

Dear David/Fiona

I am writing to you with reference to recent representations from Keith Dancey (KD).

On the 7th of May KD wrote to you to share the results of a survey of structural damage to track-side buildings along the Oxford to Bicester railway line through upper Wolvercote. Then on the 8th of May KD wrote to you with comments in response to our report '*H03-OB*'. In this representation KD raises further concern:

1. that differences in the geological conditions at the VSoA measurement site and at the locations of sensitive receivers along the scheme are sufficient that they make the predictions presented in the VSoA unreliable;
2. that existing structural damage in properties close to the scheme, reported by PB and KD, is a result of train vibration and that this has led to a perception that the ground through Wolvercote is unusually susceptible to vibration;
3. that vibration source data measured next to a railway operating at grade (where the track follows the local ground surface) cannot be used to reliably predict vibration from parts of the Scheme operating on embankment, cutting or in tunnel; and
4. that the transfer function used to predict internal vibration from external vibration is '*wrong*'.

#### **In response to the representation of the 7th May**

We advise that KD's conclusions on structural damage are at odds with the professional consensus on the likelihood of structural damage caused by railway vibration. It is unscientific to assume that correlation between perception of vibration, distance from the railway and structural damage means that the damage is necessarily caused by train vibration. Further evidence in the form of measured vibration levels would be required to conclude that railway vibration is the cause of building damage. We have responded in detail to concerns about structural damage in Section 2.2 of *H03-OB*. Here we provided detailed advice on other causes of building damage including "*internal or external disturbances such as the effects of temperature, moisture, differential settlement, trees, occupational loads, overloading, pre-stressing forces, material creep and chemical changes*". Further evidence would also be required to dismiss these factors before it could be concluded that vibration was the cause of damage.

#### **In response to the representation of the 8th of May**

##### **Point 1**

We responded to concerns about the differences between geology at the VSoA source term measurement site and the rest of the scheme in Section 2.1 of *H03-OB*. We have reviewed KD's points and all of the British Geological Survey borehole information cited by KD and Paul Buckley (PB) in the '*failures of the Atkins Report*'. We see nothing in his representation which would cause us to change our opinion that it is reasonable that Atkins have used source data obtained in Port Meadow to predict the vibration for the scheme.

##### **Point 2**

We have covered this point comprehensively in Section 2.2 of *H03-OB* and above.

##### **Point 3**

KD cites two papers which he claims prove that cuttings make a difference to the propagation of vibration including:

- M.C. Forde, D.P. Connolly *Seismic vibration measurements near high speed railway lines to validate University of Edinburgh developed software*. NERC Scientific report. Institute for infrastructure and environment, University of Edinburgh; and
- Nguyen, K-V. and Catmiri, B. (2007). *Evaluation of seismic ground motion induced by topographic irregularity*. Soil Dynamics and Earthquake Engineering, 27, 183–188

The former reference is a paper providing preliminary findings of an ongoing research project. It does state that “*cuttings produced elevated vibration levels in comparison to the at-grade and embankment cases*”. However the statements made are qualitative and no quantitative information is presented which could be used to verify the result or determine if it would be significant for the VSoA assessment.

The second reference states that “*local topographic conditions play an important role in the modification of seismic ground motion at the irregular feature itself and its neighbourhood*”. These conclusions are informed by the results of numerical modelling. The paper is written for the purpose of studying the effects of strong ground motion during earthquakes. These studies are therefore not considered to be relevant to the VSoA.

It is important to add that at no point have we claimed that the presence of embankments and cuttings “*makes no difference to the propagation of vibration*”, as suggested by KD. In *HO3-OB* we stated that “*ground vibration levels measured close to cuttings, embankments and cut and cover tunnels can reliably be predicted with train vibration source data measured from trains operating at grade with no special consideration of the topography close to the track*”. This was demonstrated in the measurement work used to develop the ground vibration prediction methods for High Speed 1.

#### **Point 4**

We have covered this point comprehensively in Section 2.2 of our note *HO2-OB*. We see nothing in KD’s representation which would cause us to change our previous advice.

I would be happy to discuss any of the above points with you on the phone.

Regards

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Arup