

**PROOF OF EVIDENCE OF MICHAEL FRASER  
NOISE AND VIBRATION**



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

**TRANSPORT AND WORKS ACT 1992**

**TRANSPORT AND WORKS (APPLICATIONS AND OBJECTIONS  
PROCEDURE) (ENGLAND AND WALES) RULES 2006**



**Chiltern Railways**

**FINAL  
27 SEPTEMBER 2010**

## **CONTENTS**

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	<b>QUALIFICATIONS AND EXPERIENCE</b>	<b>1</b>
	<b>STATEMENT OF MATTERS</b>	<b>1</b>
	<b>GENERAL POSITION</b>	<b>2</b>
	<b>SCOPE OF EVIDENCE</b>	<b>3</b>
	<b>ACOUSTIC TERMINOLOGY</b>	<b>3</b>
	<b>STRUCTURE OF EVIDENCE</b>	<b>5</b>
<b>2</b>	<b>APPROACH TO CONSTRUCTION AND OPERATIONAL NOISE ASSESSMENT AND MITIGATION</b>	<b>6</b>
	<b>ASSESSMENT OF CONSTRUCTION NOISE</b>	<b>6</b>
	<b>ASSESSMENT OF OPERATIONAL NOISE</b>	<b>8</b>
	<b>CONSTRUCTION VIBRATION</b>	<b>13</b>
	<b>OPERATIONAL VIBRATION</b>	<b>15</b>
<b>3</b>	<b>SUMMARY OF NOISE ASSESSMENT AS REPORTED IN THE ES</b>	<b>17</b>
	<b>CONSTRUCTION NOISE IMPACTS</b>	<b>17</b>
	<b>OPERATIONAL NOISE IMPACTS</b>	<b>19</b>
	<b>CONSTRUCTION VIBRATION IMPACTS</b>	<b>32</b>
	<b>OPERATIONAL VIBRATION IMPACTS</b>	<b>33</b>
<b>4</b>	<b>FURTHER NOISE ASSESSMENT, INCLUDING MODELLING AND BARRIER DESIGN, FOLLOWING THE PUBLICATION OF THE ENVIRONMENTAL STATEMENT</b>	<b>35</b>
	<b>INTRODUCTION</b>	<b>35</b>
	<b>NOISE MONITORING</b>	<b>35</b>
	<b>NOISE MODELLING</b>	<b>35</b>
	<b>VIBRATION ASSESSMENT CARRIED OUT SINCE THE ES</b>	<b>35</b>
<b>5</b>	<b>RESOLUTION OF NOISE AND VIBRATION OBJECTIONS</b>	<b>37</b>
	<b>INTRODUCTION</b>	<b>37</b>
	<b>PROVISION OF NOISE AND VIBRATION MITIGATION</b>	<b>37</b>
	<b>PROCEDURES ADOPTED TO RESOLVE OBJECTIONS</b>	<b>38</b>
	<b>OUTSTANDING OBJECTORS</b>	<b>46</b>
<b>6</b>	<b>CONCLUSIONS</b>	<b>60</b>

## **APPENDICES**

**Appendix MF 1: NOISE MONITORING RESULTS**

**Appendix MF 2: NOISE MODELLING RESULTS**

**Appendix MF 3: VIBRATION MONITORING RESULTS**

**Appendix MF 4: STANDARD RESPONSES TO OBJECTORS**

# 1 INTRODUCTION

## QUALIFICATIONS AND EXPERIENCE

- 1.1 My name is Michael Fraser. I hold a Degree in Electroacoustics from the University of Salford, and I am a Member of the Institute of Acoustics. I have worked in the field of environmental noise for more than 20 years and I am a Principal Consultant with Environmental Resources Management (ERM). In that capacity I am responsible for assessing environmental noise effects from a wide range of developments.
- 1.2 I have assessed noise effects from railway systems including the noise and vibration effects from the DLR London City Airport, Woolwich Arsenal extensions, the DLR Capacity Enhancement project (between Bank/Tower Gateway and Lewisham) and the Stratford International Extension. I provided technical review and input for the Waverley railway project in Scotland, and have undertaken assessment of Luas, Metro West and Metro North Schemes in Dublin. I have also undertaken a detailed barrier design study for the London City Airport Extension and have since measured noise from trains operating on this route. I have also undertaken numerous planning studies for proposed housing developments located close to existing railway lines.
- 1.3 I am responsible for the noise and vibration assessment of the Chiltern Railways (Bicester to Oxford Improvements) Order Scheme.

## STATEMENT OF MATTERS

- 1.4 The Secretary of State for Transport [‘the Secretary of State’] issued a Statement of Matters for the TWA Inquiry on 25 August 2010. In this Proof of Evidence, I address, in particular, the following matter from that Statement of Matters, in whole or in part:
- 1.5 “5. The likely impact on local residents, businesses and the environment of constructing and operating the Order Scheme, including:
- (a) noise and vibration”.
- 1.6 Noise impacts to ecology regarding matter 10 (e) from the Statement of Matters is addressed, in whole or in part, in Andy Coates’ Proof of Evidence (CRCL/P/10/A). This matter is stated as follows:
- 1.7 “10. The measures proposed by Chiltern Railways for mitigating any adverse impacts of the Order Scheme, including:
- (e) whether, and if so, to what extent, any adverse environmental impacts would still remain after the proposed mitigation”.
- 1.8 In the Summary Proof of Evidence of Michael Fraser, I present a summary of evidence in relation to Statement of Matters 5 (a) and my conclusions.

## GENERAL POSITION

- 1.9 My evidence covers potential environmental noise and vibration effects associated with the construction and operation of the proposed Order Scheme. As such I report on the likely extent of disturbance from noise and vibration as a result of the works proposed.
- 1.10 The general position regarding noise and vibration during construction is that there is potential for temporary noise impacts, but noise mitigation will be applied which will reduce the noise impacts. Most of the work will be carried out during the day. Short periods of disturbance (up to 10 nights at each location) will be required at four locations. Track lowering at the Wolvercot Tunnel will result in night-time noise impacts over a period of up to 4 months, based on worst case assumption regarding mitigation performance, but further mitigation can occur through liaison with the Local Authority to address any residual noise impacts so as to minimise disturbance.
- 1.11 Operational noise from trains could result in significant noise, but has in fact been well controlled even beyond the statutory requirements by the Order Scheme Promoter, Chiltern Railways. Through the design of the track and track bed, the Promoter will use the Best Practicable Means to design the railway so as to avoid significant noise and vibration impacts at existing sensitive receptors (e.g. residential properties, educational buildings and places of worship). The key steps in the approach to mitigation are described in paragraphs 1.12 to 1.16 below.
- 1.12 Where track design measures are not sufficient to mitigate significant impacts the Promoter will, if effective and reasonably practicable, provide noise barriers to mitigate noise between the track and sensitive receptors.
- 1.13 After considering all practicable mitigation measures that can be taken at source (i.e. within the railway corridor), including noise barriers, the Promoter will offer noise insulation where impacts on sensitive receptors are high.
- 1.14 The Promoter will consult with those parties who may be affected by noise and vibration explaining the mitigation measures that are proposed.
- 1.15 The Promoter will reassess the impacts of noise and vibration during the detailed design of the Order Scheme to ensure the design incorporates mitigation measures in accordance with these commitments.
- 1.16 A Draft Noise and Vibration Mitigation Policy is being produced by Chiltern Railways. This Noise Policy document is currently going through an approval process at Network Rail and will be submitted to the Inquiry once approved. The commitments in this document will be enforced through a planning condition which will make it legally binding. The Draft Noise and Vibration Mitigation Policy will apply to Chiltern Railways who will apply the mitigation necessary for the operation of the route in Phase 1 and Phase 2A, and it will also apply to the promoters of the East West Rail Scheme who will apply mitigation if and when Phase 2B is constructed.
- 1.17 The noise mitigation commitments in the Draft Noise and Vibration Mitigation Policy go beyond statutory requirements and are consistent with best practice in the industry. However, after mitigation has been delivered affected parties

may be eligible for compensation. The principles of compensation are dealt with in the Proof of Evidence of Mr Caten (**CRCL/P/11/A**).

1.18 No sources of vibration during construction or operation will give rise to building damage. Significant disturbance of building occupants from construction vibration levels are not expected during construction of the Order Scheme. The location of plant such as driven piling equipment will be restricted to locations where it will not disturb building occupants. The levels of ground vibration from trains during operation are not expected to result in significant disturbance impacts beyond approximately 10 m from the tracks. There are only five locations which receptors are within this distance. In these areas specialist resilient track forms will be used, if practicable, so that vibration from the new track at the nearest sensitive receptors will be no higher than the levels specified in BS 6472 for 'a low probability of adverse comment'. Properties which lie in close proximity to switches or crossings may receive higher levels of vibration as a result of discontinuities in the track. Design measures will therefore be proposed to minimise vibration levels at these locations. These commitments will be included in the Draft Noise and Vibration Mitigation Policy which is being developed.

#### **SCOPE OF EVIDENCE**

1.19 I refer extensively to the following parts of the Environmental Statement (ES):

- **Volume 2, Chapter 6**, which reports the assessment of noise and vibration from the construction and operation of the extension;
- **Volume 4, Annex D**, which provides reports further detail on the noise and vibration assessment;
- **Volume 3**, noise and vibration **Figures 6.1A to 6.1Q**; and
- **Volume 4, Appendix B**, which is the draft Code of Construction Practice for the Order Scheme, setting out noise and vibration control measures during construction.

1.20 In my assessments of noise and vibration, both in the ES and this proof, I have quantified expected levels, I have compared them against recognised standards and I have recommended mitigation measures where necessary to meet those standards where possible. Where adequate mitigation is not likely to be available I have reported residual effects.

1.21 To discuss the expected effects of noise and vibration I must refer to the noise and vibration numerically. The key terminology and metrics that are required are discussed below. This section explains the two main measures used to assess noise:  $L_{Aeq, period}$  and  $L_{Amax}$ . The  $L_{Aeq, period}$  metric is the recommended metric for assessing railway noise in PPG 24 (**CD/3.4**), Calculation of Railway Noise (**CD/5.12**) and the Noise Insulation (Railways and other Guided Transport Systems) Regulations 1996 (**CD/5.13**).

#### **ACOUSTIC TERMINOLOGY**

1.22 There are two sources of potential noise and vibration effects which can arise from the construction and operation of a surface railway, both of which I have considered. These are:

- *Airborne noise*: noise from above ground propagating through the air to the receptor; and
- *Ground vibration*: vibration propagating via the ground to a receptor building.

1.23 Noise levels are quantified on the decibel (dB) scale. This scale is logarithmic, which means that noise levels do not add up or change according to simple linear arithmetic. For example, two equal noise sources add up to a total noise level that is only 3 dB higher than the individual level of each. Furthermore, the human ear has such a large dynamic range that an increment of 1 dB is a very small change in noise. In fact changes in environmental noise levels of less than 2 to 3 dB are not noticeable to most people. A change in noise level of 10 dB is generally judged to be a subjective doubling of noise. The noise levels experienced in some common situations are given in Table 1 to help illustrate the decibel scale of sound level.

**Table 1 Examples of Noise Levels on the Decibel Scale**

Noise level, $L_{Aeq}$ (dB)	Noise Source
0	Threshold of hearing
30	Quiet bedroom at night
40	Whispered conversation at 2m
50	Conversational speech at 1m
60	Busy general office
70	Loud radio indoors
80	Lorry at 30 kph at 7m
90	Lawnmower at 1 m

1.24 Environmental noise generally varies over time. This means that statistical treatments such as averaging are required to quantify it. Modern sound level meters contain electrical circuitry to carry out such treatments when measuring noise. The most common treatment is logarithmic averaging to produce what is termed the Equivalent Sound Level,  $L_{eq}$ .

1.25 Sound level meters also generally apply a frequency weighting called the ‘A’ weighting to calibrate the instrument to the frequency response of the human ear which is much less sensitive to low frequency sound than to high frequencies. Thus the A-weighted equivalent level is the most common unit, and is written  $L_{Aeq}$  having the units of decibels (dBs.) The measurement time interval is generally written as part of the subscript, thus  $L_{Aeq, 0700-1900}$  hours is the A-weighted equivalent sound level averaged over the period 0700 hours to 1900 hours. The  $L_{Aeq}$  value is sensitive to changes in peak noise and is recommended for time varying noise sources such as train noise.

1.26 A measure of the ‘peak’ in a varying sound signal is the maximum A-weighted noise level,  $L_{Amax}$ .

1.27 Vibration Dose Value (VDV) is a measure of the accumulated level of ground vibration over a period and, through the application of BS6472, is the recommended metric for predicting the likelihood of adverse comments from affected building occupants. VDV is sensitive to the peak values of vibration.

1.28 Peak Particle Velocity (PPV) is a standard measure of peak vibration that is used to assess the potential for damage to building structures.

#### **STRUCTURE OF EVIDENCE**

1.29 The structure of the proof of evidence is outlined below.

- *Section 2* considers the approach to the assessment, criteria, methodology and mitigation of noise and vibration;
- *Section 3* summarises the results of the ES;
- *Section 4* describes further assessment work that has been carried out since the ES was published to further refine the mitigation of noise impacts;
- *Section 5* Summarises responses that have been made on key issues raised by Objectors, and responses to outstanding objector points.
- *Section 6 Conclusions*

My proof of evidence is accompanied by the following Appendices, bound separately as **CRCL/P/9/B**.

Appendix MF 1: Noise Monitoring Results

Appendix MF 2: Noise Modelling Results

Appendix MF 3: Vibration Monitoring Results

Appendix MF 4: Standard Responses to Objectors

## 2 APPROACH TO CONSTRUCTION AND OPERATIONAL NOISE ASSESSMENT AND MITIGATION

### ASSESSMENT OF CONSTRUCTION NOISE

#### Assessment Criteria

2.1 To evaluate the impact of construction noise, it is necessary to establish criteria above which some noticeable adverse effect may be experienced. Thresholds above which a significant construction noise impact is considered to occur are set out in Table 2 below, derived from BS 5228 <sup>(1)</sup> (CD/5.27) and other published guidance.

**Table 2 Criteria for Defining Significant Noise Impacts During Construction**

Period	Building/Type of use	Threshold for Significant Impact (façade) $L_{Aeq,T}^{(1)}$	Purpose
Daytime (0700 – 1900)	Dwellings/Offices	70dB	To maintain speech intelligibility
	Educational Buildings	65dB	To maintain speech intelligibility in classrooms
Evening (1900 – 2300)	Dwellings	65dB	To avoid disturbance
Night-time (2300 – 0700)	Dwellings	45dB <sup>(2)</sup>	To avoid sleep disturbance with a partially open window

<sup>(1)</sup>  $L_{Aeq}$  over the time intervals shown except at night when  $L_{Aeq}$  over 1 hour is used  
<sup>(2)</sup> or equal to ambient  $L_{Aeq}$  levels if the ambient noise level is higher than 45dB

2.2 The night-time criterion of 45 dB  $L_{Aeq}$  is used to determine the level above which noise has the potential to result in sleep disturbance. In some situations, higher levels may be acceptable for the following reasons:

- ambient noise levels already exceed 45 dB  $L_{Aeq}$ ;
- windows may be closed; and
- construction impacts are temporary.

2.3 The criteria apply at 1m from the facades of noise sensitive properties and take into account reflection effects. These criteria are not noise limits for construction activities, but are used solely to determine whether significant impacts are expected to occur.

(1) British Standard BS 5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: Noise. BSi, 2009.

## Construction Noise Methodology

- 2.4 Construction of the Order Scheme will largely take place during the day and will include the following elements:
- track and embankment works which are spread along the alignment;
  - structures; and
  - stations.
- 2.5 Normal hours of work are expected to be Monday to Friday from 0700 to 1900 hours and on Saturdays from 0800 to 1300 hours. Work may be undertaken outside normal hours of work after consultation with the relevant local authority and is likely to take place in the following circumstances:
- When equipment is required to run continuously for safety reasons.
  - When activities require the closure of a major road or railway.
  - Construction of a major railway structure. The areas where this is most likely are the Bicester Chord or where works are required on the operational railway.
  - Works to underbridges.
- 2.6 Construction noise levels have been predicted using the methodology set out in BS 5228 taking account of the database of measured data of items of construction plant provided. Construction plant inventories for main site activities have been compiled and noise levels from the works predicted at the closest noise sensitive properties and assessed against the criteria discussed in Table 2 to determine significance.

## Approach to Mitigation for Construction Noise

- 2.7 The approach I have adopted is well established and widely used to assess and mitigate construction noise from development and infrastructure projects. The principal legislation, the Control of Pollution Act 1974, recognises that noise disturbance cannot be used as a reason to prevent necessary construction projects, by advocating the use of 'Best Practicable Means' for reducing construction noise. The contractor will follow the procedures in the Revised Draft Code of Construction Practice (**CD/1.24**) to mitigate noise from construction sites.
- 2.8 For any night work that will be required, the Contractor will have to apply to the local authority for 'prior consent' under Section 61 of the Act. In order to approve a 'Section 61 agreement' the local authority will generally require noise predictions, based on the contractor's chosen methods of working, in order to demonstrate that the best practicable means will be used. The consent then legally binds the contractor to use those means, so the mitigation measures are enforceable.

## ASSESSMENT OF OPERATIONAL NOISE

### Assessment Criteria

- 2.9 The assessment methodology is set out in **Chapter 6** and **Volume 4, Annex D** of the Environmental Statement (**CD/1.18**) submitted with the Transport and Works Act Order Application for the Order Scheme.
- 2.10 There are no statutory limits on operational noise from railways in the UK. However, to assess noise impacts from the Order Scheme, an assessment methodology has been adopted that considered both absolute thresholds of train noise impact and also the extent to which train noise would increase existing ambient levels. This has been derived as follows.
- 2.11 Planning Policy Guidance Note (PPG) 24 <sup>(1)</sup> (**CD/3.4**) primarily gives guidance on planning new housing development and establishes Noise Exposure Categories (NECs) intended to provide guidance on the levels of acceptable noise for new housing developments that should be taken into account when determining planning permission.
- 2.12 There are four NECs ranging from NEC A to NEC D; with NEC A representing the noise levels at which need not be considered as a determining factor in granting planning permission for new housing next to existing noise sources as follows:
- For daytime noise,  $L_{Aeq, 0700-2300 \text{ hours}}$  55 dB.
  - For night-time noise  $L_{Aeq, 0700-2300 \text{ hours}}$  45 dB.
- 2.13 This guidance is for the planning of new houses next to existing noise sources. It is noted that the situation regarding the Order Scheme is not the reverse of this, but rather an existing railway corridor that is now to be better used for its purpose alongside which houses have been constructed. The standards applied to new housing are necessarily strict because housing can be built anywhere. This is not the case for noise sources such as existing railway upgrades, such as this Order Scheme, where the existing railway corridor primarily determines the route followed by the Order Scheme. PPG 24 recognises that much of the development which is necessary for the creation of jobs and construction and improvement of essential infrastructure will generate noise. PPG 24 indicates that the planning should ensure that such development does not create an unacceptable degree of disturbance, but also that the planning system should not place unjustifiable obstacles in the way of such development. .
- 2.14 The basis of these NEC levels in paragraph 2.12 of PPG 24 is a large body of research that has found that at levels below these, few people are annoyed by noise. The National Noise Incidence Study 2000 found that 55±3% of the population of England and Wales live in dwellings exposed to day-time noise levels above 55 dB  $L_{Aeq, day}$  and 68±3% of the population of England and Wales live in dwellings exposed to night-time noise levels above 45 dB  $L_{Aeq, night}$ .

(1) Planning and Noise, DoE 1994.

- 2.15 It is for these reasons that I consider these threshold levels to be stringent assessment criteria to adopt and criteria that should not be applied in isolation without consideration of pre-existing ambient noise levels.
- 2.16 The Noise Insulation (Railways and other Guided Transport Systems) Regulations 1996 (**CD/5.13**) impose a duty on the operators of railways to offer a package of noise insulation and associated measures for living rooms and bedrooms in dwellings and other residential buildings. They apply to new or modified railway systems that require the approval of the Secretary of State under the Transport and Works Act 1992 before being brought into use.
- 2.17 Insulation is mandatory in the case of long-disused systems being re-opened and for new or extended systems, but is discretionary in the case of altered systems. In all cases, the trigger levels (free-field, ie away from reflective surfaces) for the provision of noise insulation are as follows:
- 66 dB  $L_{Aeq, daytime}$  (daytime is defined as 0600-2400 hours);
  - 61 dB  $L_{Aeq, night}$  (night is defined as 2400-0600 hours).
- 2.18 Note that the predicted noise levels in Table 11 are quoted in free-field noise levels (ie noise levels excluding noise reflections from the façade which are lower than façade levels by 2.5 dB). The noise insulation trigger levels in the Regulations are quoted as 68 dB for daytime and 63 dB for night, but they include the “façade” correction of 2.5 dB. The equivalent free-field levels are 66 dB and 61 dB (to the nearest decibel).
- 2.19 Vehicles on the transport system must cause noise levels to increase by at least 1 dB and the new, altered or extended part must contribute at least 1 dB to the total noise. The assessment is to be made at the facades of residential buildings within 300 metres of the transport system. The Regulations also grant discretionary powers to the operator for the provision of insulation against construction noise.
- 2.20 These standards are taken as an unacceptable noise level and the standard above which noise insulation shall be applied to mitigate operational noise from any qualifying scheme.
- 2.21 While noise insulation is effective at avoiding noise intrusion into properties, it has several disadvantages over noise control at source; it does nothing for external areas, it can prevent opening windows, and it may cause inconvenience to the building occupant. For these reasons it is considered a low priority mitigation measure in the mitigation hierarchy.
- 2.22 In addition to comparing the levels of noise that are expected to be generated against defined day and night-time threshold levels (presented above) which annoyance or disturbance of everyday activities begins to occur; consideration must also be given to the change in ambient noise levels that will occur with the Order Scheme in operation.
- 2.23 The assessment of noise from trains using the Order Scheme adopts a combination of both approaches, and where changes in ambient noise are considered, the significance of noise impacts is assessed as follows.

**Table 3 Significance of Noise Impacts**

Amount by which Noise Criterion is Exceeded or Change in Ambient Noise Level	Impact
0 dB	None
Less than 3 dB	Slight
3 to 5 dB	Moderate
5 to 10 dB	Substantial
Greater than 10 dB	High

2.24 Using these thresholds, noise from the Order Scheme will fall into one of the following three bands:

1. Train noise below noise impact thresholds – no impact.
2. Train noise between noise impact thresholds and noise insulation trigger levels – impacts to be evaluated and baseline noise levels to be considered.
3. Train noise above noise insulation trigger levels – high impacts expected depending on baseline noise level.

2.25 If the level of train noise is below ambient noise, train noise will be less noticeable and impacts are unlikely. Hence a second tier of assessment is required in cases 2 and 3. In case 2, the predicted level of train noise is added to the measured ambient noise level to establish the change in noise that would be expected. In case 3, the Noise Insulation Regulations require that an increase of 1 dB or more due to the new noise needs to be mitigated. This is summarised below.

**Table 4 Summary of Noise Assessment Criteria (Free-field)**

Predicted Train Noise Level $L_{Aeq, period}$	Increase in Ambient ( $L_{Aeq, period}$ ) Noise or Exceedence of Threshold (free-field)	Impact Descriptor
Case 1		
Day < 55 dB (0700-2300 hrs)	N/A	No Impact
Night < 45 dB (2300-0700 hrs)	N/A	No Impact
Case 2		
Day	< 1 dB	No impact
> 55 dB (0700-2300 hrs) < 66 dB (0600-0000 hrs)	1 to 3 dB <sup>(1)</sup>	Slight impact
	3 to 5 dB	Moderate impact
	5 to 10 dB	Substantial impact
	>10 dB	High impact
Night	< 1 dB	No impact
>45 dB (2300-0700 hrs) < 61 dB (0000-0600 hrs)	1 to 3 dB	Slight impact
	3 to 5 dB	Moderate impact
	5 to 10 dB	Substantial impact
	>10 dB	High impact
Case 3		
Day > 66 dB (0600-0000 hrs).	>1 dB	Significant impact, need for noise insulation triggered
Night > 61 dB (0000-0600 hrs)	>1 dB	Significant impact, need for noise insulation triggered

Predicted Train Noise Level $L_{Aeq, period}$	Increase in Ambient ( $L_{Aeq, period}$ ) Noise or Exceedance of Threshold (free-field)	Impact Descriptor
(1) Where increases are at the border between two impact descriptors, the impact has been described as the less significant of the two significance descriptors. In Case 2 the lower of the noise change and exceedance of threshold values determines the impact.		

- 2.26 In addition, if maximum pass-by free-field noise ( $L_{Amax}$ , the instantaneous 'peak' as the train passes) regularly exceeds 82 dB, a significant impact is considered to occur, based on guidance on the prevention of sleep disturbance in PPG 24, except where ambient maximum noise levels are already above the predicted train noise level.
- 2.27 Such standards for assessing noise impacts on railway schemes have been adopted on other rail schemes in the UK. Many of these projects have been subject to Public Inquiries where the criteria and standards adopted were placed under close scrutiny. Schemes for which ERM provided the noise assessment using criteria based on the standards above include the following.
- NET Tram System Phase 2, NET (Nottingham) which has gained approval under the Transport and Works Act;
  - Centro Tram system (Birmingham) which has gained approval under the Transport and Works Act;
  - Edinburgh Tram Line 1 which gained the approval of the Scottish Parliament;
  - The Edinburgh Airport Rail Link which gained the approval of the Scottish Parliament; and
  - the Waverley Railway (now referred to as the Borders Railway) which gained the approval of the Scottish Parliament.
- 2.28 A review of heavy rail Schemes was also carried out, and the standards adopted for this Order Scheme were found to agree well with other Scheme assessment methodologies. The Schemes that were reviewed included the Glasgow Airport Railway Link (GARL), Hitchin (Cambridge Junction) and the Channel Tunnel Rail Link (CTRL).

### Train Noise Prediction Methodology

- 2.29 The Order Scheme has been considered in two phases, an initial *Phase 1* in which Chiltern Railways will operate an enhanced passenger service between Oxford and London and the current freight train service will continue, and *Phase 2B (referred to in general as Phase 2)*, in which EWR and others may operate additional services. Although there was the possibility that Cross Country trains planned to run trains when the ES was produced, they have since withdrawn this from their business plan. Therefore, the traffic that was assumed in the ES represents a worst-case prediction of the potential noise impacts. Although it would have been possible to remove these trains from the analysis of train noise they have been left in. This is to avoid the potential for changes in the likely mitigation that was published in the ES at critical locations as a result of this factor. In some marginal cases it is possible that the change in train movements could result in the withdrawal of an offer of a mitigation, which might lead to concerns from residents who had not objected as a result of a barrier being shown in the ES. Phase 2 also includes additional freight services which may run throughout the night and therefore

considers the 'worst-case' scenario and predicts the highest noise levels that are likely to occur from the operation of either *Phase 1* or *Phase 2*. In all cases, it is expected that *Phase 2* will produce higher noise levels at the nearest noise sensitive receptors and therefore this scenario has been adopted for this assessment.

2.30 Full details of the assumptions and modelling inputs are set out in **Chapter 6** and Annex D of the ES.

2.31 Noise from the operation of the railway has been predicted using the Calculation of Railway Noise procedure (CRN) developed by the Department of Transport in 1995 (**CD/5.12**). CRN is based on real measurements of many of the types of trains that are expected as a result of the Order Scheme. Additional measurements have been made to supplement CRN source data in some cases and outlined in **Annex D** of the ES (**CD/1.18**). Predictions are based on the following:

- expected passenger and freight train service frequency;
- train types;
- expected train speeds;
- train lengths;
- track type (Continuously Welded Rail (CWR) or jointed);
- location of bridges, structures and cuttings;
- gradients and likely areas of acceleration; and
- additional noise source terms provided in the *Additional Railway Noise Source Terms For "Calculation of Railway Noise 1995"* <sup>(1)</sup>.

2.32 Details of the input data used in the noise modelling may be found in **Annex D** of the Environmental Statement (**CD 1.18**) and are summarised in Table 5 and Table 6 below.

**Table 5 Modelled Train Movements along the Route during Phase 1**

Route Section	Number of Chiltern Train Movements		Number of Freight Train Movements	
	Day	Night	Day	Night
Bicester Chord	61	7	0	0
North of Gavray Junction	0	0	1	1
Gavray Junction to the MoD Sidings	61	7	1	1
MoD Sidings to the Banbury Road Sidings	61	7	3	1
Banbury Road Sidings to the Oxford North Junction	61	7	5	1
Oxford North Junction to Oxford Station	61	7	0 <sup>(1)</sup>	0 <sup>(1)</sup>

(1) There is no change in freight train movement as a result of Phase 1. Freight trains were measured (and not modelled) along this section of the Route to form the baseline, and so have not been modelled here.

(1) Additional Railway noise Source Terms For "Calculation of Railway Noise 1995". AEAT for Defra, 2007.

**Table 6 Modelled Train Movements Along the Route During Phase 2**

Route Section	Number of Chiltern Train Movements		Number of EWR Train Movements		Number of Cross Country Train Movements		Number of Freight Train Movements	
	Day	Night	Day	Night	Day	Night	Day	Night
Bicester Chord	61	7	0	0	0	0	0	0
North of Gavray Junction	0	0	64	14	32	7	17	8
Gavray Junction to the MoD Sidings	61	7	64	14	32	7	17	8
MoD Sidings to the Banbury Road Sidings	61	7	64	14	32	7	17	8
Banbury Road Sidings to the Oxford North Junction	61	7	64	14	32	7	17	8
Oxford North Junction to Oxford Station	61	7	64	14	0 <sup>(1)</sup>	0 <sup>(1)</sup>	0 <sup>(1)</sup>	0 <sup>(1)</sup>

(1) The Cross Country trains and Freight trains which use the route as a result of Phase 2 currently run between Oxford and Banbury using the section of the line between Oxford and the Oxford North Junction. For this reason there is no change in the number of these trains which use this section of the route as a result of Phase 2, and therefore they have not been modelled. As noted above, the assumed Cross Country Trains service between Bicester and Oxford North Junction is now unlikely to run.

2.33

***Approach to Mitigation for Operational Noise***

Where potential noise impacts are predicted, effective noise mitigation measures such as track based mitigation, noise barriers, or noise insulation will be applied, which will meet or exceed statutory requirements. Since publication of the ES, Chiltern Railways has developed a Draft Noise and Vibration Mitigation Policy which is undergoing Network Rail review and will be made available to the Inquiry. This draft document reflects the commitments that were made in the ES. The Draft Noise and Vibration Policy will be applied by both Chiltern Railways and the promoters of EWR, if and when it progresses. The mitigation provided will be based on the effects of noise and vibration and the service patterns that can be reasonably foreseen at the time of opening of the Chiltern Railways and EWR projects. This will be enforced through a planning condition.

2.34

Specific mitigation measures for operational noise from the Order Scheme are discussed in Section 5.1 of this Proof.

**CONSTRUCTION VIBRATION****Vibration Criteria**

2.35

Vibration from the construction of the Order Scheme has the potential to cause disturbance at sensitive receptors near to those works.

2.36

A summary of the relevant criteria for assessing the impact of vibration during construction is provided in *Table 7*. These criteria are applied to all vibration

sensitive receptors, although it is likely that higher levels of vibration are required to produce equivalent responses from the users of commercial buildings as against residential occupiers, depending on the sensitivity of those uses.

**Table 7 Criteria for Evaluating the Significance of Vibration during Construction**

Period	Building/Location	Criterion	Significance of Effect / Threshold
Anytime	Inside dwellings	0.3 mms <sup>-1</sup> PPV <sup>(a)</sup> / <sup>(b)</sup>	Threshold of Perception (Negligible effect below 0.3 mms <sup>-1</sup> ) Slight effect which is insignificant between 0.3 mms <sup>-1</sup> and 1.0 mms <sup>-1</sup>
Anytime	Inside dwellings	1.0 mms <sup>-1</sup> PPV	Complaints likely from residential occupiers, but may be tolerated if prior warning and explanation has been given to the residents (Moderate effect: above 1.0 mms <sup>-1</sup> )
Anytime	Inside dwellings	10.0 mms <sup>-1</sup> PPV	Vibration is likely to be intolerable for any more than a very brief exposure to this level. (Major effect: above 10.0 mms <sup>-1</sup> )
Anytime	Reinforced or framed structures and heavy commercial buildings	50 mms <sup>-1</sup> PPV	Protection of building structure. Levels above this are defined Major Effects, and levels below this are defined as Negligible.
Anytime	Un-reinforced or light framed structures. Residential or light commercial buildings.	15 mms <sup>-1</sup> PPV	Protection of building structure. Levels above this are defined Major Effects, and levels below this are defined as Negligible.

(a) PPV denotes peak particle velocity, as given in BS 7385 Part 2, 1993.

(b) Equipment manufacturers should be consulted where equipment malfunction could have serious consequences.

### **Construction Vibration Methodology**

2.37

The effects of vibration were considered in the ES and a robust approach was taken by considering the effect of the types of plant that are likely to result in the most significant levels of vibration. These include vibratory compaction and bored piling. It is expected that driven piling methods will not be used, except where absolutely necessary or well away from residential properties, in order to ensure acceptable levels of noise and vibration during construction. Sheet piles may be used close to water courses, however these are likely to be pushed into the ground rather than driven. Empirical data have been used

to assess the potential for disturbance and building damage during construction.

### ***Approach to Mitigation of Construction Vibration***

- 2.38 Vibration effects will be controlled in accordance with the Revised Draft Code of Construction Practice (**CD/1.24**).

### **OPERATIONAL VIBRATION**

#### ***Assessment Criteria Operational Vibration***

- 2.39 Train movements have the potential to cause impacts through vibration, causing building occupiers to perceive vibration and at certain levels to become annoyed by it. Residents in north Oxford have expressed concern that vibration from trains could damage building structures, and cause significant levels of annoyance to occupiers.

- 2.40 Vibration Dose Value (VDV) is a measure of the accumulated level of ground vibration over a period and, based on the guidance in BS 6472<sup>(1)</sup> (**CD/5.26**), is the standard metric for predicting the likelihood of adverse comments from affected building occupants. In planning terms, PPG24 (**CD/3.4**) indicates that BS 6472 should be used to assess vibration, but there is no guidance as to what is an acceptable level of disturbance. It is usually considered that the objective should be to avoid vibration levels where adverse comment would be probable.

- 2.41 BS 6472 gives the following VDV levels at or below which the probability of adverse comments is low:

- Day (0700-2300 hours) 0.4 m/s<sup>1.75</sup>; and
- Night (2300-0700 hours) 0.2 m/s<sup>1.75</sup>.

These criteria have been used as the basis of the assessment.

- 2.42 There may also be concern that vibration from trains could damage building structures. Vibration levels above which damage might occur are given in BS 5228 <sup>(2)</sup> (**CD/5.28**). The values for cosmetic damage are repeated below:

- reinforced or framed buildings 50 mm/s PPV; and
- un-reinforced or light framed buildings (typical residential) 15 mm/s PPV.

- 2.43 Vibration from trains at these levels arriving at adjacent properties is highly unlikely.

- 2.44 Groundborne noise (ie noise radiating from surfaces within a building as a result of ground vibration) from the Order Scheme will generally be at levels below that arriving via the conventional airborne path, and for this reason is

(1) British Standard BS6472-1:2008 Guide to the evaluation of human exposure to vibration in buildings. Part 1: Vibration Sources Other Than Blasting, BSi, 2008.

(2) BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration, BSi, 2009.

generally more of a concern for underground railways where airborne noise is absent. However, particularly noise sensitive buildings (eg sound recording studios) that are particularly well insulated against external airborne noise sources could potentially be affected. However, no such buildings have been identified in close proximity to the Order Scheme.

### **Operational Vibration Prediction Methodology**

2.45 Estimates of the levels of ground vibration that may be experienced have been based on measured vibration levels of similar trains to those that will be used on the upgraded Bicester to Oxford line adjacent to the London Marylebone – Banbury-Birmingham line, which is similar in terms of speed and track quality to the Order Scheme. Details of these measurements are provided in *Section D5.5.2* of **Annex D** of the Environmental Statement **Volume 4 (CD/1.18)**, and have been used as the basis of the assessment.

The results are summarised below in *Table 8*.

**Table 8 Measured Vibration Levels from Trains using the London Marylebone to Banbury and Birmingham line**

Train type	Vibration Level (Z-axis VDV) mm/s <sup>1.75</sup> at three distances from the track		
	5 m	8 m	13 m
Freight train	0.15	0.07	0.05
Passenger (DMU)	0.16	0.02	0.04
<b>Predicted daytime VDV (mm/s<sup>1.75</sup>)</b>	<b>0.58</b>	<b>0.14</b>	<b>0.15</b>
<b>Predicted night-time VDV (mm/s<sup>1.75</sup>)</b>	<b>0.39</b>	<b>0.12</b>	<b>0.11</b>

2.46 The expected levels of ground vibration at all buildings adjacent to the Order Scheme are below the assessment criteria in BS 6472 which relate to the structural integrity of buildings. Consequently, no impacts on buildings located adjacent to the Order Scheme are likely to occur.

### **Conclusion**

2.47 The potential for noise and vibration effects have been assessed using methodology and criteria which are widely applied to construction and operation of major infrastructure projects. Chiltern Railways has taken a responsible approach to the adoption of a non-statutory Noise and Vibration Policy which will ensure that the impact of the Order Scheme is properly mitigated.

## CONSTRUCTION NOISE IMPACTS

### Unmitigated Construction Noise Impacts

- 3.1 The assessment of construction noise in the ES formed a robust, and where necessary, a worst-case view of the likely noise impacts. The construction of the Bicester Chord will take about 6 months. Construction of individual road and footbridges and works at the Wolvercot Tunnel will each take between 3 and 5 months. Works at stations, including fitting out, could take up to 12 months. Track works will proceed rapidly along the railway corridor. Most work will be during the day, but night working may be required at certain locations. The contractors will be required to reduce construction noise as far as practicable.
- 3.2 Without noise mitigation, it is predicted that significant noise impacts would occur at three locations during linear track and embankment work, six locations adjacent to the Order Scheme during works on structures, and a further eight locations during construction of stations, associated roads and car parks. Whilst work at night is limited to only a few locations, noise impacts are also predicted at five locations. Four of these are short term works associated with structures, and only one, the track lowering in the Wolvercot Tunnel, will take place over a period of up to three months.

### Mitigated Construction Noise Impacts

- 3.3 Taking a conservative view of the effectiveness of standard mitigation such as selection of low noise plant, design of the works, provision of temporary noise barriers and other standard techniques, noise impacts from day and night time construction have been predicted at a number of locations for periods of between one week and three and half months. Daytime construction impacts have been predicted at Alchester House (Langford Lane crossing), The Grange (Islip) and at Quadrangle House, Stone Meadow, SS Philip and James C of E Aided School and Plater Drive in Oxford. Night-time construction impacts have been predicted at 65-97 Rewley Road, the nearest properties to the railway on William Lucy Way and Rutherford, and the nearest properties to the Wolvercot Tunnel (on Woodstock Road, Godstow Road and Five Mile Drive) in Oxford, as well as Mill Farm and Northfield Cottages. Apart from Wolvercot Tunnel, noisy works will typically take no more than 10 days in each location.
- 3.4 With standard mitigation in place, some residual significant noise impacts during daytime and night-time periods have been predicted at locations that were identified in Figures 6.1 A to Q in Environmental Statement **Volume 3** (Figures and Plans) (**CD/1.17**) and are summarised in Table 9 and Table 10.

**Table 9 Summary of Predicted Residual Daytime Impacts from Construction Works**

Receptor	Location	Structure/Work	Predicted Noise Level	Predicted Residual Exceedence of the Relevant Criteria, dB	Likely Duration of Residual Impact
S2	Alchester House	Turning heads at stopped up Langford Lane Crossing	75	5	A short period of time
S8a	The Grange	Islip Mill Lane Overbridge	74	4	Approx 15 weeks
L11	Quadrangle House	Track work	75	5	Up to 1 week
L12	Stone Meadow	Track work	71	1	Up to 1 week
S18	SS Philip and James C of E Aided School	Aristotle Lane Footbridge – New Car Parking / Resurfacing	70	5	A short period of time
S19	Plater Drive	Aristotle Lane Footbridge – New Car Parking / Resurfacing	75	5	A short period of time

**Table 10 Summary of Predicted Residual Night-time Impacts from Construction Works**

Receptor	Location	Structure/Work	Predicted Noise Level, dBA	Predicted Residual Exceedence of the Relevant Criteria, dB	Likely Duration of Residual Impact
L11a	Nearest properties to Wolvercot Tunnel (on Woodstock Road, Godstow Road and Five Mile Drive)	Track Lowering	59	14 <sup>(1)</sup>	Up to 3 months
S9	Mill Farm	Mill Stream Viaduct	46	1	Up to 10 nights
S10	Northfield Cottages	River Cherwell Viaduct	55	11	Up to 10 nights
S18a	Nearest properties on William Lucy Way and Rutherway	Castle Mill Stream viaduct replacement	60	6	Up to 10 nights
S20	65-97 Rewley Road	Sheepwash Channel Bridge (widening)	64	5	2 weekends

(1) Mitigation is based on cautious assumptions and actual levels should be lower.

### 3.5

The CoCP sets out the control measures that the Contractor must implement to ensure residual noise impacts are minimised as far as is reasonably practicable. In my view, the residual effects are acceptable given that the best practicable means will be applied and because they generally result in daytime noise impacts that are predicted to be no more than 5 dB over the assessment criterion (ie a noticeable but small difference in noise level) at only six locations. The durations of these impacts are also for relatively short periods at each receptor..

- 3.6 Where night-time works are required, and residual impacts are predicted these are limited to a short periods of time up to 10 nights at four representative receptors. Although longer periods of impacts are likely due to track lowering at Wolvercot Tunnel, these were based on conservative assumptions about the effectiveness of mitigation and I expect that further measures can be agreed, in addition to those described in the ES, which will reduce noise impacts further. This further mitigation will be set out through a Section 61 agreement, and appropriate mitigation will be agreed with the local authority as described in the CoCP. However, it may be that night-time work can be avoided through careful design at the detailed design stage.

## **OPERATIONAL NOISE IMPACTS**

### **Unmitigated Operational Noise Impacts**

- 3.7 Operational noise impacts have been considered for “Phase 1” of the Order Scheme (which includes Phase 2A, the lowering of the trackbed on the approaches to and within the Wolvercot Tunnel which has no significant effect on noise levels) based on the modelling inputs set out in the ES. The assessment of operational noise in the ES formed a worst-case view of the likely noise impacts, which was a satisfactory approach for the ES. However, the design of the Scheme has progressed as contemplated in the ES, so that lesser, or equivalent, impacts will result, and the likely mitigation has been refined to take account the current information and the views of stakeholders who have been consulted since the ES was published. That approach is integral to the Environmental Impact Assessment (EIA) process. The conclusions in the ES were robust in that without additional mitigation, substantial to high impacts, including “Phase 2” (which comprises Phase 2B ie the completion of track doubling), are predicted at 16 locations along the route, which represent a number of noise sensitive receptors. Recent work has confirmed that these results provided a satisfactory assessment of likely effects of the Order Scheme. In some cases, the results have proved to be an overestimate of the effect of the Order Scheme as discussed in Section 4. .

### **Mitigated Operational Noise Impacts**

#### **Statutory Noise Insulation**

- 3.8 Since the Order Scheme involves laying track outside of the existing rail track, Statutory Noise Insulation may need to be provided. An assessment has been carried out in order to estimate likely eligibility under the Noise Insulation (Railways and other Guided Transport Systems) Regulations 1996 (SI 1996 No. 428). (**CD/5.13**). The trigger levels (free-field, ie away from reflective surfaces) for the provision of noise insulation are 66 dB  $L_{Aeq, daytime}$  and 61 dB  $L_{Aeq, night}$ .

**Table 11 Assessment of Likely Eligibility under the Noise Insulation Regulations as a Result of Phase 2**

Receptor	Predicted Noise Levels (Free-field)		Assessment of Likely Eligibility for Noise Insulation
	Daytime (L <sub>Aeq,18h</sub> )	Night-time (L <sub>Aeq,6h</sub> )	
1 Gavray Drive (east)	51	48	No
2 Gavray Drive (west)	55	53	No
3 Whimbrel Close	66	63	Yes, approximately 3 properties
4 Langford Village	60	57	No
5 Closest properties on London Road	62	60	No
6 Langford Lane crossing house	66	62	Yes, 1 property
6a Wendlebury Farm	44	40	No
7 Holts Farm	62	59	No
8 Oddington Crossing house	69	65	Yes, 1 property
9 Islip station house	59	55	No
10 Closest properties on Kidlington Road	61	57	No
11 Kareol (level crossing keeper's house)	71	68	Yes, 1 property
12 Mill Farm	62	58	No
13 Northfield Cottages	60	56	No
14 Lakeside	63	60	No
15 Wolvercote Primary School	59	54	No
16 St. Peters Road	65	59	No
17 Cox's Ground	59	50	No
18 Merrivale Square	61	52	No
19 William Lucy Way	57	48	No
20 Northern end of Rewley Rd	54	45	No
21 Southern end of Rewley Rd	47	36	No
22 Stable Close	36	28	No

3.9

Given the extent of the Order Scheme, running through residential areas, it is notable that there are only four locations where insulation would be triggered under the Regulations. At this stage in Scheme design, this is only an

estimate based on the distance from the nearest facade receptors to the nearest track and does not take account of the exact locations of 'eligible rooms' under the Regulations. This assessment can only give an indication of properties which may be eligible, and further detailed assessment will be carried out taking account of the specific internal layout of each building and any local mitigation measures when determining eligibility under the Regulations.

### **Non-statutory Noise Mitigation**

- 3.10 The following section provides specific details of proposed mitigation and outlines where further work will be undertaken during the detailed design phase to refine mitigation measures for operational noise.

### **Mitigation Measures Proposed During Phase 1 of the Scheme**

- 3.11 If barriers are used, the exact location and length of each barrier will be determined taking into account detailed topographical information including heights of individual buildings and visual effects. In order to provide an indication of the approximate location of the potential barriers that are required to limit noise impacts in accordance with the procedures outlined in the ES, approximate barrier locations have been shown in the ES (**Volume 3, Figures 6.1A to 6.1Q**) (CD/1.17). The maximum likely lengths of barriers have been quoted where lengths cannot be accurately determined.
- 3.12 The ES anticipated that a Noise and Vibration Policy would be introduced and that barriers and other mitigation would be provided according to this policy. This is a satisfactory method of controlling noise and vibration for railway schemes. Table 12 below highlights those receptors at which noise impacts greater than moderate are predicted based on the refined noise modelling and initial discussions regarding the acceptability of mitigation with some residents. The feasibility of a noise barrier has been considered in each case, given the information available at this stage, and where the location is considered suitable, the indicative length of barrier is given. The barrier lengths reported in the ES have not been refined at this stage, but this work will be ongoing throughout detailed design. In some cases, different infrastructure solutions may be adopted where these prove to be more appropriate, and the noise barriers shown are intended to indicate the level of mitigation that can easily be achieved by this widely used form of mitigation. The exact form of mitigation will be determined during detailed design, in order to achieve the noise standards committed to in the ES and the Draft Noise and Vibration Mitigation Policy.

**Table 12 Example Residual Noise Impacts Taking Account of Potential Noise Barriers (1) – Phase 1 Scheme**

Receptor	Barrier	Description / Explanation	Notes on Barrier Suitability and Residual Impacts with Proposed Barrier
3. Whimbrel Close	Yes	Mitigation may be provided in the form of a noise barrier to protect the ground floor.	9 dB, substantial at upper floors only where barrier provides little screening.
4. Langford Village	No	Predicted noise impacts are only slightly above 'moderate' and the dis-benefits of a barrier in this location are likely to outweigh the benefits.	A 6 dB substantial residual impact is predicted.
6. Langford Lane crossing house (Alchester House)	Yes	Approximately 60 m	No significant residual impacts are expected.
7. Holts Farm	Yes	Approximately 60 m	No significant residual impacts are expected.
8. Oddington Crossing house	Yes	Approximately 30 m barrier up to proposed road overbridge to screen house closest to crossing.  See below for discussion of noise insulation to address residual impact following barrier implementation for other isolated properties that are further from the track and are not screened by the barrier.	A 6 dB substantial noise impact is predicted at the upper floors of Oddington crossing house with barrier. Maximum noise levels due to train pass-bys are likely to exceed 82 dB(A) with a barrier which has the potential to increase the risk of sleep disturbance.  Barndon Farm, the farm to the north, Oddington Grange Business Park and New House Farm are also likely to experience significant impacts. Further mitigation is discussed below.
9. Islip Station House	No	A slight impact of 3 dB has been predicted so a barrier has not been considered.	An overall slight impact is predicted, but maximum noise levels due to train pass-bys of 84 dB(A) are predicted which has the potential to increase the risk of sleep disturbance. Further mitigation is considered below
10. Closest properties on Kidlington Road	Yes	Approximately 420 m on either side of the railway from east of Kareol to the point where the cutting provides sufficient screening (to be determined during detailed design).	No significant residual impacts are expected.

<b>Receptor</b>	<b>Barrier</b>	<b>Description / Explanation</b>	<b>Notes on Barrier Suitability and Residual Impacts with Proposed Barrier</b>
11. Kareol (level crossing keeper's house)	No	A barrier at this location would be too close to the house to be effective, and has therefore not been specified.  See below for discussion of noise insulation to address impact.	A 12 dB high impact is predicted.  Further mitigation is discussed below.
12. Mill Farm	No	A large length of noise barrier is unlikely to be visually acceptable for the 3 properties at the western end of Mill Lane. Therefore, a barrier has not been specified in this location.	An 8 dB substantial impact is predicted.
13. Northfield Cottages	No	A large length of noise barrier is unlikely to be visually acceptable for the 4 properties at this location. Therefore, a barrier has not been specified in this location.	A 6 dB substantial impact is predicted.
14. Lakeside	Yes	Approximately 450 m on the east side, and approximately 50 m on the west side (adjacent to Nesbitts Farm).	No residual impacts are expected.
16. St. Peters Road	Yes	Approximately 520m on the west side, and approximately 635m on the east side, up to the First Turn bridge.	No residual impacts are expected.
17. Cox's Ground	No	Predicted noise impacts are only slightly above 'moderate' and the dis-benefits of a barrier in this location are likely to outweigh the benefits due to its urban location and potential for security problems.	A 6 dB substantial impact is predicted.
18. Merrivale Square	Yes	Approximately 420m from approximately location of the current Aristotle Lane crossing.	A 3 dB slight residual impact is predicted at upper floors only.

(1) Other infrastructure based mitigation solutions will be considered and an appropriate solution chosen following a detailed study taking into account practicability and acoustic performance to achieve the equivalent level of noise reduction.

## Further Non-statutory Noise Mitigation Measures during Phase 1

- 3.13 Where there are residual noise impacts, with noise barriers in place, which are described in Table 12 as 'high', further non-statutory noise mitigation will be considered at these locations. This is likely to take the form of noise insulation, including at the following.
- Receptor 8, Barndon Farm, the farm to the north of Oddington Crossing, Oddington Grange Business Park and New House Farm will be considered for non-statutory noise insulation which will reduce the internal effect of the 11 dB predicted impact including sleep disturbance.
  - Receptor 9, Islip Station House will be considered for non-statutory noise insulation which will reduce the internal effect of maximum noise levels to make sleep disturbance unlikely.
  - Receptor 11, Kareol (level crossing keeper's house) will be considered for non-statutory noise insulation which will reduce the internal effect of the 12 dB predicted impact including sleep disturbance.
- 3.14 If noise insulation is provided, ventilation will also be provided which will allow windows to remain closed. This will enable a reduction in noise levels inside the above properties. The outside to inside level difference from a partially open window would be approximately 15 dB, and comparison of this with the attenuation figures for various glazing systems in Annex 6 of PPG 24 (**CD/3.4**) suggests that a secondary glazing system would reduce internal noise levels by at least 15 dB compared to a partially open window. Therefore, noise insulation packages, where provided, will create acceptable internal levels, but some residual impacts to external / garden areas may remain for daytime noise.
- 3.15 At other receptors in Table 12 where the impact is less than 'high', no further mitigation will be provided and some residual noise impacts will remain. In urban locations, a 'high' impact consists of a change in noise of at least 10 dB which can be described as twice as loud. In more rural locations, the impact would result from an exceedence of very stringent standards which represent the onset of noise impacts. To put this in context, the National Noise Incidence Study 2000 found that 55±3% of the population of England and Wales live in dwellings exposed to day-time noise levels above the daytime noise standard and 68±3% of the population live in dwellings exposed to night-time noise levels above the night-time standard.

## Further Non-statutory Mitigation Measures Proposed During Phase 2 of the Order Scheme

- 3.16 Mitigation for Phase 2 impacts will only be required if and when these works, intended to be for the East-West Rail project, go ahead, and will thus be installed as part of those Phase 2 works.
- 3.17 Table 13 below highlights those receptors at which noise impacts greater than moderate without mitigation are predicted. Mitigation measures and residual impacts are outlined in the same way as described for Phase 1, based on the provision of an example mitigation package based on 2 m high barriers where

appropriate. The noise barriers that have been assumed are intended to give an example of the level of mitigation that will be achieved by a mitigation package using a widely used form of mitigation. The most appropriate form of mitigation will be determined during detailed design stage. Where I refer to noise barriers in the following sections this should therefore be read as noise barriers or other noise mitigation measure giving at least the same performance as the noise barriers outlined in the ES.

**Table 13 Example Residual Noise Impacts Taking Account of Potential Noise Barriers (1) – Phase 2 Scheme**

Receptor	Barrier	Description / Explanation	Notes on Barrier Suitability and Residual Impacts with Proposed Barrier
1 and 2. Gavray Drive	Yes	Approximately 200 m up the Bicester Chord, from Gavray Junction,	No residual impacts are expected.
3. Whimbrel Close	Yes	Mitigation may be provided in the form of a noise barrier to protect the ground floor. See below for discussion of noise insulation to address impact at upper floors.	16 dB, high at upper floors only where barrier does not provide screening. Further mitigation is discussed below.
4. Langford Village	Yes	Approximately 700 m on the east side and approximately 410 m on the west side of the rail corridor with approximately another 50 m on the west side, opposite Whimbrel Close.	A 2 dB, slight residual impact is predicted.
5. Closest properties on London Road	Yes	Approximately 100 m.	7 dB, substantial, at upper floors only where barriers are expected to provide less screening. Barriers are unlikely to be acceptable on townscape / visual impact grounds at the closest properties on Coach House Mews and Alchester Terrace. Further mitigation is discussed below.
6. Langford Lane crossing house (Alchester House)	Yes	Approximately 60 m	5 dB, moderate residual impact expected with barriers.
7. Holts Farm	Yes	Approximately 60 m	2 dB, slight residual impact expected with barriers.
8. Oddington Crossing house	Yes	Approximately 30 m barrier up to proposed road overbridge to screen house closest to crossing.  See below for discussion of noise insulation to address residual impact following barrier implementation for other isolated properties that are further from the track and are not screened by the barrier.	A 13 dB high noise impact is predicted at the upper floors of Oddington Crossing house. Further mitigation is discussed below. Maximum noise levels due to train pass-bys are likely to exceed 82 dB(A) with a barrier which has the potential to increase the risk of sleep disturbance.  Barndon Farm, the farm to the north, Oddington Grange Business Park and New House Farm are also likely to experience significant impacts. Further mitigation is discussed below.

<b>Receptor</b>	<b>Barrier</b>	<b>Description / Explanation</b>	<b>Notes on Barrier Suitability and Residual Impacts with Proposed Barrier</b>
9. Islip station house	Yes	The platform edge will provide some screening to the station house, but will not screen trains on the furthest track. No additional barrier has been assumed along the platform edge. See below for discussion on further mitigation	An 11 dB high impact is predicted at the station house. Upgraded station boundary fence or canopy could reduce this impact, but the effectiveness of any such measures and effect on station operation would need to be confirmed during detailed design and have not been accounted for here. Maximum noise levels due to train pass-bys of 85 dB(A) are predicted which has the potential to increase the risk of sleep disturbance.
		Approximately 200 m on the east side of the railway corridor from the southern end of the platform to the point at which the cutting provides similar screening for properties facing the railway on Hilltop Gardens and on the station side of Bletchingdon Road.	Impacts are expected to be lower at the properties facing the railway on Hilltop Gardens and on the station side of Bletchingdon Road with the specified noise barrier.
10. Closest properties on Kidlington Road	Yes	Approximately 420 m on either side of the railway from east of Kareol to the point where the cutting provides sufficient screening (to be determined during detailed design).	An 8 dB substantial impact is predicted with a barrier.
11. Kareol (level crossing keeper's house)	No	A barrier at this location would be too close to the house to be effective, and has therefore not been specified. See below for discussion of noise insulation to address impact.	A 16 dB high impact is predicted. Further mitigation is discussed below.
12. Mill Farm	No	Noise insulation is likely to provide a more effective solution than a large length of barrier for the 3 properties at the western end of Mill Lane. Therefore, a barrier has not been specified in this location. See below for discussion of noise insulation to address impact.	A 15 dB high impact is predicted. Further mitigation is discussed below.

<b>Receptor</b>	<b>Barrier</b>	<b>Description / Explanation</b>	<b>Notes on Barrier Suitability and Residual Impacts with Proposed Barrier</b>
13. Northfield Cottages	No	Noise insulation is likely to provide a more effective solution than a large length of barrier for the 4 properties at this location. Therefore, a barrier has not been specified in this location.	A 12 dB high impact is predicted. Further mitigation is discussed below.
		See below for discussion of noise insulation to address impact.	
14. Lakeside	Yes	Approximately 635 m on the east side, and approximately 240 m on the west side.	A 2 dB slight residual impact is predicted at 1st floor level where barrier screening is less effective.
16. St. Peters Road	Yes	Approximately 520m on the west side, and approximately 635m on the east side, up to the First Turn bridge.	An 8 dB substantial impact is predicted at 1 <sup>st</sup> floor of the closest properties (likely to be Quadrangle House and the closest properties on Bladon Close). Maximum noise levels due to train pass-bys are likely to exceed 82 dB(A) with a barrier which has the potential to increase the risk of sleep disturbance.
			A 2 dB, slight impact is predicted for ground floor flats.
17. Cox's Ground	Yes	Approximately 550m, to the Merrivale Square barrier.	A 4 dB moderate impact is predicted at top floor flats, reducing to 1 dB, slight, at the first floor level.
18. Merrivale Square	Yes	Approximately 550m, from Walton Well Road bridge.	A 6 dB substantial impact is predicted at top floor flats, reducing to 2 dB, slight, at the first floor level.

(1) Other infrastructure based mitigation solutions will be considered and an appropriate solution chosen following a detailed study taking into account practicability and acoustic performance to achieve the equivalent level of noise reduction.

## Further Non-statutory Noise Mitigation Measures during Phase 2

3.18 Where there remain residual noise impacts with the noise barriers or other mitigation in place in Table 13, some of the properties close to the railway may qualify for statutory noise insulation subject to meeting the appropriate criteria. These receptors are described in Table 11. Other receptors may not qualify for statutory noise insulation but may experience residual noise impacts that are 'high' or be at risk of increased sleep disturbance. These locations will be considered for further non-statutory noise mitigation which is likely to take the form of noise insulation, including at the following.

- Receptor 3, Whimbrel Close – The upper floors of the closest properties are likely to qualify for statutory noise insulation which will reduce the internal effect of the 16 dB predicted impact.
- Receptor 8, Oddington Crossing – the house directly on the crossing is likely to qualify for statutory noise insulation which will reduce the internal effect of the 13 dB predicted impact.
- Receptor 11, Kareol (former level crossing keeper's house) – this property is likely to qualify for statutory noise insulation which will reduce the internal effect of the 16 dB predicted impact.

3.19 If noise insulation is provided, ventilation will also be provided which will allow windows to remain closed. This will enable a reduction in noise levels inside the above properties. The outside to inside level difference from a partially open window is approximately 15 dB, and comparison of this with the attenuation figures for various glazing systems in Annex 6 of PPG 24 (**CD/3.4**) suggests that a secondary glazing system would reduce internal noise levels by at least 15 dB compared to a partially open window. This would be sufficient to reduce noise levels to acceptable internal levels.

3.20 In several other locations, the noise levels are not expected to be sufficiently high to trigger statutory noise insulation, but 'high' residual noise impacts (>10 dB) have been predicted in situations where noise barriers are not expected to be practicable or effective. Non-statutory noise insulation will be considered for these properties (in accordance with the Draft Noise and Vibration Policy, which is to be enforceable through a planning condition)

- Receptor 5, the closest properties on Coach House Mews / Alchester terrace will be considered for non-statutory noise insulation which will reduce the impact.
- Receptor 8, Oddington Crossing – the properties that are set back from the railway such as Barndon Farm, the farm to the north of the railway, the residential property located at Oddington Grange Business Park and New House Farm will be considered for non-statutory noise insulation which will reduce the impact.
- Receptor 9, Islip station house - the single property represented by this receptor will be considered for non-statutory noise insulation which will reduce the internal effect of the 11dB predicted impact.

- Receptor 12, Mill Farm – the three properties at the end of Mill Lane will be considered for non-statutory noise insulation which will reduce the internal effect of the 15 dB predicted impact.
- Receptor 13, Northfield Cottages - the four properties represented by this receptor will be considered for non-statutory noise insulation which will reduce the internal effect of the 12 dB predicted impact.

3.21 Noise insulation packages, where provided, will create acceptable internal levels, but some residual impacts to external / garden areas may remain. The procedures by which this noise and vibration mitigation will be offered are set out in the ES (CD/1.16) and the Draft Noise and Vibration Mitigation Policy.

3.22 At other receptors in Table 13 where the impact is less than 'high' (10 dB) no further mitigation will be provided and the residual noise impacts will remain.

3.23 A summary of the proposed mitigation that will be applied to individual receptors is presented in Table 14 below. Table 14 does not appear in the ES, but is a summary of the mitigated effects, and includes the results of current work. Note the Effective Residual Impact is based on achieving suitable internal noise levels ie those properties that are noise insulated are not shown as having residual impacts. It is noted that external noise levels may still be increased outside of these properties, but in all cases the impact during the day, when people may be outside their buildings, is lower than that quoted in Table 14, which is based on the worst-case night-time noise impact.

**Table 14 Summary of Noise Mitigation and Residual Impacts**

Receptor	Barrier Provided (Y/N)	Residual Noise Impact Outside Building (dB)	Glazing Provided (Y/N)	Effective Residual Impact (dB)	Comment
Phase 1					
3 Whimbrel Close	Y	9	N	9	
4 Langford Village	N	6	N	6	
5 Closest properties on London Road	N	4	N	4	
8 Oddington Crossing house	Y	6	Y	-	
8 Oddington Crossing (Isolated properties three farms and business park)	N	<11	Y	-	Barrier would be too long to screen these few isolated properties

9 Islip station house	N	3	Y	-	
11 Kareol (level crossing keeper's house)	N	12	Y	-	Barrier would be too close to property
12 Mill Farm	N	8	N	8	No barrier due to visual effects
13 Northfield Cottages	N	6	N	6	No barrier due to visual effects
17 Cox's Ground	N	6	N	6	No barrier due to visual/security effects
Phase 2					
3 Whimbrel Close	Y	16	Y	-	
5 (closest properties on London Road)					
5 (closest properties in Coach House Mews and Alchester Terrace)	N	<12	Y	-	No barrier due to visual effects. Insulation on upper floors only.
6 Langford Lane Crossing House	Y	5	N	5	
8 (Oddington Crossing House, Isolated properties three farms and business park)	Y	13	Y	-	
9 Islip station house	N	11	Y	-	

10 Closest properties on Kidlington Road	Y	8	N	8	
11 Kareol (level crossing keeper's house)	N	16	Y	-	
12 Mill Farm	N	15	Y	-	
13 Northfield Cottages	N	12	Y	-	
16 St. Peters Road	Y	8	Y	-	Insulation on upper floors only
17 Cox's Ground	Y	4	N	4	Impact at upper floors only
18 Merrivale Square	Y	6	N	6	

## CONSTRUCTION VIBRATION IMPACTS

### Unmitigated Construction Vibration Impacts

- 3.24 The ES has considered potential vibration impacts, in terms of human annoyance, and structural damage to buildings for both the construction and operational phases of the Order Scheme.
- 3.25 No significant vibration effects are likely during construction.
- 3.26 Vibration annoyance and damage from construction work is most typically associated with driven percussive piling, which is only to be undertaken in circumstances where it will be a minimum distance of 100 m from the nearest properties. At this distance it is unlikely that vibration will be perceptible. Therefore, no significant disturbance/damage from percussive piling will result. Other sources of vibration (operation of heavy equipment and vehicles) will give rise to lower levels that may be perceptible at receptors close to construction activity, but the temporary nature of the works means that they are not expected to be at levels that would be anticipated to give rise to significant impacts to residents or other occupiers. Vibration is unlikely to cause cosmetic or structural damage at any properties along the route.

### Mitigated Construction Vibration Impacts

- 3.27 The distance limit of 100m on percussive piling and other measures will ensure that no significant vibration effects are likely during construction.

## OPERATIONAL VIBRATION IMPACTS

### Unmitigated Operational Vibration Impacts

- 3.28 Existing vibration levels at sensitive receptors along the route are generally low except where these are within a few metres of the track, where intermittent vibration as a result of trains, especially freight trains may be perceptible.
- 3.29 This section sets out the results of the assessment and proposed mitigation measures to ensure vibration associated with the Order Scheme meets the appropriate criteria.
- 3.30 The estimated VDV levels of ground vibration are not expected to exceed the assessment criterion beyond approximately 10 m from the tracks. Receptors that are close to or within this distance from the tracks include Quadrangle House on St Peters Road, Kareol (the level crossing keeper's house southwest of Islip), Oddington Crossing house, 53 London Road Bicester, and the closest properties to the railway on Whimbrel Close, Bicester.
- 3.31 Properties which lie in close proximity to switches or crossings may receive higher levels of vibration as a result of discontinuities in the track. Design measures will be adopted to minimise vibration levels at these locations (outlined in *Section 6.5.6* of the ES) (**CD/1.16**). Mitigation will be implemented by using intrinsically low vibration track designs that provide continuous support to the train wheels to minimise the discontinuities in the tracks. If necessary, track bed form design will be considered in addition to further reduce the vibration. This could take the form of resilient rail fixings, under ballast mat, sleepers mounted on resilient material or isolation below a concrete track bed. This will be implemented as part of the detailed design to meet the design targets for the railway based on the BS 6472 standards adopted in the Noise and Vibration Policy. In the unexpected situations where vibration mitigation does not prove practicable, the vibration levels at the closest receptors are likely to be similar to those shown in *Table D5.7* in **Annex D** of the ES (**CD/1.18**). These levels would result in 'adverse comments' being 'possible' according to BS 6472, which is not, in my view, likely to be a significant effect.
- 3.32 Hence, whilst vibration may be perceptible in some locations, it is not expected to give rise to adverse comment (as specified in BS 6472), and significant impacts are not expected to occur, given that vibration will be both transient and at low levels.

### Mitigated Operational Vibration Impacts

- 3.33 In the areas identified, specialist resilient track forms will be used, wherever practicable, so that vibration from the new track at the nearest sensitive receptors will be no higher than the levels specified in BS 6472 for 'a *low probability of adverse comment*' as stated in the Draft Noise and Vibration Mitigation Policy.
- 3.34 The term "practicable" has been adopted applying the specific meaning used in the term Best Practicable Means (BPM) that is defined in the Environmental Protection Act 1990. The Act defines BPM as:

- having regard to the current state of technical knowledge;
- the local conditions and circumstances;
- the financial implications; and
- BPM has to be compatible with safety and safe working conditions.

3.35 It is expected that practicable options for vibration isolation, as described above will be available, and that there will be no residual impacts from train vibration in terms of disturbance to building occupants.

3.36 The existing railway was created over 100 years ago, and has been operational since that time. Experience in the UK, EU, Asia, USA, Australia and New Zealand shows that there are no damage issues relating to vibration affecting housing alongside railways. Therefore, building damage is not expected from this Order Scheme.

### **Conclusions**

3.37 The Noise and Vibration assessment in the ES represented a robust assessment using well established methodologies. It demonstrated the extent and severity of potential noise and vibration impacts and provides the basis of an effective mitigation strategy, discussed further in Sections 4 and 5.

## 4 FURTHER NOISE ASSESSMENT, INCLUDING MODELLING AND BARRIER DESIGN, FOLLOWING THE PUBLICATION OF THE ENVIRONMENTAL STATEMENT

### INTRODUCTION

- 4.1 Although the ES included a robust assessment of existing noise levels and demonstrated the likely effects of the railway, further work has been undertaken to refine knowledge of the spatial scope of the noise impacts that will result from the Order Scheme and to help design the required mitigation. This is the standard approach to scheme development and the refinement of, and debate regarding, mitigation of impacts does not stand still following an ES. This work has involved further noise monitoring and noise modelling which are discussed in this section. Baseline vibration monitoring has also been carried out and is detailed in paragraphs 4.5 to 4.7.

### NOISE MONITORING

- 4.2 Noise monitoring has been undertaken at six sites over period of several days in order to provide supporting evidence to refine the requirements for mitigation that have been identified in the ES.
- 4.3 Noise monitoring has been carried out at the following locations and is reported in **Appendix MF1**:

- 14 Whimbrel Close in Bicester;
- Cotswold House, Mill Street in Islip;
- 37 Lakeside in Oxford;
- 39A Blenheim Drive in Oxford; and
- 34 Stone Meadow in Oxford.

### NOISE MODELLING

- 4.4 Although the ES establishes the magnitude of noise impacts from the Order Scheme at a wide range of noise sensitive receptors, I have also undertaken detailed noise modelling of the Order Scheme and the mitigation that is proposed, in order to establish a more precise estimate of the extent of noise impact in areas where complex geometry exists and to estimate the number of properties that are likely to be affected. The initial results around North Oxford have shown good agreement with the results in the ES at the representative receptors shown on plans in the ES. The modelling that is being undertaken is reported in **Appendix MF2**.

### VIBRATION ASSESSMENT CARRIED OUT SINCE THE ES

- 4.5 Vibration has been monitored in order to confirm existing vibration levels in response to concerns raised by some objectors that existing vibration was high.

- 4.6 The results of vibration monitoring at Quadrangle House have suggested that the existing levels of vibration from trains are as expected, and that the assessment in the Environmental Statement is therefore robust.
- 4.7 The results of vibration monitoring are reported in **Appendix MF 3**. Results from these surveys are being discussed with individual residents who are concerned about vibration. However, at all locations it was clear that vibration from existing trains was not sufficiently large to result in building damage.

## 5 RESOLUTION OF NOISE AND VIBRATION OBJECTIONS

### INTRODUCTION

- 5.1 This section summarises the principles on which mitigation is being offered over and above the statutory requirements, and using an approach which is comparable with other railways schemes. The promoter is currently preparing a succinct statement of these commitments in the form of a Noise and Vibration Policy.
- 5.2 It also outlines the process that has been followed to respond appropriately to Objection letters and Representations.
- 5.3 Lastly it summarises the issues that have been raised by objectors which have not yet been resolved.

### PROVISION OF NOISE AND VIBRATION MITIGATION

- 5.4 Chiltern Railways will go well beyond what the law strictly demands of them, in operating a modern and highly desirable railway service, and by offering mitigation at noise levels below statutory noise levels. Mitigation is to be provided following the procedures described in the ES and which are set out in the Draft Noise and Vibration Policy, which following Network Rail review, will be made available to the Inquiry. The main provisions of the Draft Policy are described below. These will apply both to Chiltern Railways and to the subsequent provider of Phase 2. The term Promoter covers both.
- 5.5 Through the design of the track and track bed, the Promoter will use the Best Practicable Means to design the railway so as to avoid significant noise and vibration impacts at existing sensitive receptors (e.g. residential properties, educational buildings and places of worship).
- 5.6 Where these measures are not sufficient to mitigate significant impacts the Promoter will, if effective and reasonably practicable, provide noise barriers to mitigate noise between the track and sensitive receptors.
- 5.7 After considering all practicable mitigation measures that can be taken at source (i.e. within the railway corridor), including noise barriers, the Promoter will offer noise insulation where impacts on sensitive receptors are high.
- 5.8 The Promoter will consult with those parties who may be affected by noise and vibration explaining the mitigation measures that are proposed.
- 5.9 The Promoter will reassess the impacts of noise and vibration during the detailed design of the Order Scheme to ensure the design incorporates mitigation measures in accordance with this policy.
- 5.10 The Noise and Vibration policy will be enforced through a planning condition which will make it legally binding. The Noise and Vibration Policy will apply to Chiltern Railways who will apply the mitigation necessary for the operation of the route after the works in Phase 1 and Phase 2A, and it will also apply to the

promoters of the East West Rail scheme who will apply mitigation according to this policy, if and when the works in Phase 2B is constructed.

- 5.11 The Noise and Vibration Policy will provide an objective method that will ensure that noise and vibration mitigation is provided on a fair basis for all residents affected by the Order Scheme.

#### **PROCEDURES ADOPTED TO RESOLVE OBJECTIONS**

- 5.12 Following the submission of the TWA application and the Accompanying ES (**CD/1.15 to 1.18**) a total of 308 Objections were received, and of these 152 specifically mentioned concerns regarding noise and/or vibration.

- 5.13 A large number (100) of residents have chosen to state their objection to the Order Scheme by sending in a standard list of concerns. In response, standard answers have been sent to these objectors in June 2010. Since the objections focus around Wolvercote and North Oxford,, examples of noise effects were given based on the noise sensitive receptors in North Oxford that were considered in the Environmental Statement. The letters that were sent to objectors provided information focused on meeting the common concerns of the majority of noise objectors who are based predominantly in North Oxford. This standard letter is included in **Appendix MF 4**. These cover the majority of residents' concerns regarding the effects of the Order Scheme. Following the issue of this letter, a follow up letter has been sent in order to establish if there were outstanding concerns. The answers contained in **Appendix MF 4** are still correct, having been confirmed by further noise monitoring and modelling.

- 5.14 There were two standard tick sheets, covering, in summary, the following issues:

- The new track will bring trains closer to my property which will increase noise and vibration;
- Faster trains will increase noise and vibration;
- Freight trains will be longer and carry large loads which will increase noise and vibration;
- Trains can be heard above the background noise in my house, such as the television, boiler, fridge, etc., even when the windows are closed. The noise and vibration from passing trains is overwhelming in the garden and in my house if the windows are open. With many more trains, living in adjacent properties to the railway line will become intolerable, our neighbourhood will be destroyed by both the exodus of those people that can afford to move and by a fall in quality of the area. This will inevitably impact on the value of my house making moving to a similarly pleasant location (as now) within Oxford much more difficult;
- As transport by rail increases, the numbers of passengers and freight trains will continue to increase incrementally once the Order Scheme is complete leading to further increases in noise and vibration;

- 5.15 A number of request for commitments to mitigation were made under the following headings:

- Mitigation – installation of fully-effective noise and vibration barriers next to the track as a matter of urgency concurrent with the work;

- Mitigation – install track infrastructure designed to reduce noise and vibration including welded track, rail dampers, etc;
- Mitigation – use only well maintained rolling stock fitted with noise and vibration mitigating devices including wheel dampers, etc;
- Mitigation – review all noise and vibration mitigating measures every six months and repair or upgrade as necessary;
- Baseline mitigation on the number of passenger and (longer, heavier) freight trains projected to operate after completion of EastWest Rail and then no subsequent incremental increases in train traffic allowed without full consultation with residents;
- Mitigation – provide funding to equip my house with the highest quality glazing and to undertake any repairs to my house caused by vibration;
- Mitigation – maintain and enforce the present speed restriction (40mph) on all trains along the sections of the track adjoining residential areas’;
- Mitigation – no trains during the night from 00:00 until 05:00; and
- Mitigation – electrify the line as soon as practically possible.

5.16 Objectors who received a response to objections via the standard tick sheet were:

OBJ 81, OBJ 82, OBJ 83, OBJ 89, OBJ 95, OBJ 115, OBJ 119, OBJ 120, OBJ 121, OBJ 123, OBJ 124, OBJ 132, OBJ 133, OBJ 134, OBJ 138, OBJ 139, OBJ 140, OBJ 141, OBJ 142, OBJ 143, OBJ 144, OBJ 145, OBJ 146, OBJ 147, OBJ 148, OBJ 149, OBJ 150, OBJ 151, OBJ 152, OBJ 153, OBJ 154, OBJ 155, OBJ 156, OBJ 57, OBJ 158, OBJ 159, OBJ 160, OBJ 161, OBJ 162, OBJ 163, OBJ 164, OBJ 165, OBJ 166, OBJ 167, OBJ 168, OBJ 169, OBJ 170, OBJ 171, OBJ 172, OBJ 173, OBJ 174, OBJ 175, OBJ 176, OBJ 177, OBJ 178, OBJ 196, OBJ 197, OBJ 198, OBJ 204, OBJ 207, OBJ 208, OBJ 209, OBJ 210, OBJ 217, OBJ 218, OBJ 219, OBJ 223, OBJ 224, OBJ 228, OBJ 233, OBJ 243, OBJ 247, OBJ 251, OBJ 252, OBJ 253, OBJ 254, OBJ 255, OBJ 259, OBJ 262, OBJ 264, OBJ 267, OBJ 269, OBJ 271, OBJ 272, OBJ 273, OBJ 275, OBJ 276, OBJ 277, OBJ 278, OBJ 279, OBJ 280, OBJ 281, OBJ 288, OBJ 291, OBJ 295, OBJ 300, OBJ 302, OBJ 303, OBJ 304, OBJ 305.

5.17 Of these objectors OBJ 259 has withdrawn and OBJ 295 has submitted a Statement of Case.

5.18 Where specific technical questions have been raised, response letters have been sent to attempt to answer these concerns. Examples of Objectors who have adopted this approach and their key issues, are shown below. The information dealing with these standard questions has come from **Appendix MF 4**.

5.19 Objector number OBJ 14 (Mr K Dancey) was sent a letter dated 28 June 2010, which addressed the following points:

- Vibration – building damage
- Freight noise and vibration – axle weights
- Freight and passenger train speeds – speed limits
- Noise of trains
- Commitment to mitigation

- 5.20 Objector number OBJ 28 (Mr G Howe) was sent a letter dated 28 June 2010, which addressed the following points:
- Vibration and risk of structural damage
  - Noise at Wolvercote Primary School
  - Timetable restraints – Objector asking trains are restricted to between 05.30 and 21.00
  - Property devaluation
- 5.21 Objector number OBJ 30 (Miss J Childs) was sent a letter dated 28 June 2010, which addressed the following points:
- Potential increase in the speed, frequency and size of rolling stock
  - Property devaluation
- 5.22 Objector number OBJ 37 (Mr and Mrs Dieppe) was sent a letter dated 28 June 2010, which addressed the following points:
- Noise mitigation – lowering the track
  - Mitigation of noise and vibration – noise barrier
  - Minimise noise and vibration – reducing line speed
- 5.23 Objector number OBJ 38 (Mr and Mrs Lewis) was sent a letter dated 28 June 2010, which addressed the following points:
- Line speed
  - Vibration
  - Noise and noise mitigation
  - Property devaluation
- 5.24 Objector number OBJ 48 (Mrs Scott) was sent a letter dated 28 June 2010, which addressed the following points:
- Line speed, frequency and length/weight of trains
  - Noise at Wolvercote Primary School
  - Vibration and risk of structural damage
  - Commitment to mitigation
- 5.25 Objector number OBJ 49 (Prof and Mrs Ullendorff) was sent a letter dated 28 June 2010, which addressed the following points:
- Noise levels
  - Vibration

- 5.26 Objector number OBJ 54 (Ms L Wild) was sent a letter dated 28 June 2010, which addressed the following points:
- Line speed
  - Noise disturbance
  - Vibration disturbance
  - Commitment to mitigation
  - Property devaluation
- 5.27 Objector number OBJ 56 (Prof Tucker and Dr De Smet) was sent a letter dated 28 June 2010, which addressed the following points:
- Increase in noise and ground vibration
  - Trains operating during the night and early morning
  - Road traffic noise
  - Property devaluation
  - Noise mitigation and commitment to mitigation
  - Mitigating noise and vibration by reducing line speed
- 5.28 Objector number OBJ 62 (Ms Graham) was sent a letter dated 06 July 2010, which addressed the following points:
- Noise
  - Vibration
  - Line speed and weight of trains
  - Property devaluation
- 5.29 Objector number OBJ 65 (Ms Johnson) was sent a letter dated 06 July 2010, which addressed the following points:
- Increase in noise and ground vibration
  - Trains operating during the night and early morning
  - Mitigating noise and vibration by reducing line speed
  - Commitment to mitigation
  - Devaluation of property
  - Road traffic noise and transport policy
- 5.30 Objector number OBJ 71 (Mr Rosser) was sent a letter dated 06 July 2010, which addressed the following points:
- Speed limits
  - Potential noise impacts
  - Potential vibration impacts
  - Commitment to mitigation
  - Property devaluation

- 5.31 Objector number OBJ 76 (Mr Fraser) was sent a letter dated 06 July 2010, which addressed the following points:
- Consultation
  - Noise and vibration
  - Commitment to mitigation
  - Electrification of the railway
- 5.32 Objector number OBJ 78 (Drs Garry) was sent a letter dated 06 July 2010, which addressed the following points:
- Noise levels
  - Vibration
  - Request to maintain existing line speed
  - Commitment to mitigation
- 5.33 Objector number OBJ 80 (Mr and Mrs Thaller) was sent a letter dated 06 July 2010, which addressed the following points:
- Noise levels
  - Vibration
  - Mitigating noise and vibration by reducing line speed
  - Commitment to mitigation
- 5.34 Objector number OBJ 86 (Dr Acheson) was sent a letter dated 06 July 2010, which addressed the following points:
- Noise levels
  - Vibration
  - Mitigating noise and vibration by reducing line speed
  - Potential increase in freight trains
- 5.35 Objector number OBJ 88 – (Mr Napier) was sent a letter dated 16<sup>th</sup> of June, addressing the following points:
- Noise levels
  - Vibration
  - Mitigating noise and vibration by reducing line speed
  - Potential increase in freight trains
- 5.36 Subsequent conversations have identified that more specific information regarding the basis of assumptions for the assessment of freight movements, which will be provided in continuing dialogue. Monitoring has been carried out to establish vibration levels from existing trains and to identify if Quadrangle House is expected to receive unexpectedly high vibration levels as a result of its design and the local ground conditions. The measurements have shown that the range of vibration was as anticipated in the ES. Since the ES was

published further noise modelling has been carried out using as 3 dimensional noise modelling software. The building window height assumptions have also been refined and the results confirm that the predicted residual noise impact at the upper floor of Quadrangle House are 3 dB lower than predicted in the ES (ie a 5 dB residual impact at upper floors).

5.37 Objector number OBJ 106 (Mr and Mrs Clements) was sent a letter dated 06 July 2010, which addressed the following points:

- Existing damage
- Proximity of railway, line speed and freight trains
- Noise impacts and mitigation
- Noise and vibration from switch and crossings
- Vibration and risk of structural damage
- Mitigating noise and vibration by reducing line speed
- Commitment to mitigation
- Property devaluation

5.38 Objector number OBJ 112 (Mr and Mrs Pittard) was sent a letter dated 06 July 2010, which addressed the following points:

- Proximity of railway, line speed and freight trains
- Potential increase in noise and vibration
- Mitigating noise and vibration by reducing the line speed
- Noise from track maintenance
- Commitment to mitigation
- Property devaluation

5.39 Objector number OBJ 179 (Mr Hope) was sent a letter dated 06 July 2010, which addressed the following points:

- Risk of structural damage by groundbourne vibration

5.40 Objector number OBJ 180 (Mr and Mrs Strong) was sent a letter dated 06 July 2010, which addressed the following points:

- Risk of structural damage by groundbourne vibration
- Proposed changes, noise impacts and mitigation
- Property devaluation

5.41 Objector number OBJ 200 (Mr Dadds) was sent a letter dated 06 July 2010, which addressed the following points:

- Proximity of railway, line speed and freight trains
- Vibration and risk of structural damage
- Existing damage
- Noise impacts and mitigation

- Mitigating noise and vibration by reducing line speed
- Commitment to mitigation

5.42 Objector number OBJ 203 (Mr Boston) was sent a letter dated 06 July 2010, which addressed the following points:

- Noise
- Vibration
- Commitment to mitigation

5.43 Objector number OBJ 212 (Lewis and Sarah Butle) was sent a letter dated 26<sup>th</sup> July, which addressed the following points:

- Noise
- Vibration

Objector number OBJ 213 (Ms Harris) was sent a letter dated 26<sup>th</sup> July, which addressed the following points relating to noise and vibration:

- Proximity of railway, line speeds, timetable and freight trains
- Potential increase in noise and vibration
- Noise from construction
- Vibration

5.44 Objector number OBJ 229 (Mr Kauffmann) was sent a letter dated 06 July 2010, which addressed the following points:

- Proximity of railway, line speeds, timetable and freight trains
- Potential increase in noise and vibration
- Commitment to mitigation
- Property devaluation

5.45 Objector number OBJ 232 (Mr and Mrs Schoetz) was sent a letter dated 06 July 2010, which addressed the following points:

- Noise from Oxford Station and Car Park
- Road Traffic Noise
- Railway Noise

5.46 Objector number OBJ 233 (Lt. Col. Buckton) was sent a letter dated 06 July 2010, which addressed the following points:

- Line speed and number of trains
- Noise impacts and mitigation
- Mitigating noise and vibration by reducing line speed
- Vibration and risk of structural damage

- Existing damage
- Commitment to mitigation
- Property devaluation

5.47 Objector number OBJ 234 – (Ms Robertson) was sent a letter dated 06 July 2010, which addressed the following points:

- Assessment Methodology
- Line speed and number of trains
- Noise impacts and mitigation
- Mitigating noise and vibration by reducing line speed
- Vibration and risk of structural damage

5.48 Objector number OBJ 235 (Miss Dahll) was sent a letter dated 06 July 2010, which addressed the following points:

- Noise from trains in Oxford Station
- Noise and vibration
- Commitment to mitigation

5.49 Objector number OBJ 244 (Drs Conway) was sent a letter dated 06 July 2010, which addressed the following points:

- Assessment methodology
- Proximity of railway
- Noise and vibration
- Mitigating noise and vibration by reducing the line speed
- Commitment to mitigation

5.50 Objector number OBJ 265 (Mrs Best) was sent a letter dated 06 July 2010, which addressed the following points:

- Mitigating noise and vibration by reducing the line speed
- Noise and vibration

5.51 Objector number OBJ 274 (Miss Meakins) was sent a letter dated 06 July 2010, which addressed the following points:

- Potential impact of noise
- Vibration and risk of structural damage
- Property devaluation
- Commitment to mitigation

5.52 Objector number OBJ 285 (Mr Maher) was sent a letter dated 06 July 2010, which addressed the following points:

- Dualing of the line – noise
- Mitigating noise and vibration by reducing the line speed
- Noise
- Commitment to mitigation

5.53 Objector number OBJ 290 (Ms Schofield) was sent a letter dated 06 July 2010, which addressed the following points:

- Vibration and risk of structural damage
- Noise
- Property devaluation
- Commitment to mitigation

5.54 Objector number OBJ 295 (Professor Korsunsky) was sent a letter dated 14 June and 2 August 2010. The outstanding issues are dealt with in detailed in the following sections.

5.55 Objector number OBJ 301 was sent a letter dated 18 August, which addressed the following points:

- noise at night
- potential increased sensitivity to noise of vulnerable groups, and confirmation that predictions suggest that even for vulnerable groups, the stringent guideline noise levels at this location are not expected to be exceeded.

#### **OUTSTANDING OBJECTORS**

5.56 Despite the consultation with Objectors above, there are still some objectors who have concerns regarding noise and vibration, and this section describes the remaining concerns regarding noise and vibration and responds to these concerns.

5.57 Of the objectors who submitted standard Objection letters those that have responded to the follow up letter described in paragraph 5.13 are listed below. These include those who have submitted a Statement of Case shown in bold.

#### **North Oxford**

- 37 -Mr Matthew and Mrs Joy Dieppe - 33 Lakeside
- 48 - Mrs Gwen Scott (Chair of Governors at Wolvercote Primary School)
- 132 - Alice and Glyn Taylor - 15 Lakeside**
- 133 - Patricia and Albert Eastham - 19 Lakeside
- 134 - Maria C Distffabi Cocuzza 21 Lakeside
- 144 - C Rummings and E.M.J. Rummings - 47 Lakeside
- 145 - Susan Pfunder - 49 Lakeside
- 147 - Professor Dr Mehmet Guney - 53 Lakeside
- 150 - Frank Nawn - 61 Lakeside
- 153 - Ross and Fereshteh Lowen - 4 Carey Close
- 217 - J C and E A Gittins - 32 Lakeside (tick sheet)

253 - Erika Koikkalaimen - 10 Quadrangle House (tick sheet)  
274 - Nancy Meakins - 77 Blenheim Drive  
275 - Mr N and Mrs CM Goldsworthy -77 Blenheim Drive (tick sheet)  
279 - Mrs Gaynor Woodhouse - 38 Lakeside Avenue (tick sheet)  
288 - Greg and Mariha Kaser - 82 Five Mile Drive (tick sheet)  
290 - Mo Schofield – 45 Ulfgar Road  
303 - B R White - 24 Blenheim Drive (tick sheet)  
304 - Derek Summers - 34 Stone Meadow (tick sheet)  
31 - Mr Priest - 34 Stone Meadow;

### **Islip**

32 - Mr Roger Clifford Simmonds & Mrs Jennifer Simmonds - 4 Mill Farm Barns, Mill Street Islip;

117 - Howard– Mr Luciano and Mrs Christine Howard, Chipping Farm Bletchingdon Road Islip Kidlington OX5 2TH;

118 -Mr Peter and Mrs Pia Farr - Chipping Farmhouse Bletchingdon Road Islip Kidlington OX5 2TH; and

125 - Mrs Eileen Heneberry , Kareol Mill Lane Islip Oxon OX5 2SU.

5.58 Table 15 shows the objectors who have indicated to the Inquiry Programme office that they intend to attend the Public Inquiry and who are interested in issues relating to noise and vibration. Of those Objectors only those in bold have submitted a Statement of Case.

**Table 15 Objectors Who Have Informed the Programme Officer that they Intent to Attend the Public Inquiry**

<b>North Oxford</b>		Tick List Objection (yes/no)
OBJ/009	Dr M Drolet and Dr R Thomas	No
<b>OBJ/014</b>	<b>Mr K Dancey of Quadrangle Management Limited</b>	<b>No</b>
OBJ/030	Ms J Childs	No
OBJ/037	Mr M Dieppe and Ms Joy Dieppe	No
OBJ/040	Mr N Butterfield and Mrs F Butterfield	No
OBJ/056	Professor GH Tucker and Dr I De Smet	No
OBJ/061	Councillor M Gotch and Professor F Gotch	No
OBJ/076	Mr A Fraser	No
<b>OBJ/077</b>	<b>Mr J Thorowgood and H Chance</b>	<b>No</b>
OBJ/082	Mr H Moorwood	No
OBJ/086	Dr D Acheson	No
OBJ/088	Mr P Napier	No
OBJ/089	Ms V M Newtown	Yes
<b>OBJ/095</b>	<b>Mr S Young PhD CChem</b>	<b>Yes</b>
OBJ/106	Mr E McClements and Mrs L McClements	No
<b>OBJ/132</b>	<b>Mrs A Taylor and Mr G Taylor</b>	<b>Yes</b>
OBJ/135	Mr R Sederman	No
<b>OBJ/143</b>	<b>Ms M Rosenberg</b>	<b>Yes</b>
OBJ/149	Sir M Gray and Lady Gray	Yes
OBJ/179	Mr R Hope and Family	No
OBJ/180	Mr P and Mrs L Strong	No
OBJ/181	Mr and Mrs Chaisty and Family	No
<b>OBJ/212</b>	<b>Lewis and Sarah Butler</b>	<b>No</b>
<b>OBJ/213</b>	<b>Mrs Rosemary Harris</b>	<b>No</b>
<b>OBJ/232</b>	<b>Mr H Schoetz and Mrs R Schoetz</b>	<b>No</b>
OBJ/234	Ms C Robertson	No
OBJ/235	Ms S Dhall	No
OBJ/295	Professor Korsunsky	No
OBJ/297	Mr J Gittos of Engage Oxford	No

<b>Langford Lane</b>		
<b>OBJ/238</b>	<b>Mr J J D Offord, Mrs E A Offord, Mr R M Bradshaw and Mrs H S Bradshaw</b>	<b>No</b>

<b>Bicester</b>		
<b>OBJ/245</b>	<b>Mr A Buckley</b>	<b>No</b>

<b>Bicester Gavray Drive</b>		
OBJ/018	Janet Brown, Robert Brown and James Cox	No
OBJ/192	The Norman Trust	No
<b>OBJ/249</b>	<b>Mr D Keyse of J J Gallagher Limited</b>	<b>No</b>
OBJ/257	London & Metropolitan International Developments Limited	No

Key Issues raised by those objectors who have submitted a Statement of Case to clarify the unresolved issues are described below. Other receptors have raised general issues relating to noise and vibration which have been addressed in response letters.

5.59 Objectors in Wolvercote and North Oxford are covered in the following sections

**OBJ 295 (Korsunsky), 35 Lakeside, Oxford**

5.60 The key points raised in the objection (in italics) are considered below and responses to each point are given.

*Vibration Damage from freight trains*

5.61 The Environmental Statement (ES) that was submitted with the Transport and Works Act Order Application reports the overall approach that we have taken to identifying the locations and circumstances where it may be necessary to provide mitigation for vibration. The approach we have used and the level of detail to which it has gone is entirely consistent with our knowledge of the likely vibration effects of a new railway, using standard construction techniques, and follows good practice in the environmental assessment of such effects.

5.62 At this stage in the design, detailed ground investigations have not yet been undertaken. For most of the railway, except possibly in Wolvercot Tunnel, conventional ballasted track will be used, with the rails attached directly to the sleepers which are held in a graded stone formation. On the immediate approaches to and within Wolvercot Tunnel, the track will be lowered and a concrete slab may be placed under the track as part of the retaining structures. Conventional ballasted track is likely to be laid above the slab, but there are other engineering solutions which could be employed, which will, if necessary, incorporate 'damping' to reduce transmission of vibration.

5.63 Along the great majority of the railway, no specific mitigation of vibration will be necessary. At the detailed design stage, further vibration assessment will be undertaken to incorporate any specific mitigation measures that are necessary.

*Lack of Investigation of Building Damage*

5.64 It is stated that “there is already evidence of damage” on page 5 of the Statement of Case, but no evidence has been provided to the Chiltern Railways team to link this to vibration from the railway. Several objectors have stated that houses in North Oxford have already experienced structural damage arising from freight trains in the 1970s. Chiltern Railways have checked with Network Rail if they have records of any complaints of damage caused by vibration from trains, as this has been stated by a number of objectors. Their records, of all types, show no such claims have ever been made within the North Oxford area. These records predate the creation of Network Rail and go back into BR days, when the damage is claimed to have occurred. Colleagues have also spoken to Engineers who dealt with the area at that time and they also say that no such claim has ever been made. In responding to objectors we have asked if evidence to the contrary is available, but none has been provided.

5.65 The existing railway was created over 100 years ago, and has been operational since that time. Experience in the UK, EU, Asia, USA, Australia and New Zealand shows that there are no damage issues relating to housing alongside railways. Since axle loads are higher in the USA (30.4 t) than in the UK (25.5 t), it would be expected that building damage would have been reported in that part of the world if it were likely to occur, but there is no evidence of such damage. Therefore, building damage is not expected from this Order Scheme.

*Lack of Clarity of Vibration Mitigation*

5.66 Vibration mitigation will be installed to ensure that, wherever practicable, everywhere along the railway, vibration felt inside residential properties is kept to below a very strict limit, which is defined in British Standard 6472 as a “low probability of adverse comment”. In one or two locations, if full vibration mitigation is not practicable, the vibration levels will, at worst, be limited to “adverse comments possible” according to BS 6472, which is still a strict limit. Even at well above this limit, no structural or cosmetic damage to property will occur. These commitments are included in the Draft Noise and Vibration Policy and which will be conditioned to ensure that its commitments are fully met.

*Increase in Axle Weight of Freight Trains*

5.67 It is suggested in this Objector’s Statement of Case that axle weights may be increased in the future. With respect to the axle weights, these are not to be increased as a result of the Order Scheme. The maximum axleload for freight trains will, in future, be 25.5 tonnes, the same as it is now. This is normally only fully used by trains carrying bulk materials, such as gravel or crushed rock. Most other freight trains are much lighter; the typical axleload on a container train is around 17 to 18 tonnes. This is partly because consumer goods weigh much less and also because containers are transported by both road and rail, and their weight is constrained by the maximum overall weight allowed for lorries.

5.68 The Department for Transport is funding work to enable trains to carry the international standard 9’6” high containers through Wolvercot Tunnel without

the need for special low-floor wagons (as against 9'0" high containers at present). This does not mean there will be any significant increase in axleloads, since, as noted above this is constrained by the maximum weight of containers that can be carried on lorries.

*Consideration of Other Mitigation such as Track Lowering and Tunnel Structure to Enclose Track*

- 5.69 The benefits of track lowering and/or enclosure of the tracks in an artificial tunnel have not been considered in detail as a potential mitigation for noise, principally for engineering, visual impact and cost reasons.
- 5.70 Lowering the track is a major engineering operation that requires excavation and disposal of significant amounts of material. Where the railway is already in cutting, the existing cutting slopes would need to be regraded (and the cutting widened at the top) or substantial retaining structures provided. As you would expect, this is a costly and complex operation for any considerable length. Chiltern Railways is already intending to lower the track level through Wolvercot Tunnel to accommodate double track. Even this relatively short length of track lowering, which is only by about 800mm at its deepest, will require extensive engineering works within the tunnel to ensure that its structural integrity is maintained and provide an enhanced drainage system.
- 5.71 Where the railway is at grade, moderate track lowering requires disposal of material, the creation of shallow cuttings, which may not be possible within the existing railway corridor without retaining structures or the acquisition of garden land to widen the railway corridor, as well as new drainage.
- 5.72 It may be easier to lower the track where the railway is on embankment. However, in locations where a 2m noise barrier is required, at least that amount of track lowering will be required to achieve the same result. In many situations, depending on the proximity of dwellings to the railway an additional barrier at the railway boundary would still be needed to shield parts of the garden area and/or upper floors. Track lowering even in this situation is far less cost effective than a noise barrier.
- 5.73 The covering over of the railway would present a number of practical difficulties. It would be very costly to construct, be visually intrusive and have further operational costs which would have to be taken into account. The most significant of the difficulties is in respect of maintenance of the railway. Routine inspection of the track is normally done during daylight while trains are still running. If the railway is covered, artificial lighting is necessary and the "tunnel" would have to be constructed particularly wide to allow for safe access. Any significant maintenance or renewal activity becomes far more difficult in a tunnel – for example, it is not always possible to use cranes because of the restricted space. All of this leads to significantly increased operational costs.
- 5.74 The visual intrusion of the structure would also need to be carefully considered. The structure would have to be continuous at least one hundred metres to be effective for even a single dwelling. Such a major structure would need to have internal clearance above track level of at least 5.8m and

the resulting structure, for example, at Lakeside would be at least 7m plus the height of the embankment above adjacent gardens. This is much higher and more visually intrusive than the 2 m barrier that is described in the ES. Even were it feasible to provide such a structure, it would have significant adverse visual impacts, which most residents would find less acceptable than the mitigation measures we are proposing.

- 5.75 Even without having evaluated such an option in detail, we are certain that it would be both very costly and generally unacceptable to residents.

#### **OBJ 297 (Gittos/Engage)**

- 5.76 The key points raised in the objection are considered below and responses to each point are given

##### *Order Scheme will be outside of the Control of the Applicant*

- 5.77 Where potential noise impacts are predicted, effective noise performance measures will be applied, which, in general, will exceed statutory requirements. Since publication of the ES Chiltern Railways has developed a Draft Noise and Vibration Policy This will be implemented to control operational noise and vibration from the railway. This reflects the commitments in that were made in the ES. The Draft Noise and Vibration Policy will be applied to both Chiltern Railways and the promoters of EWR, if and when it progresses. This will be enforced through a planning condition. In my opinion this provides a high level of commitment which will ensure that the Order Scheme is adequately controlled in the future

##### *Effect on Noise of Two Passenger Trains Passing at Speed*

- 5.78 The noise assessment uses the  $L_{Aeq, period}$  which is the standard metric in used in the assessment of eligibility under the statutory Noise Insulation Regulations for railways, and in PPG 24, and the takes account of the total number of trains that use the Order Scheme. Since  $L_{Aeq, period}$  does not differentiate between trains arriving at the same time, it is not necessary to consider this unlikely event specifically. In terms of the maximum noise level during a train pass-by the increase in noise of two trains would be less than 3 dB which would be the smallest change in noise that would be perceptible under normal circumstances.

##### *Freight Trains*

- 5.79 The point is raised (in section 2.2 of the Statement of Case that freight trains will use "old and noisy rolling stock and heavy axle loadings". It is noted that freight stock has improved in line with developments in modern rail technology and it is maintained in good condition to minimise down time. The modern railway stock consists of disc braked vehicles which are quieter than the old tread braked systems. It therefore unlikely that it would be in the interest of commercial freight operators to use old and noisy stock as stated. The issue of axle weight is discussed in 5.66 above in relation to OBJ/295). Axle weights will not increase as a result of the Order Scheme.

5.80 The Following (in italics) are proposed as restrictive conditions for freight trains in the Objector's Statement of Case with responses shown below the appropriate condition:

*Extra requirements for trains running on this line to inspect and if necessary repair wheels in the same manner as Chiltern Railways:*

5.81 Chiltern Railways does not operate freight trains, and so cannot impose commitments to specific maintenance regimes on freight operators. However, as discussed in 5.31 above it is unlikely that it would be in the interest of commercial freight operators to operate badly maintained trains.

*Only modern stock with light axle loadings should be used*

5.82 As in 5.80 it is unlikely that it would be in the interest of commercial freight operators to operate badly maintained trains. The issue of axle weight is discussed in 5.26 above in relation to OBJ/295). Axle weights will not increase as a result of the Order Scheme.

*Continuously Welded Rail to be used throughout*

5.83 Continuously Welded Rail (CWR) is the standard track for that will be used throughout the Order Scheme.

*There should be extra measures to screen high freight containers*

5.84 The noise source height is considered in the calculation of the effectiveness of barrier screening. The height of freight containers will not affect noise levels at nearby properties as noise is generated at the rail-wheel interface and from the motive power units for DMUs and locomotive hauled trains. This is set out in the Calculation of Railway Noise which is the official method for railway noise calculation.

*Restrictions to the number of trains running between midnight and 6 am*

5.85 Unfortunately it will not be possible to limit the use of the track at night in accordance with normal railway operating procedures. However, Chiltern Railways will not be running passenger trains through the night, and services in late evening and early morning will be at a reduced frequency. A very small number of trains (perhaps 1 or 2) may arrive in Oxford after midnight or depart from Oxford before 0600.

5.86 Any overall increase in freight train numbers above those currently operated is only likely if and when the East-West Rail project goes ahead. The number of freight movements will reflect national freight demand, and will be limited by the number of available freight paths (1 per hour in each direction) and the likely market demand. Based on analysis of the number of the existing situation on the main line through Oxford, only about half of the available freight paths are likely to be used, limiting the number to perhaps five freight train movements between midnight and 0500 hours, and perhaps 8 train movements between 2300 to 0700 hours.

*Restrictions to limit shunting of strains to daylight hours*

5.87 No shunting of trains is envisaged as a result of the Order Scheme.

*Prohibit the idling of trains near residential areas.*

5.88 It is not expected that trains will need to idle in residential areas. Drivers are trained to shut down the train engine if the train has not moved for 5 minutes. Trains are also fitted with automatic cut-out systems that shut down engines if they are stationary for more than 15 minutes.

*A limit should be imposed on the axle weight of freight trains*

5.89 Freight on the UK rail network is already subject to a maximum axle load restriction of 25.5 tonnes.

*Independent monitoring should be carried out in the future and amelioration measures where and when required should be provided*

5.90 Commitments are given in the Draft Noise and Vibration Policy to monitor noise levels for a period after opening of the Order Scheme. The mitigation is designed based on freight that can be reasonably foreseen based on current plans for the railway network.

Wolvercote School

5.91 The objector has suggested that special measures are required to mitigate noise at Wolvercote School, possibly including cut-and-cover tunnelling of the track. These issues were responded to in OBJ 295 above and highlight the practical difficulties of placing track in tunnel in the Wolvercote area.

Train Whistling

5.92 It is noted that a benefit of the proposals will be the closure of open crossings and the corresponding reduction in a need for whistles. There is no requirement for drivers to sound their horns on entering or leaving the Wolvercot Tunnel. The Order Scheme will therefore have a positive effect in terms of reducing this noise source which can result in annoyance given its high level and distinctive short character.

Impact of Vibration

Concerns that ground conditions involving the Oxford Flood Plain and deposits of gravel and clay in adjacent bands move and transmit vibration.

5.93 Vibration measurements of existing railway vibration have been carried out at some of the closest receptors to the railway to identify if ground conditions give rise to vibration magnitudes that are higher than expected for railway vibration, and to confirm if the vibration levels in the ES were appropriate. The measurements are summarised in **Appendix MF3** which is bound separately in **(CRCL/P/9/B)** confirmed that vibration levels are similar to those that were assumed in the ES, and therefore the findings of the ES are considered to be robust.

## Speed of Trains

5.94 It is proposed in the Objector's statement of case that a speed limit of 30 mph should be maintained through Oxford housing areas. This is dealt with in Section 5 of the evidence of Mr Stephen Barker (**CRCL/P/6/A**).

### 5.95 **OBJ/014 - Mr K Dancey of Quadrangle Management Limited**

- Remembers vibration and structural problems associated with operation of heavy freight in the past
- Concerns about increase in vibration
- Noise barriers for this Quadrangle House are impractical and not welcome as would need to be 20 feet high (property is 3 stories with no living accommodation on ground floor)
- Unexplained mitigation measures (rail dampers)
- Installation of welded track is no different to existing track
- Wants to know in detail how the track bed and rail head would be improved and how rail dampers work

### 5.96 **OBJ/077 Mr J Thorowgood and H Chance**

- Not seen results of noise monitoring
- Speed of trains – question how trains running at or in excess of the current 30 mph could have less noise impact than higher speed trains
- Speed of trains – question necessity for higher speed trains
- Chiltern Railways assured that trains would be modern and quieter than most existing types of passenger train, however, Chiltern Railways may not always be the operator
- Freight trains – Chiltern Railways has no control over freight trains, which from experience are very noise and often run at night
- Heavy trains used to cause vibration as far as Woodstock Road
- Once TWA granted with insufficient protection to residence there would be little or no chance for further measure to eliminate vibration

### 5.97 **OBJ/095 Mr S Young PhD CChem**

- Increases in train movements, speeds, hours of operation and carriage length will result in permanent increased levels of noise and vibration and bring trains closer to their property
- Increased noise will overwhelm the garden and necessitate keeping windows closed
- Increase in cracking and structural defects
- No measures to identify and assist in ensuring cracking/structural damage does not occur
- Night time construction noise and vibration
- Insufficient mitigation for noise and vibration
- Noise reduction at the wheel rail interface would not be maintained
- Removal of landscaping will result in increased noise

- Requirement for noise attenuation measures, noise barriers at the entrance/exits to the Wolvercot Tunnel and anti vibration measures
- Personal mitigation, including double glazing and underpinning
- Failed assurances in respect of mitigation measures
- No compensation for noise has been offered during construction

5.98 **OBJ/132 Mrs A Taylor and Mr G Taylor**

The objectors' Statement of Case suggests that a tunnel should be built to reduce railway noise and maintains that vibration mitigation should be installed to reduce vibration. These concerns are addressed in the response to **OBJ 295 (Korsunsky), 35 Lakeside, Oxford** above.

5.99 **OBJ/143 Ms M Rosenberg**

- Income - Place of work (piano teacher working from home) will no longer be suitable and either an alternative site will have to be rented (thought not suitable due to professional body rules) or will have to extend and soundproof front room of house
- General noise pollution
- Concerned about noise readings taken at North Oxford Golf Club due to temporary 40 mph speed limit, recordings taken during summer holidays and a low peak times – invites readings from her back garden over 24 hours
- Provide proper mitigation

5.100 **OBJ/212 Lewis and Sarah Butler**

(ES states Phase 1 – moderate noise impact, Phase 2 substantial noise impact)

- Provide proper mitigation and deal with unacceptable noise if it does occur
- Property will be affected by high noise levels
- Cause undue interference with tenants' peaceful enjoyment of the property
- Affect property value
- Vibration – not sufficient comfort vibration will be reduced to acceptable levels
- Vibration – ensure subsidence problems will not be aggravated
- Limits on construction and operation time, rate of acceleration, measure to reduce breaking noise/revving engines, the sitting, quality and maintenance of track joints, erection of barriers and double glazing for mitigation, amongst others

5.101 **OBJ/213 Mrs Rosemary Harris**

- Increase in noise and vibration – overwhelm garden and necessitate keeping windows closed
- Cracking and structural damage from increased frequency and size of trains
- Night time construction noise and vibration require extensive mitigation

- Insufficient mitigation
- Loss of business – student accommodation unfit for studying due to noise (construction and operation), requires significant mitigation
- Future works carried out under the Permitted Development Rights once the railway is operational will result in noise
- Noise within the property will affect living conditions
- Noise reduction at the wheel rail interface would not be maintained
- Requirement for noise attenuation measures, noise barriers at the entrance/exits to the Wolvercot Tunnel and anti vibration measures
- Personal mitigation, including double glazing, underpinning, appointment of independent surveyor
- Requirement to use the latest technology
- Removal of current landscaping will result in increased noise
- No assurances of mitigation
- No compensation for noise has been offered during construction

5.102

**OBJ/232 Mr H Schoetz and Mrs R Schoetz**

- Staff car park at Oxford station to be used as additional short term parking will result in higher level of noise – previous correspondence on this matter addresses only road traffic not vehicles picking up/dropping off passengers
- Proposed secure fencing between car park and new tracks will not have noise reduction function
- Increased number of trains mean continuous noise, which they feel is not considered in the ES, or the noise from accelerating trains
- No assessment of noise from passengers (assume on the platform)
- Convinced a noise barrier of 2.5 m between new station building and north end of car park would reduce noise impacts
- Disappointed not electrification system as this would reduce noise

5.103

**OBJ/234 Ms C Robertson**

5.104

A letter was sent to this objector on the 5th of July 2010 dealing with general concerns regarding noise and vibration raised in the objection. The key points in the Objector's Statement of Case are addressed in this section.

5.105

The objector is concerned about the use of guideline values, and would prefer that WHO guidelines were used to limit noise from the Order Scheme. The guidance levels on which we are basing the mitigation thresholds 45 dB LAeq, day and 55 dB LAeq, night (outside a building) are consistent with the WHO guidelines Ms Robertson has also advocated. It should be noted that the WHO notes that these guidelines are not planning standards, and highlights that particular technological, social, economic and political factors need to be considered when applying guidance to a particular country. These guidance levels are widely adopted as the levels which represent the onset of community noise effects. Therefore, they provide a stringent lower threshold below which impacts may not occur, rather than an appropriate upper limit for noise levels from a new railway.

5.106

Concerns are also raised about considering existing noise when considering the effect of a scheme. I believe that is appropriate to consider changes in this

actual baseline situation as an indicator of the noise impact of the proposed improvements to the railway in North Oxford. If a noise source cannot be heard above the ambient noise, then it is impossible for it to have a noise impact. In a noisy area, designing the railway to meet lower levels would be prohibitively expensive, and would not produce any noticeable benefit.

5.107 Ms Robertson has also asked that noise barriers should be located as close to the source of noise as possible, rather than on the residential boundary fence line. The likely location of noise barriers that has been modelled in the ES and confirmed subsequently with more detailed modelling techniques is based on a minimum distance of 2 m between the track and the nearest rail. Such a barrier, or equivalent mitigation has been modelled at Lakeside where Ms Robertson lives. This distance cannot normally be reduced due to safety and operational constraints, such as maintaining sight lines.

5.108 Ms Robertson also considers that low frequency noise should be taken into account. Passenger and freight trains have the same source of primary noise generation, i.e. the rail/wheel interface and neither type of train is expected to be a significant source of low frequency noise.

5.109 **OBJ/235 Ms S Dhall**

5.110 Increased noise and vibration would mean windows and doors would need to be kept shut (what is currently outside the station will become inside the station and so idling trains causing noise will occur outside her house, even though assurances are this will not occur outside the station)  
Mitigation required – no space for bunds  
Claims that noise levels are already high so additional noise will make no difference is incorrect – increased frequency of trains means more time of day there is noise  
Vibration – quality of life – small house already affected by vibration

Langford Lane

5.111 **OBJ/238 Mr J J D Offord, Mrs E A Offord, Mr R M Bradshaw and Mrs H S Bradshaw**

5.112 Concerns regarding affect on equestrian business as a result of startle of horses that are not familiar with the sudden noise that the objectors' consultants feel is likely to come from the upgraded railway. If startle were to be induced the Objectors are concerned about speech interference in the riding school areas that are claimed to cause a safety issue. I have met with the Objectors, and conducted a site visit to an equivalent location adjacent to a track carrying passenger trains at the proposed speeds. Measurements and observations on site confirmed that train noise will be audible for several seconds, and will increase relatively gradually to its maximum levels. Therefore, given that trains follow a predictable path which would be a large distance from the riding school, I believe that startle effects are unlikely. I am continuing to liaise with the objectors on this subject.

5.113 The effects of construction noise on the behaviour of horses is also a concern to this objector, and we agreed that there will need to careful consideration of how these effects can be minimised during detailed planning of the road works associated with the proposed Langford Lane/Elm Tree crossing. However, it is agreed that this is likely to be a resolved.

Bicester

5.114 **OBJ/245 Mr A Buckley**

5.115 Concerns regarding the noise disturbance and possible idling of trains adjacent to property. The crossing equipment at this crossing is to be upgraded to include CCTV control from a control box, and automatic barrier systems. As a train approaches, the traffic lights and barrier lowering sequence is commenced automatically. This is described in Stephen Barker's evidence (**CRCL/P/6/A**). I expect there to be no need for trains to idle at the crossing, and therefore no additional noise disturbance is expected.

Bicester Gavray Drive

5.116 **OBJ/249 Mr D Keyse of J J Gallagher Limited**

5.117 Concerns regarding the effect of noise from trains on the proposed housing development. This evidence Richard Caten (**CRCL/P/11/A**) discusses negotiations that have been carried out with this objector. It is thought likely that a financial agreement will be reached to supply noise insulation, or other mitigation to offset any effects of the railway.

## 6 CONCLUSIONS

- 6.1 The noise and vibration assessment in the ES represented a robust assessment using well established methodology. It demonstrated the extent and the severity of potential noise and vibration impacts and set out the basis of an effective mitigation strategy.
- 6.2 It was envisaged at the time of writing the ES that a Noise and Vibration Policy would be introduced, and barriers and other mitigation provided according to this policy. This is a satisfactory method of controlling noise and vibration for railway schemes. A draft of this policy is being reviewed by Network Rail, and will be made available to the Inquiry.
- 6.3 Further continuous recording of baseline noise levels has been carried out to provide additional information regarding the scope of noise impacts. Those that can be compared directly to existing noise receptor locations show that either the ES the baseline noise levels were consistent with the new recorded noise data, or lead to a conservative assessment.
- 6.4 The ES established the magnitude of noise impacts from the Order Scheme at a wide range of noise sensitive receptors. As envisaged in the ES, detailed noise modelling is being undertaken of the Order Scheme and the mitigation that is proposed, in order to establish a more precise estimate of the extent of noise impact in areas where complex geometry exists, to estimate the number of properties that are likely to be affected and to further develop the mitigation measures. The initial results around North Oxford have shown good agreement with the results in the ES at the representative receptors shown on plans in the ES. Modelling results in north Oxford are contained in **Appendix MF 2** which is bound separately to this proof in **CRCL/ P/9/B**.
- 6.5 The results of vibration monitoring are reported in **Appendix MF 3** which is bound separately to this proof in **CRCL/ P/9/B**. Results from these surveys are being discussed to individual residents who are concerned about vibration. However, at all locations it was clear that vibration from existing trains was not sufficiently large to result in building damage, and that the magnitudes of train vibration confirm that the approach in the ES was sufficient to assess vibration.
- 6.6 Out of the total of 308 objectors, 152 specifically refer to noise and/or vibration concerns. Chiltern Railways has made substantial efforts to respond to these concerns, including meeting with objectors either in groups or individually, meeting with public representatives (MPs and Councillors), and writing both standard and bespoke letters to respond to these initial contacts. Chiltern Railways has then conducted follow up to check if any Objectors are ready to withdraw their objection.