A38 Derby Junctions

TR010022

Volume 6

6.1 Environmental Statement

Chapter 9 – Noise and Vibration

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

April 2019

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A38 Derby Junctions Development Consent Order 202[ ]

6.1 Environmental Statement Chapter 9 Noise and Vibration

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Table of Contents

List of Tables

List of Figures [TR010022/APP/6.2]

List of Appendices [TR010022/APP/6.3]

9. Noise and vibration

9.1. Introduction and competent expert evidence

9.1.1. This chapter assesses the potential noise and vibration impacts associated with the construction and operation of the Scheme, following the methodology set out in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 HD 213/11 – Revision 1 (Highways Agency, 2011) and associated Interim Advice Note (IAN) 185-15 (Highways England, 2015).

9.1.2. This chapter details the methodology followed for the assessment, summarises the regulatory and policy framework related to noise and vibration, and describes the existing environment in the area surrounding the Scheme. Following this, the design and mitigation measures proposed to manage and minimise potential noise and vibration impacts are specified, after which residual effects of the Scheme are presented. Details of any assumptions and limitations made during the assessment are also provided.

9.1.3. This noise and vibration assessment is supported by Appendices 9.1 to 9.4 [**TR010022/APP/6.3**] which provide the following:

- Appendix 9.1: Noise and vibration terminology.
- Appendix 9.2: Construction phase noise predictions.
- Appendix 9.3: Noise modelling details.
- Appendix 9.4: Noise monitoring.

9.1.4. All figures cited within this chapter are included within Environmental Statement (ES) Volume 2 [**TR010022/APP/6.2**].

9.1.5. This chapter of the ES has been prepared by competent experts with relevant and appropriate experience. The technical lead for the noise and vibration assessment has 22 years of relevant experience and has professional qualifications as follows: Member of the Institute of Acoustics (MIOA) and Chartered Scientist (CSci). Further details are provided in Appendix 1.1 [**TR010022/APP/6.3**].

9.2. Legislative and policy framework

9.2.1. As discussed in Chapter 1: Introduction, the primary basis for deciding whether or not to grant a Development Consent Order (DCO) is the National Policy Statement for National Networks (NPSNN) (Department for Transport (DfT), 2014) which, at Sections 4 and 5, sets out policies to guide how DCO applications will be decided and how the impacts of national networks infrastructure should be considered. Table 9.1 identifies the NPSNN policies relevant to the noise and vibration assessment and where in this ES chapter information is provided to address these policy requirements.

Table 9.1: Relevant NPSNN policies for the noise and vibration assessment

Relevant NPSNN para. Ref.	Requirement of the NPSNN	Location where information addresses policy requirements
5.189	Where a development is subject to EIA and significant noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment, which should form part of the environment statement: • A description of the noise sources including likely usage in terms of number of movements, fleet mix and diurnal pattern. For any associated fixed structures, such as ventilation fans for tunnels, information about the noise sources including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise. • Identification of noise sensitive premises and noise sensitive areas that may be affected. • The characteristics of the existing noise environment. • A prediction on how the noise environment will change with the proposed development. • In the shorter term such as during the construction period. • In the longer term during the operating life of the infrastructure. • At particular times of the day, evening and night as appropriate. • An assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas. • Measures to be employed in mitigating the effects of noise. Applicants should consider using best available techniques to reduce noise impacts. • The nature and extent of the noise assessment should be proportionate to the likely noise impact.	Existing noise sources are discussed in Section 9.6. Noise sensitive receptors are detailed in Section 9.5. Predictions of how the noise environment would change during Scheme construction and operation are provided in Section 9.10. Mitigation measures are identified in Section 9.9.
5.190	The potential noise impact elsewhere that is directly associated with the development, such as changes in road and rail traffic movements elsewhere on the national networks, should be considered as appropriate.	The noise impacts of the Scheme, including on the wider road network, are discussed in Section 9.10.
5.191	Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. The prediction of road traffic noise should be based on the method described in Calculation of Road Traffic Noise. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.	The noise impact assessment methodology is discussed in Section 9.3, including details of Calculation of Road Traffic Noise (CRTN) and relevant British Standards.

Relevant NPSNN para. Ref.	Requirement of the NPSNN	Location where information addresses policy requirements
5.192	The applicant should consult Natural England with regard to assessment of noise on designated nature conservation sites, protected landscapes, protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account.	The assessment of noise on biodiversity is discussed in Chapter 8: Biodiversity which provides details of consultation undertaken with Natural England.
5.195	The Secretary of State should not grant development consent unless satisfied that the proposals will meet, the following aims, within the context of Government policy on sustainable development: • Avoid significant adverse impacts on health and quality of life from noise as a result of the new development • Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development. • Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.	A discussion of how the Scheme complies with these three policy aims is provided in Section 9.10.
5.199	For most national network projects, the relevant Noise Insulation Regulations will apply. These place a duty on and provide powers to the relevant authority to offer noise mitigation through improved sound insulation to dwellings, with associated ventilation to deal with both construction and operational noise. An indication of the likely eligibility for such compensation should be included in the assessment. In extreme cases, the applicant may consider it appropriate to provide noise mitigation through the compulsory acquisition of affected properties in order to gain consent for what might otherwise be unacceptable development. Where mitigation is proposed to be dealt with through compulsory acquisition, such properties would have to be included within the development consent order land in relation to which compulsory acquisition powers are being sought.	The results of an initial assessment under the Noise Insulation Regulations are reported in Section 9.10.
5.200	Applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process.	A discussion of the Scheme impacts on noise important areas is provided in Section 9.10.

9.2.2. Other relevant policies have been considered as part of the noise and vibration assessment where these have informed the identification of receptors and resources and their sensitivity; the assessment methodology; the potential for significant environmental effects; and required mitigation. These policies include those listed below and discussed in the sections thereafter:

- National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2019): paragraph 180 relating to pollution.
- Noise Policy Statement for England Explanatory Note (NPSE) (Defra, 2010).
- Planning Practice Guidance on Noise (PPG-N) (Department for Communities and Local Government (DCLG), 2014).
- City of Derby Local Plan Review (2006) (Derby City Council (DCiC), 2006).
- Derby City Local Plan – Part 1 Core Strategy (2017) (DCiC, 2017).
- Derby Local Transport Plan LTP3 (2011 - 2026) (DCiC, 2011).
- Erewash Core Strategy (March 2014) (Erewash Borough Council (EBC), 2014), noting that there are some policies saved from the previous 2005 Local Plan (EBC, 2014).
- Derbyshire Local Transport Plan (2011 - 2026) (Derbyshire Country Council (DCC), 2011).

9.2.3. The NPPF (MHCLG, 2019) closely aligns with the aims set out in paragraph 5.195 of the NPSNN (DfT, 2014) to avoid significant adverse impacts and to mitigate and reduce other adverse impacts. It also states at paragraph 180 that planning decisions should aim to '*identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*'.

9.2.4. In accordance with the NPPF, the NPSNN policies are the primary source of policy guidance regarding this assessment.

9.2.5. The Explanatory Note within the NPSE (Defra, 2010) introduces the following concepts to aid in the establishment of significant noise effects:

- **No Observed Effect Level (NOEL)**: the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established.
- **Lowest Observable Adverse Effect Level (LOAEL)**: the level above which adverse effects on health and quality of life can be detected.
- **Significant Observed Adverse Effect Level (SOAEL)**: the level above which significant adverse effects on health and quality of life occur.

9.2.6. The NPSE recognises that 'it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations'. The levels are likely to be different for different noise sources, for different receptors and at different times of the day. The assessment methodology presented in Section 9.3 outlines the LOAEL and SOAEL used herein for each potential impact. The setting of these levels has been informed by the additional guidance in the web-based PPG-N (DCLG, 2014) on the concepts of NOEL, LOAEL and SOAEL.

9.2.7. The City of Derby Local Plan Review 2006 (DCiC, 2006) contains the following policy on pollution (including noise) which is relevant to this assessment:

- Policy E12 Pollution: 'Planning permission will not be granted for development which would generate pollutants that would be unacceptably detrimental to the health and amenity of users of the development, users of adjoining land or the environment; or where the level of existing pollutants would be unacceptably detrimental to the health and amenity of users of the proposed development.'

9.2.8. Derby City Local Plan – Part 1 Core Strategy 2017 (DCiC, 2017) does not contain any additional policies relevant to this assessment.

9.2.9. Goal 5 of the Derby Local Transport Plan LTP3 (2011 - 2026) (DCiC, 2011) is to 'Improve the quality of life for all people living, working in or visiting Derby by promoting investment in transport that enhances the urban environment and sense of place'. Noise is identified as one of the factors which influence quality of life. The Derby Local Transport Plan LTP3 (2011 - 2026) identifies a number of specific transport challenges facing Derby, including Challenge 4 to 'Minimise the negative effects of travel and existing and new transport infrastructure on local communities, air quality and the wider environment'.

9.2.10. Erewash Core Strategy (adopted March 2014) (EBC, 2014) sets out the strategy for development across the Borough over the period 2011 to 2028. It forms part of the development plan for the Borough, alongside the Erewash Local Plan Saved Policies 2005 (amended 2014), until any such policies are superseded. Policy 14: Managing Travel Demand is the only policy relating to noise and vibration within the Core Strategy relevant to this assessment. Noise and vibration is not explicitly mentioned within the policy, however, the reduction of noise and vibration in the area is used as justification for the policy. The justification states '*A combination of these factors is aimed at achieving benefits in terms of reduced car use and associated savings in carbon emissions, noise and pollution*.' No policies relevant to the Scheme and noise and vibration have been identified in the Erewash Local Plan Saved Policies 2005 (amended 2014).

9.2.11. Derbyshire Local Transport Plan (2011 - 2026) (DCC, 2011) states that 'the preferred strategy is to put emphasis on supporting a resilient local economy, contributing to better safety, security and health, and improving quality of life and promoting a healthy natural environment. The preferred strategy would also aim to achieve longer term benefits for climate change, and measures to help people under the equality of opportunity goal.' Minimising noise and vibration impacts was one of the objectives against which the options and measures in the strategy were assessed.

9.3. Assessment methodology

Baseline conditions and sensitive receptors

9.3.1. Baseline conditions in the vicinity of the Scheme are detailed in Section 9.7, which provides details of sensitive receptors in the vicinity of the Scheme and noise survey results. Sensitive receptors are illustrated in Figures 9.1a and 9.1b [**TR010022/APP/6.2**]. The vast majority of potentially sensitive receptors in the vicinity of the Scheme are residential properties. Non-residential potentially sensitive receptors includes: educational buildings, medical buildings, community

facilities (such as places of worship), designated sites (such as Sites of Special Scientific Interest (SSSI)), scheduled monuments and public footpaths (refer to Figures 9.1a and 9.1b [**TR010022/APP/6.2**]).

Construction noise

Construction noise assessment methodology

9.3.2. A quantitative assessment of Scheme construction noise impacts has been undertaken. Estimates of monthly average construction noise levels have been made for a selection of 35 of the closest identified potentially sensitive receptors to the Scheme construction works (refer to Figures 9.1a and 9.1b [**TR010022/APP/6.2**]). These selected receptors are representative of neighbouring properties in their vicinity. By choosing a selection of the closest identified potentially sensitive receptors, the reported noise impacts are, therefore, typical of the worst affected receptors and all potentially significant effects have thus been identified. At receptors further away from the construction works, the associated noise impacts would be reduced.

9.3.3. Construction noise levels have been estimated in accordance with the methodology in BS 5228: 2009+A1: 2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' (BSI, 2014). As a construction contractor has not yet been appointed to construct the Scheme, precise information on the construction works are not available. However, Highways England's appointed buildability advisors have provided reasonable assumptions regarding the construction works, plant requirements and construction traffic. Therefore, the estimated construction noise levels reported herein are based on information provided relating to the number and type of plant likely to be required for each construction activity, typical 'on' times for each item of plant, the likely location and extent of each activity, working times and which months the activity is likely to occur in. The monthly predictions are based on the likely area covered by each activity in each month. All activities programmed to occur in an individual month are assumed to occur at the same time. Further details regarding construction predictions are provided in Appendix 9.2 [**TR010022/APP/6.3**].

9.3.4. BS 5228 contains a number of example methodologies for identifying significant construction noise effects based on fixed thresholds or noise level changes. For the purposes of this assessment, the 'ABC' method has been adopted. This approach is based on setting the threshold for the onset of potentially significant adverse effects (i.e. the SOAEL, as defined in Section 9.2) depending on the existing ambient noise level. Receptors with low existing ambient noise levels (Category A) have a lower threshold than those with high existing ambient noise levels (Category C). Higher thresholds are set for normal daytime construction working hours, compared to the more sensitive evening, weekend and night-time periods. As a conservative approach, the threshold for the onset of any adverse effect (i.e. the LOAEL, as defined in Section 9.2) is set at a construction noise level equal to the existing ambient noise level. Construction noise levels between the LOAEL and the SOAEL have the potential to result in adverse noise effects, but would not normally be classed as significant adverse effects. However, noise mitigation measures are still considered and applied in such locations to seek to keep all noise effects to a minimum. Table 9.2, which is adapted from Table E.1 in BS 5228, sets out the construction noise SOAEL and LOAEL used for this assessment.

Table 9.2: Construction noise SOAEL and LOAEL for all receptors

Time of day	SOAEL $L_{Aeq,T}$ dB (façade)			LOAEL $L_{Aeq,T}$ dB (façade)
	A[1]	B[2]	C[3]	
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75	Existing ambient
Evenings (19:00 – 23:00 weekdays) and Weekends (13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays)	55	60	65	Existing ambient
Night-time (23:00 – 07:00)	45	50	55	Existing ambient

[1] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[2] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as the category A values.

[3] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than the category A values.

NOTE: if the ambient noise level exceeds the Category C threshold values then the SOAEL and LOAEL are defined as equal to the existing ambient.

9.3.5. To determine the SOAEL and LOAEL, ambient noise levels at the relevant façade of each of the selected receptors have been predicted based on the 2015 baseline traffic data (refer to the Transport Assessment Report [**TR010022/APP/7.3**]). The predictions assume that the planned resurfacing of the A38 with low noise surfacing will have taken place before the Scheme opening year in 2024 (refer to Section 9.7). As the 2015 baseline traffic flows are generally lower than those during 2024 (without the Scheme) and the low noise surfacing reduces traffic noise levels, this approach generates slightly lower assessment criteria. This approach is, therefore, considered to be conservative.

9.3.6. Construction traffic noise levels within the extents of the operational traffic noise study area (refer to Section 9.6) have been estimated by adapting the traffic noise model developed for the Scheme operational traffic noise assessment.

9.3.7. Construction traffic noise impacts along existing roads beyond the extents of the operational traffic noise study area have been estimated based on the Calculation of Road Traffic Noise CRTN methodology (DoE, 1988) Basic Noise Level (BNL) at a reference distance of 10m from the nearside carriageway, both with and without the Scheme construction traffic.

9.3.8. The construction traffic noise assessment is based on traffic data for the year 2024, with construction traffic scenarios being compared to the corresponding baseline scenario.

9.3.9. As detailed in Chapter 5: Air Quality, DCiC's is planning to install a series of traffic management measures to manage the flow of traffic in and around Stafford Street, complemented by wider network management (includes junction improvements to the Ashbourne Road/Uttoxeter Old Road junction, Uttoxeter New Road/Stafford Street junction, and Ford Street/Friar Gate junction). The purpose of these measures is to restrict traffic flows along Stafford Street and thus improve local air quality. DCiC plans to have these measures in place in mid-2019, and thus well in advance of Scheme construction (Scheme preliminary work starting late 2020, with the main works starting in early 2012). DCiC has provided information regarding these traffic management measures which have

been incorporated into the Scheme's traffic model for the construction phase assessment (given that such measures would be operational at the time of Scheme construction).

9.3.10. In line with the details as present in Chapter 2: The Scheme Section 2.6, there would be eight main scenarios for construction phase traffic management (refer to Illustration 2.1 in Section 2.6). Following a review of the characteristics of these various traffic management phases, the three construction scenarios that have the potential to result in the largest traffic noise impacts were identified as being scenarios 0, 2 and 4. These were chosen to represent the likely worst case traffic noise impacts during Scheme construction in terms of either high volumes of construction traffic on the network, traffic re-routing due to the restriction of some movements at the junctions, and the mainline traffic using the new slip roads at Markeaton junction and Little Eaton junction thereby bringing mainline traffic closer to nearby receptors. Details regarding these construction traffic management phases are provided below:

1. **Scenario 0:** this traffic management scenario is representative of when Phase 1 construction works are underway at all three junctions. Traffic would continue to use the existing road layout at all three junctions. This traffic management scenario includes the period of maximum import of fill to construct Little Eaton junction.

2. **Scenario 2:** this traffic management scenario is representative of when Phase 1 works are underway at Kingsway junction, when Phase 2 works are underway at Markeaton junction and when Phase 2 works are underway at Little Eaton junction. The existing road layout would still be in use at Kingsway junction, but traffic management would be in place at Markeaton junction and Little Eaton junction. The traffic management at Markeaton junction would include temporary junctions controlled by traffic signals and at Little Eaton junction, measures would include temporary traffic signals with some traffic being diverted onto completed sections of the new A38 alignment – this includes southbound mainline traffic at Markeaton junction using the new southbound merge and diverge slip roads, and southbound mainline traffic at Little Eaton junction using the new southbound merge and diverge slip roads.

3. **Scenario 4:** this traffic management scenario is representative of when Phase 3 works would be underway at Kingsway junction, with Phase 3 works being undertaken at Markeaton junction and Phase 4 works at Little Eaton junction. The final Scheme road layout would be in use at Kingsway junction (with some localised traffic management to complete off-line works), whilst traffic management measures would be in operation at Markeaton junction and Little Eaton junction. The traffic management measures at Markeaton junction would include temporary diversions and use of some completed Scheme sections, whilst at Little Eaton junction there would be traffic diversions for some turning movements. During this phase, southbound mainline traffic at Markeaton junction would use the new southbound merge and diverge slip roads and the new northbound on slip, whilst at Little Eaton junction northbound and southbound mainline traffic would be using the new merge and diverge slip roads.

9.3.11. These traffic management scenarios have been subject to traffic modelling, including additional construction traffic flows (heavy good vehicles (HGVs) and light vehicles as indicated in Chapter 2: The Scheme, Illustration 2.2 in Section 2.6). The traffic data have been used to assess the potential for noise impacts due to construction traffic and temporary traffic management measures – results are presented in Section 9.10.

Construction vibration

9.3.12. Construction vibration impacts have been assessed for all construction activities which are a potential significant source of vibration proposed in close proximity of any identified potentially sensitive receptors. These construction works comprise earthworks and road construction (pavement) works using vibratory rollers.

9.3.13. Piling would be required at the new bridges at each junction and the retaining walls at Markeaton junction. Rotary bored piling is proposed for these works. Vibration associated with this type of piling is minimal, therefore a discussion of the potential impacts is provided in Section 9.10 based on example measured data provided in BS 5228 (BSI, 2014). Impact or driven piling, which are a potentially significant source of vibration, are not proposed during the Scheme construction phase.

9.3.14. Vibration levels due to vibratory rollers have been estimated in accordance with the relevant methodologies in BS 5228. Source data for the vibratory rollers have been taken from Transport Research Laboratory (TRL) Report 429 (TRL, 2000). It is anticipated that two sizes of roller would be used for the works, namely a large single drum roller (approximately 13 tonnes) used predominantly for earthworks, and a medium sized twin drum roller (approximately 3.5 tonnes) used for both earthworks and road construction (pavement) works.

9.3.15. The transmission of groundborne vibration is highly dependent on the nature of the intervening ground between the source and receptor and the activities being undertaken. BS 5228 provides data on measured levels of vibration for various construction works. Vibration impacts are considered herein for both damage to buildings and annoyance to occupiers.

9.3.16. Table 9.3 details Peak Particle Velocity (PPV) vibration levels and provides a semantic scale for the description of construction vibration effects on human receptors, based on guidance contained in BS 5228.

Table 9.3: Construction vibration criteria for human receptors (annoyance)

Peak particle velocity level	Description
10mms^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level.
1.0mms^{-1}	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.
0.3mms^{-1}	Vibration might be just perceptible in residential environments.
0.14mms^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.

9.3.17. For human receptors the LOAEL is defined as a PPV of 0.3mms^{-1} (millimetres per second), this being the point at which construction vibration is likely to become perceptible. The SOAEL is defined as a PPV of 1.0mms^{-1}, this being the level at which construction vibration can be tolerated with prior warning.

9.3.18. In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far in excess of those that may cause human annoyance. Consequently, if vibration levels within buildings are controlled to those relating to annoyance (i.e. 1.0mms^{-1}), then it is highly unlikely that buildings would be damaged by construction vibration.

9.3.19. BS 7385-2: 1993 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration' (BSI, 1993) provides guidance on vibration levels likely to result in cosmetic damage and is referenced in BS 5228. Guide values for transient vibration, above which cosmetic damage could occur, are given in Table 9.4.

Table 9.4: Transient vibration guide values for cosmetic damage

Type of building	**Peak component particle velocity in frequency range of predominant pulse**	
	4Hz to 15Hz	**15Hz and above**
• Reinforced or framed structures • Industrial and heavy commercial buildings	50mms^{-1} at 4Hz and above	
• Unreinforced or light framed structures • Residential or light commercial buildings	15mms^{-1} at 4Hz increasing to 20mms^{-1} at 15Hz	20mms^{-1} at15Hz increasing to 50mms^{-1} at 40Hz and above
NOTE 1: Values referred to are at the base of the building. NOTE 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6mm (zero to peak) is not to be exceeded.		

9.3.20. BS 7385-2 states that for transient vibration, such as from individual impacts, the probability of building damage tends towards zero at levels less than 12.5mms^{-1} PPV. For continuous vibration, such as from vibratory rollers, the threshold is around half this value.

9.3.21. It is also noted that these values refer to the likelihood of cosmetic damage. ISO 4866:2010 'Mechanical Vibration and Shock. Vibration of Fixed Structures. Guidelines for the Measurement of Vibrations and Evaluation of their Effects on Structures' (ISO, 2010) defines three different categories of building damage, namely:

- Cosmetic: formation of hairline cracks in plaster or drywall surfaces and in mortar joints of brick or concrete block constructions.
- Minor: formation of large cracks or loosening and falling of plaster or drywall surfaces or cracks through brick or blocks.
- Major: damage to structural elements, cracks in support columns, loosening of joints, splaying of masonry cracks.

9.3.22. BS 7385-2 states that minor damage occurs at a vibration level twice that of cosmetic damage, and that major damage occurs at a vibration level twice that of minor damage. Therefore, this guidance has been used to define vibration criteria as detailed in Table 9.5 which can be used to assess continuous vibration impacts.

Table 9.5: Construction vibration criteria for assessing building damage

Damage risk	Continuous vibration level PPV mms^{-1}
Major	30
Minor	15
Cosmetic	6
Negligible	<6

Construction noise and vibration – significance of effect

9.3.23. The main factor in identifying the significance of construction noise and vibration annoyance effects is the magnitude of the impact relative to the SOAEL. In general, construction noise or vibration levels above the SOAEL would be considered significant, and levels below the SOAEL as not significant. However, in line with best practice, this initial decision on the significance of an effect is then combined with professional judgement which takes into account a range of other factors, including the following:

- The duration of the impact. Based on the guidance in BS 5228, construction noise or vibration levels above the SOAEL for less than 10 days (or 10 evenings, weekends or nights) in any 15, or less than 40 days (or 40 evenings, weekends or nights) in any six month period, would not normally be considered significant. With regard to the Scheme, given that the construction contractor has not been appointed yet, detailed information on the exact timing and duration of individual activities is not confirmed. Therefore, a conservative judgement has been made of the likelihood of the duration criteria being exceeded based on the available information, taking advice from Highways England's appointed buildability advisors.
- The location of the impact at the receptor. A receptor may contain areas which are more or less sensitive than others e.g. in a school, office spaces or kitchens would be considered as being less sensitive than the classrooms; or a residential property may have no windows on the affected facade.

9.3.24. With regard to the magnitude of noise and vibration impacts associated with construction traffic on public roads, this has been based on the anticipated change in traffic noise level, in accordance with the same criteria as used for short-term operational road traffic noise impacts as detailed in Table 9.7. The significance of the effect of construction traffic is considered in the same way as operational traffic noise as detailed in the section below (refer to paras. 9.3.51 and 9.3.52).

Operational noise

Operational traffic noise methodology

9.3.25. The general principle of DMRB (Highways Agency, 2011) is to allocate an assessment method according to risk - this process uses three levels of assessment: scoping, simple and detailed. The assessment level used for this Scheme is the most comprehensive detailed assessment, as the Scheme is considered to have the potential to result in significant changes in traffic noise.

9.3.26. Noise from a flow of road traffic is generated by both vehicle engines and the interaction of tyres with the road surface. The traffic noise level at a receptor, such as an observer at the roadside or residents within a property, is influenced by a number of factors including traffic flow, speed, composition (percentage of heavy duty vehicles (HDV)), road gradient, the type of road surface, the distance from the road and the presence of any obstructions between the road and the receptor.

9.3.27. Noise from a stream of traffic is not constant, but to assess the traffic noise impact a single figure estimate of the overall noise level is necessary. The index adopted by the UK Government in CRTN to assess traffic noise is $L_{A10,18h}$. This value is determined by taking the highest 10% of noise readings in each of the 18 one-hour periods between 06:00 and 00:00, and then calculating the arithmetic mean. As recorded in DMRB, a reasonably good correlation has been shown to exist between this index and the perception of traffic noise by residents over a wide range of noise exposures.

9.3.28. CRTN provides the standard methodology for predicting the $L_{A10,18h}$ road traffic noise level. Noise levels are predicted at a point measured 1m horizontally from the external façade of buildings.

9.3.29. Although the main focus of the assessment presented herein is on daytime impacts, DMRB also requires an assessment of night-time traffic noise levels using the parameter $L_{night,\ outside}$, which is the traffic noise level over the period 23:00 to 07:00. However, this parameter is not calculated by the standard CRTN methodology. DMRB refers to three methods for calculating night-time traffic noise levels developed by TRL (TRL, 2002). The most widely used is 'Method 3' which simply factors the $L_{night,outside}$ from the $L_{A10,18h}$, based on the typical diurnal pattern of traffic flows in the UK.

9.3.30. However, one of the aims of the Scheme is to alleviate congestion during the day. At night, congestion is not a problem on the existing A38, and therefore the changes in traffic noise levels due to the implementation of the Scheme would generally be smaller at night than during the day. To more accurately represent the change to night-time traffic noise levels associated with the Scheme, a method based directly on night-time traffic conditions, rather than simply factoring the daytime traffic noise levels, has been adopted.

9.3.31. A hybrid of the TRL 'Method 1' (based on individual hourly flows) and 'Method 2' (based on eight hour night time flows) has been used to assess potential night-time traffic noise impacts. The eight hour night-time traffic flow from the traffic model has been used to determine a typical one hour flow during each hour of the night and the Method 1 prediction method applied.

9.3.32. The CRTN methodology applies a 'low flow' correction between 18 hour vehicle flows of 1,000 and 4,000 and between one hour vehicle flows of 50 and 200. The low flow correction procedure amplifies the impact of changes in traffic flows which are already low, in particular at receptors very close to the road. The 1,000 18 hour flow cut off and the 50 one hour flow cut off are the lower limits of the reliability of the CRTN prediction methodology.

9.3.33. DMRB also requires consideration of the likely annoyance to residents caused by traffic noise, in both the short and long term. Individuals vary widely in their response to the same level of traffic noise. However, the average or community response from a large number of people to the same level of traffic noise is fairly stable and, therefore, a community average degree of annoyance caused by traffic noise can be related to the long-term steady state noise level. In addition, DMRB notes that people are more sensitive to abrupt changes in traffic noise, for example, following the opening of a new road, than would be predicted from the steady state relationship between traffic noise and annoyance (as described above). These effects last for a number of years. However, in the longer term, the perceived noise annoyance tends towards the steady-state level due to familiarisation.

9.3.34. The objective of the assessment, as set out in DMRB, is to gain an overall appreciation of the noise and vibration climate, both with the Scheme (Do-Something (DS)) and without the Scheme (Do-Minimum (DM)), in order to identify where noise impacts occur, and to determine where mitigation to reduce these impacts may be appropriate. These conditions are assessed for the baseline year (the year of Scheme opening) and the future assessment year (15 years after Scheme opening).

9.3.35. DMRB outlines the steps to be carried out at the detailed assessment stage, which have been followed for this assessment:

a) Identify the study area (see Section 9.6) and predict 18-hour (06:00 - 00:00) and night-time (23:00 - 07:00) traffic noise levels at all residential properties within the 600m calculation area for all assessment scenarios.

b) Carry out the following comparisons for each property in order to identify the number of properties where residents may experience an increase or decrease in traffic noise levels and annoyance:

- The DM scenario in the baseline year against the DM scenario in the future assessment year (long-term).
- The DM scenario in the baseline year against the DS scenario in the baseline year (short-term).
- The DM scenario in the baseline year against the DS scenario in the future assessment year (long-term).

c) For night-time traffic noise levels, undertake comparisons for the two long-term comparisons and for properties where the $L_{night,\ outside}$ level is 55dB or more in the relevant scenarios.

d) Assess the impact on sensitive receptors, other than residential properties, within the 600m calculation area. This is based on 18-hour (06:00 - 00:00) traffic noise levels and considers the same three comparisons as outlined in (b) above for residential properties.

e) Complete a qualitative assessment of sensitive receptors which are within the 1km boundary, but outside the 600m calculation area.

f) For affected routes which are outside the 1km boundary, complete an assessment by estimating the CRTN Basic Noise Level (BNL) on these roads (the traffic noise level at 10m) with and without the Scheme. Count the number of dwellings and other sensitive receptors within 50m of these routes.

9.3.36. Different façades of the same property can experience different changes in traffic noise level depending on their orientation to the noise source. DMRB requires that each of the above comparisons of traffic noise levels is based on the façade which experiences the least beneficial change i.e. the largest increase, or, if all façades undergo a decrease, the smallest decrease. Additionally, DMRB requires that the above comparisons of annoyance use the highest levels of annoyance in the first 15 years. For properties which experience an increase in noise due to the Scheme, the greatest annoyance is likely to be immediately after the Scheme opens to traffic. For properties which experience a decrease in noise (and also in the DM comparison), the greatest annoyance is the steady-state level of annoyance in the long term.

9.3.37. A preliminary indication of any properties likely to qualify under the Noise Insulation Regulations is provided in the assessment. A full assessment would be completed once the detailed design of the Scheme is finalised and in accordance with the timescales set out in the Noise Insulation Regulations.

9.3.38. Predicted daytime and night-time traffic noise levels have been generated using noise modelling software. The model is based on traffic data generated by a traffic model of the Scheme and the surrounding area. The traffic flow and % HDV data are taken directly from the model. However, the traffic speeds are subject to a process called 'speed banding' which assigns one of four speeds to all non-motorway roads, as set out in IAN 185/15 (Highways England, 2015). The model also includes the ground topography, ground type and buildings to form a 3D representation of the study area. Further details of the noise model data sources and assumptions are provided in Appendix 9.3 [**TR010022/APP/6.3**], whilst details of the traffic model are available in the Transport Assessment Report [**TR010022/APP/7.3**].

9.3.39. The SOAEL and the LOAEL for road traffic noise used in this assessment are detailed in Table 9.6.

Table 9.6: Traffic noise SOAEL and LOAEL for all receptors

Time period	SOAEL	LOAEL
Daytime	68dB $L_{A10,18h}$ (façade) 63dB $L_{Aeq,16h}$ (free-field)	55dB $L_{A10,18h}$ (façade) 50dB $L_{Aeq,16h}$ (free-field)
Night	55dB $L_{night,outside}$ (free-field)	40dB $L_{night,outside}$ (free-field)

9.3.40. For daytime, the SOAEL is set at 68dB $L_{A10,18h}$ (façade), which is consistent with the daytime trigger level in the Noise Insulation Regulations. For consistency with the Noise Insulation Regulations, levels of 67.5dB are rounded up to 68dB. The daytime LOAEL is set at 50dB $L_{Aeq,16h}$ (free field), based on the guidance provided in the WHO Guidelines for Community Noise (WHO,1999) regarding the onset of moderate community annoyance.

9.3.41. For night-time, the SOAEL is set at 55dB $L_{night,outside}$ (free field). This aligns with the interim night-time outdoor target level provided in the WHO Night Noise Guidelines for Europe (WHO, 2009). The LOAEL is set at 40dB $L_{night,outside}$ (free field), which is defined as the LOAEL for night-time noise in the WHO Night Noise Guidelines for Europe.

9.3.42. The road traffic noise SOAEL and LOAEL are used to consider how the Scheme complies with the three policy aims detailed in paragraph 5.195 of the NPSNN (DfT, 2014), within the context of UK Government policy on sustainable development, namely:

- To avoid significant adverse impacts i.e. reduce traffic noise levels at receptors in the study area to below the SOAEL.
- To mitigate and minimise other adverse impacts i.e. reduce traffic noise levels at receptors in the study area which are between the LOAEL and the SOAEL.
- To contribute to improvements where possible i.e. reduce traffic noise levels at all receptors in the study area where possible.

9.3.43. The assessment sets out what mitigation measures have been incorporated into the Scheme to meet these three aims, and also any measures which were not considered reasonable or practical to include.

Operational traffic vibration

9.3.44. Vibration from traffic can be transmitted through the air or through the ground. Airborne vibration is produced by the engines and exhausts of road vehicles, with dominant frequencies typically in the range of 50 - 100 Hz. Groundborne vibration is produced by the interaction of the vehicle tyres and the road surface with dominant frequencies typically in the range of 8 - 20 Hz. The passage of vehicles over irregularities in the road surface can also be a source of groundborne vibration.

9.3.45. Traffic vibration can potentially affect buildings and disturb occupiers. DMRB reports that extensive research on a wide range of buildings has found no evidence of traffic induced groundborne vibration being a source of significant damage to buildings and no evidence that exposure to airborne vibration has caused even minor damage.

9.3.46. Airborne vibration is noticed by building occupiers more often than groundborne vibration, as it may result in detectable vibrations in building elements such as windows and doors.

9.3.47. DMRB states that perceptible vibration only occurs in rare cases and identifies that the normal use of a building, such as closing doors and operating domestic appliances, can generate similar levels of vibration to that from traffic in most circumstances.

9.3.48. It is a requirement that newly constructed highways have a highway surface that is smooth and free from any discontinuities. Paragraph A5.25 of DMRB (Highways Agency, 2011) highlights that in relation to groundborne vibration: '*no evidence has been found to support the theory that traffic induced vibrations are a source of significant damage to buildings*'. Paragraph A5.26 of DMRB also states: '*Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances*'. Hence, no significant effects from traffic induced groundborne vibration due to the passage of vehicles over irregularities on the Scheme, in terms of either disturbance or damage to buildings (or other structures), are anticipated and thus no further assessment has been completed.

9.3.49. To assess the magnitude of the impact of traffic induced airborne vibration on residents, a parameter is needed which reflects a person's subjective rating of vibration disturbance. DMRB recommends the use of the $L_{A10,18h}$. The relationship between the $L_{A10,18h}$ and annoyance due to vibration is similar to that for annoyance due to steady state traffic noise, except that the percentage of people bothered by vibration is lower. For a given level of noise exposure, DMRB states that the percentage of people bothered very much or quite a lot by vibration is 10% lower than the corresponding figure for annoyance due to traffic noise. Below 58dB DMRB states that the percentage of people bothered by traffic induced vibration is zero.

9.3.50. The potential for vibration impacts is limited to the immediate vicinity of a road, and the relationship between annoyance due to vibration and traffic noise level in DMRB is based on properties located within 40m of a road. Therefore, at each property within 40m of the Scheme, the existing A38 replaced by the Scheme or other affected routes, and at which traffic noise levels are predicted to be 58dB, $L_{A10,18h}$ or more, the percentage of people likely to be bothered very much or quite a lot by vibration has been calculated (refer to Section 9.10).

Operational traffic – significance of effect

9.3.51. An initial identification of significant effects is carried out based on the magnitude of change in traffic noise levels due to the Scheme. DMRB provides two example classifications for the magnitude of the traffic noise impact of a proposed road scheme, as shown in Table 9.7. These relate to both short-term changes and long-term changes in noise levels. The short term classification detailed in Table 9.7 is the main driver of the initial identification of significant effects.

Table 9.7: Magnitude of traffic noise impacts

Short term change		Long term change	
Noise level change (rounded to 0.1 dB) $L_{A10,18h}$ dB	**Magnitude of impact**	**Noise level change (rounded to 0.1 dB) $L_{A10,18h}$ dB**	**Magnitude of impact**
0	No change	0	No change
0.1 – 0.9	Negligible	0.1 – 2.9	Negligible
1.0 – 2.9	Minor	3.0 – 4.9	Minor
3.0 – 4.9	Moderate	5.0 – 9.9	Moderate
5.0+	Major	10.0+	Major

9.3.52. In general, a negligible or minor magnitude of impact is not normally considered significant and a moderate or major magnitude of impact is normally considered significant. However, in line with best practice this initial decision on the significance of an effect is then combined with professional judgement which takes into account a range of other factors, including:

- The absolute noise levels e.g. if traffic noise levels are already very high (above the SOAEL), then a smaller noise level change than outlined in Table 9.7 may be considered significant. Conversely if traffic noise levels are very low (below the LOAEL), then a larger noise level change may be required to be considered significant.
- Where the magnitude of change in the short term lies relative to the boundaries between the bands outlined in Table 9.7 e.g. in some circumstances a change of say 2.9dB, which just falls into the minor category, may be considered significant.
- If the magnitude of change in the long term is different to that in the short term e.g. if the short term change is minor (not significant), but the long term change is moderate (significant), then a significant effect may be identified.
- The circumstances of the receptor. A receptor may contain areas which are more or less sensitive than others e.g. office spaces or kitchens in a school would be considered less sensitive than classrooms. Alternatively, a receptor may be particularly vulnerable, such as a school for hearing impaired children.
- The acoustic character of an area. e.g. if a scheme introduces road noise into an area where road noise is not currently a major source.
- The likely perception of a traffic noise change e.g. does the noise change combine with other changes, such as an increase in the visibility of a road, which may increase the perceived impact.
- The proportion of a designated site that is affected e.g. comparing the proportion of a designated site within the noise study area that is above the LOAEL or SOAEL in each assessment scenario.

Scoping

9.3.53. The proposed scope of the noise and vibration impact assessment was detailed in the EIA Scoping Report (Highways England, 2018) submitted to The Inspectorate on 15 March 2018 (refer to Chapter 1: Introduction, para. 1.3.5).

9.3.54. An overview of The Inspectorate's Scoping Opinion (refer to Appendix 4.1 [**TR010022/APP/6.3**]) in relation to noise and vibration is presented in Table 9.8, together with comments provided by statutory consultees, including the late consultation responses published on 26 April 2018. Where the assessment has been undertaken in accordance with the Scoping Opinion point, a response and the relevant ES section is provided; where an alternative approach has been agreed with the relevant stakeholders, an explanation is provided.

Table 9.8: Scoping Opinion and response

Scoping Opinion	Where addressed within the ES
Planning Inspectorate	
The Inspectorate considers that properties to be demolished do not need to be considered as part of the noise and vibration assessment, however, should the scope of demolition works change, the need for assessment would need to be reviewed and any likely significant effects assessed.	Properties to be demolished by the Scheme are not included in the DS assessment - refer to Section 9.5.
The assessment assumes that operational ground borne vibration effects will not arise due to the proposed new highways surface, which would be smooth and free of defects and based on a subjective assessment in 2015. The Inspectorate considers that operational ground borne vibration effects may be scoped out on this basis. Details of the subjective assessment undertaken in 2015 should be provided in the ES.	Refer to Section 9.7.
Noise mitigation proposals presented in the ES (such as noise barriers), should take account of existing local noise policy or plans, where available and relevant.	Refer to Section 9.2 and Section 9.9.
Limits of SOAEL and LOAEL should be agreed with the relevant local planning authority, where possible.	Refer to Section 9.3 and Section 9.4.
Paragraph 12.9.25 of the Scoping Report references calculation of night time noise levels using a hybrid of DMRB Method 1 and Method 2 as data is not available for the Method 1 approach. Paragraph 12.9.30 of the Scoping Report states that Method 1 approach will be used to undertake the noise assessment. The ES should set out a consistent description of the methodological approach to be adopted.	Refer to Section 9.3.
The Scoping Report suggests that manual adjustment of speed bands may be undertaken, where modelled speeds are close to a speed band boundary. The ES should highlight and justify any adjustments made.	Refer to Section 9.3.
Reference sources should be provided in the ES that confirm the suggested 10% reduction in annoyance due to vibration relative to noise in the $L_{A10,18hr}$ index quoted in these paragraphs and to ensure that the threshold for significant vibration effects has been set correctly.	Refer to Section 9.3.
The bullet point states that paper drawings have been provided but then states 'therefore, the location of these existing barriers will be estimated in the noise model'. The ES should be based on the engineering design information and it is assumed that the text should read 'have not been provided'	Scoping text is correct. Paper drawings of the original noise barrier locations at Bardens Drive/Ferrers Way and Kedleston Road have been provided by the maintenance contractor. They are not available electronically in CAD and therefore the locations cannot be directly imported into the noise model.

Scoping Opinion	Where addressed within the ES
Derby City Council (DCiC)	
Construction noise Given the scale of the development and the length of time expected for its construction, construction-related noise impacts are of particular concern. The report includes a scoping proposal to consider construction phase noise impacts focussed on a "selection of the closest identified potentially sensitive receptors". I would advise that the area and receptors under consideration in relation to construction noise impacts are specified in more detail within the scope. The report suggests that, based on the current programme, night-time and weekend working is not anticipated. I would strongly advise that the scheme aims to avoid night-works unless absolutely essential, given the potential for greater impacts from noise at night. The report confirms that a Construction Environmental Management Plan (CEMP) would be prepared and implemented by the selected construction contractor which would include a range of best practice measures associated with mitigating potential noise and vibration impacts. This is a sensible approach.	Selected construction receptors are identified on Figures 9.1a and 9.1b [**TR010022/APP/6.2**]– these have been agreed with DCiC and EBC. Details of anticipated essential night-time and weekend working are provided in Section 9.10. Construction mitigation measures are discussed in Section 9.9 and in the Outline Environmental Management Plan (OEMP) in Appendix 2.1 [**TR010022/APP/6.3**].
Operational noise The completed development itself also has the potential to significantly affect the local noise environment, primarily as a result of the following: • Higher traffic speeds due to the predicted reduced congestion around junctions; • Higher traffic volumes as a result of making the route more attractive; and • Closer proximity of the highway to sensitive receptors due to the enlarged layout arising from additional lanes. The methodology and study area for the assessment of operational phase noise impacts appears to be appropriate. I do not however agree with the thresholds for significant observed adverse effects (SOAELs) described in section 12.9.35. Evidence suggests significant effects well below the proposed threshold of 63 dB $L_{Aeq,16h}$ (based on a daytime outdoor free field level) and therefore, when designing mitigation, a lower threshold should be used in line with World Health organisation criteria, namely 55 dB $L_{Aeq,16hr}$. Tables 12.9 and 12.10 identify the proposed EIA classifications for magnitude of noise impacts for both the short-term and the long-term. The classifications appear to suggest that greater increases in noise over the long-term are more acceptable than those in the shorter-term. In my experience, the opposite is true i.e. people tend to tolerate higher levels of noise that are temporary whereas greater potential for nuisance exists where increases in noise are more permanent. Again, I would recommend lower	The study area and assessment methodology are detailed in Sections 9.6 and 9.3, respectively. SOAEL for operational traffic noise is set in accordance with Highways England guidance in common with other Highways England road schemes. The rationale for this approach has been discussed with DCiC. Operational traffic noise short-term and long-term magnitude of impact classifications are set in accordance with Highways England guidance in common with other Highways England road schemes. The rationale for this approach has been discussed and agreed with DCiC.

Scoping Opinion	Where addressed within the ES
thresholds for magnitude where noise mitigation is being considered for the long-term classifications, in line with those for the short-term magnitude classifications.	
Noise mitigation I note that the length of A38 highway affected by the proposed scheme contains 'important areas containing first priority locations' and 'other important areas' designated under the Environmental Noise (England) Regulations 2006 (as amended). The report confirms that Highways England has made an initial assessment of the feasibility of mitigation for these Important Areas which considers resurfacing with low noise surfacing and noise barriers. Derby City Council is currently developing a Local Noise Plan in accordance with the Environmental Noise Directive and therefore the A38 scheme will need to ensure that it is consistent with any actions on that Plan once it has been finalised. The report later confirms (in section 12.7.4) that noise mitigation has been incorporated into the proposed scheme design in the form of low noise surfacing across the extent of proposed scheme. This proposal is welcomed. According to the report, further noise mitigation, possibly in the form of new barriers, will be developed and reported in the Environmental Statement. The report does not however propose to include a full assessment in accordance with the Noise Insulation Regulations 1975. I would strongly advise that the EIA considers the requirements under the Noise Insulation Regulations in detail. A summary of a Project Control Framework (PCF) Stage 2 Assessment is provided in the report, however to the best of my knowledge this Department has not received a copy of this report to date. I would appreciate a copy of the report to be sent for review by the Environmental Protection Team at Derby City Council.	Scheme impacts upon Noise Important Areas are discussed in Section 9.10. Details of DCiC's Local Noise Plan are not yet available. Details of mitigation measures are provided in Section 9.9 and in the OEMP in Appendix 2.1 [**TR010022/APP/6.3**]. Outcome of the provisional Noise Insulation Regulations assessment are included in Section 9.10. Reasons why this is only a preliminary assessment have been discussed and agreed with DCiC. Highways England has not formally published the results of the PCF Stage 2 assessment. Results are superseded by the assessment as presented herein.

9.4. Consultation

9.4.1. The Environmental Health Departments at both DCiC and EBC have been consulted with regard to the noise assessment. Both have advised they had no specific concerns regarding noise complaints in the area or specific sensitive receptors beyond those already identified.

9.4.2. DCiC and EBC do not have a specific policy regarding construction noise or vibration, other than the adoption of standard working hours: 07:30 - 18:00 weekdays, 08:00 - 13:00 Saturdays, with no working on Sundays and Bank Holidays (refer to Chapter 2: The Scheme, Section 2.6 for a discussion on Scheme construction core working hours). Their preference is to deal with major construction projects through the use of Best Practical Means based on the guidance in BS 5228, and a construction phase Noise and Vibration Management Plan, rather than setting specific limits or requiring a Section 61 application for prior consent. Public liaison was emphasised as a key aspect of

any such management plan. EBC have a 'Considerate Contractors Guidelines for Good Site Practice' leaflet, which is discussed further in Section 9.9.

9.4.3. A meeting was held in July 2018 with DCiC Environmental Health Department at which their comments on the EIA Scoping Report (Highways England, 2018) (as detailed in Table 9.8), were discussed. DCiC has confirmed that overall the proposed assessment methodology addresses noise impacts appropriately and is deemed appropriate. No comments on the EIA Scoping Report were received from EBC, however subsequent discussions have established that they are comfortable with the proposed methodology.

9.4.4. In January 2019 DCiC confirmed that the Council has produced a draft plan to address the Noise Important Areas (NIAs) for which they are responsible as a unitary authority. As the plan has not yet been published, Highways England has not reviewed the plan. However, DCiC has advised that it does not conflict with the Scheme.

9.4.5. As detailed in Chapter 5: Air Quality, Section 5.4, a number of discussions were held with DCiC during 2018 regarding their traffic management measures to manage air quality within the city centre which is required as part of the national air quality plan. Whilst the discussion concerned air quality, the proposed traffic management measures have the potential to affect traffic flows during the Scheme construction phase, and thus affect the construction phase noise assessment. As detailed in Section 9.3, the proposed DCiC traffic management measures have been incorporated into the Scheme's traffic model for the construction phase assessment.

9.4.6. The Preliminary Environmental Information Report (PEIR) was published in September 2018 (Highways England, 2018) and presented the environmental information collected together with the preliminary findings of the assessment of likely significant environmental effects of the Scheme at the time. Comments regarding noise and vibration received during statutory consultation are detailed in Table 9.9. With regard to public consultation comments received and the associated responses, these are detailed within the Consultation Report, a copy of which is included with the DCO application [**TR010022/APP/5.1**].

Table 9.9: Consultation response

Consultation response	Where addressed within the ES
DCiC	
DCiC comments on the PEIR report were a replicate of the comments made on the EIA Scoping Report.	Refer to the responses as detailed in Table 9.8
DCC	
They note sections 2.3.4 and 2.3.5 of the PEIR and request that a detailed phasing programme of construction be included in the Environmental Statement. Note is taken of Sections 2.3.6 and 2.3.8 of the PEIR and cite the importance of modelling works taking the impact that HGV movements to/from these construction compounds/soil storage will have on the road network. DCC consider it very important that extensive transport modelling	Detailed traffic modelling of Scheme construction and operation phases has been undertaken. Such traffic data have been used to assess traffic noise effects as reported in Section 9.10. Details of traffic modelling undertaken are provided in the Transport Assessment Report [**TR010022/APP/7.3**].

Consultation response	Where addressed within the ES
works are carried out to assess the likely impacts on the highway network during construction and operation. They state that the Environmental Statement will need to take the traffic modelling outcomes into account as traffic flows will impact on air quality, noise, vibration and communities well beyond the red line boundaries.	
DCC welcome the inclusion of measures to reduce noise to neighbouring residents. DCC welcome the use of green infrastructure such as green walls, hedgerows and trees for visual screening and noise reduction.	Details of measures included in the Scheme design to mitigate noise are provided in Section 9.9 in the OEMP in Appendix 2.1 [**TR010022/APP/6.3**].

9.4.7. In addition to the consultation activities undertaken above, the Scheme design team (including the noise assessment specialists) have met with the Royal School for the Deaf on a number of occasions. This has included visits to the school in order to confirm building layouts, dimensions, and usage in order to ensure that the noise assessment accurately predicts the Scheme effects upon the school, and to assist in mitigation definition. Scheme noise impacts and mitigation proposals (e.g. noise barrier along the school boundary with the Scheme) have been discussed with the school management team.

9.5. Assessment assumptions and limitations

9.5.1. The following assumptions or limitations are relevant to this noise and vibration impact assessment:

- Speed banding has been applied to the traffic data used in the noise assessment with the exception of two locations in the operational traffic noise assessment where the modelled speed has been used directly, namely:
  - A61 south of Little Eaton junction: the Scheme would result in an increase in 18hr speeds of around 10km/hr due to a reduction in congestion. However, the speed band changes by over 30km/hr.
  - A38 mainline between Kingsway junction to Kedleston Road junction: the Scheme would increase the speed limit from 40mph to 50mph. However, the speed band is the same with and without the Scheme.

  This approach ensures the changes in speed due to the operation of the Scheme in these areas are more accurately represented in the assessment than would be the case using speed banded speeds.
- Road links with very low flows, below the lower cut off of the CRTN prediction methodology, are excluded from the assessment.
- The information on existing road surfacing on Highways England roads in the study area is based on the data in the Highways England pavement management system (HAPMS). Information on future resurfacing plans in the area is based on Highways England's current maintenance proposals (based on information provided by the Area 7 East Midlands Asset Delivery team

(Highways England)[1]). All other roads included in the detailed quantitative noise modelling are assumed to be standard hot rolled asphalt in all scenarios.

- Road surfacing corrections as follows have been assumed during the assessment, based on the requirements of DMRB:
  - Standard hot rolled asphalt:
    - Speed <75km/hr: -1.0dB.
    - Speed ≥75km/hr: -0.5dB.
  - Low noise thin surfacing:
    - Speed <75km/hr: -1.0dB.
    - Speed ≥75km/hr: -3.5dB.
- The Highways England HAPMS database contains details of one existing noise barrier on the northbound A38 diverge slip road at Palm Court junction - no height information was available, therefore, a height of 2.0m has been assumed based on a visual inspection. Paper drawings of the original noise barrier locations at Bardens Drive/Ferrers Way and Kedleston Road have been provided by the highway East Midlands Asset Delivery team - these drawings have been used to locate these existing barriers in the noise model. None of these existing barriers are critical to the outcome of the noise assessment as presented herein.
- Ordnance Survey (OS) Address Base Plus data detailing building usage and OS Building Height Attribute data have generally been used as provided. However, the heights of residential buildings have been standardised, and a check for obvious errors (such as buildings with 0m height) has been completed using information available online, and adjustments made accordingly.
- The construction assessment is based on the construction information that is currently available, with advice being provided by Highways England's appointed buildability advisors. As with all construction assessments, the exact details of construction activities would not be fully known before the contractor is appointed to complete the works who would determine their exact construction methods and programme during the detailed design stage.
- As detailed in Section 9.3, following a review of the characteristics of the various construction traffic management phases, the three scenarios that have the potential to result in the largest traffic noise impacts were identified as being scenarios 0, 2 and 4. These traffic management scenarios have been subject to traffic modelling, with the results being used to predict potential resultant traffic noise effects during Scheme construction.
- As detailed in Section 9.3, the traffic management measures for Stafford Street to be implemented by DCiC to bring forward compliance with the EU limit value have been assumed to be operational during the Scheme

[1] Area 7 comprises approximately 79km of motorway and 428km of trunk roads in Nottinghamshire, Derbyshire, Leicestershire, Lincolnshire, Northamptonshire and Rutland. It includes stretches of the M1, M69, M6, as well as the A1, A14, A38 and A46.

construction phase (and thus these measures have been integrated into the construction phase traffic model). However, such measures have not been included within the operational phase traffic model given that compliance is expected to be achieved by 2024, thus negating the need for these traffic management measures.

9.6. Study area

9.6.1. Potentially sensitive receptors within the study area have been determined from the OS address base dataset and OS mapping. DMRB (Highways Agency, 2011) defines residential properties, educational buildings, medical buildings, community facilities (such as places of worship) designated sites (such as SSSI), scheduled monuments and public footpaths as potentially sensitive to noise and vibration.

9.6.2. The study area for the quantitative assessment of construction phase noise and vibration impacts focuses on the closest identified potentially sensitive receptors to the various construction works. Receptors have been chosen based on their potential sensitivity, as defined in DMRB and as discussed with DCiC and EBC (refer to Section 9.4), and receptor proximity to the various works. The selected receptors are also representative of neighbouring properties in their vicinity. By choosing a selection of the closest identified potentially sensitive receptors, the reported impacts are, therefore, typical of the worst affected receptors such that all potentially significant effects have been identified. At receptors further away from the works, the noise and vibration impacts would be reduced.

9.6.3. The study area for the assessment of operational phase noise impacts has been defined following the guidance set out within DMRB. The study area comprises the Scheme, the existing A38 replaced by the Scheme, and all surrounding existing roads that are predicted to be subject to a change in traffic noise level as a result of the Scheme of:

- 1.0dB or more in the short term (DM opening year to DS opening year); or
- 3.0dB or more in the long term (DM opening year to DS 15 years after Scheme opening), subject to a minimum change of 1.0dB between the DM and DS 15 years after Scheme opening.

9.6.4. These roads are defined as ’affected routes’ and are identified by the analysis of the operational phase traffic data. The identification of affected routes considered all roads with 18 hour (06:00 - 00:00) weekday traffic flows above the lower cut off of the CRTN prediction methodology in all scenarios.

9.6.5. The study area for the detailed quantitative assessment of noise impacts comprises a 600m calculation area corridor on both sides of the Scheme carriageway, 600m on both sides of the existing A38 carriageway replaced by the Scheme, and 600m on both sides of all affected routes within a 1km maximum study area around the Scheme and existing A38 replaced by the Scheme.

9.6.6. For residential properties and other sensitive receptors that are within the 1km maximum study area around the Scheme and the existing A38 replaced by the Scheme, but more than 600m from an affected route, the Scheme or existing A38 replaced by the Scheme, a qualitative assessment of the traffic noise impacts has been completed.

9.6.7. For affected routes which are outside the 1km maximum study area around the Scheme and existing A38 replaced by the Scheme, an assessment has been undertaken by estimating the CRTN BNL for these routes with and without the Scheme. A count of the number of dwellings and other sensitive receptors within 50m of these routes has been undertaken.

9.6.8. The study area for the assessment of operational phase airborne vibration annoyance impacts is defined, in accordance with DMRB, as 40m from the above ground sections of the Scheme, the existing A38 replaced by the Scheme, and identified affected routes within the 1km maximum study area.

9.6.9. The 1km and 600m study areas are illustrated in Figures 9.1a and 9.1b [**TR010022/APP/6.2**]. The identified affected routes are illustrated in Figure 9.2 [**TR010022/APP/6.2**].

9.7. Baseline conditions

9.7.1. Potentially noise sensitive receptors are illustrated in Figures 9.1a and 9.1b [**TR010022/APP/6.2**]. The vast majority of potentially sensitive receptors are residential properties. A total of over 12,000 residential properties have been identified within the 1km study area.

9.7.2. Within 1km of Kingsway junction and Markeaton junction are various residential suburbs of Derby, including Mackworth to the west and New Zealand to the east. A new development predominantly comprising housing is currently being constructed to the south-east of Kingsway junction on the Kingsway hospital site. This development would be in place by the Scheme opening year (2024). Detailed layout plans are available for the development and thus these properties have been included in the assessment. A total of 17 residential properties would be demolished to the east of Markeaton junction as part of the Scheme (namely demolition of 15 detached residential properties on Queensway and the demolition of two semi-detached properties on the A52 Ashbourne Road). These properties have not been included in the DS noise assessment.

9.7.3. The eastern edge of the suburb of Allestree falls within the 1km study area of Little Eaton junction, whilst the Ford Farm Mobile Home Park is located directly off the junction, with the villages of Breadsall and Little Eaton located to the south-east and north respectively.

9.7.4. A number of developments, in addition to the development of the Kingsway hospital site, are proposed in the vicinity of the Scheme – refer to Chapter 15: Assessment of Cumulative Effects. The impact of these developments in terms of traffic flows are included within the traffic data used in the noise assessment. Three of these developments would introduce new potentially sensitive residential receptors within the 1km study areas, although they would be fairly remote from the Scheme, namely:

- Site of Mackworth College: development of up to 221 new houses, associated facilities and open space. Works are currently ongoing and the majority of the new houses are included in the OS mastermap dataset and are, therefore, directly included in the quantitative noise assessment.
- Land north-west of Mansfield Road, Breadsall Hilltop: development of up to 230 new houses. The new housing is located outside the 600m quantitative noise assessment study area.

- Land at Rough Heanor Farm, Mickleover: proposal to erect 80 dwellings, a restaurant and a coffee shop with drive-through facilities. The planning application was refused in September 2018, but may be subject to future appeal.

9.7.5. With regard to non-residential receptors, a range of educational buildings, medical buildings, and community facilities (including community centres and places of worship) have been identified within the 1km study area. These include the Royal School for the Deaf located immediately to the east of Markeaton junction (beyond the residential properties on Queensway that would be demolished by the Scheme). The school includes a number of buildings used as residential accommodation for boarding pupils. Kingsway hospital, located to the south of Kingsway junction, includes a number of residential bungalows for patients - the closest hospital building to the junction is used for administration only.

9.7.6. No designated areas (Area of Outstanding Natural Beauty (AONB), National Parks, Special Areas of Conservation (SAC), Special Protection Areas (SPA), SSSI, Scheduled Ancient Monument (SAM)) have been identified within the 1km study area. However, the Derwent Valley Mills World Heritage Site runs in a north-south direction to the west of Little Eaton junction (refer to Chapter 6: Cultural Heritage). A number of public rights of way (PRoW) fall within the 1km study areas, mainly in the vicinity of Little Eaton junction (refer to Chapter 12: People and Communities).

9.7.7. A number of public open spaces, as designated by DCiC, fall within the 1km study area (refer to Figure 9.1and 9.1b [**TR010022/APP/6.2**]), the closest of which to the Scheme are areas immediately west of Kingsway junction in Mackworth Park and adjacent to Greenwich Drive South, and Markeaton Park/Mill Pond adjacent to Markeaton junction. There is also an area of public open space off Ford Lane to the west of the River Derwent at Little Eaton junction.

9.7.8. Under the Environmental Noise Directive (END) strategic noise mapping of major roads, railways, airports and agglomerations has been completed across England, including for the A38 and other major roads around Derby. Eight 'Noise Important Areas' (those areas most exposed to noise) were identified in the Round 2 strategic noise mapping (carried out in 2012) in the 1km study area, two of which extend along the A6 (NIA 8245*) and A52 (NIA 11628*) respectively (refer to Figures 9.1a and 9.1b [**TR010022/APP/6.2**]). Details of the Noise Important Areas in the 1km study area are detailed below (together with details regarding the relevant authority):

- 8006: A38 (Highways England).
- 8004: A516 (Highways England).
- 8003: A516/A5111 .(DCiC).
- 8005: A38 (Highways England).
- 11628*: A38/A52 (Highways England/DCiC).
- 11627: A38 (Highways England).
- 7976: A38 (Highways England).

- 8245*: A38/A6 (Highways England/DCiC).

Existing noise barriers

9.7.9. The Area 7 East Midlands Asset Delivery team responsible for maintaining the A38 through Derby has provided details of a total of three sections of existing noise barrier along the relevant length of the A38. In addition, one section of barrier was identified in the Highways England HAPMS database.

9.7.10. Two short sections of 1.8m high noise barrier are located to the east and west of the A38 to the north of Kedleston Road junction. These barriers are located within the 1km study area and are identified on Figure 9.1a [**TR010022/APP/6.2**].

9.7.11. Two sections of 2.0m high noise barrier are located on the western side of the A38 to the south of Palm Court junction - these barriers are included in the traffic noise model, but are both outside the 1km study area (refer to Figure 9.1b [**TR010022/APP/6.2**]).

9.7.12. No changes to these existing noise barriers are planned as part of the Scheme as they are located beyond the Scheme extents.

Existing and future low noise surfacing

9.7.13. Highways England hold information on the existing surfacing on the roads for which they are responsible (including the A38 and A516) in their HAPMS database. This has been used to identify areas of existing 'thin surfacing', which is designated as a 'low noise' surface - these broadly consist of:

- A516 from the A38 to Manor Park Way junction.
- A38 mainline northbound and southbound south of Kingsway junction, extending almost to the A516 junction.
- A38 northbound Kingsway junction to Markeaton junction.
- A38 northbound and southbound between Markeaton junction and Palm Court junction.
- Short sections of the A38 eastbound and westbound to the west of Little Eaton junction (partial).
- A38 northbound short section south of Morley Lane and A38 southbound section north of Morley Lane (partial).

9.7.14. Where low noise surfacing only exists on part of the carriageway, the low noise surface correction has been applied within the noise model if the majority of the carriageway has a low noise surface i.e. two lanes out of three, or if there are only two lanes if the low noise surface is on the inside lane where a higher volume of traffic is concentrated.

9.7.15. In addition, the East Midlands Asset Delivery team has provided details of the locations of resurfacing with a new low noise surface completed since 2015 or planned before the 2024 Scheme opening year. This includes the vast majority of the A38 through the study area and the A516.

9.7.16. By 2039, 15 years after Scheme opening, it is assumed that Highways England will have resurfaced all the roads for which they are responsible with new low noise surfacing i.e. the A38 and A516 throughout the noise study area.

Baseline noise survey

9.7.17. A baseline noise survey was completed in June 2015. The purpose of the baseline noise survey was to assist with developing an understanding of the general noise climate along the Scheme. For example, to identify if any other local noise sources (other than road traffic) are present and contribute significantly to the local noise climate.

9.7.18. In addition, the results of the baseline noise survey have been used as part of a verification exercise for the traffic noise prediction modelling. The traffic noise model has been used to predict traffic noise levels at the 2015 monitoring locations, with the predicted and measured levels being compared. The aim of this process is to demonstrate that the noise model is giving a sensible range of results across the whole of the study area. An exact match would not be expected for a variety of reasons, for example: i) the noise predictions are based on typical weekday traffic conditions over a year, not the exact traffic conditions during the few weeks or hours of noise monitoring; ii) the prediction method is designed to be conservative in terms of the effect of wind direction whereas the wind direction is likely to vary throughout the monitoring period; iii) the noise predictions only consider road traffic noise, whereas the measurements include all ambient noise sources.

9.7.19. Noise monitoring locations are detailed on Figures 9.1a and 9.1b [**TR010022/APP/6.2**] – these locations were chosen to focus on some of the closest receptors to the Scheme. In addition, a number of residential properties in Breadsall village were also included, located between approximately 200m and 425m from the existing A38.

9.7.20. A mixture of long-term (LT) unattended monitoring over a number of weeks, and short-term (ST) daytime three hour monitoring was completed. A summary of the noise monitoring results is provided in Table 9.10, which details the range of measured noise levels for the long-term monitoring sites and a comparison with predicted traffic noise levels. Further details are provided in Appendix 9.4 [**TR010022/APP/6.3**].

Table 9.10: Baseline noise monitoring 2015 (for locations refer to Figures 9.1a and 9.1b [TR010022/APP/6.2])

Ref.	Description	ST/LT	Measured		Predicted	
			Day range	Night range	Day	Night
			$L_{A10,18h}$ dB	$L_{Aeq,8h}$ dB	$L_{A10,18h}$ dB	$L_{Aeq,8h}$ dB
M1	Kingsway Hospital	ST	63.5	-	64.0	55.6
M2	Greenwich Drive South	LT	59.8 - 61.0	52.3 - 55.3	62.9	54.6
M3	Lyttleton Street	LT	53.9 - 55.0	50.2 - 51.4	59.8	55.7
M4	Greenwich Drive North	LT	65.5 - 70.0	58.4 - 65.4	71.0	64.4
M5	Radbourne Road	LT	62.0 - 65.3	56.5 - 60.7	63.9	57.9

Ref.	Description	ST/LT	Measured		Predicted	
			Day range	Night range	Day	Night
			$L_{A10,18h}$ dB	$L_{Aeq,8h}$ dB	$L_{A10,18h}$ dB	$L_{Aeq,8h}$ dB
M6	Army Reserves Centre Site (rear of Windmill Hill Lane)	LT	58.9 - 63.6	52.5 - 59.0	62.7	56.9
M7	Queensway	LT	52.3 - 57.1	49.1 - 53.7	59.0	53.3
M8	Markeaton Park	ST	71.4	-	70.7	64.1
M9	Mobile Home Park	ST	56.5	-	62.0	55.7
M10	Breadsall north	LT	51.5 - 61.5	50.2 - 56.2	62.5	55.7
M11	Breadsall centre	LT	47.9 - 58.3	48.8 - 54.1	58.4	52.2
M12	Breadsall south	LT	48.6 - 58.6	46.4 - 52.1	57.7	52.9
M13	Footpath Breadsall	ST	47.9	-	60.9	54.6

9.7.21. As would be expected, the highest measured and predicted noise levels were recorded at locations very close to the existing A38 with an unobstructed view of the road - such as M4 and M8. M7 was also close to the A38, but the monitoring location was in the rear garden of the property, well shielded from the A38 by the property and a number of garden sheds. Noise levels at M5 were also rather lower than would be expected given the proximity of the A38, however, again the monitoring location was well shielded by a garden wall, fence and shed.

9.7.22. At the majority of monitoring locations the predicted daytime $L_{A10,18h}$ and night-time $L_{Aeq,8h}$ noise levels match very well with the upper range of the measured levels, within around 2dB. The noise prediction methodology is designed to be conservative, therefore, this is as would be expected.

9.7.23. The measured levels at the long-term monitoring sites in Breadsall M10, M11 and M12 illustrate the increasing impact weather conditions have on measured noise levels at increasing distances from a major road. At these three sites the range of measured daytime $L_{A10,18h}$ levels was 10dB, whereas at the other long-term sites closer to the existing A38, the range over the monitoring period was rather smaller. Comparison of the measured noise levels with the wind direction data illustrates that there is a general correlation between wind direction and measured noise levels in Breadsall. Days when the wind was mainly from the west, south-west or north-west (i.e. from the direction of the A38 and A61 towards the village) tend to correspond to days when noise levels were highest. Conversely days when the wind was mainly from a southerly, northerly or easterly direction tend to correspond to days when noise levels were lowest.

9.7.24. The match between measured and predicted levels is not as good at M3 and two of the short-term sites M9 and M13, where the predicted levels were rather higher than the monitoring data.

9.7.25. At M3 the predicted daytime $L_{A10,18h}$ levels are around 5dB above the upper end of the range of measured levels. At night the match is closer with predicted levels being around 3dB above the upper range of measured levels. Local conditions in the rear garden of the property and the proximity of boundary fences is the likely source of the mismatch in this area.

9.7.26. The short-term noise measurements at M9 and M13 are inherently more likely to differ from the predicted level as the measurements provide only a brief snapshot of conditions over three hours on a single day. The long-term noise monitoring at the closest long-term site in Breadsall (M11) was on-going during the short-term measurements at M9 and M13. Comparison of the results indicates that noise levels at M11 were also very low during the short-term monitoring period, more than 10dB below the upper end of the range for M11, which correlates very well with the predicted daytime levels. The wind direction was predominantly from a northerly direction during the short-term monitoring, minimising the contribution from the A38 and A61 at these locations. It is, therefore, concluded that the timing of the measurements corresponded with very low noise levels from the A38, predominantly due to the wind direction, and that it is likely that short-term monitoring on a day with the wind blowing towards the monitoring locations from the A38 and A61 would result in a much better correlation with the predicted levels.

9.7.27. Overall, the comparisons provide confidence that the noise model developed to estimate the noise impacts of the Scheme is robust.

Future baseline

Construction year baseline (2020)

9.7.28. The baseline details as reported in the section above describes the noise climate in 2015, the year that the baseline noise survey was undertaken, and for which baseline traffic data is available.

9.7.29. Preliminary works associated with the Scheme are anticipated to start in late 2020, subject to securing a DCO (refer to Chapter 2: The Scheme, Section 2.6), with construction works being completed in 2024.

9.7.30. The majority of the land that would be impacted by the Scheme (and in its vicinity) at Kingsway junction and Markeaton junction comprise the existing A38 highway and other highway infrastructure, as well as surrounding residential areas and areas of public open space. At Little Eaton junction, the majority of the land that would be impacted by the Scheme (and in its vicinity) comprises agricultural land as well as the existing A38 highway and other highway infrastructure, plus residential and commercial areas. As such, environmental baseline conditions are not anticipated to change significantly by 2020 from the conditions as detailed above. However, as detailed in Chapter 15: Assessment of Cumulative Effects, a number of development projects are ongoing, or are planned, that have the potential to change baseline conditions. Based on consideration of future anticipated developments in the area, these are not expected to affect the construction noise assessment. However, as detailed in paras. 9.7.2 and 9.7.4, some planned developments would introduce new potentially sensitive residential receptors within the 1km study areas. The impact of these developments in terms of traffic flows are included within the traffic data used in the noise assessment.

9.7.31. As detailed in Section 9.3, the traffic management measures for Stafford Street to be implemented by DCiC to bring forward compliance with the EU limit value would be in place in mid-2019, and thus well in advance of Scheme construction.

9.7.32. As detailed in Section 9.3 ambient noise levels used to set significance criteria in the construction noise assessment are based on 2015 traffic data, which is considered to constitute a conservative approach.

Opening year baseline (2024)

9.7.33. As detailed in Chapter 15: Assessment of Cumulative Effects, a number of additional development projects in the area will have been completed by 2024. These are included in the 2024 traffic data used in the construction traffic and operational traffic noise assessments.

15 years after opening baseline (2039)

9.7.34. A range of long-term potential future development proposals have been taken into account by the traffic modelling used to support the 2039 noise assessment (both with and without the Scheme).

9.7.35. A summary of predicted DM traffic noise levels and the change from the Scheme opening year (2024) to the future assessment year (2039) is provided in Table 9.11.

Table 9.11: Long-term change in predicted Do-Minimum traffic noise levels (DM 2024 to DM 2039)

Change in noise level		Daytime		Night-time
		Number of residential buildings	Number of other sensitive receptors	Number of residential buildings
Increase in noise level Daytime $L_{A10,18h}$ dB Night-time $L_{night,outside}$ dB	0.1 - 2.9	10,150	54	2,002
	3.0 - 4.9	103	0	0
	5.0 - 9.9	0	0	0
	≥10	0	0	0
No change	0	6	0	7
Decrease in noise level Daytime $L_{A10,18h}$ dB Night-time $L_{night,outside}$ dB	0.1 - 2.9	19	0	8
	3.0 - 4.9	0	0	0
	5.0 - 9.9	0	0	0
	≥10	0	0	0

9.7.36. Table 9.12 provides a summary of the corresponding change in traffic noise annoyance at residential buildings from the Scheme opening year of 2024 to the future assessment year of 2039, as required by DMRB.

Table 9.12: Long-term change in Do-Minimum traffic noise annoyance (DM 2024 to DM 2039)

Change in % annoyed		Daytime
		Number of residential buildings
Increase in annoyance level	<10%	10,250
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0
No change	0	10
Decrease in annoyance level	<10%	18
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0

9.7.37. An estimated total of 10,278 residential buildings are located within the 600m noise prediction study area (as shown on Figures 9.1a and 9.1b [**TR010022/APP/6.2**]), including the 17 buildings to be demolished by the Scheme at Markeaton junction. However, only 2,017 buildings meet the DMRB criterion of 55dB $L_{night,outside}$ at one or more façades in one or more scenarios for inclusion in the night-time traffic noise assessment, again including the 17 buildings to be demolished at Markeaton junction.

9.7.38. A total of 54 non-residential sensitive buildings are located within the 600m noise prediction study area, consisting of 27 educational buildings (university buildings, schools and nurseries), five medical buildings (medical centres and Kingsway Hospital), 22 community facilities (mainly places of worship and community centres) as shown on Figures 9.1a and 9.1b [**TR010022/APP/6.2**]. Table 9.11 and Table 9.12 are based on the façade at each building which undergoes the least beneficial change in traffic noise level from the DM 2024 scenario to the DM 2039 scenario. The results are provided for the top floor of each building, for example, 1.5m for a one storey house, 4.0m for a two storey house. Further details of the noise model set-up and assumptions are provided in Appendix 9.3 [**TR010022/APP/6.3**].

9.7.39. The traffic noise changes from DM 2024 to DM 2039 are presented as a noise difference contour plot in Figures 9.3a and 9.3b [**TR010022/APP/6.2**]. These plots are based on free-field traffic noise levels at first floor level (4.0m above ground) using a 10m x 10m grid and is provided for illustration purposes.

9.7.40. Figures 9.3a and 9.3b [**TR010022/APP/6.2**] illustrate that the majority of residential buildings (99%), and all the sensitive non-residential receptors, would experience a negligible (0.1 - 2.9 dB) increase in daytime traffic noise levels from 2024 to 2039 in the absence of the Scheme. The Derwent Valley Mills World Heritage Site located to the west of Little Eaton junction and the various public open spaces areas, including Mackworth Park and Markeaton Park would also experience a negligible increase in daytime traffic noise levels. This is due to the general growth in traffic over time. A small number (<1%) of receptors would experience a minor (3.0 - 4.9 dB) increase in noise levels - these are located on minor roads in New Zealand with existing low traffic flows. This results in a corresponding small increase in annoyance due to traffic noise at the majority of residential buildings. A very small number of residential buildings would experience no change in traffic noise levels or a negligible decrease on the worst affected façade - the negligible decreases are located on the A6 north of the A38 and are due to an anticipated reduction in speed between 2024 and 2039 as flows increase.

9.7.41. A summary of the change in annoyance due to airborne vibration from road traffic between the two DM scenarios is provided in Table 9.13. A total of 968 residential buildings have been identified within 40m of the Scheme, the existing A38 which is replaced by the Scheme, and the identified affected routes within the 1km study area. Of these 80 are located along the A38 or the Scheme (including the 17 residential buildings to be demolished by the Scheme), with the remainder located along affected routes. The majority of these residential buildings would experience a small increase in annoyance from 2024 to 2039 in the absence of the Scheme due to the general growth in traffic over time. Traffic noise levels at 194 of the 968 residential buildings are below the cut off of 58dB $L_{A10,18h}$ in both 2024 and 2039, below which annoyance due to airborne vibration from road traffic is assumed to be zero. These buildings are all located on affected routes.

Table 9.13: Long-term change in Do-Minimum traffic vibration annoyance (DM 2024 to DM 2039)

Change in % annoyed		**Daytime**
		Number of residential buildings
Increase in annoyance level	<10%	772
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0
No change	0	196
Decrease in annoyance level	<10%	0
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0

9.7.42. Table 9.14 details the long term change in the CRTN BNL at the identified affected routes beyond the 1km maximum study area. The location of these roads is illustrated in Figure 9.2 [**TR010022/APP/6.2**].

Table 9.14: Affected routes beyond 1km - change in traffic noise levels (DM 2024 to DM 2039)

Link ref.	Description	Number of receptors within 50m		BNL $L_{A10,18h}$ dB at 10m from the road		
		Residential	Non-residential	2024 DM	2039 DM	Change
2663_3503	A38 eastbound merge slip road from the A6, Allestree	20	0	69.3	69.7	+0.4
3503_2656	A38 eastbound diverge slip road to A6, Allestree	3	0	63.6	64.0	+0.4
9088_9280	Intakes Lane, Mugginton Lane End to A517 (Ashbourne Road), Cross o' th' hands	3	1 Place of Worship	59.1	60.4	+1.3
9088_9089	Mercaston Lane, Alder Lane to Intakes Lane, Mugginton Lane End, North of Mercaston	30	2 Place of Worship	61.3	62.8	+1.5
9089_9451	Mercaston Lane, North Lane to Alder Lane, south-west of Mercaston	6	0	61.6	63.1	+1.5
9330_4046	Eaton Bank, Rigga Lane to Duffield Road, Church Lane, Little Eaton	85	0	64.8	65.1	+0.3
4046_9221	Eaton Bank, Duffield Bridge to Rigga Lane, Duffield Bank	28	0	62.1	62.5	+0.4
9607_9608	Morley Lane, Alfreton Road to Quarry Road (outside 1km study area)	43	0	60.9	62.6	+1.7
9607_9609	Quarry Road, Morley Lane to Brick Kiln Lane	0	0	58.3	59.3	+1.0
9609_9606	Brick Kiln Lane, Quarry Road to A608, Morley Smithy	27	0	62.9	63.8	+0.9

9.7.43. As would be expected, all the identified affected routes are predicted to experience a negligible (0.1 - 2.9 dB) long-term increase in traffic noise levels at the roadside in the absence of the Scheme. This is due to the normal growth of traffic over time.

9.7.44. It should be noted that the majority of affected routes are minor roads with a low flow (1,000 – 4,000 vehicles 18 hour flow) in all scenarios. Therefore, the CRTN low flow correction procedure enhances the impact of relatively modest changes in traffic flow. Only the two sections of the A38 slip roads at Palm Court junction and Eaton Bank in Little Eaton have traffic flows above 4,000.

9.8. Potential impacts

9.8.1. Mitigation measures incorporated in the Scheme design and measures to be taken to manage Scheme construction are set out in Section 9.9 (and in the OEMP (refer to Appendix 2.1 [**TR010022/APP/6.3**])). Prior to implementation of defined mitigation measures, the Scheme has the potential to affect noise and vibration (positively or negatively), both during construction and once in operation - potential impacts are detailed in the sections below.

Construction

9.8.2. The main construction activities that would take place during the Scheme construction phase are site clearance, earthworks, retaining wall construction, bridge construction and road construction (pavement) works – refer to Chapter 2: The Scheme. These construction activities have the potential to result in temporary noise impacts at the receptors closest to the works.

9.8.3. The potential for temporary construction vibration impacts is dependent on the need for construction activities which are a potentially significant source of vibration, such as earthworks and road construction (pavement) works using vibratory rollers. Piling would be required at the new bridges at each junction and during construction of the retaining walls at Markeaton junction. Rotary bored piling is proposed for these works, noting that vibration associated with this type of piling is minimal. Impact or driven piling, which is a potentially significant source of vibration, is not proposed during the Scheme construction phase.

9.8.4. Construction traffic can have a temporary impact on sensitive receptors located along existing roads used by these vehicles. Details regarding additional construction traffic flows (HGVs and light vehicles) are provided in Chapter 2: The Scheme, Section 2.6 and in Illustration 2.2 in Section 2.6. Details regarding construction traffic and temporary traffic management measures are detailed in Chapter 2: The Scheme Section 2.6 and in the Traffic Management Plan (TMP) (refer to Appendix 2.3 [**TR010022/APP/6.3**]).

9.8.5. The potential for construction traffic impacts is dependent on the volume and route of construction traffic. No night-time road closures are currently anticipated with the exception of short periods to tie in the Scheme to the existing road network and to install the new bridge decks and gantries, and the new Markeaton footbridge (refer to Chapter 2: The Scheme, Section 2.6). Re-routing of existing traffic onto alternative roads during the construction works is also a potential source of temporary traffic noise impacts. At Markeaton junction and Little Eaton junctions during some traffic management phases, mainline traffic would use some of the newly constructed slip roads bringing traffic closer to existing properties. The southbound merge and diverge slip roads at Markeaton junction and the southbound diverge slip road at Little Eaton junction are slightly closer to sensitive receptors than the existing A38 and the proposed new A38 mainline.

Operation

9.8.6. The operation of the Scheme has the potential to result in both beneficial and adverse permanent traffic noise impacts. The Scheme would move the road closer to some receptors, and further away from others. In addition, traffic flows on the new A38 would be higher than those currently using the A38 (refer to

Transport Assessment Report [**TR010022/APP/7.3**]), which thus has the potential to generate adverse noise impacts.

9.8.7. The magnitude of operational traffic noise impacts at a receptor is dependent on a range of factors, including the traffic flow, composition, speed, road surface, ground topography, the presence of intervening buildings and structures, and the distance to the road. The increase in the speed limit from 40mph to 50mph between Kingsway junction and Kedleston Road junction has the potential to change traffic noise levels through this area.

9.9. Design, mitigation and enhancement measures

Construction

9.9.1. As detailed in Chapter 2: The Scheme, Section 2.5, construction of the Scheme would be subject to measures and procedures as defined within the OEMP for the Scheme (refer to Appendix 2.1 [**TR010022/APP/6.3**]). The OEMP includes a range of good practice measures associated with mitigating potential environmental impacts. The measures detailed within the OEMP would be developed into a CEMP by the selected construction contractor which would be implemented for the duration of the Scheme construction phase.

9.9.2. The CEMP would include a Noise and Vibration Management Plan which would specify the requirement for industry standard best practice construction phase noise mitigation measures to be used during all works undertaken where there is a potential for adverse effects on sensitive receptors (e.g. residential properties, schools and hospitals). The Noise and Vibration Management Plan would include relevant noise criteria, proposed surveys and a range of range of Best Practicable Means (BPM) associated with mitigating potential noise and vibration impacts. Such measures include:

- The construction contractor would appoint a Community Relations Manager (CRM) responsible for leading engagement with affected communities (see para. 9.9.5).
- Implementation of a noise insulation and temporary re-housing policy.
- Selection of quiet and low vibration equipment and methodologies.
- Review of construction programme and methodology to consider low noise and low vibration methods (including non-vibratory compaction plant where required).
- Optimal location of equipment on site to minimise noise disturbance.
- The provision of acoustic enclosures around static plant, where necessary.
- Use of less intrusive alarms, such as broadband vehicle reversing warnings.
- Compliance with working hours as permitted by the draft DCO [**TR010022/APP/3.1**], as set out in Chapter 2: The Scheme, Table 2.4 and paras. 2.6.62 to 2.6.64.
- No start-up or shut down of large vibratory rollers (approximately 13 tonnes) within 50m of receptors and medium vibratory rollers (approximately 3.5 tonnes) within 15m of receptors.

9.9.3. There is also the potential for additional attenuation of noise from construction activities through the use of localised temporary site hoardings or noise barriers. These have not been included in the assessment of construction noise in order to represent a worst-case scenario. BS 5228 advises that such barriers can provide a reduction in noise levels of 5dB when the top of the plant is just visible over the noise barrier, and 10dB when the plant is completely screened from a receptor. The effectiveness of a noise barrier depends upon its length, effective height, position relative to the noise source and to the receptors, and the material from which it is constructed. Therefore, the potential attenuation provided by any such additional localised barriers cannot be quantified at this stage. Following appointment of the construction contractor, proposals for the use of localised temporary site hoardings or noise barriers would be developed during the detailed design stage and implemented during Scheme construction.

9.9.4. In addition to the above, although not included in the assessment, where possible, material excavated from the Scheme and stockpiles would be placed so as to provide screening of noise from the works to nearby receptors during construction.

9.9.5. As detailed above, during the Scheme construction phase appropriate mechanisms to communicate with local residents would be set up to highlight potential periods of disruption (e.g. web-based, newsletters, newspapers, radio announcements etc.). This would include the appointment of a CRM responsible for leading engagement with affected communities. A Highways England Scheme web-page would be set up to provide up-to-date construction and community liaison information. It is envisaged that this would updates regarding construction progress, details of areas affected by construction, mitigation in place to reduce adverse effects. The communication strategy would minimise the likelihood of complaints, including those associated with noise and vibration. Residents would be provided with a point of contact, the CRM, for any queries or complaints. In addition, the Highways England Customer Contact Centre (HECCC) would also be available to deal with queries from the public. This includes an information line staffed by Highways England at all times. A complaint management system would be in place, in line with systems used by Highways England on other major infrastructure projects. Any noise and vibration complaints would be investigated and appropriate action taken as required. The complainant would be provided with a response outlining the results of the investigation and any action taken.

9.9.6. As detailed in the section below on operation phase noise mitigation measures, the Scheme design includes a number of noise barriers (refer to Figures 9.1a and 9.1b [**TR010022/APP/6.2**]). The 4m high operational noise barrier at the Royal School for the Deaf to the east of Markeaton junction would be constructed following demolition of the houses on Queensway. Early installation of the noise barrier would thus reduce noise effects upon the Royal School for the Deaf and other receptors to the east of the works during Scheme construction. Such works would be undertaken before the southbound diverge slip would be used for A38 mainline traffic. Similarly, the operational noise barrier at the southbound diverge slip road at Little Eaton junction would also be installed early, once the earthworks to construct the new A38 mainline and slip road are complete. Installation would be before the new slip road would be used for A38 mainline

traffic during the construction works. Such early installation would assist in reducing construction noise effects upon Breadsall village. The operational noise barriers at Kingsway Park Close would be installed once the link road to the Kingsway junction is complete, and before it is open to traffic.

9.9.7. Large quantities of materials are expected to be transported to and from the site during the Scheme construction phase which would increase the number of HGV movements on the road network. Advice from Highways England's appointed buildability advisors indicates that HGV movements on the road network may increase by approximately 350 per day (one way) during peak activities (refer to Chapter 2: The Scheme, Section 2.6 and Illustration 2.1 in Section 2.6). Details regarding traffic movements and restrictions are detailed in the TMP (refer to Appendix 2.3 [**TR010022/APP/6.3**]) which includes details of measures to be taken to minimise the impact of construction traffic on customers and stakeholders, while ensuring work is carried out efficiently. Such measures include restricting HGV movements to the strategic highway network – thus HGVs would be restricted to using the A38 (north and south), the A61 (south), the A6 (north), the A52 (west) and the A5111 Kingsway (refer to Figures 2.11a to 2.11d [**TR010022/APP/6.2**] for details of haulage and construction delivery routes). Such restrictions would assist in avoiding construction traffic impacts on nearby residential areas.

9.9.8. During the construction phase, surveys would be required which would include physical measurements and observational checks and audits to ensure that BPM were being employed at all times. The contractor would undertake and report noise and vibration surveys as is necessary to ensure and demonstrate compliance with all noise and vibration commitments and the requirements of the CEMP (refer to Section 9.11). As detailed in the OEMP (refer to Appendix 2.1 [**TR010022/APP/6.3**]), proposals for all survey locations would be set out in the CEMP.

9.9.9. The survey and compliance assurance process would be set out in the Noise and Vibration Management Plan, as part of the CEMP. Site reviews would be logged and any remedial actions recorded. Such checks would report:

- Compliance with hours of working.
- Presence of mitigation measures e.g. engine doors closed, air lines not leaking and site hoarding in place.
- Compliance with agreed working methods.
- Compliance with any specific requirements of the CEMP.

Operation and Scheme design

9.9.10. Environmental considerations have been taken into account during the development of the Scheme design, to avoid and reduce potential impacts upon nearby sensitive receptors. As detailed in Chapter 3: Scheme History and Assessment of Alternatives, noise was a consideration in the assessment of alternative routes prior to the selection of the preferred route.

9.9.11. The Scheme design would place the new A38 mainline through Kingsway junction and Markeaton junction in underpasses and thus below the level of the existing junctions – this would screen traffic from nearby sensitive receptors and thus assist in reducing noise impacts.

9.9.12. The Scheme would be constructed throughout with a thin surfacing system (i.e. a low noise surface), which results in lower levels of noise generation than a standard hot rolled asphalt surface. The use of low noise thin surfacing can reduce noise levels by 3.5dB at speeds of ≥75km/hr.

9.9.13. Following initial noise modelling of the outline Scheme design, proposals for potential noise barriers were developed in conjunction with other environmental disciplines in order to avoid secondary impacts (including, for example, landscape and visual impacts). These initial proposals for noise barriers on the mainline between Kingsway and Markeaton junctions and at Little Eaton junction were consulted upon during statutory consultation as detailed in Chapter 1: Introduction, Section 1.6 – feedback from consultation regarding noise barriers is detailed in Chapter 3: Scheme History and Assessment of Alternatives (refer to Table 3.10), whilst reference should also be made to the Consultation Report [**TR010022/APP/5.1**]. Taking into account the analysis of consultation responses, the following noise barriers have been included within the Scheme design:

- 1.5m reflective noise barrier on the east side of Kingsway Park Close, which becomes a link road access onto Kingsway junction.
- 1.5m absorptive barriers on both the northbound and southbound A38 mainline between Brackensdale Avenue bridges and Markeaton junction.
- 4.0m reflective noise barrier on the western boundary of the Royal School for the Deaf, north-east of Markeaton junction.
- 2.5m reflective noise barrier on the southbound diverge slip road to the A61 at Little Eaton junction.
- 2.5m reflective/absorptive noise barrier on the southbound A38 mainline at Little Eaton junction.
- 2.5m reflective noise barrier on the northbound A38 mainline at Little Eaton in the vicinity of the Ford Farm Mobile Home Park.

9.9.14. Details regarding the location of these noise barriers (and other mitigation measures embedded within the Scheme design) are illustrated on the Environmental Masterplans as presented in Figures 2.12a to 2.12h [**TR010022/APP/6.2**]. Table 3.2c in the OEMP (refer to Appendix 2.1 [**TR010022/APP/6.3**]) lists out mitigation measures that are integrated within the Scheme design and illustrates in the Environmental Masterplans.

9.10. Assessment of likely significant effects

Construction phase

Construction noise

9.10.1. Predicted monthly noise levels during the construction phase have been calculated over the Scheme construction period, taking into account applicable mitigation measures as detailed in Section 9.9.

9.10.2. Predicted monthly noise levels at each selected representative receptor during the construction phase are provided in Appendix 9.2 [**TR010022/APP/6.3**]. Receptor locations are marked on Figures 9.1a and 9.1b [**TR010022/APP/6.2**]. For two storey residential properties, ground floor results are provided for the daytime and evening, and first floor results for the night. For flats and non-residential buildings, the top floor is provided for all time periods. The maximum predicted construction noise level, and whether the LOAEL and/or SOAEL are predicted to be exceeded, is summarised in Table 9.15. The predicted noise levels shown are based on the area over which each activity is likely to occur over the course of each month during the Scheme construction programme. As detailed in Section 9.3, to define the SOAEL and LOAEL, ambient noise levels at the relevant façade of each of the selected receptors has been determined as based on predicted 2015 baseline traffic flows.

Table 9.15: Summary of predicted construction noise levels (exceedances of the SOAEL/LOAEL in bold underline)

Receptor ID (refer to Figures 9.1a and 9.1b [TR010022/APP/6.2])	Daytime L_{Aeq} dB (façade)			Evening/weekend L_{Aeq} dB (façade)			Night L_{Aeq} dB (façade)		
	SOAEL	LOAEL	Max. Level	SOAEL	LOAEL	Max. Level	SOAEL	LOAEL	Max. Level
R01 - Kingsway Hospital New Residential Development	65	58	58	60	55	51	56	56	53
R02 - Kingsway Hospital Residential	70	64	64	65	61	55	60	60	55
R03 - Kingsway Hospital Audrey House	65	**56**	57	60	53	51	55	52	51
R04 - Greenwich Drive South, Mackworth	70	**64**	65	65	61	60	**60**	**60**	61
R05 - Cheviot Street, New Zealand	65	**58**	62	60	**54**	58	**57**	**57**	58
R06 - Lyttelton Street, New Zealand	**70**	**65**	72	65	62	59	63	63	61
R07 - Brackensdale Avenue, Mackworth	**70**	**67**	76	65	64	61	64	64	63
R08 - Kingsway, New Zealand	75	69	69	**66**	**66**	72	**67**	**67**	73
R09 - Greenwich Gardens, Mackworth	75	72	71	69	69	67	68	68	67
R10 - Windmill Hill Lane (South), New Zealand	**75**	**68**	80	**65**	**65**	70	**66**	**66**	71
R11 - Greenwich Drive North, Mackworth	75	**70**	74	**67**	**67**	73	**67**	**67**	74
R12 - Caretakers Flat at Army Reserves Centre	**75**	**73**	83	70	70	70	**68**	**68**	70
R13 - Windmill Hill Lane (North), New Zealand	70	**63**	70	65	60	58	59	59	58
R14 - Enfield Road, Mackworth	75	**69**	72	66	66	66	**65**	**65**	66

Receptor ID (refer to Figures 9.1a and 9.1b [TR010022/APP/6.2])	Daytime L_{Aeq} dB (façade)			Evening/weekend L_{Aeq} dB (façade)			Night L_{Aeq} dB (façade)		
	SOAEL	LOAEL	Max. Level	SOAEL	LOAEL	Max. Level	SOAEL	LOAEL	Max. Level
R15 - Ashbourne Road, New Zealand	**70**	**65**	87	**65**	**62**	70	**65**	**65**	69
R16 - The Cottage, Deaf School	**65**	**62**	82	65	59	55	**61**	**61**	63
R17 - Harringay Gardens, Mackworth	70	**66**	67	65	63	60	62	62	60
R18 - Lydia House, Deaf School	**65**	**59**	80	60	**56**	59	**57**	**57**	65
R19 - University of Derby Markeaton Street	**65**	**60**	68	**60**	**57**	66	N/A[1]	N/A	N/A
R20 - Watson Street, Kedleston	65	**56**	60	60	**53**	59	**55**	**53**	60
R21 - Broadway, Kedleston	70	64	59	65	61	58	**58**	**58**	59
R22 - Kedleston Old Road	70	67	58	65	65	57	62	62	57
R23 - Holme Nook Farm, Allestree (south of A38)	**65**	**60**	66	60	57	46	56	56	46
R24 - Croft Lane, Breadsall	65	**57**	58	60	54	52	55	53	53
R25 - Lambourn Drive (South), Allestree	70	63	63	65	60	48	58	58	48
R26 - Wharfedale Close, Allestree	75	68	64	66	66	57	65	65	58
R27 - Rectory Farm Mews, Breadsall	65	**57**	59	60	54	52	55	53	52
R28 - Mobile Home Park (East)	**70**	**66**	71	**65**	**63**	67	**62**	**62**	67
R29 - Mobile Home Park (South West)	70	**64**	67	65	**61**	64	**59**	**59**	64
R30 - Lambourn Drive (North), Allestree	65	61	59	65	58	53	56	56	54

Receptor ID (refer to Figures 9.1a and 9.1b [TR010022/APP/6.2])	Daytime L_{Aeq} dB (façade)			Evening/weekend L_{Aeq} dB (façade)			Night L_{Aeq} dB (façade)		
	SOAEL	LOAEL	Max. Level	SOAEL	LOAEL	Max. Level	SOAEL	LOAEL	Max. Level
R31 - Mobile Home Park (North)	**65**	**59**	66	60	56	54	55	54	54
R32 - Rectory Lane (Centre), Breadsall	65	**57**	61	60	**53**	54	55	**53**	54
R33 - Rectory Lane (North), Breadsall	65	**60**	61	60	56	56	**56**	**56**	57
R34 - Alfreton Road, Little Eaton	65	59	55	60	56	47	59	59	48

[1] University assumed to not be sensitive to night-time construction works

9.10.3. Of the 34 selected construction noise assessment locations, 24 are predicted to experience construction noise levels which exceed the LOAEL during the daytime period in one or more months, of which 11 would also exceed the SOAEL. For the evening/weekend period, 11 receptors are predicted to exceed the LOAEL, of which six also exceed the SOAEL. For the night-time period, 16 locations are predicted to exceed the LOAEL, of which 15 exceed the SOAEL.

9.10.4. The construction noise assessment data as summarised in Table 9.15 indicates the following:

- At receptor R04 (Greenwich Drive South) the night-time exceedance of the SOAEL is limited to the period of works to construct overhead gantries in close proximity to this receptor.
- At receptors R05 (Cheviot Street) the night-time exceedance of the SOAEL is limited to night-time road lining works.
- At receptors R06 (Lyttelton Street) and R07 (Brackensdale Avenue) the daytime exceedances of the SOAEL are limited to the period of works at Brackensdale bridge.
- At receptor R08 (Kingsway) the evening, weekend and night-time exceedance of the SOAEL is limited the period of works to construct overhead gantries in close proximity to this receptor.
- At receptor R10 (Windmill Hill Lane - South) the daytime exceedance of the SOAEL is limited to the period of construction of retaining walls in close proximity to this receptor, whilst the evening, weekend and night-time exceedance is limited to the period of works to construct overhead gantries.
- At receptor R11 (Greenwich Drive North) the evening, weekend and night-time exceedances of the SOAEL are limited to the period of works to construct overhead gantries in close proximity to this receptor.
- At receptors R12 (caretakers flat at the Army Reserves Centre) the daytime exceedance of the SOAEL is limited to the period of construction of retaining walls in close proximity to this receptor, whilst the night-time exceedance is limited to the period of works to construct overhead gantries.
- At receptor R14 (Enfield Road) the night-time exceedance of the SOAEL is limited to the period of works to construct overhead gantries in close proximity to this receptor.
- At receptors R15 (Ashbourne Road), R16 (The Cottage at the Royal School for the Deaf), R18 (Lydia House at the Royal School for the Deaf) and R19 (University of Derby on Markeaton Street) the daytime exceedances of the SOAEL are limited to the period of demolition of the houses on Queensway and demolition of Markeaton footbridge.
- At receptors R15 (Ashbourne Road), R16 (The Cottage at the Royal School for the Deaf), R20 (Watson Street) and R21 (Broadway) the night-time and/or evening/weekend exceedances of the SOAEL are a result of works to construct the new overbridges at Markeaton junction.

- At receptors R18 (Lydia House at the Royal School for the Deaf) and R19 (University of Derby on Markeaton Street) the night-time and/or evening/weekend exceedances of the SOAEL are a result of works to demolish the existing Markeaton footbridge to the north of the junction.
- At R24 (Holme Nook Farm), the daytime exceedance of the SOAEL are limited to the period of works on the floodplain compensation area on the south side of the A38 (west of the River Derwent).
- At receptor R28 (Ford Farm Mobile Home Park - East) the daytime exceedances of the SOAEL are a result of the proximity to the earthworks and roadworks at Little Eaton junction.
- At receptors R28 (Ford Farm Mobile Home Park - East) and R29 (Ford Farm Mobile Home Park – South West) the night-time and/or evening/weekend exceedances of the SOAEL are a result of works to construct the new bridges at Little Eaton junction and the works to tie-in the existing road to the new road.
- At receptor R31 (Ford Farm Mobile Home Park - North) the daytime exceedance of the SOAEL is limited to the period of construction compound establishment in proximity to this receptor.
- At receptor R33 (Rectory Lane (North), Breadsall) the night-time exceedance of the SOAEL is limited to night-time road lining works.

9.10.5. As detailed in Section 9.5, the construction assessment is based on the construction information that is currently available, with advice being provided by Highways England's appointed buildability advisors. Given that the exact details of construction activities and the duration of the various works are not fully known, a conservative approach has been adopted and all the identified exceedances of the SOAEL are assumed to be at risk of exceeding the duration criteria set out in Section 9.3 of 10 or more days (or 10 evenings, weekends or nights) in any 15, or 40 or more days (or 40 evenings, weekends or nights) in any six month period. On this basis, significant adverse construction noise effects are identified at the closest receptors to the construction works between Kingsway junction and Kedleston Road junction, at the Ford Lane Mobile Home Park, the north of Breadsall, and at the property adjacent to the works at the floodplain compensation area to the west of Little Eaton junction.

9.10.6. Once the contractor is appointed and specific details of the construction works are available, the potential to reduce the magnitude of construction noise impacts (for example, through the use of localised site hoarding), would be determined through the requirements in the CEMP. In some locations where the exceedances of the SOAEL are small, this may result in the removal of significant noise effects. Where exceedances of the SOAEL are larger, the provisions of noise insulation and temporary re-housing may apply (in accordance with the OEMP - refer to Appendix 2.1 [**TR010022/APP/6.3**]).

Construction vibration

9.10.7. The activities likely to generate potentially significant vibration levels during Scheme construction are earthworks and road construction (pavement) works using vibratory rollers.

9.10.8. Piling would be required at the new bridges at each junction and to construct the retaining walls at Markeaton junction. Rotary bored piling is proposed for these works - vibration associated with this type of piling is minimal. Impact or driven piling, which is a potentially significant source of vibration, is not proposed.

9.10.9. The measured data in BS 5228 on rotary bored piling indicates that at a distance of more than 10m typical PPV levels from the boring works do not exceed the LOAEL. PPV levels due to ancillary works, such as driving in the pile casing, do not exceed the SOAEL at distances of more than 10m. No rotary bored piling works are anticipated within 10m of a potentially sensitive receptor. On this basis, vibration impacts due to rotary bored piling at the new bridges and retaining walls are not considered to result in significant adverse vibration effects.

9.10.10. Vibration levels during earthworks and road construction (pavement) works using vibratory rollers have been calculated in accordance with the procedures set out in BS 5228-2 Table E.1. Source data for a typical large and medium sized vibratory roller has been taken from TRL Report 429 (TRL, 2000).

9.10.11. With regards to structural damage, the PPV due to vibratory plant would be well below the lowest cosmetic building damage criteria of $6mms^{-1}$ at any receptors during start-up and run-down, assuming a minimum 50m separation distance is used for the large (approximately 13 tonnes) roller, and 15m for the medium sized twin drum roller (approximately 3.5 tonnes).

9.10.12. For human receptors the LOAEL for vibration annoyance is defined as a PPV of $0.3mms^{-1}$, this being the point at which construction vibration is likely to become perceptible. The SOAEL is defined as a PPV of $1.0mms^{-1}$, this being the level at which construction vibration can be tolerated with prior warning.

9.10.13. The predicted PPV due to the steady state operation of vibratory plant is estimated to exceed the SOAEL for vibration annoyance within approximately 50m of earthworks using a large (approximately 13 tonnes) roller, and approximately 20m for the medium sized twin drum roller (approximately 3.5 tonnes). Approximately 150 residential buildings are located within 50m of Scheme earthworks using a large vibratory roller - these being located along the mainline between Kingsway junction and Markeaton junction, the closest buildings at the Royal School for the Deaf, the Ford Farm Mobile Home Park, and the individual property at the southern end of Ford Lane. Approximately 20 residential buildings are located within 20m of earthworks or roadworks using a medium sized twin drum vibratory roller – these being located along the mainline between Kingsway junction and Markeaton junction, the closest building at the Royal School for the Deaf (Lydia House), and the Ford Farm Mobile Home Park. All of these receptors are also within 50m of the earthworks using a larger vibratory roller. Potential significant construction vibration annoyance effects are, therefore, identified at approximately 150 residential buildings within 50m of earthworks and roadworks activities using a large vibratory roller.

9.10.14. Given the above, there is the potential for combined significant effects from construction noise and vibration during the construction works at the receptors located in close proximity to the works between Kingsway junction and Kedleston Road junction and at the Ford Farm Mobile Home Park at Little Eaton junction.

Construction traffic

9.10.15. During the Scheme construction phase, additional traffic would be generated by the construction works directly (refer to Chapter 2: The Scheme, Section 2.6 and Illustration 2.1 in Section 2.6), whilst re-routing of existing traffic around the works would also occur in part due to local traffic management measures (refer to the TMP provided in Appendix 2.3 [**TR010022/APP/6.3**]). Both of these could result in changes in traffic flows, and therefore traffic noise levels, along existing roads. In addition, at Markeaton junction and Little Eaton junction during some phases of the works, mainline traffic would use some of the newly constructed slip roads. The southbound merge and diverge slip roads at Markeaton junction and the southbound diverge slip road at Little Eaton junction would be slightly closer to sensitive receptors than either the existing or proposed A38 mainline.

9.10.16. No night-time road closures are currently anticipated with the exception of short periods for works such as tying in the Scheme to the existing road network and to install the new bridge decks and gantries, and the new Markeaton footbridge.

9.10.17. As detailed in para. 9.3.10, traffic management scenario 0 includes the period of maximum import of fill to construct the embankment at Little Eaton junction. In this scenario traffic would use the existing road layout. Only negligible and minor (not significant) changes in traffic noise levels are predicted both in the vicinity of the Scheme and in the wider area, with the exception of the eastern side of Markeaton junction. Once the existing buildings at Queensway are demolished together with the two semi-detached properties on Ashbourne Road, the western side of the Royal School for the Deaf and the most western residential property on the A52 Ashbourne Road would directly face the existing A38 and Markeaton junction, with the shielding provided by the existing buildings being lost. The proposed 4.0m noise barrier along the western boundary of the deaf school (refer to Figure 9.1a and Environmental Masterplan Figure 2.12c [**TR010022/APP/6.2**]) would be installed as soon as possible once the intervening houses between the school and the A38 are demolished. With the noise barrier in place, moderate (significant) increases in traffic noise are anticipated at a single residential property on Ashbourne Road, and at Lydia House and the Karten building within the Royal School for the Deaf. Lydia House is used as residential accommodation for boarding pupils at the school, whilst the Karten building is the main reception building and contains offices and meeting rooms, rather than classrooms. Without the noise barrier, major increases in traffic noise would be anticipated at the Royal School for the Deaf.

9.10.18. During traffic management scenario 2 (refer to para. 9.3.10) mainline traffic would use the existing road network at Kingsway junction, northbound A38 mainline traffic at Markeaton junction would be routed on the existing road network, whilst southbound A38 mainline traffic would be routed onto the new southbound diverge and merge slip roads. Northbound traffic at Little Eaton junction would be located on the existing road network, whilst southbound A38 mainline traffic would be routed onto the new southbound diverge and merge slip roads.

9.10.19. With the 4.0m noise barrier in place at the Royal School for the Deaf, moderate (significant) increases in traffic noise are anticipated during scenario 2 at a single residential property on Ashbourne Road, and The Cottage and the Karten building within the Royal School for the Deaf. The Cottage is used as residential accommodation for parents of pupils who are becoming boarders at the school, whilst as detailed above, the Karten building is the main reception building and contains offices and meeting rooms.

9.10.20. The removal of right turn options at Markeaton junction during scenario 2, and the presence of the roadworks, could result in some local traffic finding alternative routes, including through Mackworth and New Zealand. Along the majority of roads the anticipated increase in traffic noise levels is negligible or minor in magnitude (not significant). However, on a small number of roads in Mackworth and New Zealand, where traffic flows are low, a moderate (significant) increase in traffic noise is predicted. Along the A38 itself, due to the presence of the roadworks, traffic speeds would be reduced within the Scheme extents between Kingsway junction and Markeaton junction compared to DM conditions, resulting in a slight reduction in traffic noise. In the wider area only negligible and minor (not significant) changes in traffic noise levels are predicted during scenario 2.

9.10.21. In the vicinity of Little Eaton junction, mainline traffic using the new southbound diverge and merge slip roads during scenario 2 would bring traffic closer to Breadsall. However, due to the presence of the roadworks, traffic speeds would be reduced within the Scheme extents compared to the DM situation. Therefore, traffic noise level changes in Breadsall are anticipated to be negligible (not significant) during this traffic management stage. In addition, the proposed 2.5m noise barrier on the southbound diverge slip road would be in place before the slip road is used for A38 mainline traffic during construction, thus reducing traffic noise effects further.

9.10.22. During traffic management scenario 4 (refer to para. 9.3.10), traffic would use the newly completed junction layout at Kingsway junction, northbound traffic would use the existing road network on the approach to Markeaton junction and the new northbound merge slip road to the north of the junction. Southbound mainline traffic at Markeaton junction would use the new southbound diverge and merge slip roads. Northbound and southbound A38 mainline traffic at Little Eaton junction would use the new diverge and merge slip roads.

9.10.23. With the 4.0m noise barrier in place at the Royal School for the Deaf, moderate (significant) increases in traffic noise are anticipated during scenario 4 at a single residential property on Ashbourne Road, and at The Cottage and the Karten building within the Royal School for the Deaf. As detailed above, The Cottage is used as residential accommodation for parents of pupils who are becoming boarders at the school, whilst The Karten building is the main reception building and contains offices and meeting rooms.

9.10.24. The construction works ongoing at Markeaton junction during scenario 4 would result in some local traffic finding alternative routes, including through Mackworth and New Zealand. Along the majority of roads the anticipated increase in traffic noise levels would be negligible or minor (not significant) in magnitude. However, in some locations, where DM traffic flows are low, a moderate (significant) increase in traffic noise is predicted. In the wider area only negligible and minor (not significant) changes in traffic noise levels are predicted during scenario 4.

9.10.25. In the vicinity of Little Eaton junction, A38 mainline southbound traffic would use the new southbound diverge and merge slip roads which would bring traffic closer to Breadsall. However, due to the presence of the roadworks traffic speeds would be reduced within the Scheme extents compared to the DM situation, which would reduce traffic noise at source. With the proposed 2.5m noise barrier on the southbound diverge slip road in place, traffic noise level changes in Breadsall are anticipated to be negligible (not significant) during scenario 4.

9.10.26. During the construction works various diversions for long distance traffic would be signposted, including via the A50 and the M1 and the M42, A42 and the M1. As these diversions would use major roads with existing high traffic flows, only negligible (not significant) changes in traffic noise levels are anticipated along these routes.

Operational phase traffic noise changes

Short-term traffic noise changes

9.10.27. All the operational traffic noise comparisons reported herein are based on the façade at each building which undergoes the highest adverse change, or the least beneficial change in traffic noise level as a result of the Scheme. The results are provided for the top floor of each building, for example, 1.5m for a one storey house, 4.0m for a two storey house. Further details of the noise model set-up and assumptions are provided in Appendix 9.3 [**TR010022/APP/6.3**].

9.10.28. All the noise difference contour plots (refer to Figures 9.4a and 9.4b and Figure 9.5a and 9.5b [**TR010022/APP/6.2**]) are based on free-field traffic noise levels at first floor level (4.0m above ground) using a 10m x 10m grid and are provided for illustration purposes.

9.10.29. Table 9.16 summarises the short-term change in predicted traffic noise levels in 2024 between the DM (no Scheme) and the DS (with Scheme) scenarios at both residential buildings and other sensitive receptors within the 600m study area. The short term traffic noise changes from the DM 2024 to DS 2024 are presented as noise difference contour plots in Figures 9.4a and 9.4b [**TR010022/APP/6.2**].

Table 9.16: Short-term change in predicted Do-Something traffic noise levels (DM 2024 to DS 2039)

Change in noise level		Daytime	
		Number of residential buildings	Number of other sensitive receptors
Increase in noise level daytime $L_{A10,18h}$ dB night-time $L_{night,outside}$ dB	0.1 - 0.9	8,395	43
	1.0 - 2.9	1,432	9
	3.0 - 4.9	1	1
	≥5	0	0
No change	0	177	1
Decrease in noise level daytime $L_{A10,18h}$ dB night-time $L_{night,outside}$ dB	0.1 - 0.9	218	0
	1.0 - 2.9	35	0
	3.0 - 4.9	3	0
	≥5	0	0

9.10.30. An estimated total of 10,261 residential buildings are located within the 600m noise prediction study area in the DS scenario (see Figures 9.1a and 9.1b [**TR010022/APP/6.2**]). However, only 2,000 buildings meet the DMRB criterion of 55dB $L_{night,outside}$ at one or more façades in one or more scenarios for inclusion in the night-time traffic noise assessment in the DS scenario.

9.10.31. A total of 54 non-residential sensitive buildings are located within the 600m noise prediction study area, consisting of 27 educational buildings (university buildings, schools and nurseries), five medical buildings (medical centres and Kingsway Hospital), 22 community facilities (mainly places of worship and community centres) as shown on Figures 9.1a and 9.1b [**TR010022/APP/6.2**].

9.10.32. In the daytime in the Scheme opening year of 2024, 82% of residential buildings are anticipated to experience a negligible (0.1 - 0.9 dB) increase in traffic noise levels due to the Scheme. A further 14% are anticipated to experience a minor (1.0 - 2.9 dB) increase in traffic noise levels. The overall trend in the study area is for a slight increase in traffic flows, and therefore traffic noise, as the operation of the Scheme resolves the existing congestion issues at the A38 junctions, attracting traffic to the area. In addition, the speed limit between Kingsway junction and Markeaton junction would be increased from 40mph to 50mph. Only one residential building (Lydia House within the Royal School for the Deaf) is anticipated to experience a moderate (significant) increase in traffic noise levels of just over 3dB on the worst affected facade. Lydia House is used by boarding pupils during the week.

9.10.33. No change or a reduction in traffic noise levels is anticipated at 4% of residential buildings. The magnitude of the traffic noise level reduction is moderate (significant) at three properties, all of which are located in the vicinity of Raleigh Street which currently has an access onto the A38, but which would be closed with the Scheme in operation.

9.10.34. The negligible and minor (not significant) decreases in traffic noise levels are concentrated at Greenwich Drive South (as the A38 mainline would be relocated further to the east), in the vicinity of Raleigh Street (as the A38 access would be closed by the Scheme), at the eastern end of Enfield Road (as the A38 access would be closed by the Scheme), at the eastern end of Ford Lane in Allestree (as the A38 access would be closed by the Scheme), at the Ford Farm Mobile Home Park (as the A38 mainline would be relocated further to the south), and other surrounding roads which are currently used as local alternatives to the A38.

9.10.35. The majority of non-residential sensitive buildings would experience a negligible or minor (not significant) increase in traffic noise during the day in the Scheme opening year. The Derwent Valley Mills World Heritage Site would experience a negligible change in traffic noise levels. The area of pubic open space between the A38 and Greenwich Drive South would experience a minor decrease in noise levels, whilst at Markeaton Park the traffic noise impact ranges from a negligible increase to a major decrease. Only one non-residential sensitive receptor, at the Royal School for the Deaf, would experience a moderate increase in noise levels.

9.10.36. The Noise Important Areas on the A38 (8005, 11628*, 11627, 7976 and 8245*) would generally experience a negligible increase in traffic noise due to the slight increase in traffic flows on the A38, although the proposed 1.5m high barriers on the A38 mainline between Kingsway junction and Markeaton junction would result in a slight reduction in traffic noise levels at the facades facing the A38 within Noise Important Area 8005. The residential properties within Noise Important Area 11628* facing onto the A38 would be demolished by the Scheme.

9.10.37. The sections below provide further comment on Scheme operational phase short-term traffic noise impacts at each junction in turn.

Kingsway and Markeaton junctions

9.10.38. At Kingsway junction the relocation of the mainline into an underpass through the centre of the existing junction, and the reuse of the old A38 mainline as the slip roads, would generally result in a reduction in noise levels at the closest residential properties to the west on Greenwich Drive South, and the associated areas of public open space. To the east of Kingsway junction, traffic increases on the A5111, combined with the impact of the Scheme, would result in a mainly negligible increase in traffic noise levels at the Kingsway hospital site and the associated new development, with some areas experiencing a minor increase in traffic noise levels. The potential development site at Land at Rough Heanor Farm, Mickleover south of Kingsway junction would experience a negligible increase/decrease in traffic noise levels. At Kingsway junction the main noise impact would be on Kingsway Park Close which is currently a cul de sac leading to a small industrial estate - with the Scheme in place the road would be extended to form a link road connection to the new Kingsway junction. With the proposed 1.5m noise barrier in place along the eastern side of the Kingsway Park Close (refer to Figure 9.1a and Environmental Masterplan Figure 2.12b [**TR010022/APP/6.2**]), negligible and minor increases in traffic noise levels are predicted at the rear or side facades of properties which back onto Kingsway Park Close.

9.10.39. On the A38 mainline between Kingsway junction and Markeaton junction, reductions in traffic noise are predicted at the facades of residential buildings immediately behind the proposed 1.5m noise barriers (refer to Figure 9.1a and Environmental Masterplan Figure 2.12b/2.12c [**TR010022/APP/6.2**]), and in the vicinity of the local accesses that would be closed by the Scheme. Further back from the A38, a negligible or minor noise level increase is generally predicted due to the widening of the A38, increased traffic on the A38 and re-routing of local traffic within Mackworth and New Zealand with the Scheme in operation. Some re-routing would result in reductions in traffic flows and therefore traffic noise at facades facing onto these roads, for example, along Lyttleton Street and Stanley Street. The site of the Mackworth College development is predicted to experience a negligible increase in traffic noise in the short term, in line with the majority of Mackworth.

9.10.40. At Markeaton junction, a negligible to major reduction in traffic noise levels would be anticipated at the south-east section of Markeaton Park as the A38 mainline would be relocated further east in cutting. Further away from the A38 within the park, a negligible increase is predicted due to the general increase in traffic on the A52 and the A38 north of Markeaton junction. A corresponding increase in traffic noise levels is predicted to the east of Markeaton junction. The proposed 4.0m noise barrier at the school (refer to Figure 9.1a and Environmental Masterplan Figure 2.12c [**TR010022/APP/6.2**]) limits the magnitude of the impact at the Royal School for the Deaf to a moderate increase at Lydia House used by boarding pupils during the week and a small number of facades on the north-east corner of the Karten Building (this area of the building contains offices and meeting rooms, not classrooms). The traffic noise level increase would be due to the relocation of the A38 mainline closer to the school and the removal of the shielding currently provided by the properties on Queensway which would be demolished by the Scheme. At all other school buildings the change in traffic noise levels is anticipated to be negligible or minor (not significant). It is noted that the DS traffic noise levels at the worst affected school buildings (Lydia House and the Karten building) are not dissimilar to the DM traffic noise levels at other parts of the school close to the A52. Without the proposed 4.0m noise barrier, major increases in traffic noise would be anticipated at the Royal School for the Deaf.

Little Eaton junction

9.10.41. At Little Eaton junction, the Ford Farm Mobile Home Park would generally experience a negligible reduction in noise levels in the short term as they are currently in very close proximity to the existing junction – the proposed Little Eaton junction would be slightly further away from the mobile home park with the Scheme in place, whilst a 2.5m noise barrier would be provided on the northbound A38 mainline in the vicinity of the mobile home park (refer to Figure 9.1b and Environmental Masterplan Figure 2.12f [**TR010022/APP/6.2**]). In Allestree the closure of the Ford Lane access with the A38 would reduce traffic flows in the eastern half of the housing estate, although there would be a corresponding increase in traffic flows in the western half of the estate as traffic would access the A6 to join the A38 at Palm Court junction. Overall a negligible change in noise levels is anticipated in the majority of Allestree, with small areas experiencing a minor traffic noise level increase. Separately to the Scheme,

Highways England is currently investigating noise mitigation measures on the A38 mainline south of Allestree, outside the Scheme extents, with regard to addressing Noise Important Area 8245*.

9.10.42. In Little Eaton village the majority of residential receptors would experience a negligible increase in noise levels due to the slight increase in traffic on the A38 north of the Scheme. In addition, traffic flows on B6179 Alfreton Road and Duffield Road through the village would increase with the Scheme in place as the reduction in congestion at Little Eaton junction would make these more attractive routes to the A38. A minor increase in noise levels is predicted along Duffield Road, compared to a negligible increase on B6179 Alfreton Road, due to the much lower DM flows on Duffield Road.

9.10.43. A minor increase in traffic noise levels on the A61 south of the Scheme is anticipated, due to the increase in traffic flows and speeds caused by the reduction in congestion with the Scheme in place. This would contribute to the predicted negligible increase in traffic noise in the south-west of Breadsall, along with the increase in traffic flows through the village on Croft Lane and Brookside Road.

9.10.44. The relocation of the A38 to the south and east of the existing Little Eaton junction as part of the Scheme would reduce traffic noise levels to the north and west and increase them to the south and east. However, the noise impact at the closest receptors in Breadsall would be limited to no more than negligible by the inclusion of 2.5m high noise barriers on both the southbound diverge slip road to the A61 and along the southbound mainline (refer to Figure 9.1b and Environmental Masterplan Figures 2.12f/12.2g [**TR010022/APP/6.2**]). With the noise barriers in place, slight reductions in traffic noise are anticipated at the western facades of some properties facing the A38.

Long-term changes

9.10.45. Table 9.17 summarises the long term change in predicted traffic noise levels between the 2024 DM and 2039 DS scenarios. The long term traffic noise changes from DM 2024 to DS 2039 are presented as a noise difference contour plots in Figures 9.5a and 9.5b [**TR010022/APP/6.2**].

Table 9.17: Long-term change in predicted Do-Something traffic noise levels (DM 2024 to DS 2039)

Change in noise level		Daytime		Night-time
		Number of residential buildings	Number of other sensitive receptors	Number of residential buildings
Increase in noise level daytime $L_{A10,18h}$ dB night-time $L_{night,outside}$ dB	0.1 - 2.9	10,052	52	1,708
	3.0 - 4.9	106	1	14
	5.0 - 9.9	0	1	0
	≥10	0	0	0
No change	0	25	0	46

Change in noise level		Daytime		Night-time
		Number of residential buildings	Number of other sensitive receptors	Number of residential buildings
Decrease in noise level daytime $L_{A10,18h}$ dB night-time $L_{night,outside}$ dB	0.1 - 2.9	75	0	212
	3.0 - 4.9	3	0	18
	5.0 - 9.9	0	0	2
	≥10	0	0	0

9.10.46. In the long term (2024 DM to 2039 DS) the same general pattern of traffic noise level change is observed as in the short term as described above. Increases and decreases at residential properties in the long term daytime are all negligible or minor (not significant). At night, two residential buildings in the vicinity of Raleigh Street would experience a moderate (significant) reduction in noise levels.

9.10.47. The daytime increase in traffic noise levels at the Royal School for the Deaf would remain moderate (significant), again this impact would be limited to the north-east facades of the Karten building which is not used for teaching.

9.10.48. Table 9.18 outlines the worst case change in annoyance due to the Scheme. The majority of receptors would experience a slight increase in annoyance. It should be noted that a 0.1dB increase in traffic noise levels equates to a 9.8% increase in annoyance in the short term. The one residential building which would experiences a 30% <40% increase in annoyance is Lydia House within the Royal School for the Deaf site.

Table 9.18: Worst-case change in traffic noise annoyance

Change in % annoyed		Daytime
		Number of residential buildings
Increase in annoyance level	<10%	664
	10% <20%	7,548
	20% <30%	1,949
	30% <40%	1
	≥40%	0
No change	0%	26
Decrease in annoyance level	<10%	73
	10% <20%	0
	20% <30%	0
	30% <40%	0
	≥40%	0

Receptors between 600m and 1km

9.10.49. For receptors that are within 1km of the Scheme and the section of the A38 replaced by the Scheme, but not within 600m of an affected route, only negligible increases and decreases in traffic noise levels are expected in both the short and long term. This includes the residential development at land north-west of Mansfield Road, Breadsall Hilltop.

Operational traffic noise – above SOAEL

9.10.50. Table 9.19 details the number of residential buildings in the 600m study area which would have one or more facades above the daytime or night-time SOAEL for the four assessment scenarios.

9.10.51. The Scheme would result in a slight reduction in the overall number of residential buildings above the SOAEL in the Scheme opening year (2024) and in the future assessment year (2039) during both the day and night. Residential buildings which would experience traffic noise levels being reduced to below the SOAEL with the Scheme in operation are concentrated in Mackworth and New Zealand each side of the A38 (including within Noise Important Area 8005) behind the proposed 1.5m noise barriers or close to existing accesses onto the A38 which would be closed by the Scheme, as well as at the Ford Farm Mobile Home Park.

Table 9.19: Number of residential buildings above the SOAEL

Scenario	Day	Night
2024 DM	1,127	1,895
2039 DM	1,299	1,965
2024 DS	1,115	1,799
2039 DS	1,248	1,865

9.10.52. The majority of residential buildings above the SOAEL, both with and without the Scheme, are in close proximity to main roads including the A38, the A6, Alfreton Road, the A52, Kedleston Road, and Uttoxeter New Road and more minor roads within New Zealand, Mackworth and Allestree where properties are very close to the road.

Operational traffic noise – Noise Insulation Regulations

9.10.53. A preliminary consideration of properties which may qualify for noise insulation works under the Noise Insulation Regulations has identified 13 residential buildings. These are residential units at Kingsway hospital, new flats at the Kingsway Hospital site, properties on the corner of Lyttelton Street and Kingsway Park Close, the caretakers flat at the Army Reserves Centre on Windmill Hill Lane, properties on the A52 Ashbourne Road adjacent to Markeaton junction, and properties in the south-east corner of Allestree closest to Little Eaton junction.

9.10.54. A complete Noise Insulation Regulations assessment would be completed at a later stage of the project when the Scheme design is finalised and in accordance with the timescales set out in the Regulations.

Operational traffic vibration

9.10.55. A summary of the long term change in annoyance due to airborne vibration from road traffic due to the Scheme is provided in Table 9.20. In the DS scenario a total of 951 residential buildings have been identified within 40m of the Scheme, the existing A38 which would be replaced by the Scheme, and the identified affected routes within the 1km study area. In the DS scenario 63 residential buildings would be located along the A38 and/or Scheme with the remainder located along affected routes. Traffic noise levels at 327 of these 951 residential buildings would be below the cut off of 58dB $L_{A10,18h}$ in both 2024 and 2039, below which annoyance due to airborne vibration from road traffic is assumed to be zero. These buildings are all located on affected routes.

Table 9.20: Long-term change in Do-Something traffic vibration annoyance (DM 2024 to DS 2039)

Change in % annoyed		Daytime
		Number of residential buildings
Increase in annoyance level	<10%	573
	10% <20%	0
	20% <30%	0
	30% <40%	0
	≥40%	0
No change	0%	343
Decrease in annoyance level	<10%	35
	10% <20%	0
	20% <30%	0
	30% <40%	0
	≥40%	0

9.10.56. The majority of residential buildings would experience a small increase in annoyance level. This would be due to a combination of the normal growth of traffic over time from 2024 to 2039 and the additional traffic in the area attracted by the Scheme. A total of 35 residential buildings would experience a small decrease in annoyance based on the worst affected façade - these are concentrated in the vicinity of Raleigh Street and Enfield Street which currently have accesses onto the A38, but which would be closed by the Scheme. The effect of the Scheme on operational airborne vibration impacts is classed as not significant.

Operational traffic noise – affected routes

9.10.57. Table 9.21 details the ST and LT change in the CRTN BNL at the identified affected routes beyond the 1km wider study area due to the Scheme. The location of these roads is illustrated in Figure 9.2 [**TR010022/APP/6.2**].

Table 9.21: Affected routes beyond 1km - change in traffic noise levels

Link ref.	Description	Number of receptors within 50m		BNL $L_{A10,18h}$ dB at 10m from the road			
		Residential	Non-residential	2024 DS	2039 DS	ST change	LT change
2663_3503	A38 eastbound merge slip road from the A6, Allestree	20	0	70.8	71.5	+1.5	+2.2
3503_2656	A38 eastbound diverge slip road to A6, Allestree	3	0	64.9	65.6	+1.3	+2.0
9088_9280	Intakes Lane, Mugginton Lane End to A517 (Ashbourne Road), Cross o' th' hands	3	1 Place of Worship	57.8	59.2	-1.3	+0.1
9088_9089	Mercaston Lane, Alder Lane to Intakes Lane, Mugginton Lane End, North of Mercaston	30	2 Places of Worship	60.0	61.5	-1.3	+0.2
9089_9451	Mercaston Lane, North Lane to Alder Lane, south-west of Mercaston	6	0	60.5	61.9	-1.1	+0.3
9330_4046	Eaton Bank, Rigga Lane to Duffield Road, Church Lane, Little Eaton	85	0	66.3	66.4	+1.5	+1.6
4046_9221	Eaton Bank, Duffield Bridge to Rigga Lane, Duffield Bank	28	0	63.4	63.7	+1.3	+1.6
9607_9608	Morley Lane, Alfreton Road to Quarry Road (outside 1km study area)	43	0	62.6	63.7	+1.7	+2.8
9607_9609	Quarry Road, Morley Lane to Brick Kiln Lane	0	0	60.7	61.6	+2.4	+3.3
9609_9606	Brick Kiln Lane, Quarry Road to A608, Morley Smithy	27	0	64.2	64.8	+1.3	+1.9

9.10.58. All of the identified affected links beyond 1km would experience a minor change in traffic noise levels in the short term. In the long term they would all experience a negligible or minor increase in traffic noise levels, which includes the effects of natural growth in traffic over time.

9.10.59. Mercaston Lane/Intakes Lane is a very minor local road used as a ‘rat run’ which would experience a reduction in flow due to the Scheme. The A38 slip road at Palm Court junction, Eaton Bank north of Little Eaton and Morley Lane, Quarry Road/Brick Kiln Lane would all experience a small increase in traffic flows as traffic would re-route due to the Scheme.

9.10.60. It is noted that the majority of affected routes are minor roads with a low flow (1,000 – 4,000 vehicles 18 hour flow) in all scenarios. Therefore, the CRTN low flow correction procedure enhances the impact of relatively modest changes in traffic flow. Only the two sections of the A38 slip roads at Palm Court junction and Eaton Bank in Little Eaton would have traffic flows above 4,000 vehicles.

Summary of operational traffic environmental effects

9.10.61. A summary of the identified traffic noise environmental effects is provided in Table 9.22, including a summary of the justification for the effect significance conclusions.

Table 9.22: Summary of operational traffic environmental effects

Receptor	Magnitude of impact in short term	Significance	Justification
Properties backing onto Kingsway Park Close	Negligible/minor increase	Not significant	Large increase in traffic flow on the new access link to Kingsway junction would be mitigated by a 1.5m high noise barrier.
New Zealand, Mackworth, Kedleston Road area and Kingsway Hospital area	Negligible/minor increase/ decrease	Not significant	Increased traffic in the area, increased traffic speed on A38 mainline, closure of local accesses onto the A38, realignment of A38 (horizontal and vertical), and re-routing of local traffic. There are properties above the SOAEL along the main roads, although some properties along the A38 mainline behind the noise barriers would have traffic noise levels reduced to below the SOAEL. Scheme unlikely to change residents and users of the non-residential receptors response to traffic noise.
Three residential buildings in vicinity of Raleigh Street, New Zealand	Moderate decrease	Significant beneficial	Moderate decrease in noise levels due to the closure of the existing access onto the A38 and the provision of a 1.5m high noise barriers along the A38 mainline.
Lydia House (used by boarding pupils during the week) and Karten Building, Royal School for the Deaf, Markeaton junction	Moderate increase	Significant adverse	Moderate increase in traffic noise at some facades. The A38 mainline (in cutting) and slip roads would be relocated closer to the school, whilst the intervening properties on Queensway would be demolished. A 4.0m high noise barrier would be provided on the school boundary in order to minimise the noise impact. The affected area of the Karten building is used as offices and meeting rooms (not classrooms). There would be negligible/minor changes in traffic noise levels within the remainder of the school.
Markeaton Park	Negligible increase to major decrease	Not significant	The A38 mainline would be in cutting and relocated further from the park. Some areas within the park would experience minor, moderate or major decreases in noise levels, although this is limited to the south-eastern section of the park.

Receptor	Magnitude of impact in short term	Significance	Justification
Allestree	Negligible/minor increase/ decrease	Not significant	Negligible increase in traffic noise at the majority of properties due to increased traffic in area, although there would be small number of properties with a minor increase in traffic noise levels. Minor/moderate traffic noise level decreases would be experienced at facades facing the eastern end of Ford Lane due to the closure of access onto the A38. Minor increases in traffic noise would be experienced at the western side of Allestree as local traffic would access or exit the estate off the A6 Duffield Road. Properties that are above the SOAEL are mainly located along A38 and the A6. The Scheme is unlikely to change resident responses to traffic noise.
Derwent Valley Mills World Heritage Ste	Negligible increase/ decrease	Not significant	Predominantly a negligible increase in traffic noise levels within the noise study area due to increased traffic in the area, a reduction in traffic noise in vicinity of Ford Lane due to closure of the A38 access.
Ford Farm Mobile Home Park	Negligible increase/decrease	Not significant	Worst affected facades would experience a negligible change in traffic noise. Minor or moderate decreases in noise levels would be experienced on facades facing the A38 as the Scheme would move the A38 mainline further away, plus noise mitigation provided by a 2.5m high barrier on the A38 mainline. Some properties would be reduced to below the SOAEL.
Breadsall	Negligible increase	Not significant	The A38 would be moved closer to the village, and the mainline would be positioned on an embankment. The magnitude of the traffic noise impact would be reduced to a negligible increase at the worst affected façades by the provision of 2.5m high noise barriers on the southbound A38 mainline and the diverge slip road to the A61. There would be a negligible or minor decrease in noise levels at some property facades facing the A38. The majority of properties are between the LOAEL and SOAEL. The Scheme is unlikely to change resident responses to traffic noise.

Receptor	Magnitude of impact in short term	Significance	Justification
Little Eaton	Negligible/minor increase	Not significant	There would be increased traffic flows through the village on routes connected to Little Eaton junction as the Scheme would mitigate congestion, making these more attractive routes to the A38. These would be predominantly negligible increases, although there would be minor increases in traffic noise along Duffield Road due to existing lower traffic flows. Properties above the SOAEL are mainly located along Alfreton Road. The Scheme is unlikely to change resident's response to traffic noise.
206 residential buildings on surrounding affected routes beyond 1km study area	Minor increase	Not significant	There would be minor increases in traffic noise levels on affected routes north and east of Little Eaton and on the A6 northbound off slip road at Palm Court junction. The Scheme is unlikely to change resident responses to traffic noise.
39 residential buildings and two places of worship on surrounding affected routes beyond 1km study area	Minor decrease	Not significant	There would be minor decreases in traffic noise levels on affected routes on minor roads to the north-west of the Scheme. The Scheme is unlikely to change residents and users of the non-residential receptors responses to traffic noise.

Compliance with NPSNN noise policy

9.10.62. As detailed in para. 9.3.42, the road traffic noise SOAEL and LOAEL are used to consider how the Scheme complies with the three policy aims detailed in paragraph 5.195 of the NPSNN (DfT, 2014) – this paragraph states:

'The Secretary of State should not grant development consent unless satisfied that the proposals will meet the following aims, within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life from noise as a result of the new development.
- Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development.
- Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.'

9.10.63. To maintain consistency with the DMRB terminology used throughout this assessment, the discussion below refers to adverse effects rather than impacts.

9.10.64. With regard to identifying sustainable noise mitigation measures, various factors have been considered – these include the cost versus the benefit, engineering practicality, generation of knock-on impacts (such as vegetation clearance, ecological effects, landscape and visual effects), and consultation and stakeholder engagement responses.

Construction phase

9.10.65. Significant adverse effects occur for construction noise and vibration levels above the SOAEL (see Table 9.2) which potentially occur for 10 or more days in 15, or 40 days in 6 months. Adverse effects occur at construction noise or vibration levels between the LOAEL and SOAEL. The requirement to effectively control and manage noise applies to all construction noise levels.

9.10.66. With regard to the first NPSNN aim, a significant adverse effect is predicted at the closest receptors to the construction works between Kingsway junction and Kedleston Road junction, at Little Eaton junction, the northern edge of Breadsall and adjacent to the works at the floodplain compensation area to the south of the A38 (west of the River Derwent). This is due to the close proximity of receptors to Scheme construction activities. At this stage a conservative approach has been taken, for example, any exceedances of the noise or vibration criteria are assumed to potentially exceed the duration criteria applied to identifying significant effects, and the potential benefit of site hoarding/enclosures for specific locations/activities/plant has not been included.

9.10.67. A range of mitigation measures would be implemented during the Scheme construction as detailed in Section 9.9 (and as detailed in the OEMP as provided in Appendix 2.1 [**TR010022/APP/6.3**]) – this includes:

- Selection of quiet and low vibration equipment and methodologies.
- Review of construction programme and methodology to consider low noise and low vibration methods.
- Optimal location of equipment on site to minimise noise disturbance.
- The provision of acoustic enclosures around static plant and site hoarding around specific locations/activities, where necessary.
- Use of less intrusive alarms, such as broadband vehicle reversing warnings.
- No start-up or shut down of large vibratory rollers within 50m of receptors (15m for medium sized twin drum rollers).
- Implementation of a construction noise insulation and temporary re-housing policy.
- Compliance with the working hours as specified within the draft DCO [**TR010022/APP/3.1**] (core working hours being 7:30am - 6pm Monday - Friday and 08:00am - 1pm Saturday, with no working on Sundays and Bank Holidays – refer to Chapter 2: The Scheme, Table 2.4 and paras. 2.6.62 to 2.6.64).

9.10.68. These mitigation measures would be set out in the CEMP (within a Noise and Vibration Management Plan), as based upon the OEMP as provided in Appendix 2.1 [**TR010022/APP/6.3**].

9.10.69. As detailed above, the construction contractor would review the proposed working methods to consider all sustainable mitigation measures, including identifying locations/activities/plant where site hoarding/enclosures would be installed to reduce the magnitude of the construction noise impact, with the aim of avoiding significant noise and vibration effects. However, there is the potential for some significant temporary adverse noise and/or vibration effects to remain.

This is acceptable in the context of sustainable development as factors including engineering practicality, cost versus benefit etc., as outlined above must also be considered. On this basis, it is considered that with the implementation of the mitigation measures outlined in the CEMP and in the context of sustainable development, the first aim of the NPSNN would be met during the Scheme construction phase.

9.10.70. With regard to the second NPSNN aim, adverse effects between the LOAEL and SOAEL are predicted at a range of receptors. The mitigation measures outlined in Section 9.9 (and the OEMP (see Appendix 2.1 [**TR010022/APP/6.3**])) would be applied throughout the Scheme construction works, and therefore would benefit all receptors experiencing construction noise or vibration, including those with levels between the LOAEL and SOAEL. Construction impacts between the LOAEL and SOAEL are acceptable in the context of sustainable development as factors including engineering practicality, cost versus benefit etc., as outlined above, must also be considered. On the basis of the above, with the effective implementation of the defined noise mitigation and minimisation measures, it is considered that the second NPSNN aim would be met during Scheme construction.

9.10.71. With regard the NPSNN third aim, construction by its nature introduces a new noise or vibration source into the existing environment and is temporary in duration. Therefore, the opportunities to improve existing noise levels during the Scheme construction phase are very limited.

Operational phase

9.10.72. Significant operational phase adverse noise effects would occur at traffic noise levels above the SOAEL (see Table 9.6), whilst adverse effects would occur at traffic noise levels between the LOAEL and SOAEL. The requirement of the NPSNN third aim to improve where possible applies to all traffic noise levels. Table 9.19 details the number of residential buildings in the study area which are above the SOAEL both with and without the Scheme. Almost all the remaining residential buildings in the study area are between the LOAEL and the SOAEL, both with and without the Scheme, as the night time LOAEL is set at a low level.

9.10.73. With regard to the first NPSNN aim, the vertical and horizontal alignment of the Scheme, the closure of existing accesses onto the A38, the inclusion of low noise surfacing and the provision of 1.5m high noise barriers between Kingsway junction and Markeaton junction would reduce traffic noise levels from above the SOAEL (in both DM scenarios) to below the SOAEL (in both DS scenarios) at 197 residential properties. These properties are located predominantly between Kingsway junction and Markeaton junction, and at the Ford Farm Mobile Home Park. The proposed height of the barriers between Kingsway junction and Markeaton junction has aimed to balance the need to provide noise mitigation, whilst also not obstructing property views. Feedback from statutory consultation events identified that the majority of residents wanted noise mitigation, however, there were concerns with the provision of high noise barriers.

9.10.74. The majority of the remaining residential buildings which would be above the SOAEL following Scheme opening are in close proximity to main roads, including the A38, Uttoxeter New Road, the A52, Kedleston Road, the A6, and Alfreton Road, and also minor roads within New Zealand, Mackworth and Allestree where properties are very close to the road.

9.10.75. On the A38 the very closest properties would remain above the SOAEL with the Scheme in operation, although the mitigation measures highlighted herein would reduce traffic noise levels. Additional mitigation, such as increasing the height of the barriers between Kingsway and Markeaton, is not considered to be sustainable due to other impacts and consultation feedback, as discussed above.

9.10.76. With regard to other roads, the purpose of the Scheme to improve traffic conditions on the A38 by grade separating the junctions would result in small increases in traffic on roads connecting to these junctions and traffic re-routing due to the closure of existing local accesses onto the A38. The introduction of noise mitigation measures such as noise barriers along existing roads surrounding the Scheme which already experience high noise levels, to mitigate the effects of the Scheme, is not sustainable. Such roads in built up areas have many residential and commercial buildings fronting onto the applicable roads, therefore mitigation measures such as barriers are not a practical engineering option and would have other adverse impacts (including visual impacts) whilst also causing significant access difficulties. On the basis of the above discussion, it is considered that the first NPSNN aim has been met.

9.10.77. With regard to the second NPSNN aim, additional noise barriers have been incorporated into the Scheme design at Kingsway Park Close to protect properties backing onto the new access link onto Kingsway junction, and at Little Eaton junction – refer to Section 9.9 (and Figures 9.1a and 9.1b [**TR010022/APP/6.2**]). Residential receptors in these areas are generally not above the SOAEL, but would experience a non-significant adverse effect due to the Scheme – such effects have been minimised through the inclusion of these noise barriers within the Scheme design. The decision to include these noise barriers was made in part to demonstrate that the second NPSNN aim is met. The proposed height of the barriers at Little Eaton junction has aimed to balance the need to provide noise mitigation, whilst also not having an adverse landscape impact. Feedback during statutory consultation indicated that there was a strong preference for noise barriers on the southbound A38 mainline and the southbound diverge slip road to the A61 (refer to Chapter 3: Scheme History and Assessment of Alternatives, Table 3.10).

9.10.78. The inclusion of the above identified mitigation measures as detailed in Section 9.9 (and the OEMP(refer to Appendix 2.1 [**TR010022/APP/6.3**])) demonstrates that, within the context of sustainable development, at receptors between the LOAEL and the SOAEL, the Scheme meets the requirements of the second NPSNN aim. No areas where additional mitigation would be appropriate, within the context of sustainable development, have been identified i.e. considering engineering practicality, cost, other potential impacts such as landscape and visual impacts, ecological considerations, and consultation responses.

9.10.79. With regard to the third NPSNN aim to 'improve where possible', the closure of a number of accesses onto the A38, the realignment of the A38 mainline into underpasses at Kingsway junction and Markeaton junction and inclusion of various noise barriers along the Scheme, provide noise improvements in some areas. These improvements are not fully reflected within the DMRB analysis as reported herein which takes a worst-case approach focussed on the worst affected façade of each property. For example, the façades of properties facing the A38 between Kingsway junction and Markeaton junction behind the 1.5m noise barriers, and properties on the western edge of Breadsall, would experience a reduction in traffic noise levels. On this basis, it is considered that the third NPSNN aim has been met.

9.11. Monitoring

9.11.1. Given the construction noise and vibration effects as reported in Section 9.10, monitoring would be undertaken during the Scheme construction stage to ensure that the mitigation measures as detailed in Section 9.9 (and in the contractor's CEMP/Noise and Vibration Management Plan) were being appropriately implemented. During the construction phase, surveys would be required which would include physical measurements and observational checks and audits to ensure that BPM were being employed at all times. The contractor would undertake and report noise and vibration surveys as is necessary to ensure and demonstrate compliance with all noise and vibration commitments and the requirements of the CEMP/Noise and Vibration Management Plan (refer to Section 9.11). As detailed in the OEMP (refer to Appendix 2.1 [**TR010022/APP/6.3**]), proposals for all survey locations would be set out in the CEMP/Noise and Vibration Management Plan.

9.11.2. As detailed in Section 9.9, the performance specification of specific operational mitigation measures would be confirmed at the Scheme detailed design stage to ensure the performance assumed in the assessment is achieved. Surveys would be undertaken to ensure that measures were installed as required. No further monitoring of significant operational noise effects is proposed.

9.12. Summary of assessment

9.12.1. Significant adverse construction noise and/or vibration annoyance effects are anticipated at the closest receptors to the Scheme between Kingsway junction and Kedleston Road junction, at the Ford Farm Mobile Home Park, the northern edge of Breadsall and adjacent to the Scheme works at the floodplain compensation area to the west of Little Eaton junction. Building damage vibration effects are not anticipated with minimum standoff distances between receptors and vibratory rollers (during their start-up and shut-down) in place. Significant construction traffic effects are anticipated in a small number of locations during some construction phase traffic management scenarios. This would be due to anticipated re-routing of local traffic through Mackworth and New Zealand, the demolition of buildings at Queensway which provide noise shielding to the Royal School for the Deaf and adjacent residential properties, and the use of the new southbound slip roads at Markeaton junction for mainline traffic (whilst the new mainline through Markeaton junction is being constructed).

9.12.2. As Scheme operation would resolve the existing congestion issues at these A38 junctions, traffic would be attracted to the area. In addition, the speed limit between Kingsway junction and Markeaton junction would be increased from 40mph to 50mph. As a result, the overall trend in the study area is for a slight increase in operational traffic flows, and therefore traffic noise. However, only one receptor, namely the Royal School for the Deaf, is anticipated to experience a moderate (significant) increase in traffic noise – this effect would be restricted to the worst affected façades of Lydia House which is used by boarding pupils during the week, and at the Karten building which is used for offices and meeting rooms. At all other school buildings the change in traffic noise levels is anticipated to be negligible or minor (not significant). The predicted operational traffic noise levels at Lydia House and the Karten building are not dissimilar to without Scheme traffic noise levels at other parts of the school close to the A52.

9.12.3. Reductions in operational traffic noise are anticipated in the vicinity of existing accesses onto the A38 which would be closed by the Scheme – this includes properties on Raleigh Street, Enfield Road and Ford Lane. Noise levels would also be reduced where the A38 would be realigned further away from receptors – this includes properties on Greenwich Drive South, within Markeaton Park and at the Ford Farm Mobile Home Park.

9.12.4. Traffic re-routing within Markeaton and New Zealand would occur during Scheme operation due to the closure of local accesses onto the A38, resulting in traffic noise effects that are negligible or minor (not significant).

9.12.5. A summary of the noise and vibration impact assessment is provided in Table 9.23.

Table 9.23: Noise and vibration - summary of effects

Receptor	Attribute	Impact description	Design and mitigation measures (refer to Section 9.9 and OEMP (Appendix 2.1 [TR010022/APP/6.3]))	Impact magnitude	Residual effect
Closest receptors to construction works between Kingsway junction and Kedleston Road junction, Ford Farm Mobile Home Park, the northern edge of Breadsall and works at the floodplain compensation area	Construction noise	Noise levels exceeding the SOAEL for some activities	• Use of Best Practicable Means (BPM) and compliance with the control measures as detailed in the CEMP*. Additional measures such as the use of localised temporary site hoardings or noise barriers	Exceeds SOAEL	Significant adverse
Other receptors in the vicinity of the works	Construction noise	Noise levels below the SOAEL	• Use of BPM and compliance with the control measures as detailed in the CEMP*	Below SOAEL	Not significant
Approximately 150 receptors within 50m of earthworks using large vibratory rollers (Ford Farm Mobile Home Park, south end of Ford Lane, properties between Kingsway junction and Markeaton junction and closest buildings at Royal School for the Deaf)	Construction vibration - human receptors (annoyance)	Vibration levels exceeding SOAEL	• No start-up or run-down of vibratory plant to be undertaken within 50m of receptors (large rollers) and 15m of receptors (medium sized twin drum rollers) • Use of BPM and compliance with the control measures as detailed in the CEMP* • Contactor to undertake detailed appraisal as set out in the OEMP	Exceeds SOAEL	Significant adverse
Receptors beyond 50m of earthworks using large vibratory rollers	Construction vibration - human receptors (annoyance)	Vibration levels below SOAEL	• No start up or run-down of vibratory plant to be undertaken within 50m of receptors (large rollers) and 15m of receptors (medium sized twin drum rollers) • Use of BPM and compliance with the control measures as detailed in the CEMP*	Below SOAEL	Not significant

Receptor	Attribute	Impact description	Design and mitigation measures (refer to Section 9.9 and OEMP (Appendix 2.1 [TR010022/APP/6.3]))	Impact magnitude	Residual effect
Closet receptors to earthworks or roadworks using large or medium sized rollers	Construction vibration - damage	Vibration levels considerably below onset of cosmetic damage criteria	• No start up or run-down of vibratory plant to be undertaken within 50m of receptors (large rollers) and 15m of receptors (medium sized twin drum rollers) • Use of BPM and compliance with the control measures as detailed in the CEMP*	Below criteria	Not significant
Closest receptors at Royal School for the Deaf, west end of A52 Ashbourne Road and traffic re-routing on minor roads within Mackworth and New Zealand	Construction traffic	Increases in traffic noise levels in some traffic management scenarios	• Early installation of the operational noise barrier at the Royal School for the Deaf • Implementation of traffic management measures as detailed in the Traffic Management Plan (refer to Appendix 2.3 [**TR010022/APP/6.3**])	Moderate adverse	Significant adverse
Other receptors along existing road network	Construction traffic	Changes in traffic noise levels	• Early installation of the operational noise barriers on the southbound off slip at Little Eaton junction and Kingsway Park Close • Implementation of traffic management measures as detailed in the Traffic Management Plan (refer to Appendix 2.3 [**TR010022/APP/6.3**])	Negligible/ minor adverse	Not Significant
Lydia House (used by boarding pupils during the week) and the Karten building at the Royal School for the Deaf, Markeaton junction	Operational traffic noise	Increases in operational traffic noise	• Mainline in underpass • 4.0m noise barrier on school boundary • Scheme provided with low noise surfacing	Moderate adverse	Significant adverse

Receptor	Attribute	Impact description	Design and mitigation measures (refer to Section 9.9 and OEMP (Appendix 2.1 [TR010022/APP/6.3]))	Impact magnitude	Residual effect
Three residential buildings in vicinity of Raleigh Street, New Zealand	Operational traffic noise	Decreases in operational traffic noise	• 1.5m noise barrier on the A38 mainline • Closure of existing local access onto the A38 • Scheme provided with low noise surfacing	Moderate beneficial	Significant beneficial
New Zealand, Mackworth, Kedleston Road area and Kingsway Hospital area	Operational traffic noise	Increases and decreases in operational traffic noise	• Scheme horizontal and vertical alignment • 1.5m noise barriers on the A38 mainline • Closure of local accesses onto the A38 • Scheme provided with low noise surfacing	Negligible/ minor adverse/beneficial	Not significant
Properties backing onto Kingsway Park Close	Operational traffic noise	Increases in operational traffic noise	• 1.5m noise barrier on Kingsway Park Close	Negligible/ minor adverse	Not significant
Markeaton Park	Operational traffic noise	Increases and decreases in operational traffic noise	• Scheme horizontal and vertical alignment • Scheme provided with low noise surfacing	Negligible adverse to major beneficial	Not significant
Ford Farm Mobile Home Park	Operational traffic noise	Increases and decreases in operational traffic noise	• Scheme horizontal alignment • 2.5m noise barrier on the A38 mainline • Scheme provided with low noise surfacing	Negligible adverse/ beneficial	Not significant
Breadsall	Operational traffic noise	Increases in operational traffic noise	• 2.5m barrier on the A38 mainline and south bound off slip road • Scheme provided with low noise surfacing	Negligible adverse	Not significant
Allestree	Operational traffic noise	Increases and decreases in operational traffic noise	• Scheme provided with low noise surfacing • Closure of Ford Lane access onto the A38	Negligible/ minor adverse/beneficial	Not significant

Receptor	Attribute	Impact description	Design and mitigation measures (refer to Section 9.9 and OEMP (Appendix 2.1 [TR010022/APP/6.3]))	Impact magnitude	Residual effect
Little Eaton	Operational traffic noise	Increases in operational traffic noise	-	Negligible/ minor adverse	Not significant
Derwent Valley Mills World Heritage Site	Operational traffic noise	Increases and decreases in operational traffic noise	• Scheme provided with low noise surfacing • Closure of Ford Lane access onto A38	Negligible adverse/ beneficial	Not significant
206 residential buildings on surrounding affected routes beyond 1km study area	Operational traffic noise	Increases in operational traffic noise	-	Minor adverse	Not significant
39 residential buildings and 2 places of worship on surrounding affected routes beyond 1km study area	Operational traffic noise	Decreases in operational traffic noise	-	Minor beneficial	Not significant
Receptors within 40m of the Scheme or existing A38 and affected routes	Operational airborne traffic vibration	Annoyance	• Scheme horizontal and vertical alignment • Provision of noise barriers • Scheme provided with low noise surfacing	Negligible adverse	Not significant

* included within the Noise and Vibration Management Plan (which forms part of the CEMP)

9.13. References

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