

**PROPOSED CHILTERN RAILWAYS (BICESTER TO OXFORD IMPROVEMENTS)  
ORDER**

**NOTE ON**

**THE OFFER OF VIBRATION MONITORING IN RESPONSE TO THE REQUEST FROM  
ENGAGE**

**1 Introduction**

- 1.1 This note provides a summary of the letters and other correspondence with Engage regarding the offer of further vibration monitoring that was made by Chiltern Railways in response to a request by Engage.

**2 Summary of Discussions with Objectors**

- 2.1 A verbal request was made by Jonathan Gittos of Engage on 17 November 2010 to CRCL asking for further vibration and noise baseline measurements.
- 2.2 In response, Chiltern Railways wrote to Engage on 22 November 2010, offering to undertake further vibration monitoring. The request for further baseline noise measurements was rejected, since Chiltern Railways believes that sufficient baseline measurements have already been completed and that the resulting modelling is robust.
- 2.3 The correspondence regarding this offer is attached as Appendix A. It was proposed that this monitoring should take place on Monday 29 November and Wednesday 1 December at up to four locations within residential properties to be chosen by Engage so that the monitoring and assessment could be completed within the timescales of the inquiry. The measurements were to be conducted at two locations simultaneously so that the results could be compared. ERM requested that Engage respond to this offer and confirm their acceptance of the methodology by Tuesday 23 December, in order that the appropriate technical staff could be made available, and so that vibration monitoring equipment could be hired and delivered in time. Engage was also asked to confirm that suitable access to measurement locations could be confirmed for the following week.
- 2.4 Mr. Gittos from Engage e-mailed ERM on Tuesday 23 November to accept this offer and went on to nominate one of the four locations for vibration monitoring. He also highlighted that Professor Korsunsky would discuss technical issues regarding the

measurements with ERM on behalf of Engage.

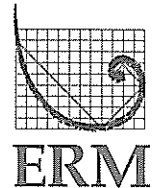
- 2.5 Emails were sent by ERM to Professor Korsunsky on 23 November asking for confirmation that measurements were to be undertaken.
- 2.6 Professor Korsunsky emailed ERM on Friday 26 November to request a change to the methodology used in the measurement and assessment of vibration. This request was not accepted by ERM on the grounds that results of additional monitoring would need to be gathered using a measurement methodology that was consistent with the previous measurements so that the results could be directly compared. A request was made to confirm that the measurements were required on the basis of the offer by close of business. It was also highlighted that if this confirmation was not forthcoming, there would be insufficient time to prepare the necessary health and safety documentation and the equipment for the surveys. It was also noted that delaying the survey would not leave sufficient time to analyse results.
- 2.7 Mr. Gittos telephoned Ian Gilder (ERM) late on 26 November to ask that further time could be given to confirm that the measurements were required.
- 2.8 Michael Fraser (ERM) followed up this telephone conversation with an e-mail to Engage (also on 26 November), informing them that they would extend the date for accepting confirmation of the four monitoring locations (and the methodology), to Sunday 28 November, and that, in consequence, the monitoring dates would have to be moved back by one day.
- 2.9 On Sunday 28 November, Professor Korsunsky sent an e-mail to Michael Fraser. This concluded that Engage “value your willingness to explain to us you interpretation procedures, provide us with more data and to undertake more measurements.
- 2.10 Professor Korsunsky made it clear that the offer of further vibration measurement would only be accepted once other steps had been completed, namely, that they “*satisfy ourselves how those prior requirements are interpreted correctly, then look at the data you collected earlier, in full detail*”.
- 2.11 CRCL has provided Professor Korsunsky on 6 December with a technical note, also attached as Appendix B, which provides a detailed analysis of the vibration measurements made at his house, 55 Lakeside.
- 2.12 Engage have decided that they wish to go through the process set out in paragraph 2.10 before any more vibration surveys take place. This cannot be undertaken in the timescale originally envisaged, which would have allowed the results and analysis to be made available to objectors well before the end of the inquiry.
- 2.13 CRCL has concluded that further surveys cannot be completed by the close of the inquiry and therefore will not meet their intended purpose. The offer therefore has been withdrawn.

Michael Fraser  
9 December 2010

Appendix A

## Copies of Correspondence with Engage re Vibration Surveys





22 November 2010

Jonathon Gittos  
Engage Oxford  
Manor Farm House  
Godstow Road  
Wolvercote  
OX2 8AJ

Your ref: OBJ/297

Dear Mr Gittos

***Request for Further Noise and Vibration Baseline Measurements***

I am writing in response to your request to Chiltern Railways for further vibration and noise baseline measurements to be undertaken. We understand that these are intended to increase ENGAGE's confidence in the measurements that have already been undertaken for the Order Scheme, and to help you consider your position in relation to the proposed planning conditions.

Chiltern Railways has considered the issues involved in collecting more noise data and have concluded that it is not practicable to undertake further noise measurements in the time available. The reasons for this are as follows:

- noise measurements are highly sensitive to weather conditions and the weather conditions at this time of year are likely to be unsuitable for noise measurements;
- given the unsettled weather, any additional measurements might take several weeks to capture sufficient suitable measurements and subsequently would take significant periods of time to analyse;
- school holidays are approaching which are not the preferred measurement periods;
- we do not believe that these are necessary as any issues that ENGAGE has identified have either lead to no changes to our conclusions, or, would suggest that the baseline noise was somewhat higher than we think, in which case the assessment would be slightly conservative;
- we have good geographical coverage for noise for this stage of the application; and
- the need for further monitoring can be carried out during detailed design of mitigation following the standards set out in the Noise and Vibration Mitigation Policy.

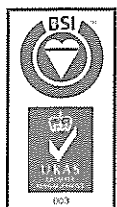
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As we know, several objectors have suggested that ground conditions are unusual in North Oxford and that vibration propagation may be affected as a result. You are aware that further measurements of existing vibration at Quadrangle House in St Peter's Road and at No 55 Lakeside have been undertaken following publication of the ES in response to these concerns and are included in evidence. The results have shown that the vibration levels are as expected for railways at the locations that have been covered.

Following the Inquiry, further measurements may be agreed with the local authority to test the ground conditions at other locations as part of discharging draft planning condition 16, but the scope of the work has yet to be discussed. Since we hope that any further measurements, although not required at this stage, will be of some assistance with these further discussions, Chiltern Railways has agreed to undertake measurements of existing vibration to meet your request. The measurements would be undertaken on the following basis:

- 1) up to 4 measurement locations are to be selected by you and agreed by ERM. The locations to be inside residential or other buildings close to the track where vibration could be an issue;
- 2) measurements will be unattended and will cover a 24 hour period at each receptor. This period is sufficient taken with the previous surveys for reliable analysis and conclusions to be drawn;
- 3) due to limitations on the number of similar equipment sets that are available for hire we will only be able to take measurements at two locations simultaneously, and then the equipment will be moved on to cover the two remaining locations;
- 4) the measurements need to be made simultaneously at each pair of locations;
- 5) it is proposed that measurements will start at the first pair of locations on Monday 29 November (access will be required at 12.30 at one location and 13.30 at the second location to set up equipment);
- 6) equipment will be collected on Tuesday 30 November (and access will be required at 13.30 and 14.30);
- 7) the process will then be repeated at the second pair of measurement locations, setting up equipment on the Tuesday the 30 November at 15.30 and 16.30 at the two locations and collecting it on Wednesday 1 December at 16.30 and 17.30 respectively;
- 8) Records of trains passing through will be gathered from signalling records for the periods during which measurements are undertaken in order to match train passes to the vibration record.
- 9) measurement locations will need to be suitable:
  - a. away from areas where the equipment could be subject to high extraneous vibration (for example areas where people pass

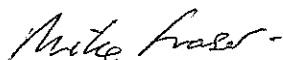
- regularly or where equipment could be disturbed by pets or children)
- b. a firm surface will need to be used as a mounting point for the equipment ie not on a carpet
  - c. one set of equipment will need to be mounted near to a structural element that is close to the outside wall of the building to reflect structural vibration and the other will be mounted on a floor which is typical of an occupied area.

Any measurements that appear to have high levels of extraneous vibration in them so that analysis time is unreasonable to separate out trains will need to be discarded without further analysis. The paired measurement may not be useable in these circumstances. If equipment failure means that results need to be repeated, arrangements will be made for repeat measurements.

These baseline measurements will not change the empirical methodology that has been adopted to date for the assessment of vibration impacts as we believe our measurements at King's Sutton give a cautious estimate of the 10 m zone within which effects are likely, and this is sufficient for this stage of the project. However, the results will be taken into account in future discussions with the local authority when establishing the areas where further study is required during detailed design.

I would be grateful if you would indicate that the offer of these measurements is acceptable by the end of Tuesday 23 November, and make arrangements with the building occupants for us to have suitable access. Otherwise an alternative programme will need to be provided, and it may not be possible to carry out the measurements.

Yours sincerely



Mike Fraser  
Principal Consultant  
ERM

No 2 Re Proposal for Further Vibration Baseline Monitoring 22 11 2010 in.txt  
From: Jonathan Gittos [jonathan@gittos.com]  
Sent: 22 November 2010 13:41  
To: Michael Fraser  
Cc: Ian Gilder  
Subject: Re: Proposal for Further Vibration Baseline Monitoring

Dear Mike

Thank you very much for your letter and email which I can confirm I have received & which I greatly appreciate.

As you know I am not one of the people directly affected by the plans so I hope you won't mind that I'm consulting with them - I'm sure there will be some concerns and suggested tweaks to your proposal and I will try to send you a reply as early as possible tomorrow.

All the best

Jonathan

On 22 Nov 2010, at 12:06, Michael Fraser wrote:

> Dear Mr Gittos,  
>  
> Following your request for Chiltern Railways to consider undertaking further baseline monitoring of noise and vibration I am pleased to confirm that further vibration baseline monitoring could be undertaken in the timescales of the Inquiry. Noise measurements are not really practicable with unsettled weather and Christmas holidays coming up, both of which could affect noise in the area.  
>  
> I would be grateful if you could let me know by the end of tomorrow (Tuesday 23 November) if you would like us to proceed with the survey work and can arrange suitable access so that we can undertake the survey next week.  
>  
> Best Regards  
>  
> Mike  
>  
> Mike Fraser  
> Principal Consultant  
> ERM  
> Eaton House  
> Wallbrook Court  
> North Hinksey Lane  
> Oxford  
> OX2 0QS  
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>  
> <letter\_to\_J\_Gittos\_Engage\_scanned.PDF>

Jonathan Gittos

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Office: +44 (0)20 7460 5395

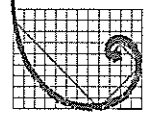
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26 November 2010

Professor A M Korsunsky  
53 Lakeside  
Oxford  
OX2 8JF

*Direct lines*  
Telephone 01865 384864  
Facsimile 01865 384848  
Email michael.fraser@erm.com



**ERM**

OBJ 297/OBJ 295

Dear Professor Korsunsky,

Thank you for your letter of the 26<sup>th</sup> of November in which you suggest that you are not satisfied that the proposed programme of vibration measurements that we have suggested to try to accommodate ENGAGE's request for such monitoring. We have carefully considered your suggestion regarding alternative measurement techniques, but we do not believe that this is appropriate given that we would like to make measurements that are consistent with those that have been carried out before so that they can be compared. (I should also note that the vibration measurements taken before did include trains and not only other events such as foot falls as was suggested in your letter. We would be pleased to discuss the existing data with you if it would help you to interpret it.)

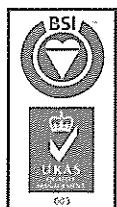
If you would like us to continue with the measurements as offered, it will be necessary to have your confirmation of access to measurement locations. If we do not receive this confirmation by close of business today, the consequence will be that there will be insufficient time to prepare the health and safety documentation, equipment for the surveys. Delaying the surveys will not be practicable as we need to ensure that sufficient time is available for post survey analysis.

I look forward to hearing from you on this issue.

Yours sincerely



Mike Fraser  
*Principal Consultant*



15 Nov 2010 10:01 2010

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No 5 Further Vibration Baseline Monitoring AK 26 11 2010 in.txt  
From: Alexander Korsunsky [alexander.korsunsky@eng.ox.ac.uk]  
Sent: 26 November 2010 12:41  
To: Michael Fraser  
Cc: Jonathan Gittos; Ian Gilder; evergreen3@engage-oxford.org.uk  
Subject: Further Vibration Baseline Monitoring

Attachments: -MFraser(ERM).pdf

Dear Mr Fraser

Request for further noise and vibration measurements

Thank you for your letter of 22 November 2010 and your e-mail addressed to Mr Gittos.

As you are aware, many residents have reservations about the noise and vibration measurements that ERM has conducted so far. The vibration traces of the measurements taken in Quadrangle House and Lakeside, attached to rebuttal evidence, failed to show any vibration from trains: only "foot fall" and "doors slams" were identified. This is a paradox: the residents feel the vibrations from trains, and so would you or anyone present within properties close to the track. These are certainly not below the nuisance level, so it is not surprising that the residents have no confidence that vibration levels from trains have been correctly measured so far.

To satisfy the aim stated in your letter, additional vibration measurements have to be conducted in a way that avoids the problems associated with the previous Lakeside and Quadrangle House measurements. The solution that is not dependent on the individual house structures nor on the inside vibration sources is to measure the vibration outside, and in the stratum of soil that is the principal transmitter of vibration to the houses. During the cross-examination of you and Mr Gilder by Engage members it was stated clearly that to improve the level of confidence, vibration measurements would need to be conducted outside. Yet your letter that suggests again conducting additional measurements inside.

The further advantage of using boreholes conduct external measurements is that it will show the geology at those locations and also give meaningful vibration readings. The stratified nature of the soil in this part of Oxfordshire means that not only Rayleigh, but also Love wave transmission is likely, resulting in longer range propagation. The measurements need to be conducted at 10m, 20m and 30m away from the track. Since you at ERM believe and state that vibration does not travel further than 10m from the line, there should be no problem for you to agree to conduct these measurements so as to increase the residents' confidence. This approach would demonstrate that Chiltern/ERM are entirely open and also ready and willing to listen and to address residents' concerns.

As you correctly state, noise measurements are highly sensitive to weather conditions. This is why the results from Lakeside should not be relied on as being representative. Hence, while we wait until the weather conditions for noise measurements improve in spring, in the meantime could you please provide all the data you collected at Lakeside, as well as revised analysis of the two early morning freight trains that produced peak noise levels of 81 dB? Freightliner confirmed that these were indeed freight trains, so the "early morning bird theory" can be dismissed.

Finally, Ian Gilder during hearings last week promised to report back to the Inquiry why Oxford's air quality management areas were not mentioned in the Environmental Statement. Perhaps you could let us know when he will do that.

Regards,

Prof Alexander Korsunsky (35 Lakeside)

Michael Fraser wrote:

> Dear Mr Gittos, and Professor Korsunsky,  
>

No 5 Further Vibration Baseline Monitoring AK 26 11 2010 in.txt

> Thank you for confirming your acceptance of the offer of vibration monitoring.  
> As discussed in the letter we will need to have confirmation that the  
> measurements are acceptable on the terms we have offered, and we will need to  
> have confirmation of the rest of the measurement locations as soon as possible.  
> We need to be sure that we will be able to carry out the surveys as described so  
> that we can book equipment tomorrow.

>  
> Best Regards

>  
> Mike

> -----Original Message-----

> From: Jonathan Gittos [mailto:jonathan@gittos.com]

> Sent: 23 November 2010 14:46

> To: Michael Fraser

> Cc: Ian Gilder; evergreen3@engage-oxford.org.uk

> Subject: Re: Proposal for Further Vibration Baseline Monitoring

>  
> Dear Mike

>  
> Thank you again for you letter.

>  
> We would like to accept your offer of monitoring at four locations and Prof  
> Alexander Korsunsky ( alexander.korsunsky@eng.ox.ac.uk ) will act as liaison on  
> our side - as you know, he has quite a lot more engineering expertise than me!

>  
> We would like the property and garden of Mo Schofield at 45 Ulfgar Road would  
> be one of our elected monitoring locations and I will leave Alexander to discuss  
> the other sites, timing and technique with you.

>  
> Best Regards

>  
> Jonathan

>  
> On 22 Nov 2010, at 12:06, Michael Fraser wrote:

>> Dear Mr Gittos,

>>  
>> Following your request for Chiltern Railways to consider undertaking further  
>> baseline monitoring of noise and vibration I am pleased to confirm that further  
>> vibration baseline monitoring could be undertaken in the timescales of the  
>> Inquiry. Noise measurements are not really practicable with unsettled weather  
>> and Christmas holidays coming up, both of which could affect noise in the area.

>>  
>> I would be grateful if you could let me know by the end of tomorrow (Tuesday  
>> 23 November) if you would like us to proceed with the survey work and can  
>> arrange suitable access so that we can undertake the survey next week.

>>  
>> Best Regards

>>  
>> Mike

>>  
>> Mike Fraser

>> Principal Consultant

>> ERM

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>> Oxford

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>> <letter\_to\_J\_Gittos\_Engage\_scanned.PDF>

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> W11 3LN  
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> Mobile: +44 (0)7785 117887  
> Office: +44 (0)20 7460 5395

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>

OBJ 297 Further Vibration Baseline Monitoring AK 28 11 2010.txt  
From: Alexander Korsunsky [alexander.korsunsky@eng.ox.ac.uk]  
Sent: 28 November 2010 17:12  
To: Michael Fraser  
Cc: Jonathan Gittos; Ian Gilder; evergreen3@engage-oxford.org.uk; ERM UK  
Chiltern Objections; Jamie Hogg; Charlene Baker  
Subject: OBJ 297 Further Vibration Baseline Monitoring

Attachments: -ERM\_20101128.pdf

Environmental Resources Management  
Eaton House  
Wallbrook Court  
North Hinksey Lane  
Oxford OX2 0QS

28 November 2010

Dear Mr Fraser

Your offer of further noise and vibration measurements

I am in receipt of your letter of 26 November 2010 that identifies correctly some of the issues that concern us that relate to train-induced vibration and its propagation. In your letter, you offer to try and resolve these issues through discussion and additional measurements.

This is logical and sensible: insufficient knowledge/confidence call for additional evaluation. Equally, logic demands that we be fully satisfied with the interpretation of data before rushing to make more measurements in the same format.

Let us have a closer look at the substantive matters.

1. You state in your letter that your earlier vibration measurements did in fact include trains. You offer to look at the data from your earlier measurements in more detail. That is just great: your offer is gratefully accepted. Let us do that, and do that properly, using transparent, reliable and verifiable scientific methods. Then we might indeed re-assure each other.
2. During cross-examination at the enquiry you said that your noise and vibration data interpretation procedures could not reliably identify the two early morning freight trains that woke up residents of Lakeside who were sleeping in their double-glazed houses with windows closed. Note that both trains were later confirmed by us to have been run by Freightliner. This discrepancy between our perception and your interpretation is a serious cause for concern about your procedures.
3. You said during cross-examination that the signal profile associated with a train passage is well-known (e.g. the rise and fall times, etc.), and that this knowledge should help identification. Nevertheless, you have not illustrated or demonstrated how this procedure is successful. That is a second cause for our concern.
4. In your statements and documents (including the recent document CRCL/INQ/31) you repeatedly assert that your methods conform to industry standards and are well-tried and tested. We find it difficult to accept that industry standard methods fail to identify the very events they are aimed to characterise, such as train passages. This creates further concerns about your assertions.
5. At 17:05 on Friday, 26 Nov, you sent us your additional submission to the enquiry on the noise and vibration mitigation policy (document CRCL/INQ/31). In the accompanying letter you require my response by end of Sunday, 28 Nov. You say it is "on a separate subject", yet it is not: it deals precisely with the matters we are trying to resolve! The document you attached is fairly lengthy and detailed. Therefore, I do not find your request reasonable.
6. In your letter you offer to "help us interpret the data". Thank you. Perhaps you could start by providing us with access to actual measurement results? This would be more helpful than to refer to graphs plotted on uninterpretable scales that we have been shown so far.

In conclusion, I confirm that we value your willingness to explain to us your interpretation procedures, provide us with more data, and to undertake more

OBJ 297 Further Vibration Baseline Monitoring AK 28 11 2010.txt  
measurements. I confirm that we accept your offer to do that with you, in the above order: satisfy ourselves how those prior measurements are interpreted correctly, then look at the data you collected earlier in full detail, and then undertake additional measurements. Only then we have a chance of achieving the objective stated in your original letter: to re-assure the residents about the basis of your noise and vibration assessment policies.

Regards,

Prof Alexander Korsunsky  
(Lakeside)

Michael Fraser wrote:

> Dear Mr Gittos, and Professor Korsunsky,

>

> We have received the phone message from Mr Gittos to Ian Gilder this afternoon. In order to be obliging as possible I can confirm that I can offer you a little more time to confirm measurement locations in accordance with our methodology. However, since this cannot go on indefinitely as resources and equipment are not available over a limitless period, I must have your confirmation of the acceptance of our proposed methodology and access to the properties by the end of Sunday 28th of November. Since the offer was made on Monday of this week I trust this will give you sufficient time to contact the relevant parties and arrange access. In order to accommodate this we will need to move the monitoring so that it starts on Tuesday next week (30th of November) and all other dates in the measurements schedule in the attached offer letter are moved forward by one day.

>

> On a separate subject I have also attached the Inquiry Note that we have written to clarify the procedures that will be followed to implement planning condition 16 relating to noise and vibration for your information. To clarify a point made by Professor Korsunsky in his letter to me today, we are not proposing to undertake further noise measurements at this stage, but the scope for further assessment of noise impacts will be developed in due course as described in the attached note.

>

>

> Regards

>

> Mike

>

> -----Original Message-----

> From: Michael Fraser

> Sent: 23 November 2010 15:37

> To: 'Jonathan Gittos'; 'alexander.korsunsky@eng.ox.ac.uk'

> Cc: Ian Gilder; evergreen3@engage-oxford.org.uk

> Subject: RE: Proposal for Further Vibration Baseline Monitoring

>

> Dear Mr Gittos, and Professor Korsunsky,

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Annex B

## Note on Vibration Monitoring at 55 Lakeside



# 1 VIBRATION MONITORING

## 1.1 INTRODUCTION

Vibration measurements were carried out at 55 Lakeside between the 12<sup>th</sup> and the 20<sup>th</sup> October. The results of this survey have been published in *Appendix A* Chiltern Railways' rebuttal evidence to Professor Korsunsky [CRCL/R/OBJ295]. This report aims to provide further detail on the data that have been provided so far.

The following data sources have been used to identify and distinguish between train movements and other extraneous events:

- TRUST freight movement data collected throughout the measurement period;
- the current GWR passenger timetable for the passenger service between Oxford and Bicester; and
- vibration 'traces' which show the PPV <sup>(1)</sup> against time during a measured vibration event.

The TRUST data have been provided below in *Table 1.1*. Additionally, 'traces' have been included for all events detailed in *Table 1.2* (as described below), in *Figures 1.2 – 1.14*.

Graphs showing measured PPV vibration magnitudes have been included for each complete 24 hour period of the survey (ie from the 13<sup>th</sup> to the 19<sup>th</sup> October 2010). The results from the 12<sup>th</sup> and 20<sup>th</sup> show very similar vibration magnitudes.

The equipment was set up to record details of individual vibration events (at greater time resolution) above a PPV of 0.2 mm/s have been provided for the 13<sup>th</sup> October 2010. A level of 0.2 mm/s has been chosen as it is a relatively low level which captures all freight train movements without producing unnecessary detail.

These details are provided in *Table 1.2* and in *Figure 1.1*. This day was chosen as it contains the highest number of freight train movements. It also includes passenger trains and extraneous movements.

(1) PPV is the peak particle velocity of a vibration event.

**Table 1.1 Bicester to Oxford Freight Analysis TRUST Data**

<b>Train Schedules</b>	<b>4M60 - Waste</b>	<b>6A14 - Aggregates</b>	<b>4V60 - Waste</b>	<b>6A49 - MOD</b>	<b>6C54 - Aggregates</b>	<b>6A48 - MOD</b>	<b>6M49 - Waste</b>
<b>Direction of Travel</b>	East <sup>(1)</sup> →	East <sup>(1)</sup> →	West <sup>(2)</sup> ←	East <sup>(1)</sup> →	West <sup>(2)</sup> ←	West <sup>(2)</sup> ←	West <sup>(2)</sup> ←
<b>Booked Timetable at Lakeside<sup>(4)</sup></b>	05:13	08:23	12:24	12:30	13:17	14:51	20:46
12/10/2010	66 + 12 (828t) <sup>(3)</sup>	Cancelled	66 + 12 (372t) <sup>(3)</sup>	light engine	Cancelled	RAN EARLY	Cancelled
13/10/2010	66 + 12 (826T) <sup>(3)</sup>	66 + 18JNA/JYA (1663t) <sup>(3)</sup>	66 + 12 (372T) <sup>(3)</sup>	RAN	66 + 18JNA/JYA (436t) <sup>(3)</sup>	Class 66 loco, no freight vehicles	Cancelled
14/10/2010	Cancelled	Cancelled	Cancelled	66 + 17(481t) <sup>(3)</sup>	Cancelled	66 + 25(804t) <sup>(3)</sup>	Cancelled
15/10/2010	66 + 12 (831t) <sup>(3)</sup>	Cancelled	66513 + 12 (372T) <sup>(3)</sup>	66 + 2(63t)	Cancelled	light engine (ran 90 min early) <sup>(3)</sup>	66 + 17(480t) <sup>(3)</sup>
16/10/2010	Cancelled	Not scheduled	Cancelled	Not scheduled	Not scheduled	Not scheduled	Not scheduled
17/10/2010	Not scheduled	Not scheduled	Not scheduled	Not scheduled	Not scheduled	Not scheduled	Not scheduled
18/10/2010	Cancelled	Cancelled	Cancelled	RAN	Cancelled	RAN	Cancelled
19/10/2010	66 + 12 (826T) <sup>(3)</sup>	Cancelled	66 + 12 (372T) <sup>(3)</sup>	RAN	Cancelled	RAN	Cancelled
20/10/2010	66 + 12 (831t) <sup>(3)</sup>	Cancelled	66 + 12 (372T) <sup>(3)</sup>	RAN	Cancelled	RAN	Cancelled

(1) 'East' is railway terminology for heading northwards past Lakeside

(2) 'West' is railway terminology for heading southwards past Lakeside

(3) Format of train configurations is: xx+yy (z) where xx shows the class of locomotive, yy gives the number of freight vehicles and z shows the trailing weight of the vehicles in tonnes

(4) This row shows the booked timetable, estimated at Lakeside. The actual time at which a freight train runs may vary slightly during the hours of operation of the GWR service. The 05.13 waste train, which operates before the start of this service however may run considerably earlier.

## 1.2 RESULTS

### 1.2.1 Vibration Levels Measured on the 13<sup>th</sup> October 2010

Using the sources of information outlined in *Section 1.1* above, all train movements have been identified. The five freight train movements ranged between 0.27 mm/s and 0.55 mm/s. Vibration events exceeding 0.2 mm/s, which include all freight trains, some passenger trains and extraneous events, are outlined in *Table 1.1* and in *Figure 1.1* below. Traces for each of these events are shown in *Figures 1.2* to *1.14*. Traces provide a high resolution view of velocity against time for one second before until one second after the peak level of each measurement. Extraneous events tend to be characterised by a sharp onset, whilst trains tend to display a slower rise and fall. Because of the length of freight trains, a rise and fall is not usually visible at all, whereas this can be seen more clearly for the shorter passenger trains (eg *Figure 1.12*). Background ambient vibration can be seen at magnitudes of approx 0.04 mm/s.

Twenty two passenger trains were noted over the passenger service period 05.59 and 21.49. Vibration magnitudes from passenger trains were found to range between 0.13 mm/s and 0.23 mm/s. Only two passenger trains produced PPV's greater than 0.2 mm/s and are therefore noted in *Table 1.2*.

**Table 1.2 Details of Vibration Events Exceeding 0.2mm/s on the 13th October 2010**

Time	Maximum PPV (mm/s)	Cause of Vibration Event	Train Details	Train Direction
04.41	0.38	Freight train	Class 66 loco plus 12 freight vehicles (trailing weight 826T)	North
08.26	0.55	Freight train	Class 66 loco plus 18 freight vehicles (trailing weight 1663T)	North
10.08	0.23	Passenger train		North
10.50	0.30	Extraneous		
12.17	0.36	Freight train	Class 66 loco plus 12 freight vehicles (trailing weight 372T)	South
12.29	0.39	Freight train	Details not available	North
12.56	0.43	Freight train	Class 66 loco plus 18 freight vehicles (trailing weight 436T)	South
13.07	0.39	Extraneous		
14.33	0.24	Extraneous		
14.38	0.27	Freight train	Class 66 loco, no freight vehicles	South
15.06	0.21	Passenger train		North
17.45	0.28	Extraneous		
21.00	0.29	Extraneous		

Figure 1.1 Details of Vibration Events Exceeding 0.2mm/s on the 13th October 2010

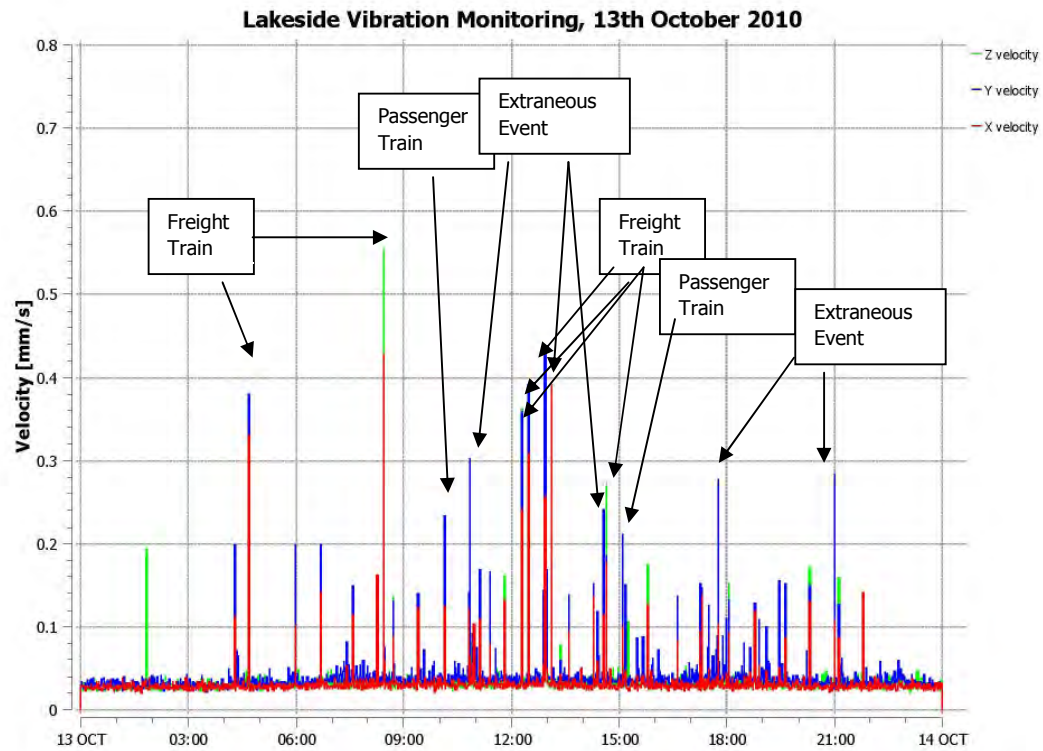


Figure 1.2 Trace for Vibration Event Recorded at 04.41 on the 13th October 2010

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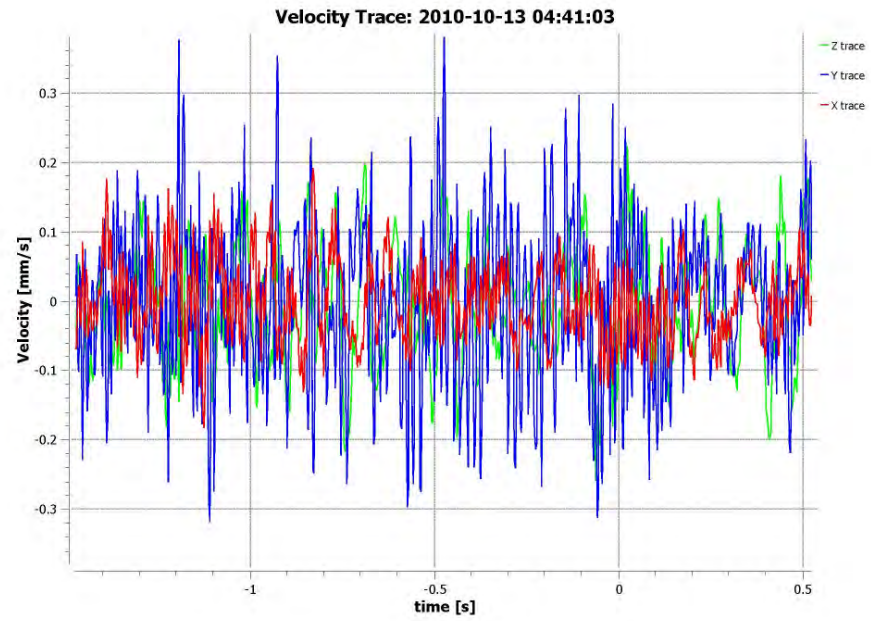


Figure 1.3 Trace for Vibration Event Recorded at 08.26 on the 13th October 2010

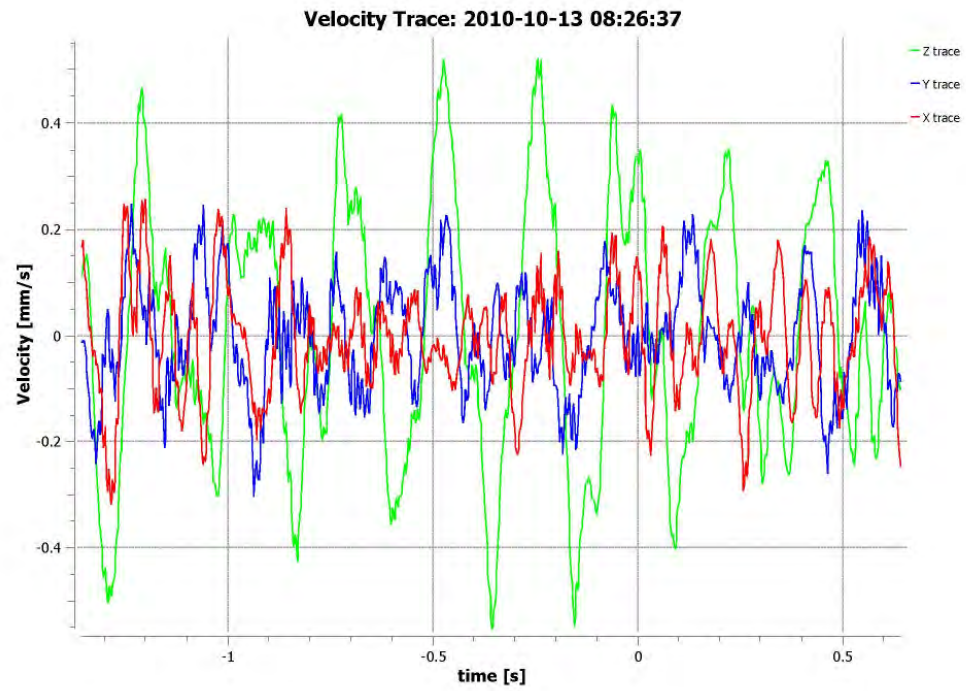


Figure 1.4 Trace for Vibration Event Recorded at 10.08 on the 13th October 2010

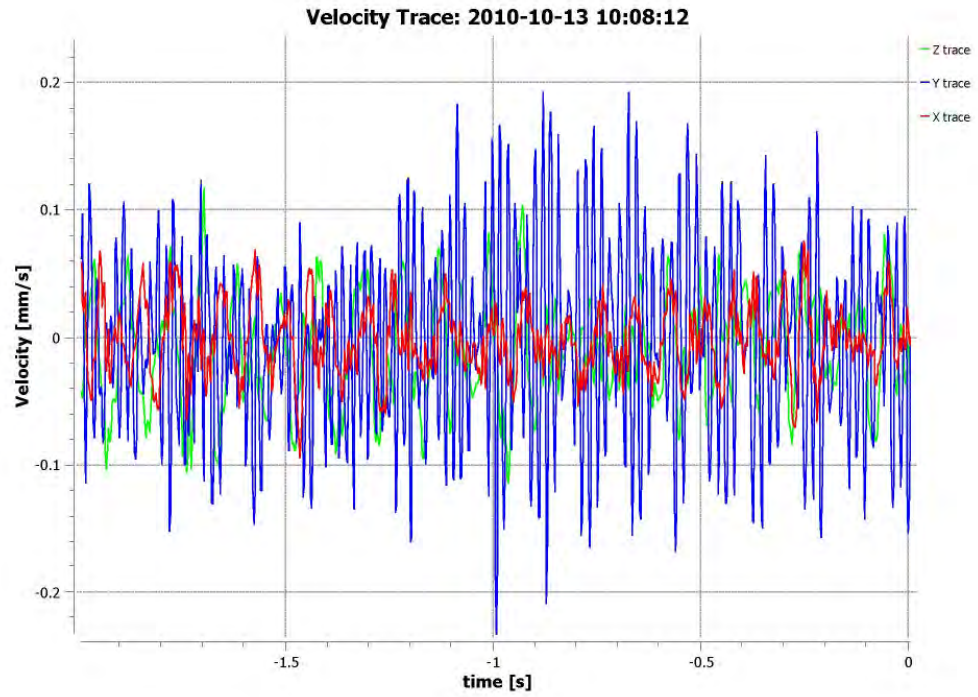


Figure 1.5 Trace for Vibration Event Recorded at 10.50 on the 13th October 2010

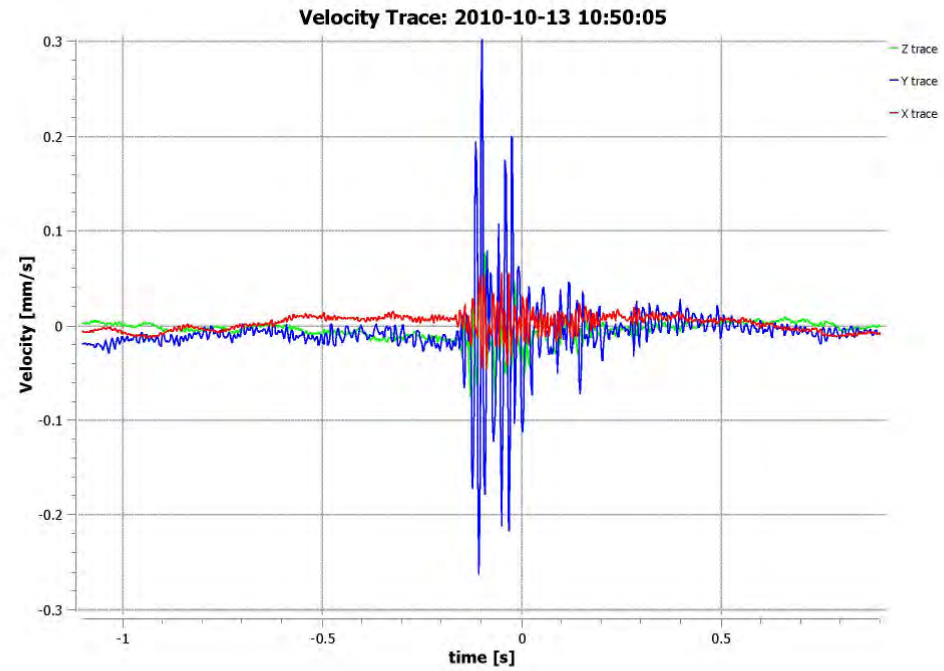


Figure 1.6 Trace for Vibration Event Recorded at 12.17 on the 13th October 2010

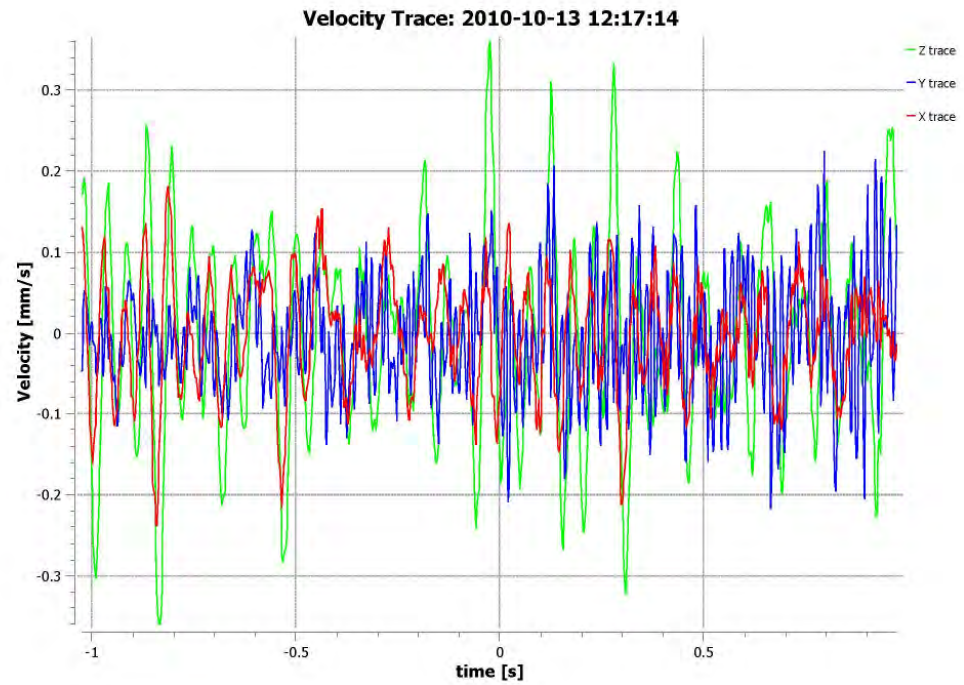


Figure 1.7 Trace for Vibration Event Recorded at 12.29 on the 13th October 2010

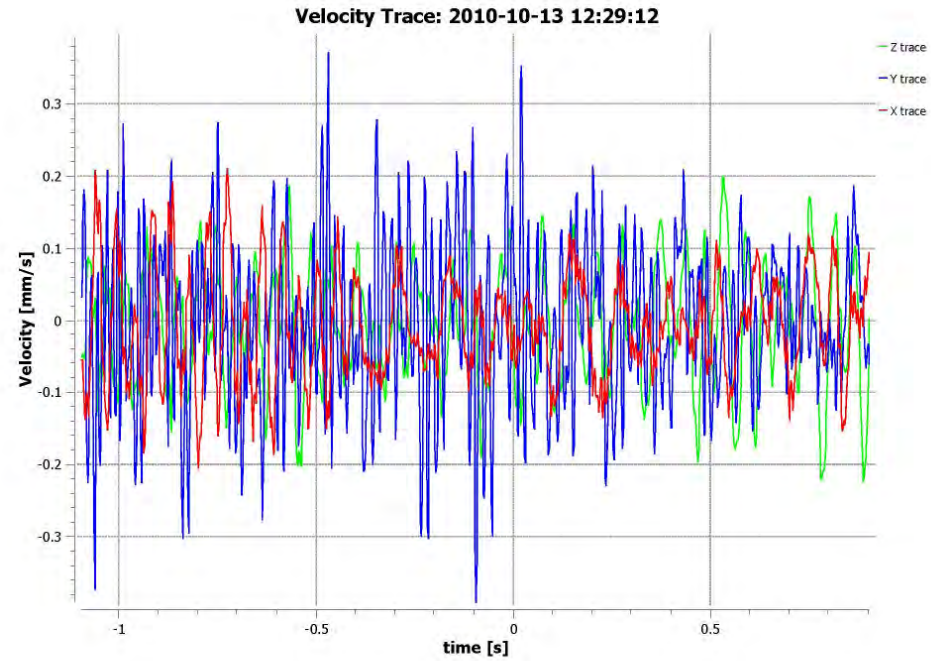


Figure 1.8 Trace for Vibration Event Recorded at 12.56 on the 13th October 2010

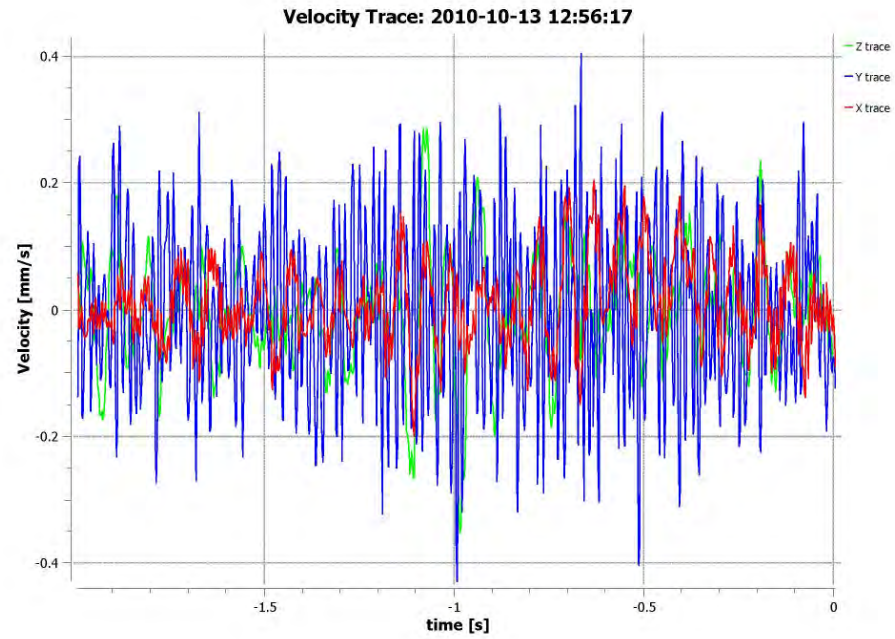


Figure 1.9 Trace for Vibration Event Recorded at 13.07 on the 13th October 2010

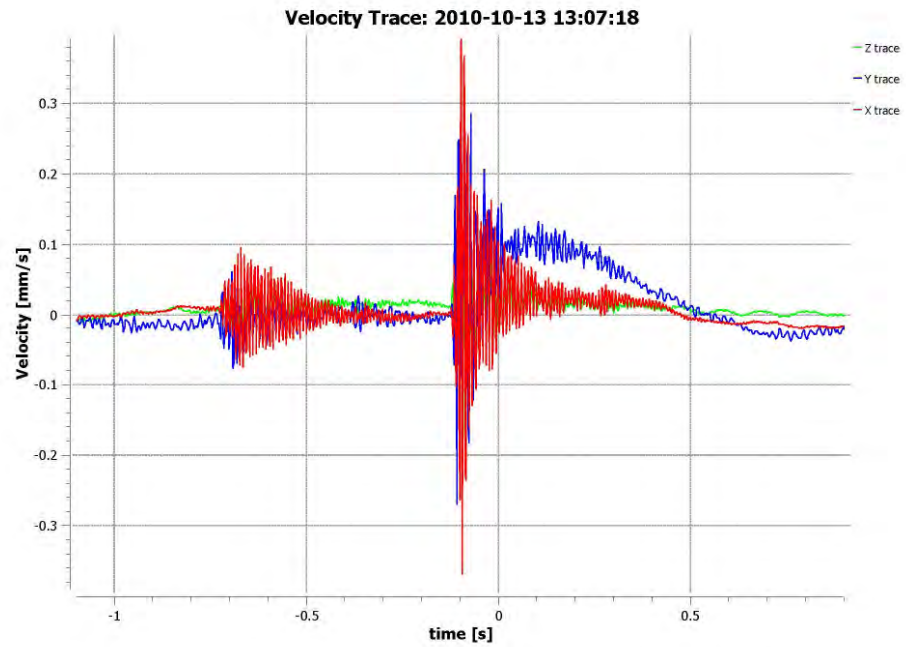


Figure 1.10 Trace for Vibration Event Recorded at 14.33 on the 13th October 2010

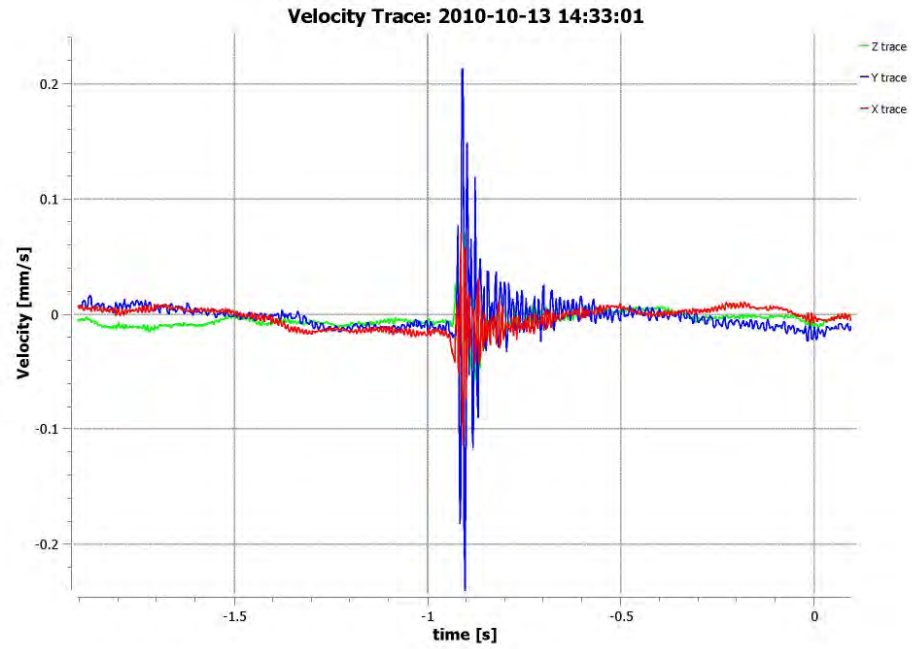


Figure 1.11 Trace for Vibration Event Recorded at 14.38 on the 13th October 2010

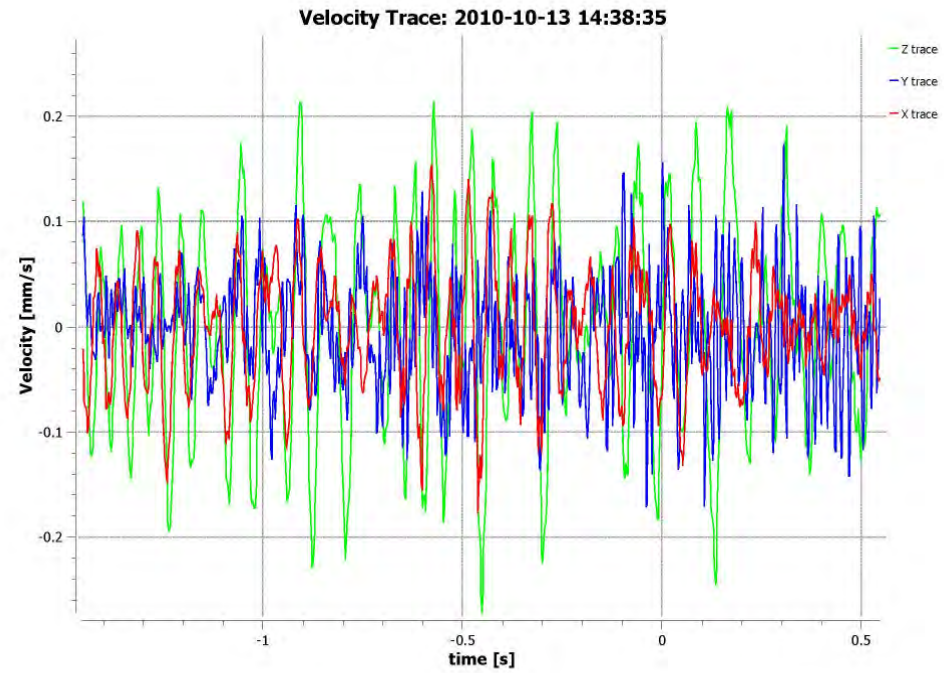


Figure 1.12 Trace for Vibration Event Recorded at 15.06 on the 13th October 2010

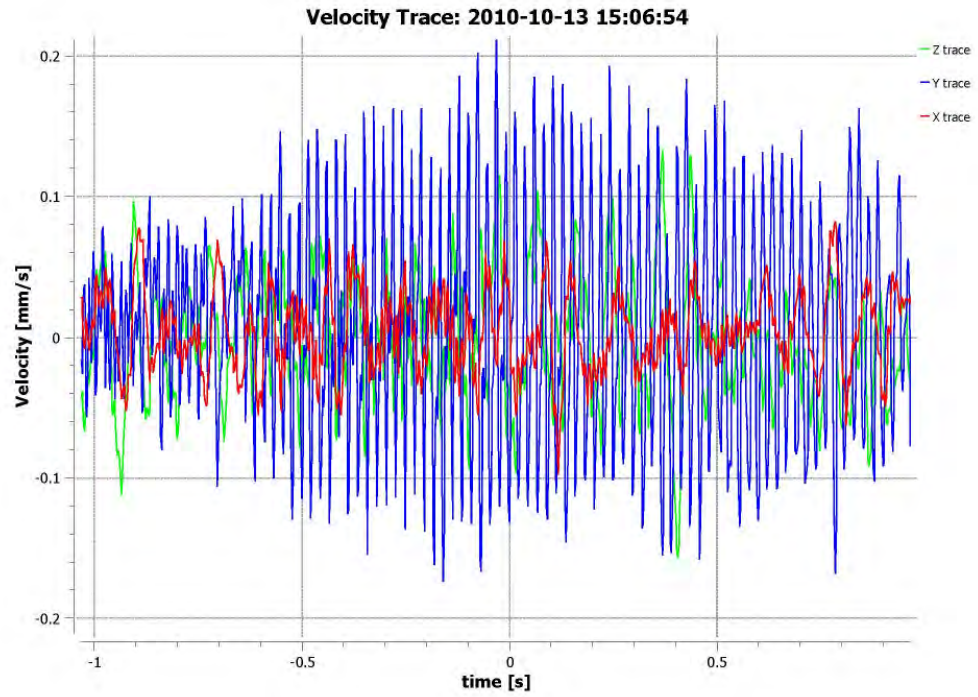


Figure 1.13 Trace for Vibration Event Recorded at 17.45 on the 13th October 2010

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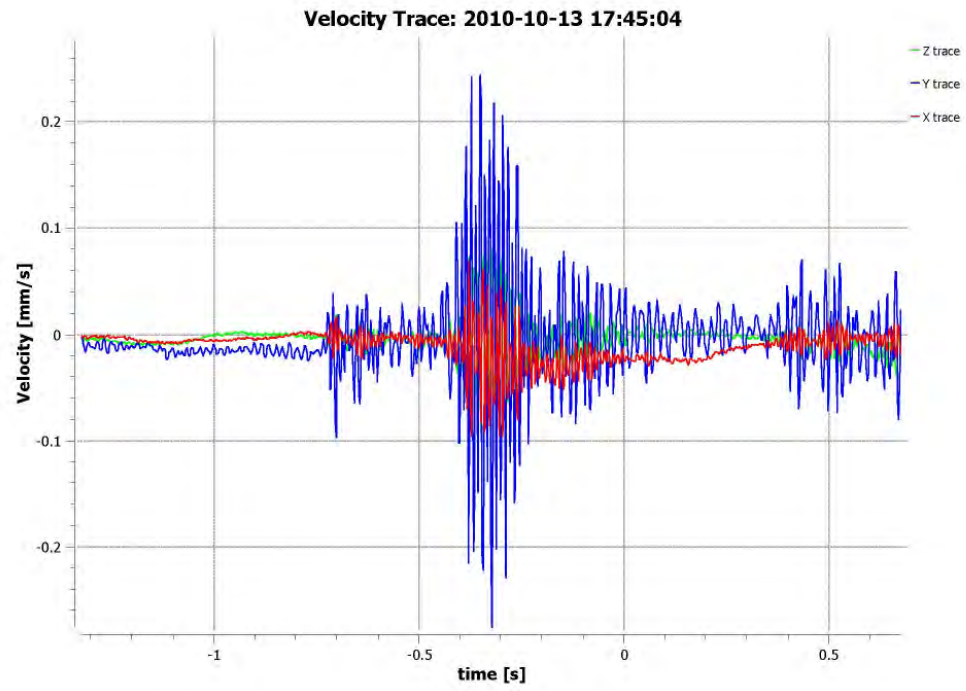
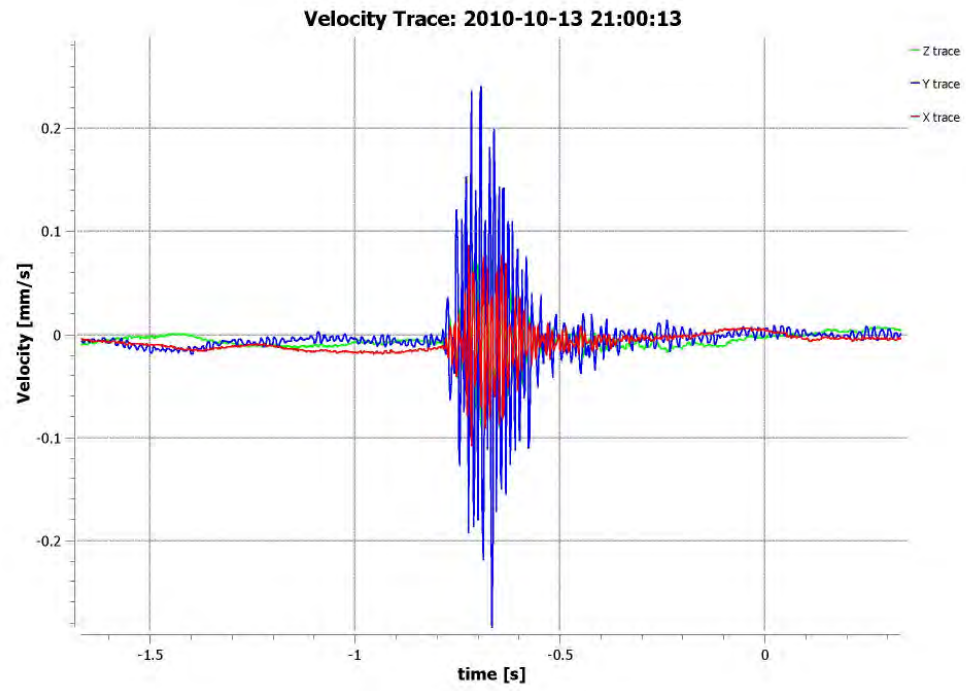


Figure 1.14 Trace for Vibration Event Recorded at 21.00 on the 13th October 2010



### 1.2.2 *Vibration Levels Measured from the 13<sup>th</sup> to the 19<sup>th</sup> October 2010*

The following graphs in *Figures 1.15 – 1.21* present the measured PPV vibration levels for each complete day of the vibration survey. The events that resulted in vibration levels above the top scale have been analysed in the same way as the traces shown in *Figures 1.2 to 1.14* and were found to be extraneous events unrelated to train vibration. A graph showing the full extent of the vibration magnitudes is included in *Figure 1.1* of Appendix A of Chiltern Railways' rebuttal to Professor Korsunsky's proof [CRCL/R/OBJ295]. The scale of the graphs has deliberately been set so that the details of the majority of events can be seen.

Figure 1.15 Results of the Vibration Monitoring on the 13th October 2010

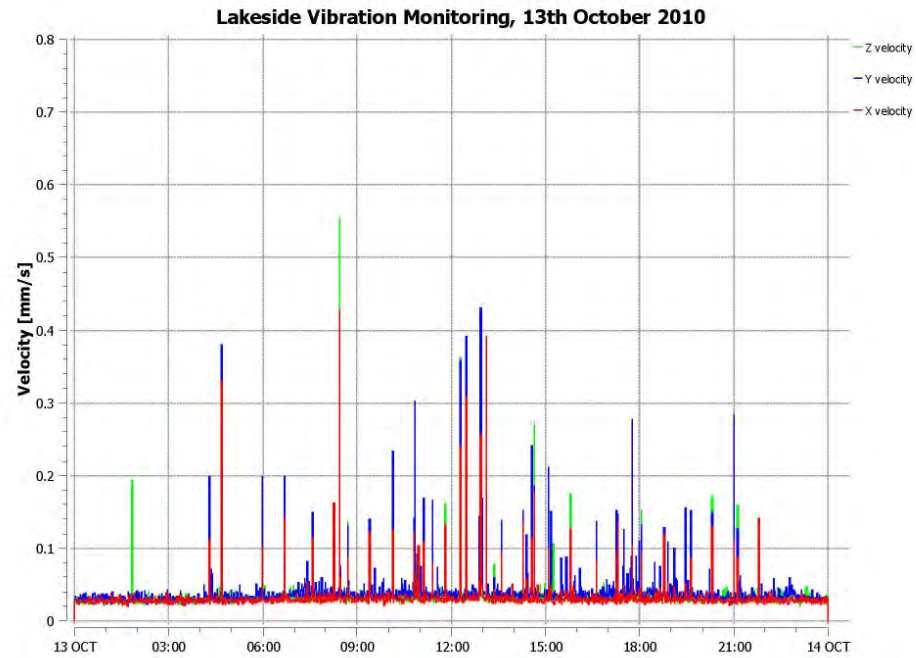


Figure 1.16 Results of the Vibration Monitoring on the 14th October 2010

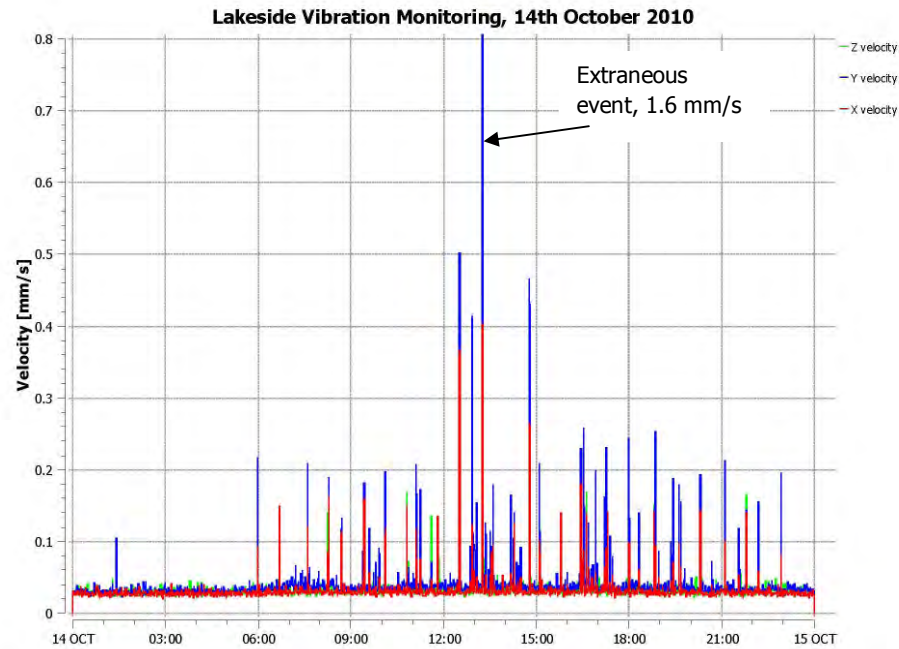


Figure 1.17 Results of the Vibration Monitoring on the 15th October 2010

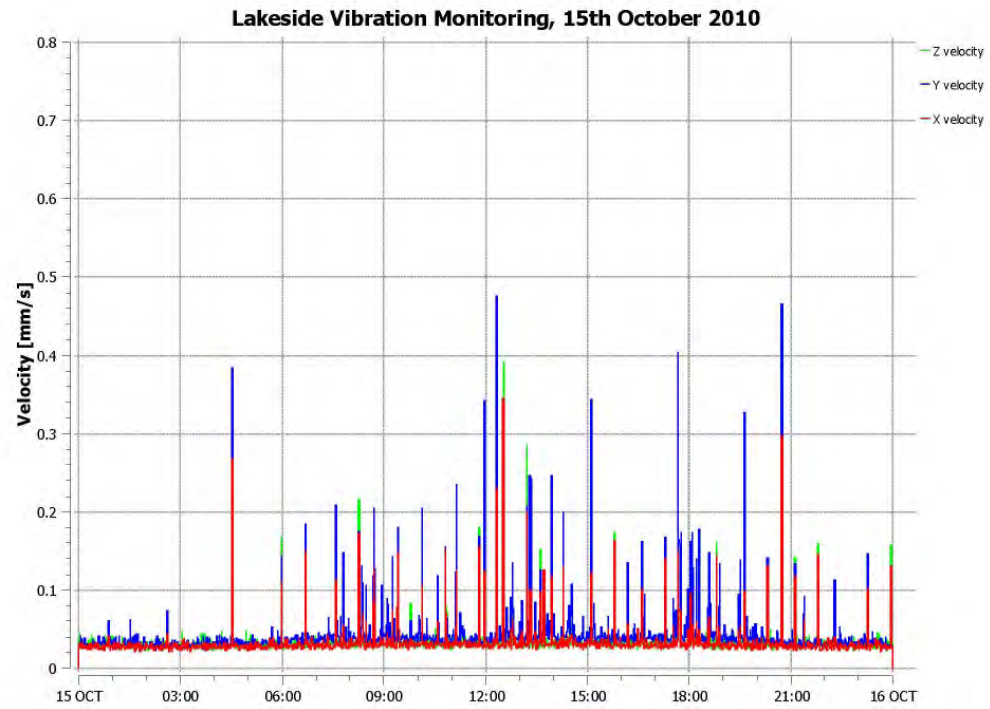


Figure 1.18 Results of the Vibration Monitoring on the 16th October 2010

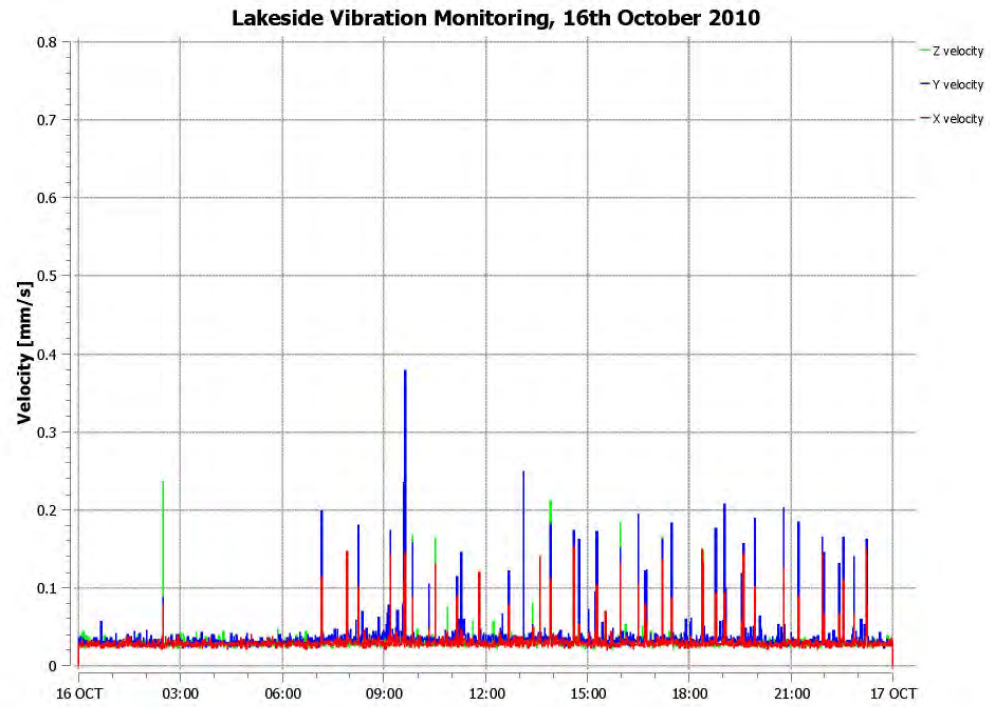


Figure 1.19 Results of the Vibration Monitoring on the 17th October 2010

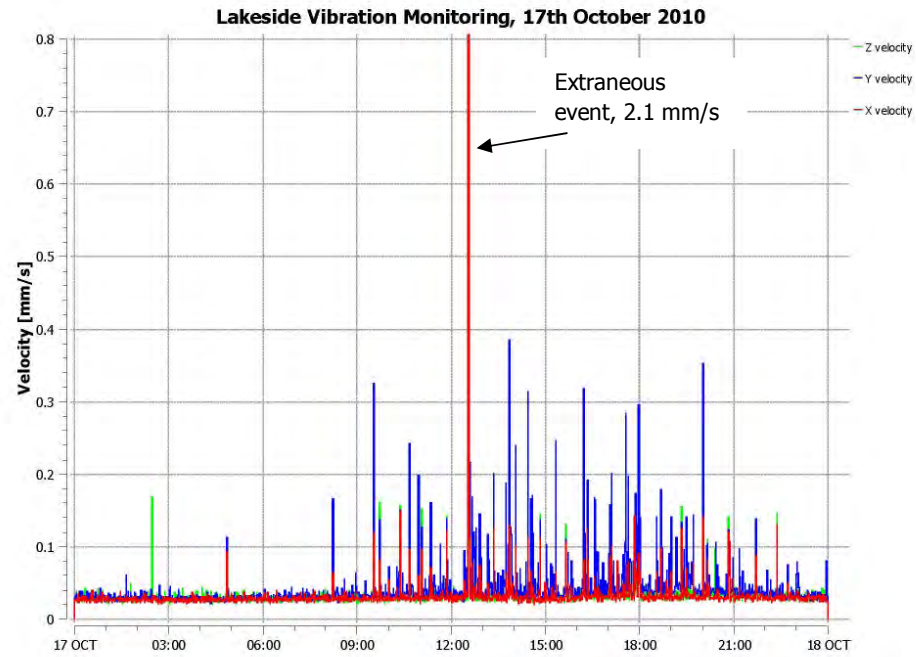


Figure 1.20 Results of the Vibration Monitoring on the 18th October 2010

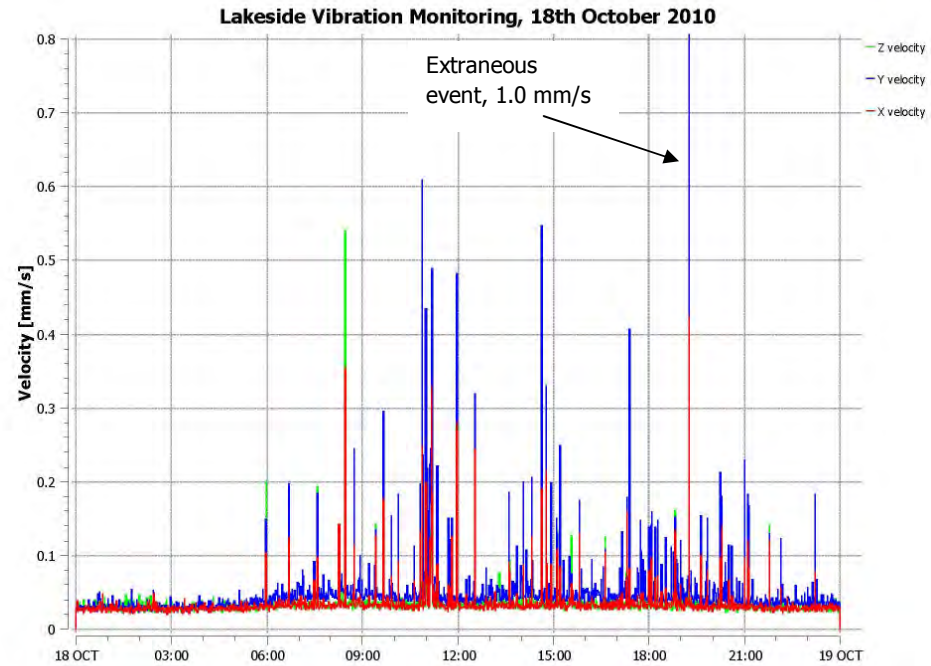


Figure 1.21 Results of the Vibration Monitoring on the 19th October 2010

