14 AIR QUALITY

14.1 INTRODUCTION

This chapter presents the findings of an assessment of the potential air quality effects of the proposals during construction and operation. For both stages the type, source and significance of the potential impacts are identified, the measures that would be employed to minimise these impacts are described and residual effects discussed.

The assessment has been carried out in accordance with the assessment procedure given in the Design Manual for Roads and Bridges (DMRB)[176] and associated guidance including Scottish Transport Analysis Guidance (STAG)[177].

The findings of the DMRB Stage 2 air quality assessment undertaken for this scheme in 1997 were that the route options considered would result in a beneficial impact on local air quality. Since the assessment was completed the 'with' and 'without development' traffic flows for the scheme have changed as shown by updated traffic count data collected in September 2006. Furthermore, since the Stage 2 DMRB assessment was produced the DMRB assessment methodology and spreadsheet tools have been updated. Therefore, an air quality assessment has been undertaken as part of the EIA for the scheme to update the assessment of the predicted impacts of the chosen route option and confirm that the previous conclusions remain valid.

An air quality assessment of the potential construction phase impacts has been undertaken as these were not considered as part of previous studies.

Appendix 14.1 provides a glossary of air quality terms used in this chapter.

14.2 LEGISLATIVE FRAMEWORK

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland[178]. The AQS sets standards and objectives for nine main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs).

Pollutants 'standards' relate to ambient pollutant concentrations in air and are set on the basis of medical and scientific evidence of how each pollutant affects human health. Pollutant 'objectives', however, are future dates by which each standard is to be achieved, taking into account economic considerations, practicability and technical feasibility.

Many of the objectives have been made statutory in Scotland with the Air Quality (Scotland) Regulations[179] and the Air Quality (Scotland) (Amendment) Regulations 2002[180].

[176] Volume 11, Section 3, Part 1 Air Quality (Highways Agency, May 2007)
[177] Scottish Transport Appraisal Guidance (STAG) (Transport Scotland, September 2006)
[178] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2) July 2007
[179] The Air Quality (Scotland) Regulations 2000, Scottish Statutory Instrument 2000 No.97
[180] The Air Quality (Scotland) Amendment Regulations 2002, Scottish Statutory Instrument 2002 No. 297

The standards and objectives for the pollutants most relevant to this assessment, as they are the main pollutants associated with emissions from road traffic, are summarised in Table 14.1.

Table 14.1: Relevant Air Quality Standards and Objectives[181]

Pollutant	Objective	Concentration measured as	Date to be achieved
Nitrogen dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1 hour mean	31 December 2005 and thereafter
	40µg/m^3	Annual mean	31 December 2005 and thereafter
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 7 times a year	24 hour mean	31 December 2010 and thereafter
	18µg/m^3	Annual mean	31 December 2010 and thereafter

At relatively high concentrations, NO_2 causes inflammation of the airways and there is evidence to show that long-term exposure to this pollutant may affect lung function and that exposure to this gas can enhance the response to allergens in sensitised individuals. Particulate matter is associated with a range of health effects including effects on the respiratory and cardiovascular systems, asthma and mortality.

There are no statutory standards or objectives relating to nuisance dust, however, under the Environmental Protection Act (1990) a local authority must serve an abatement notice where a statutory nuisance is identified.

Local Air Quality Management

Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives by the years defined in the Regulations. Where the objectives of the Air Quality Regulations are not likely to be achieved by the objective year, an authority is required to designate an Air Quality Management Area (AQMA)[182]. For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

Stirling Council has not declared any AQMAs within its area as concentrations of all pollutants assessed as part of their review and assessment work were found to be in compliance with the relevant objectives.

[181] DEFRA, July 2007. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

[182] An area designated because it has not met air quality objectives set out in the Air Quality (Scotland) Regulations and the Air Quality (Scotland) (Amendment) Regulations 2002

14.3 SOURCES OF INFORMATION

The following information was used to complete the assessment:

- Review and Assessment Reports produced by Stirling Council[183] , which were reviewed to gain an understanding of local air quality in the area of the scheme;
- air quality data for the area surrounding the site, including data from the UK Air Quality Archive[184];
- maps to confirm the location of nearby properties that may be sensitive to changes in local air quality; and
- traffic flow data provided by Grontmij.

14.4 CONSULTATIONS

The Environmental Health Department at Stirling Council was consulted on the scope and approach to the assessment. The Council was in support of the approach to the proposed assessment (see Annex A).

14.5 BASELINE

Local Monitoring Data

No monitoring of pollution concentrations has been undertaken by Stirling Council close to the study corridor. This is because air quality in this area is good i.e. considerably below the relevant AQS standards and objectives and therefore there has been no need to gather detailed information on precise pollution levels to support management measures to improve air quality.

Air quality within the study corridor will be mainly influenced by traffic using the A82 (north and south of Crianlarich) and the A85. Background concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10}) taken from the UK Air Quality Archive Website are given in Table 14.2. Concentrations given in the table are for OS grid location (238500, 725500)[185] and exclude the contribution to background concentrations from A roads within the grid square to avoid double counting with the modelling output. Data for this location have been used as review of the background concentration data for the grid squares covering the study area showed that there was very little variation in background concentrations across the area under consideration. Data for the chosen grid square approximately represents the average background concentrations over the study area. Background concentrations of oxides of nitrogen (NO_X) are also given as these were used in the calculations undertaken in the assessment of impacts.

Table 14.2: Background Pollution Concentrations

Pollutant	Year		
	2007	2010	2011
NOx	3.09µg/m^3	2.83µg/m^3	2.79µg/m^3
NO_2	2.60µg/m^3	2.40µg/m^3	2.37µg/m^3
PM_{10}	8.53µg/m^3	8.31µg/m^3	8.29µg/m^3

Background NO_2 concentrations easily meet the objective for annual mean NO_2 concentrations to be achieved by 2005 and thereafter. By 2010 background concentrations are expected to have improved further by which time the annual

[183] Stirling Council, 2007. Local Air Quality Management Progress Report; Stirling Council, 2006. Local Air Quality Strategy 2006, A Report to Stirling Council
[184] http://www.airquality.co.uk
[185] Approximately 300m north of the A82/A85 junction in Crianlarich

mean objective of 18µg/m^3 for PM_{10} concentrations must be achieved. Background concentrations of PM_{10} will easily meet this objective in all years.

14.6 ASSESSMENT METHODOLOGY

14.6.1 Construction

Construction activities would cause dust to be emitted to the atmosphere, which could have an adverse impact on local air quality.

Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. Due to this relatively large particle size, dust is only resident for short periods of time after initial release to the atmosphere, and falls out of suspension quickly and in relatively close proximity to the source of emission. Dust therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

The smaller particles of dust (typically less than 10µm in aerodynamic diameter) are known as particulate matter (PM_{10}), or 'suspended particles'. They represent only a small proportion of total dust released and due to their size remain suspended in the atmosphere for a longer period and as a result can be transported by wind over a wider area. PM_{10} is small enough to be drawn into the lungs during breathing, which in sensitive members of the public could cause an adverse reaction. As a result of this potential impact on health, standards and objectives for PM_{10} are defined in the AQS and Regulations.

A generic assessment of the effects of dust generation on local air quality during construction was undertaken using the following publications and guidance:

- Building Research Establishment (BRE)186;
- Quality of Urban Air Review Group (QUARG)187; and
- Department of the Environment (DoE)[188].

These guidance documents consider the likely sources of construction dust, the distance from the point of generation to sensitive receptors, the prevailing weather conditions and the effectiveness of dust control measures.

14.6.2 Operation

The main impacts on air quality during operation of the proposed bypass would be changes in the total emissions of pollutants including carbon dioxide (CO_2) and changes in the local concentrations of pollutants.

14.6.2.1 Local Impacts

For the prediction of local impacts due to emissions arising from road traffic using the proposed bypass, the air pollutant dispersion model Breeze Roads has been used. This model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at

[186] Kukadia, V., Upton, S. L. and Hall, D. J., 2003. Control of dust from Construction and Demolition Activities. BRE

[187] Quality of Urban Air Review Group, 1996. Airborne Particulate Matter in the United Kingdom – Third Report of the Quality of Urban Air Review Group. Prepared for the Department of the Environment

[188] Arup Environmental and Ove Arup and Partners, 1995. The Environmental Effects of dust from Surface Mineral Workings Volume 2. Prepared for Department of the Environment Minerals Division

specific locations selected by the user. More details on Breeze Roads can be found in Appendix 14.2. A detailed assessment of local impacts has been undertaken given the level of benefit to local air quality that is likely to occur at properties in the centre of Crianlarich as a result of the proposals.

Meteorological data, such as wind speed and direction, are used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model were obtained from the Met Office observing station at Strathallen (approximate grid reference: 292500, 716000) located approximately 55km to the east of Crianlarich. This station is the closest meteorological observing station that is considered to provide the most representative data of the conditions in Crianlarich. The meteorological data used for this assessment was from 2006. A windrose is provided in Appendix 14.3.

For the assessment, three scenarios were modelled in accordance with DMRB. These scenarios are as follows:

- 2007: baseline;
- 2011: without proposed bypass; and
- 2011: with proposed bypass.

The anticipated opening year of the proposed bypass is 2001.

A summary of the traffic data (which was derived from data collected as part of the work towards the traffic assessment presented in Chapter 4) and pollutant emission factors used in the assessment and a diagram showing the location of road links described can be found in Appendix 14.4. It includes details of Annual Average Hourly Traffic flows, average vehicle speeds and the percentage of Heavy Goods Vehicles (HGVs) for the local road network in all assessment years considered.

Modelled annual mean oxides of nitrogen (NO_x) were converted to annual mean NO_2 concentrations using the methodology given in DEFRA guidance for the review and assessment of air quality (LAQM.TG(09)[189]) and the NO_x:NO_2 calculator available from the UK Air Quality Archive. The calculator provides a method of calculating NO_2 from NO_x wherever NO_x emissions from road traffic are predicted using dispersion modelling.

For PM_{10}, the modelled annual mean concentrations were used to calculate the number of exceedences of the 24-hour mean objective for direct comparison with the AQS objectives, following the methodology given in LAQM.TG(09).

LAQM.TG(09) does not provide a method for the conversion of annual mean NO_2 concentrations to 1 hour mean NO_2 concentrations. However, research[190] has concluded that exceedences of the 1 hour mean objective are unlikely to occur where annual mean concentrations do not exceed 60µg/m^3. Further research carried out in 2008[191] generally supported this relationship and as a result this

[189] Department for Environment, Food and Rural Affairs (DEFRA): Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(09) (Feb 2009).
[190] D Laxen and B Marner, 2003. Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites (July 2003)
[191] A Cook, 2008: Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective

criterion has been adopted for the purposes of local air quality review and assessment.

Quantitative assessments of the impacts on local air quality from road traffic emissions associated with the proposed bypass have been completed against the current statutory standards and objectives for NO_2 and PM_{10} set out in Table 14.1 and the significance criteria provided in Table 14.3.

Table 14.3: Significance Criteria[192]

Significance Criteria	Definition
None	The development causes no change in concentrations, or The development gives rise to a small change in concentrations and no exceedences of the objectives are predicted
Minor Adverse Effect	The development gives rise to a small increase in concentrations and exceedences of the objectives are predicted with the development in place, or The development gives rise to a moderate increase in concentrations but no exceedences of the objectives are predicted
Moderate Adverse Effect	The development gives rise to a moderate increase in concentrations and exceedences of the objectives are predicted with the development in place, or The development gives rise to a large increase in concentrations but no exceedences of the objectives are predicted
Major Adverse Effect	The development gives rise to a large increase in concentrations and exceedences of the objectives are predicted
Minor Beneficial Effect	The development gives rise to a small decrease in concentrations and exceedences of the objectives are predicted, or The development gives rise to a moderate decrease in concentrations but no exceedences of the objectives are predicted
Moderate Beneficial Effect	The development gives rise to a moderate decrease in concentrations and exceedences of the objectives are predicted, or The development gives rise to a large decrease in concentrations but no exceedences of the objectives are predicted
Major Beneficial Effect	The development gives rise to a large decrease in concentrations and exceedences of the objectives are predicted

Where the magnitude of changes in concentration have been defined as follows:

- a small change is a change of less than 1$\mu g/m^3$ (or less than 2.5% of the standard);
- a moderate change is a change of ≥ 1 to <4$\mu g/m^3$ (or ≥ 2.5% to <10% of the standard);
- a large change is a change of greater than or equal to ≥ 4$\mu g/m^3$ (or ≥ 10% standard); and

[192] The criteria relate to changes in annual mean NO_2 and PM_{10} concentrations resulting from the development.

- an exceedance is defined as a concentration that is predicted to be above the standard (40μg/m^3) in, or after the objective achievement year (2005 for NO_2 and 2004 for PM_{10}) at a location where members of the public are likely to be exposed over the averaging period (1 year).

14.6.2.2 Model Validation and Verification

The Breeze Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. The model is also listed in Government guidance document LAQM.TG3(00) – Review and Assessment: Selection and Use of Dispersion Models[193].

Model validation undertaken by the software developer will not have included validation in the vicinity of the scheme considered in this assessment. It is therefore advisable to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

It was not possible to verify the modelling results for this assessment due to lack of suitable local monitoring data with which to compare the modelled results. Whilst this is not ideal predicted concentrations were found to be well below current objectives and it is highly unlikely that verifying the modelled results would alter the conclusions of the assessment.

14.6.2.3 Limitations

Discrepancies can occur between the results predicted by the dispersion model (i.e. BREEZE Roads) and the results measured at local monitoring sites. These discrepancies may be due to a number of reasons including:

- traffic flow uncertainties, including estimates of speeds, total flows and proportions of vehicle types;
- emissions estimates for vehicles;
- estimates of background concentrations;
- meteorological data uncertainties; and
- overall model limitations.

These limitations and uncertainties can be reduced through model verification. However, as it has not been possible to verify the model they will apply to the results provided in this assessment.

14.6.2.4 Sensitive Receptors

Sensitive locations are those where the public may be exposed to pollutants from the construction and operation of the proposed bypass. These would include locations sensitive to an increase in dust deposition as a result of construction activities, or exposure to gaseous pollutants from exhaust emissions from construction traffic and traffic associated with the proposed bypass once it became operational.

Locations with a high sensitivity to dust generated by construction activities include hospitals and clinics, hi-tech industries, painting and furnishing and food

[193] Review and Assessment: Selection and Use of Dispersion Models; Part IV The Environment Act 1995 Local Air Quality Management LAQM.TG(00) May 2000

processing. Locations classed as being moderately sensitive to dust include schools, residential areas and food retailers.

In terms of locations that are sensitive to gaseous pollutants emitted from engine exhausts, these would include places where members of the public would be exposed to pollution over the period of time that they are present, and therefore the most suitable AQS averaging period of the pollutant needs to be used for assessment purposes.

For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standard (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school, or adjacent to a private dwelling, however, where exposure may be for longer periods, comparison with a long-term (such as 24 hour mean or annual mean) standard may be most appropriate. In general terms, long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

To complete the assessment a number of 'receptors' were identified at which pollution concentrations were predicted. The locations of the assessment receptors are shown on Figure 14.1. They include locations adjacent or near to the routes that are likely to experience the greatest change in traffic volume as a result of the proposed bypass and therefore the impacts predicted at these locations can be considered to be representative of the likely maximum effects of the proposed scheme. The air quality assessment has focused on the change in exposure at sensitive receptors due to the proposed bypass. Figure 14.2 provides the constraints map for local air quality.

14.6.2.5 Total Emissions

The changes in total emissions of pollutants have been calculated using the 'Regional' application of the DMRB spreadsheet. This uses data for traffic flows, speeds and road types to calculate the total emissions of pollutants. A simple assessment for regional impacts has been undertaken as many of the road links considered in the assessment are predicted to have a change of more than 10% in their Annual Average Daily Traffic (AADT) flows as a result of the proposals.

14.6.2.6 Designated Sites

There are three nature conservation sites designated for their nature conservation interests in Crianlarich (see Section 9.5.3). These are:

- River Tay Special Area of Conservation;
- Ben More Site of Special Scientific Interest; and
- Glen Falloch Pinewood Site of Special Scientific Interest.

Only the River Tay Special Area of Conservation lies within 200m from the edge of the A82 and A85 (see Section 9.5.3). However, the impact of the scheme in terms of air quality and this designated site does not require assessment because its designation[194] is not for plant species or habitats listed as sensitive to changes in nitrogen deposition and air pollution in Annex F (Table F1) of the DMRB guidance.

[194] http://www.snh.org.uk/

14.7 POTENTIAL IMPACTS

14.7.1 Permanent

There are no permanent impacts associated with the scheme during construction.

14.7.2 Construction

- Construction activities would lead to the generation and release of dust. Dust may be deposited in the area immediately surrounding the source (up to 200m away) and could cause nuisance or amenity loss at sensitive locations.
- PM_{10} concentrations in the vicinity of the proposed bypass would be elevated as a result of construction processes and construction traffic.
- Emissions from construction vehicles would also lead to an increase in NO_2 concentrations.

14.7.3 Operational

- The operation of the proposed bypass may lead to changes in concentrations of NO_2 and PM_{10} at sensitive receptors (i.e. change in exposure to air pollution). It is likely that the proposed bypass would cause a reduction in pollution concentrations at receptors located along the existing route of the A82 due to the fact a large proportion of traffic would use the proposed bypass rather than the roads which make up the existing network through Crianlarich (see Section 4.4).
- The operation of the bypass may lead to changes in total emissions of pollutants, CO_2.

14.8 MITIGATION MEASURES

Mitigation measures have been identified to address the potential impacts outlined in Section 14.7.

14.8.1 Construction

The following are measures which would be employed to reduce the potential negative impacts during the construction phase:

AQ1 Vehicles carrying loose aggregate and workings would be sheeted.

AQ2 Completed earthworks would be covered or vegetated as soon as is practicable.

AQ3 Surface areas of stockpiles (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) would be minimised to reduce the area of surfaces exposed to wind pick-up.

AQ4 All construction plant and equipment would be maintained in good working order and not left running when not in use.

AQ5 Dust suppressed tools would be used for all operations.

AQ6 There would be no unauthorised burning of any material anywhere on-site.

AQ7 Design controls for construction equipment and vehicles would be implemented and appropriately designed vehicles for materials handling would be used.

AQ8 Regular inspection would be undertaken to check for dust deposits and, if necessary, local roads would be cleaned and dust removed.

AQ9 Construction traffic would not pass along sensitive roads (residential roads, congested roads, unsuitable junctions, etc.) where possible.

AQ10 Vehicles used during construction would be kept clean and would be sheeted when on public highways.

AQ11 Large-scale vehicle movements would be timed to avoid peak hours on the local road network.

14.8.2 Operational

The proposed bypass leads to a reduction in NO_2 and PM_{10} concentrations at the majority of receptors assessed. Consequently no mitigation is required for the operational phase of the proposed bypass.

14.9 ASSESSMENT OF RESIDUAL EFFECTS

14.9.1 Construction

The greatest potential for dust nuisance to occur would be within 200m of the construction activities. Approximately 47 properties are located within 200m either side of the route of the proposed bypass. The prevailing wind direction is from the south-west. Therefore the properties which would be most likely to experience dust nuisance would be those to the north-east of the route. The majority of properties in Crianlarich are located to the north-east of the proposed bypass, however, with the successful implementation of the mitigation measures outlined above the effect of the proposed bypass would be reduced from moderate/minor adverse to minor adverse/negligible (that is, not significant).

The potential for short term releases of PM_{10} from materials handling and site plant would remain following mitigation. As the magnitude of these releases is relatively small, any adverse effects resulting from them would be likely to be relatively short-term and are considered to be minor adverse to negligible following mitigation.

The residual effects of emissions from construction vehicles would be negligible because the likely volumes of traffic that would be associated with the construction phase would be relatively low (see Sections 4.3 and 12.6.3).

14.9.2 Operational

14.9.2.1 Local Effects

Full results of the dispersion modelling for the assessment of local impacts are presented in Appendix 14.5, and a summary is provided below.

The findings show that the proposed bypass would result in a small decrease in pollutant concentrations at the majority of receptors which were assessed. The concentrations predicted for 2011, both with and without the proposed bypass, are all below those predicted for the 2007 baseline year. This is due to an expected future improvement (i.e. decrease) in background concentrations and vehicle emissions.

The assessment indicates that the impact of the proposed bypass would be negligible for NO_2 and PM_{10}.

The worksheets for the local air quality appraisal undertaken in accordance with STAG are provided in Appendix 14.6 for reference. The key findings of this appraisal were that approximately 85 properties would experience an improvement in local air quality and two properties would experience a deterioration in local air quality as a result of the proposed bypass. The deterioration at these properties would be very small and is not considered to be significant. Approximately, three properties are likely to experience no change in local air quality.

Annual Mean NO_2 Concentrations
The objective for annual mean NO_2 concentrations is 40µg/m^3 to be achieved by the end of 2005 and thereafter. The results of the assessment show that in the 2007 baseline case concentrations meet this objective at all of the assessment receptors. The highest predicted concentration is 3.60µg/m^3 at Receptor 13, the façade of Glenbruar B&B in Crianlarich.

By 2011, the anticipated opening year of the bypass, predicted concentrations at all of the receptors both with and without the proposed bypass are reduced from the 2007 baseline case. The highest concentrations are predicted at Receptor 13 where the predicted concentrations are 3.15µg/m^3 in the 'without proposed bypass' scenario and 3.01µg/m^3 in the 'with proposed bypass' scenario.

A small decrease in NO_2 concentrations is predicted at the majority of assessment receptors due to the scheme. The largest predicted decrease in NO_2 concentrations is 0.29µg/m^3 at Receptor 5 (Laurelbank). These decreases would occur because the majority of traffic would use the bypass which is located further way from the majority of assessment receptors than the current route alignment. A small increase in concentrations of 0.03µg/m^3 is predicted at Receptor 4 (11 Willow Square) and 0.01µg/m^3 at Receptor 11 (the rear of no 7 Tyndrum Terrace). This is due to these receptors being located closer to the proposed bypass than they are to the existing route which vehicles use.

The predicted changes in concentrations due to the proposed bypass are very small, and would probably be indistinguishable from current conditions using available monitoring techniques. The significance of the impact of the scheme on air quality would be negligible.

Hourly Mean NO_2 Concentrations
The annual mean NO_2 concentrations predicted by the model were all below 60µg/m^3, and therefore exceedences of the hourly mean NO_2 concentration objective would be unlikely to occur.

Annual Mean PM_{10} Concentrations
The objective for annual mean PM_{10} concentrations is a concentration of 18µg/m^3 to be achieved by the end of 2010. The results of the assessment show that in the 2007 baseline case concentrations at all of the receptors considered in the assessment are predicted to easily meet the objective. The highest predicted concentration is 8.60µg/m^3 at Receptor 13, the façade of Glenbruar B&B in Crianlarich (see Figure 14.1).

By 2011, the anticipated opening year of the bypass, predicted concentrations at all of the receptors both with and without the new road are reduced from the 2007 baseline case. The highest concentrations are predicted at Receptor 13 where the predicted concentrations are 8.34µg/m^3 in the 'without proposed bypass' scenario and 8.33µg/m^3 in the 'with proposed bypass' scenario. Predicted concentrations in 2011 both with and without the proposed bypass would meet the objective for annual mean PM_{10} concentrations at all assessment receptors.

A small decrease in concentrations is predicted at seven of the assessment receptors due to the proposed bypass, no change is predicted at nine of the assessment receptors and an increase is predicted at one location. The greatest decrease in concentrations is 0.02µg/m^3 predicted to occur at Receptors 5 (Laurelbank) and 17 (a bungalow on the A82). These decreases occur again because the majority of traffic would use the bypass which is located further way

from the majority of assessment receptors than the current route alignment. A small increase in concentrations of 0.01µg/m^3 is predicted at Receptor 4 (11 Willow Square). This is due to this receptor being located closer to the proposed bypass than it is to the existing route vehicles use.

The changes in concentrations due to the proposed bypass are very small, and probably would again be indistinguishable using available monitoring techniques. The impact of the scheme would be negligible.

24 Hour Mean PM_{10} Concentrations
The objective for 24 hourly mean PM_{10} concentrations is 50µg/m^3 to be exceeded no more than seven times a year by the end of 2010 and thereafter. The results of the dispersion modelling show that in 2007 the number of days of exceedence is six and in 2011, both with and without the proposed bypass, the number of days of exceedence is seven, which is within the target figure.

Total Emissions
Table 14.4 presents the calculated total emissions of NO_x from the scheme. It considers baseline emissions in both 2007 and 2011 and presents total emissions of NO_x with the scheme operational in 2011.

Table 14.4: Total emissions of NO_x for Baseline and Future Assessment Years

Baseline Year: 2007 Future Year: 2011 kg per Year					
	Do-Minimum		Do-Something	Do-Something compared with	
	Present	Future	Future	Present Do-Min	Future Do-Min
NO_x	2697	2046	1874	-823	-172

Total NO_x emissions are predicted to decrease between 2007 and 2011 as a result of expected improvements in fuel and vehicle technology. Total emissions with the scheme operational in 2011 are a decrease from the 2011 baseline. This decrease is largely due to a reduction in the distance that vehicles would travel using the proposed bypass compared with the current road layout.

Table 14.5 presents the calculated total emissions of CO_2 from the scheme. It considers baseline emissions in both 2007 and 2011, and total emissions of CO_2 with the scheme operational in 2011.

Table 14.5: Total emissions of CO_2 for Baseline and Future Assessment Years

Baseline Year: 2007 Future Year: 2011 Tonnes per Year					
Do-minimum			Do-Something	Do Something as % of	
	Present	Future		Present Do-Min	Future Do-Min
CO_2	730	723	679	93%	94%
The total emissions from all roads considered in this assessment					

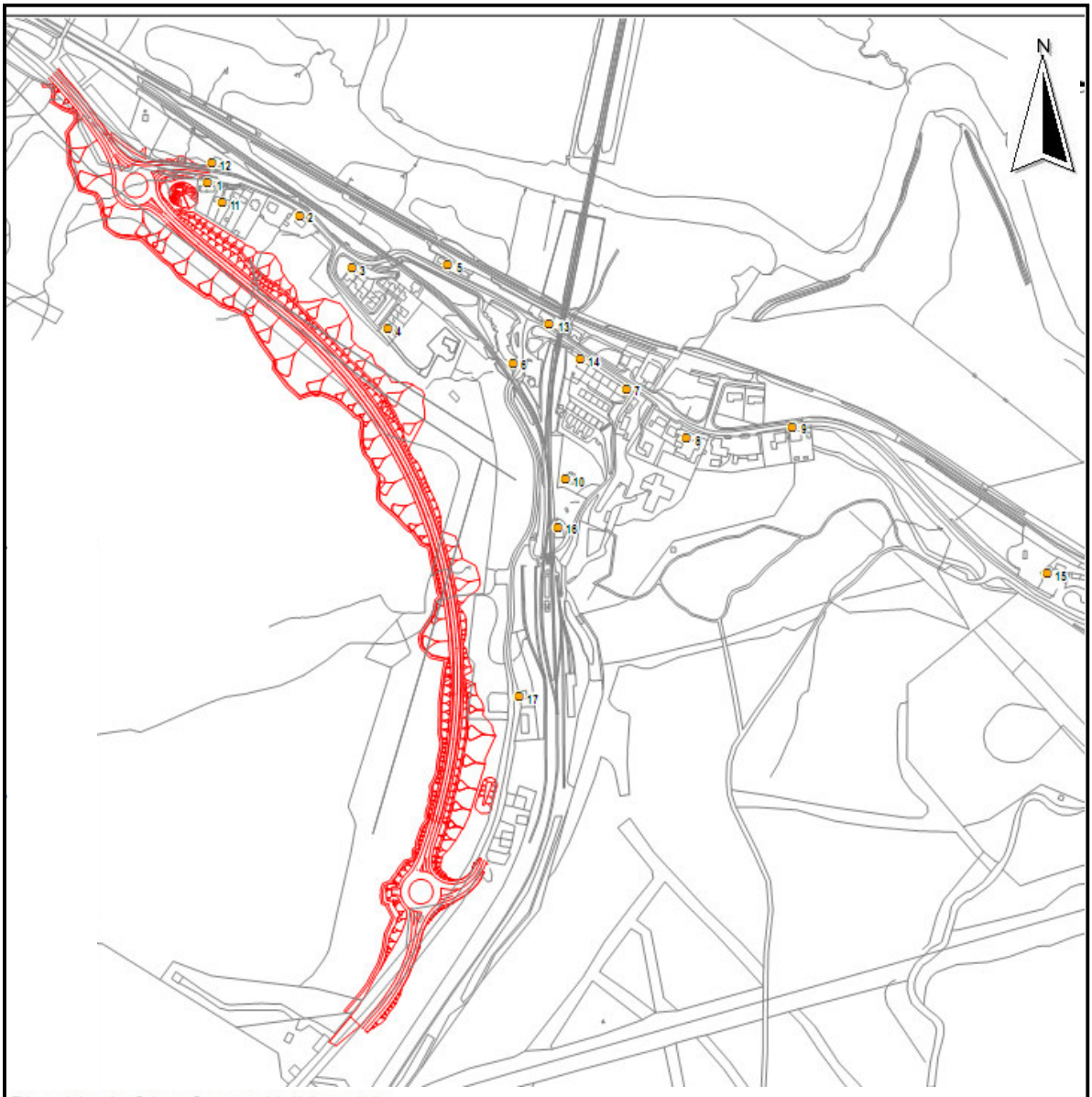
Total emissions of CO_2 are predicted to decrease between 2007 and 2011 as a result of expected improvements in fuel and vehicle technology. Total CO_2 emissions are predicted to decrease to 93% of the 2007 baseline, and 94% of the 2011 baseline with the scheme operational. This decrease is largely due to a

reduction in the distance that vehicles would travel using the proposed bypass compared with the current road layout.

The results for total emissions of other pollutants are present in Appendix 14.7**,** together with predictions of total emissions for 2007 and the scheme design year of 2026.

14.10 SUMMARY

- Air quality within the study corridor is good. Concentrations of all the pollutants which have been considered were found to be well within the statutory objectives.
- The main impacts during construction would result from emissions of dust and PM_{10}. These impacts would be minimised by implementing best management practices on site and overall the residual effects are not considered to be significant.
- During operation, the proposed bypass would lead to a small reduction in NO_2 and PM_{10} concentrations at the majority of receptors which have been assessed. An increase in pollution concentrations is predicted to occur at two receptors for NO_2 and one receptor for PM_{10} as they would be located closer to the route of the proposed bypass than they currently are to the existing route. However the increases predicted at these receptors would be small and probably indistinguishable using available monitoring techniques.
- Approximately 85 properties would experience an improvement in local air quality and two properties would experience a deterioration in local air quality as a result of the proposed bypass. The increase at these properties would be very small and is not considered to be significant Approximately, three properties are likely to experience no change in local air quality.
- Total emissions of both CO_2 and NO_x with the scheme operational would be less than the 2011 baseline. This decrease is primarily due to a reduction in the distance that vehicles would travel using the proposed bypass compared to the current road layout.
- Overall, the scheme would have positive effects on air quality for the local population.



Key

Receptor Location

DRAWN BY:	CHECKED BY:	DATE:
JMM	JG	08/08

A82(T) Crianlarich Bypass

Figure 14.1: Sensitive Receptors

TRANSPORT SCOTLAND

N
W E
S

Key

200m boundary of roads affected

Roads which will be affected by the proposals

Designated Sites

Special Area of Conservation (SAC)

DRAWN BY:	CHECKED BY:	DATE:
JMM	JG	08/07/2008

A82 Crianlarich Bypass

Figure 14.2 : Local Air Quality Constraints

Scale 1:6,500

TRANSPORT SCOTLAND