

Construction noise and vibration Monthly Report – December 2018

Three Rivers District

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Non-technical summary

This noise and vibration monitoring report fulfils HS2 Limited's commitment detailed in the Environmental Minimum Requirements (EMRs), Annex 1, Code of Construction Practice, to present the results of noise and vibration monitoring carried out within the Three Rivers District (TRD) during the month of December 2018.

This report presents data from noise and vibration monitoring installations near to the Chalfont Lane diversion and to the M25 Junction 16/17 slip road worksites. Works were undertaken to construct two slip road openings (also referred to as bell mouths), one developed on each side of the carriageway. Works at Chalfont Lane diversion included fencing, lighting works, road marking, completion of surface course and full depth reconstruction of Shire Lane. Works at Chalfont Lane widening included: between the M25 and Sunnyhill Road, works at the substation access, raised ironwork and installation of signage; between Denham Way and Sunnyhill Road, works at south and north verges and remodelling of the island on the A412; along the entire length, installation of CCTV and drainage. Works at the M25 slip roads included laying remaining base, binder and surface courses, fencing and landscaping. Inspections for defects were carried out at the Chalfont Lane widening worksite between the M25 and Sunnyhill Road, at the M25 slip roads and at the Caravan Park worksites.

Given the limited nature of works and the significant offset distance between the monitoring position and the works in the TRD region, the measured noise and vibration levels during working periods are largely attributable to underlying ambient noise levels or events occurring in proximity to the monitoring station, rather than due to construction activities.

No exceedances of the SOAEL and no exceedances of S61 trigger levels were measured due to HS2 related works during the monitoring period. No complaints were reported to HS2 for the TRD region during the December monitoring period.

Abbreviations and descriptions

The abbreviations, descriptions and project terminology used within this report can be found in the Project Dictionary (HS2-HS2-PM-GDE-000-000002).

Table 1: Table of abbreviations

Acronym	Meaning
$L_{Aeq,T}$	See equivalent continuous sound pressure level
Ambient sound	A description of the all-encompassing sound at a given location and time which will include sound from many sources near and far. Ambient sound can be quantified in terms of the equivalent continuous sound pressure level, $L_{pAeq,T}$
decibel(s), or dB	Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal (Pa)). Because of this wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audibility of sound covers a range of approximately 0-140dB.
decibel(s) A-weighted, or dB(A)	The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'.
Equivalent continuous sound pressure level, or $L_{Aeq,T}$	An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.
Exclusion of data	Measurement of noise levels can be affected by weather conditions such as prolonged periods of rain, winds speeds higher than 5m/s and snow/ice ground cover. Noise levels measured during these periods are considered not representative of normal noise conditions at the site and, for the purposes of this report, are excluded from the assessment of exceedances and calculation of typical noise levels and are also greyed out in charts. Identifiable incongruous noise and vibration events not attributable to HS2 construction noise are also excluded.
Façade	A facade noise level is the noise level 1m in front of a large reflecting surface. The effect of reflection, is to produce a slightly higher (typically +2.5 to +3 dB) sound level than it would be if the reflecting surface was not there.
Free-field	A free-field noise level is the noise level measured at a location where no reflective surfaces, other than the ground, lies within 3.5 metres of the microphone position.
Equivalent continuous sound pressure level, or $L_{pAeq,T}$	An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.
Peak particle velocity, or PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position. The PPV is a simple indicator of perceptibility and risk of damage to structures due to vibration. It is usually measured in mm/s.
Sound pressure level	The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.
Vibration dose value, or VDV	An index used to evaluate human exposure to vibration in buildings. While the PPV provides information regarding the magnitude of single vibration events, the VDV provides a measure of the total vibration experienced over a specified period of time (typically 16h daytime and 8h night-time). It takes into account the magnitude, the number and the duration of vibration events and can be used to quantify exposure to continuous, impulsive, occasional and intermittent vibration. The vibration dose value is measured in $m/s^{1.75}$.

1 Introduction

1.1.1 The nominated undertaker is required to undertake noise (and vibration) monitoring as necessary to comply with the requirements of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements, including specifically Annex 1: Code of Construction Practice, in addition to any monitoring requirements arising from conditions imposed through consents under Section 61 of the Control of Pollution Act, 1974 or through Undertakings & Assurances given to third parties. Such monitoring may be undertaken for the following purposes:

- monitoring the impact of construction works;
- to investigate complaints, incidents and exceedance of trigger levels; or
- monitoring the effectiveness of noise and vibration control measures.

Monitoring data and interpretive reports are to be provided to each relevant local authority on a monthly basis and shall include a summary of the construction activities occurring, the data recorded over the monitoring period, any complaints received, any periods in exceedance of agreed trigger levels, the results of any investigations and any actions taken or mitigation measures implemented. This report provides noise data, and interpretation thereof, for monitoring carried out by HS2 within the Three Rivers District (TRD) for the period 1st to 31st December 2018.

1.1.2 Active construction sites in the local authority area during this period include:

- Chalfont Lane diversion (see plan 1 in Appendix A)
 - Fencing;
 - Installation of lighting;
 - Road markings;
 - Full depth reconstruction of Shire Lane: excavation and installation of sub-base, installation of drainage and kerbs, final trim of sub-base, laying of base and binder courses, road markings, inspection for defects;
 - Installation of drainage and kerbs;
 - Final trim of sub-base; and
 - Installation of base course and binder.
- Chalfont Lane widening - Substation access (see plan 1 in Appendix A)
 - Installation of drainage, gullies and kerbs;
 - Final trim of sub-base; and
 - Installation of base course and binder.

- Chalfont Lane widening – Denham Way to Sunnyhill Road (see plan 1 in Appendix A)
 - Installation of service chambers and blind tank;
 - Installation of geocellular soakaway;
 - Re-soiling;
 - Remodelling island on A412;
 - South verge: installation of sub-base, gullies and kerb; final trim of sub-base and installation of base and binder courses; and
 - North verge: installation of kerbs.
- Chalfont Lane widening – M25 to Sunnyhill Road (see plan 1 in Appendix A)
 - Raise of ironwork;
 - Installation of signage; and
 - Inspection of utilities for defects.
- Chalfont Lane widening – entire length (see plan 1 in Appendix A)
 - Installation of CCTV; and
 - Installation of drainage.
- M25 On-slip (see plan 1 in Appendix A)
 - Installation of edge protection of sheet piles; and
 - Inspection for defects.
- M25 Off-slip (see plan 1 in Appendix A)
 - Fencing;
 - Landscaping and seeding;
 - Laying remaining base/binder/surface courses; and
 - Inspection for defects.
- Caravan Park (see plan 1 in Appendix A)
 - Inspection for defects.

1.1.3 The applicable standards, guidance, and monitoring methodology is outlined in the construction noise and vibration monitoring methodology report which can be found at the following location <https://www.gov.uk/government/collections/monitoring-the-environmental-effects-of-hs2>. Noise and vibration monitoring reports for previous months can also be found at this location.

1.2 Measurement locations

- 1.2.1 The following table summarises the position of noise and vibration monitoring installations within the TRD area in December 2018.
- 1.2.2 Maps showing the position of noise monitoring installations are presented in Appendix B.

Table 2: Monitoring locations

Worksite Reference	Measurement Reference	Address
Chalfont Ln widening	N2	Hill House, Chalfont Lane, West Hyde, Maple Cross, Rickmansworth, WD3 9XN
	V2	Casa Llana, Sunnyhill Road, Rickmansworth, WD3 9XN
	V3	BT Chamber, Sunnyhill Road, Rickmansworth, WD3 9XN

2 Summary of results

2.1 Exceedances of SOAEL

- 2.1.1 The lowest observed adverse effect level (LOAEL) is defined in the Planning Practice Guidance – Noise (PPG) as the level above which "noise starts to cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life".
- 2.1.2 The significant observed adverse effect level (SOAEL) is defined in the 'Planning Practice Guidance – Noise' as the level above which "noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."
- 2.1.3 Where construction noise levels exceed the SOAEL, relevant periods will be identified and summary statistics provided in order to evaluate ongoing qualification for noise insulation and temporary rehousing.
- 2.1.4 Table 3 presents a summary of recorded exceedances of the LOAEL and SOAEL due to HS2 related construction noise at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 3: Summary of exceedances of SOAEL.

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of LOAEL	Number of exceedances of SOAEL
Chalfont Ln widening	N2	Hill House, Chalfont Lane	All days	All periods	8	No exceedance

2.1.5 HS2 main construction activities were undertaken between 08:00 and 18:00 on weekdays and 08:00 to 13:00 on Saturdays. There were 8 exceedances of the LOAEL during periods of works, however due to the limited nature of works and distance between works and monitoring locations in the TRD region, these were attributable to fluctuations in the ambient noise rather than being related to construction noise from HS2 worksites. There were no exceedances of the SOAEL during periods of works.

2.1.6 Monitoring of vibration peak particle velocity (PPV) was undertaken with the purpose to ensure construction generated vibration levels were below those with potential to damage adjacent buildings, in accordance with Annex 1: Code of Construction Practice of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements. There are no LOAEL and SOAEL criteria based on PPV applicable to HS2 construction vibration.

2.2 Summary of measured noise and vibration levels

2.2.1 Table 4 presents a summary of the measured noise levels at the monitoring location over the reporting period. The $L_{Aeq,T}$ is presented for each of the relevant time periods averaged over the calendar month, along with the highest single period $L_{Aeq,T}$ that was found to occur within the month.

2.2.2 Appendix C presents graphs of the noise and vibration monitoring data over the month for each of the measurement locations. Noise data presented includes the hourly L_{Aeq} values and, where relevant, the $L_{Aeq,T}$ values (where the time period T has been taken to be the averaging period as specified in Table 1 of HS2 Information Paper E23). The full data set for the monitoring equipment can be found at the following location: <https://data.gov.uk/dataset/24542ae7-dd44-444f-b259-871c4cc43b5e/environmental-monitoring-data>.

2.2.3 Given the limited nature of works undertaken and distance between works and monitoring locations in the TRD region, the measured noise and vibration levels are largely attributable to underlying, residual levels for noise and vibration rather than being attributable to construction activities.

Table 4: Summary of measured dB L_{Aeq} data over the monitoring period.

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade Measurement	Weekly Average L _{Aeq,T} (highest day L _{Aeq,T})*					Saturday Average L _{Aeq,T} (highest day L _{Aeq,T})*					Sunday / Public Holiday Average L _{Aeq,T} (highest day L _{Aeq,T})*	
				0700 - 0800	0800 - 1800	1800 - 1900	1900 - 2200	2200 - 0700	0700 - 0800	0800 - 1300	1300 - 1400	1400 - 2200	2200 - 0700	0700 - 2200	2200 - 0700
Chalfont Ln widening	N2	Hill House, Chalfont Lane	Free-field	59.0 (63.3)	61.8 (68.5)	58.0 (60.1)	56.2 (58.9)	53.6 (63.5)	57.1 (57.7)	59.3 (60.8)	59.0 (60.2)	57.8 (60.4)	53.4 (56.4)	57.8 (60.4)	54.3 (60.9)

2.2.4 Table 5 presents a summary of the measured vibration levels at vibration monitors V2 and V3 over the reporting period. Vibration monitor V3 is located within the construction area of the Chalfont Lane widening worksite to establish source vibration levels during construction. Vibration levels measured at this locations have been correlated to measurements at monitor V2, representative of vibration levels at surrounding residential properties. Based on this analysis, supplemented by site observations for periods of missing data at monitor V3, the highest vibration levels measured in December potentially due to HS2 construction activities are presented in Table 5.

Table 5: Summary of measured PPV data over the monitoring period.

Worksite Reference	Measurement Reference	Site Address	Highest PPV measured in any axis, mm/s
Chalfont Ln widening	V2	Casa Llena, Sunnyhill Road, Rickmansworth WD3 9XN	0.29 (Z axis)
	V3 ⁽¹⁾	BT Chamber, Sunnyhill Road, Rickmansworth WD3 9XN	1.52 (X axis)

⁽¹⁾ This monitor is located within the worksite and the measured vibration levels are representative of source vibration levels. Measured levels are higher than what would be experienced at the surrounding residential properties.

2.3 Exceedances of trigger level

2.3.1 Table 6 provides a summary of exceedances of the S61 trigger noise levels determined to be due to HS2 related construction noise measured during the reporting period, along with the findings of any investigation.

Table 6: Summary of exceedances of trigger levels.

Complaint Reference Number (if applicable)	Worksite Reference	Date and Time Period	Identified Source	Results of Investigation (including noise monitoring results)	Actions Taken
-	-	-	-	-	-

2.3.2 There were no exceedances of trigger levels as defined in section 61 consents during the reporting period at any monitoring position.

2.4 Complaints

2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

Table 7: Summary of complaints.

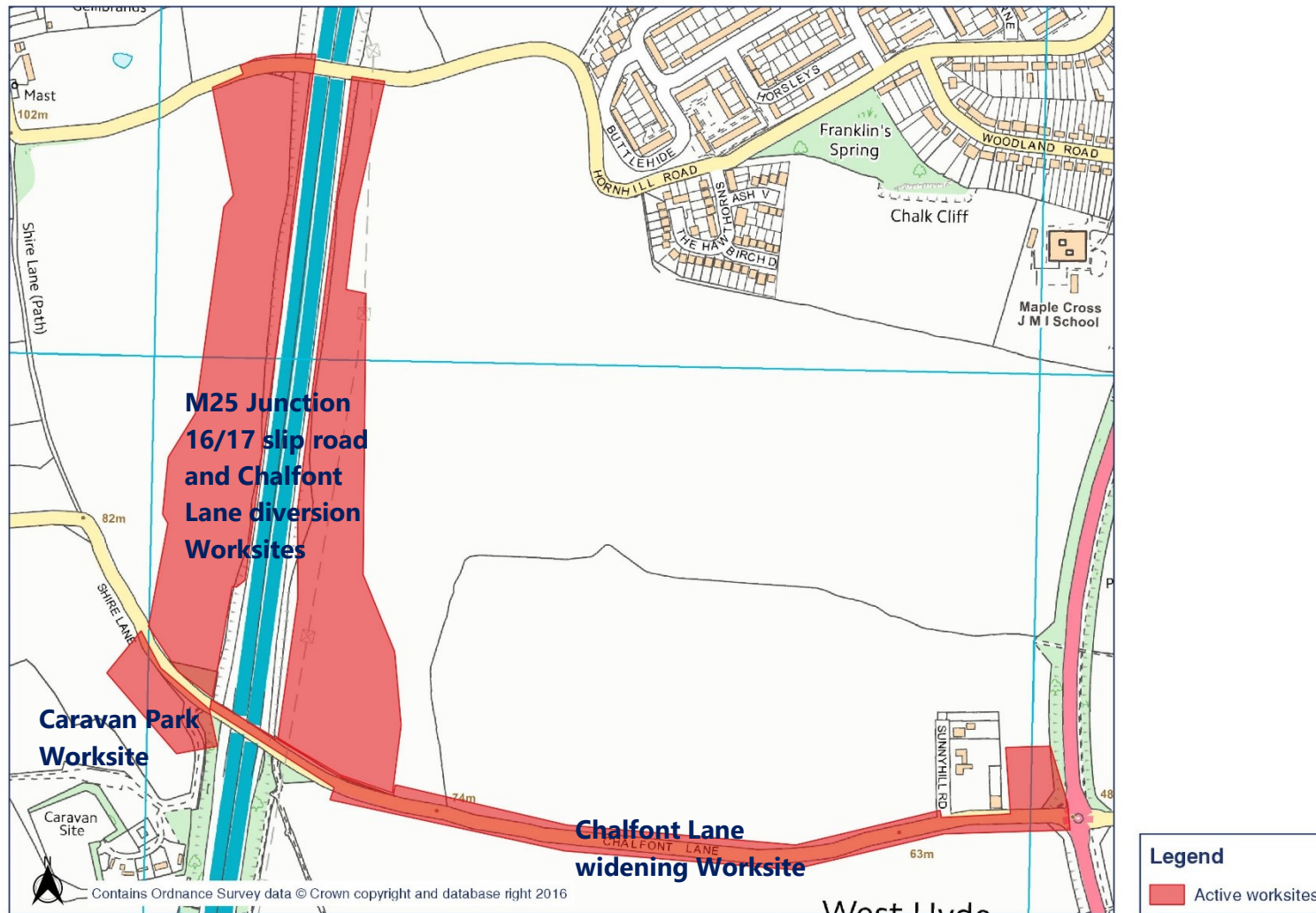
Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
-	-	-	-	-

2.4.2 No complaint regarding HS2 related construction noise or vibration were received during the reporting period in the TRD area.

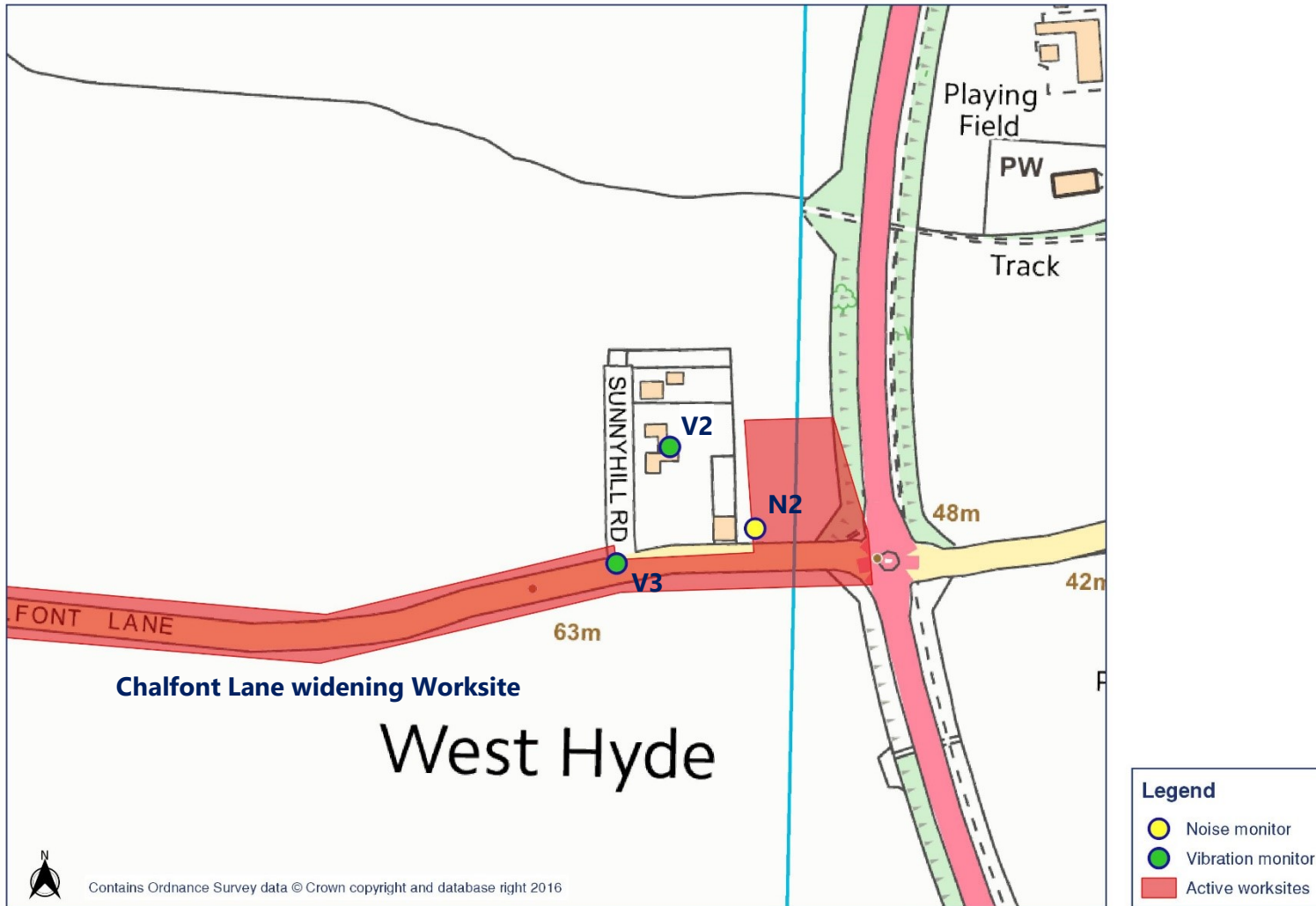
Appendix A Site Locations

HS2

Worksite identification plan - 1



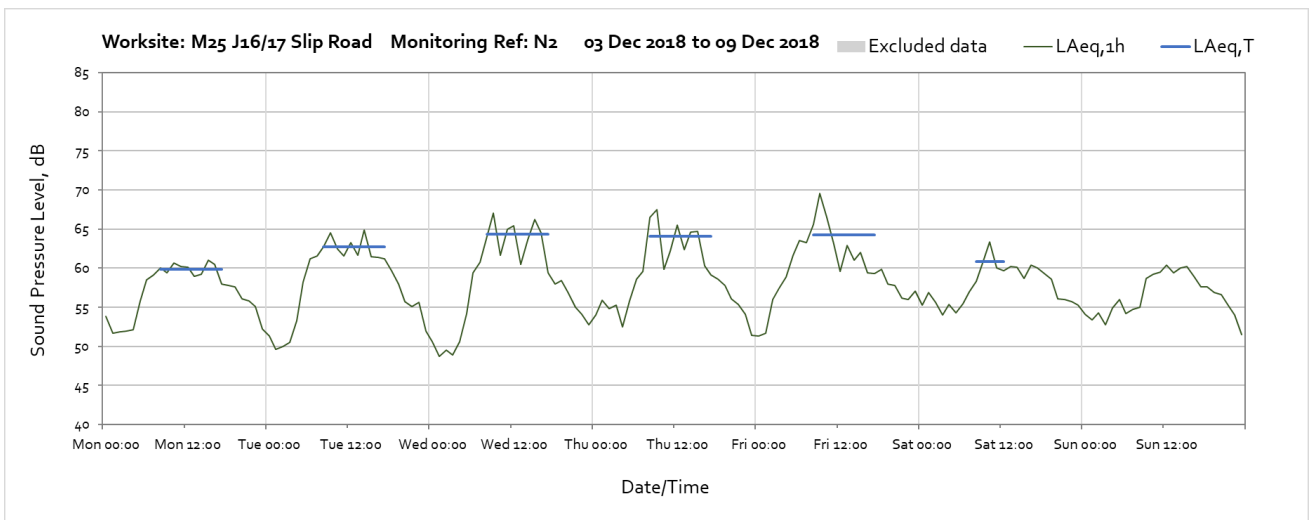
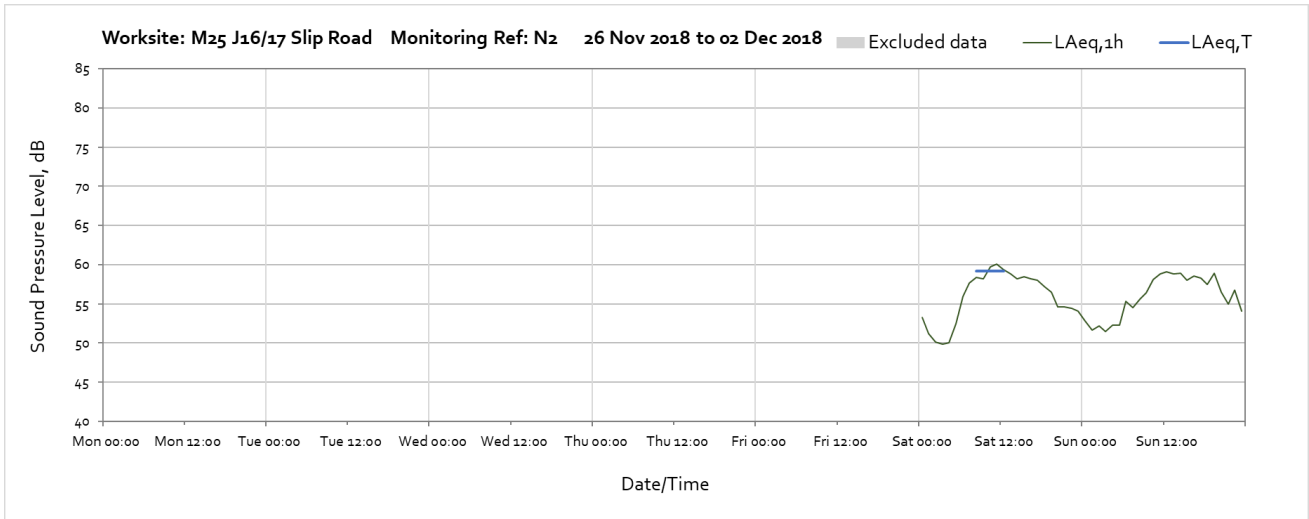
Appendix B Monitoring Locations

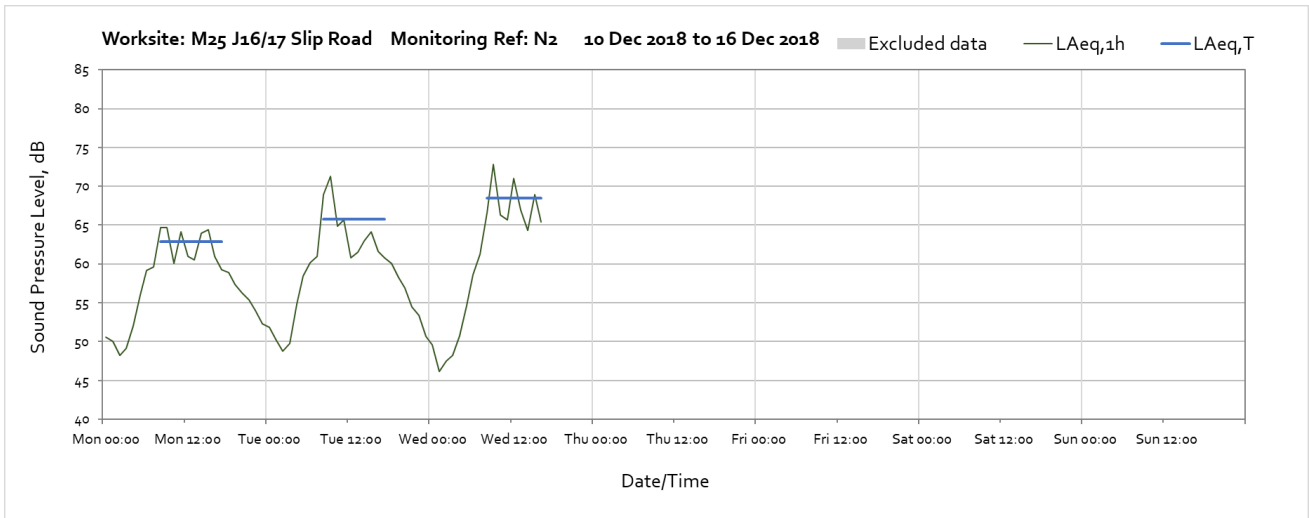


Appendix C Data

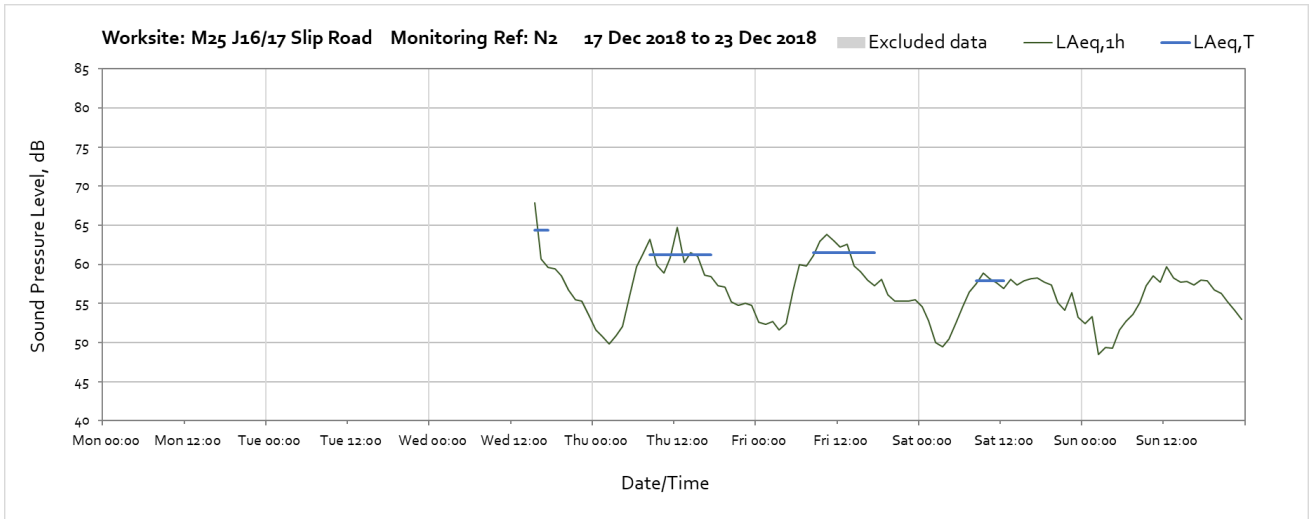
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values.

Worksite: Chalfont Lane widening – Monitoring Ref: N2

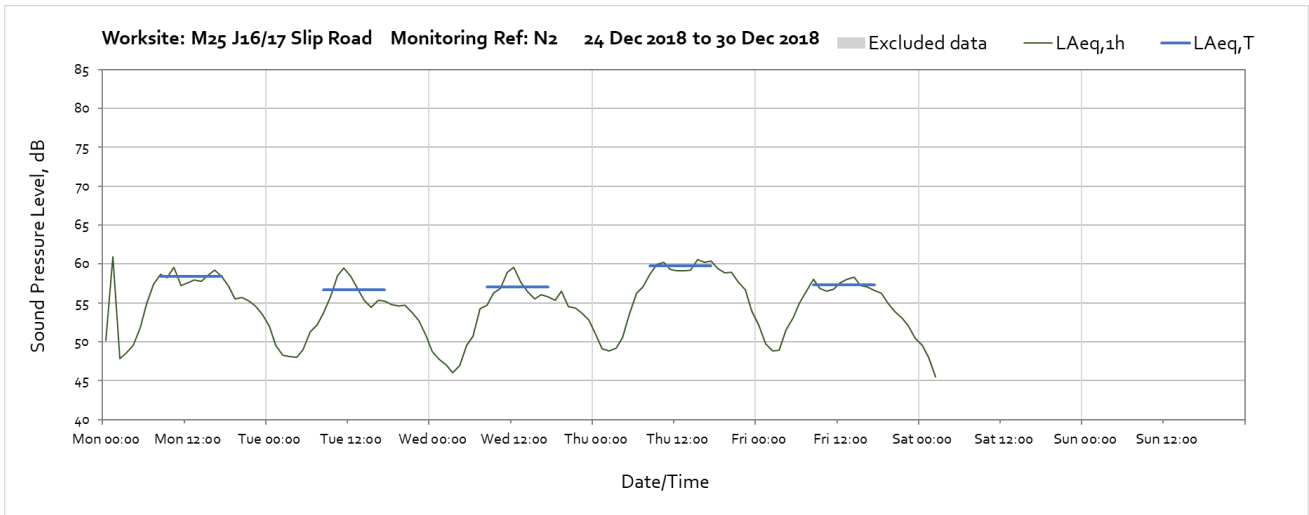




Note – Missing data between 17:00 on Wednesday 12th and 15:00 on Wednesday 19th due to a power failure.



Note – Missing data between 17:00 on Wednesday 12th and 15:00 on Wednesday 19th due to a power failure.

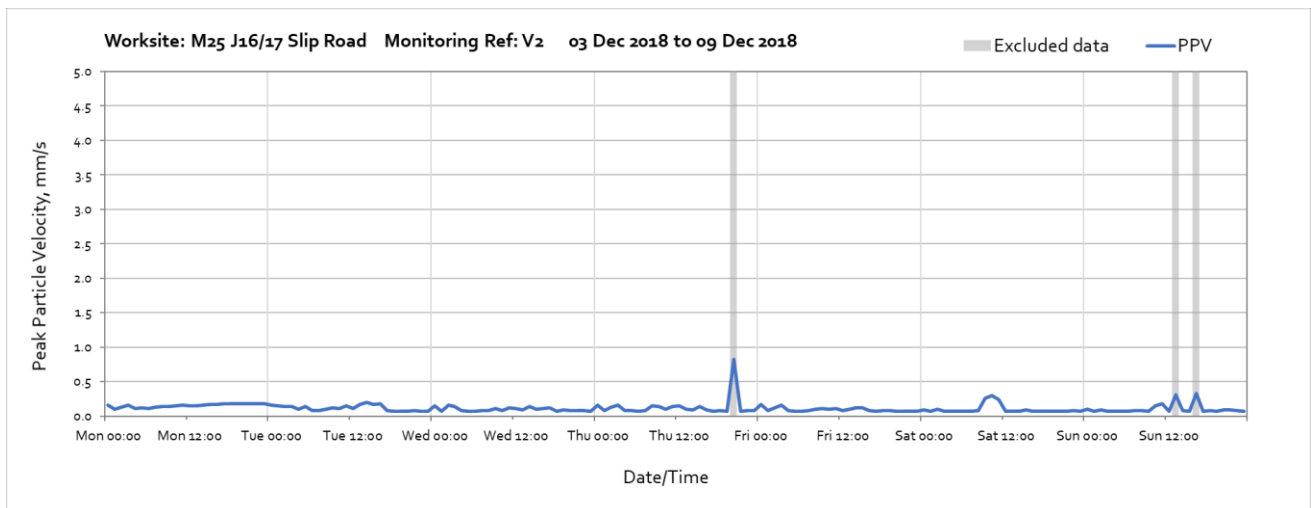
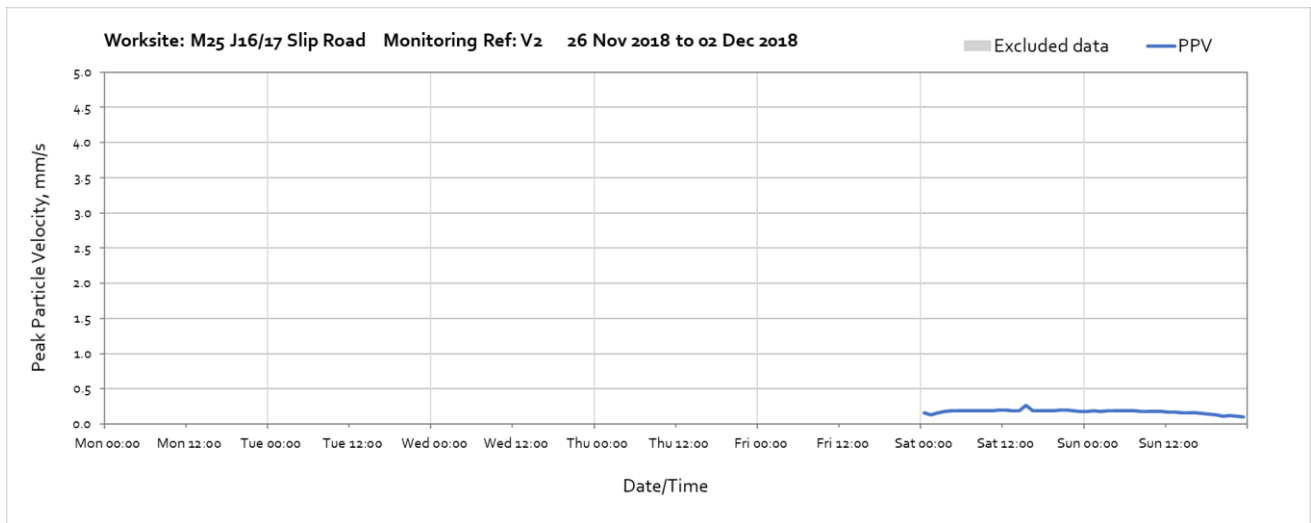


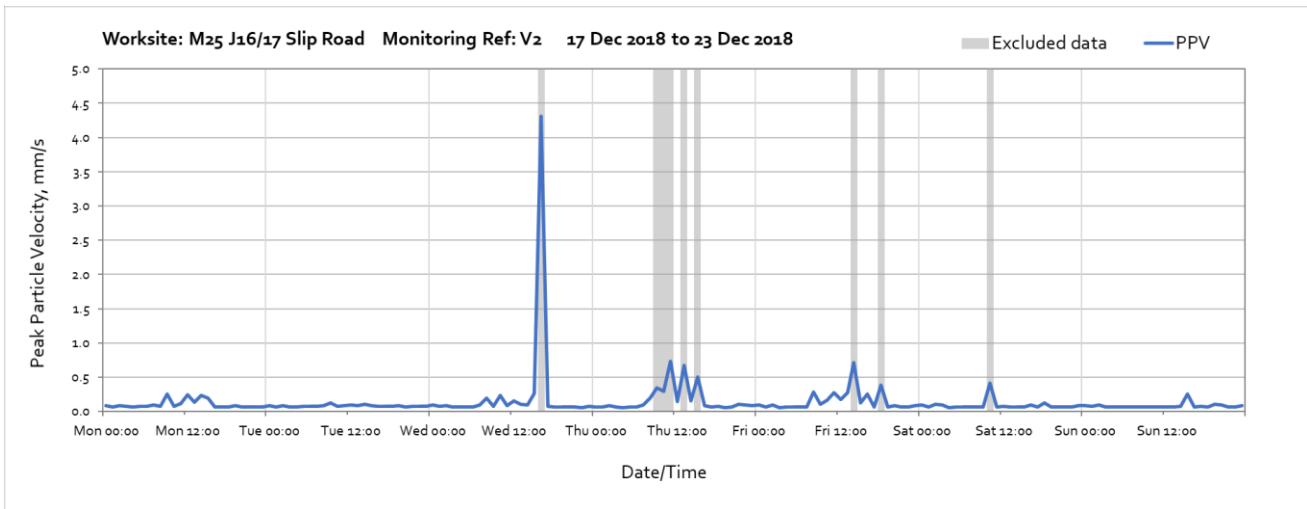
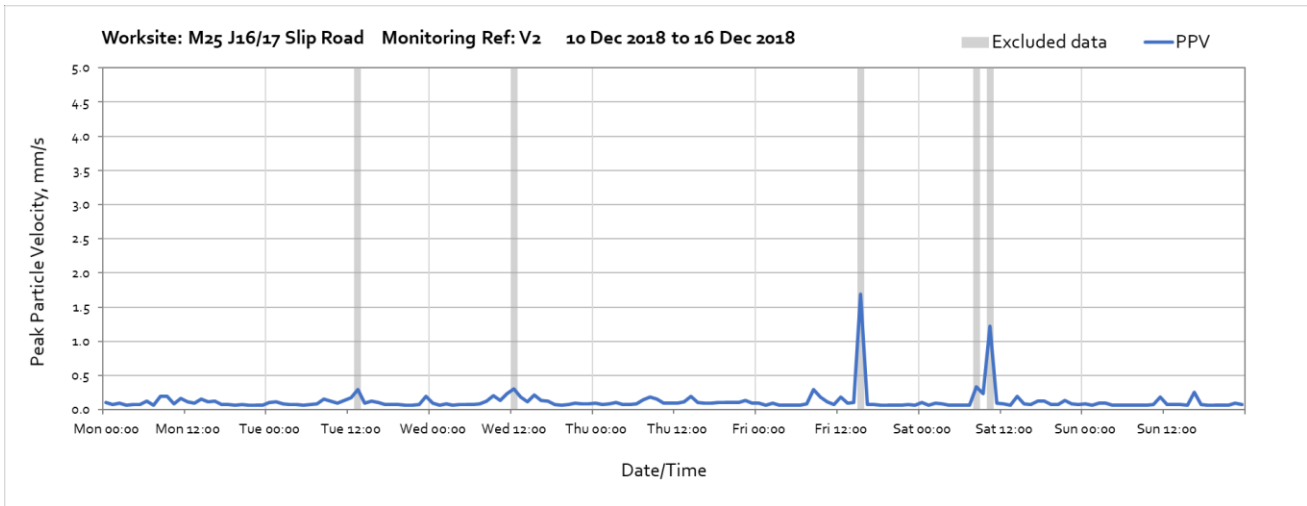
Note – Missing data between 03:00 on Saturday 29th and end of month due to a power failure.

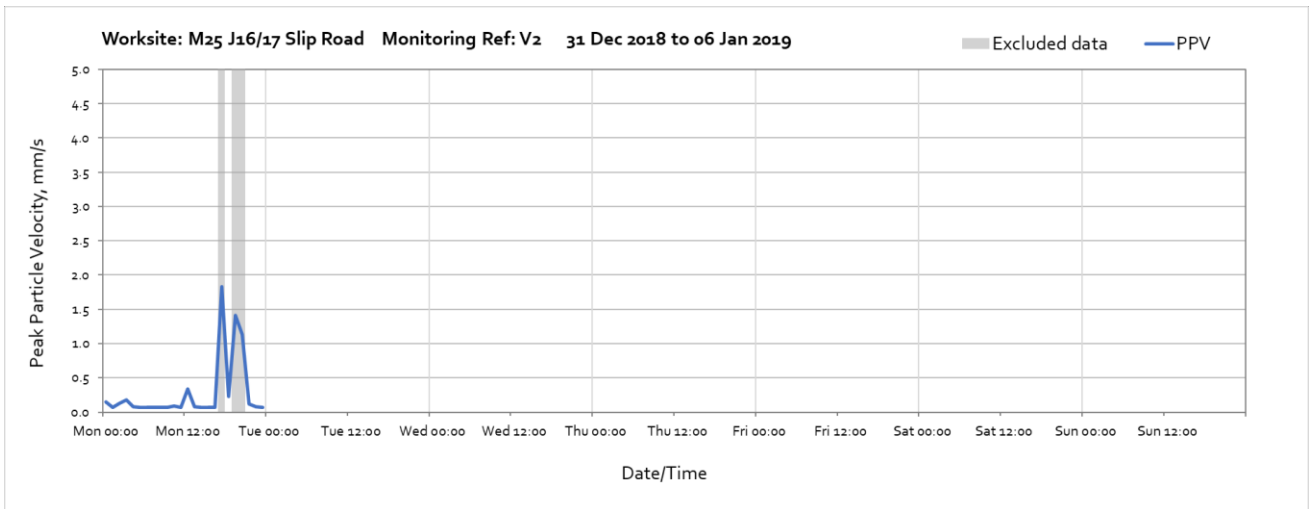
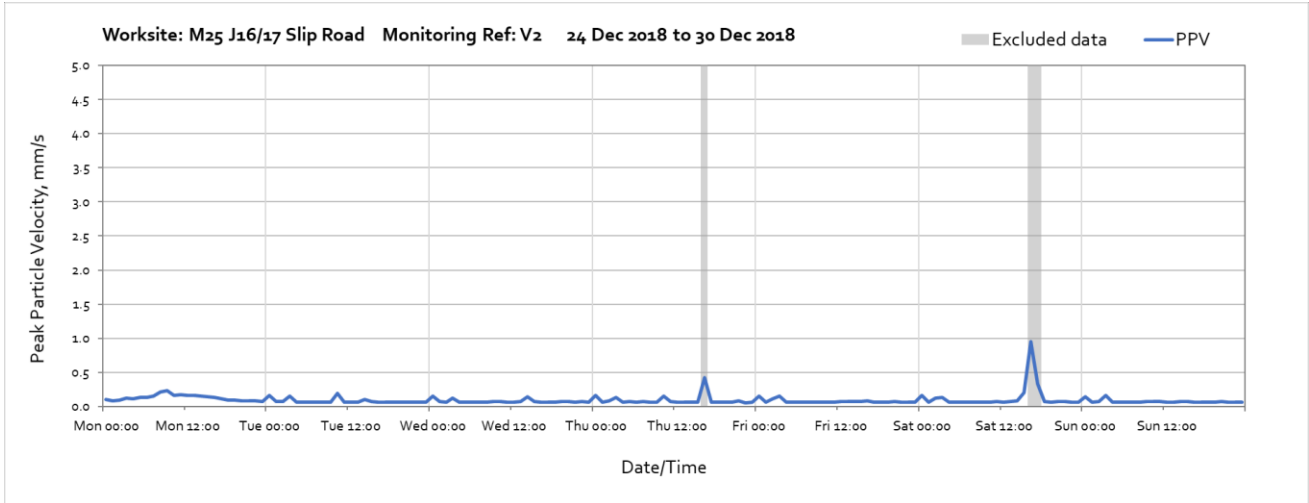
Vibration

The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the resultant PPV due to vibration components on three orthogonal axis x, y and z. Vibration levels at V2 are representative of residential properties near the Chalfont Lane widening worksite. Vibration monitor V3 is installed within the worksite area to measure vibration levels at the source. Measured vibration levels at the two locations have been compared to identify vibration events recorded at V2 potentially due to construction activities. High vibration levels measured at V2 that do not correlate to HS2 construction activities have been greyed out in the graphs and excluded to calculate values in Table 5.

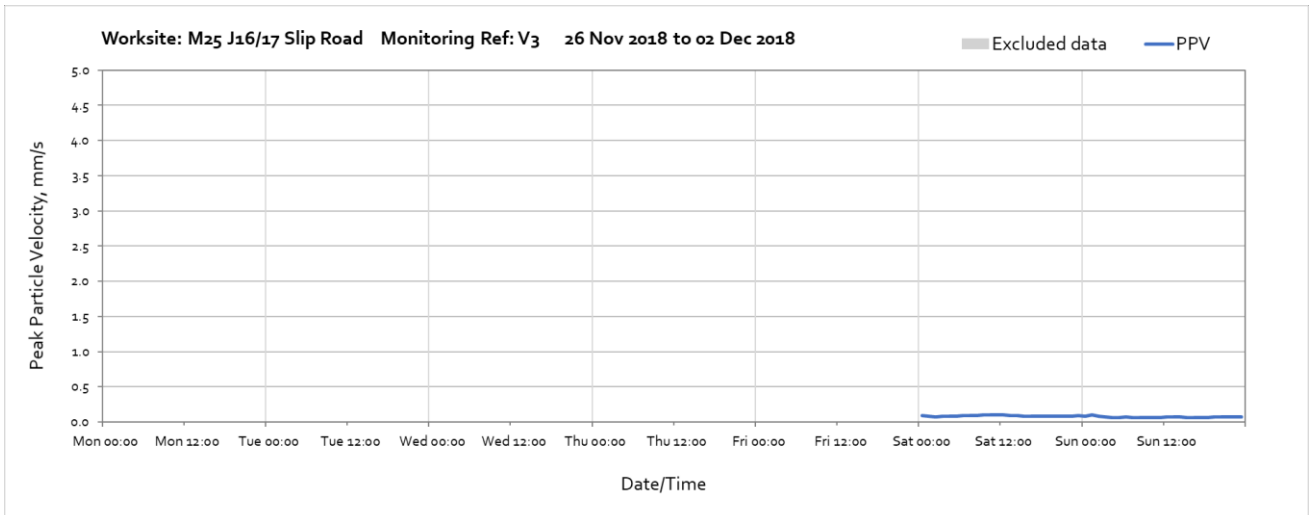
Worksite: Chalfont Lane widening – Monitoring Ref: V2

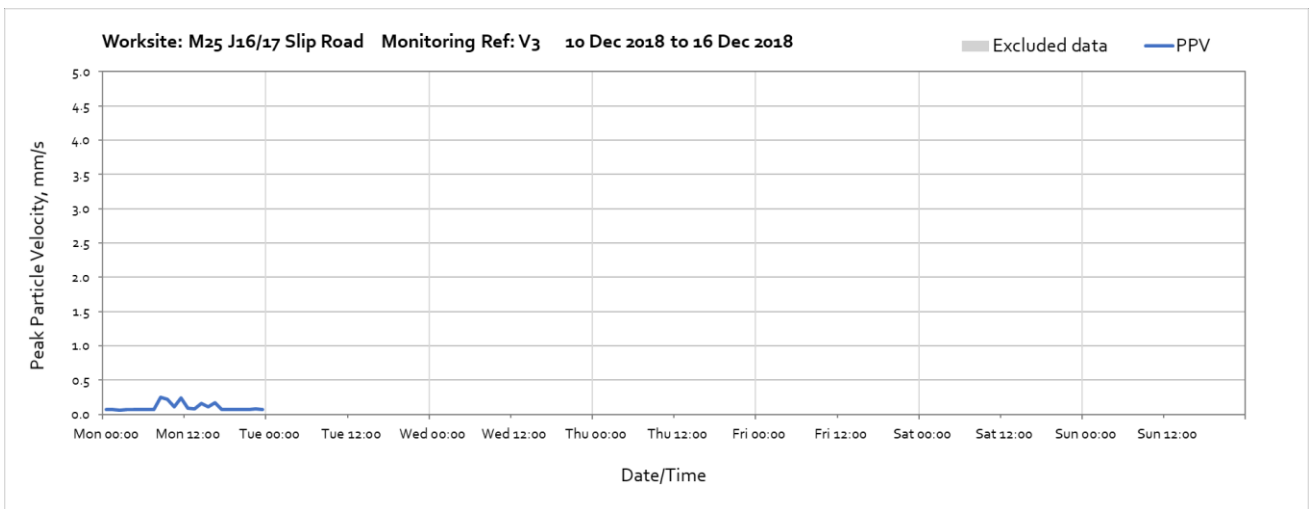
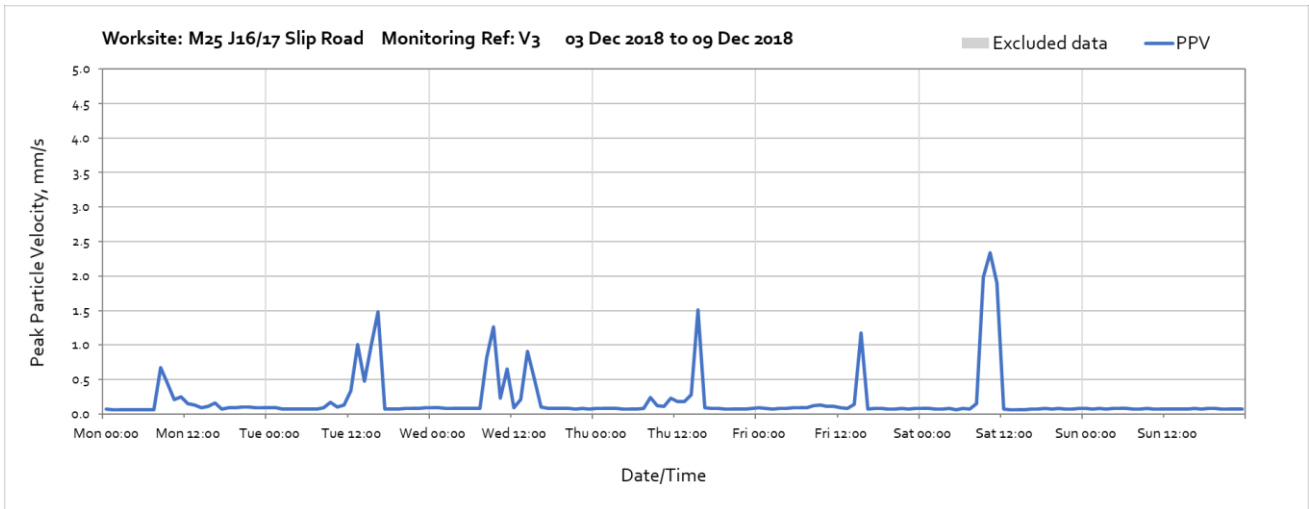




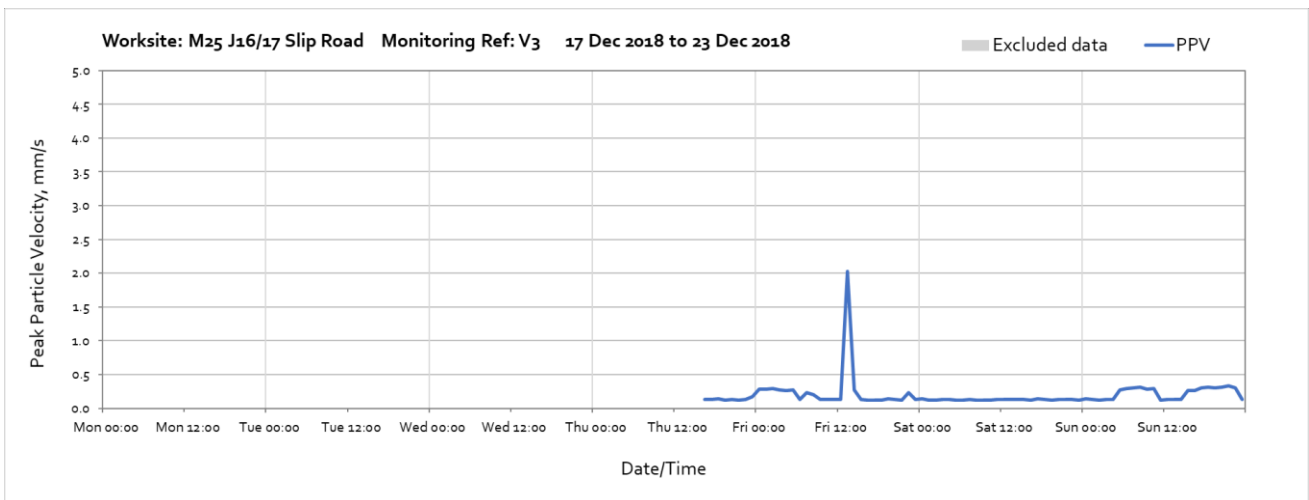


Worksite: Chalfont Lane widening – Monitoring Ref: V3





Note – Missing data from 00:00 on Tuesday 11th due to a technical fault of the vibration monitor. The instrument was returned to the manufacturer, and a replacement monitor was installed at the same location on Thursday 20th.



Note – Missing data from 00:00 on Tuesday 11th due to a technical fault of the vibration monitor. The instrument was returned to the manufacturer, and a replacement monitor was installed at the same location on Thursday 20th.

