12. Noise and Vibration

The potential noise and vibration impacts associated with the construction and operation of the A720 Sheriffhall Roundabout Improvement Proposed Scheme have been assessed in accordance with the DMRB methodology.

A baseline noise monitoring survey was completed at a total of six locations in December 2018. The results indicate that road traffic noise is the dominant source of existing noise in the area, with additional contributions from train movements in the vicinity of the railway to the east of the junction.

Mitigation measures during the construction works would be implemented through a Noise and Vibration Management Plan as part of the Construction Environmental Management Plan. This would include details of Best Practicable Means (BPM) control measures, proposed monitoring and surveys and the communication strategy for the works. Additional mitigation through the use of solid hoarding around the works boundary and/or specific activities/works would also be considered once a contractor is appointed and specific details of the works are known.

Construction works are anticipated to take place over approximately 114 weeks, the majority of the works would be carried out during normal daytime working hours. Exceedances of the BS 5228 daytime criteria for the onset of potentially significant effects are anticipated for some periods during the works at the closest sensitive receptors at Sheriffhall and Summerside. Midlothian Councils (MLC's) daytime construction noise criterion is not anticipated to be exceeded. Some works will be required to be carried out during the evening/weekend/night, such as installation of the new bridges at the flyover and tie-in works to the existing road network. During the evening/weekend minor impacts at Sheriffhall and moderate impacts at Summerside are anticipated. At night major impacts at Sheriffhall, Summerside, Campend Cottages and Melville Inn are anticipated; moderate impacts are anticipated at the closest approach of Sheriffhall Mains. The duration of the evening/weekend and night- time works will be limited. A large residual adverse effect has been identified for construction noise.

Sheet piling at the railway bridge and for temporary works at the junction, and rotary bored piling at the new flyover bridges are anticipated to be required. No compaction or ground improvement works using vibratory rollers are anticipated to be required in the vicinity of residential properties (<100m), therefore vibration impacts from compaction and ground improvement works are scoped out of the assessment. Based on the distance from the proposed piling works to the closest receptors, building damage effects or significant vibration annoyance effects are not anticipated.

Mitigation has been incorporated into the design of the Proposed Scheme through the use of low noise surfacing on the A720 mainline and sliproads. The majority of residential properties are anticipated to experience a negligible increase in traffic noise due to the operation of the Proposed Scheme. Minor increases in traffic noise levels occur on the A7 North (Old Dalkeith Road) and A6106 North (Millerhill Road) to the north of the junction as traffic flows and speeds on these roads increase. No significant residual operational effects have been identified. Decreases in traffic noise levels are anticipated at the A772 Gilmerton Road junction to the west of the Proposed Scheme. This is due to a slight reduction in traffic on the A772 and the increase in speed on the eastbound A720 Edinburgh City Bypass mainline, as congestion is reduced, which brings in the benefit of the low noise surfacing on the mainline.

12.1 Introduction

12.1.1 This chapter assesses the potential noise and vibration impacts associated with the construction and operation of the A720 Sheriffhall Roundabout Improvement, the 'Proposed Scheme', following the methodology set out in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 HD 213/11 – Revision 1 (Highways Agency, 2011). A DMRB 'detailed' level assessment has been completed. A revision to the noise section of the DMRB is due to be issued later in 2019, though fundamental changes to the methodology are not anticipated. The assessment reported herein has been completed based on the 2011 version, which was current at the time of the assessment.

12.1.2 This chapter details the methodology followed for the assessment, summarises the regulatory and planning policy framework related to noise and vibration, and describes the existing environment in the area surrounding the Proposed Scheme. Following this, the potential impacts are outlined, design and mitigation measures proposed to manage and minimise potential noise and vibration impacts are specified, and the residual impacts of the Proposed Scheme are presented. A statement of the significance of the effects is presented and compliance with policy discussed.

12.1.3 This chapter of the ES has been prepared by competent experts with relevant and appropriate experience. The technical lead for the noise and vibration assessment has 22 years of relevant work experience and is a member of the Institute of Acoustics (MIOA), the Institution of Environmental Sciences (MIEnv) and is a Chartered Scientist (CSci). Further details are provided in Appendix 1.2 – Table of Expert Competencies.

12.1.4 Appendix 12.1 - Terminology provides details of relevant noise and vibration terminology as used herein.

12.2 Approach and Methodology

Study Area

12.2.1 Potentially sensitive receptors within the study area have been determined from the OS AddressBase Plus dataset and OS mapping, with additional information obtained through site visits and discussions with the Local Authorities. DMRB defines residential properties, educational buildings, medical buildings, community facilities, designated sites, scheduled monuments and public footpaths as potentially sensitive to noise and/or vibration.

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

12.2.3 The study area for the assessment of operational phase noise impacts has been defined as outlined below, following the guidance set out within DMRB.

12.2.4 The study area is defined around the Proposed Scheme, the existing A720 Edinburgh City Bypass (‘the A720’) junction replaced by the Proposed Scheme and all surrounding existing roads that are predicted to be subject to a change in traffic noise level as a result of the Proposed Scheme of:

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

12.2.5 These roads are defined as ’affected routes’ and are identified by analysis of the traffic data. The identification of affected routes considered all roads with 18-hour (06:00-00:00) weekday traffic flows above the lower cut off of the Calculation of Road Traffic Noise (CRTN) (DoT, Welsh Office, 1988) prediction methodology of 1000 vehicles per 18 hour day in all scenarios. For the A720 the combined 2-way traffic data for each carriageway has been used to identify affected routes.

12.2.6 The study area for the detailed quantitative assessment of noise impacts comprises a 600 m calculation area around the Proposed Scheme, 600 m around the existing junction replaced by the Proposed Scheme, and 600 m either side of all affected routes within a 1 km maximum study area around the Proposed Scheme and existing junction replaced by the Proposed Scheme.

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

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

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

12.2.10 The 1 km and 600 m study areas are illustrated in Figure 12.1 'Noise Location Plan'. The identified affected routes are illustrated in Figure 12.2 'Noise Affected Routes'.

Baseline Conditions

Receptors

12.2.11 Potentially sensitive receptors have been identified based on OS mapping, OS AddressBase Plus land use datasets and discussions with the Local Authorities City of Edinburgh Council (CEC) and Midlothian Council (MLC).

Existing/Future Low Noise Surfacing

12.2.12 Details of existing and proposed low noise surfacing have been obtained from Transport Scotland (TS) and the Local Authorities.

Baseline Noise Survey

12.2.13 A baseline noise survey was completed in December 2018 at six locations. The purpose of the baseline noise survey was to assist with developing an understanding of the general noise climate in the vicinity of the Proposed Scheme. For example, to identify if any other local noise sources (other than road traffic) are present and contribute significantly to the local noise climate.

12.2.14 In addition, the results of the baseline noise survey have been used as part of a verification exercise for the traffic noise prediction modelling. The traffic noise model has been used to predict 2017 traffic noise levels at the monitoring locations, with the predicted and measured levels being compared. The aim of this process is to demonstrate that the noise model is giving a sensible range of results across the whole of the study area. An exact match would not be expected for a variety of reasons, for example, the noise predictions are based on typical weekday traffic conditions over 2017, not the exact traffic conditions during the few weeks or hours of noise monitoring in 2018; the prediction method is designed to be conservative in terms of the effect of wind direction whereas the wind direction is likely to vary throughout the monitoring period; in addition the noise predictions only consider road traffic noise, whereas the measurements include all ambient noise sources.

12.2.15 Noise monitoring locations are detailed on Figure 12.1 'Noise Location Plan' these locations were chosen to focus on some of the very closest receptors to the Sheriffhall Roundabout and the A720 mainline. The locations were discussed and agreed in advance with CEC and MLC.

12.2.16 A mixture of long-term (LT) unattended monitoring over a week, and short-term (ST) daytime 3 hour monitoring was completed, depending on the availability of a secure location at which equipment could be left unattended. A weather station was also installed at one of the noise monitoring locations to record relevant parameters including wind speed, wind direction and rainfall.

Construction Noise Impact Assessment

12.2.17 The noise levels generated by construction activities and experienced by nearby sensitive receptors, such as the occupants of residential properties, depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on site, generally expressed as a sound power level;
- The periods of operation of the plant on the site, known as its 'on-time';
- The distance between the noise source and the receptor; and
- The attenuation due to ground absorption and barrier effects.

12.2.18 Part 1 of BS 5228: 2009+A1: 2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' (BSI, 2014) provides a methodology for the estimation of likely construction noise levels as an equivalent continuous noise level averaged over a suitable assessment period ($L_{Aeq,T}$).

12.2.19 BS 5228 contains a database of the noise emission from individual items of equipment and routines which can be used to predict noise from construction activities at identified receptors. The prediction method gives guidance on the effects of different types of ground, barrier attenuation and how to assess the impact of fixed and mobile plant.

12.2.20 A quantitative assessment of construction noise impacts has been undertaken using the SoundPLAN noise modelling software, which implements the BS 5228 prediction methodology. Estimates of weekly average construction noise levels have been made for a selection of 10 of the closest identified potentially sensitive receptors to the works. These selected receptors are also representative of neighbouring properties in their vicinity. By choosing a selection of the closest identified potentially sensitive receptors the reported impacts are, therefore, typical of the worst affected receptors and all potentially significant effects are identified. At receptors further away from the works the impact would be reduced. A total of 32 residential properties and one children's nursery are located within 300m of any construction works and would potentially be affected by construction noise.

12.2.21 At this stage, before contractors have been appointed to construct the Proposed Scheme, precise information on the construction works is not available. However, the Highways Design Team has provided some assumptions on the likely nature and timing of the works. Therefore, the estimated construction noise levels are based on information which includes the number and type of plant likely to be required for each activity, typical 'on' times for each item of plant, the likely location and extent of each activity, working times and which weeks the activity is likely to occur in. The weekly predictions are based on the likely area covered by each activity in each week and all activities programmed to occur in an individual week are assumed to occur at the same time. Further details on the construction noise assessment are provided in Appendix 12.2 - Construction Noise.

12.2.22 Thresholds for the onset of potentially significant effects for construction noise have been defined by reference to the ABC Method described in BS 5228. The ABC Method provides thresholds at residential building façades based on prevailing ambient noise levels as shown in Table 12-1 'Construction Noise Thresholds at Residential Dwellings'.

Table 12-1 Construction Noise Thresholds at Residential Dwellings

Assessment Category	Threshold Value ($L_{Aeq,T}$ dB facade)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends (19:00 –23:00 weekdays; 13:00 – 23:00 Saturdays; 07:00 – 23:00 Sundays)	55	60	65
Daytime weekdays (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potential significant effect is indicated if the L_{Aeq} noise level arising from the site exceeds the threshold value for the category appropriate to the ambient noise level.
NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table, then a potential significant effect is indicated if the total noise level for the period increases by more than 3dB due to site noise.
NOTE 3: Applied to residential receptors only.

Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these threshold values.
Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A threshold values.
Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A threshold values.

12.2.23 The magnitude of the impact of construction noise has been classified in accordance with the descriptors in Table 12-2 'Magnitude of Impact for Construction Noise (Residential Dwellings)'.

Table 12-2 Magnitude of Impact for Construction Noise (Residential Dwellings)

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

12.2.24 Construction traffic noise impacts have been scoped out of the assessment on the basis that the existing operational capacity of the junction will be maintained throughout the full construction period. As a result, traffic conditions should be no worse than currently exist, thereby removing the need for traffic to re-route on to alternative unsuitable roads. Reasonable worse case construction traffic volumes are estimated at 200 heavy goods vehicle (HGV) movements per day and 100 car/light goods vehicles per day accessing the site using the A720. Based on the existing volume of traffic on the A720 this would not result in potentially significant increases in traffic noise levels in the area.

Construction Vibration Impact Assessment

12.2.25 Construction vibration impacts have been considered for proposed piling activities. Piling will be required at the two new bridges at the junction, at this stage rotary bored piling is anticipated. Sheet piling will also be required to extend the existing rail bridge and for small scale temporary works at the existing roundabout. No compaction or ground improvement works using vibratory rollers are anticipated to be required in the vicinity of residential properties (<100m), therefore vibration impacts from compaction and ground improvement works are scoped out of the assessment.

12.2.26 The passage of vibration through the ground is highly dependent on site-specific ground conditions. However, Part 2 of BS 5228 provides a range of measured historical data for a variety of different piling works. These have been used

to give an indication of the potential magnitude of construction vibration impacts from piling. Impacts are considered for both damage to buildings and annoyance to occupiers.

12.2.27 Guidance on the effects of construction vibration in terms of building damage is provided in BS 7385: 1993 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration' (BSI, 1993). It provides guidance on transient vibration levels likely to result in cosmetic damage, and is referenced in BS 5228. Limits for transient vibration, above which cosmetic building damage could occur, are given in Table 12-3 'Transient Vibration Guide Values for Cosmetic Damage'.

Table 12-3 Transient Vibration Guide Values for Cosmetic Damage

Building Type	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mms^{-1} at 4 Hz and above	50 mms^{-1} at 4 Hz and above
Unreinforced or light framed structure Residential or light commercial buildings	15 mms^{-1} at 4 Hz increasing to 20 mms^{-1} at 15 Hz	20 mms^{-1} at 15 Hz increasing to 50 mms^{-1} at 40 Hz and above

Note 1: Values referred to are at the base of the building.
Note 2: For unreinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

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

12.2.29 It is also noted that these values refer to the likelihood of cosmetic damage. ISO 4866:2010 'Mechanical vibration and shock. Vibration of fixed structures. Guidelines for the measurement of vibrations and evaluation of their effects on structures' (ISO,2010) defines three different categories of building damage:

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

12.2.30 BS 7385-2 states that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration level twice that of minor damage. Therefore, this guidance can be used to define the potential impact identified in Table 12-4 'Transient Vibration Guide Values for Cosmetic Damage'.

Table 12-4 Transient Vibration Guide Values for Cosmetic Damage

Magnitude of Impact	Damage Risk	Continuous Vibration Level PPV mms^{-1}	Transient Vibration Level PPV mms^{-1}
Major	Major	30	60
Moderate	Minor	15	30
Minor	Cosmetic	7.5	15
Negligible	Negligible	6	12

12.2.31 BS 5228 provides guidance on the impact of construction vibration in terms of annoyance, focussing on occupants of residential properties. The vibration levels and associated effects stated in BS 5228, combined with the assigned magnitude of impact, are provided in Table 12-5 'Magnitude of Impact for Vibration Annoyance'.

Table 12-5 Magnitude of Impact for Vibration Annoyance

Magnitude of Impact	Annoyance	Vibration Level PPV mms^{-1}
Major	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	10
Moderate	It is likely that vibration of this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.	1.0
Minor	Vibration might be just perceptible in residential environments.	0.3
Negligible	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	0.14

Operational Traffic Noise Impact Assessment

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

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

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

12.2.35 DMRB also requires an assessment of night-time (i.e. between 23:00 and 07:00) traffic noise levels ($L_{night,outside}$). However, this parameter is not predicted by the standard CRTN methodology. DMRB refers to three methods for calculating night-time traffic noise levels developed by the Transport Research Laboratory (TRL 2002 and 2006). The most widely used is 'Method 3' which factors the L_{night} from the $L_{A10,18h}$, based on the typical diurnal pattern of traffic flows in the UK. Method 3 has been adopted for the purposes of this assessment. A -2.5 dB correction has been applied to the night-time predicted traffic noise levels, to convert from façade to free-field levels i.e. noise levels which are unaffected by reflecting surfaces other than the ground (as advised in CRTN).

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

12.2.37 Predicted daytime and night-time traffic noise levels have been generated using the SoundPLAN noise modelling software, which implements the CRTN prediction methodology. The model is based on traffic data generated by a traffic model of the Proposed Scheme and surrounding area. The noise model also includes the ground topography, ground type and buildings to form a 3D representation of the study area. Further details of the noise model data sources and assumptions are provided in Appendix 12.3 - Noise Modelling.

12.2.38 The objective of the assessment, as set out in DMRB, is to gain an overall appreciation of the noise and vibration climate, both with (Do-Something (DS)) and without (Do-Minimum (DM)) the Proposed Scheme, to identify where noise impacts occur and to determine where mitigation to reduce these impacts is required. These conditions are assessed for the baseline year (the year of Proposed Scheme opening) and the future assessment year (15 years after Proposed Scheme opening). DMRB outlines the steps to be carried out at the detailed assessment stage:

a) Identify the study area and predict 18-hour (06:00 - 00:00) and night-time (23:00 - 07:00) traffic noise levels at all residential properties within 600 m of the Proposed Scheme, existing routes being improved or bypassed, and affected routes within the 1 km study area (affected routes are defined as existing roads which would experience a potentially significant change in traffic noise level as a result of the Proposed Scheme). Predictions are required for the Do-Minimum and Do-Something scenarios in the year of Proposed Scheme opening and 15 years after Proposed Scheme opening.

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

- The Do-Minimum scenario in the baseline year against the Do-Minimum scenario in the future assessment year (long-term) (DM 2024 to DM 2039);
- The Do-Minimum scenario in the baseline year against the Do-Something scenario in the baseline year (short-term) (DM 2024 to DS 2024); and
- The Do-Minimum scenario in the baseline year against the Do-Something scenario in the future assessment year (long-term) (DM 2024 to DS 2039).

For night-time traffic noise levels, comparisons are only required for the long-term scenario and for properties where the $L_{night,outside}$ level is 55 dB(A) or more in the relevant scenarios.

DMRB includes provision for the consideration of additional scenario comparisons. No other scenario comparisons are considered to be required for this assessment;

c) Assess the impact on sensitive receptors, other than residential properties, within the 600 m study area. This is based on 18-hour (06:00 - 00:00) traffic noise levels and considers the same two comparisons as outlined in (b) above for residential properties. Other sensitive receptors include hospitals, educational buildings, community facilities (such as places of worship), designated ecological areas such as National Scenic Areas (NSAs) National Parks, Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI), designated Scheduled Monuments and Rights of Way (RoW);

d) Complete a qualitative assessment of sensitive receptors which are within the 1 km study area, but more than 600 m from the Proposed Scheme, existing routes which are bypassed or improved, and affected routes; and

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

12.2.39 Different façades of the same property can experience different changes in traffic noise level depending on their orientation to the noise source. DMRB requires that each of the above comparisons of traffic noise levels is based

on the façade which experiences the least beneficial change i.e. the largest increase, or, if all façades undergo a decrease, the smallest decrease. Additionally, DMRB requires that the above comparisons of annoyance use the highest levels of annoyance in the first 15 years. For properties which experience an increase in noise due to the Proposed Scheme, the greatest annoyance is likely to be immediately after the Proposed Scheme opens to traffic. For properties which experience a decrease in noise (and also in the Do-Minimum comparison), the greatest annoyance is the steady-state level of annoyance in the long term.

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

12.2.41 DMRB provides two classifications for the magnitude of the noise impact of a proposed road Proposed Scheme, as shown in Table 12-6 'Classification of Magnitude of Traffic Noise Impacts – Short-Term and Long-Term' (taken from DMRB). These relate to short-term changes in noise levels and long-term changes in noise levels. Table 12-6 has been used to assess changes in operational traffic noise. The short-term classification in Table 12-6 also corresponds to the example classification provided in the Technical Advice Note Assessment of Noise (Scottish Government, 2011) for impacts for a new road affecting residential receptors.

Table 12-6 Classification of Magnitude of Traffic Noise Impacts – Short-Term and Long-Term

Short Term Traffic Noise Change $L_{A10,18h}$ dB	Long Term Traffic Noise Change $L_{A10,18h}$ dB	Magnitude of Impact
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
≥5.0	≥10.0	Major

Operational Traffic Vibration

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

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

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

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

12.2.46 It is a requirement of new highway constructions that the highway surface be smooth and free from any discontinuities. Paragraph A5.25 of DMRB highlights that in relation to ground borne vibration *'no evidence has been found to support the theory that traffic induced vibrations are a source of significant damage to buildings'*. Paragraph A5.26 of DMRB

also states: *'Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances'*. Hence, no significant effects from traffic induced ground borne vibration due to the passage of vehicles over irregularities on the Proposed Scheme, in terms of either disturbance or damage to buildings (or other structures) are anticipated and no further assessment has been completed.

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

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

Significance

12.2.49 The significance of effect is primarily a function of the value or sensitivity of the receptor and the magnitude of the impact. DMRB Volume 11, Section 3, Part 7, HD 213/11 Revision 1 states in paragraph 3.36 that '*In terms of road traffic noise, a methodology has not yet been developed to assign significance according to both the value of a resource and the magnitude of an impact*'. In the absence of specific guidance on assigning significance the approach outlined below has been adopted for all aspects of noise and vibration, including both construction and operation. This approach takes into account the guidance in the Scottish Technical Advice Note (Scottish Government, 2011) which accompanies the Scottish Planning Advise Note (PAN) 1/2011 'Planning and Noise' (Scottish Government, 2011).

12.2.50 The value or sensitivity of the receptor and the magnitude of the impact (e.g. the noise change) is combined with professional judgement which takes into account a range of other factors including:

- the absolute noise levels e.g. are existing ambient levels already very high or very low;
- the characteristics of the existing noise environment;
- the number of affected receptors;
- the duration of the impact; and,
- for non-residential receptors' the nature, times of use and design of the receptor.

12.2.51 Table 12-7 'Sensitivity of Receptors' details the sensitivity of receptors, whilst Table 12-8 'Significance of Effect' presents the initial significance of effect, based on the magnitude of impact (as detailed in the previous sections) and the sensitivity of receptors (as per Table 12-7), after which the additional factors detailed above are applied to reach a conclusion on the significance of effect.

Table 12-7 Sensitivity of Receptors

Sensitivity/Value of Receptor	Description
High	Residential properties, educational/conference buildings, medical facilities, community facilities including places of worship, theatres/auditoria/studios, quiet outdoor areas used for recreation
Medium	Designated sites (AONB, National Parks, SSSI, SPA, SAC and Scheduled Monuments
Low	Commercial and industrial premises, Rights of Way and Core Paths

Table 12-8 Significance of Effect

Magnitude of impact	Value/Sensitivity of Receptor		
	High	Medium	Low
Major	Large	Moderate	Slight
Moderate	Moderate	Moderate	Slight
Minor	Slight	Slight	Neutral
Negligible	Slight	Neutral	Neutral
No Change	Neutral	Neutral	Neutral

12.2.52 As a general rule, large and moderate effects are considered to be significant, whilst slight and neutral effects are considered to be not significant.

Limitations to the Assessment

12.2.53 The following limitations are relevant to this noise and vibration impact assessment:

- OS AddressBase Plus data detailing building usage and OS Building Height Attribute data have generally been used as provided. However, the heights of residential buildings have been standardised, and a check for obvious errors (such as buildings with 0m height) has been completed using information available online, and adjustments made accordingly.
- The construction assessment is based on the construction information that is currently available, with advice being provided by the Highway Design Team. As with all construction assessments, the exact details of construction activities would not be fully known before a specific contractor is appointed to complete the works who would determine their exact construction methods and programme during the detailed design stage.
- It is likely that the Proposed Scheme will be procured by means of a Design and Build (D&B) type contract. Under the terms of this contract type, the Contractor will undertake both the detailed design and construction of the Proposed Scheme
- It is expected that the construction work would take place within the Scheme Extents as shown on Figure 1.2 ‘The Proposed Scheme’. The Scheme Extents have informed the land take calculations undertaken for assessment purposes in this ES. The land within the Scheme Extents will be purchased under a CPO.
- It is possible that the Contractor may require construction compounds to be located out with land identified in the CPO. Should construction compounds be located out with the Scheme Extents it will be the responsibility of the Contractor to assess the environmental impacts of the construction compounds and seek to mitigate these where possible.
- As the Proposed Scheme is developed at detailed design any refinements to the design should be subject to environmental review to ensure that the residual effects would not be greater (or significantly different) than those reported in this ES. The findings of any such review should be subject to approval by TS and where necessary opinions should be sought from the statutory bodies.

12.3 Legislative and Policy Framework

Legislation

Environmental Noise (Scotland) Regulations 2006 (Scottish Parliament, 2006)

12.3.1 The Environmental Noise (Scotland) Regulations 2006 implement Directive 2002/49/EC of the European Parliament. Under the regulations the Scottish Government had an obligation to make strategic noise maps for:

- agglomerations (large urban areas with populations of more than 100,000);
- major roads (those with more than three million vehicle passages per year); and
- major railways (those with more than 30,000 train passages per year).

12.3.2 The A720 Sheriffhall roundabout and surrounding major roads were included in the second and third rounds of strategic noise mapping.

12.3.3 The Scottish Government also has an obligation to draw up action plans for locations near major roads and major railways, and for agglomerations. Consultation on the latest Transportation Noise Action Plan (Scottish Government, 2018) was recently completed. The plan identifies a number of Candidate Noise Management Areas (CNMA). The identification of CNMAs takes into account a range of factors including the absolute noise levels, the population exposed and the likely annoyance due to transport noise. The CNMAs may subsequently progress into a Noise Management Area (NMA). The NMAs will be the primary consideration when formulating environmental noise management actions/policy. No CNMAs are located within the 1 km wider study area, the closest CNMA is located on High Street/Edinburgh Road in Dalkeith to the south-east of the 1 km wider study area.

12.3.4 The 2018 Transportation Noise Action Plan outlines a number of actions which have been implemented up to 2018 and a range of future actions to be taken forward from 2019 to 2023. Future actions are designed to meet the 5 objectives of the TNAP as detailed below:

- Objective 1 - On a prioritised basis, by 2023 we will continue to manage the exposure to environmental noise in NMAs
- Objective 2 - By 2023, we will further incorporate environmental noise management within all stages of transportation planning, design, construction and maintenance activities as appropriate
- Objective 3 - By 2023, we will demonstrate a further contribution to noise management through existing and future proposals and policies
- Objective 4 - By 2023, we will promote new channels of communication to stakeholders that encourage a learning environment
- Objective 5 - By 2023, we will work with others to improve the tools available for Noise Assessment

12.3.5 Actions include engineering solutions and network operational management of roads such as:

- Apply noise management interventions on a prioritised basis during existing maintenance and improvement programmes, where reasonably practicable
- Incorporate a commitment to mitigate environmental emissions, such as noise, into all future TS Corporate and Annual Business Plans
- Ensure consideration of noise issues into the statutory process, and contract documents for new construction or maintenance contracts, franchise agreements, and specifications
- Promote Intelligent Transport Systems to better manage trunk road flows to reduce noise

- Publish a short series of investigate case studies on the planning, design, construction and maintenance aspects of transport noise.

Control of Pollution Act 1974 (UK Parliament, 1974)

12.3.6 Sections 60 and 61 of Control of Pollution Act 1974 (CoPA) provide the main legislation regarding demolition and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the local planning authority with instructions to cease work until specific controls to reduce noise have been adopted.

12.3.7 Section 61 of CoPA provides a means to apply for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site.

12.3.8 The CoPA requires that 'Best Practicable Means' (as defined in Section 72 of CoPA) be adopted for construction noise on any given site. CoPA makes reference to BS 5228 as Best Practicable Means (BPM).

Environmental Protection Act 1990 (UK Parliament, 1990)

12.3.9 Noise and vibration from construction works also fall under the remit of the Environmental Protection Act 1990 (EPA) Part 3. Road traffic noise is not covered by the EPA.

12.3.10 The EPA prescribes noise (and vibration) emitted from premises (including land) so as to be prejudicial to health or a nuisance as a statutory nuisance.

12.3.11 Local Authorities are required to investigate any public complaints of noise and vibration if they are satisfied that a statutory nuisance exists or is likely to occur or recur; they must serve a noise abatement notice. A notice is served on the person responsible for the nuisance. It requires either simply the abatement of the nuisance or works to abate the nuisance to be carried out, or it prohibits or restricts the activity. Contravention of a notice without reasonable excuse is an offence. Right of appeal to the Magistrates Court exists within 21 days of the service of a noise abatement notice.

12.3.12 In determining if a noise complaint amounts to a statutory nuisance the Local Authority can take account of various guidance documents and existing case law, no statutory noise limits exist. Demonstrating the use of best practicable means to minimise noise levels is an accepted defence against a noise abatement notice.

Land Compensation (Scotland) Act 1973 (Scottish Parliament, 1973)

12.3.13 In general noise and vibration are recognised as both a common law nuisance (either private or public) and a statutory nuisance. However, this does not apply to noise and vibration from road traffic. As a result, the Land Compensation (Scotland) Act 1973 and the Noise Insulation (Scotland) Regulations 1975 are used in respect of road traffic noise.

12.3.14 The Land Compensation (Scotland) Act 1973 Part I provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value caused by the use of public works, such as new or altered roads. Noise and vibration are two of the factors which would be considered in any claims for compensation; however the claim should consider all changes and effects, including betterment.

Noise Insulation (Scotland) Regulations 1975 (Scottish Parliament, 1975)

12.3.15 The Noise Insulation (Scotland) Regulations 1975 were made under Part II of the Land Compensation (Scotland) Act 1973. Section 3 imposes a duty, and Section 4 a power, on the relevant Highway Authority to undertake or make a grant in respect of the cost of undertaking noise insulation work in eligible buildings affected by a new or altered highway. This is subject to meeting a range of criteria on road traffic noise levels as specified in the regulations.

Section 5 also provides discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in eligible buildings with respect to construction noise.

12.3.16 It is understood that the Scottish Government are currently considering updating the 1975 Noise Insulation (Scotland) Regulations.

International Policy

World Health Organisation (WHO) Guidelines

12.3.17 The WHO issued the Community Noise Guidelines (CNG) in 1999 (WHO, 1999), the Night Noise Guidelines (NNG) in 2009 (WHO, 2009) and the Environmental Noise Guidelines (ENG) in 2018 (WHO, 2018). None of the WHO guidelines have been formally adopted by the UK government, although they have influenced policy.

12.3.18 The Guidelines provide recommended values for environmental noise, however they are not limits that must be achieved in every circumstance. The recommended values have taken no account of the cost of achieving those values, nor of the economic and social benefits of the source. The 2018 guidelines acknowledge that any limits in policy or standards must take into account cost, feasibility and preferences. TS is currently consulting with the wider Scottish Government regarding the application of the 2018 WHO Guidelines.

National Policy

National Planning Framework 3 (NPF3) (Scottish Government, 2014a)

12.3.19 The National Planning Framework (NPF3) outlines the key principles that guide the wider planning system in Scotland. NPF 3 guides Scotland's spatial development for the next 20 to 30 years, setting out strategic development priorities to support the Scottish Governments central purpose of promoting sustainable economic growth. Plans that are beneath the NPF 3 in the planning policy hierarchy are directly influenced by the goals and themes in the document. The NPF3 does not contain any specific policies or guidance on noise and vibration.

Scottish Planning Policy (SPP) (Scottish Government, 2014b)

12.3.20 Scottish Planning Policy (SPP) is a statement of Scottish Government policy on how nationally important land use planning matters should be addressed across the country.

12.3.21 The SPP does not contain any specific policies or guidance on noise or vibration. The need to consider noise impacts is acknowledged in several sections relating to specific types of development such as new commercial developments, new energy infrastructure and new mineral sites. With regard to new transport infrastructure, noise impacts are not explicitly identified, though DMRB is highlighted as a key document and the need to consider environmental constraints highlighted.

PAN 1/2011 'Planning and Noise' (Scottish Government, 2011)

12.3.22 Planning Advise Note (PAN) 1/2011 'Planning and Noise' provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. The accompanying Technical Advice Note (Scottish Government, 2011) provides advice on noise impact assessment methods. With regard to road traffic noise the accompanying Technical Advice Note refers to the DMRB assessment methodology when assessing new road schemes.

Regional Policy

South East Scotland Strategic Development Plan (SDP) (SESplan, 2013)

12.3.23 Six authorities (City of Edinburgh, East Lothian, Fife, Midlothian, Scottish Borders and West Lothian) prepared a Strategic Development Plan (SDP) for South East Scotland in 2013. The SDP is intended to set out a vision statement of their broad view on the future development of the area, along with a Spatial Strategy on the future development and land use within the area. The SDP does not contain any specific policies or guidance on noise or vibration. However, one of the aims of the SDP is to *"conserve and enhance the natural and built environment*."

Proposed South East Scotland Strategic Development Plan (SDP2) (SESplan, 2016)

12.3.24 A proposed update of the SDP (SDP2) was issued in 2016. Again, SDP2 does not contain any specific policies or guidance on noise or vibration.

12.3.25 As discussed in Chapter 2 - Need for the Scheme, the Proposed SDP (SDP2) was rejected by the Scottish Ministers on 16 May 2019, however the proposed plan has still been considered within this ES as a draft plan

Local Policy

Edinburgh Local Development Plan (City of Edinburgh Council, 2016)

12.3.26 Policy Env 22 Pollution and Air, Water and Soil Quality of the CEC Local Development Plan (LDP) states that "*Planning permission will only be granted for development where:*

a) there will be no significant adverse effects for health, the environment and amenity and either

b) there will be no significant adverse effects on: air, and soil quality; the quality of the water environment; or on ground stability

c) appropriate mitigation to minimise any adverse effects can be provided.

Pollution can arise from many sources and activities including traffic and transport, domestic heating, industrial processes, agriculture, waste disposal and landfill. Air, soil and water quality can all be affected and harmed by some forms of development and land can present a potential pollution or safety threat if it has been contaminated or destabilised by previous activities. Air, noise and light pollution can also be a source of harm to health and amenity.

The potential risk and significance of pollution will be considered when assessing planning applications, in consultation where necessary with relevant agencies, such as Scottish Environment Protection Agency and the Health and Safety Executive."

Midlothian Local Development Plan (Midlothian Council, 2017)

12.3.27 Policy ENV 18 Noise in the MLC LDP covers noise impacts in general and is not specific to transport schemes. It states "The Council will seek to prevent noisy development from damaging residential amenity or disturbing noise sensitive uses. Where new developments with the potential to create significant noise are proposed, these may be refused or require to be modified so that no unacceptable impact at sensitive receptors is generated. Applicants may be required to carry out a noise impact assessment either as part of an Environmental Impact Assessment or separately. Where new noise sensitive uses are proposed in the locality of existing noisy uses, the Council will seek to ensure that the function of established operations is not adversely affected".

12.4 Consultations

12.4.1 CEC and MLC were consulted in 2018 with regard to the proposed baseline noise monitoring methodology and locations. The finalised monitoring locations and methodology were agreed with the two Local Authorities in advance of the survey.

12.4.2 Additional consultation with regards to the assessment methodology was completed in early 2019. With regards to construction CEC advised that their maximum standard construction working hours are 7am-7pm Monday-Saturday. MLC advised that their maximum standard construction working hours are 8am-7pm Monday-Friday and 8am-1pm Saturday. It was agreed that some works will be required out of these hours, for example, due to the need to close roads to install new bridge decks. The adoption of the BS 5228 construction noise and vibration assessment methodology and 'ABC' criteria was agreed. CEC's preferred approach to controlling construction noise and vibration is through a Construction Environmental Management Plan (CEMP) which outlines the noise and vibration control measures, working hours, communication strategy, complaints procedure, monitoring etc. CEC highlighted that effective communication with affected residents would be key in particular for out of hours works. For example, they expressed a strong preference for a website which is kept up to date with details of the works as they progress and provides the relevant contact details and procedures.

12.4.3 MLC stated that their normal construction noise limit for daytime works is 75 dB $L_{Aeq,T}$ at 1 m from the façade of residential properties, this corresponds with the Category C criteria in BS 5228 (see Table 12-1 'Construction noise Thresholds at Residential Dwellings'). MLC would be keen to see controls/commitments in terms of applying best practicable means (BPM), use of temporary barriers where appropriate, a communication plan to ensure residents are kept informed etc.

12.4.4 With regards to operation the adoption of the DMRB assessment methodology was discussed and it was agreed that the need for mitigation in the vicinity of the Proposed Scheme would be considered within the assessment. Although the housing allocations to the west of the Proposed Scheme are outside the quantitative study area it was agreed with CEC that a comment would be made in the assessment on the likely impact of the Proposed Scheme in these areas. CEC expressed a more general concern over road traffic noise along the A720 affecting outdoor amenity in gardens in new housing developments, and the absence of noise mitigation measures, such as noise barriers, along the existing A720.

12.5 Baseline Conditions

Receptors

12.5.1 Potentially noise sensitive receptors are illustrated in Figure 12.1 'Noise Location Plan'. The majority of potentially sensitive receptors are residential properties. A total of approximately 500 residential properties have been identified within the 1 km study area.

12.5.2 The closest residential properties to the junction are the five properties at Summerside to the north-west and the two properties at Sheriffhall to the south-east. Further to the south-east on the A6106 is Kings Gate Lodge. Further north on the A7 North (Old Dalkeith Road) five properties and a children's nursery are located at Campend, six properties have been identified at Sheriffhall Mains to the north-east off the A6106 North (Millerhill Road). The southern edges of Danderhall, Newton Village and Millerhill are just within the 1 km study area. To the south-west a small number of properties are located on Gilmerton Road (including Melville Grange, Burnside, Melville Cottages and Melville Castle East Lodge), as well as the Elginhaugh Farm Pub and Melville Inn. Four properties are located at the Gilmerton Road Junction with the A720. The north-west edge of Dalkeith falls into the 1 km study area. In addition to the nursery on the A7 North, Shawfair Hospital and Newton Parish Church are located to the north of the Sheriffhall Roundabout,

both of which are remote from the Proposed Scheme. No designated sites (NSA's, National Park, SAC, SPA, SSSI) are located in the 1 km study area. Five scheduled monuments are located in the study area, two to the south of the junction on the edge of Dalkeith (Elginhaugh, Roman Fort and camp), two at Melville Grange (Melville Grange homestead) and one on the eastern edge of the study area at Newton Church. A number of Rights of Way (RoW) and Core Paths fall within the 1 km study area including a Core Path which crosses the Sheriffhall Roundabout from the A7 to the north to the A6106 to the south.

12.5.3 Within CEC a number of areas to the west of the Sheriffhall Roundabout are allocated for future housing, none of which fall within the 1 km study area. Within MLC the Shawfair development is partially located within the 1 km study area, including various areas allocated for housing. The area immediately to the north of the Sheriffhall Roundabout is allocated as an extension to Shawfair Park, no housing is proposed in this area. The Larkfield West and Larkfield South-West allocated housing sites on the A7 on the western edge of Dalkeith also fall within the 1 km study area.

Existing/Future Low Noise Surfacing

12.5.4 Low noise surfacing is the standard specification for the trunk road network and is currently in place on the A720 mainline and Sheriffhall Roundabout. With the Proposed Scheme in place the roundabout would transfer from TS to MLC, therefore for the with Proposed Scheme scenario low noise surfacing has been assumed for the A720 mainline and the new sliproads. All roads on the local network which are the responsibility of MLC or CEC are assumed to be standard hot rolled asphalt with and without the Proposed Scheme in operation.

Baseline Noise Monitoring

12.5.5 A summary of the short term (ST) and long term (LT) baseline noise monitoring results is provided Table 12-9 'Baseline Noise Monitoring'. Further details are provided in Appendix 12.4 - Baseline Noise Monitoring and shown in Figure 12.1 'Noise Location Plan'

Table 12-9 Baseline Noise Monitoring

Ref	Description	ST/LT	$L_{A10,18h}$ dB	
			Measured	Predicted
M1	700 Old Dalkeith Road, Summerside	LT	62.5	64.0
M2	Sheriffhall House	LT	61.3	64.0
M3	Campend Cottages	LT	75.6	62.7
M4	626 Gilmerton Road	LT	59.8	73.5
M5	Sheriffhall Mains Cottage	ST	61.1	59.9
M6	Elginhaugh Farm Pub	ST	59.1	58.2

12.5.6 The measured baseline ambient noise levels and the predicted traffic noise levels match well at the majority of locations, road traffic noise was noted as the main existing source at all locations. At locations M1, and M2 close to the junction the predicted levels are slightly higher than the measured levels, and at M3 on the A7 to the north just over 2 dB lower. At M4 on Gilmerton Road and M6 off the A7 to the south of the junction the measured and monitored levels match closely. At M5 the measured levels are around 4 dB higher than the predicted traffic noise levels. This location is close to the railway and 3-4 trains per hour were noted during the attended monitoring, in addition to regular aircraft overhead, which explains the higher measured levels.

Future Baseline (2024 and 2039)

12.5.7 A summary of predicted Do-Minimum traffic noise levels and the change from the Proposed Scheme opening year (2024) to the future assessment year (2039) is provided in Table 12-10 'Long-Term Change in Predicted Do-Minimum Traffic Noise Levels (DM 2024 to DM 2039)'.

Table 12-10 Long-Term Change in Predicted Do-Minimum Traffic Noise Levels (DM 2024 to DM 2039)

Change in Noise Level		Daytime		Night-time
		Number of Residential Buildings	Number of Other Sensitive Receptors	Number of Residential Buildings
Increase in noise level Daytime $L_{A10,18h}$ dB Night –time $L_{night,outside}$ dB	36	2	5	36
	0	0	0	0
	0	0	0	0
	0	0	0	0
No Change	14	0	14	14
Decrease in noise level Daytime $L_{A10,18h}$ dB Night –time $L_{night,outside}$ dB	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0

12.5.8

12.5.9 Table 12-11 'Long-Term Change in Do-Minimum Traffic Noise Annoyance (DM 2024 to DM 2039)' provides a summary of the corresponding change in traffic noise annoyance at residential buildings from the Proposed Scheme opening year of 2024 to the future assessment year of 2039, as required by DMRB.

Table 12-11 Long-Term Change in Do-Minimum Traffic Noise Annoyance (DM 2024 to DM 2039)

Change in % Annoyed		Daytime
		Number of Residential Buildings
Increase in annoyance level	<10%	33
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0
No change	0	17
Decrease in annoyance level	<10%	0
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0

12.5.10 An estimated total of 50 residential buildings are located within the 600 m noise prediction study area, as shown on Figure 12.1 'Noise Location Plan'. However, only 19 buildings meet the DMRB criterion of 55 dB $L_{night,outside}$ at one or more façades in one or more scenarios for inclusion in the night-time traffic noise assessment.

12.5.11 A total of 2 non-residential sensitive buildings are located within the 600 m noise prediction study area, consisting of a nursery on the A7 north of the junction and Shawfair Hospital as shown on Figure 12.1 'Noise Location Plan'.

12.5.12 Table 12-10 'Long-Term Change in Predicted Do-Minimum Traffic Noise Levels (DM 2024 to DM 2039)' and

12.5.13 Table 12-11' Long-Term Change in Do-Minimum Traffic Noise Annoyance (DM 2024 to DM 2039)' are based on the façade at each building which undergoes the least beneficial change in traffic noise level from the DM 2024 scenario to the DM 2039 scenario. The results are provided for the top floor of each building, for example, 1.5 m for a one storey house, 4.0 m for a two-storey house. Further details of the noise model set-up and assumptions are provided in Appendix 12.3 - Noise Modelling.

12.5.14 The traffic noise changes from DM 2024 to DM 2039 are presented as a noise difference contour plot in Figure 12.3 'Do-Minimum Long-Term Change (2024 DM to 2039 DM)'. The plot is based on free-field traffic noise levels at first floor level (4.0 m above ground) using a 10 m x 10 m grid and is provided for illustration purposes.

12.5.15 The majority of residential buildings (72%) and all the sensitive non-residential receptors experience a negligible (0.1-2.9 dB) increase in daytime traffic noise levels from 2024 to 2039 in the absence of the Proposed Scheme (slight adverse effect). A small number (28%) of receptors experience no change (neutral effect). This results in a corresponding small increase in annoyance due to traffic noise at the majority of residential buildings.

12.5.16 Traffic noise levels at the proposed/safeguarded housing areas in the Shawfair development and Larkfield allocated sites are predicted to experience a negligible increase (slight adverse effect), in the absence of the Proposed Scheme. Changes at the scheduled monuments are also negligible (slight effect). The allocated housing areas in CEC are outside the noise prediction study area; however, based on the results of the assessment the changes in traffic noise levels are anticipated to be negligible (slight effect) in the absence of the Proposed Scheme.

12.5.17 A summary of the change in annoyance due to airborne vibration from road traffic between the two Do-Minimum scenarios is provided in Table 12-12 'Long-Term Change in Do-Minimum Traffic Vibration Annoyance (DM 2024 to DM 2039)'. A total of 10 residential buildings have been identified within 40 m of the Proposed Scheme, existing junction which is replaced by the Proposed Scheme, and the identified affected routes within the 1 km study area. 9 of these residential buildings experience a small increase in vibration annoyance from 2024 to 2039 in the absence of the Proposed Scheme due to the general growth in traffic over time. One residential building experiences no change.

Table 12-12 Long-Term Change in Do-Minimum Traffic Vibration Annoyance (DM 2024 to DM 2039)

Change in % Annoyed		Daytime
		Number of Residential Buildings
Increase in annoyance level	<10%	5
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0
No change	0	5
Decrease in annoyance level	<10%	0
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0

12.5.18 Table 12-13 'Affected Routes beyond 1 km - Change in Traffic Noise levels (DM 2024 to DM 2039)' details the long-term change in the Calculation of Road Traffic Noise (CRTN) Basic Noise Level (BNL) at the identified affected routes beyond the 1 km maximum study area. The location of these roads is illustrated in Figure 12.2 'Noise Affected Routes'.

Table 12-13 Affected Routes beyond 1 km - Change in Traffic Noise levels (DM 2024 to DM 2039)

Link Ref.	Description	Number of receptors within 50 m		BNL $L_{A10,18h}$ dB at 10 m from the road		
		Residential	Non-Residential	2024 DM	2039 DM	Change
248:249z	A720 eastbound on-slip Straiton Junction	0	0	66.2	66.2	0.0
249z:250z	A720 eastbound on-slip Straiton Junction	0	0	65.4	65.5	+0.1
269b:276	A720 westbound on-slip, A68 (Millerhill) Junction	0	0	66.2	66.1	-0.1
276:283	A720 westbound on-slip, A68 (Millerhill) Junction	0	0	65.0	65.0	0.0
245z:244z	Lang Loan, north of Straiton Junction	0	0	63.2	63.2	0.0
246z:245z	Lang Loan, north of Straiton Junction	0	0	66.0	66.0	0.0
10011_68064, 69248_53034	A1, Near to Queen Margaret University	0	0	75.8	76.0	+0.2
68001_68065, 68075_69245	A1, Near to Queen Margaret University	0	0	76.0	76.1	+0.1
61005_69306	A6106 Millerhill Road, North of Newton Church Road	18	0	63.9	64.1	+0.2
28111_7807	Old Edinburgh Road, Dalkeith	18	1 Place of worship	53.9	55.6	+1.7
53125_7652	Dalhousie Road, Dalkeith	7	0	55.7	57.2	+1.5
7652_7742	Dalhousie Road, Dalkeith	44	0	56.3	57.4	+1.1

12.5.19 All of the identified affected routes are predicted to experience a negligible (0.1 - 2.9 dB) or zero long-term change in traffic noise levels at the roadside in the absence of the Proposed Scheme (slight effect). This is due to the normal growth of traffic over time, and on some links a small reduction in traffic speed.

12.5.20 All of the affected routes on the A720 and A1 are not within 50 m of any identified sensitive receptors. Sensitive receptors have only been identified within 50 m of four of the 112 affected routes, one on the A6106 North (Millerhill Road) north of Newton Village and three links within Dalkeith, all experience a negligible increase in the absence of the Proposed Scheme (slight adverse effect).

12.6 Potential Impacts and Effects

Construction Noise

12.6.1 Predicted weekly noise levels during the construction phase have been calculated over the Proposed Scheme construction period of approximately 114 weeks, taking into account standard best practice mitigation measures as detailed in Section 12.8.

12.6.2 Predicted weekly noise levels at each selected representative receptor during the construction phase are shown in Appendix 12.2 - Construction Noise. Receptor locations are marked on Figure 12.1 'Noise Location Plan'. For one storey residential properties the results are provided for the ground floor for all time periods. For two storey residential properties, ground floor results are provided for the daytime and top floor results for the evening and night. The

maximum predicted construction noise level, and whether the significance criteria is predicted to be exceeded, is summarised in Once the contractor is appointed and specific details of the construction works are available, the potential to reduce the magnitude of construction noise impacts, for example, through the use of localised site hoarding, will be determined through the requirements in the CEMP. In some locations where the exceedances of the criteria are small this may result in the removal of significant adverse effects.

Table 12-14 Summary of Predicted Construction Noise Levels

Receptor ID	Daytime LAeq dB (façade)			Evening/weekend LAeq dB (façade)			Night LAeq dB (façade)		
	Criterion	Max Level	Magnitude	Criterion	Max Level	Magnitude	Criterion	Max Level	Magnitude
R01 - Burnside, Gilmerton Road	70	57	Negligible	65	48	Negligible	55	48	Negligible
R02 - Melville Cottages, Gilmerton Road	75	58	Negligible	69	51	Negligible	63	51	Negligible
R03 - Melville Inn (Manager's Flat), Gilmerton Road	65	62	Negligible	65	62	Negligible	56	62	Major
R04 - Melville Castle East Lodge, Gilmerton Road	65	55	Negligible	65	53	Negligible	55	53	Negligible
R05 - Kings Gate Lodge, Melville Gate Road	65	60	Negligible	65	55	Negligible	55	55	Negligible
R06 - Old Sheriffhall Farmhouse	65	70	Major	60	61	Minor	55	61	Major
R07 - Sheriffhall House	65	74	Major	65	56	Negligible	55	56	Minor
R08 - A7 North (Old Dalkeith Road), Summerside	65	73	Major	65	68	Moderate	55	68	Major
R09 - Campend Cottages	75	72	Negligible	68	68	Negligible	62	68	Major
R10 - Sheriffhall Mains Cottage	65	58	Negligible	60	59	Negligible	55	59	Moderate

12.6.3 'Summary of Predicted Construction Noise Levels'. The predicted noise levels shown are based on the area over which each activity is likely to occur over the course of each week during the construction programme. As detailed in Section 12.2, to define the criteria for the onset of a potentially significant effect, ambient noise levels at the relevant façade of each of the selected receptors has been determined as based on predicted 2017 baseline traffic flows.

12.6.4 Of the 10 selected construction noise assessment locations, three are predicted to experience construction noise levels which exceed the criterion for the onset of potentially significant effects during the daytime period in one or more weeks. For the evening/weekend period, two receptors are predicted to exceed the criterion, and for the night-time period, six locations are predicted to exceed the criterion. For the remaining receptors/time periods no exceedances of the criteria are anticipated, the magnitude of impact is negligible, and the significance of the construction noise effect is classed as **slight adverse**.

12.6.5 The construction noise assessment data indicates the following:

- At receptor R03 (Melville Inn) major exceedances of the night-time criterion are anticipated within a 2-week period due to earthworks and road surfacing at tie-ins to the existing carriageways. The significance of the worst-case night-time construction noise effect at R03 is classed as **large adverse**.

- At receptor R06 (Old Sheriffhall Farmhouse) major exceedances of the daytime criterion are anticipated within a 2-week period due to earthworks in the vicinity of the receptor. The significance of the worst case adverse daytime construction noise effect at R06 is classed as **large adverse**. A minor exceedance of the evening/weekend criterion is anticipated during 1 week, which is classed as a slight adverse effect. An exceedance of the night-time criterion is anticipated within a total of 7 weekly periods. The magnitude of the worst-case night-time impact is major, which is anticipated to occur within 1 of these weekly periods and is classed as **large adverse** effect at R06, this is due to earthworks and road surfacing at tie-ins to the existing carriageways.

- At receptor R07 (Sheriffhall House) exceedances of the daytime criterion are anticipated within 19 weekly periods. The magnitude of the worst-case daytime impact is major, which is anticipated to occur within 3 of these weekly periods and is classed as a **large adverse** effect at R07. The large adverse effect is due to earthworks and works to the railway bridge in the vicinity of the receptor. Exceedances of the night-time criterion are anticipated within 3 weekly periods. The magnitude of the worst-case night-time impact is minor, which is anticipated to occur within 2 of these weekly periods and is classed as a **slight adverse** effect at R07. The slight adverse effect occurs at the start and end of earthworks to the central island embankment.

- At receptor R08 (A7 North (Old Dalkeith Road), Summerside) exceedances of the daytime criterion are anticipated within 22 weekly periods. The magnitude of the worst-case daytime impact is major, which is anticipated to occur within 7 of these weekly periods and is classed as a **large adverse** effect. The large adverse effect is related to mining works, construction of the subways, earthworks and pavement works in the vicinity of the receptor. A moderate exceedance of the evening/weekend criterion is anticipated within 1 weekly period and is classed as a moderate adverse effect at R08. An exceedance of the night-time criterion is anticipated within a total of 7 weekly periods. The magnitude of the worst-case night-time impact is major, which is anticipated to occur within 3 of these weekly periods and is classed as **large adverse** effect at R08. The major adverse effect is due to works to construct temporary carriageways in the vicinity of the receptor, earthworks at tie-ins to the existing carriageway, and at the start and end of earthworks to the central island embankment.

- At receptor R09 (Campend Cottages) a major exceedance of the night-time criterion is anticipated within a 2-week period, which is classed as a **large adverse** effect. The exceedances are due to earthworks and road surfacing at tie-ins to the existing carriageways.

- At receptor R10 (Sheriffhall Mains Cottage) a moderate exceedance of the night-time criterion is anticipated within 1 weekly period due to earthworks and road surfacing at tie-ins to the existing carriageways. The significance of the worst-case night-time construction noise effect is classed as **moderate adverse**.

12.6.6 Once the contractor is appointed and specific details of the construction works are available, the potential to reduce the magnitude of construction noise impacts, for example, through the use of localised site hoarding, will be determined through the requirements in the CEMP. In some locations where the exceedances of the criteria are small this may result in the removal of significant adverse effects.

Table 12-14 Summary of Predicted Construction Noise Levels[1]

Receptor ID	Daytime L_{Aeq} dB (façade)			Evening/weekend L_{Aeq} dB (façade)			Night L_{Aeq} dB (façade)		
	Criterion	Max Level	Magnitude	Criterion	Max Level	Magnitude	Criterion	Max Level	Magnitude
R01 - Burnside, Gilmerton Road	70	57	Negligible	65	48	Negligible	55	48	Negligible
R02 - Melville Cottages, Gilmerton Road	75	58	Negligible	69	51	Negligible	63	51	Negligible

[1] Exceedances of the criteria in bold

Receptor ID	Daytime L_{Aeq} dB (façade)			Evening/weekend L_{Aeq} dB (façade)			Night L_{Aeq} dB (façade)		
	Criterion	Max Level	Magnitude	Criterion	Max Level	Magnitude	Criterion	Max Level	Magnitude
R03 - Melville Inn (Manager's Flat), Gilmerton Road	65	62	Negligible	65	62	Negligible	56	62	Major
R04 - Melville Castle East Lodge, Gilmerton Road	65	55	Negligible	65	53	Negligible	55	53	Negligible
R05 - Kings Gate Lodge, Melville Gate Road	65	60	Negligible	65	55	Negligible	55	55	Negligible
R06 - Old Sheriffhall Farmhouse	65	70	Major	60	61	Minor	55	61	Major
R07 - Sheriffhall House	65	74	Major	65	56	Negligible	55	56	Minor
R08 - A7 North (Old Dalkeith Road), Summerside	65	73	Major	65	68	Moderate	55	68	Major
R09 - Campend Cottages	75	72	Negligible	68	68	Negligible	62	68	Major
R10 - Sheriffhall Mains Cottage	65	58	Negligible	60	59	Negligible	55	59	Moderate

Construction Vibration

12.6.7 Construction vibration impacts have been considered for proposed piling activities. Piling will be required at the two new bridges at the junction, at this stage rotary bored piling is anticipated. Sheet piling will also be required to extend the existing rail bridge and for small scale temporary works at the existing roundabout. No compaction or ground improvement works using vibratory rollers are anticipated to be required in the vicinity of residential properties (<100m), therefore vibration impacts from compaction and ground improvement works are scoped out of the assessment.

12.6.8 Table 12-15 'Proximity of Piling Works to Receptors' details the distance from the 10 selected potentially sensitive construction receptors to the closest location at which piling is likely to be required.

Table 12-15 Proximity of Piling Works to Receptors

Receptor	Closest Piling Works	Type of Piling	Closest Distance (m)
R01 - Burnside, Gilmerton Road	Phase 5 New bridges at flyover	Rotary bored piling	875
R02 - Melville Cottages, Gilmerton Road	Phase 5 New bridges at flyover	Rotary bored piling	615
R03 - Melville Inn (Manager's Flat), Gilmerton Road	Phase 5 New bridges at flyover	Rotary bored piling	515
R04 - Melville Castle East Lodge, Gilmerton Road	Phase 1 temporary works at roundabout	Sheet Piling	545
R05 - Kings Gate Lodge, Melville Gate Road	Phase 1 Rail bridge widening	Sheet Piling	375
R06 - Old Sheriffhall Farmhouse	Phase 1 Rail bridge widening	Sheet Piling	130
R07 - Sheriffhall House	Phase 1 Rail bridge widening	Sheet Piling	50

Receptor	Closest Piling Works	Type of Piling	Closest Distance (m)
R08 - A7 North (Old Dalkeith Road), Summerside	Phase 1 temporary works at roundabout	Sheet Piling	110
R09 - Campend Cottages	Phase 1 temporary works at roundabout	Sheet Piling	295
R10 - Sheriffhall Mains Cottage	Phase 1 Rail bridge widening	Sheet Piling	450

12.6.9 Table 12-15' Proximity of Piling Works to Receptors' indicates that only one receptor R07 Sheriffhall House is located within 100 m of any proposed piling works. Based on the measured data in BS 5228 for sheet piling there is no risk of building damage from these works at a distance of 50 m. In terms of the potential for annoyance to residents there is no risk of major impacts and a low risk of moderate impacts. On this basis the significance of the effect of the piling works in terms of annoyance is classed as **slight adverse**.

Operational Noise

12.6.10 All the operational traffic noise comparisons reported herein are based on the façade at each building which undergoes the highest adverse change, or the least beneficial change in traffic noise level as a result of the Proposed Scheme. The results are provided for the top floor of each building, for example, 1.5 m for a one storey house, 4.0 m for a two-storey house. Further details of the noise model set-up and assumptions are provided in Appendix 12.3 - Noise Modelling.

12.6.11 The noise difference contour plots are shown on the following Figures;

- Figure 12.4 'Do-Something Short Term Change (2024DM to 2024DS)'
- Figure 12.5 'Do-Something Long Term Change (2024DM to 2039DS)'

12.6.12 All the noise difference contour plots (refer to Figures 12.4-12.5) are based on free-field traffic noise levels at first floor level (4.0 m above ground) using a 10 m x 10 m grid and are provided for illustration purposes.

Short-Term Changes

12.6.13 Table 12-16 'Short-Term Change in Traffic Noise Levels (DM 2024 to DS 2024)' summarises the short-term change in predicted traffic noise levels in 2024 between the Do-Minimum (no Proposed Scheme) and the Do-Something (with Proposed Scheme) scenarios at both residential buildings and other sensitive receptors within the 600 m study area. The short term traffic noise changes from the Do-Minimum 2024 to Do-Something 2024 are presented as a noise difference contour plot in Figure 12.4 'Do-Something Short-Term Change (2024 DM to 2024 DS)'.

Table 12-16 Short-Term Change in Traffic Noise Levels (DM 2024 to DS 2024)

Change in Noise Level		Daytime	
		Number of Residential Buildings	Number of Other Sensitive Receptors
Increase in noise level Daytime $L_{A10,18h}$ dB	0.1 – 0.9	25	1
	1.0 - 2.9	15	1
	3.0 - 4.9	0	0
	≥5	0	0
No Change	0	7	0
Decrease in noise level Daytime $L_{A10,18h}$ dB	0.1 - 0.9	3	0
	1.0 - 2.9	0	0
	3.0 - 4.9	0	0

Change in Noise Level	Daytime	
	Number of Residential Buildings	Number of Other Sensitive Receptors
≥5	0	0

12.6.14 An estimated total of 50 residential buildings are located within the 600 m noise prediction study area, as shown on Figure 12.1 'Noise Location Plan'.

12.6.15 A total of 2 non-residential sensitive buildings are located within the 600 m noise prediction study area, consisting of a nursery on the A7 north of the junction and Shawfair Hospital as shown on Figure 12.1 'Noise Location Plan'.

12.6.16 As detailed in Table 12-16 'Short-Term Change in Traffic Noise Levels (DM 2024 to DS 2024)' in the short-term in 2024, 80% of residential buildings would experience a negligible (0.1-0.9 dB)) or minor (1.0 - 2.9 dB) increase in daytime traffic noise levels due to the Proposed Scheme. Around 14% would experience no change and 6% a negligible decrease. Negligible and minor changes in traffic noise are classed as a slight effect and no change as a neutral effect. No residential buildings experience a moderate (3.0 – 4.9 dB) or major (≥5 dB) increase or decrease in traffic noise levels, which would be classed as a moderate or large effect. The nursery on the A7 North in Campend is predicted to experience a minor increase in traffic noise (**slight adverse** effect), Shawfair Hospital is predicted to experience a negligible increase (**slight adverse** effect). The change in traffic noise levels at the Elginhaugh Roman fort and camp scheduled monuments east of Dalkeith ranges from negligible increase to negligible decrease (**neutral** effect). At the two scheduled monuments at Melville Grange homestead a negligible increase is anticipated (**neutral** effect). At the Newton Church scheduled monument a negligible increase is anticipated (**neutral** effect).

12.6.17 The minor increases in traffic noise levels are concentrated along the A7 North, the A6106 North and Sheriffhall Mains north of the junction, and Sheriffhall Farm east of the junction. Increases in traffic flows and speeds are anticipated on the A7 North and A6106 North with the Proposed Scheme in operation. Decreases in traffic noise levels are located at the A772 Gilmerton Road junction to the west of the Proposed Scheme, and at Elginhaugh, south of the B6392 Gilmerton Road. This is due to a slight reduction in traffic on the A772 and additionally at Gilmerton Road junction the increase in speed on the eastbound A720 mainline, as congestion is reduced, which brings in the benefit of the low noise surfacing on the mainline. The 7 properties predicted to experience no change in traffic noise levels are located at the A772 Gilmerton Road junction, at Melville Grange south of the junction, and at Elginhaugh, south of the B6392 Gilmerton Road.

12.6.18 Traffic noise levels at the proposed/safeguarded housing areas in the Shawfair development are predicted to experience a negligible increase due to the Proposed Scheme (**slight adverse** effect). Traffic noise levels at the allocated Larkfield housing sites are predicted to undergo a negligible increase (**slight adverse** effect).

Long-Term Changes

12.6.19 Table 12-17 'Long-Term Change in Traffic Noise Levels (DM 2024 to DS 2039)' summarises the long-term change in predicted traffic noise levels between the 2024 Do-Minimum and 2039 Do-Something scenarios. The long-term traffic noise changes from Do-Minimum 2024 to Do-Something 2039 are presented as a noise difference contour plot in Figures 12.5 'Do-Something Long-Term Change (2024 DM to 2039 DS)'.

Table 12-17 Long-Term Change in Traffic Noise Levels (DM 2024 to DS 2039)

Change in Noise Level	Daytime		Night-time
	Number of Residential Buildings	Number of Other Sensitive Receptors	Number of Residential Buildings
0.1 – 2.9	40	2	13

Change in Noise Level		Daytime		Night-time
		Number of Residential Buildings	Number of Other Sensitive Receptors	Number of Residential Buildings
Increase in noise level Daytime $L_{A10,18h}$ dB Night –time $L_{night,outside}$ dB	3.0 - 4.9	0	0	0
	5.0 - 9.9	0	0	0
	≥10	0	0	0
No Change	0	8	0	5
Decrease in noise level Daytime $L_{A10,18h}$ dB Night –time $L_{night,outside}$ dB	0.1 - 2.9	2	0	1
	3.0 - 4.9	0	0	0
	5.0 - 9.9	0	0	0
	≥10	0	0	0

12.6.20 In the long term (2024 Do-Minimum to 2039 Do-Something) the same general pattern of traffic noise level change is observed as in the short term as described above. Increases and decreases at residential properties in the long-term daytime are all negligible or no change (**neutral or slight** effects). Both non-residential sensitive receptors are predicted to experience a negligible increase (**slight adverse** effect). At night, all residential properties are predicted to experience a negligible increase, negligible decrease or no change (**neutral or slight** effect).

12.6.21 Table 12-18 'Worst case change in traffic noise annoyance' outlines the worst-case change in annoyance due to the Proposed Scheme. As would be expected based on the changes in traffic noise levels reported above, a corresponding small increase in annoyance due to traffic noise occurs at the majority of residential buildings.

Table 12-18. Worst case change in traffic noise annoyance

Change in % Annoyed		Daytime
		Number of Residential Buildings
Increase in annoyance level	<10%	6
	10 <20%	16
	20 <30%	18
	30 <40%	0
	≥40%	0
No change	0	9
Decrease in annoyance level	<10%	1
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0

Receptors between 600 m and 1 km

12.6.22 For receptors that are within 1 km of the Proposed Scheme and the existing junction, but not within 600 m of an affected route, only negligible increases and decreases in traffic noise levels are expected in both the short and long term (**slight adverse to slight beneficial** effect).

Operational Traffic Noise – Noise Insulation (Scotland) Regulations

12.6.23 A preliminary consideration of properties which may qualify for noise insulation works under the Noise Insulation Regulations has identified 5 residential buildings, which are all on the A7 at Campend just beyond the end of the

Proposed Scheme north of the junction. The exact end point of the Proposed Scheme would determine if these properties meet the Noise Insulation (Scotland) Regulations criteria.

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

Operational Traffic Noise – Affected Routes

12.6.25 Table 12-19 'Affected Routes beyond 1 km - Change in Traffic Noise Levels' details the short term (DM 2024 to DS 2024) and long term (DM 2024 to DS 2039) change in the Calculation of Road Traffic Noise (CRTN) Basic Noise Level (BNL) at the identified affected routes beyond the 1 km maximum study area. The location of these roads is illustrated in Figure 12.2 'Noise Affected Routes'.

Table 12-19 Affected Routes beyond 1 km - Change in Traffic Noise Levels (DM 2024 to DS 2024 and DS 2039)

Link Ref.	Description	Number of receptors within 50 m		BNL $L_{A10,18h}$ dB at 10 m from the road			
		Residential	Non-Residential	2024 DS	2039 DS	ST Change	LT Change
248:249z	A720 eastbound on-slip Straiton Junction	0	0	67.3	67.3	+1.1	+1.1
249z:250z	A720 eastbound on-slip Straiton Junction	0	0	66.4	66.4	+1.0	+1.0
269b:276	A720 westbound on-slip, A68 (Millerhill) Junction	0	0	65.1	65.1	-1.1	-1.1
276:283	A720 westbound on-slip, A68 (Millerhill) Junction	0	0	66.5	66.5	+1.5	+1.5
245z:244z	Lang Loan, north of Straiton Junction	0	0	64.3	64.3	+1.1	+1.1
246z:245z	Lang Loan, north of Straiton Junction	0	0	67.1	67.1	+1.1	+1.1
10011_68064, 69248_53034	A1, Near to Queen Margaret University	0	0	73.5	75.9	-2.3	+0.1
68001_68065, 68075_69245	A1, Near to Queen Margaret University	0	0	73.6	76.1	-2.4	+0.1
61005_69306	A6106 Millerhill Road, North of Newton Church Road	18	0	65.2	65.7	+1.3	+1.8
28111_7807	Old Edinburgh Road, Dalkeith	18	1 Place of worship	55.7	57.3	+1.8	+3.4
53125_7652	Dalhousie Road, Dalkeith	7	0	55.3	57.2	-1.1	+1.3
7652_7742	Dalhousie Road, Dalkeith	44	0	55.1	57.4	-1.2	+1.1

12.6.26 All of the affected routes on the A720 and A1 are not within 50 m of any identified sensitive receptors. Sensitive receptors have only been identified within 50 m of four of the 12 affected routes. Of these two in Dalkeith experience a minor decrease in the short term (**slight beneficial** effect), and two (in Dalkeith and on A6106 North) a minor increase (**slight adverse** effect), due to changes in traffic flows and speeds with the Proposed Scheme in place.

12.6.27 The allocated housing areas in CEC are outside the noise prediction study area further west on the A720. In the short term minor increases are anticipated on the Eastbound on slip at Straiton Junction and on Lang Loan (**slight adverse** effect) to the north of Straiton Junction.

Operational Vibration

12.6.28 A summary of the long-term change in annoyance due to airborne vibration from road traffic due to the Proposed Scheme is provided in Table 12-20 'Long-Term Change in Do-Something Traffic Vibration Annoyance (DM 2024 to DS 2039)'. A total of 10 residential buildings have been identified within 40 m of the Proposed Scheme, the existing junction which would be replaced by the Proposed Scheme, and the identified affected routes within the 1 km study area.

Table 12-20 Long-Term Change in Do-Something Traffic Vibration Annoyance (DM 2024 to DS 2039)

Change in % Annoyed		Daytime
		Number of Residential Buildings
Increase in annoyance level	<10%	10
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0
No change	0	0
Decrease in annoyance level	<10%	0
	10 <20%	0
	20 <30%	0
	30 <40%	0
	≥40%	0

12.6.29 All ten residential buildings would experience a small increase in annoyance. The effect of the Proposed Scheme on operational airborne vibration impacts is classed as not significant.

12.7 Mitigation

Construction

12.7.1 The CEMP for the Proposed Scheme would include a requirement for a Noise and Vibration Management Plan to be produced by the contractor. The measures detailed within the Noise and Vibration Management Plan would be developed by the selected construction contractor and would be implemented for the duration of the Proposed Scheme construction phase.

12.7.2 The Noise and Vibration Management Plan would include a range of industry standard best practice construction phase noise and vibration mitigation measures required during all works undertaken where there is a potential for adverse effects on sensitive receptors. The Noise and Vibration Management Plan would also include relevant noise and vibration criteria and proposed surveys. Such best practice measures include:

- compliance with standard daytime working hours for the majority of the works, to be agreed with CEC and MLC;
- agreement in advance with CEC and MLC for works outside of normal daytime working hours;
- optimal location of equipment on site to minimise noise disturbance;
- control of noise and vibration at source through the choice of low vibration/quiet working methods and plant;
- proper use of plant with respect to minimising noise and vibration emissions in line with plant manuals and completion of regular maintenance;

- fitting vehicles and mechanical plant with effective exhaust silencers which would be maintained in good, efficient working order;
- use of 'sound reduced' compressors fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use;
- use of ancillary pneumatic percussive tools fitted with mufflers or silencers of the type recommended by the manufacturers;
- shut down or throttling down to a minimum;
- machines in intermittent use in the intervening periods between work;
- positioning of all ancillary plant such as generators, compressors and pumps so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures would be provided;
- adherence to the codes of practice for construction working and piling given in British Standard 'BS 5228:2009+A1:2014' and the guidance given therein on minimising noise and vibration emissions;
- implementation of a noise insulation and temporary re-housing policy;
- provision of acoustic enclosures around static plant, where necessary; and
- use of less intrusive alarms, such as broadband vehicle reversing warnings.

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

12.7.4 During the Proposed Scheme construction phase appropriate mechanisms to communicate with local residents would be set up to highlight potential periods of disruption (e.g. web-based, newsletters, newspapers, radio announcements etc.). This would include the appointment of a Community Liaison Officer responsible for leading engagement with affected communities. An information web-page would be provided and kept up-to-date on the TS website to reflect construction and community liaison requirements. It is envisaged that the web-page would provide up-to-date information on the progress of the construction works, areas affected by construction, mitigation in place to reduce adverse effects, information regarding planned construction works (including any proposed works outside normal hours) and works recently completed. The communication strategy would minimise the likelihood of complaints, including those associated with noise and vibration. Residents would be provided with a point of contact, the Community Liaison Officer, for any queries or complaints. A complaint management system would be in place, in line with systems used by TS on other major infrastructure projects. Any noise and vibration complaints would be investigated, and appropriate action taken as required. The complainant would be provided with a response outlining the results of the investigation and any action taken.

12.7.5 During the construction phase, surveys would be required which would include physical measurements and observational checks and audits to ensure that Best Practicable Means (BPM) were being employed at all times. The contractor would employ a suitably qualified person to undertake and report such noise and vibration surveys as is necessary to ensure and demonstrate compliance with all noise and vibration commitments and the requirements of the Noise and Vibration Management Plan.

12.7.6 The survey and compliance assurance process would be set out in the Noise and Vibration Management Plan. Site reviews would be logged and any remedial actions implemented by the contractor recorded. Such checks would report:

- compliance with hours of working;
- presence of mitigation measures e.g. engine doors closed, air lines not leaking and site hoarding in place.
- compliance with agreed working methods; and
- compliance with any specific requirements of the Noise and Vibration Management Plan.

Operation and Proposed Scheme Design

12.7.7 Environmental considerations have been taken into account during the development of the Proposed Scheme design, to avoid and reduce potential impacts upon nearby sensitive receptors.

12.7.8 The Proposed Scheme would be constructed throughout with a thin surfacing system (i.e. a low noise surface), which results in lower levels of noise generation than a standard hot rolled asphalt surface. The use of low noise thin surfacing can reduce noise levels by 3 dB at higher speeds.

12.7.9 The following table, Table 12-21 ‘Summary of Noise and Vibration Mitigation Measures’ provides a summary of the noise mitigation measures proposed. This table is also included within Chapter 20 – Schedule of Environmental Commitments which will be used to inform the commitments in the contract documents.

Table 12-21 Summary Noise and Vibration of Mitigation Measures

Mitigation Item	Location/ Approximate Chainage	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required	Potential Monitoring Requirements
NV-1	Throughout Proposed Scheme	Pre-Construction & Construction	The contractor would be required to develop and implement a Noise and Vibration Management Plan to minimise noise and vibration during the works.	To predict the noise and vibration levels during the construction of the proposed scheme. It would include the design of receptor specific mitigation, such as solid site hoarding, over and above the standard 'Best Practicable Means' (BPM) mitigation detailed in the Noise and Vibration Management Plan, where required.	City of Edinburgh Council (CEC) and Midlothian Council (MLC)	-
NV-2	Throughout Proposed Scheme	Pre-Construction & Construction	As part of the Noise and Vibration Management Plan a scheme of noise and vibration monitoring including suitable trigger criteria and details of subsequent actions would be agreed by the contractor with the Environmental Health Officers of CEC and MKLC	To determine compliance with agreed noise and vibration criteria and identify any additional mitigation requirements.	CEC and MLC	Noise and/or vibration monitoring during construction
NV-3	Throughout Proposed Scheme	Pre-Construction & Construction	As part of the Noise and Vibration Management Plan BPM would be used by the contactor to limit the level of noise/vibration to which operators and receptors in the vicinity of site operations would be exposed. This includes the following: • compliance with standard daytime working hours for the majority of the works, to be agreed with CEC and MLC; • agreement in advance with CEC and MLC for works outside of normal daytime working hours; • optimal location of equipment on site to minimise noise disturbance; • control of noise and vibration at source through the choice of low vibration/quiet working methods and plant; • proper use of plant with respect to minimising noise and vibration emissions in line with plant manuals and completion of regular maintenance; • fitting vehicles and mechanical plant with effective exhaust silencers which would be maintained in good, efficient working order; • use of 'sound reduced' compressors fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use;	To reduce, as far as practicable, the level of noise and vibration to which operators and sensitive receptors in the vicinity of site operations would be exposed.	CEC and MLC	Surveys and inspections during construction to monitor implementation of BPM

Mitigation Item	Location/ Approximate Chainage	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required	Potential Monitoring Requirements
			• use of ancillary pneumatic percussive tools fitted with mufflers or silencers of the type recommended by the manufacturers; • shut down or throttling down to a minimum; • machines in intermittent use in the intervening periods between work; • positioning of all ancillary plant such as generators, compressors and pumps so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures would be provided; • adherence to the codes of practice for construction working and piling given in British Standard 'BS 5228:2009+A1:2014' and the guidance given therein on minimising noise and vibration emissions; • implementation of a noise insulation and temporary re-housing policy; • provision of acoustic enclosures around static plant, where necessary; and • use of less intrusive alarms, such as broadband vehicle reversing warnings.			
NV-4	Throughout Proposed Scheme	Pre-Construction & Construction	Implementation of a communications strategy by the contractor for the Scheme and appointment of a Community Liaison Officer.	To ensure residents are kept informed	None Required	-
NV-5	Throughout Proposed Scheme	Operation	Use of low noise surfacing on the A720 mainline and sliproads within the scheme extents.	Reduce traffic noise impacts at nearby sensitive receptors	None Required	-

12.8 Residual Effects

Construction

12.8.1 Once a contractor is appointed and specific details of the works are known then the potential for additional construction noise mitigation measures such as solid site hoarding can be determined. Therefore, at this stage the impacts and effects reported in Section 12.6 remain unchanged. Table 12-22 'Potential Noise and Vibration Construction and Operation Impacts and Residual Effects' summarises the identified potential residual construction noise and vibration effects of the Proposed Scheme.

Operation

12.8.2 No additional mitigation beyond that incorporated into the Proposed Scheme design is proposed therefore the negligible and minor impacts and slight effects reported in Section 12.7 remain unchanged. Table 12-22 'Potential Noise and Vibration Construction and Operational Impacts and Residual Effects' summarises the identified potential residual operation noise and vibration effects of the Proposed Scheme.

Cumulative Impacts

12.8.3 Only the Shawfair Park extension, which forms part of the wider Shawfair development, is located in close proximity to sensitive receptors which would be affected by the construction of the Proposed Scheme, in particular properties at Summerside. The Shawfair Park extension works are likely to be completed during normal daytime working hours, therefore if the works for the Proposed Scheme and the Shawfair Park extension occur simultaneously there is the potential to increase the magnitude of the adverse daytime construction noise impact at these properties.

12.8.4 The traffic data used in the operational traffic noise and vibration assessment includes a range of other developments. The assessment reported herein therefore incorporates the cumulative impact of other local developments.

12.8.5 No proposed new housing developments, which would introduce new sensitive receptors, have been identified in the extent of the study area which falls within CEC. Various potential housing areas within the Shawfair development and the Larkfield allocated housing sites are located within the study area, these would introduce new sensitive receptors into the area, however, none are located in the immediate vicinity of the Proposed Scheme, the closest area of the Shawfair development to the junction is commercial in nature.

12.8.6 Further details of cumulative impacts are provided in Chapter 19 – Cumulative Assessment.

Table 12-22 Potential Noise and Vibration Construction and Operation Impacts and Residual Effects

Receptor	Predicted Impacts	Magnitude of Predicted Impact	Sensitivity of Receptor	Significance of Effect	Potential Mitigation Measures	Residual Effects
Residential Properties and Other Sensitive Receptors						
Construction	Construction noise impacts at the closest identified residential properties during the day, evening/weekend and night	Negligible to Major	High	Slight to Large Adverse	Use of Best Practicable Means (BPM) and compliance with the control measures as detailed in the Noise and Vibration Management Plan. Additional measures such as use of localised temporary site hoardings to be determined once a contractor appointed.	Slight to Large Adverse
	Construction vibration annoyance impacts associated with sheet piling as part of the temporary works at the roundabout, sheet piling of the extended rail bridge and rotary bored piling of the new flyover	Minor	High	Slight Adverse	Use of BPM and compliance with the control measures as detailed in the Noise and Vibration Management Plan.	Slight Adverse
	Construction vibration building damage impacts associated with sheet piling as part of the temporary works at the roundabout, sheet piling of the extended rail bridge and rotary bored piling of the new flyover	No change	High	Neutral	Use of BPM and compliance with the control measures as detailed in the Noise and Vibration Management Plan.	Neutral
Operation	Increases in operational traffic noise due to increased traffic flows and speeds on the A7 North (Old Dalkeith Road) and A6106 North (Millerhill Road) to the north of the junction	Negligible to Minor	High	Slight Adverse	Use of low noise surfacing on the A720 mainline and sliproads.	Slight Adverse
	Slight reductions in traffic on the A772 at Gilmerton Junction and an increase in speed on the eastbound A720 mainline in the vicinity of Gilmerton Junction as congestion is reduced, which brings in the benefit of the low noise surfacing on the mainline. This results in decreases in operational traffic noise at properties close to Gilmerton Junction	Negligible	High	Slight Beneficial	-	Slight Beneficial

12.9 Compliance with Policies and Plans

12.9.1 No conflict with national, regional or local planning policy objectives have been identified.

12.9.2 CEC Policy Env 22 and MLC Policy Env 18 require a noise impact assessment to be completed for new developments. The assessment reported herein meets this requirement.

12.9.3 The CEC policy states planning permission will not be granted if significant adverse effects are likely from a development. The MLC policy aims to avoid unacceptable impacts. This assessment indicates that all permanent operational traffic noise effects would be of neutral or slight significance. Although the potential for significant adverse noise effects has been identified during the construction works these will be temporary and short term in nature. Once a contractor is appointed the potential to reduce the magnitude of the construction impacts, through the use of specific noise mitigation measures such as solid site hoarding, will be determined. The application of the CEMP will ensure construction impacts are reduced to a minimum.

12.10 Statement of Significance

Construction

12.10.1 Based on the magnitude of the anticipated construction noise impacts and the sensitivity of the receptors moderate adverse effects are anticipated at Summerside during the evening/weekend, and at the closest approach of Sheriffhall Mains during the night-time period. Large adverse effects are predicted at Sheriffhall and Summerside during the daytime and at Sheriffhall, Summerside, Campend Cottages and Melville Inn during the night-time.

Operation

12.10.2 Based on the magnitude of the anticipated change in traffic noise levels and the sensitivity of the receptors all anticipated effects are classed as neutral or slight. No moderate or large significant effects have been identified due to the operation of the Proposed Scheme.

12.11 Monitoring

12.11.1 Given the potential for significant construction noise effects as reported in Section 12.7, monitoring would be undertaken during the Scheme construction stage to ensure that the mitigation measures as detailed in Section 12.8 were being appropriately implemented. During the construction phase, surveys would be required which would include physical measurements and observational checks and audits to ensure that Best Practicable Means were being employed at all times. The contractor would undertake, and report noise surveys as is necessary to ensure and demonstrate compliance with all noise commitments and the requirements of the CEMP.

12.11.2 As detailed in Section 12.7 no potentially significant operational traffic noise effects are anticipated. The performance specification of specific operational mitigation measures (low noise surfacing) would be confirmed at the Scheme detailed design stage to ensure the performance assumed in the assessment is achieved. No further monitoring of operational noise effects is proposed.

12.12 References

British Standards Institution (1993) BS 7385-2: 1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration

British Standards Institution (2013) BS 7445: 2003 Description and measurement of environmental noise

British Standards Institution (2014) BS 5228: 2009+A1: 2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites'.

City of Edinburgh Council (2016) Edinburgh Local Development Plan (Adopted November 2016)

Department of Transport, Welsh Office (1988) Calculation of Road Traffic Noise (CRTN)

The Highways Agency, et al. (2011) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7 'Noise and Vibration' (HD 213/11)

International Organization for Standardization (ISO) (2010) ISO 4866:2010 Mechanical vibration and shock. Vibration of fixed structures. Guidelines for the measurement of vibrations and evaluation of their effects on structures

Midlothian Council (2017) Midlothian Local Development Plan (Adopted November 2017)

Scottish Government (2011a) Planning Advice Note (PAN) 1/2011 'Planning and Noise'

Scottish Government (2011b) Technical Advice Note (TAN): Assessment of Noise (Adopted March 2011)

Scottish Government (2014a) National Planning Framework 3 (NPF3) (Adopted June 2014)

Scottish Government (2014b) Scottish Planning Policy (SPP) (Adopted June 2014)

Scottish Government (2018) Transportation: Noise Action Plan (Adopted July 2014)

Scottish Parliament (2006) Environmental Noise (Scotland) Regulations 2006

SESplan (2013) South East Scotland Strategic Development Plan (SDP) (Adopted June 2013)

SESplan (2016) Proposed South East Scotland Strategic Development Plan (SDP2) (October 2016)

UK Parliament (1973) Land Compensation (Scotland) Act 1973

UK Parliament (1974) Control of Pollution Act 1974 (CoPA)

UK Parliament (1975) Noise Insulation (Scotland) Regulations 1975

UK Parliament (1990) Environmental Protection Act 1990 (EPA) Part 3

Transport Research Laboratory (TRL) (2002) Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping

Transport Research Laboratory (TRL) (2006) Method for converting the UK traffic noise index LA10,18h to EU noise indices for road noise mapping

World Health Organisation (WHO) (1999) Guidelines for Community Noise

World Health Organisation (WHO) (2009) Night Noise Guidelines for Europe

World Health Organisation (WHO) (2018) Environmental Noise Guidelines for the European Region