

TECHNICAL MEMORANDUM

Project	Deal Ground and May Gurney site, Bracondale, Norwich		
Date	03 April 2023	Memo No	13495 M001
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DEAL GROUND AND MAY GURNEY SITE – TARMAC VIBRATION SURVEY

1 INTRODUCTION

We are appointed by Serruys Property Company Limited to carry out measurements of the vibration produced by activity at Trowse Aggregates Railhead and Coated Stone Plant, which is currently operated by Tarmac. In particular, the measurements were focused on the vibration levels produced during a typical aggregate delivery by rail.

The Local Planning Authority are primarily concerned with airborne noise rather than vibration and the bulk of our input on this project is focused on that, but the aim of the measurements was to identify whether the nearest proposed residential buildings to the rail sidings might be at any risk of disturbance from vibration due to Tarmac activity.

2 CRITERIA

There are two common parameters used to assess rail and/or industrial vibration:

- Time averaged, weighted Vibration Dose Value (VDV) according to BS 6472
- Peak particle velocity (PPV) according to BS 5228

2.1 Assessment of Vibration Dose Value (VDV) according to BS 6472-1:2008

VDV measures human exposure to vibration in buildings and the prospect of human annoyance, i.e. “*probability of adverse comment*”. VDV is a way to quantify vibrations as an exposure dose based on frequency (up to 80 Hz), amplitude and regularity.

BS 6472-1:2008 ‘*Guide to evaluation of human exposure to vibration in buildings*’ (BS 6472-1) recommends W_b weighting for vertical motion and W_d for horizontal motion. These frequency weightings are defined in BS 6841:1987. W_b (vertical) is most sensitive in the range 4 Hz to 12.5 Hz and W_d (horizontal) in the range 1 Hz to 2 Hz.

The VDV is determined for the day (07:00-23:00 hrs) and night-time (23:00-07:00 hrs).

When the appropriately weighted 16-hour daytime or 8-hour night-time VDV has been derived at relevant locations, their potential significance in terms of human response can be derived from Table 1 of BS 6472-1, to assess the probability that the determined vibration dose might result in adverse comment by any person who experiences it.

Place and time	Low probability of adverse comment, VDV range in $\text{ms}^{-1.75}$	Adverse comment possible, VDV range in $\text{ms}^{-1.75}$	Adverse comment probable, VDV range in $\text{ms}^{-1.75}$
Residential buildings, 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

NOTE – For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a 16 h day

Table 1 – BS 6472 VDV criteria for residential buildings (from Table 1 of BS 6472)

2.2 BS 5228-2:2009+A1:2014

BS 5228 ‘Code of practice for noise and vibration control on construction and open sites.’ (Part 2: Vibration) provides guidance on assessment of construction vibration, but the guidance is commonly used to assess different forms of industrial vibration.

Table B.1 presents guidance on the typical effects of PPV vibration levels:

Table B.1 Guidance on effects of vibration levels

Vibration level ^{A), B), C)}	Effect
0.14 $\text{mm}\cdot\text{s}^{-1}$	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 $\text{mm}\cdot\text{s}^{-1}$	Vibration might be just perceptible in residential environments.
1.0 $\text{mm}\cdot\text{s}^{-1}$	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 $\text{mm}\cdot\text{s}^{-1}$	Vibration is likely to be intolerable for any more than a very brief exposure to this level ^{A1)} in most building environments ^{A1)} .

^{A1)}

^{A)} The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.

^{B)} A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available.

^{C)} Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment. ^{A1)}

Table 2 – BS 5228 PPV effect levels (from Table B.1)

3 MEASUREMENTS

3.1 Measurement methodology

We carried out a survey between approximately 07:30 and 11:45 hrs on Wednesday 15 March 2023 during a typical aggregate delivery. The measured activities included:

- Freight train arriving pulling aggregate cars
- Asphalt and gravel being unloaded from cars
- Shunting of cars

Measurements were carried out using a Rion VM-56 tri-axial vibration meter with the accelerometer fixed to a DIN plate and placed on soft ground approximately 40 m east of the Tarmac boundary (at the location of the nearest proposed residential blocks).

The measurement position is indicated in Figure 1.

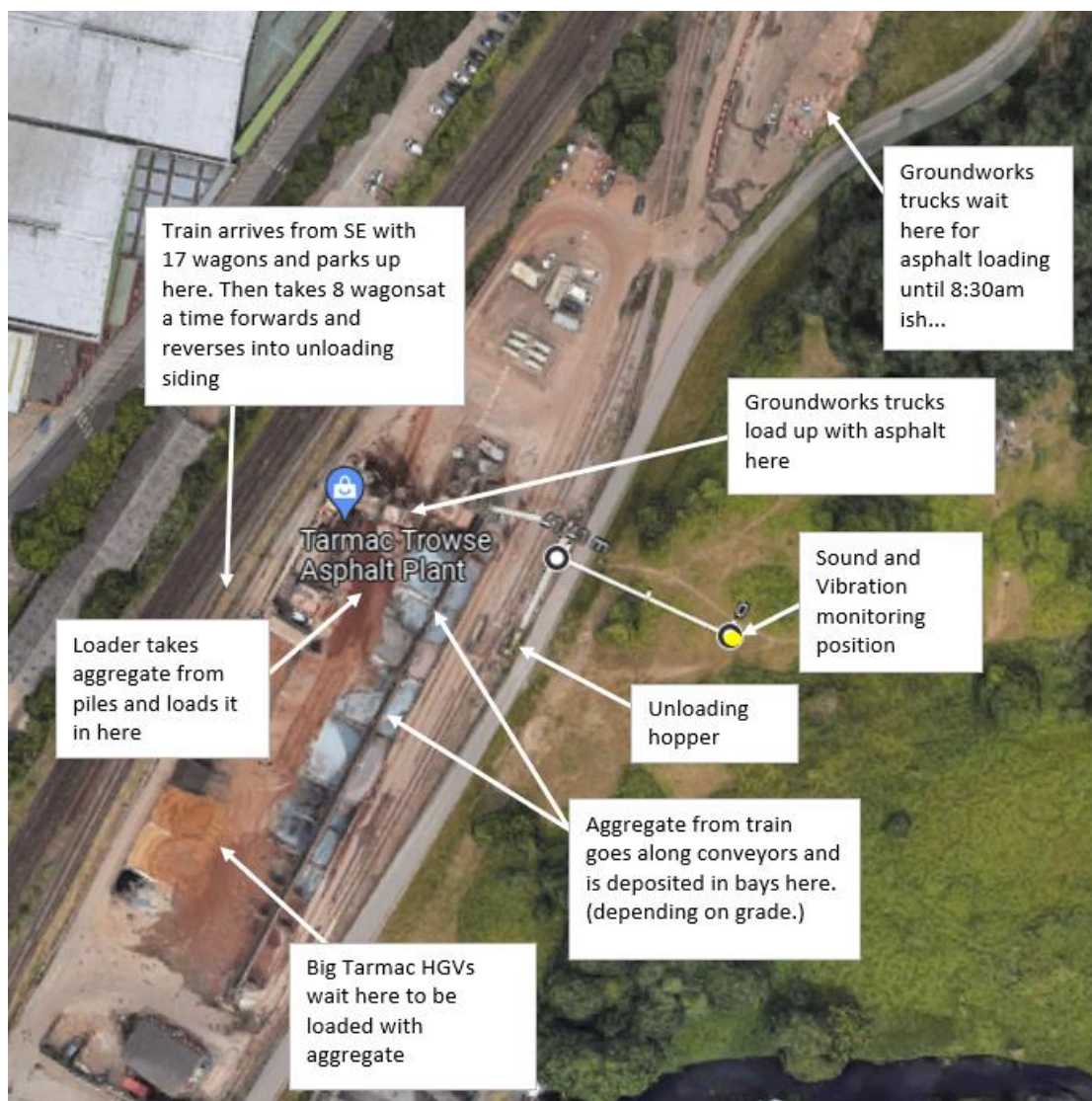


Figure 1 – Survey notes and vibration measurement position

The measured VDV and PPV levels are presented in Table 3.

Start Date / Time (dd:mm:yyyy hh:mm)	Duration (hh:mm:ss)	Measured VDV (m/s ^{-1.75})			Measured PPV levels (mm/s ⁻¹)		
		X axis	Y axis	Z axis	X axis	Y axis	Z axis
15/03/2023 07:29	00:15:00	0.00219	0.00104	0.00454	0.50	0.21	0.09
15/03/2023 07:44	00:15:00	0.0008	0.0008	0.00366	0.13	0.07	0.08
15/03/2023 07:59	00:15:00	0.00052	0.00062	0.00207	0.05	0.04	0.03
15/03/2023 08:14	00:15:00	0.00307	0.00304	0.00959	0.86	0.79	0.33
15/03/2023 08:29	00:15:00	0.00053	0.0005	0.00167	0.11	0.09	0.04
15/03/2023 08:44	00:15:00	0.00105	0.00067	0.00192	0.17	0.10	0.06
15/03/2023 09:02	00:15:00	0.0011	0.00137	0.00395	0.14	0.23	0.39
15/03/2023 09:17	00:15:00	0.0018	0.00171	0.01181	0.09	0.09	0.09
15/03/2023 09:32	00:15:00	0.00147	0.00129	0.00892	0.07	0.08	0.06
15/03/2023 09:47	00:15:00	0.00196	0.00136	0.01292	0.09	0.10	0.09
15/03/2023 10:02	00:15:00	0.00155	0.00145	0.00877	0.10	0.12	0.07
15/03/2023 10:17	00:15:00	0.0014	0.00113	0.0088	0.08	0.07	0.22
15/03/2023 10:32	00:15:00	0.00157	0.00123	0.00952	0.09	0.09	0.07
15/03/2023 10:47	00:15:00	0.00135	0.00092	0.00756	0.09	0.08	0.07
15/03/2023 11:02	00:15:00	0.00179	0.00102	0.0105	0.08	0.08	0.06
15/03/2023 11:17	00:15:00	0.00134	0.00121	0.00754	0.08	0.10	0.05
15/03/2023 11:32	00:15:00	0.00157	0.00126	0.00809	0.15	0.14	0.07

Table 3 – Measured VDV levels

4 RESULTS / CONCLUSION

4.1 VDV levels

In summary, all measured 15-minute VDV levels were below the BS 6472 thresholds for “*low probability of adverse comment*” for either daytime or night-time. Longer-term (16-hour daytime and 8-hour night-time) VDV levels would be even lower because the aggregate deliveries are not constant throughout these time intervals. In accordance with BS 6472, we therefore expect the potential impact of vibration generated by aggregate deliveries on the nearest proposed residential properties to be very low.

4.2 PPV levels

With the exception of two individual 15-minute measurements, all 15-minute PPV levels were below the BS 5228 threshold for perceptibility in residential environments.

The two exceptions were PPV levels between 0.5 – 0.86 mm/s⁻¹ which are above the threshold of 0.3 mm/s⁻¹ where vibration might be just perceptible, but below the threshold of 1 mm/s⁻¹ above which complaints might be expected in residential areas.

We therefore expect vibration from aggregate deliveries to be imperceptible for most of the time in the nearest residential properties, and unlikely to generate complaints.

4.3 Conclusion

We therefore do not consider vibration to be of any concern at the nearest (worst-case) proposed residential properties, and thus no further assessment/mitigation is required.

Report Status

Revision	Date	Prepared by	Checked by
-	03 April 2023	Gary Percival MIOA	Andy Thompson

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