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1. Witness Information

1.1.1. My name is Alfred Maneylaws. I am an Associate with AECOM Infrastructure & Environment UK Limited. My academic qualifications comprise a BSc (Hons) in Mechanical Engineering and an MSc in Applied Acoustics. I am a Corporate Member of the Institute of Acoustics and have over twenty five years' experience in the acoustics field.

1.1.2. During my employment with AECOM I have completed noise and vibration impact assessments for a broad range of projects covering road, rail, industrial and commercial developments.

1.1.3. In particular, I have provided assessments for a number of major road schemes, including the A30 Bodmin to Indian Queens Improvement, the A47 Blofield to North Burlingham Improvement, the A46 Newark to Widmerpool Improvement, the A421 M1 to Bedford Improvement, the A5-M1 Link Road, York Street Interchange in Belfast, the M3 J2 to 4a Smart Motorway and the M4 J3 to 12 Smart Motorway.

1.1.4. I am responsible for the noise and vibration impact assessment and the resulting noise and vibration impact assessment report for the Scheme.

1.1.5. The purpose of my evidence is to present the findings of the noise and vibration impact assessment for the Scheme.

2. Scope of Evidence

2.1.1. On the 6th October 2017 Leicestershire County Council made the Leicestershire County Council (Zouch Bridge Replacement) Scheme 2017, the "Scheme", and the Leicestershire County Council (A6006 Zouch Bridge Replacement, Classified Road) (Side Roads) Order 2017, the "SRO". On 6th November 2017 the Council made the Leicestershire County Council (Zouch Bridge Replacement) Compulsory Purchase Order 2017, the "CPO"; collectively the Scheme, the SRO and the CPO are referred to as the "Orders".

2.1.2. The Orders have been made to enable construction and operation of the Scheme following the grant of planning permission.

2.1.3. The Orders were submitted to the Secretary of State for Transport, National Transport Casework Team, Tyneside House, Skinnerburn Road, Newcastle Business Park, Newcastle upon Tyne, NE4 7AR in December 2017 for confirmation. The Department for Transport has issued an acknowledgement letter dated the 5th January 2018 indicating that objections have been received to the SRO and CPO, although none to the Scheme, and accordingly a Public Inquiry is to be held unless all statutory objections are withdrawn.

2.1.4. The Council considers that there is a compelling case in the public interest for the making and confirmation of the Orders to secure the outstanding land and property rights and interests (the "Order Land") as described in the schedule to the Order and shown on the map referred to in the Order (the "Order Map") and for the purposes of implementing the Scheme.

2.1.5. The purpose of my evidence is to present the findings of the noise and vibration impact assessment for the Scheme, as part of the Council's case at Public Inquiry.

2.1.6. In Section 3 of my evidence I provide a description of the Scheme, focussing on those features relevant to noise and vibration. I then go on to provide a summary of the planning policy and guidance relevant to noise and vibration in Section 4.

2.1.7. In Section 5 of my evidence I present the results of a baseline noise survey, carried out in April 2016. This survey was carried out to provide an appreciation of the prevailing noise climate in the area and to quantify existing noise levels for employment in the assessment for the Scheme.

2.1.8. I then go on to present the effects of the Scheme in Section 6, based on the results of the noise and vibration assessment work carried out in 2016 and 2017. I first discuss construction noise and vibration effects, before going on to discuss operational effects.

2.1.9. Whilst it is shown in Section 6 of my evidence that there are no significant adverse operational effects resulting from the implementation of the Scheme, I then consider in Section 7 the potential for further noise mitigation to residential properties on Main Street.

2.1.10. In Section 8 of my evidence I present an assessment of the alternative on-line route, covering both construction and operational effects, before moving on to issues raised by objectors in Section 9 and concluding remarks in Section 10.

2.1.11. There are four appendices referenced in my evidence, presented in Inquiry document "Zouch Bridge Replacement: Noise and Vibration – Appendices A to D".

2.1.12. Appendix A sets out the methodologies employed for the calculation and assessment of noise and vibration impacts for both construction and operation.

2.1.13. Appendix B presents a site plan, showing the location of the existing bridge, the scheme and the sensitive receptors employed in the assessment.

2.1.14. Appendix C presents the activities and associated plant employed in the calculation of construction noise and vibration impacts.

2.1.15. Finally, Appendix D presents noise level change contours, illustrating the impact of the Scheme in the short term and in the long term.

3. Description of the Scheme

3.1.1. The existing Zouch Bridge is situated within Zouch village in Leicestershire, 5 km north of Loughborough at approximate Ordnance Survey Grid Reference (OSGR) SK 50260 23240. The preferred location for the replacement bridge is slightly to the south of the existing one, which traverses the River Soar between Hathern Parish and Normanton on Soar Parish. This removes the need for substantial traffic diversions which would be needed during construction if the replacement bridge was built in the same place.

3.1.2. With respect to potential noise and vibration impacts, there are three main factors which must be considered:-

- The relocation of the replacement bridge and the approach roads to the south of the existing bridge.
- The replacement bridge sits at a higher level than the existing bridge.
- Currently, the speed limit over the existing bridge is 60mph, reducing to 40mph approximately 80m to the east of the bridge. With the new bridge in place it is proposed to extend the 40mph speed limit to approximately 130m west of the bridge.

3.1.3. All of these factors have been taken into account in developing the detailed assessment of noise and vibration impacts.

4. Planning Policy and Guidance

National Planning Policy Framework

4.1.1. The National Planning Policy Framework (NPPF) was first introduced in March 2012 and sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

4.1.2. The latest version of the NPPF was published in July 2018 and replaces the 2012 version.

4.1.3. In the Introduction, the 2018 version of the NPPF states:-

> Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. The National Planning Policy Framework must be taken into account in preparing the development plan, and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

4.1.4. Chapter 15 of the NPPF deals with conserving and enhancing the natural environment. Paragraph 180 in Chapter 15 states:-

> Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:
>
> - mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
> - identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
> - limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

4.1.5. With regard to 'adverse impacts' and 'significant adverse effects', the NPPF refers to the Noise Policy Statement for England (NPSE) Explanatory Note.

Noise Policy Statement for England

4.1.6. The NPSE sets out the long term vision of the UK Government's noise policy, which is to "promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development".

4.1.7. This long term vision is supported by three aims:

- “Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvements of health and quality of life.”

4.1.8. The long term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

Planning Policy Guidance

4.1.9. In March 2014, the Department for Communities and Local Government (DCLG) released its Planning Practice Guidance (PPG) web-based resource to support the NPPF. The guidance advises that local planning authorities should consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

5. Baseline Conditions

5.1.1. To assist in the understanding of the technical information presented in this proof of evidence, noise theory and terminology are provided in Appendix A.

Measured Noise Levels

5.1.2. A baseline noise survey was conducted on 21st and 22nd April 2016. Medium-term unmanned monitoring (48 hours) was undertaken at two locations (LT1 and LT2). The noise monitoring locations are shown in Figure B.1 in Appendix B. The locations were selected as they represent the closest noise sensitive properties to the proposed Scheme.

5.1.3. The instrumentation employed conformed to the requirements of BS 7445: 2003, being of class Type 1 and calibrated within the previous two years. The calibration level of the meters was checked prior to and immediately after all noise measurements. No significant change in the calibration level was noted (+/- 0.1 dB).

5.1.4. The measurements conformed to the requirements of BS 7445: 2003 with regards to the positioning of the meters. During all monitoring, weather conditions were generally dry with wind speeds below 5 m/s. Local observed weather conditions are provided in Table 5.1.

Table 5.1: Weather Conditions During Noise Monitoring

Date	Wind Speed m/s	Wind Direction	Observations
21/04/2016	2.1	E	Dry, clear
22/04/2016	4.0	E	Dry, cloudy

5.1.5. The derived daytime and night-time noise levels derived from the measurement data are provided in Table 5.2 below.

Table 5.2: Measured Noise Levels

Measurement Location	Day 07:00- 19:00	Evening 19:00 – 23:00	Night 23:00-07:00
	$L_{Aeq,T}$ (dB)	$L_{Aeq,T}$ (dB)	$L_{Aeq,T}$ (dB)
LT1: Mobile Home Park	69	68	60
LT2: 29 Main Street	58	57	52

5.1.6. The measured noise levels are presented as $L_{Aeq,T}$ levels so that they can be employed in the construction noise assessment to define Threshold Values (as explained in Section 6 and Appendix A of my evidence).

5.1.7. The $L_{Aeq,T}$ (dB) is the single number that represents the average sound energy measured over the time period T. It is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period.

Observations

5.1.8. Road traffic on the A6006 was the dominant noise source. Other noise sources were birdsong and occasional overhead aircraft. During the site visits there were no boats observed along the River Soar but it is expected that these will also be a source of noise that influences the noise climate at the closest residential receptors.

5.1.9. The noise measurements were undertaken at locations representative of the closest noise sensitive receptors to the proposed Scheme. Noise measurements at 29 Main Street are deemed to be representative of 25 Main Street and also 26 Main Street as both these receptors are located a similar distance from the A6006.

6. Effects of the Scheme

Methodology

6.1.1. The methodologies for the calculation and assessment of construction and operational noise and vibration impacts are provided in Appendix A.

Receptors

6.1.2. The assessment has identified the likely impacts at a selection of the closest sensitive receptors (R1 – R4) to the Scheme. The selected receptors are:

- R1: 1, County Bridge Mobile Home Park;
- R2: 26, Main Street;
- R3: 29, Main Street; and
- R4: 25, Main Street.

6.1.3. The locations of the selected receptors are shown in Figure B.1 in Appendix B.

Construction

6.1.4. Table 6.1 details the Threshold Values for each receptor, determined using the ABC Method in BS 5228 (Table A2 in Appendix A) and the measured baseline noise levels in Table 5.2.

Table 6.1: Threshold Values for Construction Noise Assessment

Receptor	Measured Daytime (07:00-19:00) L_{Aeq} (dB)	Threshold Value L_{Aeq} (dB)
R1: Mobile Home Park	69	75
R2: 26 Main Street	58	65
R3: 29 Main Street	58	65
R4: 25 Main Street	58	65

6.1.5. Sound power levels for each item of equipment for each construction activity have been sourced from BS 5228-1, which gives measured noise levels for various items of construction plant. These data are provided in Appendix C.

Construction of New Bridge

6.1.6. The construction of the new bridge and approach roads only is expected to be undertaken over a period of approximately 12 months.

6.1.7. The calculated free-field construction noise levels, at the location of the closest façade to each phase of bridge construction, are provided in Table 6.2. Figures in bold exceed the Threshold Value.

Table 6.2: Calculated Construction Noise Levels – Bridge Construction

Receptor	Predicted Range of Construction Noise Levels $L_{Aeq,1h}$ dB							
	Site clearance	Earthworks	Construction of abutments and piers	Piling (CFA)	Retaining walls	Bridge steelwork	Deck construction	Roadworks
R1: Mobile Home Park	**80**	**77**	59	58	67	62	61	**78**
R2: 26 Main Street	**69**	**66**	64	64	64	**66**	65	**67**
R3: 29 Main Street	**71**	**68**	60	59	60	64	64	**69**
R4: 25 Main Street	**72**	**69**	56	56	56	61	60	**71**

6.1.8. The magnitude of impact for each construction activity at each receptor during the construction of the new bridge is provided in Table 6.3.

Table 6.3: Assessment of Daytime Construction Noise – Bridge Construction

Receptor		Difference Between Predicted Noise Level and Threshold Value (dB)							
		Site clearance	Earthworks	Construction of abutments and piers	Piling (CFA)	Retaining walls	Bridge steelwork	Deck construction	Roadworks
R1: Mobile Home Park	**Difference**	+5	+2	-16	-17	-8	-13	-14	+3
	Magnitude of Impact	Mod	Minor	Neg	Neg	Neg	Neg	Neg	Minor
R2: 26 Main Street	**Difference**	+4	+1	-1	-1	-1	+1	0	+2
	Magnitude of Impact	Mod	Neg	Neg	Neg	Neg	Neg	Neg	Minor
R3: 29	**Difference**	+6	+3	-5	-6	-5	-1	-1	+4

Main Street	**Magnitude of Impact**	Major	Minor	Neg	Neg	Neg	Neg	Neg	Mod
R4: 25 Main Street	**Difference**	+7	+4	-9	-9	-9	-4	-5	+6
	Magnitude of Impact	Major	Mod	Neg	Neg	Neg	Neg	Neg	Major

6.1.9. During construction of the proposed new bridge, noise levels are predicted to fall below the determined threshold values during the majority of the construction activities, resulting in a significance of effect of Slight Adverse. However, during periods when construction works are located in close proximity to the receptors, for site clearance and earthworks, the threshold values are exceeded by up to 7 dB, classed as a Major impact, resulting in a Large Adverse significance of effect. During roadworks (road construction and surfacing) predicted noise levels exceed the threshold values, resulting in an impact of Minor at two receptors, Moderate at one, and Major at one. At Receptor R4 (25 Main Street) predicted levels exceed the threshold value by up to 6 dB. This results in a significance of effect of Large Adverse.

6.1.10. The predicted levels are a worst-case scenario and although noise levels are predicted to be high during some construction activities, these will be of short duration at the closest approach. For example, site clearance, as anticipated, results in the highest noise levels but is a relatively short term, relatively fast moving activity and the resultant noise levels to any receptor will diminish with distance. When construction activities are located further away, predicted levels are expected to fall below the threshold values.

Demolition of Old Bridge

6.1.11. The demolition of the old bridge is expected to be undertaken over a period of approximately four months.

6.1.12. The calculated range of free-field construction noise levels, at the location of the closest façade to each phase of bridge demolition, are provided in Table 6.4. Figures in bold exceed the threshold values.

Table 6.4: Calculated Construction Noise Levels – Bridge Demolition

Receptor	**Predicted Range of Construction Noise Levels $L_{Aeq,1h}$ dB**				
	Breaking out of road surface	**Services diversion**	**Demolition of bridge**	**Break-up and removal of concrete block**	**Earthworks**
R1: Mobile Home Park	**87**	**80**	64	63	**84**
R2: 26 Main Street	**71**	64	**72**	**69**	**66**
R3: 29 Main Street	**66**	59	65	65	59

R4: 25 Main Street	**67**	60	62	62	60

6.1.13. The magnitude of impact for each bridge demolition activity at each receptor is provided in Table 6.5.

Table 6.5: Assessment of Daytime Construction Noise – Bridge Demolition

Receptor		Difference Between Predicted Noise Level and Threshold Value (dB)				
		Breaking out of road surface	Services diversion	Demolition of bridge	Break-up and removal of concrete block	Earthworks
R1: Mobile Home Park	Difference	+12	+5	-11	-12	+9
	Magnitude of Impact	Major	Moderate	Negligible	Negligible	Major
R2: 26 Main Street	Difference	+6	-1	+7	+4	+1
	Magnitude of Impact	Major	Negligible	Major	Moderate	Negligible
R3: 29 Main Street	Difference	+1	-6	0	0	-6
	Magnitude of Impact	Negligible	Negligible	Negligible	Negligible	Negligible
R4: 25 Main Street	Difference	+2	-5	-3	-3	-5
	Magnitude of Impact	Minor	Negligible	Negligible	Negligible	Negligible

6.1.14. During the demolition of the old bridge, noise levels are predicted to fall below the determined threshold values for the majority of the construction activities at Receptors R3 and R4, resulting in a significance of effect of Slight Adverse. Only during ‘breaking out of road surface’ is the threshold value exceeded by up to 2 dB at Receptor R4, again resulting in a significance of effect of Slight Adverse.

6.1.15. At Receptor R1, the threshold value is predicted to be exceeded during the breaking out of the old road surface, during service diversion works and during final earthworks, resulting in a significance of effect of Slight Adverse to Large Adverse.

6.1.16. At Receptor R2, the threshold value is predicted to be exceeded during the breaking out of the old road surface, demolition of bridge, break-up of the concrete block and during final earthworks, resulting in a significance of effect of Slight Adverse to Large Adverse.

6.1.17. It should be noted that the predicted noise levels are a worst-case scenario at the closest approach between the construction activities and the receptor. Therefore, noise levels are unlikely to be high for long periods, and when demolition activities are located further away, predicted levels are expected to fall below the threshold values.

Construction Traffic Assessment

6.1.18. No information is currently available on the number of construction HGVs associated with the Scheme. However, based on similar projects it is not expected that there will be a large number of HGVs per day. Combined with the already high percentage of HGVs that currently use the A6006, the increase in HGV numbers during construction is unlikely to result in any additional noise impact upon the closest noise sensitive receptors.

Construction Vibration Assessment

6.1.19. The construction works likely to generate the highest levels of vibration at the receptors considered within the assessment is CFA piling works during the construction of the piers and abutments. CFA piling is proposed approximately 63m from the closest residential property on 26 Main Street.

6.1.20. Table 6.6 provides PPV levels for CFA piling activities under different soil conditions at various distances from piling locations which are sourced from BS 5228 Part 2.

Table 6.6: Example CFA Piling Vibration Levels

BS 5228 Reference No.	Soil Conditions	Piling Mode	Plan Distance (m)	PPV (mm/s)
101	Fill / dense ballast / Clay	CFA	20	0.05
		Auger hitting base of hole	20	0.23
103	Fill clay	CFA	10	0.38
			20	0.30
104	Fill / sand / clay	Auger hitting base of hole	10	0.96
		CFA	10	0.40
		Auger hitting base of hole	14	0.30

6.1.21. With reference to the values presented Table 6.6 and the criteria in Appendix A, piling activities are unlikely to generate perceptible levels of vibration at distances greater than 20m. Therefore, vibration will not be perceivable at the closest approach to existing residential properties. The magnitude of impact of vibration from CFA piling during construction is classed as Negligible, resulting in a Slight Adverse significance of effect.

Construction Noise Mitigation

6.1.22. During bridge construction and demolition, noise levels are predicted to exceed the threshold values when some works are in close proximity to the selected receptors. Where practicable, mitigation measures in the form of mobile noise barriers located as close to the construction activities as possible should be utilised to provide shielding between the receptors and the works.

Bridge Construction With Temporary Noise Barriers

6.1.23. Table 6.7 provides the predicted bridge construction noise levels including a 5 to 10dB reduction for a temporary noise barrier.

Table 6.7: Calculated Mitigated Construction Noise Levels – Bridge Construction

Receptor	Predicted Range of Construction Noise Levels $L_{Aeq,1h}$ dB							
	Site clearance	Earthworks	Construction of abutments and piers	Piling (CFA)	Retaining walls	Bridge steelwork	Deck construction	Roadworks
R1: Mobile Home Park	70-75	67-72	49-54	48-53	57-62	52-57	51-56	68-73
R2: 26 Main Street	59-64	56-61	54-59	54-59	54-59	56-61	55-60	57-62
R3: 29 Main Street	61-**66**	58-63	50-55	49-54	50-55	54-59	54-59	59-64
R4: 25 Main Street	62-**67**	59-64	46-51	46-51	46-51	51-56	50-55	61-**66**

6.1.24. The magnitude of impact for each mitigated construction activity at each receptor during the construction of the new bridge is provided in Table 6.8.

Table 6.8: Assessment of Mitigated Daytime Construction Noise – Bridge Construction

Receptor		Difference Between Predicted Noise Level and Threshold Value (dB)							
		Site clearance	Earthworks	Construction of abutments and piers	Piling (CFA)	Retaining walls	Bridge steelwork	Deck construction	Roadworks
R1: Mobile Home Park	**Magnitude of Impact**	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg
R2: 26 Main Street	**Magnitude of Impact**	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg
R3: 29 Main Street	**Magnitude of Impact**	Neg	Neg	Neg	Neg	Neg	Neg	Neg	Neg
R4: 25 Main Street	**Magnitude of Impact**	Neg to Minor	Neg	Neg	Neg	Neg	Neg	Neg	Neg

6.1.25. During construction of the proposed new bridge, mitigated noise levels (from a temporary noise barrier, where practicable) are predicted to fall below the determined threshold values during all of the construction activities, resulting in a significance of effect of Slight Adverse.

Demolition of Old Bridge with Temporary Noise Barriers

6.1.26. Table 6.9 provides the predicted mitigated bridge demolition noise levels including a 5 to 10 dB reduction for a temporary noise barrier.

Table 6.9: Calculated Mitigated Construction Noise Levels – Bridge Demolition

Receptor	Predicted Range of Construction Noise Levels $L_{Aeq,1h}$ dB				
	Breaking out of road surface	Services diversion	Demolition of bridge	Break-up and removal of concrete block	Earthworks
R1: Mobile Home Park	**77-82**	70-75	54-59	53-58	74-**79**
R2: 26 Main Street	61-**66**	54-59	62-**67**	59-64	56-61
R3: 29 Main Street	56-61	49-54	55-60	55-60	49-54
R4: 25 Main Street	57-62	50-55	52-57	52-57	50-55

6.1.27. The magnitude of impact for each mitigated bridge demolition activity at each receptor is provided in Table 6.10.

Table 6.10: Assessment of Mitigated Daytime Construction Noise – Bridge Demolition

Receptor		Difference Between Predicted Noise Level and L_{Aeq} Noise Limit for Short-Term Works (dB)				
		Breaking out of road surface	Services diversion	Demolition of bridge	Break-up and removal of concrete block	Earthworks
R1: Mobile Home Park	**Magnitude of Impact**	Minor - Major	Neg	Neg	Neg	Neg - Mod
R2: 26 Main Street	**Magnitude of Impact**	Neg	Neg	Neg - Minor	Neg	Neg
R3: 29 Main Street	**Magnitude of Impact**	Neg	Neg	Neg	Neg	Neg
R4: 25 Main Street	**Magnitude of Impact**	Neg	Neg	Neg	Neg	Neg

6.1.28. During demolition of the old bridge, mitigated noise levels (from a temporary noise barrier, where practicable) are predicted to fall below the determined threshold values during the majority of the construction activities, resulting in a significance of effect of Slight Adverse. The only exceptions are at Receptor R1 and R2. At R1 during the breaking out of the road surface and earthworks the significance of effect is between Slight Adverse and Large Adverse. At R2 during the demolition of the old bridge, the significance of effect is between Slight Adverse and Large Adverse.

6.1.29. In addition to mobile noise barriers, it is recommended that residents are informed of when noisy works are going to be undertaken and the likely durations. High noise levels for short periods can be tolerated if prior warning and explanation has been given.

6.1.30. Given the relatively short duration of some of the works and the fact that no viable alternative exists, in accordance with the statement from the PPG quoted above, a “higher limit for a very limited period” is appropriate. The document does not state what this limit should be; however, with the recommended mitigation in place, it is considered that the significance of the effect of bridge construction and demolition noise impacts will be reduced to minor adverse.

6.1.31. In addition to the above, a Construction Noise Management Plan should be prepared detailing the mitigation measures to be implemented, monitoring of noise emissions against noise limits, and procedures to follow should complaints be received.

6.1.32. During all construction works it is expected that the contractor will follow Best Practicable Means to further reduce noise impacts upon the local community. Best Practicable Means include the following:

- All construction plant and equipment should comply with EU noise emission limits;
- Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works should be fitted with effective exhaust silencers and should be maintained in good efficient working order;
- Selection of inherently quiet plant where appropriate. All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use. All ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- Materials should be handled with care and be placed, not dropped. Materials should be delivered during normal working hours;
- All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimum noise disturbance, i.e. furthest from receptors or behind close boarded noise barriers. If necessary, acoustic enclosures should be provided and/or acoustic shielding;
- Construction contractors should be obliged to adhere to the codes of practice for construction working and piling given in BS 5228 and the guidance given therein minimising noise emissions from the site; and
- Reference should be made to the Building Research Establishment, BRE 'Pollution Control' guidelines, Parts 1-5.

Construction Vibration

6.1.33. No mitigation is proposed for CFA piling due to the distance from the works to the nearest residential receptors.

6.1.34. With the implementation of Best Practicable means, as detailed in a Construction Noise Management Plan, it is considered that construction noise and vibration impacts can be suitably controlled to acceptable levels.

Operational Noise

6.1.35. Detailed 3-dimensional models of the existing road / bridge layout and the proposed road / bridge layout have been developed in a sophisticated noise modelling software package. The models have been used to calculate road traffic noise levels to surrounding sensitive receptors.

6.1.36. The magnitude of the impact of the operation of the proposed Scheme has been derived by calculating the change in the 18-hour traffic noise levels ($L_{A10,18h}$) at a selection of sensitive receptors close to the Scheme.

6.1.37. The calculations have employed the methodology provided in Calculation of Road Traffic Noise (CRTN), which is the standard methodology adopted in the UK for the calculation of noise levels from road traffic.

6.1.38. Road traffic data have been provided by AECOM Transport Consultants for the year of opening (2018) and 15 years after opening (2033) and are provided in Table 6.11.

Table 6.11: Road Traffic Flows for 2018 and 2033

Scenario	18hr Annual Average Weekday Traffic (AAWT)		
	2018	2033	%HGV
A6006 – Do Minimum	13,051	15,471	23
A6006 – Do Something	13,051	15,471	23

6.1.39. Currently, the speed limit over the existing bridge is 60mph, reducing to 40mph approximately 80m to the east of the bridge. With the new bridge in place it is proposed to extend the 40mph speed limit to approximately 130m west of the bridge.

6.1.40. Road traffic noise levels have been predicted for four scenarios; Do Minimum and Do Something for the assessment years of 2018 and 2033. The predicted noise levels and calculated change at the closest receptors affected by the change in alignment are provided in Tables 6.12 to 6.14.

6.1.41. Assuming that the Scheme is not brought forward, an assessment of the change in road traffic noise as a result of natural growth is provided in Table 6.12 (Do Minimum 2033 minus Do Minimum 2018).

Table 6.12: Long-term Change in Do-Minimum Traffic Noise Levels (DM 2018 to DM 2033)

Receptor	Predicted $L_{A10,18h}$ dB		Increase in noise level dB	Magnitude of Impact
	2018 Do Minimum	2033 Do Minimum		
R1: Mobile Home Park	78.1	78.8	+0.7	Negligible Adverse
R2: 26 Main Street	69.6	70.3	+0.7	Negligible Adverse
R3: 29 Main Street	66.5	67.3	+0.8	Negligible Adverse

R4: 25 Main Street	68.5	69.3	+0.8	Negligible Adverse

6.1.42. Due to natural growth in road traffic flows, predicted noise levels result in a Slight Adverse significance of effect by 2033.

6.1.43. Table 6.13 provides the short-term changes in road traffic noise levels between the 2018 Do Minimum and 2018 Do Something scenarios.

Table 6.13: Short-term Change in Traffic Noise Levels (DM 2018 to DS 2018)

Receptor	2018 Predicted $L_{A10,18h}$ dB		Increase in noise level dB	Magnitude of Impact
	Do Minimum	Do Something		
R1: Mobile Home Park	78.1	71.2	-6.9	Major Beneficial
R2: 26 Main Street	69.6	66.1	-3.5	Moderate Beneficial
R3: 29 Main Street	66.5	64.5	-2.0	Minor Beneficial
R4: 25 Main Street	68.5	68.6	+0.1	Negligible Adverse

6.1.44. Due to the change in the horizontal alignment of the road, beneficial impacts at the majority of the receptors are predicted, resulting in a significance of effect of Slight Beneficial to Large Beneficial. A Negligible Adverse noise impact is predicted at Receptor R4, resulting in a Slight Adverse significance of effect.

6.1.45. The beneficial change in noise levels at receptors R1 and R2 is due to both the carriageway being located further away from these receptors as a result of the Scheme, and also due to the extension of the 40 mph speed limit to the west of the new bridge.

6.1.46. At Receptor R3, although the carriageway is closer to this receptor, the decrease in road traffic speed has resulted in a decrease in the predicted noise level at this receptor.

6.1.47. At Receptor R4, there is a negligible increase in the predicted noise level at this receptor due to the carriageway being located slightly closer. The speed limit extension has no effect due to the speed limit remaining unchanged close to this receptor.

6.1.48. Table 6.14 provides the changes in road traffic noise between the 2033 Do Something scenario and the 2018 Do Minimum scenario, for a worst-case assessment of road noise level changes.

Table 6.14: Long-term Change in Do-Something Traffic Noise Levels (DM2018 to DS2033)

Receptor	Predicted $L_{A10,18h}$ dB		Increase in noise level dB	Magnitude of Impact
	2018 Do Minimum	2033 Do Something		
R1: Mobile Home Park	78.1	71.9	-6.2	Moderate Beneficial

R2: 26 Main Street	69.6	66.9	-2.7	Negligible Beneficial
R3: 29 Main Street	66.5	65.2	-1.3	Negligible Beneficial
R4: 25 Main Street	68.5	69.4	+0.9	Negligible Adverse

6.1.49. Beneficial impacts to Receptors R1 and R2 are predicted between the Do Something 2033 and Do minimum 2018 scenarios, resulting in a significance of effect of Moderate Beneficial and Slight Beneficial respectively. This is due to the road alignment being located further from these receptors, and also due to a reduction in speed limit.

6.1.50. At Receptor R3, although the carriageway is closer to this receptor, the reduction in road traffic speed has resulted in a decrease in the predicted noise level at this receptor.

6.1.51. At Receptors R4, a Negligible Adverse impact is predicted, resulting in a Slight Adverse significance of effect. However, it must be noted that the natural growth of road traffic over time accounts for the major part of this noise increase (as shown in Table 6.12).

6.1.52. Noise contour plots showing the predicted changes in noise levels for the Do Something 2018 minus the Do Minimum 2018 scenario and the Do Something 2033 minus the Do Minimum 2018 scenario are provided in Appendix D.

6.1.53. It is concluded that the operation of the proposed Scheme should not result in any significant adverse effects, and that beneficial effects should be provided to a number of sensitive receptors.

7. Potential for Further Mitigation

7.1.1. Whilst it is shown in Section 6 of my evidence that there are no significant adverse operational effects resulting from the implementation of the Scheme, the potential for further mitigation to residential properties on Main Street has been investigated.

7.1.2. Drawing "A6006 Zouch Bridge Replacement: Indicative Landscape Scheme Adjacent to No. 25 Main Street" (Drawing No. 2/23/176/2) shows a close boarded timber fence to the Scheme in this location. The effects of employing a 2 metre high acoustic barrier in place of this timber fence have been quantified.

7.1.3. The acoustic barrier has been implemented in the operational noise model and the noise reductions resulting from the barrier have been calculated. The results are provided in Table 7.1 for the short term and in Table 7.2 for the long term.

Table 7.1: Short-term Change in Traffic Noise Levels (DM 2018 to DS 2018) – With Mitigation to Main Street

Receptor	Predicted $L_{A10,18h}$ dB		Increase in noise level dB
	2018 Do Minimum	2018 Do Something	
21 Main Street	68.4	65.4	-3.0
25 Main Street	68.5	63.6	-4.9
27 Main Street	64.8	59.3	-5.5
29 Main Street	66.5	62.6	-3.9

Table 7.2: Long term Change in Traffic Noise Levels (DM 2018 to DS 2033) – With Mitigation to Main Street

Receptor	Predicted $L_{A10,18h}$ dB		Increase in noise level dB
	2018 Do Minimum	2033 Do Something	
21 Main Street	68.4	66.1	-2.3
25 Main Street	68.5	64.3	-4.2
27 Main Street	64.8	60	-4.8
29 Main Street	66.5	63.3	-3.2

7.1.4. Inspection of the results in Tables 7.1 and 7.2 shows moderate / major noise decreases in the short term and generally minor noise decreases in the long term, bringing an improvement in noise climate to properties on Main Street when compared to the current situation.

8. Alternative Route Assessment

8.1.1. An alternative is that the bridge be replaced on its existing line with temporary diversions of traffic.

8.1.2. The Council has indicated in its Statement of Case that one of the major factors driving its approach is to seek to replace the worn out bridge whilst minimising the effects and costs on the travelling public using the road and for those on any diversion route. In the Council's view there is an overriding advantage in pursuing the Scheme when compared with the disruption, inconvenience and costs associated with the alternative. To close the road to carry out the alternative would entail a closure for an extensive period of time, currently calculated at about 18 months, during which time all road users would have to follow a lengthy and inconvenient diversion route along roads that are not suitable for the purpose.

8.1.3. Given the relative distances from the proposed construction works to sensitive receptors, the magnitude of noise and vibration impacts during construction will not be significantly different between the Scheme and the alternative, being slightly higher at some receptors and slightly lower at others.

8.1.4. With respect to operational noise, the beneficial effects of the Scheme to sensitive receptors to the north would be reduced with the alternative, whilst the effects to receptors on Main Street would be marginally improved with the alternative (in the absence of any further mitigation to the Scheme, as discussed in Section 7 of my evidence).

9. Issues Raised By Objectors

Mr R Farrow

Grounds of Objection

9.1.1. Mr Farrow lives at 25 Main Street, Zouch, adjacent to the Scheme.

9.1.2. Mr Farrow raises four issues;-

a) Increased traffic noise as the Scheme will move traffic closer to the house.

b) The Scheme will remove trees and a large area of land.

c) An alternative is suggested that the bridge be replaced on its existing line with temporary diversions of traffic.

d) The Alternative suggestion will be cheaper.

Response

9.1.3. With respect to issue a), detailed 3 dimensional models of the existing road layout and the proposed layout have been developed in a sophisticated noise modelling software package. The models have been used to calculate road traffic noise levels to surrounding sensitive receptors, including Mr Farrow's property.

9.1.4. The calculated noise levels at this property are provided in Table 9.1, below. In the table, the following abbreviations apply:-

- DM2018: the scenario in 2018 if the proposed Scheme did not go ahead
- DM2033: the scenario in 2033 if the proposed Scheme did not go ahead
- DS2018: the scenario in 2018 with the proposed Scheme in operation
- DS2033: the scenario in 2033 with the proposed Scheme in operation

Table 9.1: Calculated Noise Levels at 25 Main Street

Scenario	Façade Noise Level
DM2018	68.5
DM2033	69.3
DS2018	68.6
DS2033	69.4

9.1.5. A change in road traffic noise of 1 dB $L_{A10,18h}$ in the short term (i.e. when a road project is opened) is the smallest that is considered perceptible. In the long term (typically 15 years after project opening), a 3 dB $L_{A10,18h}$ change is considered perceptible.

9.1.6. It can be seen that in the short term there is a negligible increase in noise level between DM2018 and DS2018.

9.1.7. In the long term there is a negligible increase in noise level between DM2018 and DS2033. It is noted that, by inspection of the change from DM2018 to DM2033, the bulk of this increase is due to increases in traffic flows over time rather than an effect of the proposed Scheme.

9.1.8. It is concluded that the proposed Scheme will not have a significant noise effect at Mr Farrow's property.

9.1.9. In their Statement of Case, Leicestershire County Council provide a response to the first item in Mr Farrow's objection, as follows:-

> *…….The Noise Assessment does not advocate any mitigation measures when comparing the current and future situations. The Council is however willing to consider the detail of its proposals given that the side slope of the proposal at the point that it passes the property is to be fenced and landscaped.*

9.1.10. If a noise barrier is provided to the Scheme in this location, as discussed in Section 7 of my evidence, significant improvements to the noise climate at this property and other properties on Main Street. The calculated noise levels at this property are provided in Table 9.2, below.

Table 9.2: Calculated Noise Levels at 25 Main Street – With Noise Mitigation

Scenario	Façade Noise Level
DM2018	68.5
DM2033	69.3
DS2018	63.6
DS2033	64.3

9.1.11. It can be seen that reductions of up to 4.9 dB in the short term would be achieved at Mr Farrow's property.

9.1.12. With respect to issue b), Mr Farrow refers to the removal of trees to enable the provision of the Scheme. Whilst there will be removal of some trees in this location, it is judged that this will not have a significant effect in terms of road traffic noise. A significant depth (> 10 metres) of closely spaced trees is required to provide any significant reduction in noise levels, which is not the case here.

9.1.13. It is recognized that psychological effects can come into play in situations such as this, whereby a person perceives a noise source (such as road traffic) as being quieter than it is because it is out of sight (e.g. obscured by trees/shrubs), even though the trees/shrubs have no measurable effect.

9.1.14. With the scheme in operation there will be planting of shrubs and trees to the proposed embankment in this location, with Mr Farrow's property at a significantly lower level than the scheme, and the road traffic should not be fully visible. Visibility will be further reduced with the provision of close a boarded fence / acoustic barrier to the Scheme at this location.

9.1.15. With respect to issue c), Mr Farrow suggests an alternative whereby the bridge is replaced on its existing line with temporary diversions of traffic. This alternative is discussed in Section 8 of my evidence, where it is judged that the Scheme is an improvement on the alternative with respect to noise and vibration.

10. Summary and Conclusions

10.1.1. In my evidence I have described the detailed construction and operational noise and vibration impact assessments carried out for the proposed Scheme.

10.1.2. I have then presented the results of those assessments.

10.1.3. I have concluded that, with the implementation of Best Practicable Means as detailed in a Construction Noise Management Plan, construction noise and vibration impacts should be suitably controlled to acceptable levels.

10.1.4. I have concluded that the operation of the proposed Scheme should not result in any significant adverse effects, and beneficial effects should be provided to a number of sensitive receptors.

10.1.5. I have then considered the provision of a noise barrier to Main Street and have concluded that a 2 metre high barrier in this location will provide significant noise decreases to residential properties on Main Street.

10.1.6. Overall, I have concluded that the proposed Scheme is acceptable in terms of noise and vibration and meets the requirements of the relevant Policy.

Zouch Bridge Replacement

Noise and Vibration – Appendices A to D

Proof of Evidence of Alfred Maneylaws BSc MSc MIOA

Prepared for Leicestershire County Council

July 2018

Table of Contents

Appendix A: Methodology

Noise Terminology

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB (A) or LpA dB. Table A1 below lists the sound pressure level in dB (A) for common situations.

Table A1: Sound Pressure Levels for a Range of Situations

Typical Noise Levels dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library. Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy road, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night time noise levels will often be smaller and the levels significantly reduced compared to daytime levels.

The equivalent continuous A-weighted sound pressure level, LAeq dB (or Leq dBA), is the single number that represents the average sound energy measured over that period. The LAeq is the sound

level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period.

Human subjects are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

Construction Noise

Noise levels generated by construction activities are regulated by guidelines and are subject to local authority control. No UK national noise limits exist for construction noise; however guidance on acceptable noise levels is provided British Standard BS 5228: 2009+A1:2014.

Construction noise and vibration levels have been predicted using the methodology given in BS 5228-1:2009+A1:2014 ‘Control of Noise from Construction and Open Sites’.

Noise levels generated by the construction works and experienced by local receptors depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on site, road traffic and other sources, generally expressed as sound power levels (Lw);
- The periods of operation of the plant on site, known as its on-time;
- The distance between the noise source and the receptor;
- The attenuation due to ground absorption, air absorption and barrier effects; and
- In some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings.

Representative plant rosters for each construction activity were defined, based on preliminary information from the client. If the activities and plant used in these noise predictions differ significantly to those actually used, it is recommended that construction noise levels be reviewed prior to construction commencing.

The following major activities have been assumed during the construction of the proposed scheme:

Bridge Construction

- Site clearance;
- Earthworks;
- Construction of piers and abutments;
- Piling (CFA);
- Retaining walls;
- Bridge steelwork;
- Deck construction; and

- Roadworks.

Bridge Demolition

- Breaking out of old road surface;
- Service diversions;
- Demolition of bridge;
- Break-up and removal of concrete block; and
- Earthworks/landscaping.

Construction noise levels have been predicted using noise calculation spreadsheets, which implement the standard noise prediction methodology given in BS 5228-1+A1:2014. Sound power levels for each item of equipment for each construction activity have been sourced from BS 5228-1, which gives measured noise levels for various items of construction plant.

BS 5228 contains a methodology for the assessment of the significance of effect of construction noise in relation to the ambient noise levels, known as the ABC method. The criteria for significance provided in BS 5228-1: 2009+A1:2014 are reproduced below in Table A2.

Table A2: Construction Noise Threshold of Significant Effect

Assessment Category	Threshold Value (dB L_{Aeq})		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and Weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Note 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold value for the category appropriate to the ambient noise level.			
Note 2: If the ambient noise level exceeds the threshold values given in the table, then a significant effect is deemed to occur if the total noise level for the period increases by more than 3 dB due to construction activity.			
Note 3: Applies to residential receptors only.			
Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			
Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.			
Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.			

For the appropriate period (night, evening/weekend, day), the ambient noise level is determined and rounded to the nearest 5 dB. The appropriate Threshold Value is then determined. The total construction noise level is then compared with this Threshold Value. If the total noise level exceeds the Threshold Value, then a significant effect is deemed to occur.

The magnitude of the impact of construction noise has been classified in accordance with the descriptors in Table A3.

Table A3: Magnitude of Impact for Construction Noise

Magnitude of Impact	Construction Noise Level minus Threshold Value or Increase in Total Noise Level ($L_{Aeq,T}$ dB façade)
Major	> 5
Moderate	3 < 5
Minor	1 < 3
Negligible	< 1

Construction Traffic

No information is currently available on the number of construction HGVs associated with the scheme. However, based on similar projects it is not expected that there will be a large number of HGVs per day. Combined with the already high percentage of HGVs that currently use the A6006, the increase in HGV numbers during construction is unlikely to result in any additional noise impact upon the closest noise sensitive receptors.

Construction Vibration

Human Annoyance

The limit of human perception to vibration is of the order of 0.15 millimetres per second (mm/s) to 0.3 mm/s peak particle velocity (ppv), in the frequency range 0.1 hertz (Hz) to 1500 Hz.

The human body is not equally sensitive to all frequencies of vibration and therefore weighting curves to reflect the frequency dependency of the body have been developed and are provided within international (ISO) Standards. The weighting gives a good correlation between the measured vibration level and the subjective feeling or impact produced by the vibration.

Ground borne vibrations may cause reactions ranging from ‘just perceptible’ through ‘concern’ to ‘alarm’ and ‘discomfort’. The subjective response to ground bourne vibration varies widely and is a function of situation, information, time of day, and duration.

BS 5228: Part 2 (BSI, 2009+A1:2014) provides empirical predictors for ground borne vibration arising from mechanical construction works, as well as historic measured vibration levels for various vibro-compaction methods. These empirical predictors have been employed in the vibration assessment.

The predicted ppv levels are compared to the guidance levels in Table B.1 in BS 5228, reproduced and adapted as Table A4 below, to identify the likelihood of complaint.

Table A4: Guidance Effects of Vibration for Human Response (from BS 5228: Part 2: 2009)

Vibration Level (mm/s)	Effect	Magnitude of Impact
< 0	None.	None
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies,	Negligible

	people are less sensitive to vibration.	
0.3	Vibration might be just perceptible in residential environments.	Minor
1.0	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.	Moderate
10	Vibration is likely to be intolerable for any more than a brief exposure to this level.	Major

Building Damage

BS 7385-2: 1993 'Evaluation and measurement for vibration in buildings - Part 2: Guide to damage levels from ground-borne vibration' provides guidance on vibration levels likely to result in cosmetic damage, and is referenced in BS 5228-2: 2009+A1:2014. Guide values for transient vibration, above which cosmetic damage could occur, are provided in Table A5.

Table A5: 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	50 mm/s at 4Hz and above	
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15Hz increasing to 50 mm/s 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.		

BS 7385-2:1993 states that the probability of building damage tends to be zero for transient vibration levels less than 12.5 mm/s ppv. For continuous vibration the threshold is around half this value.

It is also noted that these values refer to the likelihood of cosmetic damage. ISO 4866:2010 defines three different categories of building damage:

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

BS 7385-2:1993 indicates that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration level twice that of minor damage. This guidance can be used to define the magnitude of impact as shown in Table A6.

Table A6: Magnitude of Impact for Vibration Damage

Magnitude of Impact	Damage Risk	Continuous Vibration Level ppv mm/s
Major	Major	30
Moderate	Minor	15
Minor	Cosmetic	7.5
Negligible	Negligible	6

Operational Noise

DMRB Volume 11, Section 3, Part 7 provides guidance on the assessment of traffic noise and vibration impacts due to road schemes. The first level of assessment, Scoping, seeks to gather data to provide an appreciation of the likely noise and vibration consequences associated with the proposed scheme and determine the next assessment step (if any). It involves determining if:

- the project alters the alignment of any existing carriageways;
- traffic volumes, speeds or the proportion of heavy vehicles on existing roads or new routes will cause a change in noise level of more than 1 dB LA10,18h in the short-term (upon opening) or 3 dB LA10,18h in the long-term (within 15 years after opening), either during construction or operation; or
- there are any changes to the infrastructure surrounding the road that could, when the project is completed, cause the above noise change thresholds to be exceeded; or
- noise and vibration threshold criteria will potentially be exceeded during construction works; or
- there are any residential properties and other sensitive receptors within a 1km boundary around the scheme (as defined within DMRB). Other sensitive receptors are defined in the 'Value of Environmental Resources and Receptors' section below.

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 goods vehicles (HGV)), gradient, type of road surface, distance from the road and the presence of any obstructions between the road and the receptor.

The objective of the assessment, as set out in DMRB, is to gain an overall appreciation of the noise and vibration climate, both with (Do-Something (DS)) and without (Do-Minimum (DM)) the proposed scheme. The DMRB assessment has been informed by the traffic flow data generated as part of a traffic assessment of the proposed scheme.

DMRB provides two classifications for the magnitude of the noise impact of a proposed scheme, as shown in Tables 3.1 and 3.2 of DMRB (Highways Agency, 2011). These relate to short-term changes in noise levels and long-term changes in noise levels. The short-term and long-term tables are reproduced in Table A7 and Table A8.

Table A7: DMRB Classification of the Magnitude of Traffic Noise Impacts – Short-term Changes

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

Table A8: DMRB Classification of the Magnitude of Traffic Noise Impacts – Long-term Changes

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

DMRB defines the nominal study area for the noise assessment as a 1km buffer around the scheme. Within that 1 km buffer, detailed calculations are carried out for a 600 metre buffer around the scheme and 600 metre buffers around affected routes. However, DMRB recognizes that, for some schemes, the study area can be reduced.

For this scheme:

- The scheme will not result in changes in traffic flows on the local road network (including the A6006).
- The scheme extent is very limited and only those receptors close to the scheme will experience potentially significant noise changes as a result of the implementation of the scheme.

Consequently, for this scheme, the study area is as shown in Figure B.1, Appendix B.

Significance Criteria

Potential noise and vibration sensitive receptors can include residential properties, hospitals, schools, community facilities (such as places of worship), designated ecological areas, Areas of Outstanding Natural Beauty (AONB), National Parks, Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI), designated scheduled monuments and public rights of way (PRoW).

Sensitive receptors that could potentially be affected by noise and/or vibration during the construction and operation of the proposed scheme have been identified - these are shown in Figure B1 in Appendix B.

The sensitivity of receptors to noise and vibration impacts during construction and operation are defined in Table A9.

Table A9 Sensitivity of Receptors

Sensitivity/Value of Receptor	Description
Very High	Concert halls/theatres, specialist vibration sensitive equipment.
High	Residential properties, educational buildings, medical facilities
Medium	Places of worship, community facilities, offices
Low	Other commercial and industrial premises

The significance of effect is a function of the value or sensitivity of the receptor and the magnitude of the impact. Table A10 presents the significance of effect, based on the magnitude of impact and the sensitivity of receptors in Table A9.

Table A10: Significance of Effect

Magnitude of Impact	Sensitivity of Receptor			
	Very High	High	Medium	Low
Major	Very Large	Large	Large	Moderate
Moderate	Large	Moderate	Moderate	Slight
Minor	Moderate	Slight	Slight	Neutral
Negligible	Slight	Slight	Neutral	Neutral
No Change/ None	Neutral	Neutral	Neutral	Neutral

The matrix provided in Table A10 has been employed in the construction and operational assessments.

Appendix B: Site Plan

A site plan showing the scheme location, noise monitoring locations and receptor locations is shown in Figure B.1.

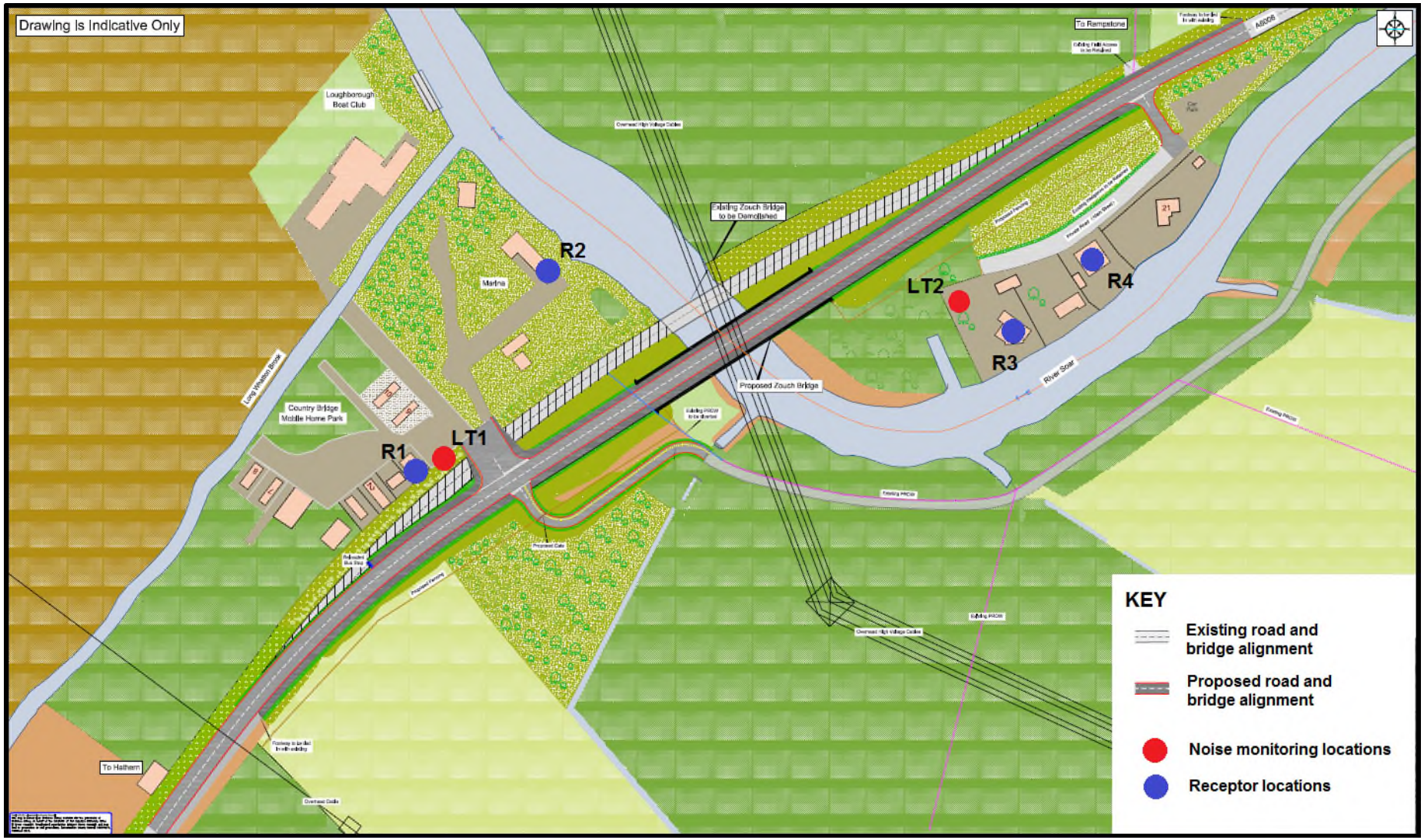

Figure B.1: Site Plan, Monitoring Locations and Receptor Locations

Appendix C: Construction Information / Data

Table C.1: Construction Plant List - Bridge Construction

Construction Activity	Plant	Sound Power Level Lw dB(A)	On-time (% of one hour)	Reference
Site clearance	Chainsaw	114	25	BS 5228 Table D.2 no 14
	Excavator	105	75	BS 5228 Table C.2 no 2
	Loading lorries	106	50	BS 5228 Table C.2 ave 26-28
Earthworks	Excavator	105	75	BS 5228 Table C.2 no 2
	Dumper	102	75	BS 5228 Table C.2 no 32
	Loading lorries	106	50	BS 5228 Table C.2 no.s 26-28
Construction of abutments and piers	Lorry mounted concrete pump	107	75	BS 5228 Table C.4 ave 26-28
	Poker vibrator	97	75	BS 5228 Table C.4 no 34
	Cement mixer truck	106	50	BS 5228 Table C.4 no 32
	Water pump	92	100	BS 5228 Table C.2 ave 45-46
Piling - CFA	CFA Piling rig	108	75	BS 5228 Table C.3 ave 21-22
	Service crane	97	75	BS 5228 Table C.3 ave 28-29
	Cement mixer truck	106	50	BS 5228 Table C.4 no 32
	Water pump	92	100	BS 5228 Table C.2 ave 45-46
Retaining walls	Cement mixer truck	106	50	BS 5228 Table C.4 no 32
	Excavator	105	75	BS 5228 Table C.2 no 2
	Water pump	92	100	BS 5228 Table C.2 ave 45-46
Bridge steelwork	Generator	94	100	BS 5228 Table C.4 ave 76-84
	Metal cutter	107	50	BS 5228 Table C.1 no 18
	Electric bolter	104	50	BS 5228 Table D.6 no 54
	Electric drill	104	75	BS 5228 Table D.6 no 54
	Welding plant	102	75	BS 5228 Table C.3 no 31

Deck construction	Lorry mounted concrete pump	107	75	BS 5228 Table C.4 ave 26-28
	Poker vibrator	97	75	BS 5228 Table C.4 no 34
	Cement mixer truck	106	50	BS 5228 Table C.4 no 32
Roadworks	Excavator	10	75	BS 5228 Table C.2 ave 14-25
	Dumper	109	75	BS 5228 Table C.5 no 16
	Asphalt spreader	104	75	BS 5228 Table C.5 ave 30-31
	Road roller	103	75	BS 5228 Table C.5 ave 25-28

Table C.2: Construction Plant List - Bridge Demolition

Construction Activity	Plant	Sound Power Level Lw dB(A)	On-time (% of hour)	Reference
Breaking out of road surface	Handheld road breaker (pneumatic)	112	50	BS 5228 Table C.5 ave 3-4
	Compressor for road breaker	93	50	BS 5228 Table C.5 no 5
	Excavator	101	75	BS 5228 Table C.5 no 11
	Loading lorries	106	50	BS 5228 Table C.2 ave 26-28
Service diversion	Excavator	105	75	BS 5228 Table C.2 no 2
Demolition of bridge Break-up and removal of concrete block	Handheld breaker (pneumatic)	112	50	BS 5228 Table C.5 ave 3-4
	Compressor for road breaker	93	50	BS 5228 Table C.5 no 5
	Pulveriser mounted on excavator	105	80	BS 5228 Table C.1 ave 3-5
	Loading lorries	106	50	BS 5228 Table C.2 ave 26-28
Earthworks/ landscaping	Excavator	105	75	BS 5228 Table C.2 no 2

Appendix D: Noise Level Change Contour Plots

Figure D.1 shows the noise level change contours (DS2018 minus DM2018).

Figure D.2 shows the noise level change contours (DS2033 minus DM2018).

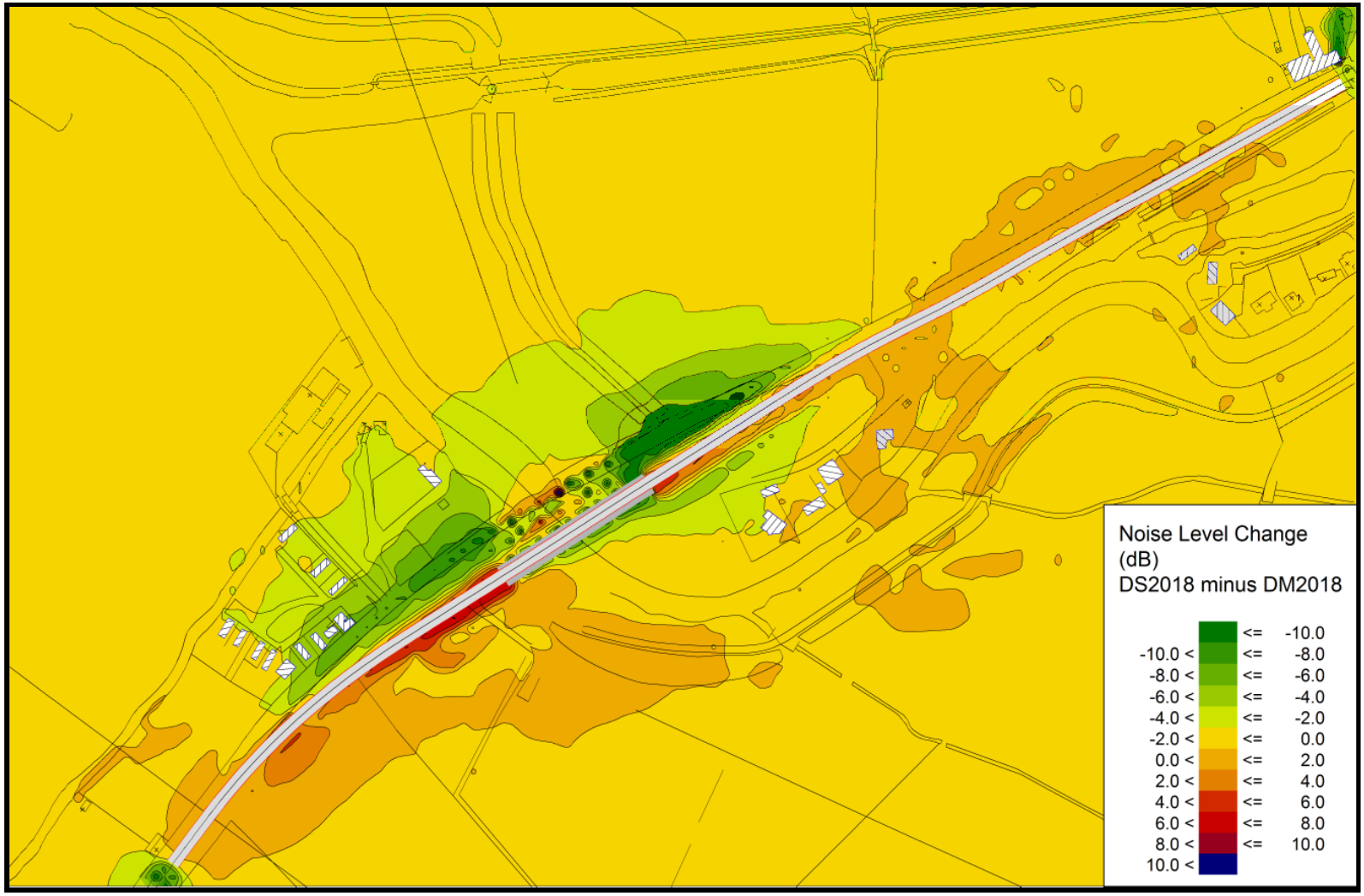

Figure D.1: Do Something 2018 Minus Do Minimum 2018

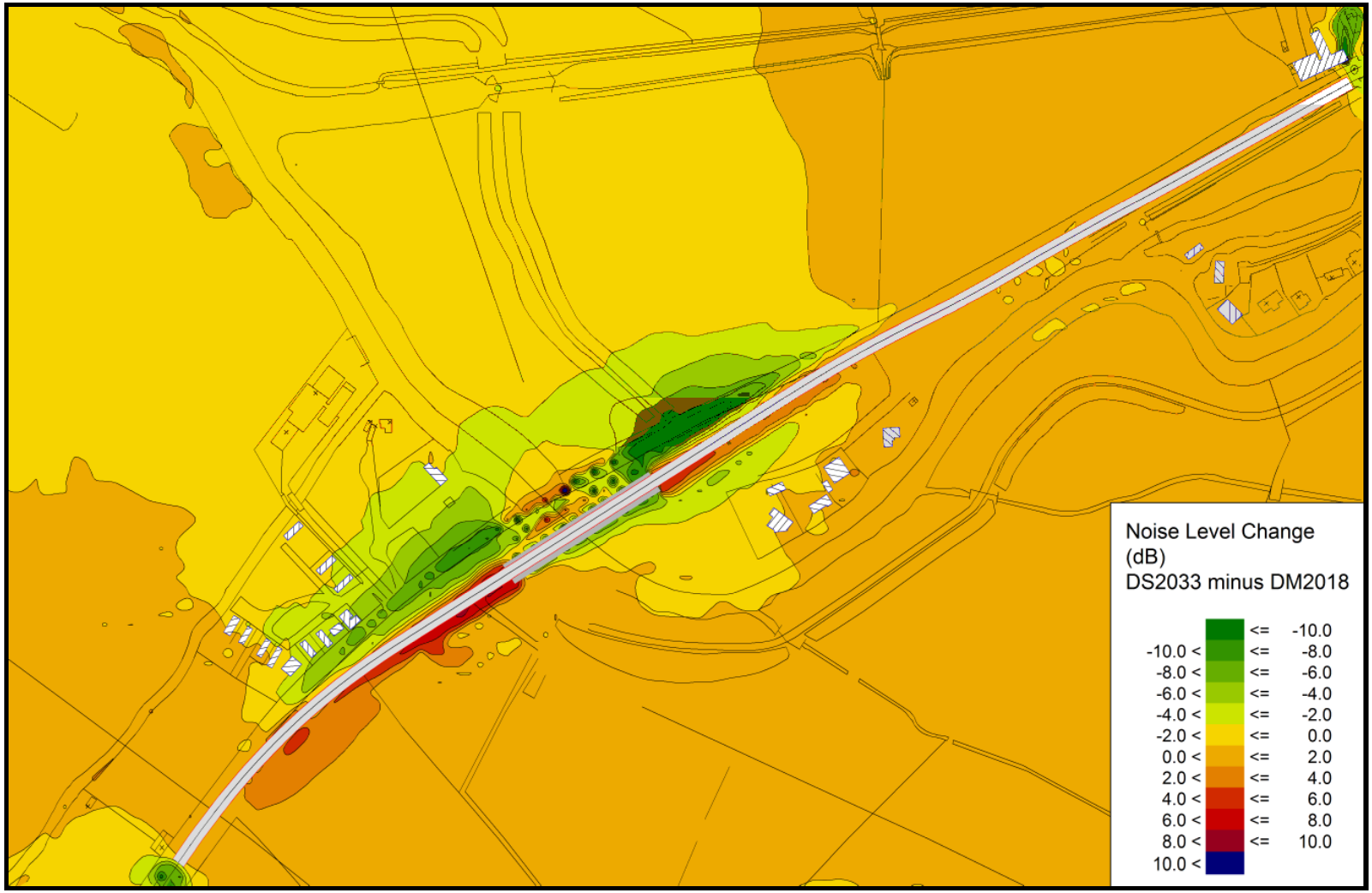

Figure D.2: Do Something 2033 Minus Do Minimum 2018

Zouch Bridge Replacement

Noise and Vibration

Proof of Evidence of Alfred Maneylaws BSc MSc MIOA

Prepared for Leicestershire County Council

July 2018