9 Air Quality

9.1 Introduction

9.1.1 Air quality is a consideration in any development proposal involving significant changes in the nature and location of emissions to air. A Design Manual for Roads and Bridges (DMRB) 'simple' air quality assessment has been undertaken to establish the potential effects of the route options on local and regional air quality. This chapter describes the assessment of the operational effects arising from the Scheme.

9.1.2 This chapter presents the DMRB Stage 2 assessment which consists of the following aspects:

- Baseline air quality: the review and assessment of the existing air quality situation within the study area.
- Local air quality: a simple assessment of the potential air quality impacts of the scheme upon representative residential receptors within the study area.
- Designated sites: an assessment of the potential air quality impacts of the scheme upon relevant designated sites within the study area. The changes to air pollution at relevant designated sites are presented in this chapter, and the potential impacts upon ecological receptors due to these changes are considered in detail in Chapter 12 (Ecology and Nature Conservation).
- Regional air quality: an assessment of the potential air quality impacts of the Scheme upon the wider area.

9.2 Approach and Methods

9.2.1 This air quality assessment identifies potential air quality impacts by predicting the changes in concentrations of air pollution as a result of the combination of background concentrations and the contributions of the roads, including the various route options, in the study area.

9.2.2 This assessment conforms to the standard practice of Environmental Impact Assessment, whereby a baseline is established, and then a future situation with the route options in place (Do Something (DS)) is compared with the situation without them (Do-Minimum (DM)).

9.2.3 The assessment follows: DMRB Volume 11, Section 3, Part 1, HA207/07: Air Quality (Highways Agency, Transport Scotland, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2007) (hereafter referred to as HA207/07); and associated DMRB Interim Advice Notes (IAN) and LAQM Technical Guidance (Defra 2016a) (hereafter referred to as LAQM TG(16)). Following the process set out in DMRB, a simple assessment has been carried out.

Relevant Legislation

9.2.4 This section provides a summary of the relevant air quality legislation and standards that have been referenced for this assessment.

Table 9.1: Relevant Air Quality Legislation

Legislation	Description
Environment Protection Act 1990 Part III.	Provides statutory nuisance provisions for nuisance dust.
Environment Act 1995, Part IV.	Defines requirements for Local Air Quality Management (LAQM).
The Air Quality (Scotland) Regulations 2000, and The Air Quality (Scotland) (Amendment) Regulations 2002.	Legislates for the Air Quality Objectives (AQOs) for pollutants set out n the 2007 Air Quality Strategy.
The National Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland, 2007.	Updates the 2000 AQS, and sets out how local air quality is managed, through the application of AQOs based on the Air Quality (Scotland) Regulations 2000 and 2002 Amendments.
The Air Quality Standards (Scotland) Regulations 2010	Transpose formalised limit values set out in the EU Ambient Air Quality Directive 2008/50/EC to UK law.

9.2.5 Directive 2008/50/EC on ambient air quality and cleaner air for Europe (Air Quality Directive) (European Union 2008) was published to consolidate previous European Directives on ambient air quality. These European Directives form the basis for UK air quality legislation. Although published in 2007, the Air Quality Strategy (AQS) (Department for Environment, Food and Rural Affairs and the Devolved Administrations 2007) is consistent with The Air Quality Standards Regulations (Scotland) 2010.

9.2.6 The UK government is responsible to the European Commission (EC) for ensuring that it complies with the provisions of the EU Directives. The UK government and governments of other member states are currently in negotiations with the EC over breaching limit values for nitrogen dioxide (NO_2) and PM_{10} (particulate matter with an aerodynamic diameter of less than 10 microns).

9.2.7 On the UK government's behalf, the Department for Transport (DfT) and Department for Environment Food and Rural Affairs (Defra) have Public Service Agreements relating to EU Limit Values.

9.2.8 The responsibilities of Local Authorities with respect to meeting air quality standards are not the same as the responsibilities of the UK government to the EC. Local Authorities do have statutory duties for Local Air Quality Management (LAQM), but are not obliged to ensure Air Quality Objectives (AQOs) are met but are worked towards in the shortest practical time.

9.2.9 It is important to recognise the difference between the EU Limit Values (for which compliance is determined at a national level by government) and the AQOs (for which compliance is determined at a local level by local authorities under the LAQM regime). Whilst the Limit Values and AQOs for the relevant pollutants (NO_2 and PM_{10}) may be set at the same concentration value (e.g. 40 $\mu g/m^3$, as an annual mean) the means of determining compliance are fundamentally different, and they must be considered separately.

9.2.10 Article 3 of the EU Directive requires Member States to nominate the competent authority for the assessment of air quality (which in the UK is the Secretary of State for the Environment) and it may be interpreted that only the competent authority can determine compliance with the Limit Values. Compliance is determined via the national monitoring network and national model (the Pollution Climate Mapping (PCM) model), and there are a number of important differences between this and the monitoring/modelling carried out by local authorities to determine compliance with the objectives. Some of these differences are summarised in Table 9.2.

Table 9.2: Comparison Between National and Local Compliance Approaches

Exposure Type	National Compliance	Local Compliance
Relevant exposure	Limit Values apply everywhere there is public access	Annual mean objectives only apply at locations where public exposure is relevant to the averaging period, e.g. at residential building facades
Treatment of junctions	Monitoring is not carried out within 25 metres of a junction and the same constraint is applied to the modelling	Junctions are specifically considered in both monitoring and modelling
Microscale	Excludes micro-environments and focuses on locations representative of 100m lengths of roads	Focuses on "hot-spot" locations
Roadside	Modelled concentrations apply to a distance of 4m from kerbside of the national road network. Local roads are excluded from the model	Focus is on concentrations at the building façade, whatever distance from the kerb and alongside any road.
Monitoring	Restricted to monitoring stations in the national network, operated to meet the Data Quality Objectives of the Directive	Principally based on local authority monitoring, including both automatic and passive diffusion samplers

9.2.11 Because of these differences, there are many locations across the UK where the national compliance with the Limit Values, and local compliance with the AQOs, are not in agreement. For the purpose of this assessment, they are treated separately. This is consistent with the advice in the relevant Planning Advice Notes (PANs) produced by Scottish Government which provide further guidance on specific topics.

Air Quality Strategy (AQS) and Local Air Quality Management (LAQM)

9.2.12 The AQOs applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297). The pollutants relevant to this assessment are nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$. The National AQS for England, Scotland, Wales and Northern Ireland (the AQS) also provides for a non-statutory objective for NOx. The relevant AQOs are presented in Table 9.3.

Table 9.3: National Air Quality Objectives (AQO)

Pollutant	AQOs	
	Concentration	Timescale
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times/yr	1 hour mean
	40 µg/m^3	Annual mean
Nitrogen Oxides (NO_x) for the protection of vegetation	30 µg/m^3	Annual mean
PM_{10}	50 µg/m^3 not to be exceeded more than 7 times/yr	24 hour mean
	18 µg/m^3	Annual mean
$PM_{2.5}$	10 µg/m^3 (Scotland only)	Annual mean

9.2.13 For a full description of the terms used in relation to air quality, the science and the legislation, reference should be made to the AQS documents, and to the supporting Defra LAQM Technical Guidance (Defra, 2016), referred to hereafter as 'LAQM TG(16)'.

9.2.14 There are no assessment methods available that can produce robust predictions of short-term concentrations from road traffic. Therefore, compliance with the short-term AQOs is assessed by following the guidance presented in LAQM TG(16), which provides a relationship between the annual mean concentration and the number of periods per year where the short-term AQO is likely to be exceeded. These relationships have been derived from examination of monitoring data across the UK.

9.2.15 The annual mean equivalent concentration for the NO_2 1 hour mean AQO is 60µg/m^3, whilst the annual mean equivalent concentration for the PM_{10} 24 hour mean AQO is 22.4µg/m^3.

9.2.16 The AQS introduces measures to control exposure to $PM_{2.5}$ (the fraction of particulate matter with an average aerodynamic diameter less than 2.5µm). This is intended to be delivered at the national level, so the control has not been incorporated into LAQM, authorities have no statutory obligation to review and assess against them.

9.2.17 Following their review of the LAQM system, the Scottish Government has decided to replace the existing Scottish objectives with the WHO guideline values. LAQM TG(16) details a PM_{10} annual mean for Scotland of 18µg/m^3 and $PM_{2.5}$ annual mean of 10µg/m^3.

9.2.18 AQOs are health-based standards that were set at a level to provide protection to the whole population.

9.2.19 NO_2 is a colourless, odourless gas which has been shown to have adverse health effects, including respiratory irritation in asthmatics. There is believed to be a threshold at which it has an effect. It is formed principally from the oxidation of nitric oxide (NO) through the action of ozone in the atmosphere. Combustion in air forms mainly NO and some NO_2 (collectively termed 'NO_x') from the combination of atmospheric nitrogen and oxygen. NO_x is emitted from internal combustion engines as well as other forms of combustion and formed from natural sources such as lightning. NO_x is also a precursor to PM_{10} and $PM_{2.5}$.

9.2.20 PM_{10} and $PM_{2.5}$ is the fraction of particulate matter (dust) in the air with an average aerodynamic diameter of less than 10µm and 2.5µm, respectively. This size range of particulate matter can penetrate deep into the lungs and has been shown to have a range of adverse health effects. These include a causal association with cardiovascular and respiratory illnesses. According to the AQS, *'it is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health'* (Department for Environment, Food and Rural Affairs and the Devolved Administrations 2007, p.16). That is to say, scientific research cannot prove than human health is at less risk with smaller dose exposure. There is no proven safe threshold. In terms of harm, economically PM is costed as being more harmful as NO_2. PM is formed from both man-made and natural sources. Primary PM is formed from the incomplete combustion of fuel (e.g. soot from diesel exhausts), sea-salt and wind-blown dust. Secondary PM is formed in the atmosphere from other pollutants such as NOx and sulphur oxides, and in certain circumstances in photochemical smogs. PM has a residence time of several days in the atmosphere, so pollution events can occur in the UK when polluted air is blown from the continent.

9.2.21 Responsibility for determining whether AQOs are complied with lies with Local Authorities within the system of LAQM. This LAQM regime is under review by Defra. Currently, Local Authorities are required to review and assess air quality within their districts, against the AQOs. Where the AQOs are not being met at relevant locations, they must declare Air Quality Management Areas (AQMAs) and develop an Air Quality Action Plan (AQAP) setting out measures to work towards reducing the concentrations of the relevant pollutants to below the relevant AQOs. The given dates for compliance with the AQOs as described in the National AQS for England, Scotland, Wales and Northern Ireland have all now passed.

9.2.22 Pollutants such as benzene and 1,3 butadiene are associated with the use of fuels for road transport (petrol). The other pollutants are potentially associated with emissions from diesel combustion. However, based on review and assessment across the UK, DMRB specifies that there is no potential risk of exceedance of the AQO or significant impacts for any pollutants other than NO_2 and PM_{10} as a result of a road scheme.

Dust Nuisance

9.2.23 One of the main concerns regarding the air quality impact during construction is the potential of impacts from fugitive dust. There are no nationally recognised criteria defining levels of dust that can cause an annoyance.

9.2.24 Fugitive dust effects can be controlled under the Statutory Nuisance provisions of Part III of the Environmental Protection Act, 1990. Where required, best practice fugitive dust control measures outlined in the Institute of Air Quality Management (IAQM) guidance on the assessment of dust (Institute of Air Quality Management 2014) have been identified. This is associated with the construction phase of the scheme, and has not been assessed at this stage (DMRB Stage 2).

Construction Phase

9.2.25 Major construction projects can give rise to increased long-term and short-term PM_{10} concentrations. However, a construction impact assessment is not required for a DMRB Stage 2 assessment. It is likely that the potential impacts from the construction phase of any of the design options would be similar:

- There is the potential for dust nuisance upon human and ecological receptors within 200m of construction sites and haulage routes associated with the proposed Scheme.
- The construction phase could potentially result in an increase in HGV vehicle flows within the study area, and therefore increased pollutant concentrations at receptors, although these would be temporary in nature.

9.2.26 Best practice construction dust mitigation measures would be implemented for any of the route options, which would reduce any potential impacts to an acceptable level. Therefore, the construction impact of the route options has no influence upon the DMRB Stage 2 process. Once a preferred option has been decided, a construction impact assessment should be undertaken at the next stage of the assessment (DMRB Stage 3).

Operational Phase

Local Air Quality Modelling Methodology

9.2.27 The assessment of the potential air quality impacts of the route options has been undertaken using the Simple Assessment method, as detailed in Annex D of HA207/07.

9.2.28 The method consists of an excel spreadsheet model to carry out calculations to produce pollutant concentrations at representative receptor locations.

9.2.29 NO_2 concentrations were calculated using the NO_x to NO_2 calculator (v5.1) available through the Defra website.

Assessment Scenarios

9.2.30 This assessment consists of two different geographic scales:

- local air quality, focusing only on the headline pollutants of NOx, NO_2, PM_{10} and $PM_{2.5}$; and
- regional air quality, focusing on NO_x, PM_{10}, carbon dioxide (CO_2).

9.2.31 The assessment method is to quantify the ambient pollution concentrations and annual emissions for the road traffic scenarios as follows:

- Baseline Year (2014);
- Modelled Opening Year (2021) – Do-Minimum (without route option(s)); and

- Modelled Opening Year (2021) – Do Something (with route option(s))

9.2.32 As well as this, future scenarios (15 years after the modelled opening year) are also considered for the regional assessment:

- Design Year (2036) – Do-Minimum (without route option(s)) and Design Year (2036) – Do Something (with route option(s)).

9.2.33 Assessment of potential impacts at designated habitat sites would focus on NO_x concentrations and nitrogen deposition, at statutorily designated sites within 200m of 'affected roads' (refer to paragraph 9.2.36).

9.2.34 This options appraisal includes the assessment of the three alignment options with an A and B variant : 1A, 1B, 2A, 2B, 3A and 3B, as outlined in Part 1, Chapter 3 (Description of Route Options) of this Stage 2 report.

Study Area

9.2.35 The study area for the assessment of local air quality has been defined in line with the guidance contained in the Design Manual for Roads and Bridges DMRB Volume 11, Section 3, Part 1 HA207/07 (referred to hereafter as 'DMRB'). It comprises:

- all land within 200m of the centre line of the existing road;
- land within 200m of the centre line of the improvement scheme; and
- land within 200m of any other 'affected roads'.

9.2.36 'Affected roads' were identified by qualifying criteria published in DMRB, based on changes between DM and DS scenarios, that would occur as a result of the scheme being implemented, as follows:

- horizontal road alignment will change by 5m or more;
- daily traffic flows will change by more than 1,000 Annual Average Daily Traffic (AADT);
- Heavy Duty Vehicle (HDV) flows will change by more than 200 AADT;
- daily average speed will change by more than 10kph; or
- peak hour speed will change by more than 20kph.

9.2.37 Data from the traffic model described in paragraphs 9.2.38 to 9.2.40 has been used to define the study area, in line with these qualifying criteria. Figure 9.1 defines the air quality study area and constraints. The study area covers the Inshes to Smithton scheme, as well as sections of the wider local road network serving these areas.

Traffic Data

9.2.38 Traffic data for the modelling scenarios has been provided from the traffic models. The base year air quality modelling uses traffic data, pollution measurements and meteorological measurements from 2014.

9.2.39 Traffic data which represents the average conditions occurring as AADT was used for the assessment. The following traffic data parameters were provided:

- total AADT flow, defined as vehicles/day;
- percentage HDV; and
- vehicle speed, in kilometres per hour (kph).

9.2.40 IAN185/15 provides supplementary guidance to HA207/07 regarding traffic speeds and the generation of speed-band banding for vehicle emissions. The guidance note applies to Highways England schemes in England and is not directly applicable in Scotland. Transport Scotland has reviewed this guidance in relation to the Scheme, and as there are no Air Quality Management Areas (AQMAs) within the study area it has not been considered further within this assessment.

Background Concentrations

9.2.41 Scottish Air Quality and Defra provide empirically-derived national background maps, which provide estimates of background pollutant concentrations on a 1km x 1km grid square resolution. This model relates the National Atmospheric Emissions Inventory (Defra 2016b) to the national network of pollution measurements. Data for NO_x, NO_2 and PM_{10} have been obtained from Scottish Air, and $PM_{2.5}$ data obtained through Defra for The Highland Council area.

9.2.42 The 'in-grid square' contribution from road sectors have been removed from the background annual mean NO_x, PM_{10} and $PM_{2.5}$ concentration estimates, and background annual mean NO_2 estimates have been corrected using the Defra's Background NO_2 Calculator (Defra, 2016). This process has been undertaken to avoid double counting of road traffic emissions. The predicted background pollutant concentrations in the study area are well below the AQOs.

Verification and Adjustment

9.2.43 The simple assessment is used to predict the road traffic contributions to NO_x, PM_{10} and $PM_{2.5}$ concentrations at representative receptors. Adjustments are applied to the model predictions based on a comparison against measured air quality concentrations, in a process known as model verification and adjustment.

9.2.44 The calculated road contributions were adjusted to correct them against measured road components derived from air quality monitoring data from the Automatic Monitoring Station in Inverness, and data obtained through a diffusion tube survey. These adjustments followed the methodology set out in LAQM TG(16).

9.2.45 A total environmental concentration is then produced by the addition of the adjusted modelled road contribution to the background concentration.

9.2.46 In July 2011, Defra published a report examining the long-term air quality trends in NO_x and NO_2 concentrations (Defra 2011). This identified that there has been a clear decrease in NO_2 concentrations between 1996 and 2002. Thereafter, NO_2 concentrations have stabilised with little to no reduction between 2004 and 2014. The report presents a similar pattern for the change in NOx concentrations over the same time period. However, the stabilisation in concentration is not reflected in the emissions factors and modelling methodology. The report concluded the identification of a gap between current projected vehicle emission reductions and measurements on the annual rate of improvements in ambient air quality, which are built into the vehicle emission factors, and the projected background maps.

9.2.47 The current trends in air quality are based on measurements of emissions from the existing vehicle fleet. From September 2014, new vehicles need to comply with the more stringent Euro 6/VI emissions standards. Vehicles complying with the Euro 6/VI emissions standard are not yet present in the datasets used to analyse long-term air quality monitoring trends. If the Euro 6/VI fleet emissions perform as predicted, then this should lead to substantial reductions in predicted future roadside air quality concentrations.

9.2.48 An approach to adjust for this issue known as the Gap Analysis method, as set out in IAN170/12v3 (Highways Agency, Transport Scotland, Welsh Assembly Government and the Department of Regional Development for Northern Ireland 2013a) has been used in this assessment.

Receptors

9.2.49 Residential receptors have been identified that represent where the maximum potential impacts of the route options may occur. Building usage was determined using the Ordnance Survey Address Layer dataset, and calculations are made at the nearest façade to the busiest road.

9.2.50 A total of 48 residential receptors (within 200m of 'affected road' links, as defined in paragraph 9.2.36) were included in the assessment and were selected using professional judgement and are either close to the 'affected roads', or representative of the maximum impacts of a route option in that area. The identified receptors are shown on Figure 9.1 to 9.7.

9.2.51 It is understood that there are a number of consented planning applications within the study area. Some of these include consent for residential dwellings. These have the potential to increase the number of residential receptors within the study area. The representative receptors chosen within this assessment include receptors within or close to the relevant planning application boundaries.

Designated Sites

9.2.52 As well as the effect on human health, the route options may result in potential air quality impacts upon the natural environment. Concentrations of pollutants in air and deposition of nitrogen can damage vegetation directly or affect plant health and productivity. The pollutant of most concern for sensitive vegetation near roads is NO_x. Increases in concentrations of NO_x directly increase nitrogen deposition.

9.2.53 An assessment of designated sites within 200m of the affected roads has been undertaken from the methodology in Annex F of HA207/07. The sites included within the assessment are detailed in Table 9.5.

Table 9.5: Designated Sites

Ecological Site	Designation	APIS Priority Habitat Type
Longman and Castle Stuart Bays / Inner Moray Firth	Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar	Littoral Sediment

9.2.54 The assessment compares the current baseline situation, future baseline situation (DM) and the future situation with scheme (DS) for NO_x concentrations and nitrogen deposition (loads) where applicable.

9.2.55 In order to assess the risk of air pollution impacts to ecosystems Critical Loads (CL) and Critical Levels are used as benchmarks. This information has been obtained from the Air Pollution Information System (APIS) website (APIS 2016).

9.2.56 A transect point was measured from the boundary of the designated site to approximately the centreline of nearest affected road, and then further transect points at 10m increments up to 200m. The spreadsheet tool was used to calculate road NO_x contribution at each transect point. If the resulting NO_x concentration exceeds the AQO of 30 μg/m^3, further data calculations into the impact upon nitrogen deposition would be required.

Regional Assessment

9.2.57 A DMRB regional air quality assessment methodology has been undertaken for the study area. This is an estimate of the change in total emissions of PM_{10}, NO_x, and carbon dioxide (CO_2) per year from all vehicles on the affected roads. The assessment was undertaken using the Defra Emissions Factor Toolkit (v7) (Defra 2016), using the traffic data provided for each link, for each of the route options and for both the modelled year of opening (2021) and design year (2036). The results have then been compared with the NAEI national carbon emissions for road transport.

Impact Assessment and Significance

9.2.58 In order to convey the level of impact of the route options, it is necessary to determine significance. The significance of an environmental impact is a function of the sensitivity of the receptor and the scale or magnitude of the impact. All assessed receptors are considered of equal sensitivity.

9.2.59 Box 1.1 of LAQM TG(16) details that annual mean objectives should apply to 'all locations where members of the public might be regularly exposed, building facades of residential properties, schools, hospitals, care homes etc'.

9.2.60 As noted in LAQM TG(16), there is not a specific requirement to define sensitivity or importance of receptors when using the magnitude of change criteria. If the receptor is the façade of a residential building, it is assumed that any member of the public could be present within the building, including the elderly, infants, or other vulnerable groups. The sensitivity of dwellings, hospitals, schools etc are therefore assumed to be equal.

9.2.61 IAN174/13 (Highways Agency, Transport Scotland, Welsh Assembly Government and the Department of Regional Development for Northern Ireland 2013b) provides updated advice for evaluating significant local air quality effects. In line with this, the magnitude of change criteria for the assessment of air quality is provided in Table 9.6.

Table 9.6: Air Quality Magnitude of Change Criteria (AQO = Air Quality Strategy Objective)

Magnitude	Magnitude of Change (Annual Mean)		
	NO_2 (AQO: 40 µg/m^3)	PM_{10} (AQO: 18 µg/m^3)	$PM_{2.5}$ (AQO: 10 µg/m^3)
Imperceptible (<1% +/- of AQO)	<0.4 µg/m^3	<0.18 µg/m^3	<0.10 µg/m^3
Small (1-5% +/- of AQO)	0.4 – 2 µg/m^3	0.18 – 0.85 µg/m^3	0.10 – 0.50 µg/m^3
Medium (5-10% +/- of AQO)	2 – 4 µg/m^3	0.85 - 1.8 µg/m^3	0.50 - 1.0 µg/m^3
Large (>10% +/- of AQO)	>4 µg/m^3	>1.8 µg/m^3	>1.0 µg/m^3

9.2.62 Highways England has developed a framework to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values only, and are to be used to inform professional judgement on significant effects of the scheme. The guideline bands are based on the Highways England's considered opinion and are intended to help provide consistency across all highways schemes. The significance categories and guideline property numbers are summarised in Table 9.7.

Table 9.7: Guideline to Number of Receptors Constituting a Significant Effect

Magnitude of Change in Pollutant Concentration:	Number of Receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large	1 to 10	1 to 10
Medium	10 to 30	10 to 30
Small	30 to 60	30 to 60

9.2.63 The significance of the change is likely to be greater, the higher above the air quality thresholds the changes are predicted to occur. Where it is predicted that the short-term NO_2 and/or PM thresholds are exceeded, then more significance should be attributed to these effects.

9.2.64 The upper and lower bands presented are guidelines and not absolutes. On occasions when the number of properties affected is above the upper guideline band, consideration should be given to all the evidence that may support or detract from a conclusion of a significant effect when coming to a concluding view. The further above the upper guideline band the more likely local air quality effects would be significant.

9.2.65 Where the results reside between the lower and upper guideline bands for any of the magnitude criteria, then the proposed Scheme effects could be significant and a judgement is required taking into account the results for all six categories of small, medium and large benefit/worsening. This judgement is based on the technical knowledge and experience of the air quality professional.

9.2.66 Scheme effects are more likely to be significant where:

- there are no / few receptors with any improvements;
- PM annual averages are also affected by small, medium or large deteriorations; and
- short-term exceedances may be caused or worsened by the scheme for either NO_2 or PM.

9.2.67 Scheme effects are more likely to be not significant where:

- there are receptors with small, medium or large improvements;
- PM annual averages are not affected by small, medium or large deteriorations; and
- short-term exceedances are not caused or worsened by the Scheme for either NO_2 or PM.

9.2.68 The establishment of overall air quality significance for the Scheme should also consider:

- whether the Scheme detracts or supports measures set out in relevant local authority AQAPs;
- if the scheme represents a low or high compliance risk with the EU Directive on Ambient Air Quality; or
- if any designated site(s) are affected and potential effective mitigation.

9.2.69 With respect to the Air Quality Directive (European Union 2008), Defra reports annually (on behalf of the UK government) on the status of air quality to the EC. Highways England's compliance risk assessment test (IAN175/13) (Highways Agency 2013c) has been developed to enable decision makers to judge a scheme's likelihood of non-compliance with the EU Directive. The compliance risk assessment test also informs the local air quality significance test.

9.2.70 There is no government guidance published for assessing the significance of the effects of individual highway schemes on regional or greenhouse gas emissions.

9.2.71 The Climate Change (Annual Targets) (Scotland) Order 2010 (Scottish Government 2010) publishes budgets for the reduction of the emissions of greenhouse gases. However, total Scottish emissions are managed and considered at a national level not on a scheme by scheme basis.

Limitations

9.2.72 It should be emphasised that because the assessment is based on a series of spreadsheet tool models of future conditions, there is therefore a margin for error in the predictions made. The tools and information used are the best available information at the time. The methodology used provides a robust comparison of the route options for the DMRB Stage 2 assessment.

9.2.73 Elements of impact prediction (such as the specific concentration at a given receptor) or whether an exceedence of AQO would or would not occur at a specific location, should be taken as indicative rather than precise. However, the assessment process is considered to be based on the most reasonable, robust and representative methodologies taking advice from published guidance.

9.2.74 Sensitive receptors have been determined using Ordnance Survey Address Layer dataset. There may in some cases be properties, such as those recently built, which are not yet present within these data sources. Every endeavour will be made to identify and consider any such properties during the next stage of assessment (DMRB Stage 3).

9.3 Policies and Plans

9.3.1 National planning policy on a variety of themes is contained within Scottish Planning Policy (SPP) (Scottish Government, 2014). In terms of the impact of proposals on air quality, SPP is focussed on:

- promoting sustainable development;
- encouraging decision making to take into account the implications of development for water, air and soil quality;
- supporting healthier living by improving the quality of the built environment and by addressing environmental problems affecting communities; and
- adapting to climate change, and in particular reducing emissions of the greenhouse gases that contribute to it.

9.3.2 Circulars and PANs produced by the Scottish Government provide further guidance on specific topics. PAN 51 (Planning, Environmental Protection and Regulation, Revised 2006) is applicable to air quality impacts.

9.3.3 Part 6 (Appendices), Appendix A8.1 (Planning Policy Context for Environmental Assessment) of this report describes the planning policies and guidance from national to local level which are relevant to Air Quality. An assessment of the compliance of the route options against all development plan policies relevant to this environmental topic is reported in Part 6 (Appendices), Appendix A8.2 (Assessment of Development Plan Policy Compliance) and a summary overview is provided in Chapter 8 (Policies and Plans), Section 8.4 (Compliance with Policies and Plans).

9.3.4 In addition, the Scottish Executive published the Air Quality and Land Use Planning (Scottish Executive 2004) guidance document which provides advice on LAQM which should be read in conjunction with PAN 51.

Regional Air Quality

9.3.5 SPP notes that decision making in the planning system should contribute to the reduction in greenhouse gasses in line with the targets set in the Climate Change (Scotland) Act 2009. The Act sets a target of an 80% reduction in emissions by 2050 and an interim target of a 42% reduction by 2020 for Scotland. The design of new development should address the causes of climate change my minimising carbon and other greenhouse gas emissions. Annual targets for 2010 – 2022 are set out in the Climate Change (Annual Targets) (Scotland) Order 2010 (Scottish Government 2010).

9.4 Baseline Conditions

9.4.1 A review and assessment of the current air quality information in the vicinity of the route options has been undertaken to establish a 'baseline' situation by which the assessment results can be compared to. This has included a desk-based review of Local Authority reports (under LAQM), a review of the latest air quality monitoring, together with air quality background mapping produced by Defra.

The Highland Council

9.4.2 Under Part IV of the Environment Act 1995, and the establishment of SEPA, the Government introduced LAQM, which placed duties on local authorities to undertake periodic reviews of air quality in their areas to assess present and likely future air quality against the AQS objectives.

Where these objectives are not likely to be met, the local authority must designate an AQMA, and produce an action plan for improvement in air quality.

9.4.3 The study area falls within the local authority area of The Highland Council. The latest LAQM report, the 2015 Updating and Screening Assessment (The Highland Council 2016) has been obtained and reviewed.

9.4.4 The report summarises previous rounds of LAQM assessments, and concludes that air quality in The Highland Council area is good, but that previous rounds of review and assessment have identified an area of Inverness City Centre with poorer air quality, and as such, an AQMA has been declared. The required Action Plan was due to be published in 2016. The report concluded that no detailed assessment was required for any pollutants. The AQMA is to the west of the assessment area, and none of the proposed route options will have a significant effect on the AQMA.

Automatic Monitoring Data

9.4.5 The Highland Council operate a Continuous Monitoring Station (CMS) on Telford Street, Inverness, 4m from the A862 (3.5km to the west of the scheme), which monitors NO_x, NO_2, PM_{10} and $PM_{2.5}$. The relevant monitoring data is presented in Table 9.8.

Table 9.8: Automatic Monitoring Station Data: Telford Street, Inverness (The Highland Council)

Telford Street Station	Grid Reference	2010 µg/m^3	2011 µg/m^3	2012 µg/m^3	2013 µg/m^3	2014 µg/m^3	Data Capture 2014
NO_2	265709, 845670	24.5	27.0	29.2	21.0	21.0	99.3%
PM_{10}		14.0	11.8	11.0	11.7	11.0	98.7%

9.4.6 The CMS results indicate NO_2 and PM_{10} concentrations within the relevant AQOs. $PM_{2.5}$ data is not yet available from The Highland Council.

Non-automatic Monitoring Data

9.4.7 The Highland Council operate 10 passive NO_2 diffusion tubes across both Inverness and Dingwall. The locations and positioning of these tubes have been reviewed with regard to using the data as background concentrations for the assessment, and to feed into the assessment verification process. The review concluded:

- Inverness: The diffusion tubes were located along the main streets within Inverness town centre, and in areas where taller buildings would create a ‘street canyon’ whereby pollutant concentrations tend to be higher due to the reduced level of dispersion where tall buildings are present. This type of monitoring location was not thought to be representative of the semi-rural nature of the study area, and was not included as part of the assessment.
- Dingwall: The two relevant diffusion tube locations are classified as ‘urban backgrounds’ within Dingwall town and are not suitable for model verification.

9.4.8 As part of the current assessment, a 6-month passive diffusion tube survey was undertaken at 15 locations around the proposed scheme, together with a co-location at the Telford Street continuous monitoring station in Inverness City Centre (with permission from Highland Council). The survey provides good data capture in most areas, and the results were bias adjusted and annualised for 2016 (in line with TG(16) guidance). Table 9.9 provides a summary of the calculated diffusion tube results.

Table 9.9: NO2 Diffusion Tube Results : Annualised 2016 NO2 Concentrations

Tube ID	Location	X	Y	Data Capture (%)	Annualised/ Bias Adjusted 2016 Conc (µg/m^3)
01	Milburn Crossing	268164	845784	100	24.7
02	Kintail House	268797	844588	100	21.0
03	Briargrove Cresent	268982	843989	100	7.3
04	Culloden Road	269291	844421	100	13.9
05	Simpsons Garden Centre (B9006)	269612	844182	100	17.5
06	A96 Tesco	268918	845702	50	26.3
07	Cradlehall Meadows	270030	844853	100	7.1
08	Sinclair Park	271142	845657	83	7.8
09	Barnchurch Road	270591	846056	100	11.5
10	Barnchurch Road Roundabout	270262	846327	100	23.6
11	Eastfield Way	269441	845357	100	10.9
12	Inshes Church	268749	844004	100	13.9
13	Culloden Road 2 (B9006)	270432	844193	100	14.8
14	Barnchurch Road/Ferntower Avenue	271884	846039	67	11.9
CMS	Co-location at Telford Street Continuous Monitor	265708	845668	100	21.8

9.4.9 The results showed NO_2 concentrations within the relevant AQOs. The data was then adjusted to 2014 concentrations, and used in the verification review of the assessment models. Table 9.9 provides a summary of the calculated diffusion tube results.

Assessed Baseline Concentrations

9.4.10 The air quality study area is defined by the traffic changes predicted to result from the route options. At the receptor locations, estimates were made using DMRB spreadsheet processes to determine the air quality situation was in the base year (2014); this is taken to represent the current air quality situation at these locations.

9.4.11 A total of 48 receptors were included in the assessment and those predicted to receive the top 10 highest pollutant concentrations across each option are detailed within the data tables in this chapter. Estimated baseline annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations are presented in Table 9.10.

Table 9.10: Baseline (2014) Concentrations at Selected Receptors

ID	Address	Base Concentration (Annual Average) (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
R110	Millburn Crossing, Millburn Road, Inverness, IV2 3TR	36.3	12.7	8.9
R111	1A, Culcabock Road, Inverness, IV2 3XW	20.0	9.0	6.6
R113	18, Balmoral Terrace, Inverness, IV2 3UU	23.5	9.7	7.1
R114	34, Culcabock Road, Inverness, IV2 3XQ	27.2	10.2	7.5
R123	5, Drumossie Avenue, Inverness, IV2 3SL	27.3	10.3	7.5
R129	29, Woodgrove Crescent, Inverness, IV2 5HN	18.3	9.1	6.7
R132	6A Inshes Holdings, Inverness, IV2 5BA	23.4	10.6	7.6

ID	Address	Base Concentration (Annual Average) (µg/m³)		
		NO_2	PM_{10}	$PM_{2.5}$
R133	7 Inshes Holdings, Inverness, IV2 5BA	23.9	10.9	7.8
R134	7a Inshes Holdings, Inverness, IV2 5BA	25.7	10.1	7.4
R135	11 Woodgrove Cresent, Inverness, IV2 5HN	18.6	9.2	6.8

9.4.12 The results show that the modelled receptors are well below the NO_2 annual mean AQO (40µg/m³) in the base year. Receptor R110 (Milburn Crossing) shows the highest NO_2 concentration of 36.3µg/m³. No receptors approach the 1 hour mean AQO of 60µg/m³.

9.4.13 None of the receptors approach the PM_{10} annual mean AQO of 18µg/m³, or are expected to exceed the 24 hour mean AQO because the modelled annual mean concentrations are less than 22.4µg/m³. All receptors are also within the relevant $PM_{2.5}$ AQO in the base year.

9.4.14 PM_{10} and $PM_{2.5}$ results are presented within each of the discussion regions, but are not discussed further.

9.5 Impact Assessment

Construction Impact Assessment

9.5.1 Best practice construction dust mitigation measures would be implemented for any of the route options, which would reduce any potential impacts to an acceptable level. Therefore, the construction impact of the design options has no influence upon the DMRB Stage 2 process.

9.5.2 Once a preferred option has been decided, and more information is available regarding the construction phrase, potential site compounds, and haulage routes, a construction impact assessment will be undertaken at the next stage of the assessment (DMRB Stage 3).

Operational Impact Assessment

9.5.3 There are no predicted exceedances of the NO_2 annual mean AQO in either the DM or DS scenario for any of the 48 receptors assessed, in any of the 1A, 1B, 2A, 2B, 3A and 3B route options.

9.5.4 PM_{10} and $PM_{2.5}$ concentrations are also not predicted to exceed the relevant AQOs (18 µg/m³ for PM_{10}, 10 µg/m³ for $PM_{2.5}$) in the DM or DS scenarios at any receptor locations, for any of the route options. PM_{10} and $PM_{2.5}$ concentrations are presented in the tables below, but are not discussed further.

Option 1A

9.5.5 The operational impact results for Option 1A are presented in Table 9.11, and include annual mean concentrations (for the Opening Year 2021) for NO_2, PM_{10} and $PM_{2.5}$ in the DM and DS scenario, together with the change as a result of Option 1A.

Table 9.11: Operational Impacts at Selected Receptors (Option 1A)

Option 1A	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do-Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R110	31.1	12.4	8.4	30.7	12.3	8.3	-0.4	-0.1	-0.1
R111	14.9	8.4	6.1	14.3	8.3	6.0	-0.7	-0.1	-0.1
R113	17.9	9.2	6.6	17.2	9.0	6.5	-0.7	-0.2	-0.1
R114	20.4	9.5	6.8	19.7	9.4	6.7	-0.7	-0.1	-0.1
R123	20.2	9.5	6.8	20.2	9.5	6.8	0.0	0.0	0.0
R129	13.8	8.6	6.3	16.9	9.6	6.8	3.1	1.0	0.5
R132	19.6	10.3	7.2	17.3	9.9	6.9	-2.4	-0.4	-0.3
R133	19.8	10.6	7.3	17.8	10.2	7.1	-2.0	-0.4	-0.2
R134	19.8	9.6	6.8	18.5	9.3	6.7	-1.3	-0.3	-0.1
R135	14.3	8.7	6.4	16.8	9.5	6.8	2.6	0.8	0.4

9.5.6 None of the receptors are predicted to experience an exceedance of the AQOs with Option 1A in operation. Figure 9.2 presents the change in NO_2 concentrations (DS-DM) for Option 1A.

9.5.7 The largest increase in concentration is at Receptor 129, with a medium increase in NO_2 of 3.1µg/m³. The receptor is close to the start of the proposed new alignment, and therefore exposed to a greater level of emissions.

9.5.8 The largest decrease is predicted at Receptor 132, with a medium decrease in NO_2 of 2.4 µg/m³. This is likely to be from traffic being re-assigned with the scheme in place.

9.5.9 The highest concentration is at R110. With Option 1A in operation, NO_2 concentrations at this receptor are reduced by 0.4µg/m³.

<u>Option 1B</u>

9.5.10 The operational impact results for Option 1B are presented in Table 9.12, and include annual mean concentrations (for the Opening Year 2021) for NO_2, PM_{10} and $PM_{2.5}$ in the DM and DS scenario, together with the change as a result of Option 1B.

Table 9.12: Operational Impacts at Selected Receptors (Option 1B)

Option 1B	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R110	31.1	12.4	8.4	30.7	12.3	8.3	-0.4	-0.1	-0.1
R111	14.9	8.4	6.1	14.3	8.3	6.0	-0.7	-0.1	-0.1
R113	17.9	9.2	6.6	17.2	9.0	6.5	-0.7	-0.2	-0.1
R114	20.4	9.5	6.8	19.7	9.4	6.7	-0.7	-0.1	-0.1
R123	20.2	9.5	6.8	20.2	9.5	6.8	0.0	0.0	0.0
R129	13.8	8.6	6.3	16.9	9.6	6.8	3.1	1.0	0.5
R132	19.6	10.3	7.2	17.3	9.9	6.9	-2.4	-0.4	-0.3

Option 1B	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
R133	19.8	10.6	7.3	17.8	10.2	7.1	-2.0	-0.4	-0.2
R134	19.8	9.6	6.8	18.5	9.3	6.7	-1.3	-0.3	-0.1
R135	14.3	8.7	6.4	16.8	9.5	6.8	2.6	0.8	0.4

9.5.11 None of the receptors are predicted to experience an exceedance of the AQOs with Option 1B in operation. Figure 9.3 presents the change in NO_2 concentrations (DS-DM) for Option 1B.

9.5.12 The largest increase in concentration is at Receptor 129, with a medium increase in NO_2 of 3.1 µg/m³. The receptor is close to the start of the proposed new alignment, and therefore exposed to a greater level of emissions.

9.5.13 The largest decrease is predicted at Receptor 132, with a medium decrease in NO_2 of 2.4 µg/m³. This is likely to be from traffic being re-assigned with the scheme in place.

9.5.14 The highest concentration are at R110. With Option 1B in operation, NO_2 concentrations at this receptor are reduced by 0.4µg/m³.

<u>Option 2A</u>

9.5.15 The operational impact results for Option 2A are presented in Table 9.13, and include annual mean concentrations (for the Opening Year 2021) for NO_2, PM_{10} and $PM_{2.5}$ in the DM and DS scenario, together with the change as a result of Option 2A.

Table 9.13: Operational Impacts at Selected Receptors (Option 2A)

Option 2A	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do-Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
R110	31.1	12.4	8.4	31.1	12.4	8.4	0.0	0.0	0.0
R111	14.9	8.4	6.1	14.3	8.3	6.0	-0.6	-0.1	-0.1
R113	17.9	9.2	6.6	17.5	9.1	6.6	-0.5	-0.1	0.0
R114	20.4	9.5	6.8	19.8	9.4	6.7	-0.6	-0.1	-0.1
R123	20.2	9.5	6.8	20.0	9.5	6.8	-0.3	0.0	0.0
R129	13.8	8.6	6.3	18.2	10.0	7.0	4.4	1.4	0.7
R132	19.6	10.3	7.2	15.5	9.7	6.8	-4.2	-0.6	-0.4
R133	19.8	10.6	7.3	15.7	9.7	6.8	-4.0	-0.9	-0.5
R134	19.8	9.6	6.8	17.6	9.1	6.6	-2.3	-0.5	-0.2
R135	14.3	8.7	6.3	17.8	9.8	6.9	3.6	1.1	0.6

9.5.16 None of the receptors are predicted to experience an exceedance of the AQOs with Option 2A in operation. Figure 9.4 presents the change in NO_2 concentrations (DS-DM) for Option 2A.

9.5.17 The largest increase in concentration is at Receptor 129, with a large increase in NO_2 of 4.4 µg/m^3. The receptor is close to the start of the proposed new alignment, and therefore exposed to a greater level of emissions.

9.5.18 The largest decrease is predicted at Receptor 132, with a large decrease in NO_2 of 4.2 µg/m^3. This receptor is close to the A9, with a slip road which will be removed (and the traffic re assigned) with Option 2A.

9.5.19 The highest concentration are at R110. With Option 2A in operation, NO_2 concentrations at this receptor will remain the same.

Option 2B

9.5.20 The operational impact results for Option 2B are presented in Table 9.14, and include annual mean concentrations (for the Opening Year 2021) for NO_2, PM_{10} and $PM_{2.5}$ in the DM and DS scenario, together with the change as a result of Option 2B.

Table 9.14: Operational Impacts at Selected Receptors (Option 2B)

Option 2B	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m^3)			Do-Something (DS) Concentration (Annual Average 2021) (µg/m^3)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m^3)		
Receptor	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
R110	31.1	12.4	8.4	31.1	12.4	8.4	0.0	0.0	0.0
R111	14.9	8.4	6.1	14.3	8.3	6.0	-0.6	-0.1	-0.1
R113	17.9	9.2	6.6	17.5	9.1	6.6	-0.5	-0.1	0.0
R114	20.4	9.5	6.8	19.8	9.4	6.7	-0.6	-0.1	-0.1
R123	20.2	9.5	6.8	20.0	9.5	6.8	-0.3	0.0	0.0
R129	13.8	8.6	6.3	18.2	10.0	7.0	4.4	1.4	0.7
R132	19.6	10.3	7.2	15.5	9.7	6.8	-4.2	-0.6	-0.4
R133	19.8	10.6	7.3	15.7	9.7	6.8	-4.0	-0.9	-0.5
R134	19.8	9.6	6.8	17.6	9.1	6.6	-2.3	-0.5	-0.2
R135	14.3	8.7	6.3	17.8	9.8	6.9	3.6	1.1	0.6

9.5.21 None of the receptors are predicted to experience an exceedance of the AQOs with Option 2B in operation. Figure 9.5 presents the change in NO_2 concentrations (DS-DM) for Option 2B.

9.5.22 The largest increase in concentration is at Receptor 129, with a large increase in NO_2 of 4.4 µg/m^3. The receptor is close to the start of the proposed new alignment, and therefore exposed to a greater level of emissions.

9.5.23 The largest decrease is predicted at Receptor 132, with a large decrease in NO_2 of 4.2 µg/m^3. This receptor is close to the A9, with a slip road which will be removed (and the traffic re assigned) with Option 2B.

9.5.24 The highest concentration are at R110 and R134. With Option 2A in operation, NO_2 concentrations at this receptor will remain the same.

Option 3A

9.5.25 The operational impact results for Option 3A are presented in Table 9.15, and include annual mean concentrations (for the Opening Year 2021) for NO_2, PM_{10} and $PM_{2.5}$ in the DM and DS scenario, together with the change as a result of Option 3A.

Table 9.15: Operational Impacts at Selected Receptors (Option 3A)

Option 3A	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do-Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R110	31.1	12.4	8.4	31.3	12.4	8.4	0.2	0.0	0.0
R111	14.9	8.4	6.1	14.7	8.4	6.1	-0.2	0.0	0.0
R113	17.9	9.2	6.6	17.7	9.1	6.6	-0.3	-0.1	0.0
R114	20.4	9.5	6.8	20.2	9.4	6.8	-0.2	-0.1	0.0
R123	20.2	9.5	6.8	20.3	9.5	6.8	0.0	0.0	0.0
R129	13.8	8.6	6.3	13.8	8.6	6.3	0.0	0.0	0.0
R132	19.6	10.3	7.2	18.4	10.1	7.0	-1.2	-0.2	-0.2
R133	19.8	10.6	7.3	19.8	10.5	7.3	0.0	-0.1	0.0
R134	19.8	9.6	6.8	21.1	9.8	7.0	1.3	0.2	0.2
R135	14.3	8.7	6.3	14.4	8.8	6.4	0.1	0.1	0.1

9.5.26 None of the receptors are predicted to experience an exceedance of the AQOs with Option 3A in operation. Figure 9.6 presents the change in NO_2 concentrations (DS-DM) for Option 3A.

9.5.27 The largest increase in concentration is at Receptor 134, with a small increase in NO_2 of 1.3 µg/m³; this receptor also has the highest concentration. The receptor is close to the proposed route option alignment, and therefore exposed to a greater level of emissions.

9.5.28 The largest decrease is predicted at Receptor 132, with a small decrease in NO_2 of 1.2 µg/m³. This is likely to be from traffic being re-assigned with the scheme in place.

Option 3B

9.5.29 The operational impact results for Option 3B are presented in Table 9.16, and include annual mean concentrations (for the Opening Year 2021) for NO_2, PM_{10} and $PM_{2.5}$ in the DM and DS scenario, together with the change as a result of Option 3B.

Table 9.16: Operational Impacts at Selected Receptors (Option 3B)

Option 3B	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do-Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R110	31.1	12.4	8.4	31.3	12.4	8.4	0.2	0.0	0.0
R111	14.9	8.4	6.1	14.7	8.4	6.1	-0.2	0.0	0.0
R113	17.9	9.2	6.6	17.7	9.1	6.6	-0.3	-0.1	0.0
R114	20.4	9.5	6.8	20.2	9.4	6.8	-0.2	-0.1	0.0

Option 3B	Do-Minimum (DM) Concentration (Annual Average 2021) (µg/m³)			Do-Something (DS) Concentration (Annual Average 2021) (µg/m³)			Change in Concentration (Annual Average 2021) (DS-DM) (µg/m³)		
Receptor	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R123	20.2	9.5	6.8	20.3	9.5	6.8	0.0	0.0	0.0
R129	13.8	8.6	6.3	13.8	8.6	6.3	0.0	0.0	0.0
R132	19.6	10.3	7.2	18.4	10.1	7.0	-1.2	-0.2	-0.2
R133	19.8	10.6	7.3	19.8	10.5	7.3	0.0	-0.1	0.0
R134	19.8	9.6	6.8	21.1	9.8	7.0	1.3	0.2	0.2
R135	14.3	8.7	6.3	14.4	8.8	6.4	0.1	0.1	0.1

9.5.30 None of the receptors are predicted to experience an exceedance of the AQOs with Option 3B in operation. Figure 9.7 presents the change in NO_2 concentrations (DS-DM) for Option 3B.

9.5.31 The largest increase in concentration is at Receptor 134, with a small increase in NO_2 of 1.3 µg/m³; this receptor also has the highest concentration. The receptor is close to the proposed route option alignment, and therefore exposed to a greater level of emissions.

9.5.32 The largest decrease is predicted at Receptor 132, with a small decrease in NO_2 of 1.2 µg/m³. This is likely to be from traffic being re-assigned with the scheme in place

Regional Assessment

9.5.33 The results for the regional assessment for Opening Year 2021 are shown in Table 9.17. Traffic data used in the assessment is the same for the A and B route option variants. The results are therefore the same, so have therefore been presented together.

Table 9.17: Regional Air Quality Assessment (Opening Year 2021)

		Annual Regional Emission in kg or tonnes				
		Base 2014	DM 2021	DS 2021	Change (DS-DM)	% of 2014 NAEI National Road Transport
Option 1A / 1B						
NO_x	*kg/yr*	48,696	37,281	38,978	1,698	0.001%
PM_{10}	*kg/yr*	3,978	5,164	5,503	338	0.002%
CO_2	*tonnes/yr*	17,529	24,413	25,544	1,130	0.001%
Option 2A / 2B						
NO_x	*kg/yr*	48,696	37,294	39,046	1,751	0.001%
PM_{10}	*kg/yr*	3,978	5,167	5,511	344	0.002%
CO_2	*tonnes/yr*	17,529	24,422	25,600	1,178	0.001%
Option 3A / 3B						
NO_x	*kg/yr*	48,696	37,294	37,306	12	0.0000%
PM_{10}	*kg/yr*	3,978	5,167	5,210	43	0.0002%
CO_2	*tonnes/yr*	17,529	24,422	24,502	80	0.0001%

9.5.34 For Options 1A, 1B, 2A and 2B, the results for the Opening Year (2021) indicate increases in NO_x, PM_{10} and CO_2 compared with the DM scenario.

9.5.35 For Options 3A and 3B, the results for the Opening Year (2021) indicate increases in NO_x, PM_{10} and CO_2 compared with the DM scenario, but to a lesser extent than the other options.

9.5.36 There is no government guidance published for assessing the significance of effects of individual highway schemes on regional or greenhouse gas emissions. This is addressed at a national, rather than scheme level. However, to provide context, the increase in emissions has been compared with the 2014 NAEI national carbon contribution for road transport (a total of 26,901 kilotonnes per year). The database does not project forward to future years. 2014 has been used as the latest dataset.

9.5.37 As shown in Table 9.17, the increase in carbon emissions from the proposed Scheme are very low in comparison to the national emissions figure. In turn, the national road transport contribution is 23% of the overall carbon emissions (for all groups) of 115,928 kilotonnes for 2014.

9.5.38 The results for the regional assessment for Design Year 2036 are shown in Table 9.18. As above, traffic data in the assessment is the same for the A and B route option variants. The results are therefore the same, and have been presented together.

Table 9.18: Regional Air Quality Assessment (Design Year 2036)

		Annual Regional Emission in kg or tonnes				
		Base 2014	DM 2036	DS 2036	Change (DS-DM)	Change as % of 2014 NAEI National Road Transport
Option 1A / 1B						
NO_x	*kg/yr*	48,696	26,559	28,483	1,924	0.001%
PM_{10}	*kg/yr*	3,978	5,752	6,317	565	0.003%
CO_2	*tonnes/yr*	17,529	26,774	28,676	1,901	0.002%
Option 2A / 2B						
NO_x	*kg/yr*	48,696	26,574	28,550	1,976	0.001%
PM_{10}	*kg/yr*	3,978	5,755	6,357	602	0.003%
CO_2	*tonnes/yr*	17,529	26,788	28,825	2,037	0.002%
Option 3A / 3B						
NO_x	*kg/yr*	48,696	26,574	26,759	185	0.0001%
PM_{10}	*kg/yr*	3,978	5,755	5,875	119	0.0006%
CO_2	*tonnes/yr*	17,529	26,788	27,054	267	0.0002%

9.5.39 For Options 1A, 1B, 2A and 2B, the results for the Design Year (2036) indicate increases in NO_x, PM_{10} and CO_2 compared with the DM scenario.

9.5.40 For Options 3A and 3B, the results for the Design Year (2036) indicate increases in NO_x, PM_{10} and CO_2 compared with the DM scenario, but to a lesser extent than the other options.

9.5.41 There is no government guidance published for assessing the significance of effects of individual highway schemes on regional or greenhouse gas emissions. This is addressed at a national, rather than scheme level. However, to provide context, the increase in emissions has been compared with the 2014 NAEI national carbon contribution for road transport (a total of 26,901 kilotonnes per year). The database does not project forward to future years. 2014 has been used as the latest dataset.

9.5.42 As shown in Table 9.18, the increase in carbon emissions from the scheme are very low in comparison to the national emissions figure. In turn, the national road transport contribution is 23% of the overall carbon emissions (for all groups) of 115,928 kilotonnes for 2014.

Designated Sites Assessment

9.5.43 An assessment of ecological receptors has been undertaken for Longman and Castle Stuart Bays SSSI. Transect points measured from the boundary of the SSSI to approximately the centreline of the nearest affected road (and then further transect point at 10m increments to 200m) were included as receptor points within the modelling assessment.

9.5.44 The results showed the closest transect with NOx concentrations below $30\mu g/m^3$ in the DM scenario in all route option scenarios. Concentrations were reduced in the DS scenarios. All other transect points were within $30\mu g/m^3$ in both DM and DS scenarios. This area of the SSSI was confirmed to be not sensitive to nitrogen, and that the APIS priority habitat was not present at this location. Further calculations of deposition were therefore not required.

9.5.45 The air quality impact of the scheme upon designated sites is therefore considered not significant.

9.6 Potential Mitigation

9.6.1 Following the air quality assessment, no mitigation measures are required for the operational phase of the scheme for any of the proposed option designs.

9.7 Summary of Route Options

9.7.1 It is predicted that the scheme would lead to small and large magnitude changes in NO_2 concentrations at receptors. However, none of the representative receptors assessed are in exceedance of the NO_2, PM_{10}, and $PM_{2.5}$ AQOs.

9.7.2 The judgement of significant effects is only required for receptors that exceed the AQOs. Therefore, the route options would not have a significant effect upon local air quality.

9.7.3 However, in order to provide a comparison of the route options, a summary of the number of receptors that see an increase, decrease or no change in NO2 concentrations for each of the route options is presented in Table 9.19.

Table 9.19: Summary of Proposed Route Options

Proposed Route Option	No. of Receptors Predicted to Experience an Improvement in Air Quality	No. of Receptors Predicted to Experience a Reduction in Air Quality	No. of Receptors Predicted to Experience No Change in Air Quality
Option 1A	22	22	4
Option 1B	22	25	1
Option 2A	23	21	4
Option 2B	23	23	2
Option 3A	23	21	4
Option 3B	23	23	2

9.7.4 It is predicted that all options would lead to small and large magnitude changes in NO_2 concentrations at receptors, but these receptors are not in exceedance of the NO_2, PM_{10}, and $PM_{2.5}$ AQOs. Table 9.19 is provided to illustrate the similarity between the route options in terms of air quality, and that air quality should not be a factor in the preferred route selection.

9.7.5 There is no government guidance published for assessing the significance of the effects of individual highway schemes on regional or greenhouse gas emissions. The regional assessment results show percentage increases in NO_x, CO_2 and PM_{10} emissions as a result of all route options, with relatively similar results for the Opening and Design Year assessments. The comparison with NAEI 2014 national carbon emissions indicates that the air quality impact of the scheme is not significant. The air quality impact upon designated sites is also considered not significant.

9.8 Scope of DMRB Stage 3 Assessment

9.8.1 The DMRB Stage 3 Assessment should include detailed air quality dispersion modelling of the preferred option. This should include local air quality sensitive receptors, any potential ecological receptors, a construction dust impact assessment, as well as an assessment of regional air quality impacts.

9.9 References

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