

Construction noise and vibration Monthly Report – June 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 Three Rivers District (TRD) during the month of June 2018.

This report presents data from noise and vibration monitoring installations near to the M25 Junction 16/17 slip road worksite. Works were undertaken to construct two slip road openings (also referred to as bell mouths), one developed on each side of the carriageway.

Works along the motorway On-slip and Off-slip included earthworks and road paving works. Road widening works were undertaken along Chalfont Lane and consisted of earthworks and installation of carrier drains. Works for the Chalfont Lane diversion began and included earthworks and installation of carrier drains. Tie-in works on Hornhill Road commenced the 25th of June and were undertaken during the night-time periods between 20:00 and 02:00.

Given the significant offset distance between the monitoring positions and the worksites in the TRD region, the measured noise and vibration levels are largely attributable to ambient noise levels 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 during the 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.

1.1.2 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 and vibration data, and interpretation thereof, for monitoring carried out by HS2 within the Three Rivers District (TRD) for the period 1st to 30th June 2018.

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

- M25 On-slip (see plan 1 in Appendix A)
 - Installation of traffic signs, street lighting columns and cabling;
 - Raise iron work;
 - Installation of headwalls/ditch linings;
 - Re-soil verges; and
 - Installation of surface course and road markings.
- M25 Off-slip (see plan 1 in Appendix A)
 - Drainage modifications to soakaways;
 - Installation of kerbs;
 - Final trim of sub-base;
 - Installation of base course and binder course;
 - Installation of edgings and slabs; and
 - Installation of traffic signs, street lighting columns and cabling.

- Chalfont Lane widening – M25 to Sunnyhill Road (see plan 1 in Appendix A)
 - Carrier drains; and
 - Earthworks.
- Chalfont Lane diversion (see plan 1 in Appendix A)
 - Bulk earthworks - Construction of V-ditches;
 - Construction of kerbs;
 - Final trim of sub-base;
 - Installation of base course and binder course;
 - Installation of traffic signs and cabling;
 - Raising ironwork;
 - Finishing headwalls and ditch linings;
 - Re-soil verges; and
 - Installation of fencing.
- Hornhill Road tie-in works (night-time works) (see plan 1 in Appendix A)
 - Earthworks;
 - Installation of sub-base; and
 - Installation of drainage, gullies and kerbs.
- Caravan park (see plan 1 in Appendix A)
 - Trial hole existing services;
 - Site clearance;
 - Installation of close-boarded boundary fencing; and
 - Topsoil strip.

1.1.4 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 www.gov.uk/government/publications/monitoring-noise-and-vibration-on-the-hs2-phase-one-route.

1.2 Measurement Locations

1.2.1 The following table summarises the position of noise and vibration monitoring installations within the TRD area in June 2018.

- 1.2.2 Maps showing the position of noise and vibration monitoring installations are presented in Appendix B.

Table 2: Monitoring locations

Worksite Reference	Measurement Reference	Address
M25 J16/17 Slip Road	N1	Gellibrands, Shire Lane, Chalfont St Peter, Maple Cross, Bucks, SL9
	N2	Hill House, Chalfont Lane, West Hyde, Maple Cross, Rickmansworth, WD3 9XN
	V1	Gellibrands, Shire Lane, Chalfont St Peter, Maple Cross, Bucks, SL9

2 Summary of results

2.1 Exceedances of LOAEL and 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 PPG 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 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 LOAEL and SOAELs.

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of LOAEL	Number of exceedances of SOAEL
M25 J16/17 Slip Road	N1	Gellibrands, Shire Lane	Night	22:00-07:00	6	No exceedance
	N2	Hill House, Chalfont Lane	Night	22:00-07:00	6	No exceedance

2.1.5 HS2 main construction activities along the M25 slip roads, Chalfont Lane, Chalfont Lane diversion and Caravan Park diversion were undertaken between 08:00 and 18:00 on weekdays. There were no exceedances of the SOAEL for noise during these periods at any noise monitoring location. Works at the Hornhill Road tie-in commenced on 25th of June and have been undertaken between 20:00 and 02:00. During these periods 6 exceedances of the LOAEL were measured at locations N1 and N2, and no exceedance of the SOAEL at either measurement positions.

2.1.6 Monitoring of vibration peak particle velocity (PPV) was undertaken with the purpose to ensure construction generated vibration levels were not of such a magnitude 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 each 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 monitoring data over the month for each of the measurement locations. 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).

2.2.3 Given the significant offset distance of the monitoring positions from worksites in the TRD region, the measured noise levels are largely dominated by the underlying ambient noise levels rather than being attributable to HS2 related construction noise.

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
M25 J16/17 Slip Road	N1	Gellibrands, Shire Lane	Free-field	51.6 (55.6)	52.8 (60.7)	54.4 (69.5)	54.2 (56.9)	51.7 (58.8)	51.0 (53.2)	51.1 (52.3)	50.2 (52.5)	56.0 (73.0)	51.6 (58.2)	55.1 (74.7)	52.6 (57.7)
	N2	Hill House, Chalfont Lane	Free-field	59.9 (73.1)	58.4 (64.3)	57.8 (61.6)	55.3 (63.8)	54.7 (84.4)	55.0 (55.4)	59.1 (64.5)	57.7 (60.8)	55.7 (57.6)	58.2 (81.8)	55.6 (58.3)	59.6 (87.2)

2.2.4 Table 5 presents a summary of the measured vibration levels at monitoring location V1 over the reporting period. The highest PPV measured during the monitoring along any axis is presented in the table. Exceptionally high values of PPV were measured in the afternoon of Tuesday 5th, Thursday 7th and Thursday 14th and in the night of Monday 18th and Wednesday 20th of June. These elevated vibration levels are thought to be due to events that fell in close proximity to the vibration monitoring station. The data was not considered representative of HS2 construction vibration levels, because high vibration generating activities were not undertaken at these times. Therefore, these exceedances have been excluded from the table below.

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
M25 J16/17 Slip Road	V1	Gellibrands, Shire Lane	0.24 (Z axis)

2.2.5 Graphs showing hourly values of PPV measured during the monitoring period are presented in Appendix C.

2.2.6 The full data set from the monitoring equipment can be found at the following location www.DATA.gov.uk.

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 during the reporting period at any monitoring position.

2.4 Complaints

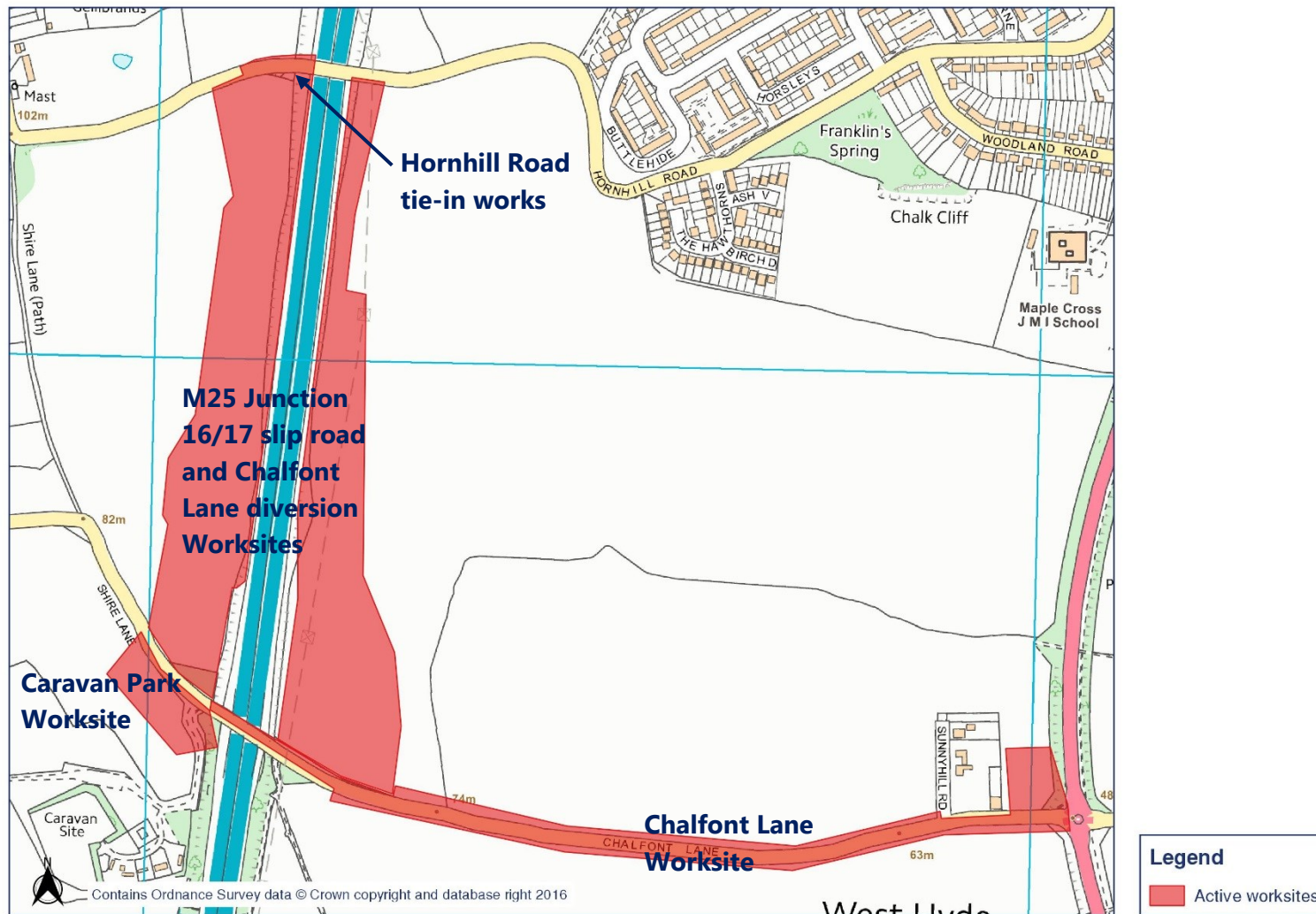
2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

Table 7: Summary of Complaints.

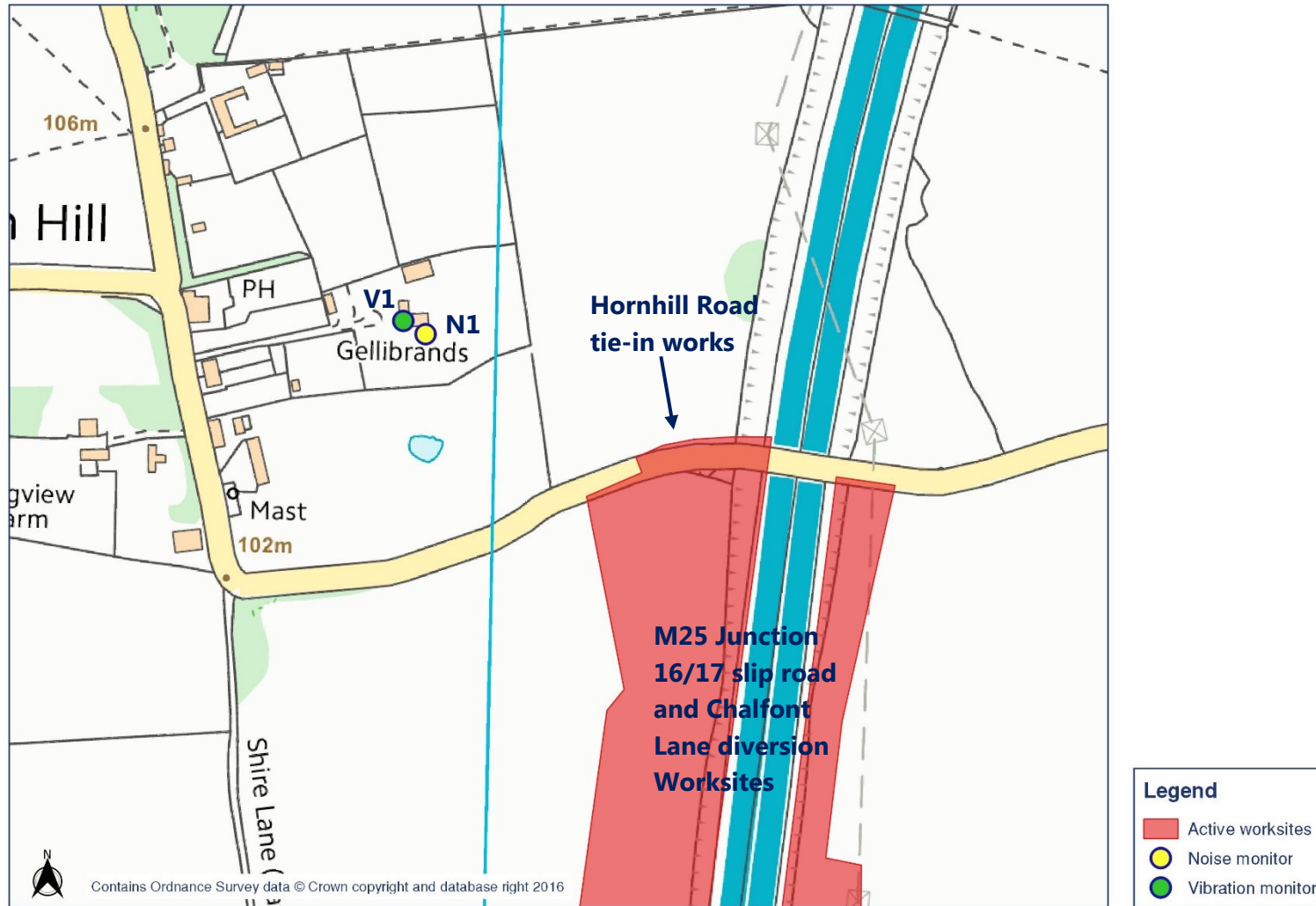
Complaint Reference	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
-	-	-	-	-

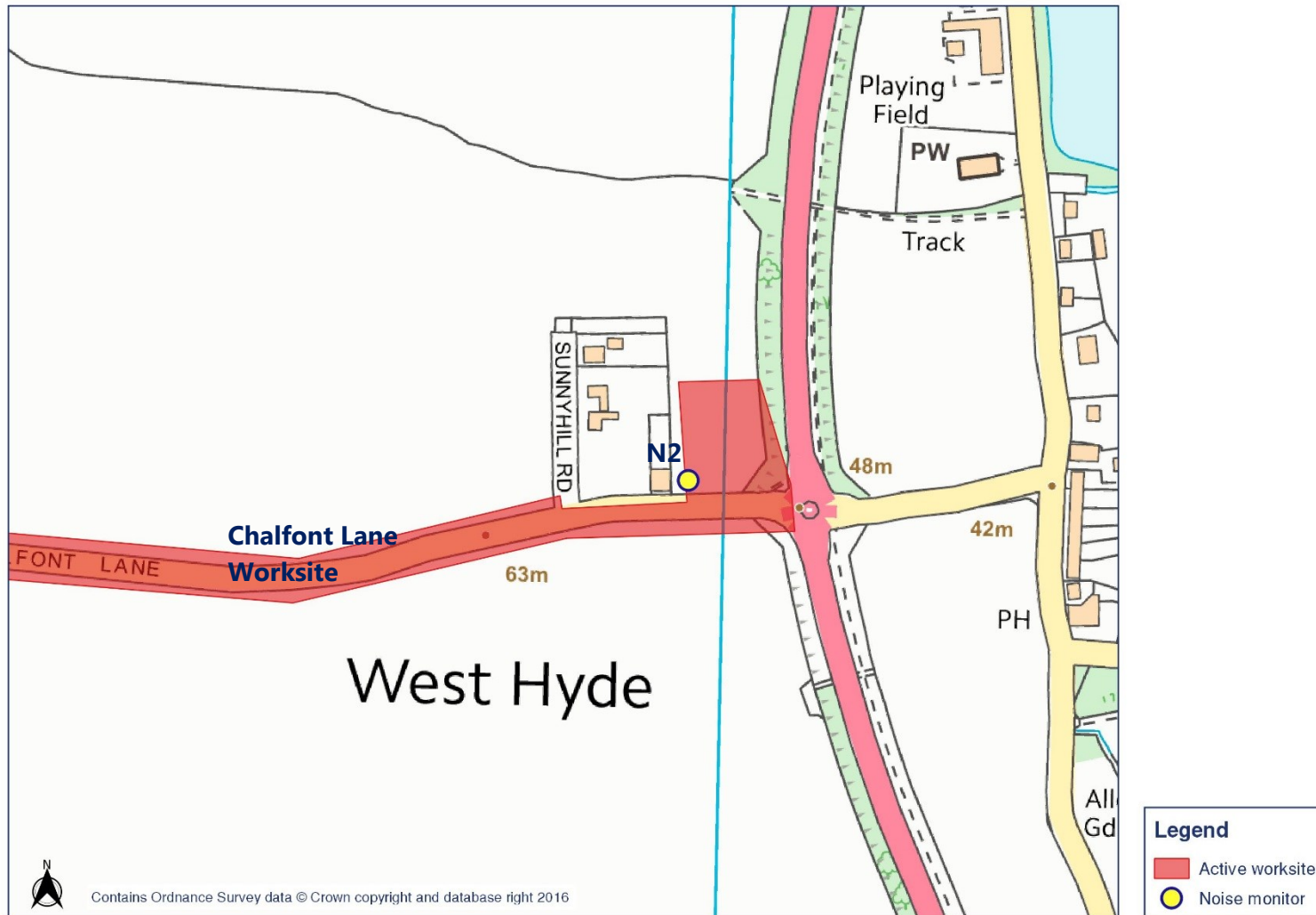
2.4.2 No complaints regarding HS2 related construction noise were received during the reporting period in the TRD area.

Appendix A Site Locations



Appendix B Monitoring Locations



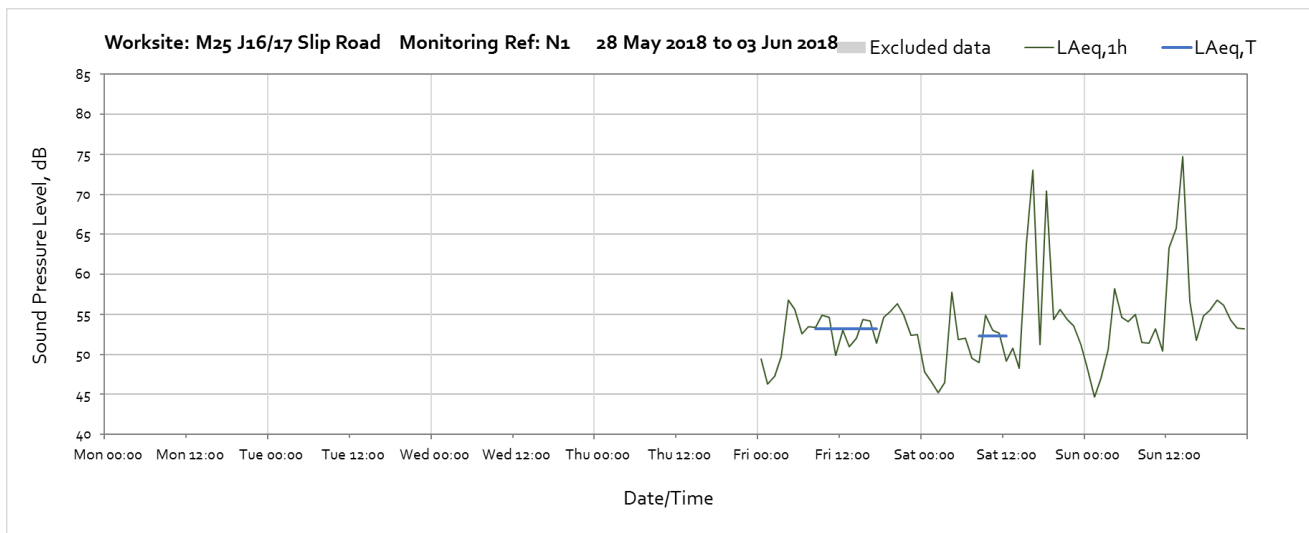


Appendix C Data

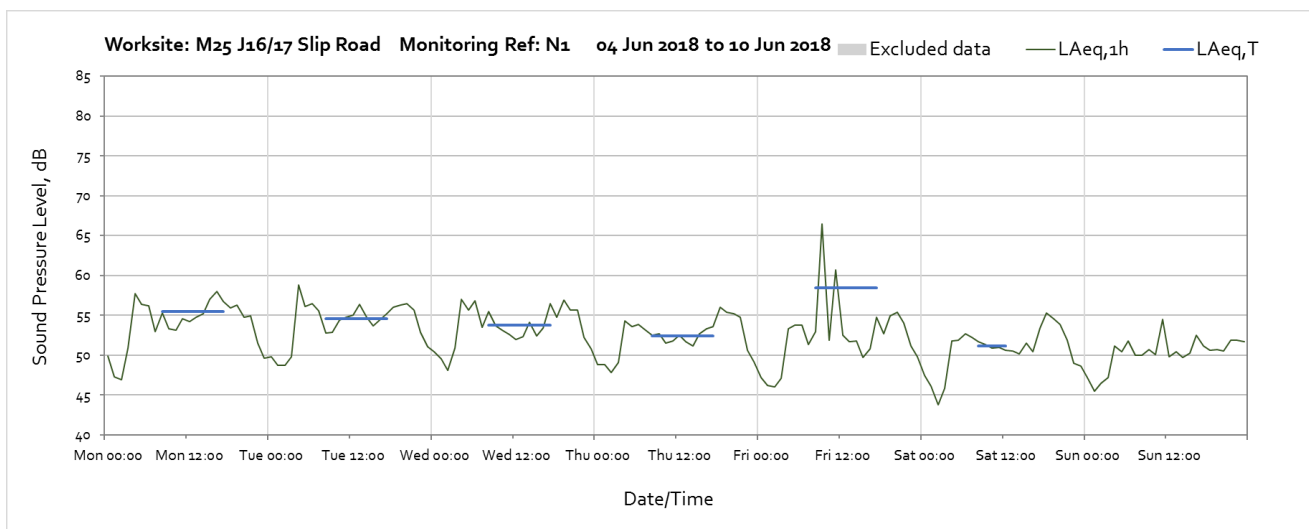
Noise

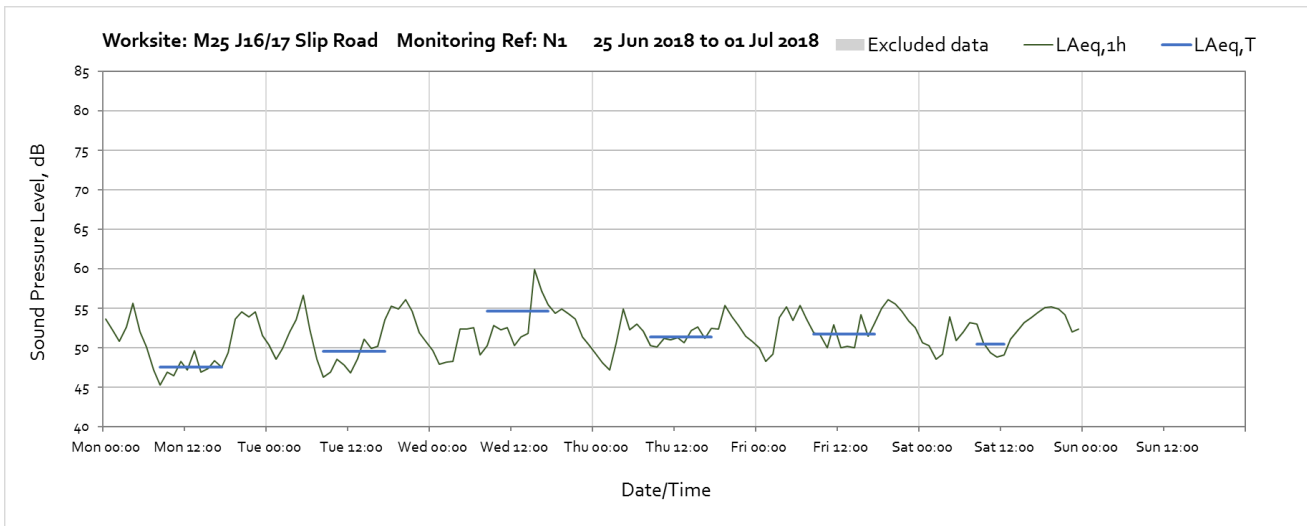
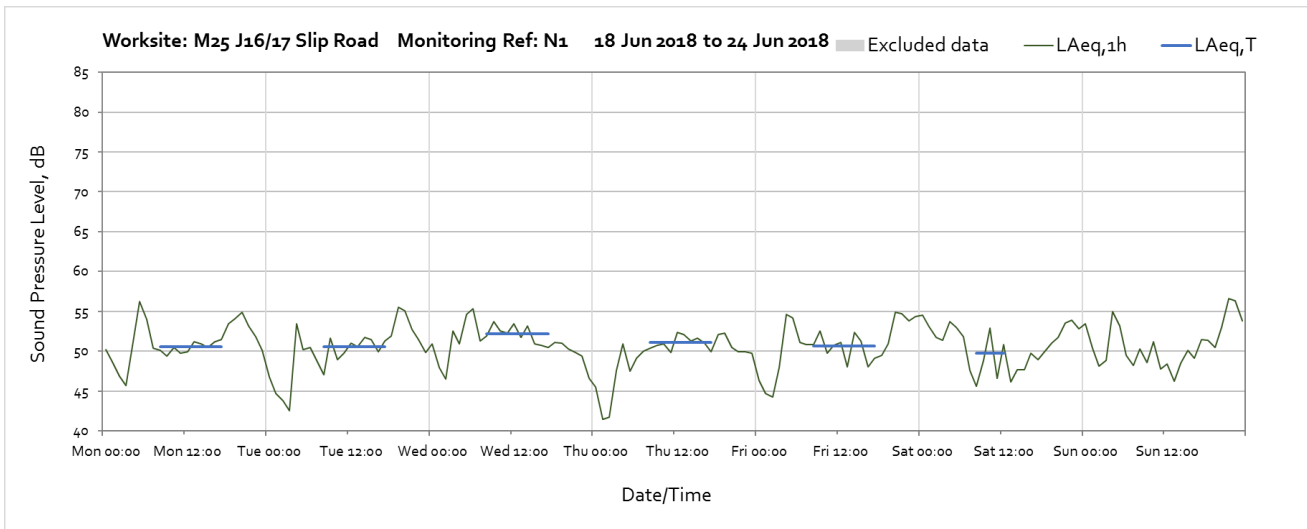
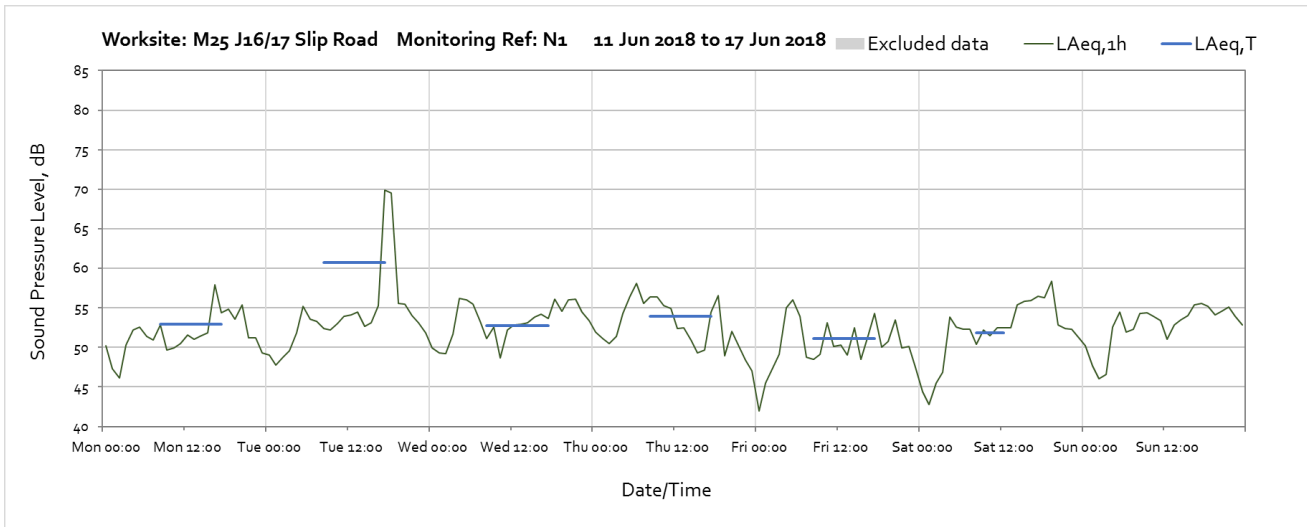
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values. There were several short periods where elevated noise levels were measured during the reporting period, however these occurred outside core working hours and therefore were not attributable to HS2 construction works.

Worksite: M25 J16/17 Slip Road – Monitoring Ref: N1

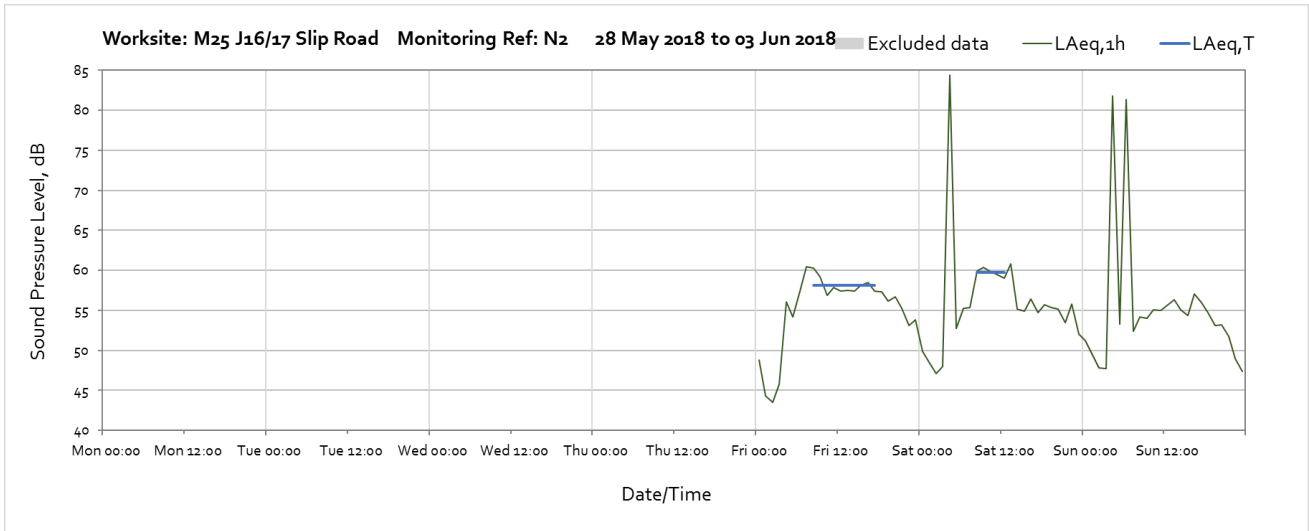


Note – Elevated noise event in the morning of Saturday 2nd, and Sunday 3rd were outside core working hours and not due to HS2 related works.

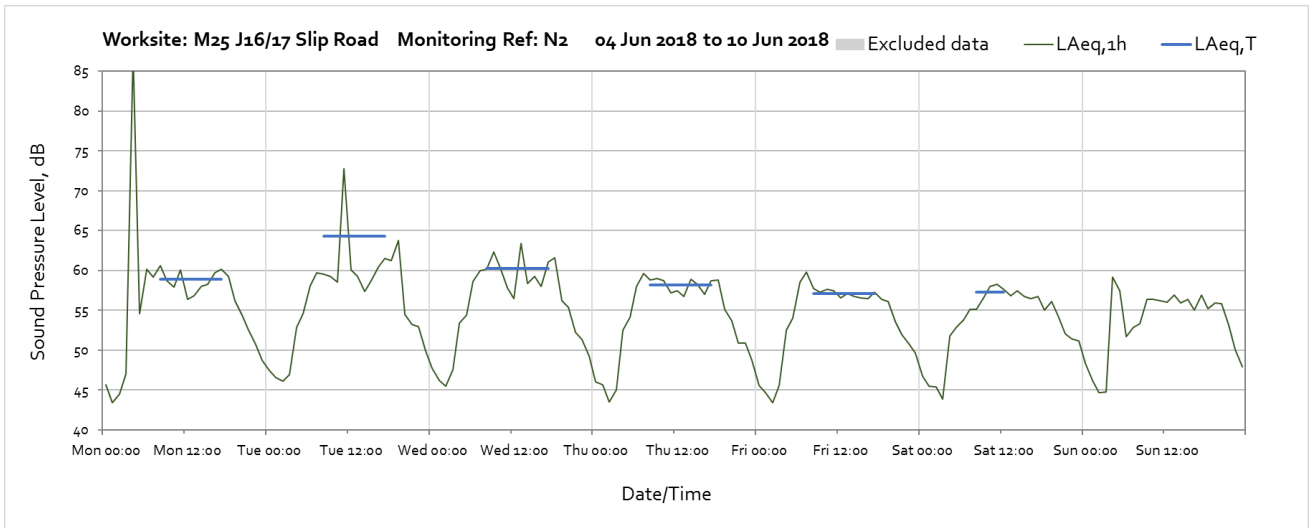




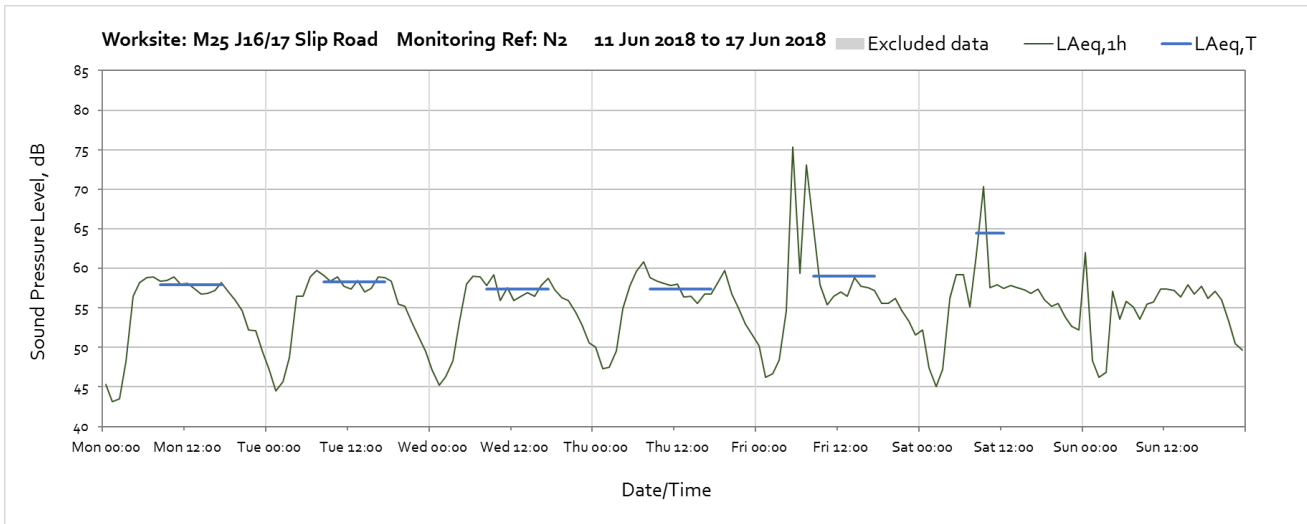
Worksite: M25 J16/17 Slip Road – Monitoring Ref: N2



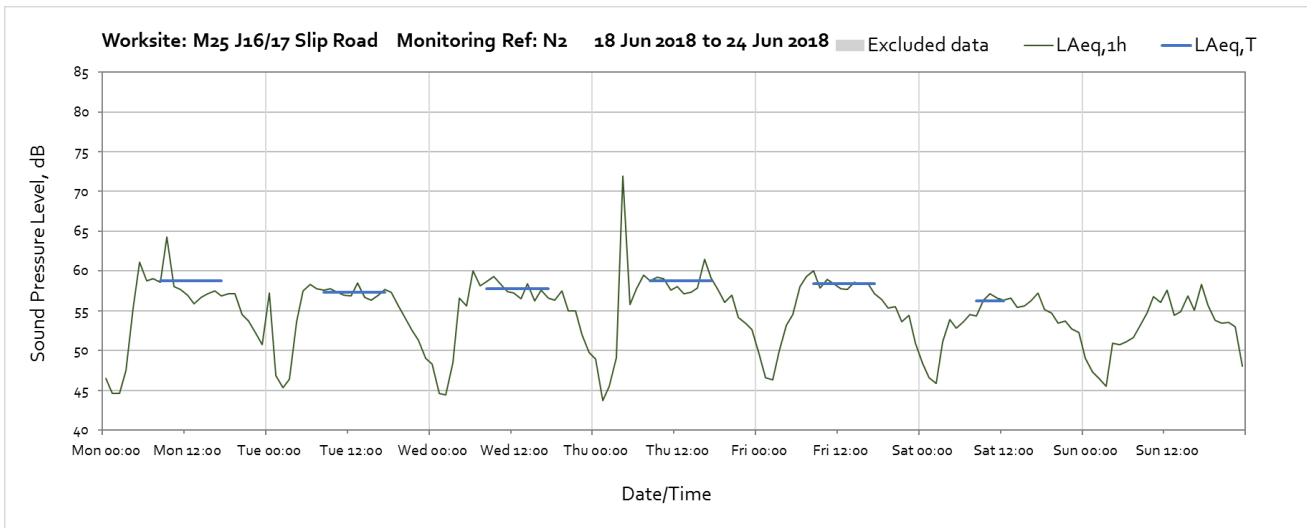
Note – Elevated noise events in the morning of Saturday 2nd, and Sunday 3rd were outside working hours and not due to HS2 related works.



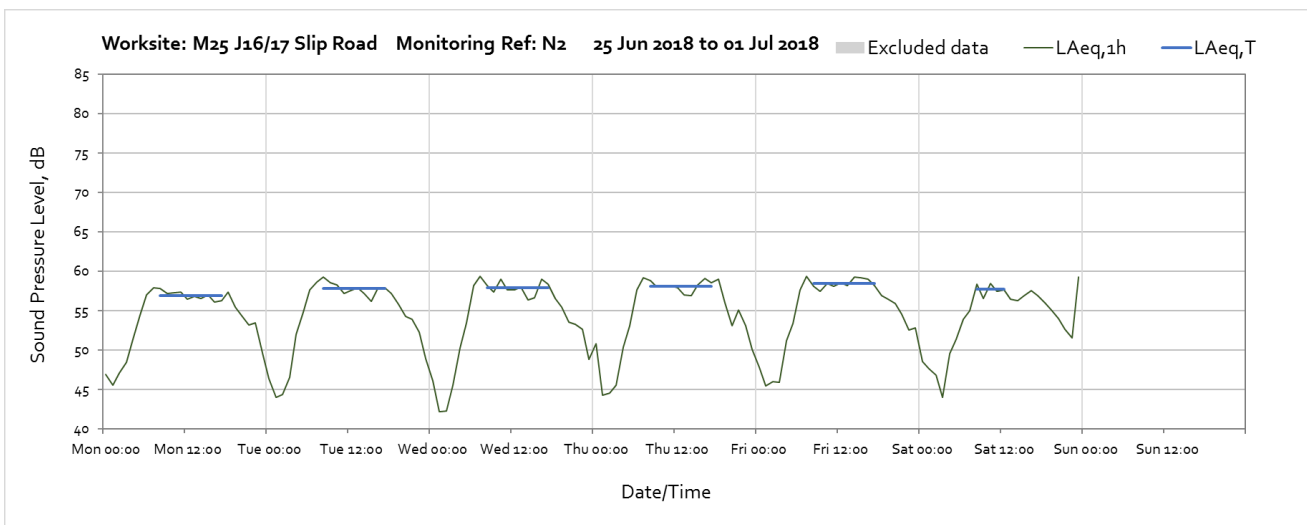
Note – Elevated noise event in the morning of Monday 4th was outside working hours and not due to HS2 related works.



Note – Elevated noise events in the morning of Friday 15th and Saturday 16th were outside working hours and not due to HS2 related works.



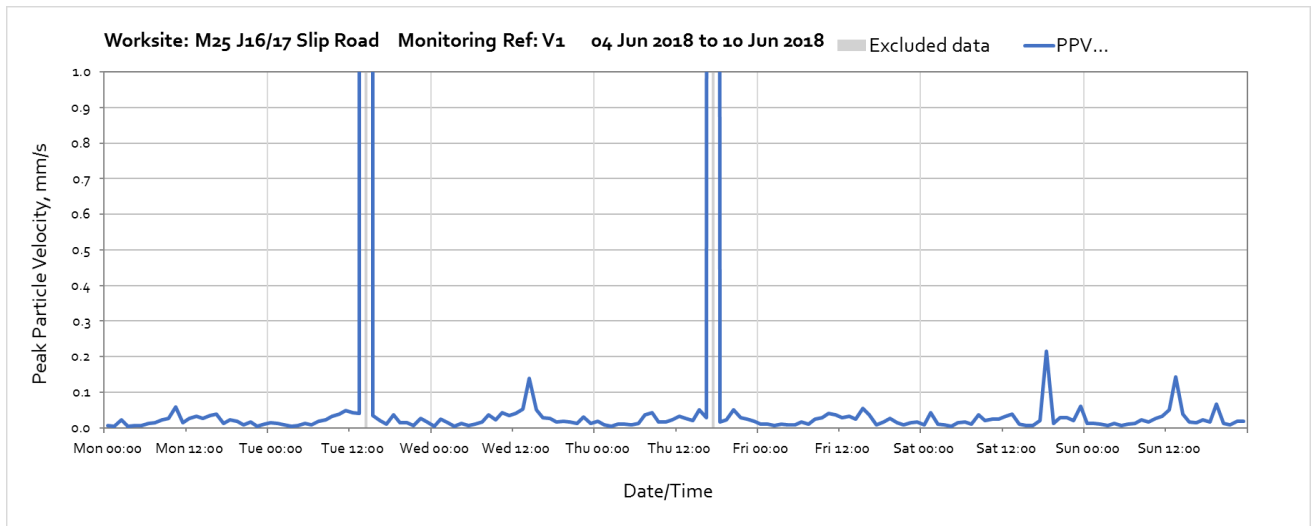
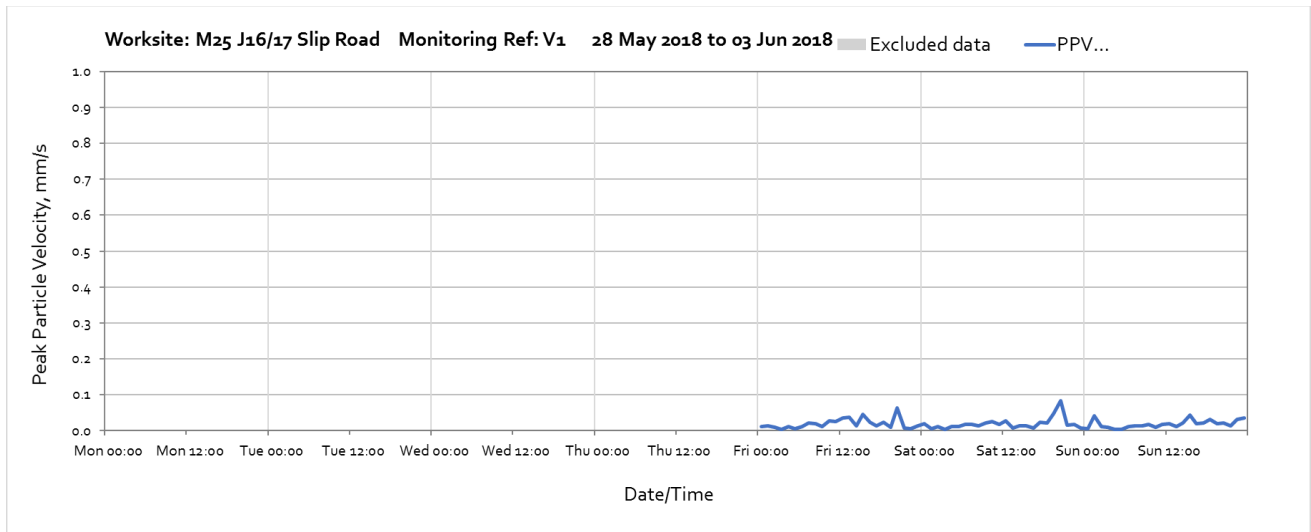
Note – Elevated noise event in the morning of Thursday 21st was outside working hours and not due to HS2 related works.



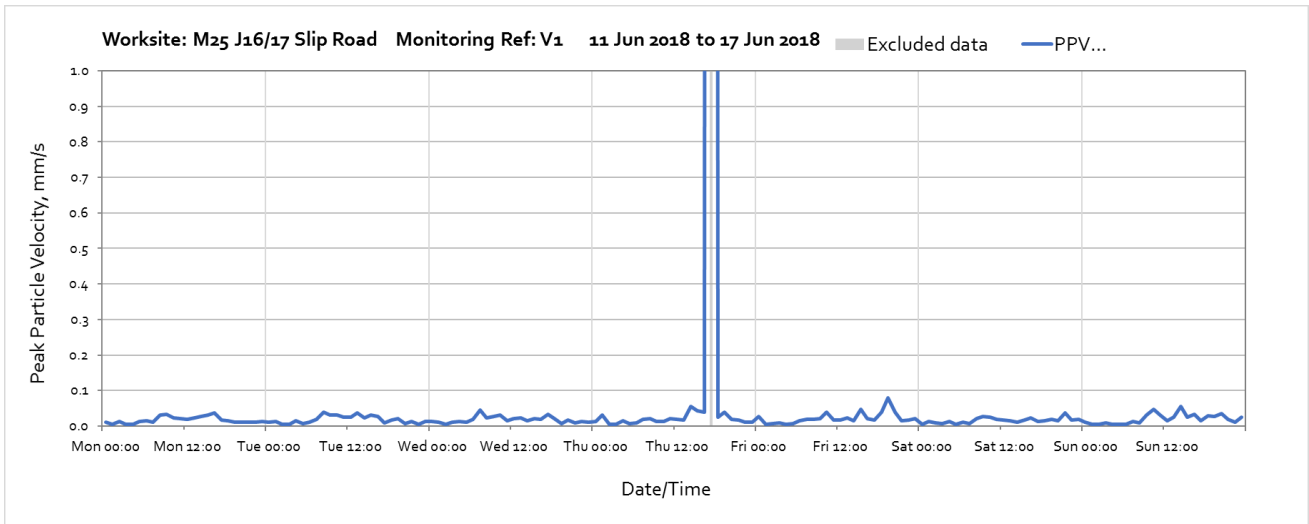
Vibration

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. Exceptionally high values of PPV were measured in the afternoon of Tuesday 5th, Thursday 7th and Thursday 14th and in the night of Monday 18th and Wednesday 20th of June, which were not related to HS2 construction activities. These data entries have been greyed out and excluded to calculate values in Table 5.

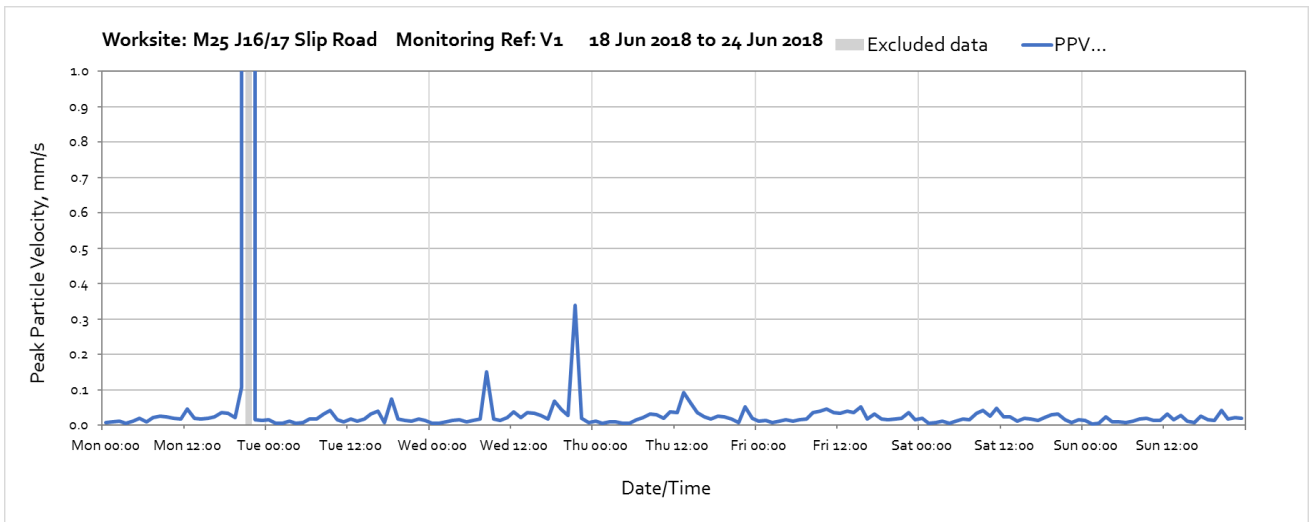
Worksite: M25 J16/17 Slip Road – Monitoring Ref: V1



Note – Elevated vibration events in the afternoon of Tuesday 5th and Thursday 7th were not due to HS2 related works.



Note – Elevated vibration event in the afternoon of Thursday 14th was not due to HS2 related works.



Note – Elevated vibration events in the night of Monday 18th and Wednesday 20th were not due to HS2 related works.

