A380 South Devon Link Road

(Kingskerswell Bypass)

Public Inquiry

Proof of Evidence

Noise and Vibration

Volume 2: Full Statement

by

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This Proof of Evidence is presented in the following documents:

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Contents of Appendices (**DCC/A/9**)

1 INTRODUCTION

1.1 Qualifications and Experience

1.1.1 My name is Richard Perkins. I am a Chartered Engineer and a Member of the Institute of Acoustics. I have a Bachelor of Engineering Degree in ElectroAcoustics from Salford University and I have had 15 years experience in the field of noise and vibration. I am a Technical Director in the Communities Business Unit of Parsons Brinckerhoff Ltd at Queen Victoria House, Redland Hill, Bristol.

1.1.2 I have worked as the technical lead for noise and vibration on all stages of scheme development from scheme identification studies to construction supervision, primarily on trunk road projects for the Highways Agency, such as the A38 Dobwalls Bypass, the M4 J27-30 widening scheme and the M27 J11-12 Widening Scheme.

1.2 Nature of Evidence

1.2.1 My evidence covers all of the noise and vibration matters in connection with the A380 South Devon Link Road (Kingskerswell Bypass). The Scheme proposals are by means of the draft Orders (**CD 1.1** to **CD 1.6**), described in the Statement of Case of Devon County Council. The draft Orders show the line of the new road, the land needed to build it and changes to the line and status of nearby existing roads, byways, bridleways and footpaths.

1.3 Involvement with the Scheme

1.3.1 I have had responsibility within Parsons Brinckerhoff Ltd for the noise and vibration assessment of this Scheme since 2004.

1.3.2 In the period since January 2009, I have been responsible for updating the previous studies to include the new guidance contained in DMRB, and WebTAG. This has involved site visits and a re-examination of the input data pertinent to the noise and vibration impacts of the scheme.

1.4 Structure of Evidence

1.4.1 Chapter 2 provides an overview of the acoustic terms and parameters used in the assessment of noise of road schemes. I describe the scales and indices used, the reasons why they are used and how they assist to evaluate and understand the noise effects of the Scheme.

1.4.2 In Chapter 3, Legislation and guidance provided by Government, applicable to the noise effects of road schemes are described, together with noise significance criteria. This includes the new methodologies issued since the Environmental Statement was issued and which are used in my evidence to update the noise and vibration studies.

1.4.3 In Chapter 4, the methods for the calculation of road traffic noise, construction noise, vibration from road traffic and vibration from construction activities are described and how they have been applied to the Scheme.

1.4.4 Chapter 5 describes the Baseline conditions and in Chapter 6, the effects of the Scheme on the residents that live in the area are described. Also described are the number of properties that would be eligible for insulation against road traffic noise, together with a review of the likely effects due to the construction noise on the closest residential receptors, road traffic vibration effects and construction vibration effects.

1.4.5 In Chapter 7, I report the outputs from the WebTAG appraisal for the Scheme, and comment on how it relates to the DMRB outputs.

1.4.6 In Chapter 8, I review and give my opinion on the alternative scheme proposed by the Kingskerswell Alliance.

1.4.7 In Chapter 9 I review and give my opinion on comments raised by other Objectors to the Scheme.

1.4.8 In Chapter 10, I review the various assessments made, and give my conclusions on the noise and vibration effects of the Scheme.

2 NOISE AND VIBRATION

2.1 Noise and its Units

Introduction

2.1.1 Sound is the sensation produced through the human ear as a result of fluctuations in the pressure of the air. It is a form of energy that travels outwards from a noise source in a series of waves. The waves have two characteristics, namely sound pressure and frequency. These are perceived by the human ear as loudness and pitch.

2.1.2 The range to which the human ear responds to sound pressure or loudness is very large; the sound pressure level at the threshold of pain is over a million times that of the quietest audible sound. For convenience, therefore, a logarithmic scale of decibels (dB), based on a reference level of the lowest audible sound is normally used. The audible range of sounds is then conveniently covered within the range 0 dB (the threshold of hearing) to 120 dB (the threshold of pain).

2.1.3 Frequency or pitch refers to the rate at which pressure fluctuations occur and is expressed as cycles per second (Hz). The human ear is most sensitive to frequencies between 1,000 and 5,000Hz, but can detect sounds in the range of 20 to 20,000Hz.

2.1.4 The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. This is achieved by using an ‘A’ weighted decibel reading, dB(A), which gives one of the best correlations with the perceived noisiness of vehicles.

Road Traffic Noise

2.1.5 The noise from each vehicle in a traffic stream comprises two components. The first component is generated by the engine, exhaust system and transmission and is the dominant noise source when traffic is not flowing freely. The second component is generated from the interaction of tyres with the road surface and is the dominant noise source under free flow conditions. Noise levels will vary depending on several factors such as vehicle speed, the road gradient, and the road surface.

2.1.6 The noise from a stream of traffic at a receptor at any instant is the sum of the noise from each of many vehicles at various distances. It is influenced by the percentage of heavy goods vehicles, as well as other factors such as distance from the noise source, the nature of the intervening ground surface and the presence of obstructions.

2.1.7 The noise level is not constant but varies from moment to moment. For assessment purposes however, it is necessary to arrive at a single figure estimate of the overall noise level. The index adopted by the Government to assess traffic noise is $L_{A10,\ 18\ hour}$.

2.1.8 The $L_{A10,\ 18\ hour}$ noise level is defined by the A-weighted sound pressure level of the ambient noise exceeded for 10% of the 18 hour period. This provides a measure of the frequently occurring higher levels of a fluctuating noise and in traffic noise assessment is normally defined between 06:00 and 24:00. The $L_{A10,\ 18\ hour}$ is the index prescribed by the Calculation of Road Traffic Noise (CRTN) (**CD 4.27**).

2.1.9 The $L_{A10,\ 18\ hour}$ noise index is also required to be used for assessing entitlement to sound insulation under the Noise Insulation Regulations 1975 and the Noise Insulation (Amendment) Regulations 1988 (**CD 4.8**)

Background Noise

2.1.10 The $L_{A90,\ T}$ background noise level is defined by the A-weighted sound pressure level of the ambient noise exceeded for 90% of a given time interval, T. This provides a measure of the lower levels of a fluctuating noise and is normally defined separately for day and night-time periods. Other percentiles are also sometimes used to describe the levels of ambient noise exceeded for different periods of time.

Construction Noise

2.1.11 During the construction period, properties may experience temporary noise problems due to construction activities. Construction noise at various levels would extend over the whole period of construction and include such varied activities as vehicle movement, excavation and the use of compressors.

2.1.12 The index used for assessing construction noise is the 'equivalent continuous sound level' L_{Aeq} index, which has been found to be more suitable for the large variations in sound intensity which can be experienced with construction activities. L_{Aeq} is defined as the equivalent steady sound that, over the period of measurement, would deliver the same noise energy as the actual intermittent or time varying noise. It is particularly suitable for describing activities which consist of occasional short periods of intensive noise between relatively long quieter periods, such as would be typical on a construction site.

2.2 Vibration due to Road Traffic and Construction

2.2.1 Traffic vibration is a low frequency disturbance producing physical movement in buildings and their occupants. Vibration due to road traffic may be found in two forms:

- ground-borne vibration
- airborne induced vibration

2.2.2 Some construction activities can be a significant source of ground-borne vibration, which have the potential to cause concern at the nearest receptors. The only potentially significant source of vibration likely to occur during construction is piling.

Ground-borne Vibration

2.2.3 Ground-borne vibration is generated by the interaction of vehicle wheels with irregularities in the road surface, and is generally found entering a building via the foundations. Ground-borne vibration is normally only a potential effect for properties very close to a road and the effects are generally insignificant beyond 50m from the kerb.

Airborne Vibration

2.2.4 High levels of low-frequency noise (50 – 100Hz) from nearby vehicle exhausts (especially heavy goods vehicles) can induce perceptible vibration in building elements and can excite building resonances, generating noise at different frequencies, for example window rattle. The majority of perceived traffic-induced vibration in dwellings is caused by low frequency airborne noise rather than ground-borne vibration.

2.2.5 Vibration levels have to be substantially higher than perception levels before even minor damage to decoration and plasterwork would occur. Vibration at a peak particle velocity (ppv) of 0.5mm/s may be just perceptible, but even cosmetic damage is unlikely to occur until a ppv of 5mm/s is exceeded. It therefore follows that if traffic vibration is kept below perceptible levels, then there is no chance of structural damage to buildings.

3 LEGISLATION, GUIDANCE AND SIGNIFICANCE

3.1 PLANS & POLICIES

3.1.1 This chapter sets out the policy framework for the environmental assessment of the Scheme in respect of noise and vibration.

3.1.2 At the national level, the Government makes policies, which indicate the way roads and infrastructure projects should be developed, and how environmental issues should be addressed when considering new road schemes. Significantly, such Government guidance seeks to integrate the consideration of transport proposals with other policy considerations, such as landscape, agriculture and nature conservation policies.

3.1.3 At the regional level, guidance provided by Government and the regional planning bodies contain statements about the role of strategic transport routes in regional development.

3.1.4 At the local level, Government is currently committed to a plan-led system for the control of development and consideration of development proposals. As a result, proposals for development in the Scheme corridor are determined in accordance with the Structure Plan for Devon and the Local Plans of Torbay Council and Teignbridge District Council.

3.1.5 Planning Policy Guidance Note 24 - Planning and Noise (**CD 4.19**) (PPG24) notes that noise can have significant effect on the environment and on the quality of life enjoyed by individuals and communities. As such, it seeks to achieve separation of noise generating activities from the most sensitive receptors, in particular residential areas.

3.1.6 Environmental concerns regarding traffic and noise are also recognized by Policy C30 of the Devon Structure Plan 2001 to 2016 October 2004 (**CD 3.2**) and Policy EP4 of the Torbay Local Plan 1995-2011 Adopted April 2004 (**CD 3.8**). There are no specific plans or policies in the Teignbridge Local Plan (**CD 3.5**) for Noise and Vibration.

3.1.7 Policy C30 states that "development should not be located where it would result in a significant increase in the level of noise pollution in existing or proposed land uses in the vicinity, and noise sensitive land uses should not be located in areas affected by significant existing noise pollution."

3.1.8 Policy EP4 states that "developments which would result in an unacceptable noise impact which cannot be overcome by mitigation measures will not be permitted. Noise sensitive development will not be permitted where it would be subject to unacceptable noise disturbance".

3.1.9 The Scheme would reduce traffic flow along the existing A380 through Kingskerswell, resulting in lower noise levels and vibration but other areas would experience increased noise levels, particularly west of Kingskerswell. There would, however, be a net decrease in properties affected by noise.

3.1.10 Protection of environmentally sensitive areas from noise is an objective within National Policy (PPG24).

3.1.11 The Scheme is assessed as having a beneficial impact against these policies.

3.1.12 The A380 South Devon Link Road (Kingskerswell Bypass) has Planning Permission from Devon County Council (dated 26th August 2005) and Torbay Council (renewed on 12.04.07). Prior to commencement of development, further noise measurements will be undertaken to bring matters up to date:

3.1.13 No objections were received at the Planning Stage from Statutory Bodies in respect to the noise and vibration impacts of the Scheme.

3.2 Legislation and Guidance

The Noise Insulation Regulations, 1975 and 1988 (Amended)

3.2.1 The Noise Insulation Regulations, 1975 and 1988 (Amended) (**CD 4.8**) (The Noise Insulation Regulations), allow for the provision of noise attenuation measures in the form of secondary glazing and mechanical ventilation to habitable rooms of residential properties affected by road traffic noise from a 'new or altered highway'. To be eligible, a property must be a dwelling within 300m of the road works and where calculated in accordance with the regulations, within 15 years from opening of the new road all three of the following conditions apply:

- The combined expected maximum traffic noise level, i.e. the relevant noise level, from the new or altered highway together with other traffic in the vicinity must not be less than the specified noise level, 68 dB $L_{A10,18hour}$;

- The relevant noise level is at least 1.0 dB more than the prevailing noise level, i.e. the total traffic noise level existing before the works to construct or improve the highway were begun;

- The contribution to the increase in the relevant noise level from the new or altered highway must be at least 1.0 dB.

3.2.2 In accordance with the Noise Insulation Regulations, offers of insulation will be made to occupiers of eligible properties within six months of the opening of the new road to public traffic. Where practicable, offers will be made prior to construction so that the property may benefit from insulation during the construction period.

Control of Pollution Act

3.2.3 The Control of Pollution Act 1974, detailed in document **DCC/A/9, Annex 1**, in respect of road schemes, applies only to the construction phase where Sections 60 and 61 of the Act confer duties and powers on Local Authorities to control noise from construction operations.

3.2.4 Under Section 60 the Local Authority may serve a notice to control the works by imposing conditions on generated noise levels, methods of working (including plant and machinery to be used) and permissible working hours and to ensure that the best practicable means of working are used where necessary.

3.2.5 Section 61 of the Act provides for an advance agreement, between the local authority and the person intending to carry out the work, on the matters that may be regulated by Section 60.

The Calculation of Road Traffic Noise

3.2.6 The Government's standard methodology for the prediction of traffic noise is given in the Department of Transport memorandum Calculation of Road Traffic Noise (CRTN) (**CD 4.27**). The current version was first published in 1988 and describes the procedures for calculating noise from road traffic.

DMRB and Other Guidance

3.2.7 In assessing the noise and vibration impacts due to road traffic, I have used HA213/08, which is DMRB Volume 11, Section 3, Part 7(**CD 4.33**). I have used the latest version of the guidance issued in August 2008, as opposed to the previous version (August 1994) that was used to prepare the Environmental Statement. Both guidance documents require traffic noise levels to be predicted for various scenarios using the Calculation of Road Traffic Noise (CRTN) (**CD 4.27**). For assessment of noise from construction activities I have used BS 5228:2009 Code of Practice for Noise and vibration control on construction and open sites. Part 1 – Noise & Part 2 - Vibration (**CD 5.18A**) and (**CD 5.19A**).

3.2.8 The August 2008 version of DMRB Volume 11, Section 3, Part 7 (**CD 4.33**) is similar to the previous version in most aspects. Some of the differences relate to the terminology used (for example it is now a Detailed Assessment as opposed to a Stage 3 Assessment), and the study area is greater than previously considered. The new methodology is discussed in more detail in Chapter 4.

3.2.9 The new version also includes new Legislation that has come out since 1994. Of particular relevance are the Environmental Noise (England) Regulations (2006) (**CD 4.48**). This is the implementation of the EU Directive 2002/49/EC on the Assessment and Management of Environmental Noise.

3.2.10 These regulations require a Member State, every five years starting in 2007, to produce noise maps for (amongst other things) major roads, to estimate the population exposed to noise, to identify hot spots of high noise exposure, and to produce action plans to mitigate the noise wherever possible. The regulations also introduce the concept of a "Quiet Area", and require a Member State to identify and protect areas that are considered to meet as yet defined criteria. However, at present, a Quiet Area only exists within "Agglomerations", (i.e. dense urban areas that meet the definition of the Regulations), and are not currently required outside of these areas.

3.2.11 Under the Directive, Defra is required to publish and consult on an Action Plan. In March 2009, Defra published two draft Action Plan documents:

- Draft Noise Action Plan "Major Roads Template (outside first round agglomerations)" (**CD 4.49**)
- Draft Noise Action Plan "Agglomeration Template" (**CD 4.50**)

3.2.12 Defra's website reports:

"This is not the formal consultation on these noise action plans – that will come later once the comments on the proposed amendments to the Regulations have been assimilated and the finalised amendments have been formally laid in Parliament"

3.2.13 The current draft noise action plan suggests that a trigger noise level of 76 dB $L_{A10,18hour}$; will be used to identify properties for mitigation.

3.2.14 The noise map for daytime covering the area of the Scheme is shown in document **DCC/A/9, Figure NV1**. The map shows that the existing A380 is subject to high traffic noise levels.

3.2.15 The study area for the Scheme is not included within an agglomeration, but as a major road. Therefore no quiet areas will be assigned within the Scheme under any subsequent Action Plan for this round of mapping.

3.3 Magnitude of Impact and Significance Criteria

Road Traffic Noise

3.3.1 Most people are able to distinguish a change of 1 dB(A) in a pure continuous tone, but changes in a fluctuating sound, such as traffic noise, are not so easily perceived. A change of about 3 dB(A) represents the threshold when, in the long-term, changes in traffic noise levels (as distinct from steady sounds) would be perceived. A difference of 10 dB(A) corresponds to a 10 fold increase in sound energy which corresponds to an approximate subjective doubling in loudness. Doubling the energy level (for example the volume of traffic) increases the noise level by 3 dB(A).

3.3.2 For the purposes of this Scheme the magnitude of impact criteria have been defined as follows:

- Changes of less than 1 dB are considered to be negligible
- a change of 1 to 3 dB would be perceptible if the change occurs in the short-term. A change of 3 dB in the long-term would be just perceptible; these changes are described as **Minor**
- a change of 3 to 5 dB would be clearly perceptible both in the short and the long-term and is described as **Moderate**
- a change of 5 dB or greater is described as **Major.**

3.3.3 **Table 1** summarises the criteria for traffic noise as described above:

Table 1: Magnitude of Impact Criteria for Road Traffic Noise

Change in noise level (dB)	**Descriptor**
0	No Change
0.1 – 0.9	Negligible – Increase or Decrease
1 – 2.9	Minimal – Increase or Decrease
3 – 4.9	Moderate – Increase or Decrease
5 or over	Major – Increase or Decrease

3.3.4 There is currently no guidance within DMRB to enable the significance of noise changes for a project to be determined. Noise impacts occur in different ways to every property in the study area, some of which can see high noise increases, others decreases.

3.3.5 For the purposes of this Scheme, the significance in terms of noise will be determined by the overall numbers of properties experiencing noise changes. If there are more properties experiencing a decrease in noise compared to an increase, then the Scheme is considered to be noise beneficial. If there are more properties experiencing an increase in noise compared to a decrease, then the Scheme is considered to be noise adverse.

Construction Noise

3.3.6 There are no recently published guidelines for suitable construction noise limits at residential properties. Limits were first suggested by the Wilson Committee (HMSO, 1963) which proposed daytime (07:00 – 19:00 hrs) limits in terms of noise levels outside the windows of the nearest occupied buildings of:

- *"70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise"*
- *"75 dB(A) in urban areas near main roads and heavy industrialised areas"*

3.3.7 Devon County Council issue construction noise limits on a project specific basis. They consider that the criteria suggested in document **DCC/A/9, Annex B** are suitable for this project. Torbay Council's noise criteria are expected to be the same for this project. Noise limits have been suggested for all properties as shown in **Table 2**.

Table 2: Construction Noise Criteria: Residential

Time of Day	**Construction Noise Levels (Free Field)**
Daytime Monday to Friday (07:00 – 19:00 hrs) Daytime Saturday (07:00 – 13:00 hrs)	72 dB $L_{Aeq,15mins}$ or Ambient $L_{Aeq, 15mins}$ +3 dB
Evening Monday to Friday (19:00-21:00 hrs) Saturdays (13:00 – 21:00 hrs) Sundays & Public Holidays (09:00 – 17:00 hrs)	62 dB $L_{Aeq,15mins}$ or Ambient $L_{Aeq, 15mins}$ +3 dB
Night (21:00-07:00 hrs) Sundays & Public Holidays (07:00 – 09:00 hrs Sundays & Public Holidays (17:00 – 21:00 hrs	Either 47 dB $L_{Aeq,5mins}$ or Ambient $L_{Aeq, 5mins}$ +3 dB (the higher level applies)

3.3.8 The significance criterion is assessed using the daily construction noise level at each receptor.

4 METHODOLOGY

4.1 Study Area and Receptors

4.1.1 The study area is defined as the area where there are roads that are predicted to be subject to a change in noise level of more than 1 dB as a result of the Scheme on opening. The study area for the Scheme is shown in document **DCC/A/9, Figure NV2**.

4.1.2 The study area consists of corridors centred on the existing A380 and the Scheme, and extends up to 2km from the Scheme in rural areas, and 1km in urban areas. Within the study area there is a calculation area, within which noise predictions are made at individual receptors within 600m of the Scheme or an affected road.

4.1.3 The study area is a mixture of mainly rural and residential, with a scattering of industrial estates, commercial receptors (such as shops, mainly in the centre of Kingskerswell village, and adjacent to the Penn Inn Roundabout) and community facility receptors (such as churches, schools, and recreational areas). The main focus of the assessment is on residential dwellings, with noise changes at other noise sensitive locations considered separately with a “simple” assessment.

4.1.4 The study area for the Scheme can be broadly split into five distinct areas of receptors:

- Area 1: Properties adjacent to the Scheme from Newton Abbott to the Aller Junction Railway Bridge

- Area 2: Properties to the east of the existing A380 in Kingskerswell village between the Aller Junction Railway Bridge and Kerswell Gardens Junction

- Area 3: Properties between the route of the Scheme and the existing A380 in Kingskerswell village between the Aller Junction Railway Bridge and Kerswell Gardens Junction

- Area 4: Properties to the West of the Scheme between the Aller Junction Railway Bridge and Kerswell Gardens Junction

- Area 5: Properties adjacent to the Scheme to the South of Kerswell Gardens Junction.

4.1.5 These 5 areas are also shown in document **DCC/A/9, Figure NV2**.

4.2 Mitigation Strategies

Road Traffic Noise

4.2.1 The design of the Scheme has included noise and vibration mitigation measures wherever possible. This includes the vertical and horizontal alignment of the Scheme, the choice of road surface, false cuttings, retaining walls, and environmental barriers to provide screening between the road and nearby receptors. Application of these measures includes:

- An optimum route alignment maximising the distance from as many receptors as possible, subject to constraints provided by other disciplines;
- A 1m high side screen along both sides of the proposed Penn Inn Flyover;

- New retaining walls at various locations along the route which also provide natural screening of the Scheme to some properties;
- Cuttings and false cuttings along the new route;
- A Barrier between the new route and the United Reform Chapel.

4.2.2 The use of a chipped stone asphalt road surface allows a 2.5 dB reduction in calculated noise levels when compared to conventional hot rolled asphalt. This is consistent with the commitment given in the section titled “Highway Maintenance and Noise” on Page 234 of the Devon Local Transport Plan 2006-2011 (**CD 3.9**).

Construction Noise

4.2.3 Prior to the start of construction, limits on construction noise levels and hours of working would be established in consultation with Devon County and Torbay Council’s and would be written into the construction specification.

4.2.4 In order to keep noise impacts from the construction phase to a minimum, a number of mitigation measures would be implemented through the CEMP. Such measures would include, for example, the fitting of effective exhaust silencers on mechanical plant.

4.2.5 Once construction commences, the contractor would be required to comply with the recommendations for practical measures to reduce noise as set out in BS 5228: Parts 1 and 2 (**CD5.18A** & **5.19A**)

4.3 Prediction Methodologies

Road Traffic Noise

4.3.1 Traffic noise levels are predicted in terms of the $L_{A10\ 18\text{-hour}}$ index in dB. The variables used in the calculation of traffic noise level are:

- the annual average week day traffic flow (AAWT) for the 18-hour period from 0600 to 2400 hours
- traffic composition expressed as the percentage of heavy vehicles
- mean traffic speed
- road gradient
- type of road surface
- distance of the receptor from the road
- nature of the ground cover between the road and the receptor
- the shielding effect of intervening obstructions such as buildings, walls and topographical features
- the shielding effects of any purpose built noise barriers or cuttings forming part of the road design
- reflections from barriers, walls or buildings on the opposite side of the road
- reflections from the facade of the receptor (if applicable)

4.3.2 The calculation methodology assumes typical traffic and noise propagation conditions that are consistent with moderate wind velocities blowing from source to receiver. The predominant wind in the study area is from the West.

4.3.3 Calculations are generally carried out to represent noise levels at houses or other buildings where the reception point is taken to be 1.0m from the building facade at a given height. In these circumstances a correction of 2.5 dB is added into the calculated noise level to take account of reflections from the building facade. Free-field calculations are not subject to this.

4.3.4 The traffic noise levels at all receptors in the calculation area are predicted for Do Minimum (without the Scheme) and Do Something (with the Scheme), in the Baseline Year (2013) and the Future Assessment Year (2028). The assumption is made that traffic would grow at the most likely forecast rates, which corresponds to “central traffic growth” for each scenario. These forecasts are still valid despite the current economic situation as the forecasts are long term and hence the assumption is that development planned over that period will still go ahead.

4.3.5 Noise levels have been predicted at every receptor location within the calculation area on each of the affected facades. For those properties that experience a decrease in noise on one facade and an increase in noise on another facade, the highest overall change (on a qualifying facade) is counted as the most significant.

4.3.6 Traffic noise levels have been calculated at two forms of receptor: facade – to represent external noise levels at buildings; and free-field – to represent the situation in the open countryside where the receptor has a recreational value.

4.3.7 Where a receptor location represents a property with more than one floor, calculations have been undertaken at each floor, at a height of 1.5m above ground for the ground floor, and at 2.5m increments for additional floors. The floor with the highest noise level on any façade is quoted.

4.3.8 For receptor locations representing recreational open spaces, noise levels have been calculated at a height of 1.5m above ground.

4.3.9 The calculations used in the assessment of the Scheme were carried out using a computer based prediction model, CadnaA, which is designed to carry out the calculation procedures given in CRTN. This involves creating a 3-dimensional digital model using base mapping, ground contours and the engineering plans for the Scheme.

Noise Nuisance

4.3.10 The subjective reaction to road traffic noise varies widely with the individual person and factors such as tonal and temporal character of the noise, time of day and the absolute level of the noise. Following evaluation of individual responses, a significance “best fit” curve has been established to indicate a level of community response to a given level of road traffic noise. This “best fit” curve is given in Annex 3 of HA213/08 (**CD 4.33**), and is taken to broadly reflect subjective reaction.

4.3.11 When a change in traffic noise levels is noticeable, the level from which the change occurs has some bearing on the subjective response to that change. For example, a 5 dB change from a traffic noise level of 45 to 50 dB(A) would bring about a different change in subjective response to a 5 dB change from 65 to 70 dB(A). For this reason, a Noise Nuisance assessment has also been carried out for the Scheme.

4.3.12 Noise Nuisance is defined by the World Health Organisation as “a feeling of displeasure evoked by noise”. Individuals vary widely in their response to the same level of traffic noise. However, the average or community response from a large number of people to the same level of traffic noise is fairly stable. Therefore, a community average degree of ‘bother' caused by traffic noise can be related to the long-term steady state noise level.

4.3.13 Methods of assessing nuisance and the methodology used are set out in HA213/08. (**CD 4.33**).

4.3.14 The results of the noise nuisance assessment are set out in Chapter 6 and are presented in bands of increases and decreases in percentage nuisance.

Construction Noise

4.3.15 Construction noise predictions have been carried out based on the methodology outlined in BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites. Noise.(**CD 5.18A**) Construction noise levels are predicted as a 'free field' equivalent continuous noise level averaged over a one-hour period ($L_{Aeq,1h}$), and then averaged over a 12 hour working day to produce the $L_{Aeq,12h}$.

4.3.16 In order to evaluate noise levels due to construction, it is has been necessary to define the various activities to be undertaken and the equipment to be used. Based upon information regarding the anticipated programme of activities during construction described in the evidence of Michael Smith **(DCC/P/3**), the magnitude of construction noise impacts has been assessed by predicting likely construction noise levels at a representative sample of the properties within 100m of the various predicted activities. The distance of 100m is the distance from the works at which the predicted construction noise levels would be above ambient noise levels at the receptor locations.

4.3.17 The principal sources of potential construction noise impact are: site clearance; earthworks including cut, fill and drainage; road surfacing; construction of structures; and heavy goods vehicle movements on haul routes.

4.3.18 An outline schedule of works has been used to determine the likely construction plant for each activity. All activities, with the exception of earthworks, have been calculated at an average distance to the nearest receptor. Earthwork activities have been calculated at the closest point to the receptor. These assumptions allow for the typically variable nature of construction activities, and represent the worst-case scenario.

4.3.19 Worst-case activity $L_{Aeq,T}$ noise levels have been estimated using the guidance provided in BS5228: 2009: Part 1 (**CD 5.18A**). Whilst this standard contains the best available information for the purposes of this assessment, it is noted that the sound power level data errs on the side of caution, with an over prediction of the likely levels at the receptors. It is envisaged that following the development of a more detailed construction programme by the contractor, overall predicted levels at receptors would be lower than the figures calculated.

4.3.20 The significance of daytime construction noise effects has been assessed by comparing predicted noise levels during the construction phase against the limits given in **Table 2**, taking into account the duration of any exceedance. The significance criterion is assessed using the daily construction noise level at each receptor.

Road Traffic Vibration

4.3.21 A method for assessing airborne induced vibration is given in HA213/08. (**CD 4.33**). Published research has indicated that the relationship between airborne vibration and nuisance generally follows that for road traffic noise. For a given level of traffic noise, the percentage of people bothered by vibration is 10% lower than the corresponding figure for noise nuisance. This enables changes in vibration nuisance to be estimated from the road traffic noise assessment using the assessment of noise nuisance between Do Minimum and Do Something between the years 2013 and 2028.

4.3.22 It is normally considered that newly constructed carriageways are unlikely to generate significant ground-borne vibration, and if appropriate levels of maintenance are achieved throughout the life of the road surface, then ground-borne vibration is not considered to be a problem. For these reasons no assessment of ground-borne vibration for residential dwellings has been carried out for the Scheme.

Vibration due to Construction

4.3.23 Some construction activities can be a significant source of ground-borne vibration, which have the potential to cause concern at the nearest receptors. The only potentially significant source of vibration likely to occur during construction is piling.

4.3.24 Whereas for airborne noise there are accepted formulae for predicting the likely noise levels at the nearest receptor, the same is not true for the passage of vibration through the ground. However, some empirical formulae have been proposed for known ground conditions based on measured data.

4.3.25 In order to ascertain the level of any impact from vibration, a calculation has been made of the vibration peak particle velocity (ppv) due to piling activities at the closest sensitive receptors. This has been undertaken using typical source data and the propagation relationship taken from BS5228: 2009 Part 2: Code of practice for noise and vibration control on construction and open sites. Vibration (**CD 5.19A**).

4.3.26 The calculated ppv values for each operation are then assessed over a 12-hour working day to predict the vibration dose value (VDV) at receptor positions using BS6472-1 2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting(**CD 5.20**).

4.3.27 Construction vibration can be both a source of nuisance and a source of building damage. Since building damage occurs at levels significantly higher than that considered to cause nuisance to humans, an assessment of vibration nuisance is made with reference to BS6472-1 2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting (**CD 5.20**). Vibration Dose Value's (VDV's) are used to assess the severity of the piling activities.

4.3.28 The significance of the possible nuisance impact of the predicted construction vibration levels has been assessed by comparing the predicted VDV with the ‘probability of adverse comment' in BS 6472, as shown in **Table 3**.

Table 3: Vibration Dose Values Above which might result in various probabilities of Adverse Comment in Residential Buildings (from BS 6472: 2008).

	Vibration Dose Values ($ms^{-1.75}$)		
Building Classification	**Low Probability of Adverse Comment**	**Adverse Comment Possible**	**Adverse Comment Probable**
Residential buildings, 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

5 BASELINE NOISE

5.1 Road Traffic Noise

5.1.1 Following liaison with landowners and residents, ambient background noise monitoring was undertaken at 8 locations as shown in document **DCC/A/9, Figure NV 3**.

5.1.2 The locations are as follows:

- M1 Adjacent to Addison Road
- M2 Adjacent to Addison Road
- M3 Adjacent to St Lukes Road
- M4 Adjacent to St Lukes Road
- M5 Foredown Lane
- M6 Foredown Lane
- M7 Greenhill Road
- M8 Edginswell Lane
- MC Garden of No 2 Aller Park Road

5.1.3 Measurement positions M1 to M4 and MC represent locations close to the existing and future road alignments. Measurement positions M5 to M8 represent locations away from the existing A380, but close to the new A380 SDLR route. The Baseline Noise Report is included in document **DCC/A/9, Annex 3**.

5.1.4 Measurements were obtained to quantify the existing ambient noise climate in the calculation area, as well as to validate the Baseline Year noise model, which is in document **DCC/A/9, Figures NV4 a to c**.

5.1.5 The results for traffic noise presented in **DCC/A/9, Figures NV4 a to c** show that properties adjacent to the existing A380 in Area 1 (M1 to M4) are exposed to high traffic noise levels, which dominates the noise climate in the area. This matches the subjective impression observed by the engineer, and correlates well with the validation exercise.

5.1.6 The results also show that properties away from existing A380, but close to the Scheme where it goes around the village of Kingskerswell in Area 3 (M5 to M7) and Area 4 (M8) are exposed to considerably less traffic noise than in Area 1, as the measurements obtained were significantly higher than the predicted traffic noise levels from the A380. The noise climate is made up of a mixture of noise sources such as road traffic, railway, and general farming activities. This again matches the subjective impression observed by the engineer, and explains the lack of correlation with the noise predictions.

5.1.7 Although no measurements were obtained, the noise climate along the A380 through the centre of Kingskerswell village is similar to that through Area 1, i.e. dominated by road traffic noise.

5.1.8 As well as a large number of residential dwellings, the study area includes a number of other noise sensitive receptors such as Schools, Churches and the Kerswell Downs area.

6 EFFECTS OF THE SCHEME

6.1 Road Traffic Noise

6.1.1 For the road traffic noise assessment, a total of 5784 individual residential receptors have been identified within the calculation area. Changes in noise levels at these receptors have been assessed.

6.1.2 All of the individual receptors are listed in document **DCC/A/9, Annex D**, together with a reference identification number, address, the calculation height for each receptor and the predicted road traffic noise levels.

6.1.3 The assessment of the effects of the Scheme is based on the following comparisons:

- 2013 Do Minimum with 2028 Do Minimum
- 2028 Do Something with 2013 Do Minimum

Effects of Do Minimum

6.1.4 If the Scheme were not to proceed, all 5784 properties would experience a **Minimal** to **Moderate** decrease in traffic noise levels in the fifteen years following the Scheme Baseline Year. This is due to a decrease in line speed on some roads, and the resurfacing of the existing roads by the Future Assessment Year with a quieter surface.

6.1.5 A summary of the noise changes and change in nuisance at residential receptors if the Scheme were not to go ahead are shown in **Table 4**. The full table is shown in document **DCC/A/9, Table A1**.

Table 4: A comparison of noise and nuisance changes for Do Minimum in the Future Assessment Year compared to the Baseline Year

Do- Minimum Baseline Year compared to Do-Minimum in the Future Assessment Year		
Change in noise/ nuisance level		**Number of Dwellings**
Increase in noise level, $L_{A10,18h}$ dB	0	0
	0.1 < 0.9	0
	1 < 2.9	0
	3 < 4.9	0
	5+	0
Decrease in noise level, $L_{A10,18h}$ dB	0.1 < 0.9	114
	1 < 2.9	4951
	3 < 4.9	717
	5+	2
Increase in nuisance level (Noise)	0	0
	< 10%	0
	10 < 20 %	0
	20 < 30 %	0
	30 < 40 %	0
	>= 40 %	0
Decrease in nuisance level (Noise)	< 10%	5782
	10 < 20 %	2
	20 < 30 %	0
	30 < 40 %	0
	>= 40 %	0

6.1.6 **Table 4** also illustrates that all residential properties will experience a decrease in noise nuisance if the Scheme does not proceed. The number of properties exposed to noise levels above 68 dB would reduce from 656 in the Baseline Year to 397 in the Future Assessment Year.

6.1.7 Other noise sensitive receptors such as Schools, Churches etc. will also experience a comparable reduction in noise and nuisance if the Scheme does not proceed.

Effects of Do Something

6.1.8 A comparison has been made of the Future Assessment Year (2028) Do Something against the Baseline Year (2013) Do Minimum. A noise change model for this comparison is shown in document **DCC/A/9, Figures NV5 a to c**. A description of the noise changes in this scenario follows by area.

Area 1: Properties adjacent to the Scheme from Newton Abbott to the Aller Junction Railway Bridge

6.1.9 On opening in 2013, through traffic would be transferred from the existing A380 onto the new Penn Inn flyover and onto the new dual carriageway road to Aller Junction Railway Bridge. Over this section, traffic would travel at higher speeds, and would see an increase in traffic flow by the Future Assessment year.

6.1.10 Noise increases as a result of this increased traffic flow and speed in this area are offset by the new low noise surface, and a 1m side screen along the Penn Inn Flyover. As a result, the majority of properties which face onto the Scheme will experience no change or a slight decrease in noise levels.

6.1.11 Properties fronting onto Shaldon Road, A382 Torquay Road, and C162 Kingskerswell Road would experience slight to moderate noise decreases as a result of low noise surfacing, and reduced traffic flows or speeds.

6.1.12 A small number of properties adjacent to the East of the Scheme on Addison Road, St Lukes's Road and Aller Park Road will experience minor to moderate noise increases where there is no natural screening afforded between them and the Scheme. Further away from the Scheme, noise changes become negative with **Negligible** to **Minor** decreases in noise.

Area 2: Properties to the east of the existing A380 in Kingskerswell village between the Aller Junction Railway Bridge and Kerswell Gardens Junction

6.1.13 On opening, road traffic will be taken along the new bypass, removing a large proportion of traffic that currently travels through Kingskerswell village. As a result, properties facing onto the existing A380 Torquay Road will experience **Moderate** to **Major** noise decreases, reducing to **Minimal** decreases further away from the A380.

6.1.14 Further to the East at the edge of the calculation area, **Minimal** to **Moderate** noise increases are observed, where the influence of the new bypass has clear line of sight to the area.

Area 3: Properties between the route of the Scheme and the existing A380 in Kingskerswell village between the Aller Junction Railway Bridge and Kerswell Gardens Junction

6.1.15 Properties in this area are likely to experience noise decreases on the facades facing the existing A380 Torquay Road, and noise increases on the facades facing the Scheme. The closer the properties are to the Scheme, the smaller the noise decreases on the A380 facing façade and the higher the noise increase on the façade facing the Scheme.

6.1.16 On opening, properties facing onto the existing A380 Torquay Road (within 50m) will experience **Moderate** to **Major** noise decreases, reducing to **Minimal** decreases as you get further away from the A380.

6.1.17 Properties within 100m to the east of the Scheme would experience **Moderate** to **Major** noise increases on the façade facing the Scheme.

Area 4: Properties to the West of the Scheme between the Aller Junction Railway Bridge and Kerswell Gardens Junction

6.1.18 On opening, road traffic will be taken along the new bypass. As a result, properties facing onto the Scheme will experience **Moderate** to **Major** noise increases, reducing to **Minimal** increases approximately 300m from the Scheme.

Area 5: Properties adjacent to the Scheme to the South of Kerswell Gardens Junction.

6.1.19 Properties in this area experience traffic noise mainly from A380 Hamelin Way, and the A322 Riviera Way, which will see minimal changes in traffic as a result of the Scheme. As a result, properties in this area will experience either no change in traffic noise, or **Negligible** to **Minimal** noise increases or decreases.

6.1.20 There are a number of commercial, industrial and residential receptors outside Kingskerswell that fall within the study area and would be affected by traffic noise changes due to the Scheme. These are considered later.

Overall Effect

6.1.21 The effect of the Scheme in the Future Assessment Year is shown in **Table 5.** The full table is shown in document **DCC/A/9, Table A2**.

Table 5: Noise Assessment (2028DS compared with 2013DM)

Do- Minimum Baseline Year compared to Do-Something in the Future Assessment Year		
Change in noise/ nuisance level		**Number of Dwellings**
Increase in noise level, $L_{A10,18h}$ dB	0	119
	0.1 < 0.9	718
	1 < 2.9	807
	3 < 4.9	283
	5+	203
Decrease in noise level, $L_{A10,18h}$ dB	0.1 < 0.9	1854
	1 < 2.9	1026
	3 < 4.9	325
	5+	449
Increase in nuisance level (Noise)	0	178
	< 10%	299
	10 < 20 %	475
	20 < 30 %	1387
	30 < 40 %	424
	>= 40 %	57
Decrease in nuisance level (Noise)	< 10%	2662
	10 < 20 %	233
	20 < 30 %	59
	30 < 40 %	10
	>= 40 %	0

6.1.22 **Table 5** illustrates that 119 residential properties would experience no change, 718 residential properties would experience a **Negligible** increase, 807 residential properties would experience a **Minor** increase, 283 residential properties a **Moderate** increase, and 203 residential properties a **Major** increase.

6.1.23 At the same time, 1854 residential properties would experience a **Negligible** decrease, 1026 residential properties would experience a **Minor** decrease, 325 residential properties would experience a **Moderate** decrease, and 449 residential properties a **Major** decrease.

6.1.24 There would be a reduction in the number of properties exposed to traffic noise levels in excess of 68 dB from 656 in the Baseline Year Do Minimum to 234 in the Future Assessment Year, Do Something. This would more than halve the number of properties exposed to high traffic noise levels if the Scheme were to proceed.

Outside the Calculation Area

6.1.25 HA 213/08 (**CD 4.33**) requires a Qualitative Assessment to be made of the study area outside the calculation area. For this scheme, it is mainly the eastern part of Area 2 and the western part of Area 4 that meet this definition, as the other three areas are densely populated, and the effects of the scheme are not noticeable at the extremities of these areas.

6.1.26 To the East side of Area 2, it is expected that the noise changes will be fairly small, with some negligible increases between 600m and 1000m from the existing A380, depending on whether there is clear line of site to the Scheme. Beyond 1000m, it is not expected that there would be any noise effects as a result of the Scheme.

6.1.27 To the West side of Area 4, it is expected that there will be **Minor** to **Moderate** increases between 600m and 1000m from the Scheme, reducing to **Negligible** increases beyond 1000m.

Other Receptors

6.1.28 HA 213/08 (**CD 4.33**) requires a "simple" level assessment to be undertaken for other properties (not residential) within the calculation area. A summary showing the noise changes for these locations is shown in **Table 6**.

Table 6 Noise Changes at Other Receptors

Option/Comparison	*Baseline Year Do Minimum vs Future Assessment Year Do Something*		
Change in Noise Level, $L_{A10,18h}$ dB	**Number of other sensitive receptors subject to a change in noise level**		**List of Receptors with a noise increase of greater than 5 dB**
	Increase in noise level	**Decrease in noise level**	
0	7		ALL SERVICES 52 MANOR DRIVE NEWTON ABBOT
0.1 - 0.9	16	193	COUNTRY CLADDING ALLER MILLS NEWTON ABBOT
1 - 2.9	8	30	SUPA ROOFING & POWER TOOLS LTD ALLER MILLS NEWTON ABBOT
3 - 4.9	9	10	
5 +	3	34	
Total	36	267	

6.1.29 **Table 6** shows that 267 Other Receptors in the calculation area would experience noise decreases if the Scheme were to proceed, 7 would experience no change, and 36 would experience increases. Three receptors listed in **Table 6** would experience **Major** noise increases.

Night Time Noise Effects

6.1.30 Using CRTN, traffic Noise levels are calculated for an eighteen hour day, which only considers the night time hours of 23.00 to midnight and 06.00 to 07.00. The latest guidance in HA213/08 (**CD 4.33**) requires a consideration of the likely noise effects between the hours of midnight and 06.00.

6.1.31 Local diurnal traffic patterns are not expected to change significantly with the new bypass, however, through traffic at night, particularly Lorries, would be passing through an area that previously would not have been exposed to high levels of traffic noise. This period is likely to give the highest noise change due to the overnight flows, but they are not considered to be any more significant than the impacts during the day.

Summary of Road Traffic Noise Effects

6.1.32 In summary, if the Scheme were not to proceed, all 5784 residential properties would experience a decrease in traffic noise levels by 2028. This is considered to be beneficial in terms of noise impact.

6.1.33 If the Scheme were to proceed, 2011 residential properties would experience an increase in noise, 119 residential properties would experience no change, and 3654 residential properties would experience a decrease in noise as a result of the Scheme. More properties would therefore experience a decrease in traffic noise levels as a result of the Scheme.

6.1.34 There would be a reduction in the number of properties exposed to traffic noise levels in excess of 68 dB from 656 in the Baseline Year Do Minimum to 234 in the Future Assessment Year, Do Something. It can therefore be concluded that on balance, the Scheme would be beneficial in terms of noise impact.

Eligibility for Road Traffic Noise Insulation

6.1.35 An assessment of properties that may be eligible for an offer of sound insulation for traffic noise under the Noise Insulation Regulations 1975 (as amended 1988) (**CD 4.8**) has been made. Sixteen properties have been identified as likely to be entitled to road traffic noise insulation under the terms of the Regulations. These are as follows:

- 16, 17, 27-31 ADDISON ROAD
- 3,5,7 & 9 ST. LUKES ROAD
- 42 ALLER PARK ROAD
- FREEWAY EDGINSWELL LANE
- HOMESTEAD EDGINSWELL LANE
- 1 GREENHILL ROAD
- 1 HUXNOR ROAD

6.1.36 There will be further assessment once detailed design is finalised in order that entitlement can be confirmed before an offer of insulation is made. The insulation normally consists of replacement by or conversion to double glazed windows for habitable rooms. This does not include kitchens, bathrooms and hallways.

6.2 Construction Noise

Construction Noise Assessment

6.2.1 Ten activities for construction noise have been chosen within the Study Area. The rationale for selection was based on the proximity to those proposed works associated with the highest source noise levels.

6.2.2 A summary of the predicted ‘worst-case’ construction noise levels (at the façade) impacting the receptors are given in **Table 7** from the calculations shown in document **DCC/A/9, Annex E**. The significance criterion is assessed using the daily construction noise level at each receptor.

Table 7 Construction Noise Assessment

Type of Works	Location of Works	Nearest Receptors	Closest Distance (m)	$L_{Aeq,15mins}$ (dB)	
				Predicted	Criterion
Percussive Piling	Penn Inn Flyover & Approach Ramp	Addison Road	15	**90**	72
Percussive Piling	Retaining Wall at St Lukes Road	St. Lukes Road	23	**87**	72
Percussive Piling	Bridge over 300m railway tunnel	Aller Road	320	64	72
Percussive Piling	Aller Road bridge	Aller Road	130	72	72
Percussive Piling	Torbay Ring Road Bridge	Edginswell House	48	**80**	72
Demolition	Retaining Wall at St Lukes Road	St. Lukes Road	23	72	72
Demolition	Retaining Wall at Romery Jones Layby	Aller Park Road	143	56	72
Demolition	Brookedor Bridge Replacement	Brookedor Gdns	13	**77**	72
Demolition	Culvert / Retaining Wall at Sainsbury's	Keyberry Road	70	62	72
Rock Drilling	South of Maddacombe Overbridge	Rock House	65	**88**	72

6.2.3 **Table 7** illustrates that the significance criterion is predicted to be exceeded at nearby receptors during the following activities:

- Piling at Penn Inn flyover and support ramp
- Piling to support the new retaining wall at St. Lukes Road
- Piling to support the Aller Road Bridge
- Piling to support the Torbay Ring Road Bridge
- Demolition of the existing retaining wall at St. Lukes Road
- Replacement of the Brookedor Bridge
- Rock drilling south of Maddacombe Overbridge

6.2.4 These activities relate to construction of the Scheme for which the best selections of plant, combined with best available techniques is still likely to exceed the threshold criterion. These relate to activities that are critical to the success of the construction program, but cannot be achieved in any other manner. The appropriate consent from the Local Authority will be obtained for these activities.

Summary of Effects of Construction Noise

6.2.5 Although daytime construction noise impacts have been identified for a variety of activities, it is considered unlikely in practice that these impacts would give rise to significant effects for the following reasons:

- The assumed construction method at this stage of the assessment is a worst-case scenario with no incorporated mitigation.

- No noise significant evening or night-time work is anticipated during the construction phase. Daytime construction noise would be kept within the limits agreed with the local authority. Where necessary, evening construction noise would be regulated by restricting the location and duration of working operations.

6.3 Vibration due to Road Traffic

Road Traffic Vibration Assessment

6.3.1 **Table 8** below shows the numbers of residential properties "bothered" by vibration.

Table 8: Summary of Vibration Impact for Do Minimum and Do Something

Change in Vibration nuisance with Scheme & without Scheme		28DS to 13DM	28DM to 13DM
Increase in nuisance level (Vibration)	< 10%	485	0
	10 < 20 %	12	0
	20 < 30 %	0	0
	30 < 40 %	0	0
	>= 40 %	0	0
Decrease in nuisance level	< 10%	1324	2030
	10 < 20 %	252	2
	20 < 30 %	115	0
	30 < 40 %	55	0
(Vibration)	>= 40 %	0	0

6.3.2 **Table 8** illustrates that 2032 properties would experience a decrease in "bother" from airborne vibration if the Scheme did not proceed. This is as a result of the predicted resurfacing of all existing roads within the study period of 15 years from opening. It further illustrates that if the Scheme proceeded, that whilst 497 properties would experience an increase in bother, 1746 properties would experience a decrease. Properties with no change are not counted.

Summary of Road Traffic Vibration Effects

6.3.3 If the Scheme were not built, bother from airborne road traffic vibration would decrease <10% due to routine resurfacing. If the Scheme were built, fewer people would see a decrease, and some would see an increase in bother from airborne road traffic vibration.

6.4 Construction Vibration Effects

Construction Vibration Assessment

6.4.1 Surface plant such as cranes, compressors and generators are not recognised as sources of high levels of vibration. Even at a close distance of 10m, peak particle velocities (ppv) significantly less than 5mms^{-1} is generated by such plant. For example, a bulldozer would generate a ppv of approximately 0.6 mms^{-1} and a 'heavy lorry on poor road surface' would generate a ppv of less than 0.1 mms^{-1}. These values are well below limits at which cosmetic building damage becomes likely (5mms^{-1}).

6.4.2 Piling has the potential to give rise to vibration levels that may give rise to adverse comment in local residential buildings. Piling is to be used at the locations presented in **Table 9**.

Table 9: Summary of Vibration Impact

Location of Works	Nearest Receptors	Closest Distance (m)	$eVDV_{,16h}$ ($ms^{-1.75}$)	
			Predicted	Criterion
Penn Inn Flyover & Approach Ramp	Addison Road	15	0.28	0.20
Retaining Wall at St Lukes Road	St. Lukes Road	23	0.16	0.20
Bridge over 300m railway tunnel	Aller Road	320	0.01	0.20
Aller Road bridge	Aller Road	130	0.02	0.20
Torbay Ring Road Bridge	Edginswell House	48	0.06	0.20

6.4.3 With reference to **Table 9**, and the values in **Table 3**, it can be seen that the predicted VDV's from the following piling activities could give rise to a low probability of adverse comment at some local receptors:

- Piling at Penn Inn flyover and support ramp
- Piling to support the new retaining wall at St. Lukes Road

6.4.4 The contractor responsible for piling will therefore ensure that the most appropriate piling technique is selected to ensure that the probability of adverse comment is reduced as far as is practicable.

7 WebTAG assessments

7.1 WebTAG Appraisal Process

7.1.1 Although the processes and purposes of the WebTAG appraisal and the environmental impact assessment are materially different, the considerations and outcomes are comparable. This reflects a consistent approach throughout the stages of Scheme design and assessment. In my opinion, there is no conflict between the two processes, which are parallel requirements of the planning and funding applications, two necessarily separate decision-making processes.

7.1.2 The WebTAG worksheet for noise takes the calculated noise levels in the future assessment scenario, with and without the Scheme at each property from the DMRB assessment, and requires them to be converted to $L_{Aeq,18h}$. These values are input into the WebTAG spreadsheet which then calculates a population exposure as opposed to the number of properties under DMRB. This is achieved by multiplying the numbers of properties by the national average household size of 2.36.

7.1.3 From this new dataset, the WebTAG spreadsheet calculates the estimated population likely to be annoyed by noise in the longer term, from which the net difference in population likely to be annoyed by noise as a result of the Scheme can be calculated. A positive value represents an increase in the people annoyed by noise.

7.1.4 WebTAG then calculates a monetarised value for the Scheme, which reflects the monetary value of the noise changes per household. A positive value reflects a net benefit (i.e. a reduction in noise overall).

WebTAG Appraisal Results for the Scheme

7.1.5 The WebTAG worksheet for the Scheme in document **DCC/A/9, Table A6** shows a net noise annoyance change of +180, and a net present value of noise of -£3,674,489. This represents a slight increase in the number of people annoyed if the Scheme were to proceed.

Comparison with the Kingskerswell Alliance Scheme

7.1.6 A comparison of the WebTAG appraisal for the two schemes reveals that they would both be comparable in terms of overall noise impact, where the change is slightly adverse, but not significantly so. The -£3 million value is fairly small, relative to the number of properties that would be affected by the schemes.

8 Response to Kingskerswell Alliance Scheme

8.1 Road Traffic Noise

8.1.1 For the road traffic noise assessment of the Kingskerswell Alliance Scheme, a total of 5715 individual residential receptors have been identified within the calculation area. This area is slightly smaller than that for the Scheme as the new route is not included in it. Changes in noise levels at these receptors have been assessed.

8.1.2 The assessment of the effects of the Scheme is based on the following comparisons:

- 2013 Do Minimum with 2028 Do Minimum
- 2028 Do Something with 2013 Do Minimum

Effects of Do Minimum

8.1.3 If the Alliance Scheme were not to proceed, by the 15th year after opening all 5715 properties would experience a decrease in traffic noise levels. The most significant reason for this predicted decrease is the proposed resurfacing of all local roads with low noise surface.

8.1.4 In addition to this, local congestion is forecast to increase between the Baseline Year and the Future Assessment Year, which will have two effects – increasing the volume of traffic while decreasing the average speed. The noise effects of these changes varies according to location, such that the total amount of reduction that local properties would experience between the Baseline Year and the Future Assessment Year ranges between approximately 1 and 5 dB.

8.1.5 A summary of the noise changes and change in nuisance at residential receptors if the Scheme were not to go ahead are shown in **Table 10.** The complete table is shown in document **DCC/A/9, Table A4.**

Table 10: A comparison of noise and nuisance changes for Do Minimum in the Future Assessment Year compared to the Baseline Year.

Do-Minimum baseline year compared with Do-Minimum in the future assessment year		
Change in noise/ nuisance level		**Number of Dwellings**
Increase in noise level, LA10,18h dB	0	0
	0.1 < 0.9	0
	1 < 2.9	0
	3 < 4.9	0
	5+	0
Decrease in noise level, LA10,18h dB	0.1 < 0.9	114
	1 < 2.9	5261
	3 < 4.9	338
	5+	2
Increase in nuisance level (Noise)	0	0
	< 10%	0
	10 < 20 %	0
	20 < 30 %	0
	30 < 40 %	0
	>= 40 %	0
Decrease in nuisance level (Noise)	< 10%	5713
	10 < 20 %	2
	20 < 30 %	0
	30 < 40 %	0
	>= 40 %	0

8.1.6 **Table 10** also illustrates that all residential properties will experience a decrease in noise nuisance if the Scheme does not proceed.

8.1.7 Other noise sensitive receptors such as Schools, Churches etc. will also experience a comparable reduction in noise and nuisance if the Scheme does not proceed.

Effects of Do Something

Properties in Kingskerswell

8.1.8 Due to the predicted increase in traffic volume and speed on the A38 through Kingskerswell as a result of the Alliance Scheme, properties local to the route, particularly those that face onto the Scheme, would be subject to a noise increase by the Future Assessment Year, despite the proposed resurfacing.

Properties near Penn Inn Roundabout

8.1.9 Due to the inclusion of a tunnel under the Penn Inn Roundabout, 54 properties would experience a **Moderate** decrease in noise levels, and 10 properties would experience a **Major** decrease.

Overall Effect

8.1.10 The effect of the Scheme in the Future Assessment Year is shown in **Table 11**. The complete table is shown in document **DCC/A/9, Table A5.**

Table 11: Noise Assessment (2028DS compared with 2013DM)

Do-Minimum baseline year compared with Do-Something in the future assessment year		
Change in noise/ nuisance level		**Number of Dwellings**
Increase in noise level, LA10,18h dB	0	20
	0.1 < 0.9	846
	1 < 2.9	396
	3 < 4.9	0
	5+	0
Decrease in noise level, LA10,18h dB	0.1 < 0.9	272
	1 < 2.9	4117
	3 < 4.9	54
	5+	10
Increase in nuisance level (Noise)	0	75
	< 10%	257
	10 < 20 %	1220
	20 < 30 %	4
	30 < 40 %	0
	>= 40 %	0
Decrease in nuisance level (Noise)	< 10%	4157
	10 < 20 %	2
	20 < 30 %	0
	30 < 40 %	0
	>= 40 %	0

8.1.11 **Table 11** illustrates that 104 residential properties would experience no change, 846 residential properties would experience a **Negligible** increase, 396 residential properties would experience a **Minor** increase, and no properties would experience either a **Moderate** or **Major** increase.

8.1.12 At the same time, 272 residential properties would experience a **Negligible** decrease, 4117 residential properties would experience a **Minor** decrease, 54 residential properties would experience a **Moderate** decrease, and 10 residential properties a **Major** decrease.

8.1.13 There would be a reduction in the number of properties exposed to traffic noise levels in excess of 68 dB from 604 in the Baseline Year Do Minimum to 452 in the Future Assessment Year, Do Something.

Summary of Road Traffic Noise Effects

8.1.14 By the Future Assessment Year without the Alliance Scheme, all 5715 properties in the calculation area would have experienced a decrease in noise. In contrast, by the Future Assessment Year with the Alliance Scheme 4159 properties would have experienced a decrease, while 1556 properties would experience an increase.

8.1.15 The Alliance Scheme can be considered to be beneficial to the local noise climate as there would be more properties with decreases than increases. There would be a reduction in the number of properties exposed to traffic noise levels in excess of 68 dB from 604 in the Baseline Year Do Minimum to 452 in the Future Assessment Year, Do Something.

Eligibility for Road Traffic Noise Insulation

8.1.16 An assessment of properties that may be eligible for an offer of sound insulation for traffic noise under the Noise Insulation Regulations 1975 (as amended 1988) (**CD 4.8**) has been made. Seventy Four properties have been identified as likely to be entitled to road traffic noise insulation under the terms of the Regulations.

WebTAG Appraisal Results for the Kingskerswell Alliance Scheme

8.1.17 The WebTAG worksheet for the Kingskerswell Alliance Scheme in document **DCC/A/9, Table A7** shows a net noise annoyance change of +153, and a net present value of noise of -£3,458,567. This represents a slight increase in the number of people annoyed if the Alliance scheme were to proceed.

9 RESPONSE TO OTHER OBJECTIONS

9.1 Responses

9.1.1 A number of objections have been raised to the Scheme in relation to noise and vibration. In this Chapter I will respond to each specific noise issue by issue as some objections relate to the same location, and also by location for specific comments. Where property references are made (e.g. Property Ref 001), these relate to the noise data in **DCC/A/9 Annex D**.

Noise in Kingskerswell Village (Obj 30)

9.1.2 Objector 30 is concerned about the traffic noise flooding the countryside, and destroying the tranquillity of the village of Kingskerswell. In relation to the village of Kingskerswell, I draw reference to document **DCC/A/9 Figure NV5 a to c** which shows the noise changes between the Future Assessment Year with the Scheme, and the Baseline Year without the Scheme.

9.1.3 This figure shows that the large majority of the village sees either no noise change, or a decrease. I estimate that 10-15% of the village would receive noise increases. I therefore consider that the large majority of the village would benefit from the Scheme. I have considered the effects of the Scheme to the countryside to the West of the Scheme earlier in my proof, noting that areas to the West of the Scheme will see minor to moderate noise increases extending up to 2km from the Scheme.

Noise in Greenhill Road Area (Obj 33,34 & 37)

9.1.4 Objectors 33, 34 and 37 are concerned about noise levels at their properties and the surrounding area, and consider that more mitigation of traffic noise should be done. They suggest that a higher embankment could have been provided to protect the residents in the Greenhill Road area from the high noise changes predicted as a result of the Scheme. In response to this, I have investigated the options to increase the height of the cutting (I.e. lower the road) by 1m and 2m, and to increase the embankment by 1m and 2m from Chainage 4150 to 4440m on the east side of the Scheme.

9.1.5 The results of the assessment at Property Ref 1254A/B and 1255A/B as reported in **DCC/A/9 Annex F** show that an additional screening height of 1m would provide up to 0.5 dB reduction in road traffic noise from a starting point of 63.5 dB and 62.2 dB in the Future Assessment Year with Scheme respectively, and an additional screening height of 2m would provide up a further 0.4 dB reduction in road traffic noise. This marginal difference is unlikely to have any significant impact on the major noise increases predicted for properties in this area, and may be little acoustic benefit for the significant additional cost.

Noise in Kerswell Down / Common Land (Obj 15, 23, 30, 38, 40, 42, 45, 48, 54, 56 & 58)

9.1.6 The issue of noise from Kerswell Down is brought up by Objectors 15, 23, 30, 38, 40, 42, 45, 48 54, 56 & 59. I have visited the site on several occasions at different times of day, and the noise levels at the site are in the range of 45-50 dB LAeq during the daytime at the six locations I have considered within the area as shown in **DCC/A/9 Annex G.** With the introduction of the Scheme, this would increase to between 48 dB and 65 dB LAeq, depending on proximity to the Scheme.

9.1.7 There are no definitive guidelines in UK Legislation to define a suitable noise criterion for an open recreational space. A “Quiet Area” exists within Agglomerations under the Environmental Noise (England) Regulations (2006) (**CD 4.48**), but this does not apply to the area around Kingskerswell.

9.1.8 I have calculated the noise levels across the area, and banded them into below 55 dB, between 55 and 60 dB and above 60 dB, as shown in **DCC/A/9, Annex G, Map 1**. The majority of the area would be below 60 dB L_{Aeq}, and although the relative change in noise levels is high compared to the prevailing ambient noise climate, which is a major noise increase, I consider that the noise impact will not be sufficient to prevent use of the area as intended.

Construction Noise and Vibration concerns (Obj 11 & 15)

9.1.9 Objections (Objector 11, 15) have been raised in relation to construction noise and vibration if the Scheme is to proceed. There is no doubt that construction noise levels will be high at various locations along the Scheme for a long period of time, but the precise details of how much and how long will not be known until a contractor has been appointed. Mitigation will be required, but effects will only be temporary.

9.1.10 This issue is also raised by Objector 15 at Rock House (Property Ref 1265A/B), particularly if blasting is used. I am informed that blasting is not intended to be used on this Scheme. Construction noise and vibration will have a significant impact on this property, as **Table 7** illustrates. Noise and vibration will need to be carefully considered at this property during the construction phase to keep impacts to a minimum.

Property Specific Objections

9.1.11 Noise is also raised as an issue by Objector 3 in points 3.1 & 3.2 of their letter. They suggest that an inadequate noise assessment has been undertaken at the J Sainsbury store (Property ref 137C) in the Environmental Statement. Noise calculations undertaken at the time of the Environmental Statement used the correct methodology, and robustly reported the noise changes across the entire Scheme.

9.1.12 This proof of evidence provides the most up to date appraisal, and noise changes at each location have been calculated in accordance with the current methodology using the updated traffic flows for the roads in the study area. This location is currently exposed to façade noise levels of 67.2 dB. If the Scheme is built, façade noise levels would decrease to 61.0dB and 61.4dB in the Baseline and Future Assessment Years respectively. This decrease is considered to have a **Major** beneficial noise impact at this receptor.

9.1.13 Construction noise is predicted to be high for some activities if the Scheme proceeds to be built. Precise details will not be available until a contractor is appointed and construction methods finalised. Noise and vibration from construction activities will be controlled by the Local Authority, and every practical mitigation will be employed to keep impacts to a minimum.

9.1.14 Objector 4 at Abbott View, 2 Aller Brake Road (Property ref 884) has raised concerns about noise at the front and side of their property, and mention trees and hedges that “deflect” noise. Noise calculations for this property show that the highest noise change occurs in the Future Assessment Year with the Scheme, and is an increase of 0.3 dB. This noise change would not be noticeable. Trees and Hedges do not mitigate noise in normal circumstances, but they do act as a visual barrier, and can provide masking noise from the wind rustling the leaves.

9.1.15 Noise is also raised as an issue by Objector 10 in point 2.1.6 of their letter. They report that an inadequate noise assessment has been at the commercial property “Barn Owl Inn” (Property ref 031C). The location is currently exposed to façade noise levels of 57.2 dB. If the Scheme is built, façade noise levels would increase to 62.2 dB and 62 dB in the Baseline and Future Assessment Years respectively. This increase of 4.8 dB is considered to have a **Moderate** noise impact at this receptor.

9.1.16 Objector 11 at 30 Aller Park Road (Property ref 823) raises concerns about the long term impact of noise from the new road. Façade noise levels are currently at 70.1 dB. This will decrease by 0.8 dB in the Future Assessment Year with the Scheme to 69.3 dB. This is a result of the new low noise surface coupled with some screening from the new road. The noise change at this property will therefore not be noticeable.

9.1.17 Objector 21 at 8 Addison Road (Property ref 1768) is concerned with noise from the Penn Inn Flyover from road traffic closer to their property. However, the inclusion of the 1m high barrier along the flyover would result in a 0.6 dB decrease at this property in the Future Assessment year, which would not be noticeable.

9.1.18 Objectors 23 & 38 at Tudor Cottage, 3 Church End Road (Property ref 1250A/B) are also concerned with noise at their property. The North façade of the property would see a **Minor** noise increase to 54.1 dB, and the South façade would see a **Minor** noise increase to 56.3 dB. This is unlikely to be noticeable over the long term.

10 CONCLUSION

10.1 Road Traffic Noise

The Existing Situation

10.1.1 The area around Kingskerswell village is currently affected by high levels of traffic noise from the large volume of traffic currently using the A380. This has a considerable deleterious effect on the residents in the village in general, and particularly on those properties that front directly onto the main road, some of which are currently exposed to traffic noise levels in excess of 68 dB(A) L_{A10}.

Traffic Noise Effects of Do Minimum

10.1.2 If the Scheme were not to proceed, all properties would experience a **Minimal** to **Moderate** decrease in traffic noise levels in the fifteen years following the Scheme Baseline Year. A growth in traffic over this period is predicted, but this is offset by a decrease in line speed on some roads, and the commitment from DCC to resurface the existing roads by the Future Assessment Year with a quieter surface. The number of properties exposed to noise levels above 68 dB would reduce from 656 in the Baseline Year to 397 in the Future Assessment Year.

Traffic Noise Effects of the Scheme

10.1.3 If the Scheme were to proceed, 3654 residential properties would experience **Minor** to **Major** decreases in noise as a result of the Scheme. 2011 residential properties would experience **Minor** to **Major** increases in noise, with 119 residential properties experiencing no change.

10.1.4 More properties would experience a decrease in traffic noise levels as a result of the Scheme, therefore it can be concluded that on balance, the Scheme would be beneficial in terms of noise impact.

10.1.5 There would also be a reduction in the number of properties exposed to traffic noise levels in excess of 68 dB from 656 in the Baseline Year Do Minimum to 234 in the Future Assessment Year.

10.1.6 Overall therefore, in terms of traffic noise effects, the Scheme would bring benefits to the area, particularly to Kingskerswell village.

Eligibility for Road Traffic Noise Insulation

10.1.7 Facades at Sixteen properties have been identified as likely to be entitled to road traffic noise insulation under the terms of the Noise Insulation Regulations 1975 (as amended 1988) (**CD 4.8**). A further assessment will be made once detailed design is finalised in order that entitlement can be confirmed before an offer of insulation is made.

10.2 Construction Noise

Construction Noise Effects

10.2.1 Construction noise impacts have been identified for a variety of activities which left unmitigated could give rise to significant temporary impacts, with those closest to the Scheme being worst affected. A full mitigation scheme will be required by the Local Authority for the contractor to ensure impacts are kept to a minimum.

Vibration due to Road Traffic

10.2.2 If the Scheme were not built, bother from airborne road traffic vibration would decrease <10% due to routine resurfacing. If the Scheme were built, fewer people would see a decrease, and some would see an increase in bother from airborne road traffic vibration.

Construction Vibration Effects

10.2.3 Construction vibration impacts have been predicted at various locations along the Scheme where piling and rock removal activities are predicted. The contractor will ensure vibration impacts are kept to a minimum.

Kingskerswell Alliance Scheme

10.2.4 If the Kingskerswell Alliance Scheme were to proceed, 4159 residential properties would experience **Minor** to **Major** decreases in noise as a result of the Scheme. 1556 residential properties would experience **Minor** to **Major** increases in noise, with 20 residential properties experiencing no change.

10.2.5 More properties would experience a decrease in traffic noise levels as a result of the alternative Scheme, and there would also be a reduction in the number of properties exposed to traffic noise levels in excess of 68 dB from 602 in the Baseline Year Do Minimum to 452 in the Future Assessment Year. Facades at Seventy Four properties have also been identified as likely to be entitled to road traffic noise insulation.

10.2.6 The Kingskerswell Alliance Scheme would have a higher overall noise impact than the Scheme as many more properties would be exposed to high traffic noise levels, and require protection by way of a Noise Insulation Grant.

Glossary of Terms and Abbreviations

A-weighting	A frequency weighting which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Units may be denoted as dB (A) or as sound pressure levels $_{LpA}$ in dB.
Ambient noise	The totally encompassing sound at a given location over a given time period.
Decibel (dB)	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level the reference quantity is 20 µPa.
Facade noise level	The noise level adjacent to the facade of a building, usually at a distance of 1 metre.
Free-field noise level	The noise level away from reflecting surfaces.
Hertz (Hz)	Unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.
$L_{A10,T}$	The A weighted level of noise exceeded for 10% of the specified measurement period, T. It gives an indication of the upper limit of fluctuating noise such as that from road traffic. $_{LA10}$ (18-hour) is the arithmetic average of the 18 hourly $_{LA10}$ (1-hour) values from 06:00 to 24:00.
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the specified time period, T. It is often used to define background noise level.
$L_{Aeq,T}$	The equivalent continuous sound level. It is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period, T.
Peak Particle Velocity (ppv)	Vibration index representing the velocity (metres/second) of a vibrating element.
Vibration Dose Value (vdv)	Vibration index based on acceleration ($m/s^{1.75}$) used for considering the effects of vibration within buildings on people. As defined in BS6472:

	Evaluation of Human Exposure to vibration in buildings (1 Hz to 80 Hz).
AAWT	Annual Average Weekday Traffic
CRTN	Calculation of Road Traffic Noise
DMRB	Design Manual for Roads and Bridges
HRA	Hot Rolled Asphalt
SPL	Sound Pressure Level