Contractor

FCBC
Queensferry Crossing

DRAGADOS | AMERICAN BRIDGE INTERNATIONAL
HOCHTIEF | MORRISON CONSTRUCTION

Project

FORTH REPLACEMENT CROSSING

Document title

VIBRATION MONITORING REPORT

JUNE 2016

00	11/07/16	First draft	MRN	LME	LME
Rev	**Rev. Date**	**Purpose of revision**	**Made**	**Reviewed**	**Approved**

Document status

FOR REVIEW

Made by Michael Richardson	Checked By: Lindsay McIntyre
Initials: MRN	Initials: LME

Document number **REP-00284**	Rev 00

Contents

Appendices:

INTRODUCTION

1.1. Monitoring of construction vibration is being undertaken by FCBC during the construction of the new Forth Crossing and associated road network. This report covers the month of June 2016. The objective of this report is to detail the vibration monitoring that has been undertaken across the site during this period, which has been done so in accordance with the Code of Construction Practice (CoCP), and Noise and Vibration Management Plan (NVMP).

1.2. FCBC carefully risk assesses noise & vibration likely to result from all construction activities, through the production of Plans for Control of Noise & Vibration (PCNVs). During the preparation of PCNVs, vibration prediction assessments are made. These assessments illustrate that no construction plant, equipment or methodology to be used by FCBC are envisaged to induce any levels of vibration at sensitive receptors that would exceed the vibration threshold levels stated in the CoCP. These assessments/predictions have been validated by means of the vibration monitoring results displayed in this report.

2. MONITORING SUMMARY

2.1. Due to the location and sensitivity of vibration monitoring equipment, the exceedances presented in the graphs included in the appendices of this report do not represent levels generated by construction, but rather show local interference around the monitoring equipment. This can include, for example, footsteps or doors being slammed, or indeed any significant movements occurring close to the monitoring equipment.

2.2. According to the BS5228-2 (2009) there is minimal documented proof of actual damage to structures or their finishes resulting from construction vibration, and damage resulting solely from well-controlled construction and demolition vibration is rare. There are many other mechanisms that cause damage, especially in decorative finishes, and it is often incorrectly concluded that vibrations from construction and demolition sites are to blame. In many cases it is not possible to ascertain the exact source of vibration, though it is possible to rule out construction as a source on an activity basis.

2.3. The works carried out in each of the various construction work areas as well as the related vibration assessments are summarised in Appendix A.

2.4. Considering the distances between the various construction work areas and sensitive receptors as well as working methods utilised, the risk of any damage to structures or nuisance to residents occurring as a result of FCBC construction-related vibration is highly unlikely.

2.5. The number of threshold exceedances at the various vibration monitoring stations during the relevant period are shown in Table 1 below.

Table 1: Number of exceedances of thresholds set out in the CoCP

June 2016

Location	PPV Exceedance		VDV Exceedance	
	Continuous ($5\ mm.s^{-1}$)	***Intermittent ($10\ mm.s^{-1}$)***	***Day ($0.4\ m.s^{-1.75}$)***	***Night ($0.2\ m.s^{-1.75}$)***
Linn Mill	6	2	0	0
Butlaw Fisheries	1	2	2	0
Clufflat Brae	17	6	0	0
Dundas Home Farm	0	0	0	0
Echline	0	0	0	0
Inchgarvie Lodge	6	4	0	0
Scotstoun	0	0	0	0
Springfield	10	0	0	0
Tigh-Na-Grian	0	0	1	0
Whinnyhill	10	7	0	0

2.6. Peak Particle Velocity (PPV) is used to measure vibration through a solid surface. When a vibration is measured, the point at which the measurement takes place can be considered to have a particle velocity. This particle vibration will take place in three dimensions (x, y and z).

2.7. The Peak Particle Velocity is the highest velocity of the 3 axis that are recorded during a particular event, and as such is appropriate for the measurement of activities such as blasting, piling and compacting. The thresholds for the Forth Replacement Crossing are 5 $mm.s^{-1}$ for continuous construction (e.g. piling), and 10 $mm.s^{-1}$ for intermittent construction (e.g. blasting).

2.8. These thresholds are set to protect against building damage. For this monitoring period, all the exceedances have been investigated thoroughly and appear to have been generated as a result of standalone, instantaneous events arising from local interferences, the exact source of which remains unknown.

2.9. Vibration Dose Value (VDV) is a metric used in vibration monitoring. It is calculated by taking the fourth root of the integral of the fourth power of acceleration after it has been frequency-weighted. The frequency-weighted acceleration is measured in $m.s^{-2}$ and the time period over which the VDV is measured is in seconds. This yields VDVs in $m.s^{-1.75}$.

2.10. The vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour (night time) or 16-hour (day time) period, is recommended in BS 6472 as the appropriate measure to evaluate human exposure to vibration in buildings in residential and other uses.

2.11. During the monitoring period, vibratory rollers and whacker plates were used intermittently at several locations around the site however no exceedances were recorded as a result of the use of this equipment.

2.12. Detailed investigation of all other exceedances (i.e. review of PPV levels over 30 seconds periods) has suggested that each resulted from isolated, non-construction related events, which occurred close to the monitoring station.

3. CONCLUSION

3.1. Considering the distance between FCBC construction works and sensitive receptors, and the methods of working utilised, the risk of damage to structures or nuisance to residents resulting from vibration is highly unlikely.

3.2. Due to the location and sensitivity of vibration monitoring equipment, the exceedances presented in the graphs included in the appendices of this report are unlikely to be generated by construction, but rather show local interference around the monitoring equipment.

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APPENDIX A – MONITORING LOCATIONS & VIBRATION ASSESSMENTS FROM RELEVANT PCNVs

Table 2: Monitoring Locations

Ref.	Monitoring Location	Crossing or Network	Main Construction Activities During June 2016
M1	Whinny Hill	Network	• Earthworks/Fill placement • Hope Street roadworks • FT03 & FT04 works • FT19 Works • FT10 Bridge Demolition • Main carriageway Roadworks • Rock breaking / crushing
M3	Tigh-Na-Grian	Crossing	• Central Tower rebar, formwork, concreting works deck section lifts and stay cable installation works • North Tower rebar, formwork, concreting works deck section lifts and stay cable installation works • Pier N1 & N2 works • AVN Rebar and concrete works
M7	Butlaw Fisheries	Crossing	• Central Tower rebar, formwork, concreting works deck section lifts and stay cable installation works • South Tower rebar, formwork, concreting works deck section lifts and stay cable installation works • Pier S1 works • Pier S2 works • Pier S3 Hydro-demolition • AVS rebar & concrete deck works
M10	Inchgarvie Lodge	Crossing	• Central Tower rebar, formwork, concreting works deck section lifts and stay cable installation • South Tower rebar, formwork, concreting works deck section lifts and stay cable installation • Pier S1 works • Pier S2 works • Pier S3 Hydro-demolition • AVS rebar & concrete deck works • South Abutment works • Main carriageway roadworks
M11	Linn Mill	Network (close proximity to Crossing)	• AVS rebar & concrete deck works • Main carriageway roadworks • South Abutment works • Excavation and breaking of SuDS detention basin
M13	Clufflat Brae	Crossing	• AVS rebar & concrete deck works • Main carriageway roadworks • South Abutment works
M14	Springfield	Network	• AVS rebar & concrete deck works • Main carriageway roadworks • South abutment works
M15	Echline	Network	• AVS rebar & concrete deck works • South abutment works • Main carriageway roadworks
M16	Scotstoun	Network	• Footpath works • Utility works

			• B800 North and South road works including bridge works • ESQ11 works • Mainline roadworks
M17	Dundas Home Farm	Network	• Utility works • B800 North and South roadworks including bridge works • Mainline roadworks

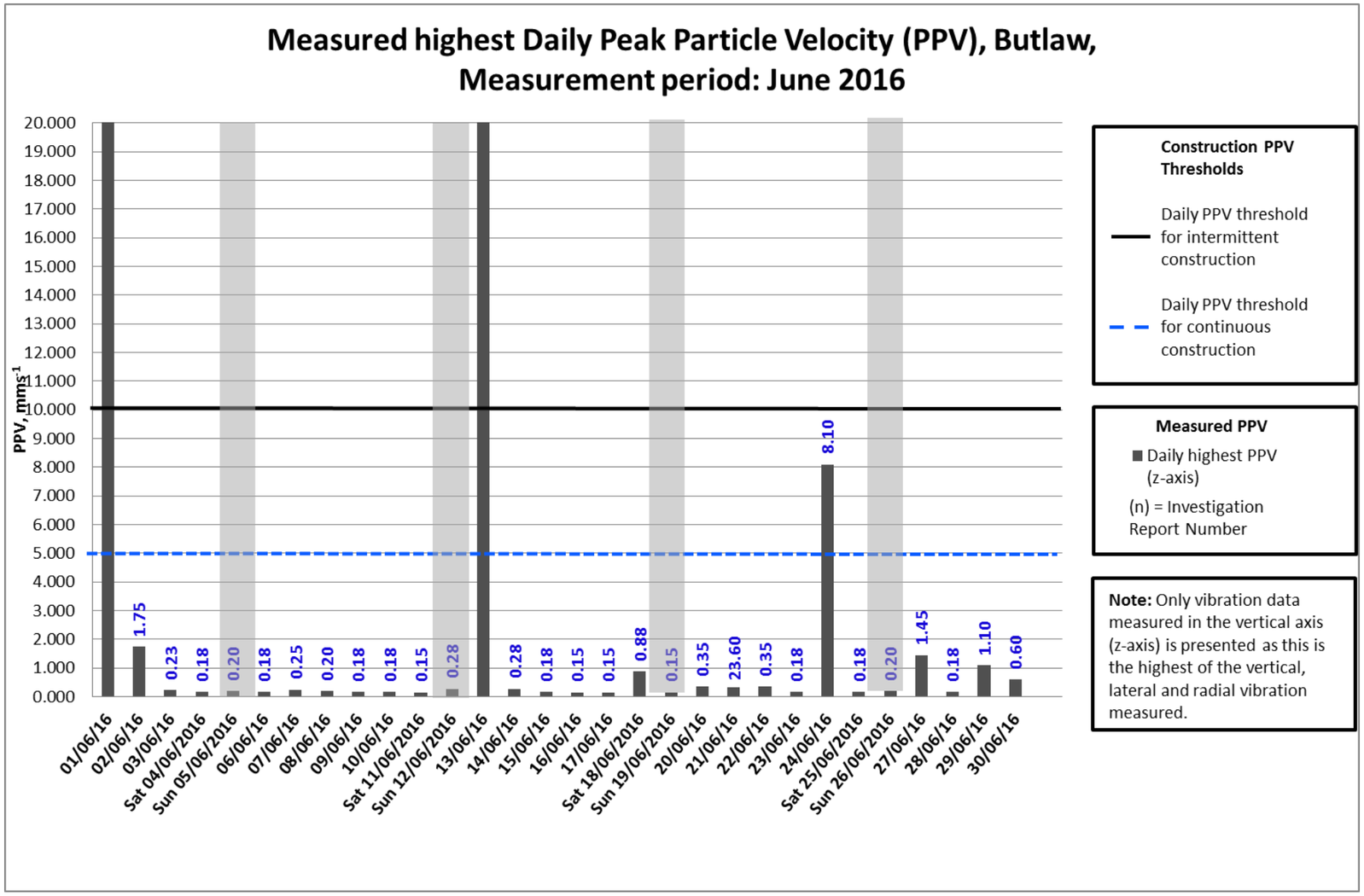
Table 3: PCNV Predicted PPV & VDV Levels

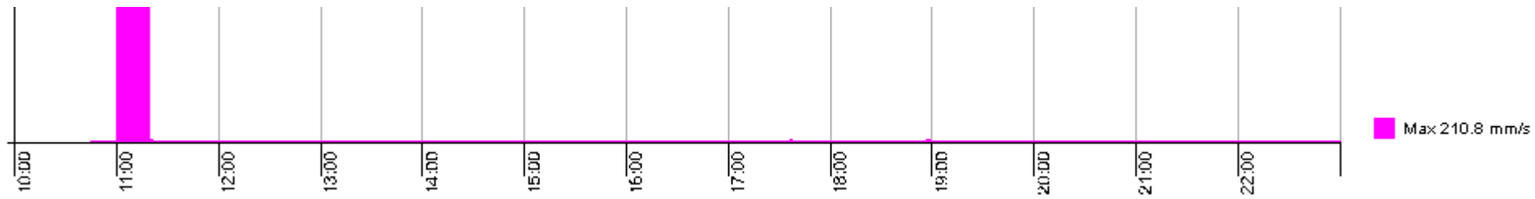
Monitor	Minimum distance from work areas (m)		Type of vibration emitting plant/activity operated at nearest work areas	Worst case predicted vibration levels	
	Day (07:00-19:00)	Night (19:00-07:00)		PPV (mm/s)	eVDV ($m.s^{-1.75}$)
Butlaw Fisheries	130	160	Roller/Whacker	0.44	0.23
Clufflat Brae	40	90	Roller/Whacker	2.44	0.37
Dundas	75	2000	Roller/Whacker	0.98	0.33
Echline	40	1000	Roller/Whacker	2.44	0.37
Inchgarvie Lodge	50	40	Roller/Whacker	1.77	0.33
Linn Mill	60	250	Roller/Whacker	1.36	0.33
Scotstoun	40	2000	Roller/Whacker	2.44	0.37
Springfield	50	300	Roller/Whacker	1.77	0.33
Tigh-Na-Grian	200	200	N/A	-	-
Whinny Hill	180	1800	Roller/Whacker	0.383	0.04

Notes on Table 3

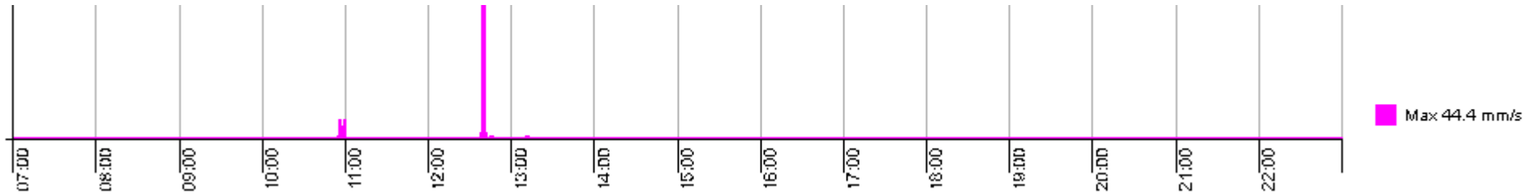
- All plant used during construction activities has been assessed with respect to vibration. The only plant utilised considered to generate appreciable levels of vibration was a vibratory roller and a whacker plate (NOTE: Hydraulic rock breakers which typically generate 4.5mm/s @ 5m, 0.4mm/s @ 20m, 0.1mm/s @ 50m have been discounted due to the distances of use from the closest receptors).
- Vibratory rollers were not operated within 20m of any sensitive receptor.
- Whacker plates were not utilised within 40m of any occupied sensitive receptor.
- All roller eVDV values in the table above are based on the worst case scenario of a vibratory roller remaining in continuous operation for 2 hours an average distance (100m) from the nearest occupied receptors.
- All whacker plate eVDV values in the table above are based on the worst case scenario of a whacker plate remaining in continuous operation for 2 hours a minimum distance from the nearest receptor.

APPENDIX B – VIBRATION GRAPHS


Measured highest Daily Peak Particle Velocity (PPV), Butlaw,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
1.75
0.23
0.18
0.20
0.18
0.25
0.20
0.18
0.18
0.15
0.28
8.10
0.28
0.18
0.15
0.15
0.88
0.15
0.35
23.60
0.35
0.18
0.18
0.20
1.45
0.18
1.10
0.60
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

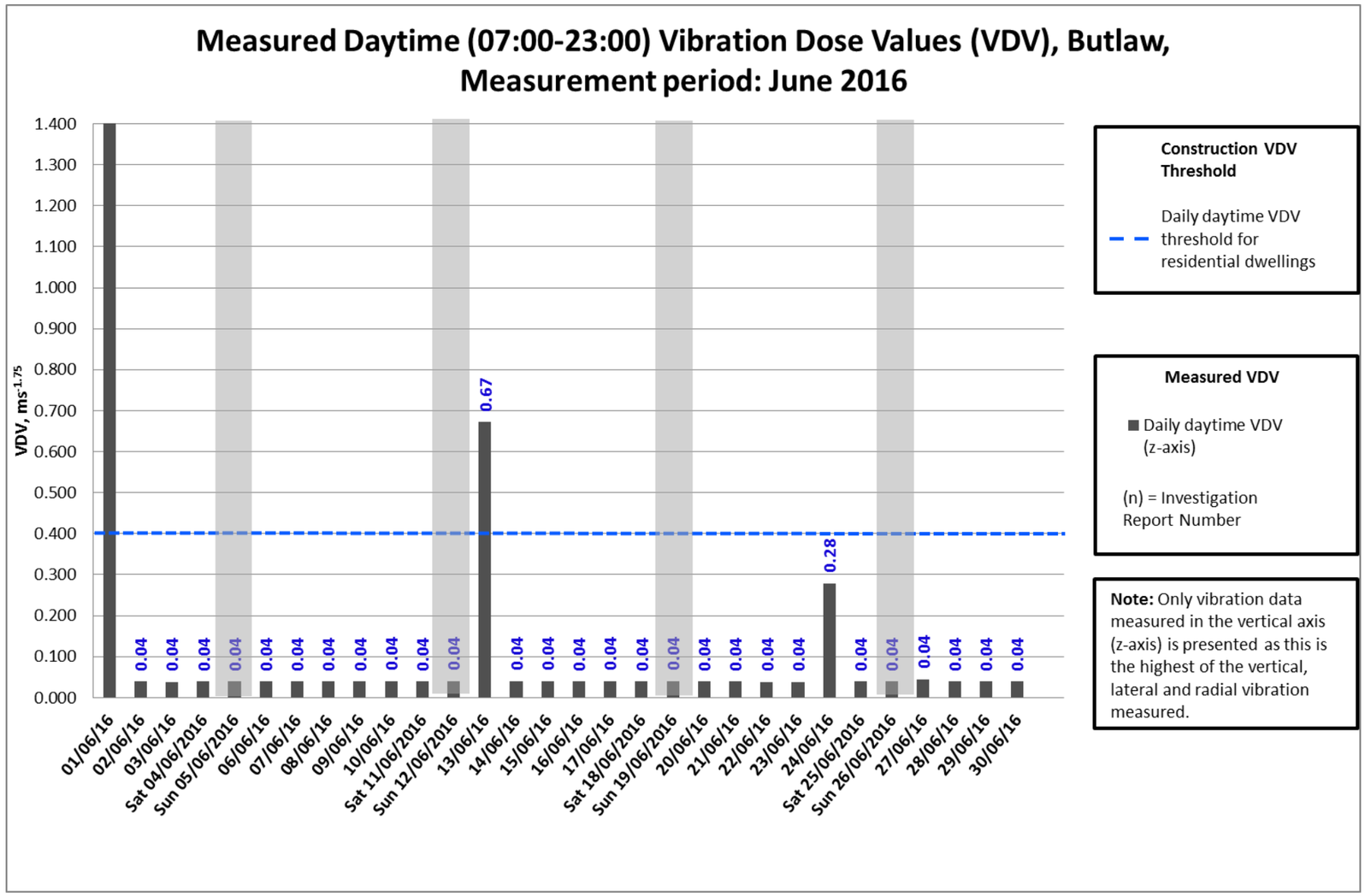


Exceedance on the 1st of June has been investigated and found to be caused by the environmental department downloading data from the Vibration monitor. Due to the proximity of the vibration storage device and the transducers (part of the device that picks up the vibration) movement made by the environmental department was picked up (graph above from the 01/06/2016).

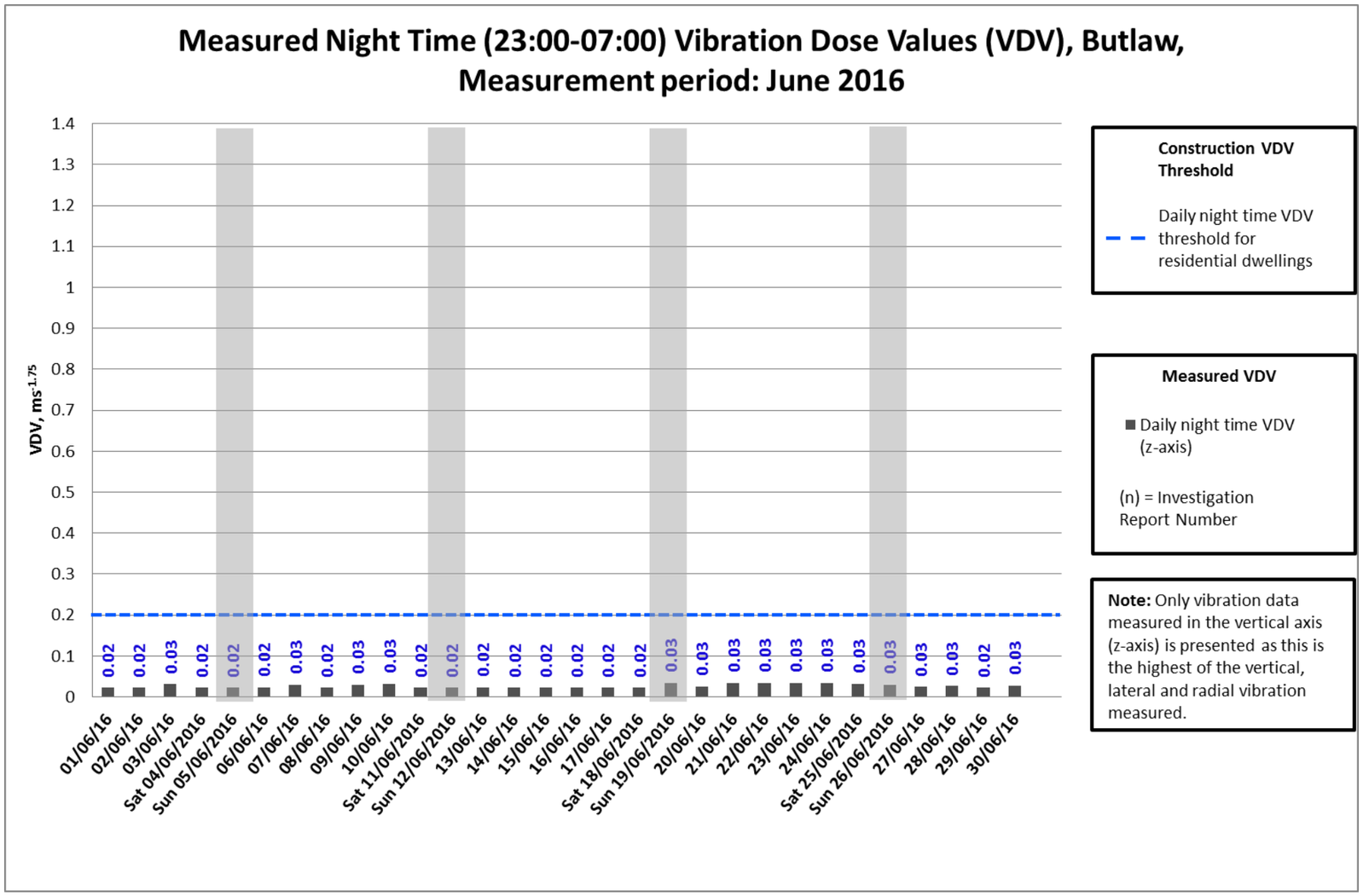


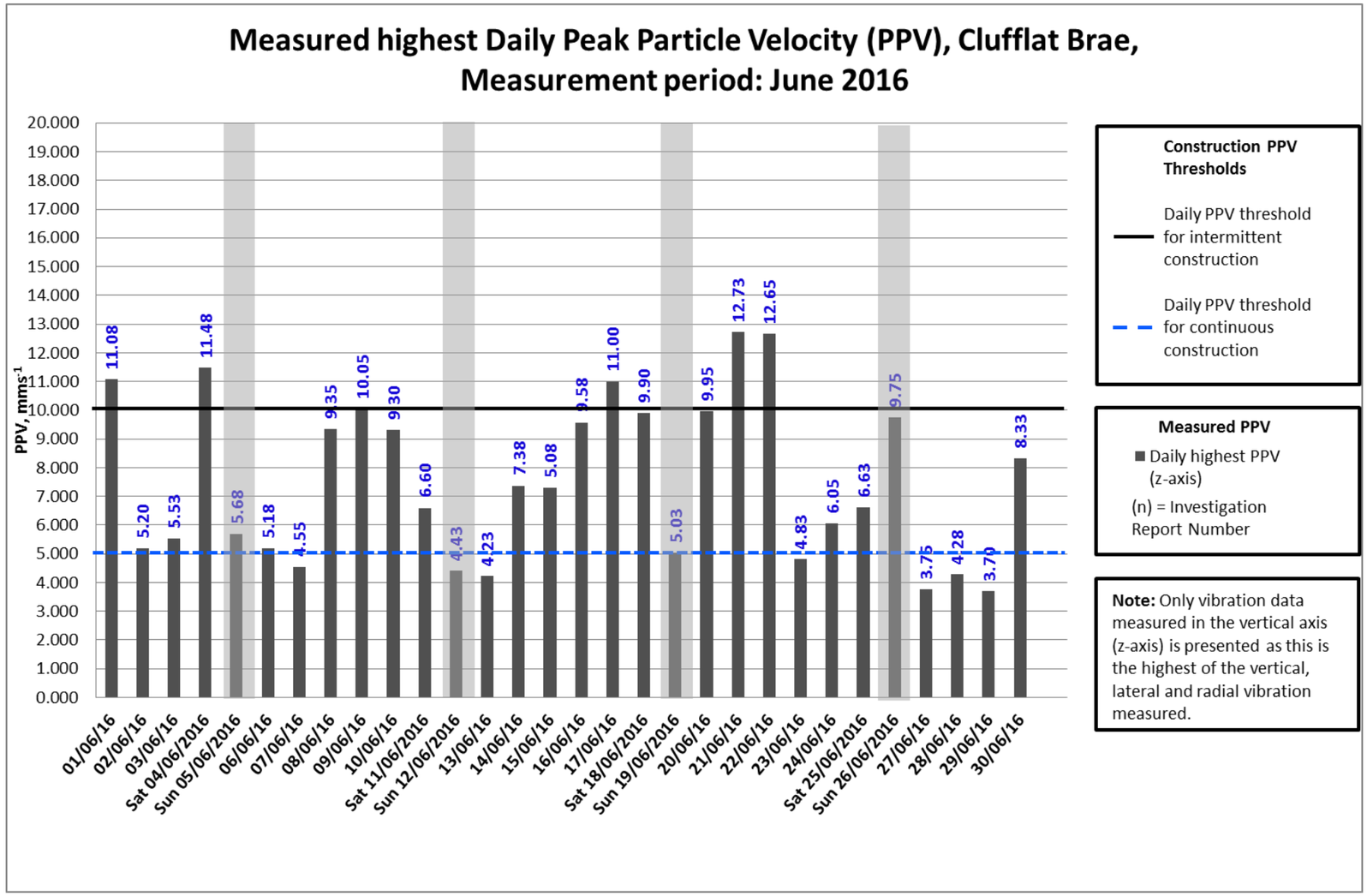
Exceedance on the 13th of June has been investigated and found to be caused by the resident cutting the grass. Due to the location of the vibration monitor this activity has been picked up (graph above from the 13/06/2016).

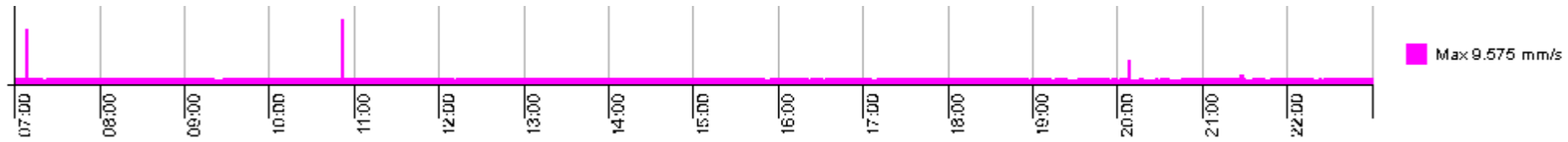
Exceedance on the 24th of June has been investigated and found likely to have been caused by localised works not related to FCBC construction works (this was identified by audio recorded on the nearby noise monitor however there hasn't been any visual evidence to support this).



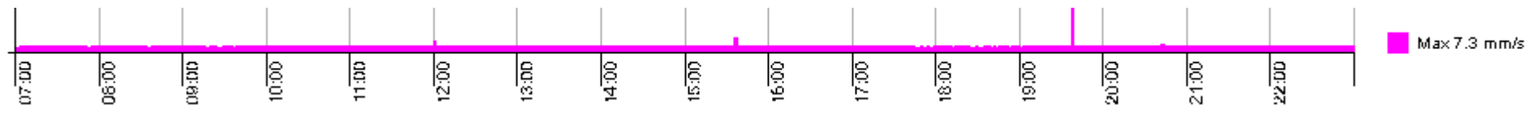
Exceedances on the 1st and 13th of June have been investigated and found to be caused by the same incidents described above (reference Butlaw PPV graph).


Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Butlaw,
Measurement period: June 2016
VDV, ms-1.75
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.02 0.02 0.03 0.02 0.02 0.02 0.03 0.02 0.03 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.02 0.03
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

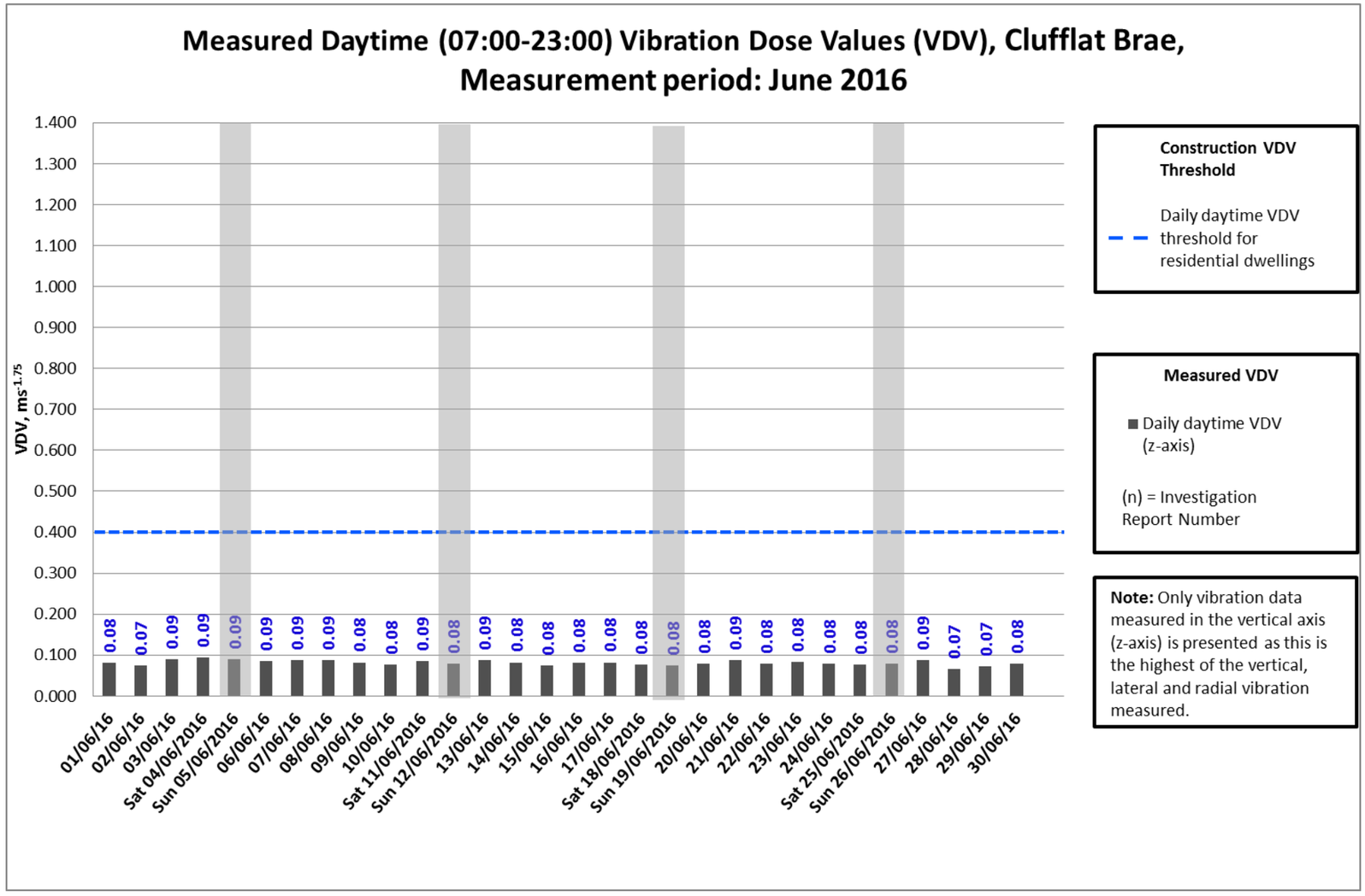

Measured highest Daily Peak Particle Velocity (PPV), Clufflat Brae,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
11.08
5.20
5.53
11.48
5.68
5.18
4.55
9.35
10.05
9.30
6.60
4.43
4.23
7.38
5.08
9.58
11.00
9.90
5.03
9.95
12.73
12.65
4.83
6.05
6.63
9.75
3.75
4.28
3.70
8.33
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

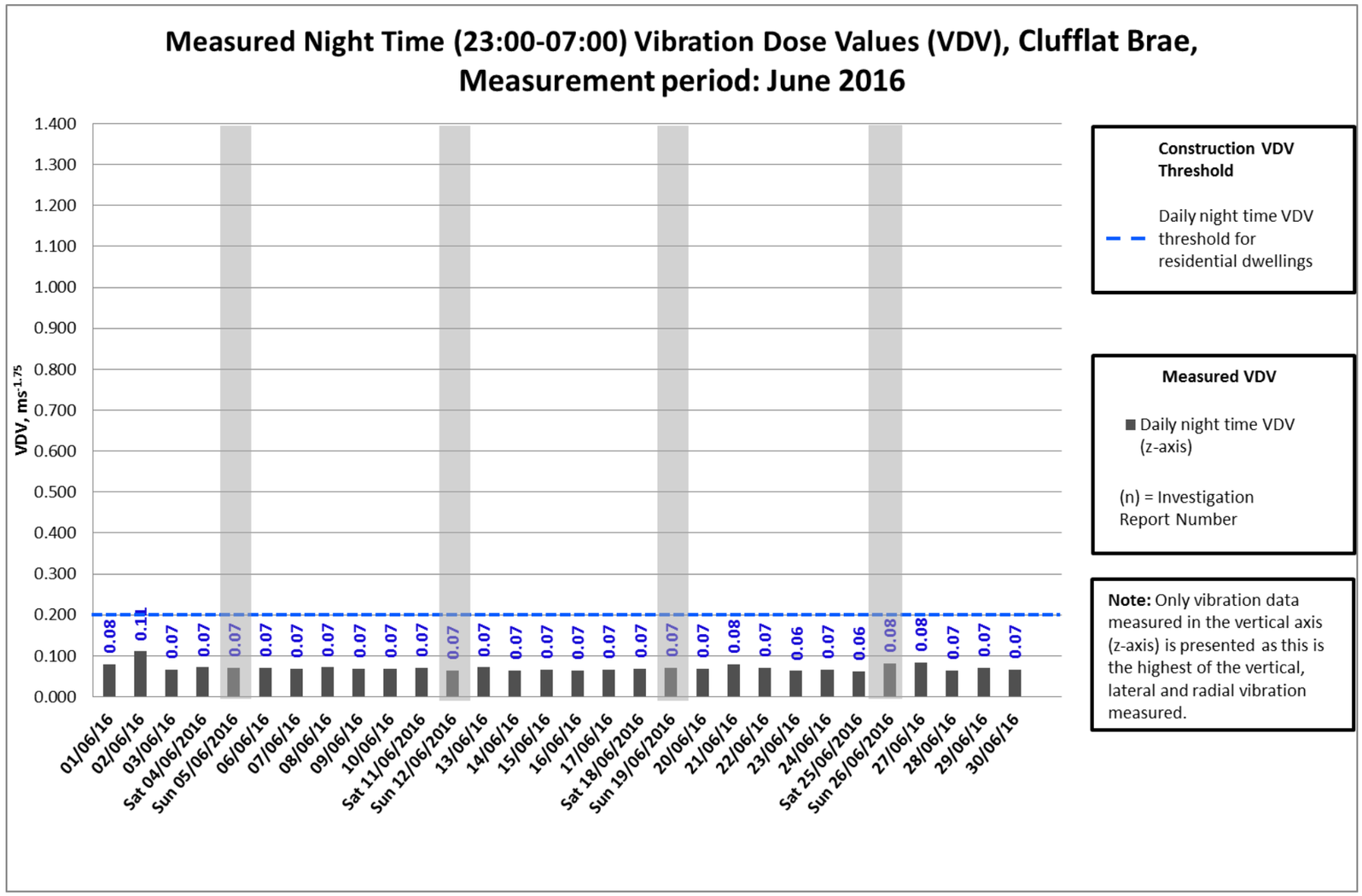


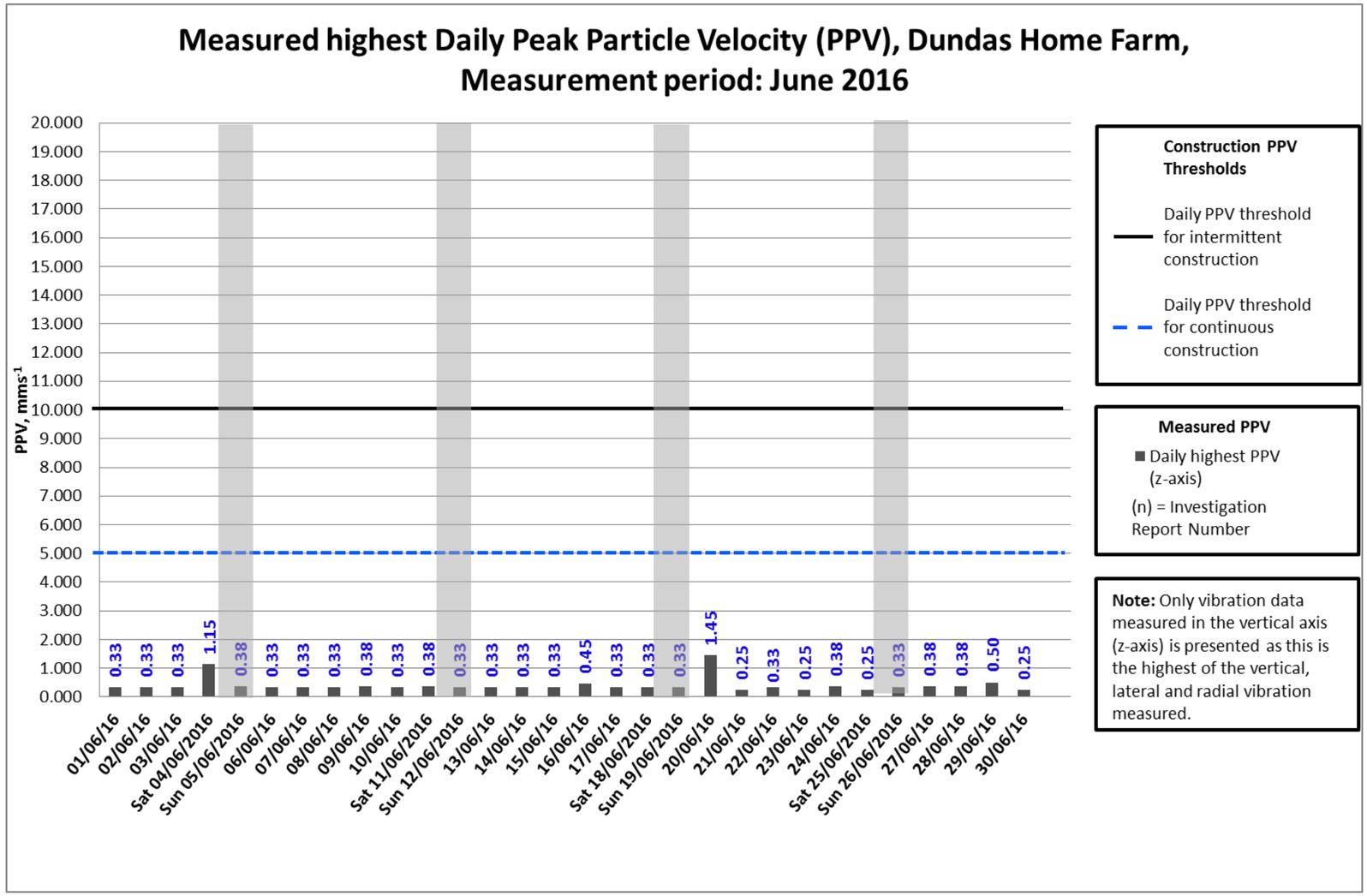
Exceedances on the 2nd, 3rd, 6th,8th, 9th, 10th, 11th, 14th, 16th, 20th, 21st, 22nd, 24th, 25th and 30th of June have been investigated and found to be caused by individual isolated events (graph above from the 16/06/2016). Due to the closest works being approximately 220m away with minimal vibration emitting equipment used and the monitor being located in a public amenity area there is a likelihood that the exceedances seen above have been caused by pedestrian use of this area.



Exceedances on the 1st, 4th, 5th, 15th, 17th, 18th, 19th, 26th and 27th of June have been investigated and found to be caused out with construction working hours and therefore it is unlikely that construction related activity was the cause of these (graph above from the 15/06/2016).


Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Clufflat Brae, Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.08 0.07 0.09 0.09 0.09 0.09 0.09 0.09 0.08 0.08 0.09 0.08 0.09 0.08 0.08 0.08 0.08 0.08 0.08 0.08 0.09 0.08 0.08 0.08 0.08 0.08 0.09 0.07 0.07 0.08
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Clufflat Brae, Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.08 0.11 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0.08 0.07 0.06 0.07 0.06 0.08 0.08 0.07 0.07 0.07
01/06/16 02/06/16 03/06/16 Sat 04/06/2016 Sun 05/06/2016 06/06/16 07/06/16 08/06/16 09/06/16 10/06/16 Sat 11/06/2016 Sun 12/06/2016 13/06/16 14/06/16 15/06/16 16/06/16 17/06/16 Sat 18/06/2016 Sun 19/06/2016 20/06/16 21/06/16 22/06/16 23/06/16 24/06/16 Sat 25/06/2016 Sun 26/06/2016 27/06/16 28/06/16 29/06/16 30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured highest Daily Peak Particle Velocity (PPV), Dundas Home Farm,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0.33 0.33 0.33 1.15 0.38 0.33 0.33 0.33 0.38 0.33 0.38 0.33 0.33 0.33 0.33 0.45 0.33 0.33 0.33 1.45 0.25 0.33 0.25 0.38 0.25 0.33 0.38 0.38 0.50 0.25
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
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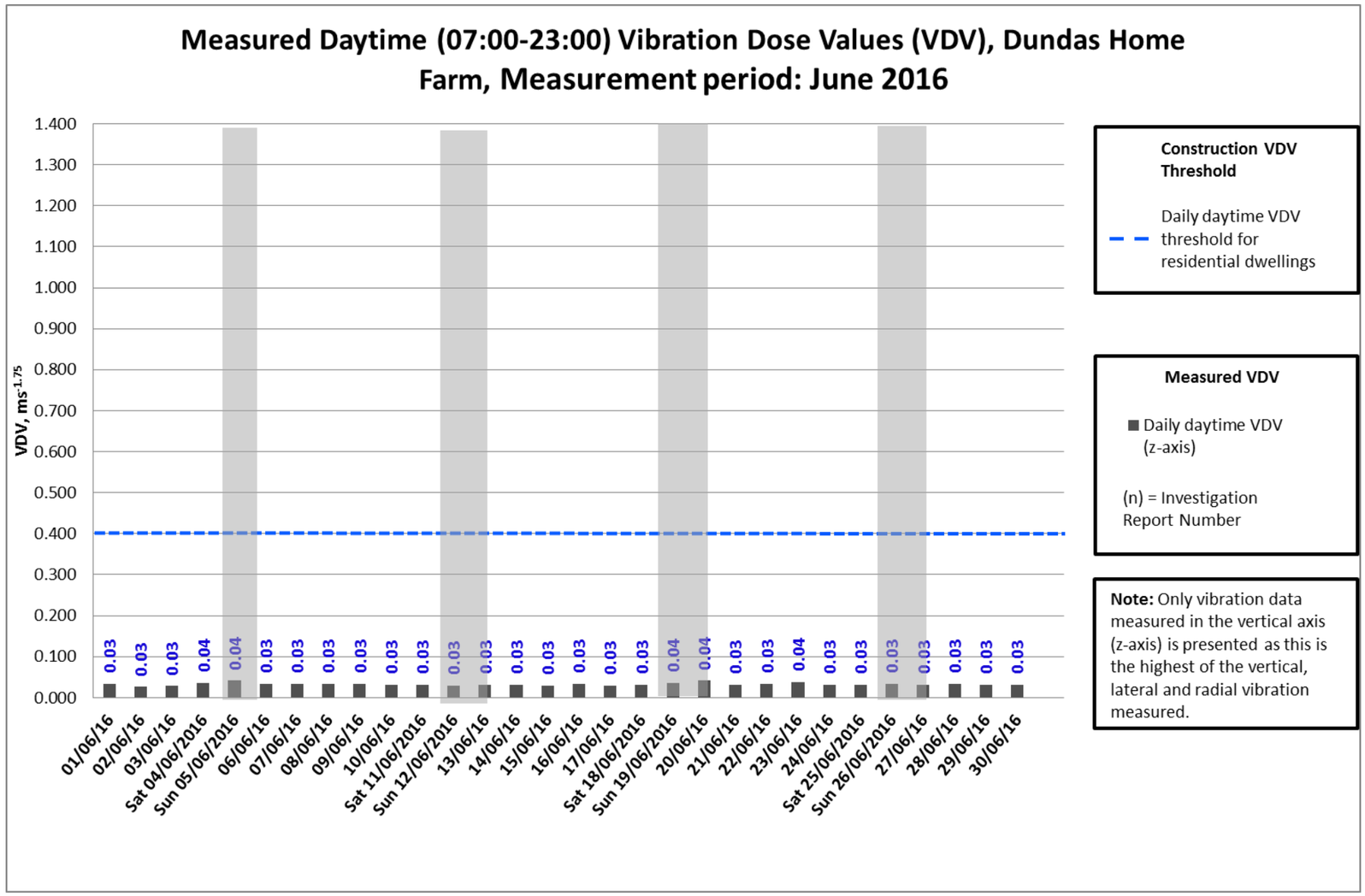
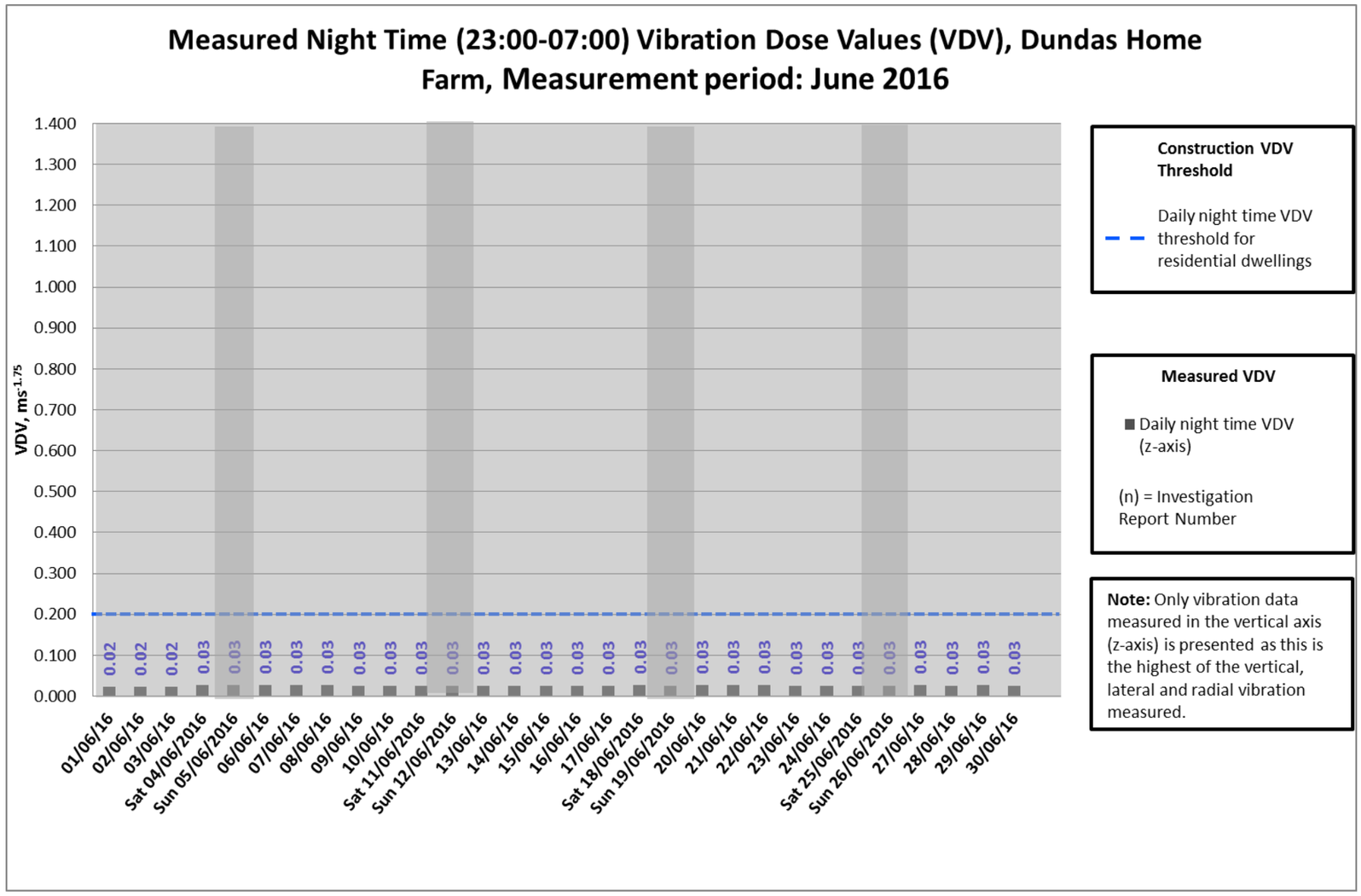
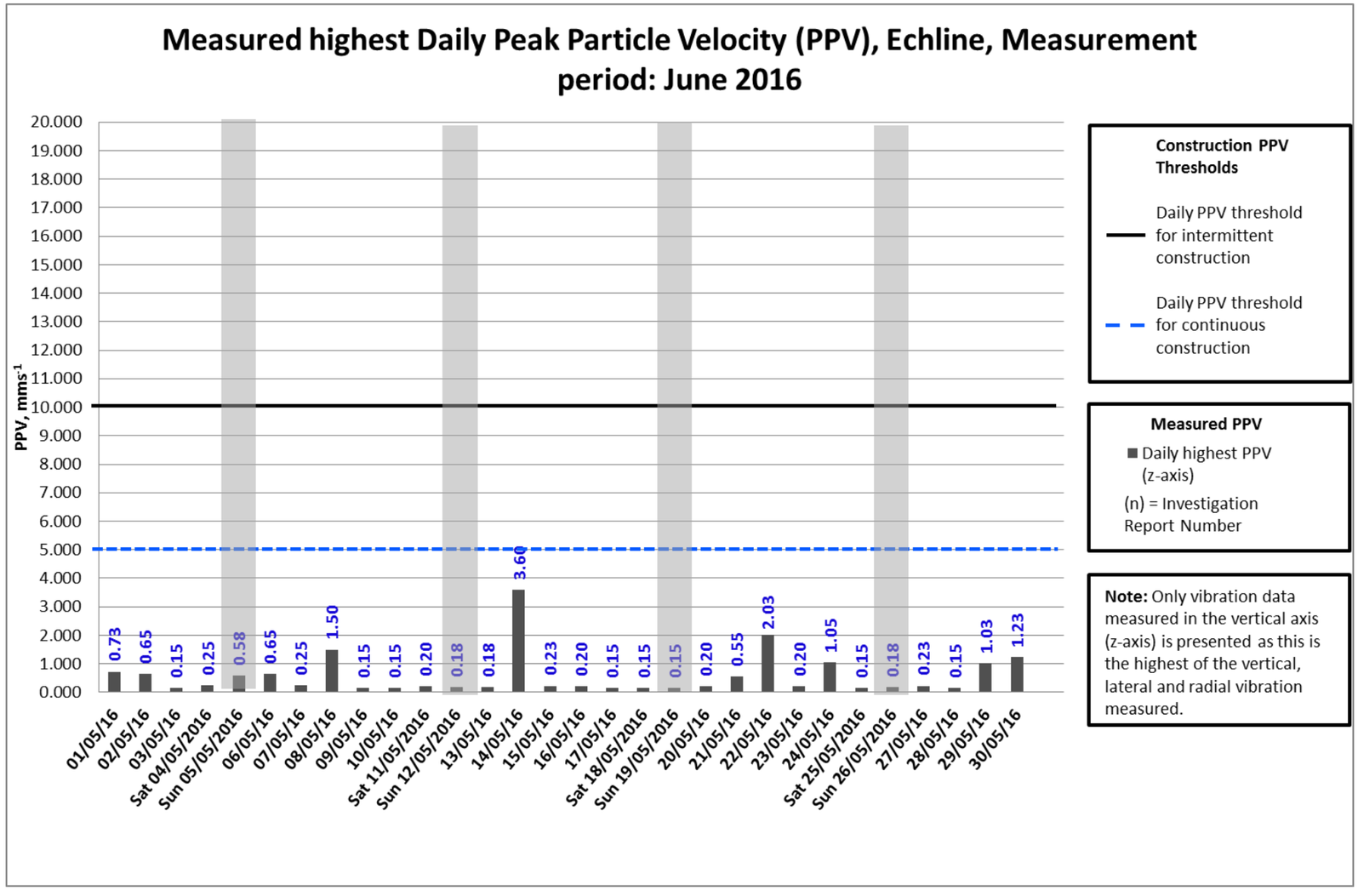
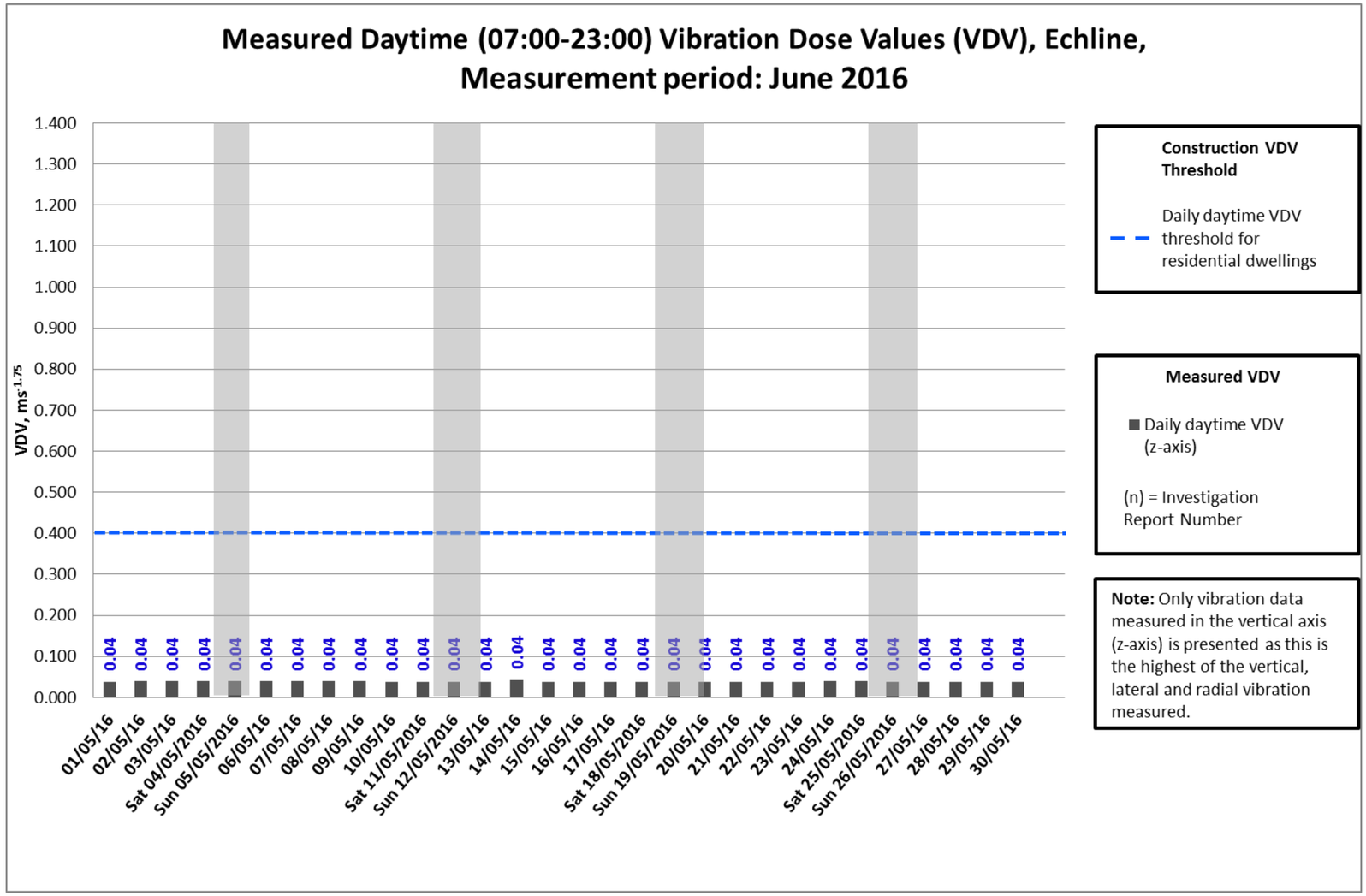
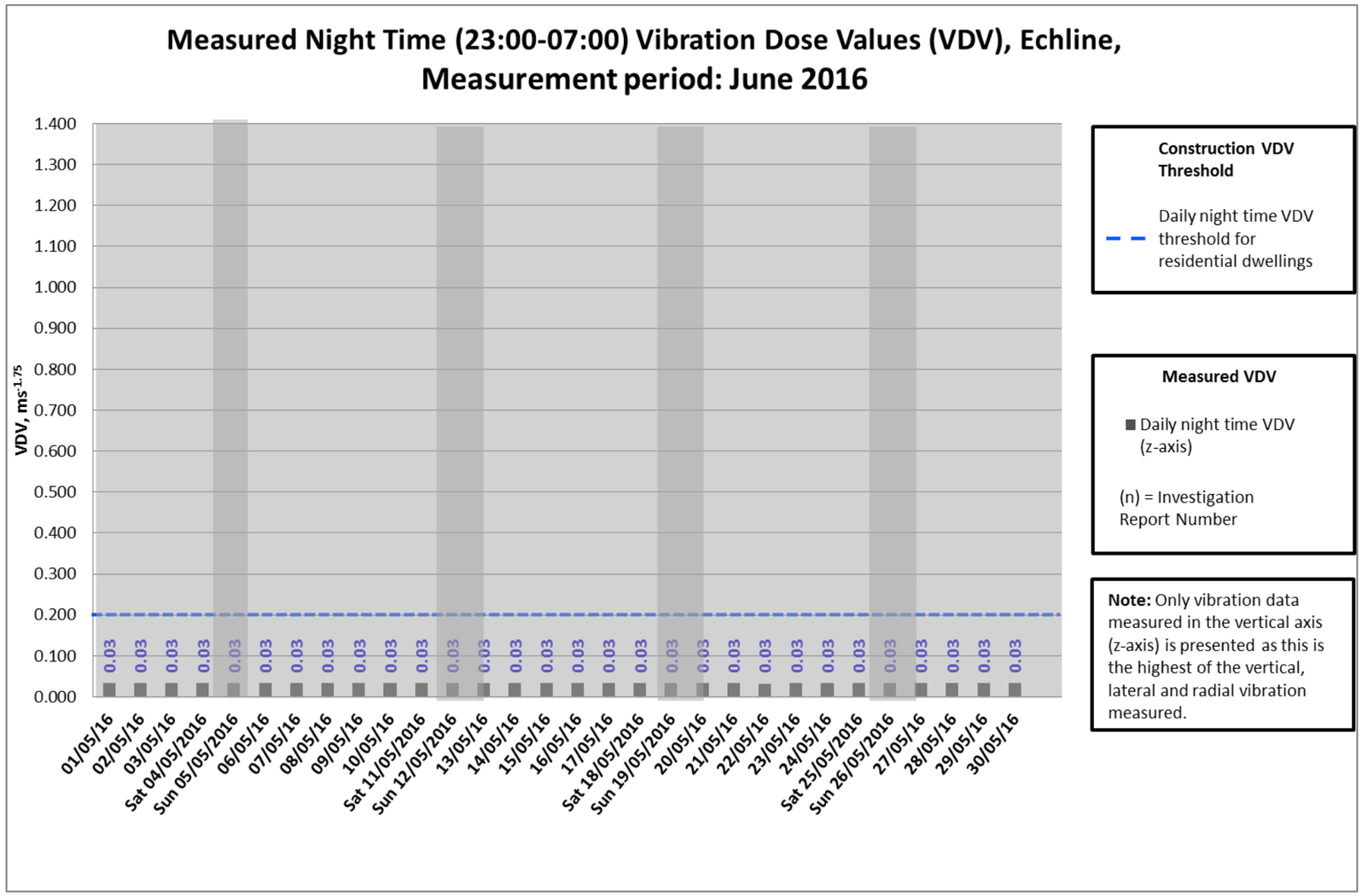
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

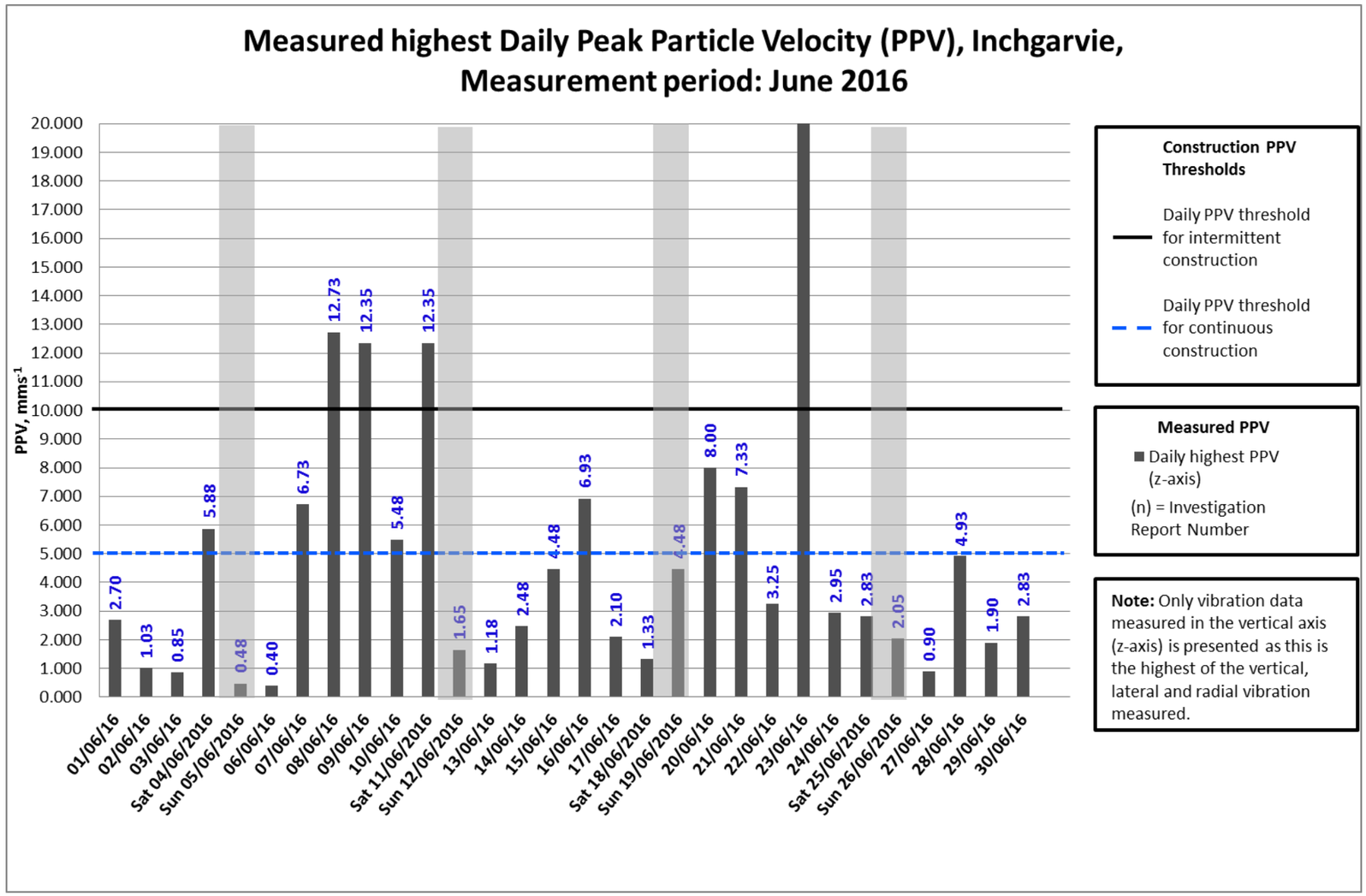

Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Dundas Home Farm, Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.03 0.03 0.03 0.04 0.04 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.04 0.04 0.03 0.03 0.04 0.03 0.03 0.03 0.03 0.03 0.03
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

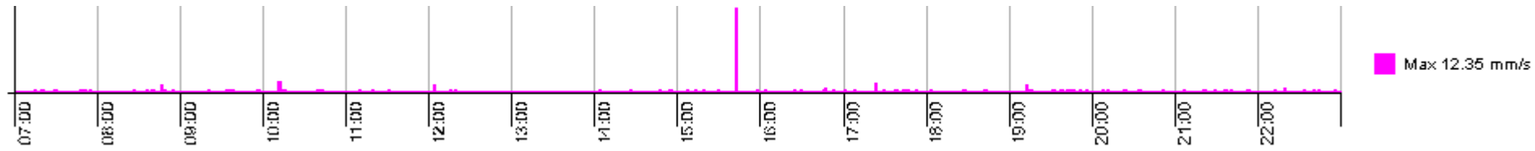

Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Dundas Home Farm, Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.02 0.02 0.02 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured highest Daily Peak Particle Velocity (PPV), Echline, Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0.73
0.65
0.15
0.25
0.58
0.65
0.25
1.50
0.15
0.15
0.20
0.18
0.18
3.60
0.23
0.20
0.15
0.15
0.15
0.20
0.55
2.03
0.20
1.05
0.15
0.18
0.23
0.15
1.03
1.23
01/05/16
02/05/16
03/05/16
Sat 04/05/2016
Sun 05/05/2016
06/05/16
07/05/16
08/05/16
09/05/16
10/05/16
Sat 11/05/2016
Sun 12/05/2016
13/05/16
14/05/16
15/05/16
16/05/16
17/05/16
Sat 18/05/2016
Sun 19/05/2016
20/05/16
21/05/16
22/05/16
23/05/16
24/05/16
Sat 25/05/2016
Sun 26/05/2016
27/05/16
28/05/16
29/05/16
30/05/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

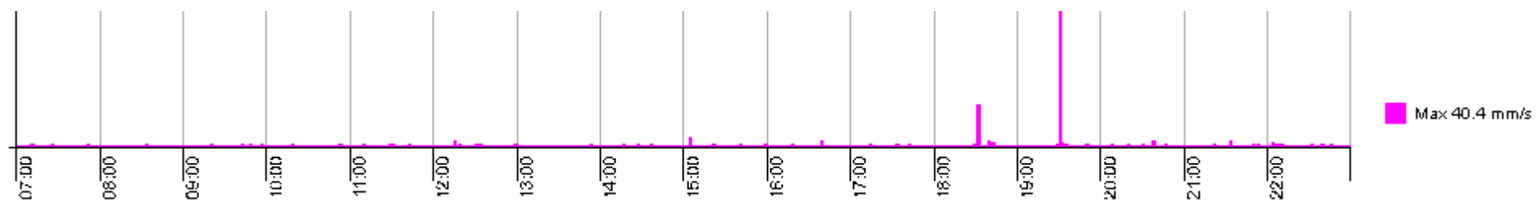

Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Echline,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.04
01/05/16
02/05/16
03/05/16
Sat 04/05/2016
Sun 05/05/2016
06/05/16
07/05/16
08/05/16
09/05/16
10/05/16
Sat 11/05/2016
Sun 12/05/2016
13/05/16
14/05/16
15/05/16
16/05/16
17/05/16
Sat 18/05/2016
Sun 19/05/2016
20/05/16
21/05/16
22/05/16
23/05/16
24/05/16
Sat 25/05/2016
Sun 26/05/2016
27/05/16
28/05/16
29/05/16
30/05/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Echline,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.03
01/05/16
02/05/16
03/05/16
Sat 04/05/2016
Sun 05/05/2016
06/05/16
07/05/16
08/05/16
09/05/16
10/05/16
Sat 11/05/2016
Sun 12/05/2016
13/05/16
14/05/16
15/05/16
16/05/16
17/05/16
Sat 18/05/2016
Sun 19/05/2016
20/05/16
21/05/16
22/05/16
23/05/16
24/05/16
Sat 25/05/2016
Sun 26/05/2016
27/05/16
28/05/16
29/05/16
30/05/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured highest Daily Peak Particle Velocity (PPV), Inchgarvie,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
2.70
1.03
0.85
5.88
0.48
0.40
6.73
12.73
12.35
5.48
12.35
1.65
1.18
2.48
4.48
6.93
2.10
1.33
4.48
8.00
7.33
3.25
2.95
2.83
2.05
0.90
4.93
1.90
2.83
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

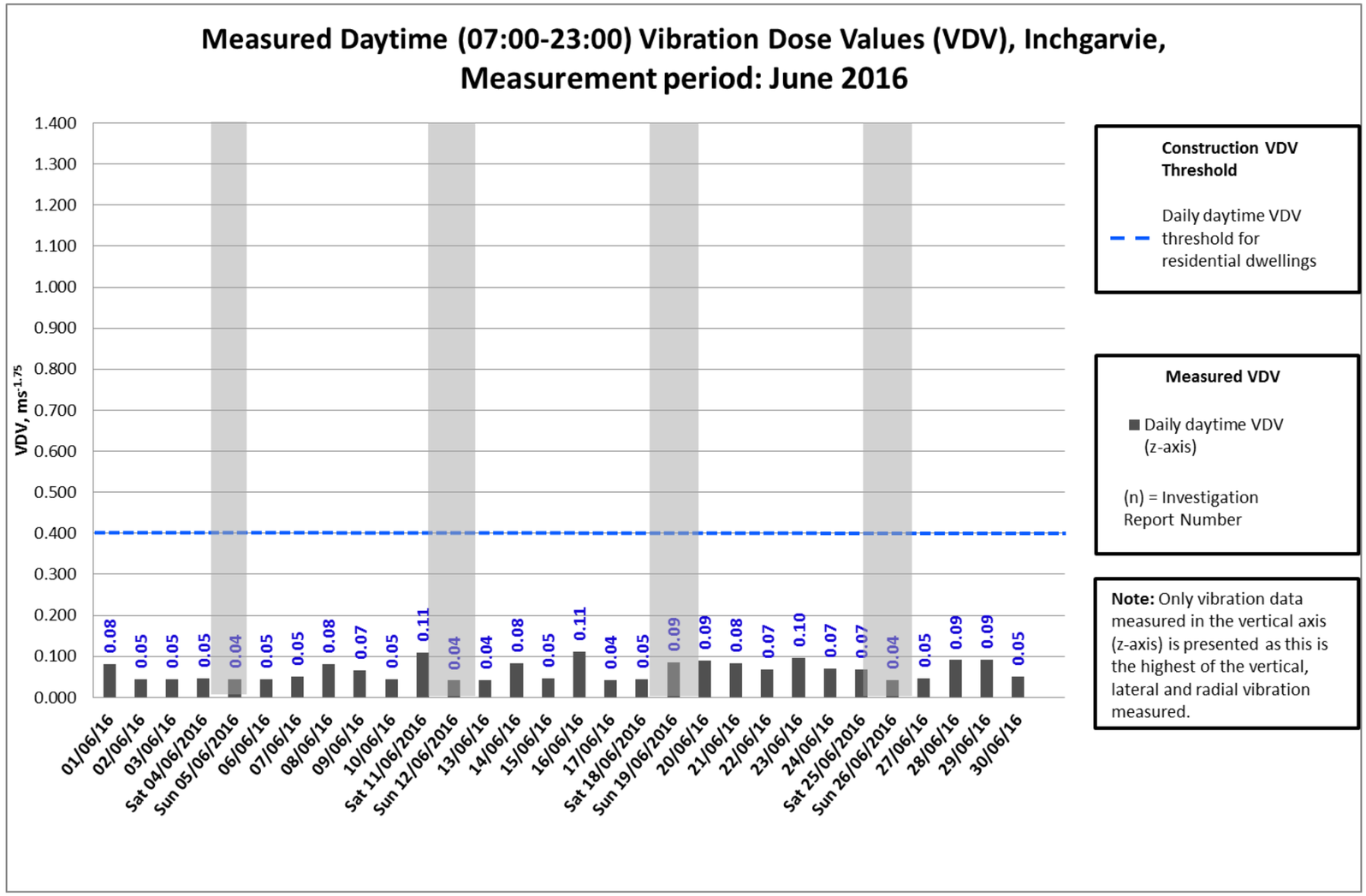


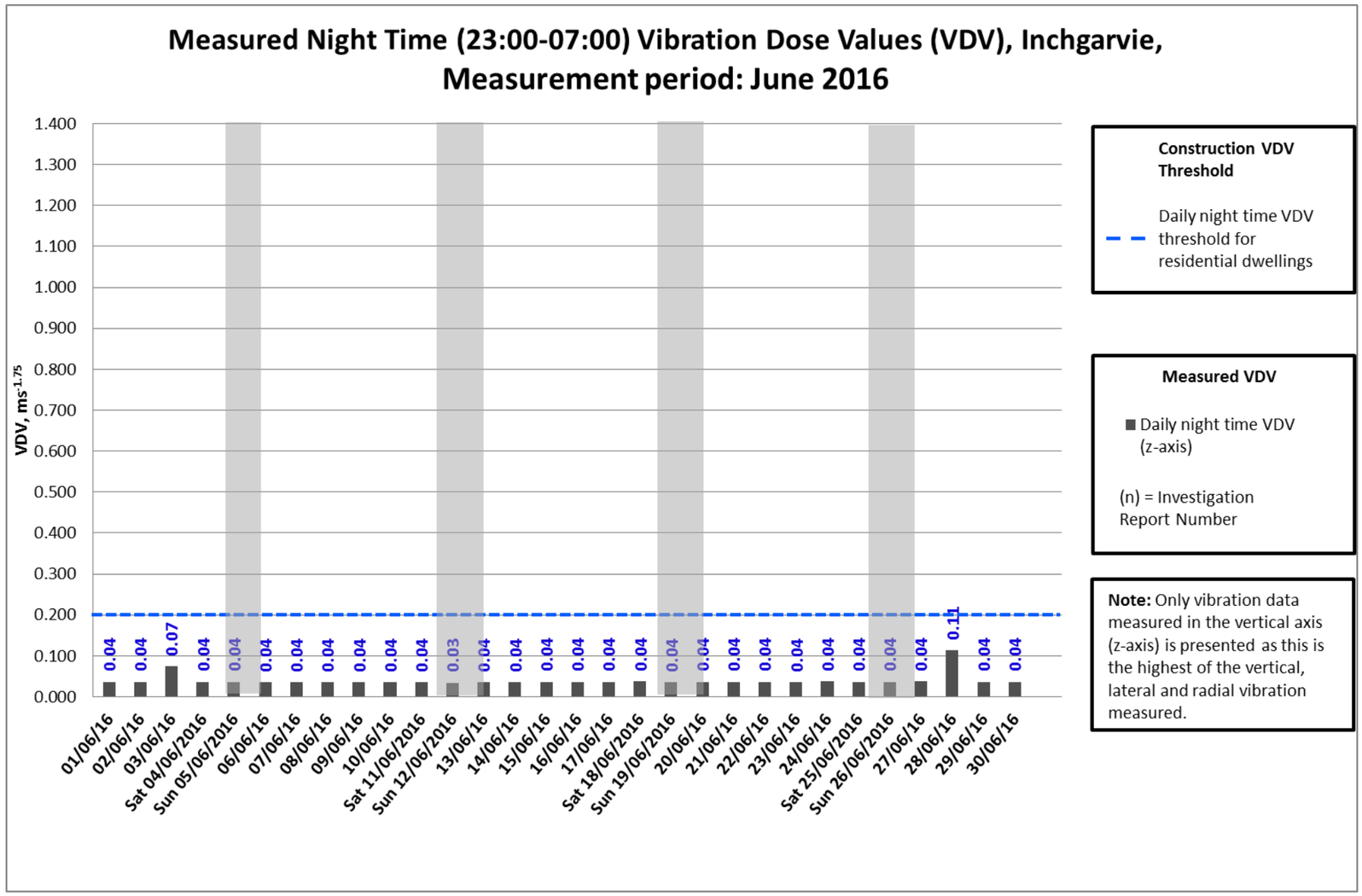
Exceedances on the 4th, 7th, 8th, 9th, 10th, 11th, 16th and 20th of June have been investigated and found to be caused by individual isolated events that are unlikely to have been construction related activities (graph above from the 11/06/2016) .

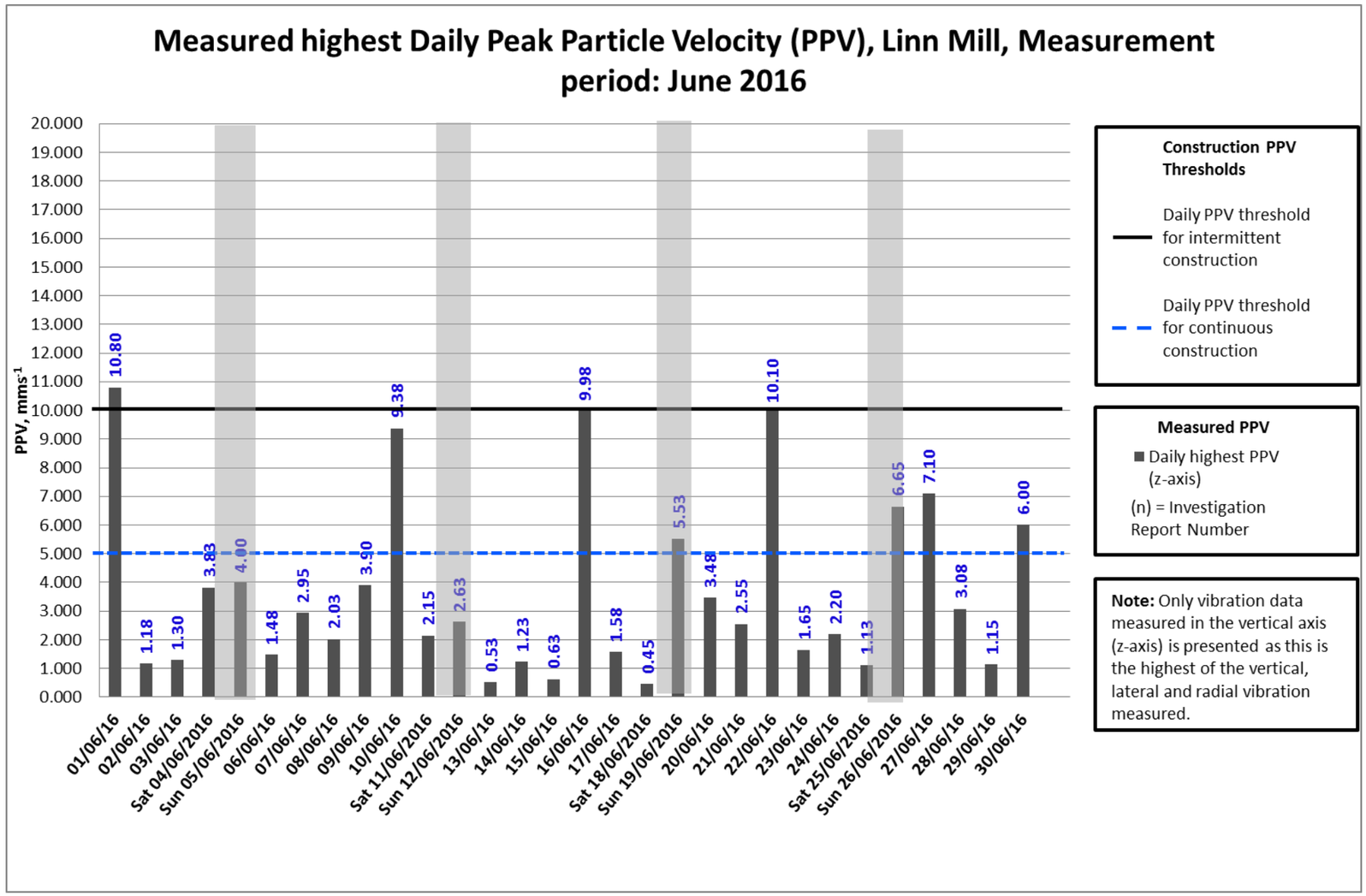


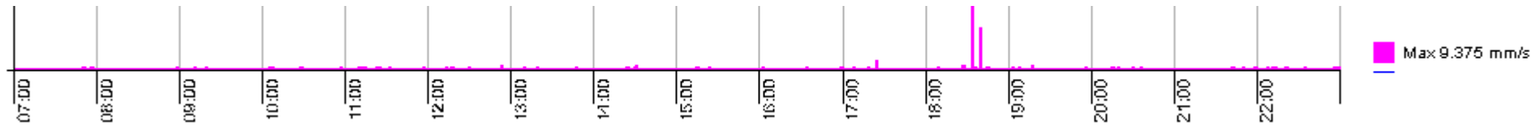
Exceedances on the 21st and 23rd of June have been investigated and found to be caused out with construction working hours and therefore it is unlikely that construction related activity was the cause of these (graph above from the 23/06/2016).

During this period, the resident at the property where the monitor is situated had ongoing private construction works. It is likely that exceedances within the graph above were caused by the works at the property rather than the construction of the new crossing and supporting infrastructure.

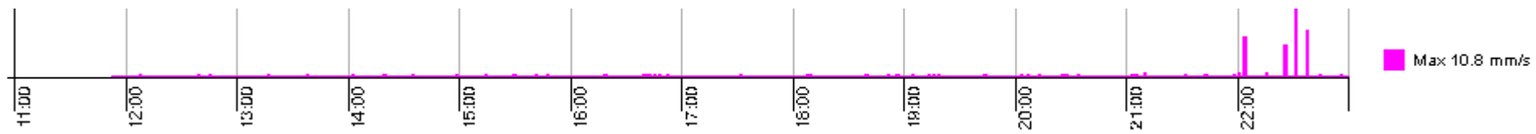

Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Inchgarvie,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.08 0.05 0.05 0.05 0.04 0.05 0.05 0.08 0.07 0.05 0.11 0.04 0.04 0.08 0.05 0.11 0.04 0.05 0.09 0.09 0.08 0.07 0.10 0.07 0.07 0.04 0.05 0.09 0.09 0.05
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Inchgarvie,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.04 0.04 0.07 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.03 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.11 0.04 0.04
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

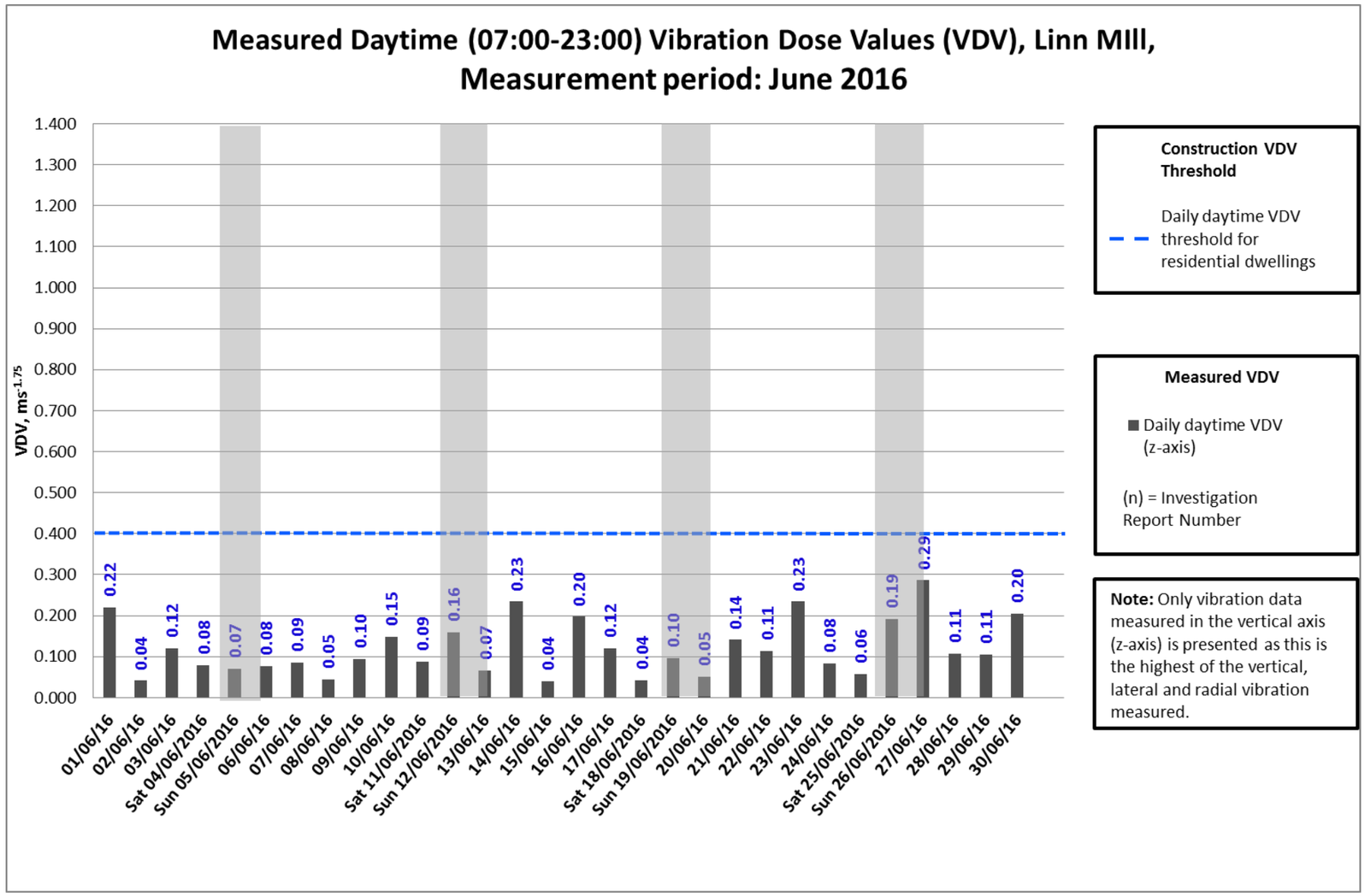

Measured highest Daily Peak Particle Velocity (PPV), Linn Mill, Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
10.80
1.18
1.30
3.83
4.00
1.48
2.95
2.03
3.90
9.38
2.15
2.63
0.53
1.23
0.63
9.98
1.58
0.45
5.53
10.10
3.48
2.55
6.65
1.65
2.20
1.13
7.10
3.08
1.15
6.00
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

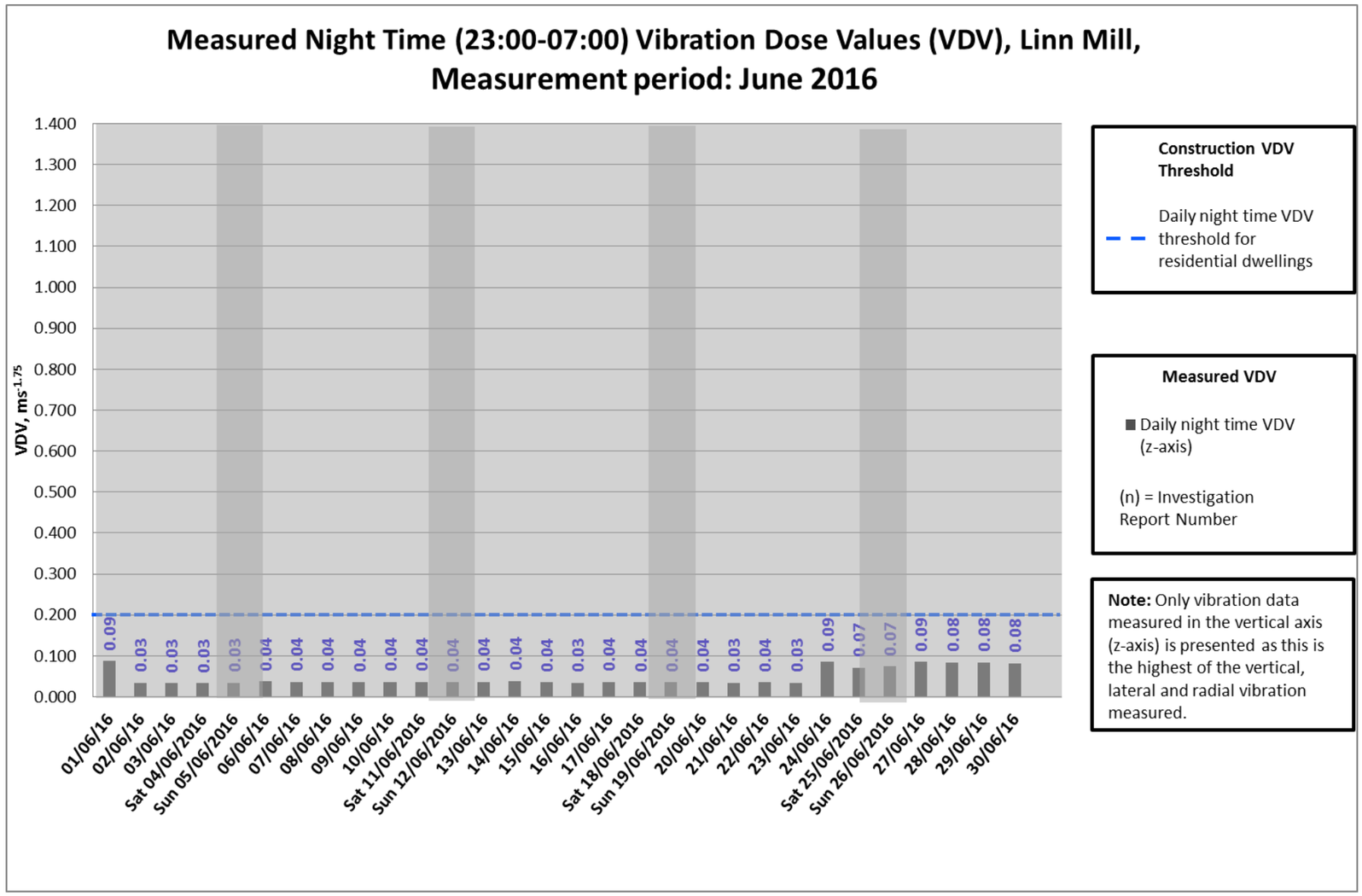


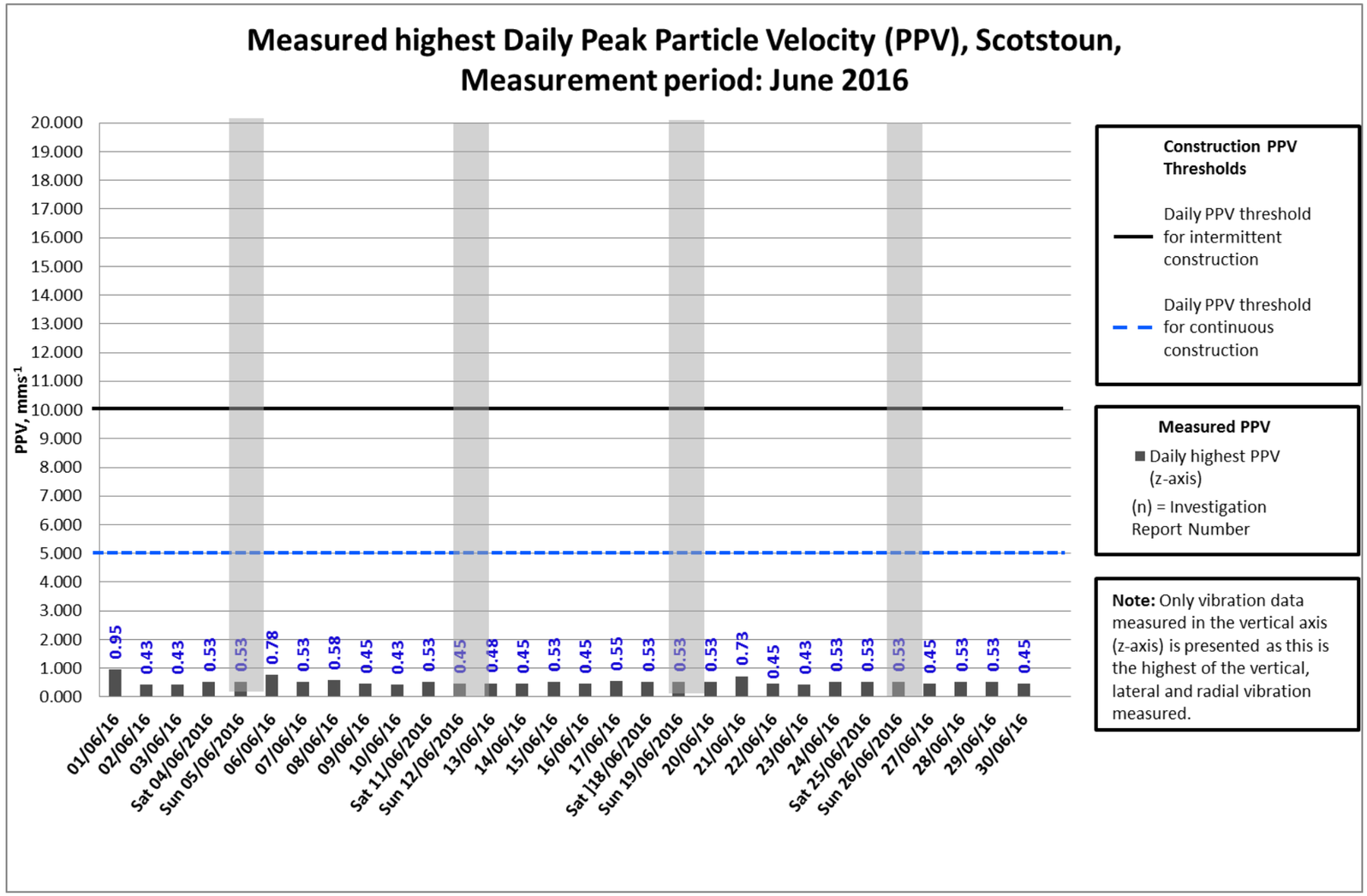
Exceedances on the 10th, 16th, 22nd, 27th and 30th of June have been investigated and found to be caused by individual isolated events that are unlikely to have been construction related activities (graph above from the 10/06/2016) .

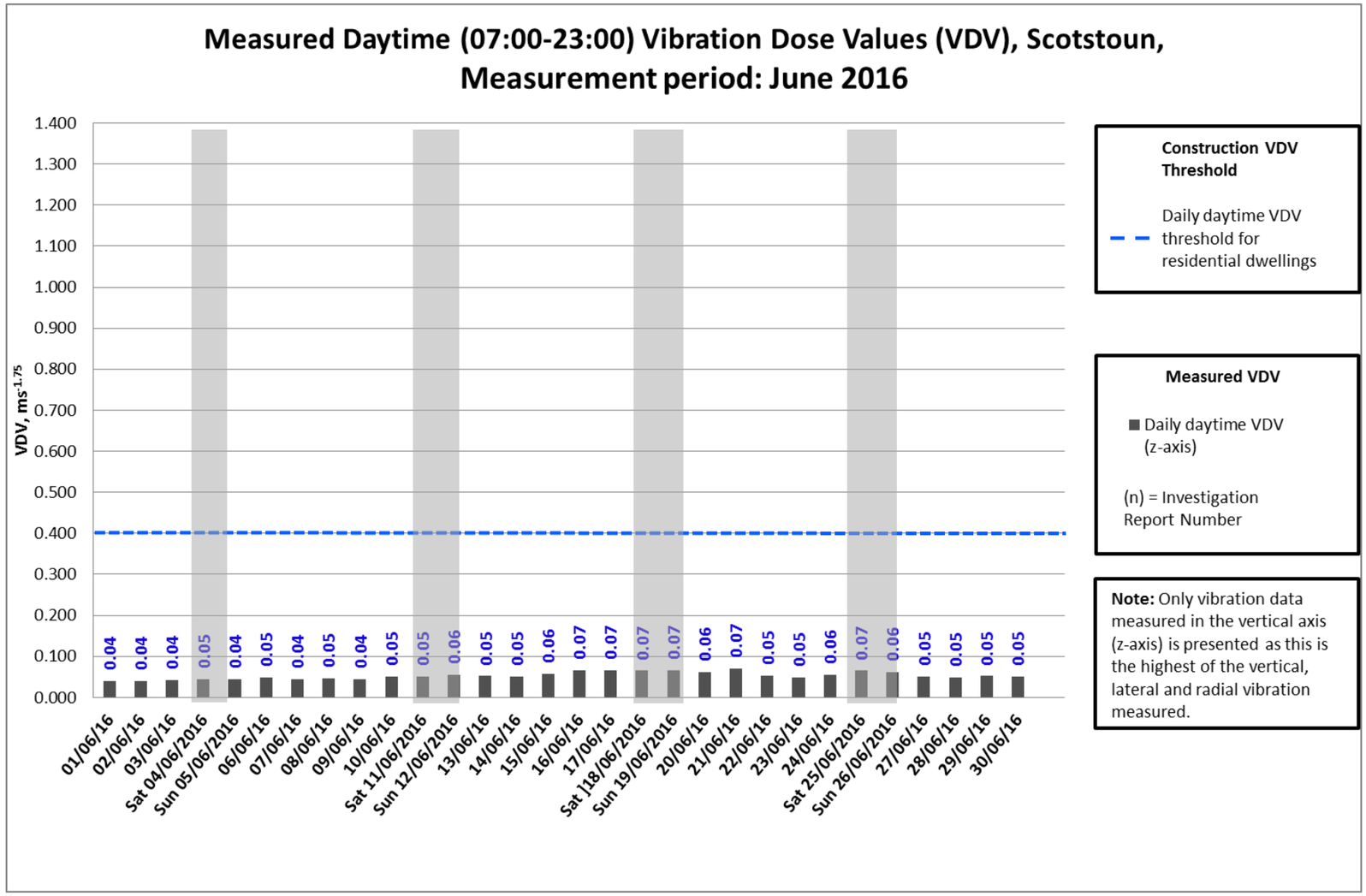


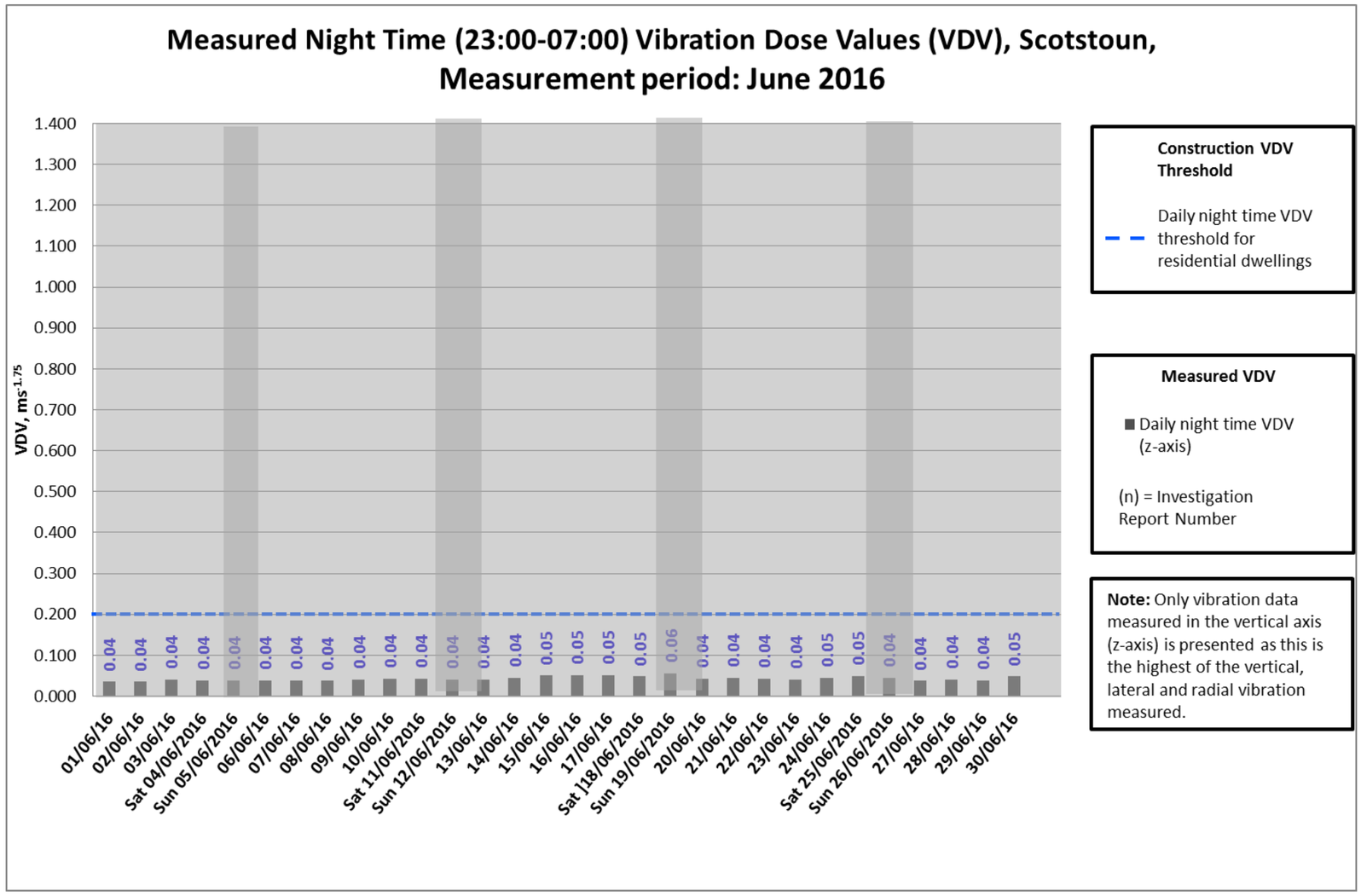
Exceedances on the 1st, 19th and 26th of June have been investigated and found to be caused out with construction working hours and therefore it is unlikely that construction related activity was the cause of these (graph above from the 01/06/2016).

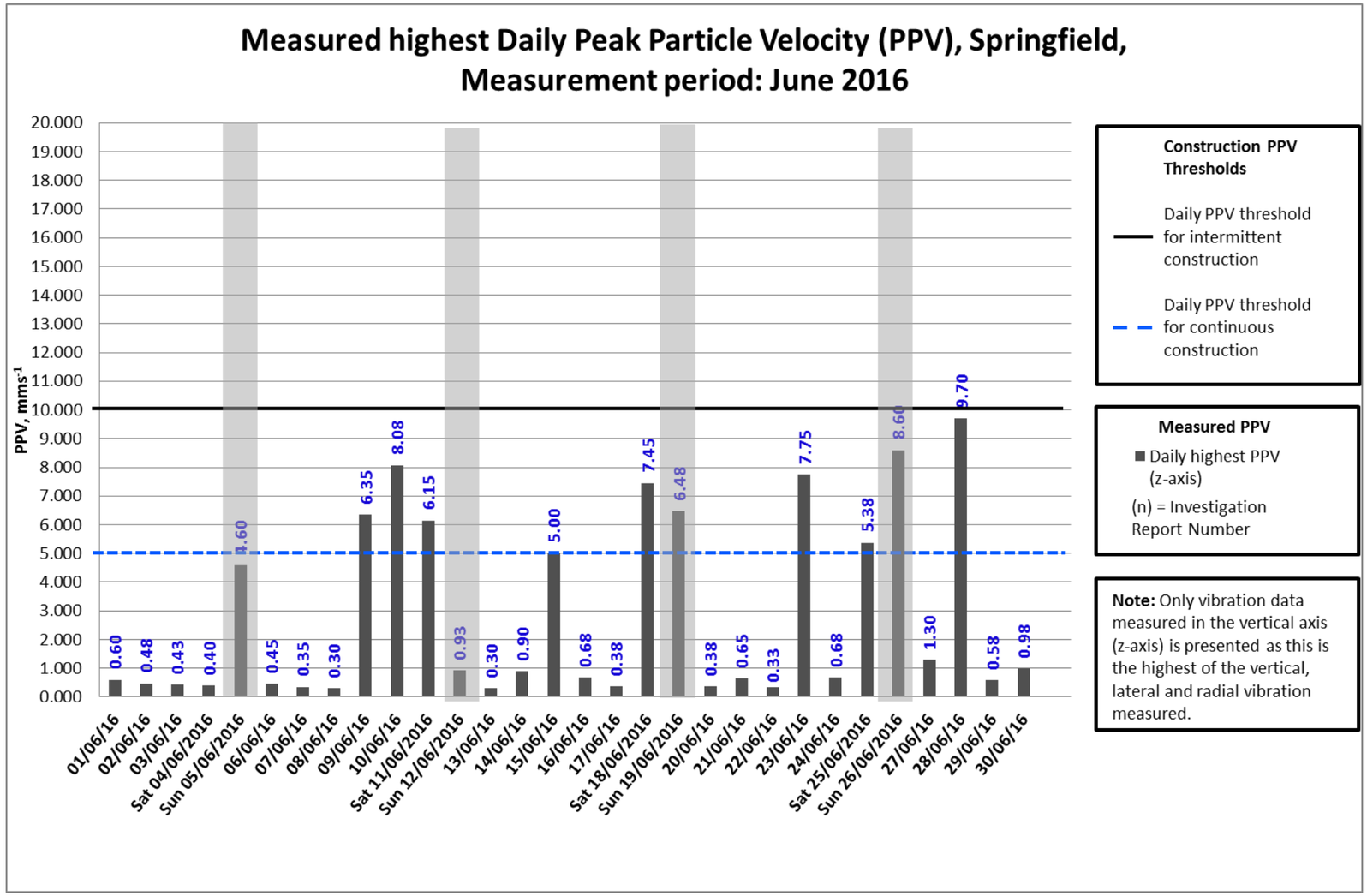

Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Linn MIll,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.22
0.04
0.12
0.08
0.07
0.08
0.09
0.05
0.10
0.15
0.09
0.16
0.07
0.23
0.04
0.20
0.12
0.04
0.10
0.05
0.14
0.11
0.23
0.08
0.06
0.19
0.29
0.11
0.11
0.20
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

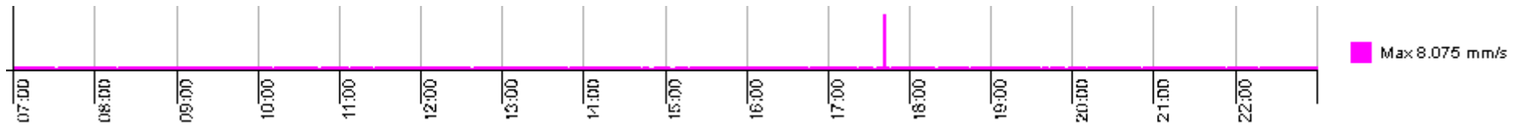

Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Linn Mill,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.09 0.03 0.03 0.03 0.03 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.03 0.04 0.04 0.04 0.04 0.03 0.04 0.03 0.04 0.03 0.09 0.07 0.07 0.09 0.08 0.08 0.08
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured highest Daily Peak Particle Velocity (PPV), Scotstoun,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0.95
0.43
0.43
0.53
0.53
0.78
0.53
0.58
0.45
0.43
0.53
0.45
0.48
0.45
0.53
0.45
0.55
0.53
0.53
0.53
0.73
0.45
0.43
0.53
0.53
0.53
0.45
0.53
0.53
0.45
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Scotstoun,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.04 0.04 0.04 0.05 0.04 0.05 0.04 0.05 0.04 0.05 0.05 0.06 0.05 0.05 0.06 0.07 0.07 0.07 0.07 0.06 0.07 0.05 0.05 0.06 0.07 0.06 0.05 0.05 0.05 0.05
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 118/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

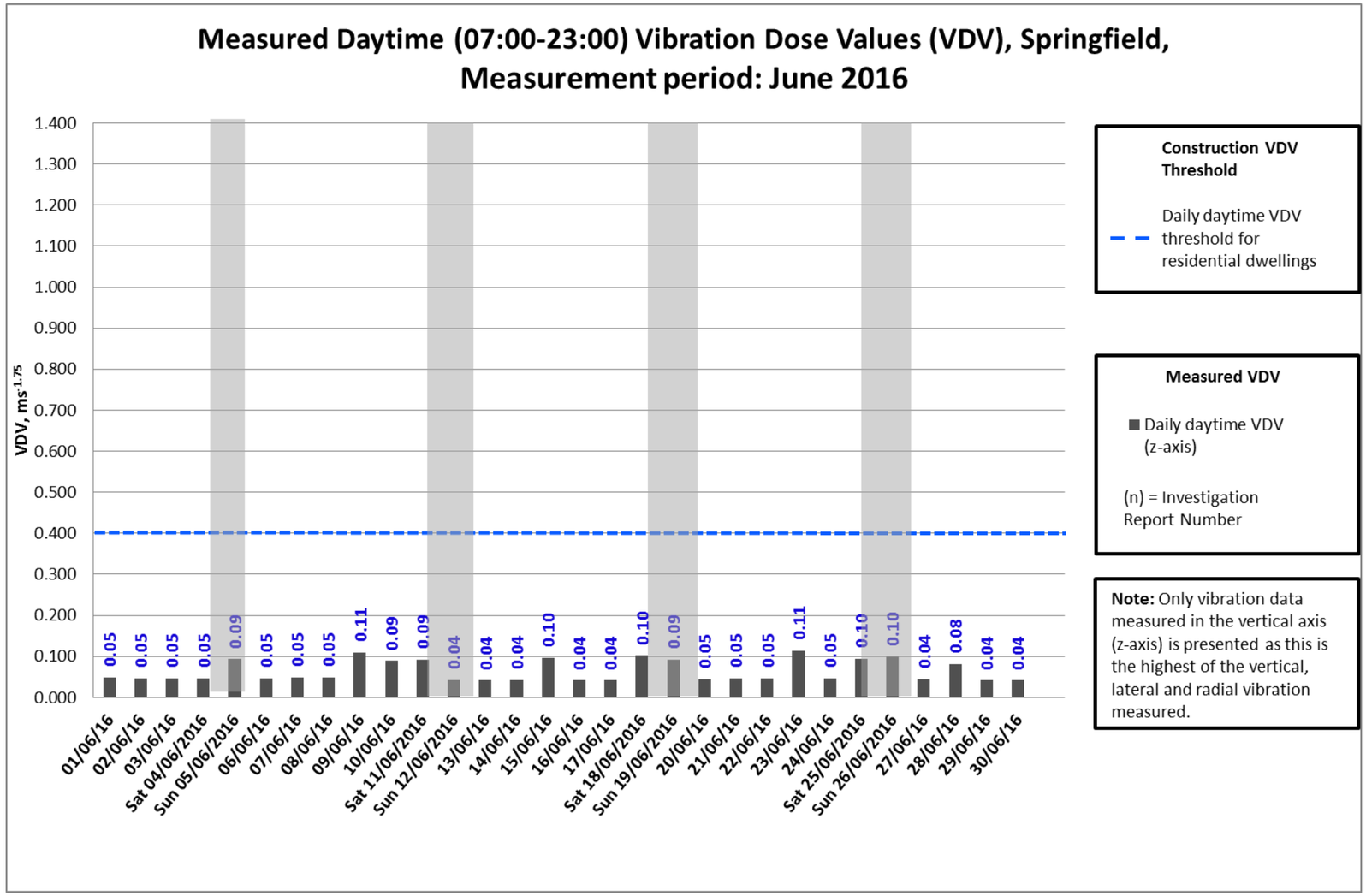

Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Scotstoun,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.05 0.05 0.05 0.05 0.06 0.04 0.04 0.04 0.04 0.05 0.05 0.04 0.04 0.04 0.04 0.05
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 118/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

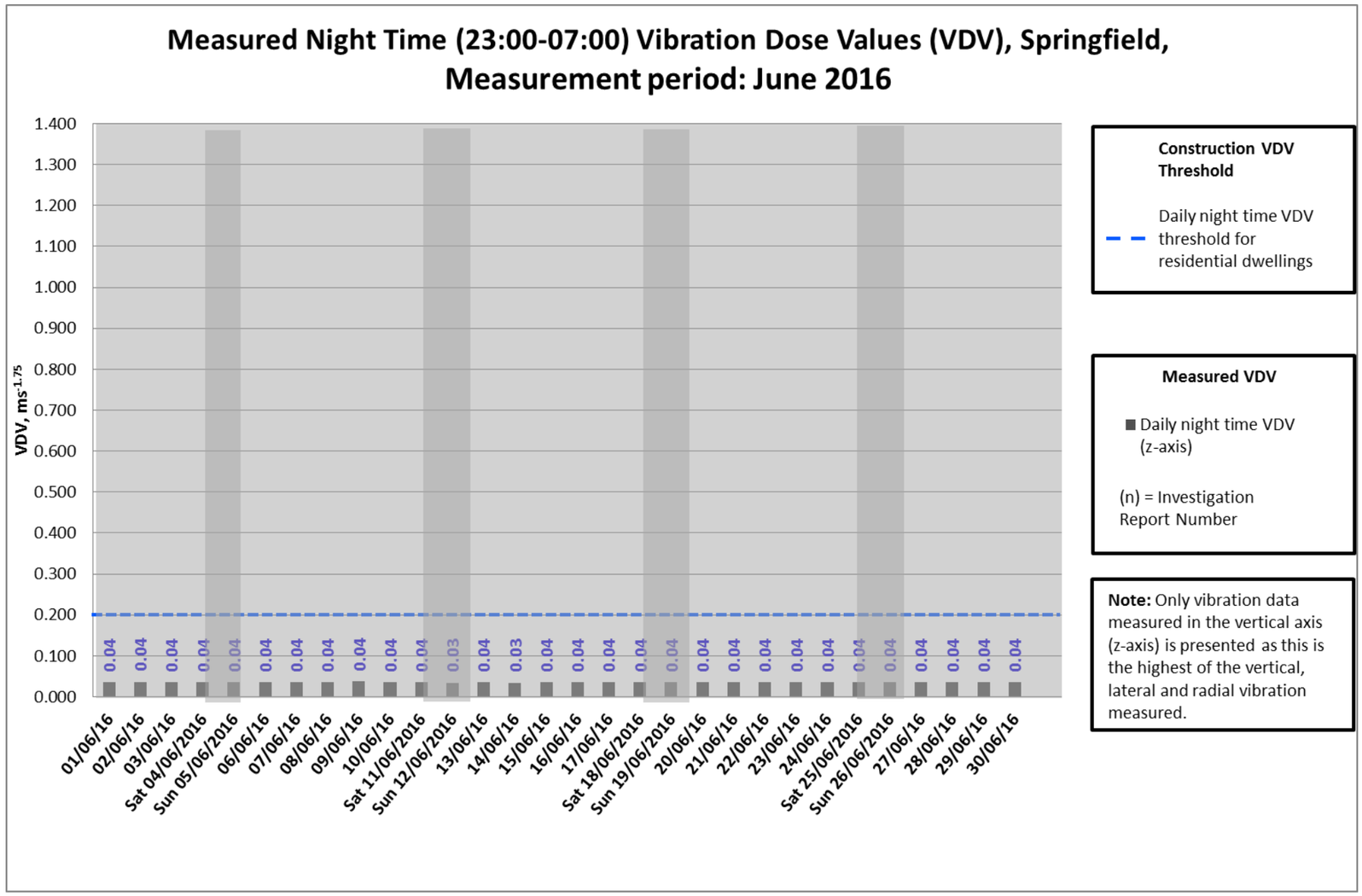

Measured highest Daily Peak Particle Velocity (PPV), Springfield,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0.60
0.48
0.43
0.40
4.60
0.45
0.35
0.30
6.35
8.08
6.15
0.93
0.30
0.90
5.00
0.68
0.38
7.45
6.48
0.38
0.65
0.33
7.75
0.68
5.38
8.60
1.30
9.70
0.58
0.98
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

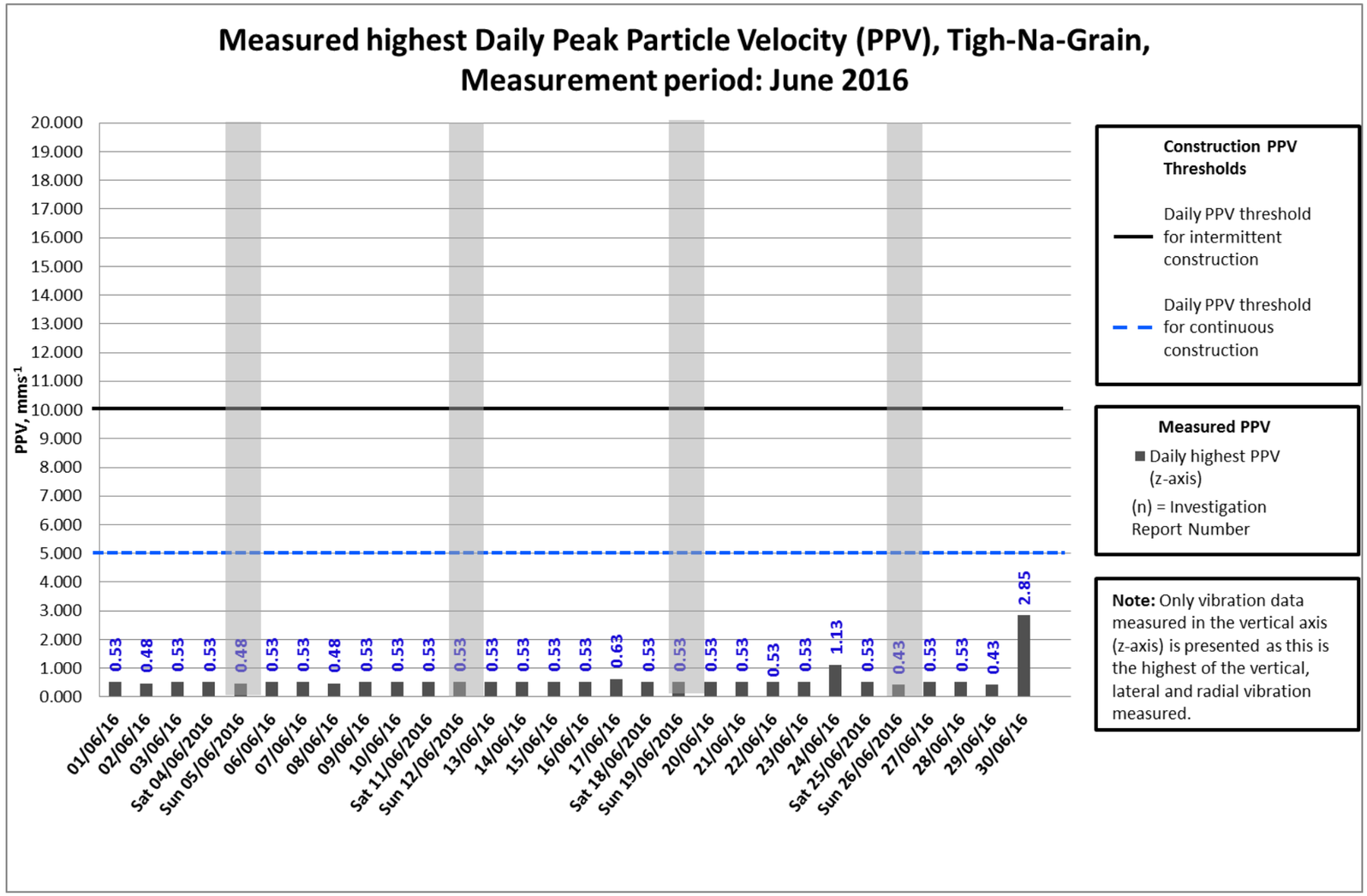


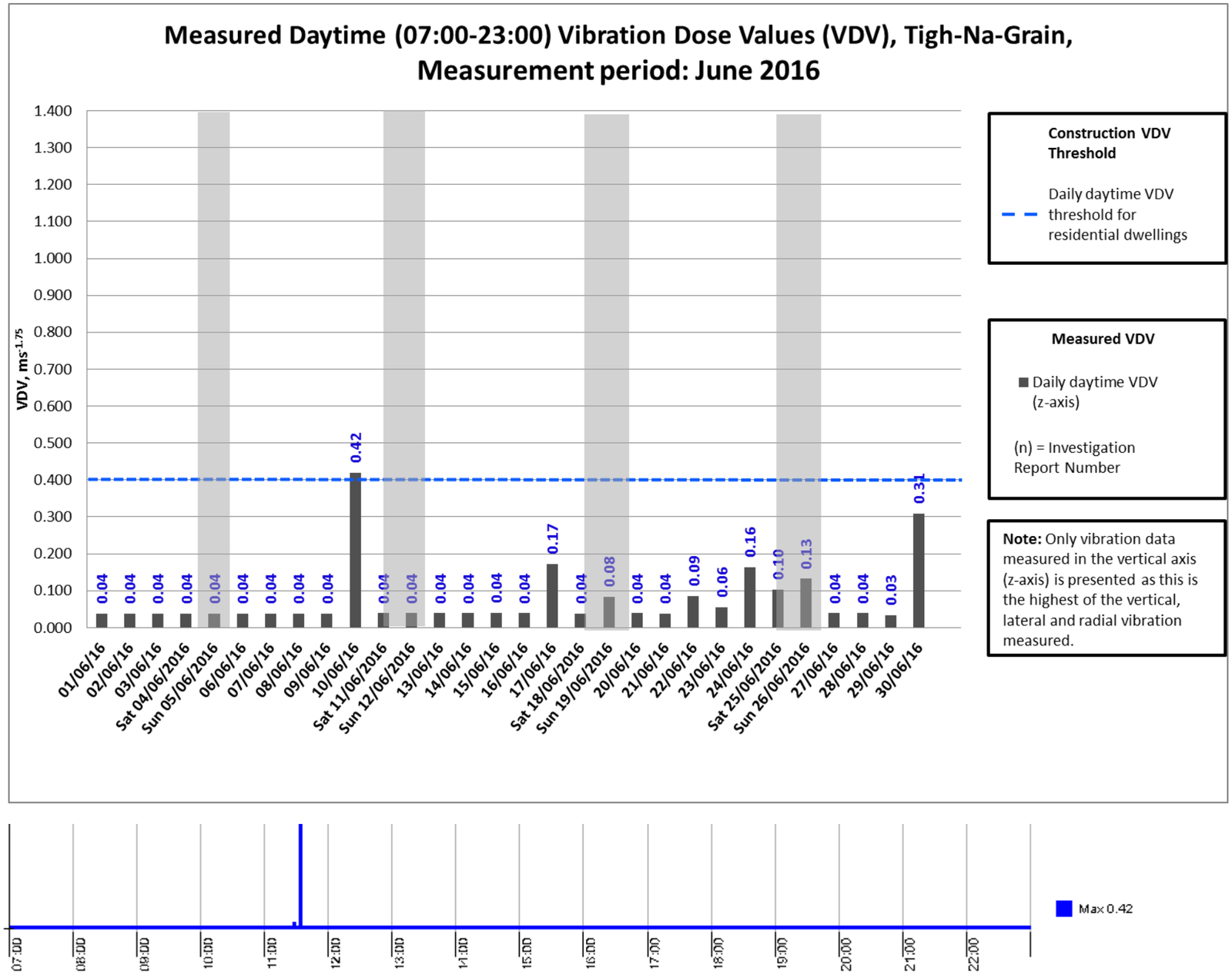
Exceedances on the 9th, 10th, 11th, 15th, 18th, 23rd, 25th and 28th of June have been investigated and found to be caused by individual isolated events that are unlikely to have been construction related activities (graph above from the 10/06/2016) .

Exceedances on the 19th and 26th of June have been investigated and were caused out of normal working hours for the road building section and as such it is unlikely that these exceedances were caused by construction related activities.

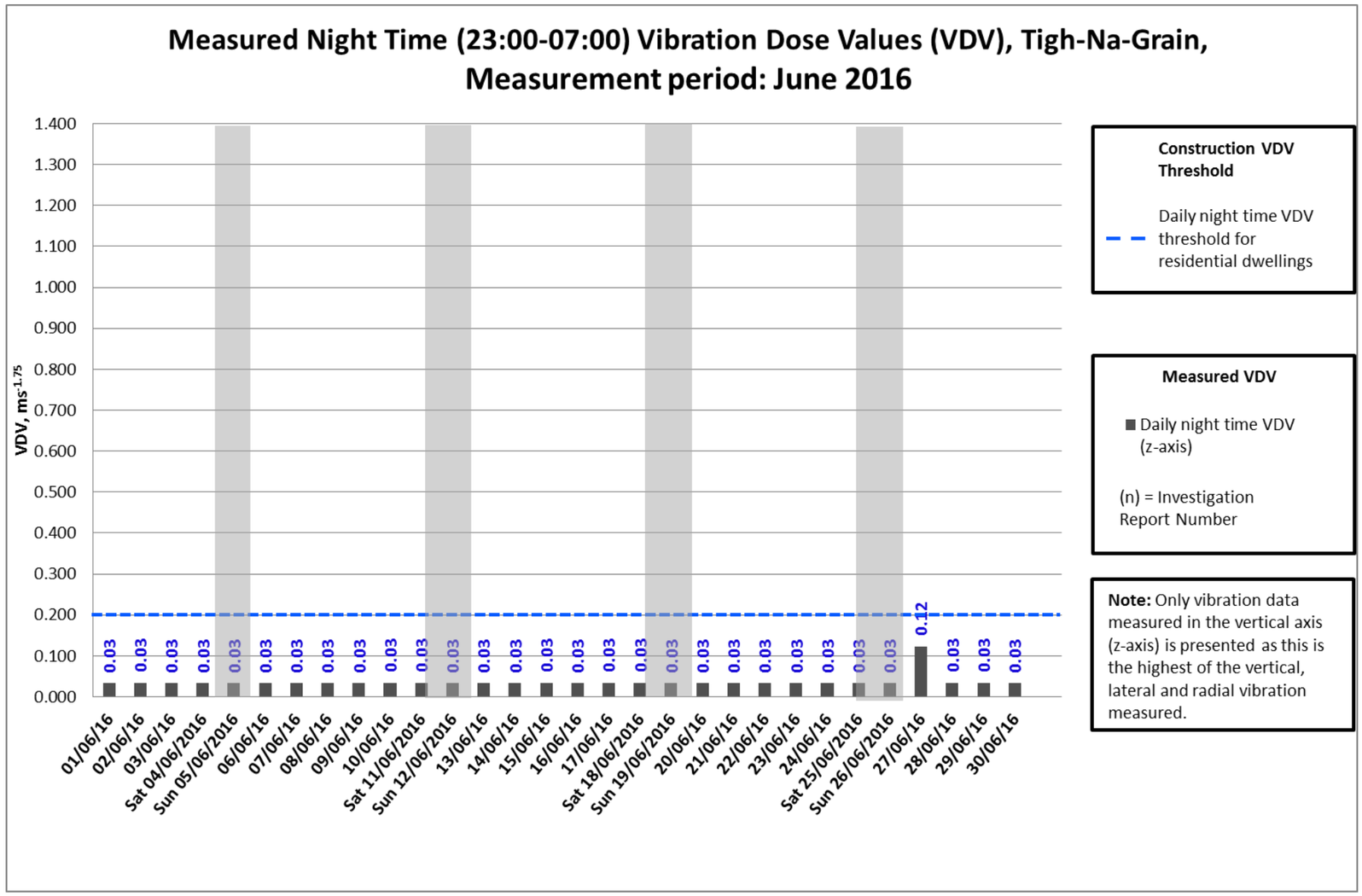

Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Springfield,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.05 0.05 0.05 0.05 0.09 0.05 0.05 0.05 0.11 0.09 0.09 0.04 0.04 0.04 0.10 0.04 0.04 0.10 0.09 0.05 0.05 0.05 0.11 0.05 0.10 0.10 0.04 0.08 0.04 0.04
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

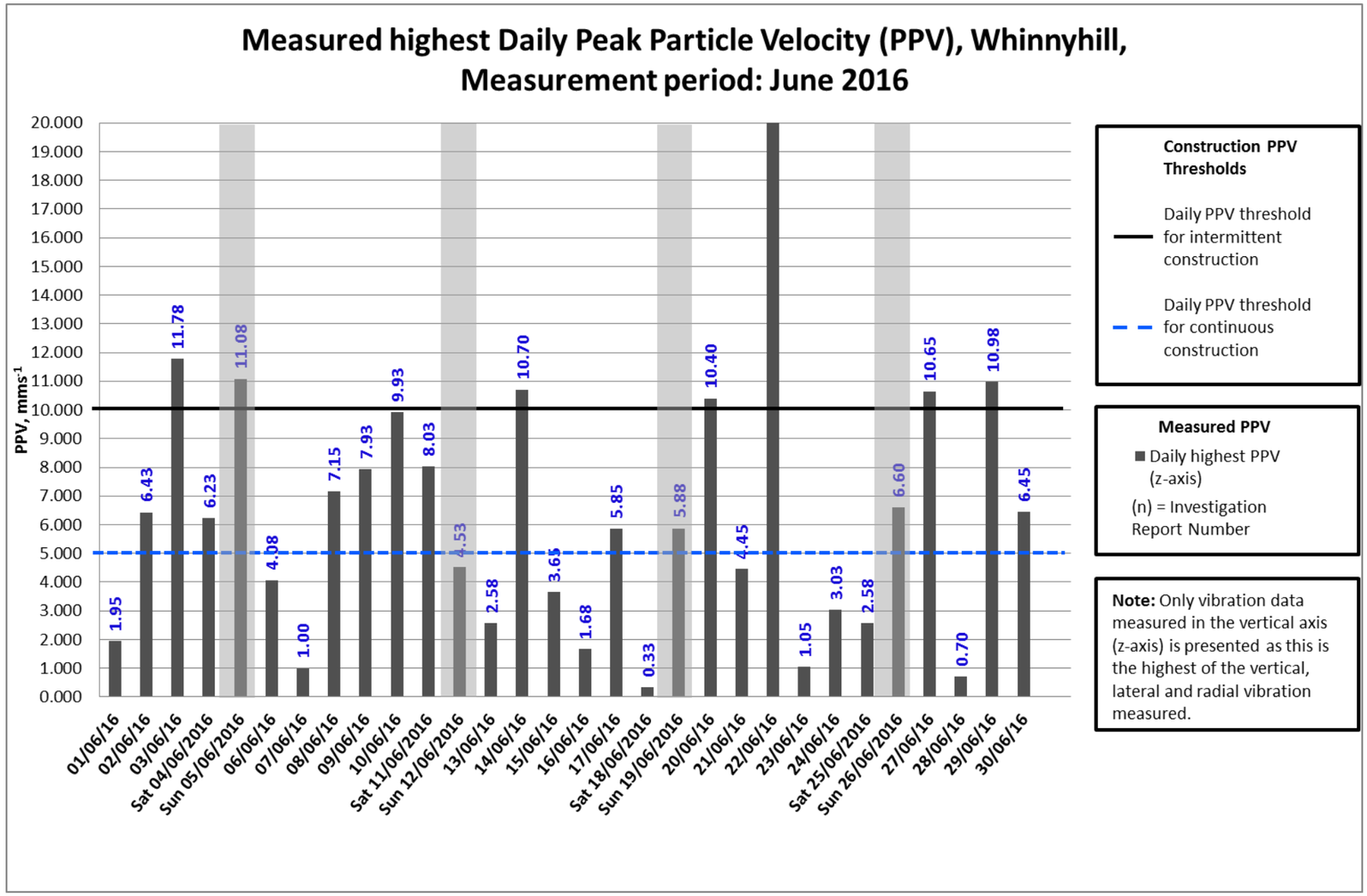

Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Springfield,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.03 0.04 0.03 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04 0.04
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

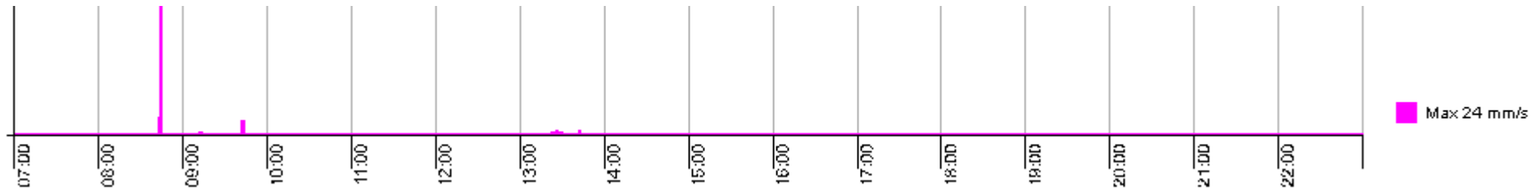

Measured highest Daily Peak Particle Velocity (PPV), Tigh-Na-Grain,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0.53 0.48 0.53 0.53 0.48 0.53 0.53 0.48 0.53 0.53 0.53 0.53 0.53 0.53 0.53 0.53 0.63 0.53 0.53 0.53 0.53 0.53 1.13 0.53 0.43 0.53 0.53 0.43 2.85
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.



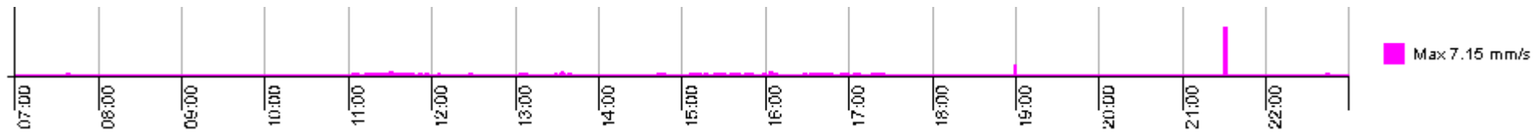
Exceedance on the 10th of June has been investigated and found to have been caused by an individual isolated event unlikely to have been related to construction activities (graph above from the 10/06/2016).


Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Tigh-Na-Grain,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.03
0.12
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

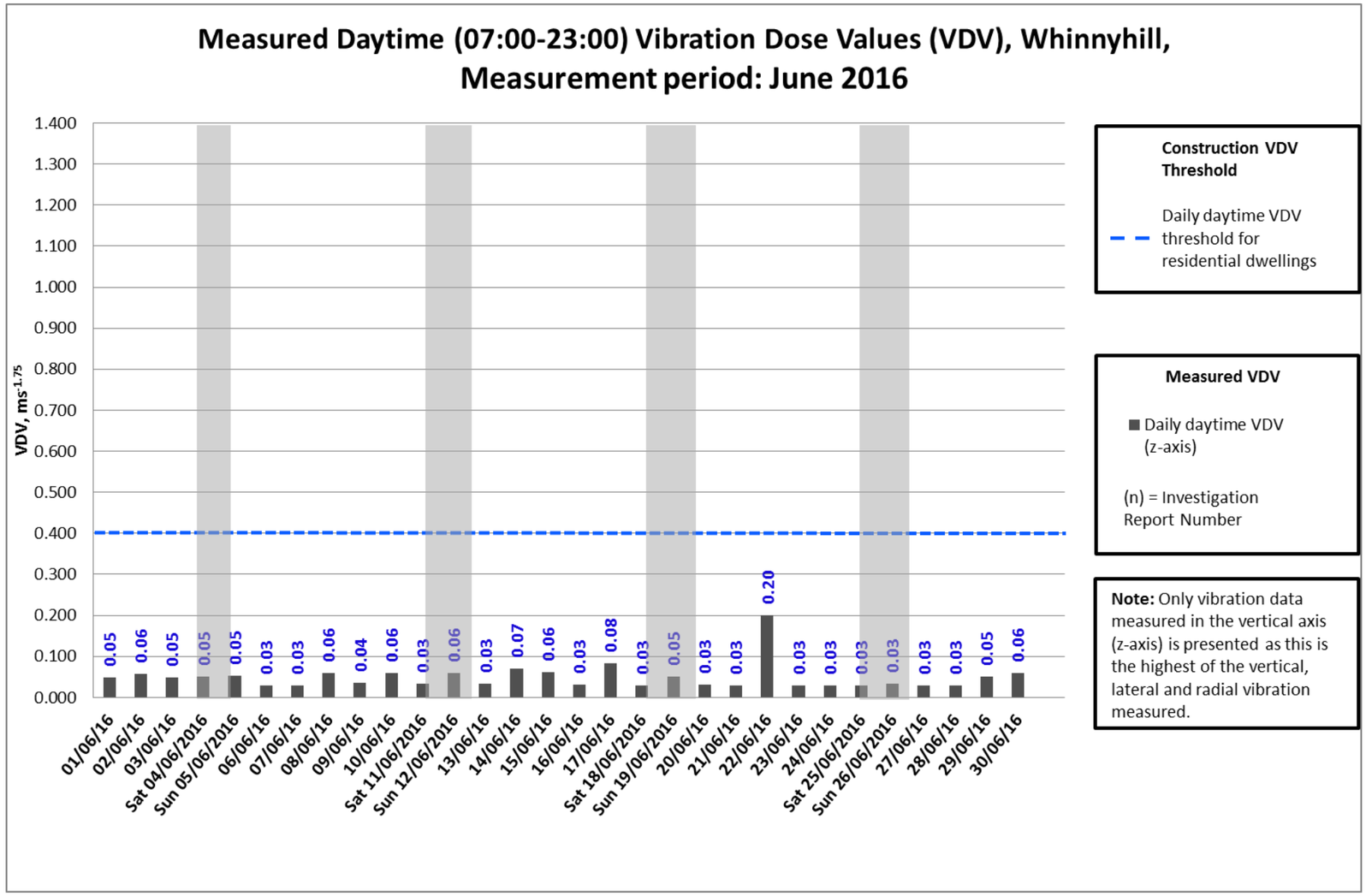

Measured highest Daily Peak Particle Velocity (PPV), Whinnyhill,
Measurement period: June 2016
PPV, mms-1
20.000
19.000
18.000
17.000
16.000
15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
6.43
11.78
6.23
11.08
4.08
1.00
7.15
7.93
9.93
8.03
4.53
2.58
10.70
3.65
1.68
5.85
0.33
5.88
10.40
4.45
1.05
3.03
2.58
6.60
10.65
0.70
10.98
6.45
1.95
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/05/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction PPV Thresholds
Daily PPV threshold for intermittent construction
Daily PPV threshold for continuous construction
Measured PPV
Daily highest PPV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.

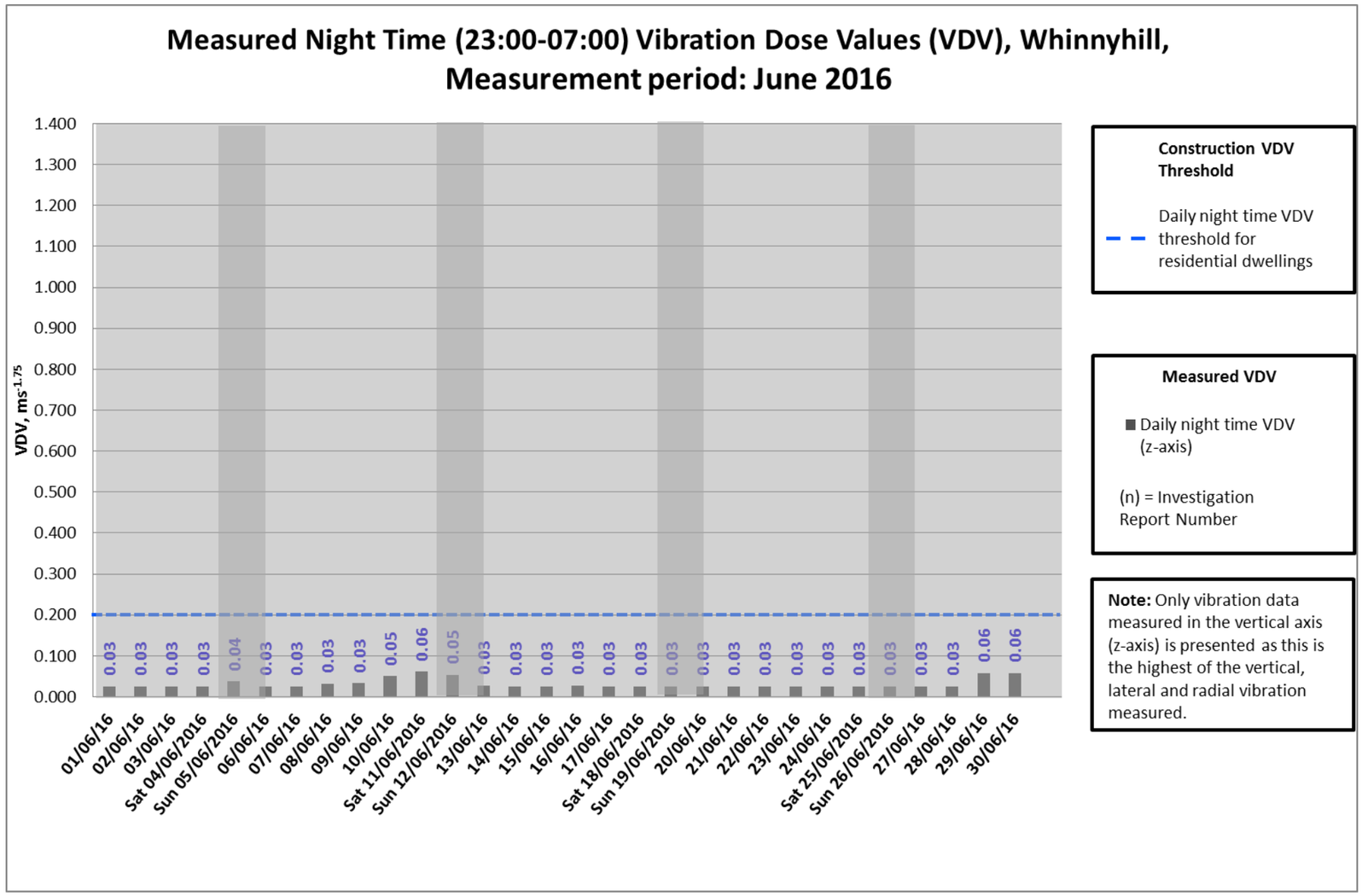


Exceedances on the 2nd, 3rd, 4th, 9th, 10th, 11th, 14th, 17th, 22nd, 27th, 29th and 30th of June have been investigated and found to have been caused by individual isolated events that are unlikely to have been construction related activities (graph above from the 22/06/2016).



Exceedances on the 5th, 8th, 19th, 20th and 26th of June have been investigated and were caused out of normal working hours for the road building section and as such it is unlikely that these exceedances were caused by construction related activities (graph above from the 08/06/2016).


Measured Daytime (07:00-23:00) Vibration Dose Values (VDV), Whinnyhill,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.05 0.06 0.05 0.05 0.05 0.03 0.03 0.06 0.04 0.06 0.03 0.06 0.03 0.07 0.06 0.03 0.08 0.03 0.05 0.03 0.03 0.20 0.03 0.03 0.03 0.03 0.03 0.03 0.05 0.06
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily daytime VDV threshold for residential dwellings
Measured VDV
Daily daytime VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.


Measured Night Time (23:00-07:00) Vibration Dose Values (VDV), Whinnyhill,
Measurement period: June 2016
VDV, ms-1.75
1.400
1.300
1.200
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.03 0.03 0.03 0.03 0.04 0.03 0.03 0.03 0.03 0.05 0.06 0.05 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.06 0.06
01/06/16
02/06/16
03/06/16
Sat 04/06/2016
Sun 05/06/2016
06/06/16
07/06/16
08/06/16
09/06/16
10/06/16
Sat 11/06/2016
Sun 12/06/2016
13/06/16
14/06/16
15/06/16
16/06/16
17/06/16
Sat 18/06/2016
Sun 19/06/2016
20/06/16
21/06/16
22/06/16
23/06/16
24/06/16
Sat 25/06/2016
Sun 26/06/2016
27/06/16
28/06/16
29/06/16
30/06/16
Construction VDV Threshold
Daily night time VDV threshold for residential dwellings
Measured VDV
Daily night time VDV (z-axis)
(n) = Investigation Report Number
Note: Only vibration data measured in the vertical axis (z-axis) is presented as this is the highest of the vertical, lateral and radial vibration measured.