

Construction noise and vibration Monthly Report – February 2021

Birmingham City

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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 Birmingham City during the month of February 2021.

Within this period monitoring was undertaken at the following worksites:

- noise monitoring was undertaken in the vicinity of the Curzon Street worksite (ref.: CS), where compound construction activities were underway.
- vibration monitoring was undertaken in the vicinity of the Museum Collection Centre worksite (ref.: MCC), where no works were undertaken in February 2021;
- noise and vibration monitoring was undertaken in the vicinity of the Twisted Oak Stables worksite (ref.: TOS), where earthwork and haul route construction were underway; and
- noise and vibration monitoring was undertaken in the vicinity of the Washwood Heath Depot worksite (ref.: WWHD), where compound construction and earthwork activities were underway.

Further works, where monitoring did not take place, were also undertaken at:

- Bromford Tunnel Intermediate Shaft Site (GI works)
- B4114 Saltley Viaduct (site set up and removal of building foundations)
- Duddeston Mill Road (sewer pipe diversion and works at substation);
- Saltley Viaduct (high voltage underground cable diversion);
- Landor Street (works at substation); and
- Faraday Avenue (cable diversion).

There were no exceedances of the HS2 threshold levels for significant noise impacts during the reporting period at any monitoring position.

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

One complaint was received during the monitoring period. A description of the complaint, the results of investigations and any actions taken are detailed in Table 7 of this report.

Abbreviations and Descriptions

The abbreviations, descriptions and project terminology used within this report can be found in Table 1.

Table 1: Table of Abbreviations

Acronym/Term	Definition
$L_{Aeq,T}$	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.
LOAEL	Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.
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.
SOAEL	Significant Observed Adverse Effect Level - the level above which significant adverse effects on health and quality of life occur.
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 HS2 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 vibration data, and interpretation thereof, for monitoring carried out by HS2 within Birmingham City for the period 1st to 28th February 2021.

1.1.3 Construction sites in the local authority area where monitoring was undertaken during this period include:

- Curzon Street worksite ref.: CS (see plan 1 in Appendix A):
 - where compound construction activities were underway.
- Museum Collection Centre worksite ref.: MCC (see plan 1 in Appendix A):
 - where no activities were undertaken in February 2021.
- Twisted Oak Stables worksite, ref.: TOS (see plan 3 in Appendix A):
 - where earthworks, including stripping of top soil, stockpiling and construction of haul route were underway.
- Washwood Heath Depot worksite, ref.: WWHD (see plan 2 in Appendix A):
 - where compound construction, including Tarmac laying in car parking area, construction of haul route for cabin delivery, and earthworks to remove soil bunds were underway.

1.1.4 Further work where monitoring did not take place, were also undertaken at the following locations:

- Bromford Tunnel Intermediate Shaft Site (GI works)
- B4114 Saltley Viaduct (site set up and removal of building foundations)
- Duddeston Mill Road (sewer pipe diversion and works at substation);
- Saltley Viaduct (high voltage underground cable diversion);
- Landor Street (works at substation); and
- Faraday Avenue (cable diversion).

1.1.5 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 Three noise and four vibration monitoring installations were active in February in the Birmingham City area. Table 2 summarises the position of noise and vibration monitoring installations within the Birmingham City area in February 2021.

1.2.2 A new noise monitor at Curzon Street was installed on 6th of February and the monitoring begun on 9th of February.

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

Table 2: Monitoring Locations

Worksite Reference	Measurement Reference	Address
Curzon Street (CS)	CS-N1	Curzon Street, Birmingham
Museum Collection Centre (MCC)	MCC-V1	25 Dolman Street, Birmingham (Top Floor)
	MCC-V2	25 Dolman Street, Birmingham (Outside)
Twisted Oak Stables (TOS)	TOS-N1	B4118-Birmingham Road, Water Orton, Birmingham
	TOS-V1	B4118-Birmingham Road, Water Orton, Birmingham
Washwood Heath Depot (WWHD)	WWHD-N1	Drews Lane, Birmingham
	WWHD-V1	Drews Lane, Birmingham

2 Summary of Results

2.1 Summary of Measured Noise and Vibration Levels

2.1.1 Table 3 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.

Table 3: Summary of Measured dB LAeq Data over the Monitoring Period.

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade Measurement	Weekly Average LAeq,T (highest Day LAeq,T)					Saturday Average LAeq,T (highest day LAeq,T)					Sunday / Public Holiday Average LAeq,T (highest day LAeq,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
CS	CS-N1	Curzon Street, Birmingham	Free-field	64.9 (67.0)	64.9 (65.4)	64.2 (66.9)	62.9 (66.0)	60.6 (66.0)	61.7 (62.4)	63.1 (64.2)	63.4 (64.2)	63.3 (64.7)	59.9 (64.3)	62.7 (67.2)	60.7 (65.2)
TOS	TOS-N1	B4118-Birmingham Road, Water Orton, Birmingham	Free-field	67.8 (71.6)	68.1 (71.5)	66.7 (70.4)	64.6 (68.8)	63.4 (70.8)	65.2 (67.0)	64.8 (68.1)	64.7 (68.8)	63.6 (69.1)	59.4 (65.2)	62.9 (68.6)	61.0 (68.9)
WWHD	WWHD-N1	Drews Lane, Birmingham	Free-field	56.8 (62.0)	57.8 (62.8)	54.8 (60.8)	53.7 (59.7)	51.6 (60.8)	53.7 (58.2)	54.1 (55.6)	54.3 (56.2)	54.3 (59.5)	50.0 (57.9)	51.7 (58.1)	50.2 (60.3)

2.1.2 Table 4 presents a summary of the measured vibration levels at each monitoring location over the reporting period. The highest component PPV measured during periods of works along any axis is presented in the table.

Table 4: Summary of Measured Component PPV Data over the Monitoring Period

Worksite Reference	Measurement Reference	Monitor Address	Highest PPV measured in any axis, mm/s
MCC	MCC-V1	25 Dolman Street (Top Floor)	N/A*
	MCC-V2	25 Dolman Street (Outside)	N/A*
TOS	TOS-V1	B4118- Birmingham Road, Water Orton, Birmingham	2.51 (X-axis)
WWHD	WWHD-V1	Drews Lane, Birmingham	2.71 (X-axis)

* No HS2 construction activities were undertaken during the month and therefore no vibration due to HS2.

2.1.3 Appendix C presents graphs of the noise and vibration monitoring data over the month for each of the measurement locations. Noise data presented consists of 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). Vibration data presented consist of hourly PPV values. 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 Exceedances of the LOAEL and SOAEL

2.2.1 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".

2.2.2 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."

2.2.3 HS2 Phase One Information Paper E23: Control of Construction Noise and Vibration sets out the LOAELs and SOAELs for construction noise.

2.2.4 Where reported construction noise levels exceed the LOAEL and SOAEL, relevant periods will be identified. Summary statistics to evaluate ongoing qualification for noise insulation and temporary rehousing are also presented where relevant.

2.2.5 Table 5 presents a summary of recorded exceedances of the LOAEL and SOAEL at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 5: Summary of Exceedances of LOAEL and SOAEL

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of LOAEL	Number of exceedances of SOAEL
CS	CS-N1	Curzon Street, Birmingham	Weekday	0800-1800	15	No exceedance
TOS	TOS-N1	B4118- Birmingham Road, Water Orton, Birmingham	Weekday	0800-1800	12	No exceedance
WWHD	WWHD-N1	Drews Lane, Birmingham	Weekday	0800-1800	2	No exceedance

2.2.6 No exceedances of the SOAEL were recorded due to HS2 construction works during February 2021. A number of exceedances of the LOAEL were recorded during weekday working periods.

2.3 Exceedances of Trigger Level

2.3.1 Table 6 provides a summary of exceedances of the S61 trigger vibration levels determined to be due to HS2 related construction vibration 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
-	-	-	-	-	-

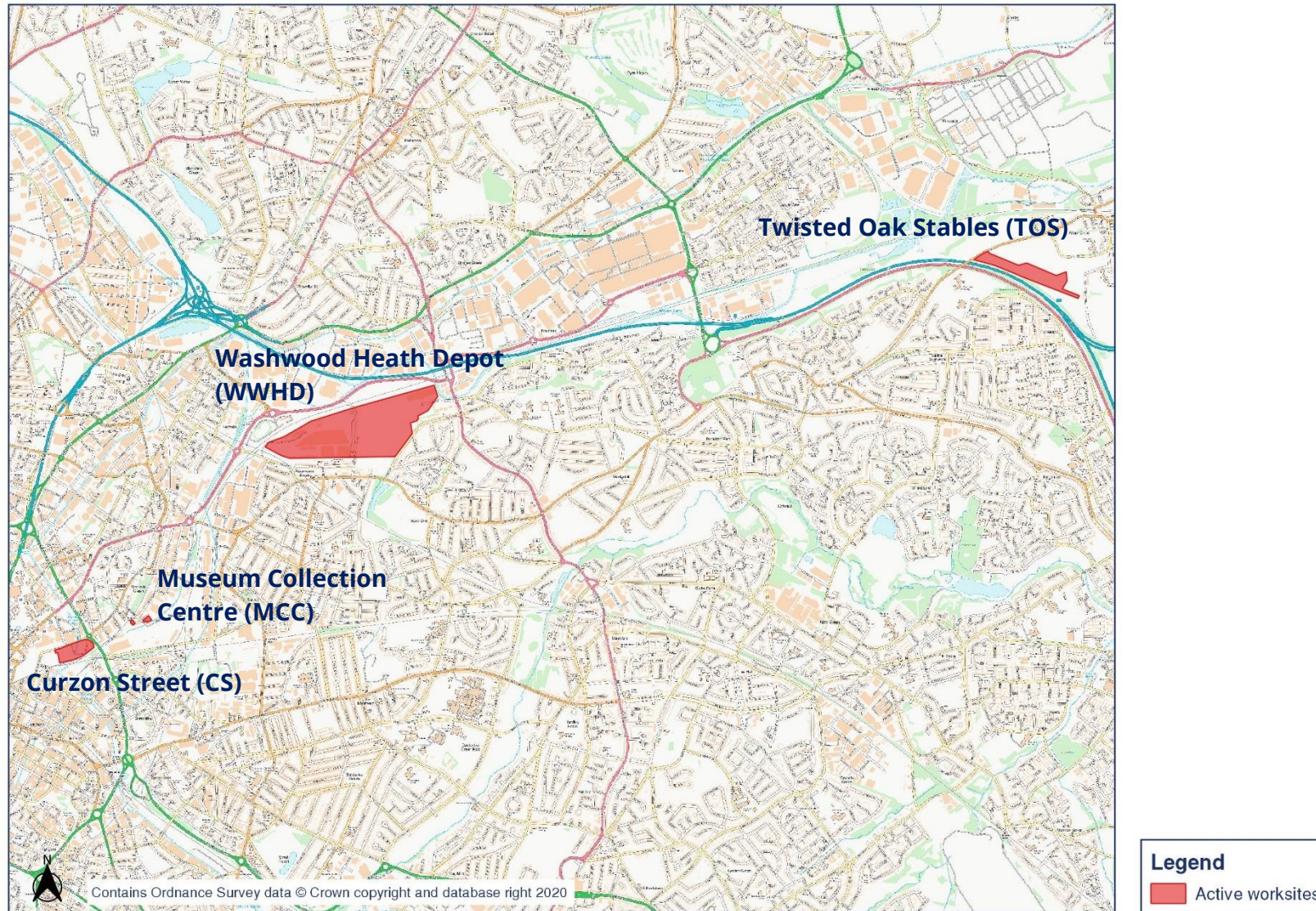
2.4 Complaints

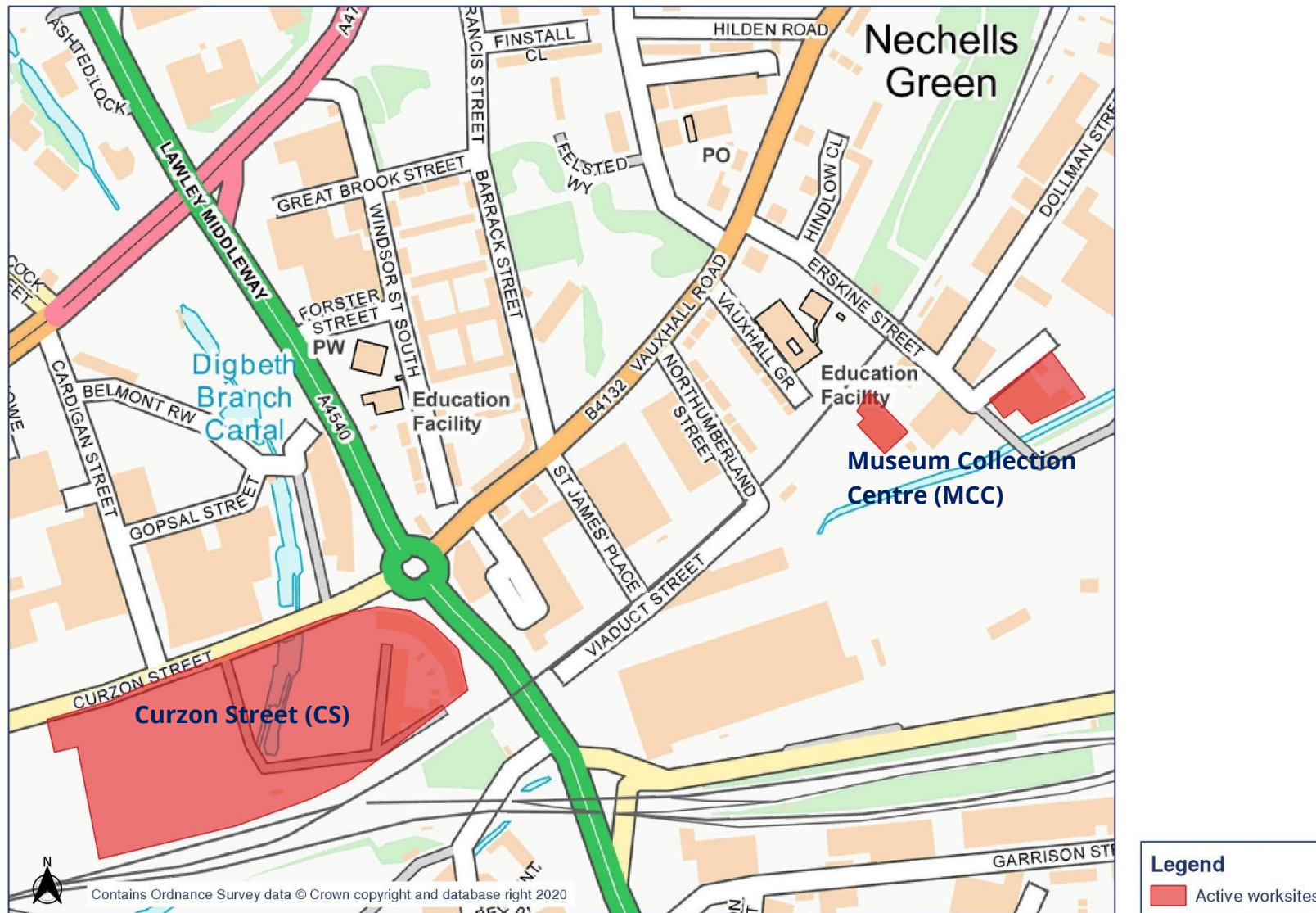
2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

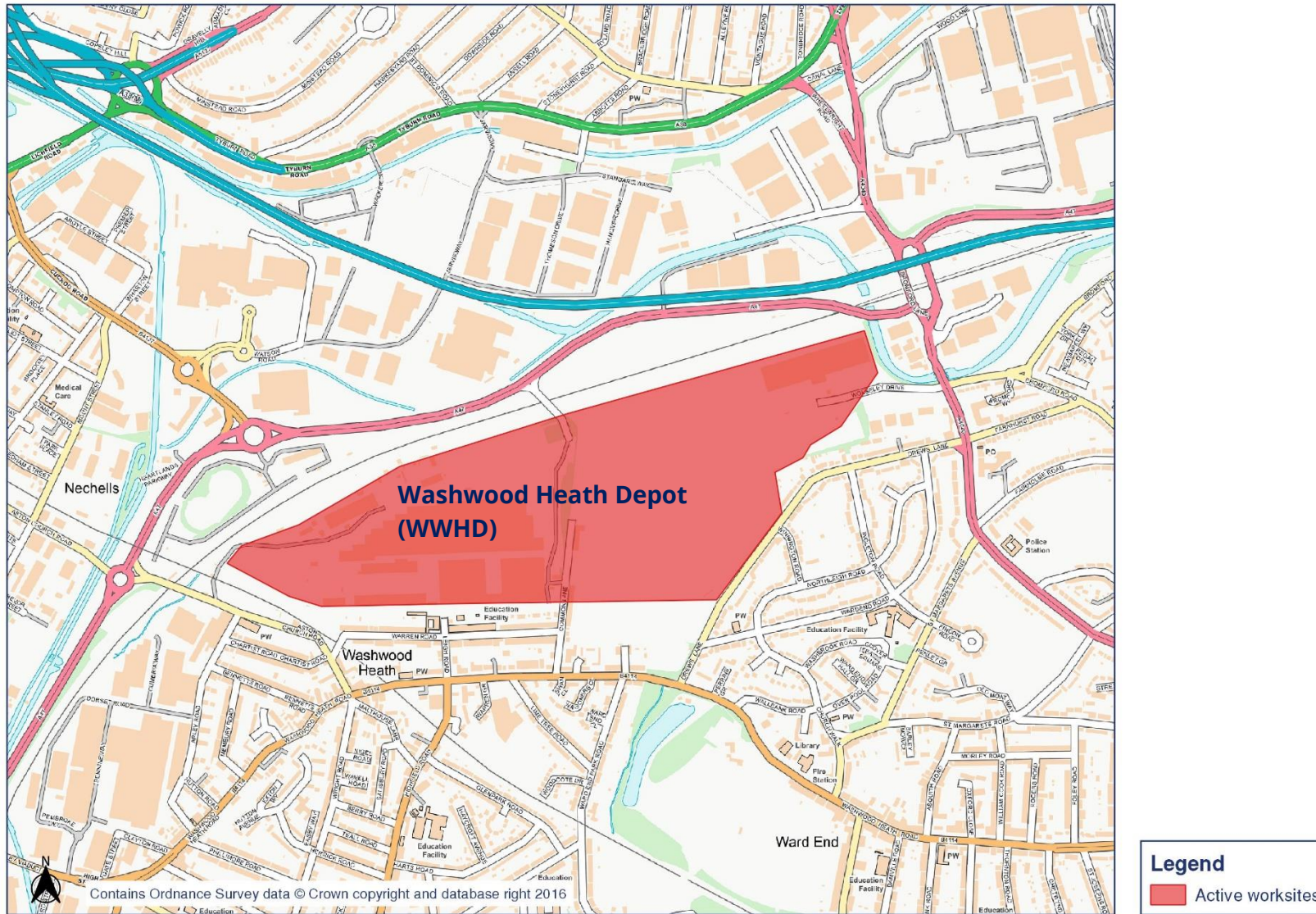
Table 7: Summary of Complaints

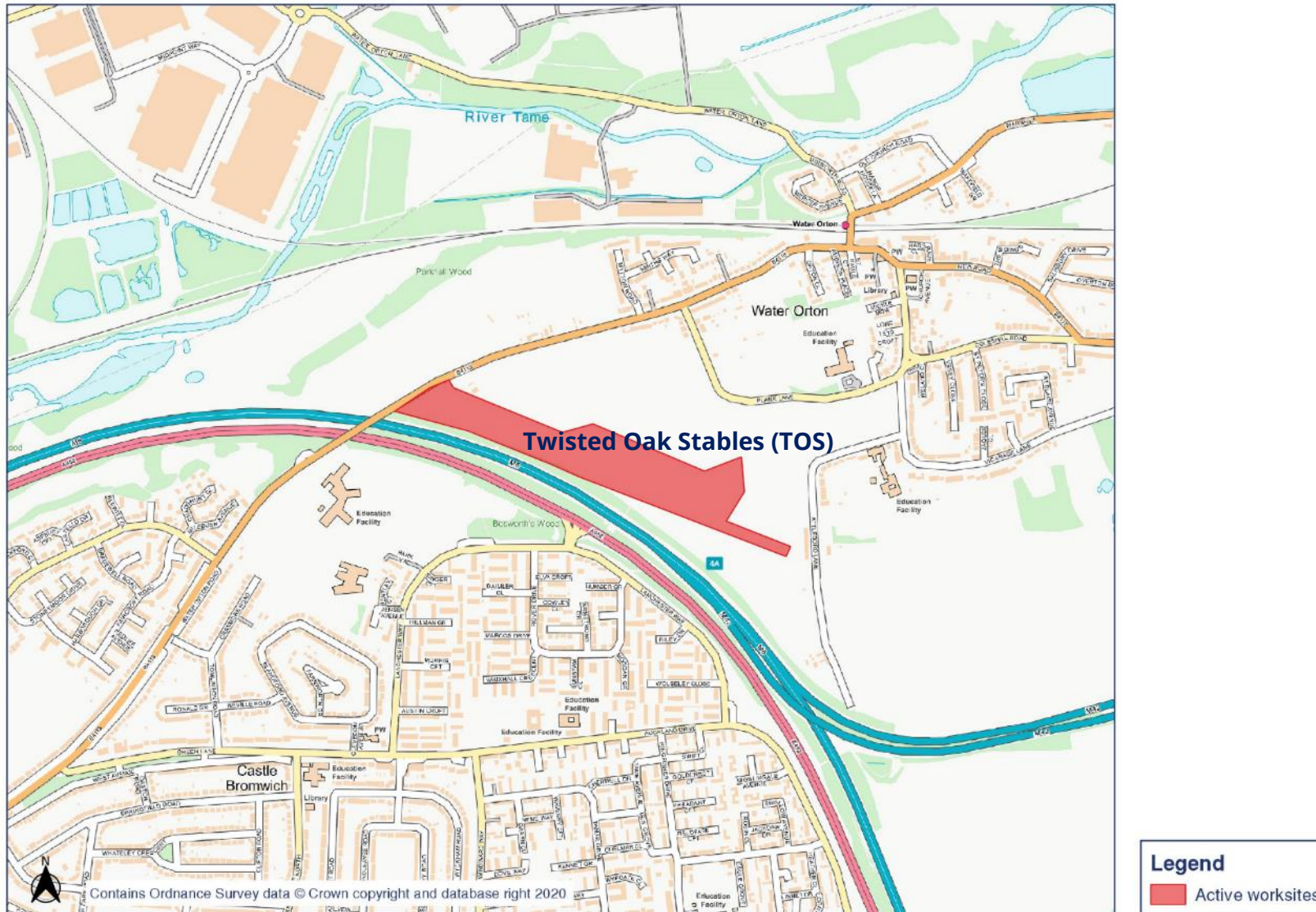
Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
HS2-21-41267-C	CS	General site noise heard at nearby residential property.	Investigation suggests, HS2 works unlikely to have caused the noise disturbance.	Stakeholder was updated on the results of the investigation and also signposted to the HS2 Commonplace website for work updates.

Appendix A Site Locations

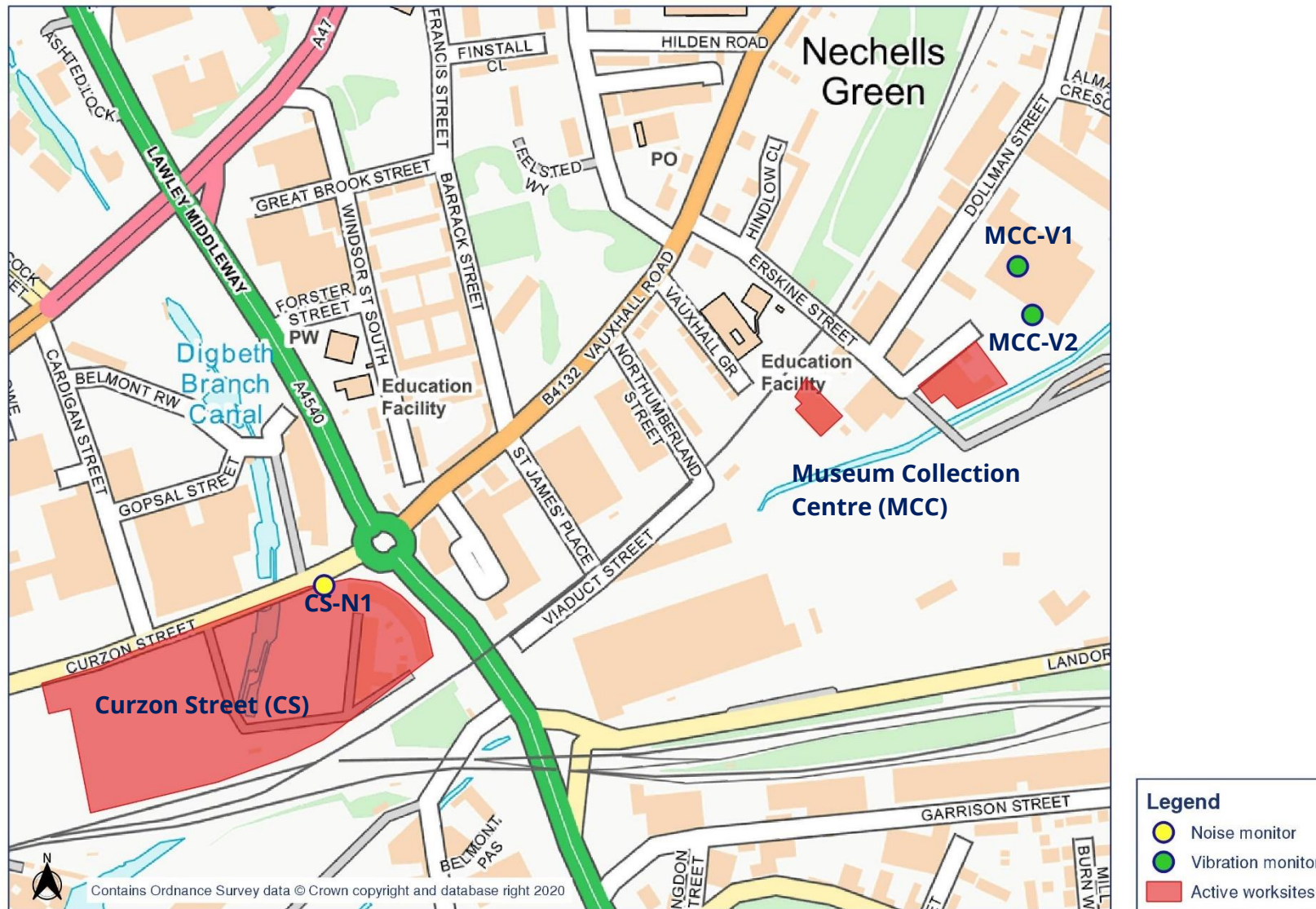


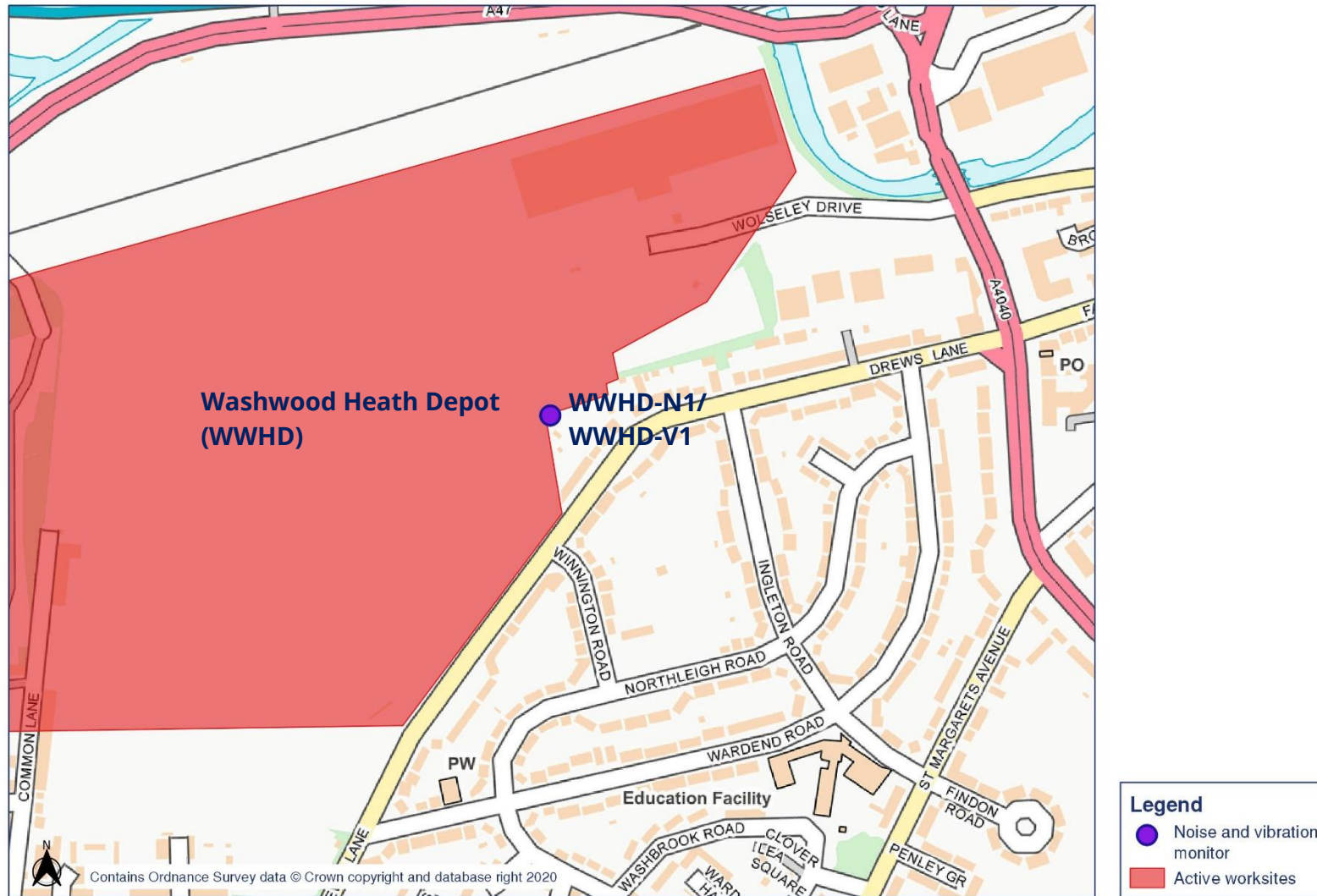


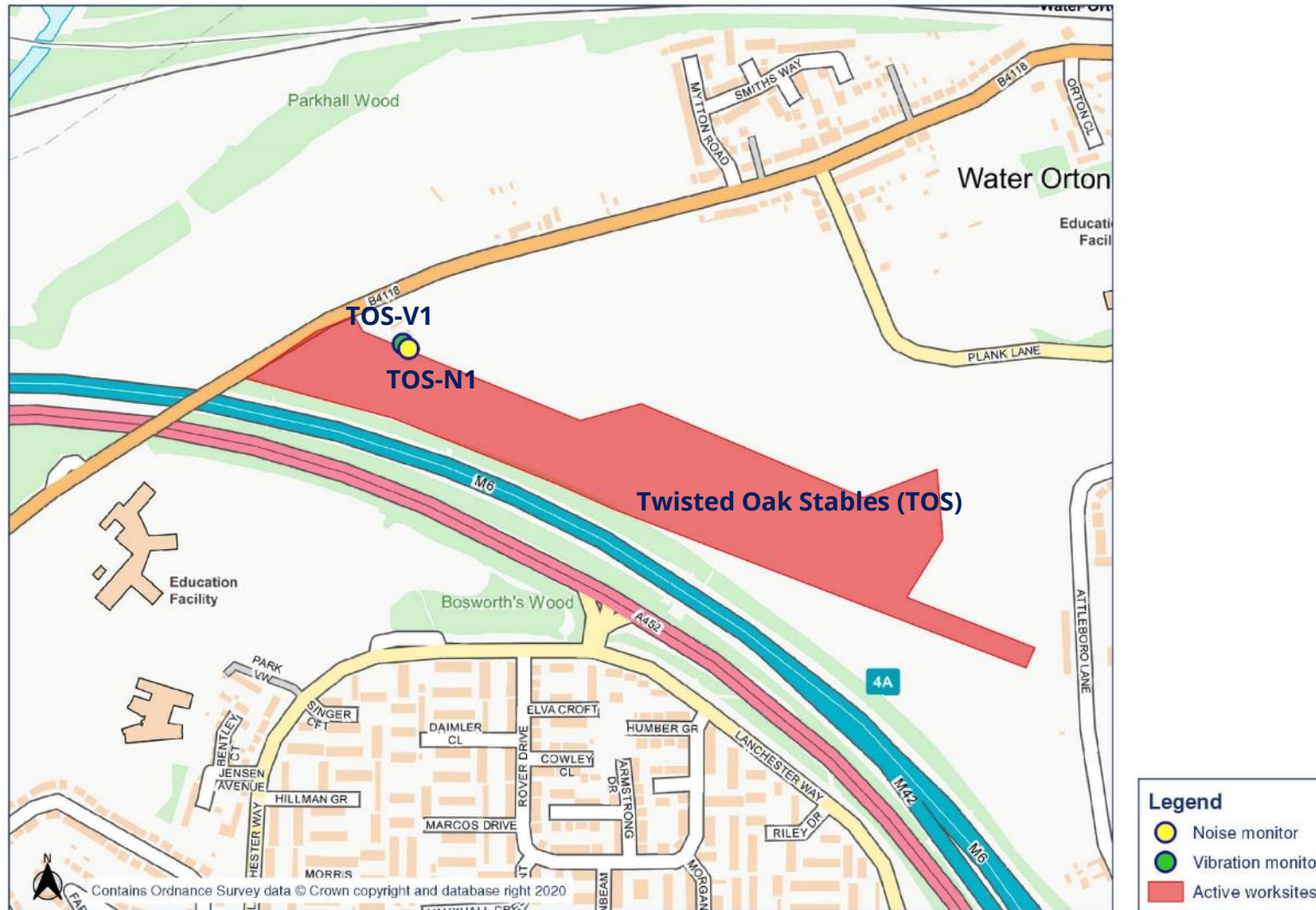




Appendix B Monitoring Locations





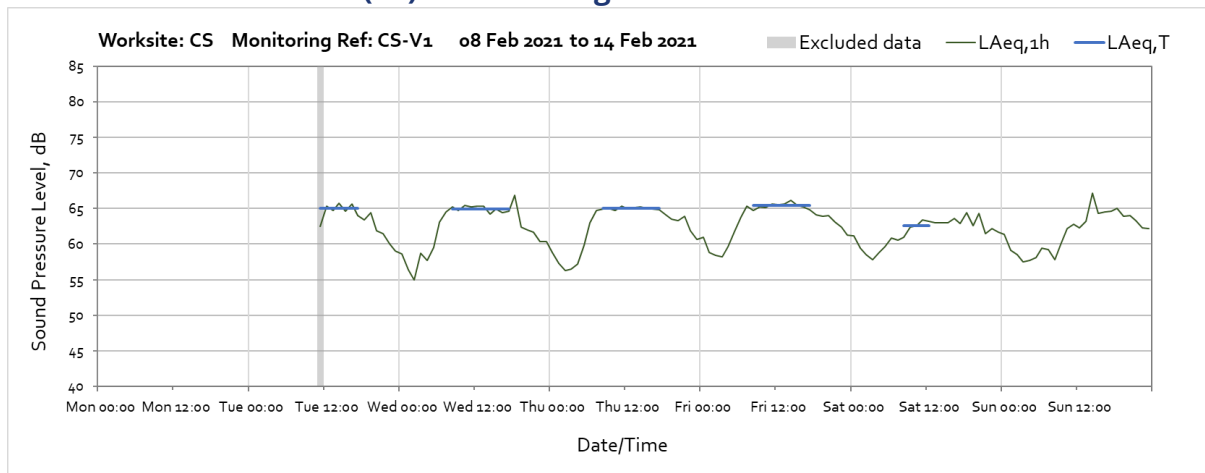


Appendix C Data

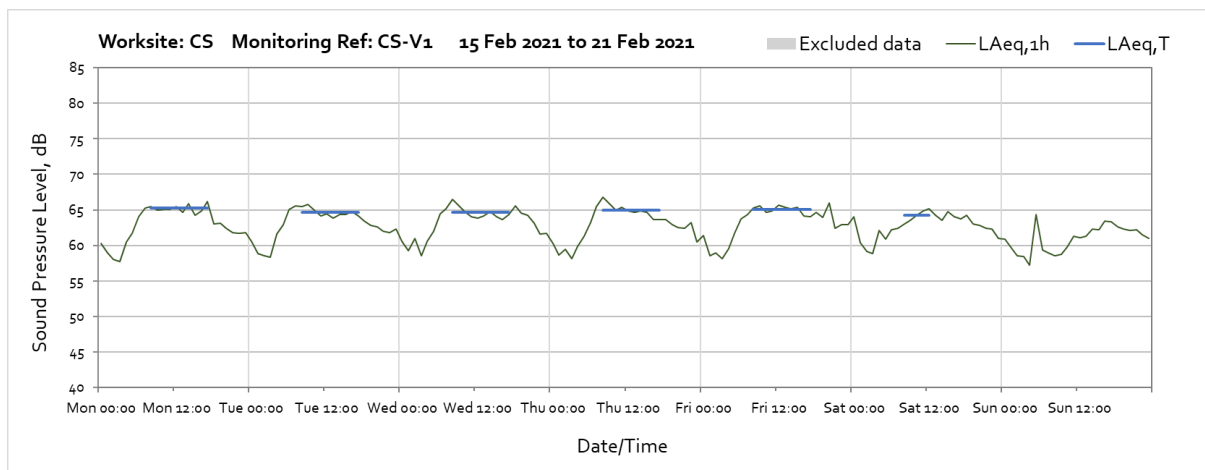
Noise

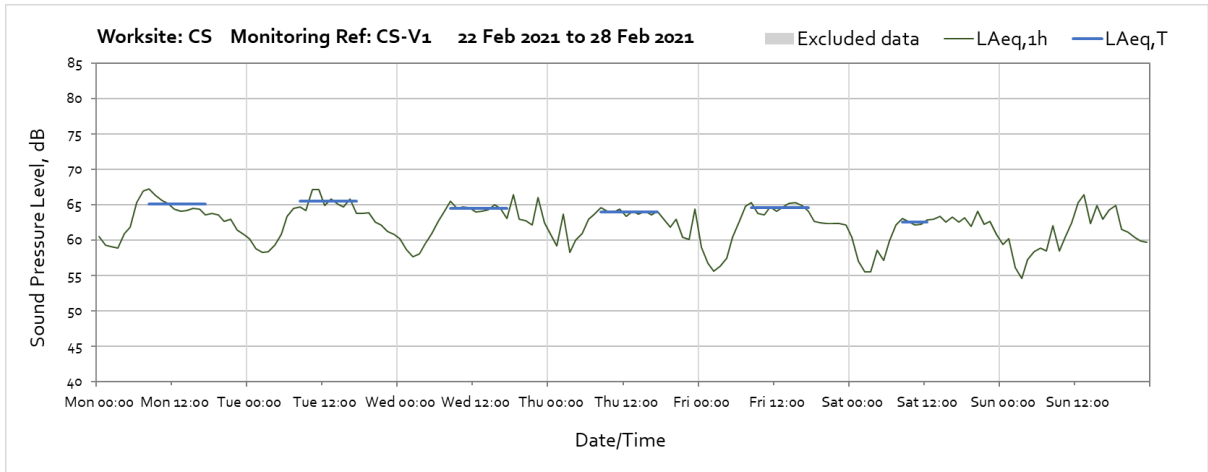
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the $L_{Aeq,T}$ values in Table 3 of the main report.

Worksite: Curzon Street (CS) – Monitoring Ref: CS-N1

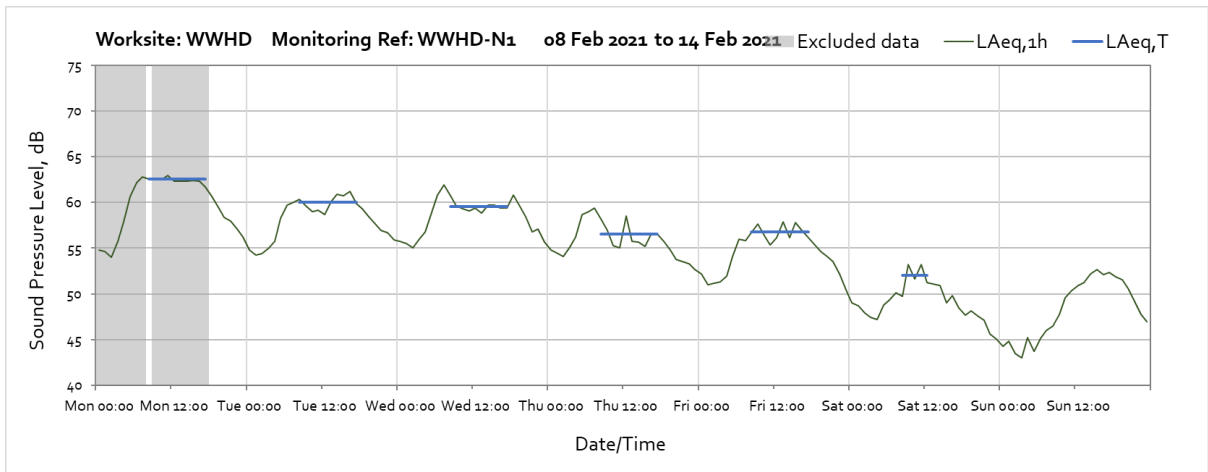
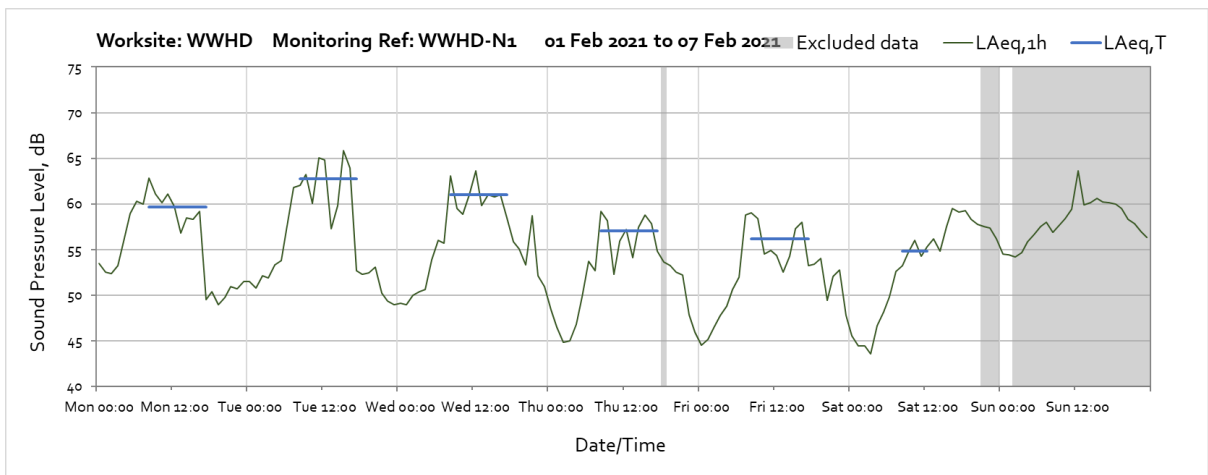


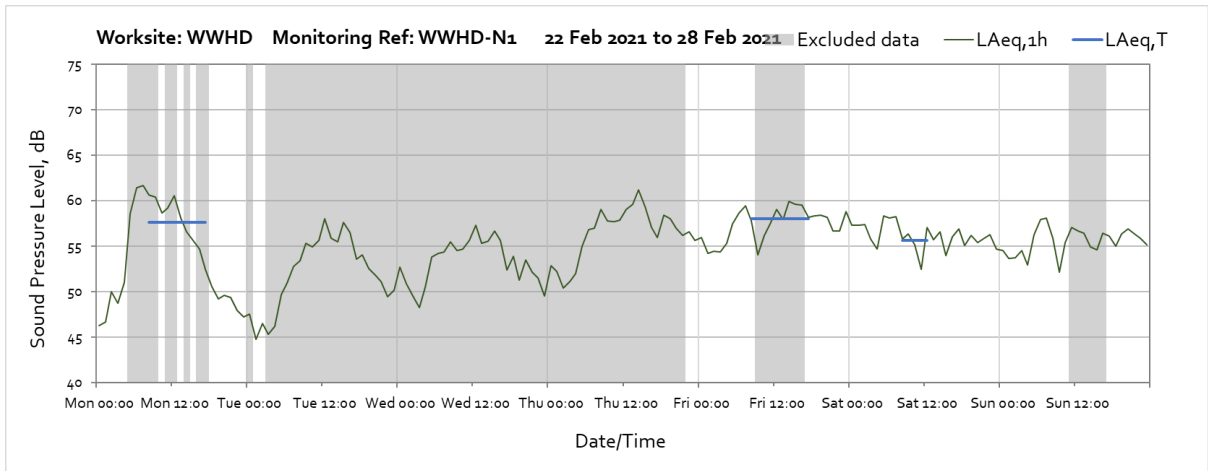
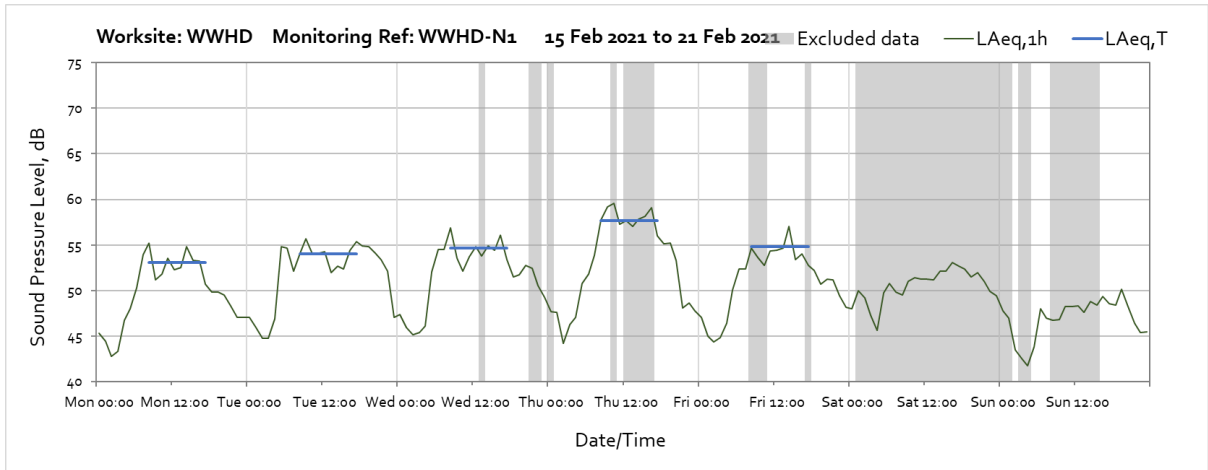
Note: The monitoring began on 9th of February 2021.



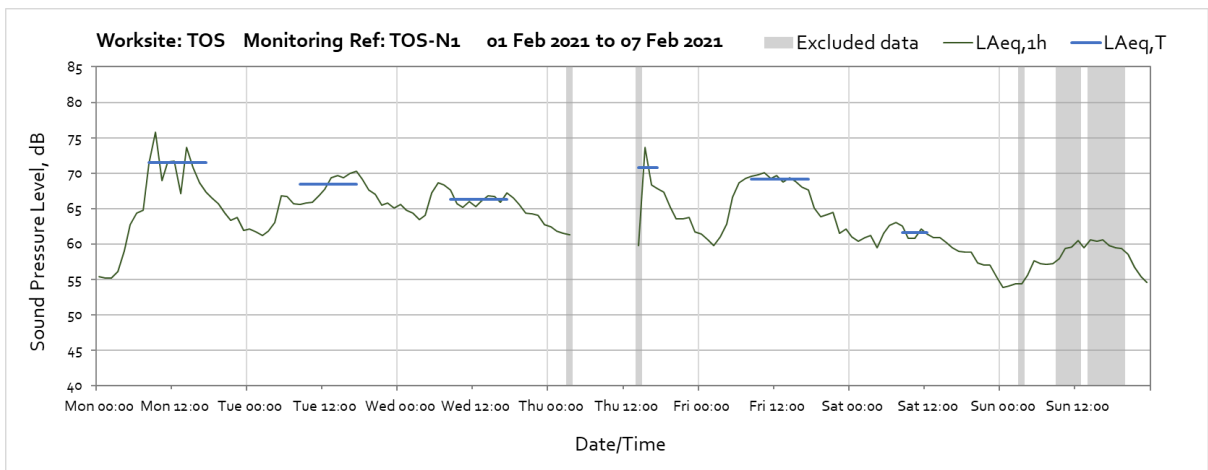


Worksite: Washwood Heath Depot (WWHD) - Monitoring Ref: WWHD-N1

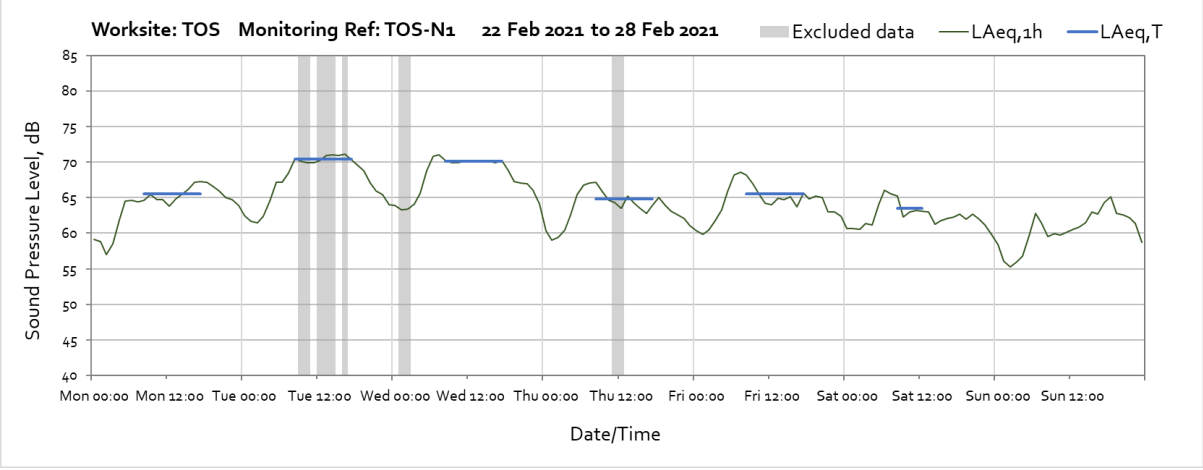
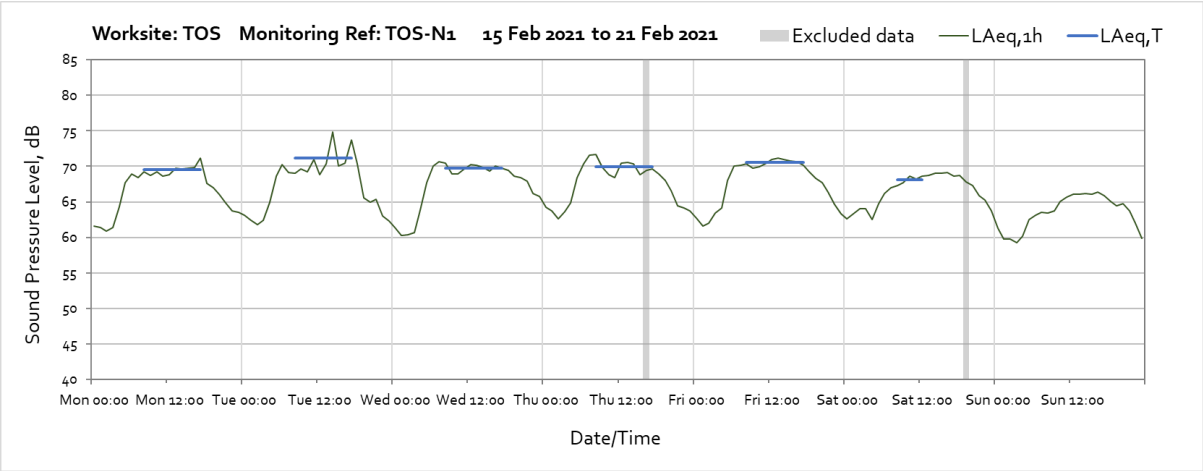
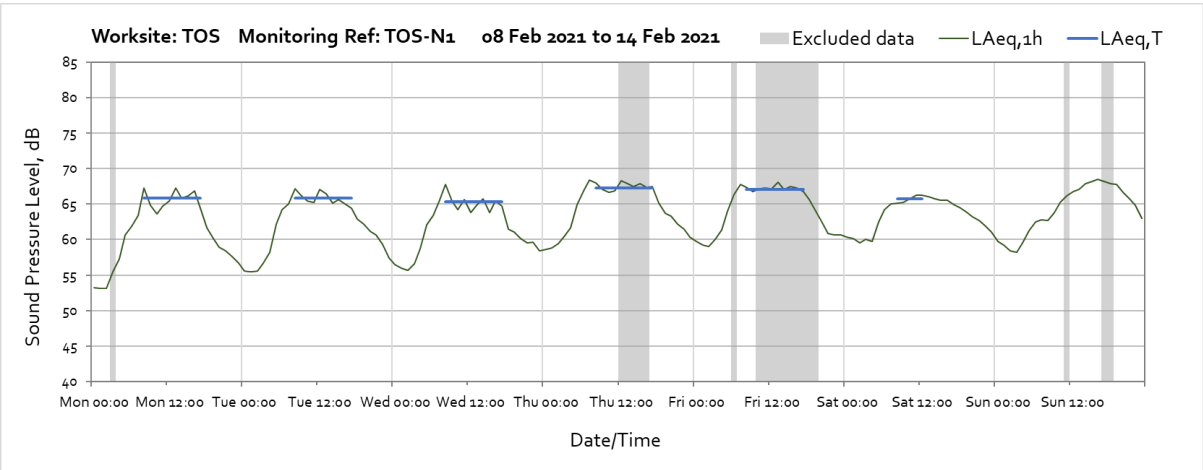




Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-N1



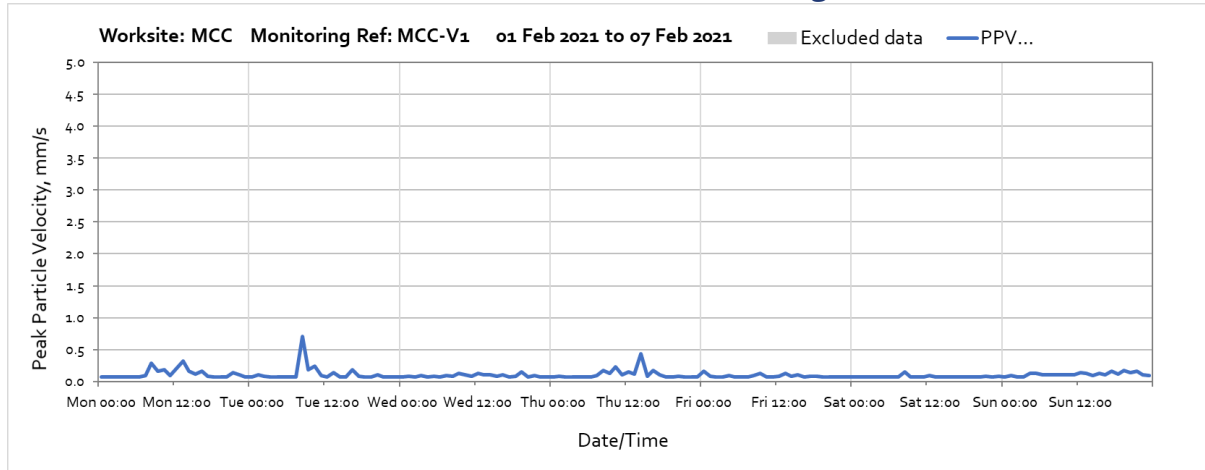
Note: Missing data between 04:00 on Thursday 4th of February and 14:00 on Thursday 4th of February were due to firmware updates.



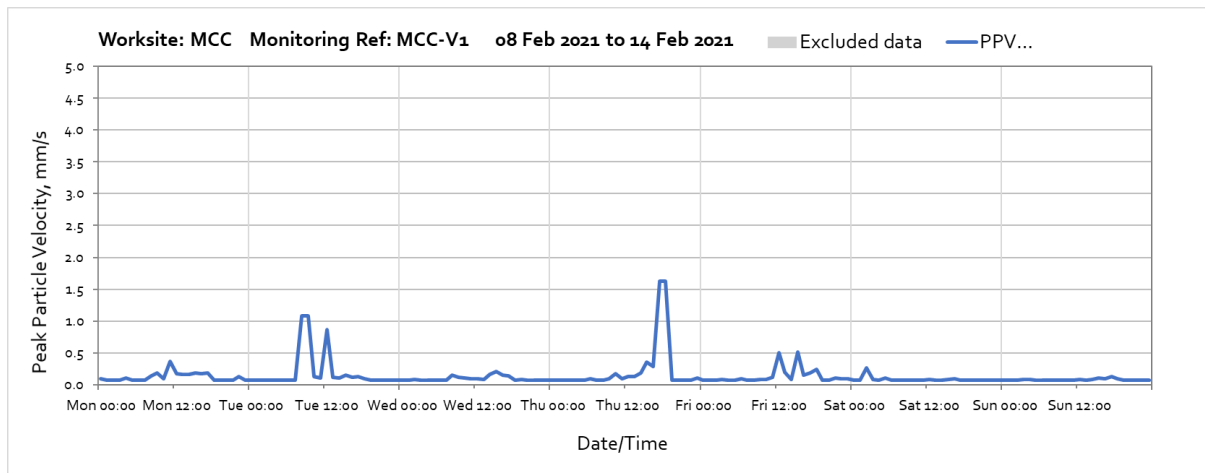
Vibration

The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the highest PPV of the three orthogonal axis x, y and z. Where high values of PPV were caused by local interference with the vibration monitor, which are not representative of HS2 construction works, these values have been greyed out in the following charts and have been excluded to calculate values in Table 4 of the main report.

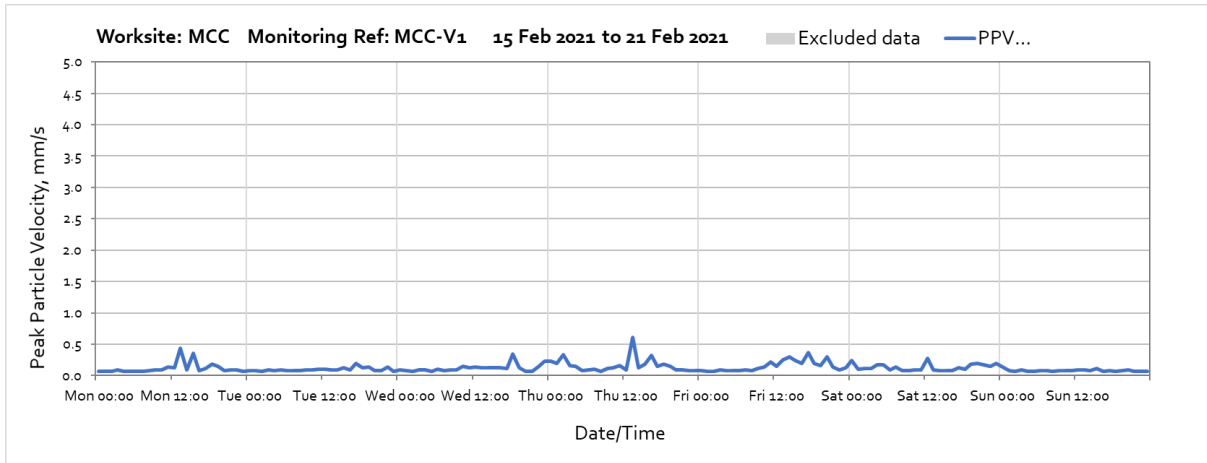
Worksite: Museum Collection Centre (MCC) – Monitoring Ref: MCC-V1



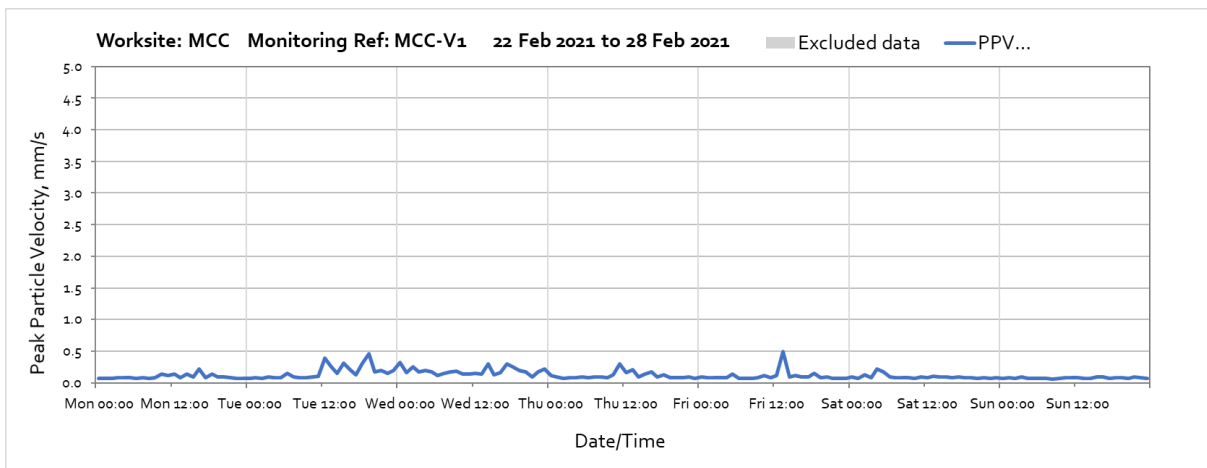
Note: No construction activities were undertaken in the month, measured vibration levels representative of ambient vibrations without contribution from HS2.



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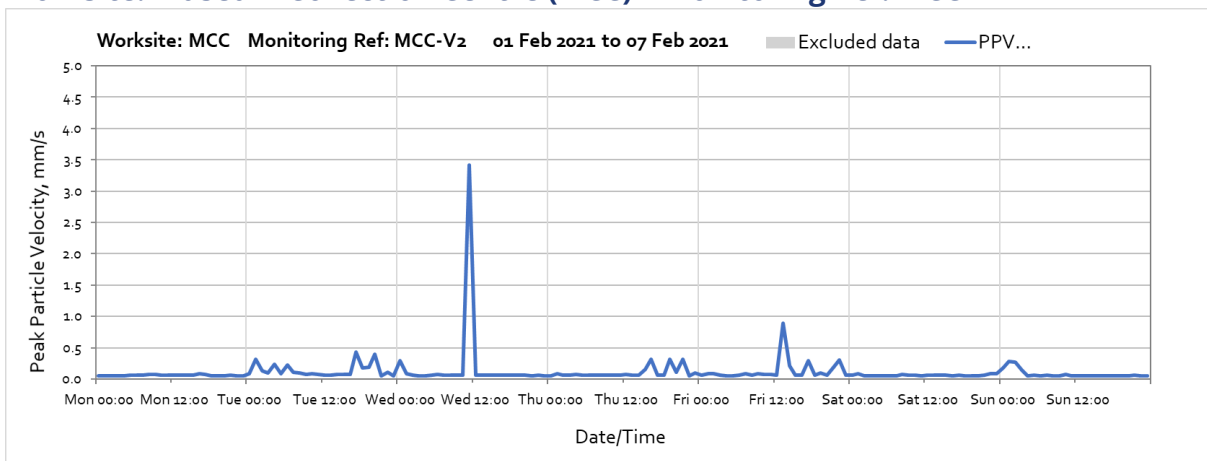


Note: No construction activities were undertaken in the month, measured vibration levels representative of ambient vibrations without contribution from HS2.

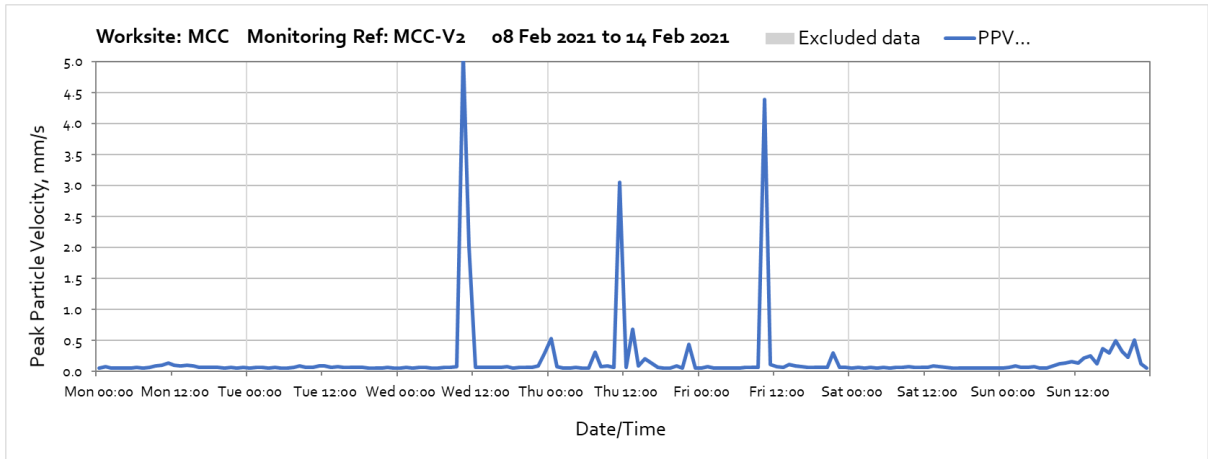


Note: No construction activities were undertaken in the month, measured vibration levels representative of ambient vibrations without contribution from HS2.

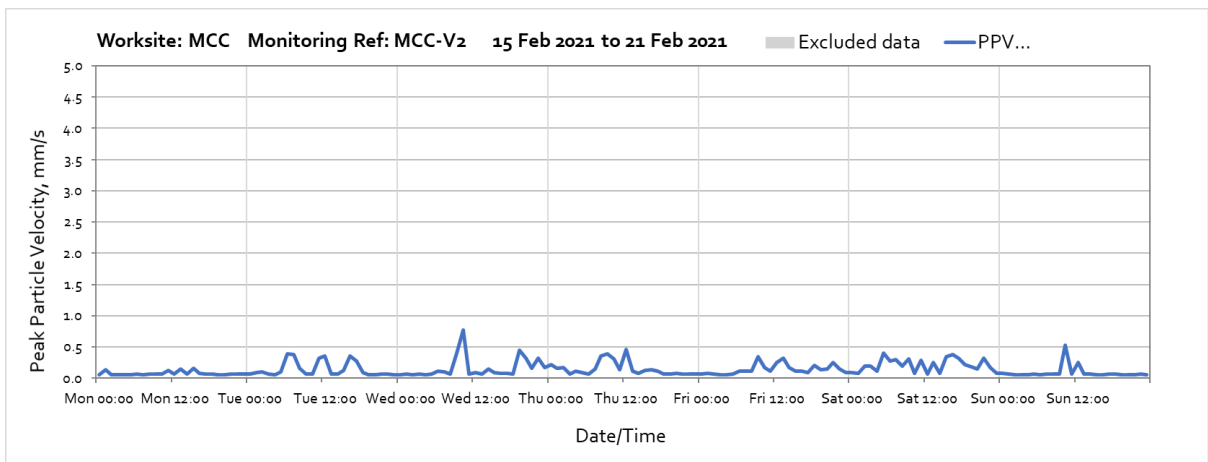
Worksite: Museum Collection Centre (MCC) – Monitoring Ref: MCC-V2



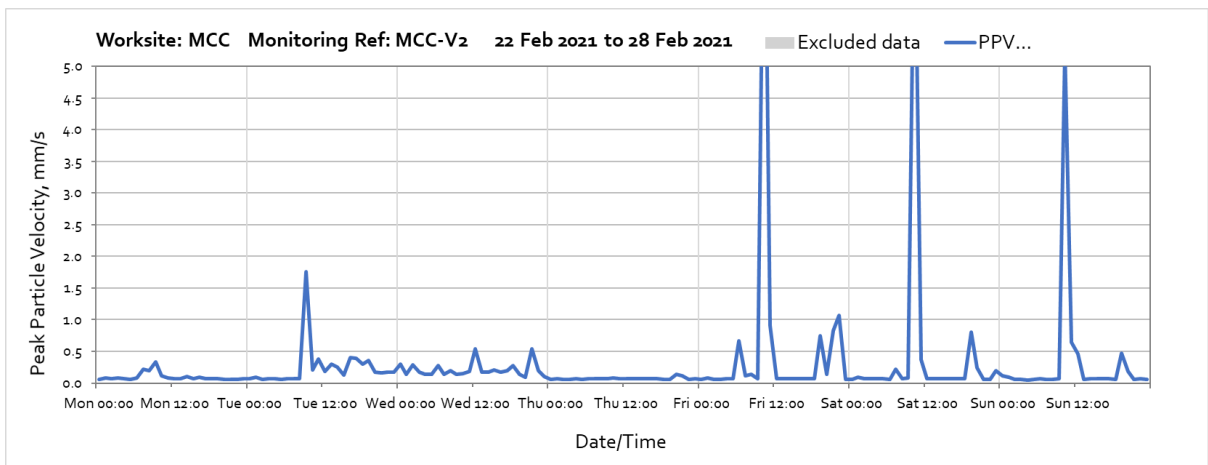
Note: No construction activities were undertaken in the month, measured vibration levels representative of ambient vibrations without contribution from HS2.



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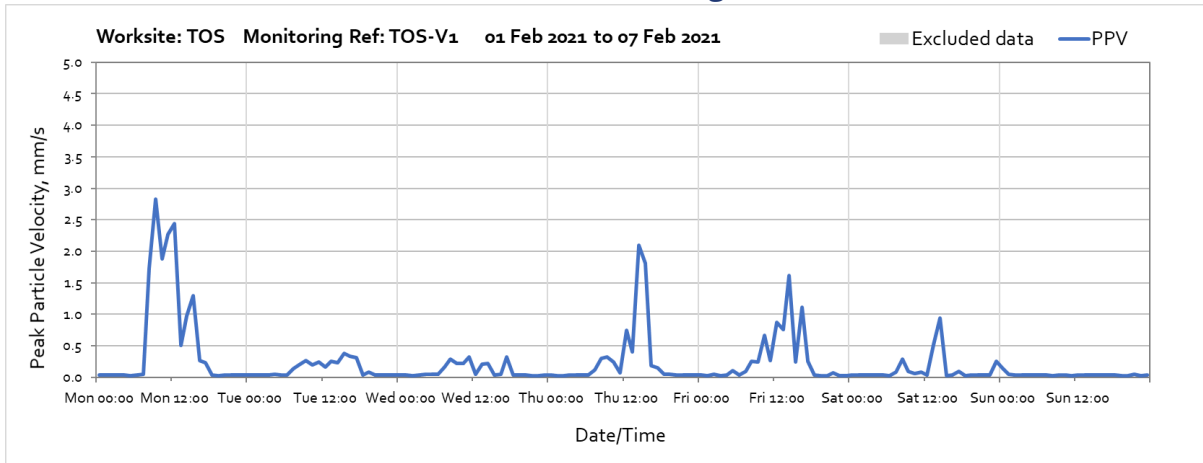


Note: No construction activities were undertaken in the month, measured vibration levels representative of ambient vibrations without contribution from HS2.

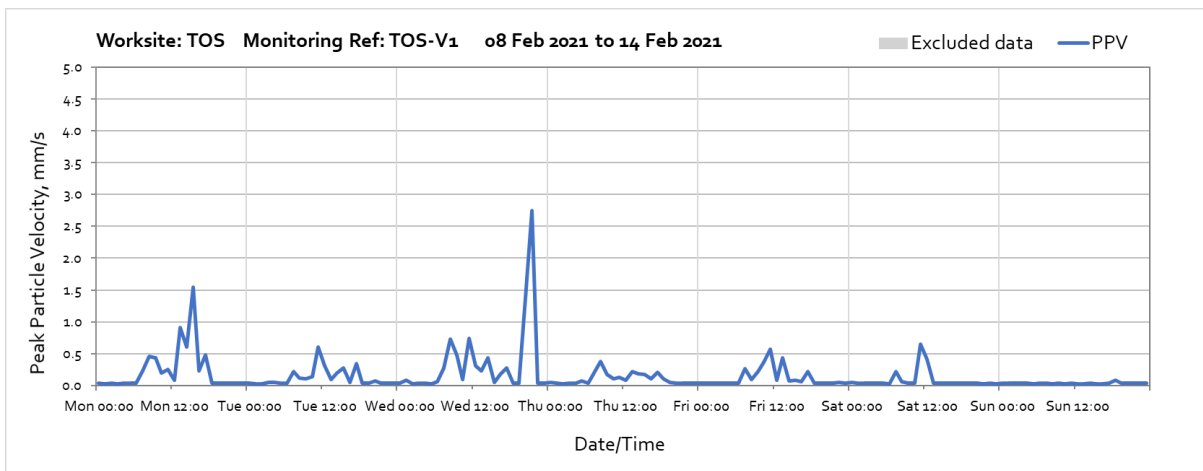


Note: No construction activities were undertaken in the month, measured vibration levels representative of ambient vibrations without contribution from HS2.

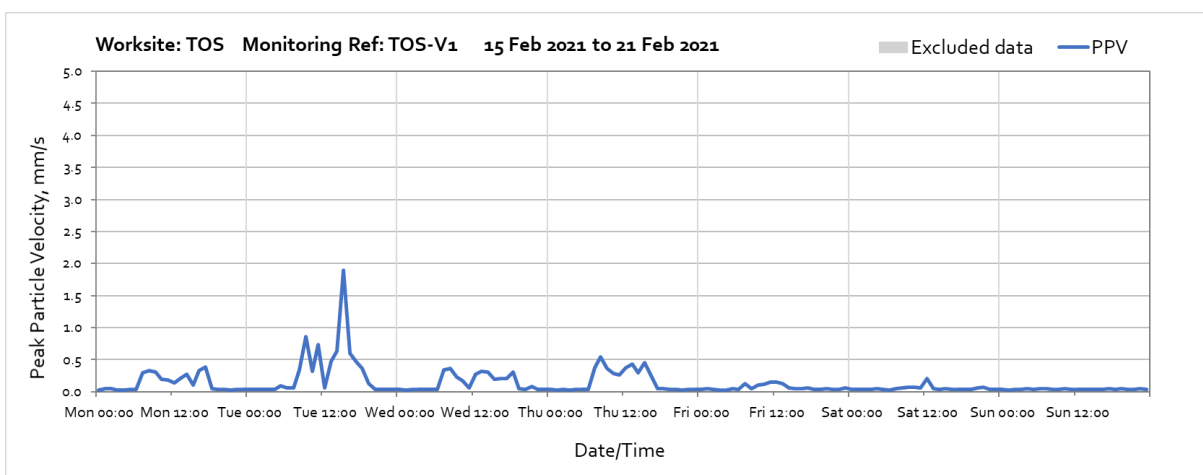
Worksite: Twisted Oak Stables (TOS) – Monitoring Ref: TOS-V1



Note: High vibration levels at various time of the week were due to the soil stripping and ground stabilisation activity undertaken at close proximity to the vibration monitor and are not representative of HS2 vibration levels at nearby receptors.



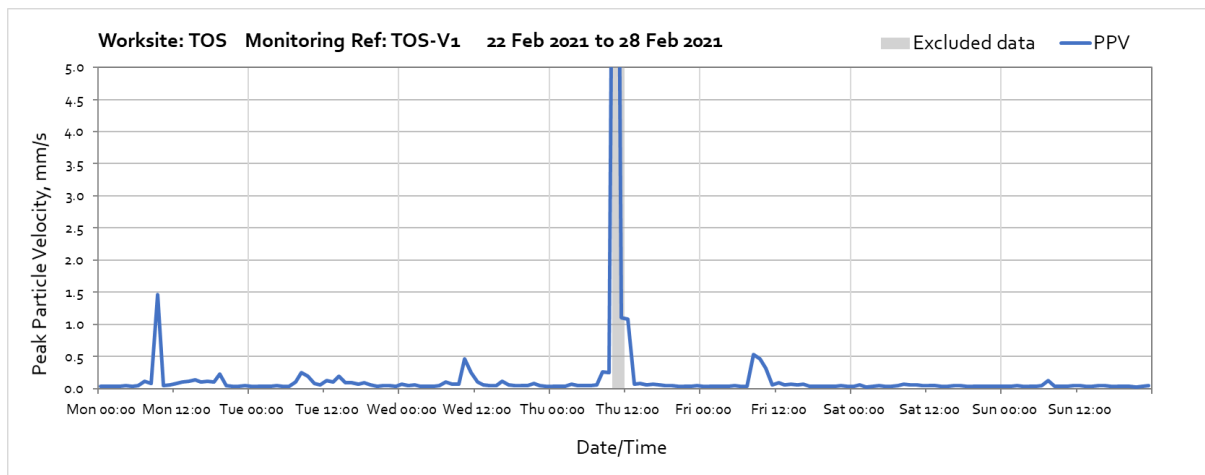
Note: High vibration levels at various time of the week were due to the soil stripping and ground stabilisation activity undertaken at close proximity to the vibration monitor and are not representative of HS2 vibration levels at nearby receptors .



Note: High vibration levels at various time of the week were due to the soil stripping and ground

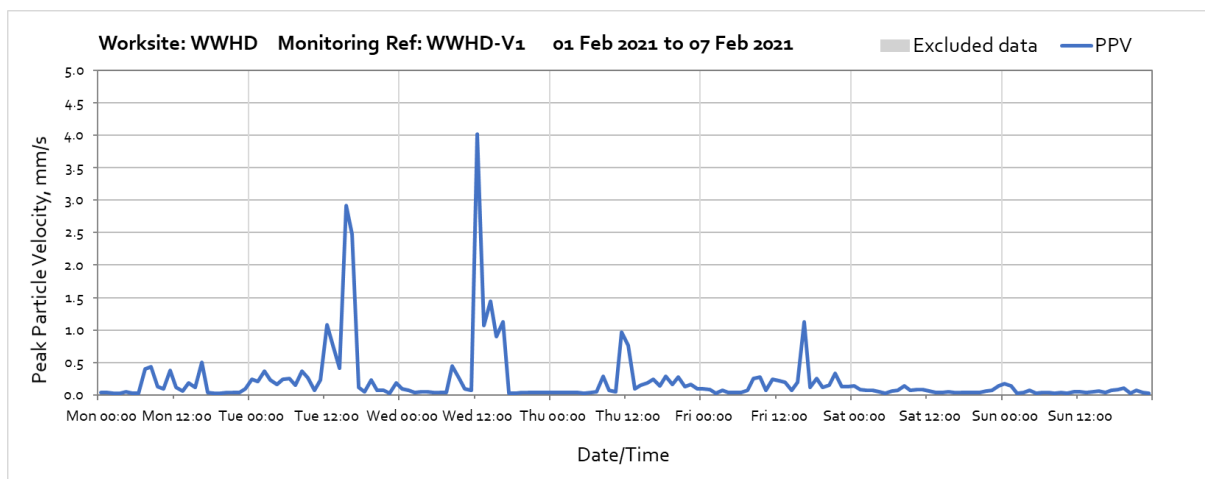
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stabilisation activity undertaken at close proximity to the vibration monitor and are not representative of HS2 vibration levels at nearby receptors.

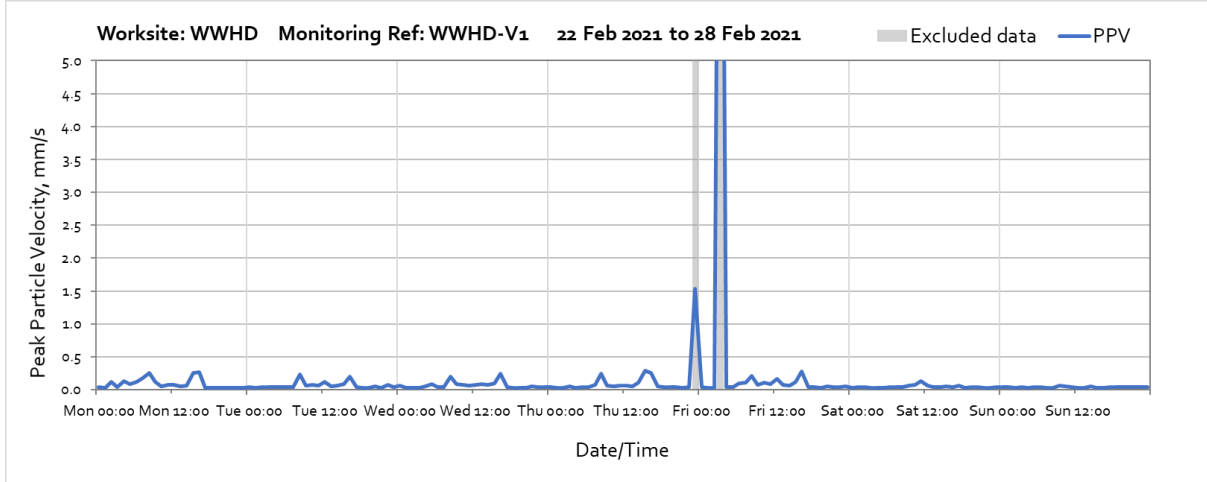
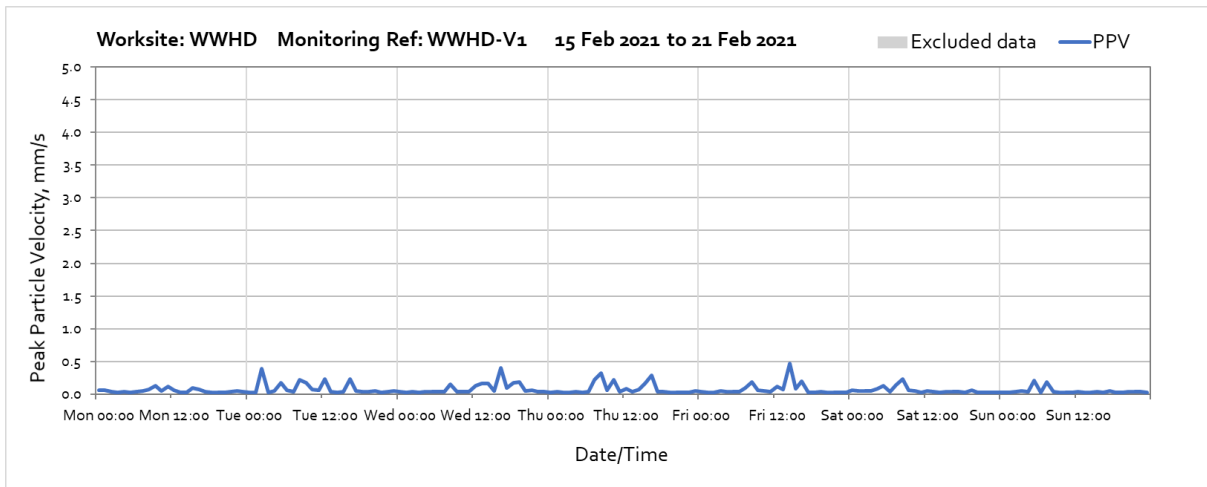
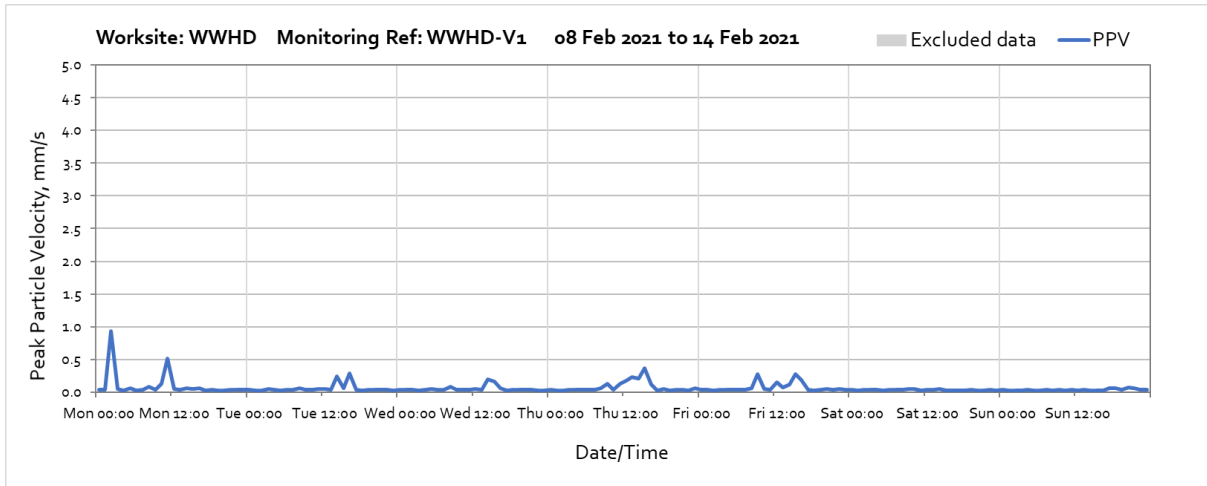


Note: High vibration levels at 10:00 on Thursday the 25th of February were due to the disturbance caused from the relocation of the monitor and are not representative of HS2 vibration levels.

Worksite: Washwood Heath Depot (WWHD) – Monitoring Ref: WWHD-V1



Note: High vibration levels between 15:00 and 16:00 on Tuesday the 2nd of February, and between 12:00 and 16:00 on Wednesday 3rd of February were due to the construction of safety bunds at close proximity to the vibration monitor and are not representative of HS2 vibration levels at nearby receptors.



Note: High vibration levels at 23:00 on Thursday the 25th of February and 03:00 on Friday the 26th of February were outside of HS2 work hours and caused due to local interference and are not representative of HS2 vibration levels.