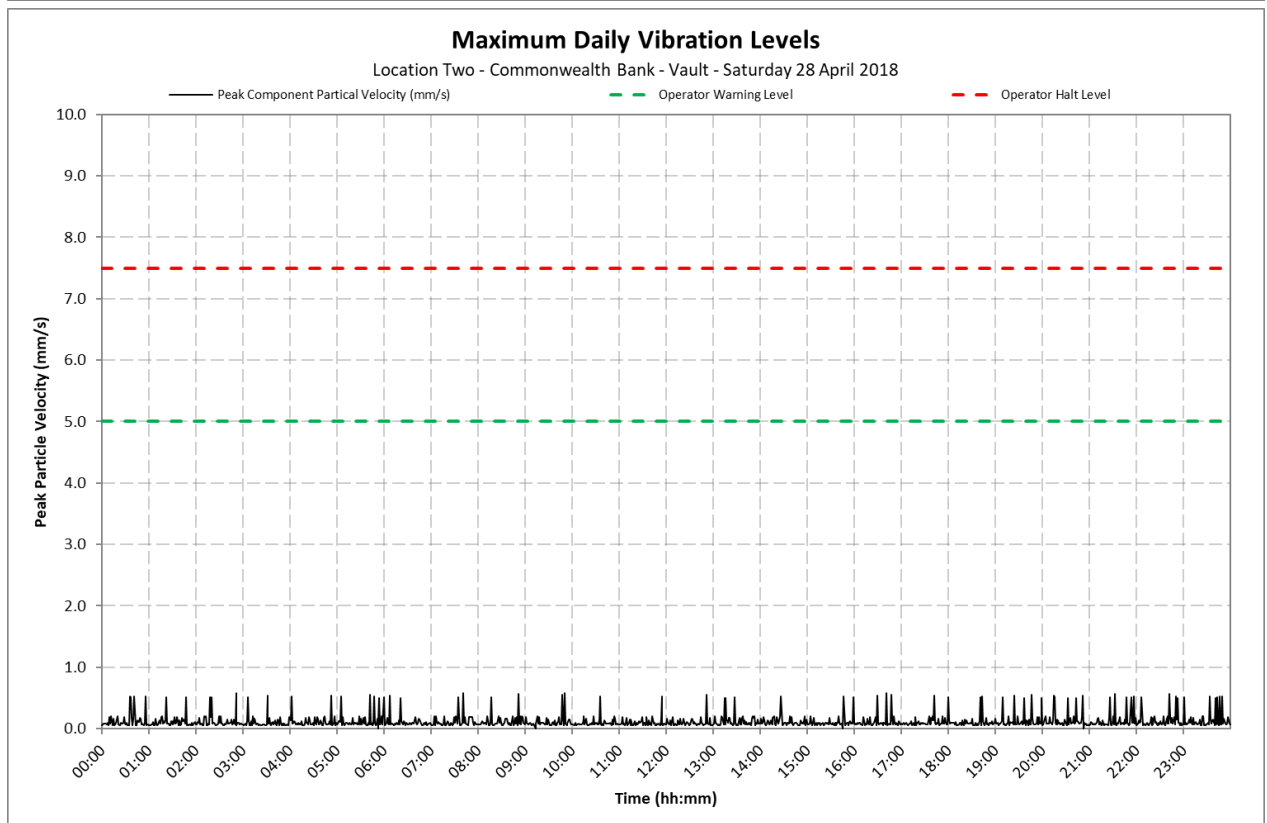
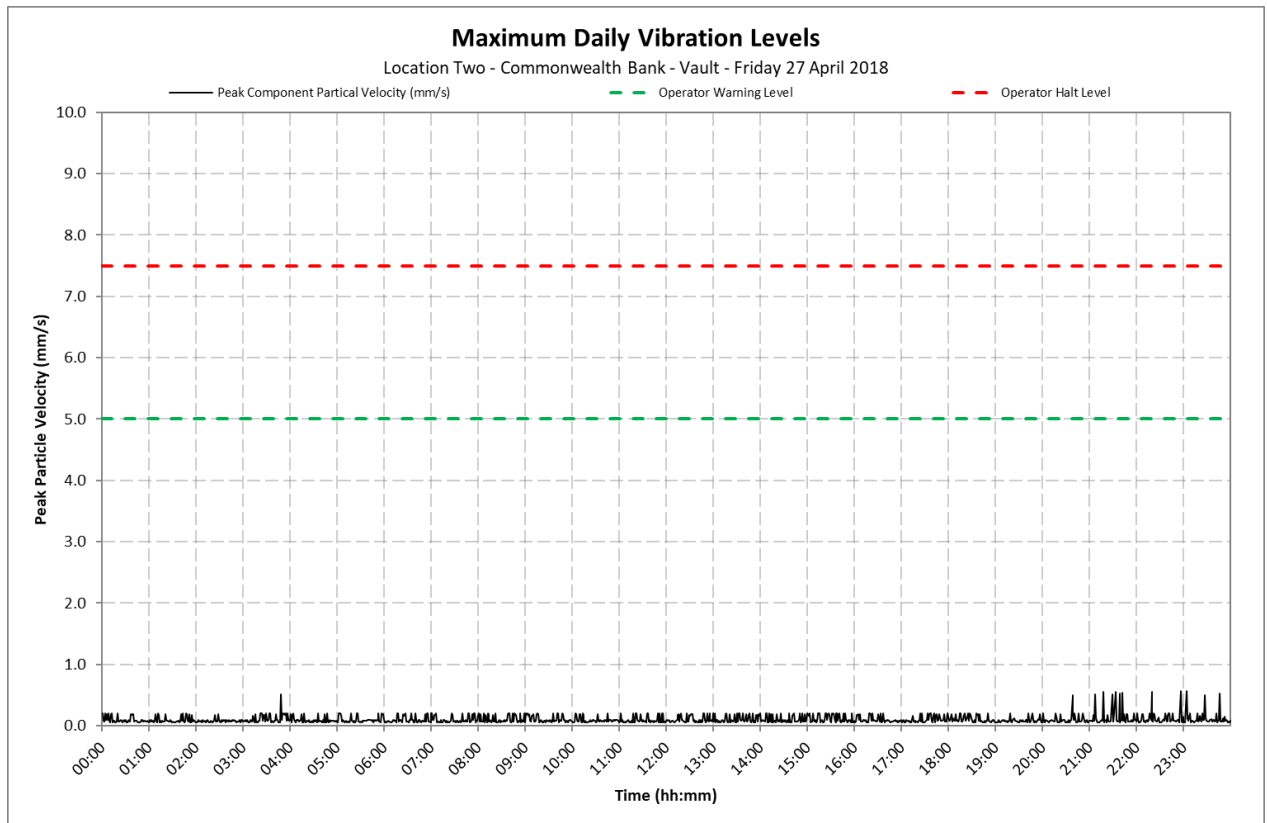
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

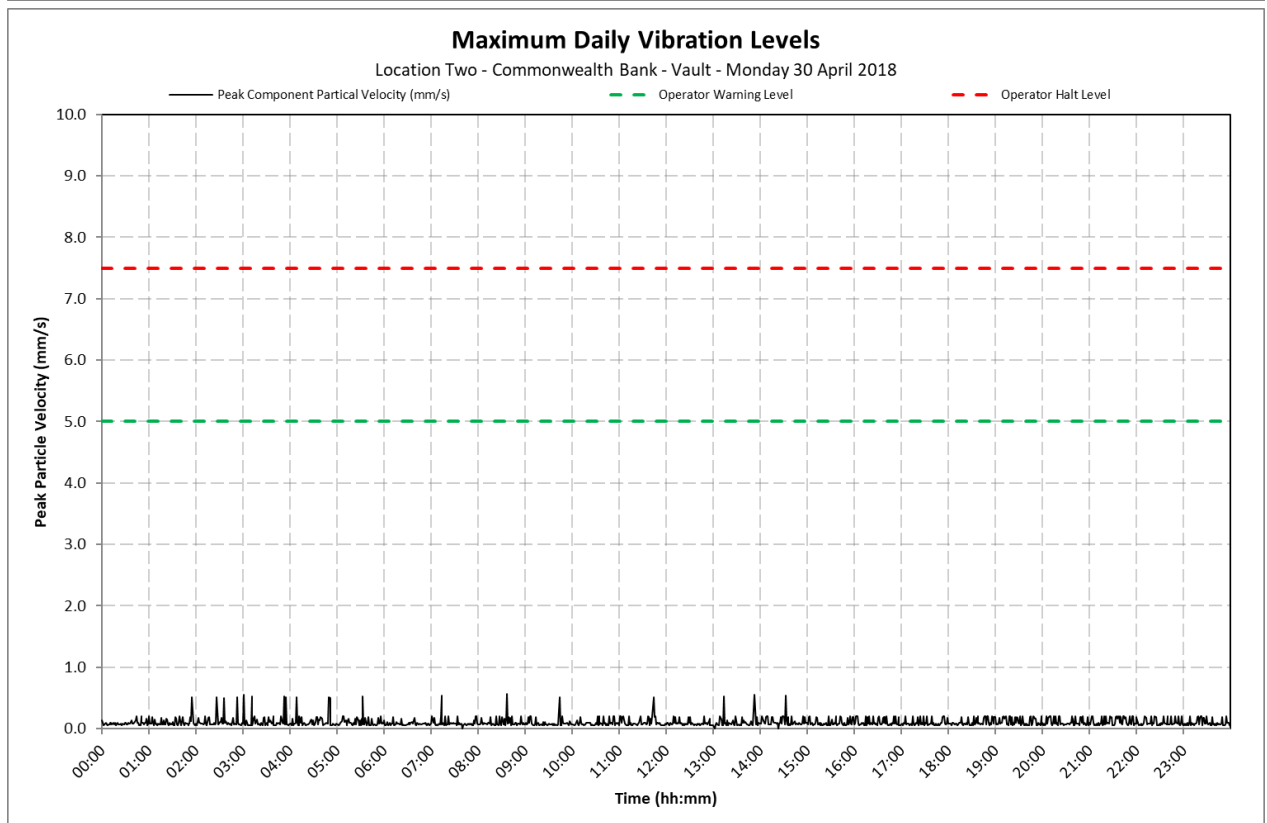
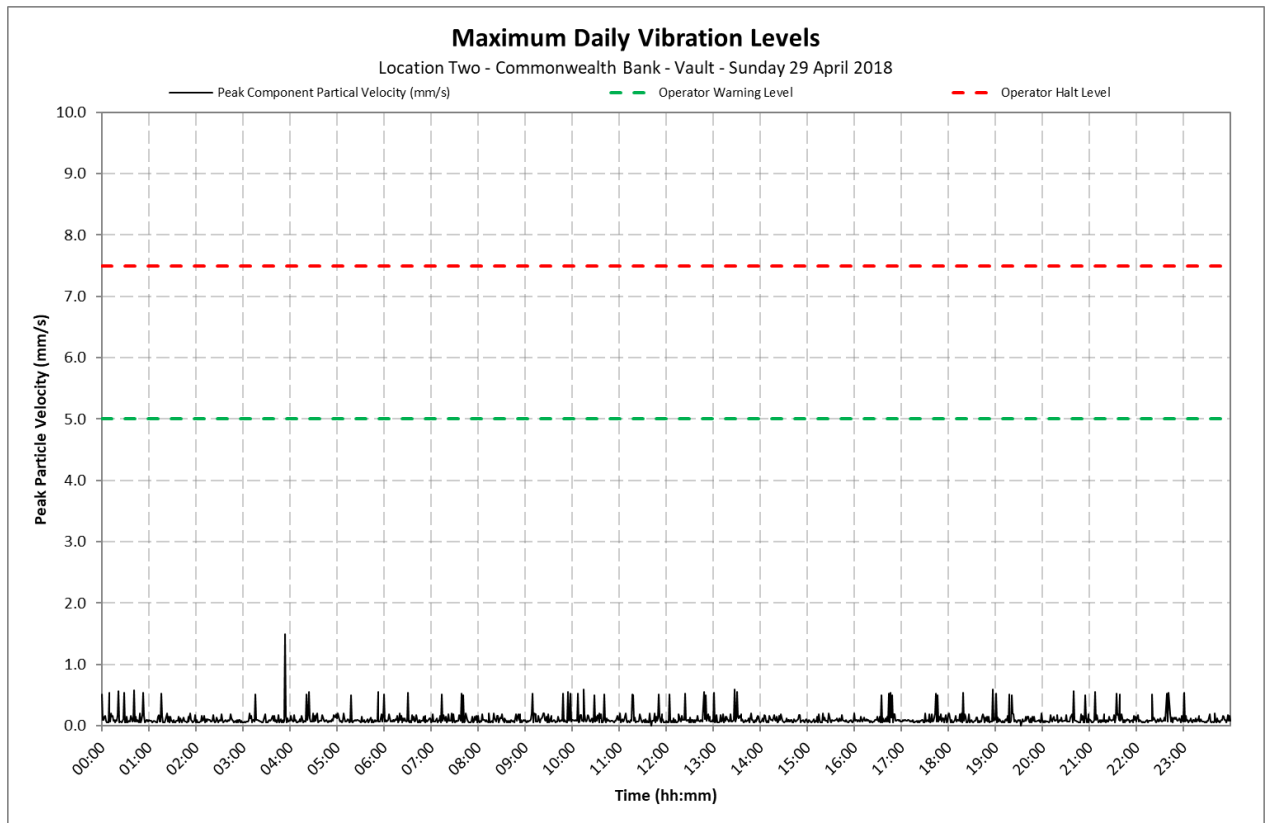
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

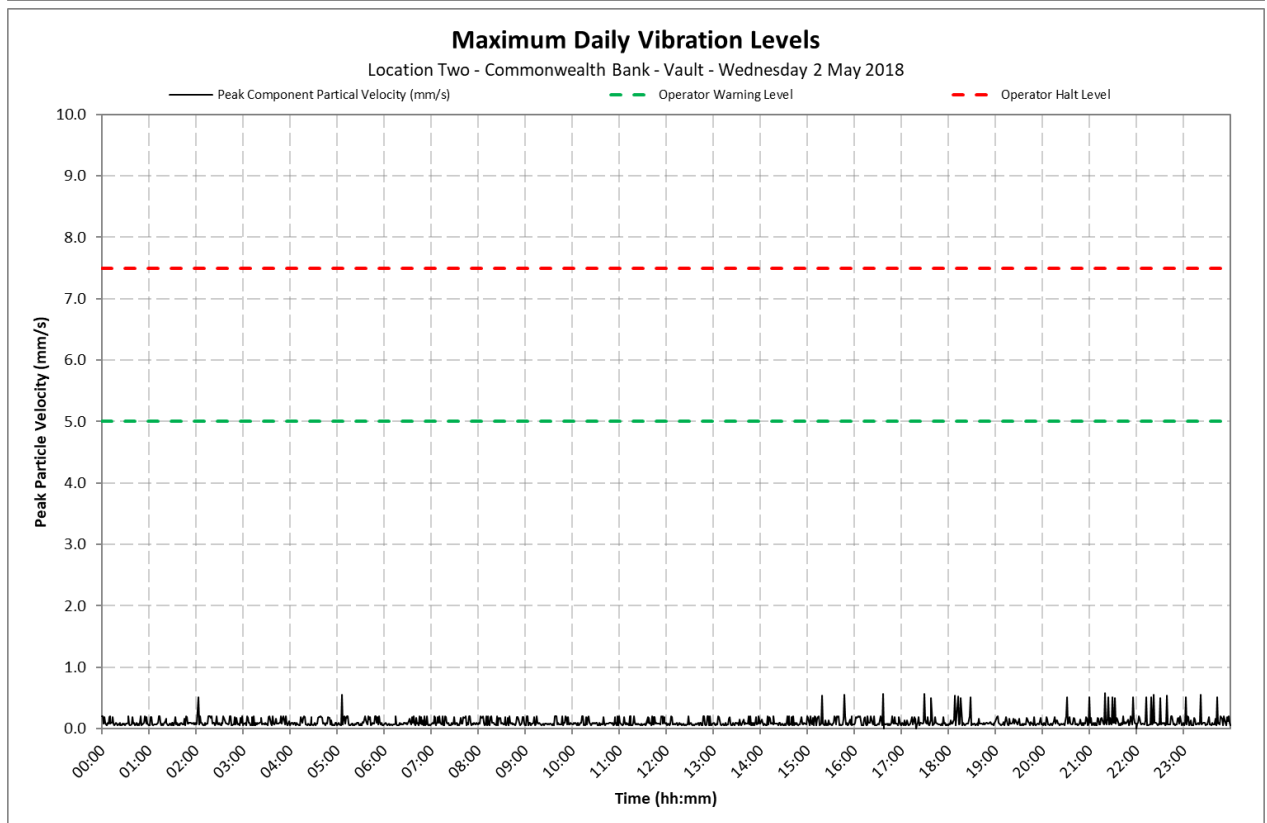
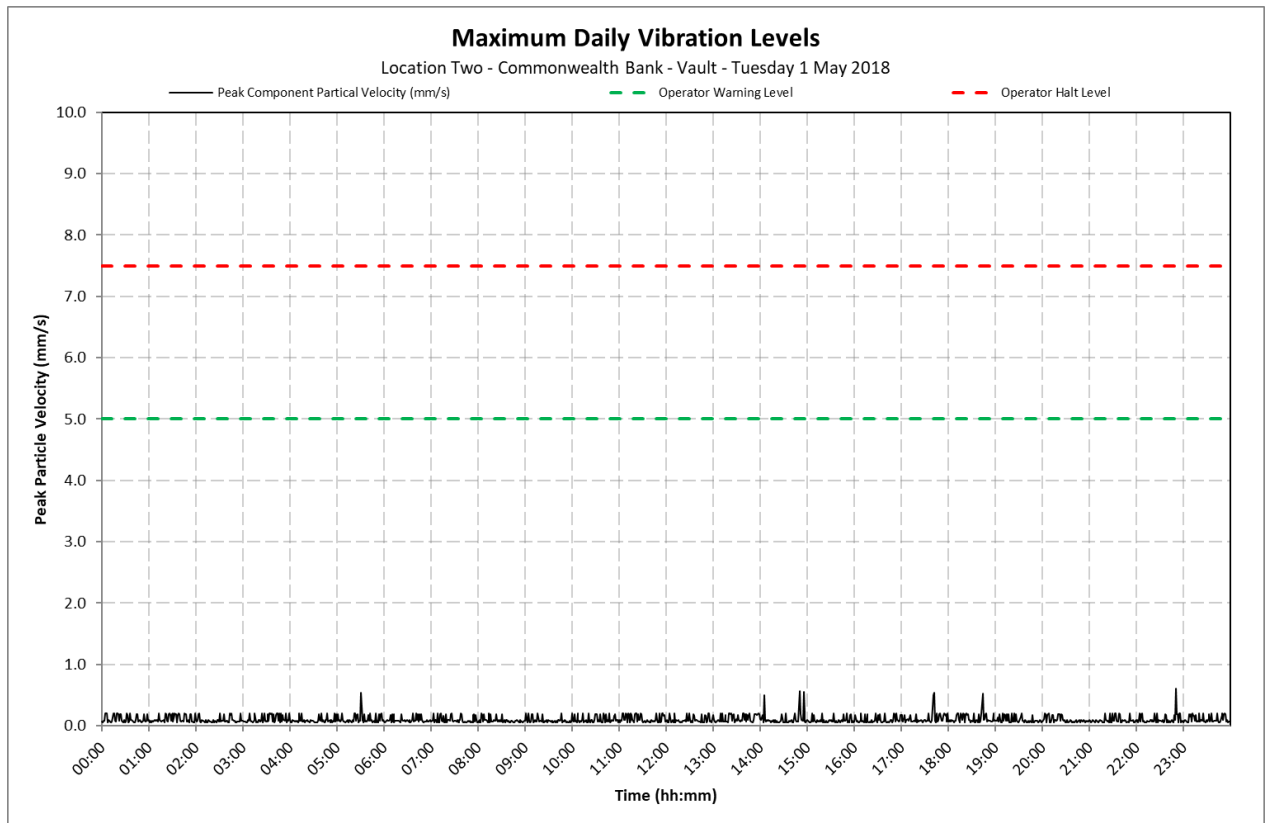
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

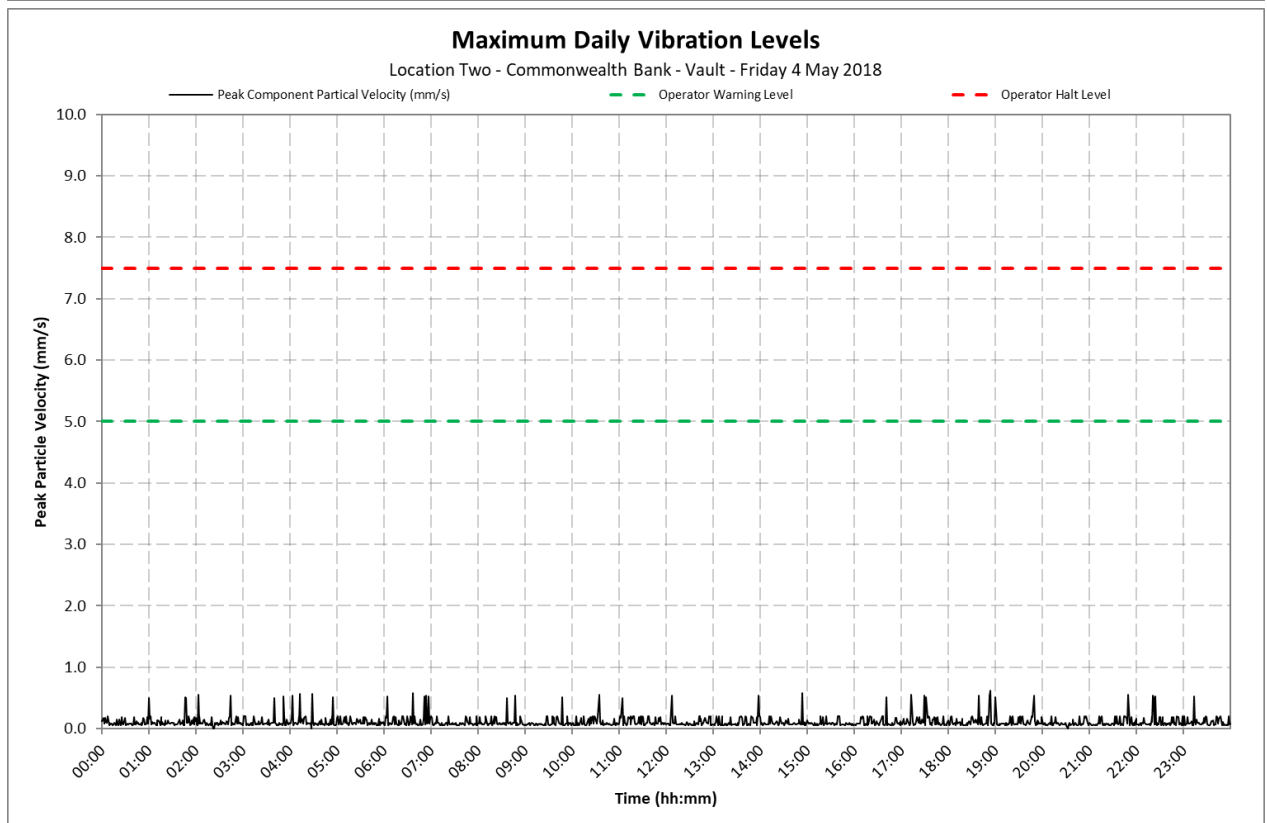
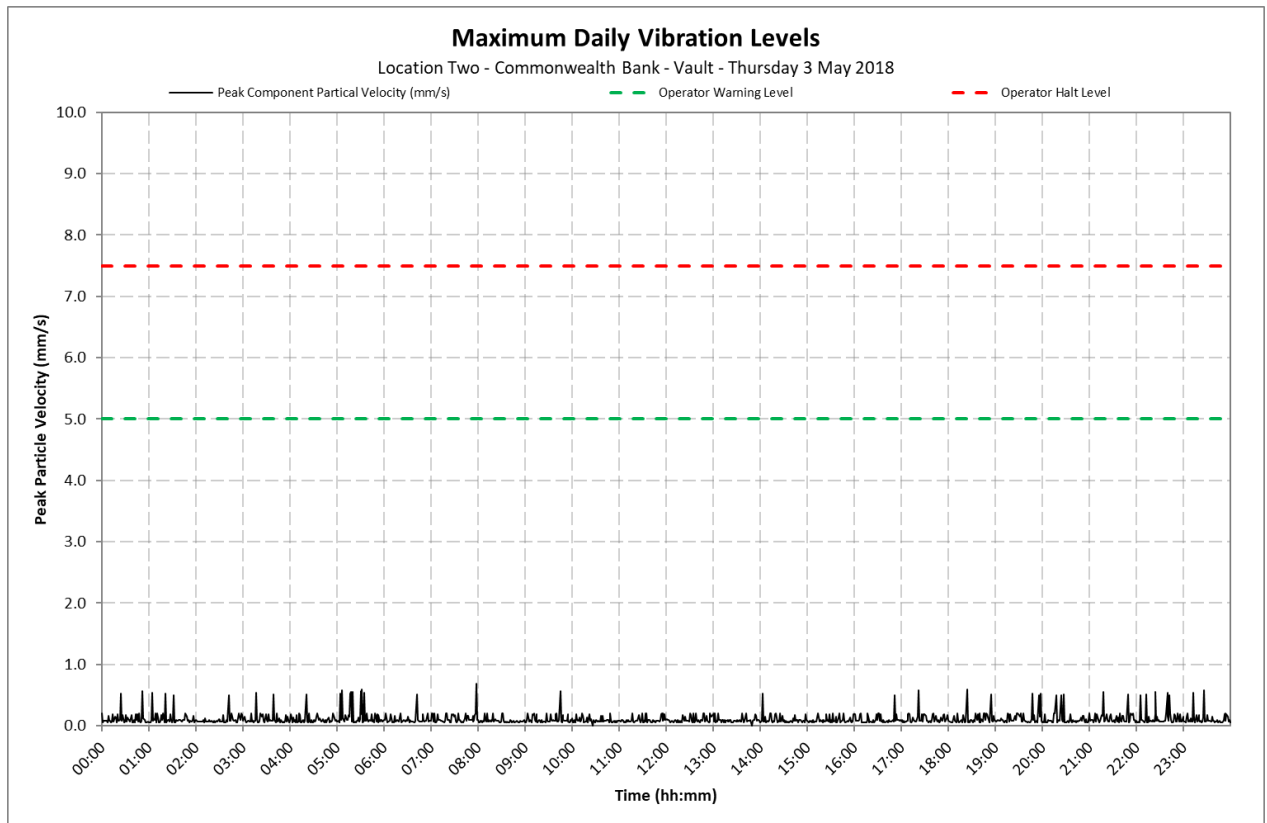
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

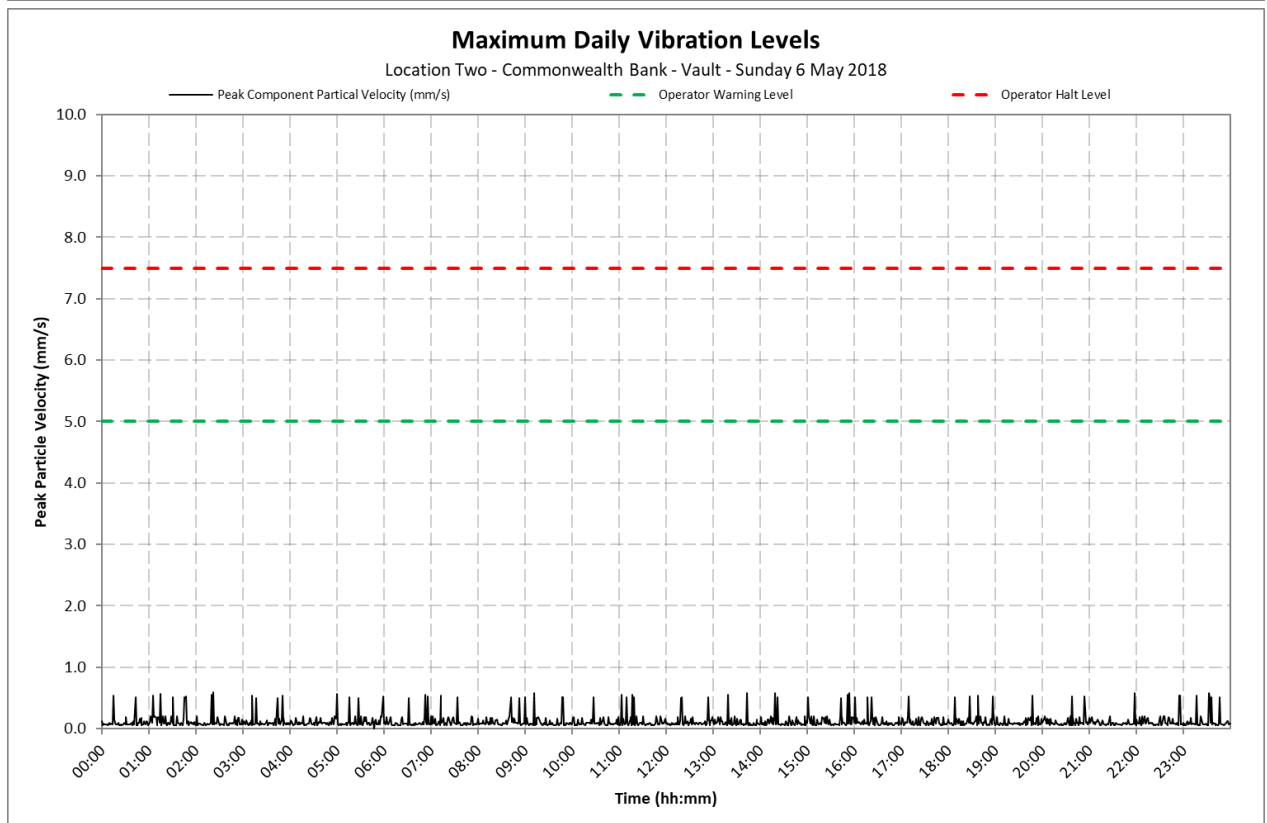
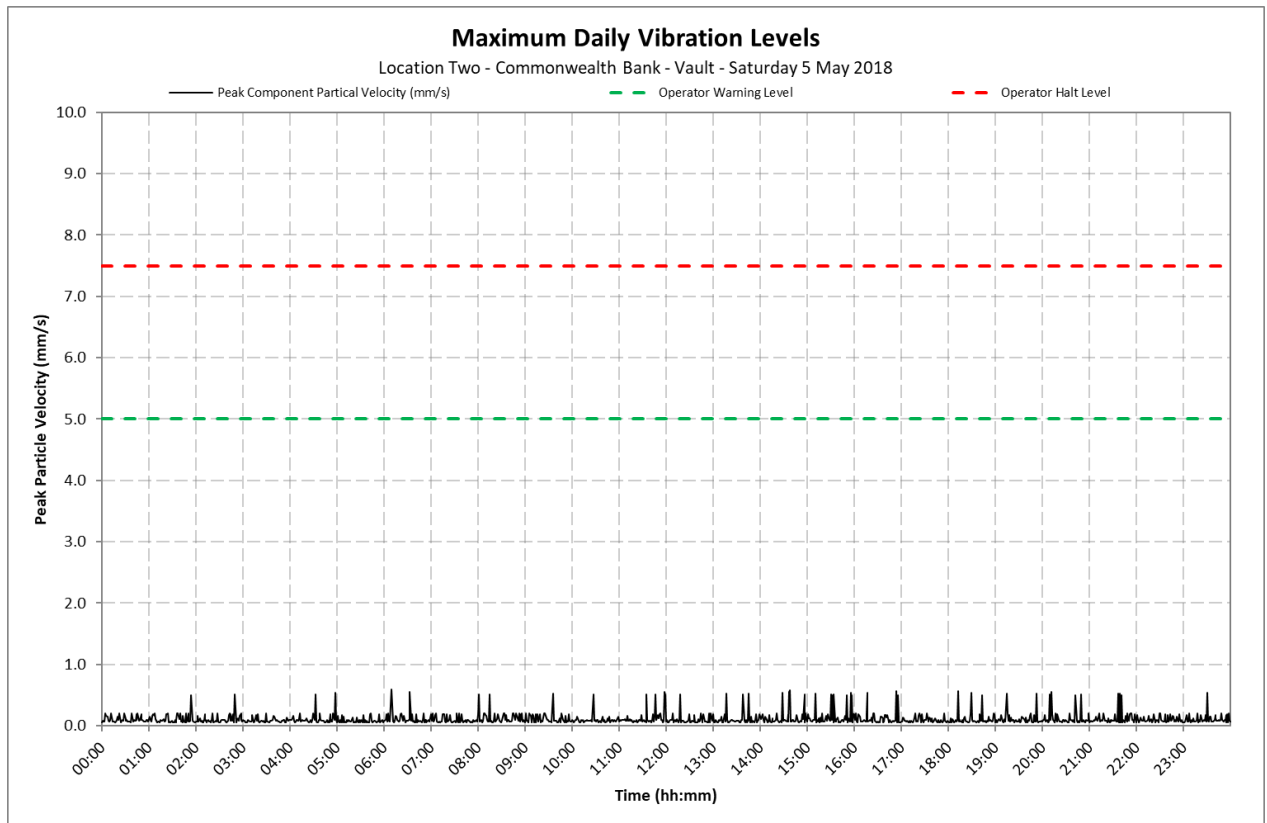
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

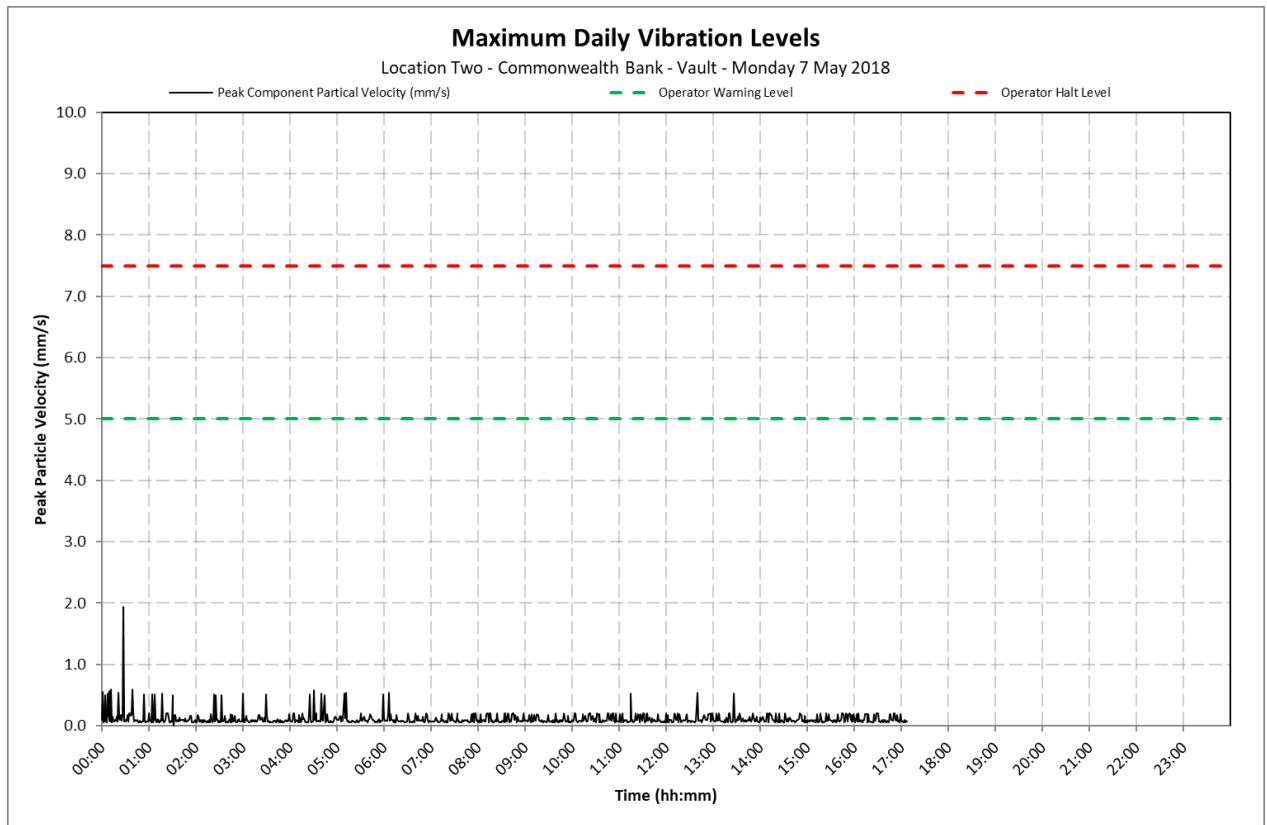
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

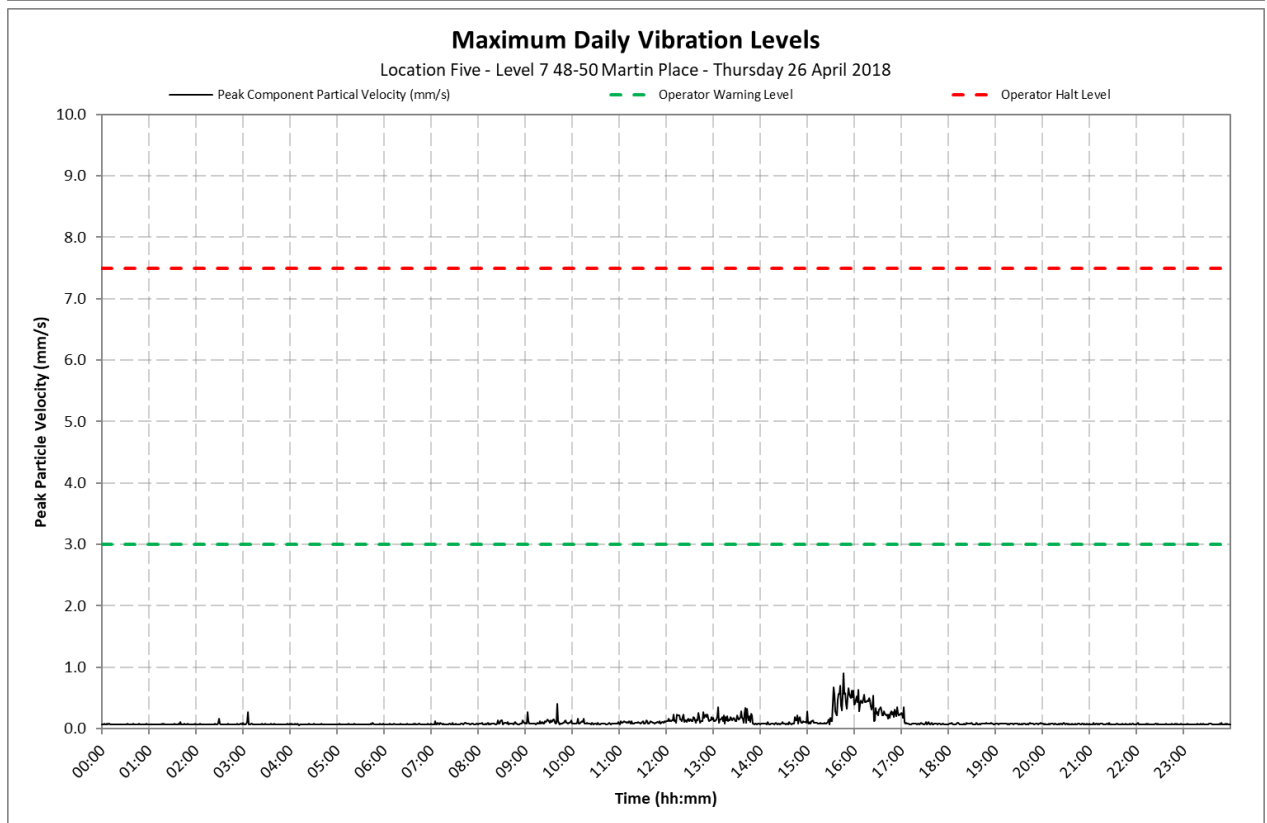
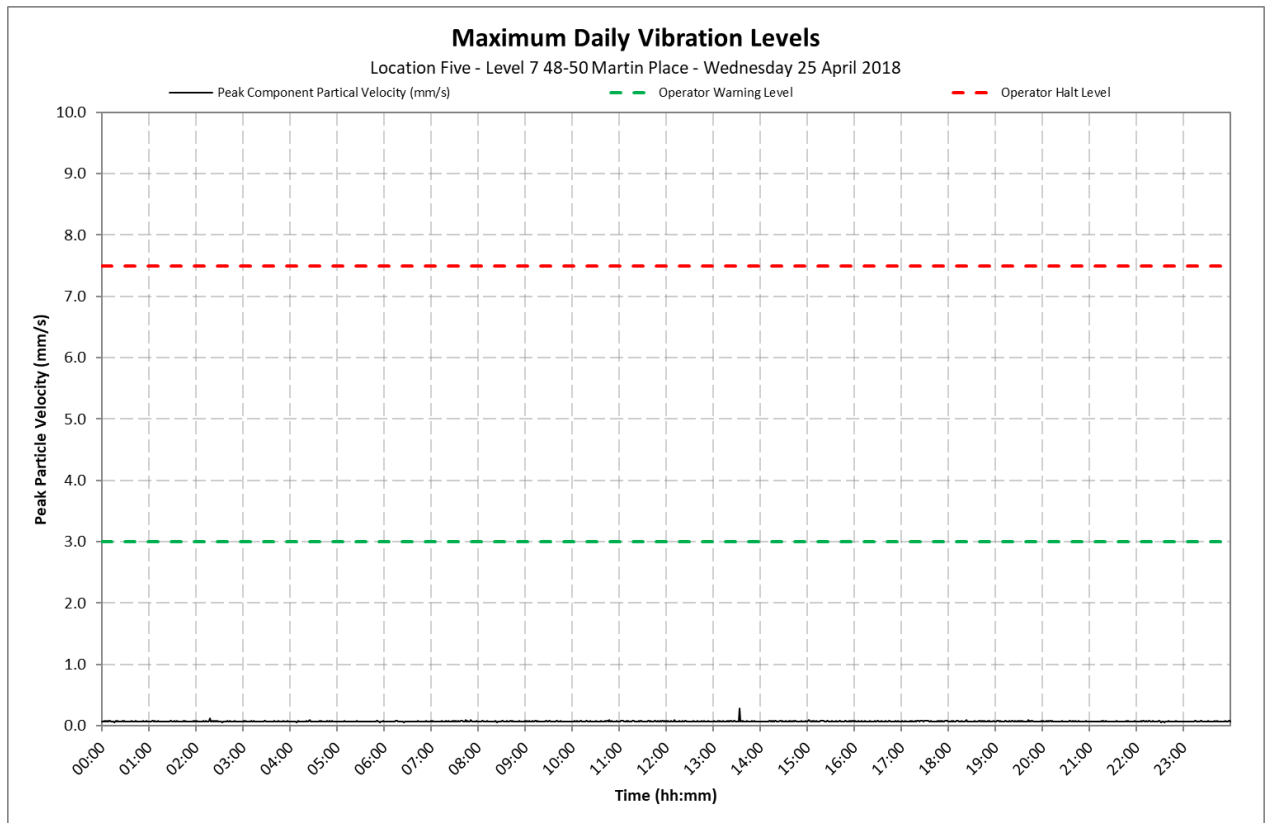
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

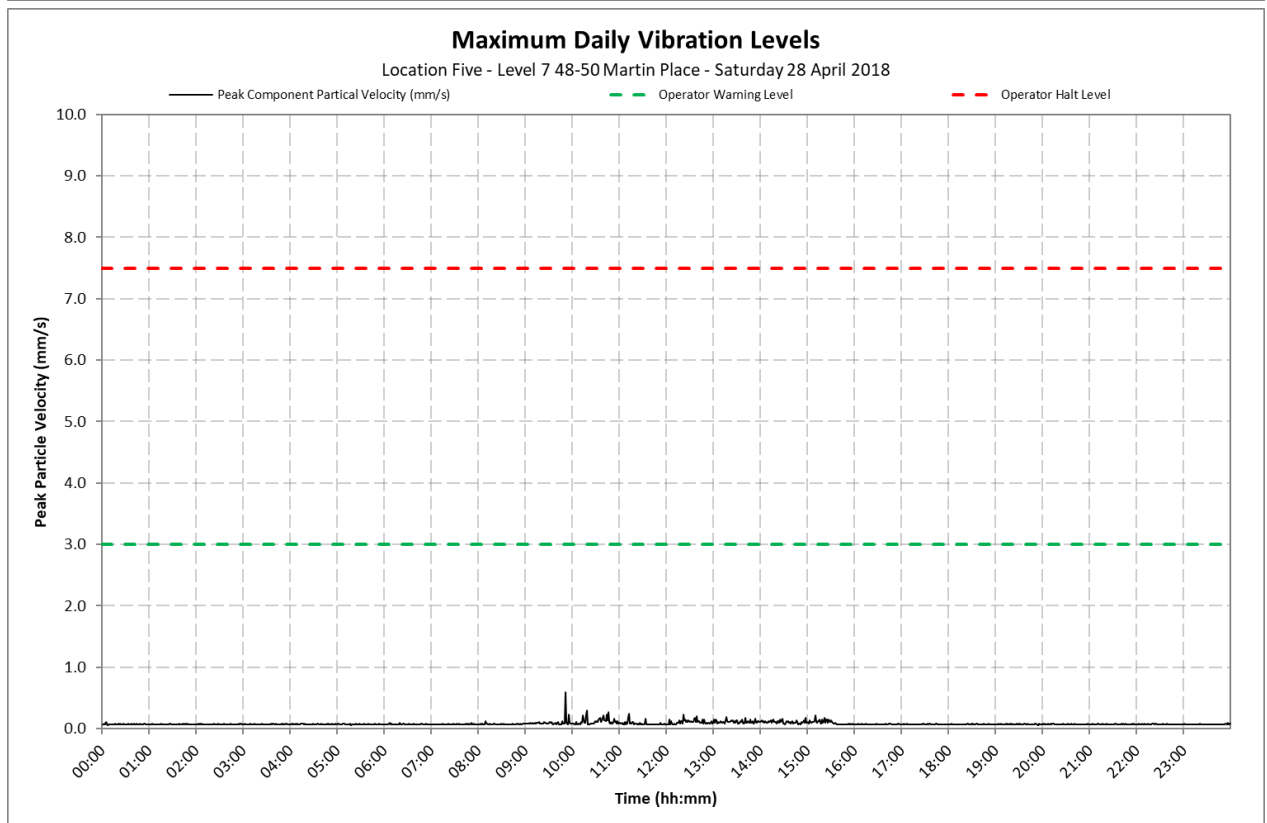
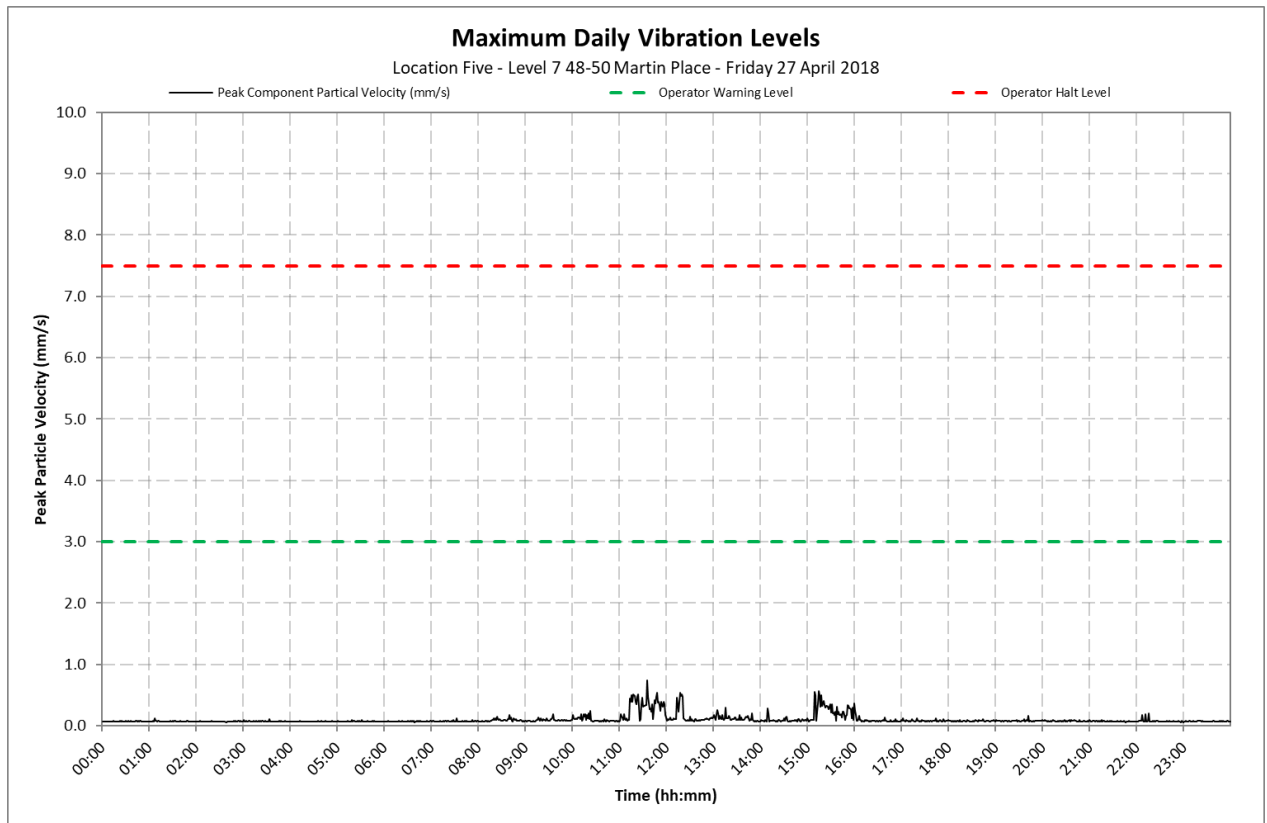
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

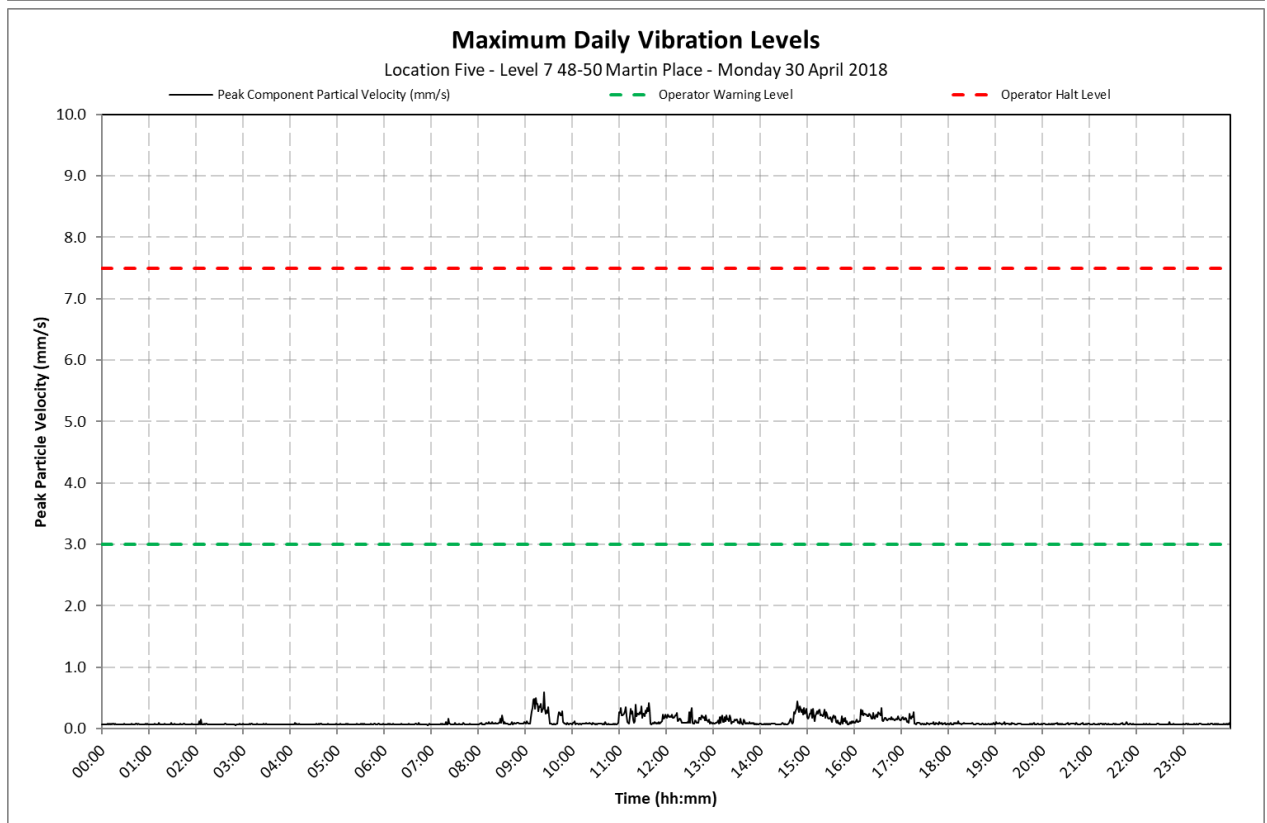
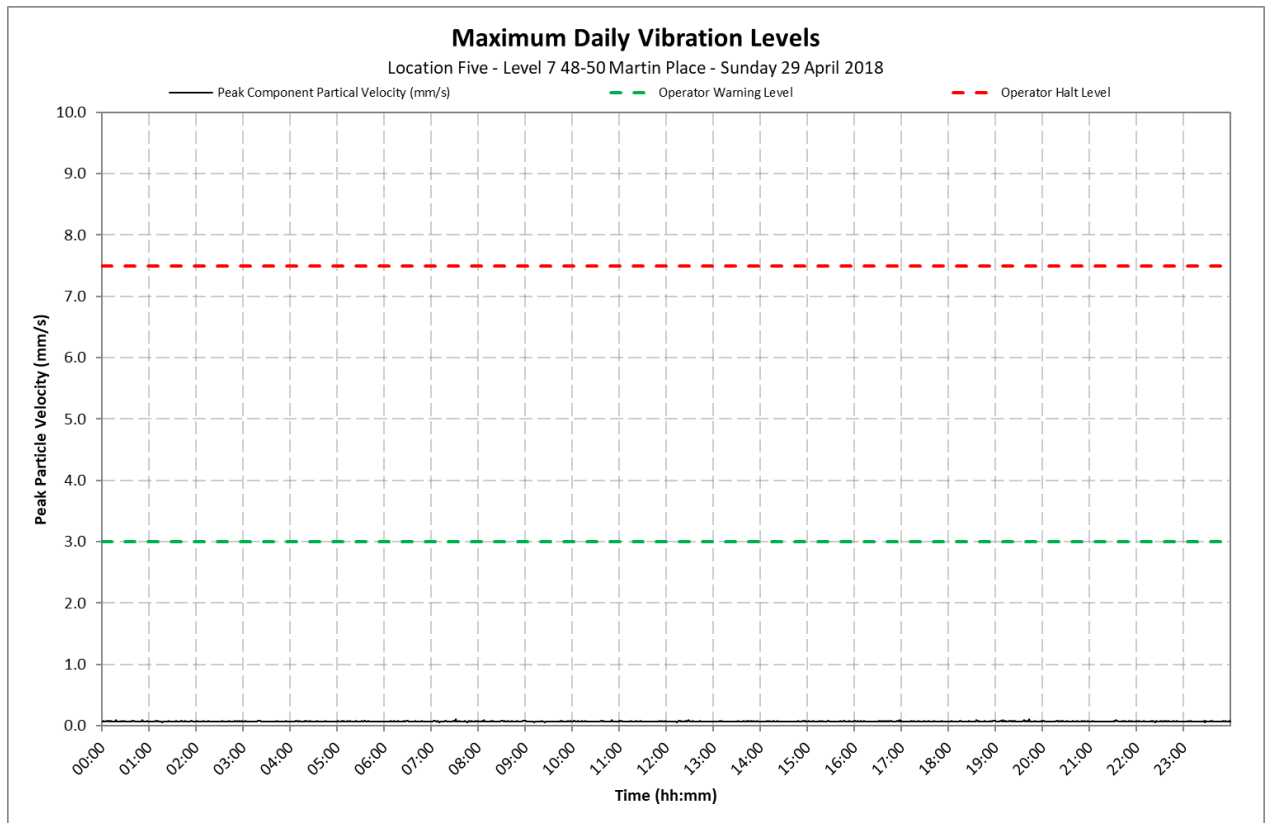
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

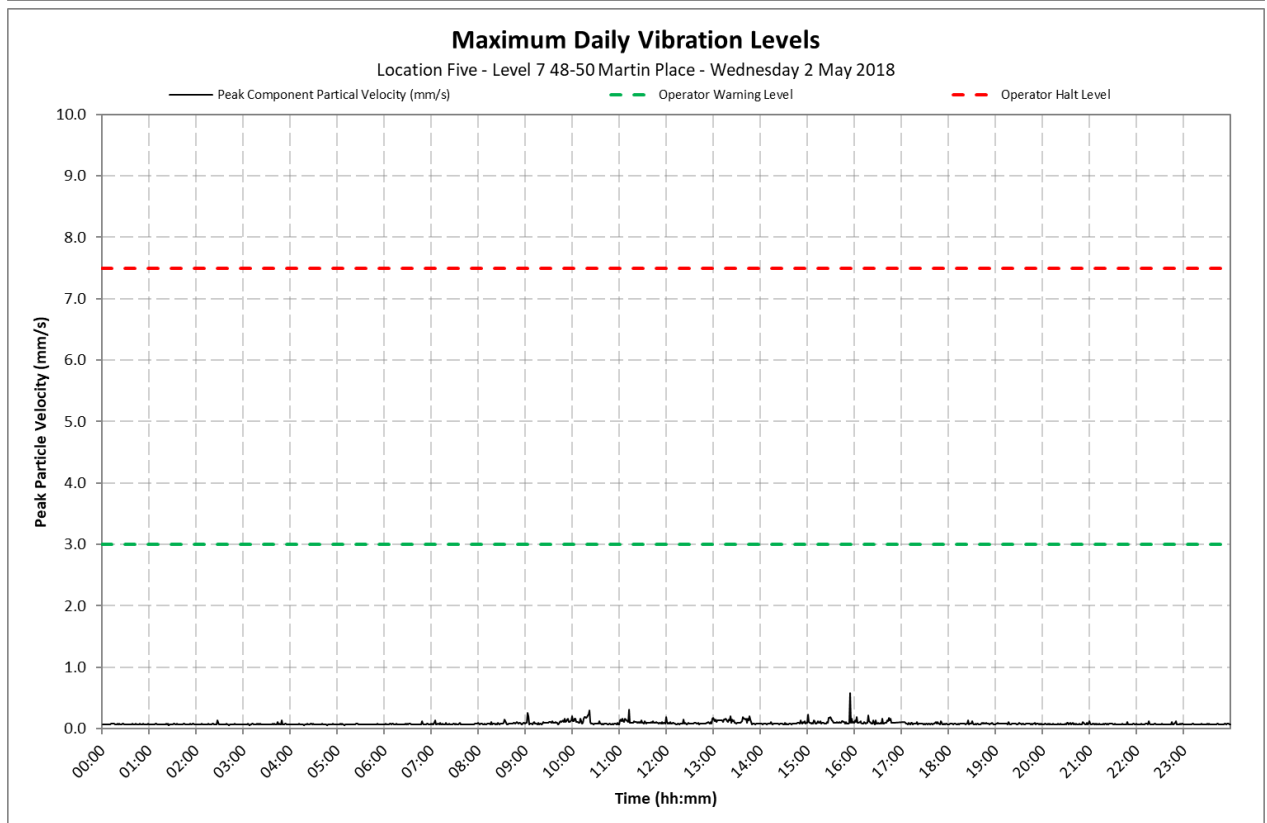
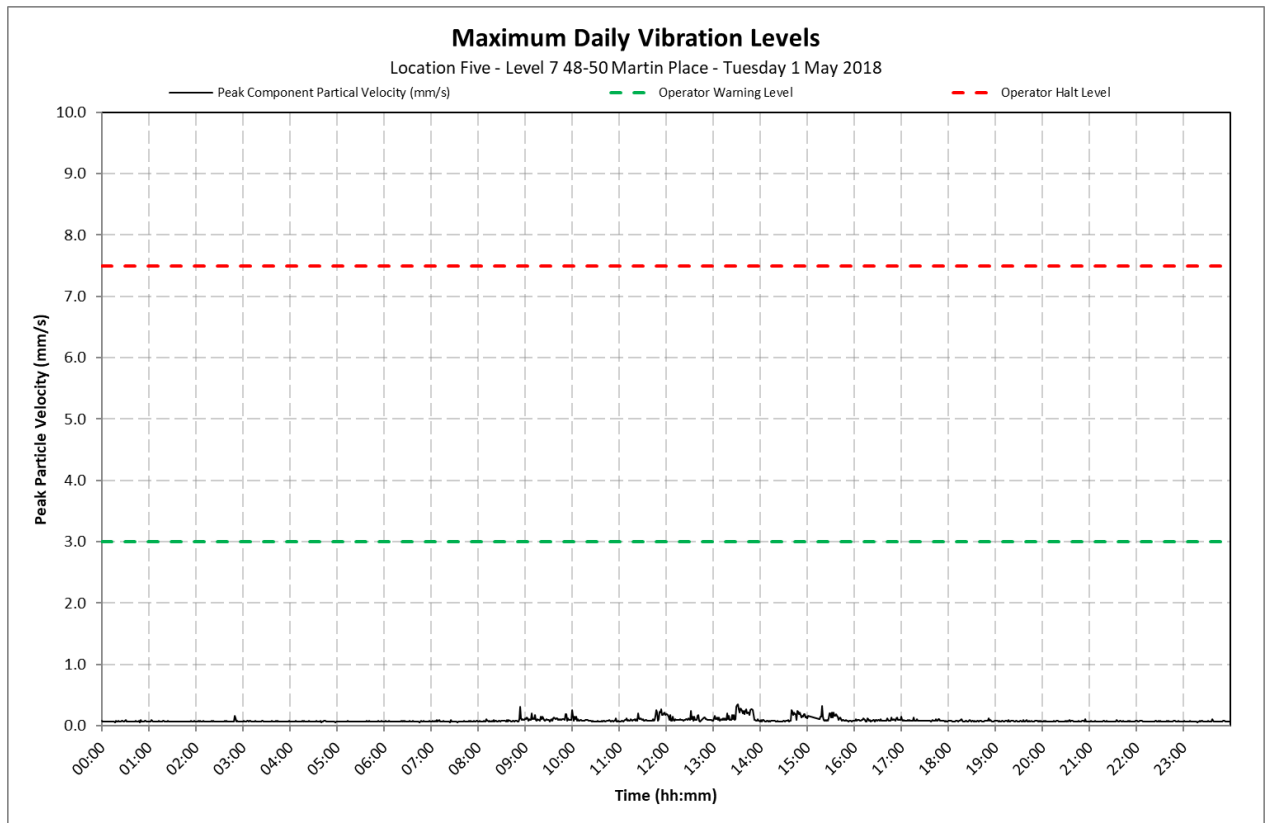
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

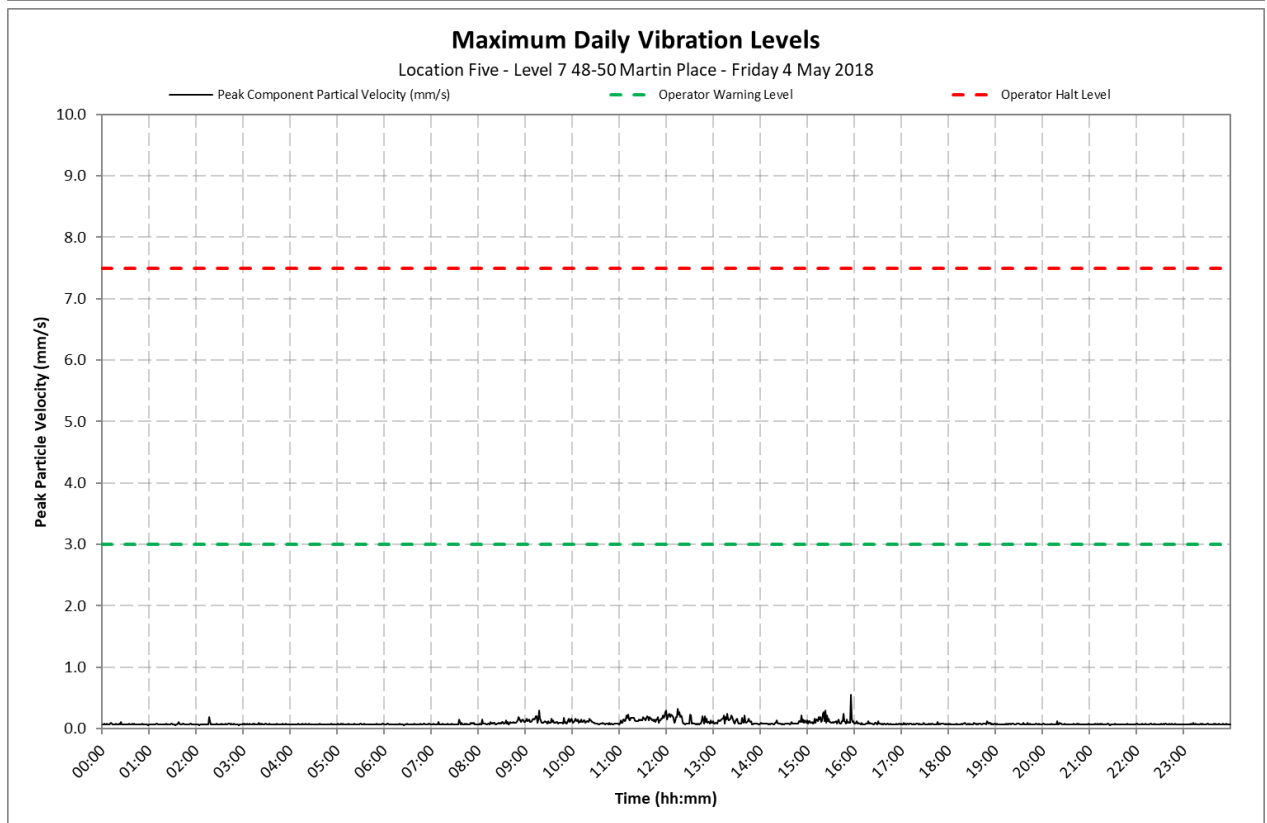
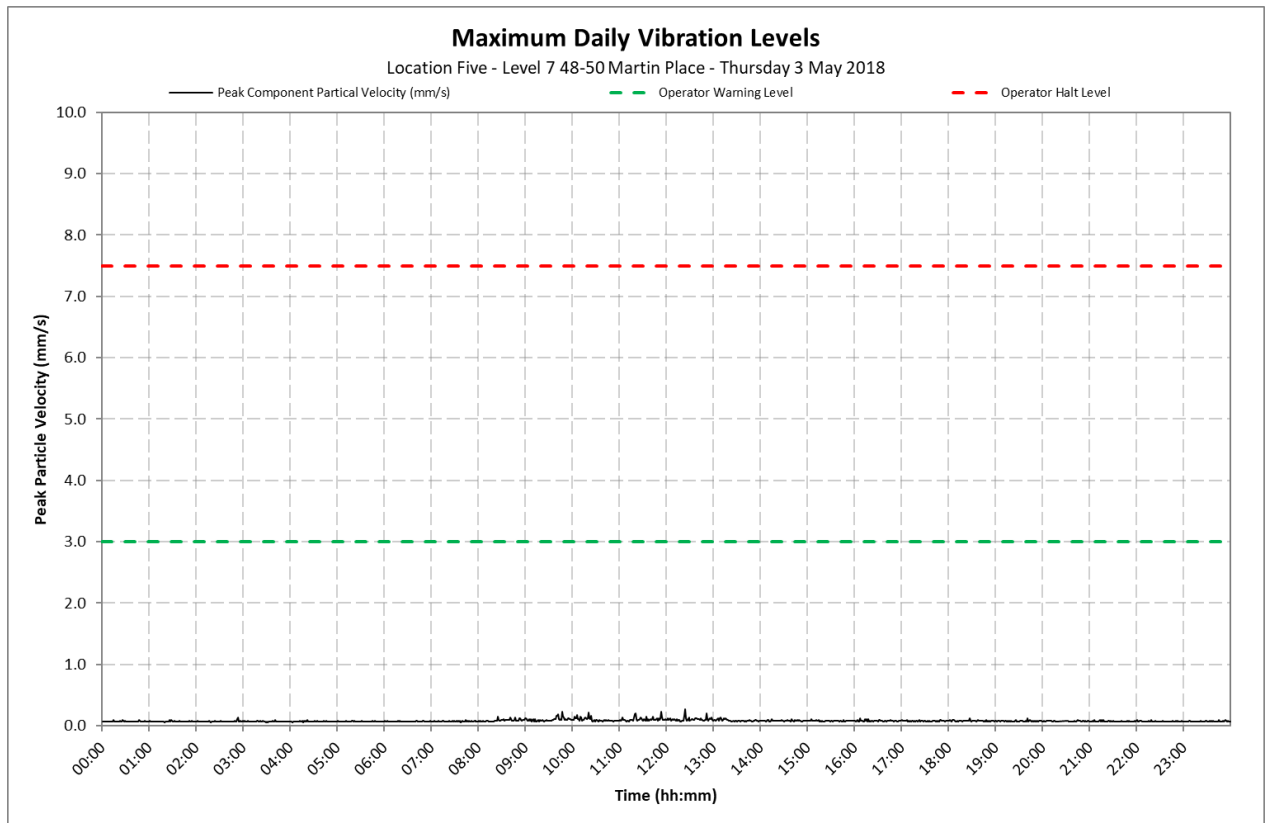
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

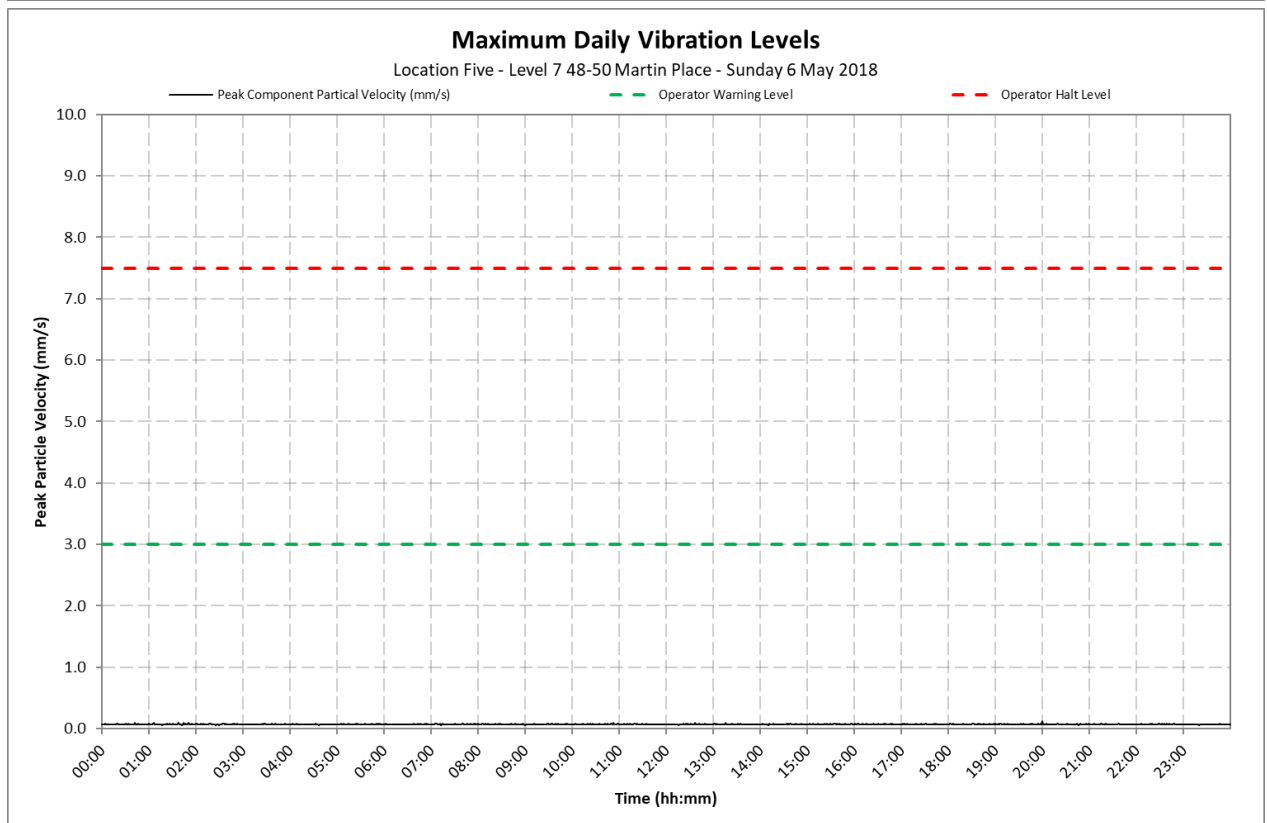
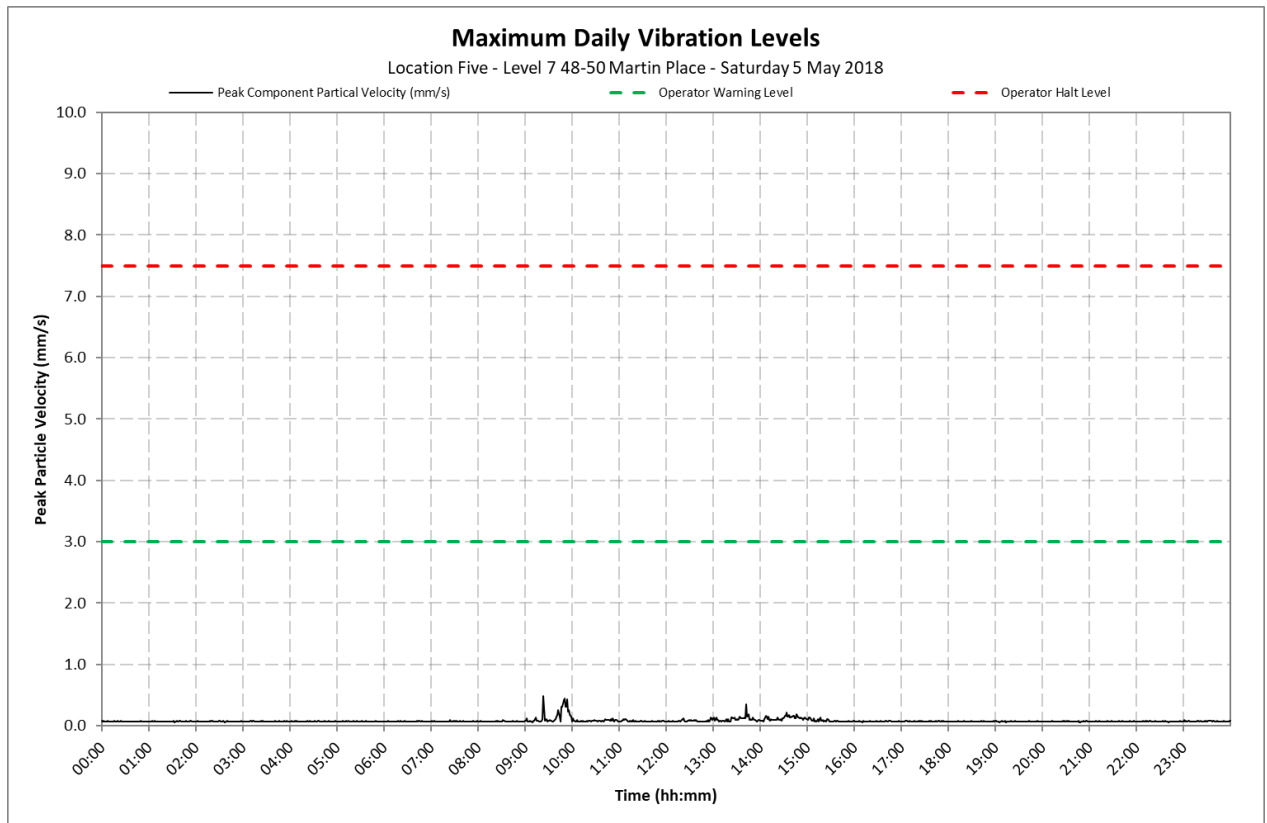
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

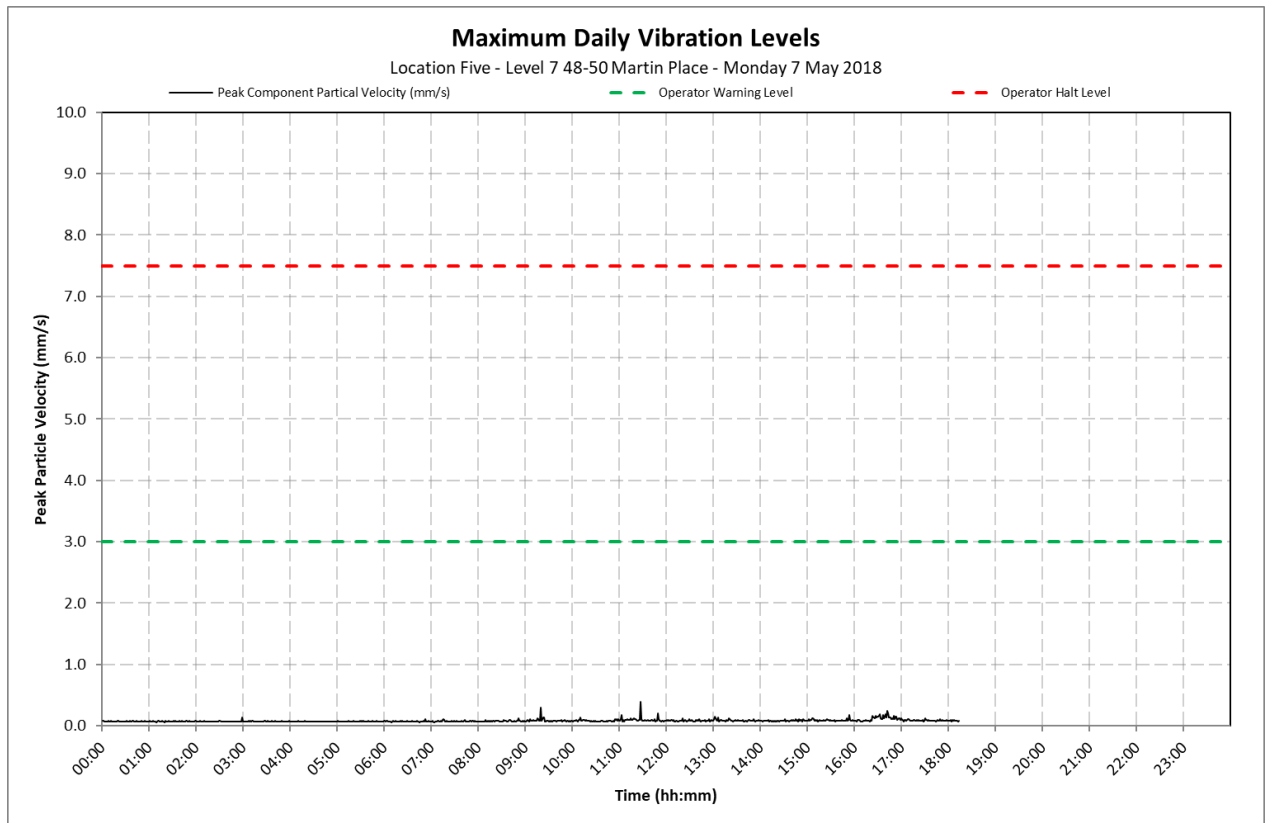
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place





16 May 2018

10-1380 R28 NV Monitoring 20180507.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 28
8 May to 14 May 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 8 May to 14 May 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

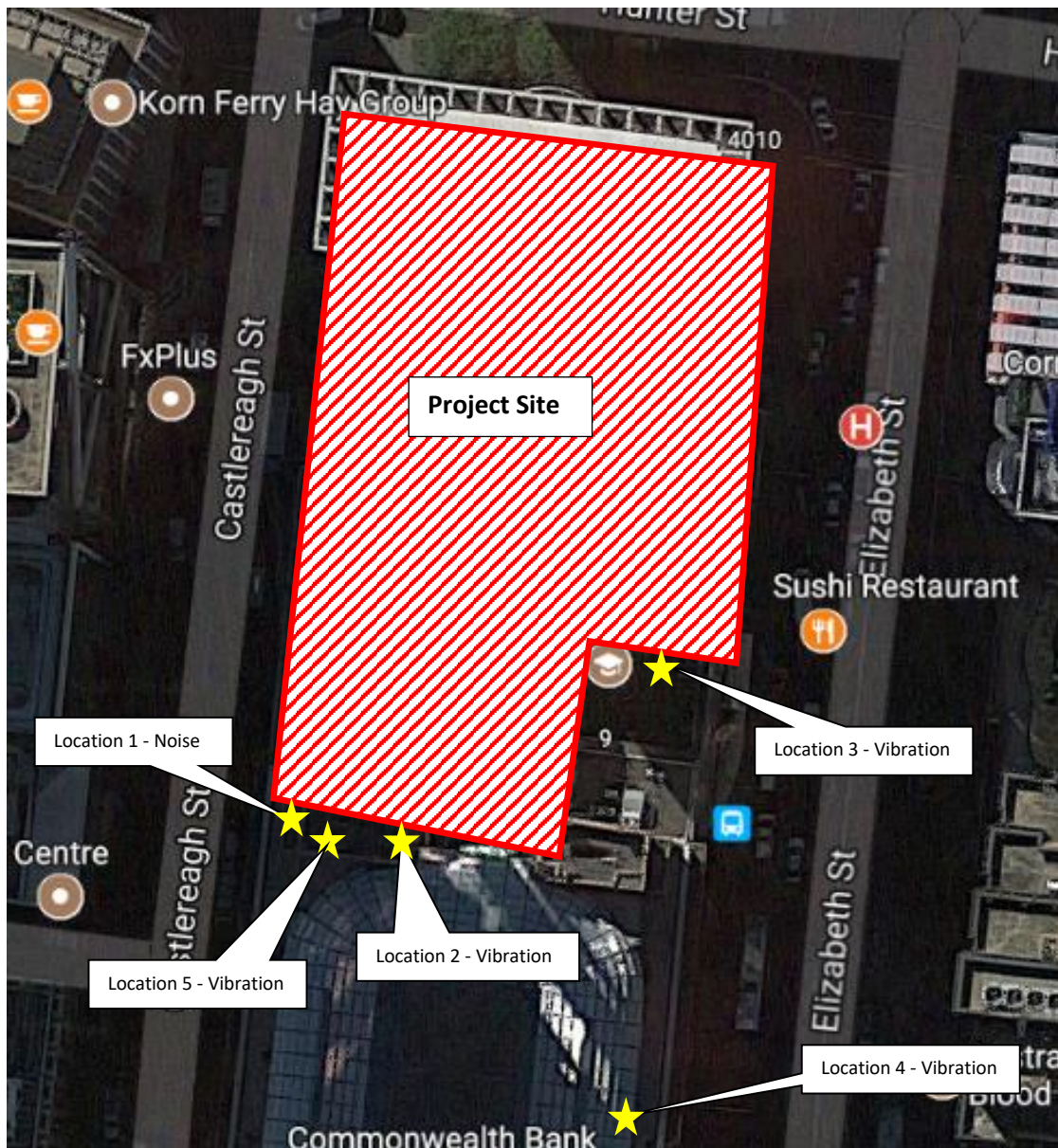
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 8 May to 14 May 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
8 May 2018	43	42	Complies	Complies
9 May 2018	46	44	Complies	Complies
10 May 2018	46	44	Complies	Complies
11 May 2018	42	40	Complies	Complies
12 May 2018	41	39	Complies	Complies
13 May 2018	39	37	Complies	Complies
14 May 2018	38	36	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 8 May to 14 May 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
8 May 2018	0.5 mm/s	Complies
9 May 2018	0.7 mm/s	Complies
10 May 2018	0.6 mm/s	Complies
11 May 2018	0.6 mm/s	Complies
12 May 2018	0.7 mm/s	Complies
13 May 2018	0.5 mm/s	Complies
14 May 2018	0.3 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
8 May 2018	0.4 mm/s	Complies
9 May 2018	0.2 mm/s	Complies
10 May 2018	0.4 mm/s	Complies
11 May 2018	0.5 mm/s	Complies
12 May 2018	0.3 mm/s	Complies
13 May 2018	0.3 mm/s	Complies
14 May 2018	0.3 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 8 May to 14 May 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 8 May to 14 May 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

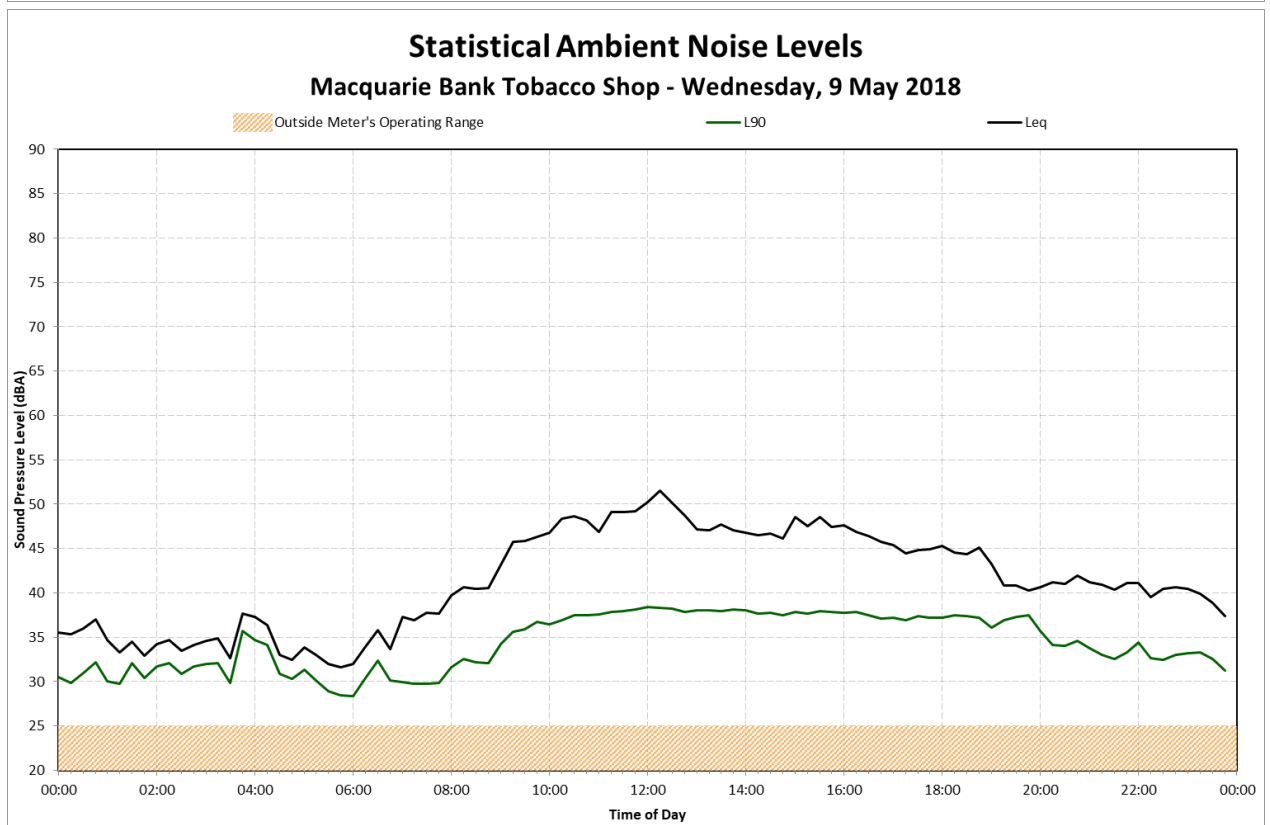
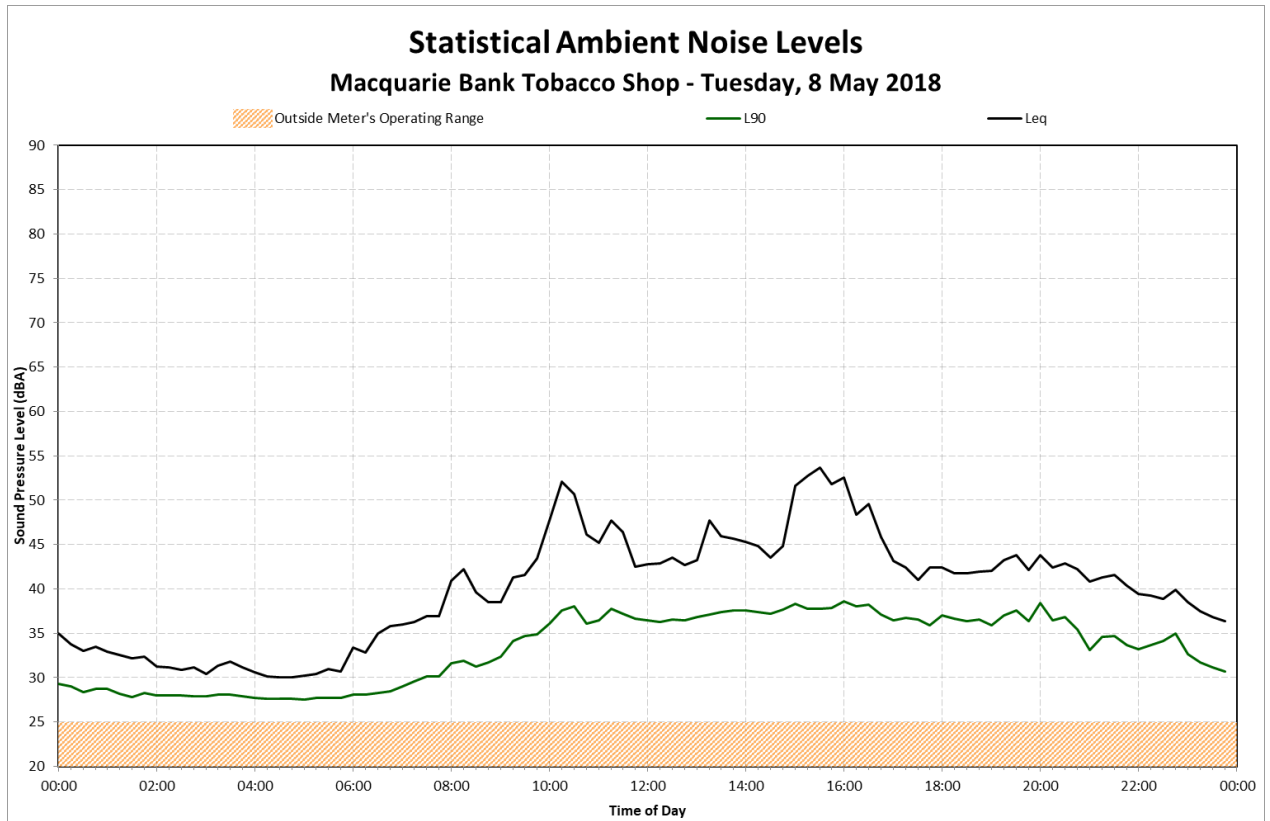
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

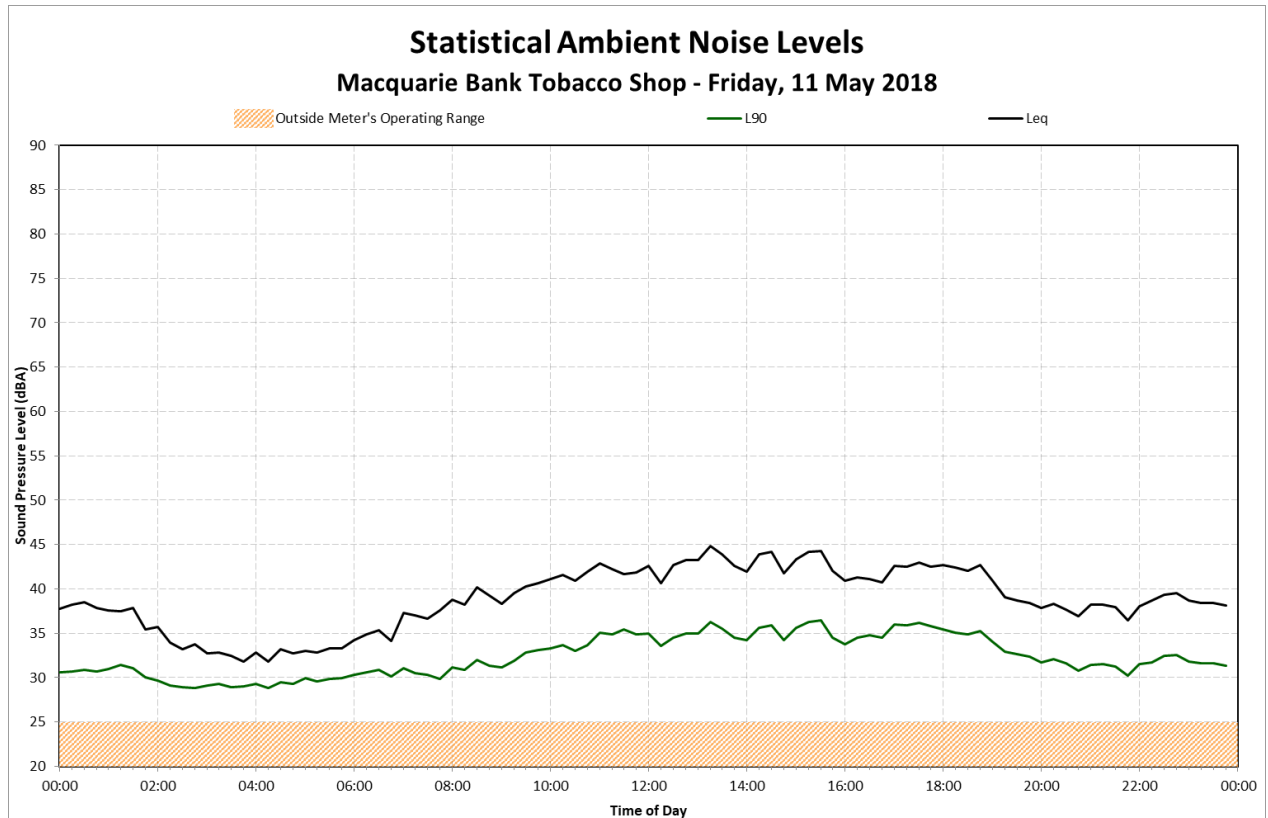
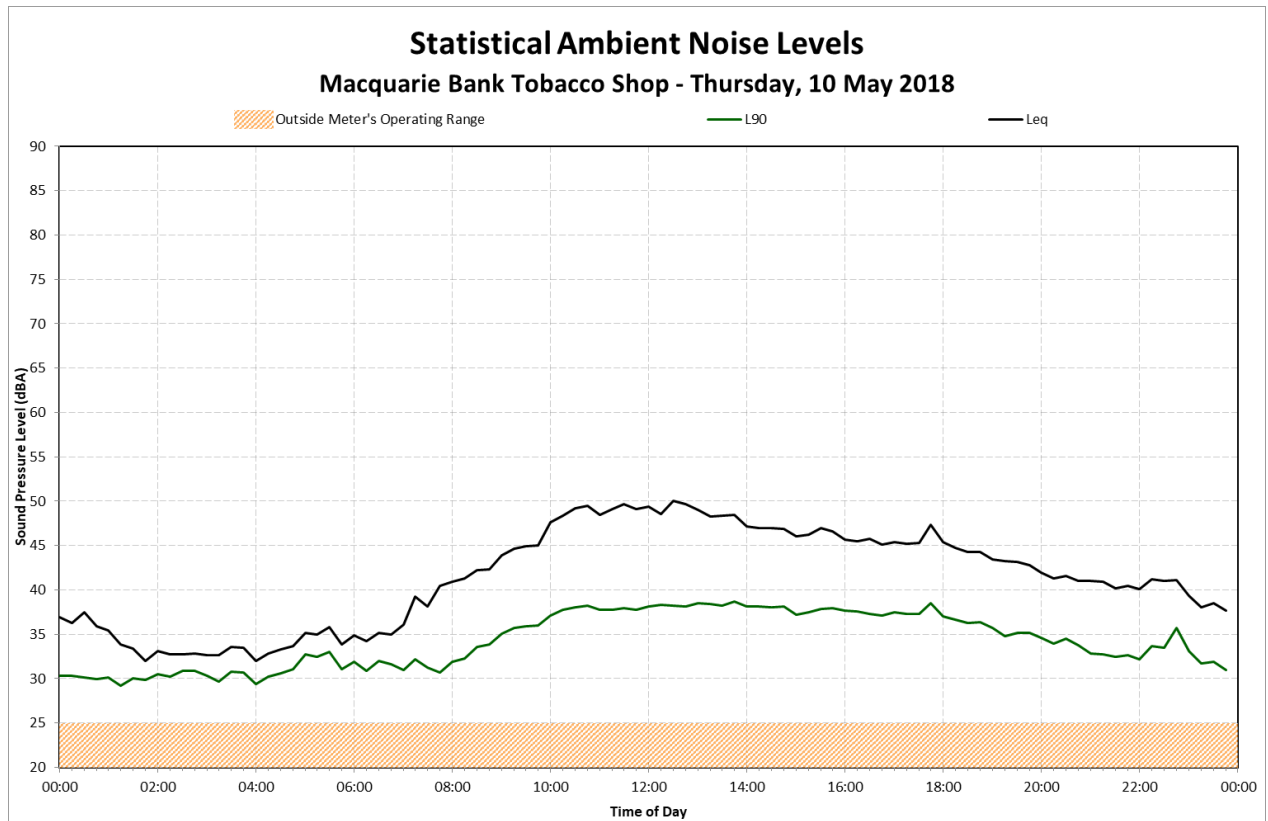
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

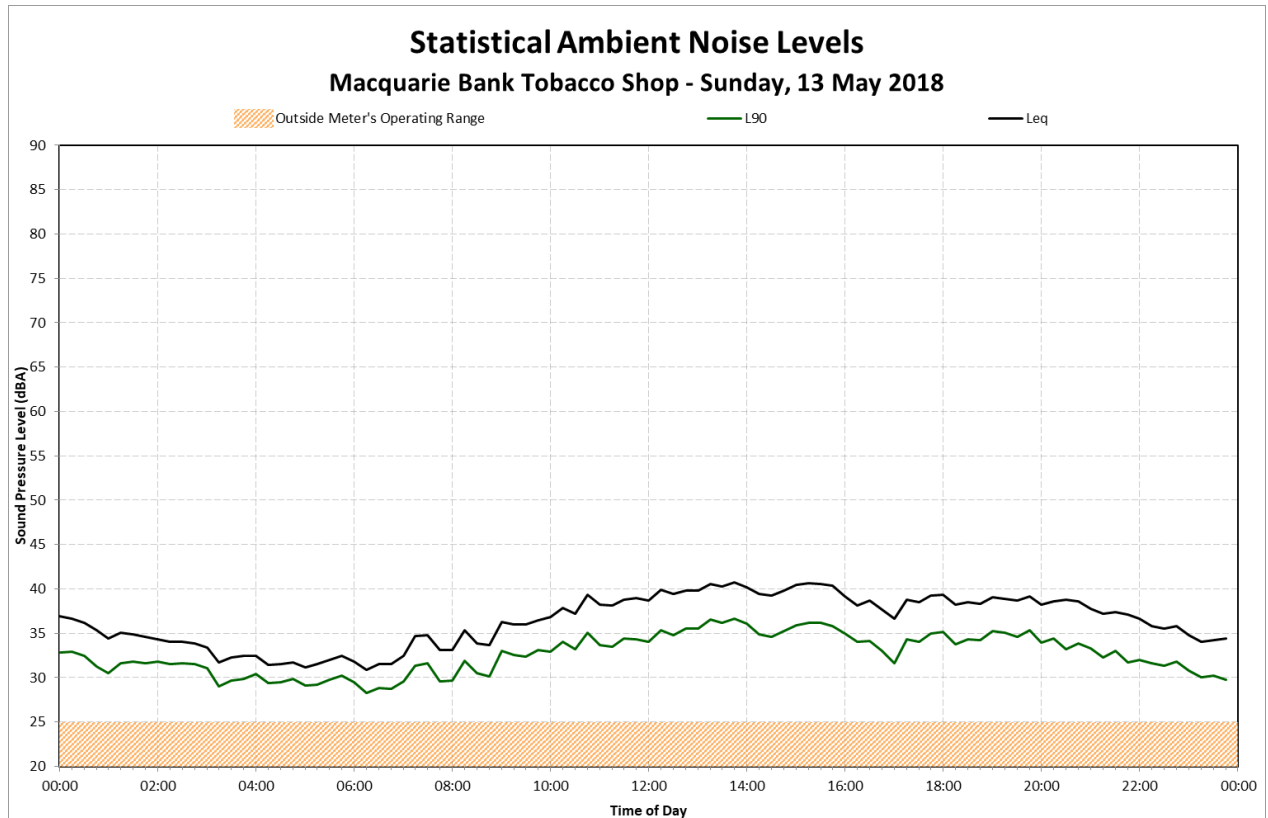
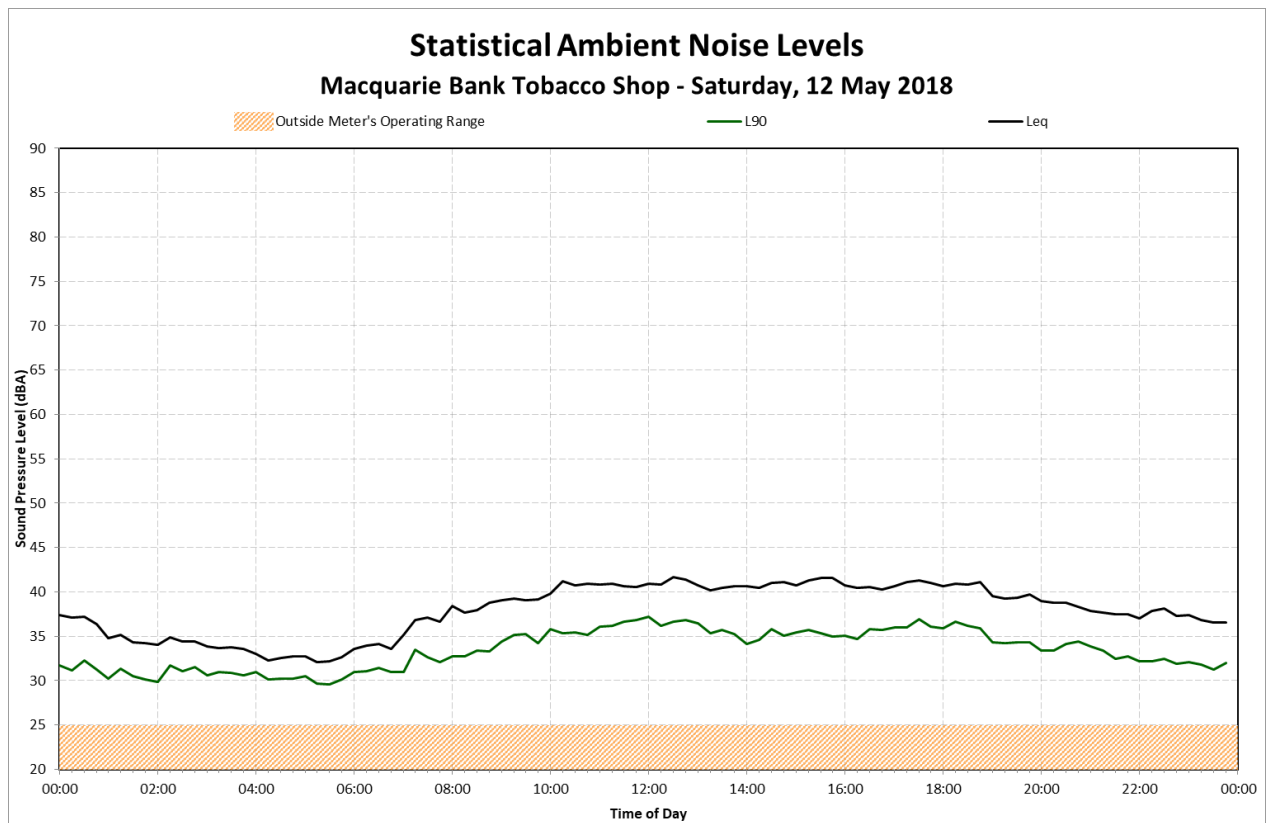
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

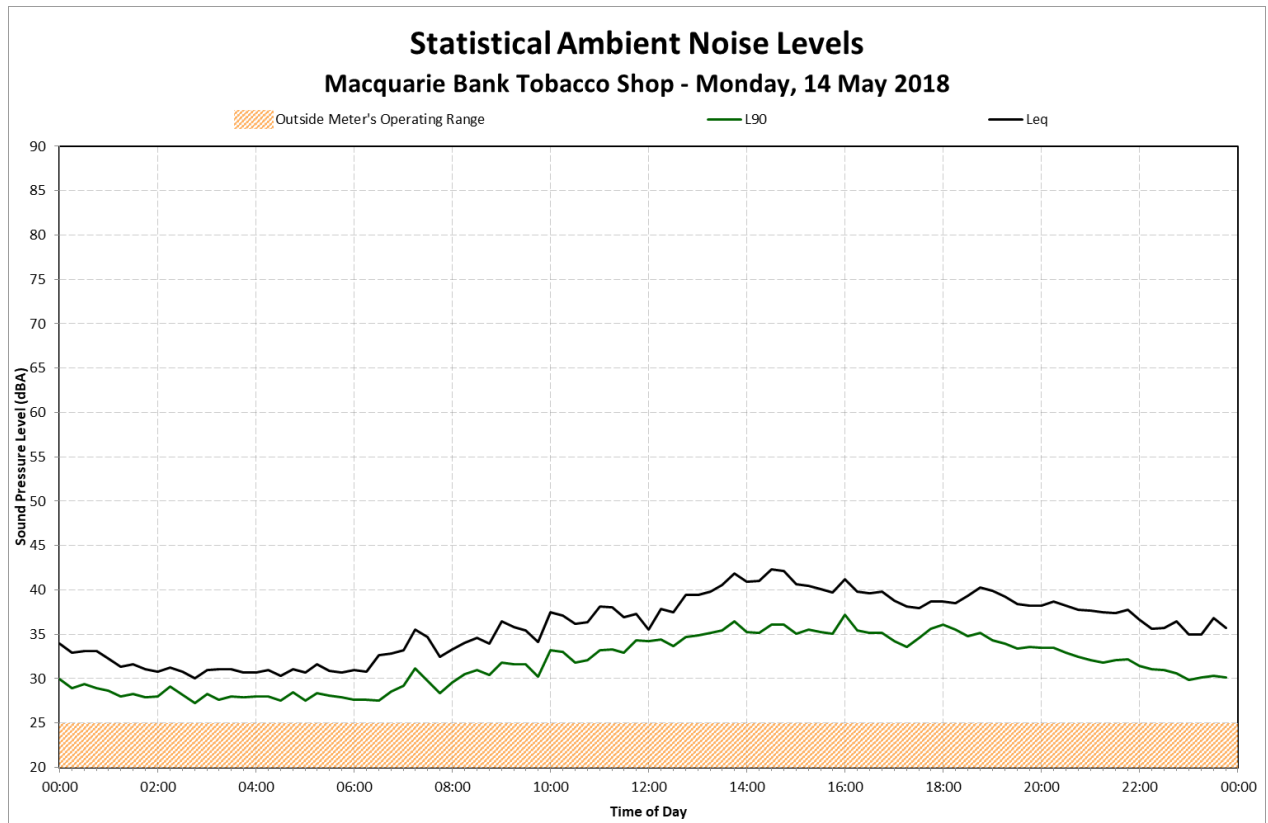
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

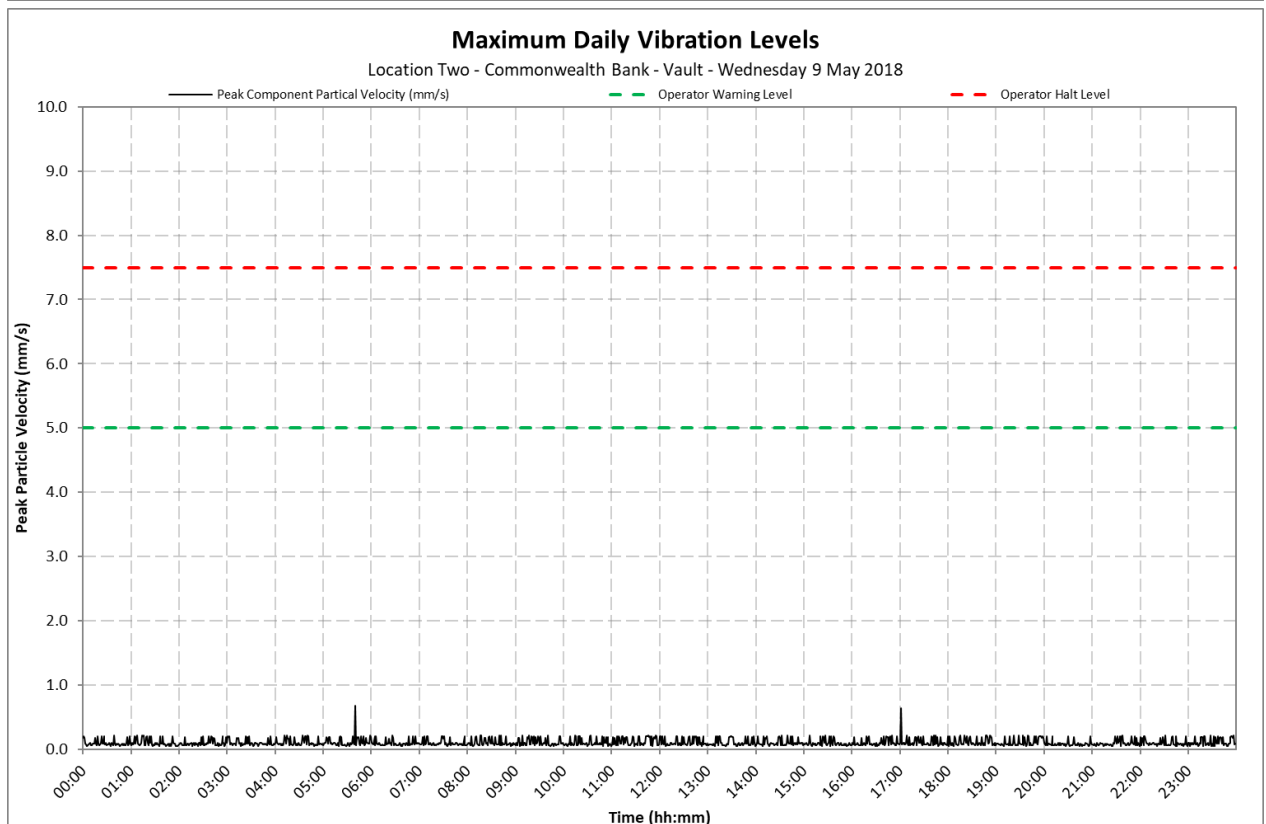
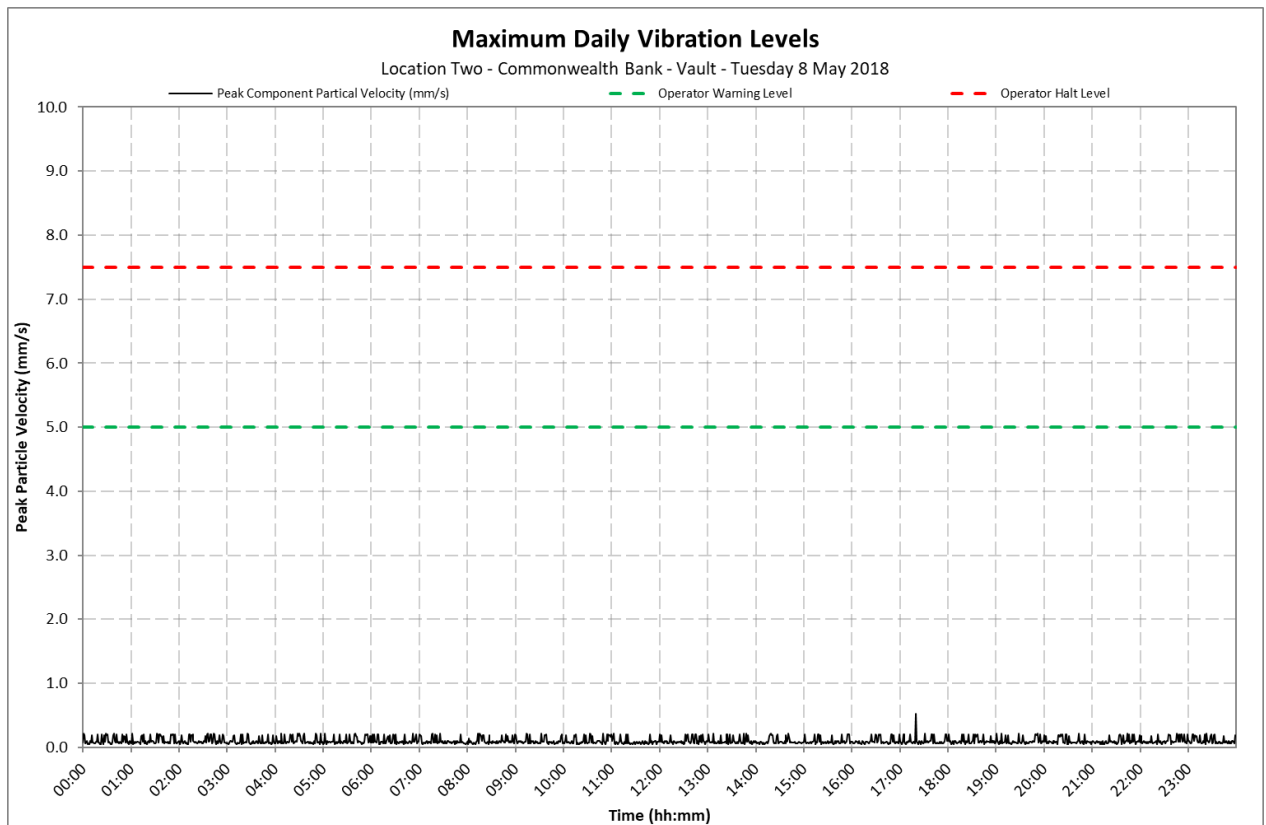
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

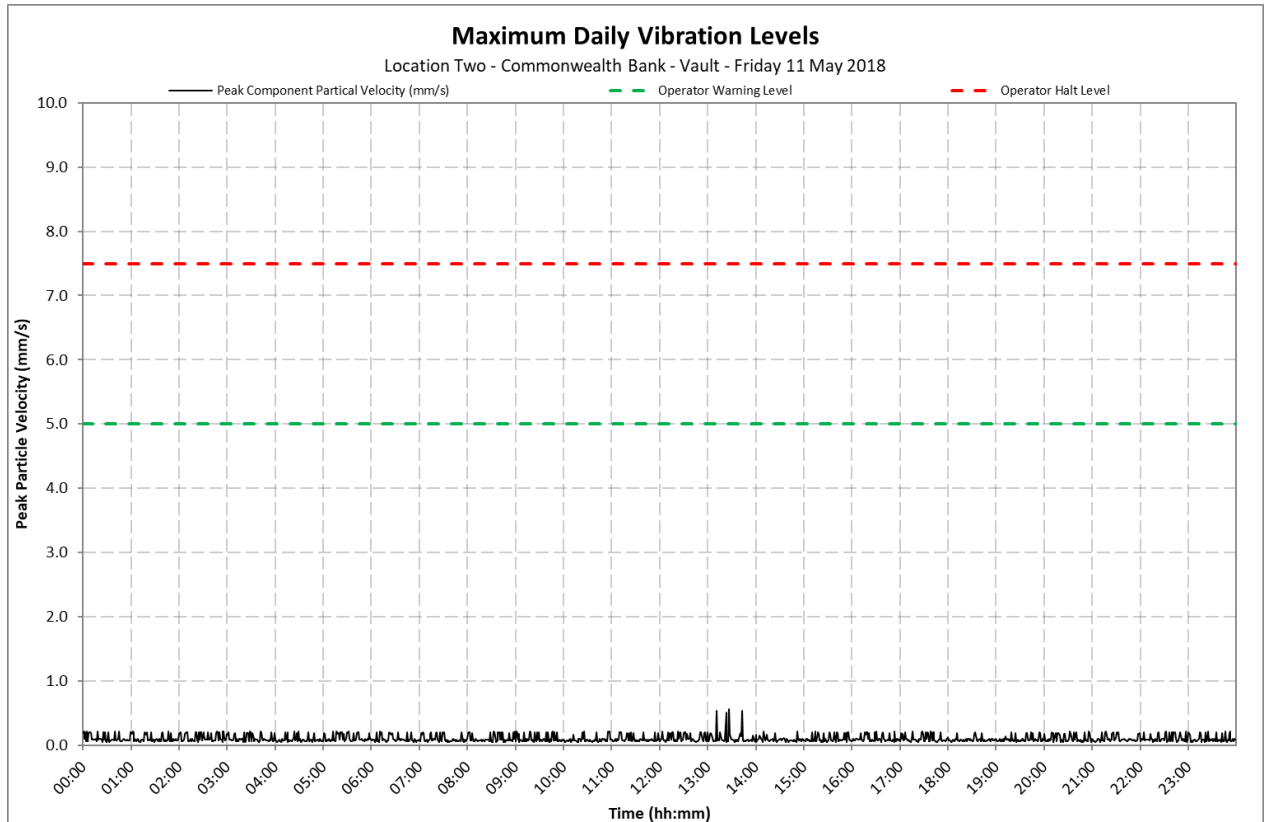
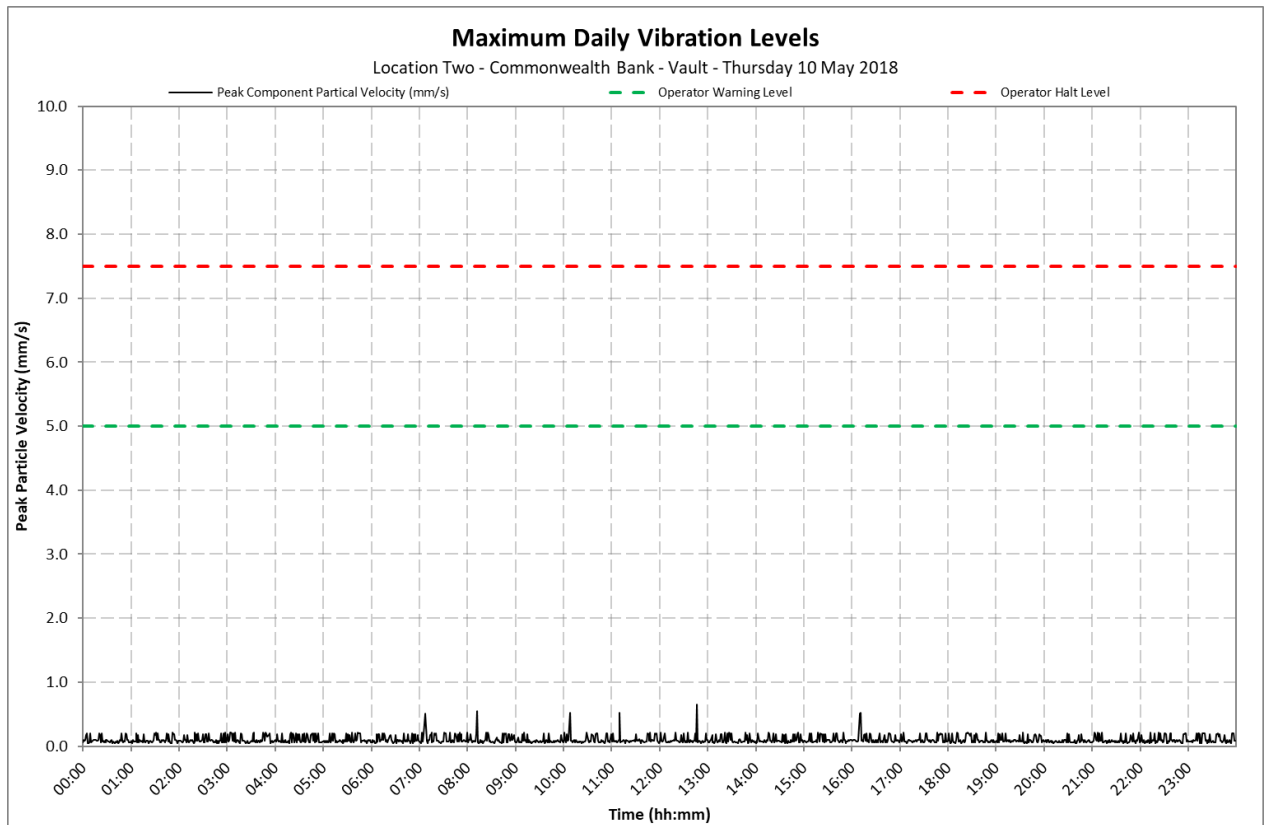
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

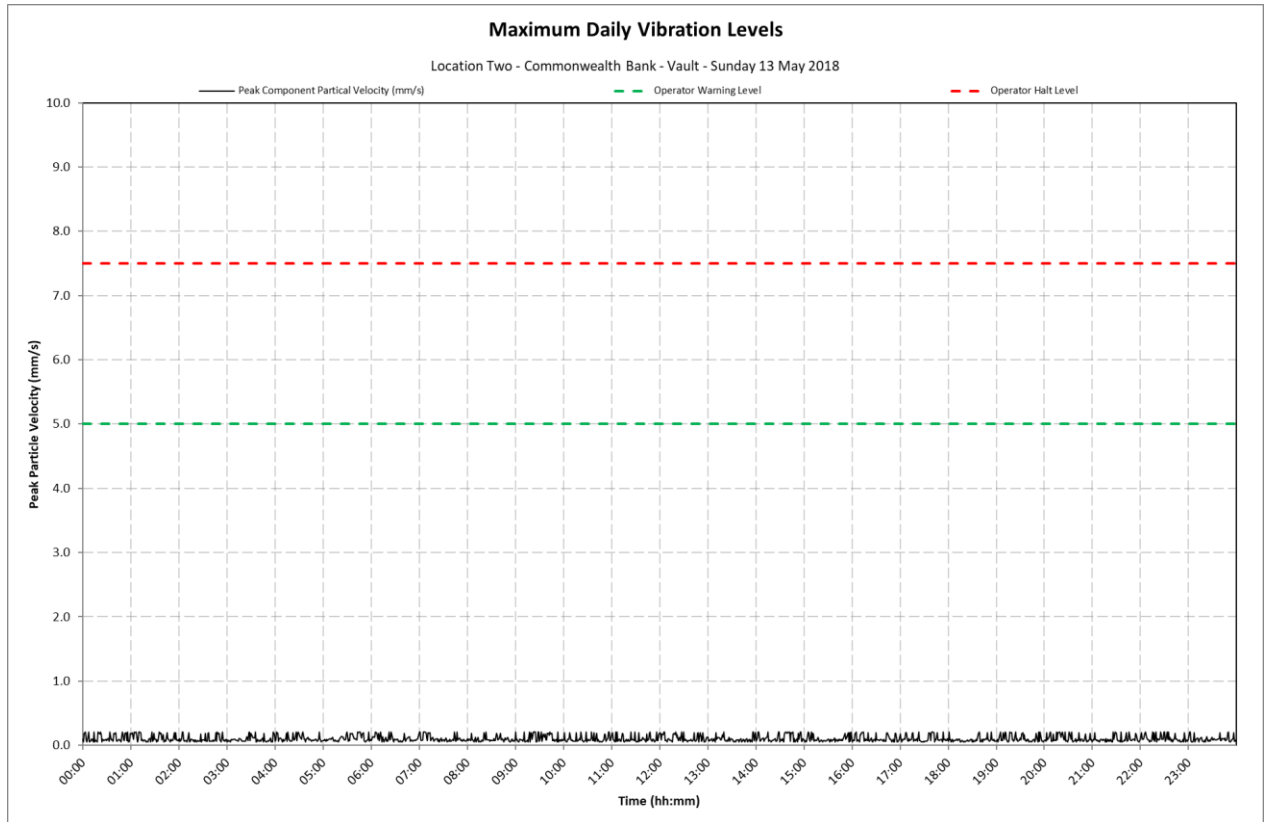
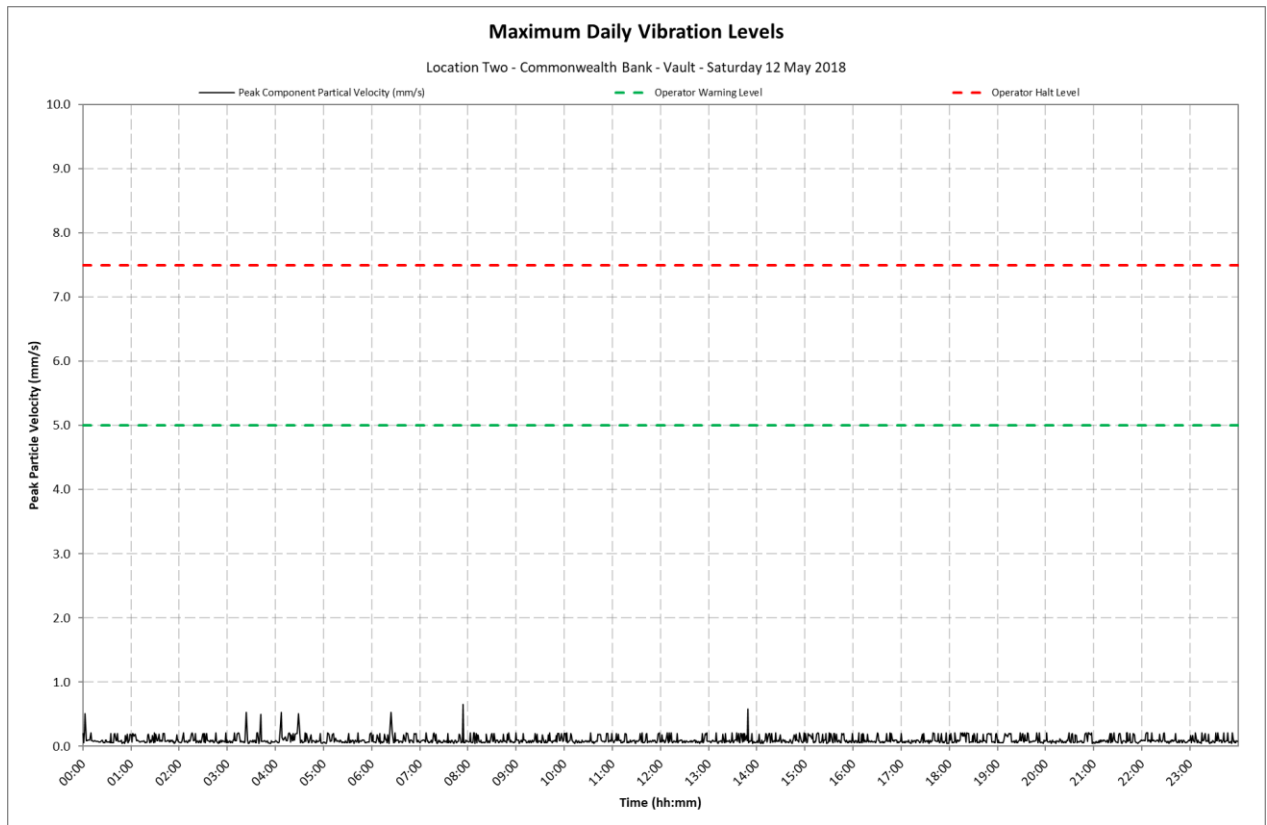
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

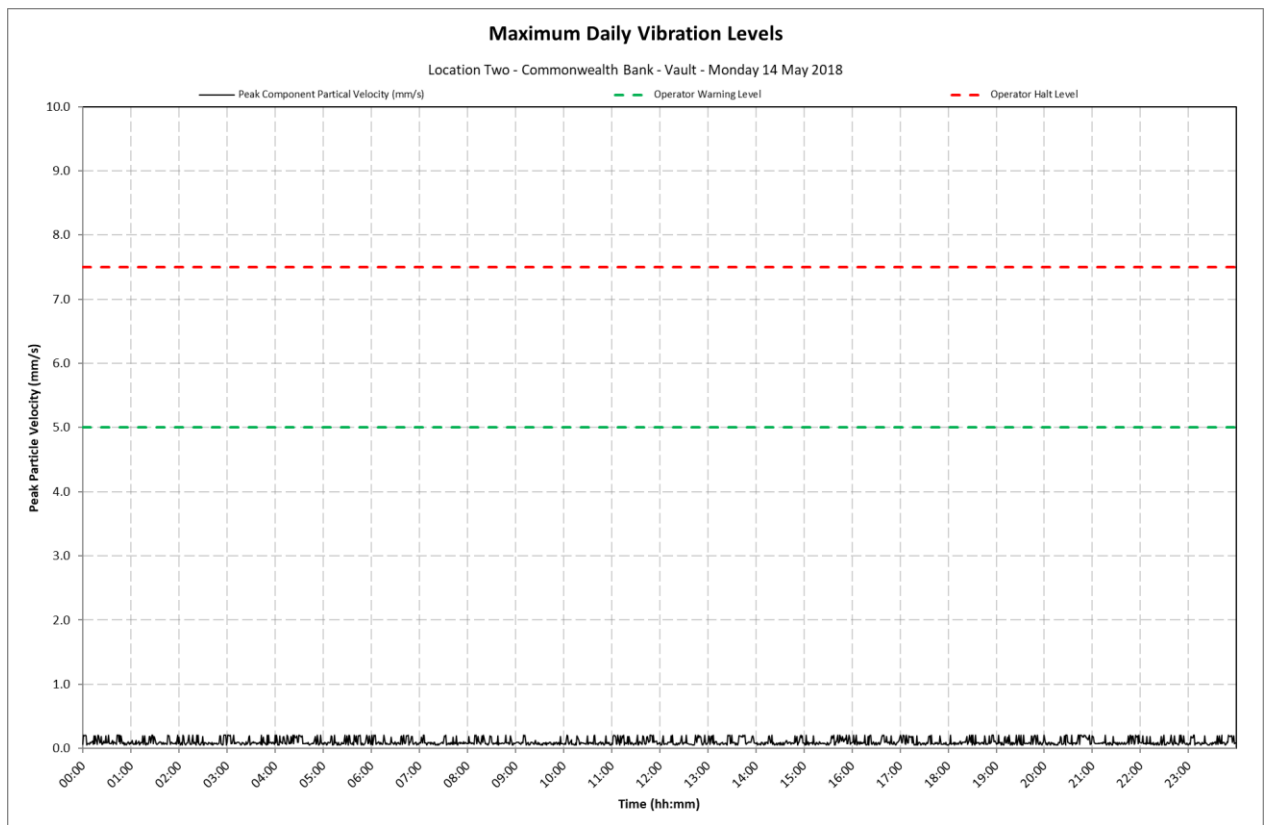
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

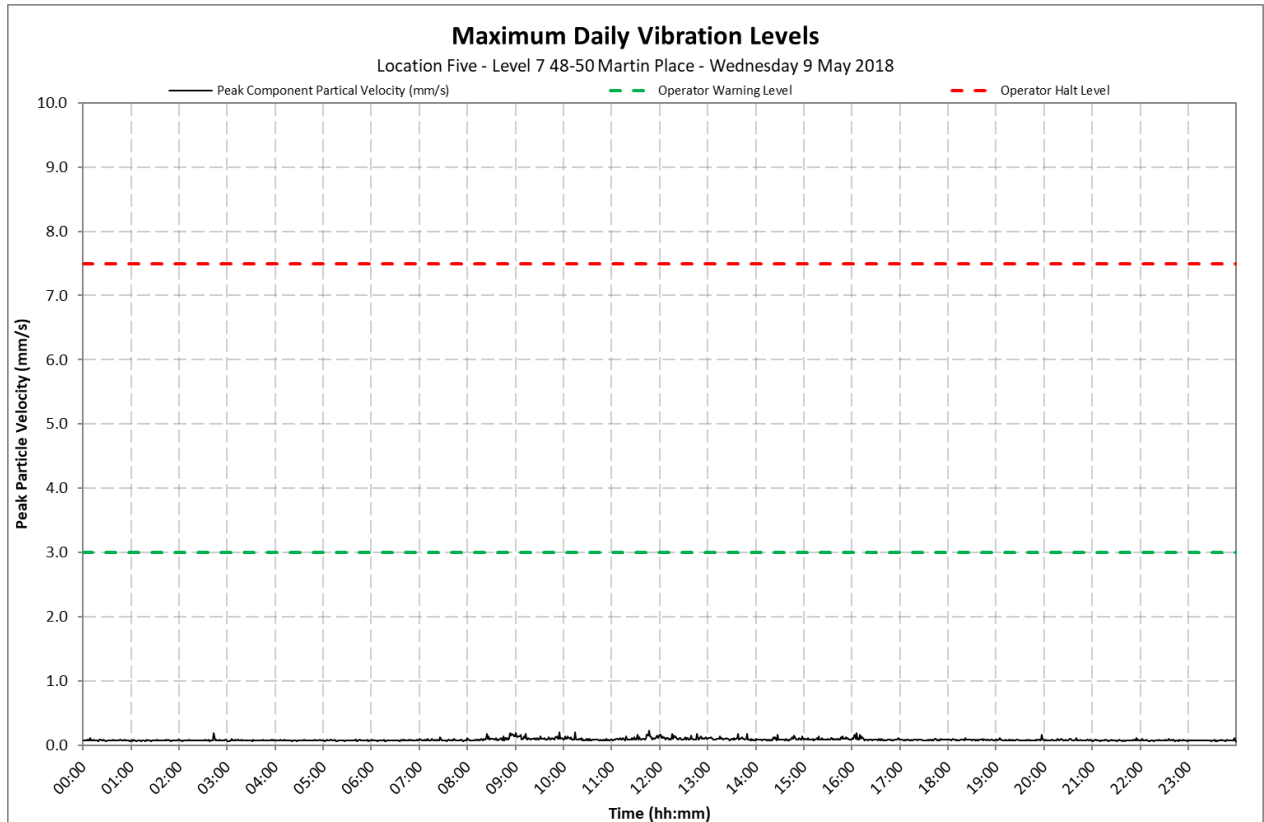
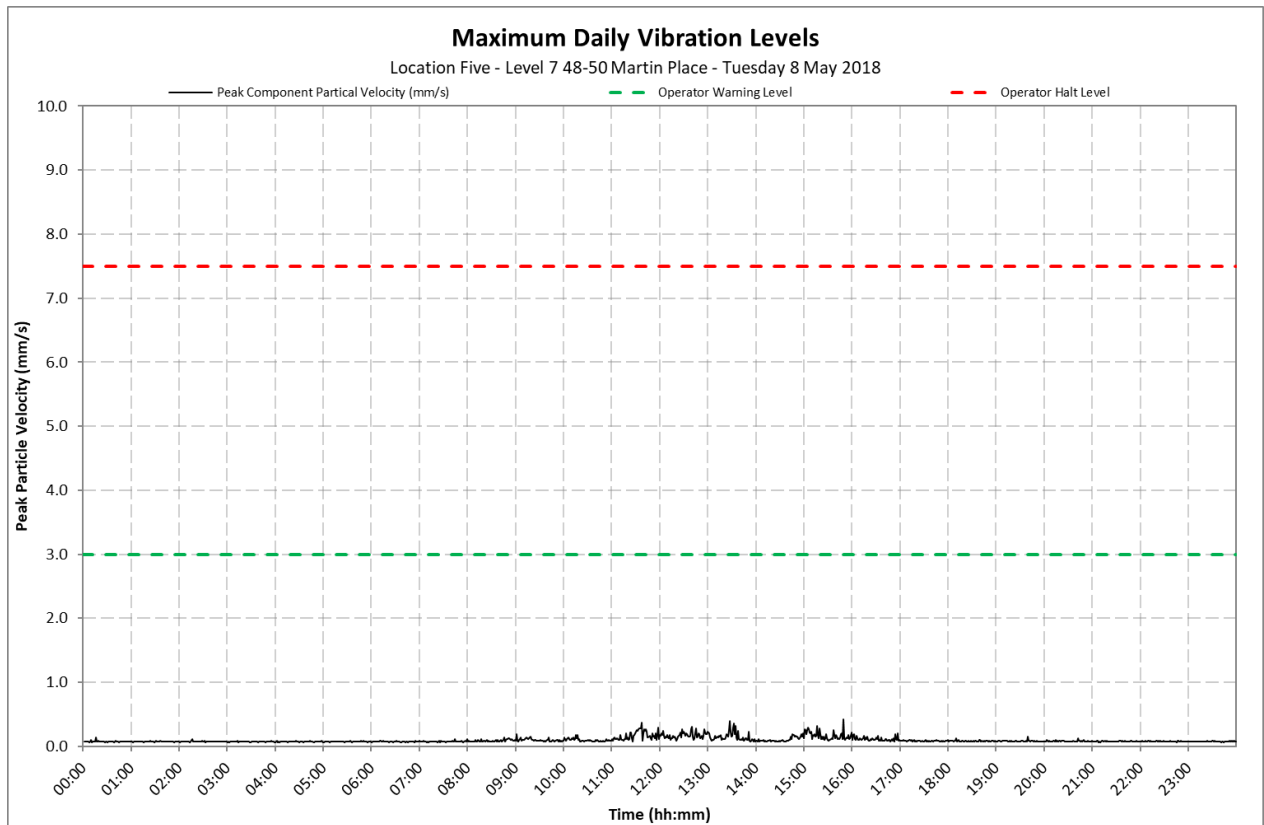
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

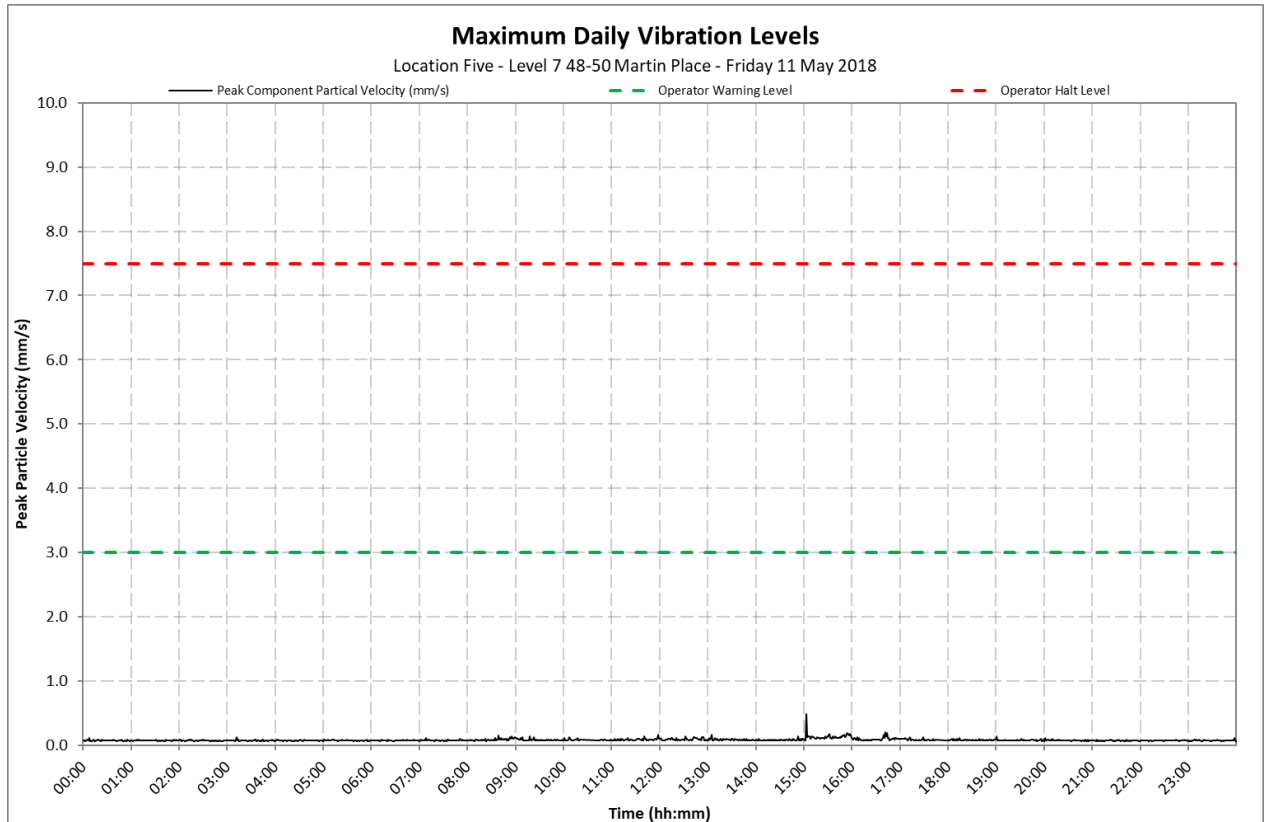
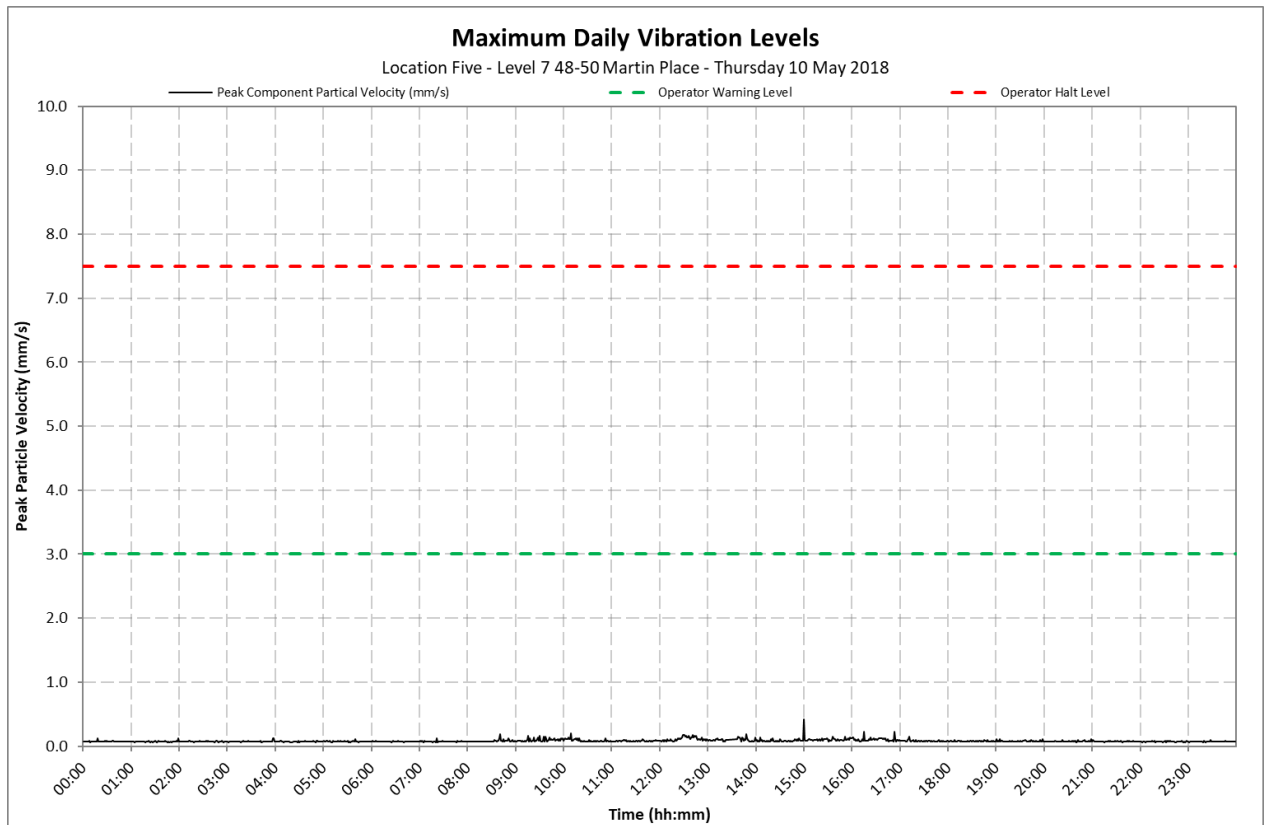
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

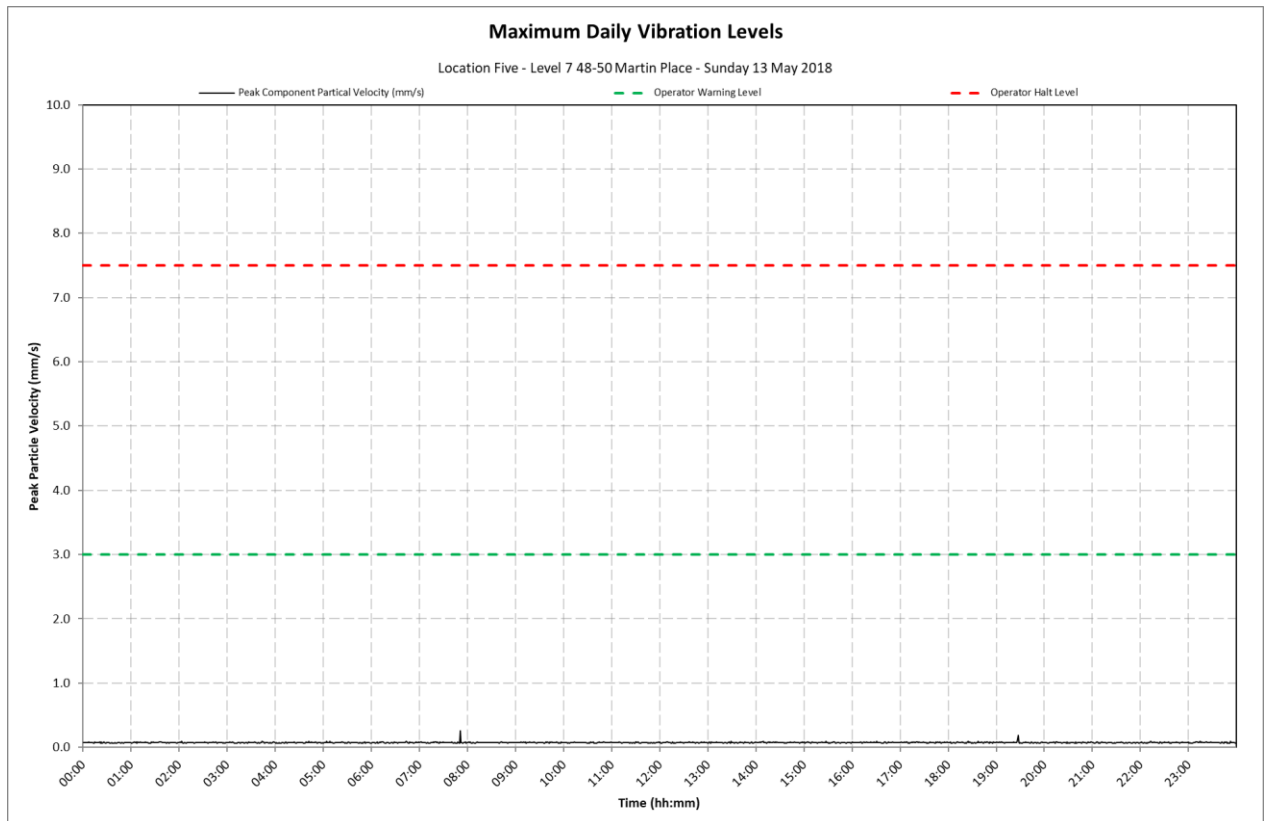
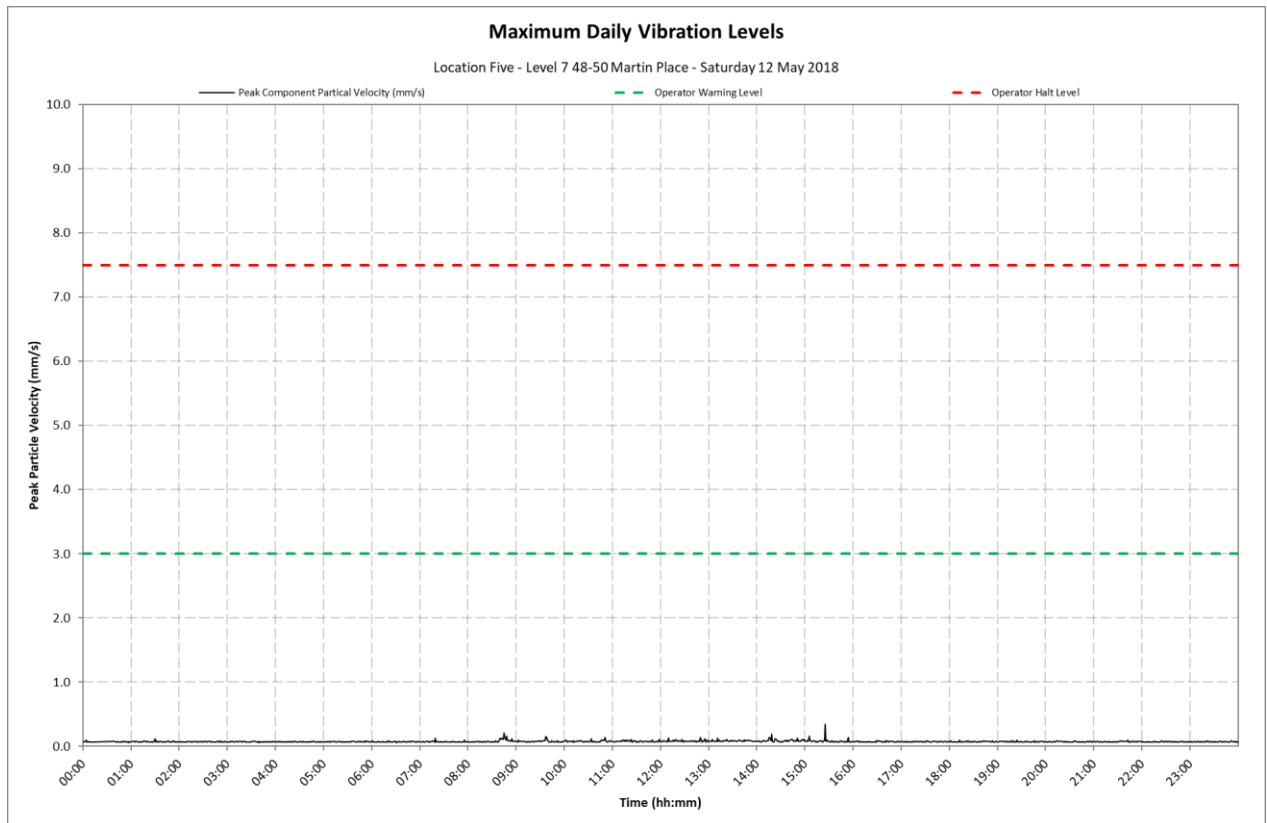
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

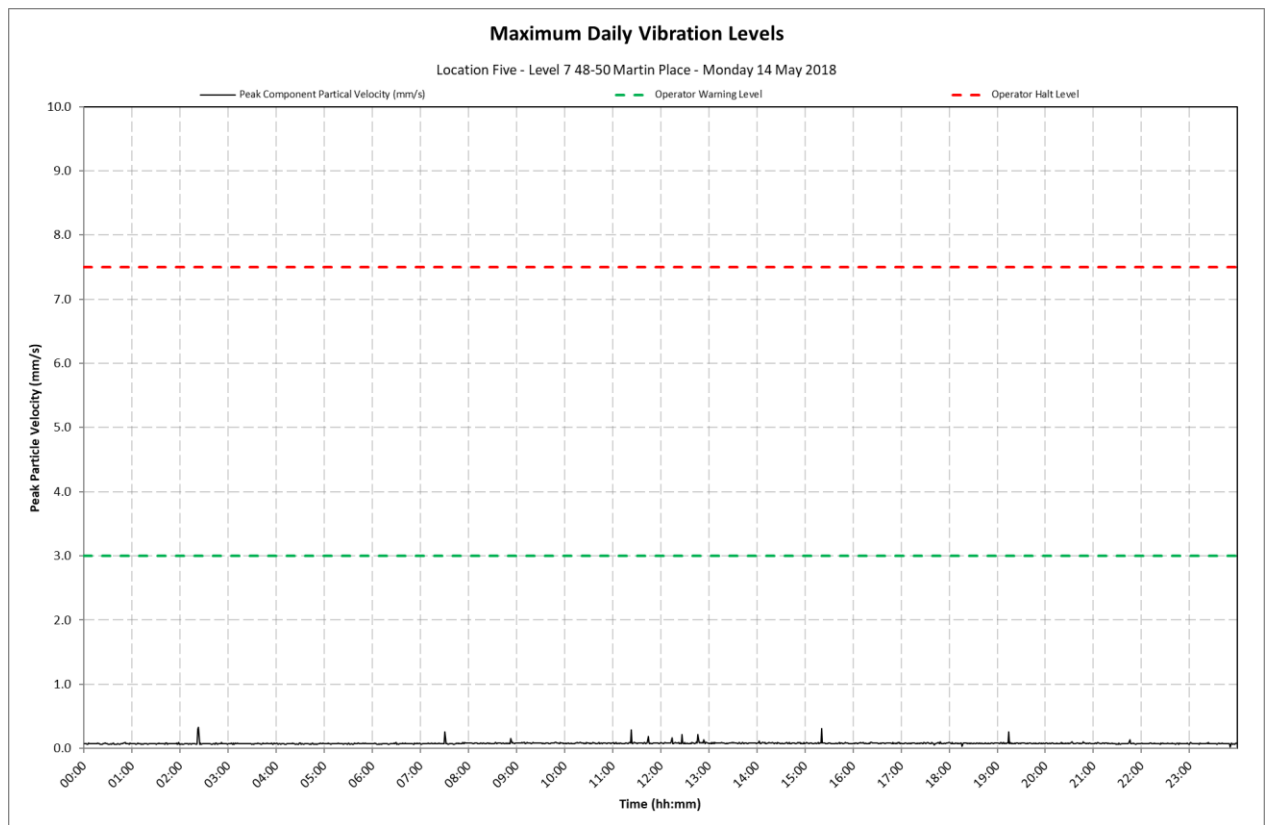
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



22 May 2018

10-1380 R29 NV Monitoring 20180522.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 29
15 May to 22 May 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 15 May to 22 May 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

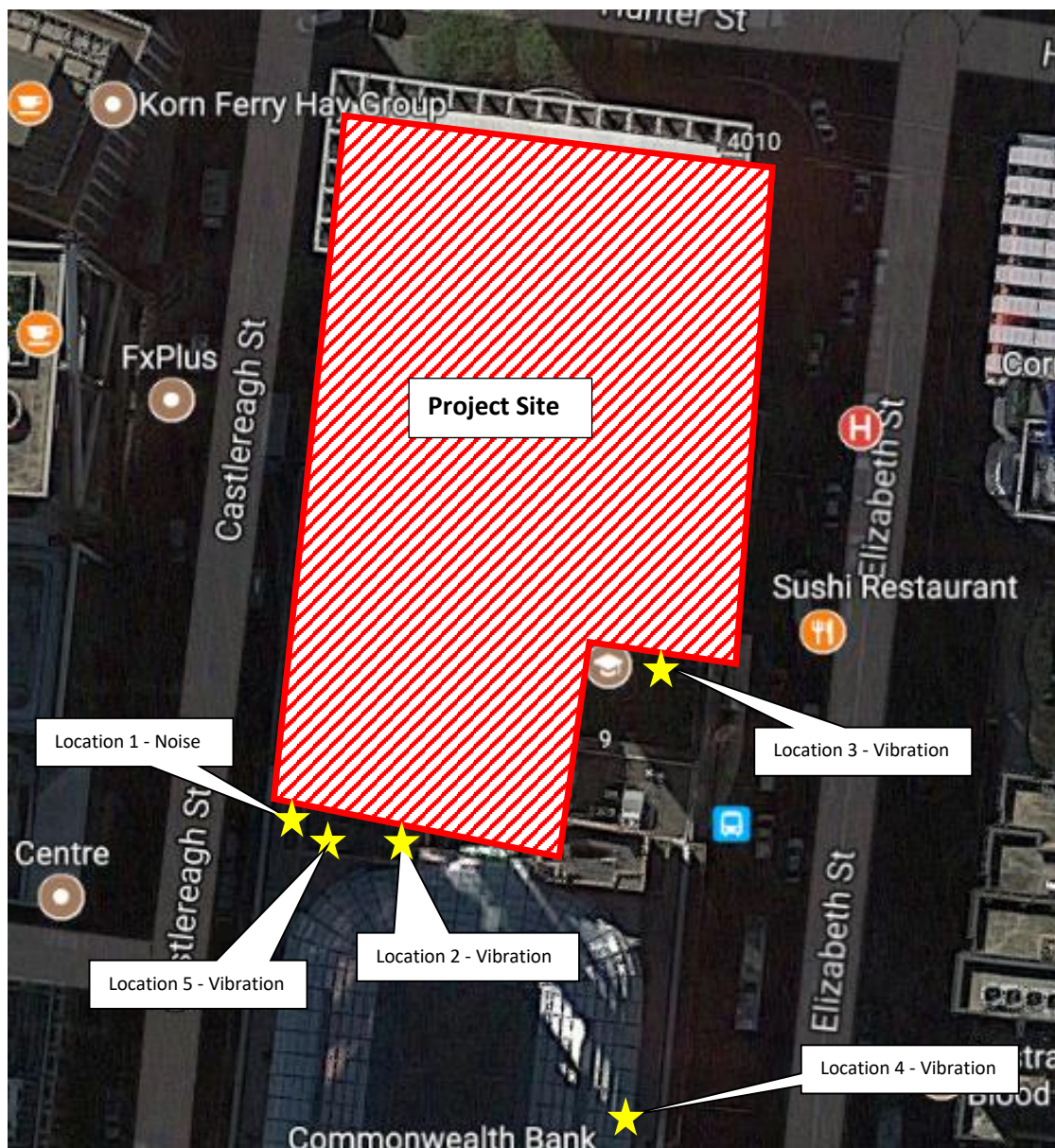
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 15 May to 22 May 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
15 May 2018	44	42	Complies	Complies
16 May 2018	46	44	Complies	Complies
17 May 2018	45	43	Complies	Complies
18 May 2018	41	40	Complies	Complies
19 May 2018	41	40	Complies	Complies
20 May 2018	38	37	Complies	Complies
21 May 2018	39	37	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 15 May to 22 May 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
15 May 2018	0.3 mm/s	Complies
16 May 2018	0.5 mm/s	Complies
17 May 2018	0.4 mm/s	Complies
18 May 2018	0.3 mm/s	Complies
19 May 2018	0.5 mm/s	Complies
20 May 2018	0.4 mm/s	Complies
21 May 2018	0.3 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
15 May 2018	0.3 mm/s	Complies
16 May 2018	0.3 mm/s	Complies
17 May 2018	0.2 mm/s	Complies
18 May 2018	0.3 mm/s	Complies
19 May 2018	0.2 mm/s	Complies
20 May 2018	0.5 mm/s	Complies
21 May 2018	0.3 mm/s	Complies

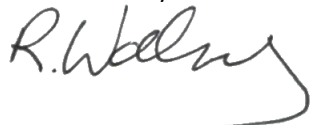
5 Conclusion

Noise monitoring conducted during the period 15 May to 22 May 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 15 May to 22 May 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

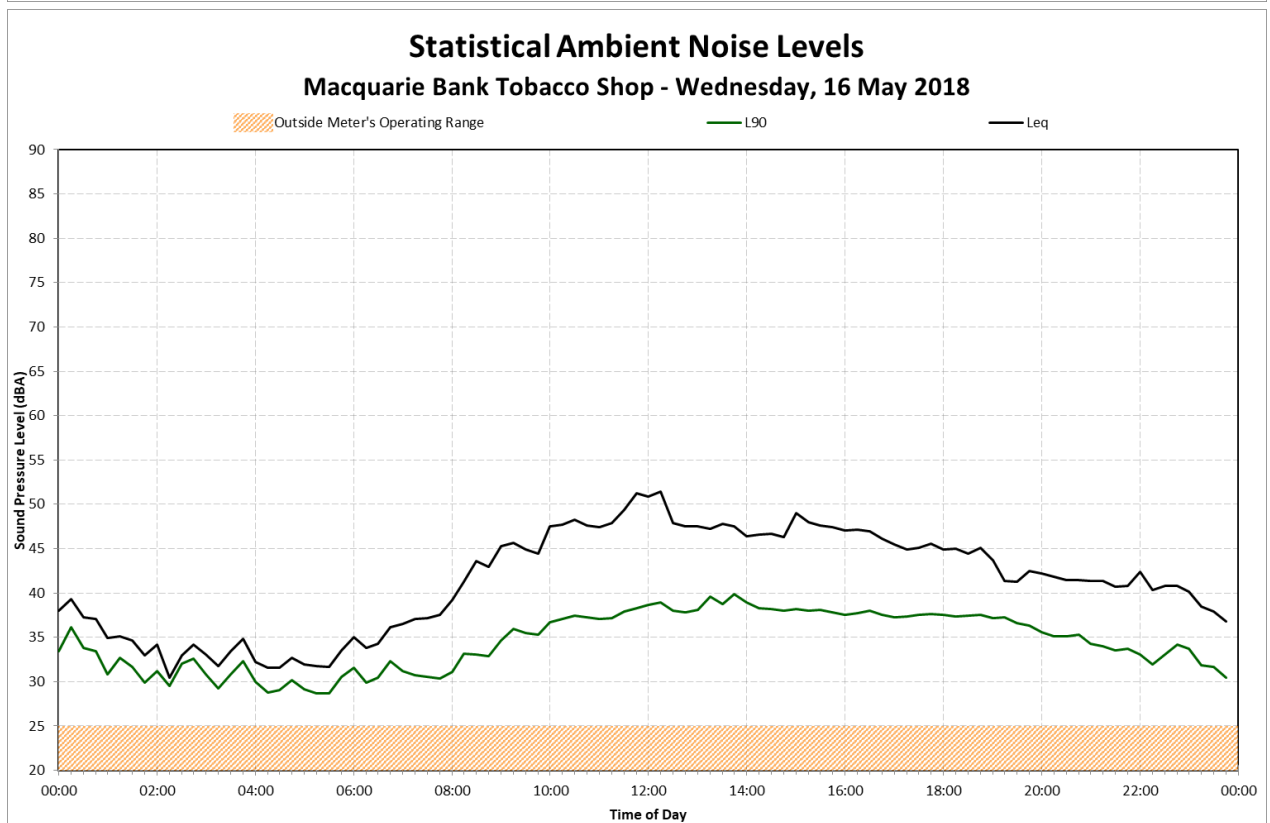
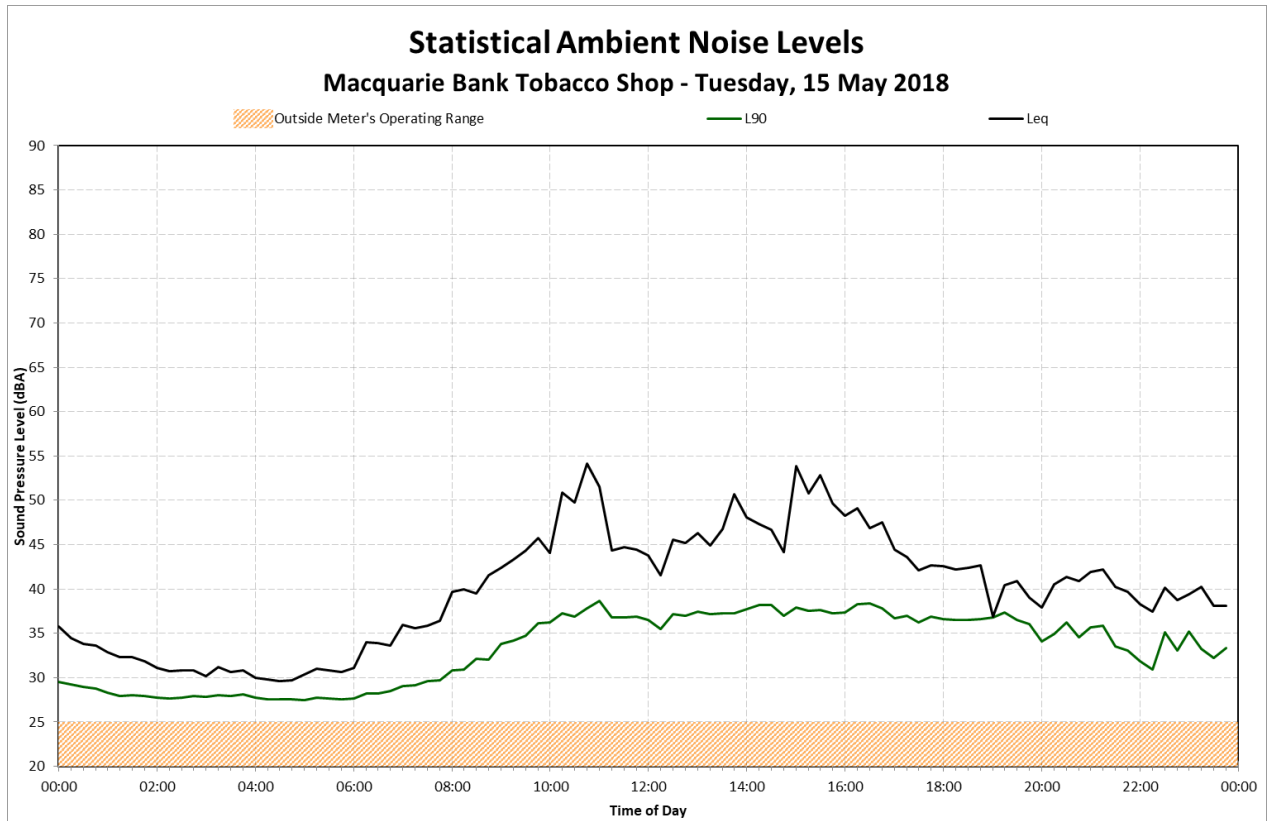
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
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Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
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PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

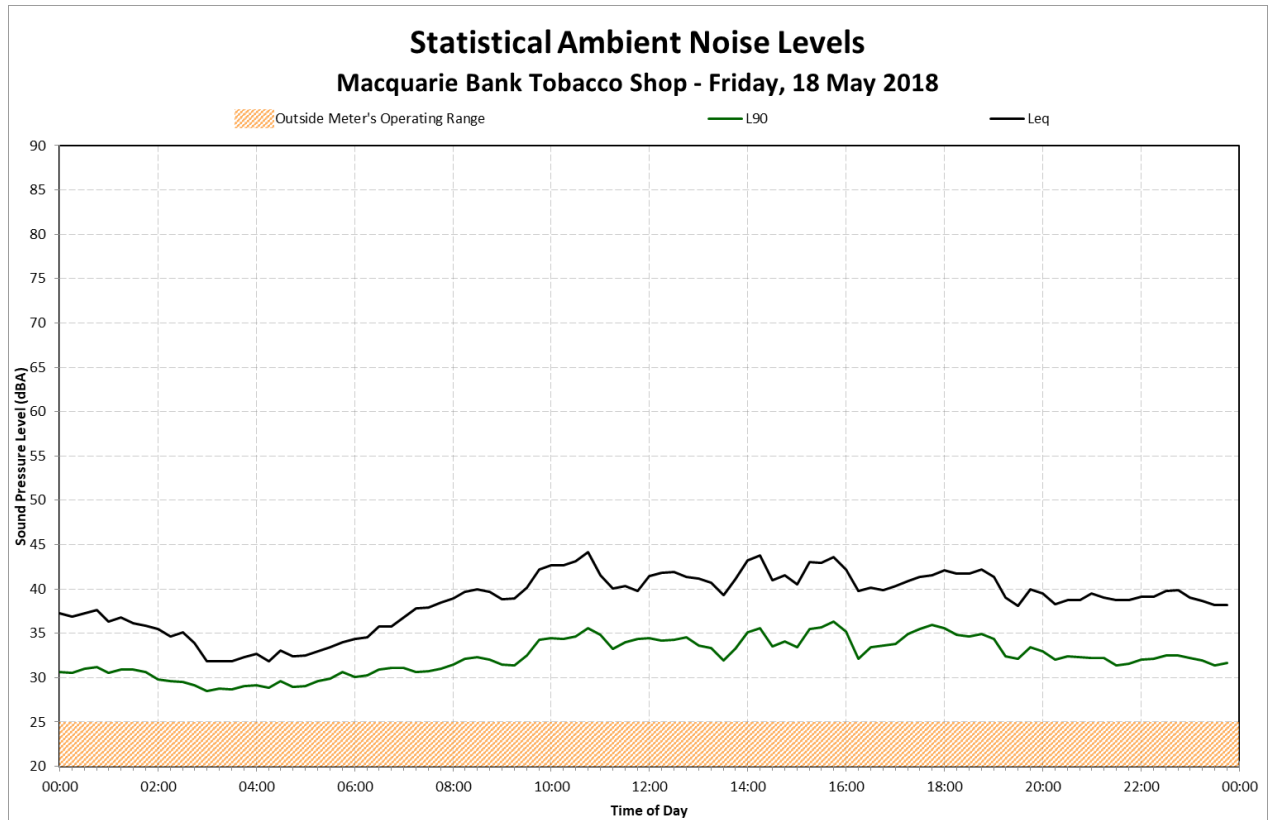
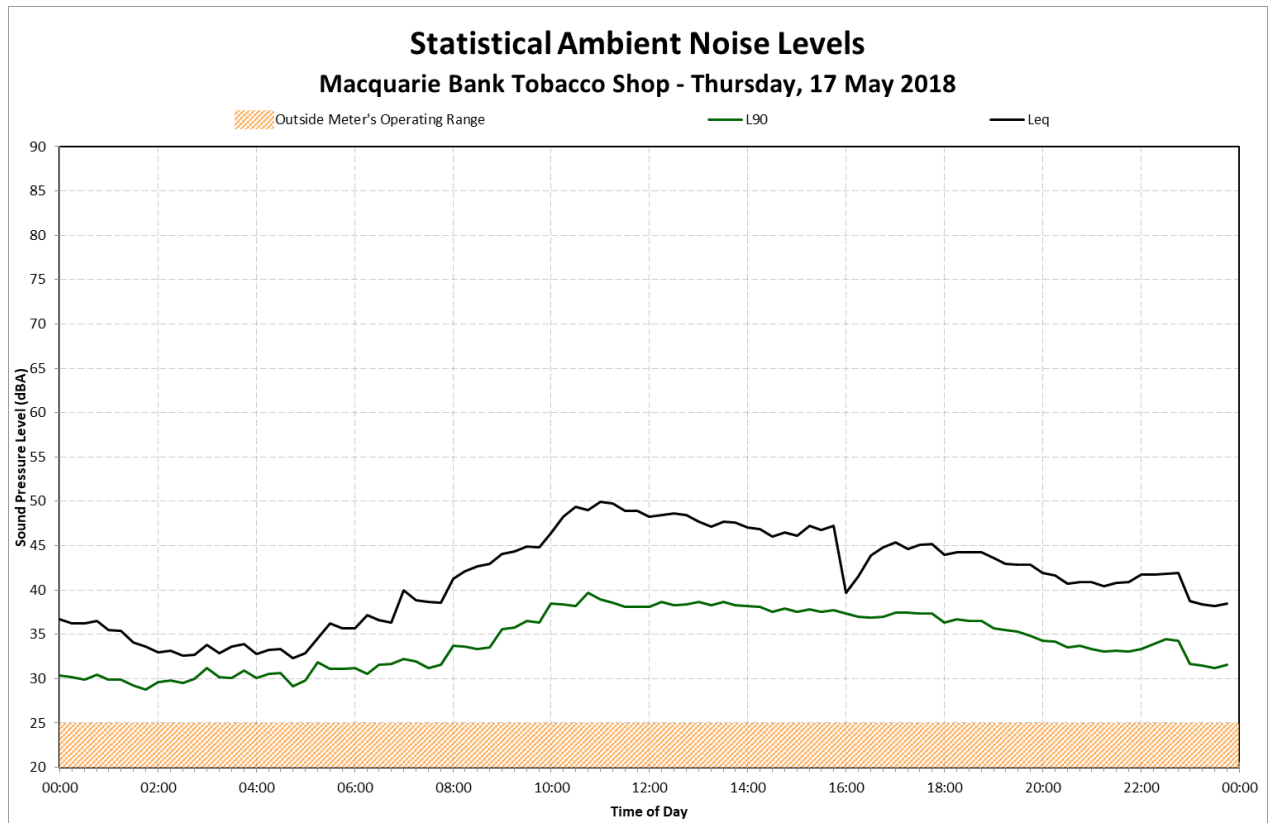
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

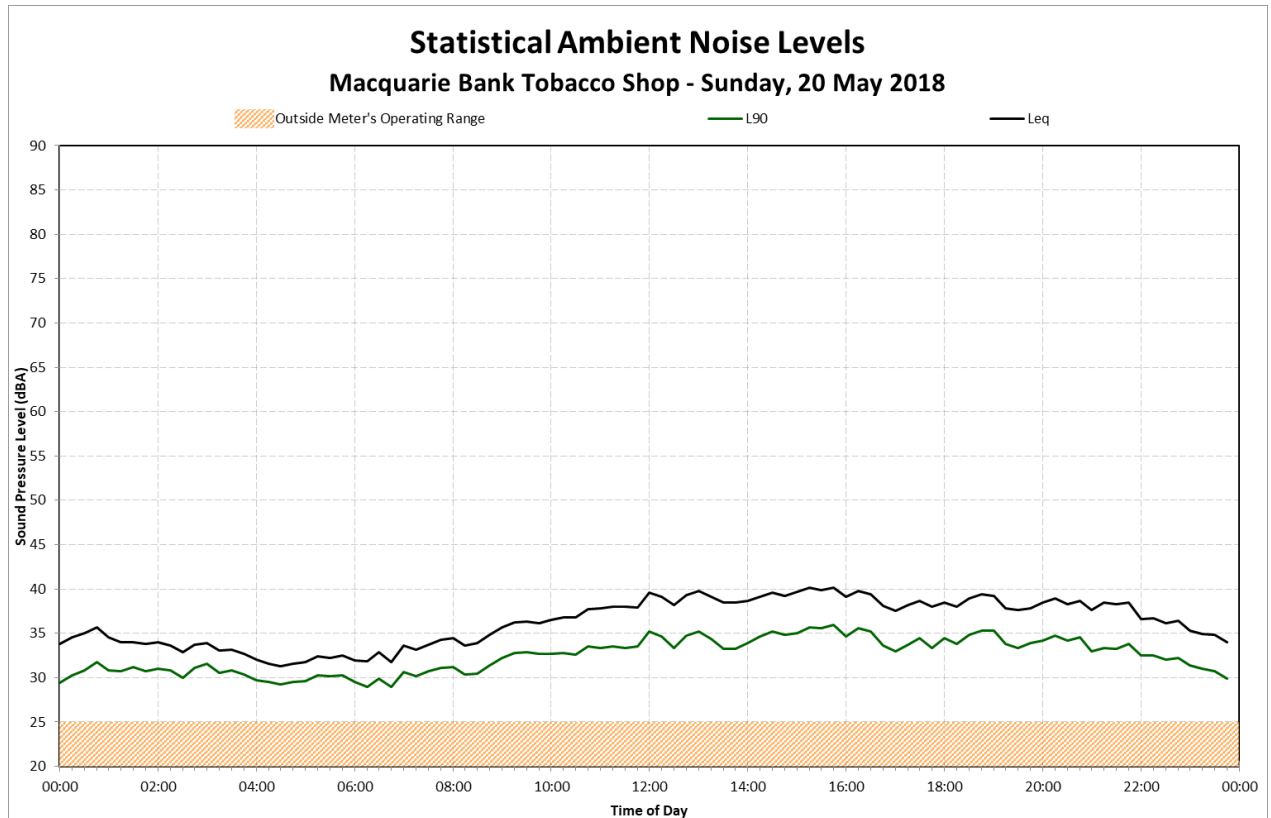
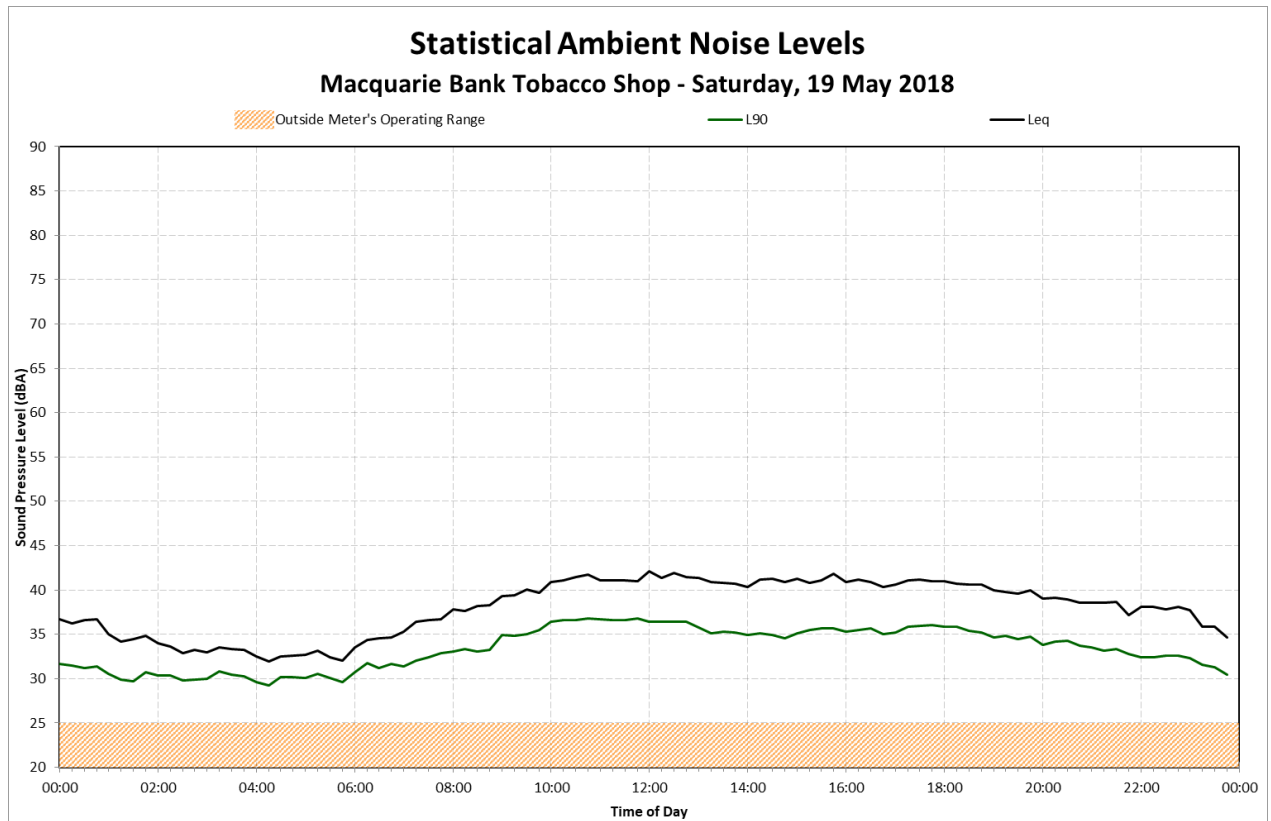
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

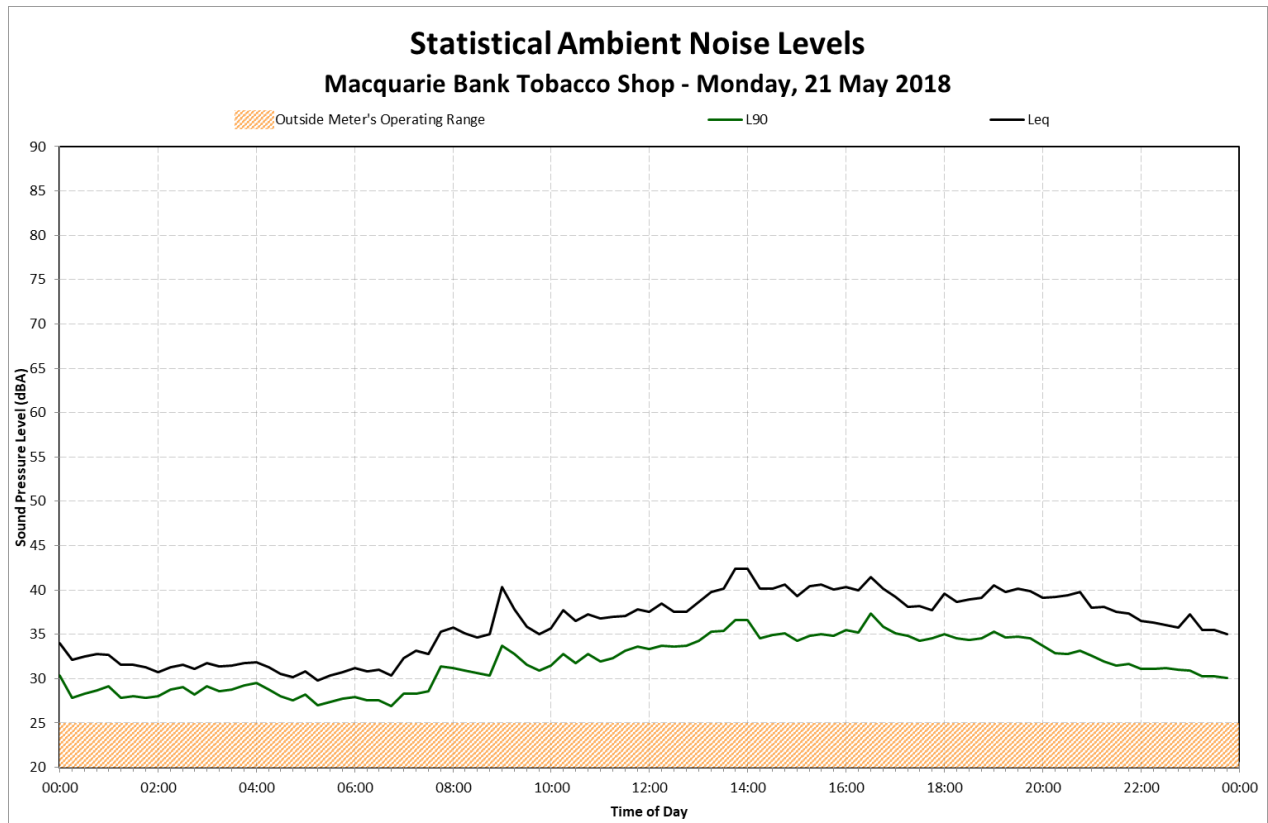
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

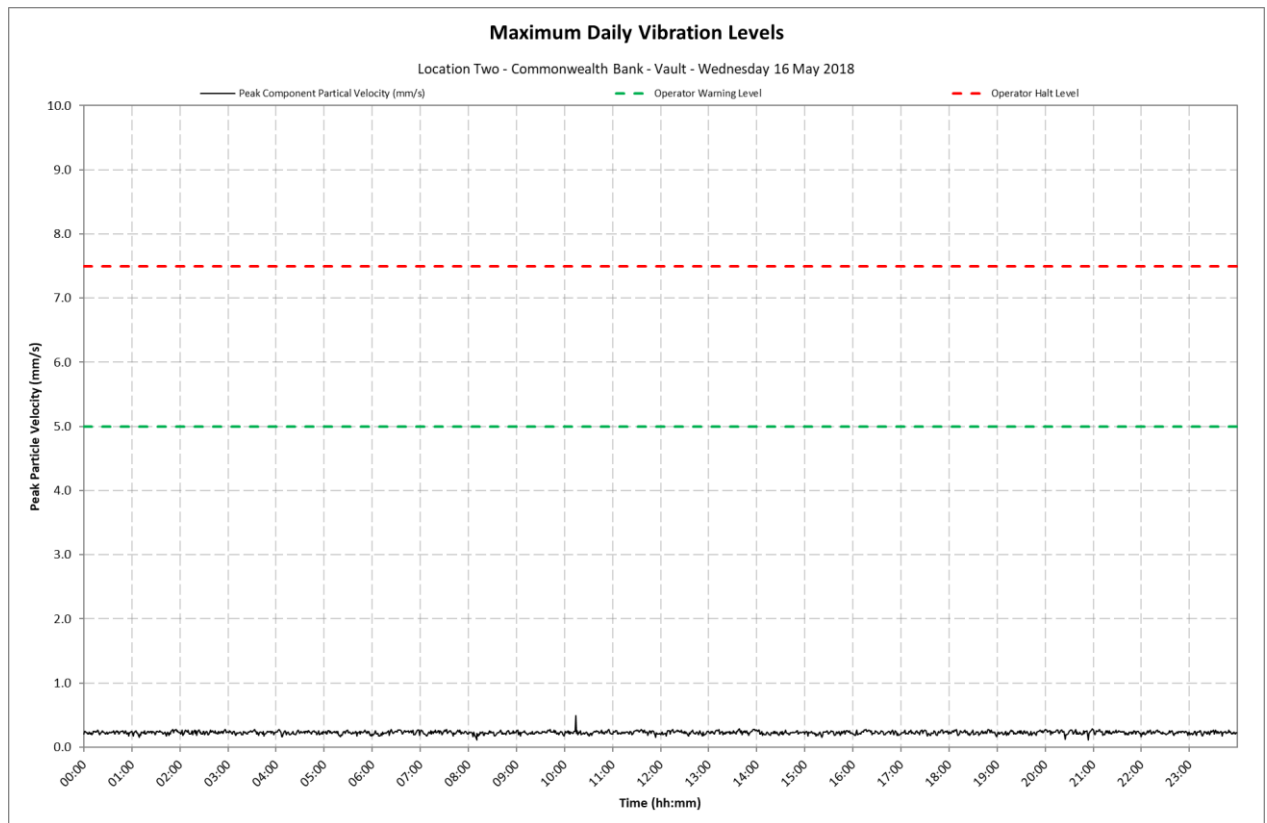
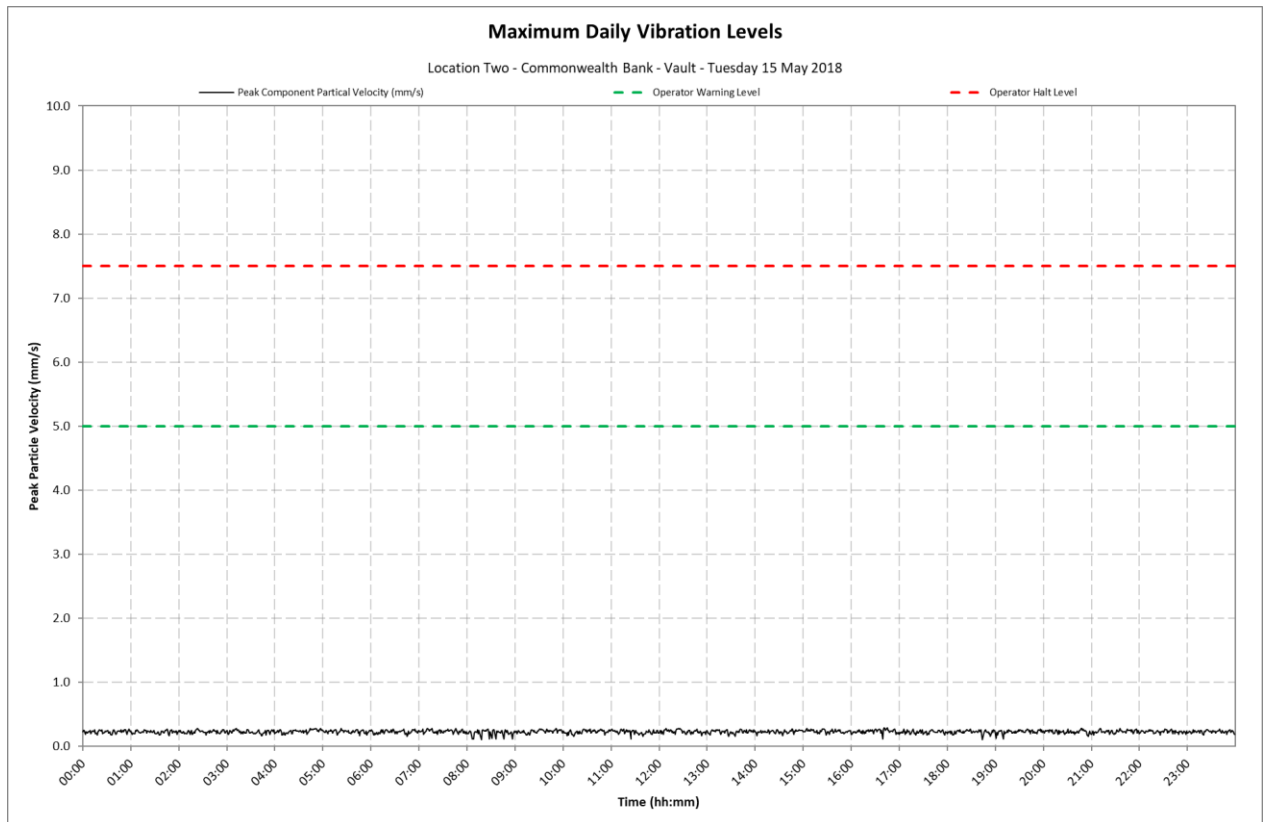
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

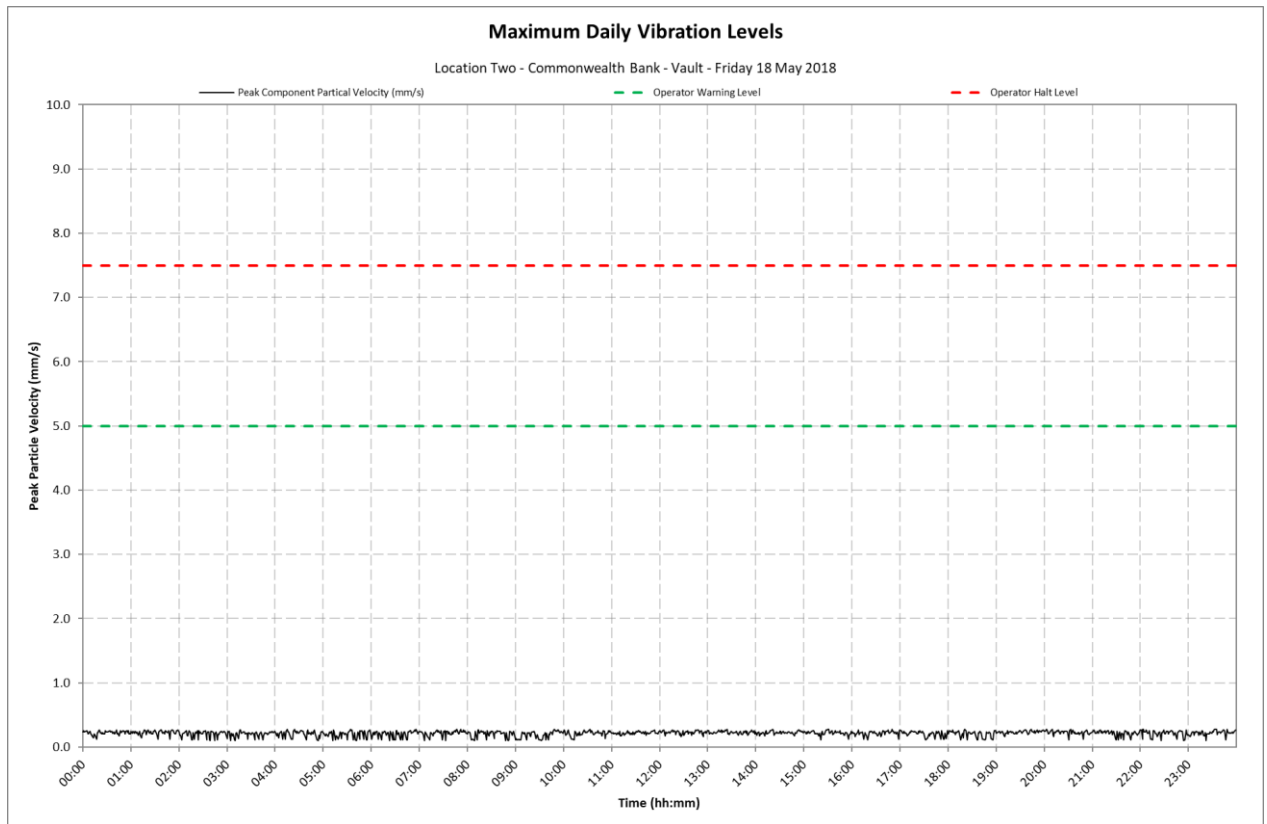
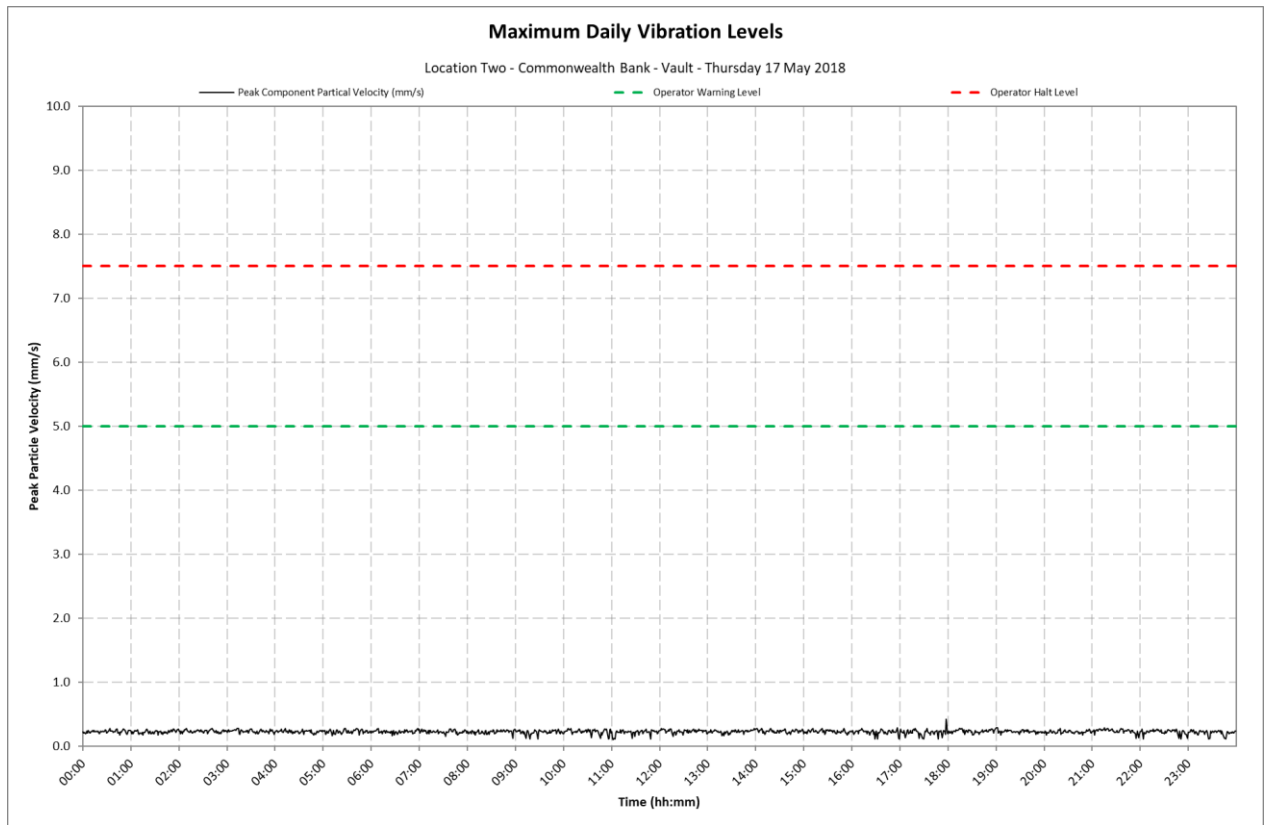
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

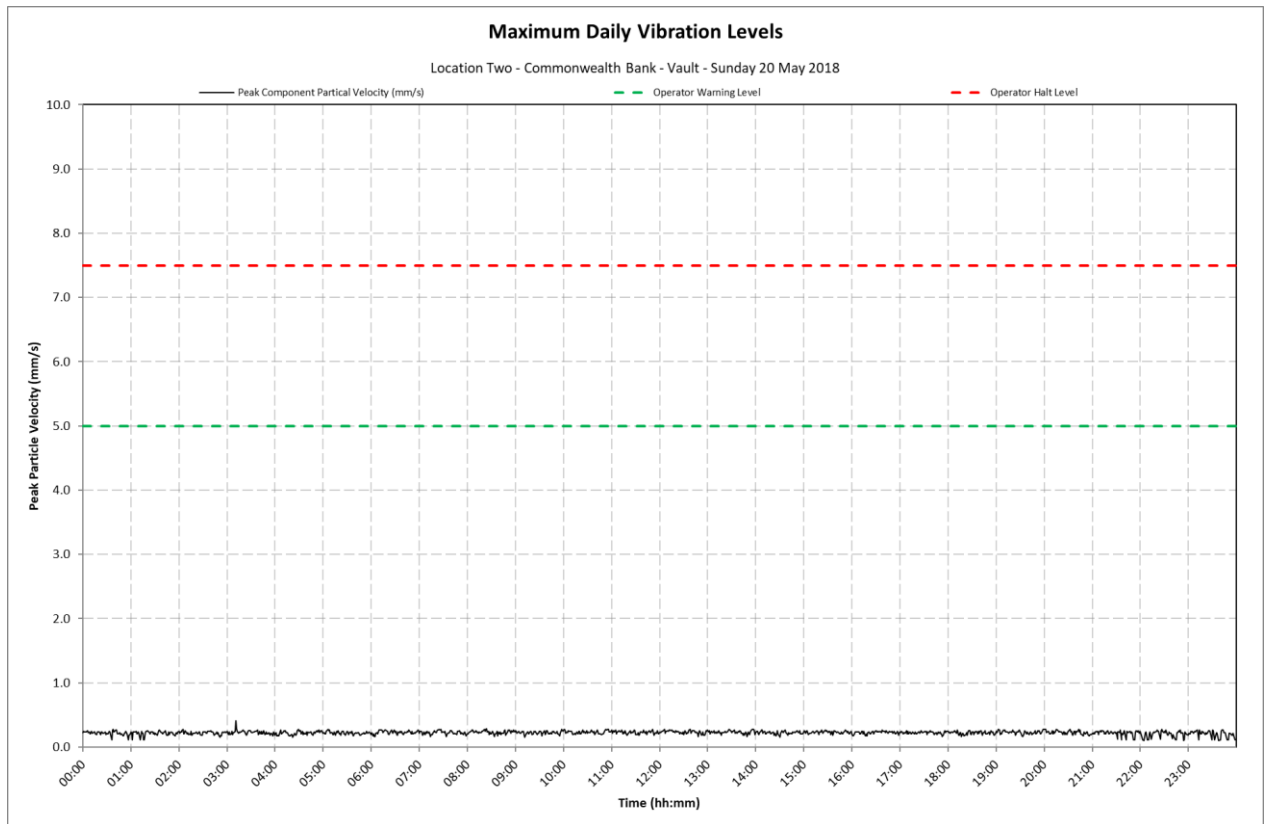
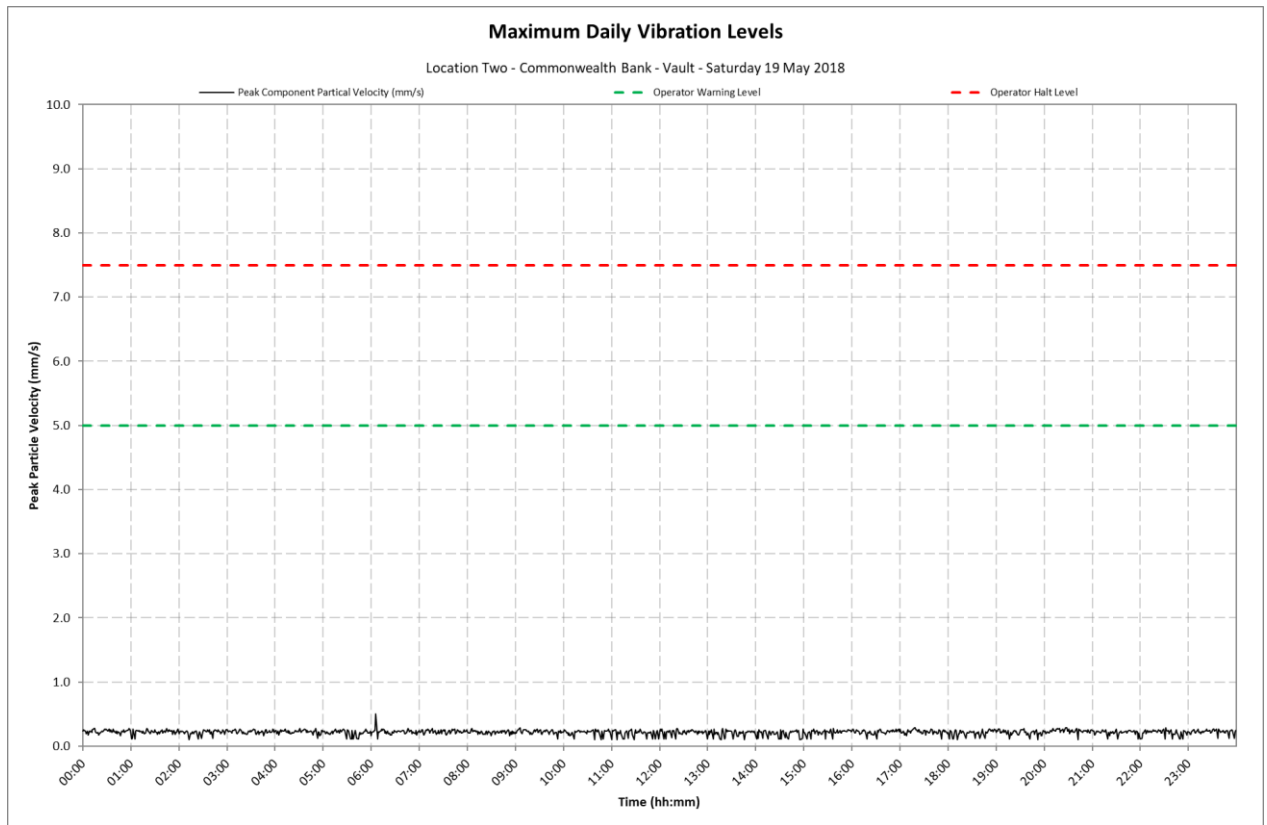
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

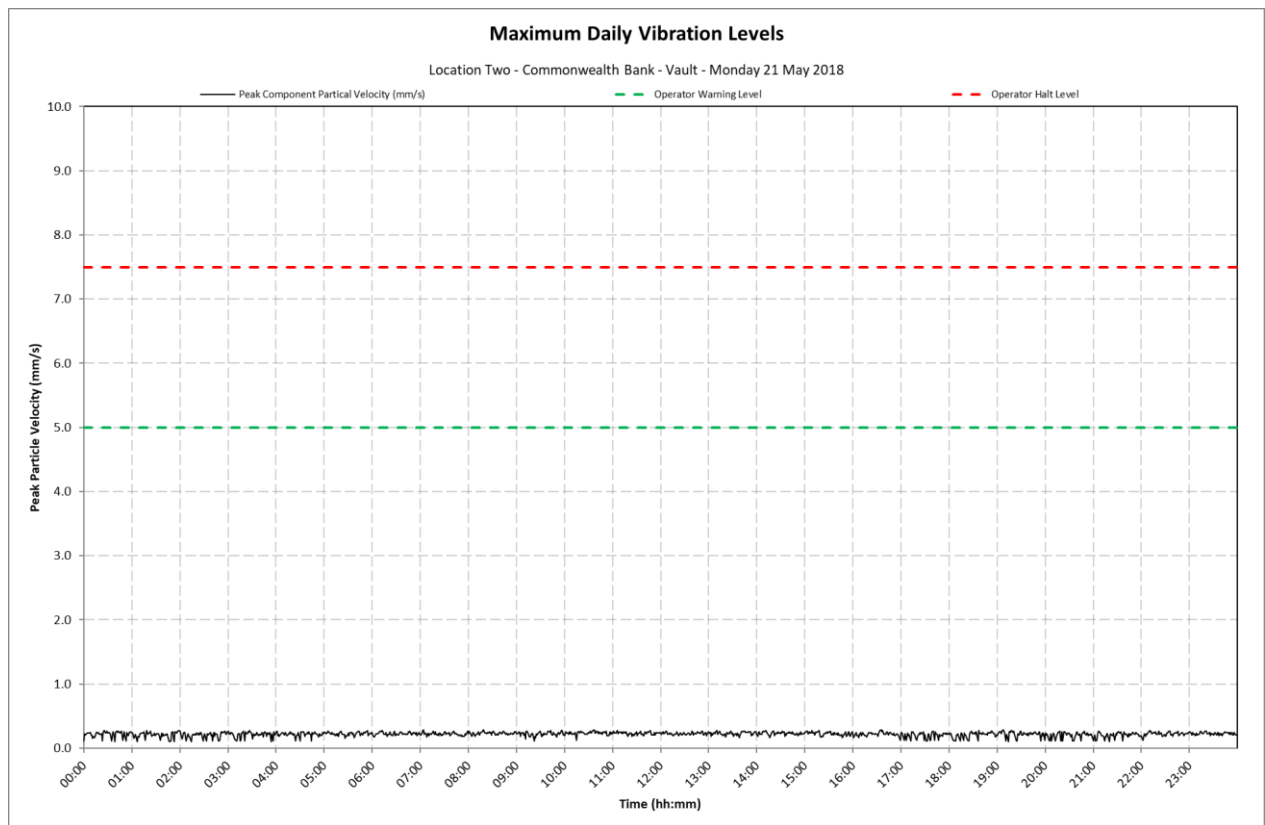
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

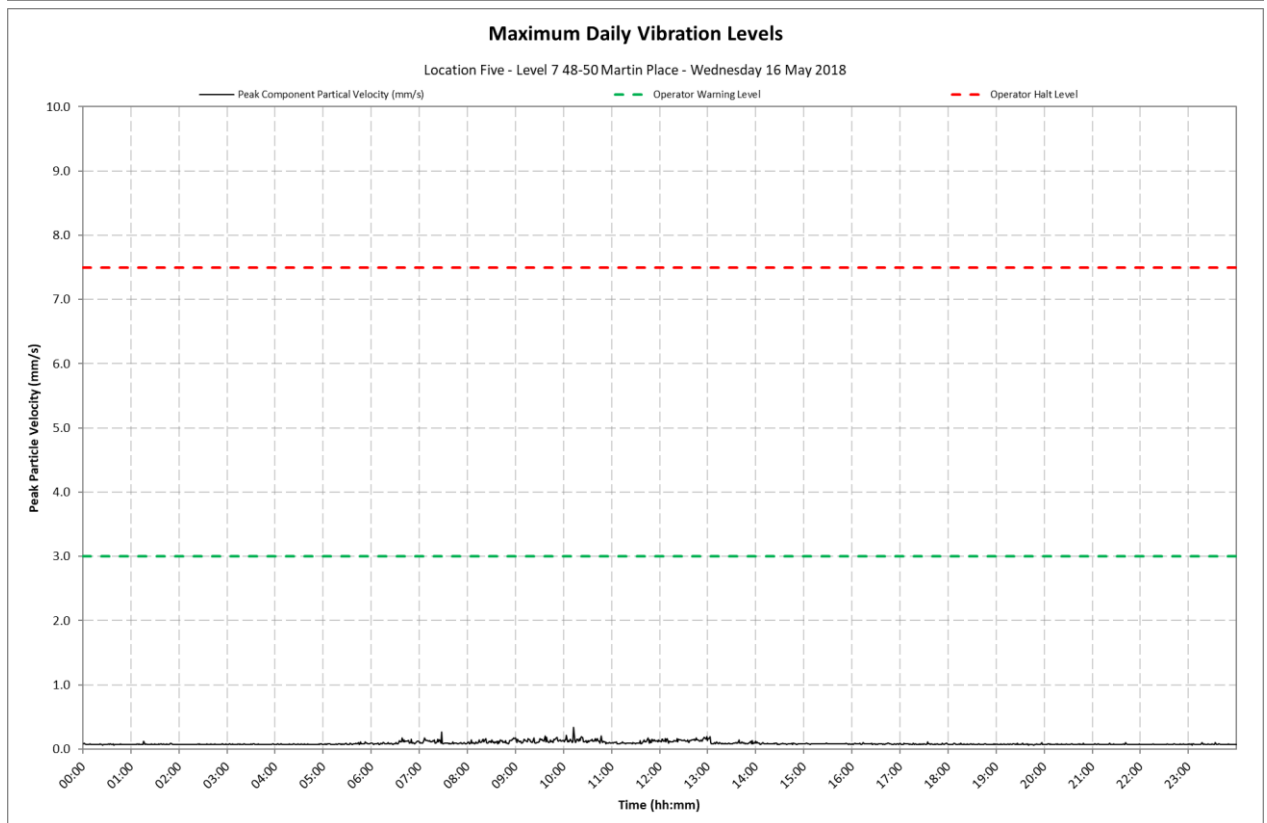
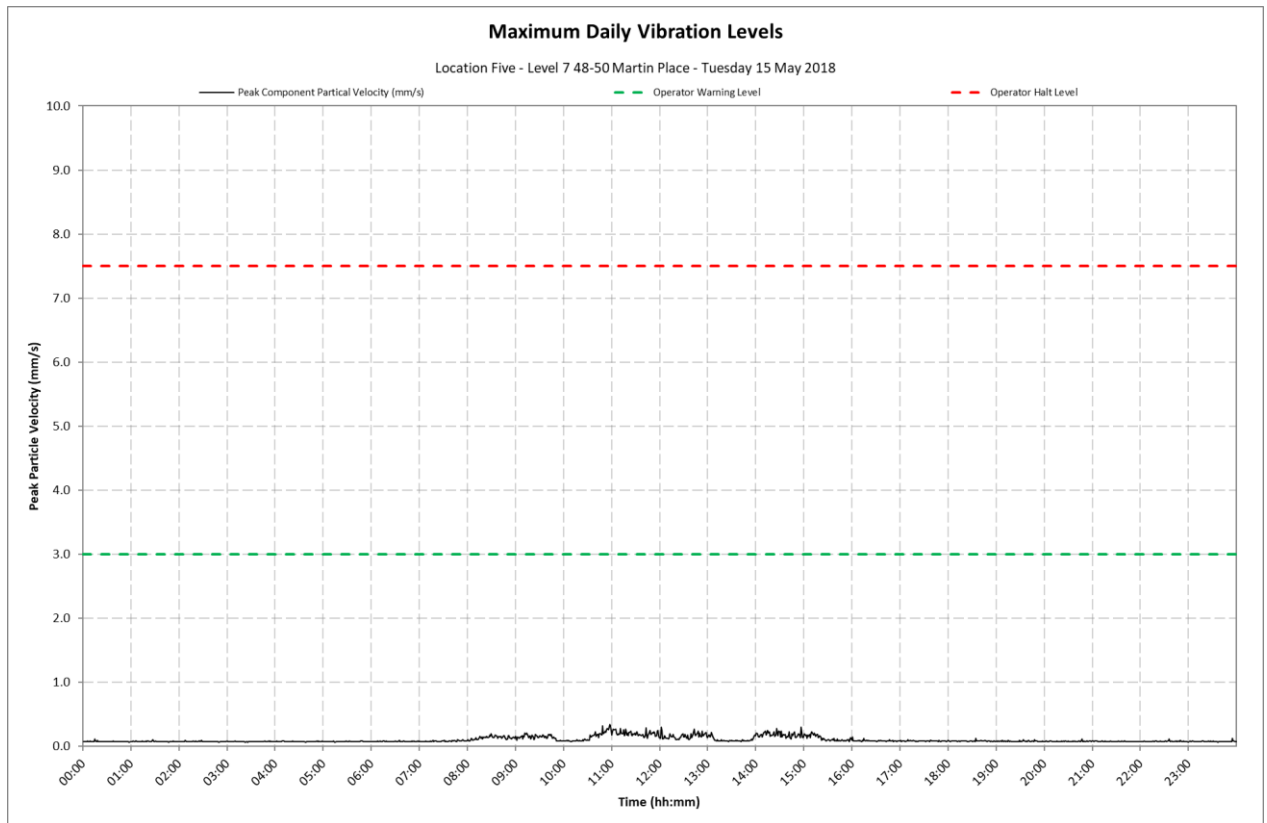
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

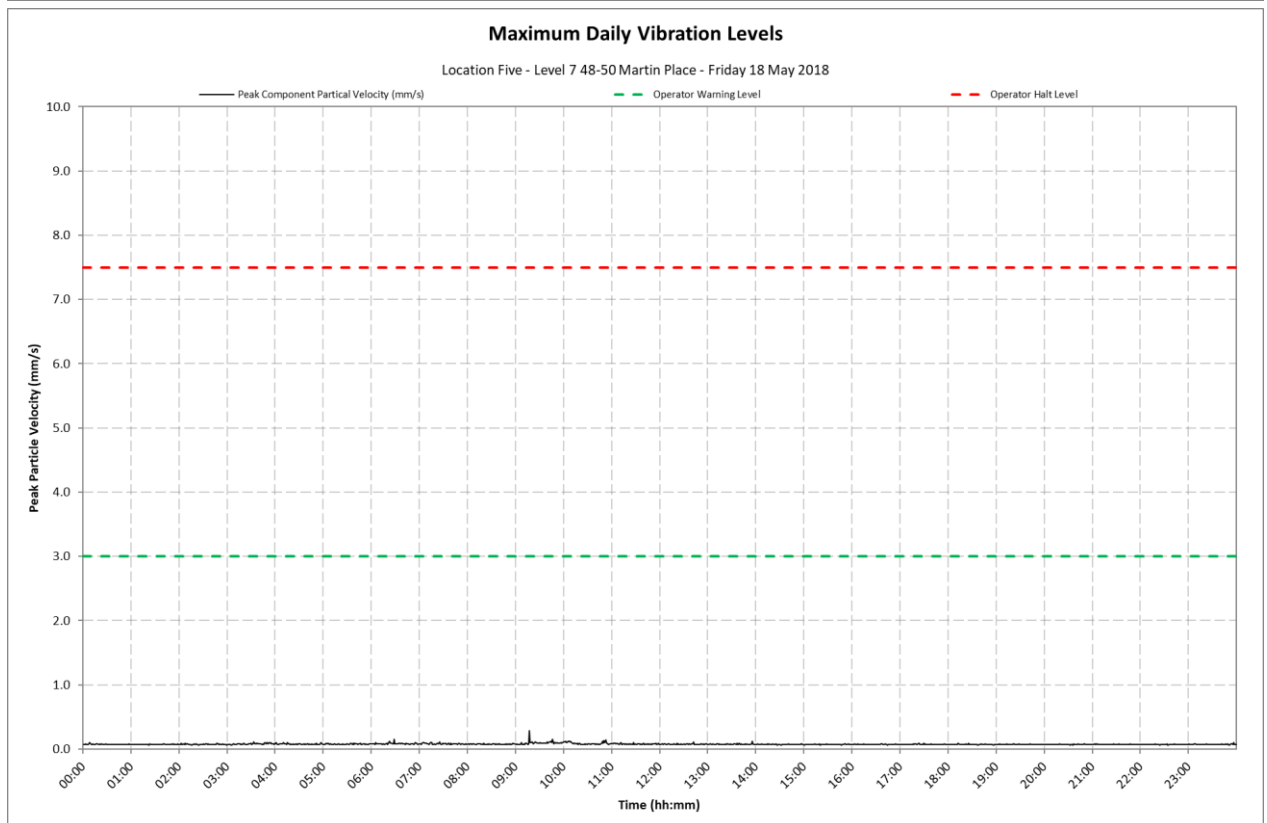
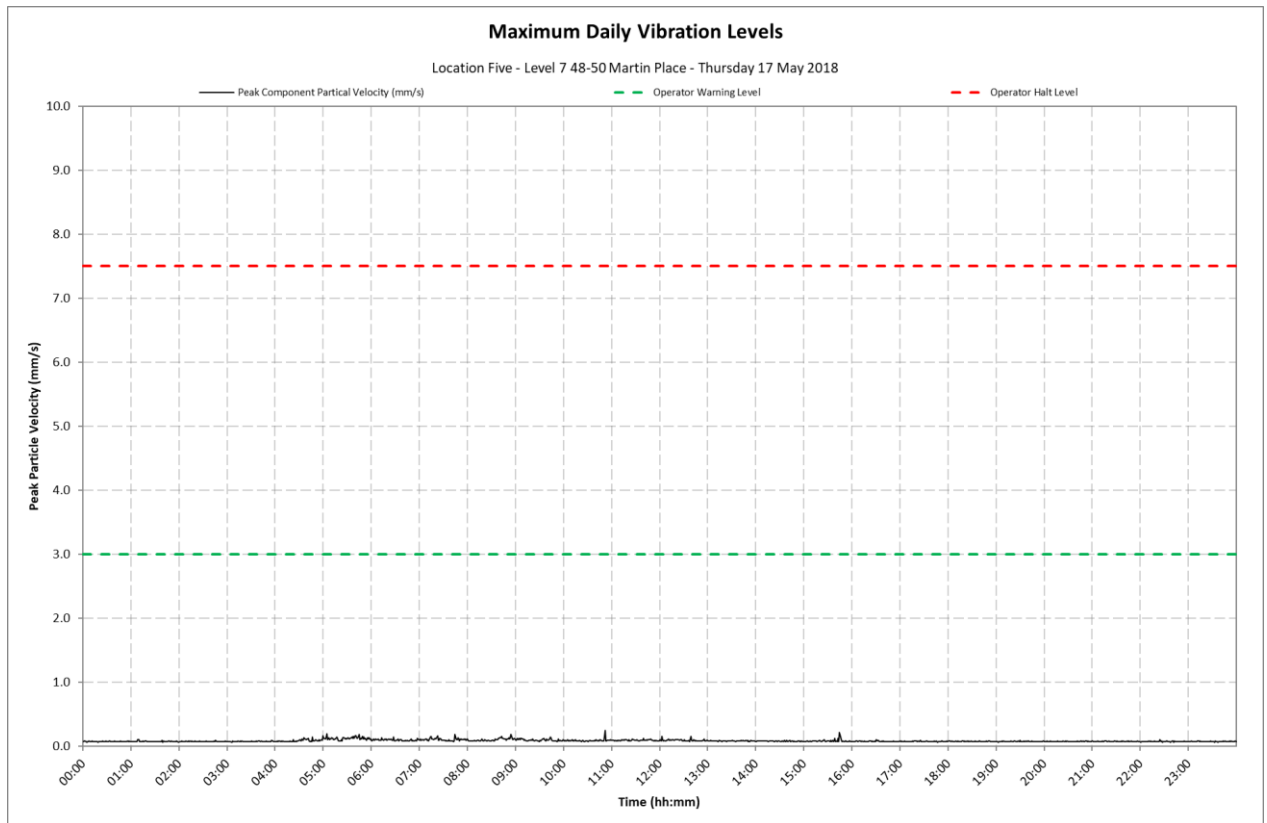
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

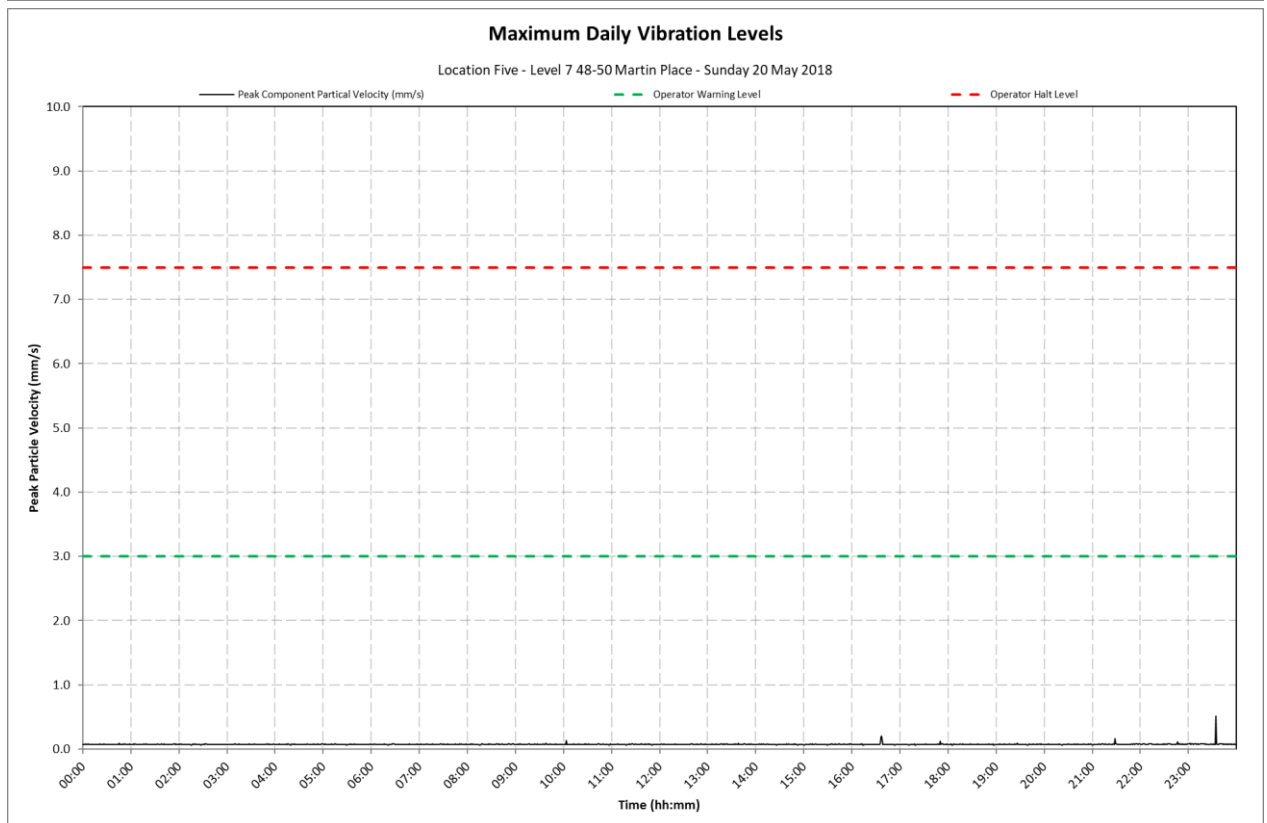
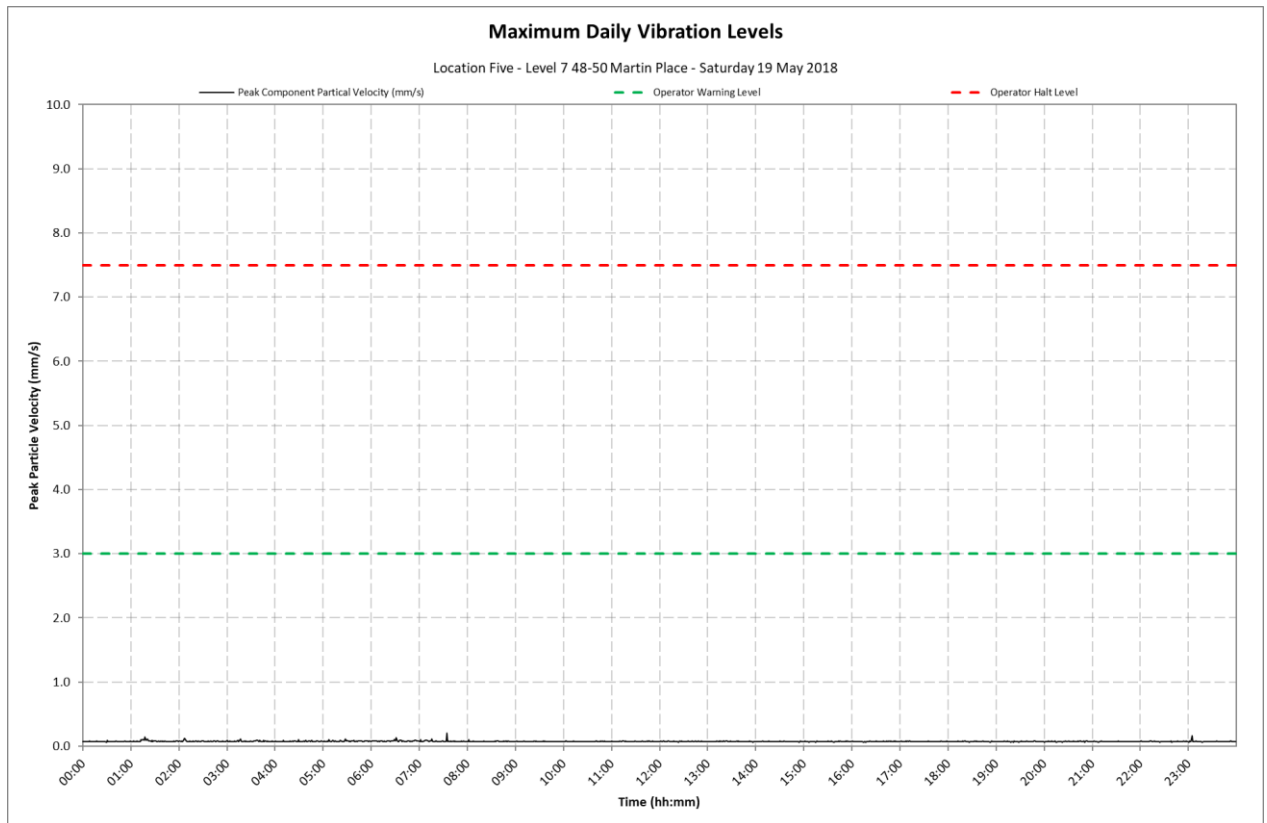
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

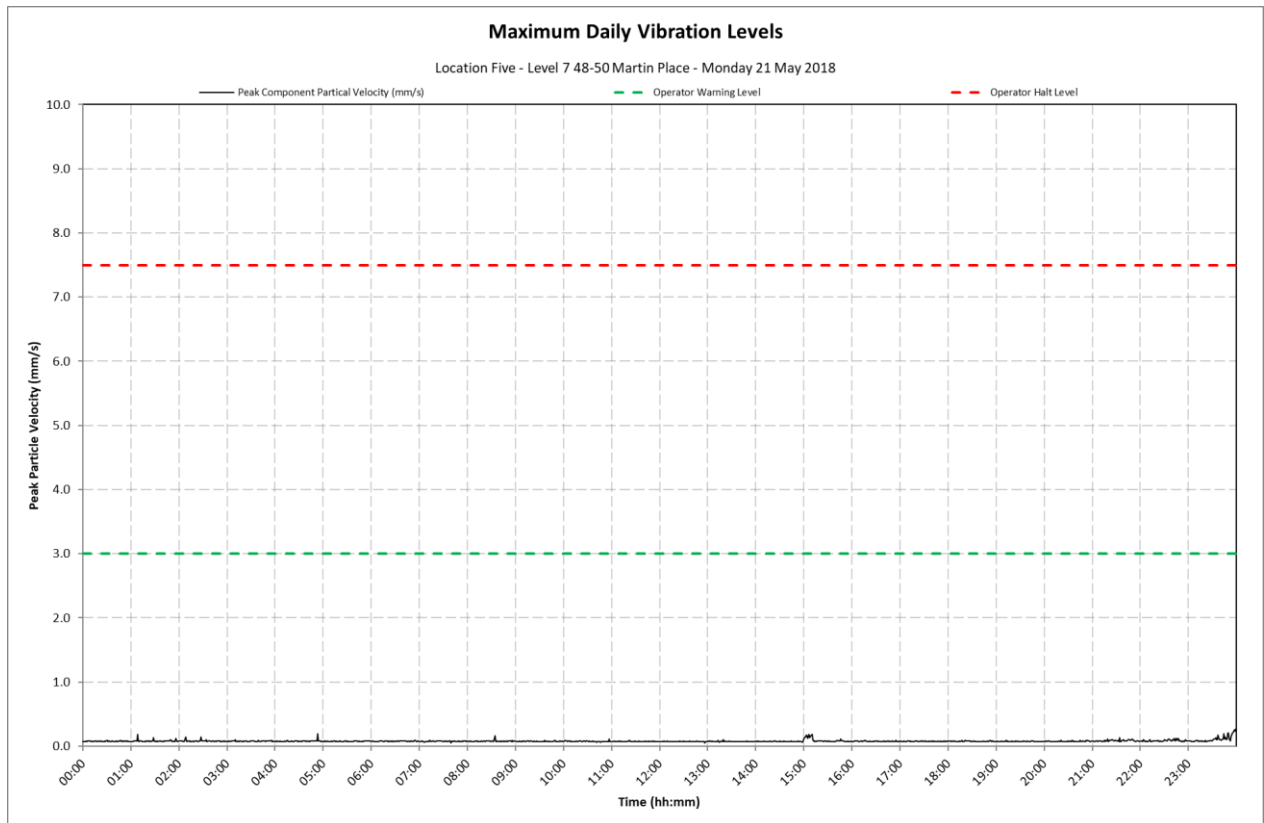
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



1 June 2018

10-1380 R30 NV Monitoring 20180601.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 30
22 May to 31 May 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 22 May to 31 May 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

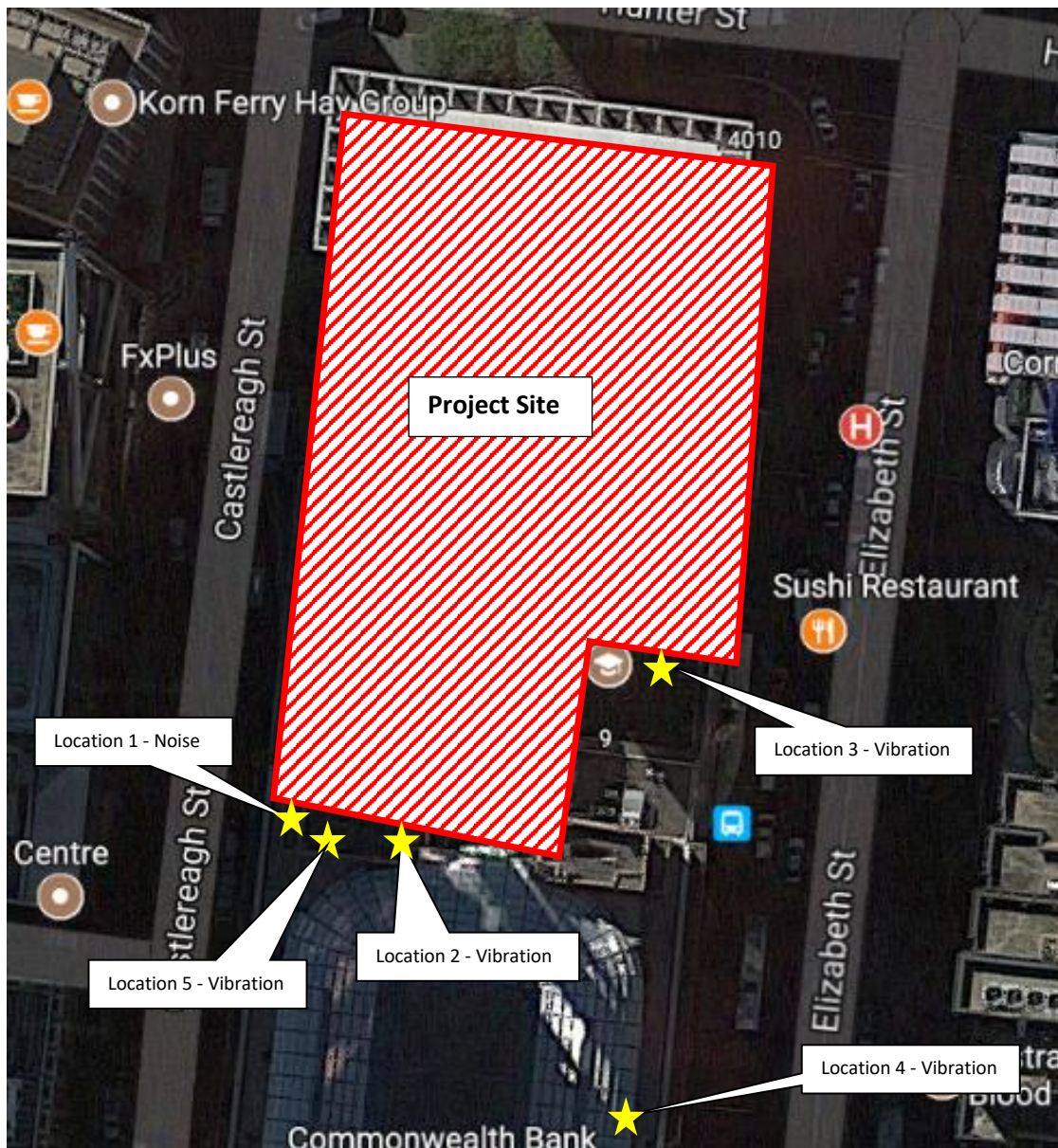
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Removed 21/11/2017)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The following vibration control limits apply:

- Early Warning Level - 3 mm/s
- Warning Level - 5 mm/s
- Halt Level - 7.5 mm/s

Note, vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 1 present a summary of the measured ambient noise levels at Location 1 during the period 22 May to 31 May 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 1 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
22 May 2018	44	43	Complies	Complies
23 May 2018	46	45	Complies	Complies
24 May 2018	45	43	Complies	Complies
25 May 2018	40	39	Complies	Complies
26 May 2018	41	40	Complies	Complies
27 May 2018	39	37	Complies	Complies
28 May 2018	39	37	Complies	Complies
29 May 2018	44	42	Complies	Complies
30 May 2018	46	44	Complies	Complies
31 May 2018	46	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 2 and **Table 3** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 22 May to 31 May 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 2 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
22 May 2018	0.6 mm/s	Complies
23 May 2018	0.3 mm/s	Complies
24 May 2018	0.5 mm/s	Complies
25 May 2018	0.6 mm/s	Complies
26 May 2018	0.5 mm/s	Complies
27 May 2018	0.7 mm/s	Complies
28 May 2018	0.4 mm/s	Complies
29 May 2018	0.5 mm/s	Complies
30 May 2018	0.5 mm/s	Complies
31 May 2018	0.5 mm/s	Complies

Table 3 Daily Measured Maximum Vibration Levels - Location 5

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
22 May 2018	0.3 mm/s	Complies
23 May 2018	0.4 mm/s	Complies
24 May 2018	0.4 mm/s	Complies
25 May 2018	0.4 mm/s	Complies
26 May 2018	0.4 mm/s	Complies
27 May 2018	0.1 mm/s	Complies
28 May 2018	0.6 mm/s	Complies
29 May 2018	0.4 mm/s	Complies
30 May 2018	0.6 mm/s	Complies
31 May 2018	0.2 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 22 May to 31 May 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 22 May to 31 May 2018 found all recorded ambient vibration levels were below the maximum vibration control limit of 7.5 mm/s at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

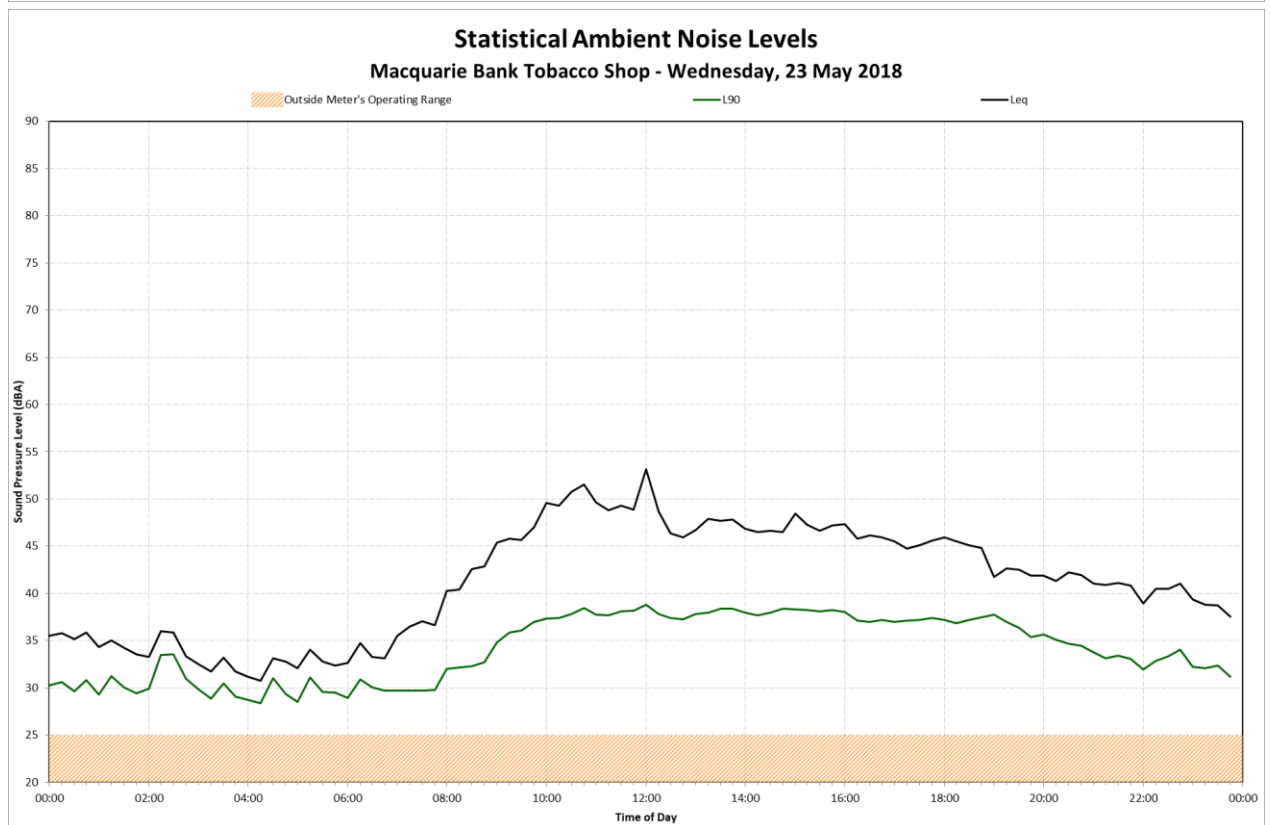
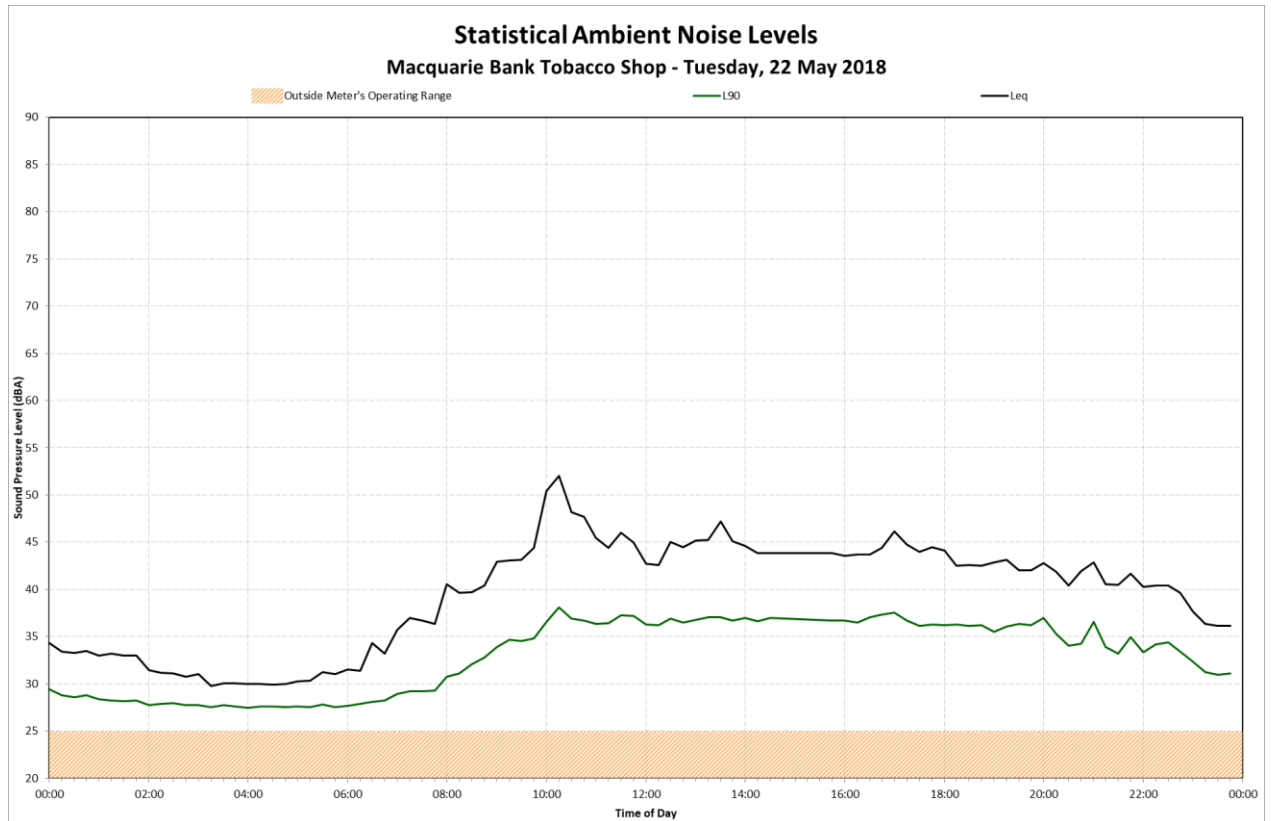
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

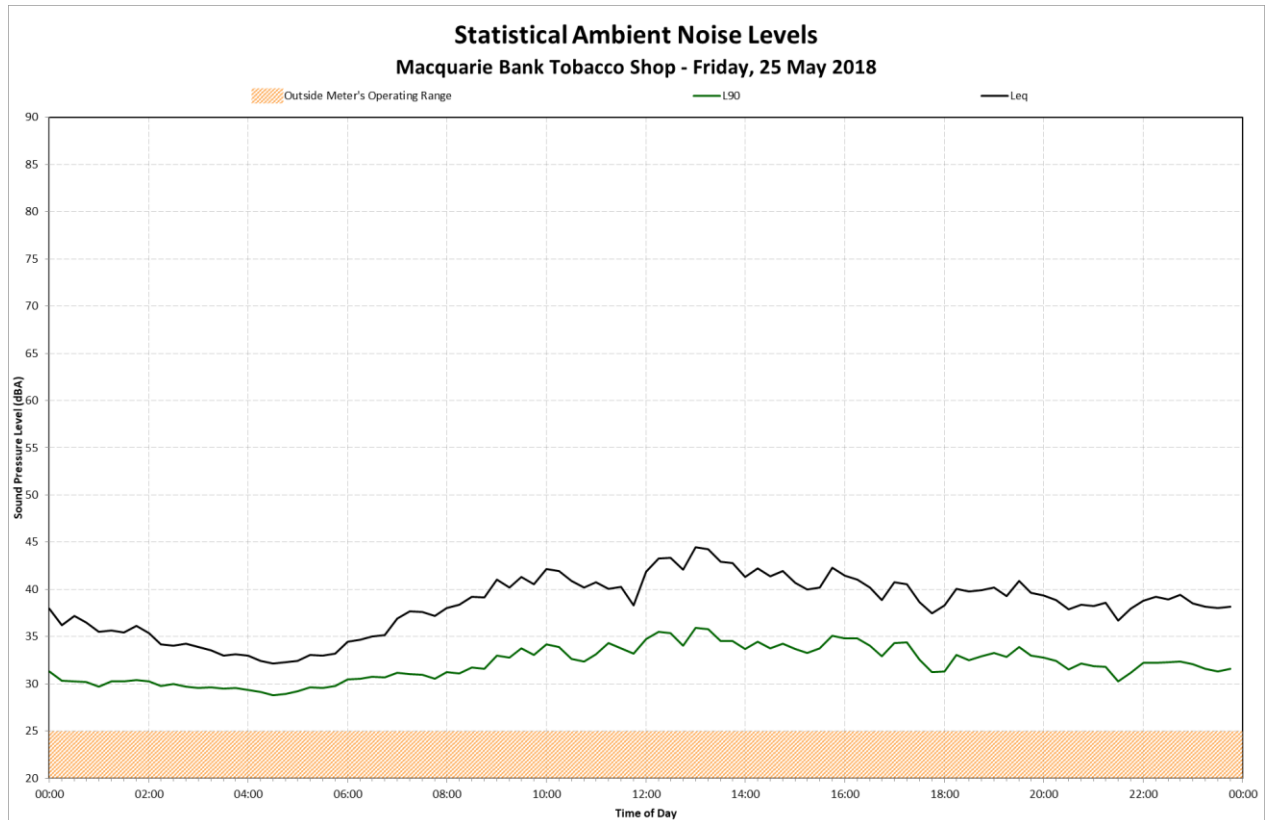
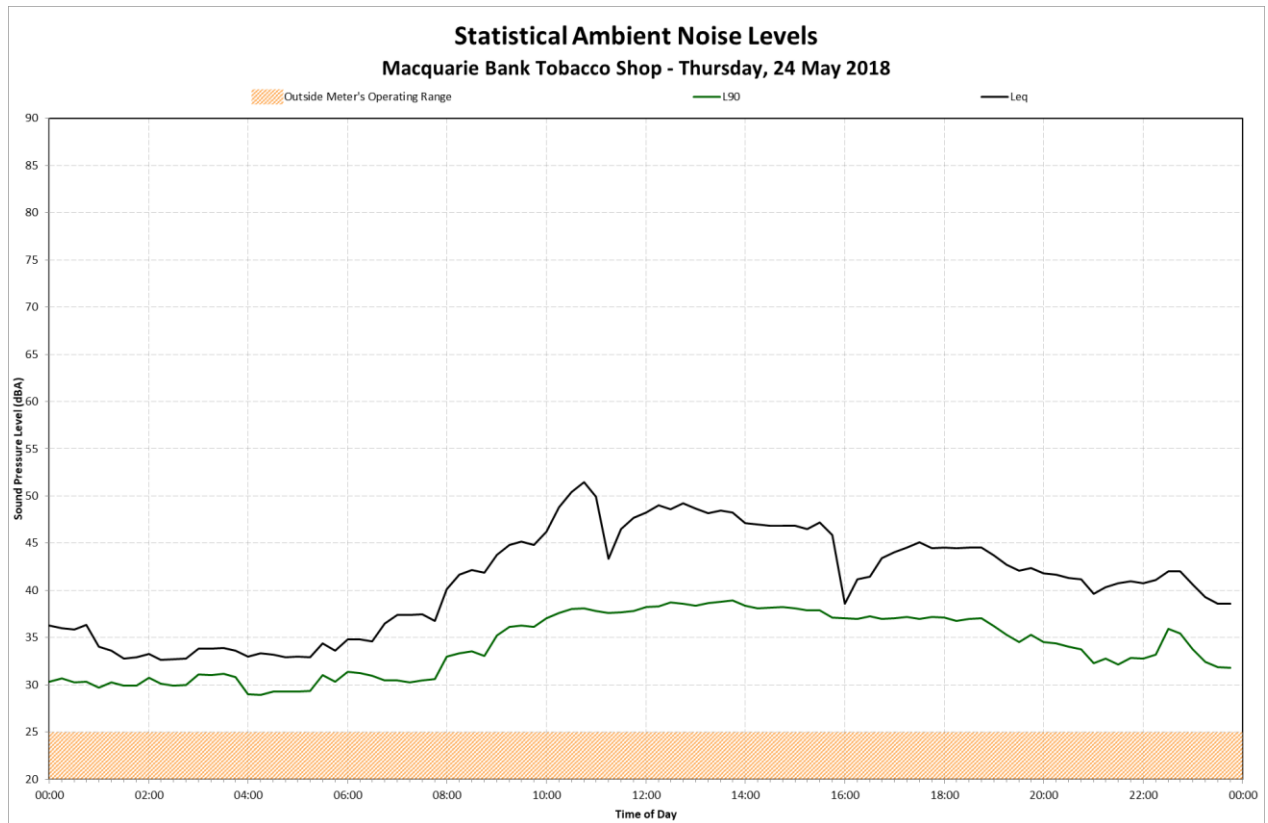
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

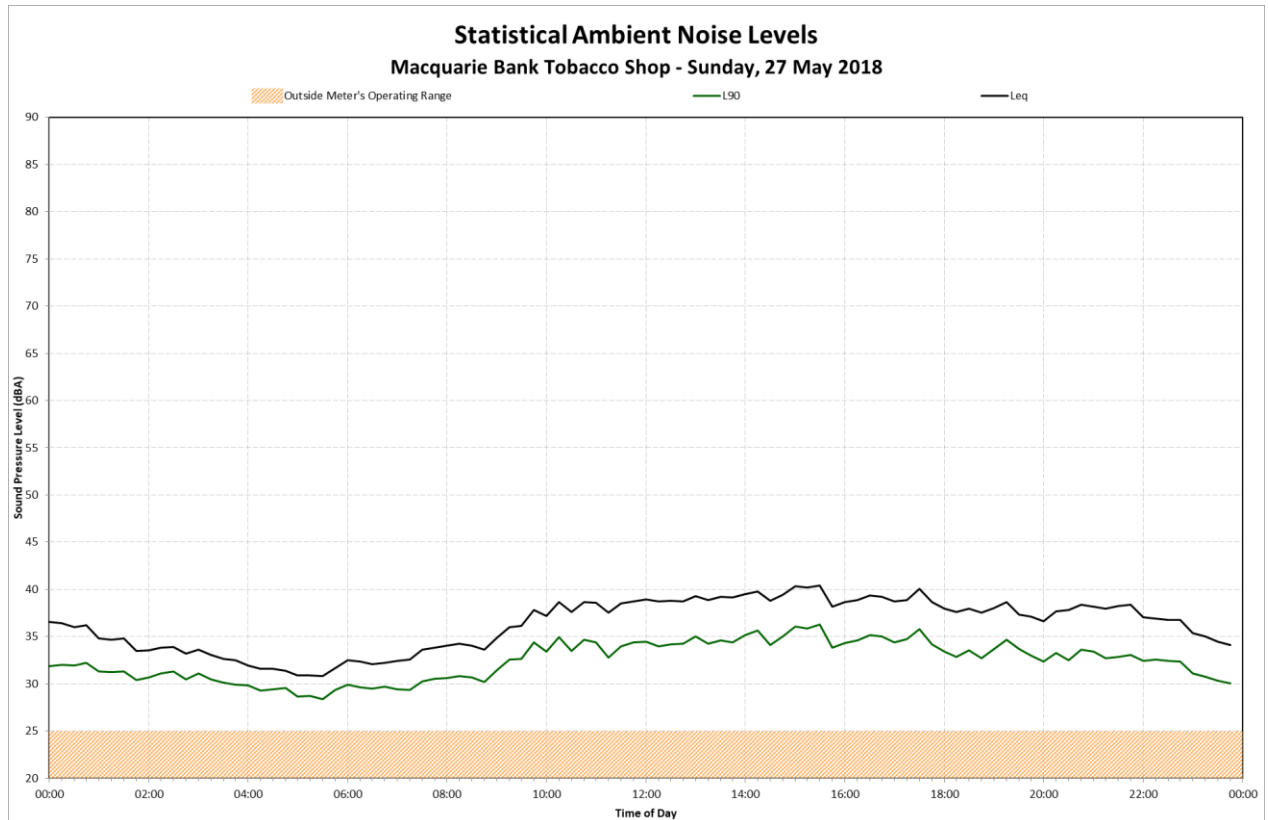
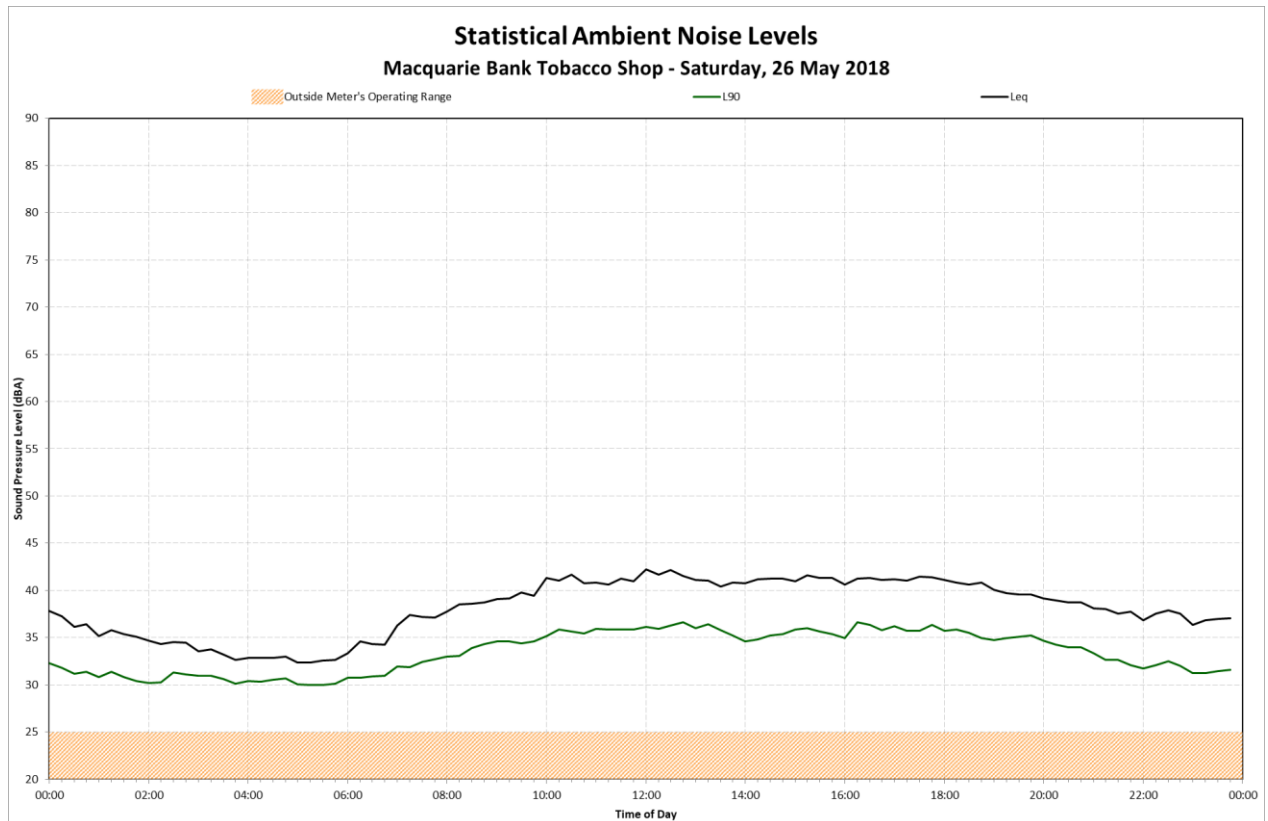
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

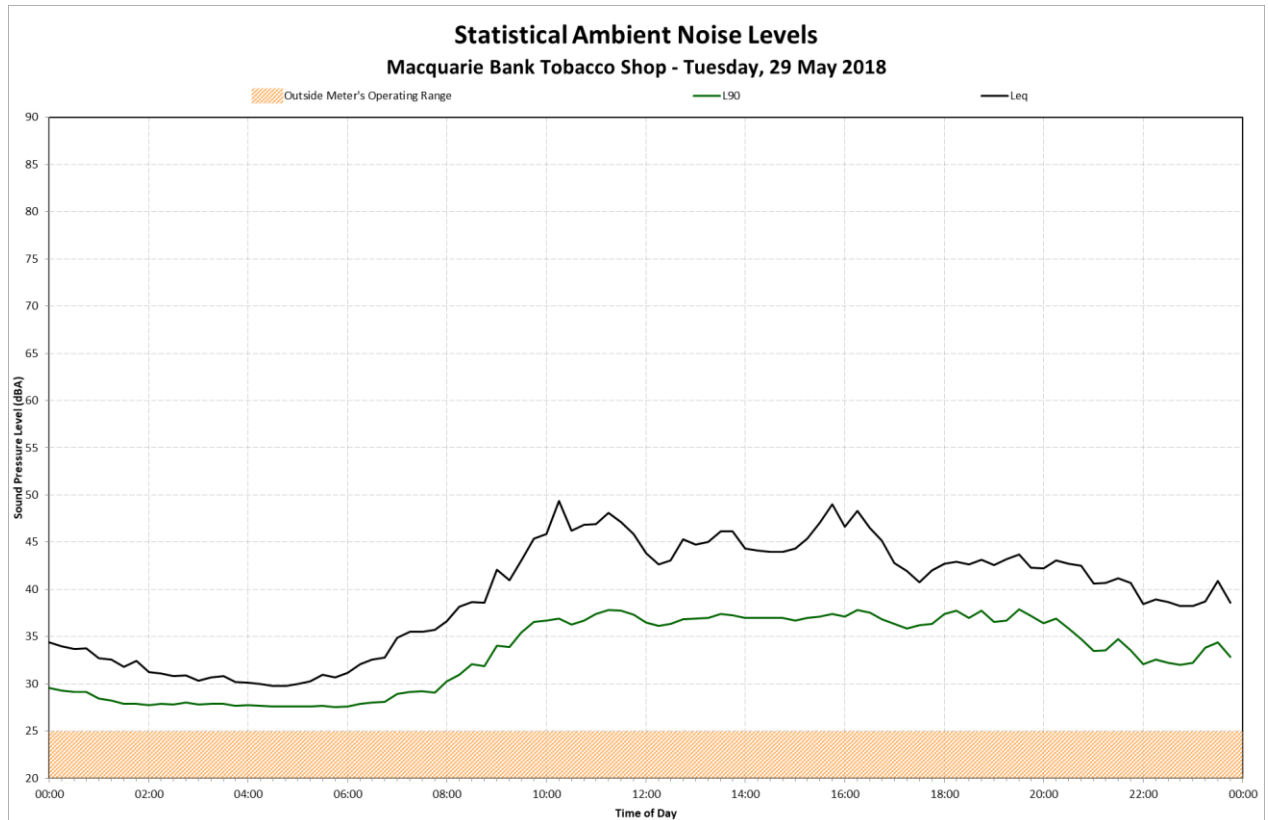
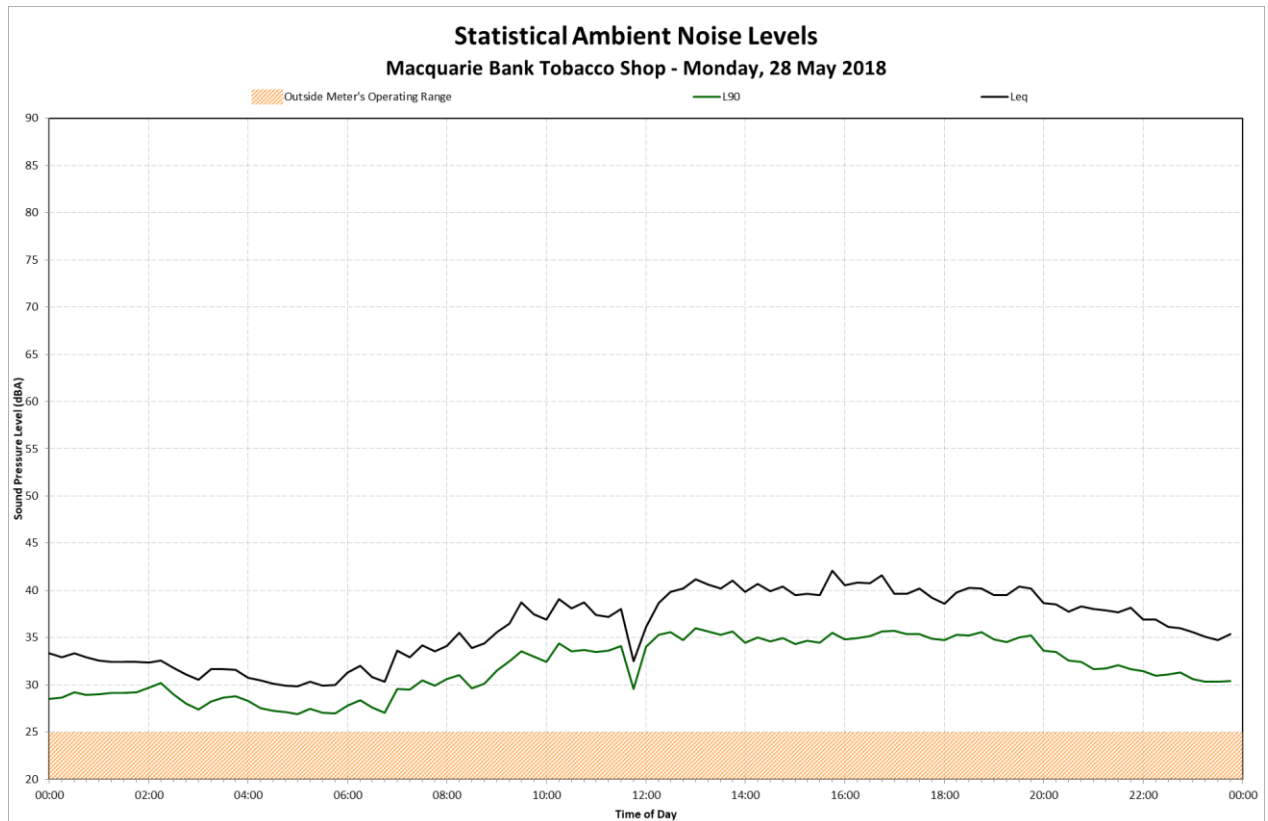
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

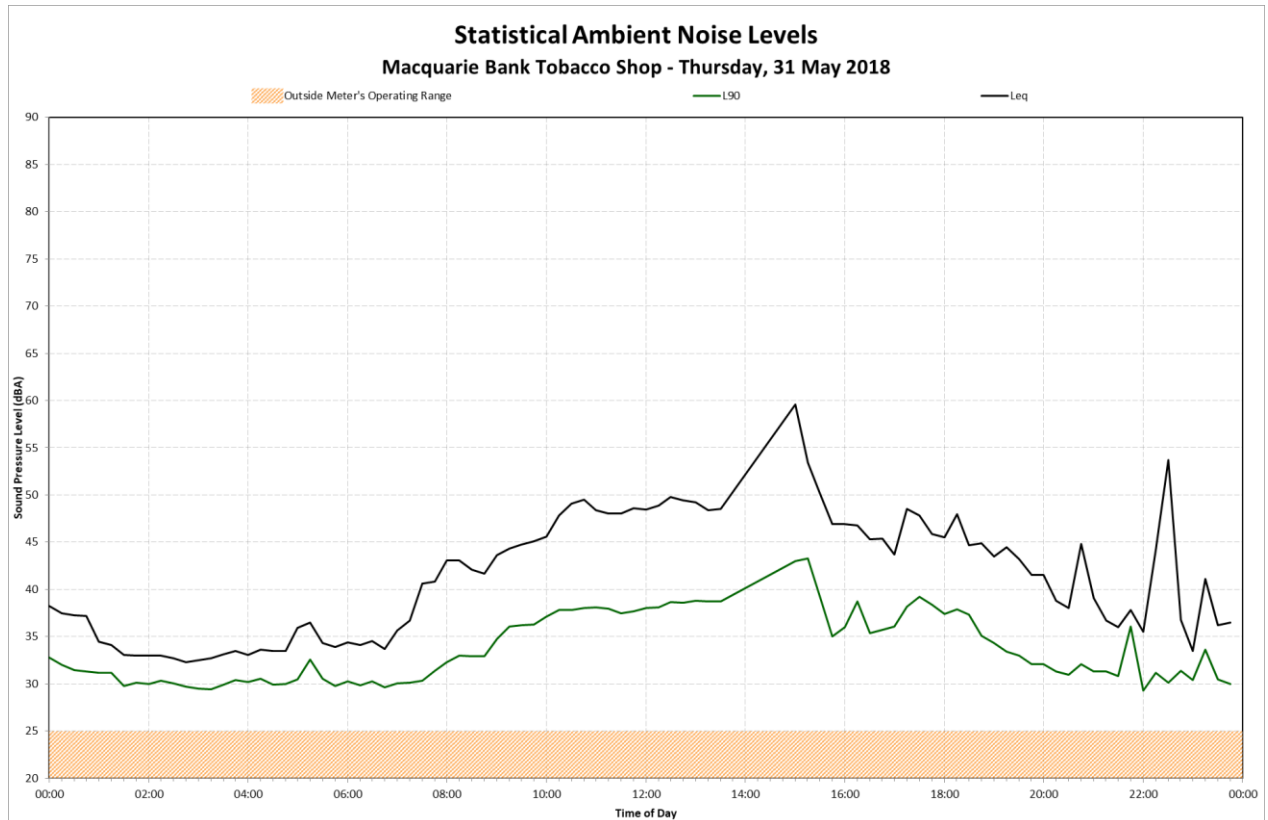
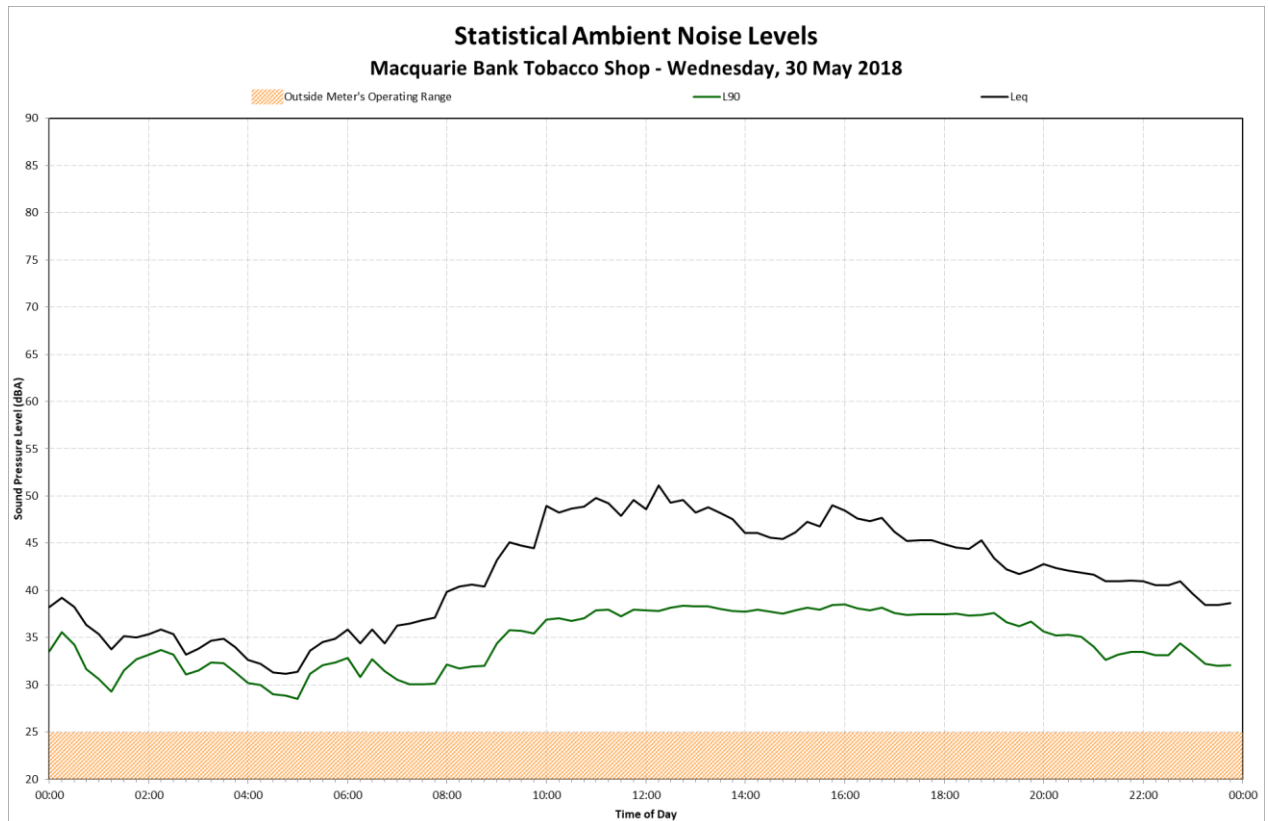
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

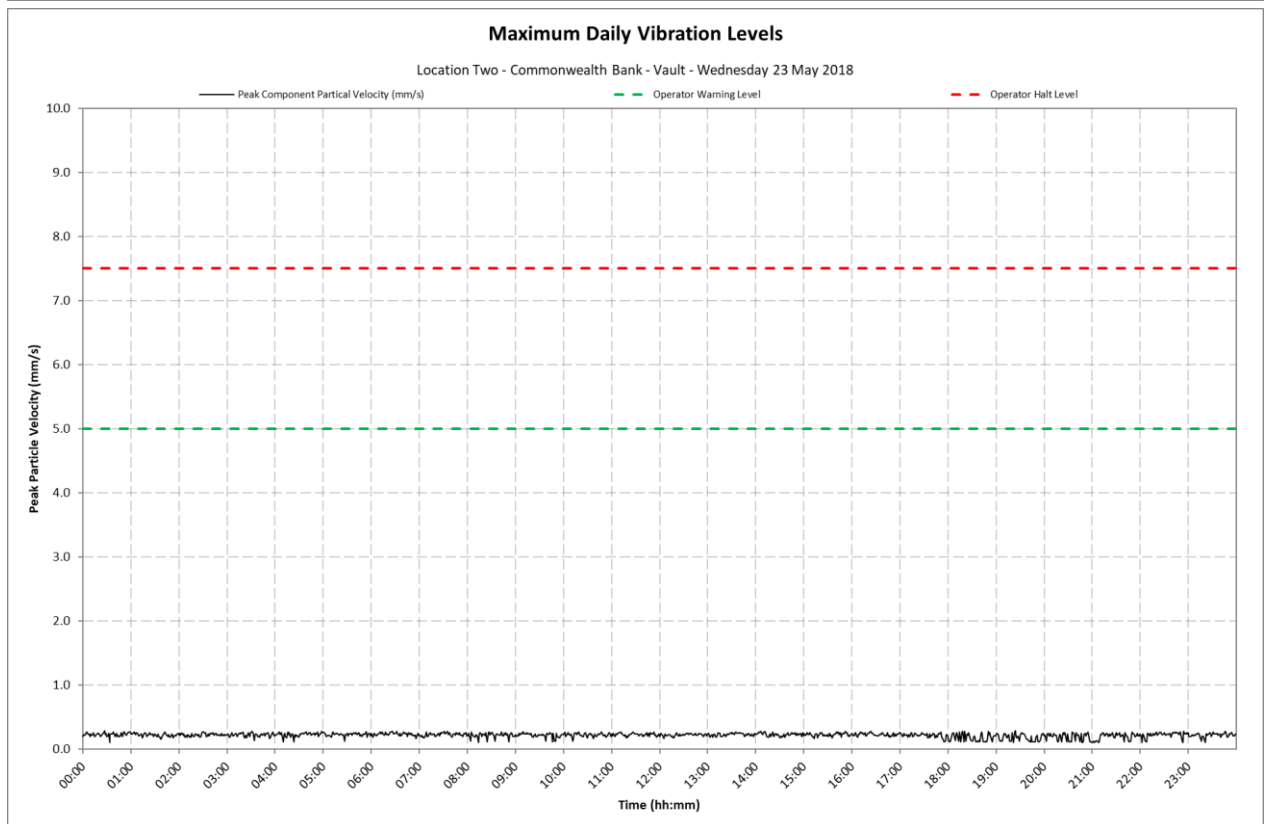
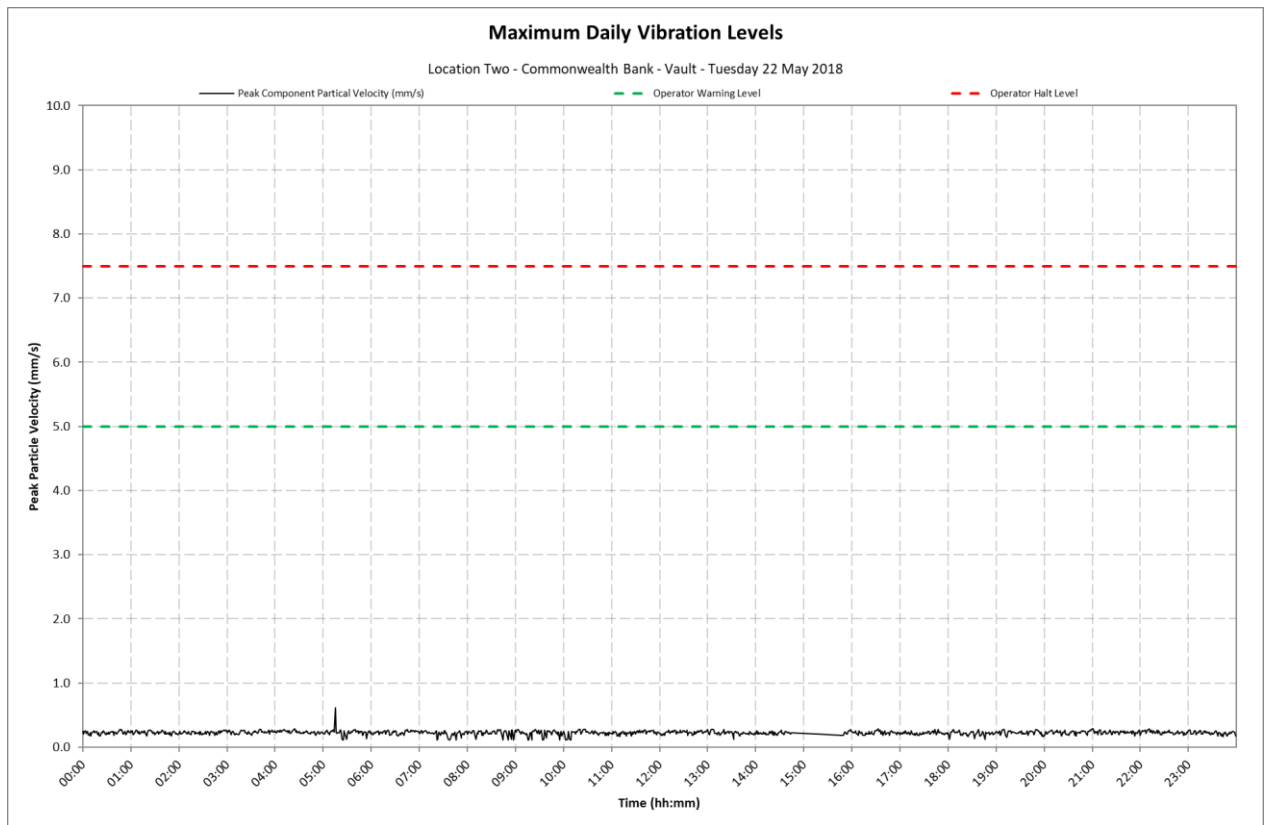
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

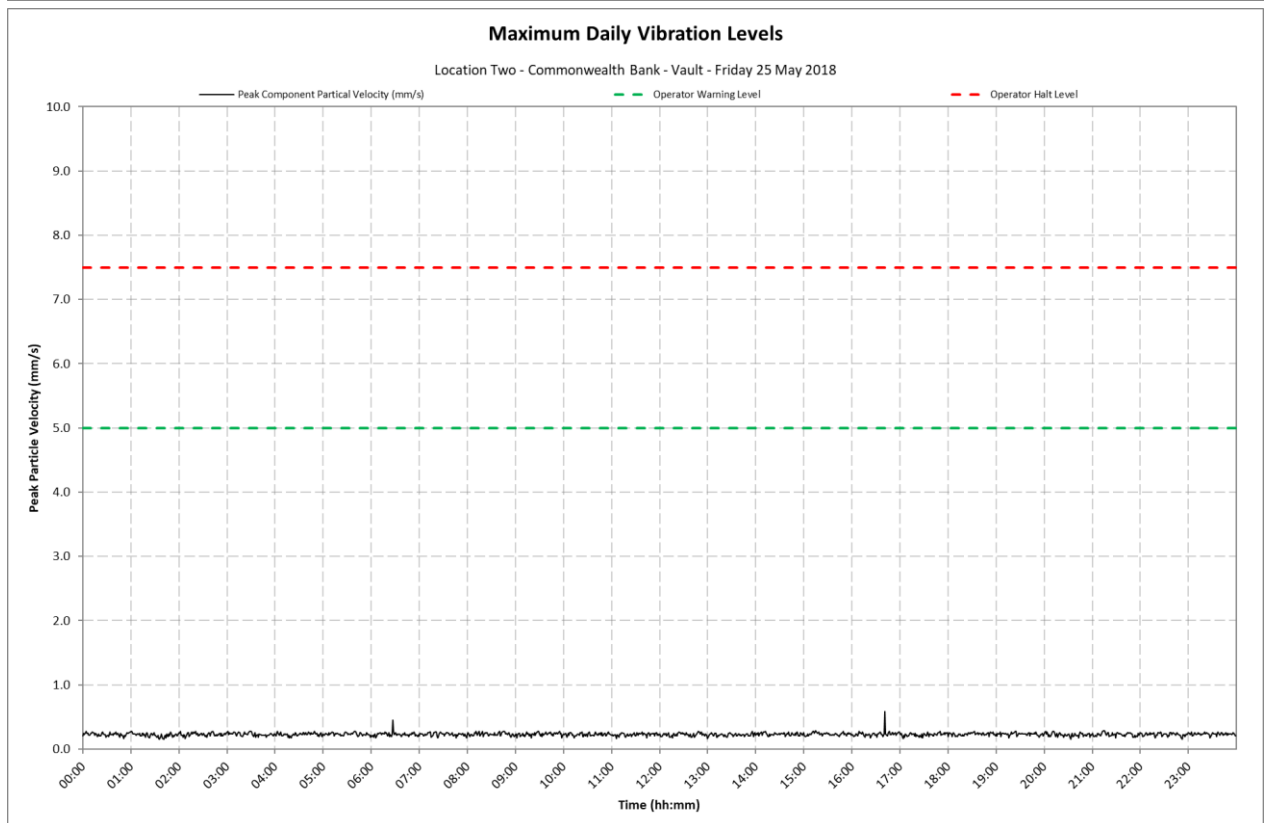
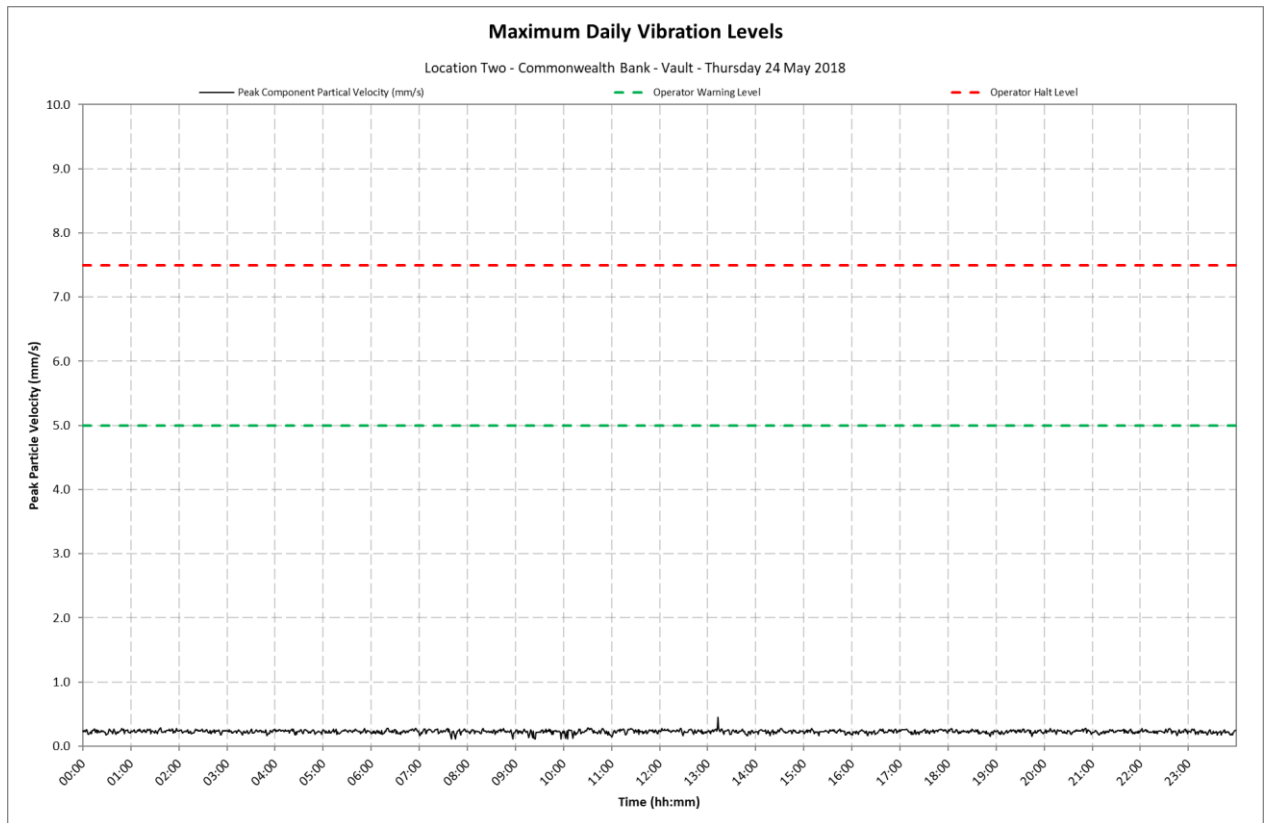
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

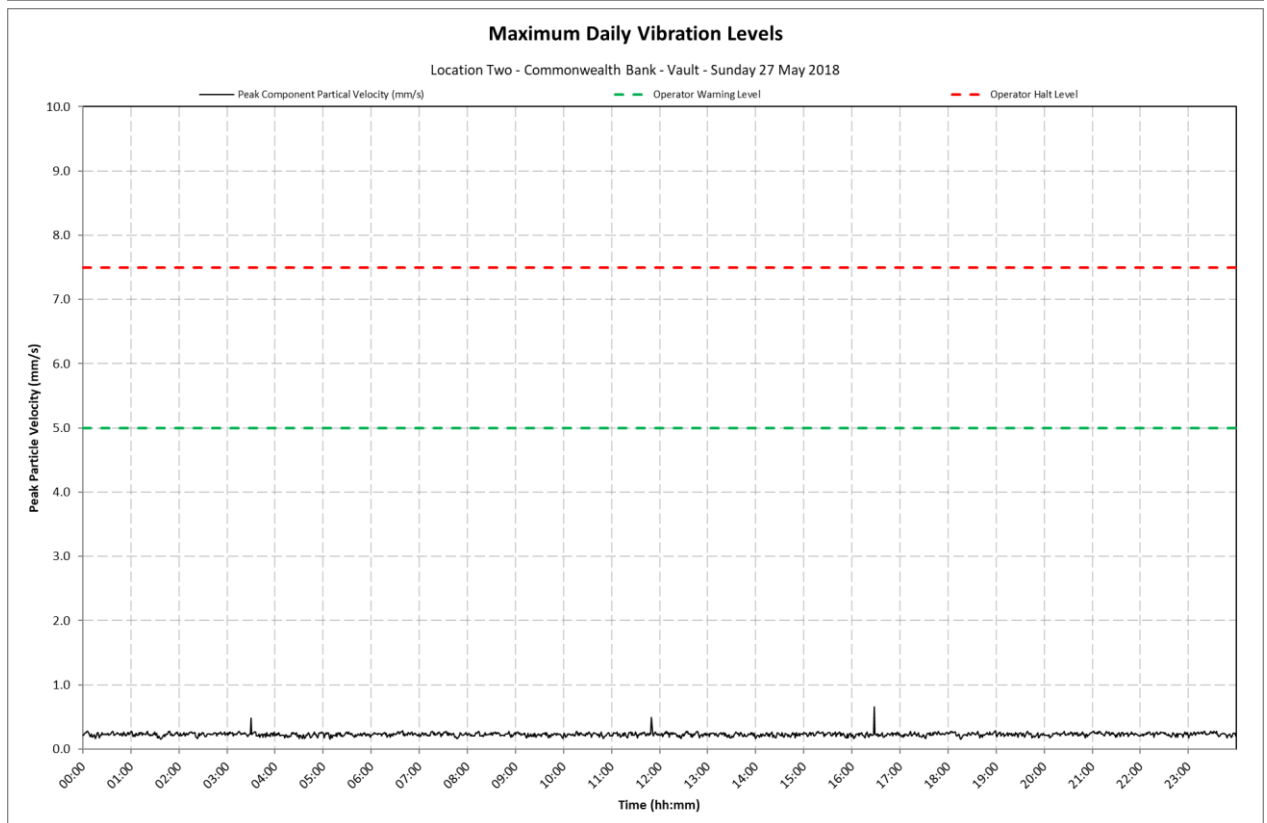
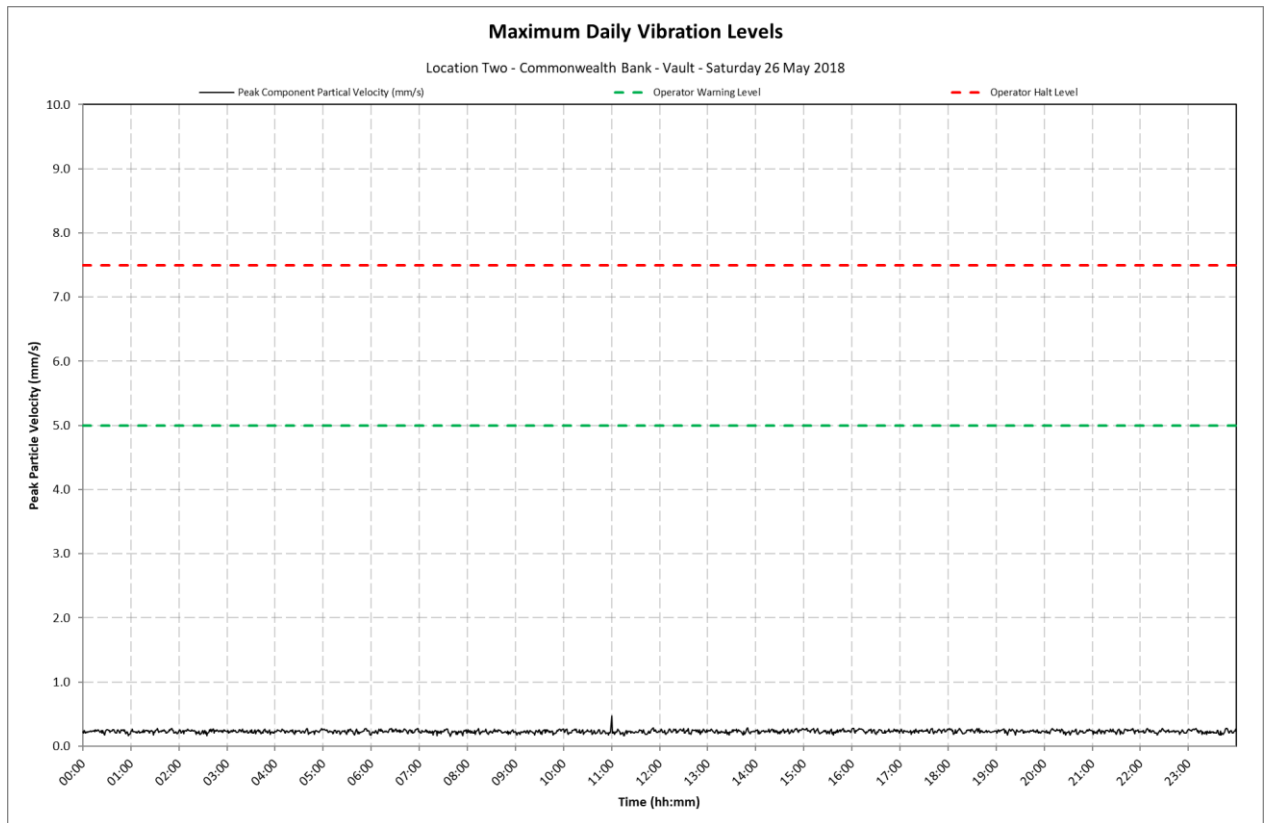
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

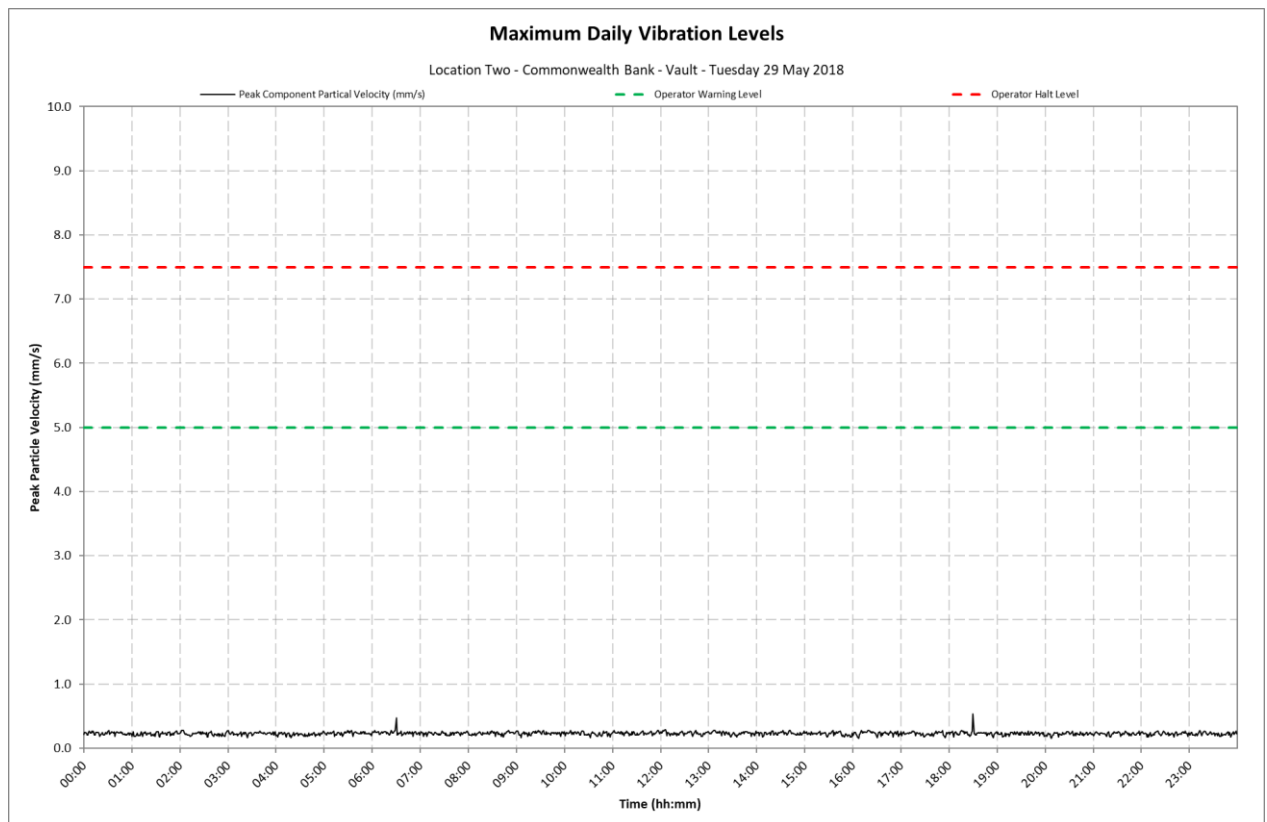
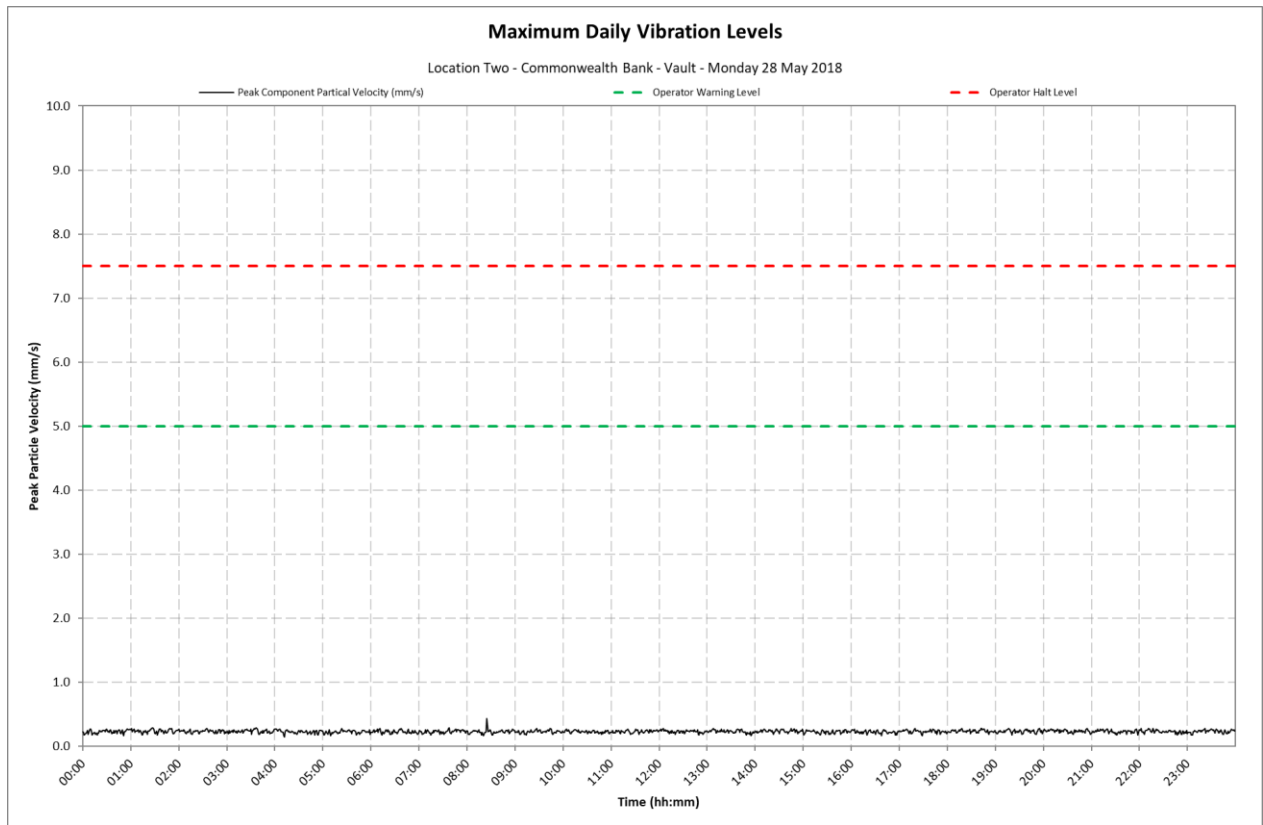
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

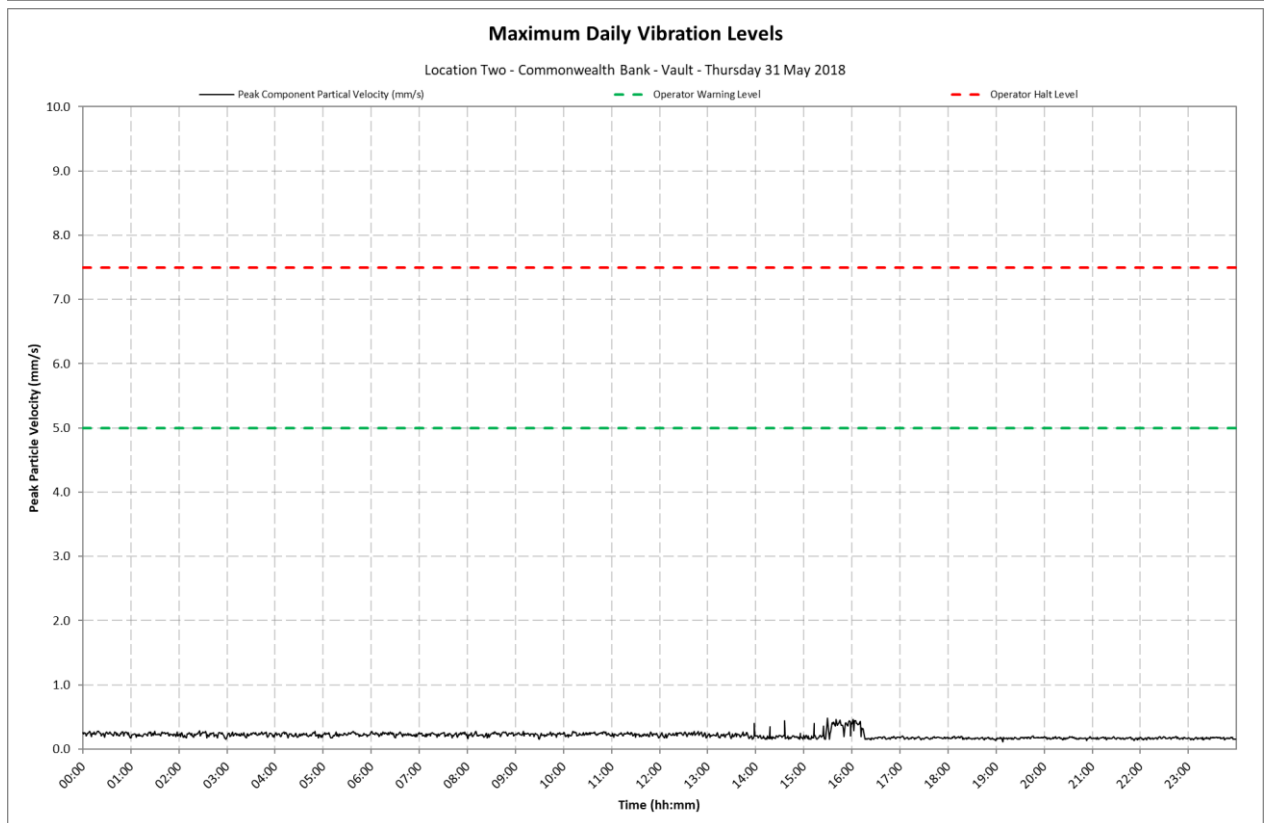
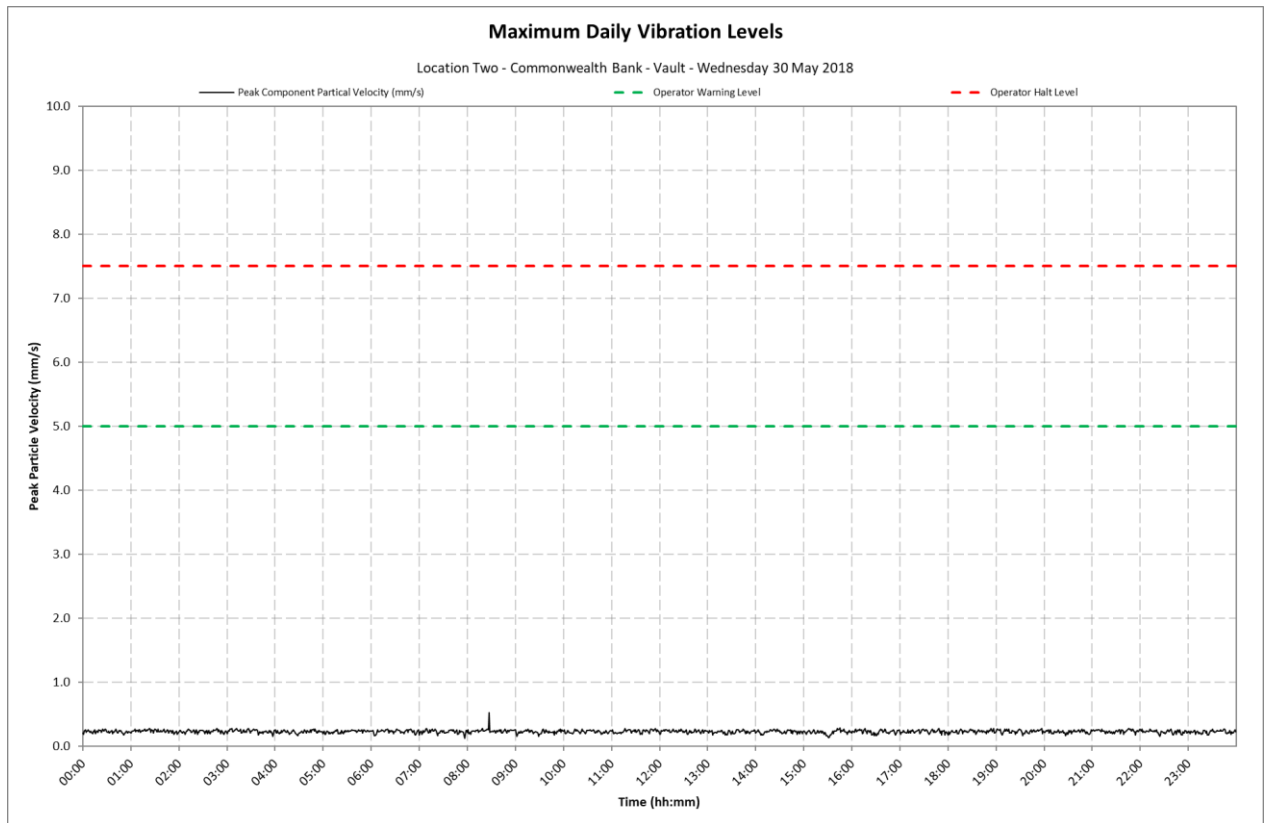
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

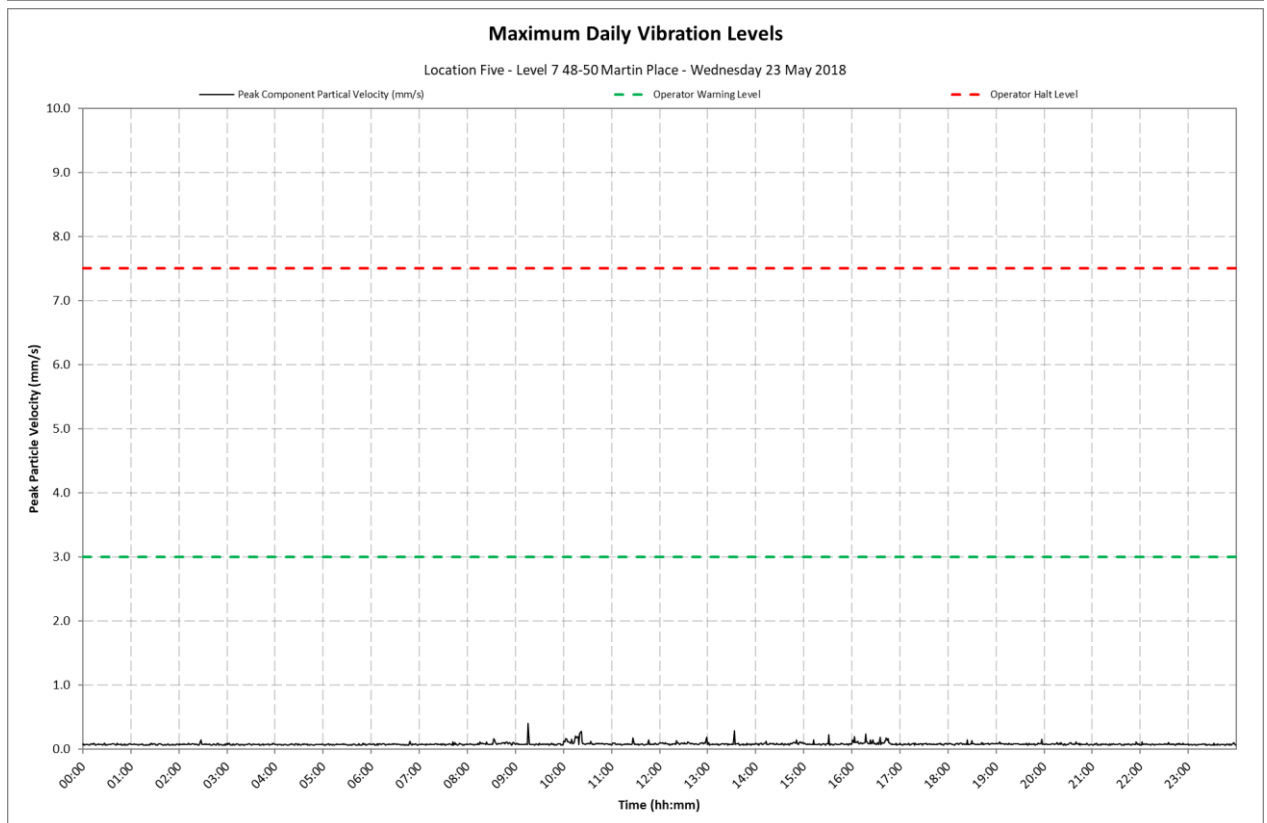
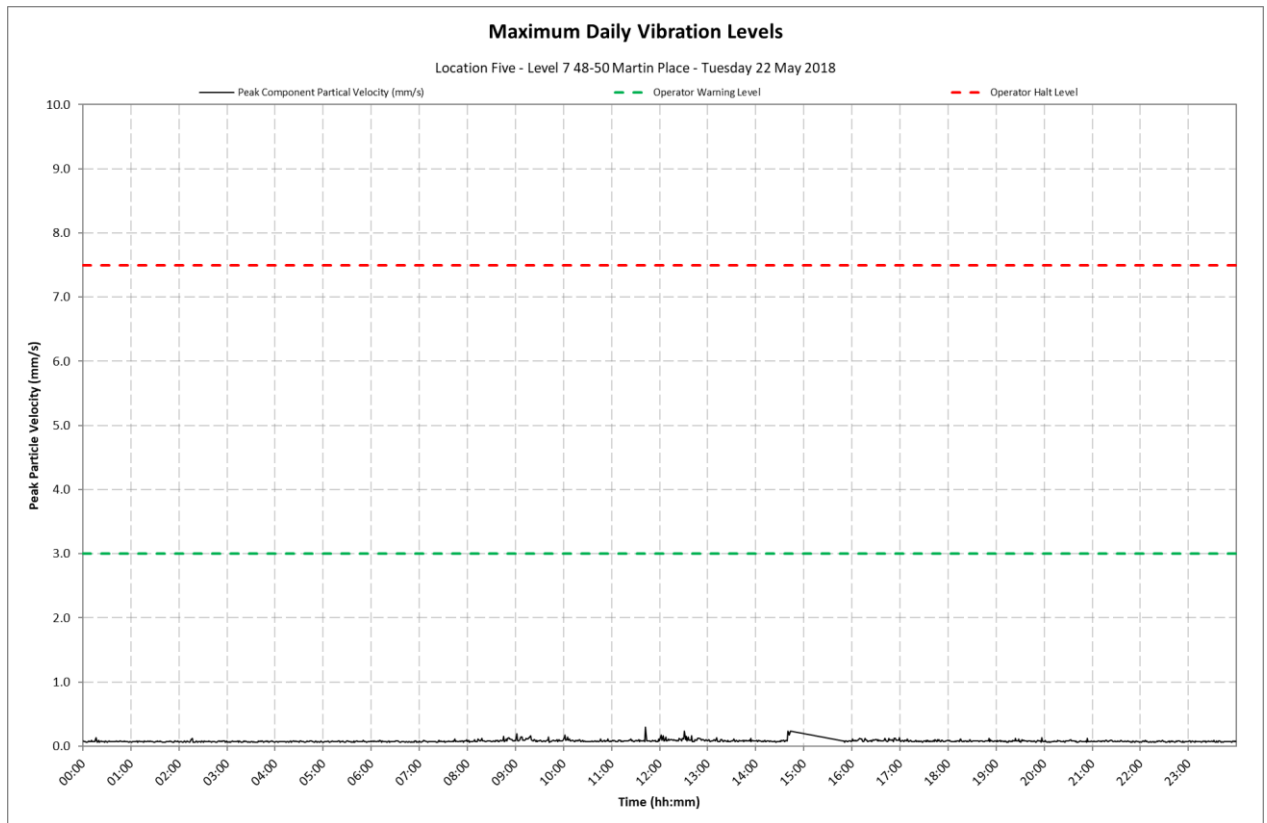
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

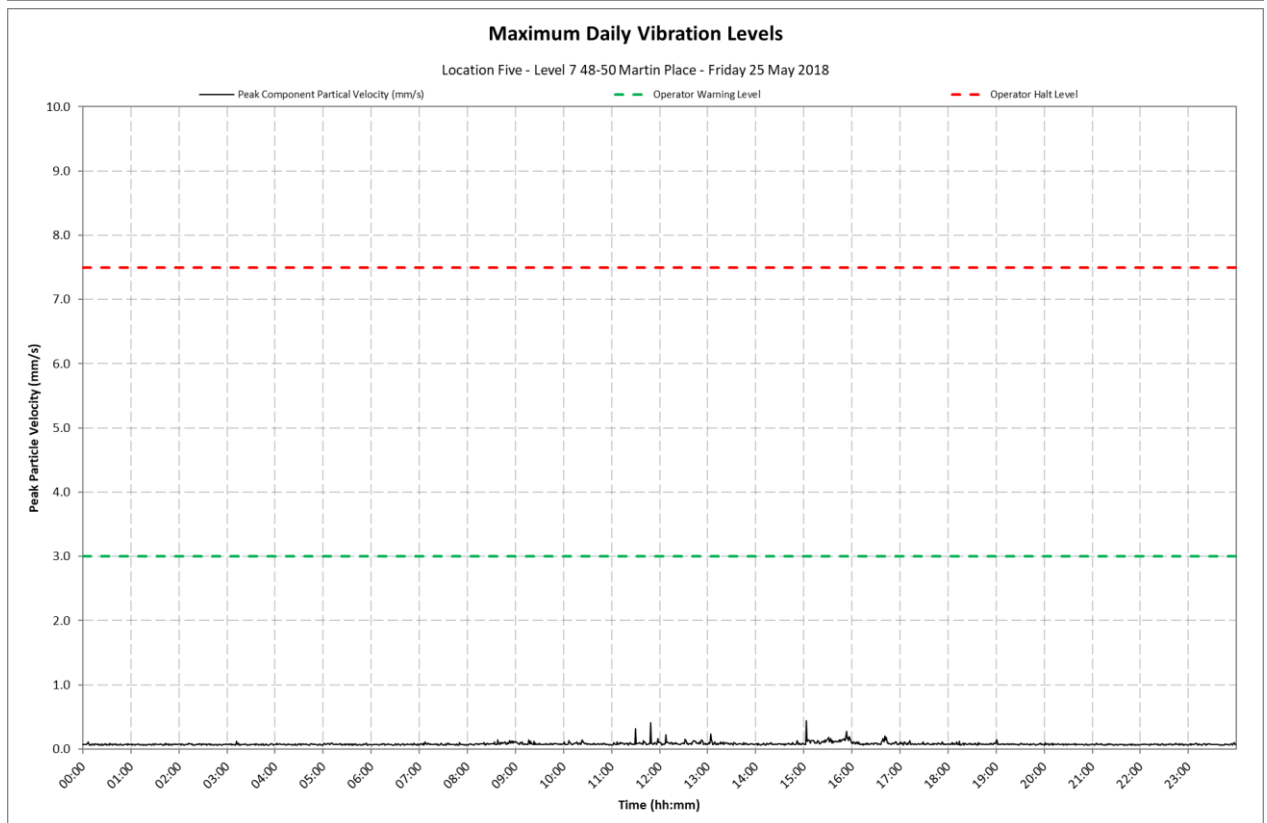
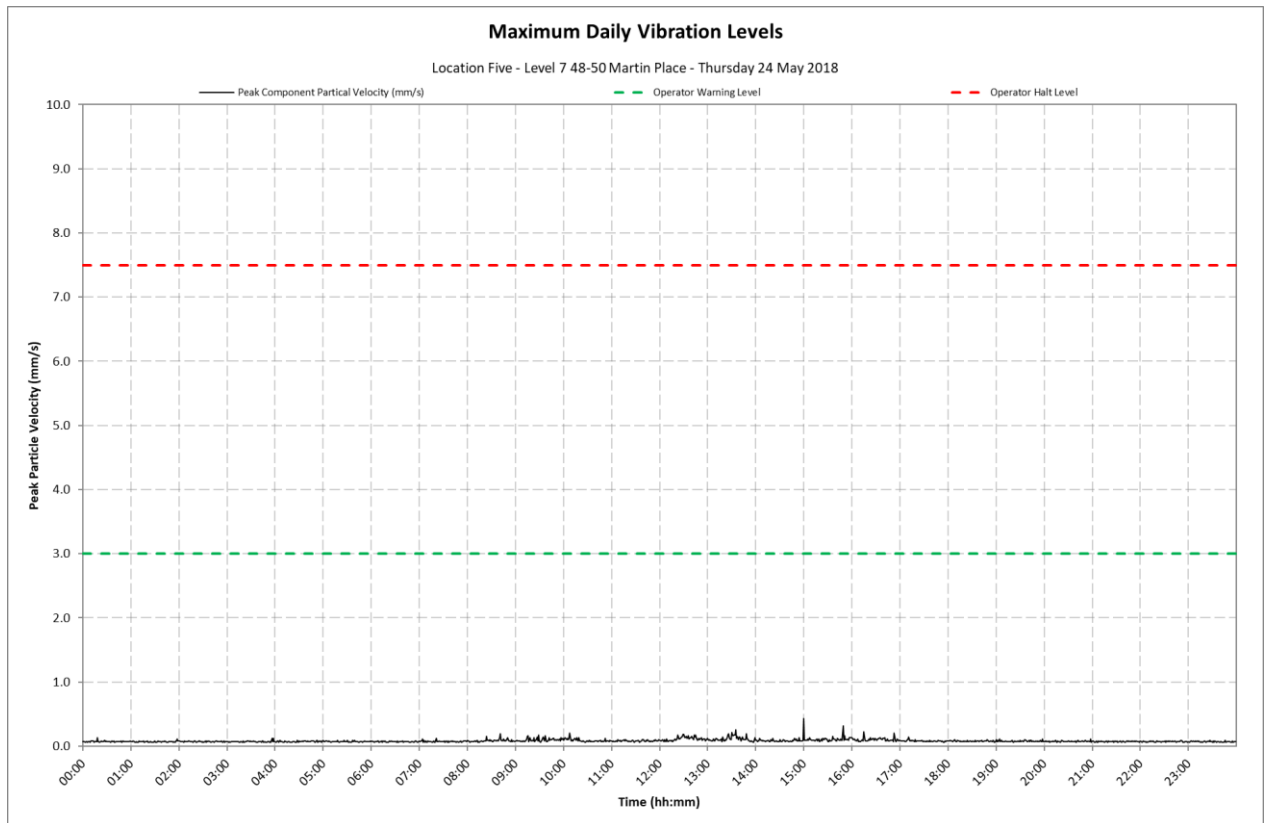
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

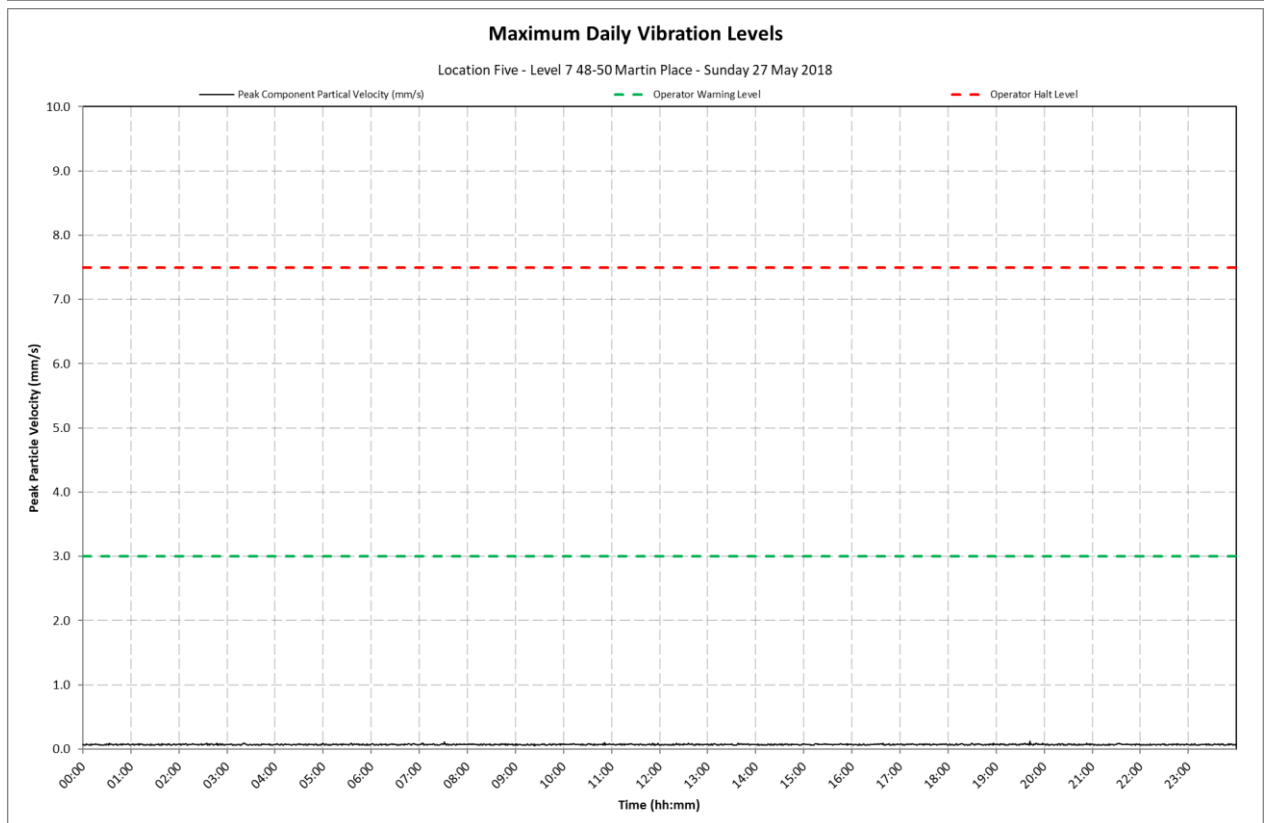
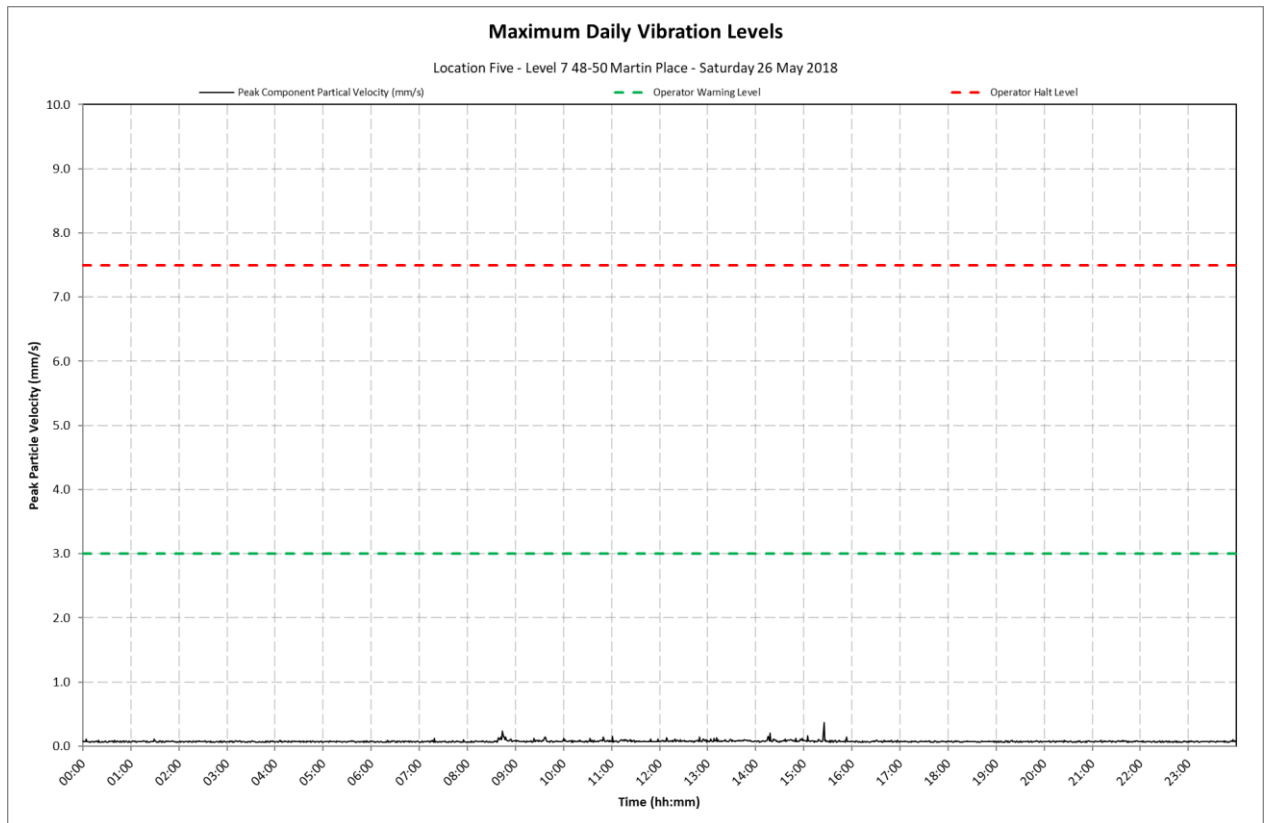
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

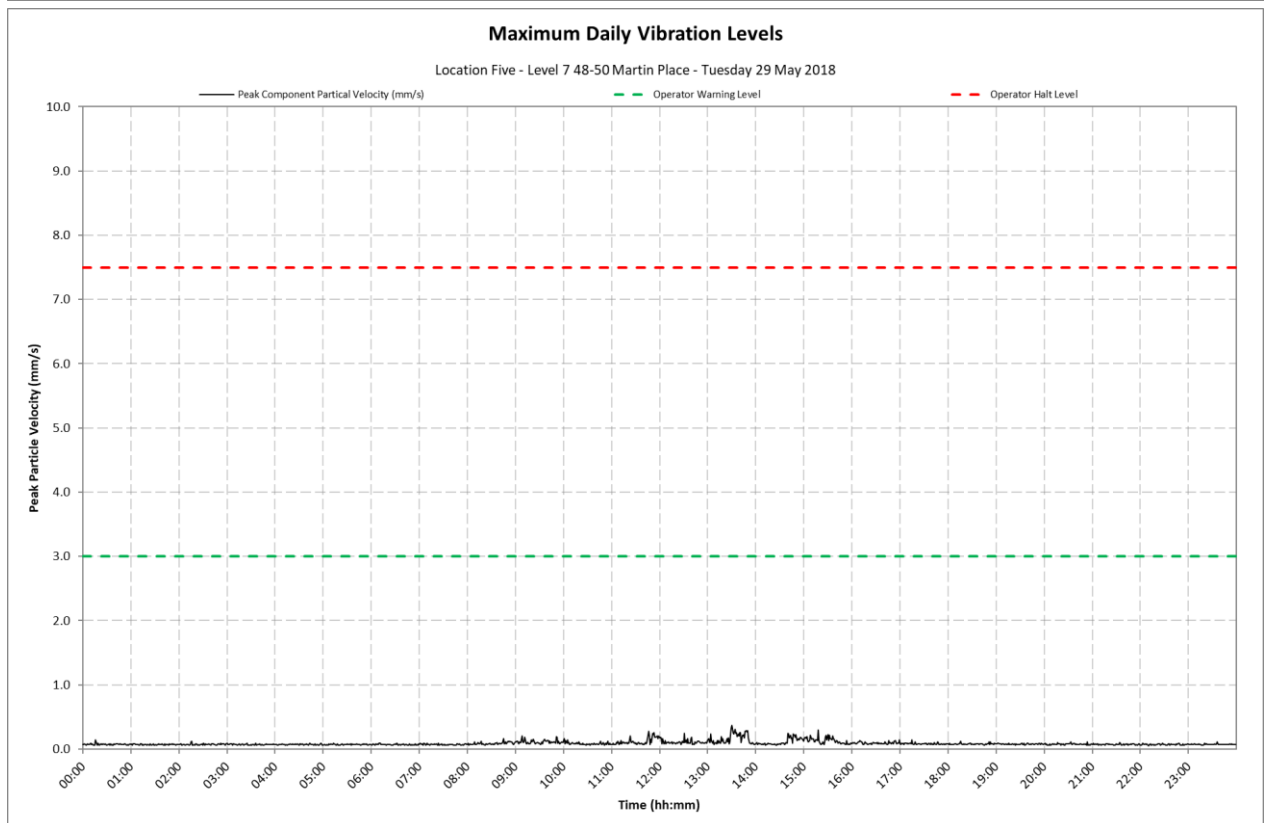
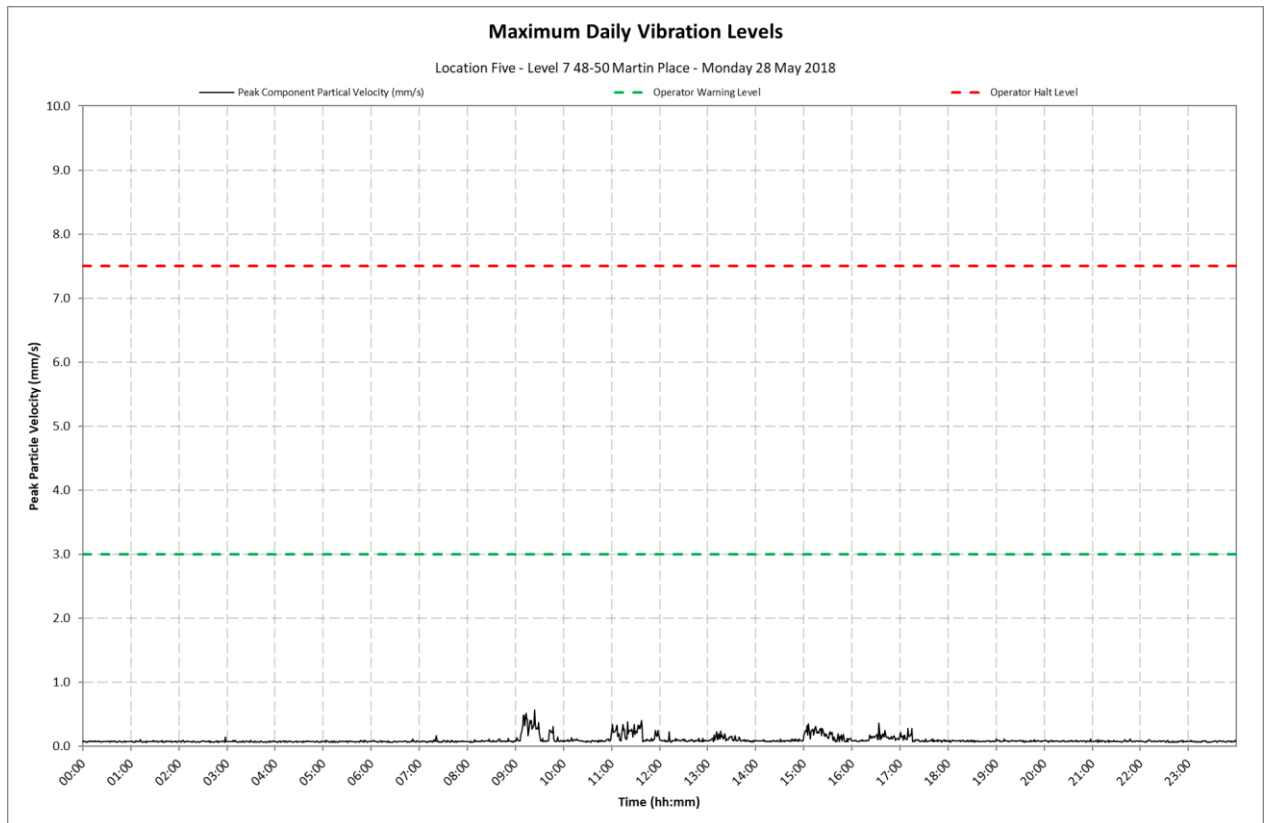
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

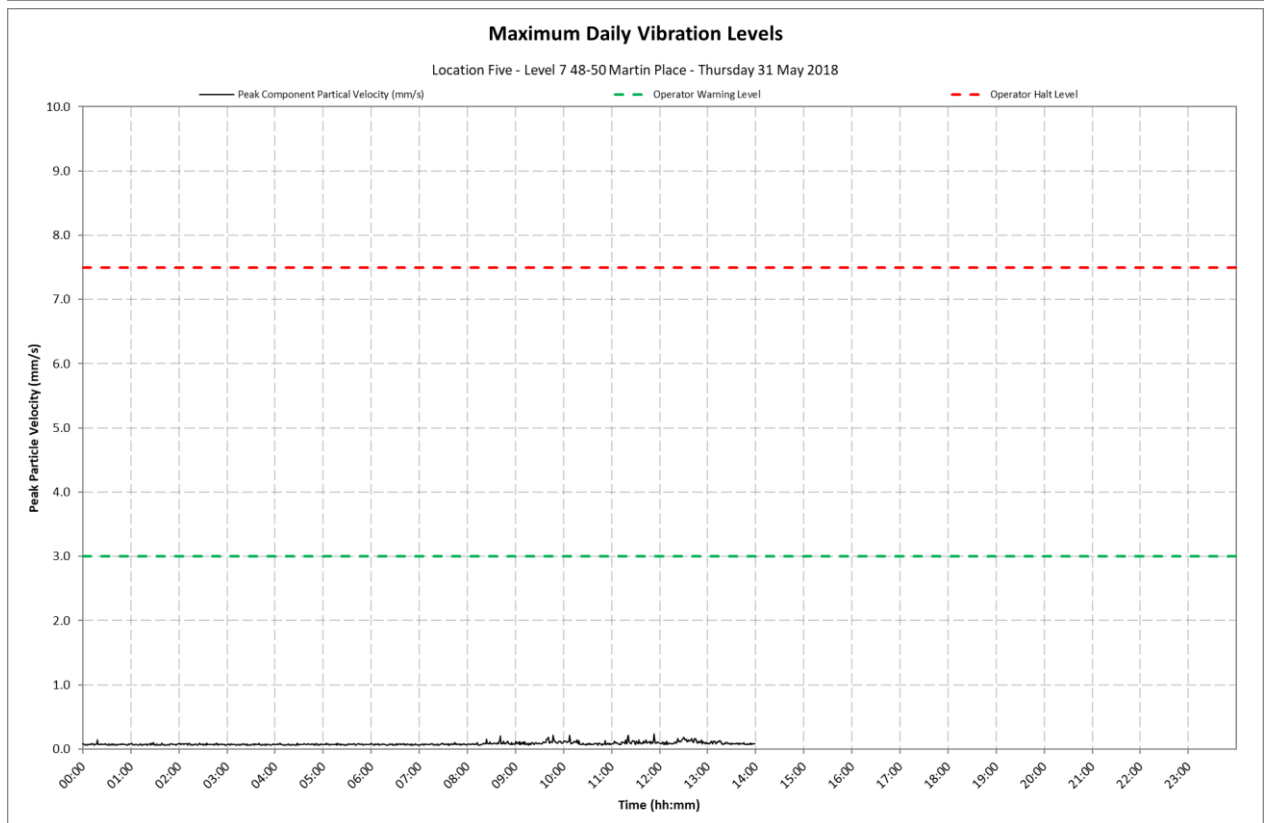
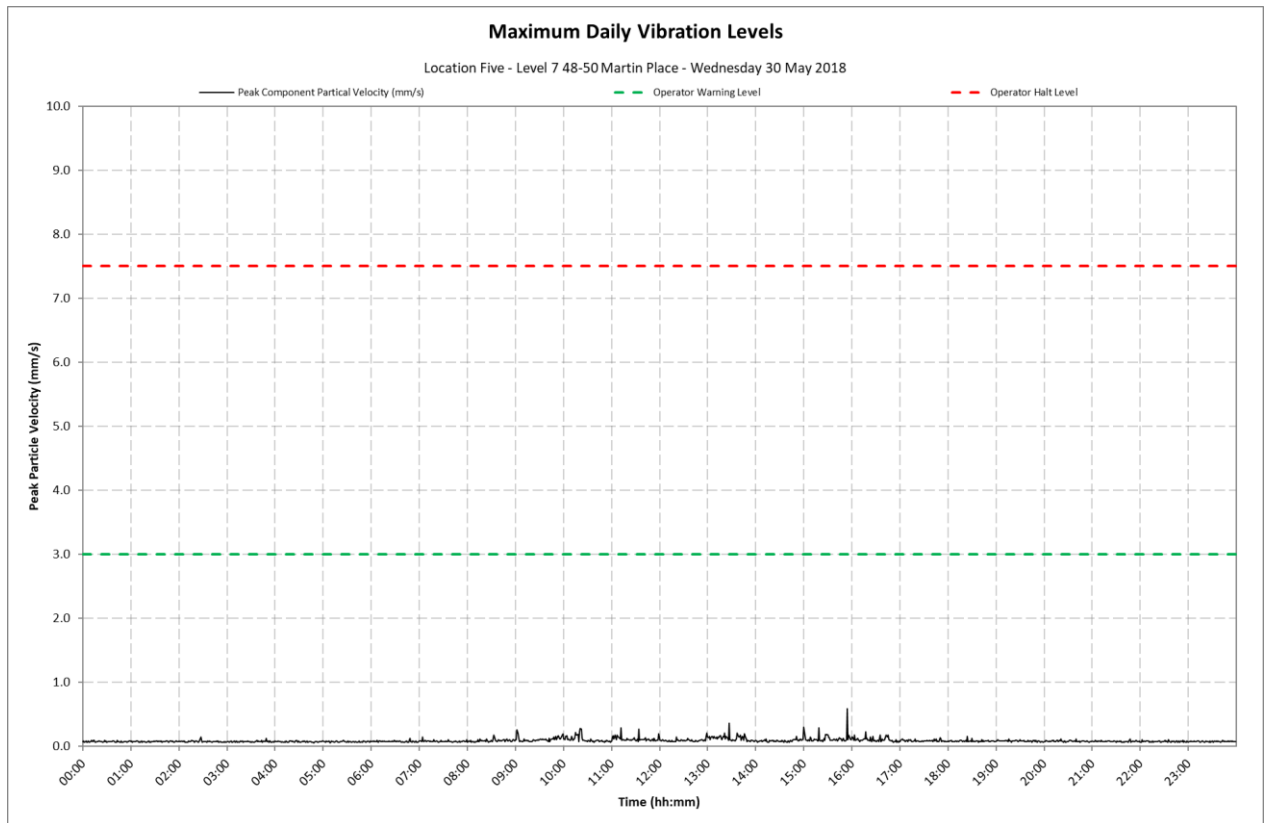
Location 5 - Level 7, 48-50 Martin Place



Appendix C2

Daily Vibration Levels

Location 5 - Level 7, 48-50 Martin Place



14 June 2018

10-1380 R31 NV Monitoring 20180718.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 31
1 June to 7 June 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 1 June to 7 June 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

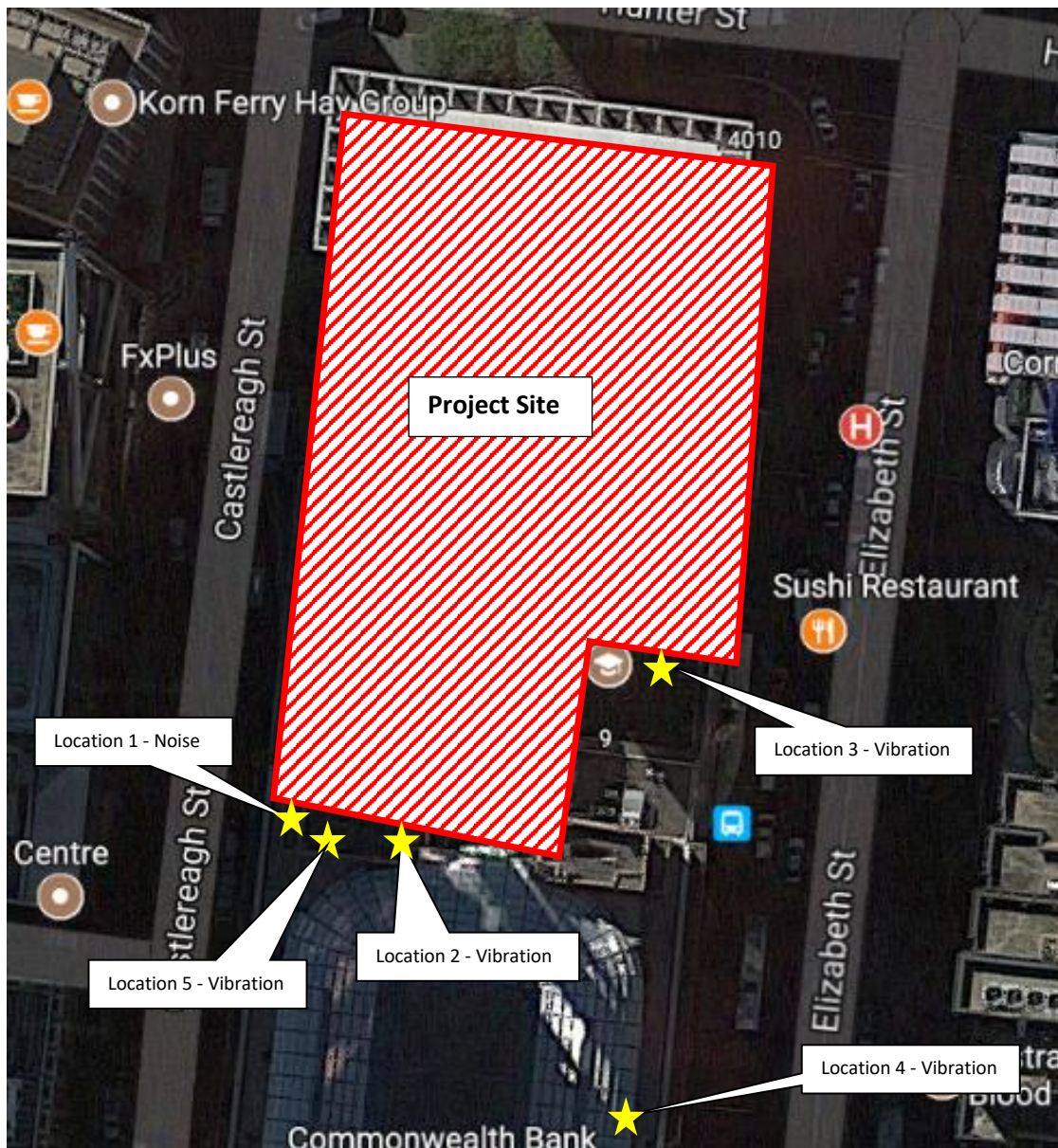
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 1 June to 7 June 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
1 June 2018	47	45	Complies	Complies
2 June 2018	38	36	Complies	Complies
3 June 2018	38	36	Complies	Complies
4 June 2018	45	44	Complies	Complies
5 June 2018	46	44	Complies	Complies
6 June 2018	46	44	Complies	Complies
7 June 2018	46	44	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 3 and **Table 4** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 1 June to 7 June 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
1 June 2018	0.2 mm/s	Complies
2 June 2018	0.2 mm/s	Complies
3 June 2018	0.2 mm/s	Complies
4 June 2018	0.2 mm/s	Complies
5 June 2018	0.2 mm/s	Complies
6 June 2018	0.8 mm/s	Complies
7 June 2018	0.2 mm/s	Complies

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
1 June 2018	1.1 mm/s	Complies
2 June 2018	5.3 mm/s	Complies
3 June 2018	0.2 mm/s	Complies
4 June 2018	8.2 mm/s	Complies
5 June 2018	2.7 mm/s	Complies
6 June 2018	8.2 mm/s	Complies
7 June 2018	2.8 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 1 June to 7 June 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 1 June to 7 June 2018 found all recorded ambient vibration levels were below the maximum vibration control limit at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

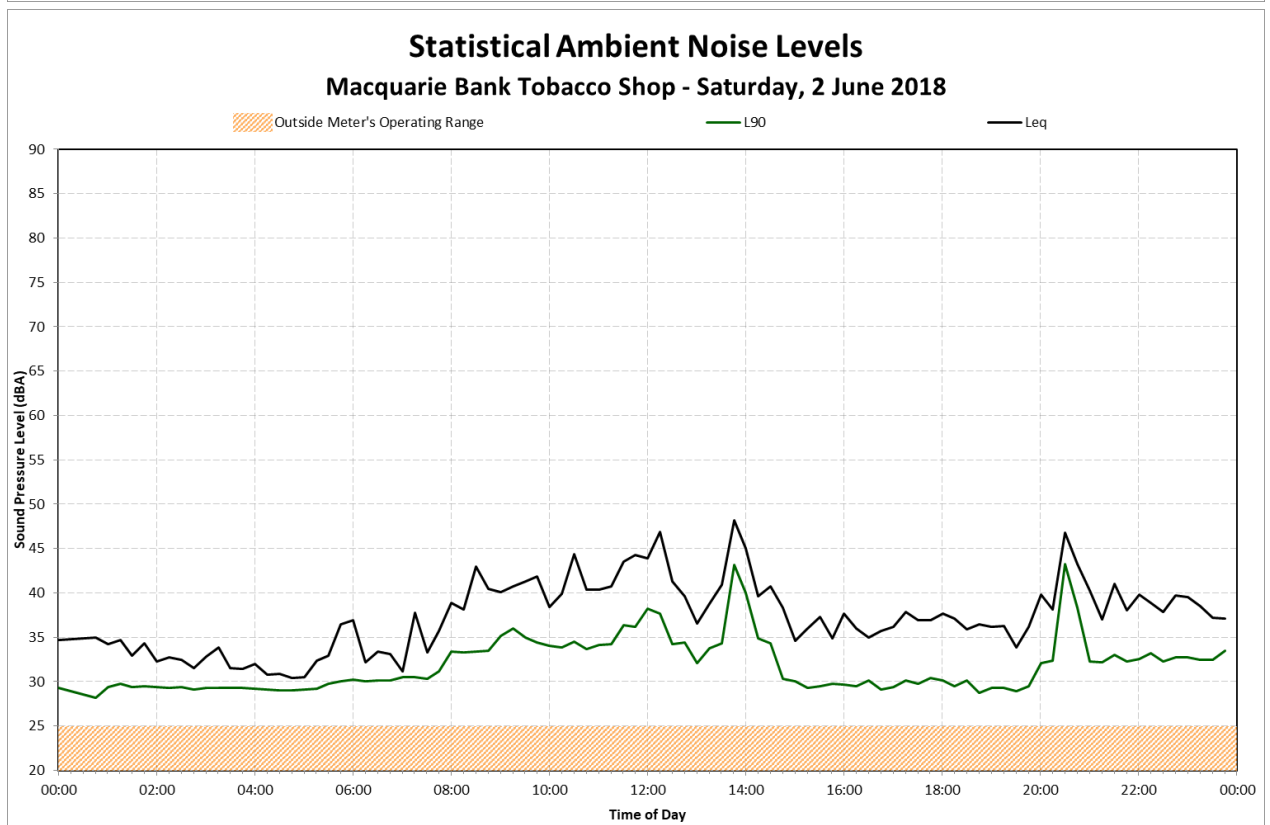
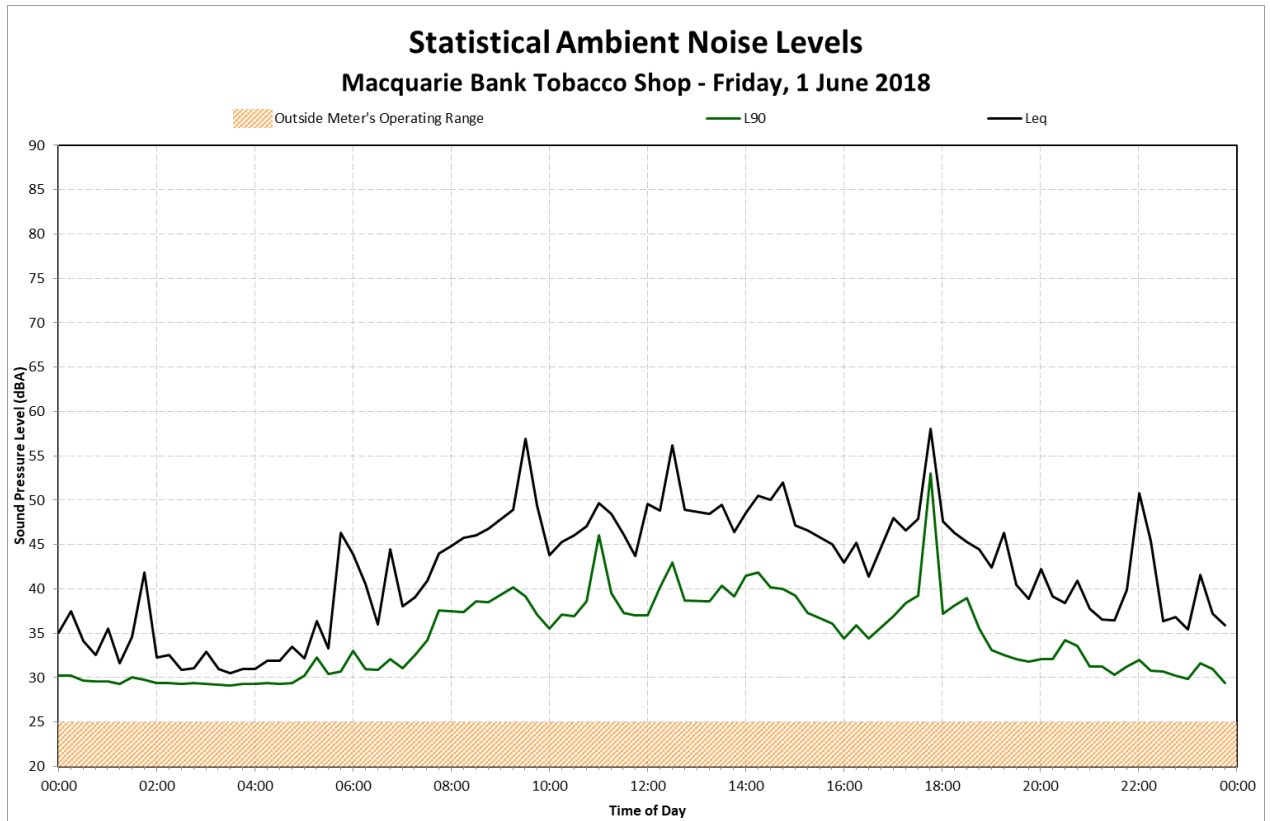
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
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L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
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PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

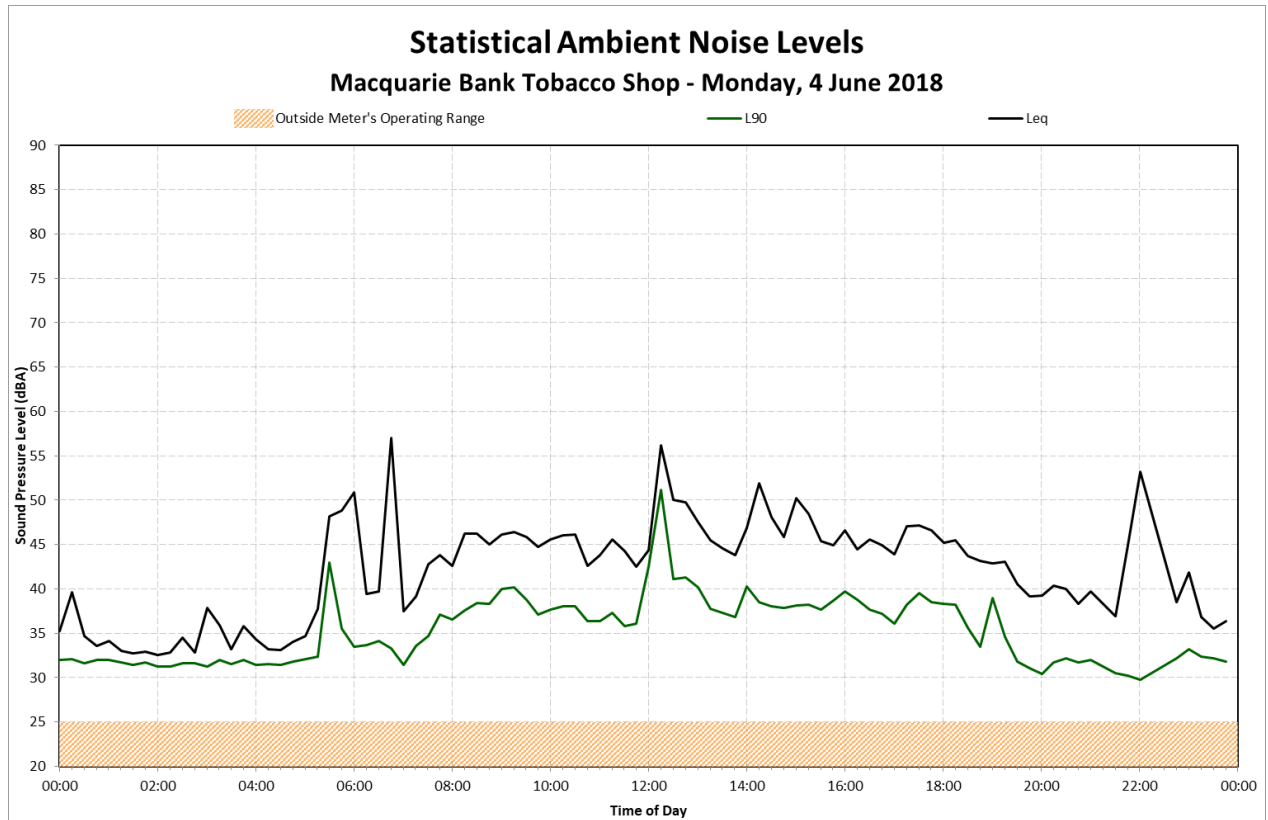
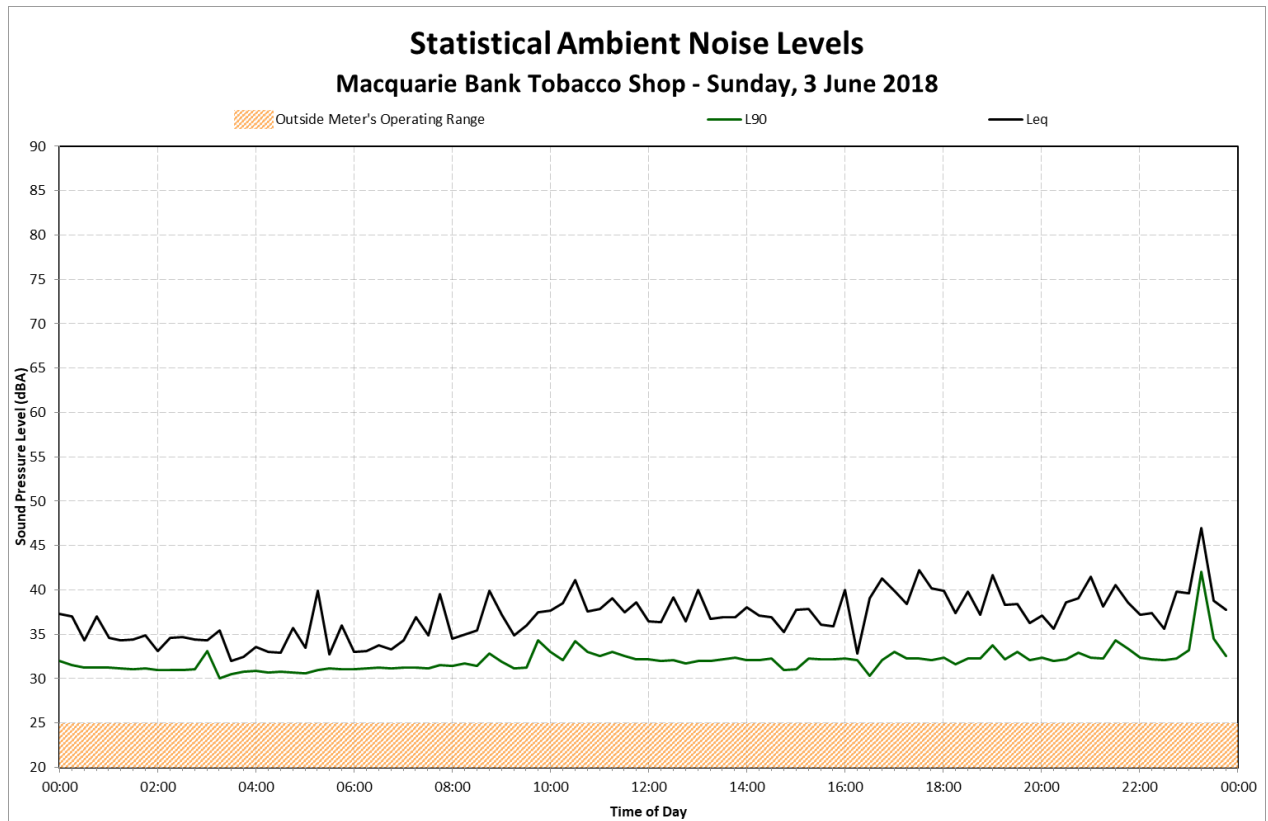
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

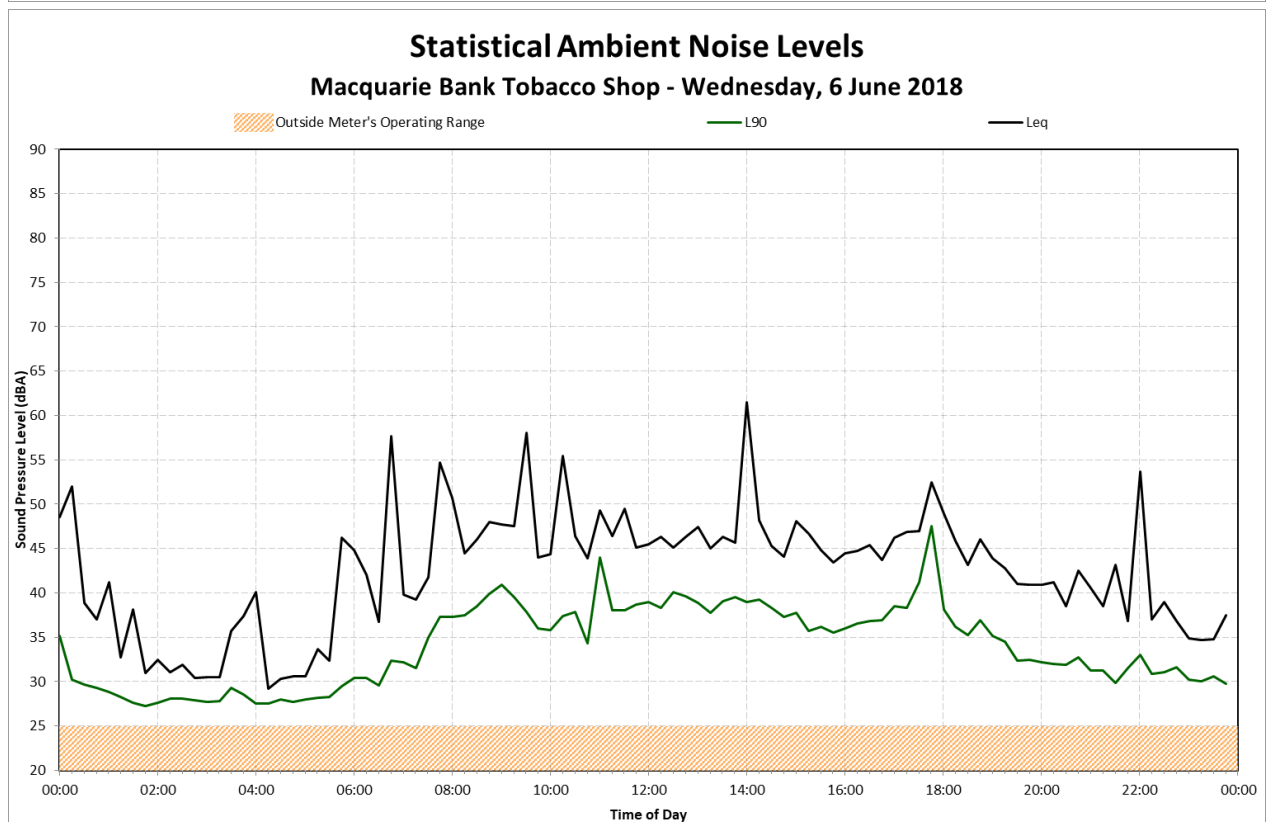
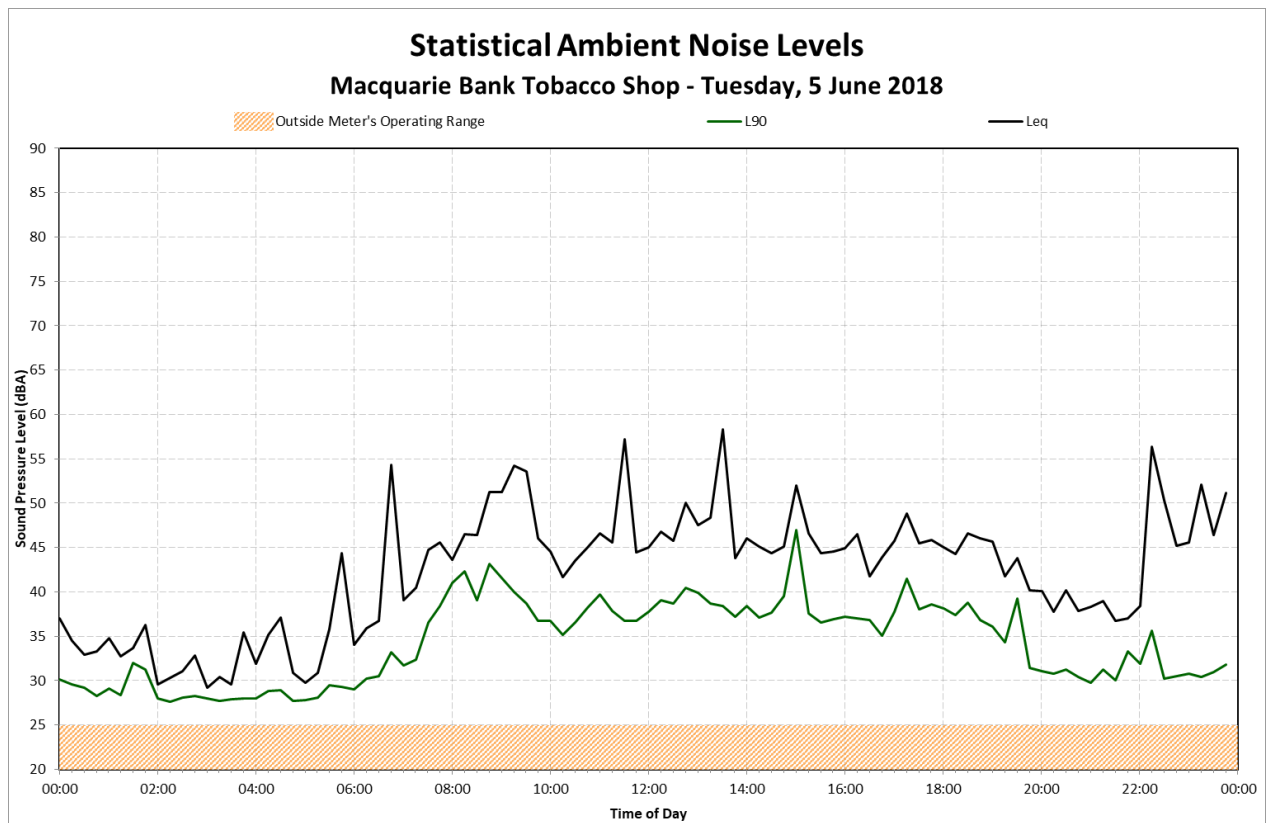
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

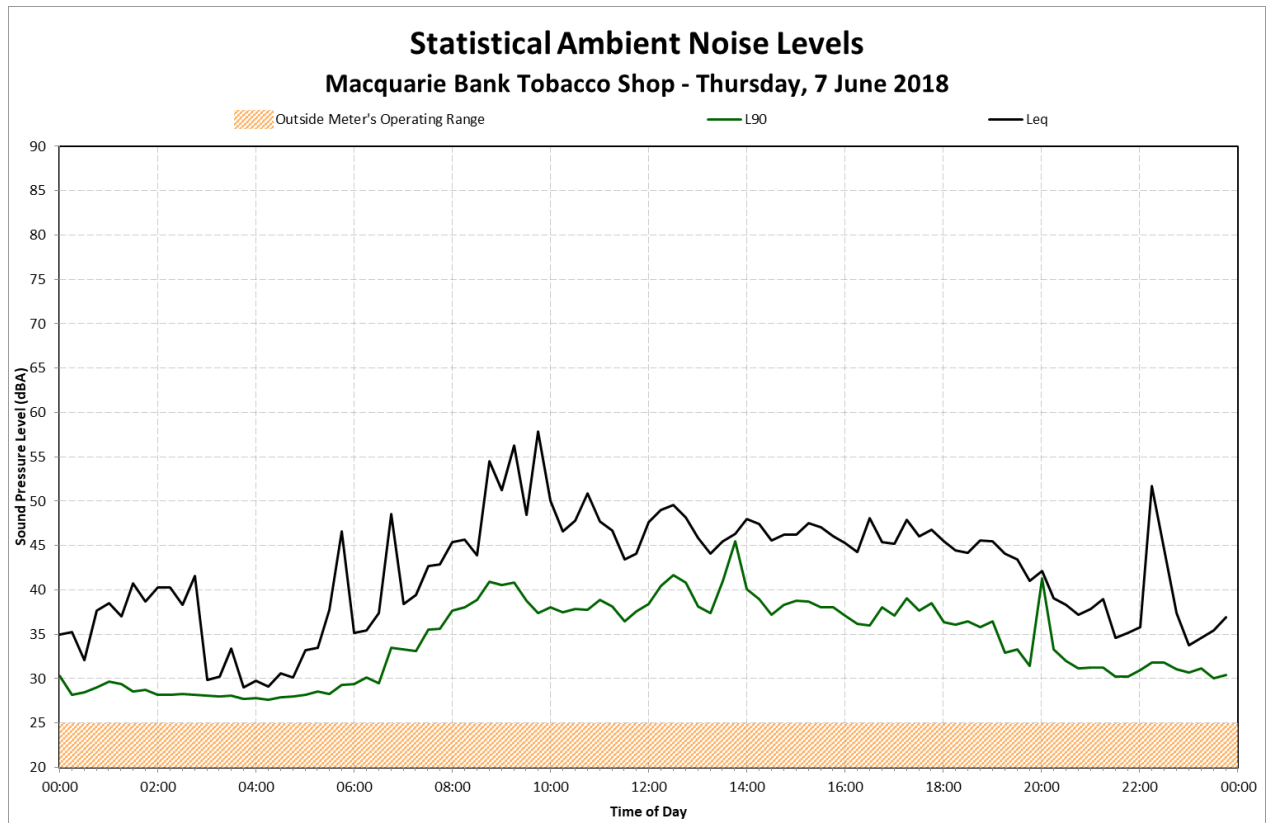
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

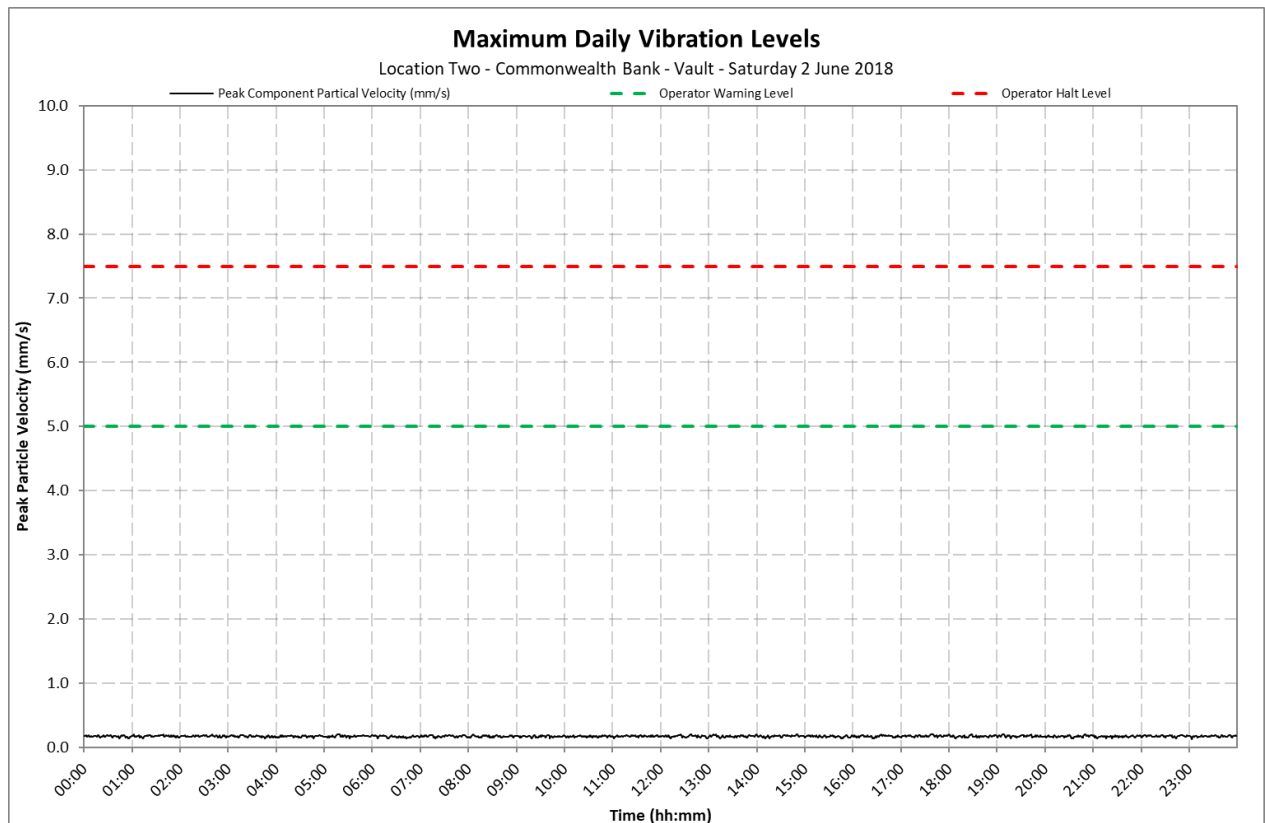
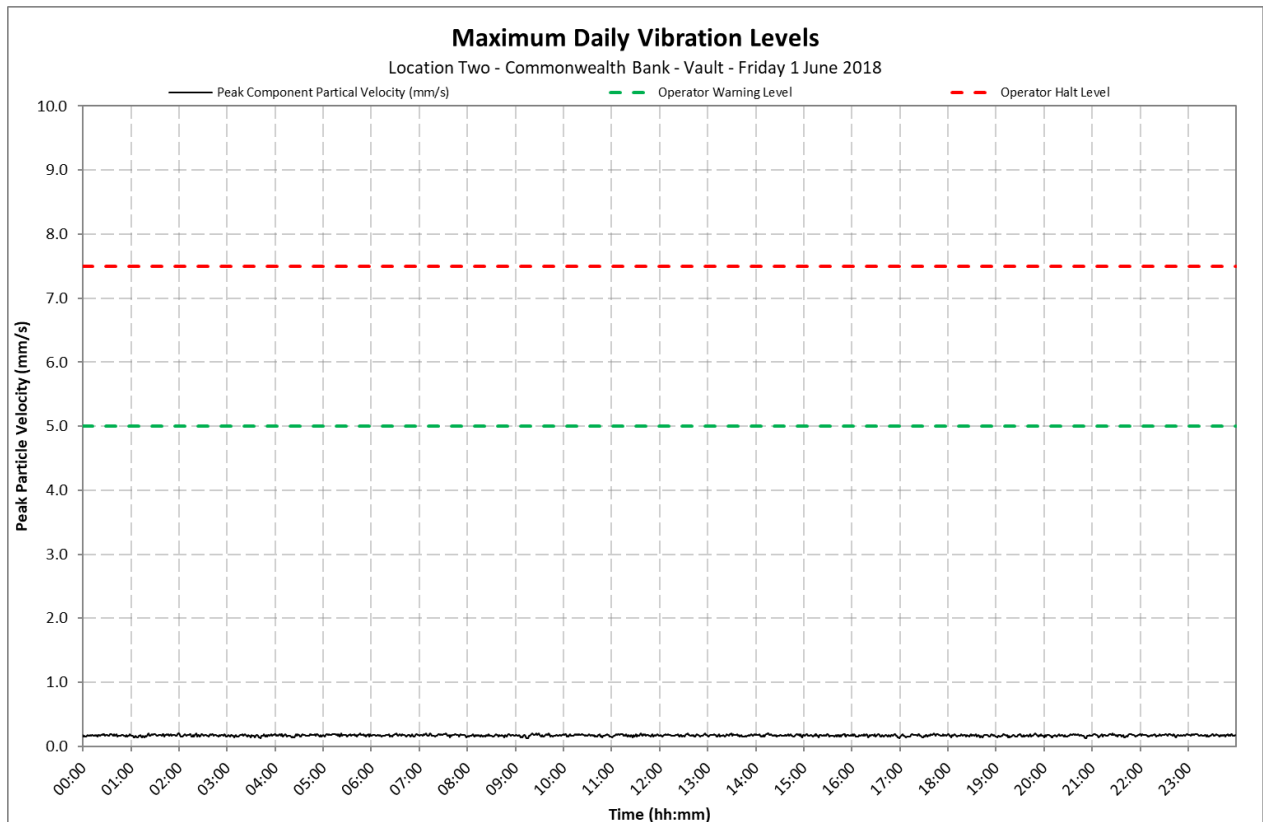
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

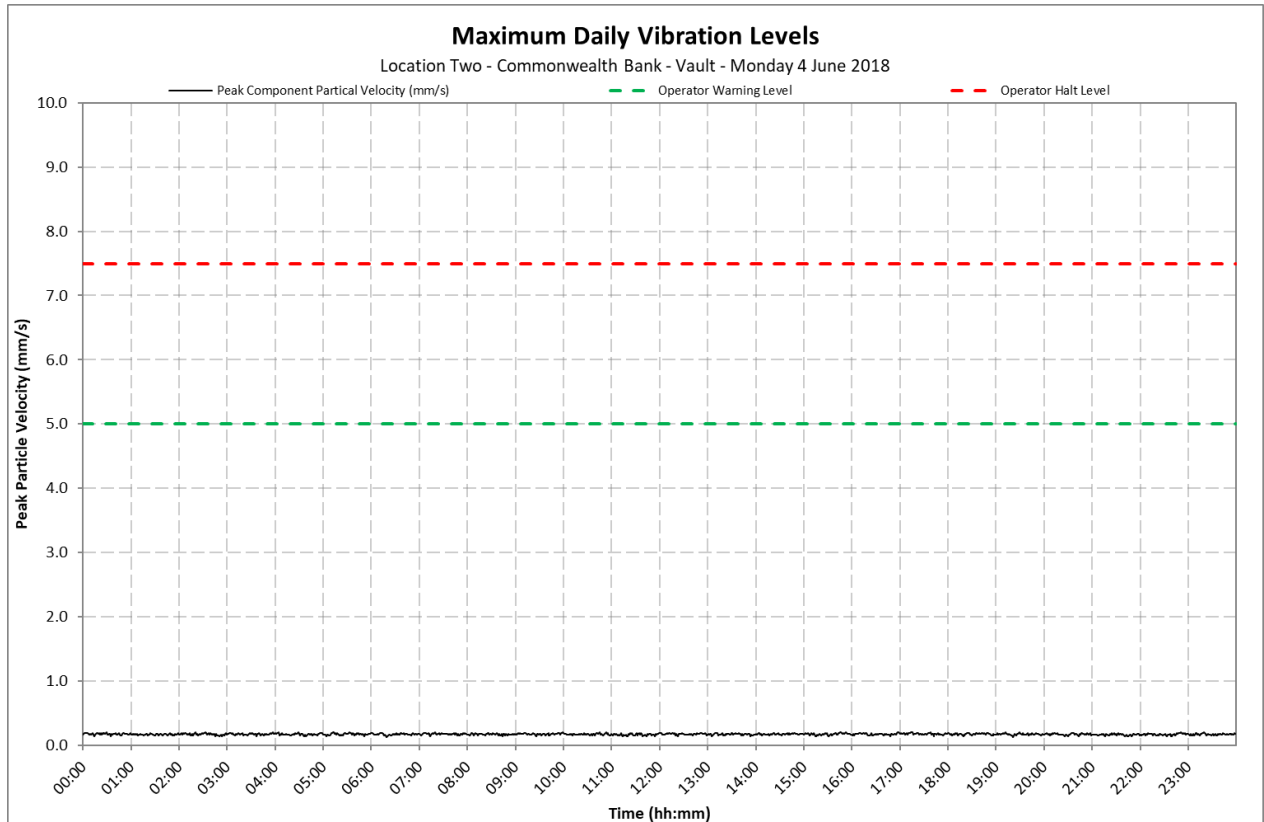
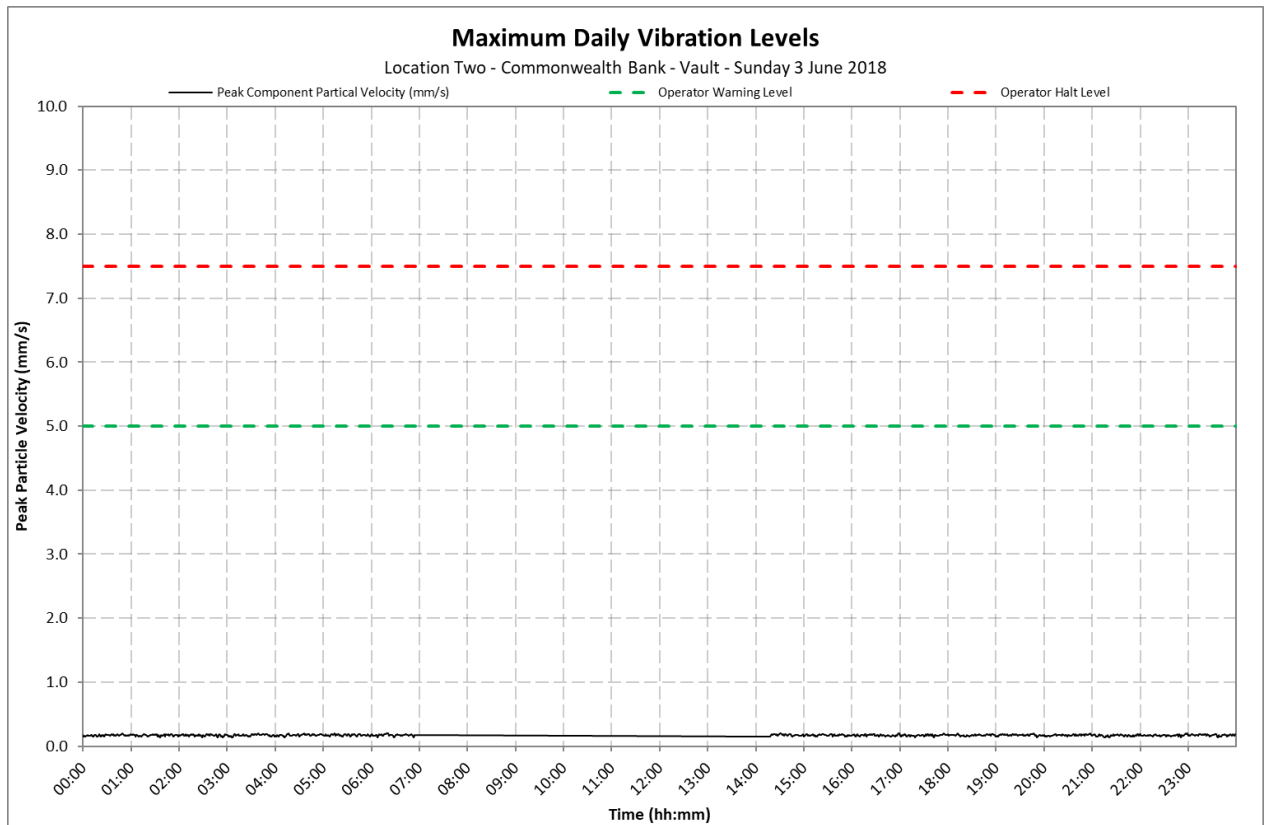
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

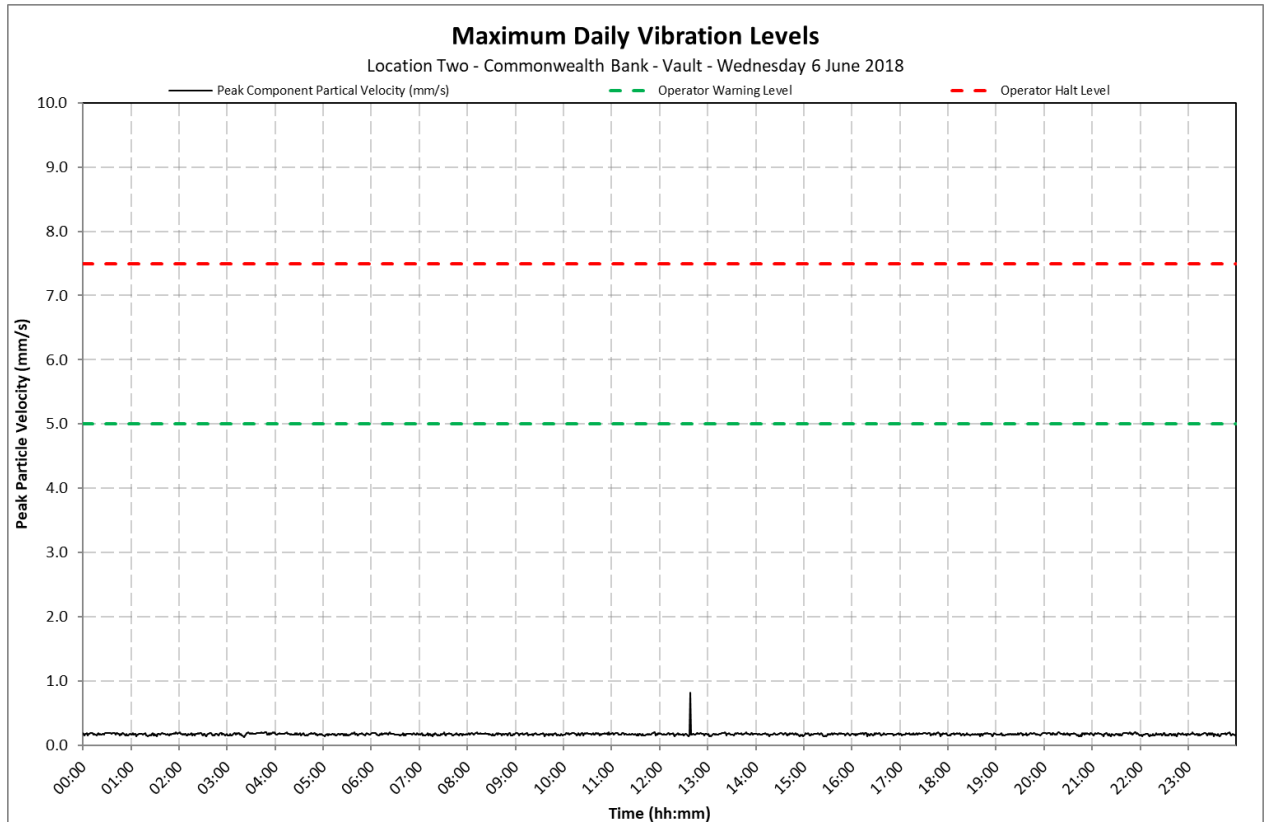
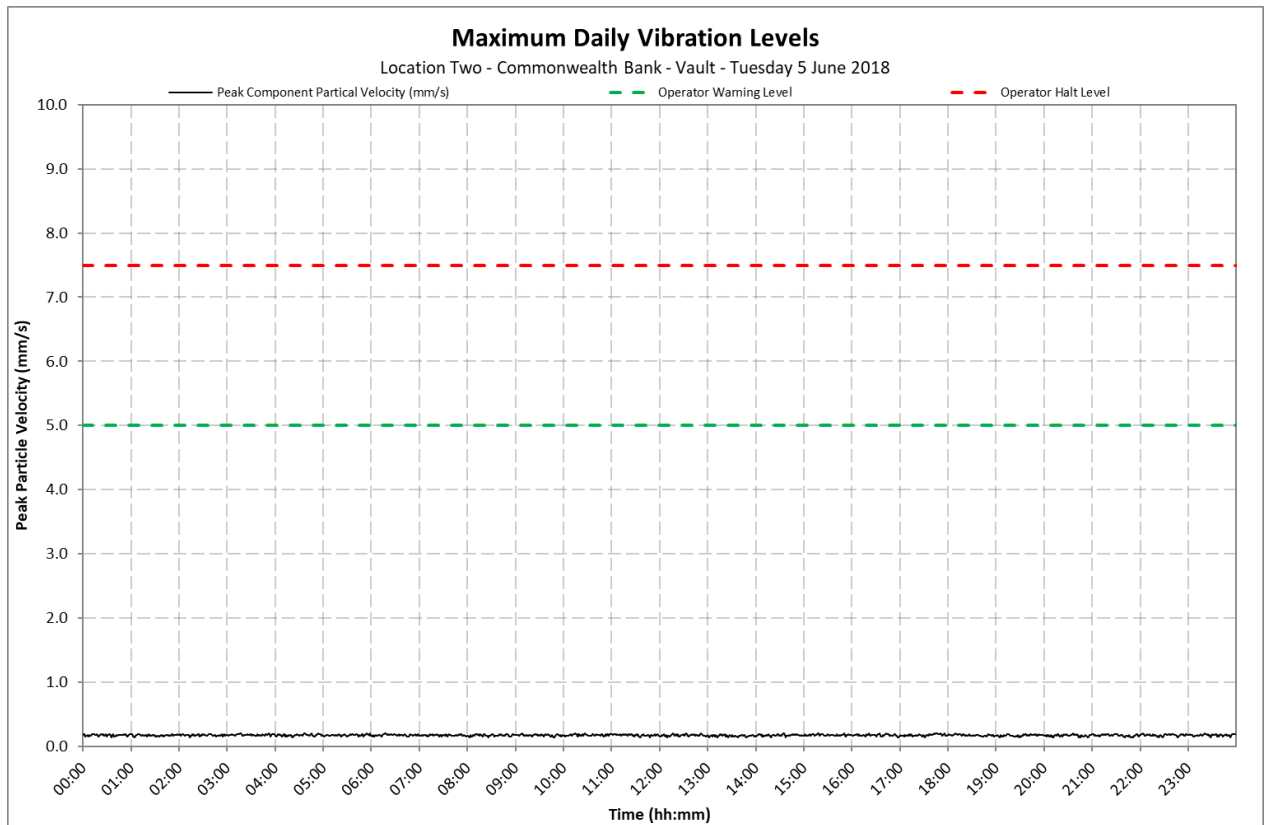
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

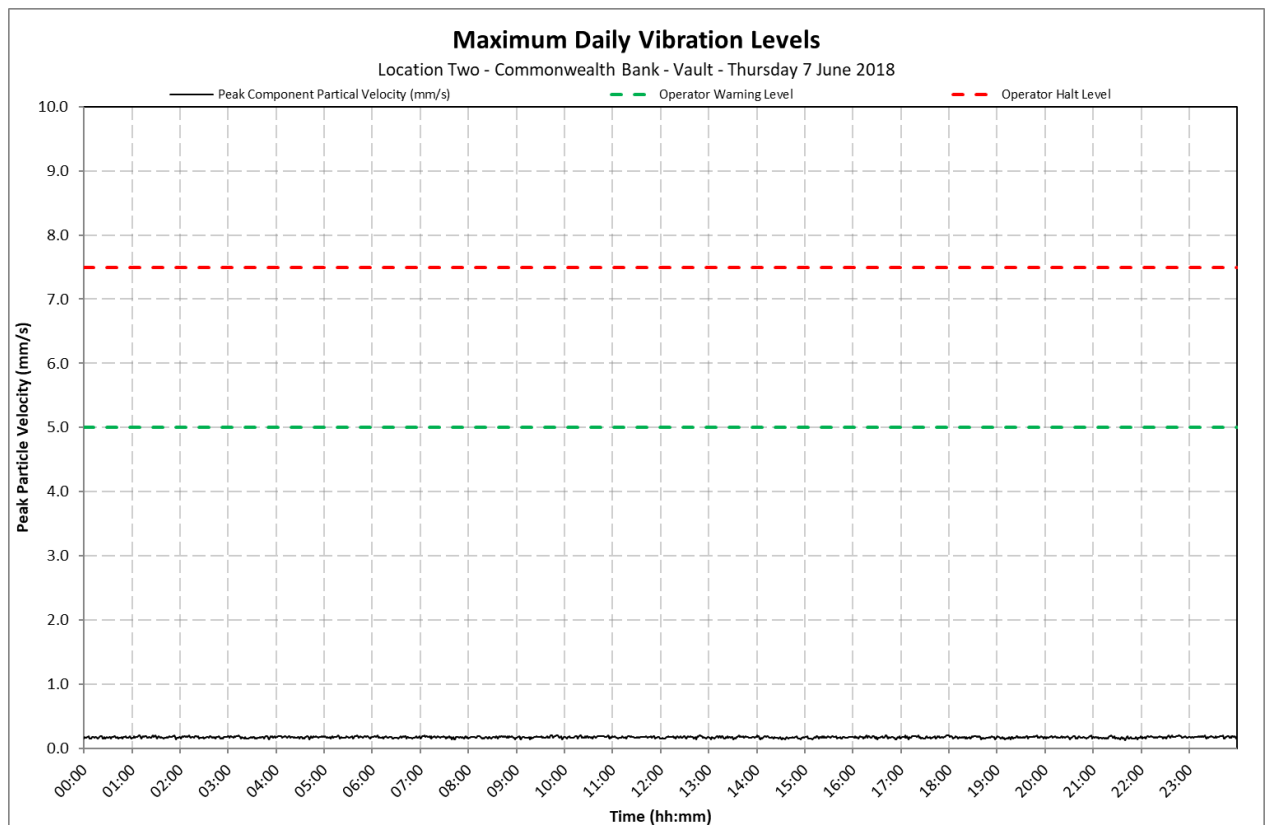
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

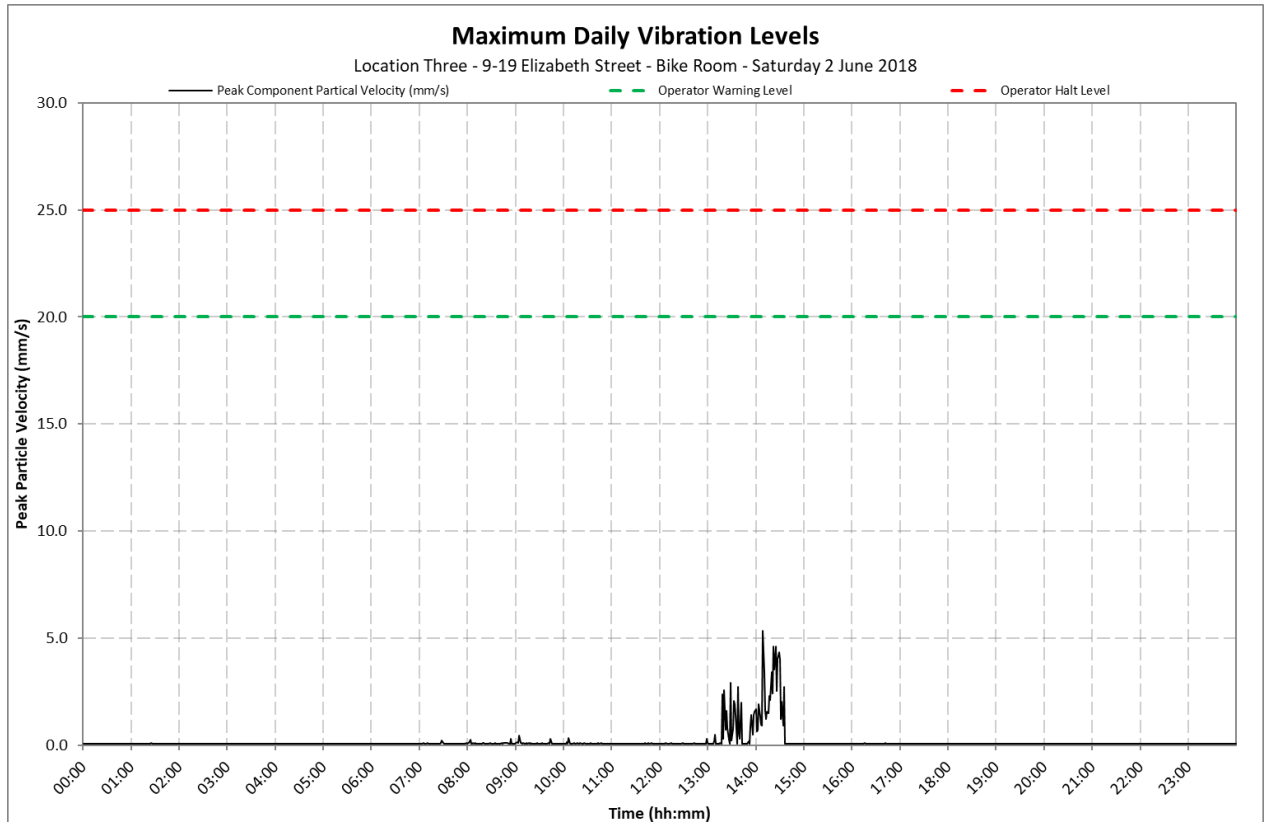
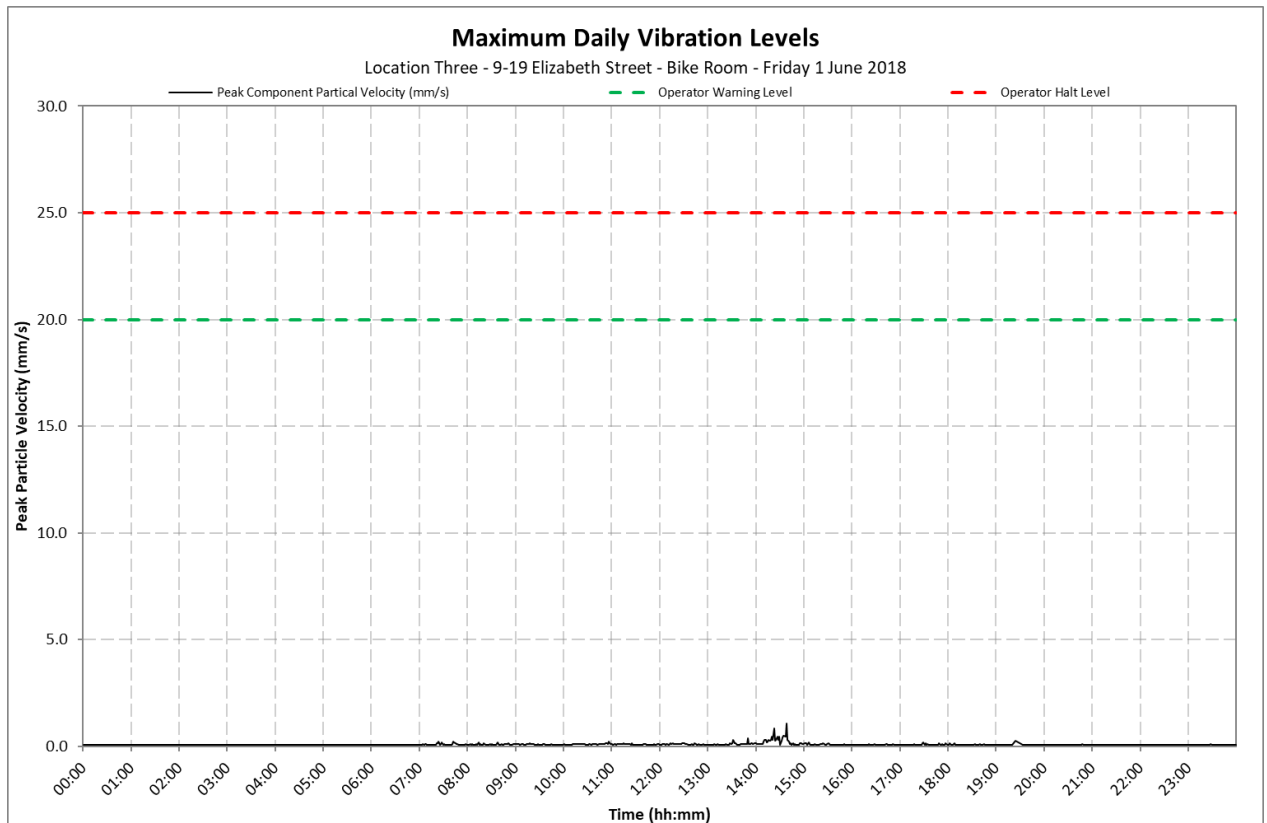
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

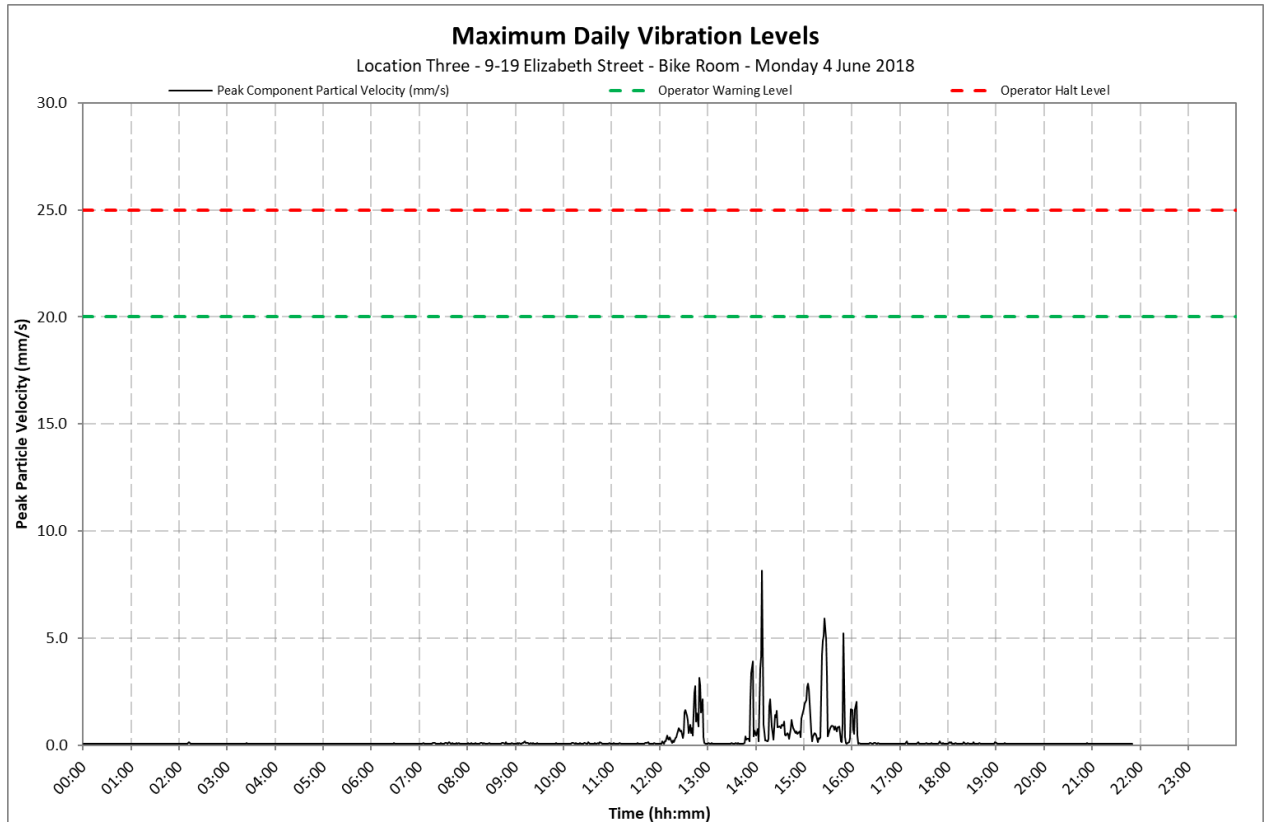
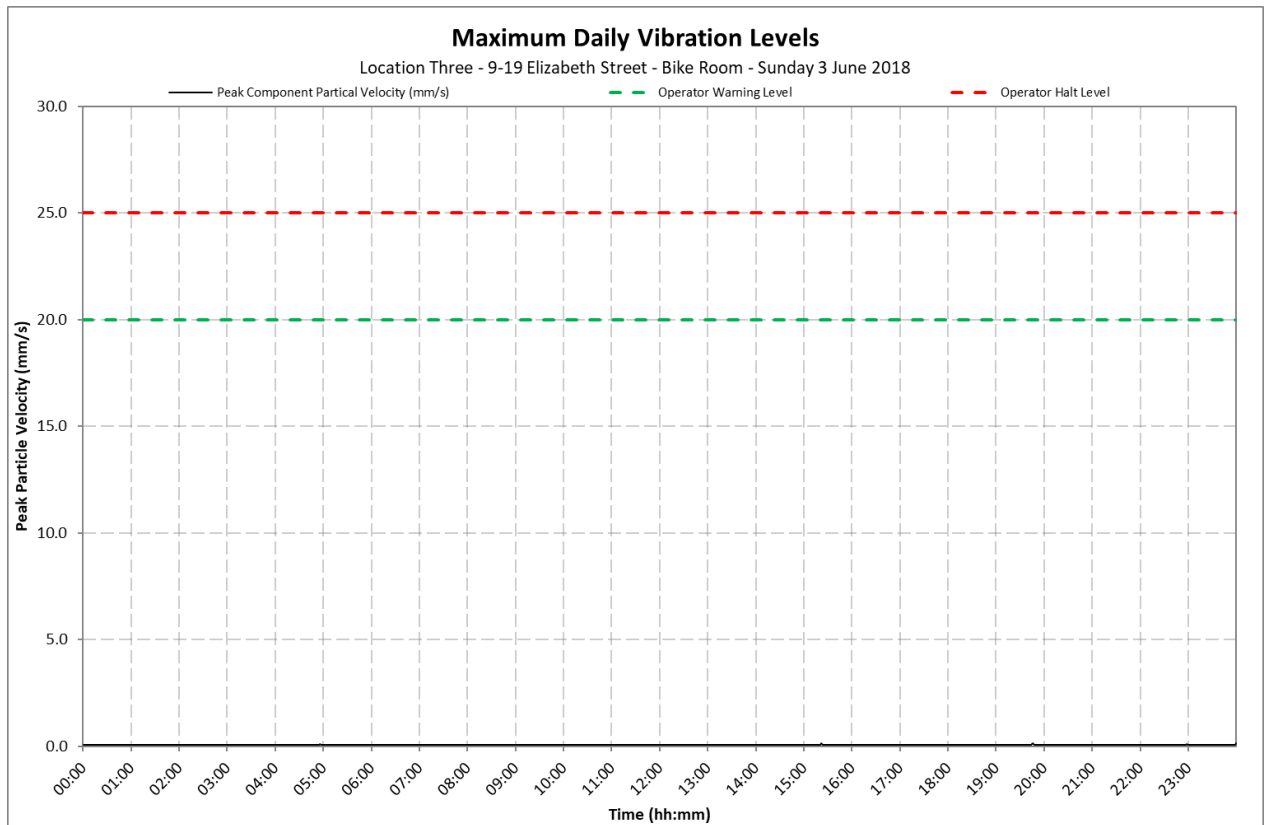
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

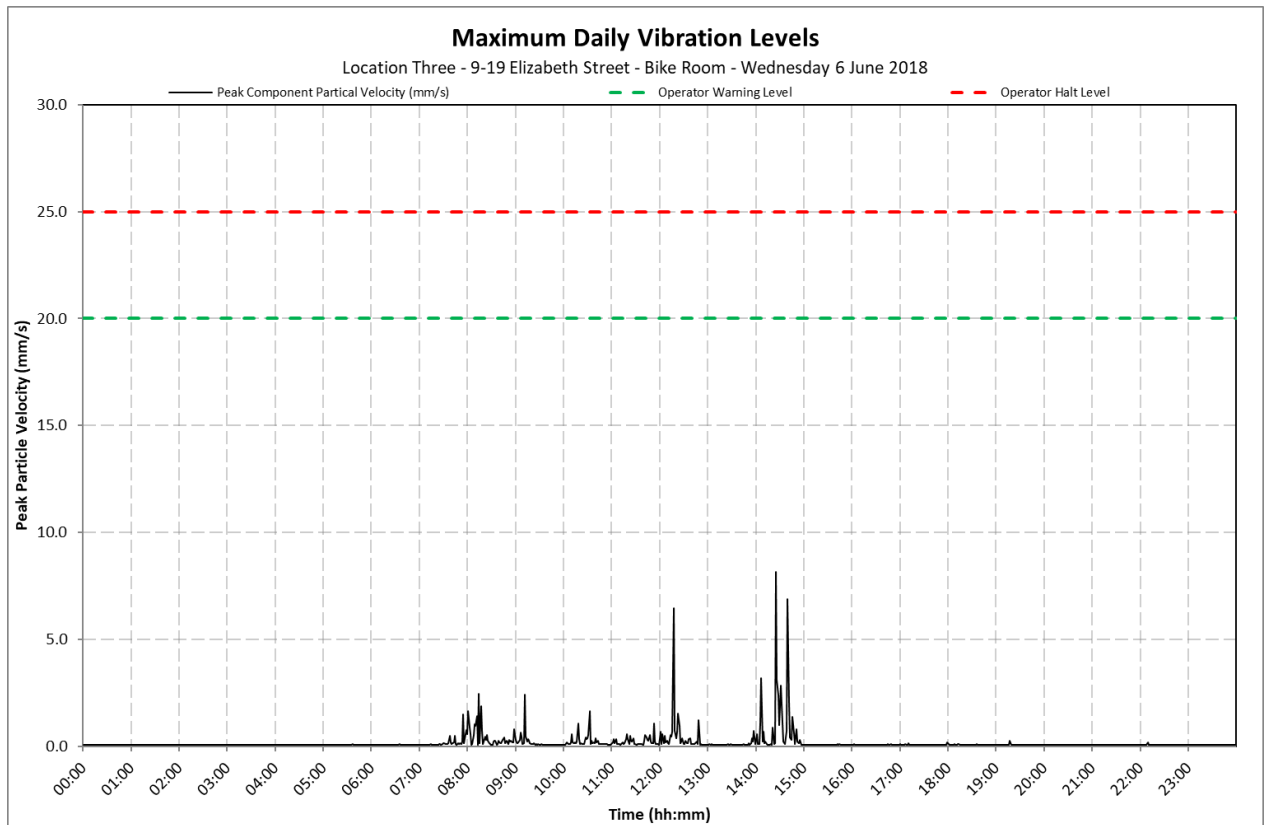
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





25 June 2018

10-1380 R32 NV Monitoring 20180718.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 32
8 June to 21 June 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 8 June to 21 June 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

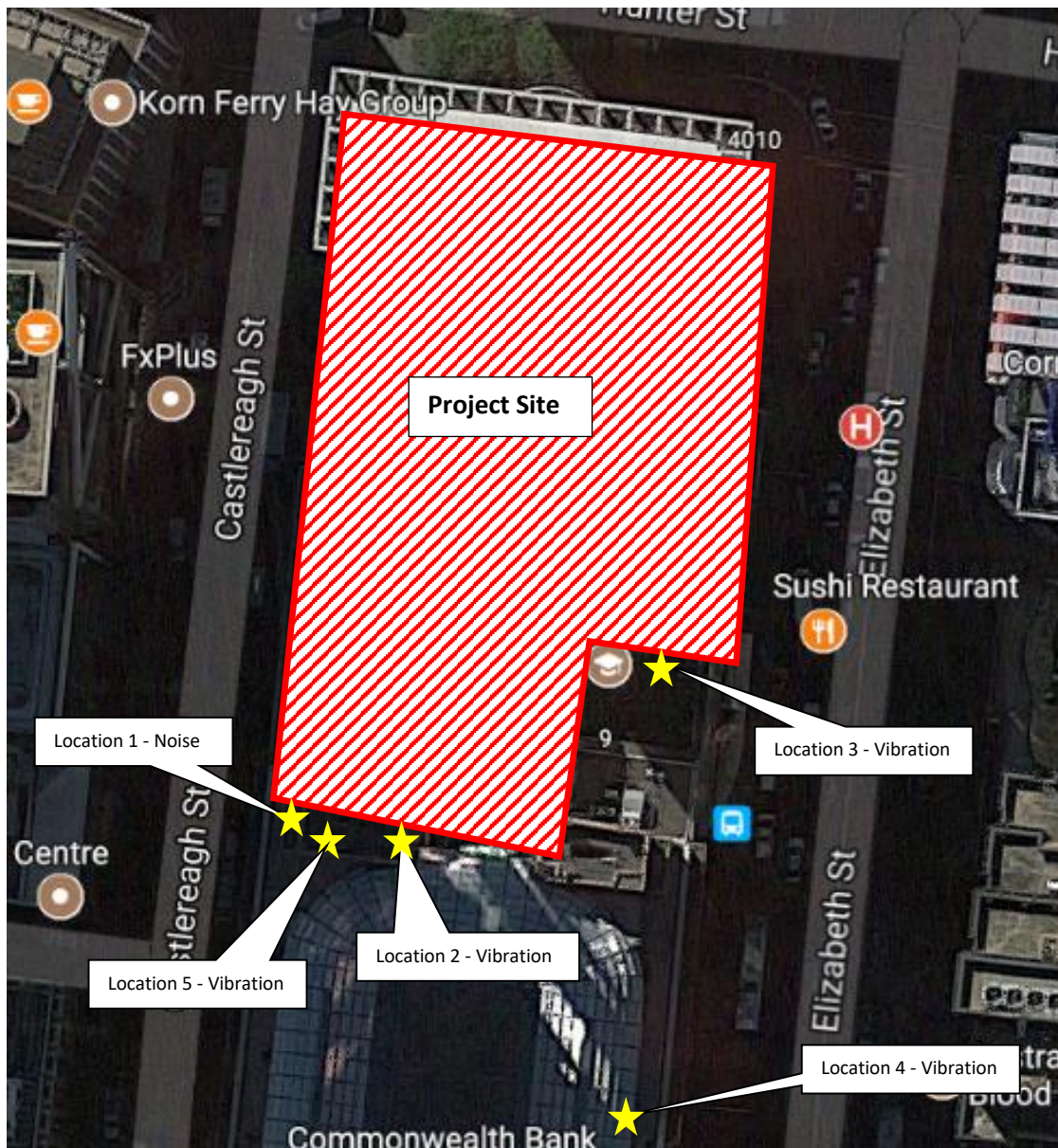
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 8 June to 21 June 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient LAeq(15minute) Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
8 June 2018	45	43	Complies	Complies
9 June 2018	35	34	Complies	Complies
10 June 2018	34	33	Complies	Complies
11 June 2018	35	33	Complies	Complies
12 June 2018	45	44	Complies	Complies
13 June 2018	45	44	Complies	Complies
14 June 2018	47	44	Complies	Complies
15 June 2018	45	44	Complies	Complies
16 June 2018	55	43	Complies	Complies
17 June 2018	37	33	Complies	Complies
18 June 2018	47	45	Complies	Complies
19 June 2018	45	44	Complies	Complies
20 June 2018	47	45	Complies	Complies
21 June 2018	47	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 3 and **Table 4** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 8 June to 21 June 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
8 June 2018	0.2 mm/s	Complies
9 June 2018	0.2 mm/s	Complies
10 June 2018	0.2 mm/s	Complies
11 June 2018	0.2 mm/s	Complies
12 June 2018	0.2 mm/s	Complies
13 June 2018	0.2 mm/s	Complies
14 June 2018	0.2 mm/s	Complies
15 June 2018	0.8 mm/s	Complies
16 June 2018	0.2 mm/s	Complies
17 June 2018	0.2 mm/s	Complies
18 June 2018	0.2 mm/s	Complies
19 June 2018	0.2 mm/s	Complies
20 June 2018	0.2 mm/s	Complies
21 June 2018	0.2 mm/s	Complies

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
8 June 2018	1.0 mm/s	Complies
9 June 2018	0.2 mm/s	Complies
10 June 2018	0.1 mm/s	Complies
11 June 2018	0.3 mm/s	Complies
12 June 2018	0.2 mm/s	Complies
13 June 2018	2.2 mm/s	Complies
14 June 2018	12.9 mm/s	Complies
15 June 2018	4.4 mm/s	Complies
16 June 2018	0.9 mm/s	Complies
17 June 2018	0.1 mm/s	Complies
18 June 2018	1.7 mm/s	Complies
19 June 2018	0.4 mm/s	Complies
20 June 2018	4.2 mm/s	Complies
21 June 2018	1.1 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 8 June to 21 June 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 8 June to 21 June 2018 found all recorded ambient vibration levels were below the maximum vibration control limit at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely

A handwritten signature in black ink, appearing to read 'R. Wakeling', with a long horizontal flourish extending to the right.

Ryan Wakeling

Principal - Acoustics & Vibration

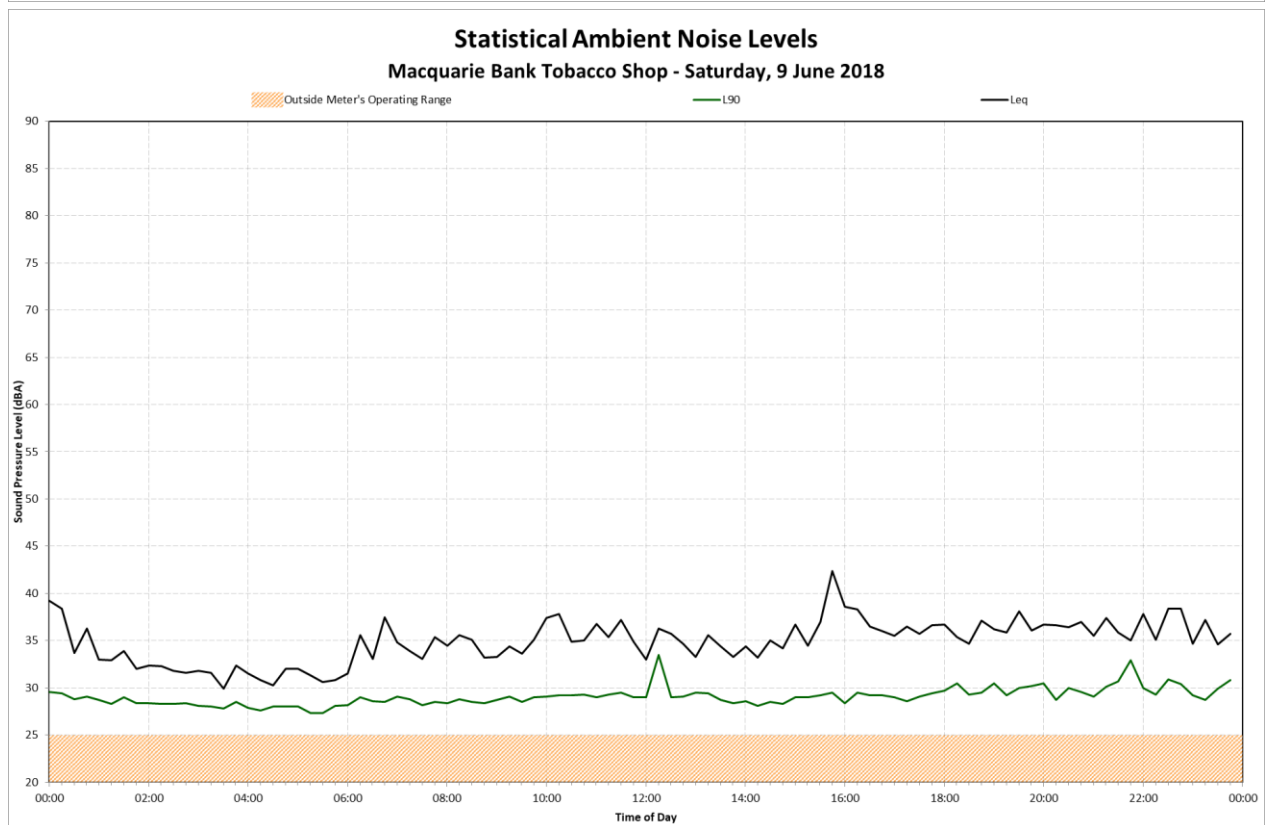
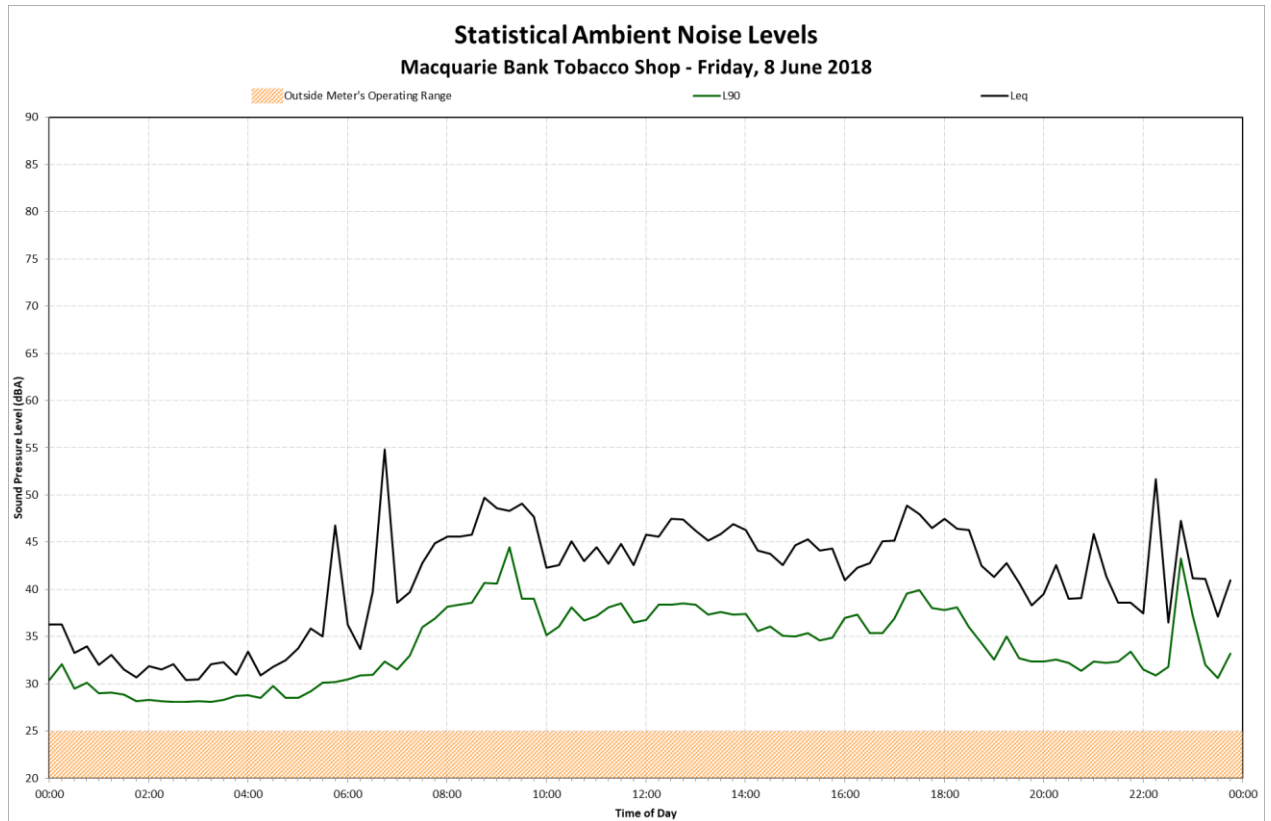
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Appendix B

Daily Noise Levels

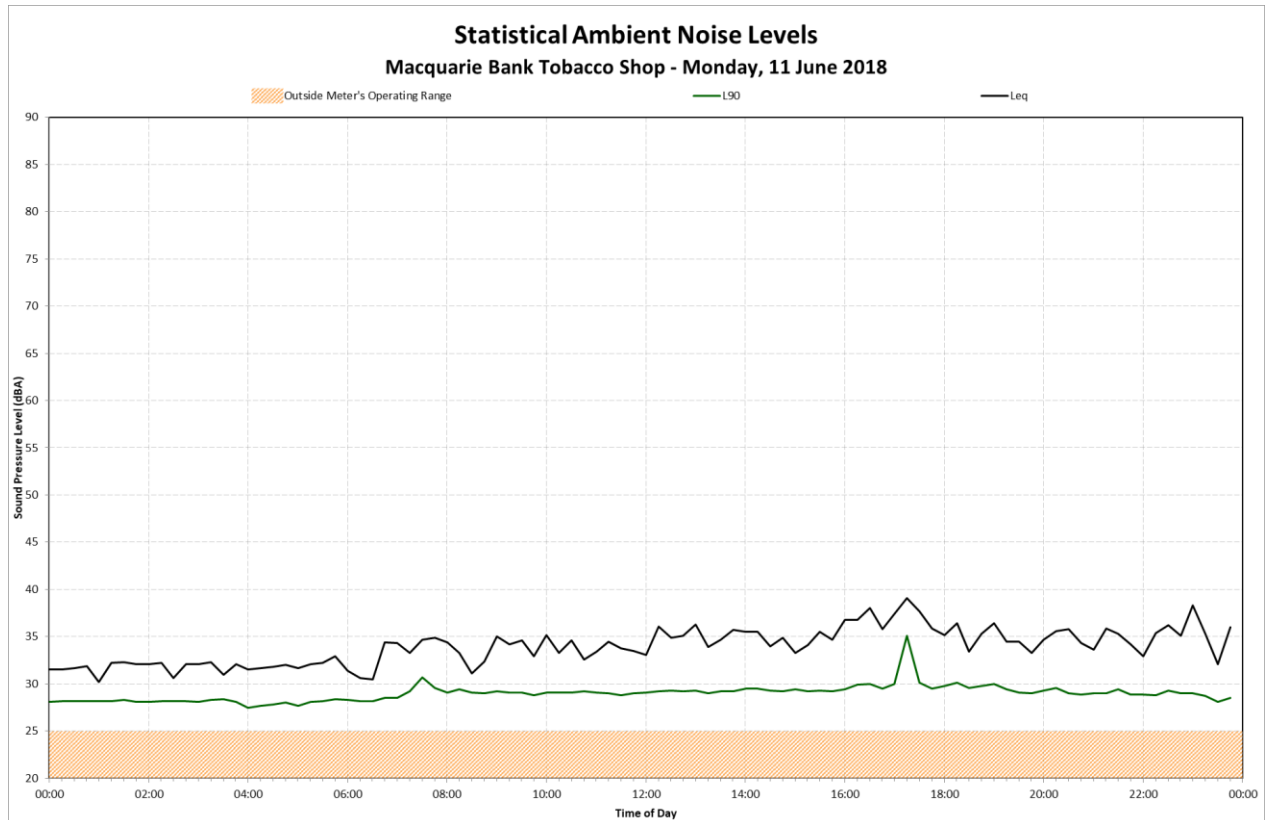
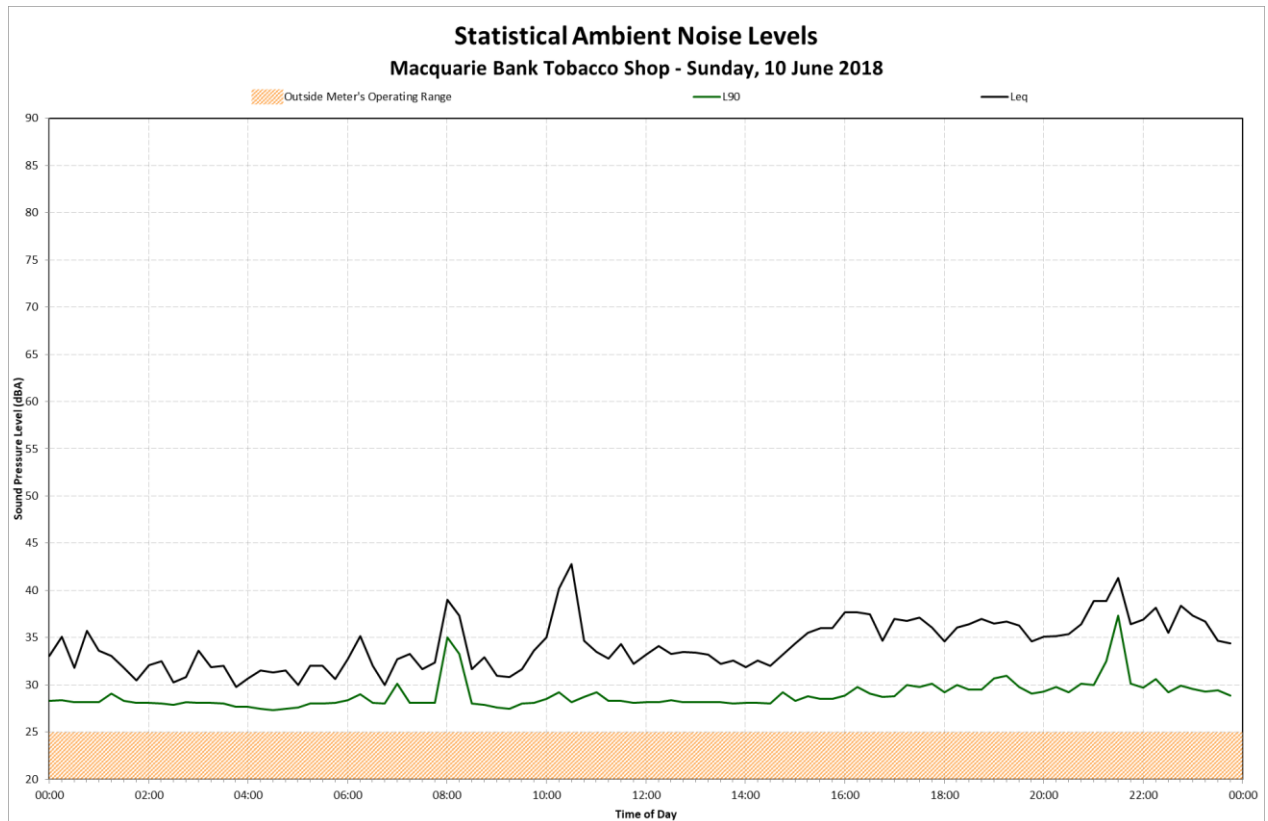
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

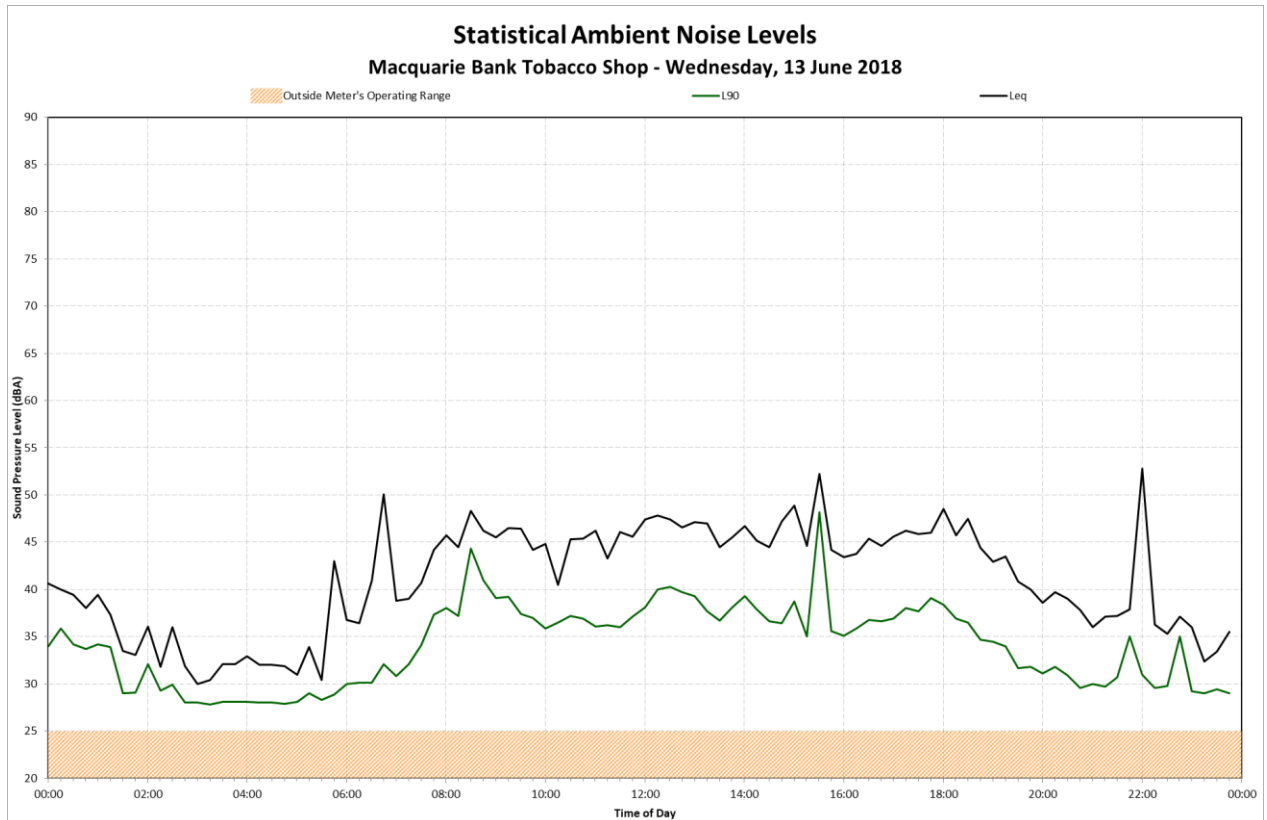
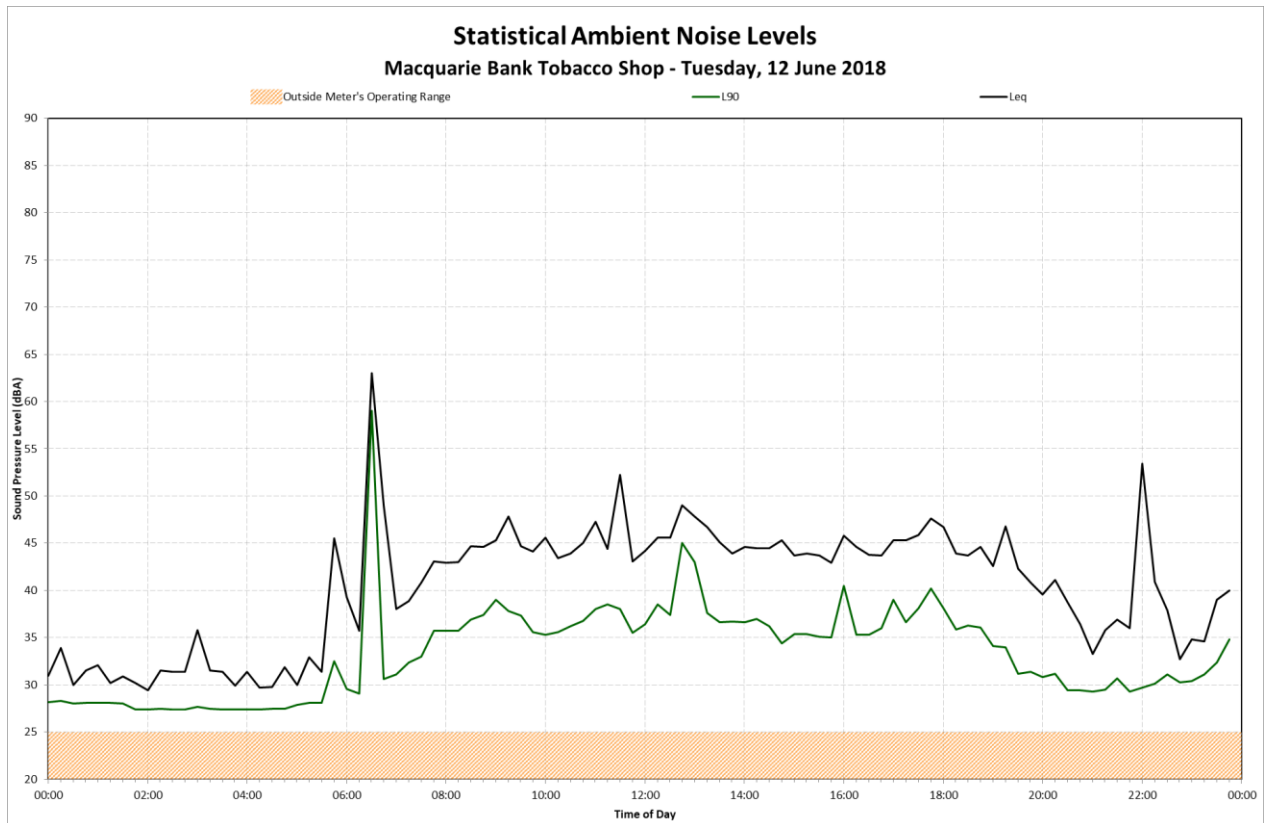
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

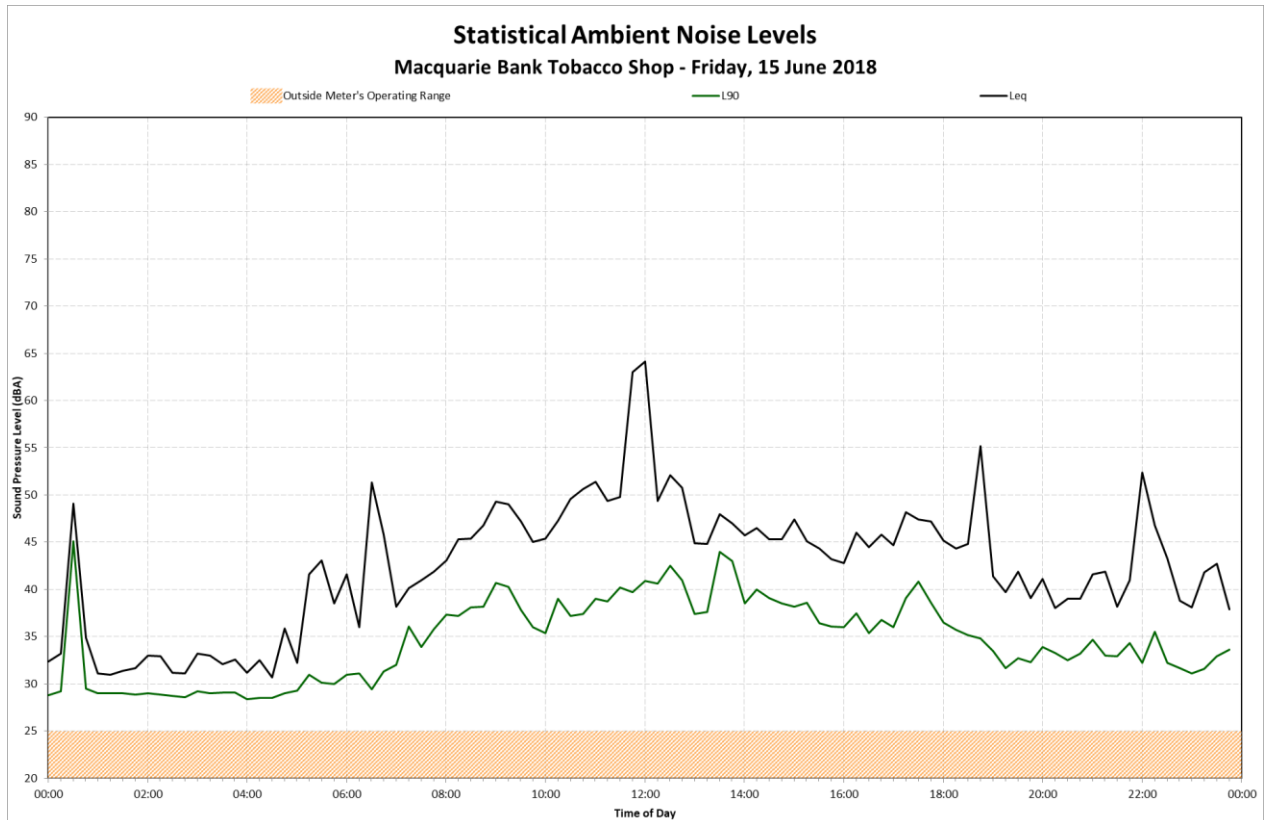
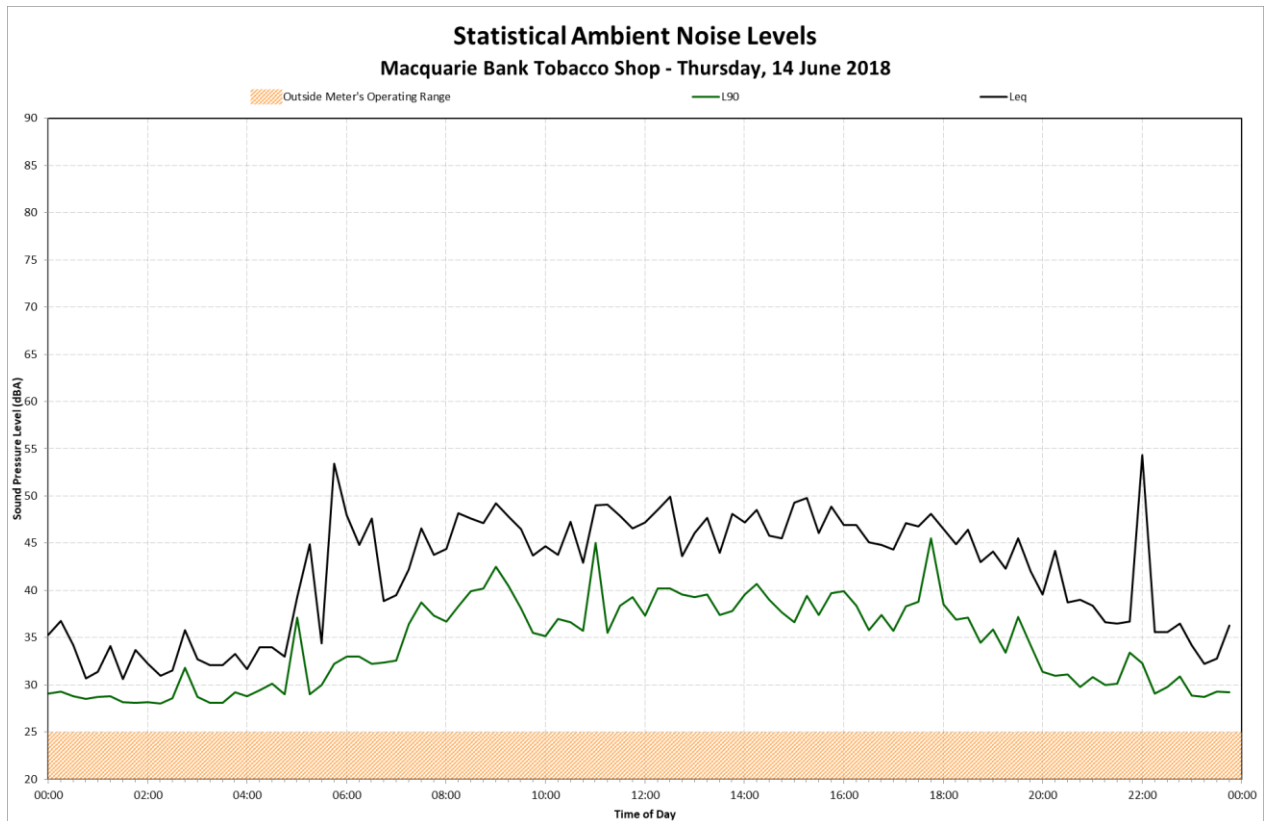
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

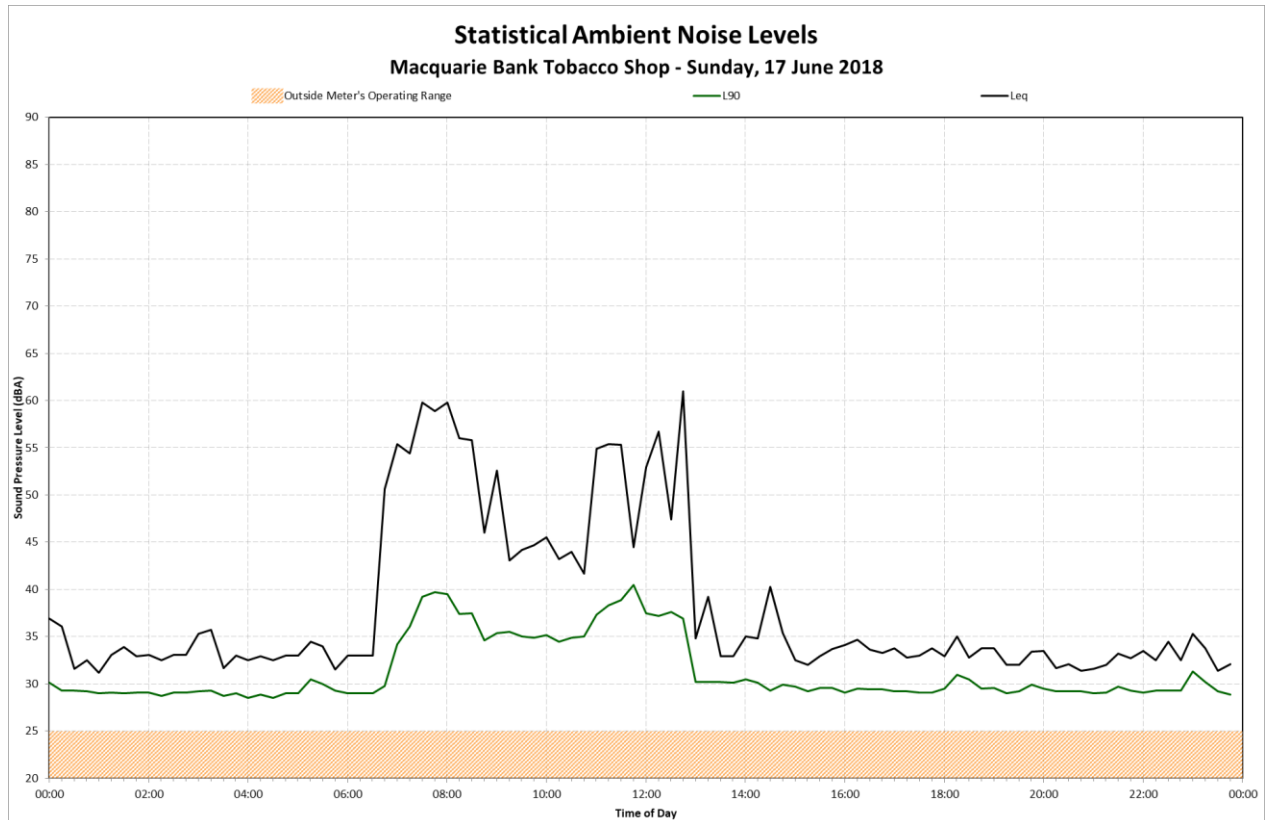
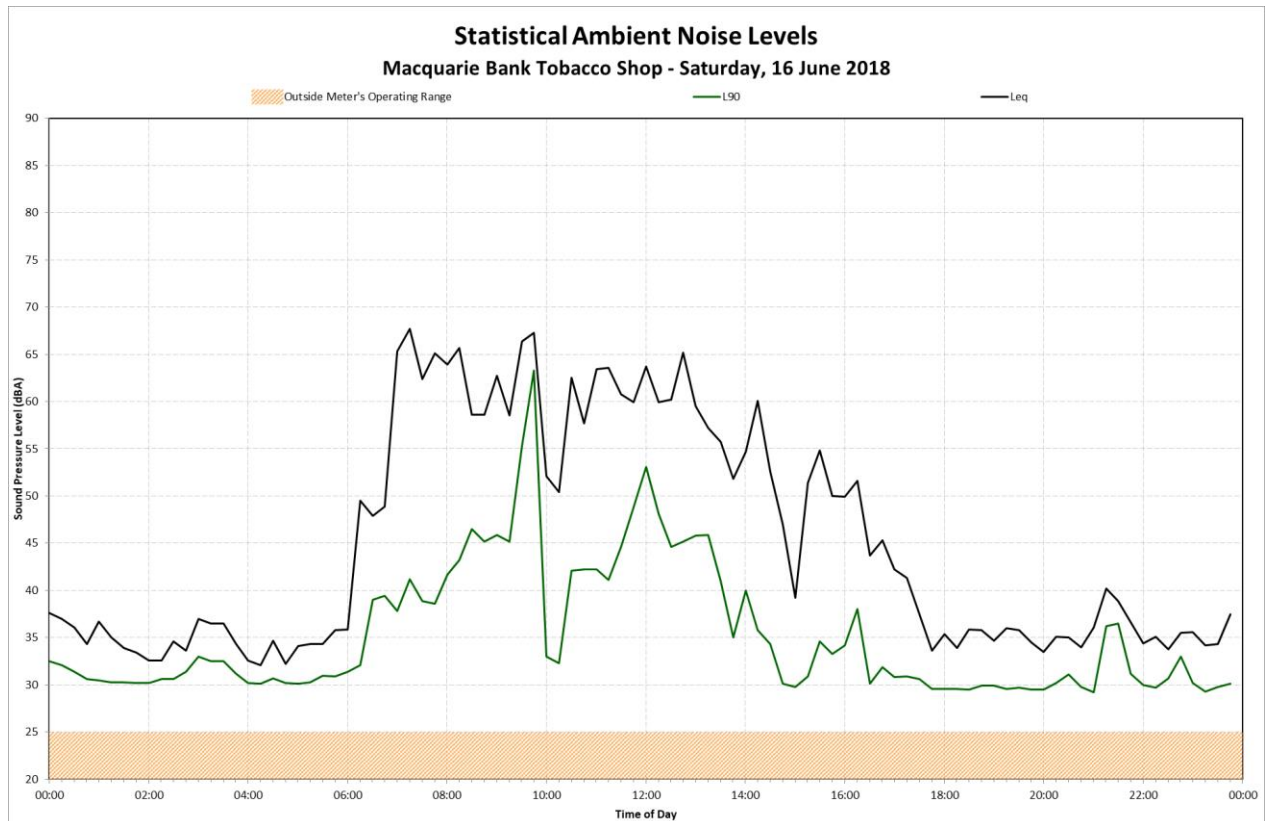
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

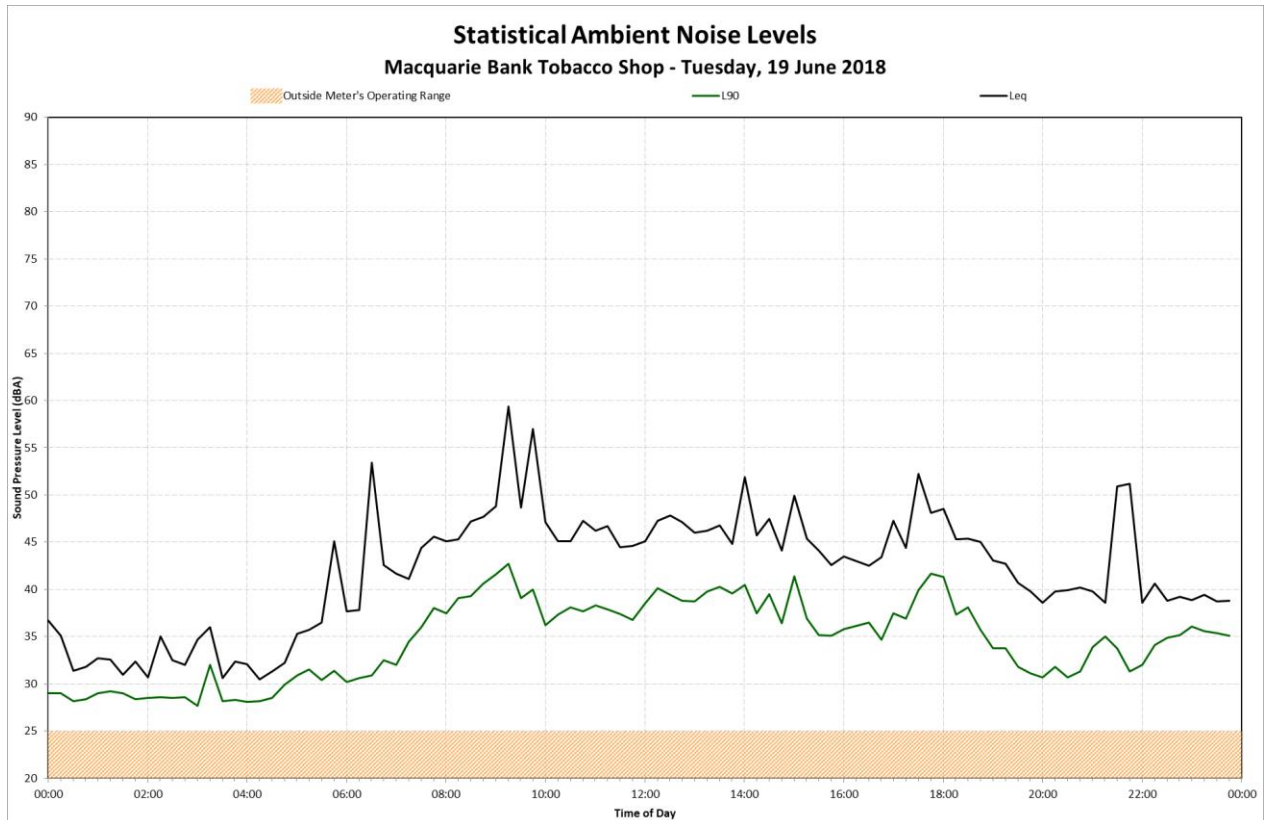
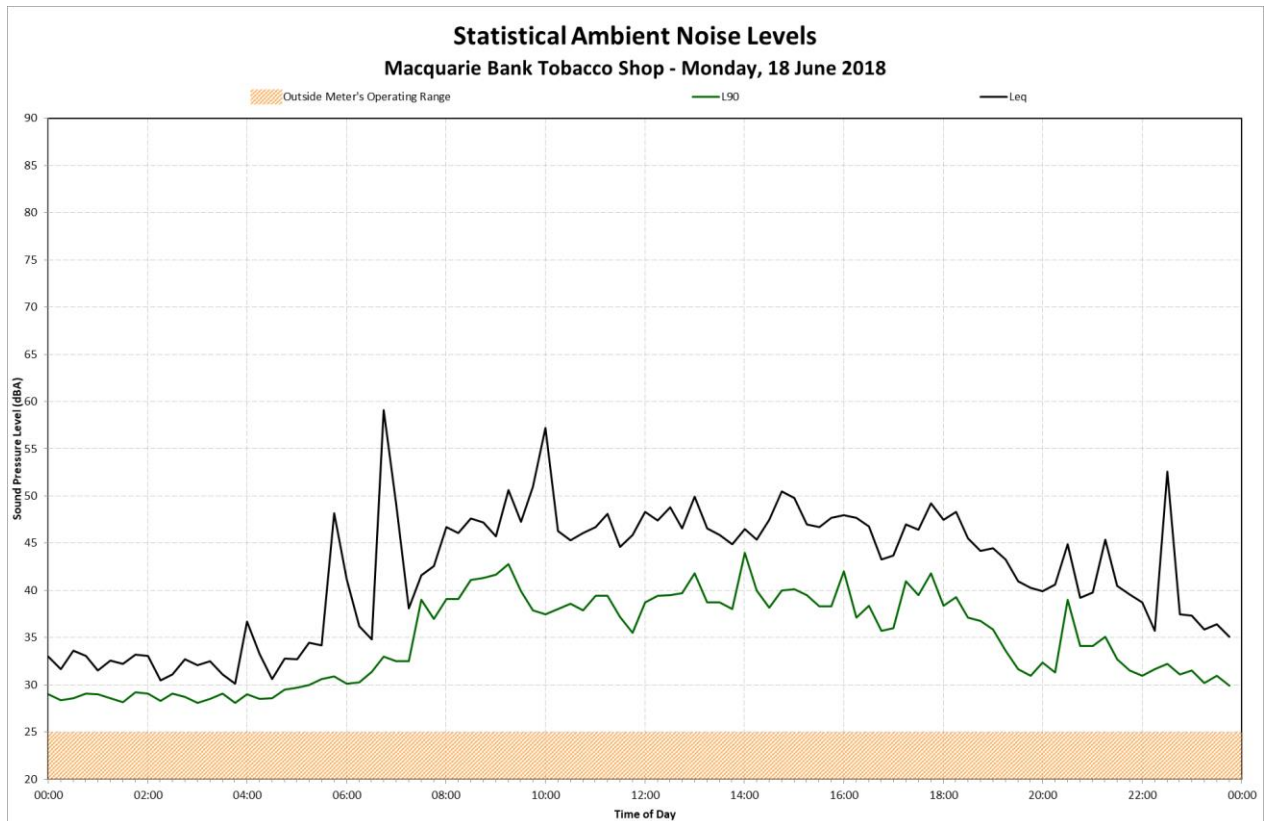
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

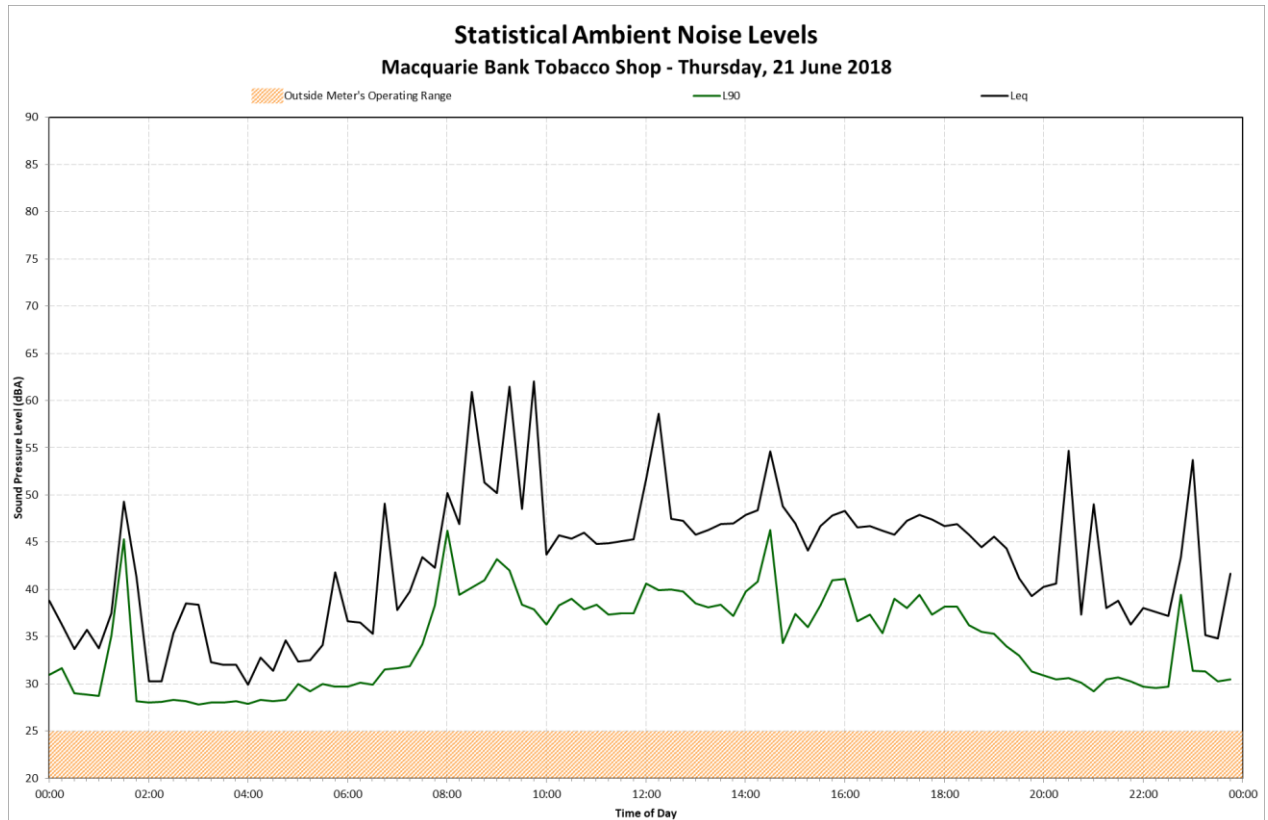
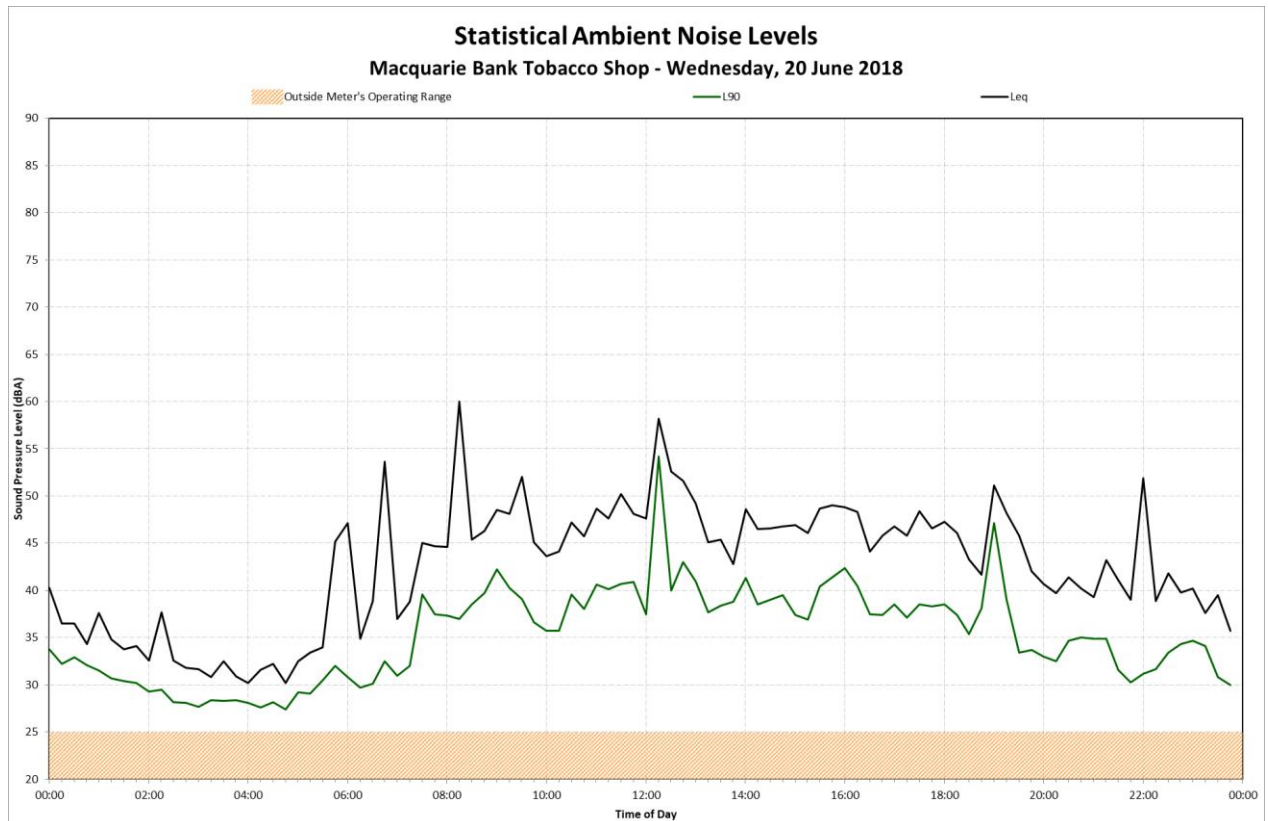
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

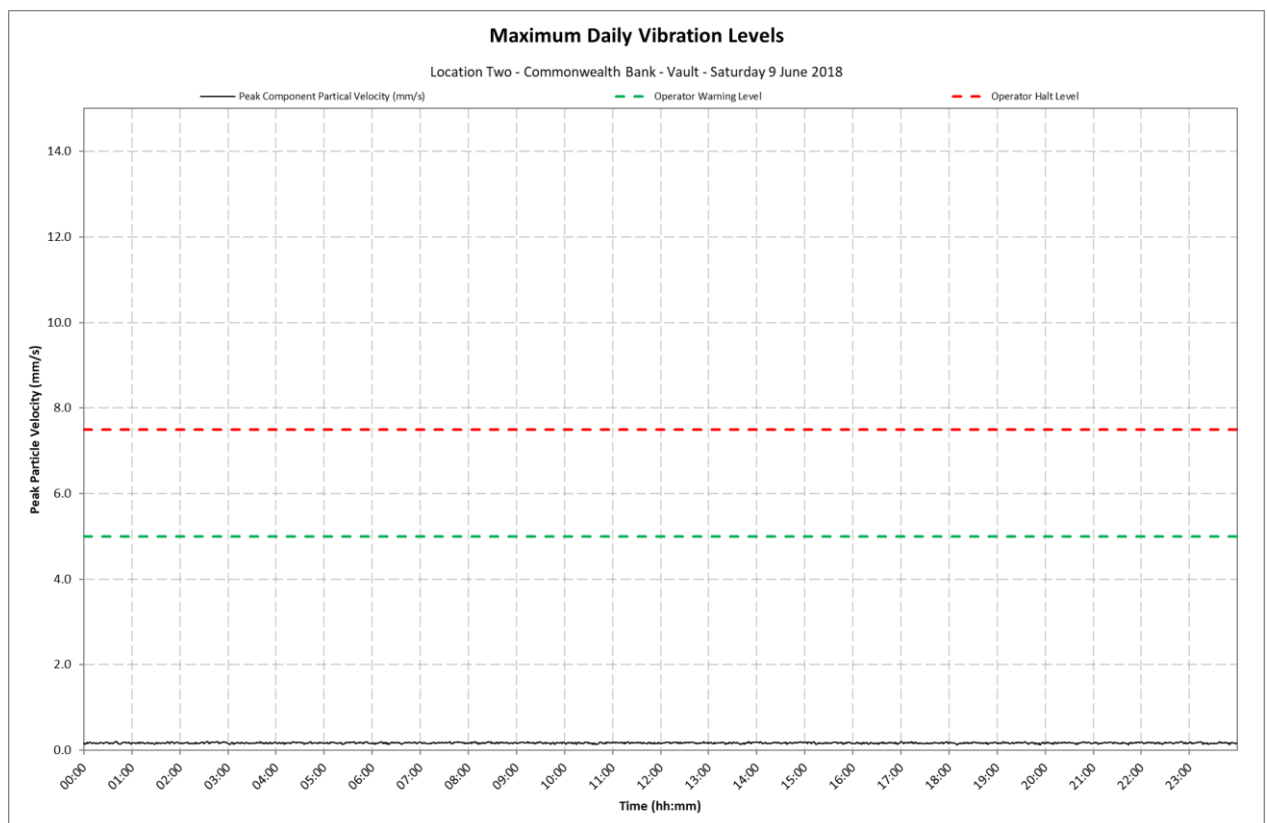
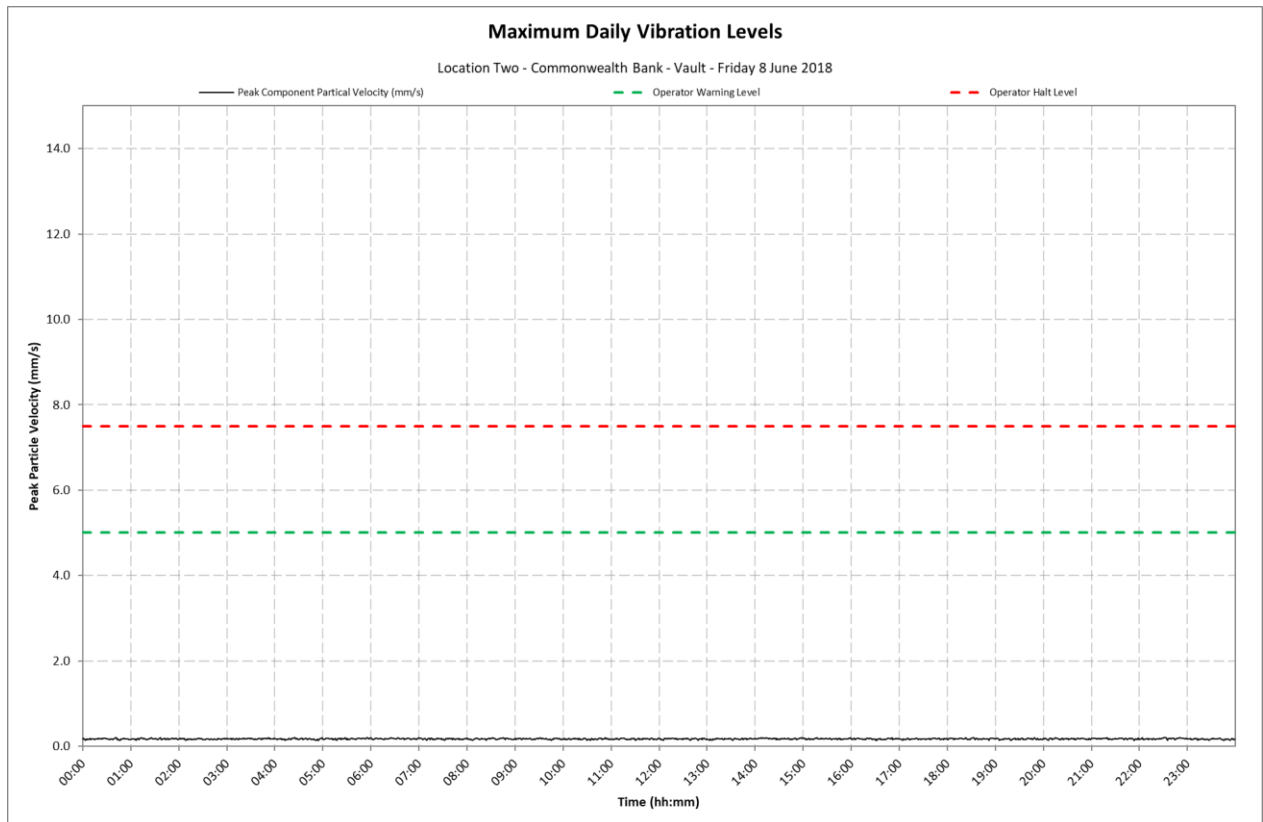
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

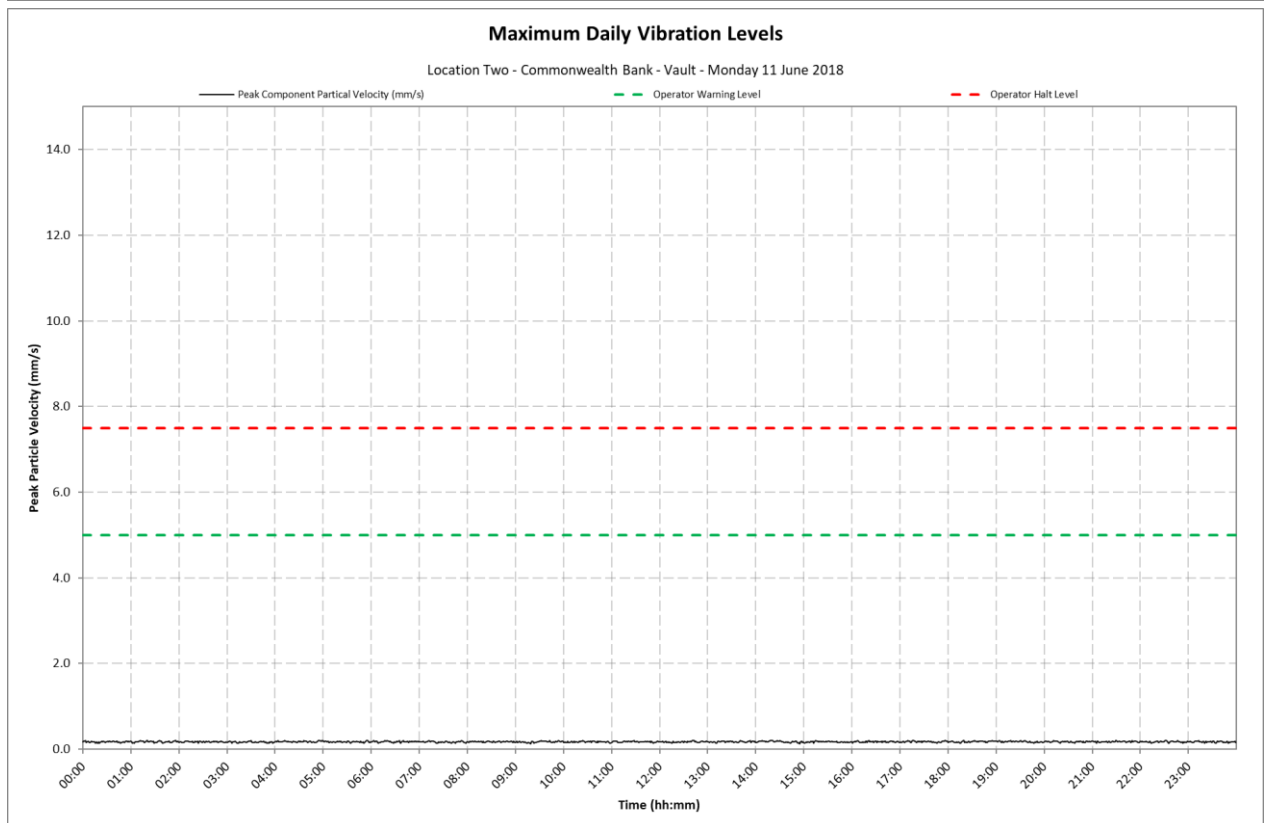
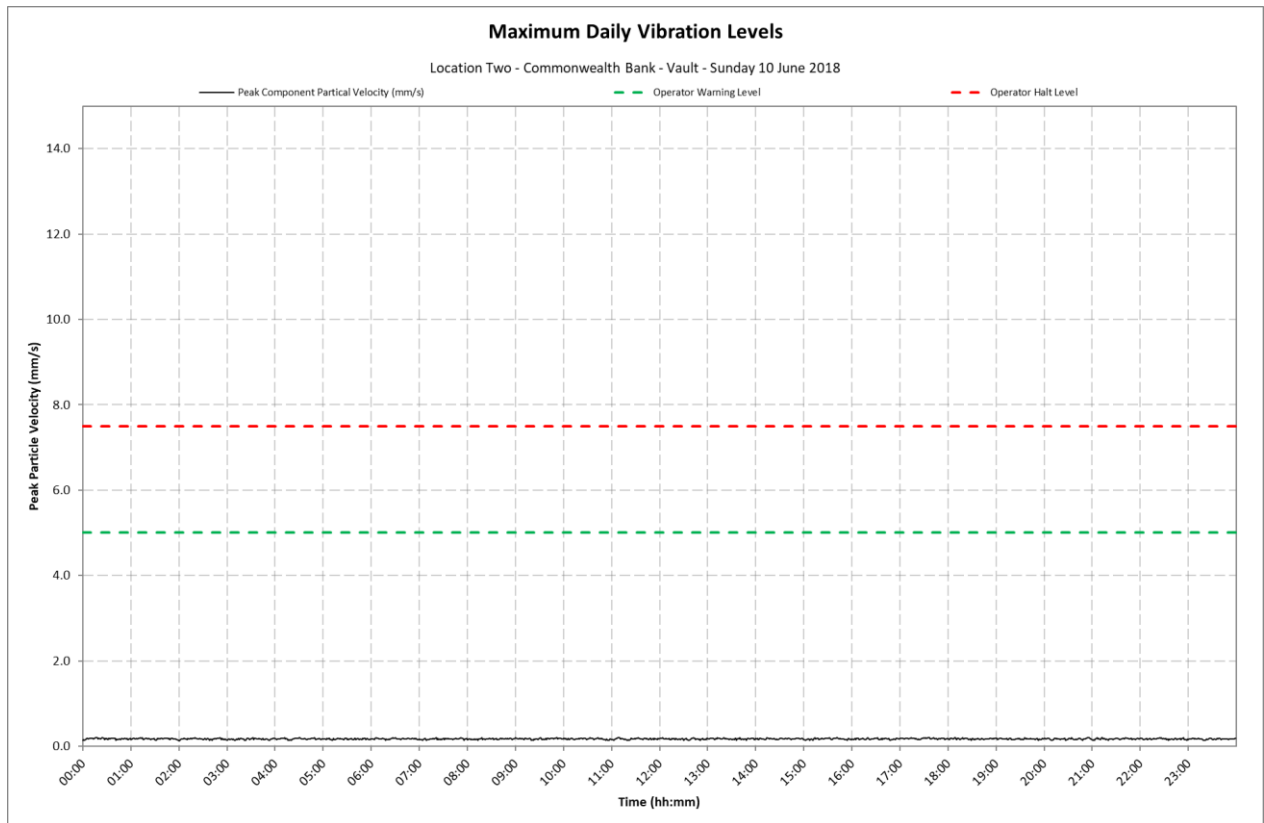
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

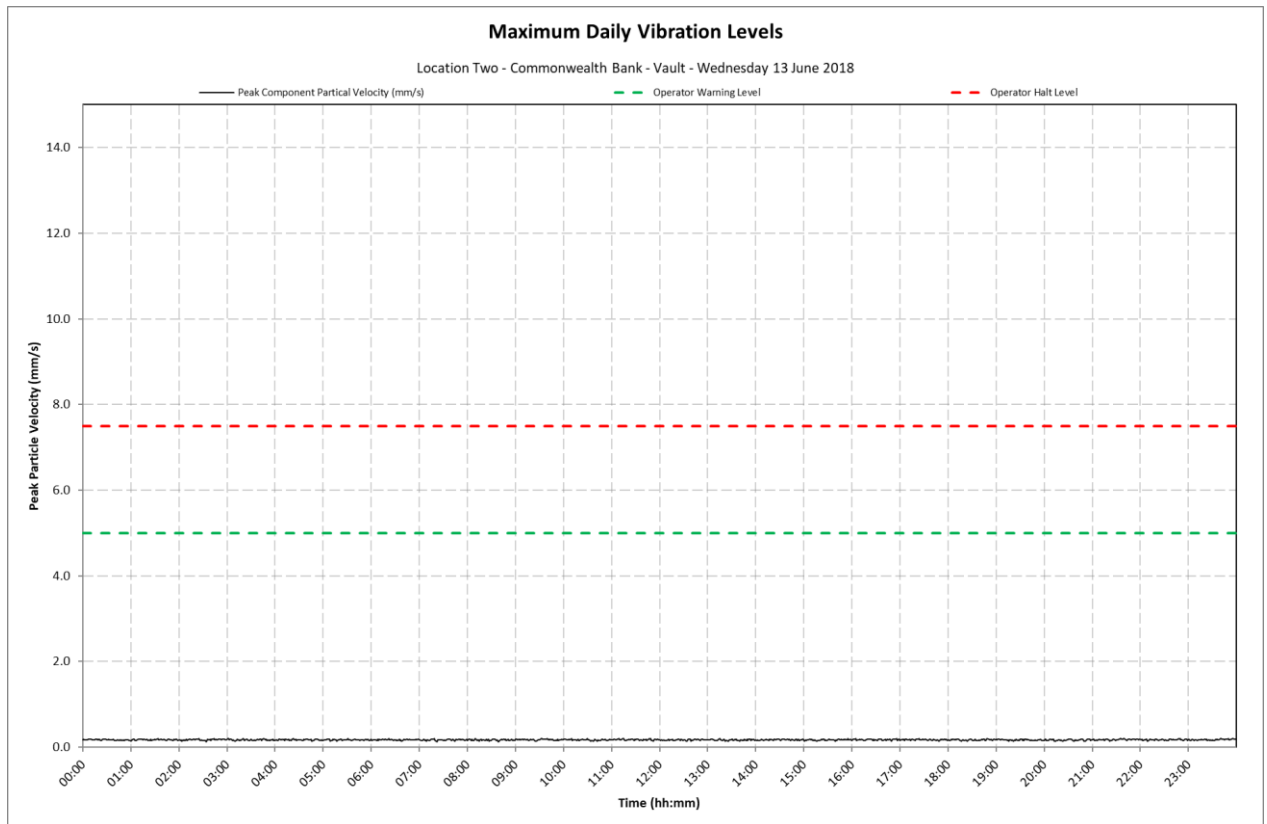
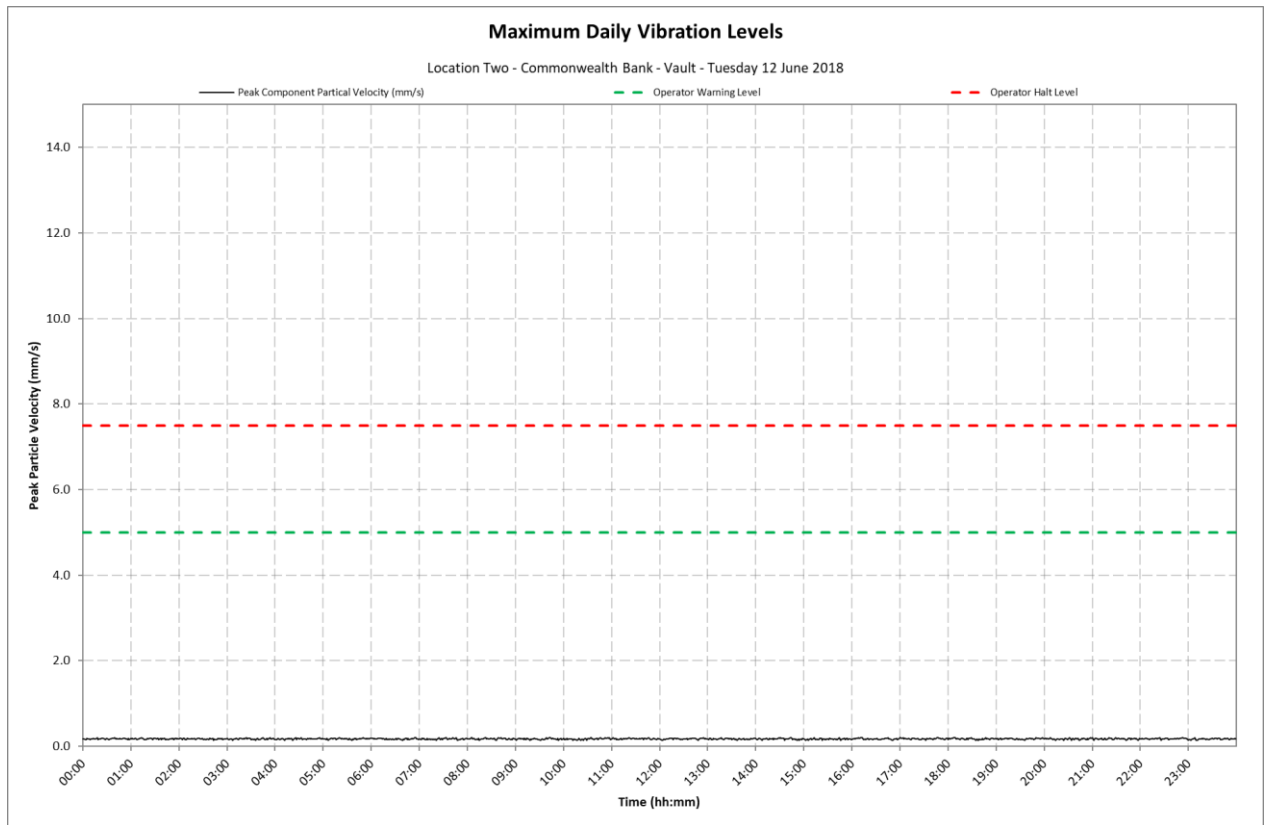
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

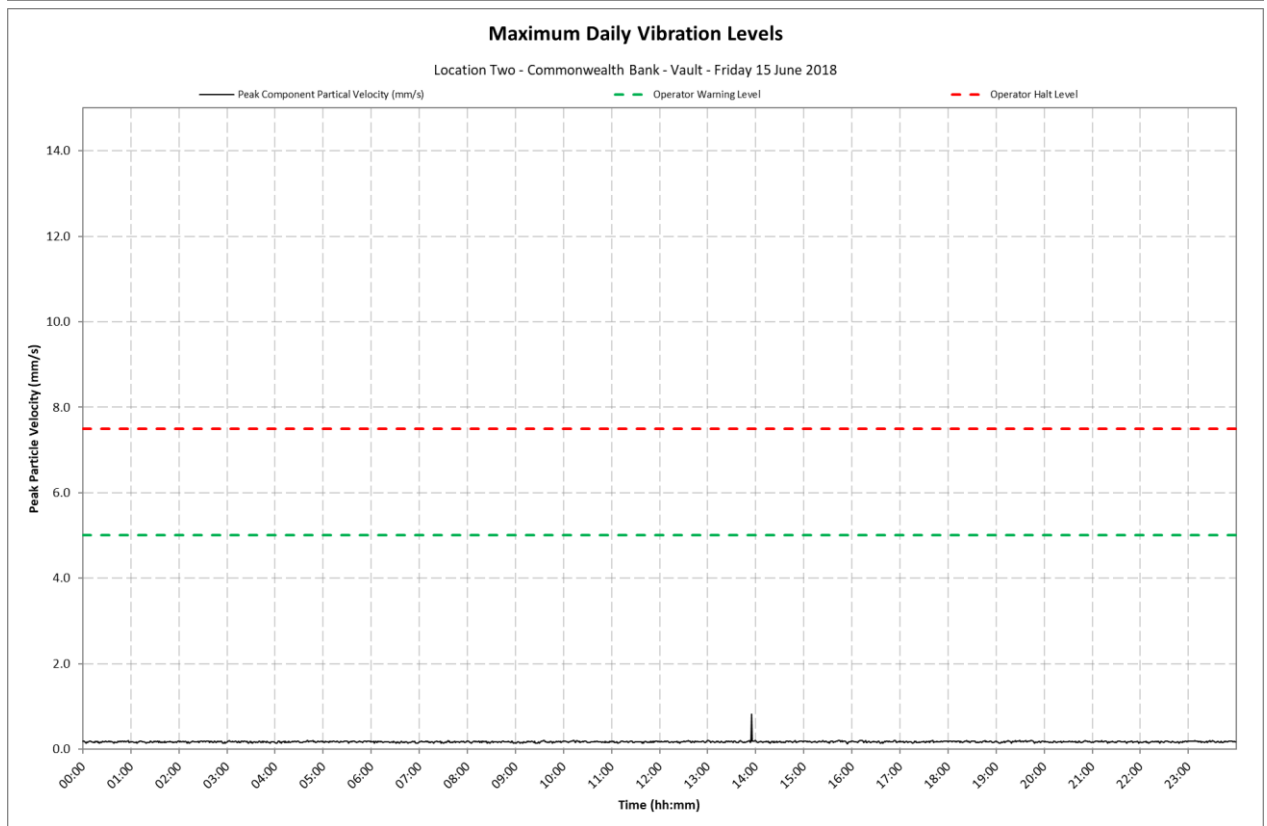
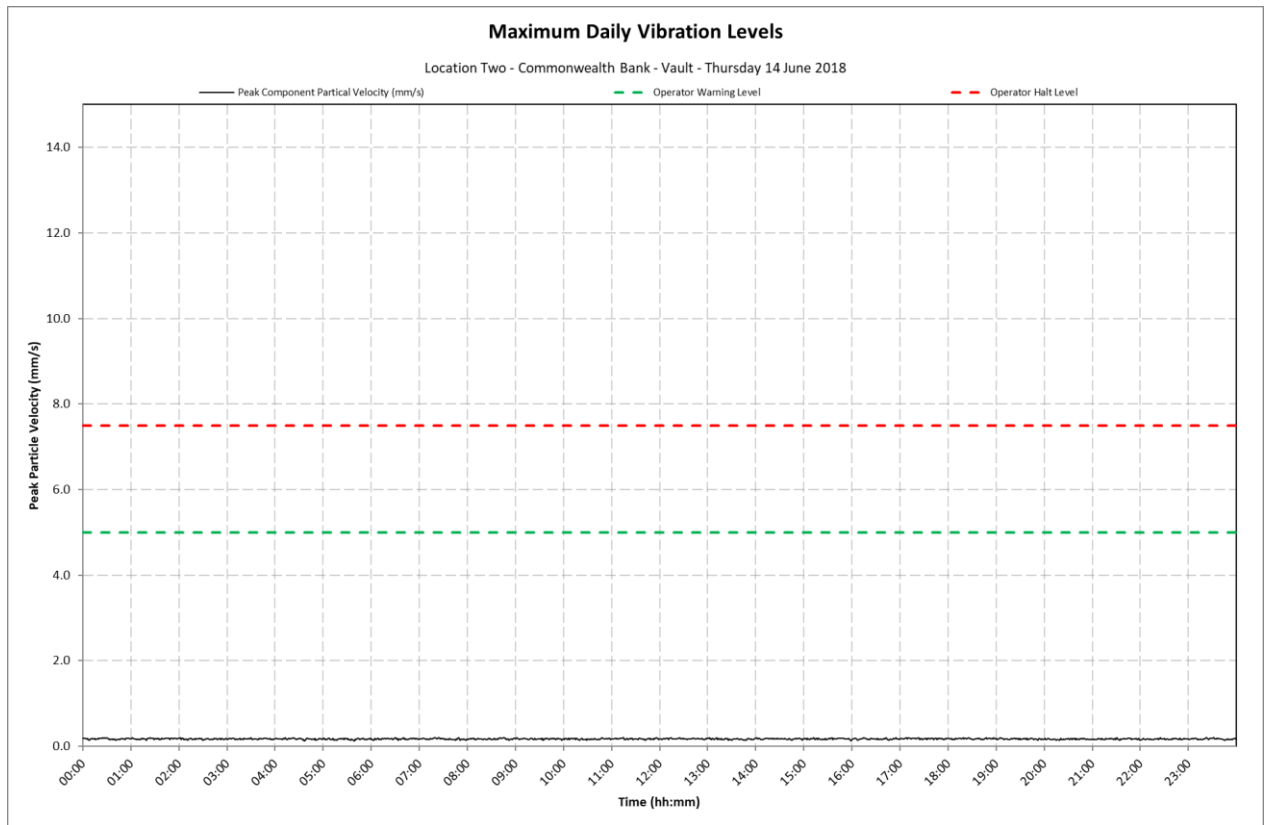
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

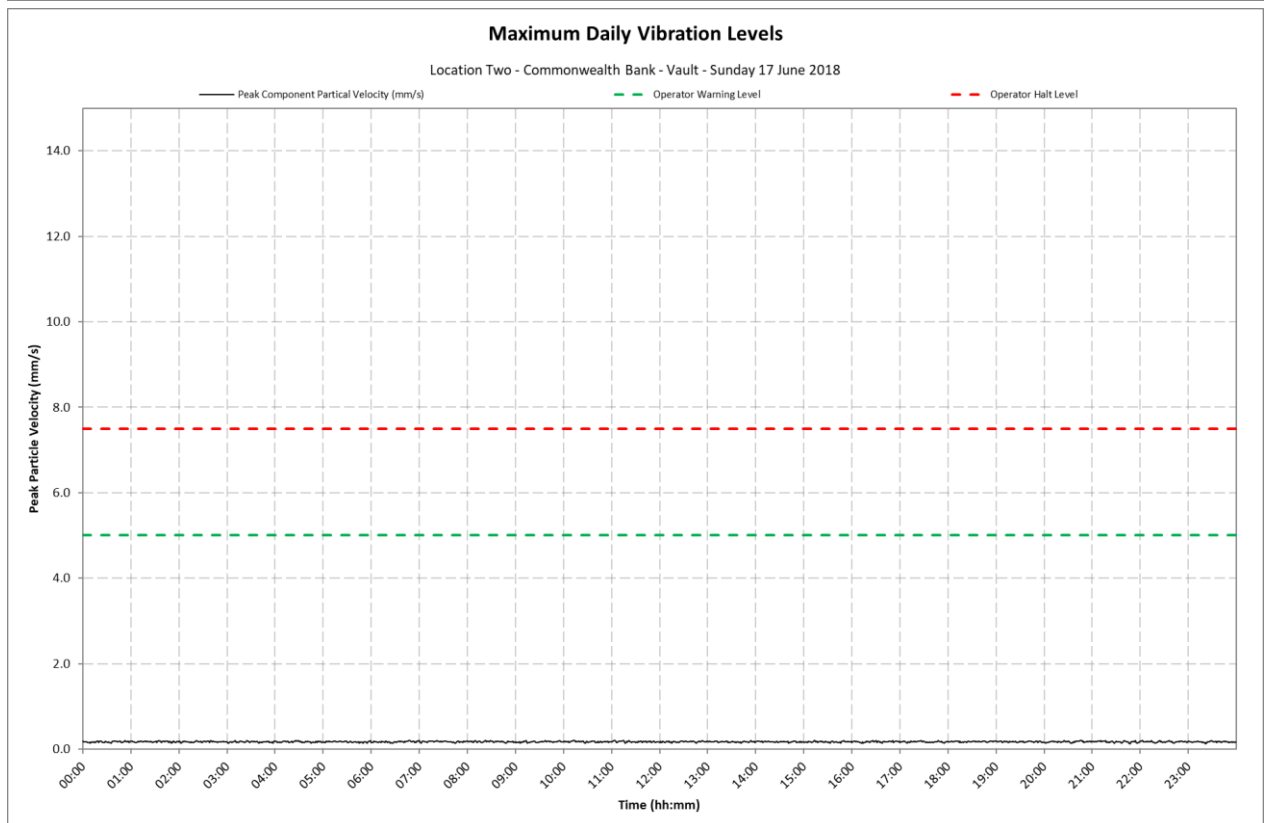
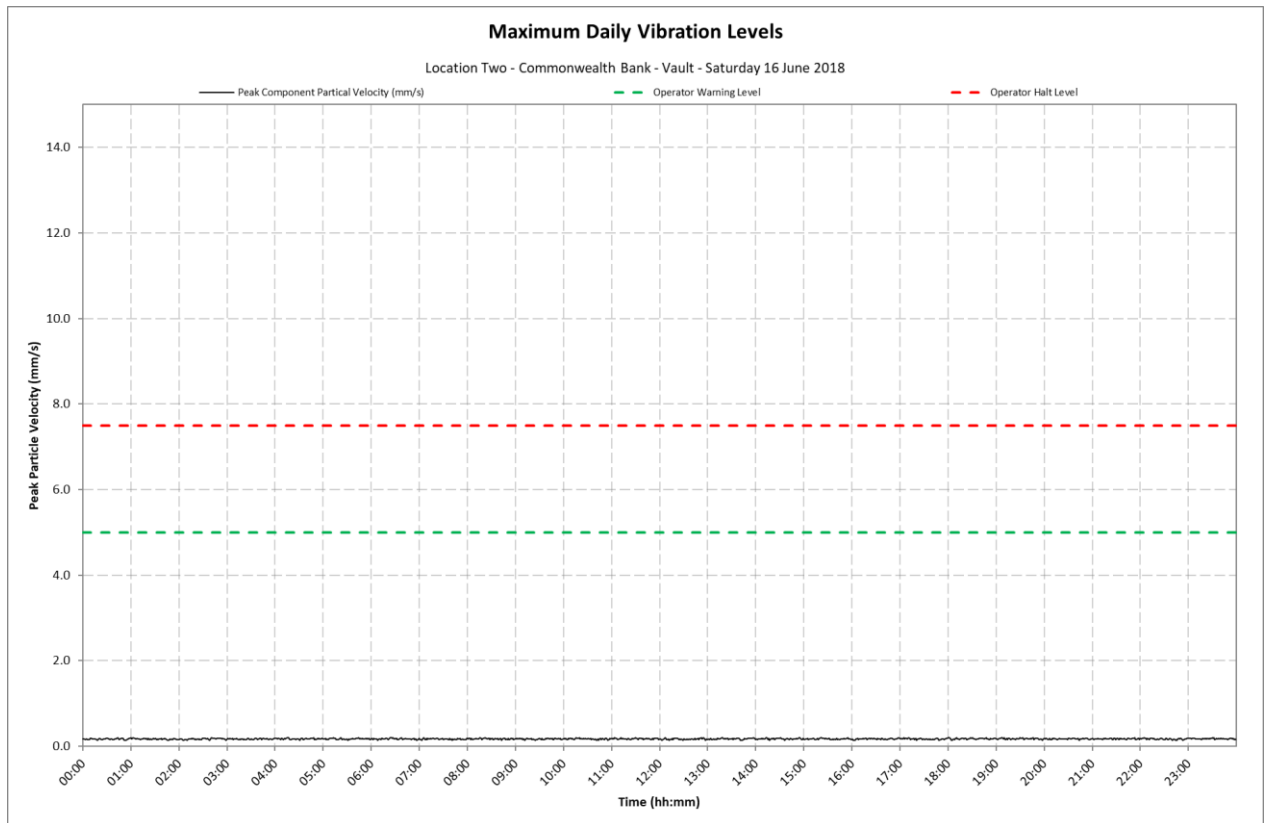
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

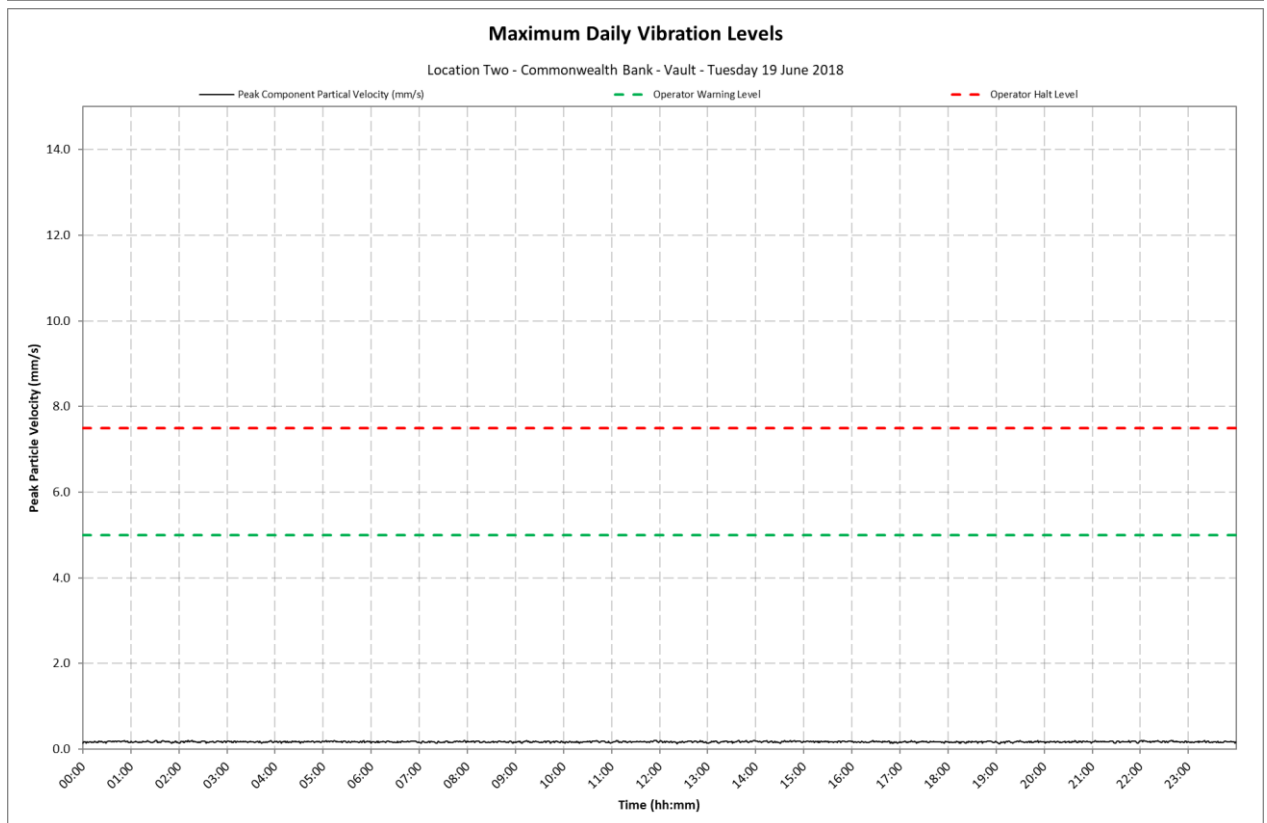
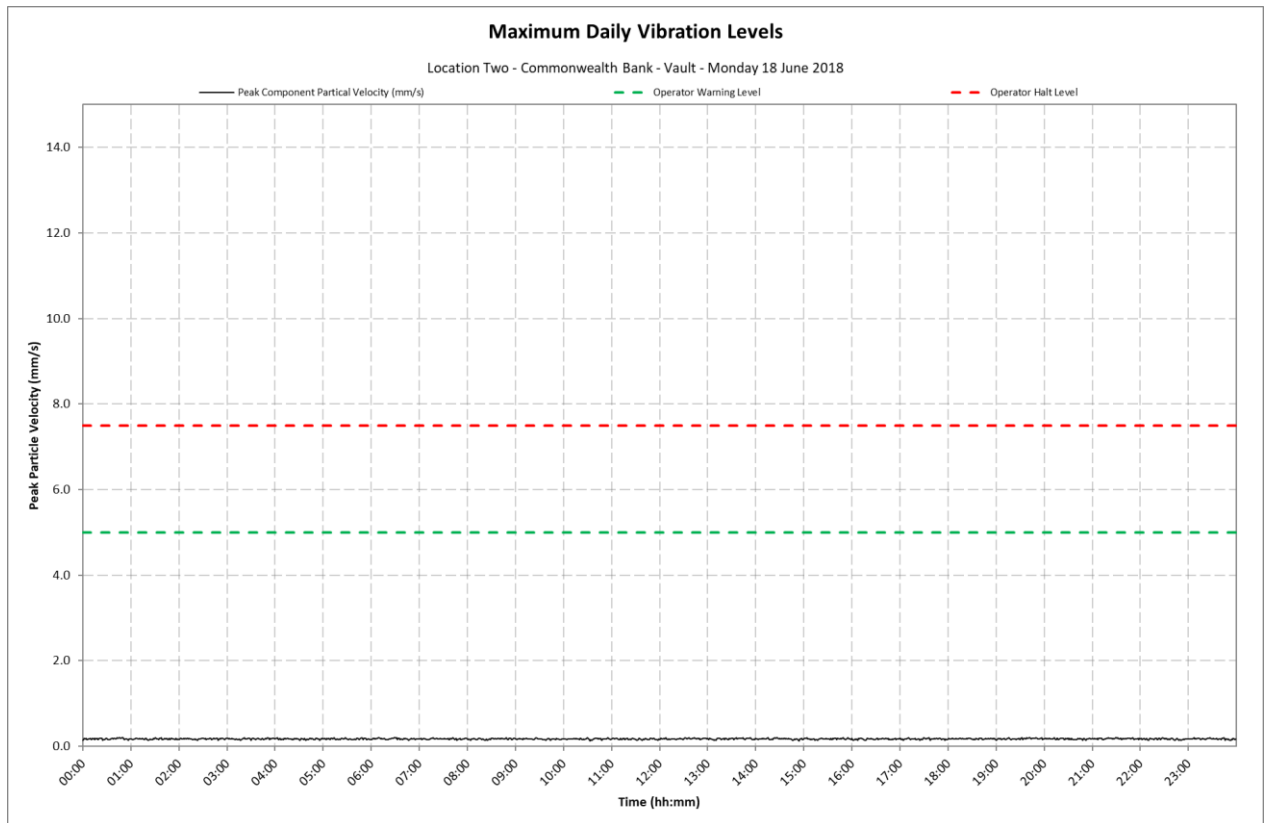
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

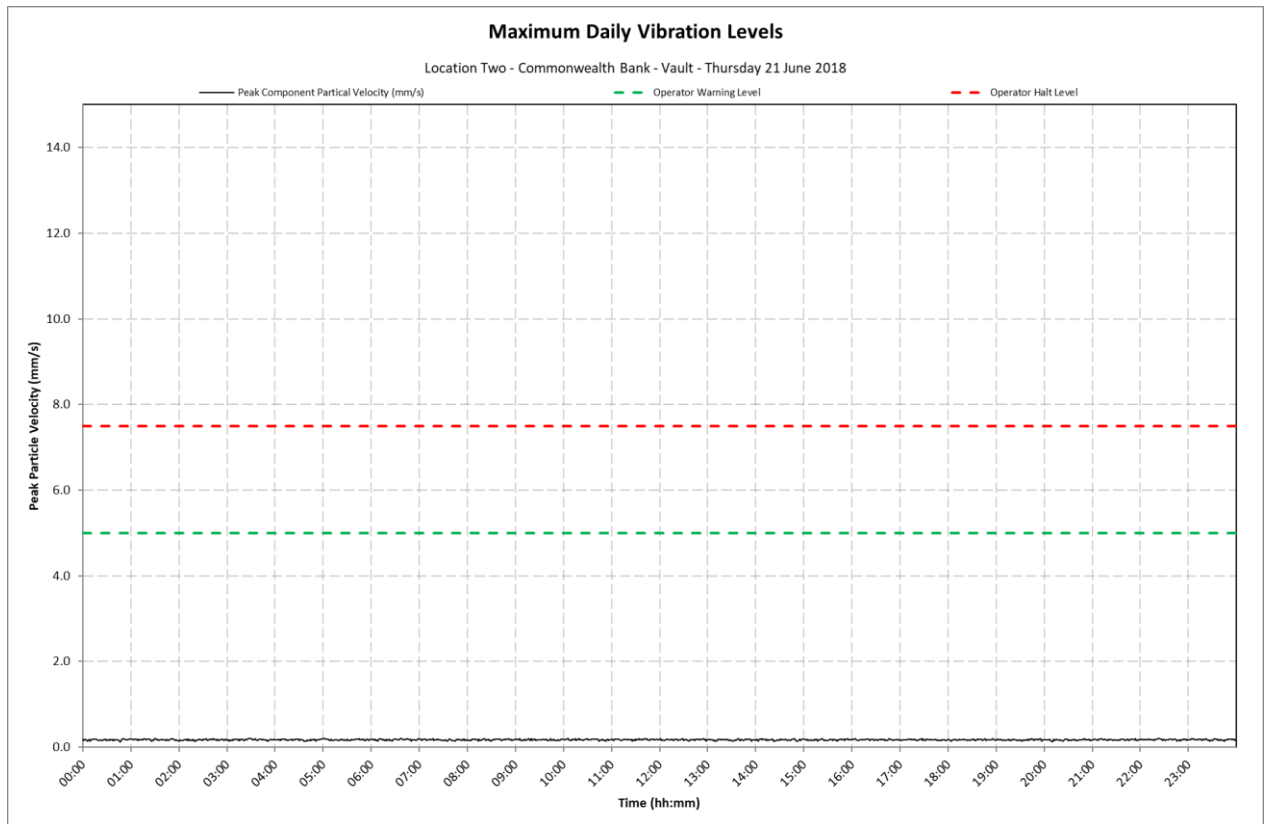
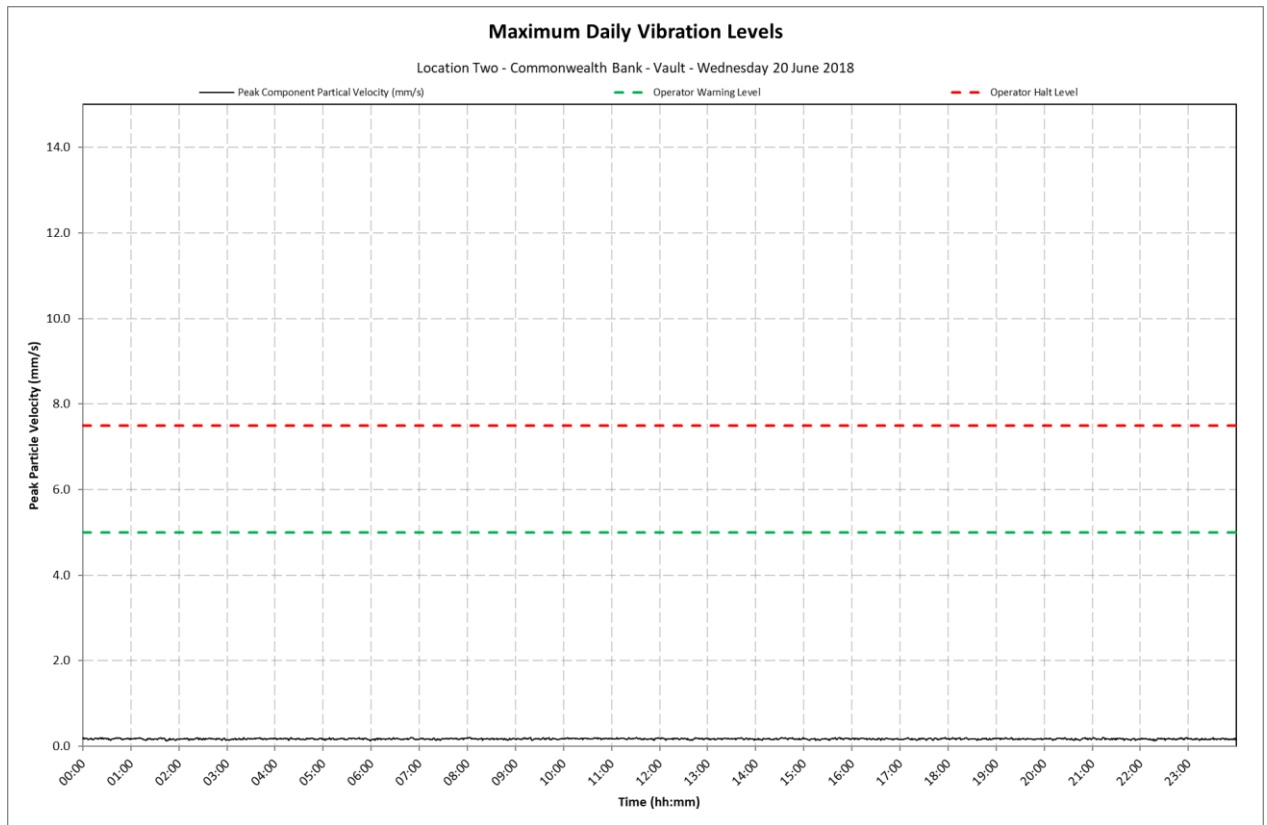
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

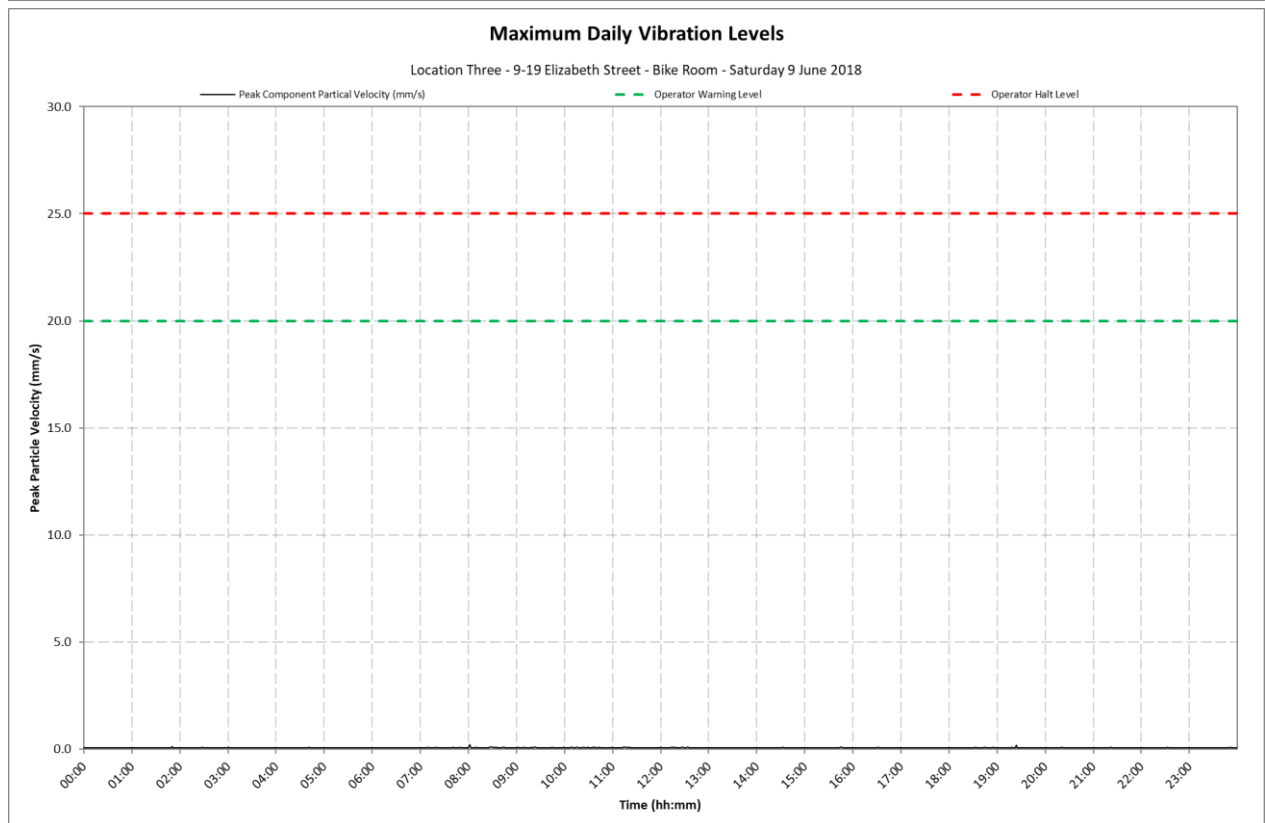
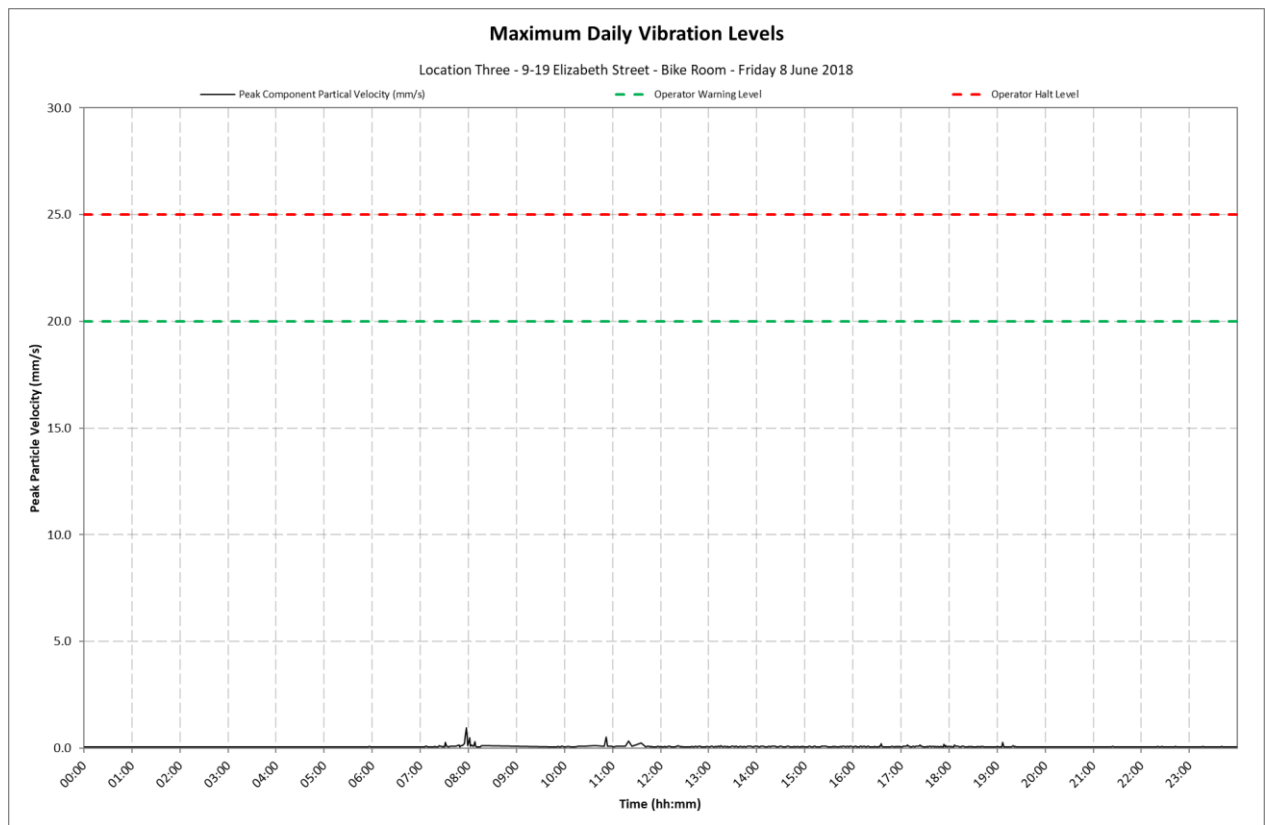
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

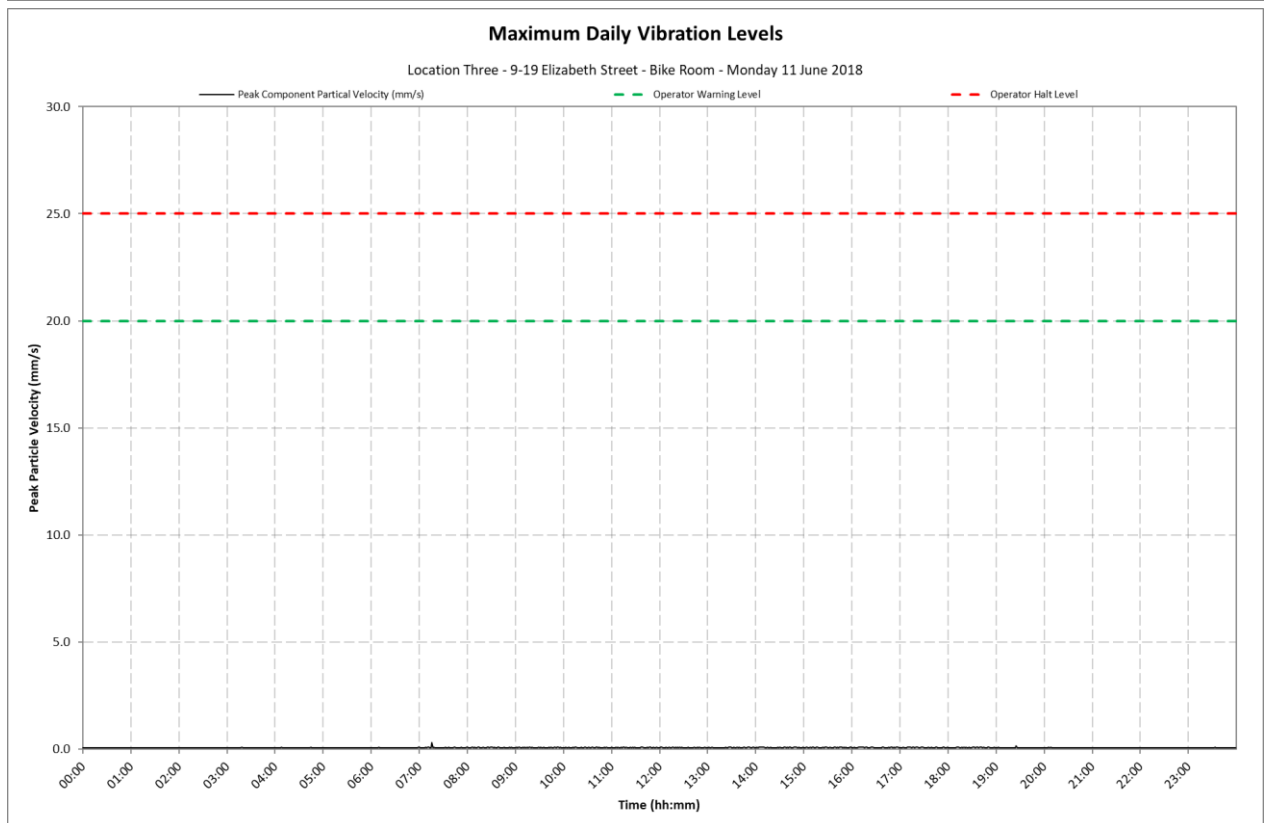
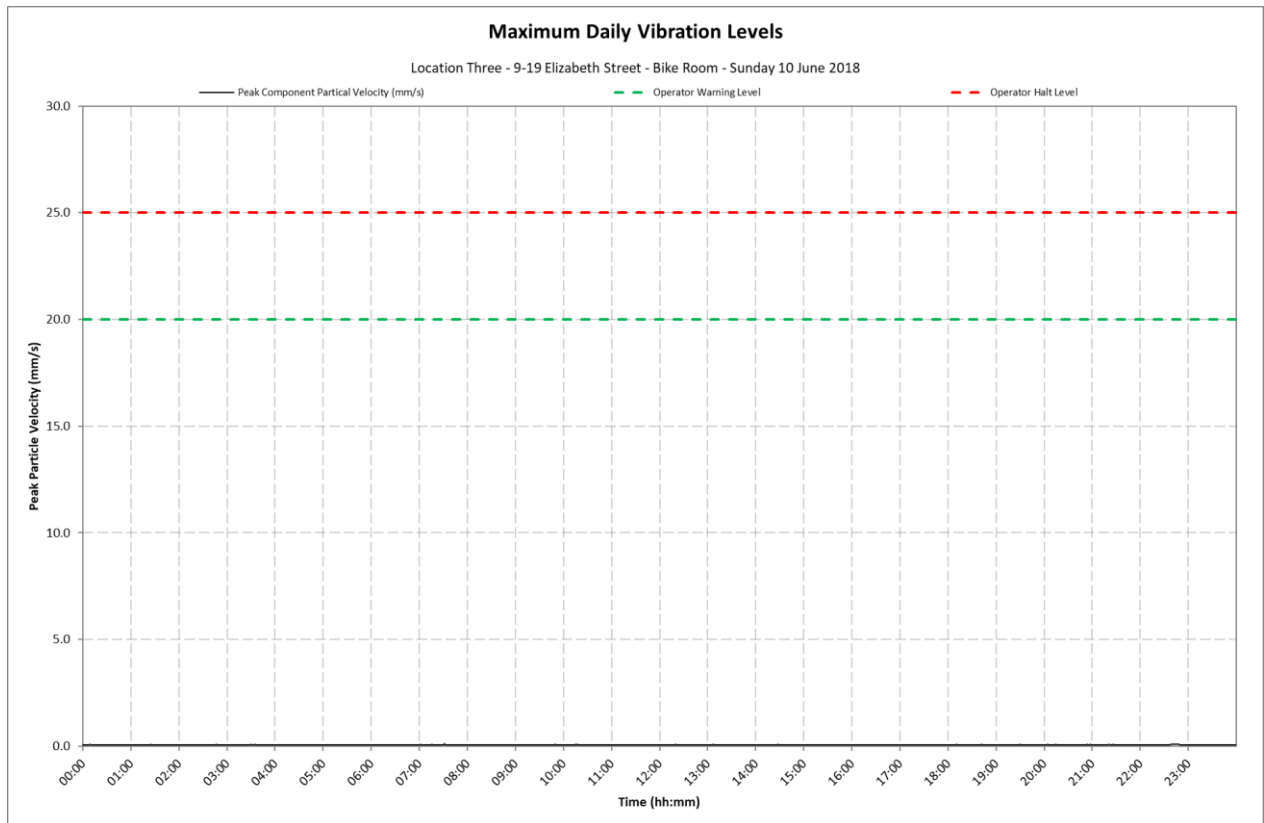
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

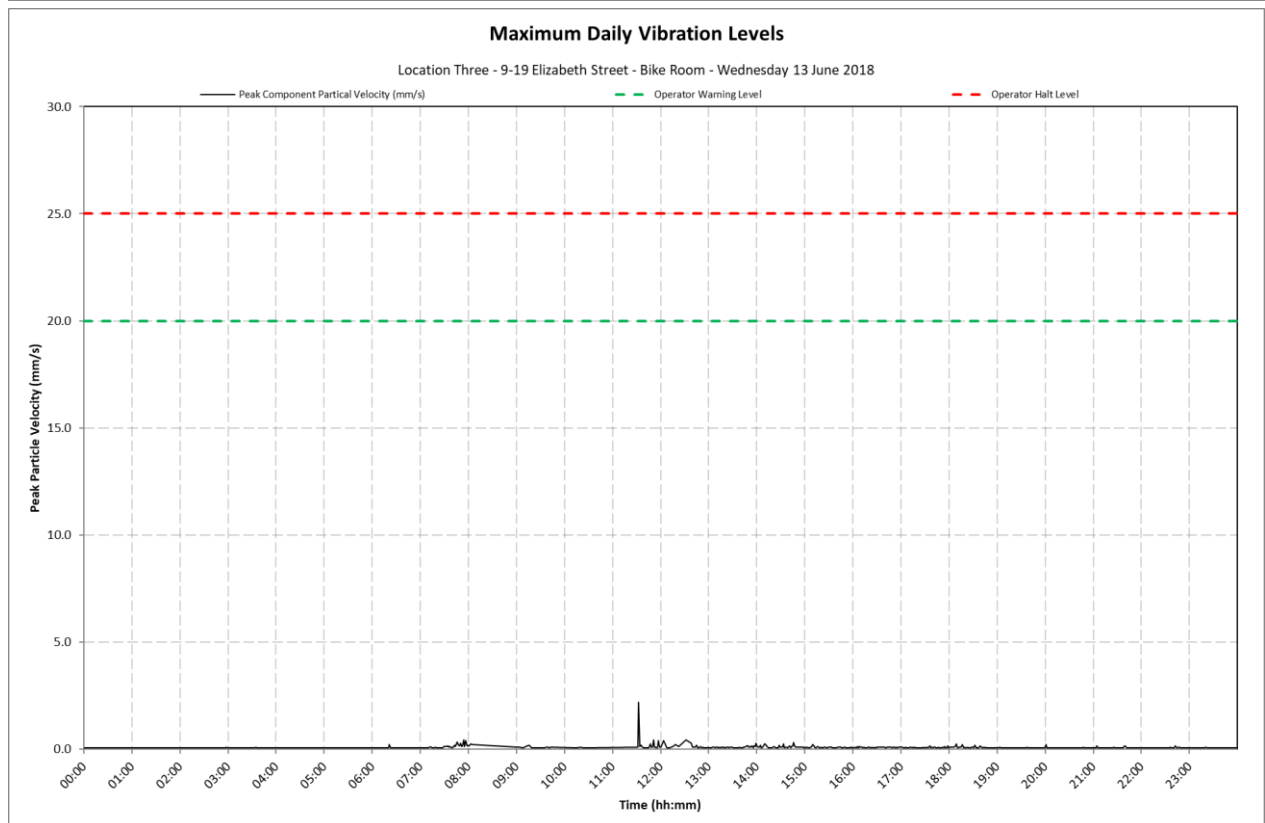
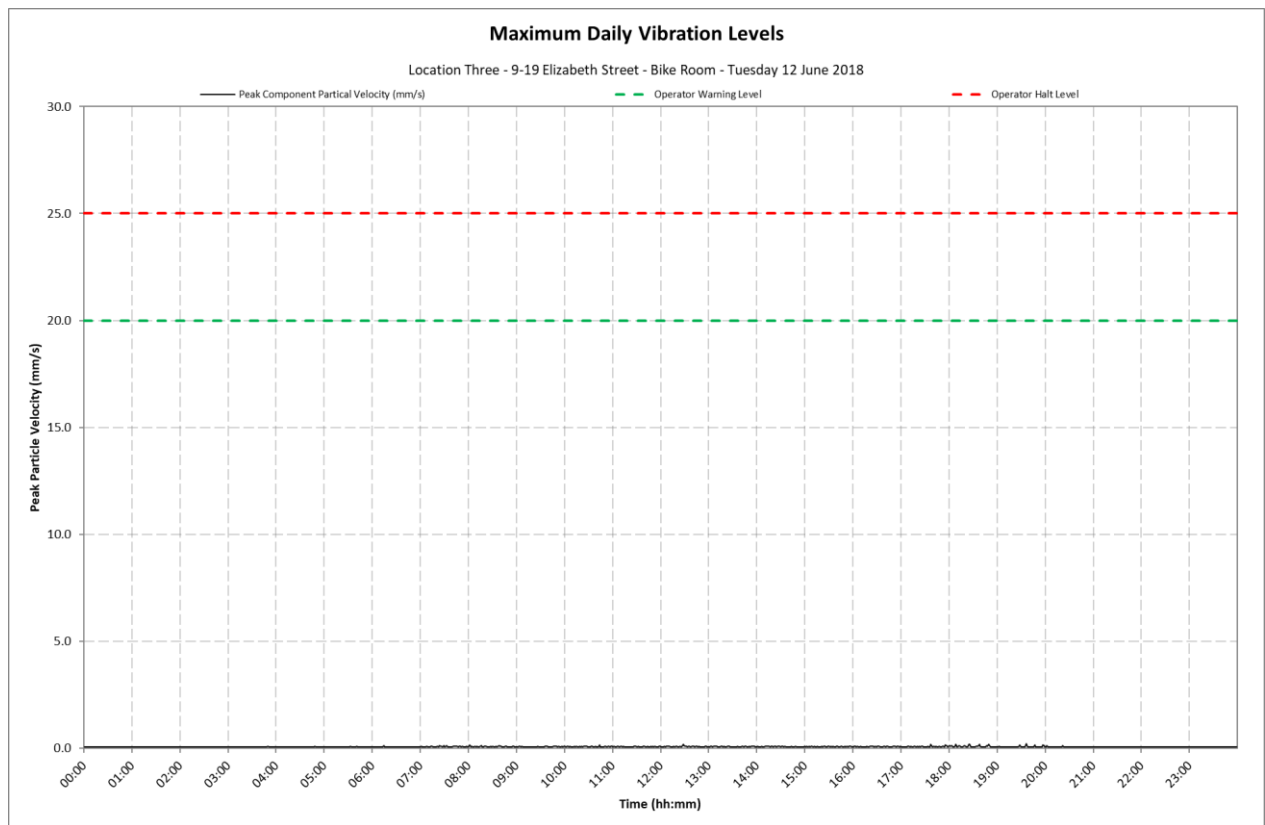
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

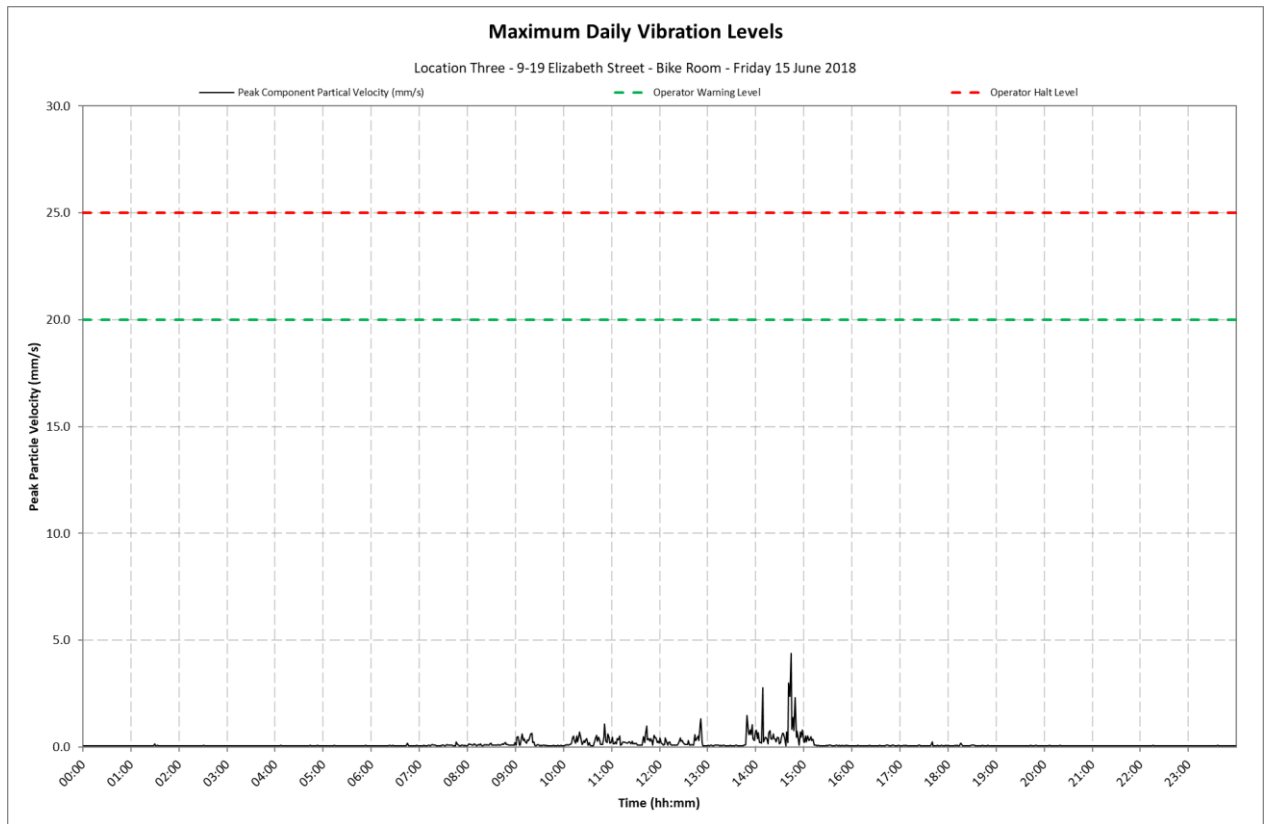
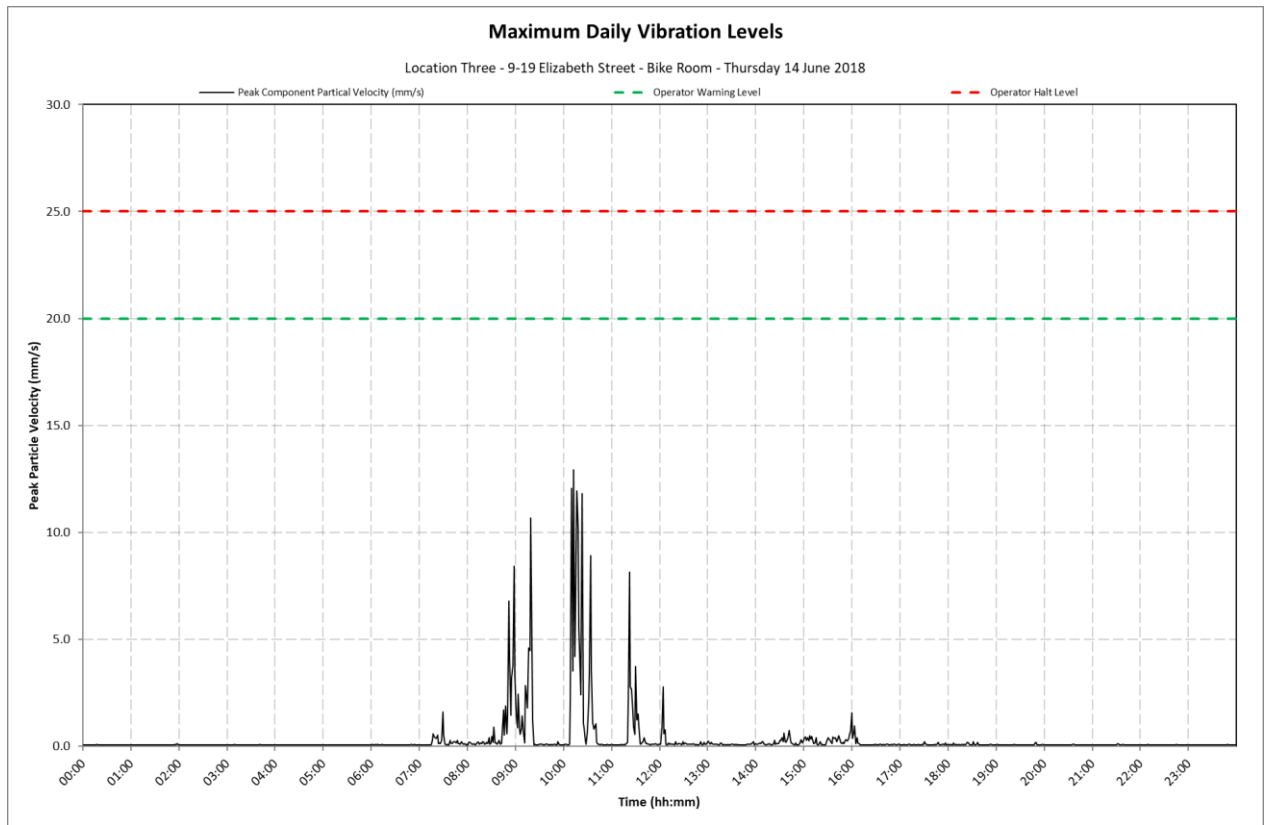
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

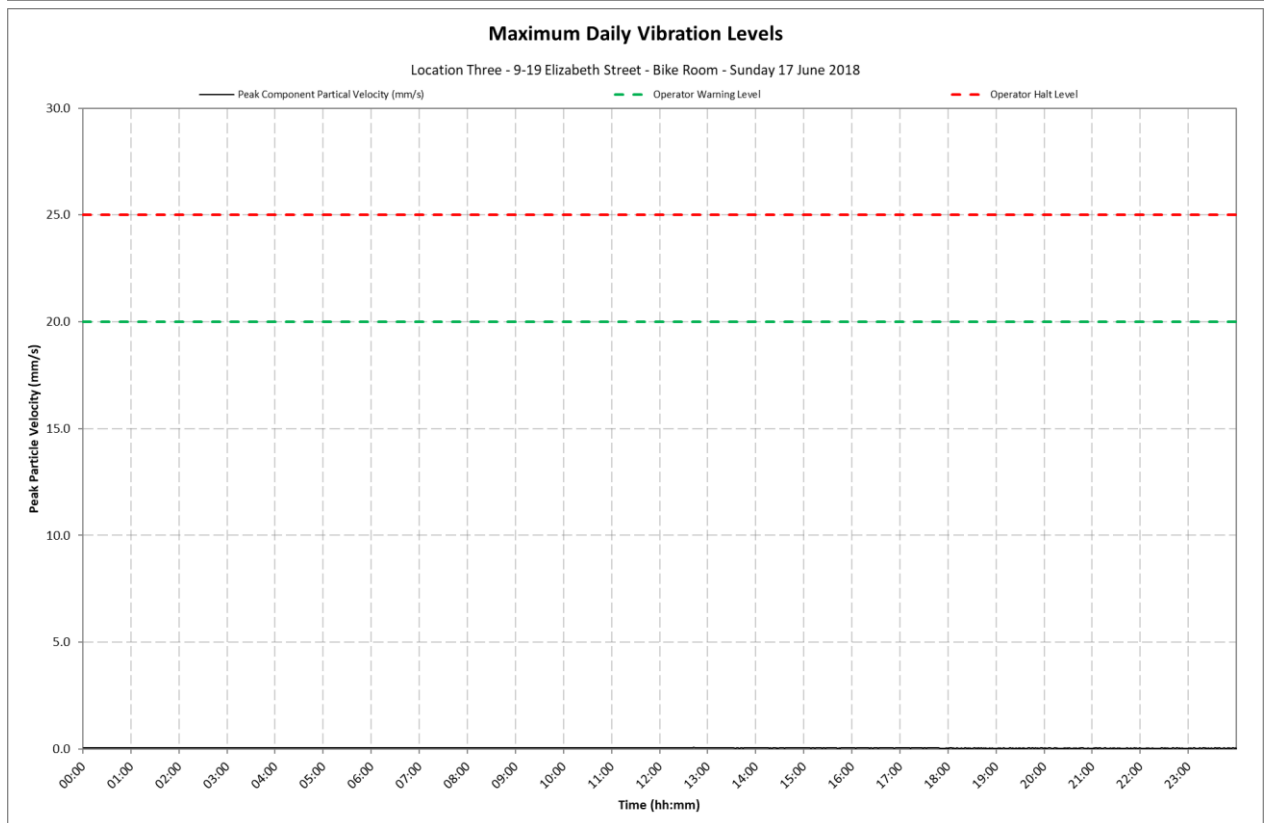
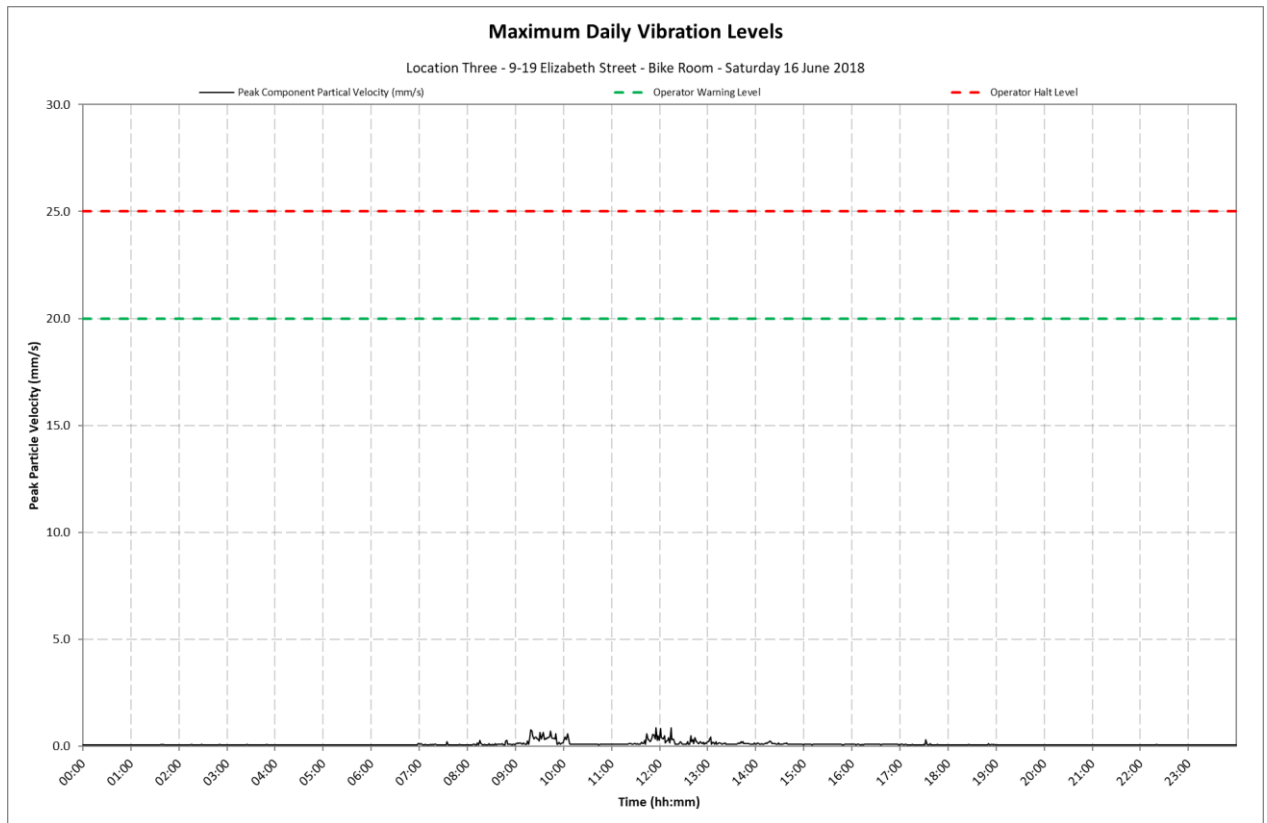
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

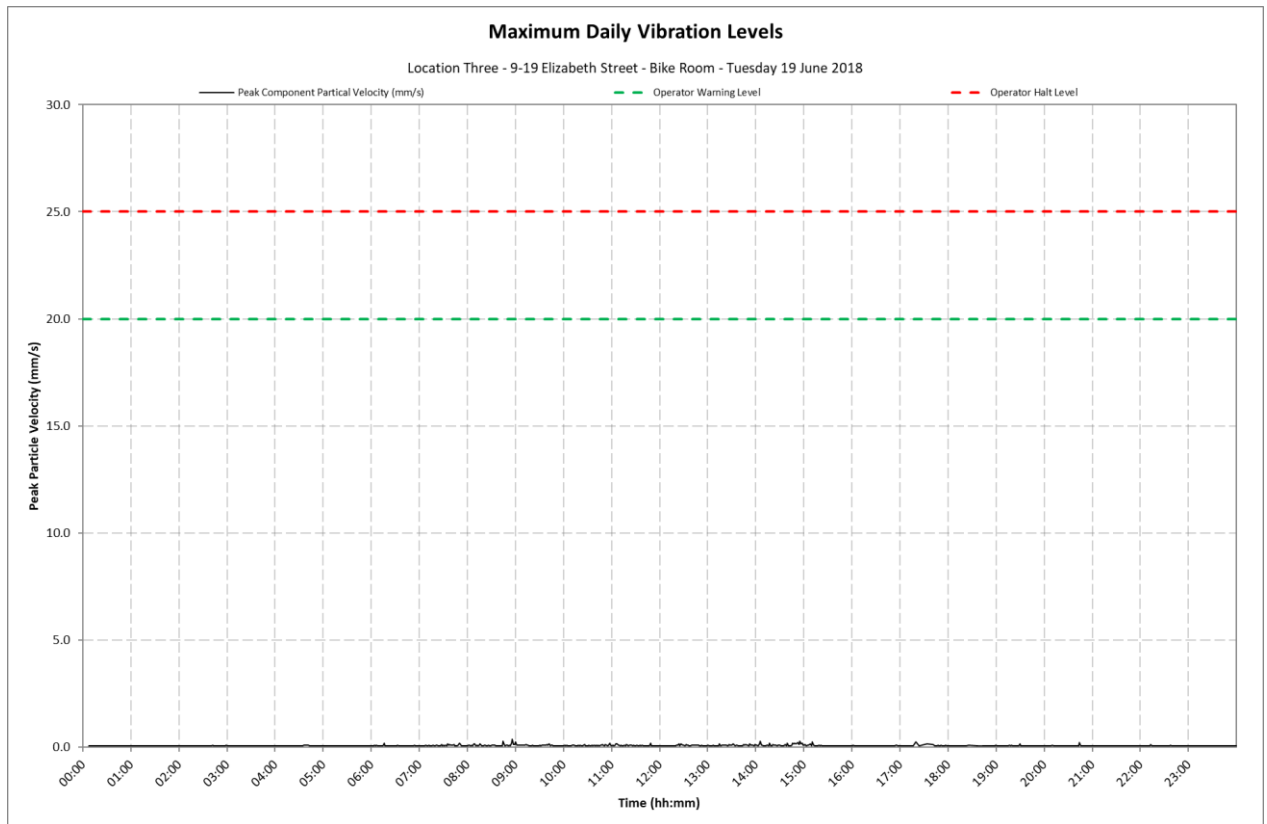
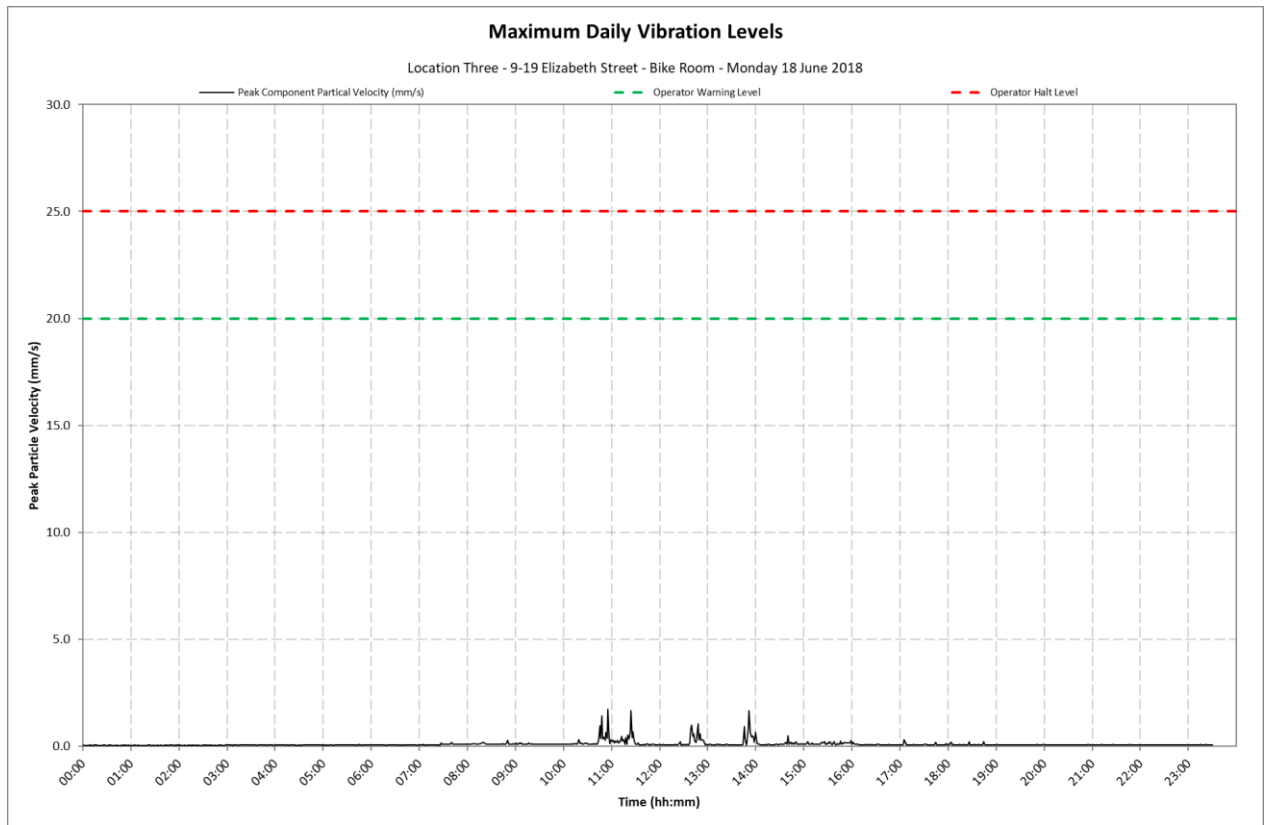
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

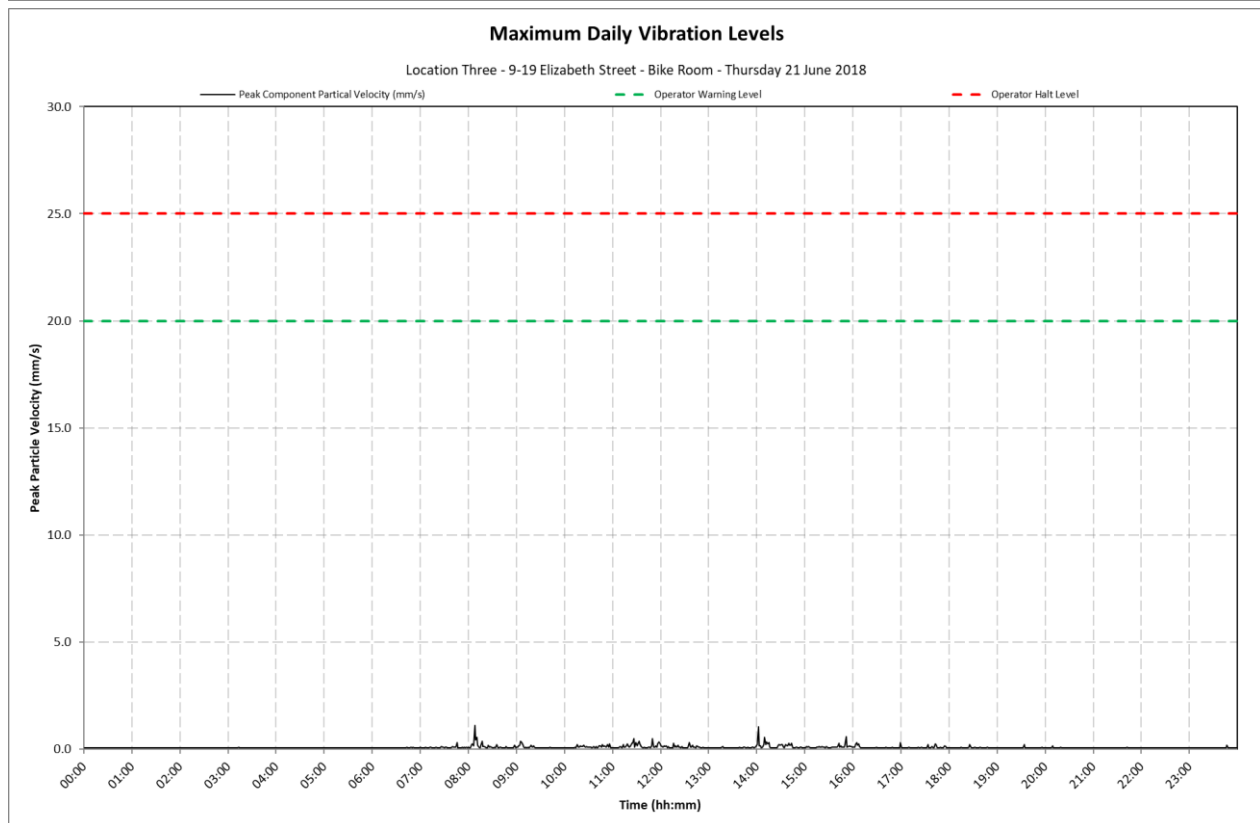
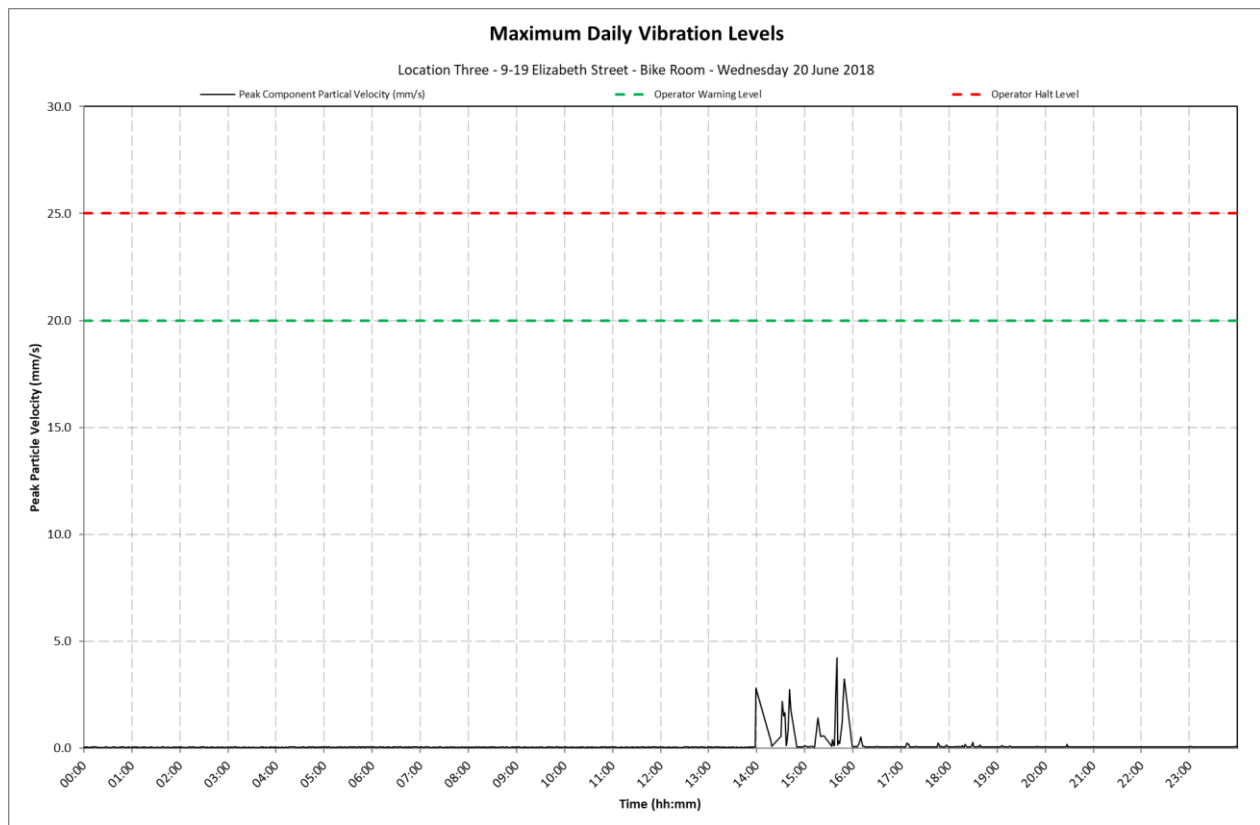
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





4 July 2018

10-1380 R33 NV Monitoring 20180718.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 33
22 June to 28 June 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 22 June to 28 June 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

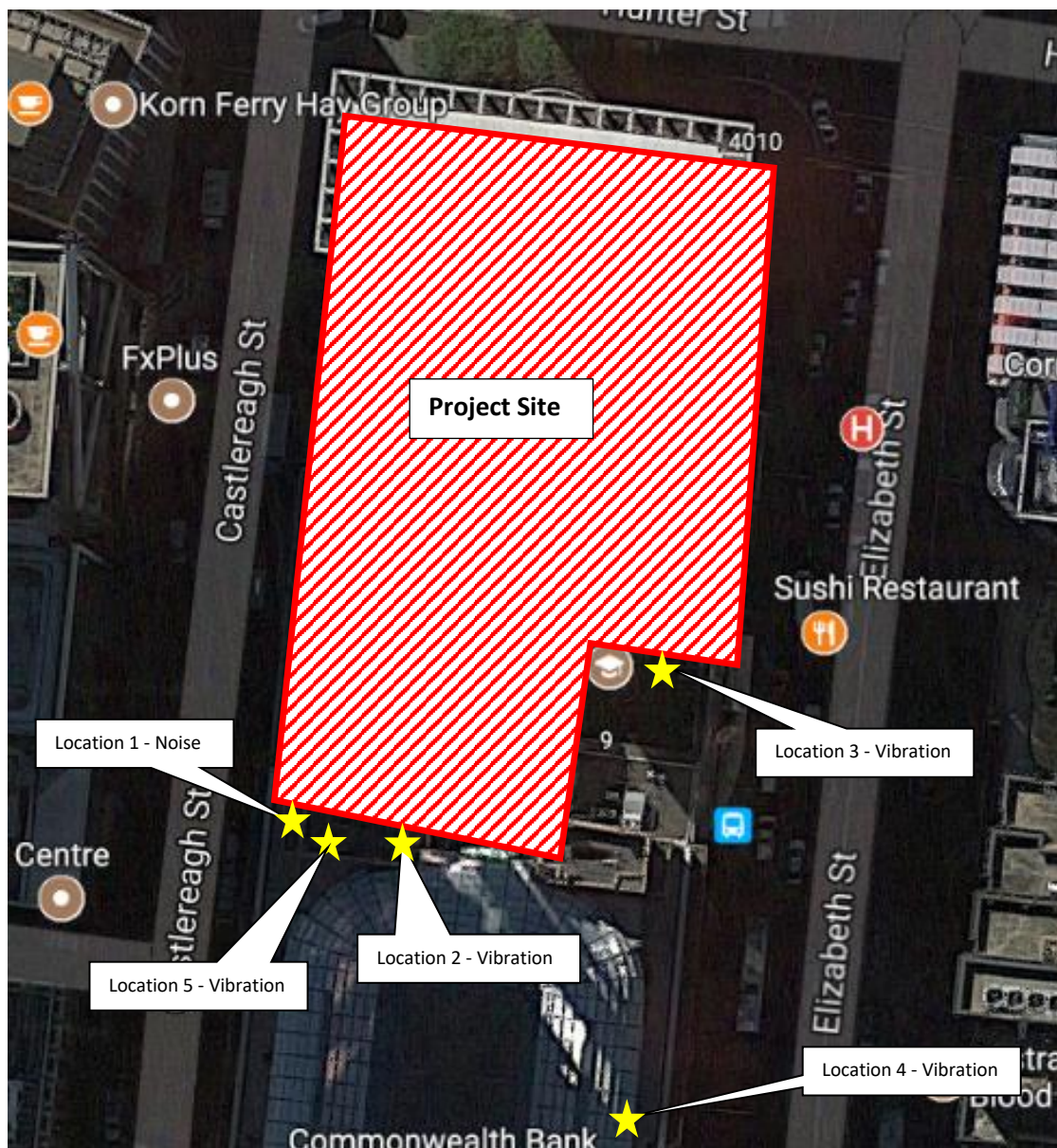
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 22 June to 28 June 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
22 June 2018	46	44	Complies	Complies
23 June 2018	39	35	Complies	Complies
24 June 2018	34	33	Complies	Complies
25 June 2018	46	45	Complies	Complies
26 June 2018	47	45	Complies	Complies
27 June 2018	47	45	Complies	Complies
28 June 2018	47	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 3 and **Table 4** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 22 June to 28 June 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
22 June 2018	0.8 mm/s	Complies
23 June 2018	0.9 mm/s	Complies
24 June 2018	0.5 mm/s	Complies
25 June 2018	0.6 mm/s	Complies
26 June 2018	1.1 mm/s	Complies
27 June 2018	0.9 mm/s	Complies
28 June 2018	2.4 mm/s	Complies

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
22 June 2018	0.9 mm/s	Complies
23 June 2018	1.9 mm/s	Complies
24 June 2018	0.5 mm/s	Complies
25 June 2018	3.5 mm/s	Complies
26 June 2018	2.4 mm/s	Complies
27 June 2018	3.1 mm/s	Complies
28 June 2018	1.4 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 22 June to 28 June 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 22 June to 28 June 2018 found all recorded ambient vibration levels were below the maximum vibration control limit at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely

A handwritten signature in black ink, appearing to read 'R. Wakeling', with a long horizontal stroke extending to the right.

Ryan Wakeling

Principal - Acoustics & Vibration

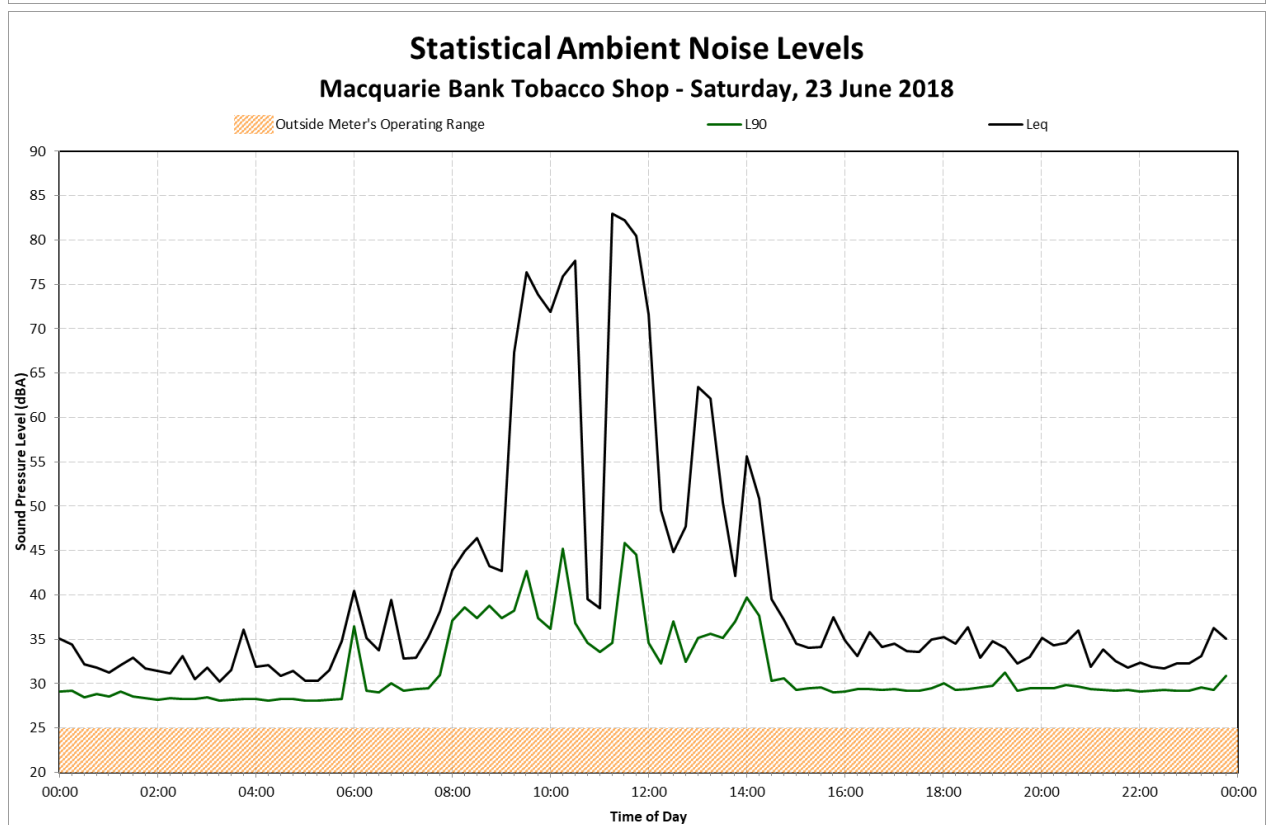
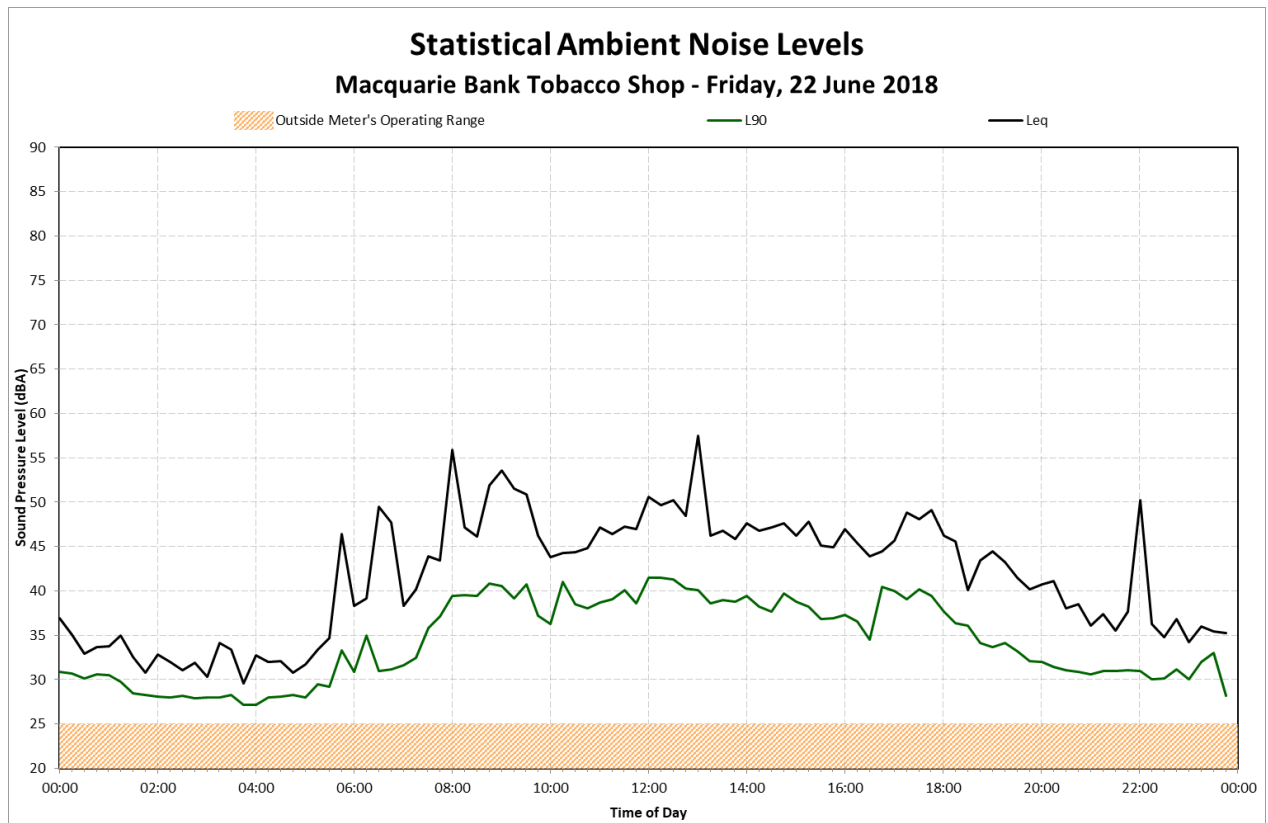
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

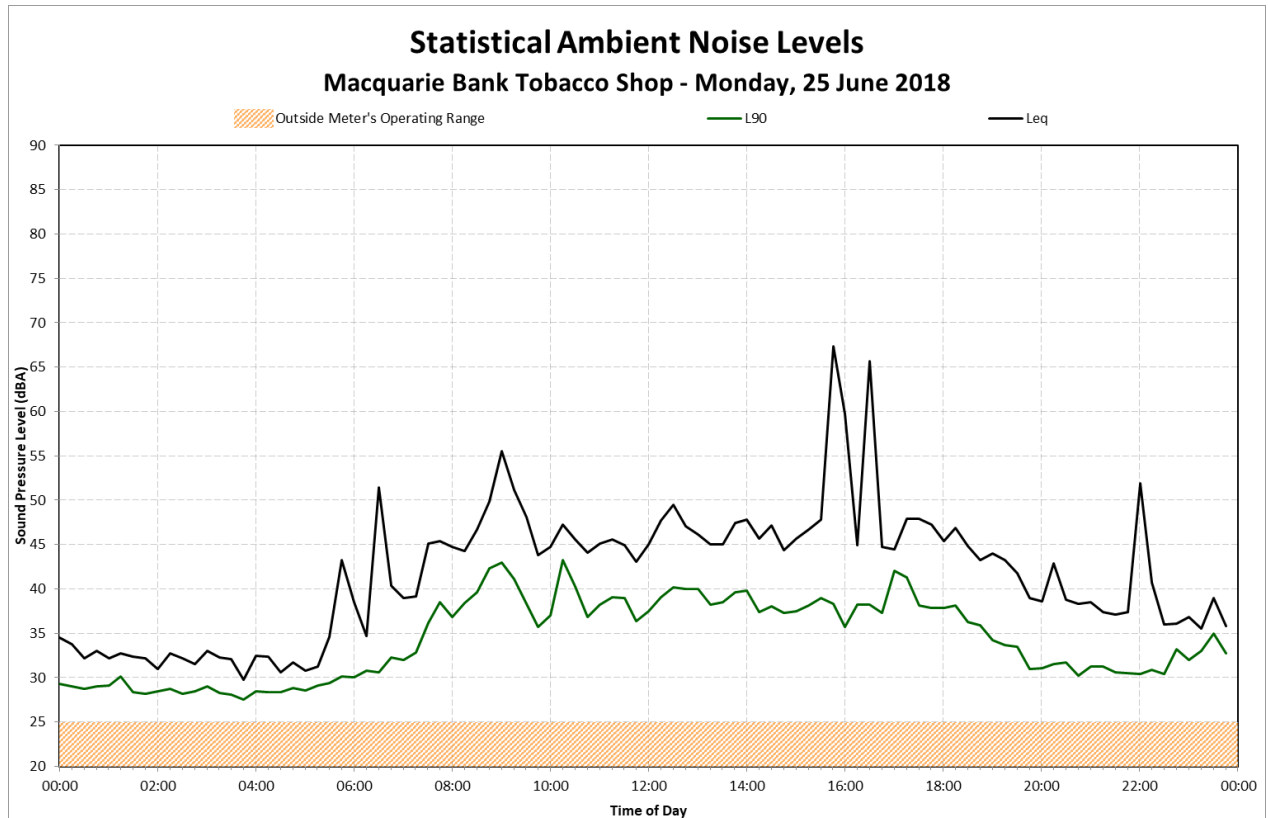
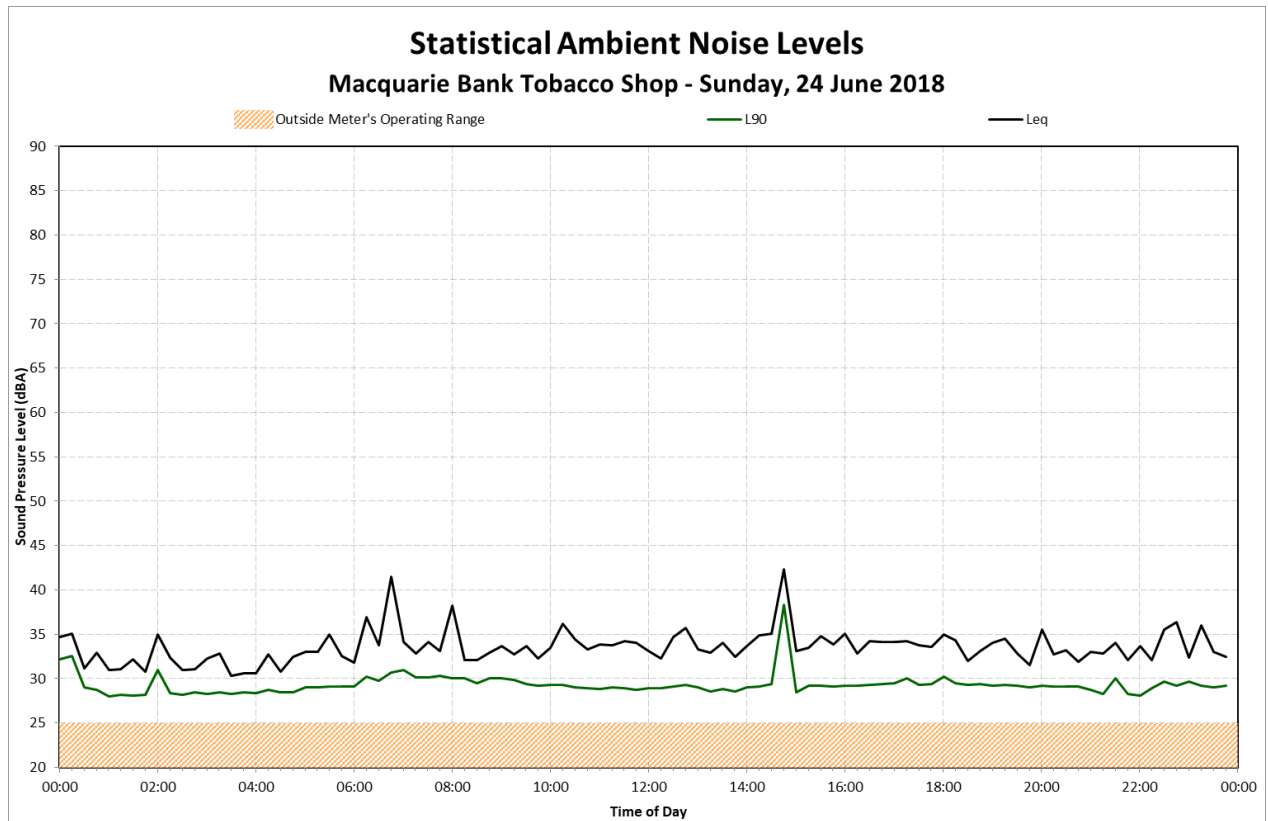
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

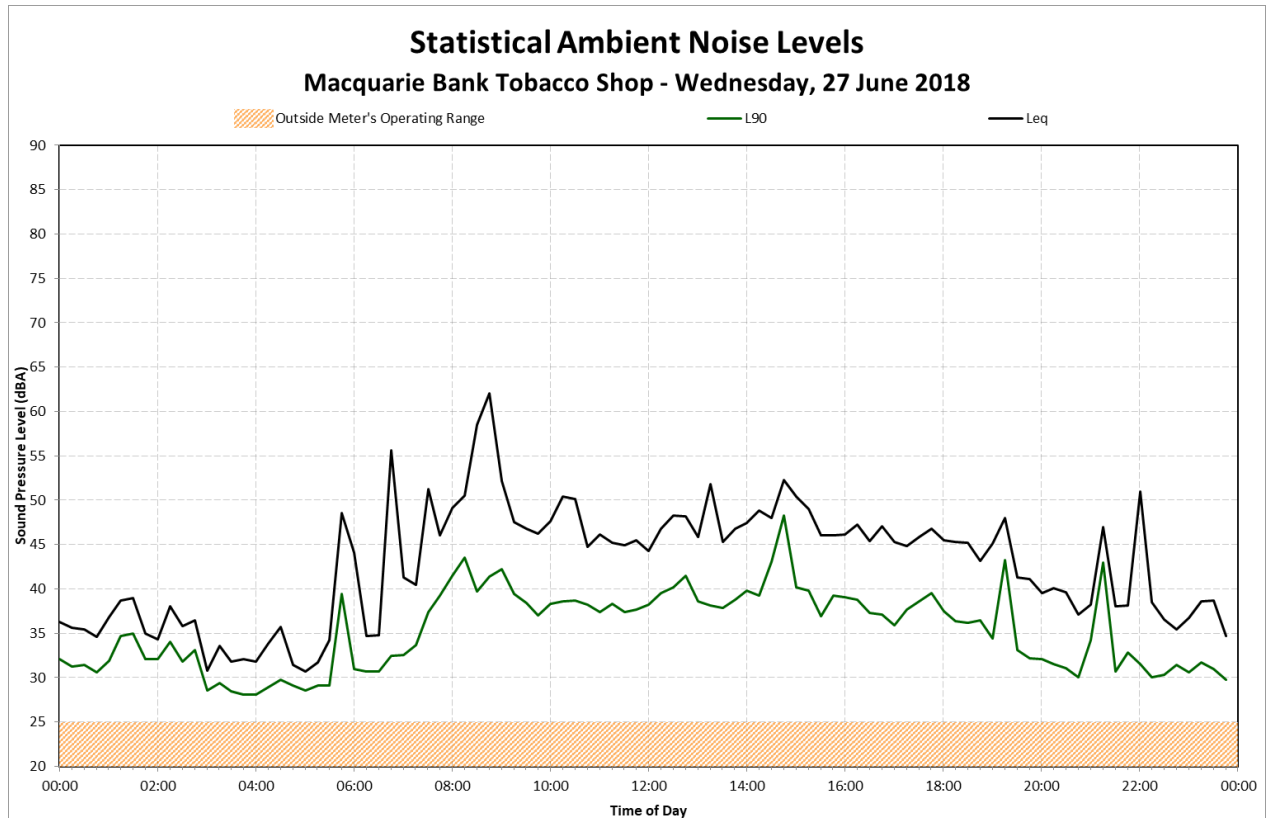
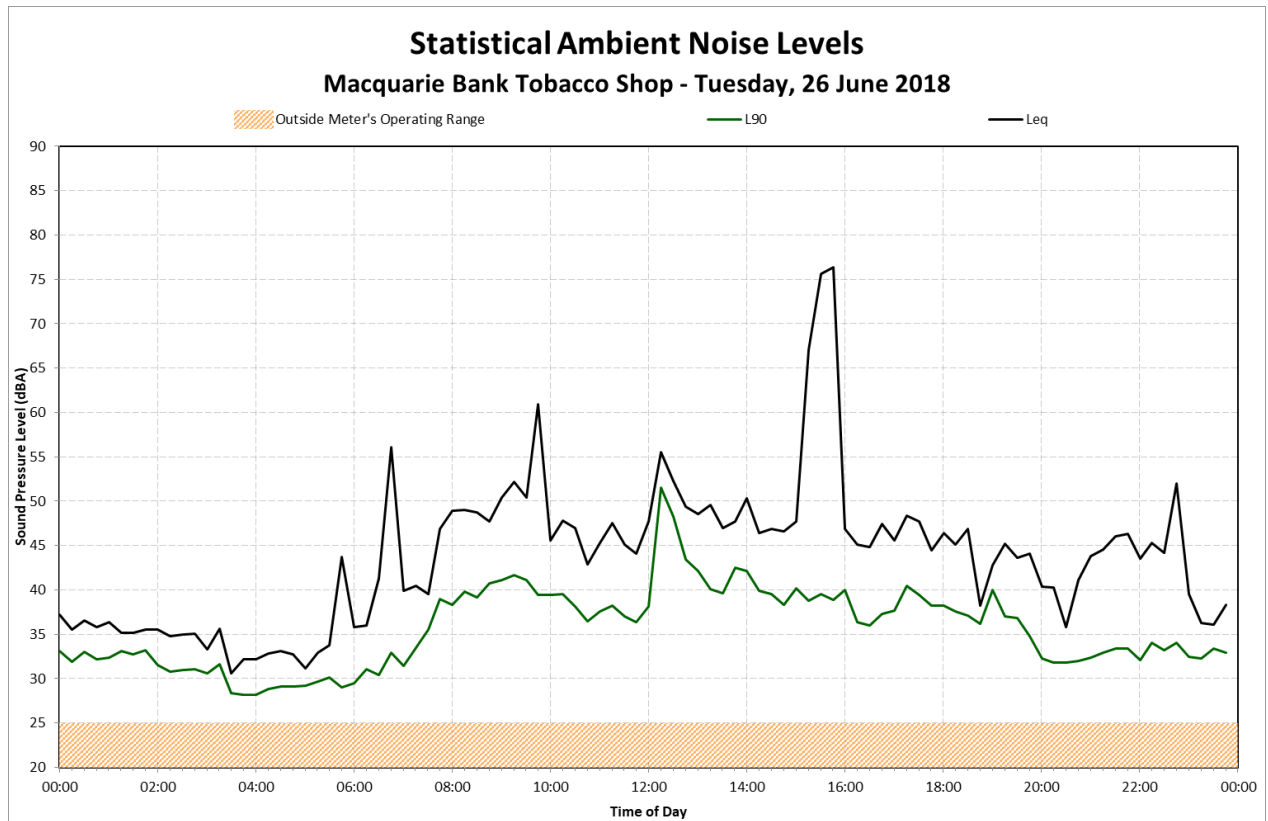
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

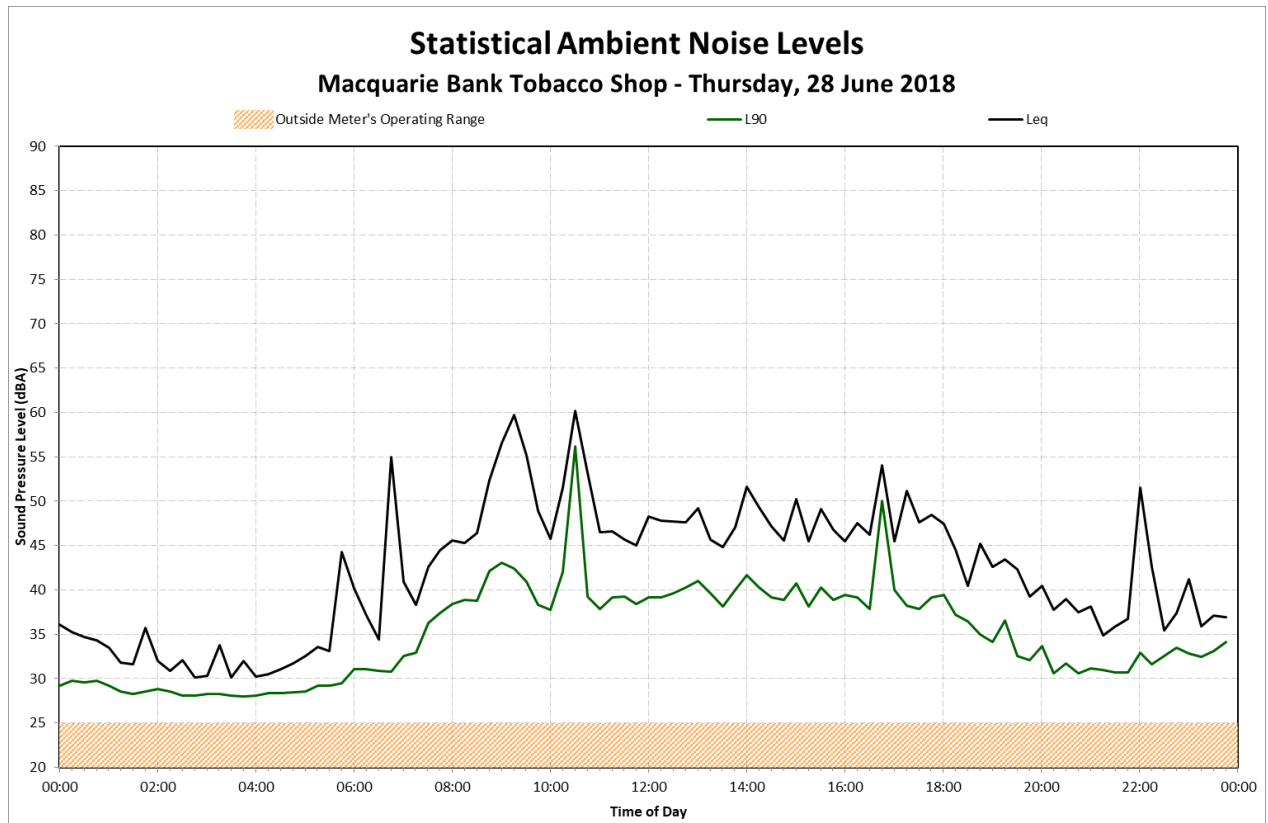
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

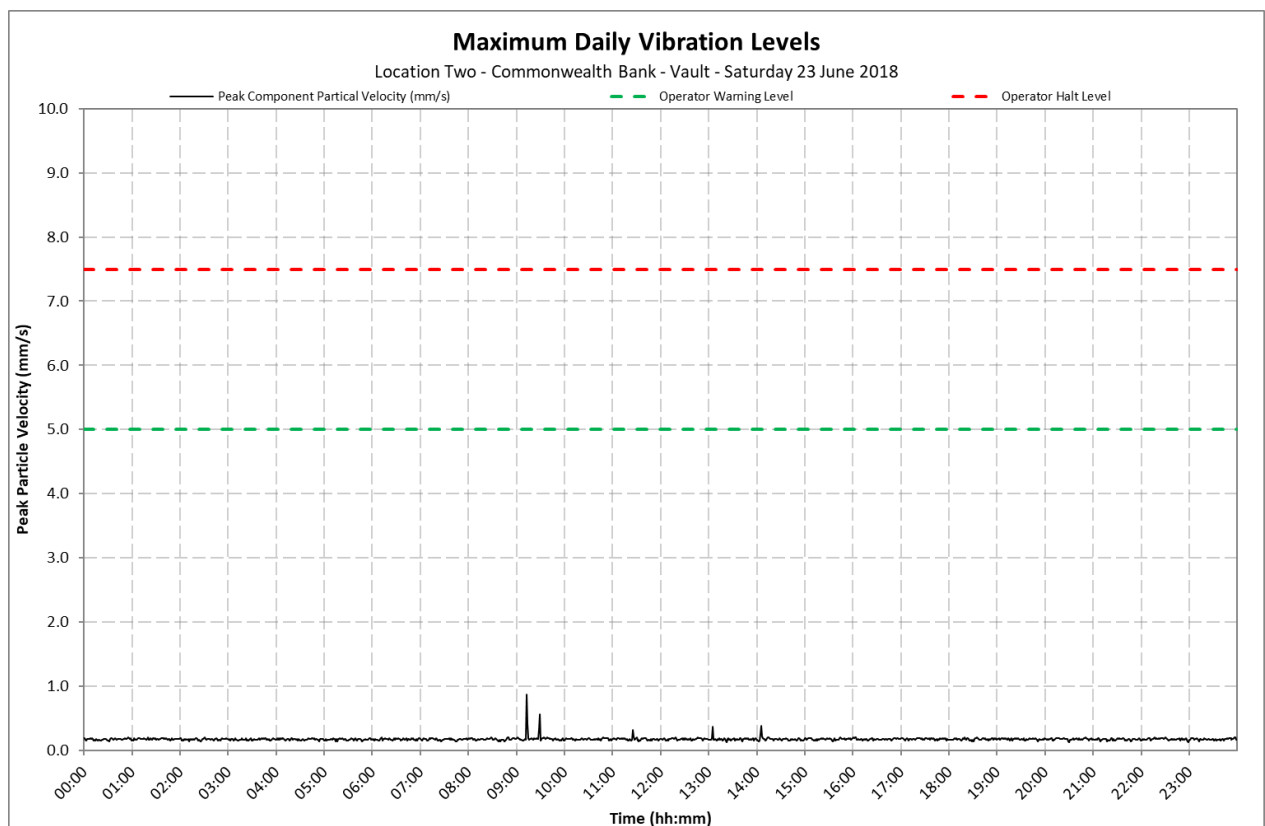
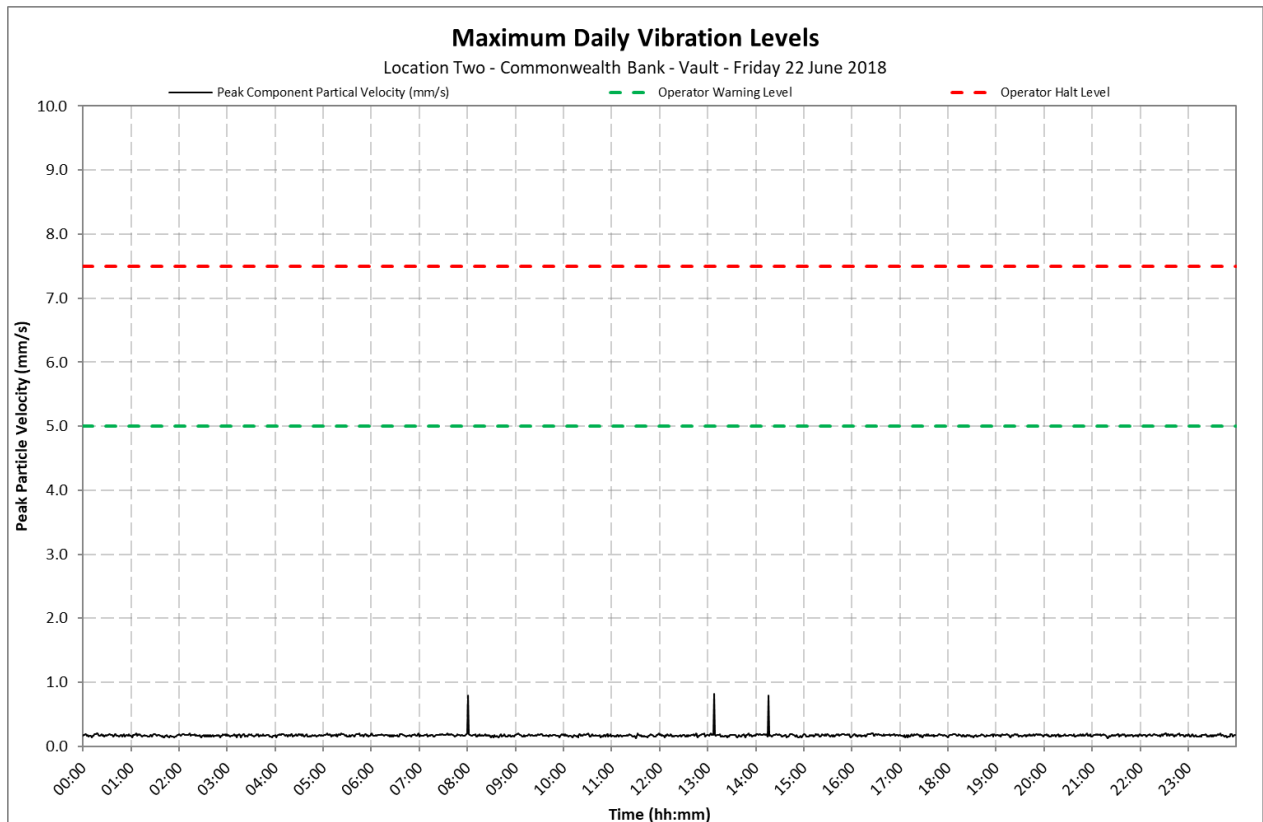
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

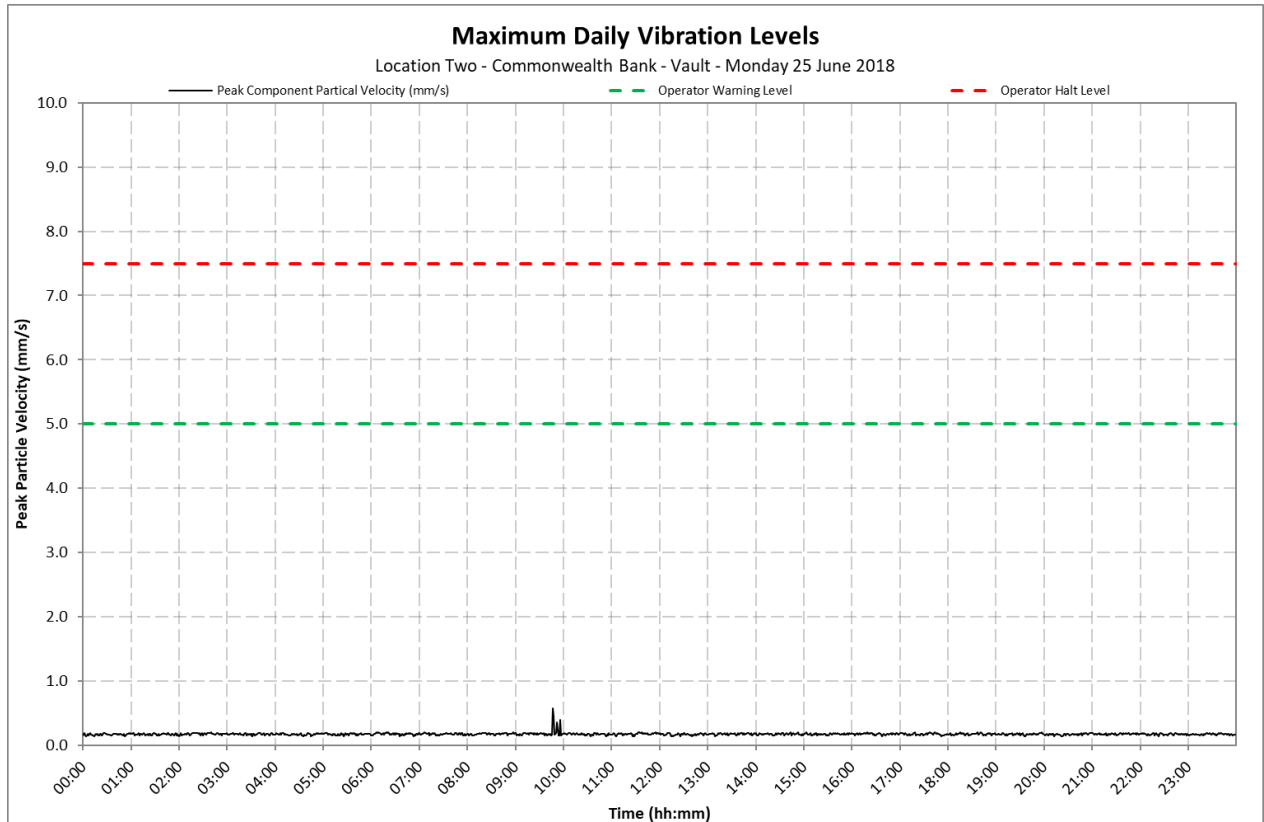
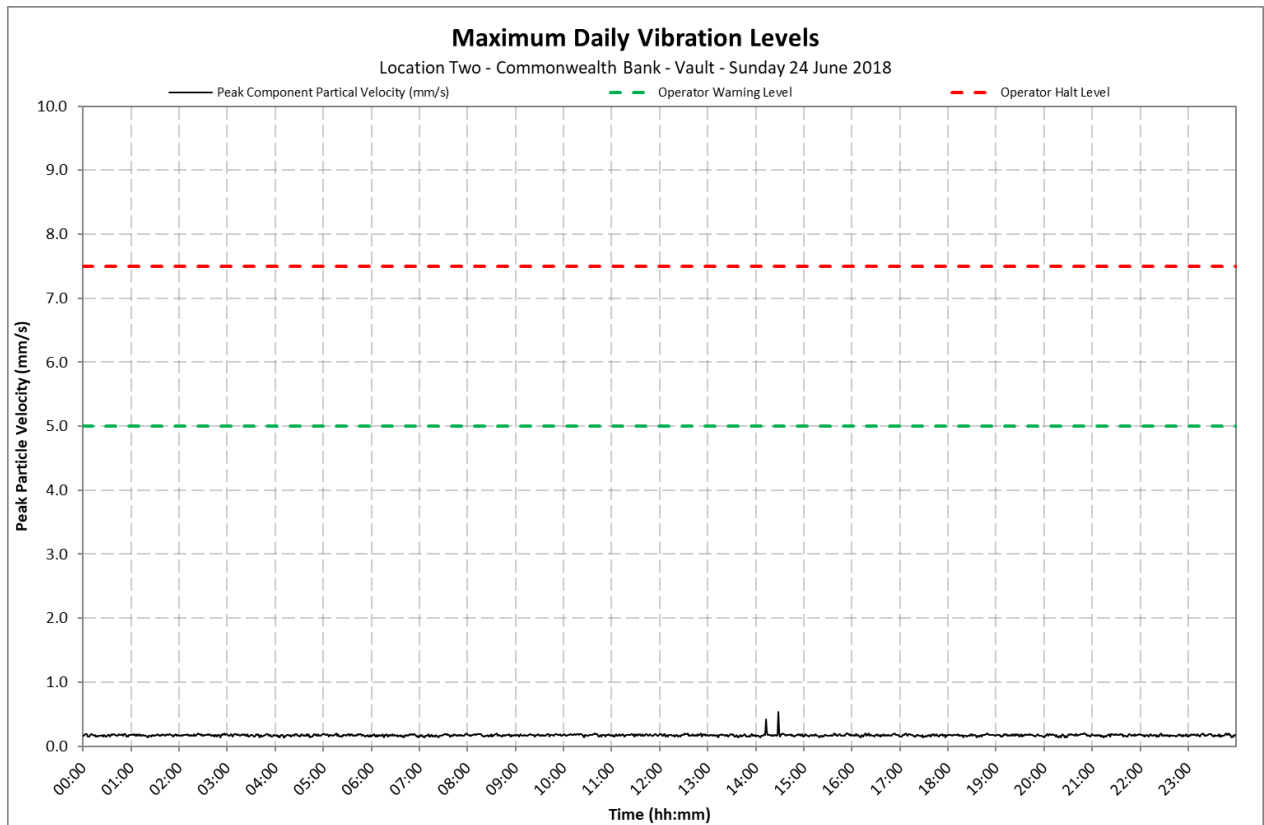
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

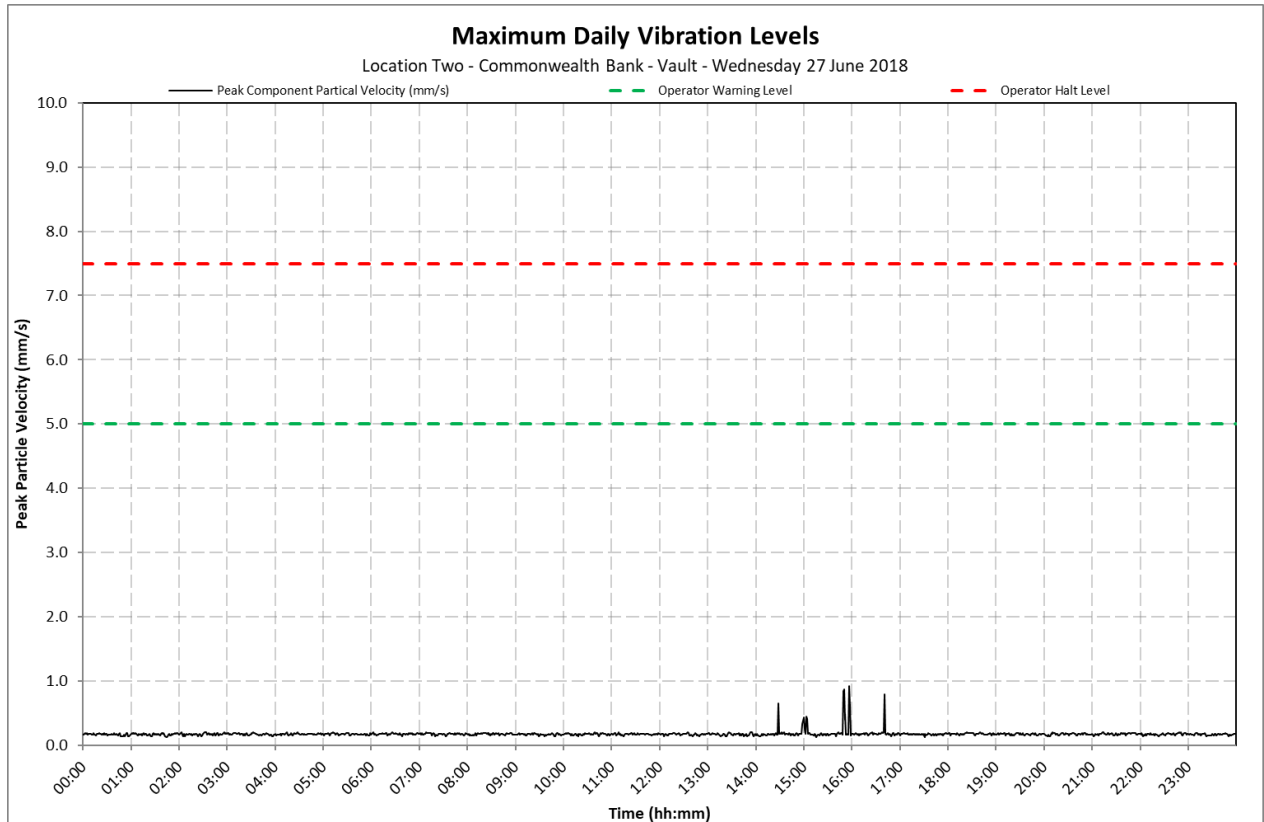
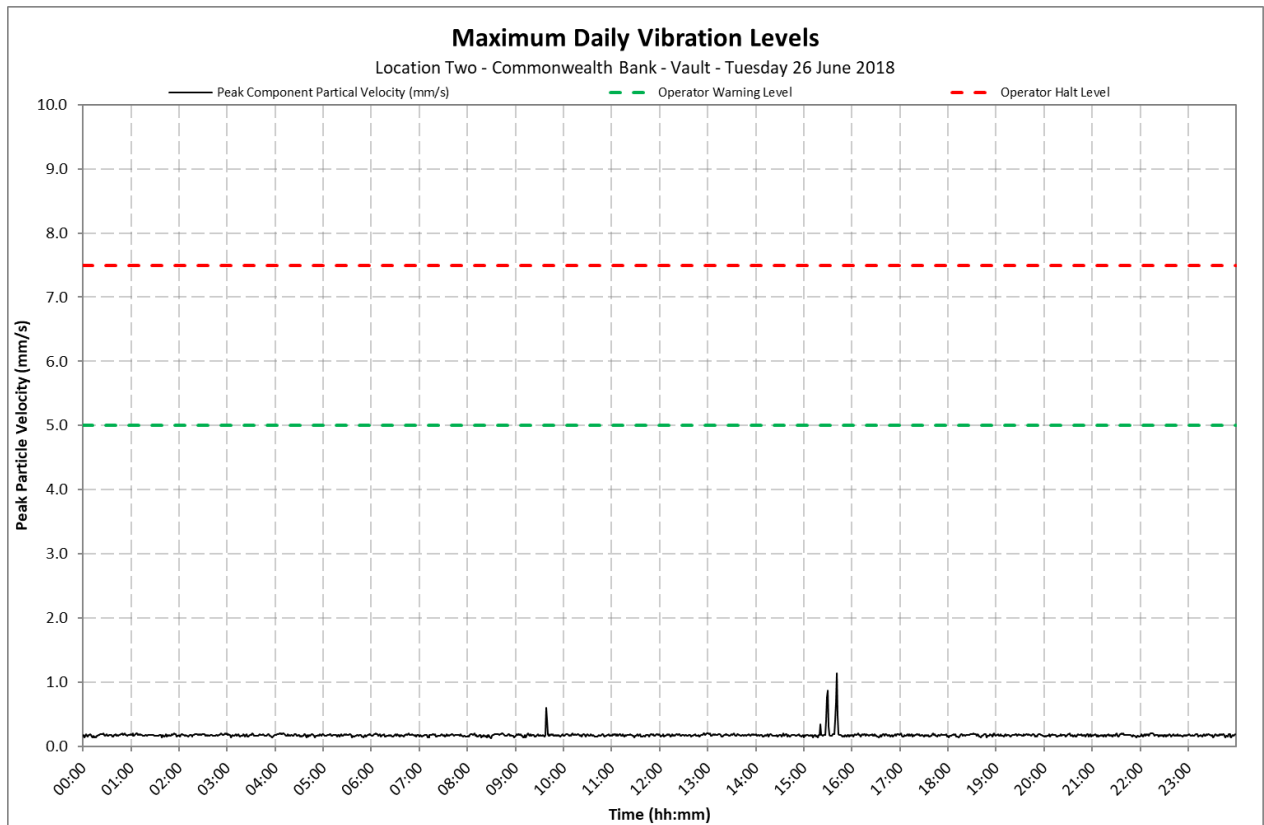
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

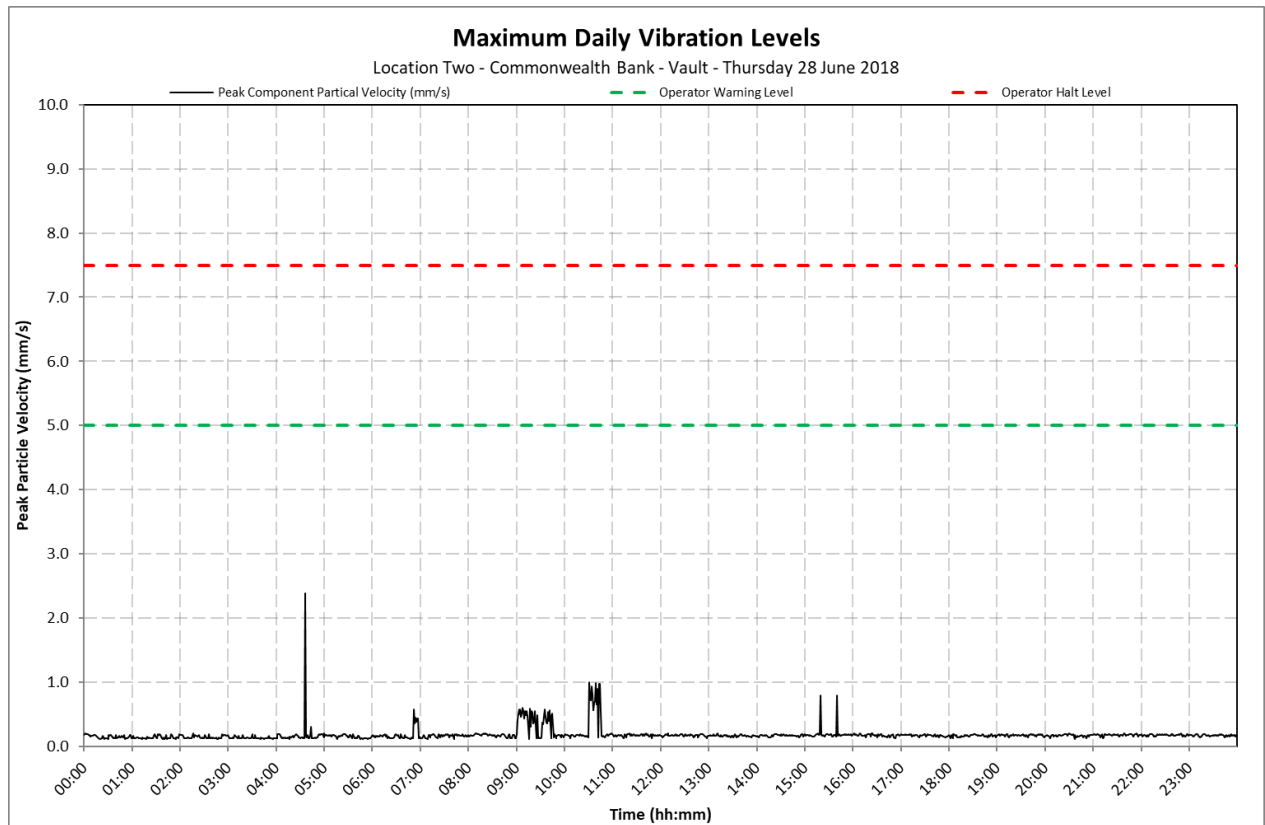
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

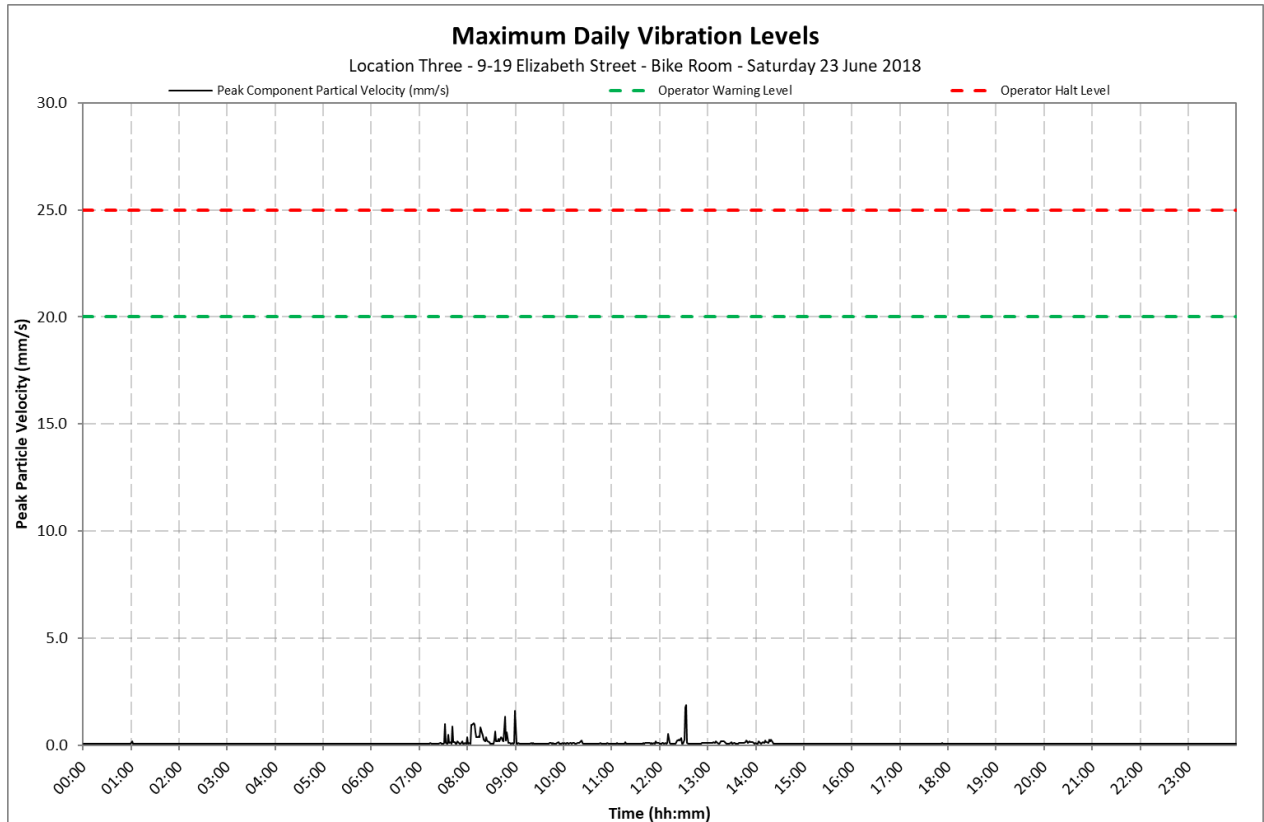
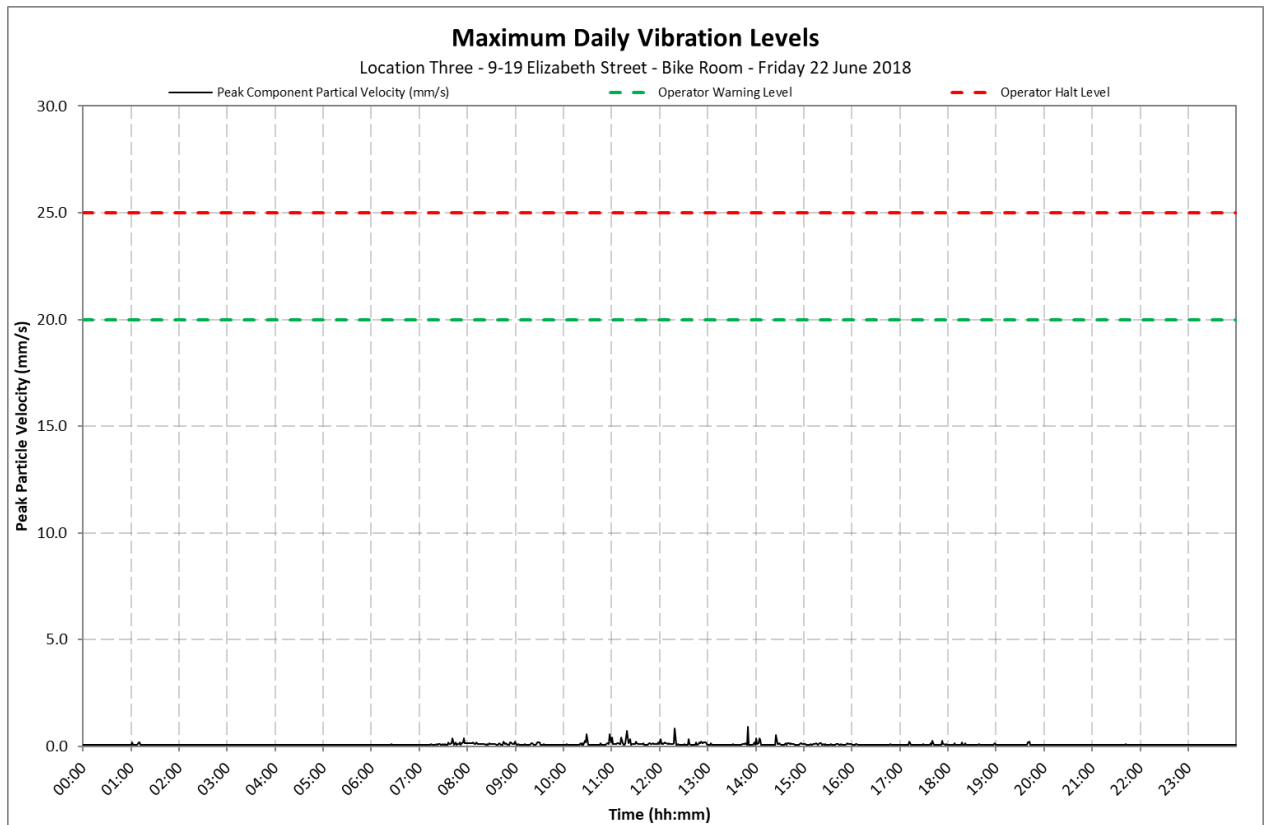
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

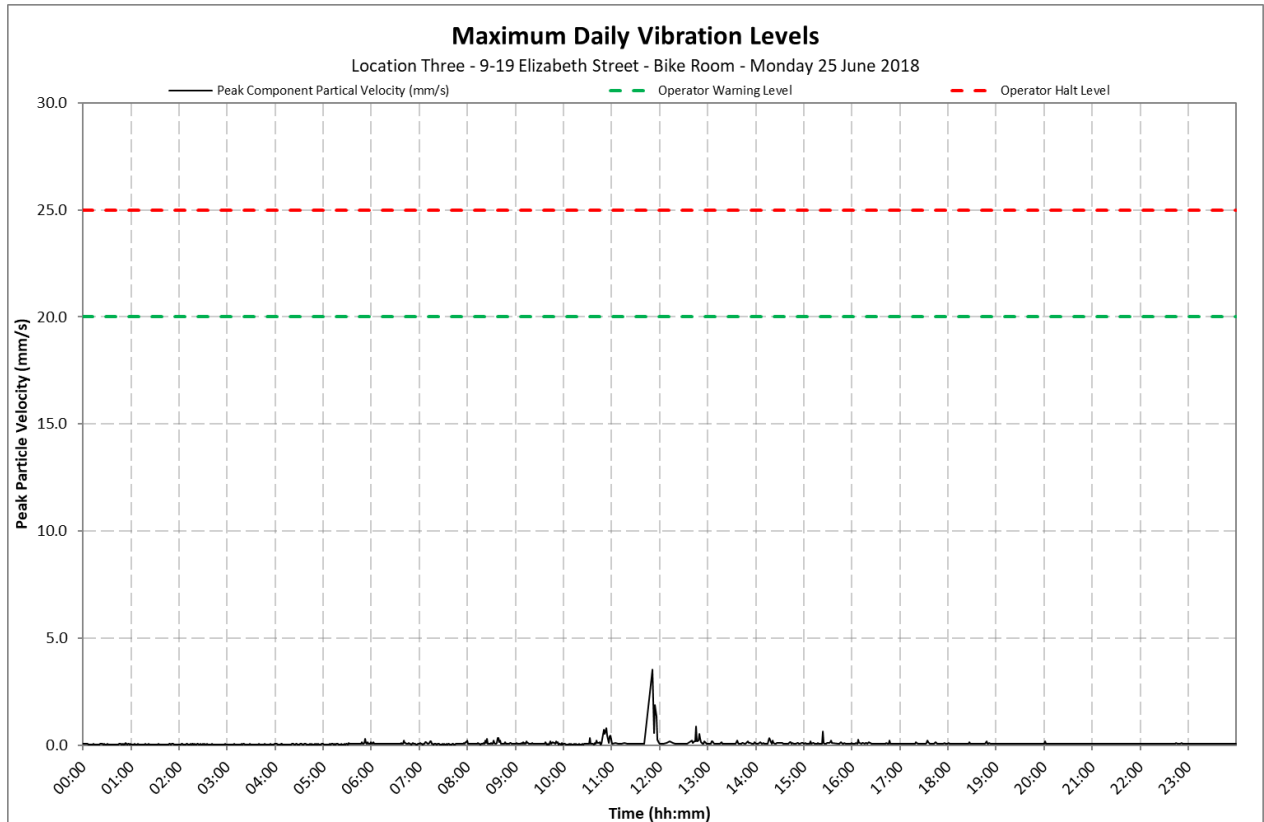
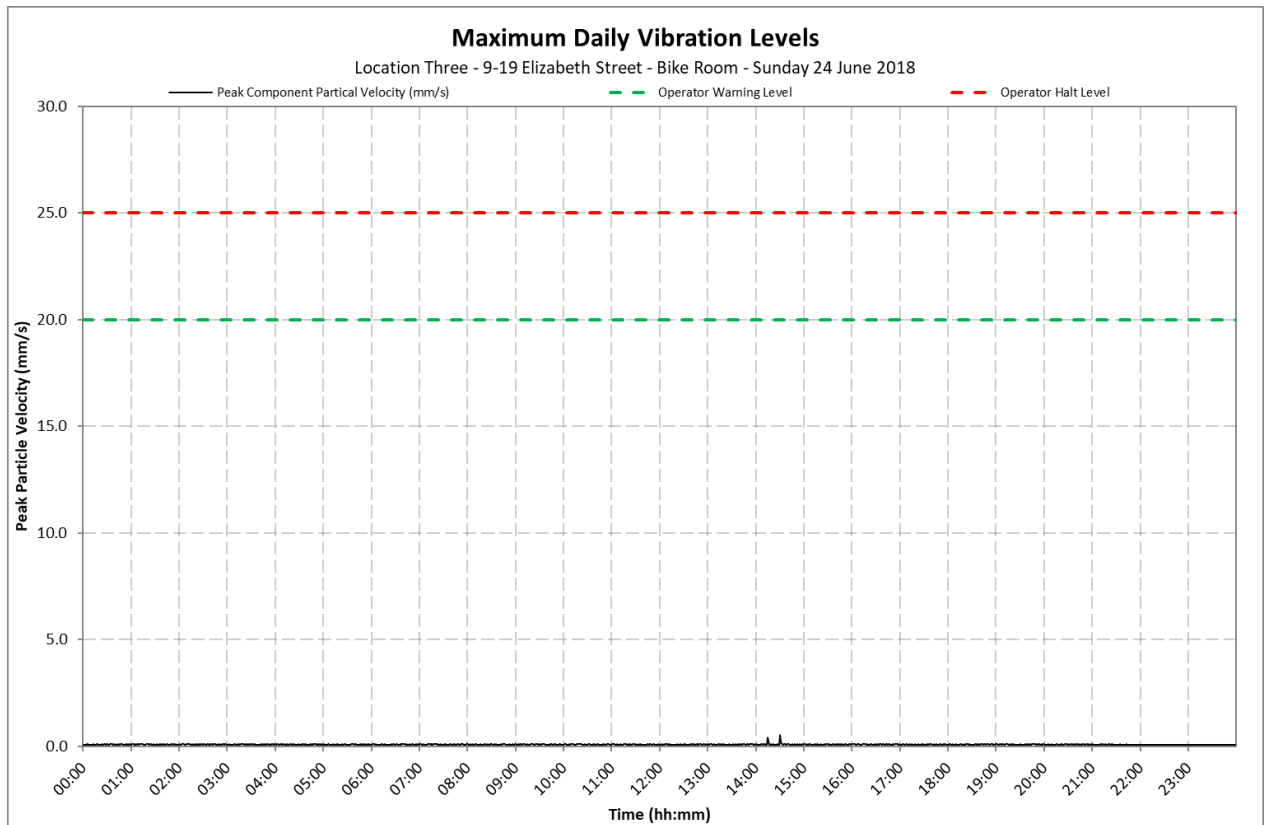
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

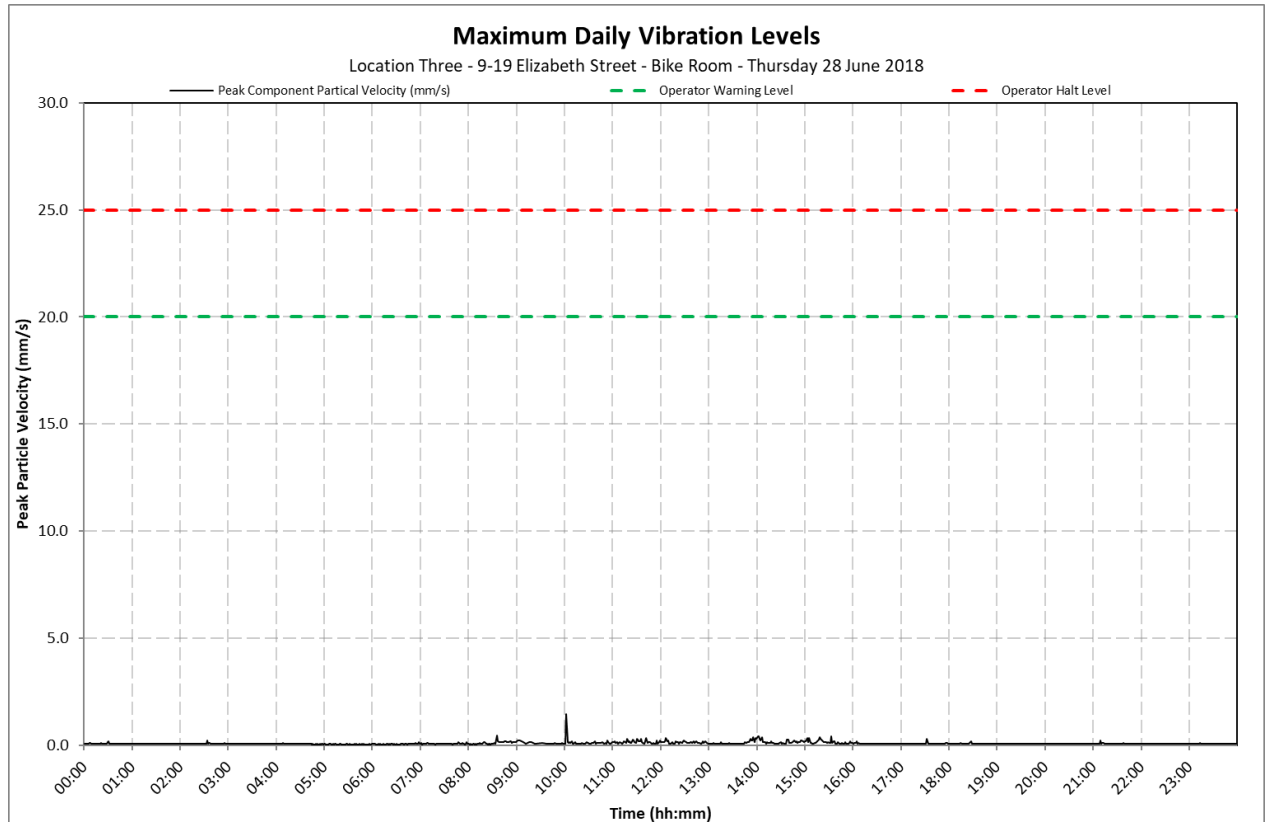
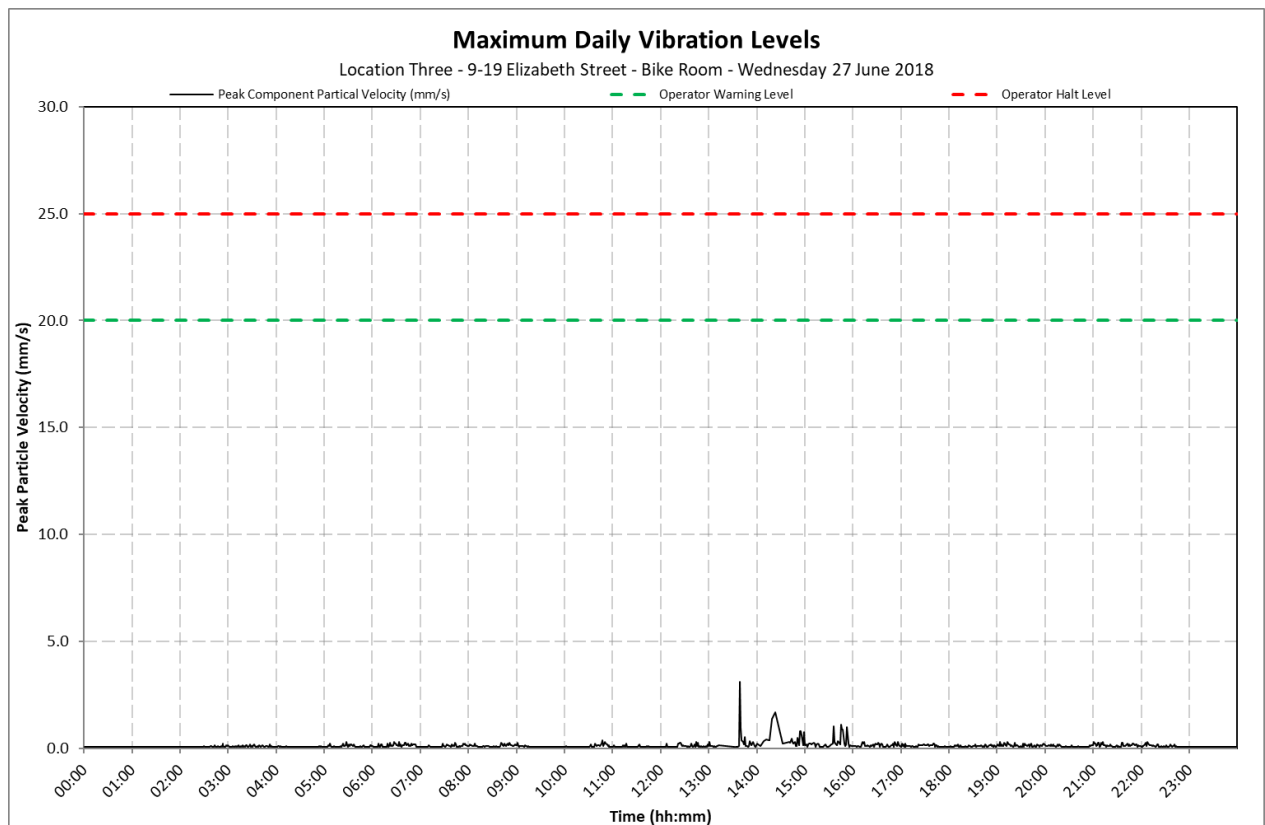
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room



13 July 2018

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Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 34
29 June to 5 July 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 29 June to 5 July 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

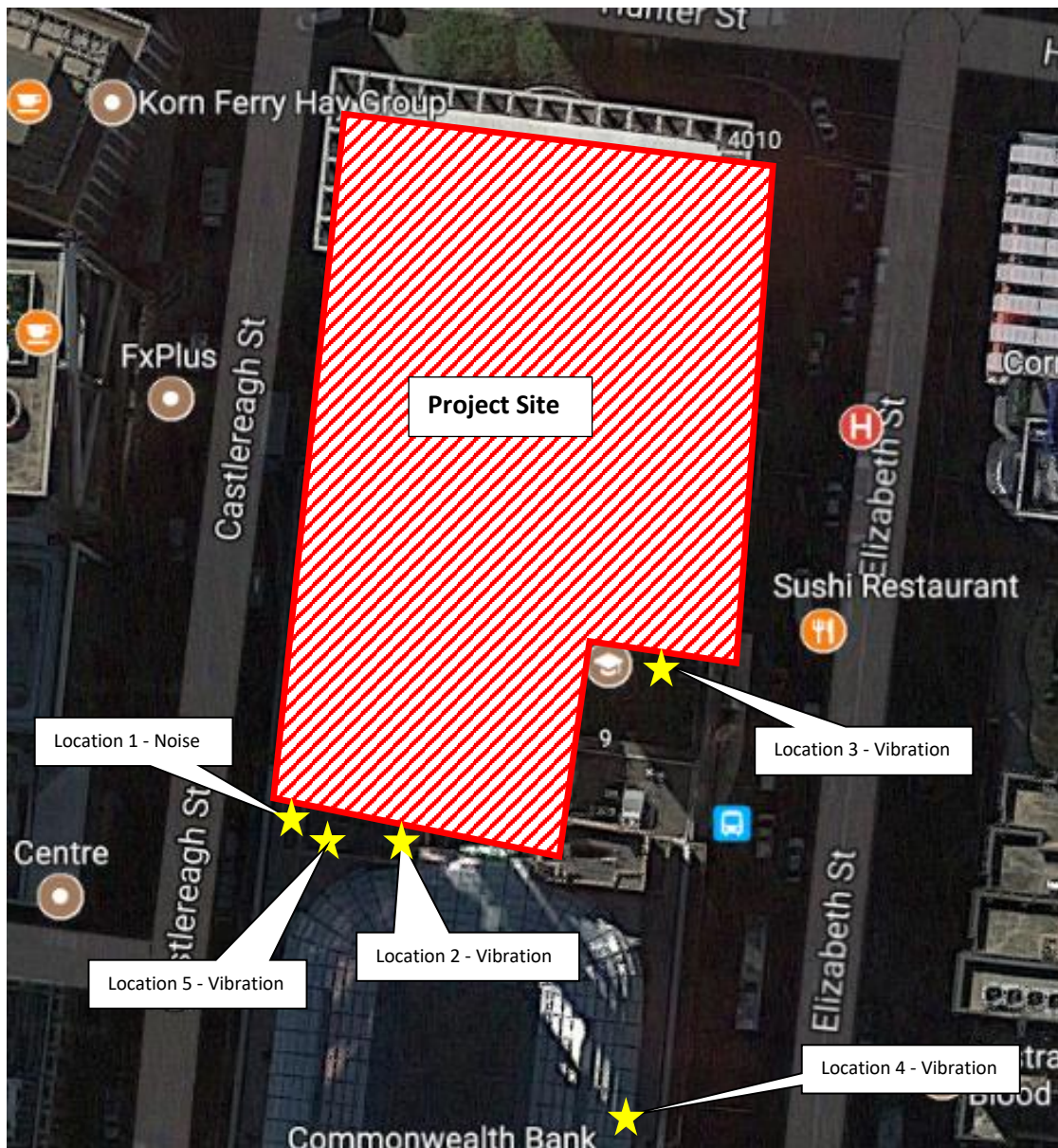
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 29 June to 5 July 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
29 June 2018	47	45	Complies	Complies
30 June 2018	39	35	Complies	Complies
1 July 2018	34	32	Complies	Complies
2 July 2018	46	45	Complies	Complies
3 July 2018	45	43	Complies	Complies
4 July 2018	45	43	Complies	Complies
5 July 2018	47	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 3 and **Table 4** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 29 June to 5 July 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
29 June 2018	0.8 mm/s	Complies
30 June 2018	0.8 mm/s	Complies
1 July 2018	0.5 mm/s	Complies
2 July 2018	0.6 mm/s	Complies
3 July 2018	0.8 mm/s	Complies
4 July 2018	1.4 mm/s	Complies
5 July 2018	0.8 mm/s	Complies

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
29 June 2018	0.3 mm/s	Complies
30 June 2018	0.2 mm/s	Complies
1 July 2018	0.2 mm/s	Complies
2 July 2018	0.6 mm/s	Complies
3 July 2018	0.4 mm/s	Complies
4 July 2018	0.7 mm/s	Complies
5 July 2018	0.2 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 29 June to 5 July 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 29 June to 5 July 2018 found all recorded ambient vibration levels were below the maximum vibration control limit at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely

A handwritten signature in black ink, appearing to read 'R. Wakeling', with a long horizontal flourish extending to the right.

Ryan Wakeling

Principal - Acoustics & Vibration

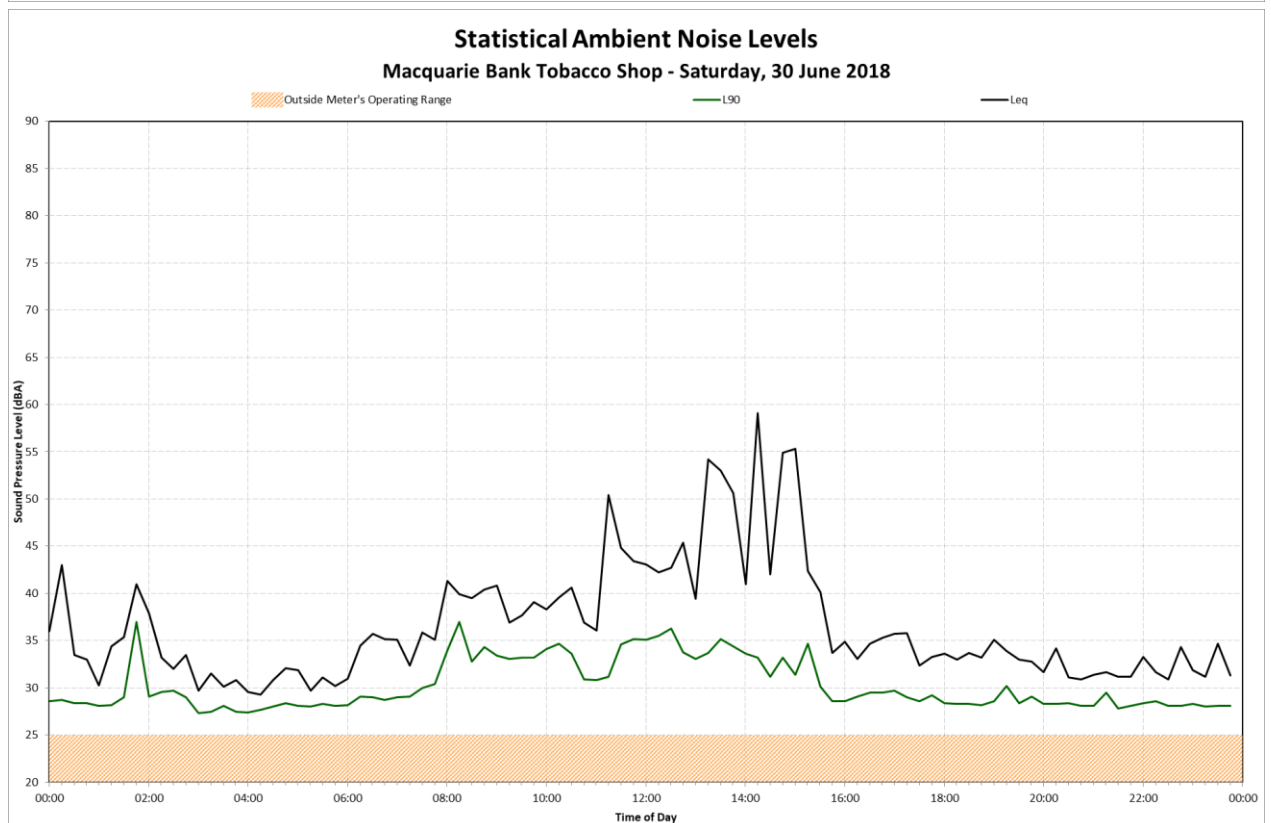
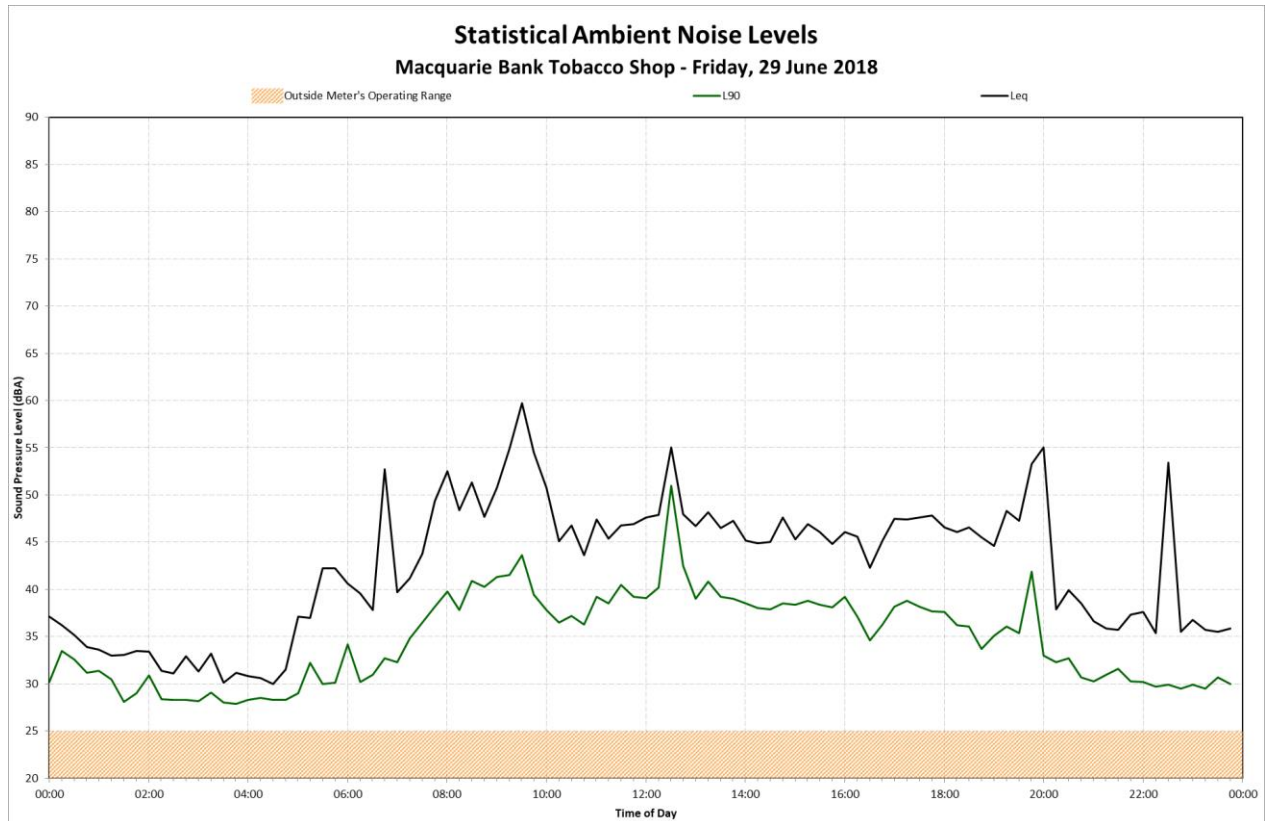
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
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L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
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Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
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PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

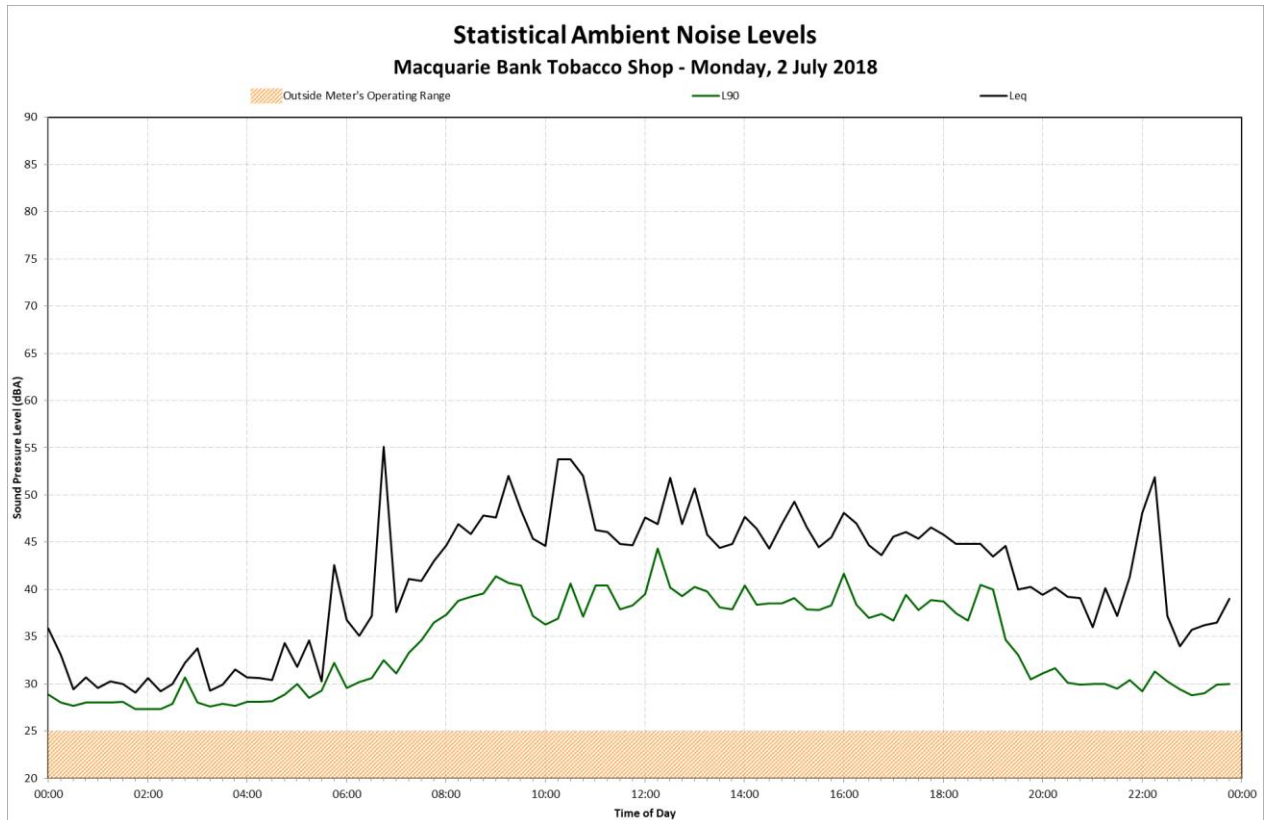
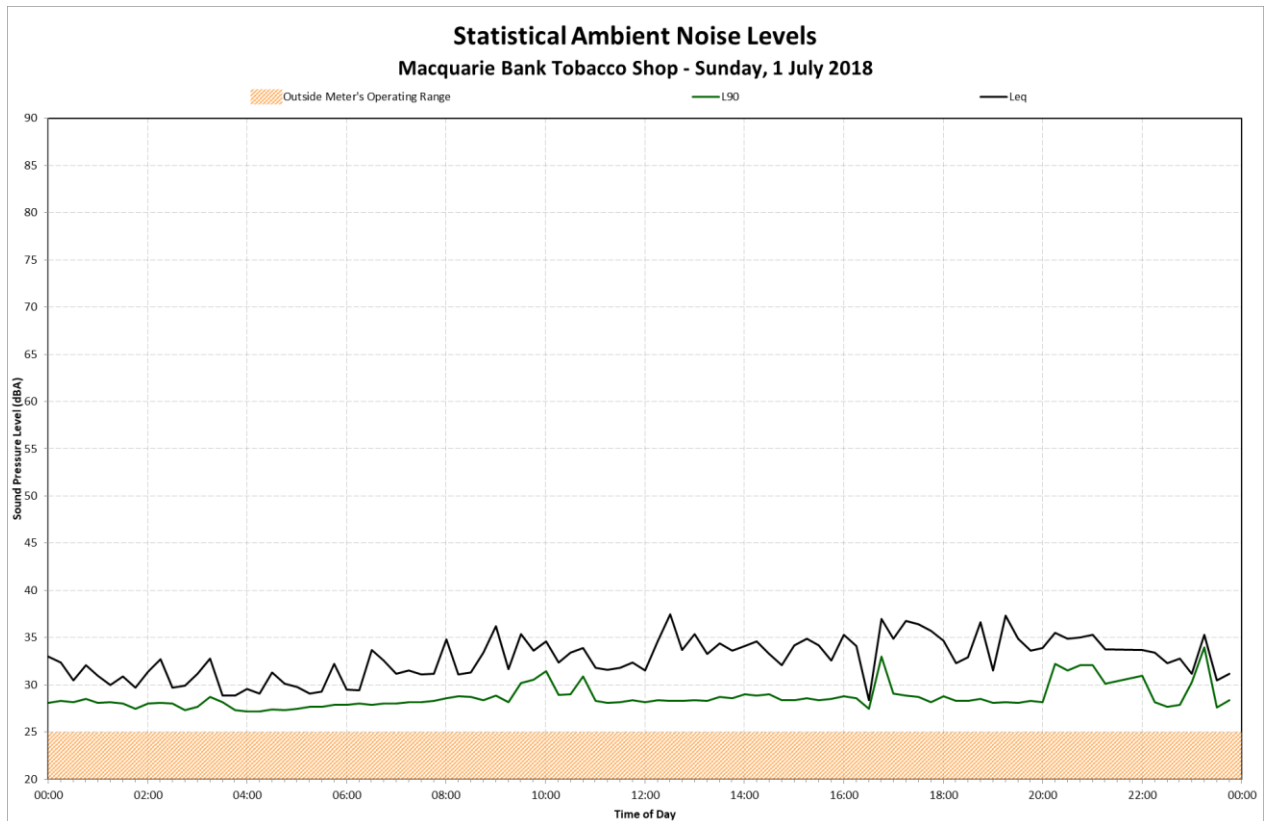
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

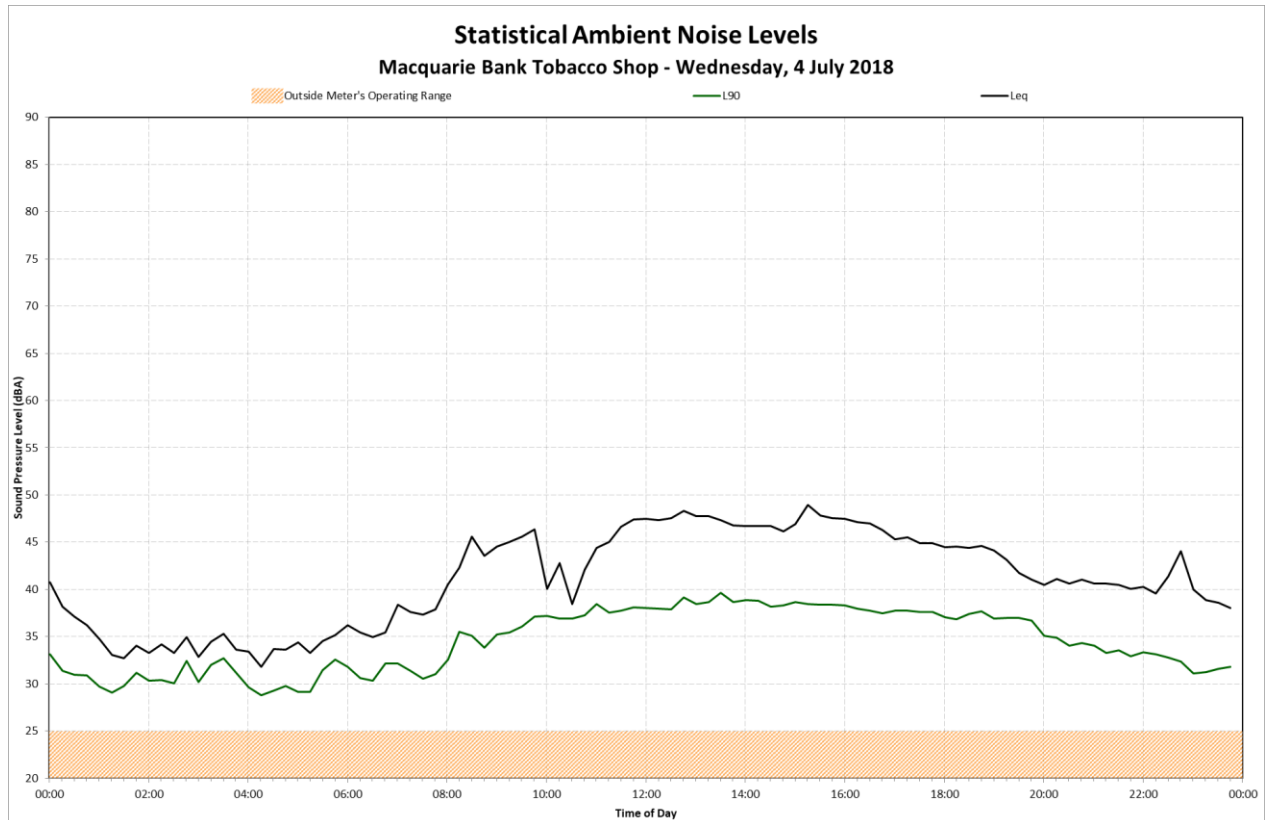
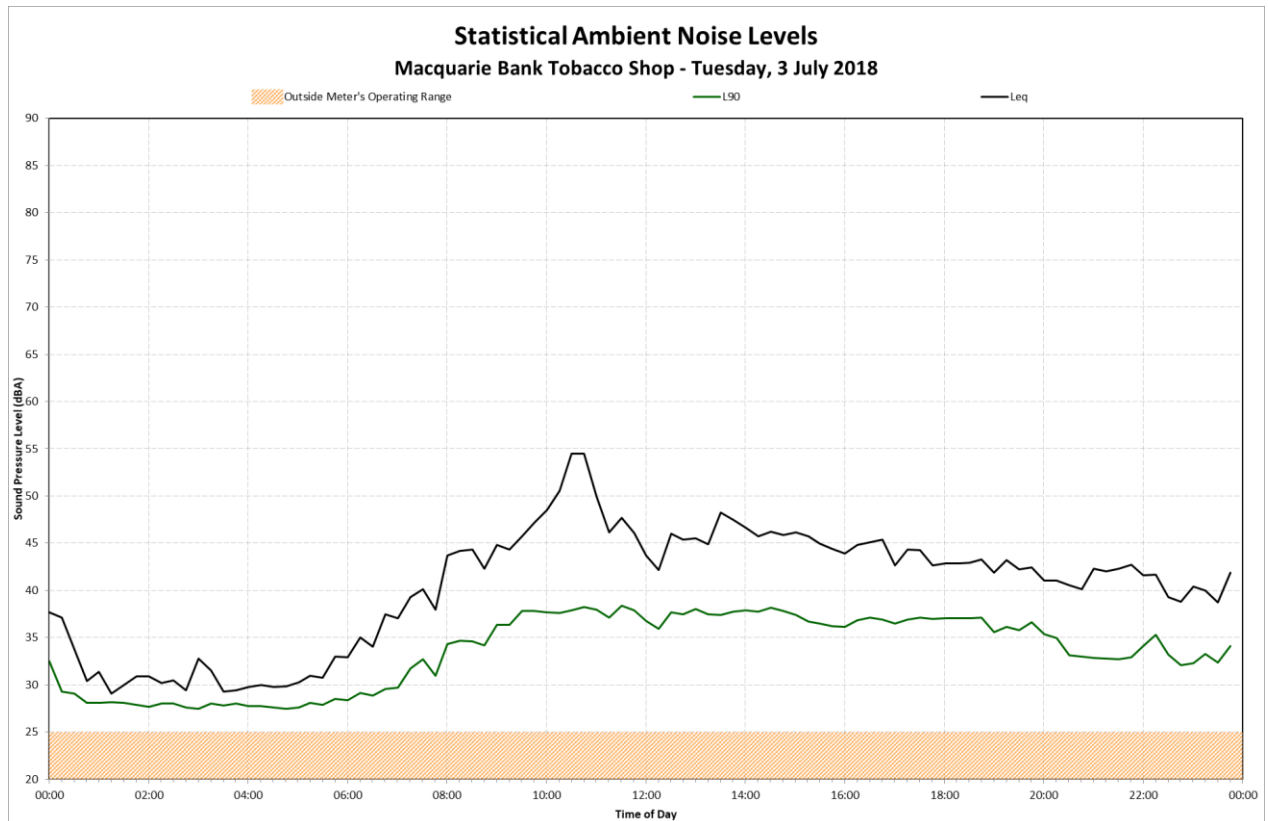
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

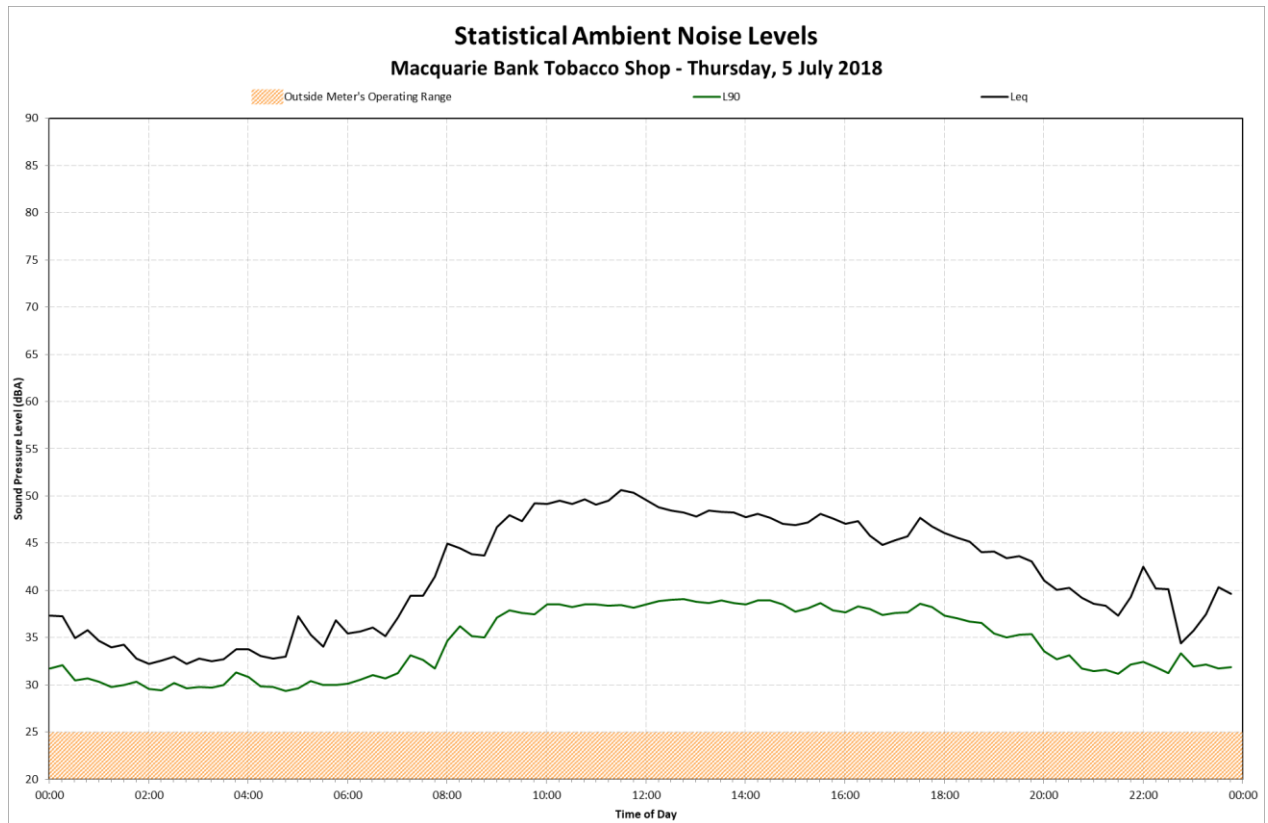
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

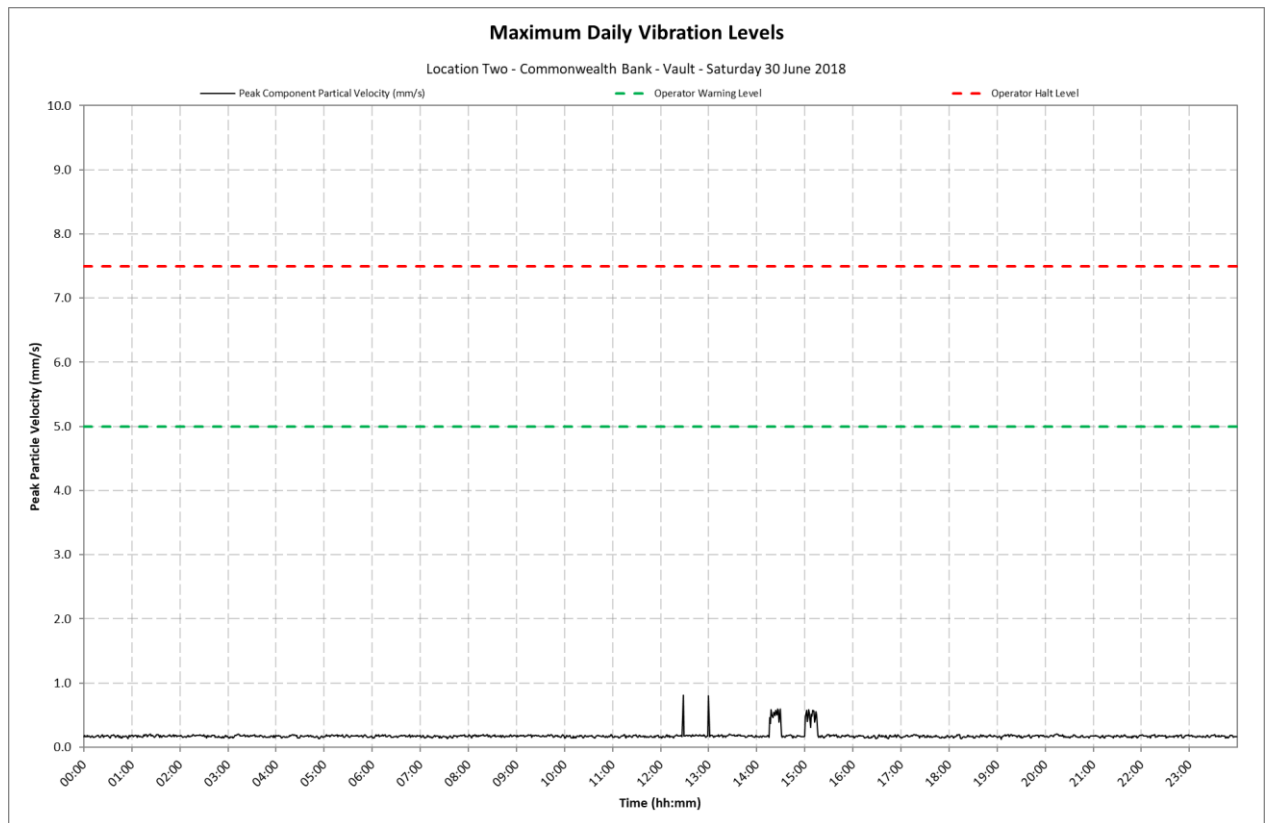
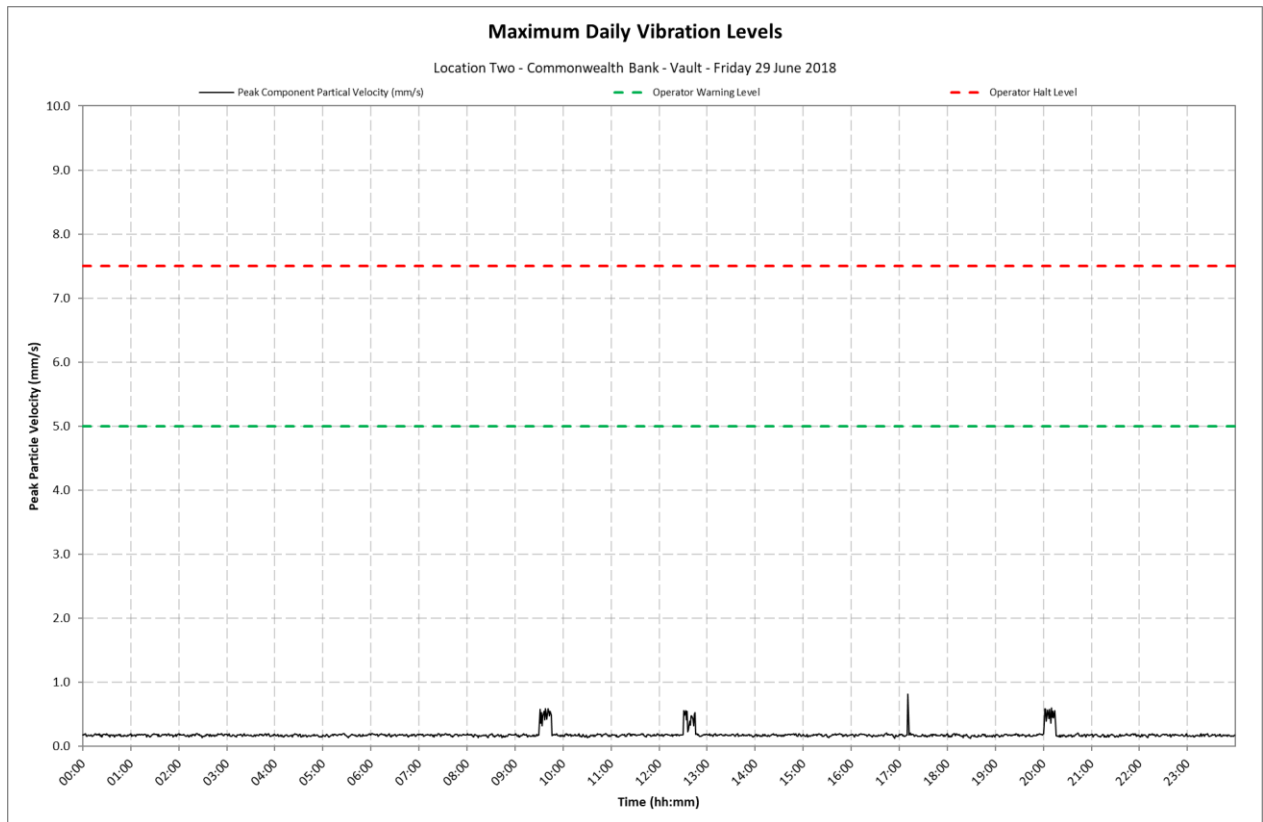
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

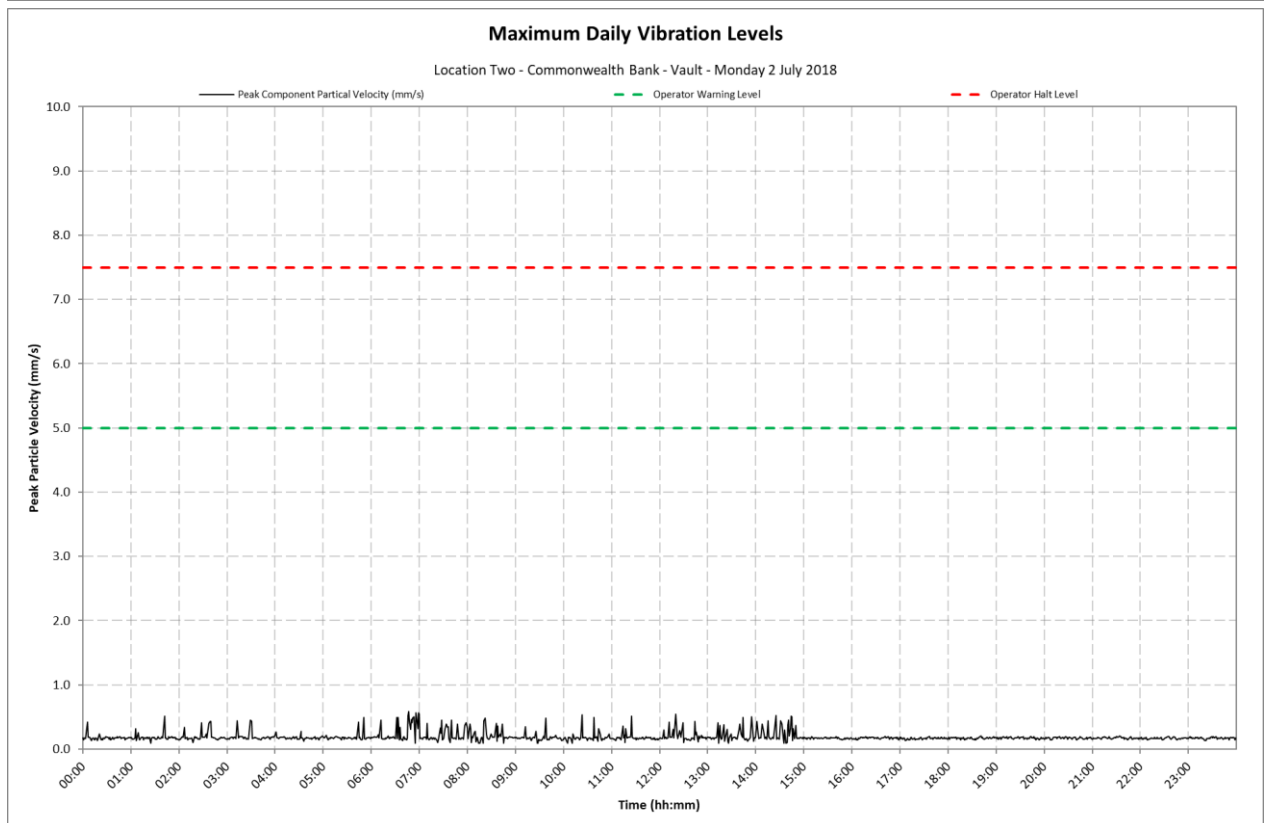
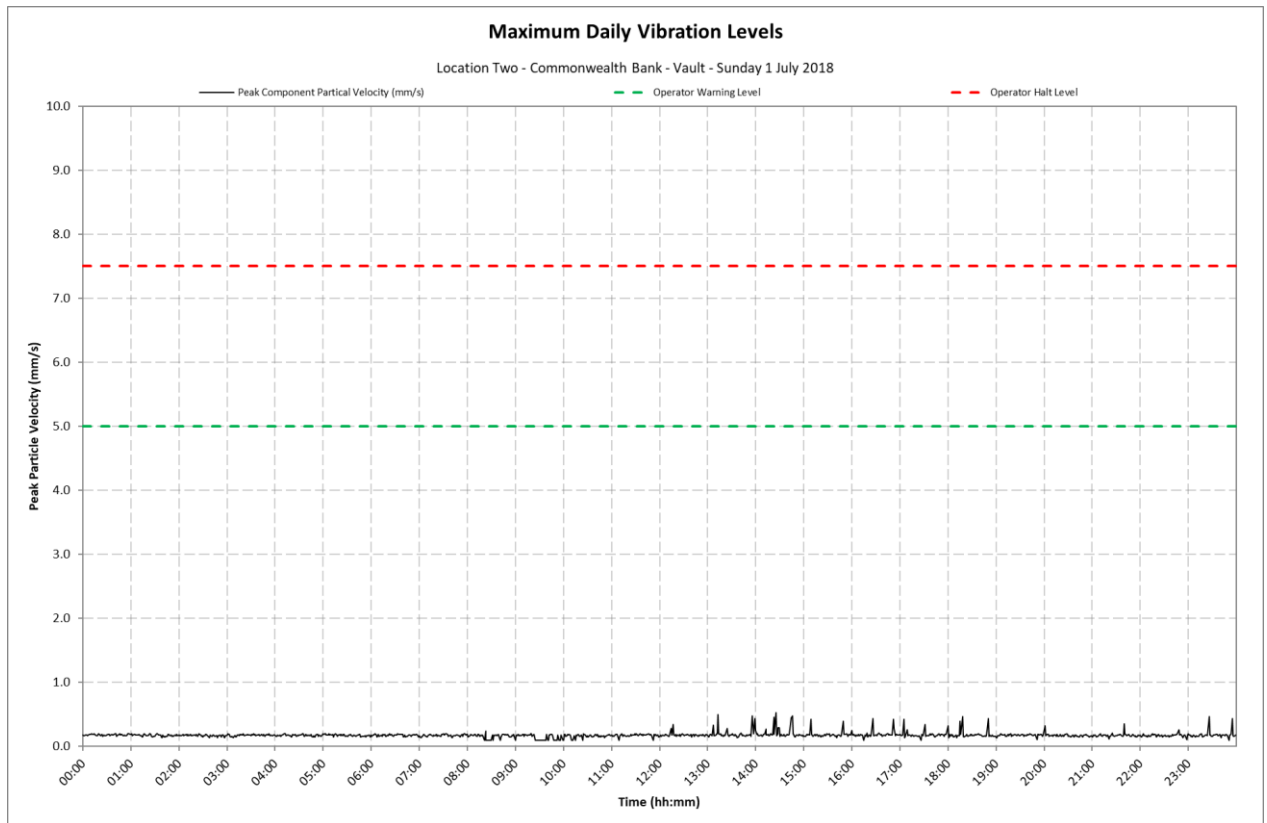
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

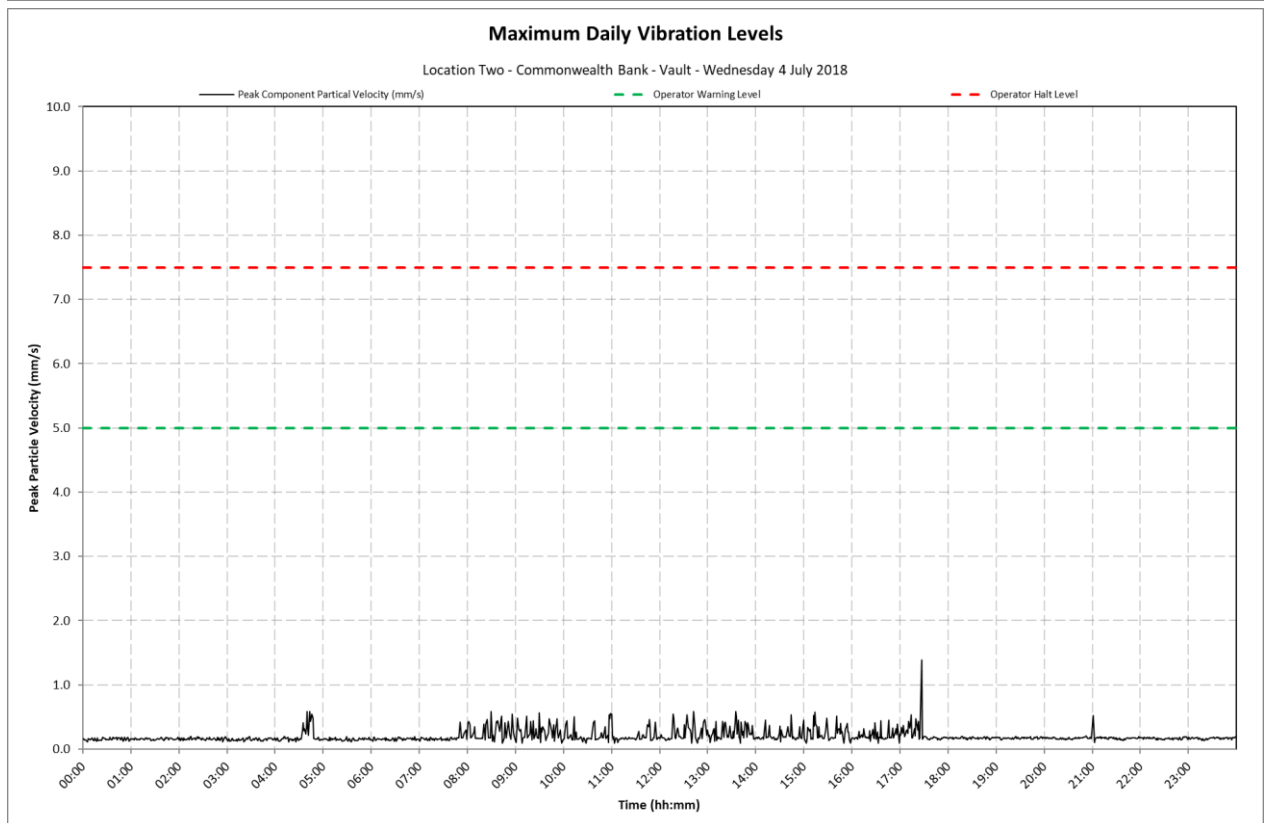
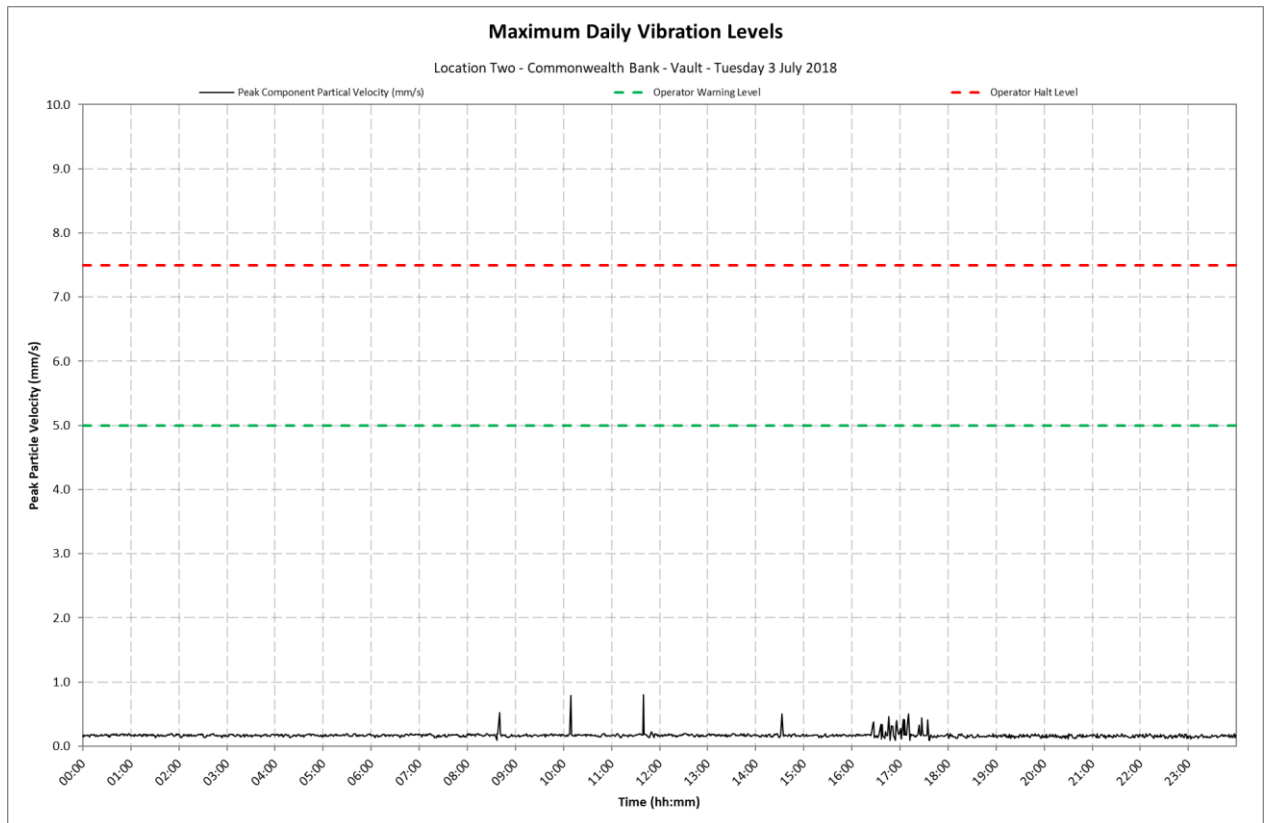
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

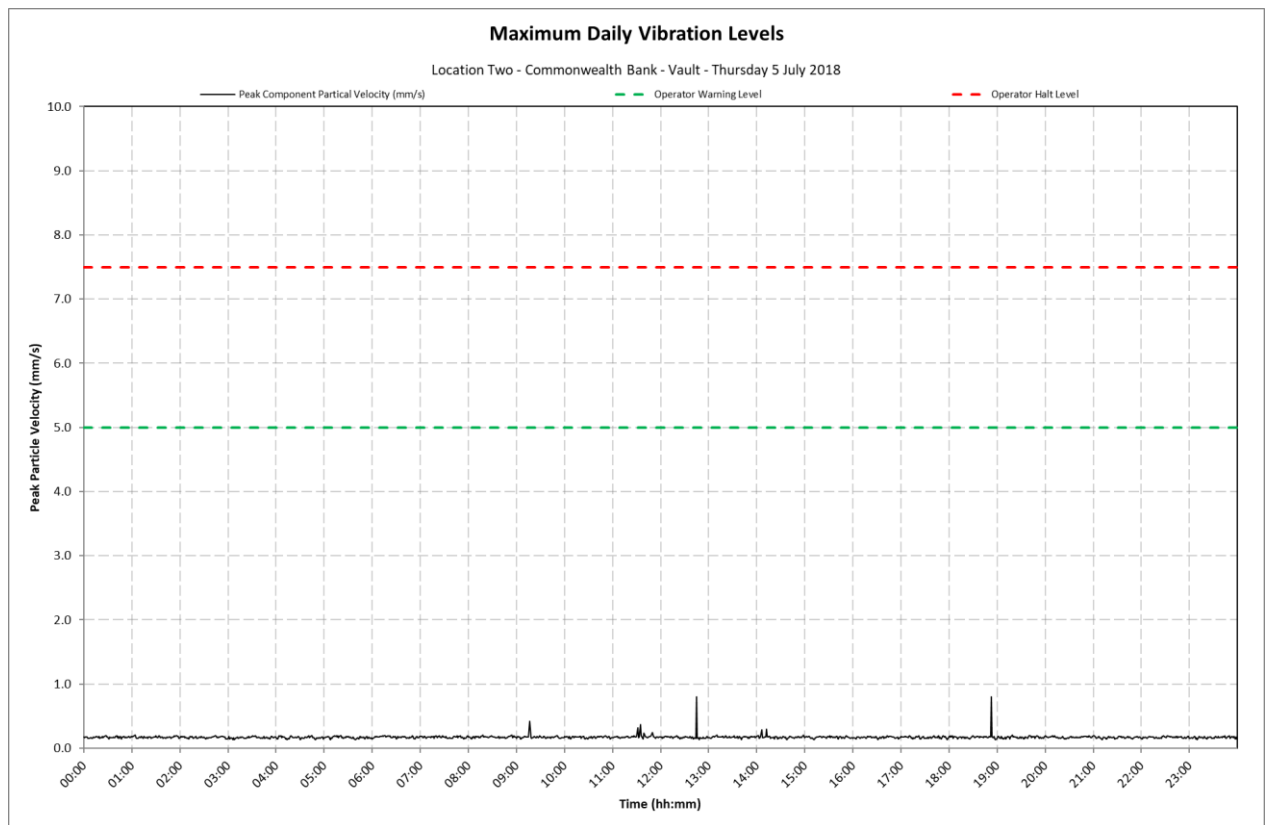
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

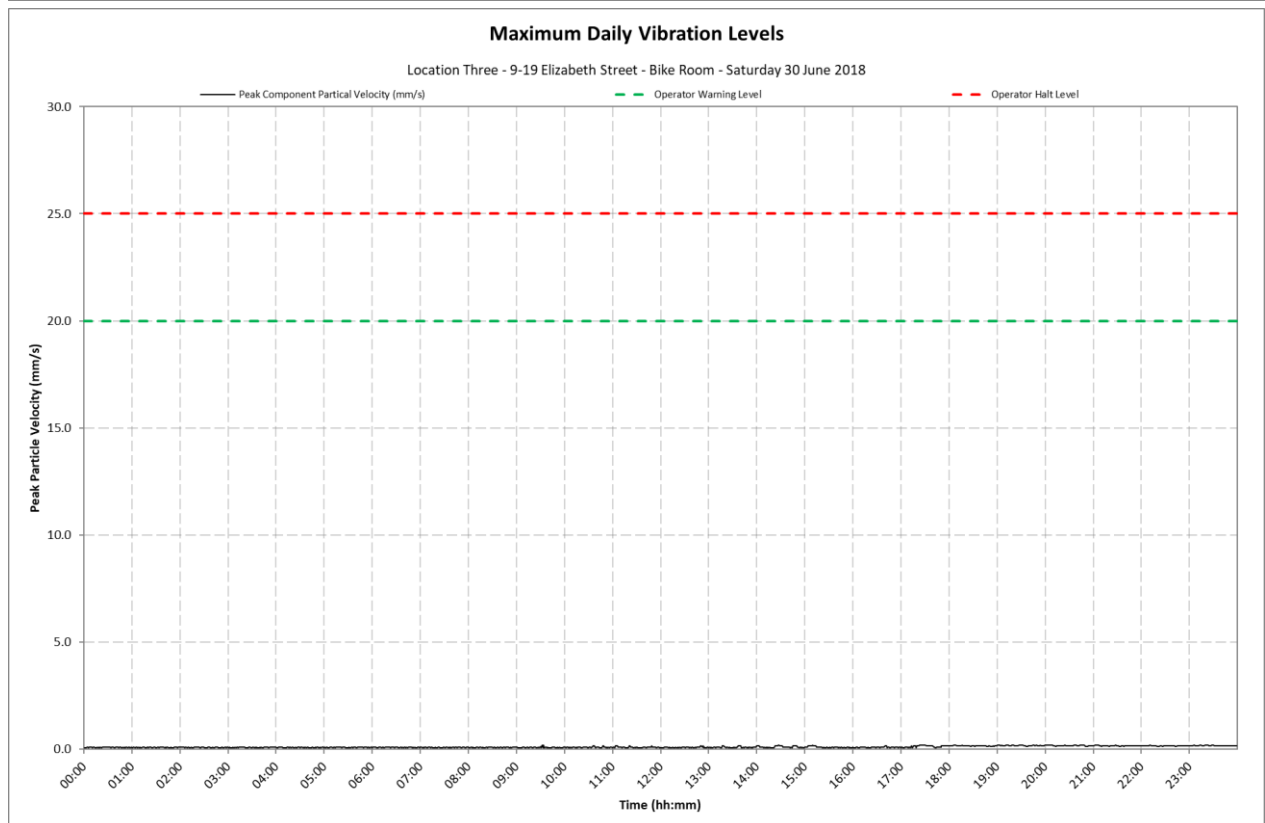
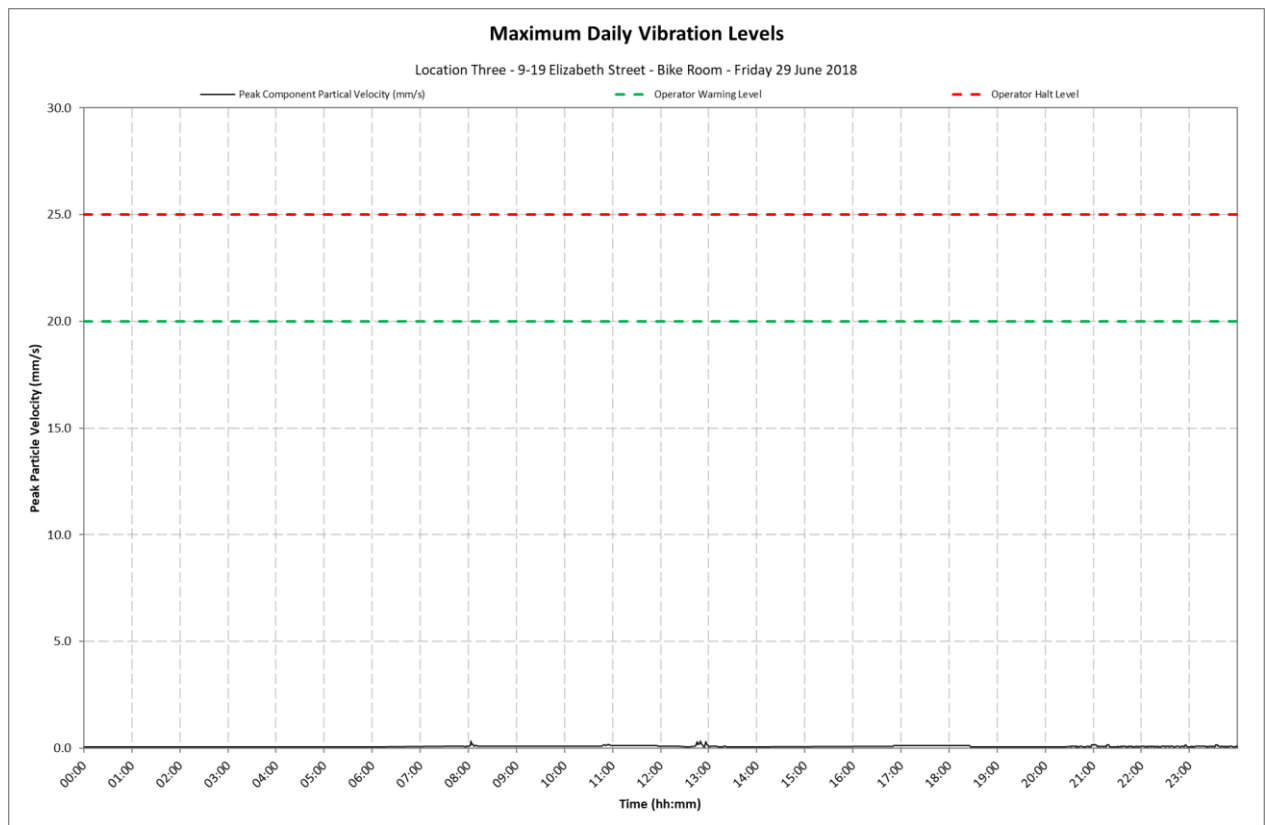
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

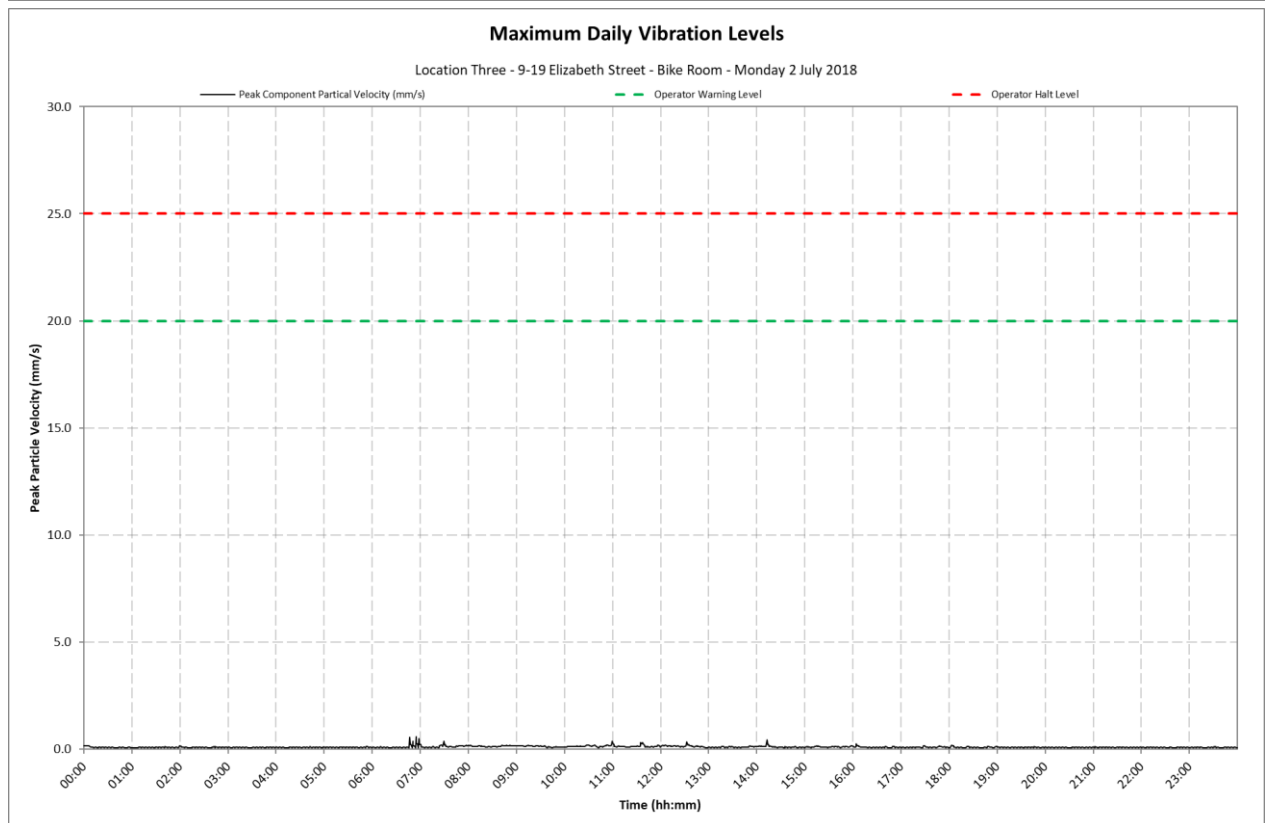
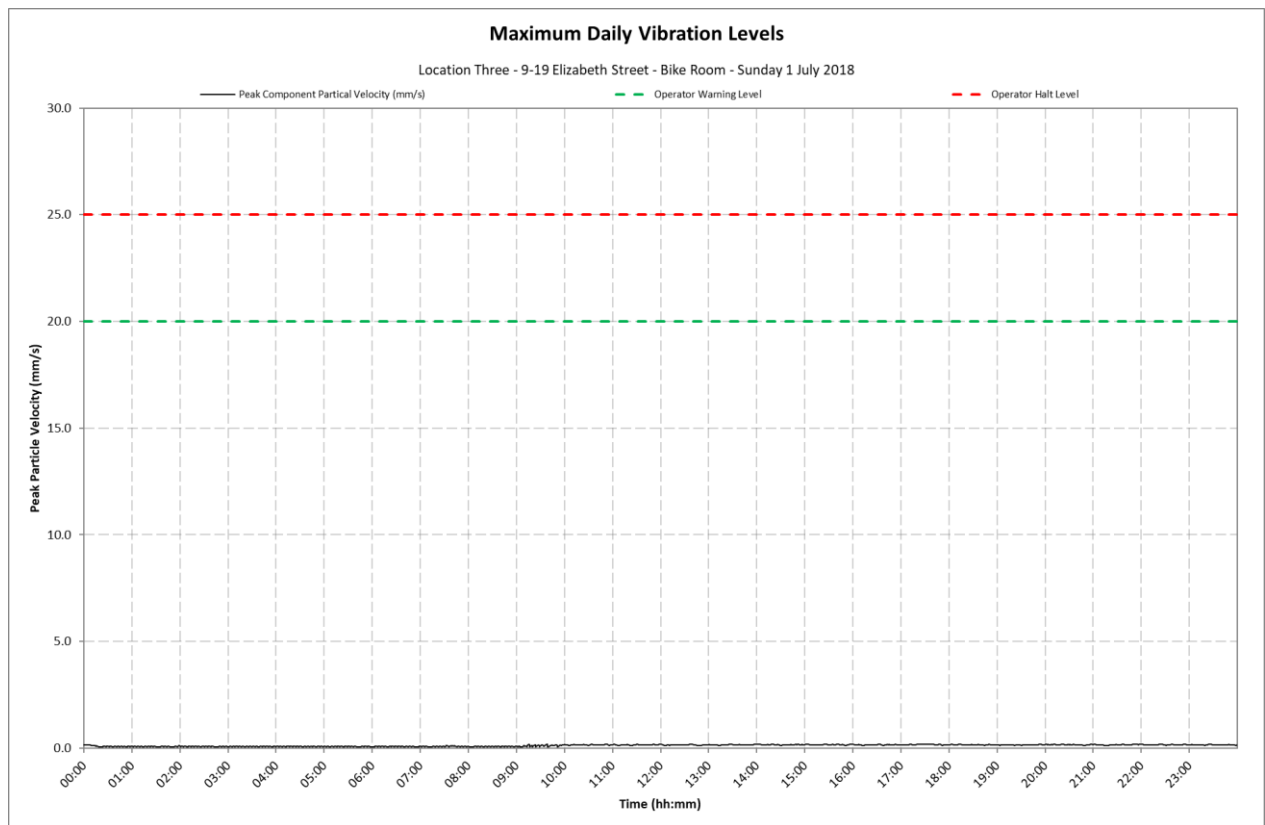
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

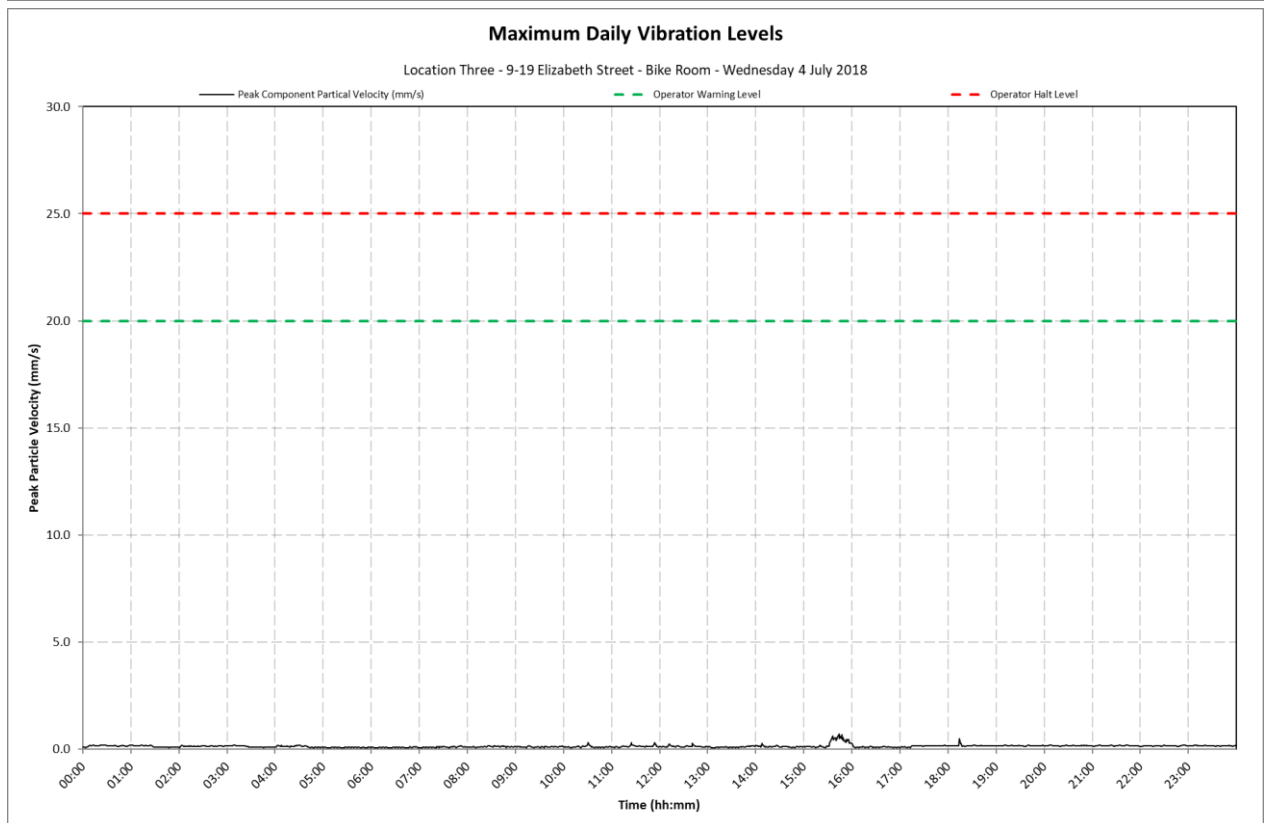
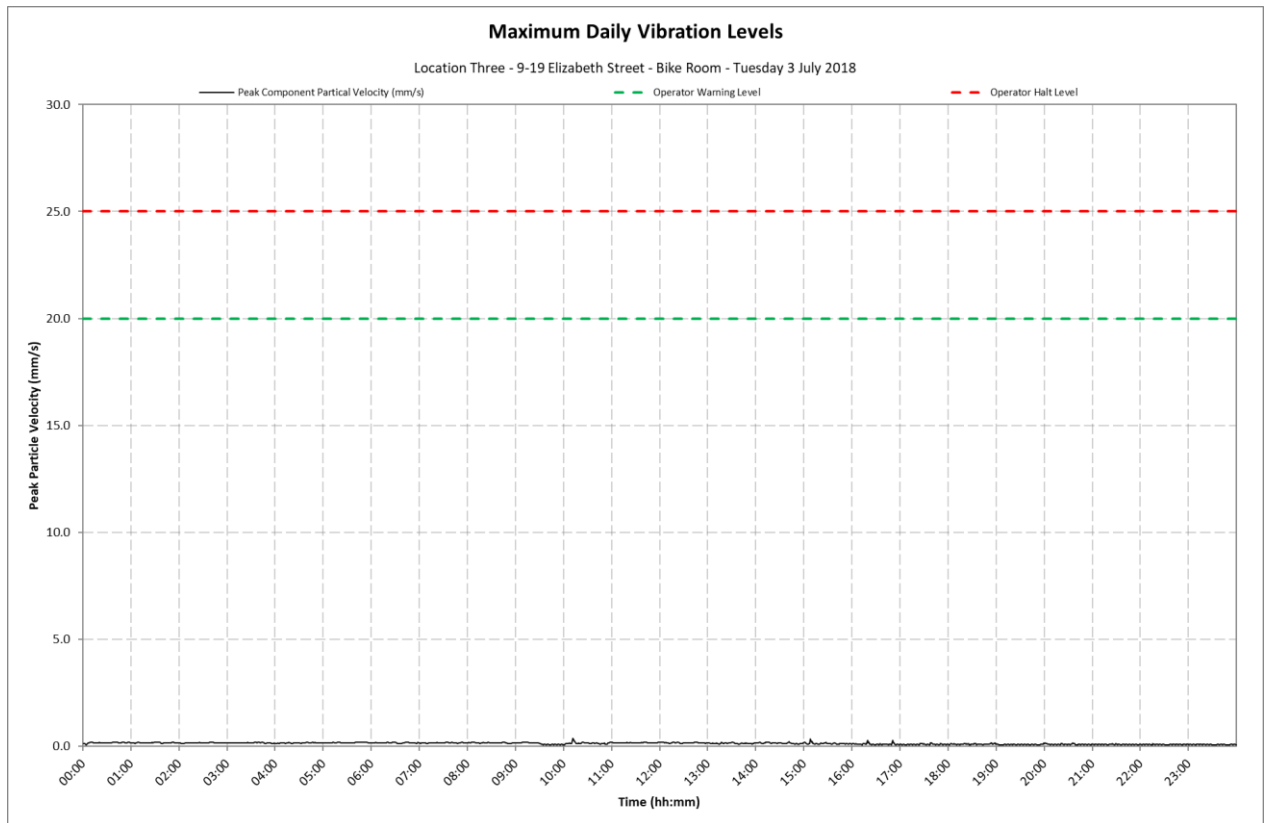
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

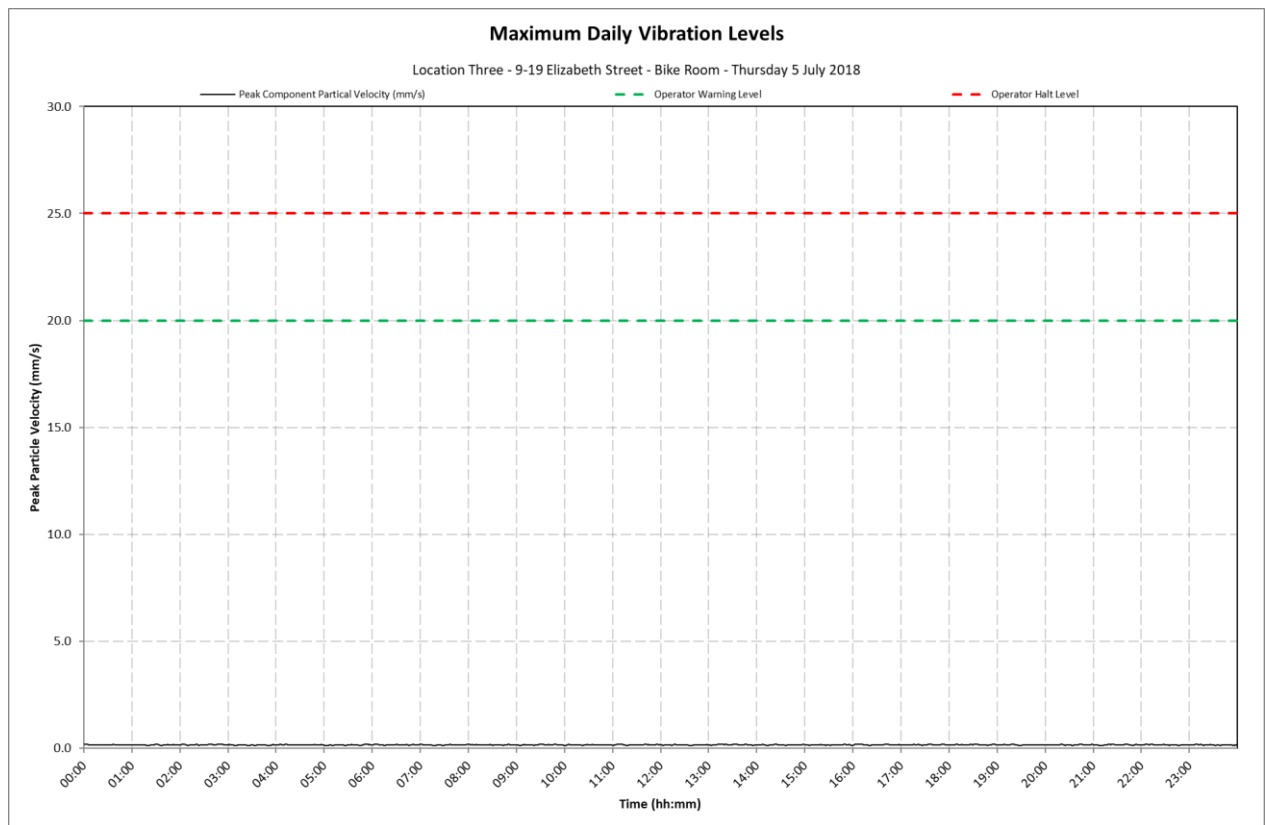
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room



24 July 2018

10-1380 R35 NV Monitoring 20180724.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 35
6 July to 19 July 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 6 July to 19 July 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

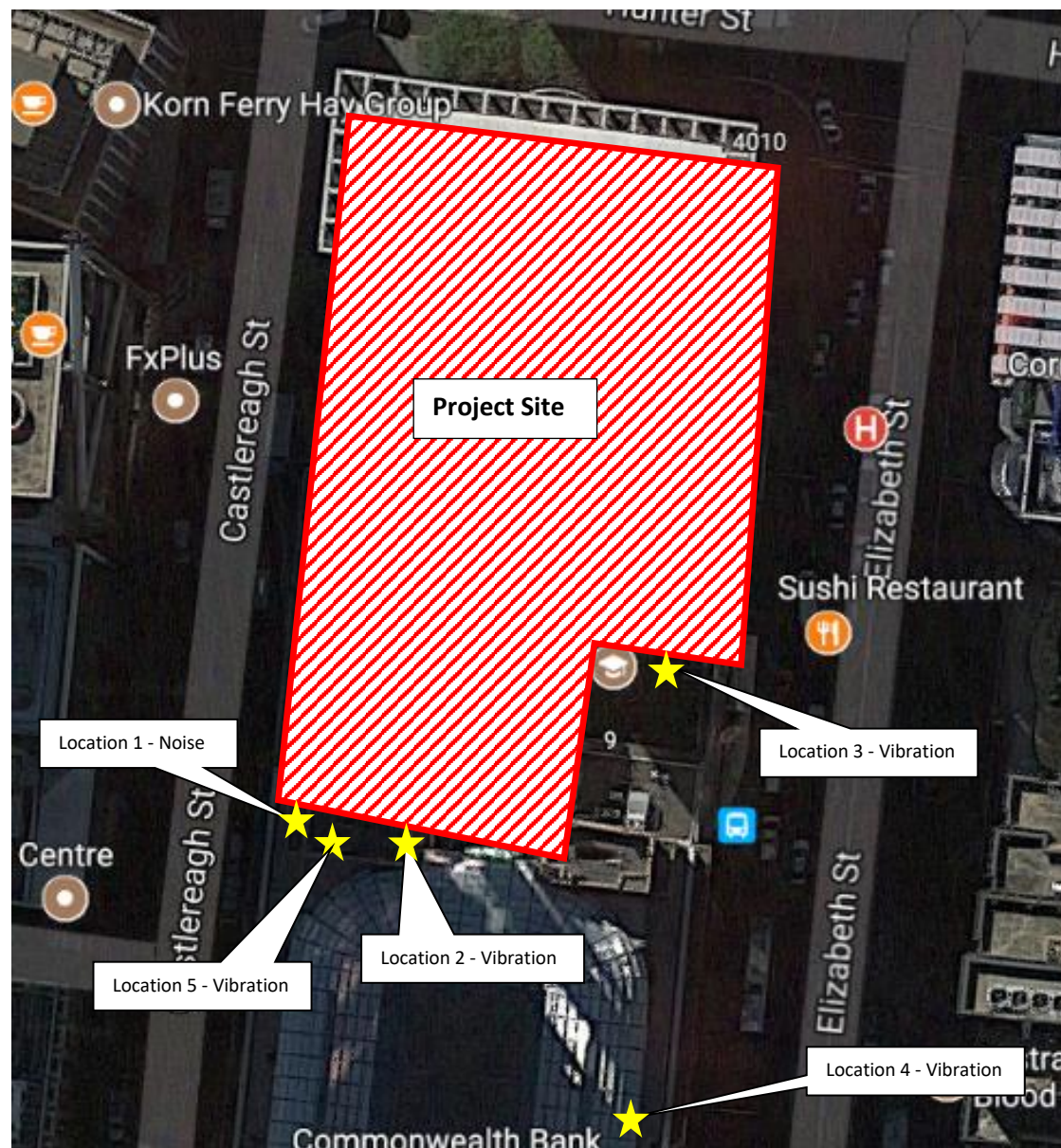
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 6 July to 19 July 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient LAeq(15minute) Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
6 July 2018	43	41	Complies	Complies
7 July 2018	41	39	Complies	Complies
8 July 2018	38	36	Complies	Complies
9 July 2018	41	40	Complies	Complies
10 July 2018	45	42	Complies	Complies
11 July 2018	47	45	Complies	Complies
12 July 2018	47	44	Complies	Complies
13 July 2018	43	41	Complies	Complies
14 July 2018	41	39	Complies	Complies
15 July 2018	37	37	Complies	Complies
16 July 2018	40	39	Complies	Complies
17 July 2018	45	44	Complies	Complies
18 July 2018	46	43	Complies	Complies
19 July 2018	46	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 3 and **Table 4** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 6 July to 19 July 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
6 July 2018	0.8 mm/s	Complies
7 July 2018	0.8 mm/s	Complies
8 July 2018	0.5 mm/s	Complies
9 July 2018	0.8 mm/s	Complies
10 July 2018	0.8 mm/s	Complies
11 July 2018	0.6 mm/s	Complies
12 July 2018	0.8 mm/s	Complies
13 July 2018	1.7 mm/s	Complies
14 July 2018	0.6 mm/s	Complies
15 July 2018	0.6 mm/s	Complies
16 July 2018	0.8 mm/s	Complies
17 July 2018	0.9 mm/s	Complies
18 July 2018	1.7 mm/s	Complies
19 July 2018	0.8 mm/s	Complies

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
6 July 2018	0.6 mm/s	Complies
7 July 2018	0.5 mm/s	Complies
8 July 2018	0.2 mm/s	Complies
9 July 2018	0.3 mm/s	Complies
10 July 2018	0.2 mm/s	Complies
11 July 2018	0.3 mm/s	Complies
12 July 2018	0.3 mm/s	Complies
13 July 2018	5.5 mm/s	Complies
14 July 2018	1.1 mm/s	Complies
15 July 2018	0.2 mm/s	Complies
16 July 2018	0.6 mm/s	Complies
17 July 2018	4.8 mm/s	Complies
18 July 2018	11.5 mm/s	Complies
19 July 2018	6.8 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 6 July to 19 July 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 6 July to 19 July 2018 found all recorded ambient vibration levels were below the maximum vibration control limit at both vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

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Ryan Wakeling

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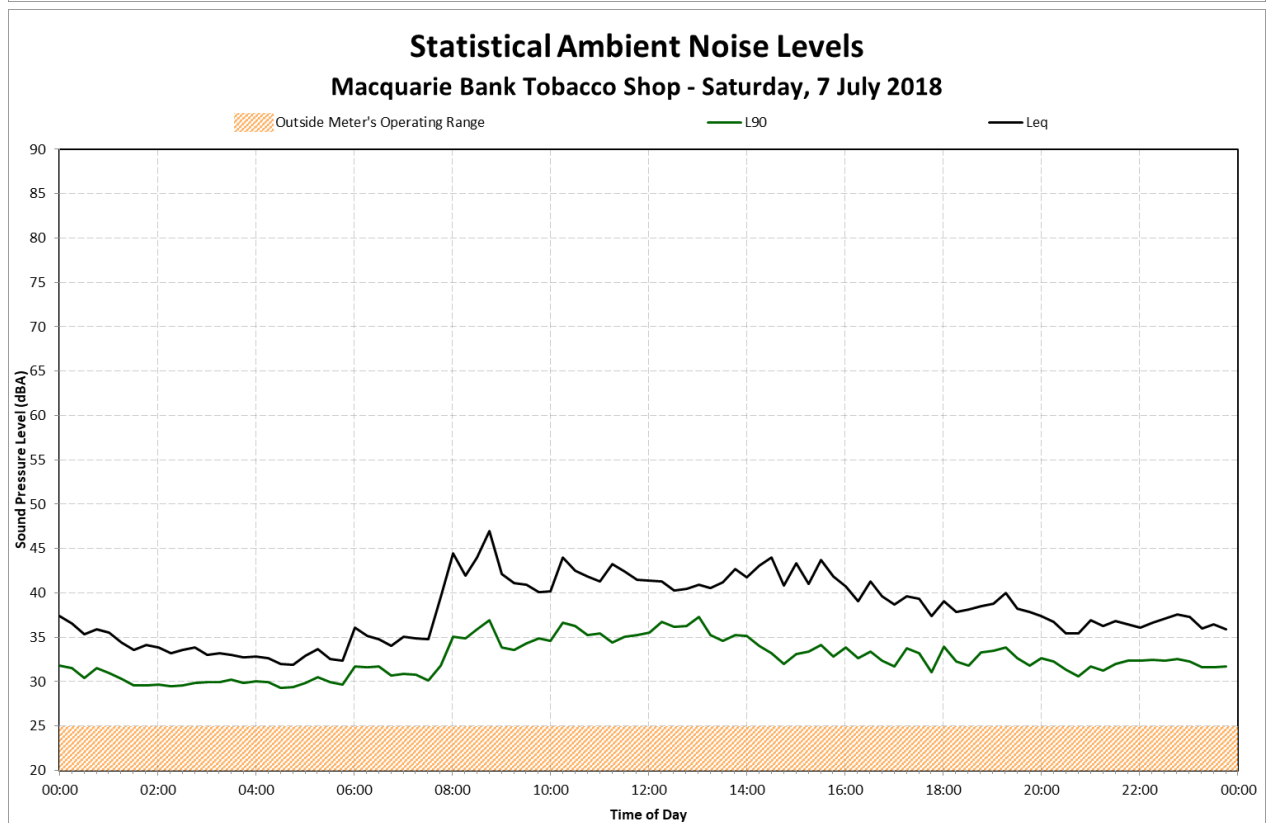
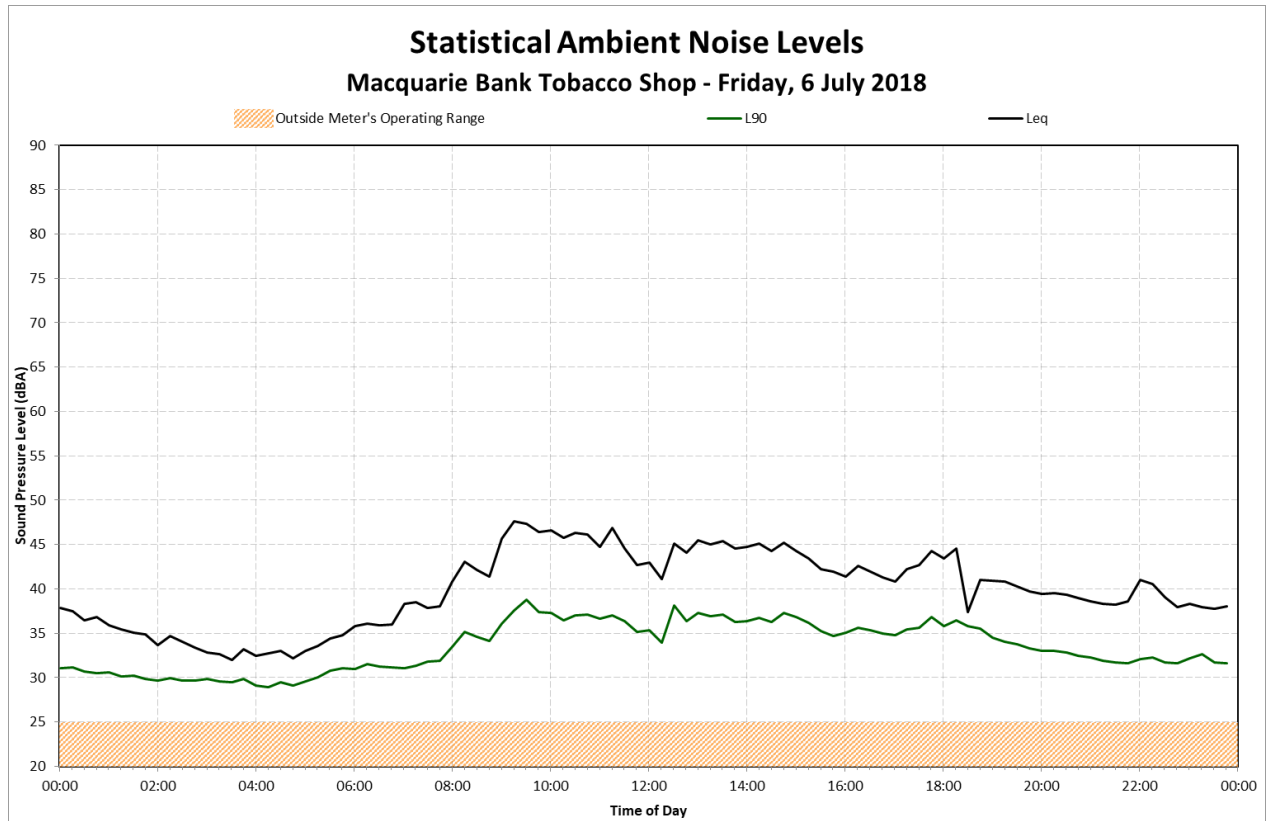
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Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
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Appendix B

Daily Noise Levels

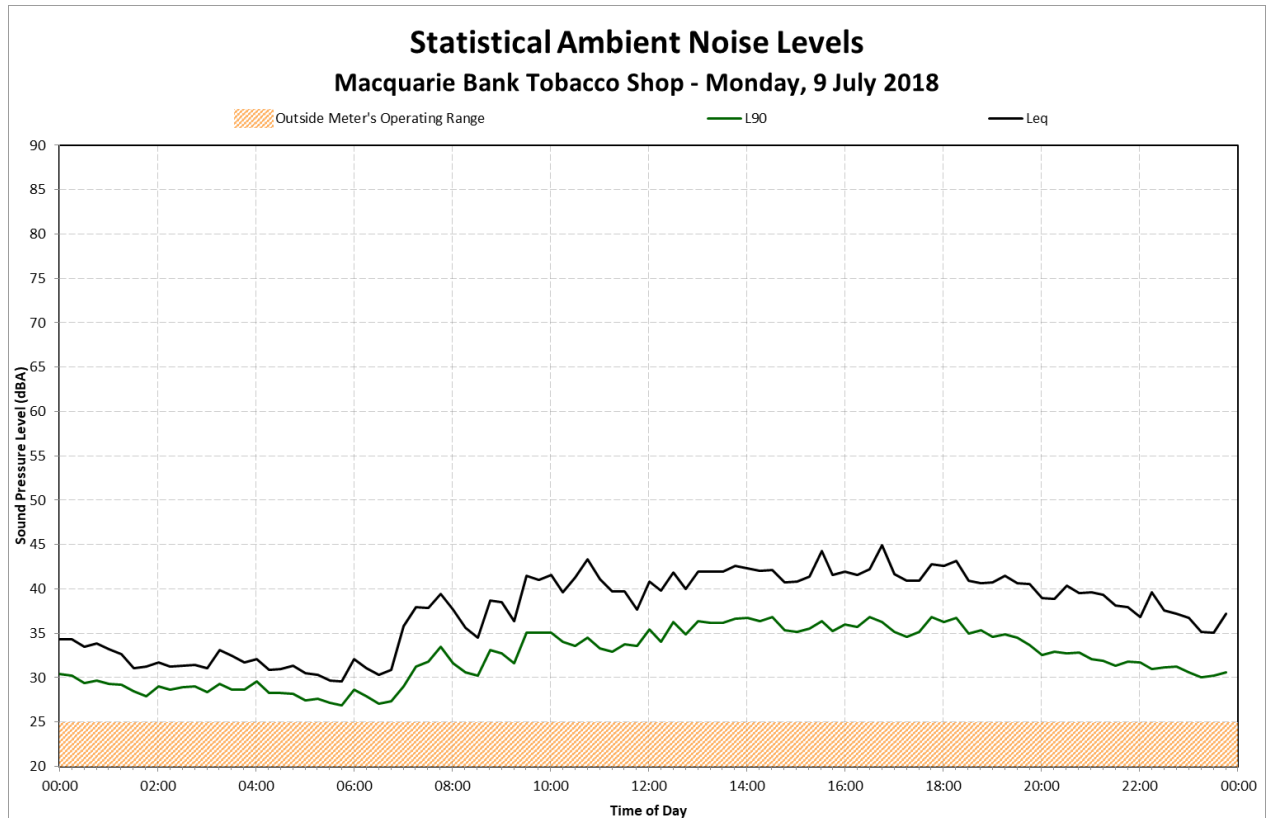
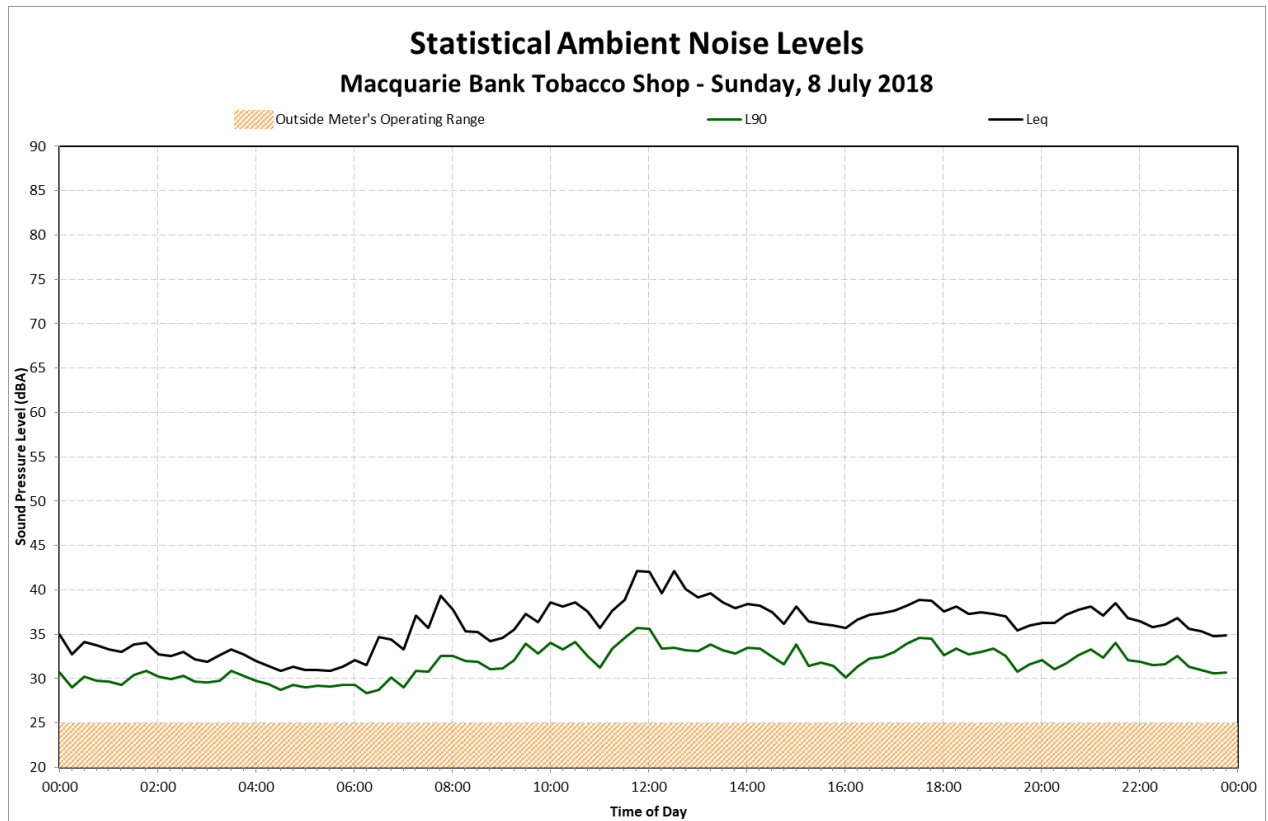
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

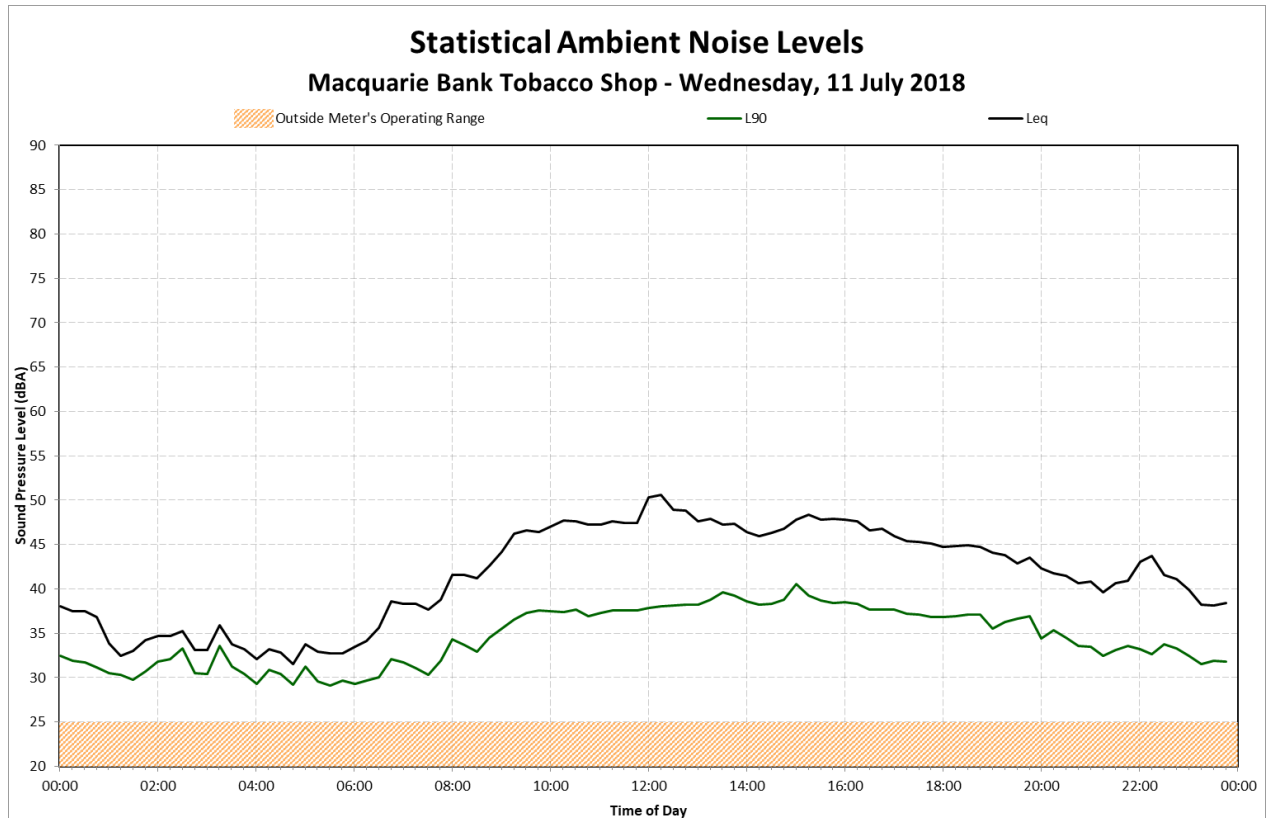
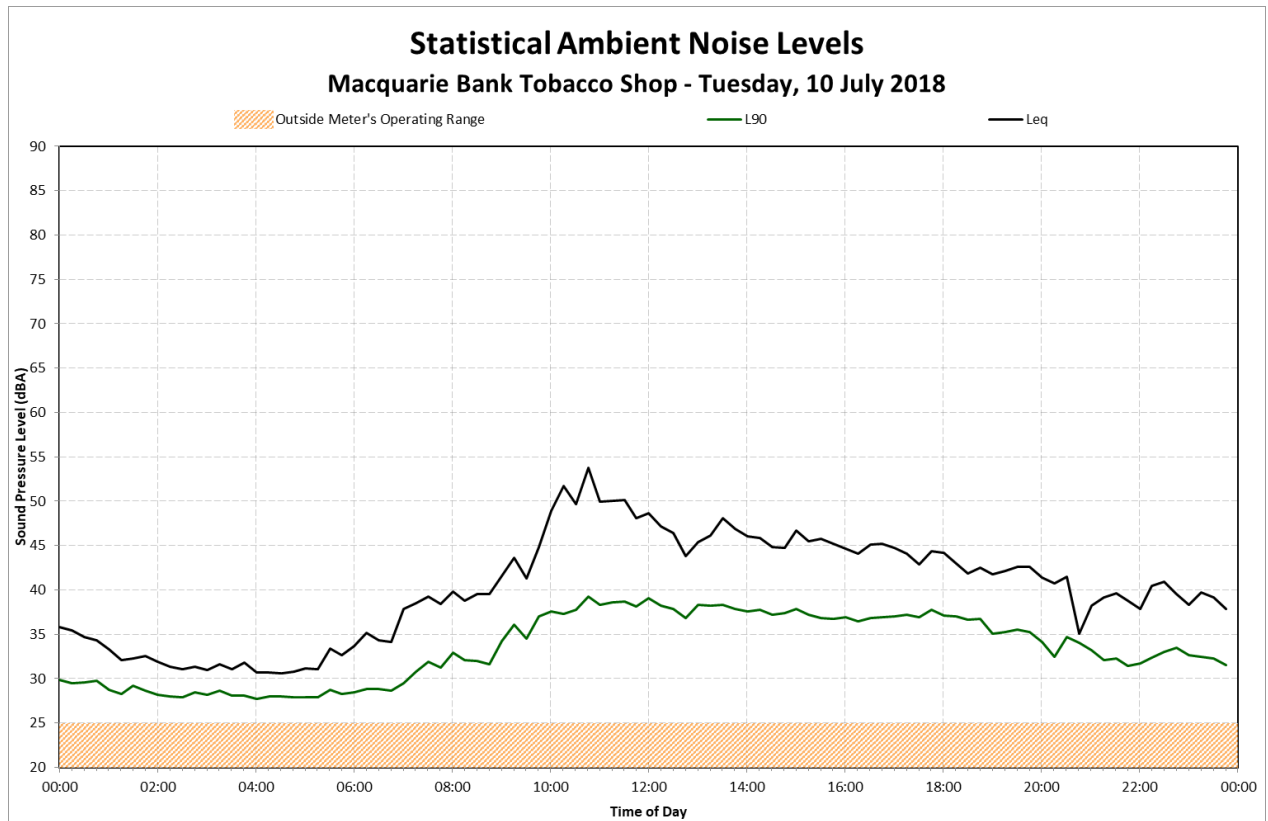
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

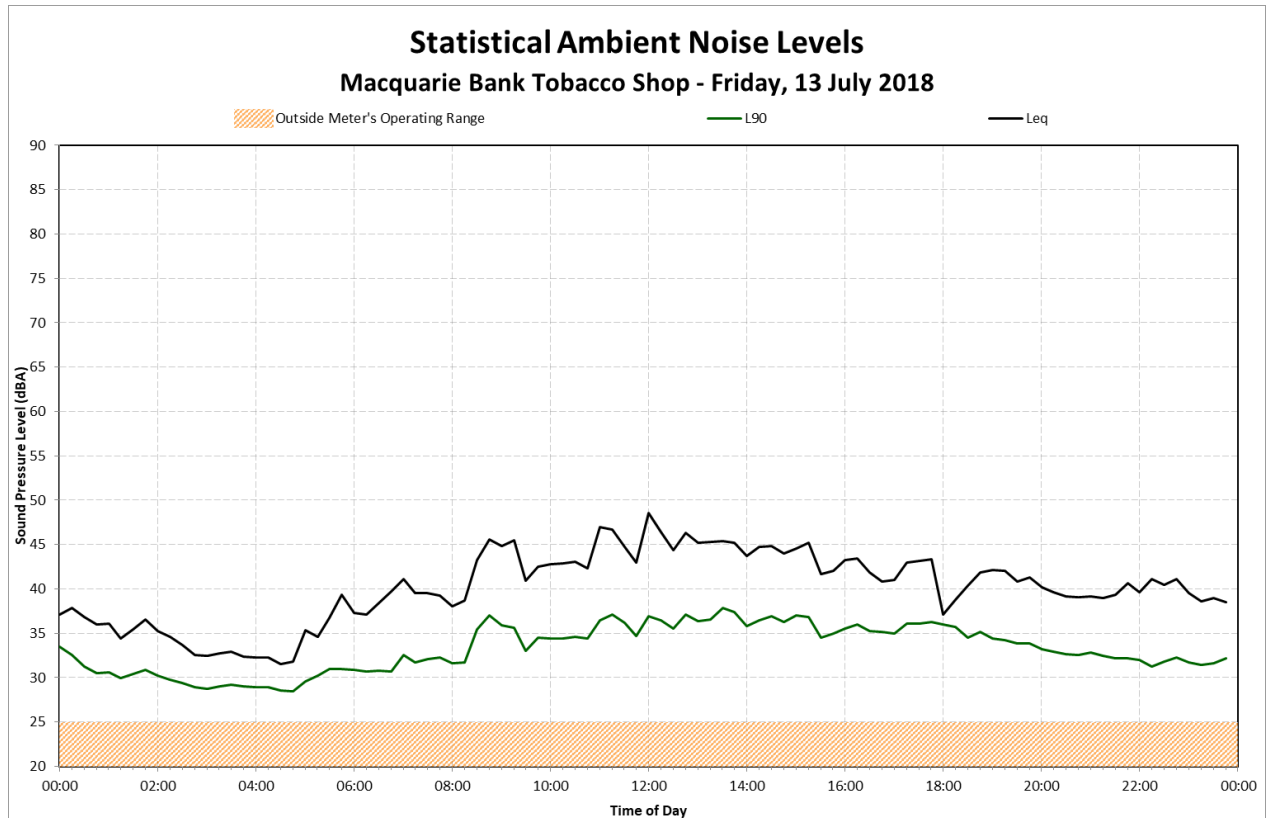
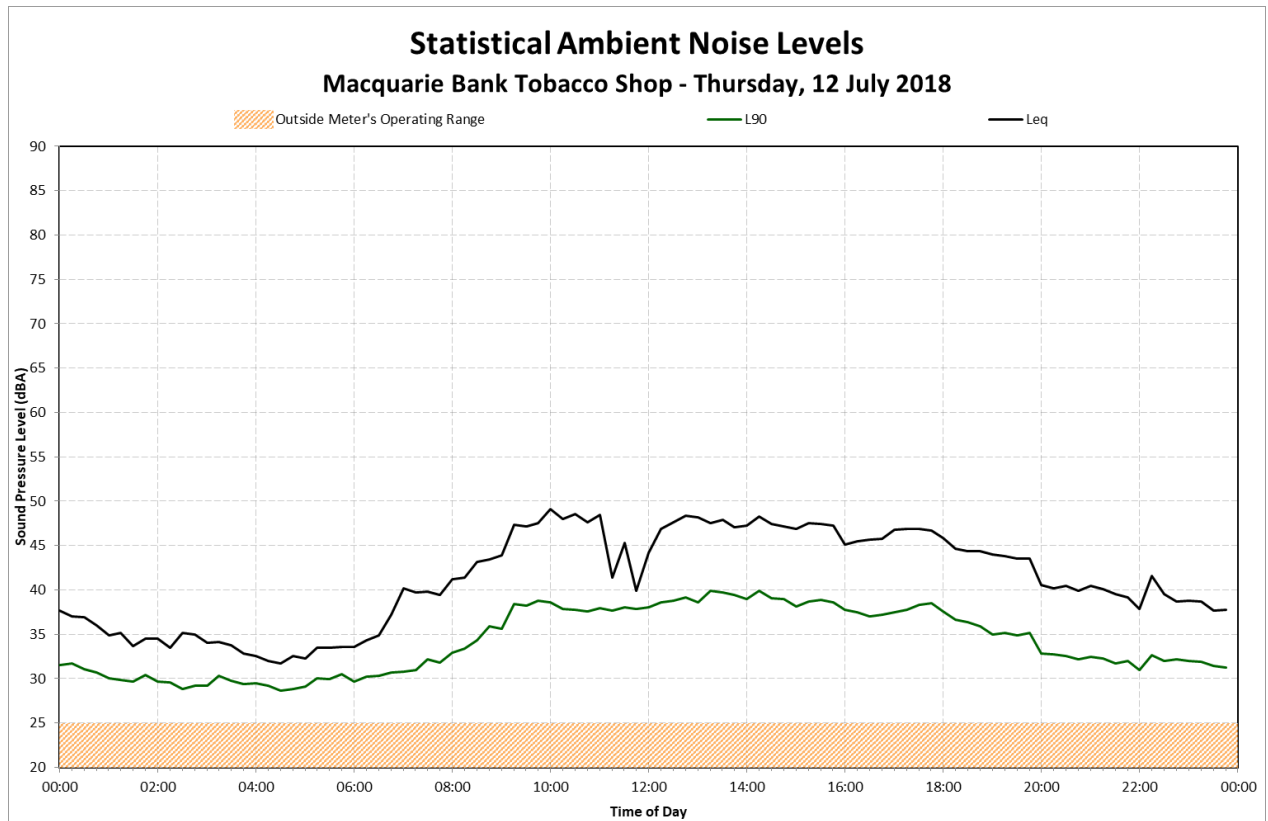
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

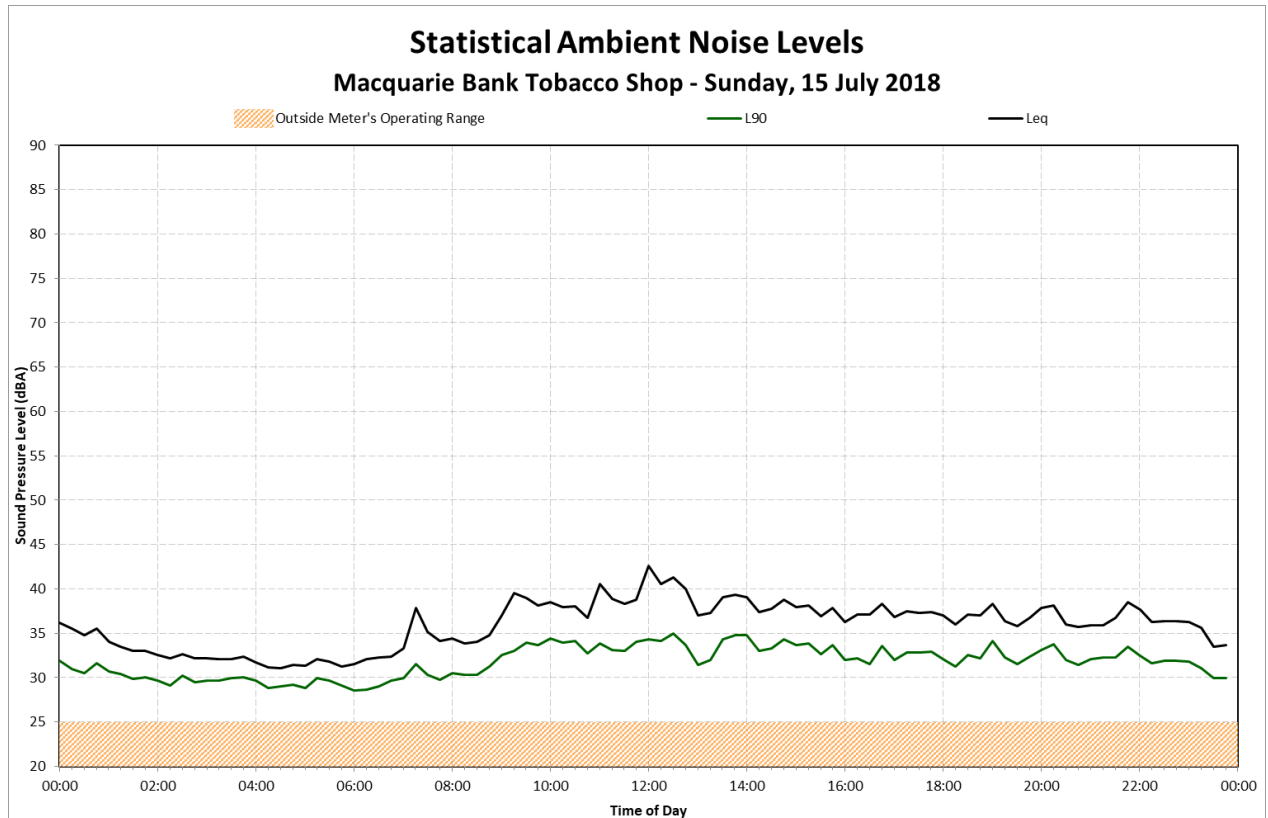
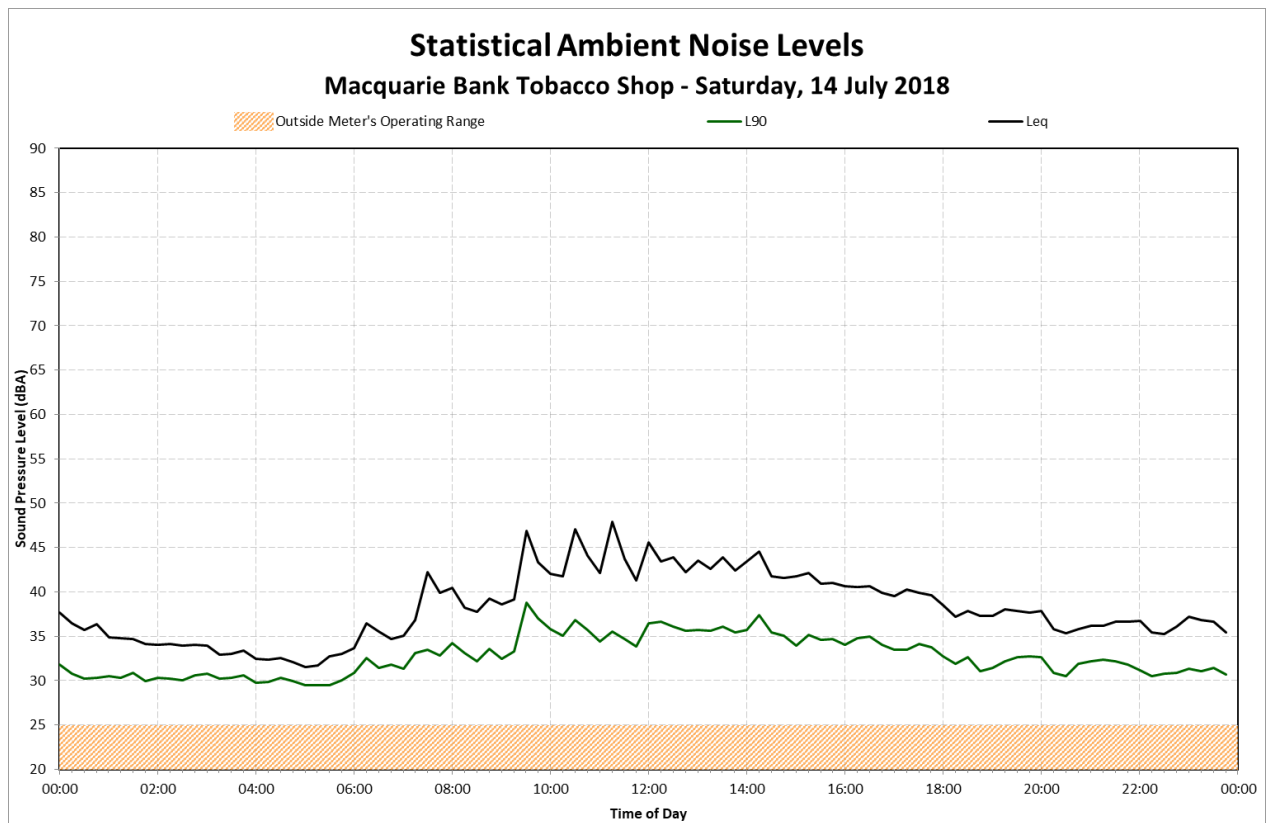
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

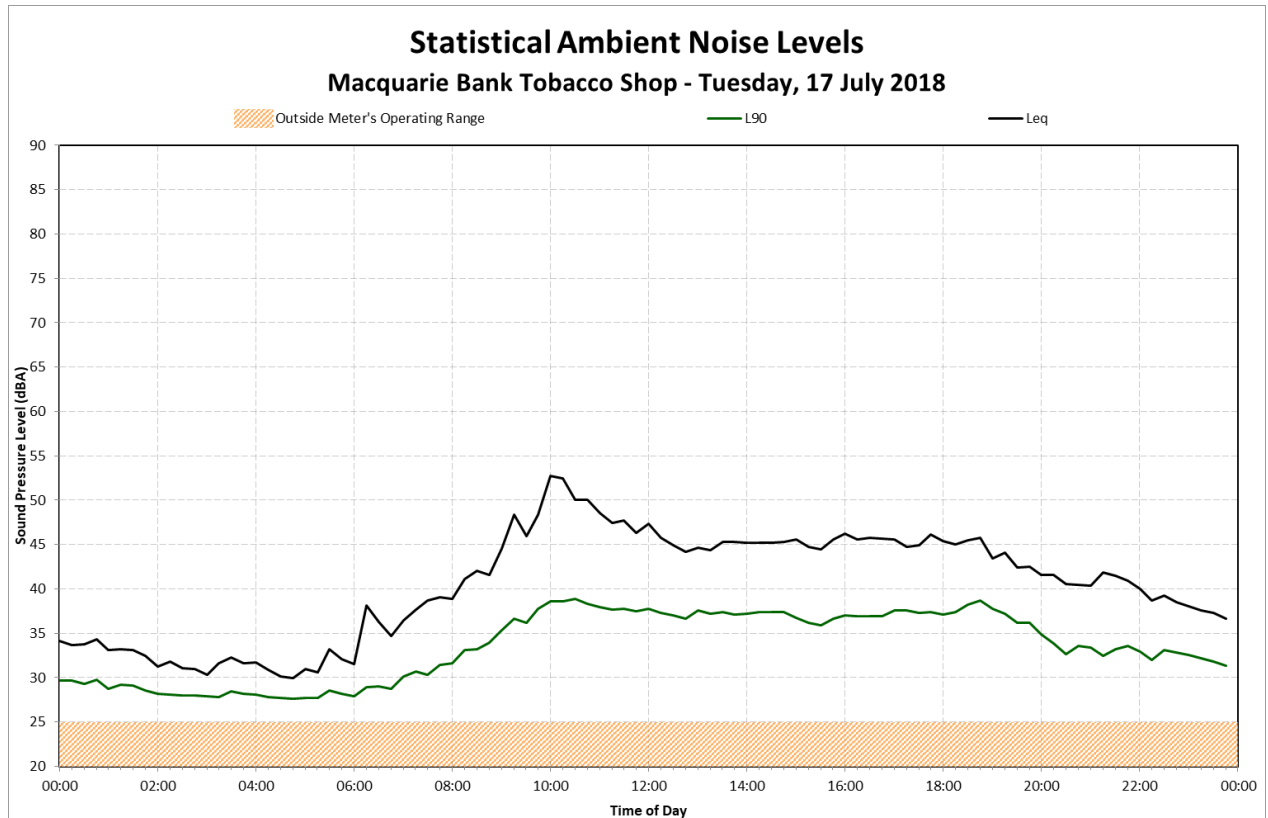
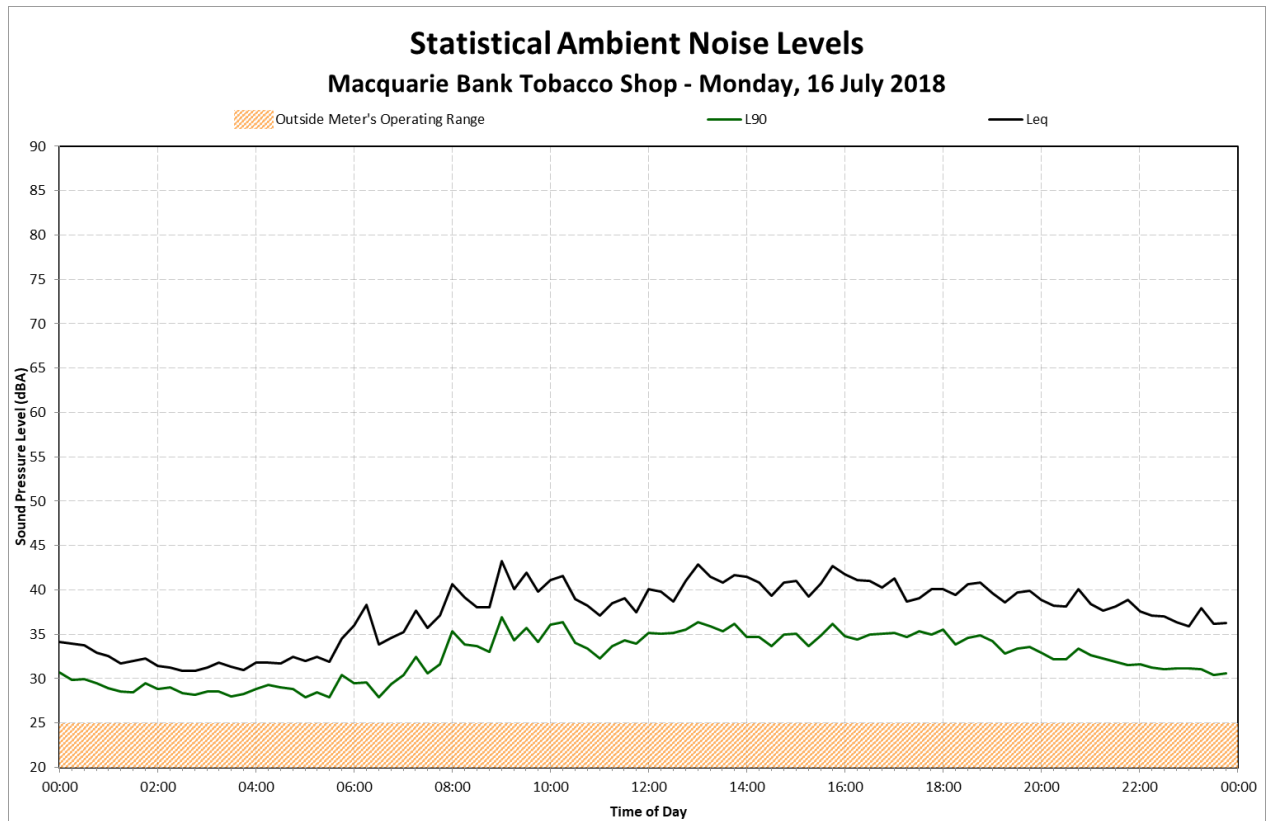
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

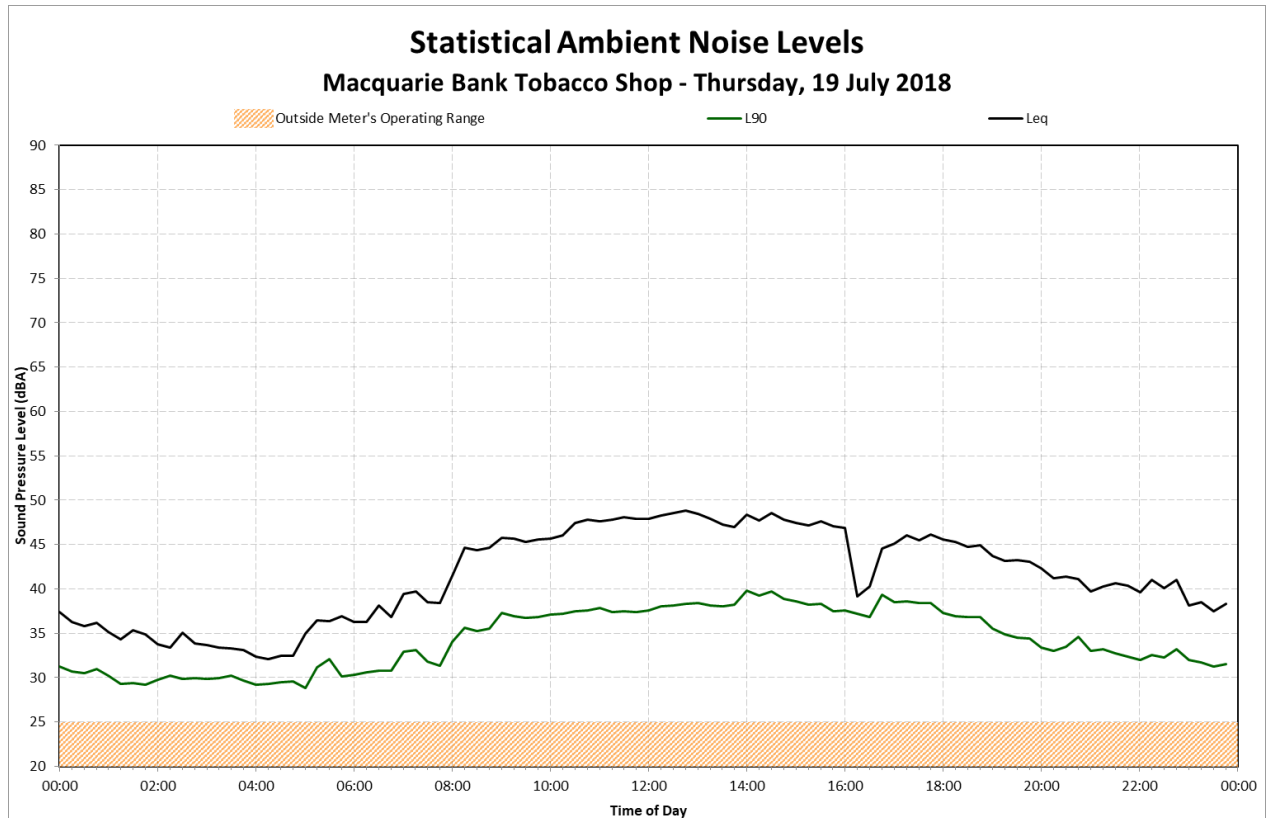
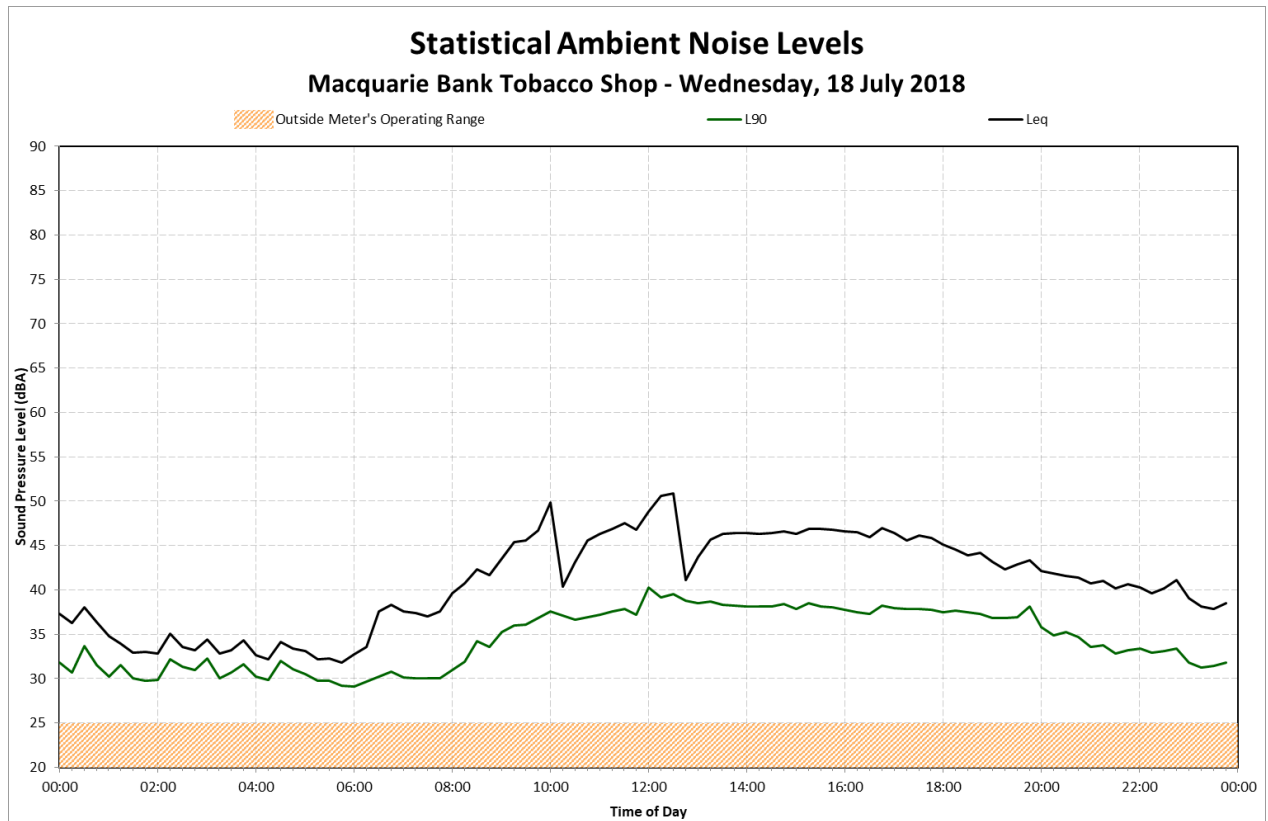
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

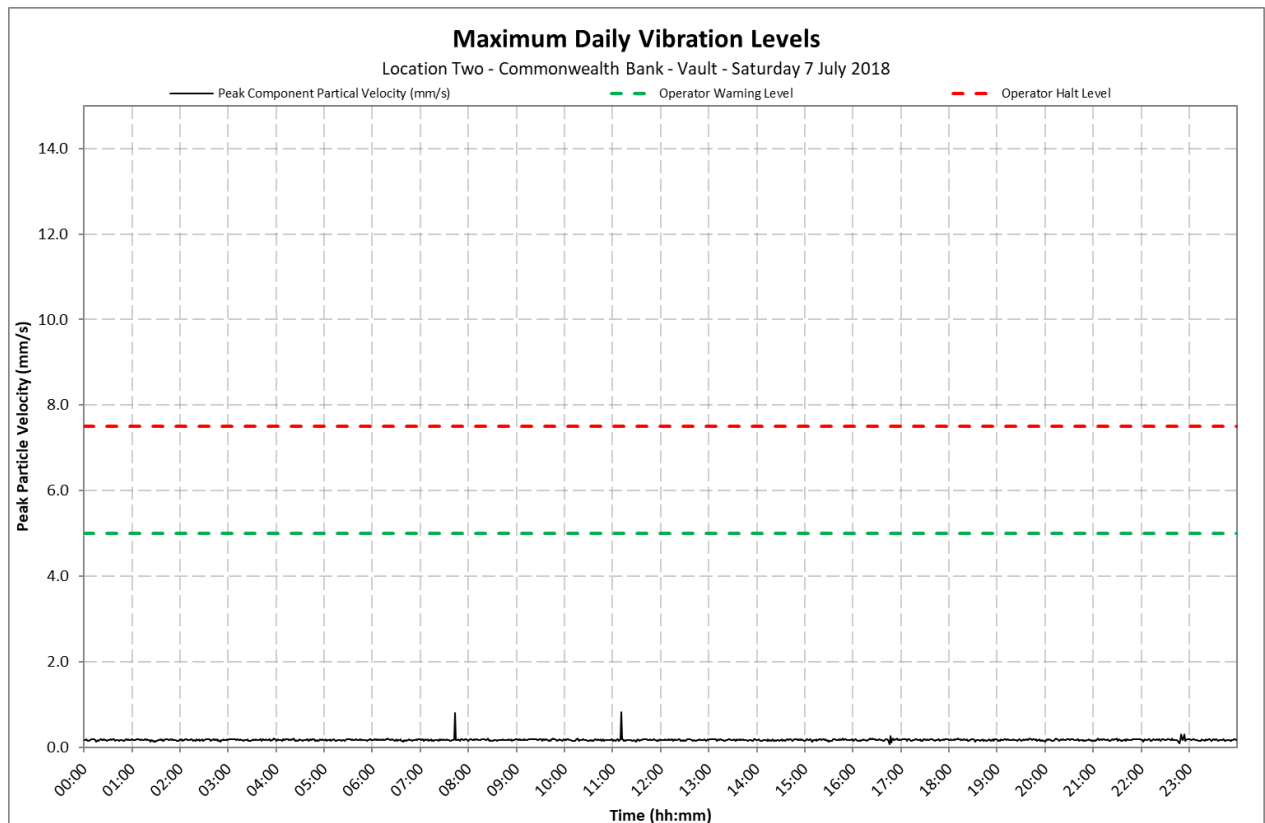
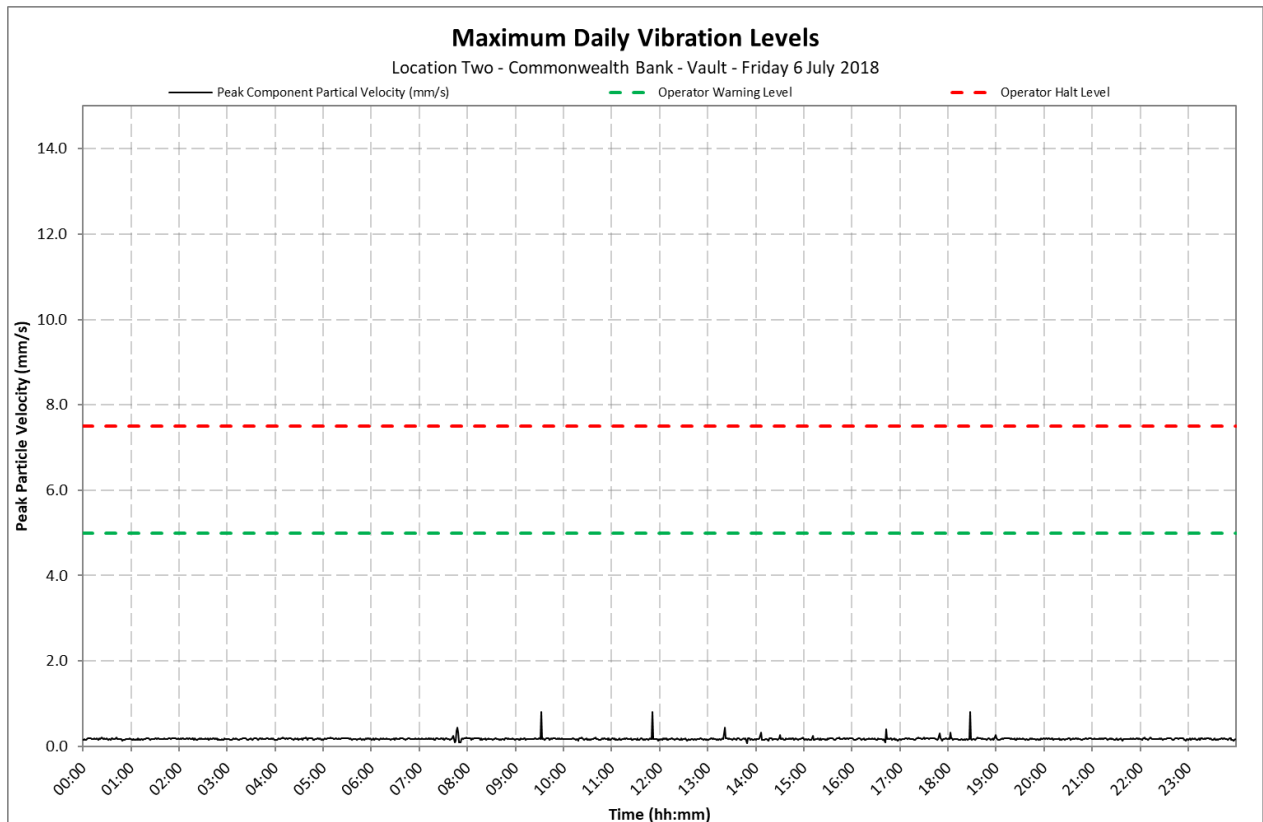
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

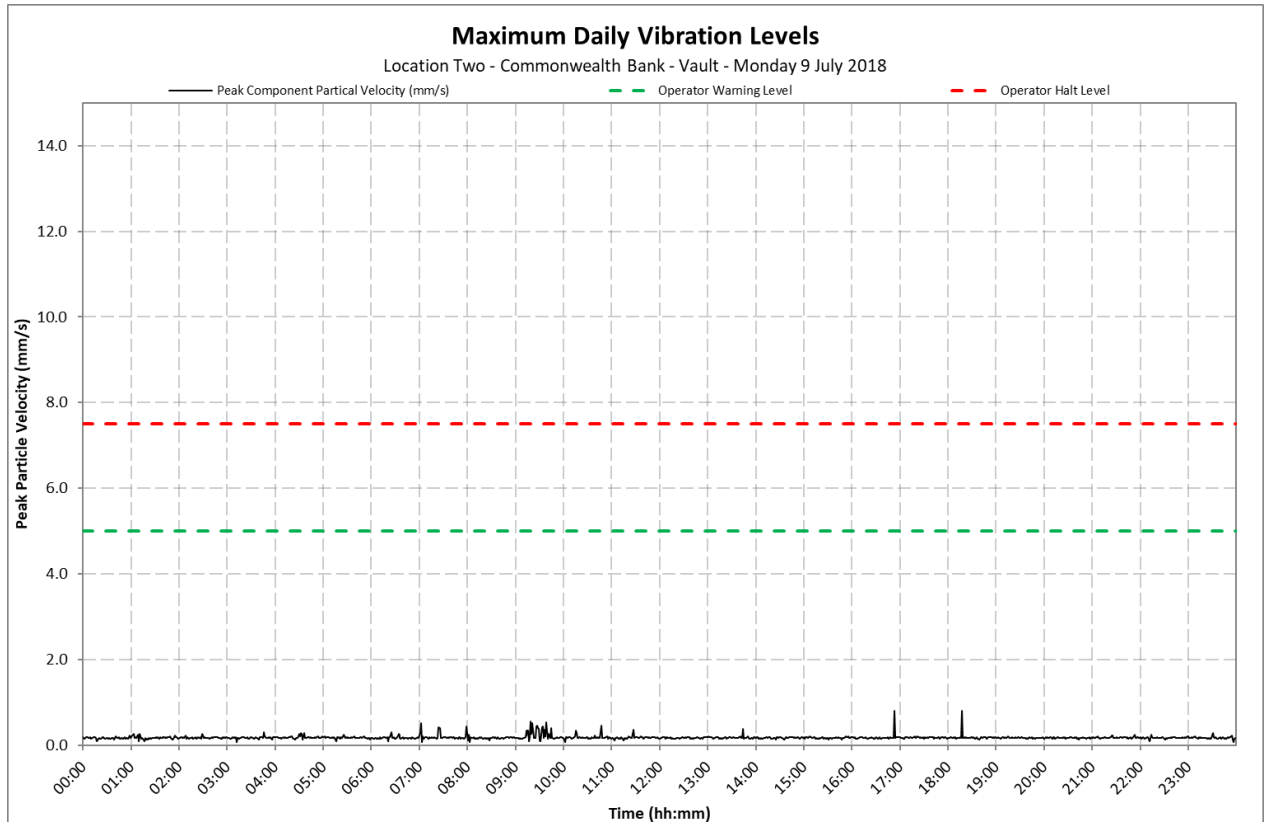
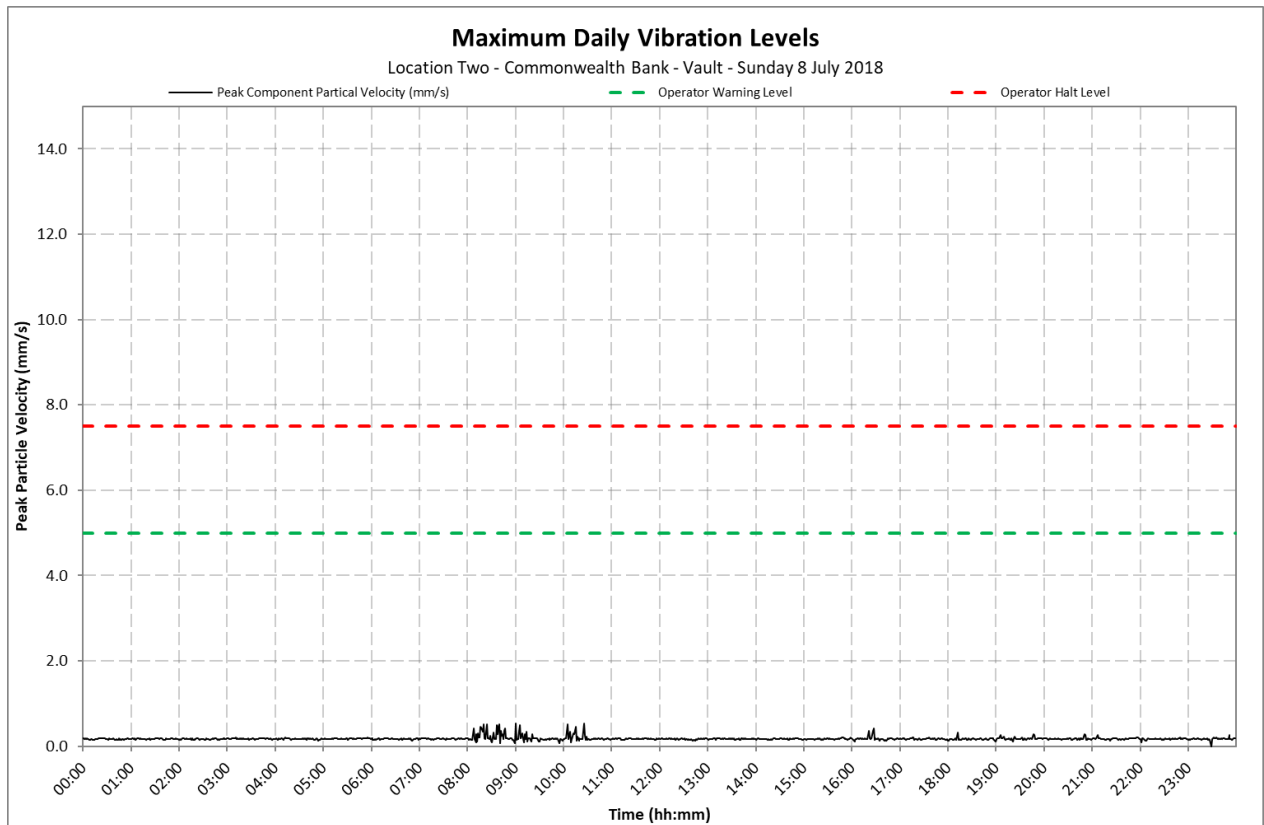
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

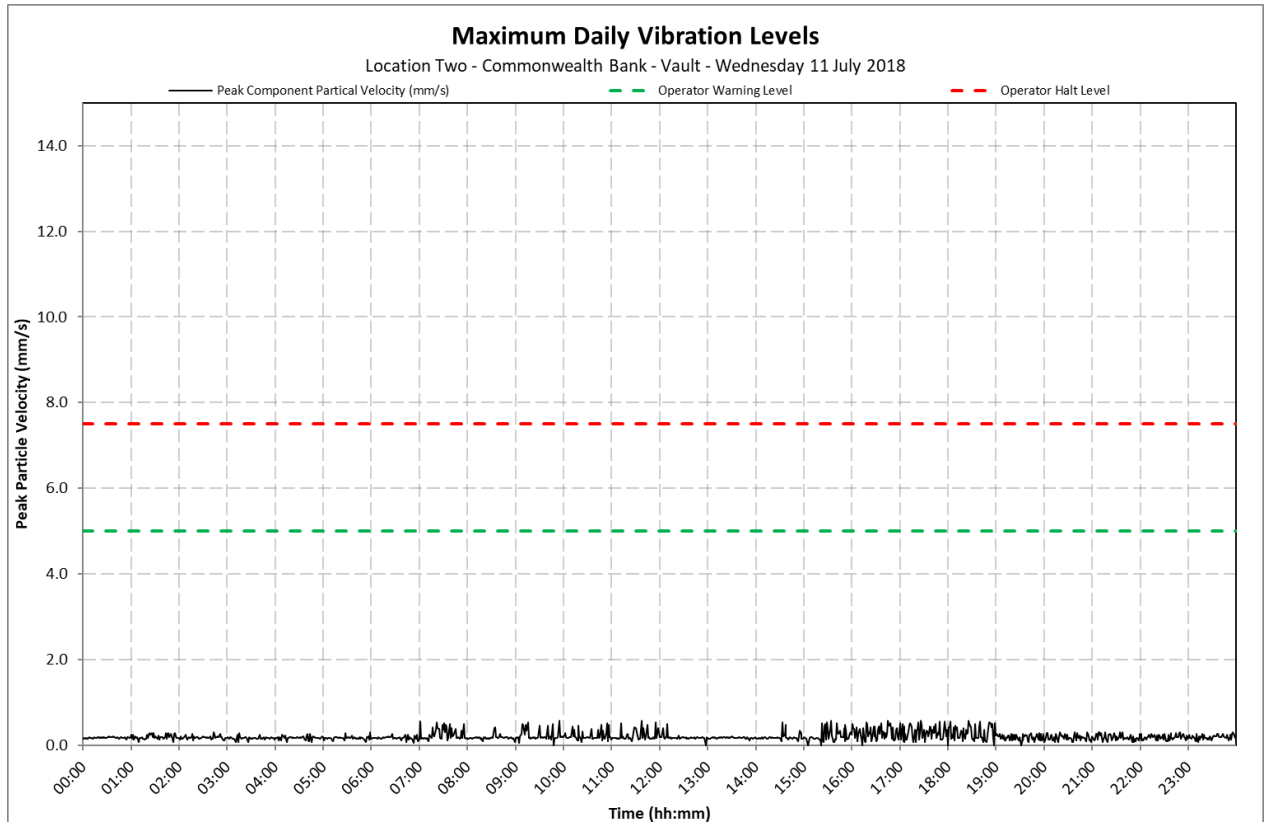
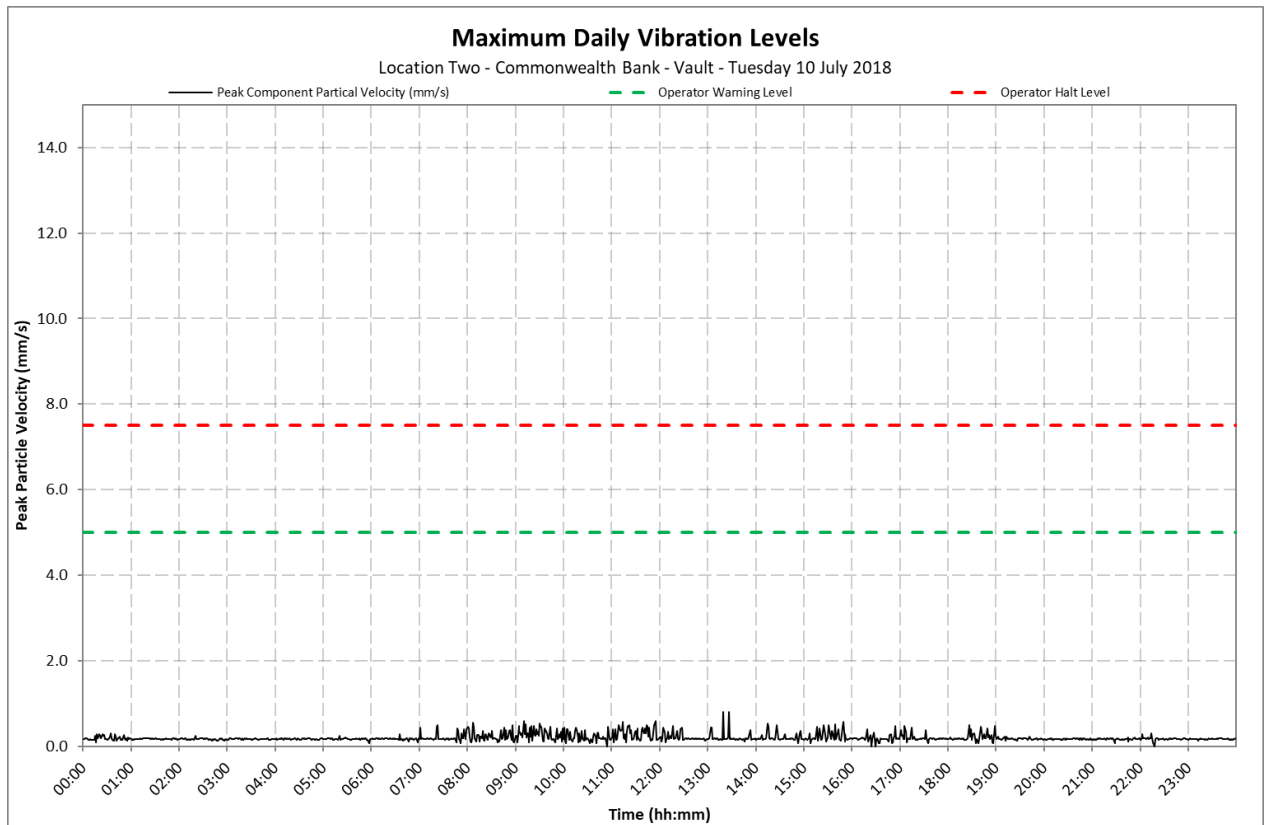
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

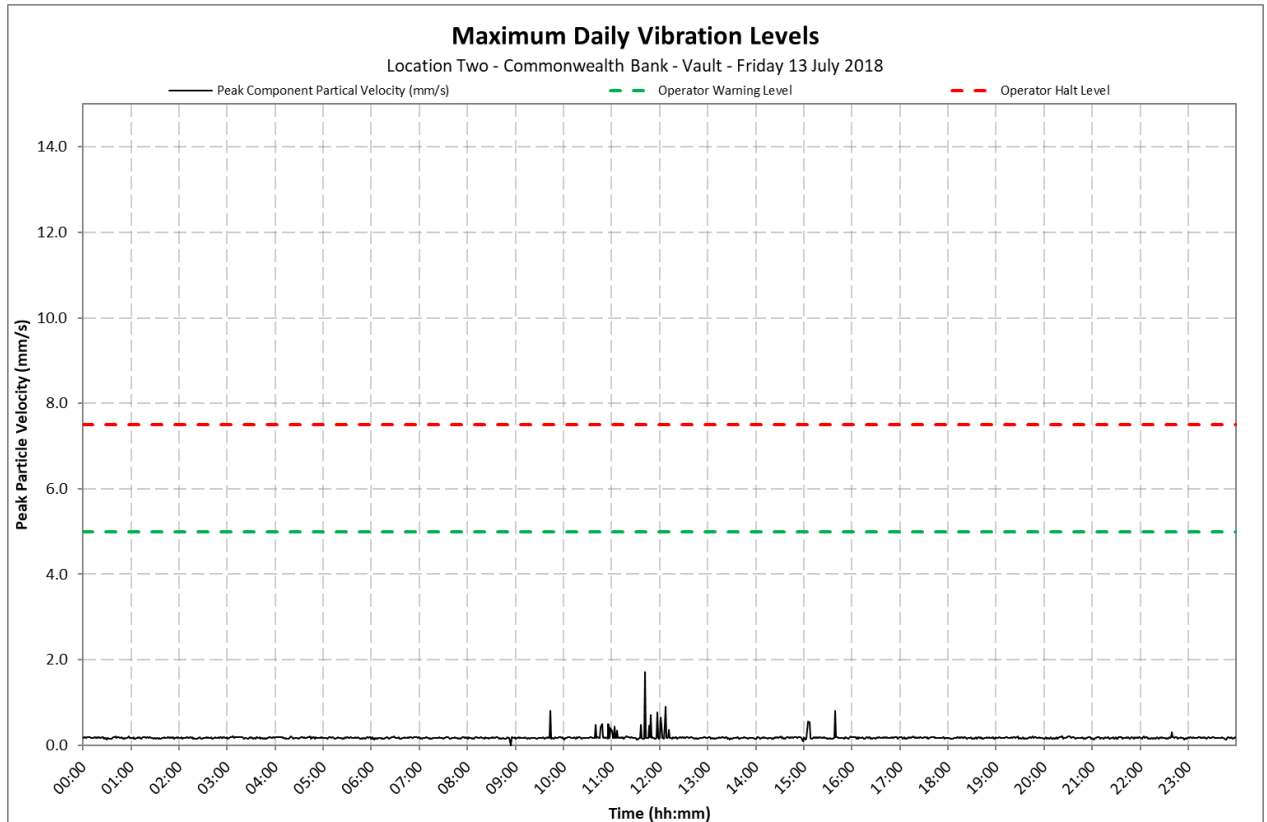
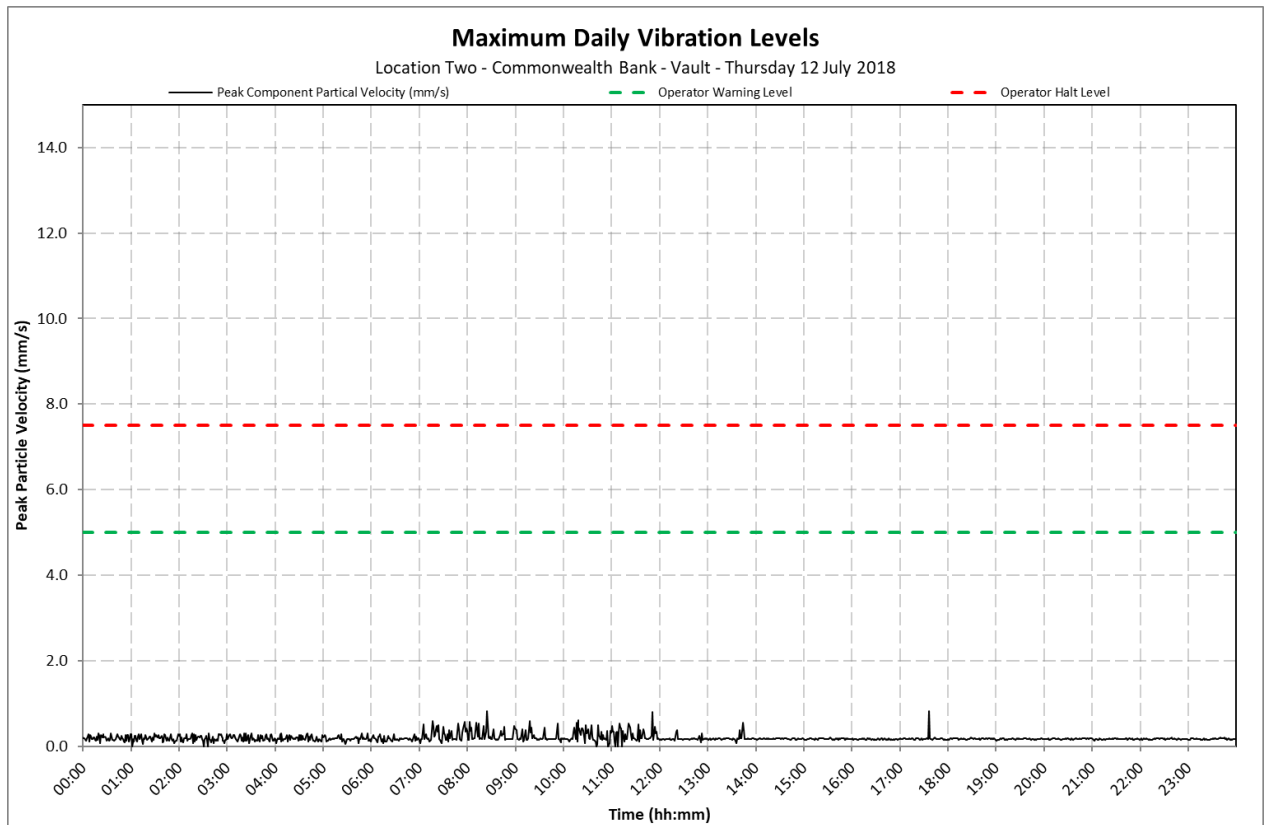
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

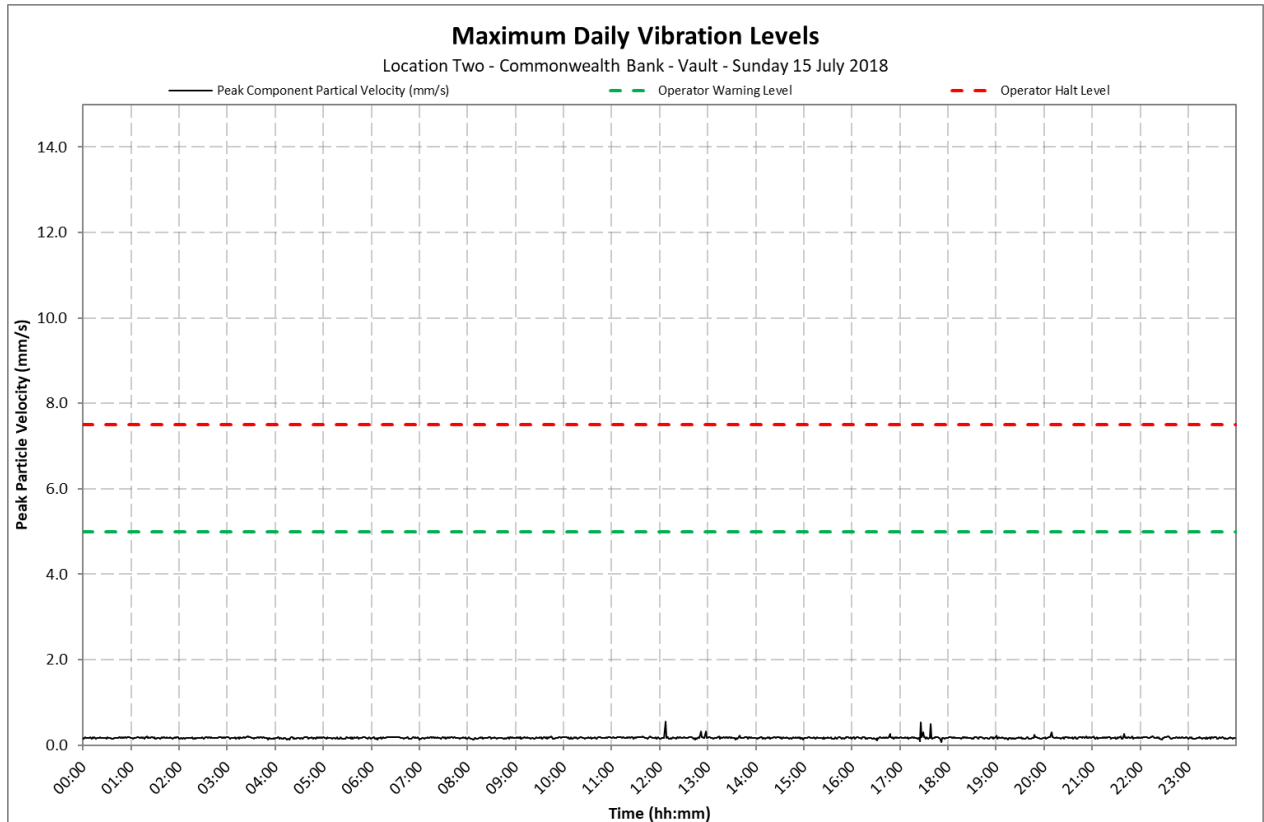
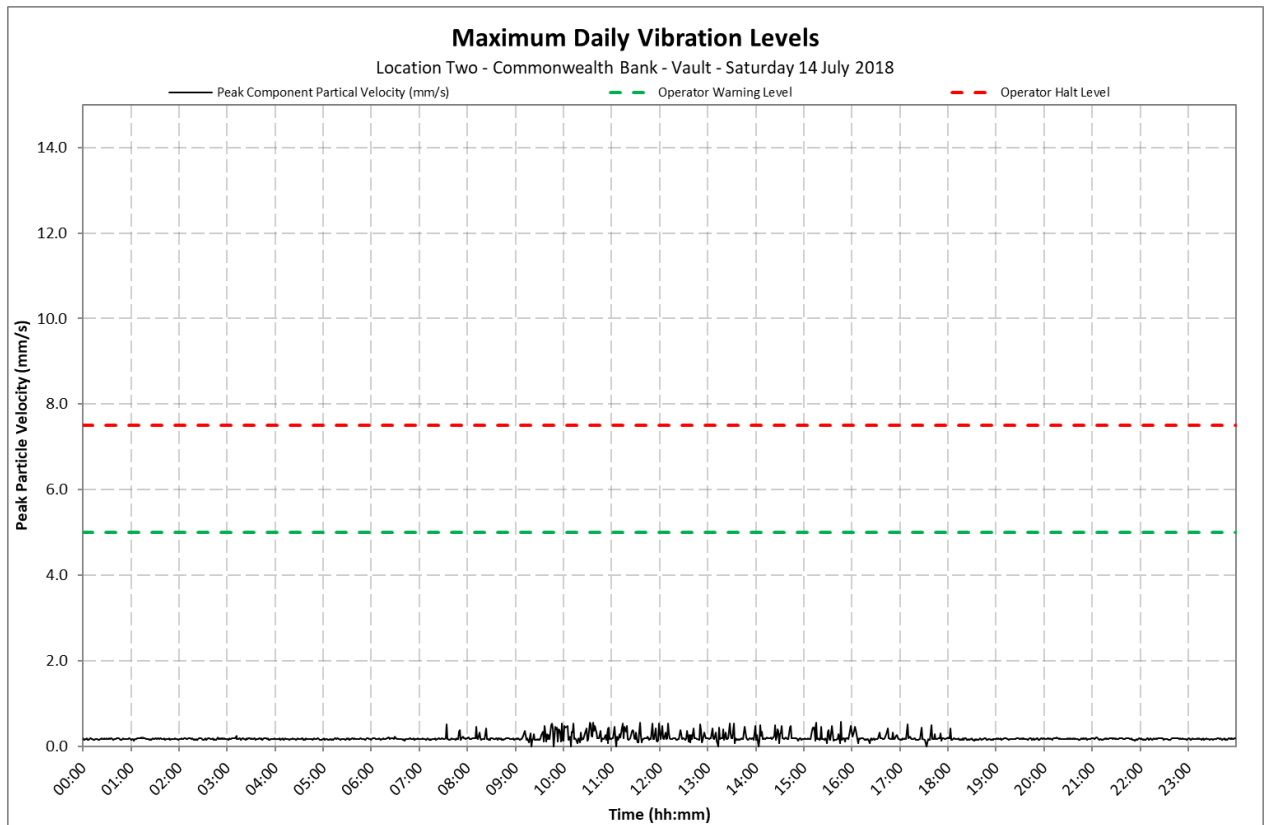
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

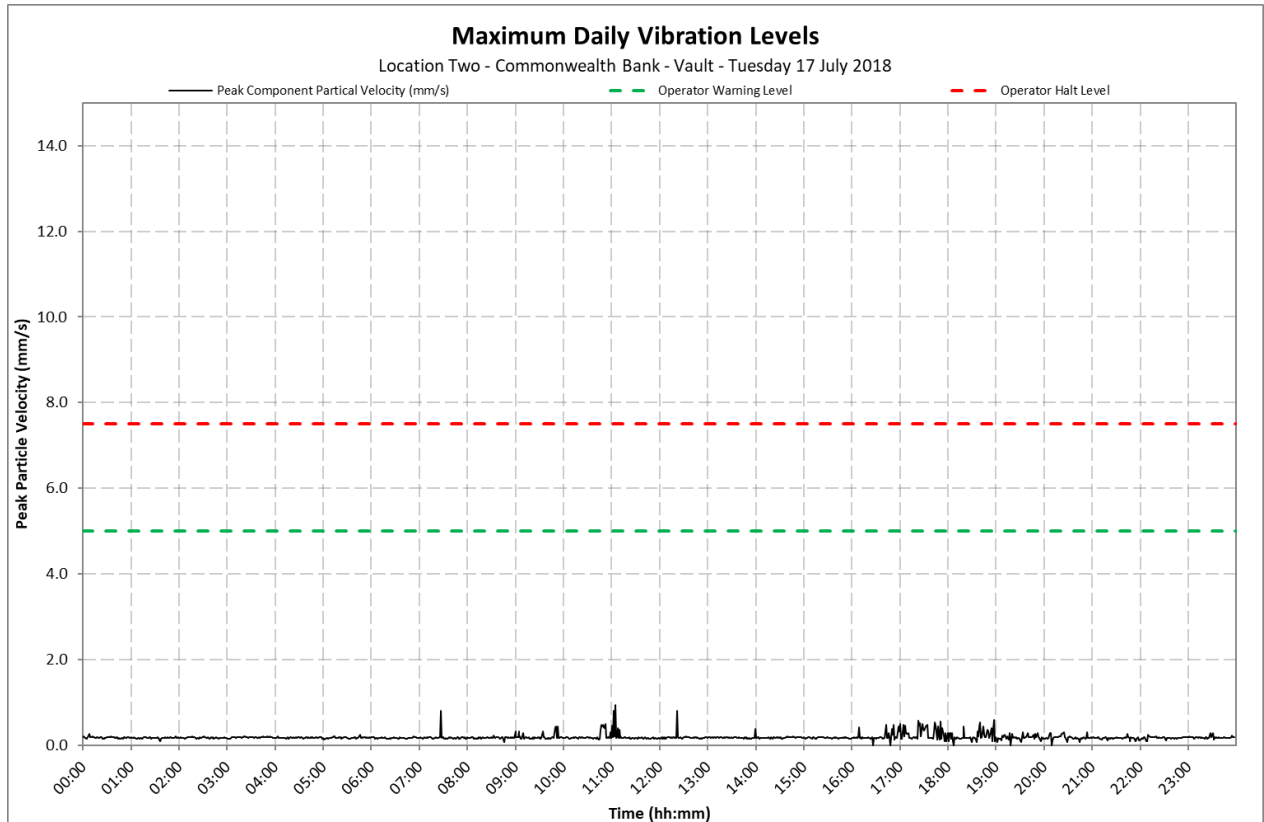
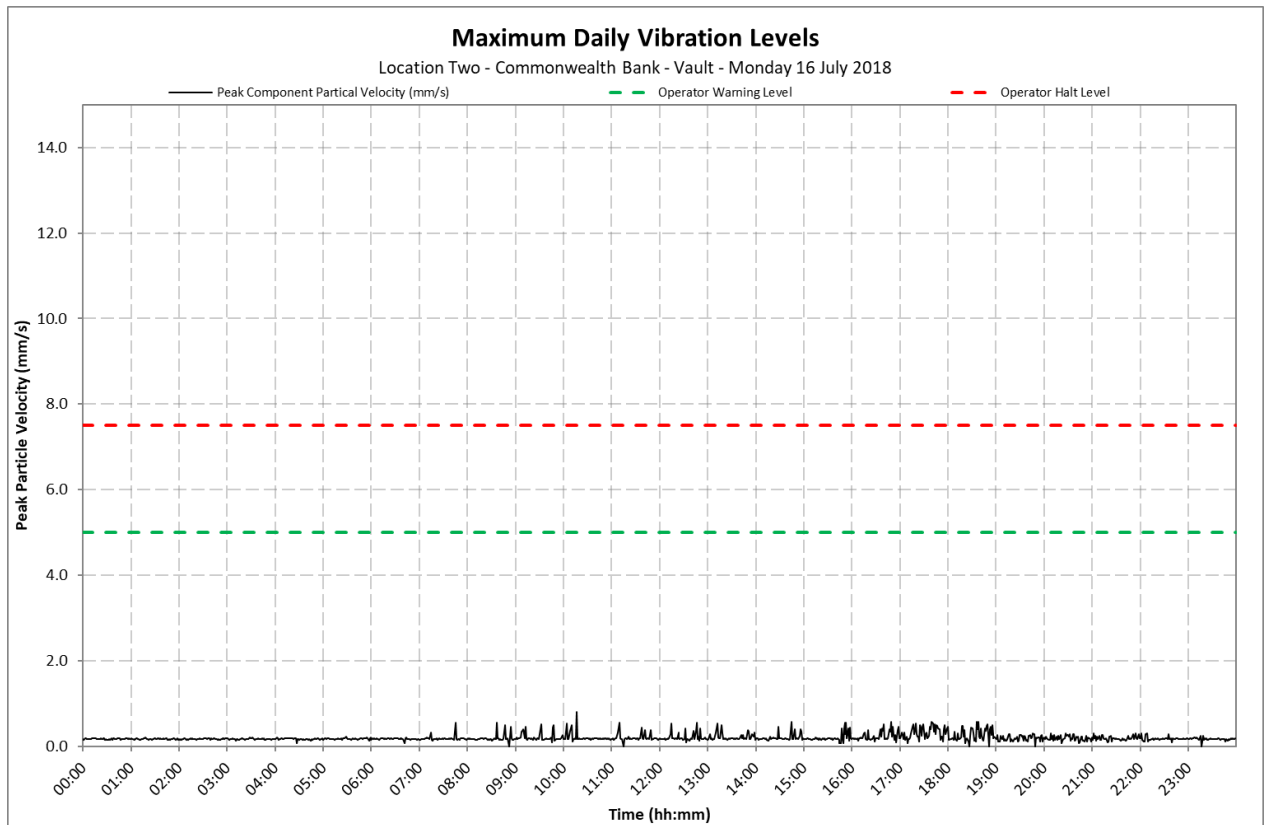
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

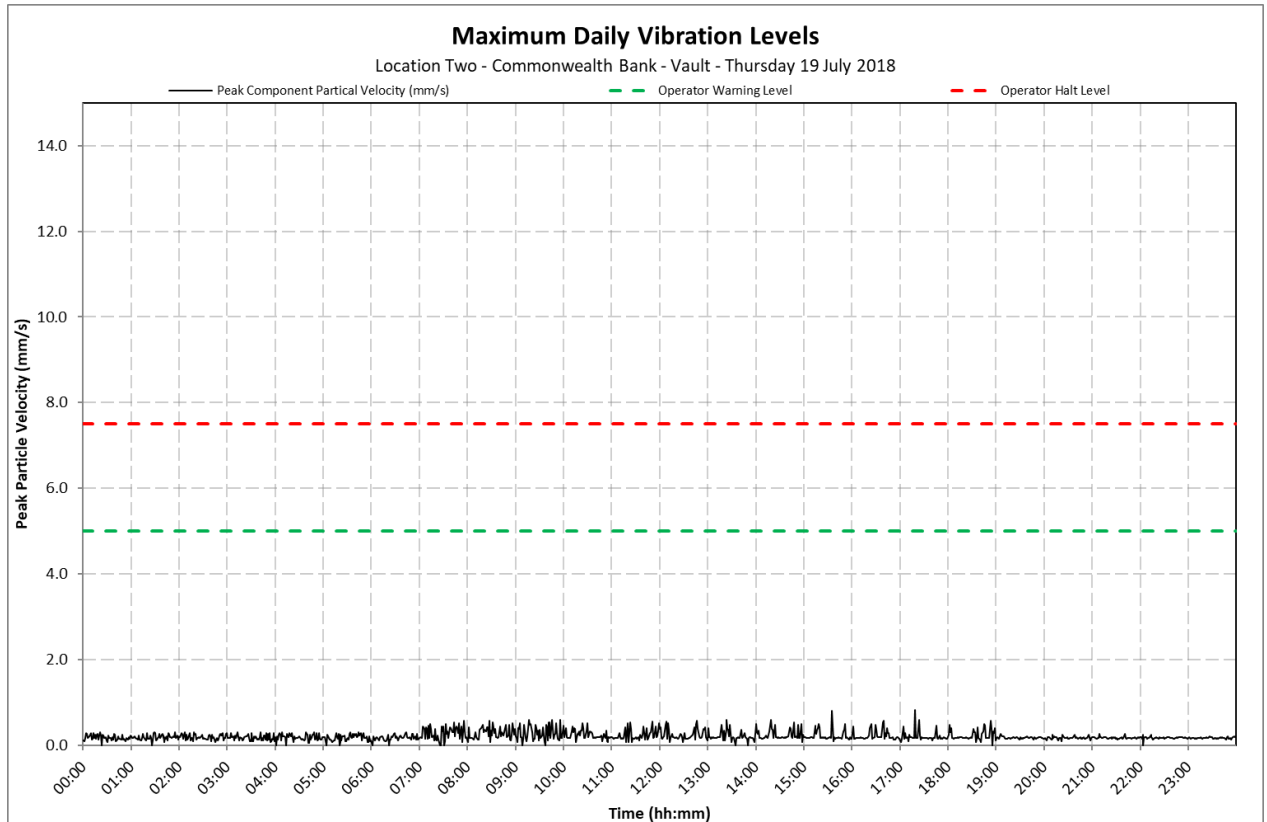
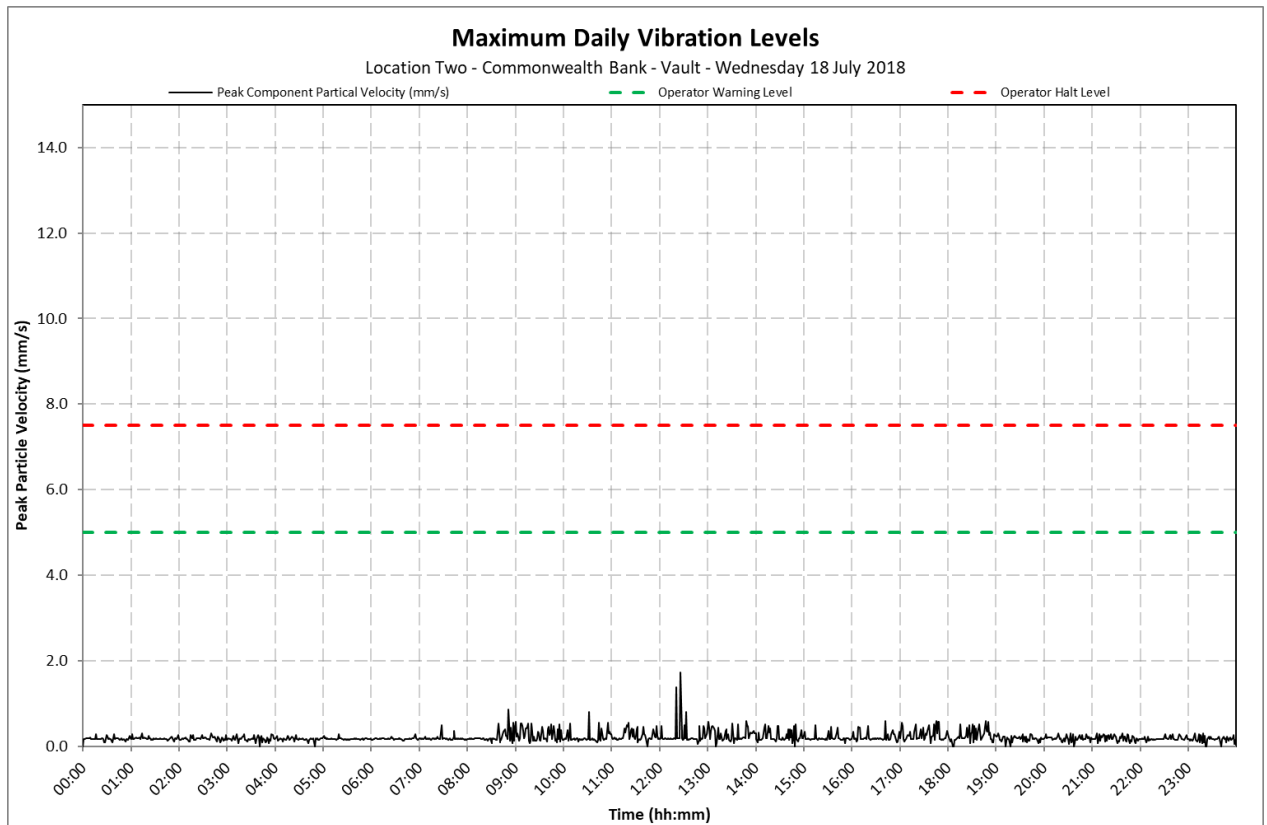
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

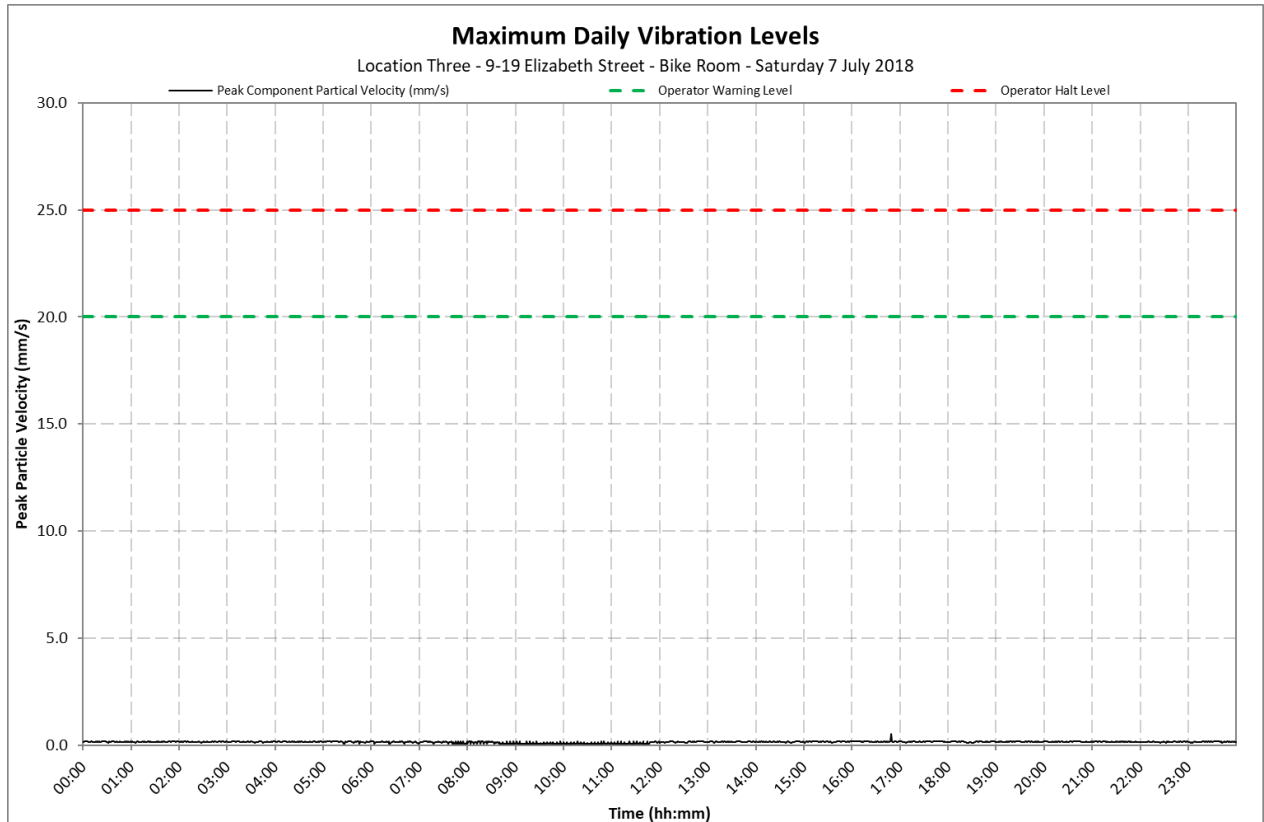
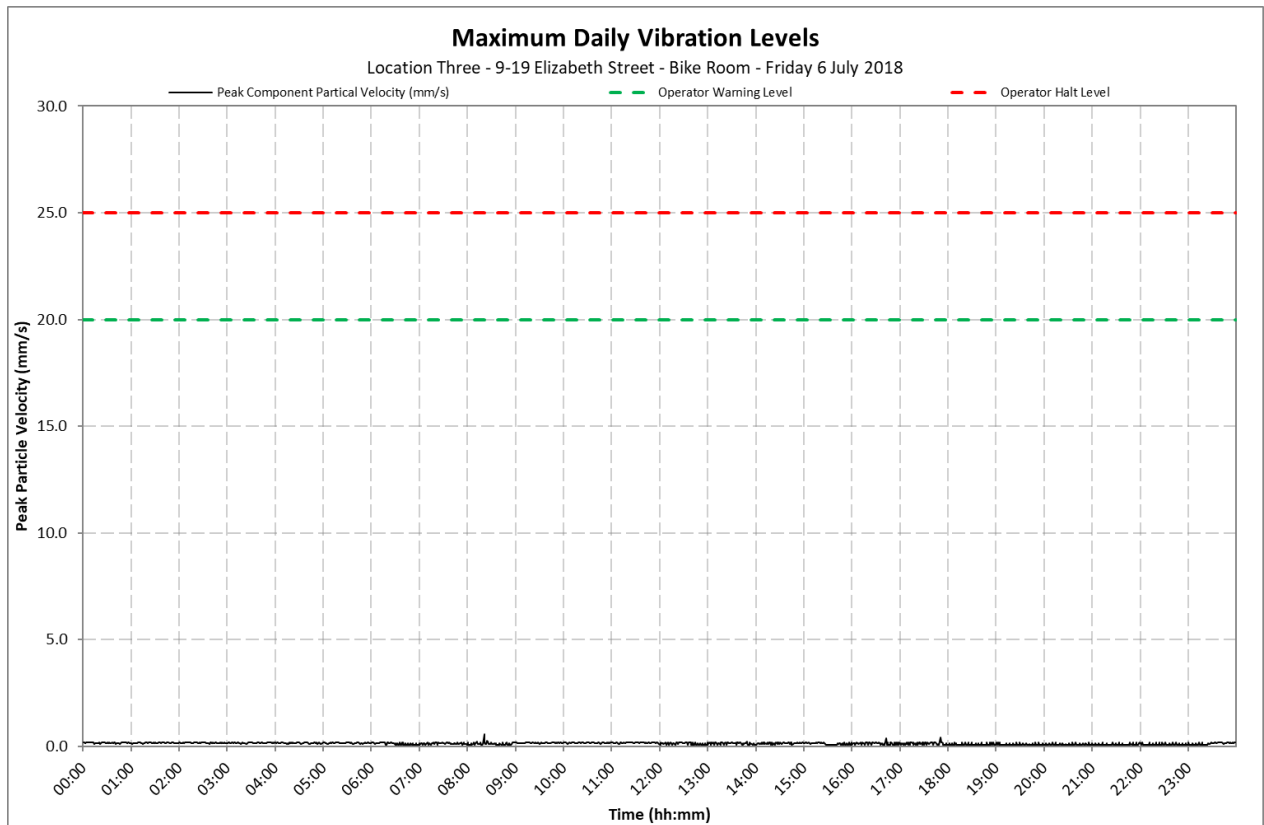
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

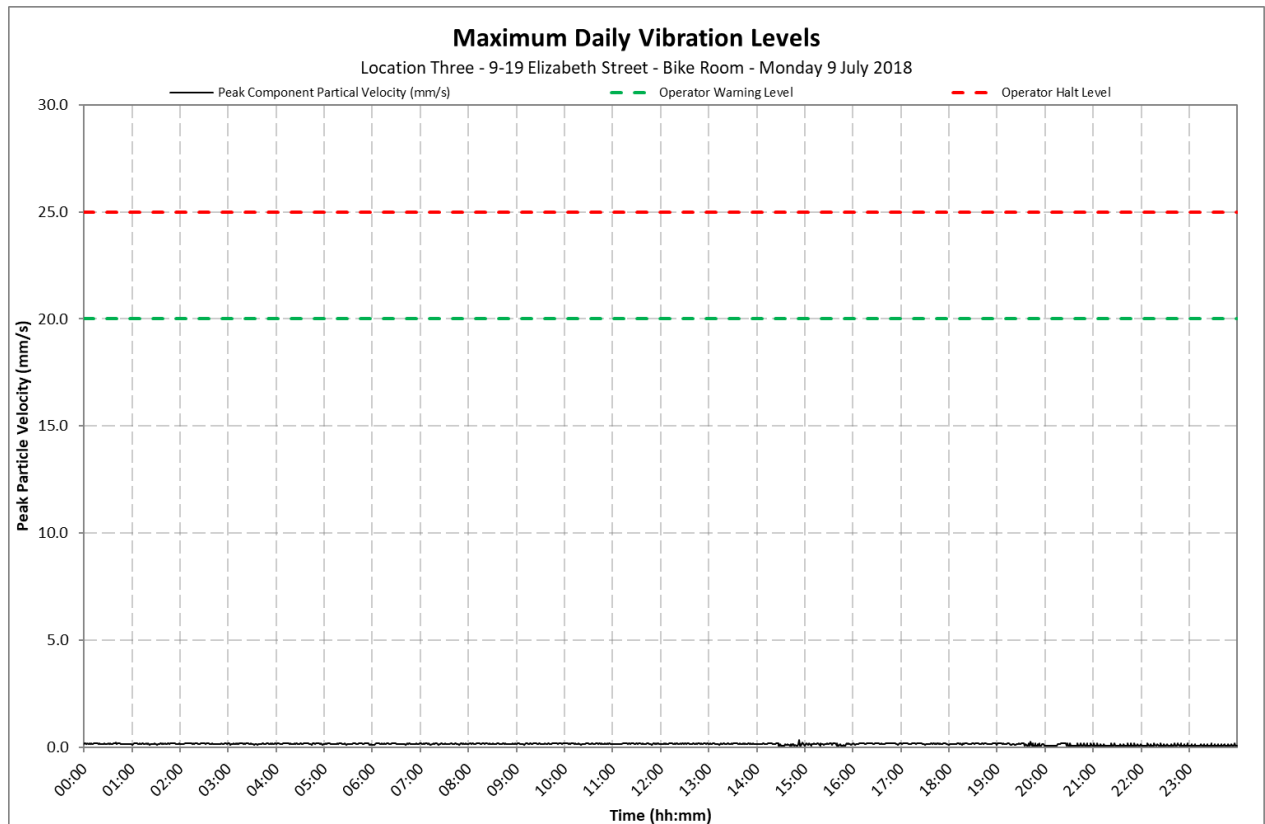
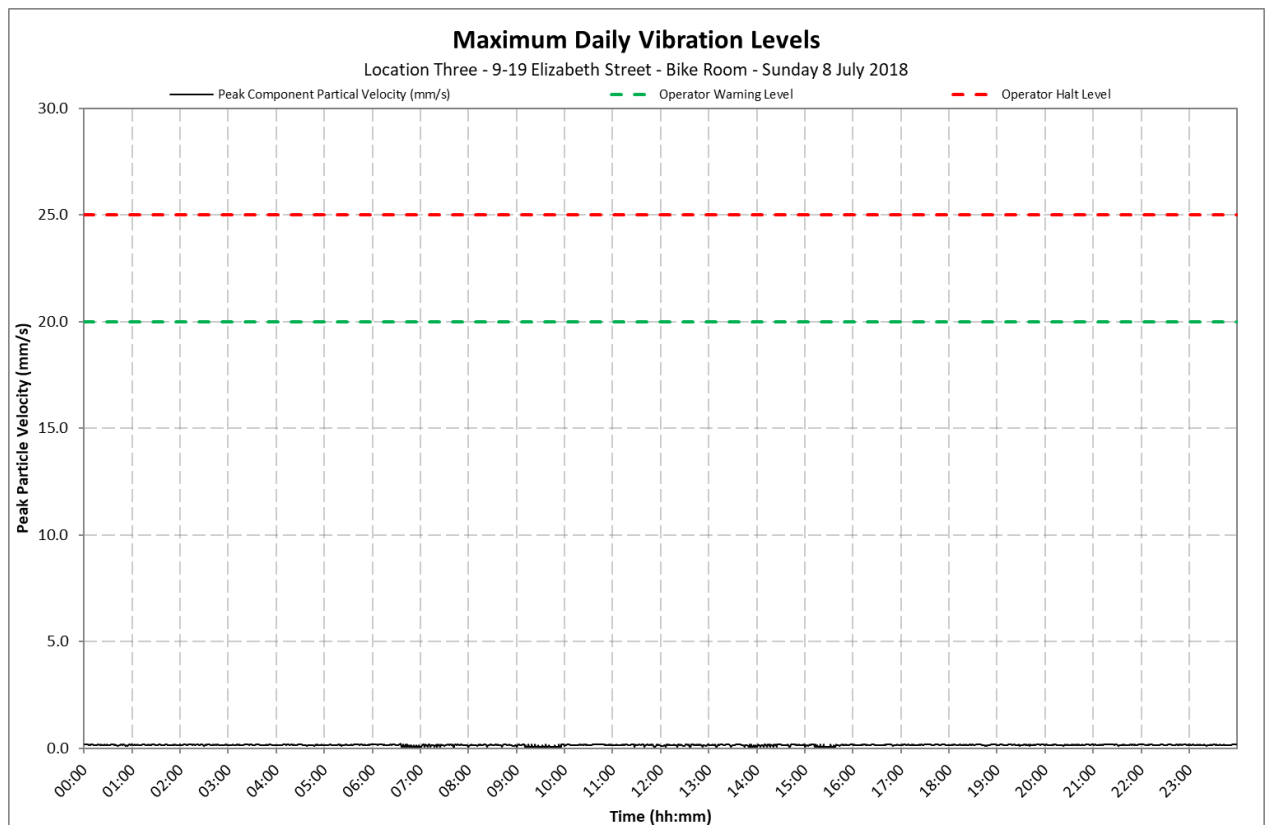
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

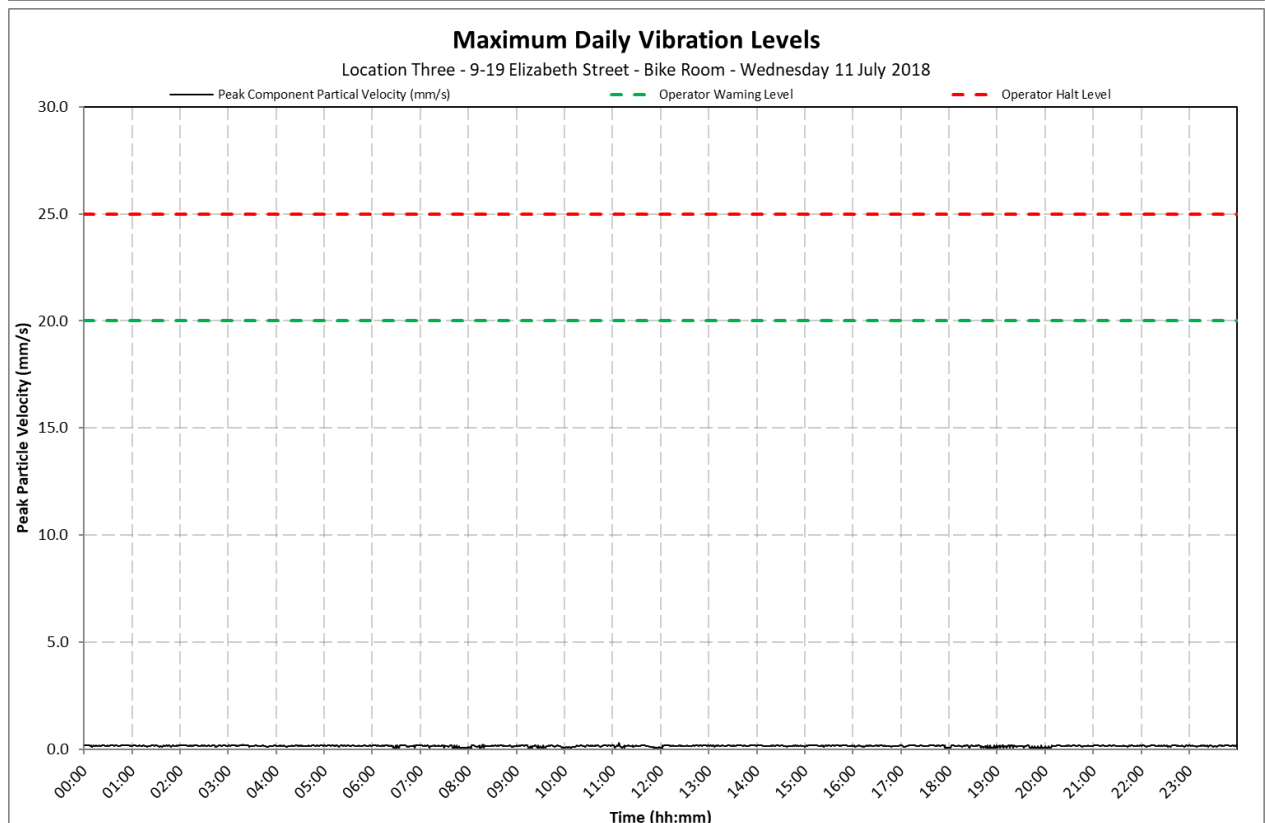
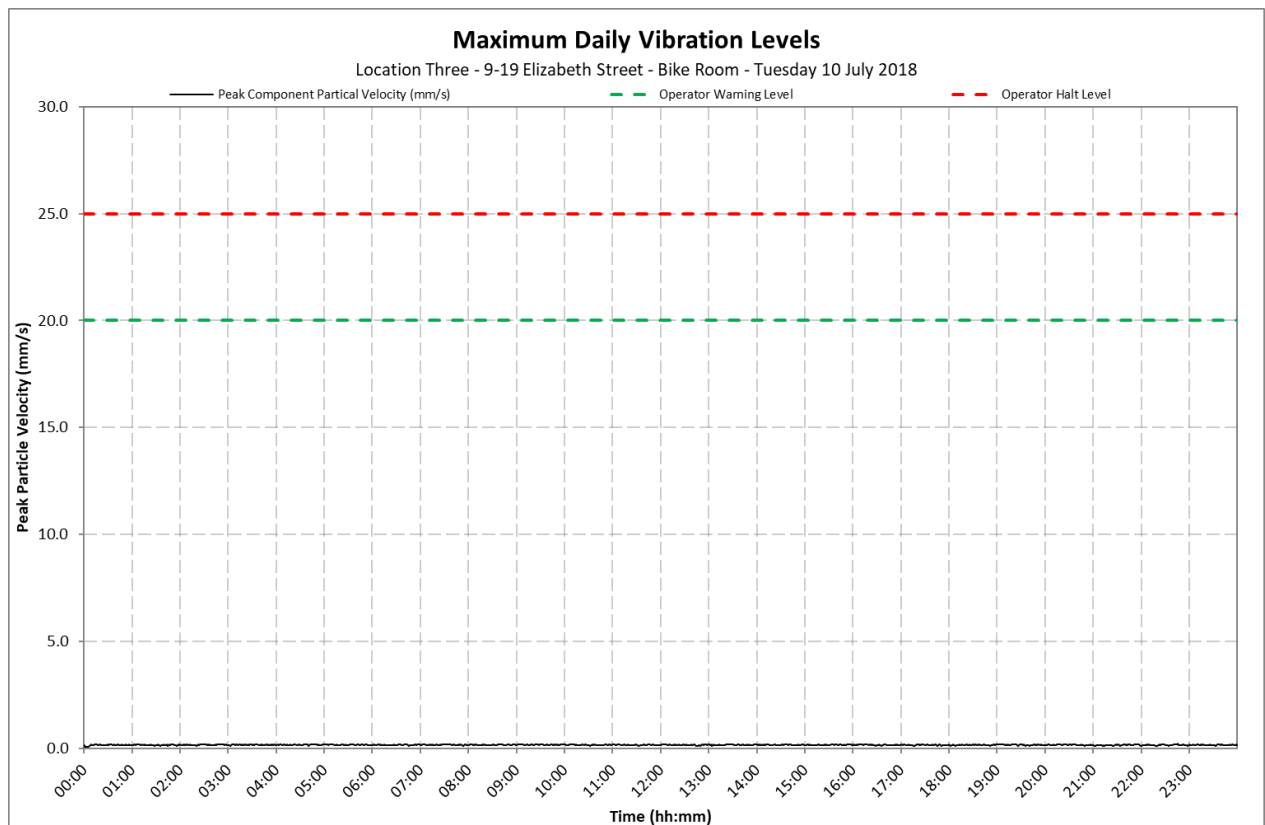
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

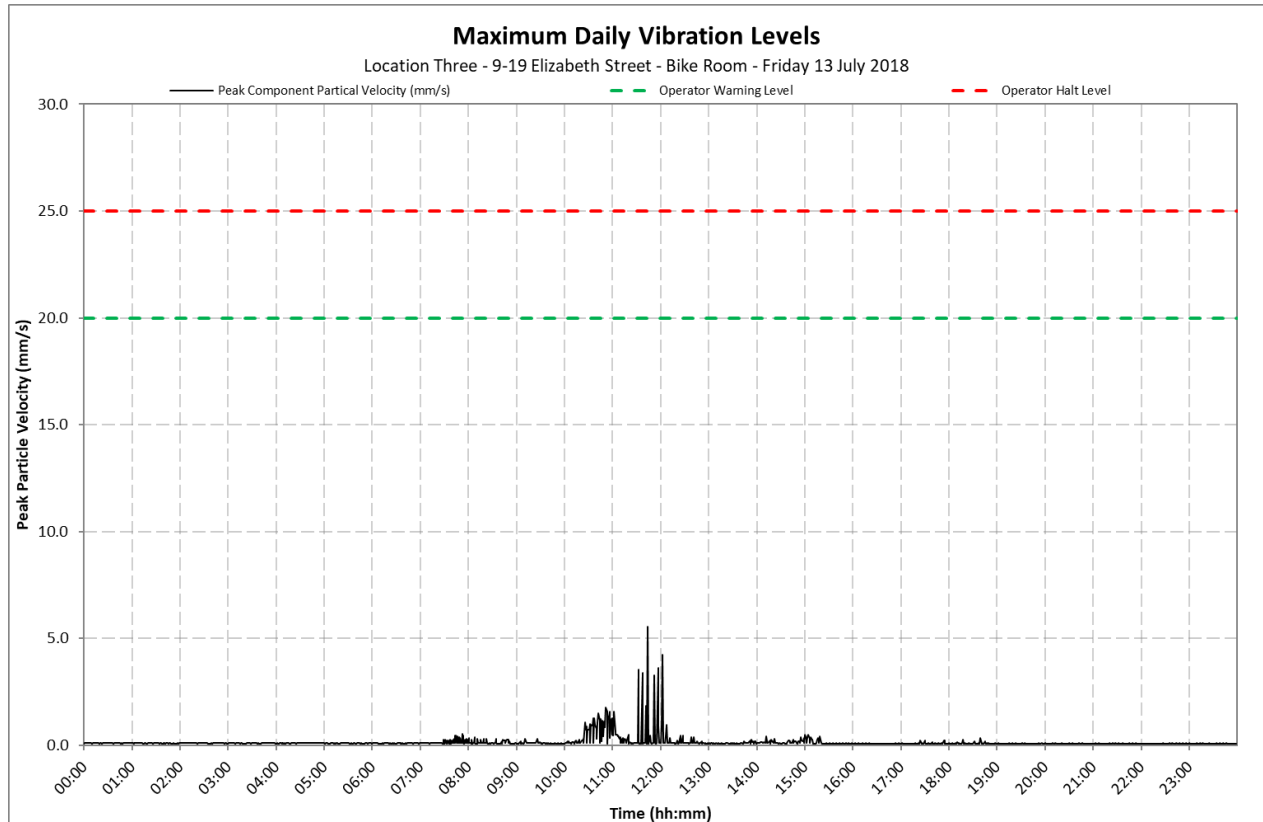
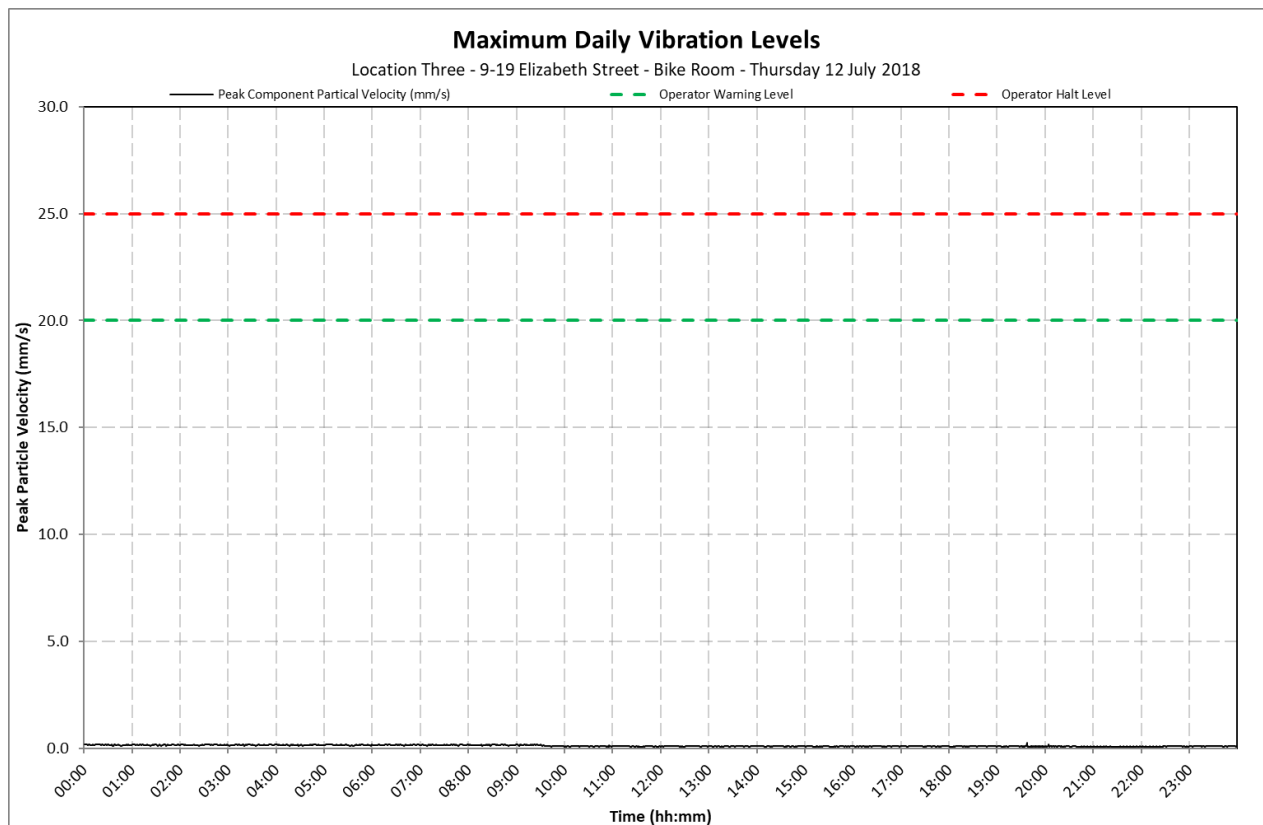
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

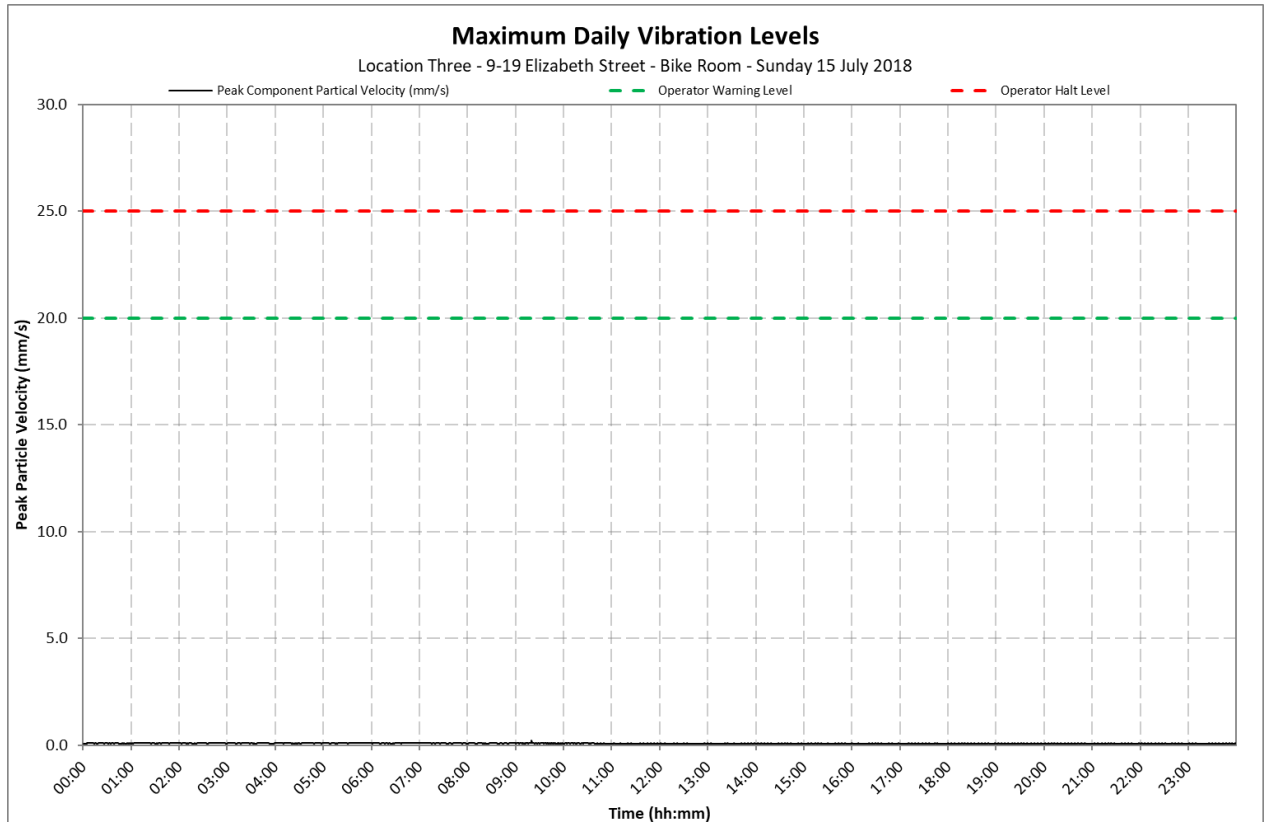
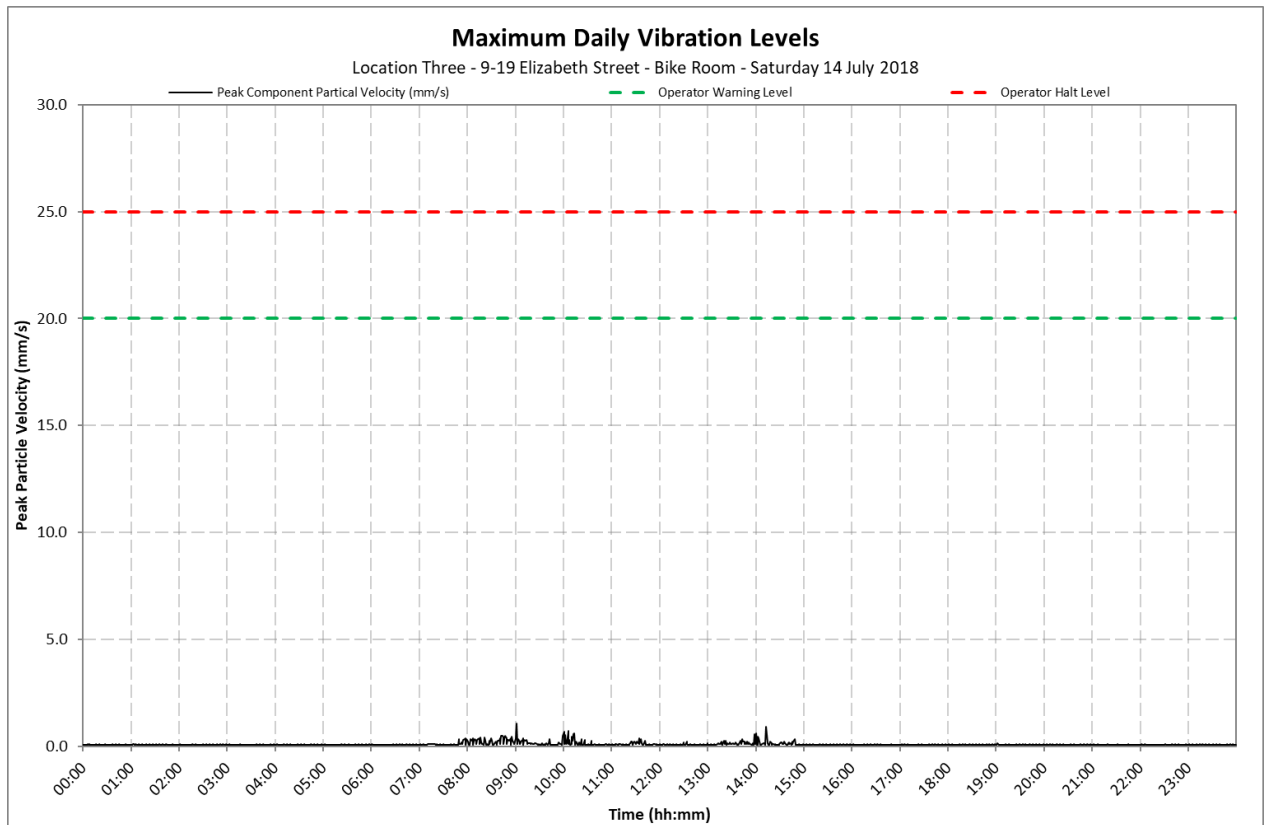
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

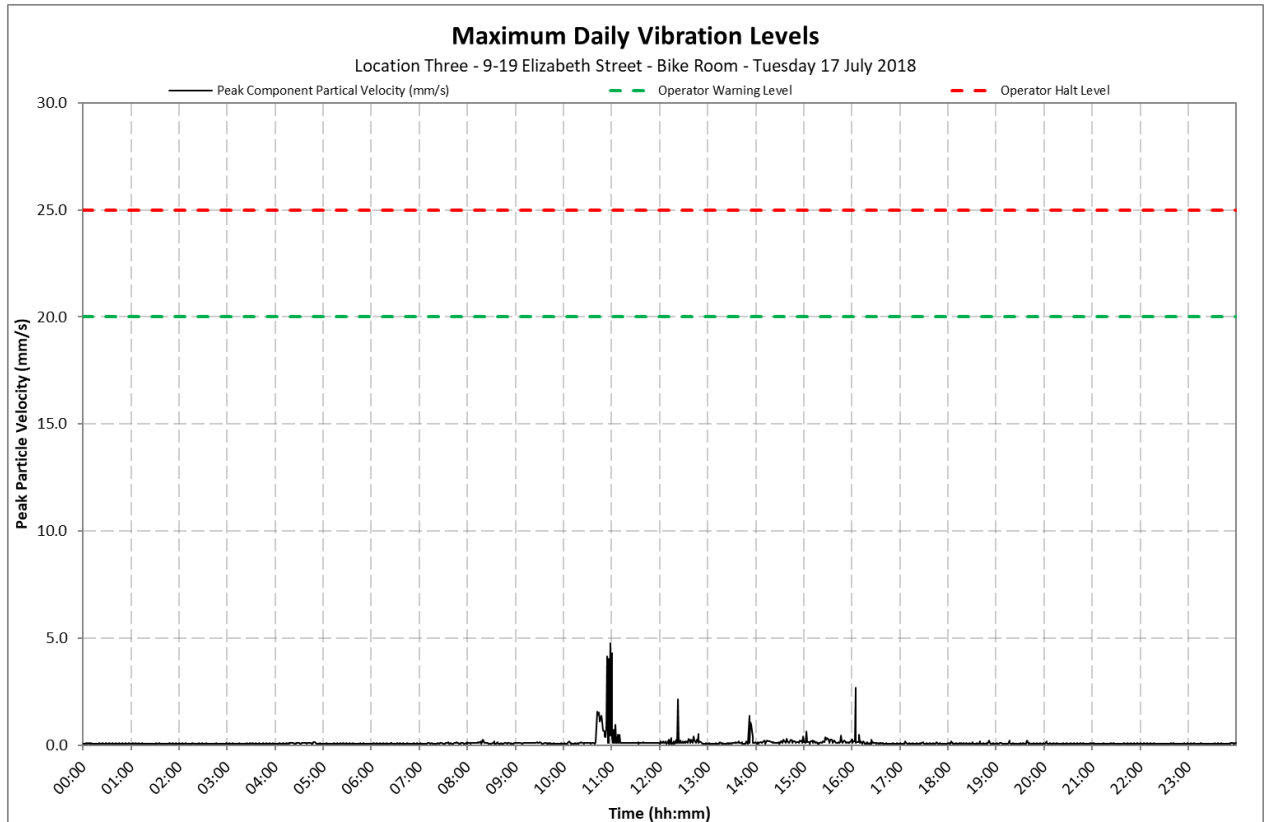
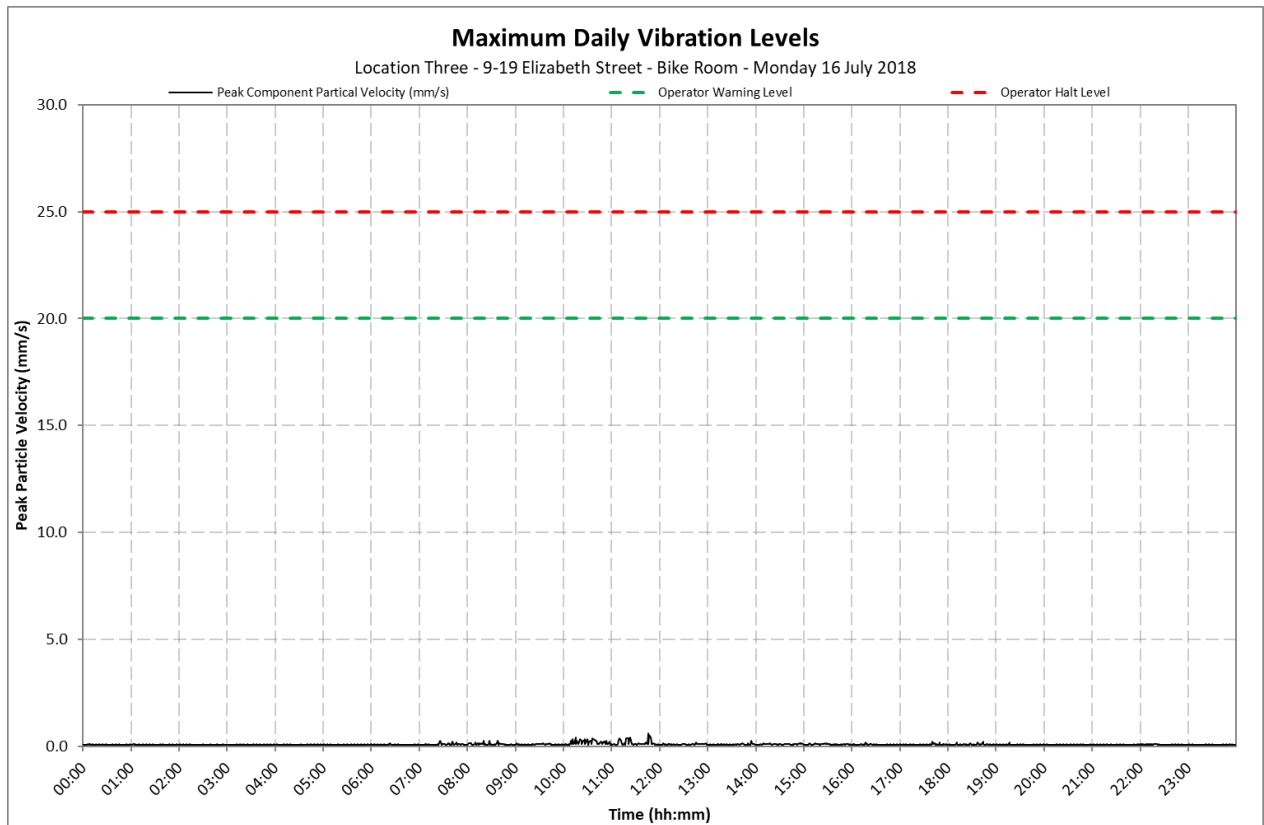
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

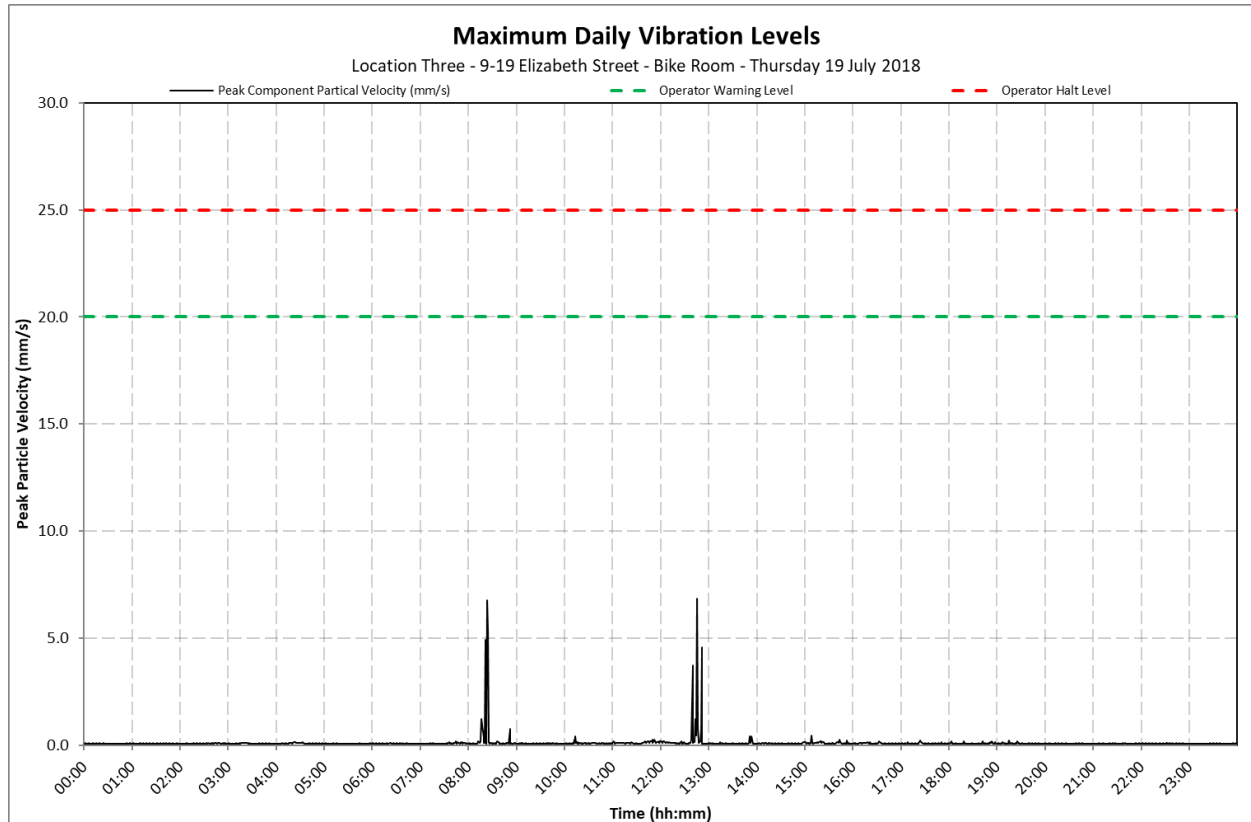
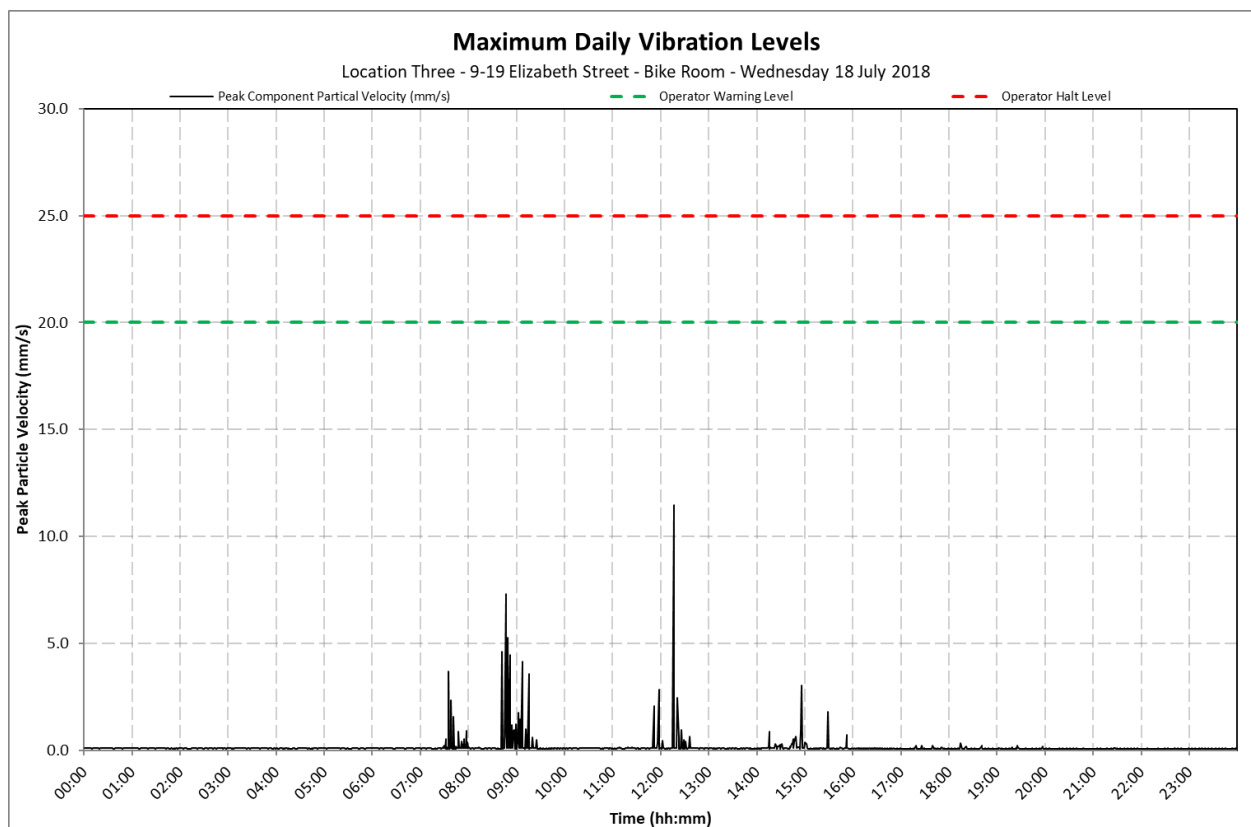
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





3 August 2018

10-1380 R36 NV Monitoring 20180803.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 36
20 July to 26 July 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 20 July to 26 July 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

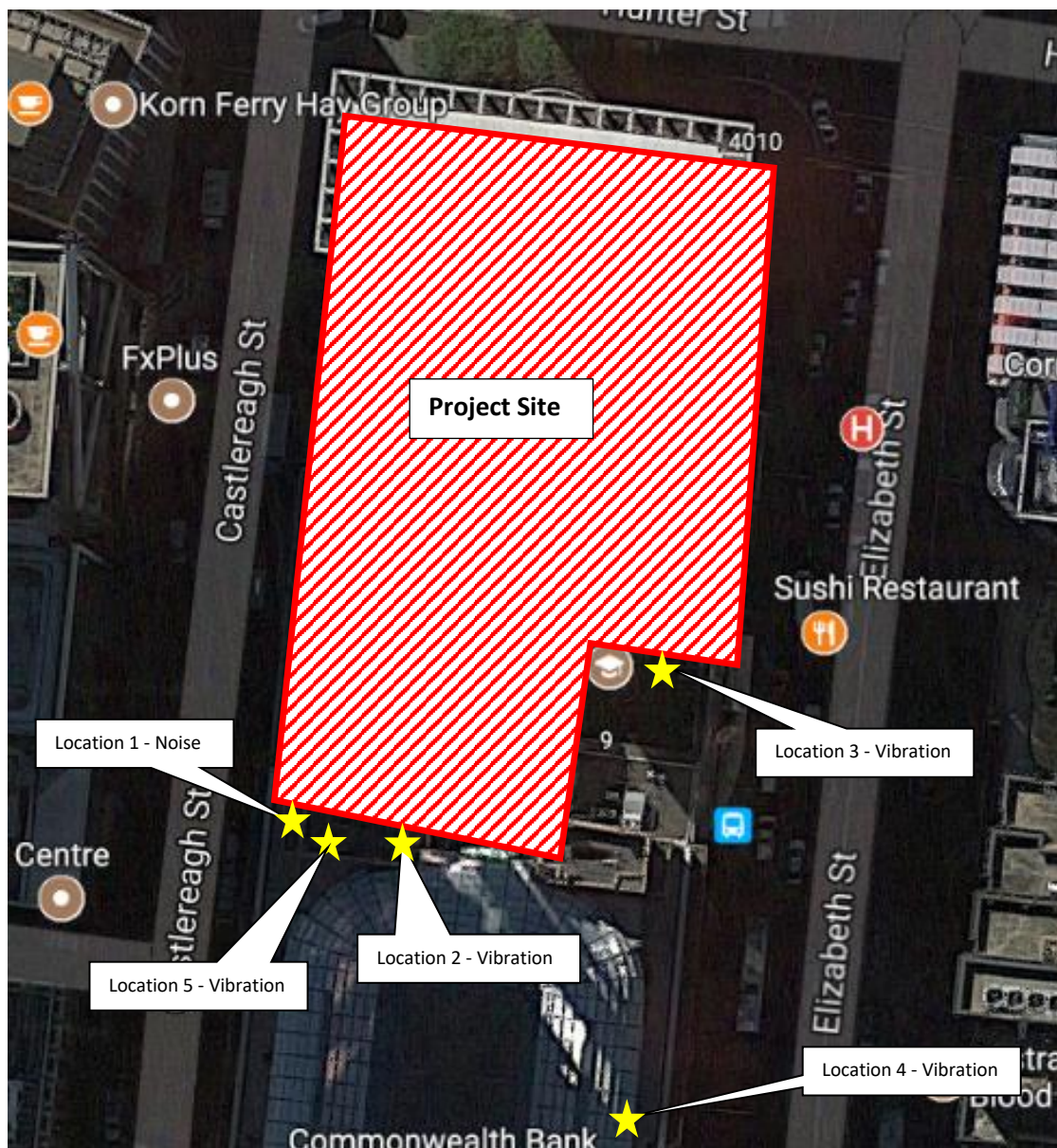
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60$ dBA for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55$ dBA for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 20 July to 26 July 2018. The full set of $L_{Aeq}(15\text{minute})$ noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient $L_{Aeq}(15\text{minute})$ Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
20 July 2018	43	42	Complies	Complies
21 July 2018	40	39	Complies	Complies
22 July 2018	38	37	Complies	Complies
23 July 2018	39	38	Complies	Complies
24 July 2018	44	43	Complies	Complies
25 July 2018	46	45	Complies	Complies
26 July 2018	47	45	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of $L_{Aeq}(15\text{ minute})$ noise levels between 7.00 am and 8.00 pm.

Table 3 and **Table 4** present a summary of the measured ambient vibration levels at Location 2 and Location 4, respectively, during the period 20 July to 26 July 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
20 July 2018	1.0 mm/s	Complies
21 July 2018	0.6 mm/s	Complies
22 July 2018	0.6 mm/s	Complies
23 July 2018	1.9 mm/s	Complies
24 July 2018	3.2 mm/s	Above Early Warning Level
25 July 2018	1.3 mm/s	Complies
26 July 2018	5.2 mm/s	Above Early Warning Level

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
20 July 2018	1.2 mm/s	Complies
21 July 2018	0.7 mm/s	Complies
22 July 2018	0.4 mm/s	Complies
23 July 2018	5.0 mm/s	Complies
24 July 2018	1.5 mm/s	Complies
25 July 2018	0.3 mm/s	Complies
26 July 2018	2.5 mm/s	Complies

5 Conclusion

Noise monitoring conducted during the period 20 July to 26 July 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 20 July to 26 July 2018 found two events which were above the early warning level at Location 2. All recorded ambient vibration levels however, were below the maximum vibration control limit at all vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling
Principal - Acoustics & Vibration

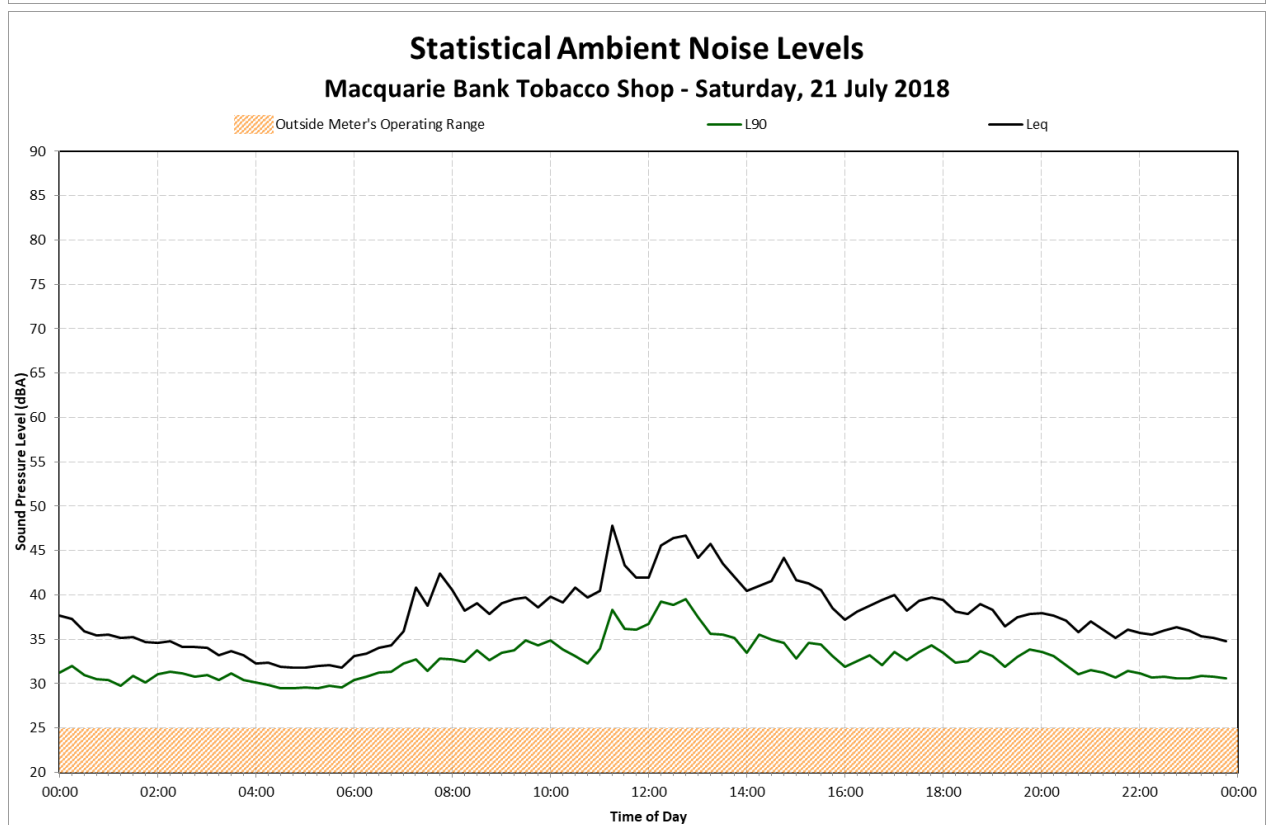
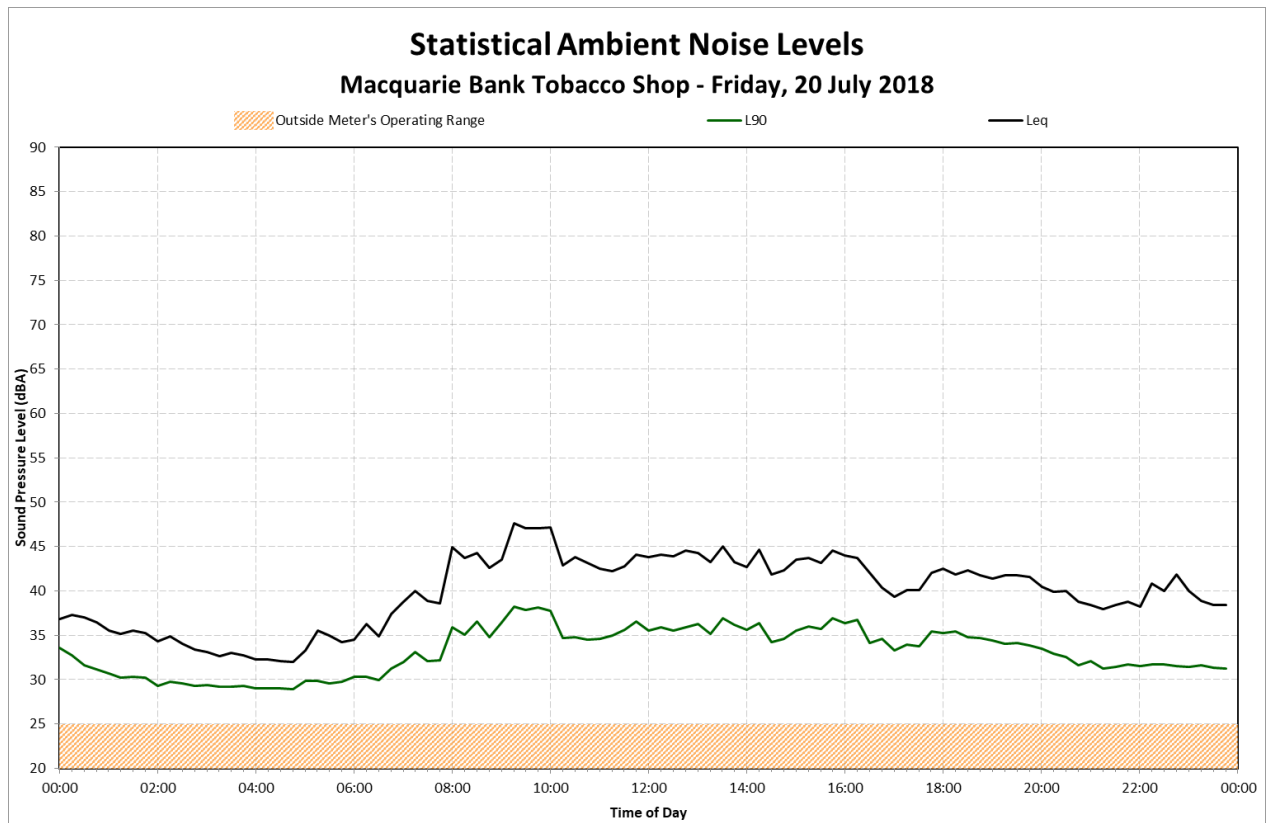
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

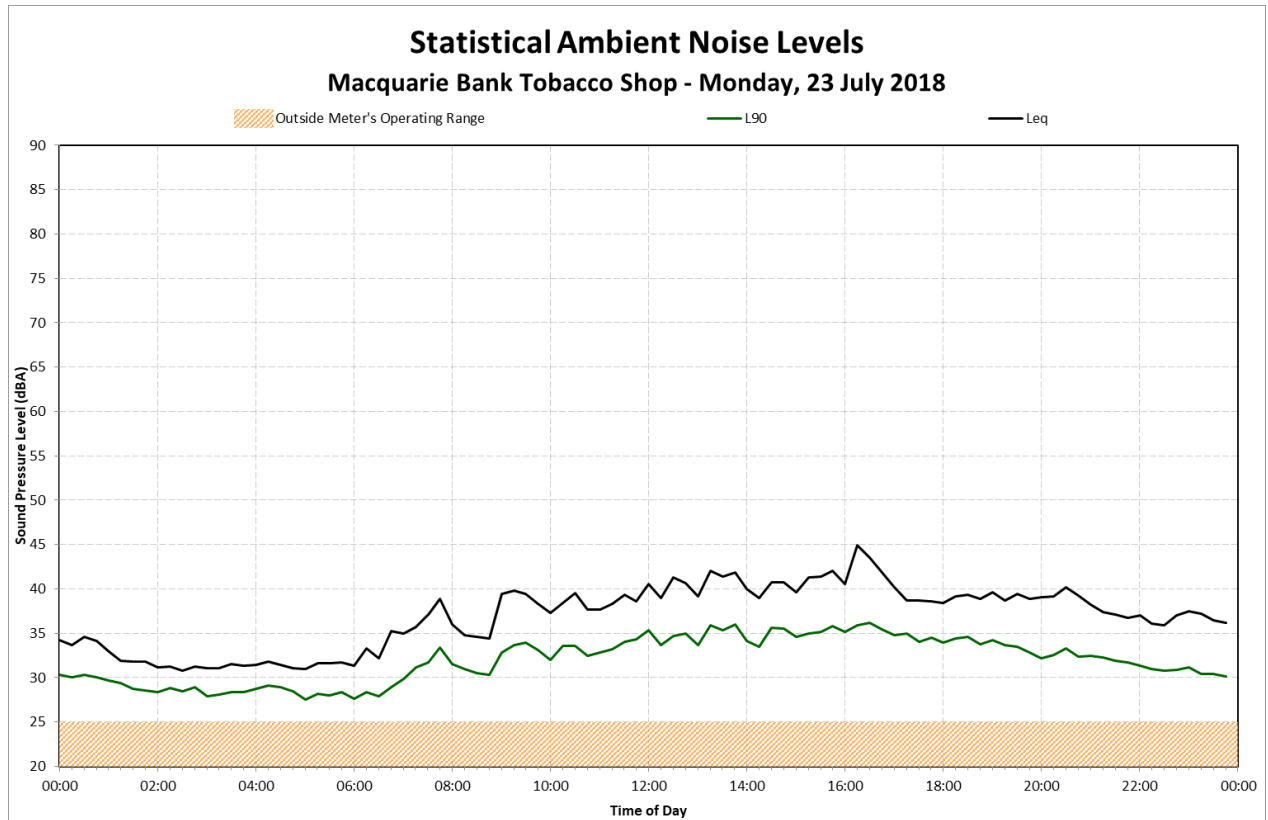
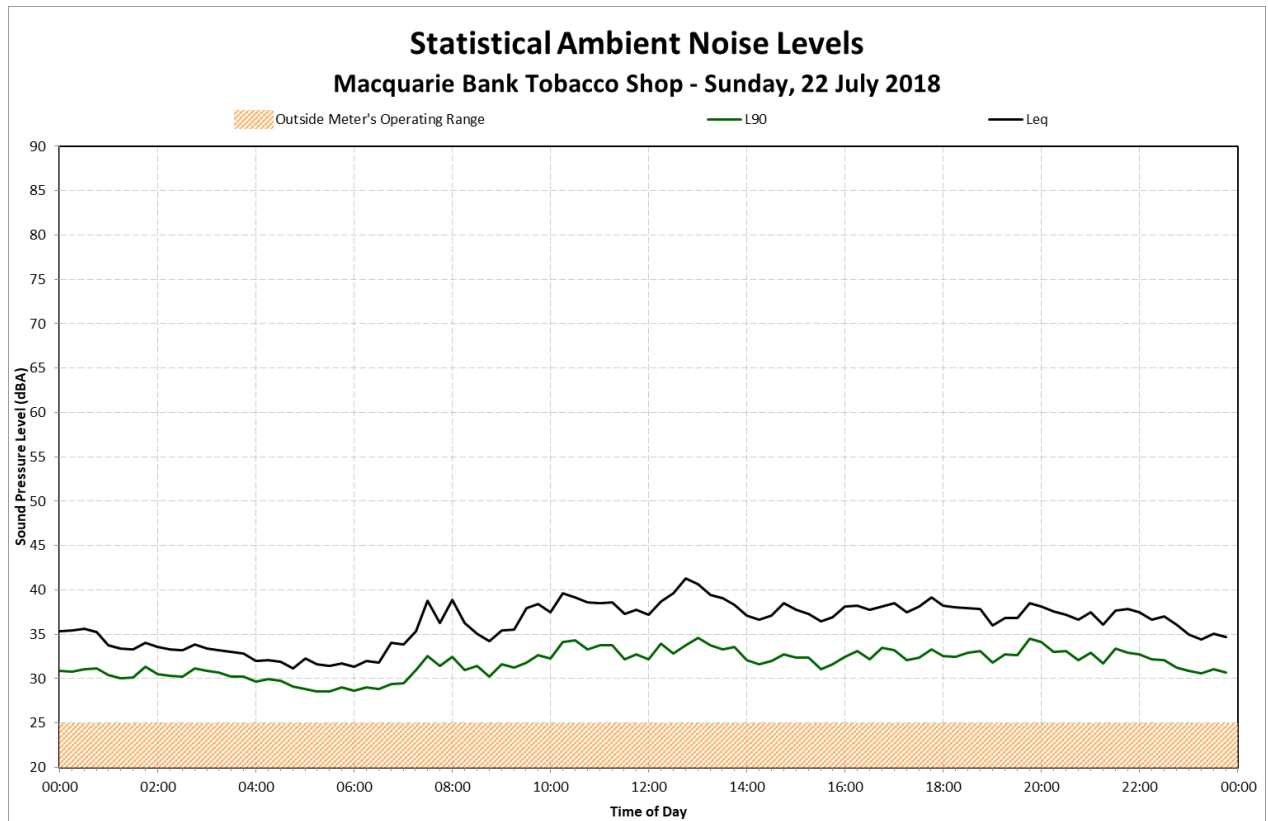
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

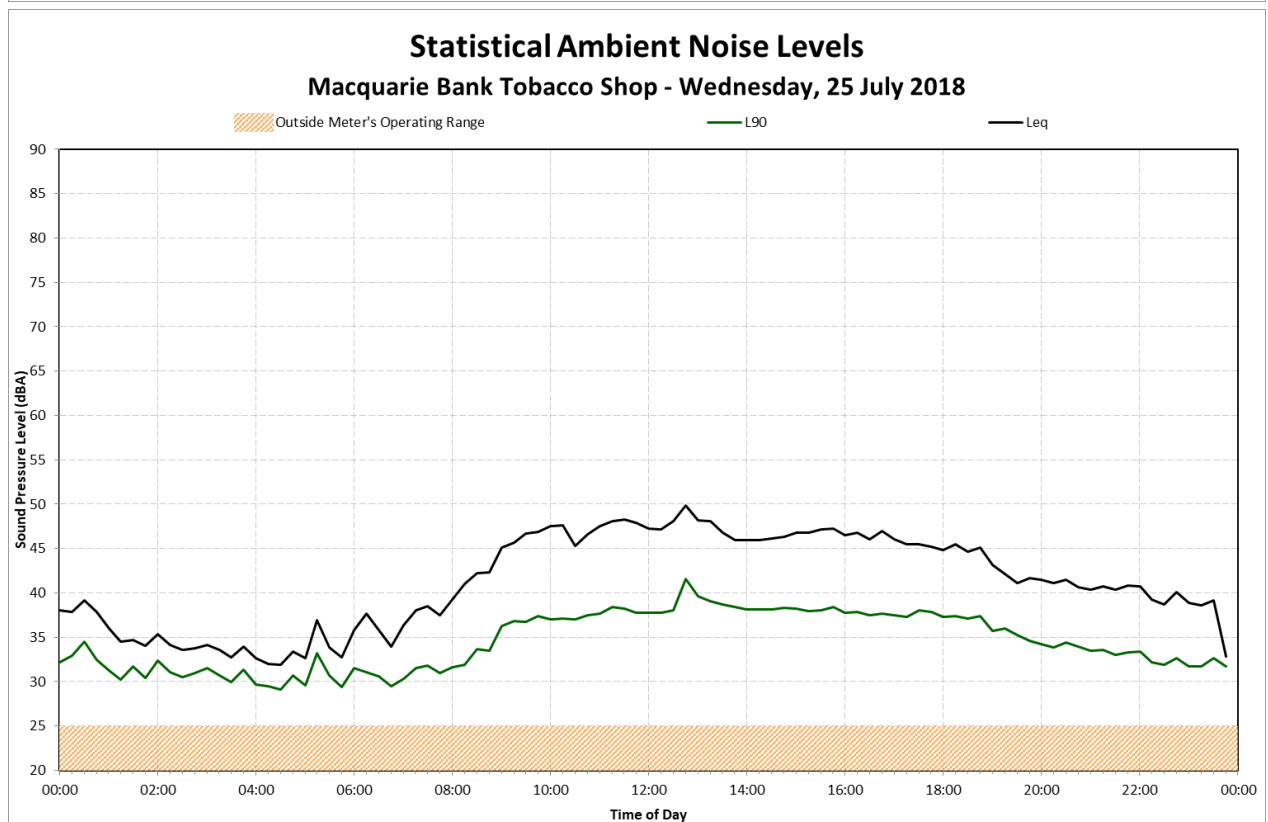
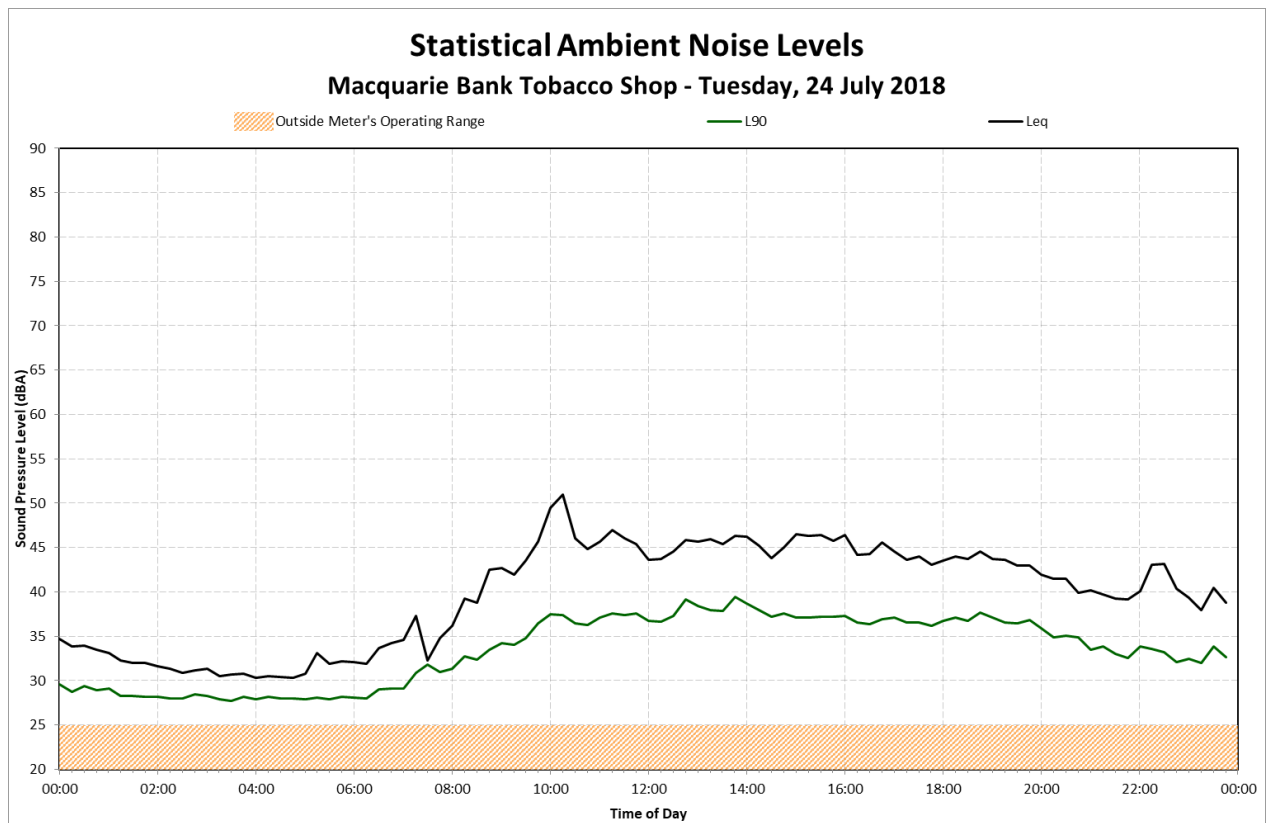
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

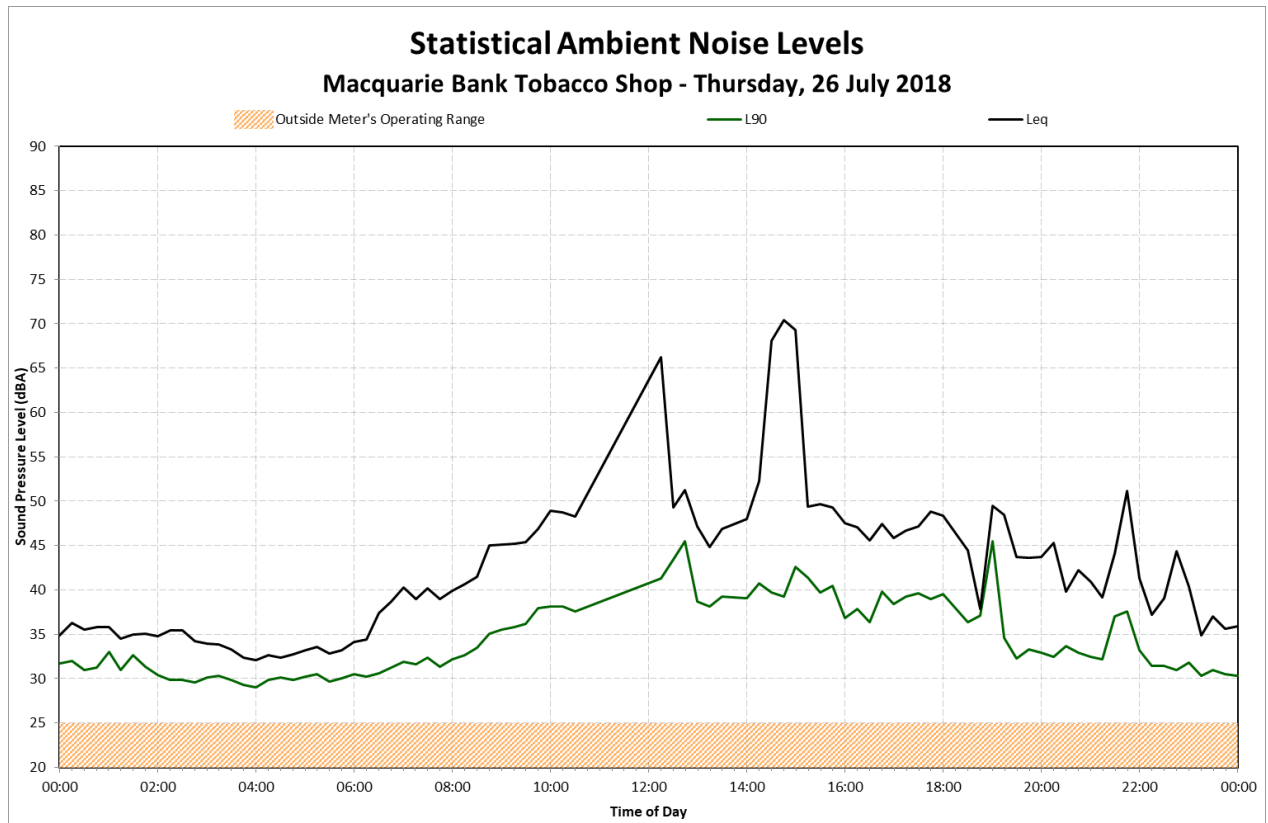
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

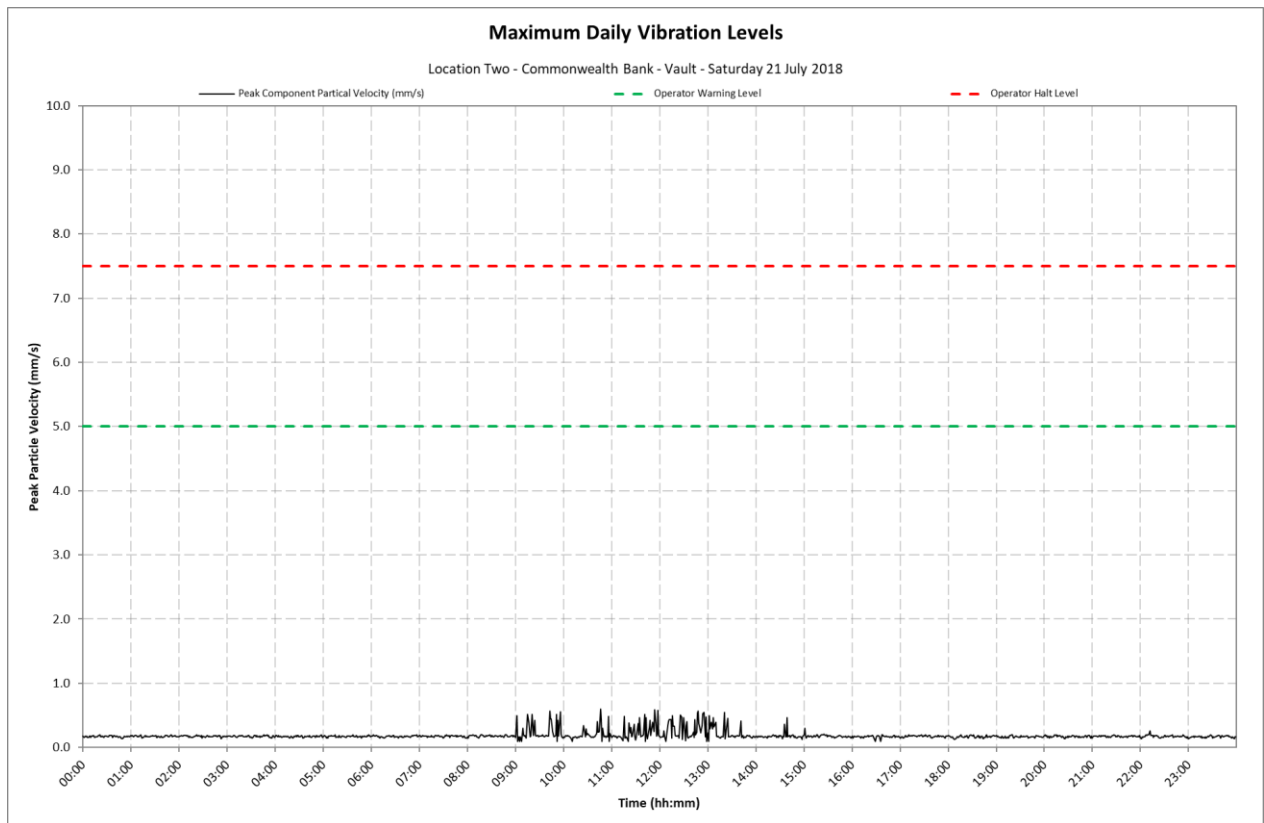
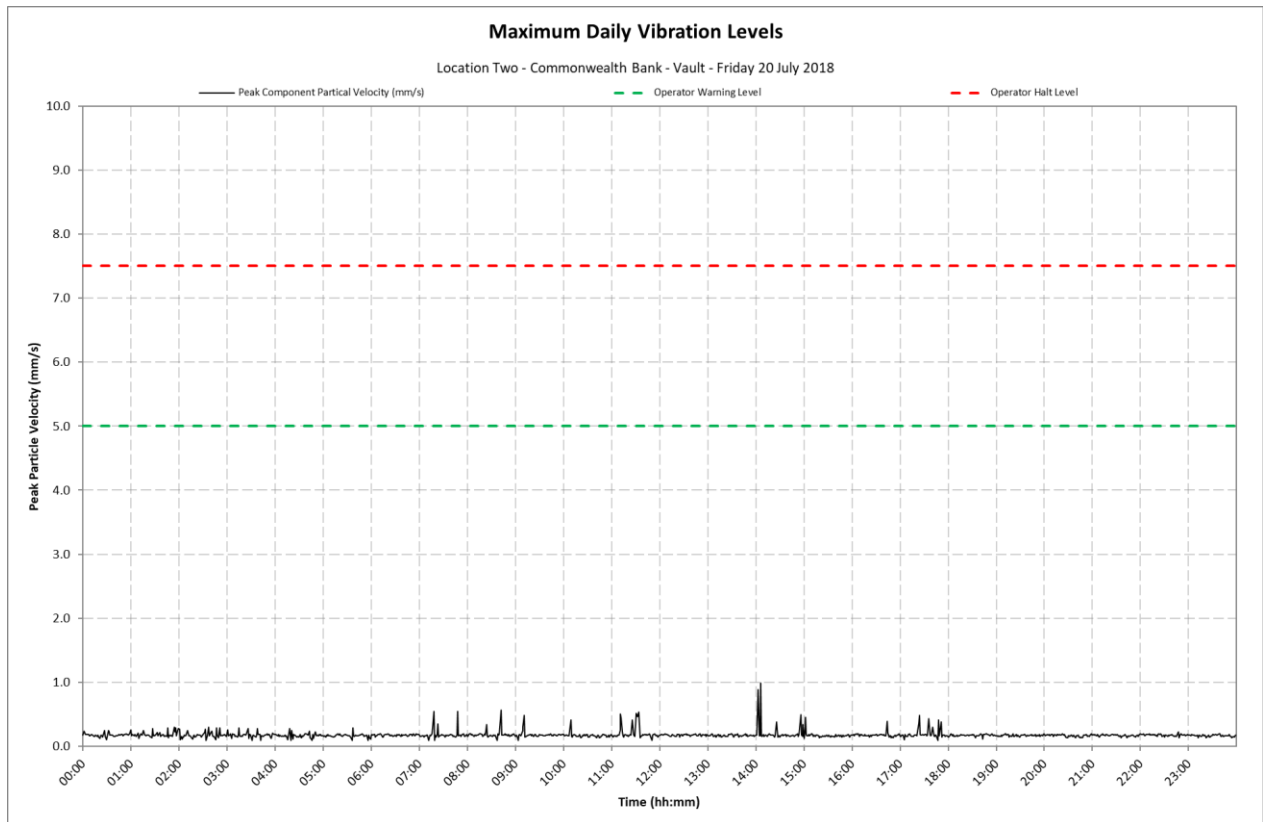
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

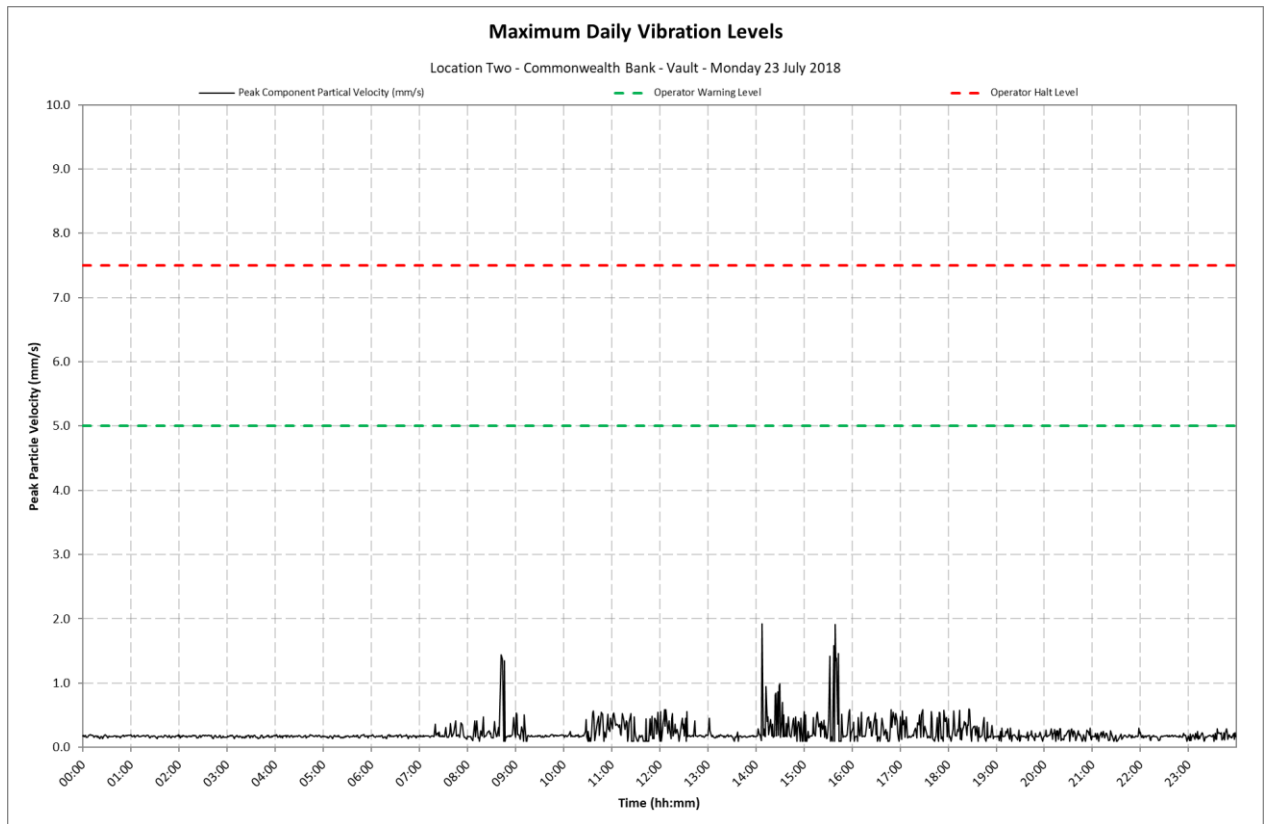
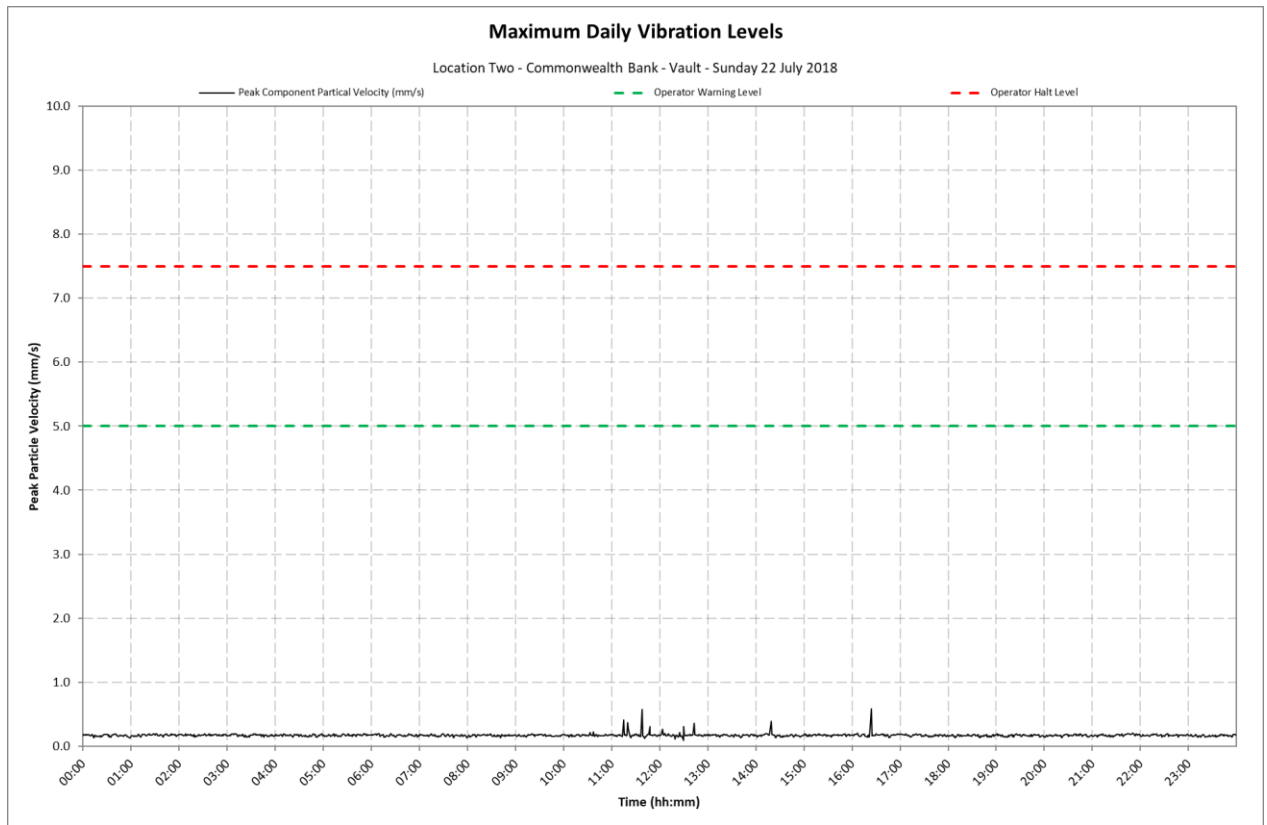
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

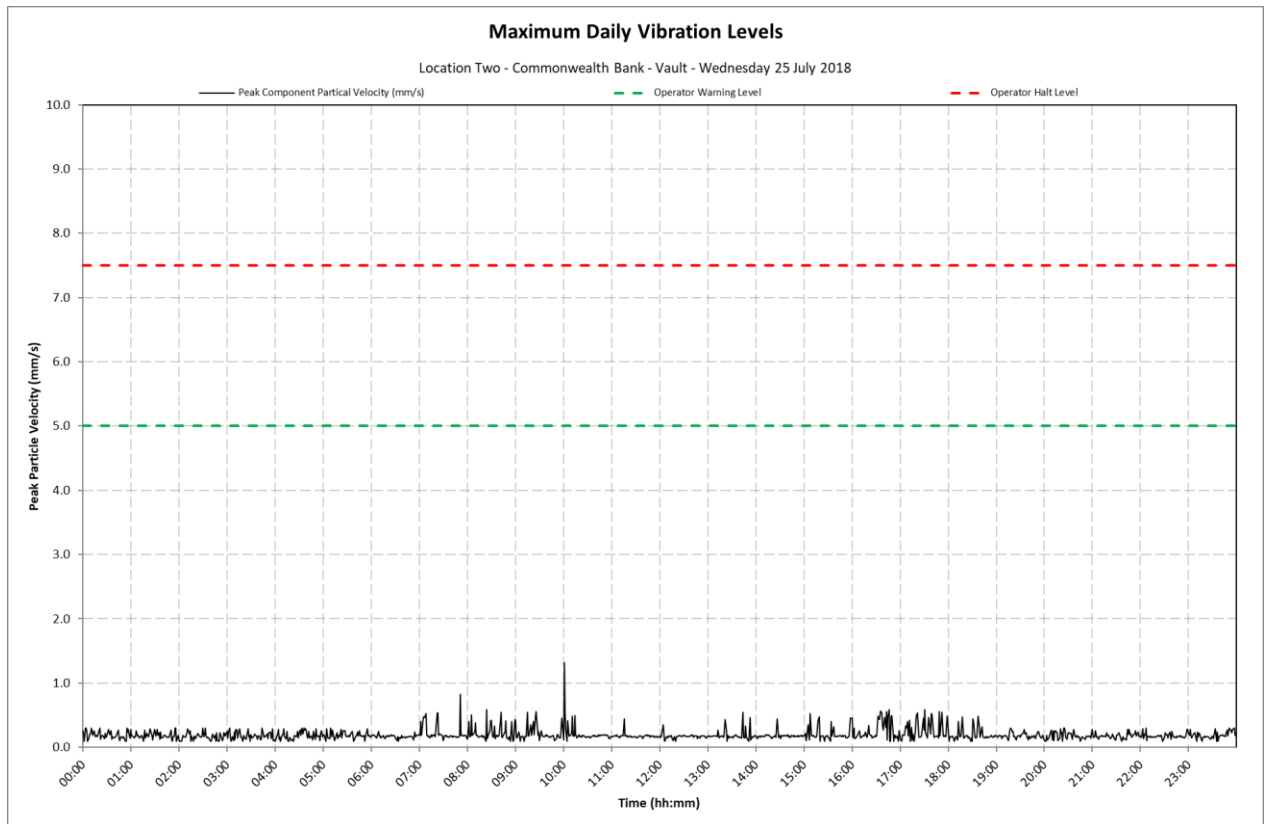
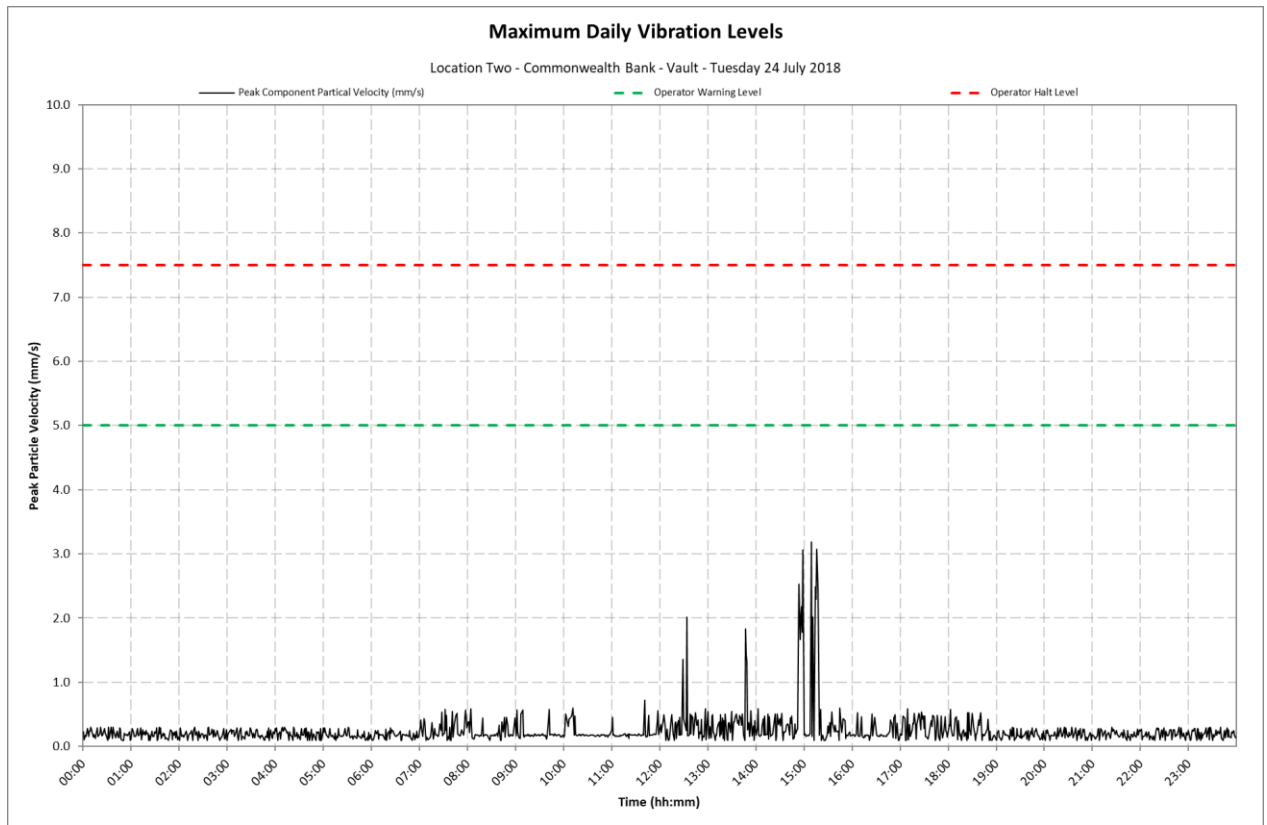
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

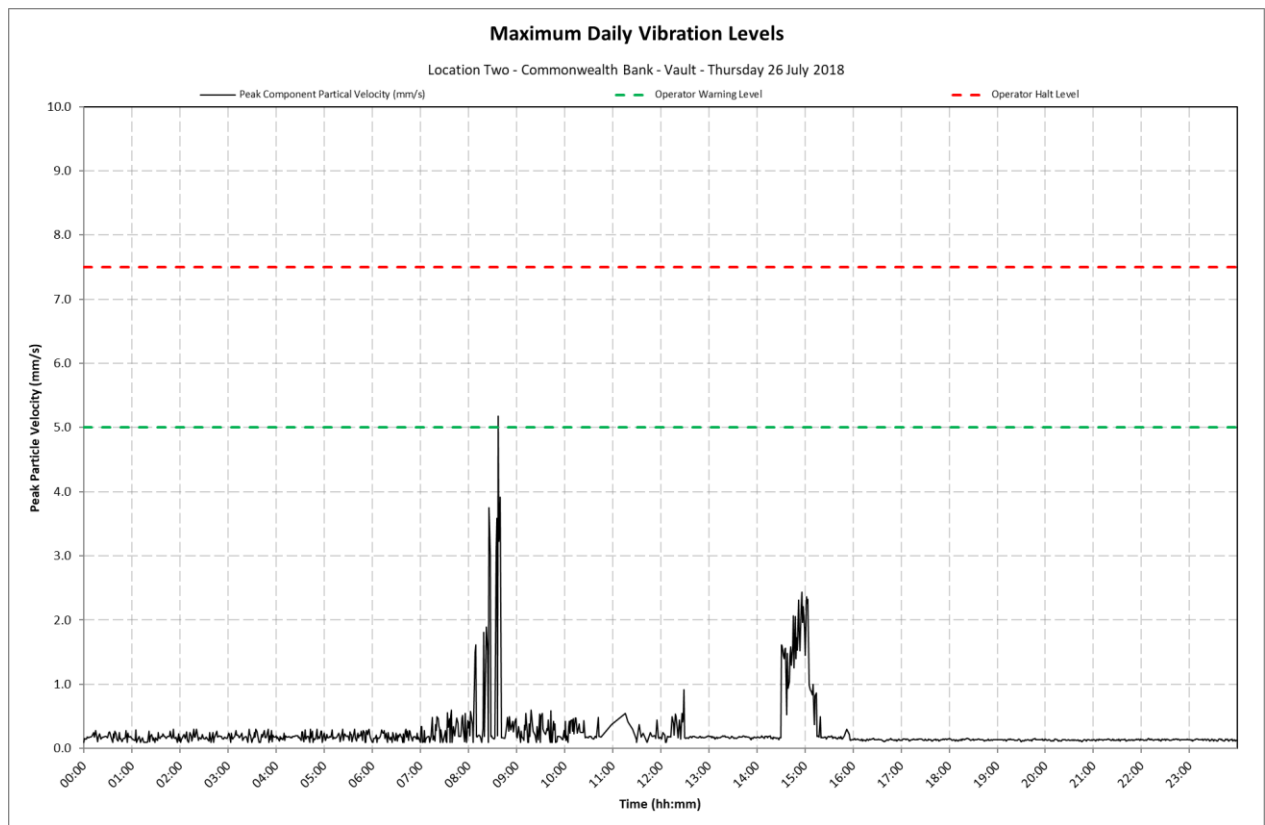
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

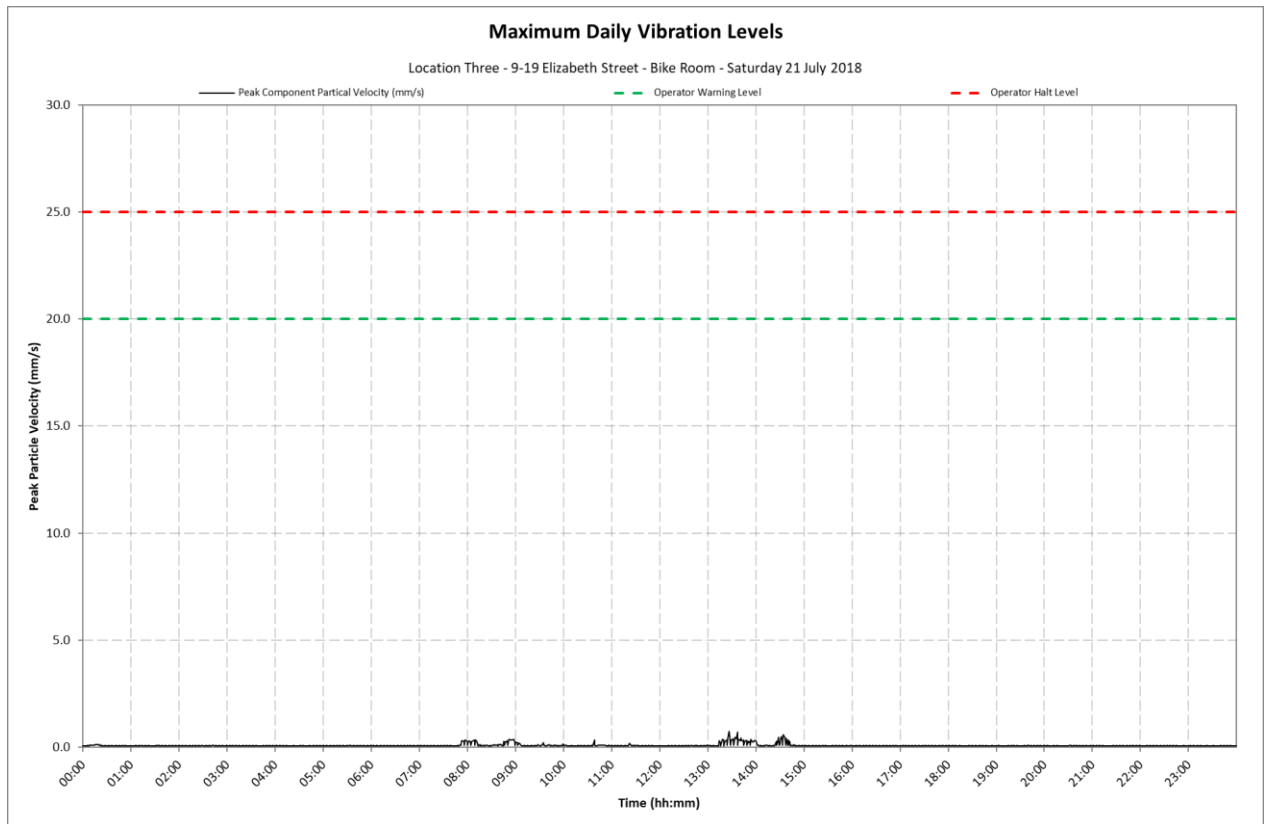
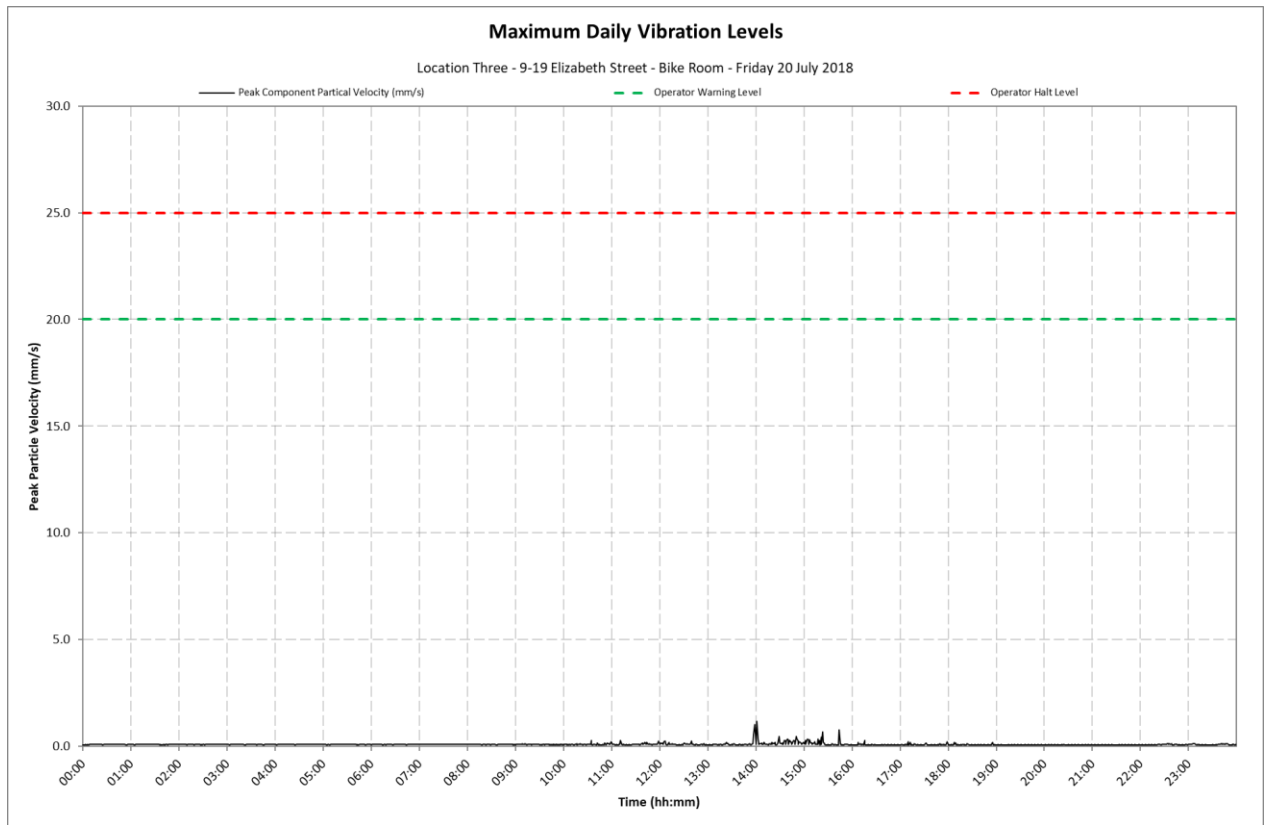
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

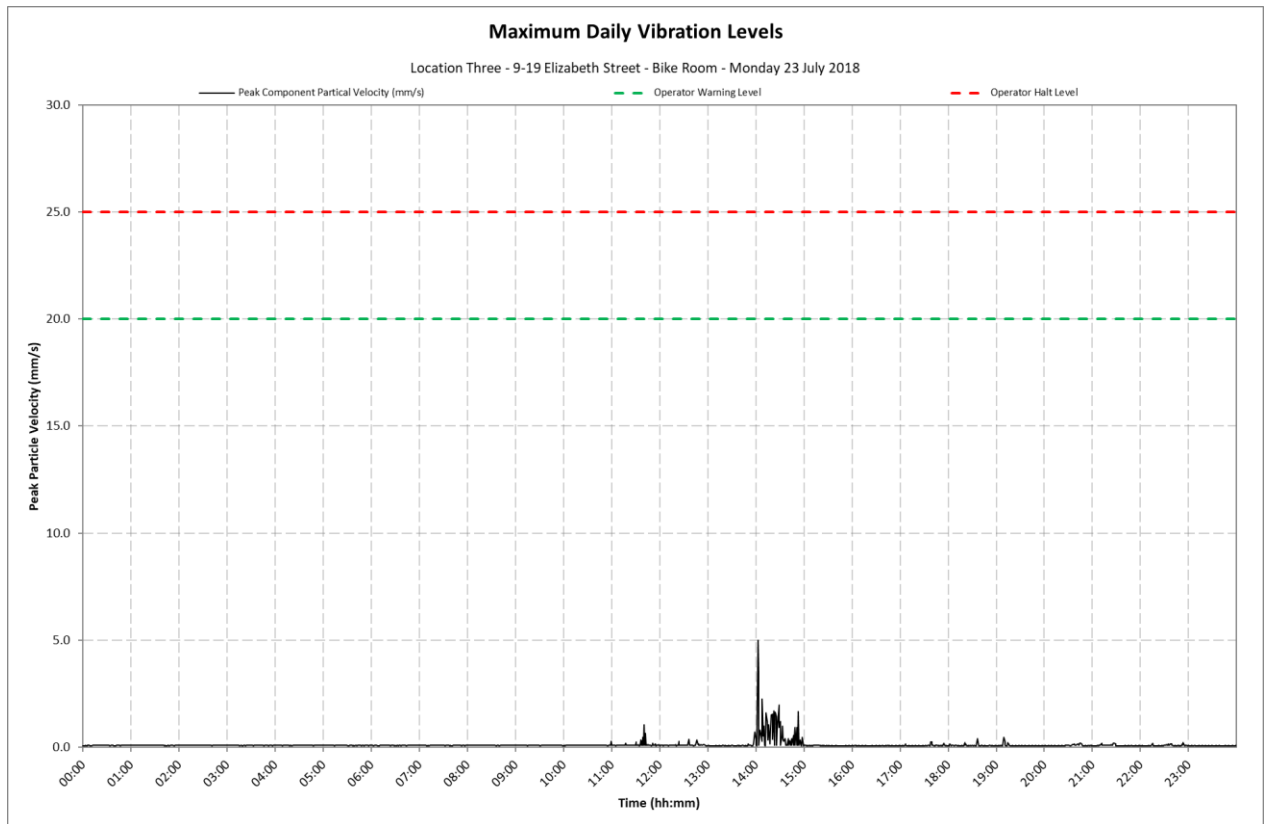
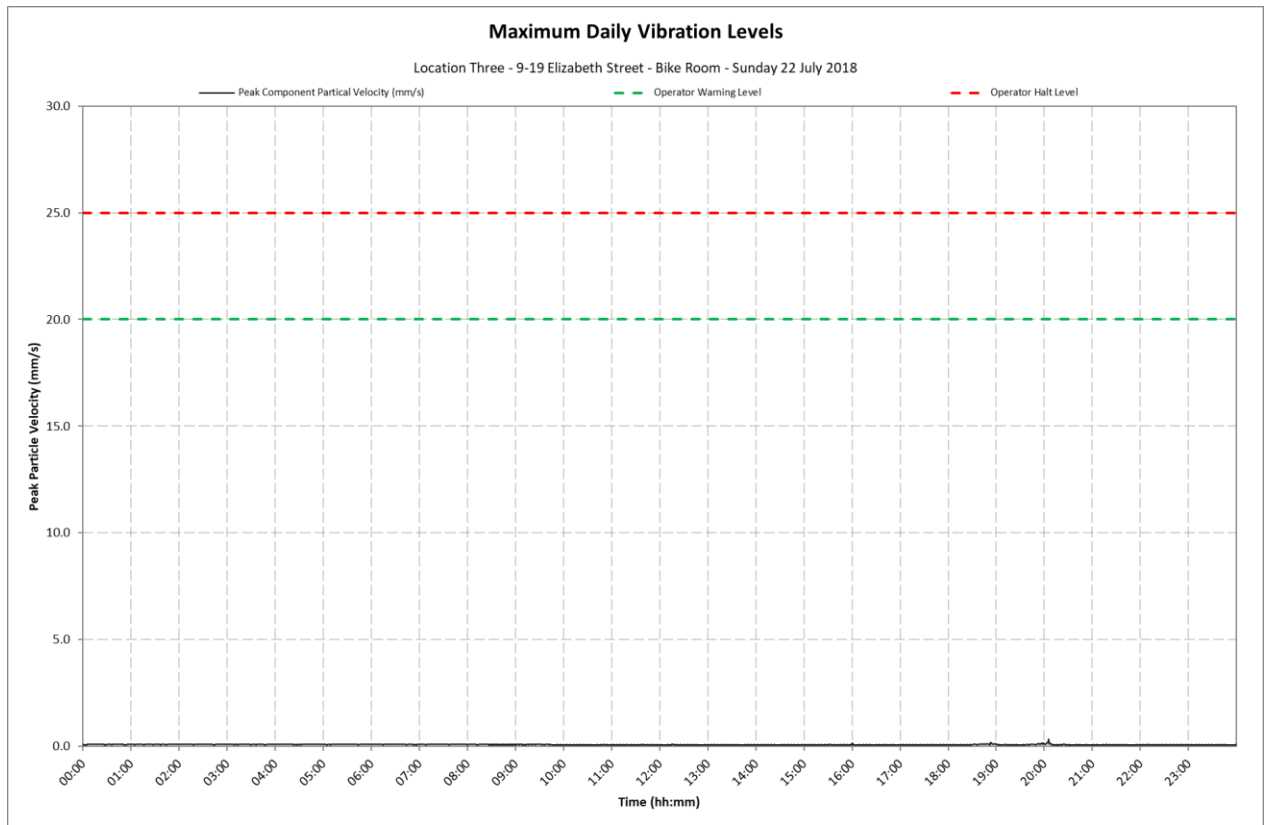
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

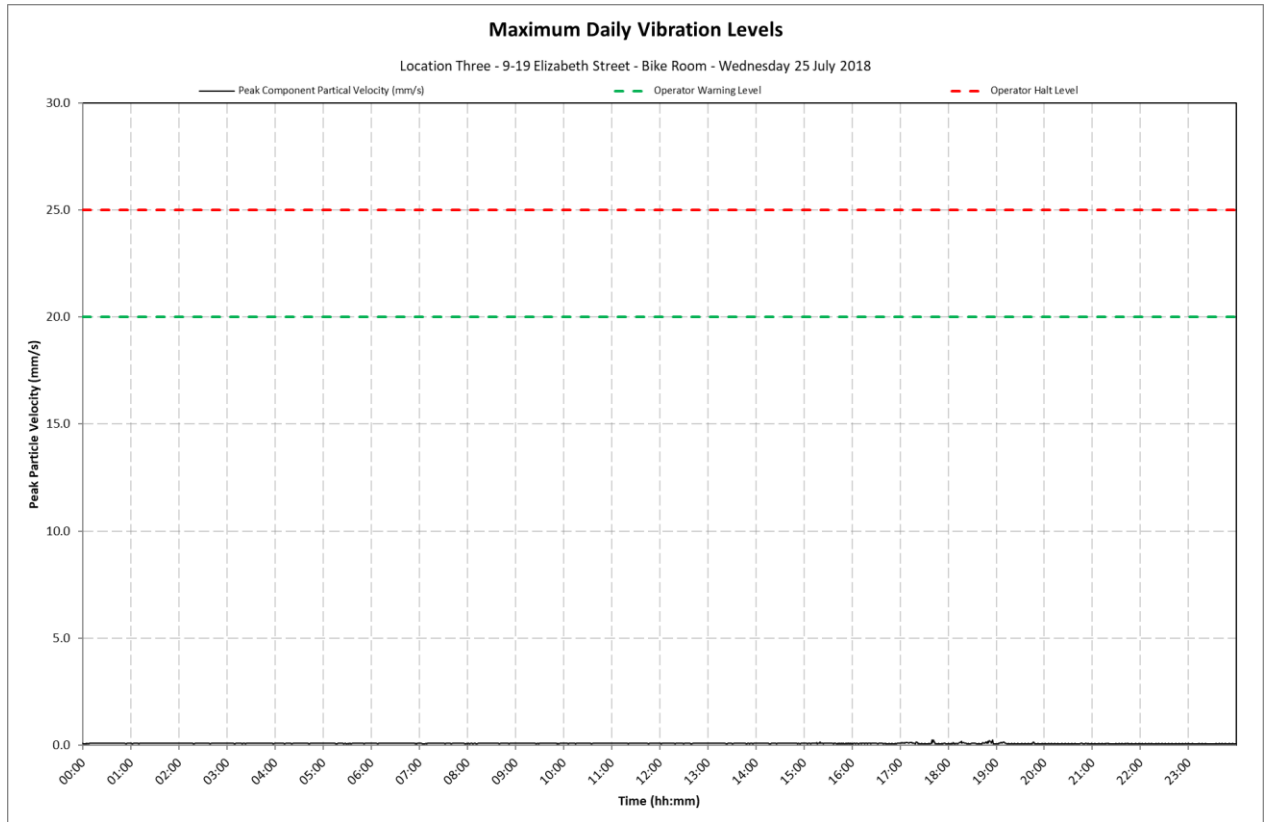
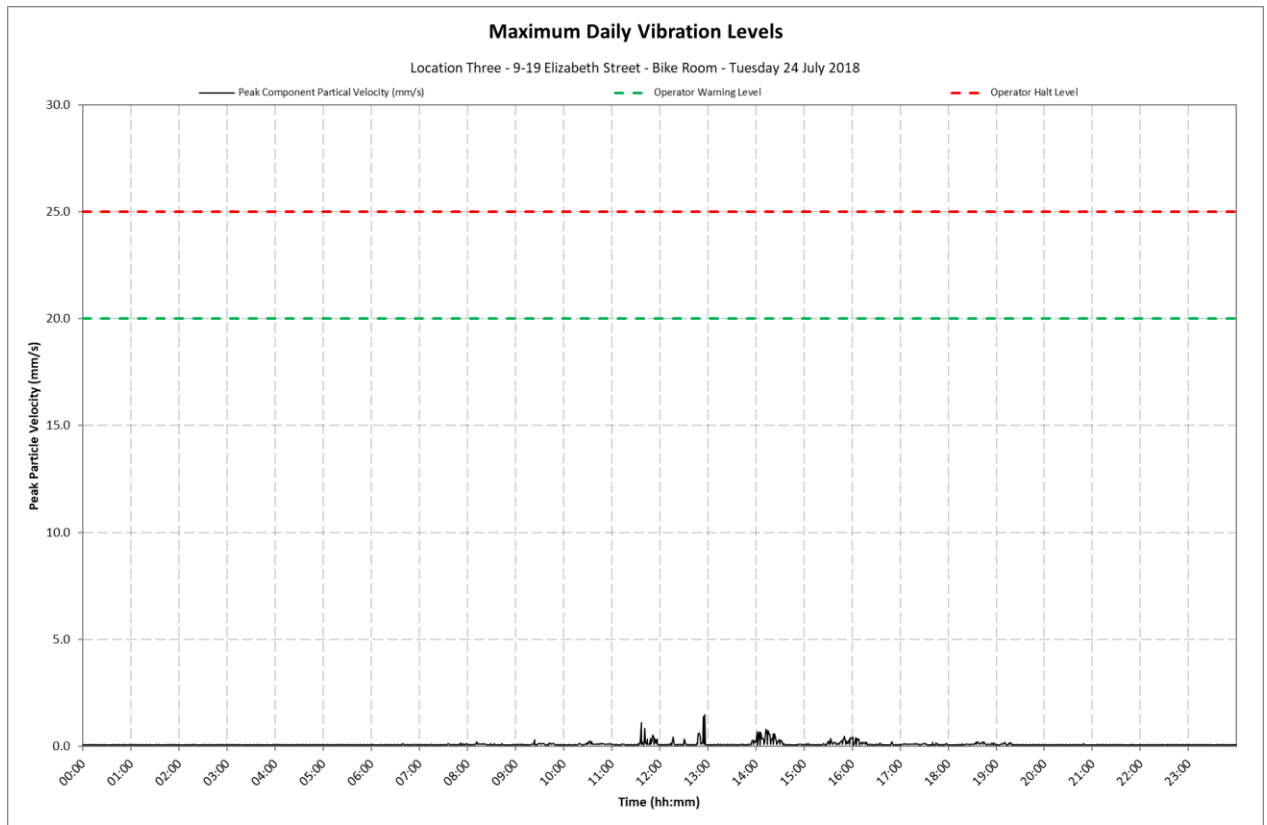
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

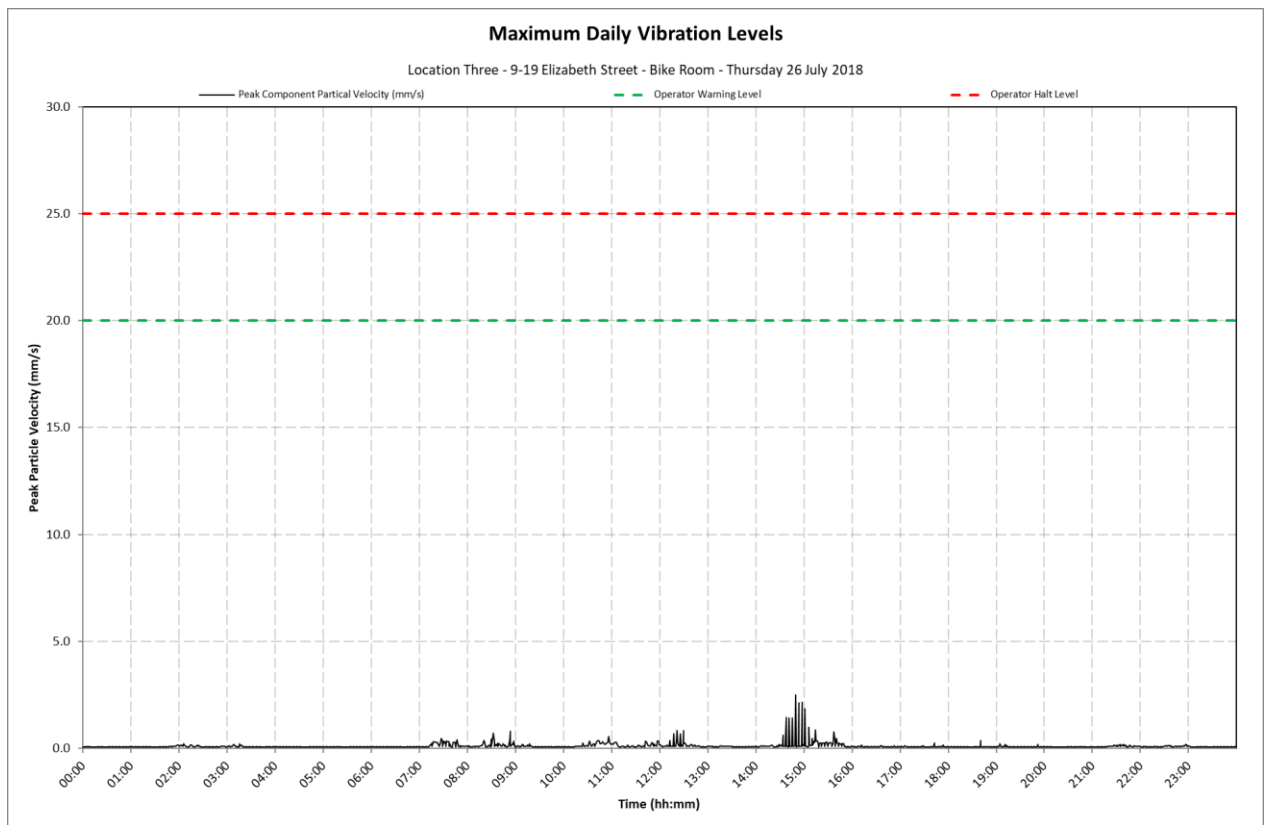
Location 3 - 9-19 Elizabeth Street - Bike Room



Appendix C2

Daily Vibration Levels

Location 3 - 9-19 Elizabeth Street - Bike Room





14 August 2018

10-1380 R37 NV Monitoring R1 20180814.docx

Metropolitan Demolitions Pty Limited
396 Princes Highway
St Peters NSW 2044

Attention: Mr Tom Mahon

Dear Tom

**Sydney Metro City & Southwest Project
Package B - Martin Place - Demolition Works
Continuous Noise and Vibration Monitoring Report 37
27 July to 12 August 2018**

1 Introduction

VMS Australia Pty Ltd (VMS) was engaged by Metropolitan Demolitions Pty Limited (MD) to conduct continuous noise and vibration monitoring in relation to demolition works associated with the Sydney Metro City & Southwest Project, Package B - Martin Place (Project Site). The Project consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street
- 8 to 12 Castlereagh Street

This report presents the continuous noise and vibration monitoring results associated with the real-time monitoring that was undertaken during the period 27 July to 12 August 2018.

The measurements were undertaken to ensure that the noise and vibration emission levels from the demolition activities were compliant with the relevant criteria on an ongoing basis and to provide real-time levels to the MD, Environmental Representative (ER), Acoustic Advisor (AA), NSW Department of Planning and Environment (DP&E) and NSW Environment Protection Authority (EPA), as required.

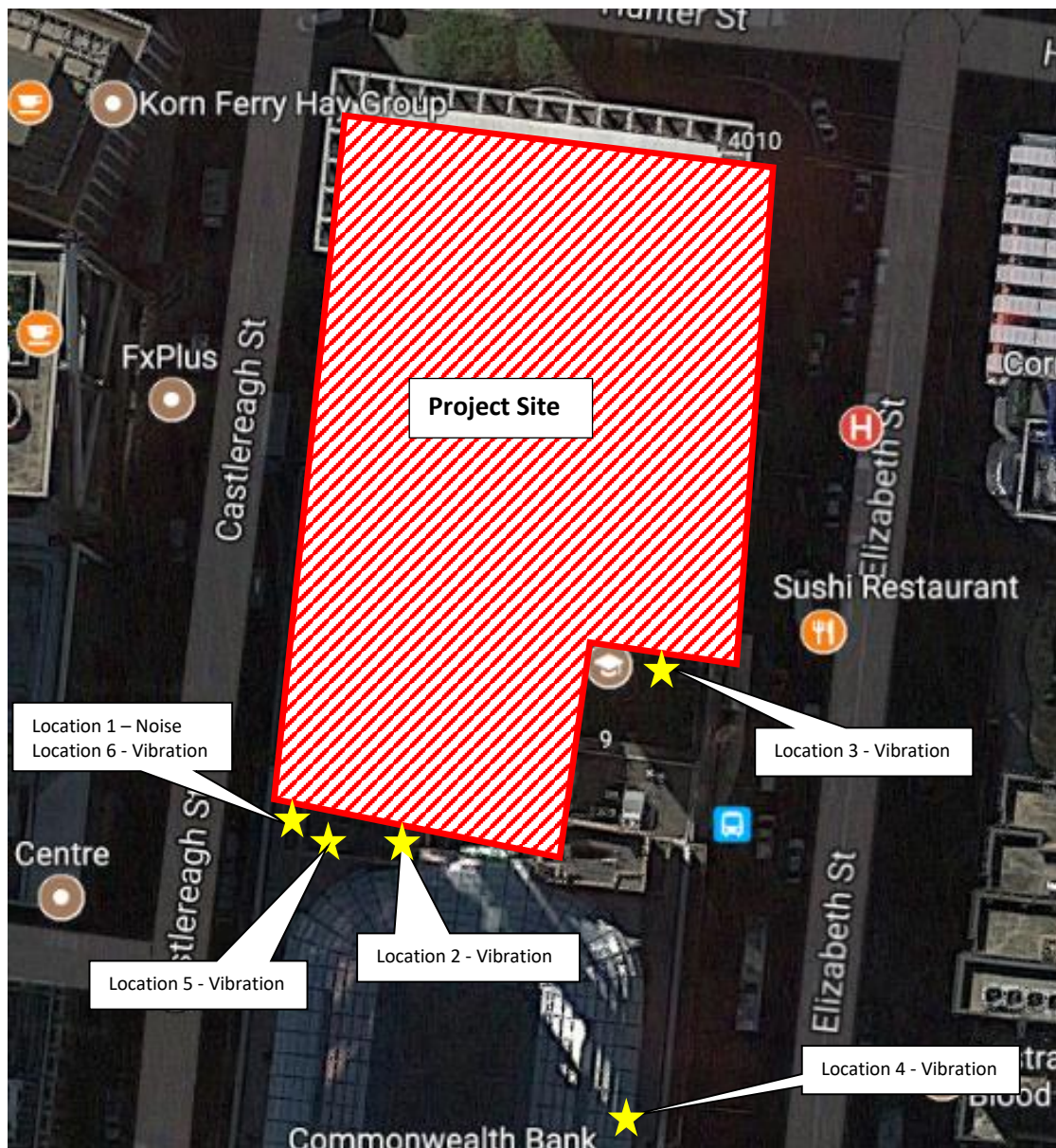
2 Monitoring Location

Continuous real-time noise and vibration monitoring was conducted at the following locations:

- Location 1 Noise Macquarie Bank Tobacco Shop (Ground floor)
- Location 2 Vibration Commonwealth Bank - Vault (Basement)
- Location 3 Vibration 9-19 Elizabeth Street - Bike Room (Reinstalled 31/05/2018)
- Location 4 Vibration Level 9, 48-50 Martin Place (Removed 30/01/2018)
- Location 5 Vibration Level 7, 48-50 Martin Place (Removed 31/05/2018)
- Location 6 Vibration Macquarie Bank Tobacco Shop (Ground floor) (Installed 26/07/2018)

The monitoring locations are shown in **Figure 1**.

Figure 1 Noise and Vibration Monitoring Locations



3 Noise and Vibration Criteria

Based on the information contained in the *Construction Noise and Vibration Management Plan (CNVMP) Sydney Metro City & Southwest Package B – Martin Place* (CNVMP, VMS Report MD1968/09 dated 4 October 2017) demolition noise and vibration criteria have been nominated and are reproduced below.

3.1 Noise Criteria - Location 1

Between the hours 7am and 8pm, the following internal noise control limits apply:

- $L_{Aeq}(15\text{minute}) < 60 \text{ dBA}$ for at least 6.5 hours
- $L_{Aeq}(15\text{minute}) < 55 \text{ dBA}$ for at least 3.25 hours

3.2 Vibration Criteria - Location 2 and 3

The relevant vibration control limits are presented below in **Table 1**.

Table 1 Vibration Control Limits

Monitoring Location	Vibration Control Limits
48-50 Martin Place (Locations 2 and 6)	Early Warning Level - 3 mm/s Warning Level - 5 mm/s Halt Level - 7.5 mm/s
9-19 Elizabeth Street (Location 3)	Warning Level - 20 mm/s Halt Level - 25 mm/s

Note 1: Vibration levels are measured in peak component particle velocities.

4 Monitoring Results

Table 2 present a summary of the measured ambient noise levels at Location 1 during the period 27 July to 12 August 2018. The full set of LAeq(15minute) noise levels are shown on daily charts presented in **Appendix B**.

Table 2 Daily Measured Ambient Noise Levels - Location 1

Date	Measured Ambient LAeq(15minute) Noise Level (dBA)		Assessment	
	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²	6.5 Hour Noise Level ¹	3.25 Hour Noise Level ²
27 July 2018	47	45	Complies	Complies
28 July 2018	41	35	Complies	Complies
29 July 2018	34	33	Complies	Complies
30 July 2018	46	44	Complies	Complies
31 July 2018	45	44	Complies	Complies
1 August 2018	46	44	Complies	Complies
2 August 2018	47	46	Complies	Complies
3 August 2018	45	44	Complies	Complies
4 August 2018	41	38	Complies	Complies
5 August 2018	45	41	Complies	Complies
6 August 2018	40	39	Complies	Complies
7 August 2018	46	44	Complies	Complies
8 August 2018	46	44	Complies	Complies
9 August 2018	46	45	Complies	Complies
10 August 2018	46	44	Complies	Complies
11 August 2018	36	35	Complies	Complies
12 August 2018	34	33	Complies	Complies

Note 1: The presented 6.5 hour noise level represents the 50th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Note 2: The presented 3.25 hour noise level represents the 25th percentile of LAeq(15 minute) noise levels between 7.00 am and 8.00 pm.

Table 3 to Table 5 present a summary of the measured ambient vibration levels at Location 2, Location 3, and Location 3 respectively, during the period 27 July to 12 August 2018. The full set of maximum vibration levels per minute are shown on daily charts presented in **Appendix C**.

Table 3 Daily Measured Maximum Vibration Levels - Location 2

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
27 July 2018	0.4 mm/s	Complies
28 July 2018	0.6 mm/s	Complies
29 July 2018	0.2 mm/s	Complies
30 July 2018	2.5 mm/s	Complies
31 July 2018	0.6 mm/s	Complies
1 August 2018	1.0 mm/s	Complies
2 August 2018	2.5 mm/s	Complies
3 August 2018	0.6 mm/s	Complies
4 August 2018	0.6 mm/s	Complies
5 August 2018	0.6 mm/s	Complies
6 August 2018	1.0 mm/s	Complies
7 August 2018	0.2 mm/s	Complies
8 August 2018	1.0 mm/s	Complies
9 August 2018	0.2 mm/s	Complies
10 August 2018	1.0 mm/s	Complies
11 August 2018	0.6 mm/s	Complies
12 August 2018	0.2 mm/s	Complies

Table 4 Daily Measured Maximum Vibration Levels - Location 3

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
27 July 2018	0.9 mm/s	Complies
28 July 2018	0.6 mm/s	Complies
29 July 2018	0.3 mm/s	Complies
30 July 2018	2.5 mm/s	Complies
31 July 2018	1.6 mm/s	Complies
1 August 2018	10.4 mm/s	Complies
2 August 2018	2.5 mm/s	Complies
3 August 2018	0.6 mm/s	Complies
4 August 2018	0.5 mm/s	Complies
5 August 2018	0.5 mm/s	Complies
6 August 2018	1.0 mm/s	Complies
7 August 2018	0.4 mm/s	Complies
8 August 2018	0.9 mm/s	Complies
9 August 2018	0.3 mm/s	Complies
10 August 2018	1.0 mm/s	Complies
11 August 2018	0.6 mm/s	Complies
12 August 2018	0.3 mm/s	Complies

Table 5 Daily Measured Maximum Vibration Levels - Location 6

Date	Measured Ambient Maximum Vibration Level (mm/s)	Assessment
27 July 2018	0.3 mm/s	Complies
28 July 2018	0.6 mm/s	Complies
29 July 2018	0.1 mm/s	Complies
30 July 2018	25.3 mm/s	Above Halt Level
31 July 2018	5.1 mm/s	Above Warning Level
1 August 2018	2.5 mm/s	Complies
2 August 2018	>30 mm/s	Above Halt Level
3 August 2018	0.5 mm/s	Complies
4 August 2018	0.3 mm/s	Complies
5 August 2018	0.1 mm/s	Complies
6 August 2018	>30 mm/s	Above Halt Level
7 August 2018	0.4 mm/s	Complies
8 August 2018	16.3 mm/s	Above Halt Level
9 August 2018	0.4 mm/s	Complies
10 August 2018	2.3 mm/s	Complies
11 August 2018	0.2 mm/s	Complies
12 August 2018	0.2 mm/s	Complies

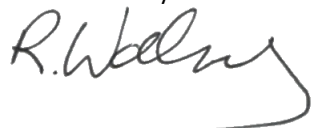
5 Conclusion

Noise monitoring conducted during the period 27 July to 12 August 2018 found the ambient noise levels to be below the internal noise control limits.

Vibration monitoring conducted during the period 27 July to 12 August 2018 daily peak vibration levels at Location 6 to be above the warning level on one occasion, and above the halt level on four occasions. All other recorded ambient vibration levels however, were below the maximum vibration control limit at all vibration monitoring locations.

I trust that the above report meets your current requirements. Should you have any questions or require any additional information, please contact me on 0481 878 761.

Yours sincerely



Ryan Wakeling

Principal - Acoustics & Vibration

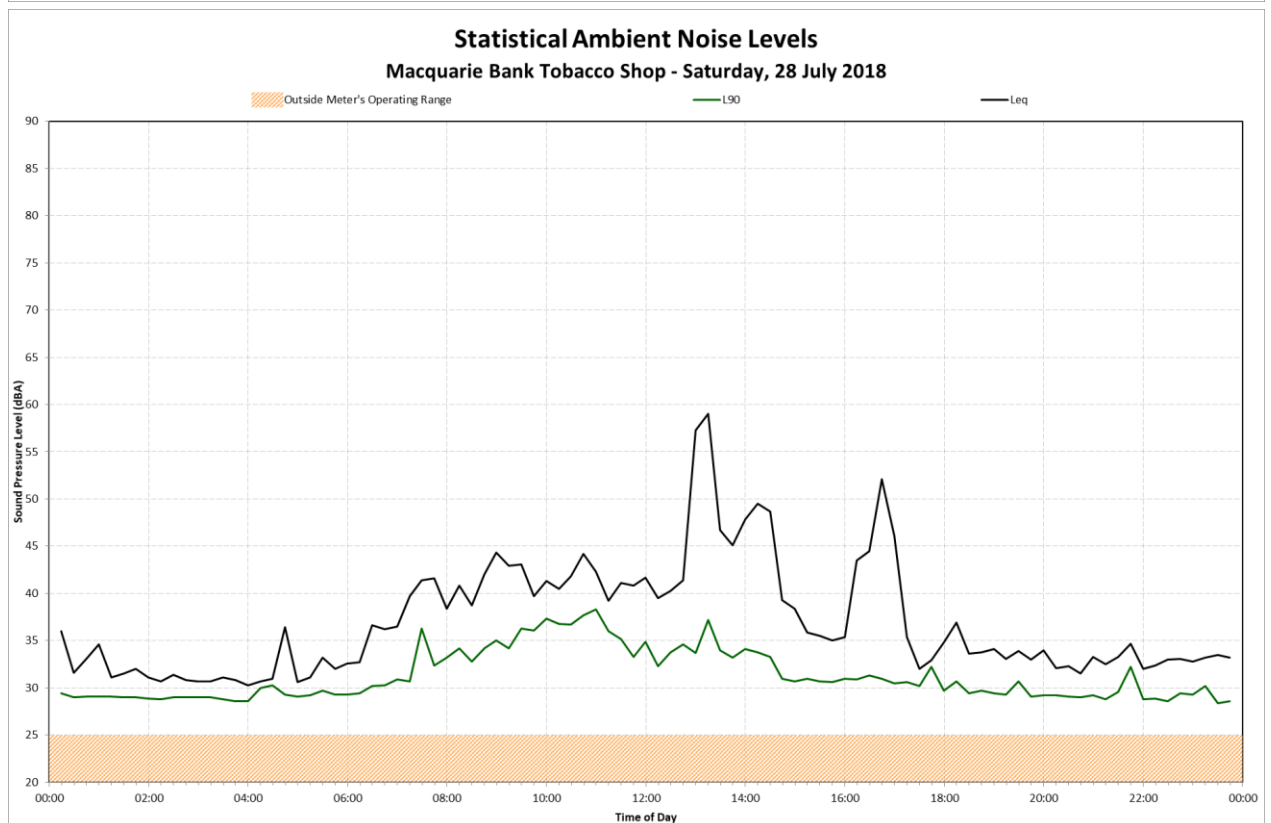
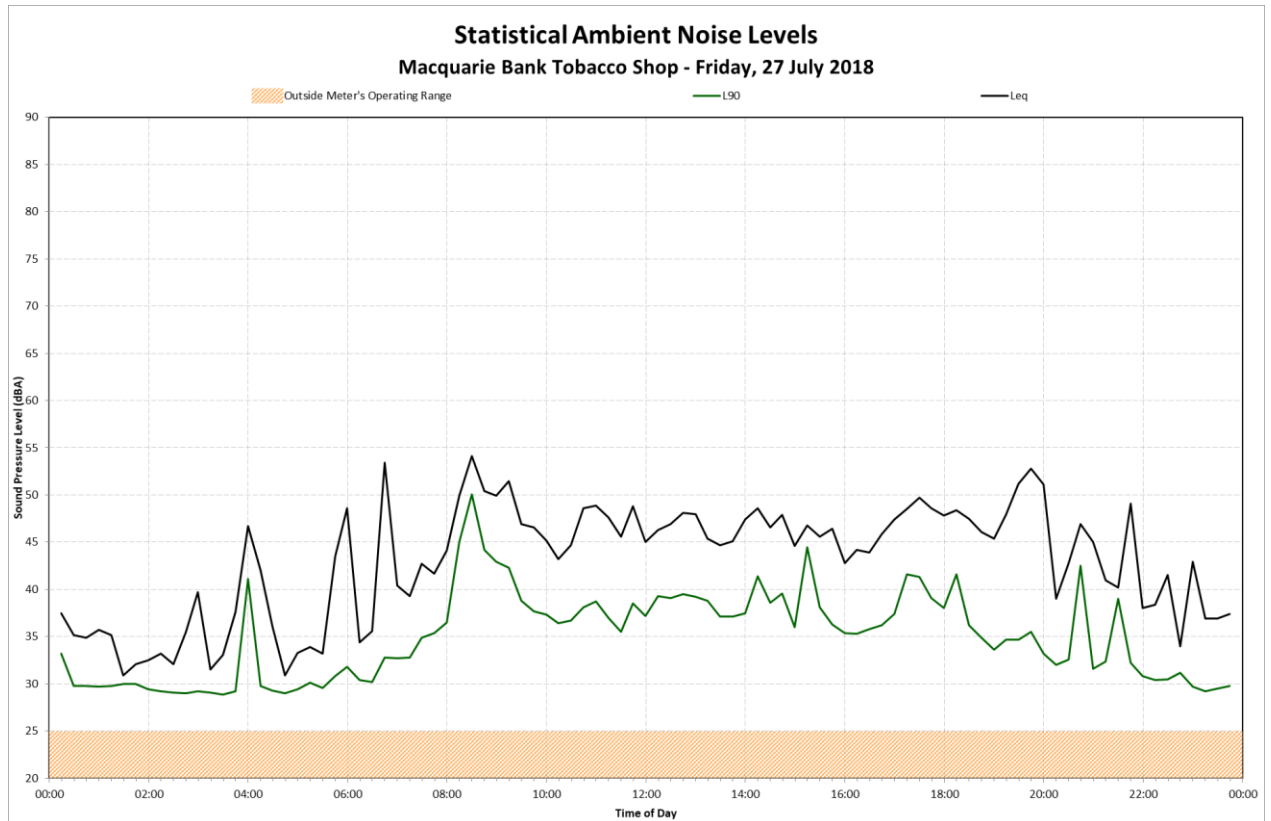
Terminology Relating to Noise and Vibration

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted, or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration, it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Root-mean-squared method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B

Daily Noise Levels

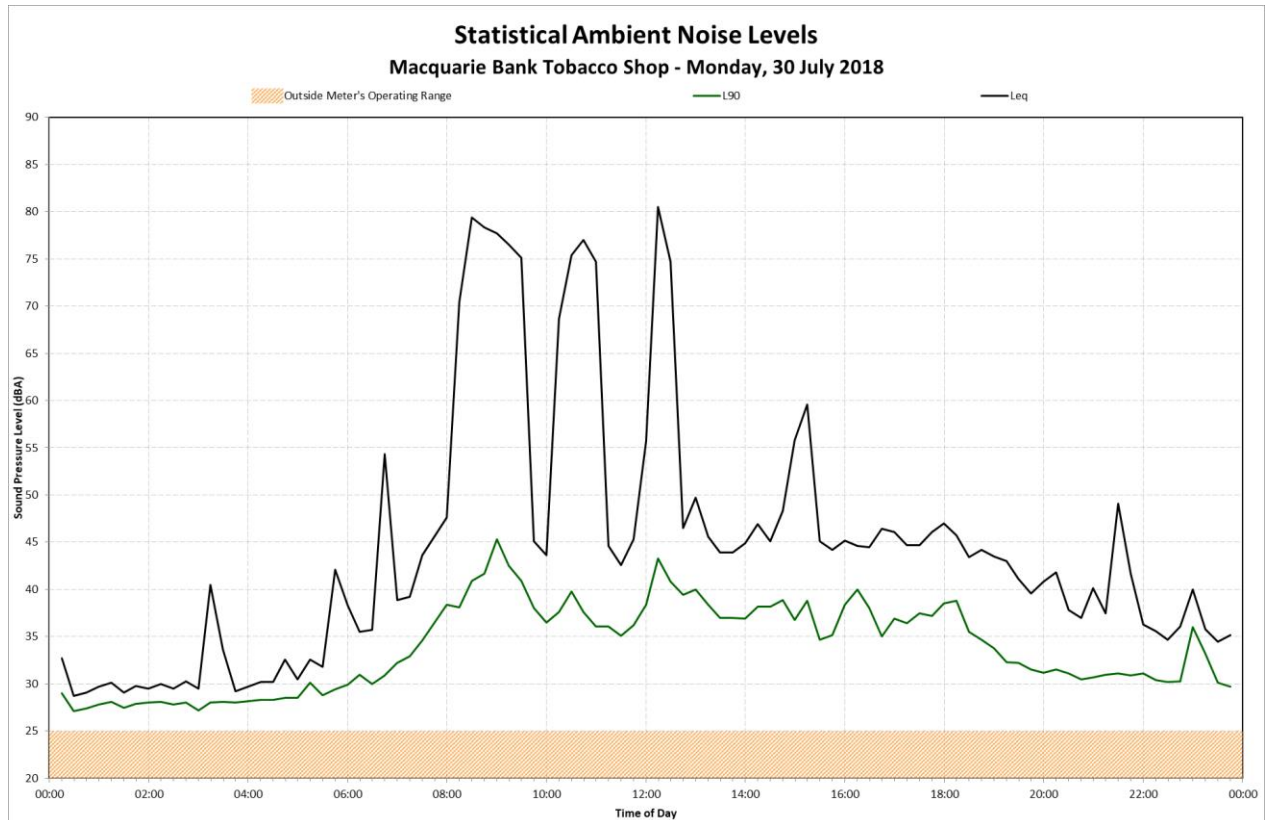
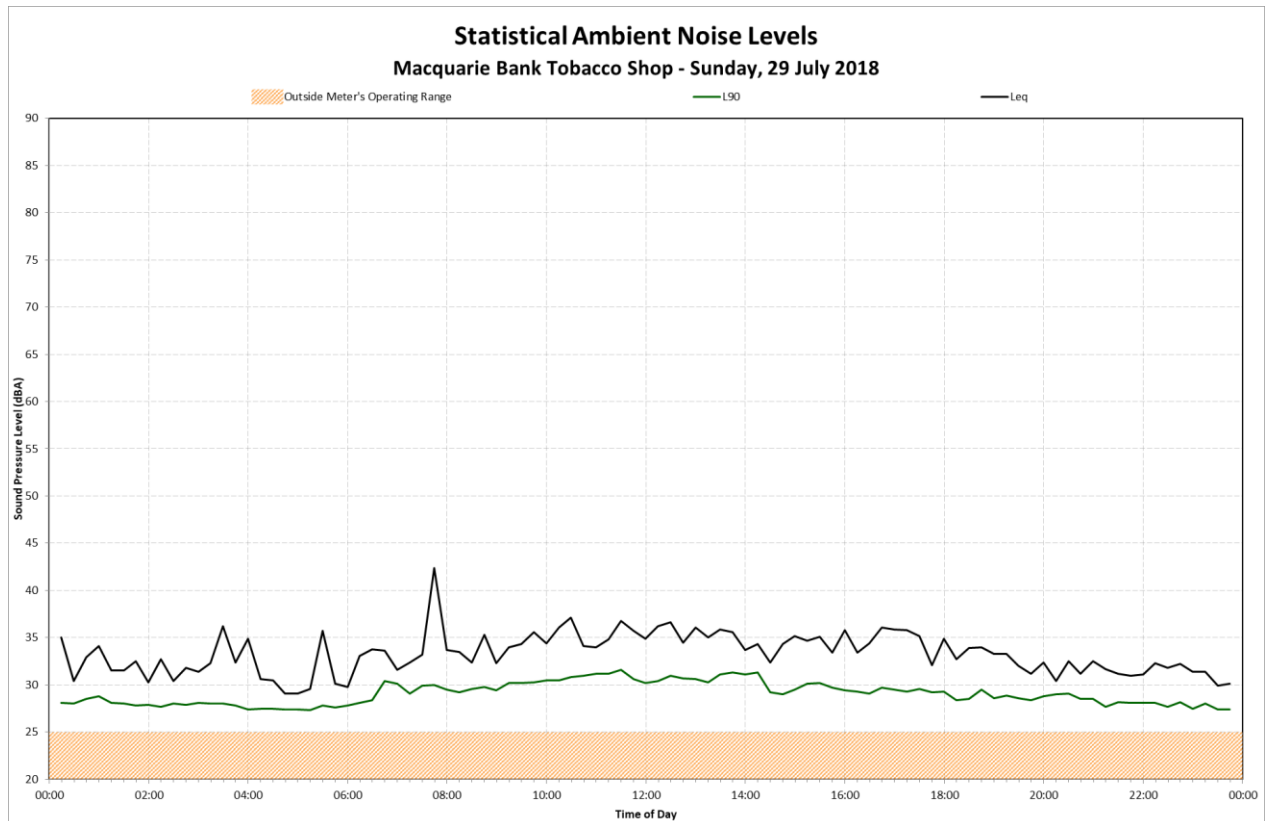
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

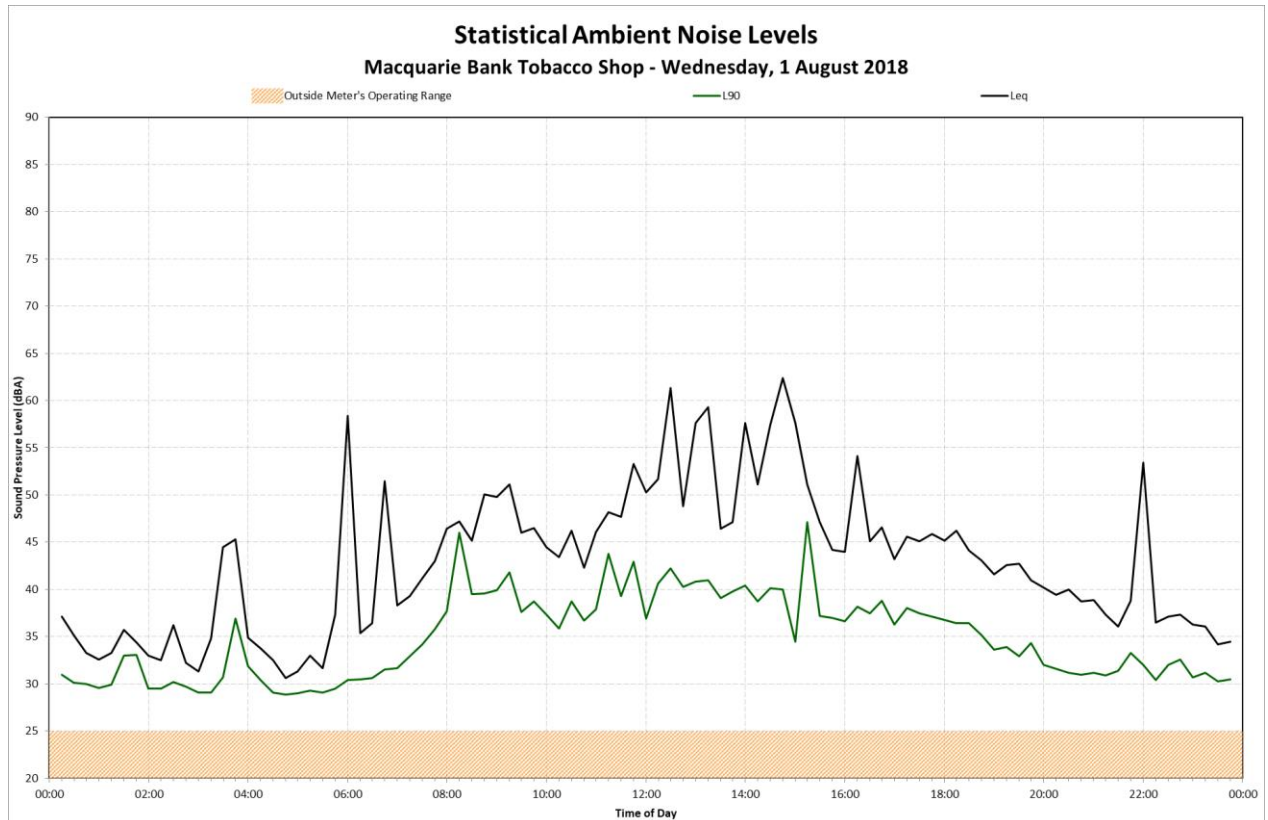
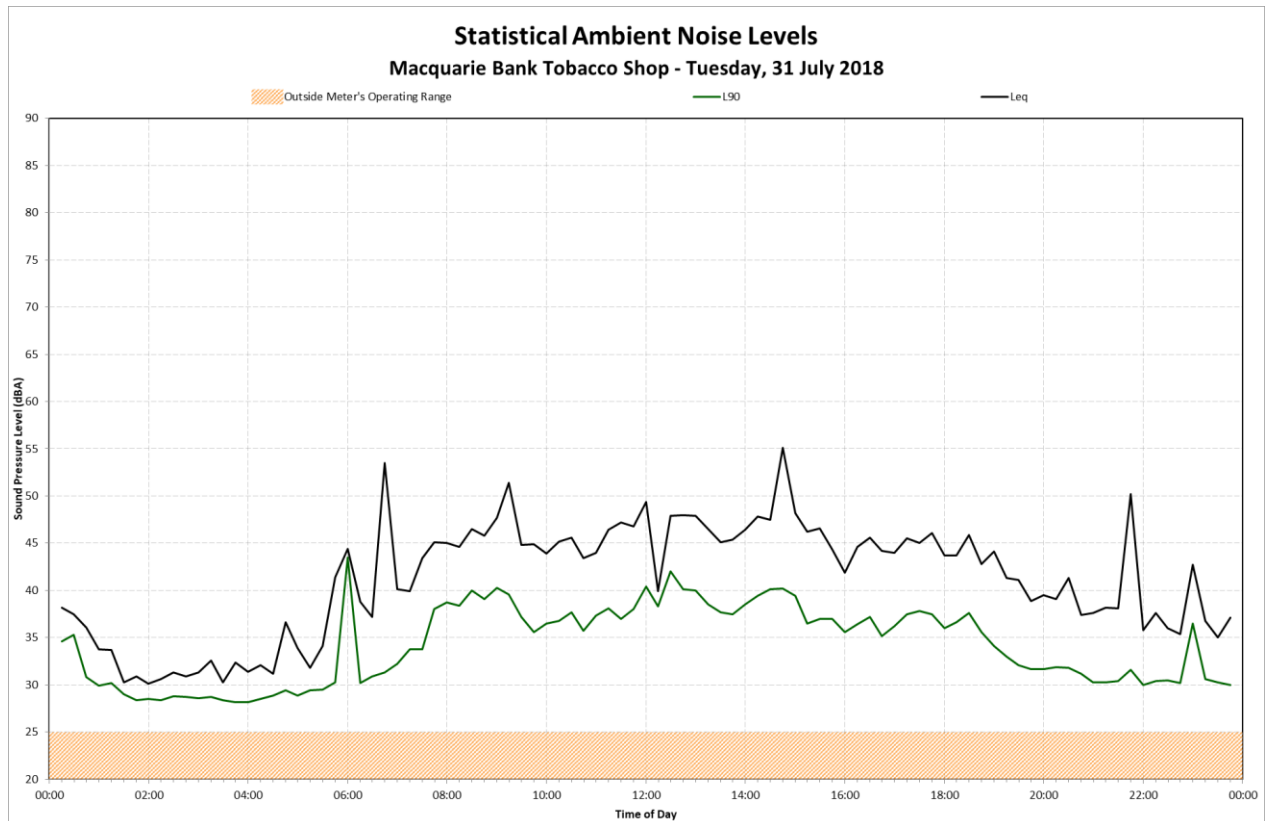
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

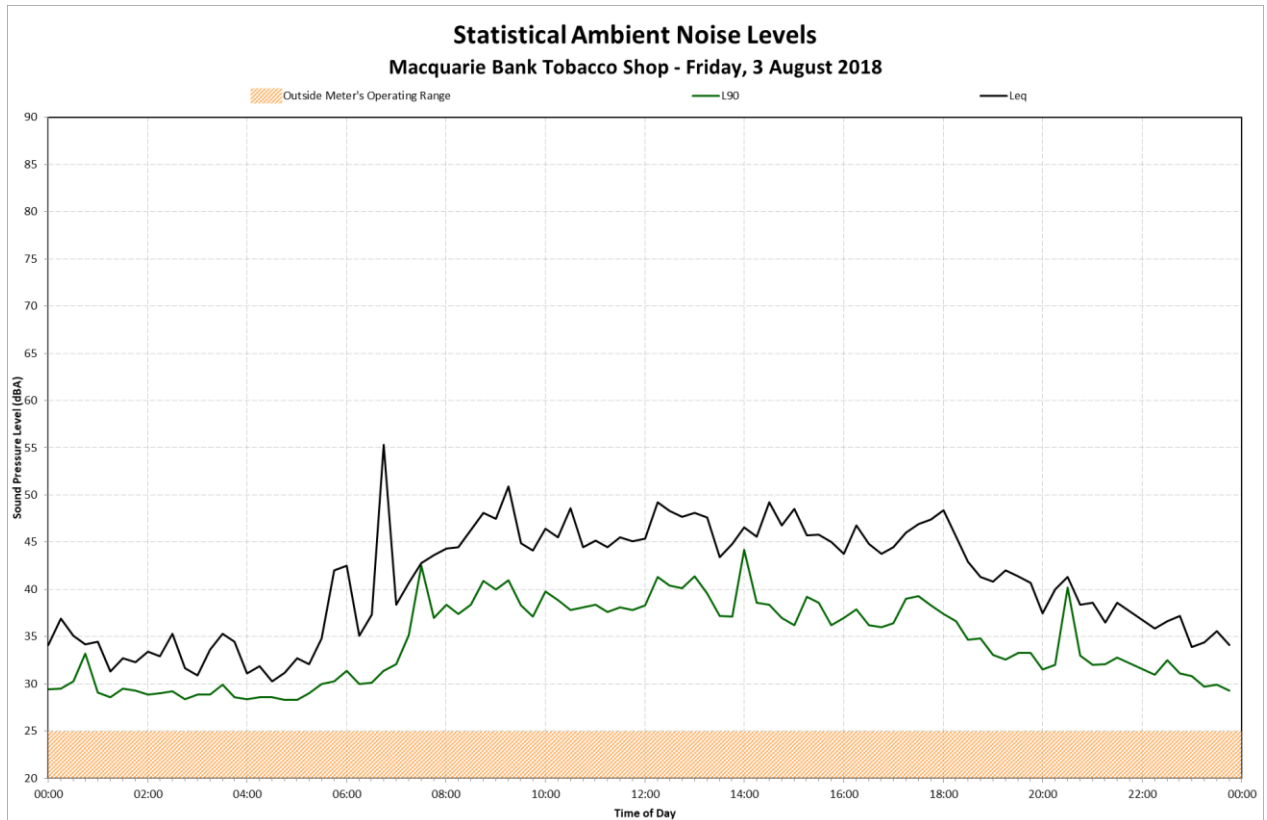
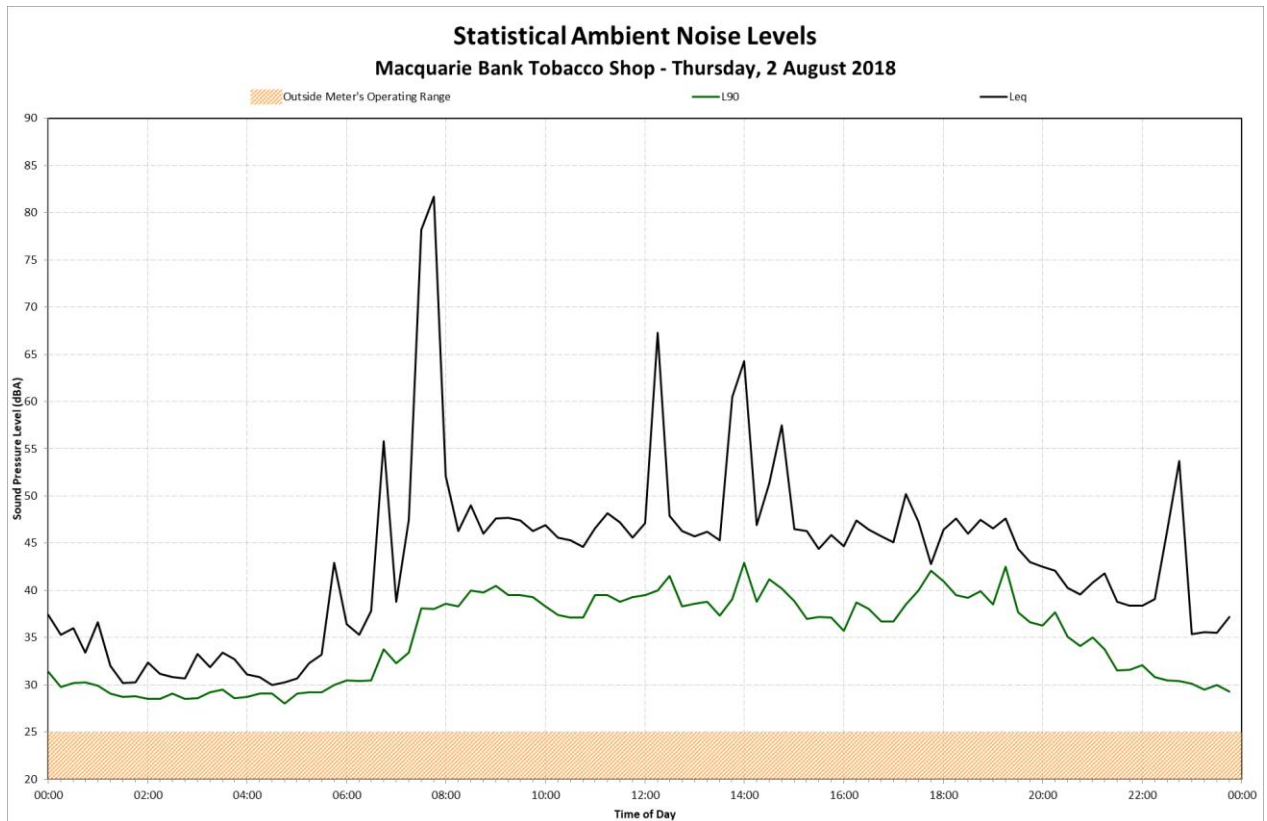
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

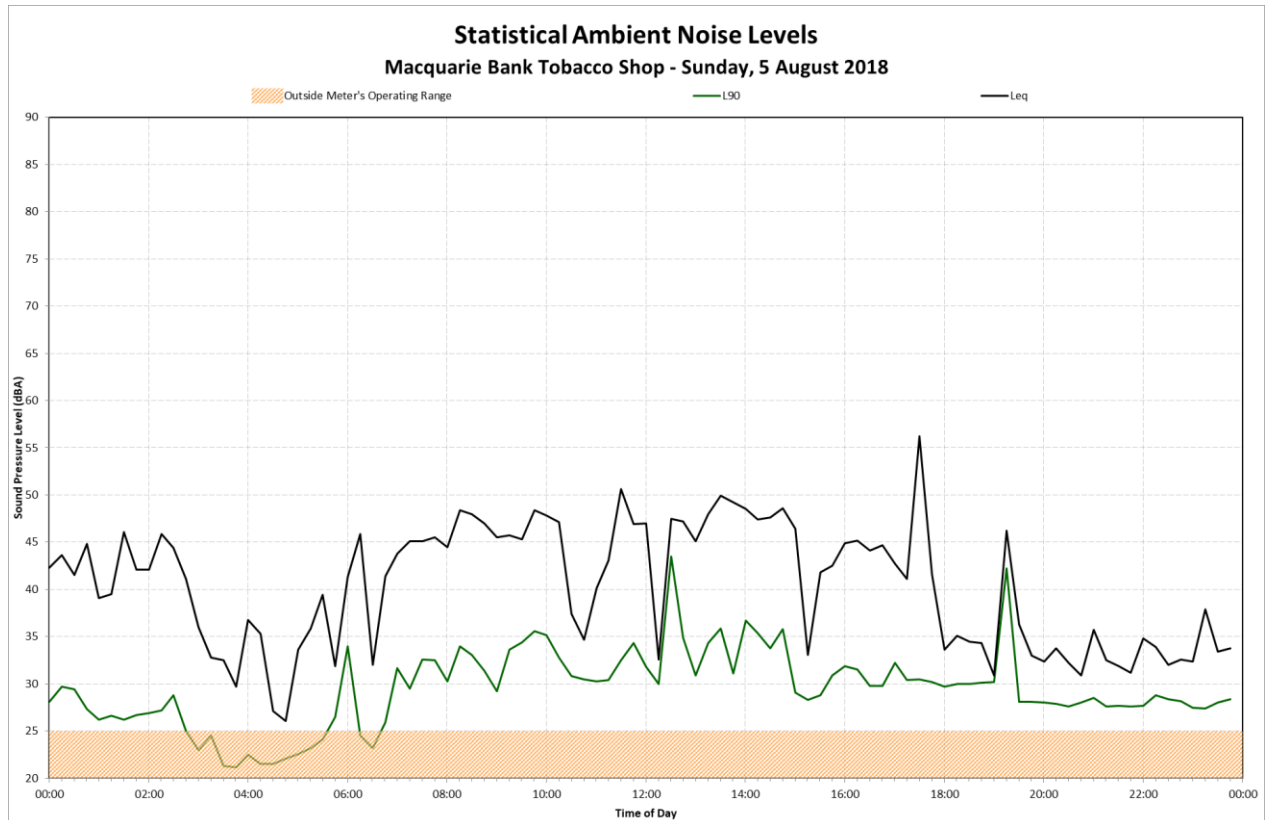
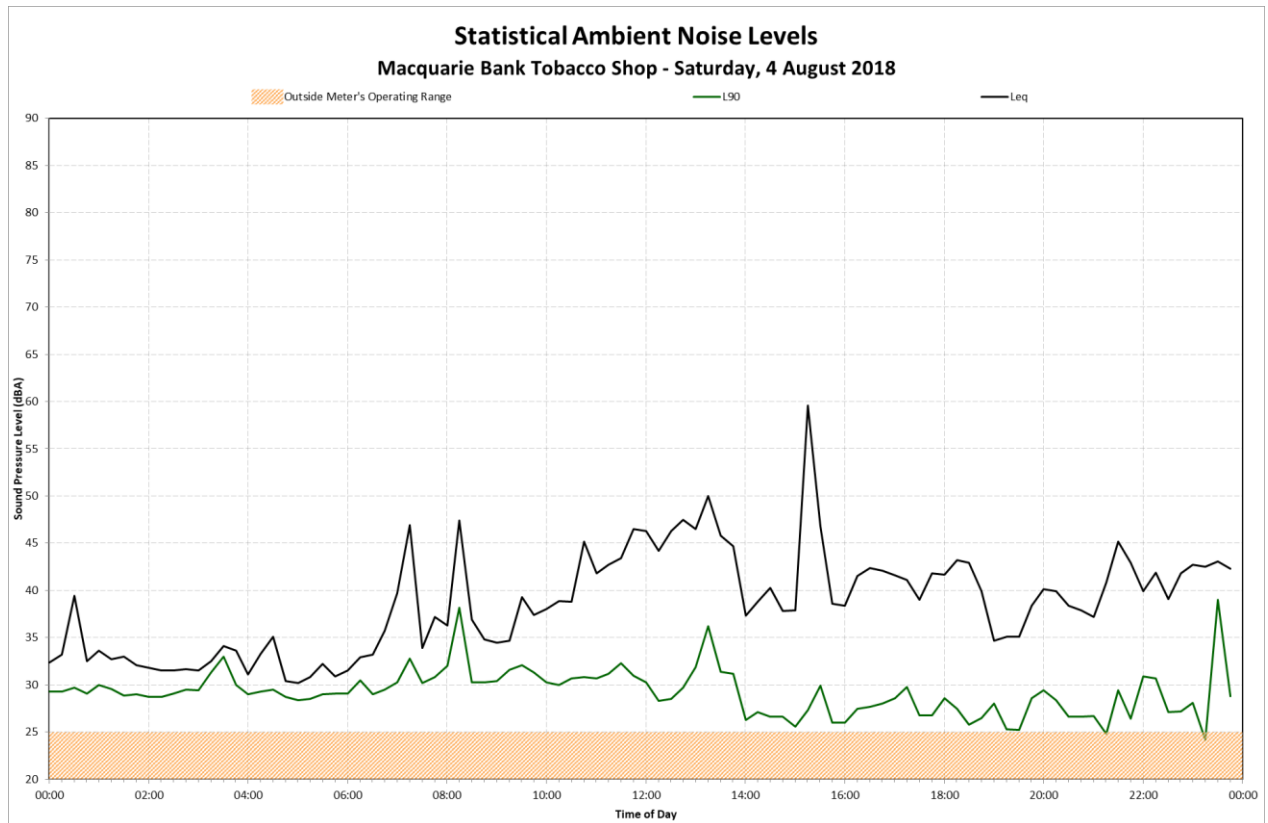
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

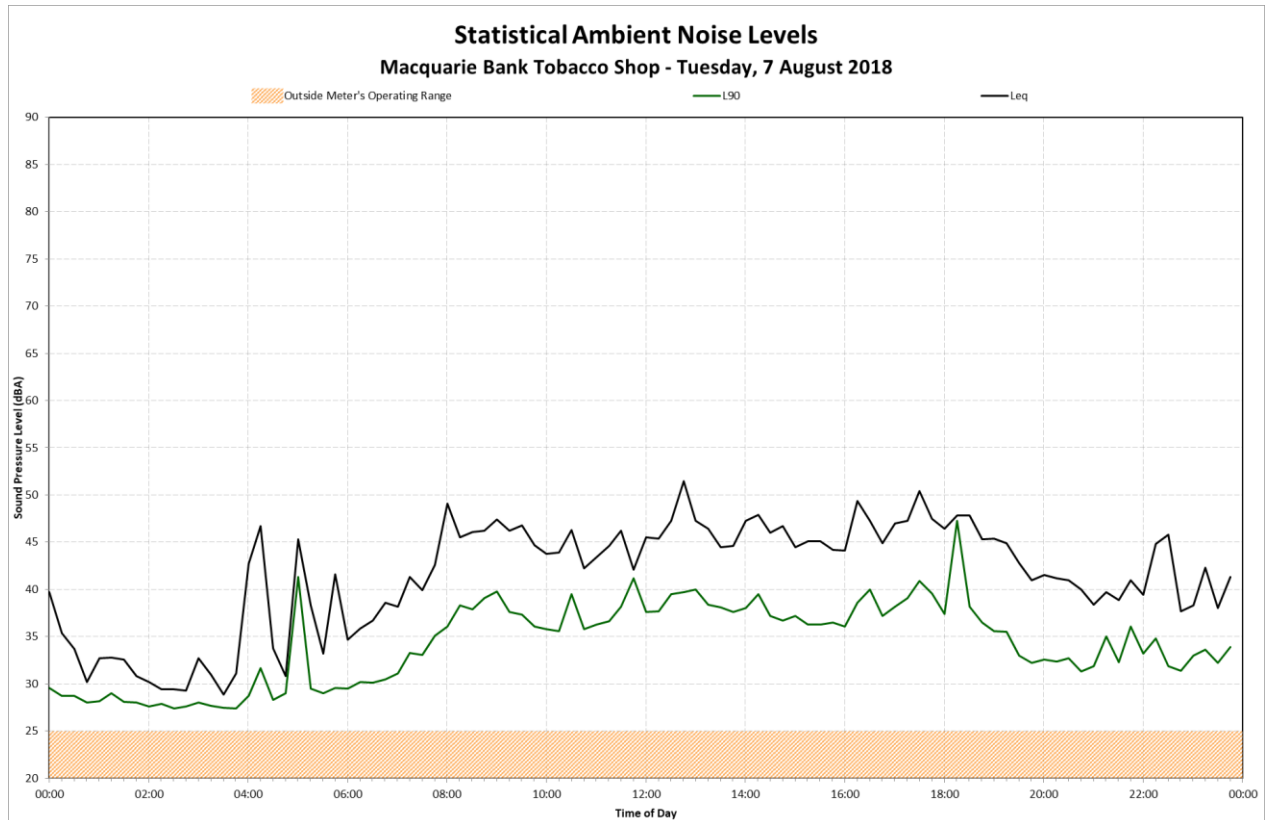
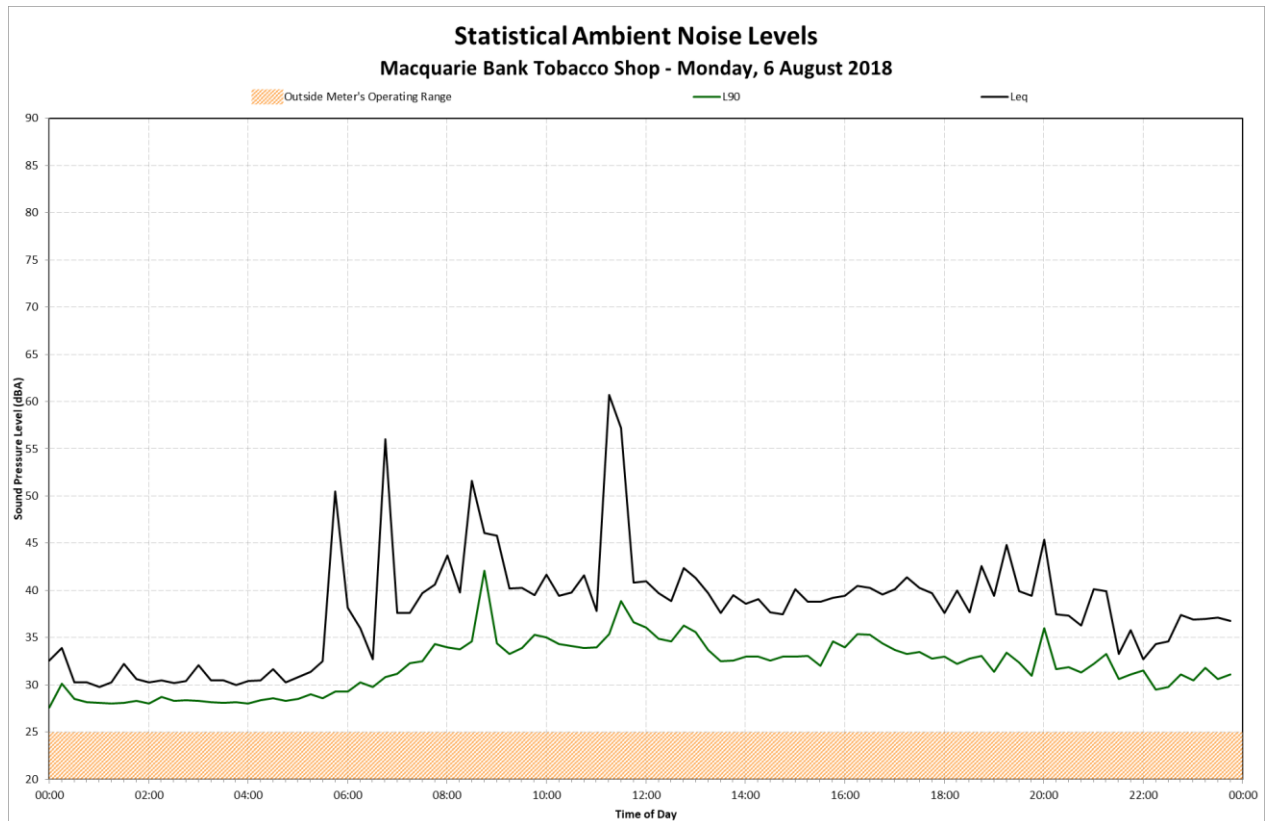
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

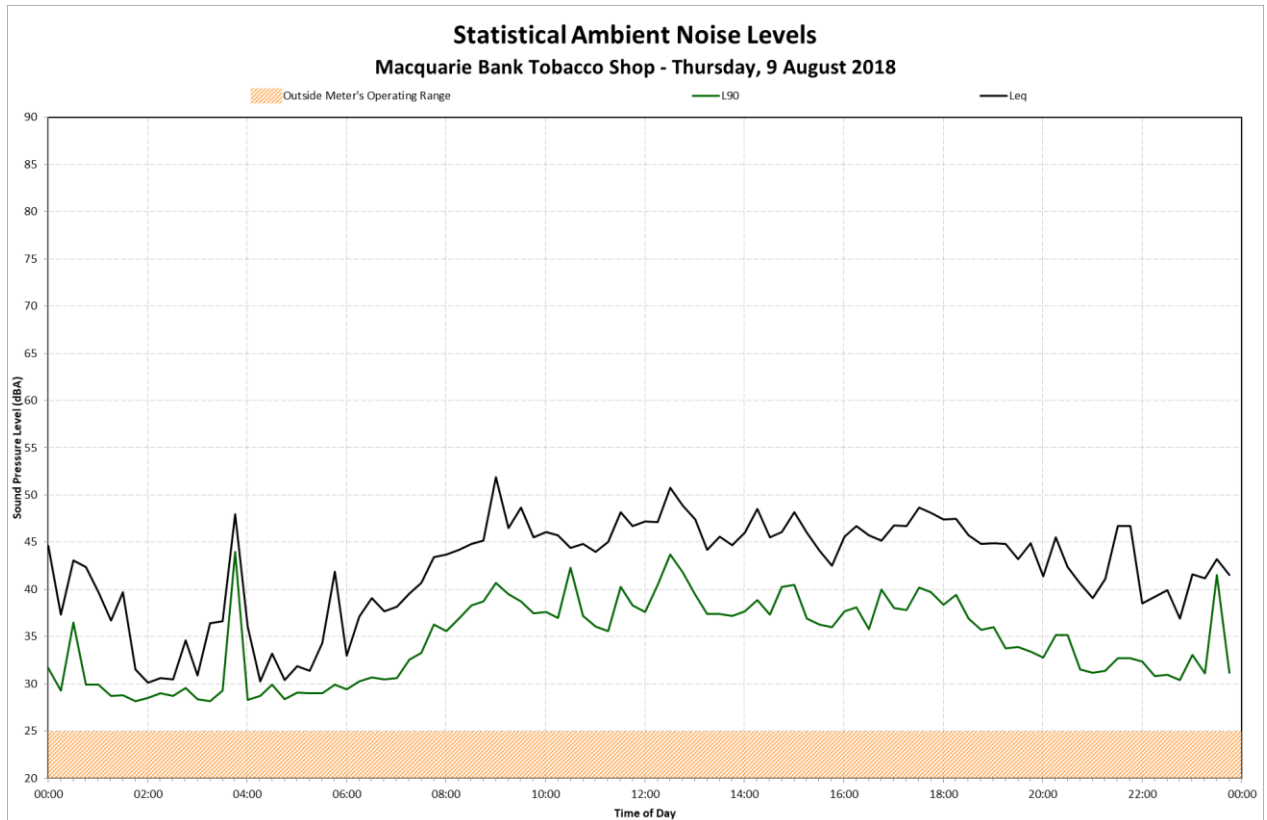
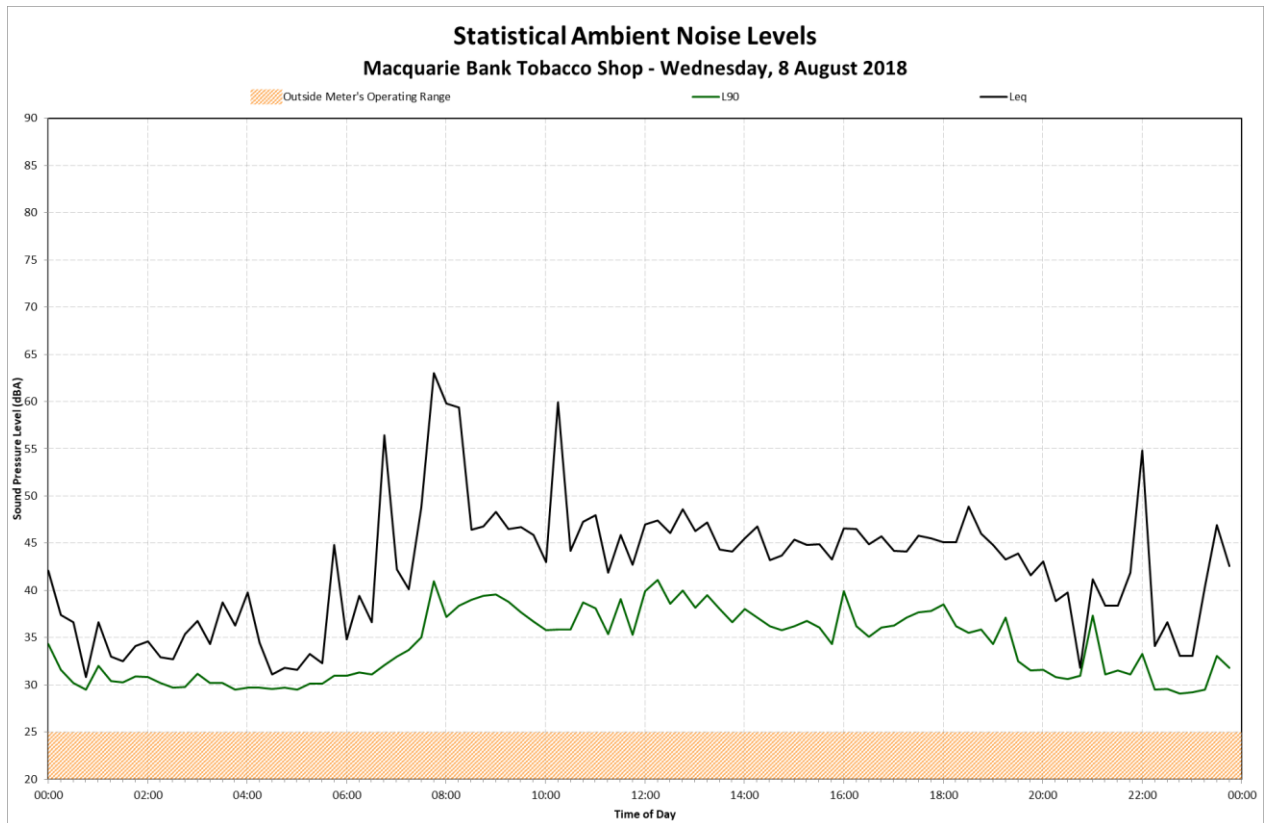
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

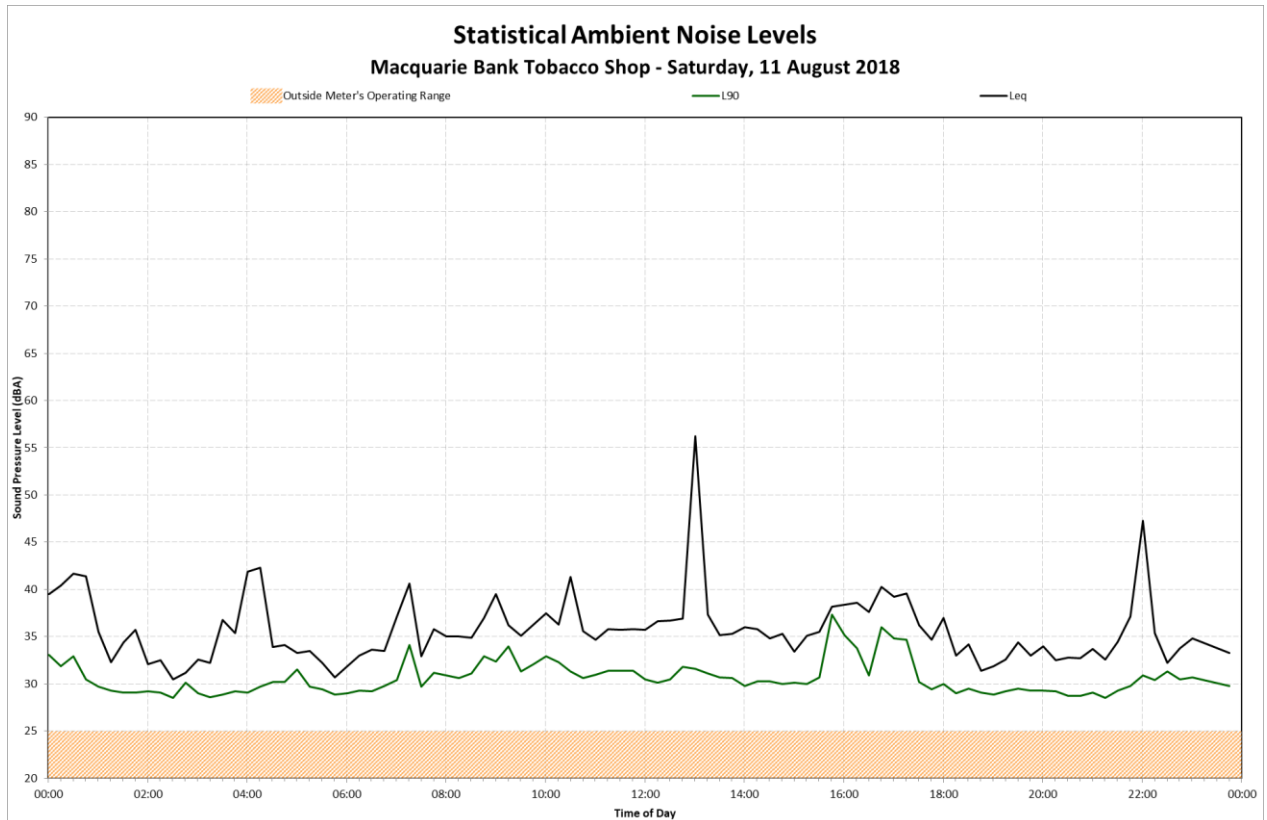
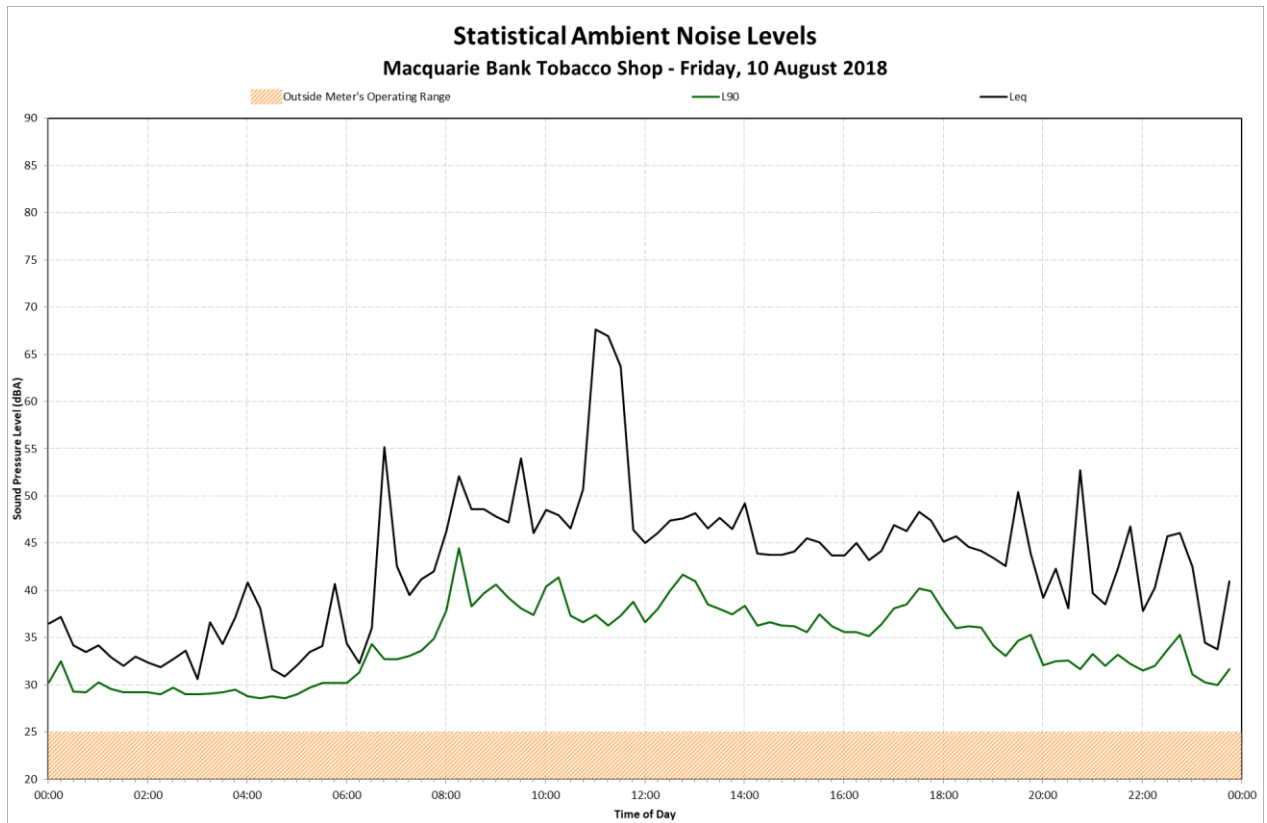
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

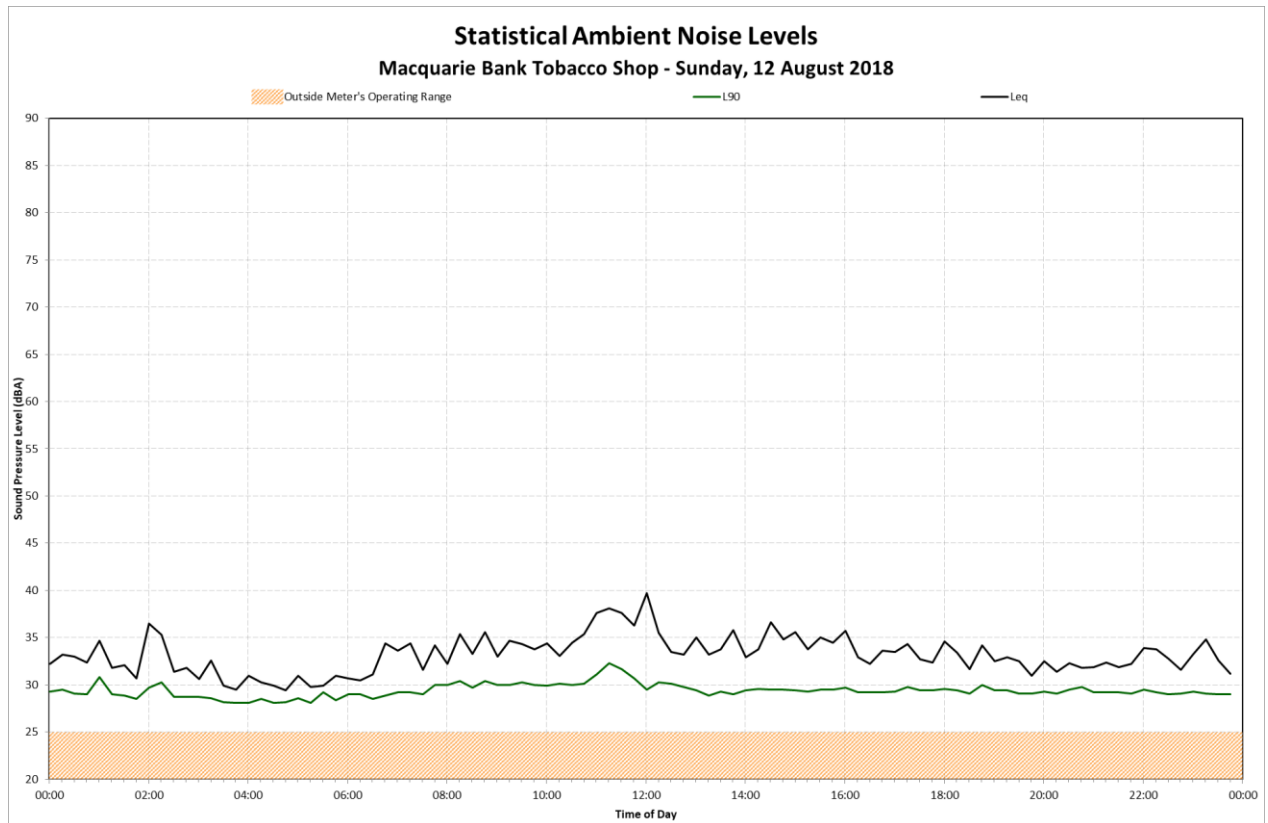
Location 1 – Macquarie Bank Tobacco Shop



Appendix B

Daily Noise Levels

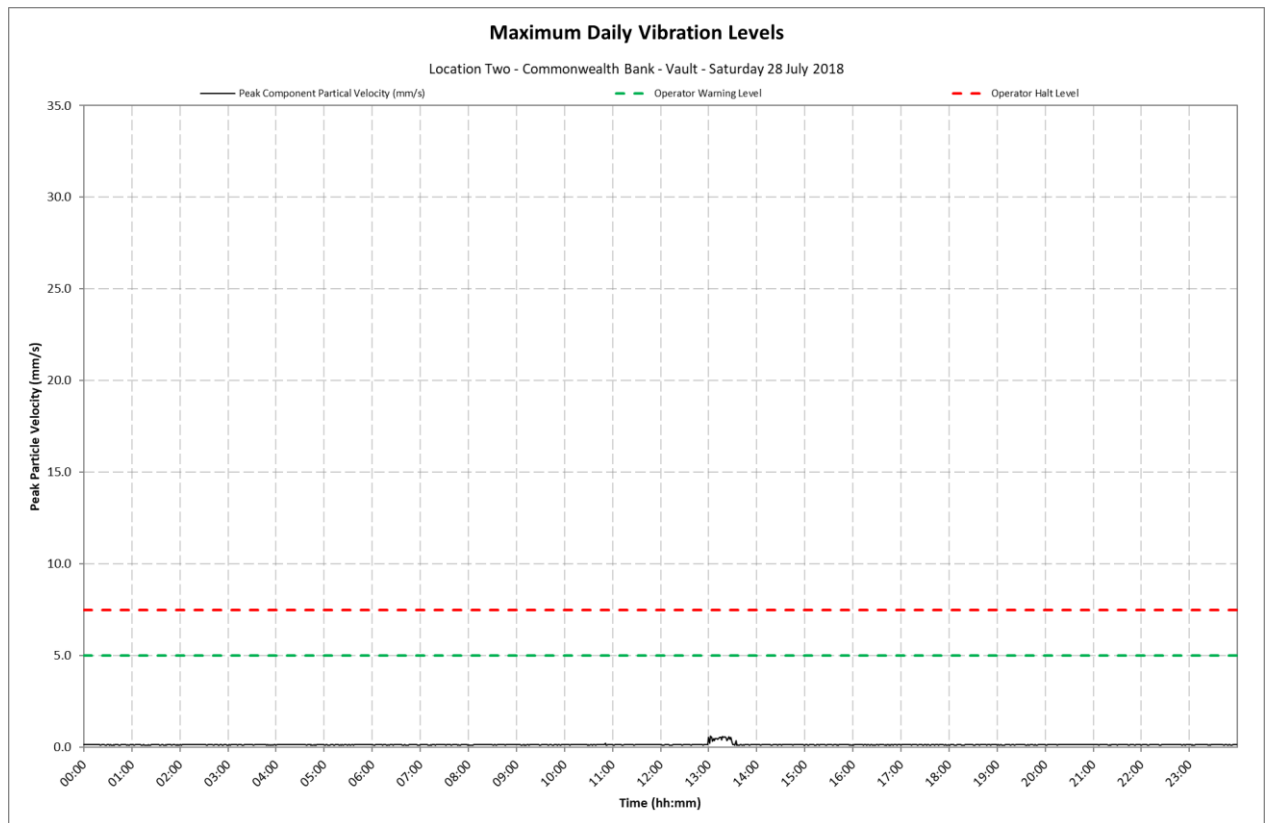
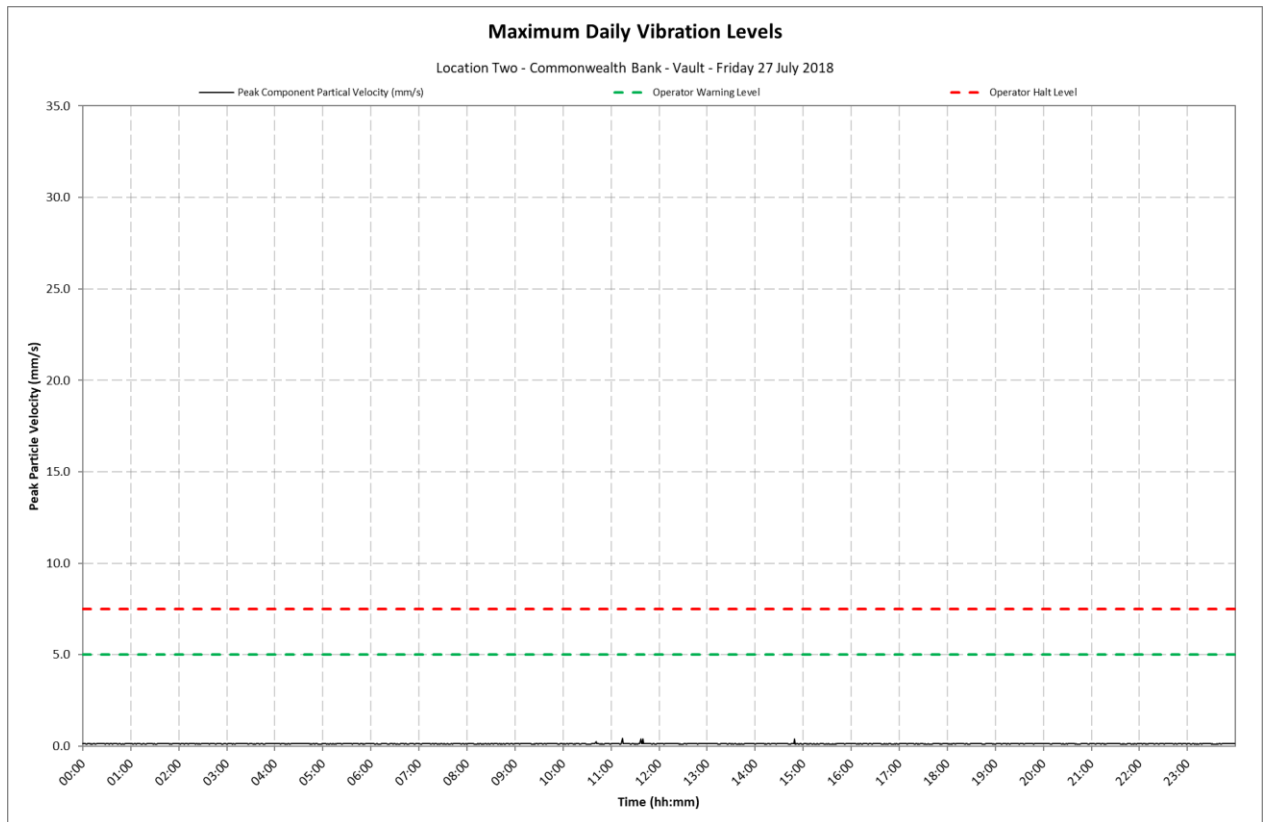
Location 1 – Macquarie Bank Tobacco Shop



Appendix C1

Daily Vibration Levels

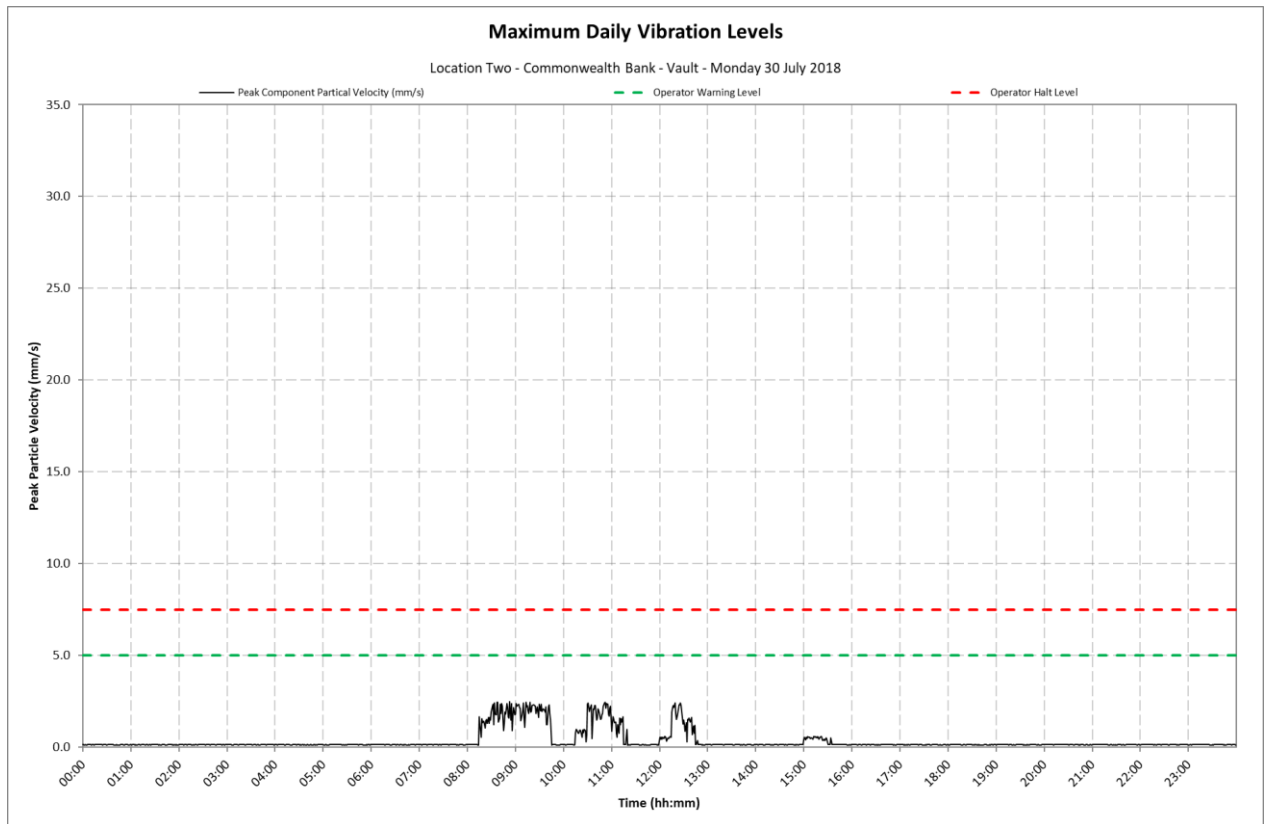
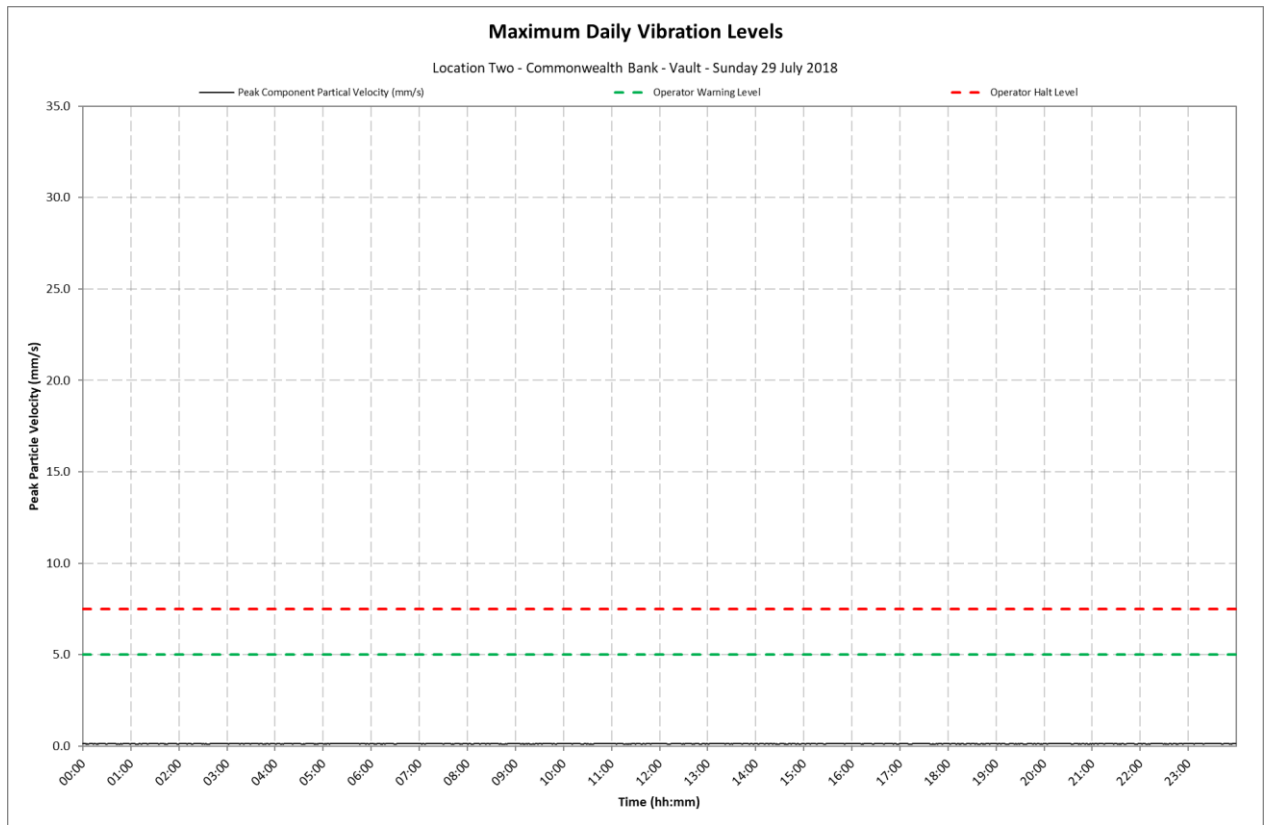
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

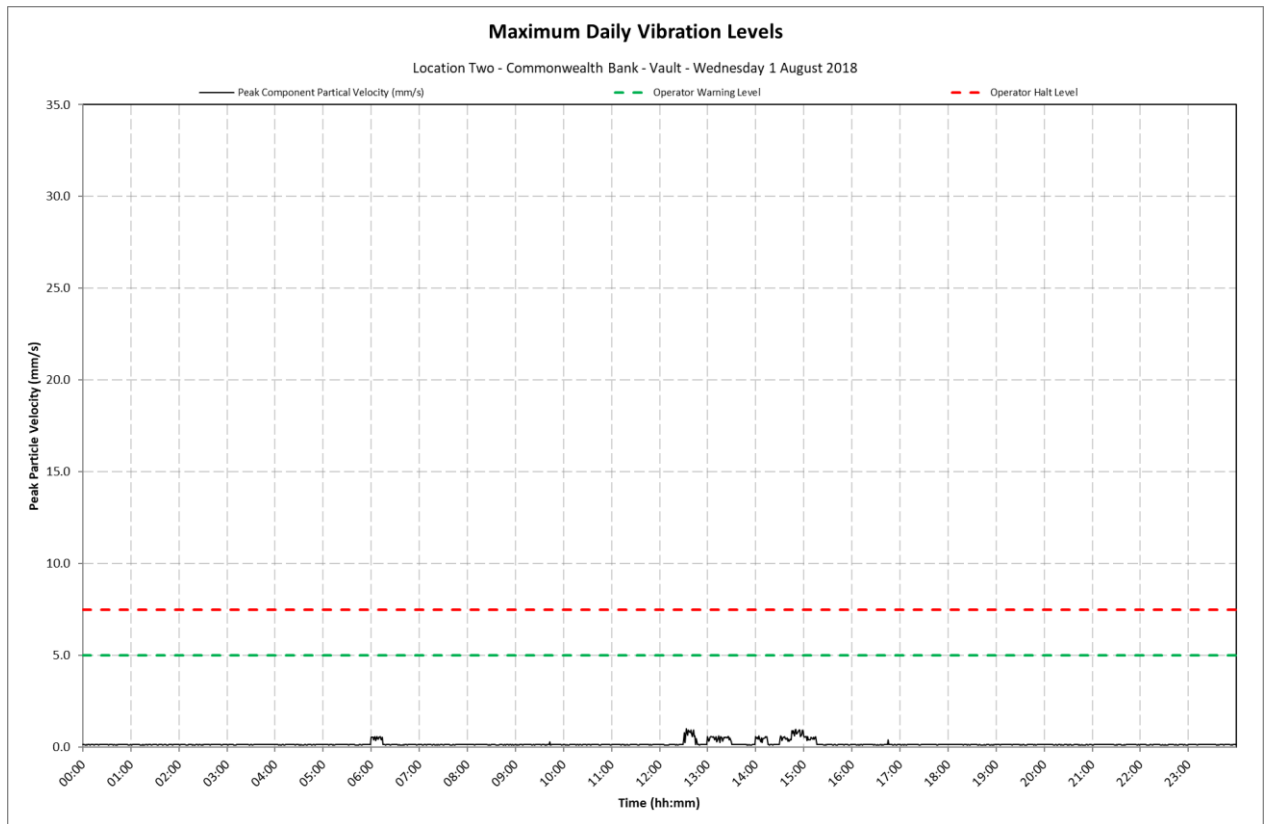
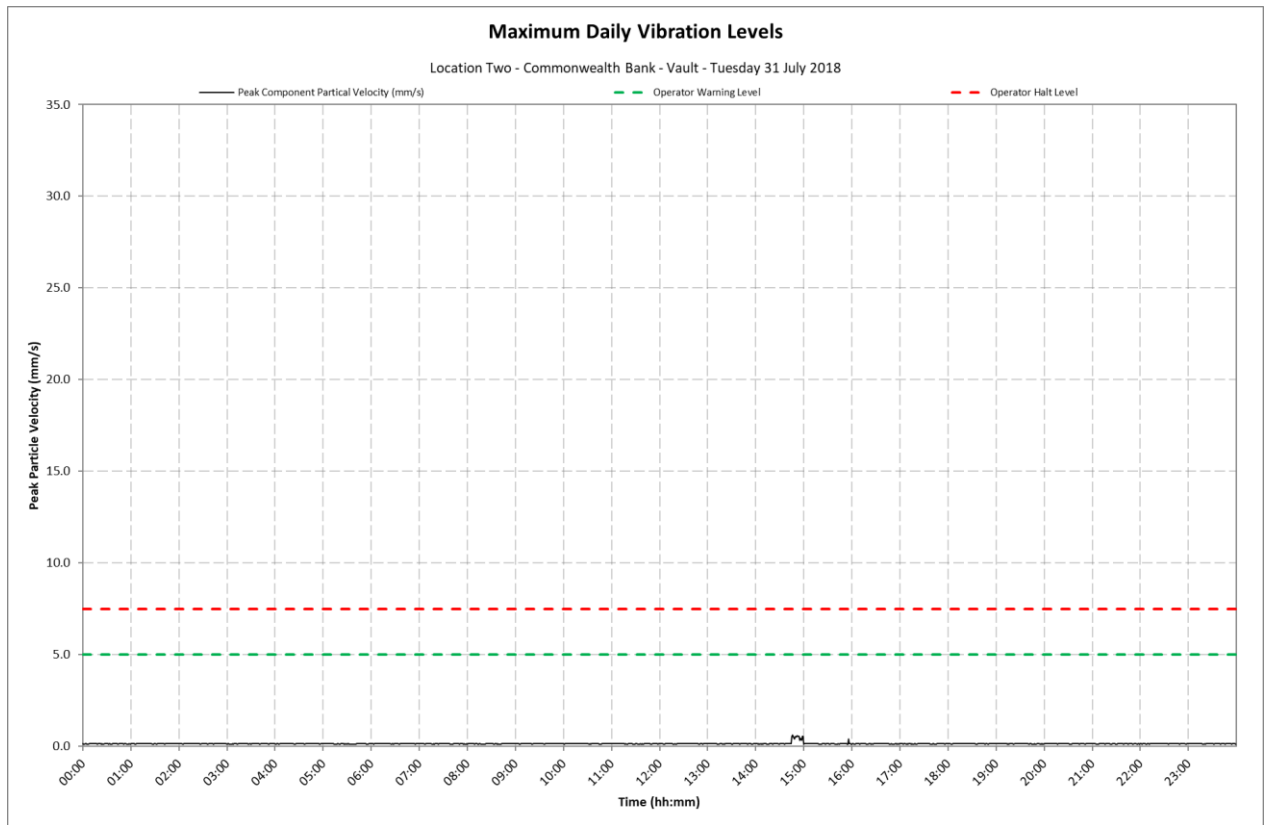
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

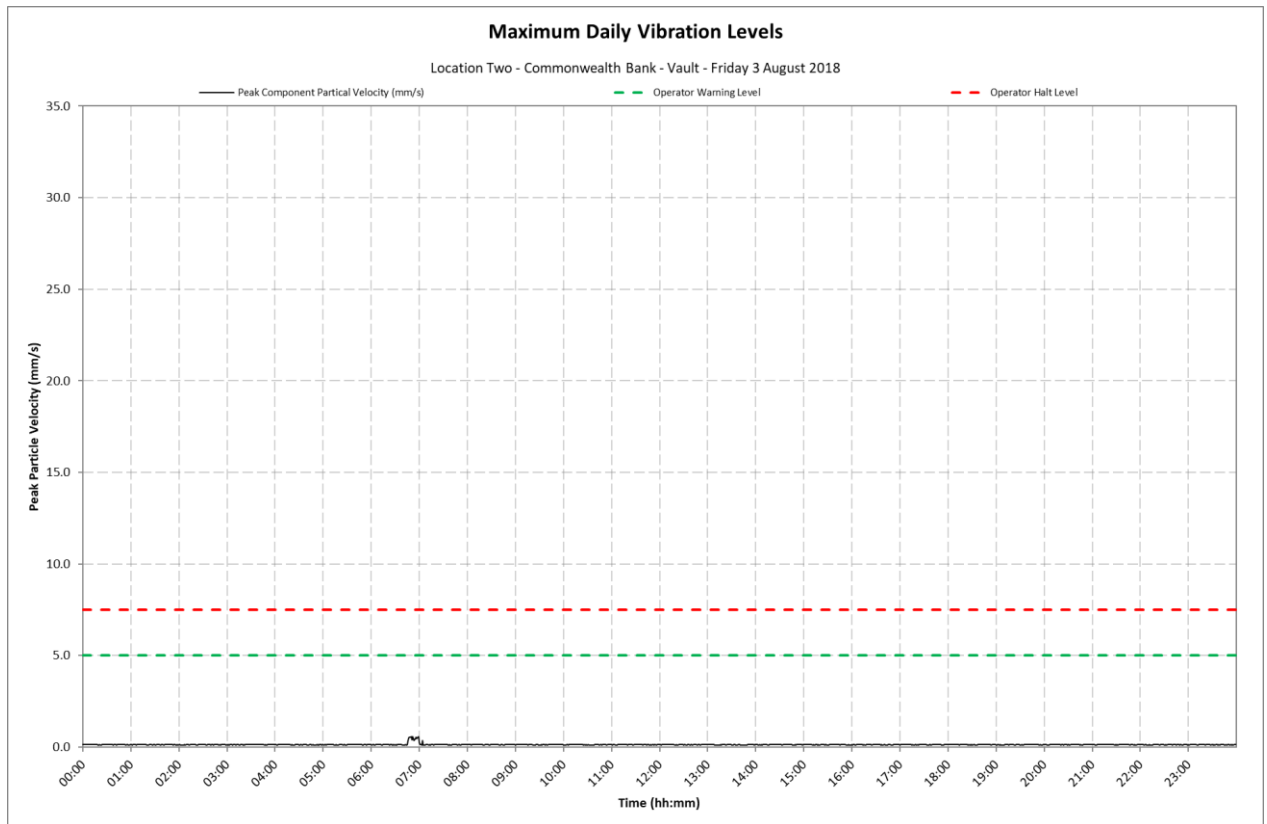
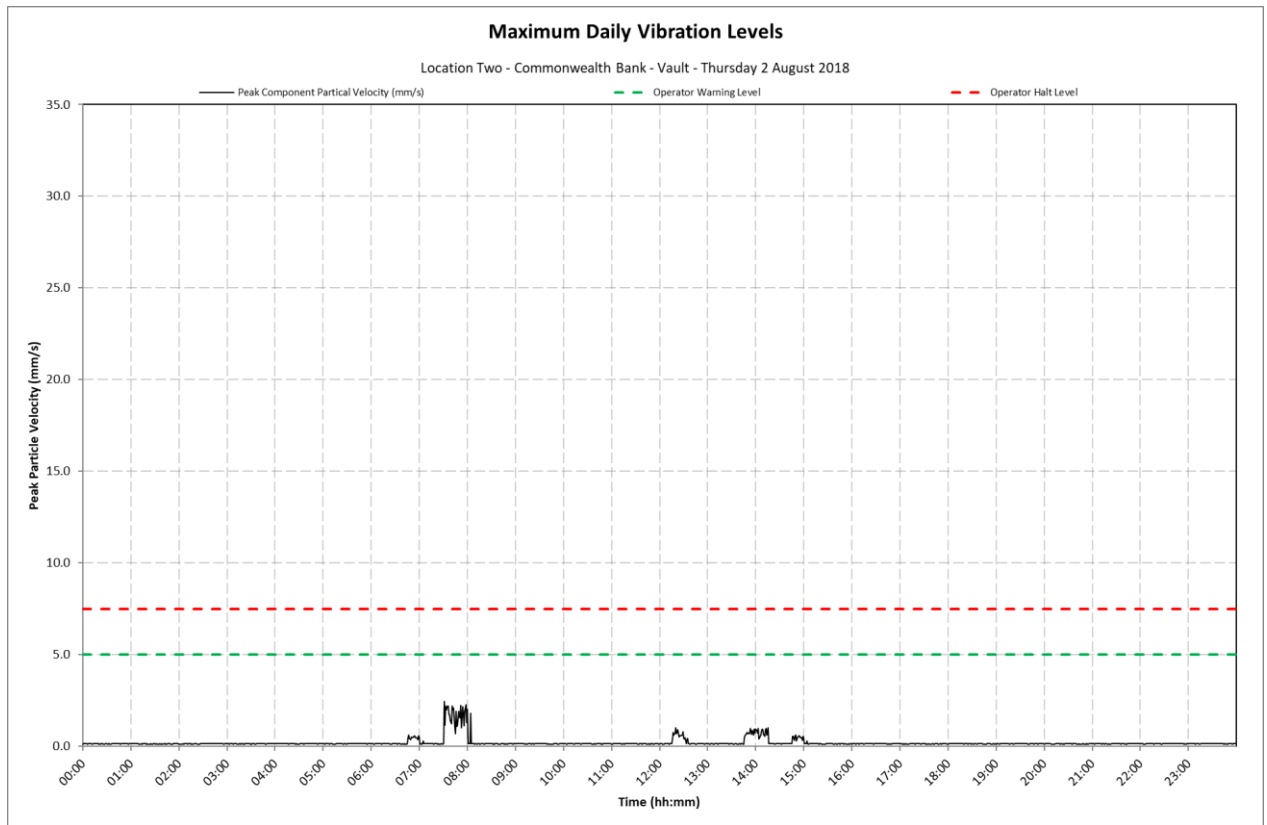
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

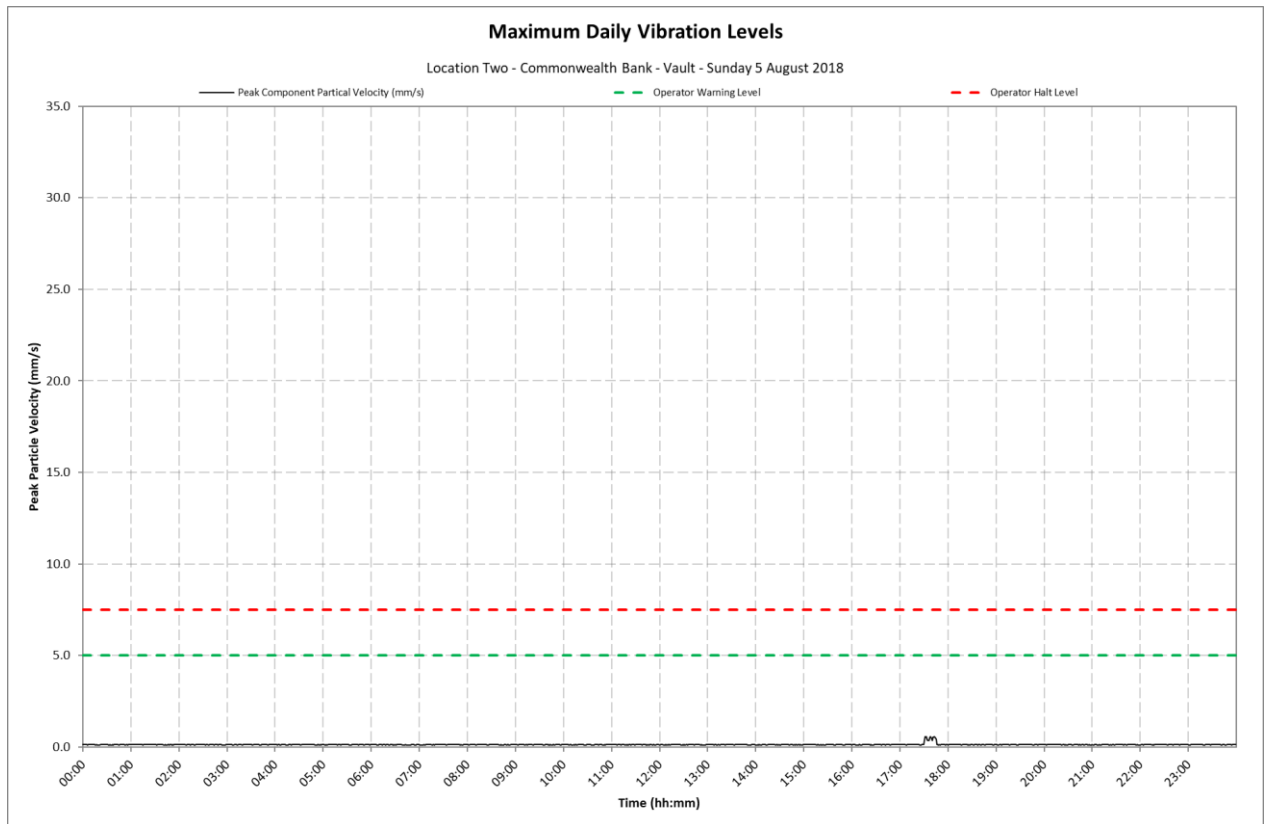
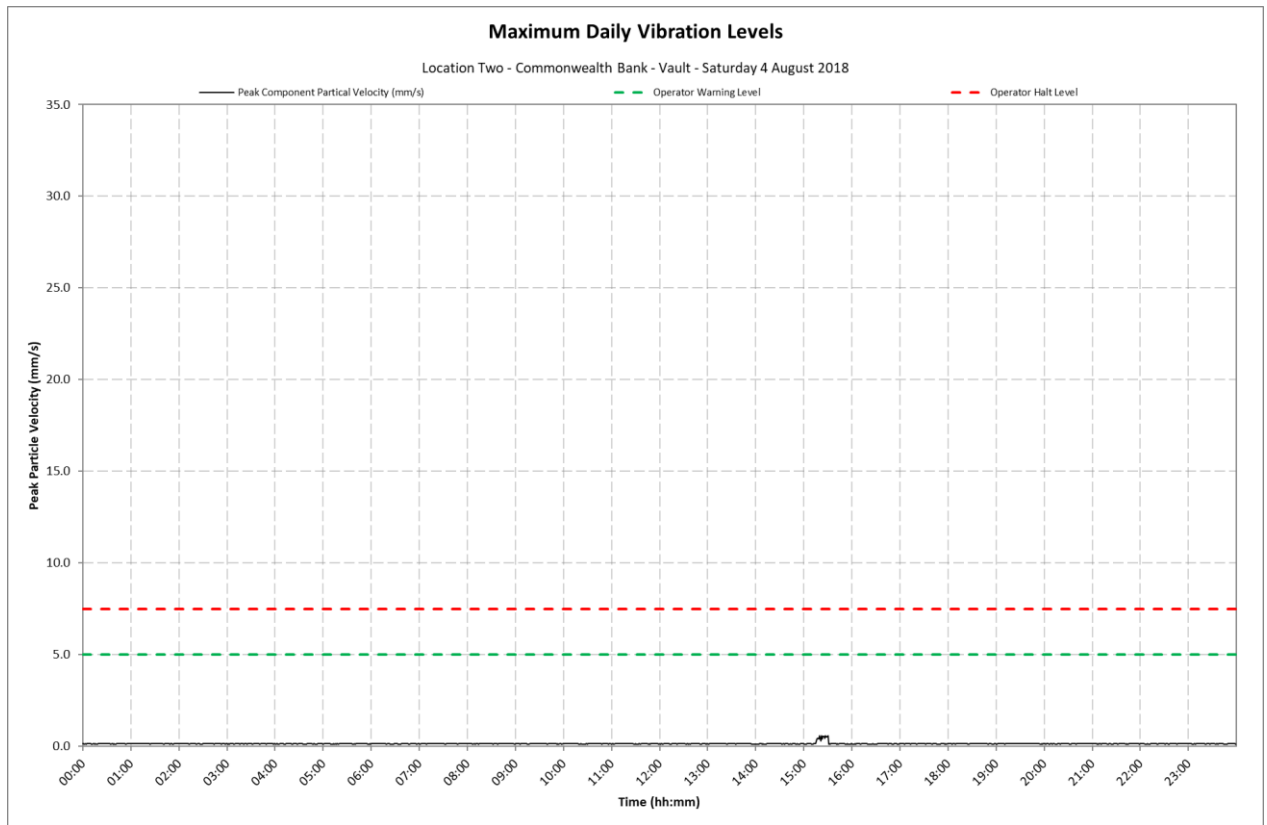
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

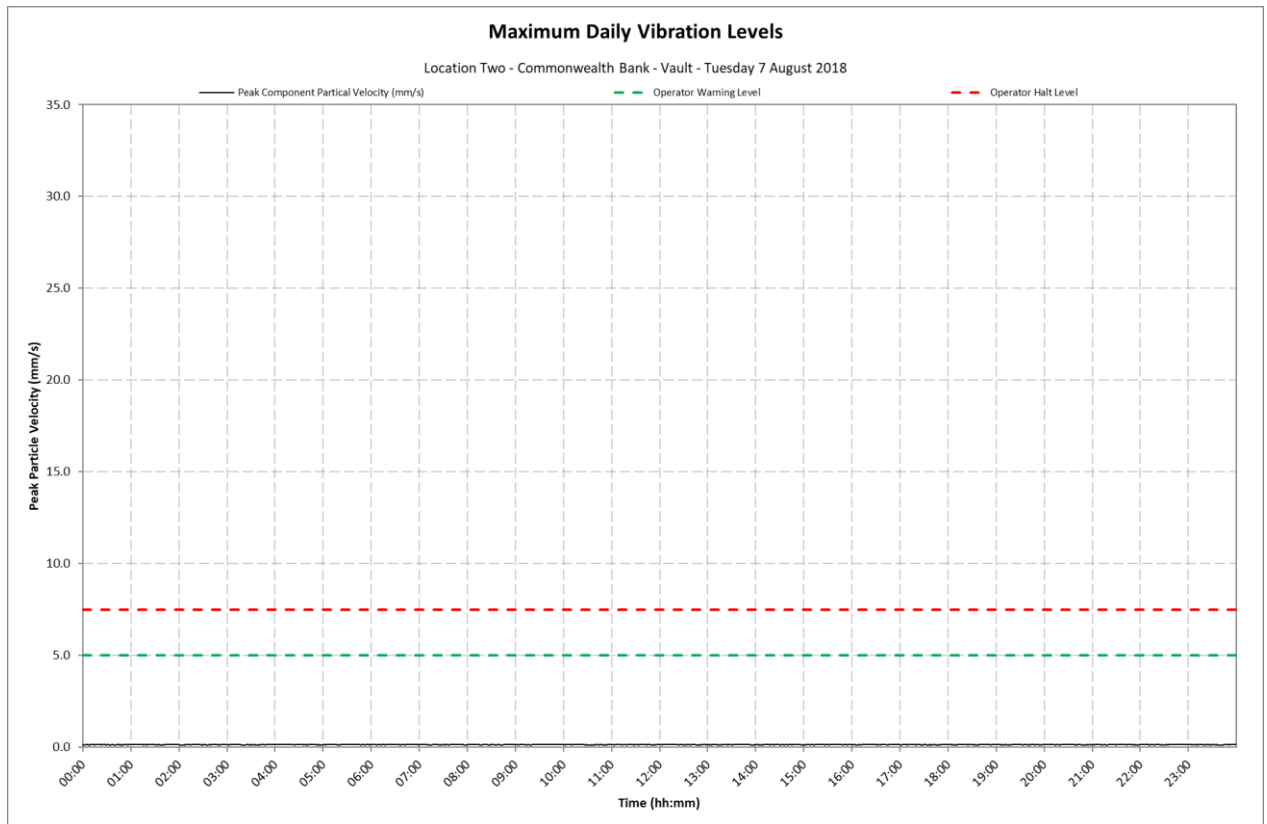
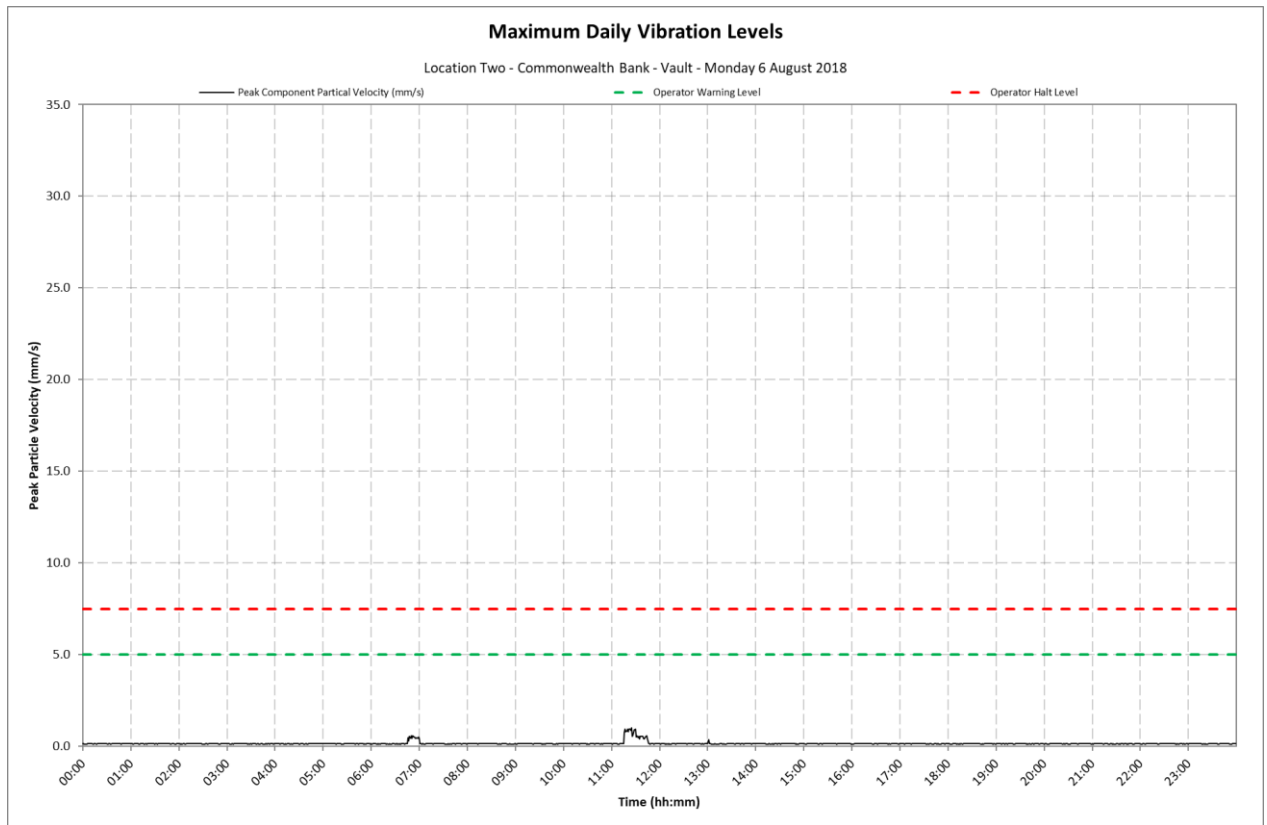
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

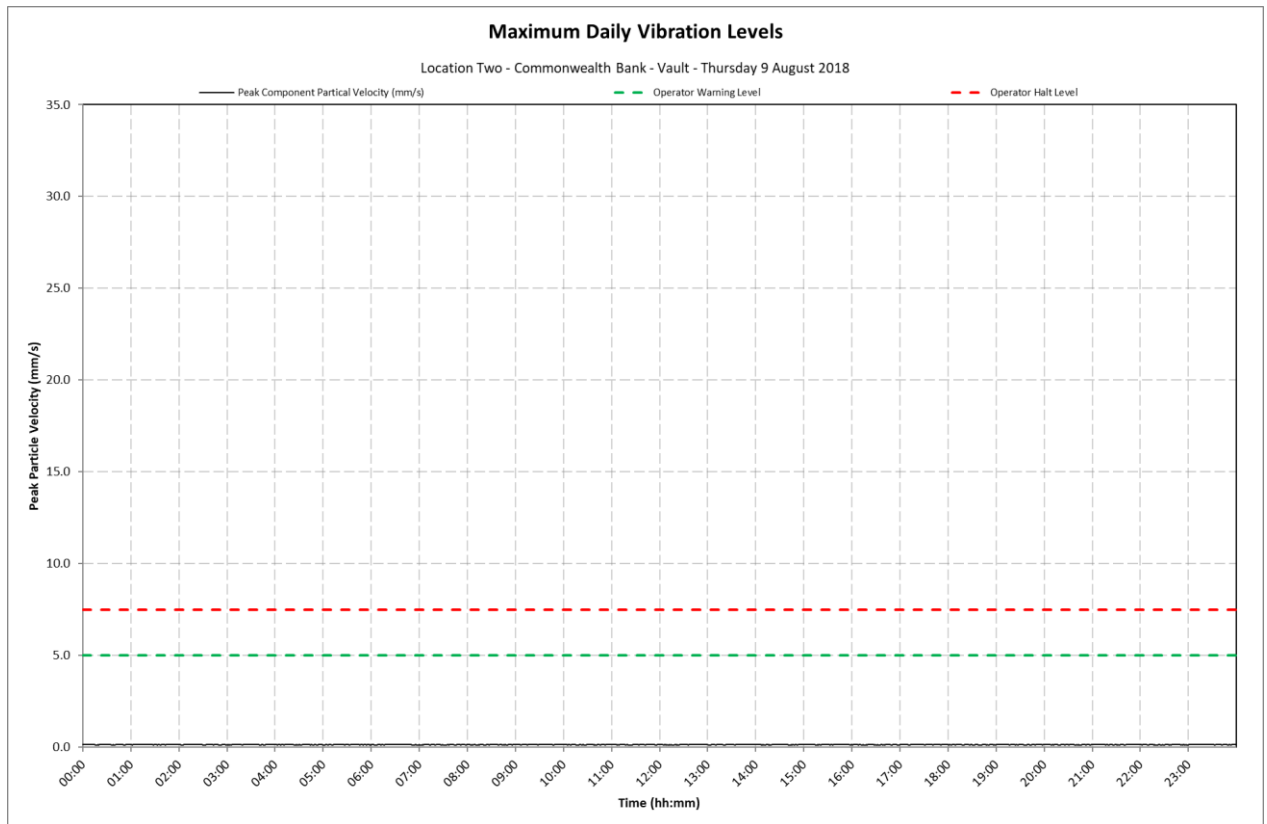
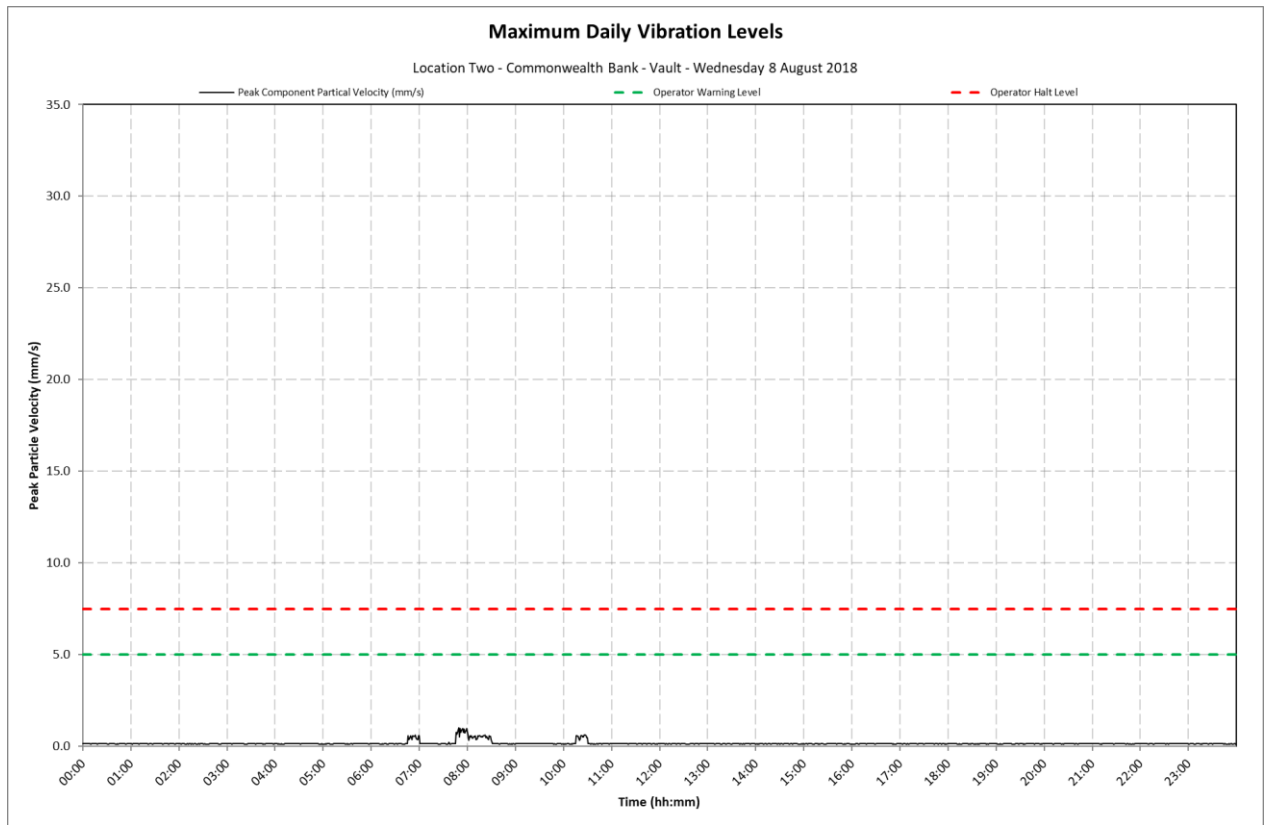
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

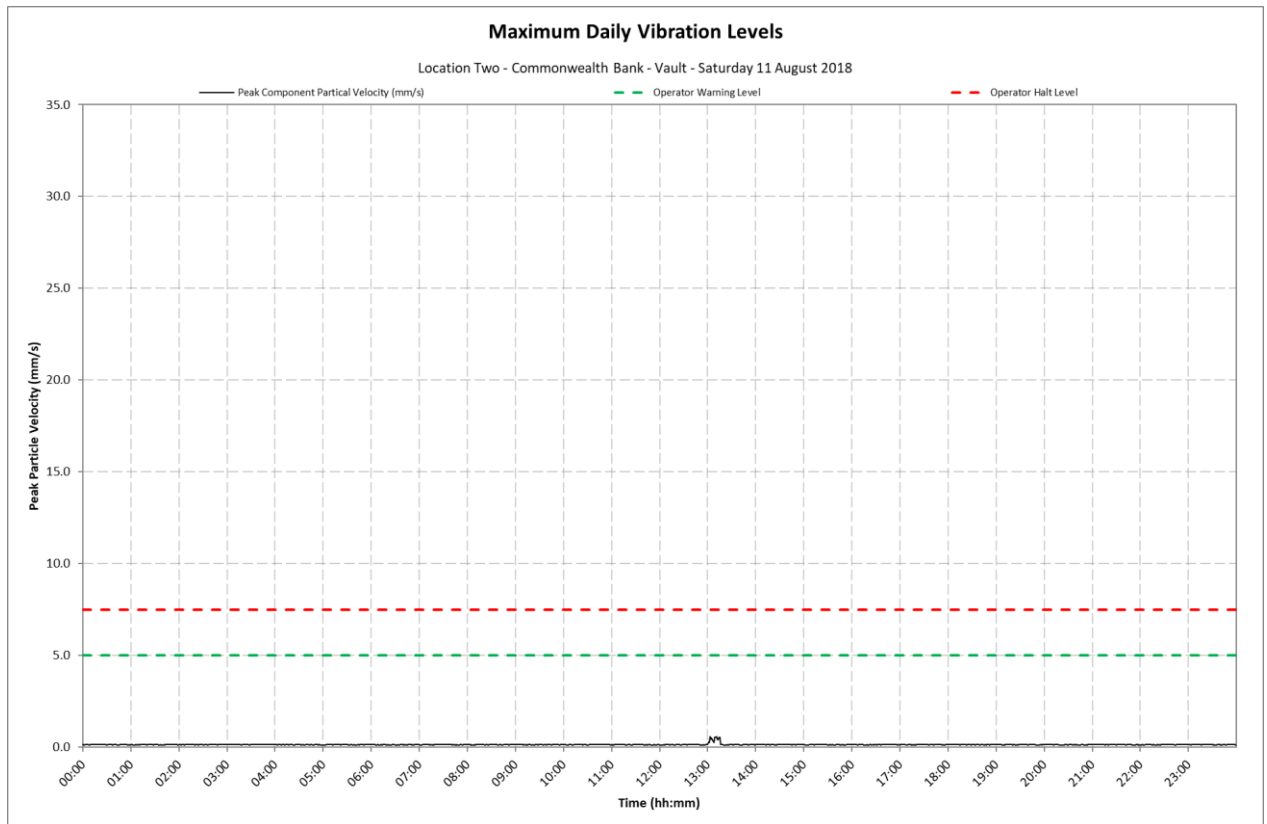
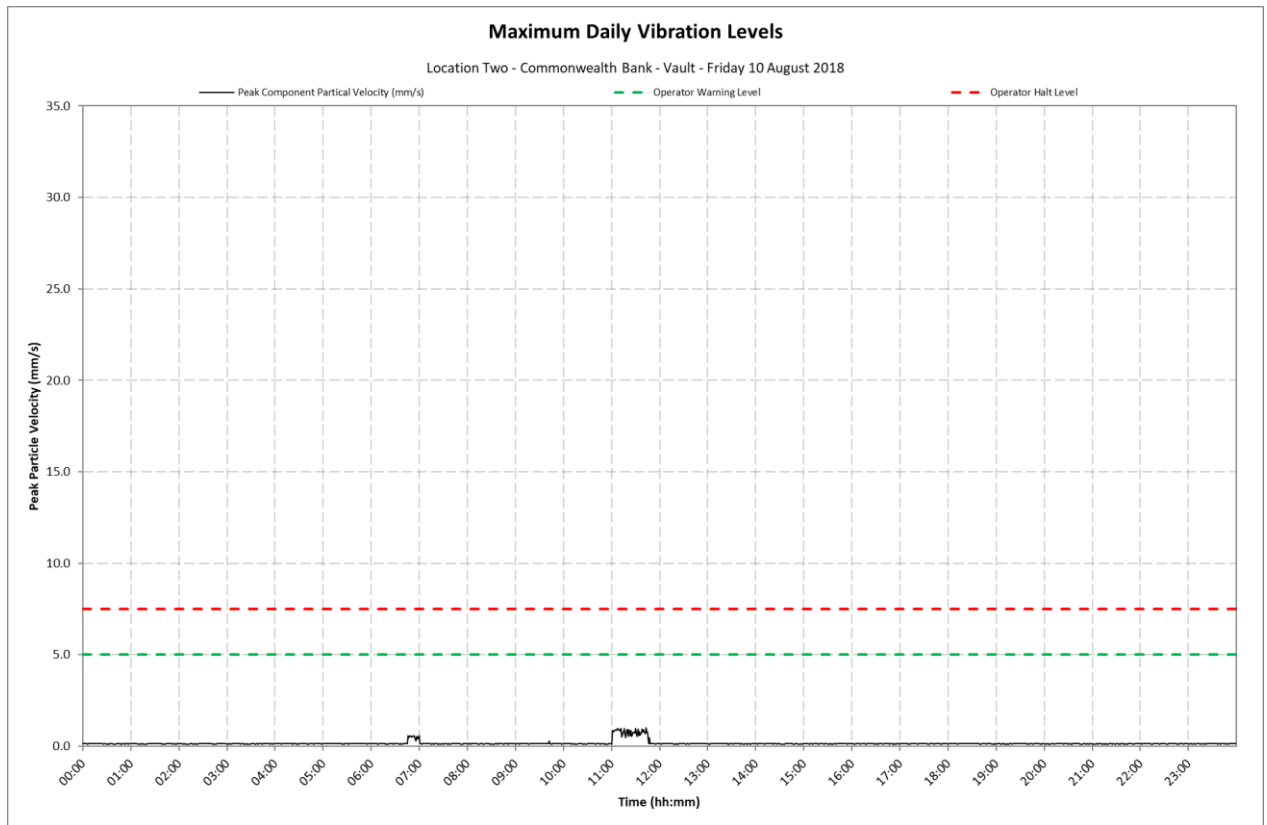
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

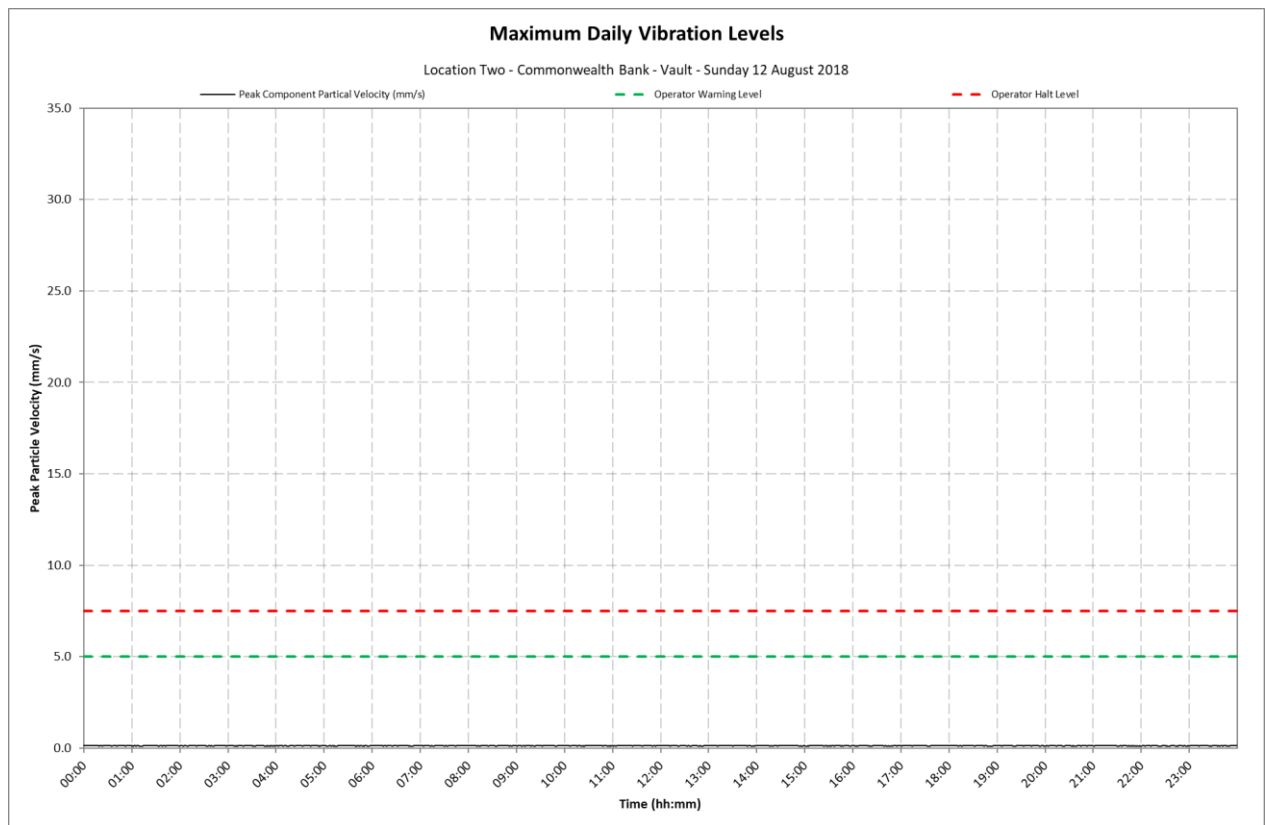
Location 2 - Commonwealth Bank - Vault



Appendix C1

Daily Vibration Levels

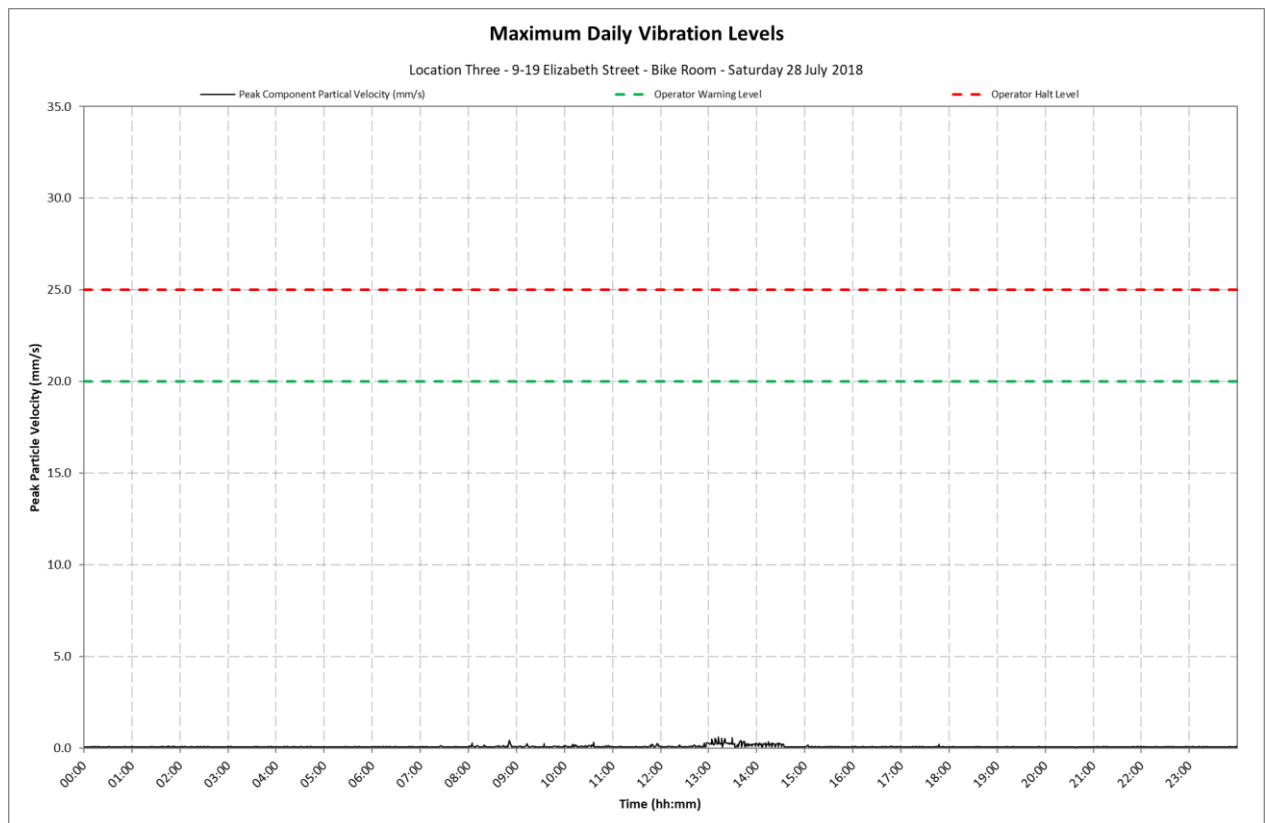
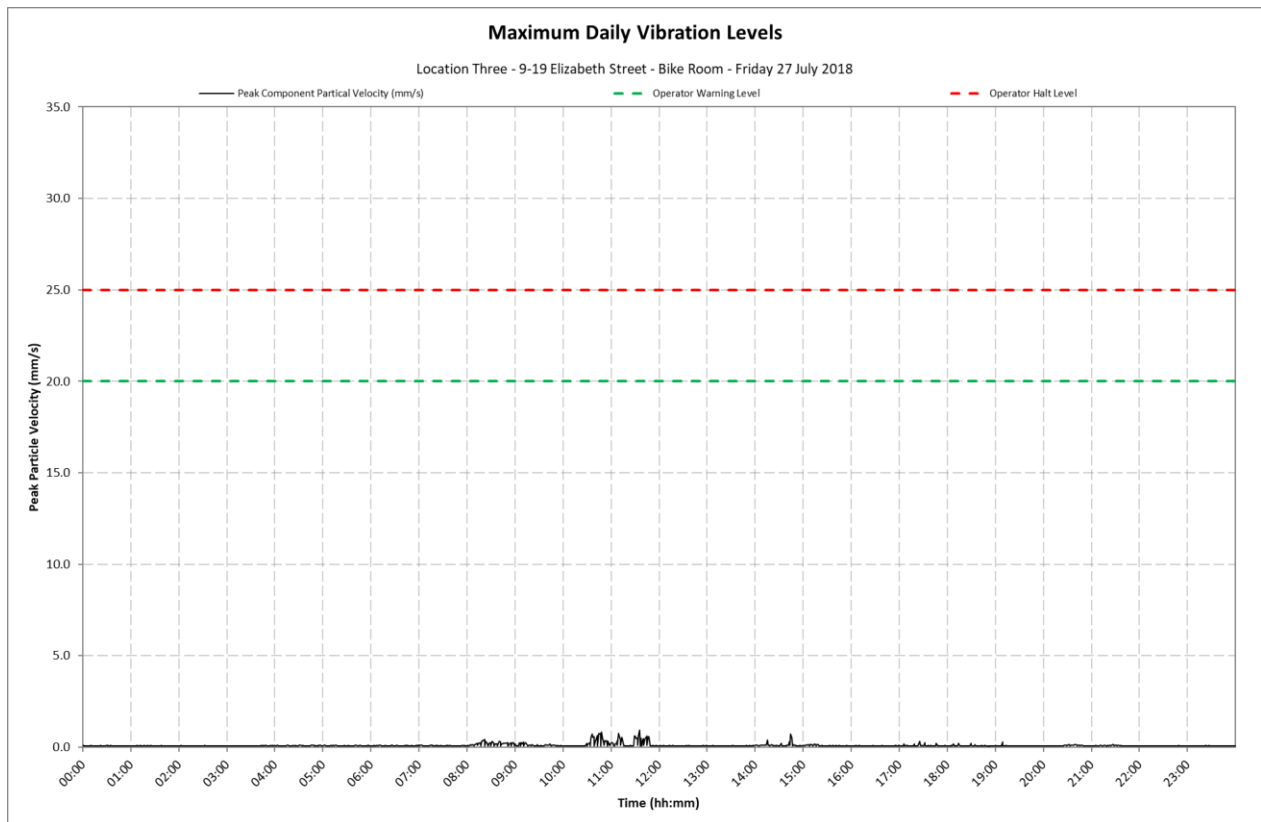
Location 2 - Commonwealth Bank - Vault



Appendix C2

Daily Vibration Levels

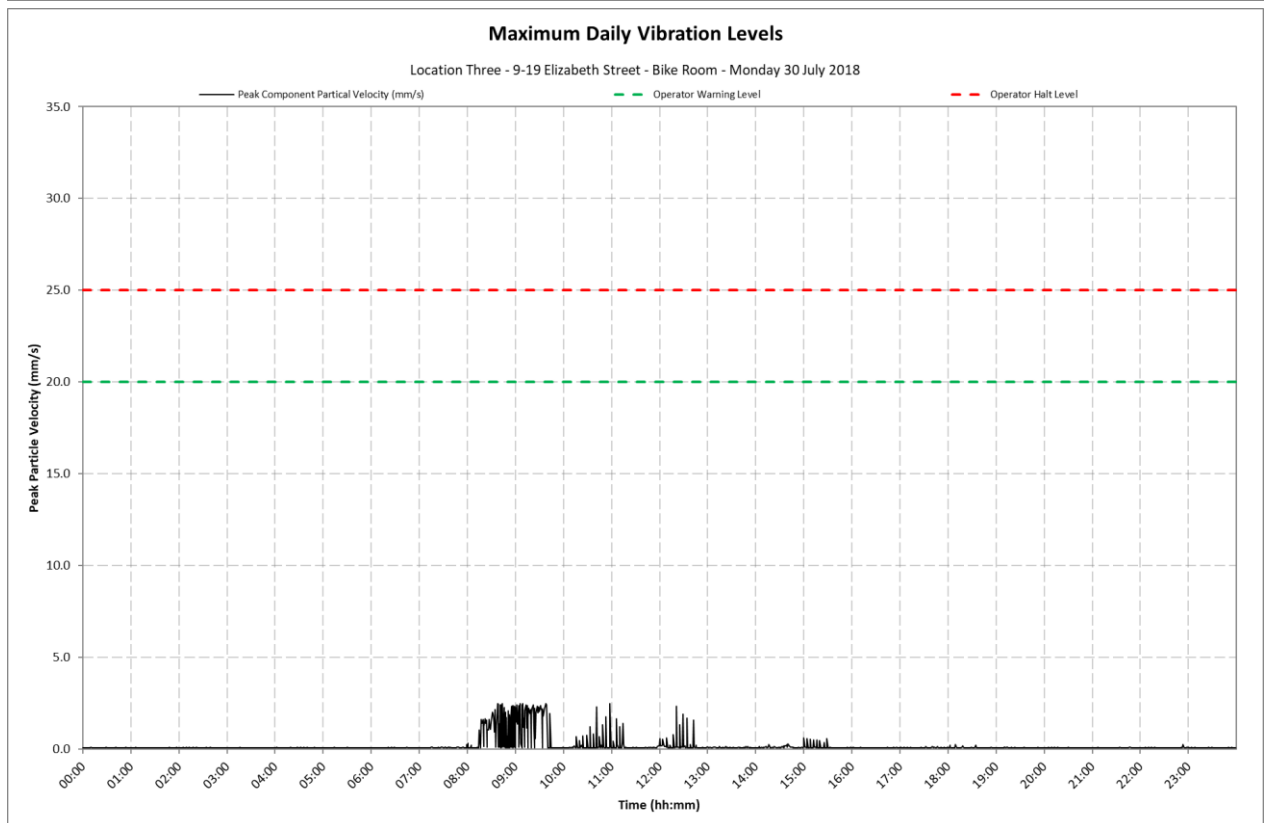
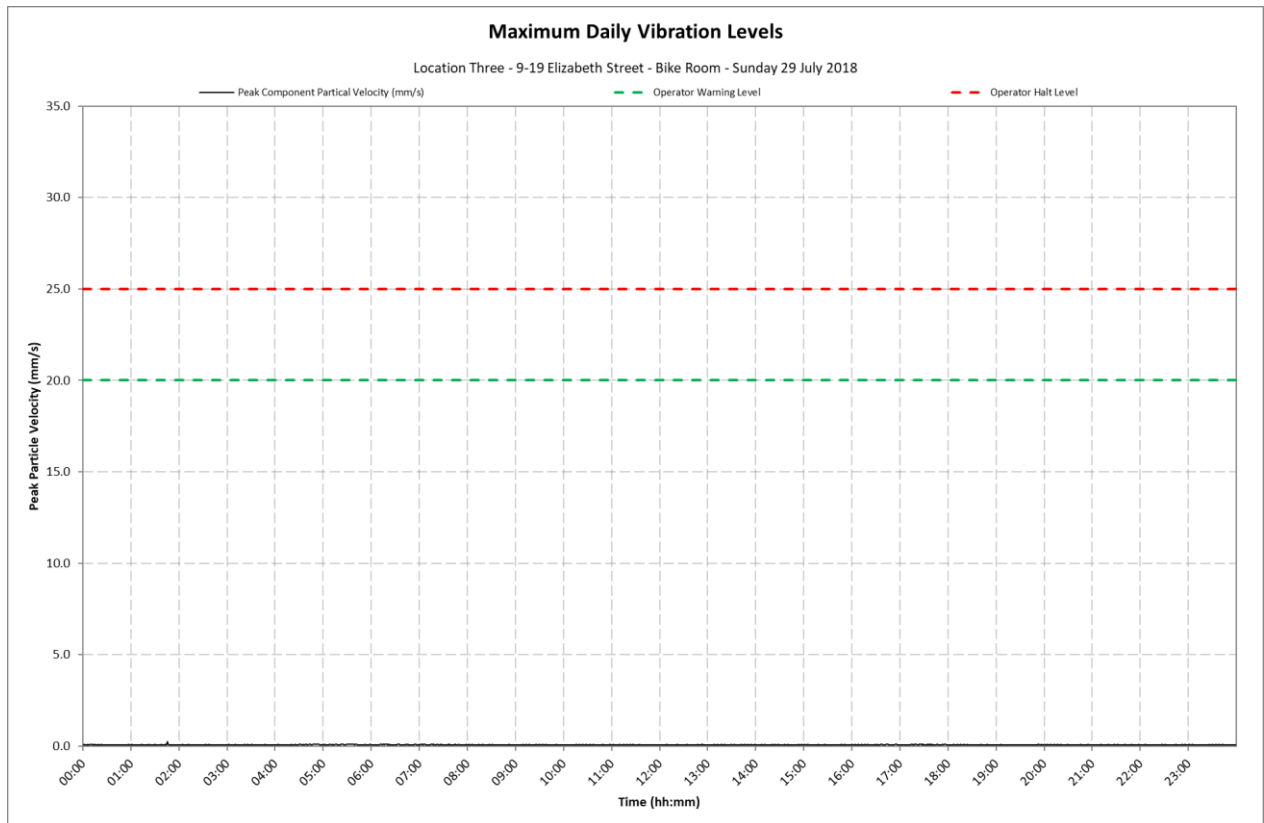
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

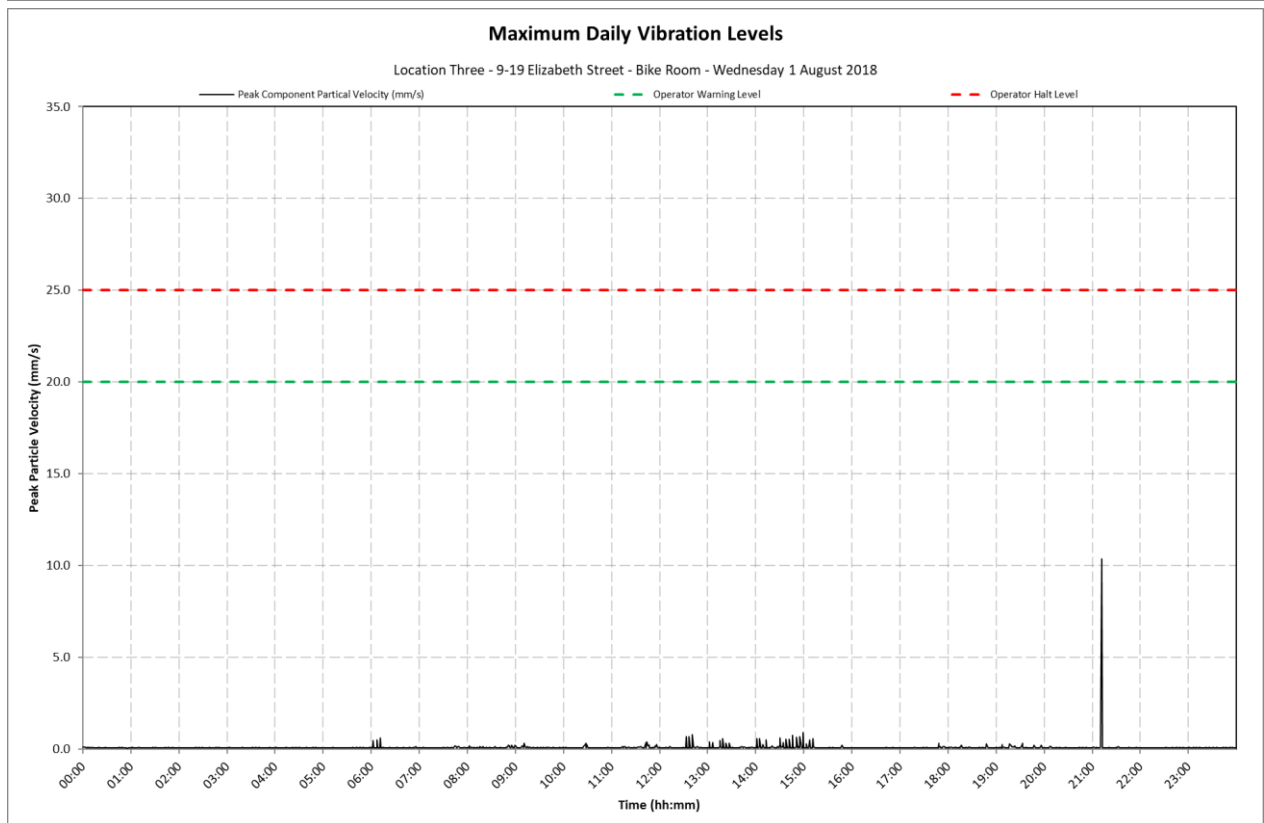
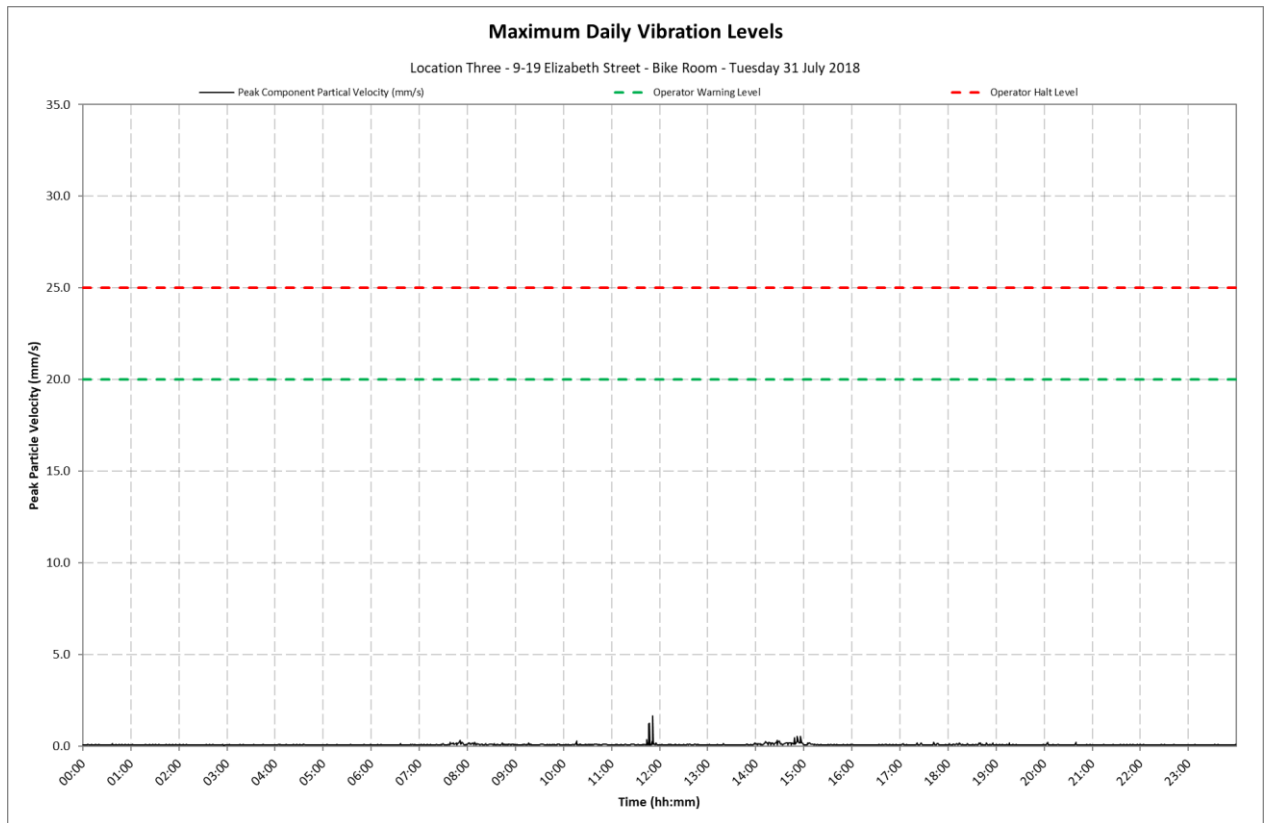
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

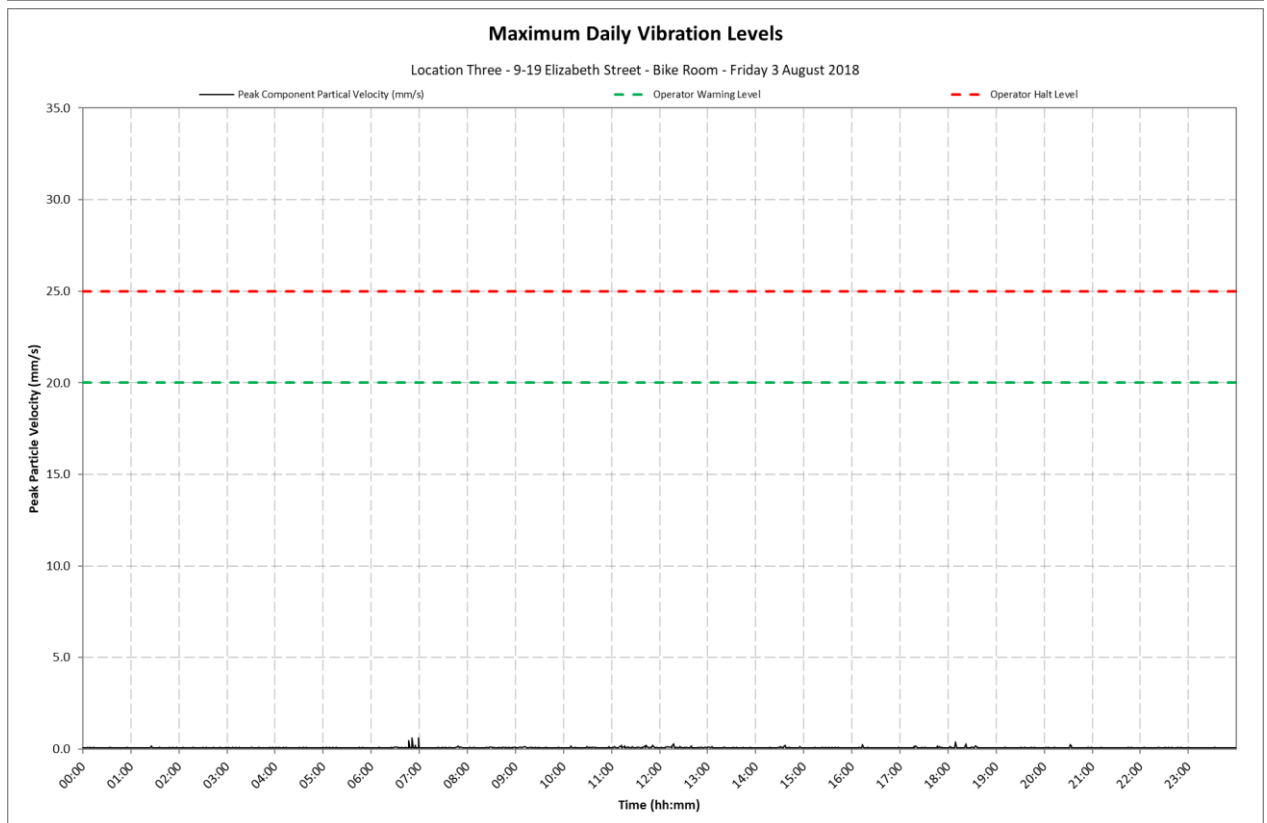
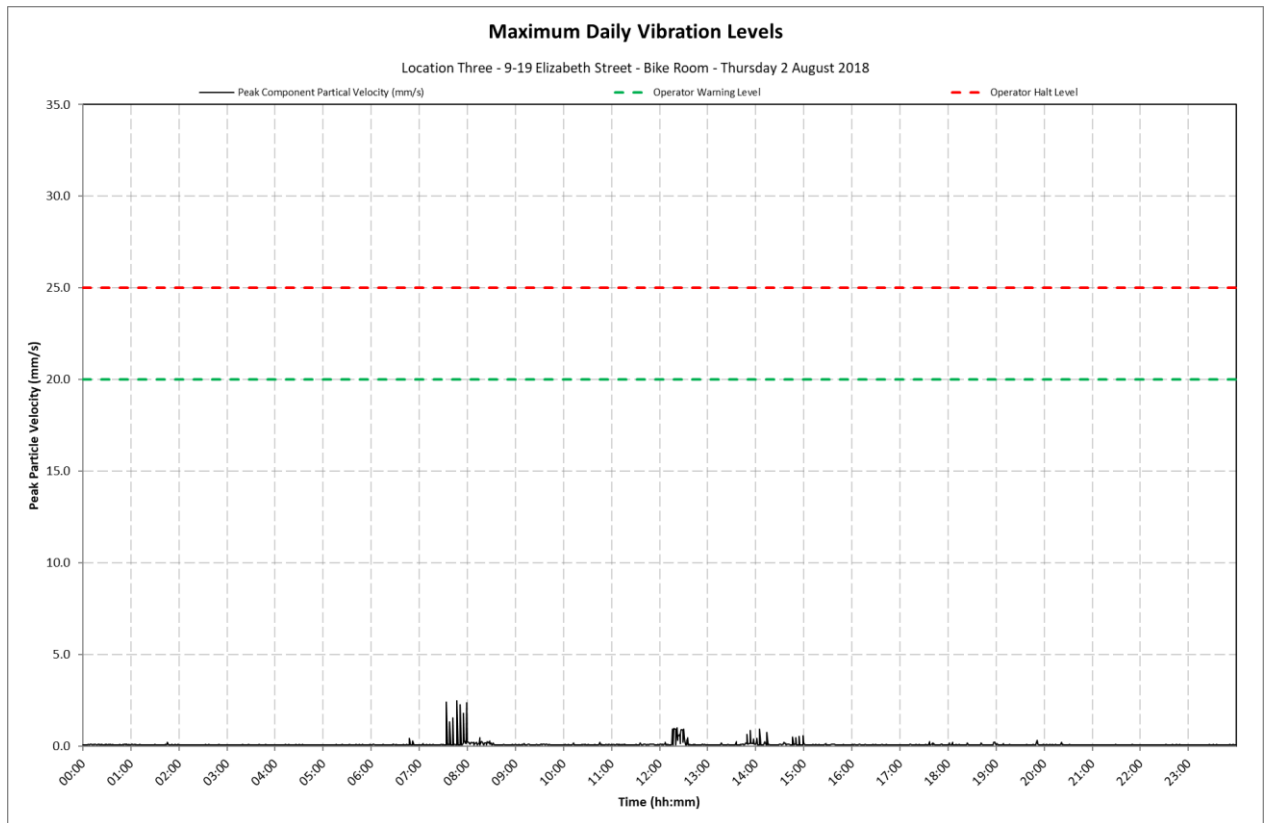
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

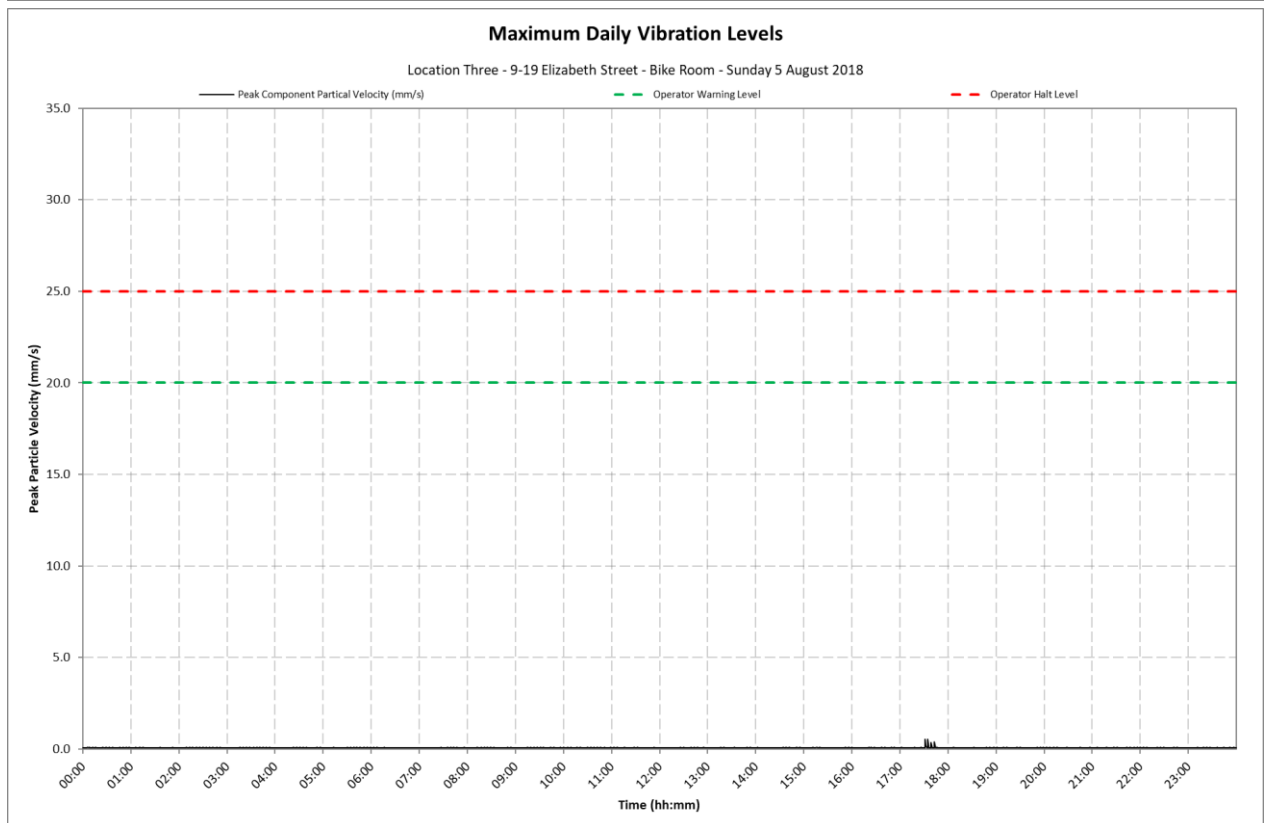
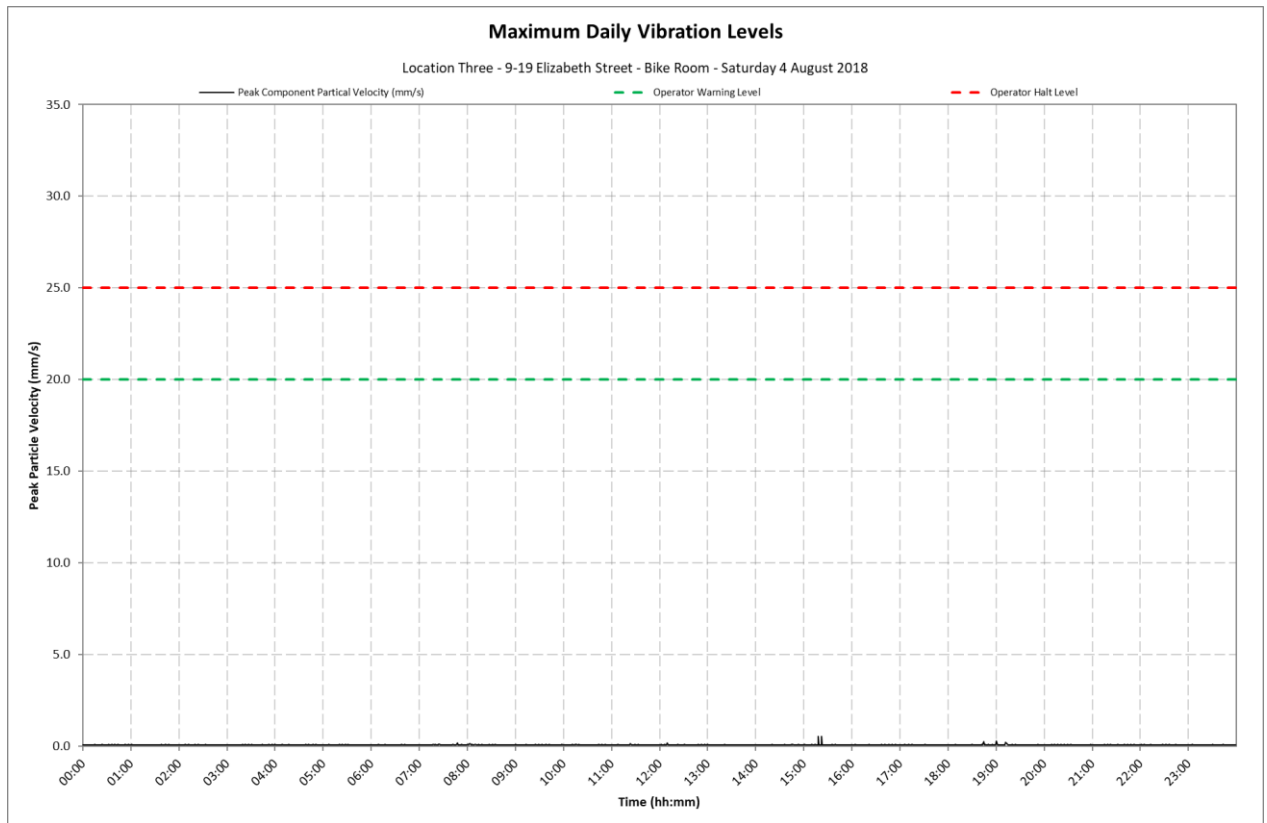
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

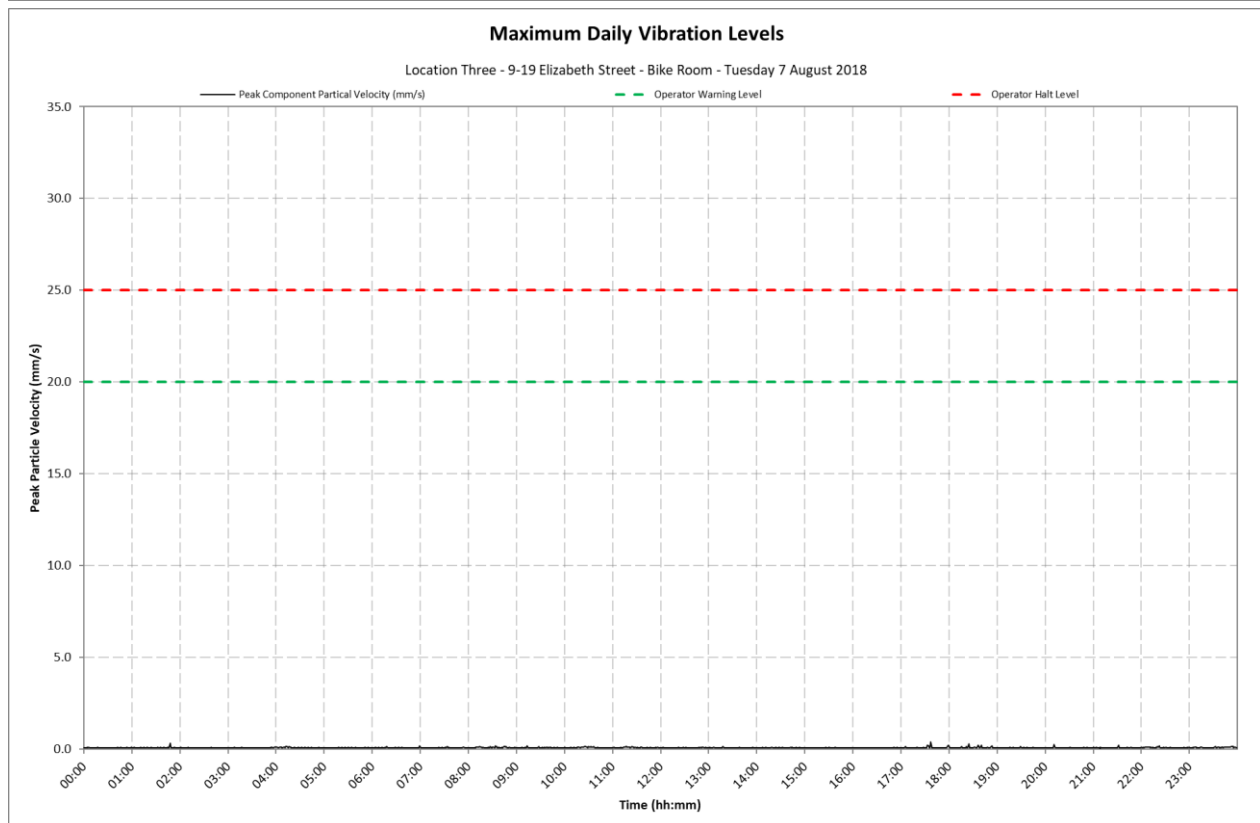
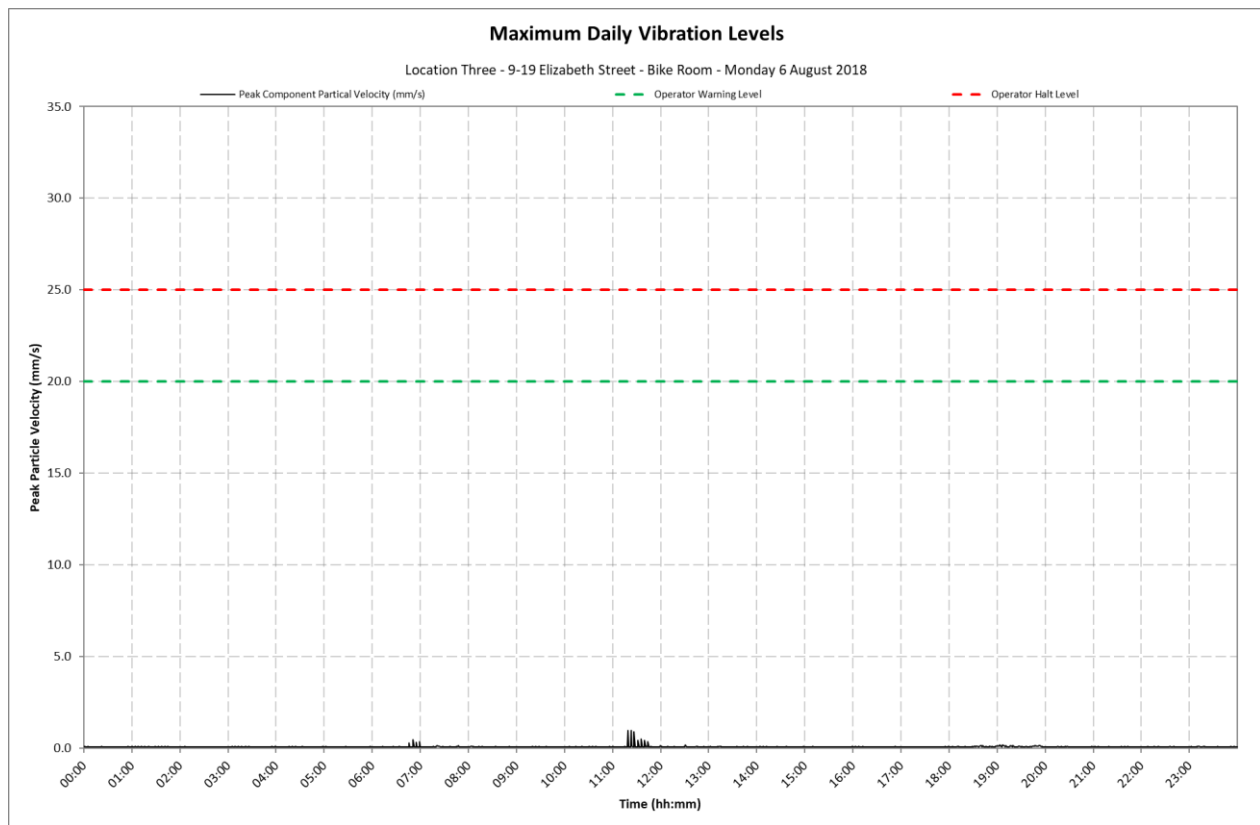
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

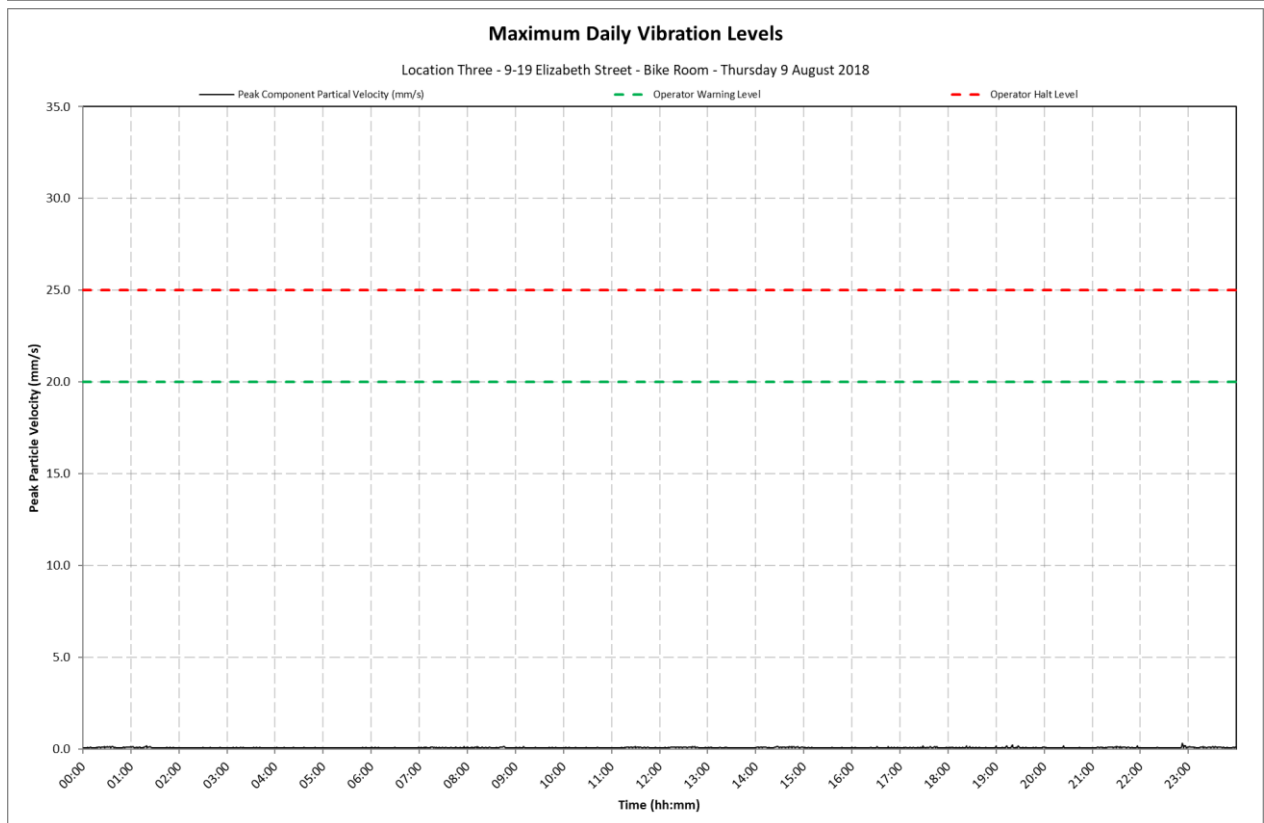
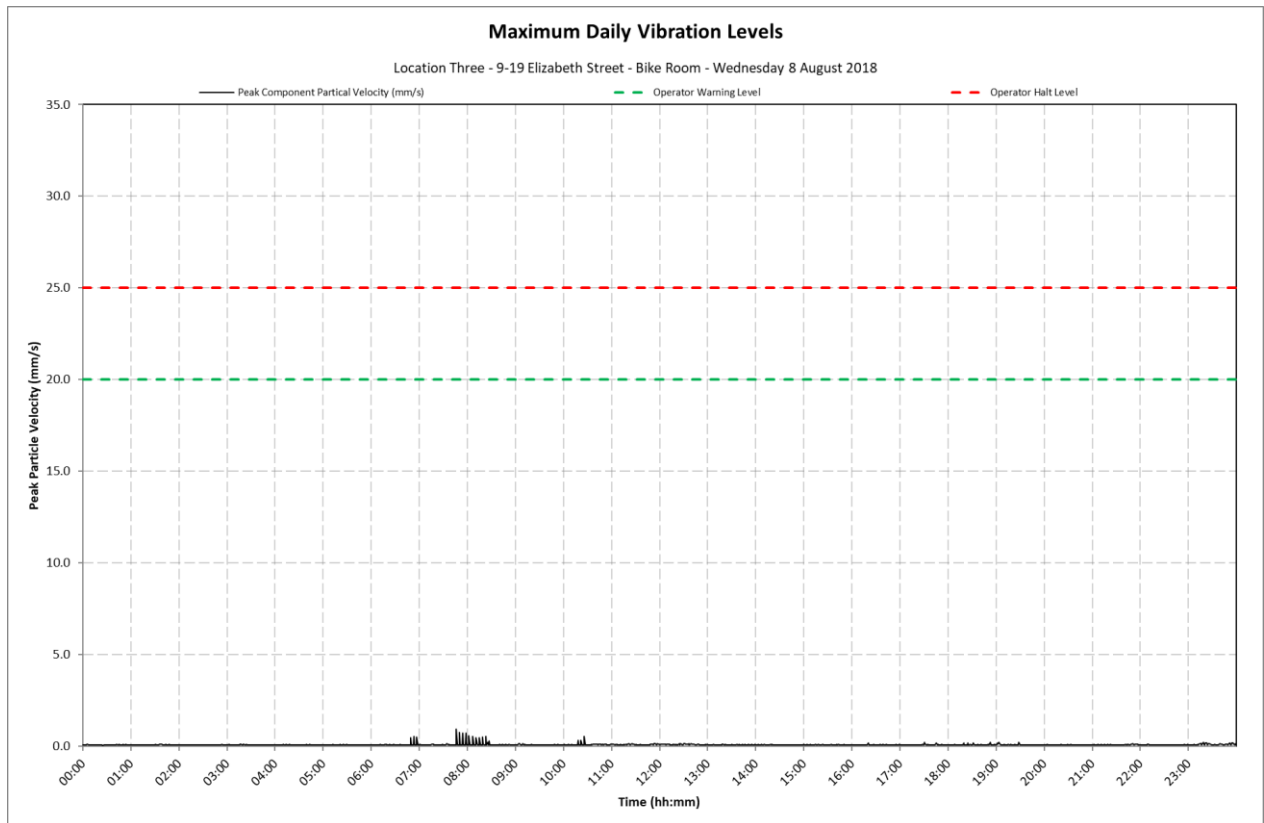
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

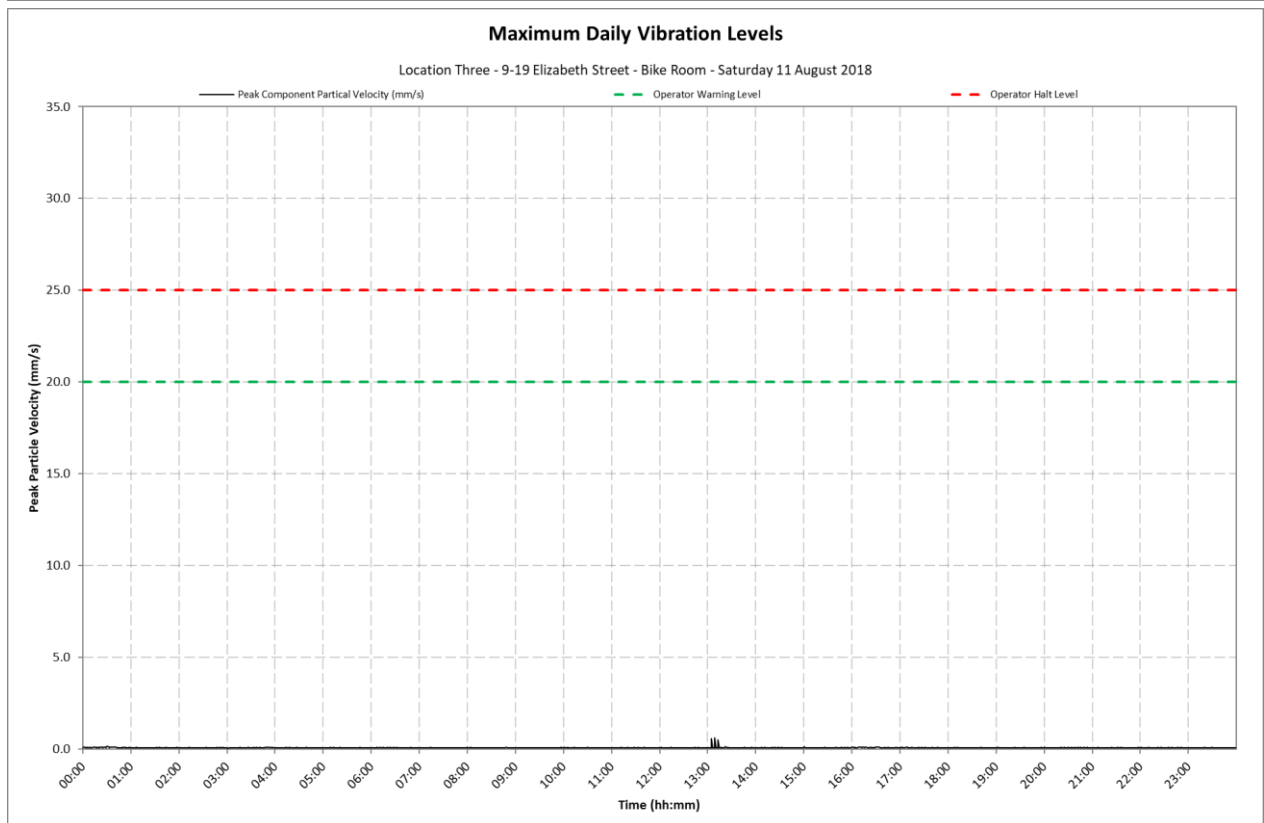
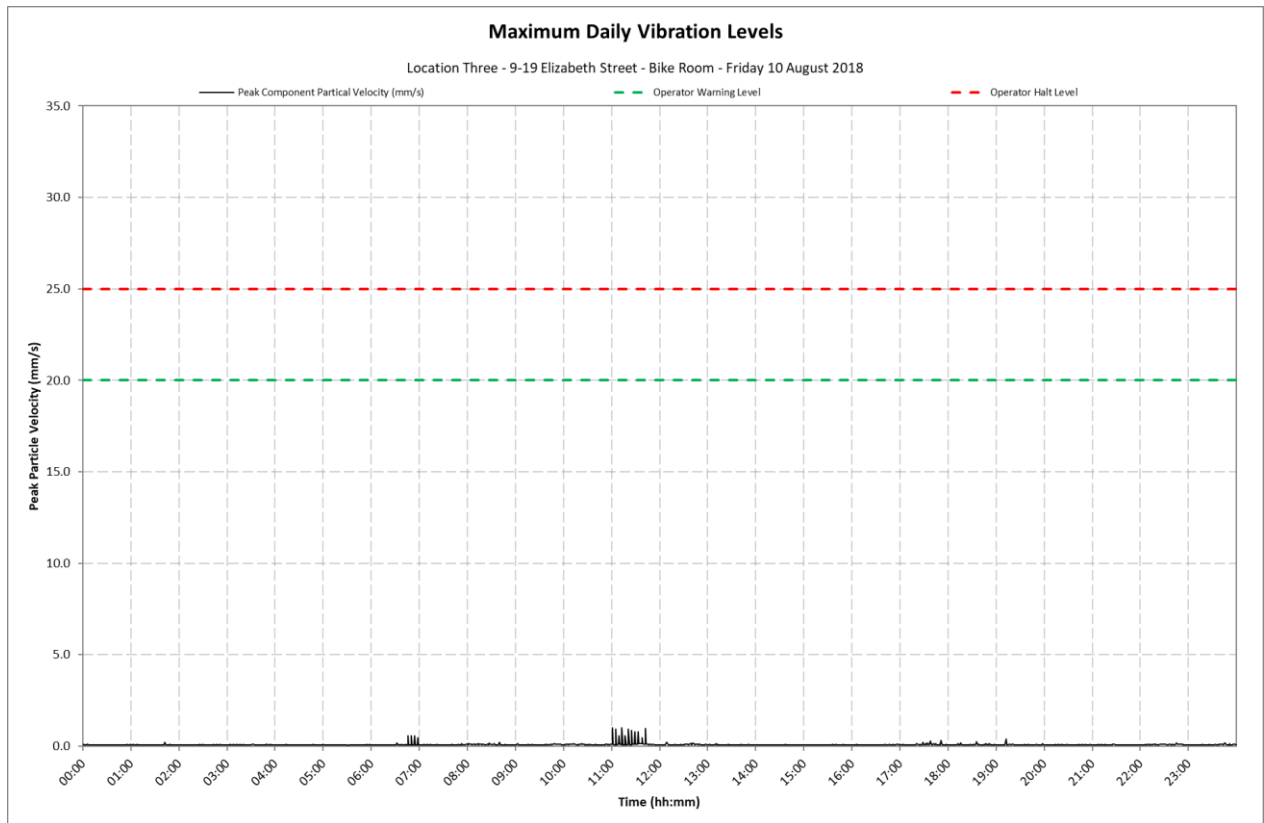
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

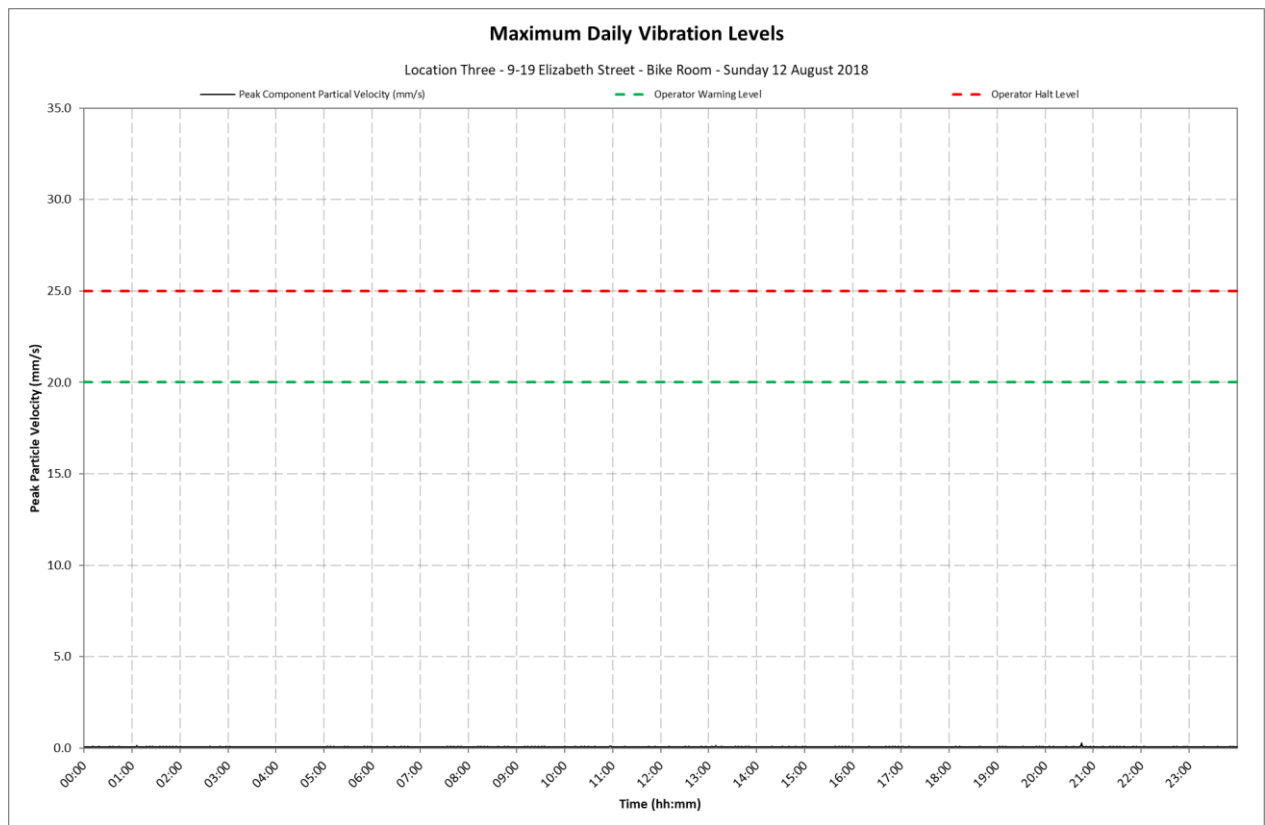
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C2

Daily Vibration Levels

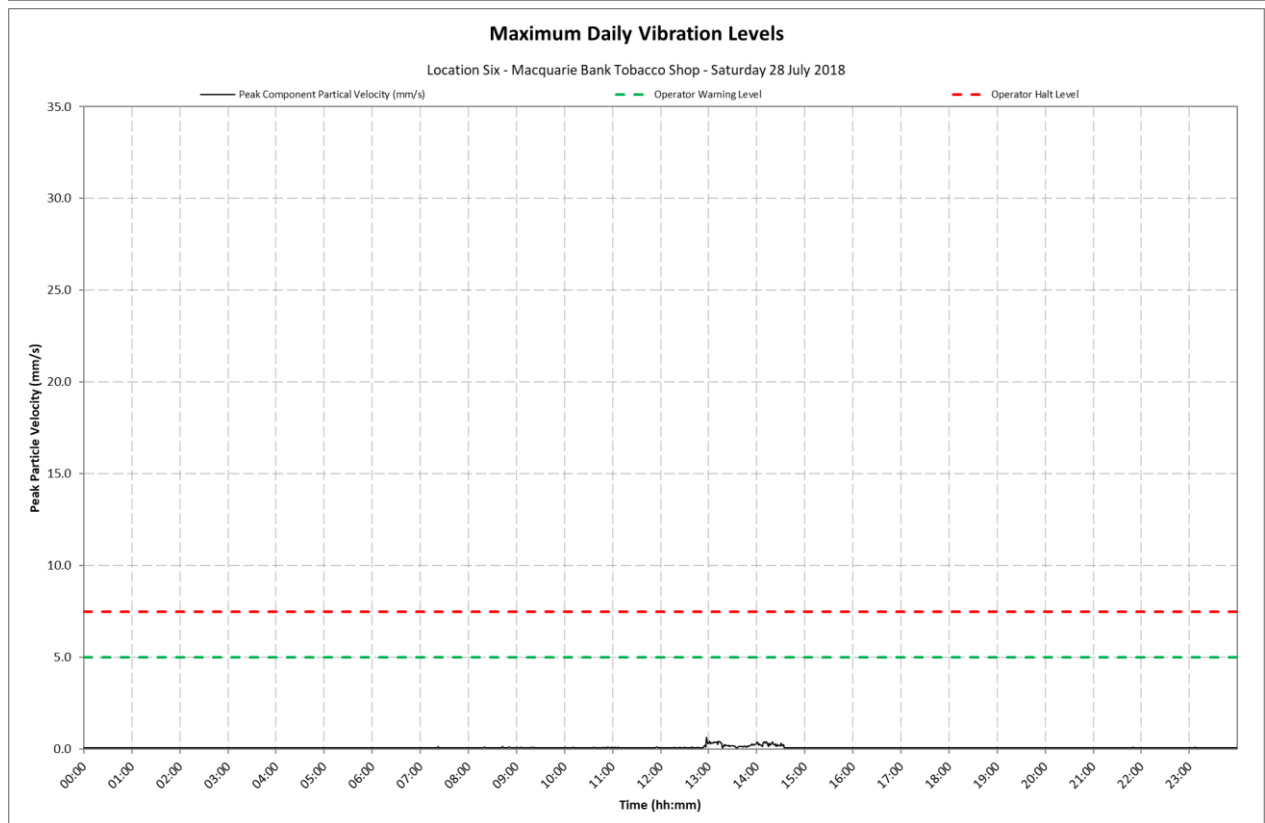
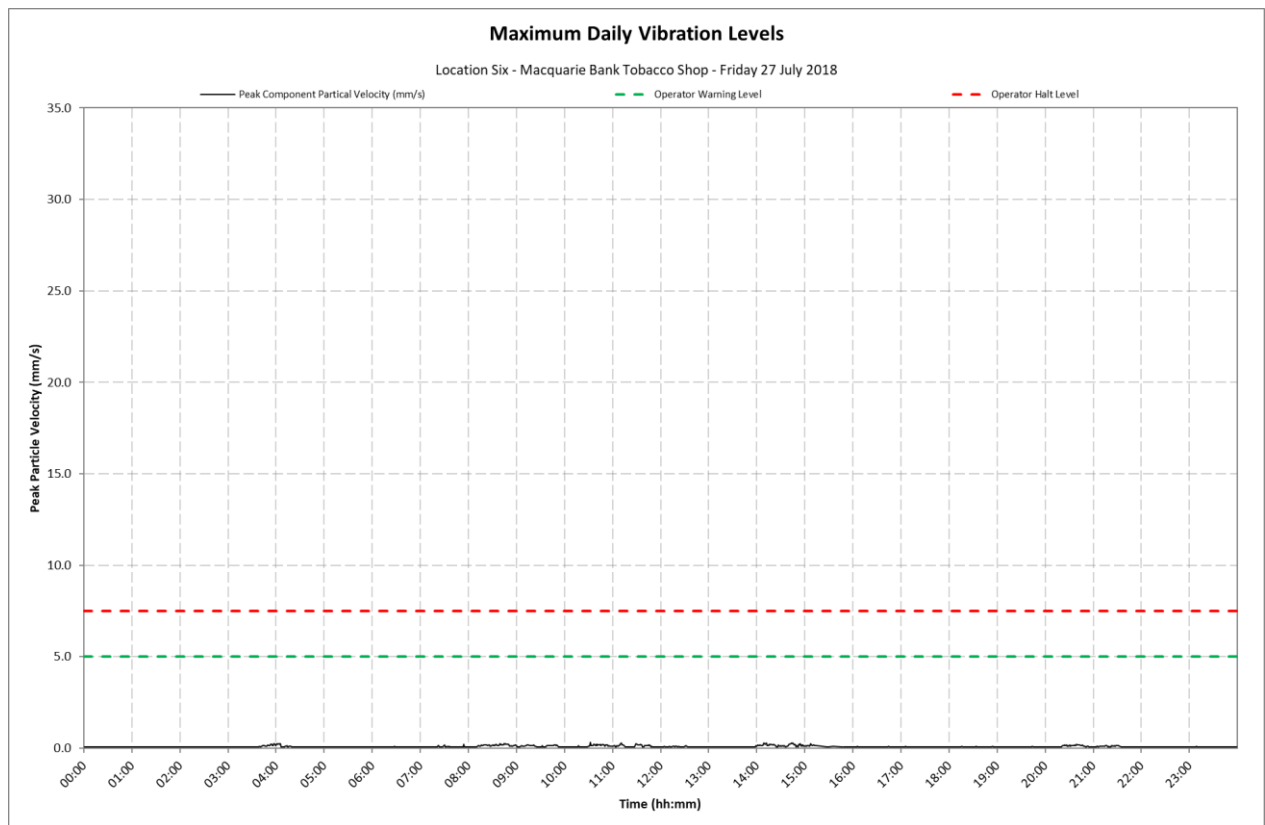
Location 3 – 9-19 Elizabeth Street – Bike Room



Appendix C3

Daily Vibration Levels

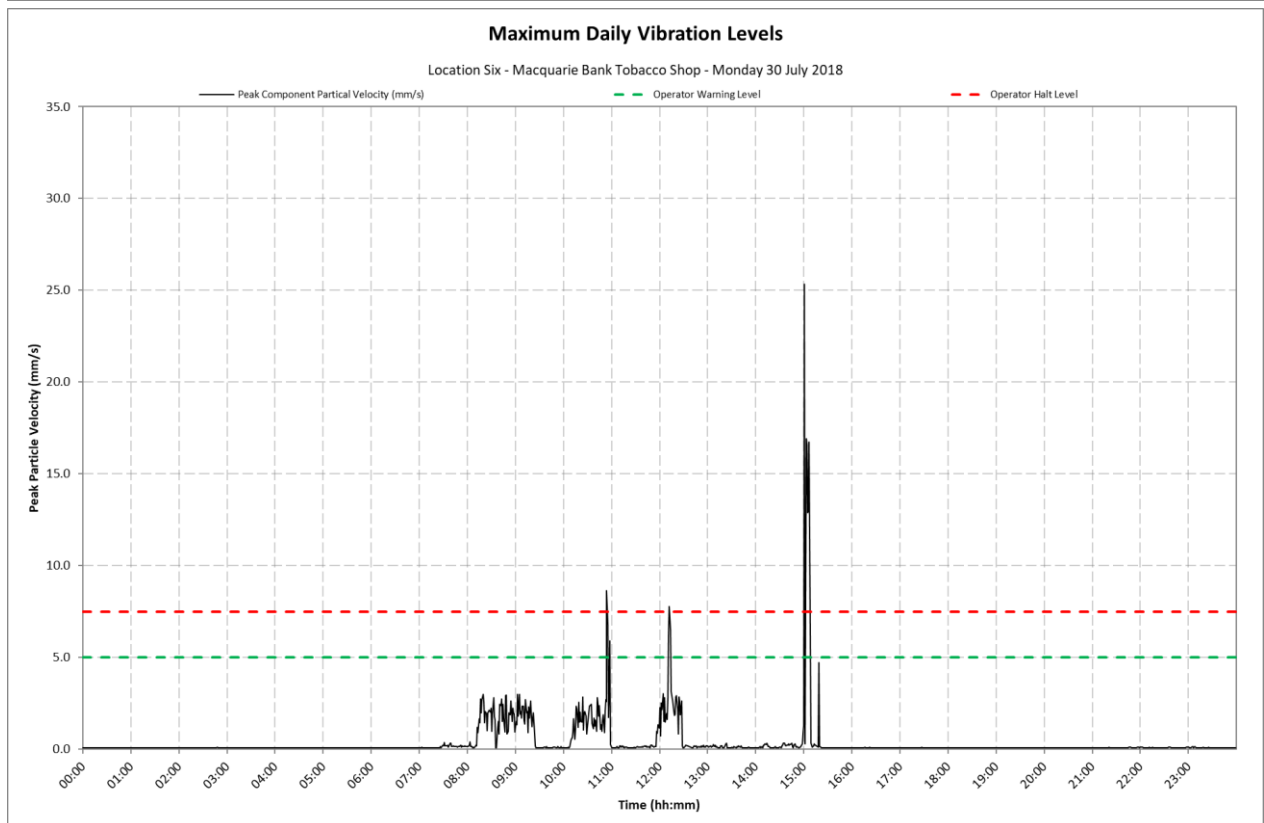
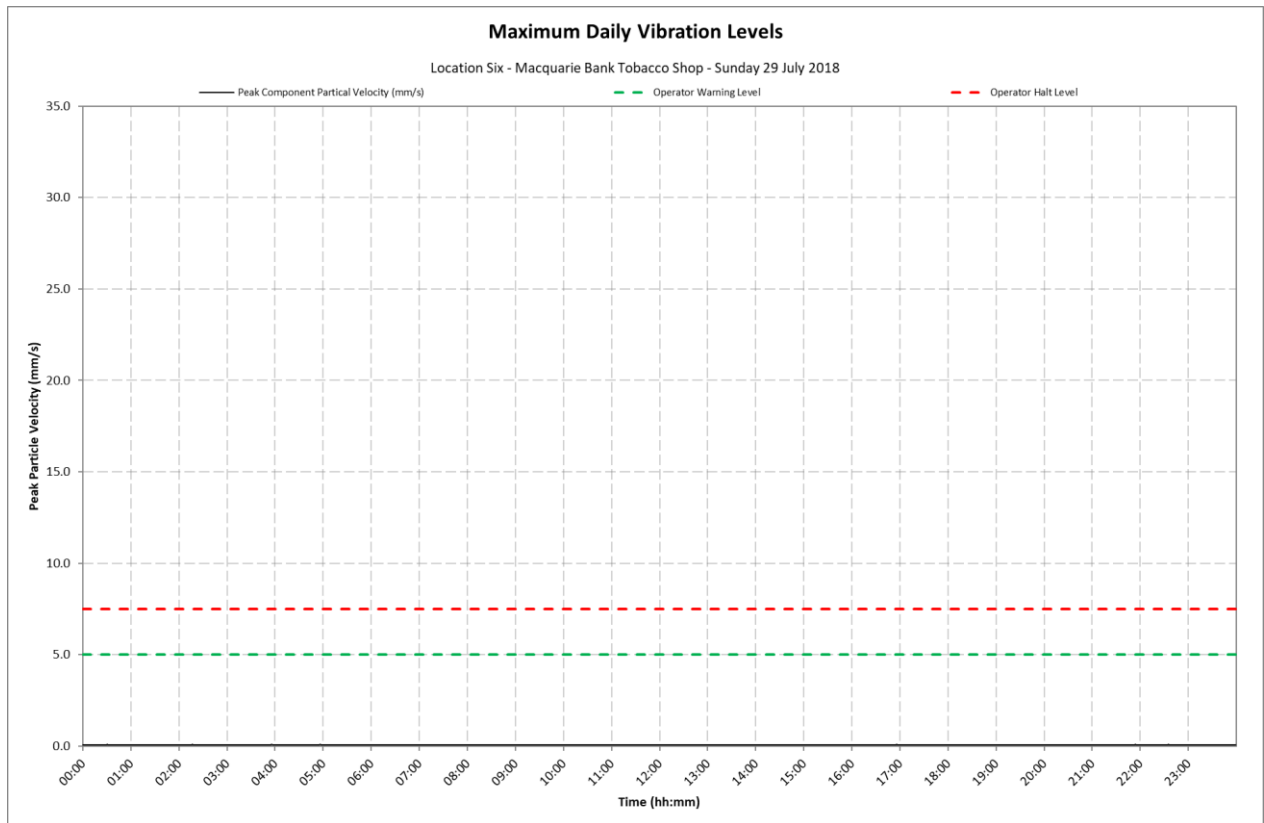
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

Daily Vibration Levels

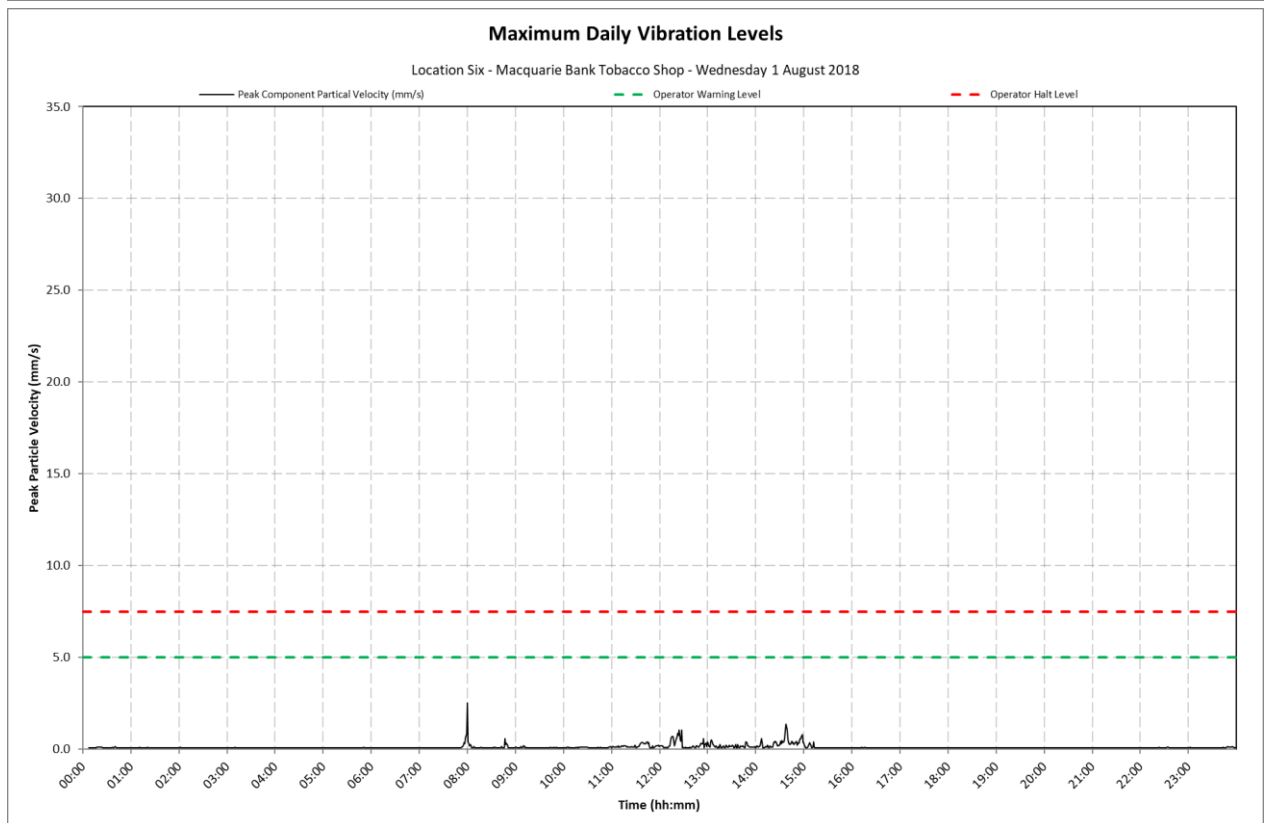
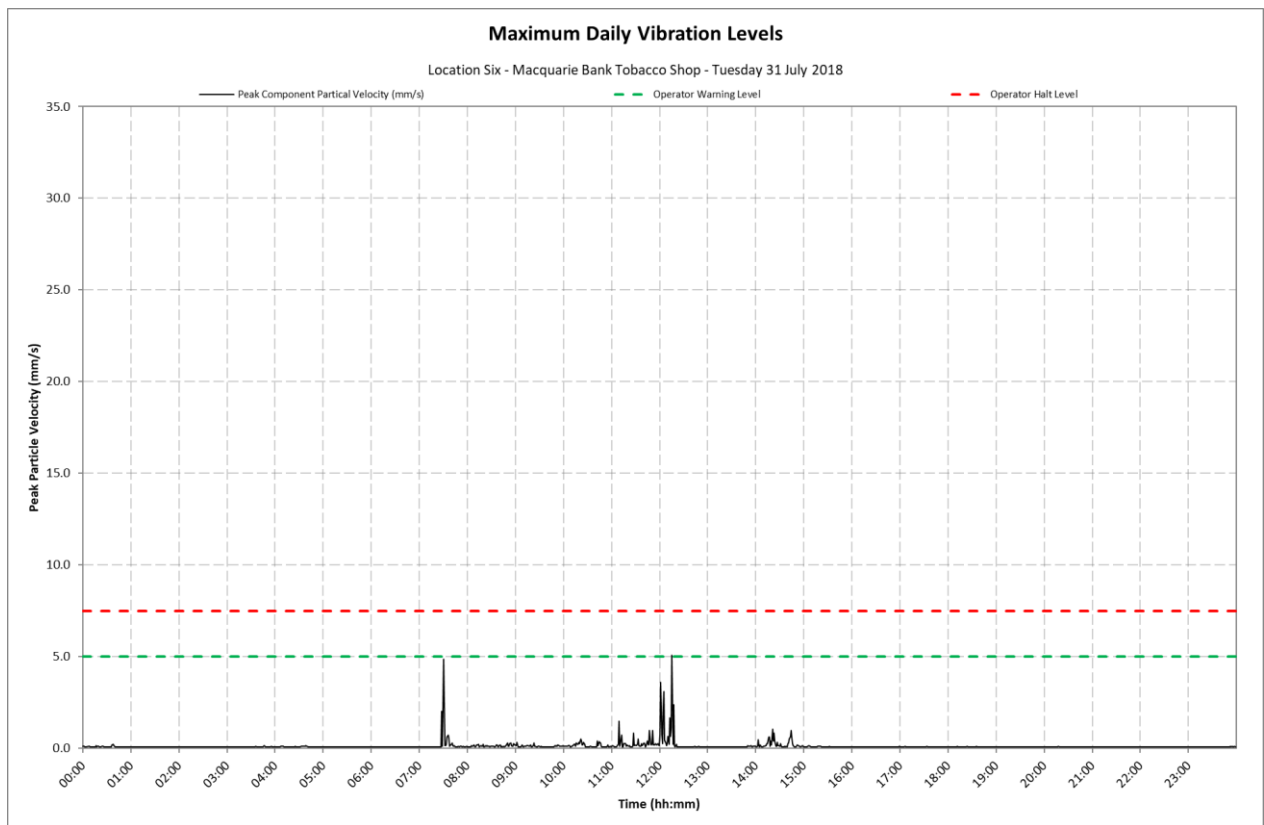
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

Daily Vibration Levels

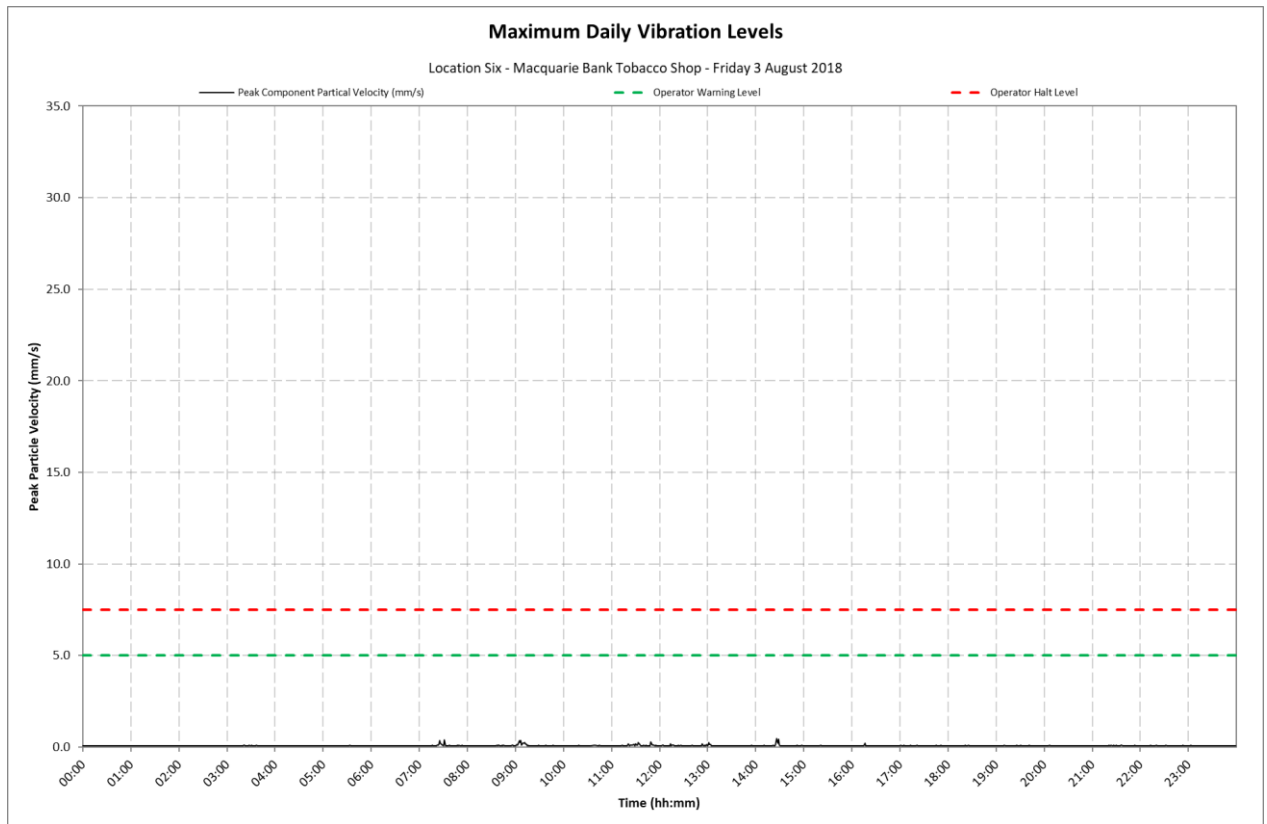
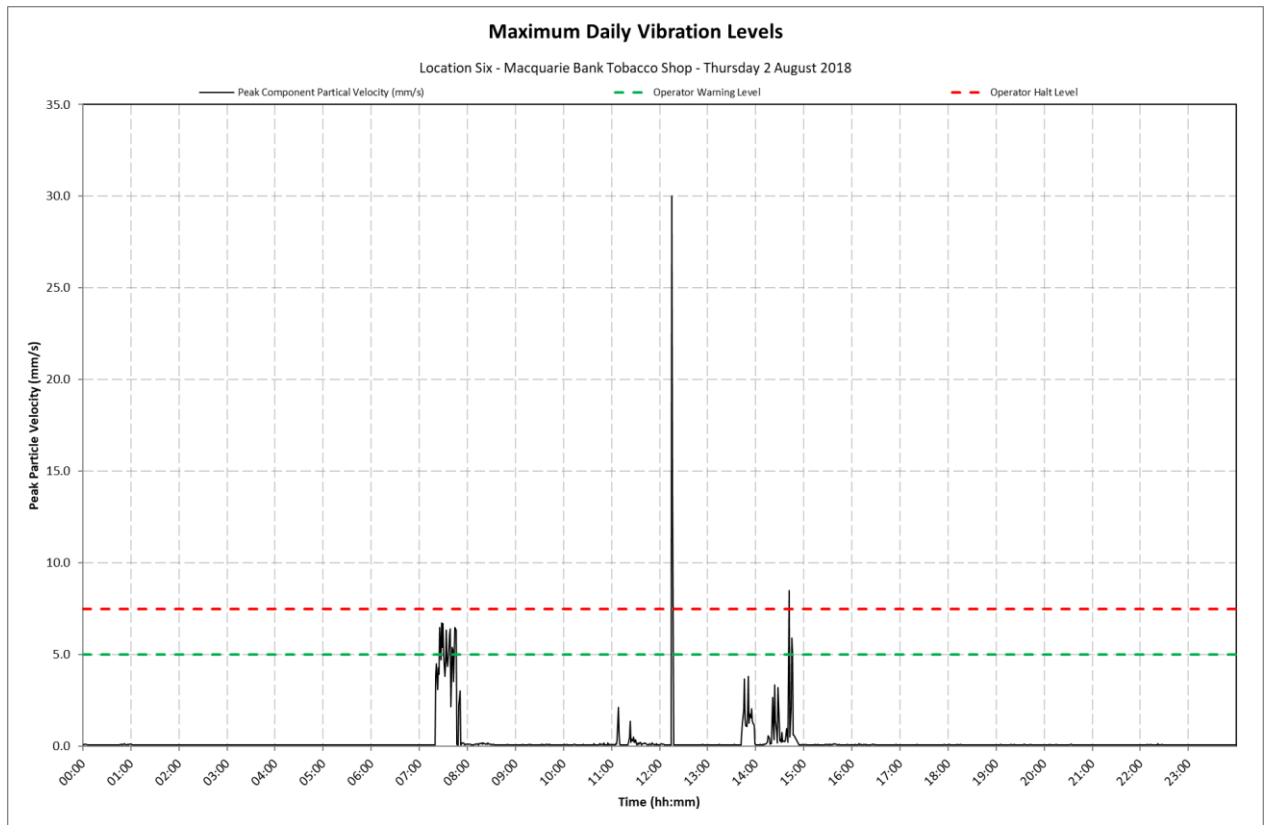
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

Daily Vibration Levels

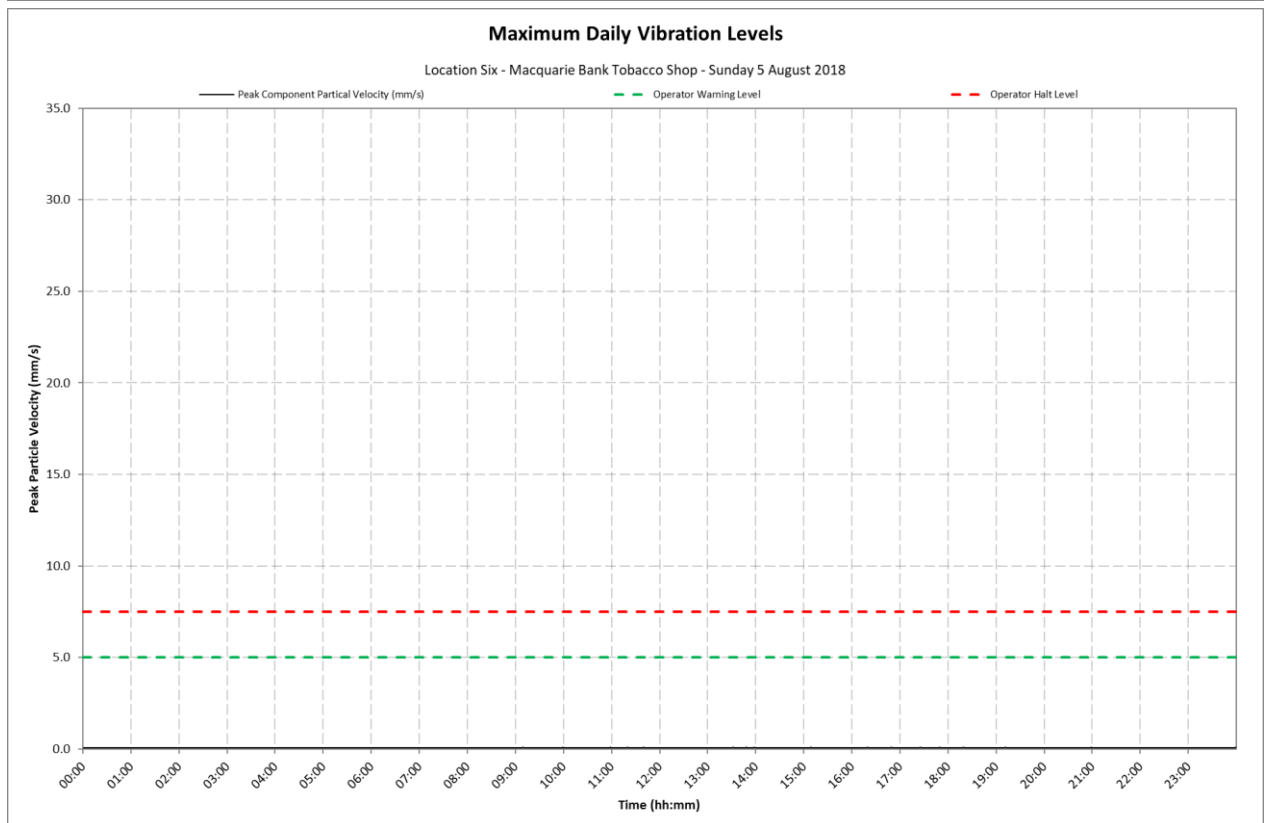
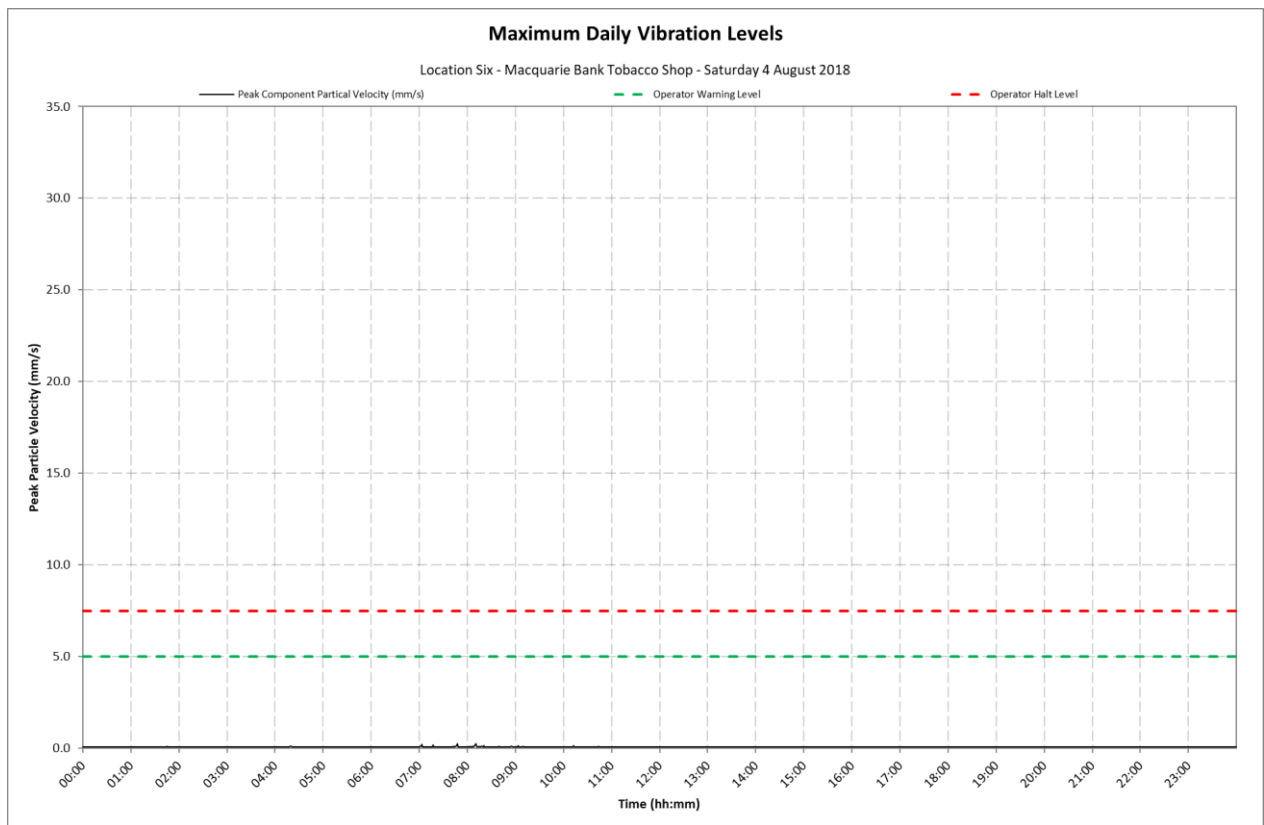
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

Daily Vibration Levels

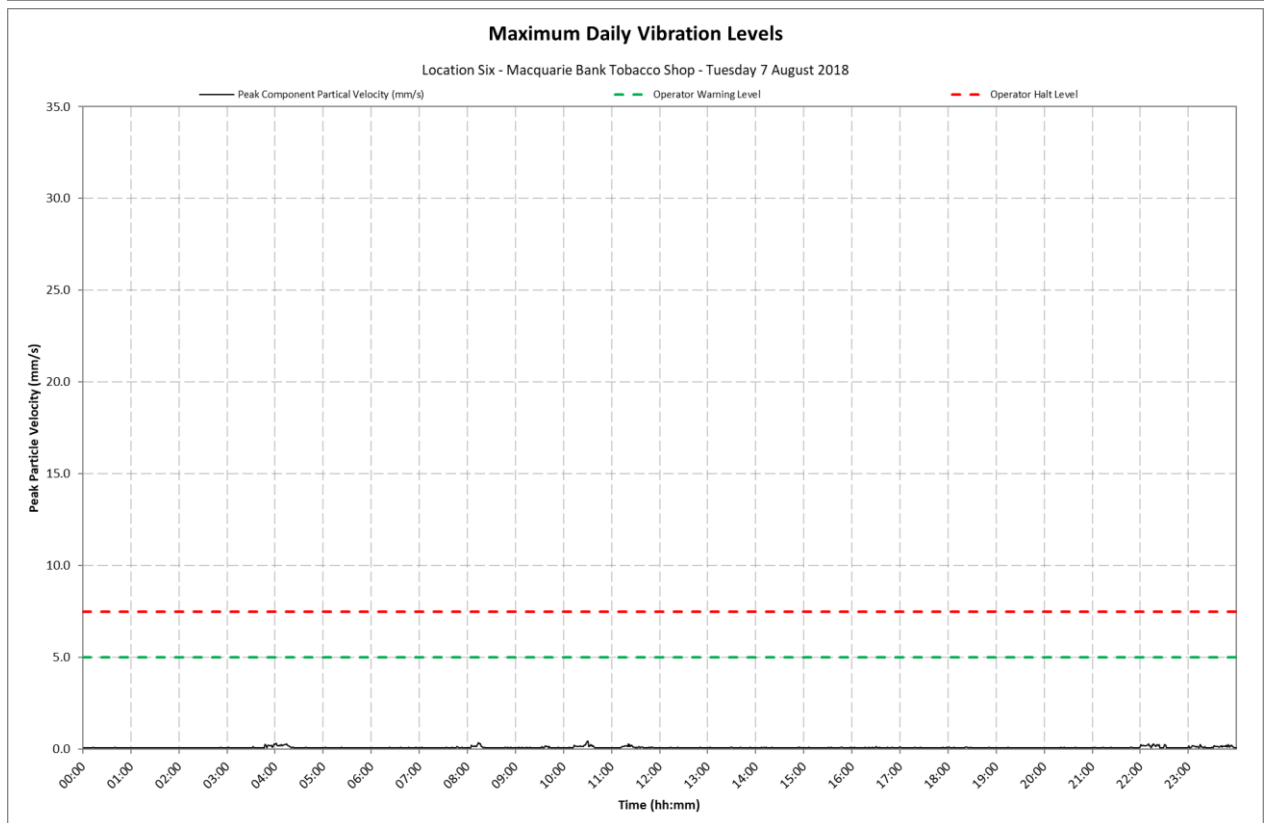
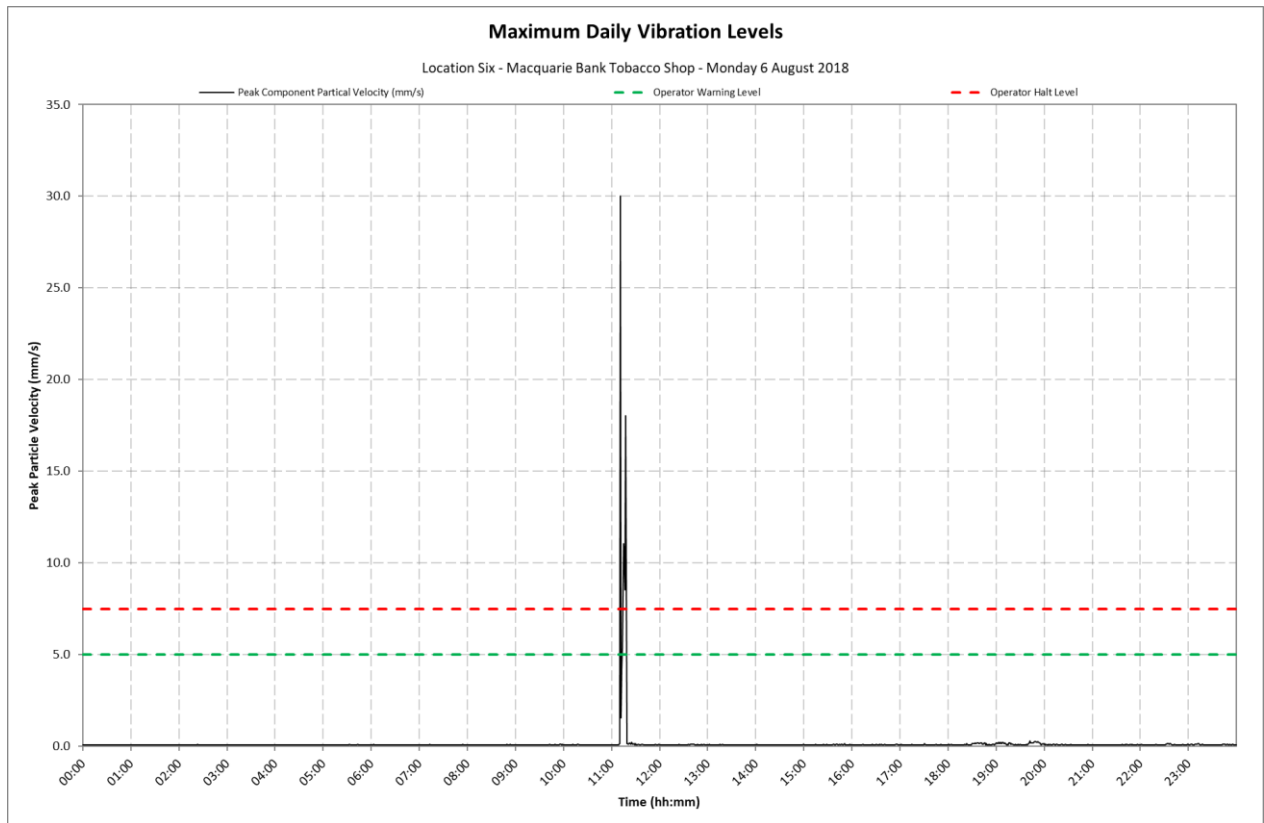
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

Daily Vibration Levels

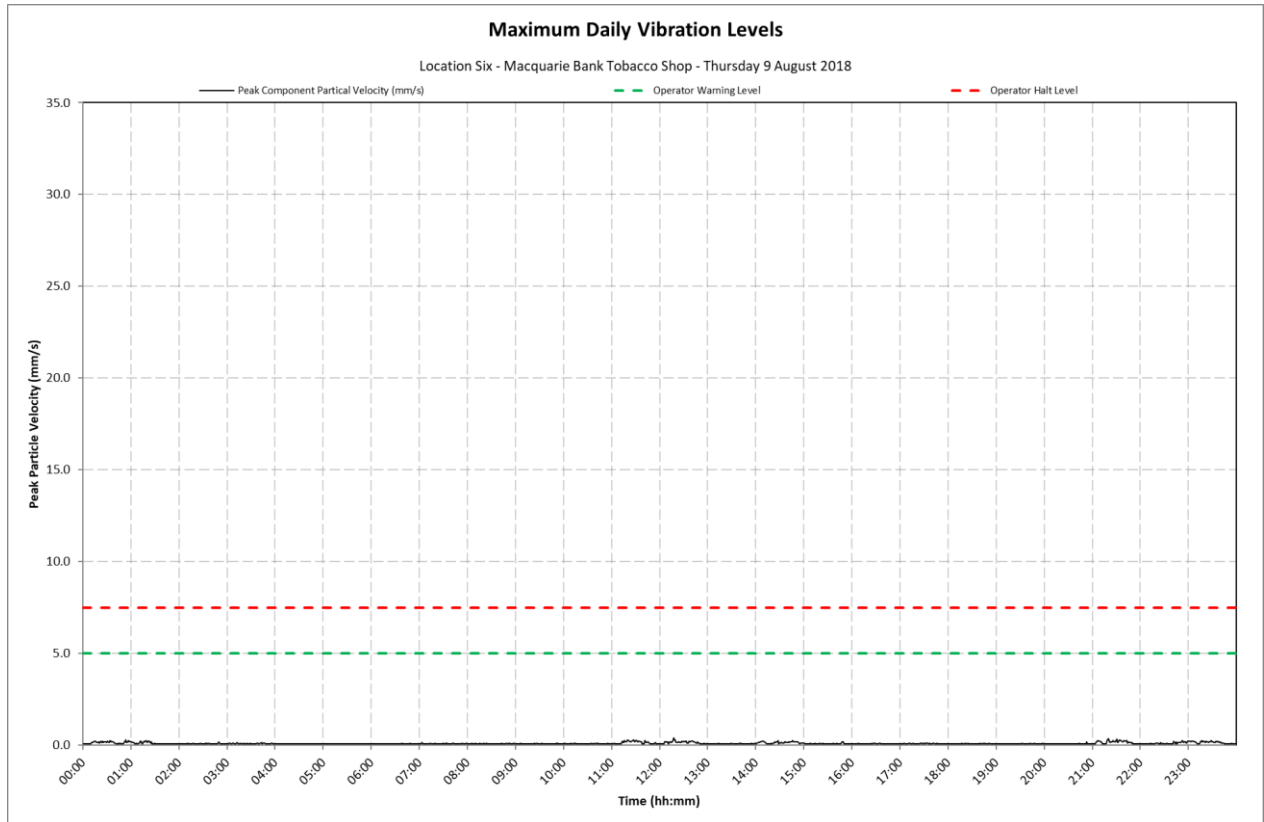
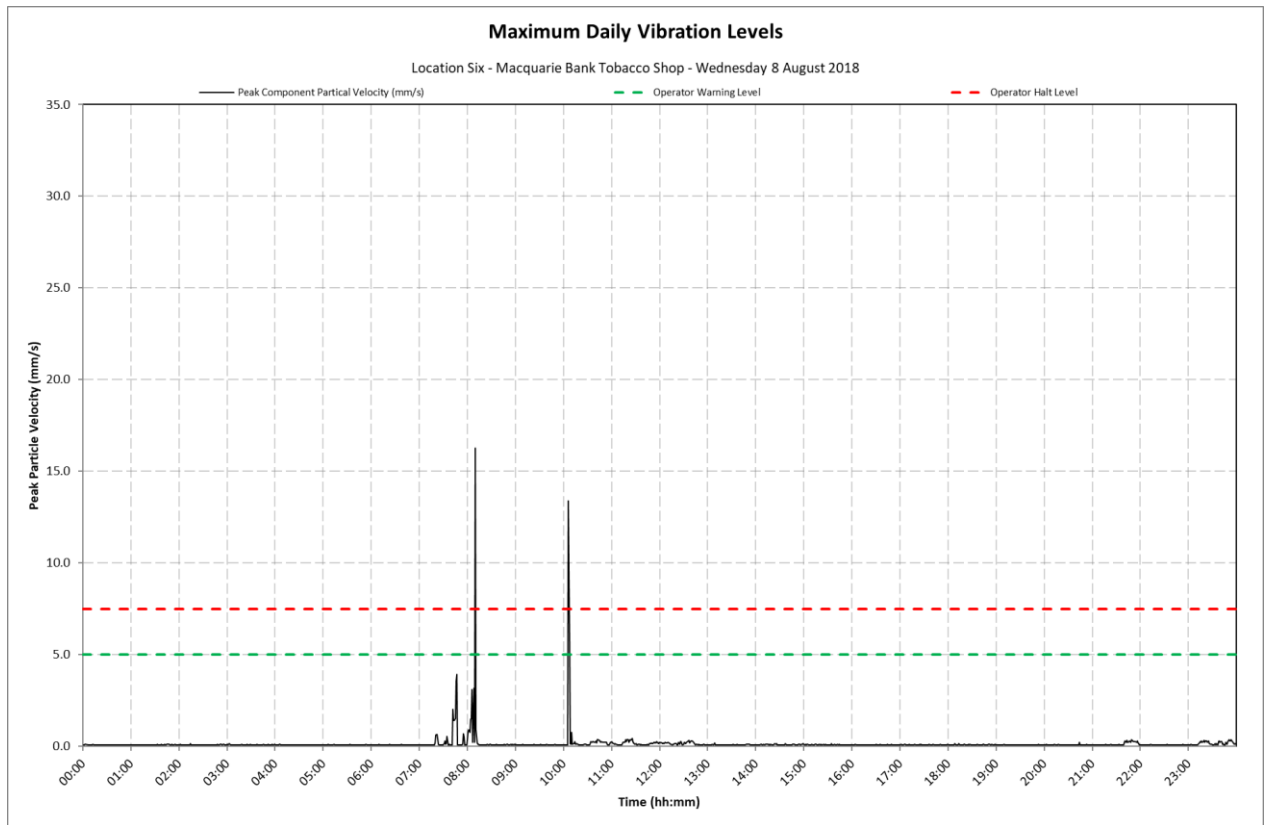
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

Daily Vibration Levels

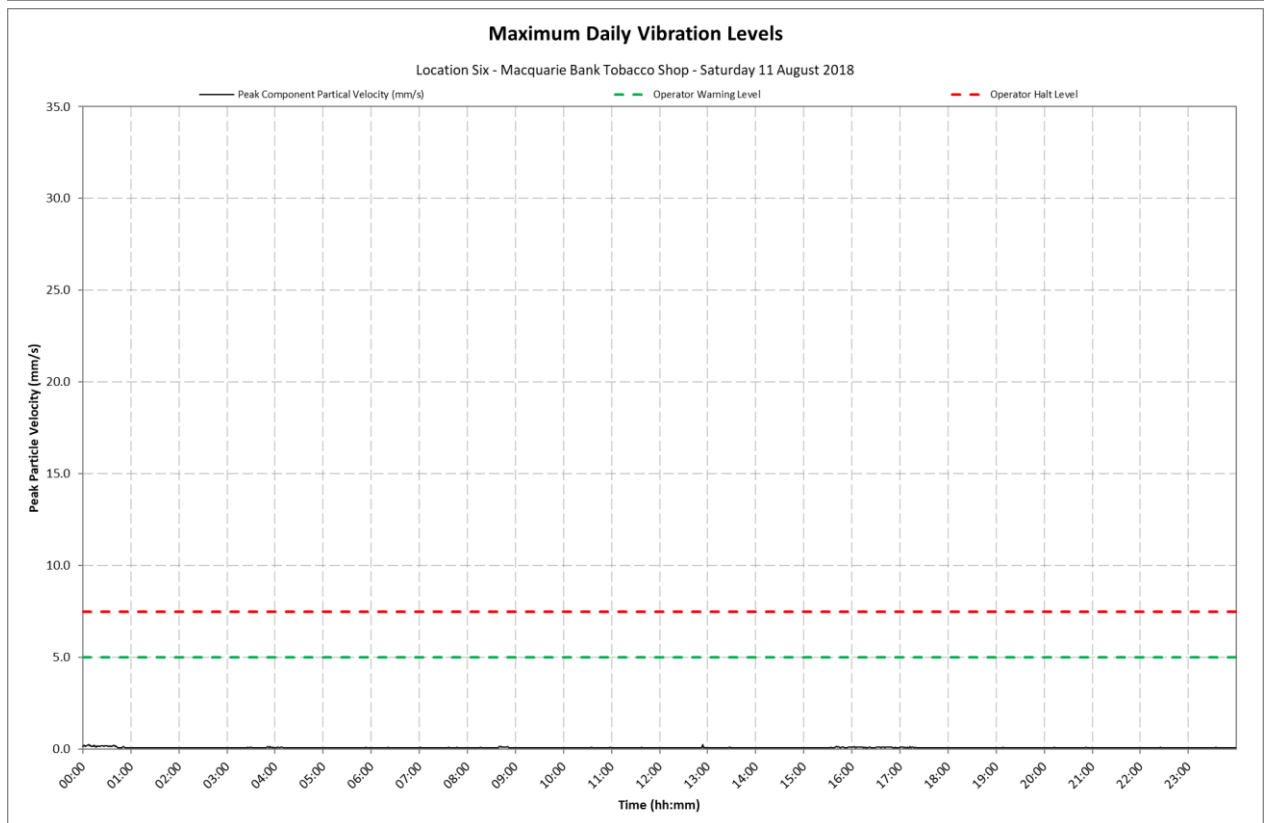
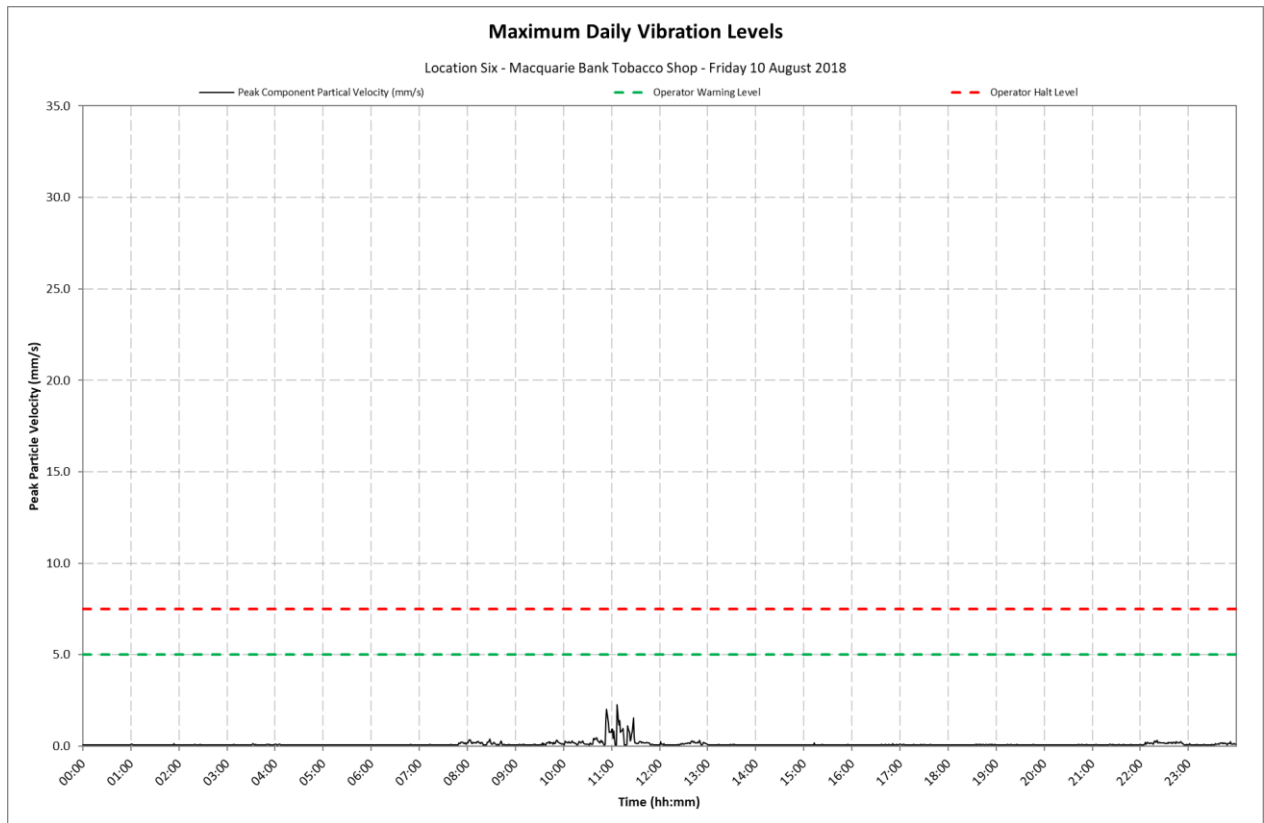
Location 6 - Macquarie Bank Tobacco Shop



Appendix C3

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