Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure

Llywodraeth Cymru
Welsh Government

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) (Amendment) Scheme 201-

The London to Fishguard Trunk Road (East of Magor to Castleton) Order 201-

The M4 Motorway (West of Magor to East of Castleton) and the A48(M) Motorway (West of Castleton to St Mellons)(Variation of Various Schemes) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and The London to Fishguard Trunk Road (east of Magor to Castleton) (Side Roads) Order 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and the London to Fishguard Trunk Road (East of Magor to Castleton)) Compulsory Purchase Order 201-

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Proof of Evidence

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RPS Planning and Environment, Noise and Vibration

Document WG 1.14.1

CONTENTS

1. Introduction

1.1. Personal Details

1.1.1. My name is Philip Evans; I am employed by RPS Planning and Environment (RPS) as a Senior Director in Acoustics. I hold a Bachelor of Science (Honours) degree in Geology and a Master of Science degree in Acoustics, Vibration and Noise Control. I have over 25 years' experience as a consultant in acoustics and have worked for a number of leading acoustics consultancies in senior management and technical positions. I am a Member of the Institute of Acoustics (IoA) and a Fellow of the Geological Society; RPS is a member of the Association of Noise Consultants (ANC).

1.1.2. My experience in acoustics has included the assessment of noise and vibration effects from most main sources found in today's environment including road traffic. I have completed many projects involving noise nuisance and complaint and undertaken research into the variability of environmental noise levels. I am a member of the committee established by the ANC that produced a *"Guide to the Measurement and Assessment of Groundborne Noise and Vibration"*; I also represent the ANC on the British Standards Institution (BSi) Sub-committee GME/21/6/4 on *"Human exposure to mechanical vibration and shock"* which revised British Standard (BS) 6472, *"Guide to evaluation of human exposure to vibration in buildings"* published in 2008. I am also co-opted onto BSi committee B/564/1 which revised BS 5228, *"Code of practice for noise and vibration control on construction and open sites"* which was re-published in 2009 and again in 2014. This committee has now also revised the 1999 version of BS 8233 *"Sound insulation and noise reduction for buildings – Code of practice"* which now has the title BS 8233:2014 *"Guidance on sound insulation and noise reduction for buildings"* and this was also published in 2014.

1.1.3. With regard to road traffic noise, in addition to the M4 Corridor around Newport (CaN – the published Scheme), I have worked on a number of major road schemes including the A465 Heads of the Valley Dualling, Section 2: Gilwern to Brynmawr, where I completed the noise and vibration assessment and was expert witness for Welsh Government on noise and vibration at the Public Inquiry. Other schemes include the A354 Weymouth Relief Road, the M40 motorway, various sections of the A55 North Wales Coast Road and various other bypass and road improvement schemes all of which have either required environmental impact assessments or other technical assessments. I have also assessed eligibility for noise insulation under the Noise Insulation Regulations 1975 (as amended) and undertaken assessments for Part 1 Claims under the Land Compensation Act 1973.

1.1.4. I am a member of the project team which is responsible for the delivery of the Scheme and I have been involved since March 2015. I provided the chapters on noise and vibration for the March 2016 Environmental Statement (ES) and ES Supplements of September 2016 and December 2016 [Documents 2.3.2, 2.4.4 and 2.4.14] with the assistance of the RPS Acoustics Team. I also confirm that I am familiar with the Scheme and have visited the alignment and the area during the day, evening and night.

1.1.5. The evidence which I have prepared and provide in this Proof of Evidence (PoE) is true and has been prepared and is given in accordance with the guidance of my professional institution and I confirm that the opinions expressed are my true and professional opinions.

1.2. Scope and Structure of this Statement of Evidence

1.2.1. My Proof of Evidence provides a summary of the construction and operational noise and vibration effects relating to the Scheme proposals as reported in the ES and as revised through the Errata

and Supplements. This summary provides details of the relevant noise and vibration policy, guidance and standards that form the assessment methodology that has been applied to this assessment for this Scheme. The assessment is predicated on traffic noise modelling of the existing, baseline situation, as informed by baseline noise surveys, and various opening year and future scenarios with the Scheme in place. This includes consideration of the noise changes that are likely occur when the existing M4 through Newport is reclassified.

1.2.2. In general terms, my evidence describes the effects that will arise from the construction and operation of the published Scheme. Whilst both the construction and operation (use) of the new road will result in adverse effects due to noise increases on properties and communities lying adjacent to the new road, the lessening of traffic on the existing M4 through Newport will reduce noise levels and hence effects through a highly populated area. This will provide a beneficial effect on a much greater population. The net result is an overall benefit, i.e. more people benefit by a noise decrease than are subject to a disbenefit due to a noise increase.

1.2.3. However, these significant adverse effects must be balanced against the reclassification of the existing M4 through the more densely populated areas of Newport. This results in consequential noise decreases and hence benefit to the population of Newport that is currently adversely affected by motorway noise. In terms of the net overall effect of the Scheme, more people benefit by a noise decrease than suffer disbenefit by a noise increase.

1.2.4. My evidence is set out under the following section headings. It should be noted that I have not reproduced the figures and tables that were provided in the ES [Document 2.3.2] or ES Supplements [Documents 2.4.4 and 2.4.14]; however, reference is made to these where relevant:

1 Introduction

2 Background and Scheme Description (as relating to noise and vibration)

3 Legislation and Policy

4 Assessment Methodology

5 Baseline Conditions

6 Limitations of the Assessment

7 Mitigation Measures Forming Part of the Scheme Design

8 Results of the Assessment

9 Summary of Effects

10 Responses to Objections

11 Summary and Conclusions

1.2.5. In Section 1.3 below, I describe the purpose of this evidence and in Section 2, I outline the background to the Scheme and identify aspects that are relevant to noise and vibration effects during the construction and operation/use of the Scheme. In Section 3, I describe the applicable legislation and policy and in Section 4, I describe the assessment methodology including the guidance, and standards that have been adopted and the consultation carried out. In Section 5, I describe the baseline conditions that were defined through noise surveys and the likely future baseline situation.

1.2.6. The various limitations of the assessment are described in Section 6 and the mitigation measures forming part of the Scheme design are described in Section 7. The results of the assessment covering construction and use of the Scheme are then described in Section 8 and in Section 9, I summarise the likely effects of the Scheme. I then

consider the objections made to the Scheme in Section 10 before, finally in Section 11, I provide my summary and conclusions.

1.2.7. It should be noted that objections to the Scheme have been received and, where appropriate, the concerns raised are also addressed within this evidence in Section 10.

1.3. Purpose of this Evidence

1.3.1. The purpose of my evidence is to describe the noise and vibration effects during the construction and operation (use) of the Scheme on human receptors identified as sensitive to either noise or vibration in terms of either nuisance (noise and/or vibration) or damage (vibration). The assessment is provided to allow full evaluation of the adverse and beneficial effects of the Scheme to allow informed decision making. It should be noted that this evidence is focused upon the effects upon human receptors, i.e. the occupants of dwellings, and structures. Noise and vibration effects upon ecology or important species or ecological protection areas, are addressed by the expert witness on Ecology, Dr Keith Jones [WG 1.18.1], and others as appropriate to the species (Dormice and Water Voles – Proof of Evidence of Mr Jon Davies [WG 1.19.1]; Bats – Proof of Evidence of Mr Richard Green [WG 1.20.1]; and Ornithology – Proof of Evidence of Mr Martin Scott [WG 1.21.1]).

1.3.2. Receptors, herein referred to as NVSRs (noise, including vibration, sensitive receptors), include residential dwellings and other buildings including those in religious, educational, health care and community use, designated areas such as Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) and some public rights of way.

1.3.3. My judgment on the overall noise and vibration effects of the Scheme has been derived from:

a) full consideration of current legislation, policy, guidance, standards and the methodology for carrying out road traffic noise and vibration assessments;
b) the results from the long and short-term surveys that were carried out to characterize the existing, baseline noise environment;
c) the results from the indicative construction noise and vibration assessment;
d) mitigation that has been incorporated into the Scheme to minimize effects during the construction and use of the Scheme;
e) the results from the road traffic noise modelling of the Scheme with mitigation which identifies the changes in noise levels from the use of the Scheme;
f) consideration of the effects of the reclassification of the existing M4 corridor which will be downgraded; and
g) comparison of the various results with appropriate criteria derived from the guidance and standards and my experience to determine effects and their significance.

1.4. Links with Other Evidence

1.4.1 The noise and vibration effects and the assessment have interrelationships with other disciplines as described below:

a) Traffic – Proof of Evidence of Mr Bryan Whittaker [WG 1.2.1] – the noise assessment is dependent upon the traffic model which provides traffic data for the noise model.

b) Engineering - Proof of Evidence of Mr Ben Sibert [WG 1.5.1] – general mentions of noise.

c) Construction - Proof of Evidence of Mr Barry Woodman [WG 1.6.1] – general mentions of noise and vibration and mitigation including for blasting.

d) Environment Design – Proof of Evidence of Dr Peter Ireland [WG 1.7.1] – general mentions of noise and noise barriers.

e) Landscape – Proof of Evidence of Mr Nick Rowson [WG 1.8.1] – general mentions of noise.

f) Cultural Heritage – Proof of Evidence of Mr Mick Rawlings [WG 1.9.1] – general mentions of noise in the heritage settings.

g) Agriculture and NMU – Proof of Evidence of Ms Julia Tindale [WG 1.10.1] – general mentions of noise.

h) Ecology and Nature Conservation – Proof of Evidence of Dr Keith Jones [WG 1.18.1] – general mentions of noise on terrestrial species and migratory fish.

i) Ecology – Dormice and Water Voles – Proof of Evidence of Mr Jon Davies [WG 1.19.1] – general mentions of noise affecting these species.

j) Ecology – Bats – Proof of Evidence of Mr Richard Green [WG 1.20.1] – general mentions of noise in relation to effects upon bats.

k) Ecology – Ornithology – Proof of Evidence of Mr Martin Scott [WG 1.21.1] - general mentions of noise in relation to effects upon birds.

2. Background and Scheme Description (As Relating To Noise And Vibration)

2.1. Background

2.1.1. The purpose of the noise and vibration assessment provided in the ES and the Supplements [Documents 2.3.2, 2.4.4 and 2.4.14] and this evidence is to identify any adverse or beneficial effects that may arise during the construction or operational phases of the Scheme. The key objectives of the assessment are to:

a) determine the significance of effects on NVSRs arising from the permanent changes in road traffic noise associated with the Scheme through the consideration of noise change, absolute levels and noise nuisance;
b) determine the significance of effects on NVSRs from the non-permanent noise and vibration levels that would arise during the construction of the Scheme; and
c) ensure that the most appropriate and effective mitigation measures have been included to minimise adverse effects without causing adverse effects in other environmental areas, e.g. landscape and visual.

2.1.2. An explanation of noise and vibration terms is provided in Appendix 13.1 of the ES, which includes example sound levels for various sources and situations.

2.2. Scheme Description

2.2.1. The full Scheme is described elsewhere (Proof of Evidence on Engineering of Mr Ben Sibert [WG 1.5.1]) but within the context of noise and vibration effects, the Scheme consists of a new, dual three-lane motorway to the south of Newport between the existing M4 Junction 29 at Castleton and the existing M4 Junction 23 at Magor and the reclassification (downgrading) of the existing M4 through Newport. Whilst both the construction and operation of the new road will result in adverse effects due to noise increases on

properties and communities lying adjacent to the new road, the lessening of traffic on the existing M4 through Newport will reduce noise levels and hence effects through a highly populated area. This will provide a beneficial effect on a much greater population. The net result is an overall benefit, i.e. more people benefit by a noise decrease than are subject to a disbenefit due to a noise increase.

2.2.2. Where adverse effects are predicted, in some areas close to the published Scheme, World Health Organisation and British Standards guideline values [Documents 14.2.14 and 14.2.15] for noise will be exceeded and some properties will be subject to significant noise changes. However, across the whole Scheme, it would appear that only 26 properties may be eligible for noise insulation (subject to detailed assessment) and of that 26, 16 lie adjacent to the existing M4 near the roundabout at Caerleon and hence will already be subject to relatively high noise levels. Therefore, only 10 properties may otherwise be eligible in other areas and hence this provides an indication that only very few properties would be subject to noise levels of such significance that further action in the form of the provision of noise insulation would be warranted. The 26 properties are identified later in Table 8.1 of this Proof of Evidence.

2.2.3. For much of its length, the proposed new section of motorway would be slightly elevated above the surrounding area which reduces the ground-absorption of noise which might otherwise occur if it was at grade. Around the north-west corner of Magor, however, the new road would be in cutting, providing significant screening where the road passes closest to densely populated urban areas.

2.2.4. Noise mitigation measures have been incorporated into the design of the Scheme and I have been party to developing these. The full list of the commitments made to date is set out in Appendix R18.1 of the ES Supplement of December 2016 [Document 2.4.14] and those relating to noise and vibration are summarised within Section 7.1 of

this evidence. Consistent with Welsh Government policy, a low-noise road surface will be used throughout the Scheme and approximately 4.1 km of noise barriers will be placed in key areas around Magor and Duffryn. These areas are where the barriers will be most effective in reducing noise levels to significant community areas. The locations and heights of these barriers have been optimised to provide the greatest benefit in terms of noise reductions to the greatest number of people without resulting in significant adverse landscape and visual effects across the area.

3. Legislation and Policy

3.1. Introduction

3.1.1. Noise and vibration can have a significant effect on the environment and on the quality of life enjoyed by individuals and communities. In this respect, the planning system promotes sustainable economic growth whilst ensuring that the quality of life is not unreasonably affected.

3.1.2. National standards and planning policy are primarily concerned with noise and vibration effects at residential receptors and vibration effects on structures. Noise and vibration effects at residential receptors for new or modified road schemes, including consequential changes on related roads, are considered primarily in terms of the noise change and change in annoyance due to increases or decreases in road traffic noise. However, in some circumstances, it is also relevant to consider the possibility of health and quality of life effects, such as sleep disturbance.

3.1.3. Vibration effects on buildings and structures may be considered in terms of the potential for damage to occur. However, vibration levels at which even cosmetic damage can occur are relatively high and, generally, these are only generated by blasting or from some other construction activities that would need to occur in very close proximity to buildings. For a reasonably maintained road without speed control measures, such as speed humps, vibration arising during operation is likely to be minimal. In relation to vibration, the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 (HD 213/11) para 3.32 [Document 6.1.8] states that:

*'PPVs [*peak *particle velocity] in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s.* Normal *use of a building such as closing doors, walking on suspended*

wooden floors and operating domestic appliances can generate similar levels of vibration to those from road traffic.' (Paragraph 3.32).

3.1.4. On this basis, vibration effects associated with road traffic on the completed highway are considered likely to be negligible and these were not considered further in the ES, i.e. this element, as relating to the potential for building damage and human exposure to vibration, was scoped out of the EIA process. However, vibration effects during construction are potentially likely and were considered within the ES and are included within this evidence.

3.2. Relevant Legislation

3.2.1. The Environmental Noise Directive (2002/49/EC) (END) [Document 14.1.2] provides the general European Union (EU) policy context under which Wales is implementing policies to manage environmental noise, including traffic noise. Other relevant legislation is described in Appendix 13.1 of the ES and identified below.

a) Control of Pollution Act 1974 [Document 14.1.3].
b) Environmental Noise (Wales) Regulations 2006 [Document 14.1.4].
c) Land Compensation Act (LCA) 1973 [Document 3.1.34].
d) Noise Insulation Regulations (NIR) 1975 (as amended 1988) [Document 14.1.1].
e) Well-being of Future Generations Act (Wales) 2015 [Document 3.1.18].

3.3. Relevant Policy Context

3.3.1. In this section I set out relevant policy at the national and the local level; further detail is provided in Appendix 13.1 of the ES.

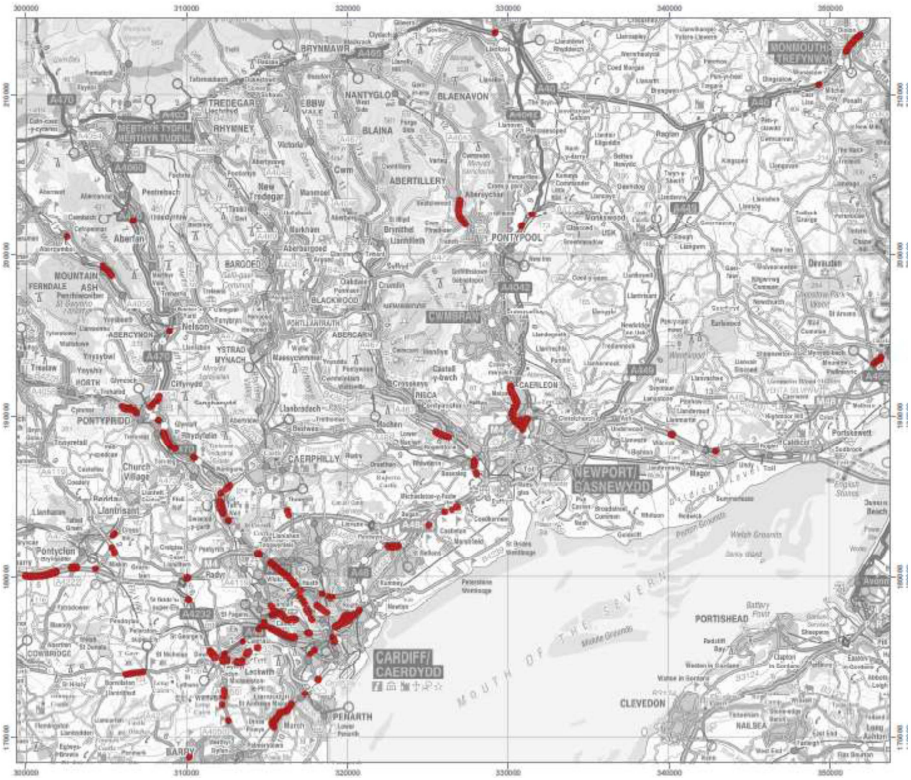
National Planning Policy

3.3.2. Planning Policy Wales [Document 5.1.3] provides the following introduction to national planning policy with regards to noise (and by implication vibration):

'Noise can affect people's health and well-being and have a direct impact on wildlife and local amenity. Noise levels provide an indicator of local environmental quality. The objective of a policy for noise is to minimise emissions and reduce ambient noise levels to an acceptable standard. Noise Action Plans, drawn up by the Welsh Ministers in relation to Wales under the Environmental Noise Directive, and the Wales Regulations, aim to prevent and reduce environmental noise where necessary and preserve environmental noise quality where it is good. They are a planning consideration in the use and development of land.'

3.3.3. 'A noise action plan for Wales 2013-2018' [Document 14.2.12] indicates 171 noise action planning priority areas (NAPPAs) for road traffic noise in Wales. Several of these areas fall around the existing M4 alignment on the northern side of Newport on some of the A roads that cross the M4 and particularly where the A459/A405 and A404 merge with the N4 which includes a section in tunnel. The areas are illustrated below where Figure 8 of the 'A noise action plan for Wales 2013-2018' is reproduced. The effect of the published Scheme will be to reduce noise along this existing area of the M4 and hence potentially achieve or assist in achieving the noise action plan for this area.

Figure 3.1 NAPPA Priority Areas in South-East Wales Based on the 2007 Noise Maps



3.3.4. The goal of the Transport Strategy for Wales 'One Wales: Connecting the Nation' [Document 6.1.3] is to promote sustainable transport networks that safeguard the environment while strengthening the country's economic and social life. The transport strategy identifies a series of high level outcomes. Outcome 15 is to '*improve the positive impact of transport on the local environment'*.

3.3.5. National planning guidance on noise is contained within Technical Advice Note (Wales) 11 [Document 14.2.3]. This document does not provide any specific guidance relating to the assessment of noise from new or altered roads but does refer to the NIR. It should also noted that on the 25th November 2015, Welsh Government released a letter reference CL-01-15 on the 'CL-01-15 Updates to Tan 11 Noise – Noise Action Plan (2013 – 18) Commitments'. This clarifies and revises TAN 11 and provides reference to standards that have been revised and re-issued since TAN 11 was originally issued in

1997. However, there does not appear to be anything included within the update that influences the noise assessment for this Scheme which hasn't already been recognised, i.e. revised standards.

Local Policy

3.3.6. The Scheme falls within the administrative areas of Monmouthshire County Council and Newport City Council. Prior to preparing the ES, both authorities had received a scoping document, and their comments and requirements were incorporated into the subsequent assessment.

Monmouthshire County Council

3.3.7. Monmouthshire County Council adopted their Local Development Plan in February 2014 [Document 5.3.2].

3.3.8. Policy EP1 of the Local Development Plan seeks to prevent development proposals that would result in unacceptable risk or harm due to air, light, noise or water pollution, contamination or land instability.

Newport City Council

3.3.9. Newport City Council adopted their Local Development Plan in January 2015 [Document 5.3.1]. The Local Development Plan has a number of strategic and general policies relating to noise, summarised below.

a) SP14: Transport proposals will be supported where they result in environmental improvements, including noise reduction.
b) GP2: Development will be permitted where there will not be a significant adverse effect on local amenity, including in terms of noise, disturbance etc.

c) GP4: Development proposals should be designed to avoid or reduce noise pollution.

d) GP6: Good quality design will be sought in all forms of development. The aim is to create a safe, accessible, attractive and convenient environment. All development should maintain a high level of pedestrian access, connectivity and be laid out so as to minimise noise pollution.

e) GP7: Development will not be permitted which would cause or result in unacceptable harm to health because of land contamination, dust, instability or subsidence, air, heat, noise or light pollution, flooding, water pollution, or any other identified risk to environment, local amenity or public health and safety.

4. Assessment Methodology

4.1. Introduction

4.1.1. The noise and vibration assessment was fully reported in the ES as revised in the Supplements and the findings are summarised in this evidence. I consider the significance of effects on NVSRs of operational changes in road traffic associated with the Scheme on noise change and absolute levels and noise nuisance, including an assessment of the effectiveness of proposed mitigation measures. This assessment of operational effects includes consideration of effects arising on the existing road network (including the existing M4 through Newport) and on the proposed new section of motorway and including associated non motorway roads.

4.1.2. The significance of temporary noise and vibration effects on NVSRs associated with the construction of the Scheme has also been assessed. It should, however, be noted that construction activities, and hence effects, are primarily associated with the proposed new section of motorway. The physical works associated with the Complementary Measures are limited and would generally occur within the footprint of the existing road alignment/land take with minimal off site effects.

4.2. Relevant Guidance

4.2.1. I briefly describe the guidance upon which this methodology is based in the paragraphs below. Calculation of Road Traffic Noise (CRTN) [Document 14.2.1] provides a methodology for calculating noise from road traffic and the DMRB provides the fundamental assessment methodology for assessing noise from new trunk roads as further informed by Interim Advice Note 185/85 [Documents 6.1.8 and 14.2.7].

CRTN

4.2.2. CRTN provides the Welsh Government's approved methodology for calculating noise from road traffic. The calculations are based on the traffic flow data and the spatial relationship between the receptor and the road. Noise levels are determined using the L_{A10} index, which is the 10^{th} percentile of the A-weighted sound pressure level. The index is normally determined for an 18-hour day (06.00 - 24.00 hours) based on the annual average weekday traffic. CRTN also provides methodologies for noise surveys.

DMRB

4.2.3. The DMRB Volume 11, Section 3, Part 7, Noise and Vibration (HD 213/11) provides guidance on assessing the noise and vibration impacts from road schemes. This has been updated in places by Interim Advice Note 185/15 and requires additional analysis based upon more appropriate speed profiles. DMRB is the most appropriate guidance for assessing noise and vibration effects from road schemes. Other guidance can also feature in certain areas with regard to consideration of appropriate noise levels for outdoor living areas where levels of 55 dB $L_{Aeq,16hr}$ [Document 14.2.14 – British Standard (BS) 8233:2014 Guidance on sound insulation and noise reduction for buildings and Document 14.2.15 – World Health Organization, Guidelines for Community Noise] are considered the maximum unless in urban areas where levels are likely to be high in any case.

4.2.4. The DMRB defines scoping and sets out simple and detailed methods for assessing the impacts of road traffic noise. Thresholds for significant operational traffic noise effects are a 1 dB change in the short-term, assessed for the opening year, and a 3 dB change in the long term, assessed by comparing the change between the opening year and the future assessment year. The baseline and

future assessment years for construction and operational effects are defined as follows:

For an assessment of temporary noise and vibration impacts (i.e. from construction or maintenance activities), the baseline year is taken as that immediately prior to the start of works. The future assessment year would be a year during the period of construction/maintenance works.
For an assessment of permanent noise and vibration impacts, the baseline year is taken as the opening year of the road project (prior to opening). This is considered to be the year which is most representative of the situation immediately before a road project opens to traffic. It should be noted that the baseline year used for this assessment could be different to the year used when predicting the Prevailing Noise Level for any calculations undertaken for the relevant Noise Insulation Regulations. The future assessment year for operation is typically the 15th year after the opening year of the road project as that is when traffic flows are generally at their highest but, in some circumstances, this may occur before the 15th year. For all Schemes, the greatest traffic flows are generally assumed to occur in the 15th year after opening and this is taken as the future assessment year.

4.2.5. The methodology requires CRTN predictions to be made for dwellings and other NVSRs affected by the Scheme, both with and without the Scheme for the opening year and the future year. This enables both the short-term and long term changes to be evaluated. The latest version of the DMRB includes separate classifications of impact magnitude for noise changes in the short-term and long term.

4.2.6. The DMRB sets out the approach for simple and detailed assessments. At the simple stage, the following two comparisons are made in order to determine the impact of the Scheme in the short-term and the long term:

a) Do-Minimum (without Scheme) scenario in the baseline year against Do-Something (with Scheme) scenario in the baseline year (short-term).
b) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

4.2.7. At the detailed stage, the following three comparisons are made in order to better understand the impact of the Scheme:

a) Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year.
b) Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year.
c) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

4.2.8. In addition to the above, although not required by the DMRB, a comparison has also been made between the Do-Minimum scenario in the future assessment year with the Do-Something scenario in the future assessment year. This gives a more understandable comparison of the effects of the Scheme relative to the situation where the Scheme was not put in place.

Interim Advice Note (IAN) 185/15

4.2.9. The DMRB guidance has been supplemented by the guidance contained in this IAN – 'Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality and Volume 11, Section 3. 7 Noise'. Essentially, CRTN fixes road speeds based upon road type but this IAN allows actual likely speeds to be considered and this this provides a more accurate assessment of likely effects in terms of the predicted noise levels.

Minerals Technical Advice Note (MTAN) Wales 1: Aggregates

4.2.10. The MTAN1 [Document 13.2.5] provides guidance on the mechanisms for delivering the policy for aggregates extraction by mineral planning authorities and the aggregates industry. It is also widely used to assess construction works of extended duration, where the construction activities are comparable with works associated with mineral extraction.

4.2.11. Paragraphs 78 to 84 provide guidance on appropriate levels and control of vibration, in particular, blasting and air overpressure.

4.2.12. The document also provides guidance on noise with regards to aggregate extraction, which might be considered relevant to the proposed construction sites involving extended earthworkings, i.e. borrow pits or areas, or extended construction works where significant activity may exceed 6 months.

4.3. British Standards

4.3.1. I briefly describe the Standards upon which parts of this assessment are based in the paragraphs below; these Standards mostly relate to construction rather than operational effects.

British Standard 5228 'Code of practice for noise and vibration control on construction and open sites', Parts 1 and 2, 2009 (as revised 2014)

4.3.2. British Standard (BS) 5228 is a two part standard comprising:

a) BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' [Document 14.2.5]; and
b) BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' [Document 14.2.6].

4.3.3. The Standard provides guidance, information and procedures on the assessment, mitigation and control of noise and vibration from demolition and construction sites. It forms the UK's primary assessment methodology for predicting, assessing, controlling and mitigating noise and vibration from these types of activities. I am a member of BSi Panel B/564/1 which drafted this Standard.

BS 4866:2010 'Mechanical Vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures'

4.3.4. Construction and industrial plant and machinery can generate groundborne vibration that is perceptible to occupants of nearby buildings. The primary cause of community concern generally relates to building damage, although concerns are often expressed at levels of vibration significantly lower than that likely to cause damage.

4.3.5. BS 4866:2010 [Document 14.2.13] provides guidance on the measurement of vibration in buildings including methodologies, measurement instrumentation, location and fixing of transducers and data evaluation. Annexes also provide advice on classifying buildings with regard to their likely sensitivity; estimating peak stress from peak particle velocity; and random data. A bibliography is also provided. The Standard supersedes BS 7385-1:1990 'Evaluation and measurement of vibration in buildings - Part 1: Guide for measurement of vibrations and evaluation of their effects on structures.

4.3.6. Assessment of the potential for cosmetic or structural damage is provided within BS 7385-2:1993 [Document 14.2.2]. Guidance on vibration from piling activities is contained within Part 2 of BS 5228. Guidance relating to the human response to vibration in buildings is contained within BS 6472-1:2008 [Document 14.2.4].

BS 7385-2:1993 'Evaluation and measurement for vibration in buildings - Part 2: Guide to damage levels from groundborne vibration'

4.3.7. BS 7385-2:1993 provides guidance on the levels of vibration above which buildings could suffer damage. It identifies the factors that influence the vibration response of buildings and describes the basic procedure for carrying out measurements. It also states that there is a particular difference between the sensitivity of people feeling vibration and the onset of levels of vibration that damage structures, and that levels of vibration at which adverse comment from people is likely are below levels of vibration which damage buildings.

BS 6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting'

4.3.8. The human body is an excellent detector of vibration, which can become perceptible at levels that are substantially lower than those required to cause even cosmetic building damage. The way in which people perceive vibration in buildings depends upon various factors, including the vibration duration, frequency, direction and activity.

4.3.9. The Standard indicates that how people inside a building respond to vibration from sources within and outwith the building, with the exception of blasting, is best evaluated with the Vibration Dose Value (VDV). The VDVs associated with various probabilities of adverse comment within residential buildings are provided in Table 1 of the Standard.

BS 6472-2:2008 'Guide to evaluation of human exposure to vibration in buildings – Part 2: Blast-induced vibration'

4.3.10. Limited blasting would be required during the construction phase, both for excavation of rock and in demolition.

4.3.11. BS 6472-2:2008 [Document 14.2.11] deals with the particular problems associated with periodic blasting within a range of inhabited buildings. For blasting, the current practice is to measure the peak particle velocity (PPV) and BS 6472-2:2008 suggests satisfactory vibration magnitudes in terms of PPV.

4.3.12. BS 6472-2:2008 also provides guidance on human exposure to blast-induced vibration in buildings and is primarily applicable to blasting associated with mineral extraction, although the criteria are also appropriate for demolition. For blasting, current practice is to measure PPV using velocity transducers (geophones).

4.3.13. For the purpose of the assessment of blasting, daytime is considered to be 08:00 to 18:00 hours Monday to Friday and 08:00 to 13:00 hours Saturday. For more than three blast vibration events per day, a reduced threshold of effect would be appropriate.

4.3.14. Whenever blasting is carried out, energy is transmitted from the blast site in the form of airborne pressure waves. The majority of the airborne energy is carried at frequencies below 20 Hz and hence is inaudible to the human ear but can be sensed as concussion or pressure. It is the combination of the sound and concussion that is known as air overpressure. Air overpressure can excite secondary vibrations at audible frequencies in buildings and it is often this effect that gives rise to adverse comments from the occupiers. However, the highest levels normally measured in the United Kingdom are generally less than 1% of the levels known to cause structural damage. Accurate prediction of air overpressure is almost impossible due to the variable effects of the prevailing weather conditions and the large distances often involved. The Standard does not suggest maximum satisfactory levels of air overpressure.

4.3.15. With regards to human response to vibration and air overpressure associated with blasting, BS 6472-2:2008 states that:

'Within residential areas people exhibit wide variations of vibration tolerance. Specific values are dependent upon social and cultural factors, psychological attitudes and expected degree of intrusion.'

and

'Experience shows that the fear of property damage has a more significant effect on human response than the effect of the vibration on the person directly, although discussion of this matter is beyond the scope of this British Standard.'

4.3.16. With regard to air overpressure, levels measured at properties near quarries in the United Kingdom are generally around 120 dB(lin), which is 30 dB below or only 3% of the limit for cracking pre-stressed poorly mounted windows. This level of 120 dB (lin) is therefore the limit most commonly adopted to prevent excess air overpressure effects.

4.3.17. Quantification of effects from blasting would be subject to detailed assessment prior to any blasting works. Mitigation would be implemented to ensure that any adverse effects are minimised.

4.4. Consultation

4.4.1. A summary of all consultation with stakeholders and consultees, such as local authorities, is provided in Table 4.1; this does not include any objections.

Table 4.1: Relevant Consultation Responses

Date	Consultee and Issue Raised	How/Where Addressed
Draft Plan consultation response (Welsh Government, 2014b)	Public responses - Concern regarding potential to resolve existing noise problems. Note that existing noise levels are high adjacent to the M4. Potential impacts on noise levels at Magor and Duffryn.	Effects on existing receptors are considered in this Proof of Evidence.
	Natural Resources Wales - Concern regarding effects of noise and vibration on biodiversity.	Within Chapter 10 of the ES: Ecology and Nature Conservation.
	Sustrans Cymru, CTC Cymru - Potential changes in noise in relation to cycle routes.	Effects on existing receptors have been considered.
Consultation during	Principal Environmental Health Officer	The baseline survey

Date	Consultee and Issue Raised	How/Where Addressed
EIA process	(EHO) (Huw Owen) Newport City Council - Clarification of short and long term baseline noise monitoring locations and suggestions for other locations.	locations reflect the suggestions of the EHO.
	Environmental Health Manager (Michelle Tett) Monmouthshire County Council Clarification of short and long term baseline noise monitoring locations and suggestions for other locations.	The baseline survey locations reflect the suggestions of the Environmental Health Manager.
Response to Scoping Document	Views of Officers of the Council, reported by Area Manager West and Strategic Delivery for Streetscene and City Services of Newport City Council - Construction noise: Insulation/rehousing to be provided where other mitigation is unsatisfactory; noise monitoring during construction; provision of a Construction and Environmental Management Plan; out of hours work by prior permission and notification of locals with Public Liaison officer; and post-construction noise monitoring to verify noise levels.	Addressed by direct response to Newport City Council.

4.5. Assessment Criteria and Assignment of Significance

4.5.1. In this subsection, I describe the approach taken to identifying sensitive receptors, predicting the magnitude of an impact and the significance of an effect.

4.5.2. Changes to the baseline conditions have been considered in terms of noise change, which is the predicted change in noise level due to the proposed new section of motorway, and change in flow on the existing M4. Consideration of noise change also includes consideration of the absolute noise level as appropriate. Baseline survey data have been used to determine a lower threshold for existing noise levels.

4.6. Receptor Sensitivity

4.6.1. Within the study area, the following types of receptors have been considered:

a) residential properties;
b) recreational uses; and
c) other sensitive receptors (such as schools, nursing homes, hospitals etc).

4.6.2. The sensitivity or value of each receptor has been described using the terms high, medium or low, taking into account the guidance set out in the DMRB Volume 11, Section 2, Part 5 HA 205/08.

4.6.3. For residential properties within the study area, sensitivity has been valued as 'medium'; this is generally the case for residential receptors. This balances their high importance against their adaptability.

4.6.4. Recreational users on Public Rights of Way (PRoW), cycle routes and other facilities are also valued as ‘low’ or 'medium' sensitivity, depending on the anticipated duration of exposure and availability of alternative quieter areas, unless particular circumstances indicate otherwise.

4.6.5. Other sensitive receptors (such as schools, nursing homes, hospitals etc.) have been valued as 'medium' sensitivity, unless particular circumstances indicate otherwise. Examples of receptors that might be considered as high sensitivity include recording studios and vibration-sensitive manufacturing processes such as microelectronics facilities. However, none of these types of facilities were identified through the EIA process and hence I do not believe that any are present or certainly not present within a critical distance of the changed infrastructure.

4.6.6. I summarise the approach to determining sensitivity in Table 4.2 below.

Table 4.2 Acoustic Receptor Sensitivity

Typical Criteria	Sensitivity
Users of PRoW; and other permitted recreational trails and users of recreational facilities where the purpose of that recreation is enjoyment of the countryside.	Low / Medium
Residential properties; and other sensitive receptors (such as schools, nursing homes, hospitals etc), unless particular circumstances indicate otherwise.	Medium
Sensitive receptors with particular circumstances - none identified.	High

4.6.7. The sensitivity and importance of ecological receptors is considered within Chapter 10: Ecology and Nature Conservation of the ES and Supplements and the Proof of Evidences of:

a) Dr Keith Jones Ecology and Nature Conservation [WG 1.18.1];

b) Dormice and Water Voles – Proof of Evidence of Mr Jon Davies [WG 1.19.1];

c) Bats – Proof of Evidence of Mr Richard Green [WG 1.20.1]; and

d) Ornithology – Proof of Evidence of Mr Martin Scott [WG 1.21.1]

4.7. Magnitude of Impact

4.7.1. The magnitude of an impact is identified using the terms major, moderate, minor, negligible and no change. The DMRB defines 'impact' as follows:

'Change that is caused by an action; for example land clearing (action) during construction which results in habitat loss (impact)' (Highways Agency et al., 2008).

4.8. Assessment of the Magnitude and Significance of Effects

Construction Phase: Noise

4.8.1. From predictions, the most significant potential impacts during construction are likely to arise from direct construction noise effects arising from plant and activities where these are up to around 115 m of NVSRs. Out of these, works at bridges, cuttings and other major earthmoving areas, for example, may be the most significant as large numbers of plant may be required, works may occur for significant periods, i.e. in excess of six months (Annex E.5, BS-5228-1:2009+A1:2014 [Document 14.2.5]), at specific locations and work may need to extend beyond normal daytime working hours. Other activities, such as embankment construction (unless this includes a haul road), laying the new road surface etc. would be transitory along the length of the proposed new section of motorway, so particular NVSRs would only be affected for a relatively short duration, i.e. less than six months.

4.8.2. Noise from construction traffic is not expected to result in widespread significant impacts but may affect receptors particularly close to parts of the existing highway network. I am not aware of any objections specifically relating to construction traffic effects.

4.8.3. It is possible that blasting may be required for certain structures or in certain areas where hard rock excavation may not be possible or effective with mechanical plant. If required, it would be intended that the blasting would be carried out once a day under controlled conditions during the period of major earthworks. Local residents and businesses would be given advanced warning of when the blasting would take place.

4.8.4. The criteria for assessing noise impact from the road construction works have been based on ‘Example Method 2 - 5 dB Change’ contained within Annex E of BS 5228-1:2014. This indicates that:

'Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB LAeq,T from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect.'

Table 4.3 Construction Noise Levels – Assessment Criteria for the Determination of Impact Magnitude

Column (C) 1	C2	C3	C4	C5
Assessment Category and Threshold Value Period ($_{LAeq}$)	**Threshold Value in Decibels (dB) [1]**			
	No change / Negligible	**Minor ct**	**Moderate Adverse Effect**	**Major ct**
Night-time (23.00 to 07.00 hours)	<40	40 - 45	45 – 55	>55
Evenings (19.00 to 23.00 hours weekdays). Weekends (13.00 to 23.00 hours Saturdays and 07.00 to 23.00 hours Sundays)	<50	50 - 55	55 – 65	>65
Daytime (07.00 to 19.00 hours) and Saturdays (07.00 to 13.00 hours)	<60	60 - 65	65 - 75	>75

1) Subject to duration criteria, and where ambient noise levels are low.

4.8.5. The calculation method contained within BS 5228-1:2014 takes account of the duration of an activity per hour, the 'on-time' and the attenuation of sound due to the effects of distance, ground attenuation and barriers or topographic features or buildings which act as barriers.

4.8.6. The assessment has been based on reasonably expected construction phases, plant items, on-times and noise levels based on the information provided within BS 5228-1:2014 [Document 14.2.] and informed by the Buildability Report and the Proof of Evidence of Mr Barry Woodman on Construction [WG 1.6.1].

4.8.7. For works near the existing M4 (including those works which could be categorised as being in rural or urban areas), the higher baseline sound levels would indicate that acceptable levels of construction

noise would be higher than for those areas with lower threshold values for day and night-time working.

4.8.8. Where predicted construction noise levels are up to 5 dB below the lower cut off values of 65 dB, 55 dB and 45 dB given in paragraph 4.8.4 above or are of short duration (less than 1 month), this is considered to be a 'no change' or negligible adverse magnitude of impact (shown in C2). For works of significant duration (of one month or more, unless works of a shorter duration are likely to result in a significant effect: where levels are between -5 dB below and equal to the criteria above (shown in C3), this is considered to be a minor adverse impact; where the criteria are exceeded by up to 10 dB (shown in C4), this is considered to be a moderate adverse impact. Noise levels greater than 10 dB above the criteria (shown in C5) are considered a major adverse impact depending on the context and duration of the works.

4.8.9. Table 4.4 is used in the assessment of noise impact associated with construction traffic on the local road network and from temporary diversion routes resulting from construction of the Scheme. Although for a given noise change, the DMRB indicates a greater magnitude of impact in the short-term compared to the long term, the temporary nature of construction works decreases the magnitude of impacts for the same noise change.

Table 4.4 Classification of Magnitude of Temporary Construction Traffic Noise Impacts

Noise Change $L_{A10, 18h}$	Magnitude of Impact
0 dB	No change
0.1– 2.9 dB	Negligible
3.0 – 4.9 dB	Minor
5.0 – 9.9 dB	Moderate
10.0+ dB	Major

(Source: Table 3.1 Highways Agency *et al.,* 2011)

Construction Phase: Vibration

4.8.10. The most significant potential impacts are likely to arise from direct construction vibration from plant and activities where these occur within close proximity of NVSRs. Based upon experience and professional judgement in relation to the distances from highways construction works at which significant noise effects can occur, a study area of 150 m between source and receptor has been used for the assessment, with the anticipated distances at which adverse impacts might occur being well within this. Piling and earthworks at bridges or cuttings may be the most significant construction works as these may last for a longer duration at specific locations and some works may be necessary outside normal daytime working hours.

4.8.11. Vibration from construction traffic is not expected to result in widespread significant impacts but may affect receptors particularly close to parts of the existing highway network or haul roads. I am not aware of any objections specifically relating to construction traffic effects.

4.8.12. BS 5228-2:2014 provides guidance relevant to vibration from construction and demolition. It includes sections on: community relations; vibration and persons on site; neighbourhood nuisance; project supervision; control of vibration and measurement.

4.8.13. As set out above, the normal index for predicting and measuring vibration levels from construction is the peak particle velocity (PPV). Based on the levels provided in BS 5228-2:2014 Table B.1, a criterion of 1 mm/s has been taken as the onset of a significant impact for vibration on people due to construction activities. The level marks where '*It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents'.* This criterion relates to human response, with the level corresponding to the onset of cosmetic building damage being an order of magnitude greater.

4.8.14. BS 5228-2:2014, Table B.2, provides limits for transient vibration above which cosmetic damage, i.e. non-structural, could occur. These are a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hertz (Hz) and 20 mm/s at frequencies above 15 Hz. A building of historic value should not, unless it is structurally unsound, be assumed to be more sensitive.

4.8.15. Should blasting be required, mitigation will be implemented to prevent significant effects from vibration at sensitive receptors. With regard to criteria, in addition to those for the effects upon structures, BS 6472-2:2008, provides guidance on acceptable levels of vibration and air overpressure relative to human exposure.

4.8.16. Appropriate limits would be set based upon those relating to building damage and those relating to human exposure in Table 1 and Section 7 of BS 6472:2:2008 and MTAN 1. The Construction Environmental Management Plan (CEMP), committed to and identified in Dr Peter Ireland's Proof of Evidence [WG 1.7.1], sets out the necessary measures to ensure compliance with these. A Pre-CEMP was provided at Appendix 3.2 of the ES; the final CEMP will be submitted to the local authority by the contractor for agreement prior to the works commencing. Additionally, should the local authorities require, Control of Pollution Act 1974, Chapter 40, Part III, Noise, Section (s.) 61 (Prior consent for work on construction sites – [Document 14.3.3]) applications can be made for specific works. These works would be those, for example, that may require out of hours working such as 24 hour concrete pours or any other continuous activity such as bridge demolitions over weekends etc. The s. 61 will specify working hours, how and where the works will be carried out, what mitigation will be applied and what monitoring will be provided.

Operational Phase: Noise

4.8.17. Traffic noise and disturbance would increase for some properties affected by the proposed new section of motorway. However, many receptors situated in close proximity to the existing heavily trafficked M4 motorway would experience decreases in traffic noise and hence disturbance. The detailed assessment of noise and noise disturbance changes has been undertaken to indicate where both beneficial and adverse changes would occur for the Scheme.

4.8.18. The DMRB Volume 11, Section 3, Part 7 provides a classification for the magnitude of impact of traffic noise from a road scheme.

4.8.19. A change in road traffic noise of 1 dB in the short-term (e.g. when a scheme is opened) is the smallest that is considered perceptible. In the long term, a 3 dB change is considered perceptible. The magnitude of impact is, therefore, considered to be different in the short-term and the long term. The classification of magnitude of impacts used for traffic noise is given in Table 4.5 (short-term) and Table 4.6 (long term). In summary, following the opening of a scheme, people are more sensitive to the immediate change in noise (hence the lower increase of 1 dB being the threshold for significance) but over time their sensitivity decreases (hence the higher increase of 3 dB being the threshold for significance). These impacts relate to changes in noise due to the permanent operation of the Scheme (not construction traffic).

Table 4.5 Classification of Magnitude of Noise Impacts in the Short-term

Noise Change $L_{A10, 18h}$	Magnitude of Impact
0 dB	No change
0.1 – 0.9 dB	Negligible
1.0 – 2.9 dB	Minor
3.0 – 4.9 dB	Moderate
5.0+ dB	Major

(Source: Table 3.1, Highways Agency *et al.,* 2011)

Table 4.6 Classification of Magnitude of Noise Impacts in the Long Term

Noise Change $L_{A10, 18h}$	Magnitude of Impact
0 dB	No change
0.1– 2.9 dB	Negligible
3.0 – 4.9 dB	Minor
5.0 – 9.9 dB	Moderate
10+ dB	Major

(Source: Table 3.2, Highways Agency *et al.,* 2011)

4.8.20. These descriptors of impact magnitude are consistent with the terminology used elsewhere in the DMRB. For example, Volume 11, Section 3, Part 2 (HA 208/07) sets out example noise impact descriptors (reproduced in Table 4.7 below). These can be used as descriptions for the above noise changes. So, for those subject to a minor noise change, the effect would be "Limited changes to noise levels or sound quality".

Table 4.7 Definitions of Impact Magnitude

Magnitude of Impact	Typical Descriptors
Major	Gross change of noise or change to sound quality
Moderate	Noticeable differences in noise or sound quality
Minor	Limited changes to noise levels or sound quality
Negligible	Very slight changes in noise levels or sound quality
No Change	No audible changes

Operational Phase: Vibration

4.8.21. Vibration effects on buildings and structures may be considered in terms of their potential to cause damage. However, vibration levels at which even cosmetic damage can occur are relatively high and, generally, these are only generated by blasting or some construction activities in very close proximity to buildings. For a reasonably maintained road without speed control measures, such as speed humps, vibration arising during operation is likely to be minimal. The DMRB states that peak particle velocity in close proximity to roads rarely exceeds 2 mm/s and is typically below 1 mm/s.

4.8.22. The effects of groundborne vibration associated with motorways are generally minimal and below perception due to the distances between the carriageways and residential receptors and the good

quality road surfaces. Therefore, a quantitative assessment of this aspect was scoped out of the ES. I am not aware of any objection to this.

4.9. Significance of Effect

4.9.1. The DMRB Volume 11 Section 2 Part 7 (HA 218/08) defines 'effect' as follows:

'Term used to express the consequence of an impact (expressed as 'significance of effect'), which is determined by correlating the magnitude of the impact to the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria. For example, land clearing during construction results in habitat loss (impact), the effect of which is the significance of the habitat loss on the ecological resource'.

4.9.2. With regards to noise and vibration, the assessment of significance is based on the guidance provided in DMRB, Volume 11, Section 2, Part 5 (HA 205/08). The significance of effect is described using the terms very large, large, moderate, slight and neutral, depending on the environmental sensitivity and the magnitude of impact.

Table 4.8 Assessment of Significance

Value/Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very large

4.9.3. The assessment of noise and vibration has been based on the Scheme with permanent acoustic measures in place (i.e. including measures forming part of the highway engineering design – central solid safety barrier of 0.9 m in height and a low noise thin road surface) and with additional proposed mitigation in place, such as

acoustic barriers in certain areas where these are effective to groups of properties.

5. Baseline Conditions

5.1. Study Area

5.1.1. The guidance in the DMRB for operational traffic noise states that the primary study area for noise and vibration should correspond to a band 600 m either side of the carriageway edge, i.e. a corridor of some 1,200 m (plus the width of the road). However, an initial review of predicted noise changes indicated significant effects could potentially occur outside this distance, due to the scale of the Scheme and the potential quietness of the surrounding area along the alignment of the new section of motorway. On this basis, the study area was increased to a band 1 km either side of the carriageway edge of the proposed new section of motorway and 1 km either side of the existing M4 (i.e. a 2 km corridor plus the width of the road). This is to ensure that all potentially affected NVSRs are duly considered.

5.2. Approach to Identification of Baseline Conditions

5.2.1. The noise environments in the vicinity of the existing M4 motorway and the proposed new section of motorway have been determined and characterised by means of baseline noise monitoring. This supplements the monitoring previously undertaken as part of earlier studies (Stage 2 Environmental Assessment [Document 4.5.5]), which informed the selection of baseline noise survey locations. Locations were selected to be representative of areas of residential development, more isolated communities, recreational uses and sites of nature conservation value. Survey location selection was based upon experience and professional judgement and reflects the consultation responses received from Newport City Council and Monmouthshire County Council at the time. The locations adopted are identified in Figures 1a to 1k of the ES Volume 3: Appendix 13.2, Baseline Sound Monitoring.

5.2.2. The baseline sound monitoring was undertaken between Tuesday 23rd June 2015 and Thursday 23rd July 2015; the monitoring was commenced as soon as the Risk Assessment and Method Statement was approved by Costain, when a period of good, stable weather was forecast and during term time. In total, 15 part attended long term, continuous surveys were completed, ranging from 7 to 16 days in duration and 28 fully attended short-term surveys of 3 hours duration were completed during the daytime period. The majority of the survey period fell within school term time, with the local schools' summer term ending 20th July 2015; the last two surveys to be collected ran into the holiday period by three days, having logged data during term time for at least one week.

5.2.3. Local meteorological conditions varied through the survey period and were logged at Gwaunshonbrown Farm, Pound Hill using an RPS deployed meteorological station co-deployed at this noise survey location. This location was considered to be representative of the general area over which the noise surveys were carried out. Noise surveys were only carried out when the weather conditions were appropriate or, where weather conditions were not appropriate, data were removed in accordance with best practice.

5.3. Baseline Environment

5.3.1. Baseline noise level data acquired for the Stage 2 Environmental Assessment were available for various locations in close proximity to the new section of motorway. However, the data were between one and seven years old. As such, characterisation and determination of existing baseline conditions has been undertaken primarily based on the 2015 data from the baseline surveys, with reference made to historic survey data, as appropriate.

5.3.2. The methodology and results of the baseline study are provided in Appendix 13.2 of the ES both in full and summary form, which

includes supporting information. I do not reproduce this information in full here but I provide a high level summary in Table 5.1 below.

5.3.3. Whilst noise levels vary from location to location and from day to day, it is considered useful to provide quantitative sound levels that are representative of general areas. These have been interpreted from the baseline surveys and may not be appropriate in all situations. Where baseline noise levels for a specific area are required, the baseline survey data have been used directly. The general characterisation of baseline sound levels in the study area is presented in Table 5.1 in terms of the ambient and background sound levels.

Table 5.1 General Characterisation of Baseline Sound Levels

	Daytime (07:00 – 23:00)		**Night-time (23:00 – 07:00)**	
	$L_{Aeq, 16hr}$	**$L_{A90, 16hr}$**	**$L_{Aeq, 8hr}$**	**$L_{A90, 8hr}$**
Near existing M4	55 - 65 dB	45 - 55 dB	50 - 60 dB	40 - 50 dB
Urban areas	45 - 55 dB	35 - 45 dB	40 - 50 dB	30 - 40 dB
Rural areas	40 - 50 dB	30 - 40 dB	35 - 45 dB	25 - 35 dB

5.3.4. As other noise metrics are referred to throughout the assessment, it is useful to note how they compare with the levels given above. From the survey data, it is apparent that the $L_{Aeq,18hr}$ (not included above) does not significantly differ from the $L_{Aeq,16hr}$ (i.e. the level measured over the 18 hr daytime is similar to that measured over the 16 hr daytime). The L_{A10} levels for daytime and night-time are, on average, 2 to 3 dB higher than for the corresponding L_{Aeq} day/night period, respectively which is as expected.

5.3.5. As an indication of the lower noise level typically experienced away from urban areas, a level of 40 dB $L_{Aeq,16hr}$ has been adopted. This equates to a level of 42 dB $L_{A10,18hr}$. It should be noted that these are average levels for the period 06:00 to 24:00 hrs and noise levels may occasionally fall below these average levels from time to time during this period and at night, i.e. between 00:00 and 06:00 hrs.

5.3.6. In general terms, the data indicate that the daytime ambient L_{Aeq} levels range from the quietest at 40 dB(A) to the loudest at 65 dB(A) where the location was near the existing M4. For the night-time, the range is from 35 dB(A) to 60 dB(A). The lower range of levels indicates that, whilst the existing levels around the Scheme alignment are low, they are not very low.

5.4. Future Baseline Conditions

5.4.1. In the absence of the Scheme, baseline noise levels around and through Newport on the existing M4 and the surrounding areas are likely to increase in accordance with the expected traffic growth for the area. In some locations, despite the growth in traffic, the predicted change in traffic speed or anticipated Heavy Goods Vehicle (HGV) content results in a slight decrease in noise levels due to decreases in speed.

5.4.2. Traffic growth figures indicate that motorway traffic in Wales increased by nearly 3% between 2013 and 2014. Growth on the existing M4 between 2014 and 2037 in the absence of the Scheme is expected to be between 0.5% and 1.9% per annum. In terms of the related increase in noise level, this would be minimal (approximately 1 dB) and the increase may also be mitigated, to some extent, by improvements in vehicle technology and legislative requirements, which will tend to reduce the sound contribution from each vehicle. The other effect, as I mention above, occurs with increasing congestion which usually results in decreasing speed and hence decreased noise emissions but this has other detrimental effects.

5.4.3. If the Scheme is approved, in general terms, as I describe in Section 2.2, whilst both the construction and operation of the new road will result in adverse effects due to noise increases on properties and communities lying adjacent to the new road, the lessening of traffic on the existing M4 through Newport will reduce noise levels and

hence effects through a highly populated area and hence will have a beneficial effect on a much greater population. The net result is an overall benefit, i.e. more people benefit by a noise decrease than are subject to a disbenefit due to a noise increase.

6. Limitations of The Assessment

6.1. General Limitations

6.1.1. In all assessments, it is good practice to consider uncertainty, which can arise from a number of different aspects of an assessment. There is a degree of uncertainty associated with:

a) for the baseline measurements - the instrumentation itself; the use of instrumentation;

b) for the calculation methodology - the source assumed within CRTN;

c) for the predictions - the sound propagation model; and

d) the subjective response of residents to the sound sources which is assumed within the DMRB methodology.

6.1.2. Uncertainty due to instrumentation error has been significantly reduced with the introduction of modern instrumentation. Uncertainty is reduced further by ensuring that all instrumentation is calibrated before and after each measurement period and is within accepted calibration intervals.

6.1.3. Every effort has been made to reduce the uncertainty of the baseline sound level measurements. Uncertainty in the baseline data has been reduced significantly by carrying out the baseline sound level survey over a period of seven days or more, allowing analysis of how representative the baseline data is given the naturally varying noise level at the site. Weather conditions during the surveys were monitored and the surveys extended or the data processed to ensure only periods of noise data when acceptable weather conditions were present were adopted for the assessment.

6.1.4. A quantitative assessment has been undertaken based on likely construction plant source levels provided by the appropriate British

Standards. This approach minimises uncertainty associated with the source term inputs to the sound propagation model.

6.1.5. With regard to subjective response of residents, the acoustics standards and guidance adopted for the assessment are based on the subjective response of the majority of the population. This is considered to be the best that can be achieved in a population of varying subjective responses, which are dependent upon a wide range of factors.

6.1.6. The traffic data considered in the assessment make use of speed-pivot analysis to best match the anticipated speed profiles. For the noise model, a minimum speed of 20 kph has been assumed, as required by the DMRB.

6.1.7. Predicted noise levels consider noise only from road links for which traffic data have been provided. This excludes many of the smaller road links around the Caldicot Levels where traffic data are not available and where the effects of the Scheme in terms of change in traffic would be minimal in any case. The prediction does not include noise from any other sources, such as wind/environmental noise, agricultural activity or industry. The effect of this is that total baseline levels would potentially be higher, as would future noise levels with the published Scheme, so the net effect in terms of noise change would be very similar.

6.1.8. From the baseline survey data, a minimum long term environmental noise baseline level of 40 dB L_{Aeq}/42 dB $L_{A10,18hr}$ has been determined (see Section 13.4 of the ES). Where operational noise levels (either existing or future) are predicted (on the basis of only the traffic data) to fall below 42 dB $L_{A10,18hr}$, a level of 42 dB $L_{A10,18hr}$ has been assumed.

6.1.9. In these circumstances, it would be the case that the noise change would be underestimated if the noise level was below 42 dB $L_{A10,18hr}$.

However, two considerations are necessary: firstly whether such an underestimate would change the noise change category that the receptor falls into; and secondly whether there are likely to be any locations where this would be the case.

6.1.10. With regard to the noise change category, given that the likely noise increases in areas where there are currently no major traffic noise source are likely to be in excess of 5 dB, these would all be subject to major noise increases in any case and hence this would make no change to the overall assessment.

6.1.11. With regard to whether there are any locations where this would in fact be the case, the baseline survey tables only show one location where the average 8-hour night-time noise level is below 40 dB L_{Aeq} (LT12 – Queens Magor Gardens - there are two nights where levels are 39 dB and 38 dB) and there are no locations where this occurs for the for the 16-hour daytime period. On this basis, whilst there could be other remote areas where levels may be lower than the minimum assumed, these are considered to be mostly unlikely or at worst very sporadic in terms of distribution. Notwithstanding this, the range of night-time L_{Aeq} levels in Table 5.1 is extended to a lower level of 35 dB L_{Aeq}, considered possible for rural areas.

6.1.12. To further qualify this, these representative levels are used for approximately 134 properties, out of the 20,000 or so properties for which an assessment has been undertaken. The 134 properties generally have been shown as experiencing an increase of around 5 to 8 dB; all being identified as a significant impact. I consider, therefore, that the adoption of the lower threshold has not resulted in the omission of any significantly adversely affected properties.

6.1.13. The assessment is based on annual traffic data, following the guidance given in the DMRB. This gives an average-case assessment, as the DMRB method does not fully account for

congestion, etc and hence could have overestimated speeds on the existing M4 through Newport and hence overestimated baseline noise levels for periods where congestion currently occurs. Correction to the speed data has been made to implement the requirements of IAN 185/15 and hence this should have allowed the assessment to reflect actual speeds and hence actual noise levels through Newport on the existing M4.

6.1.14. On the basis of the above, measures have been taken to minimise general uncertainty in accordance with best practice.

6.2. Constraints of the Methodology

6.2.1. The assessment has been undertaken in compliance with the methodology contained within the DMRB and CRTN. However, there are a number of constraints associated with these methodologies which could result, for this particular scheme which is for a road of motorway grade and speed, in an over estimate of the predicted noise levels and hence noise change. It is not possible to quantify the magnitude of these over predictions but they fall into a number of different areas, as I describe below:

6.2.2. Noise source height – CRTN assumes a source height for the noise from a vehicle of 0.5 m which is about 2/3s of the height of a wheel on a standard saloon car. Noise sources on a car are: the engine, the friction between the tyre and the wheel; and aerodynamic sources although with modern designed vehicles, this source is minimal and generally discounted. At low speed, the engine is the dominant noise source and this would have a source height probably higher than 0.5 m but, as speed increases, the road/tyre interface becomes the dominant noise source and hence the source point lowers to road level or 0 m.

6.2.3 There are at least two consequences to this:

1. With the source height reducing, so does the mean propagation height of the source. If a low noise thin surfacing road surface is being used for the published Scheme, this will then increase the potential attenuation provided by that surface through absorption that is not accommodated in the methodology – noise levels could therefore be lower than predicted due to higher absorption.

2. Where barriers are provided either at the roadside or in the central reservation, such as the solid concrete safety barrier proposed for the published Scheme, assuming a 0.5 m source height will under predict the effective barrier attenuation for motorway speed traffic where the main noise source is at 0 m. For example, the central reservation safety barrier has a height of 0.9 m; with the CRTN methodology requiring a source height of 0.5 m, this gives 0.4 m of effective barrier height which is inconsequential; however, the effective height would be 0.9 m. For the roadside barriers, these are proposed to be 2 m and no higher due to landscape and visual consequences. If one assumes a source height of 0.5 m, this gives an effective barrier height of 1.5 m whereas with a source height of 0 m, there would be an effective height of 2 m, resulting in greater attenuation – noise levels could again be lower than predicted due to greater barrier attenuation.

6.2.4 Noise reduction properties of Thin Surfacing Systems – The DMRB allows a -3.5 dB(A) correction to be adopted relative to hot rolled asphalt. This is for speeds above 75 kph; for speeds below 75 kph, the allowable correction reduces to -1 dB(A). However, there is test data to show that higher attenuations are possible and there is documented, certified test evidence using the SPB (Statistical Pass By) method (British Board of Agrément – HAPAS Tarmac Thin Surfacing Systems for Highways – Ultiflex 10 mm Thin Surfacing System) that a reduction of -5.5 dB(A) is possible as proven on a

section of the M6. Had it been possible to assume this, then noise levels predicted from the published Scheme, particularly in the short-term, would have been 2 dB(A) lower. It is not stated in the DMRB why these caps on potential reductions are provided but this may be due to the need to be conservative but also take into account degradation of the porous surface over time.

6.2.5 Vehicle noise emissions – CRTN was published in 1988 based upon source terms for vehicles at the time. Some 28 years later, whilst vehicle numbers have greatly increased, noise emissions due to improved design of tyres, engines and aerodynamics have reduced and the speed limit for motorways has not increased. On this basis, noise levels should also be lower than predicted although the amount of reduction cannot be quantified.

6.2.6 Wind effects - the methodology generally assumes moderate downwind conditions for all receptors, i.e. the wind is always blowing the noise from the source (the motorway) to the receptors in all directions. In reality, the wind generally comes from just one direction so those living downwind would be subject to more noise than those living upwind. With predominant south westerly winds, NVSRS to the south of the motorway, i.e. on the Gwent Levels, the quietest area at the current time, will receive slightly less noise than predicted but those to the north will receive levels as predicted as they were originally assessed as being downwind.

6.2.7 Based upon the above, it is likely that the noise predictions provided in the ES and the subsequent Supplements provide a worst case with regard to future noise levels from the published Scheme.

7 Environmental Commitments and Mitigation Measures Forming Part Of The Scheme Design

7.2 Environmental Commitments

7.2.4 Appendix R18.1 of the December 2016 ES Supplement Volume 3 provides the Register of Environmental Commitments Update. With regard to noise and vibration, the following commitments have been made covering both construction and operation:

Table 7.1 Schedule of Noise and Vibration Commitments

Ref. #	Source	Commitment	When
7	SHRA, p. 55	Effective construction techniques to avoid or minimise noise or vibration. These measures would be set out within the CEMP. • Integration of 'noise breaks' into the piling programme if required. • Test piling would be undertaken to determine potential vibration effects in advance of any piling works. These measures would be set out in the CEMP.	Before start of construction.
11	SEA PAS, p.32	Noise and Vibration Mitigation Measures: • Use low noise surfaces to reduce noise pollution, particularly in areas close to population and in sensitive areas; • Use noise barriers, bunds and secondary glazing to screen noise sensitive receptors where necessary. • Improve performance of noise control during construction and maintenance activities; • Manage temporary residual noise effects. • Consider noise nuisance when developing speed management strategies, HGV management pans and event management plans.	Before start of construction.
20	ES Chapter 3 Pre-EMP S2.4	Normal working hours would be 0700 to 1900 Monday to Friday and 0700 to **1700** on Saturdays, excluding public holidays. Any working outside the normal hours would be agreed with the local Environmental Health Officer and local residents would be informed. Site working hours would be closely managed and all operatives and staff would be informed of the site working hours during site induction.	During construction.
63		Subject to further discussion piling to install the cofferdam and pylon piles for the east pylon of the River Usk Crossing would be scheduled to avoid the period of highest sensitivity for underwater noise related impacts on migratory	During construction.

Ref. #	Source	Commitment	When
		fish in the River Usk (March to June inclusive). Piling activities would not take place one hour either side of high water.	
80	Pre-EMP S6.8	Noise monitoring (and vibration monitoring where appropriate) will be carried out as appropriate at or in the vicinity of potentially significantly affected residential properties during the construction phase.	During construction.
81	Pre-EMP S6.8	Prior consent for work on construction sites (CoPA 1974 Chapter 40, Part III, s.61) would be sought from Newport City Council's Environmental Health Officer, or other regulators, as appropriate to the specific area and required works, in advance of the works commencing. Where the works are agreed, affected residents would be notified of the programme for the intended works and advised of progress during the works.	"Pre and during construction.
82	Pre-EMP S6.8	Standard best-practice construction working methods and plant choice and use would be adopted during the construction phase to constitute Best Practicable Means.	During construction.
149	ES Ch 13	A 0.9 m solid barrier along central reservation is included in the noise model and will be constructed along the central reservation between the main M4 carriageways.	During construction.
150	ES Ch 13	The exact locations, alignments, heights and specification of noise barriers will be developed during the detailed design phase.	Detailed design.
151	SIAA S5	Where practicable, works in sensitive ecological areas will be programmed to avoid causing noise or vibration disturbance during sensitive periods of the year as determined for the species potentially affected.	During construction.

7.2.5 The above commitments have been assumed to be taken forward and form the basis of the assessment. Further details with regard to mitigation and comments made during consultation are provided below.

7.3 Construction

7.3.4 Following consultation with Newport City Council in relation to the Scoping Report, the Council has requested that:

'With regards to construction noise and vibration, we suggest that where in spite of mitigation, noise levels exceed trigger levels, it would be expected that a scheme of sound insulation (of costs of

[sic]) or temporary rehousing of affected residents [be offered] as appropriate, are provided. This is stated in Annex E of BS5228.

Noise monitoring (and vibration where appropriate) should be carried out at residential premises during construction to check compliance with noise and vibration limits.

Newport City Council will require a Construction and Environmental Management Plan to be produced and submitted, including details of proposed hours of work.

With regards to out of hours work, approval must be sought in advance from Environmental Health at Newport City Council and [where] work is agreed, affected residents must be notified in advance and kept up to date as the scheme progresses. We also feel that a public liaison officer should be appointed.'

7.3.5 The requirements of the Council have been considered and will be adopted and hence form measures that have been included in the assessment of effects. These are, in any case, established good practice measures that would be implemented through the Pre-Construction Environmental Management Plan (Pre-CEMP).

7.3.6 Noise and vibration monitoring would be carried out, as appropriate, at or around residential and other sensitive properties during the construction phase to check compliance with noise and vibration limits agreed with Newport City Council and Monmouthshire County Council or other regulators, as appropriate to the specific area.

7.3.7 The proposed hours of work during the construction phase are set out in the ES and the Environmental Commitments Register. Approvals would be sought from Monmouthshire and Newport City Council's Environmental Health Officers (or equivalent experts or regulators), as appropriate to the specific area. This would be undertaken in advance of the works commencing. These approvals can be formalised, as deemed appropriate by the regulator/s,

through the s. 61 Control of Pollution Act procedure for 'Prior consent for work on construction sites'. Where the works are agreed, affected residents would be notified of the programme for the intended works, and particularly of the requirement for any out-of-hours works, and kept up to date as construction progresses.

7.3.8 Standard best-practice construction working methods (such as use of silenced plant, turning off plant when not in use and selecting quieter plant where available) would be adopted during the construction phase.

7.3.9 In terms of the construction programme and activities, the Principal Contractor would engage with the local planning authorities prior to the commencement of construction.

7.3.10 The Pre-CEMP would be developed into a final CEMP prior to construction commencing. A Public Liaison Officer would be responsible for the day-to-day communication with the EHO and the general public. An Environmental Clerk (or Clerks) of Works, or Environmental Manager/s, would be responsible for the day-to-day implementation of the CEMP.

7.3.11 The following mitigation noise measures are included in the Pre-CEMP.

Communication:

a) Regularly engaging with stakeholders and the local community before and during the works.
b) Informing the community when and where noisy activities are expected to take place and for how long.
c) Displaying the project contact details including a 24-hour public helpline on the site notices.

Complaints:

a) Putting in place a suitable complaints log and investigation procedure. This procedure will be managed with the use of the Incidents, Complaints and Enquiries Database (ICE).

Working Hours:

a) Adopting the working hours set out in Chapter 3 – Scheme Construction. Where work needs to take place outside normal construction hours, this will be discussed with the Local Planning Authority via the Public Liaison Officer and agreed through the CoPA Section 61 process, as agreed where appropriate.

Access Routes:

Routing construction traffic away from NVSRs

7.3.12 As part of the additional mitigation, as an indication of the effectiveness of the temporary noise barriers, it has been assumed that barriers or other temporary screening would provide approximately 10 dB attenuation to noise at the ground floor for NVSRs near significant construction works. In practice, the screening attenuation achieved would vary, depending on the topography of the area, spatial separation and the nature of the works.

7.3.13 The above measures were assumed to be in place within the assessment provided in the ES and presented below.

7.4 Operation

7.4.4 During operation, both beneficial and adverse noise effects will occur as a consequence of the Scheme. The new section of motorway would reduce traffic and hence congestion on the existing M4. Noise measures incorporated into the design of the Scheme (embedded

mitigation) include the provision of a thin road surface system, which is relatively low noise and which would reduce noise levels as I describe in Section 6.2 of this evidence and elsewhere.

7.4.5 In addition, a solid concrete safety barrier 0.9 m in high, along the central reservation of the new section of motorway alignment may provide some screening of noise generated at the tyre-road interface. This is not primarily intended as a noise-control measure nor does its presence provide any noise mitigation within the noise model. This is due to the source height that has to be adopted, as described in Section 6.2 of this evidence, i.e. in reality, the central reservation would provide attenuation where vehicles are travelling at or close to the speed limit where the tyre/road interface is the primary source of noise for vehicles travelling at motorway speed. These mitigation measures are included in the assessment of potential operational effects described in this evidence.

Noise Barriers

7.4.6 Mitigation measures, in addition to the embedded measures, comprising noise barriers of 2 m height are proposed in four areas along the new section of motorway. This maximum height has been assumed to minimise other non-acoustic effects of the barriers, i.e. adverse landscape and visual effects. The locations of these barriers would be subject to further definitive evaluation and confirmation at the detailed design stage – the locations of the barriers are shown on Figure 13.10 of the ES. The locations as modelled are as follows:

a) Duffryn – north side of the new section of motorway –1,640 m run from the west extending to Lighthouse Road Overbridge – 2 m height protecting some 100 properties.

b) Duffryn – north side of the new section of motorway – 590 m run east from Lighthouse Road Overbridge – 2 m height protecting some 80 properties.

c) West of Magor – southeast side of the new section of motorway – 760 m run south from Green Moor Lane. 2 m height protecting approximately 100 properties and Caldicot Levels.

d) North of Magor – south side of the new section of motorway – 1,225 m run from Newport Road and Vinegar Hill - 2 m height protecting approximately 150 properties. The barrier would only be provided where comparable attenuation is not already provided by the cutting for the new section of motorway or existing barriers.

7.4.7 The exact locations, alignments, heights and specification of these barriers will be developed during the detailed design phase. However, the barriers would generally be such as to remove the direct line-of-sight between the carriageway and some or all windows on the facades of the nearer receptors hence providing the expected attenuation.

7.4.8 Despite these measures, there are isolated dwellings and small groups of properties that will still be subject to noise increases. These may therefore qualify for noise insulation or other compensation, subject to other acoustic and non-acoustic criteria being met. These would be addressed following the procedure in The NIR [Document 14.1.1] and the Land Compensation Act 1973 following construction of the Scheme (see Section 8 of my evidence for further details on properties potentially eligible for noise insulation).

8 Results of The Assessment

8.2 Description of Scheme in Relation to Noise and Vibration Effects –West to East

8.2.4 West end: towards Castleton - Properties near the Scheme are already affected by noise from the existing M4, so only a slight noise increase (typically <3 dB) has been predicted.

8.2.5 Duffryn – Houses on the southerly fringe facing the Scheme would experience an increase in traffic noise but again not to levels that would be generally considered unreasonable in accordance with appropriate standards and guidance (British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings [Document 14.2.14] and World Health Organization. Guidelines for Community Noise [Document 14.2.15] where the former states it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline values of 55 dB $L_{Aeq,T}$). The quieter outer fringe of Duffryn (e.g. Oystermouth Way) has relatively little traffic noise, which would increase to levels in the low to mid 50s dB $L_{A10,18hr}$ (L_{Aeq} levels are generally 2 to 3 dB lower than L_{A10} levels for the same measurement so a L_{A10} of 55 dB would equal and L_{Aeq} of around 53 dB).

8.2.6 Pye Corner/Picked Lane - A significant noise increase occurs, resulting in a significant detriment to residents of Picked Lane and the former Baptist Chapel. Properties would go from being subject to very little traffic noise to levels in the low to mid 60s dB $L_{A10,\ 18hr}$. Subjectively, it is considered that this is probably the most significantly affected area in terms of number of properties, change in noise levels and resulting overall level.

8.2.7 For several isolated residences on the Levels around Pye Corner, an increase in traffic noise is expected but not to levels that would be unreasonable, as I discuss in paragraph 8.1.3 above, in an urban environment (i.e. in Newport). Notwithstanding this, it is

acknowledged that the soundscape of the rural environment will be adversely changed for a considerable distance/corridor of effect. The existing M4 is audible over a wide area and the published Scheme will move most of that source south and hence audibility will move south to the extent that traffic noise will be audible, at times, all the way to the coastal area. I discuss this further in the section on tranquillity below.

8.2.8 Areas of new residential developments around the former steelworks site experience a neutral or slight (< 3 dB) noise increase but, overall, noise levels are comparable with the majority of Newport.

8.2.9 Llandevenny – This community is separated from the published Scheme by the existing Steelworks Access Road. Consideration has been given to providing additional mitigation in the form of a noise barrier for the residents but no reasonably practicable, effective solutions have been identified, i.e. if a barrier was placed along the published Scheme, noise from traffic on the Steelworks Access Road is still dominates. The village would experience a noise increase of around 5 dB, increasing from the low to mid 50s dB $L_{A10, 18hr}$.

8.2.10 Magor generally receives a minor benefit due to the low-noise surface, and reducing traffic through the village. The proposed Scheme results in a slight increase in noise to the southwest corner of Magor.

8.2.11 Through Newport - a 3 to 6 dB decrease would be experienced by properties which currently have the M4 as their dominant noise source; a benefit to a significantly large number of people. Across the Newport and Magor area, over 2,888 properties or approximately 6000 people are predicted to benefit by a noise reduction of 3 dB or greater.

8.2.12 Around J25 of the existing M4 (Caerleon roundabout), changes to the slip roads result in increased traffic on Caerleon Road into Newport. This results in a noise increase of 1 to 3 dB to a group of properties near the Caerleon roundabout which are already experiencing significant noise levels.

8.2.13 A schedule of NVSRs which, on initial calculation, meet two of the criteria given in the NIR has been produced, i.e. they may be eligible for noise insulation. This identifies properties which will both exceed a level of 68 dB $L_{A10, 18\ hr}$ either immediately following the opening of the published Scheme or in the future year, and experience at least a 1 dB increase compared to the corresponding do-minimum scenario. Note that other criteria would also have to be met. The properties are identified in Table 8.1 below.

Table 8.1 Schedule of Properties with Noise Levels Exceeding 68 dB L_{A10} and with a 1 dB Noise Increase

Properties identified by Area
Castleton: (2 properties) WR Jones and Sons, New Park Farm, Penylan Road, Newport Road, Bassaleg, Castleton, Newport, Cardiff, CF3 2UR The Barn, Mill Lane, Castleton, Newport, Cardiff, CF3 2UT
Coedkernew: (4 properties) Coedkernew House, Cardiff Road, Coedkernew, Newport, NP10 8TX Moorland View, Cardiff Road, Newport, NP10 8TX Spring Cottage, Cardiff Road, Coedkernew, Newport, NP10 8UF The Croft, Cardiff Road, Coedkernew, Newport, NP10 8UF
Pye Corner: (2 properties) Caeglas, Cae Glas, Nash Road, Nash, Newport, NP18 2BS Caeglas, Annexe, Cae Glas, Nash Road, Nash, Newport, NP18 2BS
Magor: (1 property) The Vicarage, Newport Road, Magor, Monmouthshire, NP26 3BZ
Rogiet: (1 property) 86 Caldicot Road, Rogiet, Monmouthshire, Caldicot, NP26 3SG
Existing M4 J25 Caerleon roundabout: (16 properties) 343 Caerleon Road, Newport, NP19 7HD 345 Caerleon Road, Newport, NP19 7HD 347 Caerleon Road, Newport, NP19 7HD 349 Caerleon Road, Newport, NP19 7HD 351 Caerleon Road, Newport, NP19 7HD 405 Caerleon Road, Newport, NP19 7HX

Properties identified by Area
407 Caerleon Road, Newport, NP19 7HX
409 Caerleon Road, Newport, NP19 7HX
411 Caerleon Road, Newport, NP19 7HX
413 Caerleon Road, Newport, NP19 7HX
419 Caerleon Road, Newport, NP19 7LU
2 2A, Bank Street, Newport, NP19 7HF
St. Julians Lodge, Flat 3, St Julians Lodge, Haisbro Avenue, Newport, NP19 7JS
St. Julians Lodge, Flat 6, St Julians Lodge, Haisbro Avenue, Newport, NP19 7JS
St. Julians Lodge, Flat 7, St Julians Lodge, Haisbro Avenue, Newport, NP19 7JS
St. Julians Lodge, Flat 8, St Julians Lodge, Haisbro Avenue, Newport, NP19 7JS

8.2.14 Twenty-six properties have been identified above. Of these, 16 are adjacent to the existing M4 J25 Caerleon roundabout, where the slip roads are subject to modification.

8.2.15 As mentioned above, these properties are those identified by the current model as meeting some of the required criteria for eligibility under the NIR. Absolute determination or confirmation of whether they will be eligible for noise insulation under the NIR can only be carried out at the detailed design stage. There may also be further properties not identified above which, when assessed based upon the final detailed design, also meet the NIR criteria.

8.3 Quiet Areas and Tranquillity

8.3.4 The Gwent Levels and Caldicot Moor currently have no significant infrastructure crossing them, even though they are just south of the existing M4 in the eastern area. They are also close to the docks at Newport and the northern extent does include some urban areas. Consequently, existing sound levels are relatively low as is characterised by the baseline surveys but only away from Newport and the existing M4. These levels will reduce to the south away from Newport and the various roads in the area.

8.3.5 I also acknowledge that the published Scheme will introduce a new noise source into the area. This has been recognised and the Scheme design is such that the alignment is as far north as possible to reduce effects on the Levels whilst also not causing unacceptable

impacts to larger communities to the north – this is a balance. It is the case that a number of properties will be significantly adversely affected in this area.

8.3.6 Noise from the published Scheme will spread across the Levels to a certain extent but the prevailing south westerly winds will minimise effects when the wind is from that direction. The baseline noise surveys indicate that the area is quiet, though not very quiet; this does not, however, offset the fact that the soundscape will change particularly in the northern part of the Levels. Further south towards the coast, the noise levels from the new section of motorway will reduce and hence effects will be much reduced.

8.3.7 It could be considered that the area south of the alignment of the new section of motorway is an area deemed “tranquil”. Tranquillity, or the definition of what constitutes tranquillity, is not subject to precise rules. However, generally, it is an area likely to be relatively undisturbed by noise from human sources that undermine the intrinsic character of the area. Such areas are likely to be already valued for their tranquillity and are quite likely to be seen as special for other reasons including their landscape.

8.3.8 With regard to Welsh Government guidance on this aspect, it has a page on Tranquillity on its website: http://gov.wales/topics/environmentcountryside/epq/noiseandnuisance/environmentalnoise/tranquillity/?lang=en. This defines tranquillity as an untroubled state, which is peaceful, calm and free from unwanted disturbances. This can refer to a state of mind or a particular environment. The guidance also states that tranquillity can be measured in terms of unwanted intrusions or by a balancing of positive and negative factors.

8.3.9 In order to consider this aspect further, I visited the Scheme alignment and southern areas down to the coast on the day, evening

and night of the 16th and 17th of November 2016, i.e. day, evening and night of the 16th and night/early morning of the 17th. This was my second visit to the area and the alignment, the first being in 2015.

8.3.10 The locations visited were:

a) ST1 - Hawse Lane, Wentlooge (located some 3.3 km to the south east of Castleton at the western end of the Scheme – existing M4 audible most of the time);

b) ST2 - Green Lane, off Lighthouse Road (located some 1.2 km to the north east of St Bride's Wentlooge – M4 occasionally available);

c) ST3 - Newport Wetlands RSPB Reserve (located some 1.4 km to the south west of Nash on the eastern side of the River Usk estuary – M4 not audible – noise from power station dominant night and day);

d) ST4 - Porton Road, Whitson (located some 700 m south east of Whitson towards the Magor end of the Scheme but far south – distant M4 faintly audible at times);

e) ST5 - Caldicot Moor (located some 840 m south east of Undy at the eastern end of the Scheme but to the south – M4 audible);

f) ST6 - Llanfihangel Churchyard, Llanfihangel Rogiet (located between Magor and Rogiet just south of the existing M4 – M4 very audible); and

g) ST7 - Magor March SSSI (located just south of Magor just south of the railway line – M4 audible day and evening; night-time sound dominated by construction activity on the railway).

8.3.11 Whilst it was found that there were some substantially quieter areas, the presence and effects of anthropogenic activity occurred

throughout and across the area over the full 24 hour period. This varied from traffic to industry to farming; the existing M4 was clearly audible at some of the sites visited (as described above) as was heavy industry and local commercial activity. On this basis, I would not say that this area would or should be considered tranquil and hence, on this basis, whilst the Scheme will bring more noise to this area, it will not result in loss of a tranquil area.

8.4 Assessment of Potential Land Take Effects

8.4.4 Land take associated with the new section of motorway would have no direct adverse acoustic impact or effect on the surrounding area. I describe the assessment of noise and/or vibration generated within the affected land, as arising from the construction and subsequent use of the Scheme within the construction and operational noise assessments below.

8.4.5 Land take for the new section of motorway would currently require the demolition of twelve residential properties. The noise model indicates that eleven of these twelve properties would be subject to noise levels exceeding 60 dB $L_{A10,18hr}$ in the opening year 2022 without the Scheme, primarily due to the existing M4. These properties are (it is not known whether these properties are currently occupied): The Conifers; White Cottage; San Remo; The Glen; Quarry Cottage; Myrtle House; Berryhill Cottage; Berryhill Farm (Magor Vicarage); Woodland House; Undy House; and Dunline. Only Barecroft House is predicted to be subject to levels below 60 dB $L_{A10,\ 18hr}$. Since these properties would be taken, the relevant noise increase is somewhat irrelevant; the reason for which I give below.

8.4.6 Where land take would remove residential properties from areas that are currently subject to high noise levels, such as in the immediate vicinity of the existing M4, this may be considered to be an acoustic benefit for the residents notwithstanding any other adverse effects;

assuming that residents would be likely to relocate to a quieter environment. Such effects must be viewed, however, in the context of the non-acoustic impacts and the effects demolition of such properties may have. These effects are identified elsewhere within the ES (see Chapters 8 (Cultural Heritage) and 15 (Community and Private Assets)) and Supplements.

8.4.7 The removal of these 12 properties, with regard to any acoustic screening they might have previously provided to residences beyond, has been taken into account within the noise assessment, i.e. where previously these properties may have provided screening as in barrier effects (noise reductions) to other properties beyond, these properties have been removed from the model to provide noise levels at adjacent properties without these buildings providing any screening.

8.4.8 With regard to noise, there are no significant adverse effects arising from permanent land take associated with the Scheme.

8.5 Assessment of Construction Effects

Construction Noise

8.5.4 For the assessment of construction noise effects, construction works were separated into the following categories: earthworks; roadwork elements; other structures; and the River Usk Crossing (piling & ancillary equipment; main operations). Of these, the earthworks activity has been identified as the noisiest due to the intensity of activity and the quanta of plant required, with driven piling also a noisy source. However, all activities are predicted to be within 7 dB of these most noisy works, which is within the expected variation expected day-to-day across all works. Construction noise levels would also vary significantly over time and from location to location.

8.5.5 With the screening measures (site hoardings etc) in place, the numbers of NVSRs adversely affected by construction noise would be reduced.

8.5.6 Within the expected variation of construction noise predictions, it is appropriate to approximate the distances for daytime works as: major impacts within approximately 18 m of a worksite; moderate impacts within approximately 45 m of a worksite; and minor impacts within approximately 71 m of a worksite. The extent of these areas are shown in Figures 13.11 of the ES Volume 2 [Documents 2.3.2].

8.5.7 Residential NVSRs within around 45 m of any worksite would be likely to experience a moderate or major adverse impact, resulting in effects of moderate or large adverse significance. However, these effects would be temporary, and would occur only during the most intense periods of construction. There are approximately 166 residential properties within 45 m of the construction works which may experience a potentially significant moderate adverse effect from construction noise. Of these, it is estimated that 68 fall within 18 m and may experience a major adverse impact, leading to an effect of moderate or large adverse significance. An estimated 107 properties fall within 45 to 71 m, and would experience a minor impact, leading to an effect of slight adverse significance. The duration of effect would depend on the nature of the works within each area, as identified within the buildability report (Table 7.2 of the ES Addendum Appendix 3.1 Buildability Report Supplement [Document 2.4.4]). These distance bands are summarised in Table 8.2 below.

Table 8.2 Summary of Construction Effects (with mitigation)

Impact	Buffer	Number of residential NVSRs potentially affected	Significance	
Major	18 m	68	Moderate or Large	Significant
Moderate	45 m	98	Moderate	Significant
Minor	71 m	107	Slight	Not significant

8.5.8 Measures implemented through the CEMP would ensure that any evening or night-time works effects would not significantly increase from the effects identified above.

8.5.9 No specific mitigation is proposed or possible to control noise from off-site construction traffic. Construction traffic effects would be of slight adverse significance or less, which I do not consider significant in EIA terms.

Construction Vibration

8.5.10 The results of the assessment of construction vibration are based upon use of:

a) pneumatic hammers to break-out existing road-surfaces;

b) vibratory compaction (steady state);

c) vibratory compaction (start-up/down); and

d) percussive piling; and

e) vibratory piling.

8.5.11 From the assessment criteria above at paragraph 4.8.13, at a PPV level of 0.3 mm/s, vibration might be just perceptible in residential environments. At 1.0 mm/s PPV, it is likely that vibration in residential environments could cause complaint but would be tolerated by most residents if prior warning and explanation has been given.

8.5.12 For the construction activities considered, predicted PPV vibration levels are expected to be less than 1 mm/s at approximately 30 m; and less than 0.3 mm/s beyond around 75 m. On this basis, and with reference to the thresholds adopted for construction vibration impacts, even cosmetic damage is not expected to occur at any

NSR. Nor would vibration generally be perceptible within houses assuming normal, competent ground conditions.

8.5.13 With appropriate notification of residents, scheduling, best practice mitigation and monitoring, I do not believe there would be a significant effect.

Construction Road Traffic Noise

8.5.14 The DMRB (Highways Agency *et al*., 2011. Annex 1, Page A1/3) states that:

'A change in noise level of 1 dB $L_{A10,18h}$ is equivalent to a 25 % increase or a 20 % decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3 dB $L_{A10,18h}$ is equivalent to a 100 % increase or a 50 % decrease in traffic flow.'

8.5.15 Where the additional traffic significantly increases the percentage heavy goods vehicle (HGV) content, noise changes greater than those indicated in the DMRB may occur. The change can be quantified using the procedure in the CRTN.

8.5.16 The traffic requirements for the construction of the Scheme have been assessed. During the most intensive periods of construction, a significant number of HGVs per day would be required. The magnitude of impact for NVSRs near an access or haul route but remote from any construction worksite is estimated to be negligible to minor for the majority of HGV movements during the daytime; with moderate impacts only likely for short durations during the most intense periods of construction.

8.5.17 With regards to residential dwellings, effects would be of neutral or slight significance and would not be significant for properties not already identified as affected by construction noise.

8.5.18 For those links where estimates of daily HGV movements have been provided, the effect of these being added to the existing traffic flows (based on the 2014 baseline flows) have been considered and are summarised in Table 8.3 below.

Table 8.3 Construction Traffic Noise Change

	Base 2014			Base 2014 + Construction Traffic		
	18-hr AAWT (06:00 - 00:00 hr)			18-hr AAWT (06:00 - 00:00 hr)		
Road Section	Flow	% HGV	Speed (km/h)	Hourly HGVs	Combined HGV	Noise Change (dB)
A48 Plant Crossing	18153	4.5	77	22	6.5	0.5
M4 Dock Links	10056	15.1	99	24	18.6	0.6
A48 Fabrication Yard Works Access	18153	4.5	77	22	6.5	0.5
Duffryn Works Access	No data					-
Lighthouse Rd Works Access	1715	15.2	51	24	32.2	3.2
Nash/Meadows Rd Works Access	11311	7.5	58	24	10.9	0.9
Glan Llyn Works Access	9401	13.6	52	24	17.4	0.8
TATA Works Access	9127	13.9	52	24	17.8	0.8
North Row Works Access	No data					-
Barelands Street Works Access	9724	24.1	64	24	27.3	0.6
Newport Rd Plant Crossing	10146	4.4	42	24	8.3	1.3
Newport Rd Temp Bridge	15161	3.2	47	24	5.9	1.0
Magor East Works Access	7659	9.7	105	24	14.5	0.9

8.5.19 From Table 8.3, it can be seen that NVSRs adjacent to eight of the 13 links (although there are no data for two links – see below) considered would experience a noise change of less than 1 dB; two of the 13 links would experience a noise change of between 1 dB and 3 dB. NVSRs for which road traffic on these links are currently the dominant noise source would, therefore, experience an adverse impact of negligible magnitude. One link, Lighthouse Road, is predicted to experience a noise change of just above 3 dB. NVSRs for which road traffic on Lighthouse Road is currently the dominant

noise source would experience an adverse impact of minor magnitude.

8.5.20 For two links: Duffryn Works Access and North Row Works Access, no baseline traffic data have been provided. On evaluation of these two links, I consider that construction traffic noise would not result in significant adverse effects due to the separation from residential areas and existing levels of traffic on these roads.

8.5.21 In summary, for residential receptors, construction traffic would be of slight adverse significance or less, which I do not consider as resulting in a significant adverse effect within the assessment methodology.

Complementary Measures

8.5.22 Construction works associated with the reclassification of the existing M4 include:

a) the works to remove or modify markings, signage or gantries;

b) minor modifications to the alignment of slip-roads, where it involves construction works; and

c) the construction of a proposed 120 m retaining wall between the slip road and main road on the south side of Junction 25.

8.5.23 The majority of these construction works are minor in nature and would be completed without any significant adverse noise effects. The works associated with the construction of the proposed retaining wall around Junction 25, however, have the potential to result in adverse effects on the receptors in close proximity to the works; specifically the residential dwellings on Denbigh Road and Tudor Road nearest the existing M4 slip roads.

8.5.24 These works are likely to be of a lesser magnitude than that predicted for the construction of the new section of motorway. I

consider that, without additional specific mitigation, the four residential properties at the end of Denbigh Road and Tudor Road, nearest the existing M4 slip roads, may experience a minor adverse effect, depending on the duration of the works. This would result in an effect of slight adverse significance.

8.6 Assessment of Operational Effects

8.6.4 Whilst parts of the proposed new section of motorway would lie within areas exposed to existing noise sources, such as areas close to the existing M4 or heavily industrialised areas, much of the route would introduce noise into a relatively quiet rural area. The introduction of a new noise source would inevitably change the noise character of the immediate area. NSRs would experience a quantifiable noise change, which can be used to inform a determination of the overall effect of the Scheme and to ensure that all reasonably practicable measures are implemented to mitigate any adverse effects.

8.6.5 Traffic data have been provided for a range of existing and future scenarios. Further details are provided in the Traffic Proof of Evidence of Mr Bryan Whittaker [WG 1.2.1]. These include traffic data for future scenarios including both the published Scheme and reclassification of the existing M4. Existing road alignments and topography have been obtained from Ordnance Survey (OS) data and the project team.

8.6.6 An operational noise and vibration assessment report is provided in the ES Supplements in Appendix R13.4 [Documents 2.4.4 and 2.4.14] updating the ES. This contains a full description of the prediction methodology, model input and results. I summarise the findings in this section where it is assumed that the additional mitigation has been incorporated, i.e. noise barriers in certain areas.

8.6.7 Noise barriers of 2 m in height have been considered in four areas along the new section of motorway, as discussed previously. The height and locations of these barriers will be subject to further detailed evaluation and confirmation.

8.6.8 Noise contours of predicted daytime noise levels for the Do-Something scenarios for opening and future years with additional mitigation have been provided as revised for the Supplements.

Latest Updates to the Traffic Model – TEMPro and NTEM Dataset (version (V) 7.0)

8.6.9 The National Trip End Model (NTEM) forecasts and the TEMPro (Trip End Model Presentation Program) software are used for transport modelling and planning purposes by the Department for Transport (DfT). Traffic forecasting and modelling is based upon this software and traffic noise assessments are therefore directly affected by any changes in traffic data. On 28th July 2016, a TEMPro V 7.0 was published by the DfT.

8.6.10 The revised TEMPro traffic data have been reviewed to determine the implications of the traffic flow changes on the noise assessment reported in the March 2016 ES and the subsequent ES Supplements. This has confirmed that the correction factors and hourly profile used previously do not change.

8.6.11 The difference in predicted noise levels between the Opening Year Do Minimum scenario (OYDM) and the Opening Year Do Something scenario (OYDS) at a selection of the significant model links demonstrate a maximum increase as a result of the traffic flow changes of +0.5 dB on the existing M4 and a maximum decrease of -0.8 dB on the M48.

8.6.12 For the new section of motorway to the south of Newport, the difference between the two sets of traffic forecasts would result in a

decrease of 0.1 dB to 0.2 dB in the opening year. Therefore, the effects of the TEMPro traffic revisions, as affecting the Scheme, are minimal and overall the Scheme, including the complementary measures on the existing M4, would still result in a benefit to more people in terms of noise reduction than would result in a disbenefit to people due to noise increases. Hence, the changes due to TEMPro traffic data will not affect the overall conclusions set out in the March 2016 ES or the subsequent Supplements.

8.6.13 Based upon the conclusions from the above, and the overall uncertainty within noise predictions and assessment, the traffic noise model has not been rerun as I consider that the previous results are still representative and robust.

Do-Minimum Scenario and Do-Something Scenario with Mitigation in the Opening Year (Short-Term)

8.6.14 Out of the 20,708 residential receptors included in the noise model, during the daytime period, a noise increase of at least 1 dB (of greater than negligible magnitude) is likely to occur at 2,004 receptors, with a maximum noise increase of up to 17 dB at the worst affected property. A noise decrease of at least 1 dB is likely to occur at 12,504 receptors, with a maximum noise decrease of 8 dB. There is, therefore, no change, or a negligible change, likely to occur at 6,200 receptors. However, there is a noise benefit to 12,504 receptors relative to a noise disbenefit to 2,004 receptors which indicates the benefits of the Scheme in the opening year based upon the required threshold of 1 dB for a change to be significant in the short-term; the full figures are summarised in

8.6.15 Table 8.4 below.

Table 8.4 Residential Property Count – With Committed and Additional Mitigation

Short term with	Maximum	Major	Moderate	Minor	Negligible	No	SubTotal

scheme	change					Change	
2022 Do Something <- 2022 Do Minimum	**/ dB**	**5+ dB**	**3-4.9 dB**	**1-2.9**	**0.1-0.9 dB**	**+-0.1 dB**	
Decrease	-8	1102	1786	9616	3661	-	16165
Increase	17	420	558	1026	1760	-	3764
Neutral	-	-	-	-	-	779	779
						Total:	20708

8.6.16 Out of the 68 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 1 dB is likely to occur at five receptors (these being: Church of St Michael and All Saints, Caldicot Road, Rogiet; Duffryn High School, Lighthouse Road, Duffryn; Lisweey High School, Nash Road, Newport; Premier Inn, Newport Road, Castleton, Newport; and Appletree Day Nursery, North Row, Magor), with a maximum noise increase of up to 3 dB. A noise decrease of at least 1 dB is likely to occur at 47 receptors, with a maximum noise decrease of up to 7 dB. No significant change is likely to occur at 16 receptors.

8.6.17 Based on the predicted noise change, I consider that the magnitude of impact for residential and non-residential receptors ranges between major beneficial and major adverse in the short-term. With regard to the assessment of significance, the result is an effect ranging from moderate or large beneficial to moderate or large adverse. However it is clear from

8.6.18 Table 8.4 and paragraph 8.6.14 that significantly more properties benefit from a noise decrease than are subject to a noise increase.

Do-Minimum Scenario in the Opening Year and Do-Something Scenario in the Future Assessment Year with Mitigation (Long Term)

8.6.19 Out of the 20,708 residential receptors included in the noise model, during the daytime period, a noise increase of at least 3 dB is likely

to occur at 1,178 receptors, with a maximum noise increase of 18 dB at the worst affected property. A noise decrease of at least 3 dB is likely to occur at 2,165 receptors, with a maximum noise decrease of up to 8 dB. There is therefore no change, or negligible change, likely to occur at 17,365 receptors. However, there is a noise benefit to 2,165 receptors relative to a noise disbenefit to 1,178 receptors which indicates the benefits of the Scheme in the future design year based upon the required threshold of 3 dB for a change to be significant in the long term.

8.6.20 If one considers the benefits/disbenefits ignoring the 3 dB threshold required to be adopted in the long term, 14,078 receptors benefit from a noise decrease relative to 5,497 receptors that suffer a noise increase; the full figures are summarised in Table 8.5 below.

Table 8.5 Residential Property Count - With Committed and Additional Mitigation

Long Term with Scheme	Maximum change	Major	Moderate	Minor	Negligible	No Change	SubTotal
2037 Do Something <- 2022 Do Minimum	**/ dB**	**10+ dB**	**5-9.9 dB**	**3-4.9 dB**	**0.1-2.9 dB**	**+-0.1 dB**	
Benefit	-8	0	820	1345	12300	-	14465
Disbenefit	18	28	492	658	4131	-	5309
Neutral	-	-	-	-	-	934	934
						Total:	20708

8.6.21 Whilst the figures in Table 8.5 indicate that there are some properties that will be subject to major disbenefits with noise levels increases in excess of 10 dB(A), the numbers that benefit from noise level decreases in the range 0.1 to 9.9 dB are clearly very much higher than the numbers subject to noise increases within the same range. Therefore, qualitatively, whilst it is acknowledged that there are some very significant adverse effects to 28 properties, there are many more that do gain noise decreases which will be significant and noticeable.

8.6.22 Out of the 68 non-residential sensitive receptors (buildings - e.g. religious buildings, educational facilities, medical facilities, community facilities, etc.) identified and included in the noise model, a noise increase of at least 3 dB is likely to occur at 2 receptors (these being: Duffryn High School, Lighthouse Road, Duffryn; and Lisweey High School, Nash Road, Newport), with a maximum noise increase of up to 4 dB. A noise decrease of at least 3 dB is likely to occur at 7 receptors, with a maximum noise decrease of up to 6 dB. No significant change is likely to occur at 59 receptors.

8.6.23 Based on the predicted noise change, I consider the magnitude of impact to range between moderate beneficial and major adverse in the long term. With regard to the assessment of significance, this results in an effect ranging from moderate beneficial to moderate or large adverse. However, it is clear from Table 8.5 that significantly more properties benefit from a noise decrease than are subject to a noise increase.

Do-Minimum Scenario in the Future Year and Do-Something Scenario in the Future Assessment Year with Mitigation (Long Term)

8.6.24 While the comparison of future year impacts without and with the Scheme does not form part of the DMRB assessment, it provides a useful measure of the effect of the Scheme in the future year.

8.6.25 Out of the 20,708 residential receptors included in the noise model, during the daytime period, a noise increase of at least 3 dB is likely to occur at 975 receptors, with a maximum noise increase of 18 dB. A noise decrease of at least 3 dB is likely to occur at 2,323 receptors, with a maximum noise decrease of up to 8 dB. There is therefore no change, or negligible change, likely to occur at 17,410 receptors. The full figures are summarised in Table 8.6 below.

Table 8.6 Residential Property Count - With Committed and Additional Mitigation

Long Term with Scheme	Maximum change	Major	Moderate	Minor	Negligible	No Change	SubTotal
2037 Do Something <- 2022 Do Minimum	**/ dB**	**10+ dB**	**5-9.9 dB**	**3-4.9 dB**	**0.1-2.9 dB**	**+-0.1 dB**	
Benefit	-8	0	924	1399	13729	-	16052
Disbenefit	18	26	385	564	2736	-	3711
Neutral	-	-	-	-	-	945	945
						Total:	20708

Summary of Operational Effects

8.6.26 In summary, with additional mitigation: in the short-term, 978 receptors are subject to a significant adverse effect; and 2,888 are subject to a significant beneficial effect (Table 8.4). In the long term, 520 receptors are subject to a significant adverse effect; and 820 are subject to a significant benefit (Table 8.5).

8.6.27 Initial calculations indicate that in the long term, the noise barriers would provide a significant benefit to 87 properties, decreasing noise sufficiently to change the impact category for these properties either: from major adverse to moderate adverse; from moderate adverse to minor adverse; or from minor adverse to negligible. There would be 58 fewer properties within the long term adverse category with the barriers in place

8.6.28 When considered as a whole, the Scheme has a net benefit, with an average noise level difference of -1.3 dB per property across the 20,708 properties assessed for the opening year, when comparing the Do-Minimum scenario against the Do-Something scenario. This equates to approximately a 63,000 ‘dB·people’ improvement due to the Scheme. This is calculated as follows:

1.32 (average reduction in dB across the number of properties affected (as rounded)) x 2.3 (average number of residents per property) x 20,708 (number of properties) = 63,000 (rounded)

8.6.29 Within the ES, Supplements and technical appendices, a greater number of scenarios have been considered. The different scenarios assessed therein are as follows but I consider those most applicable in terms of the comparisons and effects are described above:

2014 – Without Scheme.
2022 – Opening year 2022 Do Minimum (without Scheme).
2037 – Future year 2037 Do Minimum (without Scheme).
2022 – Opening year 2022 Do something (with Scheme, without designed or embedded mitigation).
2037 – Future year 2037 Do Something (with Scheme, without designed or embedded mitigation).
2022 – Opening year 2022 Do Something (with Scheme and designed/embedded mitigation).
2037FYDSCM – Future year 2037 Do Something (with Scheme and designed/embedded mitigation.

Operational Effects Associated with the Complementary Measures

8.6.30 The effects of the reclassification (downgrading) of the existing M4 with regards to noise are associated primarily with the change in traffic flow (decreases) on the existing M4. As this change is intrinsic within the traffic assessment for the Scheme, this is included within the assessment set out above.

8.6.31 The key elements of the reclassification that have noise implications are as follows:

a) improvements to safety, access arrangements and the ability to manage traffic by reclassifying the existing M4 between Magor and Castleton as a trunk road;

b) relief to Junction 23A of the existing M4 and the local road network with a new M4/M48/B4245 connection; and

c) providing cycle and walking friendly infrastructure.

8.6.32 None of the other elements of the reclassification would have a noise effect beyond those previously identified above for the proposed new section of motorway.

9 Summary of Effects

9.2.4 The planning system promotes sustainable economic growth, whilst ensuring that quality of life is not unreasonably affected. I consider that the Scheme appropriately reflects these aims with regard to the noise and vibration effects associated with the construction and subsequent operation of the Scheme.

9.2.5 During the construction phase, standard best construction practice would be adopted. In addition, where necessary, additional mitigation would be put in place, including temporary hoardings or noise barriers around worksites or particularly noisy activity and sound insulation provided where appropriate.

9.2.6 Specific monitoring of noise and vibration would be undertaken at residential premises at key locations during construction to check compliance with noise and vibration limits.

9.2.7 A Construction Environmental Management Plan (CEMP) would set out the controls for noise and vibration levels during construction. This would be based upon the initial draft but then finalised by the contractor prior to construction commencing. This would also be subject to agreement with Newport City Council and Monmouthshire County Council as appropriate at the time.

9.2.8 With the generic mitigation measures discussed and temporary noise barriers where appropriate, I estimate that 213 residential NVSRs might experience a moderate or major adverse impact, leading to effects of moderate or large significance. An estimated 140 properties fall within 45 to 71 m of a construction site and would experience a minor impact, leading to a slight adverse significance of effect.

9.2.9 During operation, both beneficial and adverse noise effects are predicted to occur. The proposed new section of motorway would

reduce traffic flow and hence congestion on the existing M4 potentially resulting in higher road-speeds and increased vehicle noise (but lower noise levels due to lower flow). Measures have been incorporated into the design of the Scheme to reduce noise for receptors in proximity to the proposed new section of motorway, including the provision of a thin road surface system which is relatively low noise and screening in the form of planting, bunding and retaining walls. Noise barriers of 2 m in height are proposed at four areas along the new section of motorway, although these are subject to detailed design.

9.2.10 Based on the predicted noise change, I consider the level of significance to range between major beneficial and major adverse in the short-term. In the long term, the range decreases to levels of significance between moderate beneficial and major adverse. Considering the difference between the situations in 2022 without the Scheme compared to the same year with the Scheme, with noise barriers), 978 receptors would experience a significant adverse effect and 2,888, a significant beneficial effect.

9.2.11 When considered as a whole, the Scheme has a net benefit, with an average noise level difference of -1.3 dB per property across the 20,708 properties assessed for the opening year, when comparing the Do-Minimum scenario against the Do-Something scenario. This equates to approximately a 63,000 ‘dB·people’ improvement as a result of the Scheme.

9.2.12 The Scheme would result in a positive improvement in the noise environment surrounding the existing M4 though Newport. For the new section of motorway, the published Scheme has been designed to minimise noise effects whilst not resulting in other unacceptable environmental effects. However, it is accepted that, for some areas, significant adverse effects on local amenity will occur and are

unavoidable. On balance, however, my assessment indicates that the Scheme results in a considerably greater benefit than disbenefit.

10 Responses to Objections

10.2 Introduction

10.2.4 The assessments provided within the ES and the Supplements [Documents 2.3.2, 2.4.4 and 2.4.14] and this Proof of Evidence identify the noise and vibration effects of the published Scheme. Whilst there are both adverse and beneficial noise effects, the overall balance of the effect is beneficial, i.e. more people benefit from a noise decrease than suffer a noise increase. Notwithstanding this, a number of objections have been received and those that I am aware of and that relate to noise or vibration are considered below.

10.2.5 From a review of the objections received and reviewed at the time of writing this Proof of Evidence, the topics appeared to fall into the following main areas:

a) general effects on land or property including loss of enjoyment of the property;
b) monitoring pre (baseline), during or post completion of the published Scheme;
c) noise barriers and mitigation; and
d) tranquillity.

10.2.6 I address these topics below in general terms; some of the objections include a number of the above topics so are addressed under the appropriate topic sections.

10.3 Responses

General Effects on Land or Property Including Loss of Enjoyment of the Property

Objections 0015, 0022, 0078, 0207, 0213, 0214, 0216, 0225, 0227, 0230, 0233, 0238, 0241, 0272, 0276, 0299, 0337 and Gwent Wildlife Trust

10.3.4 These objections relate to loss of enjoyment of the property or adverse effects upon the land or property. The adverse and

beneficial noise effects of the published Scheme have been described in the ES and the ES Supplements and in this Proof of Evidence. The assessments, in terms of with and without Scheme noise levels, at most properties affected have been reported and can be identified for individual properties. In any Scheme like this, there will be those that will be subject to increased noise (adverse effects) and those that will be subject to decreased noise (beneficial effects) and the assessment identifies those properties. Whilst it is unfortunate for those receiving adverse effects, compensation will be claimable though the appropriate process. For some properties subject to very high noise levels and satisfaction of other criteria, secondary noise insulation will be offered.

10.3.5 Overall the Scheme is designed to reduce congestion through Newport and the published Scheme will do this by removing traffic from the reclassified M4. The effect of this will be, in general terms, to reduce traffic noise levels through the urbanised area of Newport – this is clearly beneficial to many people. The consequences of this are increased noise levels to those properties affected by the Scheme. However, form the assessment, there are clearly more people benefitting by reduced noise levels than will be subject to increased noise levels even with optimised mitigation.

Monitoring Pre (baseline), During or Post Completion of the Published Scheme

Objections 0022, 0227 and 0272

10.3.6 As reported in the ES (Volume 3: Appendix 13.2, Baseline Sound Monitoring, and as referred to in Section 5 of this Proof of Evidence, extensive baseline measurements were carried out along the proposed alignment of the Scheme at the nearest NSRs. These locations were agreed with Newport City Council. These measurements were used to inform the construction and operational noise assessment for the published Scheme as reported in the ES,

Supplements and this Proof of Evidence. There is no reason to consider that any of this monitoring was flawed.

10.3.7 With regard to monitoring during construction, Environmental Commitment 80, as relating to the Pre- CEMP states: “Noise monitoring (and vibration monitoring where appropriate) will be carried out as appropriate at or in the vicinity of potentially significantly affected residential properties during the construction phase”. The locations and durations and reporting of the monitoring results will be agreed with Newport City Council prior to construction commencing.

10.3.8 With regard to post completion monitoring, to determine the operational effects of the Scheme, this would be carried out on the instruction of Welsh Government or Newport City Council as required.

Noise Barriers and Mitigation

Objections 0022, 0272 and 0276

10.3.9 As described in the ES and Supplements, and this Proof of Evidence, as appropriate, significant consideration has been given to minimising the noise and vibration effects of the Scheme. These considerations have taken into account the numbers of properties affected, their locations, potential mitigation options and their likely effectiveness. With regard to noise barriers, other matters also have to be considered given that the published Scheme is mostly on embankment and the visual effects of the Scheme are also of great importance, i.e. noise barrier heights need to be optimized / minimised to provide the greatest level of noise attenuation without their height causing adverse landscape and visual effects.

10.3.10 On this basis, Noise measures incorporated into the design of the Scheme (embedded mitigation) include the provision of a thin road surface system, which is relatively low noise and which would

reduce noise levels. In addition, a solid concrete safety barrier 0.9 m in high, along the central reservation of the new section of motorway alignment may provide some screening of noise generated at the tyre-road interface.

10.3.11 Mitigation measures, in addition to the embedded measures, comprise noise barriers of 2 m height proposed in four areas along the new section of motorway. This maximum height has been adopted to minimise the other non-acoustic effects of the barriers, i.e. adverse landscape and visual effects.

Tranquillity

Objection 0272

10.3.12 I deal with Quiet Areas and Tranquillity in Section 8.2 of this Proof of Evidence. From measurements and personal site visits, whilst I was found that there were some substantially quieter areas to the south of the published Scheme, the presence and effects of anthropogenic activity occurred throughout and across the area over the full 24 hour period. This varied from traffic to industry to farming; the existing M4 is clearly audible in some areas as was heavy industry and local commercial activity. On this basis, I would not say that this area would or should be considered tranquil and hence, on this basis, whilst the Scheme will bring more noise to this area, it will not result in loss of an area of tranquillity.

11 Summary and Conclusions

11.2.4 My evidence demonstrates that adverse noise effects will arise from the construction phase of the published Scheme but that these can be mitigated as far as reasonably practicable mostly to an acceptable level.

11.2.5 With regard to the operation of the Scheme, there is a clear benefit to the existing highly populated area of Newport which is currently subject to high levels of noise from the current M4. However, this benefit is offset by the adverse effects associated with the new section of motorway although these adverse effects relate to a limited number of receptors due to the lower population density and separation of the Scheme from receptors along the new alignment. Mitigation measures will be provided and these have been developed to provide the most appropriate levels of mitigation that will not result in other adverse effects such as on landscape and visual aspects of the Scheme.

11.2.6 On balance, I have demonstrated that there is a considerable net benefit to the Scheme in that many more receptors (occupants of houses) will benefit by noise reductions than by noise increases. I do, however, acknowledge that a number of properties will be subject to significant adverse noise effects but these negative effects are outweighed, in my view, by the positive effects provided by the published Scheme.

11.2.7 My Proof of Evidence includes all facts which I regard as being relevant to the opinions which I have expressed and the Inquiry's attention has been drawn to any matter which would affect the validity of that opinion. I believe the facts which I have stated in this Proof of Evidence are true and that the opinions expressed are correct. I understand my duty to the Inquiry to assist it with matters within my expertise and I believe that I have complied with that duty.

11.2.8 This evidence represents my true and professional opinion and is given in accordance with the Code of Professional Conduct of the Institute of Acoustics and the Association of Noise Consultants.