THE MERSEY GATEWAY PROJECT

NOISE AND VIBRATION

DELIVERY PHASE

CHAPTER 17.0

NOISE AND VIBRATION

C O N T E N T S

17. NOISE AND VIBRATION 17.3

17.1 Introduction 17.3
17.2 Purpose of Study 17.4
17.3 Study Area 17.7
17.4 Legislation and Planning Policy 17.9
17.5 Assessment Methodology 17.18
17.6 Baseline and Do Minimum Results 17.27
17.7 Effects Assessment of the Project 17.31
17.8 Mitigation, compensation, enhancement and monitoring 17.44
17.9 Residual Effects 17.49
17.10 References 17.57

FIGURES

Figure 17.1 The Noise and Vibration Study Area
Figure 17.2 a 2006 Base Year noise contours – day time
Figure 17.2 b 2006 Base Year noise contours – night time
Figure 17.3 a 2015 do minimum noise contours– day time
Figure 17.3 b 2015 do minimum noise contours – night time
Figure 17.4 a 2030 do minimum noise contours– day time
Figure 17.4 b 2030 do minimum noise contours – night time
Figure 17.5 a 2015 do something noise contours– day time
Figure 17.5 b 2015 do something noise contours – night time
Figure 17.6 a 2030 do something noise contours – day time
Figure 17.6 b 2030 do something noise contours – night time
Figure 17.7 Area 1 Speke Road to Widnes Loops
Figure 17.8 Area 2 SJB northern approach
Figure 17.9 Area 4 SJB southern approach
Figure 17.10 Area 5 Weston Point Expressway
Figure 17.11 Area 6 & 7 River Mersey, Wigg Island, Astmoor
Figure 17.12 Area 8 Bridgewater junction
Figure 17.13 Area 9 Central Expressway (north)
Figure 17.14 Area 9 Central Expressway (south)
Figure 17.15 Area 10 Weston Link to M56
Figure 17.16 Location of schools
Figure 17.17 Barrier location 1
Figure 17.18 Barrier location 2
Figure 17.19 Liverpool Noise Action Plan – Widnes and Halton areas

APPENDICES

Appendix 17.1 Figures not found in the main text

17. NOISE AND VIBRATION

17.1 Introduction

17.1.1 This Chapter assesses the potential noise and vibration effects of the Mersey Gateway Project including the Proposals during the construction phase and the operational phase. The potential effects have been assessed at receptors within Runcorn~~,~~ and Widnes ~~and Halton,~~ and included the consideration of both positive and negative effects on those receptors.

17.1.2 The Proposals in the Further Applications affecting the Project comprise the following:

a. Adoption of Open Road Tolling Technology from opening, as opposed to the barrier tolling authorised by the Permissions and Orders;
b. Redesign of the on- and off-slips at the formerly proposed Widnes Loops Junction to remove the loops configuration from the proposals and provide a grade separated roundabout junction;
c. Changes to the vertical alignment of the mainline of the Project as a result of other design changes;
d. Adjustments to the alignment at Lodge Lane Junction to remove the need to replace the existing busway bridge; and
e. Adoption of urban highway standards in some locations where rural standards had been used.

17.1.3 This Chapter has updated the Orders ES Noise and Vibration Chapter in line with a review of predicted traffic flows and the anticipated opening year along with the changes in the proposed construction locations and phasing.

17.2 Purpose of Study

17.2.1 The purpose of the study is to determine and, where possible, quantify whether the Project including the Proposals, will have any effect, positive or negative, in terms of noise and vibration and to identify receptors in the study area likely to experience these effects. The study area covered by the noise and vibration assessment is discussed in 17.3 below.

17.2.2 The baseline information required as part of this ES in connection with noise and vibration has been shown and an assessment has been made of how the situation may change in the future both without the Project in a 'do minimum' scenario and with the Project, including the Proposals, in a 'do something scenario'. The significance of the effects of the Project has been reported and mitigation suggested where appropriate. In addition, this chapter gives an indication of the number of residential properties that may be eligible for compensation under Part 1 of the Land Compensation Act 1973 (Ref 1) and insulation under the Noise Insulation Regulations 1975, as amended 1988 (Ref 3).

17.2.3 The potential effects have been assessed within the study area shown on Figure 17.1 for both the construction and operational phases of the Project to establish which of these potential effects is significant. These effects have been discussed in section 17.7 below.

17.2.4 Mitigation has been discussed in section 17.8 and any residual impacts have been highlighted in Section 17.9.

17.2.5 This assessment of noise and vibration for the Further Applications ES considers the implications of including the Proposals in the Project. In this sense, the chapter differs from the others in the Further Applications ES because it is not a *de novo* assessment of the Project including the Proposals. Instead it follows a similar approach to that in relation to the Transport assessment. It considers whether the Reference Design represents a worst case in comparison with the Updated Reference Design contained in the Further Applications. This is adjudged to be an appropriate approach because the changes in noise assessment terms between the Reference Design and Updated Reference Design are assessed to result in a beneficial effect in the Do Something Scenario.

17.2.6 This chapter of the Further Applications ES relies on the Transportation Assessment contained in Chapter 16. It reflects the Project as now proposed – i.e. including the Proposals contained in the Further Applications and the Updated Reference Design. It reports changes as a result of changes to the predicted traffic flows (as explained in Chapter 16) since the Orders ES. It also considers changes (if any) to the conclusions contained in the Orders ES as a result of the Proposals being included in the Project.

17.2.7 In 2009, the Reference Design was the subject of a Public Inquiry. As part of this process, the noise assessment was re-visited and updated. The key revisions considered at the inquiry related to changes in guidance issued in the intervening period, the effect of which was an expansion of the study area in line with a revision of the DMRB at that time. This is discussed in greater detail below.

17.2.8 A description of the Proposals is provided in Chapter 2. Those relevant to noise and vibration are summarised in Table 17.13 overleaf.

Table 17.13 - Summary of Proposals

Area	Summary of Proposals
A – Speke Road	a. Toll plazas removed; b. Extent of overall works reduced to reflect removal of toll plazas; c. Slip roads and embankments re-designed to reflect removal of toll plaza, low retaining wall added on northern off slip; and d. The reduced extent of the works means that there will be no requirement for any works that might affect either Steward Brook or the Old Lane Subway.
B – Ditton Junction to Freight Line	a. Toll plazas removed; b. Slip roads and embankments re-designed to reflect removal of toll plazas; and c. Main alignment shifted north to reduce adverse effects during construction in terms of disruption to road users.
C – Freight Line to St Helens Canal including the Widnes Loops Junction	a. Toll plazas removed; b. Junction, slip road and embankments re-designed (as roundabout) to reflect the removal of the toll plazas; and d. Revisions to the alignment to take account of the changes including a reduction in the vertical alignment and moving of the horizontal alignment to the south.
F – Bridgewater Junction	a. Minor re-alignment of slip roads and associated embankments; and b. Extent of slip road works reduced.
G – Central Expressway, Lodge Lane and Weston Link Junction	b. Merge / diverge to Halton Lea reinstated; c. Addition of retaining walls and traffic signals at Central Expressway slips to accommodate design developments; d. Existing Busway bridge retained with adjustments in line / level to fit alignment through existing bridge; and f. Overall extent of slip road works reduced.
I – Silver Jubilee Bridge and Widnes De-Linking	a. Removal of toll plazas; and b. Queensway reduced to three lanes to accommodate cycle/footway over existing structures.

17.2.9 Removing the toll plazas and use of Open Road Tolling (ORT) technology may affect average traffic speeds at peak times. Current traffic noise assessment guidance directly links vehicle speed to noise level such that faster flowing traffic is regarded as noisier than stop-start traffic at the toll plazas. However, free flowing traffic at the toll plazas was the basis of assessment in relation to the Reference Design. Therefore, the change from toll plazas to ORT is not considered to affect the modelled noise levels and represents a worst case assessment that has already been considered.

17.2.10 There are a series of structural options and changes proposed as part of the Further Applications and these are detailed in Chapter 2. These are not considered further in this chapter as the options are not considered likely to have significantly different impacts on local noise and vibration in comparison with previous assessments either during construction or operation.

17.2.11 For the basis of the noise and vibration assessment, the construction techniques described in the CMR have been assessed. This approach was used in the Orders ES and is maintained here.

17.2.12 As detailed in Chapter 3, a Construction and Operation Code of Practice for Environmental Management (COPE) has been developed to outline the measures required to mitigate and monitor the construction and operation of the Project. This includes noise and vibration monitoring and control measures.

17.3 Study Area

17.3.1 The study area has largely been defined by the changes in traffic flows predicted to be associated with the Project. It is based on a 600 metre distance alongside either side of all proposed road works, giving a total 1200 metre corridor. This is in line with the guidance presented the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 (Ref 2) (described in more detail in section 17.4 below). This area is identical to the final Study Area for which an assessment was reported in respect of the Reference Design reflecting the guidance at the time of the Public Inquiry and current DMRB practice for noise assessment. The study area is shown in Figure 17.1. ~~These~~ Traffic flows ~~have been~~ were provided from the Variable Demand Model (VDM) produced as part of the traffic impact study which is explained further in Chapter 16. The traffic flows for each road link ~~have been~~ were filtered according to the following criteria to determine the study area.

17.3.2 Roads in the study area with levels of traffic that will be less than or equal to 1000 vehicles per 18 hour period were excluded from the assessment. Such a traffic flow would produce a low noise level so the approach removes from the assessment those roads that are not expected to experience significant noise effects as a result of the Project.

17.3.3 ~~The Design Manual for Roads and Bridges (DMRB) Volume 11, Part 3, Section 7 (Ref 2) (described in more detail in section 17.4 below)~~ The DMRB suggests a method that can be adopted for the assessment of roads in relation to noise and vibration. The objective is to establish the magnitude and significance of noise changes for all areas where traffic volume is likely to be increased by 25% or reduced by 20%. This is broadly equivalent to an increase or a decrease of about 1 dB(A). Road links expected to experience such a change as a result of the Project have been included in the study area

17.3.4 In addition to the above criteria the study area was selected so that at least ~~a 300~~ the 600 metre corridor to either side of the road under assessment was included. Again, this is a recommendation of the DMRB. The DMRB has been developed over many years and a large number of case studies have shown that there are not likely to be impacts outside a 300 metre zone and the change to a 600m study area is intended to capture all possibly affected properties associated with road traffic noise from a given link. The study area is shown in Figure 17.1.

Project Description

17.3.5 The Project is described in detail in Chapter 2 of the Further Applications ES and in the Construction Management Report (CMR). However, a brief description is given here in relation to the noise and vibration assessment.

17.3.6 The alignment of the Project runs from the North West of Widnes to a junction with the M56 (junction 12) to the South of Runcorn. It also includes the SJB. The western extent of the proposed alignment runs along the A562 Speke Road to the west of the existing Ditton Roundabout Junction (Junction of A562 and A533). The alignment then heads eastwards along the line of, and to the south of, Speke Road towards the Ditton Junction. It then passes, via an embankment, across land currently occupied by industrial units along Ditton Road and over the Garston to Timperley rail freight line, before crossing the alignment of the existing A557 Widnes Eastern Bypass. A new junction (the "Widnes Loops Junction"), comprising a new roundabout and on/off slip to the main line of the Project, will be formed with the A557 at this location. The alignment then continues south eastward over the St Helens Canal, Widnes Warth Saltmarsh, the River, Astmoor Saltmarsh and Wigg Island, before turning south over the Manchester Ship Canal and Astmoor Industrial Estate. The alignment then connects into the existing road network in Runcorn at the Junction of the A533 Bridgewater and Central Expressways with the A558 Daresbury Expressway (the Bridgewater Junction). After this junction the route continues south along the Central Expressway (A533) towards the junctions of the Central/Southern Expressways and the Weston Point Expressway/Weston Link (known respectively as the Lodge Lane Junction and Weston Link Junction). The alignment will finally join the M56 Motorway at Junction 12.

17.3.7 For the purposes of understanding and describing the works in the Further Applications ES, the structural, highway and construction works for the Project have been split into a number of parts (known as "Construction Areas"). These components reflect the individual construction areas described within the Construction Method Report (CMR). A brief description of the construction activities at each area is given in section 17.7 of this Chapter. The construction areas include the following:

a. Area A – ~~Main Toll Plazas~~ Speke Road;
b. Area B – Ditton Junction to Freight Line;
c. Area C – Freight Line to St Helens Canal including Widnes Loops Junction;
d. Area D – Mersey Gateway Bridge;
e. Area E – Astmoor Viaduct;
f. Area F – Bridgewater Junction;
g. Area G – Central Expressway, Lodge Lane Junction and Weston Link Junction;
h. Area H – M56 Junction 12; and
i. Area I – Silver Jubilee Bridge and Widnes De-linking.

17.3.8 All of the links comprised in these areas and to be constructed as part of the works will either experience growth in traffic, be a new link with attendant traffic, or be subject to material changes (including decreases) in traffic levels. As such, the level of noise and/or vibration will be subject to change and accordingly each such link was examined.

17.4 Legislation and Planning Policy

European Legislation

17.4.1 There is currently no European legislation that governs the assessment techniques for the noise and vibration impact of new road projects. ~~Directive 2002/49/EC relates to the assessment and management of environmental noise, including roads, but primarily relates to existing roads only.~~

Environmental Nose Directive 2002/49/EC (Ref 16)

17.4.2 The Environmental Noise Directive (END) relates to the assessment and management of environmental noise, including noise from roads, but primarily relates to existing roads only. It does however require member states to produce noise maps and produce Noise Action Plans and identify First Priority Locations and Important Areas (where noise levels are currently high and should be reduced) and Quiet Areas (where low noise levels should be protected). Directive 2002/49/EC is transposed into UK law by the Environmental Noise (England) Regulations 2006, as amended (Ref 17), see below.

National Legislation

17.4.3 In the UK there is a range of legislation, planning policy and technical guidance that is relevant to the assessment of noise and vibration. A brief description of each is given in this section.

Environmental Noise (England) Regulations 2006, as amended (Ref 17)

17.4.4 The Regulations transpose the END into UK law. In particular, they require the drawing up of Noise Action Plans for all of England, focusing on the major conurbations. The Noise Action Plan – Liverpool Agglomeration (Ref 18) was published by Defra in March 2010. The agglomeration covers the Widnes and Runcorn areas.

17.4.5 The plan identifies First Action Areas and Important Areas with the study area, shown in Figure 17.19. The Local Authority should aim to reduce noise levels in these areas. The Action Plan suggests options for the mitigation of noise in the identified areas, including planning controls, maintenance, use of low noise surfaces, reduction of speed limits, or providing additional sound insulation for affected receptors.

Land Compensation Act 1973 (Ref 1)

17.4.6 This Act includes provision for compensation for loss of property value resulting from noise from a new or improved road. It also provides for noise insulation compensatory measures, including secondary glazing, for dwellings adjacent to new or improved highways, providing certain conditions are met (see below).

Noise Insulation Regulations 1975 (Ref 3)

17.4.7 The Noise Insulation Regulations 1975 (NIR) as amended in 1988 are regulations made under the Land Compensation Act 1973. Residential properties may become eligible for an offer of sound insulation to mitigate noise from the operation of the Project and/or from noise due to the construction of the Project under the terms of the NIR. The conditions for eligibility due to noise from the operation of a road are as follows:

a. The property must be within 300 metres of the nearest point of the new or altered carriageway;
b. The façade noise level due to the road traffic must be at least 68 $L_{A10,18h}$;

c. There must be at least a 1 dB(A) increase from the noise level prior to the construction; and
d. Noise from the new or altered highway must contribute at least 1 dB(A) to the road traffic noise level.

17.4.8 For noise caused during the construction of a highway scheme, the NIR provide the highway authority with discretionary powers to offer noise insulation where the works *"are expected to cause noise at a level, which, in the opinion of the highway authority, seriously affects or will seriously affect for a substantial period of time the enjoyment of an eligible building adjacent to the site"*. The NIR do not define noise levels which may cause a serious effect nor do they define what is meant by a substantial period of time. This aspect is left for the highway authority to determine. However, a commonly adopted criterion is where noise due to construction activities exceeds an $L_{Aeq,T}$ of 75 dB for 10 consecutive days. These criteria have been successfully applied at public inquiries for other major road schemes.

17.4.9 Whilst the possibility of eligibility has been considered in this Chapter a full assessment would be undertaken when the detailed design is complete. This is usual practice for projects of this type and complexity, where a reference design is developed into a detailed design following the letting of contracts.

The Control of Pollution Act, 1974 (COPA) (Ref 4)

17.4.10 The Control of Pollution Act 1974 provides for the control of noise from construction sites. Section 61 of COPA sets out procedures for obtaining consent in the form of an agreement with the relevant local authority for a noise control regime for construction works prior to the work commencing. Consent is normally granted subject to limitations on noise, restrictions on hours of working and/or possible restriction on processes allowed during the construction process. The contractor can seek a section 61 agreement by application to the local authority. If a section 61 agreement is not in place, then the local authority has powers under section 60 of COPA to control noise from construction activities through the service of a notice which can include the imposition of noise limits at prescribed locations and restrictions on the times when work on site can occur.

17.4.11 A contractor may be required to show that they are employing the *"best practicable means"* (BPM) to reduce noise levels from the construction site. BPM is defined in section 72 of COPA. In this regard 'practicable' is defined as those which are reasonably practical having regard amongst other things to local circumstances, to the current state of technical knowledge and to financial implications. In testing if BPM has been adopted the means used include the design, installation, maintenance and manner and periods of operation of plant and machinery together with the design and maintenance of buildings and any acoustic structures.

The Environmental Protection Act, 1990 (EPA) (Ref 5)

17.4.12 The Environmental Protection Act 1990 gives local authorities the power to take action where they are satisfied that a statutory nuisance is being caused. Section 80 of the EPA empowers the local authority to issue an abatement notice, however in respect of construction activities local authorities would generally use the specific powers of COPA section 60 as described above.

National Planning Policy ~~Guidance~~

17.4.13 In July 2011, The Government issued the Draft National Planning Policy Framework (Ref 19). This document is aimed at simplifying the existing national policy documents (Planning Policy Statements (PPS) and Planning Policy Guidance (PPG)) into one document, with the aim of make the planning system accessible for communities and to promote sustainable growth.

17.4.14 Advice from the planning inspectorate is:

"*It is a consultation document and, therefore, subject to potential amendment. It is capable of being a material consideration, although the weight to be given to it will be a matter for the decision maker in each particular case. The current Planning Policy Statements, Guidance notes and Circulars remain in place until cancelled.*"

17.4.15 On noise, the document states:

"The Government's objective is that planning should help to deliver a healthy natural environment for the benefit of everyone and safe places which promote wellbeing.

Local policies and decisions should ensure that new development is appropriate for its location, having regard to the effects of pollution on health, the natural environment or general amenity, taking account of the potential sensitivity of the area or proposed development to adverse effects from pollution.

Planning policies and decisions should aim to:

a. Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development

b. Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions, while recognising that many developments will create some noise; and

c. Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

Planning Policy Guidance Note 24 – Planning and Noise (PPG 24) (Ref 6)

17.4.16 Planning Policy Guidance Note 24 is currently being reviewed.

17.4.17 The main thrust of the existing guidance refers to new housing development in locations close to existing noisy activities. Little guidance is offered for situations such as the development of major transport infrastructure schemes. However the guidance gives some advice on the development of essential infrastructure. It states *"Much of the development which is necessary for the creation of jobs and the construction and improvement of essential infrastructure will generate noise. The planning system should not place unjustifiable obstacles in the way of such development. Nevertheless, local planning authorities must ensure that development does not cause an unacceptable degree of disturbance."*

Regional Policy

~~***Regional Planning Guidance for the North West RPG13 (Ref 7)***~~

~~17.4.18 RPG 13 contains no specific policies in connection with the noise and vibration impact of new road schemes.~~

Regional Spatial Strategy (Ref 14)

17.4.19 ~~There are emerging revisions to the Regional Spatial Strategy (RSS) set out in a consultation document published in March 2008.~~ There are a few references to noise, mainly in the context of mitigating noise impacts in various situations. There are no references to vibration.

17.4.20 The Coalition Government intends to abolish Regional Spatial Strategy (RSS) under powers of the Localism Act 2011(s109). Until the Secretary of State issues such an order, to revoke whole or parts of the RSS, the RSS for the North West remains part of the statutory development plan.

Local Policy

17.4.21 The Local Development Framework (LDF) is the overall name for the collection of planning documents that are currently being produced by the Council and which will eventually replace Halton's current statutory development plan, the Unitary Development Plan (UDP).

17.4.22 In May 2011, Halton Borough Council published its Revised Proposed Submission Document and submitted it to Government for examination, which is scheduled for November 2011. The Core Strategy is not yet adopted, however given its advanced stage of development and the extent of public consultation in its preparation, it is capable of carrying material weight.

Halton Borough Council's UDP (Ref 8)

17.4.23 The UDP was adopted in April 2005. The Council is in the process of preparing its Local Development Framework. Until this is complete, the UDP policies will continue to be relevant. The UDP has been saved under the Planning and Compulsory Purchase Act 2004 until 2011. ~~The following are relevant to noise and vibration assessment:~~ In terms of noise and vibration, the policies relevant to noise and vibration of the UDP assessed previously remain unchanged. These are:

Policy PR2 Noise Nuisance

17.4.24 Policy PR2 Noise Nuisance states;

"Development will not be permitted which contains any new noise source likely to cause a significant increase in ambient noise levels for either day or night time conditions and where it is likely to affect land allocated on the Proposals Map for residential or any other existing noise sensitive land uses

Justification

Noise is a widespread source of nuisance and resultant loss of amenity. Planning Policy Guidance note "Planning & Noise" 1994 (PPG24) sets the framework for planning policies related to these issues. Where there is evidence that an existing site creates significant noise problems the Council will negotiate for the overall reduction in noise levels. Conditions may be attached to any planning permission to ensure noise nuisance is not a problem."

17.4.25 Six Regeneration Action Areas (RGA) ~~are~~ were identified in the UDP for development and are referred to in the Land Use Chapter of ~~this~~ the Orders ES. They are designated for development as mixed use including housing. In designing these schemes account would have to be taken of the proposals associated with this Project.

Policy Summary

17.4.26 The general thrust of these policies is that development would be permitted as long as the noise issues are properly addressed and mitigated where appropriate to manage the size of any adverse impact.

Halton Borough Council's Core Strategy (Ref 15)

17.4.27 In May 2011, Halton Borough Council published its Revised Proposed Core Strategy Submission Document and submitted it to Government for examination, which was scheduled to take place in November 2011. The Core Strategy is not yet adopted. However, given its advanced stage of development and the extent of public consultation in its preparation, it is capable of carrying material weight.

17.4.28 The differences to the UDP assessed previously are not significant. The following are relevant to noise and vibration assessment:

Policy CS23: Managing Pollution and Risk;

"Development proposals should not exacerbate and where possible should minimise all forms of emissions and odour, water, noise and light pollution."

Policy CS16: The Mersey Gateway Project;

"Negative environmental impacts caused by the construction of the Mersey Gateway will be mitigated where appropriate, and opportunities to enhance the natural environment sought. This is particularly applicable to the Mersey Estuary Special Protection Area (SPA), Ramsar site, and Site of Special Scientific Interest (SSSI) and other areas of significant environmental value."

17.4.29 The Regeneration Action Areas set out in the UDP have been superseded by Key Areas for Change in the emerging Core Strategy. These are considered in the Land Use chapter of this Further Applications ES and are shown on Figure 9.4. This chapter reflects the emerging designation of these areas.

Technical Guidance

Design Manual for Roads and Bridges (DMRB) (Ref 2)

17.4.30 The Design Manual for Roads and Bridges provides Government guidance on the design and assessment of trunk road schemes. The principles of DMRB are the adopted method in the UK for the assessment of road schemes and are based on a large body of experience of such assessments. Volume 11, section 3, part 7, Feb 2011, sets out steps for the assessment of the noise impacts of a road scheme. The assessment considers primarily residential properties but also considers other noise sensitive locations such as schools and recreational open spaces.

17.4.31 The noise assessment becomes increasingly detailed as the design of the scheme develops ~~starting with Stage 1, being the least detailed stage, to Stage 3 being the most detailed. This assessment has been based on the principles of Stage 3~~. The latest version uses three stages, referred to as Scoping, Simple and Detailed. This assessment has been based on the principles of the Detailed assessment.

17.4.32 A Stage 3 (Detailed) assessment requires a noise assessment of all properties and other relevant locations, such as schools and recreational open spaces, that are likely to be affected by significant changes in traffic noise. The assessment compares predicted noise levels against baseline information and also identifies expected noise nuisance changes, which can be estimated from tabulated nuisance data given in the guidance. Noise measurements are not required for this assessment and comparisons are made using predicted road traffic noise levels, for the baseline and each future scenario considered. This ensures that comparisons are made on a like for like basis. The predicted noise level values, in terms of the $L_{A10,18h}$ index, are calculated using the well established methods contained in Calculation of Road Traffic Noise, which is described in more detail in ~~below~~ paragraphs 17.5.21 *et seq*.

17.4.33 DMRB recommends calculation of noise level changes for each residential property potentially affected. However, where a scheme, such as this Project, covers a large, irregularly shaped, densely populated area with some 15,000 dwellings, it is not practical to estimate noise levels at every residential receiver location. Consequently, the general principles of the DMRB recommendations have been followed in this assessment, but receptor properties have been banded into groups. This is normal practice for schemes of this size.

17.4.34 DMRB also gives guidance on the assessment of vibration from road traffic and provides a method of assessing disturbance based on the $L_{A10,18h}$ noise level.

Revisions to DMRB (2008)

17.4.35 It should be noted that following the assessment of the Reference Design the noise and vibration part of DMRB was updated (August 2008) and changes were made to the noise calculation method, however the general calculation principles are the same. Most of these changes were anticipated at the Order ES stage and were incorporated into that assessment. The main points of the revision are as follows.

17.4.36 First, to avoid anomalies in the prediction of noise from widened carriageways, e.g. 3 lanes widened to 4, it is recommended that all dual carriageway roads should be modelled as two separate line sources rather than the previous practice of modelling as one line source, except where the carriageway is separated by 3.5 metres or more. For the Reference Design, a test model was run on a section of the Central Expressway to assess the effect of this recommendation and it was shown that it resulted in small noise level differences adjacent to the carriageway but no significant difference at receptor locations. As such, this Further Applications ES replicates the previous methodology.

17.4.37 Secondly it is recommended that heavy goods vehicles should be classified as those with an unladen weight exceeding 3.5 tonnes rather than the 1.525 tonnes originally recommended in Calculation of Road Traffic Noise (see below). The reason for this recommendation is not only that heavy goods vehicle weights have increased but, more importantly, so have passenger cars and light vehicles. This means that certain passenger cars would be wrongly classified as heavy goods vehicles under the previous classification. The noise predictions in the Orders ES and in this assessment have used the good practice guidance of classifying heavy goods vehicles as those with an unladen weight exceeding 3.5 tonnes.

17.4.38 Thirdly the previous DMRB guidance for noise assessments recommended that, when estimating traffic flows, a high growth rate should be used. This was not in line with other DMRB assessment areas which were assessed on the basis of most likely growth and the revision recommended that most likely growth should now be used for road traffic noise assessments as well. Again, the traffic predictions for the Orders ES and in this assessment have all been based on the good practice guidance of using most likely traffic growth.

Revisions to DMRB (2011)

17.4.39 Further revisions were made to DMRB in 2011. The two significant changes for the noise and vibration assessment are to the impact scales and the requirement for night-time noise levels to be considered in certain areas.

17.4.40 Specifically, a second impact scale is added for short term changes (i.e. changes that take place over a short time period, such as when new a road opens). There is also a scale for long-term changes (e.g. traffic growth over an extended period). The short term change impact scale is used for assessing the impact of the New Bridge opening.

17.4.41 It is further required that the noise assessment is extended to cover night-time noise in areas where the average external night-time noise level (L_{night}) is likely to exceed 55dB(A). The use of the calculation method given in the TRL report '*Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping*' (Ref 20) is suggested and this has been used.

17.4.42 The noise model created using IMMI noise prediction software for the Reference Design is used here as the changes to the traffic flow data are small. Additional CRTN calculations are presented in this report to show the effect of changes in traffic flows on a selection of receptors. The assessment of the number of people or properties affected by noise level changes and number of properties likely to qualify for additional insulation under the Noise Insulation Regulations are based on the previous IMMI noise model from the Orders ES. As traffic flows have generally been revised downwards, this approach is regarded as a worst case assessment.

17.4.43 All noise predictions in this chapter follow the current (November 2011) guidance of DMRB. The 2011 revision of DMRB now provides guidance on the magnitude of impact for various noise level changes as follows. The only significant difference in this guidance is the sub-division of the previous moderate category which extended from 3dB to 10dB (Table 17.3 refers) into the minor and moderate categories shown below and, therefore, the Orders ES terminology has been retained consistent with this being used as a worse case assessment for the Further Applications ES.

Table 17.14 – Magnitude of impact

Noise change, $L_{A10,18hour}$		Magnitude of impact
Short Term	Long Term	
0	0	No change
0.1 – 0.9	0.1 – 2.9	Negligible
1.0 – 2.9	3.0 – 4.9	Minor
3.0 – 4.9	5.0 – 9.9	Moderate
5+	10+	Major

Calculation of Road Traffic Noise (CRTN) (Ref 9)

17.4.44 The most recent version of Calculation of Road Traffic Noise was published in 1988, having previously been published about 15 years earlier, and it contains the procedures for calculating levels of road traffic noise. This is the accepted prediction model used in the UK and is also the method specified for use in the NIR which are described above.

17.4.45 The method is based on traffic flow on the road, in this case both existing and future traffic flows from the VDM output of the traffic modelling. Various corrections are then applied for the traffic speed based on the type of carriageway, i.e. single, dual etc., the mix of traffic in particular the percentage of heavy goods vehicles and road surface type to derive a basic noise level at 10 metres from the nearside carriageway. Further corrections are then applied to account for the sound attenuation with distance from the road; ground attenuation, as acoustically absorptive ground such as grassland absorbs sound more readily than acoustically reflective surfaces such as paved areas; and screening from natural and purpose built barriers. These corrections enable an accurate prediction of the noise level expected at the required receiver position. This is the process used for the Orders ES and it forms the basis for the comparison carried out here.

BS 5228 Code of practice for noise and vibration control on construction and open sites (Ref 10)

17.4.46 BS 5228 provides wide-ranging advice on the control of noise and vibration from construction sites describes the method for predicting of construction noise. The standard is a formally adopted Code of Practice under Section 71 of the Control of Pollution Act.

17.4.47 ~~BS 5228 is produced in 5 parts. Only parts 1 and 2 1997 and part 4 1992 are relevant here. Part 1 provides a method of predicting noise from construction activities and includes a database of noise levels for various construction activities. It also provides formulae for estimating noise levels from a construction site. Part 2 gives guidance on legislation and Part 4 gives specialist advice on noise and vibration from piling techniques again including a database and a prediction method.~~

17.4.48 BS 5228 was revised in 2009 and issued in two parts, Part 1 covering noise and Part 2 covering Vibration. Part 1 provides methods of predicting noise from construction activities and includes an updated database of noise levels for various construction activities. It also provides formulae for estimating noise levels from a construction site. Part 2 gives guidance on prediction of vibration from construction works including piling techniques and also includes advice on both building damage criteria and human perception and disturbance.

17.4.49 Since production of the Orders ES, as described above, BS 5228 has been updated. However, the primary change has been to incorporate a more up to date database of source noise levels derived from a research project carried out by Defra. As this revision was anticipated, the improved database was used during the production of the Orders ES assessment and consequently conformed to the current British Standard guidance.

17.4.50 The Standard provides wide-ranging advice on the control of noise and vibration from construction sites as well as describing the method for prediction of construction noise and vibration. The previous version of the Standard was formally adopted Code of Practice under Section 71 of the Control of Pollution Act, although the current situation is that until the Statutory Instrument adopting the standard is updated the approved code of practice still refers to the previous version of the standard.

17.4.51 Construction effects are generally temporary and it is generally accepted that people are more tolerant of temporary noise and vibration than they are of permanent effects. In order to assist in the assessment of potential construction noise impact the following interpretation has been used. Daytime construction noise levels of up to 70 dB(A) have been classified as low, from 70 to 80 dB(A) as moderate and above 80 dB(A) as high. It should be remembered that the assessment is activity based; consequently, the predicted noise levels will only occur whilst that activity is actually taking place. There will inevitably be periods of inactivity when the noise level and the consequential impact will be less; hence this is a worst case assessment.

BS 6472 ~~Evaluation of human exposure to vibration in buildings (1 to 80 Hz) 1992~~ Guide to the evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting (2008) (Ref 11)

17.4.52 ~~This British Standard provides general guidance on human exposure to building vibration in the frequency range 1 Hz to 80 Hz. Curves of equal annoyance for humans are included together with measurement methods to be employed.~~ The 2008 revision of this BS provides general guidance on human exposure to building vibration in the frequency range 0.5 Hz to 80 Hz. The curves of equal annoyance previously used are replaced with multiplying factors for weighted acceleration as well as making changes to the axis system used. The Standard provides a means of estimating the probability of "adverse comment" for occupants of dwellings.

17.4.53 If during construction the assessment of vibration affecting people is required then it will be carried out in accordance with this standard.

BS 7385 Evaluation and measurement for vibration in buildings Part 1 1990, Part 2 1993 (Ref 12)

17.4.54 Part 1 of this standard is entitled Guide for measurement and evaluation of their effects on buildings and it provides basic principles for carrying out vibration measurement and for processing the data with regard to the assessment of damage to buildings.

17.4.55 Part 2 of this standard is entitled "Guide to damage levels from ground borne vibration". It identifies the factors involved in the vibration response of a building and it specifies vibration levels above which buildings could be damaged.

17.4.56 If during construction the assessment of vibration affecting buildings is required then it will be carried out in accordance with this standard.

17.5 Assessment Methodology

Introduction

Noise

17.5.1 Noise is often defined as unwanted sound and both are measured in units of decibels, dB. The human ear responds to a wide range of sounds in terms of sound level and the frequency of the sound. The audible range of sound levels is generally quoted as being from 0 dB (the threshold of hearing) to about 140 dB (the threshold of pain). The ear does not respond equally to all frequencies, but is more responsive to the mid frequencies than to the low or high frequencies. To attempt to replicate this natural response, sound level meters have a weighting network referred to as A weighting and sound levels measured using this weighting are designated A weighted decibels or dB(A).

17.5.2 In order to aid the understanding of various sound levels the following table shows the range of typical sound levels associated with situations encountered in everyday life.

Table 17.1 - Typical Sound Levels

Sound Level dB(A)	Description
140	Threshold of pain
120	Jet take off at 50 metres
100	Maximum noise level on an underground platform
80	Kerbside of a busy urban street
60	Busy general office
40	Residential area at night
20	Background in a TV and recording studio
0	Threshold of hearing

17.5.3 The measure of road traffic noise used in the UK is the $L_{A10,T}$, where L_{A10} is the level of noise exceeded for 10% of the measurement period, T. In the case of road traffic noise, T is the 18 hour period from 06.00 to 24.00 hours for an annual average weekday. The $L_{A10,18h}$ is the average of the 18 hourly $L_{A10,T}$ values from 06.00 to midnight. Although the period from midnight to 06.00 is not expressly included in this measure, research has shown that people's reaction to road traffic noise over the full 24 hour period does correlate well with the $L_{A10,18h}$ level. Thus, describing traffic noise in this way does properly reflect the likely attitude of those affected to the noise.

17.5.4 As the decibel is a logarithmic unit, a 3 dB increase in sound level represents a doubling of the sound energy. Similarly, a 3 dB reduction in sound level represents a halving of sound energy.

17.5.5 Whereas the *measurement* of sound is objective, the *perception* of sound is subjective and hence will vary from individual to individual. As a general guide, however, most people regard a 10 dB(A) increase in sound level as a doubling of loudness, whilst a change of 3 dB(A) in sound level is generally regarded as the minimum difference needed for an individual to perceive a change for sounds with similar characteristics.

17.5.6 Noise nuisance is described by the World Health Organization as "A feeling of displeasure evoked by noise". Many surveys have investigated the relationship between traffic noise and its impact on people and nuisance is often used as a general term to describe this impact.

Vibration

17.5.7 Vibration is an oscillating motion and can be transmitted to the human body through a supporting surface. In most cases this will be the ground or the floor of a building.

17.5.8 Vibration is often complex, containing many different frequencies at different levels and occurring in different directions. It is common to find that people are annoyed at levels of vibration only slightly above the threshold of perception. Perception varies according to the frequency of vibration, the direction of vibration and whether the person is sitting, standing or lying down.

17.5.9 Research has found that the human body is most sensitive to vibration in the frequency range 1 to 80 Hz, and is especially sensitive in the range 4 to 8 Hz. DMRB states that such low frequencies are not usually encountered from well maintained roads.

Construction

17.5.10 Noise and vibration from construction will vary considerably during the construction process and may affect the occupants of nearby properties and other sensitive locations, as well as the buildings themselves. However, construction impacts are regarded as localised and temporary in nature. For this reason higher levels are generally tolerated than would be the case for a permanent impact.

17.5.11 The assessment has been based on the DMRB recommendation. The number of properties within 100 metres of the construction activity has been counted, along with any other noise sensitive receptors, such as schools and recreational open spaces, identified during the assessment.

17.5.12 The extent of any significant potential impacts has also been predicted using the methods and principles of BS 5228 ~~together with a more recent database of source noise levels published by the Department for Environment, Food and Rural Affairs (Defra) (Ref 13)~~ and updated plant noise level database in its Appendix. The updated plant noise database included within BS 5228 replicates the previously published Defra database (Ref 13) used in the Orders ES assessment and therefore no changes are made to the source noise levels in calculations.

17.5.13 Although techniques are available to predict the likely noise and vibration effects from construction operations, the methodology is based on quite detailed information concerning the type and numbers of plant to be used, as well as their precise location and the length of time they are in operation. As the type of construction plant to be used and the phasing of the work has yet to be decided in sufficient detail to predict the precise effect of construction activities certain assumptions have been made.

17.5.14 In order to assess the possible effects of specific construction activities, unshielded noise levels have been calculated at set distances, 10m, 20m, 50m and 100m from generic operations, such as piling or earthworks, that could have an impact. The predictions have been produced in terms of the equivalent continuous sound level, $L_{Aeq,T}$, over the core working day.

17.5.15 The calculations assume that there are no specific mitigation measures in place. It is also assumed that the intervening ground between the construction noise sources and receptors is acoustically reflective such that there will be no attenuation of sound due to ground absorption. Importantly, this indicative analysis of construction noise takes no account of any shielding. The first row of buildings will provide considerable shielding to those buildings further behind consequently the levels only apply to the first row of building facades with an unobstructed view of the construction works.

17.5.16 The assumptions made during the construction assessment calculations in the Orders ES still stand. By cross-referencing the CMR attached to the Further Applications ES it has been found that there is no requirement to alter any of the previous assumptions from the updated CMR.

17.5.17 In carrying out predictions of the likely construction noise impact, the construction works have been divided into the following phases:

a. Ground works
Scenario 1 (Causeways & Rock armour) - 2 x 44T Excavators; 2 x 41T Dozers; 2 x 35T Dump Trucks; 2 x Vibratory rollers

Scenario 2 (Small earthwork ops) - 2 x 30T Excavators; 2 x 41t Dozers; 2 x 25T Dump Trucks; 2 x Vibratory Roller

Scenario 3 - 2 x 30T Excavators; 2 x 41T Dozers; 2 x 35T Dump Trucks; 2 x Vibratory rollers

b. Piling operations
Jetties – (2 x Hydraulic Hammer rigs, tubular steel)

Piers – (2 x Large Rotary Bored rigs;1 x Pile case vibratory driven; 4 x Truck mixers)

Towers – (1 x Sheet Vibratory Rig; 1 x Water pump; 1 x Tower Cranes) (Note Barrettes are to be used, but sheet piling likely to be noisiest activity)

c. Concreting operations
(1 x Tower Crane; 6 x Mixer Trucks; 2 x Concrete Pumps; 5 Poker Vibrators)

d. Asphalting
(1 x Asphalt Paver; 1 x 9T Dumper; 2 x 10T Wagons; 1 x 18T Wheeled Excavator; 1 x Road Planer; 1 Vibro-roller)

e. Haul Road
(4 axle lorry, 10 vehicles per hour, average speed 30 kph)

17.5.18 The predicted noise levels are given in Table 17.2 below. It should be noted that these are unchanged since the Orders ES and none of the proposed changes to the construction methodology affect the assumptions made within the noise assessment.

Table 17.2 - Predicted construction noise levels

Activity	Sound level, $L_{Aeq,T}$ dB, at distances (m)			
	10	20	50	100
Ground works Scenario 1	89	83	75	69
Ground works Scenario 2	86	80	72	66
Ground works Scenario 3	86	80	72	66
Jetty – Piling Tubular	95	91	84	78
Piers – Piling Bored	92	88	81	75
Towers – Piling Sheet	92	88	81	75
Concreting	91	85	77	71
Asphalting	89	83	76	70
Haul Road	60	57	53	50

17.5.19 In order to assist in the assessment of potential construction noise impacts, the following interpretation has been used. ~~Construction~~ Day time construction noise levels of up to 70 dB have been classified as low, from 70 to 80 dB as moderate and above 80 dB as high. It should be remembered that the assessment is activity based; consequently the predicted noise levels will only occur whilst that activity is actually taking place. There will inevitably be periods of inactivity when the noise level and the consequential impact will be less.

17.5.20 Significant adverse effects associated with vibration from construction are not anticipated as there are usually low vibration techniques that can be chosen where sensitive receptors are nearby, i.e. bored rather than driven piling.

Operational Road Traffic Noise

17.5.21 A noise modelling software package (IMMI) ~~has been~~ was used to predict the road traffic noise for both the existing situation and the future scenarios. The software follows the method given in CRTN. The results have been produced in the form of colour coded noise contours overlaid on an Ordnance Survey (OS) base map. The same model was used to assess night time noise effects in accordance with the updated DMRB.

17.5.22 All noise calculations have been based on the maximum traffic flow expected on a normal working day during the first 15 years after opening, as well as for the year of opening. Parallel calculations were made for the future do minimum scenarios, i.e. the situations were the Project not to be built. Relevant mitigation measures are included in the assessment.

17.5.23 In accordance with CRTN, the road traffic source height was taken to be 0.5 metres above the carriageway surface. The road traffic predictions also assume moderately adverse wind velocities and directions (i.e. from source to receiver), again in accordance with standard guidance. Any wind from the source to the receiver will result in slightly elevated noise levels compared with a no wind situation and hence the assessment method tends to produce a scenario that tends towards the 'worst case'.

17.5.24 All ground has been assumed to be acoustically reflecting by default. However, any known significant areas of acoustically absorptive ground have been included in the model. This approach again causes the results to tend towards a worst case assessment.

17.5.25 The Project, as envisaged, includes some area of landscaping that will reduce noise levels and these have already been taken into account in the modelling. In addition quiet road surfaces will be used throughout the Project and have been assumed for the future do-something predictions.

17.5.26 Based on the results of these predictions, comparisons have primarily been made between the do minimum situations, i.e. without the Project, and the do something situations, i.e. with the Project, in terms of an increase or decrease in noise levels and the likely consequential increase or decrease in nuisance level as defined in DMRB. This comparison has been made in terms of residential properties together with any other significant noise receivers such as schools, etc. Comment has also been provided on other sensitive receivers such as the Wigg Island community park.

17.5.27 Road traffic noise levels ~~have been~~ were calculated for 2006 representing the base year. ~~then for 2015 representing the year of opening and 2030 representing the likely year of highest traffic flow within 15 years of opening as follows, with reference being made to the corresponding contour figures~~. The Reference Design 2015 model is considered representative of the proposed 2017 opening year, and the 2030 development year (representing the likely year of highest traffic flow within 15 years of opening) is also considered representative of the 2032 development year. This is illustrated on the corresponding contour figures detailed below. In the Orders ES these figures were produced for the study area divided into two parts, Widnes and Runcorn North on one sheet and Runcorn South on another sheet, annotated a and b respectively. For the Further Applications ES the drawings that have been reproduced are for the whole study for day time and night time results, with the output annotated a and b respectively as follows:

a. The base year 2006 day time (figure 17.2 a);
b. The base year 2006 night time (figure 17.2 b);
c. The opening year 2015 do minimum day time (figure 17.3a);
d. The opening year 2015 do minimum night time (figure 17.3 b);
e. The design year 2030 do minimum day time (figure 17.4 a);
f. The design year 2030 do minimum night time (figure 17.4 b);
g. The opening year 2015 do something day time (figure 17.5 a);
h. The opening year 2015 do something night time (figure 17.5 b);
i. The design year 2030 do something day time (figure 17.6 a); and
j. The design year 2030 do something night time (figure 17.6 b).

17.5.28 For all of the above assessments a 600m distance along either side of the proposed road works has been used. The only exception to this is for the 2030 do something night-time scenario where a 300m distance was utilised, this is not considered to be a significant issue, especially for night time noise, as there are not likely to be any impacts outside a 300m zone within the night-time scenario. The modelling has shown this to be the case for the 2030 do something night-time scenario and, therefore, the assessment is considered to be appropriate.

17.5.29 Given that the modelling for the Reference Design represents a worst case scenario and is not materially altered by the inclusion of the Proposals in the Project, the model has not been re-run. Although there have been reductions in traffic levels, which are predicted in Chapter 16, it was considered that these would be unlikely to significantly affect noise levels and, where they did, the effects of the Project including the Proposals would be smaller. On this basis, it is considered appropriate to rely on the model output relating to the Reference Design.

17.5.30 In order to confirm the validity of the Reference Design modelling additional CRTN calculations have been performed using the revised traffic flow data and the Updated Reference Design to validate the modelling. This comprised a sensitivity assessment of a series of specific locations, which had been considered in the assessment of the Reference Design, together with consideration of five schools that were also assessed for the Reference Design. The locations of the receptors used are shown in Figures 17.7 to 17.16.

17.5.31 Each receptor was assessed against the 2015 Do Something Scenario vs. 2017 Do Something Scenario, and 2030 Do Something Scenario vs. 2032 Do Something Scenario. It was not considered appropriate to assess the Do Minimum Scenario as the validity of the model is only important on the assumption that the Project including the Proposals proceeds. For each receptor the following information was gathered:

a. Predicted traffic flows for 2015 Do something and 2030 Do Something used for the assessment in the Reference Design
b. Predicted traffic flows for 2017 Do something and 2032 Do Something based on the revised 2015 Do something and 2030 Do Something traffic flows

c. Distance from the receptor to the closest point on the carriageway for the Reference Design
d. Distance from the receptor to the closest point on the carriageway for the Updated Reference Design

17.5.32 Wherever possible the assessment considered the distance between the closest point on the new road and the main line where the most significant flows, representative of the Project including the Proposals as a whole, would arise.

17.5.33 It was considered that this approach, whilst not necessarily producing absolute noise levels would allow the variation arising as a result of the predicted change in traffic flows and the modifications to the design to be considered.

17.5.34 For the assessment of the Reference Design the ~~The~~ number of properties within each of the 5 dB noise bands ~~shown~~ on the noise contour graphical outputs ~~has been~~ was identified from GIS analysis. Using 2001 Census data indicating the number of people resident in each property the number of properties ~~has then been~~ was then converted to numbers of people within the 5 dB noise level bands. The ~~relationship~~ relationships between likely disturbance and road traffic noise given in DMRB ~~has been~~ were used to estimate the percentage of people bothered expected to be bothered by noise at the various noise levels. The value for the centre point of each 5 dB band has been used as the multiplier to the number of people exposed to that band to arrive at an estimate the number of people likely to be bothered by road traffic noise in the various scenarios. In this context 'bothered' means people 'bothered very much or quite a lot by noise' as defined in DMRB.

17.5.35 In order to assess the significance of impacts from road traffic noise the following descriptions have been applied to the $L_{A10,18h}$ noise level changes. ~~There are no standard descriptions available, but the following have commonly been used in other assessments.~~ This is based on the 'long-term' assessment scale in the 2011 revision of DMRB. The descriptions assume there is no material change in either the traffic mix or in the diurnal pattern of activity.

Table 17.3 Significance of noise level changes

Noise Change dB ($L_{A10,18h}$)	Description
0	No effect
0 - 3	Low effect
3 - 10	Moderate effect
10 or more	High effect

Operational Road Traffic Vibration

17.5.36 Vibration arising from road traffic can be transmitted through the air or through the ground. It is difficult to predict but, nonetheless, DMRB provides guidance on its assessment.

17.5.37 DMRB states that for new roads and for existing roads maintained in good condition, whether they are at ground level or on a bridge, ground-borne vibration is very unlikely to be an issue. However, within 40 metres of the source low frequency noise can cause light weight elements of a structure to vibrate (airborne-induced vibration). This tends only to be superficial and, although it may be noticeable by occupiers, it is very unlikely to cause any structural or even cosmetic damage. Beyond 40 metres from the source, or where buildings are screened from the source, it is extremely unlikely that there will be any vibration impact through airborne or ground-borne transmission. The levels of vibration that can arise from road traffic are extremely unlikely to cause damage to buildings.

17.5.38 DMRB suggests that the $L_{A10,18h}$ has a close association with vibration nuisance levels and the effect of vibration on residents can be estimated by subtracting 10% from the equivalent noise nuisance level. It also recommends that at noise levels below 58 dB(A) there is unlikely to be any impact due to vibration.

17.5.39 This approach has been used in this assessment. In this instance, having counted the number of properties exposed to various noise levels, in order to determine numbers of people affected a multiplier of 2.36 people per dwelling has been used. This is the occupancy figure suggested for use by the Highways Agency in the absence of more specific data.

Assessment Receptors

17.5.40 For this assessment, residential areas and schools have been identified as being receptors of high importance, canal side areas and other public open spaces receptors of medium importance and industrial/commercial areas as low importance. The Wigg Island Community Park and the Special Protection Area (SPA) have been classed as being of very high importance.

17.5.41 The particular receptors used in this assessment have been described in order from the north west towards the south east of the study area and, where appropriate, the relevant nearby Construction Management Report identification areas, A to I, described in paragraph 17.3.7 above, are shown in brackets. In addition five schools have been identified as receptors. These have also been listed in this section. Where appropriate, figures have been provided illustrating receptor locations.

17.5.42 It should be noted that although the areas referred to below differ from those used in other chapters of the Further Applications ES they are consistent with the noise and vibration chapter of the Orders ES and have be maintained to simplify the comparite approach.

17.5.43 Figures showing the area locations are referenced and the designation given elsewhere in the Further Applications ES, to which they are broadly analogous, are designated with the suffix CMR. A review has been carried out of the receptors in these areas and no significant variations have been identified.

17.5.44 **Area 1.** Figure 17.7. The A562 Speke Road **(CMR Area - A)**, Ditton junction **(CMR Area - B)** and Widnes Loops Junction **(CMR Area - C)** are all in industrial areas and there are no sensitive ~~receivers~~ receptors in the vicinity. This has not changed from the Reference Design assessment. To the south and west of the Widnes Loops, the ~~Project~~ route of the Project including the Proposals will pass over the St Helens Canal which is a sensitive receptor because in addition to canal users, the canal towpaths are often used for recreational walking. The Pennine Trail follows the St Helens Canal through this area.

17.5.45 **Area 2.** Figure 17.8. The northern approach to the SJB, the A533 Queensway **(CMR Area - I)**, passes near to a residential area (Cholmondeley Street) and to West Bank Primary School. This is currently a very heavily trafficked route and this has not changed since the Reference Design assessment was carried out.

17.5.46 **Area 3.** The area of the river Mersey to the west of the SJB is classified as a Special Protection Area (SPA) in recognition of its importance as a conservation area especially for birds. The SPA is currently subjected to noise from both road traffic using the SJB and railway noise from the adjacent rail bridge. The CMR Area I shows construction works are expected in this area.

17.5.47 **Area 4.** Figure 17.9. On the south side of the SJB there are residential areas to both the east and the west of the A533 Queensway (Brindley Street and Handley Street) which is a heavily trafficked route. The CMR Area I shows construction works are expected near to this area.

17.5.48 **Area 5.** Figure 17.10. The Weston Point Expressway A557, marks the most easterly part of the study area and in general has no adjacent noise sensitive areas as it is largely industrial in nature. This still remains the case. The exception is the residential area adjacent to Russell Road and Castner Avenue. No construction activities are expected in this area.

17.5.49 **Area 6.** Figure 17.11. The study area includes the area where the new bridge would cross the River Mersey **(CMR Area D)** and the Wigg Island Community Park on the south bank. Wigg Island has been developed as a Community Park supporting a wide variety of wildlife and it continues to be used for this purpose. The study area then crosses the Manchester Ship Canal and associated towpath.

17.5.50 **Area 7.** Figure ~~17.12~~ 17.11. The study area then passes through the industrial and commercial area known as the Astmoor industrial estate **(CMR Area E)**. This area remains in use as an industrial and commercial area.

17.5.51 **Area 8.** Figure 17.12. At this point the Bridgewater Expressway is crossed by the Central Expressway via the Bridgewater Junction **(CMR Area F)**. The ~~proposed~~ alignment of the Project including the Proposals also crosses the Bridgewater Canal.

17.5.52 **Area 9.** Figure 17.13 and 17.14. To the south of the junction on the Central Expressway, A533, there are fairly ~~densely~~ dense residential areas to both sides of the route **(CMR Area G)** stretching as far as the Weston Link Junction.

17.5.53 **Area 10.** Figure 17.15. At this point the study area follows the existing road network along the southern section of the A557 Weston Point Expressway **(CMR Area H)** leading towards the junction with the M56.

17.5.54 As indicated in paragraph ~~17.5.32~~ 17.5.41, schools have been classified as sensitive receptors of high importance. The following schools are likely to be affected by the Project including the Proposals ~~proposals~~. These are shown on Figure 17.16.

a. Cavendish School, Lincoln Close, WA7 4YZ
b. Hallwood Park Primary School, Hallwood Park, WA7 2FL
c. West Bank Primary School, Cholmondeley Street, WA8 0EL
d. Weston Point Community Primary School, Castner Avenue, WA7 4EQ
e. Woodside Primary School, Whitchurch Way, WA7 5YP

17.5.55 A review of the study area, combined with consultation, has not identified any new sensitive receptors.

Consultation

17.5.56 A scoping exercise was undertaken to identify all potential significant environmental effects likely to be associated with the construction and operation of the Project including the Proposals. As detailed in Chapter 3, the results of the scoping exercise were summarised in the Scoping Report that was published for consultation in October 2011. This was issued to a wide range of statutory and non-statutory consultees. Additional consultation carried out specifically relating to Noise and Vibration was carried out and this is detailed below.

17.5.57 The Environmental Control Officer at Halton Borough Council was contacted on 21 September 2011. The approach to the noise and vibration assessment was discussed and the EHO

agreed that an assessment demonstrating that the proposals were not environmentally worse than that assessed in the Orders ES would be acceptable in terms of measuring the scale of impacts resulting from the Project including the Proposals. It was further discussed that should any areas of increased negative impact be identified that these should be investigated further.

17.6 Baseline and Do Minimum Results

17.6.1 As reported in Chapter 16, traffic flow data was used to calculate the 2006 baseline noise levels. For the reasons set out in Chapter 16, the 2006 baseline flows are unchanged and therefore the Orders ES 2006 baseline calculations for this updated noise assessment are still considered to be valid. As changes to the opening year and design year flows are generally negative, a comparison between noise levels at a selection of example receptors has been performed to assess the change in that noise levels are not predicted to rise as a result of the Proposals. The operational impact made for the Reference Design is therefore taken to remain valid as a worst case assessment.

Overall baseline and do minimum assessment

17.6.2 The baseline results relating to the year 2006 for the areas located close to the Project alignment are shown graphically in ~~Figures~~ Figure 17.2 a ~~& b~~. The results for the two future do minimum scenarios (2015 representing 2017 and 2030 representing 2032) are shown graphically in Figures 17.3 a ~~& b~~ and 17.4 a ~~& b~~ respectively. All these contours show the noise levels in terms of the $L_{A10,18h}$ banded into 5 dB contours.

17.6.3 Night time noise contours have been produced on a similar basis. The results for the year 2006 are shown graphically in Figures 17.2 b. The results for the two future do minimum scenarios (2015 representing 2017 and 2030 representing 2032) are shown graphically in Figures 17.3 b and 17.4 b. As with the daytime results the noise levels in terms of the $L_{A10,18h}$ are banded into 5 dB contours.

17.6.4 An overall assessment has been made of the number of people within the study area exposed to various bands of noise levels. The results for the base year and for 2015 (taken as representative of 2017) and 2030 (taken as representative of 2032) do minimum are shown in ~~table~~ Table 17.4 below.

Table 17.4 – Number of people affected

$L_{A10,18h}$	2006 Base Year	2015 Do minimum	2030 Do minimum
50 – 55	20105	20781	20419
55 – 60	7513	8708	9463
60 – 65	3882	4172	4194
65 – 70	2072	2114	2400
> 70	535	681	780

17.6.5 The VDM traffic model broadly indicates that there would be an increase in traffic along the existing network even if the project were not to proceed. This increase in traffic would give rise to an increase in noise level affecting the sensitive areas affected. It can be seen from Table 17.4 that there would be an increase of just over 9% in the number of people exposed to more than 50 dB(A), $L_{A10,18h}$ in the study area. As noted above, this is considered to be a worst case assessment for the purposes of the Project including the Proposals.

Detailed baseline and do minimum assessment

17.6.6 A more detailed evaluation of the baseline and do minimum changes is set out below. This evaluation draws upon that which related to the Reference Design. This is because, as discussed above, that assessment is considered to be a worst case and has not therefore been re-run in detail.

17.6.7 It should be noted that, although the areas referred to below differ from those used in other chapters of the Further Applications ES, they are consistent with the noise and vibration chapter of the Orders ES and have be maintained to simplify the comparite approach. Figures showing the area locations are referenced and the areas given elsewhere in the Further Applications ES, to which they are broadly analogous, are designated with the suffix CMR.

17.6.8 **Area 1**. Figure 17.7. **(CMR Areas A, B, C)** Noise in this area is expected to rise by about 1 dB between 2006 and 2030 were the project not to proceed. The area of St Helens Canal currently experiences noise levels of around 55 to 60 dB from the road network.

17.6.9 **Area 2. (CMR Area I)** The road elevation increases here and there is some noise shielding by the carriageway edge. Nevertheless, the noise levels at the housing are around 70 dB. This is a high level of road traffic noise and some 34% of residents would be expected to be bothered by the noise and some 24% would be expected to be bothered by vibration. In this area, the noise level is predicted to rise by about 3dB by 2030 for the do minimum scenario.

17.6.10 **Area 3.** The River Mersey SPA to the west of the SJB currently experiences noise levels around 55 dB due to road traffic. It also experiences noise due to rail traffic using the adjacent Ethelfreda rail bridge. The noise levels due to the road traffic are predicted to rise by about 1 dB by 2030 do minimum.

17.6.11 **Area 4. (CMR Area I)** The carriageway is elevated in this area and the nearby residences to the east and west of the route (Brindley Street and Handley Street, Figure 17.9) experience noise levels around 60 dB. It would be expected that about 13% of those living here would be bothered by the noise. From the assessment it would be expected that no residents would be bothered by vibration. It is predicted that noise levels would rise by about one decibel by 2030 for the do minimum scenario, slightly increasing the proportion of the population expected to be bothered by the noise, and slightly increasing the risk of concerns about vibration.

17.6.12 **Area 5.** The main route to reach the M56 in the south of the study area is the Weston Point Expressway which passes largely through industrial areas although there are some residential areas (Figure 17.10) about 50 metres to the east of the route, e.g. Russell Road. These locations experience noise levels in the range 70 – 75 dB, similar to those to the west of the route, e.g. Castner Avenue. This is a high noise level with some 34% of those living there likely to be bothered by the road traffic noise. Due to the distance from the road it is not anticipated that residents will be bothered by vibration. This noise level is likely to rise by about 1 to 1.5 dB by 2030 for the do minimum situation.

17.6.13 **Area 6. (CMR Area D)** This assessment area includes the New Bridge where it crosses the River Mersey, together with Wigg Island and the Manchester Ship Canal (Figure 17.11). Currently noise levels are comparatively low at about 50 dB and they are expected to increase by about 1 dB by 2030 for the do minimum scenario.

17.6.14 **Area 7**. **(CMR Area E)** To the south of the Manchester Ship Canal the study area includes the Astmoor industrial estate (Figure ~~17.12~~ 17.11) where current road traffic noise levels are of the order of 50 dB and, based on the output of the ~~VFM~~ VDM traffic model for this area, are not expected to increase in the future do minimum scenario.

17.6.15 **Area 8**. **(CMR Area F)** This area includes dwellings in the vicinity of the Bridgewater junction a relatively busy junction at the northern end of the Central Expressway (Figure 17.12). Noise levels here are currently around 55 – 60 dB. This is typical for dwellings near to such a road junction. It is anticipated that only about 4 % of the exposed population would be expected to be bothered by the noise. From the assessment it would be expected that no occupants would be bothered by vibration. Noise levels in the do minimum situation are expected to rise by about one decibel.

17.6.16 **Area 9**. **(CMR Area G)** The Central Expressway is the main route for traffic travelling south between the Bridgewater Junction and the M56. Whilst there are residential areas to both sides of the route (Figures 17.13 and 17.14) they are generally of the order of 50 to 60 metres from the road with noise levels of the order of 60 – 65 dB. In the future do minimum scenario levels would be expected to increase by about 1 dB. At this level of noise it would be expected that around 13% of those affected would be bothered. The assessment has indicated that it would not be expected that any residents would be bothered by vibration.

17.6.17 **Area 10. (CMR Area H)** Further south the assessment area includes the Weston Link to M56 section (Figure 17.15). This has a fairly dense residential area to the north east of the route although the nearest dwellings are about 60 metres from the road. The noise levels here are in the 60 dB range which is moderately high but not untypical of this type of situation. At this level about 13% of the exposed population would be expected to be bothered by noise, but due to the distance from the road there is not expected to be any bother caused by vibration. Noise levels in the do minimum situation are expected to rise by about one decibel.

Night-Time Noise

17.6.18 Night-time noise level contours have been produced in line with the 2011 revision of DMRB and these show that some properties do exceed the night-time $L_{Aeq,8h}$ 55dB threshold. The numbers of properties are predicted to be as follows:

Table 17.15 – Number of properties affected

$L_{Aeq,8h}$	2006 Base Year	2015 Do minimum	2030 Do minimum
> 55	1105	1184	1347

Schools

17.6.19 For the schools in the study area, the predicted noise levels are shown in the table below in terms of the $L_{A10,18h}$ level. Whilst this assessment period (18 hours) is longer than the school day it will still give a good representation of the impact and will also account for the fact that many school buildings can be used for extra-curricular activities after normal school hours. Figures presented are calculated using CRTN. The baseline noise levels for 2006 and for the future years do minimum are shown.

Table 17.5 – Schools - road traffic noise, dB, $L_{A10,18\ h}$

	Base 2006	Do minimum 2015	Do minimum 2030
Cavendish School, Lincoln Close, WA7 4YZ	62.8	63.5	64.1
Hallwood Park Primary, Hallwood Park, WA7 2FL	66.8	67.2	67.8
West Bank Primary, Cholmondeley Street, WA8 0EL	72.2	72.7	73.0
Weston Point Community Primary, Castner Avenue, WA7 4EQ	70.5	71.5	71.9
Woodside Primary, Whitchurch Way, WA7 5YP	56.5	57.3	57.5

17.6.20 Two of the schools experience relatively high noise levels (West Bank Primary and Weston Point Community Primary) and under the do-minimum scenarios, the noise levels are expected to rise by up to about 1.5 dB. Noise levels are not so high at Cavendish School and Hallwood Park Primary, and levels are expected to rise by around 1 – 1.5 dB in the do-minimum scenarios. The noise level is much lower at Woodside Primary and an increase of about 1 dB is expected by ~~2030~~ 2032 in the do minimum scenario.

Baseline summary

17.6.21 In very general terms it can be concluded that, as would be expected, areas adjacent to the existing highway routes, including the SJB and the Weston Expressway, experience moderate to high noise levels. This is particularly the case with the SPA adjacent to the SJB, and further south alongside the Weston Expressway where traffic speeds tend to be higher. Areas adjacent to the Central Expressway are currently exposed to moderately high noise levels. The St Helens Canal, the New Bridge alignment over the River Mersey, the Wigg Island area and the Manchester Ship Canal are all currently in relatively quiet areas.

17.6.22 For the do minimum scenarios, most areas are expected to experience an increase of around 1 – 1.5 dB.

17.6.23 For the most part the distance between residential premises and the various roads means that the degree of bother arising from vibration is expected to be low.

17.6.24 There are a number of properties where the night-time $L_{Aeq,8h}$ 55 dB threshold is exceeded. The number of such properties increases in line with the natural growth of traffic flow in the 2015 and 2030 models.

17.7 Effects Assessment of the Project

17.7.1 This Chapter reports on an assessment of the likely effects of the Project including the Proposals on receptors identified earlier in this Chapter. The effects have been assessed for the construction and operation phases of the project.

17.7.2 The effect on the various sensitive receptors described above (paragraph ~~17.5.32~~ 17.5.40 *et seq*.) is considered.

Construction Phase

Overview of construction effects

17.7.3 The methodology used for assessing the construction effects is described above (paragraphs 17.5.10 – ~~17.5.18~~ 15.5.20 above).

17.7.4 The route of the Project would pass predominantly through industrial areas. However, there are some 1200 residential properties within a 100 metre corridor to either side of the route, and which could be affected by the noise levels shown in Table 17.2 (depending on their distance from the works). There is the potential that some of those residents would be bothered to some extent during the construction phase. The most densely populated residential areas are those adjacent to road works on the Central Expressway. Although all properties within the 100 metre band have been counted, in areas such as the Central Expressway, properties behind the first line of housing will benefit from a considerable element of noise shielding thus reducing the potential impact. The estimated number of properties potentially affected is, therefore, a worst case.

17.7.5 In the more detailed assessment below, the overall effect has been categorised taking account of the likely noise level from the works (based on the results shown in Table 17.2) and the relative sensitivity of the receptor as described in paragraph ~~17.5.32~~ 17.5.40.

More Detailed description of construction effects

17.7.6 It should be noted that although the areas referred to below differ from those used in other chapters of the Further Applications ES they are consistent with the noise and vibration chapter of the Orders ES and have be maintained to simplify the comparite approach. Figures showing the area locations are referenced and the designation given elsewhere in the Further Applications ES, to which they are broadly analogous, are designated with the suffix CMR.

17.7.7 **Area 1. Figure 17.7. (CMR Areas A, B, C)** Construction activities in this area are expected to involve strengthening of the ground using vibro-concrete columns though the extent of these works has been significantly reduced by the removal of the toll plazas. The works then involve the construction of the carriageway pavement, though again the extent of these works is reduced by the removal of the toll plazas. Whilst this technique employs a vibration generator, and may require piling, there are no vibration sensitive areas near and consequently there will be limited effect. This has not changed as part of the Further Applications. To the east of this assessment area works will include construction of an embankment and some bridgeworks which may involve piling. Again there are no vibration sensitive areas near to this location. This has not changed significantly as part of the Further Applications.

17.7.8 Construction works on the north bank (CMR Areas A, B and C) will largely be surrounded by industrial and commercial areas and the impact on residential areas is anticipated to be negligible negative. However, the construction site will cross the St Helens Canal and there will be a moderate negative effect in this area while the works are in progress with noise levels in the mid 70 dB range at a distance of 100 metres. This has not changed significantly as part of the Further Applications.

17.7.9 **Area 2. Figure 17.8. (CMR Area I)** The construction methods expected for this area are mostly minor in connection with the de-linking of the SJB, with some earthworks and concrete breaking for the removal of a viaduct. The deck of the SJB would be planed together with other minor works such as erecting signage. There is a housing area to the east of the SJB northern approach (Cholmondeley Street), but works here are anticipated to be minimal and effects are anticipated to be ~~low~~ negligible negative. The proposed works in this Area have not changed significantly as part of the Further Applications.

17.7.10 **Area 3.** Construction works on the deck of the SJB adjacent to the SPA are expected to be minimal with no major works and any adverse effects are expected to be negligible negative at worst. Again, the proposed works in this Area have not changed significantly as part of the Further Applications.

17.7.11 **Area 4. Figure 17.9. (CMR Area I)** To the south of the SJB there are no construction works programmed except for minor civils work in connection with re-prioritisation for public transport. This has not changed significantly as part of the Further Applications.

17.7.12 **Area 5. Figure 17.10.** There are no construction works programmed for the Weston Point Expressway. This has not changed significantly as part of the Further Applications.

17.7.13 **Area 6. Figure 17.11. (CMR Area D)** There will be construction of the bridge towers in this area which will involve a variety of techniques including sheet piling to form cofferdams, the use of cranes and concreting. The jetties and approach viaducts will also require piling using both vibratory and impact methods. The proposed construction works in this area have not been changed significantly as part of the Further Applications.

17.7.14 On the south bank (CMR Area E) there will be an approach viaduct crossing the Astmoor Saltmarsh. The construction of this viaduct, some ~~24~~ 25 metres high, will involve the formation of stone tracks for access and reinforced concrete plate piers to support the road deck. This will be one of the noisier activities potentially producing $L_{Aeq,T}$ noise levels in the mid to high 70 dB range at a distance of 100 metres. There will inevitably be an impact on Wigg Island during the construction of this phase of the works and with noise levels around 85 dB at 50 metres. The effect has been classed as high negative, there have been no significant changes in this respect in the Further Applications and so this effect remains.

17.7.15 Where the viaduct passes over the Manchester Ship Canal there is likely to be piling required with noise levels potentially in the range of 80 – 85 dB at 50 metres. This effect has been classified as moderate negative. Again, there have been no significant changes in this respect in the Further Applications and so this effect remains.

17.7.16 **Area 7. Figure ~~17.12~~ 17.11. (CMR Area E)** The road will pass through the Astmoor industrial site on an embankment and it is likely that piled foundations will be required together with concreting works. Whilst piling can cause noise levels around 85 dB at a distance of 50 metres ~~whist~~ whilst the operation is in progress, the relatively low sensitivity of this area means that the effect has been classified as ~~low~~ negligible negative and this has not changed as part of the Further Applications.

17.7.17 **Area 8. Figure 17.12. (CMR Area F)** The Bridgewater Junction involves a complex of structures and construction will involve piling, concreting and the placing of prefabricated or pre-stressed concrete beams. Where the viaduct passes over the Bridgewater Canal there is likely to be piling required with noise levels potentially in the range of 80 - 85 dB at 50 metres. Given the relative sensitivity of the canal towpaths, the effect has been classified as moderate negative. There have been no significant changes in the Further Applications in this respect and so this effect remains.

17.7.18 The area of housing near to the Bridgewater Junction embankment (area F of the CMR), is located roughly at a distance of 40 metres or so and is expected to experience noise levels around 75 to 80 dB whilst the embankment is being modified. This effect has been classed as moderate negative and as there have been no significant changes in the alignment at this location as part of the Further Applications this effect is expected to remain.

17.7.19 **Area 9. Figures 17.13 and 17.14. (CMR Area F and G)** Further south, after the Bridgewater Junction (part of area F and area G of the CMR), there is housing situated both to the east and west of the existing road. However, the housing is situated some distance from the works, typically 70 to 100 metres. There may be some impact due to construction of the new structures that will be required over the existing Expressway. Work on the main Central Expressway will be limited to traffic management and some highway alignment modifications. There will be no significant earth works. This, combined with the distance between housing and the works means that noise levels are expected to be around 70 dB and there is unlikely to be more than a low to moderate negative effect. There have been no significant changes in the alignment at this location as part of the Further Applications and this effect is expected to remain.

17.7.20 The Lodge Lane junction to Halton Brow (area G of the CMR) will require the provision of distributor roads together with a new single span bridge which will require piled foundations. There is some housing to the west of the road at approximately 30 metres and noise levels of around 75 to 80 dB are expected on occasions. Higher noise levels would occur if piling is required for bridge foundations, and the effect has been classed as moderate to high negative. Given the relatively close proximity of the housing to the works, there is the possibility that vibration from piling will be perceptible from time to time, but even at those distances, it is highly unlikely to cause any damage to properties. There have been no significant changes in the alignment at this location as part of the Further Applications and this effect is expected to remain.

17.7.21 **Area 10. Figure 17.15. (CMR Area H)** Work on the Weston link to M56 junction 12 (area H of the CMR) will be minimal in nature and in general the nearest housing is of the order of 100 metres from the works. There will be some bored piling for a new retaining wall to the south east side of the northern roundabout at the M56 junction but this will be some 150 to 200 metres from the nearest dwellings and will have no significant effect. There have been no significant changes in the alignment at this location as part of the Further Applications and this effect is expected to remain.

Schools

17.7.22 There are 2 schools that may be affected by construction activities. West Bank Primary School is adjacent to the SJB where minor works are to be carried out in connection with the de-linking of the SJB and Woodside Primary School near to the Lodge Lane Junction works.

17.7.23 As the existing noise level is relatively high at West Bank Primary and assuming the traffic noise will not change materially during the works, the noise from the construction works would probably only be audible from time to time and, the effect has been classified as ~~low~~ negligible negative.

17.7.24 The works near to Woodside Primary School will be greater and in this case, the effect has been classified as a moderate to high negative.

Operational Phase

17.7.25 The Orders ES 2015 data is taken as representative of a worst case assessment for 2017 and the 2030 data is taken as representative of a worst case assessment for 2032. This is a similar approach to that adopted by the Transportation Assessment. A sensitivity assessment is carried out to validate the modelling and determining the variations due to the changes in traffic flow and the Updated Reference Design. The outcome of the assessment is shown graphically in Figures 17.5 a and 17.6 a (day time) and 17.5 b and 17.6 b (night time).

Sensitivity Assessment

17.7.26 A sensitivity assessment was carried out at a selection of assessment receptors same as discussed in the previous section. This focussed on the potential effects from the predicted reductions in traffic that arise from the Department of Transport's revised guidance (see Chapter 16 Transportation) and any modifications incorporated into the Updated Reference Design.

17.7.27 In the sensitivity assessment, noise levels at the selected receptors are calculated following the procedures in CRTN focusing on the changes in the traffic flow data and distance changes from the kerbs of carriage ways to the façades of the receivers. The levels differences are then calculated.

17.7.28 The sensitivity assessment showed the following variations in noise levels at the defined receptors as a result of the modifications to the Reference Design and the predicted changes in traffic flows:

Table 17.16 Sensitivity Assessment Area Receptors

Area Receptor	Predicted Noise Level Difference 2017 Do Something vs 2015 Do Something (dB)	Predicted Noise Level Difference 2032 Do Something vs 2030 Do Something (dB)
Area 1 Speke Road	-0.7	-0.3
Area 1 St Helens Canal	2.5	3.1
Area 2 Cholmondley Street	-1.2	-1.2
Area 3 Beside SJB in River Mersey	-0.5	-0.5
Area 4 Handley Street	-0.9	-1.0
Area 5 Russell Street	-1.4	-1.1
Area 5 Castner Street	-1.4	-1.1
Area 6 Wigg Island	-1.5	-0.8
Area 7 Commercial Property	-1.7	-2.5
Area 8 South of Bridgewater Junction	-1.4	-1.6
Area 9 Littlegate, nr Runcorn Spur Road	-1.6	-0.9
Area 10 North of Weston Point (Rocksavage) Expressway	-1.0	-0.4

17.7.29 The sensitivity assessment for the schools shows the following variations in noise levels as a result of the modifications to the Reference Design and the predicted changes in traffic flows:

Table 17.17 Sensitivity Assessment Schools

Area Receptor	2017 Do Something vs 2015 Do Something	2032 Do Something vs 2030 Do Something
Cavendish School, Lincoln Close, WA7 4YZ	-1.6	-0.7
Hallwood Park Primary, Hallwood Park, WA7 2FL	-0.6	-0.5
West Bank Primary, Cholmondeley Street, WA8 0EL	-0.5	-0.5
Weston Point Community Primary, Castner Avenue, WA7 4EQ	-1.4	-1.1
Woodside Primary, Whitchurch Way, WA7 5YP	-1.3	-0.7

Sensitivity Assessment Summary

17.7.30 The sensitivity assessment results in the above tables show that noise levels at the assessment receptors have reduced as would be expected for the reduction in traffic flow that is predicted. The only exception is that of the receptor at Area 1 St Helens Canal.

17.7.31 At this location, as a result of the design refinements in the Proposals, the alignment of the New Bridge is closer to the receptor point. The receptor in this area is not representative of a residential area though the Trans-Pennine Way does lie along the canal towpath. However, it should be noted that the alignment of the New Bridge has moved along the canal, so whilst noise levels might have risen at this specific receptor location they will have fallen elsewhere along the canal and the Trans-Pennine Way. It would be reasonable to assume that if the receptor were moved the same distance from the canal as in the Reference Design a similar effect to that observed elsewhere in the scheme would be observed.

17.7.32 The sensitivity assessment results in the above tables showed that noise levels at the assessment receptors have reduced as would be expected for the reduction in traffic flow that is predicted, with the exception of receptor at Area 1 St Helens Canal.

Overall assessment - Noise

17.7.33 Table 17.6 below shows the numbers of people within various noise level bands for each scenario – base year, 2015 do minimum, 2015 do something, 2030 do minimum and 2030 do something as determined by the noise modelling described in paragraphs ~~17.5.19 – 17.5.27~~ 17.5.21 – 17.5.35.

Table 17.6 – Number of people within noise contour bands

$L_{A10,18h}$	Base Year 2006	Do minimum 2015	Do something 2015	Do minimum 2030	Do something 2030
50 – 55	20105	20781	17505	20419	17038
55 – 60	7513	8708	11082	9463	12869
60 – 65	3882	4172	3819	4194	4144
65 – 70	2072	2114	2087	2400	1399
> 70	535	681	497	780	668

17.7.34 From these data, the estimated number of people bothered very much or quite a lot by road traffic noise has been calculated according to the method described in paragraphs ~~17.5.26~~ 17.5.34 above. The Orders ES results have been used as a worst case assessment. The results are shown in Table 17.7 below.

Table 17.7 – Total Number of people bothered very much or quite a lot by road traffic noise

$L_{A10,18h}$	Base Year 2006	Do minimum 2015	Do something 2015	Do minimum 2030	Do something 2030
50 – 55	1206	1247	1050	1225	1022
55 – 60	751	871	1108	946	1287
60 – 65	660	709	649	713	704
65 – 70	559	571	563	648	378
> 70	182	232	169	265	227
TOTAL	**3358**	**3630**	**3539**	**3797**	**3618**
% Change from base		**+8.1**		**+13.1**	
% Change from do min			**-2.5**		**-4.7**

17.7.35 Compared to 2006 there is expected to be an increase in the number of people bothered by noise of around 8% by 2015 (2017) for the do minimum scenario due to the expected increase in traffic flow, rising to an increase of 13% by 2030 (2032) taking the Orders ES assessment as a worst case scenario. This demonstrates that without the project the noise environment would be expected to worsen were the Project not to be implemented.

17.7.36 Assuming the Project is built, the overall figures show a decrease in the number of people bothered with reductions of about 2.5% in 2015 (2017) and 4.5% in 2030 (2032) when compared to the do minimum scenario.

17.7.37 Looking at the figures in more detail it can be seen that for the do something scenario in 2030 (2032) there are decreases in the number of people bothered in the higher noise bands, above 60 dB, and in the lowest noise band, 50 to 55 dB, but an increase in the mid noise band, 55 to 60 dB. However, as indicated above, the overall effect is that fewer people would be expected to be bothered with the Project in 2030 (2032) than would be the case were the Project not to be built.

17.7.38 It can also be seen from Table 17.6, that there would be a reduction of about 20% in the number of people living in dwellings where the road traffic noise is 65 dB or more between do-something 2030 (2067) compared with the baseline (2607).

17.7.39 This is due to the fact that there will be considerably less traffic on the SJB which currently causes moderately high noise levels to nearby dwellings and to dwellings on the Weston Expressway.

Overall assessment – Vibration

17.7.40 Using the methodology described in paragraphs ~~17.5.28 – 17.5.31~~ 17.5.36 – 17.5.39 above, an estimate of the number of people in the study area likely to be bothered very much or quite a lot by vibration has been made. The Orders ES results have been used as a worst case assessment. The results are shown in Table 17.8.

Table 17.8 – Number of people bothered very much or quite a lot by vibration

	Do minimum	Do something
Base year, 2006	100	-
2015	112	120
2030	114	125

17.7.41 It can be seen that there will be a slight increase in the total number of people bothered by vibration in the future without the project due to the expected increase in traffic flow. The increase is expected to be slightly higher for the do something situation, but the differences are small. Taking account of the relative sensitivity of the receptors and the size of the expected change, the effect has been classed as a ~~low~~ negligible negative.

More Detailed assessment

17.7.42 The following section describes the future do something scenario for ~~2030~~ 2032 and makes comparison with the baseline/do-minimum data and assesses the effect. For residential areas estimates have been made of the changes in percentage of people likely to be bothered very much or quite a lot by the noise.

17.7.43 It should be noted that although the areas referred to below differ from those used in other chapters of the Further Applications ES, they are consistent with the noise and vibration chapter of the Orders ES and have be maintained to simplify the comparite approach. Figures showing the area locations are referenced and the designation given elsewhere in the Further Applications ES, to which they are broadly analogous, are designated with the suffix CMR.

17.7.44 **Area 1. (CMR Area A, B and C)** The Speke Road section of this area is expected to have a 2 to 2.5 dB increase in noise levels at 10 metres from the road side. The area is mostly industrial which has been classed as a low importance; consequently the effect has been classed as ~~low~~ negligible negative.

17.7.45 Where the road alignment passes over the St Helens Canal, as this is a newly exposed area to road traffic, noise levels are expected to rise some 7 or 8 dB to the low 60 dB range. As canal side areas have been classified as moderate importance this increase has been classed as a moderate negative effect.

17.7.46 **Area 2. (CMR Area I)** For the residential areas adjacent to the SJB northern approach there will be a reduction in traffic noise levels. This is expected to be a 5 or 6 dB reduction in noise levels to the mid 60 dB range. The percentage of people expected to be bothered by noise and by vibration will reduce by about 12%. This is classed as a moderate positive effect.

17.7.47 **Area 3.** The area of the SPA immediately adjacent to the SJB will be expected to have a reduction in noise level due to road traffic of about 5 dB to the high 40 dB range. Although there will still be intermittent noise due to passing trains and other nearby sources, taking account of the relative sensitivity of the area, the effect of the Project has been classed as high positive.

17.7.48 **Area 4. (CMR Area I) Figure 17.9.** On the south side of the SJB the housing areas will expect a 5 or 6 dB reduction in the contribution from the roads considered in this assessment to the mid 50 dB range. The percentage of people expected to be bothered by noise is expected to reduce by about 5%. It is not expected that any people will be bothered by vibration. This a positive benefit and has been classed as a moderate positive effect.

17.7.49 **Area 5. Figure 17.10.** Housing alongside the Weston Point Expressway will receive a reduction in noise levels about of 5 dB from the low 70 dB to the mid 60 dB range. This will reduce the percentage of people bothered by about 12% from 34% down to 22%. Due to the distance from the road there is not anticipated to be people bothered by vibration. Overall for this area, this has been classed as a moderate positive effect.

17.7.50 **Area 6. (CMR Area D) Figure 17.11.** The area of the New Bridge and the Wigg Island area will see increases of 5 dB or so despite an element of self shielding by the bridge deck. Although this is classified as a moderate increase, the relative sensitivity of this area means that this has been classed as a high negative effect. The increase in noise level at the Manchester Ship Canal has been classed as a moderate negative effect.

17.7.51 **Area 7. (CMR Area E) Figure ~~17.12~~ 17.11.** Where the route alignment passes through the Astmoor industrial estate it is expected that high increases in noise levels of about 10 dB will occur. Noise levels would be in the low 60 dB range which is entirely compatible with this type of use. Given the relative sensitivity of this area, the overall effect has been classed a ~~low~~ negligible negative.

17.7.52 **Area 8. (CMR Area F) Figure 17.12.** The housing near to the Bridgewater Junction will experience noise level increases of about 7 dB from 60 dB to the mid 60 dB range. The percentage of people expected to be bothered by noise and by vibration will increase by about 9%. This has been classed as a moderate negative effect. The increase in noise at the Bridgewater Canal combined with its relative sensitivity as a receptor means that the change has been classed as a moderate negative effect.

17.7.53 **Area 9. (CMR Area F and G) Figure 17.13 and 17.14.** For the housing alongside the remainder of the Central Expressway noise levels are generally anticipated to increase by about 2 to 4 dB. The percentage of people expected to be bothered by noise and by vibration will increase by about 9%. This has been classed as a moderate negative effect.

17.7.54 **Area 10. (CMR Area H) Figure 17.15.** The housing parallel to the route from the Weston Link to the M56 is expected to experience a low increase in noise level of less than 1 dB. The percentage of people bothered by noise is not expected to change. The effect has been classified as a ~~low~~ negligible negative effect.

Night-Time Noise

17.7.55 The numbers of properties predicted to exceed the night time $L_{Aeq,8h}$ 55dB threshold are shown in the following Table 17.18. It should be noted that this includes all properties within the Study Area. Overall, there is reduction in number of properties affected when comparing the Do Something and corresponding Do Minimum scenarios.

Table 17.18 – Number of properties affected

$L_{Aeq,8h}$	2006 Base Year	2015 Do minimum	2015 Do something	2030 Do minimum	2030 Do something
> 55	1105	1184	1095	1347	876

Schools

17.7.56 The predicted noise levels for the schools in the study area for the scenarios assessed are shown in Table 17.9 below.

Table 17.9 Schools - road traffic noise, dB, $L_{A10,18\ h}$

	Base 2006	Do minimum 2015	Do something 2015	Do minimum 2030	Do something 2030
Cavendish School, Lincoln Close, WA7 4YZ	62.8	63.5 (+0.7)	62.7 (-0.8)	64.1 (+1.3)	63.5 (-0.6)
Hallwood Park Primary, Hallwood Park, WA7 2FL	65.1	67.2 (+0.4)	66.2 (-1)	67.8 (+1)	67.1 (-0.7)
West Bank Primary, Cholmondeley Street, WA8 0EL	72.0	72.7 (+0.5)	66.3 (-6.4)	73 (+0.8)	67.1 (-5.9)
Weston Point Community Primary, Castner Avenue, WA7 4EQ	67.7	71.5 (+1)	64.3 (-7.2)	71.9 (+1.4)	65.6 (-6.3)
Woodside Primary, Whitchurch Way, WA7 5YP	55.6	57.3 (+0.8)	65.6 (+8.3)	57.5 (+1)	66.3 (+8.8)
NB figures in brackets for do minimum show change from base year Figures in brackets for do something show change from do minimum					

17.7.57 The noise levels in Table 17.9 are derived from the Orders ES. The sensitivity assessment indicates that overall the noise effects will be smaller as a result of the reduced traffic levels and therefore negative effects are expected to be less whilst positive effects will be greater. However, the sensitivity assessment does not suggest that the differences in noise effects are sufficient to merit reclassifying the noise effects and therefore they remain as described in the Orders ES.

17.7.58 The predicted road traffic noise levels at Cavendish School show a reduction for the do something situation of 0.6 to 0.8 dB showing that there will be a low positive effect.

17.7.59 At Hallwood Park Primary School predicted road traffic noise levels are expected to reduce for the do something scenarios by a 0.7 – 1.0 dB. This has been classified as a low positive effect.

17.7.60 For both these schools, the expected growth in traffic between 2015 and 2030 means that the reduction in noise level compared with the baseline is lower in 2030 than in 2015.

17.7.61 For West Bank Primary school road traffic noise levels now and for the future do minimum scenarios are high at 72 to 73 dB. Future road traffic noise levels for the do something scenarios are predicted to reduce by around 6 to 6.5 dB, a very noticeable reduction. This has been classed as a high positive effect.

17.7.62 Weston Point Community School is close to the Weston Point Expressway and road traffic noise levels are currently high at about 71 dB. They are expected to rise by 1 to 1.4 dB in the future do minimum scenarios. However for the do something scenarios levels will reduce by about 6 dB, again a very noticeable reduction. This has been classed as a high positive effect.

17.7.63 Woodside Primary School lies adjacent to the Central Expressway near to the Lodge Lane Junction. Road traffic noise levels are currently about 57 dB and are not predicted to alter very much in the future do minimum scenarios. However in the future do something scenarios unmitigated noise levels will increase by 8.3 to 8.8 dB. This is partly due to increased traffic flows on the Central Expressway but also due to the realignment of the carriageway layout bringing a slip road closer to the school. This is classed as a high negative effect and mitigation has been proposed to reduce the effect (see 17.8 below).

Summary of effects

17.7.64 During the construction phase of the Project there will inevitably be some negative effects, however these will not be permanent. A brief description of the construction activities has been given for each assessment area, together with an indication of the likely noise levels and the likely effect. The CMR provides detail of the construction techniques anticipated to be used. However at this stage there is insufficient detail on specific types of equipment and other details to make precise predictions. More detailed calculations will be carried out when specific plant and working methods are known.

17.7.65 There is expected to be a high negative effect at the Wigg Island Community Park during construction of the Project. This is in part due to the baseline low noise levels experienced there at present. In the adjacent Astmoor industrial estate the effect is anticipated to be low reflecting the low sensitivity of this area.

17.7.66 During construction there is expected to be a moderate negative impact on housing near to the Bridgewater Junction and along the Central Expressway as far as the Lodge Lane Junction. Here new slip roads are to be built and the negative impact has been classed as moderate to high.

17.7.67 During the operational phase the assessment has shown overall benefits for the do something scenario with a reduction in the number of people likely to be bothered by road traffic noise. The assessment of people likely to be bothered by vibration shows little change~~, although it is expected that there will be a slightly greater number of people bothered for the~~ for either the do minimum or do something scenario.

17.7.68 The main outcome of the detailed analysis is that there are anticipated to be moderate positive effects for the housing adjacent to the northern and southern approach to the SJB and all housing adjacent to the Weston Point Expressway. The positive effect to the SPA adjacent to the SJB has been classed as high. There will be a high negative effect at Wigg Island and moderate negative effects for housing adjacent to the Central Expressway.

17.7.69 There are ~~5~~ five schools in the assessment area four of which will experience lower noise levels for the do something scenario and one of which will receive higher noise levels. Of those receiving lower noise levels, two have been classified as a low positive effect (Cavendish School and Hallwood Park Primary School), and 2 will have been classified as a high positive effect (Weston Point Community School and West Bank Primary School). Woodside Primary School is expected to have a high negative impact. As noted above a sensitivity assessment has been undertaken for the ten receptor areas considered in the assessment of the Reference Design together with the five schools that were also assessed.

17.7.70 The sensitivity assessment results showed that for the majority of cases noise levels at the assessment receptors have reduced, therefore it is reasonable to take the original work as a worst case scenario. At Area 1 St Helens Canal, there is a predicted increase of up to 3.1dB. This is due to the alignment of the New Bridge has been changed so that it is significantly closer to the receptor. The receptor in this area is not representative of a residential area and therefore would not be considered a particularly sensitive receptor. On this basis this is not considered to be a significant variation.

Other Issues

17.7.71 The provision of any new housing adjacent to the alignment of the proposed project will not be compromised by the Project in terms of land allocated for housing and PPG 24 Planning and Noise (Ref 6). It will be possible by appropriate design to achieve suitable internal noise levels for any housing development.

17.7.72 Three of the Regeneration Action Areas identified in the UDP (Ref 8) and referred to in the Land Use Chapter of this ES are adjacent to the Project alignment in the Widnes Loops area, and they feature land allocated for residential development. However there is sufficient space within the areas to phase development so that noise sensitive development, such as housing, is located away from the road or is shielded by development that is not noise sensitive. This will allow development of housing without conflicting with PPG 24 or with the UDP.

17.7.73 Following completion of the Project, it is planned to redevelop land under the Astmoor viaduct. This will present no noise or vibration difficulties providing the development is suitable for the area, i.e. industrial or commercial.

Table 17.10 Summary of Potentially Significant Noise and Vibration Effects

Effect	**Receptor and Importance**	**Nature of Effect** (Permanent / Temporary and Magnitude)	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)
Construction Phase			
General construction activities	Dwellings – High importance	Temporary effect for Project duration. Approximately 1,200 dwellings within 100 metres.	Moderate negative
Noise from general construction activities including canal bridge	Area1 – St Helens Canal – medium importance	Temporary increase in noise, up to 6 months	Moderate negative
Noise from minor construction activities	Area 2 – SJB northern approach. Dwellings - high importance	Temporary increase in noise, up to 6 months	Low negative
Noise from bridge construction activities	Area 6 – Wigg Island – high importance	Temporary increase in noise, up to 27 months	High – negative
Noise from viaduct construction activities	Area 6 – Manchester Ship Canal – medium importance	Temporary increase in noise, up to 9 months	Moderate – negative
Noise from viaduct construction activities	Area 7 – Astmoor industrial estate – low importance	Temporary increase in noise, up to 25 months	Low negative
Noise from general construction activities	Area 8 – Bridgewater Canal – medium importance	Temporary increase in noise, up to 9 months	Moderate – negative
Noise from general construction activities	Area 8 – residential areas near Bridgewater Junction – high importance	Temporary increase in noise, up to 11 months	Moderate – negative
Noise from construction and highway alignment modifications	Area 9 – residential areas adjacent to the Central Expressway – high importance	Temporary increase in noise, 12 months	Low to moderate – negative
Noise from construction of distributor roads and bridge	Area 9 – residential areas adjacent to Lodge Lane Junction	Temporary increase in noise, 12 months	Moderate to high – negative
Noise from minor construction activities	West Bank Primary School – high importance	Temporary increase in noise, up to 6 months	Low – negative
Noise from construction of distributor roads and bridge	Woodside Primary School – high importance	Temporary increase in noise, 12 months	Moderate to high - negative
Operational Phase			
Overview Noise from operation of the road –	Residential areas – high importance	Permanent decrease in number of people affected by noise	Moderate positive
Overview - Vibration from operation of the road	Residential areas – high importance	Permanent – slight increase in number bothered	Low negative
Road traffic noise	Area 1 – industrial and commercial areas – Negligible importance	Permanent - slight increase	Low negative

Effect	**Receptor and Importance**	**Nature of Effect** (Permanent / Temporary and Magnitude)	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)
Road traffic noise	Area 1 – St Helens Canal – medium importance	Permanent increase in noise levels	Moderate negative
Road traffic noise	Area 2 – residential areas adjacent to northern approach to SJB – high importance	Permanent decrease in noise levels	Moderate positive
Road traffic noise	Area 3 – SPA – high importance	Permanent decrease in noise levels	High positive
Road traffic noise	Area 4 – residential areas adjacent to the southern approach to SJB – high importance	Permanent – decrease in noise levels	Moderate positive
Road traffic noise	Area 5 – residential areas adjacent to the Weston Point Expressway – high importance	Permanent – decrease in noise levels	Moderate positive
Road traffic noise	Area 6 – Wigg Island – very high importance	Permanent – increase in noise levels	High negative
Road traffic noise	Area 6 – Manchester Ship Canal – medium importance	Permanent – increase in noise levels	Moderate negative
Road traffic noise	Area 7 – Astmoor industrial estate – low importance	Permanent – increase in noise levels	Low negative
Road traffic noise	Area 8 – residential areas adjacent to Bridgewater junction	Permanent – increase in noise levels	Moderate negative
Road traffic noise	Area 8 – Bridgewater Canal – medium importance	Permanent – increase in noise levels	Moderate negative
Road traffic noise	Area 9 – residential areas adjacent to the Central Expressway	Permanent – increase in noise levels	Moderate negative
Road traffic noise	Area 10 – residential areas adjacent to the Weston link to M56	Permanent – slight increase in noise levels	Low negative
Road traffic noise	Cavendish School – high importance	Permanent – slight decrease in noise levels	Low positive
Road traffic noise	Hallwood Park Primary School – high importance	Permanent – slight decrease in noise levels	Low positive
Road traffic noise	West Bank Primary School – high importance	Permanent – decrease in noise levels of about 6 dB	High positive
Road traffic noise	Weston Point Community School – high importance	Permanent – decrease in noise levels of about 6 dB	High positive
Road traffic noise	Woodside Primary School – high importance	Permanent – increase in noise levels of about 9 dB	High negative

17.8 Mitigation, compensation, enhancement and monitoring

Mitigation of Noise during Construction

17.8.1 Some potential adverse noise impacts have been identified in this assessment. The contractor(s) should ensure that predictions of construction noise and vibration are updated as the construction programme develops. It should be remembered however, that construction impacts are temporary in nature and suitable mitigation and control measures can be introduced to minimise any negative impacts, including use of Best Practicable Means and control through a Noise and Vibration Monitoring Programme. Vibration measurement at specific receptors should be carried out in accordance with BS 5228 and BS 7385.

17.8.2 It is likely that the contactor(s) will submit an application or applications to the local authority for a Section 61 agreement under COPA (Ref 4)

17.8.3 The modifications in the Project including the Proposals are not considered to significantly alter construction noise. The contractor(s) should adopt maximum construction noise targets for the project using guidance as presented in the table below. These are based on other, similar projects but are subject to agreement with the relevant local authorities. Noise measurement terminology relates to BS 5228:~~1997~~ Part 1 2009 (Ref 10).

Table 17.11 – Recommended construction noise target levels at noise sensitive receiver

Period of Construction		Level $L_{Aeq,T}$ dB(A)	Duration T (hours)
Day			
Monday-Fridays	0700-1900	75	12
Saturdays	0700-1300	75	6
Evening (and weekends)			
Mondays-Fridays	1900-2200	65	3
Saturdays	1300-2200	65	9
Sundays	0900-1700	65	8
Night (and weekends)			
Any day	2200-0700	60	9
Sundays	0700-0900	60	2
Sundays	1700-2200	60	5

17.8.4 To keep construction noise to a minimum and within the thresholds outlined in the above table, the contractor will be expected to follow good practice including noise management mitigation measures as an integral part of a Noise and Vibration Management Plan (NVMP) for the Project which would be expected to include the following:

a. To provide good communication with the local community the contractor will appoint a community liaison officer with a publicised contact telephone number;
b. Where noisy tasks have to be undertaken close to occupied buildings, the occupiers would be given advance notice, in writing, explaining the reason for the works, the expected time and duration, and the procedures to be adopted for minimising the noise or vibration;

c. Where work has to be undertaken during either the evening or night-time periods, the Contractor would advise and consult with the environmental health officers of the Council in accordance with an agreed procedure;
d. All plant and equipment associated with the construction works would be properly maintained, provided with effective silencers and operated in such a manner as to avoid causing any excessive noise emission. Where plant has been designed to operate with engine covers to reduce noise, these would be used and remain closed while the plant is in operation. Unless otherwise directed by senior construction management, items of plant in intermittent use would be shut down during idle periods;
e. Static plant would be located in areas as far from inhabited buildings as possible and would be screened where practicable. Plant known to emit noise predominantly in one direction would, when possible, be screened or orientated so that the noise is directed away from noise sensitive areas;
f. No music or radios should be played on site;
g. Audible warning systems, such as vehicle reversing sirens, would normally be set to as low a setting as is compatible with safety requirements. Where appropriate, broadband warning systems would be used;
h. Site compounds would be located as far as possible from local occupied premises and, where possible, site buildings would be situated to provide additional screening between the works and other occupied premises. Where appropriate, the stockpiling of site materials, soil or spoil would be located where it can provide some additional screening provided that any plant associated with this would in itself not generate nuisance, provided that prevailing wind conditions would not increase the potential for nuisance due to dust. The transport of materials on or off site by road would generally take place during the normal daytime working period and where possible would also be routed away from particularly sensitive receivers; and
i. Site personnel would be informed about the need to minimise noise to the neighbouring community as well as about the health hazards of exposure to excessive noise or vibration. Their training would include advice relating to the proper use and maintenance of tools and equipment, the positioning of machinery on site to reduce noise emissions to neighbouring communities, and the avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment.

17.8.5 Night working would be kept to a minimum. However, there may be occasions where it is unavoidable such as works to the railway in Widnes. Operations such as piling works would not generally be undertaken at night.

17.8.6 Haul routes within the site would generally be on existing main roads. However, as specified in the CMR it will be possible to bring some materials in by canal direct to the site, thus avoiding the road network.

17.8.7 In addition, to these measures the constructor(s) will be required to carry out a more detailed verification of noise levels for specific construction activities when specific plant and working methods are known or when required by the local authority.

Noise Insulation Regulations (Ref 3)

17.8.8 As described in paragraph ~~17.4.5~~ 17.4.8, there is the power within these regulations to offer noise insulation to residential properties where the construction works *"are expected to cause noise at a level, which, in the opinion of the highway authority, seriously affects or will seriously affect for a substantial period of time the enjoyment of an eligible building adjacent to the site".* Levels defining 'seriously affected' or 'substantial period of time' are not given in the regulations but are commonly defined as 75 dB $L_{Aeq,12h}$ for 10 consecutive days. It is anticipated that these criteria would be used with this Project. Furthermore, if properties are found to be eligible for noise insulation as a result of operational noise, every effort would be made to bring forward such treatment so that it would assist in mitigating noise from the construction phase.

Noise and vibration monitoring during construction

17.8.9 It is common practice to conduct monitoring of noise and vibration levels during major construction projects to check that agreed targets are being met. This is likely to be required as part of a Section 61 agreement under the COPA and the contractor will be required to reach agreement on the methodology with the planning authority.

17.8.10 All monitoring should be carried out by competent personnel and should be in accordance with the guidance given in BS 5228. Noise monitoring can either be carried out at the noise sensitive receiver location or in some circumstances can be carried out on the construction site boundary with suitable corrections to enable estimation of noise levels at the required location.

17.8.11 Vibration during most construction activities is not expected to cause major effects, although piling vibration should be reviewed when suitable data are available. ~~but~~ Monitoring may be required during some piling or vibratory compaction activities. In such cases monitoring should be carried out at a location representative of the relevant sensitive receiver location.

Mitigation of Noise during Operation

17.8.12 When considering the reduction of any negative impact due to road traffic noise, the preferred mitigation option is to reduce noise at source, for example, by the provision of roadside noise barriers.

17.8.13 The following discussion of mitigation is divided into four separate areas. The sensitivity assessment shows that the reduced traffic levels will lead to lower noise effects, however, these are not considered sufficient to warrant altering the mitigation and this remains as proposed for the Orders ES.

17.8.14 Although the new bridge will pass over Wigg Island at a height of about 25 metres, a high negative impact has been identified for this location. Consideration has been given to roadside windscreens which would also reduce noise levels to an extent. However, as these screens are unlikely to be solid they will only reduce levels by 1 dB or so.

17.8.15 In the Central Expressway area the road will pass through largely residential areas and consideration has been given to the provision of roadside noise barriers to reduce the negative impacts here.

17.8.16 For a barrier to be effective it needs to be either close to the source or close to the receiver. In the situation of a new road it is convenient to place a barrier close to the source, i.e. at road side. A barrier needs to obscure the line of sight to be effective and can generally give reductions of 5 dB(A) to 10 dB(A). The required height of a barrier therefore depends on the geometry of the source height and the location of the receiver, which, in the case of a first floor bedroom window is generally taken to be 4.5 metres above ground level.

17.8.17 The proposed barriers on the Central Expressway would be located at the road side between the carriageway and the residential areas. For illustrative purposes and for the Reference Design, barriers of 2.4 metres height have been proposed in areas where the road is at ground level. This will means that noise levels at the dwellings will be expected to reduce by at least 5 dB. Where carriageways are elevated the barrier height has been reduced to 1.2 metres as the ground elevation of the barrier site provides an additional screening effect. The locations of the barriers are shown in Figures 17.17 and 17.18. This will reduce the effect of road traffic noise on all dwellings adjacent to the Central Expressway from moderate to ~~low~~ negligible.

17.8.18 In the area adjacent to the Lodge Lane junction there is anticipated to be a moderate negative effect for both residential areas and for Woodside Primary school. As in the remainder of the Central Expressway area, barriers will be provided here to reduce the potential impact. A barrier can be expected to reduce the effect from moderate to ~~low~~ negligible negative.

17.8.19 Roadside barriers alongside the Central Expressway from Bridgewater Junction to the Weston Link Junction are expected to reduce noise levels with the Project such that for the majority of properties there will be no eligibility for sound insulation under the NIR.

17.8.20 The location of the proposed barriers has been shown on Figures 17.17 and 17.18. These figures indicate in red where 2.4 metre barriers will be provided and in blue where 1.2 metre barriers will be provided.

17.8.21 Vertical barriers employed for noise attenuation should in themselves integrate with their surroundings. As described in Section 12.8 of Chapter 12 of this ES (the Landscape and Visual Impact Assessment chapter), they would be constructed as timber panels which would be visually recessive and suitable for the urban situations in which they would be deployed. In this situation timber panels would be used in association with brick plinths and pillars to promote visual coherence with the surroundings. The surface density of the timber should be at least 7 kg/sq m and the barrier should contain no gaps.

17.8.22 It should be remembered however, that if the detailed design changes then the location, height and type of barriers will need to be re-assessed.

Noise Insulation Regulations (Ref 3)

17.8.23 An estimate has been made of the number of dwellings likely to be eligible for an offer of sound insulation under the NIR. The estimate has been made for the year ~~2030~~ 2032 which is expected to show the greatest impact within 15 years of the opening of the Project. Firstly, those dwellings with a facade level of at least 68 dB $L_{A10,18h}$ and adjacent to the area of works were identified. The dwellings were then compared with the ~~2030~~ 2032 situation without the project to determine whether there would be at least a 1 dB increase due to the scheme.

17.8.24 The result of this analysis shows that approximately 120 properties may be eligible for an offer of insulation. It should be remembered that this is an indicative estimate and not a definitive statement. Furthermore, the mitigation which has been proposed above is expected to reduce noise levels such that no properties will be so adversely affected that the criteria of the regulations will be met.

Summary of mitigation

17.8.25 During the construction phase of the Project mitigation will primarily be through the adoption of a Noise and Vibration Management Plan (NVMP, as part of the Construction Environmental Management Plan (CEMP – see Chapters 22 and 23). This will specify good practice for the management of noise on the site through, for example, controlling the hours of working together with noise control targets. Many elements of a noise management plan are described in BS 5228 and these will be incorporated into the NVMP.

17.8.26 It is probable that the contractor(s) will apply for ~~a~~ Section 61 ~~agreement~~ consents with the local authority under COPA. This would have the effect of formalising many of the clauses of the NVMP into a legally binding agreement.

17.8.27 It is likely that the local authority will require a programme of monitoring during the construction phase to ensure that targets are being met.

17.8.28 For the operational phase, it is expected that noise barriers would be employed alongside the Central Expressway to mitigate the road traffic noise. These would be up to 2.4 metres in height and would be expected to attenuate noise levels such that the unmitigated moderate negative noise effect along the Central Expressway would be reduced to a negligible negative effect.

17.8.29 Although it has been estimated that around 120 properties may be eligible for noise insulation under the terms of the Noise Insulation regulations, the installation of the noise barriers described above would remove that eligibility. This provides evidence of the low residual effect of the works; however, this will be subject to detailed assessment prior to construction.

17.9 Residual Effects

17.9.1 The impact summary tables show that there would be some residual effects after mitigation and these are shown in Table 17.12 and are described below. Overall, it is considered that there are no new residual effects that arise from the Updated Reference Design and therefore the residual effects assessment remains as set out in relation to the Reference Design.

Construction residual Effects

17.9.2 During the construction phase a Noise and Vibration Management Plan (NVMP) will be implemented through the CEMP. This will include best practice on the control and management of noise and vibration. It will include the specification of noise and vibration targets together with hours of working. It will also include careful and detailed liaison between the contractor(s) and the local authority.

17.9.3 However this will not mitigate the negative construction effects entirely and it is anticipated that there will still be low to moderate negative impacts throughout the construction area particularly at Wigg Island and at Woodside Primary School.

17.9.4 The route alignment crosses 3 canals and there are anticipated to be moderate negative effects therein the vicinity of all of them during construction. Although footpaths would be diverted during construction, the diversions will still be adversely affected by noise.

17.9.5 The Wigg Island Community Park is currently a relatively quiet area and would suffer high negative effects throughout the construction of the elevated structure on the south side of the new bridge. These effects will be unavoidable.

17.9.6 Two schools will be adversely affected during construction. West Bank Primary School will have a negligible negative effect and Woodside Primary School will have a moderate to high negative effect.

Operational residual effects

17.9.7 Overall there will be moderate positive residual effects in terms of the total number of people likely to be bothered by road traffic noise from the operation of the road. A sensitivity assessment has been undertaken and this shows that reductions in traffic levels for the Project including the Proposals will result in corresponding falls in noise levels. Therefore, any changes in terms of the noise levels experienced by sensitive receptors are likely to be less that the values noted below. Mitigation measures have been proposed and on the basis of the sensitivity assessment it is not considered necessary to change these.

17.9.8 There will be low residual negative impacts in the industrial areas on the north and south banks of the River Mersey under the alignment of the Project.

17.9.9 The SPA adjacent to the SJB will experience a permanent reduction in noise level of about 5 dB which is a high positive residual effect. All residential areas from the northern approach to the SJB, the southern approach to the SJB and the Weston Point Expressway will have a permanent reduction of 5 or 6 dB for the do something scenario which is a moderate residual positive effect.

17.9.10 Wigg Island Community Park will have a high residual negative effect. Wind screens will be constructed at the road side on the New Bridge, but these will only reduce noise levels by about 1 dB and there would still be a residual negative effect.

17.9.11 The 3 canals crossed by the route alignment will all experience increases in noise level and will have moderate negative residual effects.

17.9.12 Residential areas alongside the Central Expressway will have moderate negative effects, but the use of road side noise barriers will reduce this to a low residual negative effect.

17.9.13 Of the 5 schools assessed, Cavendish School and Hallwood Park Primary will have low positive residual effects with noise level reductions of about 1 dB. West Bank Primary School and Weston Point Community Primary School will benefit from a reduction in noise of about 6 dB. This is a high positive residual effect. One school, Woodside Primary School will have its high negative effect reduced to a negligible negative by the use of road side noise barriers.

17.9.14 The sensitivity assessment shows that noise effects from the Project including the Proposals will be smaller. Though there is a reduction this not considered to be sufficient to warrant altering the mitigation measures and these have not been modified.

17.9.15 Night time noise has been assessed and is not considered to be a significant effect. No additional mitigation is considered to be necessary for this.

Table 17.12 – Summary of Residual Noise and Vibration Effects

Effect	**Receptor and Importance**	**Nature of Effect** (Permanent / Temporary and Magnitude)	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)	**Mitigation & Enhancement Measures**	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)
Construction Phase					
General construction activities	Dwellings – High importance	Temporary effect for Project duration. Approximately 1,200 dwellings within 100 metres.	Moderate negative	Noise and Vibration Management Plan (NVMP)	Moderate negative
Noise from general construction activities including canal bridge	Area1 – St Helens Canal – medium importance	Temporary increase in noise, up to 6 months	Moderate negative	NVMP	Moderate negative
Noise from minor construction activities	Area 2 – SJB northern approach. Dwellings - high importance	Temporary increase in noise, up to 6 months	Negligible negative	NVMP	Low – negative
Noise from bridge construction activities	Area 6 – Wigg Island – high importance	Temporary increase in noise, up to 27 months	High – negative	NVMP	High – negative
Noise from viaduct construction activities	Area 6 – Manchester Ship Canal – medium importance	Temporary increase in noise, up to 9 months	Moderate - negative	NVMP	Moderate - negative
Noise from viaduct construction activities	Area 7 – Astmoor industrial estate – low importance	Temporary increase in noise, up to 25 months	Negligible – negative	NVMP	Low – negative
Noise from general construction activities including canal bridge	Area 8 – Bridgewater Canal – medium importance	Temporary increase in noise, up to 9 months	Moderate – negative	NVMP	Moderate– negative
Noise from general construction activities	Area 8 – residential areas near Bridgewater Junction – high importance	Temporary increase in noise, up to 11 months	Moderate - negative	NVMP	Moderate – negative

Effect	**Receptor and Importance**	**Nature of Effect** (Permanent / Temporary and Magnitude)	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)	**Mitigation & Enhancement Measures**	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)
Noise from construction and highway alignment modifications	Area 9 – residential areas adjacent to the Central Expressway – high importance	Temporary increase in noise, 12 months	Negligible to moderate – negative	NVMP	Low to moderate - negative
Noise from construction of distributor roads and bridge	Area 9 – residential areas adjacent to Lodge Lane Junction	Temporary increase in noise, 12 months	Moderate to high – negative	NVMP	Moderate to high – negative
Noise from minor construction activities	West Bank Primary School – high importance	temporary increase in noise, up to 6 months	Negligible - negative	NVMP	Low – negative
Noise from construction of distributor roads and bridge	Woodside Primary School – high importance	Temporary increase in noise, 12 months	Moderate to high - negative	NVMP	Moderate to high - negative
Operational Phase					
Overview Noise from operation of the road –	Residential areas – high importance	Permanent decrease in number of people affected by noise	Moderate positive		Moderate positive
Overview - Vibration from operation of the road	Residential areas – high importance	Permanent – slight increase in number bothered	Negligible negative		Low – negative
Road traffic noise	Area 1 – industrial and commercial areas – low importance	Permanent - slight increase in noise	Negligible negative		Low – negative
Road traffic noise	Area 1 – St Helens Canal – medium importance	Permanent - slight increase	Negligible negative		Low – negative
Road traffic noise	Area 2 – residential areas adjacent to northern approach to SJB – high importance	Permanent decrease in noise levels	Moderate positive		Moderate positive

Effect	**Receptor and Importance**	**Nature of Effect** (Permanent / Temporary and Magnitude)	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)	**Mitigation & Enhancement Measures**	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)
Road traffic noise	Area 3 – SPA – high importance	Permanent decrease in noise levels	High positive		High positive
Road traffic noise	Area 4 – residential areas adjacent to the southern approach to SJB – high importance	Permanent – decrease in noise levels	Moderate positive		Moderate positive
Road traffic noise	Area 5 – residential areas adjacent to the Weston Point Expressway – high importance	Permanent – decrease in noise levels	Moderate positive		Moderate positive
Road traffic noise	Area 6 – Wigg Island – very high importance	Permanent – increase in noise levels	High negative		High negative
Road traffic noise	Area 6 – Manchester Ship Canal – medium importance	Permanent – increase in noise levels	Moderate negative		Moderate negative
Road traffic noise	Area 7 – Astmoor industrial estate – low importance	Permanent – increase in noise levels	Negligible negative		Low – negative
Road traffic noise	Area 8 – residential areas adjacent to Bridgewater junction	Permanent – increase in noise levels	Moderate negative	Roadside noise barriers	Low – negative
Road traffic noise	Area 8 – Bridgewater Canal – medium importance	Permanent – increase in noise levels	Moderate negative		Moderate negative
Road traffic noise	Area 9 – residential areas adjacent to the Central Expressway	Permanent – increase in noise levels	Moderate negative	Roadside noise barriers	Low – negative
Road traffic noise	Area 10 – residential areas adjacent to the Weston link	Permanent – slight increase in noise levels	Negligible- negative		Low – negative

Effect	**Receptor and Importance**	**Nature of Effect** (Permanent / Temporary and Magnitude)	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)	**Mitigation & Enhancement Measures**	**Significance** (High, Moderate, Minor, Negligible and Positive/Negative)
	to M56				
Road traffic noise	Cavendish School – high importance	Permanent – slight decrease in noise levels	Negligible positive		Low – positive
Road traffic noise	Hallwood Park Primary School – high importance	Permanent – slight decrease in noise levels	Negligible positive		Low – positive
Road traffic noise	West Bank Primary School – high importance	Permanent – decrease in noise levels of about 6 dB	High positive		High positive
Road traffic noise	Weston Point Community School – high importance	Permanent – decrease in noise levels of about 6 dB	High positive		High positive
Road traffic noise	Woodside Primary School – high importance	Permanent – increase in noise levels of about 9 dB	High negative	Roadside barriers	Low – negative

17.9.16 In terms of the Further Applications proposals, it is considered that, following mitigation, the effect of the modifications would be as follows:

Table 17.19 – New summary table of residual effects as a result of the Proposals

Area	Summary of Proposals	Summary of Effect
A – Speke Road [Noise Assessment Area 1]	a. Toll plazas removed; b. Extent of overall works reduced to reflect removal of toll plazas; c. Slip roads and embankments re-designed to reflect removal of toll plaza, low retaining wall added on northern off slip; and d. The reduced extent of the works means that there will be no requirement for any works that might affect either Steward Brook or the Old Lane Subway.	The modelling of the traffic in the Orders ES considered a worst case of flowing traffic throughout the Project, therefore, removal of the toll plazas does not affect the outcome of the assessment. The smaller extent of the works will reduce the area affected by construction noise.
B – Ditton Junction to Freight Line [Noise Assessment Area 1]	a. Toll plazas removed; b. Slip roads and embankments re-designed to reflect removal of toll plazas; and c. Main alignment shifted north to reduce adverse effects during construction in terms of disruption to road users.	The changes to the design in this area are predicted to have no significant effect on predicted noise and vibration effects. As noted above a worst case has already been adopted for the toll plazas in the Reference Design assessment. Whilst the main alignment has been moved this is not considered to lead to a significant effect as there are few sensitive receptors in this area. The modified alignment at the St Helens Canal will mean that the section of the canal affected by noise will move though the overall effects will remain consistent with the rest of this assessment. The reduced extent of the works will mean less construction noise.
C – Freight Line to St Helens Canal including the Widnes Loops Junction [Noise Assessment Area 1]	a. Toll plazas removed; b. Junction, slip road and embankments re-designed (as roundabout) to reflect the removal of the toll plazas; and d. Revisions to the alignment to take account of the changes including a reduction in the vertical alignment and moving of the horizontal alignment to the south.	
F – Bridgewater Junction [Noise Assessment Area 8]	a. Minor re-alignment of slip roads and associated embankments; and b. Extent of slip road works reduced.	The sensitivity assessment shows that Orders ES assessment remains a worse case for this section of the scheme. The assessment

Area	Summary of Proposals	Summary of Effect
G – Central Expressway, Lodge Lane and Weston Link Junction [Noise Assessment Area 9]	b. Merge / diverge to Halton Lea reinstated; c. Addition of retaining walls and traffic signals at Central Expressway slips to accommodate design developments; d. Existing Busway bridge retained with adjustments in line / level to fit alignment through existing bridge; and f. Overall extent of slip road works reduced.	shows that the reduced traffic levels will result in lower noise levels, though these are not considered to be sufficient to merit reducing the mitigation measures
I – Silver Jubilee Bridge and Widnes De-Linking [Noise Assessment Area 2, 3 and 4]	a. Removal of toll plazas; and b. Queensway reduced to three lanes to accommodate cycle/footway over existing structures.	As noted above a worst case has already been adopted for the toll plazas in the Reference Design assessment. The modifications to the design in this area have no significant effect on predicted noise and vibration effects.

17.9.17 Therefore, no new significant residual effects have been identified for the Further Applications modifications. Due to the altered traffic flow predictions the effects for the Orders ES either remain objectively the same or are reduced.

17.10 References

Ref 1 Land Compensation Act, 1973

Ref 2 Design Manual for Roads and Bridges, Volume 11 ~~Part 3, Section 7~~ Section 3, Part 7 November 2011

Ref 3 Noise Insulation Regulations, 1975, as amended in 1988

Ref 4 Control of Pollution Act, 1974

Ref 5 Environmental Protection Act 1990

Ref 6 Planning Policy Guidance Note, PPG 24 – Planning and Noise 1994

~~Ref 7~~ ~~Regional Planning Guidance for the North West RPG~~

Ref 8 Halton Borough Council's UDP 2005

Ref 9 Calculation of Road Traffic Noise, Department of Transport, Welsh Office, HMSO 1988

Ref 10 ~~BS 5228 Noise and vibration control on Construction and open sites, Part 1 and 2:1997, Part 4:1992~~ BS 5228:2009: Code of practice for noise and vibration control on construction and open sites, Part 1: Noise and Part 2: Vibration

Ref 11 ~~BS 6472 Evaluation of human exposure to vibration in buildings (1 to 80 Hz) 1992~~ BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting.

Ref 12 BS 7385 Evaluation and measurement for vibration in buildings Part 1 1990, Part 2 1993

~~Ref 13~~ ~~Defra database of construction noise (http:// www.defra.gov.uk /environment/ noise / research / index.htm)~~ – now incorporated into updated BS5228 Part 1 (Ref 10)

Ref 14 North West of England Regional Spatial Strategy – The Secretary of State's proposed changes to the draft Regional Spatial Strategy 'The North West Plan' submitted by the North West Regional Assembly – Consultation Document March 2008, published in 2010 as North West England Plan Regional Special Strategy to 2021.

Ref 15 Halton Local Development Framework Core Strategy 2011

Ref 16 Environmental Noise Directive 2000

Ref 17 Environmental Noise (England) Regulations, 2006

Ref 18 Noise Action Plan – Liverpool Agglomeration 2011

Ref 19 Draft National Planning Policy Framework 2011

Ref 20 TRL, Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping, 2002