

Lower Thames Crossing

6.3 Environmental Statement Appendices

Appendix 12.1 - Noise and Vibration Legislation and Policy

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Lower Thames Crossing

Appendix 12.1 - Noise and Vibration Legislation and Policy

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1 Noise and vibration legislation and policy framework

1.1 Legislation and policy

1.1.1 This Noise and Vibration assessment has been undertaken in accordance with relevant legislation, together with national, regional and local plans and policies.

Legislation

1.1.2 Relevant legislation that has been considered in the environmental assessment is presented in Table 1.1. The Planning Statement (Application Document 7.2) provides an assessment of the Project's strategic alignment and conformity with the National Policy Statement for National Networks (NPSNN).

1.1.3 A number of the sources of legislation referred to throughout the ES, including this chapter, derive from the law of the European Union (EU). It is noted that the impact of European legislation may need to be revised following the UK's exit from the EU but much EU-derived domestic legislation continues to have effect in domestic law. Relevant legislation is included in Table 1.1.

Table 1.1 Legislative requirements

Scale	Description of Legislation
European	<p>Directive 85/337/EEC (as amended) Environmental Impact Assessment</p> <p>Article 2 of Directive 85/337/EEC (as amended) requires Member States to adopt all necessary measures to ensure that projects likely to have significant effects on the environment are subject to an assessment of their environmental effects. Article 3 provides that the environmental impact assessment shall identify, describe and assess the environmental impacts of the project.</p>
European	<p>Directive 2002/49/EC Environmental Noise Directive</p> <p>The Directive requires Member States to prepare and publish, every five years, noise maps and noise management action plans for:</p> <ul style="list-style-type: none"> • agglomerations with more than 100,000 inhabitants • major roads (more than 3 million vehicles a year) • major railways (more than 30,000 trains a year) • major airports (more than 50,000 movements a year, including small aircraft and helicopters)
National	<p>Land Compensation Act 1973</p> <p>Part 1 of the Land Compensation Act 1973 provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value caused by the use of public works, such as new or improved roads. Noise and vibration are two of the factors which would be considered in any claims for compensation. Part 2 of the Act imposes a duty on authorities to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings. This is subject to meeting certain criteria given in the Noise Insulation Regulations 1975 (as amended 1988).</p>

Scale	Description of Legislation
National	<p>The Noise Insulation Regulations 1975 (as amended 1988)</p> <p>The Noise Insulation Regulations [NIR] 1975 (amended 1988) provide criteria for assessing the eligibility for noise mitigation or properties based on variations in traffic noise due to a new or improved road project. The regulations make provision for noise attenuation measures in the form of secondary glazing and mechanical ventilation to habitable rooms of residential properties affected by road traffic noise from a 'new or altered highway' which meet the following criteria:</p> <p>The combined expected maximum traffic noise level, i.e. the relevant noise level, from the new or altered highway together with other traffic in the vicinity must not be less than the specified noise level, 68 dB $L_{A10,18\text{-hour}}$.</p> <p>The relevant noise level is at least 1.0 dB(A) more than the prevailing noise level, i.e. the total traffic noise level existing before the works to construct or improve the highway were begun.</p> <p>The contribution to the increase in the relevant noise level from the new or altered highway must be at least 1.0 dB(A).</p>
National	<p>Control of Pollution Act 1974</p> <p>Section 61 of the Control of Pollution Act 1974 sets out procedures for those undertaking works to obtain 'Prior Consent' for construction works within agreed noise limits.</p> <p>Applications for such consent are made to the relevant local authority and contain a method statement of the works and the steps to be taken to minimise noise. Under Section 60 of the Act, the local authority has powers to attach conditions to, limit or qualify any consent to allow for changes and limit the duration of any consents.</p>
National	<p>Environmental Protection Act 1990</p> <p>Under Part III of the Environmental Protection Act 1990, local authorities have a duty to investigate noise complaints from premises (land and buildings) and vehicles, machinery or equipment in the street. It does not apply to road traffic noise but may be applicable to some construction activities. The Noise and Statutory Nuisance Act 1993 placed additional definitions in the list of statutory nuisances in Section 79 of the Environmental Protection Act 1990.</p> <p>If a local authority's Environmental Health Officer is satisfied that a complaint amounts to a statutory nuisance, then the authority must serve an abatement notice on the person responsible or in certain cases the owner or occupier of the property.</p>
National	<p>The Environmental Noise (England) Regulations 2006 (as amended 2008, 2009)</p> <p>The Environmental Noise Regulations have been introduced into the UK to implement the assessment and management of the Environmental Noise Directive 2002/49/EC. This Directive relates to the assessment and management of environmental noise in EU member states and requires noise action plans to be developed on a five-year rolling programme.</p>

Scale	Description of Legislation
National	<p>The Highways Noise Payments and Movable Homes Regulations 2000</p> <p>The Highways Noise Payments and Movable Homes Regulations 2000 provide highways authorities with a discretionary power to provide a noise payment where new roads are to be constructed or existing ones altered. The Highways Noise Payments and Movable Homes Regulations only apply to caravans and houseboats which have been lawfully stationed and are within 300 metres of the new or altered carriageway.</p>
National	<p>Environment Act 2021</p> <p>The Environment Act has two main functions:</p> <ol style="list-style-type: none"> 1. To give a legal framework for environmental governance in the UK. 2. To bring in measures for improvement of the environment in relation to waste, resource efficiency, air quality, water, nature and biodiversity, and conservation. <p>The majority of the Act does not make any immediate changes for organisations other than regulators.</p> <p>The Environment Act does not currently present specific legislative requirements relevant to Noise and Vibration. Further requirements may be implemented through secondary legislation to be made under this Act in the future, and the Project will respond as required.</p>

Policy

- 1.1.4 National policies are presented in Table 1.2, Table 1.3 and Table 1.4, with the Project response to these requirements. Where there is duplication of requirements presented in the various relevant National Policy Statements, these have been combined and a single Project response to the policy issue is provided in the table.
- 1.1.5 Table 1.5 presents regional and local policies that have been considered during the development of the Project and the DCO application.
- 1.1.6 Further detail on policy compliance can be found in the Planning Statement (Application Document 7.2).

Table 1.2 National policy

Reference	Requirement
National Policy Statement for National Networks (Department for Transport, 2014)	The National Policy Statement for National Networks (NPSNN), sets out the need for, and Government's policies to deliver, development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. It provides planning guidance for promoters of NSIPs on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State.
Noise Policy Statement for England (Defra, 2010)	The Noise Policy Statement for England (NPSE) vision is to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development. To achieve this vision the NPSE sets out the following three aims for the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development: Avoid significant adverse impacts on health and quality of life Mitigate and minimise adverse impacts on health and quality of life Where possible, contribute to improvement of health and quality of life.
National Planning Policy Framework (Ministry of Housing, Communities and Local Government, 2021)	The National Planning Policy Framework (NPPF) 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.

Table 1.3 National policy framework and the Project response

Reference	Requirement	Project response
National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014)		
Para 5.187	<i>'Noise resulting from a proposed development can also have adverse impacts on wildlife and biodiversity. Noise effects of the proposed development on ecological receptors should be assessed in accordance with the Biodiversity and Geological Conservation section of this NPS'.</i>	Noise effects on designated sites have been considered in accordance with the Biodiversity and Geological Conservation section of this NPS as part of Chapter 8: Terrestrial Biodiversity and Chapter 9: Marine Biodiversity of the Environmental Statement (ES) (Application Document 6.1).
Para 5.188	<i>'Factors that will determine the likely noise impact include:</i> <ul style="list-style-type: none"> • <i>construction noise and the inherent operational noise from the proposed development and its characteristics;</i> • <i>the proximity of the proposed development to noise sensitive premises (including residential properties, schools and hospitals) and noise sensitive areas (including certain parks and open spaces);</i> • <i>the proximity of the proposed development to quiet places and other areas that are particularly valued for their tranquillity, acoustic environment or landscape quality such as National Parks, the Broads or Areas of Outstanding Natural Beauty; and</i> • <i>the proximity of the proposed development to designated sites where noise may have an adverse impact on the special features of interest, protected species or other wildlife'.</i> 	Noise and vibration impacts linked to the temporary construction phase and the permanent operational phase are fully assessed and considered within the bounds of UK legislation and guidance, within the scope of Section 12.6 of Chapter 12. Noise and vibration effects on designated sites have been considered as part of Chapter 8: Terrestrial Biodiversity and Chapter 9: Marine Biodiversity of the Environmental Statement (ES) (Application Document 6.1)
Para 5.189	<i>'Where a development is subject to Environmental Impact Assessment (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:</i> <ul style="list-style-type: none"> • <i>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</i> 	Noise impacts linked to the Project are fully assessed and considered within the bounds of UK legislation and guidance within the scope of Section 12.6 of Chapter 12. The operational road traffic noise assessment presented within Section 12.6 of Chapter 12 has been based upon the outputs of the Lower Thames Area Model (LTAM) transport model.

Reference	Requirement	Project response
	<p><i>any distinctive tonal, impulsive or low frequency characteristics of the noise.</i></p> <ul style="list-style-type: none"> • <i>identification of noise sensitive premises and noise sensitive areas that may be affected.</i> • <i>the characteristics of the existing noise environment.</i> • <i>a prediction on how the noise environment will change with the proposed development:</i> <ul style="list-style-type: none"> <i>i. In the shorter term such as during the construction period;</i> <i>ii. in the longer term during the operating life of the infrastructure;</i> <i>iii. at particular times of the day, evening and night as appropriate.</i> • <i>an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas.</i> • <i>measures to be employed in mitigating the effects of noise. Applicants should consider using best available techniques to reduce noise impacts.</i> • <i>the nature and extent of the noise assessment should be proportionate to the likely noise impact.'</i> 	<p>A description of likely noise sources has been provided in the construction noise assessment and ventilation noise assessment within Section 12.6 of Chapter 12.</p> <p>The assessment of any tonal or impulsive characteristics from the tunnel ventilation has been taken into account in accordance with British Standard (BS) 4142:2014 (+A1:2019): Methods for rating and assessing industrial and commercial sound.</p> <p>Noise-sensitive premises and areas have been identified within the study area and are presented on Figure 12.3: Operational Road Noise and Vibration Study Area (Application Document 6.2).</p> <p>Short-term and long-term noise surveys during the daytime and night-time have been undertaken at 68 locations within proximity of the Project to understand the existing noise environment and are detailed in Section 12.4 of Chapter 12.</p> <p>Short-term noise impacts from construction have been considered in accordance with BS 5228-1 2009 (+A1:2014) as presented in Section 12.6. The assessment has also considered short-term impacts from the operation of the Project in the opening year in Section 12.6 of Chapter 12.</p> <p>The assessment has considered long-term operational noise impacts by assessing future road traffic noise 15 years after opening, in Section 12.6 of Chapter 12. Noise impacts during the night-time (23:00 to 07:00) and daytime (07:00 to 23:00) have been assessed for construction, operational road traffic noise and tunnel ventilation noise, in Section 12.6 of Chapter 12.</p> <p>Mitigation measures have been considered in Section 12.6 of Chapter 12 in relation to dwellings and Other Sensitive Receptors.</p>

Reference	Requirement	Project response
		<p>Mitigation measures for the Project have been recommended in Section 12.6 of Chapter 12.</p> <p>The assessment has been undertaken using DMRB LA 111 standards and relevant British Standards and is considered proportionate to the likely noise impact of the Project.</p> <p>The assessment has been undertaken covering the extent of the LTAM transport model area which satisfies the requirements of paragraph 5.190 of the NPSNN.</p> <p>Operational noise predictions have been undertaken in accordance with Calculation of Road Traffic Noise (CRTN) (Department for Transport and Welsh Office, 1988) and assessed in accordance with DMRB LA 111.</p> <p>Construction impacts have been predicted and assessed in accordance with BS 5228-1 2009 (+A1:2014) and BS 5228-2 2009 (+A1:2014).</p> <p>Tunnel ventilation noise has been assessed in accordance with BS 4142.</p>
<p>Para 5.190</p>	<p><i>'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'.</i></p>	<p>Noise and vibration impacts linked to the Project are fully assessed and considered within the bounds of UK legislation and guidance within the scope of Section 12.3 of Chapter 12.</p> <p>The study area is defined within the bounds of the DMRB LA 111 guidance and covers not only the Project and the bypassed route but also any other road link, including unaltered links, within the LTAM modelled area identified to experience a change in traffic flows or patterns accounting for a perceptible short-term change in road traffic noise as a result of the Project.</p> <p>As such the noise assessment considers impacts elsewhere on the national networks as a result of the Project in accordance with the DMRB LA 111 guidance.</p>

Reference	Requirement	Project response
Para 5.191	<p><i>‘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. The prediction of noise from new railways should be based on the method described in Calculation of Railway 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.’</i></p>	<p>Noise and vibration impacts linked to the Project are fully assessed and considered within the bounds of UK legislation and guidance as listed in Section 12.3 of Chapter 12:</p> <p>Operational noise predictions have been undertaken in accordance with CRTN and assessed in accordance with DMRB LA 111.</p> <p>Construction impacts have been predicted and assessed in accordance with BS 5228-1 2009 (+A1:2014) and BS 5228-2 2009 (+A1:2014).</p> <p>Tunnel ventilation noise has been assessed in accordance with BS 4142.</p>
Para 5.192	<p><i>‘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.’</i></p>	<p>Chapter 8: Terrestrial Biodiversity and Chapter 9: Marine Biodiversity of the Environmental Statement (ES) (Application Document 6.1) outline the consultation undertaken with Natural England throughout the EIA process, including agreement on the location of noise surveys. The desk-based and field survey requirements which have informed the Habitats Regulations Assessment were subject to consultation with Natural England via the EIA scoping process and reported within the Scoping Report for the Project</p> <p>Effects on protected landscapes are considered as part of ‘Tranquillity and remoteness’ in Section 7.3 of Chapter 7: Landscape and Visual.</p>
Para 5.193	<p><i>‘Developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government’s associated planning guidance on noise.’</i></p>	<p>The impacts of the Project relative to the Noise Policy Statement for England (NPSE) (Department for Environment, Food and Rural Affairs (Defra), 2010) is fully considered within Section 12.6 of Chapter 12.</p>

Reference	Requirement	Project response
<p>Para 5.194</p>	<p><i>‘The project should demonstrate good design through optimisation of Scheme layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The project should also consider the need for the mitigation of impacts elsewhere on the road and rail networks that have been identified as arising from the development, according to Government policy.’</i></p>	<p>The design of the Project has followed an iterative approach calling on the expertise of various elements of the design team to ensure the good acoustic design of the Project.</p> <p>The Design Principles, Environmental Masterplan, LEMP, CoCP and REAC, all form part of the Project control plan. The control plan is the framework for mitigating, monitoring and controlling the effects of the Project. It is made up of a series of ‘control documents’ which present the mitigation measures identified in the application that must be implemented during design, construction and operation to reduce the adverse effects of the Project. Further explanation of the control plan and the documents which it comprises is provided in the Introduction to the Application (Application Document 1.3).</p> <p>Primarily, the design approach followed, advocates the use of more natural landscaping and earthworks as the main method of noise mitigation, combined with thin surfacing systems (with acoustic mitigation properties). This has been augmented by the inclusion of acoustic fencing where earthworks measures were not possible, but mitigation was considered to be beneficial.</p> <p>The embedded earthworks mitigation for operation is set out in Table 12.27 of ES Chapter 12 and presented in Figure 2.4: Environmental Masterplan (Application Document 6.2). Relevant Design Principles (Application Document 7.5) for embedded earthworks are STR.10, S11.05, S11.09 and S14.06. The acoustic barriers are secured through REAC commitment NV011 (Section 7 of the CoCP (Application Document 6.3, Appendix 2.2)) and relevant Design Principles (Application Document 7.5) are STR.04, STR.06, STR.07, STR.09, STR.10, S10.05, S11.05, and LSP.09.</p>

Reference	Requirement	Project response
		This is presented and discussed in more detail within Section 12.5 of Chapter 12, Project design and mitigation.
Para 5.195	<p><i>‘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:</i></p> <ul style="list-style-type: none"> • <i>avoid significant adverse impacts on health and quality of life from noise as a result of the new development;</i> • <i>mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and</i> • <i>contribute to improvements to health and quality of life through the effective management and control of noise, where possible.’</i> 	<p>The noise and vibration assessment has predicted noise levels and implemented mitigation into the Project design where necessary to avoid significant adverse impacts on health and quality of life and to minimise other adverse effects on life as discussed in Chapter 13: Population and Human Health, through the mitigation implemented to control noise.</p> <p>Mitigation measures and the rationale behind the design are presented in Section 12.5 of Chapter 12: Project design and mitigation.</p> <p>Issues of policy compliance are fully considered within Section 12.6 of Chapter 12. The Planning Statement (Application Document 7.2) provides an assessment of the Project’s strategic alignment and conformity with the National Policy Statement for National Networks (NPSNN).</p>
Para 5.198	<p><i>‘Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:</i></p> <ul style="list-style-type: none"> • <i>engineering: containment of noise generated;</i> • <i>materials: use of materials that reduce noise, (for example low noise road surfacing);</i> • <i>lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural or purpose built barriers;</i> • <i>administration: specifying acceptable noise limits or times of use (e.g., in the case of railway station PA systems).’</i> 	<p>Mitigation measures and the rationale behind the design are presented in Section 12.5 of Chapter 12, Project design and mitigation.</p> <p>The design of the Project has followed an iterative approach with noise considered as a key controlling factor in the location, alignment and elevation of the Project. The primary measure being the use of more natural landscaping and earthworks as the main method of noise mitigation, combined with thin surfacing systems (with acoustic mitigation properties). This has been augmented by the inclusion of acoustic fencing where earthworks measures were not possible, but mitigation was considered to be beneficial.</p>

Reference	Requirement	Project response
Para 5.199	<i>'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.'</i>	The Noise Insulation Regulations (NIR) have been considered within the assessment of operational effects as presented within Section 12.6 of Chapter 12 and Appendix 12.7 Noise Insulation Regulations Assessment (Application Document 6.3).
Para 5.200	<i>'Applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process.'</i>	The Noise Important Areas (NIAs) have been considered within the assessment of operational effects as presented within Section 12.6 of Chapter 12. Mitigation appropriate to the project, including consideration of NIA's, is presented, and considered in Section 12.5 of Chapter 12 and Appendix 12.10 (Application Document 6.3).
National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021)		
Para 174	<i>'Planning policies and decisions should contribute to and enhance the natural and local environment by: e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans'.</i>	The impacts of the Project have been assessed in accordance with appropriate UK policy requirements, with mitigation specified within the Project to control noise as far as reasonably possible; this is detailed further within Section 12.6 of Chapter 12.

Reference	Requirement	Project response
Para 185	<p><i>‘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:</i></p> <ul style="list-style-type: none"> <i>• 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;</i> <i>• identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason’.</i> 	<p>The Project has been assessed in accordance with appropriate UK policy requirements, with mitigation specified within the Project to control noise as far as reasonably possible; this is detailed further within Sections 12.6 and 12.7 of Chapter 12.</p> <p>Noise effects on tranquillity and landscape quality are considered as part of Chapter 7: Landscape and Visual.</p>
Overarching National Policy Statement for Energy (NPS EN-1) (Department of Energy and Climate Change, 2011a)		
5.11.4	<p><i>‘Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment:</i></p> <ul style="list-style-type: none"> <i>• a description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise;</i> <i>• identification of noise sensitive premises and noise sensitive areas that may be affected;</i> <i>• the characteristics of the existing noise environment;</i> <i>• a prediction of how the noise environment will change with the proposed development;</i> <i>• in the shorter term such as during the construction period;</i> <i>• in the longer term during the operating life of the infrastructure;</i> <i>• at particular times of the day, evening and night as appropriate.</i> 	<p>The noted points are considered within the assessment presented in Appendix 12.8: National Grid Electricity Transmission Network, Assessment for Audible Noise (Application Document 6.3).</p>

Reference	Requirement	Project response
	<ul style="list-style-type: none"> • <i>an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas; and</i> • <i>measures to be employed in mitigating noise.</i> <p><i>The nature and extent of the noise assessment should be proportionate to the likely noise impact.'</i></p>	
5.11.5	<p><i>'The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered.'</i></p>	<p>The assessment considers the increase in road traffic associated with the project. This is described within Appendix 12.8: National Grid Electricity Transmission Network, Assessment for Audible Noise (Application Document 6.3).</p>
5.11.6	<p><i>'Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards¹³⁷ and other guidance. Further information on assessment of particular noise sources may be contained in the technology-specific NPSs. In particular, for renewables (EN-3) and electricity networks (EN-5) there is assessment guidance for specific features of those technologies. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards¹³⁸ and other guidance which also give examples of mitigation strategies.'</i></p> <p>[Note 137: For example BS 4142: BS 6472 and BS 8233.]</p> <p>[Note 138: For example BS 5228.]</p>	<p>The operational assessment of the National Grid Electricity Transmission (NGET) high voltage (HV) overhead transmission lines (OHLs) is assessed using guidance from BS4142:2014:A1+2019 and is presented Appendix 12.8: National Grid Electricity Transmission Network, Assessment for Audible Noise (Application Document 6.3).</p>
<p>National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (NPS EN-4) (Department of Energy and Climate Change, 2011b)</p>		
NPS EN-4 Para 2.20.3	<p><i>'The commissioning of a new pipeline can involve extensive periods of drying after hydrotesting, using air compressors, and noise mitigation may be required for this type of activity.'</i></p>	<p>Table 2.3 of Appendix 12.4 Construction Noise and Vibration Assessment (Application Document 6.3) sets out the envisaged construction plant itinerary related to the utilities works associated with the Project. It does involve the use of compressors. The control of noise is addressed in the REAC</p>

Reference	Requirement	Project response
		<p>which forms part of the CoCP (Application Document 6.3). It contains a suite of measures which would minimise and mitigate noise impacts which include:</p> <ul style="list-style-type: none"> • NV001 Noise and vibration level controls • NV002 Noise and vibration plan • NV006 Noise assessment • NV007 Best practicable means • NV009 Noise and vibration monitoring
<p>NPS EN-4 Para 2.20.4</p>	<p><i>‘A new gas pipeline may require an above ground installation such as a gas compression station on the route of the pipeline to boost transmission line pressure. A new oil pipeline may require pumping stations. These may be located in quiet rural areas, and therefore the control of noise from these facilities is likely to be an important consideration.’</i></p>	<p>No such works are required as part of this Project. So this paragraph is not relevant.</p>
<p>National Policy Statement for Electricity Networks Infrastructure (NPS EN-5) (Department of Energy and Climate Change, 2011c)</p>		
<p>NPS EN-5 Para 2.9.8</p>	<p><i>‘While standard methods of assessment and interpretation using the principles of the relevant British Standards are satisfactory for dry weather conditions, they are not appropriate for assessing noise during rain, which is when overhead line noise mostly occurs, and when the background noise itself will vary according to the intensity of the rain.’</i></p>	<p>The assessment of effects, as detailed in Section 6 of Appendix 12.8 follows well established acoustic principles for human perception of noise and the context within which the noise occurs.</p> <p>Section 5 of Appendix 12.8 outlines an alternative methodology considered by National Grid and the Applicant to be appropriate for the permanent diversion of existing overhead lines (OHLs) in the context of the Project.</p>
<p>NPS EN-5 Para 2.9.9</p>	<p><i>‘Therefore, an alternative noise assessment method to deal with rain-induced noise is needed, such as the one developed by National Grid as described in report TR(T)94,1993. This follows recommendations broadly outlined in ISO 1996 (BS 7445:1991) and in that respect is consistent with BS 4142:1997. The IPC is likely to be able to regard it as acceptable for the applicant to use this or another methodology that appropriately addresses these particular issues.’</i></p>	<p>The methodology considers the occurrence of OHL noise in both dry and wet conditions and follows the principles outlined in PS(T)134, 2021 to predict OHL source noise levels.</p>

Reference	Requirement	Project response
NPS EN-5 Para 2.9.12	<p><i>‘Applicants should have considered the following measures:</i></p> <ul style="list-style-type: none"> <i>• the positioning of lines to help mitigate noise;</i> <i>• ensuring that the appropriately sized conductor arrangement is used to minimise potential noise;</i> <i>• quality assurance through manufacturing and transportation to avoid damage to overhead line conductors which can increase potential noise effects; and</i> <i>• ensuring that conductors are kept clean and free of surface contaminants during stringing/installation.’</i> 	<p>See response to paragraphs 2.9.8 and 2.9.9 above.</p> <p>Where possible, the re-alignment of the OHL has been undertaken with noise as a consideration, however due to the works being a re-alignment of the existing OHL network, these considerations were confined by the locations and positions of the existing OHL tower network.</p> <p>The proposed OHL designs and conductor arrangements are detailed in Table 3.1 of Appendix 12.8.</p> <p>Good practice environmental measures to reduce audible noise effects through quality assurance, are detailed in paragraph 2.1.9 of Appendix 12.8.</p>
NPS EN-5 Para 2.9.13	<p><i>‘The ES should include information on planned maintenance arrangements. Where this is not the case, the IPC should consider including these by way of requirements attached to any grant of development consent.’</i></p>	<p>The maintenance arrangements for new and refurbished sections of OHL would be the same as for the existing OHL infrastructure.</p> <p>National Grid will continue undertake its statutory duty to maintain its Electricity Transmission infrastructure in accordance with the requirements of the Electricity Act 1989 (as amended).</p>

Table 1.4 Other National policies relevant to noise and vibration

Reference	Requirement	Project response
Noise Policy Statement for England (NPSE)		
Para 1.6	<i>'This NPSE sets out the long term vision of Government noise policy: Noise Policy Vision: Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.'</i>	The Project has been assessed in accordance with appropriate UK policy requirements, with mitigation specified to control noise as far as reasonably practicable; this is detailed further within Section 12.5 of Chapter 12.
Para 1.7	<i>'This long term vision is supported by the following aims: Noise Policy Aims: Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:</i> <ul style="list-style-type: none"> • <i>avoid significant adverse impacts on health and quality of life;</i> • <i>mitigate and minimise adverse impacts on health and quality of life; and where possible, contribute to the improvement of health and quality of life.'</i> 	The Project has been assessed and controlled in accordance with appropriate UK policy requirements, with control measures specified to mitigate and minimise noise; this is detailed further within Section 12.5 of Chapter 12. These aims within the NPSE are mirrored within paragraph the 5.195 of the NPSNN.

Table 1.5 Regional and local policies for noise and vibration

Local authority	Policy/legislation	Policy requirements
Essex Transport Strategy: the Local Transport Plan for Essex (Essex County Council, 2011)	Policy 9: The Natural, Historic and Built Environment	<p><i>'The County Council will protect the natural, historic and built environment from the harmful effects of transport by:</i></p> <ul style="list-style-type: none"> • <i>designing and implementing transport improvements and maintenance works that retain the integrity of the built environment, natural habitats and biodiversity, the natural and historic landscape, and water quality;</i> • <i>minimising the visual and noise impacts of transport;</i> • <i>addressing air quality issues through appropriate measures, particularly in designated Air Quality Management Areas'</i>
The London Plan (Greater London Authority, 2021)	Polict D1: London's form, character and capacity for growth	<p>Shortened Policy: Boroughs should undertake area assessments to define the characteristics, qualities and value of different places within the plan area to develop an understanding of different areas' capacity for growth. Area assessments should cover the elements listed below: 5) air quality and noise levels</p>
	Policy D3: Optimising site capacity through the design-led approach	<p>Shortened Policy: Development proposals should: 9) help prevent or mitigate the impacts of noise and poor air quality</p>
	Policy D13: Agent of Change	<p><i>A The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance-generating uses in a sensitive manner when new development is proposed nearby.</i></p> <p><i>B Development should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.</i></p>

Local authority	Policy/legislation	Policy requirements
		<p><i>C New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.</i></p> <p><i>D Development proposals should manage noise and other potential nuisances by:</i></p> <ol style="list-style-type: none"> <i>1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area</i> <i>2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations</i> <i>3) separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.</i> <p><i>E Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed.</i></p>
	<p>Policy D14: Noise</p>	<p>Shortened Policy:</p> <p>In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:</p> <ol style="list-style-type: none"> 1) avoiding significant adverse noise impacts on health and quality of life 2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change 3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses 4) improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity) 5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation

Local authority	Policy/legislation	Policy requirements
		6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles 7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.
Local Plan Core Strategy (Gravesham Borough Council, 2014)	CS19: Development and Design Principles	New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anti-crime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below: New development will be located, designed and constructed to: avoid adverse environmental impacts from pollution, including noise
Core Strategy and Policies for Management of Development (Thurrock Council, 2015)	PMD1: Minimising Pollution and Impacts on Amenity, Health, Safety and the Natural Environment	<p><i>'1. Development will not be permitted where it would cause or is likely to cause unacceptable effects on:</i></p> <ul style="list-style-type: none"> <i>i. the amenities of the area;</i> <i>ii. the amenity, health or safety of others;</i> <i>iii. the amenity, health or safety of future occupiers of the site; or</i> <i>iv. the natural environment</i> <p><i>2. Particular consideration will be given to the location of sensitive land uses, especially housing, schools and health facilities, and nationally, regionally and locally designated biodiversity sites, and areas of recreational and amenity value which are relatively undisturbed by noise and valued for this reason.</i></p> <p><i>3. The Council will require assessments to accompany planning applications where it has reasonable grounds to believe that a development may suffer from, or cause:</i></p> <ul style="list-style-type: none"> <i>i. Air pollution;</i> <i>ii. Noise pollution;</i> <i>iii. Contaminated land/soil;</i> <i>iv. Odour;</i>

Local authority	Policy/legislation	Policy requirements
		<p><i>v. Light pollution and shadow flicker;</i> <i>vi. Water pollution;</i> <i>vii. Invasion of privacy;</i> <i>viii. Visual intrusion;</i> <i>ix. Loss of light;</i> <i>x. Ground instability;</i> <i>xi. Vibration</i></p> <p><i>4. Where the assessment confirms such potential harm, planning permission will only be granted if satisfactory solutions can be achieved through design, or suitable mitigation measures can be put in place through conditions or a planning obligation. Where assessment is not forthcoming the Council may refuse permission on a precautionary basis.</i></p> <p><i>5. The Council will seek compliance with, and contribution to, EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality in local areas arising from individual sites.</i></p> <p><i>6. In the interests of supporting legitimate business activity pursuant to policy CSSP2 the Council will resist the introduction of sensitive uses in locations where their presence would be likely to lead to unreasonable restrictions over business activity having to be imposed in order to avoid unacceptable nuisance to those sensitive uses. Exceptionally the Council may accept co-location of sensitive uses with business uses where the sensitive uses are part of approved proposals for the redevelopment of a wider area from business use to a predominantly residential use.'</i></p>
	<p>PMD9: Road Network Hierarchy</p>	<p><i>'1. Routes of all levels</i> <i>The Council will only permit the development of new accesses or increased use of existing accesses where:</i></p> <p><i>i. There is no possibility of safe access taken from an existing or proposed lower category road</i></p> <p><i>ii. The design of the development minimises the number of accesses required.</i></p>

Local authority	Policy/legislation	Policy requirements
		<p><i>iii. The development makes a positive contribution to road safety or road safety is not prejudiced.</i></p> <p><i>iv. The development preserves or enhances the quality of the street scene.</i></p> <p><i>v. The development avoids causing congestion as measured by link and junction capacities.</i></p> <p><i>vi. Measures are taken to mitigate all adverse air quality impacts in or adjacent to Air Quality Management Areas.</i></p> <p><i>vii. The development will minimise adverse impacts on the quality of life of local residents, such as noise, air pollution, and the general street environment.</i></p> <p><i>viii. The development will make a positive contribution to accessibility by sustainable transport.'</i></p>
Core Strategy and Development Control Policies Development Plan Document (London Borough of Havering, 2008)	CP15: Environmental Management	To reduce their environmental impact and to address the causes and adapt to and mitigate the effects of climate change in their location, construction and use new development should: avoid a noise sensitive use being exposed to excessive noise.
	DC55: Noise	<i>'Planning permission will not be granted if it will result in exposure to noise or vibrations above acceptable levels affecting a noise sensitive development such as all forms of residential accommodation, schools and hospitals. Where the proposal would lead to a noise sensitive development being located near to a noise generating activity, a formal assessment will be required to ensure compliance with the noise exposure categories in Planning Policy Guidance Note 24, Planning and Noise. Planning conditions may be imposed to this effect.'</i>
Brentwood Replacement Local Plan (Brentwood Borough Council, 2005)	CP1: General Development Criteria	<i>'Any development will need to satisfy [...] the following:</i> <i>vii) The proposal would not have an unacceptable detrimental impact on health, the environment or amenity due to the release of pollutants to land, water or air (including noise, fumes, vibration, smells, smoke, ash, dust and grit).'</i>
	PC4: Noise	<i>'Residential and other noise-sensitive development, such as schools and hospitals, will not be permitted where the occupants would experience either significant internal or external noise disturbance. Equally, noise-generating development will not be permitted if it would have a significant unacceptable detrimental impact on the noise levels</i>

Local authority	Policy/legislation	Policy requirements
		<i>experienced by the occupiers of existing or proposed residential or other noise-sensitive development. In assessing the acceptability or otherwise of any proposals, regard will be had to the standards set out in Planning Policy Guidance Note 24.'</i>
	PC5: Traffic Noise	<i>'The council will continue to make representations to the Department of Transport and implement its own schemes where possible to ensure that adequate noise protection (including planting belts and tree screens) is introduced along the A12 corridor and elsewhere within the Borough where traffic noise is a problem.'</i>
	PC6: Transport Pollution	<i>'All new transport proposals and improvements to existing transport infrastructure and services will be assessed against their impact on air quality, noise levels and visual amenity, and will need to be designed so as to minimise any negative impacts and, where necessary, incorporate reasonable and appropriate mitigation measures.'</i>
Dartford Development Policies Plan (Dartford Borough Council, 2017)	DP5: Environmental and Amenity Protection	<p><i>1. Development will only be permitted where it does not result in unacceptable material impacts, individually or cumulatively, on neighbouring uses, the Borough's environment or public health. Particular consideration must be given to areas and subjects of potential sensitivity in the built and natural environment (including as highlighted on the Policies Map) and other policies, and other potential amenity/ safety factors such as:</i></p> <ul style="list-style-type: none"> <i>i. air and water quality, including groundwater source protection zones;</i> <i>ii. intensity of use, including hours of operation;</i> <i>iii. anti-social behaviour and littering;</i> <i>iv. traffic, access, and parking;</i> <i>v. noise disturbance or vibration;</i> <i>vi. odour;</i> <i>vii. light pollution;</i> <i>viii. overshadowing, overlooking and privacy;</i> <i>ix. electrical and telecommunication interference;</i> <i>x. HSE land use consultation zones;</i> <i>xi. land instability;</i> <i>xii. ground contamination.</i>

Local authority	Policy/legislation	Policy requirements
		<p>2. Development should not materially impede the continuation of lawfully existing uses. Where any impacts cannot be adequately mitigated, planning applications are not likely to be permitted.</p>
<p>Medway Local Plan (Medway Council, 2003)</p>	<p>BNE2: Amenity Protection</p>	<p>'All development should secure the amenities of its future occupants, and protect those amenities enjoyed by nearby and adjacent properties. The design of development, should have regard to:</p> <ul style="list-style-type: none"> i. privacy, daylight, and sunlight; and ii. noise, vibration, light, heat, smell and airborne emissions consisting of fumes, smoke, soot, ash, dust and grit; and iii. activity levels and traffic generation.'
	<p>BNE3: Noise Standards</p>	<p>'In considering the impact of noise from transport related sources on new residential development, the noise exposure categories (NECs) set out below will be applied as follows:</p> <ul style="list-style-type: none"> (i) where noise levels are within category A, noise need not be considered as a determining factor; (ii) where noise levels fall within category B, the applicant should demonstrate that adequate mitigation measures are included in the proposal to reduce noise to a satisfactory level or, where appropriate, conditions will be imposed to ensure such mitigation measures; (iii) where noise levels fall within category C, the development will not be permitted unless either (a) the site is allocated for residential development or (b) there are no alternative quieter sites available. In both cases, a substantial level of protection against noise must be provided; (iv) where noise levels are within category D, planning permission will be refused.' <p>'Noise levels⁽¹⁾ corresponding to the noise exposure categories for new dwellings $L_{Aeq,T}dB$'</p>

Local authority	Policy/legislation	Policy requirements				
		Noise source	Noise Exposure Category (NEC)			
			A	B	C	D
		Road traffic				
		07:00 – 23:00	<55	55 - 63	63 - 72	>72
		23:00 – 07:00 ⁽²⁾	<45	45 - 57	57 - 66	>66
		Rail traffic				
		07:00 – 23:00	<55	55 - 66	66 - 74	>74
		23:00 – 07:00 ⁽²⁾	<45	45 - 59	59 - 66	>66
		Air traffic				
		07:00 – 23:00	<57	57 - 66	66 - 72	>72
		23:00 – 07:00 ⁽³⁾	<48	48 - 57	57 - 66	>66
		Mixed sources⁽⁴⁾				
		07:00 – 23:00	<55	55 - 63	63 - 72	>72
		23:00 – 07:00 ⁽²⁾	<45	45 -57	57 - 66	>66
<p><i>These thresholds may be increased or decreased by up to 3dB(A) where it can be justified.</i></p> <ol style="list-style-type: none"> <i>Noise levels: the free field noise level(s) (L_{AeqT}) used when deciding the NEC of a site should be representative of typical conditions.</i> <i>Night-time noise levels (2300-0700 hours): sites where the free field individual noise events regularly exceed 80dB L_{Amax} (S time weighting) several times in any hour, should be treated as being in NEC C regardless of the $L_{Aeq,8r}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D).</i> <i>Aircraft noise: daytime values accord with the contour values adopted by the Department of the Environment, Transport and the Regions which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour</i> 						

Local authority	Policy/legislation	Policy requirements
		<p><i>values can be up to 2dB(A) higher than those of other sources because of ground reflection effects.</i></p> <p><i>4. Mixed sources: this refers to any combination of road, rail and industrial noise sources. The ‘mixed source’ values are based on the lowest numerical values of the single source limits in the table. The ‘mixed source’ NECs should only be used where no individual noise source is dominant.</i></p> <p><i>‘Residential development should be designed to minimise noise levels within gardens and/or amenity areas provided by that development, with the aim of having these areas experience a general daytime (07.00 to 23.00 hours) noise level of at most 55 L_{Aeq,T}dB. Noise sensitive development (including offices, hospitals, schools and, in respect of noise emanating from non-transport related sources, housing) should be designed to minimise the impact of existing noise sources and the applicant will be required to demonstrate that the proposed development will not be exposed to unacceptable levels of noise relative to the proposed use.</i></p> <p><i>Noise-generating development should be located and designed so as not to have a significant adverse noise impact on any nearby noise sensitive uses (including offices, hospitals, schools and, in respect of noise emanating from non-transport related sources, housing).’</i></p>
	<p>T18: New Transport Infrastructure</p>	<p><i>‘Proposals for major transport infrastructure will be assessed against the following considerations:</i></p> <p><i>(i) the provision of facilities for integrated transport, including cycling, pedestrian movement and public transport;</i></p> <p><i>(ii) the contribution of the scheme to improved safety;</i></p> <p><i>(iii) the economic impact of the infrastructure investment, through the estimated benefits of reduced journey times for commercial, business and other traffic;</i></p> <p><i>(iv) the environmental and social impact of the scheme including extent of protection for the built and natural environment, estimates of noise and vibration and proposed mitigation, severance and landscaping proposals; and</i></p> <p><i>(v) the demonstrable need for the infrastructure and its contribution to the regeneration of Medway’s economy and physical environment balanced against the need not to encourage private car journeys.’</i></p>

2 Noise-specific guidance

Table 2.1 Noise and vibration technical guidance

Technical guidance	Scope of guidance
BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise (British Standards Institution, 2014)	Part 1 of the Code of practice for noise and vibration control on construction and open sites provides guidance on the methods that can be used to predict and measure noise from construction activities and how to assess the impact on those exposed to it. In particular, Annex F sets out the methods of estimating noise from construction sites which take into account distance, ground effects, and reflections from surfaces, and screening by obstacles.
BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Vibration (British Standards Institution, 2014)	Part 2 of BS 5228 gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry specific guidance. Guidance is provided concerning methods of measuring vibration and assessing its effects on the environment.
BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (British Standards Institution, 2019)	This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations which comprise mechanical and electrical plant and equipment. The methods described use outdoor sound levels to assess the likely effects of sound on people residing at dwellings or premises used for residential purposes upon which sound is incident.
Calculation of Road Traffic Noise (CRTN), (Department for Transport and Welsh Office, 1988)	CRTN is the standard method for calculating road traffic noise in the UK. It is the Design Manual for Roads and Bridges' recommended method for calculating road traffic noise.
Converting the UK traffic noise index LA10, 18h to EU noise indices for noise mapping (TRL limited, 2002)	The document provides a methodology for the establishment of a common EU framework for the assessment and management of exposure to environmental noise. The document provides three interim methodologies for the derivation of EU noise indices (including L_{night}) from CRTN derived noise levels.
Design Manual for Roads and Bridges LA 111 Noise and vibration (Highways England, 2020)	Design Manual for Roads and Bridges provides guidance on the appropriate level of assessment to be used when considering the noise and vibration effects associated with construction, improvement, use and maintenance of motorways and all-purpose trunk roads. LA111 provides updated advice to support National Highways scheme assessments and relates to noise in the following way: <ul style="list-style-type: none"> • Modifications to the CRTN methodology • Guidance on implementation of the speed pivoting process

Technical guidance	Scope of guidance
Design Manual for Roads and Bridges LD 119 Roadside environmental mitigation and enhancement (National Highways, 2020)	This document provides guidance for determining the acoustic specification of noise barriers.
PS(T)134 'Operational Audible Noise Policy for Overhead Lines (New Build, Reconductoring, Diversion and Uprating)' Issue 2, National Grid, June 2021	PS(T)134 describes methods for predicting the environmental impact due to audible noise caused by new, reconducted, diverted or uprated overhead transmission lines. The method uses internationally recognised line noise prediction methodology to calculate noise emission levels based on operating voltage, conductor design and pylon geometry

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